*TM 1-1520-251-10

TECHNICAL MANUAL

OPERATOR's MANUAL

FOR

HELICOPTER, ATTACK, AH-64D LONGBOW APACHE

WARNING - This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec. 2751 *et seq*.) or the Export Administration Act of 1979, as amended, Title 50, U.S.C., App. 240-1 *et seq*. Violation of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DoD Directive 5230.25.

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DESTRUCTION NOTICE - Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

* This manual supercedes TM 1-1520-251-10, dated 15 December 1998, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY

29 MARCH 2002

WARNING

Personnel performing operations, procedures, and practices which are included or implied in this technical manual shall observe the following warnings. Disregard of these warnings and precautionary information can cause serious injury or loss of life.

WARNING

AVIATION LIFE SUPPORT EQUIPMENT

Aviation life support equipment shall be utilized in accordance with AR 95-1 and FM 1-302. Failure to do so may result in personal injury or loss of life.

WARNING

BATTERY ELECTROLYTE

Battery electrolyte is harmful to the skin and clothing. Neutralize any spilled electrolyte by thoroughly flushing contacted area with water.

WARNING

CANOPY JETTISON

Canopy jettison safety pins shall be installed in pilot, copilot/gunner, and external firing mechanisms when the helicopter is on the ground. The canopy jettison system is manually operated. The canopy can be jettisoned when no electrical power is on the helicopter. Pilot and copilot/gunner safety pins shall be removed before starting engines. Safety pins shall be installed during engine shutdown check. Debris may be expelled 50 feet outward when system is actuated. Pilot and copilot/gunner helmet visor should be down to prevent eye injury.

WARNING

CARBON MONOXIDE

When smoke, suspected carbon monoxide fumes, or symptoms of anoxia exist, the crew should immediately ventilate the cockpit.

WARNING

ELECTROMAGNETIC INTERFERENCE (EMI)

No electrical/electronic devices of any sort, other than those described in this manual or appropriate maintenance manuals, are to be operated by crew members during operation of this helicopter. The aircraft may experience equipment performance anomalies when flying in the vicinity of High Intensity Radio Transmission Areas (HIRTAs); accordingly, aircraft flights, whether day or night, shall use night stand-off distances in accordance with HIRTA messages.

Even when in compliance with the above paragraph, erratic behavior of these systems (communication, navigation, display and weapons) may occur when operating in and around high-powered radio and radar transmitters.

WARNING

FIRE EXTINGUISHER

Exposure to high concentrations of extinguishing agent or decomposition products should be avoided. The liquid should not be allowed to contact the skin; it may cause frostbite or low-temperature burns.

WARNING

GROUND OPERATION

Engines will be started and operated only by authorized personnel. Reference AR 95-1 and AR 95-13.

WARNING

HANDLING FUEL, OIL, AND HYDRAULIC FLUIDS

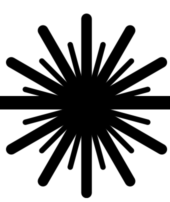
Turbine and lubricating oils contain additives which are poisonous and readily absorbed through the skin. Do not allow them to remain on skin longer than necessary. Prolonged contact may cause skin rash. Prolonged contact with hydraulic fluid may cause burns. Refer to FM 10-68 and FM 10-69 when handling fuel.

WARNING

HIGH VOLTAGE

All ground handling personnel must be informed of high voltage hazards when working near Target Acquisition Designator Sight (TADS) and Pilot Night Vision Sensor (PNVS) equipment.

WARNING



LASER LIGHT HAZARD

LASER LIGHT

The laser light beam is dangerous and can cause blindness if it enters the eye either directly or reflected from a surface. Personnel should wear approved laser protection whenever in a controlled area when laser rangefinder or laser target designators are being used. Laser shall be used only in controlled areas by qualified personnel.

WARNING

NOISE

Sound pressure levels around helicopters during some operating conditions exceed the Surgeon General's hearing conservation criteria as defined in DA PAM 40-501 Hearing protection devices, such as the aviator helmet or ear plugs, are required to be worn by all personnel in and around the helicopter during its operation.

WARNING

STARTING ENGINES AND AUXILIARY POWER UNIT

Be sure that the rotor and blast area is clear, and a fire guard is posted if available.

WARNING

VERTIGO

The anti-collision strobe lights should be off during flight through clouds to prevent sensations of vertigo as a result of reflections of the light on the clouds.

WARNING

WEAPONS AND AMMUNITION

Observe all standard safety precautions governing the handling of weapons and live ammunition. When not in use, point all weapons in a direction away from personnel and property in case of accidental firing. Do not walk in front of weapons. SAFE all weapons before servicing. To avoid potentially dangerous situations, follow the procedural warnings in this text. To prevent inadvertent rocket firing, electrical tests shall not be performed with rockets in launcher, and all other sources of inadvertent electrical power shall be kept away from the launcher. Ensure electrical equipment, even if turned off and unplugged, is not in the vicinity of a loaded launcher.

WARNING

WING STORES JETTISON

All jettison safety pins shall be installed when the helicopter is on the ground. Safety pins shall be removed prior to flight. Failure to do so will prevent jettison of wing stores.

WARNING

RADIO FREQUENCY TRANSMISSION

Personnel should remain at least five feet away from the HF radio antenna while the radio is transmitting. High levels of electromagnetic radiaton are emitted by this antenna while transmitting. The HF radio should not be operated inside hangar or metal covered building.

CHANGE
NO. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 26 July 2005

TECHNICAL MANUAL

OPERATOR'S MANUAL

FOR

HELICOPTER, ATTACK,
AH-64D
LONGBOW APACHE

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Remove pages	Insert pages
A through C/(D blank)	A through D
9-19 and 9-20	9-19 and 9-20

2. File this change sheet in the front of the publication for reference purposes.

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

Sandra R. Riley

SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army
0519613

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CHANGE NO. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 27 April 2005

TECHNICAL MANUAL

OPERATOR'S MANUAL

FOR

HELICOPTER, ATTACK,
AH-64D
LONGBOW APACHE

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Remove pages	Insert pages
A through C/(D blank)	A through D
1-1 and 1-2	1-1 and 1-2
2-3 and 2-4	2-3 and 2-4
2-13 and 2-14	2-13 and 2-14
2-25 and 2-26	2-25 and 2-26
2-41 and 2-42	2-41 and 2-42
2-49 and 2-50	2-49 and 2-50
2-57 through 2-60.1/(2-60.2 blank)	2-57 through 2-60.1/(2-60.2 blank)
2-101 through 2-106	2-101 through 2-106
2-127 and 2-128	2-127 and 2-128
	2-128.1/(2-128.2 blank)
	2-130.1/(2-130.2 blank)
2-135 and 2-136	2-135 and 2-136
2-139 and 2-140	2-139 and 2-140
2-143 and 2-144	2-143 and 2-144
2-146.1 and 2-146.2	2-146.1 and 2-146.2
2-147 and 2-148	(2-147 blank)/2-148
2-155 and 2-156	2-155 and 2-156
2-161 and 2-162	2-161 and 2-162

Remove pages	Insert pages
3-41 and 3-42	3-41 and 3-42
3-66.13 and 3-66.14	3-66.13 and 3-66.14
3-66.39 and 3-66.40	3-66.39 and 3-66.40
3A-3 and 3A-4	3A-3 and 3A-4
3A-9 through 3A-14	3A-9 through 3A-14
3A-17 through 3A-28	3A-17 through 3A-26
	3A-26.1/(3A-26.2 blank)
3A-27 and 3A-28	3A-27 and 3A-28
	3A-28.1 through 3A-28.3/(3A-28.4 blank)
3A-35 through 3A-38	3A-35 through 3A-38
3A-47 through 3A-58	3A-47 through 3A-58
3A-63 through 3A-72	3A-63 through 3A-72
3A-100.5 through 3A-100.18	3A-100.5 through 3A-100.18
(3A-101 blank)/3A-102	3A-101 and 3A-102
3A-147 through 3A-154	3A-147 through 3A-154
3A-157 through 3A-160	3A-157 through 3A-160
4-1 through 4-8	4-1 through 4-8
	4-8.1/(4-8.2 blank)
4-11 through 4-16	4-11 through 4-16
	4-16.1/(4-16.2 blank)
4-19 through 4-28	4-19 through 4-26
	4-26.1 and 4-26.3/(4-26.4 blank)
	4-27 and 4-28
4-33 through 4-36	4-33 through 4-36
	4-36.1 and 4-36.2
4-65 and 4-68	4-65 and 4-68
4-72.1 and 4-72.2	4-72.1 and 4-72.2
4-73 and 4-74	4-73 and 4-74
4-78.1 through 4-78.5/(4-78.6 blank)	4-78.1 through 4-78.6
4-95 and 4-96	4-95 and 4-96
4-111 and 4-112	4-111 and 4-112
5-11 and 5-12	5-11 and 5-12
6-5 and 6-6	6-5 and 6-6
6-11 and 6-12	6-11 and 6-12
7-13 through 7-16	7-13 through 7-16
7A-3 through 7A-6	7A-3 through 7A-6
7A-13 through 7A-18	7A-13 through 7A-18
8-3 through 8-6	8-3 through 8-6
8-9 and 8-10	8-9 and 8-10
9-15 through 9-20	9-15 through 9-20
9-27 through 9-30	9-27 through 9-30
9-37 through 9-40	9-37 through 9-40
B-3 and B-4	B-3 and B-4
B-7 through B-12	B-7 through B-12
D-1 through D-4	D-1 through D-4
Index-1 through index-48	Index-1 through index-48
	Index 49/(Index 50 blank)
Electronic 2028 Instruction Sheet and Blank	Electronic 2028 Instruction Sheet and Blank

2. File this change sheet in the front of the publication for reference purposes.

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army
0507509

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CHANGE NO. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 April 2004

TECHNICAL MANUAL

OPERATOR'S MANUAL

FOR

HELICOPTER, ATTACK,
AH-64D
LONGBOW APACHE

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A/(B blank)	A and B
	C/(D blank)
i through iii/(iv blank)	i through iv
1-1 and 1-2	1-1 and 1-2
2-14.1 and 2-14.2	2-14.1 and 2-14.2
2-17 through 2-20	2-17 through 2-20
	2-20.1 and 2-20.2
2-21 through 2-24	2-21 through 2-24
2-63 through 2-66	2-63 through 2-66
2-91 through 2-94	2-91 through 2-94
2-115 and 2-116	2-115 and 2-116
2-116.1 and 2-116.2	2-116.1 and 2-116.2
2-119 through 2-124	2-119 through 2-124
2-127 and 2-128	2-127 and 2-128
2-141 and 2-142	2-141 and 2-142
2-145 through 2-148	2-145 through 2-148
2-151 and 2-152	2-151 and 2-152
3-1 through 3-6	3-1 through 3-6
3-9 through 3-14	3-9 through 3-14

Remove pages	Insert pages
3-37 and 3-38	3-37 and 3-38
	3-66.1 through 3-66.82
3-69 through 3-72	3-69 through 3-72
3-105 through 3-108	3-105 through 3-108
3A-1 through 3A-14	3A-1 through 3A-14
3A-17 through 3A-26	3A-17 through 3A-26
	3A-26.1/(3A-26.2 blank)
3A-27 and 3A-28	3A-27 and 3A-28
3A-31 through 3A-36	3A-31 through 3A-36
3A-43 and 3A-44	3A-43 and 3A-44
3A-47 and 3A-48	3A-47 and 3A-48
3A-53 through 3A-56	3A-53 through 3A-56
3A-63 and 3A-64	3A-63 and 3A-64
3A-73 and 3A-74	3A-73 and 3A-74
3A-81 through 3A-102	3A-81 through 3A-100
	3A-100.1 through 3A-100.18
3A-101 and 3A-102	(3A-101 blank)/3A-102
3A-103 through 3A-112	3A-103 through 3A-112
	3A-112.1/(3A-112.2 blank)
3A-115 through 3A-122	3A-115 through 3A-122
	3A-122.1 through 3A-122.4
3A-125 and 3A-126	3A-125 and 3A-126
3A-129 through 3A-132	3A-129 through 3A-132
	3A-132.1 through 3A-132.4
3A-135 and 3A-136	3A-135 and 3A-136
3A-141 through 3A-156	3A-141 through 3A-156
4-5 and 4-6	4-5 and 4-6
4-9 through 4-12	4-9 through 4-12
4-15 through 4-26	4-15 through 4-26
	4-26.1 and 4-26.2
4-27 and 4-28	4-27 and 4-28
4-33 through 4-36	4-33 through 4-36
4-41 and 4-42	4-41 and 4-42
4-45 through 4-52	4-45 through 4-52
4-55 through 4-58	4-55 through 4-58
4-61 through 4-64	4-61 through 4-64
4-69 through 4-72	4-69 through 4-72
4-72.1 and 4-72.2	4-72.1 through 4-72.4
4-73 through 4-78	4-73 through 4-78
	4-78.1 through 4-78.5/(4-78.6 blank)
4-81 through 4-84	4-81 through 4-84
4-107 and 4-108	4-107 and 4-108
4-113 and 4-114	4-113 and 4-114
4-117 and 4-118	4-117 and 4-118
5-11 and 5-12	5-11 and 5-12
7-1 through 7-4	7-1 through 7-4
7A-1 through 7A-4	7A-1 through 7A-4
7A-53 and 7A-54	7A-53 and 7A-54
8-3 through 8-6	8-3 through 8-6

Remove pages	Insert pages
9-5 and 9-6	9-5 and 9-6
9-17 through 9-22	9-17 through 9-22
9-27 through 9-30	9-27 through 9-30
B-1 and B-2	B-1 and B-2
B-7 and B-8	B-7 and B-8
B-11 and B-12	B-11 and B-12
	C-5/(C-6 blank)
Index 1 through Index 41/(Index 42 blank)	Index 1 through Index 48
Cover Page	Cover Page

2. File this change sheet in the front of the publication for reference purposes.

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PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

Joel B. Hudson

JOEL B. HUDSON
Administrative Assistant to the
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0409004

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CHANGE NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 1 August 2003

TECHNICAL MANUAL

OPERATOR'S MANUAL

FOR

HELICOPTER, ATTACK,
AH-64D
LONGBOW APACHE

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Remove pages	Insert pages
a and b	a and b
c/(d blank)	c/(d blank)
A/(B blank)	A and B
i and ii	i and ii
1-1 and 1-2	1-1 and 1-2
2-1 through 2-10	2-1 through 2-10
- - - - -	2-10.1 and 2-10.2
2-11 through 2-14	2-11 through 2-14
- - - - -	2-14.1 and 2-14.2
2-17 through 2-30	2-17 through 2-30
2-35 through 2-38	2-35 through 2-38
2-43 through 2-46	2-43 through 2-46
2-49 and 2-50	2-49 and 2-50
2-50.1 and 2-50.2	2-50.1 and 2-50.2
2-57 through 2-60	2-57 through 2-60
- - - - -	2-60.1/(2-60.2 blank)
2-61 and 2-62	2-61 and 2-62
2-65 and 2-66	2-65 and 2-66
2-69 and 2-70	2-69 and 2-70
2-73 and 2-74	2-73 and 2-74
2-79 and 2-80	2-79 and 2-80
2-83 through 2-96	2-83 and 2-84
	2-84.1 through 2-84.5/(2-84.6 blank)
	2-85 through 2-96
2-103 and 2-104	2-103 and 2-104
(2-111 blank)/2-112	(2-111 blank)/2-112

Remove pages	Insert pages
2-115 through 2-164	2-115 and 2-116
- - - - -	2-116.1 and 2-116.2
- - - - -	2-117 through 2-140
- - - - -	2-140.1 and 2-140.2
	2-141 through 2-164
3-1 and 3-2	3-1 and 3-2
3-11 through 3-14	3-11 through 3-14
3-41 and 3-42	3-41 and 3-42
3-69 through 3-72	3-69 through 3-72
3-77 and 3-78	3-77 and 3-78
3-87 through 3-90	3-87 through 3-90
- - - - -	3A-1 through 3A-160
4-25 and 4-26	4-25 and 4-26
4-61 through 4-72	4-61 through 4-72
- - - - -	4-72.1 and 4.72.2
4-73 and 4-74	4-73 and 4-74
4-77 and 4-78	4-77 and 4-78
4-93 through 4-98	4-93 through 4-98
4-105 through 4-108	4-105 through 4-108
4-113 through 4-118	4-113 through 4-118
5-11 and 5-12	5-11 and 5-12
6-5 and 6-6	6-5 and 6-6
6-10.1 /(6-10.2 .blank)	6-10.1 and 6-10.2
7-13 and 7-14	7-13 and 7-14
7A-3 and 7A-4	7A-3 and 7A-4
7A-13 and 7A-14	7A-13 and 7A-14
8-1 and 8-2	8-1 and 8-2
8-5 through 8-20	8-5 through 8-20
8-21/(8-22 blank)	8-21/(8-22 blank)
9-1 through 9-34	9-1 through 9-42
A-1 and A-2	A-1 and A-2
B-1 through B13/(B14 blank)	B-1 through B14
Index 1 through Index 32	Index1 through Index 41/(Index 42 blank)
DA-Form 2028-2, 1 Jul 79	DA-Form 2028, Feb 74

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By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
0319202

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CHANGE NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 23 August 2002

TECHNICAL MANUAL

OPERATOR'S MANUAL

FOR

HELICOPTER, ATTACK,
AH-64D
LONGBOW APACHE

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Remove pages	Insert pages
A/(B blank)	A/(B blank)
2-43 through 2-50	2-43 through 2-50
- - - -	2-50.1 and 2-50.2
2-107 through 2-110	2-107 through 2-110
- - - -	2-110.1 and 2-110.2
2-111 and 2-112	(2-111 blank)/2-112
2-115 through 2-118	2-115 through 2-118
4-93 and 4-94	4-93 and 4-94
- - - -	6-10.1/(6-10.2 blank)
Index 3 through Index 6	Index 3 through Index 6
Index 11 through Index 20	Index 11 through Index 20
Index 23 and Index 24	Index 23 and Index 24
Index 27 through 30	Index 27 through 30

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By Order of the Secretary of the Army:

ERIC K. SHINSEKI
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
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NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Date of issue for original and change pages are:

Original	0	29 March 2002
Change	1	23 August 2002
Change	2	01 August 2003
Change	3	30 April 2004
Change	4	27 April 2005
Change	5	26 July 2005

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 1057 CONSISTING OF THE FOLLOWING:

Page No.	*Change No.
Cover	3
Blank	0
a	2
b	0
c	2
d Blank	0
A – D	5
i – iv	3
1-1	0
1-2	4
2-1	0
2-2	2
2-3	4
2-4 – 2-5	0
2-6 – 2-10	2
2-10.1 – 2-10.2	2
2-11 – 2-12	2
2-13	4
2-14	2
2-14.1	3
2-14.2	2
2-15 – 2-17	0
2-18 – 2-20	3
2-20.1 – 2-20.2 Added	3
2-21	3
2-22	2
2-23	0
2-24	3
2-25	4
2-26 – 2-30	2
2-31 – 2-35	0
2-36 – 2-37	2
2-38	2
2-39 – 2-41	0
2-42	4
2-43	2
2-44	1
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2028 - Example	2
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2028	2
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Technical Manual

No. 1-1520-251-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 29 March 2002

TECHNICAL MANUAL
OPERATOR'S MANUAL
FOR
HELICOPTER, ATTACK
AH-64D LONGBOW/APACHE

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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* This manual supersedes TM 1-1520-251-10, dated 15 December 1998, including all changes.

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CHAPTER 1
INTRODUCTION

1.1 GENERAL

These instructions are for use by the operators. They apply to the AH-64D Apache helicopter.

1.2 WARNINGS, CAUTIONS, AND NOTES DEFINED

Warnings, Cautions, and Notes are used to emphasize important and critical instruction and are used for the following conditions:

WARNING

An operating procedure, practice, condition or statement, which if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, condition or statement, which if not strictly observed, could result in damage to or destruction of, equipment, loss of mission effectiveness or long term health hazards to personnel.

NOTE

An operating procedure, condition or statement, which is essential to highlight.

1.3 DESCRIPTION

This manual contains the best operating instructions and procedures for the AH-64D Apache helicopter under most circumstances. The helicopter is capable of carrying two crewmembers; a pilot and a Copilot/Gunner (CPG). The helicopter is designed as a weapons delivery platform and is equipped with: a M230E1, 30mm automatic gun, aerial rockets system (2.75 inch folding fin), and point target weapons (Hellfire missiles). The observance of limitations, performance, and weight and balance data provided in this manual is mandatory. The observance of procedures is also mandatory, except when modification is required because of multiple emergencies, adverse weather, terrain, etc. Basic flight principles are not included.

THIS MANUAL SHALL BE CARRIED IN THE HELICOPTER AT ALL TIMES.

1.4 APPENDIX A, REFERENCES

Appendix A is a listing of official publications cited within this manual which are applicable to, and available for, flight crews.

1.5 APPENDIX B, ABBREVIATIONS AND TERMS

Appendix B is a list of abbreviations to be used to clarify the text in this manual only. They are not necessarily standard abbreviations.

1.6 APPENDIX C, TWO LETTER IDENTIFIERS AND SYMBOLS

Appendix C is a listing of two letter identifiers and symbols used within this manual which are applicable to, and available for, flight crews.

1.7 APPENDIX D, TACTICAL SITUATION DISPLAY (TSD) PREPLANNED, RADAR FREQUENCY INTERFEROMETER (RFI) DETECTED, AND FIRE CONTROL RADAR (FCR) MERGED SYMBOLS

Appendix D is a listing of TSD, RFI and FCR symbols used within this manual which are applicable to, and available for, flight crews.

1.8 INDEX

The Index lists, in alphabetical order, every titled paragraph, figure, and table contained in this manual. Chapter 7 and 7A Performance Data, have an additional index.

1.9 ARMY AVIATION SAFETY PROGRAM

Reports necessary to comply with the safety program are prescribed in AR 385-40.

1.10 DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

For information concerning destruction of Army materiel to prevent enemy use refer to TM 750-244-1-5.

1.11 FORMS AND RECORDS

Army aviator's flight record and aircraft maintenance records, which are to be used by crewmembers, are described in DA PAM 738-751 and TM 55-1500-342-23.

1.12 EXPLANATION OF CHANGE SYMBOLS

Changes to the text and tables, including new material on added pages, are indicated by a vertical bar in the outer margin extending close to the entire area of the material affected. Pages with emergency markings, which consist of black diagonal lines around three edges, shall have the vertical change bar placed along the outer margins between the text and diagonal lines. Change bars show current changes only. A miniature pointing hand (symbol) is used to denote a changed illustration. A vertical line in the outer margin, rather than miniature pointing hands, is utilized when there have been extensive changes made to an illustration. Change symbols are not used to indicate:

- Introductory material.
- Indexes and tabular data where the change cannot be identified.
- Blank space resulting from the deletion of text, an illustration, or a table.
- Correction of minor inaccuracies, such as spelling, punctuation, relocation of material etc., unless such correction changes the meaning of instructive information and procedures.

1.13 SERIES AND EFFECTIVITY CODES

Some AH-64D helicopters have Longbow mission equipment installed. Those helicopters will have components, displays, and procedures different from non Longbow aircraft. The designator symbol **L** indicates text headings, text contents, and illustrations pertaining to helicopters with Longbow mission equipment installed. (See Chapter 4 for listing of Longbow Fire Control Radar.)

Some AH-64D helicopters have T700-GE-701 engines installed. Those helicopters will have components, instrumentation, and procedures different from helicopters with T700-GE-701C engines installed. The designator symbols **701** and **701C** indicate material that pertains to those specific engines.

Some AH64D helicopters have Modernized TADS (MTADS) software and hardware installed. The designator symbol **MT** indicates text that pertains to helicopters with MTADS software and hardware installed. Some AH64D helicopters have software (without hardware) installed for MTADS and Modernized PNVS (MPNVS). The text will state "if the aircraft is equipped with MTADS-MPNVS provisions--".

Block 1
Block 1 aircraft are equipped with Lot 6 software which provides unique functionality. Block 1 aircraft will use chapters 1, 2, 3, 4, 5, 6, 7 **701**, 7A **701C** , (depending on which engine is installed), 8 and 9 of this manual. Equipment/Systems that are only applicable to Block 1 will have the data prefaced with a **BLK 1** icon. If the data is only applicable to a specific block, that data will start and end with a bracket ([ ]) i.e. [**BLK 1** Only applicable to Block 1 aircraft.] Units operating Block 1 aircraft may store the added chapter 3A at the direction of the commander.

Block 1 aircraft with ARC-220 HF Radio
Block 1 aircraft equipped with ARC-220 HF Radio will have data prefaced with **HF** . Chapter 3 Section IIA is a stand alone section for aircraft with the HF radio.

Block 2
The major differences between Block 1 and Block 2 aircraft are unique software, ARC-220 HF Radio, Enhanced UFD, Expanded Data Transfer Unit, Digital Map, TEAC V80AB Video Recorder, IDM-EPLRS, Emergency Locator Transmitter and Underwater Acoustic Beacon. Block 2 aircraft will use chapters 1, 2, 3A, 4, 5, 6, 7 **701**, 7A **701C** , (depending on which engine is installed), 8 and 9 of this manual. Equipment/Systems that are only applicable to Block 2 will have the data prefaced with a **BLK 2** icon. Block 2 illustrations will be shown with the text explaining the differences between Block 1 and Block 2 aircraft. If the differences are extensive, both Block 1 and block 2 illustrations will be shown. If the data is only applicable to a specific block, that data will start and end with a bracket ([ ]) i.e. [**BLK 2** Only applicable to to Block 2 aircraft.] Units operating Block 2 aircraft may store the added chapter 3 at the direction of the commander.

1.14 ILLUSTRATIONS

The exterior aircraft illustrations in this manual will depict the Mast Mounted Assembly (MMA) installed unless the illustration is specifically required technically to omit the MMA.

1.15 USE OF SHALL, SHOULD, AND MAY

Within this technical manual, the word **shall** is used to indicate a mandatory requirement. The word **should** is used to indicate a non-mandatory but preferred method of accomplishment. The word **may** is used to indicate an acceptable method of accomplishment.

CHAPTER 2
AIRCRAFT AND SYSTEMS DESCRIPTION AND OPERATION

Section I. AIRCRAFT

2.1 GENERAL

The AH-64D Apache helicopter is a twin engine, tandem seat, aerial weapons platform.

2.2 INTRODUCTION

This chapter describes the crew interface requirements for management of AH-64D Apache aircraft systems. Aircraft systems are the non-avionics systems that provide basic aircraft operations. Interface with aircraft systems is provided by the multiplex (MUX) data bus, serial link, and status lines. The aircraft MUX bus system provides the main interface for units involved in aircraft systems management.

2.3 GENERAL ARRANGEMENT

Figure 2-1 depicts the general arrangement of the AH-64D Apache helicopter including access panels and major exterior components

2.4 FUSELAGE

The fuselage includes a forward, center, and aft section. All major weight items (crew, fuel, and ammunition) are supported by bulkheads, frames, and a longitudinal support structure. The forward fuselage section contains a portion of the Extended Forward Avionics Bays (EFAB), and the CPG station. The Target Acquisition and Designation Sight (TADS), Pilot Night Vision Sensor (PNVS), and a 30mm area weapon are also mounted to this section. The center fuselage contains a portion of the EFAB, the pilot station, and provides support for the main landing gear, main transmission, wings, fuel cells, and ammunition bay. The aft fuselage section includes the vertical stabilizer and mounts the tail landing gear. The aft avionics bay and stowage compartments are contained in the aft section. The tail rotor, drive shafts, gearboxes, and stabilator are attached to the aft section.

2.5 ROTOR

The helicopter has a fully articulated four-blade main rotor system equipped with elastomeric lead-lag dampers. The tail rotor is a semi rigid design and consists of four blades.

2.6 ENGINES

The helicopter is powered by two horizontally mounted turboshaft engines. Power is supplied to the main transmission through engine mounted nose gearboxes, shafts, and over-running clutches. The main transmission drives the main and tail rotors and accessory gearbox.

2.7 WINGS

Left and right wings are attached to the center fuselage. Each wing provides two hard points for external stores pylons with hydraulic and electrical quick-disconnects.

2.8 SPECIAL MISSION KITS

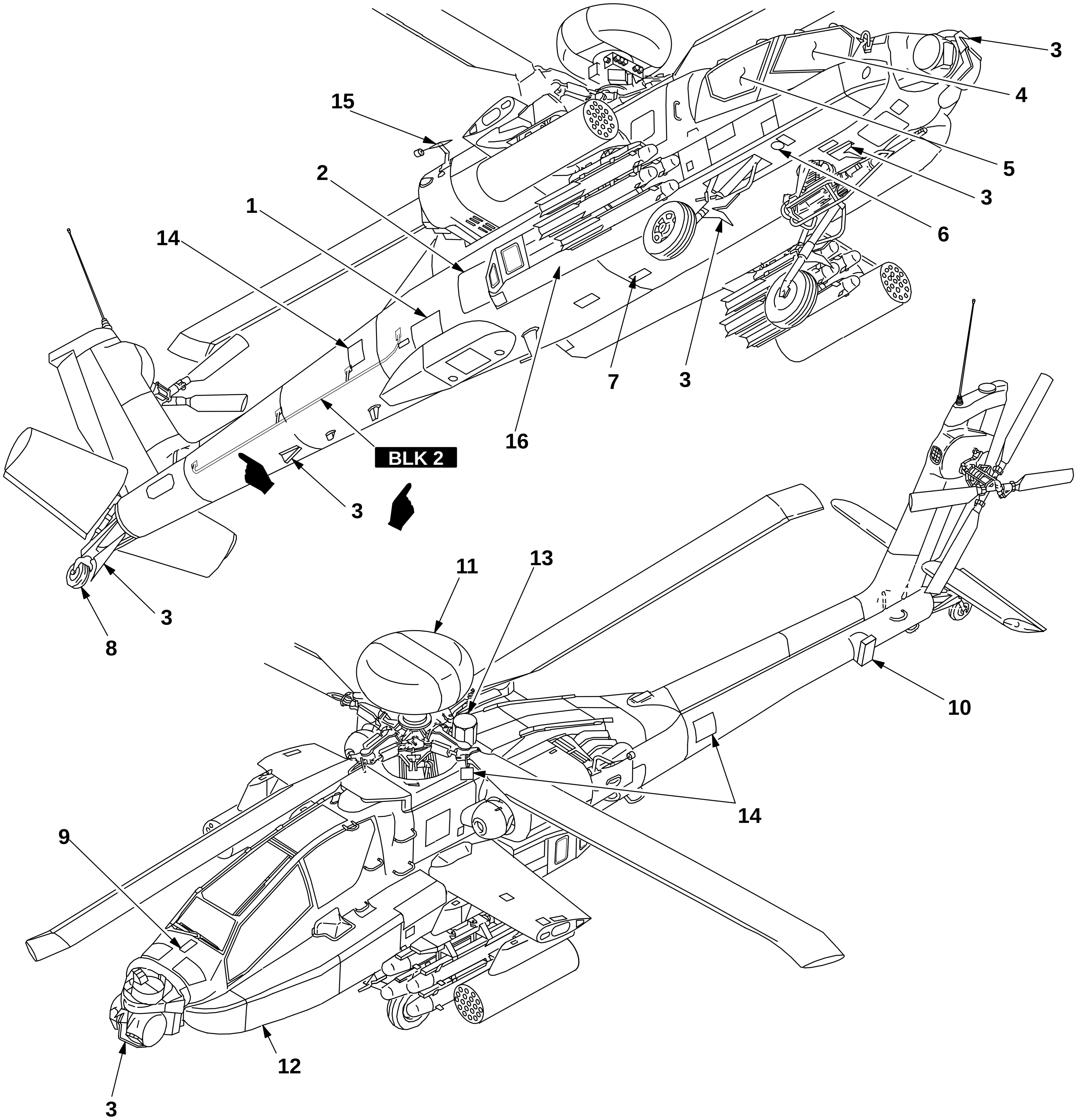
The helicopter can be equipped with a Longbow kit, infrared (IR) jammer kit, radar jammer kit, radar warning kit, laser warning kit, winterization kit, chaff kit, and extended range kit.

2.9 PRINCIPLE DIMENSIONS

Figure 2-2 illustrates principle helicopter dimensions.

2.10 TURNING RADIUS AND GROUND CLEARANCE

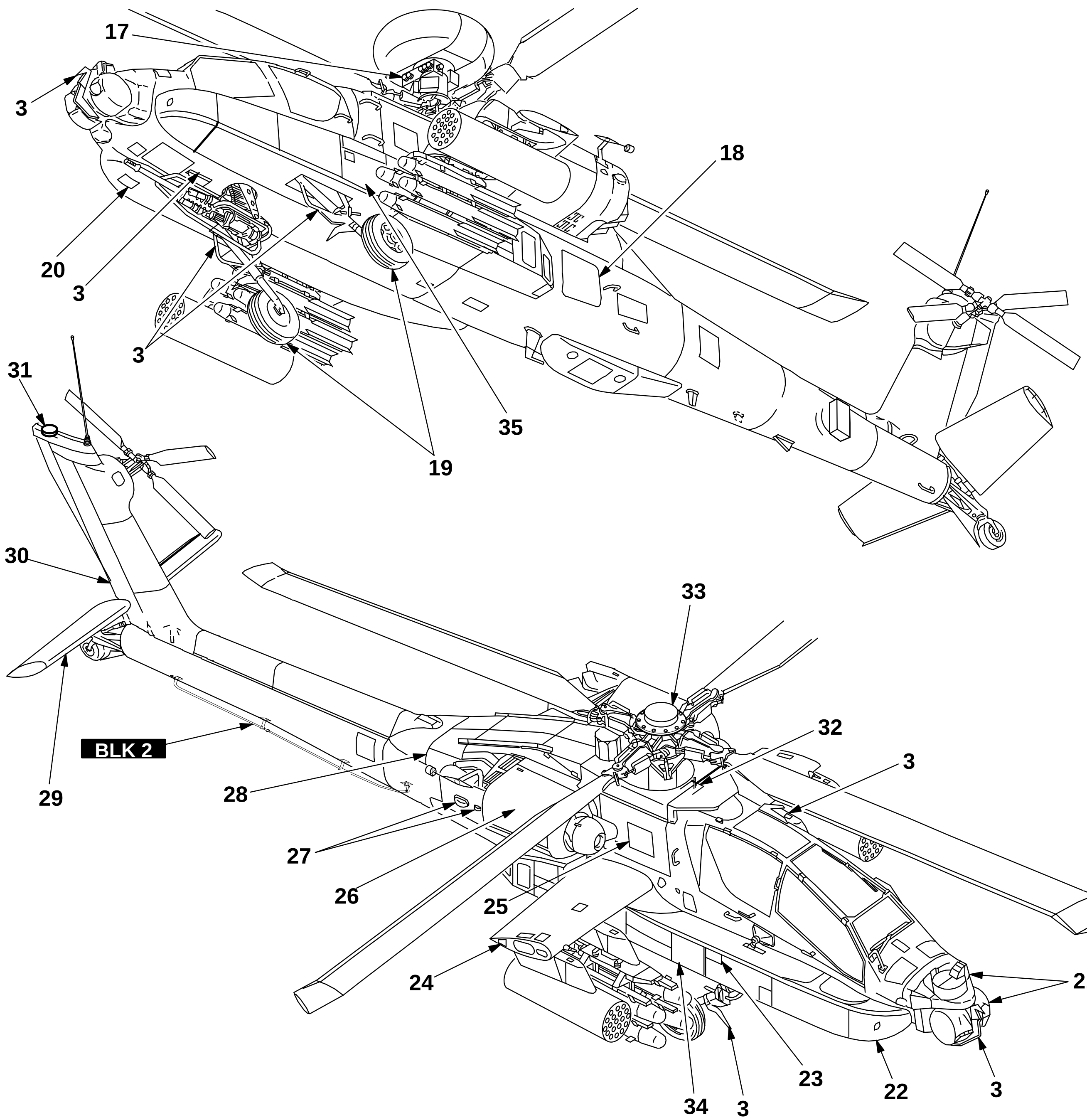
Figure 2-3 illustrates helicopter turning radius and ground clearance.



1. SURVIVAL EQUIPMENT STORAGE BAY
2. AFT AVIONICS BAY ACCESS DOOR
3. WIRE STRIKE PROTECTION SYSTEM (WSPS)
4. CPG DOOR
5. PILOT DOOR
6. SEARCHLIGHT
7. AMMUNITION BAY ACCESS DOOR
8. TAIL LANDING GEAR
9. CANOPY JETTISON HANDLE ACCESS DOOR2
10. CHAFF DISPENSER
11. MAST MOUNTED ASSEMBLY (MMA) L
12. LEFT SIDE EXTENDED FORWARD AVIONICS BAY (EFAB)
13. IR JAMMER
14. LASER WARNING SENSORS
15. AIR DATA SYSTEM (ADS) SENSOR
16. RIGHT SIDE EXTENDED FORWARD AVIONICS BAY (EFAB)

LBA0001A

Figure 2-1. General Arrangement (Sheet 1 of 2)



17. RADAR FREQUENCY INTERFEROMETER (RFI) L
18. AFT STORAGE BAY
19. MAIN LANDING GEAR
20. UTILITY LIGHT AND GROUND POWER OUTLET ACCESS DOOR
21. TADS/PNVS TURRET
22. RIGHT SIDE EFAB
23. FIRE EXTINGUISHER ACCESS DOOR
24. INTERCOMMUNICATIONS ACCESS DOOR
25. TRANSMISSION ACCESS DOOR
26. ENGINE NACELLE ASSEMBLY
27. ANTICOLLISION LIGHTS AND NAVIGATION LIGHTS
28. HYDRAULIC GROUND SERVICE PANEL ACCESS DOOR
29. HORIZONTAL STABILATOR
30. VERTICAL STABILIZER
31. GLOBAL POSITIONING SYSTEM (GPS) ANTENNA
32. ICE DETECT PROBE
33. FLAT PLATE (FCR REMOVED)
34. RIGHT FLYAWAY KIT BAY
35. LEFT FLYAWAY KIT BAY

LBA0002B

Figure 2-1. General Arrangement (Sheet 2 of 2)

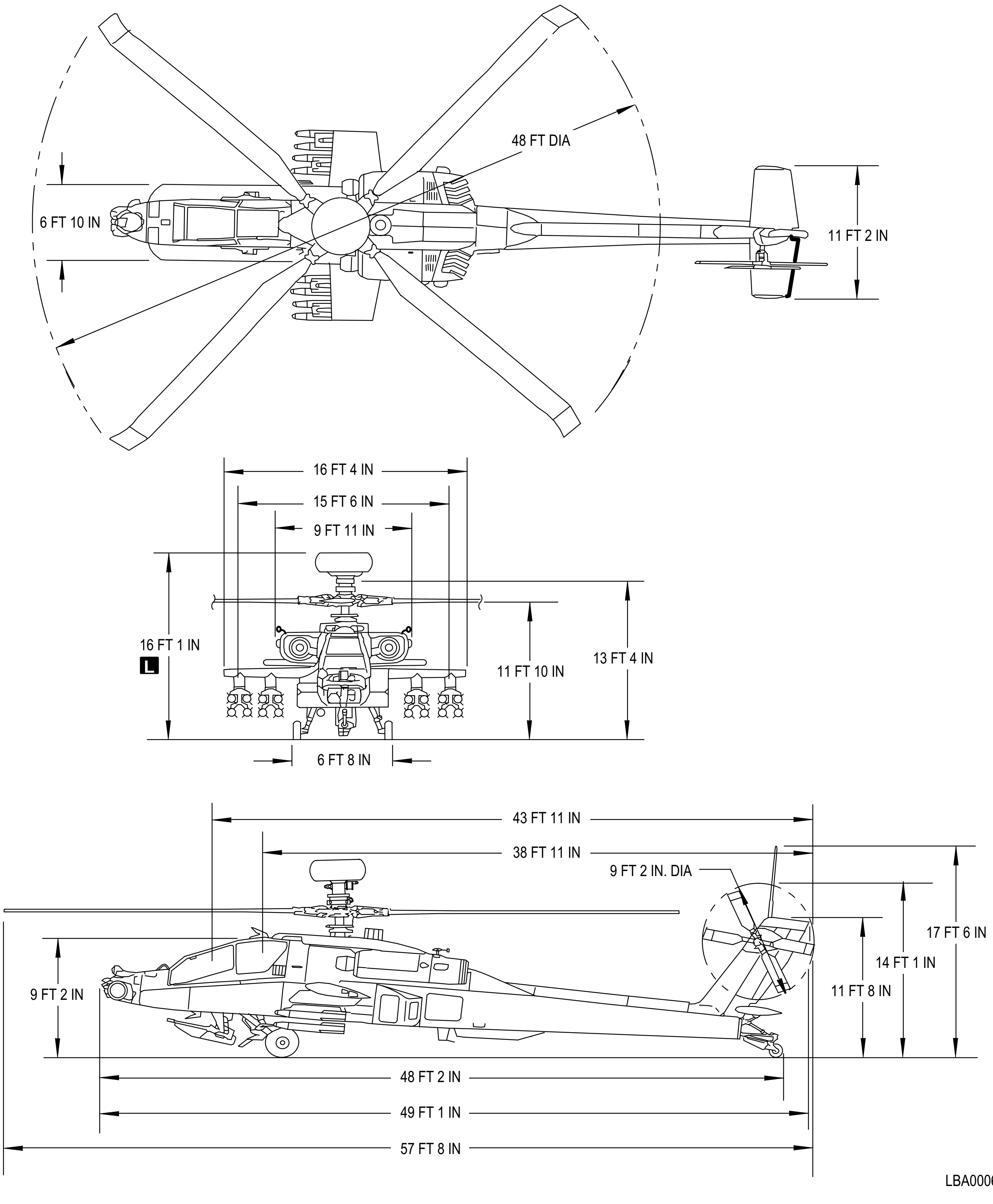


Figure 2-2. Principle Helicopter Dimensions

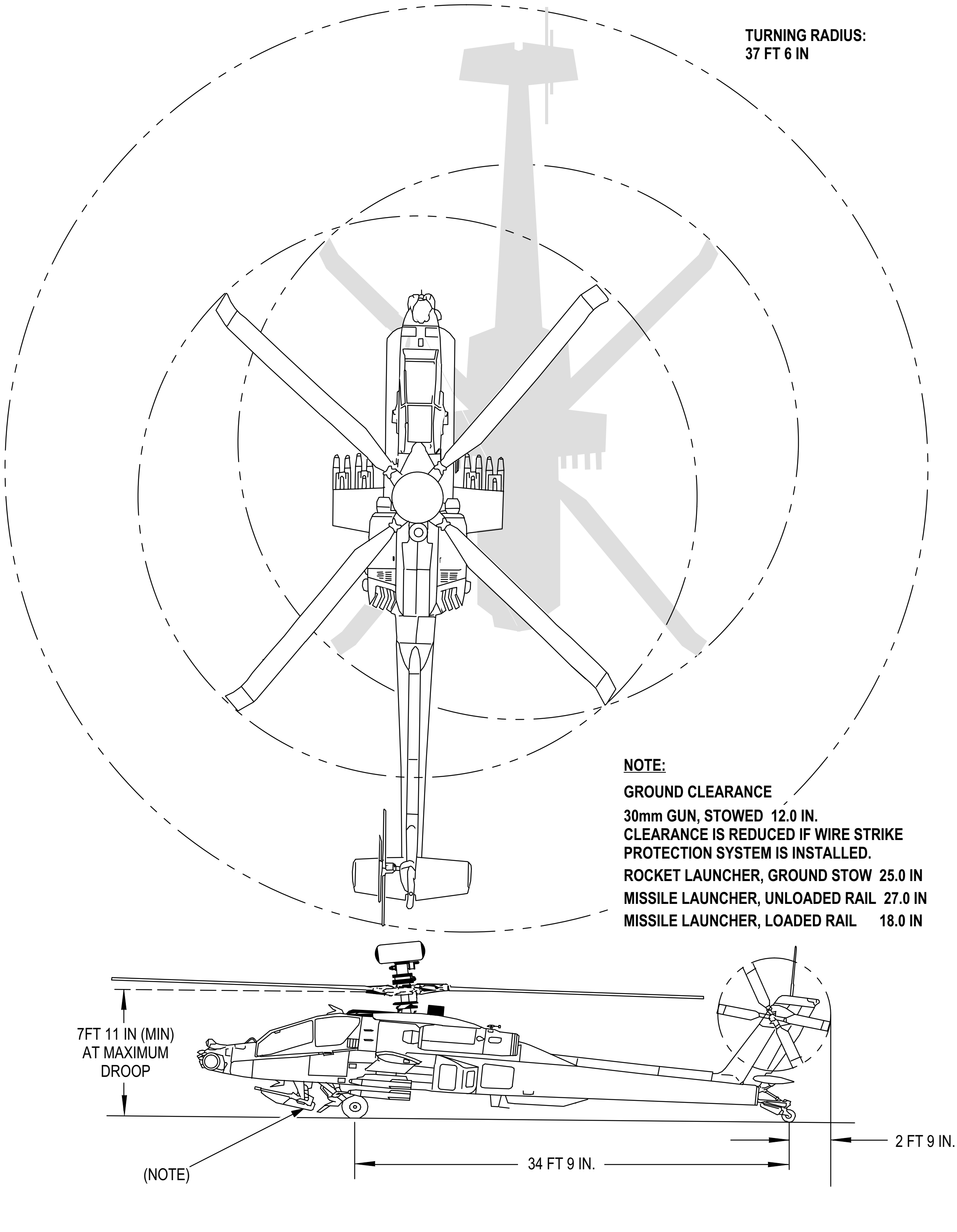


Figure 2-3. Turning Radius and Ground Clearance

2.11 DANGER AREAS

Figure 2-4 illustrates aircraft danger areas as described in the following subparagraphs:

2.11.1 Approaching Operating Aircraft. Personnel approaching an operating helicopter shall do so at a 45° angle from the front. The approach shall be made from well outside the rotor disc area until recognition is received from the pilot. The pilot will signal when closer approach is safe.

2.11.2 Tail Rotor Air Flow and Main Rotor Downwash. When the helicopter is in a hover or operating at takeoff power, the downwash and airflow may be dangerous even outside the turning radius of the helicopter.

2.11.3 Exhaust Gases. Personnel should remain clear of areas exposed to exhaust gases (i.e. helicopter engines and APU). Severe burns may result from exposure to these areas.

2.11.4 During Canopy Jettison. Acrylic fragments will be propelled up to 50 feet from the helicopter. Personnel approaching a crash damaged helicopter must look for a signal from the crew that closer approach is safe.

2.11.5 Laser. The laser must be given special safety considerations because of extreme danger involved during its operation. Relatively low laser light levels can cause permanent damage to eyes and skin burns.

2.11.6 Environmental Control System Exhaust. High temperature, high velocity air is exhausted from the rear of both EFABS. Personnel should remain clear of these exhaust areas when working on or around the helicopter.

2.11.7 [**BLK 2** **HF Radio Antenna**. Personnel should remain at least five feet away from the HF radio antenna while the radio is transmitting. High levels of electromagnetic radiation are emitted by this antenna while transmitting.]

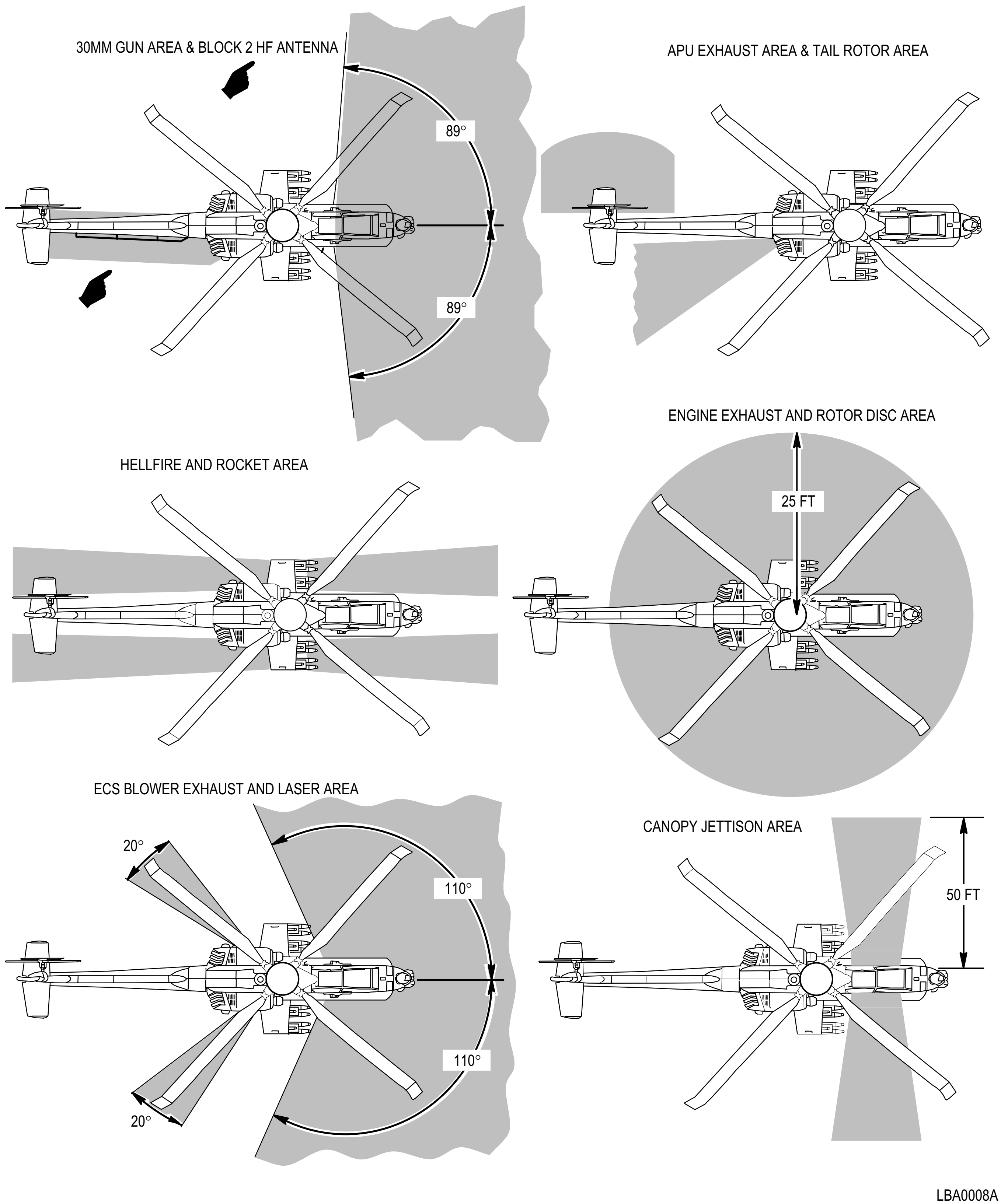


Figure 2-4. Danger Areas

2.12 CREWSTATIONS

The crewstations are arranged in tandem and are separated by a ballistic shield. The pilot station is aft of the CPG station. Handholds and steps permit the crew to enter and exit on the right side of the helicopter. A canopy covers both crew stations. The canopy frame and transparent ballistic shield form a rollover structure. Armored seats, installed in both crew stations, provide maximum survivability and minimum vulnerability.

2.13 CREWMEMBER SEATS

WARNING

Seats stroke downward during a crash, and any obstruction may increase the possibility of injury. Items shall not be placed beneath seats.

The pilot and CPG seats (fig 2-5) provide ballistic protection. They are adjustable for height only. The seats are one-piece armored seats equipped with back, seat, and lumbar support cushions. Each seat is equipped with a shoulder harness, lap belt, crotch belt, and inertial reel. The shoulder harness and belts have adjustment fittings and come together at a common attachment point. This provides a single release that can be rotated either clockwise or counterclockwise to simultaneously release the shoulder harness and all belts.

NOTE

Seat height should be adjusted to the boresight position for all flight operations. Viewing the MPD when the seat is not in the boresight position (or from outside the crewstation) can result in presentation of MPD symbol color changes, as well as reduced quality or distortion of MPD video information. The MPD viewing cone accommodates normal body movement when the seat is adjusted to the design eye position.

2.13.1 Seat Height Adjustment. Vertical seat adjustment is controlled by a lever on the right front of the seat bucket. When the lever is pulled out (sideways), the Pilot seat can be moved vertically approximately 5 inches and locked at any 5/8 inch interval, the CPG can be moved vertically approximately 3 3/4 inches and locked at any 5/8 inch interval. Springs counterbalance the weight of the seat. The lever returns to the locked position when released.

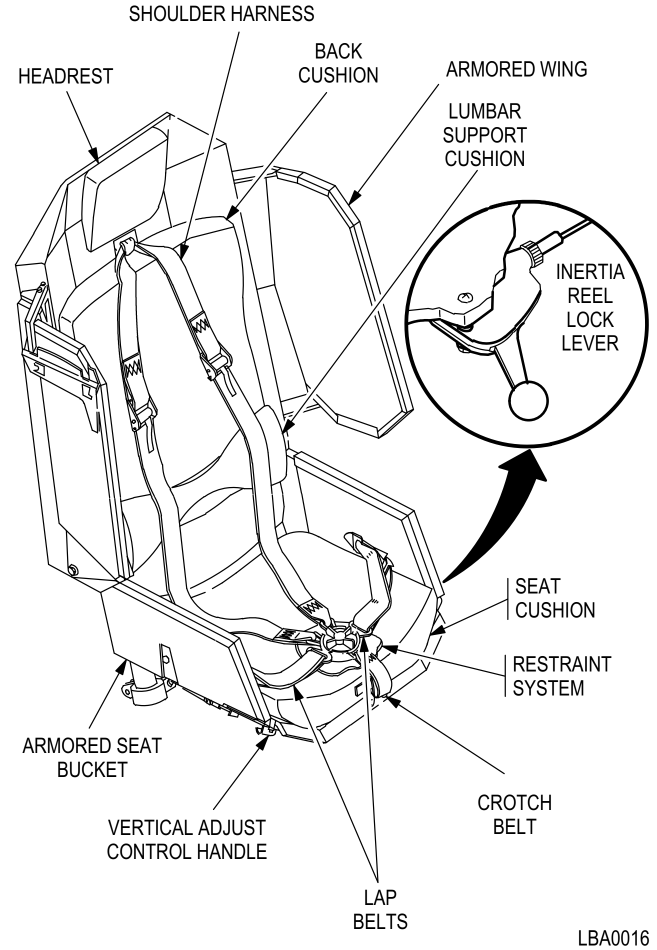
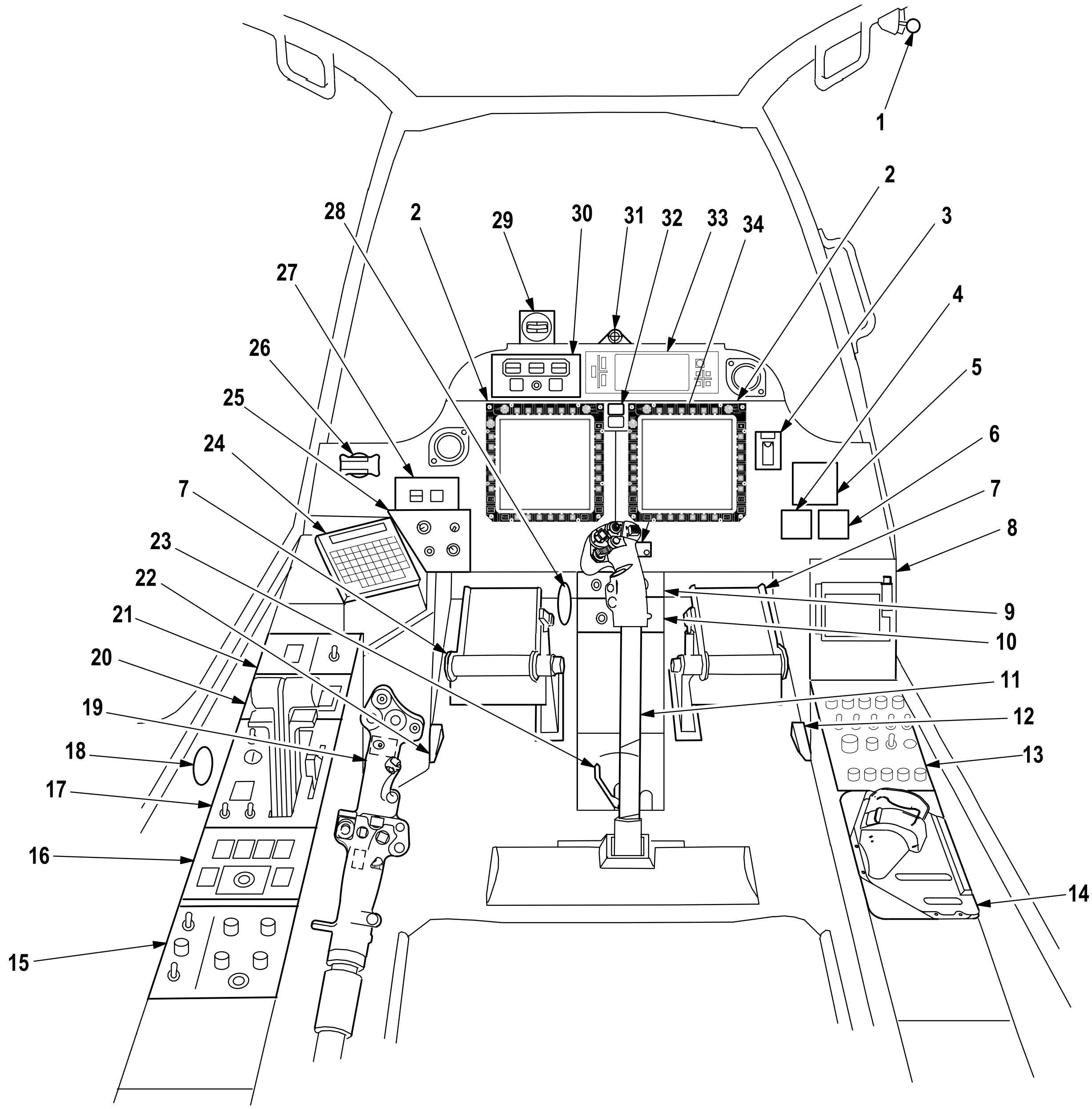


Figure 2-5. Crewmember Seat (Both Crew Stations)

2.13.2 Inertia Reel Operation. A two position shoulder harness inertia reel lock lever is installed on the left front of each seat. When the lever is in the aft position, the shoulder harness lock will engage with an acceleration of 6 Gs in any direction and/or if the webbing is exposed to an acceleration of 2-1/2 Gs or greater. In the forward position, the shoulder harness lock assembly is firmly locked. Whenever the inertia reels lock because of deceleration forces, they remain locked until the lock lever is placed in forward and then aft positions.

2.14 CONTROLS, DISPLAYS, INSTRUMENT PANELS AND CONSOLES

Figures 2-6 and 2-7 provide an overview of controls, displays, and instrumentation in both crew stations. Individual controls, displays, and instruments will be discussed with their associated systems.



1. CANOPY DOOR RELEASE LEVER
2. MULTIPURPOSE DISPLAY UNIT
3. MASTER ZEROIZE
4. AIRSPEED INDICATOR
5. ATITUDE INDICATOR
6. ALTIMETER
7. DIRECTIONAL CONTROL PEDALS
8. DATA TRANSFER INIT
9. CHECK OVERSPEED TEST/ GENERATOR RESET PANEL
10. WINDSHIELD WIPER CONTROL PANEL
11. CYCLIC STICK
12. ICS SWITCH
13. COMMUNICATIONS PANEL
14. HDU STORAGE
15. EXTERIOR/INTERIOR LIGHTING PANEL
16. STORES JETTISON PANEL
17. POWER LEVER QUADRANT
18. FREE AIR TEMPERATURE GAGE
19. COLLECTIVE STICK
20. EMERGENCY PANEL
21. TAIL WHEEL LOCK/ NVS MODE PANEL
22. PUSHTOTALK (PTT) SWITCH
23. PEDAL ADJUST LEVER
24. KEYBOARD UNIT
25. VIDEO PANEL
26. CANOPY JETTISON HANDLE
27. ARMAMENT PANEL
28. PARKING BRAKE HANDLE
29. STANDBY COMPASS
30. FIRE DETECTION/ EXTENGUISHING PANEL
31. BORESIGHT RETICLE UNIT
32. MASTER WARNING/ MASTER CAUTION LIGHTED PUSHBUTTONS
33. ENHANCED UP FRONT DISPLAY
34. RADIO CALL PLACARD

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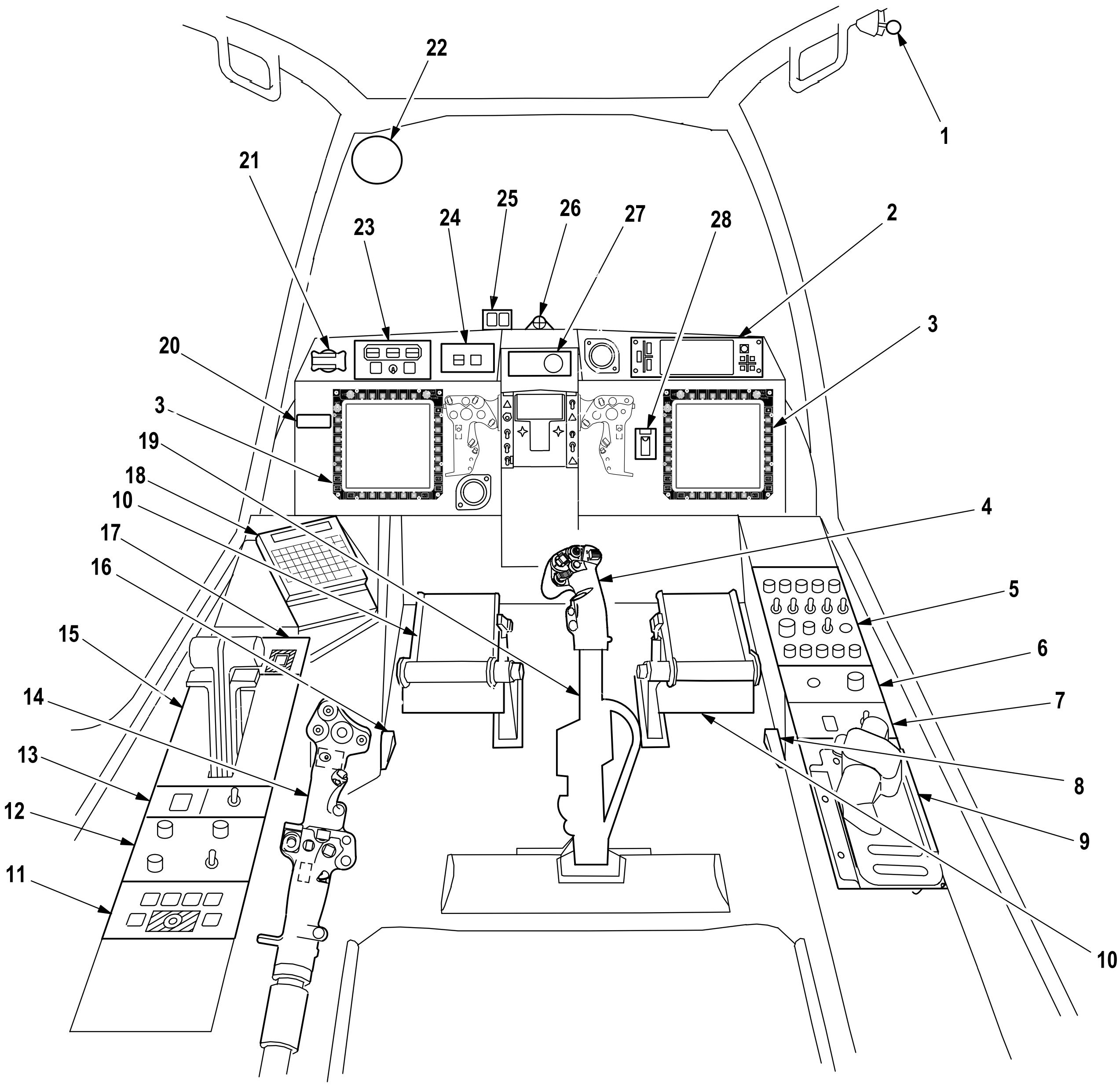
Figure 2-6A. [BLK 2 Pilot Station Diagram]



1. CANOPY DOOR RELEASE
2. ENHANCED UP FRONT DISPLAY
3. MULTIPURPOSE DISPLAY
4. CYCLIC STICK
5. COMMUNICATIONS PANEL
6. WINDSHIELD WIPER CONTROL PANEL
7. PROCESSOR SELECT PANEL
8. ICS SWITCH
9. HDU STORAGE
10. DIRECTIONAL CONTROL PEDALS
11. STORES JETTISON PANEL
12. INTERIOR LIGHTING CONTROL PANEL
13. TAIL WHEEL LOCK/NVS MODE PANEL
14. COLLECTIVE STICK
15. POWER LEVER QUADRANT
16. PUSHTOTALK (PTT) SWITCH
17. EMERGENCY PANEL
18. KEYBOARD UNIT
19. PEDAL ADJUST LEVER
20. RADIO CALL PLACARD
21. CANOPY JETTISON HANDLE
22. REAR VIEW MIRROR
23. FIRE DETECTION/EXTINGUISHING PANEL
24. ARMAMENT PANEL
25. MASTER WARNING/MASTER CAUTION LIGHTED PUSHBUTTONS
26. BORESIGHT RETICLE UNIT
27. OPTICAL RELAY TUBE
28. MASTER ZEROIZE

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Figure 2-7A. [BLK 2 CPG Station Diagram]

2.15 MAIN LANDING GEAR

Each main landing gear support consists of a trailing arm and a nitrogen/oil shock strut. The trailing arms transfer the helicopter landing and static loads to the airframe, and the shock struts absorb vertical loads. The upper ends of the left and right trailing arms attach to a cross tube which passes through the fuselage and is supported by fuselage anchored pivot bearings. The upper ends of the shock struts are attached to mounts on the fuselage structure. In addition to its normal energy absorbing function, each shock strut has a one time high impact absorbing feature. Its shear rings are sheared and a rupture disc bursts causing a controlled collapse of the strut.

2.16 TAIL LANDING GEAR

The tail landing gear consists of two trailing arms, nitrogen/oil shock strut, fork, axle, and wheel. The shock strut has an impact absorbing capability similar to that of the main landing gear shock strut. The tail wheel is 360° free swiveling for taxiing and ground handling. The tail landing gear system incorporates a spring loaded tail wheel lock. The tail landing gear is hydraulically unlocked from the crew station or manually locked/unlocked by a ground crew using a handle attached to the actuator. The tail wheel unlock system is actuated by hydraulic pressure from the utility hydraulic system. Pressure is routed to the actuator through a control valve located in the tail boom. The valve is controlled by lock/unlock switches on the **TAIL WHEEL** panel and collective flight control grip (fig 2-8). The tail wheel lock/unlock switches are alternate action pushbutton switches. Pressing a switch energizes the unlock actuator and retracts the locking pin. On the **TAIL WHEEL** panel, the pushbutton illuminates to indicate **UNLOCK.** Pressing a pushbutton again de-energizes the unlock actuator and allows spring force to insert the lock pin when the tail wheel is aligned to center position (the **UNLOCK** pushbutton light will be extinguished). When the aircraft is on the ground, an advisory message is displayed on the UFD/EUFD to indicate the commanded state of the switch: **T/W UNLK SEL** or **T/W LOCK SEL**. Switch annunciation and system status is simultaneous in both crew stations. If the tail wheel is unlocked manually, it can be locked from the either crewstation by pressing a tail wheel lock/unlock switch. The tail wheel is locked to:

- Absorb rotor torque reaction during rotor brake operation.
- Prevent shimmy during rolling takeoffs and landings.
- Prevent swivel during ground operation in high winds.
- Prevent swivel during operation on slopes.

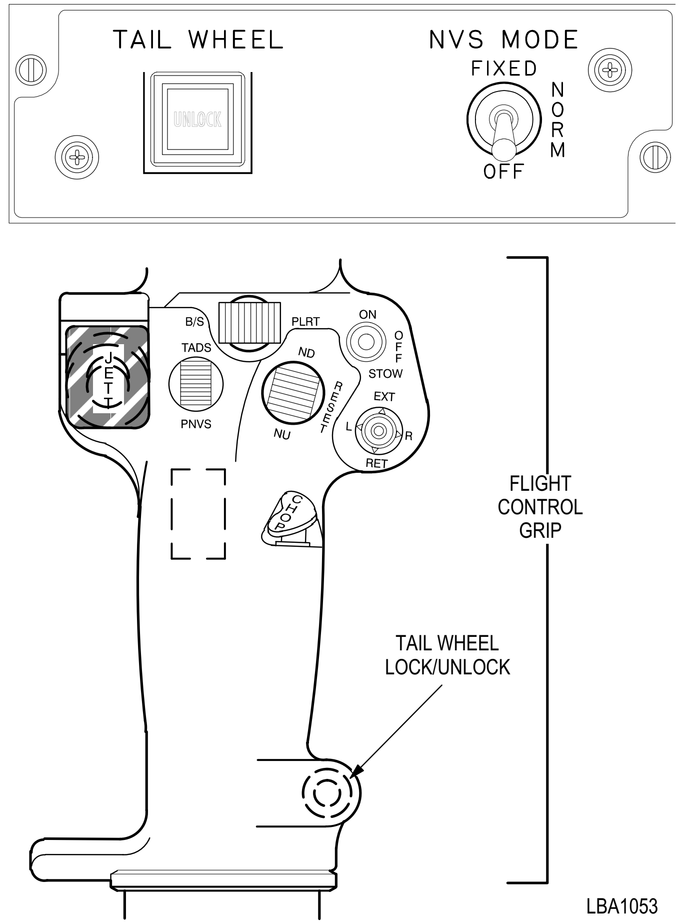


Figure 2-8. Tail Wheel Lock/Unlock Switches

2.17 LANDING GEAR BRAKES

The brake system affects only the main landing gear wheels. The main landing gear system consists of two independent hydromechanical systems, one left and one right. Braking action is initiated from either station by applying foot pressure at the top portion of the directional control pedals. This activates a master cylinder attached to each brake pedal. The master cylinders pressurize hydraulic fluid in the master cylinder system components. This pressure is transmitted through tubing to the transfer valves, and the parking brake valve, to the wheel brake assemblies. It actuates pistons in each wheel brake assembly causing friction linings to move against a floating brake disk to stop wheel rotation. When the helicopter is parked, the pilot or CPG applies and maintains pressure on the brakes until the **PARK BRAKE** handle can be pulled out by the pilot to set the parking brakes. When the brake pressure is released, the handle can be released. If the handle remains out, the parking brakes should be set.

If the **PARK BRAKE** handle (fig 2-6) is pulled out without pressure applied to the brake pedals, the **PARK BRAKE** handle may remain out but the brakes will not be set. Hydraulic pressure is maintained in the system by the compensator valves mounted on the parking brake valve. Either station can release the parking brake by exerting pressure at the top of the directional control pedals.

2.18 WINDSHIELD AND CANOPY

The windshield consists of two heated, laminated glass windshields. One is directly forward of the CPG; the other is directly above his head. The canopy consists of five acrylic panels: two on each side of the crew stations and one directly above the pilot. The two canopy panels on the right side are independently hinged. They latch and unlatch separately by interior and exterior handles. They swing upward and outward to provide entrance to, and exit from, the pilot/CPG crew stations. Failure to properly close either canopy will cause an advisory message to appear on the Up Front Display (UFD)/Enhanced Up Front Display (EUFD). The two canopy panels on the left side are fixed and do not open. Refer to Section II of this chapter for information about the canopy jettison system.

2.19 MIL-STD-1553B MULTIPLEX (MUX) BUSES

MIL-STD-1553B MUX bus channels are employed for transfer of data between the various elements of the avionics system. Each channel is redundant, for failure and damage tolerance, and consists of a primary and secondary bus routed separately within the aircraft. MIL-STD-1553B specifies a one megabit per second, serial, command/response, multi-access data bus which uses a bus controller, remote terminal command/response protocol. Figure 2-9 depicts the MUX bus architecture showing how the avionics components are connected to the MUX channels. The redundant System, Weapon, and Display Processors are each connected to two bus channels to facilitate control, monitoring, communications, and processing functions. The avionics are connected to the MUX buses in a manner which assigns related equipment to a common bus.

2.19.1 Channel 1. The primary System Processor (SP) serves as the bus controller for Channel 1. The secondary SP monitors the bus traffic to maintain coordination with the primary SP such that in the event of a failure the secondary SP can take over as the primary. Channel 1 is used to integrate the communications, electrical, keyboard, and display systems.

2.19.2 Channel 2. The primary SP also serves as the bus controller for Channel 2 which integrates the navigation and flight control equipment, as well as the Radar Warning Receiver and Data Transfer Unit. In addition, the Weapon Processors (WPs) and Display Processors (DPs) are remote terminals on Channel 2 which allows data transfer between the SP, DP, and WP.

2.19.3 Channel 3. The primary WP serves as the bus controller for Channel 3. The secondary WP monitors the bus traffic to maintain coordination with the primary WP such that in the event of a failure the secondary WP can take over as primary. Channel 3 integrates the weapons and sight subsystems.

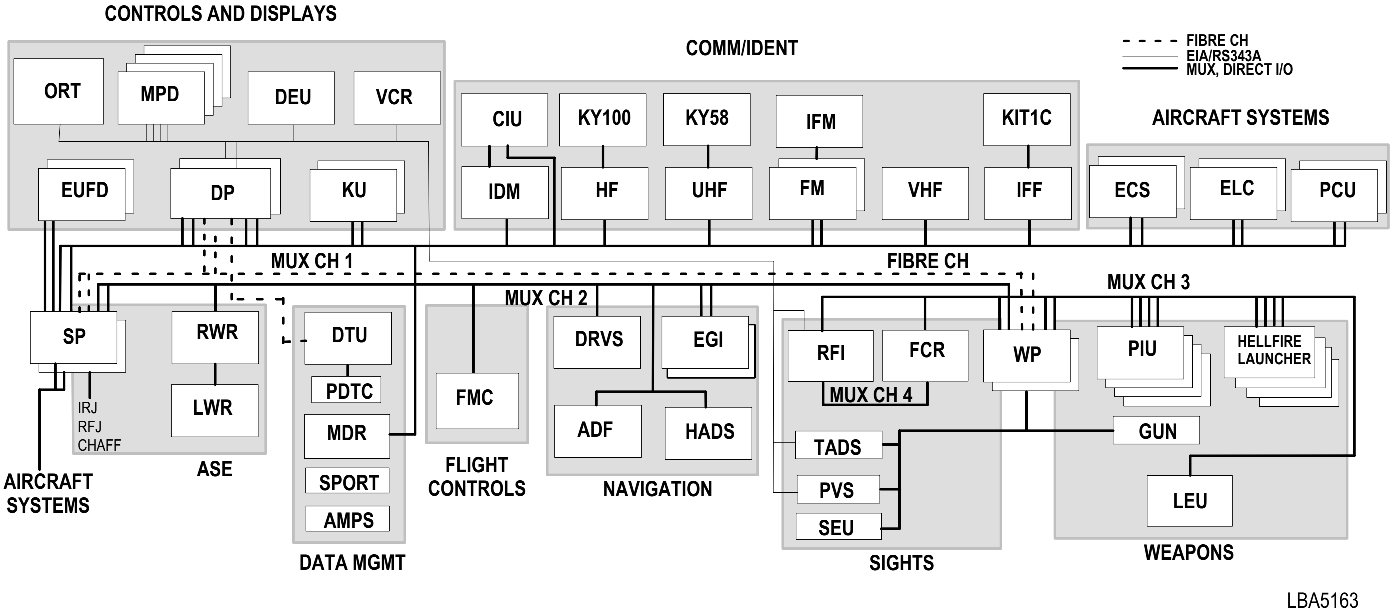
2.19.4 Channel 4. Channel 4 is dedicated to data transfer between the Fire Control Radar related equipment, including the Radar Frequency Interferometer.

2.19A [BLK 2 FIBRE CHANNEL BUSES]

The fibre channel buses are employed for transfer of data (especially large files) between the various elements of the avionics system. Each bus is redundant, for failure and damage tolerance, and consists of a primary and secondary bus routed separately within the aircraft. Figure 2-9 depicts the Fibre Channel bus architecture showing how the avionics components are connected to the Fibre channels.

2.19A.1 Fibre Channel Data Bus Loop. The System, Weapon, and Display processors are connected to this fibre channel bus. This fibre channel bus is used to pass information between the processors. This fibre channel bus can transmit 320 megabits per second. The processors are connected in an arbitrated loop fashion. The primary System Processor (SP) coordinates all message traffic and is used as the pass through for messages between the Display Processors. The mux bus connection must be established before that processor can use the fibre channel bus.

2.19A.2 DP/DTU Point to Point Fibre Channel Data Bus. Each Display Processor (DP) has a fibre channel connection with the Data Transfer Unit (DTU). This fibre channel bus is used to pass data to and from the DTU. This fibre channel bus can transmit 1024 megabits per second (but may be limited by the transfer rate of the specific DTC). Mission data files are uploaded from one of the DPs and passed to the appropriate processor over the fibre channel data bus loop. Mission files are downloaded to the DTU in a similar fashion. Map data files are uploaded independently for each DP.



LEGEND

ADF	AUTOMATIC DIRECTION FINDER	KIT1C	KIT1C ENCRYPTOR/DECRYPTOR DEVICE
ASE	AIRCRAFT SURVIVABILITY EQUIPMENT	KU	KEYBOARD UNIT
AMPS	AVIATION MISSION PLANNING STATION	KY100	KY100 ENCRYPTOR/DECRYPTOR DEVICE
CIU	COMMUNICATIONS INTERFACE UNIT	KY58	KY58 ENCRYPTOR/DECRYPTOR DEVICE
DEU	DISPLAY ELECTRONICS UNIT	LEU	LASER ELECTRONIC UNIT
DP	DISPLAY PROCESSOR	LWR	LASER WARNING RECEIVER
DRVS	DOPPLER RADAR VELOCITY SENSOR	MDR	MAINTENANCE DATA RECORDER
DTU	DATA TRANSFER UNIT	MPD	MULTIPURPOSE DISPLAY
ECS	ENVIRONMENTAL CONTROL SYSTEM	ORT	OPTICAL RELAY TUBE
EGI	EMBEDDED GPS/INERTIAL NAVIGATION UNIT	PDTC	PCMICA DATA TRANSFER CARTRIDGE
ELC	ELECTRICAL LOAD CONTROLLER	PCU	POWER CONTROL UNIT
EUFD	ENHANCED UP FRONT DISPLAY	PIU	PYLON INTERFACE UNIT
FCR	FIRE CONTROL RADAR L	PNVS	PILOT NIGHT VISION SENSOR
FM	ARC201D RADIO	RFI	RADAR FREQUENCY INTERFEROMETER L
FMC	FLIGHT MANAGEMENT COMPUTER	SEU	SIGHT ELECTRONICS UNIT
GUN	30MM AREA WEAPON SYSTEM	SP	SYSTEM PROCESSOR
HADS	HELICOPTER AIR DATA SYSTEM	SPORT	SOLDIER PORTABLE ONSYSTEM REPAIR TOOL
HF	ARC220 RADIO	TADS	TARGET ACQUISITION AND DESIGNATION SIGHT
IDM	IMPROVED DATA MODEM	UHF	ARC164 RADIO
IFF	IDENTIFICATION FRIEND OR FOE	VCR	VIDEO CASSETTE RECORDER
IFM	IMPROVED FREQUENCY MODULATION	VHF	ARC186 RADIO
IRJ	INFRARED JAMMER	WP	WEAPON PROCESSOR

Figure 2-9A. [BLK 2 Mission Equipment Package Architecture]

2.20 MULTIPURPOSE DISPLAY (MPD)

The MPD (fig 2-10) provides the capability for controlling most of the avionics systems, and serves as the primary targeting display for the FCR. The MPD allows a crewmember to customize the way he monitors aircraft and weapon systems during a mission. The MPD is a color active matrix liquid crystal display (AMLCD) which presents raster video images provided by the Display Processor (DP). The MPD is an interactive display through which systems can be controlled via bezel buttons or the remotely located cursor controllers. There are two MPDs in each crew station and they are supported by the AC power bus. MPD interfaces with aircraft subsystems are described in the applicable sections of this manual. The reference designators shown in figure 2-10; T1 - T6, L1 - L6, R1 - R6, and B1 - B6 are used throughout this manual to identify the respective MPD bezel button locations. B1 bezel button will always be the menu button.

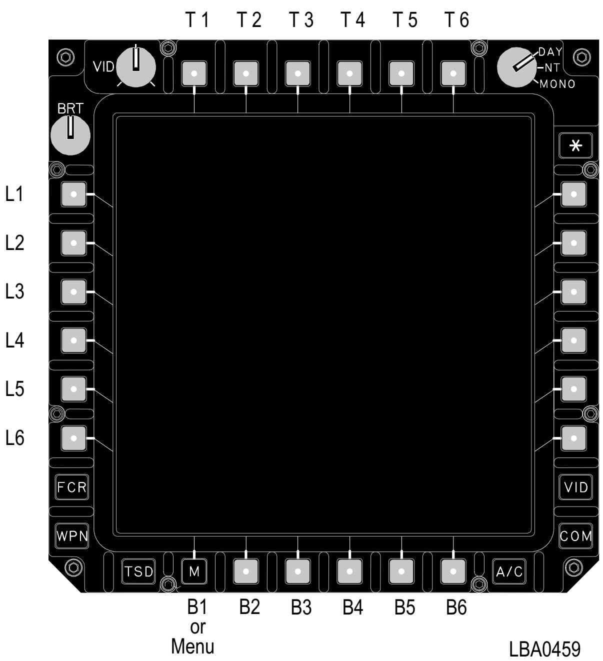


Figure 2-10. Multipurpose Display

2.20.1 Eyewear Restrictions. MPDs emit polarized light. Polarized sunglasses should not be worn by the operator, because they could make the display appear black. Sunglasses which preferentially block certain colors (such as yellow or green tint glasses) should not be used. Neutral density gray sunglasses are compatible with color displays. The MPDs are compatible with glasses and visors which protect against the aircraft's own laser. However, use of other laser protective visors should not be attempted until their compatibility with all MPD format colors has been established.

2.20.2 Cleaning Restrictions. The MPDs should be cleaned with a clean cotton cloth and alcohol. Ammonia-based cleaners shall not be used.

2.20.3 Response To Touch. The MPDs will feel warm to the touch during normal, proper operation. Crewmember touches will result in localized cooling of the glass, and a color fingerprint at the location of the touch for a very short time. This does not indicate that the displays are delicate, damaged, or easily damaged. The display surface is not soft. The displays will not be damaged by routine handling.

2.20.4 Screen Save Mode. During ground operations on external power with the throttles in the **OFF** position, the displays will enter a screen save mode in which the display backlight extinguishes if no button presses have been received within 5 minutes. The display can be brought out of screen save mode by selecting any button on either display in that crewstation. Cursor and knob operations will also interrupt the screen save mode.

2.20.5 MPD Viewability Controls. Each MPD has independent controls for adjustment of display image quality. Brightness (**BRT**), Video Enhancement (**VID**), and **DAY/NIGHT/MONO** selections are provided. Brightness is controlled locally by the MPD and is therefore unaffected by single DP operations. The remaining functions are impacted by single DP operations, as described below.

a. Brightness (BRT) Control. The **BRT** control varies the intensity of the display video and symbology. The brightness range available is affected by the **DAY/NIGHT/MONO** control selection.

b. Video Enhancement (VID) Control.

[**BLK 2** When displaying a map underlay (on the **TSD** page), the **VID** knob controls the amount of attenuation on the underlay. The attenuation allows for better visual separation of the stick map symbols from the map underlay. Leaving the **VID** knob in the center detent position provides about 50% attenuation. Rotating the knob clockwise decreases the attenuation (brightens the map underlay) to 0%. Rotating the knob counterclockwise increases the attenuation to 100%.]

c. DAY/NIGHT/MONO Control. The **DAY/NIGHT/MONO** control varies the operating range of the **BRT** controls and the color mode. **DAY** operations provide MPD white or green video and color symbols which can be used from bright daytime ambient conditions to dim twilight ambient conditions. **NIGHT** operations provide MPD white and green video and color symbols which can be used from completely dark to dimly lit or nighttime ambient conditions **MONO** operations provide green video and symbols which can be used from completely dark to dimly lit ambient or nighttime conditions. The **NIGHT** and **MONO** modes provide an expanded lower dimming range to allow fine adjustment to accommodate various nighttime ambient and dark adaptation conditions. Backlight brightness control for **DAY/NIGHT/MONO** knob is not impacted by single DP operation. However, color is impacted by single DP operation. If either MPD is set to **MONO**, only green symbols and video will be available for that MPD set. Otherwise, color symbols and white or green video will be available for that MPD set.

2.20.6 MPD Bezel Pushbutton Controls. The MPD provides pushbuttons on the bezel perimeter used to select the page presented on the MPD, or to make selections or commands specified by the adjacent display text label.

2.20.7 MPD Button Control Affect. MPD bezel pushbutton control selections may have an aircraft/system wide affect, a crew station only affect, or a MPD only affect. For example, changes to the fuel system controls affect the entire fuel system (aircraft), and controls/displays in both crew stations. However, changing the map scale on the **TSD** page affects only the control and display of the map scale within that crew station on both MPDs. Controls having an aircraft affect are referred to as common to both crew stations. Controls having a crew station affect are referred to as independent in each crew station. Page button selections have only a MPD affect. The page change is reflected only on the MPD where the page pushbutton is selected.

2.20.8 Interrupting a Process. If an MPD bezel pushbutton is pressed to start a process, pressing an unrelated MPD bezel button will abort the original process and the new selection process is accepted. For example, if a data entry button is pressed, setting the KU for data entry, and an unrelated MPD bezel pushbutton is selected, the data entry process is aborted and the new selection is accepted.

a. Page Pushbuttons. Page pushbuttons (fig 2-11) are used to select the desired page on the MPD.

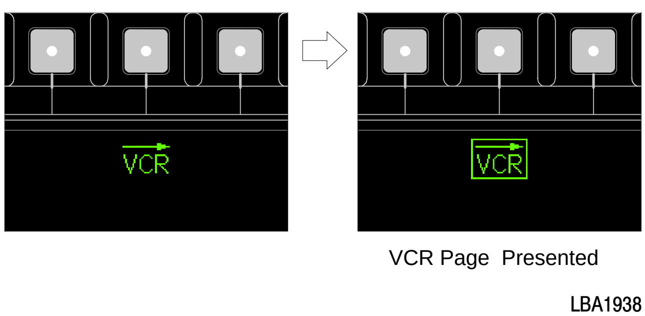


Figure 2-11. Page Pushbutton Operation

b. Maintained Pushbuttons. Maintained pushbuttons (fig 2-12) are used to set hardware or operating modes.

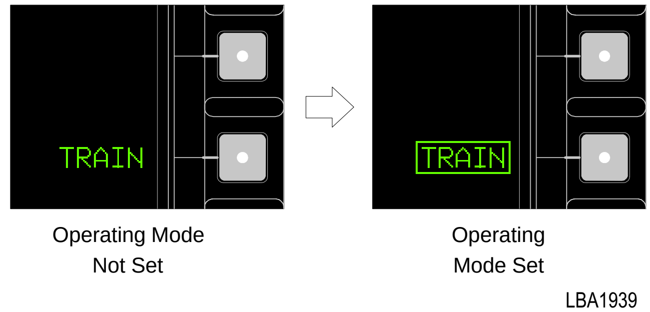


Figure 2-12. Maintained Pushbutton Operation

c. Momentary Pushbuttons. Momentary pushbuttons (fig 2-13) command the aircraft systems to perform the action described by the text label.

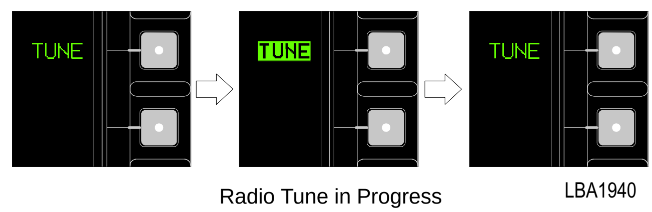


Figure 2-13. Momentary Pushbutton Operations

(1) On/Off Pushbuttons. On/Off pushbuttons (fig 2-14) command hardware to be powered on or off, or to turn operating modes on or off.

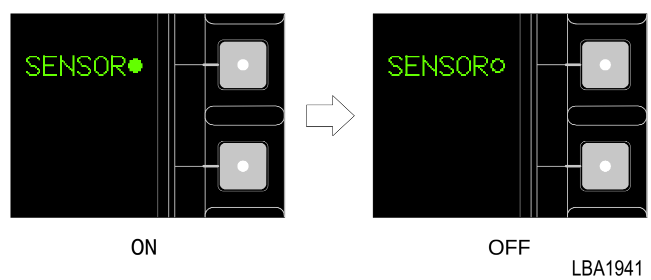


Figure 2-14. On/Off Pushbutton Operation

(2) Two State Pushbuttons. Two state pushbuttons (fig 2-15) are used to toggle hardware or operating modes between one of two states.

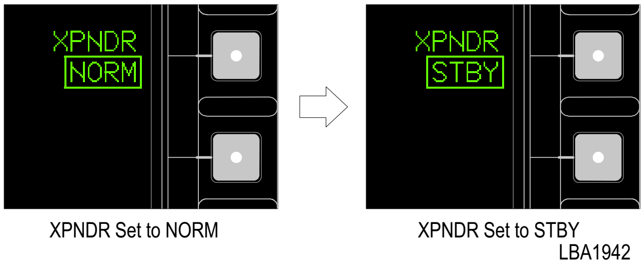


Figure 2-15. Two State Pushbutton Operation

(3) Grouped and Multi-State Option Pushbuttons. Grouped and Multi-state option pushbuttons (figs 2-16 and 2-17) are used to select the desired state of a system or operating mode when there are three or more options.

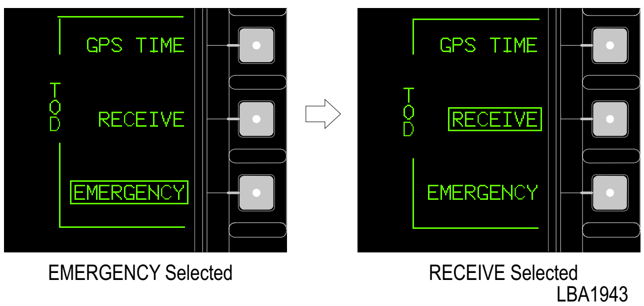


Figure 2-16. Grouped Option Pushbutton Operation

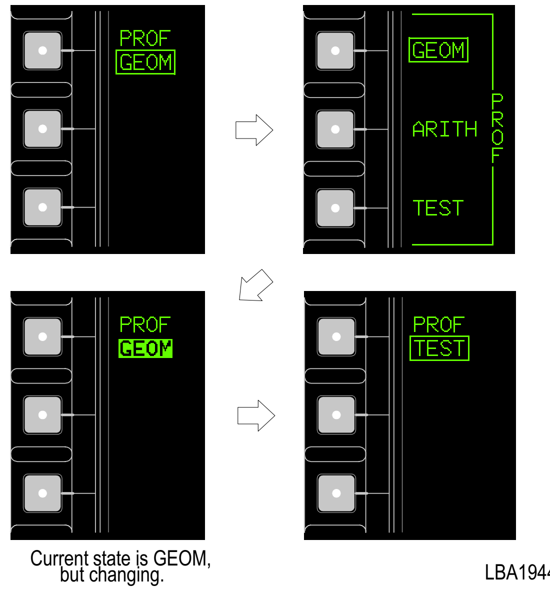


Figure 2-17. Multi-State Pushbutton Operation

(4) Data Entry Pushbuttons. Data entry pushbuttons (fig 2-18) are used to enter alphanumeric and special character data entry using the Keyboard Unit (KU).

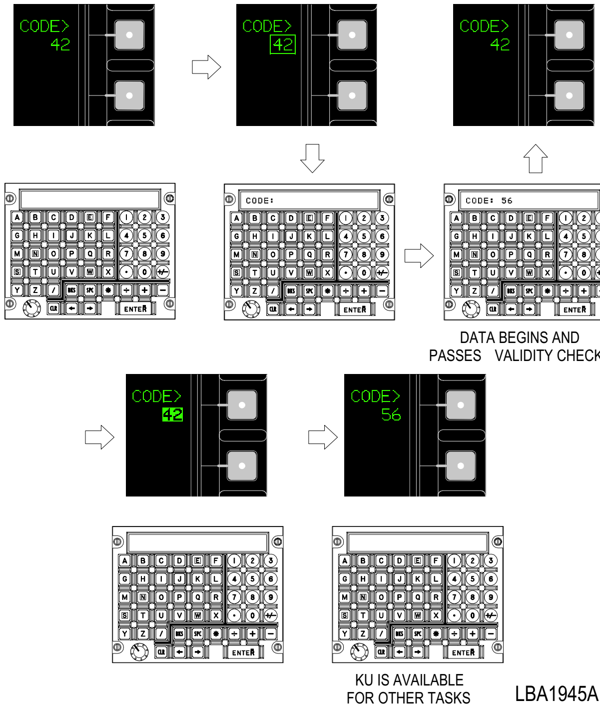


Figure 2-18. Data Entry Pushbutton Operation

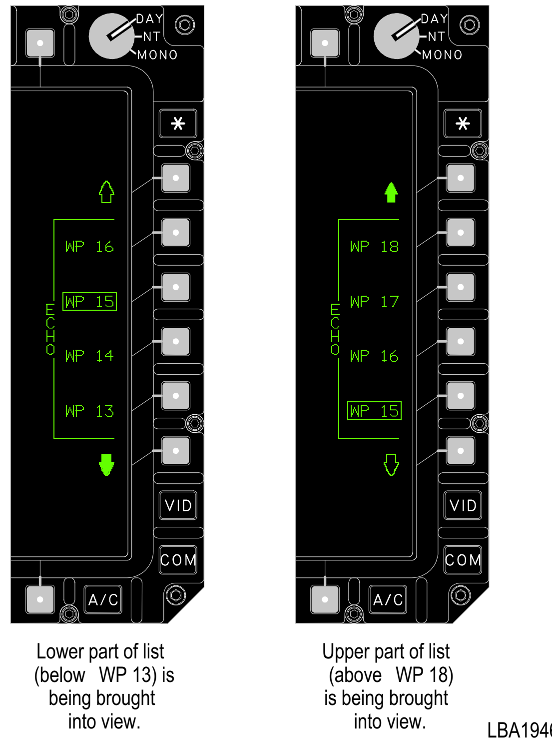


Figure 2-19. Search Pushbutton Operation

(5) Search Pushbuttons. Search pushbuttons (fig 2-19) are used to scroll through lists of buttons or to move graphics up or down.

(6) Paging List Pushbuttons. Paging list pushbuttons (fig 2-20) are used to select previous (left) and next (right) pages.

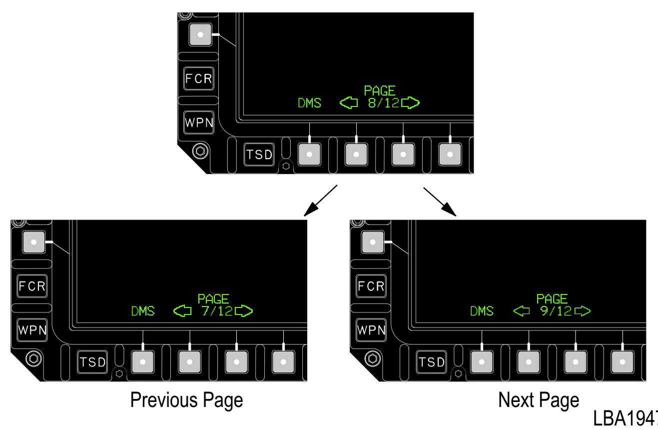


Figure 2-20. Paging List Pushbutton Operation

2.21 MPD PAGES

MPD pages are selectable by actioning variable action bezel page buttons, fixed action buttons (**FCR**, **WPN**, **TSD**, **A/C**, **COM**, or **VID**), or the Menu (**M**) button. Most MPD formats and their component controls operate independently. The same page may be presented on more than one MPD in the same crew station, or on one MPD in each crew station.

2.21.1 Subsystem Organization and the Menu Page.

All aircraft top-level pages can be accessed via the MPD through the Menu page

[BLK 2 2-21A]). The Menu page is accessed by selecting the **M** bezel button on the MPD. The top level format presented on that MPD is the format selected by the Menu page or subsystem button (**FCR**, **WPN**, **TSD**, **A/C**, **COM**, or **VID**). The top level format label is presented over the **M** button. Double actioning the menu button will call up the **DMS** page from any other page (except the Menu page).

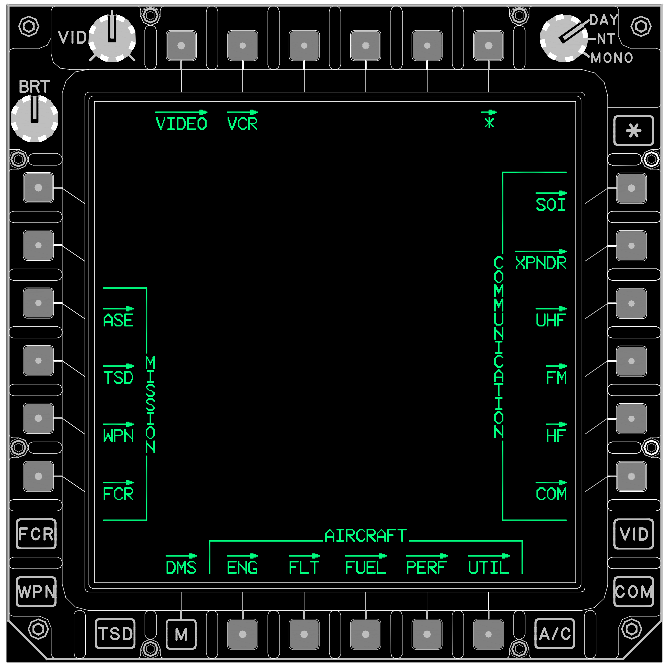


Figure 2-21A. [BLK 2 Menu Page]

- T1 **VIDEO** page button
- T2 **VCR** page button
- T6 [BLK 2 * page button]
- L3 **MISSION ASE** page button
- L4 **MISSION TSD** page button
- L5 **MISSION WPN** page button
- L6 **MISSION FCR** page button
- R1 [BLK 2 **COMMUNICATION SOI** page button]
- R2 [BLK 2 **COMMUNICATION XPNDR** page button]
- R3 [BLK 2 **COMMUNICATION UHF** page button]
- R4 [BLK 2 **COMMUNICATION FM** page button]

- R5 [BLK 2 **COMMUNICATION HF** page button]
- R6 [BLK 2 **COMMUNICATION COM** page button]
- B1 **DMS** page button
- B2 **AIRCRAFT ENG** page button
- B3 **AIRCRAFT FLT** page button
- B4 **AIRCRAFT FUEL** page button
- B5 **AIRCRAFT PERF** page button
- B6 **AIRCRAFT UTIL** page button

The top-level pages for the Fire Control Radar **FCR**, Weapons **WPN**, Tactical Situation Display **TSD**, Aircraft **A/C**, Communications **COM**, and Video **VID** controls can also be accessed directly through their respective subsystem buttons. The **DMS** top level page is accessible from any other page by double action of the Menu button.

a. VIDEO button. The **VIDEO** button (para 4.54.1) provides access to real-time display of sensor video controls.

b. VCR button. The **VCR** button (para 4.54) provides access to Video Cassette Recorder (VCR) controls, including on-board recording and tape playback.

c1. [BLK 2 **Asterisk (*) button.** The ***** button (para 2.21.3A) provides access setup to the * fixed action button.]

d. COMMUNICATION(S) SOI button. The **SOI** button (para 3.21.2) provides access to Signal Operating Instructions management.

g. COMMUNICATION(S) XPNDR button. The **XPNDR** button (para 3.44) provides access to transponder controls.

h. [BLK 2 **COMMUNICATION UHF Page Button**. The **COMMUNICATION UHF** page button displays the **UHF** page.]

i. [BLK 2 **COMMUNICATION FM Page Button**. The **COMMUNICATION FM** page button displays the **FM** page.]

j. [BLK 2 **COMMUNICATION HF Page Button**. The **COMMUNICATION HF** page button displays the **HF** page.]

l. COMMUNICATION(S) COM button. The **COM** button (para 3.21) provides access to presets and tuning.

m. DMS button. The **DMS** button (para 2.128) provides access to the Data Management formats including warnings, cautions, advisories, faults, exceedences, built-in tests, and software versions.

n. AIRCRAFT ENG button. The **ENG** button (Para 2.110.1.a) provides access to engine instruments.

o. AIRCRAFT FLT button. The **FLT** button (para 2.110.1.b) provides access to flight instruments.

p. AIRCRAFT FUEL button. The **FUEL** button (para 2.110.1.c) provides access to fuel system controls.

q. AIRCRAFT PERF button. The **PERF** button (para 2.110.1.d)) provides access to performance information and controls.

r. AIRCRAFT UTIL button. The **UTIL** button (para 2.110.1.e) provides access to the aircraft subsystem utility controls, including the cockpit environmental control system, icing controls, and flight controls.

t. MISSION ASE button. The **ASE** button (para 4.89) provides access to Aircraft Survivability Equipment (radar warning receiver, RFI, chaff, etc.) and display of any detected threats.

u. MISSION TSD button. The **TSD** button (para 3.62) provides access to the Tactical Situation Display navigation route, hazards, threat, and target coordinates, display of boundary lines, phase lines, and engagement areas as well as sensor footprint area.

v. MISSION WPN button. The **WPN** button (para 4.6) provides access to weapons mode, weapons status (loads, coding, tracking, faults), arm/safe status, sight and acquisition source moding, **LRFD** and **LST** coding, **IHADSS** grayscale, boresight controls, and chaff dispense status.

w. MISSION FCR button L. The **FCR** button (para 4.35) provides access to Fire Control Radar targeting and radar scan moding controls.

2.21.2 Automatic Paging (Autopaging) of MPD Formats. The **ENG** page is automatically presented to the crew in response to all aircraft warning messages that have voice message capability. ASE information is automatically presented to the crew in response to detection of Radar Laser Warning Receiver (RLWR) or Radar Frequency Interferometer (RFI) threats. ASE autopage thresholds may be set in accordance with paragraphs 4.89.6 through 4.89.8.

When **ENG** is autopaged, it is presented on the left MPD unless the right MPD already presents the **ENG** page, or unless the left MPD presents **FLT** page. In the latter cases, the right MPD presents the **ENG** page. The CPG can suppress **ENG** autopaging in his crew station using the **DMS AUTOPAGE** button located on the **DMS UTIL** page.

When ASE information is autopaged, the system will either, update a currently displayed **ASE** page, provide ASE information on a currently displayed **TSD** Page, or autopage the TSD with ASE information shown. When autopaged, the **TSD** page is presented on the right or left MPD unless that MPD presents the **FLT** instruments page, and there is a warning and the MPD presents the **ENG** page. Either crewmember can disable or alter the level of RFI or RLWR threat detected which causes an ASE information autopage through the AUTOPAGE grouped option button located on the **ASE** page or by multi-state option button on the TSD **UTIL** page. Threat detection threshold selections to trigger autopaging are Search, Acquisition, and Track. See paragraph 4.89.

If the current page on the MPD was displaying a video underlay when an autopage to the **TSD** page occurred, the **TSD** page will be changed to show the stick map with the video underlay. Otherwise, the **TSD** page will be displayed with the map underlay that was last viewed on one of the **TSD** pages.

2.21.3 Switch Paging of MPD Formats. The following physical switch actions cause an autopage to the MPD without bezel button selection:

a. Emergency Hydraulic (EMER HYD) Switch. If the **EMER HYD** switch on the **EMERGENCY** panel is pressed, the **ENG** page will be autopaged.

b. Engine Start. If the pilot power quadrant **ENG START** switch is pressed, the **ENG** Ground page will be autopaged in the pilots station only. Advancing both power levers to **FLY** causes the **ENG** page to change from Ground format to Air format.

c. Sight Select FCR L. Selecting the sight select switch to **FCR** establishes control of the FCR to that crew station in the mode/format last selected at the **FCR** mode switch (from either crew station). If the **FCR** page is not currently displayed on either MPD or the ORT HOD/HDD (CPG station), it is automatically called up on the left MPD (in that crew station). All controls are available. Sight selection of the FCR between the crew stations is based on last-to-select logic.

d. Instant FLT Page Access/Return. Pressing the center position (Z-axis) of the Symbol Select Switch on the Cycic Control Grip in either crewstation will autopage switch that crewmember's **FLT** Page to the left MPD. When the switch is pressed, the system will either:

- Have no effect if the **FLT** instruments page is currently displayed on the left MPD.
- Move the **FLT** page to the left MPD if not currently displayed on either MPD.
- If the **FLT** page is currently displayed on the right MPD, it will be moved to the left MPD and the format on the left MPD will be moved to the right MPD.

Subsequent switch selection will toggle the left MPD between the Flight Page format and the previous page selection. The return function will remain in effect until a page change occurs as a result of entry into single DP, autopaging, switch paging, subsystem button selection, page button selection, or ten minutes elapses since last return selection.

2.21.3A [**BLK 2** **Asterisk (*) Page.** The * page (fig 2-21B) allows either crewmember to store frequently used favorite pages in one or all of the three available queue positions **1-3.** Each MPD is capable of storing three pages for a total of six pages per crewstation. Selecting the asterisk (*) button will cycle through the stored pages in the numerical order indicated in the page store status window on the respective MPD. An arrow in the page store status window indicates the current selected page.]

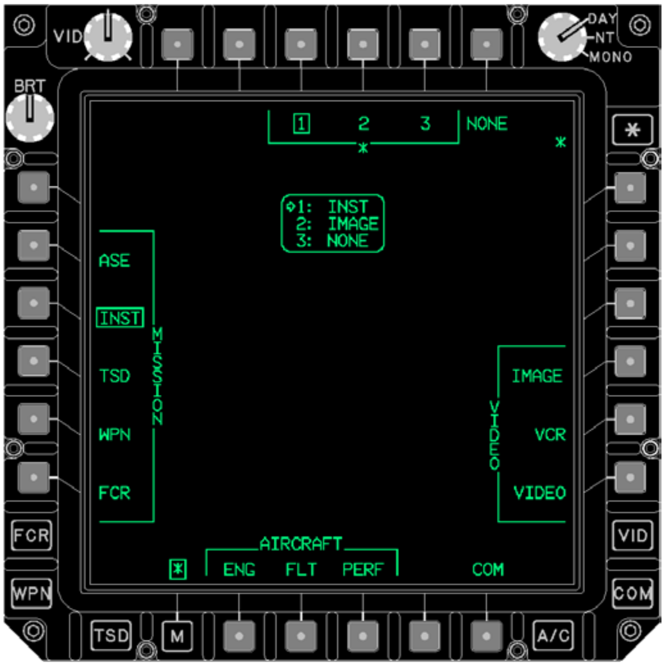


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Figure 2-21B. Asterisk (*) Page

NOTE

When at least one page has been stored the asterisk (*****) label will appear next to the asterisk button. This indicates a memory page is available to view by selecting the asterisk button. Crewmembers may also select memory pages via the cursor controller on either collective or the left hand grip by positioning the cursor over the (*****). The asterisk will become bold and selecting the z-axis/cursor enter will cycle through the stored pages in queue order.

- T3 Queue **1** button
- T4 Queue **2** button
- T5 Queue **3** button
- T6 **NONE** button
- L1 **ASE Page** store button
- L2 **INST Page** store button
- L3 **TSD Page** store button
- L4 **WPN Page** store button
- B1 **ENG Page** store button
- B2 **FLT Page** store button
- B3 **PERF Page** store button
- B5 **COM Page** store button
- ***** **ASTERISK** page cycle button
- R3 **IMAGE Page** store button
- R4 **VCR Page** store button
- R5 **VIDEO Page** store button

a. Queue **1-3 Buttons.** Selecting any of the Queue buttons determines the location for a page to be stored. The default sequence for storing is **1-2-3** based on the first available empty location. An empty location is indicated with **NONE** shown in a queue position **1-3** in the page store status window.

NOTE

Selecting any of the MISSION, AIRCRAFT, COM or VIDEO pages from the ASTERISK page will store that page in the currently boxed queue position **1-3** regardless of whether a position indicates **NONE** or a page is already stored.

b. NONE Button Selection of the **NONE** button erases the page stored in the currently boxed Queue position **1-3.**

NOTE

When **NONE** is stored in a Queue **1-3**, that position will be skipped in the page cycle sequence.

c. ASE Page Store Button. Selection of the **ASE Page** button stores the **ASE** page in the currently boxed Queue position **1-3.**

d. INST Page Store Button. Selection of the **INST Page** button stores the **INST** page in the currently boxed Queue position **1-3.**

e. TSD Page Store Button. Selection of the **TSD Page** button stores the **TSD** page in the currently boxed Queue position **1-3.**

f. WPN Page Store Button. Selection of the **WPN Page** button stores the **WPN** page in the currently boxed Queue position **1-3.**

g. FCR Page Store Button. Selection of the **FCR Page** button stores the **FCR** page in the currently boxed Queue position **1-3.**

h. ENG Page Store Button. Selection of the **ENG Page** button stores the **ENG** page in the currently boxed Queue position **1-3.**

i. FLT Page Store Button. Selection of the **FLT Page** button stores the **FLT** page in the currently boxed Queue position **1-3.**

i. PERF Page Store Button. Selection of the **PERF Page** button stores the **PERF** page in the currently boxed Queue position **1-3.**

j. COM Page Store Button. Selection of the **COM Page** button stores the **COM** page in the currently boxed Queue position **1-3.**

k. ASTERISK Page Cycle Button. Selection of the **ASTERISK** button cycles through the stored pages in Queue position order **1-3.**

l. IMAGE Page Store Button. Selection of the **IMAGE Page** button stores the **IMAGE** page in the currently boxed Queue position **1-3.**

m. VCR Page Store Button. Selection of the **VCR Page** button stores the **VCR** page in the currently boxed Queue position **1-3.**

n. VIDEO Page Store Button. Selection of the **VIDEO** page button stores the **VIDEO** page in the currently boxed Queue position **1-3.**

2.21.4 MPD Cursor Controller/Enter. Both crewmembers have the capability to select options on the MPD through the use of cursor controls mounted on the collective Mission Control Grip (fig 2-22) and the Optical Relay Tube (ORT)/TADS Electronic Display and Control (TEDAC) handgrips (fig 2-23).

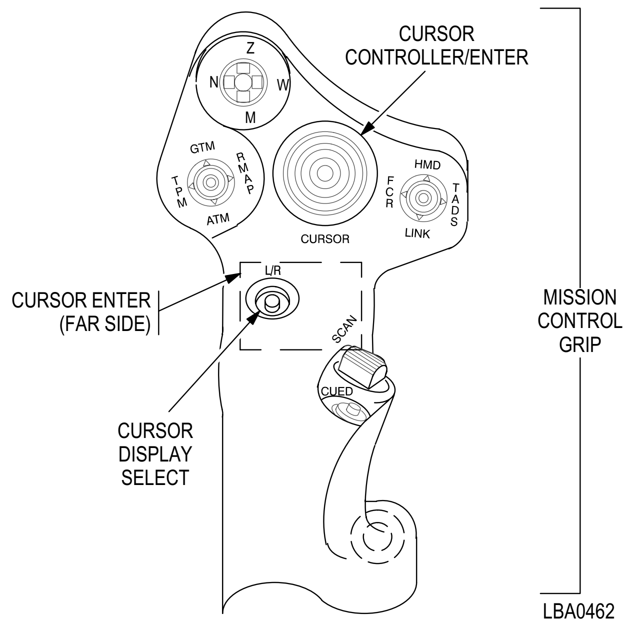

Figure 2-22. Mission Control Grip Cursor Controls

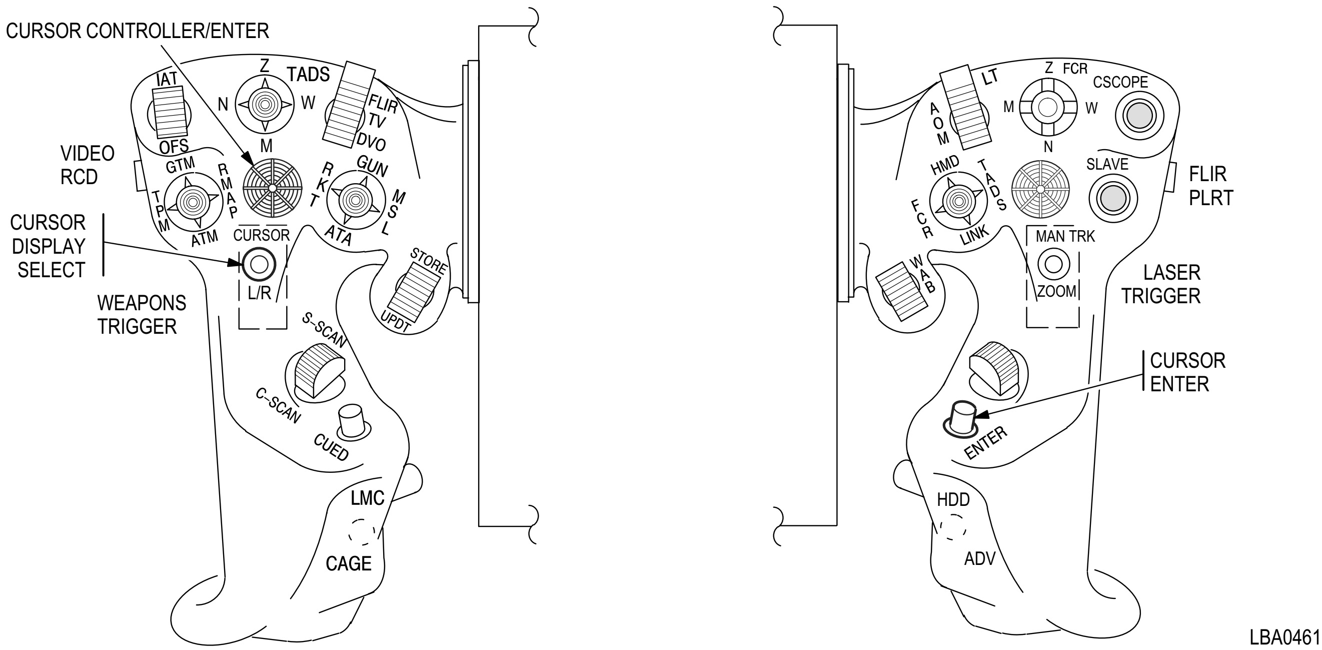

Figure 2-23. Handgrips

Control of the pilot and CPG’s MPD cursor symbols (figs 2-24, 2-25, 2-26 and [**BLK 2** 2-26A]) in each crew station is independent of the other crew station. Bezel button inputs override simultaneous cursor entered inputs. Central crosshairs are presented when in an operating mode which allows selection of individual symbols. When picking a symbol, the object to be selected is shown over a black circle.

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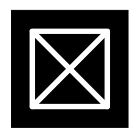
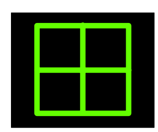
Figure 2-24. MPD Cursor Symbol

During FCR Zoom and **TSD** page target reference point creation, the cursor symbol graphic changes to a size encompassing the area to be zoomed or to be the target reference point. FCR Zoom cursor is WHITE in color.



LBA1948

Figure 2-25. MPD Cursor Symbol FCR Zoom Operation



LBA1949

Figure 2-26. MPD Cursor Symbol Target Reference Point

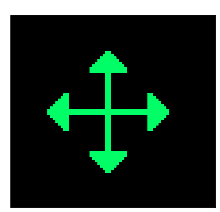


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Figure 2-26A. [BLK 2 MPD Cursor Panning Operation]

2.21.5 MPD Cursor Operation. The cursor is positioned on the MPD by providing a force input in the direction of desired movement. Cursor speed increases with increasing force applied. The cursor is positioned to another display by moving it to the adjacent edge of the MPD, and then double bumping it over to the next ORT or MPD display. The cursor can be moved to the center of the other MPD by selecting the collective Mission Control Grip or ORT LHG **CURSOR** Display Select button. Items or buttons can be selected by pressing the center detent of the cursor force controller, by pressing the cursor enter on the collective mission grip, or by selecting the **ENTER** pushbutton on the ORT RHG. The cursor is stowed in the lower left corner of the display 3 minutes after the last use. If on the **TSD** or **FCR** page, and in a valid selection area, the cursor will remain in that valid selection indefinitely. If moved from the valid selection area, the cursor will stow after 3 minutes. The cursor is automatically positioned to the **FCR** page's **NTS** button when a crewmember who has the FCR as his selected sight initiates an FCR scan or selects a new next-to-shoot symbol using the cursor. See paragraph 2.23 for single DP cursor operations.

2.22 GENERAL STATES OF MPD OPERATION

Crewmembers are provided consistent display feedback to indicate the current aircraft states. In general, information is displayed by exception. If it is not relevant to the current task or conditions, it will not be presented. For example, engine instruments will not routinely be presented constantly on the MPD after engine startup. However, the system will provide the **ENG** page automatically if an emergency condition occurs. Similarly, controls for radios which are currently not installed are not presented on the MPDs.

2.22.1 MPD Color Application. Seven colors are used to indicate the following conditions:

- Green: Normal (default), advisory conditions
- Red: Warnings, Enemy Threats
- Yellow: Cautions, Hazards
- White: Attention
- Cyan: Friendlies, sky of attitude indicator
- Brown: Ground of attitude indicator
- Partial Intensity of any of these colors, to de-emphasize normal conditions. Partial green may appear blue-green. Partial yellow may appear brown or orange.

2.22.2 MPD Status Indications and Readouts. Information which is provided by a system, such as status indications or digital readouts, are contained within a status window with rounded corners (fig 2-27). Crewmember selected options are indicated by a box.

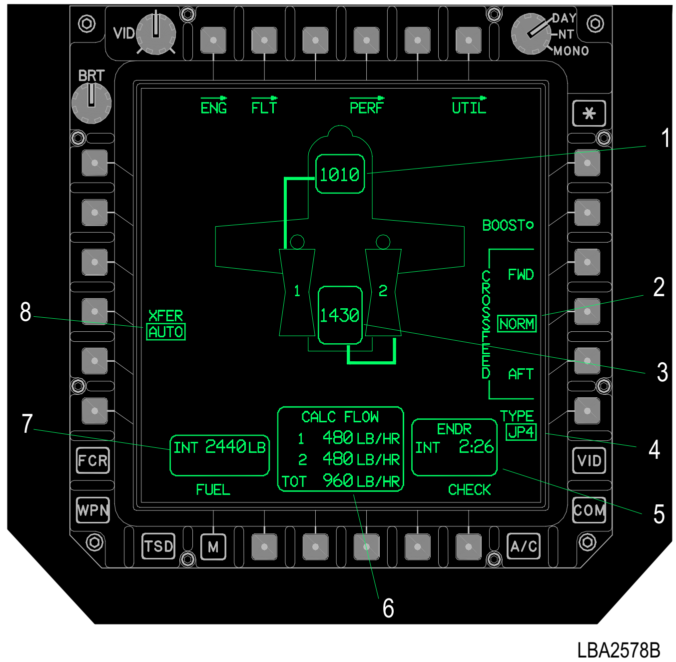

Figure 2-27. MPD Status Indicators and Readouts

1. FWD FUEL CELL QTY STATUS
2. FUEL CROSSFEED OPTION
3. AFT FUEL CELL QTY STATUS
4. FUEL TYPE OPTION
5. TIME REMAINING W/CURRENT FUEL STATUS
6. CALCULATED FUEL FLOW STATUS
7. TOTAL REMAINING INTERNAL FUEL QTY STATUS
8. FUEL TRANSFER OPTION

2.22.3 Bezel Button/Label Not Selectable. If a button is not selectable in the current operating mode, and does not contain relevant information, it is not displayed. If a button is not selectable in the current operating mode and does contain relevant information, it is displayed with a partial intensity barrier, separating it from the adjacent bezel button (fig 2-28).

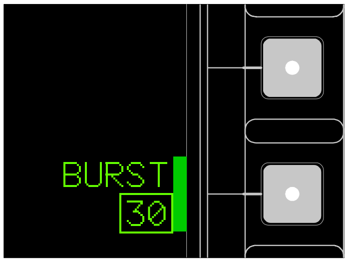

Figure 2-28. Not Selectable Bezel Edge Barrier

2.22.4 Operation In Progress (OIP). The current state of buttons are shown in inverse video while their state is changing, or an operation is in progress. The new state is shown at the completion of the process in normal video. Buttons cannot be selected while they are OIP. OIP inverse video states are shown on all button presentations within the aircraft that they affect. Figure 2-13 shows an example of the inverse video cue used for an operation in progress.

2.22.5 Command Failed. If an operator command was not implemented by the system, the button selected is shown with a white triangle (fig 2-29) between the button and text label, pointing to the button to be selected for a retry. Command fail triangles are shown on all the aircraft's affected buttons.

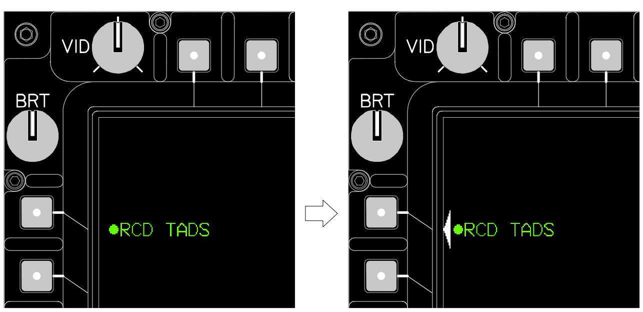

Figure 2-29. Command Failed Bezel Edge Triangle

2.22.6 Data Field Presentation of Invalid or Missing Data. Data fields, located in a data entry button or the center area of the page, display the value sent to them, whether that value is within the specified validity range or not. If the DTC loaded data is invalid (a checksum error was found), the data is considered to be missing. If data is missing for any reason a question mark is presented in the data field. If this is a result of a system error, or is a non-standard condition, this question mark will be WHITE in color.

2.22.7 Bold Font / Characters. Button labels show bold intensity when the cursor is close enough to the symbol to choose it (fig 2-30). Upon cursor selection, the bolded item will be chosen. Bold fonts are also applied to any characters shown in inverse video, and any characters which are shown RED or YELLOW in color. Note: when operating in **MONO** mode, characters which would be shown RED or YELLOW during **NIGHT** mode operations continue to be shown in bold font.

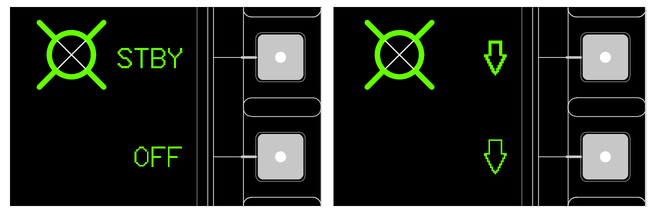

Figure 2-30. Bold Character Presentation

WARNING

While in single display processor operation, the format presented (including weapons configuration information) could belong to the opposite crew member.

2.23 MPD PAGES DURING SINGLE DISPLAY PROCESSOR (DP) OPERATION

During single DP operation, the original four MPD pages within the aircraft are reduced to two, with the left MPDs of both crew stations duplicating each other, and the right MPDs of both crew stations duplicating the other. Once a display processor has been lost, it will not be recognized as functioning again for a minimum of 10 seconds. Upon determining a DP is operational again, the MPDs will retain the same formats as presented during single DP mode, but in normal DP appearance and functionality. As a result of the page changes resulting from the failure, any ongoing crew operations at the time of the transition will be aborted. KU scratchpad data will be lost. During single DP operation, the CPG's cursor symbol graphic changes so it can be easily seen and separated from the pilot cursor, even if they are both in the home position or format center (fig 2-31). The pilots cursor does not change. Both cursors are visible in both crewstations.

2.23.1 MPD Stale Operations. [**BLK 2** During MPD Stale operations (single DP operations only), graphics and video on the affected display will not be current and the MPD bezel buttons may not respond to commands. Once an MPD Stale condition is recognized, the crew should disregard the information on the stale MPD and use the functional display. While in single DP with a LEFT or RIGHT MPD STALE message, display information critical for maintaining aircraft control should be placed on the "non-stale" MPD. The aircrew should perform operations in accordance with SINGLE DP operations. With the IHADSS/ORT STALE message active the crew should follow procedures as in total HDU Failure (para 9.26.2.b).]

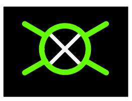

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Figure 2-31. CPG MPD Cursor Symbol (Single DP Operation)

2.23.2 MPD Format Selection. Following a failure of one of the two DPs, the remaining processor acknowledges the failure and notes the formats originally displayed in each of the four MPDs. A priority scheme determines the presentation of formats. In general, **FLT** page is the highest priority format, followed by the **ENG** page in the presence of an active warning, and finally the **TSD** page. The system identifies whether one of these top three priority formats are present, and retains the highest priority page in each crewstation. The **FLT** page is considered to be a crucial display because it must be assumed that if a crewmember has this format shown, he may be relying upon it for flight. Whenever possible, the **FLT**, **ENG**, and **TSD** pages are not switched from left to right.

If there are no priority pages presented, pages are retained based on their location: pilot retains his left format, CPG retains his right format. If a retained page presents video underlay, then that video is also retained.

2.23.3 MPD Format Appearance. The MPD formats present bold lines at the top and/or bottom of the format to provide an indication of the single DP failure. Formats presenting pilot information will present a WHITE bold line at the bottom of the page. Formats presenting CPG information only will present a WHITE bold line at the top of the page. Formats presenting information which applies to the entire aircraft will have WHITE bold lines at the top and bottom of the page (fig 2-32). Control of the MPD is based on a "last format select" logic.

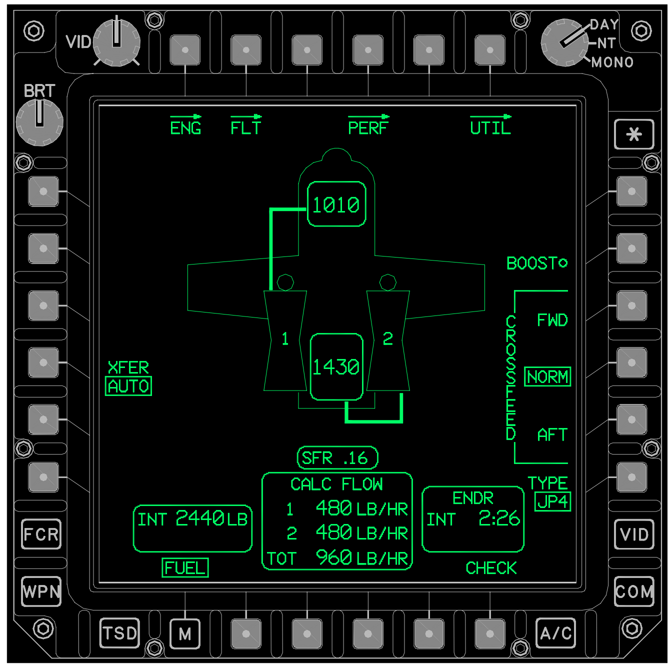

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Figure 2-32. Single DP Failure (Fuel)

2.23.4 MPD Format Control. Formats presenting pilot information can be brought to the left or right set of displays by selecting them from the pilot station. Formats presenting CPG information can be brought to the left or right set of displays by selecting them from the CPG's station. The ownership of the format is assigned to the crewmember selecting the page (last format select logic). **VID** knob and **SHARP** operations also follow a last-select logic. If either left display's **DAY/NIGHT/MONO** knob is set to **MONO**, then the left displays of both crewstations will present only green symbology and video. Similarly, if either right display's **DAY/NIGHT/MONO** knob is set to **MONO**, then the right displays of both crewstations will present only green symbology and video. Otherwise, full color symbology and white or green video will be available. Backlight brightness (**BRT** range) will be in accordance with that MPD's **DAY/NIGHT/MONO** setting.

2.24 KEYBOARD UNIT (KU)

The KU (fig 2-33) is a multipurpose control through which the crew can enter alphanumeric and special character data. The KU has an integrated light emitting diode (LED) scratchpad display to provide visual feedback for data entry check, data entering prompts, calculator functions, and operator validation feedback. The KU communicates with the display processor via the MUX bus. The KU consists of a scratchpad display, alphanumeric pushbuttons, calculator function buttons, special function buttons, and a scratchpad display brightness control. When there is no ongoing MPD data entry button operation, the KU can be used as a notepad to enter data.

2.24.1 Scratchpad Display. The KU scratchpad accepts up to 44 characters, and can display up to 22 of these characters at a time. If the scratchpad exceeds 22 characters, the remaining text can be scrolled in and out of the scratchpad area using the left or right arrows. The scratchpad also presents an up to 9 character prompt followed by a colon. The scratchpad LEDs can be tested by selecting the **A** and **+** keys simultaneously.

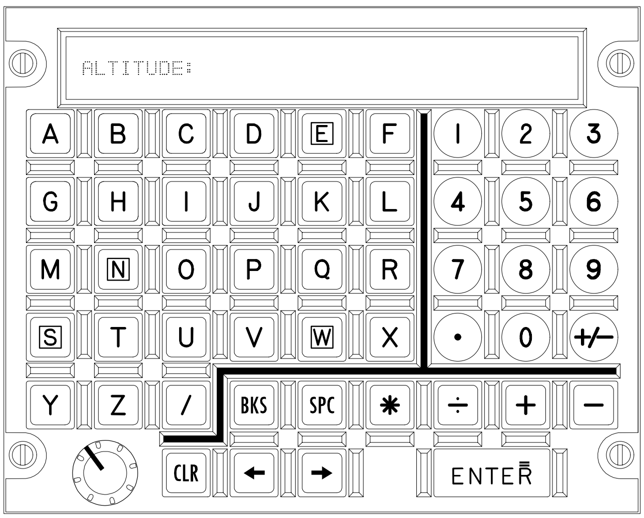


Figure 2-33. Keyboard Unit (KU)

2.24.2 KU Lighting. The pushbutton brightness is controlled by the interior lights primary knob. Scratchpad brightness is controlled by the knob on the lower left corner of the unit. When the KU has not been in use for a minute, the display is not illuminated. Pressing any button or actioning a data entry key will illuminate the keyboard display.

2.24.3 KU Operation. The KU becomes active in response to MPD selection of a data entry button or if user input is required when a reauthentication request is issued by a Tactical Internet security officer. A short prompt and colon are presented, indicating the anticipated data to be entered. No data is accepted by the system from the scratchpad until **ENTER** is pressed. Upon selection of **ENTER**, the DP reads the scratchpad data and determines its validity. If it is valid, this data is accepted and the scratchpad blanks. If it is invalid, the scratchpad data will flash. The next operator keystroke stops the flashing and allows the crew to edit the data.

2.24.4 KU Keys. The KU provides alphanumeric, decimal, plus/minus, backspace, insert (space), left arrow, right arrow, clear, multiply, divide, plus, minus, and enter/equals keys.

2.25 UP-FRONT DISPLAY (UFD)/ENHANCED UP-FRONT DISPLAY (EUFD)

The UFDs/EUFDs (fig 2-34 and 2-35) provide uninterrupted presentation of critical information under battery power and normal electrical power conditions. The first 5 lines of the active display is divided by vertical lines into warning, caution, and advisory areas (columnar, left to right). The next four lines of the display present VHF, UHF, FM1 and FM2 radio status. The last line presents total fuel quantity, transponder (**XP**) status, and local or Zulu time.

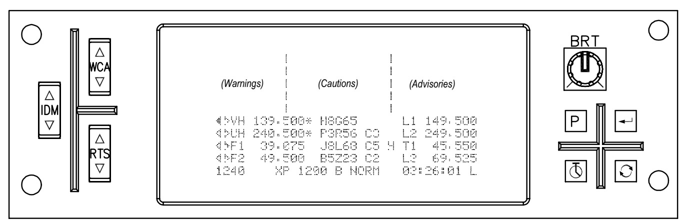


Figure 2-35. [BLK 1 / BLK 2 Enhanced Up-Front Display (EUFD)]

2.25.3 Enhanced Up-Front Display (EUFD). The EUFD (fig 2-35) is a monochrome, LED display. The display presents a test pattern to check the LEDs when the RTS (rocker switch - down) and swap buttons are pressed simultaneously.

2.25.5 [BLK 2 **EUFD Rocker Switch Push Controls**. The EUFD rocker switch push controls are WCA, IDM, and RTS. The EUFD push button controls are Preset, Enter, Stopwatch, and Swap. The EUFD control knob is BRT.]

a. WCA Control. The **WCA** rocker switch controls scrolling of the warning, caution, and advisory lists in the upper portion of the EUFD. If there are more than seven warnings, cautions, or advisories to be displayed the vertical lines separating the WCA lists will display a double arrowhead indicating the direction to scroll the WCA lists into view on the EUFD. The **WCA** rocker switch is also used inconjunction with the EUFD Preset Window to select one of ten presets for tuning the current RTS radio.

b. IDM Control. The **IDM** rocker switch controls the selection of a radio for IDM transmission. The inverse diamond symbol is your current IDM transmit radio. The diamond symbol is the other crew member's IDM tranmit radio. When both crew members have the same radio selected for IDM transmit the symbols merge into a solid block symbol. The **IDM** rocker switch allows cycling up or down through the available radios to select an IDM transmit radio. The **IDM** rocker switch can be momentarily pressed for single radio selection or continually pressed to scroll through the available radios. Selection of the **IDM** rocker switch is circular such that selection beyond the top or bottom of the list of available radios will cause the IDM tranmit symbol to be displayed at the bottom or top of the list.

c. RTS Control. The **RTS** rocker switch controls the selection of a radio for voice transmission. The left facing solid triangle is your current voice transmit radio. The right facing solid triangle is the other crew member's voice transmit radio. The **RTS** rocker switch allows cycling up or down through the available radios to select a voice transmit radio. The **RTS** rocker switch can be momentarily pressed for single radio selection or continually pressed to scroll through the available radios. Selection of the **RTS** rocker switch is circular such that selection beyond the top or bottom of the list of available radios will cause the RTS transmit symbol to be displayed at the bottom or top of the list. NOTE: The **RTS** switch located on the cyclic grip only allows cycling down through the available radios.

d. Preset (P) Control. The Preset button opens or closes the EUFD Preset Window on the EUFD display. The EUFD Preset Window is used to select one of ten presets, in order to tune a single channel frequency into the current RTS radio.

e. Enter Control. The Enter button is used to initiate a tune of the current RTS radio, based on the preset select arrow symbol displayed in the EUFD Preset Window. Depressing the Enter button when the preset select arrow symbol is displayed in the EUFD Preset Window will close the EUFD Preset Window, regardless of whether or not the preset selected is valid (i.e. an invalid preset will not actually tune, but the EUFD Preset Window will close). Depressing the Enter button when the preset select arrow symbol is not displayed in the EUFD Preset Window will not close the EUFD Preset Window, nor initiate a tune.

f. Stopwatch Control. The Stopwatch button starts, stops, and resets the stopwatch function. The stopwatch timer field is displayed in the lower right portion of the EUFD display, above the clock field. Depressing the Stopwatch button for the first time will start the stopwatch timer. Depressing the Stopwatch button again will stop the stopwatch timer. To continue the stopwatch timer the Stopwatch button can be depressed again. To reset the stopwatch timer, the Stopwatch button needs to be held depressed for approximately 2 seconds. The stopwatch timer field is not displayed when reset. The stopwatch timer function is independent in each crew station.

g. Swap Control. The Swap control swaps the current RTS radio, encryption, and IDM net configuration with the standby radio, encryption, and IDM net configuration.

h. BRT Control. The **BRT** control varies the brightness of the EUFD.

Section II. EMERGENCY EQUIPMENT

2.26 EMERGENCY EQUIPMENT

Emergency equipment on the helicopter consists of a Canopy Jettison System, Stores Jettison System, portable fire extinguisher, Engine and Auxiliary Power Unit (APU) Fire Detection/Extinguishing System, two first aid

ability Equipment - CBR Blower.] [BLK 2 Emergency equipment also includes Survivability Equipment - CBR Blower, Emergency Locator Transmitter and Underwater Acoustic Beacon.]

2.27 CANOPY JETTISON SYSTEM

The canopy jettison system is installed to provide a rapid emergency exit for the crewmembers. The transparent portions of the four canopy side panels can be jettisoned by means of a detonating cord installation. The system is controlled manually.

WARNING

To prevent eye injury, pilot and CPG helmet visors should be down prior to canopy jettison. Debris may be expelled 50 feet outward.

The **CANOPY JETTISON** handles (fig 2-36) are located in the upper left area of the instrument panel in each crew station. The handles incorporate a safety pin which is to be removed before flight. Canopy jettison is accomplished by turning the handle 90°, releasing, and pushing in (**TURN 90° PUSH**). An external ground crew handle is located under a quick release panel directly forward of the forward crew compartment windshield. All four canopy side panels are jettisoned by activating any of the three jettison handles.

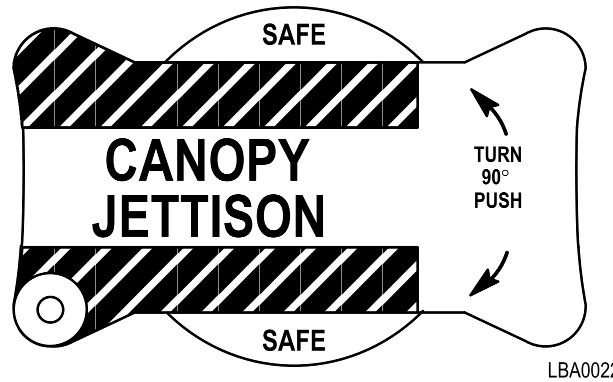


Figure 2-36. CANOPY JETTISON Handle

2.28 STORES JETTISON SYSTEM

NOTE

Only that crewstation arming the stores jettison panel can de-arm it. Once armed, either crewstation can activate jettison.

2.28.1 STORES JETTISON Panel. Pressing one or more of the alternate action pushbuttons on the **STORES JETTISON** panel (fig 2-37) will illuminate the selected pushbutton(s) to indicate that the stores jettison function at selected stations is **ARM**ed. Pressing an illuminated pushbutton a second time will cause that pushbutton's light to be extinguished, indicating that stores jettison at that station is no longer **ARM**ed. Pressing the recessed **JETT** pushbutton will cause stores to be jettisoned from all **ARM**ed stations.

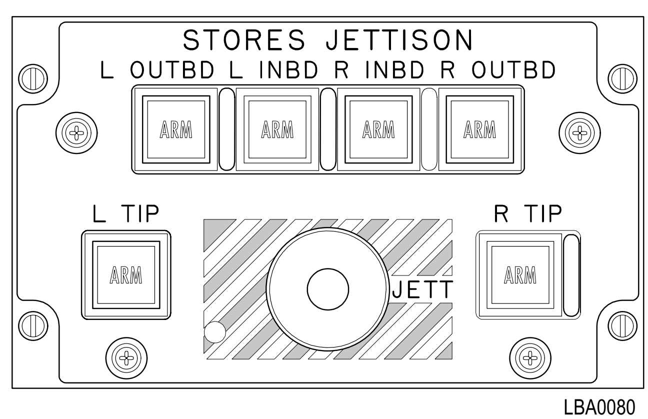


Figure 2-37. STORES JETTISON Panel

2.28.2 Emergency Stores Jettison (JETT) Switch. Pressing the guarded **JETT** switch on the flight control section of the collective flight control grip (fig 2-38) will cause all external stores to be jettisoned from the aircraft at the same time.

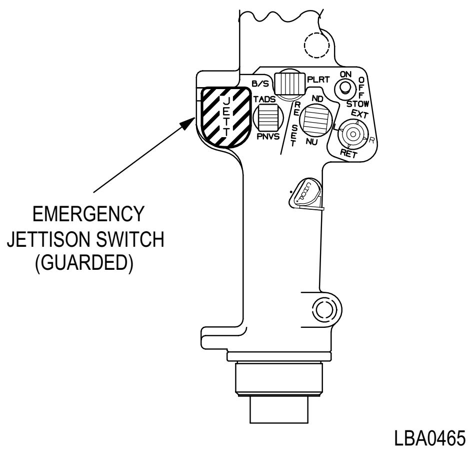


Figure 2-38. Emergency Stores Jettison (JETT) Switch

2.29 PORTABLE FIRE EXTINGUISHER

WARNING

Exposure to high concentrations of fire extinguishing agent or decomposition products should be avoided. The gas should not be allowed to contact the skin; it could cause frostbite or low temperature burns. If agent comes in contact with the skin, seek medical help immediately.

A pressurized fire extinguisher is mounted on a quick release support located in the Extended Forward Avionics Bay (EFAB) fairing aft of the right EFAB access door and above the main landing gear wheel. It is accessible through a hinged access panel which is marked **FIRE EXTINGUISHER INSIDE**. The fire extinguisher compound is released by a hand operated lever located on top of the extinguisher. Inadvertent discharge of the bottle is prevented by a breakaway safety wire across the actuating lever. Operating instructions are printed on the fire extinguisher.

2.30 ENGINE AND APU FIRE DETECTION/ EXTINGUISHING SYSTEM

Two optical sensors, which react to visible flames are located in each engine compartment and in the APU compartment. In case of a fire, amplified electrical signals from the sensors illuminate the appropriate pushbutton switch on the **FIRE DET/EXTG** panel (fig 2-39).

2.30.1 Engine and APU Fire Extinguishing Bottles. Fire extinguishing agent is stored in two spherical bottles each containing a nitrogen precharge. The bottles, designated as primary **(PRI)** and reserve (**RES***)*, are mounted on the fuselage side of the engine 1 firewall. Bottle integrity may be checked by inspecting the thermal relief discharge indicator disk (viewed from below the left engine nacelle). A pressure gage on each bottle indicates the nitrogen precharge pressure.

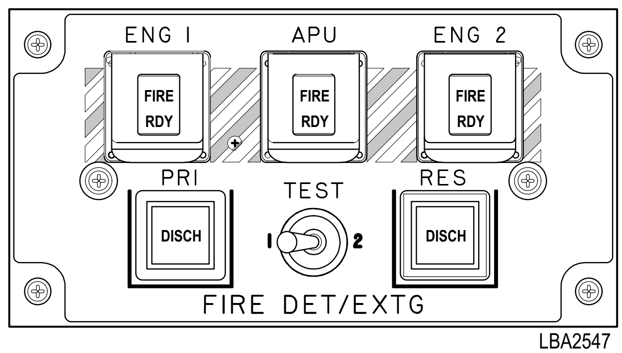


Figure 2-39. Fire Detection/Extinguishing Panel

2.30.2 Fire Detection/Extinguishing (FIRE DET/EXTG) Panel. Each crew station contains a **FIRE DET/ EXTG** panel. **FIRE** warning lights are combined with Ready (**RDY**) lights in alternate action pushbutton switches. The **FIRE/RDY** pushbutton switches have hinged cover guards to prevent inadvertent actuation. The color of each legend is NVIS yellow. The **RDY**, Primary *(***PRI**) Discharge *(***DISCH***)*, and Reserve *(***RES***)* **DISCH** legends are NVIS green. The **PRI DISCH** and **RES DISCH** lights are momentary action pushbutton switches.

NOTE

When positioning the fire detection test switch to position 1 or 2, hold the test switch in the TEST position for approximately 2 seconds before releasing it to the spring loaded center position (**OFF**) to ensure full voice warning activation. If the above procedure is not followed, the crew will not receive a proper response to the test initiation and may not receive a full voice warning reply of all circuits.

a. Fire Detection Circuit TEST Switch. The **TEST** switch is a three position toggle switch used to test fire detection circuits **1** and **2**. The switch is spring loaded to center (OFF) position.

Placing the **TEST** switch in the left ***(1***) position tests one-half of the fire detection circuit for each engine, the APU, and the aft deck overheat sensors, and tests the master warning light and voice warning. All three **FIRE** switches illuminated confirms all circuits are operable.

Placing the **TEST** switch in the right (**2***)* position tests the other half of the fire detection circuit in the same manner. All three **FIRE** switches and both **DISCH** switches illuminated confirms all circuits are operable.

Failure of a pushbutton to illuminate or a voice warning to annunciate during either test indicates a fault in the circuit being tested.

b. FIRE Lighted Pushbutton. The **FIRE** pushbutton is used to isolate a fire and arm that area's fire extinguishing system. When sensors detect a fire in either engine nacelle or the APU compartment, the **FIRE** pushbutton legend associated with that area will illuminate in both crewstations along with the master warning light and voice warning. When the warning occurs, the MPD will autopage to the **ENG** Emergency format.

WARNING

- **Ensure the aircraft controls are configured for single engine operation prior to pressing the illuminated FIRE pushbutton.**
- **Pressing the FIRE pushbutton (whether illuminated or not) will shut off the fuel to the selected engine or APU. This action can only be reversed from within the same crewstation.**

(1) Pressing the illuminated **FIRE** pushbutton will arm the fire extinguishing system, shut off fuel flow to the indicated engine or APU, shut off bleed air from the indicated engine or APU, close the cooling louvers to the indicated engine, turn off the voice warning message, and turn off the master warning light. When the **RDY** light is ON, the system is armed.

(2) Pressing the same **FIRE** pushbutton a second time (in the same crew station) will reverse the above functions and disarm the fire extinguishing system.

NOTE

The **FIRE** switches will remain illuminated until the sensors no longer detect a fire. For a crewstation to discharge or reset the system, that crewstation **FIRE** pushbutton must be armed/dearmed.

c. Fire Extinguisher Discharge (DISCH) Lighted Push Button Switches. When a **FIRE** pushbutton has been armed and the **RDY** light is **ON**, pressing the illuminated **PRI DISCH** pushbutton will discharge the primary fire bottle and extinguish the **DISCH** light, indicating the primary fire bottle has discharged and is no longer available. If this fails to extinguish the fire and the **FIRE** light is still illuminated, pressing the illuminated **RES DISCH** pushbutton will discharge the reserve bottle and extinguish the **DISCH** light, indicating the reserve fire bottle is discharged and no longer available.

2.30.3 Aft Deck Fire. Three pneumatic fire/overheat detectors are located in the aft deck area. One detector is mounted on the main transmission support, and one on each of the two firewall louver doors. A transmission aft deck fire warning is provided by crewstation voice message, flashing master warning pushbutton, UFD/EUFD and MPD warning messages. There is no extinguishing agent for the aft deck area.

2.31 FIRST AID KITS

The helicopter is equipped with two first aid kits, one on the inside aft portion of the pilots right canopy panel and one on the lower side of the CPGs left console. The location of the first aid kits is shown in Chapter 9.

2.32 MASTER ZEROIZE SWITCH

CAUTION

The use of the MASTER ZEROIZE switch is a "Last Ditch" procedure that should be used only when the compromise of classified information to hostile forces is imminent. This procedure causes physical damage to aircraft circuit cards, and should not be used as a normal operation procedure.

The **MASTER ZEROIZE** switch (fig 2-40), located on the right side instrument panel in pilot and CPG stations, is a toggle switch covered by a red guard secured with safety wire. **MASTER ZEROIZE** erases all DTC data and all FCR data including FCR programming from non-volatile memory (NVM). It includes a destructive zeroize of the non-volatile memory of the FCR Programmable Signal Processor (PSP) in addition to the data listed in the description of the **EMERGENCY** panel **ZEROIZE** switch in Chapter 3. **MASTER ZEROIZE** does not zeroize any of the User Data Modules (UDM). In order to zeroize, the aircraft must have power and the FCR must be **ON**.

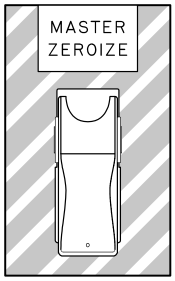


Figure 2-40. Master Zeroize Switch

2.33 SURVIVABILITY EQUIPMENT

er.] [BLK 2 Survivability equipment includes a CBR Blower, Emergency Locator Transmitter and Underwater Acoustic Beacon.]

2.33.1 CBR Blower. The Chemical, Biological, Radiological Filter/Blower (CBR) blower system is capable of providing filtered air to the flight crew, when the cockpit air supply is believed to be contaminated. Each crewmember carries his own CBR mask on board. The CBR mask is attached to the external power source located on the left side of the crew seat in each crew station.

2.33.2 [BLK 2 Emergency Locator Transmitter (ELT)]. The ELT is provided to allow search/rescue teams to locate the aircraft and/or the crew. The ELT can be actuated either by internal gravity switches (crash) or manually using the **OFF-TEST/ARM/ON** switch (fig 2-40A). The ELT is located behind the CPG seat on the right side. It can be removed, as required, and carried with the crew. The ELT is battery operated and fully self-contained. The ELT is equipped with a lanyard that has an attached shorting plug. The shorting plug is used to de-activate the gravity switches. The shorting plug should be installed at all times except when flying (at the discretion of flight crew). Installing the shorting plug eliminates accidental activation of the transmitter. The shorting plug must be removed and stowed during normal flight. The transmitter transmits an intermittent tone at 121.5 MHz and 243.0 MHz simultaneously.

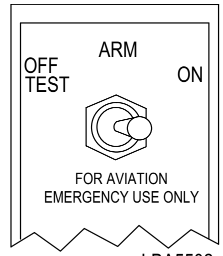


Figure 2-40A. [BLK 2 Emergency Locator Transmitter]

The **OFF-TEST/ARM/ON** switch is a three position switch that is spring loaded from the **OFF-TEST** position to the **ARM** position. It must be manually placed in the **ON** position or to the **ARM** position from the **ON** position.

NOTE

Transmitter test shall only be performed during the first five minutes after the hour.

The **OFF-TEST** position has two functions:
(1) To turn the transmitter off.
(2) To check power output (battery condition).

The **ARM** position allows for the ELT to start transmitting (if shorting plug is removed) if either of the G-switches (360 degree and/or vertical switch) are actuated.

The **ON** position allows for transmitting manually.

2.33.3 [BLK 2 Underwater Acoustic Beacon]. The UAB is provided to allow search/rescue teams to locate the aircraft if it has been ditched. The UAB is actuated by water (salt or fresh). The UAB is located forward of the pilot's left control pedal**.** The UAB is is battery operated and completely self-contained. When actuated, the UAB transmits at 37.5 KHz.

Section III. ENGINES AND RELATED SYSTEMS

2.34 ENGINES

The T700-GE-701 701 and T700-GE-701C 701C engines (fig 2-41) are front drive turboshaft engines of modular construction. One horizontally mounted engine is housed in an engine nacelle on each side of the fuselage aft of the main transmission above the wing. The engine is divided into four modules: cold section, hot section, power turbine section, and accessory section.

2.35 COLD SECTION MODULE

The cold section module includes the main frame, diffuser and mid frame assembly, the inlet particle separator, the compressor, the output shaft assembly, and associated components. The compressor has five axial stages and one centrifugal stage. There are variable inlet guide vanes and variable stage 1 and stage 2 stator vanes. Components mounted on the cold section module are: the Digital Electronic Control (DEC) 701C/Electronic Control Unit (ECU) 701, history recorder/history counter, ignition system, and electrical cables as well as the accessory section module.

2.36 HOT SECTION MODULE

The hot section module consists of three subassemblies: the gas generator turbine, the stage 1 nozzle assembly, and the annular combustion liner.

2.37 POWER TURBINE SECTION MODULE

The power turbine module includes a two stage power turbine and exhaust frame. Mounted on the power turbine module is the thermocouple harness, the torque and overspeed sensor, and the N_P sensor.

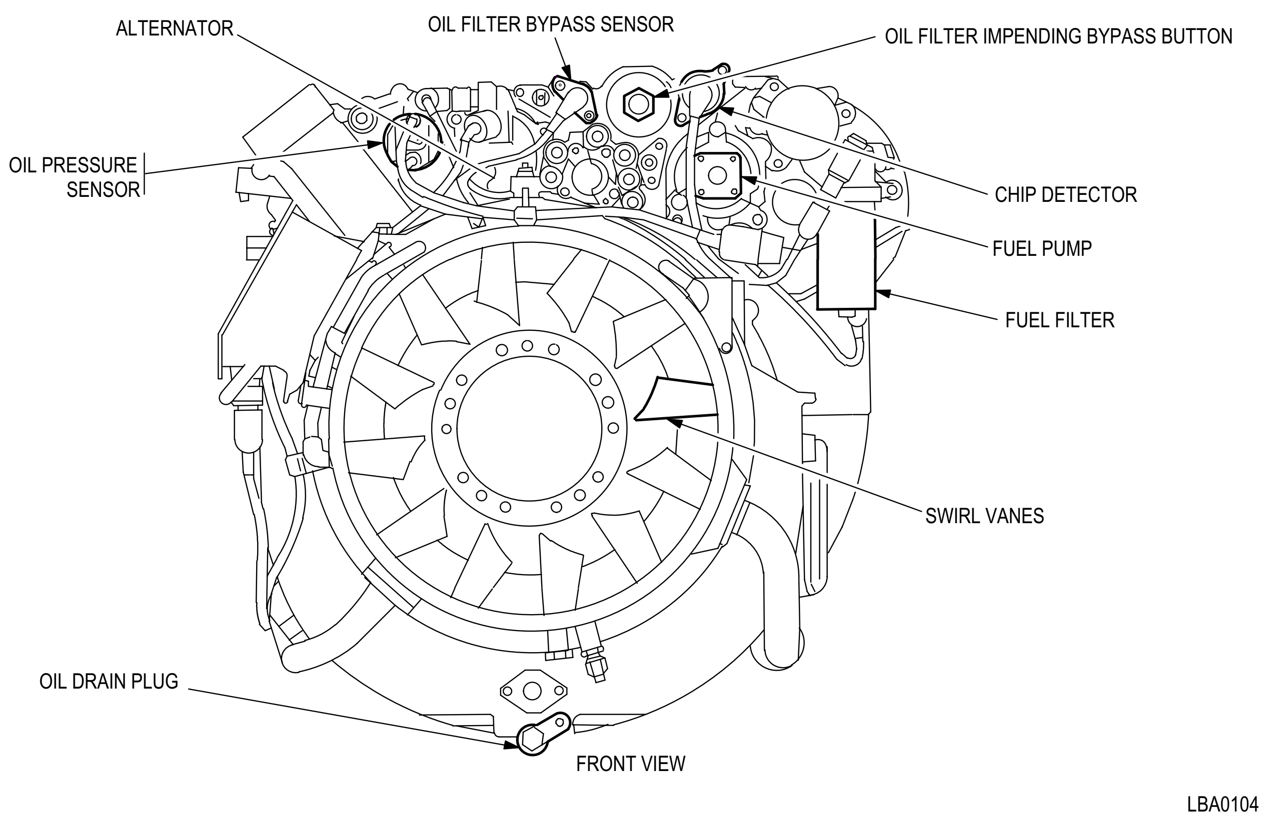


Figure 2-41. T700-GE-701 / T700-GE-701C Engine (Sheet 1 of 2)

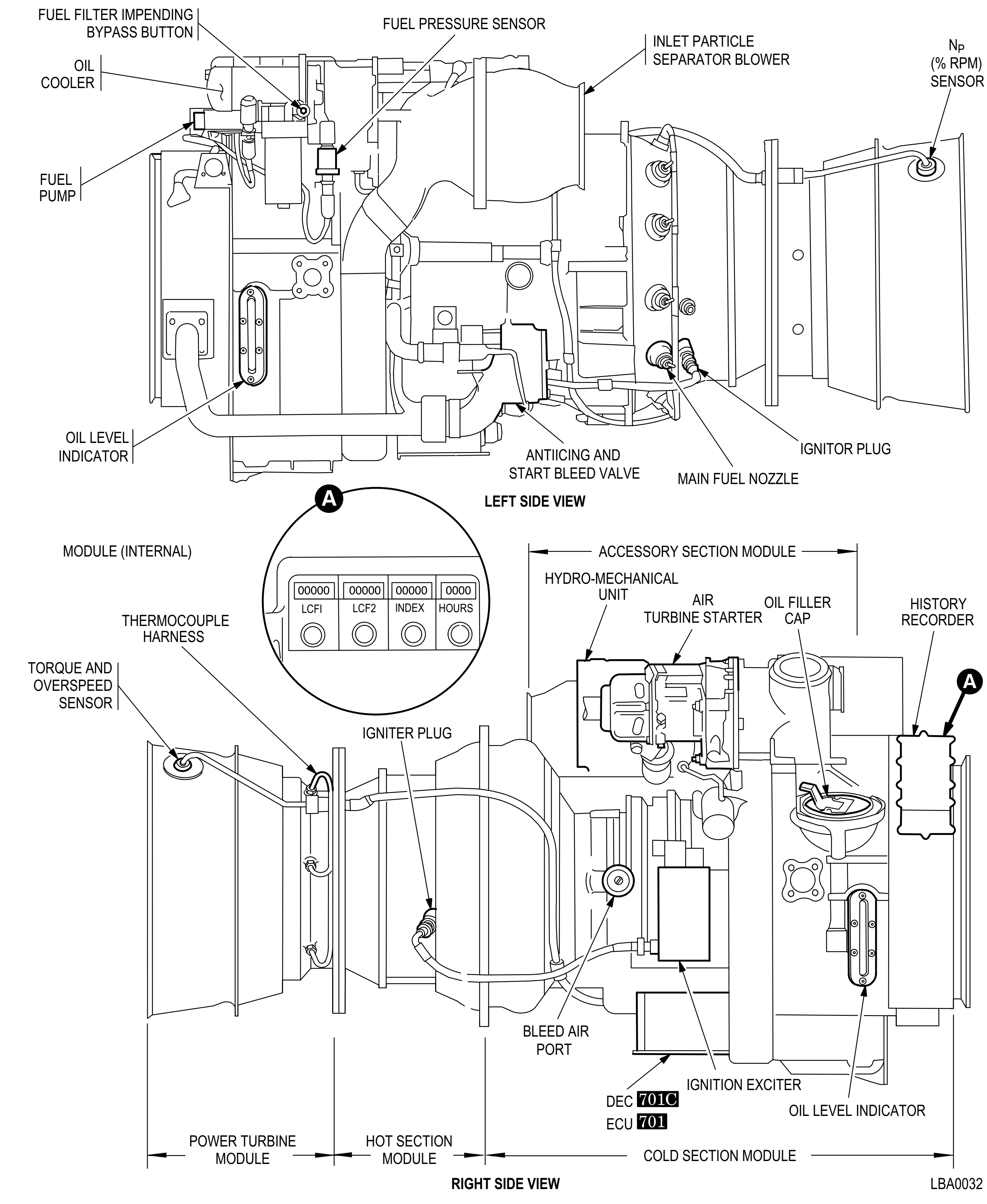


Figure 2-40. T700-GE-701 / T700-GE-701C Engine (Sheet 2 of 2)

2.38 ACCESSORY SECTION MODULE

The accessory section module includes the top mounted accessory gearbox and the following components: a hydromechanical unit (HMU), a fuel boost pump, oil filter, oil cooler, alternator, oil lube and scavenge pump, particle separator blower, fuel filter assembly, chip detector, oil/filter bypass sensors, oil/fuel pressure sensor, overspeed and drain valve (ODV), and an air turbine starter.

2.39 ENGINE COOLING

Each engine is cooled by air routed through the engine nacelle. Airflow is provided by eductor pumping action of the infrared suppressor. Fixed louvers on the top and bottom of the aft portion of each nacelle and movable doors in the bottom forward portion of each nacelle accelerate convection engine cooling after shutdown. The movable door is shut by engine bleed air pressure during engine operation and is spring loaded to open during engine shutdown.

2.40 AIR INDUCTION SYSTEM

The engines receive air through a bell mouth shaped nacelle inlet at the front of the engine. Air flows around the nose gearbox fairing before entering the engine nacelle inlet. From the inlet, air continues through canted vanes in the swirl frame where swirling action separates sand, dust, and other particles. Separated particles accumulate by centrifugal force in a scroll case. The particles are ejected overboard via a blower which forces them through a secondary nozzle of the infrared suppression device. Clean air, meanwhile, has passed through a swirl vane which straightens the airflow and channels it into the compressor inlet.

2.41 ENGINE AND ENGINE INLET ANTI-ICING SYSTEM

CAUTION

To prevent damage to the engines, the engine anti-ice system shall be manually activated when the aircraft is flown in visible moisture and Free Air Temperature (FAT) is less than +41 °F / +5 °C.

The engine anti-ice system includes the engine, the engine inlet fairings, and the nose gearbox fairings. Engine fifth stage bleed air is used to heat the swirl vanes, nose splitter, and engine inlet guide vanes of each engine. The nose gearbox fairing is an electrically heated fairing to prevent the formation of ice on each engine nose gearbox fairing. Operation of the system may be automatic or manual. Engine anti-ice controls are described in section IX.

2.42 ENGINE FUEL CONTROL SYSTEM

The engine has a conventional fuel control system: power control lever position and the degree of collective pitch basically establish the power output demands placed on the engines. Engine power is trimmed automatically through interaction of the HMU and the ECU 701/DEC 701C. The ECU 701/DEC 701C of each engine exchanges torque signals with the opposite engine to achieve automatic load-sharing between engines.

2.42.1 Fuel Boost Pump. A low-pressure suction fuel boost pump is installed on the front face of the engine accessory gearbox. It ensures that the airframe fuel supply system is under negative pressure, thus reducing the danger of fire in case of fuel system damage. If the **ENG 1 FUEL PSI** or **ENG 2 FUEL PSI** caution message appears at idle speed and above, it could indicate a leak or restriction in the helicopter fuel system or a failed engine boost pump.

2.42.2 Fuel Filter. A fuel filter is located between the fuel boost pump and the high-pressure pump in the HMU. If this filter becomes clogged and impedes the passage of fuel, a bypass valve permits fuel to bypass the filter. The differential pressure initiating bypass actuates the fuel-pressure bypass sensor, thus causing the **FUEL1 BYP** or **FUEL2 BYP** caution to appear. An impending filter bypass button on the filter housing pops out when filter element differential pressure indicates impending bypass.

2.42.3 Hydromechanical Unit.. The HMU provides metered fuel to the combustor to control the gas generator (N_G) speed. The HMU contains a high pressure fuel pump to supply fuel to the metering section. The HMU responds to mechanical inputs from the aircrew through the power available spindle (PAS) and the load demand spindle (LDS). The PAS is mechanically connected to the pilot's power levers while the LDS is connected to a bellcrank attached to the collective servo. The HMU regulates fuel flow and controls positioning of the inlet guide vanes, variable compressor stage 1 and 2 vanes as well as the anti-ice and start bleed valve in response to engine inlet air temperature, compressor discharge air pressure, N_G speed, PAS and LDS positioning, and the ECU 701, DEC 701C.

The HMU will additionally provide N_G overspeed protection in the event the gas generator exceeds 108 - 112%. When an N_G overspeed is sensed, fuel flow to the combustor is stopped within the HMU which causes the engine to flame out.

2.42.4 Overspeed and Drain Valve (ODV). The ODV responds to a signal from the ECU/DEC. Under normal operation, fuel is routed from the HMU via the oil cooler and through the ODV to the combustor. When an N_P overspeed condition is sensed, a signal from the ECU 701/ DEC 701C closes a solenoid in the ODV, thus routing fuel back into the HMU. All residual fuel is drained overboard. Fuel flow to the fuel manifold ceases, and the engine flames out.

2.43 ENGINE ELECTRICAL SYSTEM

2.43.3 Digital Electronic Control 701C. The DEC is mounted in the same location as the ECU. The DEC can be overridden like the ECU by momentarily advancing the engine **POWER** lever to **LOCKOUT**. The DEC, which incorporates improved technology, performs the same functions as the ECU except for the following functional and control improvements. The DEC can be fully powered by either the engine alternator or by 400 Hz, 120 Vac aircraft power. It incorporates logic which will eliminate torque spike signals during engine start-up and shutdown. The DEC control logic contains a Maximum Torque Rate Attenuator (MTRA) feature designed to reduce the risk of exceeding the dual engine torque limit during uncompensated maneuvers. These are any maneuvers where pedal or cyclic inputs are made but no collective control input occurs. For example, large transient engine torque increase can occur during left pedal and left lateral cyclic inputs when performing maneuvers such as rapid hovering turns or forward flight roll reversals. The MTRA is designed to reduce fuel flow and limit rate of torque increase to approximately 12% per second when transient engine torque exceeds 100% during an uncompensated maneuver. However, any collective control increase during the maneuver can override the MTRA and normal maximum engine torque rate increase can be achieved. The MTRA feature is not active in the DEC logic under single engine conditions. The DEC contains an automatic hot start preventer (HSP). The DEC also provides signal validation for selected input signals within the electrical control system. Signals are continuously validated when the engine is operating at flight idle and above. If a failure has occurred on a selected input signal, the failed component or related circuit will be identified by a pre-selected fault code. Fault codes (Table 2-1) will be presented on the engine torque display located on the aircraft **ENG** page.

Fault codes will be displayed starting with the lowest code for four seconds on/two seconds off, rotating through all codes and then repeating the cycle. The fault codes will be displayed on the engine torque vertical tape and digital display only when all of the following conditions are met:

- N_G less than 20 percent
- N_P less than 35 percent
- Other engine shutdown
- Aircraft 400 Hz power available

The fault codes can be suppressed by pressing either **OVSP TEST** switch. The fault codes can be recalled by again pressing either **OVSP TEST** switch. Once a failure has been identified, the fault code will remain available for diagnostic indication until starter dropout on the next engine start.

Table 2-1. Signal Validation - Fault Codes

Signal Failed	Diagnostic indication on Torque Display (± 3% Tolerance)
DEC	15%
N_P Demand Channel	25%
Load Share	35%
TGT Channel	45%
Alternator Power	55%
N_G I Channel	65%
N_P Channel	75%
Torque and Overspeed Channel	85%
Hot Start Prevention Channel	95%
Aircraft 400Hz Power	105%
Collective Channel	115%

2.43.4 Engine TGT Limiter Function 701C. The DEC incorporates a steady state dual and single TGT limiting function which restricts fuel flow within the HMU to prevent engine overtemperature. The limiting function has an inherent +/- 4° C variance factor. In addition to the limiter variance, the resistance in the cabling and circuitry between the DECU and the SP, DP, and MPD **ENG** page is enough to produce a +/-8° C variance factor. Applying the sum of these two factors, the dual engine limiter setting is allowed a value of 867 +/- 12 (855-879)° C and the single engine (contingency power) limiter setting is allowed a value of 896 +/- 12 (884-908)° C. The TGT limiter setting for a particular engine can change within these ranges over a period of time.

2.43.5 Hot Start Prevention 701C. The hot start prevention (HSP) system is a part of the DEC and prevents overtemperature during engine start. The HSP system receives power turbine speed (N_P) signal, gas generator speed (N_G) signal, and turbine gas temperature (TGT). When N_P and N_G are below their respective hot start reference, and TGT exceeds 900° C an output from the HSP system activates a solenoid in the overspeed and drain valve. This shuts off fuel flow and causes the engine to shut down. The HSP system will not operate if aircraft 400 Hz power is not present at the DEC. The HSP system can be turned off by pressing and holding either **OVSP TEST** switch during the engine starting sequence.

2.43.6 Fuel Pressure Warning System. The engine fuel pressure warning system for each engine consists of a pressure switch that will cause the **ENG1 FUEL PSI** or **ENG2 FUEL PSI** caution messages to be displayed when fuel pressure drops below 8 psi.

2.43.8 Engine Alternator 701C. The engine alternator supplies AC power to the ignition circuitry and DEC for its control function. Additionally, it also provides the N_G speed signal to the aircraft. When the engine alternator power to the DEC is lost, aircraft 400 Hz, 115 Vac power is provided to prevent an engine overspeed condition. Engine operation and N_P and torque signals are not affected. If the portion of the engine alternator providing the N_G signal to the aircraft is lost, the N_G indication for the affected engine will be 0.00 %, the engine out warning for that engine will be annunciated, and the capability to start that engine will be lost.

2.43.9 Ignition System. Each engine has an ignition exciter unit with two igniter plugs. The exciter unit receives power from its engine alternator. The **MSTR IGN** keylock switch on the pilot engine power lever quadrant is an enabling switch to the **ENG START** switches. When an **ENG START** switch is placed to **START**, pneumatic motoring of the engine starter takes place and the ignition system is energized. Ignition cutout is automatic after the engine starts. Following aborted starts (Chapter 8, Operating Procedures and Maneuvers), the engine must be motored with the ignition system disabled. This is done by placing the **ENG START** switch to **IGN ORIDE**. Chapter 5 contains the starting cycle limitations.

2.44 ENGINE OIL SUPPLY SYSTEM

Each engine is lubricated by a self-contained, pressurized, recirculating, dry sump system. Included are oil supply and scavenge pumps, an emergency oil system, an integral oil tank, a filter, an oil cooler, and seal pressurization and venting. An inline chip detector, located down stream of the scavenge pump, causes a caution message to be displayed if metal chips are detected.

2.44.1 Engine Emergency Oil System. Small oil reservoirs, built into the engine oil sumps, are kept full during normal operation by the oil pump. If oil pressure is lost, oil will bleed slowly out of these reservoirs and be atomized by air jets thus providing an oil mist lubrication for the engine bearings for thirty seconds at 75% N_G. A caution message will be displayed when oil pressure drops below 20 - 25 psi.

2.44.2 Oil Tank. Pertinent oil grades and specifications are in Section XV. The filler port is on the right side of the engine. The oil level is indicated by a sight gage on each side of the tank. Oil is supplied to the oil pump through a screen. The scavenge pump returns oil from the sumps to the oil tank through six scavenge screens.

2.44.3 Oil Cooler and Filter. Scavenge oil passes through an oil cooler before returning to the tank. It is cooled by transferring heat from the oil to fuel routed through the cooler. If the oil cooler pressure becomes too high, a relief valve will open to dump scavenge oil directly into the oil tank. Oil discharged from the oil pump is routed through a disposable element filter. As the pressure differential across the filter increases, the first indication will be a popped impending bypass button. As the pressure increases further, a caution message will be displayed on the UFD/EUFD. During engine starting, with oil temperature below the normal operating range, pressure may be high enough to close the oil filter bypass sensor switch. In this situation, the advisory message will remain on until the oil warms up and oil pressure decreases. The impending bypass indicator has a thermal lockout below 100° F (38° C) to prevent the button from popping.

2.44.4 Engine Chip Detector. Each engine chip detector is mounted on the forward side of the accessory gearbox. It consists of an integral magnet, electrical connector, and a housing. A removable screen surrounds the magnet. The detector attracts magnetic particles at a primary chip detecting gap. If chips are detected, a message will be displayed on the UFD/EUFD. These chip detectors are of the non-fuzz burning type.

2.45 ENGINE STARTING SYSTEM

The engine uses an air turbine starter for engine starting. System components consist of the engine starter, a start control valve, an external start connector, check valves, controls, and ducting. Three sources may provide air for engine starts: APU bleed air, engine bleed air, or an externally connected ground source. In any case, the start sequence is the same. With the **MSTR IGN** switch to **BATT**, placing the **ENG START** switch momentarily to **START** will initiate an automatic start sequence. An **ENG1 START** or **ENG2 START** advisory message will appear when an engine start is initiated. Compressed air is then directed through the start control valve to the air turbine starter. As the air turbine starter begins to turn, an overrun clutch engages which causes the engine to motor. The starter turbine wheel and gear train automatically disengage from the engine when engine speed exceeds starter input speed. At approximately 52% N_G, air to the starter shuts off, and ignition is terminated. If the engine does not start, the **POWER** lever must be returned to **OFF** and the **ENG START** switch must be placed at **IGN ORIDE** (which aborts the automatic engine start sequence) momentarily before another start is attempted. Chapter 8 explains abort start procedures, and Chapter 5 contains the start cycle limits. If the engine is equipped with a DEC 701C, fuel flow to the engine will be automatically shut off if TGT exceeds 900 °C during the start sequence. If this occurs, the **POWER** lever must be returned to **OFF** and the **ENG START** switch must be placed in **IGN ORIDE** (which aborts the automatic engine start sequence).

2.45.1 APU Engine Start. The APU provides bleed air for engine start. A complete description of the APU appears in Section XII.

2.45.2 Engine Bleed Air Start. Either operating engine bleed air may be used to start an engine that has failed in flight or engine not started by APU/AGPU during aircraft ground start. The single engine starting sequence is the same as for APU/AGPU starting except; that the source of air pressure is provided by the operating engine. When using this technique ensure adequate bleed air pressure is available by increasing collective pitch to a value that will increase N_G of the bleed air source engine to a minimum of 95%.

2.45.3 External Source for Engine Starting. An external air receptacle under the No. 1 engine nacelle provides an attachment point for an air line to start either engine from an external source. The assembly contains a check valve to prevent engine bleed air or IPAS pressurized air from being vented overboard.

2.46 INFRARED (IR) SUPPRESSION SYSTEM

The IR suppression system consists of the primary nozzle and three secondary nozzles. The primary nozzle is mounted to the engine exhaust frame and directs exhaust gases into the secondary nozzle. The three secondary nozzles are attached and sealed to the engine nacelle. During engine operation, exhaust gases are cooled by air drawn through the transmission area by a low pressure area created by the eduction action of the primary nozzle. Angles of the primary and three secondary nozzles prevents a direct view of the hot internal engine components. The cooler air is mixed with the hot air in the three secondary nozzles cooling the exhaust gases.

2.47 ENGINE CONTROL SYSTEM

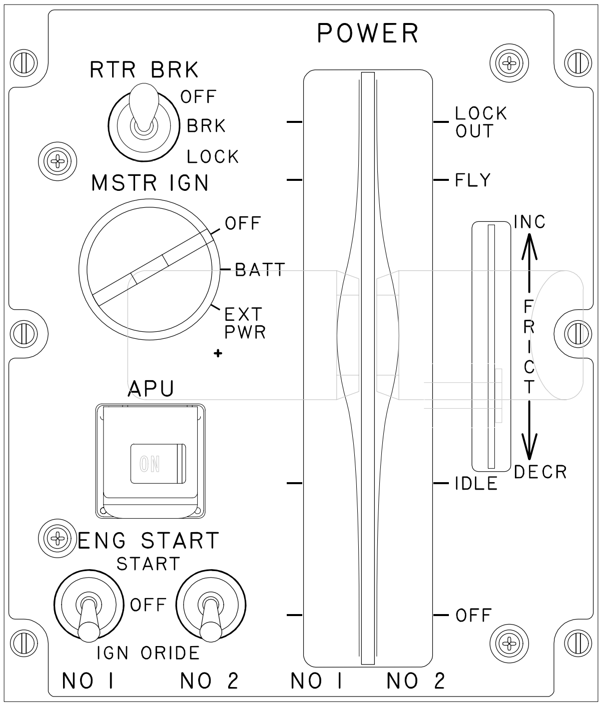
The engine control system consists of the engine power lever quadrant, the engine chop controls, the load demand system, and the overspeed protection system.

2.47.1 Engine Power Lever Quadrant. The **POWER** lever quadrants (fig 2-42) allow either crewmember to manage engine power. The two quadrant control panels are different, although the **POWER** levers are identical. Friction however, can be set on only the pilot levers. The **POWER** levers have four detent positions: **OFF**, **IDLE**, **FLY**, and **LOCKOUT**. The pilot detent override controls are mechanical while the CPG's are electrically operated. Movement of either **POWER** lever moves a cable to mechanically shut off fuel or to set N_G speed. For flight, the lever is advanced to **FLY**. By moving the **POWER** lever momentarily to **LOCKOUT**, then retarding past **FLY**, N_G speed may be manually controlled. With the **POWER** lever at **LOCKOUT**, the TGT limiting system is deactivated, and TGT must be closely monitored and controlled. The overspeed protection system is not disabled in the **LOCKOUT** position.

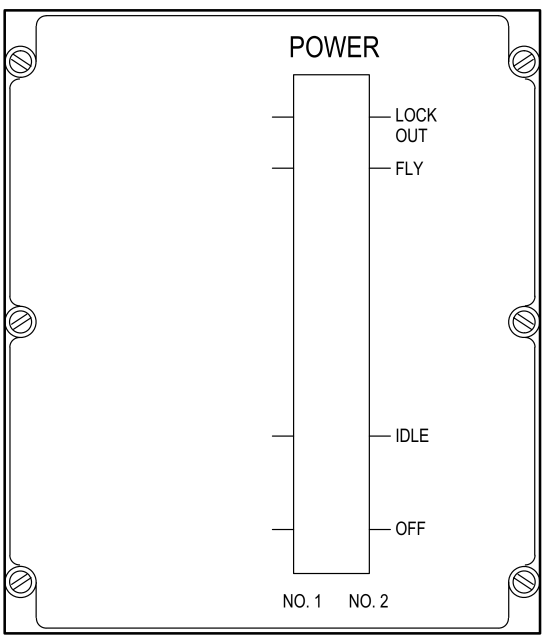
CAUTION

- **Conditions permitting, POWER levers should be retarded to IDLE before resetting CHOP button.**
- **Application of collective during CHOP operations will cause the Load Demand system to allow the engines to spool up.**
- **With the POWER levers in FLY, resetting the CHOP button will cause an erroneous ENG1 and ENG2 OUT warning to be activated.**

2.47.2 Pilot and CPG Engine Chop Control. A **CHOP** button is located on both the pilot and CPG collective flight grips and is protected by a red spring loaded guard. When the engine **CHOP** button is pressed, the speed of both engines is reduced to idle; and a warning message will appear on the UFD/EUFD. The engine chop circuit is reset by pressing the **CHOP** button a second time.



PILOT POWER LEVER QUADRANT LBA0463



PILOT POWER LEVER QUADRANT LBA2541

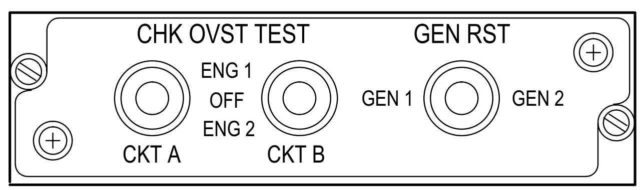
Figure 2-42. POWER Lever Quadrants

2.47.3 Engine Load Demand System. When the engine **POWER** lever is in **FLY**, the ECU 701/DEC 701C and HMU respond to collective pitch position to automatically control engine speed and provide required power. During emergency operations when the **POWER** lever is moved to **LOCKOUT** and then retarded to an intermediate position, between **IDLE** and **FLY**, the engine will respond to collective input, but control of engine speed is no longer automatic and must be managed manually using the **POWER** lever.

WARNING

The T700-GE-701 and T700-GE-701C engine is designed to shut down when an overspeed condition is sensed. The OVSP TEST circuit trips at 95 - 97% N_P and should never be performed in flight. A power loss will result. Only maintenance is authorized to make this check.

2.47.4 N_P Overspeed Protection System. The overspeed protection system prevents turbine overspeed. The system receives power turbine speed signals from the torque and overspeed sensors located in the exhaust frame. If the N_P meets or exceeds 119.6± 1 %, two frequency sensing circuits output a signal to the overspeed system which causes the Overspeed Drain Valve (ODV) to shut off fuel flow to the engine. Two overspeed test switches are located on the **CHK OVSP TEST/GEN RST** panel (fig 2-43). The switches, labeled **CKTA** and **CKTB**, permit the use of two separate circuits to test each engine in the normal power turbine speed range. The overspeed test switches are used during maintenance operational checks.



LBA0020

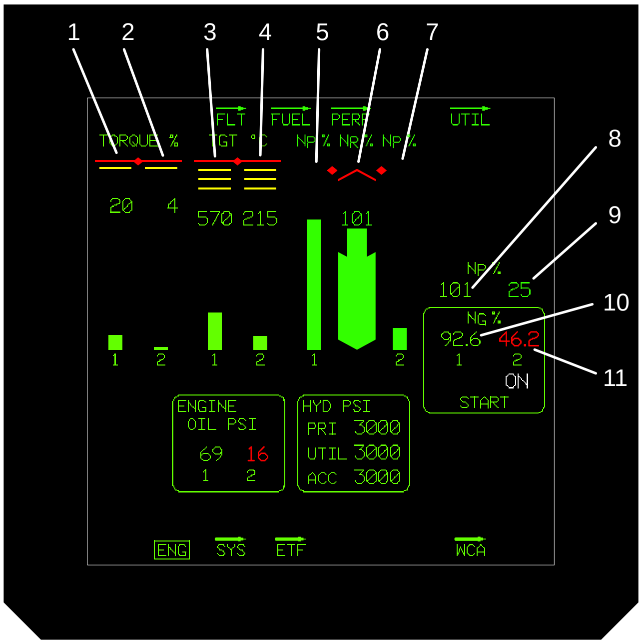
Figure 2-43. Check Overspeed Test/Generator Reset Panel

2.48 ENGINE (ENG) PAGE INDICATION

Engine operational parameters are indicated on the Engine (**ENG**) page. The **ENG** page has three formats: a “Ground” format, an “In-Flight” format and an “Emergency” format. Engine performance data is provided on the **PERF** page and is described in Chapter 7. The controls and displays necessary to establish engine and aircraft torque factors (ETF/ATF) are located on the **ETF** page which is also described in Chapter 7.

2.48.1 ENG Page Ground Format. At aircraft power up, the left MPD in both crew stations defaults to **ENG** ground format page (fig 2-44).

a. ENG Page Instruments. ENG page instruments display torque, engine and main rotor indications in the upper area of the format (fig 2-44, Table 2-2). Operation of these systems is indicated by color digital readouts and vertical tapes with operational limit markings.



LBA-30

Figure 2-44. ENG Page Instruments

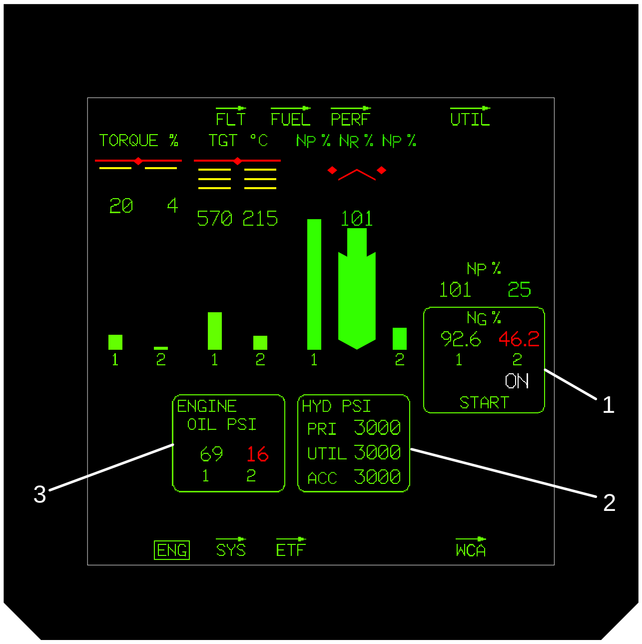
NOTE

The following descriptions of **ENG** page indications give ranges of those displays. Refer to Chapter 5 for system limits, instrument markings, and restrictions.

Table 2-2. Engine Instruments Displays

1. Engine **1** Torque (**TORQUE %**).
   Tape: 0 to 130% resolution 1%.
   Digital Readout: 0 to 255%, resolution 1%.
2. Engine **2** Torque (**TORQUE %**).
   Tape: 0 to 130% resolution 1%.
   Digital Readout: 0 to 255%, resolution 1%.
3. Engine **1** Turbine Gas Temperature (**TGT °C**).
   Tape/Digital Readout: 0° to 999 °C, resolution 1°.
4. Engine **2** Turbine Gas Temperature (**TGT °C**).
   Tape/Digital Readout: 0° to 999 °C, resolution 1°.
5. Engine **1** Power Turbine Speed (**N_P %**).
   Tape: 0 to 120 % RPM resolution 1%.
6. Main Rotor Speed (**N_R %**).
   Tape: 0 to 120% RPM, resolution 1%.
   Digital Readout: 0 to 130%, resolution 1%.
7. Engine **2** Power Turbine Speed (**N_P %**).
   Tape: 0 to 120% RPM, resolution 1%.
8. Engine **1** Power Turbine Speed (**N_P %**).
   Digital Readout: 0 to 130%, resolution 1%.
9. Engine **2** Power Turbine Speed (**N_P %**).
   Digital Readout: 0 to 130%, resolution 1%.
10. Engine **1** Gas Generator Speed (**N_G %**).
    Digital Readout: 0 to 120%, resolution 0.1%.
11. Engine **2** Gas Generator Speed (**N_G %**).
    Digital Readout: 0 to 120%, resolution 0.1%.

b. Ground Format Indications. The lower half of the **ENG** page ground format displays engine oil pressure and hydraulic pressure information in digital form (fig 2-45). The ground format will be displayed if the starter is engaged during flight. The **ENG** page ground format displays the following system indications within the parameters listed.



LBA3002

Figure 2-45. Ground Format Indications

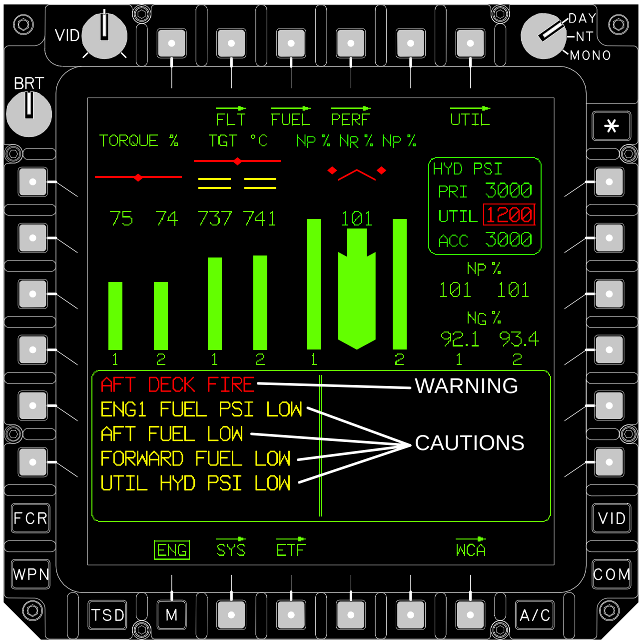
Table 2-3. Start, Engine Oil, Hydraulic Systems Status

1. Start status (**START**) window. The START status window and starter mode **ON** or **OVRD** label (WHITE) will be displayed when the starter is engaged.
2. Hydraulic pressure (**HYD PSI**) status window. The Primary (**PRI**), Utility (**UTIL**), and Accumulator (**ACC**) pressures will be displayed in the lower area of the page on the ground format, and in the upper right area of the in-flight format when hydraulic pressure is less than 1260 psi or greater than 3300 psi for more than 5 minutes or greater than 3400 psi for more than 5 seconds.
Digital Readout: 0 to 6000 psi, resolution 10 psi.
3. Engine oil pressure **(ENGINE OIL PSI)** status window. The engine **1** and **2** oil pressures will be displayed in the lower area of the page on the ground format, and in the upper right area of the in-flight format when oil pressure is less than 23 psi or greater than 120 psi. Digital Readout: 0 to 255 psi, resolution 1 psi.

NOTE

Display of the **HYD PSI** status window takes priority over the **ENGINE OIL PSI** status window on the **ENG** page in-flight format.

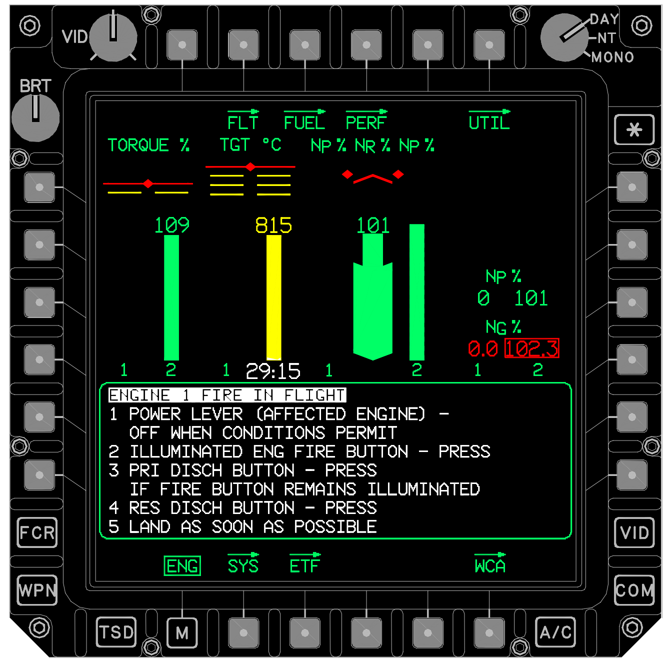
2.48.2 ENG Page In-Flight Format.. The upper half of the **ENG** page in-flight format (fig 2-46) displays the same indications as the ground format. When both **POWER** levers are advanced from **IDLE** to **FLY**, the **ENG** page automatically changes from Ground format to In-flight format. The lower half of the page will list active cautions in YELLOW and warnings in RED as they occur, or display emergency procedures when applicable.



LBA-3003

Figure 2-46. In-flight Format - Active Warnings and Cautions

This text, displayed in WHITE, is provided to allow the crew to rapidly verify procedures once immediate corrective action has been taken.



LBA5191

Figure 2-47. ENG Instruments Page Emergency Format

NOTE

Emergency procedures will be displayed on the **ENG** page emergency format only when a DTC with procedures data is installed and loaded.

2.48.3 ENG Page Emergency Format. The **ENG** page emergency format (fig 2-47) is automatically displayed in response to all aircraft warnings. The upper half of the **ENG** page emergency format displays the same indications as the ground and in-flight formats (Table 2-2). The lower half of the page will display a window containing the immediate action steps associated with the active warning condition.

2.48.4 Count-Down Timers. Count-down-timers are displayed in WHITE on the MPD **ENG** Page (fig 2-48) and decrement based upon the parameters listed in Table 2-4. When a timer has decremented completely, it displays 0:0 until reset. In addition Engine TGT values are displayed on the **FLT** Page and the HMD based upon the parameters in Table 2-5.

NOTE

During multiple timer operations, the highest timer number (1-4) value will be displayed. Earlier timers will continue to run. As power is reduced, each preceding timer value will be displayed, and each timer will be reset, automatically, in order.

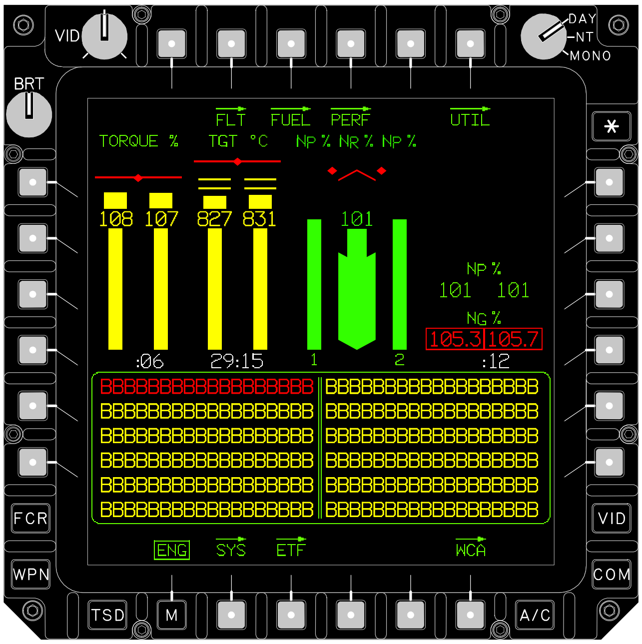


Figure 2-48. Engine Instrument Timers

Table 2-4. Engine Page Timers

PARAMETER	CONDITIONS
TORQUE	Dual Engine: › 100%, timer decrements from 6 seconds.
	Single Engine: › 110% (contingency), timer decrements from 2 minutes and 30 seconds (timer 1).
	› 122% timer decrements from 6 seconds (timer 2).
TGT (**-701**)	Dual Engine:› 807 °C, timer decrements from 30 minutes.
	Single Engine:› 807 °C, timer decrements from 30 minutes (timer 1).
	>864 °C, timer decrements from 2 minutes and 30 seconds (timer 2).
	› 919 °C, timer decrements from 12 seconds (timer 3).

Table 2-4 Engine Page Timers (cont)

TGT (**-701C**)	Dual Engine: › 810 °C, timer decrements from 30 minutes. (timer1).
	Either engine: › 870 °C, timer decrements from 10 minutes (timer 2).
	Single Engine: >810 °C, timer decrements from 30 minutes (timer 1)
	› 870 °C, timer decrements from 10 minutes (timer 2).
	<878 °C timer decrements from 2 minutes and 30 seconds (timer 3).
	<896 °C timer decrements from 12 seconds (timer 4).
N_G	Either engine N_G › 102.2%, timer decrements from 12 seconds.
N_P 1	Engine 1 N_P > 105%, timer decrements from 12 seconds.
N_P 2	Engine 2 N_P > 105%, timer decrements from 12 seconds.

Table 2-5. MPD FLT Page and HMD TGT

TGT (**-701**)	Dual engine: › 807 °C, timer decrements from 30 minutes. TGT value is displayed on HMD and FLT page during the final 2 minutes.
	Single engine: › 864°C, timer decrements from 2 minutes and 30 seconds. TGT value is displayed on HMD and FLT page the entire 2 minutes and 30 seconds (timer 2).
TGT (**-701C**)	Dual engine: › 810 °C, timer decrements from 30 minutes. TGT value is displayed on HMD and **FLT** page during the final 2 minutes (timer 1).
	› 870 °C, timer decrements from 10 minutes. TGT value is displayed on HMD and **FLT** page during the final 2 minutes (timer 2).
	Single Engine: >878 °C, timer decrements from 2 minutes and 30 seconds. TGT value is displayed on HMD and **FLT** page the entire 2 minutes and 30 seconds (timer 3).

Section IV. FUEL SUPPLY SYSTEM

2.49 FUEL SUPPLY SYSTEM

NOTE

Fuel grades, specifications, and servicing instructions are described in Servicing, Parking, and Mooring, Section XV.

The fuel system (fig 2-49) provides fuel and fuel management provisions to operate both engines and the APU. Fuel is stored in two crash resistant, self sealing fuel cells; one forward and one aft of the ammunition bay. Fuel may be transferred from either cell to the other. Fuel levelling can be accomplished manually or automatically. The system is also equipped to selectively crossfeed fuel to engines from either the forward or aft fuel cells. The aircraft has provisions for carrying external fuel tanks on the wing pylon attach points. There is also a provision for an internal auxiliary fuel cell carried in the ammunition bay.

2.50 FUEL TANKS

Two internal fuel cells provide the main storage for the aircraft fuel supply. The forward fuel cell holds 156 gal.; the aft fuel cell holds 220 gal.

2.51 EXTENDED RANGE KIT

Up to four auxiliary tanks can be mounted on the four wing pylons for extended range operations. Each auxiliary tank holds up to 230 usable gal. The auxiliary tanks can be jettisoned in the same manner as any other externally mounted stores.

2.51A INTERNAL AUXILIARY FUEL SYSTEM (IAFS)

An internal auxiliary fuel cell can be installed in the ammunition bay for extended range operations. The internal auxiliary fuel system holds a 129, or a 98, usable gal. cell. The fuel cell may be equipped with a fuel probe that measures the fuel quantity.

2.52 FUEL TRANSFER SUBSYSTEM

The fuel transfer subsystem allows for the transfer of fuel between the internal fuel cells and from both the external tanks and the internal auxiliary fuel cell to the internal fuel cells. The internal fuel transfer pump is a pneumatically driven pump that allows the transfer of fuel between the forward and aft fuel cells, and from external fuel tanks to the internal forward and aft cells. The internal transfer mode provides manual and automatic selections via the MPD. When external fuel tanks are mounted on both the inboard and outboard pylons, pressurized air is routed into the outboard auxiliary tank forcing the fuel from the outboard auxiliary tank to the inboard auxiliary tank and then to the internal fuel cells. When an internal auxiliary fuel cell is installed, an electric pump is used to transfer fuel from the internal auxiliary fuel cell directly into the forward and aft fuel cells simultaneously. Both auxiliary fuel subsystems are selected on/off via the MPD and managed through fuel system priorities.

2.53 FUEL CROSSFEED SUBSYSTEM

WARNING

The CROSSFEED button shall be set to NORM position at all times while in flight, unless executing emergency procedures for engine 1 fuel PSI and engine 2 fuel PSI. A malfunctioning crossfeed valve could result in a single engine flameout.

The crossfeed subsystem allows both engines to draw fuel from either internal fuel cell. There are two crossfeed valves, one for each engine. The valves are three-way, four-position valves. The crossfeed modes are crewmember selectable functions via the MPD. Crossfeed mode selections are described in paragraph 2.60.4. The AFT crossfeed is automatically activated for the engine being started by the system processor during engine start. After start, the crossfeed is automatically reset to **NORM**.

2.54 FUEL QUANTITY SUBSYSTEM

The fuel quantity subsystem measures remaining fuel and detects low levels in the forward and aft fuel cells. The fuel quantity is displayed in lb for each cell and for the total internal fuel remaining. A forward fuel low caution message is displayed when the forward cell quantity drops below 240 lb or when the low level switch in the fuel cell is activated. The low level switch will be activated at a lower fuel quantity of 175 $\pm$20 lb. An aft fuel low caution message is displayed when the aft cell quantity drops below 260 lb or when the low level switch in the fuel cell is activated. The low level switch will be activated at a fuel quantity of 240 $\pm$20 lb. When an auxiliary tank is empty an advisory is annunciated.

2.55 FUEL BOOST SUBSYSTEM

The fuel boost pump provides pressurized fuel during engine start and is used to increase fuel pressure when manually selected **ON**. The pneumatically driven boost pump pressurizes the fuel line out of the aft cell. Under normal operation, fuel is drawn out of the fuel cells by the main engine fuel pumps.

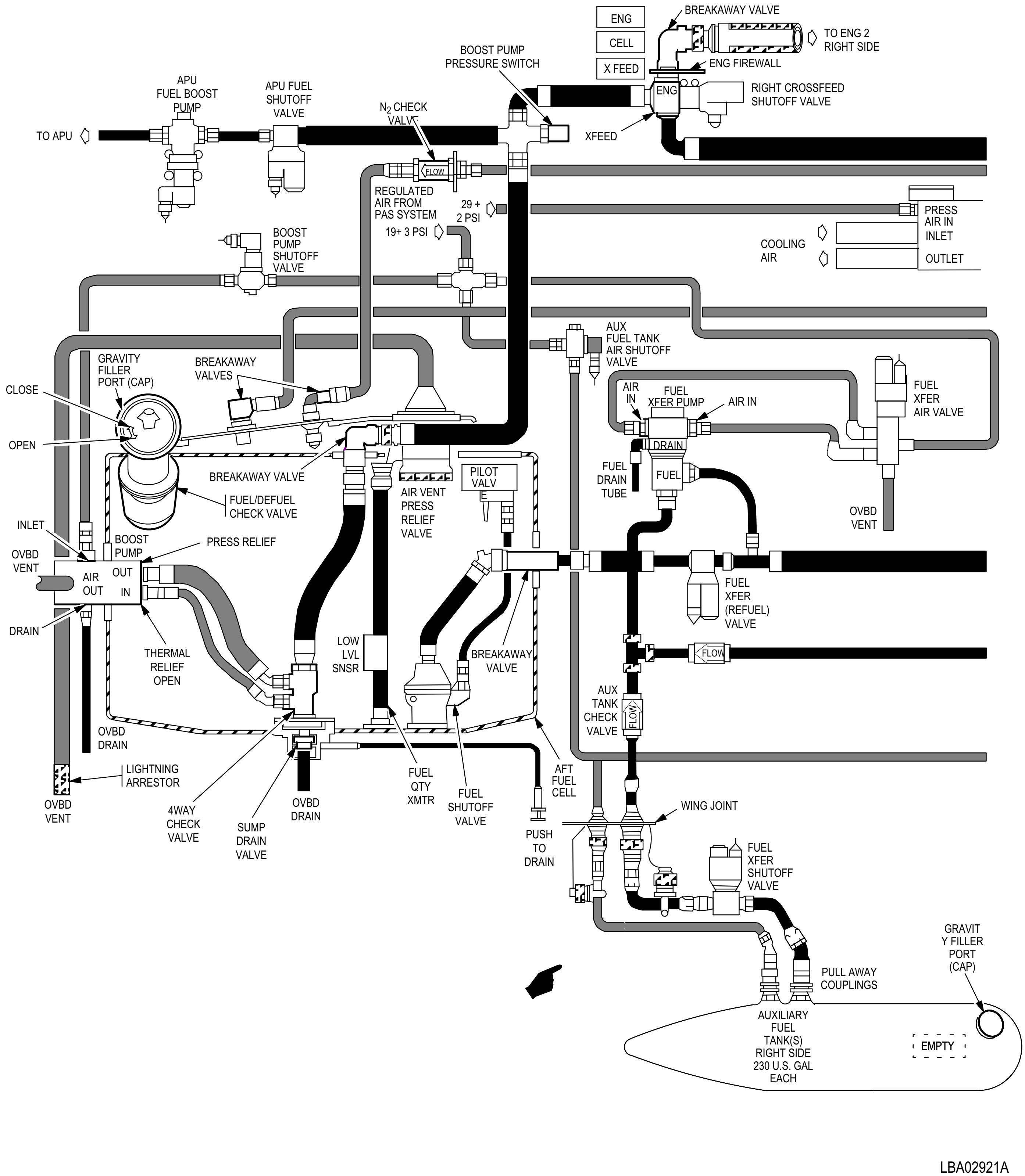


Figure 2-49. Fuel System (Sheet 1 of 2)

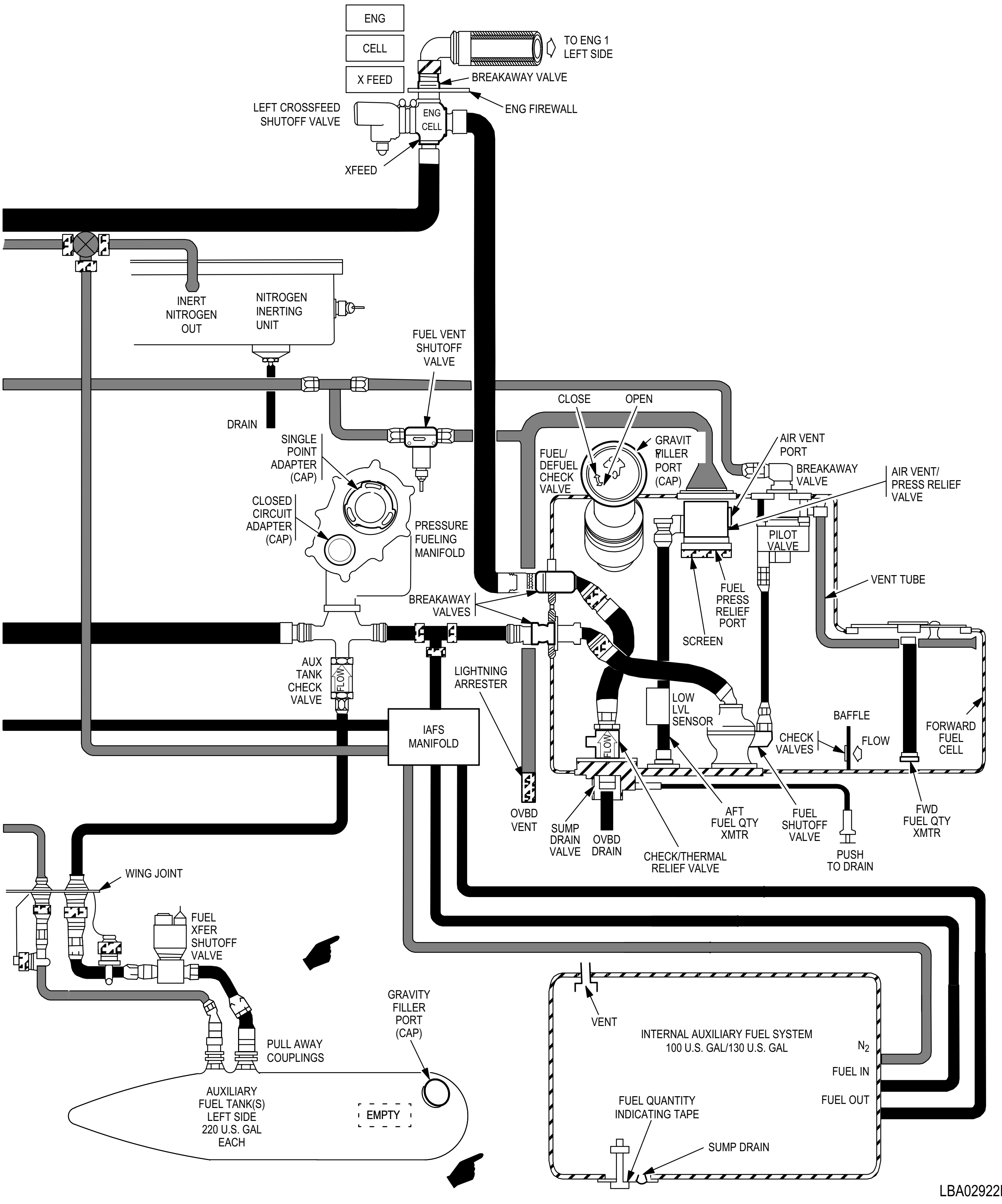


Figure 2-49. Fuel System (Sheet 2 of 2)

2.56 FUEL FLOW RATE SUBSYSTEM

The fuel flow rate subsystem calculates engine fuel consumption rate in lb/hr.

2.57 APU FUEL SUBSYSTEM

The APU fuel subsystem provides fuel to the APU. It consists of an electrically driven APU boost pump which draws fuel from the aft fuel cell and provides pressurized fuel to the APU. The APU shut-off valve controls the flow of fuel from the aft cell to the APU via the boost pump.

2.58 REFUEL SUBSYSTEM

The refuel subsystem allows for pressurized refueling via a single point adapter or a closed circuit adapter. It also allows for gravity refueling via fuel cell filler ports for the external fuel tanks and the forward and aft internal fuel cells. The internal auxiliary fuel cell can only be refueled via a pressurized adapter. The external refuel panel provides direct control of the refuel, vent, level control valve units, and internal auxiliary fuel cell.

2.59 NITROGEN INERTING UNIT (NIU)

The NIU reduces fire hazards associated with fuel cell ullages (air space) by filling the ullage with oxygen depleted air. The NIU is self contained and automatically operated whenever pressurized air and 115 Vac is available. A press-to-test panel (fig 2-50) is located in the aft avionics bay. The press-to-test button will only be valid when pressurized air and 115 Vac is applied to the system. The press-to-test button will indicate that the NIU is not providing pressurized air. The NIU utilizes pressurized air from the pressurized air manifold and purges about 70% of the oxygen present. This air is then regulated into the aft fuel cell and onward into the FWD fuel cell. When transferring fuel from the internal auxiliary fuel cell, all air is diverted to the internal auxiliary fuel cell.

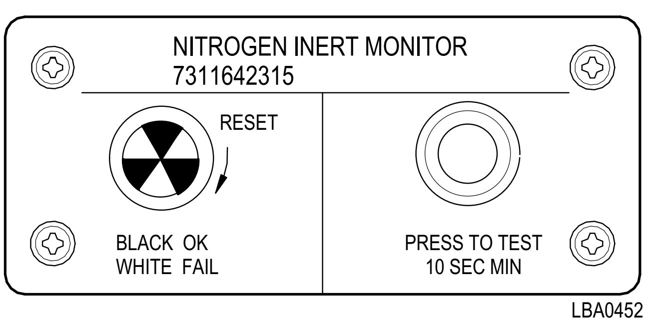


Figure 2-50. NIU Test Panel

2.60 MPD FUEL MANAGEMENT PAGE

The **FUEL** page displays all information and controls required to manage the internal fuel system (fig 2-51), the external auxiliary system, and the internal auxiliary fuel system (para 2.61 and 2.61A). The aircraft icon is laid out in the same relative position as the physical equipment on the aircraft. Status windows for fuel quantity, fuel flows and aircraft endurance are located at the lower portion of the display. When a crewmember selects an operation, the associated fuel lines will be displayed to provide a graphic representation of fuel routing.

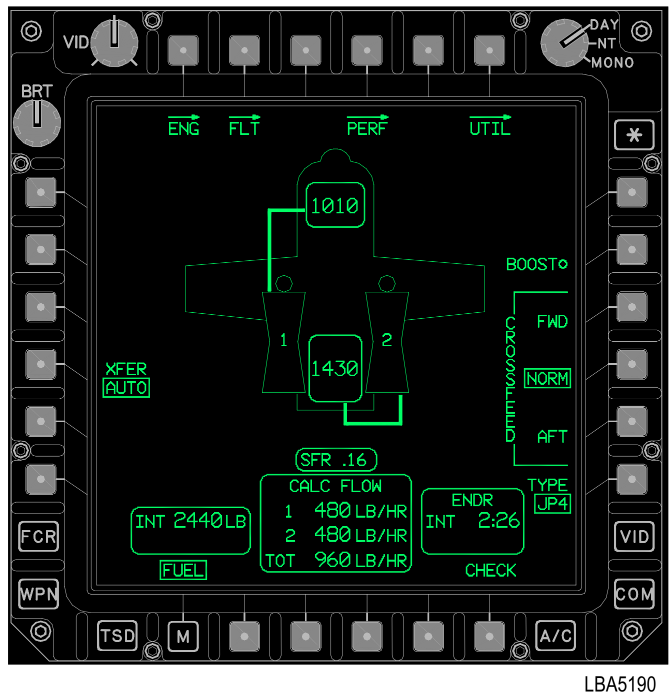


Figure 2-51. Fuel Page - Standard Configuration

Bezel button selections are as follows:

- T1 **ENG** button
- T2 **FLT** button
- T4 **PERF** button
- T6 **UTIL** button
- L4 **XFER** button
- R2 **BOOST** ON/OFF button
- R3 **CROSSFEED FWD** button
- R4 **CROSSFEED NORM** button
- R5 **CROSSFEED AFT** button
- R6 **TYPE** button
- B6 **CHECK** button

2.60.1 Transfer (XFER) Button. The **XFER** control buttons (fig 2-52) allow crewmembers to balance the fuel load between the forward and aft fuel cells. Four option buttons, **FWD**, **OFF, AFT**, and **AUTO**, provide the means to transfer fuel between the forward and aft fuel cells.

NOTE

Selecting either **FWD** or **AFT** button will automatically override any previous internal transfer selection.

a. Forward (FWD) XFER Button. The **FWD** button allows the manual transfer of fuel from the aft fuel cell to the forward fuel cell.

b. Off (OFF) XFER Button. The **OFF** button stops the transfer of fuel between the forward fuel cell and the aft fuel cell.

c. Aft (AFT) XFER Button. The **AFT** button allows the manual transfer of fuel from the forward fuel cell to the aft fuel cell.

d. Automatic (AUTO) XFER Button. The **AUTO** button (fig 2-53) allows crewmembers to select automatic fuel levelling between the forward and aft fuel cell (Table 2-6).

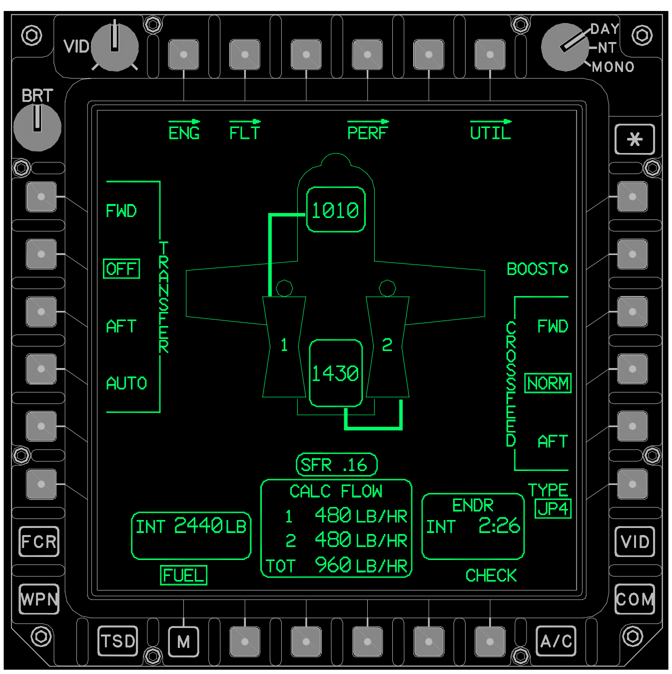


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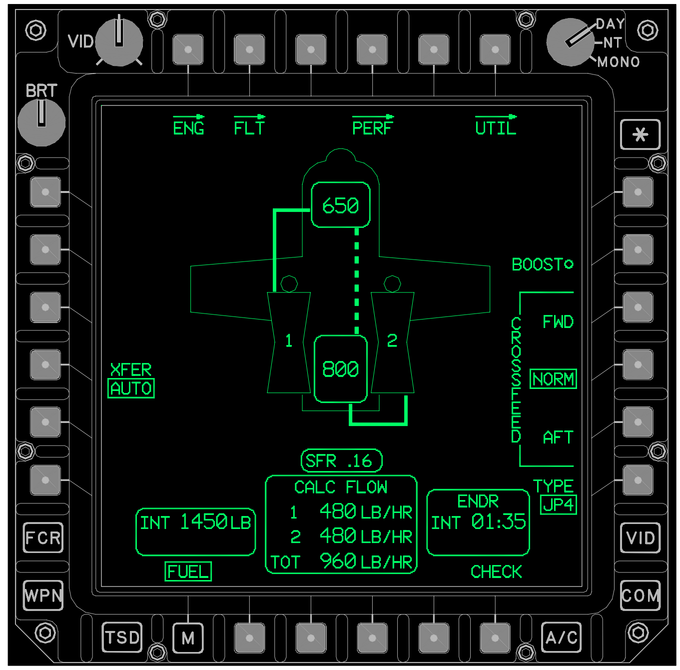
Figure 2-52. Fuel Transfer Options



LBA5000

Figure 2-53. Automatic Fuel Transfer

Table 2-6. Automatic Fuel Levelling Conditions (with AUTO selected)

BEGIN AUTO LEVELLING TO AFT TANK
1. Engines 1 and 2 are running.
2. APU or ENG bleed air is on.
3. Aft Fuel level <814 lb
4. No Fwd Fuel Low level indication.
5. Fwd Fuel quantity >280 lb
6. If Fwd Fuel quantity >500 lb and is >100 lb more than Aft Fuel quantity.
7. If Fwd Fuel quantity <500 lb and is >50 lb more than Aft Fuel quantity.
HALT AUTO LEVELLING TO AFT TANK
1. Fwd Fuel low level Caution.
2. Fuel split <20 lb
3. APU is off and ENG bleed air is off

Table 2-6. Automatic Fuel Levelling Conditions (with AUTO selected) (cont)

AUTO LEVELLING TO FWD TANK
1. Engines 1 or 2 are running.
2. APU or ENG bleed air is on.
3. Fwd Fuel level <814 lb
4. No Aft Fuel Low level indication.
5. Aft Fuel quantity >240 lb
6. If Aft Fuel quantity >500 lb and is >100 lb more than Fwd Fuel quantity.
7. If Aft Fuel quantity <500 lb and is >50 lb more than Fwd Fuel quantity.
HALT AUTO LEVELLING TO FWD TANK
1. Aft Fuel low level Caution.
2. Fuel split <20 lb
3. Fwd tank is full
4. APU is off and ENG bleed air is off

2.60.2 Transfer Status. When the internal transfer system is commanded on, the fuel transfer line will be displayed and marquee to indicate direction of transfer. The fuel transfer line is displayed in WHITE for three seconds upon activation and then turns green. Transfer status is also indicated during automatic transfer. Fuel transfer is stopped when fuel split is less than 20 lb.

2.60.3 Boost (BOOST) ON/OFF Button. The **BOOST** button controls boost pump operation. The **BOOST** button provides an **ON** dot to the right of the **BOOST** label when the boost has been activated. When the boost pump has been actioned on the system automatically sets the fuel **CROSSFEED** to **AFT** and the **CROSSFEED AFT** button.

2.60.4 Fuel Page Crossfeed Selections. Three selectable buttons, **FWD**, **NORM** and **AFT**, will allow selection of which cells will feed each engine. Both engines will feed from either the forward or aft cell when selected. This allows the pilot an emergency means to continue flight to a safe area after sustaining fuel system damage. Crossfeed routing can be used on the ground to control fuel feed during hot refueling.

a. Forward (FWD) CROSSFEED Button. The **FWD** button routes fuel from the forward fuel cell to engine 1 and 2. The aircraft icon reflects the **FWD** selection by providing a graphic representation of the forward fuel cell routing fuel to engine 1 and 2. The lines are displayed in WHITE for three seconds upon change of state, then they are displayed in GREEN.

b. Normal (NORM) CROSSFEED Button. The **NORM** button routes fuel from the forward fuel cell to engine 1 and aft fuel cell to engine 2. The aircraft icon reflects this state by providing a graphic representation of the fuel cell lines. The lines are displayed in WHITE for three seconds upon change of state, then they are displayed in GREEN.

c. Aft (AFT) CROSSFEED Button. The **AFT** button routes fuel from the aft fuel cell to engine 1 and 2. The aircraft icon reflects the **AFT** selection by providing a graphic representation of the aft fuel cell routing fuel to engine 1 and 2. The lines are displayed in WHITE for three seconds upon change of state, then they are displayed in GREEN.

2.60.5 Fuel Type Selection. The system will default to fuel type JP-8. The operator will have the option to select the fuel type other than JP-8 through the **TYPE** button. Selection of the **TYPE** button will display the fuel type selections **JP-8**, **JP-5**, and **JP-4**. Fuel **TYPE** entries affect external fuel tank and non-probed internal auxiliary fuel cell quantity computations by changing fuel density values. Internal fuel quantity densities are sensed automatically. The fuel **TYPE** also affects the calculated fuel flow.

2.60.6 Status Windows. The following status windows are displayed during normal aircraft fuel configuration:

a. Forward (FWD) Fuel Cell Quantity. The **FWD** fuel quantity is displayed in green at the top area of the aircraft icon and provides forward fuel cell quantity. The forward fuel cell quantity is displayed in YELLOW when the cell is detected as low level. The **FWD** fuel cell display range is 0 to 1100 lb and depicts in units of 10 lb.

b. Aft (AFT) Fuel Cell Quantity. The **AFT** fuel cell quantity is displayed in green in the bottom area of the aircraft icon and provides aft fuel cell quantity. The aft fuel cell quantity is displayed in YELLOW when the cell is detected as low level. The **AFT** fuel cell display range is 0 to 1500 lb and depicts in units of 10 lb.

c. Internal (INT) Fuel Quantity Status Window. The **INT** fuel quantity data field is displayed in the lower left corner of the **FUEL** page and provides the crewmember the total fuel quantity of the forward and aft fuel cells only. The internal fuel quantity is displayed in YELLOW when either the forward or aft fuel cell quantity is displayed in YELLOW. Internal fuel quantity is displayed within a range of 0 to 2600 lb in increments of 10 lb. The internal fuel quantity is monitored by internal sensors and does not require any operator input.

d. Endurance (ENDR) Status Window. The **ENDR** status window is displayed in the bottom right corner of the page and provides the amount of fuel (forward fuel cell and aft fuel cell) remaining in time. Endurance is based on calculated fuel flow and will vary based upon power application. The remaining time is displayed in WHITE when it is less than 20 minutes.

e. Fuel Flow (CALC FLOW) Status Window. The **CALC FLOW** is displayed in the bottom center of the **FUEL** page and provides crewmembers with the uncorrected main engines calculated fuel flow in lb per hour (LB/HR). Fuel flow is calculated based on static/free air temperature, engine torque, pressure altitude, fuel type, and engine type. The engine 1 & 2 fuel flow data field has a display range of 0 to 950 LB/HR in increments of 5 LB/HR. The total fuel flow data field has a display range of 0 to 1900 LB/HR in increments of 5 LB/HR.

f. Specific Fuel Range (SFR) Status Window. The **SFR** is displayed above the **CALC FLOW** status window. **SFR** is a calculation of ground speed in knots divided by the total fuel uncorrected flow for the present power setting, and is used to determine power settings for optimum fuel economy during cruise. **SFR** will display only when airspeed is ten kts or above.

2.61 FUEL PAGE EXTERNAL AUXILIARY FUEL TANK SELECTION

WARNING

Extended Range Fuel System (ERFS) tanks do not have any ballistic protection and are vulnerable to high-speed projectiles. Projectiles passing through a fueled ERFS tank can generate a fuel driven fuselage fire and or cause the tank to detonate with the potential for losing both thw aircrew and aircraft.

The fuel system will detect the presence and location of external auxiliary tanks on the aircraft and display icons representing the external tanks on the **FUEL** page (fig 2-53A). A float switch in each tank indicates when that tank is empty and the **FUEL** page displays a WHITE indicator **E** on the center of the tank icon.

Additional Bezel buttons available when auxiliary fuel tanks are installed are:

- L1 — **L AUX** Fuel Transfer ON/OFF button
- L5 — **AUX GALLONS EXT** button
- R1 — **R AUX** Fuel Transfer ON/OFF button

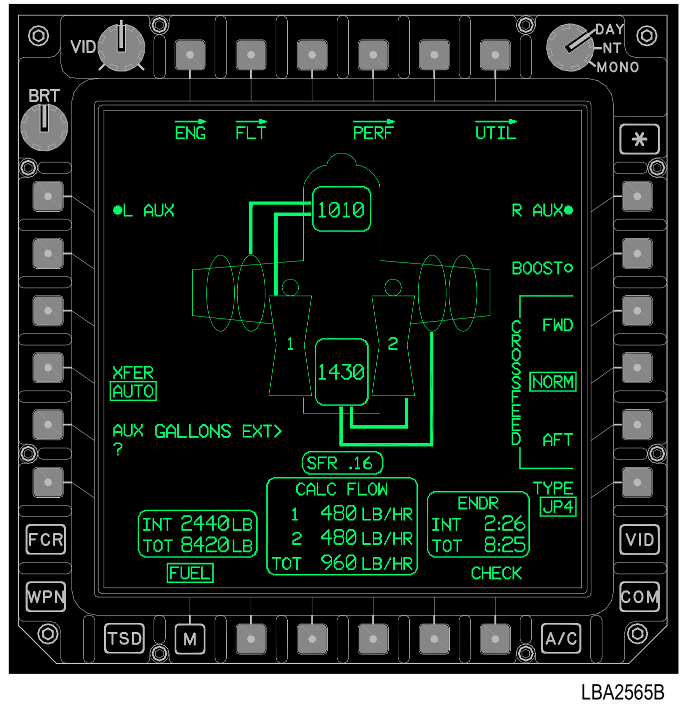


Figure 2-53A. Fuel Page - External Auxiliary Fuel Tanks Installed

2.61.1 External Auxiliary Fuel Transfer Operation. External fuel transfer can be accessed on the **FUEL** page. If tank(s) are installed on the left side of the aircraft, **L AUX** selection is displayed. If tank(s) are installed on the right side of the aircraft, **R AUX** selection is displayed. A crewmember can select one or both auxiliary fuel tank transfers.

2.61.2 LEFT and RIGHT AUX ON/OFF Buttons. The **AUX** on/off buttons start or stop fuel transfer from left and/or right tanks. The left and/or right fuel tanks must be installed on the aircraft for the **AUX** buttons to be displayed. When an **AUX** button is activated, the respective fuel line graphic will be shown and the **ON** dot will be displayed. The lines are displayed in WHITE for three seconds upon activation, then they are displayed in GREEN.

NOTE

Auxiliary fuel quantity must be added through the **AUX GALLONS EXT** data entry button on the **FUEL** page.

a. Either left or right aux fuel transfer mode will be commanded to off when any of the following occurs:

- A crewmember deselects aux transfer via the MPD.
- The SP loses communication with both WPs.
- The auxiliary tanks on that side of the aircraft indicate empty.
- AC power is lost.

b. If an internal fuel transfer is commanded, the external auxiliary fuel transfer will be suspended until the the forward/aft transfer is complete. The MPD **R/L AUX** button will display the auxiliary transfer mode as **ON** while in the suspended mode. [**BLK 2** Additionally, the external fuel transfer lines will be displayed in partial intensity green while suspended.] A crewmember may select auxiliary transfer on and off while in the suspended mode. This applies to both manual and automatic internal fuel cell transfers.

2.61A FUEL PAGE INTERNAL AUXILIARY FUEL TANK INSTALLED

The fuel system will detect the presence and configuration of the internal auxiliary fuel system on the aircraft and display an icon representing the internal auxiliary fuel cell on the **FUEL** page (fig 2-53B). A pressure switch indicates when the tank is empty, an advisory is displayed on the UFD/EUFD, and the **FUEL** page displays a WHITE indicator **E** on the center of the tank icon when empty.

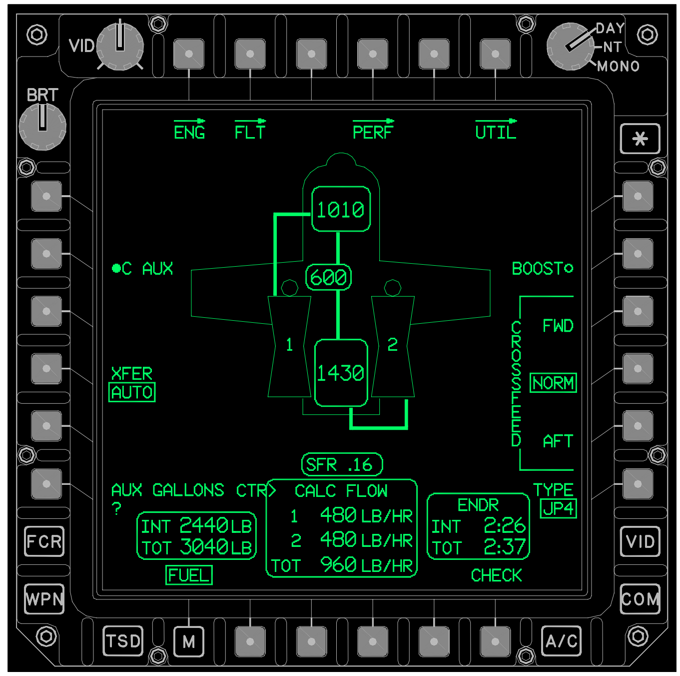


Figure 2-53B. Fuel Page - Internal Auxiliary Fuel Tank Installed

Additional Bezel buttons available when an internal auxiliary fuel cell is installed are:

- L2 **C AUX** Fuel Transfer ON/OFF button
- L6 **AUX GALLONS CTR** button (unprobed)

2.61A.1 Internal Auxiliary Fuel Transfer Operation. Internal auxiliary fuel transfer can be accessed on the **FUEL** page. When an internal auxiliary fuel cell is installed, the **C AUX** selection is displayed.

a. The internal aux fuel transfer mode will be commanded to off when any of the following occurs:

- A crewmember deselects aux transfer via the MPD.
- AC power is lost.
- The auxiliary tank is indicated as empty or failed.

b. If either an internal fuel transfer or an external auxiliary transfer is commanded, the internal auxiliary fuel transfer will be suspended until the the forward/aft/external transfer is complete. The MPD **ON** button will display the auxiliary transfer mode as on while in the suspended mode. [**BLK 2** Additionally, the external fuel transfer lines will be displayed in partial intensity green while suspended. A crewmember may select auxiliary transfer **ON** and **OFF** while in the suspended mode.] This applies to both manual and automatic internal fuel cell transfers.

2.61A.2 Center AUX On/Off Button. The **C AUX** on/off button starts or stops the fuel transfer from the center tank. The center fuel tank must be installed on the aircraft for the **C AUX** button to be displayed. When the **C AUX** button is activated, the fuel line graphic will be displayed and the on dot will be displayed. Lines are displayed in WHITE for three seconds upon activation, then they are displayed in GREEN. Fuel is transferred from the internal auxiliary fuel cell to both the forward and aft fuel cells simultaneously.

NOTE

Unless probed, internal auxiliary fuel quantity must be added through the **AUX GALLONS CTR** data entry button on the **FUEL** page.

2.61A.3 Status Windows. Additional status is displayed when auxiliary fuel tanks are installed. This data field will only be displayed when the system has detected that there are external tanks located on the aircraft.

a. Total (TOT) Fuel Quantity Status. The **TOT** quantity is displayed in the bottom left corner of the **FUEL** page and provides the crewmember the total fuel quantity of the forward, aft, and all auxiliary tanks. This data field will only be displayed when the system has detected that there are external tanks located on the aircraft. The total fuel quantity data field has a display range of 0 to 8840 lb in increments of 10 lb. Auxiliary fuel quantity must be added through the **AUX GALLONS EXT** and/or **AUX GALLONS CTR** data entry buttons.

b. Total Endurance (ENDR TOT) Status. The **ENDR TOT** status window is displayed in the bottom right corner of the **FUEL** page and provides the total endurance based on the fuel remaining in the forward cell, aft cell, and all auxiliary fuel tanks. Total endurance is based on calculated fuel flow and will vary based upon power application.

2.62 FUEL CHECK

2.62.1 Fuel CHECK Button. When selected, the fuel **CHECK** button allows the calculation of (fig 2-54) burnout, VFR reserve, and IFR reserve times, based on the fuel quantity change, during the selected 15, 20, or 30 minute intervals.

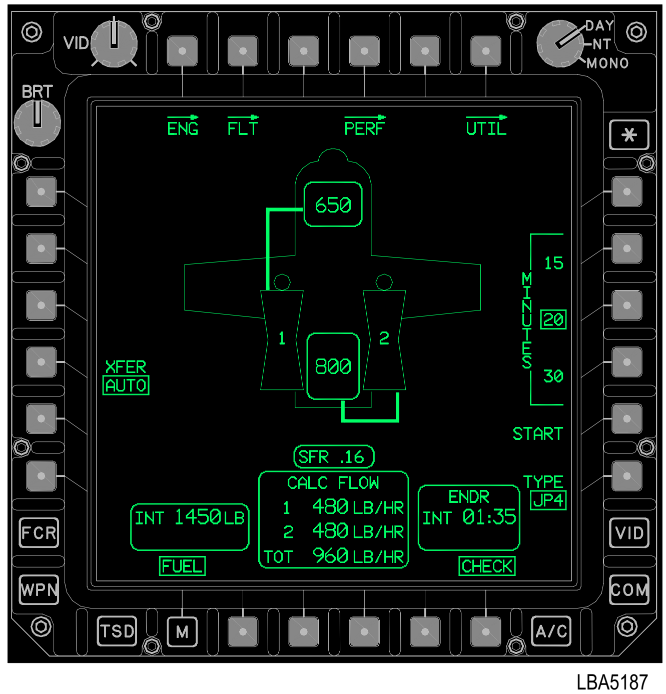


Figure 2-54. Fuel Page - CHECK Format

Additional bezel buttons available when **CHECK** is selected:

- R2 **15** (**MINUTES**) button
- R3 **20** (**MINUTES**) button
- R4 **30** (**MINUTES**) button
- R5 **START/STOP** button

2.62.2 Fuel Check Operation. Either crewmember may initiate a fuel check by selecting the **CHECK** button, pressing the desired **MINUTES (15, 20, or 30)** button and then pressing the **START** button. A status window in the upper left corner will display the **START** time, **RUN** time, and burn **RATE**. Upon completion of the check (fig 2-55), a status window, in the upper right corner, will display calculated **BURNOUT**, **VFR RES**, and **IFR RES** times in the currently selected time format, Zulu or local. The fuel check may be terminated prior to the selected **MINUTES** by selecting **STOP**. If neither crewmember is viewing the **CHECK** format at the conclusion of the check, an advisory will appear on the UFD/EUFD. Selection of the **CHECK** format by either crewmember will remove the advisory. Additional fuel checks may be initiated by selecting the **START** button.

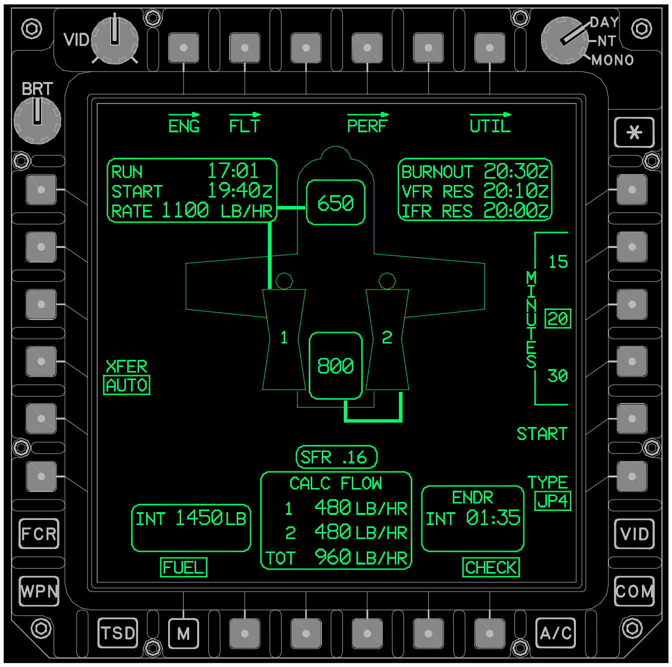


Figure 2-55. Fuel Page - CHECK Complete

Section V. FLIGHT CONTROL SYSTEM

2.63 FLIGHT CONTROL SYSTEM

The AH-64D employs an irreversible hydromechanical flight control system (fig 2-56). The hydromechanical system is mechanically activated with conventional cyclic, collective, and directional controls, through a series of push pull tubes and bellcranks which activate four airframe-mounted hydraulic servocylinders. The four hydraulic servocylinders control longitudinal/lateral cyclic, main rotor collective, and tail rotor pitch. The servocylinders incorporate integral Stability and Command Augmentation System (SCAS) actuators which are active whenever the Flight Management Computer (FMC) is on. Linear Variable Differential Transducers (LVDTs) are incorporated into each of the flight control axes. The LVDTs measure the positions of the controls and provide this information to the FMC. Hydraulic power is supplied by two independent hydraulic pumps which are mounted on the accessory gearbox of the main transmission. The FMC provides rate damping, command augmentation, attitude and altitude hold within the ± 10% (20% forward pitch) authority of the system. An electrically actuated horizontal stabilator is attached to the lower aft portion of the vertical stabilizer. Movement of the stabilator is commanded by the FMC in either a manual or automatic mode. A trim feel system is incorporated in both the cyclic and pedals providing a control force gradient with control displacement from a selected trim position. A trim release switch allows momentary disengagement of the trim feel system.

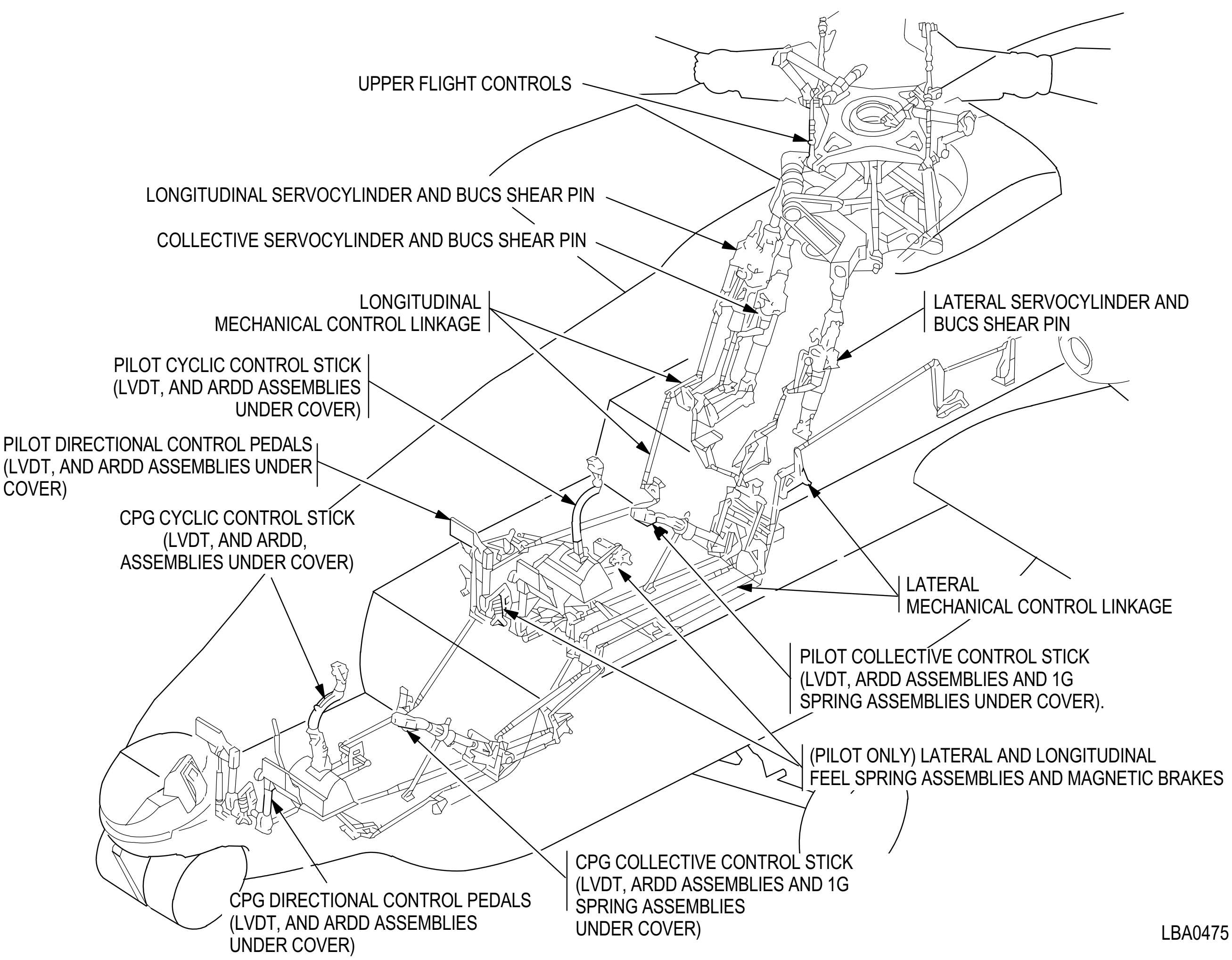


Figure 2-56. Flight Controls System

2.64 CYCLIC CONTROL SUBSYSTEM

Conventional cyclic control sticks (fig 2-57) are attached to individual support assemblies which house the primary longitudinal and lateral control stops and two LVDT's. The cyclic stick grips incorporate the force trim release, hold mode switch, and the FMC release button. The CPG cyclic stick incorporates a fold down mechanism to minimize interference when the CPG is not flying the aircraft. The CPG cyclic stick is fully effective in either the up or down position.

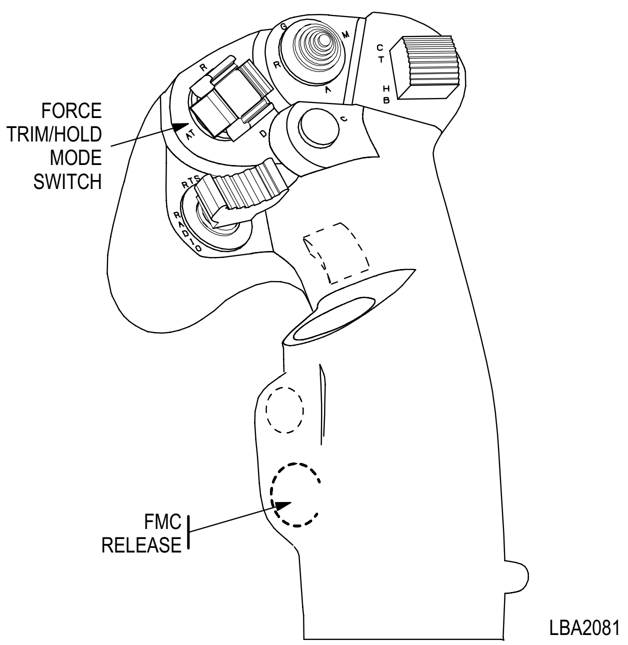


Figure 2-57. Cyclic Grip Flight Control Switches

2.65 COLLECTIVE CONTROL SUBSYSTEM

The collective pitch control system consists of identical collective grips (fig 2-58) in each cockpit. Movement of the collective is transmitted to the collective servocylinder for control of main rotor blade pitch angle and to the load demand spindle of each engines hydromechanical unit for load anticipation. Located at the base of each collective control is the primary control stop, an LVDT, and a 1G balance spring. The 1G spring counterbalances the weight of the collective control sticks. Both collective control sticks employ a friction adjustment twist grip. The collective control grips also provide the stabilator control switch.

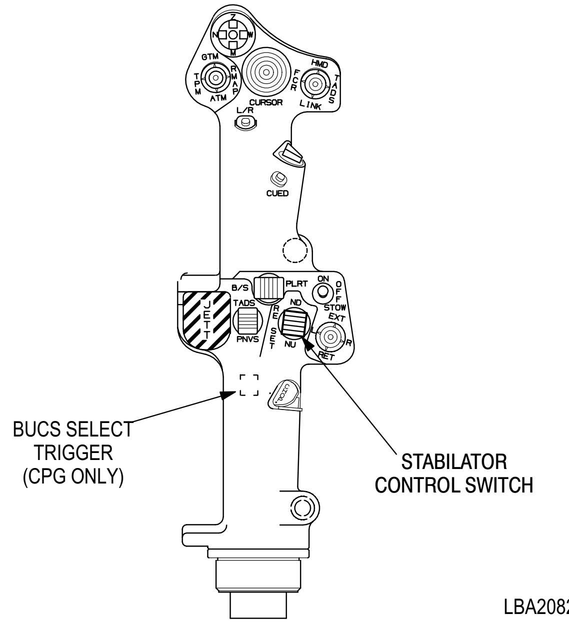


Figure 2-58. Collective Grip Flight Control Switches

2.66 DIRECTIONAL CONTROL SUBSYSTEM

The directional control system consists of pedals in each crew station which activate the tail rotor servocylinder located in the vertical stabilizer. Attached to each directional pedal assembly is a control stop and one LVDT. Pedal adjustment is accomplished through a lock/unlock lever located between and aft of the pedals. Wheel brakes are incorporated into the upper portion of the control pedals.

2.67 FORCE TRIM SUBSYSTEM

WARNING

Even with the force trim ON, the flight controls must be monitored at all times while the rotors are turning. When force trim is selected OFF from the A/C UTIL page, no force gradient will be available to position the cyclic. Hands off cyclic capability will NOT be available.

A force trim system is incorporated in the longitudinal, lateral and directional control axes. The force trim system is designed to keep the controls in the position that the pilot or CPG selects. The force trim system is located beneath the pilots floor. The Force Trim Release (FTR) switch allows the crewmember to momentarily interrupt the system. When interrupted, the force trim brakes allow movement of the controls without any resistance. When engaged, the magnetic brakes lock and the spring assemblies resist control movement. DC electrical power is required for operation of the system and a complete failure would disable the system and allow the cyclic and pedals to move freely without resistance from the trim feel springs.

2.68 HORIZONTAL STABILATOR

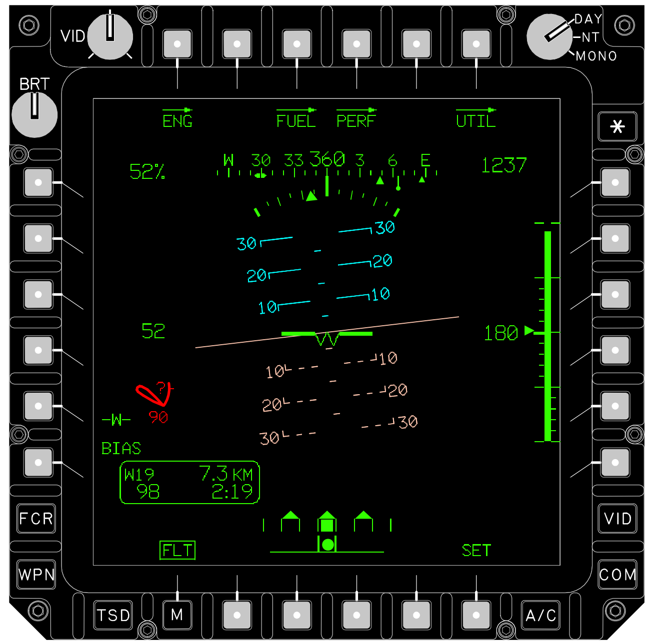
The stabilator provides pitch trim angle control and improves over-the-nose visibility at low airspeeds. The stabilator has both an automatic and a manual mode. The automatic mode is engaged following power-up of the aircraft and is controlled by the FMC. Two modes are available within the automatic control system. The auto-mode provides automatic scheduling in accordance with collective position, airspeed, and pitch rate. The Nap Of the Earth/Approach (NOE/A) mode commands the stabilator to 25° trailing edge down, up to a speed of 80 KTAS. At speeds greater than this, the stabilator schedule reverts to the auto-mode. A manual mode is selectable at airspeeds less than 80 KTAS, or is engaged when the automatic system fails. Manual control or stabilator reset is affected through the stabilator control switch on the collective flight grip. Depressing the stabilator control switch will reset the stabilator to the **AUTO** mode. Stabilator positioning is accomplished by two tandem DC motor actuators. Stabilator position information (in degrees) is presented on the **SYS** page, and relative position information on the the **FLT** page and on the FLT **SET** page. The stabilator trailing edge incorporates Gurney flaps for increased aerodynamic stabilization.

2.68.1 FLT and FLT SET Page. Stabilator indications on the **FLT** and FLT **SET** (fig 2-59) pages are as follows:

a. The stabilator symbol is displayed in WHITE without airspeed information when the stabilator is operating in the manual mode. When the stabilator has been detected as failed, the stabilator symbol is displayed in YELLOW along with the limiting TAS for the current stabilator position. The stabilator symbol and TAS limit are displayed in RED when the current TAS is greater than the TAS limit.

b. The nominal true airspeed (TAS) limit is displayed just below the symbol to indicate the maximum operating airspeed limit when the stabilator has been detected as failed. When the position of the stabilator is unknown, the nominal airspeed limit will default to the TAS equivalent of 90 KIAS. When FMC data is not valid, the nominal IAS limit is displayed.

c. The “?” symbol is displayed in red just above the symbol when the stabilator has been detected as failed and the position of the stabilator is unknown.



LBA2083A

Figure 2-59. FLT Page - Stabilator Symbol

2.68.2 Engine SYS Page. Indications in the Stabilator Status Window on the engine **SYS** page (fig 2-60) are as follows:

a. The stabilator trailing edge angle is displayed at a range from -10° up to 35° down. A “?” symbol is displayed when the stabilator has been detected as failed and the position of the stabilator is unknown.

b. The stabilator orientation is presented as “UP” or “DN” (down). This indication is not presented when the stabilator has been detected as failed.

c. The nominal TAS limit is displayed to indicate the maximum operating airspeed limit for the current trailing edge angle. The limit is displayed in WHITE when the stabilator is operating in the manual mode; the limit is displayed in YELLOW when the stabilator has been detected as failed. When the position of the stabilator is unknown, the nominal airspeed limit will default to the TAS equivalent of 90 KIAS. When FMC data is not valid, the nominal IAS limit is displayed.

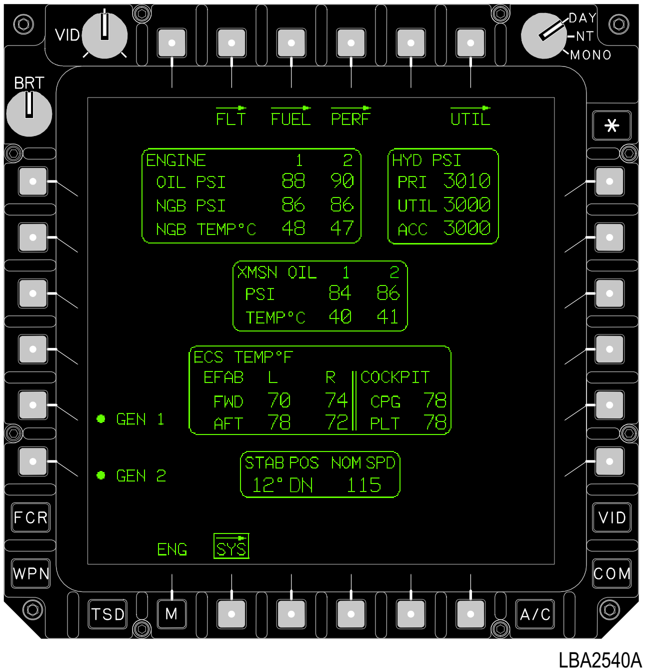


Figure 2-60. SYS Page - Stabilator Status

2.69 CONTROL SWITCHES

Control switches are integrated into the cyclic and collective to allow hands-on cyclic and collective manipulation of the systems. The cyclic grip (fig 2-57) incorporates an Flight Management Computer (FMC) release button and the Force Trim/Hold Mode switch. The FMC release button immediately disengages the SCAS if pressed. The Force Trim/Hold Mode switch is a five position center maintained switch. In the center position, SCAS, force trim and the hold mode, if selected, are active. Pressing the switch up (forward) to the Release (**R**) position interrupts force trim and the attitude hold mode references if the hold modes are selected. Releasing the force trim switch re-engages the force trim at the new location and resets the attitude hold modes to the new conditions. Pressing the switch down to the Disengage (**D**) position disengages any selected hold modes. Pressing the switch to the left to the attitude (**AT**) position engages/disengages the position, velocity, or attitude hold mode. Pressing the switch to the right to the altitude (**AL**) position engages/disengages the radar or barometric altitude hold mode. Attitude and Altitude hold switches are momentary **ON/OFF**. Selecting the switch once turns the mode **ON**; selecting the switch a second time turns the mode **OFF**. The collective control flight grip incorporates a switch for control of the horizontal stabilator. The three position switch allows the stabilator to be moved throughout its complete range and to be reset to the automatic mode. When the stabilator is in the **NOE/APPR** mode, pressing the stabilator **RESET** button will disengage the **NOE/APPR** mode.

2.70 MPD FMC CONTROLS

The A/C **UTIL** page (fig 2-61) displays controls for the FMC. The controls have two possible initialization conditions; ground and in-flight. If startup occurs in-flight, the FMC controls will be set to the state they were in before the power interrupt. If startup occurs on the ground, all modes and controls are on except the NOE/Approach mode. The Stability and Command Augmentation System (SCAS) will automatically be engaged following EGI alignment.

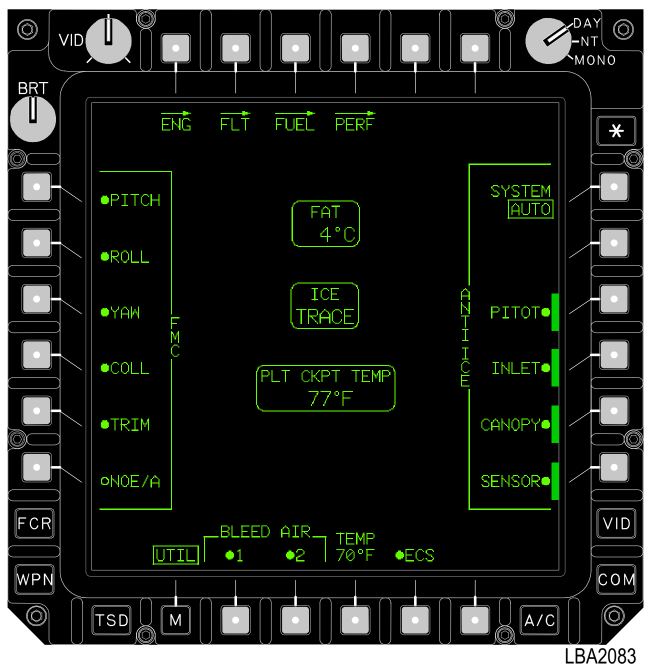


Figure 2-61. UTIL Page

2.71 STABILITY AND COMMAND AUGMENTATION SUBSYSTEM (SCAS)

NOTE

The FMC is susceptible to electrical switching transients at voltage levels below that found on the aircraft. Susceptibility is characterized by uncommanded disengagement of SCAS functions in some or all axes.

The SCAS has three functions; Stabilization System, Command System, and the Hold modes. The Stabilization System provides rate damping in all axes. Additionally, the Stabilization System automatically provides turn coordination at speeds greater than 40 kts, and dampens any atmospheric upsets to the airframe in order to stabilize the aircraft. The Command System provides a uniform aircraft response for a given control input at all airspeeds. The Hold modes are designed to provide limited hands-off flight and decrease pilot workload. The FMC monitors all inputs and will disengage on an axis-by-axis basis if a failure occurs.

2.72 HOLD MODES

WARNING

- **Hold modes operate through the SCAS system, and as such provide only limited capability. The system is not capable of maintaining the selected flight condition in all flight conditions. The pilot shall continually monitor the aircraft's flight condition to ensure safe operation.**
- **Fly the aircraft to a stabilized trimmed state before engaging attitude, hover, or altitude hold. Alternatively, fly the aircraft with the trim gradient (FTR switch released) until the aircraft is stabilized at the desired trimmed state. Failure to follow this procedure may result in undesirable and/or unsuspected aircraft responses.**

The hold modes are divided into altitude and attitude hold (fig 2-62). The modes are activated through the five-position Force Trim / Hold Mode switch. Upon activation, the pilot is provided with a visual indication that the mode is engaged (see Section XIV). Upon disengagement, the flight cues are removed and a tone sounds. The attitude hold mode can be engaged anytime the SCAS channels and Force Trim are on. However, the mode is only active in-flight. The pilot can "fly through" the hold modes in any or all axes. When the FMC senses control motion above the breakout in any axis or the force trim is momentarily released, that axis reference is no longer held. When the controls are returned to trim, the FMC captures and holds the new reference.

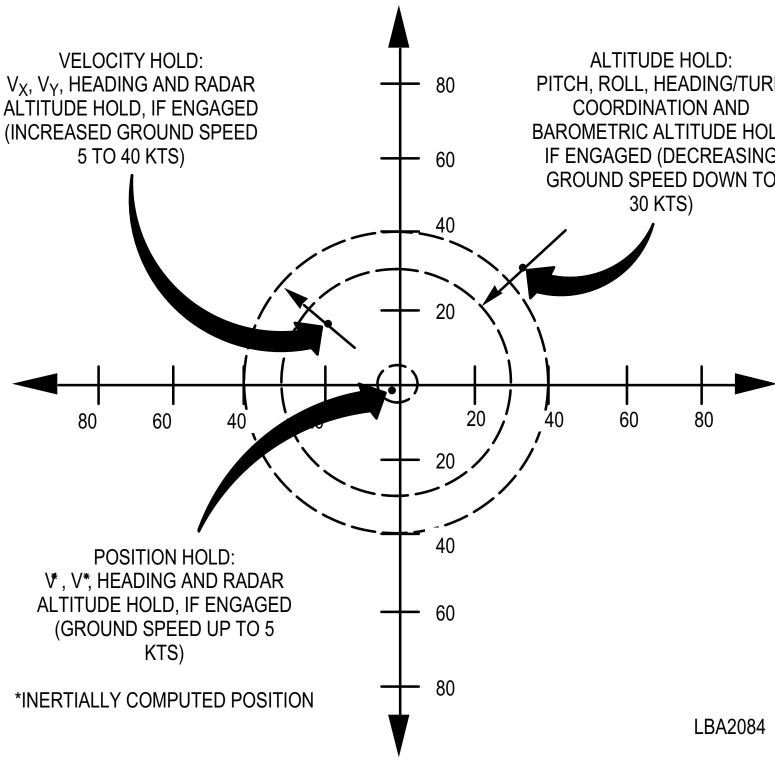


Figure 2-62. Hold Mode Engagement Regions

2.72.1 Use of Force Trim during Hold Mode Operations.

WARNING

Even with the force trim ON, the flight controls must be monitored at all times while the rotors are turning. When force trim is selected OFF from the A/C UTIL page, no force gradient will be available to position the cyclic. Hands off cyclic capability will NOT be available.

The force trim release provides two functions to the hold modes: 1) it provides a means to communicate to the flight control system that the pilot wants to establish a new reference condition to hold, and 2) it provides a mechanism to allow the SAS sleeves to re-center, providing the greatest possible margin for maintaining any of the desired hold conditions.

a. **Force Trim Operational Theory**. When the SAS is attempting to hold a position or attitude it develops a bias towards one side. As the wind or other disturbances continue to upset the aircraft this can lead to a case where more response is required than SAS can provide (the SAS has only ± 10% of the total actuator authority in roll, yaw, and collective actuators, and 20% and -10% in the pitch actuator). When all of the SAS authority is used up, the SAS is saturated. When this occurs a flight control tone will sound and a message will appear on the UFD/EUFD, meaning that the SAS is saturated in one or more axes. At this point, the SAS will be totally ineffective in the axis that is saturated.

b. **Force Trimming Procedure**. When the force trim release is actioned it causes the SAS command to decay or “washout” at a one second rate. Actioning or “bumping” the force trim release for only a fraction of a second resets the mechanical portion of the force trim to a zero force state, but does not provide enough time to re-center the SAS. The best procedure to follow after receipt of a SAS saturated message, or entering a hold mode, is to fly the aircraft to the desired state (hover, velocity, or attitude) then press and hold the **FTR** button for 3 seconds. This allows the SAS time to re-center providing the most margin for any external disturbances to the aircraft.

NOTE

Yaw breakout ranges (Table 2-7) increase in order to provide good pedal response at a hover. They also de-sensitize the pedals in order to prevent disengaging the heading hold mode during cruise flight.

Table 2-7. Flight Control Breakout Values

Pitch and Roll cyclic displacement ≥ 0.25 in.
Collective displacement ≥ 0.50 in.
Pedal displacement depends on the Attitude Hold submode as follows:
Position hold ≥ 0.10 in.
Velocity hold ≥ 0.20 in.
Attitude hold ≥ 0.30 in.

2.72.2 Attitude Hold. This mode is divided into four submodes of operation: position hold, velocity hold, attitude hold, and heading hold. Activation of a submode is dependent on inertial ground speed.

a. **Position hold submode**. Position hold may be engaged below 5 kts ground speed provided the force trim is operational. The FMC uses velocity inputs from the EGI to approximate and maintain a position. Heading hold is provided and, if Altitude Hold is engaged, a three dimensional hover hold is available. If the aircraft drifts out of a 48 foot boundary (one rotor diameter) and the hold mode is engaged, the Flight Controls tone will sound and a UFD/EUFD advisory message will be displayed.

b. **Velocity hold submode**. Velocity hold may be engaged at ground speeds between 5 kts and 40 kts (30 kts when decelerating in attitude hold mode). The force trim system must be operational and **ON**. The FMC uses input from the EGI to maintain a constant velocity. Heading Hold is active and Altitude Hold may be engaged.

NOTE

This is not a terrain following mode. The radar altimeter provides only distance from the ground directly below the aircraft and does not provide any approaching terrain variation information.

c. Attitude Hold Submode. The FMC uses EGI rates and attitudes to maintain the selected aircraft attitude. Attitude hold will either maintain the attitude and heading that existed when the mode was selected or the attitude/heading that existed when the force trim was released. Heading hold is provided in this mode until the pilot initiates a turn. Upon initiating a turn, the turn coordination mode will engage while maneuvering. When the turn is completed, heading hold will automatically re-engage.

1. Attitude Hold Engagement. Attitude Hold may be engaged when ground speed $>$ 40 kts; pitch attitude $<$ $\pm$ 30°; roll attitude is $<$ $\pm$ 60°; and pitch and roll rates are $<$ 5°/second. Attitude hold will re-reference to a new pitch or roll attitude when the force trim release button is no longer being asserted and the aircraft is within the attitude limits defined previously. If the roll $<$ 3°, the roll reference will be automatically set to zero (wings level).
2. Turn Coordination. Yaw turn coordination operates in conjunction with heading hold at speeds $>$ 40 kts ground speed in Attitude Hold submode. Heading hold will revert to turn coordination when:
   a. Pilot displaces pedals $>$ 0.3 in. from trim position.
   b. Pilot applies roll cyclic input $>$ 0.25 in. from trim position.
   c. Pilot actions force trim release.
   d. Aircraft rolls $>$ $\pm$ 7° from level.
3. Turn coordination with the Attitude Hold mode **OFF** operates continuously at speeds $>$ 40 kts ground speed. Turn coordination will revert to YAW SAS when:
   a. Pilot displaces pedals $>$ 0.3 in. from trim position.
   b. Pilot actions force trim release.
   c. Sideslip is re-referenced only when the force trim release is actioned.

d. Heading Hold Submode.

NOTE

There is no pilot symbology or tone indications of heading hold engagement or disengagement.

1. Heading Hold submode is engaged when Attitude Hold mode is **ON** when:
   a. Pilot displacement of the pedals is $<$ the breakout values listed in table 2-7.
   b. Yaw rate is $<$ 3°/second.
   c. Pilot displacement of roll cyclic input is $<$ 0.25 in. from trim position.
   d. Roll attitude is $<$ $\pm$ 3° from level.
2. Heading Hold submode is engaged when Attitude Hold mode is **OFF** (SAS only) when:
   a. Ground speed is $<$ 40 kts.
   b. Pilot displacement of the pedals is $<$ 0.1 in. from trim position.
   c. Yaw rate is $<$ 3°/second.
   d. One second has passed after heading hold was disengaged.

e. Altitude Hold Submode. The Altitude Hold submode may be engaged at any airspeed. Vertical velocity must be less than 200 fpm at a hover, or 400 fpm at cruise for the mode to engage. The Altitude Hold mode will automatically disengage when:

1. Pilot displaces the collective more than 0.50 in. from the reference position.
2. Rotor speed is $>$ 104%.
3. Rotor speed is $<$ 97%.
4. Either engine torque exceeds 100%.
5. Either engine TGT exceeds 867 °C.

CAUTION

In the event the radar altitude hold function fails due to radar altimeter or subsystem failure and the BAR HOLD and RADHLD FAIL advisories are not displayed, the Altitude Hold mode should be disengaged to prevent an inadvertent loss of altitude. The Altitude Hold mode may be subsequently re-engaged as long as the proper UFD/EUFD advisories are present.

f. Radar Altitude to Barometric Altitude Hold Changeover. When the altitude hold mode is engaged and the aircraft is within 0 - 40 kts groundspeed and between 0 - 1428 ft AGL, the aircraft will be in the Radar Altitude hold mode; anything outside these parameters and the aircraft will be in Barometric hold mode.

2.73 BACK-UP CONTROL SYSTEM (BUCS)

CAUTION

- **Engagement of the BUCS system may occur without Automatic Roller Detent Decoupler (ARDD) breakout during crew force fights if a CPG BUCS select switch failure has also occurred. Servoactuator LVDT probe migration may aggravate the force fight condition. If a BUCS engagement occurs after a control force fight, attempt to recover the aircraft without severing the mechanical controls and follow established procedures for BUCS ON flight.**
- **If during a force fight with the CPG BUCS select switch activated, and a breakout of the ARDD occurred, the BUCS would not provide a three second easy on and would subject the aircraft to a large control transient.**
- **Breakout of the ARDD at the base of the collective control will eliminate the normal mass of the control system and may cause the collective to move slightly in response to rotor system vibration. This slight movement will be detected by the LVDT and can produce an unwanted heave (collective) application. Increasing collective friction can eliminate this characteristic.**

2.73.1 Description. The Back-Up Control System (BUCS) is a single-channel, non-redundant, fly-by-wire control system that can electronically operate all four control axes. The BUCS is modeled to duplicate the mechanical flight controls without the Stability Augmentation System (SAS) engaged. This provides identical control authority and handling qualities as SAS-OFF flight in any given flight control axis. A shear pin is located on each of the flight control actuators and an Automatic Roller Detent Device (ARDD) is located on each control, in each crewstation, to allow the controls to decouple in the event of a control jam. This system allows the controls to decouple regardless of where the jam takes place. The FMC uses Linear Variable Displacement Transducers (LVDT) control position and actuator position to calculate the equivalent mechanical control command when in BUCS. Rotary Variable Displacement Transducers (RVDT) are used to sense a decoupling of the ARDDs, and LVDTs are used to sense a mistrack and send control movement information to the FMC. The FMC electrically controls the BUCS servo valve on the primary side of the affected flight control actuator. The primary hydraulic system and the FMC must be operational for BUCS to operate.

WARNING

- **When BUCS is engaged, do not release the flight controls until the flight has been completed and the main rotor has come to a complete stop. Force trim may or may not be available in the BUCS ON axis.**
- **BUCS can become engaged when a mistrack between the controls and the actuator is sensed. This commonly occurs when external power is provided to the aircraft without hydraulic power. Applying hydraulic power and completing an FMC IBIT may clear the BUCS engagements.**

2.73.2 Operation. When BUCS is engaged, an FMC disengaged caution and a **SAS DISENGAGED** (**A/C UTIL** page) for the axis in BUCS will be displayed. Several types of engagements are possible, and are covered, by crewstation, in the following paragraphs.

WARNING

A BUCS jam engagement in the aft cyclic longitudinal control direction or in the left or right pedal tail rotor control direction may result in limited control authority (from the point of the jam) because the actuator is unable to break the actuator shear pin. The worst case jam condition in the longitudinal aft cyclic (jam occurs at the actuator) will result in a 12% aft control authority from the point of the jam. Forward cyclic can break the shear pin and gain full control. The yaw axis may be limited to +/- 25% control authority from the point of jam. If flight control authority is insufficient for a hover, attempt a run-on landing.

CAUTION

After a BUCS engagement and transition to BUCS controlled flight, a flight controls controllability check (small control inputs in each axis to check for correct response) should be conducted to establish if any other control axis has been affected.

a. Control System Engagement Logic (Pilot crewstation - pilot flying the aircraft).

(1) Jams. A jam can occur anywhere in the flight control system through malfunction or battle damage. Should the pilot be unable to move the controls, in one or more axes, he should aggressively decouple into the appropriate axis. The pilot can expect the control to displace to full throw when the ARDD releases. The FMC will wash in full authority over a period of approximately three (3) seconds allowing the pilot to center the controls and transition to BUCS controlled flight. SAS will be **OFF** in the engaged axis. Force trim will be **ON** in all axes. Hold modes will be available in the axes that SAS is available. The UFD/EUFD will display the BUCS caution messages.

(2) Severances.

(a) Severance aft of the pilot's control. A severance can occur due to malfunction or battle damage between the pilots' controls and the actuator. In this case the BUCS will automatically engage when the pilot achieves the proper mistrack with respect to RAM LVDT (17.5 %, except in longitudinal aft where the mistrack must be 27.5%). The BUCS flight control logic will wash in full authority over a period of approximately one (1) second allowing the pilot to transition to BUCS controlled flight. SAS will be **OFF** in the engaged axis. Force trim will be **ON** in all axes. Hold modes will be available in the axes that SAS is available. The UFD/EUFD will display the BUCS caution messages.

(b) Severance between crewstations. If a severance occurs between the crewstations the pilot will retain full mechanical control. The pilot should keep flying on the mechanical flight controls. When a mistrack is detected, a master caution light and flight control tone will be presented and, on the UFD/EUFD, a **BUCS FAIL** X (X = **P**, **R**, **Y**, or **C**) and **FMC DISENGAGED** caution messages will be displayed. The CPG controls will not follow the pilot control inputs in the axis that is severed. SAS will be **OFF** in the severed axis. Force trim feel will not be available to the CPG in in the severed axis. Hold modes will be available in the axes that SAS is available.

b. Control System Engagement Logic (Copilot crewstation - CPG flying the aircraft).

(1) Jams.

The CPG will have to decouple the ARDD. BUCS will automatically engage in the affected axis. Breakout values will be approximately 15% higher than the pilots' values. The CPG can expect the control to displace to full throw when the ARDD releases. The FMC will wash in full authority over a period of approximately three (3) seconds allowing the CPG to center the controls and transition to BUCS controlled flight. SAS and force trim will be OFF in the engaged axis. Hold modes will be available in the axes that SAS is available. The UFD/EUFD will display the BUCS caution messages.

(2) Severances.

(a) Severance Aft of the Pilot's control. A severance can occur due to malfunction or battle damage between the pilots' controls and the actuator. Because the two crewstations are still mechanically linked together, this type of severance will operate the same as in the pilot station. BUCS will automatically engage when both the pilot and CPG LVDTs achieve the proper mistrack with respect to the RAM LVDT. The FMC will wash in full authority over a period of approximately one (1) second allowing either crewmember to transition to BUCS controlled flight. SAS will be OFF in the engaged axis. Force trim will be ON in all axes. Hold modes will be available in the axes that SAS is available. The UFD/EUFD will display the BUCS caution messages.

CAUTION

The effect of the CPG assuming control with the BUCS trigger select is to transfer control of the aircraft from a flight control that still retains some integrity to that of a non-redundant electronic means of flight control. This shall only be activated if the pilot is incapable of flying the aircraft.

NOTE

The CPG must create the proper mistrack. If the CPG repositions the flight control (affected axis) to a position that is is less than the appropriate mistrack value and engages the BUCS trigger, engagement will not occur. The CPG may engage the trigger and hold it prior to achieving the mistrack. BUCS engagement will occur when the proper mistrack is reached.

(b) Severance between the crewstations. If sufficient mistrack is detected between the pilot control position and CPG control position, the master caution light and flight control tone will be presented in both crewstations, and the UFD/EUFD will display **BUCS FAIL** X (X = **P**, **R**, **Y**, or **C**) and FMC disengaged caution messages. In this instance, the pilot still has full mechanical control. The CPG should transfer control of the aircraft to the pilot. If it is necessary for the CPG to the fly the aircraft, the BUCS trigger should be engaged and BUCS control will be established after sufficient mistrack between CPG control position and the RAM position is reached. The **BUCS FAIL** message will be replaced by the appropriate **BUCS ON** caution message. The FMC will wash in full authority over a period of approximately one second, allowing the CPG to transition to BUCS controlled flight. SAS and force trim will be off in the severed axis. Hold modes will be available in the axis that SAS is available.

c. BUCS-Flight Transfer of Controls. Transfer of controls should only be accomplished if the flying crewmember is incapacitated or in the case of the CPG flying the aircraft and a severance occurs between the crewstations. Table 2-8 lists the procedures for transfer of control between the crewmember in BUCS and the opposite crewmember.

Table 2-8. BUCS Flight - Transfer of Controls

CONDITION	CREWMEMBER IN BUCS	TRANSFER TO	ACTION
JAM	PILOT	CPG	The CPG must decouple the ARDD and engage the BUCS trigger
SEVERANCE AFT OF THE PILOT'S SEAT	PILOT	CPG	No action required
SEVERANCE AFT OF THE PILOT'S SEAT	CPG	PILOT	No action required
SEVERANCE BETWEEN THE CREWSTATIONS	(NOT IN BUCS) PILOT REMAINS IN NORMAL MECHANICAL CONTROL	CPG	The CPG must achieve the proper mistrack and engage the BUCS trigger
JAM	CPG	PILOT	The pilot must decouple the ARDD.
SEVERANCE	CPG	________	Cannot transfer from CPG to pilot.

Section VI. HYDRAULIC AND INTEGRATED PRESSURIZED AIR SYSTEMS (IPAS)

2.74 HYDRAULIC SYSTEMS

The hydraulic systems consist of two independent systems: the primary system and the utility system. They are similar but not identical, and have separate as well as shared functions.

2.75 PRIMARY HYDRAULIC SYSTEM

The primary hydraulic system (fig 2-63) provides hydraulic power to the primary side of all four flight control servocylinders. Only the primary sides of these servo actuators have electrohydraulic valves that allow the Flight Management Computer (FMC) to affect the flight controls. Consequently, failure of the primary hydraulic system will result in the loss of FMC. The primary hydraulic equipment includes a hydraulic pump, manifold, and servo actuators.

2.76 PRIMARY HYDRAULIC PUMP

The primary hydraulic pump is mounted on the accessory drive case of the main transmission (left side). The pump is a constant pressure, variable displacement design, driven by the transmission accessory gear train.

2.77 PRIMARY HYDRAULIC MANIFOLD

The primary manifold is installed on the left forward quadrant of the transmission deck. Its function is to store, filter, and regulate the flow of hydraulic fluid as well as provide analog pressure, dirty filter, and low level indications. The manifold reservoir is pressurized on the return side by IPAS air acting on the manifold reservoir piston. This prevents pump inlet cavitation. Servicing crews introduce fluid to the reservoir through the Ground Support Equipment (GSE) connections or the hand pump. The primary hydraulic system fluid capacity is 6 pt. The reservoir stores approximately 1 pt.

2.77.1 Air Bleed Valve. The air bleed valve is used to deplete the pressurized air from the manifold reservoir for system repair or service.

2.77.2 Reservoir Low Level Indicating Switch. A reservoir low level indicating switch is activated by the manifold reservoir piston. The UFD/EUFD displays the minimum operating level caution message.

2.77.3 Manifold Pressure and Return Filters. Filters on both manifold pressure and return sides have mechanical dirty filter indicators for visual inspection. These indicators operate on differential pressure. Only the return filter has bypass valve provision. In addition to the mechanical/visual indicators both filters contain electrical switches that provide signals to generate a caution message on the UFD/EUFD.

2.77.4 Fluid Level Indicator. A fluid level indicator in the manifold housing allows visual inspection of the reservoir fluid level.

2.77.5 Primary System Pressure Sensing Switch. A pressure switch senses primary system pressure and informs the pilot and CPG of a low fluid pressure condition by generating a caution message on the UFD/EUFD.

2.77.6 Pressure Transducer. A pressure transducer measures hydraulic pressure on the pressure side of the manifold and transmits this value to the MPD.

2.77.7 Pressure Transducer. A pressure transducer measures hydraulic pressure on the pressure side of the manifold and transmits this value to the MPD.

2.78 UTILITY HYDRAULIC SYSTEM

The utility hydraulic system (fig 2-64) provides hydraulic power to the utility side of all four flight control servocylinders. This system also provides hydraulic power to the rotor brake, area weapon turret drive, ammunition handling system, APU start motor, tail wheel unlock actuator, external stores elevation actuators and emergency hydraulic system. Equipment includes a hydraulic pump, manifold, and servocylinders. The pump is mounted on the accessory drive case of the main transmission (right side). The significant difference in the primary and utility hydraulic is the manifold. Additional components in the system are the accumulator, rotor brake, and the utility hydraulic return accumulator that dampens hydraulic pressure surges caused by sudden actuation of the gun turret.

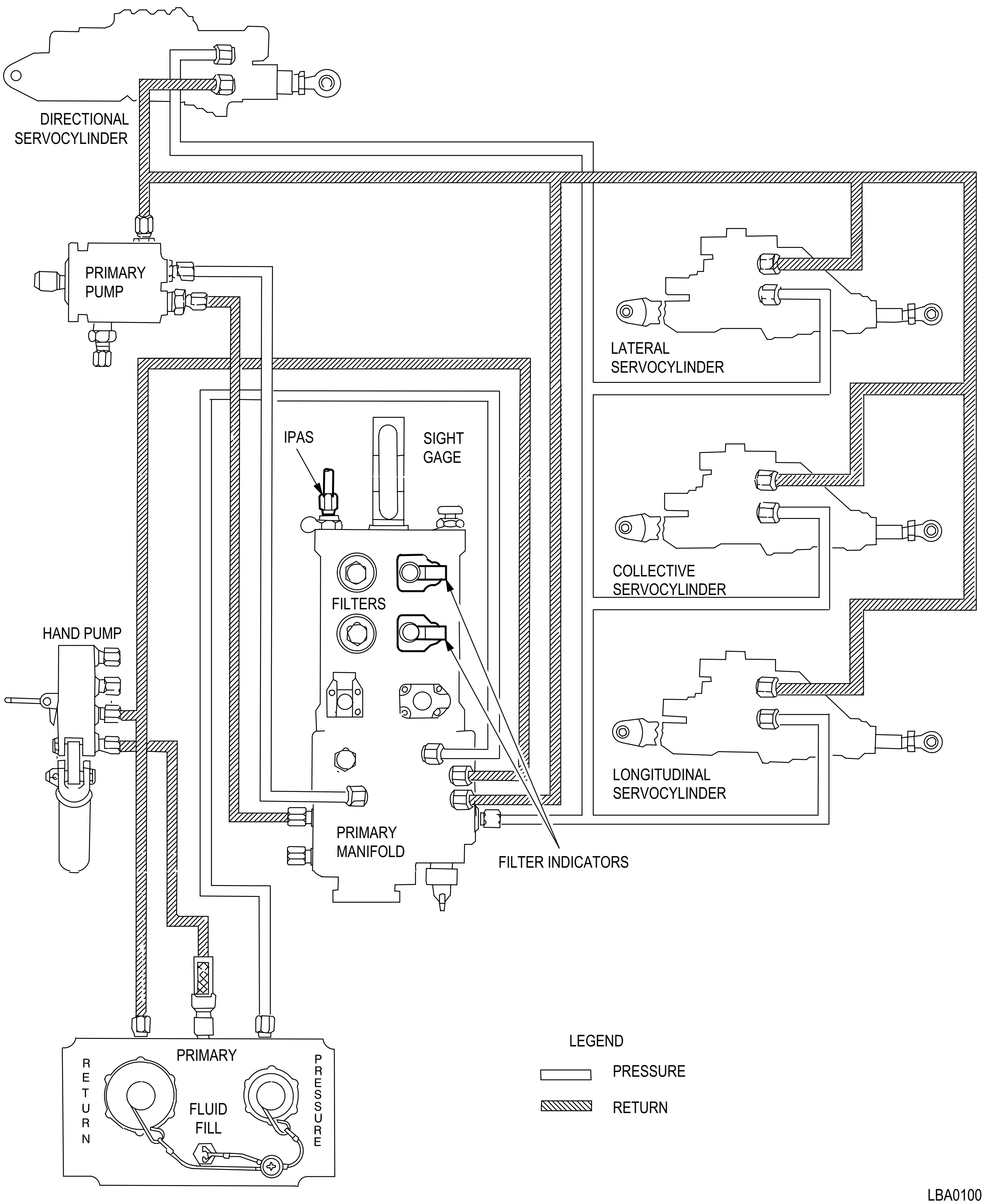


Figure 2-63. Primary Hydraulic System

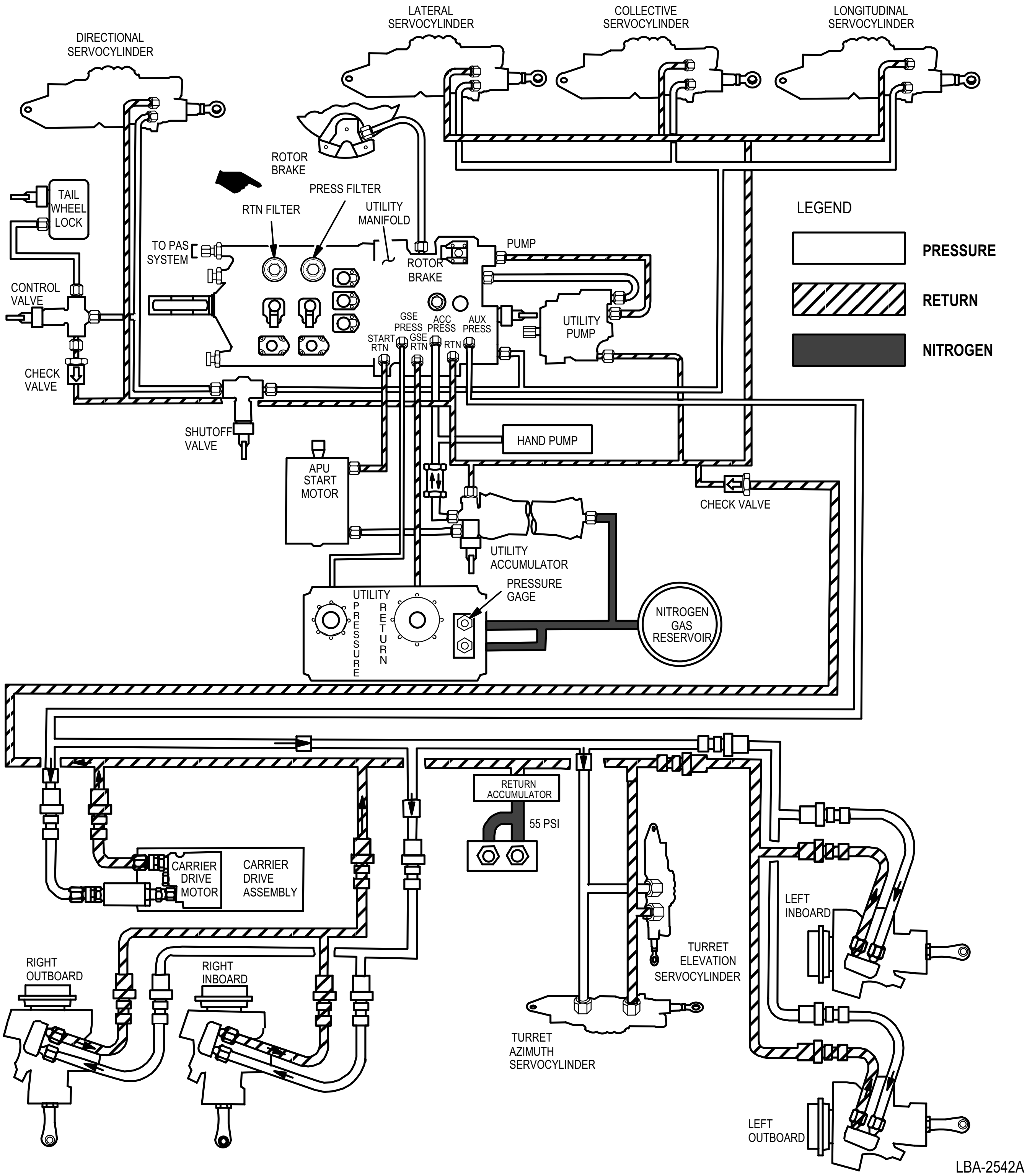


Figure 2-64. Utility Hydraulic System

2.79 UTILITY HYDRAULIC MANIFOLD

The utility manifold is installed on the aft main fuselage deck on the right side. It stores, filters, supplies, and regulates the flow of utility hydraulic fluid. Demands on the utility system are much greater than those on the primary system, and the utility manifold is therefore larger. The utility manifold incorporates the utility accumulator hydraulic pressure transducer and rotor brake solenoids not duplicated on the primary manifold.

2.79.1 Low Level and Auxiliary Isolation Valves. The low level and auxiliary isolation valves permit hydraulic fluid to flow to external stores, ammo carrier drive, and area weapon turret. If reservoir fluid level decreases significantly, the reservoir piston, driven by IPAS air, closes the low level valve. The auxiliary isolation valve, which normally requires two sources of pressure to permit fluid flow, then closes and denies hydraulic power to the area weapon turret, external stores actuator, and ammo carrier drive.

2.79.2 Shutoff Valve. A shutoff valve in the pressure line to the directional servo and tail wheel unlock actuator is actuated by the low level switch in the utility system reservoir. The utility side of the directional servo actuator and the tail wheel unlock actuator become inoperative if a low utility system fluid level is sensed.

2.79.3 Accumulator Isolation Valve. The accumulator isolation valve normally isolates accumulator pressure from the rest of the utility system but allows system flow from the pump to pass through a portion of the valve to the utility side of the tandem servocylinders.

2.79.4 Override Solenoid. An override solenoid, deenergized to the closed position, permits crew management of accumulator reserve pressure. Upon activation of the **EMERG HYD** pushbutton, the override solenoid valve energizes open and accumulator fluid passes to the accumulator isolation valve via emergency routing. In this case, another portion of the accumulator isolation valve permits accumulator fluid to flow to the utility side of the servocylinders.

2.79.5 Pressure Transducer. An accumulator hydraulic pressure transducer in the manifold provides the pilot with a continuous indication of accumulator pressure on the accumulator hydraulic pressure indicator. During normal operation, the indicated pressure is the same as the utility hydraulic system. A pressure transducer measures hydraulic pressure on the pressure side of the manifold and transmits this value for display on the MPD.

2.79.6 Rotor Brake Solenoid Valves. The solenoid valves are controlled by the **RTR BRK** switch on the pilot **POWER** lever quadrant (fig 2-42) adjacent to the **POWER** levers. When this switch is positioned to **BRK**, utility system pressure is applied to stop the rotor brake disc on the main transmission. When positioned to **LOCK**, the brake OFF solenoid valve traps pressure between the manifold and the utility system accumulator.

2.79.7 Reservoir Low Level Indicating Switch. A reservoir low level indicating switch is activated by the manifold reservoir piston. A minimum operating level caution message is presented on the UFD/EUFD sent from the low level indicating switch.

2.79.8 Manifold Pressure and Return Filters. Filters on both manifold pressure and return sides have mechanical dirty filter indicators for visual inspection. These indicators operate on differential pressure. Only the return filter has bypass valve provision. In addition to the mechanical/visual indicators both filters contain electrical switches that provide signals to generate a caution message on the UFD/EUFD

2.79.9 Fluid Level Indicator. A fluid level indicator in the manifold housing allows visual inspection of the reservoir fluid level.

2.79.10 Utility System Pressure Sensing Switch. A pressure switch senses utility system pressure and informs the pilot and CPG of a low fluid pressure condition by generating the caution message on the UFD/EUFD.

2.80 UTILITY HYDRAULIC ACCUMULATOR

NOTE

The accumulator should be checked on preflight and thru-flight inspections for a minimum of 2600 psi prior to APU start.

The accumulator stores hydraulic fluid at 3000 psi. The accumulator provides damping for fluid pressure changes, hydraulic power for rotor brake application, APU starting, and emergency flight control operation. The start valve opens when the **APU ON** button is pressed to **ON** and closes automatically at 60% APU speed.

2.81 UTILITY HYDRAULIC RETURN ACCUMULATOR

The utility hydraulic return accumulator stores hydraulic fluid at 55 psi. The accumulator dampens hydraulic pressure surges caused by sudden actuation of the gun turret.

2.82 HYDRAULIC SYSTEM HAND PUMP

A hand pump is installed, next to the primary system GSE panel, on the right side of the aircraft. The pump provides one method of charging fluid pressure in the utility accumulator as well as access for the ground crew to fill the primary and utility reservoirs. The control lever may be moved to any of three positions. This opens one of three check valves to the accumulator or to either reservoir.

2.83 HYDRAULIC SYSTEM CONTROLS AND DISPLAYS

Operation of the hydraulic system is automatic except in emergency situations, tail wheel locking/unlocking, and rotor brake activation. Hydraulic system indications are displayed on the **ENG** page ground format (fig. 2-65) and **SYS** page (fig 2-66).

2.83.1 ENG Page Ground Format.. See Section III for descriptions of **ENG** page ground indications.

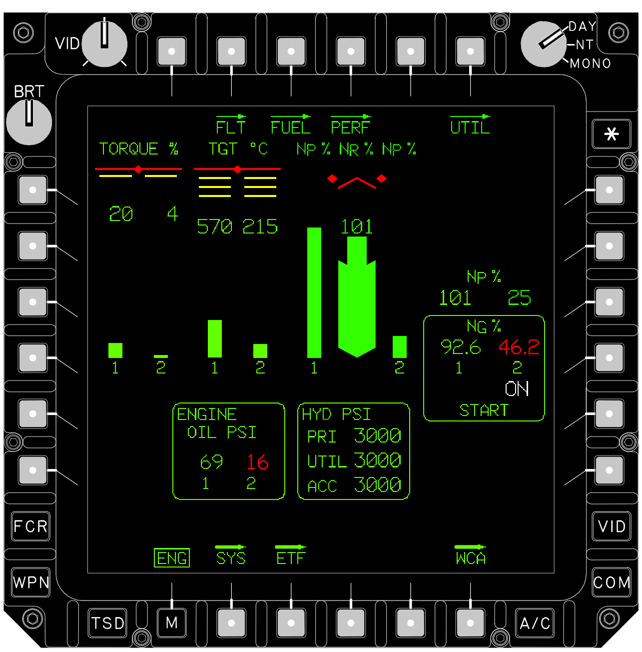


Figure 2-65. ENG Page Ground Format

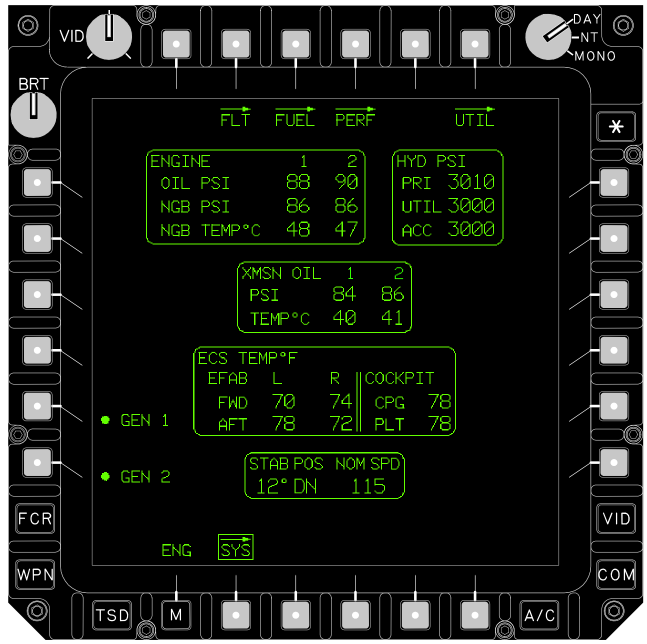


Figure 2-66. SYS Page

2.83.2 SYS Page. The following hydraulic pressures (**HYD PSI**); primary (**PRI**), utility (**UTIL**) and accumulator (**ACC**) are indicated on the **ENG SYS** page:

NOTE

The following descriptions of **SYS** page hydraulic system indications give ranges of those displays. Refer to Chapter 5 for system limits and restrictions.

PRI/UTIL/ACC PSI

0 to 6000	displayed in increments of 10 psi.
3410 - 6000	YELLOW ≥5 seconds RED w/box
3310 - 3400	YELLOW ≥5 minutes RED w/box
1260-6000	GREEN
0-1250	RED w/box

2.83.3 Emergency Hydraulics. An override solenoid valve, normally de-energized closed, permits crew management of accumulator reserve pressure. Upon activation of the **EMER HYD ON** button on the **EMERGENCY** panel (fig 2-67), the button will become illuminated, the valve energizes open and accumulator fluid passes via emergency routing to the utility side of the servo actuators.

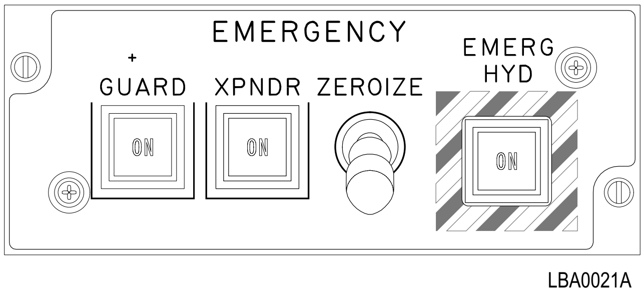


Figure 2-67. EMERG HYD Pushbutton

CAUTION

Do not place the **RTR BRK** switch in **LOCK** position with rotors turning.

NOTE

When engaging rotor lock, pause in the **BRK** position until the **RTR BRK** advisory message is displayed prior to placing the switch in the **LOCK** position. The **POWER** levers will not advance past the ground idle detent with the rotor brake switch in the **LOCK** position.

2.83.4 Rotor Brake. The rotor brake is a disc brake mounted at the aft end of the main transmission. The rotor brake reduces turnaround time for aircraft loading and servicing and prevents windmilling of the rotor system during gusty wind conditions. The **RTR BRK** switch on the pilot **POWER** lever quadrant has three modes: **OFF**, **BRK**, and **LOCK**. The **BRK** mode reduces time required to stop the main rotor system after engine shutdown. The **LOCK**-mode is used to prevent windmilling in strong winds and for locked rotor dual engine starts. When both engines are at idle and the switch set at **LOCK** (full 3000 psig utility hydraulic system pressure), the brake prevents the drive train and power turbine from being driven by the gas turbine. A system of three interlocks prevents the rotor brake from being locked when the power levers are in any position except **IDLE** or **OFF** When the switch is set at **BRK** solenoid valves in the utility hydraulic manifold operate and applies 337 psig to actuate the the brake. When rotors are stopped, the switch may be set to **LOCK** which causes the solenoid valves in the manifold to de-energize and all available utility hydraulic system or accumulator pressure to be applied to the brake. With the switch at **OFF**, the only hydraulic pressure to the brake is 30 psig from the pressurized air system which, when operating, pressurizes the return side of the utility hydraulic system. If helicopter power is lost, the rotor brake, if previously set at **LOCK** remains locked as long as accumulator pressure is available.

2.83.5 Tail Wheel Lock. Utility hydraulic pressure is used by the tail wheel lock actuator to unlock the tail wheel. The tail wheel can be locked or unlocked from either crew station via the **TAIL WHEEL** panel or collective grip switch (refer to Section I). The tail wheel can also be locked or unlocked by ground crew using a handle provided on the locking device.

2.84 INTEGRATED PRESSURIZED AIR SYSTEM (IPAS)

Pneumatic power for the IPAS (fig 2-68) is generated by dual engine bleed air, APU or AGPU air. The IPAS pressurizes, regulates, and distributes air to the following:

- Air turbine starter
- Fuel boost and transfer pumps
- External fuel tanks
- Hydraulic reservoirs
- Engine inlet anti-ice
- Ice detect probe aspirator
- Nitrogen inerting unit
- Engine firewall/cooling
- Utility receptacle
- Environmental Control System (ECS)

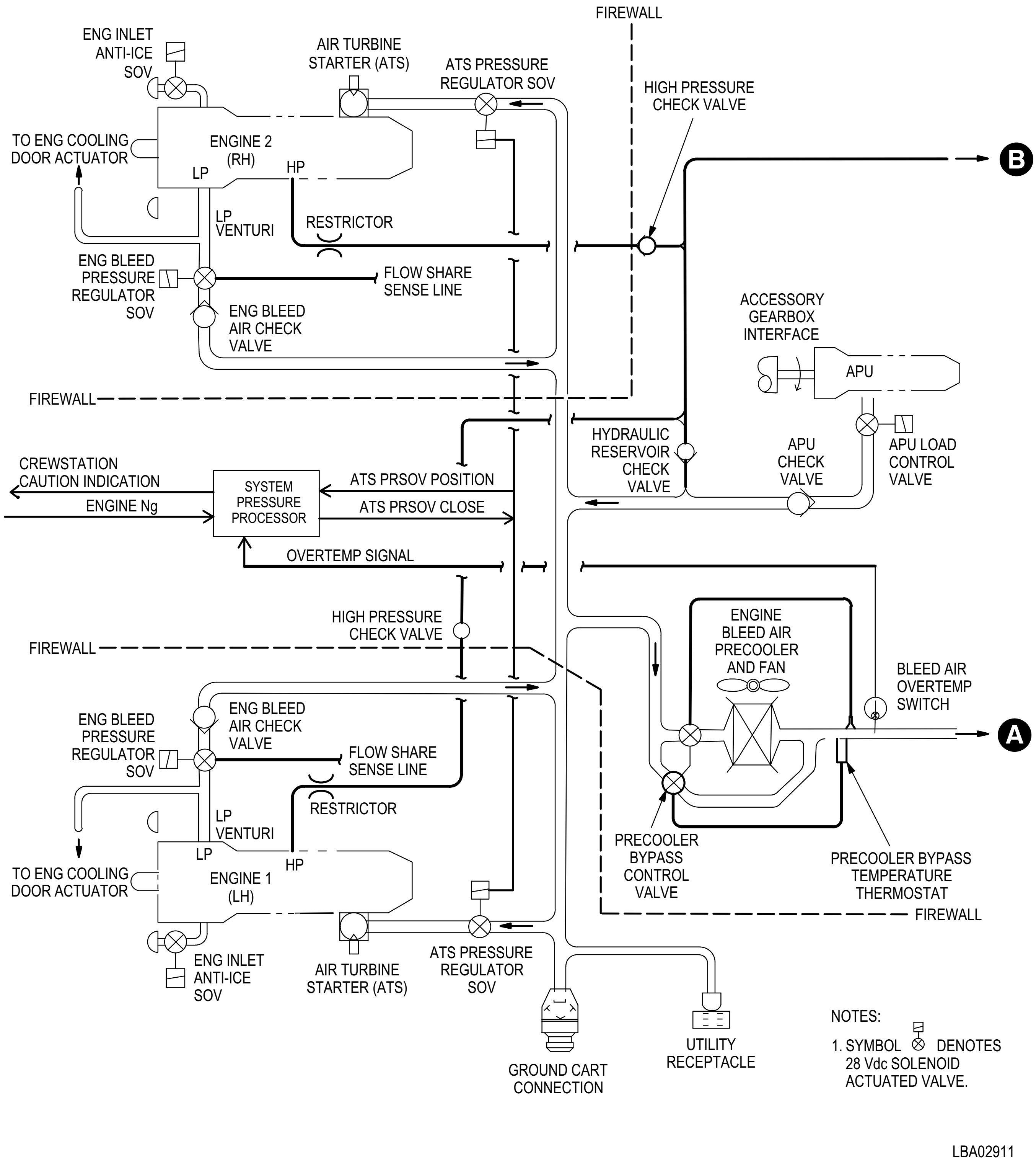


Figure 2-68. Integrated Pressurized Air System (Sheet 1 of 2)

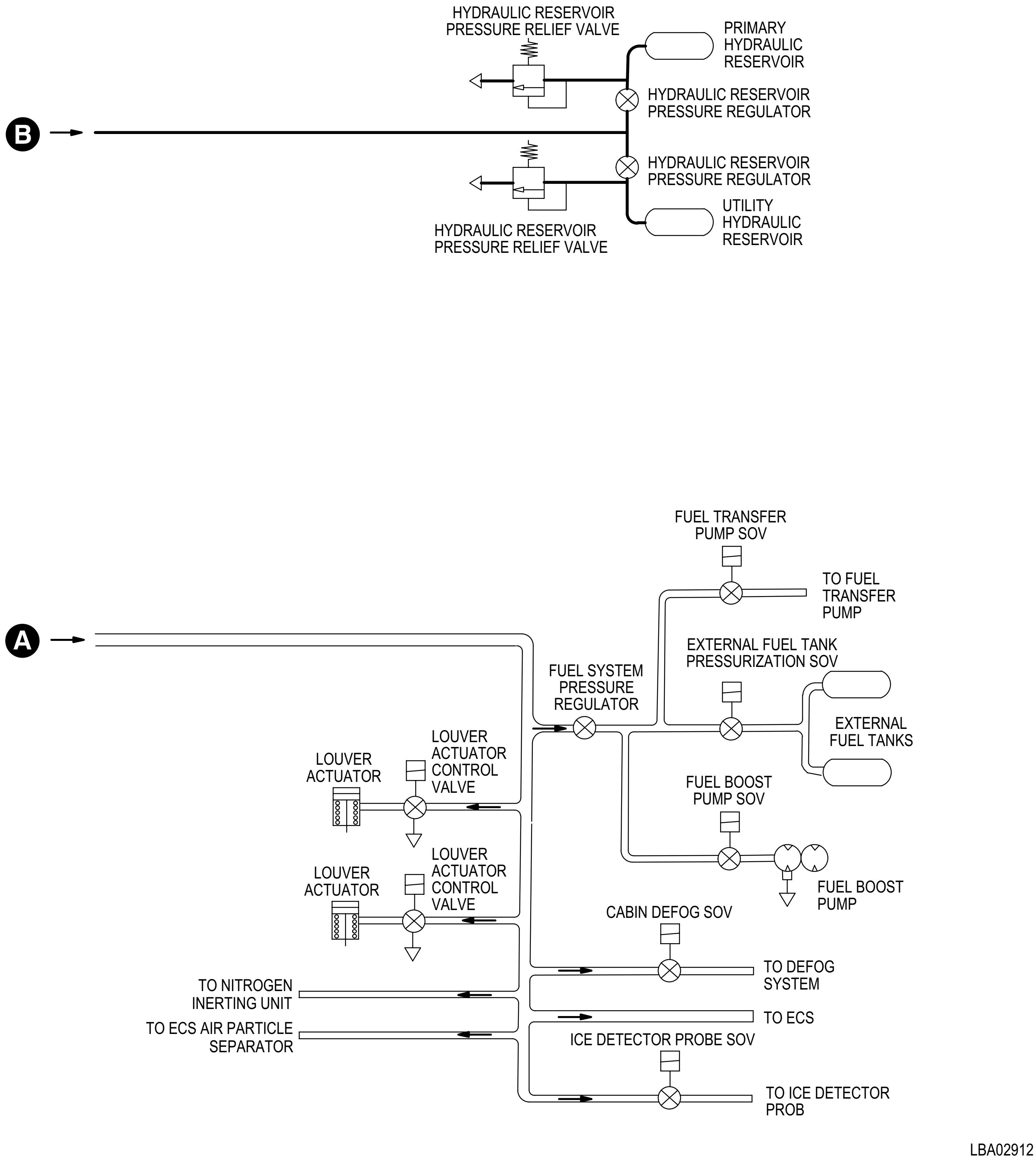


Figure 2-68. Integrated Pressurized Air System (Sheet 2 of 2)

2.84.1 Dual Engine Bleed Air. The IPAS subsystem primary pneumatic power source is dual engine bleed air. Bleed air is provided by both engines during normal operation.

2.84.2 Single Engine Bleed Air. The secondary source of pneumatic power for the IPAS is single main engine bleed air.

2.84.3 Power Up. During aircraft power up, APU bleed air is the pressurized air source and is used to start main engines. External air from an AGPU or another aircraft may be used to start engines via the external air receptacle. Each engine has a low and high pressure bleed air port. The high pressure port is used exclusively to pressurize the hydraulic reservoirs and the low pressure port supports the remaining functions. Low pressure flow and pressure is controlled by the engine bleed pressure regulator and shutoff valve. High pressure flow and pressure is controlled by a restrictor and a regulator.

2.84.4 IPAS Contro. Control of IPAS is an integrated function provided by system processors, display processors, and the Electrical Power Management System (EPMS). The **A/C UTIL** page (fig 2-69) provides **BLEED AIR 1** and **2ON/OFF** pushbuttons.

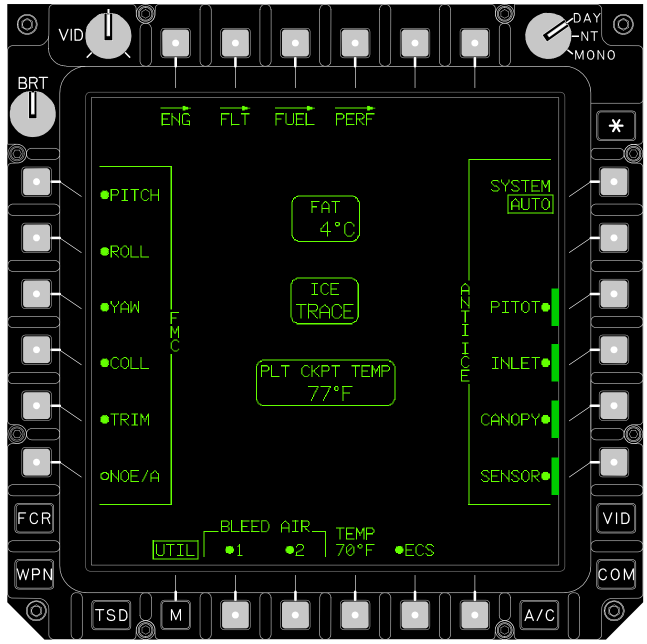


Figure 2-69. A/C UTIL Page (Pilot)

2.84.5 PAS Cautions. Crewmembers are provided the following IPAS advisory messages via the Warning/Caution/Advisory system:

a. Engine Bleed Air Fail. This advisory message occurs when engine 1 and/or engine 2 primary shutoff valve is in the commanded position and the system processor commands the engine 1 and/or engine 2 bleed air shutoff valve open or closed and it does not move.

b. Engine Bleed Air Overtemperture. When the system processor receives a bleed air overtemperature signal, it will send a caution message to the UFD/EUFD.

Section VII. DRIVE TRAIN SYSTEM

2.85 INTRODUCTION

The drive train (fig 2-70) transmits engine power to the rotors and to accessories mounted on the transmission. The drive train includes the following:

- Two engine nose gearboxes
- Two input shafts
- APU drive shaft and couplings
- Couplings and input clutch to the main transmission
- Main transmission
- Main rotor drive shaft
- Tail rotor drive shafts

Intermediate gearbox

- Tail rotor gearbox

2.86 MAIN ROTOR DRIVE SYSTEM

2.86.1 Engine Nose Gearboxes. One engine nose gearbox is mounted on the front of each engine. They reduce drive shaft speed and change the angle of the drive. Both nose gearboxes have self contained pressurized oil systems with provisions to ensure limited operation if a total loss of pressurized lubrication occurs. The input drive shafts have flexible couplings that require no lubrication. Sensors and detectors monitor the nose gearboxes and provide information to crewmembers about oil temperature, oil pressure, and the presence of metal chips. High oil temperature, low oil pressure, and presence of metallic chips in the gearbox cause cautions to be annunciated in the crew stations.

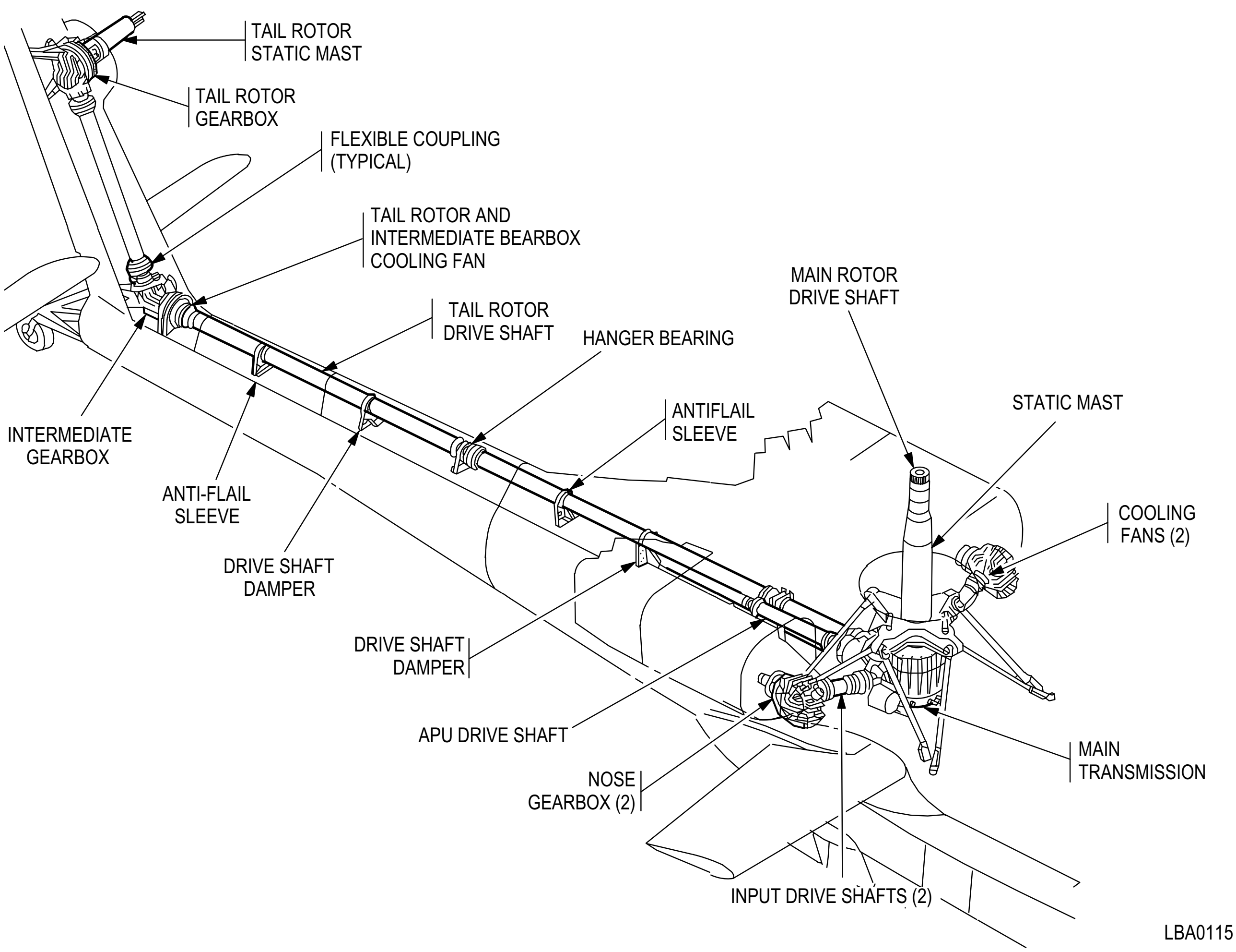


Figure 2-70. Drive Train

2.86.2 Main Transmission. The main transmission is mounted below the main rotor static mast base which allows its removal without removing the upper controls, mast or hub. The main transmission combines the two engine nose gearbox inputs, reduces output RPM, and provides drive to the main rotor, tail rotor, accessories, and rotor brake disc. Sensors in the transmission monitor conditions and provide crewstation caution messages.

a. Main Rotor Drive Shaft. The main rotor drive shaft is designed to carry torque loads only. The rotor hub is on a static mast which carries vertical or bending loads. The drive shaft rotates inside the static mast.

b. Reduction Gearing. The main transmission has a three stage primary reduction gearing with two engine inputs, main rotor, and tail rotor power output. An over running clutch provides APU drive to the accessory section of the transmission when the rotor is stopped.

c. Accessory Gearbox. The accessory gearbox is driven by the APU drive shaft or engine drive shafts and provides shaft power to the main generators and the hydraulic pumps while the rotor is stationary or rotating. The oil pressure in the gearbox is monitored by the accessory oil pressure switch. Reduction gearing and drive shaft coupling is provided.

d. Main Transmission Lubrication. The main transmission has two independent oil systems. Each system has its own sump, pump, filter, and heat exchanger. Oil level sight gages are located in the transmission housing at each oil sump. These systems are not totally independent in the usual sense because during normal operation, the oil mixes. If oil loss occurs in either sump or in either heat exchanger, the diverter (float) valve will seal off that sump to prevent a total loss of oil.

2.87 DRIVE TRAIN CONTROLS AND DISPLAYS

Engine nose gearbox and main transmission systems indications are displayed on the **SYS** page (fig 2-71).

NOTE

The following descriptions of **SYS** page engine(s) NGB and main transmission indications give ranges of those displays. Refer to Chapter 5 for system limits and restrictions.

2.87.1 Engine NGB Oil Status Indications. The following engine oil status indications are displayed on the **SYS** page:

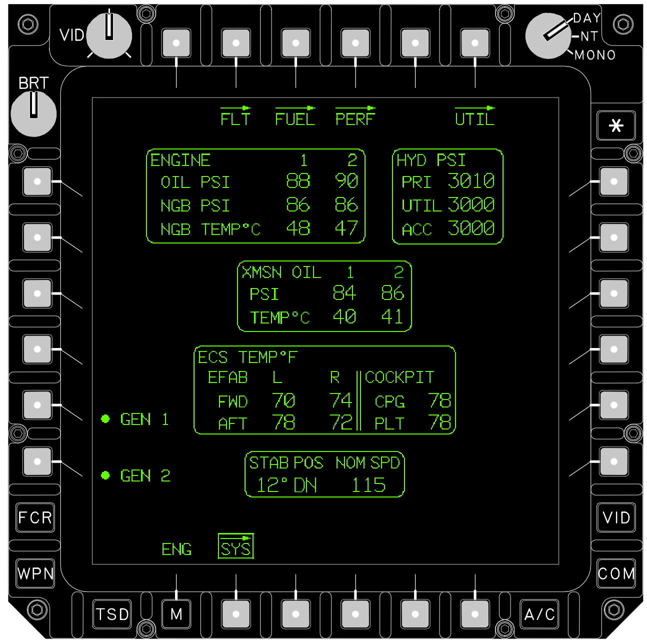


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Figure 2-71. SYS Page

NGB1 OR 2 OIL PRESSURE (PSI)

0 to 100 psi	Resolution 1 psi.
30 - 100 psi	Normal operation (GREEN)
30 psi	Minimum (<30 RED w/box)

NGB1 OR 2 OIL TEMPERATURE (°C)

-32 to 149	Resolution 1°
134	Maximum (>134 RED w/box)
0 - 134	Normal operation (<134 GREEN)

2.87.2 Transmission Oil Status Indications. The following main transmission oil status indications are displayed on the **SYS** page:

XMSN 1 OR 2 OIL PRESSURE (PSI)

0 to 100 psi	Resolution 1 psi
30 - 100 psi	Normal operation (GREEN)
30 psi	Minimum (<30 RED w/box)

XMSN 1 OR 2 OIL TEMPERATURE (°C)

-32 to 149	Resolution 1°
134	Maximum (>134 RED w/box)
-32 - 134	Normal operation (<134 GREEN)

2.88 TAIL ROTOR DRIVE SYSTEM

The tail rotor drive system consists of the tail rotor drive shafting, couplings, hanger bearing, dampers, anti-flail assemblies, and intermediate and tail rotor gearboxes.

2.88.1 Tail Rotor Drive Shaft. There are four tail rotor drive shaft sections. Three tail rotor drive shaft sections lead from the transmission to the intermediate gearbox. Two are of equal length. The fourth section is installed on the vertical stabilizer between the intermediate and tail rotor gearboxes. Hanger bearings support the longer shafts. The two equal length shafts incorporate friction dampers and anti-flail assemblies. Flexible couplings, attached to the shaft ends, are capable of accommodating shaft misalignments throughout the power range.

CAUTION

Prolonged OGE hover (20-30 minutes) with outside air temperature above 75° F (24° C) may cause the intermediate gearbox to overheat.

2.88.2 Intermediate Gearbox. The intermediate gearbox reduces RPM and changes the angle of drive to the tail rotor. The intermediate gearbox is a grease lubricated sealed unit. Four thermistors monitor temperature and an accelerometer measures vibration to provide crewmembers with UFD/EUFD caution messages.

CAUTION

Prolonged OGE hover (20-30 minutes) with outside air temperature above 75° F (24° C) may cause the tailrotor gearbox to overheat.

2.88.3 Tail Rotor Gearbox. The tail rotor gearbox, mounted on the vertical stabilizer, reduces the output rpm and changes the angle of drive. The tail rotor output shaft passes through the gearbox static mast. All tail rotor loads are transmitted to the static mast. The output shaft transmits only torque to the tail rotor. Lubrication of this gearbox is identical to that of the intermediate gearbox. As with the intermediate gearbox, four thermistors monitor temperature and an accelerometer measures vibration to provide crewmembers with UFD/EUFD caution messages.

Section VIII. ROTORS

2.89 ROTOR SYSTEM

The rotor system (fig 2-72) consists of a four bladed, fully articulated main rotor and a four bladed tail rotor assembly with two teetering rotor hubs.

2.90 MAIN ROTOR ASSEMBLY

The main rotor has four removable blades. The rotor head allows the four blades to flap, feather, lead, or lag independently. The head consists of a hub assembly, pitch housings, rotor dampers, and lead-lag links. The main rotor is controlled by the cyclic and collective control sticks through a swashplate mounted about the static mast. This arrangement allows the static mast, rather than the main rotor drive shaft, to assume all flight loads. The hub is splined to the main rotor drive shaft by a drive plate adapter bolted to the hub. The hub is secured to the static mast by a large locknut secured with multiple bolts. The hub houses two sets of grease lubricated, sealed roller bearings that transfer hub loads to the static mast. Mechanical droop stops limit blade droop. When blade droop occurs, a striker plate on the pitch housing contacts a roller. The roller presses a plunger against a droop stop ring on the lower portion of the hub.

2.90.1 Pitch Housing. The pitch housing permits blade pitch changes in response to flight control movements transmitted through the swashplate. This is made possible within the four pitch housings by “V” shaped stainless steel strap assemblies that twist and flap to permit blade feathering, flapping, and carry the centrifugal force load. Cyclic and collective stick inputs are transmitted to the pitch housing horns by pitch links attached to the swashplate. Feather bearings are installed inboard on the pitch housing to allow vertical and horizontal loads to be transferred from pitch housing to the hub. Centrifugal loads are transmitted by each strap assembly to the hub.

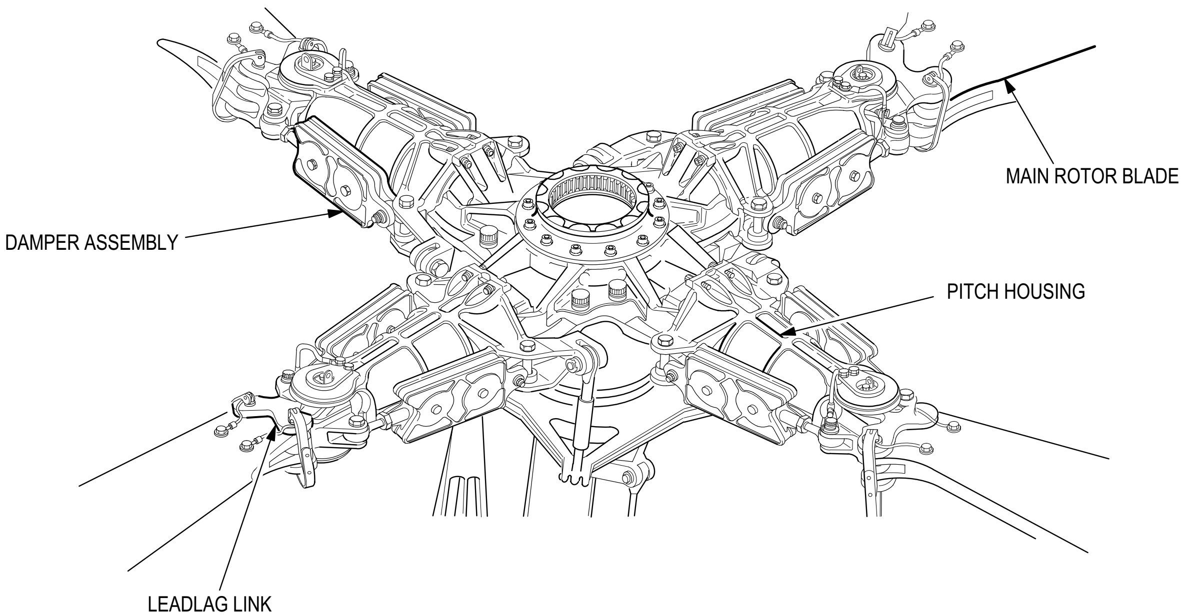
2.90.2 Lead Lag Links. Lead-lag links are connected to the outboard end of each pitch housing and are secured in place by a pin and two bearings allowing the links to move horizontally. The pin goes through the “V” portion of each strap within the pitch housing.

2.90.3 Damper Assembly. Two damper assemblies control lead-lag movement of each main rotor blade. Each damper attaches outboard to a link lug and inboard to a trunnion at the pitch housing. The dampers contain elastomeric elements that distort to allow the blade to lead or lag.

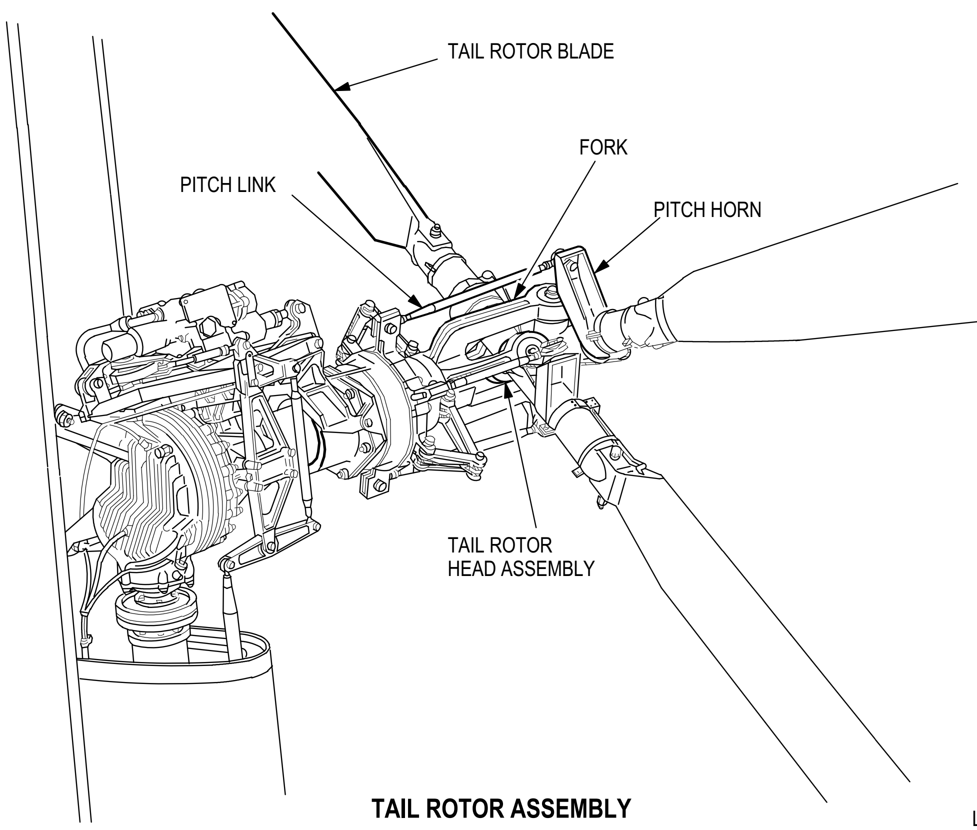
2.90.4 Main Rotor Blades. The outboard tip is swept aft 20° and tapers to a thinner section. Tip weights are installed in the blades. Each blade is secured to its lead-lag link by two blade attachment pins. These pins can be removed without the use of tools. Sets of five doublers are located on the upper and lower surfaces of the blade at the blade root.

2.91 TAIL ROTOR ASSEMBLY

The tail rotor system is of semi-rigid, teetering design. Two pairs of blades, each pair fastened to its own delta hinged hub, provide anti-torque action and directional control. A titanium fork houses four elastomeric teetering bearings and drives the rotating swashplate through an attached scissors assembly. The tail rotor assembly is splined to, and driven by, the tail rotor gearbox drive shaft which passes through a static mast. Blade pitch changes are made when directional control inputs cause the non-rotating swashplate to act upon the rotating swashplate. One pitch link for each blade, attached to the rotating swashplate and pitch horn, causes blade movement about two pitch change bearings in the blade root. Centrifugal forces are carried by strap assemblies attached outboard to the blade root and inboard at the hub center. An elastomeric bearing assembly positions the hub and strap pack in the tail rotor fork. Each blade has one stainless steel spar and two aluminum spars. Doublers, adhesive, and rivets attach the blade to the blade root. Brackets on the root fitting hold chord-wise balance weights. Span-wise balance weights are installed in blade tip caps.



MAIN ROTOR ASSEMBLY



TAIL ROTOR ASSEMBLY

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Figure 2-72. Rotor System

Section IX. UTILITY SYSTEMS

2.92 ANTI-ICE SYSTEM

The anti-ice protection systems provides crewmembers with automatic and manual means to prevent ice accumulation (anti-ice). Anti-ice subsystems are installed in the airspeed sensors, engine inlets, engine nose gearboxes, canopy, sensor shrouds and windows of TADS/PNVS.

2.92.1 Ice Detect Probe. The Ice Detect Probe aspirator will become active when the Free Air Temperature (FAT) decreases to 5° C or less. When the ice detect probe senses ice, it sends a discrete ice detect signal and an analog icing rate signal to the SP. In the **AUTO** mode, the SP commands all anti-icing functions to an **ON** state when the icing rate signal indicates an icing condition. The probe will be deactivated when the FAT increases to 7° C or higher. The SP will not command the anti-icing functions to **OFF**. In **MANUAL** control, the anti-ice system operation is independent of icing conditions.

2.92.2 Anti-Ice System Controls. The **A/C UTIL** page (fig 2-73) **ANTI-ICE SYSTEM** button toggles the system between **MANUAL** and **AUTO** modes.

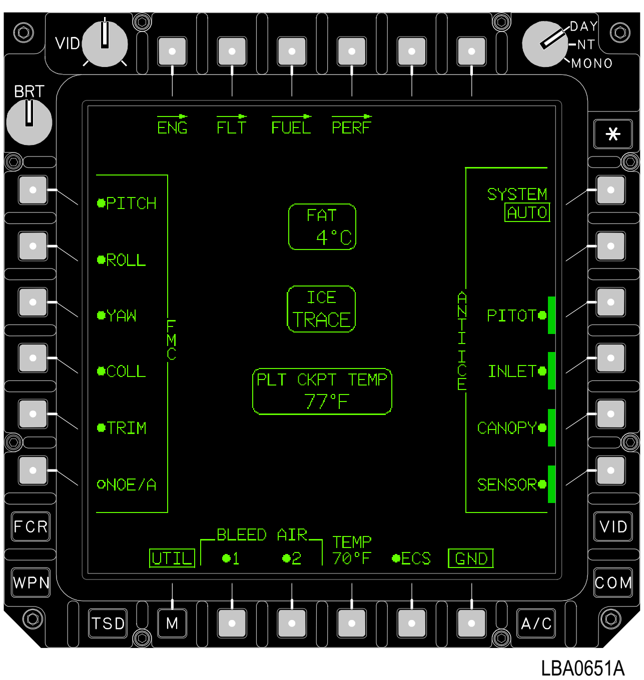

Figure 2-73. A/C UTIL Page (Pilot)

a. AUTO Mode. When in the **AUTO** mode, **ANTI-ICE** system buttons are not selectable when an icing conditions is detected. The buttons are selectable in this mode when no icing condition is detected. The SP uses the ice status signal from the ice detector signal processor and FAT status from the FMC to determine when to activate the anti-ice systems. Once activated, anti-ice systems are not automatically set to off; the systems must be manually selected to off.

b. MANUAL Mode. When in **MANUAL** mode, the **ANTI-ICE** system buttons are selectable. When entering the **MANUAL** mode, any anti-ice system that is currently **ON** (activated in the **AUTO** mode), will remain in an **ON** state.

c. FAT Status Window. The current FAT value is displayed in the **FAT** status window. The range value of **FAT** is from -50° C to +50° C.

d. ICE Status Window. The current ICE status is displayed in the **ICE** status window. The state of the **ICE** status is displayed in conditions of **TRACE** (GREEN), **LIGHT** (WHITE), **MODER** (YELLOW), or **SEVERE** (RED).

2.92.3 Airspeed Sensors Anti-Ice. The airspeed sensors anti-ice system prevents formation of ice that could cause false indications from the pitot tubes and Air Data Sensors. When **PITOT** is selected, power is applied to heat the pitot tubes and ADS, which prevents ice formation on the tubes and sensors.

2.92.4 Engine INLET Anti-Ice System. The engine anti-ice system includes the engine, engine inlet fairings, and nose gearbox fairings. Engine fifth stage bleed air is used to heat the swirl vanes, nose splitter, and engine inlet guide vanes on each engine. The nose gearbox fairing is electrically heated to prevent ice from forming on the sensors.

2.92.5 CANOPY Anti-Ice. Canopy windshield anti-ice is incorporated into the pilot and CPG middle forward looking windshields. Heating elements and sensors are embedded into the windshield laminates. When **CANOPY** is selected, heat produced by the elements prevents ice formation on the windshields.

WARNING

Do not touch TADS/PNVS shroud windows. Electrical shock can result, and heaters in these fairings can cause serious burns. If shock or burns occur, seek medical aid.

2.92.6 TADS/PNVS SENSOR Anti-Ice.

a. Inflight. **SENSOR** anti-ice prevents ice formation on turret shrouds, boresight and sensor modular windows. Anti-icing is accomplished via thermostatically controlled heating elements in the shrouds and electronically regulated power through the conductive window coatings.

b. GND Position. The **SENSOR** anti-ice is inhibited from operation when the helicopter is on the ground. This inhibit may be overridden by using the sensor anti-ice ground (**GND**) override on/off button (fig 2-73).

2.93 RAIN REMOVAL

The rain removal system consists of two Windshield wipers and canopy defog.

2.93.1 Windshield wipers. Two electrically driven wipers are mounted on the canopy frame to remove moisture from the two windshields. The wipers have two speeds and a park position and are controlled by the **WINDSHIELD** panel **WIPER** rotary switch (fig 2-74) in each crew station.

2.93.2 Canopy Defog. Pressurized hot air is mixed with crew station conditioned air and directed against the canopy side panels to defog them. Canopy defog is controlled by the **WINDSHIELD** panel **DEFOG** pushbutton switch (fig 2-74) in each crew station.

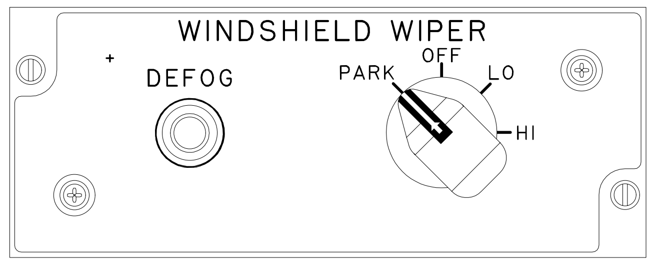

Figure 2-74. Windshield Panel

Section X. ENVIRONMENTAL CONTROL SYSTEM

2.94 ENVIRONMENTAL CONTROL SYSTEM (ECS)

The ECS (fig 2-75) provides crew station ventilation, heating, and Vapor Cycle Cooling System (VCCS) air conditioning. The VCCS is the primary source of cool air for the Extended Forward Avionics Bays (EFAB) and the TADS/PNVS. No heating is required in the EFABs.

NOTE

- During engine starts in the heating mode, conditioned air will cease to be provided until starter drop-out. Non-conditioned airflow will continue.
- When a canopy door is unlatched, cooling air will not be provided to that crewstation (heating mode is unaffected by canopy position).
- Operating the aircraft in a loose grass environment could cause the ECS condenser inlet to become clogged. This could result in a single or double condenser overtemp condition.

2.94.1 ECS Normal Operation. Environmental cooling is provided by two independently operated VCCS systems. Crewstation heating uses bleed air from the main engines or APU via the IPAS. System control is performed by the Digital Control Unit (DCU). One VCCS system will service the aft right and left hand EFAB and the pilot crew station. The other system will service the forward right and left hand EFAB, CPG crew station and the TADS/PNVS. The aft avionics bays are supplied ambient air circulation via a fan. Temperature sensors, located in each crew station and EFAB, provide temperature status to the appropriate VCCS system allowing independent crew station and EFAB cooling.

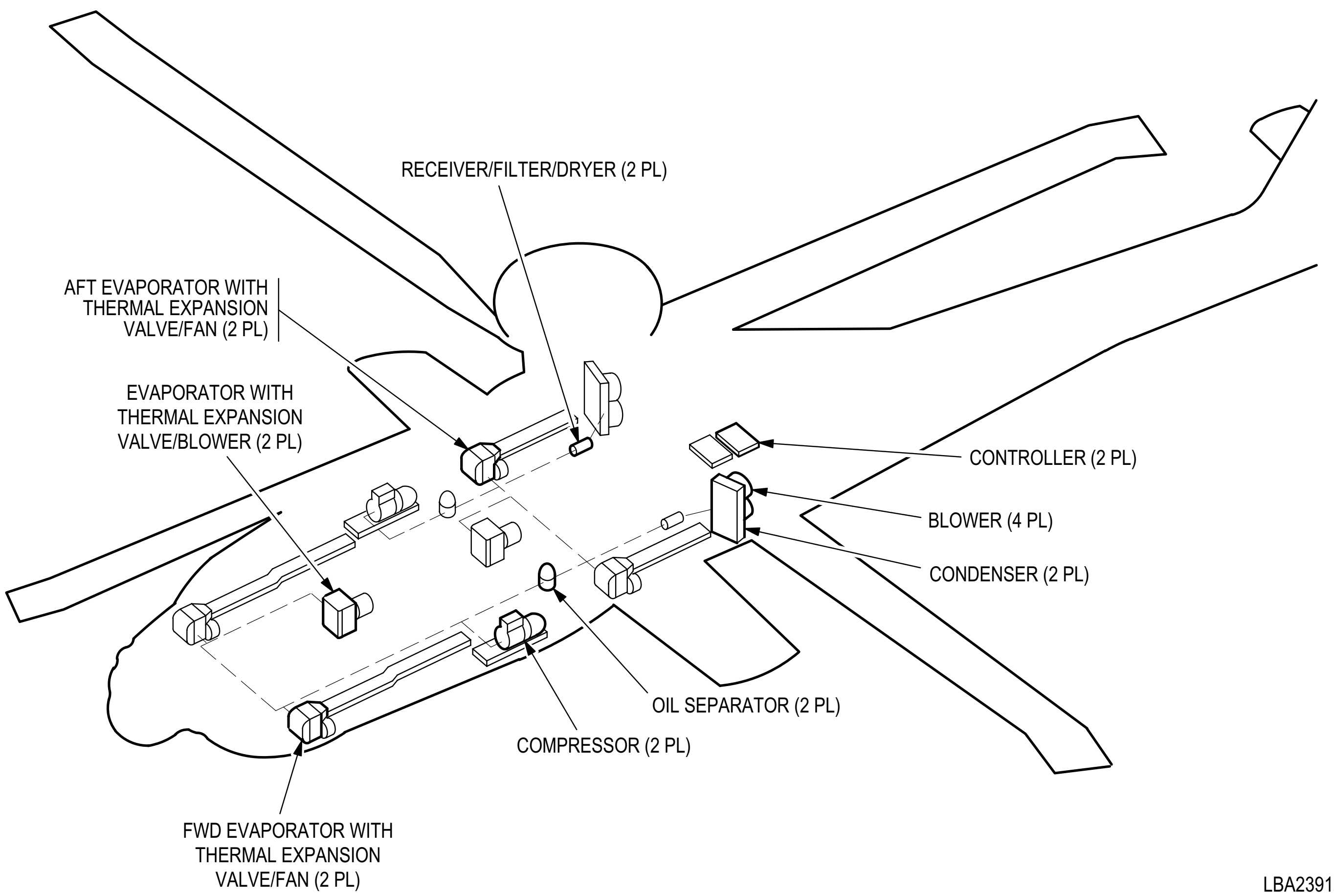

Figure 2-75. Environmental Control System (ECS)

2.94.2 ECS Controls and Displays. Controls and displays required to manage the ECS are provided on the **A/C UTIL** page (fig 2-76) and the **SYS** page. ECS controls consist of an **ECS ON/OFF** button, a data entry **TEMP** (temperature) set button and a current crew station **TEMP** status window located on the **A/C UTIL** page. Individual crew compartment air temperature readouts are displayed on the **SYS** page. ECS variables involving the equipment, EFABS, and crewstations can be viewed on the **ECS** page.

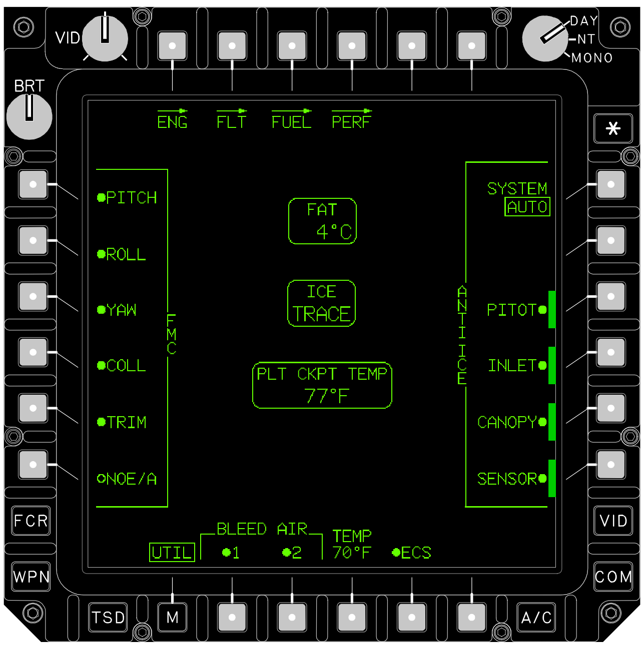

Figure 2-76. A/C UTIL Page (Pilot)

a. ECS ON/OFF Button. The **ECS** button toggles the ECS between **ON** and **OFF**. Upon aircraft power up, the ECS defaults **ON**.

b. TEMP Set Button. After crewmember selects **TEMP** button, the desired crew station temperature is entered in 1° increments, 50° F to 90° F, via the Keyboard Unit (KU). The crewmember then selects **ENTER** on the KU and the new temperature setting will be displayed above the **TEMP** button. Upon aircraft power up, **TEMP** will default to the last value set prior to shutdown. This data entry is independent in each crewstation.

c. Temperature Status Windows. The current crew station ambient temperature is displayed in the **TEMP** status window on the **A/C UTIL** page (fig 2-76). The range value for the **PLT/CPG CKPT TEMP** status window is from -65° F to +160° F in 1° increments. Each crewstation and EFAB compartment (left/right/forward and aft) temperature is displayed in the **ECS TEMP° F** status window on the **SYS** page (fig 2-77). An EFAB compartment temperature is displayed in YELLOW when it is greater than 105°. The range value for the **ECS TEMP° F** window is from -65° F to +160° F and displayed in 1° increments.

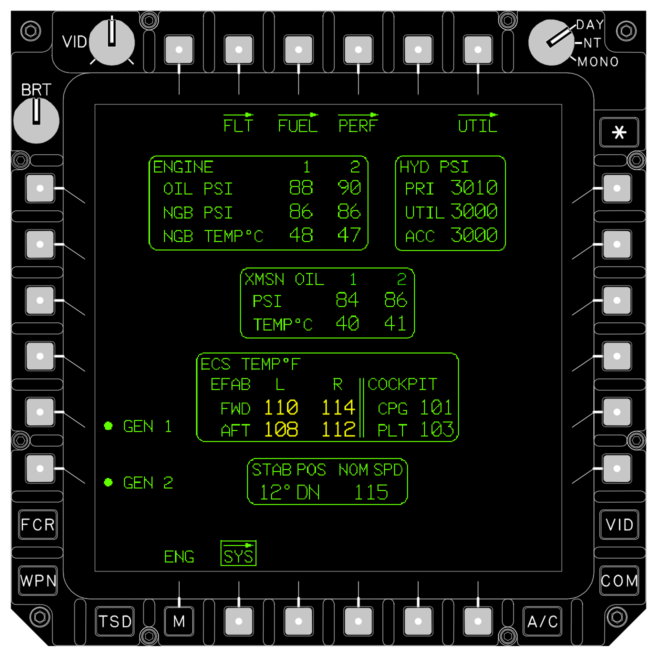

Figure 2-77. SYS Page

CAUTION

To obtain optimum performance from the heating and cooling system, the gaspers must be full open. Adjusting the temperature level rather than closing gaspers will increase the reliability of the blower. Closing two or more gaspers will cause the blower to operate in a stall region, increasing noise levels. Operating with all gaspers closed may cause the blower to overheat and shutdown.

d. Crewstation Gasper Adjustment. Each crewstation air distribution system features two torso gaspers, two head gaspers and two leg vents. The torso and head gaspers may be manually adjusted open or closed for airflow regulation and may be positioned up to 60° off centerline in any direction for crew comfort. The torso gaspers are located on the front instrument panel facing the crewmember, while the head gaspers are located over each shoulder of the crewmember. The leg vents are located above both legs of each crewmember and are not adjustable.

2.95 CREWSTATION BACKUP COOLING

During most ECS failure modes, the EFAB and crewstation blowers will continue to circulate air to each compartment, and the Air Particle Separator (APS) will provide ambient air to the crewstations. There is one interconnect valve located in the air distribution ducting between the two crewstations. In the event of a cockpit cooling failure, the Digital Control Unit (DCU) will send a signal to the interconnect valve to fully open the valve, thus allowing airflow between the two cockpits. The crewstation blower to the affected crewstation will shut down and allow the remaining crewstation blower to supply both cockpits with conditioned air. It is possible with an Air Particle Separator and ECS failure that the blowers may be disabled and no fresh air is provided.

2.95.1 ECS Failure. The system begins to monitor for ECS failure when generator power is applied. The ECS failure caution occurs when the system processor detects various ECS failures. Failures of the forward and aft ECS systems are usually temporary and the blowers continue to operate. Failure of the ECS control is usually permanent and the blowers may be disabled. The UFD/EUFD and MPD will display the related caution message.

2.96 VENTILATING SYSTEM

In the event of an ECS failure, the EFABS and crew station blowers will continue to circulate air to each compartment, and the Air Particle Separator (APS) will provide ambient air to the crew stations. In the event of an ECS and APS failure the blowers may be disabled and no fresh air is provided.

Section XI. ELECTRICAL SYSTEM

2.97 INTRODUCTION

The electrical system (fig 2-78) produces and distributes all of the electrical power required for operation of the helicopter. The electrical system provides: AC power generation, DC power generation, and battery power.

2.98 ELECTRICAL POWER MANAGEMENT SYSTEM (EPMS)

The EPMS (fig 2-79) consists of two High Power Switching Modules (HPSM) and two Electrical Load Centers (ELC). On each HPSM is mounted a Circuit Breaker Panel (CBP). The EPMS and the CBPs provide distribution for AC, DC, battery power, and ground power. EPMS operation is fully automated. Because of redundancy, there are no normal indications for the EPMS subsystem). Failures within the EPMS are displayed on the MPD Data Management System (**DMS**) page (refer to Section XVI). Busses 1, 3 and 5 are tied together in each of the respective power distribution systems as are busses 2, 4 and 6 (Figs 2-80,2-81 ,2-82 ,2-83).

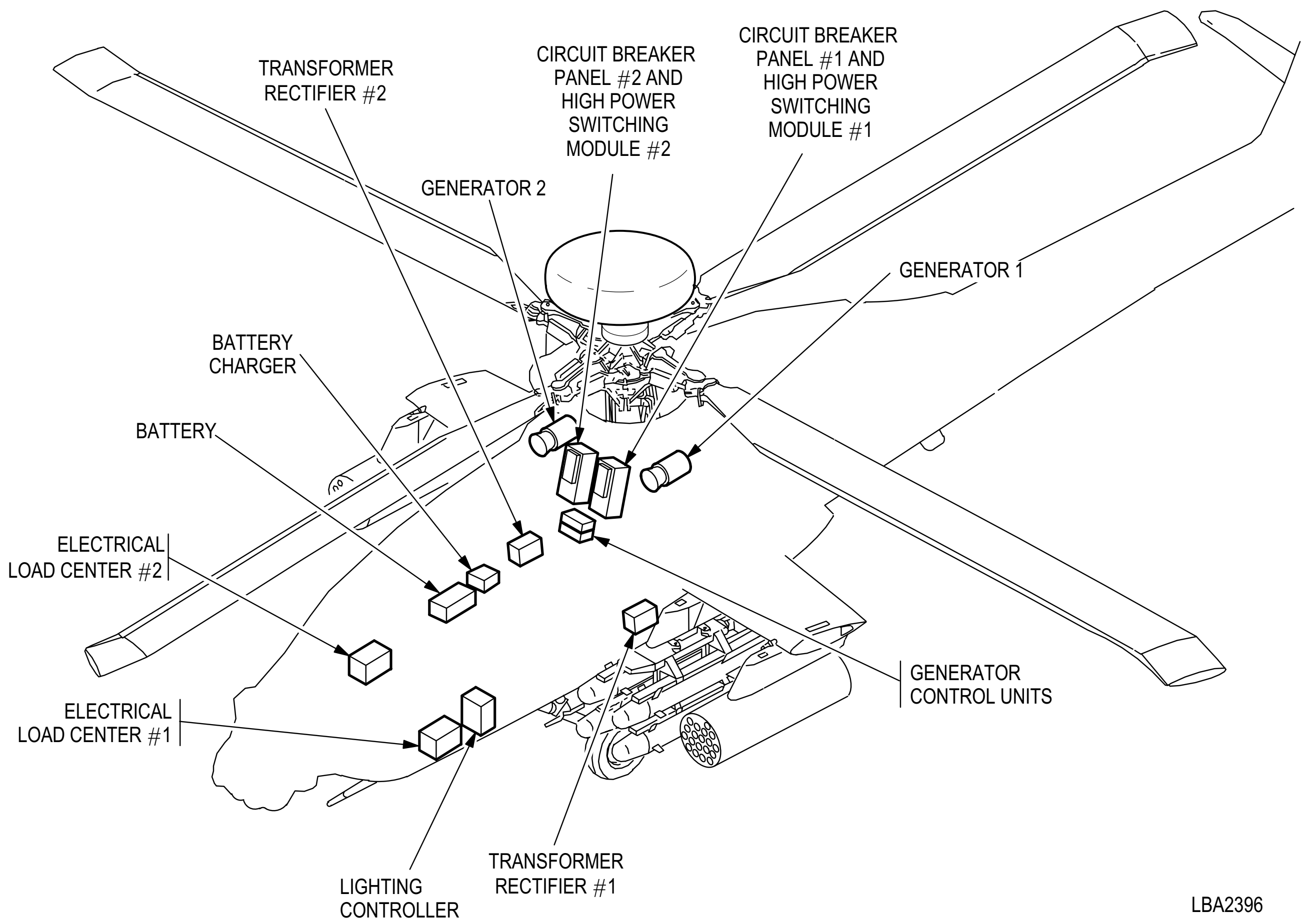

Figure 2-78. Electrical System Components

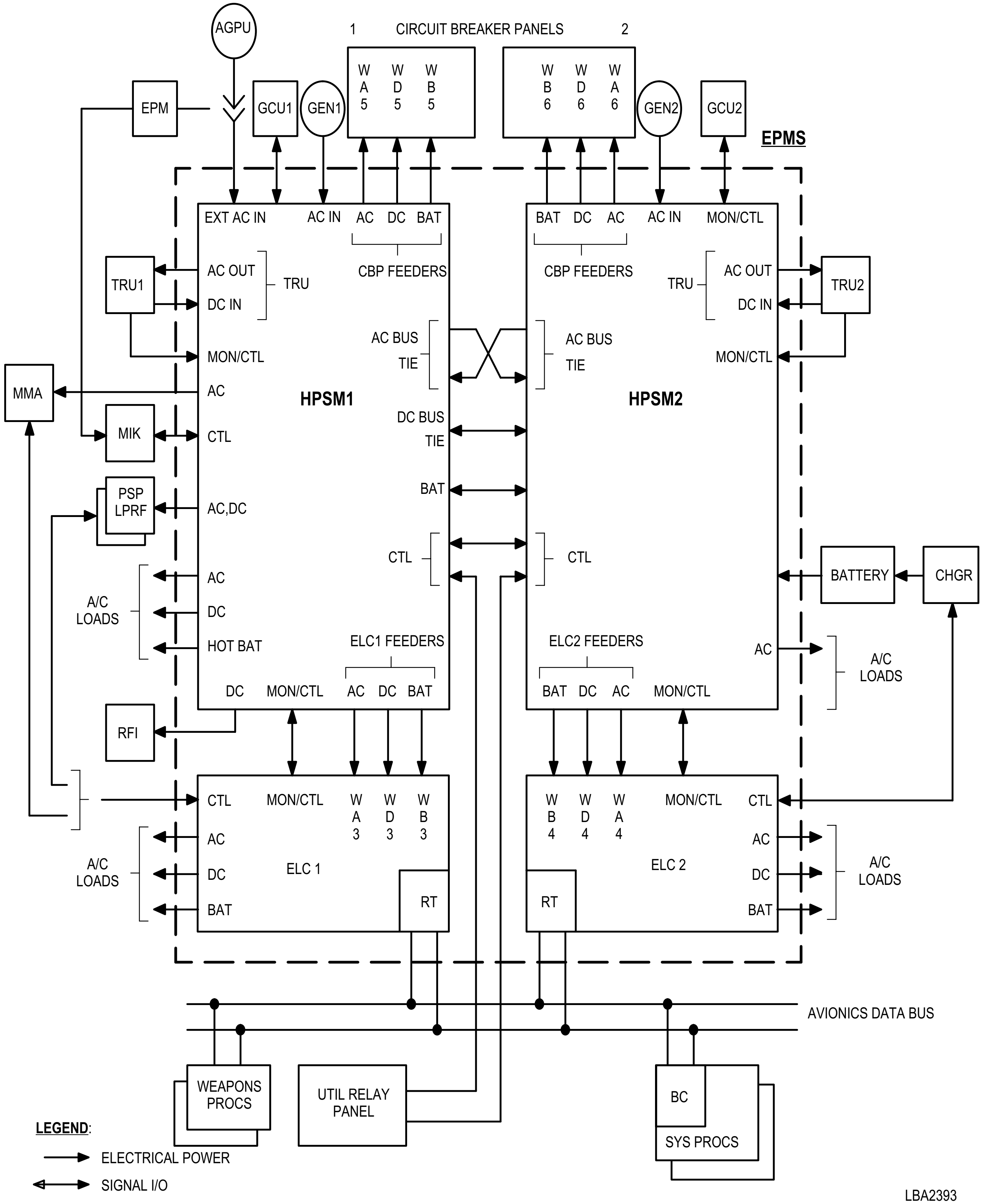

Figure 2-79. Electrical Power Management System

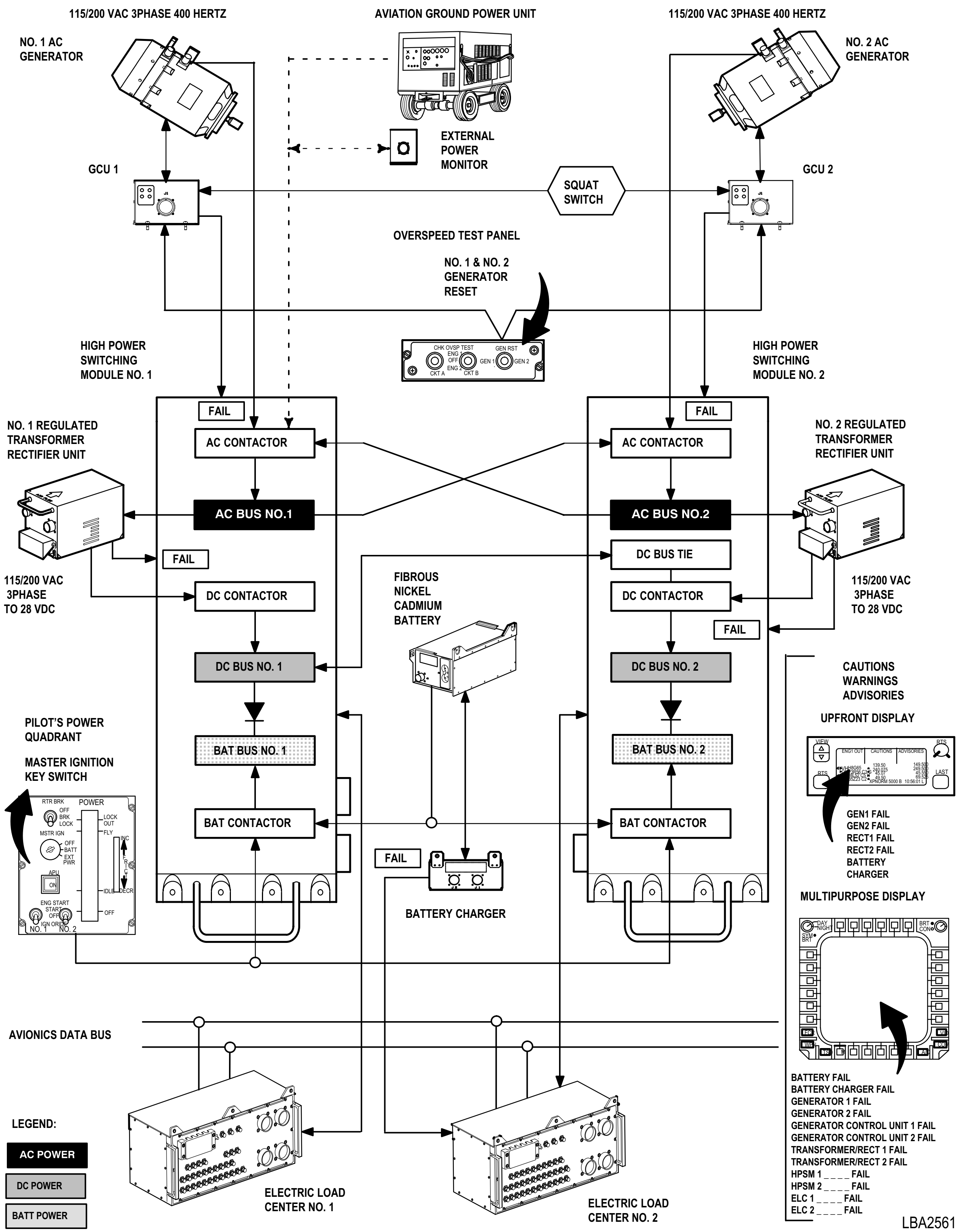

Figure 2-80. Electrical Power Distribution

AC BUS NO. 1

- AFT LH FAB FAN
- AIR PARTICLE SEP
- ANTI COLL/FORM LTS
- CPG CKPT FAN
- CPG RH MPD
- DISPL PROC #1
- ECS COMP 1
- ELC1 AC
- ENG 1 OVSPD
- FCR
- FWD COND BLWR A
- FWD COND BLWR B
- FWD LH FAB FAN
- GUN MOTOR
- HF ARC220 FAN
- IHADSS SEU
- LASER EU
- NOSE GRBX HEATER 1
- PLT LH MPD
- PNVS EU
- RH/LH FANS AFT BAYS
- TADS PWR SUPPLY

AC BUS NO. 2

- AFT COND BLOWER A
- AFT COND BLOWER B
- AFT RH FAB FAN
- AMMO MOTOR
- BATTERY CHARGER
- CANOPY HEATER
- CPG LH MPD
- DISP PROC #2
- ECS COMP 2
- ELC2 AC
- ENG2 OVSPD
- FANENG BLEED AIR
- FWD RH FAB FAN
- GND SVC RECPT AC
- IHADSS DEU
- NITROGEN INERT
- NOSE GRBX HEATER 2
- PLT CKPT FAN
- PLT RH MPD

AC BUS NO. 3

- AIR DATA SENSOR
- IAFS FUEL PUMP
- P1 1760 AC
- P2 1760 AC
- WP&SP 1&2/STAB SYN

AC BUS NO. 4

- AWS AC
- CPG FLT CONT (REF B)
- ICE PROB HEATER
- P3 1760 AC
- P4 1760 AC
- PLT FLT CONT (REF A)

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Figure 2-81A. [BLK 2 AC Power Distribution]

DC BUS NO. 1

- DCU 1
- EGI 1A
- EGI 2A
- EGI ANT SPLITTER
- ELC1 DC
- ENG CHOP
- FAN AFT BAY
- GRBX XDCR
- IAFS FUEL QTY
- IR JAM CONTROL
- KYBD PLT
- P1 ACTR PWR
- P1 PIU PWR
- P2 ACTR PWR
- P2 PIU PWR
- PLT CBR FLTR BLWR
- PLT SIGHT SW
- PRI LT CPG
- PRI LT PLT
- PSP/LPRF
- RADAR JAM
- RFI
- SELECT JTSN
- STAB ACTR LH
- TADS/PNVS
- TESS LRFD
- TESS TECU
- TESS TLIA
- WPNS PROC #1

DC BUS NO. 2

- ADF
- AREA WPNS SYS DC
- BATT HTR
- BUCS/FMC CMPTR
- CPG CBR FLTR BLO
- CPG SIGHT SW
- DCU 2
- EGI 1B
- EGI 2B
- ELC2 DC
- FUZZ BURNER
- GND SVC RECPT DC
- HADS
- KEYBD CPG
- NAV LTS/ANTI COL
- P3 ACTR PWR
- P3 PIU PWR
- P4 ACTR PWR
- PNVS EU
- PR PIU PWR
- SIDE LOADER
- STAB ACTR RH
- STAB CNTRL
- VIDEO RCDR
- WPNS PROC #2
- WSHLD WPR CPG
- WSHLD WPR PLT

DC BUS NO. 3

- CANOPY HEAT
- CHAFF ARM
- ELC1 DC CONT
- ENG1 A1/START BL
- FUEL VALVE
- IAFS CTRL
- LASER WRN RCVR
- LW PITOT HTR
- LW ROCKET ARM
- LWT 1760 DC1
- LWT 1760 DC2
- P1 1760 DC1
- P1 1760 DC2
- P2 1760 DC1
- P2 1760 DC2
- PNVS STANDBY
- RDR WRN RCVR
- TADS STANDBY

DC BUS NO. 4

- DPLR SENSOR
- ELC2 DC CONT
- ENG2 AI/START BL
- GUN ARM
- ICE SIG PROC/ASP SOV
- IHADSS DEU PWR
- IHADSS SEU PWR
- P3 1760 DC1
- P3 1760 DC2
- P4 1760 DC1
- P4 1760 DC2
- RDR ALTM PWR
- RESERVED FOR ROTOR
- RW PITOT HTR
- RW ROCKET ARM
- RWT 1760 DC1
- RWT 1760 DC2

LBA5168

Figure 2-82A. [BLK 2 DC Power Distribution]

BATT BUS NO. 1

- CPG PWR LEVER
- EMER JTSN
- FIRE DET ENG #1
- FIRE EXT CPG
- FM1 ARC201
- FM2 ARC201
- GEN 2 BACKUP
- HF ARC220
- HF KY100
- HYD XDCR UTIL
- IDM
- IFM AMP
- LD MAINT PRCS SEL
- RTR/TADS BRAKES
- SEC/CPG ADV LTS
- SQUAT SWITCH
- SYS PROC #1
- TAIL WHL LOCK
- UPFRONT DISPL PLT

BATT BUS NO. 2

- CIU
- DATA XFR UNIT
- EMG S/O VALVE
- FIRE DET APU
- FIRE DET ENG #2
- FIRE EXT PLT
- FLT CNTRL TRIM
- GEN 1 BACKUP
- HYD XDCR PRI/EMER
- INT GRBX TEMP ALM
- KY58
- LDG SRCH LIGHT
- MDR
- PLT ADV LTS
- REFUEL PNL
- STDBY INSTR
- SYS PROC #2
- UHF ARC164
- UPFRONT DSPL CPG
- UTIL LTS MAINT
- UTIL RLY PNL
- VHF ARC186
- XPNDR/IFF

BATT BUS NO. 3

- ELC1 BAT CONT
- ENG1 ATS
- ENG1 BL/LOUVER
- ENG1 OIL PRESS
- FDMU PROVISION
- FUEL CRSFD1
- ZEROIZE PNL

BATT BUS NO. 4

- APU ECU PWR/START
- APU FUEL BOOST AND
- ELC2 BAT CONT
- ENG2 OIL
- ENG2 ATS
- ENG2 BL/LOUVER
- FUEL BOOST SOV
- FUEL CRSFD2
- VIDEO CONT PNL/BPIA
- XFER AIR VALVE

BATT HOT BUS

- COLD RFL PANEL
- HPSM1 CONT
- HPSM2 CONT
- MIK SW & MDR

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Figure 2-83A. [BLK 2 Battery Power Distribution]

2.98.1A [BLK 2 Circuit Breaker Panel (CBP) 1. CBP 1 receives 115/200 Vac, 28 Vdc, and 24/28 Vdc input from HPSM 1. It contains the CBs necessary to supply the unswitched secondary loads on the No. 1 busses. CBP 1 is mounted on the forward face of HPSM 1. Figure 2-84A shows which CBs are located on CBP 1.]

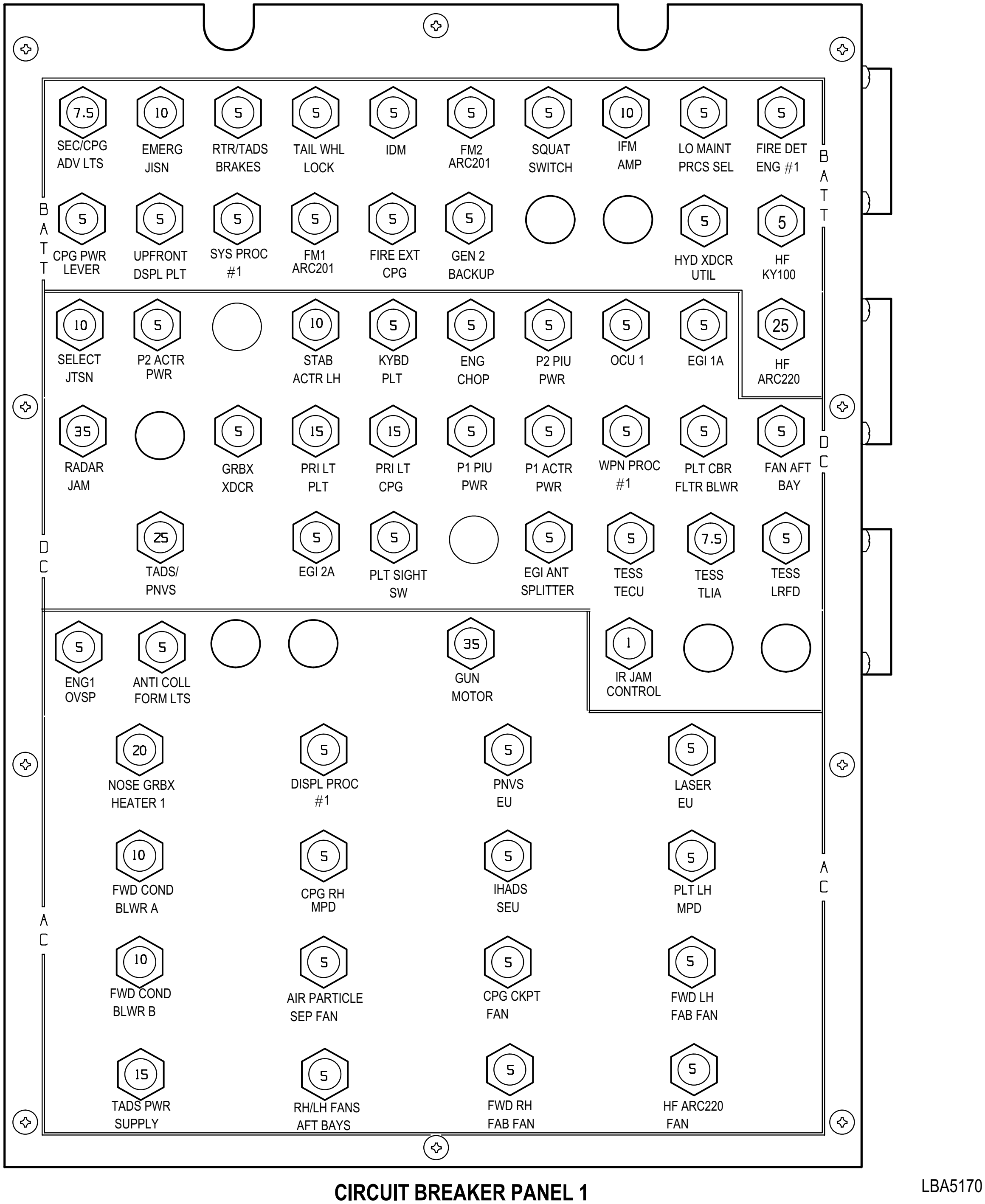

Figure 2-84A. [BLK 2 Circuit Breaker Panel 1]

2.98.2A [**BLK 2** **Circuit Breaker Panel (CBP) 2**. CBP 2 receives 115/200 Vac, 28 Vdc, and 24/28 Vdc input from HPSM 2. It contains the CBs necessary to supply the unswitched secondary loads on the No. 2 busses. CBP 2 is mounted on the forward face of HPSM 2. Figure 2-85A shows which CBs are located on CBP 2.]

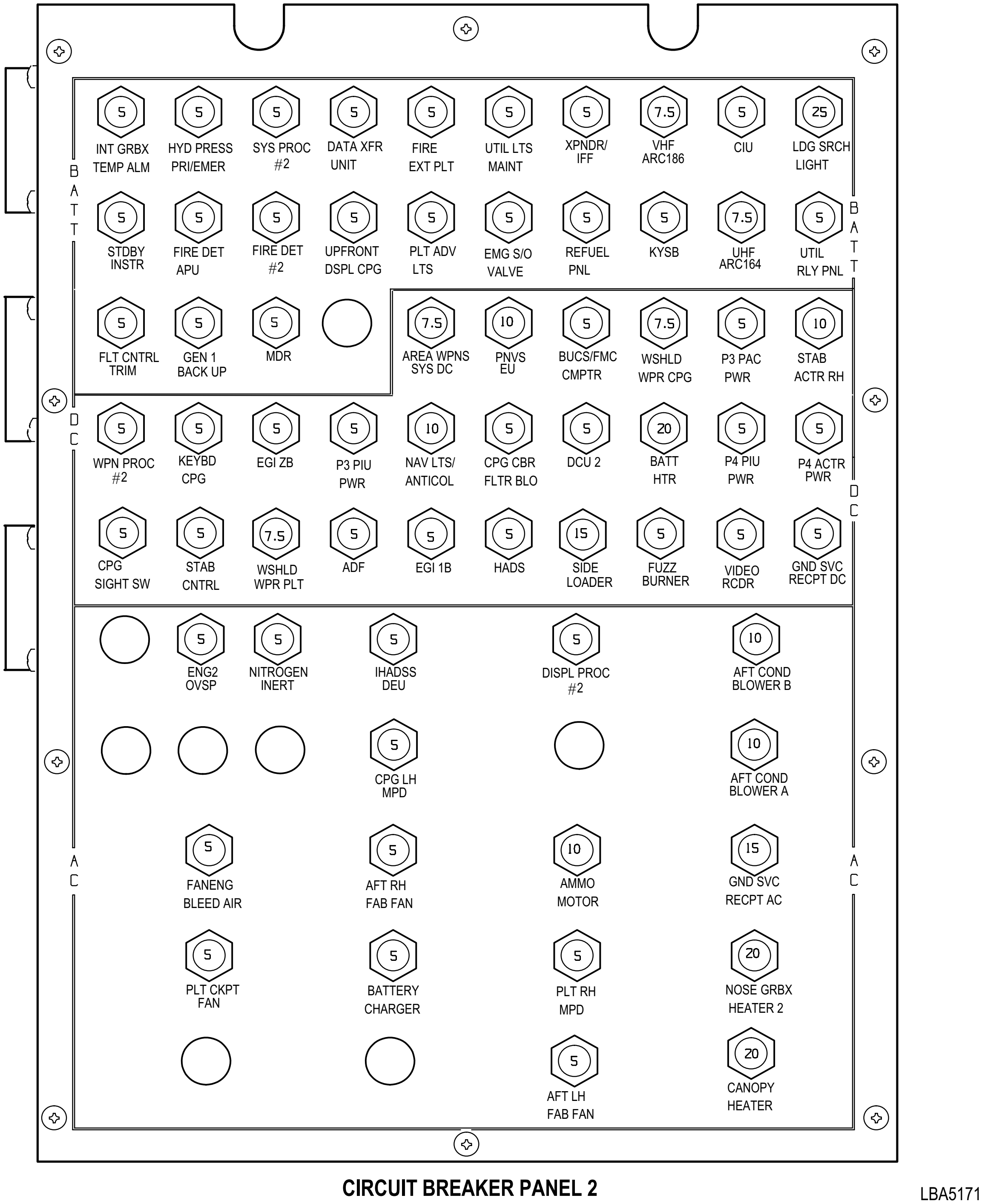

Figure 2-85A. [**BLK 2** **Circuit Breaker Panel 2**]

2.98.3 Electrical Load Center 1. ELC 1 receives 115/200 Vac, 28 Vdc, and 24/28 Vdc input from HPSM 1. It contains the Circuit Breakers (CB) and remote controlled switches necessary to supply the switched secondary loads on the No. 1 busses. It also receives commands from the system processors for positioning the remote controlled switches. ELC 1 is located in the left forward EFAB. Figure 2-86 shows the CBs located on ELC 1.

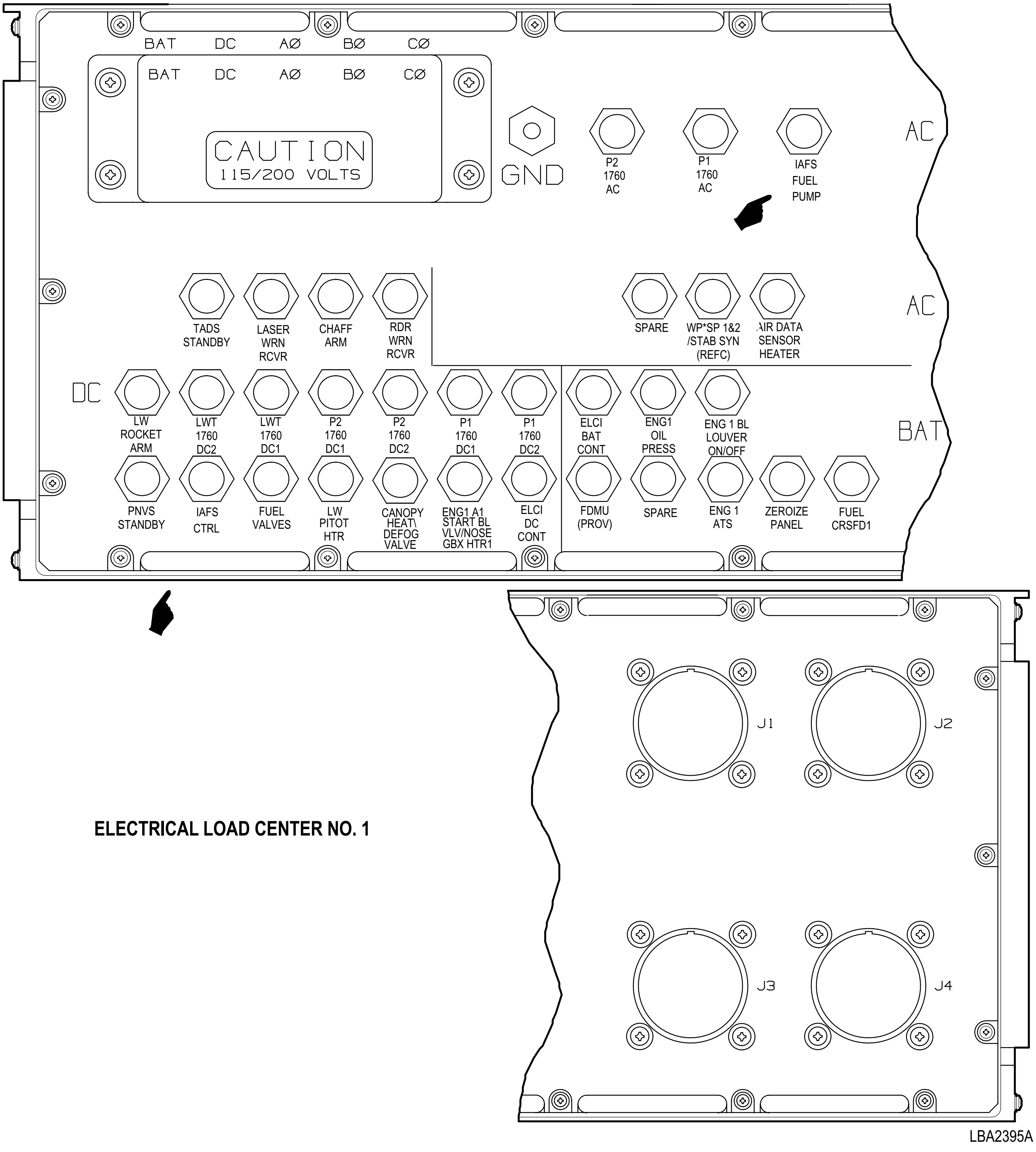

Figure 2-86. ELECTRICAL LOAD CENTER NO 1 Circuit Breakers

2.98.4 Electrical Load Center 2. ELC 2 receives 115/200 Vac, 28 Vdc, and 24/28 Vdc input from HPSM 2. It contains the Circuit Breakers (CB) and remote controlled switches necessary to supply the switched secondary loads on the No. 2 busses. It also receives commands from the system processors for positioning the remote controlled switches. ELC 2 is located in the right forward EFAB. Figure 2-87 shows the CBs located on ELC 2.

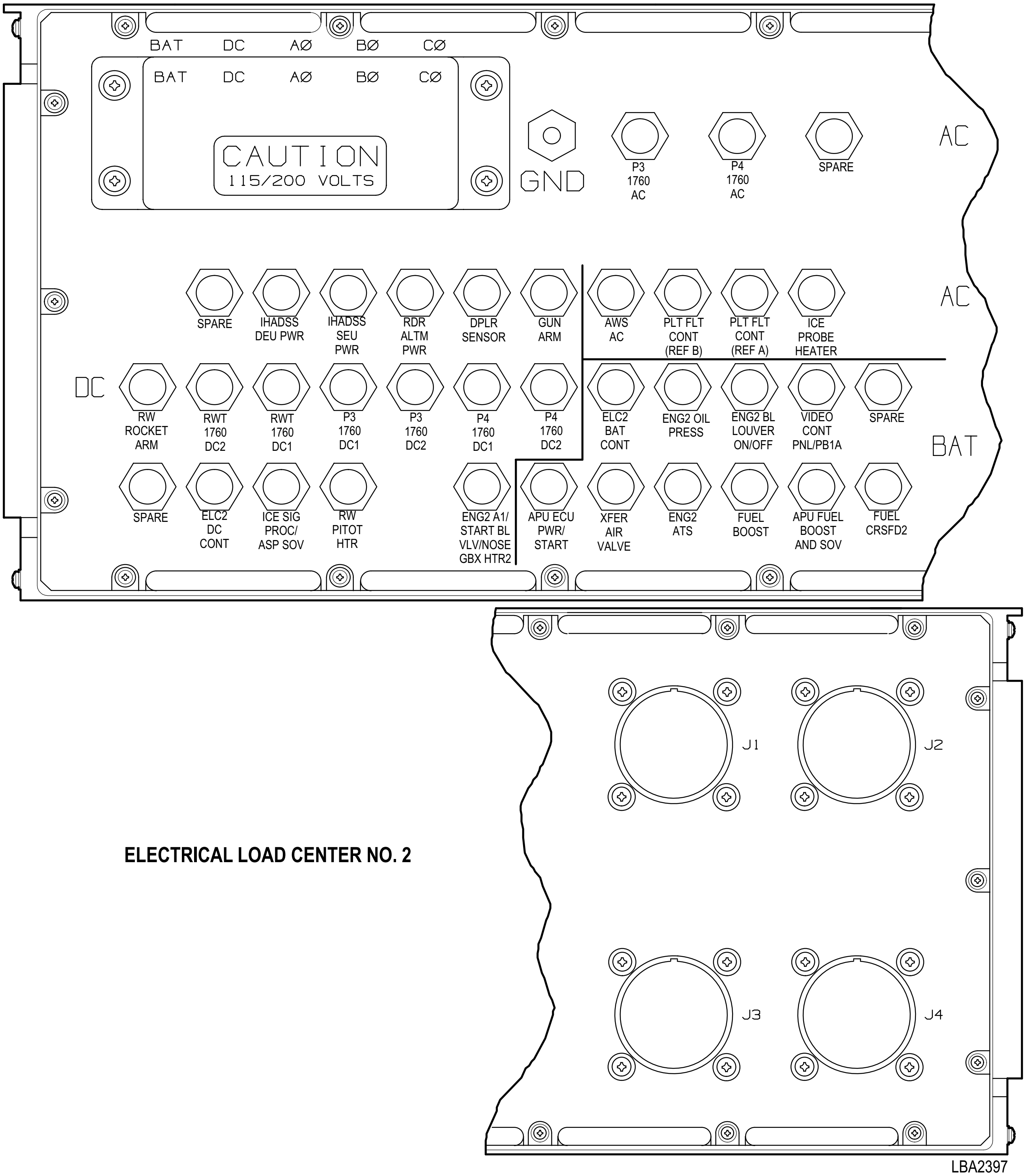

Figure 2-87. ELECTRICAL LOAD CENTER NO 2 Circuit Breakers

2.99 BATTERY

The battery subsystem consists of one 24 Vdc, 15 ampere hour, sealed cell, Fibrous Nickel Cadmium (FNC) battery and associated battery charger. Both the battery and battery charger are located in the right center EFAB. The battery provides power during ground refueling, APU starting, and engine starting. The battery also provides backup power in the event of a loss of all other DC power (fig 2-83). In that event, the battery will supply the normal in flight battery loads for a minimum of 12 minutes provided the battery is at least 80% charged. During normal operation the battery is isolated from the battery busses and is charged by the battery charger.

2.99.1 Battery Power Control. Battery power is controlled by the **MSTR IGN** switch (fig 2-88) on the pilot **POWER** lever quadrant. The ignition key is not required to actuate the **MSTR IGN** switch. With the **MSTR IGN** switch in the **OFF** position, power is still applied to the refuel panel. When the refuel switch on the refuel panel is turned **ON**, the aircraft may be refueled without the need to turn the **MSTR IGN** switch to the **BATT** position. When the **MSTR IGN** switch is placed in the **BATT** position, the battery is connected to the battery busses unless the busses are being supplied by the Transformer Rectifier Unit (TRU) power. If the battery busses are being powered by the output of the TRU, the battery is isolated and placed in the charge mode. In the event that TRU power is lost, the battery will automatically be connected to the battery busses (fig 2-83).

2.99.2 Battery Power Indications. Any time the battery charger fails, an advisory message is displayed on the UFD/EUFD, and battery charging is terminated. If the charger detects a battery fault an advisory message is displayed on the UFD/EUFD, and battery charging is terminated.

2.100 BATTERY CHARGER

The battery charger is normally powered by 115 Vac supplied from CBP 2. The charger automatically maintains the battery in a full state of charge. Additionally the battery charger monitors the battery temperature and state of health. If it detects a battery fault, it is reported to the system processor for display on the UFD/EUFD. The charger also monitors itself for a fault and if a fault is detected that is also reported to the system processor for display on the UFD/EUFD. In the event of a battery or battery charger failure, battery charging is automatically terminated and can not be restarted until the fault has cleared. Finally the battery charger controls the battery internal heater. When the internal temperature of the battery drops below 10° C the battery heater is activated. The internal heater is functional between 10° C and -40° C, therefore, an external heater blanket is not required. The battery heater is powered by the aircraft 28 Vdc bus via CBP 2.

2.101 DC ELECTRICAL SYSTEM

Two regulated 28 Vdc, 350 amp TRUs are the primary DC power source, each capable of supplying managed power to all DC loads. The TRUs convert AC input to 28 Vdc. They are self monitoring for over temperature. TRU fail status is displayed on the UFD/EUFD.

2.101.1 Total DC Circuit Load Support. Either TRU, in conjunction with either generator, is capable of supporting the total DC bus load.

2.101.2 DC BUS Interface with Battery Electrical System. Primary DC bus 1 and DC bus 2 provide 28 Vdc to battery bus 1 and bus 2 through two diodes. These diodes isolate the battery electrical system from DC bus load when TRU electrical power has failed.

2.101.3 TRU Failure. In the event of a TRU failure, a caution message will be annunciated on the MPD and the UFD/EUFD. The failed DC bus system is then transferred to the remaining operational DC bus system.

2.102 AC ELECTRICAL SYSTEM

The AC generation subsytem consists of two 45 KVA, 3 Phase, 4 wire, 115/200 Vac, 400Hz, air cooled, brushless AC generators and two Generator Control Units (GCU). Each generator normally supplies its respective AC bus, AC bus 1 or AC bus 2. In the event of a generator failure the remaining generator has sufficient power to supply all AC loads, without the need to load shed. Each generator control unit provides voltage regulation, control and protection for its associated generator. Protection is provided against undervoltage, overvoltage, underfrequency, over current/short circuit, and differential/feeder fault operation. [BLK 1 Aircraft equipped with 7-511B11019-11 and -13 GCUs, underfrequency protection is inhibited in flight and undervoltage protection is inhibited during underfrequency operation. Aircraft equipped with 7-511B11019-15 -17, -19 and -21 GCUs, underfrequency protection is functional in flight and undervoltage protection is inhibited during underfrequency operation.] [BLK 2 Underfrequency protection is functional in flight and undervoltage protection is inhibited during underfrequency operation.]

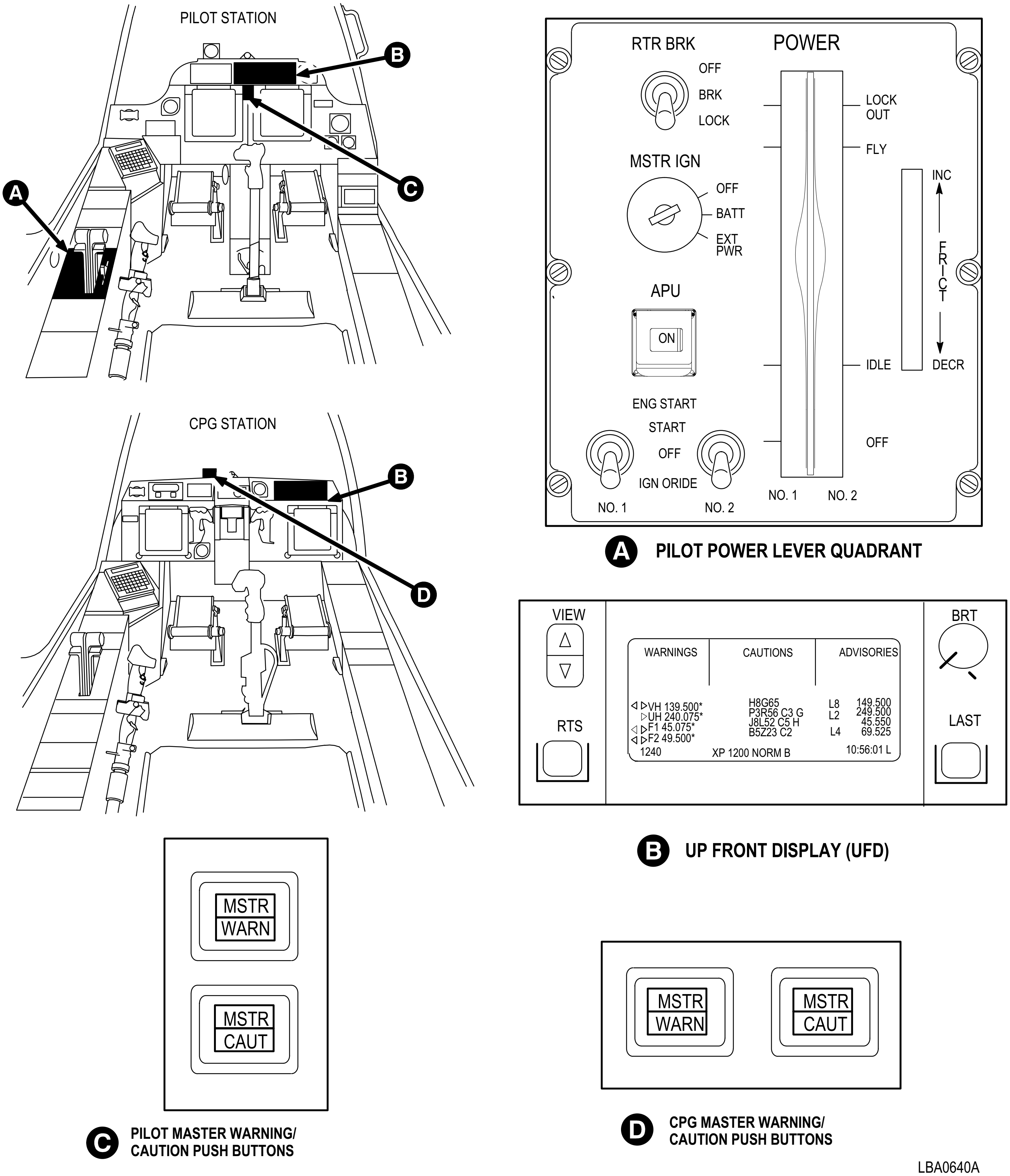

Figure 2-88. Battery Control and Indicators

2.102.1 Generators. Each generator is capable of supplying power to all aircraft loads. Each generator is equipped with a GCU which provides automatic start up and generator protection and fault detection for automatic shutdown. If one generator fails, its load is automatically transferred to the other generator.

a. Generator Drive. The generators are driven simultaneously by the accessory gearbox. The accessory gearbox is driven by the APU or engines/main rotor.

b. Generator Operation. During normal operation, each generator carries approximately 50% of the electrical load. Each generator powers a three phase bus managed by the EPMS. A bus interlock configuration prevents generators from operating in parallel or operating in parallel with an external power source. Either generator is capable of supporting both AC busses.

c. Generator Electrical Output Management. Generator output is managed by the associated GCU, which regulates output voltage and provides protection against undervoltage, overvoltage, underfrequency, over current/short circuit, and differential/feeder fault operation. Underfrequency protection is inhibited in flight and undervoltage protection is inhibited during underfrequency operation. The GCU connects its associated generator to the appropriate AC primary bus. The GCU disconnects and de-energizes its generator under the following adverse operating conditions:

- Overcurrent/short circuit
- Overvoltage (the AC generator output voltage is greater than 125 Vac).
- Undervoltage (the AC generator output voltage drops below 100 Vac for longer than 200 ±50 milliseconds).
- [BLK 1 Aircraft equipped with 7-511B11019-11 and -13 GCUs, underfrequency (during ground operation, the AC generator output frequency drops to between 365 to 380 Hz for 1 to 3 seconds).
  Aircraft equipped with 7-511B11019-15 -17, -19 and -21 GCUs underfrequency (during ground operation, the AC generator output frequency drops to between 365 to 380 Hz for 1 to 3 seconds; during flight operation, AC generator frequency drops to 306 Hz for 1 second).]
- [BLK 2 Underfrequency (during ground operation, the AC generator output frequency drops to between 365 to 380 Hz for 1 to 3 seconds; during flight operation, AC generator frequency drops to 306 Hz for 1 second).]

2.102.2 AC Power Indications. Anytime a generator is failed, a caution message will be displayed on the UFD/EUFD and the MPD **CAUTION** page.

2.102.3 AC Power Controls. Generator output is automatically controlled by the GCU. In the event of an annunciation, the pilot may reset either generator with the **GEN RST** switch on the **CHK OVSP TEST/GEN RST** panel (fig 2-89). A generator may be selected **OFF** through the **SYS** page.

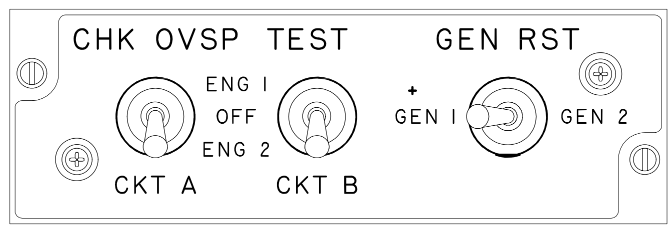

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Figure 2-89. Check Overspeed Test/Generator Reset Panel

2.103 EXTERNAL/GROUND POWER

Ground power is applied to the helicopter by connecting the power cable from the Aviation Ground Power Unit (AGPU) to the external power receptacle located in the right hand aft fuselage (refer to Section XV). Ground power supplies power to all aircraft loads.

2.103.1 External/Ground Power Controls. When the **MSTR IGN** switch is in the **EXT** power position, the external power monitor automatically controls the application of power to the helicopter and monitors for degraded power supply.

2.103.2 External/Ground Power Indications. The UFD/EUFD will display an advisory when the external power access door is open.

Section XII. AUXILIARY POWER UNIT (APU)

2.104 INTRODUCTION

WARNING

- **To prevent an accidental APU start, the APU ECU PWR/START circuit breaker located on the ELECTRICAL LOAD CENTER NO. 2 in the right hand EFAB shall be out when battery or external power is connected to the helicopter and unqualified personnel are in or around the pilots crew station.**
- **The APU ECU testing performed shows that certain transmitters can preclude the APU from being started or will cause it to be shut down. Additionally, it is possible that uncommanded overspeeds could occur without overspeed protection. The aircrew should exercise caution when starting the APU in any location where the APU has not been previously operated, especially in the vicinity of high powered transmitters.**

The APU (fig 2-90) indirectly provides hydraulic pressure and electrical power for the operation of helicopter systems whether the engines are operating or not. The APU also provides, directly, pressurized air for the operation of helicopter systems anytime the APU is ON (whether or not the main engines are driving the transmission accessory section). The APU provides the means of engine starting without the need for an AGPU. It is located just inboard of the right engine nacelle in the aft equipment bay. The APU consists of a gearbox, a compressor, and a turbine section, together with associated fuel, lubrication, and electrical systems.

2.104.1 Fuel System. The aft fuel cell provides all fuel for APU operation and is discussed in more detail in Section IV of this chapter. The APU fuel control automatically regulates fuel flow. The APU burns approximately 175 lb of fuel per hour.

2.104.2 Lubrication System. The APU has a self contained oil system. An oil filler cap is located on the left side of the unit. Oil cooling is provided by airflow over cooling fins at the compressor inlet. The oil level sight gage is located on the right side and is an integral part of the oil sump. The sight gage can be inspected through a door in the bottom of the right engine nacelle.

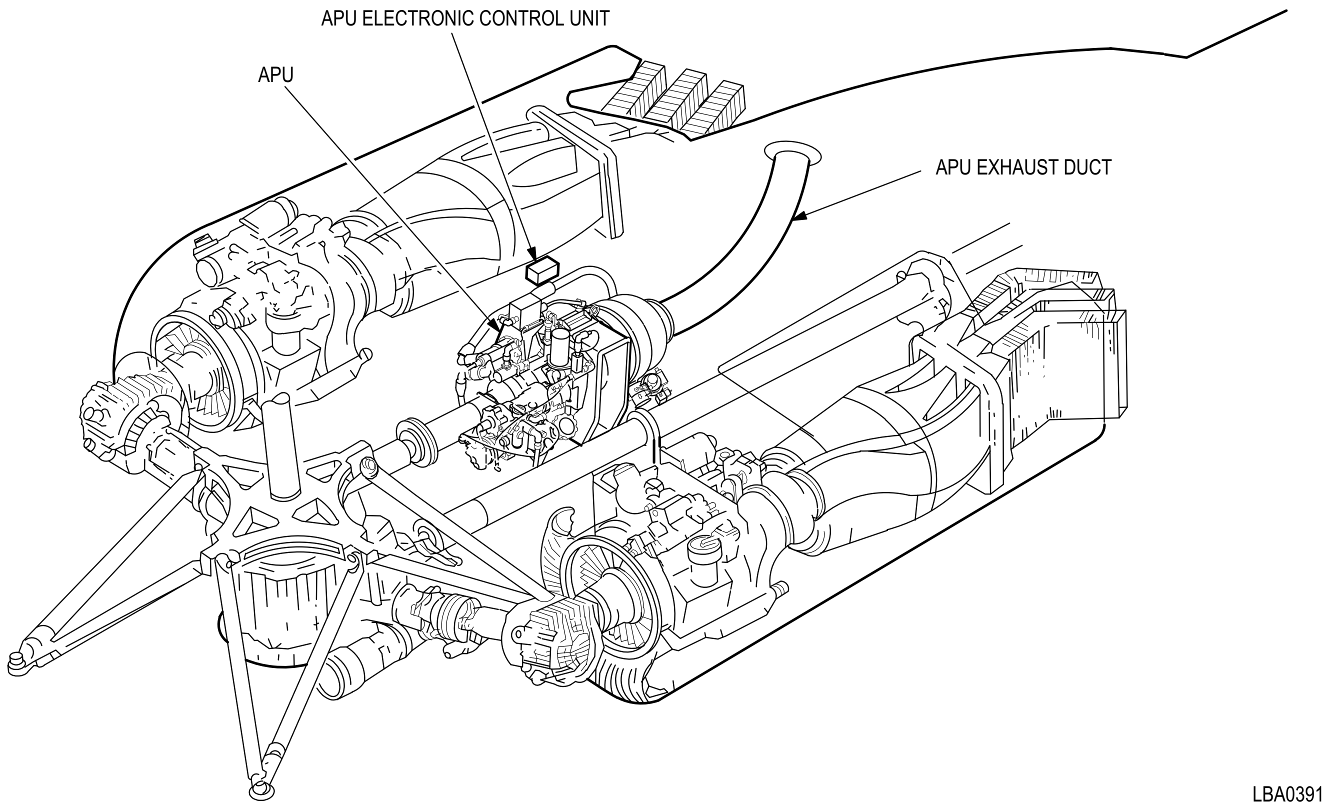

Figure 2-90. APU Location

2.104.3 Electrical System. The APU electrical system requires DC power. This power is normally delivered by the helicopter battery when the **MSTR IGN** switch is set to **BATT**.

2.104.4 APU Control Switch. The **APU** control switch is a momentary button switch located on the pilot **POWER** lever quadrant (fig 2-88). This switch applies dc power to energize the APU boost pump, open the APU fuel shutoff valve, and sends a signal to the APU ECU to commence the start sequence. The **APU** momentary button switch turns the **APU ON** and **OFF**, and has a hinged cover to prevent inadvertent actuation. When the **APU** is turned **ON** and the APU speed reaches 95%, the **ON** legend in the button illuminates and an advisory is displayed on the UFD/EUFD.

2.104.5 APU Electronic Control Unit (ECU). The APU ECU provides for automatic start and operation of the APU and Power Takeoff clutch (PTO) engagement. The start valve opens when the **APU** switch is pressed to **ON** and closes automatically at 60% APU speed. The ECU monitors the APU for loss of thermocouple, overtemperature, overspeed, overcurrent, low oil pressure, percent rpm, and exhaust gas temperature. The APU ECU transmits a shutdown signal to the APU whenever the **APU** button switch on the pilot **POWER** lever quadrant is set to **OFF**. The ECU also transmits the shutdown signal automatically for fault detection of any of the monitored functions. An advisory is sent from the low oil pressure switch when automatic shutdown occurs. The PTO clutch actuation is also controlled by the APU ECU. Normally, PTO clutch engagement occurs at 60% APU speed if the main transmission temperature is above 0 °F; however, if the main transmission temperature is below 0 °F, it will engage at 95% APU speed.

2.104.6 Main Transmission Low Oil Temperature Sensor. The main transmission low oil temperature sensor provides transmission oil temperature information to the system processor for cold start of the APU.

2.104.7 Utility Hydraulic Accumulator. The accumulator, located on the deck of the aft equipment bay below the APU, provides hydraulic pressure to the APU hydraulic starter through a solenoid operated hydraulic start valve. The utility hydraulic accumulator is discussed in more detail in Section VI of this chapter.

2.104.8 APU Advisories. The APU advisories are displayed on the UFD/EUFD and MPD and are listed in Table 2-15.

Section XIII. LIGHTING

2.105 LIGHTING EQUIPMENT

NOTE

The search/landing light, crew station flood lights, signal lights, and utility lights are the only lights available under battery power.

The aircraft lighting system consists of exterior and interior lighting and their associated controls. The main function of the aircraft exterior lighting is to provide visual indications to other aircraft for navigation and safety reasons. The aircraft interior lighting provides crewmembers with Night Vision Goggle (NVG) compatible lighting.

2.106 EXTERIOR LIGHTING EQUIPMENT

Exterior lighting equipment (fig 2-91) consists of formation lights, navigation lights, anticollision lights, a search/landing light, and an inspection and maintenance light.

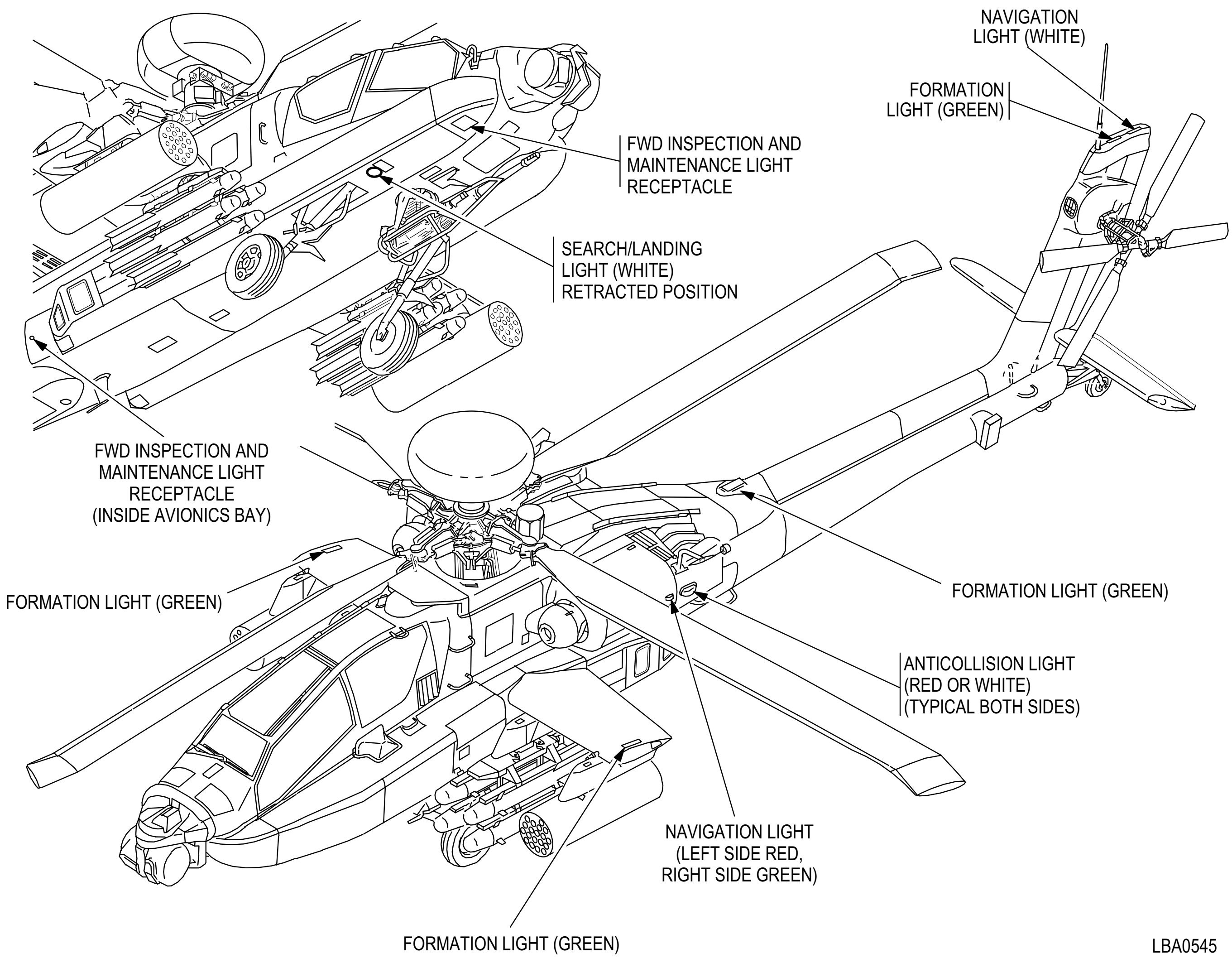

Figure 2-91. Exterior Lighting Equipment

2.106.1 Formation Lights. The green formation lights provide visual orientation information regarding position of the helicopter to adjacent aircraft in formation flight. They are located on the upper surface of each wing, the upper centerline of the aft fuselage, and on the upper surface of the vertical stabilizer. The formation (**FORM**) lights rotary control knob on the pilot Exterior/Interior Lighting (**EXT LT/ INTR LT**) panel varies the intensity of the formation lights from **OFF** to **BRT** (bright). For description and operation of pilot and CPG lighting control panels, refer to paragraph 2.107.

2.106.2 Navigation Lights. The navigation lights indicate aircraft position and direction to other aircraft during flight. One green light is located on the right engine nacelle and one red light is located on the left engine nacelle. One white aft navigation light is located on the top aft side of the vertical stabilizer. The navigation (**NAV**) lights switch on the pilot **EXT LT/INT LT** panel has three positions, **BRT**, **OFF**, and **DIM**.

2.106.3 Anti-collision Lights. The anti-collision lights provide a visual anti-collision warning during all phases of flight. High intensity red and white anti-collision strobe lights are located on each engine nacelle. The anti-collision (**ANTI COL**) lights switch on the pilot **EXT LT/INT LT** panel has three positions: **WHT, OFF** and **RED**.

CAUTION

- **The searchlight can reach temperatures capable of igniting combustible/ flammable materials. Do not land in areas such as high grassy meadows with the searchlight ON.**
- **Burning of the aircraft skin is possible if the searchlight is over-extended.**
- **R/H EFAB door should not be left open with the searchlight on.**

NOTE

Searchlight motion is inhibited for 60 seconds after the **ON/OFF/STOW** switch is placed in the **STOW** position.

2.106.4 Search/landing Light. The retractable searchlight provides omnidirectional search and landing light during low visibility conditions. The searchlight is located in a fairing under the forward section of the right Extended Forward Avionics Bay (EFAB), just forward of the landing gear attachment. The searchlight control switches (fig 2-92) are located on the flight control grip of the collective control stick. Setting the **ON/OFF/STOW** switch to **ON** supplies 28 vdc to the searchlight. The searchlight position switch is a four position thumbforce control switch used to manually control searchlight motion.

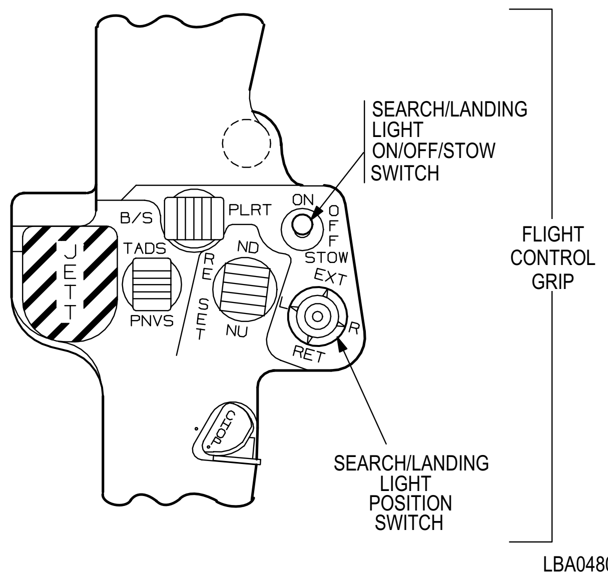

Figure 2-92. Search/Landing Light Control Switches

2.106.5 Inspection/Maintenance Light. The inspection/maintenance light is stored in the left equipment stowage compartment. Two plug-in electrical receptacle locations and the light's 50 ft long cord facilitates inspection and maintenance at all points on the helicopter. One receptacle is located adjacent to the CPG station on the underside of the right EFAB, forward of the searchlight. The second receptacle is located in the right aft avionics bay. Operation of the inspection/maintenance light is controlled by an **OFF**/**BRT** rheostat switch which is integral with the light.

2.107 LIGHTING CONTROLS

Aircraft exterior lighting (excluding the searchlight) is controlled via the **EXT LT** section of the pilot **EXT LT/INTR LT** panel (fig 2-93). Aircraft interior lighting can be controlled independently for each cockpit by use of the **INTR LT** section of the pilot **EXT LT/INTR LT** panel or the CPG **INTR LT** panel.

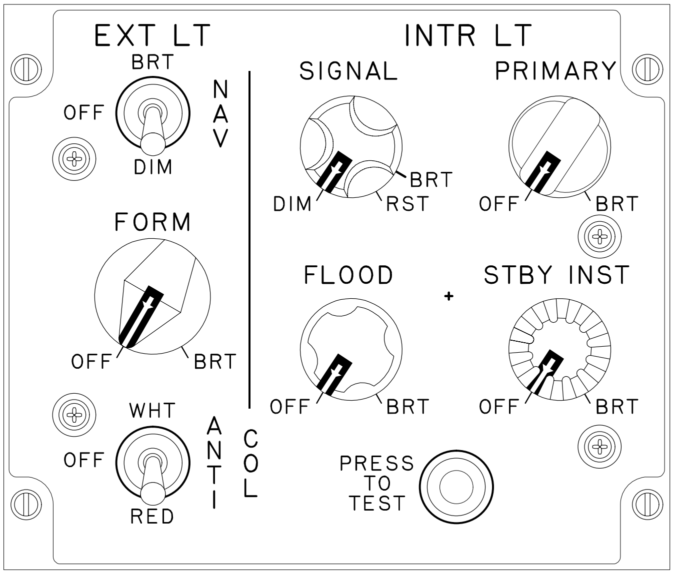

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Figure 2-93. Pilot EXT LT/INTR LT Panel

2.107.1 INTR LT Panel. The **INTR LT** section of the pilot panel controls the lighting in the pilot's station and consists of four rotary control knobs and a **PRESS-TO-TEST** button. The CPG **INTR LT** panel (fig 2-94) controls the lighting in the CPG's station and consists of three rotary control knobs and a **PRESS-TO-TEST** button.

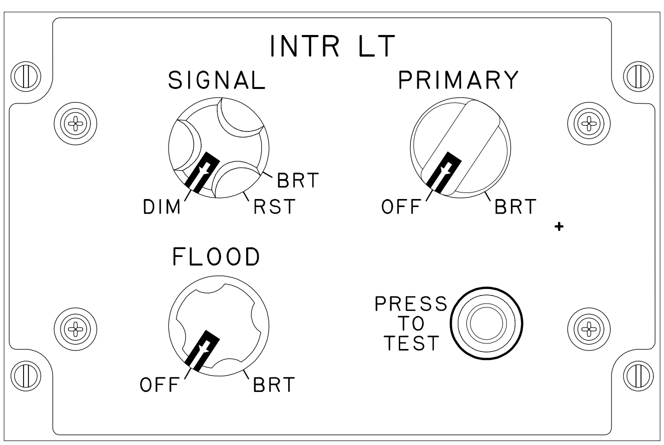

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Figure 2-94. CPG INTR LT Panel

NOTE

The Lighting Distribution Unit in the pilot crewstation contains variable resistors (available to maintenance personnel) to allow balancing of individual panels in the standby instruments lighting system for uniform intensity within the crewstation throughout the **STBY INST** control dimming range.

2.108 INTERIOR LIGHTING EQUIPMENT

The interior lighting system includes four subsystems powered by the Lighting System Controller: primary, secondary/emergency, signal, and standby instrument lighting. Each cockpit also has one utility light.

2.108.1 Primary Lighting. Primary lighting consists of integrally illuminated lightplates, display bezels and keypads. The **PRIMARY** variable resistor rotary control allows for continuous adjustment of the crewstation primary lighting system brightness from **OFF** to **BRT**. Turning the **PRIMARY** variable resistor from **OFF** towards **BRT** informs the Lighting System Controller that the cockpit is in a "night" condition and allows for the **SIGNAL RST** position to function for resetting to a dim mode. The **FLOOD** control must be **OFF** or less than the midpoint of its range to allow **SIGNAL RST**. The **PRIMARY** lights control is on the pilot **EXT LT/INTR LT** panel and on the CPG **INTR LT** panel.

2.108.2 Secondary/Emergency Lighting. Secondary/emergency lighting consists of floodlights to provide crew compartment illumination and is powered by the battery bus as an alternate to primary lighting. The **FLOOD** variable resistor rotary control allows for continuous adjustment of the floodlighting system brightness from **OFF** to **BRT**. Turning the **FLOOD** control clockwise past the midpoint of the control range informs the Lighting System Controller that the cockpit is in a "bright" condition and reverts the **SIGNAL** lights to **BRT**. Turning the **FLOOD** control counterclockwise past the midpoint of the control range allows for the **SIGNAL** lights to reset to a dim mode. The **FLOOD** lights control is on the pilot **EXT LT/INTR LT** panel and on the CPG **INTR LT** panel.

2.108.3 Standby Instrument Lighting. Standby instrument lighting consists of integral illumination of the four standby flight instruments in the pilot station. The **STBY INST** variable resistor rotary control allows for continuous adjustment of the standby instruments lighting system brightness from **OFF** to **BRT**. The **STBY INST** lights control is on the pilot **EXT LT/INTR LT** panel.

2.108.4 Signal Lighting. Signal lighting includes warning, caution, and advisory indicators/switches. The **SIGNAL** variable resistor rotary control allows for continuous adjustment from **DIM** to **BRT** for the **SIGNAL** lighting. The rotary control knob for **SIGNAL** lighting includes a **RST** position to allow for reset to dim mode for night conditions. The warning lights have a fixed daytime brightness (28 vdc) and a fixed nighttime brightness (14 vdc). The caution and advisory lights have a fixed daytime brightness (28 vdc) and a variable nighttime brightness (14 vdc max.). The **SIGNAL** variable resistor controls the signal lighting brightness for the advisory lights from **BRT** to **DIM**, but does not extinguish the lights. Initial aircraft power-up sets the **SIGNAL** lighting to full daytime brightness. If the **PRIMARY** lights control is **ON**, and the **FLOOD** lighting control is less than the midpoint position, then turning the **SIGNAL** control clockwise to the momentary **RST** position results in reset to the dim mode for night conditions. In the event of a power interrupt, the signal lighting reverts to the daytime brightness; the crewmember must manually turn the control to **RST** for night conditions. Turning the **FLOOD** control clockwise past the midpoint of the control range informs the Lighting System Controller that the cockpit is in a "bright" condition and reverts the **SIGNAL** lights to the bright mode. Turning the **FLOOD** control counterclockwise past the midpoint of the control range allows for the **SIGNAL** lights to reset to a dim mode. The **PRESS TO TEST** button allows all **SIGNAL** lighting lamps to be tested at once. The **SIGNAL** lights control and **PRESS TO TEST** button are on the pilot **EXT LT/INTR LT** panel and on the CPG **INTR LT** panel.

2.108.5 Utility Light. The utility light is stowed (via a bayonet base) in the left side of each crewstation. The hand-held light has a coiled cord and is powered by the battery bus. The utility light has a built-in variable rheostat control for continuous adjustment of the light from **OFF** to **BRT**, and a press-to-hold **BRT** button. The beam can be adjusted from **SPOT** to **FLOOD**. The color of the illumination can be adjusted to **WHITE** or **NVG GREEN**.

Section XIV. FLIGHT INSTRUMENTS

2.109 INTRODUCTION

Instruments discussed in this section are, for the most part, those that directly measure flight performance. Flight instruments are available on the IHADSS and the MPD **FLT** page. The CPG can present flight symbology, HOD/HDD displays, and video displays on the ORT.

2.110 MPD FLT PAGE

The **FLT** page (fig 2-95) presents flight instrument symbology required for flight from the MPD. The majority of the buttons and some of the graphics are presented only when the FLT **SET** button is selected,

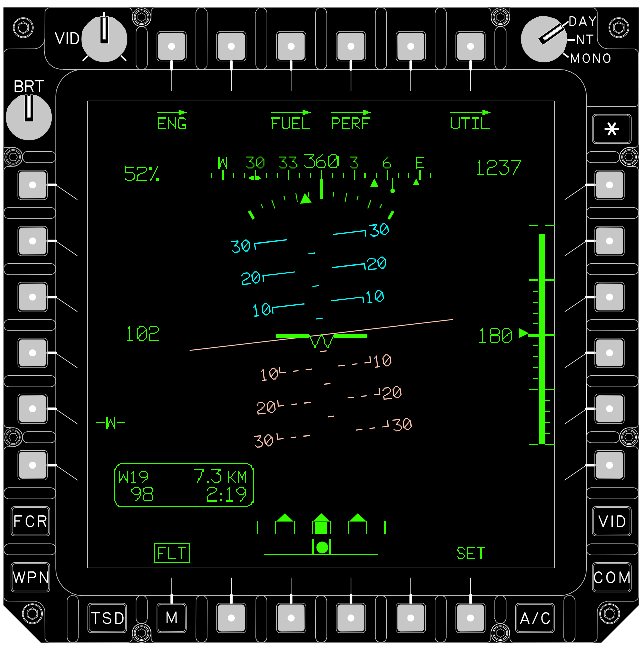

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Figure 2-95. FLT Page

- T1 **ENG** (Engine) page button
- T3 **FUEL** page button
- T4 **PERF** (Performance) page button
- T6 **A/C UTIL** (Utility) page button
- L5 **-W-** (Waterline) button
- B6 **FLT SET** button

2.110.1 MPD FLT Page Buttons. The **FLT** page (figs 2-95 and 2-96) provides the following button selections:

a. ENG Page Button. Pressing the **ENG** page button presents the Engine instrument page.

b. FLT Page Button (On second level only). Pressing (deselecting) the **FLT** page button returns the MPD to the top-level format.

c. FUEL Page Button. Pressing the **FUEL** page button presents the Fuel page.

d. PERF Page Button. Pressing the **PERF** page button presents the Performance page.

e. A/C UTIL Page Button. Pressing the **A/C UTIL** button presents the Aircraft Utility page.

f. -W- Button. The **-W-** button allows the crew to align the attitude indicator and HMD horizon line to the waterline symbol in the pitch axis. The word **BIAS** is presented below the waterline button when a bias has been applied using the up or down bias buttons. Deselecting the **-W-** button clears any manually applied bias from the attitude indicator and HMD horizon line.

g. FLT SET button. Selection of the **FLT SET** button presents the control buttons necessary to set or enter data on the **FLT** page. Deselecting the **FLT SET** button blanks these control buttons and additional graphics, and returns the format to the **FLT** page.

2.110.2 MPD FLT Page graphics. The **FLT** Page provides the following graphics (fig 2-96):

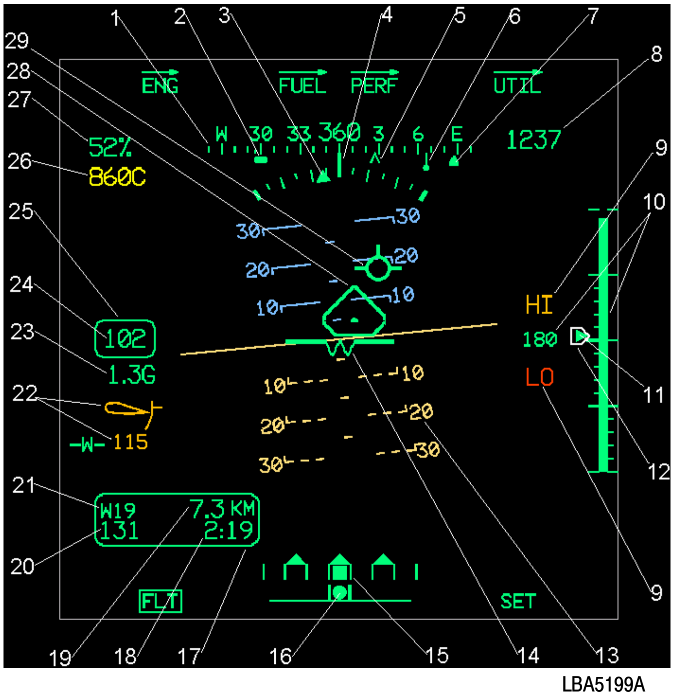


Figure 2-96. FLT Page Symbols

1. Heading Scale. The heading scale is centered in the top area of the page. The moving scale has a total range of 360°. It displays an instantaneous 180° in 10° increments, and the major cardinal points are labeled N, S, E, and W. Current magnetic heading is located in the center of the heading scale as a 3 digit data field. The heading scale is presented when the EGI has determined its true heading, and has a position for determining magnetic variance.

2. FCR L Centerline Bearing. The FCR centerline bearing is displayed along the bottom of the magnetic heading scale. It represents the azimuth of the current FCR scan centerline (or line of bearing) when the centerline is within the displayed portion of the heading scale. The FCR centerline bearing is presented when the heading scale is presented and the requirements for presentation of the FCR footprint on the TSD Page are met.

3. Bank Angle. The bank angle indicator provides an analog indication of the aircraft's current bank angle in degrees. The bank angle indicator consists of a fixed curved tape presenting a minimum of 30° to the left and 30° to the right of the 0° bank in 5° increments. The bank angle triangle is aligned and fixed to the roll movement of the attitude indicator. As the bank angle increases, the bank angle tick marks expand to show a larger portion of the compass rose. When the angle of bank exceeds ”20°, the entire symbol is shown WHITE in color. The bank angle is presented if the attitude indicator is presented.

4. Lubber Line. The lubber line is aligned to the centerline of the aircraft. It is the reference for both heading and angle of bank.

5. Command or Bobup Heading. The command heading chevron symbol along the bottom of the magnetic heading scale indicates the heading to the next navigation waypoint selected through the navigation subsystem. The symbol is presented when there is a valid next waypoint and the heading scale is presented. Upon selection of the cyclic symbol select bobup mode, the symbol represents the heading at the initiation of the bobup symbol. The symbol remains at the bobup heading until the bobup mode is disengaged or the heading becomes invalid.

6. ADF Bearing. The ADF bearing is presented along the bottom of the magnetic heading scale, representing the instantaneous bearing to the tuned ADF Non-Directional Beacon (NDB). It is displayed only when a valid bearing signal is received by the ADF system and the heading scale is presented.

7. Alternate (Pilot or CPG) Sensor Bearing. The alternate crewmembers sensor bearing is presented as a triangle along the bottom of the heading scale. It is only presented when the heading scale is presented and the opposite crewmembers sight is valid. This allows one crewmember to see the other crewmember's selected sensor's line of sight azimuth. The symbol is not presented in a crew station when the other crewmembers selected sight is FCR.

8. Barometric or Inertial Altitude. Barometric altitude is presented in feet in the upper right area of the page. The total range of barometric altitude is from -2300 to 20,000 ft, in 10 ft increments. Barometric altitude is not presented when the ADS has identified internal continuous BIT faults, when there is no last stored altimeter settings, or when barometric pressure data is out of valid range. The inertial altitude (calculated MSL altitude) is WHITE in color and presented in feet with the WHITE text “INRTL” beneath it when barometric altitude is not available, or when the EGI has identified internal continuous BIT faults, and when inertial altitude data is valid. Inertial altitude presented is the calculated MSL altitude using inertial altitude information. The total range of inertial altitude is from -2300 to 20,000 ft, in 10 ft increments. The System Processor computes the displayed INRTL MSL altitude, using the Inertial altitude and present position information from the primary INU. Maximum allowable error is 70 ft.

9. Radar Altitude HI and LO. The radar altitude HI and LO indicators are displayed just above and below the radar altitude digital readout. The YELLOW HI and RED LO indications can be set to present at 1 to 1428 ft. If the HI or LO indications are set to 0, they are not presented to the crew.

10. Radar Altitude and Vertical Scale. The radar altitude is presented with a digital readout and analog tape in the center right area of the page. When the radar altitude HI indicator is presented, the radar altitude digital readout and analog tape are shown YELLOW in color. When the radar altitude LO indicator is presented, the radar altitude digital readout and analog tape are shown RED in color. An audio message is presented when aircraft altitude is equal to LO set altitude and is less that 10 ft AGL, or is 10% below the LO set altitude and is between 11 ft and 999 ft AGL, or is 100 ft below the LO altitude and is between 1000 ft and 1428 ft AGL. Radar altitude is displayed as a digital readout in 1 ft increments from 0 to 50 ft AGL, and 10 ft increments from 50 ft AGL to a maximum altitude of 1428 ft AGL. The radar altitude vertical scale is presented when the aircraft is operating at an altitude between 0 and 200 ft (ascending), or 10 and 180 ft (descending). The analog scale has tic marks to the right of the tape in 10 ft increments up to 50 ft, and 50 ft increments from 50 to 200 ft. The radar altitude digital readout and scale are not presented when the radar altitude data is not valid, exceeds 1428 ft, the radar altimeter is not powered on, or out of range.

11. Rate of Climb. The rate of climb scale and indicator triangle are located to the left and adjacent to the radar altitude vertical scale. The scale is presented with a filled triangle pointer indicating the current rate of climb. Tic marks designate rates of climb or descent at 100 fpm increments to ± 500 fpm, and a single tic mark designates the 1000 fpm location. Both positive altitude (climb) and negative altitude (descent) are displayed on the FLT page; only negative altitude is displayed on the HMD. When the triangle is in either 1000 fpm limit position, a WHITE data field indicating the current rate of climb or descent is presented adjacent to the triangle. The data field shall present the rate of climb or descent to the nearest 100 fpm. The rate of climb is not presented if the EGI is not providing valid earth referenced velocities vertical speed information.

12. Altitude Hold. When the flight control system is attempting to hold altitude, a horizontal "home plate" symbol is placed at the zero rate of climb symbol position as the altitude hold symbol. If this hold mode fails or is disengaged, a flight controls tone is initiated and the symbol changes to WHITE in color, flashes for 3 seconds and is then removed.

13. Attitude Indicator. The attitude indicator is presented in the center area of the page. It is dynamic and provides the pitch and roll attitude of the helicopter. The attitude indicator displays 90° pitch nose up and 90° pitch nose down around the lateral axis and 360° around the longitudinal axis. The sky portion of the pitch ladder is CYAN, and the horizon line and ground portion of the pitch ladder are BROWN. The attitude indicator is presented if the EGI attitude data is valid.

14. Waterline. The waterline symbol (fig 2-97) provides a central status reference of the pitch ladder. It becomes filled to indicate that the attitude indicator is offset in the pitch axis by selection of the -W- button or by manual application of a BIAS.

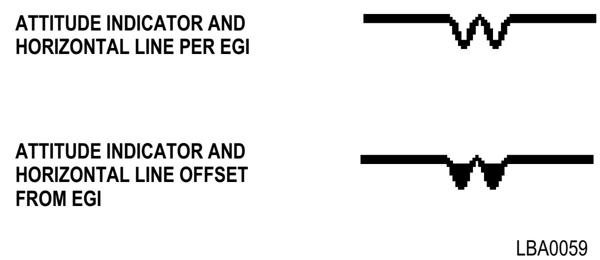


Figure 2-97. Waterline Symbol

15. Turn Rate. The turn rate indicator provides an analog indication of the aircraft current turn rate in degrees per second. The turn rate indicator is displayed on a horizontal scale in the lower center area of the display just above the skid/slip ball. It indicates both the direction and rate of turn the aircraft is experiencing. Vertical tic marks represent the limits for centered (no turn), one-half standard rate turn, and full standard rate turn (box centered under the triangle). Full travel to the left or right represents 4.8° per second. If inertial data is not available, the symbol is not presented.

16. Skid/Slip. The skid/slip ball provides an indication of the amount of side acceleration and how well a turn is coordinated. Reference lines represent the limits for in-trim or coordinated flight. Full travel to the left or right represents +0.15G. If inertial acceleration is not available (the inertial data is not valid), the skid/slip ball or ground speed are not presented.

17. Navigation Data Status Window. A status window is presented in the lower left area of the page, containing ground speed, destination point, distance and time to go. The status window is removed whenever all of its interior data fields are not presented.

18. Time To Go. The time to go indicates how much time it will take to reach the fly-to destination point based on the aircraft's current ground speed. Time to go is not presented when aircraft ground speed is at or below 15 kts, or the estimated time is greater than or equal to 10 hours. The seconds digits are only presented when the time is less than 5 minutes. Time to go is only presented when the destination point or ground speed are presented and inertial velocities are valid.

19. Distance To Go. The distance to go indication is a digital readout which provides distance from present position to the fly-to destination point. It is displayed to the 0.1 km or nm. The valid range is 0.0 to 999.9 km/nm. The distance to go digital readout is only presented when the destination point or ground speed are presented.

20 Ground Speed. Ground speed is presented to the nearest knot. Ground speed is only presented when the INU is aligned.

21. Destination Point. The destination point indicates the waypoint (“**W**##”), hazard (“**H**##”), control measure (“**C**##”), target (“**T**##”), or threat (“**T**##”) currently selected as the fly-to destination point. If a destination point is not available, the symbol is not presented.

22. Stabilator. The stabilator position is provided to the aircrew by the stabilator symbol (fig 2-98). This symbol presents an icon depicting the side view of the air foil positioned at the current stabilator angle. An adjacent arc scale provides reference from -10° to +35°. A zero degree tick mark is provided for increased situational awareness during manual operations and as a quick reference for aircraft shutdown procedures. See para 2.68.1 for a description of the stabilator symbol. This WHITE symbol is presented whenever the stabilator is operating in manual mode for any reason (intentional selection by the crew, or as a result of automatic system failure). If the stabilator is failed such that manual input is not able to alter the position, a digital readout providing the TAS limit is presented beneath the icon, and the symbol set is shown YELLOW in color. Additionally, if the flight control system fails such that the system does not know the stabilator condition, the icon with ? and TAS limit are presented. The symbol is shown RED in color when TAS exceeds the stabilator TAS limit.

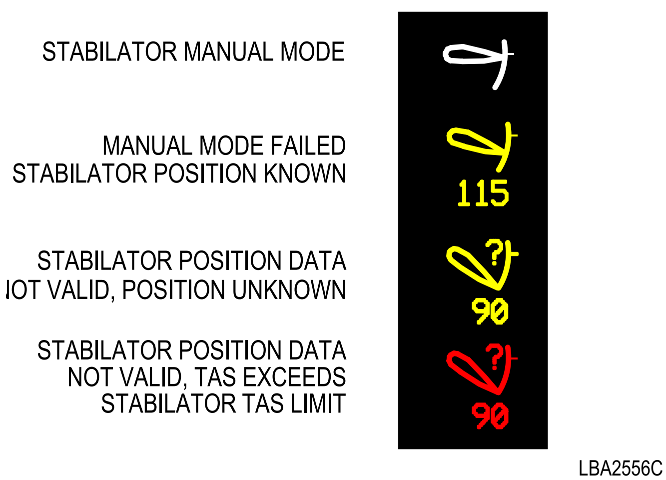


Figure 2-98. Stabilator Position Symbology

23. G Status. A digital indication of the load factor is provided when the aircraft is within 1/4 G of the Chapter 5 load factor limit, or exceeding 2 Gs. If the current load factor is within 1/4 G of the Chapter 5 load factor limit, it is shown as WHITE in color. If the current load factor exceeds the Chapter 5 load factor limit, it is shown as RED in color. This load factor limit is dynamic, and determined for the current altitude, velocity, and gross weight conditions. The G status digital readout is located beneath the airspeed digital readout for easy reference in flight. Once the G status is presented, it is presented for a minimum of 2 seconds prior to removal. The G status is not presented if acceleration data is not available from the EGI.

24. Airspeed. The true airspeed in knots is presented in the left middle area of the page. The airspeed becomes boxed (square corners and is shown RED in color) to indicate the airspeed has reached Velocity Not to Exceed (VNE). The valid airspeed range is 0 to 210 kts in 1 kt increments. If airspeed data is not available, airspeed is not presented.

25. Attitude Hold. When the flight control system is attempting to hold attitude, a status window is placed around the airspeed digital readout to indicate attitude hold. If this hold mode fails or is disengaged, a flight controls tone is initiated and the symbol changes to WHITE in color, flashes for 3 seconds and is then removed.

26. TGT. The engine turbine gas temperature (TGT) digital readout is presented in the upper left area of the page format. It is only presented when 2 or 2.5 minutes remain in a particular TGT limit range. See paragraph 2.48.4 in this chapter.

27. Engine Torque. The engine torque is presented as a digital readout in the upper left area of the page. It indicates the highest engine torque of the two engines. When a greater than 12% torque split occurs between engines, the torque flashes to indicate impending single engine operation. The torque is boxed when 98% or higher, indicating an impending continuous torque limit of 100%. The torque and box color correspond to the color of the presentation on the ENG page.

28. Navigation FLY-To CUE. If the aircraft is equipped with MTADS provisions, the nav fly-to cue represents direction to the active next navigation waypoint and is used in conjunction with the flight path vector to aid in navigation. It is a small diamond shaped polygon with a flat bottom and a dot in the center. When properly aligned, the flight path vector will fit within the cue. When shown over wide FOV video imagery (HMD, TDU or MPD), the symbol is virtual. When presented on the MPD **FLT** page, it is not virtual.

29. Flight Path Vector. If the aircraft is equipped with MTADS provisions, the flight path vector provides an indication of projected aircraft flight path. It is a small dynamic circle with tic marks on the outer portion of the circle at the three, nine, and twelve o'clock positions. It is a virtual symbol when shown over wide FOV video imagery to indicate the outside world reference with regard to actual helicopter flight path. When presented on the MPD **FLT** page, it is not virtual. The vector represents the point towards which the helicopter is flying. The horizontal difference between the head tracker and the flight path vector indicates the aircraft sideslip direction and magnitude, when both are not limited. The flight path vector flashes when edge limited, and is only presented when the INU body velocities are valid, and the 3-dimensional velocity magnitude is > 5 kts ground speed.

2.111 MPD FLT PAGE, FLT SET SELECTED

Selection of the FLT **SET** button presents the control buttons necessary to configure the **FLT** page units of display, set the barometric altitude/pressure, set the criteria for presentation of the **HI** and **LO** radar altitude indications, power the radar altimeter, reset the accelerometer, apply a manual bias to the attitude indicator and HMD horizon line, and monitor symbols not continuously displayed on the **FLT** Page when FLT **SET** is not selected.

2.111.1 MPD FLT Page With FLT SET Selected Buttons. With the FLT **SET** button selected, (fig 2-99) the **FLT** Page provides the following button selections:

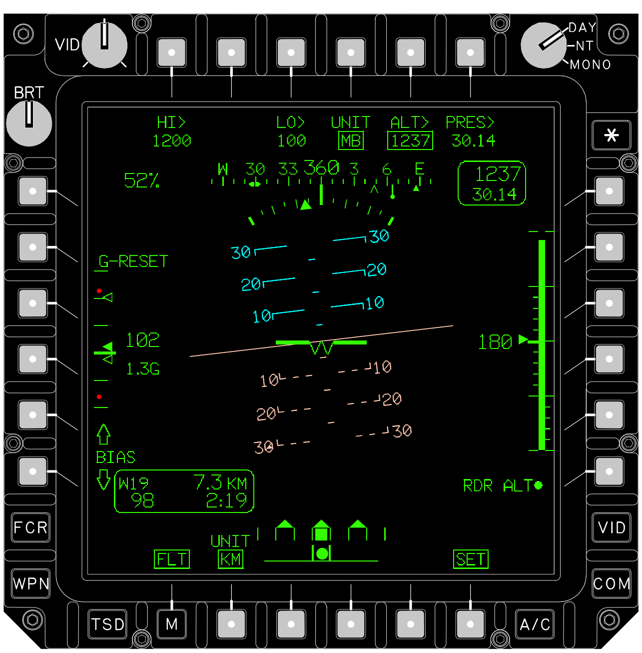


Figure 2-99. FLT Page, FLT SET Selected

- T1 Radar Altitude **HI** button
- T3 Radar Altitude **LO** button
- T4 **UNIT IN/MB** (inches/millibars) button
- T5 Barometric **ALT** button
- T6 Barometric **PRES** button
- L2 Accelerometer **G-RESET** button
- L5 Up **BIAS** Set button
- L6 Down **BIAS** Set button
- R6 **RAD ALT** ON/OFF button
- B2 **UNIT KM/NM** button
- B6 FLT **SET** button

a. HI Button. The **HI** button displays and allows editing of the altitude which triggers presentation of the Radar Altitude **HI** indication. The **HI** button is presented if the radar altimeter is on.

b. LO Button. The **LO** button displays and allows editing of the altitude which triggers presentation of the Radar Altitude **LO** indication and presentation of the audio message "altitude low". No LO audio or visual indication is presented when LO is set to 0. The **LO** button is presented if the radar altimeter is 0.

c. UNIT IN/MB Button. The **UNIT IN/MB** button sets the units of display for the barometric pressure digital readout and the barometric **PRES** button. Barometric pressure can be displayed in either inches of mercury ("**IN**") or millibars ("**MB**").

d. ALT Button. The **ALT** button displays and allows editing of the current barometric altitude. The barometric altitude button is not presented if the ADS has failed.

e. PRES Button. The **PRES** button displays and allows editing of the current barometric pressure. Barometric pressure data ranges from 28.10 to 30.99 in. of mercury in 0.01 in. of mercury increments, or 951.5 to 1,049.4 mb in 0.1 mb increments. Changes in barometric altitude are reflected in both barometric altitude and pressure presentations. The barometric pressure is not presented if the ADS has failed.

f. G-RESET Button. The **G-RESET** button is displayed above the accelerometer. This function resets the accelerometer tell-tales to 1 G.

g. Up and Down BIAS set buttons. The up **BIAS** set button allows the air crew to add nose-up bias to the pitch ladder and horizon line. The down **BIAS** set button allows the air crew to add nose-down bias to the pitch ladder and horizon line. The up and down bias buttons can apply as much as 10° pitch offset in either direction. Typical uses of this control include applying a pitch offset, in increments of 1°, to the attitude indicator and HMD horizon line's EGI setting prior to takeoff.

It can also be used while in flight to add an additional bias to the pitch ladder and horizon line after the attitude indicator has been aligned to the waterline. The bias applied can be cleared by deselecting the waterline button. When a bias has been applied, a BIAS data field is presented on the **FLT** page below the **-W-** button (FLT **SET** not selected), or between the up and down **BIAS** buttons (FLT **SET** selected). These buttons are not presented when the EGI altitude data is not valid.

h. RAD ALT Button. The **RAD ALT** on/off button provides the crew the ability to power the radar altimeter. The system default is ON for normal operations or ground power interruptions. The system will store the last status setting and return the radar altimeter to that state in the event of in-flight power interruption.

i. UNIT KM/NM button. The **UNIT KM/NM** button is presented below the navigation data status window, and sets the units for display of distance to go and for the TSD between **KM** and **NM**.

j. FLT SET button. Selection of the FLT **SET** button presents the control buttons necessary to set or enter data on the **FLT** page

k. FLT page button (on second level FLT page only). Pressing the **FLT** page button returns the MPD to the top-level format.

2.111.2 MPD FLT Page With FLT SET Selected Graphics. The **FLT** (Flight Instruments) Page, provides the symbols shown on the **FLT** page (fig 2-96), and the following additional graphics (fig 2-100):

Figure 2-100. FLT Page Symbols

1. Barometric Pressure and Status Window. Barometric pressure is presented in the upper right area of the page. Total range of barometric pressure is 28.10 to 30.99 in. of mercury in 0.01 in. of mercury increments, or 951.57 to 1,409.44 mB in 0.1 mB increments. When FLT SET is selected, the barometric pressure and altitude are presented surrounded by a status window. Barometric pressure is not presented unless the ADS finds its pressure altitudes to be valid and within valid range.

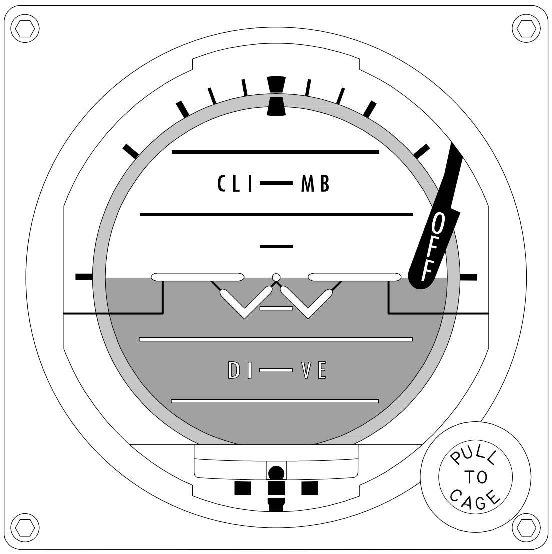
2. G Status. The G status digital readout is presented continuously when FLT SET is selected, rather than only when within 1/4 G of the dynamic limit. The G status is not presented if acceleration data is not available from the EGI. See also para 2.110.2.23.

3. Accelerometer. The accelerometer is displayed in the middle of the display format left of the airspeed digital readout. It has six components: indicated acceleration, positive acceleration tell-tale, negative acceleration tell-tale, positive acceleration limit, negative acceleration limit, and scale tic marks. A dynamic solid triangle is provided to indicate the total G forces that the aircraft is currently experiencing. When the current acceleration exceeds a limit, the triangle is RED. The displayed range is -1 G to +4 Gs. As this vertical tape moves in a positive or negative direction along the scale, it leaves “tell-tale” open triangles at the extreme points of its movement as an indication of recent G forces. When the tell-tale acceleration exceeded a limit, it is shown as RED. The tell-tale triangle positions and colors are reset to 1 G and GREEN by the accelerometer reset button. The upper and lower G force limits, shown as RED dots on the scale, are developed from the flight envelope based on aircraft airspeed and gross weight. If acceleration data is not available from the INU, the symbol is not displayed.

2.112 STANDBY FLIGHT INSTRUMENTS (PILOT STATION ONLY)

The pilot standby flight instruments directly measure and provide independent backup displays of aircraft flight performance (altitude, airspeed, attitude, and compass heading) in case of primary power or flight reference system failure. The standby flight instruments receive 28 Vdc from the emergency dc bus.

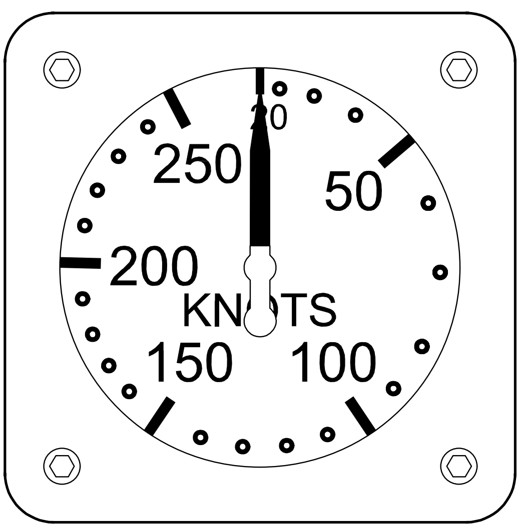
2.112.1 Standby Attitude Indicator. The standby attitude indicator (fig 2-101) displays helicopter attitude. The indicator can display 360° of roll and ± 85° of pitch.



LBA0664

Figure 2-101. Standby Attitude Indicator

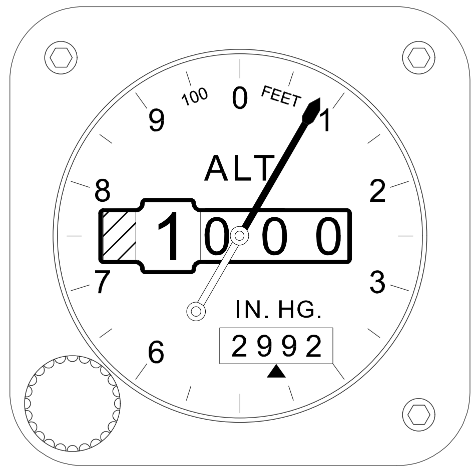
2.112.2 Standby Airspeed Indicator. The standby airspeed indicator (fig 2-102) presents indicated airspeed (0 - 250 kts) from the right pitot probe.



LBA0077

Figure 2-102. Standby Airspeed Indicator

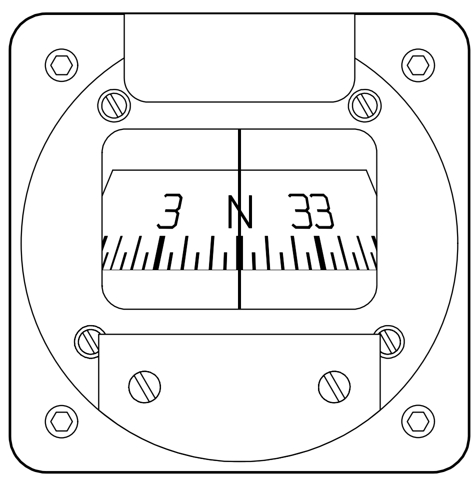
2.112.3 Standby Altimeter. The standby altimeter indicator (fig 2-103) is graduated in 50 ft increments marked at 100 ft intervals (0 - 9 x 100). Just left of center is a 1000 ft drum and a 10,000 ft drum to supplement the scale pointer. The scale window in the lower right of the instrument face, indicates barometric pressure setting in inches of mercury. It is adjustable by use of the barometric pressure set knob on the lower left corner of the indicator case. Maximum allowable error is 70 ft.



LBA0078

Figure 2-103. Standby Altimeter

2.112.4 Standby Magnetic Compass. The standby magnetic compass (fig 2-104) is attached to the pilot glareshield just left of center. A correction card is mounted under the compass.



LBA0665

Figure 2-104. Standby Magnetic Compass

Section XV. SERVICING, PARKING, AND MOORING

2.113 SERVICING

Servicing information and procedures for the various systems or components are covered in the following paragraphs. Servicing points for fuel, engine oil, main transmission, nose gearbox, and auxiliary power unit oil (fig 2-105). Fuel, lubricants, specifications, and fuel capacities are listed in Table 2-9.

2.113.1 External Hydraulic, Pressurized Air and Electrical Requirements.

a. External Hydraulic Power Requirements. External hydraulic power requirements are 3000 PSI at a flow rate of 6 GPM for both the Primary and Utility hydraulic systems.

b. External Pressurized Air Requirements. An external air source that provides 40 psig and 30 lb per minute (300 cfm) air flow is required to pressurize the system for engine start.

CAUTION

28 Vdc from an external power source is not required in order to apply 115/200 Vac to the helicopter. If 28 Vdc is applied from the external power source, damage to the helicopter may occur. Prior to applying external electrical power, it must be confirmed that pins E and F of the external power cable do not have 28 Vdc and that they are jumpered. Pins E and F must be jumpered in order to apply external electrical power to the helicopter.

c. External Electrical Power Requirements. External electrical power requirements are 115/200 Vac, 400 Hz, and 45 KVA.

2.113.2 Fuel Types. Fuels are classified as primary, commercial equivalent, or emergency, as follows:

- Primary fuels are JP-4, JP-5, and JP-8.
- Commercial equivalent fuels are found in Table 2-10.
- Emergency fuels - None authorized.

2.113.3 Use of Fuels. There are special limitation on the use of commercial fuels (Table 2-10). For the purpose of recording, fuel mixtures shall be identified by the major component of the mixture.

2.113.4 Interchangeable Fuels. Fuels having the same NATO code number are interchangeable. Jet fuels (Table 2-10) conforming to specification ASTM D-1655 may be used when MIL-T-5624 fuels are not available. Interchanging fuel may change engine operating characteristics under the following circumstance.

a. NATO F-40 Fuel. Aircraft using NATO F-40 (JP-4) may be refueled with NATO F-44 (JP-5) or commercial ASTM type A fuels. The engine operating characteristics may change because of lower operating temperatures. Slower acceleration, lower engine speed, harder starting, and greater range may be experienced.

b. NATO F-44 Fuel. Aircraft using NATO F-44 (JP-5) may be refueled with NATO F-40 (JP-4) or commercial ASTM type B fuels. The engine operating characteristics may change because of higher operating temperatures. Faster acceleration, higher engine speed, easier starting, and less range may be experienced.

c. NATO F-34 Fuel. NATO F-34 (JP-8) is almost identical to commercial ASTM type A-1 fuels, but with a corrosion inhibitor/lubricity improver and fuel system icing inhibitor additives.

2.113.5 Mixing of Fuels. When changing from one type of authorized fuel to another, for example: JP-4 to JP-5 it is not necessary to drain the fuel system before adding new fuel.

2.113.6 Oil Types. Oils are classified as primary, commercial equivalent, or emergency as follows:

- Primary oils are found in Table 2-11.
- Commercial equivalent oils are found in Table 2-11.
- Emergency oils - None authorized.

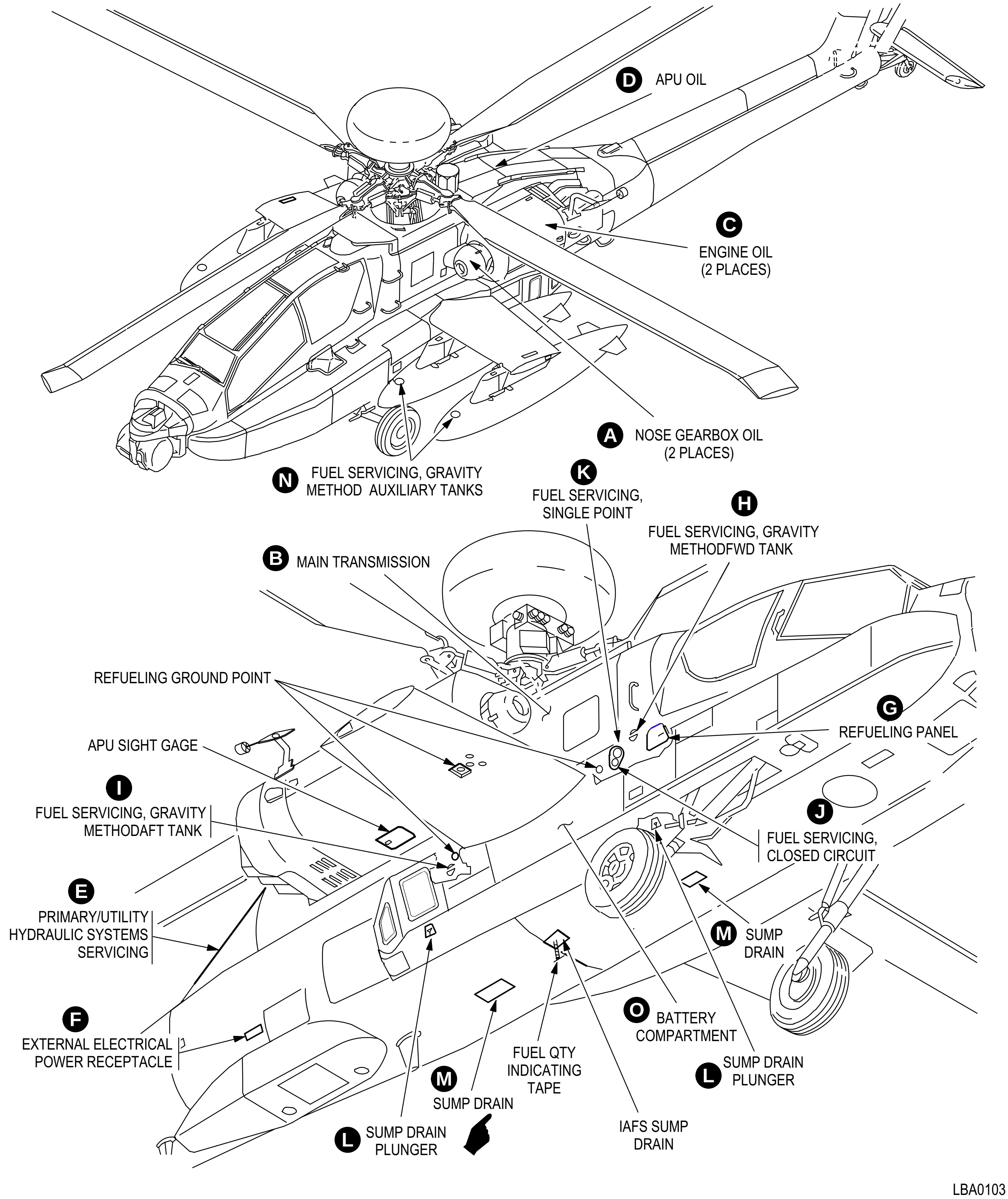


Figure 2-105. Servicing Diagram (Sheet 1 of 5)

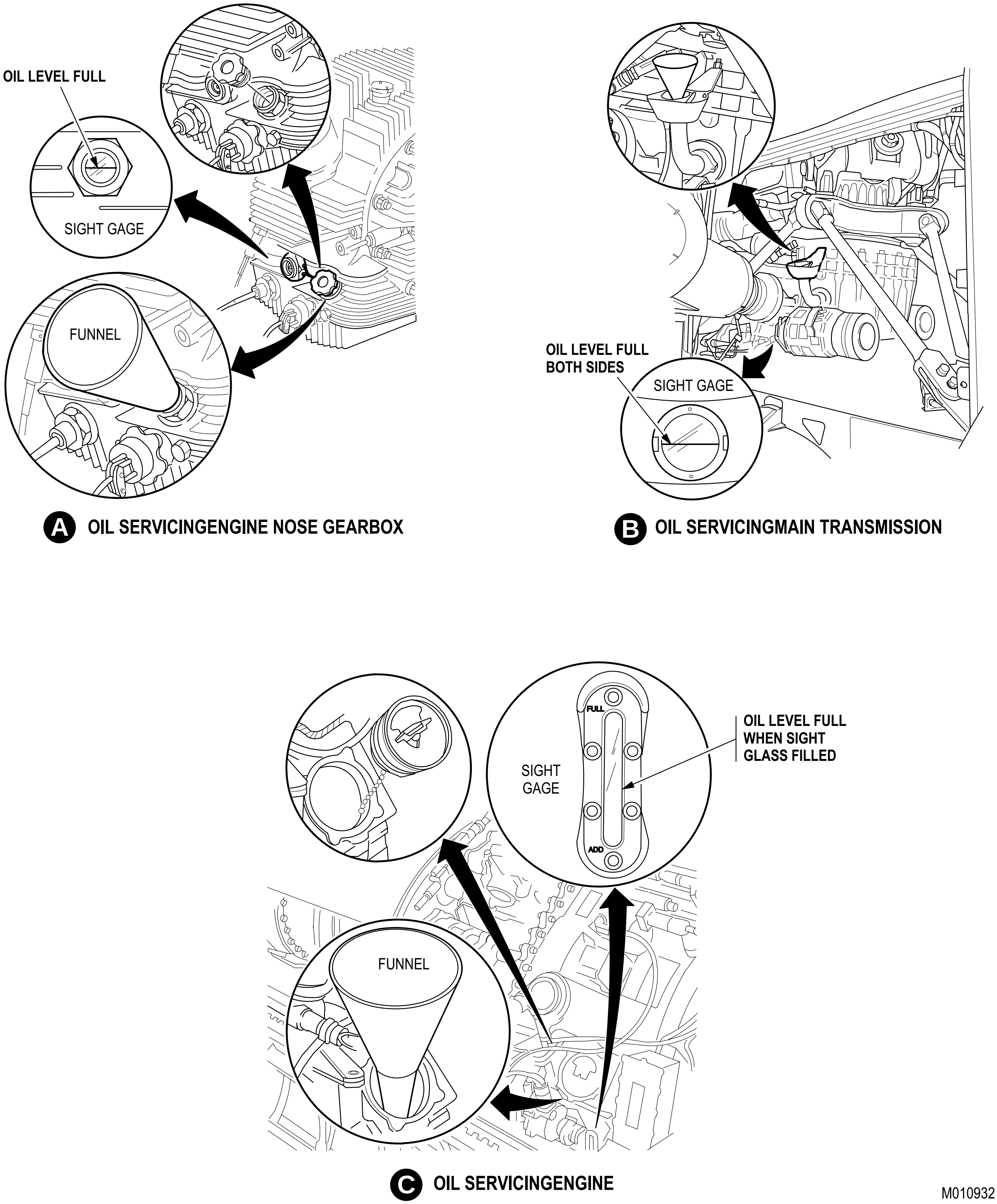


Figure 2-105. Servicing Diagram (Sheet 2 of 5)

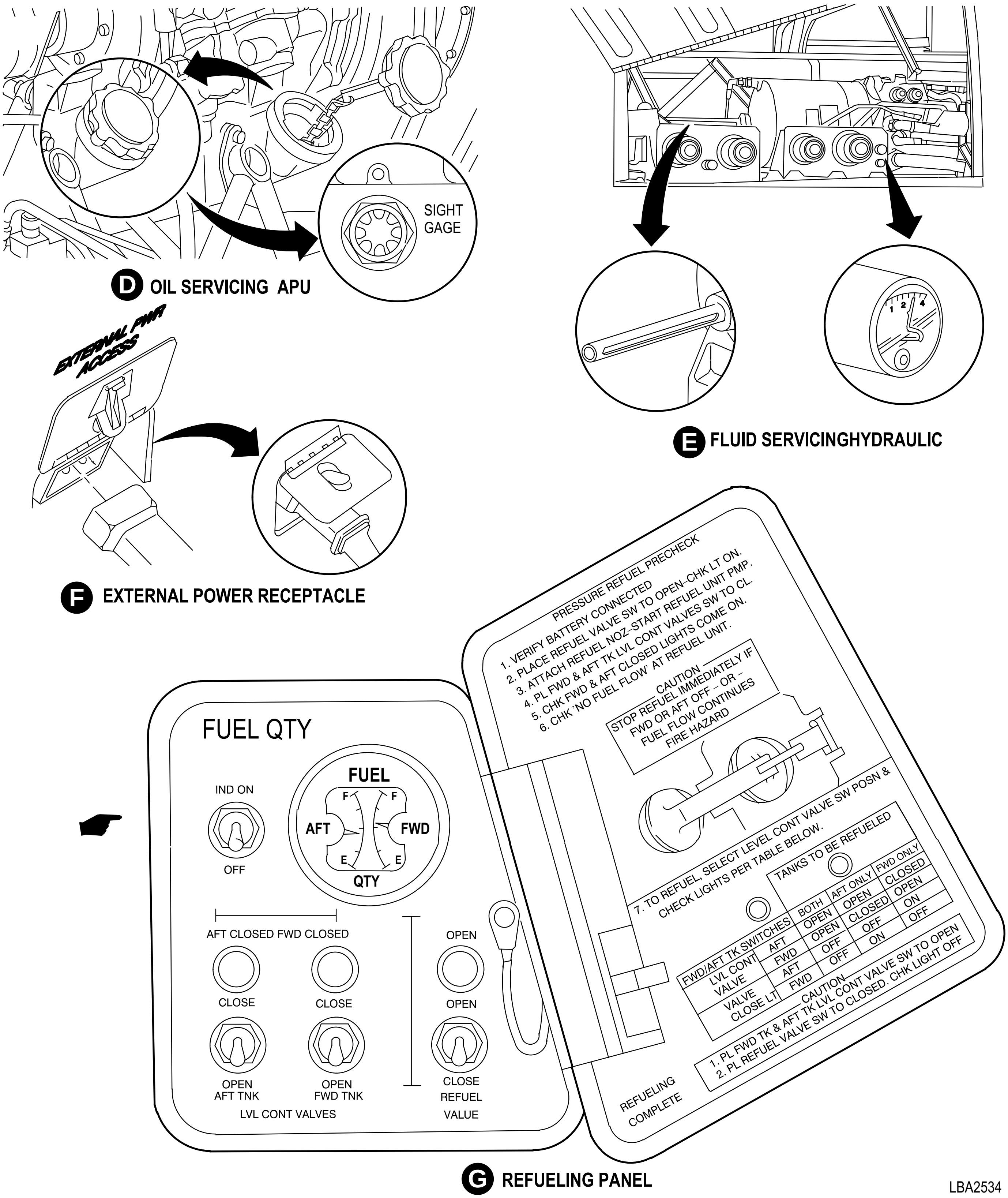
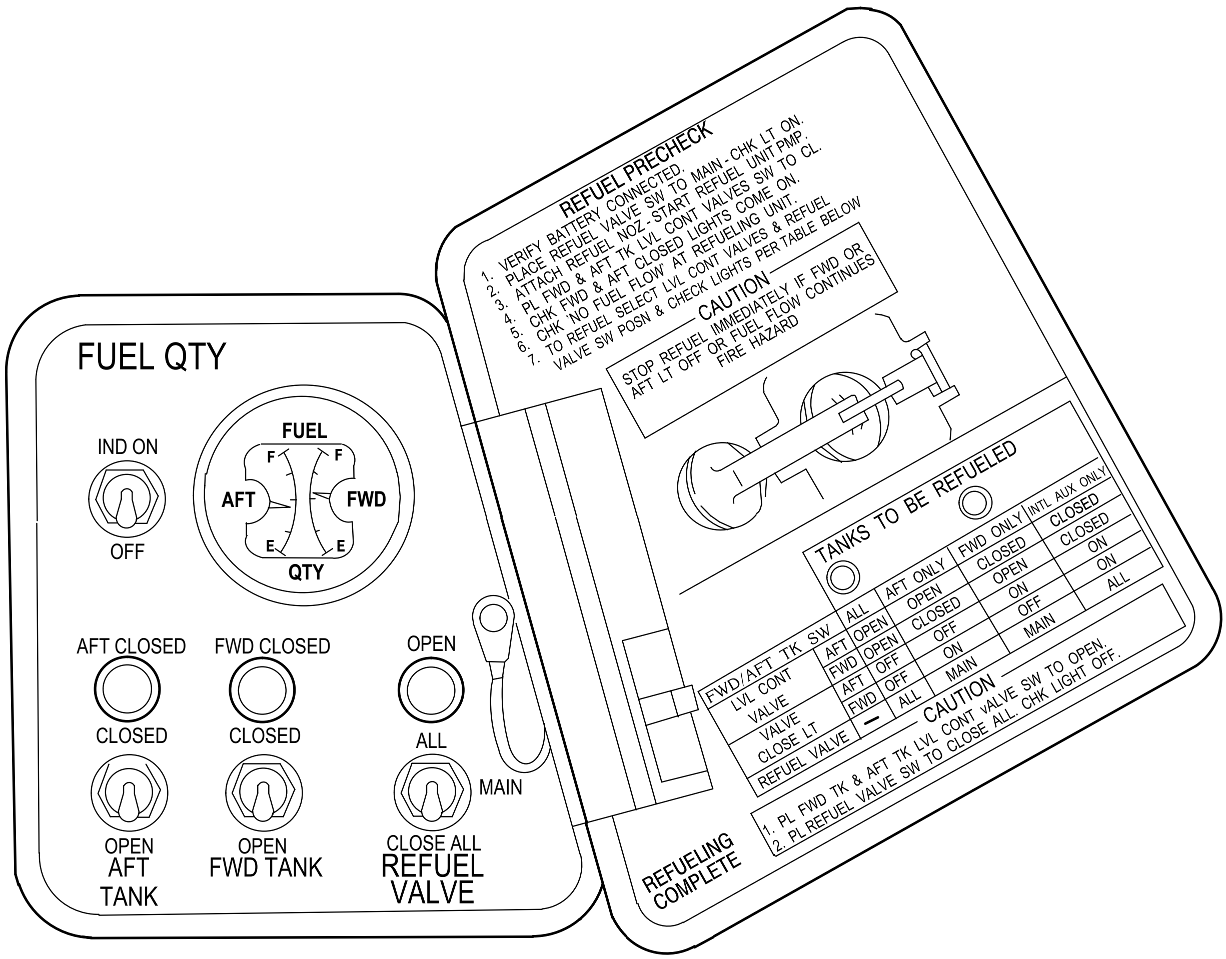


Figure 2-105. Servicing Diagram (Sheet 3 of 5)



G REFUELING PANEL (INTERNAL AUXILIARY FUEL SYSTEM)

LBA5025

Figure 2-105. Servicing Diagram (Sheet 4 of 5)

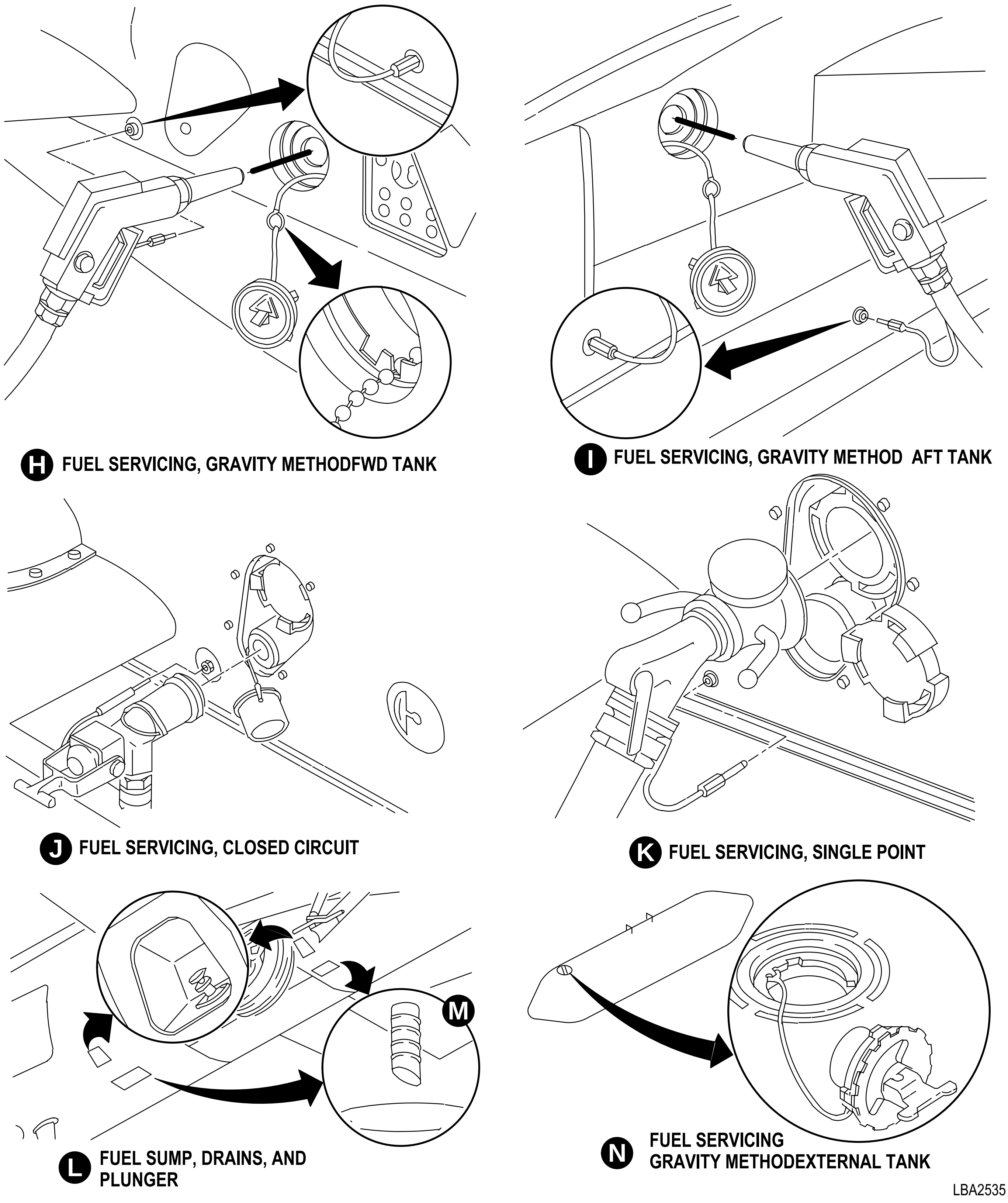


Figure 2-105. Servicing Diagram (Sheet 5 of 5)

Table 2-9. Fuel and Lubricant Specifications and Capacities

Tank or System	Capacity US	Name	Materials Spec	Grade
Forward Fuel Cell	156 gal usable 156 gal total	Turbine Fuel	MIL-T-5624 MIL-T-5624* MIL-T-83133	JP-4 JP-5 JP-8
Aft Fuel Cell	219 gal usable 220 gal total	Turbine Fuel	MIL-T-5624 MIL-T-5624* MIL-T-83133	JP-4 JP-5 JP-8
Auxiliary Fuel Tank	229 gal usable 230 gal total (each tank)	Turbine Fuel	MIL-T-5624 MIL-T-5624* MIL-T-83133	JP-4 JP-5 JP-8
Internal Auxiliary Fuel System	129 gal usable 130 gal total	Turbine Fuel	MIL-T-5624 MIL-T-5624* MIL-T-83133	JP-4 JP-5 JP-8
IAFS Combo-Pak	98 gal usable 100 gal total	Turbine Fuel	MIL-T-5624 MIL-T-5624* MIL-T-83133	JP-4 JP-5 JP-8
Engine Oil	7 qt	Lubricating Oil	MIL-L-23699* MIL-L-7808	
Main Transmission	45 pt (22.5 qt)	Lubricating Oil	MIL-L-23699* MIL-L-7808	
Engine Nose Gearbox	5 pt (2.5 qt) (each gearbox)	Lubricating Oil	MIL-L-23699* MIL-L-7808	
Intermediate Gearbox	2 lb, 2 oz	Grease, SYN-Tech	HMS 20-1155 NS 4405 FG	
Tail Rotor Gearbox	3 lb, 5 oz	Grease, SYN-Tech	HMS 20-1155 NS 4405 FG	
Auxiliary Power Unit (APU)	2 qt	Lubricating Oil	MIL-L-23699* MIL-L-7808	
Primary Hydraulic System	3 qt	Hydraulic Fluid	MIL-H-83282* MIL-H-5606	
Utility Hydraulic System	2.6 gal	Hydraulic Fluid	MIL-H-83282* MIL-H-5606	
Main Landing Gear Shock Strut	3.8 qt	Hydraulic Fluid Nitrogen	MIL-H-5606	
Tail Landing Gear Shock Strut		Hydraulic Fluid Nitrogen	MIL-H-5606	
Brake System	0.32 gal	Hydraulic Fluid	MIL-H-5606	
Engine Air Turbine Starter	0.422 pt	Lubricating Oil	MIL-L-23699* MIL-L-7808	

* Use in ambient temperatures of -25 °F (-32 °C) and above.
Do not mix lubricating oils MIL-L-23699 and MIL-L-7808.
Do not mix hydraulic fluids MIL-H-83282 and MIL-H-5606.

Table 2-10. Approved Fuels

US Military Fuel NATO Code No.	JP-4 (MIL-T-5624) F-40 (Wide Cut Type)	JP-5 (MIL-T-5624) or JP-8 (MIL-T-83133) F-44 or F-34 (High Flash Type)	
COMMERCIAL FUEL (ASTM-D-1655)	JET B	JET A	JET A-1 NATO F-34
American Oil Co.	American JP-4	American Type A	
Atlantic Richfield	Arcojet B	Arcojet A	Arcojet A-1
Richfield Div		Richfield A	Richfield A-1
B.P. Trading	B.P.A.T.G.		B.P.A.T.K.
Caltex Petroleum Corp.	Caltex Jet B		Caltex Jet A-1
Cities Service Co.		CITGO A	
Continental Oil Co.	Conoco JP-4	Conoco Jet-50	Conoco Jet-60
Gulf Oil	Gulf Jet B	Gulf Jet A	Gulf Jet A-1
EXXON Co. USA	EXXON Turbo Fuel B	EXXON A	EXXON A-1
Mobil Oil	Mobil Jet B	Mobil Jet A	Mobil Jet A-1
Phillips Petroleum	Philjet JP-4	Philjet A-50	
Shell Oil	Aeroshell JP-4	Aeroshell 640	Aeroshell 650
Sinclair		Superjet A	Superjet A-1
Standard Oil Co.		Jet A. Kerosene	Jet A-1 Kerosene
Chevron	Chevron B	Chevron A-50	Chevron A-1
Texaco	Texaco Avjet B	Avjet A	Avjet A-1
Union Oil	Union JP-4	76 Turbine Fuel	
Belgium	BA-PF-2B		
Canada	3GP-22F	3-6P-20x20	
Denmark	JP-4 MIL-T-5624		
France	Air 3407A		
Germany	VTL-9130-006	UTL-9130-0007/UTL 9130-010	
Greece	JP-4 MIL-T-5624		
Italy	AA-M-C-1421	AMC-143	
Netherlands	JP-4 MIL-T-5624	D ENG RD 2493	
Norway	JP-4 MIL-T-5624		
Portugal	JP-4 MIL-T-5624		
Turkey	JP-4 MIL-T-5624		
United Kingdom (Britain)	D. Eng RD 2454	D.Eng RD 2498	

NOTE: COMMERCIAL FUEL LIMITATIONS
Anti-icing and Biocidal Additive for Commercial Turbine Engine Fuel. The additive provides anti-icing protection and functions as a biocide to kill microbial growths in aircraft fuel systems. Icing inhibitor conforming to MIL-I-27686 shall be added to commercial fuel, not containing an icing inhibitor, during refueling operations, regardless of ambient temperatures. Refueling operations shall be accomplished in accordance with accepted commercial procedures. This additive (Prist or equivalent.) is not available thru the Army Supply System, but is to be locally procured when needed.

Table 2-11. Approved Oils

Approved Domestic Commercial Oils for MIL-L-7808	
Manufacturer’s Name	Manufacturer’s Designation
American Oil and Supply Co.	PQ Turbine Oil 8365
Humble Oil and Refining Co.	ESSO/ENCO Turbo Oil 2389
Mobile Oil Corp.	RM-184A/RM-201A
Approved Domestic Commercial Oils for MIL-L-23699	
Manufacturer’s Name	Manufacturer’s Designation
Americal Oil and Supply Co.	PQ Turbine Lubricant 5247/ 6423/6700/7731/8878/9595
Bray Oil Co.	Brayco 899/899-G/899-S
Castrol Oil Co.	Castrol 205
Chevron International Oil Co., Inc.	Jet Engine Oil 5
Crew Chemical Corp.	STO-21919/STO-21919A/STD 6530
W.R. Grace and Co. (Hatco Chemical Div.)	HATCOL 3211/3611
Humble Oil and Refining Co.	Turbo Oil 2380 (WS-6000)/2395 (WS-6495)/2392/2393
Mobile Oil Corp.	RM-139A/RM-147A/Avrex S Turbo 260/Avrex S Turbo 265
Royal Lubricants Co.	Royco 899 (C-915)/899SC/ Stauffer Jet II
Shell Oil Co., Inc.	Aeroshell Turbine Oil 500
Shell International Petroleum Co., Ltd.	Aeroshell Turbine Oil 550
Standard Oil Co., of California	Chevron Jet Engine Oil 5
Stauffer Chemical Co.	Stauffer 6924/Jet II
Texaco, Inc.	SATO 7377/7730 TL-8090
Approved Foreign Commercial Oils for MIL-L-7808	
Data not available at this time.	
Approved Foreign Commercial Oils for MIL-L-23699	
Data not available at this time.	

2.114 FUEL SYSTEM SERVICING

Each fuel cell is serviced through gravity filler receptacles or is pressure filled through closed circuit or single point adapters (fig 2-105 sheet 4 of 4). Table 2-9 lists individual tank capacities.

2.114.1 Gravity Refueling.

WARNING

When opening anti-syphoning device on external tank flapper valve, extreme care should be exercised when releasing air pressure to preclude venting of fuel overboard through the filler neck.

CAUTION

To prevent damage to fuel system, do not exceed maximum fueling pressure of 15 psi.

For gravity refueling, open fuel vent shutoff valve, remove filler cap, pull chain (opening anti-syphoning device), and using correct fuel, service fuel cells to the required levels (Table 2-9).

2.114.2 Closed-Circuit Pressure Refueling.

CAUTION

Refueling pressure will not exceed 55 lb/psig. Damage to fuel system may result.

Using service instructions printed on the inside panel of the refuel panel access door (fig 2-105 sheet 3 of 4), perform pressure refueling pre-check. Remove adapter cap, and using a standard US Army nozzle, service fuel cells with the correct fuel to the required level (Table 2-9). Using the standard US Army nozzle, fuel flow at 15 psi is 56 gal per minute (gpm).

2.114.3 Single-Point Adapter (SPA) Pressure Refueling.

CAUTION

Refueling pressure will not exceed 55 lb/psig. Damage to fuel system may result.

Using servicing instruction printed on the inside panel of the refuel panel access door (fig 2-105 sheet 3 of 4), perform pressure refueling pre-check. Remove adapter cap, and using a standard US Army supplied SPA nozzle, fill fuel cells with correct fuel to the required level (Table 2-9). With the SPA nozzle, fuel flow at 50 psi is at least 100 gpm.

NOTE

Auxiliary fuel quantity must be added through **AUX GALLONS** data entry button on the **FUEL** page

2.114.4 Refueling of External Auxiliary Tanks. The external auxiliary tanks are gravity filled through filler receptacles. Remove the gravity filler caps and service tanks with correct fuel to the required levels (Table 2-9).

2.114.4A Refueling of Internal Auxiliary Fuel System (IAFS). The IAFS can only be pressure refueled using the Closed-circuit or Single Point adapter. Basic procedures are the same as for refueling the main cells (para 2.114.2 and 2.114.3). The IAFS can be refueled separately from, or together with, the main fuel cells. Configure the switches in the refueling panel to refuel the desired cells (see refueling panel decal) and refuel using normal procedures.

2.114.5 Fuel Sump Drains. Two fuel sump drains, one for each internal fuel tank, are located on the underside of the fuselage. These drains are used to drain fuel or water and to check for fuel contamination. To actuate, press the plunger. Hold until sufficient fuel has drained.

2.114.5A IAFS Sump Drains. The IAFS is equipped with a sump drain used for draining fuel or water or to test for contamination. This is accessed by opening the IAFS sump access door located at the bottom of the ammo bay cover. To activate, press the plunger until sufficient fuel has drained.

2.114.5B Fuel Quantity Indicating Tape. The fuel quantity indicating tape, located on aft center of the modified ammunition bay door, is a mechanical indicator of the fuel quantity in the internal auxiliary fuel cell.

2.114.6 Rapid Refueling. The helicopter can be refueled for rapid turnaround using one of the following procedures:

- Warm refueling with both engines shut down, rotor stopped, and APU running.
- Hot refueling with engine 2 shutdown and rotors turning.
- Hot refueling using the D1 nozzle with both engines operating and rotors turning.

The following additional procedures shall be observed for rapid refueling:

CAUTION

- **Pilot and CPG shall perform their armament safety checks prior to entering the Forward Area Refueling Point (FARP).**
- **Radio transmissions (automated or crew initiated) shall be limited to EMERGENCIES ONLY until refueling has been completed.**
- **The IDM's AUTO REPLY and AUTO ACK shall be turned off BLK 1 or the IDM INHBT button shall be selected BLK 2.**
- **BLK 1 Aircrews shall ensure that there are no actively tuned TACFIRE nets prior to refuel/rearm.**
- **Prior to departure, ground personnel shall advise the pilot that the fuel caps are installed and grounding cables are removed.**
- **Uncommanded FM transmissions may occur during IDM IBIT, FALLBACK, when the CIU circuit breaker is open, or during CIU power-up. CIU power-up occurs during aircraft power-up and upon CIU circuit breaker reset.**

NOTE

- There is no UFD/EUFDadvisory associated with the selection of the **HF GND OVRD** button.
- The **IDM INHBT** button will not inhibit automated HF radio transmissions

a. Rapid (Warm) Refueling. The following procedures and steps shall be observed for warm refueling with both engines shut down, rotor stopped, and APU running:

1. **TAIL WHEEL** switch - **LOCK**.
2. **PARK BRAKE** - Set.
3. Weapons - Secure
4. **A/S** switch - **SAFE**
5. APU - Start
6. Engine **PWR** levers - **IDLE** for 2 minutes, then **OFF**.
7. IDM auto transmit - Disable
    a. **SET** page **IDM INHBT** - Select, **IDM INHIBIT** advisory boxed

    or BLK 1 perform b,c, and d

    b. **AUTO REPLY** - Off

    c. **AUTO ACK** - Off

    d. TACFIRE Net - Not tuned.

NOTE

When selected, the **IDM INHBT** button is continuously displayed as Operation In Progress.

8. **HF RADIO** - Disable auto radio transmission capability
    a. **HF RADIO GND OVRD** - Off.

    or

    b. **HF RADIO SILENT** - On**.**
9. **RTR BRK** switch - **BRK** (below 50% N_R until rotor stopped, then **OFF**).
10. **ANTI-COL** switch - **OFF**.
11. Refueling - Monitor.
12. Refueling completed - Verify [BLK 1 **REFUEL VALVE**] or [BLK 2 **REFUEL VALVE OPEN**] (UFD/EUFD) and **REFUEL VALVE OPEN** (MPD) cautions are not displayed.
13. IDM auto transmit capability - Set as required
    a. **SET** page **IDM INHBT** - Deselect as required: **IDM INHIBIT** advisory is not displayed and **IDM INHIBIT** button is non OIP

    or BLK 1 perform b,c, and d

    b. **AUTO REPLY** - Set as required

    c. **AUTO ACK** - Set as required

    d. TACFIRE Net - Set as required.
14. **HF RADIO** - Set as required
    a. **HF RADIO GND OVRD** - On or Off.

    and/or

    b. **HF RADIO SILENT** - On or Off.
15. **ANTI-COL** switch - As Desired.
16. Engines Start - Perform appropriate **STARTING ENGINES** procedure.

b. Rapid (HOT) Refueling. The following procedures and steps shall be observed for hot refueling with engine 2 shut down and rotors turning or using the D1 nozzle with both engines operating and rotors turning:

1. **TAIL WHEEL** switch - **LOCK**.
2. **PARK BRAKE** - Set.
3. Weapons - Secure.
4. **A/S** switch - **SAFE**.
5. Engine **POWER** levers - As required.
   a. Both engines running and rotors turning -
   (1) **POWER** Lever **NO 2** to **IDLE**.
   (2) **FUEL** page **XFER** button - **OFF.**

   or

   b. Single engine and rotors turning - **POWER** Lever **NO 2** to **IDLE** for 2 minutes, then **OFF**.
6. IDM auto transmit - Disable
   a. **SET** page **IDM INHBT** - Select : **IDM INHIBIT** advisory boxed

   or BLK 1 perform b,c, and d

   b. **AUTO REPLY** - Off

   c. **AUTO ACK** - Off

   d. TACFIRE Net - Not tuned

NOTE

When selected, the **IDM INHBT** button is continuously displayed as Operation In Progress

7. **HF RADIO** - Disable auto radio transmission capability
   a. **HF RADIO GND OVRD** - Off.

   or

   b. **HF RADIO SILENT** - On
8. **ANTI-COL** switch - **OFF**.
9. Refueling - Monitor. When the aft tank is full - **CROSSFEED** - **AFT**. Continue to refuel the forward tank.
10. Refueling completed - Verify [BLK 1 **REFUEL VALVE**] or [BLK 2 **REFUEL VALVE OPEN**] (UFD/EUFD) and **REFUEL VALVE OPEN** (MPD) cautions are not displayed.
11. IDM auto transmit capability - Set as required
    a. **SET** page **IDM INHBT** - Deselect as required: **IDM INHIBIT** advisory is not displayed and **IDM INHIBIT** button is non OIP

    or BLK 1 perform b,c, and d

    b. **AUTO REPLY** - Set as required

    c. **AUTO ACK** - Set as required

    d. TACFIRE Net - Set as required
12. **HF RADIO** - Set as required
    a. **HF RADIO GND OVRD** - On or Off.

    and/or

    b. **HF RADIO SILENT** - On or Off
13. **ANTI-COL** switch - As Desired.
14. Collective - Apply until 60% torque (No 1 engine) is reached or aircraft is light on wheels. Maintain power setting for 30 seconds.
15. **CROSSFEED** - **NORM**. Maintain power setting for 30 seconds.
16. Collective - Reduce to minimum torque.
17. Engine **POWER** levers - As required.
    a. Both engines running and rotors turning -
    (1) **POWER** Lever **NO 2** to **FLY**.
    (2) **FUEL** page **XFER** button - **AUTO.**

    or

    b. Single engine and rotors turning - Perform appropriate engine 2 start. Use crossbleed procedure.

NOTE

There is an increased probability of engine No.1 or No. 2 FUEL PSI LOW UFD/EUFD message, master caution illumunation and flame out due to non-use of the single engine torque pull procedure. While the dual engine feed forward tank will not remove air from the ammunition bay feed line. Air accumulation in the No. 1 engine fuel feed hose is not affected.

c. Rapid (HOT) Refueling (Sandy Environment). The following procedures and steps shall be observed for hot refueling in sandy environments with engine 2 shut down and rotors turning or using the D1 nozzle with both engines operating and rotors turning:

1. **TAIL WHEEL** switch - **LOCK**.
2. **PARK BRAKE** - Set.
3. Weapons - Secure.
4. **A/S** switch - **SAFE**.
5. Engine **POWER** levers - As required.
   a. Both engines running and rotors turning -
   (1) **POWER** Lever **NO 2** to **IDLE**.
   (2) **FUEL** page **XFER** button - **OFF.**

or

b. Single engine and rotors turning - **POWER** Lever **NO 2** to **IDLE** for 2 minutes, then **OFF**.

6. IDM auto transmit - Disable

a. **SET** page **IDM INHBT** - Select : **IDM INHIBIT** advisory boxed

or BLK 1 perform b,c, and d

b. **AUTO REPLY** - Off

c. **AUTO ACK** - Off

d. TACFIRE Net - Not tuned

NOTE

When selected, the **IDM INHBT** button is continuously displayed as Operation In Progress

7. **HF RADIO** - Disable auto radio transmission capability

a. **HF RADIO GND OVRD** - Off.

or

b. **HF RADIO SILENT** - On

8. **ANTI-COL** switch - **OFF**.

9. Refueling - Monitor. When the aft tank is full - **CROSSFEED** - **AFT**. Continue to refuel the forward tank.

10. Refueling completed - Verify [BLK 1 **REFUEL VALVE**] or [BLK 2 **REFUEL VALVE OPEN**] (UFD/EUFD) and **REFUEL VALVE OPEN** (MPD) cautions are not displayed.

11. IDM auto transmit capability - Set as required

a. **SET** page **IDM INHBT** - Deselect as required: **IDM INHIBIT** advisory is not displayed and **IDM INHIBIT** button is non OIP

or BLK 1 perform b,c, and d

b. **AUTO REPLY** - Set as required

c. **AUTO ACK** - Set as required

d. TACFIRE Net - Set as required

12. **HF RADIO** - Set as required

a. **HF RADIO GND OVRD** - On or Off.

and/or

b. **HF RADIO SILENT** - On or Off

13. **ANTI-COL** switch - As Desired.

14. Engine **POWER** levers - As required.

a. Both engines running and rotors turning -
(1) **POWER** Lever **NO 2** to **FLY**.
(2) **FUEL** page **XFER** button - **AUTO.**

or

b. Single engine and rotors turning - APU start. Engine 2 start. **POWER** Lever **NO 2** to **FLY**.

15. Collective - Reduce to minimum torque.

16. Switch **CROSSFEED** to **FORWARD** position so that both engines feed from forward tank for 60 seconds.

17. Switch **CROSSFEED** to **NORMAL** and wait 30 seconds.

18. After 30 seconds, switch **CROSSFEED** to **AFT** and wait 60 seconds.

19. After 60 seconds, switch **CROSSFEED** to **NORMAL** and wait 30 seconds.

2.115 ENGINE OIL SYSTEM SERVICING

The engine oil tank is located within the engine frame. It is serviced through a gravity filler port. An oil-level sight gage is located near the gravity filler port. When the oil level falls to the add mark, replenish with the correct oil (Table 2-11) until the level reaches the full mark on the sight gauge.

2.116 MAIN TRANSMISSION SERVICING

The main transmission is located below the main rotor static mast base in the center fuselage section. Access to the oil filler cap and the right sump oil-level sight gage (fig 2-105 sheet 2 of 4) is through the transmission access panel on the right side of the fuselage. The left sump oil level sight gage can be viewed through the transmission access door on the left side of the fuselage. Add oil to the proper service level. Table 2-11 lists the proper oil to use. The proper level is an average between both left and right sight glasses and should be one-half (1/2) full in the sight glass.

2.117 AUXILIARY POWER UNIT (APU) SERVICING

The APU oil filler cap and oil level sight gage (fig 2-105 sheet 3 of 4) are located on the oil reservoir on the APU gearbox. The oil level can be viewed through an access panel under the No 2 engine. Remove the oil filler cap and add oil until the oil level reaches the proper service level. Table 2-11 lists the proper oil to use.

2.118 NOSE GEARBOX SERVICING

The engine nose gearboxes are mounted on the front of each engine. When the oil falls below the proper service level, replenish with correct oil. Table 2-11 lists the correct oil to use. Proper service level is oil filled to one-half of the sight glass (fig 2-105 sheet 3 of 4).

2.119 HYDRAULIC SYSTEM SERVICING

The hydraulic system should only be serviced with the approved fluids (Table 2-11). Detailed hydraulic system servicing instructions are contained in TM 1-1520-Longbow/Apache.

2.120 EXTERNAL PRESSURIZED AIR SOURCE

An external air receptacle (fig 2-106) under the No 1 engine nacelle provides an attachment point for an external air line to start either engine or accomplish maintenance functions. An external air source that provides 40 psig and 30 lb per minute air flow is required to pressurize the system for engine start. The maximum pressure from a ground source shall not exceed 50 psig.

2.121 TOWING THE HELICOPTER

Tow the helicopter by attaching a tow bar to the tail wheel fork. Towing the helicopter must be accomplished by trained personnel in accordance with instructions in TM 1-1520-Longbow/Apache.

2.122 MOORING THE HELICOPTER

The helicopter is moored IAW TM 1-1520-Longbow/Apache.

2.123 CANOPY AND WINDSHIELD CLEANING

The canopy and windshield should be carefully cleaned with clear water and a moist chamois or paper cleaning towel. Grease or oil spots should be removed with a paper cleaning towel moistened in an approved plastic cleaning agent.

2.124 TADS/PNVS SHROUD WINDOW CLEANING

TADS/PNVS shroud windows should be cleaned, using a paper cleaning towel (lens paper preferred) moistened with a solution of an approved mild detergent and clean water, followed by a clean water rinse. Special optics cleaning procedures (TM 1-1520-Longbow/Apache) should be used to clean the shroud windows as soon as practicable.

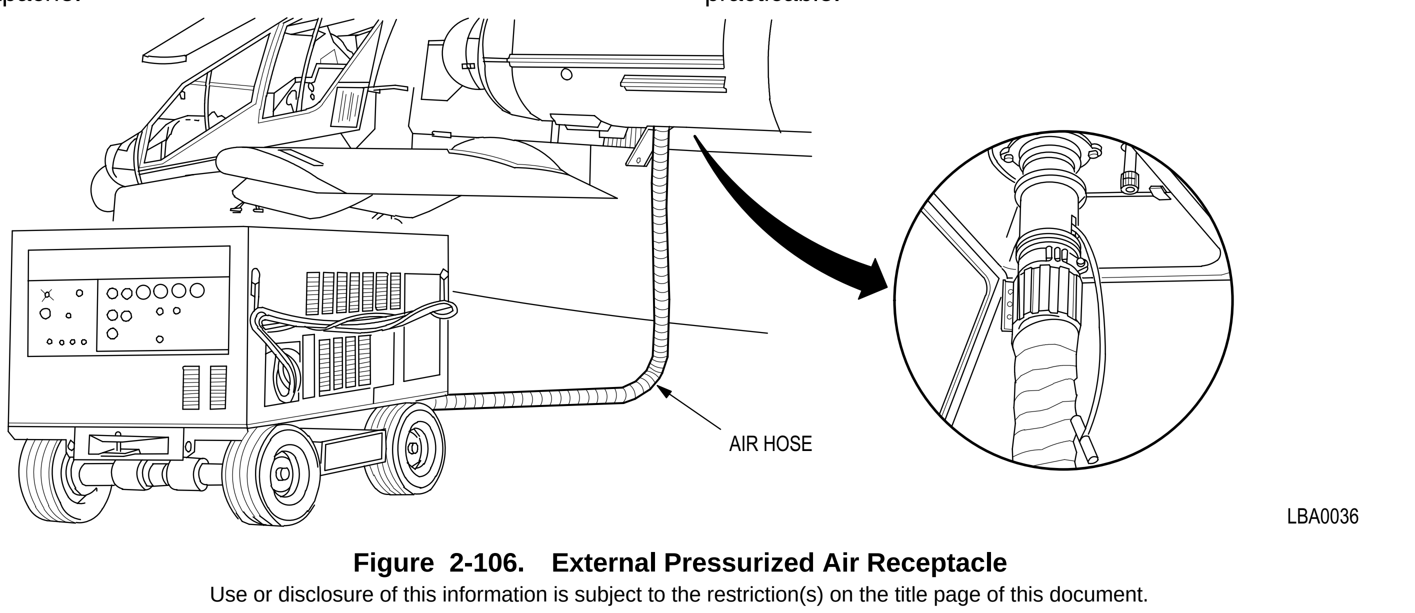


Figure 2-106. External Pressurized Air Receptacle

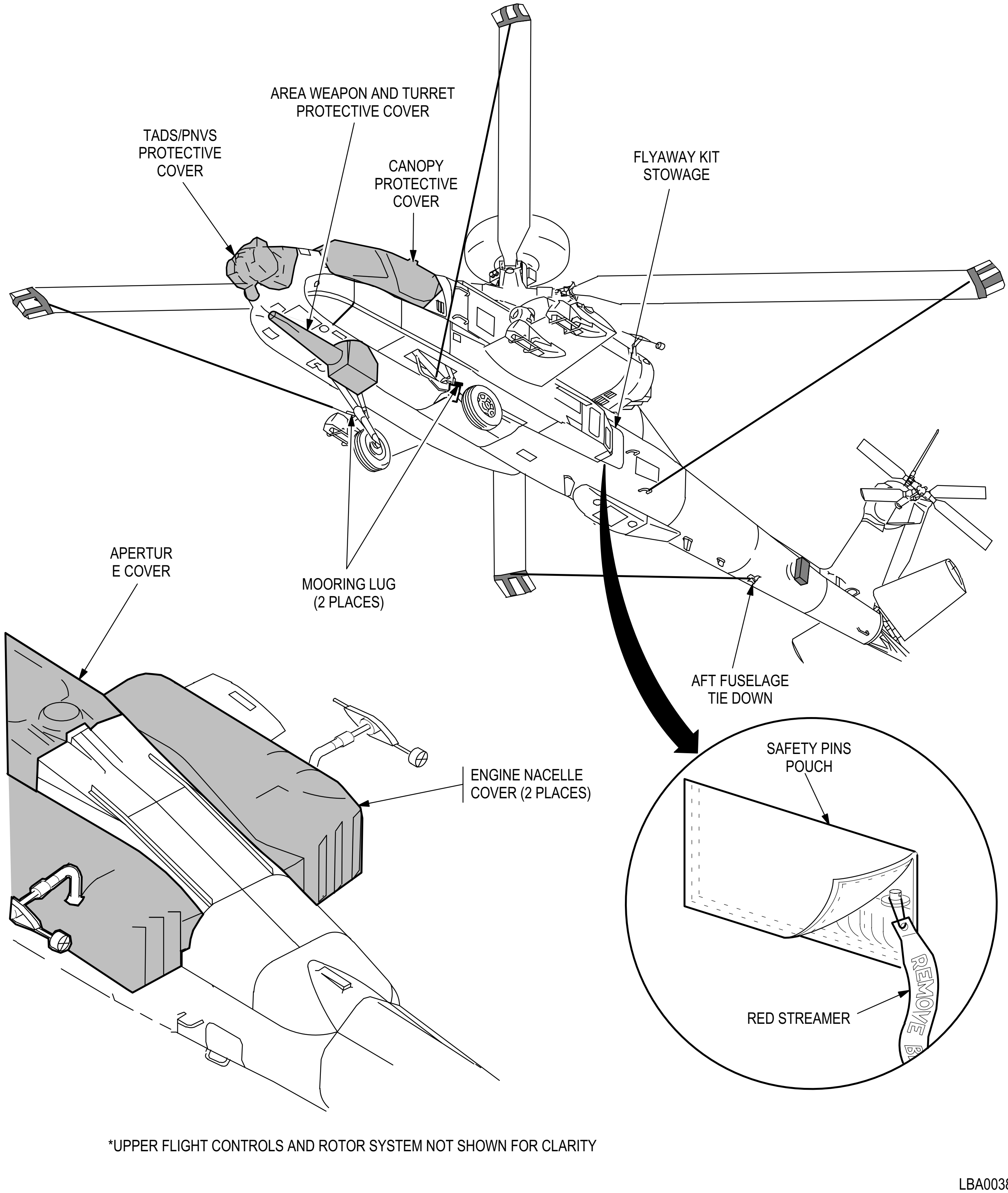


Figure 2-107. Protective Covers, Mooring, and Towing Provisions (Sheet 1 of 2)

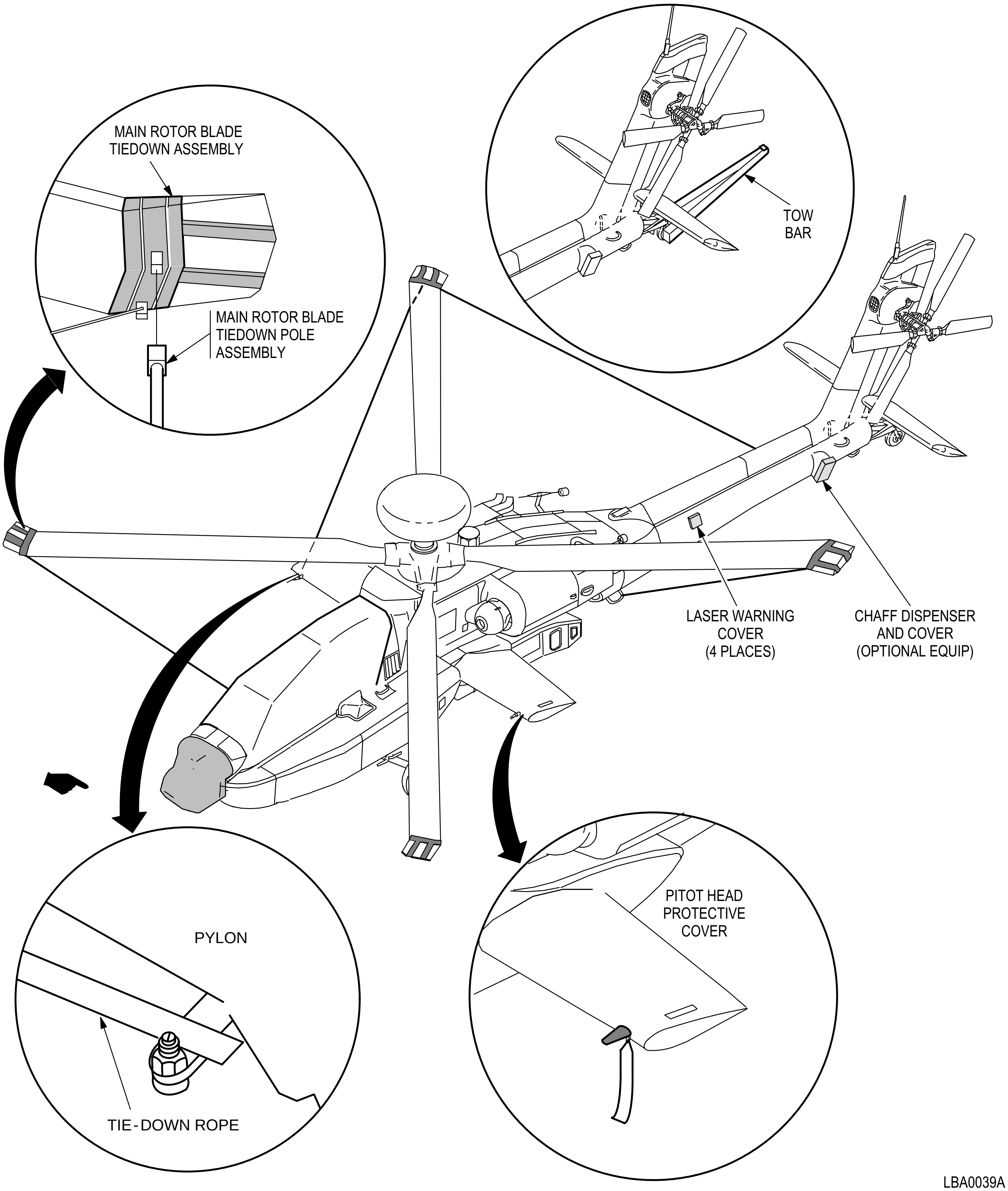


Figure 2-107. Protective Covers, Mooring, and Towing Provisions (Sheet 2 of 2)

Section XVI. DATA MANAGEMENT SYSTEM

2.125 INTRODUCTION

This section describes the display formats and dedicated components associated with the operation of the Data Management System (DMS) as well as the location and function of each component. The DMS displays are integrated into the following major components.

2.126 DMS HARDWARE

The DMS is made up of System Processors (SPs), Display Processors (DPs), Weapons Processors (WPs), a Communication Interface Unit (CIU), a Data Transfer Unit (DTU), a Maintenance Data Recorder (MDR) and the off-aircraft Aviation Mission Planning Station (AMPS).

2.126.1 System Processor (SP). The aircraft contains two SPs. The SP commands all subsystem initiated tests, monitors system status and fault information, and processes the information for display. The SP provides aircraft information to the DTU. There is a processor select panel which provides a manual selection option. Non volatile memory data exchange between SPs only occurs when the SP Processor is in the **AUTO** position.

2.126.2 Display Processor (DP). There are two DPs, each of which controls two Multipurpose Displays (MPDs). The DPs provide display information to the MPDs, Optical Relay Tube (ORT) or TEDAC , VCR, and Integrated Helmet and Display Sight System (IHADSS) displays. The DP also processes keyboard, bezel button, and cursor inputs. The DPs receive video recorder and sensor video signals and distribute the signals to the appropriate display. [BLK 2 The DPs detect when one of the Color Image Processing Modules (CIPM) or the Monochrome Image Processing Modules (MIPM) is not currently updating a particular display (MPDs, IHADSS, ORT or TEDAC). If this occurs during dual DP operations, the SP will allow the faulty DP to reset. This reset will cause the crew to be in single DP operations, the reset should last 13 to 24 seconds.]

2.126.3 Weapons Processor (WP). The aircraft contains two WPs. The WPs command portions of weapons subsystem initiated tests directly with the DPs, provides system status and fault information to the SPs, and processes that information for display.

2.126.4 Communication Interface Unit (CIU). The CIU provides voice messages and tones for the Warnings, Cautions, and Advisories (WCA) subsystem.

2.126.5 [BLK 1 **Data Transfer Unit (DTU)**. DTU is the name given to the combination of the following hardware:]

a. [BLK 1 **Data Transfer Cartridge (DTC)**. The DTC is a solid state memory device that facilitates transfer of data from the mission planning station to the aircraft via the Data Transfer Receptacle, described below. The DTC has 256 Kilobytes of battery powered memory available.]

b. [BLK 1 **Data Transfer Receptacle (DTR)**. The DTR (fig 2-108) accepts the DTC to facilitate uploading data from the DTC to selected LRUs and downloading of aircraft information from the SP to the DTC.]

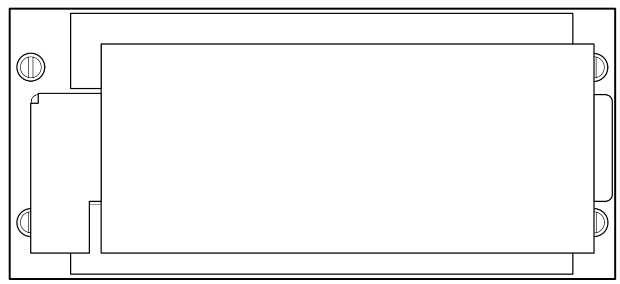


Figure 2-108. BLK 1 Data Transfer Receptacle

2.126.5A [BLK 2 **Data Transfer Unit (DTU)**. The DTU (fig 2-108A) is a four slot Personal Computer Memory Card International Association (PCMCIA) interface unit. The DTU will accept up to four type I, II, or III DTCs. The DTU is connected directly to the DPs with two dedicated fibre channels.]

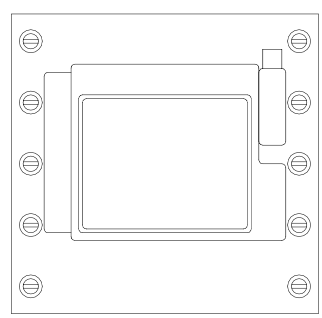


Figure 2-108A. BLK 2 Data Transfer Unit

a. [BLK 2 **Data Transfer Card (DTC)**. The DTC is a PCMCIA flash memory card that facilitates transfer of data from the AMPS to the aircraft via the DTU. The DTC can store up to two gigabytes of mission data and/or digital maps.]

Use or disclosure of this information is subject to the restriction(s) on the title page of this document.

2.126.6 Maintenance Data Recorder (MDR). The MDR is a solid state memory device which provides crash survivable data storage for mishap investigation and enhanced aircraft maintenance. The MDR will store Flight Data, Maintenance Faults, Maintenance Excellences, and WCAs. Operation of the MDR is automatic and requires no crewmember interaction.

2.127 DATA TRANSFER MANAGEMENT

Crewmembers can select the type of data to be uploaded to the aircraft. The system processor will automatically upload the saved status files to the aircraft after a power failure has occurred. Selecting an upload function commands the system to retrieve specific data from the DTC and upload them into the system memory for system or mission operations. For data loading procedures see paragraph 2.129. Refer to Table 2-12 for DTC Upload Data.

Table 2-12. DTC Upload Data

Data to be Loaded*	A	B	C	D	E	F	G	H	I	J	K	L	M	N
BLK 1 IDM Free Text	X	X												
BLK 1 IDM Tacfire Movement Messages	X	X												
BLK 1 IDM Tacfire Auto Authentication	X	X												
BLK 1 COMM Presets	X	X												
BLK 1 COMM Preset Nets	X	X												
BLK 1 Call Sign Frequencies	X	X					X					X		
BLK 1 Authentication/Reply Codes	X	X					X					X		
BLK 1 Transmit Authenticate Codes	X	X					X					X		
BLK 1 IDM Subscribers Net Assignments	X	X												
BLK 1 IDM Auto Response Transmit Flag	X	X												
BLK 1 IDM Protocol Address	X	X												
BLK 1 IDM Channels 1-4	X	X												
BLK 1 IDM Tacfire Authentication Transmit Codes	X	X												
BLK 1 IDM Tacfire Authentication Receive Codes	X	X												
BLK 1 IDM Nets 1-8 Configuration	X	X												
BLK 1 IDM Channels 1-4 Net Assignments	X	X												
Waypoints/Hazards	X[1]		X	X										
Control Measures	X[1]		X	X										
Targets and Threats	X[1]		X	X										
Routes	X[1]		X	X										
BLK 2 IDM Configuration 1 IDM Configuration 2	X	X												
Radio Selections	X	X												
Multiple Word of Day (MWOD)	X	X												

Table 2-12. DTC Upload Data - continued

Data to be Loaded*	A	B	C	D	E	F	G	H	I	J	K	L	M	N
BLK 2 COMM Presets	X	X					X[2]					X[2]		
Suffixes	X	X					X					X		
Expanders	X	X					X					X		
SOI Authentication Codes	X	X					X					X		
BLK 1 NAV Mode/Present Position	X										X			
BLK 2 NAV Mode/Present Position											X			
Boundaries and Phase Lines	X[1]		X	X			X					X		
Engagement Areas	X[1]		X	X			X					X		
Laser Codes	X[1]		X	X			X[2]							X[2]
ADF	X[1]		X	X			X[2]					X[2]		
Weapons Selections	X				X									
FCR Lethal Ranges	X				X		X			X				X
Sight Mode Selects	X				X									
FCR Control Selects	X				X									
Miscellaneous (Tail #, W & B, Perf Data, ASE)	X						X[2]		X				X[2]	
Emergency Procedures	X					X	X		X			X		
Priority Fire Zones	X[1]		X	X			X[2]					X[2]		
No Fire Zones	X[1]		X	X			X[2]					X[2]		
Shot At							X[2]	X[2]				X[2]		
BLK 2 Comm Member Directory	X	X					X					X		
BLK 2 Comm Preset Directory	X	X					X					X		
FCR Priority Scheme[4]														
BLK 2 HF Configuration[5]														
BLK 2 HF ECCM Configuration[5]														
BLK 2 BMP Views[3]														
Laser Keywords[3]														
BLK 2 Threat Ranges[3]														

* A = Master Load B = All Comm Data C = All Mission 1 D = All Mission 2 E = Wpns/Sights
F = Emerg Proc G = Thru Flt H = Shot At I = Misc J = FCR Lethal Rng
K = Nav L = DP Autoload M = SP Autoload N = WP Autoload

Note[1] Master Load uploads Mission 1 data as current mission. To use Mission 2 data, it must be uploaded as the current mission (overwrite Mission 1 Data).

Note[2] Changes made during the current mission will be uploaded.

Note[3] These files are automatically uploaded when the DTU door is closed and any DTU advisories are cleared.

Note[4] FCR priority schemes are uploaded as necessary upon selection of the PRIORITY SCHEME button on the FCR UTIL page.

Note[5] HF files are only loaded when the HF button is selected.

2.128 DMS PAGE

The **DMS** page (fig 2-109) is accessible from the MENU page using the **DMS** button. For the purposes of the following discussions in this section, all subsequent pages of the DMS subsystem are accessed from the **DMS** page. The **DMS** page provides a listing of the system faults detected through one of the BIT tests or direct input to the system processor, and a complete listing of all current advisory messages. When a fault is detected, the crew will be given a message no greater than 18 characters long. If more than one fault occurs with the same message, the message is only displayed once. Faults and advisories are listed in order of occurrence with the most recent indication being given on the top of the list. If more than one page of data is available for display, **PAGE** buttons shall be displayed at the bottom bezel buttons and scroll both columns of the display at the same time. The dividing lines are drawn at all times on this format.

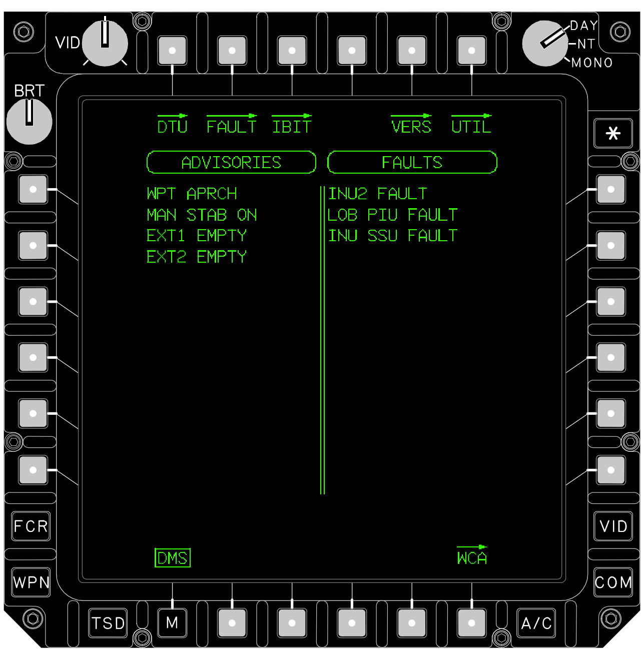


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Figure 2-109. [BLK 1 DMS Page]

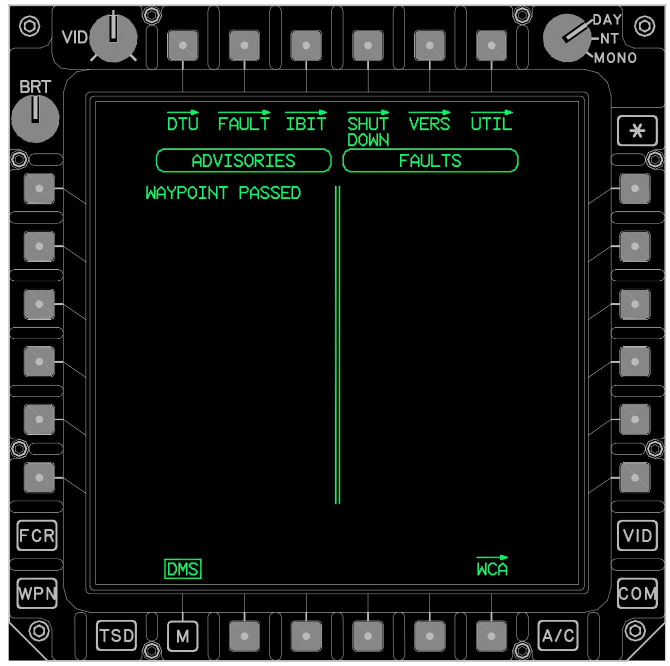

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Figure 2-109A. [BLK 2 DMS Page]

The following selections are available on the **DMS** page:

- T1 **DTU** page button
- T2 **FAULT** page button
- T3 **IBIT** page button
- T4 BLK 2 **SHUTDOWN** page button
- T5 **VERS** page button
- T6 **UTIL** page button
- B2 **PAGE** down button
- B3 **PAGE** up button
- B6 **WCA** page button

2.128.1 DTU. The **DTU** button accesses the **DTU** page. For description and operation of the **DTU** see paragraph 2.129.

2.128.2 FAULT. The **FAULT** button accesses the **FAULT** page. For description and operation of the **FAULT** page see paragraph 2.130.

2.128.3 IBIT. The **IBIT** button accesses the **IBIT** selection page. For description and operation of the **IBIT** page see paragraph 2.131.

2.128.4 [BLK 2 **SHUTDOWN.** The **SHUTDOWN** button accesses the **SHUTDOWN** page. For description and operation of the **SHUTDOWN** page (para 2.131A).]

2.128.4 VERS. The **VERS** button accesses the software version listing page of selected LRU software loads. For description and operation of the **VERS** page (para 2.132).

2.128.5 UTIL. The DMS **UTIL** button provides the means to access the DMS **UTIL** page. For the description and operation of the DMS **UTIL** page (para 2.133).

2.128.6 PAGE. The DMS **PAGE (UP/DOWN)** list buttons are only displayed when the **ADVISORIES** column or **FAULTS** column exceeds a count of 15. The **PAGE (UP/DOWN)** buttons permit the operator to select the next page of **ADVISORIES/FAULTS** where a maximum of 14 in either column could be displayed. When two pages are presented, **ADVISORIES** and **FAULTS** are unique where they are not repeated from one page to the other.

2.128.7 WCA. The **WCA** button accesses the **WCA** page. For description and operation of the **WCA** page (para 2.134).

2.128.8 Advisory Column Listing Area. The left column of the **DMS** page lists current advisory information. The most recent advisory messages are listed on the top line as they occur, with previous messages shifting down one line each time a new advisory is listed. The text string includes up to 18 characters in length.

2.128.9 Fault Column Listing Area. The right column of the **DMS** page lists the current faults. The text string includes up to 18 characters in length. The most recent fault message is listed on the top line as it occurs. Fault messages are an abbreviated functional description of the messages displayed on the **FAULT** page. Faults come from three sources: PBIT, CBIT, and IBIT. PBIT is automatically performed when power is applied to the system. CBIT is also automatic and is performed at regular intervals on certain components. IBIT is discussed in paragraph 2.131.

2.129 DTU PAGE

The **DTU** page ([BLK 1 fig 2-110], [BLK 2 fig 2-110A]) provides the capability to select the type of data to be loaded into the aircraft systems, and [BLK 2 the capabiltiy to enter the ownship's TI USERNAME/PASSWORD and set the associated MSG SECURITY level.] Selecting a load function allows the system to accept selected data from the DTC(s). The pilot has access to the **MASTER LOAD** button that will load all primary system initialization data from the DTC at one time. The pilot also has the ability to selectively load subsystem data from the DTC such as communications and navigation data files.

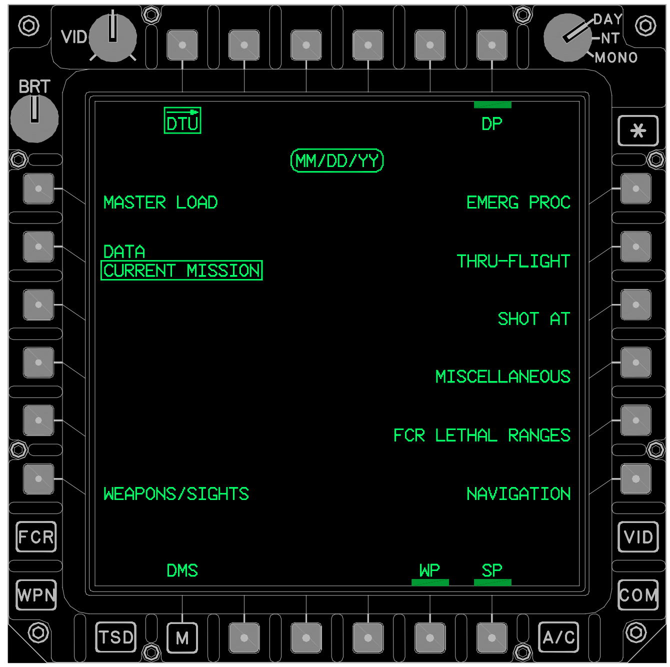

Figure 2-110. [BLK 1 DTU Page]

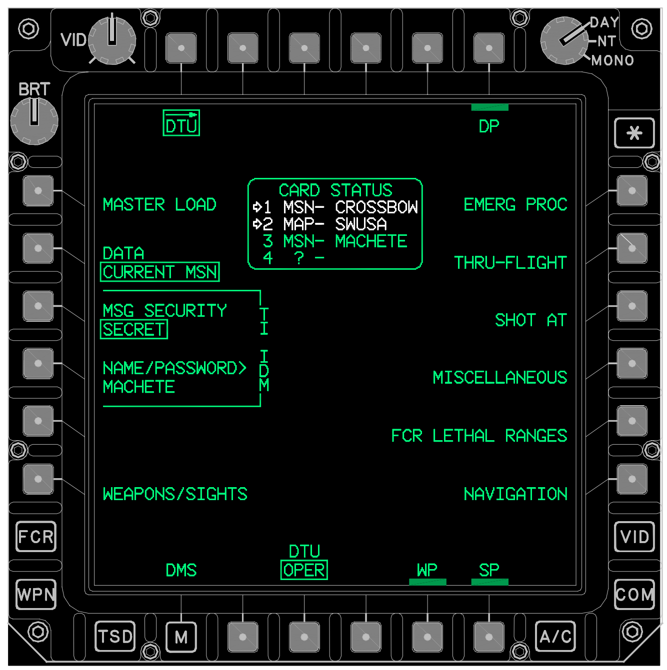

Figure 2-110A. [BLK 2 DTU Page]

The following unique selections are available on the **DTU** page:

- T6 **DP** button
- L1 **MASTER LOAD** button
- L2 **DATA** button
- L6 **WEAPONS/SIGHTS** button
- R1 **EMERG PROC** button

- R2 **THRU-FLIGHT** button
- R3 **SHOT AT** button
- R4 **MISCELLANEOUS** button
- R5 **FCR LETHAL RANGES** button
- R6 **NAVIGATION** button
- B3 [BLK 2 **DTU** button]
- B5 **WP** button
- B6 **SP** button

2.129.1 DTU UPLOAD ADVISORIES & OPERATIONAL CONDITIONS.

a. [BLK 2 **Card Status Window**. The card status window (fig 2-110A) is displayed in the top center of the **DTU** page when the DTU mode is set to **OPER**. The card status window displays the type and name of the card in each of the four slots. If a card is not mission or map, type a “?” is displayed in place of the type. The DTC card status window is presented whether or not a mission card is installed. The aircraft will use the first mission and map card it finds. The arrow and white color indicate which cards are being used by the aircraft.]

b. [BLK 1 **Date Status Window**. The DTU page date status window (fig 2-110) displays the date information found in the DTC status block. The SP checks to ensure that the information is within the valid ranges, but crewmembers must check to ensure that the DTC date is valid for any particular mission.]

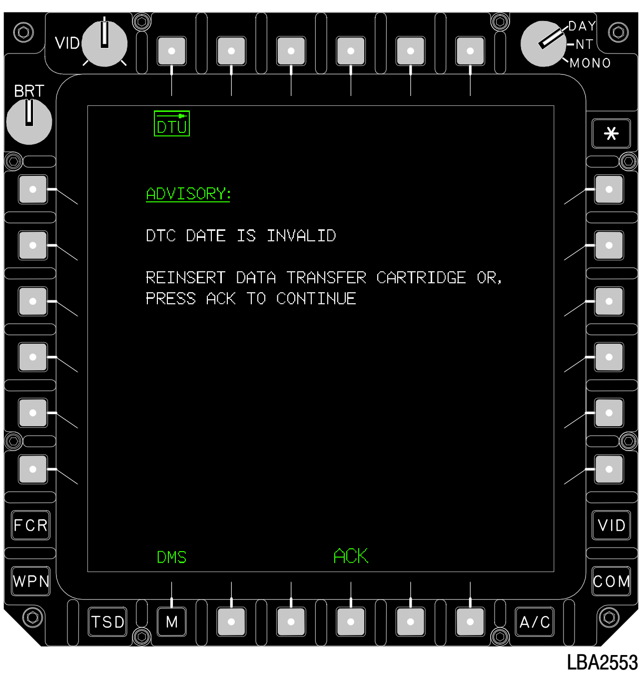

Figure 2-111. DTC Advisory Messages

NOTE

No mission or map data is being transferred to or from the DTC card(s) when the DTU ACK button is displayed]

c. [BLK 1 **DTU Acknowledge**. The **DTU ACK** (Acknowledge) momentary option button (B4) (fig 2-111) will be displayed for advisories which can be acknowledged. Selecting **ACK** will clear the advisory and present the **DTU** page. The **DTU ACK** button will not be displayed after selection. Through this process the operator is acknowledging that the data found on the DTC may or may not be valid for use.]

d. [BLK 1 **DTC Not On Board Advisory**. When the system processor detects that the DTC has not been inserted into the DTR, a signal is sent to the DP to display the **DTC NOT ON BOARD ADVISORY**, colored WHITE. No selections will be available on the **DTU** page until a DTC is detected in the DTR.

e. [BLK 1 **DTU Not Ready Advisory**. When the system processor detects that the DTC has not been uploaded into the DTR, a signal is sent to the DP to display the **DTU NOT READY ADVISORY,** colored WHITE. No selection will be available on the **DTU** page until a DTC is detected in the DTR.]

f. [BLK 1 **DTC Corrupted Advisory**. When the system processor detects (via counter) that the DTC cartridge status block upload has been attempted three times without the operation proceeding to the MTOC upload sequence, the SP will stop the operation and set the **DTC CORRUPT ADVISORY** message, colored WHITE. No selections shall be available on the **DTU** page until the DTC can be replaced or reprogrammed.]

g. [BLK 1 **DTC Version Mismatch Advisory**. When the DTC version expected by the system processor does not match the DTC version recorded on the cartridge, the system processor sets the **DTC Version Mismatch ADVISORY** message, colored WHITE. No selections shall be available on the **DTU** page until the DTC can be replaced or reprogrammed.]

h. [BLK 1 **DTC Advisory Messages**. The SP checks three areas in the DTC status block data to determine DTC status: First, the SP will check for valid date, then a valid status block checksum, and finally, a valid Main Table Of Contents (MTOC). If any of these conditions are invalid, a signal is sent to the DP. The DP processes the signal and sends a signal to the MPD to display the appropriate advisory messages, colored WHITE (fig 2-111). Any combination of the three messages can appear at one time. These conditions do not keep the crewmember from using the DTU functions; they are used to inform him of DTC status before uploading operations begin. Selecting the **DTU ACK** button will clear the screen and make available all the **DTU** page selections.]

i. [BLK 2 DTU Connection Not Established Advisory]. When neither DP can establish a connection with the DTU over the fibre channel or when a DP has lost connection with the SP over the fibre channel, this advisory is displayed. The DTU Connection Not Established advisory is colored white. No selections will be available until the DP establishes a fibre channel connection with the SP and one of the DPs has established a connection with the DTU.]

j. [BLK 2 **Data Transfer Unit is Not Ready Advisory**. When the DP detects that the DTU door is opened, it will display this advisory. The Data Transfer Unit is Not Ready advisory is displayed white. No selections will be available until the DTU door is closed and a mission card is present.]

NOTE

DTC should not be removed until the last line displays **DTC WRITE COMPLETE**.

k. [BLK 2 **DTU Initialization Is in Progress Advisory**. This advisory is displayed when the DTU door is first closed. While the advisory is displayed, the DTU is checking which DTCs are present and what files are available on those DTCs.]

l. [BLK 2 **DTU IBIT Is In Progress Advisory**. This advisory is displayed when the DTU is currently running IBIT. This advisory is colored white. No selections will be available until the DTU has completed it's IBIT.]

m. IDM Data Transfer In Progress Advisory. When the crew elects to send data from either Mission 1 or Mission 2 or to store data into Mission 1 or Mission 2, the data will be retrieved from or stored to the DTU. During this time, the **IDM DATA TRANSFER IS IN PROGRESS** message, colored WHITE will be displayed on the **DTU** page. No DTU selections will be available until this task is completed.

n. DTU Load Error Listing Area. The DTU load error listing area (fig 2-112) informs crewmembers of the upload being run, present status, and the loading errors detected during DTU data uploading. Error messages for these selections will then be listed accordingly. All errors will be colored WHITE. If the load listing area contains more than 15 errors, the **PAGE** scrolling buttons will be displayed. The last line of text on page 1 will be the first line of text on page 2. The number of pages available is based on the number of errors listed.

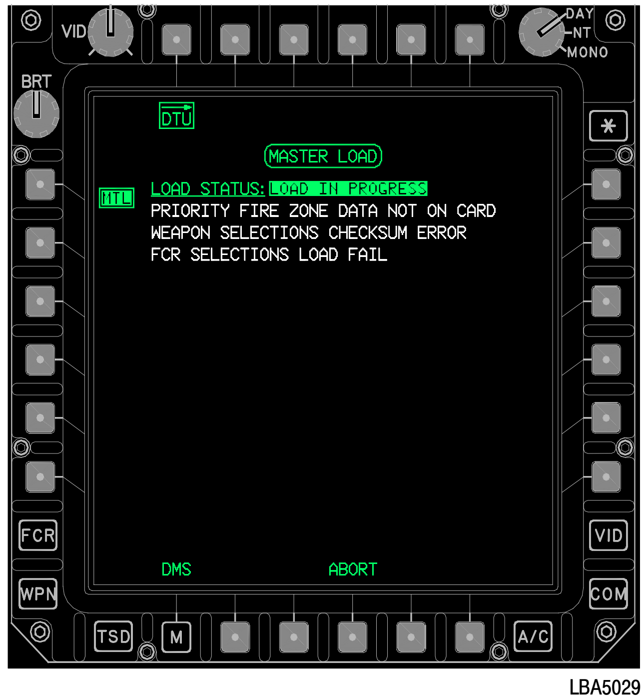

Figure 2-112. DTU Load Error Listing Area

- B4 **ABORT** Upload button

o. PAGE. The DTU **PAGE** List buttons will be presented when the DTU load error listing area contains more than 15 errors to allow the operator to select the next page of the list The last line of text on the first page will be the first line of text on the second page.

p. ABORT. The **ABORT** Upload momentary option button will appear at the B4 position only when a DTU upload is in progress. Selecting **ABORT** will interrupt the DTU up-load and display the current load status in the DTU load error listing area.

2.129.2 DP. The **DP** auto load button ([BLK 1 fig 2-110], [BLK 2 fig 2-110A]) provides feedback status during the automatic process of up-loading the DP. It will be displayed with a barrier on the **DTU** page when no upload is in progress. [BLK 1 The SP automatically initiates this upload process to each DP that transitions from a non-operational state to a normal or single DP operating mode.] [BLK 2 The SP initiates this upload process to both DPs when one DP transitions from a nonoperational state to a normal or single operating mode.] This process is also initiated as part of full system power-on and will take priority in the up-loading operation. If an error is detected during upload, the crewmember can also cause the automatic process to become initiated through the use of the **THRU-FLIGHT LOAD**. [BLK 1 DP autoload is in progress for approximately 3 minutes.]

NOTE

Selection of **MASTER LOAD** or **COMMUNICATIONS ALL** will not load HF data.

2.129.3 MASTER LOAD. The **MASTER LOAD** button ([BLK 1 fig 2-110], [BLK 2 fig 2-110A]) provides crewmembers with the means to upload all subsystem initialization files at one time from the DTC. **MASTER LOAD** automatically selects mission 1 data as the default for uploading. The purpose of the **MASTER LOAD** is to reduce the number of aircrew button selections for initializing aircraft systems at the beginning of a mission. Data loaded from **MASTER LOAD** is data loaded by the AMPS. [BLK 1 **MASTER LOAD** is in progress for approximately 5 minutes.]

2.129.3A MSG SECURITY. See **SECURITY LEVEL** button defined (paragraph 3A.26.2)

2.129.3B NAME/PASSWORD. The **NAME/PASSWORD** button allows the operator to enter a user name and password to compare with what has previously been loaded into the IDM via the DTU. This information is required to login to the TI.

2.129.4 WEAPONS/SIGHTS. The **WEAPONS/SIGHTS** button ([BLK 1 fig 2-110], [BLK 2 fig 2-110A]) provides a means of uploading weapons/sights data from the DTC.

2.129.5 EMERG PROC. The **EMERG PROC** load button ([BLK 1 fig 2-110], [BLK 2 fig 2-110A]) provides the means of uploading the emergency procedures data block from the DTC. The data is used by the **ENG** page for displaying emergency procedures for warnings.

CAUTION

Some thru-flight data will be lost unless the THRU-FLIGHT button is selected within one minute upon power up.

NOTE

[BLK 2 The **THRU-FLIGHT** files cannot be updated if the DTU is in STBY.]

2.129.6 THRU-FLIGHT. The **THRU-FLIGHT** load button ([BLK 1 fig 2-110], [BLK 2 fig 2-110A]) provides the means of uploading thru-flight data. The purpose of THRU-FLIGHT is to reduce the number of aircrew button selections for initializing aircraft systems for continuing a mission. THRU-FLIGHT occurs automatically in the air after an aircraft power interrupt, or as a selective option on the ground. The button will be displayed WHITE until the SP begins to overwrite the THRU-FLIGHT data on the DTC. Data loaded from THRU-FLIGHT is a mixture of AMPS data and data downloaded from the aircraft during flight. [BLK 1 THRU-FLIGHT is in progress for approximately 4 minutes.] The data is partitioned and loaded between the SP, DP and WP during a **THRU-FLIGHT** autoload. Items marked as loading from the current mission (table 2-12) will be lost if not loaded immediately.

2.129.7 SHOT AT. The **SHOT AT** load button ([BLK 1 fig 2-110], [BLK 2 fig 2-110A]) provides the means of uploading the SHOT AT data blocks from the DTC. This is stored data of locations where Hellfire missiles were launched to during an engagement.

2.129.8 MISCELLANEOUS. The **Miscellaneous** Load button ([BLK 1 fig 2-110], [BLK 2 fig 2-110A]) provides the means of uploading checklist/emergency procedures data, weight and balance data, **PLAN/MAX PERF** data, CHAFF settings and fuel corrector data (for **CALC** fuel data) from the DTC. [BLK 1 **Miscellaneous** Load is in progress for approximately 1 minute.]

2.129.9 FCR LETHAL RANGES. The **FCR LETHAL RANGES** load button ([BLK 1 fig 2-110], [BLK 2 fig 2-110A]) provides the means of uploading the FCR lethal ranges data from the DTC. This data is used to assist the FCR in prioritizing targets.

2.129.10 NAVIGATION. The **NAVIGATION** load button ([BLK 1 fig 2-110], [BLK 2 fig 2-110A]) provides the means of uploading the mode/present position from the DTC. This data is used to initialize the Inertial Navigation Unit (INU).

2.129.11 [**BLK 2** **DTU MODE BUTTON**. The The DTU MODE two-state button (fig 2-110A) is used to control the state of the DTU. When the DTU is commanded to the stand-by mode, all read operations will be cancelled and all write operations will be finished. If power is removed from the DTU in the operate state, any changes to files being written at that point in time will be lost.]

2.129.12 WP. The **WP** auto load functions the same as the **DP** auto load described in subparagraph 2.129.2 of this section. [**BLK 1** WP autoload is in progress for approximately 15 seconds.]

2.134.13 SP. The **SP** auto load functions the same as the **DP** auto load described in subparagraph 2.129.2 of this section. [**BLK 1** SP autoload is in progress for approximately 10 - 15 seconds.]

2.129.14 DATA. The **DATA** multistate button (fig 2-113 and 2-113A) controls which upload options are presented. **DATA** options include: **CURRENT MISSION**, **MISSION 1, MISSION 2** and **COMMUNICATIONS** and **BLK 2** **AVIONICS UPDATE.**

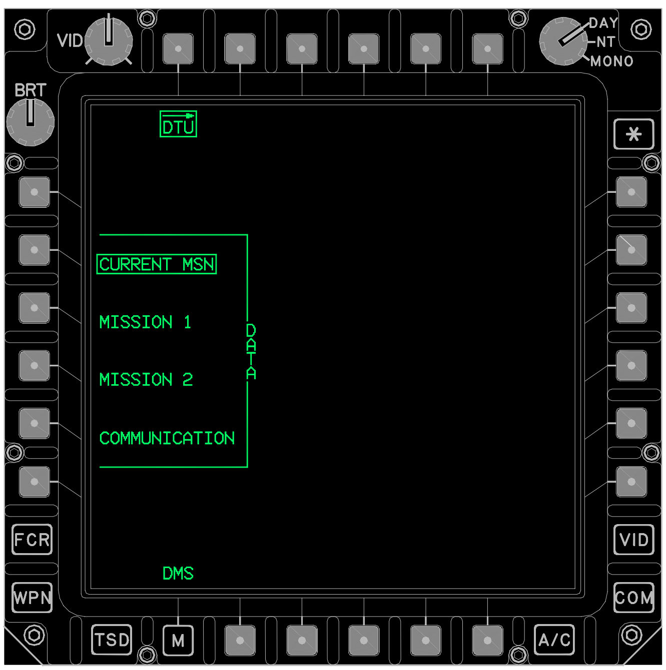

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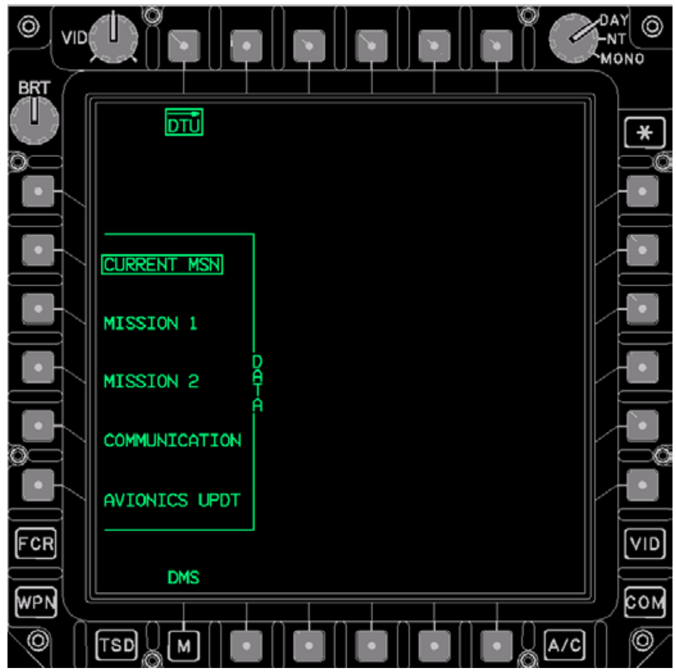
Figure 2-113. DTU Page DATA Selected



LBA5494

Figure 2-113A. BLK 2 DTU Page DATA Selected

2.129.15 CURRENT MISSION DATA. When **CURRENT MISSION** is the selected option of the **DATA** button (fig 2-113), the following selections are available:

- L2 **DATA CURRENT MSN** button
- L3 **DATA MISSION 1** button
- L4 **DATA MISSION 2** button
- L5 **DATA COMMUNICATION** button
- L6 **[BLK 2 AVIONICS UPDATE** button]

2.129.16 MISSION 1 DATA. When **MISSION 1** is the selected option of the **DATA** button ([**BLK 1** fig 2-114], [**BLK 2** fig 2-114A]).

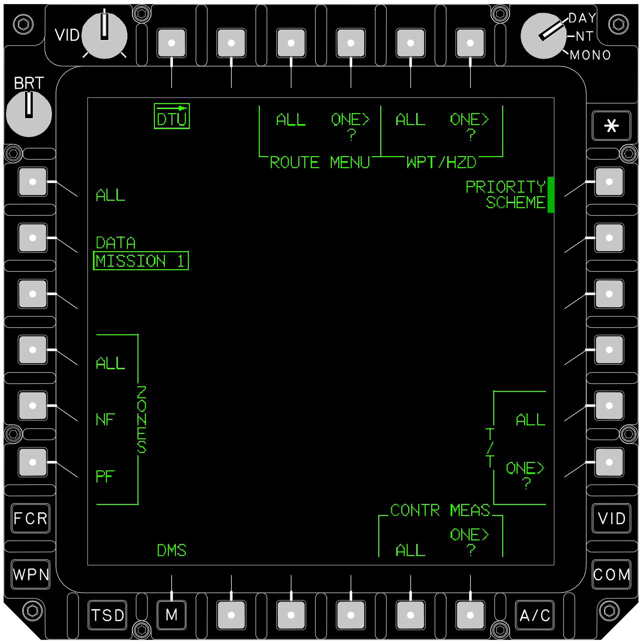


Figure 2-114. [BLK 1 MISSION 1 DATA Selections]

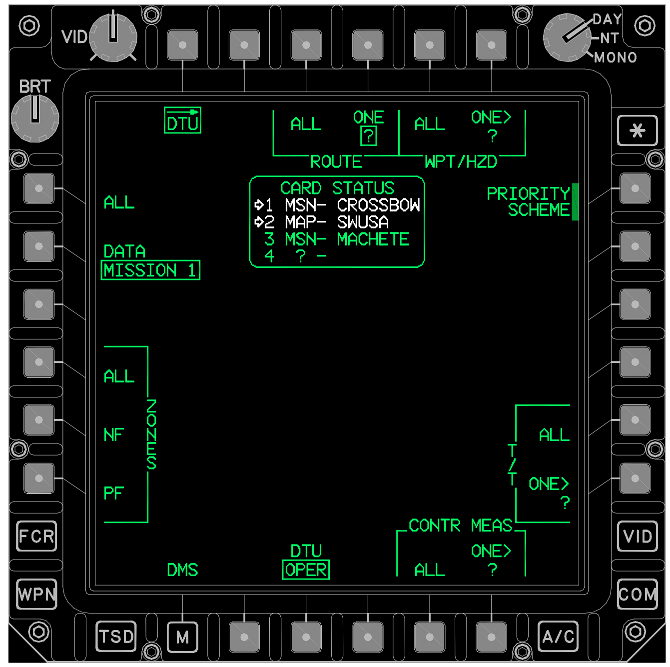


Figure 2-114A. [BLK 2 MISSION 1 DATA SELECTIONS]

The following unique selections are available when **MISSION 1** is selected:

- T3 **ROUTE MENU ALL** button
- T4 **ROUTE MENU ONE** button
- T5 **WPT/HZD ALL** button
- T6 **WPT/HZD ONE** button
- L1 **ALL** button
- L4 **ZONES ALL** button
- L5 **ZONES NF** button
- L6 **ZONES PF** button
- R1 **PRIORITY SCHEME** button
- R5 **T/T ALL** button
- R6 **T/T ONE** button
- B5 **CONTR MEAS ALL** button
- B6 **CONTR MEAS ONE** button

a. ROUTE MENU ALL. The **ROUTE MENU ALL** load button provides the operator a means of uploading the route data. This data is used to set all ten mission 1 routes into the aircraft.

b. ROUTE MENU ONE. The **ROUTE MENU ONE** load button provides the operator a means of uploading one route from the route data.

c. WPT/HZD ALL. The **WPT/HZD ALL** load button provides the operator a means of uploading the waypoints/hazards data. This data is used to set all waypoints and hazards into the aircraft.

d. WPT/HZD ONE. The **WPT/HZD ONE** load button provides the operator a means of uploading one waypoint or hazard from the waypoints/hazards data. This data is used to set one of the 50 possible **MISSION 1** waypoints/hazards into the aircraft.

e. ALL. The **ALL** load button provides the operator a means of uploading all **MISSION 1** data from the DTC. This capability is used to rapidly set all configurations.

f. ZONES ALL. The **ZONES ALL** load button provides the operator a means of uploading both the priority and no fire zones data. This data is used to set all zones into the aircraft.

g. ZONES NF. The **ZONES NF** load button provides the operator a means of uploading the priority no fire zones data. This data is used to set all no fire zones into the aircraft.

h. ZONES PF. The **ZONES PF** load button provides the operator a means of uploading the priority fire zones data. This data is used to set all priority fire zones into the aircraft.

i. PRIORITY SCHEME. The **PRIORITY SCHEME** load button provides feedback during the upload of a priority scheme. This process is initiated when a PRIORITY SCHEME selection of D through G is made on the FCR UTIL Page.

j. T/T ALL. The **T/T ALL** load button provides the operator a means of uploading the targets and threats data.

k. T/T ONE. The **T/T ONE** load button provides the operator a means of uploading one target or threat from the targets and threats data (50 possible).

l. CONTR MEAS ALL. The **CONTR MEAS ALL** load button provides the operator a means of uploading the control measures data.

m. CONTR MEAS ONE. The **CONTR MEAS ONE** load button provides the operator a means of uploading one control measure from the control measures data (49 possible).

2.129.17 MISSION 2. When **MISSION 2** is the selected option of the **DATA** button the selections for the type of mission data to be uploaded to the aircraft are the same as **MISSION 1** data.

2.129.18 COMMUNICATIONS. When **COMMUNICATIONS** is the selected option of the **DATA** button ([BLK 1 fig 2-115], [BLK 2 fig 2-115A])

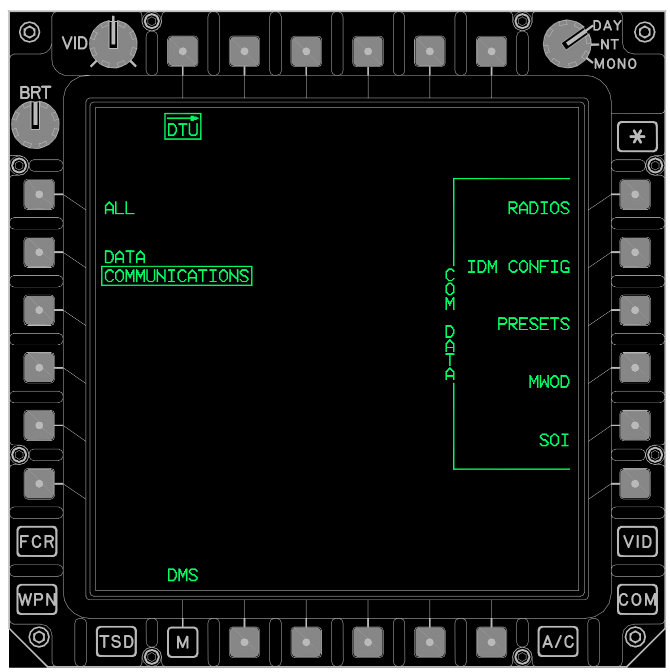


Figure 2-115. [BLK 1 COMMUNICATIONS DATA Selections]

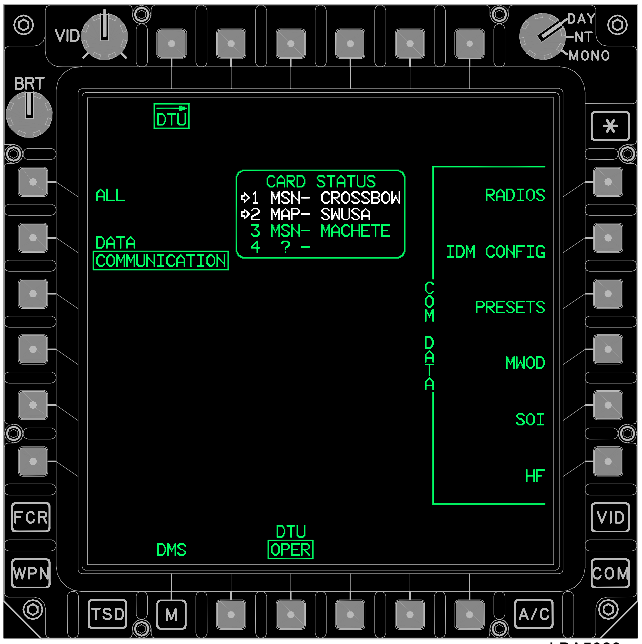


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Figure 2-115A. [BLK 2 COMMUNICATIONS DATA Selections]

The following unique selections are available when **COMMUNICATIONS** is selected:

- L1 **ALL** button
- R1 **COM DATA RADIOS** button
- R2 **COM DATA IDM CONFIG** button
- R3 **COM DATA PRESETS** button
- R4 **COM DATA MWOD** button
- R5 **COM DATA SOI** button
- R6 [BLK 2 **COM DATA HF** button]

a. ALL. The **ALL** load button provides the operator a means of uploading all **COMMUNICATIONS** data from the DTC. This capability is used to rapidly set all configurations.

b. COM DATA RADIOS. The **COM DATA RADIOS** load button provides the operator a means of uploading radio selections data from the DTC. This data is used to rapidly set the radios configurations.

c. COM DATA IDM CONFIG. The **COM DATA IDM CONFIG** load button provides the operator a means of uploading the communications IDM DATA from the DTC. This data is used to rapidly set the IDM configuration data, loaded via the **IDM CONFIG** load button, providing an interface between aircraft radios and the mission equipment. Digital data is converted into or out of Frequency Shift key format for transmission or reception as though it were voice. IDM communications occur over the crewmembers selected radio. The following data is loaded during an **ALL IDM CONFIG** upload:

- [BLK 1 IDM Auto Response Transmit Flag]
- [BLK 1 IDM Subscribers Net Assignments 1-5]
- [BLK 1 IDM Protocol Address]
- [BLK 1 IDM Channels 1-4]
- [BLK 1 IDM Nets 1-8 Configuration]
- [BLK 1 IDM Channels 1-4 Net Assignments]
- [BLK 1 IDM Tacfire Authentication Transmit Codes]
- [BLK 1 IDM Tacfire Authentication Receive Codes]
- [BLK 1 IDM Tacfire Freetext]
- [BLK 1 IDM Tacfire Movement Messages]
- [BLK 1 IDM Tacfire Auto Authentication Subscriber]
- [BLK 2 IDM Config 1]
- [BLK 2 IDM Config 2]

d. COM DATA PRESETS. The **COM DATA PRESETS** load button provides the operator a means of uploading the communications presets data from the DTC. This data is used to rapidly set the communications presets configurations. The following data is loaded during an **ALL PRESETS** upload:

- Comm Presets
- [BLK 1 Comm Preset Nets]
- [BLK 2 Comm Member Directory]
- [BLK 2 Comm Preset Directory]

e. COM DATA MWOD. The **COM DATA MWOD** load button provides the operator a means of uploading MWOD data from the DTC. This data is used to rapidly set the MWOD configurations.

f. COM DATA SOI. The **COM DATA SOI** load button provides the operator a means of uploading the SOI data from the DTC. This data is used to rapidly set the SOI configurations. The following data is loaded during an **ALL SOI** upload:

- [BLK 1 SOI Callsigns and Frequencies]
- SOI Suffixes
- SOI Expanders
- [BLK 1 SOI Authentication Challenge and Reply]
- [BLK 1 SOI Tx Authentication Codes]
- [BLK 2 SOI Authentication Codes]

g. [BLK 2 COM DATA HF. The **COM DATA HF** load button provides the operator a means of uploading the HF data from the DTC. The data is used to rapidly configure the HF radio. The following data is loaded during an HF upload

- HF Configuration
- HF ECCM Configuration]

2.128.18A AVIONICS UPDT button. When **AVIONICS UPDT** is the selected option of the **DATA** button ([[**BLK 2** fig 2-115B])

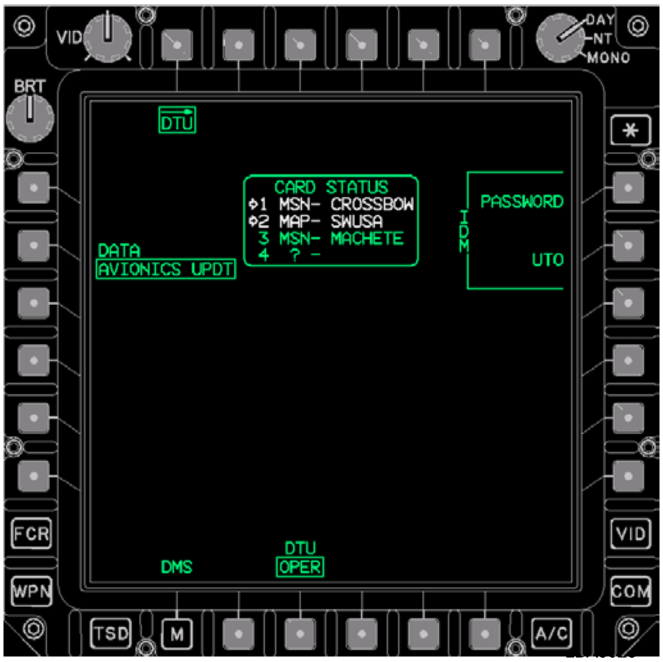

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Figure 2-115B. [BLK 2 AVIONICS UPDT DATA Selections]

The following unique selections are available when **AVIONICS UPDT** selected:

- R1 **PASSWORD** button
- R2 **UTO** button

a. PASSWORD. Selecting the **PASSWORD** button will load the password/username files into the IDM. Password files contain an expiration tag of up to 60 days from the day the files were created.

b. UTO. Selecting the UTO button will load up to five UTO files into the IDM. UTO's are current for an indefinite period, they only change as units/equipment are removed or added to a division.

2.129.19 DTU Data For Autoloads. Data is downloaded (stored) to the DTU from the aircraft and used to reload processors after a power interrupt or switchover.

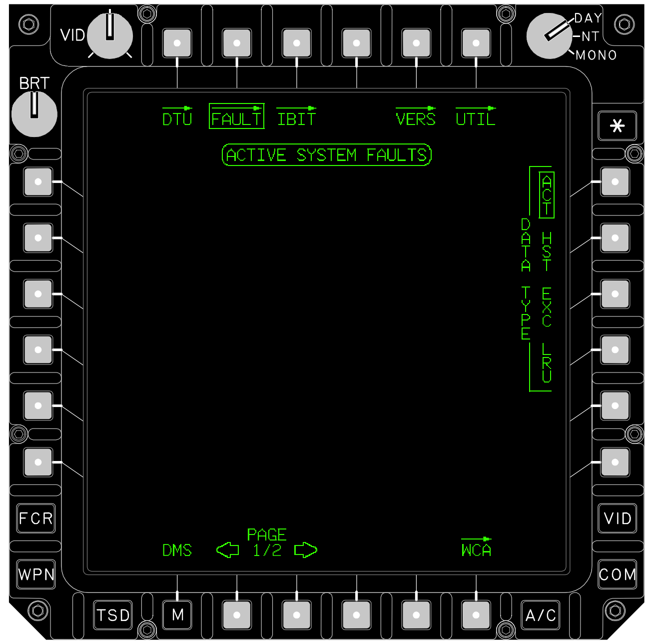
The following files are downloaded to the cartridge, and reloaded to the processors.

- Miscellaneous
- ADF Presets
- Laser Codes
- Shot At Data
- Priority Fire Zones
- No Fire Zones
- [**BLK 2** Comm Presets]

The following files are downloaded to the cartridge, but are not reloaded.

- Waypoints and Hazards
- Control Measures
- Routes
- Targets and Threats

2.129.20 WP Requested Uploads. The laser keywords are uploaded from the DTU on request by the WP. The laser keyword upload occurs automatically and is not crew selectable. Up to nine laser keywords can be stored on the DTC.

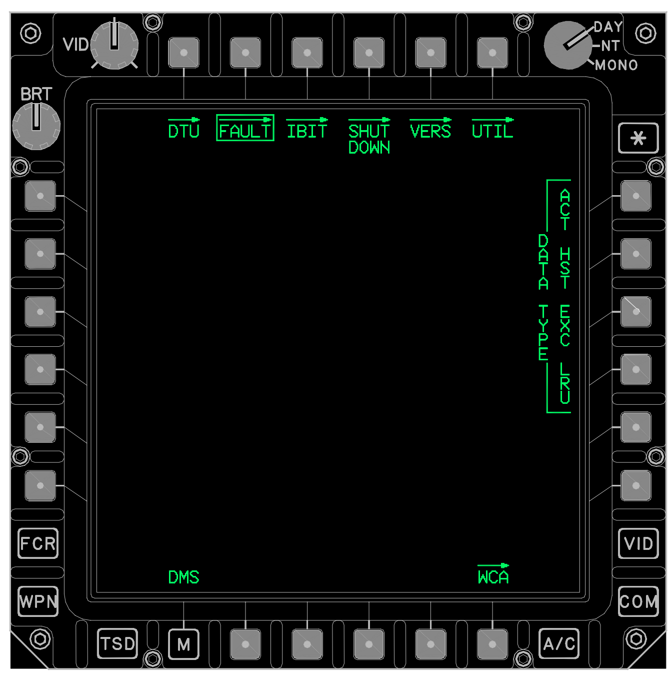


LBA1807

Figure 2-116. [BLK 1 Fault Page]

2.130 FAULT PAGE

The **FAULT** page button is available on the **DMS**, [**BLK 2** **SHUTDOWN**], **VERS**, DMS **UTIL**, and **WCA** pages. Selection of the **FAULT** page button displays the **FAULT** page ([**BLK 1** fig 2-116], [**BLK 2** fig 2-116A]), and displays all of the currently active faults. Faults come from three sources; Power-up Built-In-Test (PBIT), Continuous Built-In-Test (CBIT), and Initiated Built-In-Test (IBIT). The PBIT function will be automatically performed when power is applied to the system. Each component will run its PBIT when power is applied and report any line maintenance faults (e.g., LRU, LRM) on the **FAULT** page. PBIT occurs without crewmember input. The CBIT function will be performed at regular time intervals on certain components. When faults are detected, they are reported in the same manner as the PBIT faults. The IBIT faults reporting is discussed under the **IBIT** page. The messages remain listed until the fault is reset/fixed or until the system is powered down. When 15 or more faults are active, the format displays the **PAGE** buttons as a means of accessing additional pages of data. Faults are listed in order of occurrence with the most recent fault given at the top of the list. The **DATA TYPE** buttons allow for selecting different type information.



LBA5159

Figure 2-116A. [BLK 2 Fault Page]

The following unique selections are available on the **FAULT** page:

- R1 **DATA TYPE ACT** button
- R2 **DATA TYPE HST** button
- R3 **DATA TYPE EXC** button
- R4 **DATA TYPE LRU** button
- B2 **PAGE** button
- B3 **PAGE** button

2.130.1 Fault Display Area. The fault display area provides a chronological listing of the last 30 active faults, 128 historical faults, or exceedences which have occurred based on the data type selected. It is broken down into 15 lines of text, 35 characters in length with a maximum potential of 10 pages.

2.130.2 DATA TYPE Active (ACT) Button. The **DATA TYPE ACT** button provides the operator with the means of accessing the currently active faults in the system. Upon selection of the **DATA TYPE ACT** grouped option button, the system shall display up to 30 currently active faults in the fault display area.

2.130.3 DATA TYPE Historical (HST) Button. The **DATA TYPE HST** button provides the operator with the means of accessing all the faults that were detected and stored in the system. Upon selection of the **DATA TYPE HST** grouped option button, the system displays up to 128 historical faults in the fault display area.

2.130.4 DATA TYPE Exceedences (EXC) Button. The **DATA TYPE EXC** button provides the operator with the means of accessing all the exceedences that were detected and stored in the system. Upon selection of the **DATA TYPE EXC** grouped option button, the system displays up to 128 exceedence records in the fault display area.

2.130.5 DATA TYPE Line Replaceable Unit (LRU) Button. The **DATA TYPE LRU** button provides the operator with the means of accessing the LRU faults that were detected and stored in the system. Upon selection of the **DATA TYPE LRU** grouped option button, the system displays the LRU selections available.

2.131 IBIT PAGE

IBIT allows crewmembers to test specific subsystems. The **IBIT** page button displayed on the **DMS** page is the means of access to the **IBIT** page (fig 2-117). The IBIT function is divided into subsystems for selection by the crewmembers. Upon entering the IBIT page from the DMS page, the system will default to the **WEAPONS/SIGHTS/SUBSYSTEMS** format. The crewmember is allowed to leave the IBIT page when any IBIT is in progress. Exiting the IBIT page will not abort the IBIT. When the crewmember returns to the DMS subsystem and selects the **IBIT** page button, the **IBIT** page with the IBIT listing area (fig 2-118) is displayed if the test is still in progress or if it has been completed and the results are not yet shown. The following selections are available on the **WEAPONS/SIGHTS/SUBSYSTEMS** default **IBIT** page:

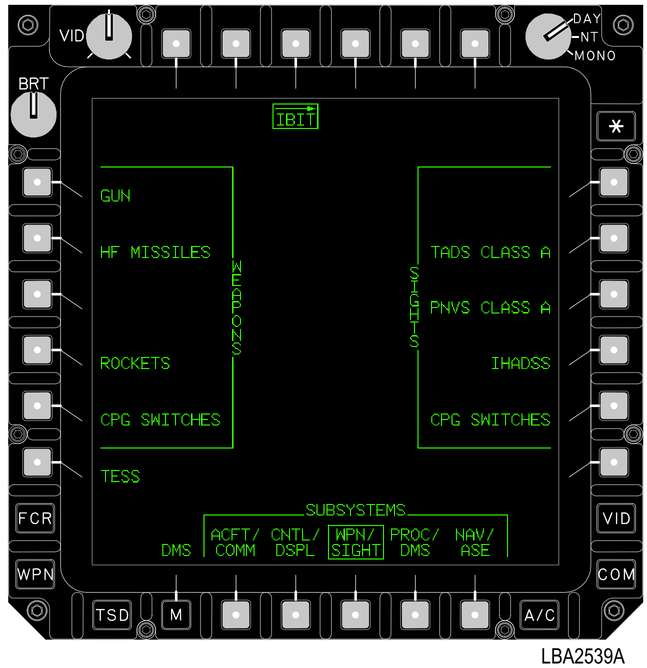


Figure 2-117. IBIT Page

The following selections are available on the **IBIT** page:

- L1 **WEAPONS GUN** button
- L2 **WEAPONS HF MISSILE** button
- L4 **WEAPONS ROCKETS** button
- L5 **WEAPONS PLT (**or **CPG) SWITCHES** button
- L6 **TESS** button
- R1 **SIGHTS FCR** button
- R2 **SIGHTS TADS CLASS A (or B)** button
- R3 **SIGHTS PNVS CLASS A (or B)** button
- R4 **SIGHTS IHADSS** button
- R5 **SIGHTS PLT (**or **CPG) SWITCHES** button
- B2 **SUBSYSTEMS ACFT/COMM** button
- B3 **SUBSYSTEMS CNTL/DSPL** button
- B4 **SUBSYSTEMS WPN/SIGHT** button
- B5 **SUBSYSTEMS PROC/DMS** button
- B6 **SUBSYSTEMS NAV/ASE** button

a. IBIT Listing Area. The IBIT listing area (fig 2-118) is used to inform the operator on the test being run, the status, and the faults detected during the IBIT. The **TEST STATUS** line provides feedback to determine whether the test is completed, in-progress, or failed. This information is provided to the right of the test status title. The IBIT listing area will display up to 15 lines of text with fault descriptions no greater than 35 characters in length. If more than 15 faults are displayed, the **IBIT PAGE** list buttons (B2 and B3) will be displayed to allow the operator to select the next page of the list.

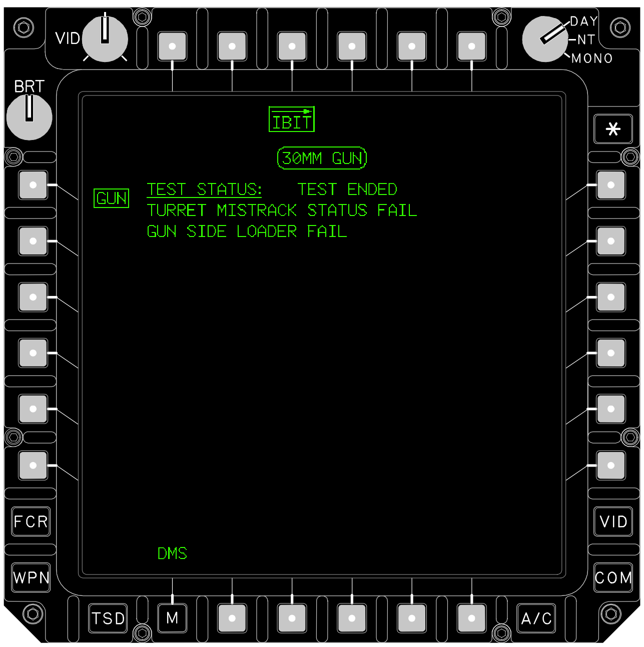


Figure 2-118. IBIT Listing Area (Gun)

b. IBIT Page List (PAGE). The **IBIT PAGE** List buttons (B2 and B3) (fig 2-118) are presented when the IBIT listing area contains more than 15 faults. This allows the operator to select the next page of the list. The last line of text on page 1 shall be the first line of text on page 2. Two pages will be available for displaying any faults detected during IBIT test.

c. IBIT Abort (ABORT). The IBIT **ABORT** momentary option button (B4) is presented when an IBIT is in progress. The **ABORT** button will interrupt the IBIT and display only the IBIT listing area with no faults displayed. If the particular IBIT is an interactive test, or the test has a crew or advisory prompt, the **ABORT** selection will also return the operator to the IBIT listing area without any faults displayed.

d. IBIT Acknowledge (ACK). The IBIT **ACK** momentary option button (B5) is presented when an IBIT is in progress and an interactive page is displayed. The **ACK** button is used to acknowledge that the operator read and understood a warning or advisory message, or performed the steps listed. When the **ACK** is selected, either the next interactive page will be presented, or the IBIT listing area will be presented with any faults displayed. This button is only used for IBIT that require operator interaction.

h. ACFT/COMM. The **ACFT/COMM** grouped option button provides the selections for IBIT test within the aircraft and communications subsystems.

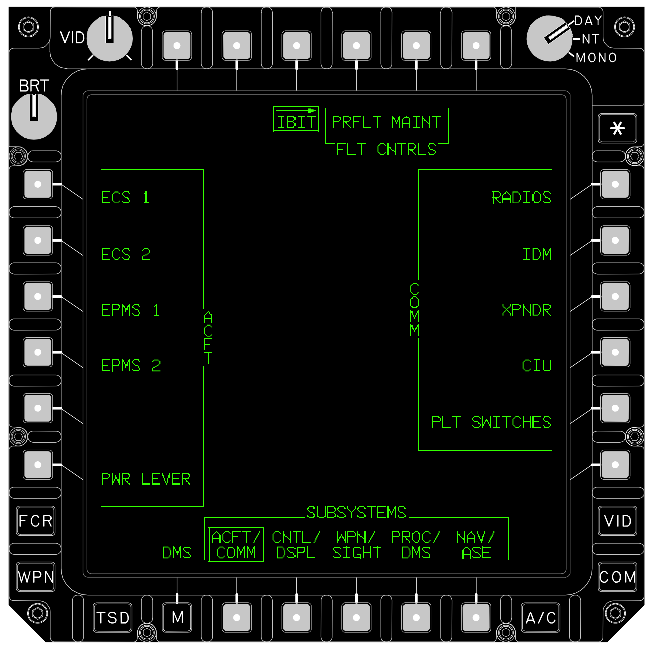


Figure 2-119. ACFT/COMM Page - Pilot

The following unique selections are available on the **ACFT/COMM** format (fig 2-119):

- T4 **FLT CNTRLS PRFLT** button
- T5 **FLT CNTRLS MAINT** button
- L1 **ACFT ECS1** button
- L2 **ACFT ECS2** button
- L3 **ACFT EPMS1** button
- L4 **ACFT EPMS2** button
- L6 **ACFT PWR LEVER** button
- R1 **COMM RADIOS** button
- R2 **COMM IDM** button
- R3 **COMM XPNDR** button
- R4 **COMM CIU** button
- R5 **COMM PLT (or CPG) SWITCHES** button

2.131.1 COMM RADIOS. The **COMM RADIOS** grouped option button (fig 2-120) provides the selections for the individual IBIT for the radios.

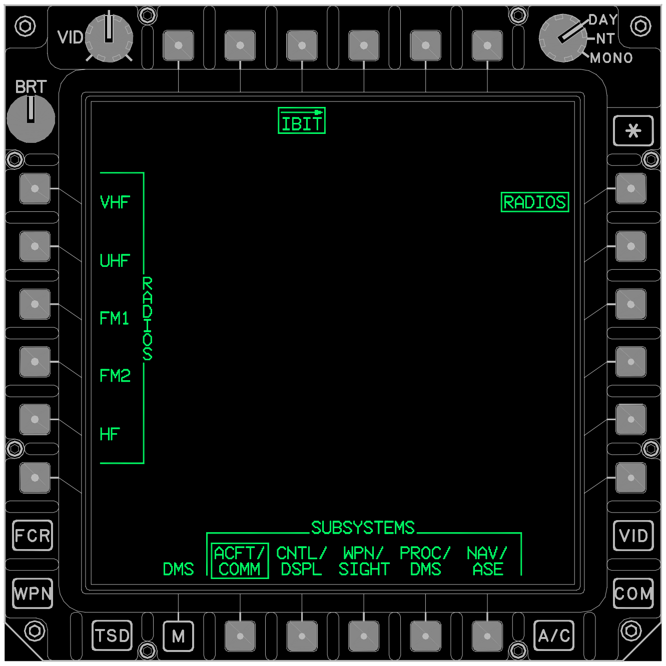


Figure 2-120. COMM RADIOS Page

The following unique selections are available on the **COMM RADIOS** format:

- L1 **RADIOS VHF** button
- L2 **RADIOS UHF** button
- L3 **RADIOS FM 1** button
- L4 **RADIOS FM 2** button
- L5 **RADIOS HF** button

2.131.2 CNTL/DSPL. The **CNTL/DSPL** (controls and displays) grouped option button will provide the selections for the IBIT for the aircraft controls and displays subsystems.

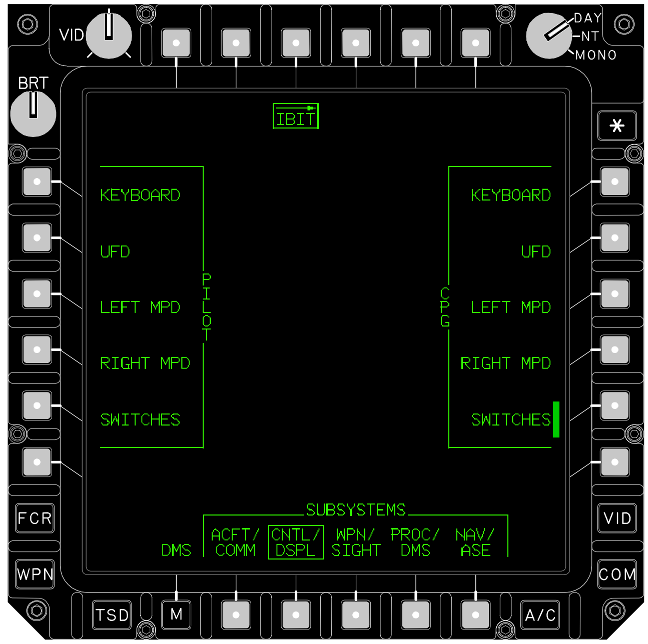


Figure 2-121. CNTL/DSPL Format

The following unique selections are available on the **CNTL/DSPL** format (fig 2-121):

- L1 **PILOT KEYBOARD** button
- L2 **PILOT UFD/EUFD** button
- L3 **PILOT LEFT MPD** button
- L4 **PILOT RIGHT MPD** button
- L5 **PILOT SWITCHES** button
- R1 **CPG KEYBOARD** button
- R2 **CPG UFD** button
- R3 **CPG LEFT MPD** button
- R4 **CPG RIGHT MPD** button
- R5 **CPG SWITCHES** button

2.131.3 PROC/DMS. The **PROC/DMS** (processors and DMS) grouped option button will provide the selections for the IBIT for the processors and Data Management Subsystems (fig 2-122).

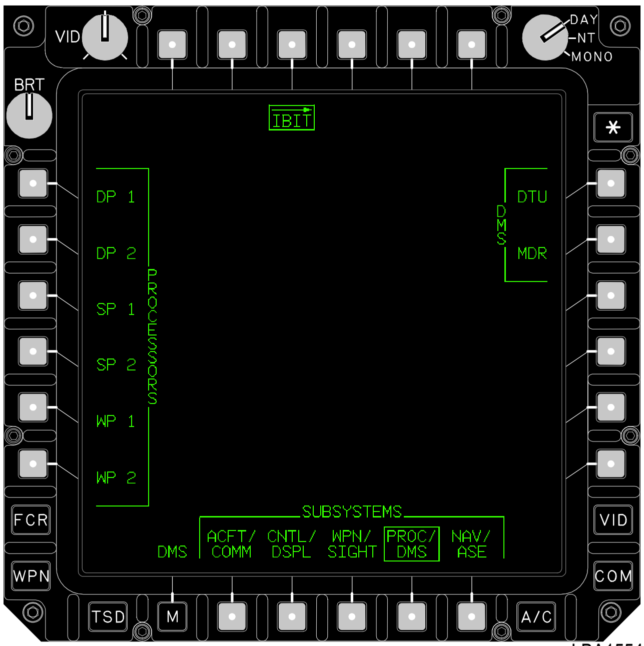


Figure 2-122. PROC/DMS Format

The following unique selections are available on the **PROC/DMS** format:

- L1 **PROCESSORS DP1** button
- L2 **PROCESSORS DP2** button
- L3 **PROCESSORS SP1** button
- L4 **PROCESSORS SP2** button
- L5 **PROCESSORS WP1** button
- L6 **PROCESSORS WP2** button
- R1 **DMS DTU** button
- R2 **DMS MDR** button

2.131.4 NAV/ASE. The **NAV/ASE** (navigation and aircraft survivability equipment) grouped option button (fig 2-123) provides the selections for the IBIT within the navigation and ASE subsystems.

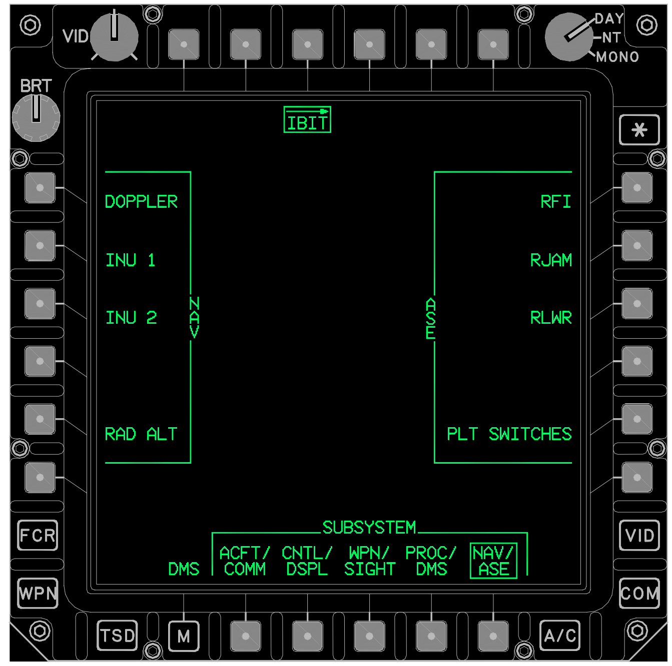


Figure 2-123. NAV/ASE Format - Pilot Crew Station

The following selections are available from the **NAV/ASE** format:

- L1 **NAV DOPPLER** button
- L2 **NAV INU 1** button
- L3 **NAV INU 2** button
- L5 **NAV RAD ALT** button
- R1 **ASE RFI** button
- R2 **ASE RJAM** button
- R3 **ASE RLWR** button
- R5 **ASE PLT** (or **CPG**) **SWITCHES** button

2.131A [BLK 2 SHUTDOWN PAGE]

The **SHUTDOWN** page (fig 2-124) is available on the **DMS**, **FAULT**, **VERS**, and **DMS UTIL** pages. The **SHUTDOWN** page is used to access aircraft subsystem shutdown controls.

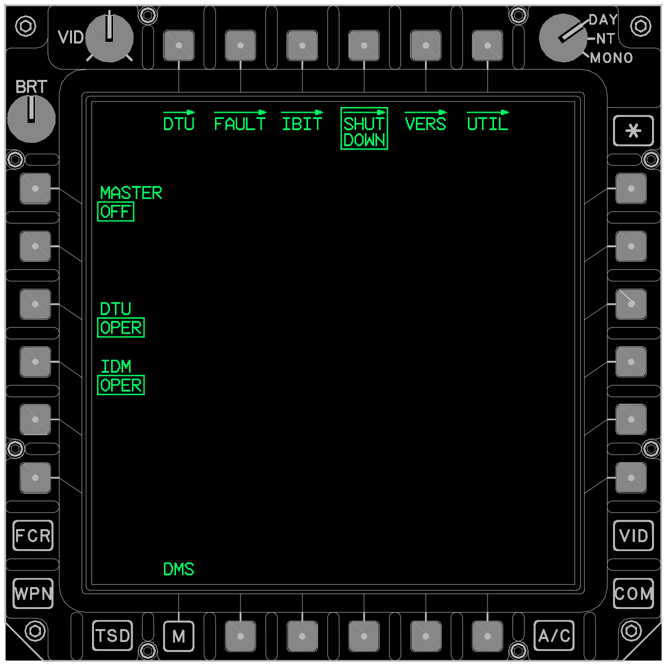


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Figure 2-124. SHUTDOWN PAGE

The following unique selections are available on the **SHUTDOWN** page:

- L1 **MASTER OFF** button.
- L2 **FCR** button.
- L3 **TADS** button.
- L4 **PNVS** button.
- R5 **MODE 4 HOLD** button
- R6 **IDM** button.
- B3 **DTU** button.

2.131A.1 MASTER OFF button. The **MASTER OFF** button is used to shutdown aircraft systems. Selecting the **MASTER OFF** button will set the FCR, TADS, and PNVS to off. In addition, it will set the DTU and IDM to STBY. The **MODE 4 HOLD** button and Stabilator symbol are not affected by this selection.

2.131A.2 FCR button. The **FCR** button enables disables the FCR.

2.131A.3 TADS button. The **TADS** button enables and disables the TADS.

2.131A.4 PNVS button. The **PNVS** button enables and disables the PNVS.

2.131A.5 MODE 4 HOLD button. Selecting the **MODE 4 HOLD** button prevents erasure of the Mode 4 Codes in the Kit-1C computer when the aircraft is on the ground and power is removed from the **XPNDR** system. The codes will be lost if power is removed for more than 20 seconds. The button will be displayed with a barrier when the aircraft is in the air. Following a selection, if the aircraft transitions to an 'in-air' state for more than 60 seconds, the hold selection will be reset. Once on the ground, it will be necessary to again select the **MODE 4 HOLD** button to retain the codes. The **MODE 4 HOLD** button is not displayed if the Kit-1C computer is not installed

2.131A.6 IDM button. The **IDM** button permits the operator to toggle between standby and operate. The IDM is initialized to **STBY** when the aircraft is powered up. When a COM upload is commanded which contains IDM configuration data (such as MASTER LOAD, IDM CONFIG, COM ALL, etc.), the IDM will automatically mode to **OPER**. When the IDM is in **STBY**, digital messages cannot be transmitted or received. The IDM must be set to **STBY** before removing power from the IDM. When in **STBY**, an **IDM IN STANDBY** advisory will be displayed on the **COM** page and UFD/EUFD. Failure to set the IDM to STBY could corrupt the IDM'S software.

2.131A.7 DTU button. The **DTU** button is used to place the DTU in the standby mode prior to aircraft shutdown. The **DTU** button toggles between STBY and OPER. The DTU is set to OPER at aircraft start up. The DTU must be set to STBY prior to removing power from the DTU. Failure to set the DTU to STBY could corrupt the DTC.

2.131A.8 Stabilator. The stabilator position is provided to the aircrew by the stabilator symbol and functions as described on page 2-102. It is displayed on the **SHUTDOWN** page for access during shutdown.

2.132 VERSION (VERS) PAGE

The **VERS** page ([**BLK 1** fig 2-125], [**BLK 2** fig 2-125A]) is available on the **DMS** page, **FAULT** page, [**BLK 2** **SHUTDOWN** page], DMS **UTIL** page, and **WCA** page. The **VERS** page button will be the means of accessing to the software **VERS** page. The **VERS** page provides a listing of all the software versions currently used by the systems to the operator. [**BLK 2** The **VERS** page is organized into subsystems similar to the IBIT page. the default page is the **PROC/DMS** page.]

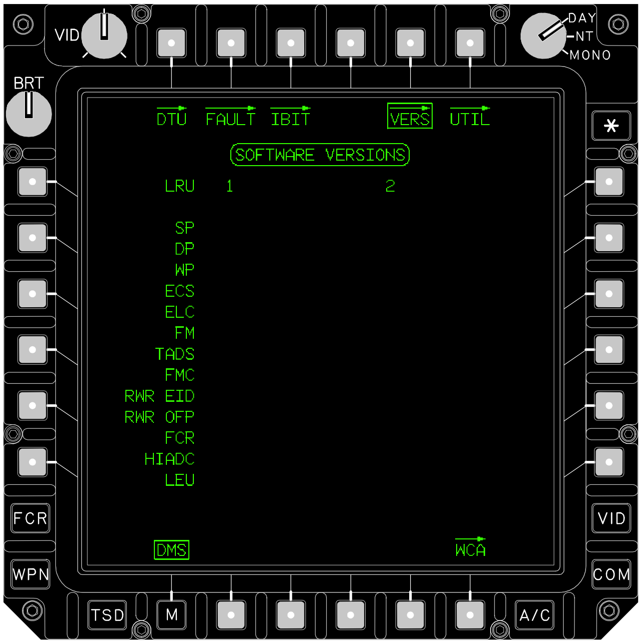

Figure 2-125. [BLK 1 Version (VERS) Page]

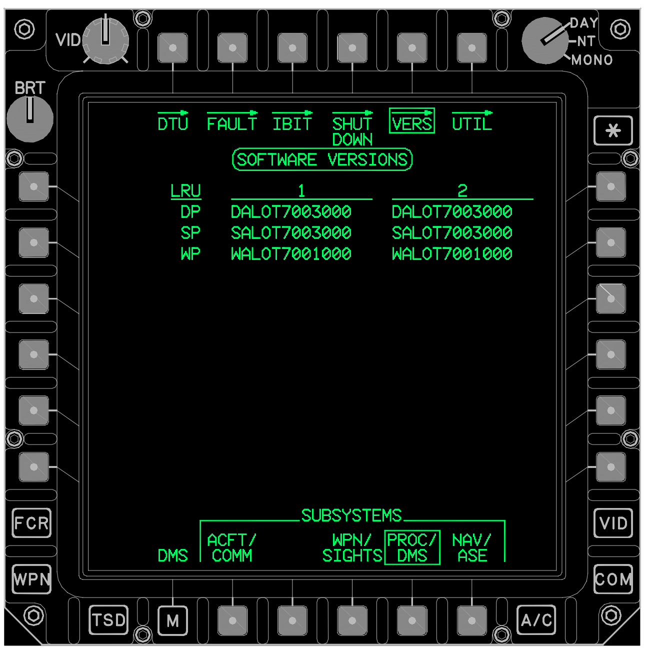

Figure 2-125A. [BLK 2 Version (VERS) Page]

The following unique selection is available on the VERS page:

- B2 - B6 [BLK 2 **SUBSYSTEMS** buttons]

2.133 DMS UTILITY (UTIL) PAGE

The DMS **UTIL** button is displayed on the **DMS**, **FAULT**, [BLK 2 **SHUTDOWN**], **VERS** and **WCA** pages. The DMS **UTIL** page provides the means of accessing the various DMS utility functions ([BLK 1 fig 2-126], [BLK 2 fig 2-126A]). On the left, the DMS **UTIL** page provides all the **BORESIGHT** page functions along with some maintenance operational functions. Maintenance operators are provided with a means of DP, WP and Highly Integrated Air Data Computer (HIADC) soft switch selection capability for fault isolation purposes. These are noted by the **DP SELECT**, **WP SELECT**, and **HIADC SELECT** functions. On the right, the DMS **UTIL** page provides the current local or Zulu time, system time, current date, aircraft tail number and CPG autopage disable function of the aircraft systems Engine page. The **FTEST** page, **TEST** page, and **ECS** functions are accessible at the bottom of the DMS **UTIL** page.

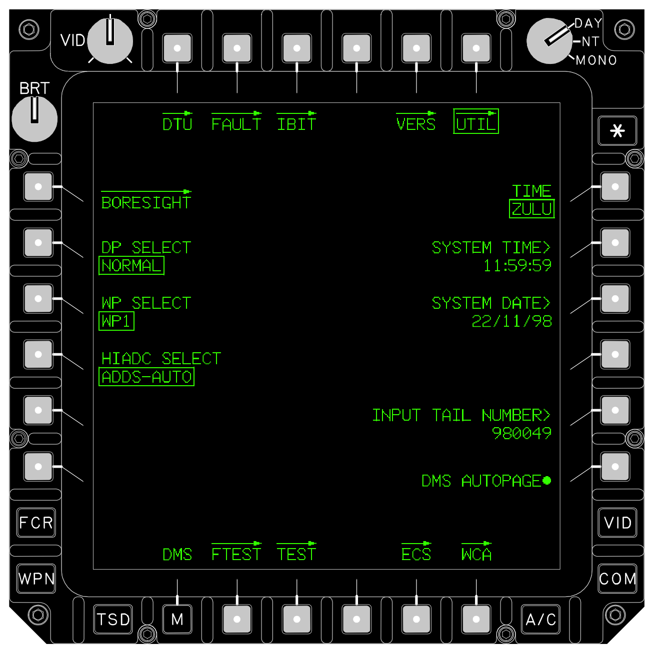

Figure 2-126. [BLK 1 DMS UTIL Page]

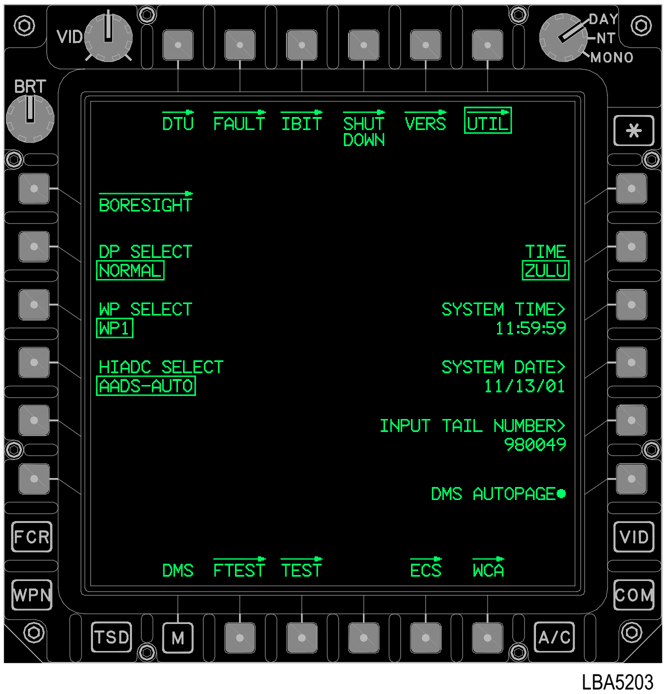

Figure 2-126A. [**BLK 2** DMS **UTIL** Page]

The following unique selections are available on the DMS **UTIL** page:

- L1 **BORESIGHT** page button
- L2 **DP SELECT** button
- L3 **WP SELECT** button
- L4 **HIADC SELECT** button
- R1 [**BLK 1** **TIME (LOCAL/ZULU)** button]
- R2 [**BLK 2** **TIME (LOCAL/ZULU)** button]
- R2 [**BLK 1** **SYSTEM TIME** button]
- R3 [**BLK 2** **SYSTEM TIME** button]
- R3 [**BLK 1** **SYSTEM DATE** button]
- R4 [**BLK 2** **SYSTEM DATE** button]
- R5 **INPUT TAIL NUMBER** button
- R6 **DMS AUTOPAGE** On/Off button (CPG only)
- B2 **FTEST** page button
- B3 **TEST** page button
- B5 **ECS** page button

2.133.1 BORESIGHT. The **BORESIGHT** Page (L1) provides the means for conducting CBHK procedures and boresighting the TADS, PNVS, Pylons, Gun, INU1, INU2, Doppler, Highly Integrated Air Data Computer (HIADC), Gun Dynamic Harmonization, and Blade Positioning Synchronization (BPS) with the Fire Control Radar, and the Tactical Engagement Simulation System (TESS) as part of the TADS and Gun boresight options.

2.133.2 DP SELECT. The **DP SELECT** multi-state button provides the means for the maintenance operator to select between DP Normal, DP1 Single or DP2 Single Operation. These selections are for ground maintenance fault isolation purposes only, and are not selectable when the aircraft is in the air.

2.133.3 WP SELECT. The **WP SELECT** multi-state button provides the means for the maintenance operator to select between WP1 Single or WP2 Single Operation. These selections are for ground maintenance fault isolation purposes only, and are not selectable when the aircraft is in the air.

2.133.4 HIADC SELECT. The **HIADC SELECT** multi-state button provides the means for the maintenance operator to select the Airspeed And Direction Sensor (AADS) between AADS-AUTO, AADS-LH, or AADS-RH Operation. These selections are for ground maintenance fault isolation purposes only, and are not selectable when the aircraft is in the air or the power levers are not **OFF**.

2.133.5 TIME. The DMS **TIME** two-state button sets the display mode of time to LOCAL or ZULU. An **L** or **Z** appears on the UFD/EUFD to designate either local or Zulu time.

2.133.6 SYSTEM TIME. The DMS **SYSTEM TIME** button allows the operator to input current local or Zulu time, depending on the DMS **TIME** two-state button setting. The DMS system time will also be found in the lower right-hand corner of the UFD/EUFD.

2.133.7 SYSTEM DATE. The DMS **SYSTEM DATE** button allows the operator to input the current date. The current date can be input through the keyboard unit (KU). The KU is enabled when the operator selects the DMS **SYSTEM DATE** button.

2.133.8 INPUT TAIL NUMBER. The DMS **INPUT TAIL NUMBER** button allows the operator to input the aircraft tail number into the SP. The KU is enabled when the DMS **INPUT TAIL NUMBER** button is selected. The 6 digit number is displayed in the bottom mode portion of the button position after the user completes the input.

2.133.9 DMS AUTOPAGE. The **DMS AUTOPAGE** on/off button allows the CPG to disable automatic paging of warning indications on the **ENG** page in the CPG crew station. The default state for DMS **AUTO** on/off button will be on.

CAUTION

The FTEST/ETEST page button is designed for engineering use only. System damage may occur if used by unauthorized personnel.

2.133.10 FTEST/ETEST. The **FTEST** page button allows the engineering maintenance operator to perform test functions on the Fire Control Radar (FCR). The **ETEST** (engineering test) page provides access to three test formats which allows the engineering maintenance operator to perform test functions.

2.133.11 TEST. The **TEST** page button allows the maintenance operator to access the read memory location (address) functions for the DP, SP, WP and Hellfire Missiles. When any of these test modes are tested, a memory location listing area is provided where hexadecimal information is provided for the test being run.

2.133.12 ECS. The **ECS** page provides a means of displaying the current Environmental Control System variables affecting each crewstation, ECS components and EFABs.

2.134 WARNING/CAUTION/ADVISORY (WCA) PAGE

The **WCA** button is available on the **DMS**, **FAULT**, **VERS**, **ENG**, and **DMS UTIL** page. The **WCA** page button is the means of accessing the **WCA** page. The **WCA** page (fig 2-127) provides the operators with the total listings of current and past Warnings, Cautions, and Advisories. The **WCA** page **W/C/A HISTORY** area is capable of listing up to 128 W/C/A messages which can be up to 18 characters long, in 2 columns, on 5 pages. W/C/As are listed in order of occurrence with the most recent occurrence given at the top of the left column on page 1, wrapping around to the top of the right column, and then to page 2 left column. New W/C/A messages are displayed in inverse video to distinguish them from those W/C/A messages which occurred since the last time the operator selected the **WCA RESET** function.

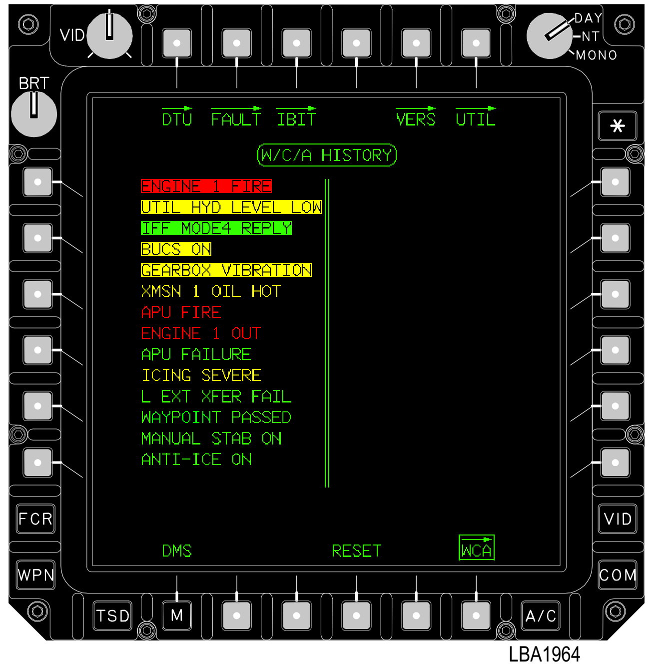

Figure 2-127. WCA Page

The following selections are available on the **WCA** page:

- B2 **PAGE** button
- B3 **PAGE** button
- B4 **RESET** button

2.134.1 PAGE. The WCA **PAGE** List buttons (B2 & B3) allow the operator to select the next page when the **WCA LISTING AREA** contains 30 or more W/C/As. The last message on page 1 shall be the first message on page 2. This same approach will occur for additional pages if applicable.

2.134.2 RESET. The WCA **RESET** momentary button is used to acknowledge that the operator has seen the W/C/A messages that have occurred since the last time the WCA **RESET** momentary option button was selected. These messages will then remain listed in inverse video until the operator selects **WCA RESET** or when the system is powered down. Upon selecting the WCA **RESET** momentary button, the inverse video of the new W/C/A messages is removed. Once a WCA has been acknowledged, if the condition reccurs, the message will not be displayed as inverse video.

2.135 WCA OPERATIONS

NOTE

The crewstation lighting is partially compatible with the AN/AVS-6 goggles. Illumination of the Master Caution Light may degrade NVG operations.

The warning/caution/advisory (WCA) system provides the crewmembers with the status of all warnings, cautions, and advisories via a master warning lighted pushbutton, a master caution lighted pushbutton, the fire detect and extinguish panel, UFD/EUFD messages, MPD messages, voice messages for warnings, and audio tones for cautions and advisories. The WCA system definition relates to aircraft systems and not threat/survivability information. The basis for this distinction is the difference in the desired response between a WCA message and a threat warning. The WCA messages indicate the need to take note of system malfunctions and take corrective action if possible, while threat warnings do not indicate this same need. Mission equipment related messages may be displayed on the optical relay tube (ORT) and IHADSS as required. The following paragraphs define and describe WCA system operations.

2.135.1 Warning Operations. A warning indicates the existence of a hazardous condition requiring immediate corrective action. Warning conditions are indicated by the **MSTR WARN** lighted pushbutton, the UFD/EUFD message in the warning display area, voice messages, and MPD format displays. For the engine and auxiliary power unit (APU) fire conditions, the fire detect/extinguish panel provides operator indications. Section XVII, Table 2-13 lists all warning messages and associated descriptions. The associated emergency procedures for these warnings are established in Chapter 9.

a. MSTR WARN Lighted Button. The **MSTR WARN** lighted button (fig 2-128) alerts crewmembers to observe a warning message displayed on the UFD/EUFD and announced by the voice message system. The **MSTR WARN** lighted button will flash “MSTR WARN” in NVIS yellow at a 4Hz rate when a warning is detected. When one crewmember depresses the flashing **MSTR WARN** button, the voice message will be extinguished in both crew stations. However, each crewmember is required to depress the **MSTR WARN** lighted button in their respective crew station to acknowledge the warning condition, and turn off the indicator light.

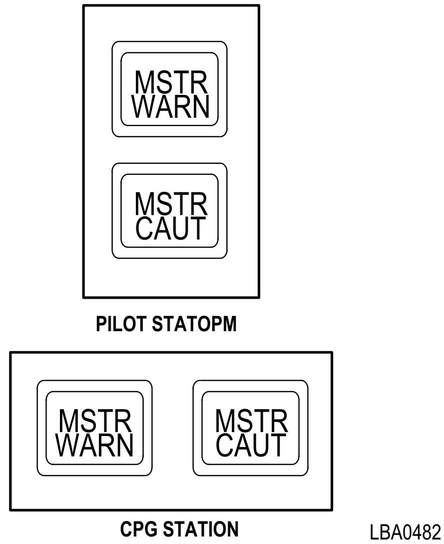

Figure 2-128. Master Warning/Master Caution Lighted Buttons

b. UFD/EUFD. Warnings are displayed in the top left area of the UFD/EUFD (fig 2-129 and 2-130). The UFD/EUFD is capable of displaying up to a maximum of [BLK 1 five] [BLK 2 seven] warning messages simultaneously with up to 18 characters per message. Any previous warning messages that have not been corrected will move down one line to allow the current message to be displayed on the top line. When a condition is corrected, the warning message will be removed from the UFD/EUFD. The format of a UFD/EUFD warning message is general heading first, specific location or subsystem next, then the nature of the emergency. As an example, in the Engine 1 Out warning message (fig. 2-129), the general heading is **ENG**, the specific location is **1**, and the nature of the emergency is **OUT**.

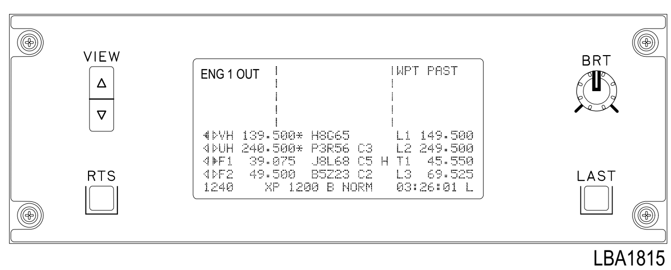

Figure 2-129. Up Front Display (UFD)

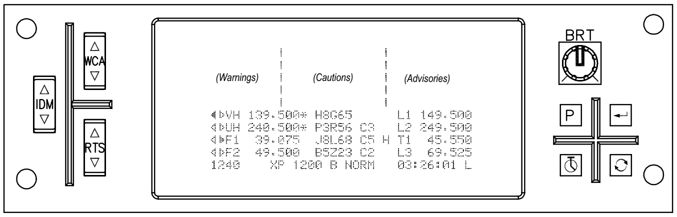

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Figure 2-130. Enhanced Up Front Display (EUFD)

c. Voice Messages. Warning annunciations are accompanied by a voice message given through the aircrew headset. Verbiage of the voice messages are listed in Table 2-13. A message is repeated until it is no longer active or the operator acknowledges the message by depressing the **MSTR WARN** lighted button. At that time, if the voice message has been given at least once, it will be silenced. If the voice message has not been given once, it will be completed before the voice is stopped. Warning messages are given in the time of occurrence order. If more than one warning occurs, they will alternate. A single acknowledgement of the **MSTR WARN** lighted button will extinguish multiple voice messages, provided that each has been output through the headset once.

d. MPD. For warnings, the current MPD display will automatically change to the **ENG** In-Flight page with the information needed by the operator to quickly assess the situation and take corrective action. For warnings, emergency procedures are given on the **ENG** In-Flight page if they have been loaded from the DTC, except for **HIGH RTR** and **ENG CHOP**.

2.135.2 Caution Operations. A caution indicates the existence of an impending dangerous condition requiring attention but not necessarily immediate action. Caution conditions are indicated by the **MSTR CAUT** lighted button, the UFD/EUFD caution display area, and a caution tone. Caution indications for mission equipment may also be given on the ORT or IHADSS. Caution conditions are indicated by the **MSTR CAUT** lighted button (fig 2-128), the UFD/EUFD caution display area, and a caution tone. Chapter 9 lists all cautions and associated corrective actions. Table 2-14 lists all caution messages and associated descriptions.

a. MSTR CAUT Lighted Button. The **MSTR CAUT** lighted button alerts crewmembers to observe a condition displayed on the UFD/EUFD caution display area. The **MSTR CAUT** lighted button will illuminate steadily in NVIS Green B when a caution condition is detected. The crewmember depresses the **MSTR CAUT** lighted button to acknowledge the caution. Each crewmember will be required to acknowledge the **MSTR CAUT** in his crew station.

b. UFD/EUFD. Caution messages are displayed in the center area of the display. When a caution occurs, it will be displayed on the top line of the UFD/EUFD. The message length for cautions is limited to 18 characters. When a caution condition is detected, the new caution message will be displayed on the top line of the caution display section of the UFD/EUFD. If more than [BLK 1 five] [BLK 2 seven] caution messages have been detected, a DOWN arrow will be displayed to the left of the last message displayed. The operator may then use the **VIEW** rocker switch at the upper left corner of the UFD/EUFD to scroll the display to additional messages. Messages on the top line will shift off the display and the next [BLK 1 five] [BLK 2 seven] messages will be displayed in the viewing area. The list will continue to move in this manner if the **VIEW** switch is held down continuously for more than 2 seconds. When the end of the list is reached, the list will stop moving. If the operator presses the **VIEW** switch twice quickly, the top of the list will be displayed.

c. MPD. Cautions and warnings are listed in the lower portion of the **ENG** page in a time sequenced list. Cautions (like warnings) will remain on the MPD list until the situation is corrected.

d. Caution Tones. A caution tone consisting of a concurrent low then high frequency tone will sound for 1.5 seconds upon detection of a caution. The tone will repeat every 10 seconds until the operator acknowledges the caution or the situation is corrected. When the operator acknowledges the caution by depressing the illuminated **MSTR CAUT** button, the tone will stop.

2.135.3 Advisory Operations. An advisory indicates safe or normal configuration, condition, or performance, operation of essential equipment, or attracts attention and imparts information for routine action. Advisory conditions are indicated by a message in the UFD/EUFD advisory display area. Some advisory tones also play an associated tone or voice message. Table 2-15 lists all advisory messages and associated descriptions. Chapter 9 lists advisories and associated corrective actions if required.

a. UFD/EUFD. Advisory message length is limited to 18 characters. When an advisory occurs, it will be added to the advisory listing on the UFD/EUFD. If more than [BLK 1 five] [BLK 2 seven] advisory messages have been detected, a DOWN arrow will be displayed to the left of the last message displayed. The crewmember may then use the **VIEW** rocker switch at the upper left corner of the UFD/EUFD to scroll the display to additional messages. Messages on the top line will shift off the display and the next [BLK 1 five] [BLK 2 seven] messages will be displayed in the viewing area. The list will continue to move in this manner if the **VIEW** switch is held down continuously for more than 2 seconds. When the end of the list is reached, the list will stop moving. If the operator presses the **VIEW** switch twice quickly, the top of the list will be displayed.

b. MPD. Advisory messages are displayed on the DMS Page and the WCA Page. The advisories are listed in order of occurrence with the most recent indication being given on the top of the list. If more than one page of data is available for display, **PAGE** buttons shall be displayed at the bottom bezel buttons (B2 and B3) and scroll both columns of the display at the same time. The dividing lines are drawn at all times on these formats.

c. Flight Controls Tone. The tone for advisories currently used is a single mid-range frequency flight controls tone. The tone is given once and will stop without any interaction required by crewmembers.

d. IDM Tone. A series of mid-range frequency tones sounding similar to a ringing phone.

e. Voice Messages. Voice messages are played through the aircrew headset. The voice message is given once and will stop without any interaction required by the crew members.

2.136 DMS DEDICATED PANELS

2.136.1 FIRE Detection/Extinguish (DET/EXTG) Panel. Description and operation of the **FIRE DET/EXTG** panel is in Section II of this chapter

2.136.2 ZEROIZE Switch. Description and operation of the **ZEROIZE** switch is in Chapter 3, Section II.

2.136.3 PROCESSOR SELECT Panel. The **PROCESSOR SELECT** panel (fig 2-128) gives the CPG lighted feedback regarding which system processor is currently acting as the primary. In addition, it provides a hard switch for manual override to switch processors if the crewmembers determine this is necessary. If the switch is placed in any position but **AUTO**, the system processors lose their automatic switching capability. If the switch is not in the **AUTO** position, the secondary SP cannot provide internal health status updates to the primary SP.

NOTE

If crewmember manually selects **SP1** or **SP2** and the selected SP fails, the unselected SP will not automatically become primary. The switch must be manually placed back into the **AUTO** position (to allow automatic selection of the healthiest SP) or into the other SP position (to force a switchover to the other SP).

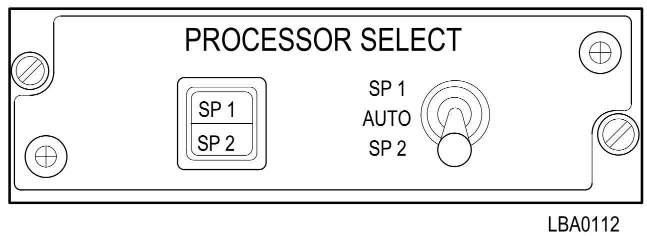


Figure 2-128. PROCESSOR SELECT Panel

Section XVII. WARNING/CAUTION/ADVISORY MESSAGES

2.137 WARNING MESSAGES

Warning messages are presented to crewmembers via the UFD/EUFD and MPD Page formats. A listing of warnings, cause for the warning, and applicable voice warning is presented in table 2-13.

Table 2-13. Warning Messages

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	VOICE MESSAGE
[BLK 1 ENG CHOP] **[BLK 2 ENGINE CHOP]**	Engine chop function has been activated.	**ENGINE CHOP**	Engine chop.
	Optical flame detectors in engine 1 have detected a fire.	**ENGINE 1 FIRE**	Engine one fire.
[BLK 1 ENG1 OUT] **[BLK 2 ENGINE 1 OUT]**	Engines were running and E1 N_G < 63% (throttle not in OFF), or E1 N_P < 94% (throttle in **FLY**, TORQUE < 28%).	**ENGINE 1 OUT**	Engine one out.
[BLK 1 ENG2 OUT] **[BLK 2 ENGINE 2 OUT]**	Engines were running and E2 N_G < 63% (throttle not in OFF), or E2 N_P < 94% (throttle in FLY, TORQUE < 28%).	**ENGINE 2 OUT**	Engine two out.
[BLK 1 ENG1 OVSP] **[BLK 2 ENGINE 1 OVERSPEED]**	E1 N_P > 114% and E1 N_G > 52%.	**ENGINE 1 OVERSPEED**	Engine one overspeed.
	Optical flame detectors in engine 2 have detected a fire.	**ENGINE 2 FIRE**	Engine two fire.
[BLK 1 ENG2 OVSP] **[BLK 2 ENGINE 2 OVERSPEED]**	E2 N_P > 114% and E2 N_G > 52%.	**ENGINE 2 OVERSPEED**	Engine two overspeed.
	Optical flame detectors in the APU have detected a fire.	**APU FIRE**	APU fire.
[BLK 1 HIGH RTR] **[BLK 2 HIGH ROTOR RPM]**	N_R > 105%.	**HIGH ROTOR RPM**	Rotor RPM high.

Table 2-13. Warning Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	VOICE MESSAGE
[BLK 1 LOW RTR] **[BLK 2 LOW ROTOR RPM]**	N_R < 95%.	**LOW ROTOR RPM**	Rotor RPM low.
[BLK 1 DECK FIRE] **[BLK 2 AFT DECK FIRE]**	Overheat detectors in the aft deck have detected a fire.	**AFT DECK FIRE**	Aft deck fire.
[BLK 1 HYD FAIL] **[BLK 2 HYDRAULIC FAIL]**	Pri and Util hydraulic PSI is < 1250.	**[BLK 1 HYD FAILURE]** **[BLK 2 HYDRAULIC FAIL]**	Hydraulic failure.
[BLK 1 TAIL RTR] **[BLK 2 TAIL ROTOR HYD]**	Pri hydraulic PSI is < 1250 and Util hydraulic level is detected as low.	**TAIL ROTOR HYD**	Tail rotor hydraulic failure.

2.138 CAUTION MESSAGES

Caution messages are presented to crewmembers via the UFD/EUFD and MPD Page formats. A listing of Cautions, and cause for the Caution and Caution tone, is presented in Table 2-14.

Table 2-14. Caution Messages

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	CAUTION TONE
[BLK 1 ENG1 CHIPS] [BLK 2 ENGINE 1 CHIPS]	Metallic chips have been detected in engine 1.	**ENGINE 1 CHIPS**	YES
[BLK 1 ENG2 CHIPS] [BLK 2 ENGINE 2 CHIPS]	Metallic chips have been detected in engine 2.	**ENGINE 2 CHIPS**	YES
[BLK 1 ENG1 FUEL PSI] [BLK 2 ENGINE 1 FUEL PSI LOW]	Engine 1 fuel psi has been detected < 8 psi.	**[BLK 1 ENG 1 FUEL PSI LOW] [BLK 2 ENGINE 1 FUEL PSI LOW]**	YES
[BLK 1 ENG2 FUEL PSI] [BLK 2 ENGINE 2 FUEL PSI LOW]	Engine 2 fuel psi has been detected < 8 psi.	**[BLK 1 ENG 2 FUEL PSI LOW] [BLK 2 ENGINE 2 FUEL PSI LOW]**	YES
[BLK 1 ENG1 OIL PSI] [BLK 2 ENGINE 1 OIL PSI LOW]	Engine 1 oil psi has been detected <23psi.	**[BLK 1 ENG 1 OIL PSI LOW] [BLK 2 ENGINE 1 OIL PSI LOW]**	YES
[BLK 1 ENG2 OIL PSI] [BLK 2 ENGINE 2 OIL PSI LOW]	Engine 2 oil psi has been detected <23psi.	**[BLK 1 ENG 2 OIL PSI LOW] [BLK 2 ENGINE 2 OIL PSI LOW]**	YES
[BLK 1 OIL 1 BYPASS] [BLK 2 ENG 1 OIL BYPASS]	Engine 1 oil filter is bypass condition, positive engine 1 run status, Message displayed at 60-80 psid; impending bypass (no message) at 44-60 psid.	**ENG 1 OIL BYPASS**	YES
[BLK 1 OIL 2 BYPASS] [BLK 2 ENG 2 OIL BYPASS]	Engine 2 oil filter is bypass condition, positive engine 2 run status, Message displayed at 60-80 psid; impending bypass (no message) at 44-60 psid.	**ENG 2 OIL BYPASS**	YES
APU ON	APU is ON, aircraft is in the air.	**APU ON**	YES
[BLK 1 ACC OIL PSI] [BLK 2 ACC OIL PSI LOW]	Accessory pump oil psi has been detected as < 28 ± 2 psi; N_R > 10%.	**ACC OIL PSI LOW**	YES
[BLK 1 GRBX TEMP] [BLK 2 GEARBOX TEMP HIGH]	Intermediate or T/R gearbox temperature has been detected as hot by the thermal alarm unit (285 ± 5° F).	**GEARBOX TEMP HIGH**	YES
[BLK 1 GRBX VIB] [BLK 2 GEARBOX VIBRATION]	Intermediate or T/R gearbox has been detected with excessive vibrations.	**GEARBOX VIBRATION**	YES
[BLK 1 GRBX1 CHIPS] [BLK 2 GEARBOX 1 CHIPS]	Metallic chips have been detected in NGB 1.	**GEARBOX 1 CHIPS**	YES

Table 2-14. Caution Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	CAUTION TONE
[BLK 1 GRBX2 CHIPS] [BLK 2 GEARBOX 2 CHIPS]	Metallic chips have been detected in NGB 2.	**GEARBOX 2 CHIPS**	YES
[BLK 1 GRBX1 OIL HOT] [BLK 2 GEARBOX 1 OIL HOT]	NGB 1 oil temperature has been detected as hot by the thermal sensing switch (140 ± 5.5°C).	**GEARBOX 1 OIL HOT**	YES
[BLK 1 GRBX2 OIL HOT] [BLK 2 GEARBOX 2 OIL HOT]	NGB 2 oil temperature has been detected as hot by the thermal sensing switch (140 ± 5.5°C).	**GEARBOX 2 OIL HOT**	YES
[BLK 1 GRBX1 OIL PSI] [BLK 2 GRBX 1 OIL PSI LOW]	NGB 1 oil psi has been detected < 28 ± 2 psi; (N_R > 65%, N_G > 52%) for 30 seconds.	**GRBX 1 OIL PSI LOW**	YES
[BLK 1 GRBX2 OIL PSI] [BLK 2 GRBX 2 OIL PSI LOW]	NGB 2 oil psi has been detected < 28 ± 2 psi; (N_R > 65%, N_G > 52%) for 30 seconds.	**GRBX 2 OIL PSI LOW**	YES
[BLK 1 XMSN CHIPS] [BLK 2 MAIN XMSN CHIPS]	Metallic chips have been detected in XMSN.	**MAIN XMSN CHIPS**	YES
[BLK 1 XMSN1 OIL HOT] [BLK 2 XMSN 1 OIL HOT]	MN XMSN1 oil temperature has been detected as hot by the thermal sensing switch (140 ± 5.5°C).	**XMSN 1 OIL HOT**	YES
[BLK 1 XMSN2 OIL HOT] [BLK 2 XMSN 2 OIL HOT]	MN XMSN2 oil temperature has been detected as hot by the thermal sensing switch (140 ± 5.5°C).	**XMSN 2 OIL HOT**	YES
[BLK 1 XMSN1 OIL PSI] [BLK 2 XMSN 1 OIL PSI LOW]	MN XMSN1 oil psi has been detected <28 ± 2psi; (N_R > 65%, N_G > 52% for 30 seconds.	**XMSN 1 OIL PSI LOW**	YES
[BLK 1 XMSN2 OIL PSI] [BLK 2 XMSN 2 OIL PSI LOW]	MN XMSN2 oil psi has been detected <28 ± 2psi; (N_R > 65%, N_G > 52% for 30 seconds	**XMSN 2 OIL PSI LOW**	YES
[BLK 1 GEN1 FAIL] [BLK 2 GENERATOR 1 FAIL]	Generator 1 detected as failed.	**GENERATOR 1 FAIL**	YES
[BLK 1 GEN2 FAIL] [BLK 2 GENERATOR 2 FAIL]	Generator 2 detected as failed.	**GENERATOR 2 FAIL**	YES
[BLK 1 BOOST PUMP] [BLK 2 BOOST PUMP FAIL]	Boost pump was commanded ON and has been detected as being OFF.	**[BLK 1 BOOST PUMP FAILURE] [BLK 2 BOOST PUMP FAIL]**	YES
[BLK 1 FUEL XFER] [BLK 2 FUEL XFER FAIL]	At least one of the following has been detected as failed: 1) Forward cell fuel shutoff valve; 2) Aft cell fuel shutoff valve; 3) transfer air valve; or 4) transfer fuel pump.	**[BLK 1 FUEL XFER FAILURE] [BLK 2 FUEL XFER FAIL]**	YES

Table 2-14. Caution Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	CAUTION TONE
[BLK 1 FWD FUEL LOW] [BLK 2 FORWARD FUEL LOW]	FWD fuel cell level less than 240 lbs or low level switch activation.	**FORWARD FUEL LOW**	YES
AFT FUEL LOW	AFT fuel cell level less than 260 lbs or low level switch activation.	**AFT FUEL LOW**	YES
[BLK 1 REFUEL VALVE] [BLK 2 REFUEL VALVE OPEN]	Refuel valve detected as open.	**REFUEL VALVE OPEN**	YES
[BLK 1 XFEED1 VALVE] [BLK 2 XFEED 1 VALVE FAIL]	Engine 1 crossfeed valve commanded to move and the valve did not go to the commanded position.	**XFEED 1 VALVE FAIL**	YES
[BLK 1 XFEED2 VALVE] [BLK 2 XFEED 2 VALVE FAIL]	Engine 2 crossfeed valve commanded to move and the valve did not go to the commanded position.	**XFEED 2 VALVE FAIL**	YES
[BLK 1 FUEL 1 BYPASS] [BLK 2 ENG 1 FUEL BYPASS]	Engine 1 fuel filter clogged and has bypassed.	**ENG 1 FUEL BYPASS**	YES
[BLK 1 FUEL 2 BYPASS] [BLK 2 ENG 2 FUEL BYPASS]	Engine 2 fuel filter clogged and has bypassed.	**ENG 2 FUEL BYPASS**	YES
[BLK 1 PRI HYD LVL] [BLK 2 PRI HYD LEVEL LOW]	PRI hydraulic fluid level detected as low; ‹ 1.5 c.i.	**PRI HYD LEVEL LOW**	YES
[BLK 1 PRI HYD PSI] [BLK 2 PRI HYD PSI LOW]	Primary hydraulic PSI < 1250 psi.	**PRI HYD PSI LOW**	YES
[BLK 1 UTIL HYD LVL] [BLK 2 UTIL HYD LEVEL LOW]	UTIL hydraulic fluid level detected as low; ‹ 7 c.i.	**UTIL HYD LEVEL LOW**	YES
[BLK 1 UTIL HYD PSI] [BLK 2 UTIL HYD PSI LOW]	Utility hydraulic PSI < 1250 psi.	**UTIL HYD PSI LOW**	YES
PRI HYD BYP	PRI hydraulic return system indicates a “dirty filter” impending bypass condition (based on N_R >10% or PTO clutch engagement). Pressure delta of >70 psi; bypass is at 100 ± 15 psid.	**PRI HYD BYP**	YES
UTIL HYD BYP	UTIL hydraulic return system indicates a “dirty filter” impending bypass condition (based on N_R >10% or PTO clutch engagement). Pressure delta of >70 psi; bypass is at 100 ± 15 psid.	**UTIL HYD BYP**	YES
[BLK 1 RTR BRK ON/LK] [BLK 2 ROTOR BRAKE ON/LK]	Rotor brake is ON; at least one power lever is NOT OFF.	**ROTOR BRAKE ON/LK**	YES

Table 2-14. Caution Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	CAUTION TONE
[BLK 1 RECT1 FAIL] **[BLK 2 RECTIFIER 1 FAIL]**	Transformer/rectifier 1 detected as failed.	**RECTIFIER 1 FAIL**	YES
[BLK 1 RECT2 FAIL] **[BLK 2 RECTIFIER 2 FAIL]**	Transformer/rectifier 2 detected as failed.	**RECTIFIER 2 FAIL**	YES
RJAM FAIL	Radar jammer is in the operate mode and detected as failed.	**RJAM FAIL**	YES
IRJAM FAIL	IR jammer is **ON** and detected as failed.	**IRJAM FAIL**	YES
MODE4 CAUTION	XPNDR mode 4 not operating: 1) valid mode 4 key not loaded; 2) XPNDR “zeroed”; 3) XPNDR detected as failed during BIT; or 4) a compatible mode 4 interrogation received but no reply transmitted.	**MODE4 CAUTION**	YES
[BLK 1 ENG1 A-ICE] **[BLK 2 ENG 1 A-ICE FAIL]**	Engine 1 anti-ice system detected as failed.	**ENG 1 A-ICE FAIL**	YES
[BLK 1 ENG2 A-ICE] **[BLK 2 ENG 2 A-ICE FAIL]**	Engine 2 anti-ice system detected as failed.	**ENG 2 A-ICE FAIL**	YES
[BLK 1 CANOPY A-ICE] **[BLK 2 CANOPY A-ICE FAIL]**	The canopy Anti-Ice system is on and has been detected as failed.	**CANOPY A-ICE FAIL**	YES
ICING SEVERE	Severe icing conditions have been detected.	**ICING SEVERE**	YES
ECS FWD FAIL	ECS ON for 4 minutes; compressor and/or condenser detected as disabled, or ECS 1 MUX is not available.	**ECS FWD FAIL**	YES
ECS AFT FAIL	ECS ON for 2 minutes; compressor and/or condenser detected as disabled, or ECS 2 MUX is not available.	**ECS AFT FAIL**	YES
ECS FAIL	Both ECS FWD FAIL and ECS AFT FAIL are set.	**ECS FAIL**	YES
[BLK 1 FMC DISENG] **[BLK 2 FMC DISENGAGED]**	FMC has disengaged in one or more axes if all the following are true: 1) any of the SCAS axes are failed or OFF; and 2) the aircraft is airborne or N_R >90%.	**FMC DISENGAGED**	YES
FMC FAIL	The FMC has been detected as failed.	**FMC FAIL**	YES
[BLK 1 STAB FAIL] **[BLK 2 AUTO/MAN STAB FAIL]**	System processor detects failure in both automatic and manual stabilator mode.	**AUTO/MAN STAB FAIL**	YES
[BLK 1 MAG TRIM OFF] **[BLK 2 MAG FORCE TRIM OFF]**	Magnetic force trim detected as **OFF**.	**MAG FORCE TRIM OFF**	YES

Table 2-14. Caution Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	CAUTION TONE
[BLK 2 PASSWORD RE ENTER]	This caution will inform the crew that the auto-login attempt in response to a re-authenticate request by Security Officer failed and therefore, they need to manually enter on the KU the username/password TI login.	**PASSWORD RE ENTER**	YES
[BLK 2 MSN DATA IN-VALID]	No connection to FCL and invalid Mission Data.	**MSN DATA INVALID**	YES
[BLK 2 TI-IDM DISABLE]	The IDM EBC OFP has been physically destroyed by either a Tactical Internet (TI) security administrator, following an improper challenge of the login password, or by a cyber-warfare saboteur/attack.	**TI-IDM DISABLE**	YES
[BLK 2 LEFT MPD STALE]	The graphics and video on a display is not current. The display contains the repeated video that is not updating. The MPD bezel buttons may not respond.	**CIPM1 STALE FAIL**	YES
[BLK 2 RIGHT MPD STALE]	The graphics and video on a display is not current. The display contains the repeated video that is not updating. The MPD bezel buttons may not respond.	**CIPM2 STALE FAIL**	YES
[BLK 2 IHADSS/ORT STALE]	The graphics and video on a display is not current. The display contains the repeated video that is not updating. The MPD bezel buttons may not respond.	**MIPM STALE FAIL**	YES
NOTE: With any **BUCS ON** Caution, an **FMC DISENG** message will be displayed			
BUCS ON	The **BUCS** is engaged (FMC cannot determine axes or crewstation)	**BUCS ON**	YES
[BLK 1 BUCS ON PILOT P BLK 2 [BUCS ON PLT PITCH]	The BUCS is engaged in one or more axes (Jam or Severance).	**BUCS ON PLT PITCH**	YES
[BLK 1 BUCS ON PILOT R BLK 2 [BUCS ON PLT ROLL]	The BUCS is engaged in one or more axes (Jam or Severance).	**BUCS ON PLT ROLL**	YES
[BLK 1 BUCS ON PILOT Y BLK 2 [BUCS ON PLT YAW]	The BUCS is engaged in one or more axes (Jam or Severance).	**BUCS ON PLT YAW**	YES
BLK 1 BUCS ON PILOT BLK 2 [BUCS ON PLT COLL]	The BUCS is engaged in one or more axes (Jam or Severance).	**BUCS ON PLT COLL**	YES

Table 2-14. Caution Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	CAUTION TONE
[BLK 1 BUCS ON CPG P] [BLK 2 BUCS ON CPG PITCH]	The BUCS is engaged in one or more axes (Jam or Severance).	**BUCS ON CPG PITCH**	YES
[BLK 1 BUCS ON CPG R] [BLK 2 BUCS ON CPG ROLL]		**BUCS ON CPG ROLL**	YES
[BLK 1 BUCS ON CPG Y] [BLK 2 BUCS ON CPG YAW]		**BUCS ON CPG YAW**	YES
[BLK 1 BUCS ON CPG C] [BLK 2 BUCS ON CPG COLL]		**BUCS ON CPG COLL**	YES
BUCS FAIL	The **BUCS** has failed (FMC cannot determine axes).	**BUCS FAIL**	YES
[BLK 1 BUCS FAIL P] [BLK 2 BUCS FAIL PITCH]	The BUCS has failed in one or more axes.	**BUCS FAIL PITCH**	YES
[BLK 1 BUCS FAIL R] [BLK 2 BUCS FAIL ROLL]		**BUCS FAIL ROLL**	YES
[BLK 1 BUCS FAIL Y] [BLK 2 BUCS FAIL YAW]		**BUCS FAIL YAW**	YES
[BLK 1 BUCS FAIL C] [BLK 2 BUCS FAIL COLL]		**BUCS FAIL COLL**	YES

2.139 ADVISORY MESSAGES

Advisory messages are presented to crewmembers via the UFD/EUFD and MPD Page formats. A listing of Advisories, and cause for the Advisory and Advisory tone, is presented in Table 2-15.

Table 2-15. Advisory Messages

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 1 AUTO STAB] **[BLK 2 AUTO STAB FAIL]**	Automatic stabilator mode has failed.	**[BLK 1 AUTO STAB FAILURE]** **[BLK 2 AUTO STAB FAIL]**	NO
[BLK 1 MAN STAB ON] **[BLK 2 MANUAL STAB ON]**	Manual stabilator mode selected; AUTO mode operational.	**MANUAL STAB ON**	NO
[BLK 1 RTR BRK ON] **[BLK 2 ROTOR BRAKE ON]**	Rotor brake is ON and both PCLs OFF.	**ROTOR BRAKE ON**	NO
[BLK 1 FWD FAB HOT] **[BLK 2 FWD LFAB HOT]**	ECS1 EFAB left supply air temperature sensor output > 80° for 5 seconds continuous, with aircraft power available for at least ten minutes, and squat switch status = AIR or GROUND.	**FWD LFAB HOT**	NO
[BLK 1 FWD FAB HOT] **[BLK 2 FWD RFAB HOT]**	ECS1 EFAB right supply air temperature sensor output > 80° for 5 seconds continuous, with aircraft power available for at least ten minutes, and squat switch status = AIR or GROUND.	**FWD RFAB HOT**	NO
[BLK 1 AFT FAB HOT] **[BLK 2 AFT LFAB HOT]**	ECS2 EFAB left supply air temperature sensor output > 80° for 5 seconds continuous, with aircraft power available for at least ten minutes, and squat switch status = AIR or GROUND.	**AFT LFAB HOT**	NO
[BLK 1 AFT FAB HOT] **[BLK 2 AFT RFAB HOT]**	ECS2 EFAB right supply air temperature sensor output > 80° for 5 seconds continuous, with aircraft power available for at least ten minutes, and squat switch status = AIR or GROUND.	**AFT RFAB HOT**	NO
[BLK 1 ECS DGR FWD] **[BLK 2 ECS DEGRADED FWD]**	Advisory is set when any of the following FAIL indications are set: DCU, CMP, L OR R EFAB FAN, CPG FAN, CPG TCV, CND FANS or APS FAN.	**ECS DEGRADED FWD**	NO
[BLK 1 ECS DGR AFT] **[BLK 2 ECS DEGRADED AFT]**	Advisory is set when any of the following FAIL indications are set: DCU, CMP, L OR R EFAB FAN, CPG FAN, CPG TCV, CND FANs or APS FAN.	**ECS DEGRADED AFT**	NO
EFABS HOT	SP sets EFAB HOT RH/LH when any of the following two are set: EFAB HOT LH FWD; EFAB HOT RH FWD; EFAB HOT RH AFT; or EFAB HOT LH AFT.	**EFABS HOT**	NO

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
EFABS HOT	SP sets EFAB HOT RH/LH when any of the following two are set: EFAB HOT LH FWD; EFAB HOT RH FWD; EFAB HOT RH AFT; or EFAB HOT LH AFT.	**EFABS HOT**	NO
ECS OFF	SP sets ECS OFF advisory to the DP when ECS MODE = OFF.	**ECS OFF**	NO
[BLK 1 ECS DGR] [BLK 2 ECS DEGRADED]	When both ECS1 DEGR and ECS2 DEGR are set, the SP sets ECS DEGRADED advisory instead.	**ECS DEGRADED**	NO
[BLK 1 EXT PWR] [BLK 2 EXT PWR DOOR OPEN]	EXT PWR access door detected as open.	**EXT PWR DOOR OPEN**	NO
BATTERY	Battery detected as failed.	**BATTERY**	NO
CHARGER	Battery charger detected as failed.	**CHARGER**	NO
[BLK 1 ACCUM PSI] [BLK 2 ACCUM OIL PRESS LO]	Hydraulic accumulator oil psi detected as being < 1250.	**ACCUM OIL PRES LO**	NO
[BLK 1 ENG1 PWR] [BLK 2 ENGINE 1 PWR FAIL]	Engine 1 emergency backup power detected as failed; monitored when positive engine 1 run status is received.	**ENGINE 1 PWR FAIL**	NO
[BLK 1 ENG2 PWR] [BLK 2 ENGINE 2 PWR FAIL]	Engine 2 emergency backup power detected as failed; monitored when positive engine 2 run status is received.	**ENGINE 2 PWR FAIL**	NO
[BLK 1 ENG1 PWR OK] [BLK 2 ENGINE 1 POWER OK]	Engine 1 emergency backup power available (displayed during Eng 1 OVSP circuit B test).	**ENGINE 1 POWER OK**	NO
[BLK 1 ENG2 PWR OK] [BLK 2 ENGINE 2 POWER OK]	Engine 2 emergency backup power available (displayed during Eng 2 OVSP circuit B test).	**ENGINE 2 POWER OK**	NO
[BLK 1 IGN1 ON] [BLK 2 IGN 1 FAILED ON]	Engine 1 ignition is on after being commanded OFF. System monitors for ignition fail when start sequence is complete.	**[BLK 1 IGN 1 FAILURE ON] [BLK 2 IGN 1 FAILED ON]**	NO
[BLK 1 IGN2 ON] [BLK 2 IGN 2 FAILED ON]	Engine 2 ignition is on after being commanded OFF. System monitors for ignition fail when start sequence is complete.	**[BLK 1 IGN 2 FAILURE ON] [BLK 2 IGN 2 FAILED ON]**	NO
[BLK 1 ENG1 START] [BLK 2 ENGINE 1 START]	NO. 1 ENG START switch in START.	**ENGINE 1 START**	NO

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 1 ENG2 START] [BLK 2 ENGINE 2 START]	NO. 2 ENG START switch in START.	**ENGINE 2 START**	NO
[BLK 1 ENG 1 ORIDE] [BLK 2 ENG1 OVERRIDE]	NO. 1 ENG START switch in IGN ORIDE position.	**ENG1 OVERRIDE**	NO
[BLK 1 ENG 2 ORIDE] [BLK 2 ENG2 OVERRIDE]	NO. 2 ENG START switch in IGN ORIDE position.	**ENG2 OVERRIDE**	NO
ATS1 HANG	Turbine starter #1 did not drop out at 52% N_G; it is engaged and N_G is > 68% and increasing.	**ATS1 HANG**	NO
ATS2 HANG	Turbine starter #2 did not drop out at 52% N_G; it is engaged and N_G is > 68% and increasing.	**ATS2 HANG**	NO
CANOPY OPEN	The canopy has been detected as open.	**CANOPY OPEN**	NO
[BLK 1 ICING] [BLK 2 ICING DETECTED]	Ice forming (trace, light or moderate) condition detected.	**ICING DETECTED**	NO
ANTI-ICE ON	At least one of the anti-ice systems has been commanded ON (automatically or manually); ENG 1 or 2, sensors, air speed or canopy.	**ANTI-ICE ON**	NO
AICE MAN	Anti-ice system automatic mode has failed and has been commanded to the manual position.	**AICE MAN**	NO
[BLK 1 EXT1 EMPTY] [BLK 2 EXTERNAL 1 EMPTY]	External fuel tank 1 detected as empty; monitored when generator power is applied.	**EXTERNAL 1 EMPTY**	NO
[BLK 1 EXT2 EMPTY] [BLK 2 EXTERNAL 2 EMPTY]	External fuel tank 2 detected as empty; monitored when generator power is applied.	**EXTERNAL 2 EMPTY**	NO
[BLK 1 EXT3 EMPTY] [BLK 2 EXTERNAL 3 EMPTY]	External fuel tank 3 detected as empty; monitored when generator power is applied.	**EXTERNAL 3 EMPTY**	NO
[BLK 1 EXT4 EMPTY] [BLK 2 EXTERNAL 4 EMPTY]	External fuel tank 4 detected as empty; monitored when generator power is applied.	**EXTERNAL 4 EMPTY**	NO
[BLK 1 L EXT XFER] [BLK 2 L EXT XFER FAIL]	Left ext fuel transfer commanded ON and detected as failed.	**L EXT XFER FAIL**	NO

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 1 R EXT XFER] [BLK 2 R EXT XFER FAIL]	Right ext fuel transfer commanded ON and detected as failed.	**R EXT XFER FAIL**	NO
[BLK 1 FUEL P SNSR] [BLK 2 #1 FUEL SNSR FAIL]	Ten seconds after initial battery power powerup, the SP did not sense the expected low pressure fuel sensor state.	**#1 FUEL SNSR FAIL**	NO
[BLK 1 FUEL P SNSR] [BLK 2 #2 FUEL SNSR FAIL]	Ten seconds after initial battery power powerup, the SP did not sense the expected low pressure fuel sensor state.	**#2 FUEL SNSR FAIL**	NO
FCR FAULT	In the Ground Targeting Mode (GTM) only, selecting the reserved terrain selection enables a Moving Target Indication (MTI) only mode in the FCR P8 software load and subsequent. The Stationary Target Indicator (STI) target detection process is disabled. This selection will cause an FCR fault message on the UFD/EUFD and an FCR STI FAIL indication on the DMS page.	**FCR FAULT**	NO
RFI FAULT	RFI subsystem fault detected.	**RFI FAULT**	NO
[BLK 1 FALLBACK] [BLK 2 CIU FALLBACK]	CIU fallback mode commanded ON (ICS hot mic, and one radio per crewstation selected).	**CIU FALLBACK**	NO
[BLK 1 GO FALLBACK] [BLK 2 GO CIU FALLBACK]	CIU fallback mode should be commanded ON (ICS hot mic, and one radio per crewstation selected).	**GO CIU FALLBACK**	NO
FM1 CUE	FM1 radio has received a transmission on the designated cue frequency.	**FM1 CUE**	NO
FM2 CUE	FM2 radio has received a transmission on the designated cue frequency.	**FM2 CUE**	NO
[BLK 1 RDR JAM ON] [BLK 2 RADAR JAMMER ON]	Radar jammer actively jamming.	**RADAR JAMMER ON**	NO
RJAM FAIL	Radar jammer in STBY mode and detected failed.	**RJAM FAIL**	NO
[BLK 1 MODE4 REPLY] [BLK 2 IFF MODE4 REPLY]	XPNDR mode 4 replying to XPNDR mode 4 interrogation.	**IFF MODE4 REPLY**	NO
[BLK 1 BLD AIR OFF] [BLK 2 BLEED AIR OFF]	Engines 1 and 2 bleed air sources have been manually shut off.	**BLEED AIR OFF**	NO
[BLK 1 BLD AIR HOT] [BLK 2 BLEED AIR HOT]	A bleed air overtemperture detected > 490 °F.	**BLEED AIR HOT**	NO
[BLK 1 BLD AIR1] [BLK 2 ENG1 BLD AIR FAIL]	Engine 1 bleed air primary shutoff valve failed to move to commanded position.	**ENG1 BLD AIR FAIL**	NO

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 1 BLD AIR2] [BLK 2 ENG2 BLD AIR FAIL]	Engine 2 bleed air primary shutoff valve failed to move to commanded position.	**ENG2 BLD AIR FAIL**	NO
[BLK 1 UPDT POSN] [BLK 2 UPDATE POSITION]	NAV system detects update to present position is required (primary INU position error greater than 1.85 km).	**UPDATE POSITION**	NO
[BLK 1 UPDT HDG] [BLK 2 UPDATE HEADING]	NAV system detects update to magnetic heading is required (primary INU heading error greater than 10°).	**UPDATE HEADING**	NO
[BLK 1 WPT APRCH] [BLK 2 WPT APPROACHING]	ETA to next waypoint ONE minute; remains on until TSD page displayed in either crewstation or waypoint passed.	**WPT APPROACHING**	NO
[BLK 1 WPT PASSED] [BLK 2 WAYPOINT PASSED]	Active waypoint passed. Remains on until TSD page displayed in either crewstation or for one minute.	**WAYPOINT PASSED**	NO
NAV FAULT	Navigation subsystem fault detected (GPS, Doppler, or INU fail).	**NAV FAULT**	NO
[BLK 1 INU SEA TYP] [BLK 2 INU SEA TYPE]	INU ALIGN SEA selected with no sea alignment data in memory.	**INU SEA TYPE**	NO
[BLK 1 INU 1 BRST] [BLK 2 ENTER INU 1 BRST]	Primary SP has no INU 1 boresight data in memory.	**ENTR INU 1 BRST**	NO
[BLK 1 INU 2 BRST] [BLK 2 ENTER INU 2 BRST]	Primary SP has no INU 2 boresight data in memory.	**ENTR INU 2 BRST**	NO
[BLK 1 ATT HOLD] [BLK 2 ATTITUDE HOLD]	Attitude Hold is engaged. Upon disengagement, advisory tone comes ON.	**ATTITUDE HOLD**	Flight control tone
[BLK 1 ATTHLD FAIL] [BLK 2 ATTITUD HOLD FAIL]	Attitude/Hover hold failed.	**ATTITUD HOLD FAIL**	Flight control tone
[BLK 1 RAD HOLD] [BLK 2 RAD ALT HOLD]	Radar altimeter altitude hold is engaged. Upon disengagement, advisory tone comes ON.	**RAD ALT HOLD**	Flight control tone
[BLK 1 RADHLD FAIL] [BLK 2 RAD ALT HOLD FAIL]	Radar Alt Hold has failed	**RAD ALT HOLD FAIL**	Flight control tone
[BLK 1 BAR H0LD] [BLK 2 BAR ALT HOLD]	Barometric Hold is engaged. Upon disengagement, advisory tone comes ON.	**BAR ALT HOLD**	Flight control tone
[BLK 1 BARHLD FAIL] [BLK 2 BAR ALT HOLD FAIL]	Barometric altitude hold failed. Upon disengagement, advisory tone comes ON.	**BAR ALT HOLD FAIL**	Flight control tone

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
HOVER DRIFT	Hover drift > 48 ft detected.	**HOVER DRIFT**	Flight control tone
[BLK 1 ALT DRIFT] **[BLK 2 ALTITUDE DRIFT]**	Significant deviation from reference altitude (Baro 100 ft deviation; Radar >1400 ft, 100 ft deviation; Under 1400 ft deviation is linear: 5 ft at 10 ft AGL to 100 ft at 1400 ft).	**ALTITUDE DRIFT**	Flight control tone
[BLK 1 SAS SATURAT] **[BLK 2 SAS SATURATED]**	SP has set a SAS saturated true state condition if the true state has not been set in the previous 3 seconds when: 1) pitch, roll, or collective is saturated › 1 second; or yaw › 5 seconds.	**SAS SATURATED**	Flight control tone
MPD HOT	The MPD has detected it has components which have overheated. MPD performance is degraded and may fail if the situation continues.	**MPD HOT**	NO
WPT/HZD	IDM has received a single waypoint and hazard.	**WPT/HZD**	NO
CTRLM	IDM has received a single control measure.	**CTRLM**	NO
TGT/THRT	IDM has received a single target/threat.	**TGT/THRT**	IDM tone
[BLK 1 FCR TGT RPT] **[BLK 2 FCR TGT REPORT]**	IDM has received a FCR target(s) report.	**[BLK 1 FCR TGT RPT]** **[BLK 2 FCR TGT REPORT]**	IDM tone
[BLK 1 BDA RPT] **[BLK 2 BDA REPORT]**	IDM has received a BDA report.	**BDA REPORT**	IDM tone
PF ZONE	IDM has received a priority fire zone.	**PF ZONE**	IDM tone
NF ZONE	IDM has received a no fire zone.	**NF ZONE**	IDM tone
RFHO	IDM has received a single RF handover target file.	**RFHO**	IDM tone
[BLK 1 ATHS TABLE] **[BLK 2 ATHS TABLE LOW]**	ATHS TABLE authentication codes detected as low.	**ATHS TABLE LOW**	NO
[BLK 1 ATHS MSG] **[BLK 2 ATHS MESSAGE]**	IDM has received an ATHS formatted message.	**ATHS MESSAGE**	NO
[BLK 1 XMIT NAK VH] **[BLK 2 XMIT NAK VHF]**	At least one of the receiving IDM or ATHS subscribers within the team (or for zone messages, within the zone) did not respond to the transmission on the VHF radio with an acknowledge.	**XMIT NAK VHF**	NO

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 1 XMIT NAK UH] **[BLK 2 XMIT NAK UHF]**	At least one of the receiving IDM or ATHS subscribers within the team (or for zone messages, within the zone) did not respond to the transmission on the UHF radio with an acknowledge.	**XMIT NAK UHF**	NO
[BLK 1 XMIT NAK F1] **[BLK 2 XMIT NAK FM1]**	At least one of the receiving IDM or ATHS subscribers within the team (or for zone messages, within the zone) did not respond to the transmission on the FM1 radio with an acknowledge.	**XMIT NAK FM1**	NO
[BLK 1 XMIT NAK F2] **[BLK 2 XMIT NAK FM2]**	At least one of the receiving IDM or ATHS subscribers within the team (or for zone messages, within the zone) did not respond to the transmission on the FM2 radio with an acknowledge.	**XMIT NAK FM2**	NO
[BLK 1 IDM MSG]	IDM has received notification that all IDM/SOI data files will be received. Individual advisory messages for each of the files will be displayed as the IDM receives each file separately.	**ALL IDM/SOI**	NO
[BLK 1 IDM MSG]	IDM has received the first of two sections (day 1) of the SOI suffix file.	**SOI SUFFIX 1/2**	NO
[BLK 1 IDM MSG]	IDM has received the second of two sections (day 1) of the SOI suffix file.	**SOI SUFFIX 2/2**	NO
[BLK 1 IDM MSG] **[BLK 2 IDM MESSAGE]**	IDM has received the complete waypoint and hazard file.	**WPT/HZD FILE**	NO
[BLK 1 IDM MSG] **[BLK 2 IDM MESSAGE]**	IDM has received the complete route file.	**ROUTE FILE**	NO
[BLK 1 IDM MSG] **[BLK 2 IDM MESSAGE]**	IDM has received a free text message.	**FREE TEXT**	IDM TONE
[BLK 1 IDM MSG] **[BLK 2 IDM MESSAGE]**	IDM has received notification that all mission 1 data files will be received. Advisory messages for each of the files will be displayed as the IDM receives each file separately.	**MISSION 1**	NO
[BLK 1 IDM MSG] **[BLK 2 IDM MESSAGE]**	IDM has received notification that all mission 2 data files will be received. Advisory messages for each of the files will be displayed as the IDM receives each file separately.	**MISSION 2**	NO

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	IDM has received notification that all current mission data files will be received. Individual advisory messages for each of the files will be displayed as the IDM receives each file separately.	**[BLK 1 CURR MIS-SION] [BLK 2 CURRENT MISSION]**	NO
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	IDM has received the complete areas file.	**AREAS FILE**	NO
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	IDM has received the complete lines file.	**LINES FILE**	NO
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	IDM has received the complete control measures file.	**CTRLM FILE**	NO
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	IDM has received the FCR priority scheme file.	**FCR PRI SCHEME**	NO
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	IDM has received the TADS laser codes file.	**LASER CODES**	NO
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	IDM has received the complete target/threat file.	**TGT/THRT FILE**	IDM tone
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	IDM has received a single route file.	**ROUTE**	NO
[BLK 1 IDM MSG]	IDM has received the first of three IDM data files, IDM configuration.	**IDM CONFIG 1/3**	NO
[BLK 1 IDM MSG]	IDM has received the second of three IDM data files, IDM net members.	**NET MEMBRS 2/3**	NO
[BLK 1 IDM MSG]	IDM has received the third of three IDM data files, IDM presets.	**PRESETS 3/3**	NO
[BLK 1 IDM MSG]	IDM has received the SOI authentication tables file.	**SOI AUTH**	NO
[BLK 1 IDM MSG]	IDM has received the SOI call signs and frequencies file.	**SOI C/S & FREQ**	NO
[BLK 1 IDM MSG]	IDM has received the SOI call sign expanders file.	**SOI EXPND**	NO
[BLK 2 IDM PASSWRD RESPNS]	When user successfully logs in to the TI Network following a reauthenicate request, this advisory alerts them to the fact that the IDM will transmit a message to the security officer due to the successful login.	**IDM PASSWRD RESPNS**	NO
[BLK 2 IDM SECURITY MSG TX]	If user fails three or more times attempting to login in the TI Network, this advises the crew the IDM may tramsmit a message to the security officer.	**IDM SECURITY MSG TX**	NO
PP RESPONSE	IDM has responded to a query from another aircraft for present position data.	**PP RESPONSE**	NO
PF/NF ZONE	IDM has received a priority or no fire zone file.	**PF/NF ZONE**	IDM tone

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 1 PP RPT] **[BLK 2 PP REPORT]**	IDM has received a manually sent present position report.	**PP REPORT**	NO
[BLK 1 BDA RESPONS] **[BLK 2 BDA RESPONSE]**	IDM has responded to a query from another aircraft for BDA data.	**BDA RESPONSE**	NO
[BLK 1 PP QUERY]	IDM has received a query from another aircraft for a Present Position report. This query will be answered automatically by the IDM; the message may not be presented for a very long period of time.	**PP QUERY**	NO
[BLK 2 PP QUERY]	IDM has received a query from another aircraft for a Present Position report. This query will be answered automatically by the IDM if the auto-response function is invoked from the RPT page. In this event, the message may not be presented for a very long period of time.	**PP QUERY**	NO
[**BLK 1 BDA QUERY]**	IDM has received a query from another aircraft for BDA data. This query will be answered automatically by the IDM; the message may not be presented for a very long period of time.	**BDA QUERY**	NO
[BLK 2 BDA QUERY]	IDM has received a query from another aircraft for BDA data. This query will be answered automatically by the IDM if the auto-response functionis invokedfrom the RPT page. In this event, the message may not be presented for a very long period of time.	**BDA QUERY**	NO
PIM FAULT	The WP has determined that either Laser Code Keywords are resident on the DTC, but no PIM LEU is installed; or anomalies exist in at least one of the following: 1) LEU upload errors, 2) individual HF Launcher upload errors.	**PIM FAULT**	NO
[BLK 1 LSR KEYWORD] **[BLK 2 LASER KEYWORD FAIL**	The WP has determined that one or more of the Laser Code Keywords did not upload to the WP due to a DTC/DTU anomaly.	**LASER KEYWORD FAIL**	NO
[BLK 1 TW UNLK SEL] **[BLK 2 TAIL WHL UNLK SEL]**	The tail wheel unlock position has been selected. (This advisory is only presented when the aircraft is on the ground.)	**TAIL WHL UNLK SEL**	NO
[BLK 1 TW LOCK SEL] **[BLK 2 TAIL WHL LOCK SEL]**	The tail wheel lock position has been selected. (This advisory is only presented when the aircraft is on the ground.)	**TAIL WHL LOCK SEL**	NO
[BLK 1 MDR MEM LOW] **[BLK 2 MDR MEMORY LOW]**	The MDR memory is low and approaching full. (This advisory is only presented when the aircraft is on the ground.)	**MDR MEMORY LOW**	NO

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 1 MDR FULL] **[BLK 2 MDR MEMORY FULL]**	The MDR memory has been determined to be full. The MDR is recording in a degraded mode and some MDR maintenance data is not available. This advisory is only presented when the aircraft is on the ground.	**MDR MEMORY FULL**	NO
[BLK 1 FMC DISENG] **[BLK 2 FMC DISENGAGED]**	The FMC has disengaged resulting from any of the SCAS channels being failed or off with a fully functional FMC and 1553 MUX Bus.	**FMC DISENGAGED**	NO
APU START	APU is in the start mode.	**APU START**	NO
[BLK 1 APU PWR ON] **[BLK 2 APU POWER ON]**	APU ECU has power and APU is not ON; not yet > 95% speed.	**APU POWER ON**	NO
APU ON	APU is ON and aircraft on ground; APU > 95% speed; monitored from APU start sequence initiation.	**APU ON**	NO
APU STOP	APU is in the stop mode; momentarily displayed when APU shutdown sequence initiated.	**APU STOP**	NO
APU FAIL	APU detected as failed; monitored from APU start sequence initiation.	**[BLK 1 APU FAILURE]** **[BLK 2 APU FAIL]**	NO
[BLK 1 APU FUELVLV] **[BLK 2 APU FUEL VALVE]**	APU fuel shutoff valve failed to go to commanded position.		NO
[BLK 1 APU OVRSPD] **[BLK 2 APU OVERSPEED]**	APU ECU has determined the gas generator has reached an overspeed condition.		NO
[BLK 1 APU LO OILP] **[BLK 2 APU LO OIL PRESS]**	APU ECU has determined the APU oil pressure is below minimum operating value.		NO
[BLK 1 APU OVRTMP] **[BLK 2 APU OVERTEMP]**	APU ECU has determined the APU temperature has reached an overtemperture condition.		NO
[BLK 1 APU OVRCUR] **[BLK 2 APU OVERCURRENT]**	APU ECU has determined the APU output current has reached an over current condition		NO
[BLK 2 APU ECU FUEL]	During the APU start sequence, the SP determined that the APU ECU did not command the APU fuel solenoid at the correct time. (See Fault 570.)		NO

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 1 APU ECUSTRT] [BLK 2 APU ECU STARTER]	SP has determined the APU ECU did not command the APU starter at the correct time.		NO
[BLK 1 APU ECU IGN] [BLK 2 APU ECU IGNITOR]	SP has determined the APU ECU did not command the APU igniter at the correct time.		NO
[BLK 1 APU ECU PTO] [BLK 2 APU ECU PTO CLUTCH]	SP has determined the APU ECU did not command the APU PTO clutch at the correct time.		NO
[BLK 1 APU ECUSTOP] [BLK 2 APU ECU STOP]	SP has determined the APU ECU did not respond to an OFF command.		NO
[BLK 1 APU CMDFAIL] [BLK 2 APU COMMAND FAIL]	SP has determined the APU ON discrete indicates the incorrect state after completion of an APU start or stop sequence.		NO
[BLK 1 APU RPMDECR] [BLK 2 APU RPM DECREASE]	APU RPM decreased by more than 30% of the maximum RPM achieved during the APU start sequence.		NO
[BLK 1 APU NO IGN] [BLK 2 APU NO IGNITION]	APU EGT temperature did not rise during the APU start sequence.		NO
[BLK 1 APU EGT] [BLK 2 APU EGT TEMP]	APU started successfully, however APU EGT temperature did not show a rise during the APU start sequence.		NO
APU OIL SW	Ten seconds after initial (battery power) powerup, the SP did not sense the expected APU low oil pressure sensor state.		NO
ELC APU PTO	ELC 2 has lost control of load controller.		NO
ELC APU ECU	ELC 2 has lost control of load controller.		NO
[BLK 1 ELC APUSTRT] [BLK 2 ELC APU STARTER]	ELC 2 has lost control of load controller.		NO
[BLK 1 ELC APU BST] [BLK 2 ELC APU BOOST PUMP]	ELC 2 has lost control of load controller.		NO
[BLK 1 ELC APUFUEL] [BLK 2 ELC APU FUEL VALVE]	ELC 2 has lost control of load controller.		NO
[BLK 1 FUEL CHECK] [BLK 2 FUEL CHK COMPLETE]	Indicates to the crew the fuel check calculation is complete.	**FUEL CHK COMPLETE**	NO

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 1 FARM RPT] **[BLK 2 FARM REPORT]**	The IDM has received a manually sent Fuel/Ammunition/Rockets/Missiles (FARM) status report.	**FARM REPORT**	NO
FARM QUERY	The IDM has received a query from another aircraft for a Fuel/Ammunition/Rockets/Missiles (FARM) report. This query will be automatically answered by the IDM; the message may not be presented for a very long period of time.	**FARM QUERY**	NO
[BLK 1 ATHS MSG] **[BLK 2 ATHS MESSAGE]**	The IDM has received an ATHS formatted message.	**[BLK 1 ATHS MSG]** **[BLK 2 ATHS MESSAGE]**	NO
[BLK 1 ARTY RQST T] **[BLK 2 ARTY FIRE RQST TAC]**	The IDM has received either an ATHS fire request grid, fire request quick, fire request shift, forward observer command, subsequent adjust, or end of mission and surveillance message.	**ARTY FIRE RQST TAC**	YES
[BLK 1 OBSRV RDY T] **[BLK 2 OBERVER READY TAC]**	The IDM has received an ATHS observer location message.	**OBSERVER READY TAC**	YES
[BLK 1 AIR RQST T] **[BLK 2 AIR FIRE RQST TAC]**	The IDM has received an ATHS airborne fire request, mission command, check all, or target position update message.	**AIR FIRE RQST TAC**	YES
[BLK 1 FARM RPT T] **[BLK 2 FARM REPORT TAC]**	The IDM has received an ATHS airborne situation report.	**FARM REPORT TAC**	YES
[BLK 1 MOVE CMD T] **[BLK 2 MOVE COMMAND TAC]**	The IDM has received an ATHS airborne movement command range.	**MOVE COMMAND TAC**	YES
[BLK 1 ATHS MSG] **[BLK 2 BULK MESSAGE TAC]**	The IDM has received an ATHS initialization message.	**BULK MESSAGE TAC**	NO
[BLK 1 MAYDAY T] **[BLK 2 MAYDAY REPORT TAC]**	The IDM has received an ATHS airborne mayday message.	**MAYDAY REPORT TAC**	YES
[BLK 1 FREE TEXT T] **[BLK 2 FREE TEXT TAC]**	The IDM has received an ATHS free text message.	**FREE TEXT TAC**	YES
[BLK 1 BDA RPT T] **[BLK 2 BDA REPORT TAC]**	The IDM has received an ATHS airborne battle damage assessment/casuality report.	**BDA REPORT TAC**	YES
[BLK 1 PP RPT T] **[BLK 2 PP REPORT TAC]**	The IDM has received an ATHS auto position update reply and the auto-reply is currently off.	**PP REPORT TAC**	YES

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 1 PP QUERY T] [BLK 2 PP QUERY TAC]	The IDM has received an ATHS auto position update request and the auto-report is currently off.	**PP QUERY TAC**	YES
[BLK 1 MSG 2 OBS T] [BLK 2 MSG TO OBSERVR TAC]	The IDM has received an ATHS message to observer message.	**[BLK 1 MSG 2 OBS T] [BLK 2 MSG TO OBSERVR TAC]**	YES
[BLK 1 SPOT RPT T] [BLK 2 SPOT REPORT TAC]	The IDM has received an ATHS spot report message.	**SPOT REPORT TAC**	YES
[BLK 1 NEG SPOT T] [BLK 2 NEG SPOT RPT TAC]	The IDM has received an ATHS negative spot report message.	**NEG SPOT RPT TAC**	YES
[BLK 1 ARTY INTL T] [BLK 2 ARTY INTELGRID TAC]	The IDM has received an ATHS artillery intelligence report message.	**[BLK 1 ARTY INTL GRID T] [BLK 2 ARTY INTELGRID TAC]**	YES
[BLK 2 HF KY FAIL]	Advises crew to select the Crypto (KY-100) Bypass for the HF radio.	**HF KY FAIL**	NO
[BLK 2 HF KY BYPASS ENBLD]	Advises crew Crypto (KY-100) Bypass relay for the HF radio has been enabled.	**HF KY BYPASS ENBLD**	NO
[BLK 2 CMWS DEGRADED]	The Common Missile Warning System is operating in a degraded mode. This fault is cleared upon display of the DMS page.	**CMWS DEGRADED**	NO
[BLK 2 IR JAMMER DEGRADED]	The IR Jammer is operating in a degraded mode. This fault is cleared upon display of the DMS page.	**IR JAMMER DEGRADED**	NO
[BLK 2 CMDS DEGRADED]	The Countermeasure Dispensing System is operating in a degraded mode. This fault is cleared upon display of the DMS page.	**CMDS DEGRADED**	NO
[BLK 2 OBSERVER MSN UPDT]	The IDM has received an observer mission update.	**OBSERVER MSN UPDT**	YES
[BLK 2 MSG TO OBSERVER]	The IDM has received a message to observer message.	**MSG TO OBSERVER**	YES
[BLK 2 AIRBORNE FIRE MSN]	The IDM has received an airborne fire mission message.	**AIRBORNE FIRE MSN**	YES
[BLK 2 SPOT REPORT]	The IDM has received a spot report.	**SPOT REPORT**	YES
[BLK 2 SITREP]	The IDM has received a situation report.	**SITREP**	YES
[BLK 2 FIELD ORDERS]	The IDM has received field orders.	**FIELD ORDERS**	YES
[BLK 2 INFO REQUEST]	The IDM has received an information request.	**INFO REQUEST**	YES

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 2 NET JOIN REQUIRED]	A mismatch has been detected and a NET JOIN is required.	**NET JOIN REQUIRED**	NO
[BLK 2 IDM INHIBIT]	The IDM has been placed in the INHIBIT mode.	**IDM INHIBIT**	NO
[BLK 2 IDM FAULT]	The IDM has lost communication over the RS232 CSMA port with one or both of the FM radios.	**IDM FAULT**	NO
[BLK 2 SEEKING TI]	A radio is tuned to the Internet protocol and is attempting to find the TI server.	**SEEKING TI**	NO
[BLK 2 *FREE TEXT]	The IDM has received a flash free message.	***FREE TEXT**	YES
[BLK 2 *FCR TGT REPORT]	The IDM has received a flash FCR Target(s) report.	***FCR TGT REPORT**	YES
[BLK 2 *BDA REPORT]	The IDM has received a flash BDA report.	***BDA REPORT**	YES
[BLK 2 *PP REPORT]	The IDM has received a flash manually sent Present Position report.	***PP REPORT**	YES
[BLK 2 *OBSERVER MSN UPDT]	The IDM has received a flash oberver mission update.	***OBSERVER MSN UPDT**	YES
[BLK 2 *MSG TO OBSERVER]	The IDM has received a flash message to oberver message.	***MSG TO OBSERVER**	YES
[BLK 2 *AIRBORNE FIRE MSN]	The IDM has received a flash airborne fire mission message.	***AIRBORNE FIRE MSN**	YES
[BLK 2 *SPOT REPORT]	The IDM has received a flash spot report.	***SPOT REPORT**	YES
[BLK 2 *SITREP]	The IDM has received a flash situation report.	***SITREP**	YES
[BLK 2 *FIELD ORDERS]	The IDM has received flash field orders.	***FIELD ORDERS**	YES
[BLK 2 *INFO REQUEST]	The IDM has received a flash information request.	***INFO REQUEST**	YES
[BLK 2 CPG UFD HOT]	The CPG’s Up-front Display has detected an overtemperature condition.	**CPG UFD HOT**	NO
[BLK 2 PLT UFD HOT]	The Pilot’s Up-front Display has detected an overtemperature condition.	**PLT UFD HOT**	NO
[BLK 2 CTR TANK EMPTY]	The Internal Auxiliary Fuel System is empty. The calculated IAFS fuel level is low and when the IAFS was commanded to transfer, the fuel lines did not pressurize.	**CTR TANK EMPTY**	NO

Table 2-15. Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE
[BLK 2 CTR XFER FAIL]	The Internal Auxiliary Fuel System failed to transfer fuel. The calculated IAFS fuel level is not low and when the IAFS was commanded to transfer, the fuel lines did not pressurize.	**CTR XFER FAIL**	NO
[BLK 2 DTC WRITING]	The DTU door has been opened, but the DTU is finishing writing the FAT on the DTC. The DTC cards should not be removed.	**DTC WRITING**	NO
[BLK 2 DTC WRITE COMPLETE]	The DTU door has been opened, and the DTU has finished writing the FAT on the DTC. The advisory indicated the DTC cards ready to be removed.	**DTC WRITE COMPLETE**	NO

2.140 TESS ADVISORY MESSAGES

TESS advisory messages are presented to crewmembers via the UFD/EUFD and MPD Page formats and as voice mesages. A listing of Advisories, cause for the Advisory, Advisory Tone, and Voice Message is presented in Table 2-16.

Table 2-16. TESS Advisory Messages

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE	VOICE MESSAGE
[BLK 1 TESS NO GPS] [BLK 2 TESS NO GPS TRACK]	TESS has not been able to track the GPS satellites.	**TESS NO GPS TRACK**	NO	
[BLK 1 SIM KILL] [BLK 2 TESS SIM KILL]	TESS has detected a simulated kill condition.	**TESS SIM KILL**	NO	You have been killed.
[BLK 1 SIM HIT] [BLK 2 TESS SIM HIT]	TESS has detected a simulated hit condition. Remains on for 8 seconds.	**TESS SIM HIT**	NO	You have been hit.
[BLK 1 SIM MISS] [BLK 2 TESS SIM NEAR MISS]	TESS has detected a simulated near miss condition. Remains on for 8 seconds.	**TESS SIM NEAR MISS**	NO	Near miss.
[BLK 1 SIM RESET] [BLK 2 TESS SIM RESET]	TESS has established the aircraft in a reset state after a simulated hit or kill condition (i.e. the aircraft is in the same state it began the excercise in). Remains on for 8 seconds.	**TESS SIM RESET**	NO	Simulation is reset.
[BLK 1 SIM RESURR] [BLK 2 TESS SIM RES-SURRECT]	TESS has established the aircraft in a resurrected state after a simulated hit or kill condition (i.e. the aircraft is in the same state before being hit or killed). Remains on for 8 seconds.	**TESS SIM RESSURRECT**	NO	Simulation is resurrected.
[BLK 1 LIVE ROUND] [BLK 2 TESS LIVE GUN AMMO]	TESS has determined live gun ammo is present on the aircraft.	**TESS LIVE GUN AMMO**	NO	
[BLK 1 LIVE ATAM] [BLK 2 TESS LIVE ATA MSL]	TESS has determined a live ATA missile is present on the aircraft.	**TESS LIVE ATA MSL**	NO	
[BLK 1 LIVE HF MSL] [BLK 2 TESS LIVE HF MSL]	TESS has determined a live hellfire missile is present on the aircraft.	**TESS LIVE HF MSL**	NO	
[BLK 1 LIVE ROCKET] [BLK 2 TESS LIVE ROCKET]	TESS has determined a live rocket is present on the aircraft.	**TESS LIVE ROCKET**	NO	

Table 2-16. TESS Advisory Messages - continued

UFD TEXT EUFD TEXT	PARAMETER OR FAULT	MPD PAGE TEXT	ADVISORY TONE	VOICE MESSAGE
[BLK 1 TESS STORES] **[BLK 2 TESS STORES ERROR]**	TESS has found a stores conflict. The configuration load simulated by the TESS system does not match a possible aircraft configuration.	**TESS STORES ERROR**	NO	
TESS FAIL	TESS has detected a fault condition that will inhibit operation of the TESS weapon emulation. Remains on until the DMS page is displayed.	**TESS FAIL**	NO	
TESS FAULT	TESS has detected a fault condition that degrades, but does not inhibit the TESS weapon emulation. Remains on until the DMS page is displayed.	**TESS FAULT**	NO	

CHAPTER 3A
BLK 2 AVIONICS

Section I. GENERAL

3A.1 DESCRIPTION

Avionics equipment includes communication equipment and navigation equipment. This chapter describes each major item with respective locations on the airframe and antenna locations.

3A.2 AVIONICS EQUIPMENT CONFIGURATION

Communication/Navigation equipment configurations are shown in Table 3A-1. Communication/Navigation antenna locations are shown in Figure 3A-1.

3A.3 AVIONICS POWER SUPPLY

CAUTION

Uncommanded FM transmissions may occur during IDM IBIT, FALLBACK, when the CIU circuit breaker is open, or during CIU power-up. CIU power-up occurs during aircraft power-up and upon CIU circuit breaker reset.

Power to operate all of the avionics communication equipment is provided by the emergency dc bus. This allows back-up battery power to be used in case of an aircraft electrical failure. External power may also be applied. See Chapter 2, Section XI for more information on electrical power supply.

NOTE

- Testing of the aircraft has shown that there may be significant self-generated interference [HF missile launchers, Doppler Navigation System (DNS) antennae, MPDs, etc.] and local conditions (radio, television stations, public transmitters) that affect aircraft communications receivers. Reception ranges may be significantly reduced, whereas, transmission capability is normally unaffected.
- The VHF-AM (ARC-186) radio can transmit clearly. A slight range and audibility degradation occurs at the high band frequencies in directions from 0 to 120 degrees from the nose. Reception is achieved up to a range of 22 NM except with frequencies above 145 MHz where the direction degradation is severe.
- The UHF-AM (ARC-164) radio provides the second best overall performance. Two line-of-sight blockages occur with the UHF radio that completely block reception and transmission due to pylon-mounted weapons. These blockages are in 25-degree directional arcs, from 012 to 037 degrees and from 323 to 348 degrees from the nose. A slight range and audibility degradation occurs around the tail directions from 120 to 240 degrees from the nose. Although transmissions are clear, the maximum reception range for UHF is approximately 30 NM below 300 MHz and approximately 35 NM above 300 MHz. Communications in combat operations and with ATC should take these factors into consideration.
- The FM-1 radio transmits clearly and provides the third best overall performance. A slight range and audibility degradation occurs at the low and high band of frequencies in directions from 120 to 210 degrees from the nose. Reception is achieved up to a maximum range of 29 NM for plain and 22 NM for cipher text mode. The exception is near 40 and 80 MHz where reception is achieved to a maximum range of 23 and 16.5 NM respectively. Non-line-of-sight reception is expected to be nonexistent.
- The FM-2 radio can transmit clearly at slightly reduced ranges. A severe reception range and audibility degradation occurs on most frequencies compared to the FM-1. The maximum line-of-sight reception range is 22 NM, except for frequencies of 32, 40 and 80 MHz that can be as low as 13 NM.

Table 3A-1. Communication/Navigation Equipment

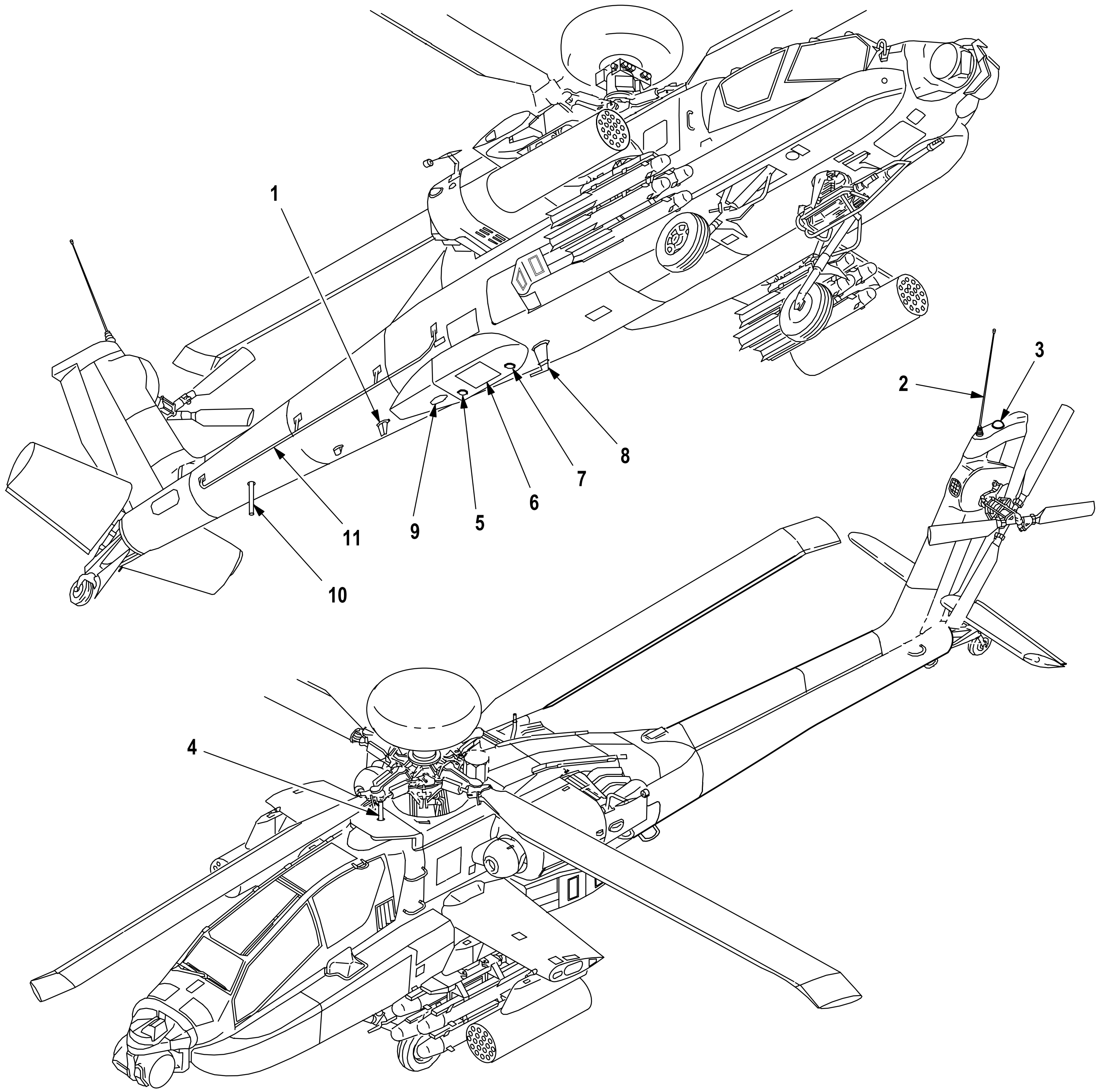
Equipment	Nomenclature	Use	Range	Control Location	Remarks
Inter-communication	Communication Control Panel (COMM)	Inter-communication between crew members, wing station communications and volume control.	Within crew stations and two external receptacles located on the wing tips.	Pilot right console and CPG right console	Pilot volume controls RH wing volume, CPG volume controls LH wing volume.
VHF-AM Communication	Radio set RT-1300B/ ARC-186(V) VHF	Two-way voice communications VHF-AM frequency range 116 to 151.975 MHz. Receives only frequency range 108 to 115.975 MHz.	Line of sight	MPD, EUFD, and COMM panel	
UHF-AM Communication	Radio set RT-1145F/ ARC-164(V) UHF (HAVE QUICK) Radio set RT-1614 (HQ2)	Two-way voice communication UHF-AM frequency range of 225 to 399.975 MHz. Contains a separate dedicated guard receiver fixed-tuned to 243 MHz.	Line of sight	MPD, EUFD, and COMM panel	Provides the capability to monitor the guard frequency while receiving and transmitting on any frequency other than 243 MHz. Provides the capability for frequency hopping (FH) and secure communications.
VHF-FM Communication	Radio set RT-1478D/ ARC-201D VHF Single Channel Ground and Airborne Radio Set (SINCGARS)	Two-way voice communication VHF-FM in the frequency range of 30 to 87.975 MHz.	Line of sight	MPD, EUFD, and COMM panel	Provides the capability for FH and secure communications.
HF Communication	Radio set ARC-220 HF	Two-way voice communication HF in the frequency range of 2.0000 to 29.9999 MHz.	Non-Line of sight	MPD, EUFD, and COMM panel	Provides the capability for non-line of sight communications.

Table 3A-1. Communication/Navigation Equipment - continued

Equipment	Nomenclature	Use	Range	Control Location	Remarks
Voice Security System	TSEC/KY-58 (CIPHER DEVICE)	Secures communication for UHF radio.	Not applicable	MPD, EUFD, and EMERGENCY panel.	The COMSEC subsystem provides control of the TSEC/KY-58 from both crew stations. It has the capability to store up to 6 Crypto Net Variables.
Voice/Data Security System	TSEC/KY-100 (CIPHER DEVICE)	Secures communication for HF radio.	Not applicable	MPD and EUFD,	The COMSEC subsystem provides control of the TSEC/KY-100 from both crew stations. It has the capability to store up to 6 Crypto Net Variables.
FM amplifier	Improved FM (IFM)	Varies power output of FM1.	Not applicable	MPD	Is a variable power amplifier capable of providing RF output at four power levels.
Transponder set	RT-1836/ APX-118(V)	Transmits a reply coded to a radar interrogator system.	Line of sight	MPD, EUFD, and EMERGENCY panel.	Includes mode S growth provisions and embedded encrypted Mode 4 operation.
Transponder set	RT-1471/ APX-100(V)	Transmits a reply coded to a radar interrogator system.	Line of sight	MPD, EUFD, and EMERGENCY panel.	Optional installation to RT1836/APX-118
Identification Friend or Foe (IFF)	Kit-1C computer	Provides encrypted mode 4 operation.	Not applicable	Not applicable	Not reguired for RT1836/APX-118
Communication Interface Unit	CIU P/N 7-513200010	Provides centralized processing and distribution of communication data and audio signals.	Not applicable	Not applicable	Provides audio switching, conditioning, and mixing capabilities; crew monitor and transmitter selections; and voice messages and warning tones.
Improved Data Modem	IDM, MD-1295/A TYPE - 304 VERSION 7.1x	Provides a host interface between tactical aircraft radios and data bus.	Not applicable	MPD	IDM V7.1x supports transmit/receipt of Longbow, TACFIRE, Tactical Internet, and Fire Support protocol data.

Table 3A-1. Communication/Navigation Equipment - continued

Equipment	Nomenclature	Use	Range	Control Location	Remarks
Embedded Global Positioning Inertial Navigation System (EGI)	GPS	Provides position and velocity information to the INU	Not applicable	MPD	
	INU	Provides acceleration, angular rate, heading, velocity, position, and position error estimates data.	Not applicable	MPD	
Radar Altimeter	Altimeter, Radar AN/APN-209	Provides actual terrain clearance height.	0 - 1428 ft	MPD/IHADSS	
Doppler Radar Velocity Sensor (DRVS)	AN/ASN-157	Provides aircraft referenced ground velocities to the EGI.	Not applicable	MPD	
Air Data System	ADS	Computes air mass referenced data to provide the Omni-directional airspeed, Barometric Altitude, and Outside Air Temperature information necessary to display Mean Sea Level (MSL) terrain elevation for the aircraft present position.	Not applicable	Not applicable	
Automatic Direction Finder (ADF)	AN/ARN-149	Provides a relative bearing to the station signal as well as an audio output of the received signal.	Line of sight	MPD	



1. UHF
2. VHF-AM/FM1 WHIP
3. GLOBAL POSITIONING SYSTEM (GPS)
4. UPPER TRANSPONDER
5 RADAR ALTIMETER (TRANSMITTER)
6. RADAR DOPPLER
7. RADAR ALTIMETER RECEIVER
8. VHF-FM2
9. ADF
10. LOWER TRANSPONDER
11. HF

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Figure 3A-1. Communication/Navigation Antennas

Section II. COMMUNICATIONS SUBSYSTEM

3A.4 INTRODUCTION

This section covers the description and operation of the aircraft communication subsystem and the Transponder/ IFF subsystem (fig 3A-2). Both voice and digital communications are supported by the following equipment:

- ARC-186(V) VHF-AM Radio Set
- ARC-164(V) UHF-AM Radio Set (HAVEQUICK)
- TSEC/KY-58 (CIPHER DEVICE)
- ARC-201D VHF-FM (SINCGARS) 2 each
- IFM-101A/AM-7189A/ARC Improved FM (IFM) Amplifier
- ARC-220 HF Radio Set
- TSEC/KY-100 (HF CIPHER DEVICE)
- APX-100(V) Transponder

or

- APX-118(V) Transponder
- MD-1295/A Improved Data Modem (IDM)
- Load Maintenance Panel (LMP) (COMSEC)

NOTE

The APX-100(V) Transponder or APX-118(V) may be installed. If APX-100(V) is installed, Kit-1C computer must be installed for Mode 4 operation.

Each crewstation provides the crew with independent control and status monitoring of the communication subsystem via the Multi-Purpose Display (MPD), Enhanced Up Front Display (EUFD), and Keyboard Unit (KU). In addition, monitor select and volume/squelch controls for each of the five radios are controlled by the **COMM** panel in each crewstation. The communication subsystem equipment is powered from the battery bus and defaulted to **ON** when power is applied. However crew control of the radios is limited until aircraft or external power is applied. After aircraft power has been applied to the MPDs, rapid initialization of the radio presets and Signal Operating Instructions (SOI) can be accomplished via the Data Transfer Unit (DTU).

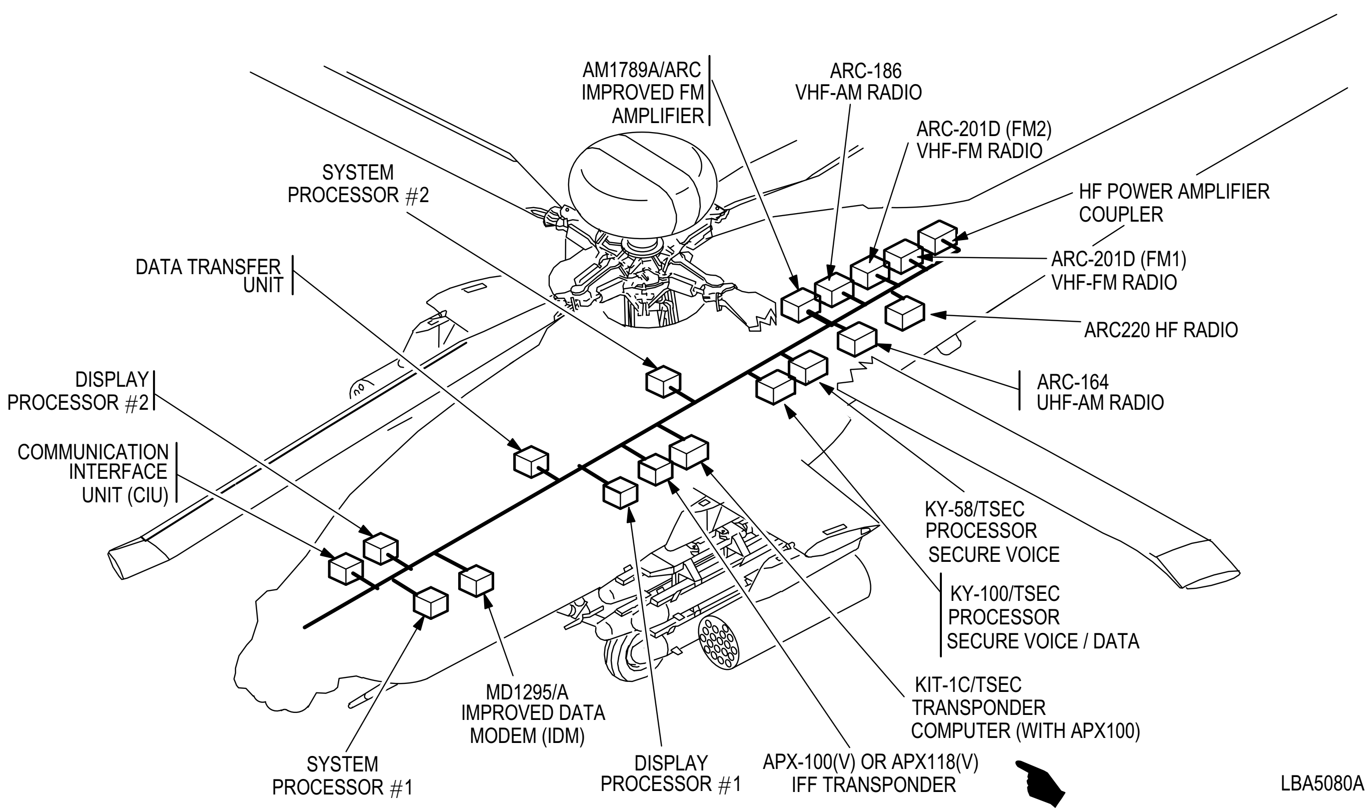

Figure 3A-2. Communications Subsystem

3A.5 ARC-186(V) VHF-AM RADIO SET

The aircraft has one ARC-186 VHF radio which provides two-way communication over VHF-AM frequency range (116.000 through 151.975 MHz) in 0.025 MHz channel spacing.

NOTE

ARC-186 FM frequencies (30.000 through 87.975 MHz) are not implemented. See paragraph 3A.8

3A.5.1 VHF Tone. Selecting the **VHF TONE** button will not generate a tone from the radio but will transmit a ”dead carrier” over the air for maintenance.

3A.6 ARC-164(V) UHF-AM RADIO SET (HAVE QUICK)

The aircraft has one ARC-164 UHF radio which provides two-way communications over UHF-AM frequency range (225.000 through 399.975 MHz) in 0.025 MHz channel spacing. The radio contains a separate, dedicated guard receiver fixed tuned to 243.000 MHz, thus providing capability to simultaneously monitor guard frequency (243.000 MHz) while receiving and transmitting on any frequency other than 243.000 MHz. When the transceiver is tuned to 243.000 MHz, the dedicated guard receiver is automatically turned **OFF**. The radio set has squelch capability and can operate in either single channel or frequency hopping mode. The frequency hopping capability of the UHF radio is referred to as HAVE QUICK. There can be one of two versions of HAVE QUICK radios installed in the aircraft. HAVE QUICK 1 radios provide the capability to load one word of day into the radio and utilize 6 training frequencies for the training mode. HAVE QUICK 2 radios provide the capability to load up to six words of the day into the radio and utilize 16 training frequencies for the training mode.

3A.6.1 Frequency Hopping (FH) Capability (HAVE QUICK). The FH capability is an Electronic Counter-Counter Measure (ECCM) enhancement to the standard UHF radio by which the frequencies being used and the dwell times are rapidly changed many times a second. The radio requires three items to determine the FH pattern:

a. Time of Day (TOD). The TOD is synchronized to the radio clock, which is normally set to Coordinated Universal Time (UTC). The TOD is required by the radio to maintain its internal clock, which controls the FH timing. The crew may send or receive the TOD signal if FH communication is desired through non-TOD synchronized radios. Receiving the TOD affects only the internal clock of the UHF radio.

b. Word of Day (WOD). The WOD is classified and controlled by the National Security Agency (NSA). The WOD programs the FH pattern and rate. The radio cannot function in the FH mode without a valid WOD. A WOD is required for each day and consists of up to six segments, which code the radio for FH. For HaveQuick 2 radios, the WOD must be tagged with its operational day (1-31). The WODs are loaded into the radio through the DTU or by the crew.

c. Net Number. The net number programs the radio to operate in one of the FH modes, selects the frequency table to be used and determines entry point into the FH pattern. Net numbers enable multiple station pairs to operate simultaneously using the same WOD and TOD without interference. The net number will be loaded into the radio through the DTU or via the crew.

3A.6.2 UHF Tone. Selecting the **UHF TONE** button generates an audio tone from the radio and transmits the tone over the air.

3A.7 TSEC/KY-58 VOICE SECURITY SYSTEM

The aircraft has one TSEC/KY-58 Voice Security System for the UHF radio, which provides encrypted communication. The TSEC/KY-58 has the capability to store up to six Crypto Net Variables (CNV). CNVs are COMSEC variables required to establish the encryption process inside the TSEC/KY-58. CNVs are generally loaded directly into the TSEC/KY-58 with a fill device by the maintenance crew at the Remote Selectable Fill Port, but may also be loaded through RF Link. TSEC/KY-58 controls are implemented on the MPD and/or the **EMERGENCY** Panel and the LMP.

3A.7.1 KY-58 Tones. The KY-58 generates tones for variable loading and failure conditions. An additional tone is generated when the KY-58 is ready to transmit or receive.

NOTE

The FM radios can take as long as 10.0 seconds to completely tune/configure to a **COM** preset. the FM radios are available for voice transmission within 2.0 seconds of tuning but the transmissions may be broken.

3A.8 AN/ARC-201D VHF-FM SINGLE CHANNEL GROUND & AIRBORNE RADIO SET (SINCGARS)

The aircraft has two ARC-201D VHF-FM radios with Software Improvement Program (SIP) enhancements. The radio sets provide two-way communications over the VHF-FM frequency range of 30.000 through 87.975 MHz in 0.025 MHz channel spacing. The radio set operates in either single channel or frequency hopping (FH) mode. The two ARC-201D radios are referred to as FM1 and FM2 or, in general, as FM. Secure voice/data communications are provided by COMSEC equipment which is embedded in the radios. Each SINCGARS-SIP radio (FM1/FM2) has a Carrier Sense Multiple Access (CSMA) line installed that communicates directly with the IDM. The CSMA connection with the IDM is required for Joint Variable Message Format (JVMF) communications over Tactical Internet (TI) and Fire Support (FS) Protocols. The CSMA supports advanced net monitoring (Net Access Delay) capabilities and is used to report the ARC-201D's configuration status to the IDM whenever a TI or FS preset-net is tuned.

3A.8.1 Frequency Hopping (FH) Capability. This enhancement provides a FH capability (frequencies and dwell times are rapidly changed many times a second). FH provides an anti-jamming capability which can operate in conjunction with a secure communications mode. Zeroizing the individual radio can be accomplished from the MPD. Three items required to determine FH patterns are:

a. Time. Time is in the form: day, hour, and minutes. Time is required by the radio to maintain its internal clock, which controls FH timing.

b. Hopset. The Hopset is classified and controlled by the NSA. The Hopset programs frequency hopping rate and frequency hopping pattern. The range of Hopsets is between 001 - 999. There are up to six Hopsets loaded into the radio. Hopset information can be inserted locally through the fill device with control provided by the load maintenance panel (LMP) and connected via the remote selectable **FILL** port. It can also be distributed by Radio Frequency (RF) link also known as ECCM Remote Fill.

c. Lockout Set. During frequency selection for the Hopsets, it may be determined that interference may result between two nets using the same frequency. In this case one of two types of lockouts, common or unique, is automatically loaded when the system locally filled or through an ECCM Remote Fill.

3A.9 IMPROVED FM (IFM)

The aircraft has one IFM amplifier to vary the RF power output of the FM1. The four power levels are listed in Table 3A-2.

Table 3A-2. RF Output Levels

Power Setting	Effective Radiating Power (Watts)
LOW	2.5
NORM	10.0
HIGH	40.0
OFF	10.0

The communications subsystem provides capability to set IFM Power to **LOW /NORMAL /HIGH /OFF** via the MPDs.

CAUTION

- **The IFM should be turned OFF when operating the radios on battery power to avoid draining the aircraft battery.**
- **Transmitting IFM in HIGH while both FMs are tuned to the same frequency may cause damage to the FM2 receiver.**

NOTE

Failure of the IFM will turn off the sidetone from the ARC-201D FM1 radio. An IFM failure is also reported during radio IBIT. The FM1 radio may still be able to transmit at its own internal power of 10 Watts. Should an IFM failure occur it is recommended to turn IFM off.

3A.10 AN/ARC-220 HF RADIO SET

The aircraft has one ARC-220 HF radio. The ARC-220 provides High Frequency airborne communications in the 2.0000 through 29.9999 MHz frequency range, in 0.1 kHz spaced steps. The ARC-220 operates in the following modes:

- Manual tuning
- Preset Channel tuning
- ALE (Automatic Link Establishment)
- ECCM Frequency Hopping
- Emergency

The Emergency mode is a preprogrammed configuration of the ARC-220 radio. The ARC-220 radio will be referred to hereinafter as the HF radio. Refer to Table 3A-3 for HF advisory and status messages.

Table 3A-3. HF Radio Advisory/Status Message Table

Advisory/Status Message	Description
ANT TUNING	Radio is tuning the antenna
ANT UNTUNED	Radio ECCM net is not pre-tuned
CALLING	An ALE call is being transmitted
CALL FAILED	ALE call has failed on all attempts.
CALL RESPND?	ALE call detected: however, radio set to SILENT mode, crew must press PTT to establish call.
CHECK MSG	Radio received text message: can be reviewed and/or deleted.
FILL CHECK	Radio is checking fill data.
FILL PROCESS	Radio is processing fill data.
FILL RECVING	Radio is receiving fill data.
FILL WAITING	Radio is waiting for fill data.
GO DATA ONLY	Transmission quality poor, should switch to data transmission only.
LINKED	ALE link established
PP RECEIVED	Radio received a present position report; can be stored or deleted.
RECVING CALL	Incoming ALE call being received.
RECVING DATA	Radio is receiving digital data.
SOUNDING	Radio is sounding.
SENDING DATA	Radio is sending digital data.
SENDING TIME	Radio is sending the current time.
STANDBY	Radio is in standby mode.
SYNCING	Radio is synchronizing.
TIME SYNC FAIL	Synchronized time between radios has failed
UNSYNC	Radio is currently not synchronized.
XMIT READY	Radio has transmitted ECCM preamble and is ready to transmit.
ZEROIZED	Radio is being zeroized.

3A.11 KY-100 HF RADIO COMMUNICATION SECURITY SYSTEM

The aircraft has one TSEC/KY-100 Communications Security System which provides encrypted communications for the HF radio. The TSEC/KY-100 transforms voice, digital data, or analog data into ciphertext information. The TSEC/KY-100 has the capability to store up to six Crypto Net Variables (CNV). CNVs are COMSEC variables required to establish the encryption process inside the TSEC/KY-100. CNVs are generally loaded directly into the TSEC/KY-100 with a fill device at the Remote Selectable Fill Port, but may also be loaded through RF Link. TSEC/KY-100 controls are implemented on the MPD.

3A.12 APX-100 TRANSPONDER

The aircraft contains one transponder, an APX-100 or APX-118 (para 3A.12A), which provides automatic radar identification of the aircraft to all suitably equipped stations. The transponder receives, decodes, and responds to interrogation of the following modes:

MODE 1	Provides 32 possible code combinations that can be selected in-flight. Possible code combinations are: 00-03, 10-13, 20-23, 30-33, 40-43, 50-53, 60-63, and 70-73.
MODE 2	Provides 4096 possible code combinations. The desired code must be set on the ground on the APX-100 located behind access panel L160. Possible code combinations are 0000-7777.
MODE 3/A	Provides 4096 possible code combinations that can be selected in-flight. Possible code combinations are 0000-7777.
MODE C	Provides altitude information obtained from the FMC.

NOTE

- KIT-1C is not required in the aircraft with the APX-118 transponder.
- When the KIT-1C is not installed in the aircraft, the **MODE 4** selection will not be shown on the MPDs.

3A.12.1 KIT-1C MODE 4 Computer. Provides a crypto-secure mode of identification for the APX-100 transponder, by relying on an encrypted interrogation. It utilizes two classified operational codes which are loaded directly into the KIT-1C computer via a fill device through the Remote Selectable Fill Port in the aft avionics bay. Code selection is limited to **A** or **B**, which corresponds to the operational day. Other MODE 4 capabilities are:

- When on the ground, the **MODE 4 HOLD** enables the computer to save the last **MODE 4** codes for utilization on the next power-up.
- **IDENT** selection located on the MPD and **COMM** panel enables **IDENT** transmission to ID ownship on others' radar screens.
- Selectable **MODE 4** audio cueing.
- Selectable **MODE 4** EUFD visual cueing.
- Selectable **EMERGENCY** mode.

3A.12A APX-118 TRANSPONDER

The APX-118 provides automatic radar identification of the aircraft to all suitably equipped stations. The transponder receives, decodes, and responds to interrogation of the following modes:

MODE 1	Provides 32 possible code combinations that can be selected in-flight. Possible code combinations are: 00-03, 10-13, 20-23, 30-33, 40-43, 50-53, 60-63, and 70-73.
MODE 2	Provides 4096 possible code combinations. Possible code combinations are 0000-7777.
MODE 3/A	Provides 4096 possible code combinations that can be selected in-flight. Possible code combinations are 0000-7777.
MODE 4	Provides a crypto-secure mode of identification by relying on an encrypted interrogation. It utilizes two classified operational codes which are loaded directly into the transponder via a fill device through the Remote Selectable Fill Port in the aft avionics bay. Code selection is limited to **A** or **B**, which corresponds to the operational day.
MODE C	Provides altitude information obtained from the FMC.
MODE S	Provides Aircraft Address, Aircraft Tail Number, and the Aircraft Flight ID.

CAUTION

Failure to place the IDM in STBY mode prior to removing aircraft power may result in corrupted data files or damage to the IDM.

3A.13 IMPROVED DATA MODEM (IDM)

NOTE

Testing has shown that reception ranges are often degraded by five NM or more over those ranges where voice communication can be received.

The aircraft is configured with a single IDM, which supports the digital communication requirements for Longbow Air Force Application Program Development (AFAPD), TACFIRE, Tactical Internet and Fire Support protocols.

a. The IDM serves as the digital host interface between the aircraft's radios and the data bus for specific mission equipment. IDM communications occur over a crewmember's selected digital radio channel, as determined by that crewmember's EUFD IDM transmit select indicator, or the tuned FM1 or FM2 radio for Fire Support artillery messages. Management of the IDM is performed through the communications subsystem.

NOTE

- Each crewstation is equipped with its own unique EUFD **IDM** select switch and indicator (fig 3A-4). A blocked diamond symbol on the left side of the EUFD format represents each station's unique **IDM** select indicator.
- The opposite crew member's EUFD **IDM** select indicator (fig 3A-4) is displayed as a filled diamond symbol. If both crew members have the same radio selected for IDM transmit, then a filled block symbol will be displayed.
- The **IDM** select indicator is not used by the system when a FS preset-net is tuned to either FM1 or FM2 and a **TSD RPT ARTY** page message is sent or received.
- The **IDM** will delete all JVMF messages (TI and FS) anytime that the TI is detuned.

b. The IDM serves as the Tactical Internet Controller Device (TICD) for aviation. It is compatible with the Force Battlefield Command for Brigade and Below (FBCB2) device and the TI architecture. A TI/FS Carrier Sense Multiple Access line connects both of the ARC-201D radios directly to the IDM. The CSMA implementation supports:

- TI and FS net access and monitoring requirements
- Upon tuning the SINCGARS-FS and/or SINCGARS-TI frequency, the SINCGARS SIP radio(s) configuration is reported to the IDM.

Through the CSMA port, the IDM compares the SINCGARS radio configuration with its own configuration. If a mismatch is detected, a white **NET JOIN** status is displayed on COM page while an automatic net join synchronization process is conducted. The status is removed once the IDM and the ARC-201D radio are synchronized. The NET JOIN status will remain displayed in the rare case where the NET JOIN synchronization fails: the operator may attempt another SINCGARS-FS/TI tune to restart the NET JOIN process.

c. The IDM's two major software and hardware version numbers may be recalled and displayed on the DMS **VERS** page. IDM's TACFIRE software and processor firmware versions are recalled through the following **ATHS** page button tree: **START** page **1/3**, **RESET DATA>** page **1/1**, **<SW-VERS** page **1/4**, **2/4**, **3/4**, and **4/4** pages.

NOTE

The IDM's hardware and software version numbers are not displayed on **VERS** page if IDM is in **STBY**.

d. The IDM is implemented with an **INHIBIT** button on the **SET** page that, when selected, inhibits all IDM radio data transmissions. The IDM receives data transmissions but does not automatically respond. The I**NHIBIT** feature is primarily used during refuel/rearm operations.

e. Prior to removing power from the aircraft, the **IDM** button is required to be placed to **STBY**. In **STBY,** the IDM is no longer capable of transmitting any data messages and will no longer receive JVMF messages. The IDM button is located on both the DMS **SHUTDOWN** page and **SET** pages.

3A.14 LOAD MAINTENANCE PANEL (LMP)

The LMP (fig 3A-3) consists of a keypad, display, front panel control switches, and knobs. It is co-located in the RH aft avionics bay with the Remote Selectable Fill Port.

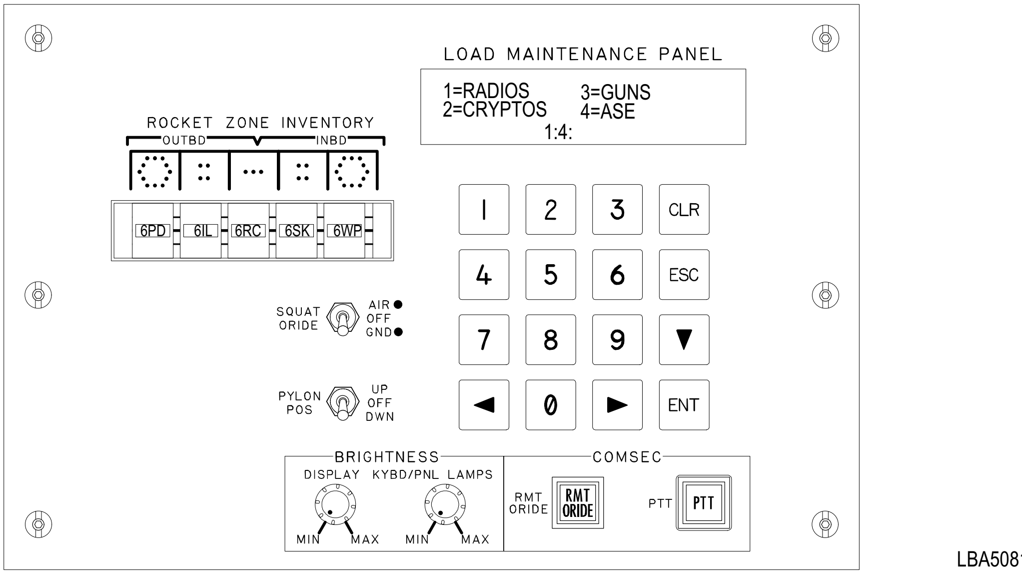

Figure 3A-3. Load Maintenance Panel

3A.14.1 LMP Capabilities. The LMP provides the following capabilities:

- Position pylons for loading stores.
- Override the **SQUAT SWITCH** setting to simulate airborne conditions for troubleshooting and testing while on the ground.
- Display and specify rocket types associated with each of the aircraft rocket zones.
- Display and specify 30mm Gun rounds count.
- Display and specify Chaff count.
- Specify data download to the FM radios.
- Specify/verify data download to the HF radios.
- Specify data download to the HF Radio's Crypto device
- Press-to-talk (**PTT**) and Remote Override (**RMT ORIDE**) **COMSEC** pushbuttons.

3A.14.2 Remote Override (RMT ORIDE) Button. The **RMT ORIDE** button disables MPD control and enables front panel (KY-58) control capabilities for Crypto Net Variables loading purposes. The **RMT ORIDE** button is automatically disabled when the aircraft is airborne and must be manually actuated on the ground for any further loading.

NOTE

ICS communication is the only recommended communication during PTT operations. Do not use UHF at this time.

3A.14.3 Press-To-Talk (PTT) Button. The PTT button enables the transfer of Crypto Net Variable(s) from the Fill device to the KY-58. This CNV transfer can be initiated by keying the appropriate radio from either crewstation.

3A.14.4 LMP Lighting. To save power, all LMP displays and lamps are extinguished while airborne. After landing, pressing any LMP keypad button reactivates the LMP displays and status lights. This initial key press is not interpreted as a data entry keystroke.

3A.14.5 RADIO Selections. LMP provides the capability to select the individual radio formats (1= FM1; 2= FM2; 3= HF) for data fills and HF data verification. Selection of the ESC key returns the operator to the index.

a. FM1 and FM2 Radio Fill Selections. The LMP provides for frequency hopping and COMSEC variable fill selections via LMP keyboard. Selections are available for the following fill device capabilities:

- Single Hopset Preset
- Single Lockout Set Preset
- Single COMSEC variable
- Complete set of Hopset/Lockout Set/COMSEC

Single Hopset/Lockout Set/COMSEC variable filling requires two separate fill devices. A complete set of Hopset/ Lockout Set/COMSEC variable filling can be achieved with a single fill device. LMP display feedback is provided for function in-progress, function completion, function PASS and function FAIL status.

b. HF Radio Fill Selections. The LMP provides for keyfill, datafill, and verification selections via LMP keyboard. A fill device is required for both the keyfill and datafill. The following selections are available from the LMP with the HF radio option selected:

- Keyfill load
- Datafill load
- Verify keys
- Verify data

The VERIFY KEYS selection provides status of the key load for LP3 (cipher for ECCM) and ECCM. The VERIFY DATA selection provides status of the datafill load. A display of the HF MODE CHANGE FAIL message indicates when the HF failed to change modes properly when commanded to perform a keyfill, datafill, verify keys, or verify data. The datafill load verification and return code includes:

- PRE OP (operable), ND (no data), NK (no keys)
- LP3 OP, ND, NK
- ECCM OP, ND, NK
- MAN OP, ND, NK
- ALE OP, ND, NK
- EMER OP, ND, NK

3A.14.6 LMP CRYPTO Selection. The LMP CRYPTO selection provides the capability to access the formats for selecting the installed individual crypto devices for key fills.

3A.15 UP FRONT DISPLAY (EUFD) COMMUNICATION CONTROLS

EUFD communication controls (fig 3A-4) are as follows:

3A.15.1 IDM Rocker Switch. The **IDM** switch permits the operator to select a tuned radio for IDM data message transmission. The **IDM** switch is located on the left side of the EUFD, centered, to the left of the **RTS** and **WCA** rocker switches. The IDM rocker permits cycling up or down through the displayed list of radios. Repeated momentary depression of down selections beyond the last radio in the list will cause the IDM indicator to start over at the top of the list. Repeated momentary depression of up selections beyond the first radio in the list will cause the RTS indicator to start over at the bottom of the list.

3A.15.2 Radio Transmit Select (RTS) Rocker Switch. The **RTS** switch permits the operator to select a radio for voice transmission. The **RTS** switch is located on the lower left side of the EUFD, to the right of the **IDM** rocker switch, and below the **WCA** rocker switch.

The EUFD displays a filled-left-arrow character on the left side of the format for that crewstation's RTS indicator. the opposite crewstation's **RTS** indicator is displayed as a filled-right-arrow character. The **RTS** rocker permits cycling up or down through the displayed list of radios. Repeated momentary depression of down selections beyond the last radio in the list will cause the RTS indicator to start over at the top of the list. Repeated momentary depression of up selections beyond the first radio in the list will cause the RTS indicator to start over at the bottom of the list.

3A.15.3 Preset (P) Button. The **P** button opens or closes the EUFD Preset Window on the EUFD display. The EUFD Preset Window is used to select one of ten single channel presets for tuning the selected voice radio. The **P** button is located on the right side of the EUFD display just below the brightness **BRT** knob.

3A.15.4 Preset Enter button. The **Preset Enter** (down-left arrow) button is used to initiate a single channel tuning of the selected voice radio, based on the preset selected indicator (i.e. arrow symbol) in the EUFD Preset Window. The **Preset Enter** button is located to the right of the **P** button, and above the Swap button.

3A.15.5 Swap Button. The Swap button permits the exchange ("swapping") of the standby frequency/mode, call sign, and net type with the primary frequency/mode, call sign, and net type for the currently-selected radio as displayed in the EUFD. In addition to the swapping of data, the system will automatically tune a frequency and reconfigure the corresponding radio and IDM when the net type is L (Longbow AFAPD), T (TACFIRE), I (Tactical Internet) or F (Fire Support). The swap button, with two "turning arrows" is located to the right of the stop watch button and below the preset enter button. The standby frequency/mode, call sign, and net type is located on the right side of the display and the primary frequency/mode, call sign, and net type for the current RTS radio is displayed on the left side of the display.

3A.16 EUFD COMMUNICATIONS DATA FORMAT

The EUFD displays a select subset of current status information of the communication subsystem, in the lower half of the display (fig 3A-4).

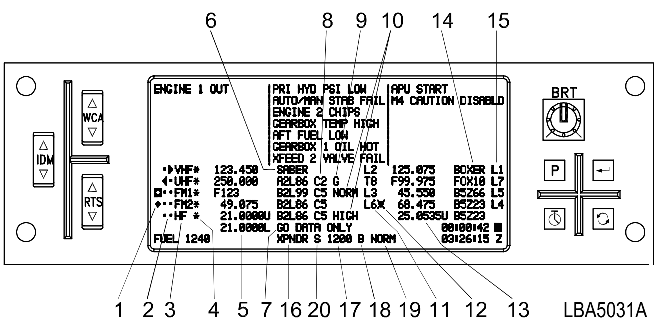

Figure 3A-4. EUFD Data Format

EUFD communications symbology, used in the display fields (fig 3A-4) are numbered as follows:

1. The EUFD displays a blocked diamond symbol in the left-most field of the display for that crewstation's IDM (transmit/receive) indicator. The opposite crewstation's IDM indicator is displayed as a filled diamond symbol. If both crew members have the same radio selected for IDM data transmission, then a filled block symbol will be displayed.
2. The EUFD displays a left-pointing arrow symbol in the second field for that crewstation's RTS (transmit/receive) indicator. The opposite crewstation's RTS indicator is displayed as a right-pointing arrow symbol. Dots (no arrow) indicate that the radio is enabled for monitoring (receiving) only.
3. Radio identifier (**VHF**, **UHF**, **FM1**, **FM2** or **HF**).
4. Squelch Off/On status (asterisk indicates squelch On).
5. Currently tuned frequency/FH parameters.

- When the UHF radio is in Frequency Hopping mode, the UHF frequency displayed on the EUFD is an 'F' followed by the net number. When in the Training mode, the UHF frequency displayed on the EUFD is a 'T' followed by the training net number.
- When SINCGARS is in Frequency Hopping mode, the Active Hopset is displayed in the corresponding EUFD FM Current Frequency location in the form Fxxx, where xxx is the Hopset ID.

6. Call Sign (EUFD primary) currently assigned to the currently tuned radio: MAN = manual tune; GUARD = Guard tune
7. HF radio status (Table 3A-3).
8. Cipher Off/On status and Crypto Net Variable (UHF, FM 1, FM 2, and HF only).
9. Guard (**G**) receiver Off/On (UHF only).
10. Power status. IFM power status includes **OFF**, **LOW**, **NORM**, **HIGH**. HF power status includes **LOW**, **MEDIUM**, **HIGH**.
11. IDM Net status (**I** = Internet, **F** = Fire Support, **L** = Longbow {AFAPD}, and **T** = Tacfire).
12. Tactical Internet Connected indicator. Presence of a filled circle superimposed with an X indicates that preset is tuned to the Tactical Internet (**I**) protocol and the TI radio is connected to the TI-Network.
13. Standby (last tuned) frequency/FH parameters.
14. Standby Call Sign is a previously tuned preset that is now passively resident in the EUFD's standby area until swapped back to primary.
15. Standby IDM Net Status (**I**, **F**, **L**, or **T**)
16. Transponder identifier.
17. Transponder Mode 3/A status and code.
18. XPNDR Mode 4 code. Presence of code indicates Mode 4 is On.
19. Transponder Master Control (**STBY/NORM/EMER**) status.
20. XPNDR Mode S enable/disable status which is only displayed if an APX-118 is installed.

3A.17 COMMUNICATIONS (COMM) PANEL

There is a **COMM** panel (fig 3A-5) in each crewstation to provide volume control and other functions for the respective crewstation. Following is a description of the **COMM** panel controls:

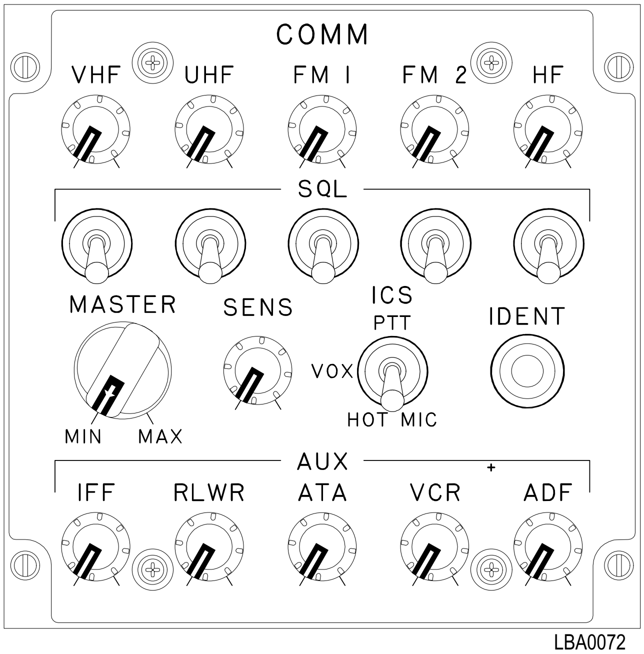

Figure 3A-5. Communications (COMM) Panel

3A.17.1 Volume Controls. The top row of five knobs provide independent volume control for the respective radios. Monitoring of the radios, VCR, and ADF audio can be disabled by pulling out the respective control knob which removes the appropriate monitor status dot from the EUFD, unless selected as the active transmitter.

3A.17.2 Squelch (SQL) Switches. The **SQL** switches are momentary toggle switches that provide squelch on/off capability. There is a **SQL** switch for each radio, located directly below the corresponding volume control knob.

3A.17.3 MASTER Control. The **MASTER** control provides the capability to adjust the audio level (volume) of all signals associated with the communication subsystem and controls the applicable crewstation helmet and wing connection volume levels.

3A.17.4 Sensitivity (SENS) Control. The **SENS** control provides the capability to adjust the audio threshold level when the ICS mode switch is in the **VOX** position. The system only transmits when voice level exceeds the threshold setting of the **SENS** adjustment. To increase sensitivity rotate control clockwise.

3A.17.5 ICS Mode Switch. The **ICS** mode switch provides selection of the audio keying system for communication between crew stations. Following are the three modes that can be selected with the **ICS** switch:

a. Push-To-Talk (PTT). The **PTT** position allows communication only while the **ICS PTT** switch is being depressed.

b. VOX. The **VOX** position allows communication between crewmembers only when their voice levels exceed the threshold level as set with the **SENS** control.

c. HOT MIC. The **HOT MIC** position allows continuous communication between crewmembers.

3A.17.6 IDENT Switch. The **IDENT** switch allows the transponder to be placed in IDENT mode. This switch performs the same function as the **IDENT** option label located on the MPD **XPNDR** page.

3A.17.7 AUX Controls

a. Identification, Friend or Foe (IFF). The **IFF** knob provides independent volume control of the **IFF MODE 4** audio.

b. Radar/Laser Warning Receiver (RLWR). The **RLWR** knob provides independent volume control of the **RLWR** audio.

c. Air-To-Air (ATA). This knob is not currently used.

d. Video Cassette Recorder (VCR). The **VCR** knob provides independent volume control of the VCR playback audio.

e. Automatic Direction Finder (ADF). The **ADF** knob provides independent volume control of the ADF audio.

3A.18 EMERGENCY PANEL

The **EMERGENCY** panel (fig 3A-6) communications functions provides for tuning the UHF radio to the **GUARD** frequency, selection of the transponder (**XPNDR)** emergency mode, and zeroizing classified data.

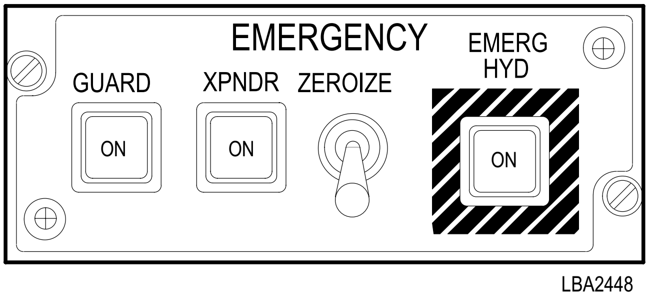

Figure 3A-6. EMERGENCY Panel

3A.18.1 GUARD Lighted Button. Pressing this button tunes the UHF radio to its guard frequency, which is displayed on the EUFD, and causes the system to automatically select (RTS) the UHF radio. Pressing the **GUARD** button again commands the system to swap the primary and standby locations of the EUFD: 1) the guard frequency is swapped into the EUFD's standby frequency location; and 2) the radio and/or preset-net data previously in the standby location is swapped back into the EUFD's primary location.

3A.18.2 XPNDR Lighted Button. Pressing this button sets a code of 7700 in mode 3/A. The **XPNDR** Mode 3/A button has to be moded ON and **XPNDR MASTER** button can be in NORM or STBY prior to activating the **XPNDR** emergency button. The EUFD provides a status of **7700 EMER** to indicate that emergency transponder mode has been selected. To exit the emergency transponder mode, press the **XPNDR** button again, which will extinguish the light. After deactivation, the system does not reset any codes until they are entered manually or with the Data Transfer Cartridge (DTC).

3A.18.3 ZEROIZE Switch. The **ZEROIZE** switch is actioned by first pulling it up and out of the locked position, next to the forward position, and then returning the switch to the locked or after position to complete the zeroization process. Actioning the **ZEROIZE** switch zeroes-out the following classified data:

a. COMSEC variables.

b. FM1 and FM2 Hopsets.

c. FM1 and FM2 lockout sets.

d. HF radio.

e. HQ1 WOD or HQ2 MWOD from radio, and SP Non-Volatile Memory (NVM).

f. All Signal Operating Instructions (SOI) tables/data in Data Processor (DP) NVM.

g. Mode 4 (KIT-1C).

h. IDM network parameters.

i. IDM team member indications in the IDM and DP NVM.

j. Tactical Situation Display (TSD) Waypoints, Targets/Threats, and Control Measures.

NOTE

- Emergency zeroize does not erase classified data in the FCR and DTC

3A.19 CYCLIC GRIP COMMUNICATIONS CONTROLS

The cyclic control grips provide the crew with the **RADIO/ICS** Push-To-Talk (PTT) switch and the Radio Transmit Select **(RTS)** switch.

3A.20 ICS/RADIO FOOT CONTROLS

CS/Radio foot controls are identical for both crew stations and are located on the forward crew station deck. The radio PTT foot control is located on the left side of the crew station. The ICS PTT foot control is located on the right side of the crew station.

3A.21 COMMUNICATION SUBSYSTEM DISPLAY FORMAT OVERVIEW

The Communication Subsystem controls and displays are accessed through the MPDs in each crew station. The paging tree (fig 3A-7) illustrates the structure of the COM subsystem pages.

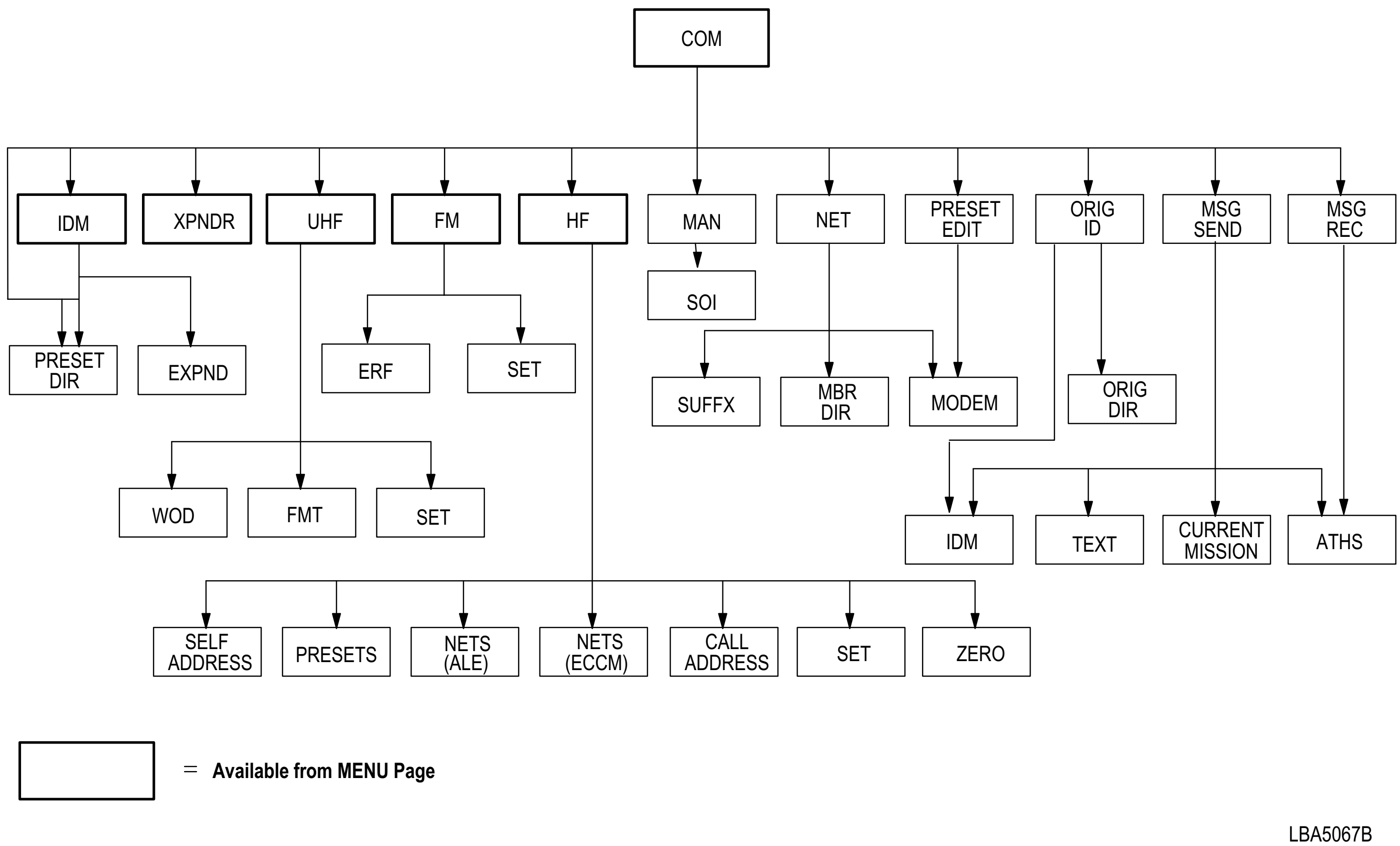

Figure 3A-7. COM Subsystem Paging Tree

3A.22 COMMUNICATIONS PROTOCOL AND NETWORKS

The following communications protocol and network terminologies are used throughout this section:

3A.22.1 Originator ID. The unique digital identification of the ownship or a formal leadership role entity associated with the ownship. Digital ID's include: 1) LONGBOW; 2) TACFIRE; 3) TACTICAL INTERNET {TI}; and 4) FIRE SUPPORT {FS}.

NOTE

An entity is any single platform, system, leadership role position, staff role position, etc. that has an assigned digital ID relationship.

3A.22.2 Network. A functionally related group of members that are assigned and configured with a common: 1) radio type; 2) SC frequency, or HOPSET/ECCM ID; 3) call sign; 4) crypto key, when required; 5) protocol, for digital networks; 6) BDE MULTICAST , when operating over TI; and 7) Unit Task Organization, when operating over TI.

NOTE

- Tactical Internet Enhanced Position Location Reporting System (EPLRS) BN/ BDE Wide Network refers to a battalion/ brigade multicast group that employs the EPLRS-Radio Set as the net's digital radio
- The Tactical Internet SINCGARS Stub Network is a SINCGARS Software Improvement Program (SIP) network that is "stubbed" into the EPLRS network through a gateway; also referred to as a "Roamer Net"

3A.22.3 Member. A member, or subscriber, is a single member or station assigned to a network. Each digital member entity is assigned a unique digital identification. Digital ID's include: 1) LONGBOW; 2) TACFIRE; 3) INTERNET {TI}; and 4) FIRE SUPPORT {FS}.

3A.22.4 Team Member. A team member is a network member designated to receive Longbow, Tacfire, Tactical Internet, or Fire Support team messages. Each digital network may contain up to 16 team members (including ownship).

3A.22.5 Primary Member. A primary member is a network member designated to receive primary messages from the **TSD RPT** page over a Longbow net, Tactical Internet or Fire Support net. There are a maximum of 8 primary members (including the ownship) per digital network (1-10). A net member does not have to be a team member to be a primary member.

3A.22.6 Tactical Internet (TI). An automated, router-based communications network protocol that employs commercial internet standard protocols to move Joint Variable Message Format data vertically and horizontally. The TI is comprised of two parallel messaging components: 1) Situational Awareness messaging; and 2) Command and Control messaging.

3A.22.7 Fire Support (FS). A point to point JVMF MIL-STD-220B protocol, independent of the Tactical Internet, designed to meet real time point-to-point artillery message requirements. The FS protocol is being phased in as the successor to the legacy TACFIRE protocol. The AH-64D supports the artillery's quick fire net protocol which is comprised of three additional elements: 1) ACCESS RANK; 2) TOTAL STATIONS; and 3) STATION ID.

3A.22.8 Unit Reference Number (URN). The digital ID associated with TI, and FS member entities and MultiCast Groups (MCG). A valid URN could range from 1 through 16,777,215.

3A.22.9 Multicast. Used by the IDM to send a single TI JVMF message (size limited) to the ownship's MCG. Multicast is used by the IDM as a tool to reduce overall bandwidth demands on the TI network. The IDM controls how each message is sent. Each digital TI battalion and brigade has its own associated MCG Unit Reference Number listed in the Unit Task Organization (representing a digital division) that resides in the IDM. The IDM does not require operator input of the MCG URN.

3A.22.10 Joint Variable Message Format (JVMF). Messages with format governed by the Joint Interoperability of Tactical Command and Control Systems Variable Message Format Technical Interface Design Plan and MIL-STD-2045-47001B. JVMF messages are currently used with the TI and FS protocols.

3A.22.11 Unit Task Organization (UTO). The UTO is the Tactical Internet's instruction for how the IDM connects to any of the various entities within a division. The UTO is organized around the structure of a division and its subordinate organizations in terms of entities within actual units such as entity personnel, entity equipment, and the absolute TI data associated with all the unique entities. The IDM's current **TI UTO** is displayed on the **ORIG ID** or **MSG SEND/RCV** IDM **SET** page.

3A.22.12 SINCGARS Gateway. The gateway is used by some ground element SINCGARS SIP platforms (only an unspecified amount of ground elements) to connect to the Tactical Internet's battalion EPLRS or brigade EPLRS wide network. The SINCGARS gateway is composed of a SINCGARS SIP radio linked, through an Internet Controller Card (INC), to an EPLRS-Radio Set. The mission of the gateway is to connect ("stub") SINCGARS SIP TI radios to the Tactical Internet's BN or BDE EPLRS wide network.

NOTE

- The SINCGARS gateway is also commonly referred to as either a "Stub Net Gateway" or "Roamer Net Gateway
- Army Aviation exclusively utilizes EPLRS or BFT to connect to the actual TI network.
- The Enhanced Position Location Reporting System (EPLRS) provides a secure, near real-time, jam resistant, data communications capability
- An EPLRS network consists of a number of EPLRS Radio Sets (EPLRS-RS) controlled by an EPLRS Net Control Station (EPLRS-NCS)

3A.22.13 Situational Awareness (SA) Reporting. When tuned to the TI, the default setting for the IDM is to send **AUTO SA** reports to a SA server as determined by, the first occurrence of, either the preset elapsed time or the preset distance an aircraft has moved. The SA server disseminates the SA data to all the entities that are logged in. The **AUTO SA** is accessed and edited from the **ORIG ID** or **MSG SEND/RCV** IDM **SET** page.

3A.22.14 Situational Awareness (SA) Receiving. When tuned to the TI, the IDM automatically updates the SA data periodically. Controls for the display of SA icons are located on the TSD page and the SA page. SA provides different icons to represent Friendly, Enemy, Enemy ADA, Unknown, and Unknown ADA. The icons are shape and color coded (see Appendix C).

3A.23 COMMUNICATIONS (COM) PAGE

The **COM** page (fig 3A-8) is used to manage up to ten preset-networks. All ten (1-10) of the preset-networks, support Tactical Internet and Fire Support protocols while Longbow and TACFIRE protocols may only be used with preset-nets one through eight (1-8). Any of the ten **COM** page preset-nets may be replaced through using the PRESET DIRectory's preset replace function. The PRESET DIR is a database capable of containing up to 60 Longbow, TACFIRE, Tactical Internet, Fire Support, and voice-only preset database items with up to 15 members each. Selecting the **COM** subsystem button or the **COM** page button from the **MENU** page displays the **COM** page. Various communication subsystem status windows and control selections are provided by bezel buttons located along the edges of the MPD. The paging options at the top of the page provide access to subsystem functional pages.

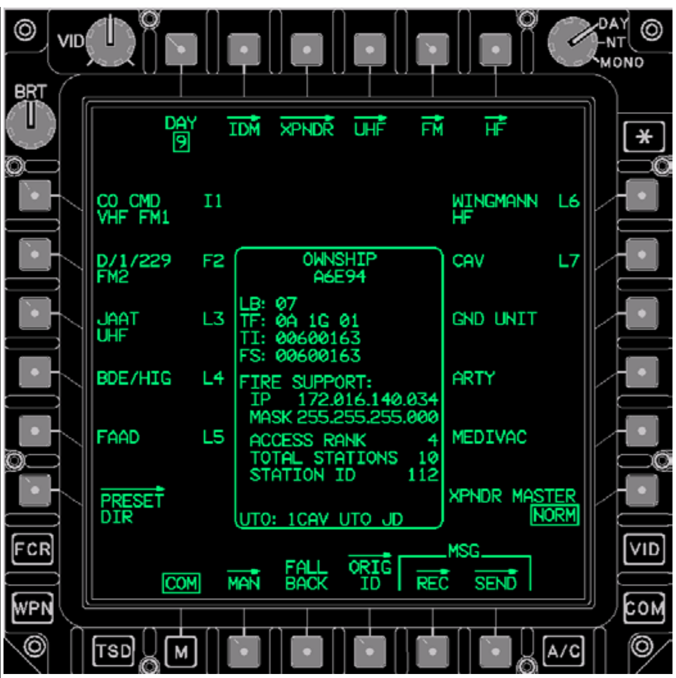

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Figure 3A-8. COM Page

Buttons on the **COM** page are described below:

- T1 **DAY** button
- T2 **IDM** button
- T3 **XPNDR** button
- T4 **UHF** button
- T5 **FM** button
- T6 **HF** button
- L1-L5 **PRESET** buttons
- L6 **PRESET DIR** button
- R1-R5 **PRESET** buttons
- R6 **XPNDR MASTER** button
- B2 **MAN** button
- B3 **FALL BACK** button
- B4 **ORIG ID** button
- B5 **MSG REC** button
- B5 **MSG SEND** button

NOTE

An operator change to the DAY button will not detune any of the currently tuned preset-nets; when desired, the operator is required to perform subsequent tunes to invoke the new selected DAY's data.

3A.23.1 DAY Button. The **DAY** button provides the capability to toggle between the two SOI days of the SOI data that is displayed within the communications subsystem. The two SOI days are numbers with a range of 1-10. When the operator actions the **DAY** button the Display Processor updates the SOI data to the alternate day. Selecting the button again will toggle the data back to the original day. Changing the **DAY** button only effects a change to the MPD data presentation, a tune or re-tune is required to effect EUFD preset-net status changes. The SOI day number is uploaded to the Display Processor from the DTC as part of the Presets upload.

3A.23.2 IDM Page Button. The **IDM** button displays the **IDM** page.

3A.23.3 XPNDR Page Button. The **XPNDR** button displays the **XPNDR** page.

3A.23.4 UHF Page Button. The **UHF** button displays the **UHF** page.

3A.23.5 FM Page Button. The **FM** page button displays the **FM** page.

3A.23.6 HF Page Button. The **HF** page button displays the **HF** page.

3A.23.7 PRESET Buttons. The **PRESET** (1-10) buttons provide the capability to tune the **VHF**, **UHF**, **FM 1**, **FM 2,** and **HF** radios. The **VHF**, **UHF**, **FM 1**, and **FM 2** buttons also provide configuration control for the IDM channels. The **PRESET** buttons are not selected upon display of the **COM** page. The **PRESET** buttons each contain two lines of text information. The first line contains the Unit ID, IDM net protocol, and IDM net number. The second line contains the Radio Status. Presets 1-8 support “L”, “T”, “I”, and “F” digital net configurations while presets 9-10 exclusively supports “I” and “F” digital net configurations.

3A.23.8 PRESET DIR Button. The **PRESET DIR** page button displays the **PRESET DIR** page. See paragraph 3A.32.

3A.23.9 XPNDR MASTER Button. The **XPNDR MASTER** button toggles between Standby (**STBY**) and Normal (**NORM**) modes.

3A.23.10 MAN Page Button. The **MAN** button displays the **MAN** page.

3A.23.11 TUNE PRI/STBY Button. The **TUNE PRI/STBY** button can be toggled between Primary and Standby tuning modes. When set to Primary mode, the selected **PRESET** will be actively tuned to its radio/frequency/mode, and IDM and crypto modes will be set if equipped. Standby mode will send all tune data to the UFD’s standby state, and will replace all previous values corresponding to the radio type. The standby state may be swapped and activated to primary by the operator through the UFD’s swap function.

3A.23.12 FALL BACK Button. The **FALL BACK** button is selected upon a CIU failure as indicated by the EUFD advisory “**GO FALLBACK**”. Selection of the **FALL BACK** button will prompt for a **YES** or **NO** confirmation to initiate Fall Back. However, the **FALL BACK** button will not prompt for confirmation to exit Fall Back. Once Fall Back is initiated the EUFD advisory will change to “**FALLBACK**”.

NOTE

- The pilot and CPG floor, push to talk switches are inoperative when operating the CIU in the Fall Back mode.
- Operating in the Fall Back mode requires a TEMPEST microphone to communicate on either intercom or the the radios.
- The aircrew is required to tune/set the UHF/VHF radios to TACFIRE (analog) to enable voice communications when using the CIU in analog FALLBACK.

The following occurs when Fall Back is initiated:

- Pilot is RTS to the UHF radio.
- UHF radio will go secure if a KY-58 is installed and turned ON. If the FILL position selected is not loaded with a CNV, only plain radio reception is available. Attempting to transmit will result in a steady tone.
- CPG is RTS to the VHF radio.
- Pilot and CPG radio monitor levels are defaulted to a fixed level.
- ICS communication between the Pilot and CPG is moded to Hot MIC (TEMPEST MIC Only).

3A.23.13 MSG REC Page Button. The **MSG REC** button displays the message receive (**MSG REC**) page.

3A.23.14 MSG SEND Page Button. The **MSG SEND** button displays the **MSG SEND** page.

3A.23.15 OWNSHIP Status Window. The **OWNSHIP Status** window (fig 3A-8) displays the ownship’s global COM and IDM data. Before flight reference permits the crew to check the OWNSHIP’s IDM-COM data at one single top level location without the requirement to page through the **ORIG ID** Page and **SET** page options following a DTU Load with the IDM in **OPER**. The **OWNSHIP Status** window includes the following data fields:

- **LB** (Longbow) Digital ID
- **TF** (TACFIRE) Digital ID, Team ID, and Broadcast ID
- **TI** (Tactical Internet) Digital ID Unit Reference Number
- **FS** (Fire Support) Digital ID Unit Reference Number
- **FIRE SUPPORT - IP** (Internet Protocol) Address
- **FIRE SUPPORT - MASK**
- **FIRE SUPPORT - ACCESS RANK**
- **FIRE SUPPORT - TOTAL STATIONS**
- **FIRE SUPPORT - STATION ID**
- **UTO**

3A.23.16 ORIG ID Page Button. The **ORIG ID** page button displays the ORID ID page (paragraph 3A.25).

3A.24 IDM AND TI PROTOCOL STATUS WINDOWS

The aircrew is provided with situational IDM and TI protocol status windows described in subparagraphs 3A.24.1, 3A.24.2, 3A.24.3, and 3A.24.4. All IDM-Protocol status windows will display in the upper left side of the MPD to the right of and between the BRT control knob and the L1 VAB (fig 3A-9).

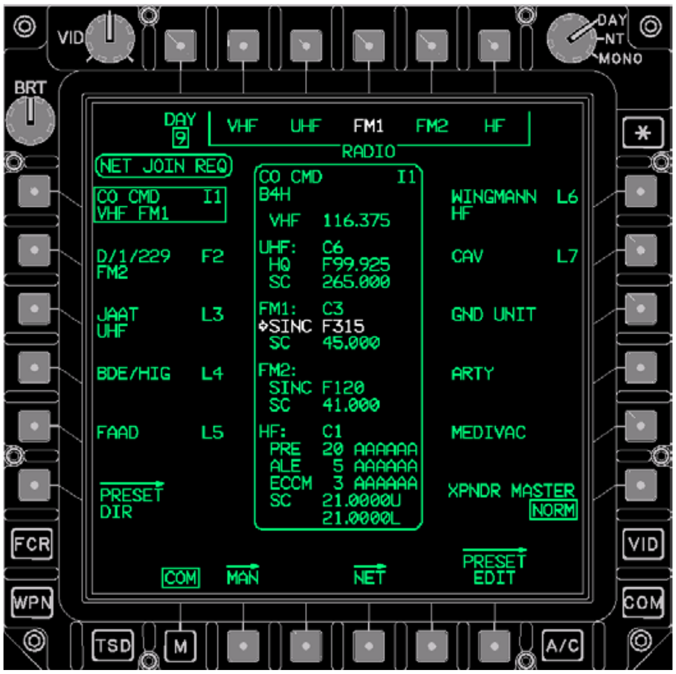

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Figure 3A-9. NET JOIN REQ Status Window

3A.24.1 IDM IN STANDBY Status Window. The **IDM IN STANDBY** status window is displayed whenever the IDM is in the standby mode. This status window is displayed in white. No digital messages can be transmitted or received until the IDM is placed in the operational mode.

3A.24.2 IDM INHIBIT Status Window. The **IDM INHIBIT** status window is displayed whenever the IDM **SET** page **INHBT** button is selected. Digital messages cannot be transmitted or received until the IDM is placed in the operational mode. This status window is displayed in white and an associated EUFD IDM INHIBIT advisory is displayed. See paragraph 3A.26.9.

NOTE

When the IDM INHBT button is selected, L, T, TI and FS command and control messages are still received. However, FS artillery messages cannot be received, since the IDM is required to transmit ACK back to the sending platform in order to receive the message. TI messages will be received unless the size of the message is too large (>576 byte packet) or the length of time since the last automatic present position report has timed out.

3A.24.3 NET JOIN REQ Status Window. The **NET JOIN REQ**uired status window, displayed in white, (fig 3A-9) is commonly displayed for several seconds following a FS or TI FM1/FM2 radio tune when the IDM is expecting a different radio configuration then what the radio has reported. An automatic NET JOIN to SINC the IDM with the selected FM radio is performed each time that a FS or TI preset-net is tuned to FM1/FM2. Digital messages cannot be transmitted over the tuned TI or FS preset-net until the advisory is no longer displayed.

NOTE

- When a EUFD **IDM FAULT** is reporting a **TI FM1 NO RESPONSE**, **TI FM2 NO RESPONSE**, **FS FM1 NO RESPONSE**, or **FS FM2 NO RESPONSE**, the system has lost the ability to detect a mismatch condition and will not issue a NET JOIN status window.
- In the case that the NET JOIN REQ status window remains displayed following a TI tune, the operator should ensure that the pertinent FM radio's HOPSET number (###) matches the TI UTO's NET ID number (###) and then retune the radio.

3A.24.4 TI SEEK Status Window. The **TI SEEK** status window is displayed when either FM1 or FM2 has been tuned to the Tactical Internet and the IDM has not established a connection to a TI EPLRS-network gateway. This status window, fig 3A-8, is displayed in inverse green. The IDM will continuously transmit until the gateway sends a system message to the IDM that the TI EPLRS network has been established. Once established, the **TI** status window will extinguish and a EUFD TI Gateway Connected indicator symbol will display; see paragraph 3A.16-12 and fig 3A-4.

3A.24.5 TI FOUND Status Window. The **TI FOUND** status window is displayed when either FM1 or FM2 has been tuned to the Tactical Internet and the IDM has established a connection to a TI EPLRS-network gateway.

3A.24.6 TI LOGIN REQUIRED Status Window. The **TI LOGIN REQUIRED** status window is displayed when the preset selected is for the TI protocol, and a valid username and password to verify TI has not been entered. Any FM1/FM2 TI preset tune performed without a LOGIN will mode the preset-net to voice and will tune radio settings. LOGIN of a valid username and password is accomplished through the **DTU** page **NAME PASSWORD** button (paragraph 2.129.3B).

3A.24.7 URN NOT IN UTO Status Window. The **URN NOT IN UTO** status window is displayed to show that the ownship URN is not in the current UTO when a TI radio tune is executed. This indicates either an incorrect UTO or an incorrect URN. Accordingly, the operator may attempt to correct this by changing to another UTO that contains the ownship URN from the **IDM** page **UTO** button, or by correcting the ownship URN from the **ORIG ID** page **TI URN ID** or **FS URN ID** button.

3A.24.8 TI UTO UPDATE REQ Status Window. The **TI UTO UPDATE REQ** status window is displayed when a UTR (Unit Task Reorganization) has been issued, making changes to the UTO. The operator may continue using the current UTO or may select another UTO from the **IDM** page **UTO** button, but should update the affected UTO database when they return to the FARP.

3A.25 ORIG ID PAGE Button. The **ORIG ID** page (fig 3A-10) is accessed by selecting the **ORIG ID** page button located on the **COM** page. The **ORIG ID** page provides a means of editing the originator/ownship's callsign and digital identification for the the L, T, TI, and FS IDM protocols and Quick Fire Net parameters. Upon display of the page, the **DIGITAL ID LONGBOW/TACFIRE** button is selected. The ORIG ID page also contains the **SET** page button (paragraph 3A.26).

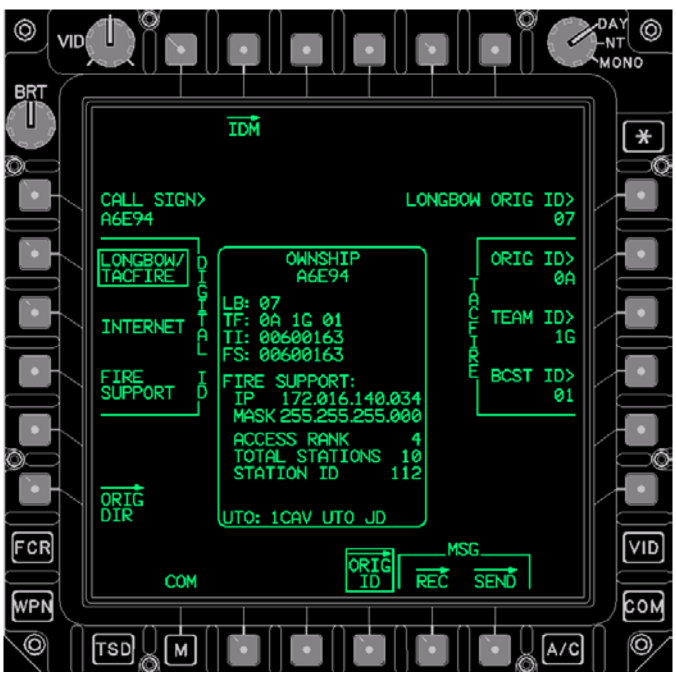

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Figure 3A-10. ORIG ID Page LONGBOW/TACFIRE

Buttons on the **ORIG ID** page, **LONGBOW/TACFIRE** selected:

- T2 **IDM** button
- L1 **CALL SIGN** button
- L2 **DIGITAL ID LONGBOW/TACFIRE** button
- L3 **DIGITAL ID INTERNET** button
- L4 **DIGITAL FIRE SUPPORT** button
- L6 **ORIG DIR** button
- R1 **LONGBOW ORIG ID** button
- R2 **TACFIRE ORIG ID** button
- R3 **TACFIRE TEAM ID** button
- R4 **TACFIRE BCST ID** button
- B4 **ORIG ID** button
- B5 **MSG REC** button
- B6 **MSG SEND** button

3A.25.1 CALL SIGN Button. The originator's **CALL SIGN** data entry button permits editing, and creation of, the originator's call sign as displayed in the OWNSHIP Status window.

3A.25.2 DIGITAL ID LONGBOW/TACFIRE Button. The **LONGBOW/TACFIRE** button selections permits the editing, and creation, of **LONGBOW ORIG ID**, **TACFIRE ORIG ID, ORIG BCST ID, and ORIG TEAM ID** page.

3A.25.2A ORIG DIR Button. The **ORIG DIR** button supports the selection and editing/creation of ORIG global data for current and future digital protocols. The ORIG DIR uses the MBR DIR data base items.

3A.25.3 LONGBOW ORIG ID Button. The **LONGBOW ORIG ID** data entry button permits editing the IDM Originator ID for the Longbow protocol. This ID is used as the sender's ID when transmitting Longbow messages. The keyboard label displays **LONGBOW ID** and accepts a one or two-character input between 0-39, A-Z, 1A-1Z, 2A-2Z, or 3A-3I.

3A.25.4 TACFIRE ORIG ID Button. The **TACFIRE ORIG ID** data entry button permits editing the IDM originator ID for the Tacfire protocol. This ID is used as the sender's ID when transmitting Tacfire messages. The keyboard label displays **TACFIRE ID** and accepts a one or two character input between 0-39, A-Z, 1A-1Z, 2A-2Z, or 3A-3I.

NOTE

The **TACFIRE TEAM ID** has to initially be entered as a member in at least one TACFIRE preset-net prior to the **TACFIRE TEAM ID** being entered through the **ORIG ID** page.

3A.25.5 TACFIRE TEAM ID Button. The **TACFIRE TEAM ID** data entry button permits editing the originator's

Tacfire Team ID. This ID represents the TACFIRE team address associated with ownship's IDM. The keyboard label displays **TEAM ID** and accepts a one or two character input between 0-39, A-Z, 1A-1Z, 2A-2Z, or 3A-3I.

NOTE

The **TACFIRE BCST ID** has to initially be entered as a member in at least one TACFIRE preset-net prior to the **TACFIRE BCST ID** being entered through the **ORIG ID** page.

3A.25.6 TACFIRE BCST ID Button. The **TACFIRE BCST ID** data entry button permits editing the IDM's Broadcast ID for the Tacfire protocol. This ID represents the TACFIRE broadcast address associated with the originator's aircraft. The keyboard label displays **BROADCAST ID** and accepts a one or two character input between 0-39, A-Z, 1A-1Z, 2A-2Z, or 3A-3I.

3A.25.7 DIGITAL ID INTERNET Button. The originator's **DIGITAL ID INTERNET** button (fig 3A-11) selection commands the display of Tactical interface originator ID data.

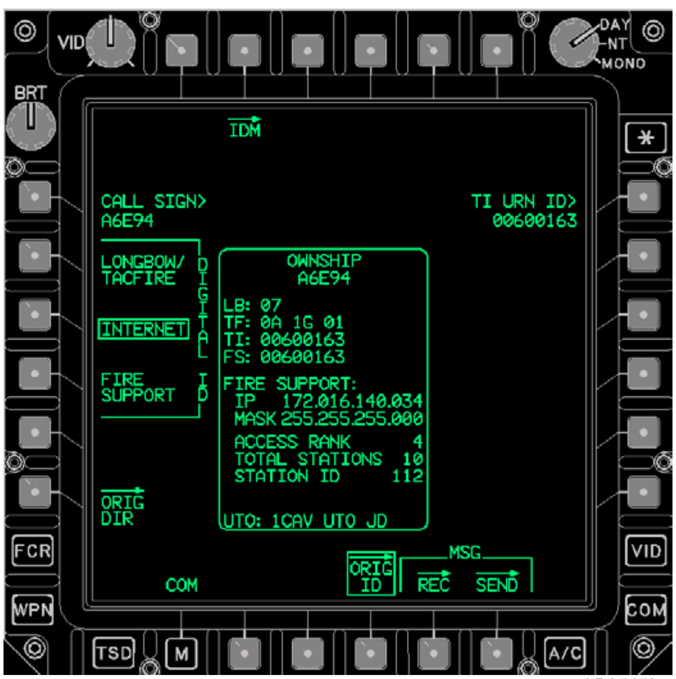

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Figure 3A-11. ORIG ID Page INTERNET

Unique buttons on the **ORIG ID** page, **INTERNET** selected:

- L3 **DIGITAL ID INTERNET** button
- R1 **TI URN ID** button

NOTE

Editing the TI URN ID button will also edit the FS URN ID: the 304 5.1x IDM only supports a single URN for both protocols

3A.25.8 TI URN ID Button. The originator's **INTERNET TI URN ID** data entry button permits editing the current tactical internet digital URN ID. The keyboard label displays **TI URN** and accepts a data entry of 0 through 16,777,215.

3A.25.9 DIGITAL ID FIRE SUPPORT Button. The originators **DIGITAL ID FIRE SUPPORT** button (fig 3A-12) selection commands the display of Fire Support originator ID data.

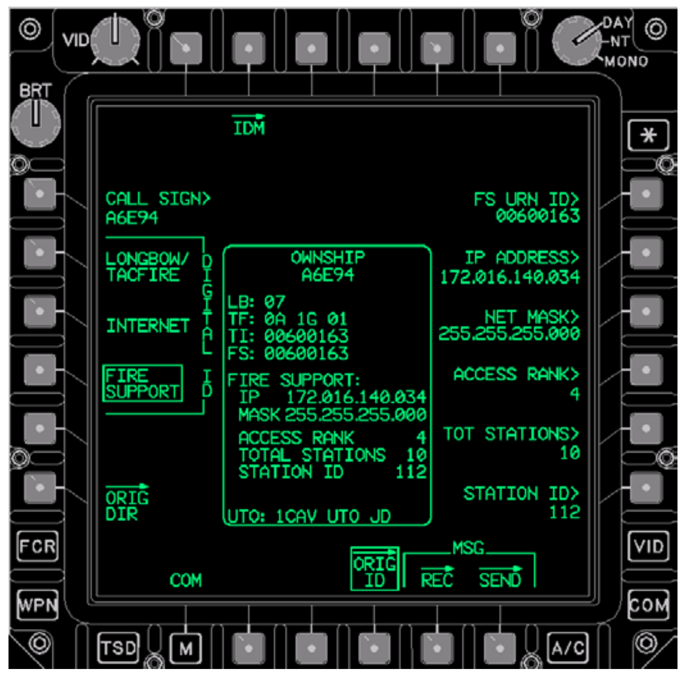

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Figure 3A-12. ORIG ID Page FIRE SUPPORT

Buttons on the **ORIG ID** page, **FIRE SUPPORT** selected:

- T2 **IDM** button
- L1 **CALL SIGN** button
- L2 **DIGITAL ID LONGBOW/TACFIRE** button
- L3 **DIGITAL ID INTERNET** button
- L4 **DIGITAL FIRE SUPPORT** button
- R1 **FS URN ID** button

- R2 **IP ADDRESS** button
- R3 **NET MASK** button
- R4 **ACCESS RANK** button
- R5 **TOT STATIONS** button
- R6 **STATION ID** button
- B4 **ORIG ID** button
- B5 **MSG REC** button
- B6 **MSG SEND** button

3A.25.10 FS URN ID Button. The originator's **Fire Support Unit Reference Number** data entry button permits editing, and creation of, the originator's FS URN ID. The keyboard label displays **FS URN** and accepts a data entry of 0 through 16,777,215.

NOTE

- The existing FIRE SUPPORT network requires a unique IP association with each entity's digital ID URN.
- Editing the FS URN ID button will also edit the TI URN ID: the 304 v7.x IDM only supports a single URN for both protocols.

3A.25.11 IP ADDRESS Button. The originator's **FIRE SUPPORT IP ADDRESS** data entry button permits editing the current fire support IP address. The keyboard label displays **IP ADDR** and accepts a data entry of 0.0.0.0 through 255.255.255.255.

3A.25.12 NET MASK Button. The **ORIG ID** page **FIRE SUPPORT NET MASK** data entry button displays, and allows modification of, the current fire support net mask. The keyboard label displays **NET MASK** and accepts a data entry of 0.0.0.0 through 255.255.255.255.

NOTE

- When required by the artillery, a NET mask is used to create subnets and to determine what subnet an IP address belongs to.
- The advantage of a subnet is that JVMF traffic on the same subnet doesn't have to go out onto the network above it, reducing the traffic bandwidth on the larger network.

3A.25.13 ACCESS RANK Button. The originator's **FIRE SUPPORT ACCESS RANK** data entry button permits editing, and creation of, the current fire support quick fire net access rank. The keyboard label displays **ACCESS RANK** and accepts a data entry of 0 through 127.

3A.25.14 TOT STATIONS Button. The originator's **FIRE SUPPORT TOT STATIONS** data entry button permits editing the quick fire net's total number of fire support stations. The keyboard label displays **TOT STAT** and accepts a data entry of 0 through 127.

3A.25.15 STATION ID Button. The originator's **FIRE SUPPORT STATION ID** data entry button permits editing the fire support quick fire net station ID. The keyboard label displays **STATION ID** and accepts a data entry of 4 through 127.

3A.26 IDM PAGE

The **IDM** page is accessed by selecting the **IDM** page button from either the **COM** page, **ORIG ID** page, or the **MSG SEND** page. The **IDM** page provides a means of editing various IDM parameters for both the Tactical Internet and Fire Support. It also provides access to changing the IDM's mode (standby or operate) and to inhibit the IDM from sending messages.

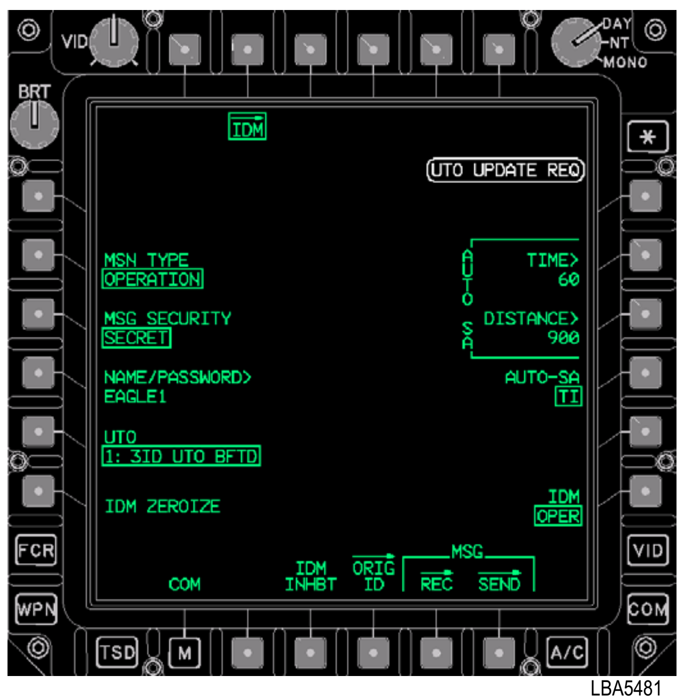

Figure 3A-13. IDM SET Page

Buttons on the **SET** page:

- L2 **MISSION TYPE** button
- L3 **MSG SECURITY** button
- L4 **NAME/PASSWORD** button

- L5 **UTO** button
- L6 **IDM ZEROIZE** button
- R2 **IAUTO SA** button
- R3 **AUTO SA DUSTANCE** button
- R4 **AUTO SA** button
- R6 **IDM OPER/STBY** button
- R3 **IDM INHIBIT** button

3A.26.1 MSN TYPE Button. The IDM page **MSN TYPE** button provides the means to change the operational indicator of the messages transmitted on the Tactical Internet or Fire Support Nets. Selecting the **MSN TYPE** button provides three options: **OPERATION**, **EXERCISE,** and **SIMULATION**.

3A.26.2 MSG SECURITY Button. The **IDM** page **MSG SECURITY** button provides a means to change the security level of the messages transmitted over the Tactical Internet or Fire Support Nets. Selecting the **MSG SECURITY** button provides three options: **SECRET**, **CONFIDENTIAL**, and **UNCLASSIFIED**.

NOTE

- The IDM will not accept incoming TI and FS messages that are set to a security classification level that is higher than the current login security level setting.
- The resident IDM UTO's are received from the loaded DMS DTU page.

3A.26.3 UTO Button. The **IDM** page **UTO** button provides a means to select / change the single **UTO** that the IDM will utilize. The UTO button displays the UTO number and name descriptor. Selecting the **UTO** button will display up to 5 different UTO edit button options (figure 3A-13A), each one associated with a display field number of 1-5. All the numbered UTO edit button display fields include a unique UTO name descriptor of up to 12 characters. Selecting a numbered UTO edit button will: 1) command the IDM to use the selected UTO; 2) command the **IDM** page to be displayed; 3) display the UTO's asscociated number of 1-5 with the **UTO** button; 4) will display the TI UTO status window with the active UTO's unique name descriptor (paragraph 3A.26.11).

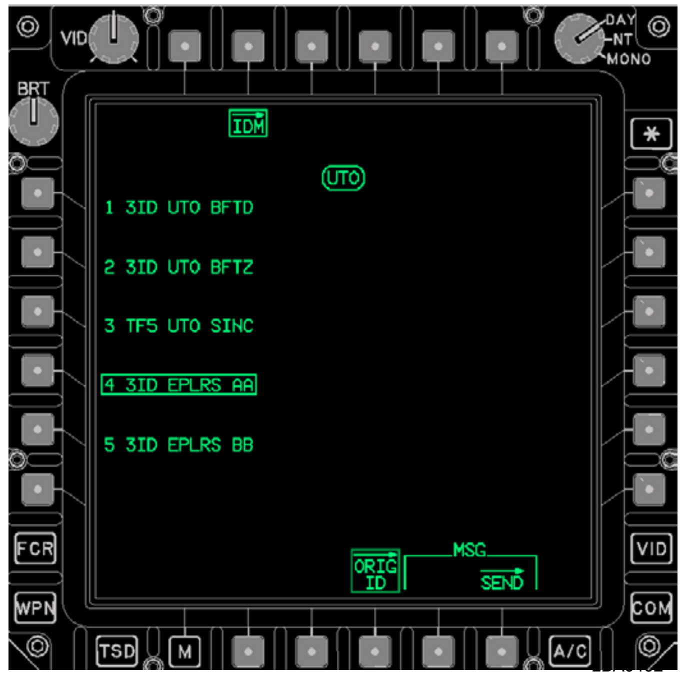

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Figure 3A-13A. UTO EDIT OPTIONS

NOTE

Member data is retained in DP NVM and is not reset, with the exception of IDM messages, the remaining data can subsequently be reloaded via the DTC.

3A.26.4 IDM ZEROIZE Button. The **IDM ZEROIZE** button provides a yes/no confirmation for resetting the following data in the IDM:

- **Originator data** (for tactical internet information)
- **Subscriber data**
- **Teams**
- **Nets**
- **Zones**
- **Messages** (that reside in the message receive buffer)

3A.26.5 AUTO SA TIME Button. The **ORIG ID/MSG SEND** IDM **SET** page **AUTO SA TIME** data entry button allows the operator to set the maximum time interval for the IDM to transmit the TI Entity Data Message message (providing the present position information) to the Tactical Internet SA server. The IDM will only send this message when tuned to the TI and the **SA ON/OFF** button is **ON.** The valid data entry is 11 through 4095 seconds.

3A.26.6 AUTO SA DISTANCE Button. The **ORIG ID/ MSG SEND** IDM **SET** page **AUTO SA DISTANCE** data entry button allows the operator to set the maximum change in distance before the IDM sends the TI Entity Data Message message (providing the present position information) to the Tactical Internet SA server. The IDM will only send this message when tuned to the TI and the **SA ON/OFF** button is **ON**. The valid data entry is 10 - 2000 meters.

3A.26.7 AUTO-SA Button. The **AUTO SA** button allows the operator to either enable JVMF position reports to be automatically issued over TI, or to DISABLE the IDM's capability to automatically report the TI Entity Data Message message (providing the present position information) to the Tactical Internet SA server. The message will be transmitted when the time set by the **AUTO SA TIME** has elapsed or the aircraft has moved (from the last position reported) farther than the distance set by the **AUTO SA DISTANCE**.

3A.26.8 IDM OPER/STBY Button. The **IDM** page's **IDM OPER/STBY** button permits the operator to toggle between standby and operate. Whenever the IDM is in **STBY**, digital messages cannot be transmitted and JVMF messages will not be received. The IDM must be set to **STBY** before removing aircraft power or prior to the need to reset the IDM circuit breaker. When in **STBY**, an **IDM IN STANDBY** advisory will be displayed on the **COM** page and EUFD.

NOTE

Any SA data or JVMF messages already received will be lost when the IDM transitions to **STBY**.

3A.26.9 IDM INHBT Button. When selected, the IDM **SET** page **IDM INHBT** button prevents the IDM from performing automatic message transmits on any IDM tuned radio (including machine ACKs for all protocols and automated response messages). The selected **IDM INHBT** button is white and the send buttons will be removed from all pages. When selected, an **IDM INHIBIT** advisory will be displayed on the **COM** page and EUFD.

- The **IDM INHBT** button does not inhibit HF radio transmissions.
- The HF radio's transmissions are inhibited when the HF is moded to SILENT or, when on the ground, the HF GND ORIDE button is not selected (unboxed).

3A.26.10 IDM MISMATCH STATUS Window. The **IDM MISMATCH STATUS** window displays the mismatch status for TI IDM parameters. This status window is only displayed when TI is tuned to one of the radios and the IDM is reporting one of the parameters is different from what was commanded by the DP.

3A.26.11 UTO STATUS Window. The **ORIG ID/MSG SEND** IDM **SET** page **UTO STATUS** window displays the Unit Task Organization (UTO) that the IDM is currently configured with. This status window is only displayed when the IDM is in operate.

3A.27 COM PAGE - PRESET SELECTED

The **COM** page (fig 3A-14) preset status window displays the data associated with the preset that is currently selected.

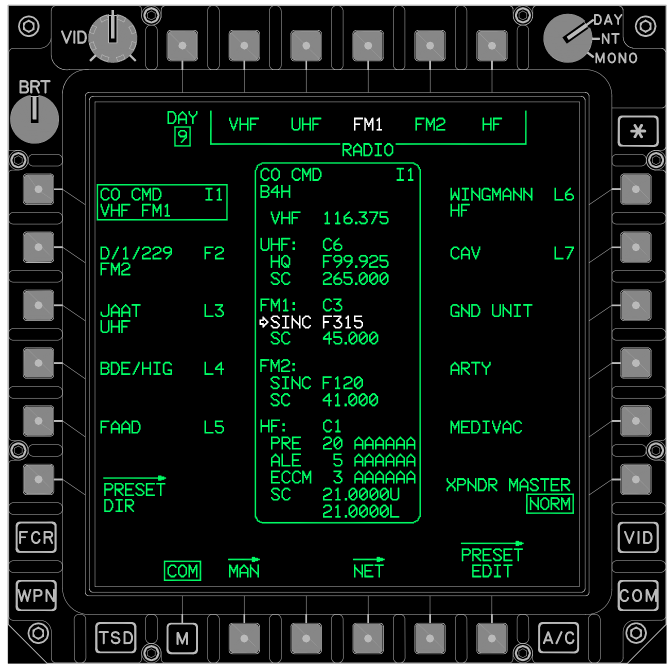


Figure 3A-14. COM Page (PRESET Selected)

The following unique buttons are displayed on the **COM** page when a preset is selected:

- T2 **RADIO VHF** button
- T3 **RADIO UHF** button
- T4 **RADIO FM1** button
- T5 **RADIO FM2** button
- T6 **RADIO HF** button
- B4 **NET** page button
- B6 **PRESET EDIT** page button

NOTE

Each specific RADIO T2-T6 buttons are displayed anytime the selected preset contains valid data for the radio type.

3A.27.1 NET Page Button. The **NET** button displays the net member page. See paragraph 3A.33.

3A.27.2 PRESET EDIT Page Button. The **PRESET EDIT** button displays the preset edit page. See paragraph 3A-17.

3A.27.3 COM PRESET Status Window. The **COM PRESET** status window data is displayed in the following field order:

- Unit ID
- Call Sign
- DM Type and IDM Preset-Net Number
- VHF Frequency
- UHF CNV status
- UHF HQ Net number
- UHF Single Channel Frequency
- FM1 CNV status
- FM1 SINC net number
- FM1 Single Channel Frequency
- FM2 CNV status
- FM2 SINC HOPSET number
- FM2 CNV status
- HF CNV status
- HF PRE
- HF ALE
- HF ECCM
- HF SC (Upper/Lower)

The Primary frequency is displayed in white and designated by a white arrow.

3A.28 MAN PAGE

The **MAN** page (fig 3A-15) provides the capabilities:

- Tune the VHF and/or UHF guard frequency.
- Manually tune the VHF, UHF, FM1, FM2, and HF radios through frequency data input.
- Select antenna bandwidths for the UHF and VHF radios.
- UHF/VHF radio test tone button access.
- Provides access to the SOI AUTH and SOI EXPND pages

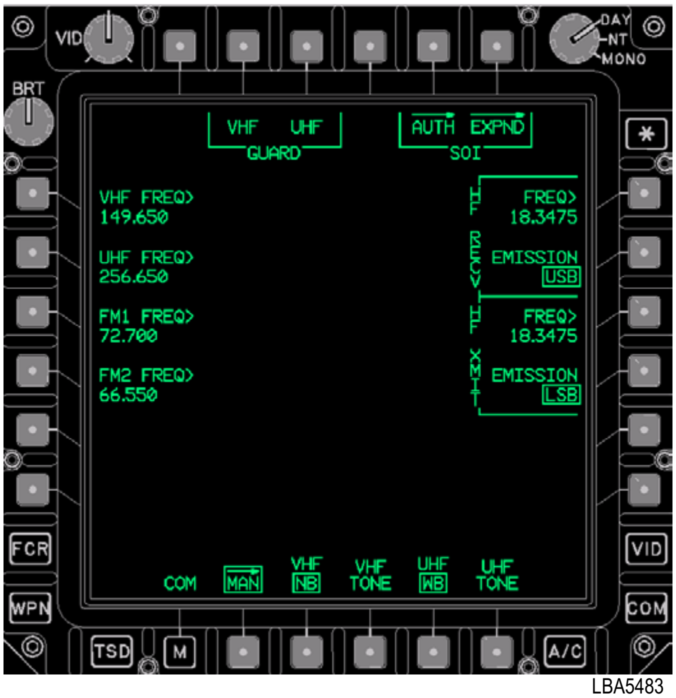


Figure 3A-15. MAN Page

The **MAN** page contains the following unique buttons:

- T2 **VHF GUARD** button
- T3 **UHF GUARD** button
- T5 **SOI AUTH** page button
- T6 **SOI EXPND** button
- L1 **VHF FREQ** button
- L2 **UHF FREQ** button
- L3 **FM1 FREQ** button
- L4 **FM2 FREQ** button
- R1 **HF RECV FREQ** button
- R2 **HF RECV EMISSION (USB/LSB)** button
- R3 **HF XMIT FREQ** button
- R4 **HF XMIT EMISSION (USB/LSB)** button
- B3 **VHF WB/NB** antenna button
- B4 **VHF TONE** button
- B5 **UHF WB/NB** antenna button
- B5 **UHF TONE** button

3A.28.1 VHF GUARD Button. The **VHF GUARD** button provides the capability to rapidly tune the VHF radio to the guard frequency.

3A.28.2 UHF GUARD Button. The **UHF GUARD** button provides the capability to rapidly tune the UHF radio to the guard frequency.

3A.28.3 VHF FREQ Button. The **VHF FREQ** data entry button provides the capability to manually tune the VHF radio (108.000 through 151.975 MHz at 0.025 spacing) using the KU. The KU label display is VHF FREQ and the selection of the KU's ENTER button commands the VHF radio to tune to the manually set frequency.

3A.28.4 UHF FREQ Button. The **UHF FREQ** data entry button provides the capability to manually tune the UHF radio (225.000 through 399.975 MHz at 0.025 spacing steps) using the KU. The KU label display is UHF FREQ and the selection of the KU's ENTER button commands the UHF radio to tune to the manually set frequency.

3A.28.4A SOI AUTH Page Button. The **SOI AUTH** page button provides the capability to authenticate communication transmissions and access expanders.

3A.28.4B SOI EXPND Page Button. The **SOI EXPND** page (fig 3A-15F) provides the capability to view the expander lookup table.

3A.28.5 FM1 FREQ Button. The **FM1 FREQ** data entry button provides the capability to manually tune the FM1 radio (30.000 through 87.975MHz at 0.025 MHz steps) using the KU. The KU label display is FM1 FREQ and the selection of the KU's ENTER button commands the FM1 radio to tune to the manually set frequency.

3A.28.6 FM2 FREQ Button. The **FM2 FREQ** data entry button provides the capability to manually tune the FM1 radio (30.000 through 87.975MHz at 0.025 MHz steps) using the KU. The KU label display is FM2 FREQ and the selection of the KU's ENTER button commands the FM2 radio to tune to the manually set frequency.

3A.28.7 HF RECV FREQ Button. The **HF RECV FREQ** data entry button provides the capability to manually tune the HF radio receive frequency (2.0000 through 29.9999 MHZ at 0.1 kHz steps). The KU label display is HF RECV FREQ and the selection of the KU's ENTER button commands the HF radio to tune to the manually set HF RECV frequency.

3A.28.8 HF RECV EMISSION Button. The **HF RECV EMISSION** button provides the capability to select the HF radio receive emission mode for the manual receive frequency. The button provides the following **HF RECV EMISSION** multi-state options:

- **AME** to select Amplitude Modulation Equivalent.
- **CW** to select Continuous Wave.
- **LSB** to select Lower Sideband.
- **USB** to select Upper Sideband.

Upper Sideband is the default receive emission mode upon power-up. Changing the receive emission mode of the HF radio automatically changes the transmit emission mode to the same value.

3A.28.9 HF XMIT FREQ Button. The **HF XMIT FREQ** data entry button provides the capability to manually tune the HF radio receive frequency (2.0000 through 29.9999 MHZ at 0.1 kHz steps). The KU label display is HF XMIT FREQ and the selection of the KU's ENTER button commands the HF radio to tune to the manually set HF XMIT frequency.

3A.28.10 HF XMIT EMISSION Button. The **HF XMIT EMISSION** button provides the capability to select the HF radio receive emission mode for the manual receive frequency. The button provides the following **HF XMIT EMISSION** multi-state options:

- **AME** to select Amplitude Modulation Equivalent.
- **CW** to select Continuous Wave.
- **LSB** to select Lower Sideband.
- **USB** to select Upper Sideband.

Upper Sideband is the default receive emission mode upon power-up. Changing the receive emission mode of the HF radio automatically changes the transmit emission mode to the same value.

3A.28.11 VHF WB/NB Button. **VHF WB/NB** button provides the capability to toggle between the WB (Wide Bandwidth, 18KHz) and NB (Narrow Bandwidth, 9.5KHz) modes. The default state upon power-up for the VHF bandwidth is narrow.

3A.28.12 VHF TONE Button. The **VHF TONE** momentary button provides the capability to enable the VHF Radio (ARC-186) Test Tone. Selection of the **VHF TONE** button transmits an over the air radio generated tone. The tone is used for test and problem isolation.

3A.28.13 UHF WB/NB Button. **UHF WB/NB** button provides the capability to toggle between the WB (Wide Bandwidth, ±35KHz deviation from the channel frequency allowing more noise or crosstalk from frequencies within .025MHz) and NB (Narrow Bandwidth allows ±12KHz deviation from the channel frequency) modes. The default state upon power-up for the VHF bandwidth is narrow. The UHF bandwidth is automatically set to WB option when the UHF mode is set to the **UHF CIPHER** and to NB when the UHF mode is set to the **UHF PLAIN**. Upon power-up, the UHF bandwidth is determined by the state of the UHF KY-58.

3A.28.14 UHF TONE Button. The **UHF TONE** momentary button provides the capability to enable the UHF Radio (ARC-164) Test Tone. Selection of the **UHF TONE** button transmits an over the air radio generated tone. The tone is used for test and problem isolation.

3A.28A MAN SOI AUTH Page

The **AUTH** page (fig 3A-15A) provides the capability to authenticate communication transmissions and access expanders.

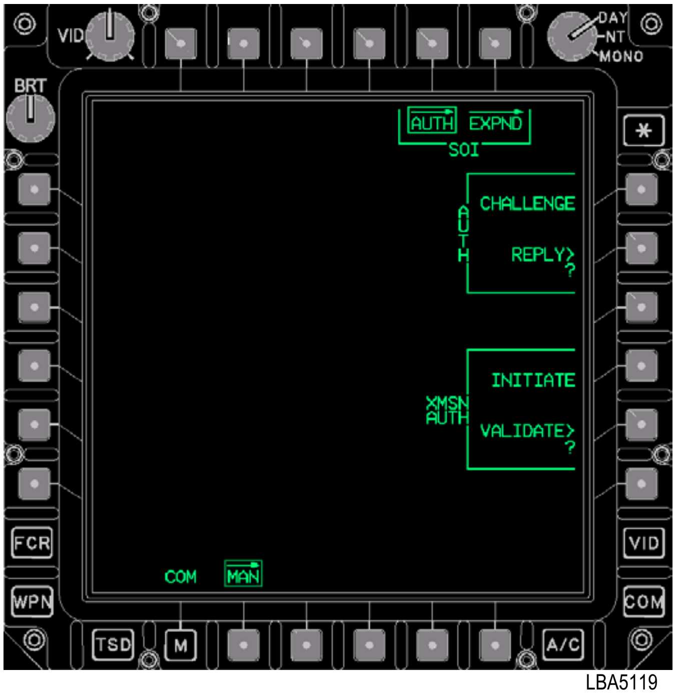
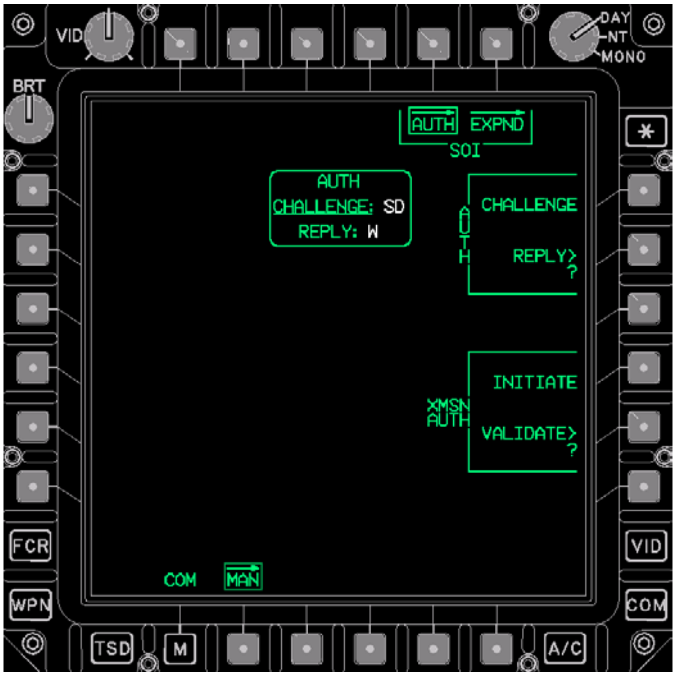


Figure 3A-15A. MAN SOI AUTH Page

- T5 **AUTH** (Authentication) page button
- T6 **EXPND** (Expander) page button
- R1 **AUTH CHALLENGE** button
- R2 **AUTH REPLY** button
- R4 **XMSN AUTH INITIATE** button
- R5 **XMSN AUTH VALIDATE** button

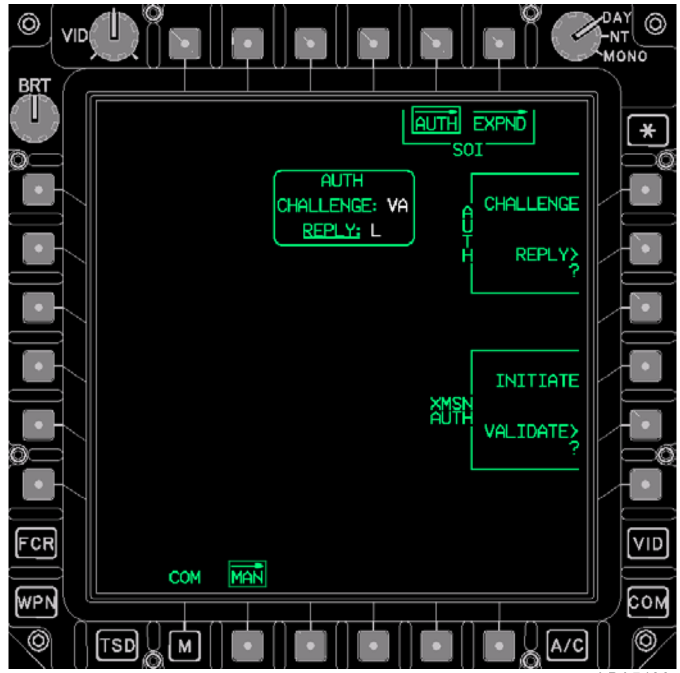
3A.28A.1 AUTH CHALLENGE Button. The **AUTH CHALLENGE** button provides the capability to extract the challenge/reply table and display the codes within the **AUTH CHALLENGE REPLY** window (fig 3A-15B).



LBA5485

Figure 3A-15B. AUTH Page - AUTH CHALLENGE

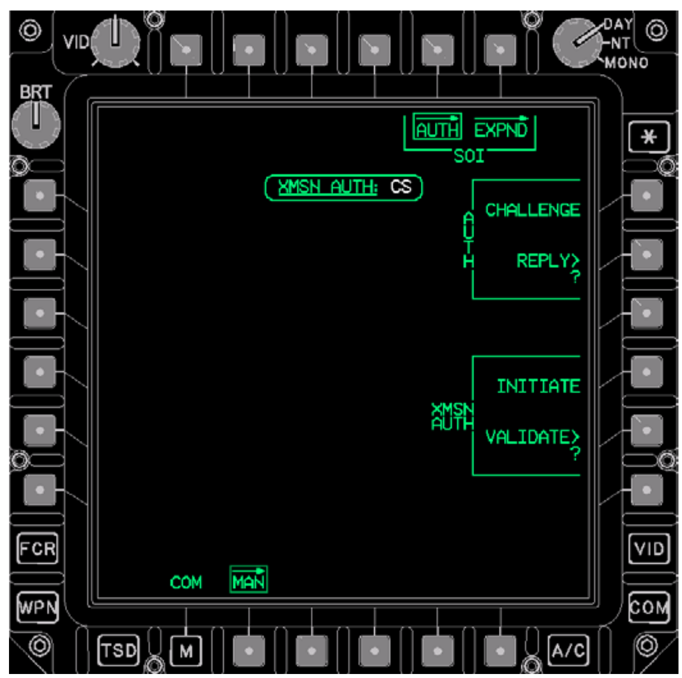
3A.28A.2 AUTH REPLY Button. The **AUTH REPLY** button provides the capability to enter a challenge code and extract the reply code from the challenge/reply table and display the code within the **AUTH CHALLENGE REPLY** window (fig 3A-15C).



LBA5486

Figure 3A-15C. AUTH Page - AUTH REPLY

3A.28A.3 XMSN AUTH INITIATE Button. The **XMSN AUTH INITIATE** button extracts the transmit authentication codes and displays them in the **XMSN AUTH** window (fig 3A-15D).



LBA5487

Figure 3A-15D. AUTH Page - XMSN AUTH INITIATE

NOTE

An **ALL CODES USED** message will be displayed in white when all the codes have been used.

3A.28A.4 XMSN AUTH VALIDATE Button. The **XMSN AUTH VALIDATE** button (fig 3A-15E) provides the capability to verify a transmit authentication code from the transmit authentication table. The **VALID** label is displayed when the transmit authentication matches the transmit authentication code entered through the KU. The **INVALID** label is displayed when the transmit authentication table does not match the transmit authentication code entered through the KU.

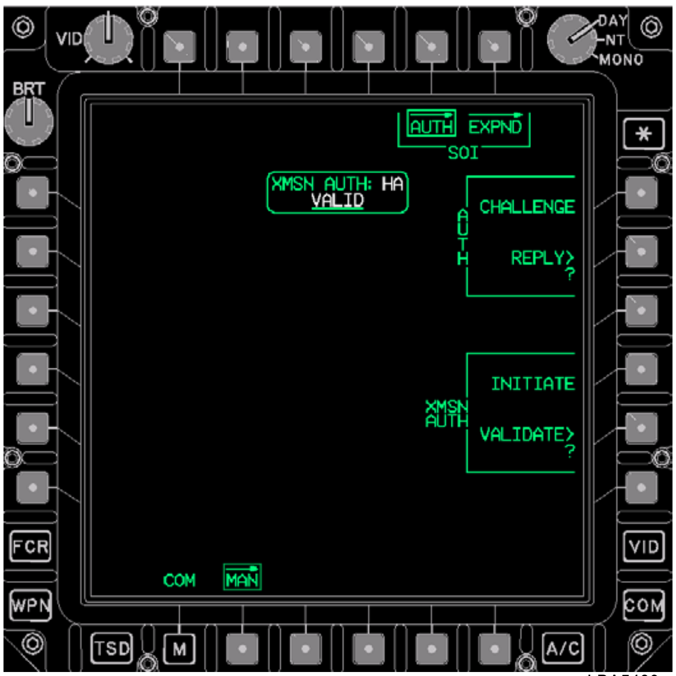


Figure 3A-15E. AUTH Page - XMSN AUTH VALIDATE

3A.28A.5 EXPANDER (EXPND) PAGE

The **EXPND** page (fig 3A-15F), a view-only page, provides the capability to view the expander lookup table. The expander lookup table displays the one character expander and descriptor field. Up to 26 expanders may be displayed from the lookup table.

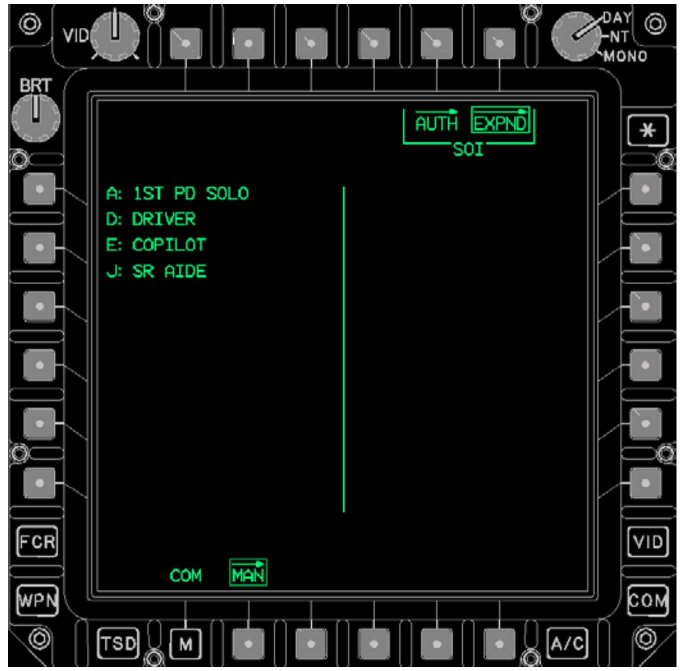


Figure 3A-15F. MAN SOI EXPND Page

3A.28A.6 EXPND Page Button. The **EXPND** button displays the **EXPND** page (para 3A.23).

3A.29 COM PAGE - PRESET AND RADIO SELECTED

The **COM** page (fig 3A-16) specific **TUNE VHF**, **FM1**, **FM2**, or **HF** button options are displayed following the selection of a RADIO option button.

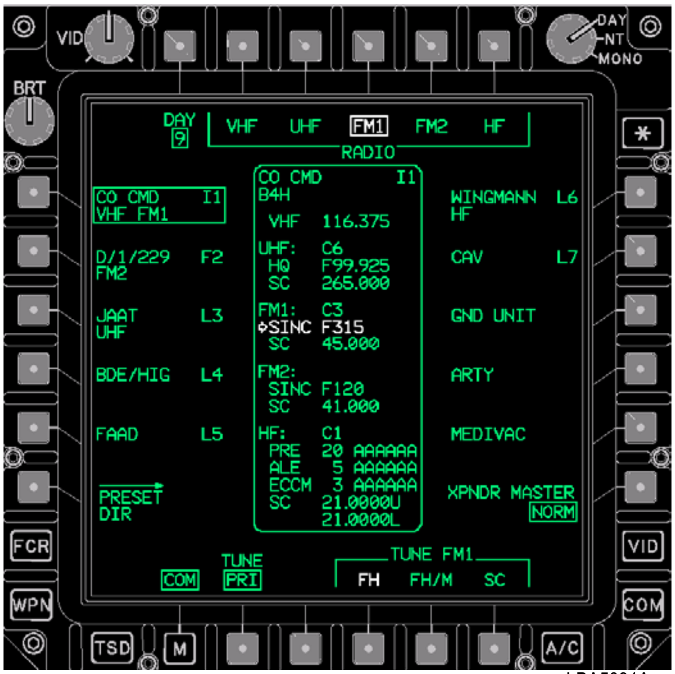


Figure 3A-16. COM Page Preset and Radio FM1 Selected

The COM page with preset selected contains the following unique buttons:

- T2 **RADIO VHF** button
- T3 **RADIO UHF** button
- T4 **RADIO FM1** button
- T5 **RADIO FM2** button
- T6 **RADIO HF** button

a. TUNE RADIO Command IDM-RADIO Configuration Updates. When a VHF, UHF, FM1, or FM2 **TUNE RADIO** button assigned to an IDM preset-net is selected the following radio and IDM processes occur:

- The radio will tune-configure.
- The radio channel in the IDM will be configured when the preset has an IDM protocol assigned.
- The Crypto in the KY will be configured if the preset has a Crypto Net Variable displayed.

NOTE

TI and FS preset-nets require the exclusive use of either FM1 or FM2. A TI or FS preset NET tuned to a UHF, VHF, or HF radio will change the preset-net to voice only.

b. TUNE RADIO Command EUFD Radio Status Line Update. When any one of the **TUNE RADIO** option buttons is selected, the EUFD's preexisting primary radio status line is moved to the EUFD's standby area and the EUFD primary status is updated with the applicable **PRESET STATUS** windows:

- Call Sign.
- Frequency.
- Frequency-Hop/ECCM.
- IDM Protocol.
- Crypto Status Fields.

c. TUNE RADIO Command PRESET Button Update. When any one of the **TUNE RADIO** option buttons is selected, the radio tuned will be displayed in the second line of the selected **PRESET** button.

3A.29.1 PRESET RADIO VHF Button. The selection of the **PRESET RADIO VHF** button will command the display of the **TUNE VHF** option button.

- B6 **TUNE VHF SC** button

Selecting the TUNE VHF SC button tunes the VHF radio to the frequency displayed in the VHF SC status field of the PRESET STATUS window.

3A.29.2 PRESET RADIO UHF Button. The selection of the **PRESET RADIO UHF** button will command the display of the **TUNE UHF** button options.

- B4 **TUNE UHF FH** button
- B6 **TUNE UHF SC** button

a. TUNE UHF FH Button. Selecting the **TUNE UHF FH** button tunes the UHF radio to the HQ NET ID as displayed in the **UHF HQ** status field of the **PRESET STATUS** window.

b. TUNE UHF SC Button. Selecting the **TUNE UHF SC** button tunes the UHF radio to the frequency displayed in the UHF SC status field of the **PRESET STATUS** window.

3A.29.3 PRESET RADIO FM1 or FM2 Button. The selection of the **PRESET RADIO FM1 or FM2** button will command the display of the **TUNE FM1 or FM2** button options.

- B4 **TUNE FM1 or FM2 FH** button
- B5 **TUNE FM1 or FM2 FH/M** button
- B6 **TUNE FM1 or FM2 SC** button

a. TUNE FM1 or FM2 FH Button. Selecting the **TUNE FM1 or FM2 FH** button tunes the specific FM radio to the SINC FH using the NET ID displayed in the **FM1 or FM2 SINC** status field of the **PRESET STATUS** window.

b. TUNE FM1 or FM2 FH/M Button. Selecting the **TUNE FM1 or FM2 FHM** button tunes the specific FM radio to the SINC FH/M mode using the NET ID that is displayed in the **FM1 or FM2 SINC** status field of the **PRESET STATUS** window. The FH/M tune makes the aircraft the master of the SINCGARS NET.

c. TUNE FM1 or FM2 SC Button. Selecting the **TUNE FM1 or FM2 SC** button tunes the specific FM radio to the frequency displayed in the **FM1 (or FM2)** SC status field of the **PRESET STATUS** window.

3A.29.4 PRESET RADIO HF Button. The selection of the **PRESET RADIO HF** button will command the display of the **TUNE HF** button options.

- B3 **TUNE HF PRE** button
- B4 **TUNE HF ALE** button
- B5 **TUNE HF ECCM** button
- B6 **TUNE HF SC** button

NOTE

An IDM preset-net tuned to a **HF RADIO TUNE** button option will change that preset-net to voice only.

a. TUNE HF PRE Button. Selecting the **TUNE HF PRE** button tunes the HF radio to preset 1 through 20 as displayed in the **HF PRE** status field of the **PRESET STATUS** window.

b. TUNE HF ALE Button. Selecting the **TUNE HF ALE** button tunes the HF radio to the HF ALE Channel (1 through 5) that is displayed in the **HF ALE** Status Field of the **PRESET STATUS** window.

c. TUNE HF ECCM Button. Selecting the **TUNE HF ECCM** button tunes the HF radio to the HF ECCM Net displayed in the HF ECCM Status Field of the **PRESET STATUS** window.

d. TUNE HF SC Button. Selecting the **TUNE HF SC** button tunes the HF radio to the HF SC frequencies for both the upper (U) and lower (L) sidebands as displayed in the HF SC Status Field of the **PRESET STATUS** window.

3A.30 PRESET EDIT PAGE

The **PRESET EDIT** page (fig 3A-17) provides the capability to modify the currently selected preset as displayed in the **PRESET STATUS** window. Along with the Unit ID, those items currently displayed for edit are displayed in full intensity in the **PRESET STATUS** window, as opposed to partial intensity.

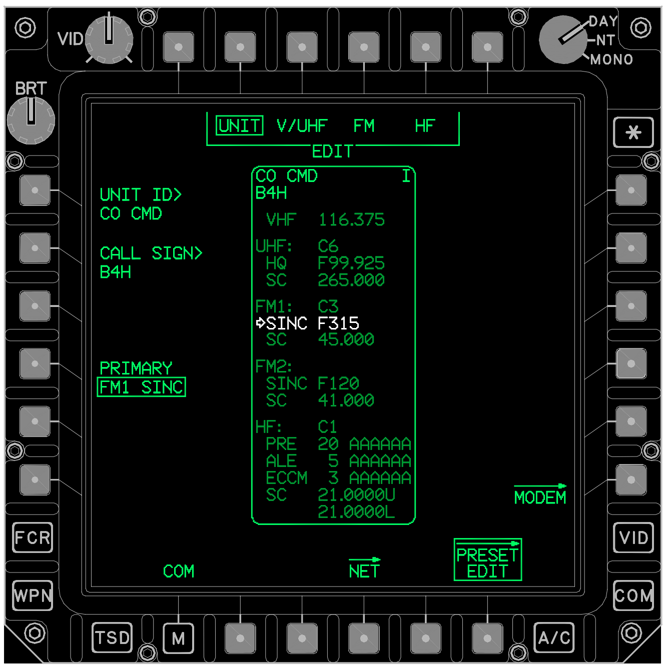


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Figure 3A-17. PRESET EDIT Page (UNIT Selected)

The **PRESET EDIT** page contains the following unique buttons when the **EDIT** grouped option is **UNIT**:

- T2-T5 **EDIT** buttons
- L1 **EDIT UNIT ID** button
- L2 **EDIT CALL SIGN** button
- L4 **EDIT PRIMARY RADIO/MODE** button
- R6 **MODEM** page button

3A.30.1 EDIT Buttons. The **EDIT** buttons provide the capability to select a specific element of a preset's COM data to edit.

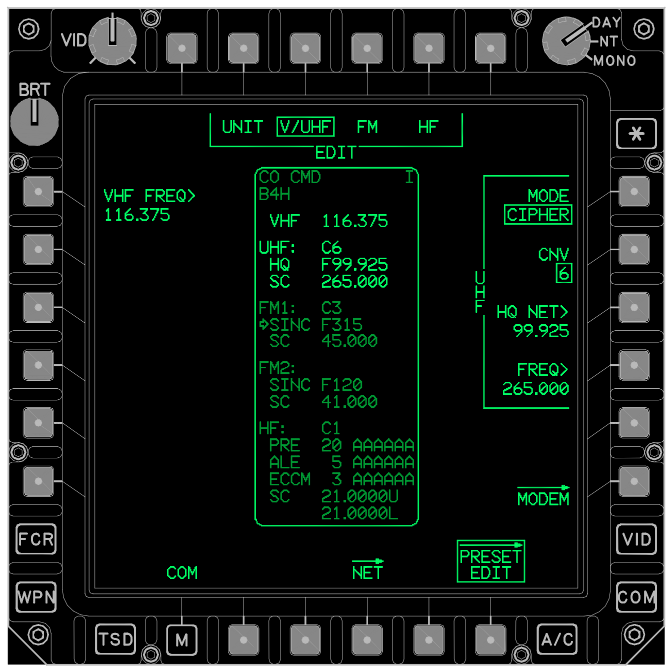
3A.30.2 EDIT UNIT ID Button. The **EDIT UNIT ID** button changes the preset Unit ID.

3A.30.3 EDIT CALL SIGN Button. The **EDIT CALL SIGN** button changes the preset call sign.

3A.30.4 EDIT PRIMARY RADIO Button. The **EDIT PRIMARY RADIO** button provides the capability to change the radio-frequency/radio-mode association of the Primary Radio indicator arrow (i.e. non-solid arrow) in the **PRESET STATUS** window.

3A.30.5 MODEM Page Button. The **MODEM** button displays the **MODEM** page. See paragraph 3A.31.

3A.30.6 PRESET EDIT Page Button. The **PRESET EDIT** page button displays the **PRESET EDIT** page (fig 3A-18).



LBA5093

Figure 3A-18. PRESET EDIT Page (V/UHF Selected)

The **PRESET EDIT** page contains the following unique buttons when the **EDIT** grouped option is **V/UHF**:

- L1 **EDIT VHF FREQ** button
- R1 **EDIT UHF MODE** button
- R2 **UHF CNV** selection button
- R3 **EDIT HQ NET** button
- R4 **EDIT UHF FREQ** button
- R6 **MODEM** button

3A.30.7 EDIT VHF FREQ Button. The **EDIT VHF FREQ** button changes the VHF element of the preset to a frequency in the range of 108.000 through 155.995, in increments of 5 KHz (except for invalid 8.33 KHz channels).

3A.30.8 EDIT UHF MODE Button. The **EDIT UHF MODE** button provides the capability to change the UHF Crypto Mode by toggling between Plain or Cipher mode for the selected preset.

3A.30.9 EDIT UHF CNV Button. The **EDIT UHF CNV** button allows changing the Crypto Net Variable, for the selected preset, from 1-6.

3A.30.10 EDIT HQ NET Button. The **EDIT HQ NET** button changes the HAVEQUICK net number of the preset in the range of 00.000 to 99.975.

3A.30.11 EDIT UHF FREQ Button. The **EDIT UHF FREQ** button changes the UHF element of the preset to a frequency in the range of 225.000 through 399.985 MHz in increments of 5 KHz.

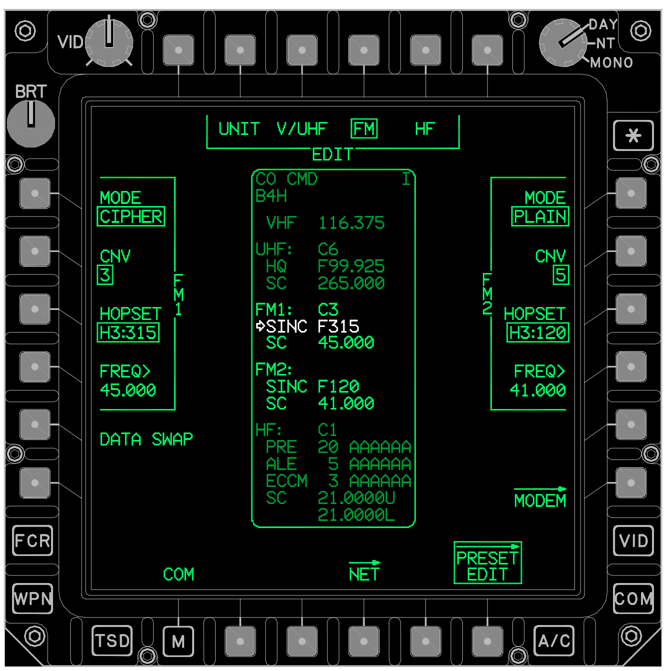


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Figure 3A-19. PRESET EDIT Page (FM Selected)

NOTE

The **PRESET EDIT FM** selected page buttons (fig 3A-19) for FM1 and FM2 are functionally identical and the definitions below apply to both radios.

3A.30.12 EDIT FM1/FM2 MODE Button. The **EDIT FM 1/FM2 MODE** button provides the capability to change the UHF Crypto Mode by toggling between Plain or Cipher mode for the selected preset.

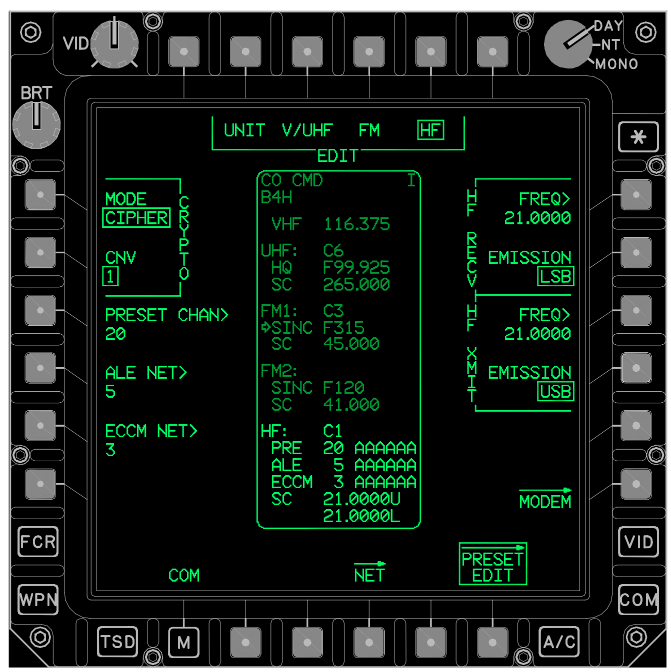
3A.30.13 EDIT FM1/FM2 CNV Button. The **EDIT FM1/FM2 CNV** button allows changing the Crypto Net Variable for the selected preset from 1-6.

3A.30.14 EDIT FM1/FM2 HOPSET Button. The **HOPSET** button provides six **HOPSET** button options. The hopset selected determines the radio FH characteristics (hopping rate, frequencies and frequency order).

3A.30.15 EDIT FM1/FM2 FREQ Button. The **EDIT FM1/FM2 FREQ** button changes the FM1/FM2 for the selected preset to a frequency in the range of 30.000 through 87.995, in increments of 5 KHz.

3A.30.16 EDIT FM1/FM2 DATA SWAP Button. The **EDIT FM1/FM2 DATA SWAP** button exchanges the FM1 and FM2 data displayed on the **PRESET EDIT FM** selected page.

3A.30.17 EDIT HF CRYPTO MODE Button. The **EDIT HF CRYPTO MODE** button (fig 3A-20) provides the capability to change the HF Crypto Mode by toggling between Plain or Cipher mode for the selected preset.



LBA5095

Figure 3A-20. PRESET EDIT Page (HF Selected)

3A.30.18 EDIT HF CRYPTO CNV Button. The **EDIT HF CRYPTO CNV** button allows changing the Crypto Net Variable for the selected preset from 1-6.

3A.30.19 EDIT HF PRESET CHAN Button. The **EDIT HF PRESET CHAN** button changes the HF Preset channel number of the preset in the range of 1-20.

3A.30.20 EDIT HF ALE NET Button. The **EDIT HF ALE NET** button changes the HF ALE net number of the preset in the range of 1-20.

3A.30.21 EDIT HF ECCM NET Button. The **EDIT HF ECCM NET** button changes the HF ECCM net number of the preset in the range of 1-12.

3A.30.22 EDIT HF RECV FREQ Button. The **EDIT HF RECV FREQ** button changes the HF manual receive frequency of the preset in the range of 2.0000 through 29.9999 MHz, in increments of 100 Hz.

3A.30.23 EDIT HF RECV EMISSION Button. The **EDIT HF RECV EMISSION** button changes the HF manual receive emission of the preset between **LSB** (Lower Side Band), **USB** (Upper Side Band), **CW** (Continuous Wave), or **AME** (Amplitude Modulation Equivalent).

3A.30.24 EDIT HF XMIT FREQ Button. The **EDIT HF XMIT FREQ** button changes the HF manual transmit frequency of the preset in the range of 2.0000 through 29.9999 MHz, in increments of 100 Hz.

3A.30.25 EDIT HF XMIT EMISSION Button. The **EDIT HF XMIT EMISSION** button changes the HF manual transmit emission of the preset between **LSB** (Lower Side Band), **USB** (Upper Side Band), **CW** (Continuous Wave), or **AME** (Amplitude Modulation Equivalent).

3A.31 MODEM PAGE BUTTON

The **MODEM** page button displays the **MODEM** page. The **MODEM** page provides the capability to modify the IDM net that is assigned to the PRESET button. The **MODEM** page is accessed by selecting the **MODEM** page button from the **PRESET EDIT** or **NET** page. The selected preset's current IDM type L, T, I, F, or NONE determines the protocol displayed on the MODEM page.

3A.31.1 PROTOCOL Button. The **PROTOCOL** button (fig 3A-21) provides the capability to select **LONGBOW, TACFIRE, INTERNET, FIRE SUPPORT** or **NONE.**

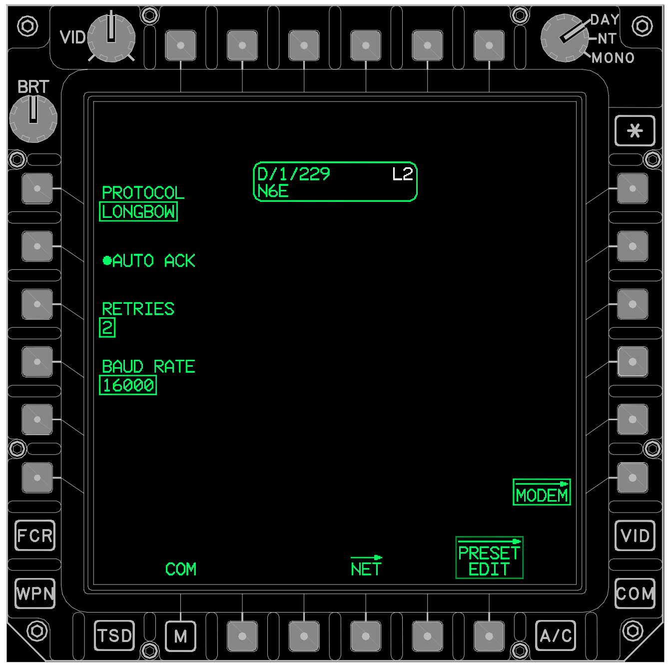


Figure 3A-21. MODEM Page With LONGBOW Selected

NOTE

The Longbow Protocol used in the IDM is also known as the Air Force Applications Program Development (AFAPD)

3A.31.2 LONGBOW PROTOCOL. When the multi-state **PROTOCOL** button is selected to **LONGBOW,** the following unique buttons are displayed:

- **AUTO ACK** button
- **RETRIES** button
- **BAUD RATE** button

a. AUTO ACK Button. The **AUTO ACK** button provides the capability to enable or disable the auto acknowledge mode.

b. RETRIES Button. The **RETRIES** button provides the capability to select the number of retransmissions the IDM performs (**2**, **1**, or **0**) with no acknowledgement from a subscriber.

c. BAUD RATE Button. The **BAUD RATE** button provides the following baud rate options:

- **16000**
- **8000**
- **2400**
- **1200**
- **600**
- **300**
- **150**
- **75**

3A.31.3 TACFIRE PROTOCOL. When the multi-state **PROTOCOL** button (fig 3A-22) is selected to **TACFIRE**, the **MODEM** page displays the **TACFIRE PROTOCOL** buttons.

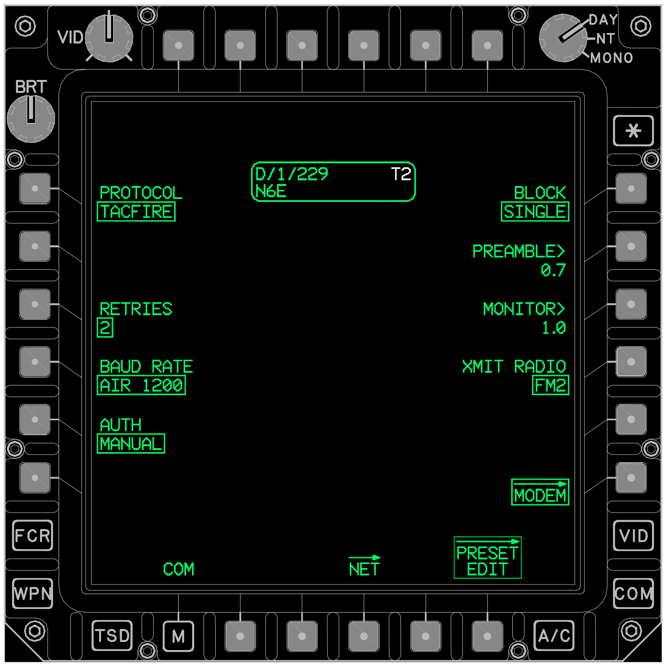


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Figure 3A-22. MODEM Page With TACFIRE Selected

When the **TACFIRE** button is selected, the following unique buttons are displayed:.

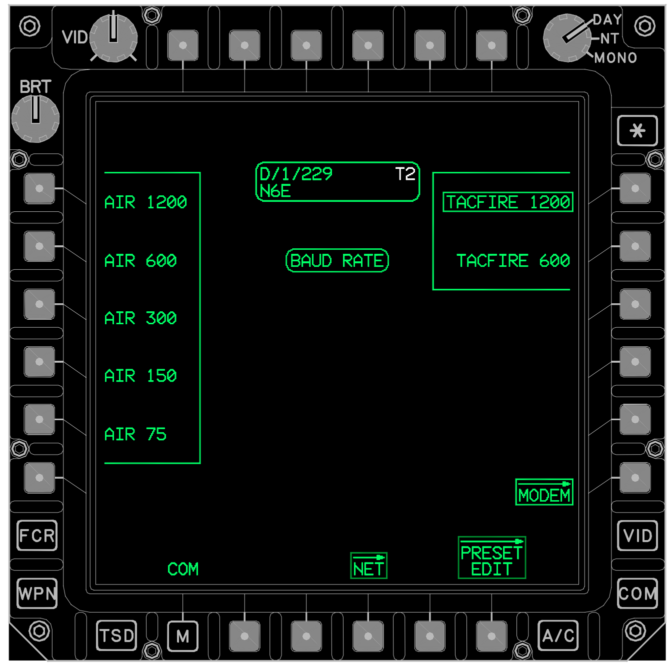
- **RETRIES** button
- **BAUD RATE** button
- **AUTH** button
- **BLOCK** button
- **PREAMBLE** button
- **MONITOR** button
- **XMIT RADIO** button

a. RETRIES Button. The **RETRIES** button provides the capability to select the number of retransmissions the IDM performs (**2**, **1**, or **0**) with no acknowledgement from a subscriber.

b. BAUD RATE Button. The **BAUD RATE** button (fig 3A-23) provides baud rate options of:

- **1200**
- **600**
- **300**
- **150**
- **75**

TACFIRE 1200 and **TACFIRE 600** are the only options available for **TACFIRE** messages sent to artillery. **TACFIRE 1200** is the default for the **TACFIRE** nets. The slower rates for the **AIR NETS** are to be used only if reception is poor at high rates.



LBA5098

Figure 3A-23. MODEM Page With TACFIRE and BAUD RATE Selected

c. AUTH Button. The **AUTH** two-state button allows the crew to toggle between **NONE** and **MANUAL**. If **NONE** is selected, no authentication is required. This function automatically displays **NONE** due to use of automatic authentication. If **MANUAL** is selected, an operator input of the transmission authenticator is required each time transmission is attempted. **MANUAL** authentication is normally only used in air-to-air or air-to-ground **TACFIRE**. If **MANUAL** is selected, but no manual authentication is desired at the time of transmission, the message will be sent on the second press of the **SEND** button.

d. BLOCK Button. The **BLOCK** two-state button allows the crew to toggle between **SINGLE** and **DOUBLE**. **SINGLE BLOCK** sends each segment of data once per **SEND**. **DOUBLE BLOCK** sends each data segment twice per **SEND**. **DOUBLE** should be used when atmospheric conditions/reception are poor or when jamming is suspected.

NOTE

- A minimum preamble of 0.4 seconds is required when transmitting through crypto equipment. The longer the preamble, the longer the air time.
- When establishing communications with AFATDS, ensure that 2.3 seconds is used by both the AH-64D and the artillery.

e. PREAMBLE Button. The **PREAMBLE** button is the ON AIR time that establishes a digital link between the radios prior to the message being sent. Selecting the **PREAMBLE** button provides the capability to modify this ON AIR time. An interval between 0.1 and 9.9 seconds may be entered.

f. MONITOR Button. Selection of the **MONITOR** button allows the crew to modify the time that the IDM listens for interfering traffic prior to transmitting the message. A time from 0.5 seconds to 9.9 seconds or **OFF** may be entered. To turn this function off the crew must enter zero, the word **OFF** is displayed on the **ATHS** page. If more than 15 seconds have elapsed after the **SEND** button has been depressed, the IDM will reset automatically and the **SEND** button must be pressed again. Voice transmission has priority over digital transmission; therefore, the IDM will wait until the airway is clear of voice traffic if a monitor time has been selected.

g. XMIT RADIO Button. Selection of the multi-state **XMIT RADIO** button allows the crew to select the radio that the IDM will use to transmit the **TACFIRE** digital messages. Preset options of **VHF**, **UHF**, **FM1**, and **FM2** are displayed upon selection of of the **XMIT RADIO** button. When the preset is selected and tuned to a radio, that radio will be set at **XMIT RADIO**. After the preset has been tuned to a radio, this button allows the operator to configure it to a different radio. Artillery **TACFIRE** nets are normally set on **FM1** or **FM2**.

3A.31.4 INTERNET PROTOCOL Button. When the multi-state **PROTOCOL** button is selected to **INTERNET**, no unique button is displayed.

3A.31.5 FIRE SUPPORT PROTOCOL Button. When the **PROTOCOL** button (fig 3A-24). is selected to **FIRE SUPPORT**, the **MODEM** page displays the **FIRE SUPPORT PROTOCOL** buttons.

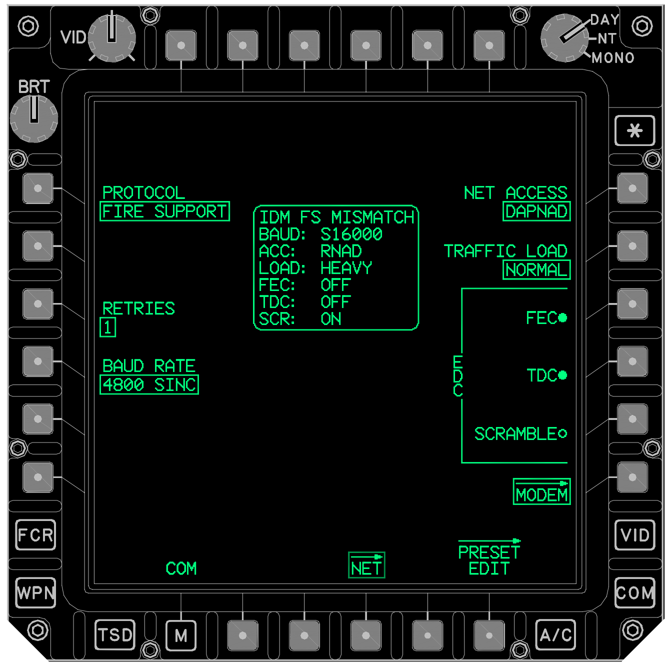


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Figure 3A-24. MODEM Page With FIRE SUPPORT Selected (IDM Mismatch Detected)

When **FIRE SUPPORT** is selected, the following unique buttons are displayed:

- **BAUD RATE** button
- **NET ACCESS** button
- **TRAFFIC LOAD** button
- **EDC FEC** button
- **EDC TDC** button
- **EDC SCRAMBLE** button
- **RETRIES** button

a. BAUD RATE Button. The **BAUD RATE** button (fig 3A-25) specifies the baud rate and the mode for the currently selected preset's IDM Net which will be used for sending and receiving fire support data. The button provides options of the following **SINC BAUD RATES**:

- **16000**
- **4800**
- **2400**
- **1200**
- **600**

The button provides options of the following **ENHANCED BAUD RATES**:

- **9600**
- **4800**
- **2400**
- **200**

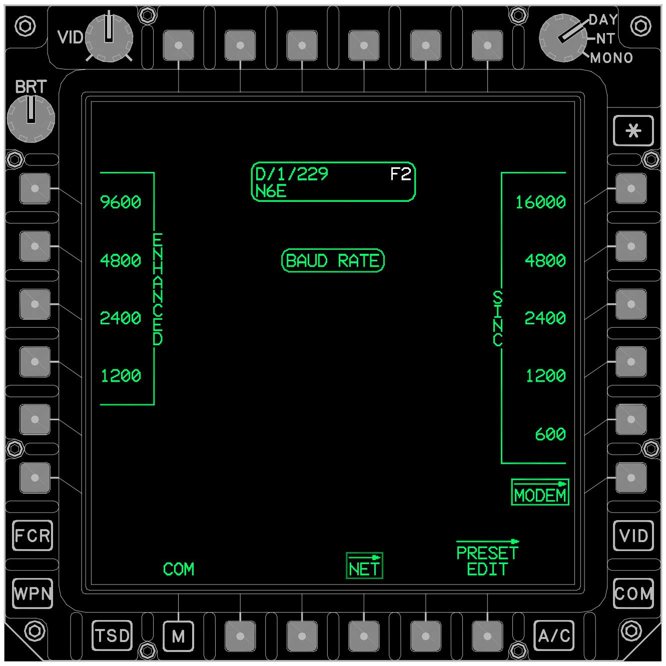

Figure 3A-25. MODEM Page with FIRE SUPPORT BAUD RATE Selected

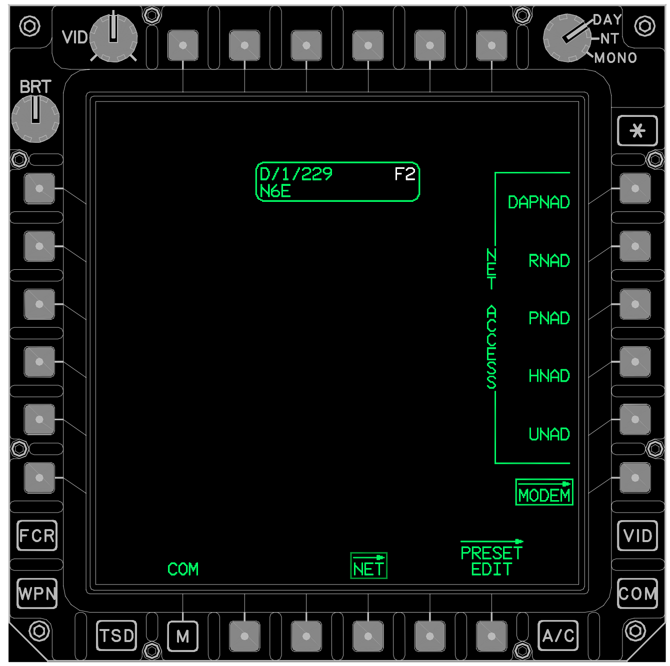

Figure 3A-26. MODEM Page With FIRE SUPPORT NET ACCESS Selected

b. NET ACCESS Button. The **NET ACCESS** button (fig 3A-26) provides the means to select 1 of 5 net access delay methods that the IDM will use with the selected **FIRE SUPPORT** preset. The presence of multiple members on a single net requires a method of controlling the transmission opportunities for each member. The net access delay selections detect when the net is busy and regulate transmission opportunities over the net. Modes include the following selections:

- **DAPNAD**
- **RNAD**
- **PNAD**
- **HNAD**
- **VNAD**

c. TRAFFIC LOAD Button. The **TRAFFIC LOAD** button provides the means to select 1 of 3 **TRAFFIC LOAD** button options for use with the preset selected. The **TRAFFIC LOAD** button options set the flow control parameter size. Button options include:

- **HEAVY**
- **NORMAL**
- **LIGHT**

A **HEAVY** TRAFFIC LOAD selection places a greater loading on a single channel. **NORMAL** TRAFFIC LOAD should be selected unless FS has instructed otherwise.

d. EDC FEC/TDC/SCRAMBLE Buttons. The **ERROR DETECTION CORRECTION (EDC)** On and Off buttons provide the means for configuring the error detection parameters that the IDM will use with the **FIRE SUPPORT** protocol for the preset selected. **EDC** On/Off buttons include **FEC**, **TDC**, and **SCRAMBLE.**

- **FEC (Forward Error Correction)** coding provides IDM Error Detection and Correction (EDC) capabilities to compensate for errors induced during transmission.

NOTE

When an **ENHANCED** baud rate (Error Detect Control mode internal to the radio) has been selected, **FEC** On should not be used; however, the NET parameters are determined by the Fire Support NET administrator.

- **TDC (Time-Dispersive Coding)** bit interleaving formats data into TDC blocks. TDC reduces bit errors during the transmission of messages. All Fire Support protocol compliant receivers have TDC decoder capabilities to translate: **FEC** with **TDC**, or **FEC** with **TDC** and **SCRAMBLE**.

NOTE

The AH-64D is DC response compliant. Enable SCRAMBLE only when briefed by the artillery NET administrator. SCRAMBLE supports legacy systems that are not yet JVMF-FS enabled.

- **SCRAMBLE (Data scrambling)** is required anytime that a Fire Support NET transmitter element does not have a DC response capability and there is the possibility that long strings of ones or zeros could be transmitted.

e. RETRIES. The **RETRIES** button (fig 3A-24) provides the capabiilty to select the number of FS retransmissions the IDM performs (**2, 1,** or **0**) with no acknowledgement from the subscriber.

f. IDM FS MISMATCH Status Window. The **IDM FS MISMATCH** status window (fig 3A-24) displays the mismatch status for Fire Support IDM parameters. This status window is only displayed when Fire Support is tuned to one of the radios and the IDM is reporting one of the parameters is different from what was commanded by the DP. Potential Fire Support mismatch parameters include:

- FS Baud Rate
- Net Access
- Traffic Load
- EDC

The status window represents the current IDM configuration.

3A.32 PRESET DIR PAGE

The **PRESET DIR** page (fig 3A-27) accesses a pre-mission developed database of up to 60 digital/voice **PRESET** items. The **PRESET DIR** page supports manual page searching, KU data searching, the selection of single **PRESET** items, and the replacement of **COM** page presets with **PRESET** items. The **PRESET DIR** page button is displayed following a DTU load and is accessed via the **PRESET DIR** button presented on either the **COM** page or **SOI** page.

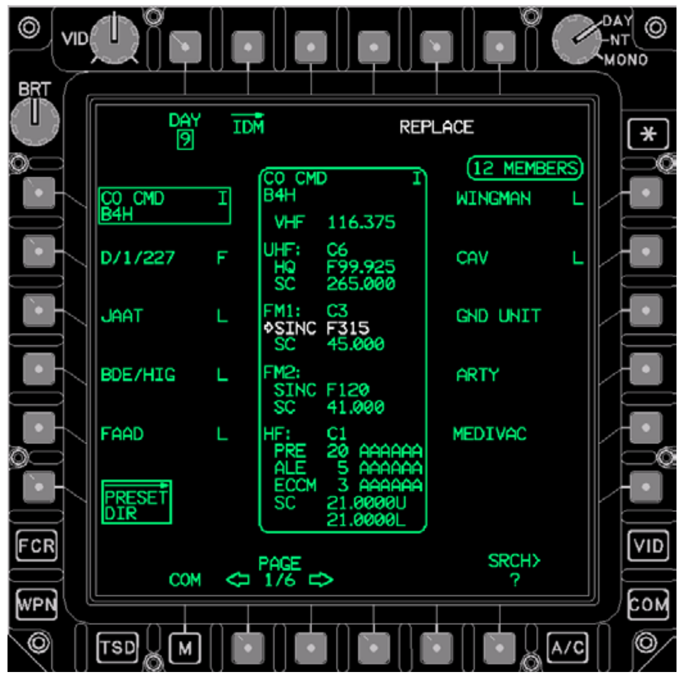

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Figure 3A-27. PRESET DIR Page

The **PRESET DIR** page contains the following unique buttons:

- T5 **REPLACE** button
- L1-L5 **PRESET** buttons
- R1-R5 **PRESET** buttons
- B2 **PAGE BACK** button
- B3 **PAGE FORWARD** button
- B5 **ABORT** button (conditional)
- B6 **SRCH** button

NOTE

Selecting the **PRESET REPLACE** location 9 or 10 with a Longbow or Tacfire **PRESET** item will store the COM and member data, however, the net-type will be changed to voice. Preset 9 and 10 will only digitally support Fire Support and Internet protocols, while presets 1 through 8 may be used with any protocol.

3A.32.1 REPLACE Button. The **PRESET DIR LOCATION REPLACE** format is displayed when the **REPLACE** button (fig 3A-28) is selected. This display format provides the means to replace any one of the ten **COM** page presets with the selected **PRESET** item. When the selected **PRESET** item is assigned with a Longbow or Tacfire protocol, the **REPLACE PRESET** location display button locations 1 through 8 are white while presets 9 through10 are green. When the selected **PRESET** item is assigned an Internet or Fire Support protocol, all presets are displayed in white. The selection of any one of the **PRESET REPLACE** location buttons commands the replacement of that locations **COM** page preset with the selected **PRESET** items COM, IDM, and member data. Following the system's successful processing of the replace-store operation, the **COM** page will display showing that the replace was made.

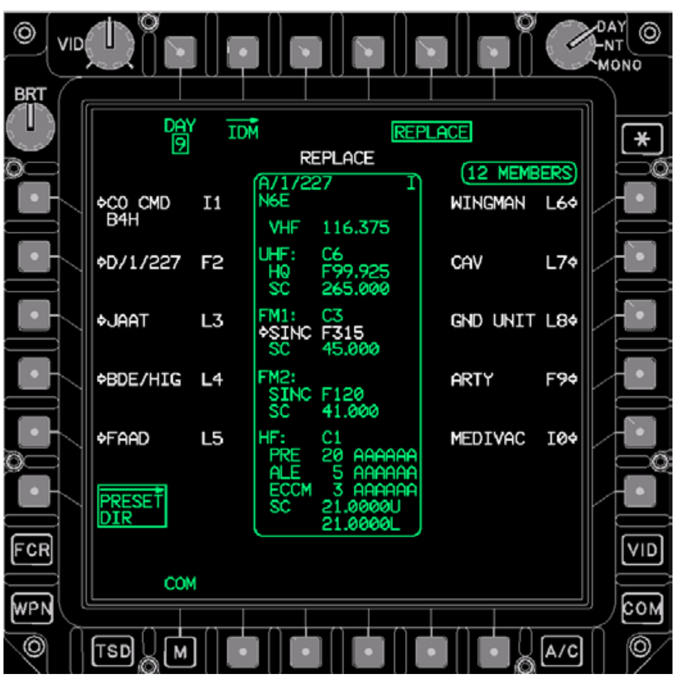

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Figure 3A-28. PRESET DIR - REPLACE Button Selected

3A.32.2 PRESET Buttons. The **PRESET DIR** page button provides access to a premission developed database containing up to 60 **PRESET** items. Each of the **PRESET** items possess identical data type capabilities and capacities as does the **COM** page presets inclusive of members. Upon the display of the page, the first valid **PRESET** item will be selected and the corresponding **PRESET** item status window (para 3A.32.3 and fig 3A-27) is displayed along with the **PRESET** item **MEMBER** status window. Each **PRESET** item button contains two lines of information, with the first line containing the Unit ID field and the digital protocol fields. The second line contains the Unit Call Sign field. The digital protocol assignment is represented by the presence of either an **L** (Longbow), **T** (TACFIRE), **I** (Tactical Internet), or **F** (Fire Support) which indicates the current protocol of the selected **PRESET** Item.

3A.32.3 PRESET ITEM Status Window. The **PRESET** item status window (fig 3A-27) displays the field contents of the currently selected **PRESET** item. The primary radio/mode and frequency/ECCM will be displayed in white. Status window data fields includes:

- Unit ID
- Call Sign
- IDM Type and IDM Preset-Net Number
- VHF Frequency
- UHF CNV status
- UHF HQ Net number
- UHF Single Channel Frequency
- FM1 CNV status
- FM1 SINC net number
- FM1 Single Channel Frequency
- FM2 CNV status
- FM2 SINC net number
- FM2 CNV status
- HF CNV status
- HF PRE
- HF ALE
- HF ECCM
- HF SC

3A.32.4 PRESET ITEM MEMBER Status Window. The **PRESET** item **MEMBER** status window (fig 3A-27) displays the quantity of existing members for the selected **PRESET** item. The status window displays the **PRESET** item's total member count field status as a number of 0 through 15 followed by **MEMBERS**. **PRESET** item members are not editable from the **PRESET DIR** page.

3A.32.5 ABORT Button. The **ABORT** button (fig 3A-29) provides the means to abort a search during OIP or after search is complete. The **ABORT** button is displayed when a search is initiated. Aborting a search restores the **PRESET** item page list and resets the page number to one.

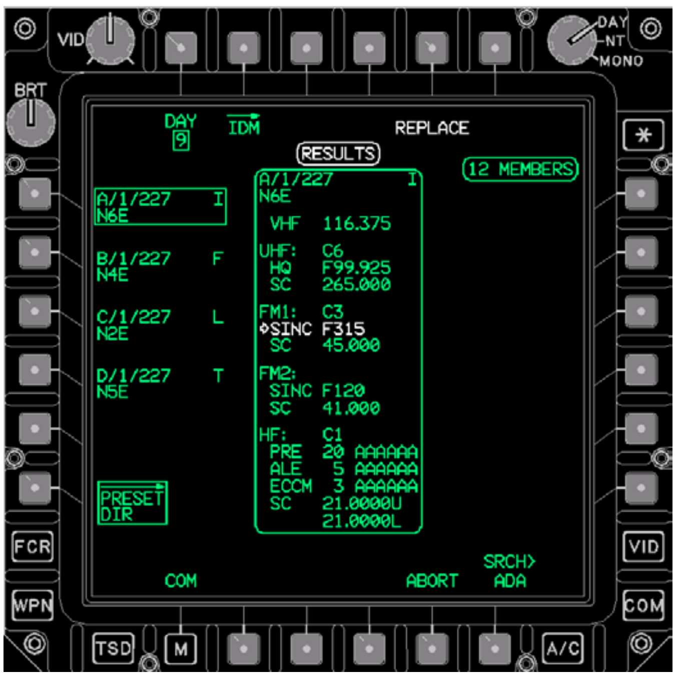

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Figure 3A-29. PRESET DIR Page - Database SRCH With RESULTS Posted

The **PRESET DIR** page with search **RESULTS** posted has the following unique button:

- B5 **ABORT** button

3A.32.6 SRCH Button. The **PRESET ITEM SEARCH** data entry button provides the means to search for a specific preset item in the preset directory's database. Searching and replacing functionality provides the means to quickly replace Longbow, Tacfire, Tactical Internet, Fire Support, and Voice presets. The keyboard label reads **PRESET SEARCH** and the data entry may be all or a portion of either the Unit ID or Call Sign of a preset. **PRESET** item search will begin following the selection of **KB ENTER** key and an **ABORT** button will display at this time.

3A.32.7 SRCH RESULTS Format. The **PRESET DIRECTORY** page posts and displays matched search results as they occur in a **SEARCH RESULTS** format. The **RESULTS** status window (fig 3A-29) is displayed during a search to reflect that the **PRESET** items being displayed are matches to search data. Posted preset results may be reviewed and stored while the search continues. The **PRESET** list buttons control presentation of search result pages. If there are 10 or less **PRESET** item matches found in a search, then the page buttons will not be displayed.

3A.32.8 NO MATCH Status Window. The **NO MATCH** status window is displayed when there was no match found during a preset PRESET DIR database item search. When called, the **NO MATCH** status will be displayed in white in the location immediately above the **SRCH** button.

3A.33 NET PAGE

The **NET** page displays the preset member data associated with the selected **COM** page preset-net, provides editing for 1 to 15 members for Longbow, Tacfire, Internet, Fire Support, and NONE protocols, and provides access to the **MBR DIR** page. Additionally, it provides advisory status windows for the selected net member's Callsign/Suffix status and IDM digital ID settings and an abbreviated ownship (para 3A.23.15) status window.

The **NET (LONGBOW, TACFIRE, TI, Fire Support and NONE)** page (fig 3A-30) has the following unique buttons:

- T1 **SUFFX** (Suffix) button
- T2 **DEL** (MEMBER) button
- T2 **URN** (Fire Support) button
- T3 **TEAM** button
- T4 **PRI** button
- T4 **IP** (Fire Support) button
- T5 **C/S** button
- T6 **SUB** (Longbow/Tacfire) button
- T6 **URN** (Internet) button
- L1-L5 **MEMBER** buttons
- L6 **MBR DIR** button
- R1-R5 **MEMBER** buttons
- R6 **MODEM** button
- B2 **PAGE** Back button
- B3 **PAGE** Forward button
- B5 **CLEAR** (Tacfire only) button

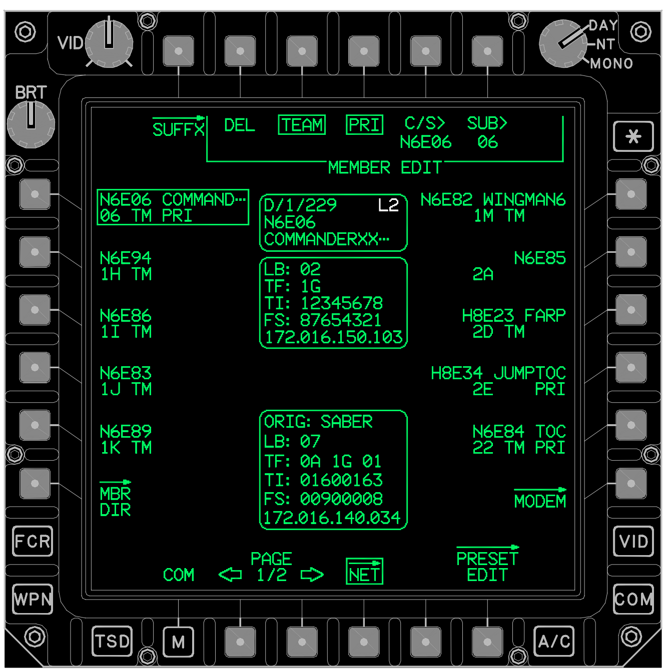

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Figure 3A-30. NET Page - (Longbow Team Member Selected)

3A.33.1 SUFFX Button. The **SUFFX** button displays the **SUFFX** page (para 3A.33.17).

3A.33.2 MEMBER DEL Button. The **MEMBER DEL** button provides the capability to delete the selected member. This button is only displayed for a preset with an assigned IDM net and a valid call sign as displayed in the **MEMBER CALL SIGN** button. Selection of the **MEMBER DEL** button will prompt for a **YES** or **NO** confirmation to initiate the deletion. Selecting the **YES** confirmed button deletes the data associated with the selected **MEMBER** button and returns the crewmember out of the member delete confirmation mode. Selecting **NO** returns the crewmember out of the member delete confirmation mode.

3A.33.3 MEMBER URN (Fire Support) ID Button. The net **MEMBER FS Unit Reference Number ID** data entry button (fig 3A-31) provides the capability to edit or create the selected net member's URN ID. The net **URN ID** button is displayed whenever a Fire Support net **MEMBER** button is selected and the the **URN** maintained option button is selected. Each member's URN ID is mapped to its respective Internet Protocol (IP) address (para 3A.33.6) through the net **MEMBER FS IP ID address** data entry button. When selected, the keyboard label will display **FS URN ID** and will accept an entry of 0 through 16,777,215.

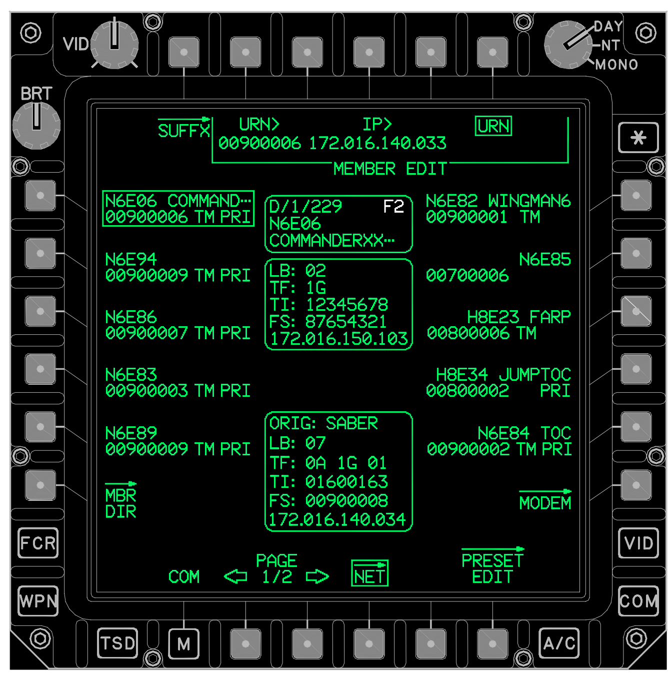

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Figure 3A-31. NET Page - (Fire Support Net Member Selected, URN Selected Edit Mode)

3A.33.4 MEMBER TEAM Button. The **TEAM** button provides the capability of toggling a net member's team designation on or off. Selecting the **TEAM** button assigns and unassigns team member status independently of the **PRI** (primary) status. Selecting the **TEAM** button will add the selected member to the IDM net associated with the currently displayed preset and display the **TM** status on the second field of the selected **MEMBER**s button. This button is only displayed if the net member currently selected has a subscriber or URN digital ID.

3A.33.5 MEMBER PRI Button. The **PRI** (primary) button provides the capability to toggle a net member's primary designation on or off. Selecting the **PRI** button assigns and unassigns primary member status independently of the **TEAM** status. Selecting the **PRI** button will add the selected member to the IDM net associated with the currently displayed preset and display the **PRI** status on the second field of the selected **MEMBER'**s button. This button is only displayed if the net member currently selected has a subscriber or URN digital ID and if there are not already seven members designated as primary members.

3A.33.6 MEMBER IP (Fire Support) ID Button. The net **MEMBER FS IP ID** data entry button provides the capability to edit, or create, the selected member's Fire Support IP ID. The net **MEMBER FS IP ID** button is displayed whenever a Fire Support net **MEMBER** button is selected and the the **URN** maintained option button is selected. The Fire Support protocol's IP address ID is mapped to the member's Fire Support URN ID number (para 3A.33.3) through the net **MEMBER URN ID** data entry button. When selected, the keyboard label will display **FS IP** with four fields separated by three decimals and each field will accept an entry of 0 through 255.

3A.33.7 MEMBER C/S Button. The **MEMBER C/S** data entry button provides the capability to edit or create the selected members call sign. This button is only displayed for a preset with an assigned IDM net. When selected, the keyboard label will display **CALL SIGN** and will accept an entry of 3 to 5 characters.

3A.33.8 MEMBER SUB (Longbow/Tacfire) ID Button. The preset net **MEMBER SUB ID** data entry button provides the capability to edit, or create, the selected members Longbow or Tacfire preset net subscriber ID. The preset net **MEMBER SUB ID** button is displayed upon the selection of a **MEMBER** button and Longbow or Tacfire is the selected protocol. The keyboard label displays **SUBSCRIBER ID** and accepts a one or two character input between 0-39, A-Z, 1A-1Z, 2A-2Z, or 3A-3I.

3A.33.9 MEMBER URN (Internet) ID Button. The net **MEMBER URN** Internet **ID** data entry button (fig 3A-31) provides the capability to edit or create the selected net member's URN ID. The net **URN ID** button is displayed whenever an Internet protocol net **MEMBER** button is selected and the the **URN** maintained option button is selected. When selected, the keyboard label will display **FS URN ID** and will accept an entry of 0 through 16,777,215.

3A.33.10 MEMBER Buttons. The member buttons provide the capability to create, edit, and assign/unassign team and priority member status for up to 15 IDM preset net members or create/edit up to 15 voice net members. The preset net **MEMBER** buttons contain two fields of information. The first field contains the Call Sign ID and Suffix Description. The second field contains the Digital ID, Team Status, and Primary Status. The Call Sign ID is displayed with up to a five character free text descriptor. The Suffix Description is displayed with up to the first eight characters of the free text descriptor. When selected, a preset net member status window (para 3A.33.15) and net member IDM status window (para 3A.33.16) will be displayed providing a display of the selected member's COM and digital data.

3A.33.11 MODEM Page Button. The **MODEM** button displays the **MODEM** page (para 3A.31).

3A.33.12 MBR DIR Page Button. The **MEMBER DIRECTORY** page button displays the **member directory** page (para 3A.34).

3A.33.13 PAGE Back and PAGE Forward Buttons. Allows selection between two pages of preset members.

3A.33.14 CLEAR (TACFIRE) Button. The **CLEAR** button, displayed in white, is only displayed if the IDM has detected extraneous Tacfire subscribers. This may occur if the crew deletes subscribers from a Tacfire net, but then performs an upload of the original Tacfire member data from the DTC. Pressing the **CLEAR** button will delete the extraneous Tacfire subscribers from the IDM.

3A.33.15 MEMBER Status Window. The net **MEMBER** status (fig 3A-30, 3A-31, and 3A-32) is displayed when a net **MEMBER** is selected.

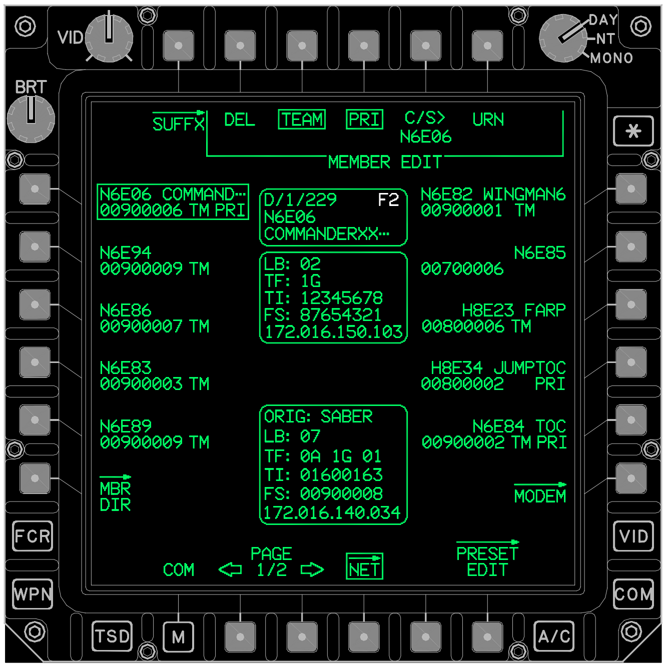

Figure 3A-32. NET Page - (Fire Support Net Member Selected)

The status window contains 3 fields:

- Unit ID and Net Protocol
- Call Sign
- Suffix Descriptor.

3A.33.16 MEMBER IDM Status Window. The net **MEMBER IDM** status (fig 3A-30, 3A-31, and 3A-32) window is displayed when a net **MEMBER** is selected. The status window contains five fields:

- LB (Longbow subscriber ID)
- TF (Tacfire subscriber ID)
- TI (Tactical Internet URN ID)
- FS (Fire Support URN ID)
- XXX.XXX.XXX.XXX (FS IP Address)

3A.33.17 SUFFX Page Button. The **SUFFX** page (fig 3A-33) displays the Suffix data that has been loaded from the DTC. The **SUFFX** page provides the capability to modify members with a suffix.

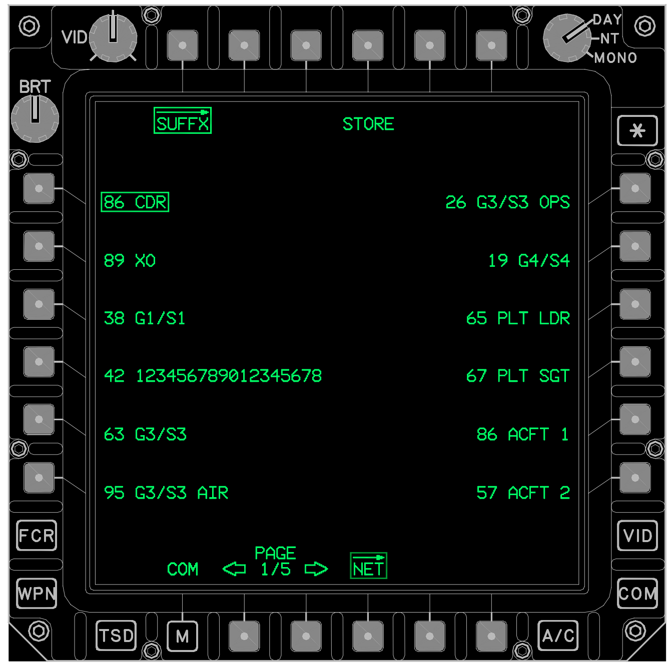

Figure 3A-33. SUFFX Page - (Net Member Selected)

The **SUFFX** page contains the following unique buttons:

- T4 **STORE** button
- L1-L6 Suffix buttons
- R1-R6 Suffix buttons
- B2 **PAGE** Back button
- B3 **PAGE** Forward button

3A.33.18 STORE Button. Selecting the **STORE** button provides the capability to store the selected Suffix into a selected preset net member button location on the **NET** page. Also as part of this selection, a new subscriber call sign for the **NET MEMBER** selected is created using the selected Preset's call sign and the selected Suffix ID. This button is displayed in white.

3A.33.19 Suffix Buttons. The Suffix buttons are displayed on the left and right sides of the **SUFFX** page.

3A.33.20 PAGE Back and PAGE Forward Buttons. Allows selection of multiple pages of suffixes.

3A.34 MBR DIR PAGE

The **MEMBER DIRECTORY** page (fig 3A-34) is capable of maintaining a 500 member data base (directory), and provides the capability to page search, auto search, and add or replace preset net members into a digital net. The member directory data base is developed during premission planning and is loaded from the DTC. The **MBR DIR** page is accessed via the **NET** page. Member automatic search and store functionality provides the operator with the capability to quickly build Longbow, Tacfire, Tactical Internet, and Fire Support digital nets.

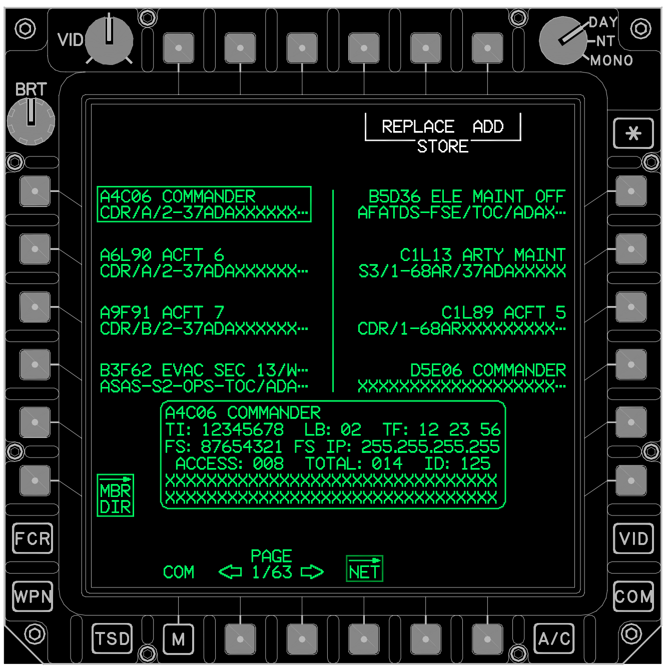

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Figure 3A-34. MBR DIR page

The **MBR DIR** page contains the following unique buttons:

- T5 **STORE REPLACE** button
- T6 **STORE ADD** button
- L1-L4 **MEMBER** buttons
- R1-R4 **MEMBER** buttons
- B2 **PAGE** BACK button
- B3 **PAGE** FORWARD button
- B5 **ABORT** button (Conditional)
- B6 **SRCH** button (Conditional)

3A.34.1 STORE REPLACE Button. The **STORE REPLACE** button presents the **NET LOCATION STORE Page** format (para 3A.34.11).

3A.34.2 STORE ADD Button. The **STORE ADD** button stores the selected MEMBER (database item) to the first vacant **NET** page MEMBER location (para 3A.34.12).

3A.34.3 MEMBER Buttons. The **MEMBER** buttons represent the digital members that have been loaded in the Member Directory and are not associated with the SOI database. The display ordering of members (i.e., 1 through 500) is determined by how the database was established during premission planning. The **MEMBER** button format consists of three fields:

- Call sign
- SUFFIX
- URN descriptor's first 20 characters of up to 64 characters located beneath the callsign

3A.34.4 MEMBER Review Status. Window. The **MEMBER** Review status window (fig 3A-34) displays when a **MEMBER** button is selected. The status window displays all the database elements for the selected **MEMBER** button and consists of six lines with 13 data fields.

The **MEMBER** Review status window contains the following unique data fields:

- Callsign and Suffix
- TI URN ID, LB ID, TF ID, TF TM ID, and TF BCST ID
- FS URN ID, FS IP ID
- ACCESS###, TOTAL ###, ID###
- URN Descriptor, first 32 characters
- URN Descriptor, second 32 characters

3A.34.5 PAGE Back and PAGE Forward Buttons. The **PAGE** Back and Forward buttons permit the manual selection of the member directory pages for locating members.

3A.34.6 ABORT Button. The **ABORT** member search button provides the capability to abort a search during an active database search or, after a search has completed, it may be selected to return to the page search format (para 3A.34.7 and 3A.34.8 and fig 3A-35).

3A.34.7 SRCH Button. The Member Search data entry button provides the capability to initiate a search for a specific member or a group of members. When the **SRCH** button is selected, the KU label displays **MBR SEARCH** and the data entered may be all or a portion of the Call Sign, or up to any 8 sequential characters of the 64 character URN Descriptor. During a search, results are posted and displayed (fig 3A-35) in a **RESULTS** format. If there is no match made during the search, then the **NO MATCH** status window (para. 3A.34.10) is displayed in white just above the **SRCH** button.

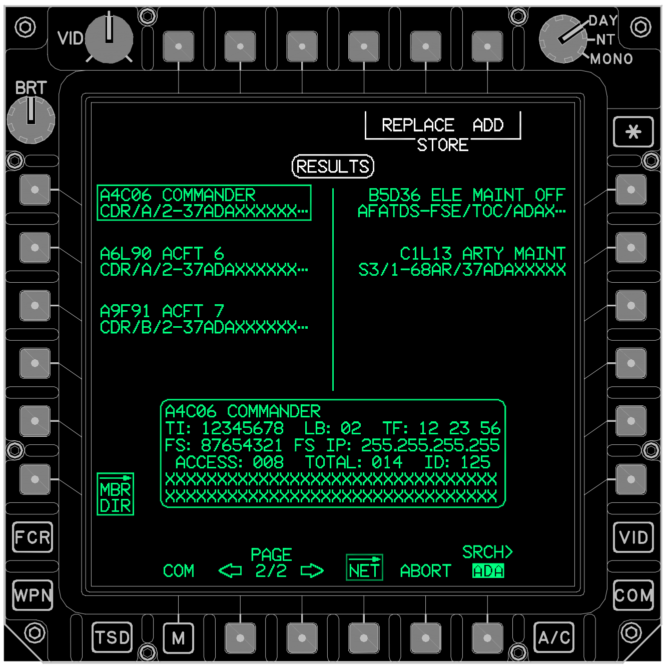

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Figure 3A-35. MBR DIR RESULTS Format

3A.34.8 SRCH RESULTS Format. The Member Directory page posts and displays matched search results as they occur in a **SRCH RESULTS** format. The **RESULTS** status window (fig 3A-35) is displayed during a search to reflect that the Member Directory listings being displayed are matches to search data.

3A.34.9 MBR SRCH Status Bar. The member SRCH status bar graphic provides awareness of the overall search progress. There are 25%, 50%, and 75% complete hatch marks for quick assessment of the searching progress. Posted member results may be reviewed and stored while the search continues. Page buttons will not display until the ninth result is posted.

3A.34.10 NO MATCH STATUS Window. The **NO MATCH** status window displays when there is not a search match made in the Member Directory. The status will be displayed in white, replacing the SRCH status bar.

3A.34.11 STORE REPLACE Button. The **STORE REPLACE** button presents the Net Member location format. All fifteen Net Member locations will display in white with an arrow to identify that they are available for storage. The **REPLACE** status window (fig 3A-36) is displayed in white at the top center of the net member location format. The Member Selected status window displays the selected Member Directory item's data that has been selected for replacement storage. When a Net Member location button is selected that had contained a preexisting net member, that member will be replaced with the new member. Following a Net Member location **REPLACE** selection, the **NET** page will display with the preset-net member that was just stored selected.

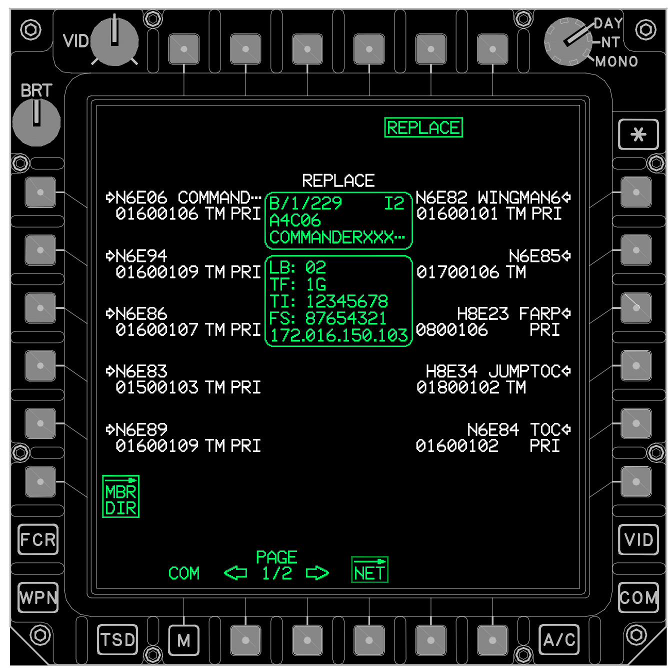

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Figure 3A-36. MBR DIR REPLACE Item Location Format

3A.34.12 STORE ADD Button. The **STORE ADD** button stores the selected member to the first open net location of the selected preset. When all net locations for a preset are filled with members (i.e., 15 locations), the **ADD** button will barrier. The Member Store Location Status window displays, in white, when a member was successfully added to the preset-net. The status window displays the available **NET** member location that the selected Directory Member was stored to.

3A.35 MSG REC PAGE

The **MSG REC** page (fig 3A-37) provides the operator the capability to manage IDM messages that are received within the IDM's message receive buffer or to manage HF messages that are received within the HF radio's receive buffer. The crew is cued when a message is received by a EUFD advisory, message receive tone (para 2.139, table 2-15) and the message appearing on the **MSG REC** page. Additionally, Longbow messages received containing TSD data and JVMF C2 messages will cue the crew by displaying a **RCVD** button on the **TSD** page.

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Figure 3A-37. MSG REC Page (Source IDM)

The **MSG REC** page contains the following unique buttons:

- T2 **SOURCE** button
- T2 **STORE/RVW** button
- T3 **LOCATION CURR** button (Longbow)
- T3 **COMPLY WILL** button (JVMF)
- T4 **LOCATION MSN1** button (Longbow)
- T4 **COMPLY HAVE** button (JVMF)
- T5 **LOCATION MSN2** button (Longbow)
- T5 **COMPLY CAN'T** button (JVMF)
- T6 **DEL** button
- L1-L6 **Message** Receive buttons
- R1-R6 **Message** Receive buttons
- B2 **PAGE** Back button
- B3 **PAGE** Forward button
- B4 **ATHS** Page button

NOTE

Storage of an IDM message will overwrite the selected mission data.

3A.35.1 SOURCE Button. The **SOURCE** button toggles between **IDM** or **HF** message receive controls and messages.

CAUTION

Storing a **BLOCK 01 COM ALL IDM/SOI** file message will delete all Tactical Internet and Fire Support data for the current preset-nets. If this occurs, the COM presets will have to be reloaded.

3A.35.2 STORE/RVW Button. The **STORE/RVW** button provides the capability to store a data message or review (para 3A.35.9) a FREE TEXT (Longbow or Internet), FIELD ORDERS (Internet or Fire Support), or INFORMATION REQUEST (Internet or Fire Support) message, or any ATHS message received via the IDM. The **STORE** and **RVW** buttons will display after an applicable message has been selected. The **STORE** button will not display if the selected **Internet** or **Fire Support** message was not properly formatted by the sender. The **STORE** button stores the data associated with the selected **Message** button and then deletes the message from the IDM buffer unless the **Internet** message sender requested a compliance message. When an operator acknowledgement (ACK) is requested by the **Internet** or **Fire Support** message sender, an operator **ACK** message is transmitted at the time that the message is either stored or reviewed unless the IDM has been inhibited. If a **TACFIRE** message is selected for review, then upon activation of the **RVW** button the page will automatically switch to the page **MSG RCVD** page of the **ATHS TACFIRE**. Refer to the ATHS section for more information.

3A.35.3 LOCATION CURR / MSN1 / MSN2 Buttons. The **MSG REC** page **CURR**, **MSN1**, and **MSN2** buttons (fig 3A-38) provide the capability to specify where a Longbow message file, or files, will be stored. Selecting the **CURR** button will store the selected **Longbow** message or messages to the current (active) locations and displays. Selecting the **MSN1** or **MSN2** buttons will store the message, or messages, to either MISSION1 or MISSION2 on the DTC.

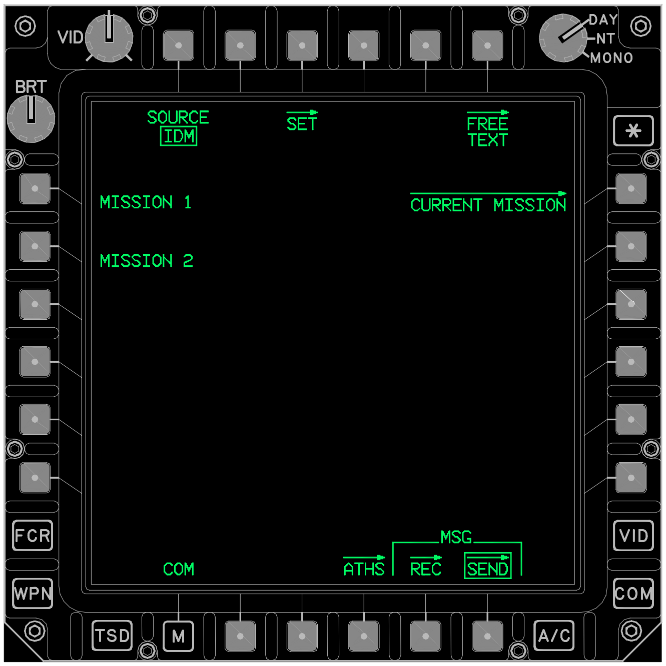

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Figure 3A-38. IDM Page

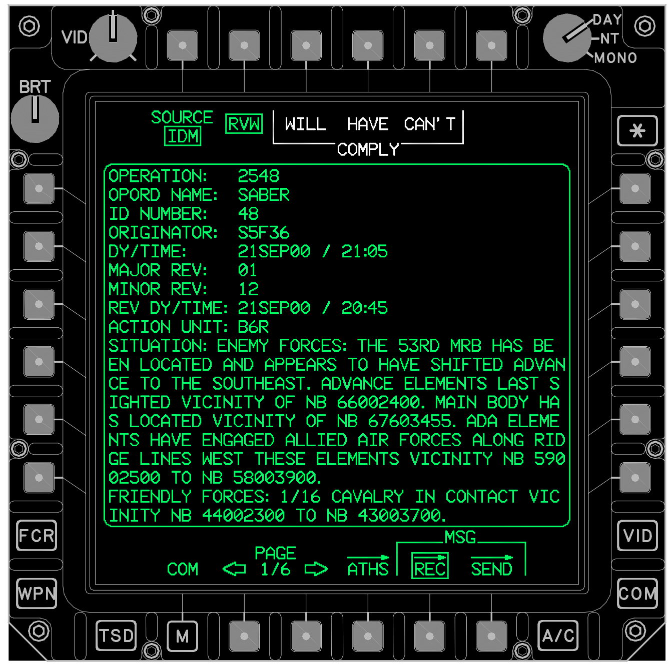

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Figure 3A-39. Message Buttons (FIELD ORDER Selected)

NOTE

The **LOCATION MSN1** or **MSN2** buttons are barriered anytime that a Longbow data message is selected and the mission card is not available, corrupt, or busy with a different task.

3A.35.4 COMPLY WILL/HAVE/CAN'T Buttons. The **WILL**, **HAVE**, and **CAN'T** buttons (fig. 3A-39) are displayed when the sender of the selected **Internet or Fire Support** message requested an operator compliance response, the selected message has been reviewed or stored, and one of the radios is tuned to either the **Fire Support** or **Internet** protocols. When one of the **WILL**, **HAVE**, or **CAN'T** buttons is selected, a message with the corresponding response will be sent back to the sender.

3A.35.5 DEL Button. Selecting the **DEL** button deletes the IDM message associated with the selected message button. When a compliance is requested by an **Internet** or **Fire Support** message sender, the **DEL** button will not be displayed until either the **WILL**, **HAVE**, or **CAN'T COMPLY** button has been selected.

3A.35.6 Message Buttons. There can be up to 12 message buttons per page (fig 3A-37) and up to 13 pages. On the top line, the type of message will be displayed, along with the protocol the message was received on. If the message is not valid per the indicated type a "**?**" will be displayed at the beginning of the second line. If the sender of the message requested an operator response, the second line, toward the beginning, will display the word **COMPLY** and the message will be displayed white. The priority cue is displayed in the middle of the second line if the sender of the message placed a higher priority than routine on the message. A message with the priority cue of priority would display **PRI** in white, a priority of immediate would display **IMMED** in yellow, a priority of flash would display **FLASH** in yellow, and a priority of emergency would display **EMERG** in yellow. The call sign of the sender is displayed at the end of the second line. If the sender is a subscriber to one of the presets, the call sign will be displayed, otherwise a "**?**" will be displayed. New incoming messages are displayed at the end of the buffer.

3A.35.7 PAGE Back and PAGE Forward Buttons. Allows selection of multiple pages of received IDM messages.

3A.35.8 ATHS Page Button. The **ATHS** button (fig 3A-39) displays the **ATHS** page.

3A.35.9 RVW Message Window. The **RVW** message window (fig 3A-39) allows the crewmembers to review text based messages (Free Text, Field Orders, and Information Request messages) received over the IDM. The status window can display up to 19 lines of 44 characters. When used with the **PAGE Back and PAGE Forward** buttons, up to six pages of a message can be viewed. The **MSG REC** page contains the following unique buttons when **SOURCE** is **HF**:

- T2 **RVW** button
- T5 **FWD** button
- T6 **DEL** button
- L1-L5 **Message** Receive buttons
- L6 **PP** Receive button
- R1-R5 **Message** Receive buttons

3A.35.10 FWD Button. The **FWD** button (figs 3A-40 and 3A-41) transmits the HF message associated with the selected **MSG REC HF MSGS** button on the current frequency or mode.

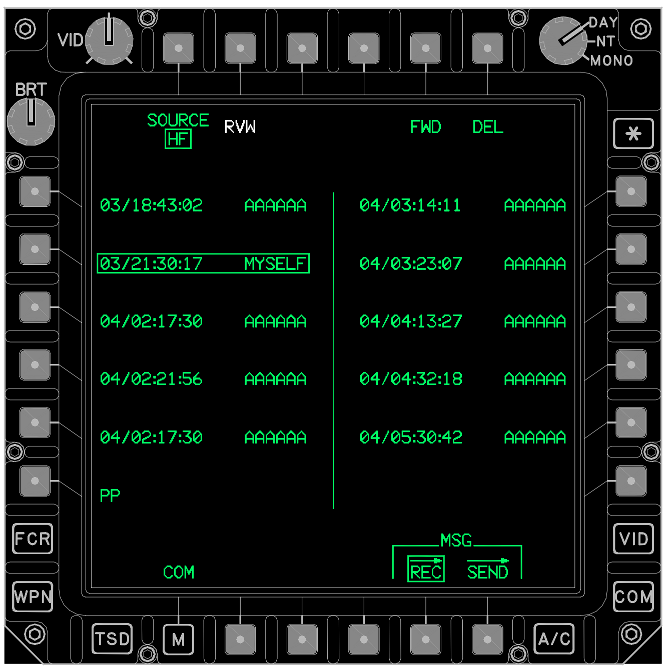

Figure 3A-40. MSG REC Page (Source HF)

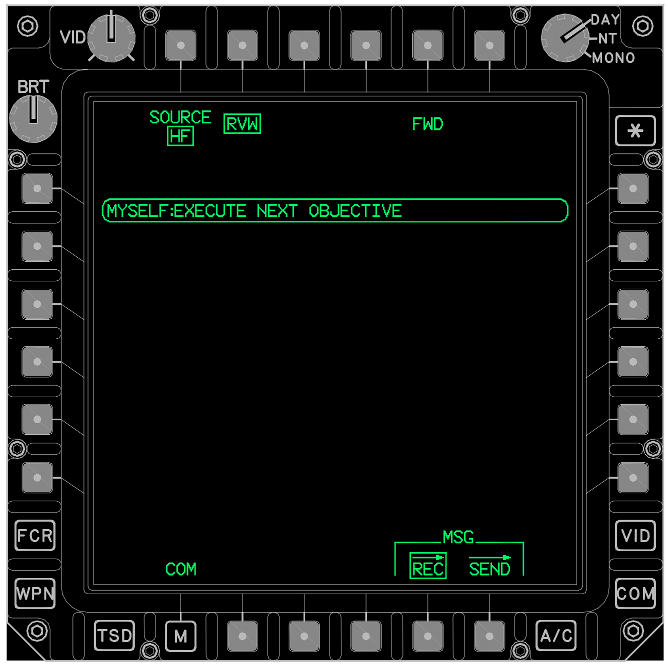

Figure 3A-41. MSG REC Page (HF RVW Selected)

3A.35.11 DEL Button. Selecting this button deletes the HF message associated with the selected Message Receive button. Selection of the **DEL** button will prompt for a **YES** or **NO** confirmation to initiate the deletion.

3A.35.12 Message Receive Buttons. There can be up to 10 messages buttons (fig 3A-40). The message will be displayed with the day and time it was received and the first six characters from the sender's call address.

3A.35.13 PP Receive Button. The **PP** button (fig 3A-42) provides controls to store or delete a present position report. The **PP** button is displayed when a present position report is received over the HF radio.

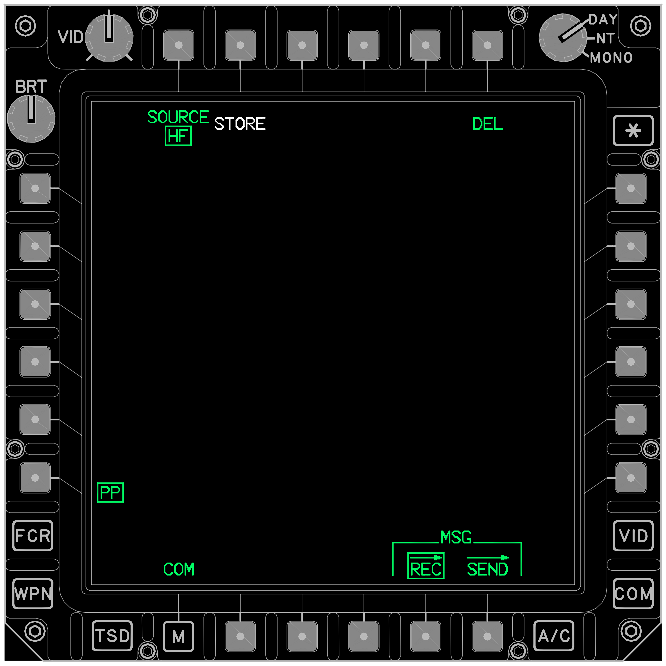

Figure 3A-42. MSG REC Page (HF PP Selected)

3A.35.14 Free Text Message Window. The Free Text Message Window (fig 3A-41) allows the crewmembers to review Free Text messages received over the HF radio. The **MSG REC** page contains the following unique buttons when **SOURCE** is **HF** and **PP** is selected:

- T2 **STORE** button
- T6 **DEL** button

3A.35.15 STORE Button. The **HF PP STORE** button (fig 3A-42) provides the capability to store a present position report received over the HF radio into the control measures file, location 92.

3A.35.16 DEL Button. Selecting this button deletes the HF present position report. Selection of the **HF PP DEL** button will prompt for a **YES** or **NO** confirmation to initiate the deletion.

3A.36 MSG SEND PAGE

The **MSG SEND** page (fig 3A-43) provides controls to send **MISSION 1**, **MISSION 2**, or **ALL IDM/SOI** data files via the IDM to **Longbow** protocol team members. It also provides access to the **IDM** page which is used to configure the IDM and message parameter defaults. It also provides access to the **CURRENT MISSION** page which is used for sending selected components of the current mission to team members.

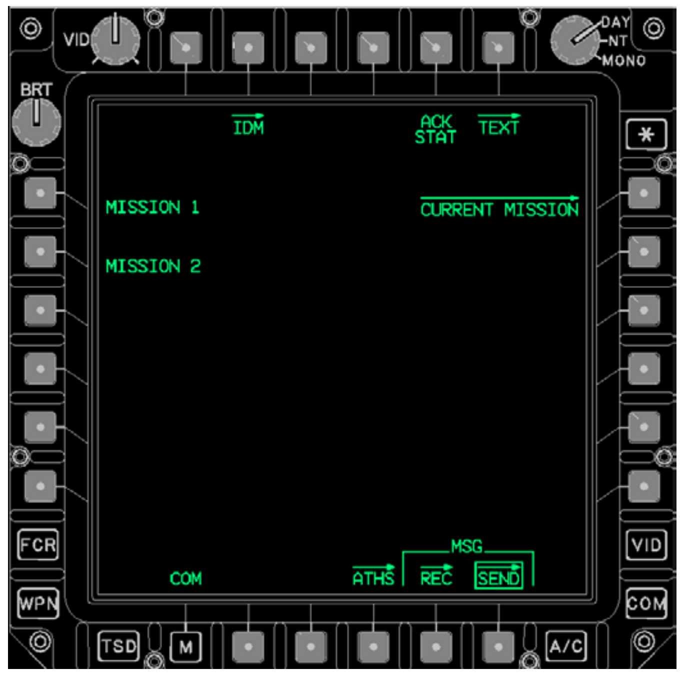

Figure 3A-43. MSG SEND Page

The **MSG SEND** page contains the following unique buttons:

- T3 **IDM** button (TI message settings)
- T5 **JVMF ACK** button
- T6 **TEXT page** button
- L1 **MISSION 1** button
- L2 **MISSION 2** button
- L3 **ALL IDM/SOI** buttons
- R1 **CURRENT MISSION** button
- R6 **SEND** button

3A.36.1 IDM Button. The **IDM** button displays the IDM-page (para 3A.26).

3A.36.2 JVMF ACK Button. The **JVMF ACK** button displays the **JVMF ACK STATUS** window.

3A.36.3 MISSION 1 (or 2) Buttons. The **MISSION** buttons provide the capability to transmit the **MISSION 1** (or **2)** files to selected **Longbow** protocol team members upon the selection of the **IDM SEND** button.

3A.36.4 CURRENT MISSION Button. The **CURRENT MISSION** button displays the **LONGBOW** protocol **CURRENT MISSION** page.

3A.36.5 SEND Button. The **SEND** button is displayed if the IDM is in the operate mode. The EUFD IDM transmit select indicator is assigned to a compatible IDM protocol net and a valid team member is in the net. The **FREE TEXT** message is compatible with Longbow, Internet, and Fire Support protocols while all other **MSG SEND** page messages are exclusive to Longbow protocol nets. The selection of the **SEND** button will command the system to transmit the selected files through the selected channel of the IDM. The data is only sent to team members.

3A.36.6 JVMF ACK STATUS Window. The **JVMF ACK STATUS** window can be selectively opened using the **JVMF ACK** button, and provides detailed status to the operator of ACK, NAK, receiving platform operator intentions (e.g., WILCO, CANTCO) for the last JVMF message sent, accepting JVMF messages issued via HF radio. Status is provided individually for all platforms to which a message was sent.

3A.36.7 TEXT Page Button. The **TEXT** page presents the MPS TEXT MSG options and the FREE TEXT MSG editing display

3A.36.8 SEND Status Window. The **SEND** status window (fig 3A-47) provides a MPD display of the radio, IDM protocol, and preset-net status that the IDM transmit select indicator for that crew station.

3A.37 CURRENT MISSION PAGE

The **CURRENT MISSION** button displays the **CURRENT MISSION** page (fig 3A-47). The **CURRENT MISSION** page provides the capability to individually select the type of information to be sent over the IDM using **Longbow** (AFAPD) protocol. Selection of the **ALL** button allows transmission of all current files. Once an item is selected, selecting the **SEND** button will initiate transmission over the IDM.

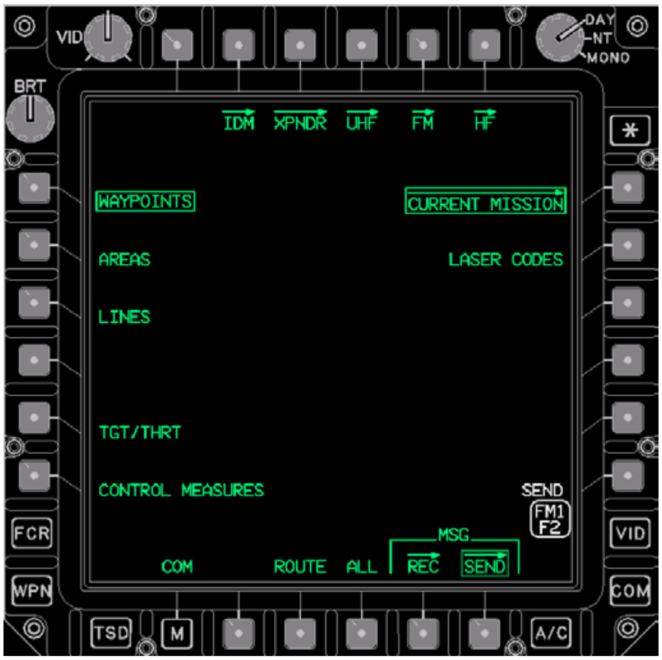

Figure 3A-47. CURRENT MISSION Page

The **CURRENT MISSION** page contains the following unique buttons:

- L1 **WAYPOINTS** button
- L2 **AREAS** button
- L3 **LINES** button
- L4 **ROUTE (CURRENT)** button
- L5 **TGT/THRT** button
- L6 **CONTROL MEASURES** button
- R2 **LASER CODES** button
- R6 **SEND** button
- B3 **ROUTE** button
- B4 **ALL** button

3A.37.1 WAYPOINTS Button. The **WAYPOINTS** button allows sending of the current waypoints file over the IDM.

3A.37.2 AREAS Button. The **AREAS** button allows sending of the current engagement areas file over the IDM.

3A.37.3 LINES Button. The **LINES** button allows sending of the current phase lines file over the IDM.

3A.37.4 TGT/THRT Button. The **TGT/THRT** button allows sending of the current target and threats file over the IDM.

3A.37.5 CONTROL MEASURES Button. The **CONTROL MEASURES** button allows sending of the current control measures file over the IDM.

3A.37.6 LASER CODES Button. The **LASER CODES** button allows sending the current laser codes file over the IDM.

3A.37.7 SEND Button. The **SEND** button is only displayed if a valid **CURRENT MISSION** file is selected to be sent. The selection of the **SEND** button will command the system to transmit the selected files through the selected channel of the IDM. The selection of the **SEND** button will command the system to transmit the selected files through the selected **LONGBOW** protocol channel of the IDM. The data is only sent to **LONGBOW** team members.

3A.37.8 ROUTE Button. The **ROUTE** button allows sending of the current route file over the IDM. The **ROUTE** button presents all of the current routes files available for sending over the IDM (fig 3A-48).

3A.37.9 ALL Button. The **ALL** button allows sending of all current mission files over the IDM.

3A.38 CURRENT MISSION - ROUTE SELECTIONS

The **ROUTE** button (fig 3A-48) provides the capability to select various routes for sending over the Longbow IDM protocol.

Figure 3A-48. CURRENT MISSION Page (ROUTE Button Selected)

The **ROUTE** button provides the following unique buttons:

- L1-L6 **ROUTE** buttons
- R2-R5 **ROUTE** buttons
- B4 **ALL** button

3A.38.1 ROUTE Buttons. The **ROUTE** buttons allow selection of a single route file to send over the IDM.

3A.38.2 ALL Button. The **ALL** button allows sending of all route files over the IDM.

3A.39 TEXT PAGE

The **TEXT** page (fig 3A-49 and fig 3A-50) provides the capability to send a Mission Planning Station (MPS) non editable text message or create a free text message for transmission through the IDM using Longbow, Internet, or Fire Support protocols or through the HF radio's modem.

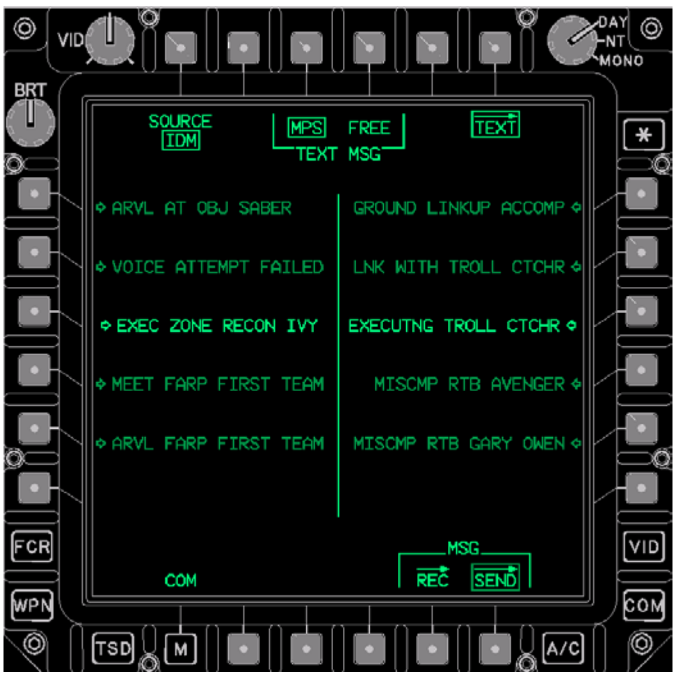

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Figure 3A-49. TEXT Page (Source IDM - MPS TEXT)

The **TEXT** page contains the following unique buttons when **SOURCE** is **IDM** and **FREE TEXT** is selected (refer to fig 3A-50):

- T1 **SOURCE** button
- T3 **MPS TEXT** button
- T4 **FREE TEXT** button
- L1-L4 **IDM TEXT (1-4)** buttons
- R6 **SEND** button
- B4 **CLEAR** button

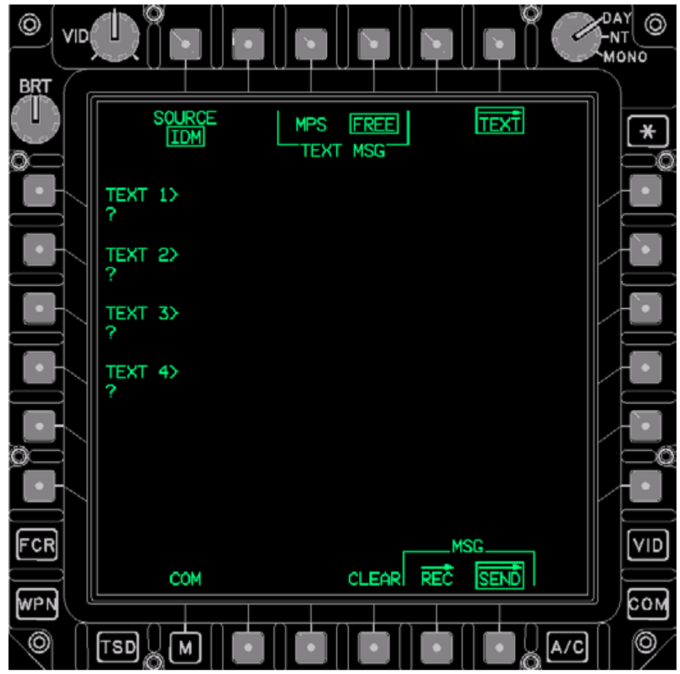

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Figure 3A-50. TEXT Page (Source IDM - FREE TEXT)

3A.39.1 SOURCE Button. The **SOURCE** button toggles between **IDM** or **HF** free text message controls.

3A.39.2 MPS TEXT Button. The **MPS** TEXT button displays up to 10 non-editable premission planned text messages that may be selected and sent to any JVMF entity.

3A.39.3 FREE TEXT Button. The **FREE** TEXT button displays the editable FREE TEXT format used to develop free text messages that may be sent via Longbow (AFAPD) or JVFM.

3A.39.4 IDM FREE TEXT Buttons. Each **IDM FREE TEXT (1-4)** button provides the capability to load four 44-character messages into the system for transmission by the IDM radio.

3A.39.3 SEND Button. The **SEND** button transmits the **IDM TEXT** message through the selected channel of the IDM or through the HF's modem. With SOURCE to IDM, the data is only sent to team members.

3A.39.4 CLEAR Button. The **CLEAR** button clears the data contained in the **IDM TEXT** buttons.

The **TEXT** page contains the following unique buttons when **SOURCE** is **HF** and **FREE TEXT** is selected (fig 3A-51):

- L1-L4 **HF TEXT (1-4)** buttons
- R6 **SEND** button
- B4 **CLEAR** or **ABORT** button

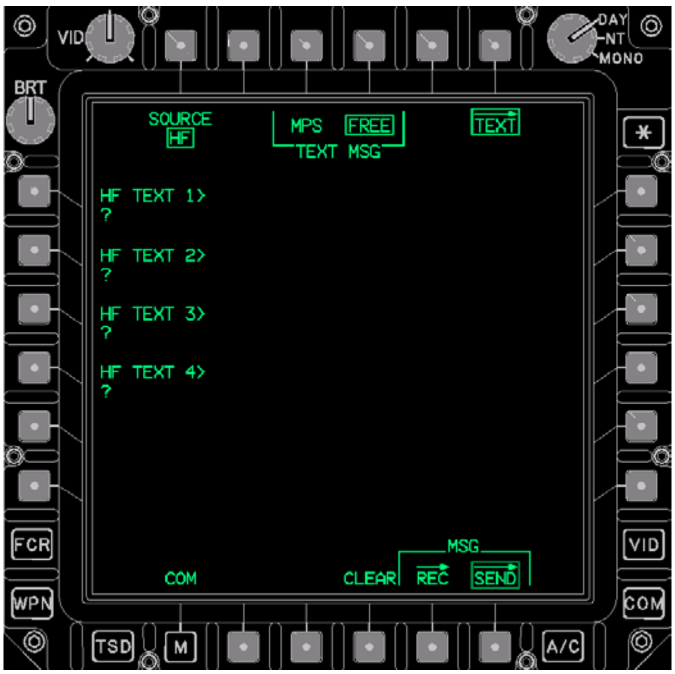

Figure 3A-51. TEXT Page (Source HF - FREE TEXT)

3A.39.5 HF TEXT Buttons. Each **HF TEXT (1-4)** button provides the capability to load four 44-character messages into the system for transmission by the HF radio.

3A.39.6 SEND Button. The **SEND** button transmits the **HF TEXT** message through the HF radio's modem.

3A.39.7 CLEAR/ABORT Buttons. The **CLEAR** button clears the data contained in the **HF TEXT** buttons. The **ABORT** button is displayed while the **HF TEXT** is being sent, in order to allow the crew to abort the transmission.

The **TEXT** page contains the following unique buttons when **SOURCE** is **IDM** and **MPS TEXT** is selected (refer to fig 3A-49):

- T1 **SOURCE** button
- L1-L5 **MPS IDM MESSAGE (1-5)** buttons
- R1-R5 **MPS IDM MESSAGE (6-10)** buttons
- R6 **SEND** button

3A.40 MPS IDM MESSAGE Buttons. The **MPS IDM MESSAGE** buttons provide the capability to review an MPS pre-planned message and select it for transmission by the IDM

The **TEXT** page contains the following unique buttons when **SOURCE** is **HF** and **MPS TEXT** is selected (refer to fig 3A-52):

- T1 **SOURCE** button
- T2 **RVW** button
- L1-L5 **PM (1-5)** buttons
- L6 **PP** button
- R1-R5 **PM (6-10)** buttons
- R6 **SEND** button
- B2-B3 **PAGE LEFT/RIGHT** buttons
- B4 **CLEAR** or **ABORT** button

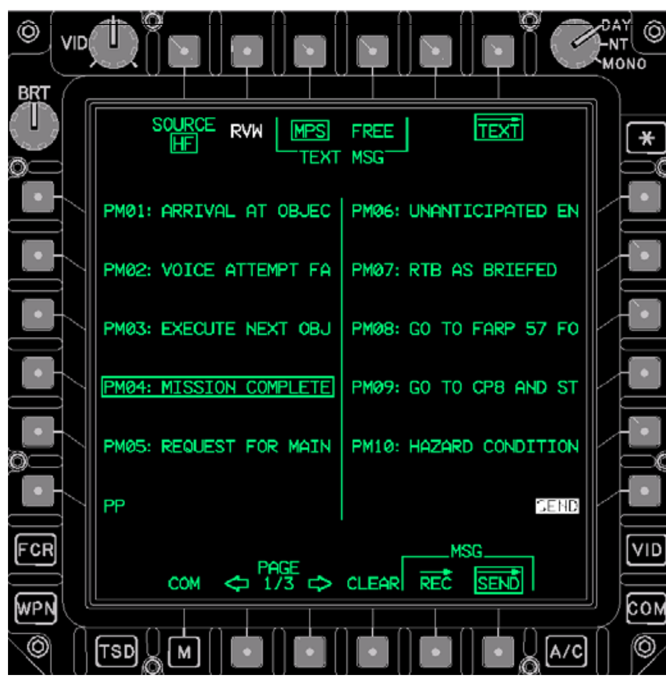

Figure 3A-52. TEXT Page (Source HF - MPS TEXT)

3A.40.1 SOURCE Button. The **SOURCE** button toggles between **IDM** or **HF** free text message controls.

3A.40.2 RVW Button. The **RVW** button allows the operator to review the MPS pre-planned messages.

3A.40.3 PM Buttons. The **PM** buttons allow the operator to select an MPS pre-planned message for review or transmission by the HF radio.

3A.40.4 PP Button. The **PP** button provides the capability to send the ownship present position over the HF radio's modem.

3A.40.5 PAGE LEFT/RIGHT Buttons. The **PAGE LEFT/RIGHT** buttons allows the operator to scroll to the previous or next page of 10 preplanned HF messages.

NOTE

Due to the APX-118 hardware and software fielding plan, it is possible to have either an APX-100 or APX-118 installed. See paragraph 3A.42 for APX-100 and paragraph 3A.42A for APX-118.

3A.42 XPNDR PAGE (APX-100)

The **XPNDR** page for the APX-100 (fig 3A-57) provides the capability to control the APX-100 transponder functions.

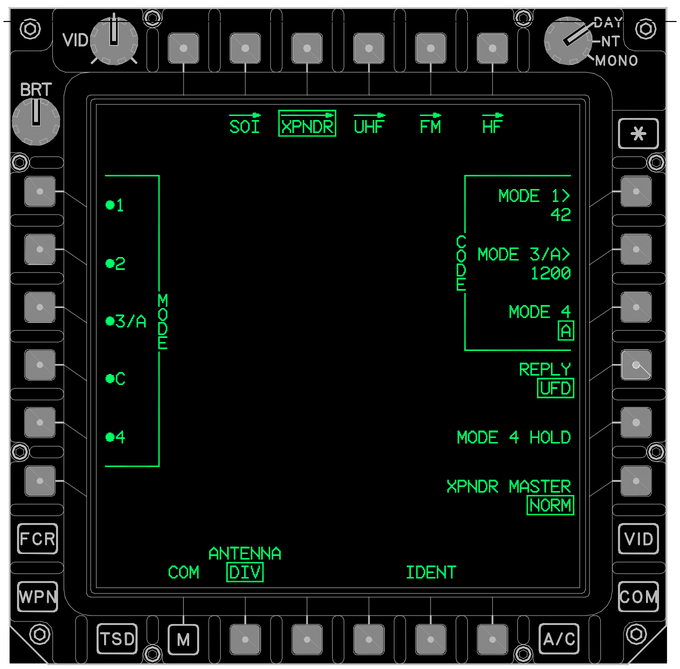

Figure 3A-57. XPNDR Page (APX-100)

3A.42.1 XPNDR Page Button. The **XPNDR** page contains the following unique buttons:

- L1 **MODE 1** button
- L2 **MODE 2** button
- L3 **MODE 3/A** button
- L4 **MODE C** button
- L5 **MODE 4** button
- R1 **CODE Mode 1** button
- R2 **CODE Mode 3/A** button
- R3 **CODE Mode 4** button
- R4 **REPLY** button
- R5 **MODE 4 HOLD** button
- R6 **XPNDR MASTER** button
- B2 **ANTENNA** button
- B5 **IDENT** button

3A.42.2 MODE 1 Button. The **MODE 1** button enables/disables **MODE 1** replies.

3A.42.3 MODE 2 Button. The **MODE 2** button enables/disables **MODE 2** replies.

3A.42.4 MODE 3/A Button. The **MODE 3/A** button enables/disables **Mode 3/A** replies**.** When **MODE 3/A** button is selected **OFF**, the **MODE C** button is automatically turned **OFF**.

3A.42.5 MODE C Button. The **MODE C** button enables/disables the **MODE C** transmission. When **MODE C** button is selected **ON**, the **MODE 3/A** button is automatically turned **ON**.

3A.42.6 MODE 4 Button. The **MODE 4** button enables/disables **MODE 4**. The **MODE 4** Code data field on the EUFD (para 3A.16) is updated when the mode has been changed.

3A.42.7 CODE MODE 1 Button. The **CODE MODE 1** button provides the capability to change the **MODE 1** code.

3A.42.8 CODE MODE 3/A Button. The **CODE MODE 3/A** button provides the capability to change the **MODE 3/A MODE 2** codes.

NOTE

- The **MODE 2** code must be manually entered on the face of the APX-100.
- If an APX-118 is installed, but the APX-100 MPD controls are present due to the APX-118 hardware and software fielding plan, the **MODE 2** Code entry procedure must be performed as described below.

1. Select **MODE 3/A** button and enter “2222”.

NOTE

If the assigned mode 2 code is not entered within 15 seconds, 2222 will be displayed as the current **MODE 3/A** code.

2. Select the **MODE 3/A** button again and enter the **MODE 2** Code.

3A.42.9 CODE MODE 4 Button. The **CODE MODE 4** button toggles between **XPNDR** code **MODE 4 A** and **B**. The code Mode 4 data field is updated when the code has been changed. When the APX-100 is installed, the **CODE MODE 4** button is only displayed if the KIT-1C computer is installed.

3A.42.10 REPLY Button.The **REPLY** button controls the feedback the crew will receive when the **XPNDR** fails to reply (i.e **MODE 4** disabled) or unsuccessfully replies (i.e. no codes loaded or wrong codes, A or B, selected) to a **MODE 4** interrogation. In either case, if the **REPLY** button is set to **UFD/AUDIO**, the **XPNDR** will generate the IFF tone to alert the crew of a failed interrogation and display the mode 4 advisory on the EUFD. If the **REPLY** button is set to **UFD**, then only the EUFD advisory indication is used. If set to **OFF**, then no indication is used.

3A.42.11 MODE 4 HOLD Button. Selecting the **MODE 4 HOLD** button causes the Mode 4 Codes to be saved to xpndr non-volitile memory so the Mode 4 Codes will not be erased when the aircaft is on the ground and power is removed from the **XPNDR**. To successfully save the Mode 4 Codes, the **MODE 4 HOLD** button must be pressed while the aircraft is in the air (squat switch disabled). The **MODE 4 HOLD** button is only displayed with the Kit-1C comsec device is installed.

3A.42.12 XPNDR MASTER Button. The **XPNDR MASTER** button changes the transponder mode between **STBY** (Standby) and **NORM** (Normal). The **XPNDR** will only repond to interrogations when in **NORM.**

3A.42.13 ANTENNA Button. The **ANTENNA** multi-state button allows the crew to control which antenna the xpndr will reply from when interrogated (Top, Bot or Diversity).

3A.42.14 IDENT Button. The **IDENT** button provides the capability to command the **XPNDR** to ident. When selected, the ident mode is enabled for 15-30 seconds for modes 1, 2, and 3/A (if enabled). The **IDENT** button will not be displayed when the **XPNDR** is in **STBY**.

3A.42A XPNDR PAGE (APX-118)

The **XPNDR** page for the APX-118 (fig 3A-57A) provides the capability to control the APX-100 transponder functions.

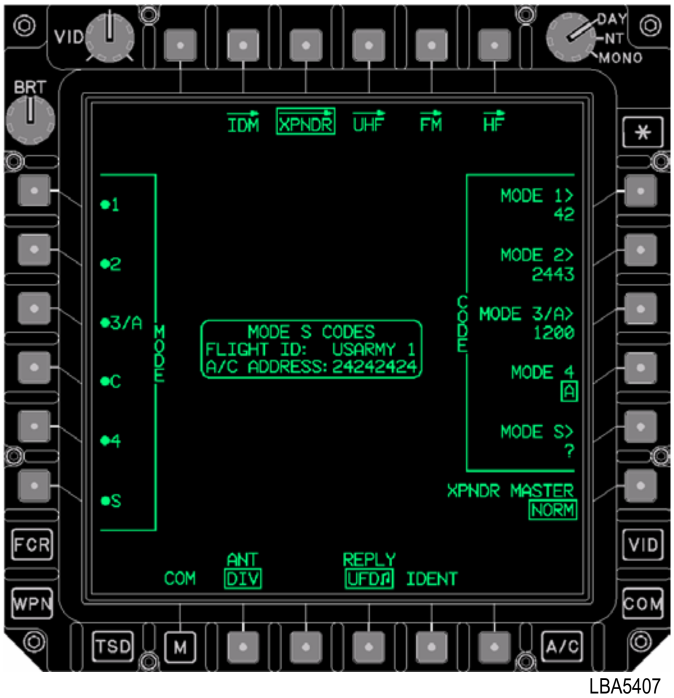

Figure 3A-57A. XPNDR Page (APX-118)

3A.42A.1 XPNDR Page Button. The **XPNDR** page contains the following unique buttons:

- L6 **MODE S** button
- R2 **CODE Mode 2** button
- R3 **CODE Mode 3/A** button
- R4 **CODE Mode 4** button
- R5 **CODE Mode S** button
- B2 **ANTENNA** button
- B4 **REPLY** button

3A.42A.2 MODE S Button The **MODE S** button enables/disables **MODE S** replies. The mode S enabled/disabled field on the EUFD is updated to reflect the button's current mode (para 3A.16).

3A.42A.3 CODE MODE 2 Button The **CODE MODE 2** button provides the capability to change the **MODE 2** Code.

3A.42A.4 CODE MODE 3/A Button. The **CODE MODE 3/A** button provides the capability to change the **MODE 3/A** code.

3A.42A.5 CODE MODE 4 Button. The **CODE MODE 4** button toggles between **XPNDR** code **MODE 4 A** and **B**. The code Mode 4 data field is updated when the code has been changed.

NOTE

The APX-118 does not allow disable of the Mode 4 EUFD advisory message via the **REPLY** button. The only way to disable the advisory message is to turn Mode 4 off using the Mode 4 on/off button.

3A.42A.6 REPLY Button. The **REPLY** button controls the feedback the crew will receive when the **XPNDR** fails to reply (i.e **MODE 4** disabled) or unsuccessfully replies (i.e. no codes loaded or wrong codes, A or B, selected) to a **MODE 4** interrogation. In either case, if the **REPLY** button is set to **UFD(music note)**, the **XPNDR** will generate the IFF tone to alert the crew of a failed interrogation and display the mode 4 advisory on the EUFD. If the **REPLY** button is set to **UFD**, then only the EUFD advisory indication is used. If set to **OFF**, then no indication is used.

3A.42A.7 ANTENNA Button. The **ANTENNA** multi-state button allows the crew to control which antenna the **XPNDR** will reply from when interrogated (Top, Bot or Div). The APX-118 will only be moded to Top or Bot for about 60 seconds before returning to Div

3A.42A.8 MODE S Status Window. The **MODE S Status Window** indicates to the crew the current values of the **MODE S** Codes for both the Flight ID and the Aircraft Address.

3A.43 UHF PAGE

The **UHF** page (fig 3A-58) provides specific controls for the ARC-164 UHF radio.

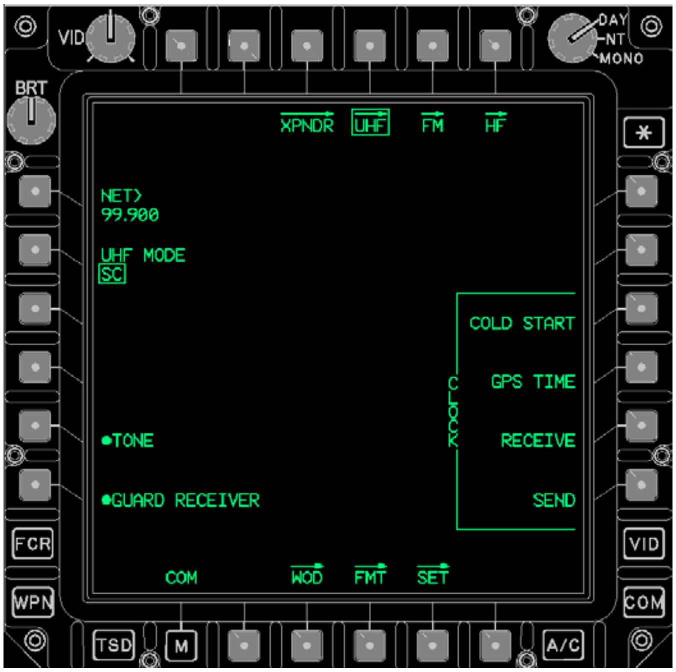

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Figure 3A-58. UHF Page

The **UHF** page contains the following unique buttons:

- L1 **NET** button
- L2 **UHF MODE** button
- L5 **TONE** button
- L6 **GUARD RECEIVER** button
- R2 **CAL DAY** button
- R3 **COLD START** button
- R4 **GPS TIME** button
- R5 **RECEIVE TIME** button
- R6 **SEND TIME** button
- B3 **WOD** page button
- B4 **FMT** page button
- B5 **SET** page button

3A.43.1 UHF MODE Button. The **UHF MODE** button provides the capability to control the mode of the UHF radio. Options are **SC** (Single Channel) and **HQ** (HAVE QUICK).

3A.43.2 NET Button. The **NET** button allows the crew to enter a HAVE QUICK net number into the UHF radio. HAVE QUICK net numbers allow multiple station pairs to operate simultaneously using the same TOD (Time of Day) and WOD (Word of Day) without interference.

3A.43.3 TONE Button. The **TONE** button allows the crew to enable/disable the HAVE QUICK tones in the UHF radio.

3A.43.4 GUARD RECEIVER Button. The **GUARD RECEIVER** button enables/disables the UHF radio's monitoring of the guard frequency.

3A.43.5 CAL DAY Button. The **CAL DAY** button provides the capability to change the Calendar Day in the UHF radio. The Calendar Day is the internal date utilized by the UHF radio. When the Calendar Day and a WOD match in the UHF radio, the associated segments become active, allowing HAVE QUICK communications.

3A.43.6 COLD START Button. The **COLD START** button activates the Emergency Cold Start of the UHF radio's internal clock. This will reset and start the UHF radio's internal clock at zero hundred hours. The **COLD START** button is used when there is no other TOD available and a reference time is required. The **COLD START** button is barriered when the UHF radio is in HAVE QUICK mode.

3A.43.7 GPS TIME Button. The **GPS TIME** button causes the current time from the EGI to be loaded into the UHF radio's internal clock. The **GPS TIME** button is barriered when the UHF radio is in HAVE QUICK mode.

NOTE

Notify the other crewmember when initiating the **UHF RECEIVE** button, to prevent inadvertent termination of reception.

3A.43.8 RECEIVE TIME Button. The **RECEIVE TIME** button configures the UHF radio to TOD receive. A tone is generated upon successful reception of time. If TOD is not received within 60 seconds, the UHF radio will exit the receive mode.

3A.43.9 SEND TIME Button. The **SEND TIME** button transmits the TOD. A tone in the headset sounds when the TOD is transmitted.

3A.43.10 WOD Page Button. The **WOD** button displays the **UHF WOD** page (para 3A.44).

3A.43.11 FMT Page Button. The **FMT** button displays the **FMT** page (para 3A.45).

3A.43.12 SET Page Button. The **SET** page button displays the **SET** page. The page contains the UHF CRYPTO button and UHF CNV button which are used to configure the Crypto device (para 3A.46).

3A.44 UHF WOD PAGE

The **UHF WOD** page (fig 3A-59) allows the crew to manually enter and load WOD and WOD Segments into the UHF radio.

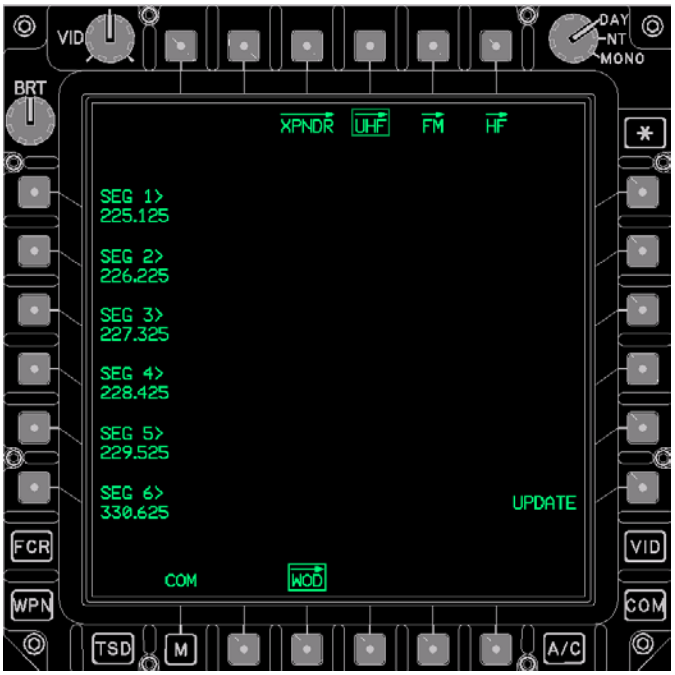

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Figure 3A-59. UHF WOD Page

The **UHF WOD** page contains the following unique buttons:

- R6 **UPDATE** button
- L1-L6 **SEG (1-6)** (segment) buttons
- B4 **CLEAR** button

3A.44.1 UHF WOD DAY Button. Upon entry to the **UHF WOD** page the **UHF WOD DAY** button is zeroized. The **UHF WOD DAY** button allows entry of a WOD for a new set of WOD Segments. When the Calendar Day and a WOD match in the UHF radio, the associated segments become active, allowing HAVE QUICK communications.

3A.44.2 UPDATE Button. The **UPDATE** button loads the **DAY** and **SEG** data into the UHF radio. Upon a valid update into the UHF radio, a tone is generated and the **WOD STATUS** window is updated.

NOTE

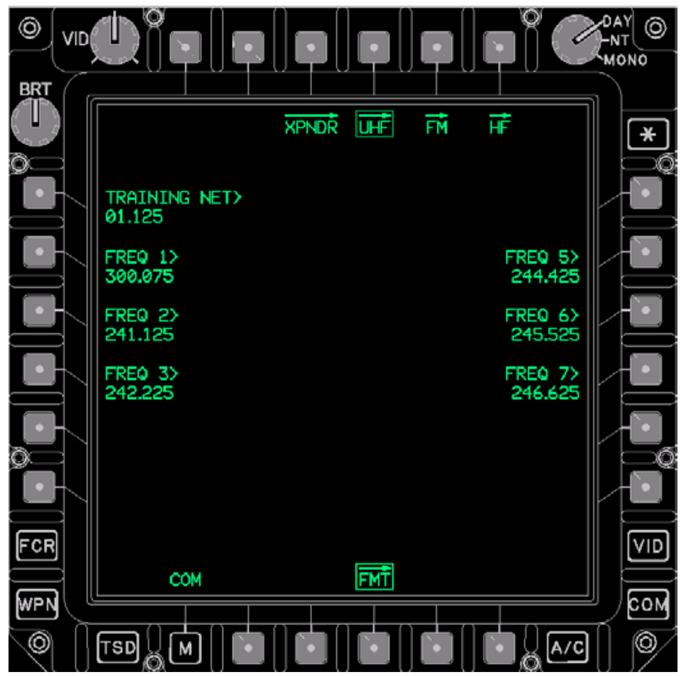
Deselecting the WOD page prior to selection of the update button will remove the segments from the segment buttons and will replace them with question marks. Entry of segments in one crewstation cannot be monitored in the opposite crewstation.

3A.44.3 SEGment Buttons. Upon entry to the **UHF WOD** page the **SEG** buttons are zeroized. The **SEG** buttons allow entry of up to six WOD segments for update into the UHF radio. At least one WOD segment must be loaded into the UHF radio for HAVE QUICK operation.

3A.44.4 CLEAR Button. The **CLEAR** button provides the capability to clear (i.e. zeroize) the data in the **DAY** and **SEG** buttons.

3A.45 UHF FMT PAGE

The **UHF FMT** page (fig 3A-60) contains the HAVE QUICK Training Frequencies which can be entered or modified and then loaded into the UHF radio.



LBA5128A

Figure 3A-60. UHF FMT Page

The **UHF FMT** page contains the following unique buttons:

- L2-L5 **FREQ** buttons
- L6 **UPDATE** button
- R2-R5 **FREQ** buttons
- B2 **PAGE** Back button
- B3 **PAGE** Forward button

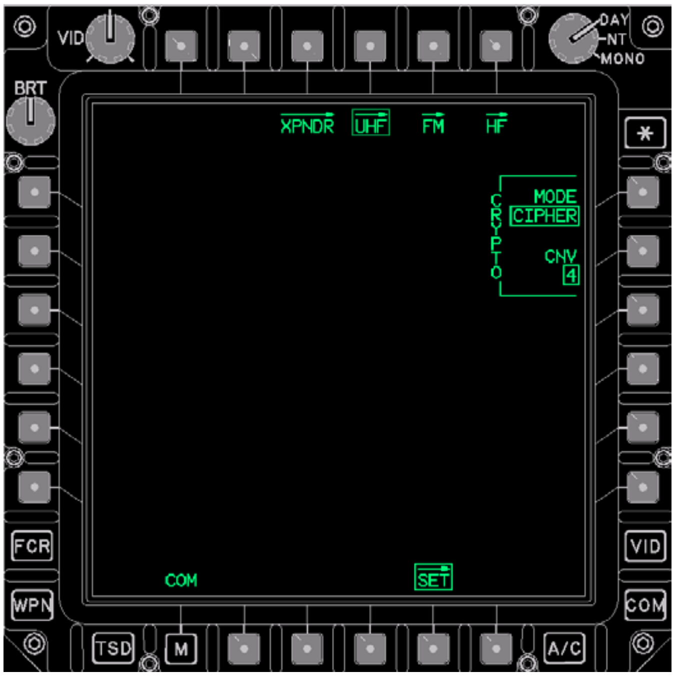
3A.45.1 FREQ Buttons. The **FREQ** buttons provide the capability to enter or modify the 16 HAVE QUICK Training Frequencies.

3A.45.2 UPDATE Button. The **UPDATE** button loads the UHF FMT **FREQ** data into the UHF radio. Upon a valid update into the UHF radio, a tone is generated.

3A.45.3 PAGE Back and PAGE Forward Buttons. Allows selection between two pages of HAVE QUICK Training Frequencies.

3A.46 UHF SET PAGE

The **UHF SET** page (fig 3A-61) contains the **CRYPTO MODE** and **CRYPTO CNV** buttons for the UHF radio.



LBA5129A

Figure 3A-61. UHF SET Page

The **UHF SET** page contains the following unique buttons:

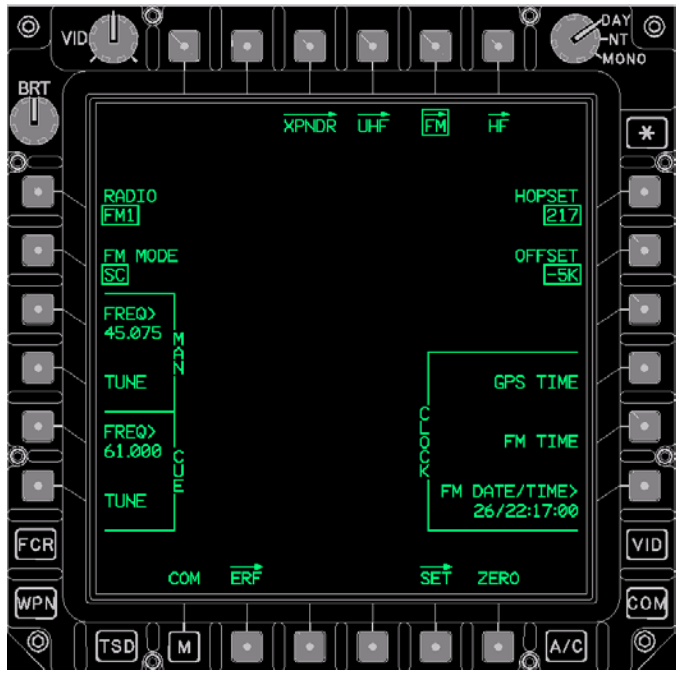
- L2 **CRYPTO MODE** button
- L6 **CRYPTO CNV** button

3A.46.1 CRYPTO MODE Button. The **CRYPTO MODE** button controls the operation of the KY-58. The button provides options of **CIPHER**, **PLAIN**, and **RECEIVE**.

3A.46.2 CRYPTO CNV Button. The **CRYPTO CNV** button provides the capability to change the UHF crypto net variable with options of 1 through 6.

3A.47 FM PAGE

The **FM** page (fig 3A-62) provides the capability to control the FM radios and their FH modes. The radio control buttons on the **FM** page are only displayed if the radio is installed.



LBA5130A

Figure 3A-62. FM Page - SC MODE

The **FM** page contains the following unique buttons:

- L1 **RADIO** button
- L2 **FM 1 MODE** or **FM 2 MODE** button
- L3 **MAN FREQ** button
- L4 **MAN TUNE** button
- L5 **CUE FREQ** button
- L6 **CUE TUNE** button
- R1 **HOPSET** button
- R2 **OFFSET** button
- R3 **LATE NET** button
- R4 **CLOCK GPS TIME** button
- R5 **CLOCK FM TIME** button
- R6 **CLOCK FM DATE/TIME** button
- B2 **ERF** page button
- B5 **SET** page button
- B6 **ZERO** button

3A.47.1 FM RADIO Button. The **RADIO** button provides the capability to toggle the display between the **FM1** and the **FM2** radio controls.

3A.47.2 FM MODE Button. The **FM Mode** button provides the capability to control the mode of the selected radio. The button provides options of **FM SC**, **FM FH**, and

FM FH/M (Frequency Hopping/Master). **SC** mode allows access to the **ERF** Page. **FH** mode allows access to the **ERF** Receive Page. **FH/M** mode allows access to the **ERF** Send Page.

3A.47.3 MAN FREQ Button. The **MAN FREQ** button provides the capability to change the Manual frequency of the selected radio.

3A.47.4 MAN TUNE Button. The **MAN TUNE** button provides the capability to tune the radio to the frequency that is displayed within the **MAN FREQ** window.

3A.47.5 CUE FREQ Button. The **CUE FREQ** button provides the capability to change the Cue frequency of the selected radio.

3A.47.6 CUE TUNE Button. The **CUE TUNE** button provides the capability to tune the radio to the frequency that is displayed within the **CUE FREQ** window.

3A.47.7 HOPSET Button. The **HOPSET** button provides seven options that include the six **HOPSET** buttons and the **MAN** button. The hopset ID selected determines the radio FH characteristics (hopping rate, frequencies, and frequency order).

3A.47.8 OFFSET Button. The **OFFSET** button provides the capability to control the offset (-10K, -5K, 0, +5K, +10K) from the single channel FM frequency. The **OFFSET** button is only displayed when the **FM1 MODE** or **FM 2 MODE** is set to SC.

3A.47.9 LATE NET Button. The **LATE NET** button is used to synchronize to an operational net whose **TOD** is not within the 4 second (plus/minus) frequency hopping communication window. The late net function may only be used if the two net **TOD**s are within 1 minute (plus/minus) of each other. This button is only displayed when the SINC mode is FH.

3A.47.10 CLOCK GPS TIME Button. The **GPS TIME** button causes the current time from the EGI to be loaded into the radio and extracts that time from the selected radio and displays the data within the **DATE/TIME** button.

3A.47.11 CLOCK FM TIME Button. The **FM TIME** button extracts the current time from the selected radio and displays the data within the **DATE/TIME** button.

3A.47.12 CLOCK FM DATE/TIME Button. The **FM DATE/TIME** button provides the capability to change the date and time currently loaded into the selected radio. This data is displayed for 1 minute, then is considered stale.

3A.47.13 ERF Page Button. Selecting the **ERF** page button will display the ERF page. The **ERF** page provides the operator the capability to manage hopsets and lockout sets (para 3A.48).

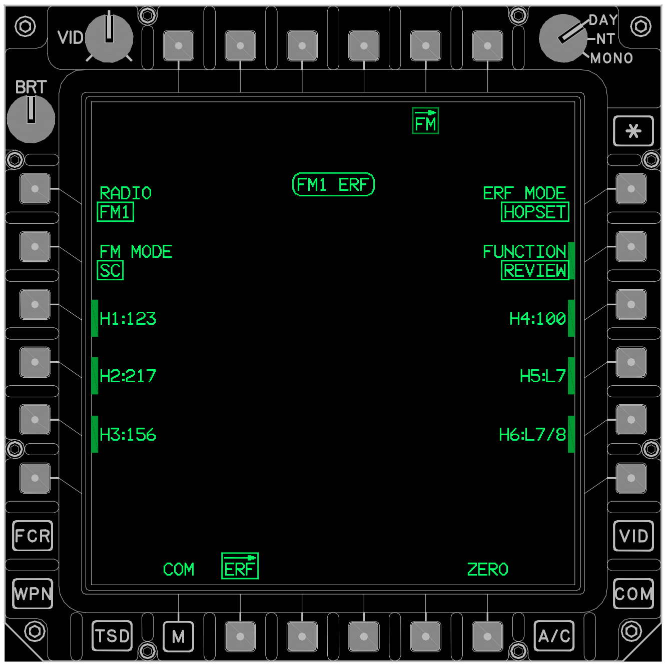
3A.47.14 SET Page Button. The **SET** page button displays the **FM SET** page, which contains the **POWER** button, the **CRYPTO** button and the **CNV** button.

3A.47.15 ZERO Button. The **ZERO** button provides the capability to zeroize the FM radio.

3A.47.16 ERF RECEIVE Window. The white **ERF RECEIVE** window will display on the **FM ERF**, and **ERF SEND** pages whenever the **ERF RECEIVE** button on the **ERF RECEIVE** page is left selected for receipt of multiple ERFs.

3A.48 FM ERF PAGE

The **FM ERF** page (figs 3A-63 and 3A-64) provides the capability to manage Hopsets and Lockout sets data. The FM ERF page incorporates three distinct modes of operation (para 3A.48.5).

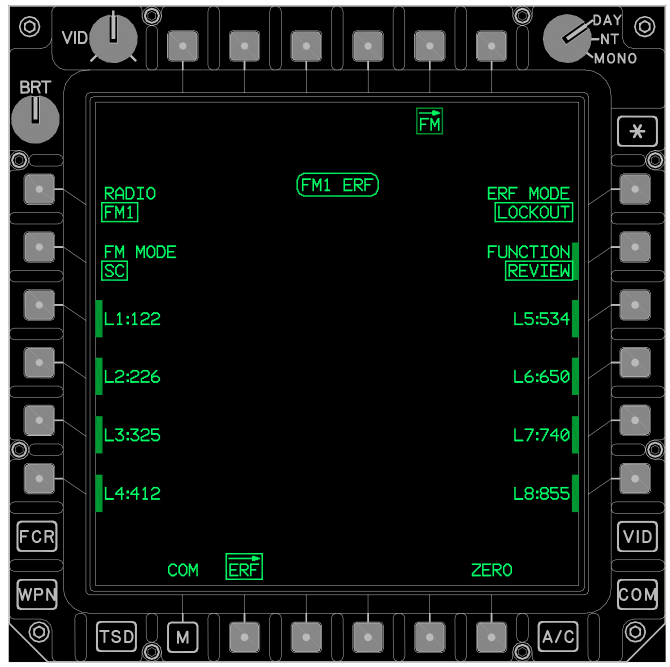


LBA5135

Figure 3A-63. FM ERF Page - Hopset Mode

The **ERF** page contains the following unique buttons:

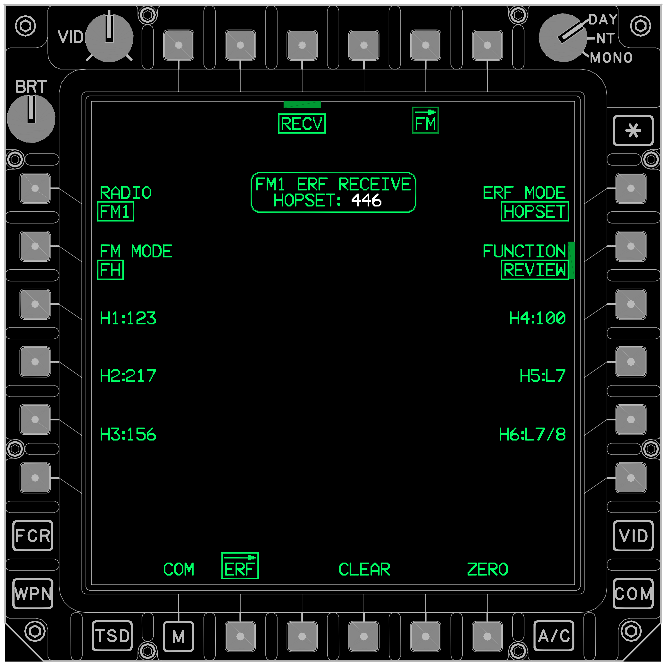
- T3 **RECEIVE OR SEND** button
- T4 **STORE** button
- L1 **RADIO** mode button
- L2 **FM MODE** button
- L3-L6 **H**opset/**L**ockout buttons
- R1 **ERF MODE** button
- R2 **FUNCTION** button
- R3-R6 **H**opset/**L**ockout buttons
- B4 **CLEAR** button
- B6 **ZERO** button



LBA5136

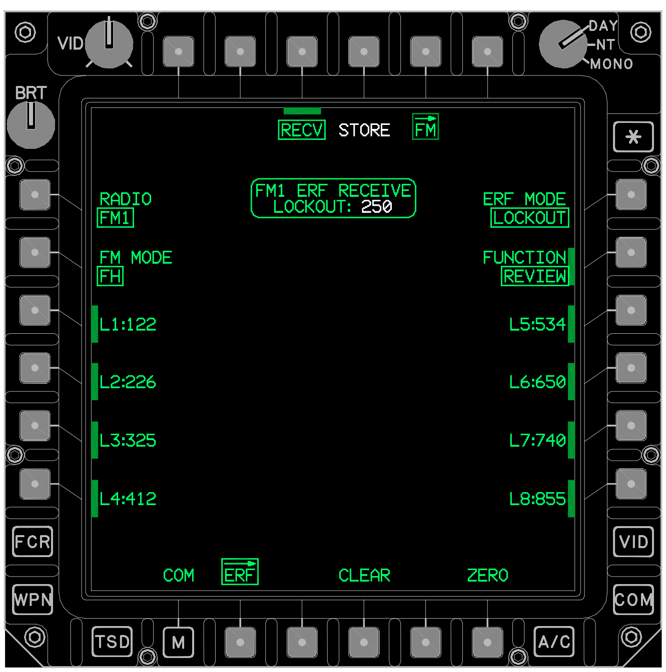
Figure 3A-64. FM ERF Page - Lockout Mode

3A.48.1 RECEIVE Button. The **RECEIVE** button (figs 3A-65 and 3A-66) provides the capability to command the radio to the **ERF** receive mode. The radio remains in the **ERF** receive mode to receive multiple ERFs for 5 minutes unless the **RECEIVE** button is manually deselected or automatically deselected when a confirmed **CLEAR** is performed. When a hopset or lockout set is received, this button will be barriered until the **H**opset or **L**ockout is either cleared or stored (fig 3A-65). The **RECEIVE** button is only available when the **FM MODE** button set to **FH**.



LBA5137

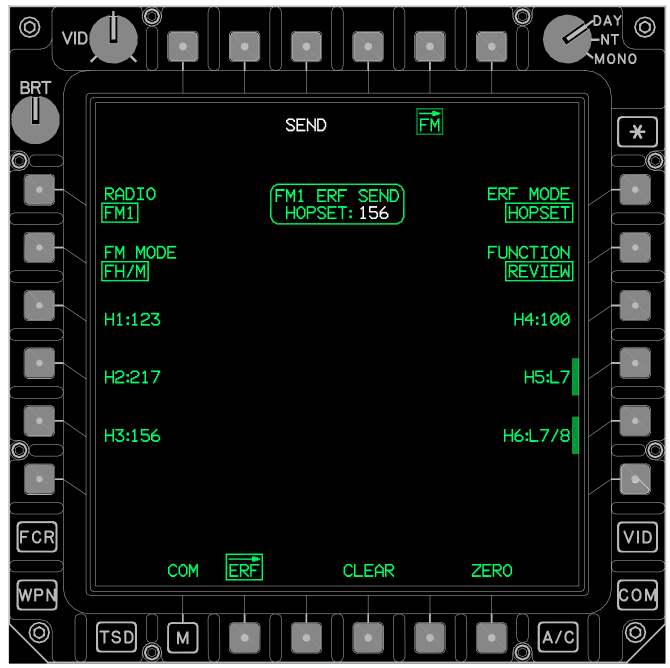
Figure 3A-65. FM ERF RECEIVE Page - Hopset Received



LBA5138

Figure 3A-66. FM ERF RECEIVE Page - Lockout Received

3A.48.2 SEND Button. The **SEND** button (fig 3A-67) commands the radio to transmit the hopset or lockout ID displayed within the **FM ERF** status window. This button is only displayed when an **H** or **L** button is selected while the **FUNCTION** button is set to **REVIEW**. The **SEND** button is displayed in white and is only available when the **FM MODE** button set to **FH/M**.



LBA5139

Figure 3A-67. ERF Page - FH/M Mode, ERF SEND HOPSET Displayed

3A.48.3 STORE Button. The **STORE** button is only displayed when a valid lockout has been received into the holding memory buffer as displayed in the **FM ERF** status window. The **STORE** button is displayed in white and is only available when the **FM MODE** button set to **FH**.

3A.48.4 RADIO Button. The **RADIO** button configures the **FM ERF** page to present controls for either the **FM1** or **FM2** radio.

3A.48.5 FM MODE Button. The **FM MODE** button controls the ECCM mode of the selected FM radio:

- Single Channel
- Frequency Hopping
- Frequency Hopping Master

a. In Single Channel operation, the FM radio transmits and receives on a single frequency. Although not operating in an ECCM mode, the radio can minimize interference with the use of frequency offsets. When operating in Single Channel mode, a frequency hopping net can be initialized using the manual hopping frequency. Similarly, the CUE function is available in Single Channel mode, which allows a single channel operator that is not currently within a frequency hopping net to “cue”, or contact, the frequency hopping net.

b. In Frequency Hopping modes, the FM radio automatically changes its operating frequency at a predetermined rate to reduce effects of jamming. Frequency hopping mode allows the reception of hopset and lockout set frequencies from other FM radios via the ERF function. The FM radio generates the FM Load - Receiving ERF tones when hopsets or lockout sets are received by the radio.

c. Frequency Hopping Master mode is similar to Frequency Hopping mode. However, the radio operating in Frequency Hopping Master mode has additional capabilities to allow it to be used by the frequency hopping net controller. When operating as the Frequency Hopping Master, the FM radio specifies the timing of all others in the frequency hopping net. Frequency hopping master mode allows the transmission of hopset and lockout set frequencies to other FM radios via the ERF function.

3A.48.6 ERF MODE Button. The **ERF MODE** button operates in two modes: **HOPSET** and **LOCKOUT**. The **HOPSET** mode configures the system for the reception of hopsets. The **LOCKOUT** mode configures for the reception of lockout sets**.**

3A.48.7 FUNCTION Button. The **FUNCTION** button provides the capability to select **REVIEW** and **DELETE** for hopsets and lockouts and **COPY** functions for hopsets.

3A.48.8 Hopset (H) Buttons.

a. FM MODE FH. When receiving HOPSETS, selecting one of the **ERF HOPSET** buttons (fig 3A-65) stores the hopset that is displayed within the **RECEIVE** hopset window to that button.

b. FM MODE FH/M. When sending the **ERF HOPSET** buttons (fig 3A-67) provide the capability to select a hopset to be transmitted through the ERF process. The current hopset to be sent is displayed in the **SEND HOPSET** window and an intermittent beep will be heard until the hopset is sent or cleared.

3A.48.9 Lockout (L) Buttons.

a. FM MODE FH. The **L** buttons are only selectable when deleting Lockouts.

b. FM MODE FH/M. The **L** buttons provide the capability to select a lockout to be transmitted through the ERF process. The current lockout to be sent is displayed in the **SEND LOCKOUT** window (fig 3A-68).

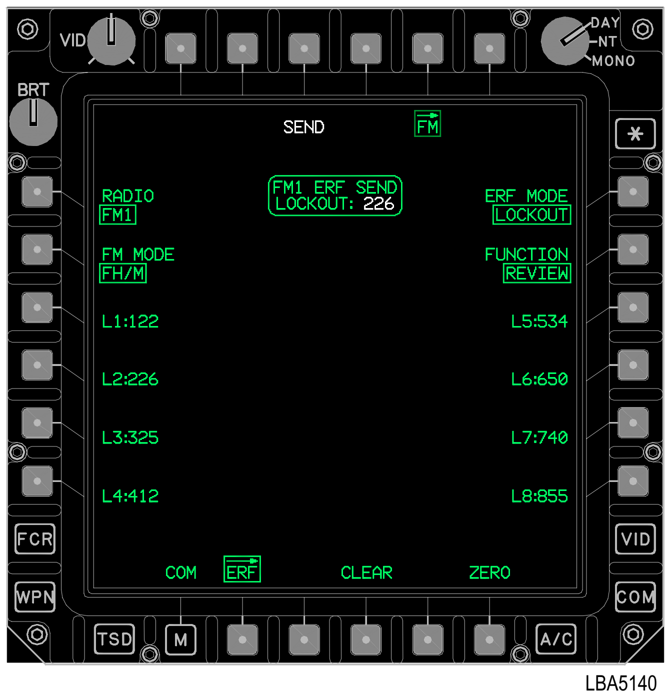
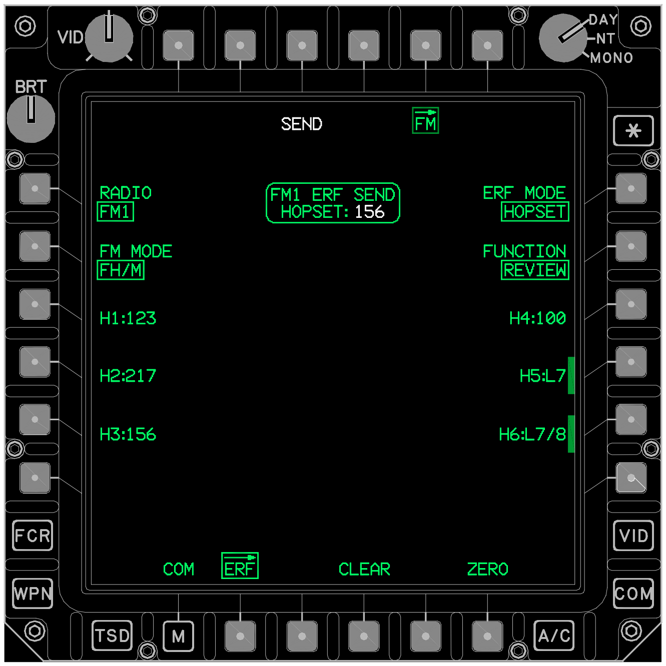


Figure 3A-68. FM ERF Page - SEND Lockout

3A.48.10 CLEAR Button.

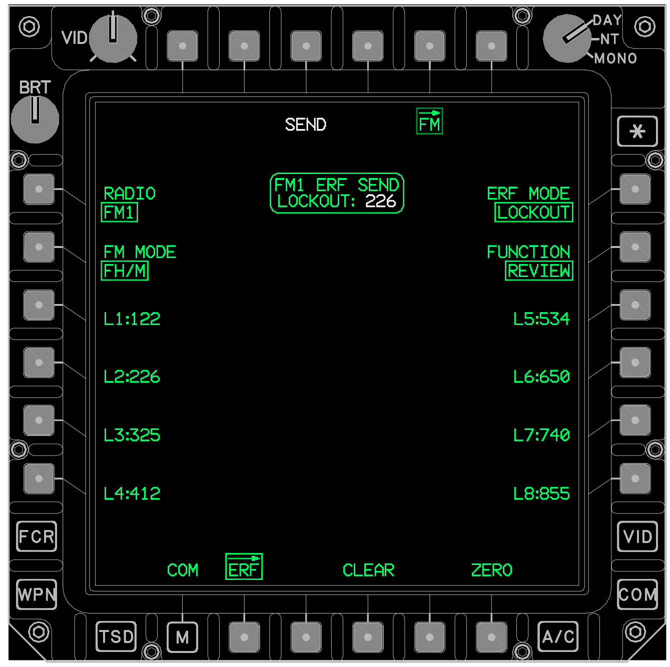
a. FM MODE FH. The **CLEAR** button (fig 3A-65) provides the capability to clear a **HOPSET** or **LOCKOUT** from the holding memory buffer. The **CLEAR** button will display upon receipt of a **HOPSET** or **LOCKOUT** and when in **COPY** mode.

b. FM MODE FH/M. The **CLEAR** button (fig 3A-69) clears the hopset or lockout that was selected for sending. The **CLEAR** button removes the **SEND** button and itself (fig 3A-71). The **CLEAR** button will display when in **COPY** or **EDIT** modes.



LBA5141

Figure 3A-69. ERF Page - SEND HOPSET



LBA5142

Figure 3A-70. ERF Page - SEND LOCKOUT

NOTE

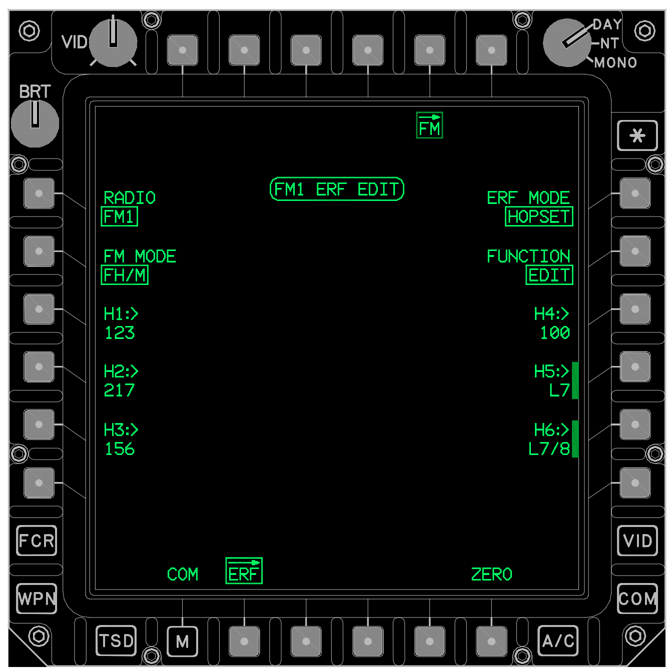
A **YES/NO** confirmation will only display when the **CLEAR** button is used to clear a received **HOPSET** or **LOCKOUT**.

3A.48.11 RECEIVE HOPSET Window. The **RECEIVED HOPSET** window (fig 3A-65) is displayed when the system has received a valid **HOPSET**. The **HOPSET** will be displayed in white.

3A.48.12 RECEIVE LOCKOUT Window. The **RECEIVE LOCKOUT** window (fig 3A-66) is displayed when the system has received a valid **LOCKOUT**.

3A.48.13 ERF SEND HOPSET Window. The **ERF SEND HOPSET** window (fig 3A-69) displays the hopset data that is to be transmitted through the **ERF** process with the selection of the **SEND** button.

3A.48.14 ERF SEND LOCKOUT Window. The **ERF SEND LOCKOUT** window (fig 3A-70) displays the lockout data that is to be transmitted through the **ERF** process with the selection of the **SEND** button.



LBA5143

Figure 3A-71. ERF Page - HOPSET Edit

3A.49 HF PAGE

The **HF** page (fig 3A-72) provides specific controls for the ARC-220 HF radio.

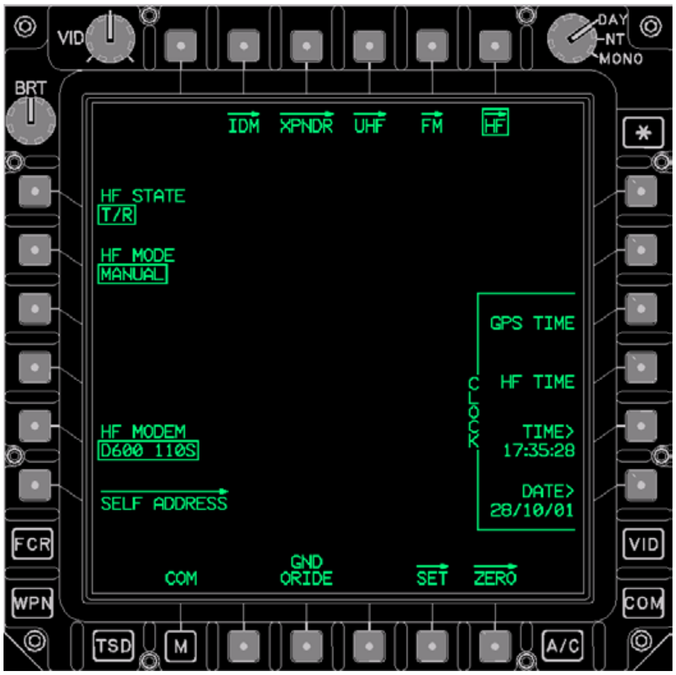


Figure 3A-72. HF Page - MANUAL Mode

The **HF** page contains the following unique buttons when in **MANUAL** mode:

- L1 **HF STATE** button
- L2 **HF MODE** button
- L5 **HF MODEM** button
- L6 **SELF ADDRESS** page button
- R3 **CLOCK GPS TIME** button
- R4 **CLOCK HF TIME DISPLAY** button
- R5 **CLOCK TIME** button
- R6 **CLOCK DATE** entry button
- B3 **GND ORIDE** button
- B5 **SET** page button
- B6 **ZERO** page button

3A.49.1 HF STATE Button. The **HF STATE** button provides the capability to set the HF radio to **STBY** (Standby), **SILENT**, or **T/R** (Transmit/Receive). Standby is the power up mode of the HF radio. Silent mode allows reception of voice and data, but not automated transmissions. Manual transmissions of voice (using PTT switch) and data (using **HF SEND** buttons) are still possible while in Silent mode. Normal HF radio operations occur when in the Transmit/Receive mode.

3A.49.2 HF MODE Button. The **HF MODE** button provides the capability to configure the HF radio into **MANUAL**, **PRESET**, **ALE** (Automatic Link Establishment), **ECCM** (Electronic Counter Counter Measure Frequency Hop), or **EMERGENCY.** Manual mode allows for tuning of the HF radio from the **MAN** page. Preset mode provides up to 20 preprogrammed frequency channels to tune the HF radio. **ALE** mode provides up to 20 preprogrammed nets. And **ECCM** mode provides up to 12 preprogrammed nets to establish links with various callers. Emergency mode is a preprogrammed configuration of the radio for use in an emergency.

3A.49.3 HF MODEM Button. The **HF MODEM** button provides the capability to select from up to 12 preprogrammed modem configurations for data communications.

3A.49.4 SELF ADDRESS Page Button. The **SELF ADDRESS** button displays the **HF SELF ADDRESS** page (para 3A.50).

3A.49.5 CLOCK GPS TIME Button. The **CLOCK GPS TIME** button causes the current time from the EGI to be loaded into the HF radio's internal clock. Selection of this button changes the **HF STATE** to STBY.

3A.49.6 CLOCK HF TIME Display Button. The **CLOCK HF TIME** display button provides the capability to get the current time and date from the HF radio and have it displayed in the **CLOCK TIME** and **DATE** buttons.

3A.49.7 CLOCK TIME Button. The **CLOCK TIME** button provides the capability to view the current time in the HF radio or to change the time in the HF radio.

3A.49.8 CLOCK DATE Button. The **CLOCK DATE** button provides the capability to view the current date in the HF radio or to change the date in the HF radio.

CAUTION

There are no UFD/EUFD indications when the HF radio override is selected.

3A.49.9 GND ORIDE Button. The **GND ORIDE** button provides the capability when selected, to override the safety inhibits, in order to transmit on the HF radio while the aircraft is on the ground.

3A.49.10 SET Button. The **SET** button displays the **HF SET** page (para 3A.58).

3A.49.11 ZERO Button. The **ZERO** button displays the **HF ZERO** page (para 3A.59).

3A.50 HF SELF ADDRESS PAGE

The **HF SELF ADDRESS** page (fig 3A-73) provides up to 20 non-modifiable self address options for selection.

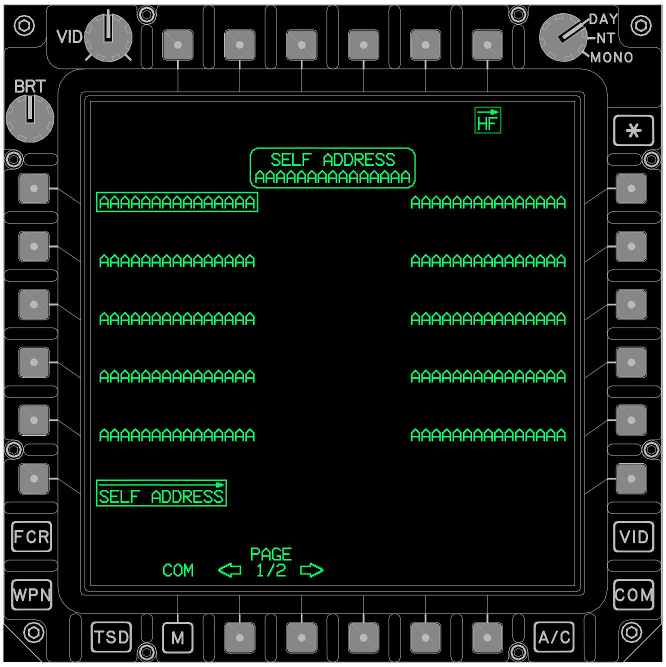


Figure 3A-73. HF SELF ADDRESS Page

The **HF SELF ADDRESS** page contains the following unique buttons:

- L1-L5 HF self address option buttons
- R1-R5 HF self address option buttons
- B2 **PAGE** Back button
- B3 **PAGE** Forward button

3A.50.1 HF Self Address Option Buttons. The HF self address option buttons provide the capability to select from up to 20 non-modifiable self addresses in the HF radio.

3A.50.2 PAGE Back and Forward Buttons. Allows selection between two pages of HF self addresses.

3A.50.3 HF SELF ADDRESS Status Window. The **HF SELF ADDRESS** status window displays the current self address selected in the HF radio.

3A.51 HF PAGE - PRESET MODE

The **HF PRESET** Mode (fig 3A-74) provides specific controls and status when the HF radio is in the Preset mode.

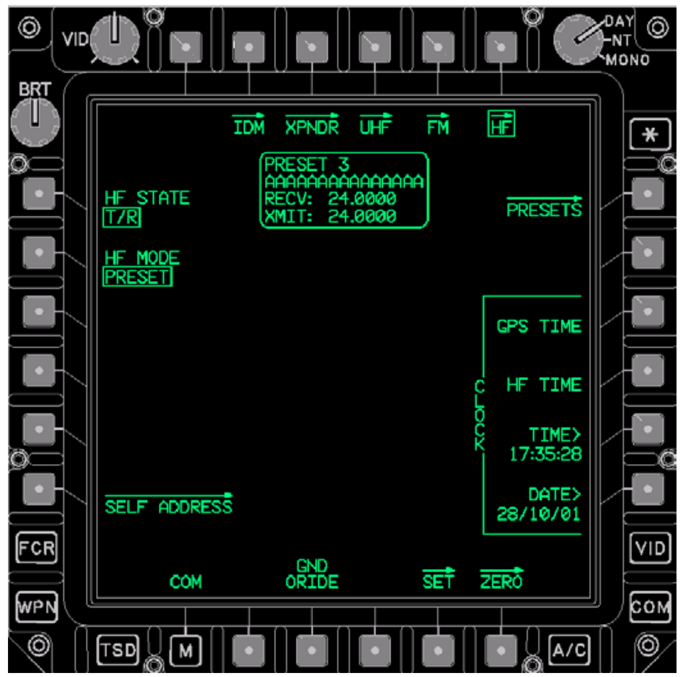


Figure 3A-74. HF Page - PRESET Mode

The **HF** page contains the following unique button when in **PRESET** mode:

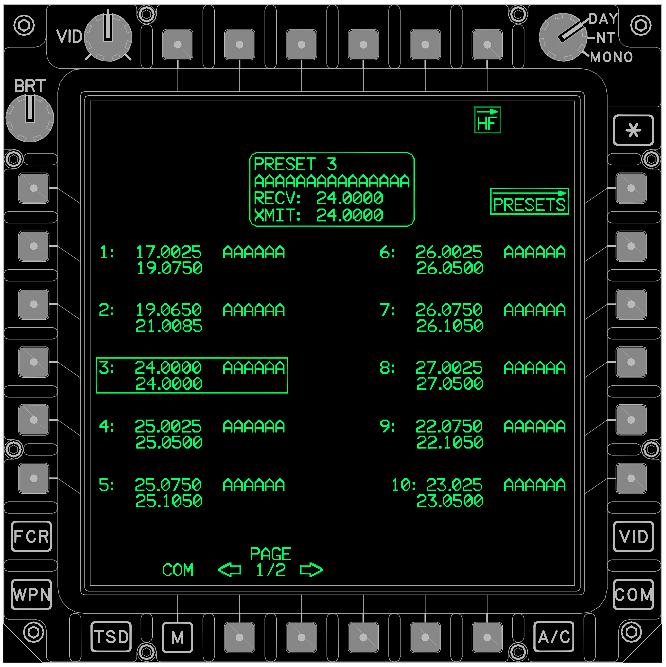
- R1 **PRESETS** page button

3A.51.1 PRESETS Page Button. The **PRESET** button displays the **HF PRESETS** page (para 3A.52).

3A.51.2 HF PRESET Status Window. The **HF PRESET** status window displays the current preset channel number, name, and receive/transmit frequencies when the HF radio is in Preset mode.

3A.52 HF PRESETS PAGE

The **HF PRESETS** page (fig 3A-75) provides up to 20 non-modifiable preset channels for selection, when the HF radio is in the Preset mode.



LBA5147

Figure 3A-75. HF PRESETS Page

The **HF PRESETS** page contains the following unique buttons:

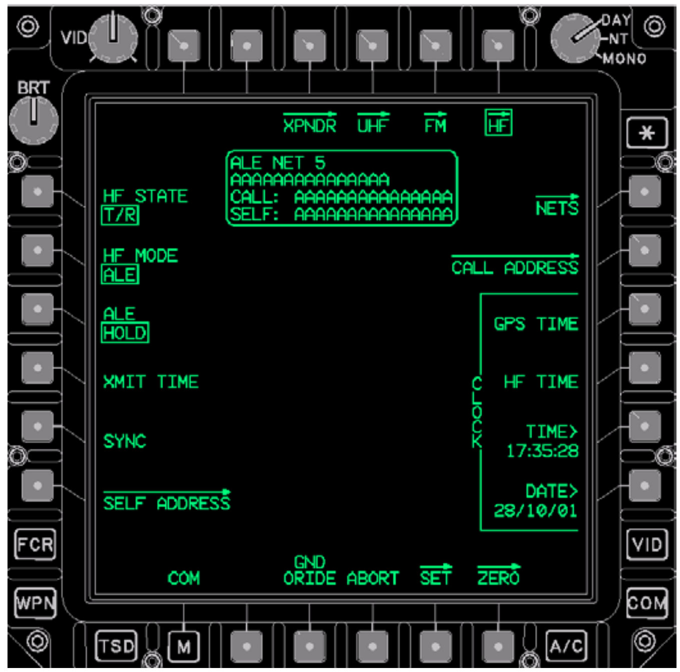
- L2-L6 HF preset channel buttons
- R2-R6 HF preset channel buttons
- B2 **PAGE Back** button
- B3 **PAGE Forward** button

3A.52.1 HF Preset Channel Buttons. The **HF PRESET CHANNEL** buttons provide the capability to select from up to 20 non-modifiable preset channels in the HF radio.

3A.52.2 PAGE Back and PAGE Forward Buttons. Allows selection between two pages of HF preset channels.

3A.53 HF PAGE - ALE MODE

The **HF ALE** Mode (fig 3A-76) provides specific controls and status when the HF radio is in the ALE mode.



LBA5148A

Figure 3A-76. HF Page - ALE Mode

The **HF** page contains the following unique buttons when in **ALE** mode:

- L3 **ALE HOLD/SCAN** button
- L4 **XMIT TIME** button
- L5 **SYNC** button
- R1 **NETS** page button
- R2 **CALL ADDRESS** page button
- B4 **ABORT** button

3A.53.1 ALE HOLD/SCAN Button. The **ALE HOLD/SCAN** button toggles between **HOLD** and **SCAN**.

3A.53.2 XMIT TIME Button. The **XMIT TIME** button provides the capability to send the HF radio's current time over the current ALE net.

3A.53.3 SYNC Button. The **SYNC** button provides the capability to synchronize with others on the current ALE net.

3A.53.4 NETS Page Button. The **NETS** page button displays the **HF ALE NETS** page (para 3A.54).

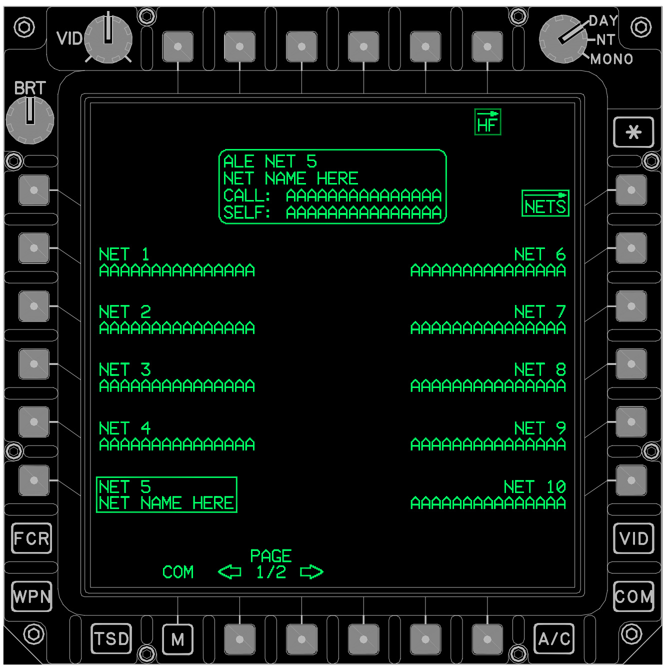
3A.53.5 CALL ADDRESS Page Button. The **CALL ADDRESS** page button displays the **HF CALL ADDRESS** page (para 3A.57).

3A.53.6 ABORT Button. The **ALE ABORT** button provides the capability to abort any ALE function in progress.

3A.53.7 ALE Status Window. The **ALE** status window displays the current ALE net number, name, call address, and self address, when the HF radio is in ALE mode.

3A.54 HF ALE NETS PAGE

The **HF ALE NETS** page (fig 3A-77) provides up to 20 non-modifiable ALE nets for selection.



LBA5149

Figure 3A-77. HF ALE NETS Page

The **HF ALE NETS** page contains the following unique buttons:

- R2-R6 **NET (1-5)** option buttons
- L2-L6 **NET (6-10)** option buttons
- B2 **PAGE Back** button
- B3 **PAGE Forward** button

3A.54.1 NET (1-10) Option Buttons. Option buttons provide the capability to select from up to 20 non-modifiable ALE nets in the HF radio.

3A.54.2 PAGE Back and PAGE Forward Buttons. Allow selection between two pages of HF ALE nets.

3A.55 HF PAGE - ECCM MODE

The **HF ECCM** Mode page (fig 3A-78) provides specific controls and status when the HF radio is in the ECCM mode. In ECCM operation the HF radio will frequency hop on a set of frequencies. Each radio in the net must have the same ECCM data fill and time of day to interchange voice or data in this mode.

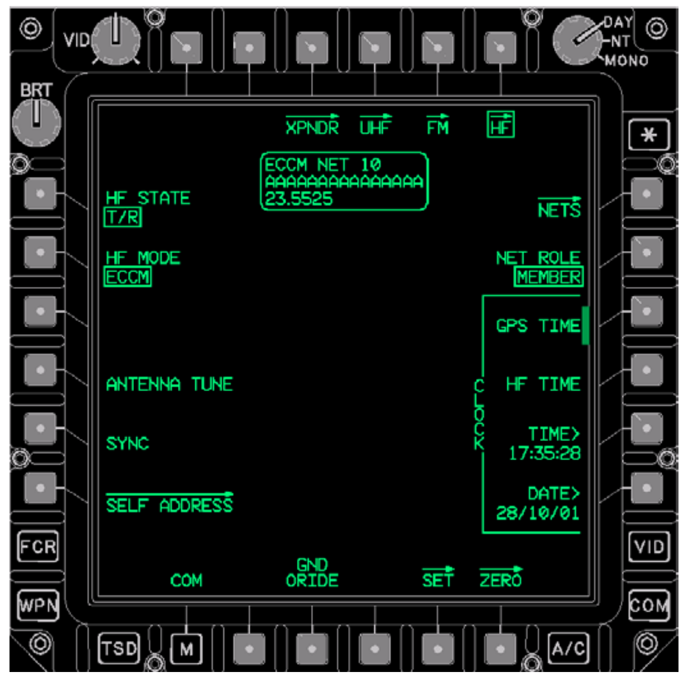


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Figure 3A-78. HF Page - ECCM Mode

The **HF ECCM Mode** page contains the following unique buttons:

- L3 **ANTENNA TUNE** button
- L4 **SYNC** button
- R2 **NET ROLE** button

3A.55.1 ANTENNA TUNE Button. Selecting the **ANTENNA TUNE** button initiates tuning of the ECCM scan-set.

3A.55.2 SYNC Button. Selecting the **SYNC** button initiates an ECCM time synchronization of the ECCM scan-set.

3A.55.3 NET ROLE Button. The **NET ROLE** button provides the capability to select the Net Role of the ownship when the HF radio is in ECCM mode. The multi-state options are:

- **MEMBER**, to select Member
- **ALT TIME SERVER**, to select Alternate Net Time Server
- **TIME SERVER**, to select Net Time Server

Member is the default role upon power-up.

3A.56 HF ECCM NETS PAGE

Selecting the **ECCM NETS** page button calls the **ECCM NETS** page to display. The **HF ECCM NETS** page provides up to 12 non-modifiable ECCM nets for selection (fig 3A-77). The **ECCM NETS** page status window will display **ECCM NET** with the selected number of the selected net.

The **HF ECCM NETS** page contains the following unique buttons:

- R2-R6 **NET (1-5)** options button
- L2-L6 **NET (6-10)** options button
- B2 **PAGE Back** button
- B3 **PAGE Forward** button

3A.57 HF CALL ADDRESS PAGE

The **HF CALL ADDRESS** page (fig 3A-79, 3A-80, 3A-81, and 3A-82) provides special call address controls, including up to 20 non-modifiable Star Net call addresses, up to 20 non-modifiable Auto call addresses, and up to 100 Other call addresses for selection.

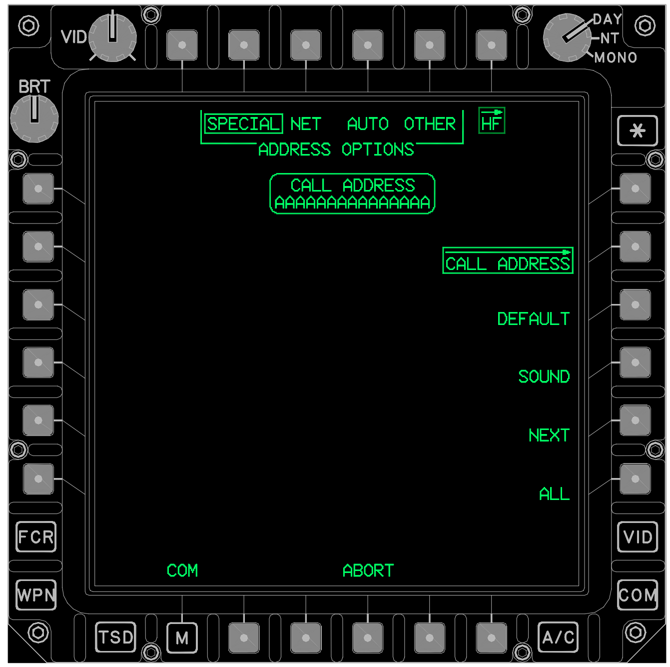


Figure 3A-79. HF CALL ADDRESS Page (SPECIAL Selected)

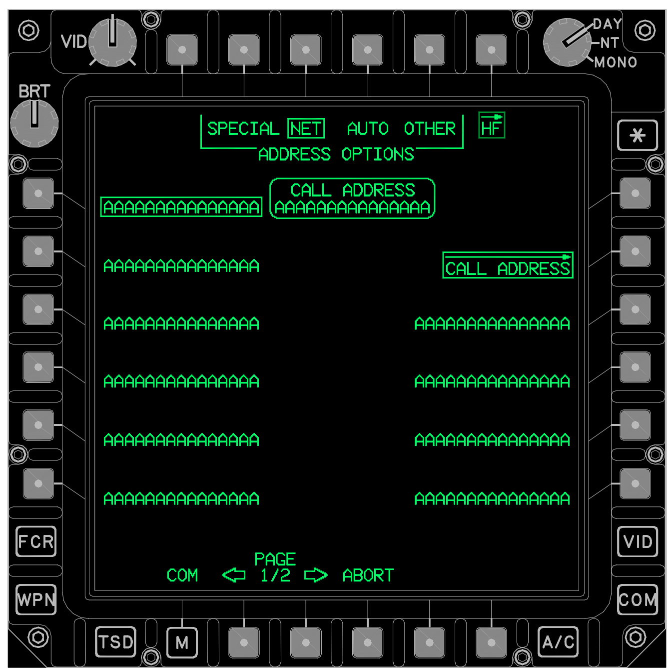
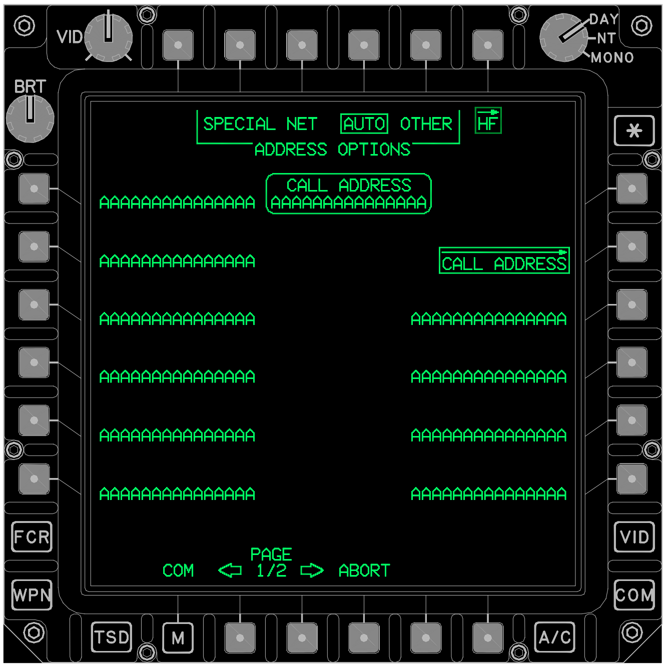
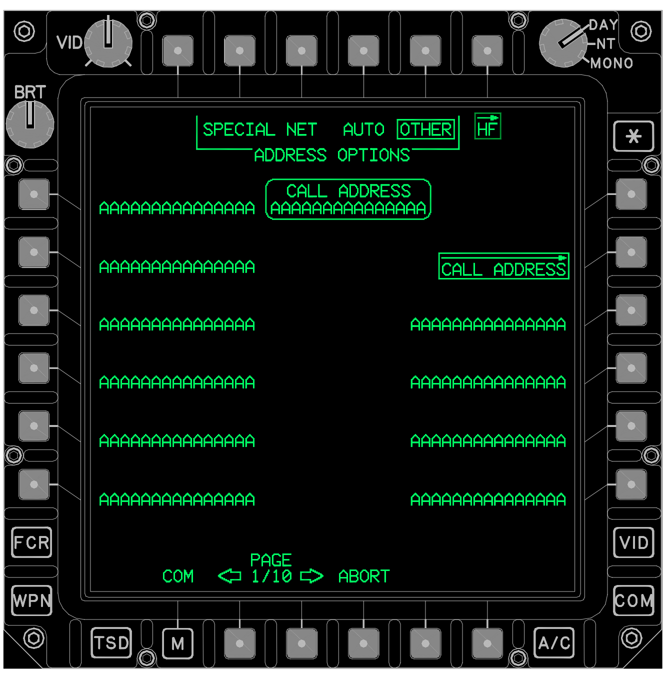


Figure 3A-80. HF CALL ADDRESS Page (NET Selected)



LBA5153

Figure 3A-81. HF CALL ADDRESS Page (AUTO Selected)



LBA5154

Figure 3A-82. HF CALL ADDRESS Page (OTHER Selected)

The **HF CALL ADDRESS** page contains the following unique buttons when **SPECIAL** is selected:

- T2-T5 **ADDRESS OPTIONS** buttons
- R3 **DEFAULT** button
- R4 **SOUND** button
- R5 **NEXT** button
- R6 **ALL** button
- B3 **ABORT** button

3A.57.1 ADDRESS OPTIONS Buttons. The **ADDRESS OPTIONS** buttons provide the capability to select between **SPECIAL**, **NET** (Star Net), **AUTO**, or **OTHER** call address selection options.

3A.57.2 DEFAULT Button. The **DEFAULT** button sets the call address to the default call address for the current ALE net.

3A.57.3 SOUND Button. The **SOUND** button sets the current call address to SOUND and initiates sounding on the current ALE net. This function can be terminated prematurely by selecting the **ABORT** button.

3A.57.4 NEXT Button. The **NEXT** button sets the last linked with call address for the current net and then tries to connect on channels in the ranked channel list for the net that would be considered poorer channels. This function can be terminated prematurely by selecting the **ABORT** button.

3A.57.5 ALL Button. The **ALL** button sets the call address to ALL for the current ALE net and allows a call to all ALE stations in the network.

3A.57.6 ALL Button. The **ABORT** button provides the capability to abort any ALE function in progress.

3A.57.7 ALL Button. The **HF CALL ADDRESS** status window displays the current Call Address selected in the HF radio.

The **HF CALL ADDRESS** page contains the following unique buttons when **NET** is selected:

- L1-L6 NET CALL ADDRESS buttons
- R3-R6 NET CALL ADDRESS buttons
- B2 **PAGE Back** button
- B3 **PAGE Forward** button

3A.57.8 NET CALL ADDRESS Buttons. The NET CALL ADDRESS buttons provide the capability to select from up to 20 non-modifiable Star Net Call Addresses in the HF radio.

3A.57.9 PAGE Back and PAGE Forward Buttons. These buttons allow selection between two pages of HF Star Net Call Addresses.

The **HF CALL ADDRESS** page contains the following unique buttons when **AUTO** is selected:

- L1-L6 AUTO CALL ADDRESS buttons
- R3-R6 AUTO CALL ADDRESS buttons

3A.57.10 AUTO CALL ADDRESS Buttons. The AUTO CALL ADDRESS buttons provide the capability to select from up to 20 non-modifiable Auto Call Addresses in the HF radio.

The **HF CALL ADDRESS** page contains the following unique buttons when **OTHER** is selected:

- L1-L6 OTHER CALL ADDRESS buttons
- R3-R6 OTHER CALL ADDRESS buttons

3A.57.11 OTHER CALL ADDRESS Buttons. The OTHER CALL ADDRESS buttons provide the capability to select from up to 100 non-modifiable Other Call Addresses in the HF radio.

3A.58 HF SET PAGE

The **HF SET** page (fig 3A-83) provides on/off and ancillary controls.

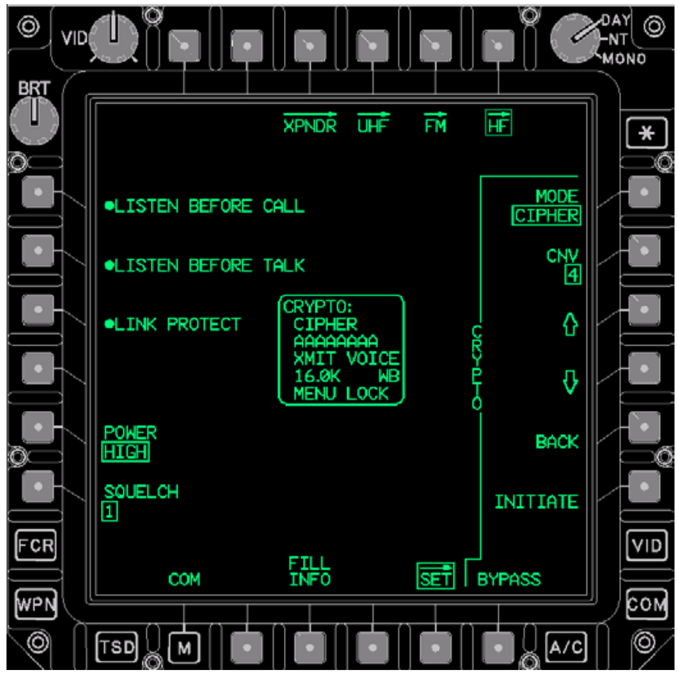


Figure 3A-83. HF SET Page

The **HF SET** page contains the following unique buttons:

- L1 **LISTEN BEFORE CALL** button
- L2 **LISTEN BEFORE TALK** button
- L3 **LINK PROTECT** button
- L5 **POWER** button
- L6 **SQUELCH** button
- R1 **CRYPTO MODE** button
- R2 **CRYPTO CNV** button
- R3 **CRYPTO UP ARROW** button
- R4 **CRYPTO DOWN ARROW** button
- R5 **BACK** button
- R6 **CRYPTO INITIATE** button
- B3 **FILL INFO** button
- B6 **CRYPTO BYPASS** button

3A.58.1 LISTEN BEFORE CALL Button. The **LISTEN BEFORE CALL** button enables/disables the listen before call function in the HF radio.

3A.58.2 LISTEN BEFORE TALK Button. The **LISTEN BEFORE TALK** button enables/disables the listen before talk function in the HF radio.

3A.58.3 LINK PROTECT Button. The **LINK PROTECT** button enables/disables ALE link protection in the HF radio.

3A.58.4 HF POWER Button. The HF **POWER** button provides the capability to set the HF radio power output to **LOW**, **MEDIUM**, or **HIGH**.

3A.58.5 HF SQUELCH Button. The HF **SQUELCH** button provides the capability to set the HF radio squelch level to **1**, **2**, **3**, **4**, or **5**, which takes affect when squelch is enabled from the **COMM** Panel.

3A.58.6 HF CRYPTO MODE Button. The HF **CRYPTO** button provides the capability to control the operation of the HF radio's Crypto device. The button provides the options of:

1) **PLAIN**, for non-encrypted communication;

2) **CIPHER** (for encrypted communication);

3) **RECEIVE**, to receive a Crypto Net Variable through the RF link process;

4) **OFFLINE**, to turn off Crypto device.

The Crypto data field on the EUFD is updated when the mode is changed. The Crypto state is uploadable from the Data Transfer Cartridge. Upon power up, the last Crypto state used is restored.

3A.58.7 HF CRYPTO CNV Button. The HF **CNV** button provides the capability to change the HF Crypto Net Variable. The button provides 6 (1 through 6) variable options. The HF CNV data field on the EUFD is updated when the code has been modified. The HF Crypto Net Variable option may be set via the AMPS. Upon power up, the last HF Crypto Net Variable option is used.

3A.58.8 HF CRYPTO UP ARROW Button. The HF **CRYPTO UP ARROW** button provides the capability to scroll up thru the KY-100's menu system.

3A.58.9 HF CRYPTO DOWN ARROW Button. The HF **CRYPTO DOWN ARROW** button provides the capability to scroll up thru the KY-100's menu system.

3A.58.10 HF CRYPTO INITIATE Button. The HF **CRYPTO INITIATE** button provides the capability to initiate selections from the KY-100 menus.

3A.58.11 BACK Button. The HF **BACK** button provides the capability to back out of KY-100 menus.

3A.58.12 HF FILL INFO Button. Selection of the HF **FILL INFO** button commands the **HF FILL** status window to display.

3A.58.13 HF CRYPTO BYPASS Button. The HF **CRYPTO BYPASS** button provides the capability to bypass the HF radio's crypto device in case of failure.

3A.58.14 FILL STATUS Window. The **FILL STATUS** window (fig 3A-84) displays the fill status of data in the HF radio. The **FILL STATUS** window is not available while a fill is in progress.

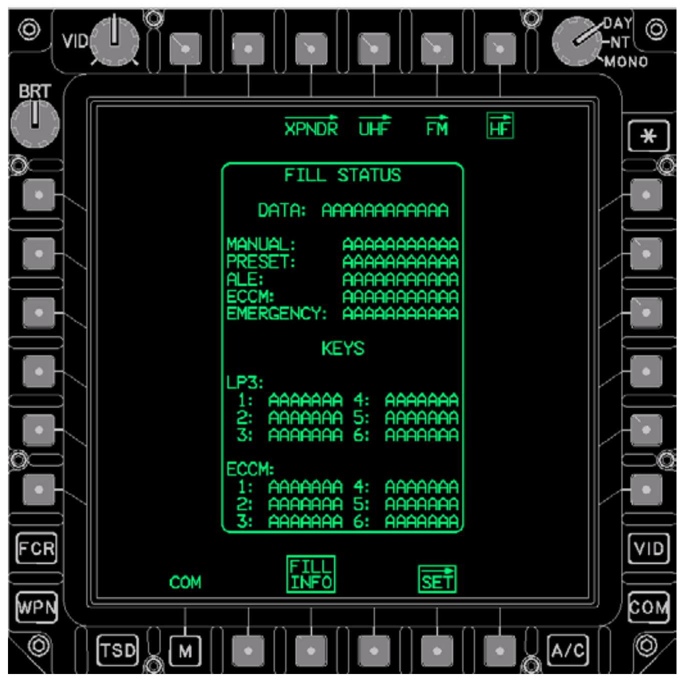


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Figure 3A-84. HF SET Page (FILL INFO Selected)

3A.59 HF ZERO PAGE

The **HF ZERO** page (fig 3A-85) provides controls to zeroize either data or keys in the HF radio, for diagnostic purposes.

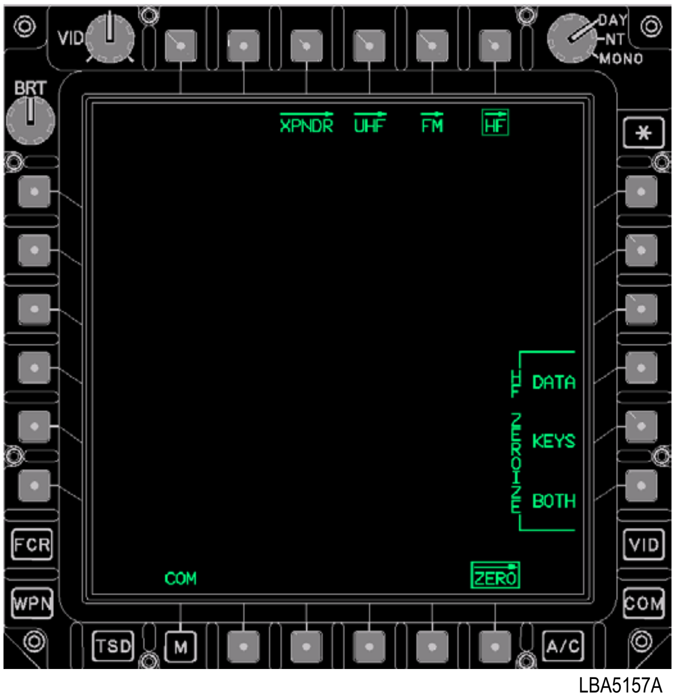

Figure 3A-85. HF ZERO Page

The **HF ZERO** page contains the following unique buttons:

- R4 **HF ZEROIZE DATA** button
- R5 **HF ZEROIZE KEYS** button
- R6 **HF ZEROIZE BOTH** button

3A.59.1 HF ZEROIZE DATA Button. The **HF ZEROIZE DATA** button will zeroize non-key data in the HF radio. Selection of this button will prompt for a **YES** or **NO** confirmation to initiate the zeroize.

3A.59.2 HF ZEROIZE KEYS Button. The **HF ZEROIZE KEYS** button will zeroize LP1 and LP2 keys in the HF radio. Selection of this button will prompt for a **YES** or **NO** confirmation to initiate the zeroize.

3A.59.3 HF ZEROIZE BOTH Button. The **HF ZEROIZE BOTH** button will zeroize all data and keys in the HF radio. Selection of this button will prompt for a **YES** or **NO** confirmation to initiate the zeroize.

3A.60 ARC-164 HAVE QUICK (HQ) PROCEDURES

3A.60.1 Automatic Loading HQ Data.

NOTE

- When using the DTU to load **HQ WOD** data into the aircraft, all **HQ WOD** data is loaded.
- **HQ FMT** data must be entered manually into the aircraft. There is no DTU upload capability. **HQ FMT** data is the same data for the UHF radio.

1. **DTU** - Select **MASTER LOAD**.

or

2. **DTU DATA COMMUNICATIONS** - Select **ALL** or **MWOD**.

3A.60.2 Manual Loading HQ Data.

NOTE

- The last two digits of the first segment in any **WOD** specifies the hoprate in the **FH** mode:
  xxx.x00 (slowest)
  xxx.x25
  xxx.x50
  xxx.x75 (fastest)
  Best results for **FH** (secure), use hop-rates between xxx.x00 or xxx.x25.
- The calendar day (via GPS/RECEIVE TOD/**CAL DAY**) number specifies which **WOD** segment list the radio will use.
- Operational **NET** numbers are allocated as follows:
  yy.y00 - HQ1 Mode
  yy.y25 - HQ2 NATO usage
  yy.y50 - HQ2 non-NATO countries
  Where y is any number 0 to 9. All other operational **NET** number combinations are illegal.
- Training **NET** numbers are allocated as follows:
  When using **WOD** segment lists for training (first segment in a given **WOD** must be 300.0xx), **NET** numbers are 00.z00. Where z is any number 0 to 4; z specifies which of the frequencies in the **WOD** segments hopping will start on.
  When using the **TSET** segment list for training, **NET** numbers are 0z.z25. The suffix of 25 specifies that the **TSET** frequency list in the radio is to be used for hopping. The z.z is any number 0.0 to 1.5 and designates which of the frequencies in the list will be used to start hopping.

1. **COM** - Select.
2. **UHF** - Select.
3. **WOD** - Select.
4. **WOD** Day number - Enter.
5. Enter **WOD** Segments1 through 6.
6. **UPDATE** - Press.
7. Repeat steps 4 through 6 as necessary until all **WOD** Segments have been entered.
8. **WOD** - Deselect.
9. **NET** - Enter.
10. **CAL DAY** - Enter.
11. **UHF** - Deselect when complete.

or

If FMT values are to be entered, perform the following:

12. **UHF** - Select.
13. **FMT** - Select.
14. Enter **FMT** Frequencies1 through 16.
15. **UPDATE** - Press.
16. **FMT** - Deselect.
17. **NET** - Enter.
18. **UHF** - Deselect.

3A.60.3 Update FMT.

1. **UHF** - Select.
2. **FMT** - Select.
3. **TRAINING UPDATE** - Press.
4. **FMT** - Deselect.
5. **UHF** - Deselect.

3A.60.4 Receive TOD Signal.

1. **UHF** - Select (verify correct frequency).
2. **RECEIVE** - Select, can now receive TOD for the next 60 seconds.
3. **UHF** - Deselect.

3A.60.5 Create Cold Start TOD.

1. **UHF** - Select.
2. **CAL DAY** - Enter.
3. **COLD START** - Press.
4. **UHF** - Deselect.

3A.60.6 Create GPS TOD.

1. **UHF** - Select.
2. **GPS TIME** - Press.
3. **UHF** - Deselect.

3A.60.7 Send TOD.

1. **UHF** - Select (verify correct frequency).
2. **SEND** - Press.
3. **UHF** - Deselect.

3A.60.8 Activation of HAVEQUICK (Frequency Hopping).

1. Automatic load **HQ** data (para 3A.60.1).

or

2. Manual load **HQ** data (para 3A.60.2).
3. Update **WOD** or **FMT** segments in radio (para 3A.62.3).
4. **UHF** - Select.
5. **UHF MODE** - Select **FH** (verify no tone).
6. **UHF** - Deselect.

3A.61 EMERGENCY LOCATOR TRANSMITTER CHECK PROCEDURE

NOTE

If the **UHF GUARD RECEIVER** is enabled during aircraft power up and the ELT warble tone is not heard, the following check is not required.

1. EMERGENCY PANEL GUARD button - Press or manually input 121.500/243.000.
2. Guard frequency - Monitor for ELT warble tone.

if warble tone is heard:

3. ELT **OFF-TEST/ARM/ON** switch - Reset **OFF-TEST** switch.

3A.62 ARC-201D FM PROCEDURES

NOTE

- Selections on the **FM** page take 3 to 4 seconds to complete in changing the modes of the ARC-201D radio. DO NOT make a second or subsequent selection until the first selection OPERATION IN PROGRESS is complete.
- In order to send or receive an ERF, using the **MAN** hopset, a hopset must be stored in location 1 in the ARC-201D radio.
- An **ERF** procedure (**ERF SEND** or **ERF RECEIVE**) WILL NOT work correctly if the **MAN** and **CUE** frequencies are the same while in **FH/M** mode with the **MAN** hopset selected. Avoid setting the same frequency for **MAN** and **CUE**.

3A.62.1 Automatic Loading of SINCGARS Data.

NOTE

The DTU will automatically load the initial power-up, **MAN**, and **CUE** frequencies for each radio. It WILL NOT load the hopset and lockout set data. This must be done through the LMP.

1. **DTU** - Select **MASTER LOAD**.
2. **DTU DATA COMMUNICATIONS** - Select **ALL**.

3A.62.2 Manual Loading of SINCGARS Data.

1. **COM** - Select.
2. **FM** - Select.
3. **RADIO** - Select **FM1** or **FM2** as desired.
4. **MAN** frequency - Enter.
5. **CUE** frequency - Enter.
6. **HOPSET** - Select to verify loaded hopsets.
7. **HOPSET** - Select.
8. Repeat steps 3 through 7 for other FM radio, as desired.
9. **FM** - Deselect.

3A.62.3 Set Base Time-of-Day (TOD)/NET (Hopset) Synchronization.

NOTE

- To ensure all aircraft will use approximately the same **TOD** within ± 4 seconds, select the **CLOCK GPS TIME** button. Other methods are permissible but may require more detailed coordination; any method used must ensure that the base **TOD** is within ± 4 seconds.
- The base **TOD** only needs to be set once, but the ERF **SEND**/**RECEIVE** procedure for final synchronization must be accomplished with each Net Control Station (Hopset) using different base times.
- After **TOD** synchronization, if the ARC-201D radio battery backup is installed with good batteries, the radio will hold synchronization for approximately 24 hours after aircraft power is off.

1. **FM** - Select.
2. **RADIO** - Select **FM1** or **FM2** as desired.
3. **GPS TIME** - Press.
4. **FM DATE/TIME** - Verify correct time is displayed.

If GPS time is unsuccessful or manual time entry is desired, proceed to step 5

5. **FM DATE/TIME** - Enter date, hours, and minutes in 24 hour format.

If NET (Hopset) Synchronization only is required, perform the following Cold Start procedure:

6. **RADIO** - Select **FM1** or **FM2**, if required.
7. Execute **ERF SEND**/**ERF RECEIVE** procedure, as appropriate, to complete synchronization.
8. Repeat step 7, as necessary, for each different Net Control Station (Hopset) that will be used.
9. Repeat steps 2 through 8 for other FM radio, as desired.
10. **FM** - Deselect.

3A.62.4 ERF Send.

1. **FM** - Select.
2. Automatic Loading of SINCGARS data (para 3A.62.1).

or

3. Manual Loading of SINCGARS Data (para 3A.62.2).
4. **RADIO** - Select **FM1** or **FM2** as desired.
5. HOPSET - Select **MAN**.
6. **FM MODE** - Select **FH/M**.
7. **ERF** - Select.
8. **FUNCTION** - Review.
9. **ERF MODE** - Select HOPSET or LOCKOUT as desired.
10. HOPSET or LOCKOUT-SET - Select.
11. **SEND** - Select.
12. Repeat steps 8 through 10 as necessary to complete ERF transfer for all hopsets and lockout sets desired.
13. **ERF** - Deselect.
14. **FM MODE** - Set as desired.

3A.62.5 ERF Receive.

1. **FM** - Select.
2. **RADIO** - Select **FM1** or **FM2** as desired.
3. **HOPSET** - Select **MAN**.
4. **ERF** - Select.
5. **FUNCTION** - Set to Review.
6. **ERF MODE** - Select hopset or lockout, as directed.
7. **RECEIVE** - Select.
8. HOPSET data received - Store in desired storage location.

or

9. LOCKOUT data received - **STORE** Select.
10. **RECEIVE** - Deselect.
11. Repeat steps 8 or 9 as necessary to complete ERF transfer for all hopsets and lockout sets desired.
12. **ERF** - Deselect.
13. **FM** - Deselect.

3A.62.6 Activate Frequency Hopping Mode.

1. **FM** - Select.
2. **RADIO** - Select **FM1** or **FM2** as desired.
3. **NET** (Hopset) Synchronization (para 3A.62.6) - Verify complete.
4. **HOPSET** - Select desired hopset.
5. **FM MODE** - Select **FH** or **FH/M**.
6. **FM** - Deselect.

3A.63 COMSEC OPERATION

3A.63.1 PRESET EDIT Method.

1. **PRESET EDIT** - Select.
2. EDIT buttons - Select **V/UHF**, **FM**, or **HF** as desired.
3. **V/UHF** - Select.
   a. UHF MODE - Select **PLAIN** or **CIPHER**.
   b. UHF CNV - Select desired CNV fill number.
4. **FM** - Select.
   a. FM1 or FM2 MODE - Select **PLAIN** or **CIPHER**.
   b. FM1 or FM2 CNV - Select desired CNV fill number.
5. **HF** - Select.
   a. HF MODE - Select **PLAIN** or **CIPHER**.
   b. HF CNV - Select desired CNV fill number.

3A.63.2 SET CRYPTO Operations.

1. **COM PAGE or MENU PAGE** - Select.

2. **UHF** - Select.

   a. **SET** - Select.

   b. **CRYPTO MODE** - Select **PLAIN** or **CIPHER**.

   c. **CRYPTO CNV** - Select desired CNV fill number.

3. **FM** - Select.

   a. **SET** - Select.

   b. **RADIO FM1** or **FM2** - Select.

   c. **CRYPTO MODE** - Select **PLAIN** or **CIPHER**.

   d. **CRYPTO CNV** - Select desired CNV fill number.

4. **HF** - Select.

   a. **SET** - Select.

   b. **CRYPTO BYPASS** - Deselect.

   c. **CRYPTO MODE** - Select **PLAIN** or **CIPHER**.

   d. **CRYPTO CNV** - Select desired CNV fill number.

3A.63.3 IMPROVED DATA MODEM PRESET- NET SETUP.

3A.63.4 Automatic Loading of IDM NET Data.

1. **DTU** - Select **MASTER LOAD.**

or

2. **DTU DATA COMMUNICATIONS** - Select **ALL** or **IDM**.

3A.63.5 Manual Loading of IDM PRESET-NET Data.

1. **COM** - Select.

2. **DAY** - Select desired day.

3. **PRESET** - Select.

4. **PRESET EDIT** - Select.

5. **EDIT UNIT** - Select (Selected on display of page).

   a. **UNIT ID** - Select **a**nd edit as desired.

   b. **CALL SIGN** - Select and edit as desired.

6. **EDIT V/UHF** - Select.

   a. **VHF FREQ** - Select and enter frequency.

   b. **UHF MODE** - Select **CIPHER** or **PLAIN**.

   c. **UHF CNV** - Select **CNV 1 - 6** as desired.

   d. **UHF HQ NET** - Select and enter net ID.

   e. **UHF FREQ** - Select and enter frequency.

7. **EDIT FM** - Select.

   a. **FM1 MODE** - Select **CIPHER** or **PLAIN**.

   b. **FM1 CNV** - Select **CNV 1 - 6** as desired.

   c. **FM1 HOPSET** - Select as desired.

   d. **FM1 FREQ** - Select and enter frequency.

   e. **FM2 MODE** - Select **CIPHER** or **PLAIN**.

   f. **FM2 CNV** - Select **CNV 1 - 6** as desired.

   g. **FM2 HOPSET** - Select as desired.

   h. **FM2 FREQ** - Select and enter frequency.

8. **EDIT HF** - Select.

   a. **HF MODE** - Select **CIPHER** or **PLAIN**.

   b. **HF CNV** - Select **CNV 1 - 6** as desired.

   c. **PRESET CHAN** - Select and enter 1-20 for the desired preset channel.

   d. **ALE NET** - Select and enter 1-20 for the desired ECCM net.

   e. **ECCM NET** - Select and enter 1-12 for the desired ECCM net.

   f. **HF RECV FREQ** - Select and enter frequency.

   g. **HF RECV EMISSION** - **LSB** or **USB** as required.

   h. **HF XMIT FREQ** - Select and enter frequency.

   i. **HF XMIT EMISSION** - **LSB** or **USB** as required.

9. **MODEM** - Select.

NOTE

Lower baud rates for the Longbow protocol may improve long range digital communications.

10. MODEM **PROTOCOL** - Select as required.

   a. **LONGBOW** - Select and set parameters as required.

      (1) **AUTO ACK** - Select.

      (2) **RETRIES** - Select.

      (3) **BAUD RATE** - Select.

   b. **TACFIRE** - Select and set parameters as required.

      (1) **RETRIES** - Select.

      (2) **BAUD RATE** - Select.

      (3) **AUTH** - Select.

      (4) **BLOCK** - Select.

NOTE

If operating with crypto equipment, the minimum preamble time that is functional is 0.7 seconds.

      (5) **PREAMBLE** - Select.

      (6) **MONITOR** - Select.

      (7) **XMIT RADIO** - Select.

   c. **INTERNET** - Select as required.

   d. **FIRE SUPPORT** - Select and set parameters as required.

      (1) **BAUD RATE** - Select.

      (2) **NET ACCESS** - Select.

      (3) **TRAFFIC LOAD** - Select.

      (4) **EDC FEC**- Select.

      (5) **EDC TDC** - Select.

      (6) **ECS SCRAMBLE** - Select.

   e. **NONE** - Select for voice net as required.

11. **PRESET EDIT** - Deselect.

12. NET - Select.

NOTE

- A maximum of 16 subscribers/team members of which 8 can be primary members (including ownship) are allowed when the protocol of the selected preset is Longbow or Internet.
- A maximum of 16 team members of which 2 can be primary members (including ownship) are allowed when the protocol of the selected preset is Fire Support.
- Valid Longbow and Tacfire member subscriber numbers range from 0 - 39, A-Z, 1A-1Z, 2A-2Z, and 3A- 3I.

13. NET Member location (1-15) - Select the desired location.

   a. MEMBER EDIT **DEL** - Select to clear member data as desired.

   b. MEMBER EDIT **C/S** - Select and enter callsign as desired.

   c. MEMBER EDIT **SUB** - Select and enter subscriber ID for Longbow or Tacfire as required.

   d. MEMBER EDIT **URN** - Select and enter URN ID for Internet as required.

   e. MEMBER EDIT **URN** - Select URN mode and edit Fire Support URN ID and IP as required for Fire Support.

   f. MEMBER EDIT **TEAM** - Select or deselect as desired.

   g. MEMBER EDIT **PRI** - Select or deselect as desired.

14. NET Member location (1-15) - Repeat step 13 a through g as desired for other members.

15. **NET** - Deselect when completed.

3A.64 TRANSMITTING AIR FORCE APPLICATION PROGRAM DEVELOPMENT (AFAPD) PROTOCOL MESSAGES

NOTE

- The Longbow Protocol is sometimes referred to as the AFAPD protocol.
- IDM Transmit Select must be used to select a radio with a valid IDM Net before transmission. The **SEND** selection will not be displayed if the selected radio does not have a valid IDM Net.
- IDM messages capable of being transmitted from the **TSD** or **FCR** displays will only have the **SEND** selection displayed if the member(s) have been selected. Member(s) will only be displayed on TSD RPT display if they have been designated as primary members.

3A.65 TRANSMITTING JOINT VARIABLE MESSAGE FORMAT (JVMF) PROTOCOL MESSAGES OVER THE TACTICAL INTERNET

NOTE

- The Internet Protocol is sometimes referred to as the JVMF protocol.
- IDM Transmit Select must be used to select a radio with a valid protocol and IDM Net before transmission. The **SEND** selection will not be displayed if the selected radio does not have a valid protocol or IDM Net.
- IDM messages capable of being transmitted from the **TSD** displays will only have the **SEND** selection displayed if the member(s) have been selected. Member(s) will only be displayed on the TSD RPT display if they have been designated as primary members.

3A.66 TRANSMITTING JOINT VARIABLE MESSAGE FORMAT (JVMF) PROTOCOL MESSAGES OVER THE FIRE SUPPORT NET

NOTE

- The Fire Support Protocol is sometimes referred to as the JVMF protocol.
- If the message is being sent from the **ARTY** page, the **SEND** selection will be displayed when an FM radio is tuned to the Fire Support Protocol (these messages only apply to the Fire Support Net and only one radio can be tuned to that protocol at a time). For all other messages, IDM Transmit Select must be used to select a radio with a valid protocol and IDM Net before transmission. The **SEND** selection will not be displayed if the selected radio does not have a valid protocol or IDM Net.
- IDM messages capable of being transmitted from the **TSD** displays will only have the **SEND** selection displayed if the member(s) have been selected. Member(s) will only be displayed on the TSD RPT display if they have been designated as primary members.

Table 3A-4. Messages

RADIO	Message Format	**AFAPD**		**ATHS**		**JVMF**		**JVMF**		**N/A**	
	Protocols	**LONGBOW**		**TACFIRE**		**TI**		**FS**		**HF**	
VHF/ARC-186		X		X							
UHF/ARC-164		X		X							
FM/ARC-201D		X		X		X		X			
AN/ARC-220HF										X	
MESSAGE	**TSD REC**	**TX**	**REC**	**TX**	**REC**	**TX**	**REC**	**TX**	**REC**	**TX**	**REC**
FREE TEXT		X	X			X	X	X	X	X	X
MISSION 1 or 2		X	X								
ALL IDM CEOI		X	X								
WAYPOINT files		X	X								
AREAS files		X	X								
LINES files		X	X								
INDIVIDUAL ROUTE file		X	X								
ALL ROUTES file		X	X								
TGT/THREATS files		X	X								
CONTROL MEASURES files		X	X								
LASER CODES (PRF only)		X	X								
WAYPOINT/HAZARD	X	X	X								
CONTROL MEASURE	X	X	X								
TGT/THREAT	X	X	X								
BDA (SHOT-AT)	X	X	X								
BDA QUERY	X	X	X								
FCR TARGET(S)	X	X	X								
PRESENT POSITION	X	X	X			X*1	X	X*1	X	X	X
PRESENT POSITION QUERY	X	X	X			X	X	X	X		
FARM	X	X	X								
FARM QUERY	X	X	X								
SITREP	X					X	X	X	X		
SITREP REQUEST							X		X		
SPOT REPORT ***NOTE 4**	X					X	X	X	X		
PRIORITY FIRE ZONE(S)	X	X	X								
NO FIRE ZONE(S)	X	X	X								
FCR RFHO	X	X	X								
AIR FIRE MISSION - SAL REQUEST	X						X		X		
AIR FIRE MISSION - FIRE	X						X		X		

Table 3A-4. Messages - continued

RADIO	Message Format	**AFAPD**		**ATHS**		**JVMF**		**JVMF**		**N/A**	
	Protocols	**LONGBOW**		**TACFIRE**		**TI**		**FS**		**HF**	
MESSAGE	**TSD REC**	**TX**	**REC**	**TX**	**REC**	**TX**	**REC**	**TX**	**REC**	**TX**	**REC**
AIR FIRE MISSION - EOM	**X**						**X**		**X**		
OBSERVER READINIESS REPORT								**X**			
AIR FIRE MISSION - ACPT/REJT						**X**		**X**			
AIR FIRE MISSION - READY						**X**		**X**			
AIR FIRE MISSION - SHOT						**X**		**X**			
CALL FOR FIRE								**X**			
ON-CALL FIRE COMMAND								**X**			
MESSAGE TO OBSERVER	**X**						**X*2**		**X**		
OBSERVER MISSION UPDATE	**X**						**X*2**		**X**		
CHECK FIRE - ALL or MISSION								**X**			
CANCEL CHECK FIRE - ALL or MISSION								**X**			
ADJUST FIRE - REPEAT/RNDS IMPACT								**X**			
END OF MISSION AND SURVEILLANCE								**X**			
FRAGO (FIELD ORDERS)							**X**		**X**		
INFORMATION REQUEST							**X**		**X**		
SA DATA (Sent automatically)						**X**					
ATHS MESSAGES	**X**			**X*3**	**X*3, 4**						

NOTE 1	Cannot perform auto-response in JVMF, but can issue report.
NOTE 2	This is a technical capability that does not reflect the normal operational use of this message.
NOTE 3	Reviewing an ATHS MSG from the COM MSG RCV page will call the ATHS message receive page to display. The sending and receiving of all ATHS/TACFIRE messages can only be achieved through the ATHS page structure and not the TSD or MSG SEND/MSG RCV pages. Refer to table 3A-4E for ATHS/TACFIRE message types that are supported by the IDM.
NOTE 4	ATHS messages are not uniquely defined for TSD REC function and a standard **ATHS MSG** descriptor is used to annunciate the receipt of an ATHS (TACFIRE) message.

Table 3A-4A. To transmit LONGBOW Messages

TYPE OF MESSAGE	MPD SELECTIONS/ACTIONS	TO SEND MESSAGE
RF Target Handover	After FCR scan, on **FCR** display select NTS. Select **RFHO**	Select PRI member, then **SEND**
FCR Targets - All	**TSD RPT TGT ALL**	Select PRI member, then **SEND**
FCR Targets - Priority	**TSD RPT TGT PRI**	Select PRI member, then **SEND**
FCR Targets - Single or Multiple	**TSD RPT TGT** Cursor select single or multiple **FCR** target icons	Select PRI member, then **SEND**
Shot At - All	**TSD RPT BDA ALL**	Select PRI member, then **SEND**
Shot At - Ownship	**TSD RPT BDA OWN** Mode **MSG** to **SEND**	Select PRI member, then **SEND**
Shot At - Query	**TSD RPT BDA OWN** Mode **MSG** to **RQST**	Select PRI member, then **SEND**
Pres Posn Report	**TSD RPT PP** Mode **MSG** to **SEND**	Select PRI member, then **SEND**
Pres Posn Query	**TSD RPT PP** Mode **MSG** to **RQST**	Select PRI member, then **SEND**
FARM Report	**TSD RPT FARM** Mode **MSG** to **SEND**	Select PRI member, then **SEND**
FARM Query	**TSD RPT FARM** Mode **MSG** to **RQST**	Select PRI member, then **SEND**
Single Stored Target/Threat	**TSD POINT XMIT** Use cursor to select or point data entry method to select target or threat	Select PRI member, then **SEND**
Single Waypoint/Hazard	**TSD POINT XMIT** Use cursor to select or point data entry method to select waypoint/hazard	Select PRI member, then **SEND**
Single Control Measure	**TSD POINT XMIT** Use cursor to select or point data entry method to select control measure	Select PRI member, then **SEND**
Zones - Priority Fire	**TSD BAM PF**	Select PRI member, then **SEND**
Zones - No Fire	**TSD BAM NF**	Select PRI member, then **SEND**
Zones - All	**TSD BAM BOTH**	Select PRI member, then **SEND**

Table 3A-4A. To transmit LONGBOW Messages - continued

TYPE OF MESSAGE	MPD SELECTIONS/ACTIONS	TO SEND MESSAGE
Freetext	**COM MSG SEND FREETEXT SOURCE IDM** Enter freetext	**SEND**
Waypoints file	**COM MSG SEND CURRENT MISSION WAYPOINTS**	**SEND**
Routes file	**COM MSG SEND CURRENT MISSION ROUTE ALL**	**SEND**
Single route	**COM MSG SEND CURRENT MISSION ROUTE**, Select desired Route	**SEND**
Laser codes	**COM MSG SEND CURRENT MISSION LASER CODES**	**SEND**
Comm Data All	Not implemented in BLK 2	
Control Measures file	**COM MSG SEND CURR MISSION CONTROL MEASURES**	**SEND**
Boundary/Phase Lines file	**COM MSG SEND CURR MISSION LINES**	**SEND**
Engagement Areas file	**COM MSG SEND CURR MISSION AREAS**	**SEND**
Stored Targets/Threats file	**COM MSG SEND CURR MISSION TGT/THRT**	**SEND**
Current Mission - All	**COM MSG SEND CURR MISSION ALL**	**SEND**
MISSION 1 - All files	**COM MSG SEND MISSION 1**	**SEND**
MISSION 2 - All files	**COM MSG SEND MISSION 2**	**SEND**

Table 3A-4B. To Transmit JVMF messages over the Tactical Internet*

TYPE OF MESSAGE	MPD SELECTIONS/ACTIONS	TO SEND MESSAGE
Freetext	**COM MSG SEND FREETEXT SOURCE IDM** Enter freetext	**SEND**
Information Request	**TSD RPT PP** Mode **MSG** to **RQST**	Select primary member, then **SEND**
Present Position Report	**TSD RPT PP** Mode **MSG** to **SEND**	Select primary member, then **SEND**

Table 3A-4B. To Transmit JVMF messages over the Tactical Internet* - continued

TYPE OF MESSAGE	MPD SELECTIONS/ACTIONS	TO SEND MESSAGE
Spot Report	**TSD RPT SPOT** Modify options as required	Select primary member, then **SEND**
*These messages can also be sent via the Fire Support net		

Table 3A-4C. To Transmit JVMF messages over the Fire Support Net*

TYPE OF MESSAGE	MPD SELECTIONS/ACTIONS	TO SEND MESSAGE
Call for Fire	**TSD RPT ARTY MSG CFF** Default to NTS or cursor select target/threat. Modify options as required	Verify primary member selected, then **SEND**
Cancel Check Fire - All	**TSD RPT ARTY MSG CANC CHK** Select **CMD** to **ALL**	Verify primary member selected, then **SEND**
Cancel Check Fire - Single Mission	TSD RPT ARTY MSG CANC CHK Select CMD to RESUME or EOM	Verify primary member selected, then **SEND**
Check Fire - All	**TSD RPT ARTY MSG CHK FIRE** Select **TARGET** to **ALL**	Verify primary member selected, then **SEND**
Check Fire - Single Mission	**TSD RPT ARTY MSG CHK FIRE** Select **TARGET** to **SINGLE**	Verify primary member selected, then **SEND**
End of Mission	**TSD RPT ARTY MSG EOM**	Verify primary member selected, then **SEND**
End of Mission/Surveillance	**TSD RPT ARTY MSG EOM/SURV** Modify options as required	Verify primary member selected, then **SEND**
Observer Readiness Report	**TSD RPT ARTY MSG OBS RDY**	Verify primary member selected, then **SEND**
On Call Request	**TSD RPT ARTY MSG CFF**	Verify primary member selected, then **SEND**
* These messages cannot be transmitted via the Tactical Internet. Conversely, all JVMF messages that can be transmitted via the Tactical Internet can be sent via the Fire Support net as well.		

Table 3A-4D. To Transmit HF messages (SOURCE HF)

TYPE OF MESSAGE	MPD SELECTIONS/ACTIONS	TO SEND MESSAGE
Freetext	**COM MSG SEND FREETEXT SOURCE HF** Enter freetext	**SEND**
Present Position (PP)	**COM MSG SEND - SOURCE HF PP** Select	**SEND**
Pre Program Text (1 of 25)	**COM MSG SEND - SOURCE HF** Select Pre Programmed Text Msg	**SEND**

3A.67 through **3A.70** Deleted.

3A.71 ATHS-TACFIRE IMPROVED DATA MODEM

3A.71.1 ATHS-TACFIRE Mission Capabilities. Tactical Fire (TACFIRE) is a legacy battlefield communication tool that manages complex messages such as aerial and artillery fire requests, reports, emergency broadcasts, automatic reporting of status, movement commands, and general free text messages.

The primary function of TACFIRE is to coordinate firepower and communications with both legacy artillery systems and legacy OH-58D. The AH-64D type 304 IDM and avionics system supports the transmission and reception of 2.9I TACFIRE messages, which are compatible with the Advanced Field Artillery Tactical Data System (AFATDS - when set to TACFIRE protocol), TACFIRE computer, Forward Entry Device (FED), and handheld Digital Messages Device (DMD).

Like all the other IDM protocol messages, the crew station TACFIRE message receipt notification is provided through the UFD (with tone) and the message receive page.

NOTE

- The AFATDS is the successor of the TACFIRE computer. AFATDS is backward compatible with the legacy TACFIRE computer and the IDM ATHS-TACFIRE (TACFIRE mode) message format.
- The artillery's more recent 220B JVMF protocol (equivalent to the AH-64D FIRE SUPPORT JVMF protocol) is the successor to TACFIRE and is commonly, but not exclusively, the message protocol that is used to request and control artillery fire with BLK2 AH-64D.

The 2.9I TACFIRE is designed to maintain current mission status for up to eight active airborne fire missions, two active artillery fire missions, and two preplanned artillery fire missions. The IDM retains all TACFIRE mission essential data in nonvolatile storage and will store 12-48 (1-4 TACFIRE radios) previously received TACFIRE messages. The system also supports the shooter/designator execution of a digital remote HELLFIRE mission and other airborne fire missions specifying rockets, gun, or HELLFIRE direct. The ATHS-TACFIRE supports digital artillery fire missions as the Forward Artillery Aerial Observer (FAAO) and transmits/receives spot situation reports, battle damage assessments, and casualty reports. Legacy aircraft team situational awareness capabilities are enhanced by the ability to track team member Fuel, Ammo, Rockets, and Missile (FARM) status along with the ability to track the present position of up to 15 team members per query.

3A.71.2 Physical Description and Implementation. The IDM is composed of a single Line Replaceable Unit (LRU) that receives pertinent data over the 1553B bus from the DMS, EGI, SP, WP, onboard sensors, MPD, Keyboard Unit (KU), and through the receipt of processed TACFIRE messages. The **TACFIRE** pages are controlled by each independent crew station. When the **ATHS** page button is selected from either crew station, the processed TACFIRE format will be displayed on the MPD that requested the page. Following aircraft power-up, the initial TACFIRE format in both crew stations will always be the **TACFIRE INDEX** page. However, once the TACFIRE format is changed in a specific crew station, the last displayed format will always be displayed in that crew station upon the next **ATHS** page button selection.

The type 304 IDM is configured with Operational Flight Program (OFP) software package Version 2, Revision 5 (also referred to as 2.9I). This package consists of the Army User Interface (AUI) Computer Software Configuration Item (CSCI) Version 2.9I and Modem CSCI Version R3.42. Together, they are identified by the Computer Program Identification Number (CPIN): MD-1295/A-01A01-U-V2.00(OFP.R5).

In respect to the AH-64D crew station implementation, the terms Automatic Target Handover System (ATHS) and TACFIRE are used interchangeably. The **ATHS** page is accessed, for the purpose of sending or receiving TACFIRE messages, by selecting the **ATHS** page button from the **MSG REC** page, **MSG SEND** page, RPT page, or by selecting the **MSG RCV** page's **RVW** button when an ATHS message is selected.

The TACFIRE protocol incorporates two modes of operation: 1) AIR NET mode; and 2) TACFIRE (TFR) NET mode. Both the AIR and TACFIRE modes are set anytime that a MODEM page BAUDRATE associated with the desired mode is selected e.g., TACFIRE 1200 or AIR 1200. If a TACFIRE NET is to be used exclusively between IDM equipped aircraft, then AIR (default) NET mode should be used. When communications will be established with the artillery, legacy ATHS, or handheld DMD, then the TFR NET mode should be selected. Differences in message format and capabilities between the AIR and TFR modes exist.

TACFIRE messages may be transmitted to and from other TACFIRE capable aircraft, artillery TACFIRE/FIST ground systems systems, DMD, and SINCGARS configured Portable Flight Planning System - Army (PFPS-A) computer or AMPS computer.

3A.71.3 ATHS-TACFIRE Initialization.

NOTE

- The aircraft's ATHS-TACFIRE Net management functionality is set, edited, and controlled by the operator using the **ORIG ID** page, **NET** page, and **MODEM** page.

- The **ATHS** (TACFIRE) page should only be accessed for the purpose of sending and receiving TACFIRE messages or as follows: 1) when operating with legacy TACFIRE-only aircraft to check their SITREP subscriber aircraft/weapons status data; 2) when conducting single aircraft training and a different/net radio needs to be set for receiving messages sent from/ to the ownship; and 3) possible maintainer requirements to view the IDM IP address for loading purposes and to view a detailed IDM listing of the various software and firmware module versions on **START** (R2), **RESET DATA>** (R3), **<SW-VERS** (L4) **1 / 4** pages.

- Editing from the **ATHS** (TACFIRE) **START NET** page (e.g., adding/removing subscribers/members) will cause a data mismatch to occur between the aircraft displays and the IDM which will invoke the **CLEAR** button to display on the associated **COM** page TACFIRE preset-net. A subsequent selection of the **CLEAR** button will send the DP data to the IDM, overwriting any existing data for that preset in the IDM.

- Following an aircraft startup, the initial displayed **ATHS-TACFIRE** format will always be the **INDEX** page. After off-paging from an **ATHS** page format, the next selection of the **ATHS** page button will display the last **ATHS-TACFIRE** page format that had previously been displayed in that crew station. Regardless of what specific **ATHS** page is currently displayed, selecting the **INDEX** button will command the **INDEX** page (top level **ATHS** page) to display.

- A complete and detailed description of the TACFIRE subsystem is described in Technical Bulletin 11-5895-1632-10.

The IDM **TACFIRE** page format was designed to support any IDM aircraft inclusive of legacy non-1553 bused and non-integrated aircraft. This means that the TACFIRE format includes a number of pages that are not used by the AH-64D crew member. This is particularly true with the **START** pages. All TACFIRE NET management/editing should be accomplished through the normal AH-64D page and interfaces used for all the other IDM protocols.

a. DTU load and Manual Initialization. A TACFIRE preset-net is either initialized automatically through a DTU load or manually, through the same common pages that are used with all the other IDM protocols; **ORIG ID** page (fig 3A-86), **COM** preset **NET** page (fig 3A-87), and **NET MODEM** page (fig 3A-88). An automatic initialization is contingent on a TACFIRE preset-net having been constructed on the PFPS-A/AMPS and downloaded to the DTC.

b. ORIG ID Page. Editing of the TACFIRE originator/ownship ID is accomplished from the **ORIG ID** page and not from the **ATHS** (TACFIRE) **START** page. To setup TM and BC ID, any one of the aircraft's 8 preset-nets protocol has to be set as TACFIRE, has to contain the TM and BC ID (just as a member), and TM and BC ID members have to be set with an active TM member assignment. Refer to figure 3A-10 for complete button descriptions of the **ORIG ID** page.

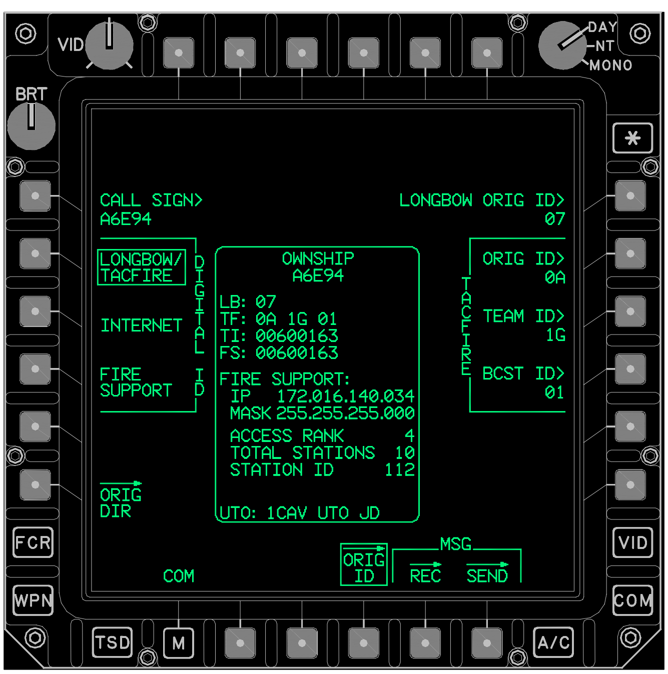

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Figure 3A-86. ORIG ID Page TACFIRE Settings

c. NET Page. Editing of a TACFIRE preset-net members/subscribers or other data is accomplished through the COM Preset-Selected **NET** page and associated **MODEM** page. Data editing performed from the aircraft **NET** page will update the IDM; however, data editing from the IDM (**ATHS START NET** page) will not usually update the aircraft display. Refer to figure 3A-30 for all the button descriptions of the **NET** page.

To enable the message send capability to any of a TACFIRE preset-net members, they must first be assigned as TM members, otherwise the IDM will not acknowledge their presence and will not permit the entry of their subscriber/member ID for sending messages.

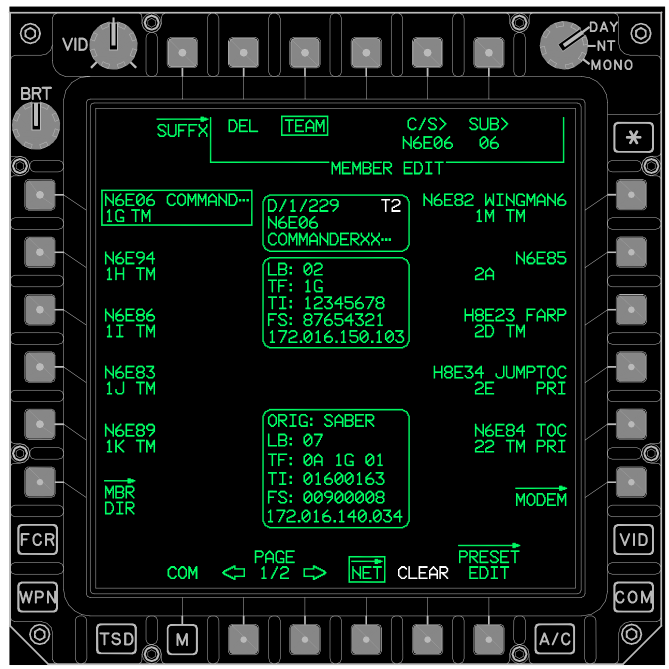

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Figure 3A-87. NET Page TACFIRE Protocol

d. MODEM Page. The **MODEM** page is used to set all the TACFIRE protocol parameters required to communicate with an AIR net or TFR net. Refer to figure 3A-22 for all the button descriptions of the **MODEM** page.

The TACFIRE's AIR (aircraft) or TFR (TACFIRE-artillery) mode control is accomplished through the **BAUD RATE** button. To enable the AIR mode select an AIR baud rate option (L1-L6), to enable the TACFIRE-Artillery mode select a TACFIRE baud rate option (R1-R2) as required.

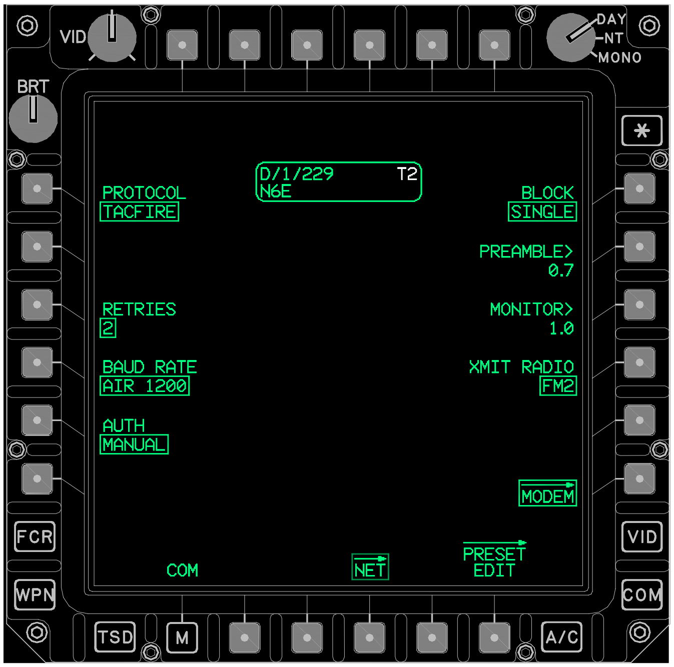

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Figure 3A-88. MODEM Page TACFIRE Protocol

3A.71.4 Artillery TACFIRE Parameter Premission Planning Considerations.

a. General. To increase the probability of successful TACFIRE message exchanges with the artillery, the observer/designator's aircraft settings must be identical to those used by AFATDS. It is also critical to ensure that the FM1 or FM2 radio used with artillery TACFIRE messaging is set to CIPHER. AFATDS requires CIPHER to enable its automatic acknowledgement of an observer/designator's TACFIRE message. Without the receipt of machine ACKS, the IDM could re-transmit multiple copies of the same message and create duplicate missions. The common indication in the crew station of an incompatible AFATDS setting, assuming the aircraft is within LOS, is that the observer/designator's platform will not display ACKS.

b. AFATDS Pre-Mission Settings. The attack helicopter unit's TOE or OPCON Fire Support Officer (FSO), will normally be responsible for obtaining and distributing the artillery's TACFIRE configuration settings. The TACFIRE data distributed by the FSO represent the configuration settings of a specific Artillery unit's Fire Direction Control (FDC) and battery's AFATDS devices.

NOTE

- All artillery TACFIRE operations must be conducted over a secure (CIPHER) net to enable AFATDS machine-ACK messages.
- The artillery's TACFIRE net mode will only support subscriber IDs that begin with with a zero (0-9, 0-Z).
- Prior to conducting TACFIRE operations with the artillery, perform a voice communications check with AFATDS and a FREE TEXT message.

c. AFATDS Mission Settings. The FDC's AFATDS has to include the TACFIRE compatible type device that each of its subscribers are using loaded in its database. AFATDS currently does not have an IDM type device setting so they should assign the IDM platform as an ATHS device. If they assign an IDM user as a FED type device the way that targets are recorded may become an issue. AFATDS uses some different configuration and data handling techniques based on the device that it is communicating with. If the observer is recorded as an ATHS type, EOM RAT correctly causes the previously assigned target number (e.g., AA2345) to be moved to a separate target list for later reference called EOM RAT-T processing. If the observer is recorded as a FED type, End Of Mission Record as Target (EOM RAT) causes an incompatible assignment of a Known Point Number (K) called EOM RAT-K processing. The following parameters are common artillery TACFIRE (FED/ATHS) settings:

NOTE

Information contained in parenthesis with an asterisk (*****) are the equivalent Field Artillery AFATDS term translations for those used by the IDM and aircraft.

1. TACFIRE preset-net FM1 or FM2 MODE - CIPHER (*****SECURE) using a common CNV.

2. FM single channel frequency or SINCGARS hopset (*****NET ID) - set as required.

3. RETRIES - Select a low setting of 0 or 1.

4. **MODEM** page BAUD RATE (*****DATA ENCODING) -select TACFIRE 1200 (*****TFR or FSK 1200). The artillery **TACFIRE** page format is moded by the IDM whenever a TACFIRE baud rate is selected from the **MODEM** page.

The unique artillery TACFIRE mode format for the **WEAPONS STATUS** Page (for a SUBSCRIBER/MEMBER) and **PRESENT POSITION STATUS** Page (for a SUBSCRIBER/MEMBER) are automatically updated upon receipt of a Situation/Status Report and will display the following mode unique format:

a. The WEAPONS STATUS Page (for SUBSCRIBER) for a TACFIRE (TFR) net contain only the two laser codes.

b. The PRESENT POSITION STATUS Page (for SUBSCRIBER) for a TACFIRE (TFR) net contain only UTM and ALT. The SITREP is essentially a position report for the Artillery.

NOTE

- The AFATDS SINCGARS-ICOM radio datarate is set to a "TF" data rate while the aircraft SINCGARS data rate and mode is automatically set anytime that the TACFIRE preset-net MODEM BAUDRATE is set to TACFIRE 1200.
- Aircraft Error Control is automatically set to EDC/TDC when a TACFIRE BAUD RATE is selected: the artillery may state EDC/TDC as a value in pre-mission instructions.

5. AUTH (*****AUTHENTICATION) - N/A Not in use.

6. BLOCK (*****BLOCK MODE) - SINGLE.

7. PREAMBLE (*****KEY TIME) - 1.4 sec or as required. This may need to be increased to ensure radio communications. Key times of less than 1.4 have occasionally caused AFATDS to receive duplicate transmissions from the ATHS platform.

8. MONITOR TIME (*****NET ACCESS DELAY) is typically set at 1.0

9. XMIT RADIO - TUNE FM1 or FM2 in CIPHER.

3A.71.5 Air to Air TACFIRE Parameter Premission Planning Considerations.

a. General. To increase the probability of successful Air to Air TACFIRE message exchanges, all aircraft operating on the same TACFIRE net should typically have the same settings. The following settings are common configuration settings:

1. TACFIRE preset-net FM1 or FM2 MODE - CIPHER (CNV1-6) or PLAIN - set as required.

2. RETRIES - Set as required.

3. **MODEM** page BAUD RATE and MODE**.** Typically, aircraft will utilize the AIR NET mode parameters by selecting a **MODEM** page BAUD RATE of AIR 1200. Other optional selections include AIR 600, AIR 300, AIR 150, or AIR 75.

   The unique AIR mode format for the **WEAPONS STATUS** Page (for a SUBSCRIBER/MEMBER) and **PRESENT POSITION STATUS** Page (for a SUBSCRIBER/MEMBER) are automatically updated upon receipt of a Situation/Status Report and will display the following mode unique format:

   a. The **WEAPONS STATUS** Page (for SUBSCRIBER/MEMBER) for an AIR net contains COD1 and COD2 (two laser codes), ATGM, A/A, RKTS, and gun AMMO.

   b. The **PRESENT POSITION STATUS** Page (for SUBSCRIBER/MEMBER) for an AIR net contain UTM, ALT, FUEL (fuel remaining), and also TEAM and BC addresses.

4. AUTH - N/A Not in use.

5. BLOCK - SINGLE.

6. PREAMBLE - 1.4 sec or as required This may need to be increased to ensure radio communications.

7. MONITOR - is typically set at 1.0.

8. XMIT RADIO - TUNE radio as required: 1) VHF; of 2) UHF (HAVQUICK or SC); or 3) FM1/FM2 SINCGARS (hopset or SC).

3A.71.6 ATHS TACFIRE Operations.

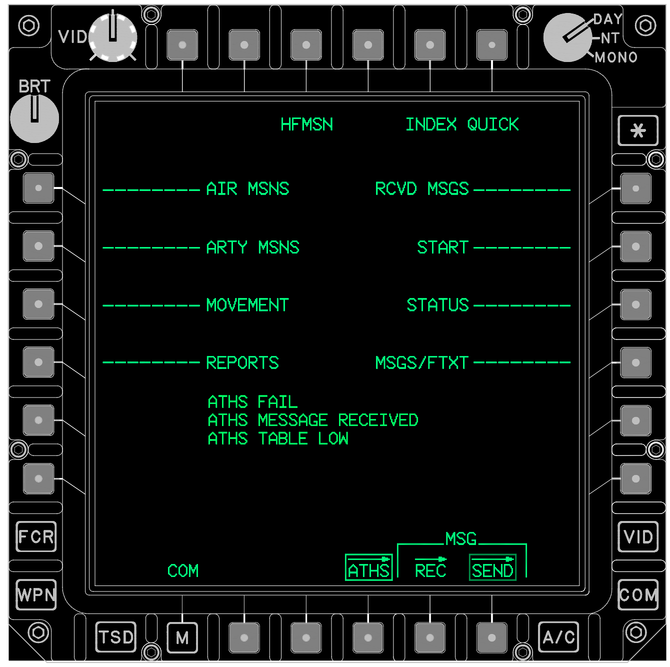

Figure 3A-89. ATHS Page TACFIRE Index Format

a. INDEX Page. A total of eight (8) separate sections may be accessed from the **INDEX** page. The 8 sections are displayed with associated line-keys, a series of dashes, aligned with specific L1-L4 or R1-R4 MPD variable action buttons. The 8 sections and associated buttons include:

- **L1 AIR MSNS**
- **L2 ARTY MSNS**
- **L3 MOVEMENT**
- **L4 REPORTS**
- **R1 RSVD MSGS**
- **R2 START**
- **R3 STATUS**
- **R4 MSGS/FTXT**

b. Common ATHS-TACFIRE Buttons. In addition to the 8 line key sections three unique buttons are displayed on all the **ATHS-TACFIRE** pages.

- **T3 HFMSN**
- **T5 QUICK**
- **T6 INDEX**

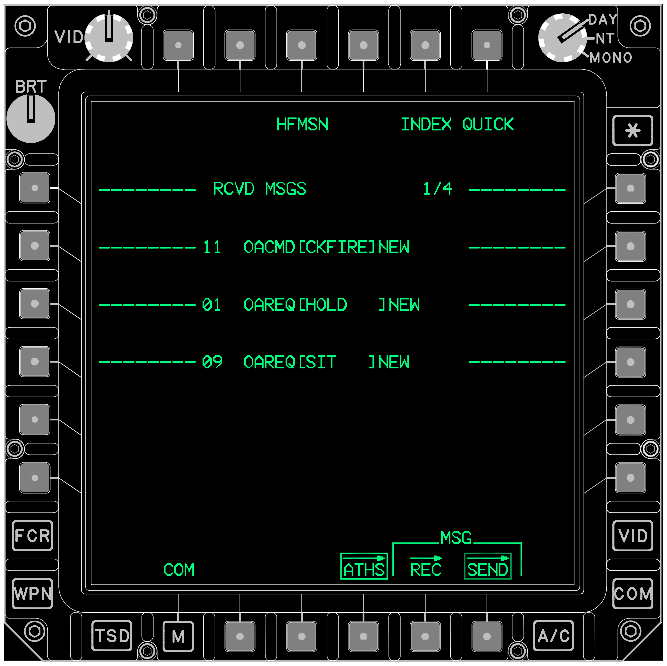

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Figure 3A-89A. ATHS-TACFIRE RCVD MSGS Page

c. ATHS-TACFIRE Advisories. The **ATHS INDEX** page reserves the data area beneath the last two line keys for ATHS-TACFIRE specific advisories. **ATHS INDEX** page caution/advisories include:

- **ATHS MESSAGE RECEIVED**
- **ATHS TABLE LOW (no longer used by the artillery)**
- **ATHS FAIL**

ATHS MESSAGE RECEIVED indicates that an ATHS-TACFIRE message has been received. **ATHS TABLE LOW** indicates the authentication tables have less than 20 available lines remaining; however, the artillery no longer uses the table. **ATHS FAIL** indicates the IDM ATHS-TACFIRE component has failed.

3A.71.7 General ATHS-TACFIRE Button Control. The TACFIRE message format Left and Right momentary buttons are displayed whenever the **ATHS** page is selected. The selection of a TACFIRE Left or Right momentary button initiates the requested TACFIRE format paging, data entry, or other selection in accordance with the current TACFIRE button option selection. The **TACFIRE** pages employs a set of ASCII characters to denote operator interface functionality of specific fields. When manual entry of information is required, a greater than (>) or less than (<) sign will appear which points away from the associated line key to signify that operator input must be made using the KU (the ENTER key is required). If only limited choices are available and rapid selectivity is required, a caret (^) will be present beside the key field of information pointing upward. Pressing this line key will scroll through each available option. The "*" defines which line is active for paging or keyboard data input. When the crew selects a line for data entry but the MPD button selected is not the current data entry line (does not display an asterisk), the DP will output the appropriate keyboard character to the TACFIRE until this line becomes the current data entry line, as designated by the asterisk character "*". Once the current data entry line is detected, the DP will then output the appropriate keyboard character to the ATHS. A double pound sign (##) indicates a numeric entry button. A double ampersand sign (@@) indicates alpha character entry button.

3A.71.8 HFMSN Button (T3). When participating in a shooter role, the **HFMSN** button (T3) is selected (boxed) by the operator upon receipt of an AIR MSN message and deselected at other times.

3A.71.9 QUICK Button (T5). Selecting the **QUICK** button (T5) provides direct access to various previous/preset messages. The **QUICK** button appears on all the **ATHS-TACFIRE** pages and provides direct access to any one of the following menu items:

- Summary Page of Highest Priority Received Message.
- Airborne Mission Summary Page.
- Artillery Mission Summary Page.
- Mayday Message Summary Page.
- Quick Menu Page.

3A.71.10 INDEX Button (T6). Selecting the **INDEX** button (T6) provides direct access to the ATHS-TACFIRE **INDEX** page para 3A.71.6.

3A.71.11 SEND button (R5). Selecting the **SEND** button will transmit the selected TACFIRE message to the subscriber/ member displayed within the subscriber data ID bloc adjacent to the L1 linekey. The **SEND** button is displayed on any of the ATHS-TACFIRE pages where the destination subscriber data ID bloc is displayed.

NOTE

The **START** page button description is listed out of sequential button order to facilitate the contiguous description of all the ATHS-TACFIRE message buttons, and to reinforce a systems ordered approach to how/when AH-64D operators interface with ATHS-TACFIRE parameters.

3A.71.12 START PAGE Button – Description.

NOTE

- Do not use the **START** pages to perform TACFIRE NET management.
- The **RESET** line-key button should not be used if it is desired to maintain the TI situational awareness icons.
- The **RESET** line-key button will clear TACFIRE and Longbow ORIG ID, BC and TM ID, remove TM status for members in a TACFIRE NET, and SA DATA.

a. The ATHS-TACFIRE's **START** page (R2) paging structure is the sole means by which operators of non-integrated legacy aircraft edit TACFIRE ownship ID, BC/TM ID, TACFIRE nets, and TACFIRE protocol parameters. AH-64D operators should always utilize the same COM subpages that are used to manage all the other digital protocols when working with the TACFIRE protocol.

b. The ATHS (TACFIRE) **START** page (R2) should only be accessed under the following conditions:

(1) When conducting single aircraft training and a different/net radio needs to set for receiving messages sent from/to the ownship.

(2) Possible maintainer requirement to view the IDM IP address for loading purposes and to view a detailed IDM listing of the various software and firmware module versions on **START** (R2), **RESET DATA>** (R3), **<SW-VERS** (L4) 1/4 pages.

(3) If it is necessary to prepare/edit any of the six message preset selections or any of the six movement preset selections.

NOTE

When it is necessary to RESET the TACFIRE resident data in the IDM, it is recommended to access the **SET** page and select the **ZEROIZE** button in place of accessing the **ATHS START** page **RESET** button. These buttons support identical functionality.

c. The **START** page **RESET** line-key button clears all data and table entries from the IDM ATHS-TACFIRE component and the Longbow ORIG ID. Following a REST, any **COM** page preset TACFIRE net will have to be selected and any pertinent members will have to be redesignated as TM members following a ZEROIZE.

3A.71.13 AIR MSNS Page (INDEX Page L1). The **AIR MSN LIST** page is displayed upon selecting the **AIR MSNS** button (L1) from the **INDEX** page (figure 3A-89). The **AIR MSN LIST** page is capable of storing eight specific AIR (fire) MISSION requests in the IDM. To request and respond to airborne fire missions. NEW air or HELLFIRE missions may be defined or existing missions modified through the **AIR MSN** (REQUEST) **LIST** pages.

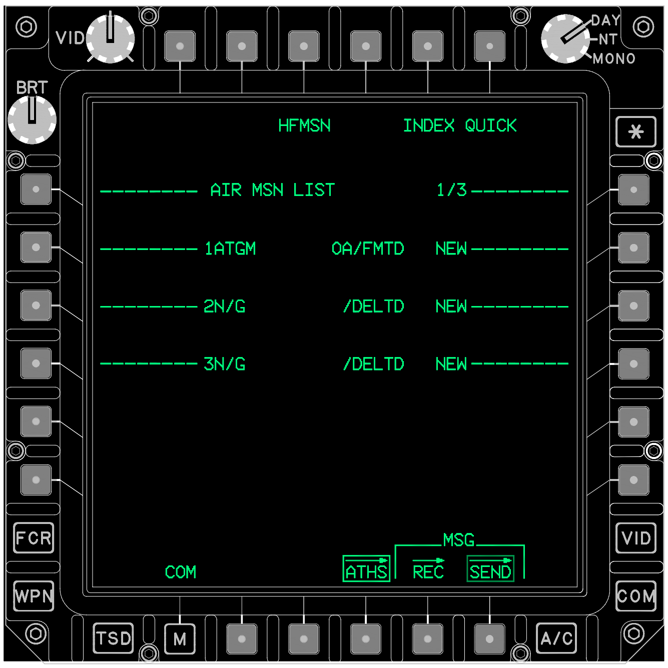

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Figure 3A-89B. AIR MSN (REQUEST) LIST Page

AIR MSN LIST selections include:

- L2-L4 **XXXX** or **#N/G** (3 pages).

Pressing the left line keys adjacent to the desired mission number LIST pages accesses the previously established air mission request pages. Upon selection, complete mission request information is displayed. #N/G represents #NOT/GIVEN where there is no previous data entered.

- R1 **1/3** to **3/3** (3 pages).

The three **AIR MSN** (REQUEST) LIST pages 1/3 through 3/3 display mission command, firing element (subscriber) to which request was sent, and mission status in line with the mission number (1-8). Stepping through the air request list is accomplished by pressing the R1 key on the MFD. The following mission command and status entries may be displayed.

- R2-R4 **XXXX** or **XN/G** (3 pages).

Pressing the right line keys adjacent to **NEW** accesses the **AIR MISSION TYPE** page for initiating new STANDARD or HELLFIRE air mission requests.

3A.71.14 AIR MSN TYPE Page.

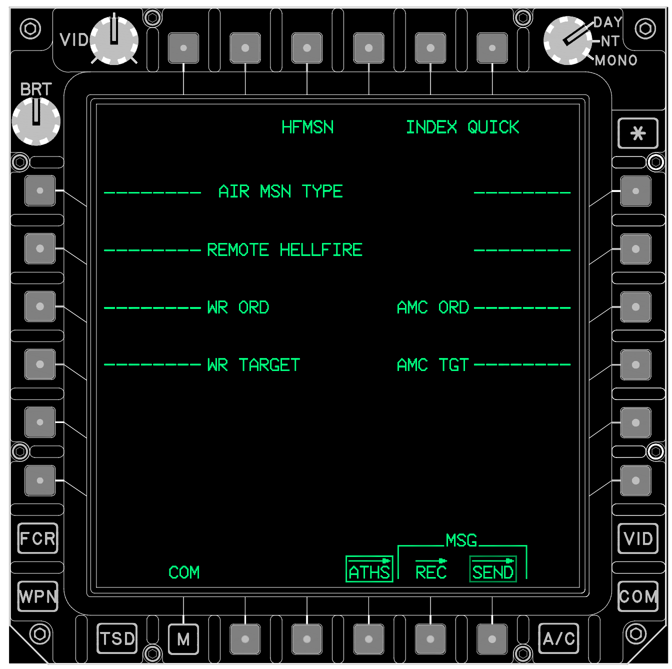

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Figure 3A-89C. AIR MSN TYPE Page

Fire mission selections include:

- L2 **REMOTE HELLFIRE** (para. 3A.71.24).
- L3 **AMC ORDNANCE** (para. 3A.71.25).
- L4 **WR ORDNANCE** (para. 3A.71.26).
- R3 **AMC TARGET** (para. 3A.71.27).
- R4 **WR TARGET** (para. 3A.71.28).

3A.71.15 ARTY MSNS Page (INDEX Page L2). The **ARTY MSN LIST** page is displayed upon selecting the **ARTY MSNS** button (L2) from the **INDEX** page (figure 3A-89). **ARTY MSN LIST** page enables observer/designators to request and respond to artillery fire missions. Supports 2 preplanned (preformatted) artillery missions, 2 new artillery missions, and allows the modification of existing missions. Artillery mission data is formatted to be consistent with the artillery FDC and forward observer DMD.

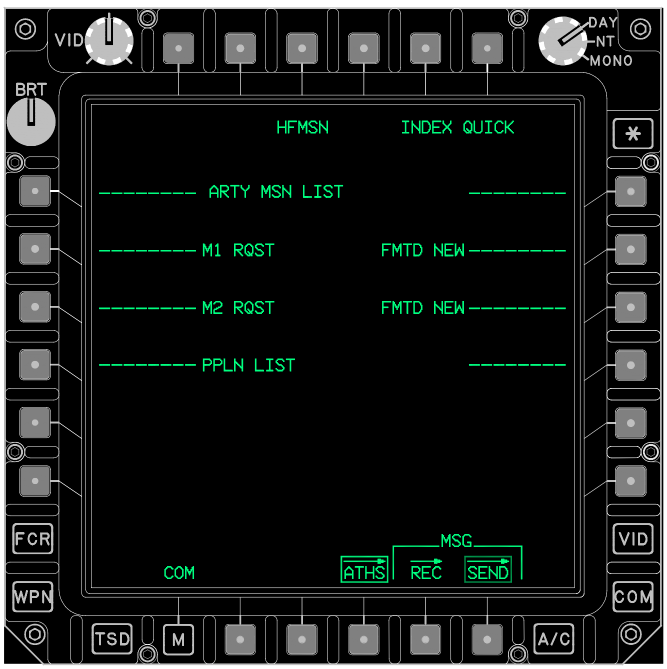

Figure 3A-89D. ARTY MSN LIST Page

ARTY MSN LIST page buttons include:

- **L2** **M1 RQST -** Preplanned mission #1.
- **L3** **M2 RSST -** Preplanned mission #2.
- **L4** **PPLN LIST -** Accesses the preplaned list.
- **R2** **FMTD NEW** - Opens **ARTY MSN TYPE** page (figure 3A-89E).
- **R3** **FMTD NEW** - Opens **ARTY MSN TYPE** page (figure 3A-89E).
- **R3** **FMTD NEW -** New ARTY mission.

3A.71.16 ARTY MSN TYPE Page. The **ARTY MSN TYPE** page is displayed upon selecting either of the **ARTY MSN LIST** pages **FMTD NEW** buttons.

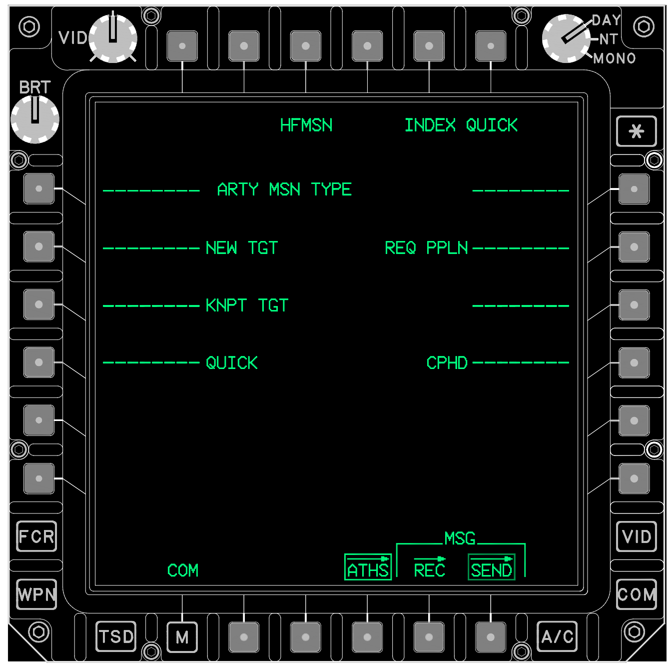

Figure 3A-89E. ARTY MSN TYPE Page

ARTY MSN TYPE page buttons include:

- L2 **NEW TGT** (new target) - The Observer defines the Target type and the strength for a new Target.
- L3 **KNPT TGT** (Known Point target) - A location previously identified and numbered, known both to the requester and to the artillery FDC. The requester then provides the Target type and strength.
- L4 **QUICK** (quick fire) - The requester enters only a Known Point or a Target Number. All other data is known by the artillery FDC. (Target Number is the preferred method).
- R2 **REQ PPLN** (preplan) - The Observer provides the type of fire request either FPF or CPHD guided munitions. Only one FPF can be preplanned at a time; however, both preplanned missions can be CPHD. The requester then provides the Target position.
- R4 **CPHD** (COPPERHEAD) - The Target position is defined as NEW TGT or KNPT and Known Point number is provided to the firing element.

3A.71.17 MOVEMENT Page (INDEX L3). The **MOVEMENT** page is displayed upon selecting the **MOVEMENT** button (L3) from the **INDEX** page (figure 3A-89). Allows position instructions to be given without the use of voice communications.

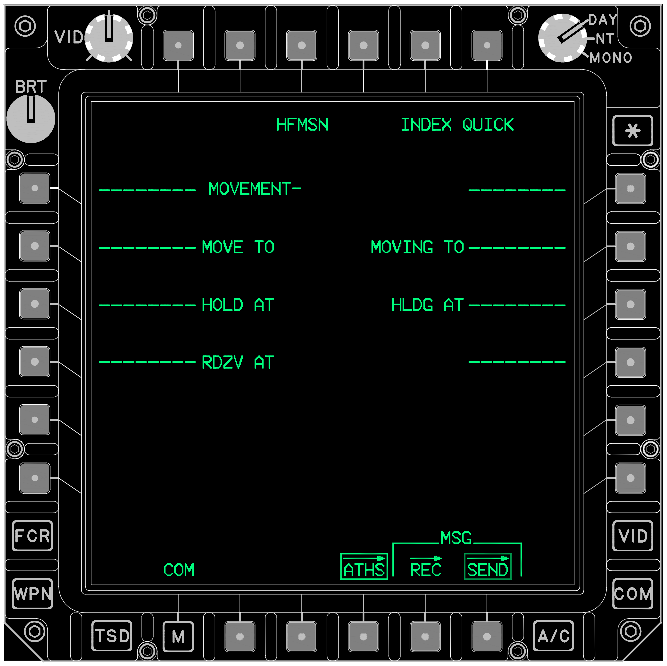

Figure 3A-89F. MOVEMENT Page

MOVEMENT page button options are:

- L2 **MOVE TO**.
- L3 **HOLD AT**.
- L4 **RDZV** (rendezvous) **AT**.
- R2 **MOVING TO**.
- R3 **HLDG** (holding) **AT**.

Selecting any of the **MOVEMENT** page options will display 3 movement destination/location options:

- L2 **PRESET** - Permits selection of any six preset positions.
- L3 **MY POSITION** - Enables automatic transmission of own current position.
- L4 **OTHER** - Enables freetext communications.

3A.71.18 REPORTS Page (INDEX L4). The **REPORTS** page is displayed upon selecting the **REPORTS** button (L4) from the **INDEX** page (figure 3A-89). Permits the ownship to provide information to both team and broadcast net members. The following reports are selectable from the **REPORT TYPE SELECT** page.

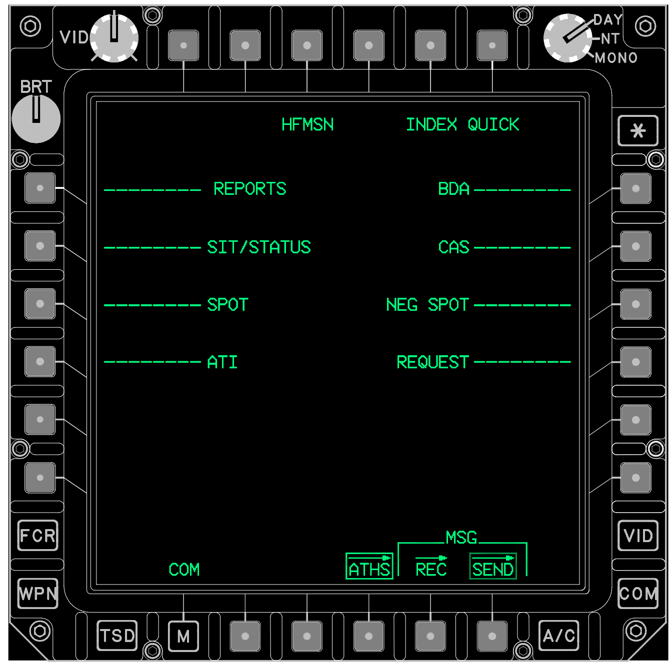

Figure 3A-89G. REPORTS Page

REPORTS page button options are:

- L2 **SIT/STATUS** (Situation/Status) - States the operator's own situation and status.
- L3 **SPOT** (Positive Spot) - Reports target activity.
- L4 **ATI** (Artillery Target Intelligence) - Provides intelligence to artillery units.
- R1 **BDA** (Battle Damage Assessment) - Provides battle damage assessment to artillery or AIR MSN controlling units.
- R2 **CAS** (Casualty) - Provides casualty report capability.
- R3 **NEG SPOT** (Negative Spot) - Provides no target activity.
- R4 **REQUEST REPORT** - Requests reports from destination net subscriber/members. The following reports may be requested from other subscriber/members.
- L2 **SIT/STATUS** (Situation/Status).
- L3 **SPOT** (Spotter).
- R2 **BDA** (Battle Damage Assessment).
- R3 **CAS** (Casualty).
- R4 **POS UPDT** (Automatic Position Update).

3A.71.19 RCVD MSGS Page (INDEX R1). The **RCVD MSGS** page is accessed by selecting either the **RCVD MSGS** button (R1) from the **INDEX** page (fig 3A-89) or the **MSG RCV** page **RVW** button when an ATHS MSG (TACFIRE) message is selected.

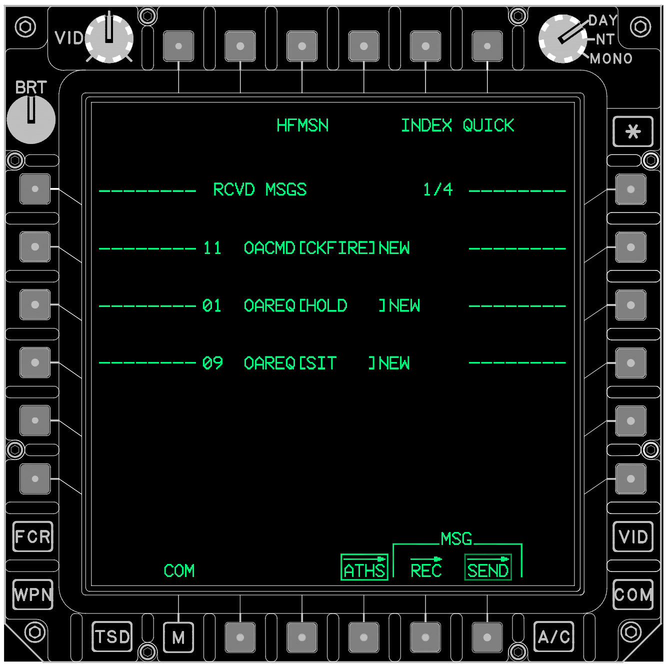

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Figure 3A-89H. RCVD MSGS Page

The **RCVD MSGS** page allows the operator to:

- R1 **1/1 - X/16** - Access the message page listing (up to 16 pages).
- L1-L3 Review newly received messages.
- L1-L3 Review previously retained messages (12-48 = 12 for each TACFIRE radio).
- L1-L3 Delete messages no longer needed.

Received messages review pages displaying **DEL** or **DELETE** next to a line key may be deleted from the page where they are reviewed.

3A.71.20 STATUS Page (INDEX R3). The **STATUS** page is displayed upon selecting the **STATUS** button (R3) from the **INDEX** page (fig 3A-89). Displays OWN (OWNSHIP) WPNS and PPSN data that is sent with the sending of a SITREP from the OWNSHIP and displays the SUBS (Subscriber/member) WPNS and STATUS when SITREPS have been received.

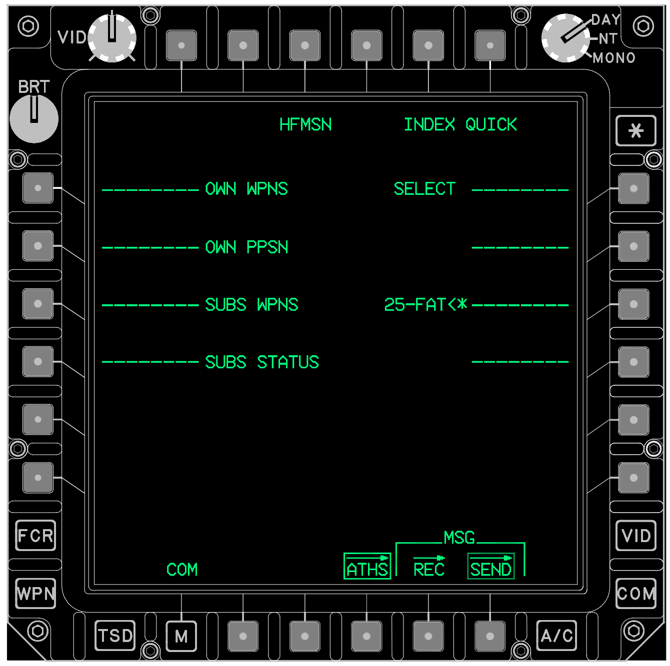

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Figure 3A-89I. STATUS Page

Status page button option buttons:

- L1 **OWN WPNS - WEAPONS STATUS** page (for **OWN**) containing information of own weapons stores.
- L2 **OWN PPSN - PRESENT POSITION STATUS** page (for **OWN**) containing information on own position, altitude, fuel status, and current team and broadcast addresses.
- L3 **SUBS WPNS - WEAPONS STATUS** page (for **SUBSCRIBER**). There is a separate **WEAPONS STATUS** page (for **SUBSCRIBER**) for each defined subscriber in the net.
- L4 **SUBS STATUS - PRESENT POSITION STATUS** page (for **SUBSCRIBER**). There is a separate **PRESENT POSITION STATUS** page (for **SUBSCRIBER**) for each defined subscriber in the net.
- R1 **SELECT - STATUS SUBSCRIBER SELECT** page. This page permits the operator to access position and weapons status information from a particular subscriber, rather than stepping through the status of all defined subscribers in listed order.

- R3 **XX-FAT<*** - Displays the free air temperature (FAT) (-43 to 80 degrees C). Enters the FAT.

All subscriber data will be displayed using one of two formats: 1) AIR; or 2) TACFIRE (TFR). The **WEAPONS STATUS** page (for **SUBSCRIBER**) and **PRESENT POSITION STATUS** page (for **SUBSCRIBER**) are different depending upon whether the subscriber is defined in an AIR or a TACFIRE (TFR) format type. The formats are automatically set in association with the **MODEM** page **BAUD RATE** type selection: an AIR baud rate e.g., **AIR 1200**, sets the AIR format; and A TACFIRE format e.g., **TACFIRE 1200**, sets the TACFIRE format.

The **WEAPONS STATUS** page (for **SUBSCRIBER**) for an AIR baud rate net contains COD1 and COD2 (two laser codes), ATGM, A/A, RKTS, and gun AMMO. The **WEAPONS STATUS** page (for **SUBSCRIBER**) for a TACFIRE (TFR) baud rate net contain only the two laser codes.

The **PRESENT POSITION STATUS** page (for **SUBSCRIBER**) for an AIR net contain UTM, ALT, FUEL (fuel remaining), and also TEAM and BC addresses.

The **PRESENT POSITION STATUS** page (for **SUBSCRIBER**) for a TACFIRE (TFR) baud rate net contain only UTM and ALT. The SITREP is used as a PP report with the artillery.

3A.71.21 MSGS/FTXT Page (INDEX R4). Permits the operator to compose and transmit any preset/free text message up to 35 characters at a time.

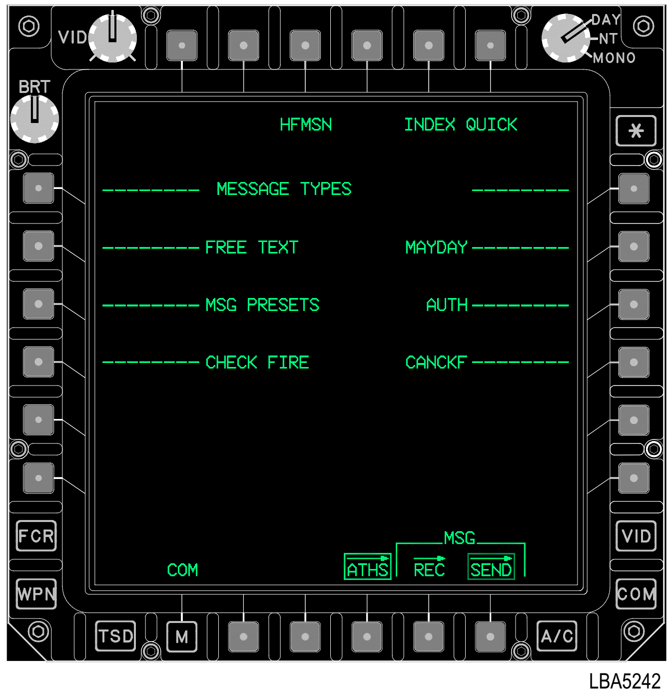

Figure 3A-89J. MSGS/FTXT (MESSAGE TYPES) Page

MSGS/FTXT page (MESSAGE TYPES) button options include:

- L1 **FREETEXT**
- L2 **MSG PRESETS**
- L3 **CHECK FIRE**
- R2 **MAYDAY**
- R3 **AUTH** (authentication)
- R4 **CANCKF** (CANCEL CHECK FIRE)

3A.71.22 Air and Artillery Message Sets. The Air mode net of TACFIRE and the Artillery mode net of TACFIRE supports different message sets. For Air and Artillery message capability (refer to table 3A-4E). When sent to AFATDS, some of the message types will respond with an ACK even though nothing is actually received and displayed by AFATDS. A message such as a SITREP request will not provide an ACK. The **STATUS** page has to be accessed to determine the response by checking subscriber / member data.

Table 3A-4E. Air and TACFIRE mode message compatibility

MSGS/FTXT			
Type	**Receive an AFATDS ACK**	**Received by AFATDS**	**Remarks**
FREE TEXT	Yes	Yes	Air and Artillery
MSG PRESETS	Yes	Yes	Air and Artillery
CHECKFIRE	Yes	No	Send Checkfire by voice (known issue)
MAYDAY	No	No	Air only
AUTH	N/A	N/A	Message format no longer used
CANCKF	Yes	Yes	Automatically processed by AFATDS
REPORTS			
Type	**Receive an AFATDS**	**Received by AFATDS**	**Remarks**
SIT/SAT	Yes	Yes	Air and Artillery. Automatically updates location; however, in the artillery TAC FIRE mode fuel, laser code, and ammo are not updated as they are in AIR mode.
SPOT REPORT	Yes	No	Air only (arty ACK but no msg receipt)
ARTY	Yes	Yes	Artillery only. No message is generated -- target goes into the AFATDS suspect target list
BDA/CAS	Yes	No	Air only (or as part of Artillery thread)
NEG SPOT	Yes	No	Air only (arty ACK but no msg receipt)
REQUEST	No	No	Air only (arty ACK but no msg receipt)
MOVEMENT			
Type	**Receive an AFATDS ACK**	**Received by AFATDS**	**Remarks**
MOVE TO	No	No	Air only
HOLD AT	No	No	Air only
RDZV AT	No	No	Air only
MOVING TO	No	No	Air only
HOLD AT	No	No	Air only
	No	No	Air only

3A.71.23 Target/Position Buffer Coordinate Autofill. A number of AIR and ARTY messages allow the operator to automatically populate target and other coordinate data into a message. This is normally accomplished using the **TSD** page and the CAQing of any WPTHZ, CTRLM, or TGT/THRT. Following a **SET** page ZEROIZE or an **ATHS START** page "RESET" the applicable TACFIRE message coordinates will not contain any displayed values until the operator provides them. A new feature implemented for non-integrated platforms, referred to as the Common Target Position Buffer (CTPB), will often require AH-64D operators to select the 2.9I TACFIRE **UPD GRD** (UPDATE GRID) button (R4) to overwrite an existing coordinate value. The UPD GRD button has to be selected, anytime that a valid grid coordinate is displayed in the grid reference component of an applicable message.

NOTE

- If an existing coordinate will not permit an AUTO UPDATE with CAQing, select the 2.9I TACFIRE **UPD GRD** (UPDATE GRID) button (R4) where displayed on the various coordinate pages (the **REMOTE HELLFIRE** page does not support this feature).

The reports and missions that use the Target/Position Buffer coordinate autofill fields are:

- AIR MISSION (Target Position)
- AIRBORNE SPOT REPORT (Target Position)
- AIRBORNE NEGATIVE SPOT REPORT (Report Position, only on operator initiated CAQ, initially set to OWN Present Position)
- AIRBORNE CAS REPORT (Report Position only on operator initiated CAQ, initially set to OWN Present Position)
- AIRBORNE BDA REPORT (Report Position)
- ARTILLERY (ATI) REPORT (Target Position)
- ARTILLERY MISSION - Request Phase (Target Position)
- ARTILLERY MISSION - Shift Phase, if needed (Round Position)

The Subscriber IDs beginning with a zero (0) are required for communication with older devices and net specifications especially those using the Artillery TFR net type.

3A.71.24 Remote HELLFIRE (Aircraft Remote HELLFIRE Mission).

OBSERVER/DESIGNATOR: (REMOTE HELLFIRE).

1. Locate target using aircraft sensors and use TSD CAQ as necessary for automatic entry of target coordinates.
2. **ATHS** page (B4) – Select as required.
3. **INDEX** button (T5) - Select as required.
4. Select **AIR MSNS**.
5. Select Mission 1 on **AIR REQ** List Pages 1/3 by pressing **NEW**. (fig 3A-89B).
6. On **MSN TYPE** Page - Select **REMOTE HELLFIRE**.
7. On **AIR MISSION SUMMARY** page.
   a. Evaluate/set coordinates (R4) as required.
   b. Evaluate/set Target Type (R3) as required.
   c. Evaluate/set Target Activity (R4) as required.
   d. Press R2 to access **AIR CONTROL SUMMARY** page.
8. On **AIR CONTROL SUMMARY** page.
   a. Evaluate **MST** (L1) for multiple missiles.
   b. Evaluate/set Laser Code/Rounds (L3) - as required.
   c. Review/set **MSL TRAJ** (R2) as required.
   d. Press R1 to access **AIR MISSION SUMMARY** page.
9. Evaluate/set **DEST SUB ID** as required.
10. Press **SEND** to request mission.

NOTE

- At this point the Observer waits for the Shooter to send an ACCEPTED message.
- This process begins with a RECEIVED MESSAGE message.

SHOOTER: (REMOTE HELLFIRE).

11. Receive message.

    a. **MSG RCV** page, **ATHS MSG** select, **RVW** button select (will automatically open the **TACFIRE RCVD MSGS** page).

    - or -

    b. Select **ATHS** button and **INDEX** button to access IDM Top Menu page.

12. Select **RCVD MSGS** as required.

13. To review selected message, press the corresponding LEFT key.

14. Review/change information on **AIR MISSION SUMMARY** page.

15. Review/change information on **AIR CONTROL SUMMARY** page.

16. Select **HFMSN** button (T3) - evaluate target location with AIR MSN symbol modifier displayed around T52 and note that HF missile laser codes have auto-moded or are set as required.

17. Verify Mission Command is **ACCEPT** or as required on **AIR MISSION SUMMARY** page. If denied/aborted, the thread will stop upon **SEND**.

18. Press **SEND**.

NOTE

Upon receipt of the **ACCPT**, the Observer waits for the Shooter to send a **READY** message.

SHOOTER: (REMOTE HELLFIRE).

19. Verify Mission Command is **READY** on **AIR MISSION SUMMARY** page.

In addition to displaying the HELLFIRE symbol modifier around T52, the selection of the **HFMSN** button will automatically code the requested missiles and set the frequencies. The Launcher must then verify the D (LDA) and S (SEP) angle. The LDA is the laser designation angle and is the area in front of the launching aircraft that the designating aircraft should avoid. This angle is +/- 30 degrees of the launcher gun-target line and will flash at 30 degrees or greater. The S (Separation) angle is +/- 60 degrees from the target back towards the designator aircraft. This is the angle that the designator should be inside to preclude a missile miss due to laser angle to the missile. The SEP angle will flash when the angle is greater than 60 degrees. The launcher should verify that the target is within range. The bearing to the target is relative to the launcher in this case and the > indicates the closest direction to turn, with the amount of degrees required, to the target. Range and bearing are displayed appropriately for the aircraft location (launcher and designator). The launcher selects R1 to access page 2/3.

20. Press **SEND**.

NOTE

At this point the Shooter waits for the Observer to send a **FIRE** message or **CHECK FIRE** message.

OBSERVER/DESIGNATOR: (REMOTE HELLFIRE) Steps 21 through 28 are CHCKFIRE control procedures.

21. On the **OBSERVER**: press **C**: (L2) to access command select page.

22. Select **CHECK FIRE** anytime that an operational or safety requirement exists to halt the progress of the mission.

23. Press **SEND**.

24. Verify receipt by Shooter.

25. Press **C**: (L2) to access command select page. When the situation dictates a need to continue with the progress of the mission or end a mission.

26. Select **CANCKF** or **END MSN** as required.

27. Press **SEND**.

28. Verify receipt by Shooter.

NOTE

If **END MSN** sent, the thread stops here.

SHOOTER: (REMOTE HELLFIRE).

29. Shooter selects **READY** (AGAIN) and sends.

OBSERVER/DESIGNATOR: (REMOTE HELLFIRE).

Upon receipt of the READY message, perform the following:

30. Verify Mission Command is **FIRE** on **AIR MISSION SUMMARY** page.

31. Press **SEND**.

32. Press (R2) to access the **AIR CONTROL SUMMARY** page. Remain on this page to monitor Time-of-Flight countdown.

At this point the Observer waits for the Shooter to send a **SHOT** message.

SHOOTER: (REMOTE HELLFIRE).

33. Verify Mission Command is **SHOT** on **AIR MISSION SUMMARY** page.

34. Press **SEND**.

35. UPON machine **ACK** receipt - **FIRE** missile(s).

At this point the Shooter waits for the Observer to send an **EOM** message.

OBSERVER/DESIGNATOR: (REMOTE HELLFIRE).

NOTE

Upon receipt of a **SHOT** message the missile is in the air the Observer performs laser operations as required using the time of flight countdown.

36. Return to **AIR MISSION SUMMARY** page.

37. Select **CMD** (R2).

38. Select **END MSN**.

39. Press **SEND**.

SHOOTER: (REMOTE HELLFIRE).

40. **HFMSN** button (T3) deselect. HELLFIRE missile settings will mode back to the original settings and the **AIR MSN** symbol modifier is removed from the display.

3A.71.25 AMC ORDNANCE (Air Request – At My Command Ordnance).

OBSERVER/DESIGNATOR: (AMC ORDNANCE).

1. Locate target using aircraft sensors and use **TSD CAQ** as necessary for automatic entry of target coordinates.

2. **ATHS** page (B4) – Select as required.

3. **INDEX** button (T5) - Select as required.

4. Select **AIR MSNS**.

5. On **AIR REQUEST** List page - Select from Mission 1 through 8 on **AIR REQ** List pages 1/3-3/3 by pressing **NEW**.

6. On **MSN TYPE** page - Select **AMC ORD**.

7. Select Ordnance Type.

8. Select Ordnance Type.

9. On **AIR MISSION SUMMARY** page.

   a. Evaluate/set Ordnance Type (L3) as required.

   b. Evaluate/set target coordinates (L4) as required.

   c. Evaluate Fire Control.

   d. Evaluate/set **DEST SUB ID** as required.

   e. Evaluate/set Target Description as required.

   f. Evaluate/set Target Activity as required.

   g. Press **SEND** to request mission.

NOTE

At this point the Observer waits for the Shooter to send an ACCEPTED message.

SHOOTER: (AMC ORDNANCE).

NOTE

This process begins with a RECEIVED MESSAGE.

10. Select **IDM/INDEX** switch to access IDM Top Menu page.

11. Receive message.

    a. **MSG RCV** page, **ATHS MSG** select, **RVW** button select (will automatically open the **TACFIRE RCVD MSGS** page).

    - or -

    b. Select **ATHS** button and **INDEX** button to access **IDM** Top Menu page.

12. Select **RCVD MSGS** as required.

13. To review a selected message - Press the corresponding LEFT key.

14. Review/change information on **AIR MISSION SUMMARY** page. Verify Mission Command is **ACCEPT**.

15. Select **HFMSN** button (T3) - evaluate target location with **AIR MSN** symbol modifier displayed around T52.

16. Press **SEND**.

NOTE

At this point the Observer waits for the Shooter to send a **READY** message.

SHOOTER: (AMC ORDNANCE).

17. Complete fire position preparation.

18. Verify Mission Command is **READY** on **AIR MISSION SUMMARY** page.

19. Press **SEND**.

NOTE

At this point the Shooter waits for the Observer to send a **FIRE** message.

OBSERVER/DESIGNATOR: (AMC ORDNANCE).

20. Verify Mission Command is **FIRE** on **AIR MISSION SUMMARY** page.

21. Press **SEND**.

NOTE

At this point the Observer waits for the Shooter to send a **SHOT** message.

SHOOTER: (AMC ORDNANCE).

22. Verify Mission Command is **SHOT** on **AIR MISSION SUMMARY** page.

23. Press **SEND**.

24. UPON machine **ACK** receipt - FIRE the ordnance.

NOTE

At this point the Shooter waits for the Observer to send a **EOM** message.

OBSERVER/DESIGNATOR: (AMC ORDNANCE).

25. Select **CMD** (R2).

26. Select **EOM**.

27. Press **SEND**.

3A.71.26 WR ORDNANCE (Air Request When Ready Ordnance).

OBSERVER: (WR ORDNANCE).

1. **TSD CAQ** as necessary for automatic entry of target coordinates.

2. **ATHS** page (B4) – Select as required.

3. **INDEX** button (T5) - Select as required.

4. Select **AIR MSNS**.

5. On **AIR REQUEST** List page - Select from Mission 1 through 8 on **AIR REQ** List pages 1/3-3/3 by pressing **NEW**.

6. On **MSN TYPE** page - Select **WR ORD**.

7. Select Ordnance Type. **[HE]**

8. On **AIR MISSION SUMMARY** page.

    a. Evaluate/set Ordnance Type (L3).

    b. Evaluate/set target coordinates (L4). **[POINT 2]**

c. Review Fire Control.

d. Evaluate/set **DEST SUB ID**.

e. Evaluate/set Target Description.

f. Evaluate/set Target Activity.

9. Press **SEND** to request mission.

NOTE

At this point the Observer waits for the Shooter to send an **ACCEPTED** message.

SHOOTER: (WR ORDNANCE).

NOTE

This process begins with a **RECEIVED MESSAGE**.

10. Select **IDM/INDEX** switch to access **IDM** Top Menu page.

11. Receive Message.

a. **MSG RCV** page, **ATHS MSG** select, **RVW** button select (will automatically open the **TACFIRE RCVD MSGS** page).

- or -

b. Select **ATHS** button and **INDEX** button to access **IDM** Top Menu page.

12. Select **RCVD MSGS** as required.

13. To review a selected message - Press the corresponding LEFT key.

14. Review/change information on **AIR MISSION SUMMARY** page. Verify Mission Command is **ACCEPT**.

15. Press **SEND**.

NOTE

At this point the Observer waits for the Shooter to send a **READY** message.

SHOOTER: (WR ORDNANCE).

16. Verify Mission Command is **READY**.

17. Shooter will shoot when ready and send a **SHOT** message.

SHOOTER: (WR ORDNANCE).

18. Verify Mission Command is **SHOT** on **AIR MISSION SUMMARY** page.

19. Press **SEND**.

20. Press **SEND**. At this point the Shooter waits for the Observer to send an **EOM** message.

OBSERVER: (WR ORDNANCE).

21. Select **CMD** (R2).

22. Select **EOM**.

23. Press **SEND**.

3A.71.27 AMC TARGET (Air Request – At My Command Target).

OBSERVER: (AMC TARGET).

1. Locate target using aircraft sensors and use **TSD CAQ** as necessary for automatic entry of target coordinates.

2. **ATHS** page (B4) – Select as required.

3. **INDEX** button (T5) - Select as required.

4. Select **AIR MSNS**.

5. On **AIR REQUEST** List page - Select **MISSION 1** on **AIR REQ** List pages 1/3 by pressing **NEW**.

6. On **MSN TYPE** page - Select **AMC TGT**.

7. On **AIR MISSION SUMMARY** page.

a. Change Ordnance Type (L3). **[HE]**

b. Change target coordinates (L4). **[POINT 5]**

c. Review Fire Control.

d. Review/change **DEST SUB ID**.

e. Review/change Target Description. **[BUILDING]**

f. Review/change Target Activity. **[STATIONARY]**

8. Press **SEND** to request mission.

NOTE

At this point the Observer waits for the Shooter to send an **ACCEPTED** message.

SHOOTER: (AMC TARGET).

NOTE

This process begins with a **RECEIVED MESSAGE**.

9. Select **IDM/INDEX** switch to access **IDM** Top Menu page.

10. Receive Message.

    a. **MSG RCV** page, **ATHS MSG** select, **RVW** button select (will automatically open the **TACFIRE RCVD MSGS** page).

    - or -

    b. Select **ATHS** button and **INDEX** button to access **IDM** Top Menu page.

11. Select **RCVD MSGS** as required.

12. To review a selected message - Press the corresponding LEFT key.

13. Review/change information on **AIR MISSION SUMMARY** page. Verify Mission Command is **ACCEPT**.

14. Press **SEND**.

NOTE

At this point the Observer waits for the Shooter to send a **READY** message.

SHOOTER: (AMC TARGET).

15. Verify Mission Command is **READY** on **AIR MISSION SUMMARY** page.

16. Press **SEND**.

NOTE

At this point the Shooter waits for the Observer to send a **FIRE** message.

OBSERVER: (AMC TARGET).

17. Verify Mission Command is **FIRE** on **AIR MISSION SUMMARY** page.

18. Press **SEND**.

NOTE

At this point the Observer waits for the Shooter to send a **SHOT** message.

SHOOTER: (AMC TARGET).

19. Verify Mission Command is **SHOT** on **AIR MISSION SUMMARY** page.

20. Press **SEND**.

21. UPON machine **ACK** receipt - FIRE the ordnance.

NOTE

At this point the Shooter waits for the Observer to send an **EOM** message.

OBSERVER: (AMC TARGET).

22. Select **CMD** (R2).

23. Select **EOM**.

24. Press **SEND**.

3A.71.28 WR TARGET (Air Request - When Ready Target).

OBSERVER: (WR TARGET).

1. Select **IDM/INDEX** switch to access **IDM** Top Menu page.

2. Select **AIR MSNS**.

3. On **AIR REQUEST** List page - Select from Mission 1 through 8 on **AIR REQ** List pages 1/3-3/3 by pressing **NEW**.

4. On **MSN TYPE** page - Select **WR TGT**.

5. On **AIR MISSION SUMMARY** page.

    a. Change Ordnance Type (L3). **[HE]**

    b. Change target coordinates (L4). **[POINT 4]**

    c. Review Fire Control.

    d. Review/change **DEST SUB ID**.

    e. Review/change Target Description. **[AIRCRAFT]**

f. Review/change Target Activity. **[STATIONARY]**

6. Press **SEND** to request mission.

NOTE

At this point the Observer waits for the Shooter to send an **ACCEPTED** message.

SHOOTER: (WR TARGET).

NOTE

This process begins with a **RECEIVED MESSAGE** message.

7. Select **IDM/INDEX** switch to access **IDM** Top Menu page.

8. Select **RCVD MSGS**.

9. To review a selected message - Press the corresponding LEFT key.

10. Review/change information on **AIR MISSION SUMMARY** page. Verify Mission Command is **ACCEPT**.

11. Press **SEND**.

At this point the Observer waits for the Shooter to send a **READY** message.

SHOOTER: (WR TARGET).

12. Verify Mission Command is **READY** on **AIR MISSION SUMMARY** page.

13. Press **SEND**.

NOTE

At this point the Shooter will shoot when ready and send a **SHOT** message.

SHOOTER: (WR TARGET).

14. Verify Mission Command is **SHOT** on **AIR MISSION SUMMARY** page.

15. Press **SEND**.

16. FIRE ordnance once Machine **ACK** received

At this point the Shooter waits for the Observer to send an **EOM** message.

OBSERVER: (WR TARGET).

17. Select **CMD** (R2).

18. Select **EOM**.

19. Press **SEND**.

3A.71.29 ARTILLERY REQUEST (FIRE REQUEST Grid/FR Grid).

NOTE

AFATDS actions are not shown.

1. Locate target using aircraft sensors and use **TSD CAQ** as necessary for automatic entry of target coordinates.

2. **ATHS** page (B4) – Select as required.

3. **INDEX** button (T5) - Select as required.

4. Select **ARTY MSNS** button (L2) to access Artillery Mission pages.

5. Select **NEW** button (R2) or (R3) as desired (will replace any mission in M1 or M2 Respectively).

6. Select **NEW TGT** (L2) as Mission Type.

7. Review/change the Mission Summary page options as required.

   a. Review/change Fire Control page options> (R2) as required. Options include:

      (1) **TGT** (L1) – Enter assigned number e.g. **[AA5025]**, as required.

      (2) **CONT** (L2) – Select/set FIRE CONTROL method as required.

      (3) **PRI** (L3) – Select/set PRIORITY as required.

      (4) **SH/FZ** (L4) – Select/set SHELL/FUZE as required.

      (5) **ROUND OBSERVATION^** (R2) – Select/set Round Observation as required.

(6) **ANG** (R3) – Select/set ANGLE as required.

(7) Press **1/1** (R1) to access Summary page.

b. **TGT>** (R3), review/change Target Description as required.

c. **TGT** Location> (R4), review/change as required, Target Location page options include:

(1) Review/change Target by manual entry.

(2) Review **TGT BRG**.

NOTE

If the altitude data autofill is not present (e.g. no DTED data not available), a four digit operator data entry is required for the altitude field (inclusive of leading zeros) before the entry will be accepted. During testing, an inconsistency has been noted where the same altitude entered at different times required different amounts of leading zeros. The number of leading zeros that the altitude field requires varies from 3 to 6 and does not appear to have a definite pattern.

(3) Review **ALT**.

(4) Review/change **DEG/MILS**.

(5) Review/Change **SQ**.

(6) Press **1/1** (R1) to access Mission Summary page.

d. Verify/Set correct Destination **SUB** address (L1).

8. Press **SEND** (R4) to request mission.

9. Status (L3) will change to **ACPTD** when **MTO** is received. Review **MTO** (R2) as needed.

NOTE

If a check fire is required to be issued during the progress of the mission send the check fire order by voice, the AFATDS has a known issue with the 2.9I TACFIRE check fire message.

10. Status (L3) will change to **SHOT** when fired.

11. Status (L3) will change to **SPLSH** for impact warning (if requested).

12. Status (L3) will change to **RDCPL** for rounds complete (as appropriate).

13. To end mission w/disposition, casualties as follows:

a. Select (L2), then select **EOM RAT**.

b. Select **DISPO/CAS** (L4), then select and set as required.

c. Select **CAS** (L2) and set as required.

14. Press **SEND**.

3A.71.30 ARTILLERY REQUEST (Time On Target).

NOTE

AFATDS actions are not shown. All times are Zulu Time.

1. Locate target using aircraft sensors and use **TSD CAQ** as necessary for automatic entry of target coordinates.

2. **ATHS** page (B4) – Select as required.

3. **INDEX** button (T5) - Select as required.

4. Select **ARTY MSNS** (L2) to access Artillery Mission pages.

5. Select **NEW** button (R2) or (R3) as desired (will replace replace any mission in M1 or M2 Respectively).

6. Select **NEW TGT** (L2) as Mission Type.

7. Review/change the Mission Summary page as required for **TOT** options:

a. Select **<FIRE CONTROL** button (L2) - and select the **TOT** button (T2). The page will mode back and the **<FIRE CONTROL** will also display **TOT**.

b. Enter Time On Target as required e.g., **[ZULU + 5 MIN]**.

c. Review/change Target Description (R3).

d. Review/change Target Location page (R4).

e. Verify/set Destination **SUB L1 ID.**

f. Press **SEND** to transmit TOT Freetext Message.

8. Review/change the Mission Summary page as required (L2).

a. On Mission Command page select - **RQST**.

b. Review/change Fire Control.

(1) **CONT** – Select **TOT**.

(2) **PRI** – Select **[NORMAL]**.

(3) **SH/FZ** – Select **[NO PREF]**.

(4) R2 – Select Round Observation **[OK]**.

(5) **ANG** – Select **[LO]**.

(6) Press **1/1** (R1) to access Summary page.

9. Press **SEND** to request mission.

10. Status (L3) will change to **ACPTD** when **MTO** is received. Review **MTO** (R2) as needed.

11. Status (L3) will change to **SHOT** when fired.

12. Status (L3) will change to **SPLSH** for impact warning (if requested).

13. Status (L3) will change to **RDCPL** for rounds complete (as appropriate).

3A.71.31 FIRE MISSION REQUEST (FR with AUTO CALC Shift).

1. Locate target using aircraft sensors and use **TSD CAQ** as necessary for automatic entry of target coordinates.

2. **ATHS** page (B4) – Select as required.

3. **INDEX** button (T5) - Select as required.

4. Select **ARTY MSNS** (L2) to access Artillery Mission pages.

5. Select **NEW** button (R2) or (R3) as desired (will replace replace any mission in M1 or M2 Respectively).

6. Select **NEW TGT** (L2) as Mission Type.

7. Review/change the Mission Summary page as required.

a. Review/change Fire Control by pressing (R2).

(1) **TGT** – Enter assigned number (if required).

(2) **CONT** – Verify/Set as required.

(3) **PRI** – Verify/Set as required.

(4) **SH/FZ** – Verify/Set as required.

(5) (R2) – Verify/Set Round Observation as required **[OK]**.

(6) **ANG** (R3)– Select as required **[LO]**.

(7) Press **1/1** (R1) to access Summary page.

b. Review/change Target Description as required.

c. Review/change Target Location page pressing (R4). On Target Location page.

(1) Review/change Target Location.

(2) Review/change **TGT BRG**.

NOTE

If the altitude data autofill is not present (e.g. no DTED data not available), a four digit operator data entry is required for the altitude field (inclusive of leading zeros) before the entry will be accepted. During testing, an inconsistency has been noted where the same altitude entered at different times required different amounts of leading zeros. The number of leading zeros that the altitude field requires varies from 3 to 6 and does not appear to have a definite pattern.

(3) Review/change **ALT**.

(4) Review/change **DEG/MILS**.

(5) Review/change **SQ**.

(6) Press **1/1** (R1) to access Mission Summary page.

d. Verify Destination **SUB**.

8. Press **SEND** to request mission.

9. Status (L3) will change to **ACPTD** when **MTO** is received. Review **MTO** (R2) as needed.

10. Status (L3) will change to **SHOT** when fired.

11. Status (L3) will change to **SPLSH** for impact warning (if requested).

12. Status (L3) will change to **RDCPL** for rounds complete (as appropriate).

13. To end mission, select (L2), then select **EOM RAT** and press **SEND**.

14. (R4) will change to **##-KNPT** when the known point target number is received.

NOTE

Record the Known Point target number.

15. To conduct the SHIFT mission, select **IDM/INDEX** switch to access **IDM** Top Menu page.

16. Select **ARTY MSNS** to access Artillery Mission pages.

17. Select **NEW** next to mission to be replaced (M1 or M2).

18. Select **KNPT TGT** as Mission Type.

19. Enter two-digit **KNPT NO**.

20. Select Target Type. **[ARMOR 10]**

21. Review/change The following on the Mission Summary page.

a. Shift (L5).

b. Shift (L1)– Verify/Set **SHIFT CALC** for automatically performing calculations using the laser for the center of the rounds burst or perform MAN adjustment. Type C in KU and press enter to display the **SHIFT** summary page for an automatic adjustment.

c. With the **SHIFT CALC** summary page displayed, note the **TGT** grid originally sent to the FDC is present and lase the center of the rounds burst. The **RND** data field should now have the rounds impact grid displayed.

d. Review/change Fire Control by pressing (R2).

e. Review/change Fire Control.

(1) **CONT** – Select/Set as required. **[ADJ FIRE]**

(2) **PRI** – Select. **[NORMAL]**

(3) **SH/FZ** – Select. **[NO PREF]**

(4) (R2) – Select Round Observation. **[OK]**

(5) **ANG** – Select. **[LO]**

(6) Press **1/1** (R1) to access Summary page.

f. Verify Destination **SUB ID**.

22. Press **SEND** to request mission.

23. Status (L3) will change to **ACPTD** when **MTO** is received. Review **MTO** (R2) as needed.

24. Status (L3) will change to **SHOT** when fired.

25. Status (L3) will change to **SPLSH** for impact warning (if requested).

26. Status (L3) will change to **RDCPL** for rounds complete (as appropriate).

27. To end mission w/disposition, casualties as follows:

    a. Select/set (L2), then select **EOM**.

    b. Select/set **DISPO/CAS** (L4) as required.

    c. Select/set **CAS** (L2) as required.

28. Press **SEND**.

3A.71.32 ARTILLERY REQUEST (FR Grid with MAN Shift).

NOTE

AFATDS actions are not shown.

1. Locate target using aircraft sensors and use **TSD CAQ** as necessary for automatic entry of target coordinates.

2. **ATHS** page (B4) – Select as required.

3. **INDEX** button (T5) - Select as required.

4. Select **NEW** button (R2) or (R3) as desired (will replace replace any mission in M1 or M2 Respectively).

5. Select **NEW TGT** as Mission Type.

6. Review/change the following on the Mission Summary page.

    a. Review/change Fire Control by pressing (R2). **[FFE]** as required.

    b. On Fire Control page.

        (1) **CONT** – Select/Set.

        (2) **PRI** – Select/Set.

        (3) **SH/FZ** – Select/Set.

        (4) (R2) – Select Round Observation. **[OK]**

        (5) **ANG** – Select/Set.

        (6) Press **1/1** (R1) to access Summary page.

    c. Review/change Target Description e.g. **[ARMOR 1]**.

    d. Review/change Target Location page by pressing R4.

    e. On Target Location page.

        (1) UPD GRD or manual entry.

        (2) Review/change **TGT BRG**.

        (3) Review/change **ALT**.

        (4) Review/change **DEG/MILS**.

        (5) Review/change **SQ**.

        (6) Press **1/1** (R1) to access Mission Summary page.

    f. Verify Destination **SUB ID**.

7. Press **SEND** to request mission.

8. Status (L3) will change to **ACPTD** when **MTO** is received. Review **MTO** (R2) as needed.

9. Status (L3) will change to **SHOT** when fired.

10. Status (L3) will change to **SPLSH** for impact warning (if requested).

11. Status (L3) will change to **RDCPL** for rounds complete (as appropriate).

12. Select **SHIFT.**

13. Press (R1) For Manual.

14. Enter **DROP=XX** and/or **RIGHT=XX** as required.

15. Select (R1) and will return to Summary page.

16. Review the Mission Summary page.

17. Press **SEND** to request shifted fire.

18. Status (L3) will change to **SHOT** when fired.

19. Status (L3) will change to **SPLSH** (if requested).

20. Status (L3) will change to **RDCPL** for rounds complete (as appropriate).

21. To end mission w/ disposition, casualties as follows:

    a. Select (L2), then select **EOM RAT**.

    b. Select **DISPO/CAS** (L4), then select.

    c. Select **CAS** (L2), then select.

22. Select **SHIFT**, Press (R1).

23. Enter **DROP=XX**, **RIGHT=XX** as required.

24. Press **SEND.**

3A.71.33 FIRE MISSION REQUEST, END OF MISSION RECORD AS TARGET SEND and SUBSEQUENT FR QUICK.

1. Locate target using aircraft sensors and use **TSD CAQ** as necessary for automatic entry of target coordinates.

2. **ATHS** page (B4) – Select as required.

3. **INDEX** button (T5) - Select as required.

4. Select **ARTY MSNS** to access Artillery Mission pages.

5. Select **NEW** button (R2) or (R3) as desired (will replace replace any mission in M1 or M2 Respectively). Select **NEW** next to mission to be replaced (M1).

6. Select **NEW TGT** as Mission Type.

7. Review/change the following on the Mission Summary page.

    a. Review/change Fire Control by pressing (R2). **[FFE]**

    b. Review/change Fire Control.

        (1) **TGT** – Enter assigned number (if required).

        (2) **CONT** – Select/Set as required.

        (3) **PRI** – Select/Set. **[NORMAL]**

        (4) **SH/FZ** – Select/Set. **[NO PREF]**

        (5) R2 – Select Round Observation. **[OK]**

        (6) **ANG** – Select/Set. **[LO]**

        (7) Press **1/1** (R1) to access Summary page.

    c. Review/change Target Description.

    d. Change Target Location page by pressing (R4).

    e. On Target Location Page.

        (1) Review/change Target Location as required.

        (2) Review/change **TGT BRG**.

NOTE

If the altitude data autofill is not present (e.g. no DTED data not available), a four digit operator data entry is required for the altitude field (inclusive of leading zeros) before the entry will be accepted. During testing, an inconsistency has been noted where the same altitude entered at different times required different amounts of leading zeros. The number of leading zeros that the altitude field requires varies from 3 to 6 and does not appear to have a definite pattern.

        (3) Review/change **ALT**.

        (4) Review/change **DEG/MILS**.

        (5) Review/change **SQ**.

(6) Press **1/1** (R1) to access Mission Summary page.

f. Verify Destination **SUB**.

8. Press **SEND** to request mission.

9. Status (L3) will change to **ACPTD** when **MTO** is received. Review **MTO** (R2) as needed.

10. Status (L3) will change to **SHOT** when fired.

11. Status (L3) will change to **SPLSH** for impact warning (if requested).

12. Status (L3) will change to **RDCPL** for rounds complete (as appropriate).

13. To end mission, select (L2), then select **EOM RAT** and press **SEND**.

NOTE

The Target Number will retained by artillery for later recall. [**RECORD TARGET #]**

14. To Run Second Mission Select **IDM/INDEX** switch to access I**DM** Top Menu page.

15. Select **ARTY MSNS** to access Artillery Mission pages.

16. Select **NEW** next to mission to be replaced (M1 or M2).

17. Select **QUICK** as Mission Type.

18. Select Target Position as **TGT NO**.

19. Enter **TGT NO** recorded above.

20. Review the Mission Summary page.

21. Press **SEND** to request mission.

22. Status (L3) will change to **ACPTD** when **MTO** is received. Review **MTO** (R2) as needed.

23. Status (L3) will change to **SHOT** when fired.

24. Status (L3) will change to **SPLSH** (if requested).

25. Status (L3) will change to **RDCPL** for rounds complete (as appropriate).

26. To end mission w/disposition, casualties as follows:

    a. Select (L2), then select **EOM**.

    b. Select **DISPO/CAS** (L4), then select.

    c. Select **CAS** (L2), then select.

27. Press **SEND**.

3A.71.34 Artillery Intelligence Message (ATI GRID).

1. Locate target using aircraft sensors and use **TSD CAQ** as necessary for automatic entry of target coordinates.

2. **ATHS** page (B4) – Select as required.

3. **INDEX** button (T5) - Select as required.

4. Select **REPORTS**.

5. Select **ATI**.

6. Enter **DEST**.

7. Select **REL** option.

8. Select Target Type as required.

9. Select Target Strength as required.

10. Change Target Location page by pressing (R4).

    a. On Target Location page.

        (1) Target Location Review/Set as required.

NOTE

- If the altitude data autofill is not present (e.g. no DTED data not available), a four digit operator data entry is required for the altitude field (inclusive of leading zeros) before the entry will be accepted. During testing, an inconsistency has been noted where the same altitude entered at different times required different amounts of leading zeros. The number of leading zeros that the altitude field requires varies from 3 to 6 and does not appear to have a definite pattern.

(2) Change **ALT**.

(3) Review **SQ**.

b. Press **1/1** (R1) to access ATI Summary page.

11. Review/change Summary page.

12. Press **SEND**.

3A.71.35 Fire Mission (Copperhead Final Protective Fire [CPHD FPF]).

1. Locate target using aircraft sensors and use **TSD CAQ** as necessary for automatic entry of target coordinates.
2. **ATHS** page (B4) – Select as required.
3. **INDEX** button (T5) - Select as required.
4. Select **ARTY MSNS** to access Artillery Mission pages.
5. Select **NEW** button (R2) or (R3) as desired (will replace replace any mission in M1 or M2 Respectively). Select **NEW** next to mission to be replaced (M1).
6. Select **REQ PPLN** to choose preplan mode.
7. Select **CPHD**.
8. **ARTY** Mission Summary page appears with **MSN1** label.
9. Press **SEND**.
10. An MTO from FDC that changes status (L3) to **ACPTD** indicates PPLN request is accepted.
11. Select **IDM/INDEX** switch to access **IDM** Top Menu page.
12. Select **ARTY MSNS** to access Artillery Mission pages.
13. Select **PPLN LIST**.
14. Press P1 **NEW** to designate the desired preplanned mission number.
15. Press **M1 ACPTD PPLN** or **M2** to insert the accepted PPLN request into the PPLN List. (The preplanned mission is now on file; IDM may be used for other purposes and mission executed later.)

To execute a preplanned mission:

16. Select **IDM** switch to access **IDM INDEX** page, Press (L2) (**ARTY MSNS**) to access the ARTILLERY.
17. Select **IDM/INDEX** switch to access **IDM** Top Menu page.
18. Select **ARTY MSNS** to access Artillery Mission pages.
19. Select **PPLN LIST**.
20. Select **P1** as desired.
21. Press **SEND**.
22. Status (L3) will change to **SHOT** when fired.
23. Status (L3) will change to **DSGNT** (if sent).
24. Perform designate operation.
25. Status (L3) will change to **RDCPL** for rounds complete.
26. To end mission, select (L2), then select **END FPF** and press **SEND**.

3A.71.36 Fire Mission (Copperhead Fire Request Grid [CPHD FR] Grid).

1. Locate target using aircraft sensors and use **TSD CAQ** as necessary for automatic entry of target coordinates.

2. **ATHS** page (B4) – Select as required.

3. **INDEX** button (T5) - Select as required.

4. Select **ARTY MSNS** to access Artillery Mission pages.

5. Select **NEW** button (R2) or (R3) as desired (will replace replace any mission in M1 or M2 Respectively). Select **NE**W next to mission to be replaced (M1).

6. Select **CPHD** as Mission Type.

7. Select Target Position as **NEW TGT**.

8. Review/change the following on the Mission Summary page.

   a. Review/change Fire Control by pressing (R2). **[AMC FFE]**

   b. Review/change Fire Control.

      (1) **TGT** – Enter assigned number (if required).

      (2) **PRI** – [**URGENT**].

      (3) **SH/FZ** – Verify/Select **CPHD**.

      (4) (R2) – Select Round Observation **[OK]**.

      (5) **ANG** – Select **[LO]**.

      (6) Press **1/1** (R1) to access Summary page.

   c. Review/change Target Description as required **[ARMOR]**.

   d. Review/change Target Location page by pressing (R4).

   e. On Target Location page.

      (1) Review/change Target Location.

      (2) Review/change **TGT BRG**.

NOTE

If the altitude data autofill is not present (e.g. no DTED data not available), a four digit operator data entry is required for the altitude field (inclusive of leading zeros) before the entry will be accepted. During testing, an inconsistency has been noted where the same altitude entered at different times required different amounts of leading zeros. The number of leading zeros that the altitude field requires varies from 3 to 6 and does not appear to have a definite pattern.

      (3) Review/change **ALT**.

      (4) Review/change **DEG/MILS**.

      (5) Review/change **SQ**.

   f. Press **1/1** (R1) to access Mission Summary page.

   g. Verify Destination **SUB**.

9. Press **SEND** to request mission.

10. Status (L3) will change to **ACPTD** when **MTO** is received. Review **MTO** (R2) as needed.

NOTE

The Observer is awaiting a **READY** command/status from the FSE.

11. Status (L3) will change to **READY**.

12. Verify the Mission Command is **FIRE**.

13. Press **SEND** to fire the mission.

14. Status (L3) will change to **ACPTD** when **MTO** is received. Review **MTO** (R2) as needed.

NOTE

The Observer is awaiting a **READY** command/status from the FSE.

15. Status (L3) will change to **READY**.

16. Verify the Mission Command is **FIRE**.

17. Press **SEND** to fire the mission.

18. Status (L3) will change to **SHOT** when fired.

19. Status (L3) will change to **DSGNT** (if sent).

20. Perform designate operation.

21. Status (L3) will change to **RDCPL** for rounds complete.

22. To end mission w/disposition, casualties as follows:

    a. Select (L2), then select **EOM**.

    b. Select **DISPO/CAS** (L4), then select. **[BURN]**.

    c. Select **CAS** (L2), then select **[10]**.

23. Press **SEND**.

3A.71.37 Aircraft Message PP REQUEST/REPLY.

1. **ATHS** page (B4) – Select as required.

2. **INDEX** button (T5) - Select as required.

3. Select **REPORTS**.

4. Select **REQUEST**.

5. Select **POS UPDT**.

6. Enter **TEAM SUB ID** for **DEST**.

7. Select **SUB NET** entry, if shown.

8. Press **SEND**.

9. Press corresponding LEFT key to toggle between subscriber **MGRS UTM** coordinates and range/bearing (kilometer and degrees) from OWNSHIP.

NOTE

A few seconds may be required before response is received and displayed.

3A.71.38 Aircraft MOVEMENT Message.

1. **ATHS** page (B4) – Select as required.

2. **INDEX** button (T5) - Select as required.

3. Select **MOVEMENT** (L3) from **INDEX** page.

4. Select Movement Type as required e.g. **[MY POSITION]**.

    a. If **MY POSITION**, then **OWN** Present Position coordinates and text **"MY POSITION"** will be message text.

5. **DEST** – Enter.

6. Review/change Summary page.

7. Press **SEND**.

8. Observer reviews received message.

3A.71.39 Aircraft Message SIT/STAT REPORT.

Purpose: To report the operator's own situation and activity (mode status) when conducting AIR mode baud rate operations or for sending the platform's present position when conducting TACFIRE mode baud rate operations with the artillery.

NOTE

- This message has a different form in TACFIRE (TFR) mode nets than in AIR mode nets due to the differing requirements of artillery and air operations.
- The grid zone character is also sent in the TFR form of this message. In order for it to be properly defined, the **ARTILLERY TARGET POSITION** page must have been filled in either as part of an Artillery Report (or Artillery Mission). The Report (or Mission) did not have to be transmitted.

1. **ATHS** page (B4) – Select as required.

2. **INDEX** button (T5) – Select as required.

3. **REPORTS** button (L4) – Select.

4. **SIT/STATUS** button (L2) – Select.

5. **MY ACTIVITY** mode – Select as required.

- L2 **HOLDING** (holding my position).
- L3 **CONT MSN** (continuing mission).
- L4 **OBS TGT** (observing the target).
- R2 **ENGAGING** (engaging in battle).

Selecting an activity mode will command the SITUATION REPORT SUMMARY format to display, the ***>DEST:** button L1 will be filled with the TM ID (if contained in the **ORIG ID** page), and the KU will be active with **“ATHS:”** and flashing cursor displayed.

6. KU (ATHS:) – Enter destination subscriber/ member ID as required.

7. **DEST (*)** button (L1) – Validate correct **DEST ID** displayed.

NOTE

- Assuming that a weapons initialization check has been accomplished, the AH-64D sends the IDM the pertinent MUX data required to auto-fill all the SITREP SUMMARY data options (negates any requirement for operator editing).
- The SITREP SUMMARY option format was designed for aircraft that do not support the IDM SITREP auto-fill capability.

The SITREP SUMMARY page data considerations:

a. Fuel – Do not overwrite the 1553 auto-fill value.

b. Activity - Review/change as required (the activity is set by the operator prior to the display of the SITREP SUMMARY format. The operator may edit the activity if a change in activity occurs prior to sending the message).

c. Position - Do not overwrite the 1553 auto-fill value.

d. **WEAPONS STATUS** Page – Do not overwrite the 1553 auto-fill values, all data is derived through the 1553 databus. Selecting the page will display the following auto-fill options:

[COD1 = XXXX] (L2), MSL PRI CHAN laser code set during WPNS INIT checks.

[XXXX = COD2] (R2), MSL ALT CHAN laser code set during WPNS INIT checks.

[ATGM = XX] (L3), Hellfire Missiles that are detected on the bus.

[A/A = XX] Air to Air missiles (growth) detected on the bus.

[RKTS = XX] 2.75 inch rockets detected on the bus.

[AMMO = XXXX] 30mm round count (detected LMP or WPN load page setting).

8. **SEND** button (R5) - Select.
9. **XMT#/ACK** response (R1) – Observe.

3A.71.40 Aircraft Message SPOT REPORT.

NOTE

- The only time that a coordinate is not auto-filled in the spot report UTM grid location > data entry field is when there has been no CTLM or TGT CAQ since the aircraft last power-up.
- The SPOT REPORT target location should normally be input using the TSD CAQ function when there is a UTM grid already displayed.

1. **ATHS** page (B4) – Select as required.
2. **INDEX** button (T5) – Select as required.
3. **REPORTS** button (L4) – Select.
4. **SPOT** button (L3) – Select (KU “ATHS:” is active upon display of SPOT REPORT summary).
5. KU (ATHS:) – Enter destination subscriber/ member ID as required.

6. **DEST (*)** button (L1) – Validate correct **DEST ID** displayed.

7. **^OBS** selection button (L3) – Validate/Set (toggle) as required.

- **ENGAG**
- **OBSRV**
- **CONT**

8. **TARGET DESC>** data button (R3) – Validate or select and set as required - Selection will display the **TARGET DESC** control format options as follows:

   Target Type (up to 3). **[ARMOUR, ASSEMBLY(TROOPS), CENTER (DIVISION)]**

   On SPOT TARGET DESC page, select Target Strength (up to 3). **[10, 20,50]**

   Select Target Activity. (Applies to all Targets in report.) **[MOVING SE]**

9. Press **1/1** (R1) to access **SPOT RPT SUMMARY** page.

10. Press (R4) to access **AIR TGT POSN** page.

11. Review/change Target Position using **UPD GRD** or manual entry.

12. Press (R1). **DEST** – Enter.

13. Review/change **OBS ACT** - As required.

14. **DEST** (L1) - Select.

15. KU (ATHS:) – Enter destination member/subscriber ID.

16. Press **SEND**.

3A.71.41 Aircraft BDA REPORT Message.

1. **ATHS** page (B4) – Select as required.

2. **INDEX** button (T5) – Select as required.

3. Select **REPORTS**.

4. Select **BDA**.

5. **DEST** – Enter.

6. Manually enter data for **BDA** on **DETAIL** page.

   [ARMOR = As required.**]**

   [PERSONAL = As required.**]**

   [VEHICLE = As required.**]**

   [ACFT = As required.**]**

7. Review/change Summary page.

8. Press **SEND**.

3A.71.42 Aircraft Negative SPOT REPORT.

1. **ATHS** page (B4) – Select as required.

2. **INDEX** button (T5) – Select as required.

3. Select **REPORTS**.

4. Select **NEG SPOT**.

5. **DEST** – Enter.

6. Review/change **OBS ACT** - As required.

7. Press (R4) to change location position using manual entry.

8. Press (R1) to return.

9. Press (R3) to access **NEG SPOT REPORT DETAIL** page.

10. Enter freetext. **[NOTHING BUT SAND]**

11. Press (R1) to return.

12. Press **SEND**.

13. Observer reviews received message.

3A.71.43 Aircraft MAYDAY Message.

1. Select **IDM/INDEX** switch to access **IDM** Top Menu page.
2. Select **MSGS/FTXT**.
3. Select **MAYDAY**.
4. **DEST** – Enter.
5. Review/change location.
6. Press **SEND**.
7. Observer reviews received message.

3A.71.44 Aircraft MSGS/FTX (FREE TEXT, BDA, CAS, CHECK FIRE, CANCKF).

System Connectivity (FREE TEXT) from shooter:

1. **ATHS** page (B4) – Select as required.
2. **INDEX** button (T5) – Select as required.
3. Select **MSGS/FTXT**.
4. Select **FREE TEXT**.
5. Enter **DEST** sub.
6. Message Type – Select **DATA**.
7. (L3) key – Select and enter desired free text message - As required.
8. Press **SEND**.
9. Observer reviews received message.

3A.71.45 Aircraft BDA REPORT.

1. **ATHS** page (B4) – Select as required.
2. **INDEX** button (T5) – Select as required.
3. Select **REPORTS**.
4. Select **BDA**.
5. **DEST** – Enter.
6. Enter Report Position - As required.
7. Manually enter data for **BDA** on **DETAIL** page.
   a. **ARMOR** = As required.
   b. **PERS** = As required.
   c. **VEH** = As required.
   d. **ACFT** = As required.
8. Review/change Summary page.
9. Press **SEND**.
10. Observer reviews received message.

3A.71.46 Aircraft CAS REPORT.

1. **ATHS** page (B4) – Select as required.
2. **INDEX** button (T5) – Select as required.
3. Select **REPORTS**.
4. Select **CAS**.
5. **DEST** – Enter.
6. Manually enter data for **CAS** on **DETAIL** page.
   a. **ARMOR** = As required.
   b. **PERS** = As required.
   c. **VEH** = As required.
   d. **ACFT** = As required.
7. Review/change Summary page.
8. Press **SEND**.
9. Observer reviews received message.

3A.71.47 Aircraft CHECK FIRE Message.

1. **ATHS** page (B4) – Select as required.
2. **INDEX** button (T5) – Select as required.
3. Select **MSGS/FTXT**.
4. Select **CHECK FIRE**.
5. Enter **DEST** sub.
6. Press **SEND**.
7. Observer reviews received message.

3A.71.48 Download (Transfer) Current Com Data From Source Aircraft To Target Destination DTC.

NOTE

- **SAVE** status is written to the topmost mounted (slot 1-4) Mission DTC loaded in the DTU upon a change to the ownship's COM data or after one minute of elapsed time following the mounting of the DTC.
- The target DTC has to be mounted as the topmost MSN DTC in the source aircraft's DTU.
- Current MSN files will also be written to the DTC.
- This procedure is performed on the ground with internal or external power supplied.

When an aircrew has a requirement to exchange current COM data via the DTC, the Pilot (P) of the source aircraft (data download) will perform the following steps.

1. **DTU** or **DMS SHUTDOWN** page - Select and display.
2. **DTU** mode button - Select **STBY** as required.
3. DTU door - Open.
4. Target destination mission DTC - Mount DTC in the source aircraft's topmost DTU slot (remove any pre-existing DTC in the largest slot, as required).

NOTE

The ownship's DTC will write the current **COM SAVE** status, along with **MSN SAVE** status to the topmost MSN DTS card after DTC card has been properly mounted (**DTU OPER**) and one minute of time has elapsed.

5. DTU door - Latch and note **DTU** button mode from **STBY** to **OPER**, and then allow sixty seconds to elapse.
6. DTU mode button - Select **STBY** and wait for **OIP** to complete.
7. DTU door - Open.
8. Target DTC - Remove.

NOTE

The DTU **COM SAVE** status transfer process may be reinitiated with other DTC's as required.

3A.71.49 Upload (Transfer) Current Com Data To Target Destination Aircraft From DTC.

NOTE

- The originator (source) data contained on an updated target destination DTC is a reflection of the originating (source) aircraft's **SAVE** status data.
- The target DTC has to be mounted as the topmost MSN DTC in the source aircraft's DTU.
- The Pilot (P) of an aircraft (data exchange target aircraft) desiring to update the COM configuration to a unit's current COM configuration has no more than one minute to select **THRU-FLT** following the mounting of the DTU containing updated data.
- If a **THRU-FLT** is not initiated prior to one minute after mounting the DTC, the DTC will be overwritten with that aircraft's own **SAVE** status.
- Following a **THRU-FLT** data load of **SAVE** status data retrieved from a data exchange source aircraft, aircrews will need to edit the originator data using either the **ORIG DIR REPLACE** button or manually editing the **ORIG ID** data.
- Aircrews using the **ORIG DIR**'s **SEARCH** and **REPLACE** functions will significantly reduce the potential for data input error and reduce the time that would otherwise be required to manually edit originator data.

When an aircrew has a requirement to exchange current COM data via the DTC, the Pilot (P) of the source aircraft (data uploading) will perform the following steps.

1. **DMS DTU** page - Select and display.
2. DTU mode button - Select **STBY** as required.
3. DTU door - Open.
4. Updated target DTC - Mount DTC in the source aircraft's topmost serviceable DTU slot (remove any pre-existing DTC in the target slot as required).

5. DTU door - Latch and note **DTU** button mode from **STBY** to **OPER**.

NOTE

The **DMS DTU** page may be selected and displayed simultaneously on the opposite MPD.

6. **THRU FLT** button - Select and note load status prior to one minute of elapsed time.

7. **ORIG ID** page data - Edit, using the **ORIG DIR** page **REPLACE** button or perform manual editing as required.

Section III. NAVIGATION SUBSYSTEM

3A.72 INTRODUCTION

This section describes crew interface requirements for management of the navigation subsystem (fig. 3A-90). The navigation subsystem provides aircraft heading, attitude, Present Position (PP), velocity (relative to ground and air), radar and barometric altitude, and distance information for piloting and navigating. The navigation subsystem consists of the following major components:

1. Embedded Global Positioning System Inertial Navigation System (EGI).
2. Doppler Radar Velocity Sensor (DRVS).
3. Air Data System (ADS).
4. Radar Altimeter (RAD ALT).
5. Automatic Direction Finder (ADF).
6. High Integrated Air Data Computer (HIADC).
7. Flight Management Computer (FMC).

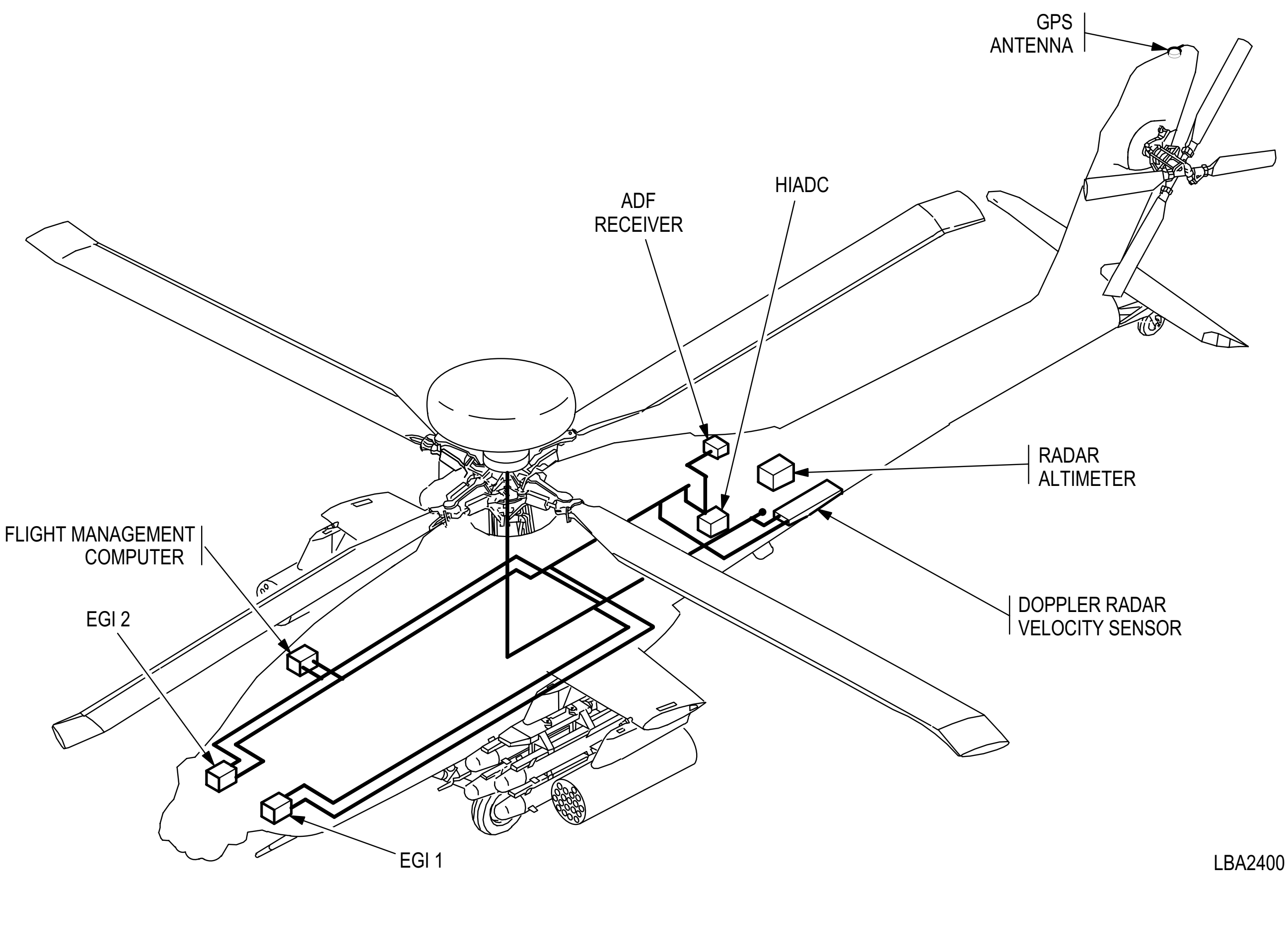

Figure 3A-90. Navigation Subsystem

3A.73 EMBEDDED GLOBAL POSITIONING SYSTEM INERTIAL NAVIGATION SYSTEM (EGI)

The aircraft has two EGIs which use internal accelerometers, rate gyro measurements, and external sensor measurements to estimate the aircraft state. Only one EGI provides aircraft state information to aircraft systems while the second EGI is for backup. The external sensor measurements include range and range rate from the GPS, velocity from the DRVS, barometric altitude, and manual position updates from the system processor (SP). Incorporated within the EGI is an Inertial Measurement Unit (IMU) and the processing functions for performing the inertial navigation computations, GPS navigation solutions, receiver management, and Kalman filter estimates to support all aircraft and weapon systems requirements.

The data derived from the EGI includes :

- Acceleration
- Angular rate
- Attitude
- Heading
- Velocity
- Position
- Position Error Estimate

a. System Description. The EGI is a velocity aided, strapdown, ring laser gyro based inertial unit. The EGI unit also houses the 5-channel GPS receiver.

b. Operation. Initialization and alignment of the EGI is automatically controlled by the primary System Processor (SP) upon generator power up of the aircraft. Upon power up, the SP provides the boresight numbers stored in non-volatile memory, for each EGI and doppler, and the last NAV mode stored (i.e. Land or Sea) at power down of the aircraft. If no boresight numbers have been stored, the NAV system will provide an advisory on the EUFD, prompting the aircrew for input for the respective EGI and doppler boresight numbers.

Once the EGIs have been provided the boresight numbers and the NAV mode, the EGIs will determine the aircraft attitude. Upon finding attitude (i.e. attitude displayed on the **FLT** page), the NAV system will provide the EGIs with position information from the primary EGIs GPS (if tracking satellites) or the NAV system’s last stored position at power down.

If no GPS or last stored present position is available, the NAV system will provide an advisory prompt on the EUFD directing the crew to enter a present position. If a GPS position is given to the EGIs to align to, the EGIs initial position confidence on the TSD **UTIL** page will read approximately .031 km. If a stored position is given to the EGIs to align to, the EGI initial position confidence on the TSD **UTIL** page will read approximately 9.00 km. When a position is manually entered to the EGIs to align to on the ground, the EGI initial position confidence on the TSD **UTIL** page will read approximately .050 km.

Upon the EGIs being given a present position, the NAV system will provide an alignment command to the EGIs. The EGIs alignment time is approximately 4 minutes on the ground. When an in-flight alignment is performed by an INU reset the alignment time, with GPS tracking satellites with crypto keys verified and doppler velocities available, is approximately 35 seconds. If an in-flight alignment is performed with doppler velocity aiding only (no GPS), the alignment time is approximately 6 minutes.

The heading tape symbology is displayed and TSD Map Frozen Cue is removed when alignment of the primary EGI is complete. The reaching of alignment of the secondary EGI is noted by the removal of the inhibit selection bar beside the primary **INU** selection on the **TSD UTIL** page. There is no effect on the NAV system accuracy if the engines are started, or if the main rotor is turning during alignment.

3A.73.1 Global Positioning System (GPS).

a. System Description. The GPS receiver installed in each EGI is a 5-channel receiver. The receiver is capable of operating in either C/A code or encrypted P/Y code. The Group User Variable (GUV) is the normal encryption key used. The GUV key is loaded into the EGI using a fill device. When keyed the GPS receiver will automatically use anti-spoof/jam capabilities when they are in use. The EGI keying connector is located in the aft avionics bay on the multifill port panel. The EGI will retain the key through power ON/OFF/ON cycles. Because of safeguards built into the EGI, it is not considered classified when keyed. The antenna for the GPS receiver is located on the top of the vertical stabilizer.

NOTE

The GPS signal is vulnerable to jamming and spoofing operations. Under these conditions some or all satellites may be unboxed and/or aircraft position, airspeed and/or position confidence may be excessively high or changing quickly.

b. Operation. The operation of the GPS receiver is entirely automatic. The GPS receiver is powered when the EGI is powered. If the GPS is keyed, it may take as long as 12 minutes to verify the key with the satellites. The GPS provides range and range rate information to the EGI as well as position and time information to the System Processor (SP). When the GPS has tracked the first satellite, it will update the date and time to the Navigation System. There are no specific operator actions that may be taken with the GPS system.

c. Data Transfer Unit (DTU). The DTU is used to load mission data, digital maps, and images into the aircraft. The data is transferred by the DTU from the Data Transfer Card (DTC). The DTC is programmed using the Aviation Mission Planning System (AMPS). The AMPS writes the coordinate files for waypoints, control measures, hazards, targets, threats, and routes with their associated waypoints. The NAV mode and present position for the EGI's can be loaded from the DTC. Whenever the pilot or CPG makes changes to any of the waypoints or routes, the SP will automatically update the DTC with those changes. The SP will preserve those changes in the event of an electrical power transient.

3A.73.2 Map Datums. Map datums are mathematical models of the Earth used to calculate the coordinates on maps and charts. Currently, many datums are used throughout the world to produce maps. The standard for US Forces is World Geodetic System 1984 (WGS 84). However, many US Military Grid Reference System (MGRS) and foreign maps are still based on other datums. Not correcting for different datums can cause significant errors. The coordinates for a point on the Earth's surface in one datum will not match the coordinates from another datum for the same point. The Navigation System requires that the datum be entered with the coordinate data. If it is not entered, it will default to the present position datum. The datum included with each set of coordinate data allows the Navigation System to calculate the compensations for different datums. The datum used is identified by a two digit number. Table 3A-6 lists all of the datums that may be used with the Navigation System.

Table 3A-6. Datum Names and Codes

Datum Name/Description	Datum Code Used By Navigation System
Adindan	01
ARC 1950	02
Australian 66	03
Bukit Rimpah: Indonesia	04
Camp Area Astro	05
Djarkarta: Indonesia	06
European 1950	07
Geodetic Datum 1949	08
Ghana	09
Guam 1963	10
Gunung Segara: Indonesia	11
Gunung Serindung: Indonesia	12
Herat North	13
Hjorsey	14
Hu-Tzu-Shan	15
Indian: Mean Value For Thailand And Viet-Nam	16
Ireland 1965	17
Kertau: West Malaysia	18
Liberia 1964	19
Local Astro	20
Luzon	21
Merchich	22
Montjong Lowe: Indonesia	23
Minna	24
North American Datum of 1927: Continental US	25

Table 3A-6. |Datum Names and Codes (cont)

Datum Name/Description	Datum Code Used By Navigation System
North American Datum of 1927 Alaska: Canada	26
Old Hawaii: Maui	27
Old Hawaii: Oahu	28
Old Hawaii: Kauai	29
England Scotland Wales	30
Qornoq	31
Sierra Leone 1960	32
Campo Inchauspe: Argentina	33
Chua Astro: Paraguay	34
Corrego Alegre: Brazil	35
Provisional South American 1956	36
Yacare: Uruguay	37
Tananarive Observatory: South American 1925	38
Timbali: East Malaysia	39
Tokyo: Japan: Korea: Okinawa	40
Carthage	41
Special Datum: Indian Special	42
Special Datum: Luzon	43
Tokyo Special	44
WGS 84 Special Datum	45
WGS 72 (Sino-Soviet Bloc)	46
WGS 84 Standard Datum*	47

*All FAA Sectionals and FLIP use this datum for coordinate data.

3A.73.3 EGI Operational Procedures.

CAUTION

The GPS system may provide erroneous system data during normal GPS operations due to signal jamming and spoofing operations. Verify proper EGI operation using the TSD UTIL page, position checks, and attitude display against external references and back-up instruments. If jamming or spoofing is suspected, perform position updates. Position updates will temporarily delay erroneous position errors only.

NOTE

If the aircraft has been moved over one nautical mile since it's last power down (LAT/LONG data differs more than one minute from actual position) and does not acquire satellites within a short time (three-five minutes) after power up, the following procedures will help insure a good alignment.

a. Aircraft Moved Over One Nautical Mile Since Last power Down.

(1) Manual Procedure.

(a) Ensure that the current Zulu date and time are entered on the **TSD UTIL** page.

(b) Check the left side of the **TSD** page to see if the **HDG** selection is displayed. If so, select **PSN** and enter the aircraft current position. (The **HDG** selection must be displayed when entering the current position.) If **HDG** is not displayed or the **HDG** selection is removed while the current position data is being entered, perform an **INU1** and **INU2** reset and then quickly (within one minute) enter the aircraft current position.

(2) DTU Procedure.

(a) If the correct aircraft current position has been entered on the DTU, selecting **Navigation** on the **DTU** page will automatically update the current stored position and reset the EGI(s) if the Position Confidence (PC) values are greater than 0.031 km.

b. EGI Position Updates (GPS and/or Doppler Aiding Not Available).

(1) EGI position updates can be accomplished anytime the **PSN** selection on the **TSD** page is present (Primary EGI Position Confidence value greater than 0.050 km).

(2) If the position is not updated before the Position Confidence factor increases to approximately 0.10 km the EGI(s) may not apply the full correction to present position. In cases like this, several position updates may be required to minimize the differences between EGIs position and actual position. If the confidence factor gets too high, the EGIs may reject all position updates. If this is the case, the aircraft will need to land, crew perform an INU1 and INU2 reset followed by an immediate present position update to align the EGIs.

3A.74 AN/ASN-157 DOPPLER RADAR VELOCITY SENSOR (DRVS)

The aircraft contains one DRVS, which consists of a receiver/transmitter, antenna, signal data converter computer, and a 1553B interface, all combined in one unit. The DRVS provides aircraft referenced ground velocities to both EGIs as a velocity aiding source.

3A.75 AIR DATA SYSTEM (ADS)

The ADS is comprised of two independent air data subsystems. The Flight Management Computer (FMC) comprises the first air data subsystem, and the Helicopter Air Data System (HADS) comprises the second air data subsystem.

3A.75.1 Helicopter Air Data System (HADS). The HADS is comprised of a High Integrated Air Data Computer (HIADC), two Airspeed and Direction Sensors (AADS) probes, a Selector Valve Assembly (SVA), and a Utility Relay Box (URB). The AADS probe senses airspeed magnitude, direction, and free airstream temperature. The AADS probe interfaces indirectly through the SVA and URB to the HIADC. The right AADS probe temperature sensor is the only probe to provide temperature information directly to the SP. The left AADS probe temperature sensor is not used. The SP controls the selection of which AADS probe provides information to the HIADC, based on status information from the HIADC. The HIADC contains the processor and related hardware, along with ambient and pitot pressure sensors, to compute air mass related data.

3A.75.2 FMC. The FMC air data subsystem also contains the processor and related hardware to compute pressure altitude, pitot airspeed and density altitude related information. The FMC receives longitudinal and lateral True Air Speeds, static temperature, and longitudinal and lateral True Air Speed non-filtered indirectly from the HIADC via the SP. The FMC outputs, via the MUX bus, a common airdata message of the received HIADC and derived FMC airdata information to those onboard aircraft subsystems requiring it. The FMC provides the following data:

- Pressure Altitude
- Density Altitude
- Barometric Altitude
- Static Air Pressure
- Sideslip Angle
- Lateral True Air Speed
- True Air Speed
- Calibrated Air Speed
- Longitudinal True Air Speed
- Static Temperature
- Air Density Ratio

3A.76 AN/APN-209 RADAR ALTIMETER (RADALT)

The aircraft contains one Radar Altimeter. The Radar Altimeter consists of a receiver/transmitter and antennas which provides actual terrain clearance height. The information is displayed on the MPD and Helmet Display Unit (HDU) and presented in audio format via the CIU for low altitude exceedances only.

Together the ADS and the Radar Altimeter provide the information necessary to display mean sea level (MSL) terrain elevation for the aircraft present position under certain valid data parameters.

3A.77 AN/ARN-149 AUTOMATIC DIRECTION FINDER (ADF)

The ADF receives frequencies from 100 to 2199.5 khz. The ADF has two functional modes of operation: ANT and ADF. In ANT mode the ADF functions as an audio receiver providing only an audio output of the received signal. In ADF mode it functions as an automatic direction finder system that provides a relative bearing to the station signal as well as an audio output of the received signal.

3A.78 NAVIGATION SUBSYSTEM CONTROLS AND DISPLAYS

Navigation subsystem controls and displays are integrated into the following major components:

- Multipurpose Displays (MPD)
- Keyboard Unit (KU)
- Enhanced Up Front Display (EUFD)

The TSD frame of reference is relative to one of three selectable orientations on the **MAP** page; north-up, track-up, or heading-up. In the PAN mode, the TSD frame of reference is determined by the PAN controls. The TSD uses graphic symbols to illustrate waypoints and routes, hazards, phase lines, targets/threats, and various control measures. The KU can be used to enter information when required. The NAV system provides, on the EUFD, advisories for waypoint approach and passage, entry of EGI boresight data, and position update.

3A.79 MPD TACTICAL SITUATION DISPLAY (TSD)

The **TSD** page, (fig 3A-91) controls navigation subsystem moding. Selecting the TSD subsystem button or the TSD button from the **MENU** page calls up the **TSD** page which integrates various navigation status windows, graphic symbols, digital maps, and control selections.

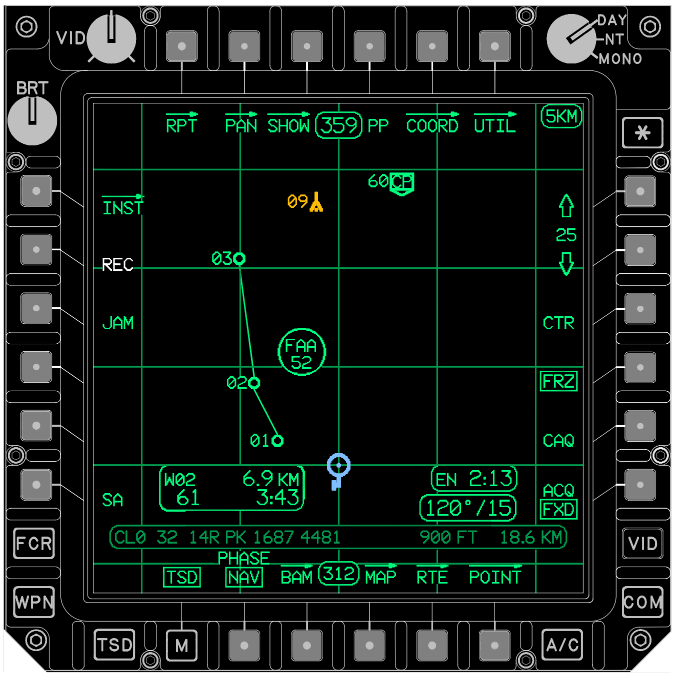

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Figure 3A-91. TSD Page

- T1 **RPT** Page button
- T2 **PAN** Page Page button
- T3 **SHOW** Page button
- T4 **PP** button
- T5 **COORD** Page button
- T6 **UTIL** Page button
- L1 **INST** Page button
- L2 **REC** button
- L3 **JAM** button
- L5 **HDG** button
- L6 **PSN** button
- L6 **SA** button
- R1 **Map Viewing Range UP** button
- R2 **Map Viewing Range DOWN** button
- R3 **CTR** button
- R4 **FRZ** button
- R5 **CAQ** (Cursor Acquisition) button
- R6 **ACQ** button
- B2 **PHASE** button
- B3 **BAM** Page button
- B4 **MAP** page button
- B5 **RTE** Page button
- B6 **POINT** Page button

3A.79.1 TSD Map Functionality. The TSD can be configured for 2 different phases of the mission**.** The **NAV** phase provides enroute information and the, **ATK** phase provides information pertaining to the battle area.

3A.79.2 RPT Page Button. Selection of the **RPT** button will cause the **RPT** page to be displayed.

3A.79.3 PAN Page Button. Selection of the **PAN** button will cause the **PAN** page to be displayed.

3A.79.4 SHOW Page Button. Selection of the **SHOW** Page button will cause the **SHOW** page to be displayed.

3A.79.5 Present Position (PP) Button. Selecting the **PP** button commands display of the present position status window.

3A.79.6 COORD Page Button. Selection of the **COORD** button will cause the **COORD** page to be displayed.

3A.79.7 TSD UTIL Button. Selection of the **UTIL** button will cause the **UTIL** page to be displayed.

3A.79.8 Map Viewing Range UP Button. The map viewing range buttons (R1 & R2) are used to change the range (in KM or NM) of the map on the screen in the 2D mode and the field of view (in degrees) in the 3D mode. The number between the arrows indicates the height and width (in kilometers or nautical miles as selected on the FLT page) in the 2D map mode and in degrees of field of view in the 3D map mode. Selection of the **Arrow** Up button causes more map to be displayed (changing the 2D zoom and/or scale or the 3D field of view of the map as necessary). If the button is selected and released, the next higher default map viewing range or field of view option will be selected. If selected and held, the map will continuously zoom out. For a brief time afterwards the number will be bolded, indicating selection of the Arrow UP will fine tune the map viewing range or field of view. The default Map viewing ranges for the 2D map are: 400K/216NM, 150K/81NM, 100K/54NM, 75K/40.5NM, 50K/27NM, 25K/13.5NM, 15K/8.1NM, 10K/5.4NM, 5K/2.7NM, 2K/1.1NM and 1K/.5NM. The default Map fields of view for 3D map are: 15, 30, 45, 60, 75, and 90 degrees.

3A.79.9 Map Viewing Range DOWN Button. Selection of the **Arrow** Down button causes less map to be displayed (changing the 2D zoom and/or scale of the 3D field of view of the map as necessary). If the button is selected and released, the next lower default map viewing range or field of view option button will be selected. If selected and held, the map will continuously zoom in. For a brief time afterwards the number will be bolded, indicating selection of the Arrow down will fine tune the map viewing range or field of view.

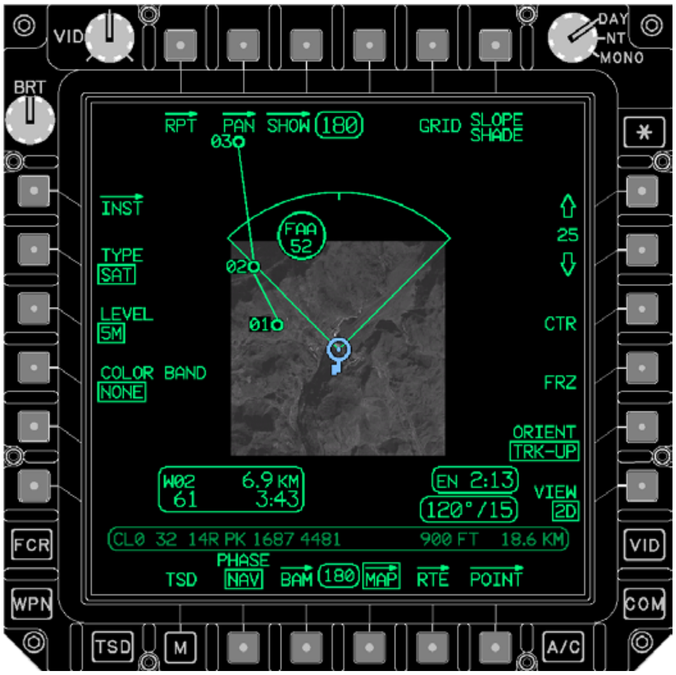

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Figure 3A-91A. MAP Viewing Range (Extended)

NOTE

Certain maps can be zoomed out further than the viewable limits of the map in order to show the entire FCR footprint when the ownship is centered on the display. (The 12.5K Scale maps can only be zoomed to show the entire footprint when the ownship is decentered.)

3A.79.10 Center (CTR) Button. Selecting the **CTR** button toggles the ownship symbol to the center or aft section of the map area (based on orientation selection) on the display.

3A.79.11 Freeze (FRZ) Button. Selection of the **FRZ** button provides the ability to freeze the map display or return to an active display.

3A.79.12 Cursor Acquisition (CAQ) Button. The **CAQ** button allows for rapid selection of points/icons on the TSD to set as an acquisition source. When the **CAQ** button is selected the crewmembers can use the cursor to select any of the following on the TSD page for use as acquisition source:

- Waypoints, Hazards, Control Measures
- Pre-planned or Stored Targets/Threats
- FCR Detected Targets
- RFI Detected Targets
- A Terrain **TRN** location on the TSD selected using the cursor

With **CAQ** selected, the crewmember's cursor is active for selecting a terrain point on the TSD. When the crewmember does not select a point on the TSD the **TRN** (terrain) "cross" symbol is displayed with the label **PLT or CPG**. The **TRN** symbol is white. The geographic location is stored in coordinate **COORD** file T55 for the pilot and T56 for the CPG. If each crewmember has a point selected, two **TRN** symbols with the appropriate crewstation label will be displayed on the TSD. RFI detected threats are only selectable when the selected sight is TADS or Helmet Mounted Display (HMD). Selecting the **CAQ** button freezes the TSD map.

3A.79.13 Acquisition (ACQ) Button. The **ACQ** button provides the ability to select the desired acquisition source for the selected sight. See Chapter 4 for description of selections.

3A.79.14 INST Page Button. Selection of the **INST** button will cause the **INST** page to be displayed.

3A.79.15 Receive (REC) Button. The **REC** button is used to receive the most recent IDM messages that can be received from the TSD page. The **REC** button is only displayed when a message is in the IDM buffer. The **REC** button is displayed in WHITE. When the REC button is selected by a single push, the received grouped options are displayed with up to four IDM messages (IDM sender callsign) displayed. Selection of an IDM callsign will store the message to the current mission or automatically switch to the RCVD message page for TACFIRE messages. When the **REC** button is selected by a double push, the last message received will be stored. When the selected message is one of the following, the message will be stored in the appropriate current mission file location without being identified:

- **WPT/HZD**
- **CTRLM**
- **TGT/THRT**
- **FCR TGT RPT**
- **BDA REPORT**
- **PF ZONE**
- **NF ZONE**
- **PF/NF ZONE**
- **RFHO**
- **PP REPORT**
- **FARM REPORT**

When the message received is one of the following, selecting the IDM callsign will automatically switch to the **RCVD MSG** page of the **ATHS-TACFIRE**. See figure 3A-89A in paragraph 3A.71.6 for more information.

- **FREE TEXT TAC**
- **BDA REPORT TAC**
- **FARM REPORT TAC**
- **PP QUERY TAC**
- **PP REPORT TAC**
- **MAYDAY REPORT TAC**
- **MOVE COMMAND TAC**
- **SPOT REPORT TAC**
- **NEG SPOT RPT TAC**
- **AIR FIRE RQST TAC**
- **ARTY INTELGRID TAC**
- **ARTY FIRE RQST TAC**
- **MSG TO OBSERVER TAC**
- **OBSERVER READY TAC**

When the message received is one of the following, selecting the IDM callsign will cause the appropriate symbol to display on the TSD.

- **SPOT REPORT**
- **SITREP**
- **AIR FIRE MISSION**
- **MSG TO OBSERVER**
- **OBSERVER MSN UPDT**

3A.79.16 Radar Jammer (JAM) Button. This button is only displayed when the jammer is turned ON. Selecting the **JAM** button toggles the radar jammer between **STBY** and **OPER**.

NOTE

Situational Awareness (SA) information is provided by the IDM. The aircraft must be logged on to the TI in order to receive SA data.

3A.79.17 Situational Awareness (SA) Button. See para 3A.87.3d and fig 3A-91B for a description of this button.

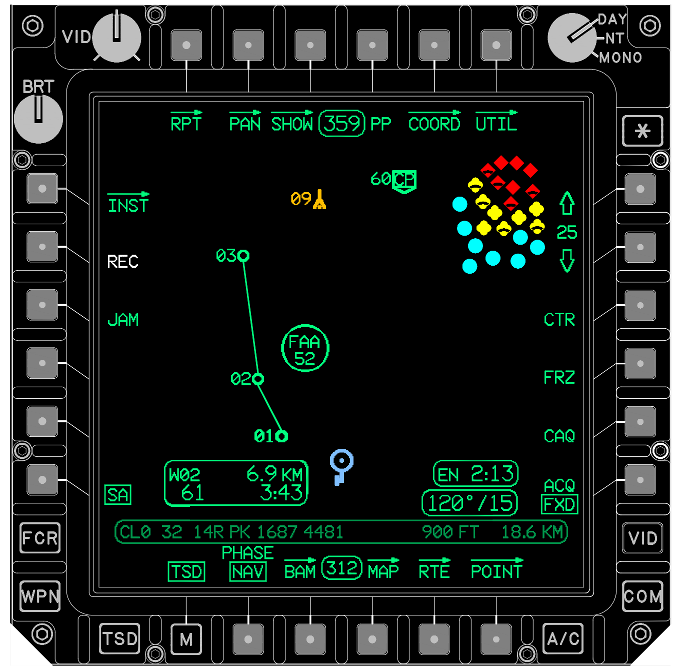

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Figure 3A-91B. SA Selected On

3A.79.18 Heading (HDG) Button. The system displays the **HDG** button when the primary EGI estimated heading error is greater than 10 degrees. The **HDG** button is displayed in WHITE. Selecting the **HDG** button brings up the **HEADING** button which is used to enter a new heading.

a. HEADING Button. The **HEADING** button is used to enter the correct aircraft heading through the KU. An **UPT** button is displayed when the new heading has been entered.

b. Heading Update (UPT) Button. The **UPT** button is used to command the system to update both EGIs with the aircraft heading entered with the **HEADING** button.

3A.79.19 PSN Button. The **PSN** button is displayed in WHITE. The system displays the **PSN** update button when the estimated radial position error from the primary EGI is greater than 50 meters (0.050 Km). Selecting **PSN** will cause the **POSITION** button to be displayed.

a. POSITION Button. The **POSITION** button is used to enter the correct LAT/LONG or UTM coordinates through the KU. Selecting the **POSITION** button will arm the KU for entry of the new coordinates. The system will accept LAT/LONG or UTM coordinate data, with or without the entry of the datum. If a coordinate is entered without a datum, then the system assumes whatever the current datum being flown is what the coordinate being entered is in. Rather than entering the coordinates using the KU, the crew can also select any coordinate point (waypoint, hazard, control measure, or stored target/threat) using the cursor control. The system loads the UTM coordinates for the selected point. If a coordinate point is not selected, the cursor can be used to pick anywhere on the map. The system loads the UTM coordinates of that location. A **UPT** button is displayed when the new coordinates have been entered.

b. Position Update (UPT) Button. The **UPT** button is used to command the EGIs to update their present position with the new coordinates entered using the **POSITION** button.

3A.79.20 PHASE Button. The **PHASE** button allows the crew to select either **NAV** (Navigation) or **ATK** (Attack) mode of operation. The mode of operation affects which information is presented on the **TSD** page and which options are available on the **SHOW** page.

3A.79.21 Battle Area Management (BAM) Page Button. Selection of the **BAM** button will cause the battle area management page to be displayed.

3A.79.22 MAP Button. Selection of the **MAP** button will cause the **MAP** page to be displayed.

3A.79.23 Route (RTE) Page Button. Selection of the **RTE** button will cause the route page to be displayed.

3A.79.24 Point (POINT) Page Button. Selection of the **POINT** button will cause the point page to be displayed.

3A.79.25 Next Waypoint Status Window. The next **WAYPOINT** status window is displayed in the lower left area of the MPD. It is displayed in the **NAV** mode to provide information regarding the current active waypoint being directly flown to or the current flight route being flown. The status window includes the following:

a. Next Waypoint Letter and Number. The next waypoint letter identifies the active destination point type, which can be a waypoint "W", hazard "H", control measure "C", or a target/threat "T". The next waypoint number will be a number form 1 to 99 (depending on the point type).

b. Distance To Go. The distance to go will be displayed in either kilometers or nautical miles based on the unit setting on the **FLT SET** Page.

c. Time To Go. The time to go will display either minutes and seconds if the time is <5 minutes, or hours and minutes if the time is >5 minutes and >10 hours.

d. Ground Speed. If the current calculated ground speed is valid, it will be displayed in kts.

3A.79.26 Aircraft Heading Status Window. The aircraft heading status window is displayed at the top center of the format.

3A.79.27 Grid Status Window. The grid status is displayed in the upper right corner of the format when **GRID** is selected from the **MAP** page. The status window shows the distance (in KM or NM as selected via the **FLT SET** page) between the grid lines.

3A.79.28 Map Frozen Cue. The TSD map frozen cue (fig 3A-92) is a bold dashed and a frozen ownship symbol at the centered/ decentered location, to indicate the map is not in a dynamic state. The dynamic ownship (CYAN), TADS footprint, and FCR footprint will continue to move about the viewable area, and the heading and waypoint information will provide continuous real-time situational awareness. The following control selections cause the map to freeze:

- **BAM** page button
- **CAQ** button
- **FRZ** button
- **PAN** buttons

NOTE

TSD Map Frozen Cue is in place until Primary EGI alignment is complete.

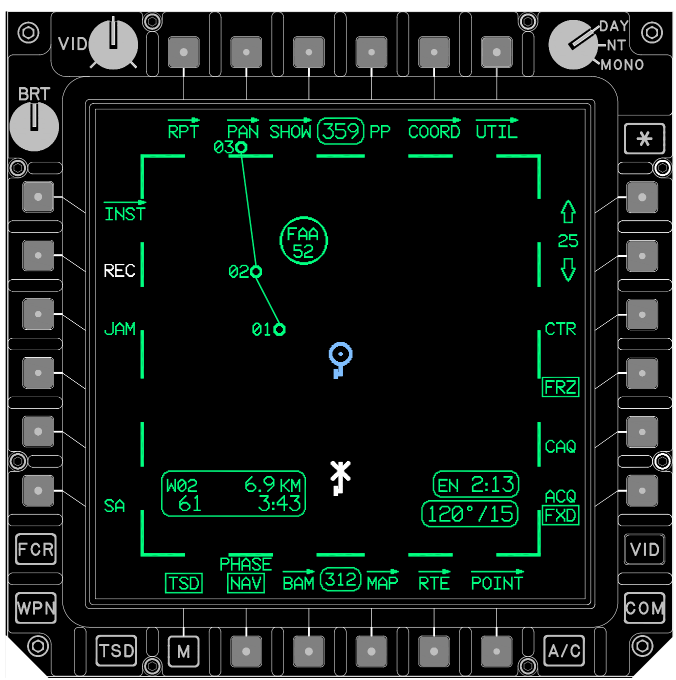

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Figure 3A-92. TSD Map Frozen Cue

3A.79.29 Next Waypoint Heading Status Window. The next waypoint heading status window is displayed at the bottom center of the format.

3A.79.30 Cursor Location Status Window. The cursor location status window is displayed in the lower center of the format. The status window displays the cursor position in UTM. If UTM is not valid, LAT/LONG coordinates will be used. As the aircraft moves or as the cursor is moved over the TSD map the cursor position will update and indicate the cursor position's MSL Altitude of the terrain if DTED is available for that area. If DTED is not available, the altitude will be displayed as "?". Range from the ownship is displayed in KM or NM. If the distance is greater than 1000KM or 1000NM, a "?" will be displayed. When the cursor is moved to an alternate display, the cursor location status window will display the last cursor position in partial intensity.

3A.79.31 Present Position Status Window. The present status window is displayed in the lower center of the format when the **PP** button is selected. The status window includes the following information:

- Latitude
- Longitude
- UTM coordinate data
- Current Mean Sea Level (MSL) elevation of the terrain below the aircraft

NOTE

The displayed TOF is initiated after selecting the **REC** button, however, actual TOF is initiated when message is transmitted.

3A.79.32 Observer Mission Update Status Window. The observer mission update status window is displayed in the upper right of the format of the **TSD**, **RPT**, **ARTY**, and **AF** pages. It is displayed or removed from display in conjunction with selection for display of the message to observer status window. It is not displayed when the time of flight not available status window is presented. The status window is also displayed when projected time of flight for artillery rounds indicates time to impact is between 1 and 30 seconds.

3A.79.33 Message to Observer Status Window. The message to observer status window is displayed in the center right of the format of the **TSD**, **RPT**, **ARTY**, and **AF** pages, and can be displayed or removed from display via cursor or button selection. The status window is not enabled for display when a check fire-target or check fire-all condition is in effect.

3A.79.34 Spot Report Status Window. The spot report status window is displayed in the upper portion of the format of the **TSD**, **RPT**, and **ARTY** pages. It can be displayed or removed from display via cursor or button selection.

3A.79.35 Situation Report Status Window. The situation report status window is displayed in the upper portion of the format of the **TSD**, **RPT**, **ARTY**, and **AF** pages. It can be displayed or removed from display via cursor or button selection.

3A.79.36 Airfire Mission Status Window. The airfire mission status window is displayed in the upper portion of the format of the **TSD**, **RPT**, **ARTY**, and **AF** pages, and has the property that allows it to be displayed or removed from display via cursor or button selection.

3A.79.37 Time of Flight Not Available Status Window. The time of flight not available status window is displayed in the upper right of the format of the **TSD**, **RPT**, **ARTY**, and **AF** pages. It is displayed in conjunction with display of the message to observer status window.

3A.79.38 Endurance Status Window. The **EN** status window is displayed in the lower right area of the format to indicate total fuel endurance time at the present power setting. Calculations include fuel in internal, center, and auxiliary tanks (if installed). The **EN** label is displayed in WHITE and flashes when the total fuel endurance is 20 minutes or less.

3A.79.39 Check Fire All Status Window. The check fire all status window is displayed in the upper center of the format of the **TSD**, **RPT**, **ARTY**, and **AF** pages. It is displayed when the check fire all condition exists.

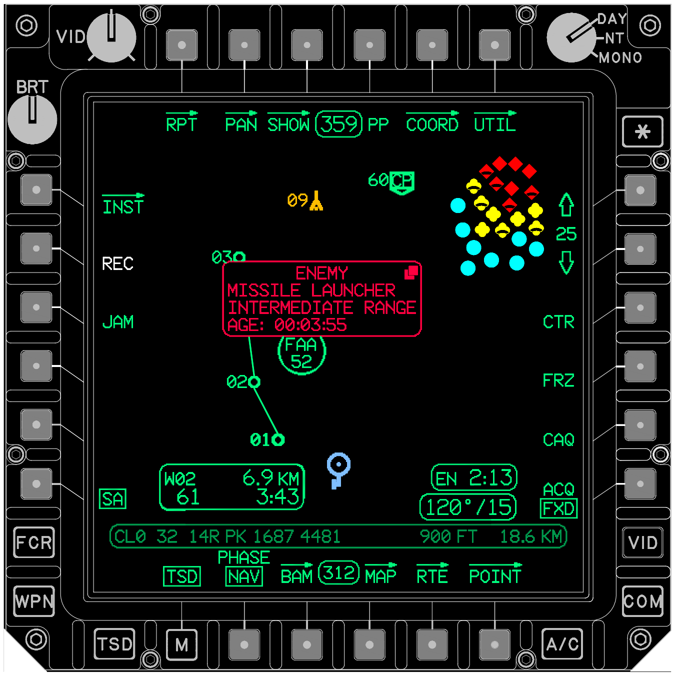

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Figure 3A-92A. SA Status Window, Small

3A.79.40 SA Status Window, Small. The small **SA** status window (fig 3A-92A) is displayed in the center of the format of the **TSD** page. It is displayed when a **SA** icon is selected. The small **SA** status window provides information about the selected icon. The small **SA** status window frame and text are color coded to match the selected icon. The status window includes the following information:

- Friendly, Enemy, or Unknown
- Type
- Subtype
- Age (how old the information is)
- Unit ID or URN

3A.79.41 SA Status Window, Large. The large SA status window is displayed in the center of the format of the **TSD** page. It is displayed when the expand icon on a small SA status window is selected. The large SA status window provides additional information about the selected icon. In addition to the information included in the small SA status window. The large SA status window frame and text are also color coded to match the additional selected icon. The large status window contains the following information:

- Course and Speed
- UTM Coordinate data
- Latitude and Longitude
- Altitude (MSL in Feet)

3A.79.42 Engage Status Window. The engage status window is displayed in the upper right of the format of the **ARTY** page when all requirements have been satisfied to allow transmission of an on-call request (OCR) message, and no OCR has yet been issued. The status window is also presented on the **AF** page during the conduct of a remote SAL hellfire mission. It serves as a prompt that a "SHOT" message has been transmitted and the target should now be engaged.

3A.79.43 Compliance Request Status Window. The compliance request status window is displayed in the upper left corner of the format of the **TSD**, **ARTY**, and **AF** pages. It is displayed when a compliance request has been issued with a JVMF message that can be stored from the TSD, ARTY or AF page. **COMPLY REQ** status window will be displayed on the TSD page after receipt of the message if a compliance is required. Response to a compliance request must be initiated via the **MSG REC** page

3A.79.44 Wind Direction/Velocity Status Window. Wind direction and velocity is selectively displayed in the **NAV** and **ATK** phases**,** in the lower right corner of the TSD. If wind speed is less than 5 knots, the label CALM is displayed. When N_r is less than 50% and wind speed is greater than 45 knots, wind speed is displayed in YELLOW.

3A.80 TSD MAP SYMBOLOGY

The following paragraphs describe various symbols and the conditions under which they appear within the **TSD** map area. The symbols are displayed in geographic fidelity according to the map scale selected. The display of any particular symbol depends upon the **PHASE** selection and the state of the control selections on the **SHOW** page. Also, symbols cannot be displayed on a 3D map. See para 3A.87.1, 3A.87.2 and 3A.82.2.

3A.80.1 Ownship Symbols. The dynamic ownship symbol is displayed in CYAN and represents the helicopter position within the dynamic mapping area. Specifically, the dot in the center of the ownship symbol depicts the present position of the helicopter relative to the map symbols. The frozen ownship symbol is displayed in WHITE, with stopped rotors, and remains at the centered or decentered position as selected.

3A.80.2 Route Line. The route line is a straight line connecting the points (waypoints, hazards, and control measures) in the current route. The route line becomes partial intensity when the active destination point is other than the next point in the current route.

3A.80.3 Direct-To Line. The route direct-to line is a straight line indicating a direct course to the selected point.

3A.80.4 Grid Lines. Grid lines are displayed when grid is selected on the **MAP** page. Grid lines are the default for all maps except **CHART** 1:50,000 and 1:100,000. The ownship is the origin of the grid (except in North-Up/de-centered). The grid lines are displayed in partial intensity green when no video underlay or map underlay is displayed. If video or map underlay is present, grid lines are displayed in black.

3A.80.5 Waypoint/Hazard (WPTHZ) Icon. A **WPTHZ** icon indicates the location, type and number of a waypoint or hazard stored in the waypoint/hazard coordinate data files. Hazard icons are displayed in YELLOW. The waypoint/hazard number is displayed to the left of the waypoint or hazard symbol. The waypoint/hazard number will be displayed inverse video when any of the following conditions exist:

a. When on the **RTE** page with the **ADD** button selected and the waypoint/hazard is the currently selected waypoint/hazard.

b. When on the **RTE** page and the waypoint/hazard is the currently selected waypoint/hazard.

c. When on the **POINT** page and the waypoint/hazard is currently the active waypoint/hazard.

d. When on the **POINT** page with the **ADD, EDIT, DEL**, or **XMIT** button selected and the waypoint/hazard is currently the active waypoint/hazard.

The valid range for the waypoint/hazard numbers is 1 to 50. There are 6 different waypoint symbols and 4 hazard symbols that can be displayed on the TSD (App D). Hazards on the **TSD** page are always displayed in both phases. Waypoint symbols are always displayed in the **NAV** phase and may be displayed in the ATK phase if **CURRENT ROUTE** is selected. When the waypoint/hazard files are loaded from the DTC, a number is stored for each data file saved that indicates the “SAFE SET” for that loaded DTC file (maximum of 25 points). This prevents overwriting a ”SAFE SET” file via normal storing procedures. Data can be deleted from SAFE SET via the **DEL** button or changed from within the ownship via the **EDT** button. An incoming IDM message, if elected to be stored, can also overwrite a SAFE SET. For example: If 10 waypoints/hazards are loaded through the DTC, and then point number 11 is stored after DTC loading, the SP will not attempt to store a waypoint/hazard with an index less than 11. If the DP requests to store a point with an index of less than 11, then the SP will do this.

3A.80.6 Control Measure (CTRLM) Icon. A **CTRLM** icon indicates the location, type and number of a control measure stored in the coordinate data files. Friendly control measure icons are displayed in CYAN and enemy control measure icons are displayed in RED. The control measure type and number is usually displayed within the **CTRLM** icon. The point number will be displayed in inverse video when the point is the currently selected or active point. The control measure file is made up of 49 points. The valid range for the point numbers is 51 to 99. Present position responses are stored in C93 through C99 and are displayed on the TSD with the helicopter icon. (Appx D).

3A.80.7 Threat/Target (THRT/TGT) Icon. The **THRT/TGT** icon indicates the location/number of a target or the location/type of a threat stored in the coordinate data files. **THRT/TGT** icons are displayed in RED. When the **THRT/TGT** icon is a stored target, the icon is a **T** followed by the target file number. When the **THRT/TGT** icon is a preplaned target/threat, the icon may be a symbol with a 2 digit identifier. The target/threat number will be displayed inverse video when the threat has been selected on the **POINT** page in the **RVW**, **EDIT**, **DEL** or **XMIT** modes.

The valid range for the target/threat numbers is 1 to 56 The FCR target coordinate data is stored in T50 when the CAQ button is used to select an FCR target symbol. The coordinate data for the **ATHS** air fire mission target is stored in T51. The JVMF call for fire target grid location is stored in T52. The JVMF Air Fire Mission target is stored in T53.The JVMF spot report is stored in T54. The Pilot's terrain acquisition source is stored in T55 and the Copilot's in T56. Targets over 50 do not exist on the DTC and are not transmitted in any of the AFAPD messages. Targets over 50 cannot be edited nor can new targets be added/stored into targets over 50 via the **POINT** page. The T51 ATHS TARGET can be deleted when the HFMSN button is not selected. The SAFE SET also applies to the targets/threats file.

3A.80.8 ATHS TARGET Icon. The **ATHS TARGET** icon is a large octagonal white icon. The **ATHS TARGET** icon is displayed around T51 when **HFMSN** is selected.

3A.80.9 Message to Observer Symbol. The message to observer symbol (fig 3A-93) is a large circular white icon with protruding edges. The large symbol size allows it to be centered at the same location as a target/threat while enabling both symbols to be recognizable simultaneously. Presentation of the symbol provides feedback regarding the geographic location of a platform-directed artillery call for fire. The symbol can be cursor-selected to open the message to observer status window when a check fire condition is not in effect. It is automatically displayed on the TSD page when a call for fire mission has been initiated, a message to observer has been received and stored, and the object location resides within the map boundaries.

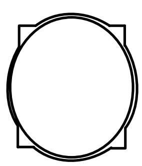

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Figure 3A-93. Message To Observer Symbol

3A.80.10 LINE Icon. The **LINE** icon indicates the location and name of a geographic line stored in the coordinate data files. The designated label indicates the type of **LINE** icon.

3A.80.11 AREA Icon. The **AREA** icon indicates the boundary location, label, and number of a target engagement area stored in the coordinate data files. The engagement area label/number (EA##) of the **AREA** icon is at the center point of the geographic area.

3A.80.12 ASE Footprint Symbol. The ASE footprint symbol is a square border providing a perimeter line or footprint which segregates RLWR (inside) and RFI (outside) threat symbols. It is automatically displayed on the **TSD** page when a threat is detected by the RLWR.

3A.80.13 TADS Footprint Symbol. The TADS footprint symbol is a GREEN straight line which originates at the ownship symbol and changes in length and azimuth to indicate TADS LOS positioning within the map area. The GREEN line changes to a WHITE line when TADS is lasing. An open center crosshair symbol displays full intensity at the end of the TADS footprint symbol to provide precise position feedback on the map. The TADS footprint symbol displays when TADS is the selected sight for the CPG or either crewmember has linked TADS to his current selected sight.

3A.80.14 FCR Footprint Symbol. The FCR footprint symbol is a perimeter of GREEN lines which originates at the ownship symbol to indicate the FCR scan footprint or FCR scan azimuth and area of coverage within the map area. The GREEN lines change to WHITE lines when the FCR is scanning. An azimuth tick displays at the midpoint of the arc within the FCR footprint symbol to provide precise azimuth feedback on the map. The FCR footprint symbol displays when FCR is the selected sight for either crewmember or either crewmember has linked FCR to his current selected sight.

3A.80.15 FCR Target Symbols. FCR target symbols within the map area indicate target information detected during an FCR scan. Two types of target symbols are displayed: FCR priority target symbols and FCR total target symbols. FCR priority target symbols representing moving targets may move due to updated target position from the radar. The target placement within the map area following each scan will indicate the direction and apparent rate of movement of those targets. The high priority FCR targets display full intensity YELLOW; lesser priority targets are partial intensity YELLOW and half size (maximum targets displayed is 256). When the map viewing range (default selections, press and release) is:

- Greater than 25km; the Next to Shoot and Alternate Next to Shoot symbols will not be displayed.

- 50km; FCR Priority Targets (Ownship and IDM) are displayed as small squares (full intensity). FCR Total Targets (Ownship and IDM) are displayed as small squares (partial intensity).
- Greater than 50km; FCR Priority Targets (Ownship and IDM) will not be displayed. FCR Total Targets will not be displayed.
- Greater than 100km; FCR footprint will not be displayed.

3A.80.16 Spot Report Symbol. The spot report symbol (fig 3A-94) is a large square white icon. The large symbol size allows it to be centered at the same location as a control measure while enabling both symbols to be recognizable simultaneously. Presentation of the symbol provides operator feedback regarding the geographic location of a reported group of entities. The symbol can be cursor-selected to open the spot report status window. It is automatically displayed on the **TSD** page when a spot report has been received and stored in T54, and the object location resides within the map boundaries.

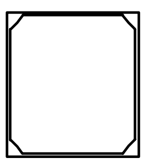

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Figure 3A-94. Spot Report Symbol

3A.80.17 Airfire Mission Symbol. The airfire mission symbol (fig 3A-95) is a large octagonal white icon. The large symbol size allows it to be centered at the same location as a control measure while enabling both symbols to be recognizable simultaneously. Presentation of the symbol provides operator feedback regarding the geographic location of targets from an observer-directed request for hellfire mission. The symbol can be cursor-selected to open the airfire mission status window. It is automatically displayed on the **TSD** page when a properly formatted remote hellfire mission has been received and stored in T53, and the object location resides within the map boundaries.

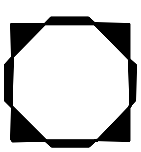

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Figure 3A-95. Airfire Mission Symbol

3A.80.18 Airfire Observer Symbol. The airfire observer symbol (fig 3A-96) is identical to the IDM subscriber symbol, excepting that the text string displayed below indicates “OBS”. The symbol provides operator feedback regarding the geographic location of the observer for a requested hellfire mission. It is automatically displayed on the **TSD** page when a properly formatted remote hellfire mission has been received and the object location resides within the map boundaries. The **OBS** location resides in the SP only and not in any coordinate file.

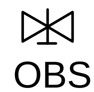

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Figure 3A-96. Airfire Observer Symbol

3A.80.19 Situation Report Symbol. The situation report symbol (fig 3A-97) is a cyan JVMF subscriber symbol, populated within by the text string “SIT”. The symbol provides operator feedback regarding the geographic location of the unit reporting its situation. The symbol can be cursor-selected to open the situation report status window. It is automatically displayed on the **TSD** page when a situation report has been received and the object location resides within the map boundaries. The **SIT** location resides in the SP only and not in any coordinate file.

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Figure 3A-97. Situation Report Symbol

3A.80.20 Call for Fire Symbol. The call for fire symbol (fig 3A-98) is a large circular white icon. The large symbol size allows it to be centered at the same location as a target/threat while enabling both symbols to be recognizable simultaneously. Presentation of the symbol provides operator feedback regarding the geographic location of a platform-directed artillery call for fire. It is displayed on the **TSD** page when a call for fire mission has been initiated and sent via the **ARTY** page. It may also be displayed when the **MSG** button is selected to CFF. The symbol defaults to the location of the NTS target, and can be changed to the location of a target/threat via cursor selection of the desired threat.

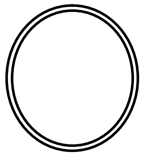

Figure 3A-98. Call For Fire Symbol

3A.80.21 Check Fire Symbol. The check fire symbol (fig 3A-99) is a large x-shaped white icon. It is superimposed over the message to observer symbol, and is displayed on the **TSD** page when a call for fire mission has been initiated, a message to observer has been received and approved, and a mission check fire has been sent via the **ARTY** page.

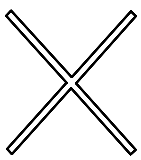

Figure 3A-99. Check Fire Symbol

3A.80.22 JVMF Subscriber Symbol. When a JVMF present position report is received and stored, the transmitting platform is characterized as a helicopter (if platform = Kiowa or Apache) and an IDM subscriber symbol (Appendix C) is plotted on the TSD. Otherwise, the transmitting platform is generically reflected as a JVMF subscriber and its position is demarked using the JVMF subscriber symbol (fig 3A-100).The JVMF position report is also stored in Control Measure point 91.

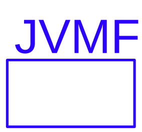

Figure 3A-100. JVMF Subscriber

3A.80.23 RFI Threat Icon Symbol. When a threat is detected by the RFI, an RFI threat icon symbol is displayed along the outside perimeter of the ASE footprint symbol within the map area to indicate azimuth (relative direction) and threat type information on the **TSD** page. Friendly emitter icons are displayed in CYAN and enemy/gray threat icons are displayed in YELLOW. Stale threat icons are displayed in partial intensity.

3A.80.24 RLWR Threat Icon Symbol. When a threat is detected by the RLWR, a RLWR threat symbol is displayed along the inside perimeter of the ASE footprint symbol within the map area to indicate azimuth (relative direction) and threat type information on the **TSD** page. Enemy/gray threat icons are displayed in YELLOW. Stale threat icons are displayed in partial intensity.

3A.80.25 Shot- At Icon. This system stores target coordinates in the coordinate data shot-at file each time a target is engaged (actual or simulated) with the Hellfire Missile system by the ownship in the ownship file. For RF missile engagements, the coordinates of the NTS target are stored to the shot-at file. For SAL autonomous missile engagements (LRFD code = missile seeker code), the target coordinates stored are derived using the CPG's sight and range source regardless of which crewmember conducts the engagement. For SAL remote missile engagements (LRFD ≠ missile seeker code), the target coordinates stored are those last stored in the shot-at file. If no previous launches have occurred since power up, the latitude, longitude, and altitude values stored to the shot-at file will be all zeros. The shot-at icon is an **X** symbol with no label or number. The **X** symbol will be on top of the target symbols if the target was engaged after the last scan, otherwise it will be below target symbols. A total of 16 locations are available in the ownship file.

3A.80.26 IDM Shot-At Icon. The IDM shot-at icon is a partial intensity **X** symbol with no label or number. It represents locations where targets have been engaged by aircraft other than the ownship. The IDM provides target coordinates for storage in the coordinate data shot-at file after being accepted by the crew. A total of 128 locations are available in the IDM shot-at file.

3A.80.27 HSI Icon. The HSI icon is a Magnetic Compass Rose which can be selectively displayed in the **NAV** and **ATK** phases. The HSI is always displayed on the **INST/INST UTIL** pages.

3A.80.28 Waypoint Approach and Passage Advisories. When neither crewmember has the dynamic map displayed, or the TSD displays are frozen, an advisory message is displayed on the EUFD when the aircraft is within one minute of passing a waypoint or upon waypoint passage.

3A.81 TSD (UTIL) PAGE

The TSD **UTIL** page, (fig 3A-101) can be used to initiate navigational system alignments, reset the INUs, enable the Doppler, modify the current datum, and enter system time and date data. The TSD **UTIL** page also provides both INUs position confidence.

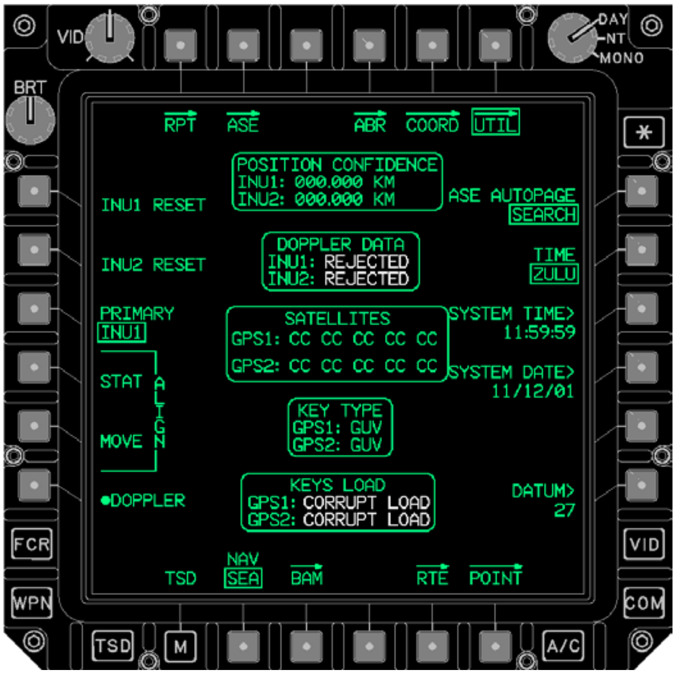

Figure 3A-101. TSD UTIL Page

The TSD **UTIL** page provides access to the following unique functions:

- T6 TSD **UTIL** button
- L1 **INU1 RESET** button
- L2 **INU2 RESET** button
- L3 **PRIMARY** button
- L4 **ALIGN STAT**ionary button
- L5 **ALIGN MOVE** button
- L6 **DOPPLER** button
- R1 **ASE AUTOPAGE** button
- R2 **TIME** button
- R3 **SYSTEM TIME** button
- R4 **SYSTEM DATE** button
- R6 **DATUM** button
- B2 Navigation Mode (**NAV**) button

3A.81.1 INU1/2 RESET Button. The **INU1/2 RESET** buttons resets the **INU1/2**. It is primarily used when the data from the INU is invalid or inaccurate.

3A.81.2 PRIMARY Button. The **PRIMARY** button is used to select the active INU: **INU1/2**. The button state indicates the active (primary) INU whether selected automatically by the system or manually by the operator. It is selectable only when both INUs are operational and equal in status.

3A.81.3 ALIGN STATIONARY (STAT) Button. The **ALIGN STAT** button is displayed only when the state of the **NAV** mode button is set to **SEA** and the primary and/or secondary INU has a position from the GPS or has been manually entered and that it is ready to initiate a stationary navigation system alignment.

3A.81.4 ALIGN MOVE Button. The **ALIGN MOVE** button displayed only when the state of the **NAV** mode button is set to **SEA** and the primary and/or secondary INU has a position from the GPS or has been manually entered and that it is ready to initiate a moving navigation system alignment. These are only displayed when on the ground in **SEA** mode.

3A.81.5 DOPPLER Button. The **DOPPLER** button enables or disables the Doppler.

3A.81.6 ASE AUTOPAGE Button. The **ASE AUTOPAGE** button is used to select the state or condition of an acquiring threat system which causes autopaging of threat warning information. The **ASE AUTOPAGE** is crewstation independent. The available selections are:

- **SEARCH**
- **ACQUISITION**
- **TRACK**
- **OFF**

3A.81.7 TIME Button. The **TIME** button sets the display mode of time to **LOCAL** or **ZULU**.

3A.81.8 SYSTEM TIME Button. The **SYSTEM TIME** button sets the current **LOCAL** or **ZULU** time. The **ZULU** time must be entered before the **LOCAL** time. When a **ZULU** System Time is entered, the system processor sets its clock to the entered time, and sends this time to the respective primary and secondary EGIs if their respective GPS is not tracking enough satellites. To determine if the GPS used the time, monitor the Satellite Status window. If the time entered is used, the respective GPS Satellite ID numbers in the Satellite Status window, will momentarily blank, then reappear.

3A.81.9 SYSTEM DATE Button. The **SYSTEM DATE** button sets the current date. When a system date is entered, the system processor sets its Date to the entered system date, and sends this date to the respective primary and secondary EGIs if their respective GPS is not tracking enough satellites. To determine if the GPS used the date, monitor the Satellite Status window. If the date entered is used, the respective GPS Satellite ID numbers in the Satellite Status window, will momentarily blank, then reappear.

3A.81.10 DATUM Button. The **DATUM** button allows entry of a new datum in place of the default datum entered at the mission planning station. If the pilot enters a **D** using the KU, the system returns to the default datum and automatic datum updates, based on the current waypoints and their datums in the current route being flown.

NOTE

When the INU is reset or power is applied to the INU, the MPD will not display symbols that use INU information until the INU determines that its data is valid.

3A.81.11 Navigation (NAV) Mode Button. The **NAV** mode button selects the navigation mode: (**LAND** or **SEA)** The primary System Processor (SP), upon generator power up, automatically controls initialization and alignment of the EGIs of the aircraft. Upon system power up, the last **NAV** mode stored **LAND** or **SEA**, at power down will be selected automatically by the SP. The flight crew should confirm the correct moding of **LAND** or **SEA** (**SEA**-Stationary or Moving) for the initialization/alignment process based on the current aircraft configuration. After takeoff, (in-flight) the Navigation Mode switch is used to select **LAND** or **SEA** using the criteria of where the aircraft is to be primarily operated for the mission. The **LAND** mode is used when operating primarily over terrain. The **SEA** mode is used when operating primarily over water. When the **LAND** or **SEA** mode selection is made in-flight, there will be no apparent change to the flight crew (with the exception of the displayed **LAND** or **SEA** mode) but the navigation system will change the weighting of the Doppler velocity data to provide the best navigational accuracy (most significantly during degraded navigation modes).

3A.81.12 POSITION CONFIDENCE Status Window. The **POSITION CONFIDENCE** status window in the upper area of the page presents position confidence status for **INU1** and **INU2**. This value represents the 95% probable radial position error of the position estimate of latitude and longitude. It is displayed in WHITE when the value is greater than 50 meters, **FAILED,** or when the INU is not installed.

3A.81.13 DOPPLER DATA Status Window. The **DOPPLER DATA** status window provides the Doppler aiding status of **INU1** and **INU2**: **USED**, **REJECTED** (WHITE), or **MEMORY** (WHITE).

3A.81.14 SATELLITE Status Window. The **SATELLITE** status window provides the satellite number(s) that the EGI is attempting to track. The box indicates that a particular satellite is being tracked.

3A.81.15 KEY TYPE Status Window. The **KEY TYPE** status window provides an indication to the crewmember what type of key has been loaded into GPS receivers 1 and 2. If a Group Unique Variable (GUV) is loaded this status window will show **GUV**. If a Weekly key is loaded the status window will be blank, but the GPS keys status window will indicate **LOADED**.

3A.81.16 KEYS LOAD Status Window. The **KEYS LOAD** status window provides the current state of the GPS keys loaded into GPS receivers 1 and 2. The following states are valid for display:

- **ERASE FAIL** (WHITE)
- **NONE** (WHITE)
- **CORRUPT LOAD** (WHITE)
- **VALID**
- **INCORRECT** (WHITE)
- **VERIFIED**
- **LOADED**

3A.82 MAP PAGE

The **MAP** page (fig 3A-102) provides the crew with the controls for selecting the MAP underlay for display on the TSD and the orientation selection for how the TSD and symbology are displayed relative to the ownship.

3A.82.1 MAP Page - DIG Map. The **MAP** page with **DIG** as the selected **TYPE** (fig 3A-102) displays a map based on **DTED** elevation posts which can have line and area features overlaid on top of it. This page provides access to the following unique functions:

- T4 **GRAY** button
- T5 **GRID** button
- T6 **SLOPE SHADE** button
- L2 **TYPE** button
- L3 **LEVEL** button
- L3 **SCALE** button
- L4 **COLOR BAND** button
- L5 **CONTOURS** button
- L6 **FFD** button
- R5 **ORIENT** button
- R6 **VIEW** button

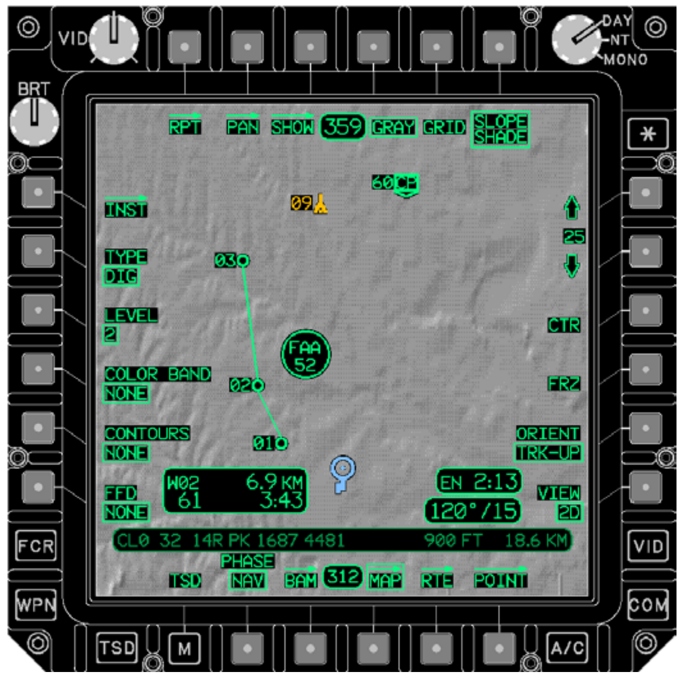

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Figure 3A-102. MAP Page (DIG Map)

a. GRAY Button. The **GRAY** maintained option button is only displayed when the **MAP** type is set to **DIG**. When the **GRAY** button is selected, **DTED** underlay is displayed in shades of gray. When **GRAY** is not selected, **DTED** underlay is displayed in shades of green.

b. GRID Button. Selecting the **GRID** maintained option button will display grid lines on the TSD. With the **GRID** button selected, the grid status window is displayed in the upper right corner of the TSD. **GRID** will default to **ON** for all maps except **CHART** 1:50 and **CHART** 1:100.

c. SLOPE SHADE Button. The **SLOPE SHADE** maintained option button is only displayed if **TYPE** is set to **DIG**, **CHART**, or **SAT** and **DTED** is available on the DTC. The **SLOPE SHADE** button is used to enable/disable slope shading. Slope shading provides a 3D effect to **DTED** data. The **SLOPE SHADE** button is automatically enabled when the **DIG** option of the **TYPE** button is selected. It is disabled when any other option of the **TYPE** button is selected. The "phantom light source" for shading is fixed to the upper left corner of the format. For DIG and Chart maps, the slope shading is based on the level of DTED corresponding to the **SCALE** button. For SAT maps, it always is based on Level 2 DTED. (Slope shading will not be displayed in areas which do not have DTED information.)

NOTE

Video underlay is not available for display on the TSD when the selected **TYPE** is anything other than **STICK**.

d. TYPE Button. The **TYPE** multistate button is used to select the type of map underlay that will be displayed on the TSD. Options are displayed only if there is map data available for that option loaded on a DTC. Selection of the **TYPE** button will display the **TYPE** grouped options with the following selections:

(1) DIG. The **DIG** option selects the digital map as an underlay. If a DTED data file is loading or is not available for the area being displayed on the MPD, the **STICK** map will be displayed over a flat green or gray color as indicated by the **GRAY** button.

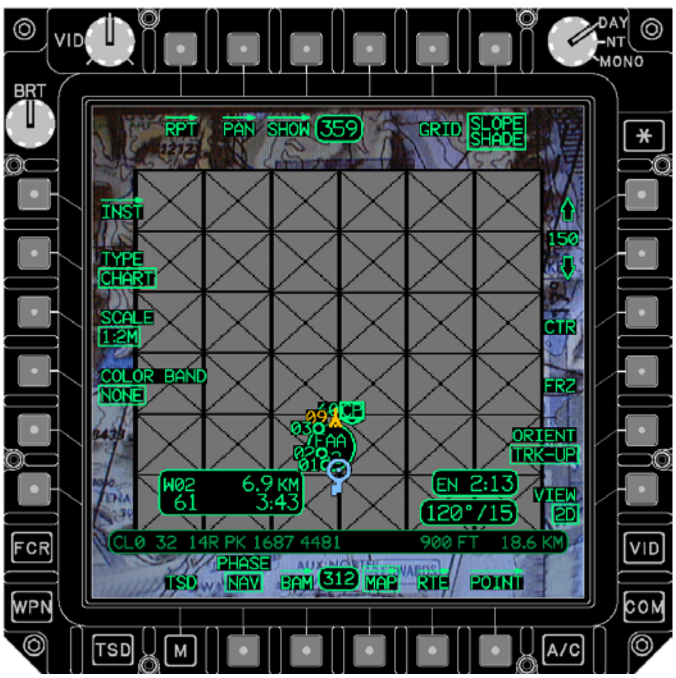

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Figure 3A-102A. File Not Found Cue

(2) CHART. The **CHART** option selects a **CADRG** (Compressed ARC Digitized Raster Graphics) map as an underlay. If a CARDG data file is currently loading for an area being displayed on the MPD, the **STICK** map will be displayed over a flat gray color. If that CADRG data file is not available on the DTC, that area will change to the file not found cue (fig 3A-102A).

NOTE

If the map viewing range is greater than 25 KM (13.5 NM), it will be changed to that viewing range when the **SAT** option is selected.

(3) SAT. The **SAT** option selects the **CIB** (Controlled Image Base) map as an underlay (satellite based maps). If a CIB data file is currently loading for an area being displayed on the MPD, the **STICK** map will be displayed over a flat gray color. If that CIB data file is not available on the DTC, that area will change to the file not found cue. If the map viewing range is larger than 25 KM (13.5 NM), the **STICK** map will be displayed.

(4) STICK. The **STICK** option selects the stick map (standard TSD symbology) with no map underlay displayed.

e. LEVEL Button. The **LEVEL** two-state button is used to select which DTED level (0, 1, or 2) of the **DIG** map to be displayed as the underlay for the current viewing range. The DP will automatically select the best scale for the selected viewing range (shown by a green arrow). The **LEVEL** button will also override the automatic DP selection and retain the new selection in RAM. This is selectable only if the two levels of the DTED for the current viewing range are available on the DTC. This button is replaced by the **SCALE** button when FFD data is selected to be displayed.

e. SCALE Button. The **SCALE** multistate button is used to select the level of DTED and the scale of the Foundation Feature Data (FFD) to be displayed as the underlay for the current viewing range. The DP will automatically select the best scale of FFD for the selected viewing range (shown by a green arrow). The **SCALE** button will also override the automatic DP selection and retain the new selection in RAM. These options are displayed only if the associated map data is available on the DTC and the scale can be supported in the current viewing range. If FFD data is not available for a given scale, the option may be replaced by a **LVL 0**, **LVL 1**, or **LVL 2** option. Selecting this option will automatically set the **FFD** button to **NONE** and change the **LEVEL** button to the selected DTED level.

(1) 1:5M and 1:2M Buttons. These **SCALE** options use DTED Level 0 data.

(2) 1:1M and 1:500K Buttons. These **SCALE** options use DTED Level 1 data.

(3) 1:250K, 1:100K, 1:50K, and 1:2.5K Buttons. These **SCALE** options use DTED Level 2 data.

f. MAP COLOR BAND Button. The **MAP COLOR BAND** multistate button provides the capability to select two different elevation color schemes over a digital map underlay and a disable option. The **MAP COLOR BAND** button is only displayed if **TYPE** is set to **DIG**, **CHART**, or **SAT** and **DTED** is available on the DTC. For DIG and Chart maps, the color banding is based on the level of DTED corresponding to the **SCALE** button. For SAT maps, it always is based on Level 2 DTED. (Color banding will not be displayed in areas which do not have DTED information.)

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Figure 3A-102B. A/C COLOR BAND MAP

(1) A/C Button. The **A/C** button enables a dynamic color shading of the digital maps for elevation information (fig 3A-102B). The terrain at or above the aircraft's current altitude will be shaded in a transparent red and terrain within 50 feet from the aircraft's current altitude will be shaded in a transparent yellow.

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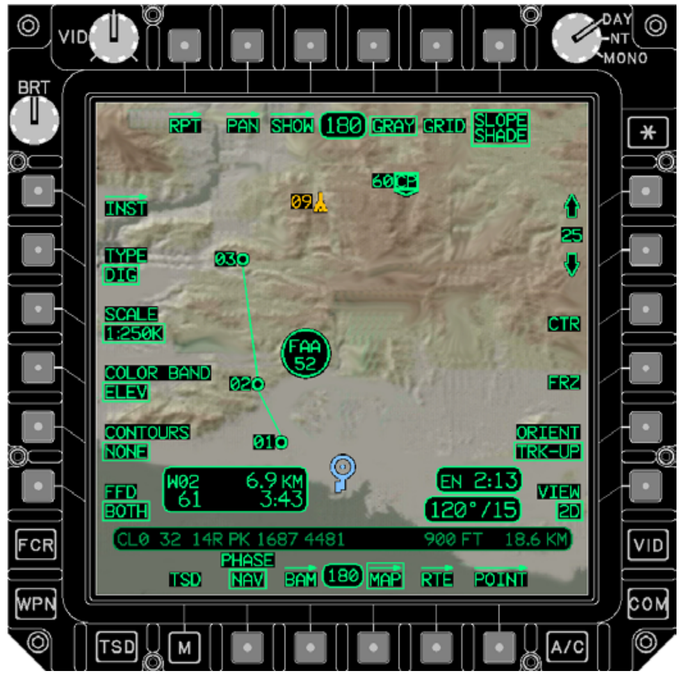
Figure 3A-102C. ELEV COLOR BANDS



LBA5262

Figure 3A-102D. ELEV COLOR BAND MAP

(2) ELEV Button. The **ELEV** button enables a static color shading of the digital maps for elevation information (fig 3A-102D). The elevation between bands will be uploaded from the DTC and breaks up the corresponding terrain into 8 color bands. If the MPD is displaying colors, the various elevation bands are shaded from lower terrain in dark green to higher terrain in dark brown. If the MPD is displaying the colors in the mono mode, varying shades of green (from light green to black) will be used. The overlays will all be a partially transparent version of that color to allow the map to be displayed under the elevation shading.

(3) NONE Button. The **NONE** button disables color shading of the digital maps for elevation information.

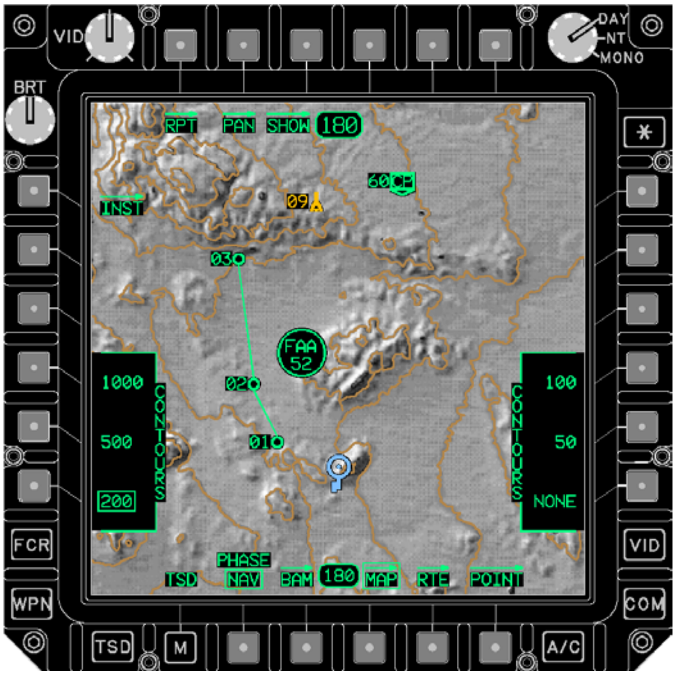


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Figure 3A-102E. CONTOUR LINES

g. CONTOURS Button. Selecting the **CONTOURS** multistate button displays the **CONTOURS** grouped options with the currently selected contour boxed (fig 3A-102E). The **CONTOURS** button is only displayed if **TYPE** is set to **DIG** and DTED is available on the DTC. This button is used to set the interval (in feet) between the contour lines. Contour lines are displayed in brown. Contour line selections include: 1000, 500, 200, 100, 50, and NONE. The contour lines are based on the level of DTED corresponding to the **SCALE** button. (Contour lines will not be displayed in areas which do not have DTED information.)

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Figure 3A-102F. FFD MAP

h. FOUNDATION FEATURE DATA (FFD) Button. Selecting the **FFD** button overlays the linear and area cultural foundation features on top of the DTED underlay (fig 3A-102F). The options are **AREAS**, **LINES**, **BOTH**, and **NONE** (to disable the display of all foundation features). The **FFD** button is only displayed if **TYPE** is set to **DIG** and **FFD** files are available on the DTC for the selected level of DTED. This button will be barriered if the FFD data available on the DTC cannot be displayed at the selected map viewing range.

NOTE

Colors for Foundation Feature Data are defined and set by the user AMPS.

Table 3A-6B. Foundation Features

AREA FEATURES	LINEAR FEATURES
Moonscape (default no file)	Ground (default no file)
Ground	Ferry/Ford
Tree	Tree
Marsh	Road
Sand	Path

Table 3A-6B. Foundation Features - continued

AREA FEATURES	LINEAR FEATURES
Rock	Pipe
Snow/Ice	Cliff
Industrial	Gully
Boundary	Boundary
Airport	Runway
Railroad	Railroad
Tower	Tower
Water Structures	Industry/Building
Building	Bridge
Urban	Fence/Barrier
Water	Water

i. ORIENT Button. The **ORIENT** multistate button is used to select the orientation of the map. The following selections are available for orientation:

(1) HDG-UP. When **HDG-UP** is selected, the **MAP** uses the aircraft heading as the UP orientation.

(2) TRK-UP. The TRK-UP option is the default selection. When the **TRK-UP** option is selected the aircraft ground track is used as the UP orientation. The ownship icon will rotate as to the aircraft heading. If the ground speed is not greater than 30 knots or the ground speed is not within 30 degrees of magnetic heading, the orientation will be the same as heading up.

NOTE

Selection of **N-UP** could result in loss of situational awareness on the TSD.

(3) N-UP. When **N-UP** (north-up) is selected, true north is used as the UP orientation. The ownship icon on the TSD will rotate so it is always pointed in the aircraft heading direction. In **N-UP** de-centered mode the ownship icon will "ferris-wheel" around the display during aircraft pedal turns.

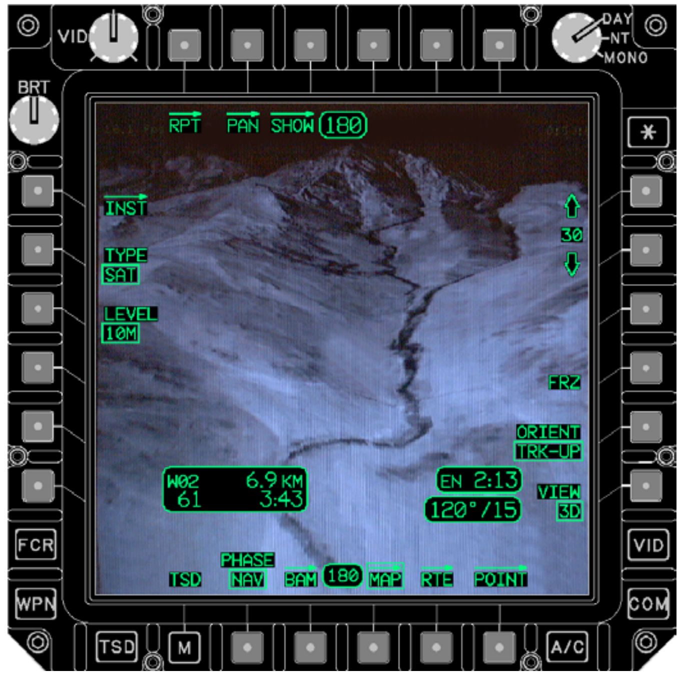

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Figure 3A-102G. 3D VIEW

j. VIEW Button. The map **VIEW** two state button (R6) allows the user to select either a two dimensional (**2D**) map or a three dimensional (**3D**) map (fig 3A-102G). This button will not be displayed if the **MAP TYPE** button is set to **STICK**. This button is not selectable if DTED Level 1 Data is not available. When the map **VIEW** button is set to **3D**, symbology will not be displayed on the map.

k. DTED Data Not Available Cue. Areas of the map which don't have DTED information will be shaded in a transparent purple. (If the underlay has a lot of color it may look like it is slightly off color). This indication is displayed when **SLOPE SHADE**, **COLOR BAND**, or **CONTOURS** are selected to be displayed.

3A.82.2 MAP PAGE - CHART Map. The **MAP** page with **CHART** as the selected **TYPE** (fig 3A-102H) displays a CADRG (Compressed ARC Digitized Raster Graphics) map as an underlay. This page provides access to the following unique functions:

- L3 **SCALE** button

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Figure 3A-102H. CHART MAP

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Figure 3A-102I. CHART (Ciy Graphics) MAP

a. SCALE. The **SCALE** multistate button is used to select the scale of the CHART map to be displayed as the underlay for the current viewing range. The DP will automatically select the best scale for the selected viewing range (shown by a green arrow). The **SCALE** button will also override the automatic DP selection and retain the new selection in RAM. These options are displayed only if the associated map data is available on the DTC and the scale can be supported in the current viewing range.

(1) 1:5M and **1:2M Buttons**. These **SCALE** options correspond with DTED Level 0 data.

(2) 1:1M and **1:500K Buttons**. These **SCALE** options correspond with DTED Level 1 data.

(3) 1:250K, **1:100K**, **1:50K**, and **1:2.5K Buttons**. These **SCALE** options correspond with DTED Level 2 data.

3A.82.3 MAP PAGE - SAT Map. The **MAP** page with **SAT** as the selected **TYPE** (fig 3A-102J) displays a **CIB** (Controlled Image Base) map as an underlay (satellite based maps). This page provides access to the following unique functions:

- L3 **LEVEL** button

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Figure 3A-102J. SAT MAP

a. LEVEL Button. The **LEVEL** two state button is used to select which level (5m or 10m pixel resolution) of the **SAT** map to be displayed as the underlay for the current viewing range. The DP will automatically select the best scale for the selected viewing range (shown by a green arrow). The **LEVEL** button will also override the automatic DP selection and retain the new selection in RAM. This button is not displayed if the map viewing range is greater than 25KM (13.5 NM). This is selectable only if both types of map data are available on the DTC.

3A.82.4 MAP PAGE - STICK Map. The **MAP** page with **STICK** as the selected **TYPE** (fig 3A-102K) removes a digital map underlay and allows a video underlay to be seen underneath the stick map. This page does not have any unique buttons.

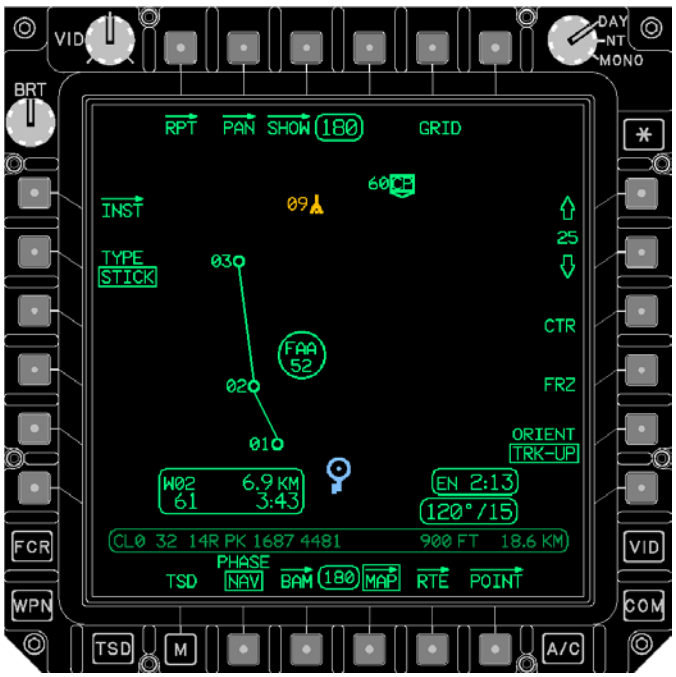

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Figure 3A-102K. STICK MAP

3A.83 PAN PAGE

The **PAN** page (fig 3A-103) provides the capability to pan the TSD. The TSD may be panned along the current route, to a coordinate data file location, UTM/LAT-LONG coordinate or to a cursor selected point. Selection of the **PAN** page will cause the **PAN** controls to be displayed. **CURSOR** is the default panning mode. Additionally, the cursor is active for selection of a pan destination in the **NORM** pan mode. When the **PAN** page is selected the following unique functions are available:

- T4 Left Pan **HDG** Arrow
- T5 Pan **HDG** Data Entry button
- T6 Right Pan **HDG** Arrow
- L1 Pan **POINT** button
- L2 Next **WPT** in RTE button
- L3 Forward in **RTE** Arrow button
- L3 Pan **PITCH** up Arrow
- L4 Back in **RTE** Arrow button
- L4 Pan **PITCH** entry button
- L5 Last **WPT** in RTE button
- L5 Pan **PITCH** down Arrow
- L6 **PAN** mode button
- R3 Pan **ALT** pitch up Arrow
- R4 Pan **ALT** entry button
- R5 Pan **ALT** pitch down Arrow
- R5 **LAST PAN** button
- R6 Pan **ALT CNTL** button
- R6 Pan **3D EYE** button

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Figure 3A-103. PAN Page

3A.83.1 LAST PAN Button. When the map is made live, the DP will store the panned location and heading. Selection of the **LAST PAN** button returns the map to that location and heading.

3A.83.2 HDG Left/Right Arrow Buttons. Pressing the left/right arrow buttons momentarily changes the pan heading in 1 degree increments. Pressing and holding changes the heading at 40 degrees per second.

3A.83.3 HDG Button. The HDG button is used for data entry of the pan heading.

3A.83.4 POINT Button. Selection of the POINT button allows entry of UTM/LAT-LONG coordinate or a coordinate data file point number for pan destination.

3A.83.5 Next/Last WPT in RTE Buttons. Selecting the Next/Last **WPT** buttons momentarily pans forward (up) to the next waypoint or back(down) to the previous waypoint in a single step or continuous if pressed and held.

3A.83.6 Forward/Backward in RTE Button. Selecting the **RTE** button momentarily pans forward (up) to the next waypoint or back(down) to the previous waypoint in small increments or continuous if pressed and held.

3A.83.7 PAN Mode Button. The **PAN** two-state button is used to select the mode of the **PAN** function. The following selections are available for **PAN** mode:

a. CURSR Button. The **CURSR** button is the default selection for the **PAN** mode**.** The **CURSR** button allows the crewmember to use the cursor thumb-force control to **PAN** the map. When in the cursor mode the map underlay will move in the direction selected using the cursor thumb-force controller. When in the **CURSR PAN** mode the crewmember's cursor changes to a directional cursor. The cursor mode is changed to **NORM** and the crewmember's normal cursor is displayed for any of the following reasons:

- **PAN MODE** changed to **NORM**
- **"Z-Axis"** is selected with the cursor thumb-force controller
- **PAN** page button is deselected

b. NORM Button. The **NORM** mode allows the cursor to be used in a normal manner (selecting buttons, etc.) and to pan by jumping to a point.

3A.83.8 ALT CNTL Button. The pan **ALT CNTL** button is used to display the altitude panning controls. These controls are used to change the altitude of the frozen map for visibility shading and aircraft banding. This button is displayed when one of those two features is on and the map is 2D.

a. ALT Up/Down Buttons. Selection of the **ALT** up/down **ARROW** buttons will change the altitude of the eyepoint (above the ground). Selecting this button will change the altitude by 10 feet. Selecting and holding this button will change the altitude at a constant rate. This button is displayed when either the pan **ALT CNTL** or **3D EYE** button is selected.

b. ALT Entry Button. The pan **ALT** entry button is used to enter in the altitude of the eyepoint (above the ground). This button is displayed when either the pan **ALT CNTL** or **3D EYE** button is selected. When the map is initially frozen, this button is defaulted to the aircraft's radar altitude.

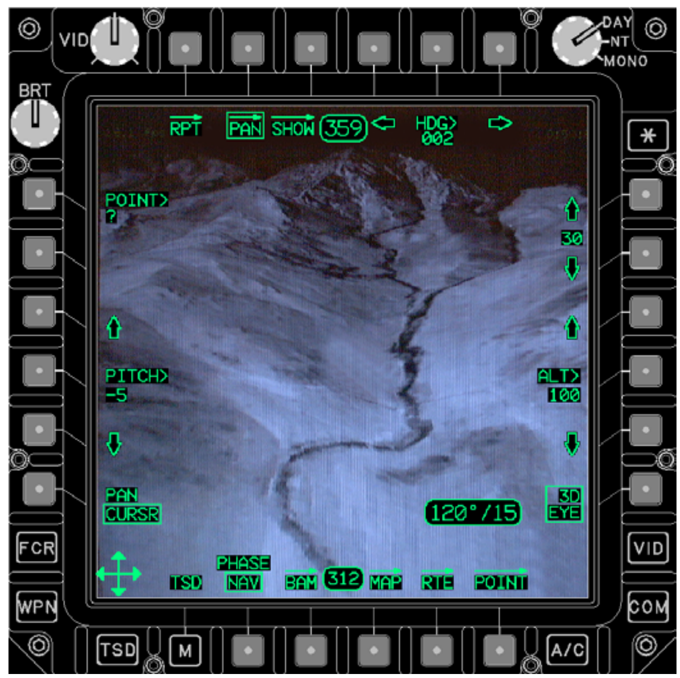

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Figure 3A-103A. 3D EYE

3A.83.9 3D EYE Button. The pan **3D EYE** button is used to display the **3D** map panning controls (fig 3A-103A). These controls are used to move the eye point or modify the viewing angle from the eyepoint. This button is displayed when the map is 3D.

a. PITCH Up/Down Button. Selection of the **PITCH** up/down **ARROW** buttons will change the viewing angle from the eyepoint (look up/down). Selecting this button will change the viewing angle 1 degree. Selecting and holding this button will change the viewing angle at a constant rate. This button is only displayed when the **PAN 3D EYE** button is selected.

b. PITCH Entry Button. The pan **PITCH** data entry button (L4) is used to enter in a viewing angle from the eyepoint. This button is only displayed when the pan **3D EYE** button is selected. When the map is initially frozen, this button is defaulted to the aircraft's pitch.

c. ALT Up/Down Buttons. See para 3A.83.8.

d. ALT Entry Button. See para 3A.83.8.

3A.84 INST PAGE

NOTE

ADF MODE, FREQ, **TEST**, **LAST**, **TONE**, **IDENTIFY**, **EMER 500**, **EMER 2182** options will not be displayed if the ADF system is not enabled.

The **INST** page (fig 3A-104) is used to control the ADF System and provide the symbology necessary to perform ADF navigation. A compass rose, heading select indicator (with inverse heading), and Non Directional Beacon identifier/frequency status are displayed over the moving map display. The next **WAYPOINT** status window is displayed in the lower left portion of the page. The **ENDR** and **WIND** status windows are displayed in the lower right portion of the page. The moving map is always dynamic unless the INU data is invalid. NDB symbols whose free text match one of the presets can be selected from the **INST** and **INST UTIL**. When selected the **ADF** will be tuned to the matching preset.

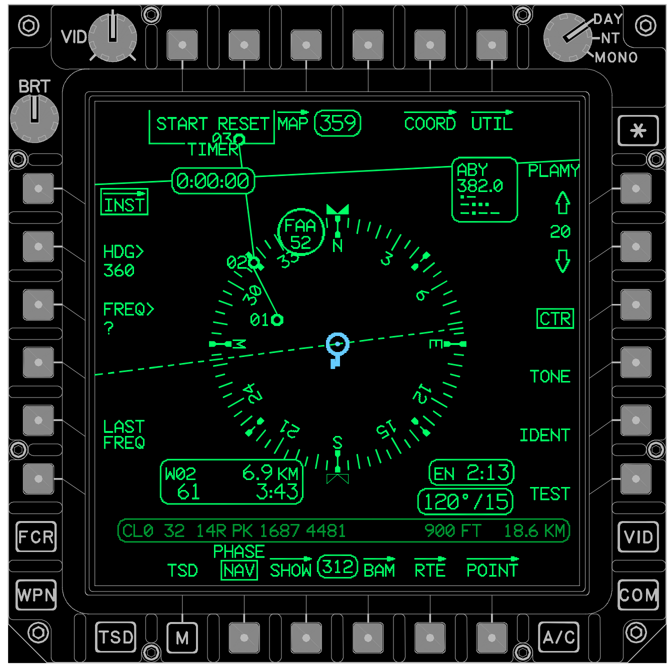

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Figure 3A-104. INST Page

The **INST** page contains the following unique buttons:

- T1 **TIMER START/STOP** button
- T2 **TIMER RESET** button
- T6 **INST UTIL** button
- L2 Selected Heading (**HDG**) button
- L3 **NDB FREQUENCY (FREQ)** button
- L5 **LAST FREQUENCY (LAST FREQ)**
- R4 **TONE** button
- R5 **IDENT** button
- R6 **TEST** button

3A.84.1 TIMER START/STOP Button. The **TIMER START/STOP** button is used to start/stop the digital timer readout.

3A.84.2 TIMER RESET Button. The **TIMER RESET** button is used to reset the digital timer readout displayed in the **TIMER** status window..

3A.84.3 HDG Button. The **HDG** button is used to set the numeric magnetic heading value for the Heading Select Indicator. The **HDG** button is only displayed if the INU is operational.

3A.84.4 NDB FREQ (Frequency) Button. **FREQ** button is used to manually set the numeric value of a NDB frequency or commercial broadcasting station.

3A.84.5 LAST FREQ (Last Frequency) Button. **LAST FREQ** button is used to toggle between the current and previously tuned NDB frequency or commercial broadcasting station.

3A.84.6 TONE Button. Selecting the ADF **TONE** button causes the normal audio to be replaced by the 1000 Hz tone for continuous wave (CW) operation.

3A.84.7 IDENTIFY Button. Selecting the ADF **IDENTIFY** button causes the normal audio output to be filtered for clarity.

3A.84.8 TEST Button. The **TEST** button is used to test the ADF System circuits and strength of the station signal received. Selecting the **TEST** button causes the ADF Bearing Pointer to momentarily shift approximately 90° right from the present bearing for several seconds then return to the original bearing. A faulty system circuit could possibly cause the ADF Bearing Pointer to shift to a value other than approximately 90° right. The rate at which the ADF Bearing Pointer returns to the original bearing indicates the relative strength of the station signal received.

3A.84.9 Timer Status Window. The timer status window is used to display the elapsed time of the timer. The window has a format of **H:MM:SS** and a range of **0:00:00** to **9:59:59**.

3A.84.10 NDB Status Window. The **NDB** status window displays in the upper right area of the **INST** page to indicate the current frequency, station identifier letters, and morse code to which the the ADF system is tuned. The station identifier letters and morse code are displayed only when there is an identifier associated with the tuned frequency or the tuned frequency is an emergency frequency. If the frequency is invalid, it will be displayed WHITE.

3A.84.11 Compass Rose. The circular arrangement of tic marks (compass rose) rotates about a point to provide the instantaneous magnetic heading of the helicopter. The compass rose is constructed with tic marks of three sizes: long tics for 30° increments, medium tics for 10° increments, and short tics for 5° increments. Cardinal point heading values are displayed within the the compass rose and remain upright as the compass rose rotates on the page. The compass rose is placed at either the centered or decentered position based on current selection of the **CTR** button.

3A.84.12 ADF Bearing Pointer. The ADF bearing pointer is displayed from the edge of the magnetic compass rose, through the ownship, to the edge of the display to indicate magnetic bearing of the current signal being received by the ADF system.

3A.84.13 Heading Select Indicator. The heading select indicator is displayed on the periphery of the magnetic compass rose to indicate the magnetic heading value entered at the **HDG** select button. A heading bug reciprocal is also displayed on the periphery of the compass rose.

3A.85 INST UTILITY (UTIL) PAGE

The UTIL page (fig 3A-105) is used to provide access to the stored preset ADF frequencies and utility selections. The presets can be edited or tuned based on crew inputs.

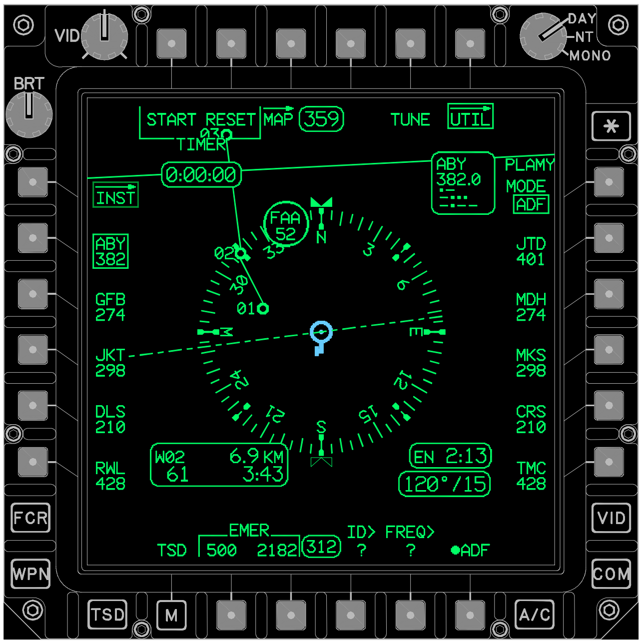

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Figure 3A-105. INST UTIL Page

The **INST UTIL** page contains the following unique buttons:

- T5 **TUNE** button
- L2 - L6 ADF PRESET buttons
- R1 **ADF MODE** button
- R2 - R6 ADF PRESET buttons
- B4 ADF Preset Identifier (**ID**) button
- B5 ADF Preset Frequency (**FREQ**) button
- B6 **ADF** button

3A.85.1 TUNE Button. The NDB preset **TUNE** button is used to tune the ADF receiver to the frequency of the selected ADF preset station button.

3A.85.2 ADF Preset Buttons. The ADF preset buttons are used to select specific ADF preset stations for tuning or editing.

3A.85.3 MODE Button. Selecting the ADF **MODE** button displays **ANT**.

3A.85.4 ID Button. The NDB preset identifier **ID** button is used to enter the NDB station identifier letters for the selected ADF preset button.

3A.85.5 FREQ Button. The NDB preset frequency **FREQ** button is used to enter the NDB station frequency value for the selected ADF preset button.

3A.85.6 ADF Button. Selecting the **ADF** button alternately toggles the ADF System between enabled and disabled.

3A.86 ABBREVIATION (ABR) PAGE

The **ABR** page (fig 3A-106), a view only page, provides a list of the correct two-letter identifications for a specific waypoint, hazard, control measure, target, or threat. The abbreviation page also includes the two-digit identifier for each of the datums associated with its spheroid.

NOTE

There are no unique buttons on the **ABR** page.

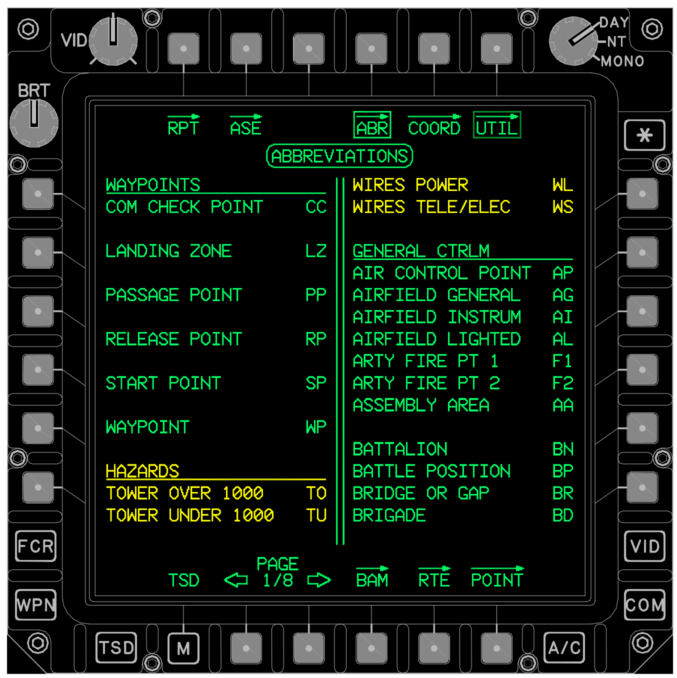

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Figure 3A-106. ABR Page

All available abbreviations are listed in tables 3A-7 through 3A-14 in their appropriate page mode.

Table 3A-7. Abbreviations Listing Page 1 Mode

Abbreviation Name	ID
WAYPOINTS	
Comm Check Point	CC
Landing Zone	LZ
Passage Point	PP
Release Point	RP
Start Point	SP
Waypoint	WP
HAZARDS	
Tower over 1000 (YELLOW)	TO
Tower Under 1000 (YELLOW)	TU
Wires Power (YELLOW)	WL
Wires Tele/Elec (YELLOW)	WS
GENERAL CTRLM	
Air Control Point	AP
Airfield General	AG
Airfield Instrum	AI
Airfield Lighted	AL
Arty Fire Pt 1	F1
Arty Fire Pt 2	F2
Assembly Area	AA
Battalion	BN
Battle Position	BP
Bridge or Gap	BR
Brigade	BD

Table 3A-8. Abbreviations Listing Page 2 Mode

ABBREVIATION NAME	ID
Checkpoint	CP
Company	CO
Corps	CR
Division	DI
FARP Fuel Only	FF
FARP Ammo Only	FM
FARP Fuel/Ammo	FC
Forwd Assemb Area	FA
Grnd Lite/Sm Town	GL
Holding Area	HA
IDM Subscriber	ID
JVMF Subscriber	JV
NBC Area	NB
NDB Symbol	BE
Railhead Point	RH
Regiment/Group	GP
US Army	US
FRIENDLY CTRLM	
ADU Friendly (CYAN)	AD
Air Assault Frien (CYAN)	AS
Air Cavalry Frien (CYAN)	AV
Airborne Friend (CYAN)	AB
Armor Friend (CYAN)	AM
Armor Cav Friend (CYAN)	CA

Table 3A-9. Abbreviations Listing Page 3 Mode

ABBREVIATION NAME	ID
Av Maint Friend (CYAN)	MA
Chemical Friend (CYAN)	CF
Decon Friend (CYAN)	DF
Engineers Friend (CYAN)	EN
ElecWar Friend (CYAN)	FW
Growth CTRLM FR1 (CYAN)	Z1
Growth CTRLM FR2 (CYAN)	Z2
Growth CTRLM FR3 (CYAN)	Z3
Fixed Wing Friend (CYAN)	WF
Field Arty Friend (CYAN)	FL
Heli Attack Frien (CYAN)	AH
Heli Genrl Frien (CYAN)	FG
Hospital Friend (CYAN)	HO
Infantry Friend (CYAN)	FI
Mech Infantry Fr (CYAN)	MI
Medical Friend (CYAN)	MD
TOC Friend (CYAN)	TF
Unit ID Friend (CYAN)	FU
ENEMY CTRLM	
Air Assault Enemy (RED)	ES
Air Cavalry Enemy (RED)	EV
Air Defense Enemy (RED)	ED
Airborne Enemy (RED)	EB

Table 3A-10. Abbreviations Listing Page 4 Mode

ABBREVIATION NAME	ID
Armor Cav Enemy (RED)	EC
Armor Enemy (RED)	AE
Av Maint Enemy (RED)	ME
Chemical Enemy (RED)	CE
Decon Enemy (RED)	DE
Engineers Enemy (RED)	EE
Elec War Enemy (RED)	WR
Field Arty Enemy (RED)	EF
Fixed Wing Enemy (RED)	WE
Growth CTRLM EN1 (RED)	Z4
Growth CTRLM EN2 (RED)	Z5
Growth CTRLM EN3 (RED)	Z6
Heli Attack Enemy (RED)	EK
Heli Genrl Enemy (RED)	HG
Hospital Enemy (RED)	EH
Infantry Enemy (RED)	EI
Mech Infantry En (RED)	EM
Medical Enemy (RED)	EX
TOC Enemy (RED)	ET
Unit ID Enemy (RED)	EU
PREPLANNED TGT/THRT	
ADU AMX-13 (RED)	AX
ADU Aspide (RED)	AS
ADU Friendly (RED)	AD

Table 3A-11. Abbreviations Listing Page 5 Mode

ABBREVIATION NAME	ID
ADU Gepard (RED)	GP
ADU Growth 1 (RED)	G1
ADU Growth 2 (RED)	G2
ADU Growth 3 (RED)	G3
ADU Growth 4 (RED)	G4
ADU Spada (RED)	SD
ADU M1983 (RED)	83
ADU Unknown (RED)	U
AIR DEF 2S6/SA-19 (RED)	S6
Gun Air Defense (RED)	AA
Gun Generic (RED)	GU
Gun Marksman (RED)	MK
Gun Sabre (RED)	SB
Gun Self Prop (RED)	GS
Gun Towed (RED)	GT
Gun ZSU-23 (RED)	ZU
Naval Systems (RED)	NV
Radar Battl Surv (RED)	SR
Radar TGT Acq (RED)	TR
RBS-70 (RED)	70
SAM Blowpipe (RED)	BP
SAM Bloodhound (RED)	BH
SAM Chapparal (RED)	CH
SAM Crotale (RED)	CT
SAM CSA-2/1/X (RED)	C2
SAM Hawk (RED)	HK
SAM Javelin (RED)	JA
SAM Patriot (RED)	PT
SAM Redeye (RED)	RE
SAM Rapier (RED)	RA
SAM Roland (RED)	RO

Table 3A-12. Abbreviations Listing Page 6 Mode

ABBREVIATION NAME	ID
SAM SA-1 (RED)	1
SAM SA-2 (RED)	2
SAM SA-3 (RED)	3
SAM SA-4 (RED)	4
SAM SA-5 (RED)	5
SAM SA-6 (RED)	6
SAM SA-7 (RED)	7
SAM SA-8 (RED)	8
SAM SA-9 (RED)	9
SAM SA-10 (RED)	10
SAM SA-11 (RED)	11
SAM SA-12 (RED)	12
SAM SA-13 (RED)	13
SAM SA-14 (RED)	14
SAM SA-15 (RED)	15
SAM SA-16 (RED)	16
SAM SA-17 (RED)	17
SAM SAMP (RED)	SM
SAM SATCP (RED)	SC
SAM Self Prop (RED)	SP
SAM Shahine/R440 (RED)	SH
SAM Starstreak (RED)	SS
SAM Tigercat (RED)	TC
SAM Stinger (RED)	ST
SAM Towed (RED)	SA
SAM Vulcan (RED)	VU
Target Ref Point (RED)	TG
AIRY	AIR
England Scott WALE	30
AUSTRALIAN NATL	AUS
Australian 66	3

Table 3A-13. Abbreviations Listing Page 7 Mode

ABBREVIATION NAME	ID
BESSEL 1841	BES
Bukit Rimpah Indo	4
Djarkarta Indo	6
Gunung Segara	11
Tokyo Jap Kor Oki	40
Tokyo Special	44
CLARK 1880	CL0
Adindan	1
ARC 1950	2
Ghana	9
Liberia 1964	19
Merchich	22
Minna	24
Sierra Leone 1960	32
Carthage	41
CLARK 1866	CL6
Guam 1963	10
Luzon	21
NAD 27 ConUS	25
NAD 27 Alaska Can	26
Old Hawaii Maui	27
Old Hawaii Oahu	28
Old Hawaii Kauai	29
Luzon Special	43
EVEREST SABAH	EVB
TIMBALI E MALAYS	39
EVEREST 1830	EVE
Indian Thai Viet	16
Indian Special	42

Table 3A-14. Abbreviations Listing Page 8 Mode

ABBREVIATION NAME	ID
INTERNATIONAL 1924	INT
Camp Area Astro	5
European 1950	7
Geodetic Dat 1949	8
Herat North	13
Hjorsey	14
Hu-Tzu-Shan	15
Qornoq	31
Campo I Argentina	33
Chua A Paraguay	34
Corrego A Brazil	35
Prov 1956 S Amer	36
Yacare Uraguay	37
Tananarive Observ	38
MODIFIED AIRY	MAI
Ireland 1965	17
EVEREST 1948	MEV
Kertau W Malaysia	18
WORLD GEO SYS 72	W72
WGS72 Sino-Soviet	46
WORLD GEO SYS 84	W84
Gunung Serindung	12
Local Astro	20
Montjong Low Indo	23
WGS 84 Special	45
WGS 84 Default	47

3A.87 SHOW PAGE

The **SHOW** page manages the symbology displayed on the **TSD** during the **PHASE** selected. Like buttons that are selected/deselected in one **PHASE** are not automatically selected/deselected in the other **PHASE.** The buttons that are boxed in (fig 3A-107) are defaulted upon power being applied to the display processor. The moving map is displayed on the **SHOW** page. Symbols will be displayed or removed as buttons are selected if they are in the displayed map area. The **SHOW** page has three subpages: **SA**, **THRT SHOW**, and **COORD SHOW**.

3A.87.1 SHOW Page - Navigation (NAV). The **NAV PHASE** of the **SHOW** page (fig 3A-107) is used to provide access to navigation data.

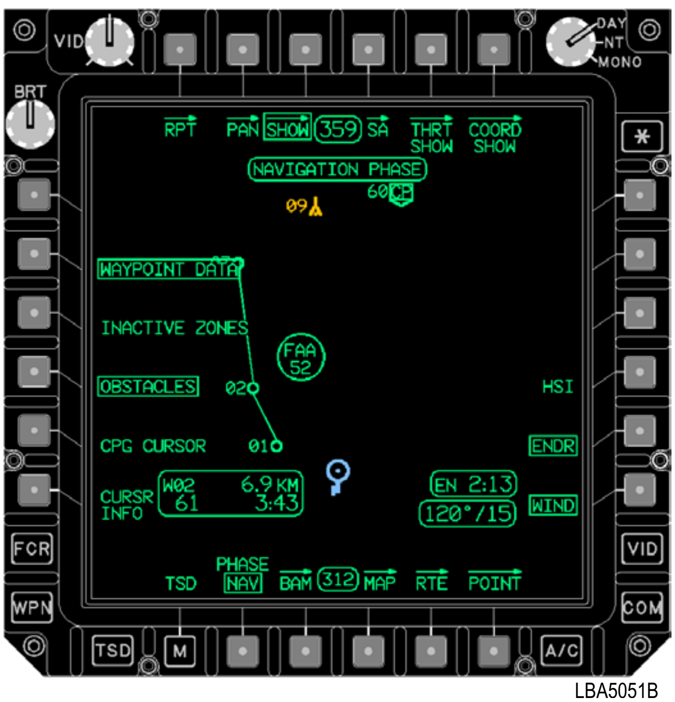

Figure 3A-107. SHOW Page (NAV PHASE)

The **NAV PHASE** of the **SHOW** page contains the following unique buttons:

- T4 **SA** page
- T5 **THRT SHOW** page
- T6 **COORD SHOW** page
- L2 **WAYPOINT DATA** button
- L3 **INACTIVE ZONES** button
- L4 **OBSTACLES** button
- L5 **PLT** (or **CPG**) **CURSOR** button
- L6 **CURSOR INFO** button
- R4 **HSI** button
- R5 **ENDR** button
- R6 **WIND** button

a. SA Page Button. Selecting the **SA** button displays the **SA** page on the TSD.

b. THRT SHOW Page Button. Selecting the **THRT SHOW** button displays the **THRT SHOW** page on the TSD.

c. COORD SHOW Page Button. Selecting the **COORD SHOW** button displays the **COORD SHOW** page on the TSD**.**

d. WAYPOINT DATA Button. Selecting the **WAYPOINT DATA** button displays the next waypoint status window on the TSD.

e. INACTIVE ZONES Button. Selecting the **INACTIVE ZONES** button displays the inactive fire zones on the TSD.

f. OBSTACLES Button. Selecting the **OBSTACLES** button displays obstacles on the TSD.

g. PILOT or CPG CURSOR Button. Selecting the **PILOT** or **CPG CURSOR** button (crewstation dependant) displays the other crewmember's cursor when the opposite crewmember has the cursor on the TSD.

h. CURSOR INFO Button. Selecting the **CURSOR INFO** button displays the cursor position in UTM coordinates, distance from the ownship (KM or NM), and DTED elevation (if available) within the **CURSOR POSITION** status window. The **CURSOR POSITION** status window is only displayed when the **CURSOR INFO** button is selected.

i. HSI Button. Selecting the **HSI** button displays the magnetic compass rose on the TSD.

j. ENDR Button. Selecting the **ENDR** button displays the **ENDR** status window on the TSD.

k. WIND Button. Selecting the **WIND** button displays the **WIND** status window on the TSD**.**

l. NAVIGATION Status Window. The **NAVIGATION** status window displays the status of the **PHASE** button.

3A.87.2 SHOW Page - Attack (ATK). The **ATK PHASE** of the **SHOW** page (fig 3A-108) is used to provide access to battlefield data.

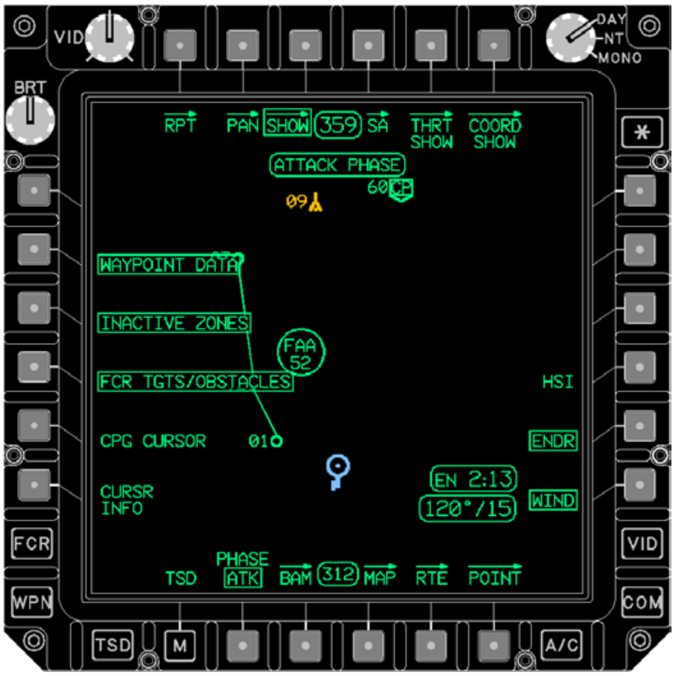

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Figure 3A-108. SHOW Page (ATK PHASE)

The **ATK PHASE** of the **SHOW** page contains the following unique buttons:

- T2 **CURRENT ROUTE** button
- L4 **FCR TGTS/OBSTACLES** button

a. CURRENT ROUTE Button. Selecting the **CURRENT ROUTE** button displays the current route and all of its selected points, including direct-to navigation points on the TSD.

b. FCR TGTS/OBSTACLES Button. Selecting the **FCR TGTS/OBSTACLES** button displays the low priority FCR targets or obstacles on the TSD.

c. ATTACK Status Window. The **ATTACK** status window displays the status of the **PHASE** button.

3A.87.3 SHOW Page - Situational Awareness (SA) Page. The **SA** page (fig 3A-109) is used to control the display of situational awareness data and other JVMF related icons. The options on this page are not independent between phases. Selection of the **SA** page will clear **SA** degraded advisory.

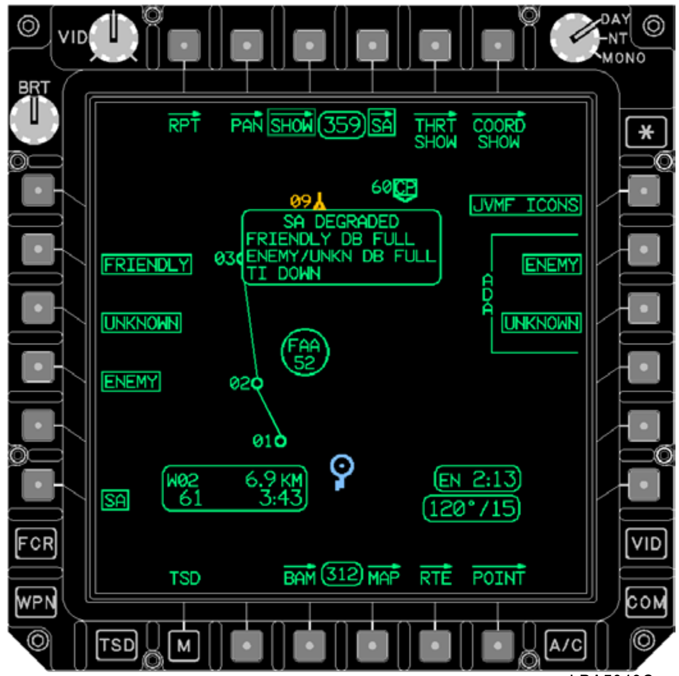

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Figure 3A-109. SHOW SA Page

The **SA** page contains the following unique buttons:

- L2 **FRIENDLY** button
- L3 **UNKNOWN** button
- L4 **ENEMY** button
- L6 **SA** button
- R1 **JVMF ICONS** button
- R2 **ADA ENEMY** button
- R3 **ADA UNKNOWN** button

a. FRIENDLY Button. Selecting the **FRIENDLY** button displays the blue **FRIENDLY SA** icons on the TSD.

b. UNKNOWN Button. Selecting the **UNKNOWN** button displays the yellow **UNKNOWN SA** icons on the TSD.

c. ENEMY Button. Selecting the **ENEMY** button displays the red **ENEMY SA** icons on the TSD.

d. Situational Awareness (SA) Button. This button is displayed when the **PSN** button is not displayed. Selecting the **SA** button toggles the display of all **SA** icons ON and OFF.

e. JVMF ICONS Button. Selecting the **JVMF ICONS** button displays the Message to Observer, Adjust Fire, Spot Report, Airfire Mission, Airfire Observer, Situation Report, Call for Fire, and Check Fire Symbols.

f. ADA ENEMY Button. Selecting the ADA **ENEMY** button displays the red **ENEMY ADA SA** icons on the TSD.

g. ADA UNKNOWN Button. Selecting the ADA **UNKNOWN** button displays the yellow **UNKNOWN ADA SA** icons on the TSD.

h. SA Degraded Status. The **SA Degraded Status** window is provided when the SA Friendly database becomes full, the SA Enemy/Unknown database becomes full, or if the Tactical Internet is down after receiving updates to the SA database.

3A.87.4 SHOW Page - THRT SHOW (THRT VIS). The **THRT SHOW** page is used to control the display of threats, rings, and intervisibility shading. The **THRT SHOW** page toggles between **THRT** and **OWN** via the **VIS** button to allow for display of either type of rings and intervisibility. The options on this page are not independent between phases.

NOTE

If the threat has a detection range of 4.8 KM or less, the map will display real intervisibility shading only if Level 2 DTED data is available for that threat. If the detection range is between 4.8 and 19.2 KM, the map will only use Level 1. If it is greater than 19.2 KM, the map will only use Level 0. Therefore if **VIS SHADE** is selected for a threat and the Level of DTED required isn't available for that area, the map will shade the entire ring, showing the worst case.

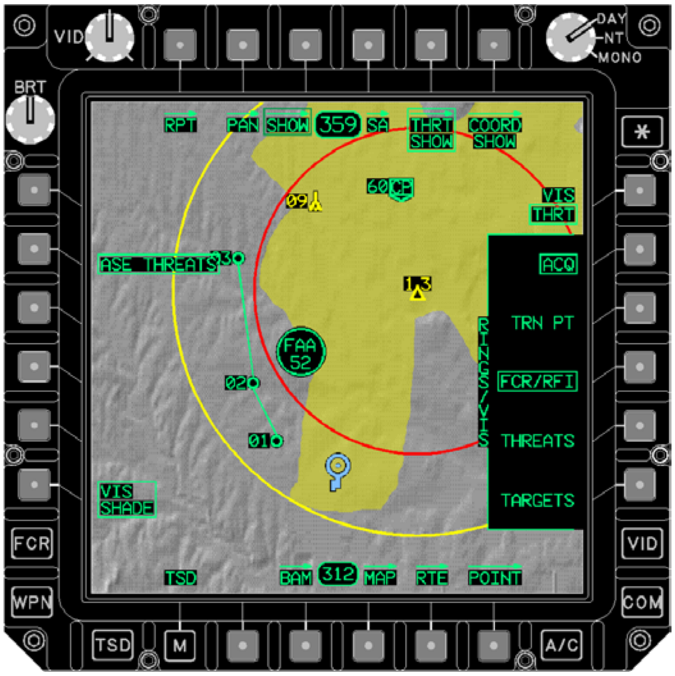

Figure 3A-109A. THRT SHOW Page - VIS THRT Selected

The **THRT SHOW** page with the **VIS THRT** option selected (fig 3A-109A) contains the following unique buttons:

- L2 **ASE THREATS** button
- L3 **TRN PT ALT** up arrow button
- L4 **TRN PT ALT** data entry button
- L5 **TRN PT ALT** down arrow button
- L6 **VIS SHADE** button
- R1 **VIS** button
- R2 **AQC** button
- R3 **TRN PT** button
- R4 **FCR/RFI** button
- R5 **THREATS** button
- R6 **TARGETS** button

a. ASE THREATS Button. Selecting the **ASE THREATS** button displays the RFI/RLWR detected threats on the TSD.

b. TRN PT ALT UP/DOWN Arrow Buttons. Selecting the **TRN PT ALT** up/down arrow buttons allows the crewmember to change the altitude for the intervisibility shading of the **TRN PT**. A single push of the button changes the terrain point altitude in 5 foot increments. Holding the button continuously changes the altitude.

c. TRN PT ALT Data Entry Button. Selecting the **TRN PT ALT** button allows the crewmember to enter an altitude via the KU which modifies the intervisibility of the **TRN PT** based on a given altitude.

d. VIS SHADE Button. Selecting the **VIS SHADE** button displays intervisibility shading for all items corresponding to the buttons selected in the bracket.

e. VIS Button. Selecting the **VIS** button toggles between **THRT** and **OWN**. **THRT** shows where the selected icons can see the aircraft at its current altitude. The **OWN** option shows where the aircraft could see at the given altitude.

NOTE

Intervisibility and rings will only be displayed if the associated icon is currently enabled for display. Threat intervisibility will only be displayed for threats which have detected ranges (uploaded from the DTC).

f. AQC Option. Selecting the **AQC** option displays threat rings for the selected **AQC** TXX source (when applicable).

g. TRN PT Option. Selecting the **TRN PT** option displays threat rings for both the PLT and CPG terrain points.

h. FCR/RFI Option. Selecting the **FCR/RFI** option displays threat rings for FCR targets which have been merged with RFI threats.

i. THREATS Option. Selecting the **THREATS** option displays threat rings for preplanned threats.

j. TARGETS Option. Selecting the **TARGETS** option displays threat rings for preplanned targets.

3A.87.5 SHOW Page - THRT SHOW (VIS OWN). Selecting the **THRT SHOW** page (fig 3A-109B) is used to control the display of ownship relative rings and intervisibility shading.

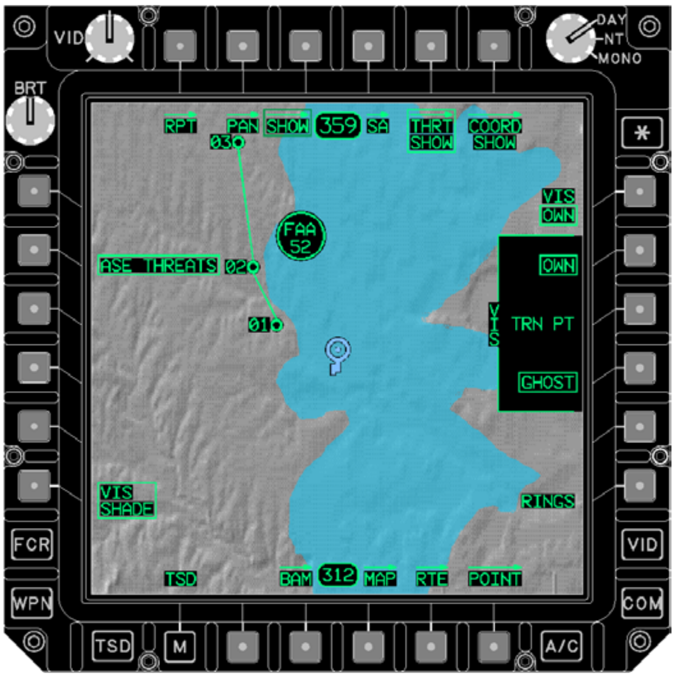

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Figure 3A-109B. THRT SHOW Page - VIS OWN Selected

The **THRT SHOW** page with the **VIS OWN** option selected contains the following unique buttons:

- R2 **OWN** button
- R3 **TRN PT** button
- R4 **GHOST** button
- R6 **RINGS** button

a. OWN Option. Selecting the **OWN** option enables the display of a lethality ring and/or intervisibility for the ownship.

b. TRN PT Option. Selecting the **TRN PT** option enables the display of lethality rings and/or intervisibility for both the PLT and CPG terrain points.

c. GHOST Option. Selecting the **GHOST** option enables the display of a lethality ring and/or intervisibility for the ghostship.

d. RINGS Button. Selecting the **RINGS** button displays rings for all selected **RINGS** maintained options.

3A.87.6 SHOW Page - COORD SHOW (NAV PHASE). The **COORD SHOW** page (fig 3A-109C) is used to provide access to additional battlefield data.

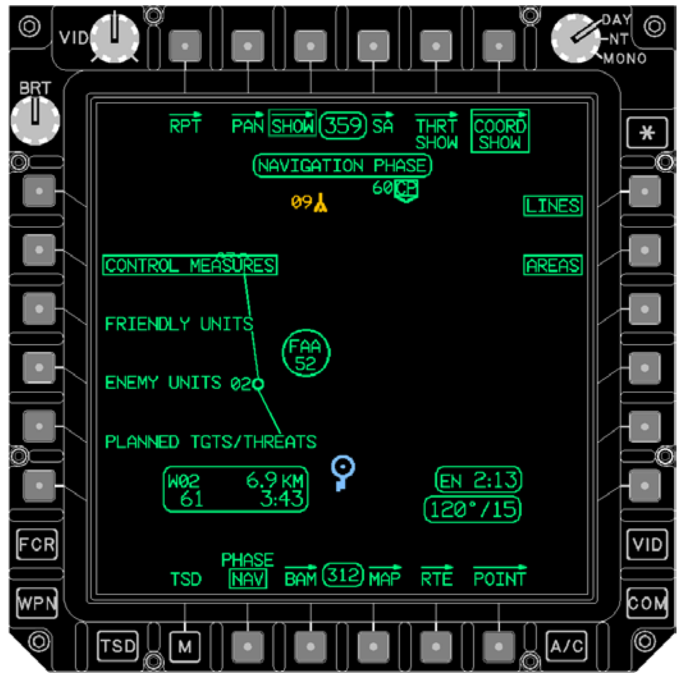

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Figure 3A-109C. COORD SHOW Page (NAV)

The **COORD SHOW** page (NAV Phase) (fig 3A-109C) contains the following unique buttons:

- L2 **CONTROL MEASURES** button
- L3 **FRIENDLY UNITS** button
- L4 **ENEMY UNITS** button
- L5 **PLANNED TGTS/THREATS** button
- R1 **LINES** button
- R2 **AREAS** button

a. CONTROL MEASURES Button. Selecting the **CONTROL MEASURES** button displays all of the control measures except the enemy units and friendly units on the TSD. Deselecting the **CONTROL MEASURES** button removes all of the control measures except the enemy units and friendly units and those control measures that are part of the current route, including direct-to navigation.

b. FRIENDLY UNITS Button. Selecting the **FRIENDLY UNITS** button displays the friendly unit control measures on the TSD.

c. ENEMY UNITS Button. Selecting the **ENEMY UNITS** button displays the enemy unit control measures on the TSD.

d. PLANNED TGTS/THREATS Button. Selecting the **PLANNED TGTS/THREATS** button displays the planned and stored targets and threats on the TSD.

e. LINES Button. Selecting the **LINES** button displays **LINES** on the TSD.

f. AREAS Button. Selecting the **AREAS** button displays **AREAS** on the TSD.

3A.87.7 SHOW Page - COORD SHOW (ATK PHASE). The **COORD SHOW** page (fig 3A-109D) is used to provide access to additional battlefield data.

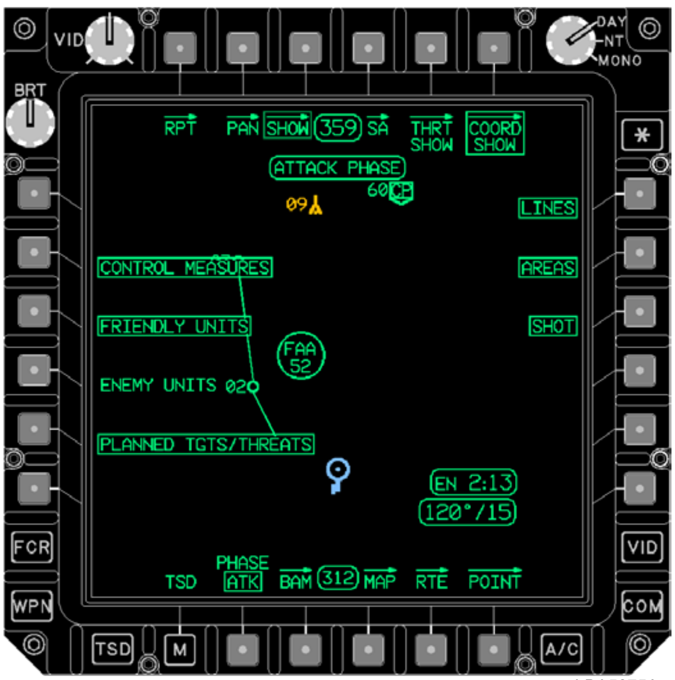

Figure 3A-109D. COORD SHOW Page (ATK)

The **COORD SHOW** page (ATK Phase) contains the following unique button:

- R3 **SHOT** button

SHOT Button. Selecting the **SHOT** button displays the shot-at Xs on the TSD.

3A.88 DELETED

3A.89 POINT PAGE

The **POINT** page (fig 3A-110) provides the ability to manage the waypoints/hazards, control measures, and target/threats files. The **POINT** page defaults to reviewing the active destination point. The crewmember can select any waypoint, hazard, control measure, and target/threats for review.

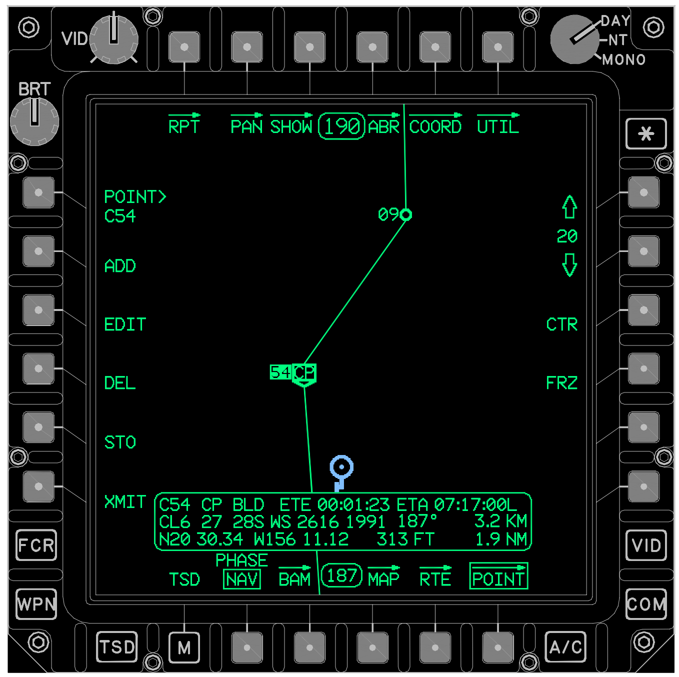

Figure 3A-110. POINT Page

The **POINT** page contains the following unique buttons:

- L1 **POINT** button
- L2 **ADD** button
- L3 **EDIT** button
- L4 **DEL** button
- L5 **STO** button
- L6 **XMIT** button

3A.89.1 POINT Button. Selecting the review **POINT** button arms the KU for entry of the point type (**W**, **H**, **C**, or **T**) and the point number. The cursor can also be used to select the point.

3A.89.2 ADD Button. The **ADD** button allows the creation of a new waypoint, hazard, control measure, or threat which is added to the coordinate data files. Selecting the **ADD** button calls up the **IDENT** button and the Point **TYPE** buttons. The system defaults to the waypoint (**WP**) button in the **NAV** phase and to the target (**TGT**) button in the **ATK** phase. At this point, the cursor can be used to add the default point as indicated by the Point **TYPE** button. The free text will be defaulted to the point type and point number. The cursor position when the cursor acknowledge was selected will be used for the location. The point altitude will be based off of the DTED information if available for the specified location. Otherwise, the altitude is defaulted to the elevation of the ground below the aircraft.

a. Point TYPE Buttons. The point **TYPE** buttons are displayed when the **ADD** button is selected. These buttons are used to select the type of point to be added to the file. Selecting a point **TYPE** button sets the type of coordinate data according to the respective selection. When the waypoint, hazard, control measure, or threat file is full, the respective point **TYPE** buttons are not selectable.

(1) Waypoint (WP) Button. Selecting the **WP** button changes the type of point to be added to waypoint. The identifier defaults to **WP**.

(2) Hazard (HZ) Button. Selecting the **HZ** button changes the type of point to be added to hazard. The identifier defaults to a Tower Under 1000 feet **TU**.

(3) Control Measure (CM) Button. Selecting the **CM** button changes the type of point to be added to control measure. The identifier defaults to a Check Point **CP**.

(4) TARGET (TG) Button. Selecting the **TG** button changes the type of point to be added to target/threat. The identifier defaults to a Target **TG**.

b. Identifier (IDENT) Button or EDIT Button. The **IDENT** button is displayed when either **ADD** or **EDIT** is selected. The crew can either accept the default by pressing the KU **ENTER** or type in a two character point identifier for the selected type of point and select the KU **ENTER**. Once the KU enter is selected, the button label will change to **FREE**. The crew can either accept the default or enter in up to three letter description. Once the KU **ENTER** is selected, the button label will change to **UTM LAT/LONG**. The crew can accept the default, enter a coordinate using the KU, enter a point number using the KU, or select a point on the map using the cursor. An example of each is:

- **UTM**: **11SGQ52184911**
- **LAT/LONG**: **N742594W1205768**
- **Point Type and Point Number : C95.**
- **Pick a point off the map using the cursor (the cursor coordinate will update in the review status window).**

Entry convention for **LAT/LONG** is one contiguous string with no decimal points in degrees, minutes, and hundredths of minutes. Latitude Northing degrees will contain two digits; Longitude Easting degrees will contain three digits with leading zeros. Once the KU **ENTER** is selected, the button label will change to **ALTITUDE**. The crew can accept the default or enter an altitude using the KU. Once the KU **ENTER** is selected, the system displays the added/modified point in the review status window and the **ADD** or **EDIT** button is deselected.

When editing a point, the defaults are set to the current values for that point. When adding a point, the defaults are set as follows. For the identifier, the default is set per the **TYPE** button. The free text is defaulted to the point type and number. The coordinate is defaulted to the present position of the aircraft. If DTED information for the specified location is available, the altitude is defaulted to altitude in the DTED information for the entered coordinate. Otherwise the altitude is defaulted to the Mean Sea Level (MSL) of the ground below the aircraft.

3A.89.3 EDIT Button. Selecting the **EDIT** button calls up the edit **FREE** button with the last valid coordinate data selected and the free text of the selected point.

3A.89.4 Delete (DEL) Button. Selecting the **DEL** button calls up the delete **POINT** button with the last valid coordinate data selected and the **DELETE YES/NO** buttons.

a. Delete YES Button. Selecting the Delete **YES** button will delete the currently selected waypoint, hazard, control measure, or target/threat that has been selected by the delete **POINT** button.

b. Delete NO Button. Selecting the Delete **NO** button will cause the system to abort the delete process and deselect the **DEL** button.

3A.89.5 Store (STO) Button. Selecting the **STO** button calls up the **NOW** button used to store a waypoint or target within the coordinate data files using the flyover store process. The review status window displays only the waypoint identifier, type, and altitude associated with the point file data to be added. The default values used are as follows:

- Point Type: W or T
- Point Number: The next lowest number available for the appropriate coordinate file
- Point Identifier: WP or TG
- Free Text: FLY
- Altitude: Present position MSL terrain altitude if the valid necessary information of ADS and Radar Altimeter is available.

a. TYPE Button. The **TYPE** two state button is used to determine what type of point is going to be stored when the **NOW** button is selected or the **STORE** button on the LHG is selected. The **TYPE** toggles between WP and TG. The **TYPE** button defaults based on the phase selected when **STO** is selected:

- WP is the default in the NAV phase
- TG is the default in the ATK phase

b. NOW Button. The **NOW** button commands the system to add a point using the current aircraft position and altitude. The free text will read FLY for points stored using the flyover method.

NOTE

The system will add a target unless the **POINT** page is displayed with **STO** selected and **TYPE** is set to **WP**.

c. TADS LOS Store Procedure. An optional method to store a waypoint or target using the **STO** button is to designate the point to be stored using the TADS laser. The CPG must sight select TADS and arm the aircraft. After selecting the **STO** button the CPG will point the TADS laser to the correct location and lase for range and select the **STORE** pushbutton on the LHG. This will cause the system to add a waypoint or target to the system using the offset from the TADS laser range to the aircraft position and the aircraft altitude. TADS LOS can also store points using Auto Range/Default Range or Manual Range. Points can also be stored using HMD and Auto Range/Default Range or Manual Range. The free text will reflect the LOS used to store the target, TAD or HMD.

3A.89.6 XMIT Button. Selecting the **XMIT** button calls up the send **POINT** button with the last valid coordinate data selected, IDM subscriber buttons, and the transmit **SEND** button used to send a waypoint, hazard, control measure, or target/threat over the IDM communication network.

3A.89.7 POINT Review Status Window. The **POINT** review status window in the lower part of the mapping area provides coordinate data pertaining to a selected point depending upon the moding of the **POINT** page. The data fields displayed within the status window include the following:

- Point Type and Number
- Point Identifier
- Free Text Identifier
- Estimated Time Enroute (**ETE**)
- Estimated Time of Arrival (**ETA**)
- Spheroid
- Datum
- UTM Coordinates
- Bearing
- Distance to Go (Km)
- Latitude/Longitude Coordinates
- Altitude
- Distance to Go (NM)

3A.90 ROUTE (RTE) PAGE

The **RTE** page (fig. 3A-111) allows the crewmember to access current route information, select a new route, build a route, or select a direct route to a point.

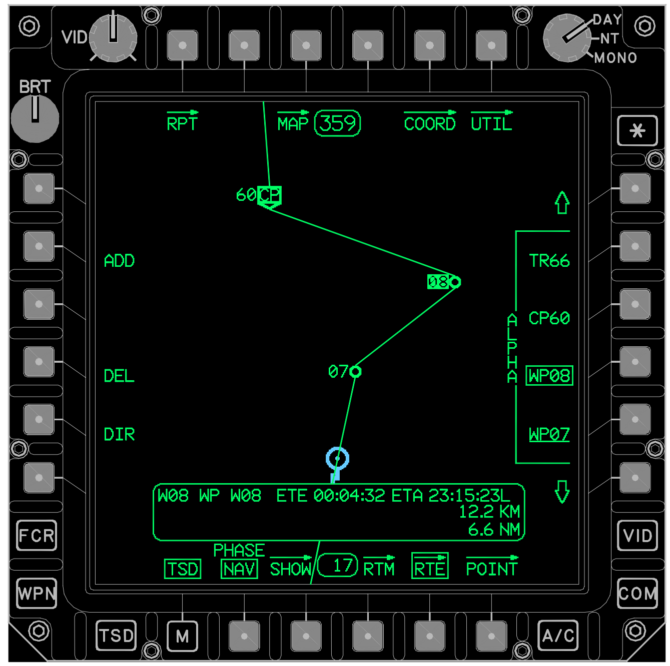

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Figure 3A-111. RTE Page

The **RTE** page also contains the following unique buttons:

- L1 **POINT** button
- L2 **ADD** button
- L4 **DEL** button
- L5 **DIR** button
- R1 Route Scroll Up button
- R2 - R5 Route **POINT** buttons
- R6 Route Scroll Down button
- B4 **RTM** button

3A.90.1 POINT Button. The **POINT** button is displayed when either the **ADD** button or **DIR** button is selected. The crew must enter the existing point type using the KU.

3A.90.2 ADD Button. Selecting the **ADD** button allows the crew to add existing waypoints, hazards, and control measures to the current route. The system does not permit adding a target or threat to the route. To add a point to the route, first select the **ADD** button, and the system calls up the **POINT** button. Next, select the **POINT** button and enter the point to be added using the KU, or use the cursor to select the point to be added. Next, select the point in the route window which the selected point is to be inserted in front of. The system modifies the route to include the selected point.

3A.90.3 Delete (DEL) Button. Selecting the **DEL** button allows the crew to delete an existing waypoint, hazard, or control measure from the current route. To delete a point from the route, first select the **DEL** button. Next, select the Route Point Number button which lists the point for deletion. The system modifies the route to exclude the selected point.

NOTE

The Next Waypoint Status Window will reflect the point selected as ”DIRECT TO”.

3A.90.4 Direct (DIR) Button. Selecting the **DIR** button allows the crew to select an existing waypoint, hazard, or control measure or target/threats as the point to which a direct route will be created.

NOTE

When either a direct-to inside the route or outside the route is created, the route line will go partial intensity, and the direct-to route line will be shown in full intensity.

a. Direct To In The Route. To create a direct route to a point, first select the **DIR** button and the system makes the Route Point buttons available for selection. Next, select the point in the route window at which the direct-to route is to be created.

b. Direct To Outside The Route. To create a direct route to a point, outside the route, first select the **DIR** button. The system calls up the **POINT** button. Select the **POINT** button and enter the point to which a direct route will be created using the KU, or use the cursor control to select the point to which a direct route will be created from the map display.

3A.90.5 Route Menu (RTM) Button. The **RTM** button allows access to the Route Menu page.

3A.90.6 Route Scroll UP/DOWN Buttons. Selecting the route scroll buttons causes the points within the route to shift in order to display points along the route.

3A.90.7 Route POINT Buttons. The route **POINT** number buttons provide the ability to review, add, delete, or perform a direct route to a point in the current route. The point label which represents the active destination is underlined. The route number option buttons act as momentary buttons when adding, deleting or performing a direct-to to a point in the current route.

3A.90.8 Route Grouped Options. The route window provides a display of the next four waypoints, hazards, or control measures in the current route. The route name displays within the bracket along the left side of the grouped options.

3A.90.9 RTE Review Status Window. The **RTE** review status window in the lower area of the map provides the ability to review coordinate point data for points in the current route. The data fields of the route review status window include the following:

- Point type and number
- Point identifier
- Free text identifier
- Estimated Time Enroute (ETE) based on position of the aircraft in the route
- Estimated Time of Arrival (ETA) based on position of the aircraft in the route
- Distance to go along the route (KM)
- Distance to go along the route (NM)

CAUTION

The Next Waypoint Status Window will reflect the first point in the selected route. To enter route from other than the start point, perform a ”DIR TO” to the appropriate waypoint to ensure the Next Waypoint Status Window is valid.

NOTE

If **ADD**, **DEL**, and **DIR** are not selected, then the default is review mode.

3A.91 ROUTE MENU (RTM) PAGE

The **RTM** page (fig 3A-112) allows the crewmember to review stored route information, select a route for navigation, or delete a stored route. Two pages display a total of ten stored routes. The **NEW** route button defaults to selected upon display of the page.

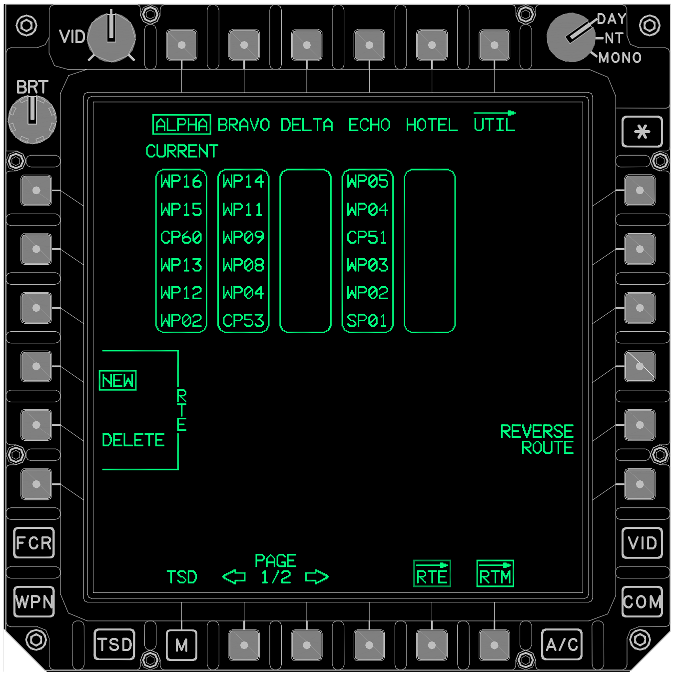


Figure 3A-112. ROUTE MENU (RTM) Page

The **RTM** page contains the following unique buttons:

- T1 - T5 Route name buttons
- L4 **RTE NEW** button
- L5 **RTE DELETE** button
- R5 **REVERSE ROUTE** button

3A.91.1 Route Name Buttons. The Route Name buttons provide the ability to select a particular route to be the current route for navigation or to be deleted from the route file. The **CURRENT** label is displayed just above the selected route window. Route name can only be entered through the AMPS.

3A.91.2 RTE NEW Button. Selecting the **RTE NEW** button allows the crewmember to designate a route as the new current route for navigation.

3A.91.3 RTE DELETE Button. The **RTE DELETE** button allows the crewmember to permanently delete a route. Once the **RTE DELETE** button is selected, selecting one of the route name buttons calls up the delete route **YES** and **NO** buttons.

a. RTE Delete YES Button. Selecting the delete route **YES** button will cause the system to delete all the points from the selected route. The coordinate data of the points will remain in memory.

b. RTE Delete NO Button. Selecting the delete route **NO** button will cause the system to abort the delete route process.

3A.91.4 REVERSE ROUTE Button. The **REVERSE ROUTE** button allows the crewmember to reverse the waypoint order in the current route. If the active point in the current route is the first point, the new active point will be set to the last point. If the active point is not the first, the new active point will be set to the previous point. If a direct-to point is the active point, the active point will not be changed.

3A.91.5 Route Status Windows. A route window is displayed for each of the five routes presented on **RTM** page 1 or 2 to indicate the first 6 points within each route and the route selected as the current route. A route window displays just below its associated route name button in the upper area of the format. In addition, the **CURRENT** label displays just above the route window which is selected as the current active route for navigation.

3A.92 COORDINATE (COORD) PAGE

The target/threat **COORD** page (fig 3A-113) provides access to coordinate file data. The **COORD** page contains the complete coordinate data file of stored targets and threats. The **COORD** page also provides the ability to select a target or threat as the acquisition option or to expand the display of detailed target or threat information for review. The system shall initialize to the first page unless the current acquisition source (T##) is a target or threat. If the crew attempts to add or store more than 50 targets or threats, the system overwrites the target or threat starting one location past the end of the target and threat safe set. The target and threat file has up to 25 locations protected from overwriting referred to as the safe set. The SP protects all targets, up to 25, that are loaded from the DTC. The crew can edit these protected files, but they will not be overwritten. The SP will only use these protected locations for storing if the target or threat that was initially loaded in that location has previously been deleted.

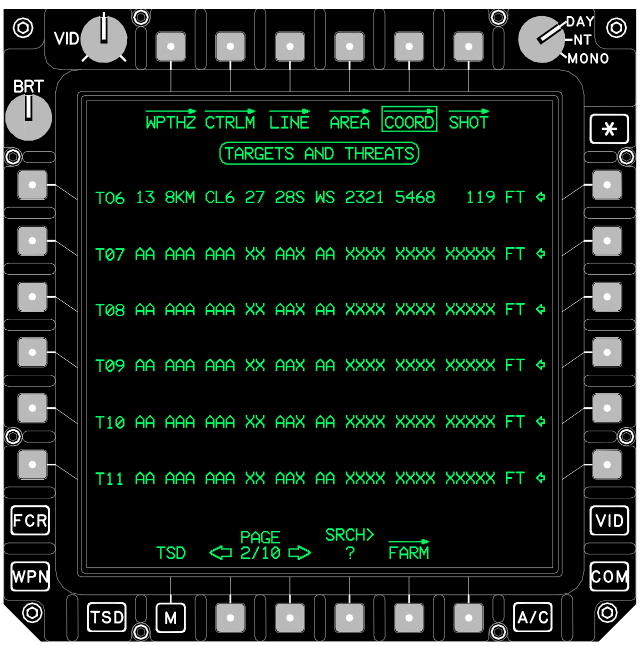


Figure 3A-113. COORD Page

- T1 **WPTHZ** button
- T2 **CTRLM** button
- T3 **LINE** button
- T4 **AREA** button
- T6 **SHOT** button
- L1 -L6 Acquisition Selection buttons
- R1 - R6 Point Expansion buttons
- B4 Search (**SRCH**) button
- B5 **FARM** button

3A.92.1 Waypoint/Hazard (WPTHZ) Page Button. Selection of the **WPTHZ** button will cause the waypoint/hazard page to be displayed.

3A.92.2 Control Measures (CTRLM) Page Button. Selection of the **CTRLM** button will cause the control measures page to be displayed.

3A.92.3 LINE Page Button. Selection of the **LINE** button will cause the **LINE** page to be displayed.

3A.92.4 AREA Page Button. Selection of the **AREA** button will cause the **AREA** page to be displayed.

3A.92.5 Shot-At (SHOT) Page Button. Selection of the **SHOT** button will cause the Shot-At page to be displayed.

3A.92.6 Target/Threat Coordinate Acquisition Selection Buttons. The **COORD** acquisition select buttons rapidly select a target or threat from the file as an acquisition source.

3A.92.7 Target/Threat Coordinate Expansion Buttons. Selection of the **COORD** expansion buttons expands the single line of target or threat information into three lines of information. The single line of target or threat information contains the following:

- Target/Threat type and number
- Target/Threat identifier
- Free text identifier
- Spheroid
- Datum
- UTM coordinates
- MSL elevation

The expanded three lines of information contain the following additional information:

- Estimated Time Enroute (ETE)
- Estimated Time of Arrival (ETA)
- Bearing
- Distance to go (Km)
- Latitude/Longitude coordinates
- Distance to go (NM)

When an expansion button is selected it will automatically deselect any other previously selected expansion button.

3A.92.8 Target/Threat Coordinate Search (SRCH) Button. The target/threat coordinate **SRCH** button provides the ability to rapidly search within the target/threat coordinate data file.

3A.92.9 Fuel, Ammo, Rockets, and Missiles (FARM) Button. Selecting the **FARM** button displays the **FARM** page.

3A.93 WAYPOINT/HAZARD (WPTHZ) PAGE

The **WPTHZ** page (fig 3A-114) accesses the coordinate file data of waypoints and hazards. The **WPTHZ** page allows for the selection of a waypoint or hazard as the acquisition option or to expand the display of detailed waypoint or hazard information for review. The system initializes to the first page unless the current acquisition source (T##) is a waypoint or hazard.

The selections made from the **WPTHZ** page are identical to the selections made on the **COORD** page except that when selecting an acquisition select button, the acquisition source will change to a waypoint or hazard instead of a target or threat.

3A.94 CONTROL MEASURE (CTRLM) PAGE

The **CTRLM** page (fig 3A-115) accesses the coordinate file data of control measures. The **CTRLM** page allows for the selection of a control measure as the acquisition option or to expand the display of detailed control measure information for review. The system initializes to the first page unless the current acquisition source (T##) is a control measure. The selections made from the **CTRLM** page are identical to the selections made on the **COORD** page except for the following: When selecting acquisition select button, the acquisition source will change to a control measure instead of a target or threat. The **SRCH** button has a valid range of 51 to 99.

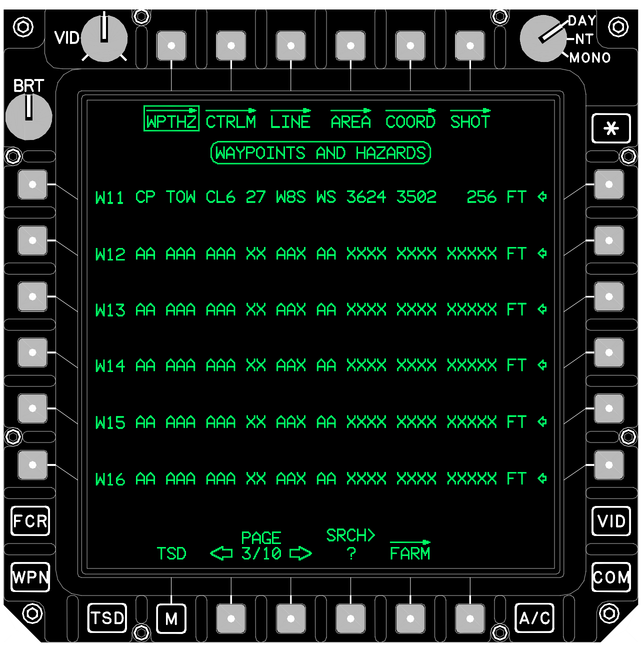


Figure 3A-114. WAYPOINTS and HAZARDS Page

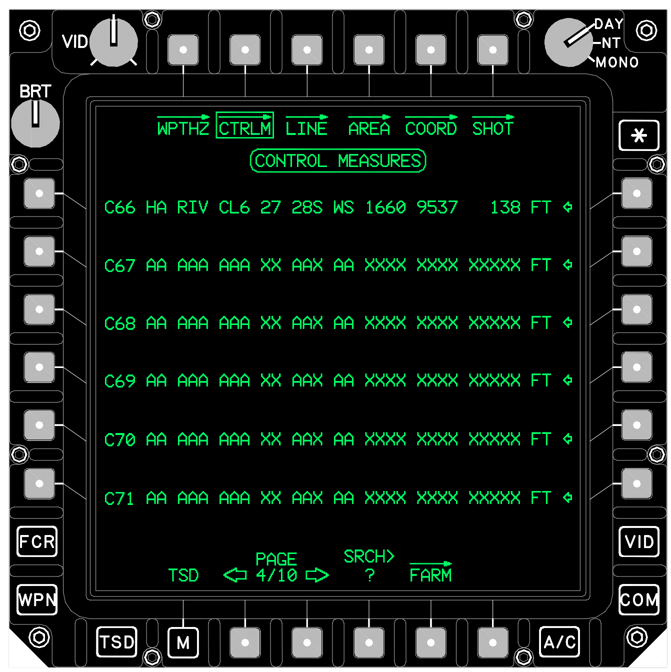


Figure 3A-115. CONTROL MEASURES Page

3A.95 LINE PAGE

The **LINE** page (fig 3A-116) provides the ability to view the coordinates associated with each of the 15 (maximum) boundary and phase lines stored in the navigation data base. The system initializes to the first page. The **LINE** data display area lists the data stored for each line in the file. Each line may consist of between two and four points.

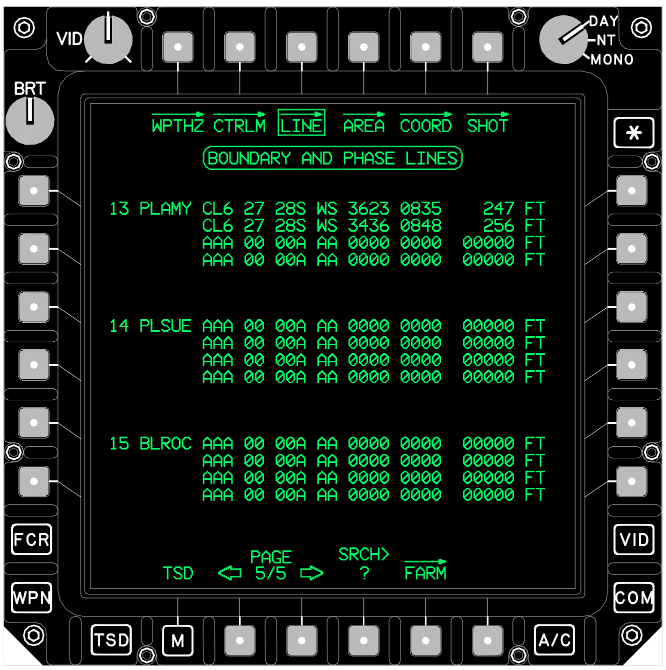


Figure 3A-116. LINE Page

The list includes the following information:

- Line file number
- Line identifier
- UTM coordinate for each point
- MSL altitude for each point

3A.96 AREA PAGE

The **AREA** page shown in (fig 3A-117) provides the ability to view the coordinates associated with each of the 12 (maximum) areas stored in the navigation data base. The system initializes to the first page. The **AREA** page is identical to the **LINE** page such that the page is for viewing only. One difference between the lines and areas is that each area must be made up of four points. The **AREA** data display area lists the data stored for each area in the file.

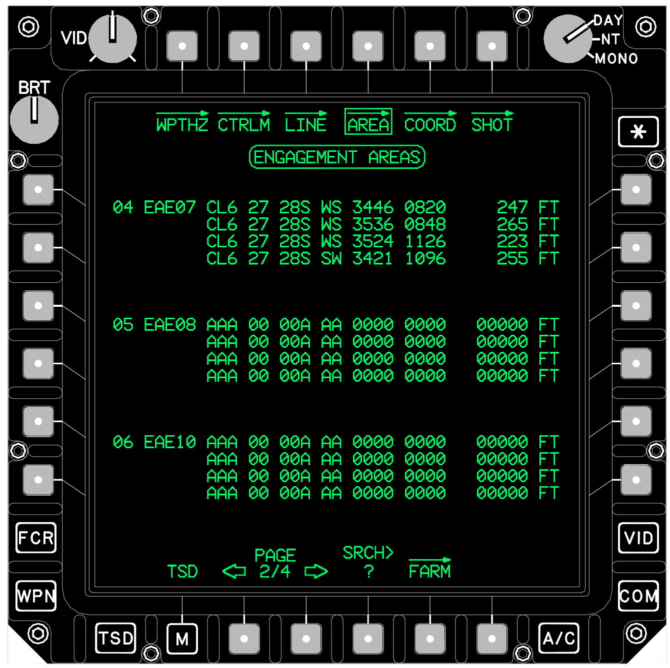


Figure 3A-117. AREA Page

The list includes all four points defining the area and includes the following information:

- AREA file number
- AREA identifier
- Spheroid
- Datum
- UTM coordinate for each point
- MSL altitude for each point

3A.97 SHOT PAGE

The **SHOT** page, shown in (fig 3A-118) accesses the coordinate file data of shot-at locations stored in the navigation data base. This file is capable of storing up to 128 shot-at locations on 26 display pages of 6 points per page. The file is split into 2 parts. The first 16 locations are reserved for targets shot-at by the ownship. The last 112 locations are reserved for targets shot-at by other aircraft. If more that 16 targets are shot-at by the ownship, the system will overwrite shot-at locations beginning with the first position in the file. If more than 112 shot-at locations are added to the file, the system will overwrite the shot-at locations beginning with the 17th position in the file.

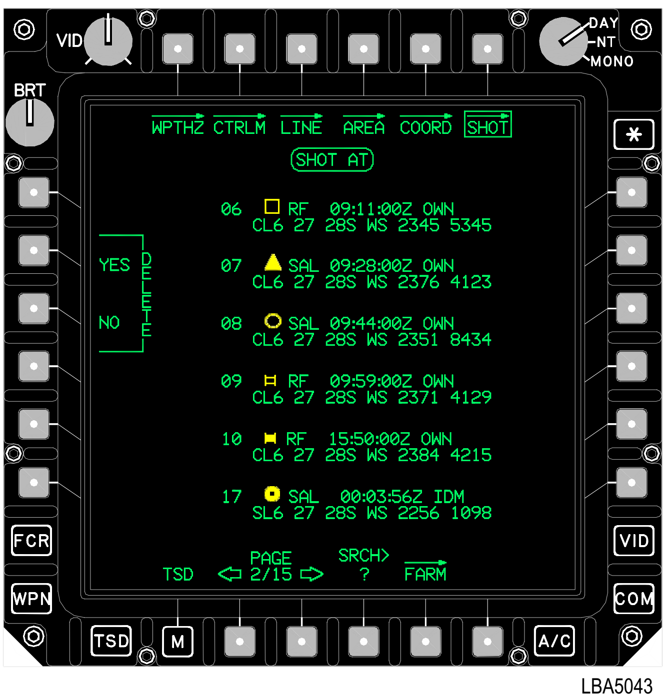


Figure 3A-118. SHOT Page

The **SHOT** page contains the following unique buttons:

- L3 **DEL** button

3A.97.1 Delete (DEL) Button.

The **DEL** buttons allows the crew to delete all shot-at location coordinate points received from other aircraft. Selecting the **DEL** button calls up the Delete Shot **YES** and Delete Shot **NO** buttons.

3A.97.2 SHOT-AT Data Display Area.

The **SHOT-AT** data display area lists the data stored for each shot-at in the file. The display area includes the following information:

- Shot-at file number
- Target symbol
- Missile type
- Zulu Time of trigger pull
- OWN or IDM indication
- Spheroid
- Datum
- UTM coordinate of Shot-at (para 3.62.16)

3A.98 FUEL, AMMO, ROCKETS, AND MISSILES (FARM) PAGE

The **FARM** page (fig 3A-119) allows the crew to quickly review **FARM** reports. Selecting the **FARM** button will display data from the last seven received **FARM** reports. However, if a **FARM** report is received and the call sign matches a **FARM** report currently in the system, the **FARM** report will be overwritten. If a **FARM** report is received and the call sign does not match an existing **FARM** report it will be written to the next available location. If a location is not available, the oldest **FARM** report will be overwritten.

The **TYPE** button allows the crew to determine what type of **FARM** report data is displayed **PP**, **EXPEN**, **MSL** or **BASIC**. The reports are sorted from the newest to oldest based on date/time (then by call sign).

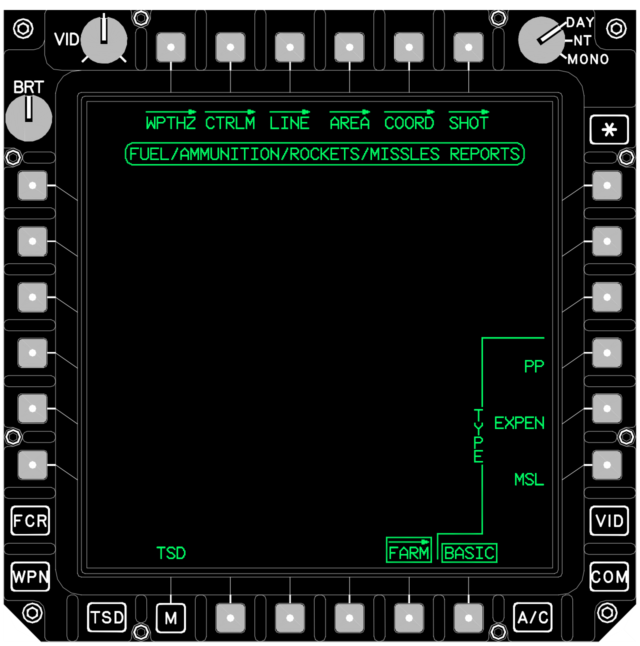


Figure 3A-119. FARM Page

NOTE

- If a system is turned off the message will indicate its information is not available.
- If the aircraft is in simulation mode, the simulated inventory will be sent.
- If the aircraft is configured for TESS and has detected any live ordinance the gun quantity present, rocket launcher present, and HELLFIRE launcher present will indicate not present in the message. The message will indicate the gun, rocket, and HELLFIRE quantities are not available.
- If equipment failure occurs (or hang fires) those quantities will not be included in the message.
- If data is invalid or no launchers are present, “NA” will be displayed in the appropriate column on the page.

a. BASIC Button. Displays basic **FARM** data (fig 3A-120). The SAL column on this page displays the sum of **SAL1** and **SAL2** missiles.

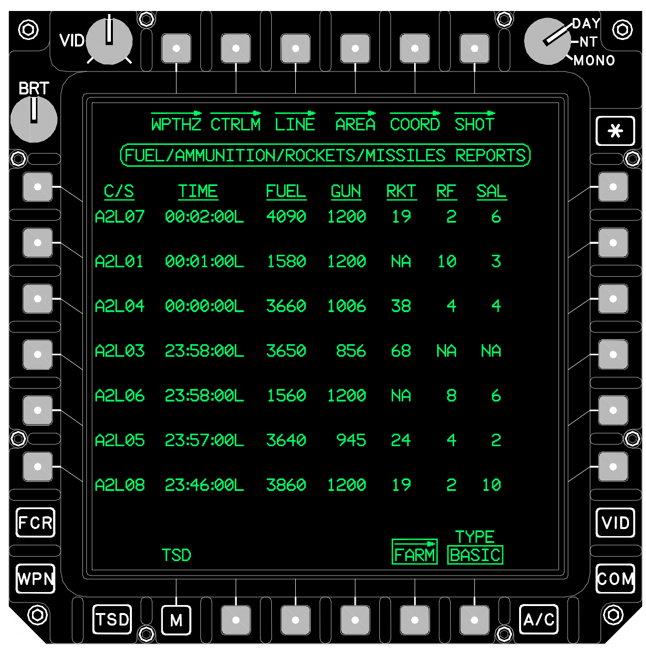
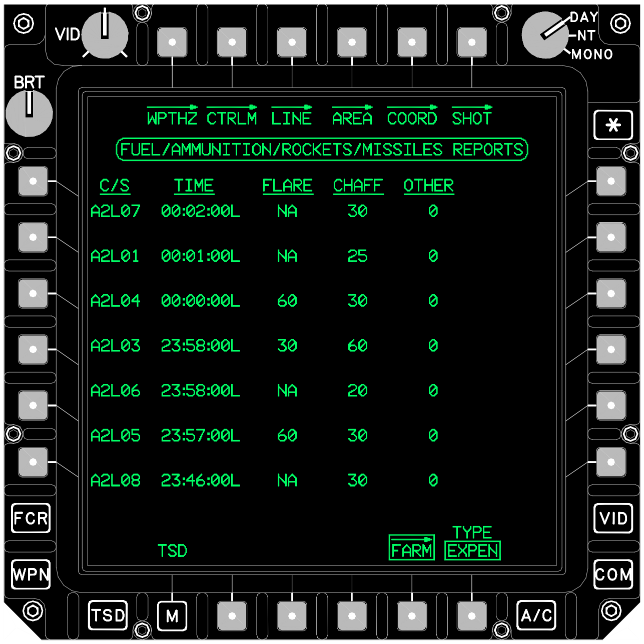


Figure 3A-120. BASIC FARM Data

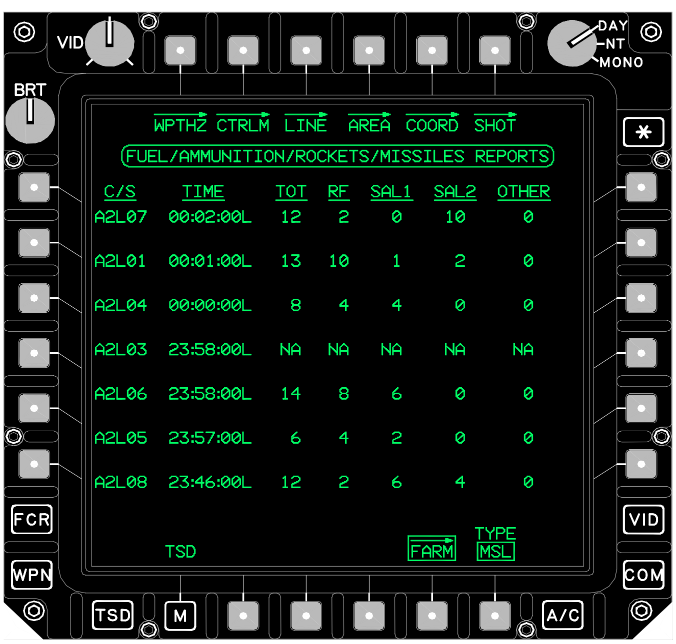
b. **EXPEN Button**. Displays all ASE Expendables (fig 3A-121).



LBA5009

Figure 3A-121. EXPEN FARM Data

c. **MSL Button**. Displays specific Hellfire missile counts (fig 3A-122). "Other" is the difference between the total missile count and sum of the **RF**, **SAL1**, and **SAL2** counts.

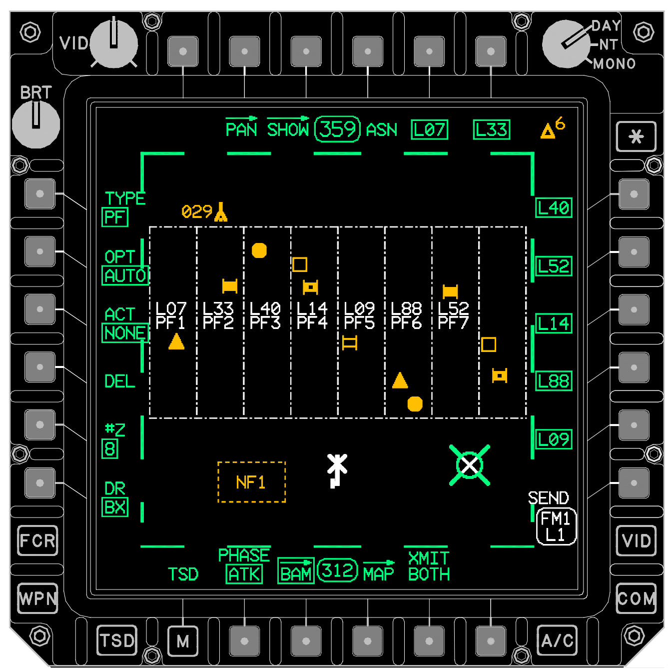


LBA5010

Figure 3A-122. MSL FARM Data

3A.99 BATTLE AREA MANAGEMENT (BAM) PAGE

The **BAM** page (fig 3A-123, or fig 3A-124) is displayed in the **NAV** or **ATTACK** phases. Selecting the **BAM** page will freeze the TSD. The **BAM** page provides the ability to construct and assign priority fire and no fire zones for the battle management mission segment. A maximum of 8 priority fire zones and 8 no fire zones can be displayed on the TSD. A maximum of 1 priority fire zone and up to 8 no fire zones can be active at any time. Active PFZ and NFZ's will marquee to aid the crew in determining which of the zones are active. The active priority fire and no fire zones affect the prioritization on the next scan after the zone has been created, received, or reassigned. FCR targets detected within an active priority fire zone out-prioritize the FCR targets which fall outside the zone. FCR targets detected within the active no fire zones are not prioritized.



LBA5042A

Figure 3A-123. BATTLE AREA MANAGEMENT (BAM) Page, Type PF

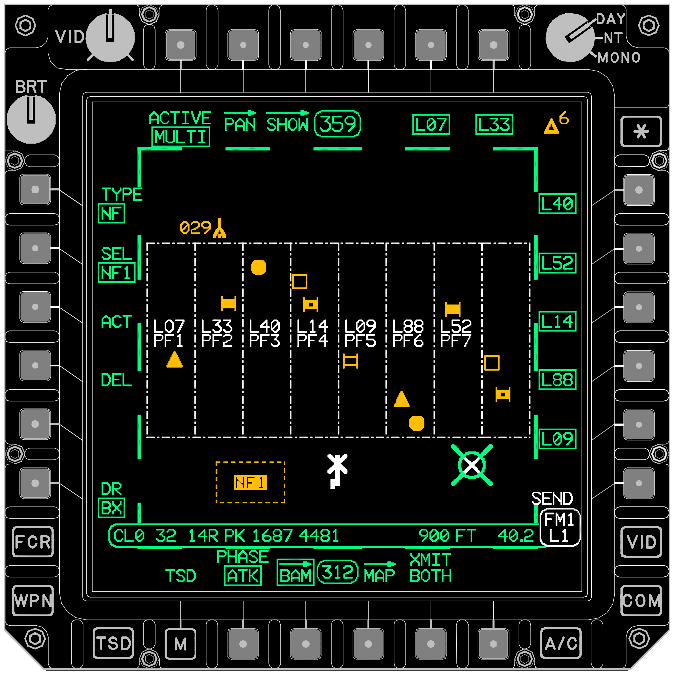


Figure 3A-124. BATTLE AREA MANAGEMENT (BAM) Page, Type NF

The **BAM** page contains the following buttons:

- T1 **ACTIVE** Button
- T4 **ASN** Button
- T5/6 Subscriber Buttons
- L1 **TYPE** Button
- L2 **OPT** Button
- L3 **ACT** Button
- L4 **DEL** Button
- L5 **#Z** Button
- L6 **DR** Button
- R1 - R5 Subscriber Buttons
- R6 **SEND** Button
- B2 **CLR** Button
- B5 **XMIT BOTH** Button
- B6 **OWN** Button

3A.99.1 Active (ACT) Button. The **ACT** button allows for selection of an active priority fire zone and/or active no fire zones. The system displays the **ACT** button only when fire zones are loaded into the system. When the **ACTIVE** button is set to **MULTI**, each no fire zone can be individually activated or deactivated using the **ACT** button. When a no fire zone is being deactivated and it is the current single active no fire zone, the first no fire zone that is found to be active starting from NFZ1 will be selected as the single active no fire zone for the IDM transmission.

3A.99.2 Assign (ASN) Button. Selecting the **ASN** button commands the system to display the Priority Fire Zone Identifier buttons and make the Subscriber Identifier and **OWN** buttons available for selection, (fig 3A-125). The **ASN** button is displayed whenever priority fire zones are present in the system or all the points for the zones being created have been entered.

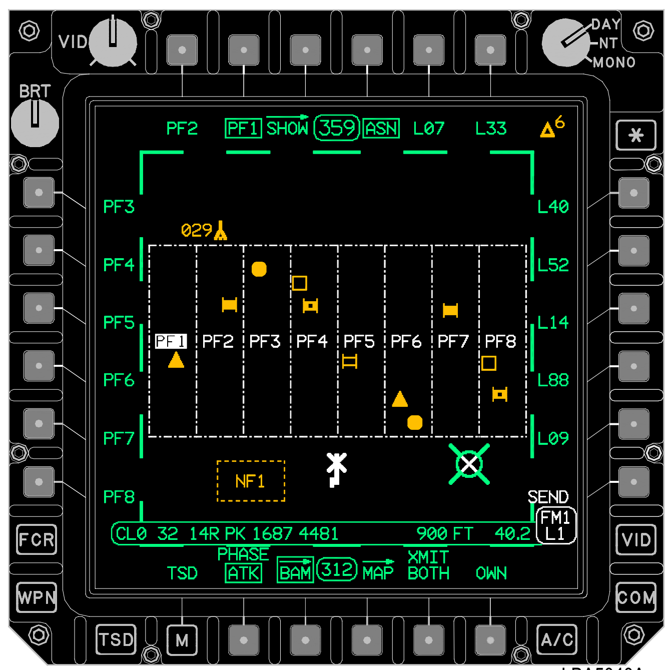


Figure 3A-125. Assign (ASN) Button Selected

3A.99.3 TYPE Button. The **TYPE** button allows the crew to toggle between Priority Fire (**PF**) and No Fire (**NF**) zone controls (fig 3A-123).

3A.99.4 Option (OPT) Button. The **OPT** button is displayed when the **TYPE** is **PF,** and allows the crew to select the AUTO, MAN or TRP drawing method. AUTO is the default.

a. Automatic (AUTO) Button. Selection of the **AUTO** button enables the cursor control to select four points which connect to form a quadrilateral polygon. Selecting the fourth corner of the polygon divides the polygon into a number of priority fire zones 1-8, as determined by the current value of the **#Z** button. When the crewmember has selected the first point the **CLR** button will be displayed. When the crewmember has selected the last point, the **ASN** and **SEND** buttons will be displayed. Selection of the **OPT** button removes all of the existing priority fire zones from the MPD in preparation of drawing a new PFZ.

b. Manual (MAN) Button. Selection of the **MAN** button enables the cursor to select points for each zone that will be created based on the current setting of the **#Z** button. When the crewmember has selected the first point the **CLR** button will be displayed. When the crew has selected the last point of the last priority fire zone, the **ASN** and **SEND** buttons will be displayed.

c. Target Reference Point (TRP) Button. Selection of the **TRP** button enables the cursor to select a point on the map as the center of the priority fire zones to create. The size of the zones is based on the setting of the kilometer **KM** button. When the crew has selected the reference point, the **ASN**, **CLR** and **SEND** buttons will be displayed.

(1) Kilometer (KM) Button. The **KM** (kilometer) button displays when the **TRP** button is selected. Selecting the **KM** (kilometer) button allows the crew to select the size (1-3 km) of the TRP PFZ. The zone size is measured in terms of the length of one side of the square box for each of the four zones. The default size is 2 km.

3A.99.5 Number (#Z) Button. Selecting the **#Z** (1-8) button allows the crew to select the number of zones to be created. The number of the zones to be created defaults to the number of zone members designated plus one for the ownship.

3A.99.6 Draw (DR) Button. Selecting the **MAN** or **AUTO** button calls up the **DR** button, which toggles between **BX** (box) and **LN** (line) modes of the cursor operation. The box mode allows the crew to select two opposite corners of a box for PF/NF zone construction. The **LN** mode allows the operator a quadrilateral polygon for a PF/NF zone. Using the **LN** method to draw, the zones will be oriented parallel to the first line drawn.

3A.99.7 SELECT (SEL) Button. When the **TYPE** is **NF,** the **SEL** button allows the crew to select the NF zone to modify (fig 3A-124). Each active NFZ is indicated by an arrow. Empty zones (undrawn) are WHITE with a question mark next to the number.

NOTE

- Instead of selecting the **ACT** or **ACCEPT** buttons, the crew may begin drawing the next no fire zone and the previously drawn zone will automatically be accepted.
- The DP will keep track of all the active no fire zones and the single active no fire zone when the **ACTIVE** button is set to MULTI for backwards compatibility. This will allow the receiving DP to use the appropriate data, either multiple active no fire zones or a single active no fire zone based on the receiving aircraft current capability.
- Both the DP and the FCR will automatically configure to the capability of the other. This will allow an FCR with single active no fire zone capability to be installed with a DP with multiple active no fire zone capability or vice-versa with no impact other than the functional differences between multiple and single active no fire zone.

3A.99.8 ACCEPT Button. The **ACCEPT** button allows the crew to accept a NFZ permanently if all the points for the new NFZ have been entered.

3A.99.9 DELETE (DEL) Button. The **DEL** button allows the crew to delete all Priority Fire zones or each No Fire zone individually. Crew has YES/NO option.

NOTE

Although the IDM messages will support sending data between differently configured aircraft (i.e., some single active no fire zone and some multiple active no fire zones) it is advised that aircraft communicating be set to the same active mode (if possible) to avoid data being ignored due to different modes of operation.

3A.99.10 ACTIVE Button. When the **TYPE** is **NF**, the **ACTIVE** button allows the crew to switch between MULTI(ple) and SINGLE mode. When in MULTI active mode, more than one no fire zone can be active at the same time. When in SINGLE active mode, only one no fire zone can be active at one time. If another no fire zone is active at the time a no fire zone is activated, it will automatically be deactivated. When the FCR is powered on, the **ACTIVE** button will be barriered and the DP will automatically mode to either MULTI or SINGLE based on the capability of the FCR.

3A.99.11 Subscriber Identifier Buttons. To assign individual priority fire zones to each subscriber, the crew will select the subscriber buttons in the desired sequence. In turn, the system assigns **PF1** to the first subscriber selected, **PF2** to the second subscriber selected, and so forth, until all assignments are completed. The crew may also deselect the subscriber identifier buttons to remove the subscriber from the selected priority fire zone.

3A.99.12 SEND Button. Selecting the **SEND** button transmits the priority fire zones to the selected zone members on the IDM net. The **SEND** button will be displayed when the last point of the priority fire zones or no fire zone,being created has been entered. The **XMIT BOTH** button will determine if both the PF and NF zones are transmitted or only the current type of zone determined by the **TYPE** button are transmitted.

3A.99.13 Clear (CLR) Button. The CLR button clears the last cursor entry for the polygon in progress. Subsequent selections will remove the next to last cursor entry and so on.

3A.99.14 XMIT BOTH Button. Selecting the **XMIT BOTH** button allows the crew to select/deselect sending both PF and NF zones when **SEND** is selected.

3A.99.15 OWN Button. The crew selects the **OWN** button to assign the selected priority fire zone to the ownship. The system displays the word **OWN** in the center of the priority fire zone assigned to the ownship.

3A.99.16 Priority Fire Zones. A maximum of 8 priority fire zones can be created/displayed on the TSD. Only the active priority fire zone is displayed in WHITE full intensity. The inactive priority fire zones are displayed partial intensity. The active PFZ will marquee on the TSD and FCR pages. The label for the PZF will be removed to allow the crew to easily identify the highest priority targets. The Active priority fire zone will be displayed in both GTM and ATM mode on the FCR Page.

3A.99.17 No Fire Zones. Eight no fire zones can be created/displayed on the TSD. No fire zones are displayed in full intensity in YELLOW. The active no fire zones will marquee on the TSD and FCR pages.

3A.100 REPORT (RPT) PAGE

The **RPT** page (fig 3A-128) provides the ability to send reports using the IDM to network primary members, or to query those members for the selected report. The **RPT** page contains the following unique buttons:

- T4 **STAT** button
- T5-T6 Subscriber buttons
- L1 **BDA** button
- L2 **TGT** button
- L3 **PP** button
- L4 **FARM** button
- L5 **SIT** button
- L6 **SPOT** button
- R1 - R5 Subscriber buttons
- B2 **REPLY**/**MSG** button
- B5 **ARTY** Page button
- B6 **AF** Page button

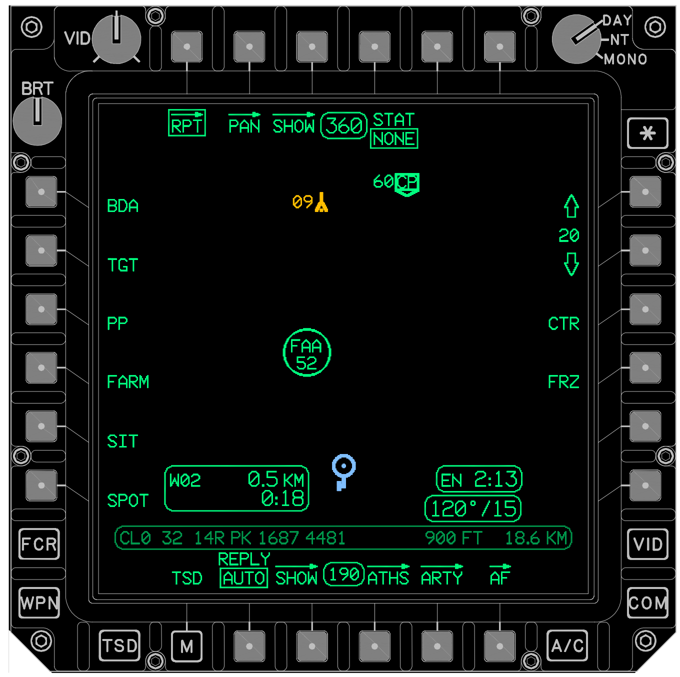


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Figure 3A-128. RPT Page

3A.100.1 STAT Button. Selecting the **STAT** button calls up the **NONE**, **MTO**, **AFM**, **SPOT** and **SIT** buttons. The default selection is **NONE**, or the last option selected for which a corrresponding closure **STATUS** window is displayed.

a. NONE Button. Selecting the **NONE** button closes any currently displayed closeable status window.

b. MTO Button. Selecting the **MTO** button causes display of the message to obsesrver status window.

c. AFM Button. Selecting the **AFM** button causes display of the Airfire Mission Status window.

d. SPOT Button. Selecting the **SPOT** button causes display of the **SPOT** Report status window.

e. SIT Button. Selecting the **SIT** button causes display of the Situation Report Status WIndow.

3A.100.2 Battle Damage Assessment (BDA) Button. Selecting the **BDA** button (fig 3A-129) calls up the **ALL** and **OWN** buttons. The **OWN** button is default selected.

a. ALL BDA Button. Selecting the ALL button instructs the system to transmit all of the BDA reports over a radio with Longbow protocol selected when the crew selects the SEND button.

b. OWN BDA Button. Selecting the OWN button instructs the system to transmit or request BDA reports for the ownship when the crew selects the SEND button.

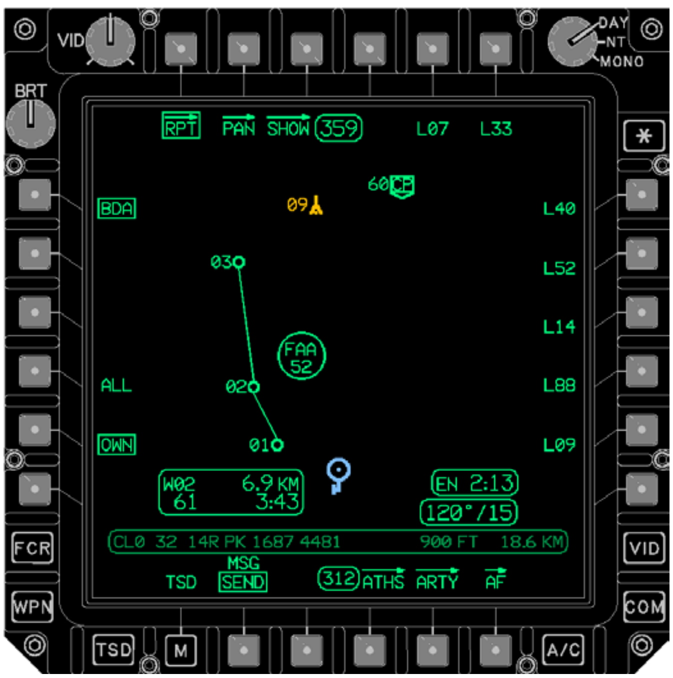

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Figure 3A-129. Page Layout When BDA Is Selected

3A.100.3 FCR Targets (TGT) Button. Selecting the **TGT** button calls up the **ALL** and **PRI** (Priority) buttons, and enables the cursor to select individual FCR target(s). FCR targets can only be sent, they can not be requested.

a. ALL FCR Targets Button. Selecting the **ALL** button instructs the system to transmit all FCR targets (high and low priority) when the crewmember selects the **SEND** button.

b. Priority (PRI) FCR Targets Button. Selecting the **PRI** button instructs the system to transmit only high-priority FCR targets (up to 16) when the crew selects the **SEND** button.

c. Selecting Individual FCR Targets. If neither the **ALL** nor the **PRI** button is selected, the crew can select individual FCR target(s) that the system will transmit out when the crew selects the **SEND** button.

3A.100.4 Present Position (PP) Report Button. Selecting the **PP** button commands the system to transmit or request out the aircraft present position when the crew selects the **SEND** button. The **PP** report works with Longbow, Tactical internet, and Fire Support protocols.

3A.100.5 Fuel, Ammo, Rockets, and Missiles (FARM) Button. Selecting the **FARM** button commands the system to transmit or request a **FARM** report when the crew selects the **SEND** button. The **FARM** report only works with the Longbow protocol.

a. The following data will be transmitted to or requested from all selected subscribers when the crew selects the **SEND** button.

- Call Sign (5 characters)
- Date (month, day, and year)
- Present Position (Lat/Long)
- Elevation (feet)
- Fuel Quantity (Lbs)
- Gun rounds present and quantity
- Rockets (launcher present and quantity)
- Hellfire missiles (quantity of SAL 1, SAL 2, and RF)
- Quantity of all ASE Expendables

3A.100.6 Situation (SIT) Report Button. Selecting the **SIT** button calls up the **MISSION** and **OP NATURE** buttons. The **SIT** report is issued when the crew selects the **SEND** button. The situation report provides the recipient with the aircraft location, fuel type and quantity, and weapons inventory. Weapons load is actual inventory if tactical weapons are on board, and simulated inventory if operating in TESS mode.

a. MISSION Button. Selecting the **MISSION** button instructs the system to indicate whether or not the crew can accomplish the current mission. The options are; **WILL COMPLY** or **CAN'T COMPLY**.

b. OP NATURE Button. The **OP NATURE** multi-state button is used to select the operational nature of the aircraft at the time of the SITREP report. Selecting the **OP NATURE** button enables the crew to select from a variety of options including;

- **BATTLE H.O.** (Hand Over)
- **MOVE**
- **MOVE TO CONTACT**
- **ATTACK**
- **ZONE RECON**
- **ROUTE RECON**
- **AREA RECON**
- **SCREEN**
- **FARP**

3A.100.7 SPOT Report Button. The **SPOT** report button is used to send a SPOT report. Selecting the **SPOT** button will call additional selections to be sent with the SPOT report. The SPOT report is used to issue a target handover based on an FCR scan or a selected target/threat file.

a. ALLIANCE Button. The **ALLIANCE** button is used to indicate the target alliance. Selecting the **ALLIANCE** button displays the selections; **FRIENDLY**, **UNKNOWN**, and **HOSTILE**. The crewmember can then select the target alliance. The default selection for **ALLIANCE** is **UNKNOWN**.

b. REPORT Button. The **REPORT** two-state button is used to establish the type of spot report being sent. Selecting the **REPORT** button will toggle between **PRI FCR** and **TGT/THRT**. **PRI FCR** is the default selection.

(1) PRI FCR Selection. When **REPORT** is set to **PRI FCR**, the SPOT report is sent based on the last FCR scan conducted with up to 16 targets sent. If no FCR targets are detected, a crewmember must set the **REPORT** button to **TGT/THRT** and select a target/threat file, or the **SEND** button will not display.

NOTE

When the **REPORT** button is set to **PRI FCR**, the SPOT report should not be used to send from one Longbow aircraft to another. If more than 14 priority FCR targets exist, the IDM may lock-up during transmission.

(2) TGT/THRT Selection. When **REPORT** is set to **TGT/THRT**, additional controls are displayed for inclusion in the SPOT report. The **TGT/THRT** report is used to send a single **TGT/THRT** or Control Measure file.

(3) TGT/THRT Status Window. The TGT/THRT status window is displayed when report is set to TGT/THRT. The status window displays the data entered by the crewmember that will be sent in the SPOT report. Information includes: Target number (e.g. T01), Quantity, Course and Speed.

c. THRT Button. The **THRT** button is used to manually enter data pertaining to the SPOT report for the report. When a target/threat is cursor-selected, or a target/threat number is entered, the crewmember will be prompted to add the following data using the KU:

- Target Number
- Quantity
- Course (in degrees)
- Speed (in knots)

d. TARGET Button. The **TARGET** button is used to select a target type for the SPOT report. Selecting the **TARGET** button will display the grouped options including:

- **APC**
- **TANK**
- **TRUCK**
- **ARTY**
- **BRIDGE**
- **BUILDING**
- **ASMBLY AREA**
- **TROOPS**
- **ADU**
- **AIRCRAFT**

e. ENEMY ACT (Activity) Button. The **ENEMY ACT** button is used to establish the activity of the enemy unit for the SPOT report. Selecting the **ENEMY ACT** button displays the **ENEMY ACT** grouped options including:

- **STATIONARY**
- **ASSEMBLING**
- **RIVER XING**
- **NO ACTIVITY**
- **DEFENDING**
- **WITHDRAWING**

3A.100.8 Subscriber Buttons. The subscriber buttons are used to select intended message recipients. Default is all subscribers selected for the TGT, PP, and FARM and none selected for BDA, SPOT, and SIT.

3A.100.9 3.82.6 RPLY/MSG (Reply/Message) button. The **RPLY/MSG** button is used to select whether or not the ownship replies automatically to a request or not, and establishes whether an outgoing message is a request for information or is actually sending ownship information.

NOTE

The **FARM QUERY** message must be manually replied to.

a. RPLY (Reply) Button. The **RPLY** button is displayed when no report types (e.g. BDA) are selected. The button determines if the ownship will automatically respond to queries for AFAPD, PP and BDA reports. It toggles between **AUTO** and **OFF**.

b. MSG Button. The **MSG** button displays once one of the following reports is selected; **BDA**, **PP**, or **FARM**. The **MSG** button is used to select whether the report is being sent or a request is being made. The **MSG** button toggles between **SEND** and **RQST** with **SEND** as default.

3A.100.10 Artillery (ARTY) Page. The **ARTY** page (fig 3A-130) provides the ability to send data messages to the primary Fire Support Element (FSE) member of the selected artillery net. Tactical AFAPD and JVMF messages can also be received from this page. The **ARTY** page button is only accessed from the **RPT** or **AF** page, and contains the following unique buttons:

Figure 3A-130. ARTY Page

- T5 Primary Subscriber button
- L1 **MSG** button
- L3 **TARGET** button (CFF)
- L3 **CHECK ALL** button (ABORT)
- L4 **QTY** button (CFF)
- L4 **SITREP** button (ABORT)
- L5 **CONTROL** button (CFF/REPEAT/ADJUST)
- L5 **SPOT** button (ABORT)
- L5 **TARGET** button (CHK FIRE)
- L6 **DANGER CLOSE** button (CFF/REPEAT/ADJUST)
- L6 **EFFECT** button (EOM/SURV)
- L6 **ARTY MISSION** button (ABORT)
- R5 NONE button

3A.100.11 Primary Subscriber Button. The PRIMARY SUBSCRIBER button is displayed when a primary subscriber has been assigned to the fire support net, and indicates the call sign of the primary subscriber. Artillery mission messages sent via the **ARTY** page are intended for the FSE only, therefore only the single subscriber is presented.

3A.100.12 MSG Button. The message multi-state button is used to select what type of message is being sent or to abort out of a message thread. Selecting the **MSG** button displays the MESSAGE grouped options for selection of message type. Based on the message type selected additional selections will be displayed on the ARTY page. The message options include:

a. CHK FIRE (Check Fire) Selection. The **CHK FIRE** selection (fig 3A-130) is used to send a Check Fire message to the Fire Support Net. There are two selections available for a check fire message and are selected using the **TARGET** button. Whenever a CHK FIRE ALL or by TARGET is sent by the platform the STAT LAST will automatically be displayed to provide the operator with the capability to view the operator response once it is received.

NOTE

Check fire enables interface to prevent directing further fires on target, however, it is important to back this up with a radio call anytime that an operator ack is not received

(1) TARGET Button. The **TARGET** button is used to select the parameters of a check fire. The **TARGET** button toggles between **ALL** and **SINGLE**. The default selection is **ALL,** if no **CFF** mission is in progress, otherwise the default is set to **SINGLE.** When **ALL** is effected all active **CFF** within the Fire Support Net are ceased. When **SINGLE** is effected, only the **CFF** sent from the ownship is ceased.

NOTE

- Only one ARTY mission can be selected at any given time.
- The target number is provided in the MTO (message to observer), and is required to process any subsequent transmit or receive messages in the mission. Many buttons may be barriered or not displayed if a valid MTO has not been processed and/or approved.

b. Observer Readiness (OBS RDY) Button. Selecting the **OBS RDY** button commands the system to transmit out the observer readiness report when the crew selects the **SEND** button.

NOTE

Dynamic time of flight assumes that rounds were fired at time a SHOT update was received (stored) in the aircraft.

c. Call For Fire (CFF) Button. Target selection defaults to the FCR NTS when **CFF** (ref 3A-131) is selected. The crewmember can cursor select a target or FCR target set for the **CFF** message. The **CFF** icon is displayed over the NTS symbol or the target selected by the crewmember.

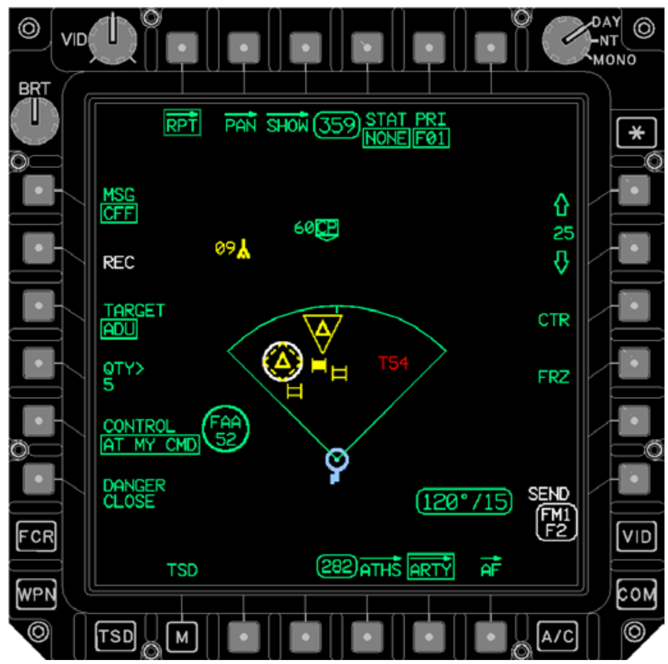

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Figure 3A-131. ARTY Page with CFF

(1) TARGET Button. The **TARGET** button is used to designate the type of target(s) in the **CFF** message. **TARGET** is barriered if a **CFF** mission from ownship is active. Target selections available include:

- **APC**
- **TANK**
- **TRUCK**
- **ARTY**
- **HARD/TGT**
- **MECH/TROOPS**
- **MOTOR/TROOPS**
- **TROOPS**
- **ADU**
- **AIRCRAFT**

NOTE

Low priority generally assigned to mission if **CAN'T OBS** is indicated.

(2) Quantity (QTY) Button. The **QTY** button allows for the amount of targets in the **CFF** message. The default quantity is based on whether targets were based on an FCR scan which would default the quantity to FCR targets detected, or a crewmember selected Target/ Threat file which would default the quantity to one.

(3) CONTROL Button. The control method button allows for selection of the control method to be used by the ownship in the **CFF** message. The default selection is **AT MY CMD** (at my command). Also available for selection is **WHEN RDY** (when ready) and **CAN'T OBS** (can't observe)**.**

(4) DANGER CLOSE Button. The danger close button allows the ownship to indicate a danger close condition for the **CFF** message. The **DANGER CLOSE** button is also selectable for a **REPEAT** and/or **ADJUST** message.

d. Subsequent Adjust - REPEAT Button. Selecting the **REPEAT** button calls up the **CONTROL** method and **DANGER CLOSE** buttons, and commands the system to transmit out the subsequent adjust - repeat message when the crew selects the **SEND** or **FIRE** button. In an established mission in which the initial subsequent adjust indicates "at my command" and the FSE indicates it is ready to engage via an observer mission update, selecting the **REPEAT** button commands the system to transmit out the on call request when the crew selects the **FIRE** button.

e. Cancel Check Fire (CANC CHK) Button. Selecting the **CANC CHK** button will cancel the check fire-target, or cancel check fire-all report once the crew selects the **SEND** button. The CANC CHK will allow the artillery to resume fires.

f. Subsequent Adjust - Rounds impact (ADJUST) Button. Selecting the **ADJUST** button calls up the **CONTROL** method and **DANGER CLOSE** buttons, and commands the system to transmit out the subsequent adjust -rounds impact message when the crew member selects the **SEND** or **FIRE** button. Designation of rounds impact location is performed via HMD or TADS (see below). In an established mission in which the method of control is "at my command" and the FSE indicates it is ready to engage via an observer mission update, selecting the **ADJUST** button commands the system to transmit out the on call request when the crew member selects the **FIRE** button.

(1) TADS/HMD LOS Store. Upon selection of the **ADJUST** button, if the **ARTY** page is, and the **POINT** page is not, displayed in the CPG crewstation, designation of the rounds impact location is enabled. The CPG must sight select TADS or HMD and arm the aircraft. The CPG will point the TADS or HMD sight to the correct location and update range via laser (TADS), automatically, manually, or by default. The designated location is retained in local memory while on the **ARTY** page with **ADJUST** selected, and is retained in non-volatile memory subsequent to transmit of the information via a subsequent adjust message.

g. End Of Mission (EOM) Button. Selecting the **EOM** button commands the system to transmit the end of mission without battle damage assessment, when the crew selects the **SEND** button. If the ownship-originator had a CHK FIRE Target or CHK FIRE ALL in effect, sending an EOM message will both end the mission and cancel the check fire. In the case of an EOM with an active CHK FIRE in place, the platform will automatically send CANC CHK fire message following the sending of the EOM message and the STAT LAST (JVMF ACK) is automatically displayed.

NOTE

An ARTY mission must be completed (End of Mission) to disengage artillery platform automated processing An artillery mission must be aborted before a new ARTY mission can be initiated.

h. End Of Mission And Surveillance (EOM/SURV) Button. Selecting the **EOM/SURV** button calls up the **EFFECT** button, and commands the system to transmit out the end of mission and surveillance message, with battle damage assessment, when the crew selects the **SEND** button. If the ownship-originator had a CHK FIRE Target or CHK FIRE ALL in effect, sending an EOM/SURV message will both end the mission and cancel the check fire. In the case of an EOM/SURV with an active CHK FIRE in place, the platform will autmatically send CANC CHK fire message following the sending of the EOM message and the STAT LAST (JVMF ACK) is automatically displayed.

(1) Effect Achieved (EFFECT) Button. The **EFFECT** button allows the platform to provide battle damage assessment to the FSE as part of an end of mission and surveillance message.

NOTE

The abort feature allows full control and prevents potential lock-up in a mission when connectivity with another platform is lost.

i. ABORT Button. Selecting the **ABORT** button calls up the, **CHECK ALL**, **SITREP**, **SPOT** and **ARTY MISSION** buttons within the **CLEAR** grouped options.

(1) Clear Check Fire All (CHECK ALL) Button. Selection of the **CLEAR CHECK ALL** button commands the system to delete check fire all information. Prior to abort, the mission data is used to drive presentation and selection capability for related buttons, status windows, and symbols. The check fire all consists of data retained from the check fire-all and cancel check fire-all messages.

(2) Clear Situation Report (SITREP) Button. Selection of the sitrep button commands the system to delete all received situation report information, including the sitrep icon and sitrep status window.

(3) Clear Spot Report (SPOT) Button. Selection of the spot button commands the system to delete all received spot report information, including the spot icon and spot status window.

(4) Clear ARTY MISSION Button. Selection of the **CLEAR MISSION** button commands the system to delete all CFF mission related information. Prior to abort, the mission data is used to drive presentation and selection capability for related buttons, status windows, and symbols. The call for fire mission consists of data retained from the, call for fire, message to observer, observer mission update, on call request, check fire-target, cancel check fire-target, subsequent adjust (REPEAT and ADJUST) and end of mission and surveillance messages.

NOTE

Only the primary FS Net member can be addressed for a transmit message.

j. SEND Button. Selecting the **SEND** button transmits the designated artillery message. The **SEND** button will be displayed when the IDM is in operate mode, a radio (FM1 or FM2) is assigned to the Fire Support net radio, a valid primary subscriber is assigned, and all mission thread requirements leading up to transmittal of the designated JVMF message have been satisfied.

NOTE

Selecting the SEND/FIRE button on the ARTY page will transmit the ARTY message over the Fire Support Net regardless of the radio to which the crewmember is RTS'd.

k. FIRE Button. Selecting the **FIRE** button transmits the on call request message. The **FIRE** button will be displayed when the IDM is in operate mode, a radio (FM1 or FM2) is assigned to the Fire Support net, a valid primary subscriber is assigned, and all mission thread requirements leading up to transmittal of the on call request have been satisfied.

l. ENGAGE Status. The **ENGAGE Status** window is presented on the **ARTY** page when all conditions have been fulfilled to indicate an **ON CALL** request message needs to be transmitted to request artillery fire.

3A.100.13 Airfire (AF) Page. The **AF** page (fig 3A-132) provides the ability to send and receive air fire mission messages using the IDM to primary tactical internet or fire support net members.

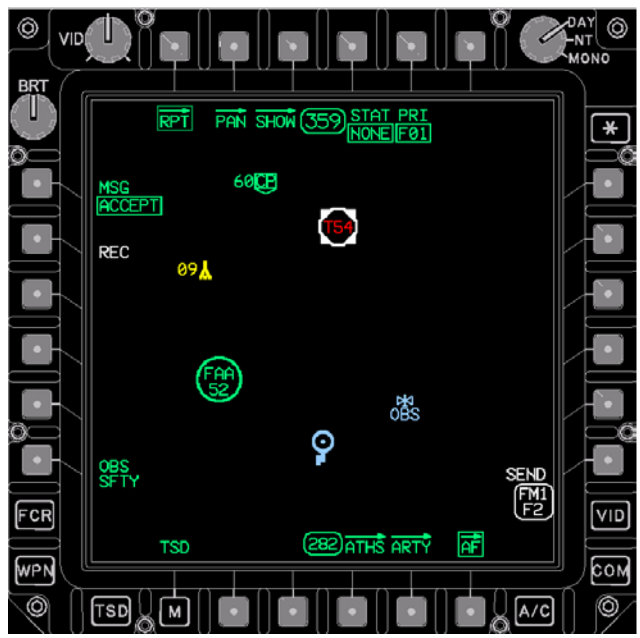

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Figure 3A-132. Airfire (AF) Page

The **AF** page contains the following unique buttons:

- T5 Subscriber button
- L1 **MSG** button
- L2 **ABORT** button
- L5 **OBS SFTY** button
- R6 **SEND** button

3A.100.14 MSG Button. Selecting the **MSG** button enables configuration of the **AF** page for the airfire message to be transmitted. Currently, all airfire messages transmitted and received on the aircraft pertain to conduct of a remote SAL Hellfire mission, in which the Apache acts in the shooter (vs. observer) role. Normal sequence of communications is as follows:

- Receive Remote SAL Hellfire mission request
- Transmit “Accept” or “Reject” (If transmit “reject”, mission is considered terminated)
- Transmit “Ready”
- Receive “Fire”
- Transmit “Shot”
- Receive “End of Mission”

NOTE

Ensure Hellfire TOF caculation is available prior to transmit of “**READY**”.

a. READY Button. Selecting the **READY** button commands the system to transmit the “Ready” message, as well as pre-calculated time of flight, for the SAL remote Hellfire mission when the crew member selects the **SEND** button.

b. SHOT Button. Selecting the **SHOT** button commands the system to transmit the “Shot”message for the SAL remote Hellfire mission when the crew member selects the **SEND** button.

c. ACCEPT Button. Selecting the **ACCEPT** button commands the system to transmit the “Accept” message for the SAL remote Hellfire mission when the crew member selects the **SEND** button.

d. REJECT Button. Selecting the **REJECT** button commands the system to transmit the “Reject” message for the SAL remote Hellfire mission when the crew member selects the **SEND** button.

3A.100.15 ABORT Button. Selecting the **ABORT** button calls up the **AF MISSION** button.

a. AF MISSION Button. Selection of the (clear) mission button commands the system to delete all airfire mission related information. Prior to abort, the mission data is used to drive presentation and selection capability for related buttons, status windows, and symbols. The airfire mission consists of data retained from all transmitted and received air fire mission messages relating to a remote SAL Hellfire mission.

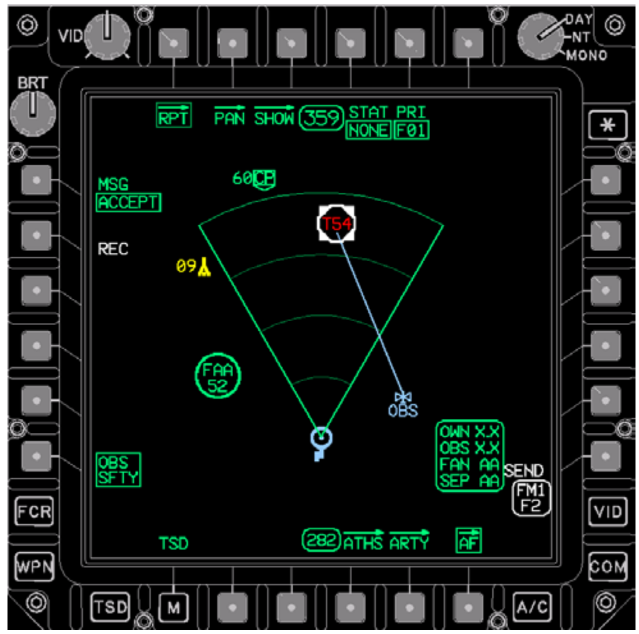

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Figure 3A-132A. AF Page OBS SFTY Selected

3A.100.15A OBS SFTY Button. Selecting the **OBS SFTY** button provides the operator with the information required to safely and effectively conduct an AF MISSION. Refer to 3A-132A in support of the following:

a. SAL Missile Safety Fan. The SAL missile safety fan is a green +/- 30 range fan extending from the ownhip location with a range arc displayed every 2km to a max range display of 8km and a range tic is dsiplayed at the 3, 5, and 7 km increments. The safety fan is always available for display following primary EGI alignment.

b. OBS LOS cue. The OBS LOS cue is a blue line that drawn between the AF target symbol modifier and the OBS symbol. The primary purpose for the cue is to provide a cue to the OBServers location when not displayed on the MPD. An AF mission message has to have been received prior to the display of this cue.

c. AF CONTROL STATUS. The **AF CONTROL STATUS** status window is presented on the **AF** page when the a **OBS SFTY** is selected and an AF mission message has been received. The **AF CONTROL STATUS** status window displays: 1) **OWN** range; 2) **OBS** range; **FAN** GO/NG; and **SEP** GO/NG. If the status values are all displayed in green the mission may be executed safely without if a value is displayed in white a performance paramter has been exceeded. The OBS range values are currently based off the OH-58D’s laser performance for a 90% probablilty of a hit with a SAL missile.

3A.100.16 Subscriber Buttons. Are used to select intended message recipients. Default is no subscribers selected for any variation of the airfire mission message.

3A.100.17 ENGAGE Status. The **ENGAGE** status window is presented on the **AF** page when a **SHOT** message has been transmitted and an **END OF MISSION** message has not yet been received.

3A.100.18 END OF MSN Status. The **END OF MSN** status window is presented on the **AF** page, and indicates that an end of mission JVMF message has been received from the airfire mission observer. This signifies the airfire mission as complete.

3A.101 INITIALIZATION

The Navigation subsystem initializes automatically upon aircraft power application. The present position will be automatically loaded by the SP. If a present position does not exist, the crew can enter in the present position using the position update procedure (para 3A.101.1). Should power be interrupted, the system stores the last known aircraft position. Upon application of power, the system initiates an alignment as follows:

- Starts EGI alignment
- Reads the last stored present position
- Sets the Doppler Radar to ON
- Sets the map viewing range to 25 km (upon ground power up)
- Reads all stored routes from memory
- Reads all waypoint, hazard, control measure, target, threat, line and area data
- Sets the map and ownship symbol to the de-centered position
- Sets TSD Map Frozen Cue
- Reset Digital Map information

3A.101.1 Perform a Fly-over or TADS LOS Position Update.

1. **TSD** page - Select.
2. **PSN** button - Select.
3. Option 1: Cursor
   a. Select a location on the map with the cursor. (The accuracy of the cursor location increases with smaller map viewing ranges).
   b. Fly over the selected location, if not currently at that location.
   c. **UPT** button - Select.

   or

   Option 2: Keyboard Entry

   a. **POSITION** button - Select.
      (1) Enter new position in either **UTM** or **LAT/LONG** coordinates or enter an existing point number using the KU.
      (2) Fly over the known position, if not currently at that location.
      3 **UPT** button - Select.

   or

   Option 3: TADS LOS

   a. **POSITION** button - Select. Enter new position in either **UTM** or **LAT/LONG** coordinates or enter an existing point number using the KU.
   b. RHG **LRFD** trigger - Press.
   c. LHG **STORE**/**UPDT** switch - **UPDT**.

3A.102 NORMAL OPERATIONS

The following paragraphs describe procedural steps required for interface with the navigation subsystem via the TSD, and the systems response to crewmembers input.

3A.102.1 Add a Waypoint, Hazard, Control Measure, or Target/Threat.

1. **TSD** page - Select.
2. **POINT** page - Select.
3. **ADD** button - Select.
4. **TYPE** button - Select Waypoint (**WP**), Hazard (**HZ**), Control Measure (**CM**), or Target Threat (**TG**).
5. Option 1: Default Points Select a location on the map with the cursor.

   or

6. Option 2: Specific Points
   a. **IDENT** button - Enter Point identification on **KU** or accept default.
   b. **FREE** Text - Select and/or, Enter.
   c. **UTM LAT/LONG** coordinates - Enter coordinates on **KU** or accept default.
   d. **ALTITUDE** - Select and/or, Enter.

3A.102.2 Store a Waypoint or Threat/Flyover.

1. **TSD** page - Select.
2. **POINT** page - Select.
3. **STO** button - Select.
4. **TYPE** button - Toggle for Waypoint or Target/ Threat.
5. Option 1: Fly-over.
   a. Fly to the waypoint target/threat location.
   b. **NOW** button - Select.

or

6. Option 2: TADS/HMD LOS Method.
   a. Sight Select (CPG) - **TADS** or **HMD**.
   b. Place selected sight on waypoint or target/ threat.
   c. Provide desired Range source:
      (1) TADS: Laser, Auto, Manual, or Default.
      (2) HMD: Auto, Manual, or Default.
   d. **LHG Store** button - Press.

3A.102.3 Add an Existing Point to the Current Route.

1. **TSD** page - Select.
2. **RTE** page - Select.
3. **ADD** button - Select.
   a. Cursor Method:
      (1) Select existing point using cursor.
      (2) Select the point in the route grouped options which the added point is inserted in front of.

or

   b. KU Method:
      (1) **POINT** button select type, (W.H.C.), and number.
      (2) Select the point in the route grouped options which the added point is inserted in front of.

3A.102.4 Create Priority Fire Zones.

1. **TSD** page - Select.
2. **BAM** page - Select.
3. **TYPE** - Set to **PF**.
4. **OPT** button - Set to:
   a. Select **AUTO** Button for **AUTO** method of Priority Fire Zone creation.
      (1) Set the #Z button.
      (2) Accept default Draw (**DR**) Box (**BX**) method or select **DR** Line (**LN**) button.
      (3) Select the corners of the Priority Fire Zone using the cursor and enter function.
      (4) **ASN** button - Select.
      (5) Select the desired PRI member button(s) to assign the number of zones selected above.
      (6) **XMIT BOTH** button - Select (boxed) to XMIT both the PF and NF as desired.
      (7) **IDM RTS** - Confirm desired Longbow protocol radio selected.
      (8) **SEND** button - Select.
   b. Select **MAN** method of **PF** creation.
      (1) Accept or modify the **#Z** button.
      (2) Accept default Draw (**DR**) Box (**BX**) method or select **DR** Line (**LN**) button.
      (3) Draw one to eight priority fire zones using the cursor and enter function in the box or line mode. The number of zones to draw is based on the **#Z** button.
      (4) **ASN** button - Select
      (5) Select the desired PRI member button(s) to assign that **PF**.
      (6) **XMIT BOTH** button - Select (boxed) to XMIT both the PF and NF as desired.
      (7) **IDM RTS** - Confirm desired Longbow protocol radio selected.
      (8) **SEND** button - Select.

or

c. Select **TRP** method of **PF** creation.

(1) **KM** button - Accept or modify.

(2) Select desired point on the map display using the cursor and enter function.

(3) **ASN** button - Select**.**

(4) Select PRI member button(s) to assign that **PF** to the selected member.

(5) **XMIT BOTH** button - Select (boxed) to XMIT both the PF and NF as desired.

(6) **IDM RTS** - Confirm desired Longbow protocol radio selected.

(7) **SEND** button - Select.

3A.102.5 Transmit BDA Reports (ALL or OWN), FCR TGT (Selective, ALL, PRI), FARM, or PP Reports.

BDA, FCR TGT, and FARM reports are exclusively used with the Longbow, Tactical Internet, or Fire Support protocols.

1. **TSD** page - Select.

2. **RPT** page - Select.

a. **BDA** - Select.

(1) **ALL** or **OWN** - Select

(2) **IDM RTS** - Confirm desired Longbow protocol radio selected.

(3) **PRI MEMBER** button(s) - Select as appropriate.

(4) **SEND** button - Select.

or

b. **TGT** - Select.

(1) Select **ALL**, **PRI**, or use cursor.

(2) **IDM RTS** - Confirm desired Longbow protocol radio selected.

(3) **PRI MEMBER** button(s) - Select as appropriate.

(4) **SEND** button - Select.

or

c. **FARM** - Select.

(1) **IDM RTS** - Confirm desired Longbow protocol radio selected.

(2) **PRI MEMBER** button(s) - Select as appropriate.

(3) **SEND** button - Select.

or

d. **PP** - Select.

(1) **IDM RTS** - Confirm desired protocol (L, I, or F) radio selected.

(2) **PRI MEMBER** button(s) - Select as appropriate.

(3) **SEND** button - Select.

3A.102.6 Request BDA, FARM, or PP Reports.

BDA and FARM reports are exclusively used with the Longbow protocol while PP reports are used with Longbow, Tactical Internet, or Fire Support protocols.

1. **TSD** page - Select.

2. **RPT** page - Select.

a. **BDA** or **PP** - Select.

(1) **MSG** button - **RQST**.

(2) **IDM RTS** - Confirm desired Longbow protocol radio selected.

(3) **PRI MEMBER** button(s) - Select as appropriate.

(4) **SEND** button - Select.

3A.102.7 Add a NF Zone.

1. **TSD** page - Select.
2. **BAM** page - Select.
3. **TYPE** button - Select **NF**.
4. **SEL** button - Select.
5. Select a **NF** (NF1-NF8, as appropriate)
6. **DR** button - Select **LN** or **BX**.

   a. Select four corners of a quadrilateral polygon (or two corners of the box rectangle) using the cursor.

7. **ACT** (Active) or **ACCEPT** - Select.
8. **IDM RTS** - Confirm desired radio selected.
9. **PRI MEMBER** button(s) - Select as appropriate.
10. **SEND** - Select.

3A.102.8 Transmit Situation (SIT) Report.

The following requires configuration of FM1 or FM2 to support Tactical Internet or Fire Support digital communications.

1. **TSD** page - Select.
2. **RPT** page - Select.
3. **SIT** button - Select.
4. **MISSION** button - Select as appropriate.
5. **OP NATURE** button - Select as appropriate.
6. **IDM RTS** - Confirm desired radio selected.
7. **PRI MEMBER** button(s) - Select as appropriate.
8. **SEND** button - Select.

3A.102.9 Transmit Spot Report (Priority FCR Targets or Single Target).

The following requires configuration of FM1 or FM2 to support Tactical Internet or Fire Support digital communications.

1. **TSD** page - Select.
2. **RPT** page - Select.
3. **SPOT** button - Select.
4. **REPORT** button - Verify or set **TGT/THRT** or **PRI/FCR** as required.
5. Target Source - Cursor select **T##** or **FCR** target.

NOTE

Target information may be entered via L1 sequential data entry button.

6. **THRT** button - Select and enter sequential KU data as required (TGT/THRT, QTY, CRS, and SPEED).
7. **ALLIANCE** button - Select as appropriate.
8. **TARGET** button - Verify/set as required.
9. **ENEMY ACTIVITY** button - Verify/set as required.
10. **PRI MEMBER** button(s) - Select as appropriate.
11. **IDM RTS** - Confirm desired radio selected.
12. **SEND** button - Select.

3A.102.10 Transmit/Receive Artillery Call For Fire Mission Messages.

The following artillery messages, listed in nominal sequential order, requires a tuned Fire Support protocol preset-net configuration using either the FM1 or FM2 radio.

a. Transmit Observer Readiness Report (ORR).

1. **TSD** page - Select.
2. **RPT** page - Select.
3. **ARTY** page - Select.
4. **MSG** button - Select.
5. **OBS RDY** button - Select.
6. **PRI** member button - Verify/set (FSE) as required.
7. SEND STATUS display - Confirm required FS preset-net is tuned.
8. **SEND** button - Select.

b. Transmit Call For Fire (CFF) - Ready or Can't Observe.

The following steps represents a continuous mission where the PLT or CPG has a **TSD-RPT-ARTY** page displayed following the transmittal of an ORR.

1. **MSG** button - Select.
2. **CFF** button - Select.
3. Target Source - Acquire using cursor select T## target, FCR target, or use NTS FCR target.
4. Target modifier symbol - Check that symbol is centered around the correct target.
5. **TARGET** button - Verify/set as required.
6. **QTY** button - Verify or enter target quantity.
7. **CONTROL** button - Verify/set as required.
8. **DANGER CLOSE** button - Verify select/deselect as required.
9. **PRI** member button - Verify/set (FSE) as required.
10. **SEND** button - Select.

c. Receive Message to Observer (MTO).

When the IDM receives a MTO message, an advisory tone will sound, the EUFD will display **MSG TO OBSERVER**, and the selection on the TSD **REC** button will display a **MSG TO OBSERVER** message button.

1. **REC** button - Select.
2. **MSG TO OBSERVER** button - Select.
3. **MTO** symbol modifier - Cursor select and review data contents of **MESSAGE TO OBSERVER** display window.

NOTE

The **TSD-RPT-ARTY** page **STAT** button may also be used to maximize and minimize the MTO message display window.

d. Receive Observer Mission Update (OMU).

When the IDM receives an **OMU** message, an advisory tone will sound, the EUFD will display **OBS MSN UPDATE**, and the selection of the TSD **REC** button will display an **OBSERVER MSN UPDATE** message button. During the process of a typical artillery mission the FSE may transmit up to 6 **OMU** messages. Once received, a secondary **OMU** status window is available and its display is controlled using the **MTO** status display. Depending on the method of control and the message thread, the **OMU** status window will display **UPDATE** with **READY, SHOT, SPLASH,** or **ROUNDS COMPLETE** and **TOF: XXX SEC**.

1. **REC** button - Select.
2. **OBSERVER MSN UPDT** button - Select.
3. **MTO** symbol modifier - Cursor select, as required, and verify **OBSERVER MSN UPDATE** data.

NOTE

- TOF countdown begins at the time the **OMU** message, indicating **READY**, is physically received by the PLT or CPG, while the **OMU** message was transmitted at the actual time of artillery fire.
- The **OMU** display window will always display maximized whenever TOF is equal to or less than 30 seconds and has not yet counted down to zero.

e. Transmit On Call Request (AT MY CMD Control).

To transmit an On Call Request Message, a **CFF** with a method of control of **AT MY CMD** has to have been previously transmitted, an approved **MTO** has to have been received, **MSG** button must be selected to **CFF** and an **OMU** update must indicate **READY**. The initiating PLT or CPG receives feedback that the requirements for the On Call Request have been met when receipt of the **OMU** causes display of a white **ENGAGE!** status window and the **FIRE** button appears in place of the **SEND** button.

1. **MTO** - Receive.
2. **MSG** button selected to **CFF**.
3. **ENGAGE!** status window - Displayed.
4. **FIRE** button - Select to send FIRE command at the optimum time/situation.

f. Transmit End of Mission (EOM) and/or Surveillance (SURV).

1. **MSG** button - Select.
2. **EOM** or **EOM/SURV** button - Select as required.
3. **SEND** button - Select.

g. Abort Call For Fire Mission (ARTY MISSION).

The **ARTY MISSION** abort feature is used to clear an artillery mission upon its completion or to clear an incomplete mission (in the middle of its message threads) if connectivity was lost with the FSE prior to mission completion. The abort function is designed to only clear the artillery mission threads inclusive of all artillery symbol modifiers and status windows. The abort function does not inform the FSE that the mission has been terminated.

1. **TSD** page - Select.
2. **RPT** page - Select.
3. **ARTY** page - Select.
4. **MSG** button - Select.
5. **ABORT** button - Select.
6. **ARTY MISSION** button - Select.

h. Transmit Check Fire - Target or All.

An **MTO** has to be received into the crew station prior to the platform enabling the control that permits transmitting a **CHK FIRE TARGET SINGLE** message.

The **CHK FIRE TARGET ALL** message option is always accessible in support of a contingency requirement to shutdown all artillery fires on a battlefield sector. An operator acknowledgement request is always sent to AFATDS as part of both the **CHK FIRE TARGET SINGLE** and **CHK FIRE TARGET ALL** messages. An AFATDS **OPERATOR ACK** sent to the originator of a Check Fire message provides feedback that the FDC: **1)** Operator Acknowledged (**ACK**); **2)** Will Comply (**WILCO**); **3)** Can't Comply (**CANTCO**); or **4)** Have Complied (**HAVCO**).

1. **TSD** page - Select.
2. **RPT** page - Select.
3. **ARTY** page - Select.
4. **MSG** button - Select.
5. **CHK FIRE** button - Select.
6. **TARGET** button - Verify/select **SINGLE** or **ALL**.

NOTE

TARGET ALL. is barriered until a MTO has been received and **TARGET SINGLE** is the default selection following the receipt of a MTO.

7. **PRI** member button - Verify/set (FSE) as required.
8. **SEND** button - Select.

NOTE

To ensure that the **CALL FOR FIRE STAT** window is not prematurely overwritten, the aircrew should not transmit any other JVMF messages following the transmission of a **CHK FIRE** message (when possible) until the AFATDS operator sends an operator response

9. **ACK STAT** window (auto displayed) - Observe AFATDS operator ACK response for any of the following: **1)** Acknowledged (**ACK**); **2)** Will Comply (**WILCO**); **3)** Can't Comply (**CANTCO**); or **4)** Have Complied (**HAVCO**)

i. Transmit Cancel Check Fire (EOM and RESUME) Message.

An operator acknowledgement request is always sent to AFATDS as part of the **CANC CHK** message. An AFATDS **OPERATOR ACK** sent to the originator of a CANC CHK type message provides feedback that the FDC: **1)** Acknowledged (**ACK**); **2)** Will Comply (**WILCO**); **3)** Can't Comply (**CANTCO**); or **4)** Have Complied (**HAVCO**)

1. **MSG** button - Select.
2. **CANC CHK** button - Select.

NOTE

There are two options used for canceling check fires: **1) EOM** = cancel the mission without resuming fires; **2) CANC CHK** = resume fires and cancel the check fire condition

3. **End of Mission Option**
   a. **EOM** Button - Select.
   b. **SEND** button - Select.

   Sending an **EOM** Button will end both the active artillery mission and end the active **CHK FIRE** status (single or all).

   c. **CANC CHK** - Observe automatic send via the STAT LAST following the EOM send commande
4. **Resume Fire Option**
   a. **CANC CHK** Button - Select.

   When **CANC CHK** is selected and the message is subsequently sent, the artillery is then cleared to resume firing: a **CANC CHK** is only performed when it is desired to resume fires and end the active check fire condition.

   b. **EOM** Button - Select.

NOTE

To ensure that the **CALL FOR FIRE STAT** window is not prematurely overwritten, do not transmit any other JVMF messages following the transmission of a **EOM/CANC CHK** message until the AFATDS operator sends an operator response

5. **ACK STAT** window (auto displayed) - Observe AFATDS operator ACK response for any of the following: **1)** Acknowledged (**ACK**); **2)** Will Comply (**WILCO**); **3)** Can't Comply (**CANTCO**); or **4)** Have Complied (**HAVCO**)

j. Abort Check Fire Mission (ARTY MISSION).

The abort **CHECK ALL** function is designed to only clear the **CHECK ALL** threads and the **CHECK ALL** symbol modifiers and status windows.

1. **TSD** page - Select.
2. **RPT** page - Select.
3. **ARTY** page - Select.
4. **MSG** button - Select.
5. **ABORT** button - Select.
6. **CHECK ALL** button - Select.

k. Transmit Subsequent Adjust - Repeat.

The repeat message capability is enabled in the ownship following the receipt of a **MTO** during an active call for fire mission from the CPG station. This message is used to indicate error in artillery targeting by relaying location of rounds impact.

1. **MSG** button - Select.
2. **REPEAT** button - Select.
3. **CONTROL** button - Verify/set as required.
4. **DANGER CLOSE** button - Verify or select/deselect as required.
5. **PRI** member button - Verify/set (FSE) as required.
6. **SEND** button - Select.

l. Transmit Subsequent Adjust - Rounds Impact.

The rounds impact (repeat) message capability is enabled in the ownship following the receipt of a **MTO** during an active call for fire mission from the CPG station. This message is used to indicate error in artillery targeting by relaying location of rounds impact.

1. **MSG** button - Select.
2. **ADJUST** button - Select.
3. **CONTROL** button - Verify/set as required.
4. **STORE** button - Verify or select/deselect as required.
5. TADS/HMD - Acquire and range (Laser, MAN, AUTO, default) rounds impact.
6. **STORE** button - Select **LHG STORE** button or **TSD POINT** page **STORE** button.
7. **PRI** member button - Verify/set (FSE) as required,
8. **SEND** button - Select.

3A.102.11 Receive Tactical Messages (General).

Messages that may be received from the **TSD** page **REC** are listed in paragraph 3A.79.15. The following requires configuration of the radio to support AFAPD, Tactical Internet, or Fire Support net digital communications as appropriate.

1. **TSD** page - Select.
2. **REC** button - Select.
3. **REC** option button - Select as appropriate.
4. TI and FS Messages - Open and review data as required.

3A.102.12 Receive/Transmit Air Fire Messages (SAL Shooter Role).

The following requires configuration of FM1 or FM2 to either Fire Support or Tactical Internet digital communications.

a. Receive Air Fire Mission (AFM) SAL Shooter Request.

1. AIRBORNE FIRE MISSION - EUFD message advisory displayed.
2. **TSD** page - Select.
3. **RPT** page - Select.
4. **AF** page - Select.
5. **REC** button - Select.
6. **MSG** button - Select as appropriate.
7. **AIR FIRE MISSION** message button - Select.
8. **AFM** symbol modifier - Cursor select and review data contents of display window.

NOTE

The **TSD-RPT-AFM** page **STAT** button may also be used to maximize and minimize the MTO message window.

b. Transmit - ACCEPT/REJECT.

Once an AFM is accepted, the remainder of the message threads are conducted from the **AF** page. Accepting a mission does not mean that the aircraft is necessarily ready. The **AF** page. **OBS-SFTY** button should be selected and the mission parameters should be evaluated to determine when and if the mission can be executed. If a mission is rejected, the mission thread is complete and the mission will have to be aborted (cleared) by the operator prior to initiating a new mission.

1. **OBS SFTY** button - Select and evaluate safety parameters
2. **RPT** page - Select as required.
3. **AF** page - Select as required.
4. **MSG** button - Verify default or select as required.
5. **ACCEPT** or **REJECT** button - Select as required.
6. **PRI** member button - Verify/set as required.
7. **IDM RTS** - Confirm desired radio selected as required.
8. **SEND** button - Select.

c. Transmit - Ready.

Once the aircraft is within constraints and ready to fire, the READY message is transmitted.

1. **MSG** button - Verify/select **READY**.
2. **PRI** member button - Verify/set as required.
3. **IDM RTS** - Confirm desired radio selected as required.
4. **SEND** button - Select.

d. Receive - FIRE Command.

1. **REC** button - Select.
2. **AIR FIRE MISSION** message button - Select.

e. Transmit - SHOT.

Once the SHOT message is transmitted the **ENGAGE!** status window is displayed in white to denote that the target should now be engaged.

1. **MSG** button - Verify/select **SHOT**.
2. **PRI** member button - Verify/set as required.
3. **IDM RTS** - Confirm desired radio selected as required.
4. **SEND** button - Select.

f. Receive Air Fire Mission End of Mission (EOM) Message.

Once the EOM message is received, the **END OF MISSION** status window is displayed in white on the **AFM** page.

1. **REC** button - Select.
2. **AIR FIRE MISSION** message button - Select.

3A.102.13 Abort AF Mission Thread.

1. **TSD** page - Select.
2. **RPT** page - Select.
3. **AF** page - Select.
4. **MSG** button - Select.
5. **ABORT** button - Select.
6. **AF MISSION** option button - Select to delete mission data.

3A.102.14 Abort RPT and ARTY Mission Threads.

1. **TSD** page - Select.
2. **RPT** page - Select.
3. **ARTY** page - Select.
4. **MSG** button - Select.
5. **ABORT** button - Select.
6. **CHECK ALL**, **SITREP**, **SPOT** or **ARTY MISSION** option button - Select as appropriate.

CHAPTER 4
MISSION EQUIPMENT

Section I. SIGHTING SUBSYSTEM

4.1 INTRODUCTION

This section provides a description of the helicopter Sight Subsystem and associated operational procedures. It includes a description of sight components, controls and displays, system operations, and procedural checklists.

Due to the integration of functionality throughout components of the Mission Equipment, some descriptions and operational procedures are covered under more than one heading. To understand the complete operation of these systems, it is necessary to understand this complete chapter as well as related data in chapter 3.

The sighting system (fig 4-1) uses Electro-Optical (EO) and radar L components to provide target acquisition/ designation and navigation assistance capabilities in day, night, and limited visibility conditions. The system provides the means to aim Hellfire missiles, the gun, or rockets. The sighting system consists of the following:

- Integrated Helmet and Display Sight System (IHADSS)
- AN/AAQ-11 Pilot Night Vision Sensor (PNVS)
- AN/ASQ-170 Target Acquisition Designation Sight (TADS)
- AN/APG-78 Fire Control Radar (FCR) L

IHADSS, TADS, PNVS, and the FCR L can operate independently or in various sensor combinations as acquisition and range sources.

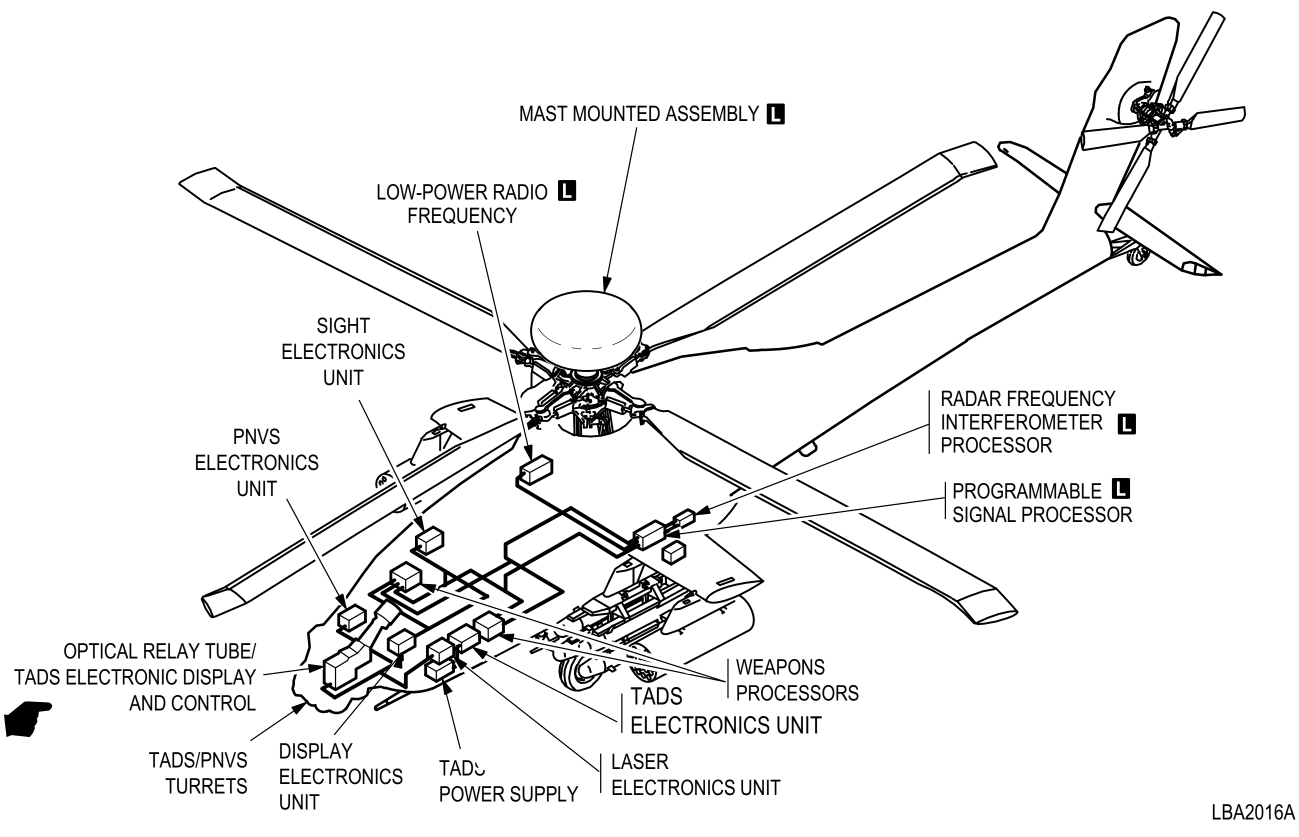


Figure 4-1. Sight Subsystem

4.2 VIDEO CONTROL PANEL

The pilot **VIDEO** control panel (fig 4-2), located on the left side of the pilot instrument panel, allows the crewmember to adjust the brightness and contrast intensity of the HMD, symbology brightness, and gain and level of the **FLIR** video.

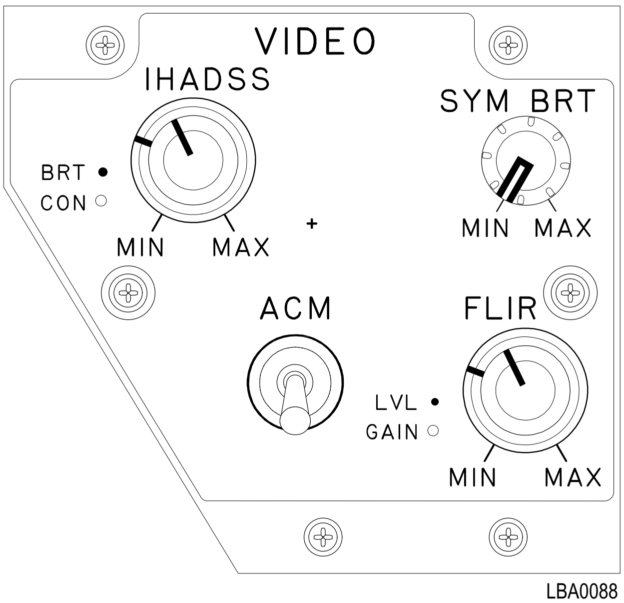


Figure 4-2. Pilot VIDEO Panel

4.2.1 Symbol Brightness. The **SYM BRT** control adjusts the intensity of the symbology brightness. The adjustment varies from black to white.

4.2.2 IHADSS Display Brightness. The **IHADSS BRT** control adjusts the grayscale and/or image brightness intensity.

4.2.3 IHADSS Display Contrast. The **IHADSS CON** control adjusts the grayscale and/or image contrast intensity.

4.2.4 FLIR Gain. The **FLIR GAIN** control adjusts FLIR gain for the PNVS or TADS FLIR imagery as selected at the Night Vision System (**NVS**) select switch.

4.2.5 FLIR Level. The **FLIR LVL** control adjusts FLIR level for the PNVS or TADS FLIR imagery as selected at the (**NVS**) select switch.

4.2.6 Automatic Contrast Mode (ACM). The **ACM** control provides automatic FLIR gain and level control. The **ACM** position disables the FLIR gain and level controls and automatically adjusts FLIR gain and level control to compensate for scene thermal content changes and switching polarities. The down position (no label) disables ACM and enables the **FLIR GAIN** and **FLIR LVL** knobs.

4.3 NVS MODE PANEL

The **NVS Mode Panel** (fig 4-3), located on the left console in each crew station, contains the **NVS MODE** switch. The **NVS MODE** switch selects the operational mode of the selected NVS. The **OFF** position commands the selected NVS to the stow position. The **NORM** (center) position commands the selected NVS to slew to the crewmembers IHADSS Line Of Sight (LOS). The **FIXED** position commands the selected NVS to the fixed forward position. The Pilot's default NVS sensor is PNVS and the CPG's default NVS sensor is TADS. This can be changed by selecting the **NVS SELECT** switch on the collective and follows the last select logic.

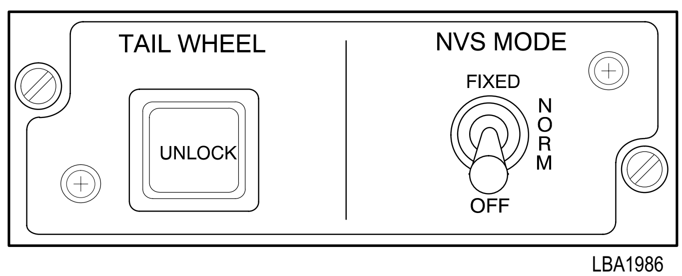


Figure 4-3. NVS MODE Panel

4.4 CYCLIC CONTROL GRIP

The cyclic control grip (fig 4-4) in each crewstation includes a symbology select (**SYM SEL**) switch. The **SYM SEL** switch selects 1 of 4 modes of IHADSS flight symbology. The 2 aft selections are Hover (**H**) and Bob-up (**B**); the 2 forward selections are Transition (**T**) and Cruise (**C**). Depressing the **SYM SEL** switch will also cause the **FLT** page to display on the left MPD.

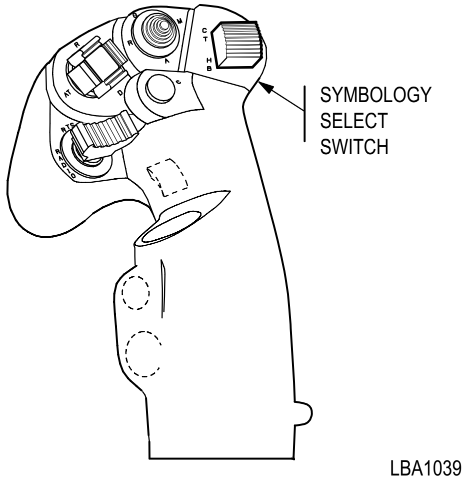


Figure 4-4. Cyclic Control Grip

4.5 COLLECTIVE CONTROL

The collective control (fig 4-5) in each crew station is equipped with a mission control grip and flight control grip and provides access to various sight subsystem controls.

4.5.1 Polarity/Boresight. The **PLRT B/S** switch is used to store the IHADSS boresight alignment and change FLIR image polarity.

If the aircraft is equipped with MTADS-MPNVS provisions, the **PLRT** position of the **PLRT B/S** switch is used to change FLIR image polarity. The **B/S** position is a growth position for MPNVS sensor selection.

NOTE

If the pilot selects TADS, either with the NVS select switch or linking the TADS to the FCR, while the CPG is sight select TADS, the CPG's sight will default to HMD and weapons will be de-actioned.

4.5.2 NVS Select. The NVS Select switch is a two position momentary switch (**PNVS**, **TADS FLIR**). The night vision sensor select switch is used in conjunction with the NVS mode switch to select the desired night vision sensor. To control a NVS, set the select switch to the desired NVS and set the NVS mode switch for desired operation (para 4.3). Selection of an NVS by a crewmember will automatically provide the remaining NVS to the other crewmember. NVS control is updated to the most recent selection made.

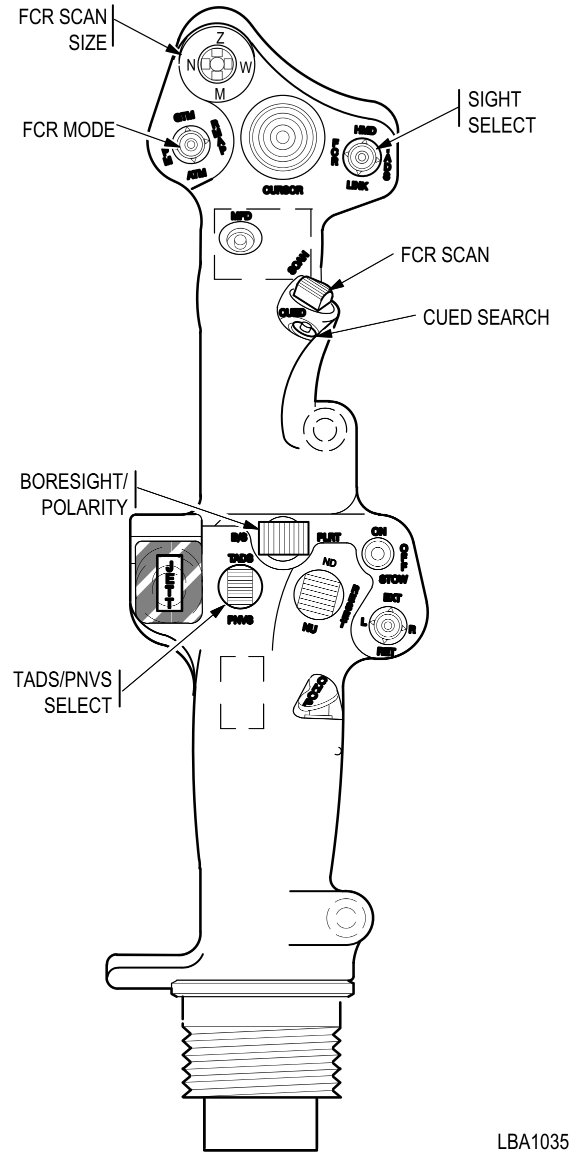


Figure 4-5. Collective Control Grip

4.5.3 FCR Mode L. The **FCR** mode switch selects 1 of 4 operational modes of the FCR. This function is active only when the FCR is the selected sight. Placing the switch momentarily to the desired position selects the respective mode: ground targeting mode (**GTM**), radar map mode (**RMAP**), air targeting mode (**ATM**), or terrain profiles mode (**TPM**).

4.5.4 FCR Scan Size L. The **FCR** scan size switch selects one field of view (scan width) for the selected FCR targeting mode. This function is active only when the FCR is the selected sight. The scan size state remains as last selected regardless of the targeting mode. Placing the switch momentarily to the desired position selects the respective scan size: wide, (**W**), medium, (**M**), narrow, (**N**), or zoom (**Z**).

4.5.5 Sight Select. The sight select switch is used to select one of three sights or to link the TADS and FCR. This switch is independently controlled in each crewstation. Placing the switch momentarily to the desired position selects the respective mode: **HMD**, **TADS, FCR**, or **LINK** L. The **LINK** function sets the FCR centerline to the TADS LOS when the selected sight is **TADS**, or sets the TADS LOS to the FCR NTS LOS when the selected sight is FCR. Reselecting the **LINK** function toggles **LINK** off. The TADS sight select switch is not active in the pilots' crewstation. FCR sight selection is based on the last to select logic. Selection of the FCR through the sight select switch automatically displays the FCR targeting format for the selected mode on the left MPD. Refer to paragraph 4.47.4 for **LINK** function description.

4.5.6 FCR SCAN L. The FCR **SCAN** switch activates and deactivates the FCR transmitter. This function is active when the FCR is the selected sight. The switch is also active in the CPG station when the TADS is the selected sight and link function is selected.

4.5.7 CUED Search L. The **CUED** search switch is used to rapidly orient the FCR antenna toward an RFI detected emitter and conduct an FCR scan to correlate the location of that emitter in the GTM, ATM, and RMAP targeting modes. This function is active only when the FCR is the selected sight.

4.6 WEAPONS (WPN) PAGE

The **WPN** page (fig 4-6) is used to functionally control sight and weapons moding. Selecting the WPN Subsystem button or the WPN page button from the **MENU** page calls up the WPN page. Various sight and weapons subsystem status windows, icons, and control selections are included on the page to reduce workload and enhance situational awareness. Some status and control selections are common to both crew stations while others are crew station unique. Weapons subsystem descriptions are provided in Section II.

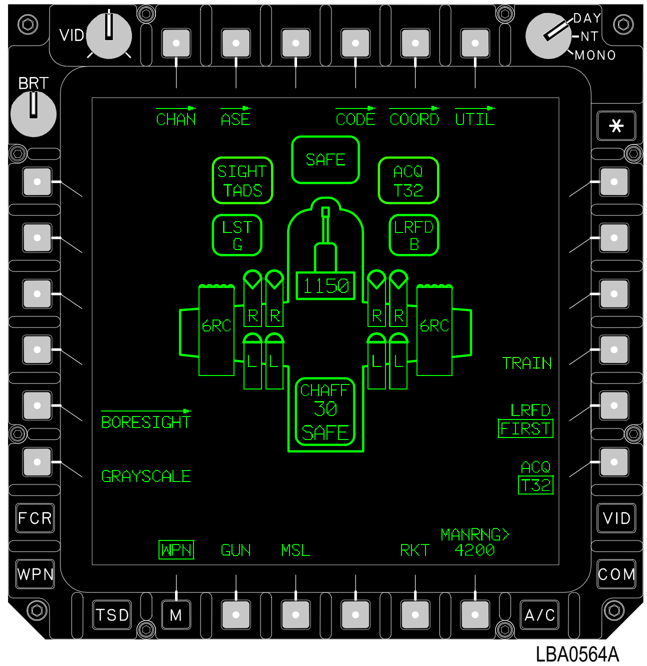


Figure 4-6. WPN Page

The **WPN** page contains the following unique sight buttons:

- T4 Laser **CODE** button
- T6 WPN **UTIL** button
- L5 **BORESIGHT** button
- L6 **GRAYSCALE** button
- R5 **LRFD** button
- R6 **ACQ** button
- B6 **MANRNG** button

4.6.1 Laser CODE Butto. The **CODE** button accesses stored laser codes.

4.6.2 WPN UTIL Button. The WPN **UTIL** button accesses sight subsystem utility functions.

4.6.3 BORESIGHT Button. The B**ORESIGHT** button accesses the IHADSS/TADS boresight controls.

4.6.4 GRAYSCALE Button. The **GRAYSCALE** button activates the grayscale mode for display on the crew members HMD.

4.6.5 LRFD Button. The **LRFD** button selects between the **FIRST** or **LAST** in a series of laser range pulses for processing as the laser range value.

4.6.6 ACQ Button. The **ACQ** button selects an acquisition source to slave or cue the selected sight to another line of sight or a point on the ground.

4.6.7 MANRNG Button. The **MANRNG** button sets the active range source to a manually entered value or commands the range source to an automatic mode via the KU. With auto mode selected the last entered manual range will remain displayed on the WPN page. This selection is independent in each crewstation.

4.6.8 SIGHT Select Status Window. The **SIGHT** select status window indicates the current state of the sight select function in that crew station: **HMD**, **TADS** (CPG only), and **FCR**.

4.6.9 Acquisition (ACQ) Select Status Window. The **ACQ** select status window indicates the current state of the acquisition select function in that crew station; **PHS**, **GHS**, **SKR**, **RFI**, **FCR**, **FXD**, **TADS**, **TXX, and TRN**.

4.6.10 LRFD Status Window. The **LRFD** status window indicates the current state of the LRFD Code selection.

4.6.11 LST Status Window. The **LST** status window indicates the current state of the LST Code selection.

4.7 WPN UTILITY (UTIL) PAGE

4.7.1 Pilot WPN UTIL Page. The WPN **UTIL** page (figs 4-7 and 4-7A) in the pilot station is as depicted below.

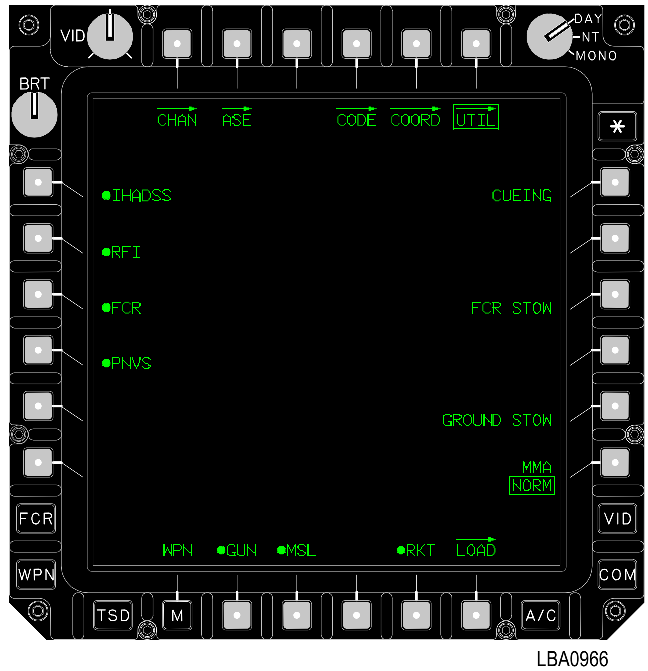


Figure 4-7. Pilot WPN UTIL Page

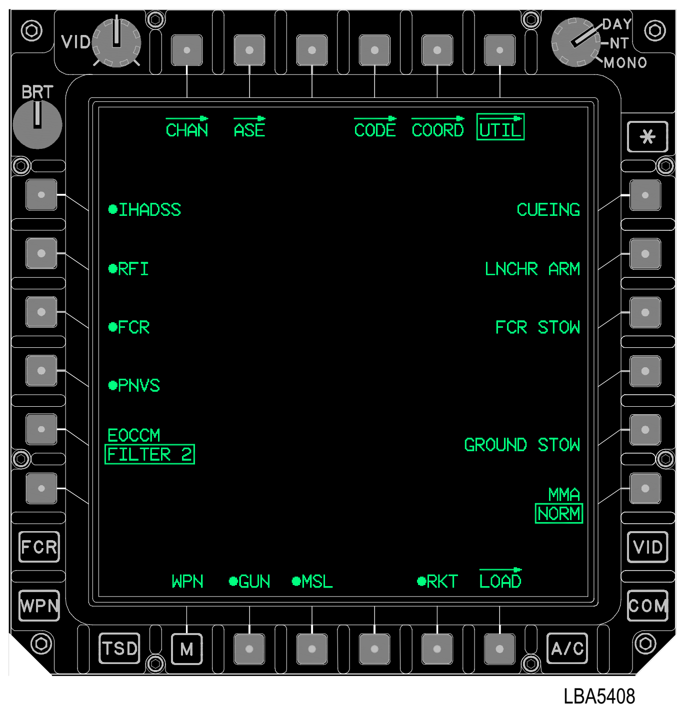


Figure 4-7A. [MT Pilot WPN UTIL Page]

The WPN **UTIL** page is unique to each crew station and provides the Pilot the following selections:

- L1 **IHADSS** button
- L2 **RFI** Enable button L
- L3 **FCR** button L
- L4 **PNVS** button
- L5 [MT **EOCCM** button]
- R1 **CUEING** button
- R3 **FCR STOW** button L
- R6 **MMA** button L

a. IHADSS Button. The **IHADSS** button enables the IHADSS.

b. RFI Button L. The **RFI** button enables the RFI. If MMA **NORM**, the RFI is enabled automatically. If MMA pinned, the RFI may be enabled manually.

c. FCR Button L. The **FCR** button enables the FCR. If MMA **NORM**, this function is selectable.

d. PNVS Button. The **PNVS** button enables the PNVS. The PNVS is enabled automatically 1 minute following aircraft power up. This button may be used to enable the PNVS should it become necessary to begin PNVS powerup sooner than 1 minute.

e. [MT **EOCCM Button**. The **EOCCM** button selects the type of FLIR EOCCM filter in the pilot station: **FILTER 1**, **CLEAR**, or **FILTER 2**. The selected state is reflected in the NVS selected status on the flight format on the pilot's HMD.]

e. CUEING Button. The **CUEING** button selects sensor cueing in the pilot station.

f. FCR STOW Button L. The **FCR STOW** button stows the FCR antenna.

g. MMA Button L. The **MMA** button selects the state of the MMA: **NORM** or **PINNED**. For the **FCR** to be turned on, MMA **NORM** must be selected. The default setting is **PINNED**. Selecting the **MMA** button to **NORM** powers up the FCR and RFI.

4.7.2 CPG WPN UTIL Page. The WPN **UTIL** page (fig 4-8) in the CPG station is as depicted below.

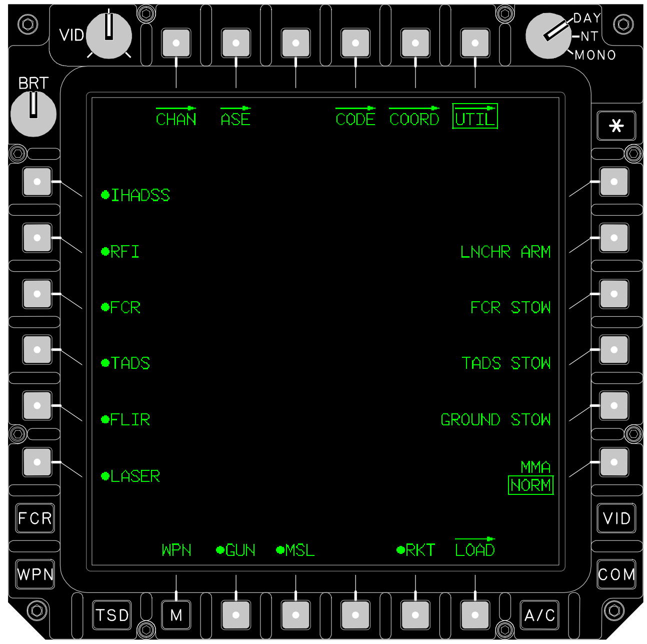


Figure 4-8. CPG WPN UTIL Page

The WPN **UTIL** page is unique to each crew station and provides the CPG the following unique selections:

- L4 **TADS** button
- L5 **FLIR** button
- L6 **LASER** button
- R4 **TADS STOW** button

a. TADS Button. The **TADS** button enables the TADS. The TADS and FLIR are enabled automatically upon aircraft power up. The TADS and FLIR are enabled automatically 1 minute following aircraft power up. This button may be used to enable the TADS should it become necessary to begin TADS/FLIR powerup sooner than 1 minute.

b. FLIR Button. The **FLIR** button enables the TADS FLIR.

c. LASER Button. The **LASER** button enables the TADS laser transceiver.

d. TADS STOW Button. The **TADS STOW** button stows the TADS turret.

4.8 BORESIGHT PAGE

The sight **BORESIGHT** page accesses IHADSS boresight controls in both crew stations and TADS boresight controls in the CPG station. The sight **BORESIGHT** page is unique to each crew station.

4.8.1 Pilot BORESIGHT Page. The **BORESIGHT** page (figs 4-9 and 4-9A) in the pilot station provides the following selections:

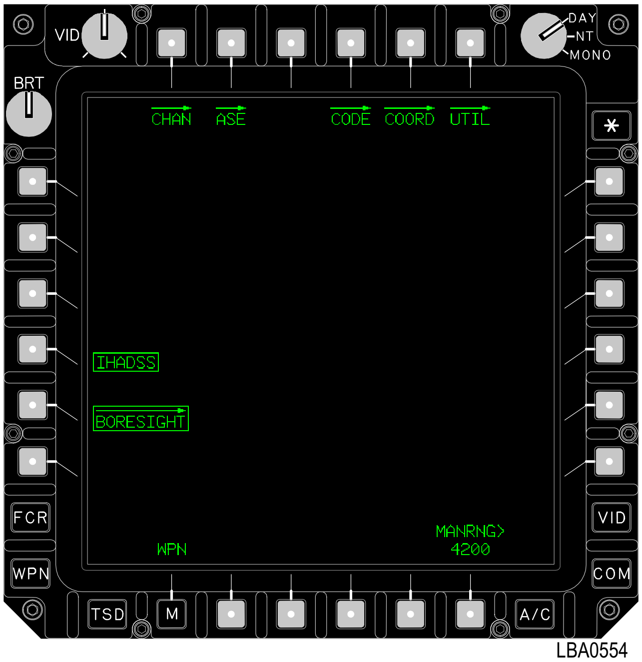


Figure 4-9. Pilot BORESIGHT Page

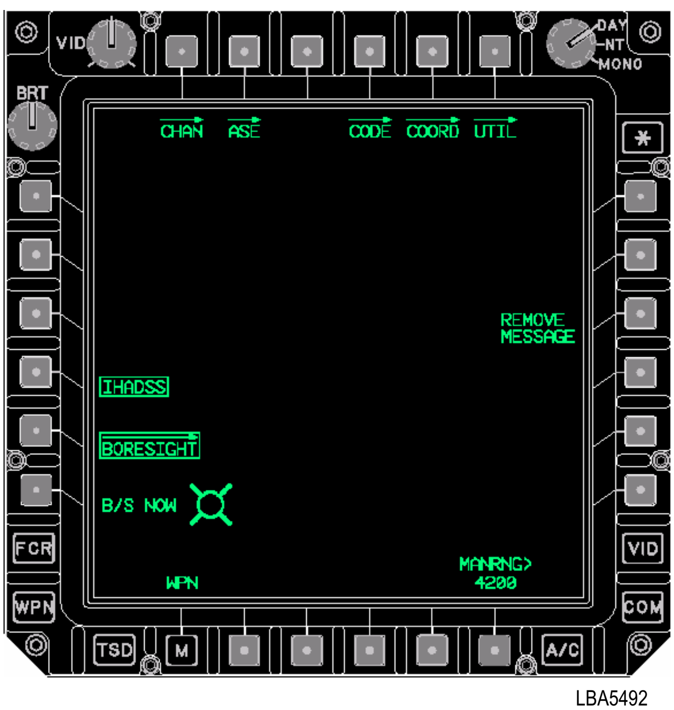


Figure 4-9A. Pilot BORESIGHT Page (Aircraft Equipped with MTADS Provisions)

- L4 **IHADSS** button
- L5 Sight **BORESIGHT** button

a. IHADSS Button. The **IHADSS** button is used to perform IHADSS boresight. Selecting the **IHADSS** boresight button causes the IHADSS to enter the boresight mode, turn on the light in the boresight reticle unit (BRU), and activate the **B/S** HMD function on the collective flight control grip.

If the aircraft is equipped with MTADS-MPNVS provisions, selecting the **IHADSS** boresight button causes the IHADSS to enter the boresight mode, turn on the light in the boresight reticle unit (BRU), and display the **B/S NOW** button with the MPD cursor within the button selection area (for use with the collective **ENTER** switch). The **REMOVE MESSAGE** button is also presented.

b. BORESIGHT Button. The **BORESIGHT** button is used to access the **BORESIGHT** page controls.

c. B/S NOW Button. The **B/S NOW** button is used to boresight the IHADSS. Selecting the **B/S NOW** button stores IHADSS boresight data.

d. REMOVE MESSAGE Button. The **REMOVE MESSAGE** button is used to remove the **IHADSS B/S REQUIRED** HAD sight status message when the selected sight is HMD.

4.8.2 CPG BORESIGHT Page. The **BORESIGHT** page (fig 4-10) in the CPG station provides identical selections as in the pilot station except for the following:

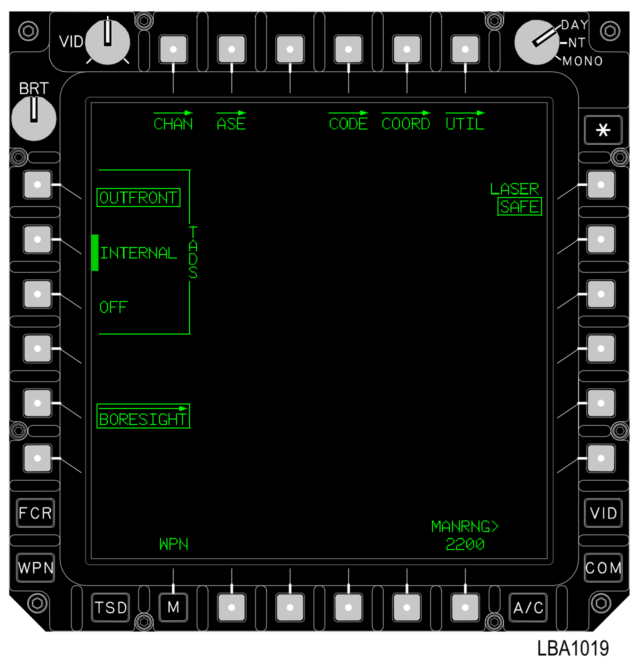


Figure 4-10. CPG BORESIGHT Page

- L1 **TADS OUTFRONT** button
- L2 **TADS INTERNAL** button
- L3 **TADS OFF** button
- R1 **LASER** button

a. TADS OUTFRONT Button. The **OUTFRONT** button is used to perform the outfront boresight procedure. Selecting the **TADS OUTFRONT** button causes the TADS to enter the outfront boresight mode. [**MT** This button is not displayed if the aircraft is equipped with MTADS.]

b. TADS INTERNAL Button. The **TADS INTERNAL** button is used to perform the internal boresight procedure. Selecting the **TADS INTERNAL** button causes the TADS to enter the internal boresight mode. [**MT** This selection initiates the automated internal boresight sequence (para 4.30).]

c. TADS OFF Button. The **OFF** button is used to set the Outfront and Internal boresight modes to off. Selecting the boresight **OFF** button causes the TADS to exit the selected boresight mode.

d. LASER Button. The **LASER** button is used to **ARM** and **SAFE** the LRFD when performing an internal or outfront boresight procedure. It is displayed in YELLOW when in the **ARM** state. This button is presented only when the laser is enabled on the WPN **UTIL** page and the **TADS OUTFRONT** or **TADS INTERNAL** option is selected. The **LASER** button will default to the state of the **A/S** button on the **ARMAMENT** panel. When the **A/S** button is in the **ARM** state, the **LASER** button will be displayed with a barrier in the **ARM** state. When the **A/S** button is in the **SAFE** state, the **LASER** button is selectable. In the latter case, if the **LASER** button is in the **ARM** state and a selection is made to leave the **BORESIGHT** page, the **LASER** button will be set to **SAFE**.

4.9 LASER CODE (CODE) PAGE

The laser **CODE** page (fig 4-11) is used to access 16 stored laser codes. This selection is common to both crew stations. In addition, it is used to provide access to the laser **FREQ** page to set the laser frequency for each code. The **CODE** page contains the following selections and status windows:

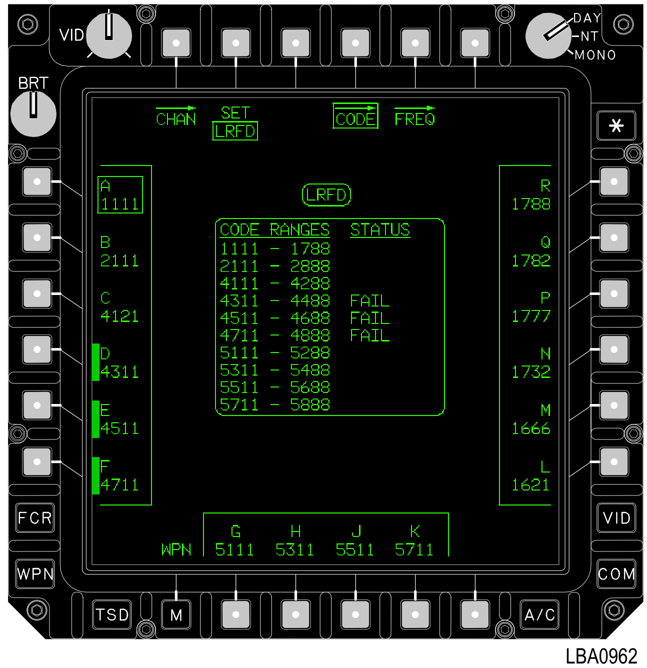


Figure 4-11. CODE Page

- T2 Code **SET** button
- T4 Laser **CODE** button
- T5 Laser **FREQ** button
- L1 - L6 Code buttons
- R1 - R6 Code buttons
- B2 - B5 Code buttons

4.9.1 SET Button. The laser code **SET** button sets which system is to be the recipient of a code selection. Selecting the **SET** button sets the state for code selection to the LRFD or the LST. This selection is common to both crew stations.

4.9.2 Laser Code Buttons. 16 buttons containing the codes and frequencies currently set are used to select the active laser code for the LRFD or LST as selected at the **SET** button. A laser code button will be displayed with a barrier when that code is not available.

4.9.3 FREQ Button. The laser **FREQ** button accesses stored laser code frequencies.

4.9.4 LRFD/LST Status Window. The **LRFD/LST** status window in the upper area of the laser **CODE** page indicates the current **LRFD/LST** code selections as set by the **SET** button described above. PIM codes are not available for use by the LST. [**MT** PIM codes are available for use by the LST.]

4.9.5 CODE RANGE and KEYWORD STATUS Window. The **CODE RANGE** and **STATUS** window is located in the center area of the laser **CODE**, **FREQ** and **CHAN** pages.

a. CODE RANGE. The **CODE RANGE** indicates the laser code ranges which are supported by the laser keywords resident on the DTC. The helicopter is capable of supporting the Tri-Service pulse repetition frequency (PRF) laser codes and USAF, Hellfire and Copperhead pulse interval modulation (PIM) laser codes. In order for the LRFD, [MT LST] and Hellfire subsystem to use a PIM laser code the appropriate keyword, for the specific code range, is required:

1111 - 1788	Tri-Service	PRF
2111 - 2888	USAF	PIM
4111 - 4288	Hellfire-A	PIM
4311 - 4488	Hellfire-B	PIM
4511 - 4688	Hellfire-C	PIM
4711 - 4888	Hellfire-D	PIM
5111 - 5288	Copperhead-A ...	PIM
5311 - 5488	Copperhead-B ...	PIM
5511 - 5688	Copperhead-C ...	PIM
5711 - 5888	Copperhead-D ...	PIM

b. STATUS Area. The **STATUS** area indicates the code range status for the LRFD, [MT LST] and Hellfire subsystems.

FAIL Indicates the DTC laser keyword for this code range has a checksum error.

N/A Indicates that no equipment is capable of using this code range.

MSL ONLY Indicates that only the missile subsystem is capable of using this code range.

LRFD ONLY Indicates that only the LRFD is capable of using this code range.

[MT **LST ONL** Indicates that only the LST is capable of using this code range.]

[MT **LRFD/LST ONLY** Indicates that only the LRFD and LST is capable of using this code range.]

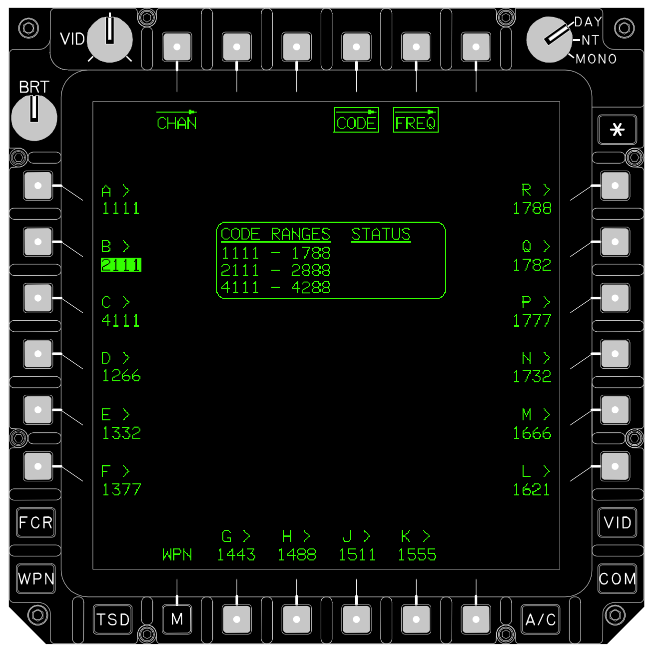
[MT **LRFD/MSL ONLY** Indicates that only the LRFD and the Hellfire subsystem is capable of using this code range.]

[MT **LST/MSL ONLY** Indicates that only the LST and the Hellfire subsystem is capable of using this code range.

"?" Indicates that data for display of keyword data is not valid.]

4.10 LASER FREQUENCY (FREQ) PAGE

The laser **FREQ** page (fig 4-12) provides access to the laser code frequency buttons to change the frequency of available laser codes. Selecting the laser **FREQ** button calls up the laser code frequency data entry buttons which appear with respect to the same 16 locations as the laser buttons described above.



LBA5244

Figure 4-12. FREQ Page

4.10.1 Laser Code Frequency Buttons. The 16 laser code frequency buttons are used in conjunction with the KU to enter laser code frequencies for each of the available laser codes. Each character of the four digit entry is limited in range as listed in paragraph 4.9.5.a.

4.11 IHADSS DESCRIPTION

WARNING

In the event of IHADSS failure with gun selected and the HMD as the selected sight, the gun will remain at its last command position. Gun firing is inhibited. When the gun is de-actioned, it will return to the stowed position.

The IHADSS (fig 4-13) establishes the crewmember line of sight (LOS). The pilot/CPG LOS is provided to the weapons processor for sensor pointing, symbol generation, ranging, and/or weapons aiming. It also provides the display of TADS/PNVS video and symbology. The IHADSS consists of the Integrated Helmet Unit (IHU), the Helmet Display Unit (HDU), Sensor Survey Units (SSU), Sight Electronics Unit (SEU), Display Electronics Unit (DEU), Display Adjustment panel (DAP), and a Boresight Reticle unit (BRU). HMD symbology is generated and then mixed with any sensor video underlay by the display processor.

4.12 HELMET DISPLAY UNIT (HDU)

The HMD is provided on the HDU in each crew station. The HDU consists of a CRT with optical elements which project the selected symbology and sensor imagery onto a combining lens. The HDU is attached to the right side of the helmet during normal use. The attached HDU is rotated in front of the right eye for viewing of the display or can be rotated vertically away from the eye when not in immediate use. When not attached to the helmet, the HDU shall be stored in the holster located on the right console. The DEU provides power and video signals to each crewmember HDU through DAP located in each crew station. The BRU in each crew station is used to boresight the crewmember helmet. Adjustments on the HDU permit image rotation (leveling), collimation with the crewmember LOS (centering), and focusing. Both crewmembers can adjust symbol brightness, video brightness, and contrast. The CPG controls are on the ORT or TEDAC panel, while the pilot uses the **VIDEO** panel.

4.13 IHADSS SYMBOLOGY FORMATS

IHADSS symbology is displayed in one of two formats: the flight symbology format or the weapons symbology format. The flight symbology format consists of those symbols, scales, and digital readouts required for pilotage. The weapons symbology format consists of the symbology required for employment of the sight and weapons systems by the CPG. Weapons engagements can be conducted using either weapons or flight symbology. Unique weapon symbols are displayed in either format when the respective weapon is selected in a crew station. Pilot station HMD provides pilot flight symbology in all normal (2 display processor) operating modes. CPG station HMD provides CPG flight symbology when the CPG selected sight is HMD or the CPG **NVS MODE** switch is set to the **NORM** or **FIXED** position. CPG station HMD provides pilot flight symbology when the ORT video select switch has been set to **PNVS** or the TEDAC **PNV** video select button is selected. CPG station provides Weapons symbology whenever it has not been out-prioritized by Flight symbology: When the selected sight is **TADS** or **FCR**, the **NVS MODE** switch is set to **OFF**; and the ORT video select switch is set to **TADS**, **FCR**, or **GS** or the TEDAC **TAD**, **FCR**, or **G/S** video select button is selected. Single DP operation of the IHADSS is described in paragraph 4.50.3.

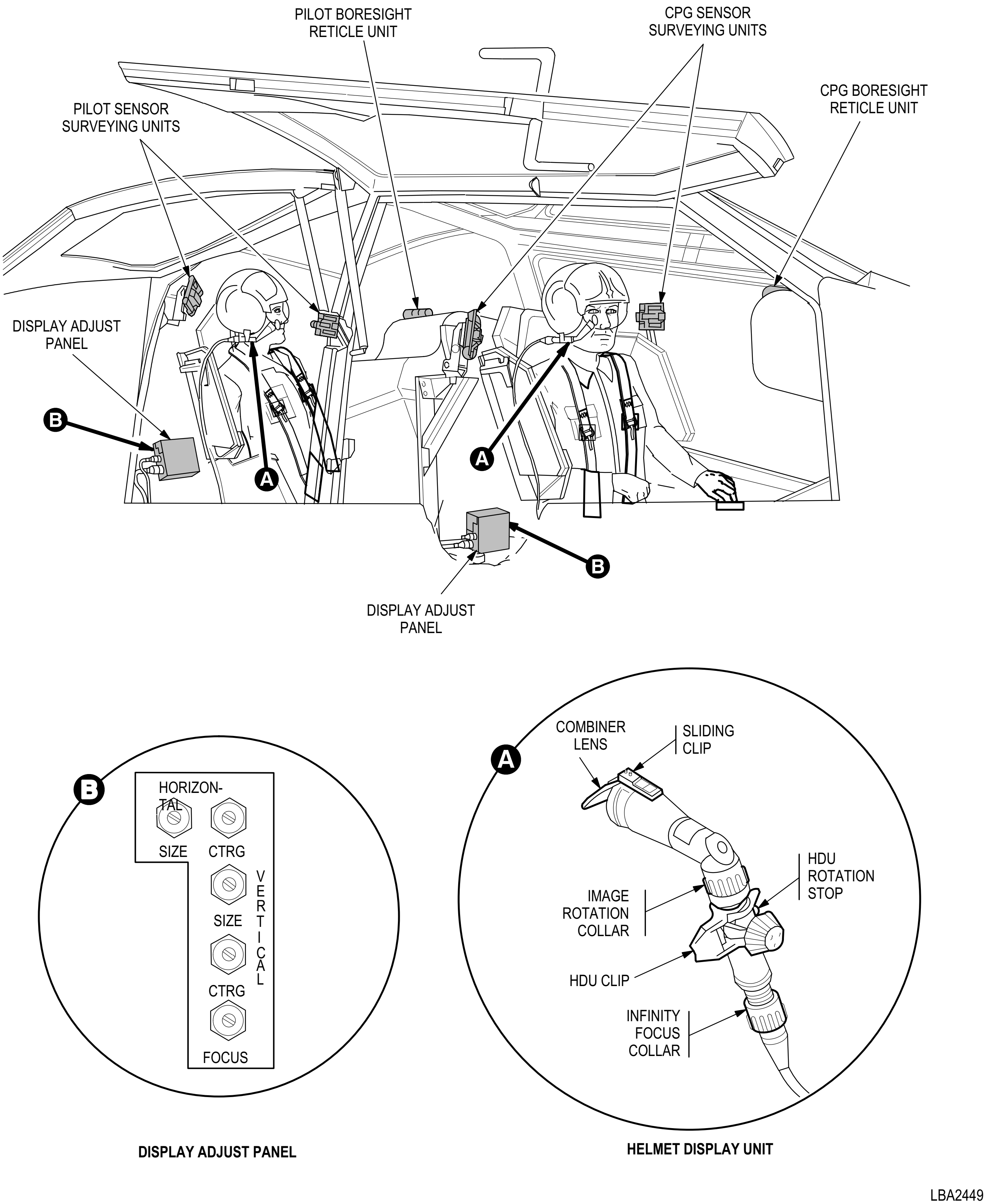


Figure 4-13. Integrated Helmet and Display Sight System (IHADSS)

4.14 FLIGHT SYMBOLOGY FORMAT

Flight symbology provides either crewmember flight information for use as the primary flight display within the crew station. These flight formats can be configured to either Hover (**H**), Bob-up (**B**), Transition (**T**), and Cruise (**C**) modes. The flight mode presented can be selected by the crewmember using the Cyclic Symbology Select switch. When presented on the HMD, ORT or TEDAC Display Unit (TDU), all flight symbology is green in color. When presented on the MPD (as can be done using the VIDEO Page, VSEL selected), and the MPD is operating in DAY or NIGHT mode, the non-green colors noted in the following paragraphs will be presented. Conditions under which flight symbols are presented are defined in paragraphs 4.13 and 4.50.3.

4.14.1 Hover Mode Symbology. The following symbols are provided within the Hover Mode symbol set (fig 4-14).

NOTE

Items not described below function as described in Chapter 2, Section XIV.

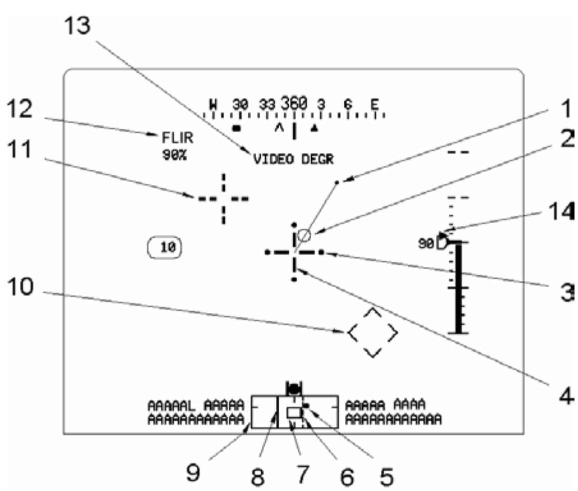


Figure 4-14. Flight Symbology - Hover Mode

1. Velocity Vector . The Velocity Vector symbol indicates the magnitude and direction of the aircraft velocity relative to the nose of the aircraft. It represents 6 kts ground speed during hover and bob-up modes and 60 kts ground speed in transition mode. The velocity vector is a solid line whose origin is the center of the LOS Reticle. The line orients in the direction of the helicopter movement. It extends and withdraws (in length) from the origin to indicate longitudinal and lateral velocities of ground movement. The symbol flashes when an inertial velocity error greater than 0.3 meters per second exists. The vector will blank when inertial data is not valid.

2. Acceleration Cue . The Acceleration Cue provides magnitude and direction indication of the aircraft's acceleration.

(a) Hover and Bob-up Modes. The origin of the Acceleration Cue is the outer end of the Velocity Vector when the vector is at less than maximum scale. The origin of the Acceleration Cue is the center of the LOS Reticle when the Velocity Vector is at or greater than maximum scale.

(b) Transition Mode. The acceleration cue is always referenced to the tip of the velocity vector. The symbol flashes when a greater than 0.3 meters per second error in inertial data exists and blanks when inertial data is not valid.

3. Cueing Dots. Cueing dots are displayed at the outer tips of the LOS Reticle, and indicate the quadrant containing the selected acquisition source. A cueing dot appears at the upper or lower tip of the reticle when a change in elevation is required and, appears at the left or right tip when a change in azimuth is required. They appear at all four tips of the LOS Reticle and flash when the **IHADSS B/S REQUIRED** message is present within the High Action Display's Sight Status field. The cueing dots do not appear when the acquisition source is within 4° of the line of sight.

4. LOS Reticle . The LOS Reticle is a cross-hair located in the center area of the flight format. It represents the LOS of the crewmember's selected sight and is used as an aiming reticle. It is also used as a reference for boresighting as well as for the Head Tracker, the Horizon Line, the Velocity Vector, the Acceleration Cue, and the Hover Position Box. The LOS Reticle flashes when the crewmember's LOS is invalid or his selected PNVS or TADS sensor is at its limit. It also flashes when the gun is the selected weapon and the gun system has failed and is not following the crewmember's head.

5. Cued LOS Dot . The CUED LOS dot is a dynamic dot symbol displayed within the sensor field of regard. It represents the active acquisition LOS. It is edge limited to the current field of regard.

6. FCR Last Centerline L. The FCR last scan centerline is a dashed, vertical line displayed within the sensor field of regard. It is displayed to represent the FCR centerline of the most recent scan for which target information is currently being displayed. It is only visible when the current centerline has been repositioned from the azimuth of the most recent scan, and the FCR is valid.

7. Field of View Box . The field of view box is a small, dynamic box displayed within the field of regard. it represents the relative position of the TADS/PNVS 30° X 40° field of view within the field of regard. It is edge limited to the currently displayed field of regard. The field of view box is not presented if the field of regard is not presented. The field of view box represents the pilots HMD on the pilot's flight formats. It represents the CPG's HMD when the CPG's selected sight is HMD. It represents the TADS when the CPG's selected sight is TADS or FCR

8. FCR Current Centerline L. The FCR current centerline is a solid, vertical line within the current sensor field of regard. This line represents the current centerline of the FCR.

9. Field of Regard. A box representing the selected sensor's field of regard (FOR) is displayed at the bottom of the flight symbology format. The FOR box edges mark the AZ limits for each sensor.

(a) PNVS FOR. The PNVS field of regard (fig 4-15) represents the following: The top of the box marks +20°, the horizontal tic marks indicate the 0° position, and the bottom of the box marks -45°. The left side of the box marks -90°, the center vertical tic marks indicate 0°, and the right side of the box marks +90°.

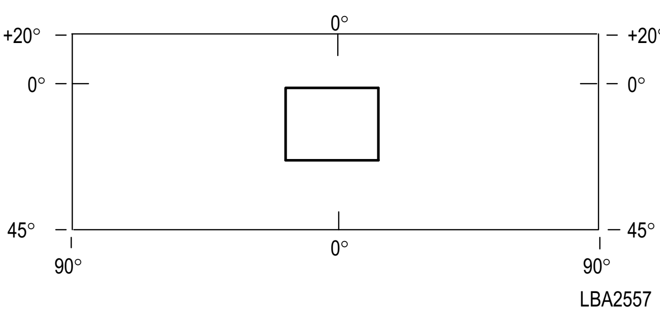


Figure 4-15. PNVS Field Of Regard

(b) TADS FOR. The TADS field of regard (fig 4-16) represents the following: The top of the box marks +30°, the horizontal tic marks indicate the 0° position, and the bottom of the box marks -60°. The left side of the box marks -120°, the left vertical tic marks indicate -90°, the center vertical tic marks indicate 0°, the right vertical tic marks indicate +90°, and the right side of the box marks +120°.

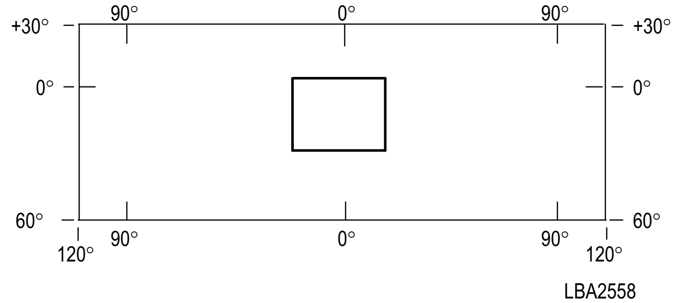


Figure 4-16. TADS Field Of Regard

10. Head Tracker . The Head Tracker indicates the pilot head position relative to the aircraft datum line. This is a virtual symbol whose range of display is 30° vertically and 40° horizontally about the nose of the helicopter.

11. Cued LOS Reticle . The Cued LOS reticle is a dashed crosshair symbol which represents the crewmembers selected acquisition source. In the pilots station the Cued LOS reticle is only presented when the **CUEING** button is selected.

12. [**MT** **Selected PNVS Sensor.** The PNVS selected sensor data field presents the name of the selected PNVS sensor: **TV** or **FLIR**. The selected EOCCM FLIR filter is incorporated into this status: **1FLIR** (filter 1). **2FLIR** (filter 2), or **FLIR** (clear). **TV** status is a growth provision for an image intensification system.]

13. [**MT** **Video Degraded/Frozen Status.** The **VIDEO DEGRADED** or **VIDEO FROZEN** status is displayed when the respective condition is detected (para 4.50.4A). This status is displayed as confirmation, when experiencing either condition, that it has been detected by the system.]

14. Rate of Climb . The rate of climb scale and indicator triangle are located to the left and adjacent to the radar altitude vertical scale. The scale is presented with a filled triangle pointer indicating the current rate of climb. Tic marks designate rates of climb or descent at 100 fpm increments to +/-500 fpm, and a single tic mark designates the 1000 fpm location. When the triangle is in the 1000 fpm descent limit position, a WHITE data field indicating the current rate of descent is presented adjacent to the triangle. The data field shall present the rate of descent to the nearest 100 fpm when the rate of descent exceeds 1000 fpm. The rate of climb limit data field is reserved for barometric altitude. Rates of climb/descent are not presented if the EGI is not providing valid vertical speed information.

15. Additional Symbols. The following symbols are defined in chapter 2 for the **FLT** Page:

- Airspeed
- Altitude Hold
- Attitude Hold
- Engine Torque
- G Status
- Heading Scale
- ADF Bearing
- Alternate Crew member Sensor Bearing
- Command Heading
- FCR Centerline Bearing
- Lubber Line
- Radar Altitude
- Radar Altitude HI
- Radar Altitude LO
- Radar Altitude Vertical Scale
- Rate of Climb
- Skid/Slip Ball
- Turbine Gas Temperature (TGT)

4.14.2 Bob-up Mode Symbology. The Bob-up Mode symbols (fig 4-17) consist of the Hover Mode symbols, with the following additions:

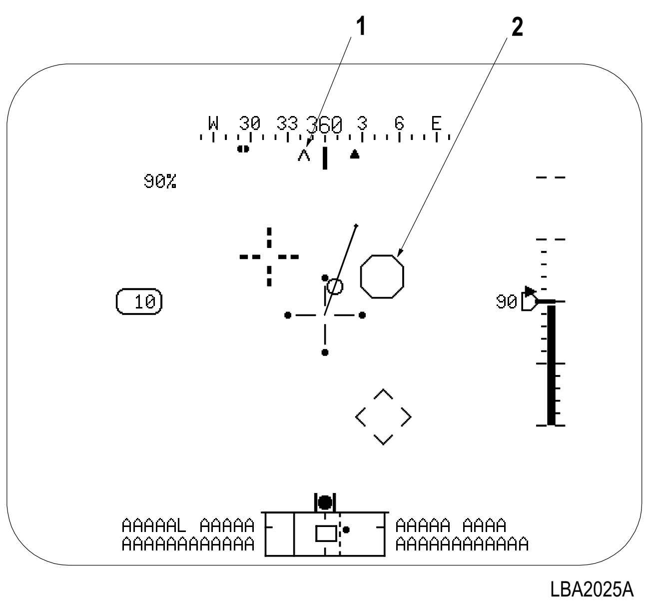


Figure 4-17. Flight Symbology - Bob-up Mode

1. Bob-up Heading. The bob-up heading chevron is presented along the bottom of the magnetic Heading Scale. It represent the heading of the helicopter upon the initiation of the Bob-up Mode. It remains at that heading until the Bob-up Mode is disengaged or heading becomes invalid. If heading was not valid upon bob-up initiation or the heading scale is not presented, this symbol is not displayed.

WARNING

The Bob-up box may drift in a stationary hover. Outside cockpit visual cues must be the principle source of rotor clearance.

2. Bob-up Box. The bob-up box is a dynamic box displayed in the shape of an octagon. It initializes at the center of the LOS Reticle upon selection of the Bob-up Mode. The bob-up box moves about the format to indicate the relative position of the helicopter to the spot on the earth where the box was initialized. If the bob-up box moves to the maximum displacement on the format, it hangs at the edge and continues to move about the edge of the format to indicate the relative direction to the initialization point. The bob-up box shows an approximately 12 ft square area on the ground. Maximum displacement to the edge of the format represents approximately 40 ft laterally or 40 ft longitudinally. The symbol is not presented when inertial data is not valid.

4.14.3 Transition Mode Symbology. The Transition Mode symbols (fig 4-18) consist of the Hover Mode symbols, with the following additions:

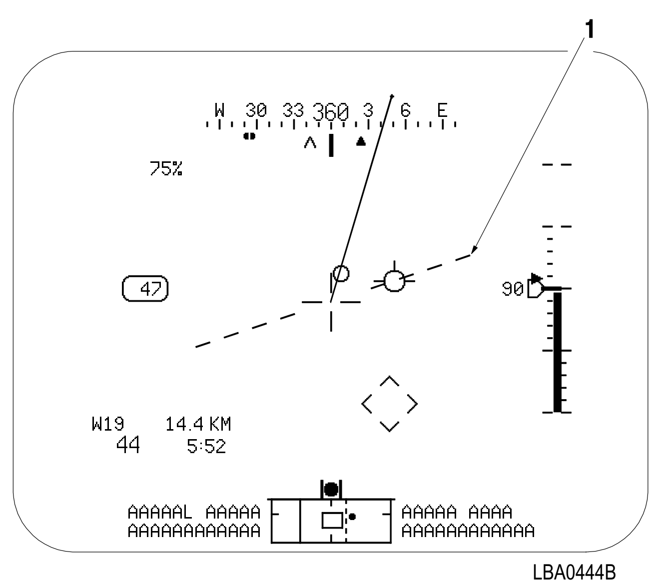


Figure 4-18. Flight Symbology - Transition Mode

NOTE

The horizon line and attitude indicator horizon bar will appear to jump when changing between transition and cruise modes. This is due to the difference in display scaling/ rate of movement between the horizon line (2:1 movement) and the horizon bar (4:1 movement).

1. Horizon Line. The horizon line is a brown dynamic split dashed line positioned horizontally in the center of the format about the center of the LOS reticle. It represents an artificial horizon relative to the LOS reticle. The symbol moves within ±30° in pitch, and hangs at the end positions of this range for pitch attitudes greater than ±30°. The horizon line is not presented when inertial data is not valid

2. Additional Symbols. The following symbols are defined in chapter 2 for the **FLT** Page:

- Destination Point
- Distance to Go
- Time to Go
- Groundspeed
- Flight Path
- Nav Fly-To

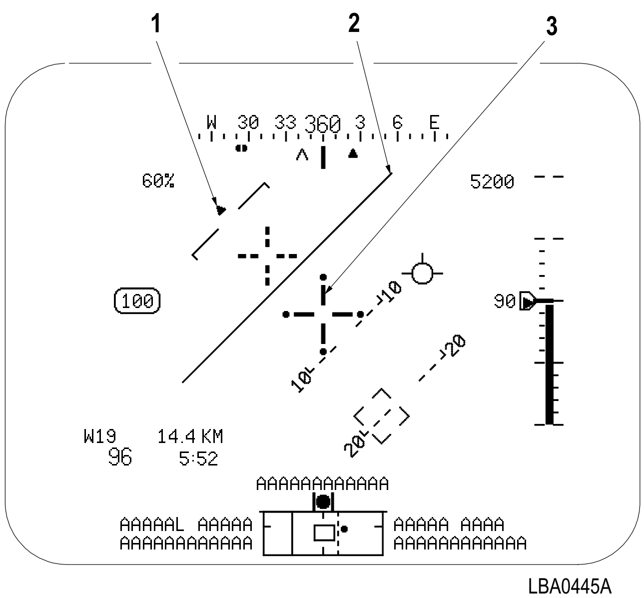


Figure 4-19. Flight Symbology - Cruise Mode

4.14.4 Cruise Mode Symbology. The Cruise Mode symbols (fig 4-19) consist of the Transition Mode symbols, with the following additions or changes:

1. Bank Angle. The bank angle presentation operates as described in chapter 2 for the FLT page. However, the bank angle triangle is presented without the associated tic mark scale on the Cruise Mode flight format.

NOTE

The horizon line and attitude indicator horizon bar will appear to jump when changing between transition and cruise modes. This is due to the difference in display scaling/ rate of movement between the horizon line (2:1 movement) and the horizon bar (4:1 movement).

2. Attitude Indicator. The attitude indicator presentation operates as described in chapter 2 for the **FLT** page, however, to offer less obstruction of the real-world or imagery background, 5° tic marks are not presented, and the scaling has been changed.

3. LOS Reticle. In Cruise Mode, the LOS reticle is a bold cross-hair located in the center of the cruise mode flight format. It represents the LOS of the pilots selected sight and is used as an aiming reticle. It is also used as a reference for boresighting and the pilot head tracker. The reticle flashes when the pilots line of sight is invalid or the selected sensor is at its limit. It also flashes when the gun is selected and the gun system has failed.

4. Barometric or Inertial Altitude. The barometric or inertial altitude, is defined in chapter 2 for the **FLT** page.

4.15 WEAPON SYMBOLOGY FORMAT

The weapon symbology format (fig 4-20) is displayed in the CPG station on the TDU, ORT HOD/HDD and HMD when FCR or TADS is the selected sight, and the HMD is not being used for NVS, as described in paragraphs 4.13 and 4.50.3.

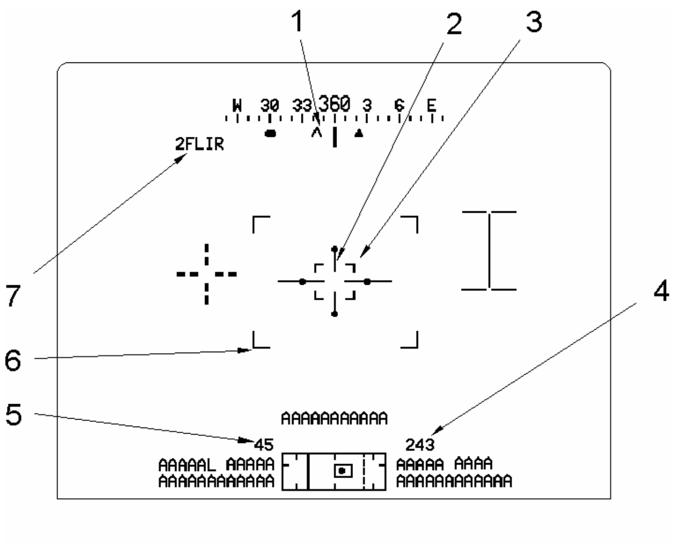


Figure 4-20. Weapons Symbology Format

The following symbols, defined in Chapter 2 for the **FLT** Page, are also presented in the Weapon format and in Chapter 4 for the flight symbology format:

- Cued LOS reticle
- Cueing dots
- Cued LOS dot
- FCR current centerline **L**
- FCR last scan centerline **L**
- Field of view box
- TADS FOR box
- Heading scale
- FCR centerline bearing **L**
- Alternate sensor bearing
- LOS reticle
- Lubber line

4.15.1 Weapon Symbology. When presented on the HMD or ORT, all weapon symbology is green in color. When presented on the MPD (as can be done using the VIDEO Page, VSEL selected), and the MPD is operating in DAY or NIGHT mode, the non-green colors noted in the following paragraphs will be presented.

1. CPG LOS Bearing. The CPG LOS Bearing is a chevron displayed along the bottom of the magnetic heading scale (in place of the command heading). It represents the LOS direction of the CPG HMD or TADS sensor in degrees of azimuth. If FCR is the CPG selected sight, it represents the LOS direction of the TADS sensor. If the heading scale is not presented, this symbol is not displayed.

2. TADS LOS Reticle. The TADS LOS Reticle is a crosshair symbol which represents the TADS line of sight. It is internally generated by the TEU and is displayed as a part of TADS imagery. The TADS LOS reticle will flash when the gun is the selected weapon and the gun system has failed. The TADS LOS reticle color corresponds to the video color.

3. Image Auto Track Gates. The Image Auto Track (IAT) gates are a set of four dynamic gate symbols displayed only when the **IAT/OFS** switch is activated. The IAT gates originate at the TADS LOS reticle and move out in the format to capture a selected object with FLIR or DTV imagery. The IAT gates will attempt to capture an object contrast according to the position of the IAT **POLARITY** switch. The IAT gates color corresponds to the video color.

[**MT** Unique primary and secondary track symbols are displayed when activating the **IAT/OFS** switch. Objects are tracked using edge tracking and inertial tracking (para 4.26.2).]

4. Radar Altitude. The radar altitude presentation operates as described in chapter 2 for the **FLT** page. It is located to the right of the field of regard, above the high action display.

5. Airspeed. The airspeed presentation operates as described in chapter 2 for the **FLT** page. Its location on the weapon format is to the left of the field of regard, above the high action display.

6. TADS FOV Brackets. The TADS FOV brackets are displayed in the center area of the format surrounding the LOS reticle. They appear as corner marks on the display to indicate the amount of the currently displayed imagery of TADS that will be displayed in the next narrower field of view (FOV). They only appear when a next narrower FOV is available, and TADS imagery is presented on the format.

7. TADS Selected Sensor. The TADS selected sensor data field presents the name of the selected TADS sensor: **DVO** (ORT only), **DTV**, or **FLIR**. [**MT** The selected EOCCM FLIR filter is incorporated into this status: **1FLIR** (filter 1). **2FLIR** (filter 2), or **FLIR** (clear).] The TADS selected sensor data field is not presented if there is no TADS video shown.

8. LMC On Indicator. The LMC On (fig 4-20A) symbol consists of four short end-cap lines displayed near the end of the TADS LOS reiticle lines. If the aircraft is equipped with MTADS-PNVS provisions, this indicator is displayed when LMC is on.

9. Laser Firing Indicator. The Laser Firing indicator (fig 4-20A) consists of a large "X" symbol displayed in conjunction with the TADS LOS reticle. If the aircraft is equipped with MTADS-PNVS provisions, this indicator is displayed when the LRFD is lasing.

Figure 4-20A. LMC On and Laser Firing Indicators

4.15.2 Weapon Symbols. Unique weapons symbols are presented on the flight and weapon formats to indicate weapon aiming and status information.

a. Rocket Steering Cursor. The rocket steering cursor is a dynamic I-beam symbol which indicates the delivery mode and how to point the aircraft for the rocket delivery. If the CPG has actioned rockets, the rocket steering cursor is presented on both pilot and CPG formats. If the pilot has actioned rockets, the pilots rocket steering cursor is presented only on the pilot's displays. The cursor moves about in the format to indicate the azimuth and elevation position of the helicopter in relation to the selected sight LOS to provide a steering cue to the crewmember. The cursor is displayed with a solid vertical line when pylon articulation is in process. The cursor shall be dashed when a safety or performance inhibit (Table 4-5) is in force, indicating crew action is required prior to firing rockets. A gap in the center vertical line indicates the pylons are in ground stow position (Figure 4-21) shows the four possible appearances of the rocket steering cursor:

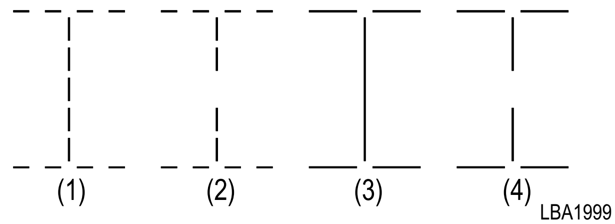


Figure 4-21. Rocket Steering Cursors

(1) Articulating/inhibited rocket steering cursor.

(2) Stowed/inhibited rocket steering cursor.

(3) Articulating rocket steering cursor.

(4) Stowed rocket steering cursor.

b. Fixed Gun Aiming Reticle. The fixed gun aiming reticle (fig 4-22) is the same graphically as the cued LOS reticle. It represents a fixed impact point for a given range. It is presented only when the crewmember actions the gun in the fixed mode.

Figure 4-22. Fixed Gun Aiming Reticle

c. Gun DH Reticle. The Gun DH Reticle is the same graphically as the cued LOS reticle. The position of this symbol is controlled by the **MAN TRK** thumb force controller to designate the impact point/area of the gun rounds following dynamic harmonization gun firing.

d. Missile Constraints Box. The Hellfire missile constraints box (fig 4-23) is used to indicate the delivery mode and direction to orient the aircraft for the Hellfire missile launch. A dashed line type indicates the missiles are out of constraints. A solid line indicates the missiles are in constraints. If a SAL missile is actioned but not tracking, the constraints box size is set to LOAL (small box). If the missile transitions into TRACK mode, the constraints box will be set to LOBL (large box). RF missile constraints box is based on target handover data, which determines actual missile trajectory mode. If the missile does not enter a LOBL RADAR mode, the constraints box is set to LOAL. The constraints box size does not directly correlate to an angle (such as seeker FOV). For SAL missiles, the allowable angle is larger for LOBL (20°) than for LOAL (7.5°). Alignment of the aircraft to the target LOS is not as critical so the LOBL constraints box is larger. For RF missiles in either LOAL or LOBL trajectory mode, the allowable angle is 20°. If the RF missile is tracking and the target range is $\geq$ 1 km, the allowable angle is 20°. If the RF missile is tracking and the target range is $<$ 1 km, the allowable angle is 5°.

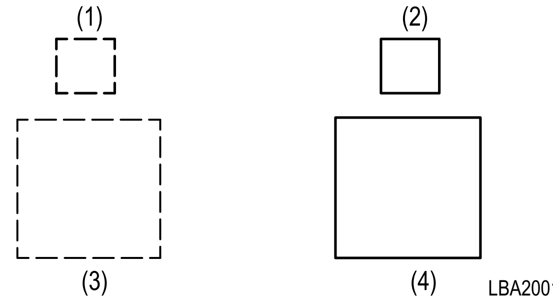


Figure 4-23. Missile Constraint Boxes

(1) LOAL out-of-constraints missile box.
(2) LOAL in-constraints missile box.
(3) LOBL out-of-constraints missile box.
(4) LOBL in-constraints missile box.

4.15.3 C-Scope Symbols L. FCR symbols are presented in the C-Scope format on the flight and weapon symbology formats. Target symbols are displayed in GTM, RMAP, or ATM. Terrain profile lines and obstacle symbols are displayed in TPM.

a. FCR Target Symbols. Target symbols (fig 4-24) are provided to indicate the azimuth and elevation location of targets detected during last scan. Target symbol color is IAW the **FCR** page presentation of targets described in para 4.44.4

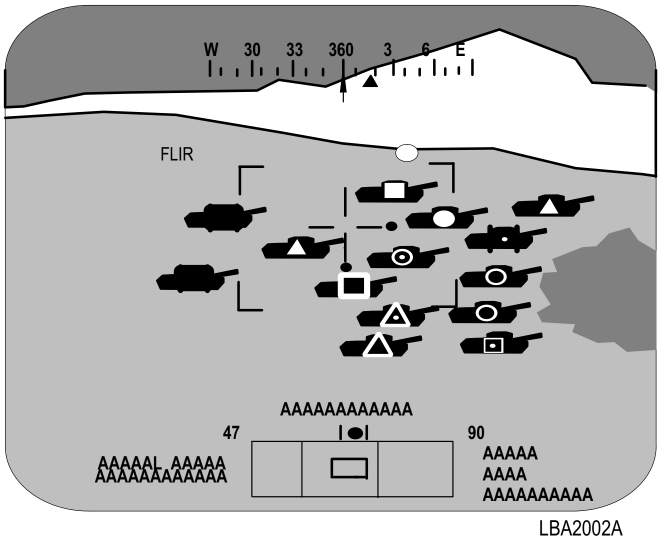


Figure 4-24. FCR Target Symbols in C-Scope (example TADS FLIR WFOV)

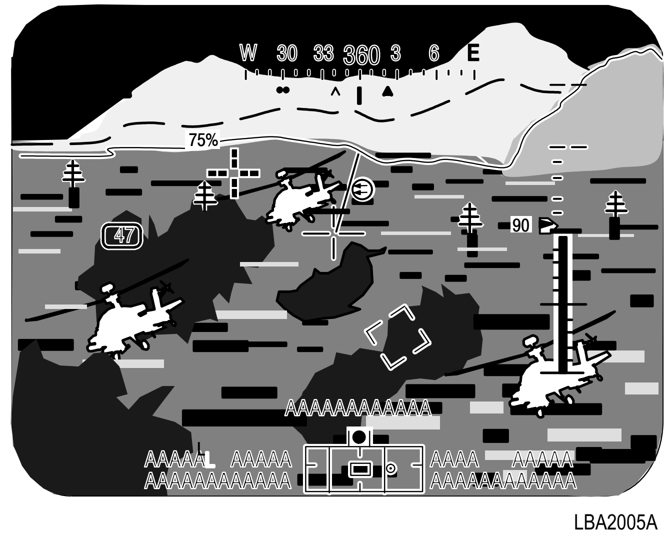


Figure 4-26. FCR Profile Lines and Obstacles in C-Scope

WARNING

The terrain profiling mode of the FCR shall not be relied upon for primary pilotage information.

b. Profile Line Symbols. Terrain profile lines (fig 4-25) are provided to indicate the greatest elevation at up to four ranges from the helicopter. The number of lines displayed is selected on the FCR page, TPM Format. The solid (nearest) line is shown WHITE in color.

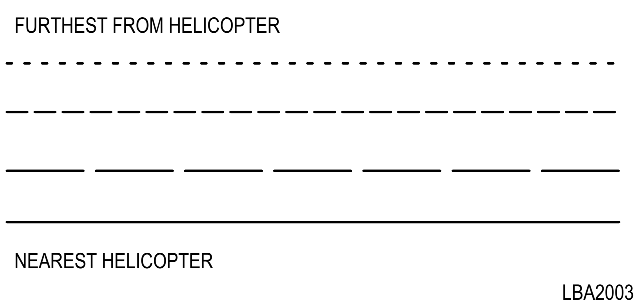


Figure 4-25. Terrain Profile Line Dash Patterns

c. Obstacle Symbol. Obstacle symbols are provided to indicate towers or other items with significant changes in vertical elevation plus radar cross section and minimum height detected by the FCR in Terrain Profiles mode (fig 4-26). The obstacles are YELLOW in color. Obstacles are not presented if FCR data is not valid.

4.16 HIGH ACTION DISPLAY (HAD) FORMAT

The HAD is located along the bottom of the weapons and flight symbology formats (fig 4-27). It is subdivided into seven status message fields and provides information independently by crew station. The messages are typically presented in priority order based on the selected sight and/or weapon system. Messages on MPD will be in green unless otherwise indicated in the following tables.

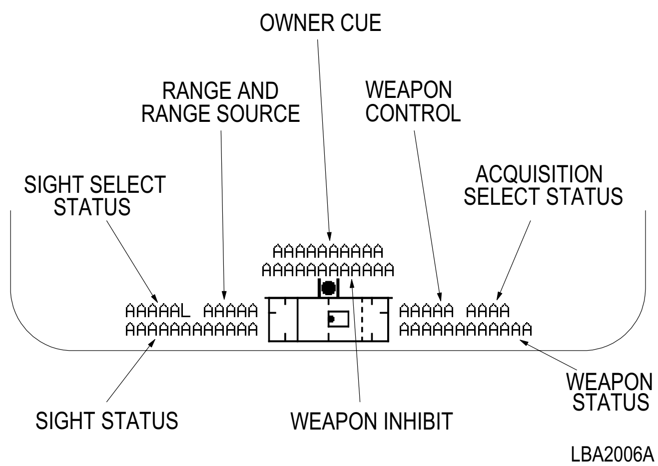


Figure 4-27. Pilot and CPG HAD Format

4.16.1 Sight Status Field. The HAD sight status field (Table 4-1) is located on the bottom left of the display field and occupies 12 character spaces. This field provides sight status messages in the priority order based on the crew station and selected sight.

Table 4-1. HAD Sight Status Field Messages

Message	Color	Description
BOT		(Beginning of Tape) The tape is at the beginning position.
CHK	White	The VCR door is not latched or the tape presence is not detected. The crewmember should check the tape or tape door.
CUE UPDT		The TADS cue update boresight has been selected by placing the **IAT** in **MANUAL** and the **SLAVE** switch **OFF** when **BORESITE** has been selected via the MPD. Applies only to CPG
ENERGY LOW		Laser energy has been detected as low. Presented only when laser is firing. Applies only to CPG.
EOT		(End of Tape) The VCR tape is at the end; no tape remains.
FCR FAIL L	White	The FCR has been detected as NO-GO, and the FCR antenna defaults to fixed forward, if possible.
FCR HOT L	Yellow	An impending overtemperature condition exists (80-90% of overheat threshold) within the FCR components. The FCR will automatically shut down when the temperature limit is exceeded unless the FCR TEMP ORIDE button is selected.
FCR NOT READY L	White	The FCR is not available because of BIT or Power-Up. The message alternates (FCR, then NOT READY) at the alternating text rate.
FCR XMIT L		The FCR is transmitting.
FIRE MSLS		The minimum interval between launches has elapsed in a rapid fire Hellfire missile engagement, and more than one missile is present in the priority channel after launch of a missile. This message is displayed for 2 seconds.

Table 4-1. HAD Sight Status Field Messages (cont)

Message	Color	Description
FIXED		The selected sight (FCR/TADS) is in the fixed position.
FLIR NOT COOL		The TADS FLIR has not cooled down sufficiently for optimum performance; cool down should not exceed 15 minutes. The message alternates (FLIR, then NOT COOL) at the alternating text rate. Applies only to CPG.
FLIR OFF		The FLIR has been turned OFF, the TADS is still powered. Applies only to CPG.
HF TOF-NN		Indicates time (in seconds) until missile impact for a remote launch. If more than one missile is in flight, the display will show TOF for the missile first launched, then the subsequently launched missiles.
IHADSS B/S REQUIRED		IHADSS boresight required. This message alternates (IHADSS B/S, then REQUIRED) at the alternating text rate.
IHADSS FAIL	White	The IHADSS has been detected as NO-GO for that crewstation by the DMS. The IHADSS LOS defaults to fixed forward for the affected crewstation.
IHADSS LOS INVALID	White	This condition is caused by any one of the following conditions: IHADSS failure, IHADSS power being off, blockage of the line-of-sight between the SSU and helmet, or the head of the crewmember being outside the head-motion box. The IHADSS LOS is frozen at the last valid computation until the LOS is computed as valid. The message alternates (IHADSS LOS, then INVALID) at the alternating text rate.
INTERNAL B/S		The TADS internal boresight has been selected via the MPD. Applies only to CPG.

Table 4-1. HAD Sight Status Field Messages (cont)

Message	Color	Description
INTER-NAL B/S.. RE-QUIRED	White	The system has determined a TADS internal boresight is necessary. The boresight will be required at system power-up and once every 50 minutes thereafter MT .
LASE NN TRGT		The laser designator must be lasing the target for missile terminal guidance. The message is displayed for 4 seconds starting at TOF=12 calculated missile time of flight during LOAL launches.
LASER FAIL	White	Indicates LRF/D Failure. Applies only to CPG.
LIMITS		The selected sight, TADS, FCR, or PNVS (in NVS mode) is at a limit. Also applies to TADS or FCR when linked L.
LRFD CODE ?	White	The selected LRFD laser code is not usable. Applies only to CPG.
LST CODE ?	White	The selected LST laser code is not usable. Applies only to CPG.
ARTY TOF = NN		Indicates time (in seconds) until artillery rounds impact for a call for fire mission. Time of flight countdown will begin when the message is opened and is based on estimated TOF determined by the sender. If more than one "shot" time is issued, time of flight is based upon the most recently opened message.
MMA PINNED L		The operator has indicated to the system that the MMA is pinned in a fixed forward position.
MSL LAUNCH		Indicates tactical missile launch for a remote designator. This message is displayed for 2 seconds.
NAV DATA INVALID	White	The FCR has been selected as the active sight and the RF handover data recently received has been detected as outside the optimum navigational parameters for weapons engagement. Safety inhibit.

Table 4-1. HAD Sight Status Field Messages (cont)

Message	Color	Description
NVS B/S ERR	White	The weapon processor has detected an alteration of internal values affecting the PNVS alignment. The PNVS will function normally but without alignment correction.
NVS DIRECT	White	The TADS Electronics Unit has been detected as NO-GO. The PNVS turret is being directed by the weapons processor and its azimuth is limited to 75° left and right.
NVS FAIL	White	DMS has determined the PNVS turret or electronics or the TADS (if it is the NVS) as NO-GO.
NVS FIXED		The operator has selected the NVS fixed mode.
NVS NOT COOL	White	The PNVS FLIR or TADS FLIR has not cooled down for optimum performance.
OUT-FRONT B/S		The TADS outfront boresight has been selected via the MPD. Applies only to CPG.
PNVS SBIT..IN PROG-RESS	White	At power-up, the PNVS is performing a 30 second functional test of electronic equipment MT.
RECORD FAIL	White	The video tape recorder is commanded to record video, but it is not recording.
RE-CORD-ING		The video tape recorder is recording video.
REMOTE		The Hellfire missile system is set up for remote missile launch, i.e., the priority missile channel does not match the LRFD code. Applies only to CPG.
RFI DATA?	White	The FCR has been commanded to perform a cued search and no threat data is available.
RFI FAIL L	White	The RFI has been detected as NO-GO.
RFI NOT READY L	White	The RFI is not available because of BIT or Power-up. The message alternates (RFI, then NOT READY) at the alternating text rate.

Table 4-1. HAD Sight Status Field Messages (cont)

Message	Color	Description
SA-NUC..IN PROG-RESS	White	Indicates TADS or PNVS is performing SANUC during ground initialization MT.
SA-NUC..RE-QUIRED	White	During TADS or PNVS initialization, the system has determined that a SANUC should be performed and the crew is in control of a sensor other than FLIR MT.
SIM LAUNCH		Indicates training missile launch for a remote designator. This message is displayed for 2 seconds.
TADS B/S	White	The weapon processor has detected an alteration of internal values affecting TADS alignment. The TADS will function normally without alignment correction. Applies only to CPG.
TADS FAIL	White	The TADS has been detected as NO-GO. Applies only to CPG.
TADS SBIT..IN PROG-RESS	White	At power-up, the TADS is performing a 30 second functional test of electronic equipment MT.
TARGET DATA?	White	Indicates no target data is available.
WET	White	The VCR has detected moisture on the tape. The VCR can continue to play or record, but to do so may damage the VCR and/or tape. Recommend turning VCR off to unthread the tape.
?	White	An error has occurred. An illogical and invalid condition has been identified.

4.16.2 Range and Range Source Status Field. The HAD range and range source field (table 4-2) is located on the top left of the display field and occupies five character spaces. This field provides range and range source messages based on the crew station.

Table 4-2. HAD Range and Range Source Status Field Messages

Message	Color	Description
***XXXX**		Indicates range source is laser. Range is displayed in meters, maximum value is 9999. The asterisk is present when the laser is firing and the Weapons Processor is receiving valid range data from the laser rangefinder/designator. The asterisk flashes when a multi-target condition is detected in the range data.
1.5		The weapon processor is using the default range in the pilot station because the selected range source is not valid.
3.0		The weapon processor is using the default range in the CPG station because the selected range source is not valid.
AXX.X		The weapon processor is using an autorange solution . It is based on selected sight LOS and radar altitude. Range displayed is in km, maximum value is 50 km.
MXX.X		The weapon processor is using a manual range entered at the KU in the pilot station. Range displayed is in km (entered in meters at the KU). The maximum value is 50 km.
NXX.X		The weapon processor is using a valid navigational range value to the target, waypoint/hazard, or control point in the acquisition source option. The range value will increase or decrease based on helicopter movement or position changes. Range displayed is in km, maximum value is 32 km.

Table 4-2. HAD Range and Range Source Status Field Messages (cont)

Message	Color	Description
RX.X L		The weapon processor is using radar range as a result of employing the FCR in the pilot station. Range is displayed in km, maximum value is 9.9 km.
?	White	?An error has occurred. An illogical and invalid condition has been identified.

4.16.3 Weapon Control Status Field. The HAD weapon control status field (table 4-3) is located on the top right of the display field and occupies 5 character spaces. This field provides the status of the selected weapon in the opposite crew station.

Table 4-3. Weapon Control Status Field Messages

Message	Color	Description
CGUN		CPG has actioned GUN system.
CMSL		CPG has actioned Missile system.
COOP		Both PILOT and CPG have actioned the Rocket system.
CRKT		CPG has actioned Rocket system.
PGUN		PILOT has actioned Gun system.
PMSL		PILOT has actioned Missile system.
PRKT		PILOT has actioned Rocket system.
?	White	An error has occurred. An illogical and invalid condition has been identified.

4.16.4 Weapon Status Field. The HAD weapon status field (table 4-4) is located on the bottom right of the display field and occupies 12 character spaces. This field provides weapon status messages based on the selected weapon system.

Table 4-4. Weapon Status Field Messages

Message	Color	Description
2 CHAN TRACK		Indicates priority and alternate channels are tracking.
ALT CHAN TRK		Indicates alternate channel is tracking.
ALT CODE ?	White	Indicates selected code for alternate channel is unusable. This is due to the lack of PIM Code/ Keyword correlation or the SAL SEL is AUTO, the selected code is PIM and no SAL 2 missiles are available but SAL 1 missiles are available. Only displayed in ripple mode.
DIR MAN		HF Missile trajectory is set to DIR and missile MODE is set to MAN.
DIR NORM		HF Missile trajectory is set to DIR and missile MODE is set to NORM.
DIR RIPL		HF Missile trajectory is set to DIR and missile MODE is set to RIPL.
FIRE MSLS		The minimum interval between launches has elapsed in a rapid fire HF missile engagement, and more than one missile is present in priority channel after launch of a missile.
GUN B/S	White	The gun has not been boresighted or failed the boresight verification. The gun will function normally but without boresight corrections.
GUN FAIL	White	The gun system has been actioned but has been detected as NO-GO. Recycle the GUN System- ON/OFF power button. If the fault message clears, continue operation.
GUN JAM	White	The gun has been detected as jammed.

Table 4-4. Weapon Status Field Messages (cont)

Message	Color	Description
HANG-FIRE	Yellow	The fire signal was sent but umbilical separation did not occur. This message is displayed for 6 seconds, during which time all HF missiles on that side of the helicopter become “not available” and are inhibited from firing.
HF TOF=NN		Indicates time (in seconds) until missile impact. If more than one missile is in flight, the display will show TOF for the missile first launched, then the subsequently launched missiles.
HI MAN		Missile trajectory is set to HI and missile MODE is set to MAN.
HI NORM		Missile trajectory is set to HI and missile MODE is set to NORM.
HI RIPL		Missile trajectory is set to HI and missile MODE is set to RIPL.
LASE NN TRGT		The message is displayed for 4 seconds starting at TOF =12 calculated missile time of flight during LOAL launches.
LIMITS	White	Indicates pylons commanded to elevation limit.
LO MAN		Missile trajectory is set to LO and missile MODE is set to MAN.
LO NORM		Missile trajectory is set to LO and missile MODE is set to NORM.
LO RIPL		Missile trajectory is set to LO and missile MODE is set to RIPL.
LOAL MAN		RF missile trajectory is defaulted to LOAL and missile MODE is set to MAN.
LOAL NORM		RF missile trajectory is defaulted to LOAL and missile MODE is set to NORM.
LOBL INHIBIT		Indicates LOBL INHIBIT mode is selected.
LOBL MAN		Missile trajectory is set to LOBL and missile MODE is set to MAN.

Table 4-4. Weapon Status Field Messages (cont)

Message	Color	Description
LOBL NORM		Missile TRAJ is set to LOBL and missile MODE is set to NORM.
LOBL RIPL		Missile trajectory is set to LOBL and missile MODE is set to RIPL.
MISFIRE	Yellow	Indicates a HF misfire has occurred. The fire signal was sent but umbilical separation did not occur at the predicted time. This message is displayed for 2 seconds.
MSL LAUNCH		Indicates launch commanded in the tactical mode. This message is displayed for 2 seconds.
MSL SELECT		Missiles have been actioned, but no primary channel has been selected.
MSL TYPE?	White	Indicates no missiles of the selected type (RF or SAL) are available.
NO ACQUIRE	White	Indicates the RF missile has completed its attempts to acquire the target and has returned to ready mode.
NO MISSILES	White	Indicates no missiles (RF or SAL) are available.
NO ROCKETS	White	Indicates available rocket quantity is 0.
PRI CHAN TRK		Indicates priority channel is tracking.
PRI CODE ?	White	Indicates selected code for the priority channel is unusable. This is due to lack of PIM Code/Keyword correlation or the SAL SEL is AUTO, the selected code is PIM and no SAL 2 missiles are available but SAL 1 missiles are available.
DEF SCHEME X		Indicates the selected lethal ranges in use is the default data (within FCR) and the selected priority scheme (A-G) for the FCR. This message is only given when no weapon is actioned and FCR is the selected sight.

Table 4-4. Weapon Status Field Messages (cont)

Message	Color	Description
MOD SCHEME X		Indicates selected lethal ranges in use is the modified data (from the DTC) and the selected priority scheme (A-G) for the FCR. This message is only given when no weapon is actioned and FCR is the selected sight.
PYLON B/S	White	Weapon has not been boresighted or failed the boresight verification. Subsystems will function normally but without pylon CBHK corrections.
RF MSL TRACK		Indicates an RF missile is tracking.
RKT TOF=NN		Indicates time (in seconds) until rocket impact. If more than one volley is in flight, the display will show TOF for the last volley launched.
ROUNDS NNNN		The gun system has been actioned and the NNNN indicates the number of rounds remaining and will count down one unit for each firing PULSE.
SAL SEL?	White	Indicates the selected SAL missile type is unavailable. Only displayed in SAL1 or SAL2 SAL SELECT modes.
SIM LAUNCH		Indicates launch commanded in the training mode. This message is displayed for 2 seconds.
TYPE?	White	Indicates no rocket type selected.
WEAP-ON?	White	The weapons trigger has been pulled without a weapon being actioned.
?	White	An error has occurred. An illogical and invalid condition has been identified.

4.16.5 Weapon Inhibit Status Field. The HAD weapon inhibit field (table 4-5) is located in the center area of the display field just above the Sensor FOR box and occupies 12 character spaces. This field provides an indication of safety or performance inhibit messages based on the selected weapon system.

Table 4-5. HAD Weapon Inhibit Status Field Messages

Generic Inhibits		
ALL TRKS DEL	White	Displayed for 4 seconds to indicate all TADS target tracks have been deleted by the CPG **MT** .
LIVE AMMO	Yellow	Indicates live ammunition has been detected (or gun round entered in rounds counter) when powering up a TESS missile. Safety inhibit.
TRK X DEL	White	Displayed for 4 seconds to indicate TADS target track number X has been deleted by the CPG **MT** .
TRK X DROP	White	Displayed for 4 seconds to indicate TADS target track number X has been dropped by the tracker **MT** .
?	White	An error has occurred. An illogical and invalid condition has been identified.
Message	**Color**	**Description**
HELLFIRE Inhibits		
ACCEL LIMIT	White	Indicates the vertical acceleration is less than or equal to .5 Gs and may cause the main rotor blades to obstruct the trajectory of the weapon. Safety inhibit.
ALT LAUNCH	White	Indicates an alternate launch is in progress. Safety inhibit.
BACK-SCAT-TER	White	Indicates, based on Missile Seeker vs TADS LOS, the seeker is not tracking the TADS Laser designation. Safety inhibit.
BAL LIM-IT	White	Indicates range or other engagement parameters exceed the ballistics processing capability of the system.

Table 4-5. HAD Weapon Inhibit Status Field Messages (cont)

Message	Color	Description
HELLFIRE Inhibits (cont)		
DATA INVALID	White	This weapon has been actioned, the FCR has been selected as the active sight and the RF handover data recently received has been detected as outside the navigational performance parameters for weapons engagement. Safety inhibit.
GUN OBSTRUCT	White	Indicates the missiles resident on inboard launchers are inhibited from launch because the gun is out of coincidence and may obstruct the trajectory of the missile. Safety inhibit.
LASER RANGE?	White	The ST/UPDT switch on the LHG has been selected to the UPDT position and the current range source is other than laser.
LOS INVALID	White	Indicates the selected LOS is either failed or invalid. Selection of HMD as the sight when HMD symbology belongs to the alternate crewmember will also generate this inhibit. This condition can occur either when the CPG selects presentation of the pilot information using the ORT VID SEL select or TEDAC PNV switch, and can also occur during single display processor operations. Safety inhibit.
MSL NOT RDY	White	No HF missiles are ready for launch: no SAL missile priority channel selected or RF missile transfer alignment not complete.
PYLON ANGLE	White	Indicates the pylon position is > 10 ° from the optimum launch position or that pylon position is unknown. Performance inhibit.
PYLON ERROR	White	Indicates the aircraft is on the ground and the pylons position is unknown or that the pylons are positioned such that the missile may strike the ground near the aircraft. Safety inhibit.

Table 4-5. HAD Weapon Inhibit Status Field Messages (cont)

HELLFIRE Inhibits (cont)		
Message	**Color**	**Description**
PYLON LIMIT	White	Indicates that the commanded pylon position exceed the pylon articulation limits (+4° to -5° on ground) (+4° to -15° in air). Performance or safety inhibit dependent on air/ground status.
RATE LIMIT	White	Indicates the aircraft pitch, roll or yaw rate or acceleration is excessive. Performance inhibit.
ROLL LIMIT	White	Indicates the aircraft roll position is excessive. Performance inhibit.
SKR LIMIT	White	Indicates the missile seeker azimuth or elevation gimbal limit has been reached. Performance inhibit.
TRAINING	White	Indicates the weapon training mode is active, or the TESS is enabled, and the armament control is in the ARM state and a weapon is actioned in either crew station.
TXX	White	Displayed for 4 seconds to indicate file address in which the coordinate data has been stored (TADS/FCR target store switch on LHG).
YAW LIMIT	White	Indicates yaw position of the aircraft with respect to the target is excessive. Applies to LOAL mode only. Performance inhibit.
GUN Inhibits		
ALT LAUNCH	White	Indicates a Rocket or Hellfire launch is in progress. Safety inhibit.
AZ LIMIT	White	Indicates the gun is positioned at an azimuth limit. Safety inhibit.
BAL LIMIT	White	Indicates range or other engagement parameters exceed the ballistics processing capability of the system.
COINCIDENCE	White	Indicates the gun is currently out of coincidence. Safety inhibit.

Table 4-5. HAD Weapon Inhibit Status Field Messages (cont)

Message	Color	Description
GUN Inhibits (cont)		
EL LIMIT	White	Indicates the gun is positioned at an elevation limit. Safety inhibit.
LOS INVALID	White	Indicates the selected LOS is either failed or invalid. Safety inhibit.
SAFE	White	Indicates the weapon system has not been ARMed through the **ARMAMENT** control panel.
TRAINING	White	Indicates the weapon training mode is active, or the TESS is enabled, and the armament control is in the ARM state and a weapon is actioned in either crew station.
TXX	White	Displayed for 4 seconds to indicate the file address in which the coordinate data has been stored.
ROCKET Inhibits		
ACCEL LIMIT	White	Indicates that the vertical acceleration is less than .5 G's and may cause the main rotor blades to obstruct the trajectory of the rockets. Safety inhibit.
ALT LAUNCH	White	Indicates that a Hellfire launch is in progress. Safety inhibit.
GUN OBSTRUCT	White	Indicates the rockets resident on inboard launchers are inhibited from launch because the gun is out of coincidence and may obstruct the trajectory of the rockets. Safety inhibit.
LOS INVALID	White	Indicates that the selected LOS is either failed or invalid. Safety inhibit.
PYLON ERROR	White	Indicates that the pylon elevation position is not equal to the commanded pylon position. Safety inhibit.
ROCKET Inhibits (cont)		
PYLON LIMIT	White	Indicates that the commanded pylon position exceed the pylon articulation limits (+4° to -5° on ground) (+4° to -15° in air). Performance or safety inhibit dependent on air/ground status.
SAFE	White	Indicates the weapon system has not been ARMed through the **ARMAMENT** control panel.
TRAINING	White	Indicates the weapon training mode is active, or the TESS is enabled, and the armament control is in the ARM state and a weapon is actioned in either crew station.
TXX	White	Displayed for 4 seconds to indicate the file address in which the coordinate data has been stored.
TYPE SELECT	White	Indicates that no rocket type is selected. Safety inhibit.

4.16.6 Sight Select Status Field. The HAD sight select status field (table 4-6) is located on the top left of the display field and occupies 5 character spaces. This field provides status of the state of the selected sight in that station. The **LINK** status L displays when the FCR and TADS are operating in a linked mode.

Table 4-6. HAD Sight Select Status Field Messages

Message	Color	Description
P-FCR/ C-FCR	White	The PLT or CPG has selected FCR as the active LOS.
P-FCRL/ C-FCRL	White	FCR is the selected sight and TADS is linked to the FCR NTS. If a missile is tracking, TADS is linked to the missile LOS.
P-HMD/ C-HMD	White	The PLT or CPG has selected HMD as the active LOS.
TADS	White	The CPG has selected TADS as the active LOS.
TADSL L	White	TADS is the selected sight and FCR is linked to the TADS.
?	White	An error has occurred. An illogical and invalid condition has been identified.

4.16.7 HMD FORMAT OWNER CUE. During single DP operations, the HMD FORMAT OWNER CUE will read **PLT FORMAT** or **CPG FORMAT**. This will flash for 3 seconds whenever the ownership changes, and upon entry/ exit into single DP operations. Refer to paragraph 4.50.3.

4.16.8 Acquisition Select Status Field. The **HAD** acquisition select status field (table 4-7) is located on the top right of the display field and occupies 4 character spaces. This field provides status of the selected acquisition source in that crew station.

Table 4-7. HAD Acquisition Status Field Messages

Message	Color	Description
FCR L		The operator has selected FCR as the acquisition source.
FXD		The operator has selected FXD as the acquisition source.
GHS		The operator has selected GHS as the acquisition source.
PHS		The operator has selected PHS as the acquisition source.
RFI L		The operator has selected RFI as the acquisition source.
SKR		The operator has selected SKR as the acquisition source.
TADS		The operator has selected TADS as the acquisition source.
TXX, or CXX, or WXX, or HXX		The operator has selected TXX, CXX, WXX, or HXX as the acquisition source.
TRN		The operator has selected Terrain Point as the acquisition.
?	White	An error has occurred. An illogical and invalid condition has been identified.

4.17 PNVS DESCRIPTION

NOTE

If using **EXT PWR** TADS/PNVS will not power up automatically.

The PNVS consists of a FLIR sensor contained in a stabilized rotating turret mounted above the TADS. The aircraft may be equipped with legacy PNVS or Modernized PNVS (MPNVS) which includes an improved FLIR sensor with EOCCM filters and growth provisions for an image intensification system to compliment the FLIR. This system permits the pilot to fly nap-of-the-earth (NOE), and enhances navigation at night or in limited adverse weather. The PNVS provides the pilot or CPG with a high resolution FLIR video.

4.18 PNVS OPERATION

When **NVS NORM** is selected, the turret is slaved to the helmet LOS. During normal operations, the pilot has control of the PNVS turret. However, if the pilot becomes incapacitated, the CPG may take control of the PNVS.

4.18A [MT FLIR SCENE ASSISTED NON-UNIFORMITY CORRECTION (SANUC)

The SANUC process is performed in order to assure full convergence of the NUC coefficients to fully optimize FLIR image quality for PNVS and TADS.

Standard Process Initialization

- The standard SANUC process will be automatically performed following FLIR cool-down. No imagery will be displayed during cool-down and SANUC. Once the SANUC is completed (approximately 14 seconds). FLIR imagery will be displayed and the sensor will become available for use.
- During SANUC, the optics are defocused to remove high frequency scene content and SANUC thresholds are opened up to allow rapid update of both gain and level coefficients.
  For PNVS, this operation requires the gimbal to move to fixed forward and dither in elevation for several seconds so that the FLIR sensor sees a variety of temperatures in the scene.
  For TADS, the turret will move to fixed forward and dither in elevation for several seconds.
- If the turret is in use with a TV sensor when FLIR cool-down is complete, SANUC will not be performed until FLIR is selected as the sensor.

One-Touch Process Initialization

- The one-touch SANUC process will be performed for FLIR power-up in the air. It will take approximately one second to perform a single point correction at the scene temperature when FLIR cool-down is complete. No imagery will be displayed during cool-down, however, imagery will be available during the one-touch and the opaque filter will be visible. The opaque filter is used as the single reference for the one-touch, which corrects for offset errors, but not gain or quadratic coefficient errors.

The SANUC process is performed under the following circumstances:

- For normal ground initialization, the standard SANUC initialization process that involves gimbal slewing remains for normal TADS FLIR power-up on the ground.
- For rapid/emergency departure/power interruptions/in-flight initialization, a quick one-touch procedure is implemented for use while the aircraft is in the air. The weight-on-wheels signal being sent form the aircraft to the M-TEU or M-PEU is used to determine which procedure will be performed.
  The SANUC coefficients change during operation to remove residual fixed pattern noise and are able to pull the image in over the next few minutes. During the remainder of the flight, additional one-touch updates are performed.
- For IBIT, a commanded SANUC update is integrated into the IBIT process (for ground testing). Also, a commanded one-touch update is integrated into the IBIT process (for flight testing).
- For TADS internal boresight, in the case of the TADS FLIR, a one-touch is used to perform a near-term SANUC coefficient update for boresighting.
  Typical in-flight boresight is performed twice per flight. Integrating an additional one-touch update into the beginning of the internal boresight process provides the best-compensated image prior to delivering weapons. This is an automatic step in the boresight process and is performed during the gimbal slew time.
- For standby (turret in stow), one touch update is performed upon exit. This is a quick, easy method to recalibrate the image.

4.19 PNVS ANTI-ICE

When the pilot or CPG selects anti-ice using the aircraft **UTIL** page **ANTI-ICE SENSOR** button and the helicopter is off the ground, 115 Vac is applied to the PNVS shroud window and a shroud frame heater. When the anti-ice is turned on (automatically or manually) and the aircraft is in the air, power is applied to the PNVS window and shroud frame heaters. PNVS anti-ice can be selected when the aircraft is on the ground by using the **GND** button.

4.20 TADS DESCRIPTION

NOTE

If using **EXT PWR** TADS/PNVS will not power up automatically.

The TADS assembly is an Electro-Optical system that uses direct view optics (DVO)(ORT only), a day television (DTV) sensor, a laser spot tracker (LST), a laser rangefinder/ designator (LRF/D), and a forward looking infrared (FLIR) sensor for day, night, and limited adverse weather operations. The aircraft may be equipped with legacy TADS or Modernized TADS (MTADS) which includes an improved FLIR sensor and, in addition to the components listed above, automated internal boresight, EOCCM filters, a multi-target tracker and growth provisions for an extended range (XR) zoom FOV.

4.20A TADS ELECTRONIC DISPLAY AND CONTROL (TEDAC) CONTROLS

The TEDAC bezel panel (fig 4-27A) provides access to the controls necessary to adjust video on the TEDAC Display Unit (TDU) and the CPG HMD.

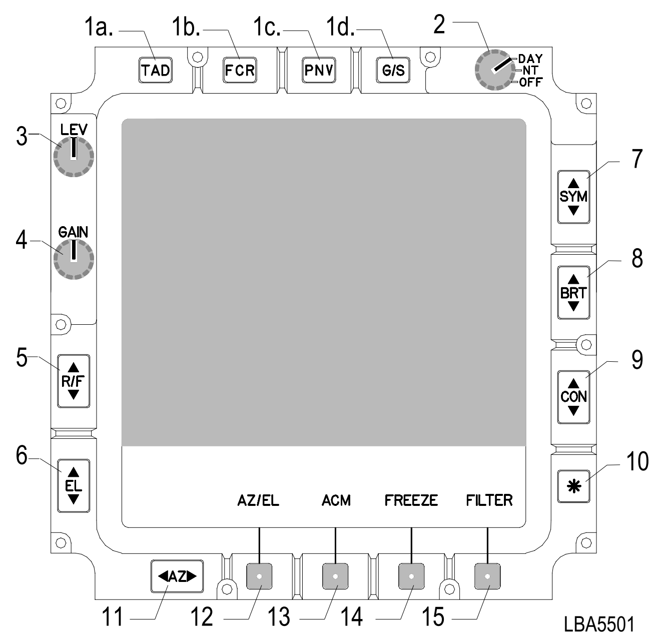


Figure 4-27A. TEDAC Controls

1. Video Select Buttons. These bezel pushbuttons select the video source to be displayed to the CPG on the TDU. The default video upon initialization is based on the default sight selection of HMD (flight format, no video).

Subsequently selecting one of these pushbuttons will provide the selected video.

a. TAD. The **TAD** pushbutton selects TADS as the video source.

b. FCR. The **FCR** pushbutton selects the FCR targeting format to be displayed.

c. PNV. The **PNV** pushbutton selects PNVS as the video source.

d. G/S. The **G/S** pushbutton activates the grayscale for the video display. The G/S format will completely fill the display area and the bottom bezel button labels will be removed.

2. Day/Night/Off Mode. The **DAY/NT/OFF** control knob selects the TEDAC day, night and off modes of operation.

a. DAY. The day mode provides a brighter day mode luminance with a white backlight color. Video appears as shades of gray.

b. NT. The night mode extinguishes the backlight brightness and provides a lower night mode luminance with a green NVG compatible backlight. Video appears as shades of green.

c. OFF. The off position extinguishes all iluminating backlight even though the video is routed to the TDU.

3. FLIR Level. The FLIR **LEV** control adjusts FLIR level for the TADS or PNVS FLIR imagery as selected at the NVS select switch.

4. FLIR Gain. The FLIR **GAIN** control adjusts FLIR gain for the TADS or PNVS FLIR imagery as selected at the NVS select switch.

5. Range Focus. The **R/F** switch adjusts video focus in DTV or FLIR video. The minimum distance that may be focused is 500m for FLIR NFOV or MFOV; 1500m for DTV NFOV.

6. Elevation Adjust. The **EL** adjust switch is used for various boresight adjustments. It is active only when the **AZ/EL** boresight enable button is selected.

NOTE

Symbol Brightness (**SYM**), Display Brightness (**BRT**) and Display Contrast (**CON**) rocker switches operate in three different modes:
Step Input - Momentarily pressing and releasing the switch will cause a single step change.
Slow Rate Input - Pressing and holding the switch for 1/2 second will cause change continually at the slow rate.
Fast Rate Input - Pressing and holding the switch for more than one second will cause change continually at a fast rate.

7. Symbol Brightness. The **SYM** switch adjusts the intensity of the TADS LOS reticle, IAT gates and FCR targeting format symbology brightness. The adjustment varies form black to white.

8. Display Brightness. The display **BRT** switch adjusts the grayscale and/or image brightness intensity.

9. Display Contrast. The **CON** switch adjusts the grayscale and/or image contrast intensity.

10. Asterisk (*) Button. The (*) pushbutton adjusts the brightness and contrast to nominal settings to rapidly regain visibility of the selected video. The settings are unique to the day or night selection of the **DAY/NT/OFF** control.

11. Azimuth Adjust. The **AZ** adjust switch is used for various boresight adjustments. It is active only when the **AZ/EL** boresight enable pushbutton is selected.

12. AZ/EL Boresight Enable. The **AZ/EL** boresight enable button is used to enable boresight controls. Selecting the pushbutton will cause the **AZ/EL** label to become boxed and enable the **EL** and **AZ** bezel switches for various boresight adjustments.

13. Automatic Contrast Mode (ACM). The **ACM** button is used to activate the ACM. Selecting the **ACM** pushbutton will cause the **ACM** label to become boxed and activate the ACM. In this mode, FLIR **LEV** and **GAIN** controls are disabled and FLIR gain and level are automatically adjusted to compensate for scene thermal content changes and switching polarities.

NOTE

All other switches/pushbuttons on the TEDAC bezel remain active when the display is in a **FREEZE** state. Any inputs/adjustments made when the display is in this state will become visible when the **FREEZE** button is deselected.

14. Display Freeze. The **FREEZE** button is used to freeze the video imaging on the TDU. Selecting the **FREEZE** button will cause the **FREEZE** label to become boxed and freeze the currently selected video. The video image may be returned to normal by deselecting the **FREEZE** button or by selecting another video source.

15. Sensor Filter. The **FILTER** button is used to select between the two spectral filters in the TADS FLIR sensor. The FLIR filters are used as countermeasures protection. Selecting the **FILTER** pushbutton will cause the **FILTER** label to become boxed and set the FLIR filter to maximum. The filter may be returned to clear by deselecting the **FILTER** button. The TADS FLIR filter is functional only on aircraft equipped with the Optically Improved (OI) TADS.

[MT The **FILTER** button is used to select between the three spectral filters in the TADS FLIR sensor: Clear, Filter 1, and Filter 2. The FLIR filters are used as countermeasures protection. Selecting the **FILTER** pushbutton will cause the **FILTER** label to become boxed when Filter 1 or 2 is selected. Selections are set sequentially to Filter 1, Clear, Filter 2, Clear, Filter 1, etc. The selected state is reflected in the selected sensor status on the weapon format on the TDU/HMD The filter should be inserted when a circular type pattern containing saturated pixels and encompassing approximately 1/5 the FOV is observed. A reduced size in the circular type pattern will result.]

16. TEDAC Display Unit (TDU). The TDU is used for viewing images generated by the TADS DTV or FLIR, FCR L or VCR. It is an active matrix liquid crystal display (AMLCD) with a viewable area 5 inches square. Video imagery is presented in a 4x3 aspect display area in the upper portion of the viewable area. Control labels for the **AZ/EL**, **ACM**, **FREEZE**, and **FILTER** buttons are displayed in the lower portion of the viewable area.

4.21 OPTICAL RELAY TUBE (ORT) CONTROLS

The ORT control panel (fig 4-28) provides access to the controls necessary to adjust video on the HOD/HDD and the CPG HMD. The adjustable faceplate includes an optical eyepiece with adjustable focus.

1. FLIR Level. The FLIR **LVL** control is used to adjust FLIR level for the TADS or PNVS FLIR imagery as selected at the NVS select switch.

2. FLIR Gain. The FLIR **GAIN** control adjusts FLIR gain for the TADS or PNVS FLIR imagery as selected at the NVS select switch.

3. Range Focus. The **RNG FOC** switch adjusts video focus in DTV or FLIR video. The minimum distance that may be focused is 500m for FLIR NFOV or MFOV; 1500m for DTV NFOV.

4. Video Select. The **VID SEL** switch selects the video source to be displayed to the CPG on the ORT HOD/HDD. Placing the switch to one of three positions will select the video source: **TADS**, **FCR** L, or **PNVS**.

5. Grayscale. The **GS** switch activates the grayscale for the ORT HOD or HDD video displays. The grayscale is displayed on these displays based on the selection of the HDD switch located on the ORT RHG.

6. Visor Retract. Inactive.

7. Night Mode. The **NT** switch activates the night filter. Momentarily pressing the **NT** pushbutton switch toggles the red night filter for the HDD.

8. Automatic Contrast Mode (ACM). The **ACM** control provides automatic FLIR gain and level control. The **ACM** position disables the FLIR gain and level controls and automatically adjusts FLIR gain and level control to compensate for scene thermal content changes and switching polarities. The down position (no label) disables ACM and enables the FLIR GAIN and FLIR LVL knobs.

9. Symbol Brightness. The **SYM BRT** control adjusts the intensity of the ORT format, TADS LOS reticle, and IAT gate symbology brightness. The adjustment varies from black to white.

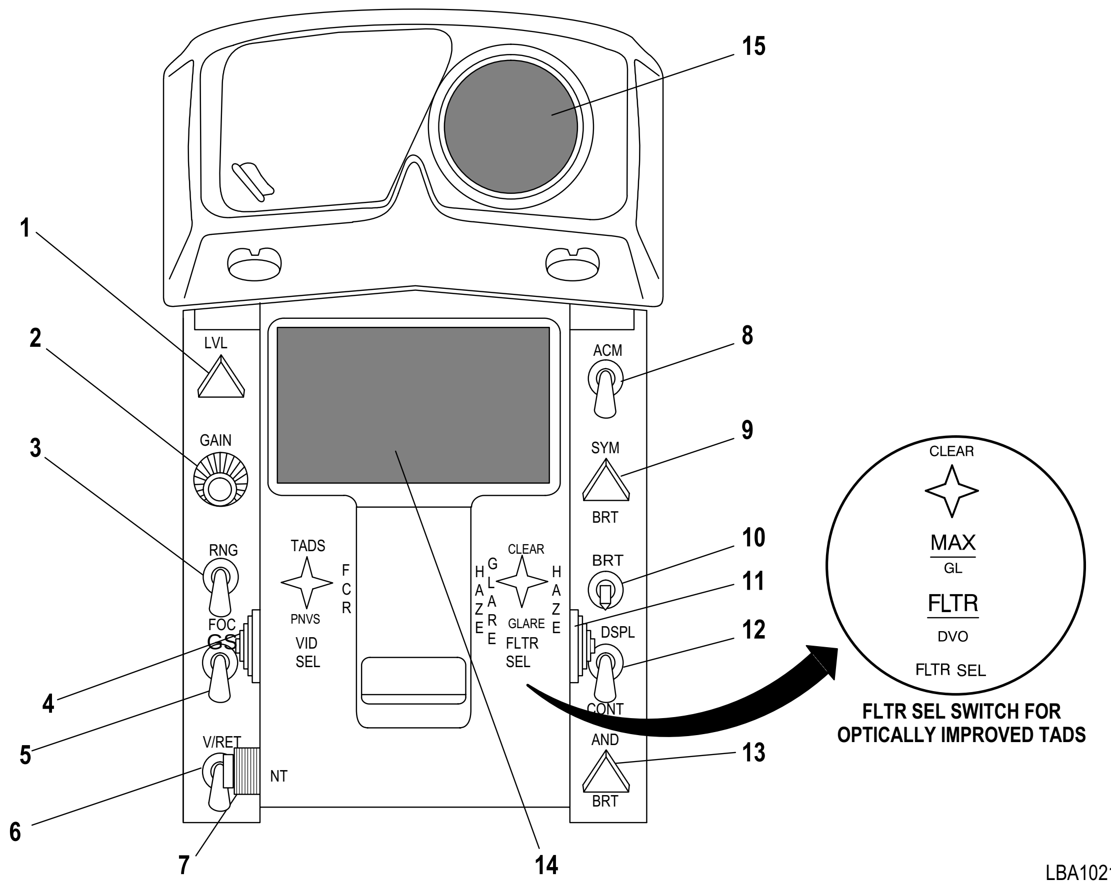


Figure 4-28. ORT Control Panel

10. Display Brightness. The display **BRT** control adjusts the grayscale and/or image brightness intensity.

11. Filter Select. The **FLTR SEL** switch located on the right side of the ORT control panel selects a filter for the DVO. Placing the switch to one of two positions will select the DVO filter: **CLEAR**, **HAZE GLARE**, **GLARE**, or **HAZE**. In the Optically Improved (OI) TADS, filter selection can also be made when sensor select is FLIR. The FLIR filters are used as countermeasures protection. There are two selections: **CLEAR** and **MAX**.

[**MT** The **FLTR SEL** switch located on the right side of the ORT control panel selects between the three spectral filters in the TADS FLIR sensor: Clear, Filter 1, and Filter 2. The FLIR filters are used as countermeasures protection. The selected state is reflected in the selected sensor status on the weapon format on the ORT/HMD.]

12. Display Contrast. The **DSPL CONT** control adjusts the grayscale and/or image contrast intensity.

13. Alphanumeric Display (AND) Brightness. The **AND BRT** control adjusts the brightness intensity of the AND.

14. Head Out Display (HOD). The HOD is used for viewing images generated by the DTV, TADS FLIR, PNVS, FCR **L**, and VCR.

15. Head Down Display (HDD). The HDD is viewed through the faceplate eyepiece. It is used for direct viewing of real world images through the DVO as well as viewing of images generated by the DTV, TADS FLIR, PNVS, FCR **L**, and VCR. It is also used to view the AND status messages.

4.22 ORT ALPHANUMERIC DISPLAY (AND)

The alphanumeric display (AND) is located below the head down display in the ORT. It consists of a light emitting diode array of 24 character spaces long and 4 spaces high (fig 4-29). The AND provides information to the CPG for use in the operation of sight and weapons systems.

F	F	F	F	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	F	F	F	F
F	F	F	F	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	F	F	F	F
F	F	F	F	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	F	F	F	F
F	F	F	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F	F	F

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Figure 4-29. Alphanumeric Display

The status fields (sections) displayed in the AND are:

a. Sight Status Field.

b. Weapon Status Field.

c. Tracker Status Field.

d. LRFD and LST Code Status Field.

e. Enhancement Display Status Field.

f. Missile Inventory and Status Field.

4.22.1 AND Messages. Messages will be centered within the appropriate status field.

4.22.2 AND Sight Status Field. The AND sight status field is located on the top left of the display adjacent to the left missile status and inventory field and occupies 8 character spaces. Messages and their definitions are contained in table 4-8.

Table 4-8. Sight Status Field Messages

MESSAGE	DEFINITION
CSCOPE	C-scope has been turned **ON**.
FLIRFAIL	FLIR has been detected as NO-GO. Night side capabilities are lost including use of the TADS for NVS pilotage. CPG must use DVO or DTV.
IMPEND LASER INHIBIT	The laser is approaching conditions which will prohibit it from firing. The message alternates (**IMPEND**, then **LASER**, then **INHIBIT**).
LASER INHIBIT	The laser has been inhibited from firing. The message alternates (**LASER**, then **INHIBIT**).
LRFD COOLANT	TADS LRF/D power is **ON** and the transceiver coolant level detected as low. The message alternates (**LRFD**, then **COOLANT**).
LSTCODE?	The selected LST laser code is not usable.
PLT TADS	The pilot controls the TADS as the NVS sensor through LINK.
RFDCODE?	The selected LRFD laser code is not usable.

Table 4-8. Sight Status Field Messages (cont)

MESSAGE	DEFINITION
TADSFAIL	TADS has been detected as NO-GO and the TADS LOS defaults to fixed forward.
TADS NOT READY	TADS is selected and turret internal temperature has not reached operating temperature. The message alternates (**TADS NOT**, then **READY**).
TADSTEMP	TADS is selected and the turret internal temperature is detected as overheating.
TGT LOS INVALID	The LOS to the selected TXX acquisition source is invalid. The message alternates (**TGT LOS**, then **INVALID**).
TV FAIL	TADS has been detected as NO-GO. CPG must use DVO or FLIR.

4.22.3 AND Weapon Status Field. The AND weapon status field is located between the sight status field and the right missile status and inventory field and occupies eight character spaces. Messages and their definitions are contained in tables 4-9 through 4-11.

Table 4-9. Weapon Status Field Messages (WAS = MSL)

MESSAGE	DEFINITION
ALT CHAN TRACK	Alternate missile channel tracking. The message alternates (**ALT CHAN**, then **TRACK**).
ALTCODE?	Indicates selected code for the alternate channel is unusable. This is due to the lack of PIM Code/Keyword correlation or the SAL SEL is AUTO, the selected code is PIM and no SAL 2 missiles are available but SAL 1 missiles are. Only displayed in ripple mode.
DIR MAN	Missile trajectory is direct; missile mode is manual.
DIR NORM	Missile trajectory is direct; missile mode is normal.

Table 4-9. Weapon Status Field Messages (WAS =MSL) (cont)

DIR RIPL	Missile trajectory is direct; missile mode is ripple.
FIRE MISSILES	Minimum time between launch has elapsed in rapid fire Hellfire missile engagement, and one or more missiles are present in the **PRI** channel after launch of a missile. The message alternates (**FIRE**, then **MISSILES**).
HANGFIRE	Fire signal sent but umbilical separation did not occur at predicted time. Message is displayed for 6 seconds, during which time all missiles on that side of the aircraft become “not available” and are inhibited from firing. Replaces **“MSL LNCH/TOF = NN”**.
HFTOF=NN	Indicates time (in seconds) until missile impact. If more than one missile is in flight, displays TOF for first missile launched, then subsequent missiles.
HI NORM	Missile trajectory is high; missile mode is normal.
HI RIPL	Missile trajectory is high; missile mode is ripple.
HI MAN	Missile trajectory is high; missile mode is manual.
LASE NN TARGET	Cue to lase target for terminal missile guidance. Displayed for 4 seconds starting at TOF=12. Calculated TOF in place of “**TOF = NN”** message is displayed if actual trajectory is not LOBL. The message alternates (**LASE NN**, then **TARGET**).
LOAL MAN	Missile launch mode is LOAL; missile mode is manual.
LOALNORM	Missile launch mode is LOAL; missile mode is normal.
LOBL INH	The LOBL inhibit mode is selected (RF missile launch).
LOBL MAN	Missile launch mode is LOBL; missile mode is manual.
LOBLNORM	Missile launch mode is LOBL; missile mode is normal.
LOBLRIPL	Missile launch mode is LOBL; missile mode is ripple.

Table 4-9. Weapon Status Field Messages (WAS =MSL) (cont)

LO MAN	Missile trajectory is low; missile mode is manual.
LO NORM	Missile trajectory is low; missile mode is normal.
LO RIPL	Missile trajectory is low; missile mode is ripple.
MISFIRE	Indicates a HF misfire has occurred. The HF launch sequence was initiated and aborted prior to missile launch. This message is displayed for 2 seconds.
MSL LNCH	Missile launch commanded in tactical mode. Message is displayed for 2 seconds.
MSL SEL	No priority channel selected.
MSLTYPE?	Indicates no missiles of the selected type (RF or SAL) are available.
NO... ACQUIRE	The RF missile has completed attempts to acquire the target and has returned to the standby mode. The message shall alternate **(NO**, then **ACQUIRE**).
NO MSLS	Indicates missiles have been actioned, but no RF missiles available.
PRI CHAN.. TRACK	Priority missile channel tracking. The message alternates (**PRI CHAN**, then **TRACK**).
PRICODE?	Indicates selected code for the primary channels is unusable. This is due to lack of PIM Code/Keyword correlation or the SAL SEL is AUTO, the selected code is PIM and no SAL 2 missiles are available but SAL 1 missiles are.
PYLN B/S	Pylons have not been boresighted, or have failed boresight verification. Subsystems will function normally but without pylon boresight corrections.
RF MSL... TRACK	RF missile channel tracking. The message alternates (**RF MSL**, then **TRACK**).

Table 4-9. Weapon Status Field Messages (WAS =MSL) (cont)

SAL SEL?	Indicates the selected SAL missile type is unavailable. Only displayed in SAL1 or SAL2 SAL SELECT modes.
SIGHT?	Sight selected for HF missile launch is not valid or has failed.
SIM LNCH	Missile launch commanded in training mode. Message is displayed for 2 seconds.
TGTDATA?	No target data available for RF missile launch.
2CHAN... TRACK	Priority and alternate missile channels tracking. The message alternates (**2CHAN**, then **TRACK**).

Table 4-10. Weapon Status Field Messages (WAS=RKT)

MESSAGE	DEFINITION
LIMITS	The wing pylons have articulated to the elevation limit.
NO RKTS	The rocket quantity available is 0.
PYLON B/S	The pylons have not been boresighted or have failed the boresight verification. Subsystems will function normally but without pylon boresight corrections.
RKT BIT... INPROG	The rocket system components are undergoing a power-on BIT. The message alternates (**RKT BIT**, then **INPROG**).
RKT G-S	The wing pylons are commanded to ground stow.
RKT NORM	The rocket system is operating in the normal articulation mode.
RTOF=NN	Indicates time (in seconds) until rocket impact. If more than one volley is in flight, the display will show TOF for the volley last launched.
SIGHT?	The sight selected for rocket launch is not valid or it has failed.
TYPE?	No rocket warhead type is selected.

Table 4-11. Weapon Status Field Messages (WAS=GUN)

MESSAGE	DEFINITION
GUN B/S	The gun has not been boresighted or has failed the boresight verification. The gun will function normally but without pylon boresight corrections.
GUN FAIL	The gun has been detected as failed. Recycle the GUN system-ON/OFF POWER button. If the fault message clears, continue operation.
GUN JAM	The gun has been detected as jammed.
RDSNNNN	The gun system is operating in the selected mode. The NNNN indicates the number of rounds remaining and will count down in real time as the gun is fired.
SIGHT?	The sight selected for gun firing is not valid or it has failed.
WEAPON?	The weapons trigger has been pressed with no weapon system actioned.

4.22.4 AND Tracker Status Field. The AND tracker status field is located directly below the sight and weapon status fields and occupies 16 character spaces. Messages and their definitions are contained in table 4-12.

Table 4-12. AND Tracker Status Field

MESSAGE	DEFINITION
PNVS STOW	The PNVS is stowed.
TADS STOW	The TADS is either stowed or in an internal boresight mode.
TADS FIXED	The TADS is in the fixed forward position.
LST FAIL	The LST has been detected as failed.
LST TRACK	The LST is tracking remotely designated laser energy.
LST SEARCH	The LST is scanning under manual control.
LST AUTO SEARCH	The LST is scanning in the automatic search pattern.
IAT FAIL	The image auto tracker has broken track.

Table 4-12. AND Tracker Status Field (cont)

MESSAGE	DEFINITION
IAT BREAK-LOCK	The image auto tracker has broken track.
IAT OFFSET	IAT offset tracking is engaged.
IAT TRACK	IAT tracking is engaged and tracking.
IAT B/W	IAT polarity is black on white.
IAT W/B	IAT polarity is white on black.
IAT AUTO	IAT is in the automatic mode

4.22.5 AND LRFD and LST Code Status Field. The AND LRFD and LST code status field is located directly below the tracker status field and occupies 16 character spaces. Messages and their definitions are contained in table 4-13.

Table 4-13. AND LRFD and LST Status Field

MESSAGE	DEFINITION
LRFD FIRST	The LRFD has been activated and the LRFD button is set to FIRST.
LRFD LAST	The LRFD has been activated and the LRFD button is set to LAST.
CODELST=A	LRFD is not operational but the LST is operational and the selected code is A.
CODELST= LRFD=G	LST is not operational but the LRFD is operational and the selected code is G.
CODELST=A LRFD=G	Both systems are operational and the code selected from the CODE Page is displayed for each.

4.22.6 AND Enhancement Display Status Field. The AND Enhancement Display status field is located directly below the LRFD and LST code status field and occupies 16 character spaces. Messages and their definitions are contained in table 4-14.

Table 4-14. AND Enhancement Display Status Field

MESSAGE	DEFINITION
FIXED IMPACT RTCL	Rockets OR Gun Actioned, Rocket launchers stowed/Gun in fixed mode.
PRI=?ALT=?	No missiles ready.
PRI=AALT=B	The priority channel code is A with missile(s) ready; alternate channel missiles are ready.

Table 4-14. AND Enhancement Display Status Field (cont)

PRI=BALT=?	The priority channel code is B with missile(s) ready; alternate channel missiles are not ready.
AH-64D APACHE	Displayed when no other message is displayed.

4.22.7 AND Missile Inventory and Status Field. The AND Missile Inventory and Status fields are located on both ends of the AND and each field occupies 16 character spaces, 4 spaces wide and 4 spaces high. Each side is divided vertically in half to provide space for the status of missiles of 2 launchers on each wing. Each launcher is subdivided into 8 spaces, 2 vertical spaces for each missile status message. Messages and their definitions are contained in tables 4-15 through 4-18.

Table 4-15. AND Missile Inventory and Status Field (MISSILE TYPE)

MESSAGE	DEFINITION
L	Laser missile.
A THROUGH R	Code of missile in place of L.
R	RF Missile.
T (STEADY)	Missile seeker in a track state.

Table 4-16. AND Missile Inventory and Status Field (MISSILE STATUS)

MESSAGE	DEFINITION
S	Missile selected.
R (STEADY)	Missile ready.
R (FLASHING)	Priority missile for LOAL engagement.
T (FLASHING)	Priority missile for LOBL engagement.

Table 4-17. AND Missile Inventory and Status Field (MISSILE FAULT CONDITION)

MESSAGE	DEFINITION
M U	Missile Unlatched on the launcher.
M F	Missile has failed.
M A	Missile launch has aborted/misfired.
M H	Missile has hangfired.
S F	Missile launch station has failed.
N A	Missile not available.
O T	Missile detected in over-temperature status.

Table 4-18. AND Missile Inventory and Status Field (MISSILE STATUS)

MESSAGE	DEFINITION
F F A A I I L L	Missile launcher failed.
S S A A F F E E	Missile launcher ARM/SAFE is in the SAFE position.

4.23 ORT BOTTOM CONTROLS

The ORT bottom controls (fig 4-30) consists of those controls necessary to perform certain TADS boresight adjustments.

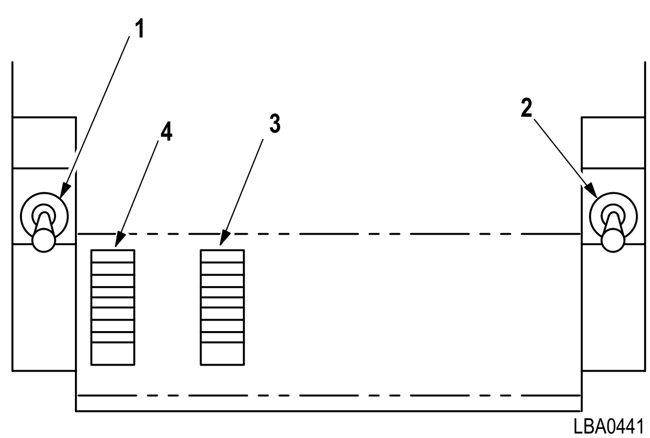


Figure 4-30. ORT Bottom

4.23.1 BORESIGHT ENABLE (1). The **BORESIGHT ENABLE** switch enables sensor boresighting functions. Placing the switch to the **UP** position enables the azimuth and elevation knobs for various boresight adjustments. Placing the switch to the **CENTER** position disables the azimuth knob, elevation knob, and DVO boresight switch. Placing the switch to the **DOWN** position enables the DVO boresight adjust switch.

4.23.2 DVO Boresight Adjust (2). The **DVO BRSI**T switch is used for boresight adjustment to the DVO crosshairs. Placing the switch to the **UP** position causes the DVO crosshairs to rotate clockwise. Placing the switch to the **DOWN** position causes the DVO crosshairs to rotate counterclockwise in a helical motion.

4.23.3 Azimuth Adjust (3). The azimuth adjust knob is a knurl potentiometer knob used for various boresight adjustments.

4.23.4 Elevation Adjust (4). The elevation adjust knob is a knurl potentiometer knob used for various boresight adjustments.

4.24 LEFT HANDGRIP (LHG)

The LHG (fig 4-31) in the CPG station provides access to the various sight subsystem control functions.

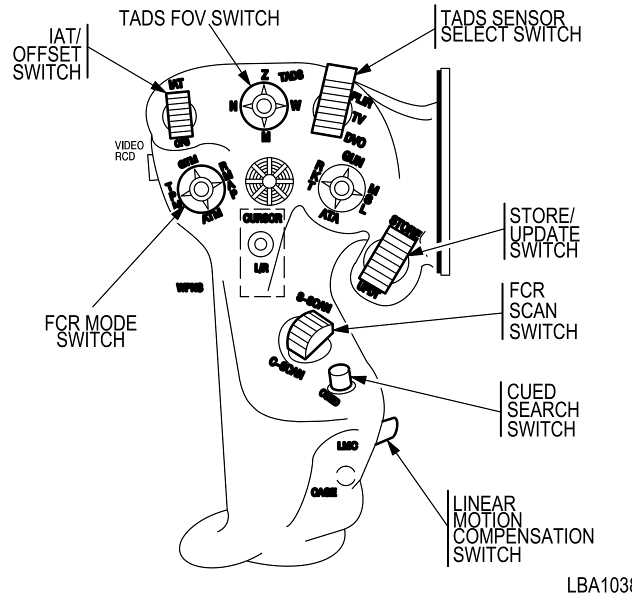


Figure 4-31. LHG

4.24.1 Image Auto Track/Offset. The **IAT/OFS** switch engages or disengages the image autotracker and offset tracking.

[**MT** The **IAT/OFS** switch is used to control the multi-target tracker (MTT). The **IAT** position engages the tracker to establish a primary target track. Pressing and holding the switch in the **IAT** position for longer than 0.6 seconds will initiate manual sizing control of the tracking gates. This position is also used to adjust an aim point within the primary tracking gates. The **OFS** position returns the TADS LOS to the primary track when offset tracking. This position also deletes target tracks when the LOS is on a primary or secondary track (see 4.26.2).]

4.24.2 TADS Field of View (FOV) Select. The **TADS FOV** select switch selects a field of view for the selected sensor. Placing the switch momentarily to the desired position will select the respective **TADS FOV**: Wide (**W**), Medium (**M**), Narrow (**N**) , or Zoom (**Z**). The fields of view available are dependent on the sensor selected.

4.24.3 TADS Sensor Select. The TADS sensor select switch selects the desired TADS sensor for sighting or acquisition of targets. Placing the switch to the desired position will select the respective TADS sensor: **FLIR**, **TV**, or **DVO**(ORT only).

4.24.4 Store/Update. The **STORE/UPDT** performs the update or store function of waypoint/targeting.

4.24.5 FCR Scan L. Functions as described on the collective mission grip (para 4.5.6).

4.24.6 Cued Search L. Functions as described on the collective mission grip (para 4.5.7).

4.24.7 Linear Motion Compensation. The **LMC** switch is used to aid in tracking. It compensates for helicopter movement as well as target movement.

4.24.8 FCR Mode L. Functions as described on the collective mission grip (para 4.5.3).

4.25 RIGHT HANDGRIP (RHG)

The RHG (fig 4-32) in the CPG station provides access to the various sight subsystem control functions.

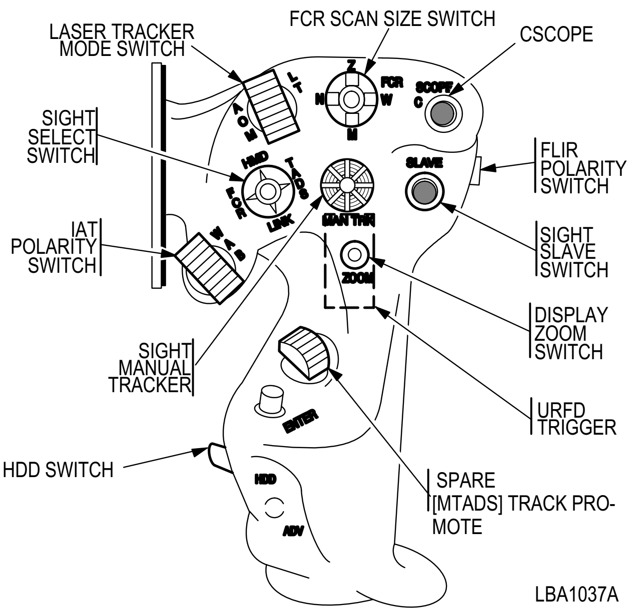


Figure 4-32. RHG

4.25.1 Sight Select. Functions as described on the collective mission grip (para 4.5.5).

4.25.2 Laser Tracker Mode. The **LT** mode switch is used to select the mode of the laser spot tracker. Placing the switch to the desired position selects the respective mode: Automatic (**A**), Off (**O**), or Manual (**M**).

4.25.3 FCR Scan Size L. Functions as described on the collective mission grip (para 4.5.4).

4.25.4 C-SCOPE L. The **C-SCOPE** switch is used to activate the C-scope display of FCR target information on flight and weapons symbology formats.

4.25.5 FLIR Polarity. The **FLIR PLRT** switch is used to change FLIR polarity.

4.25.6 Sight Slave. The sight **SLAVE** switch is used to slave the selected sight and/or provide cueing to the selected acquisition LOS. The SLAVE state remains **ON** until the **SLAVE** switch is toggled **OFF** or an acquisition selection is made.

4.25.7 Display Zoom L. The display **ZOOM** switch is used to view FCR targeting information at approximately a 6:1 zoom display. Pressing the pushbutton causes the selected FCR targeting format to be displayed in a zoom format centered about the designated next-to-shoot (NTS) target symbol. Pressing the **ZOOM** switch again will return the display to the normal targeting format.

4.25.8 LRFD Trigger. The LRFD trigger is used to obtain laser range and/or to designate a target for laser-guided munitions. Pressing the trigger to the first detent activates the laser transmitter to transmit a series of laser ranging pulses. Pressing the trigger to the second detent activates the laser transmitter for ranging and target designation.

4.25.9 [**MT Spare Switch.** The Spare Switch is used to select sequentially through multiple target tracks. Pressing forward moves the TADS LOS to the next secondary track in sequence and promotes it to primary. Pressing aft moves the TADS LOS to the previous secondary track in sequence and promotes it to primary (see 4.26.2).]

4.25.10 Head Down Display Select. The **HDD** select switch is used to select the HDD display for viewing. Pressing the **HDD** pushbutton alternately selects between the **HDD** and **HOD**.

4.25.11 Sensor Manual Tracker. The **MAN TRK** thumb force controller is used to control the TADS turret or FCR L antenna (centerline) to move during manual tracking.

4.25.12 IAT Polarity. The **IAT** polarity switch is used to select the FLIR/DTV contrast polarity for the image auto tracker. Placing the switch momentarily to the desired position selects the respective tracker polarity: White (**W**), Auto (**A**), or Black (**B**).

4.26 TADS TARGET TRACKING

Target track mode or cued (predetermined) turret position commands are generated manually through CPG use of the RHG **MAN TRK** control or electronically by the WP and the TEU. Maximum TADS turret gimbal movement is +120° and -180° in azimuth, +30° and -60° in elevation. Target track mode is selected with LHG and RHG switches.

4.26.1 Manual Track. Manual tracking is selected by pressing the RHG **SLAVE** switch. To track the target in manual, the CPG operates the RHG **MAN TRK** control in the direction needed to keep the TADS pointed at the target. If the aircraft or target is moving, the use of LMC will greatly reduce CPG workload.

NOTE (ORT)

If IAT is selected while DVO is the selected sensor and FLIR is on, the DVO FOV will default to NFOV and the TEU will use FLIR video for tracking the target. DTV video will be displayed on the HOD. Since FLIR video is used to track the target and DVO does not display IAT tracker gates, impending breaklocks cannot be detected and IAT track criteria cannot be evaluated by the CPG.

4.26.2 IAT. IAT automatically tracks targets detected with DTV or FLIR. Operation is basically the same using either sensor. IAT should be used to track, designate, and engage targets when there is sufficient target-to-background contrast. IAT is selected by setting the LHG **IAT/OFS** switch to **IAT**. IAT identifies a target by contrast, surrounds the target with tracker gates, and calculates the difference between target centerline and selected FOV center point. Good track criteria (video parameters evaluated by IAT) must be established for proper IAT operation. When IAT tracker gates start to flash, an impending IAT breaklock condition exists. While the impending breaklock condition exists, IAT will try to reacquire the target. If IAT does not reacquire the target, within a required period of time, IAT enters a stop mode. In the stop mode, IAT gates change to 4 solid rectangles. When in the stop mode, the CPG has manual track control of the TADS LOS. If LMC is off when the IAT enters the stop mode, LOS will stop. If LMC is on, the LOS will continue to move at the last commanded slew rate. Once IAT is selected, setting the **IAT/OFS** switch to **OFS** will engage the IAT offset tracking capability. In this mode, the **MAN TRK** thumbforce controller is re-enabled so the TADS may be manually tracked away from the target to allow for offset lasing during Hellfire missile engagements/ranging. Actioning the **IAT/OFS** switch again to **OFS** will disengage offset tracking and the TADS will resume automatic tracking of the target. Actioning the **IAT/OFS** switch again to **IAT** will disengage automatic tracking and re-enable the **MAN TRK** thumbforce controller for manual tracking.

[**MT** **MTT.** The TADS multi-target tracker is capable of tracking one primary and two secondary targets using DTV or FLIR. Operation is basically the same using either sensor, however, tracks can be maintained in only one sensor at a time. The sensor may be changed between DTV and FLIR while tracking the target, however, the target will still be tracked in the original sensor. If the sensor is changed while tracking the target, symbology will offset due to internal paralax correction. The digital image tracker functions based on the edge of the target. It also incorporates an inertial track filter which uses previous track information to determine predicted target locations.

A primary target track is selected by setting the LHG **IAT/OFS** switch to **IAT**. The primary autotrack function surrounds the target with tracker gates, sizes the gates based on target edge detection techniques, and initiates automatic tracking. The track number will be displayed below and to the right of the gates. Pressing and holding the switch in the **IAT** position for longer than 0.6 seconds will initiate manual sizing control of the tracking gates. Gates will start near the LOS recticle center, then expand and shrink back down, and then begin the growth cycle again. Sizing will continue until the switch is released at the desired size. Size will not exceed 50% of the FOV.

Once a primary track is established, the TADS LOS may be manually slewed to acquire additional tracks or to allow for offset lasing during Hellfire missile engagements/ranging. The amount of slewing (offset tracking) allowed is limited to the extent that the primary track cannot be forced out of the current FOV.

Setting the **IAT/OFS** switch to **IAT**, when the TADS LOS is within the primary tracking gates, will adjust the 'aim point' symbol to the desired location on the target/object. Setting the **IAT/OFS** switch to **IAT** when the TADS LOS is not within the primary tracking gates will cause the MTT to attempt a primary target track as described above.

Selecting a second target track will establish that track as the primary track and the previous track will become a secondary track. A unique flag and flag post symbol will be displayed in conjunction with the secondary track. The track number will be displayed within the flag symbol. In addition, the total number of target tracks will be displayed in the upper right area of the weapon format when the MTT is in use.

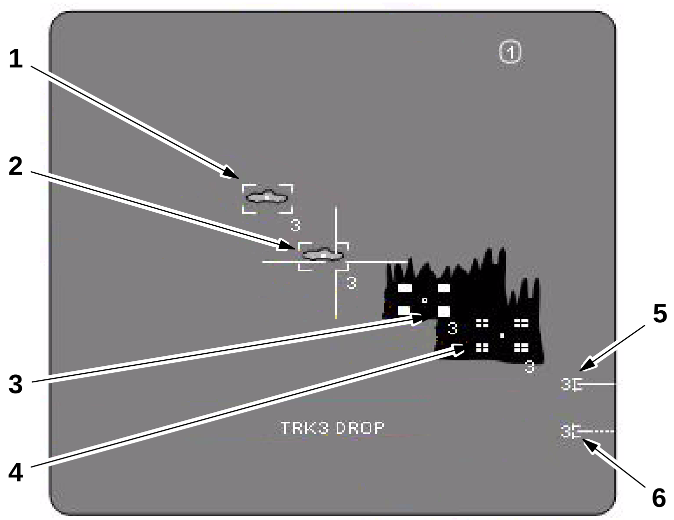
When the TADS LOS is not within the primary tracking gates, setting the **IAT/OFS** switch to **OFS** for less than 0.5 seconds will disengage offset tracking and slew the TADS LOS to the primary track. At this point, the TADS LOS may again be manually slewed as required. Placing the TADS LOS on a primary or secondary track (symbol bolds) and setting the **IAT/OFS** switch to **OFS** will delete that track. If the primary track is deleted, the previously selected secondary track will become the primary track. Pressing and holding the switch in the **OFS** position for longer than 0.5 seconds anywhere within the FOV will delete all target tracks. Track delete messages will be displayed in the HAD Weapon Inhibit message field.

When tracking multiple targets, the RHG **SPARE** Switch may be used to select sequentially through multiple target tracks. Pressing forward moves the TADS LOS to the next secondary track in sequence and promotes it to the primary track. Pressing aft moves the TADS LOS to the previous secondary track in sequence and promotes it to primary

If the selected sight is changed to HMD or FCR when the MTT is in use, tracks will continue to be maintained until dropped. It is possible to change the selected sight back to TADS and resume tracking tasks. If the **SLAVE** or **LINK** functions are activated, all tracks will be deleted.

Primary tracking gates and secondary track symbols are symbol coded to provide feedback for various track states.

a. Primary Track Gates. Primary Track Symbols (fig 4-32A) are described below. Primary track gates will flash when approaching 50% of the FOV, limited at FOV edge, or when the gates are extremely small.



LBA-5996

Figure 4-32A. Primary Track Gates

1. Normal Gate The normal gates are displayed around the target image; updated based on image processing.

2. Bold Gate The gates become bold when the TADS LOS is within the gates selectable area.

3. Inertial Gate Inertial gates are displayed as four box symbols when the track is being maintained inertially because of an obscuration within the FOV.

4. Low Confidence Gate Low confidence gates are displayed as four box symbols segmented into 4 smaller boxes after 5 seconds of inertial tracking. The track will be dropped after 10 seconds.

5. Inertial Bar An inertial bar symbol with a small bracket at the end and associated track number will be displayed at the edge of the FOV when an inertial track is out of the FOV.

6. Low Confidence Bar A low confidence dashed bar/bracket and associated track number will be displayed at the edge of the FOV after 10 seconds of inertial tracking out of the FOV. The track will be dropped after 15 seconds.

b. Secondary Track Symbols. Secondary Track Symbols (fig 4-32B) are described below.

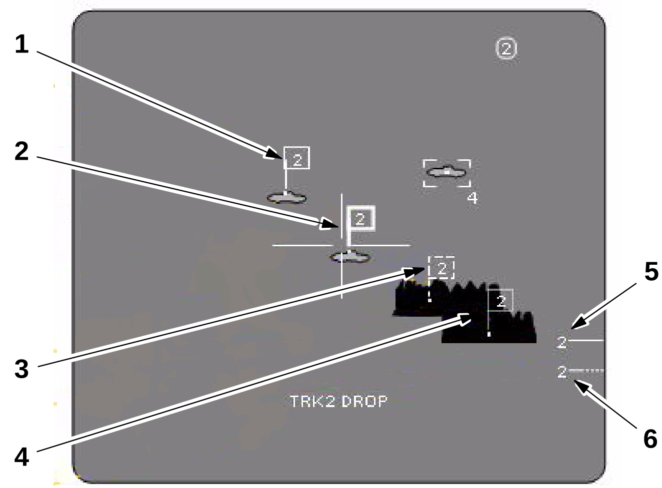


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Figure 4-32B. Secondary Track Gates

1. Normal Gate The normal flag symbol is displayed just above the track aim point.

2. Bold Gate The flag symbol becomes bold when the TADS LOS is within the symbol's selectable area.

3. Inertial Gate The inertial flag symbol is displayed in dashed lines when the track is being maintained inertially because of an obscuration within the FOV.

4. Low Confidence Gate The low confidence flag symbol is displayed in small dotted lines after 5 seconds of inertial tracking. The track will be dropped after 10 seconds.

5 Inertial Bar An inertial bar symbol and associated track number will be displayed at the edge of the FOV when an inertial track is out of the FOV.

6. Low Confidence Bar A low confidence dashed bar and associated track number will be displayed at the edge of the FOV after 5 seconds of inertial tracking out of the FOV. The track will be dropped after 15 seconds.]

4.26.3 Laser Spot Tracker (LST). The LST provides the CPG with the capability of searching for and tracking reflected laser energy of the selected code. The **LT** mode switch on the RHG is used to select the desired LST mode: Automatic (**A**), Off (**O**), or Manual (**M**). Placing the LT switch to the **A** position arms the LST and commands the TADS into an automatic 4-bar scan around the TADS LOS at the point of engagement. Placing the **LT** switch to the **M** position arms the LST and allows for manual tracking of the TADS to search in the area of interest. In either mode, when laser energy of the selected code is detected by the LST, it will auto-track the TADS about the laser energy spot. Placing the **LT** switch to **O** will turn the LST off and release the TADS to normal control. The LST is only PRF code capable and therefore will not track PIM coded laser energy.

4.27 TADS DRIFT NULL

The TADS system has the capability to null the turret servo drift by either auto or manual drift null. Servo drift can be identified as happening whenever the TADS turret is under manual control, the CPG is not making any inputs with the thumbforce controller and the reticle appears to drift off the aim point. The aim point should remain within the narrow FOV of the DTV for 30 seconds. If it does not, or a lesser amount of drift is desirable, perform Manual Servo Drift Null (para 4.55.5 or 4.55.5A). Auto Drift Null is active from the time the TADS is first turned on. It is only inactive when the manual servo drift procedure is being performed. Auto Drift Null is not as precise as Manual Servo Drift Null so some residual servo drift will always be present when it is active.

Paragraphs 4.27.1 and 4.27.2 deleted

4.28 TADS BORESIGHT OPERATION

Boresight aligns TADS sensors to a coincident LOS. Boresight includes an internal and outfront boresight. TADS boresight is initiated by selecting the weapon page **BORESIGHT** button and selecting the internal or outfront boresight button. Boresight procedures are contained in paragraph 4.55.

4.29 TADS CUE UPDATE

Performance of cue update ensures that the TADS turret is in proper position relative to the boresight assembly prior to firing the laser for internal boresight. If cue update is adjusted internally, then outfront boresight must be performed following the cue update. Cue update procedure is contained in para 4.55.

4.30 TADS INTERNAL BORESIGHT

The internal boresight aligns the DTV and FLIR sensors to the laser and the DVO (ORT only) to the DTV sensor line of sight. Internal boresight shall be performed as part of preflight procedures prior to any firing of laser or weapons when TADS is used as imaging sensor. Internal boresight can also be performed in flight to ensure boresight accuracy without requiring outfront boresight as a follow-up. Internal boresight procedure is contained in para 4.55.

[**MT** Internal boresight shall be performed as part of preflight procedures prior to any firing of laser or weapons when TADS is used as imaging sensor. Internal boresight can also be performed in flight. Internal boresight errors can develop in-flight due to temperature changes within the internal components of TADS (thermal drift). It is recommended that an internal boresight be accomplished 2 times per 2.5 hour flight.

TADS internal boresight is an automated process which independently boresights the DTV and FLIR sensors. The DTV boresight must be performed successfully before the FLIR boresight can be performed. Once the FLIR boresight is complete, the internal boresight is complete. If an ORT is installed, the DTV boresight must be performed successfully prior to boresighting the DVO.

Initiating an internal boresight automatically sets the CPG selected sight to TADS, the sensor to TV and the FOV to narrow. A standby prompt is displayed while the TADS turret slews to the boresight position and prepares for the process. At initial powerup, the system will conduct an automatic cue search which will take less than 90 seconds before indicating it is ready for boresight. Subsequent attempts to perform an internal boresight under the same powerup will include a preparation time of less than 15 seconds as it will not involve a cue search. During these waits, boresight target images will appear and disappear in TADS video. These images do not necessarily align with weapon symbology and are not manipulated in any way by the CPG.

When the system is ready, a laser warning window and boresight procedure prompt will be displayed. The CPG will be required to arm the laser and pull the laser trigger during DTV internal boresight, otherwise, no action is required by the CPG during FLIR internal boresight. If the TADS FLIR is not cooled upon completion of DTV boresight, a not cool status will be displayed and the process will be ended. In addition, status windows will be displayed to indicate when the boresight(s) are in progress, complete, or failed. Internal boresight procedure is contained in para 4.55.]

4.31 TADS OUTFRONT BORESIGHT

WARNING

The narrow and zoom FOV TADS FLIR imagery has inaccuracies for lasing or weapons direction following TADS internal boresight. TADS outfront boresight validation and adjustment (if necessary) shall be performed prior to using the TADS FLIR imagery for laser or weapons operations.

Performance of outfront boresight ensures FLIR LOS is in coincidence with laser LOS. Outfront boresight should be checked prior to any firing of laser or weapons when TADS FLIR is used as the imaging sensor. Outfront boresight must be performed after a cue update adjustment. Target requirements for the outfront boresight procedure are as follows:

1. A target a minimum of 0.5 km away from the helicopter is required. Target must be clearly visible and trackable through both FLIR and TV sensor NFOV. Target must have the same center as viewed in both FLIR and TV sensors.

2. Outfront boresight procedure is contained in para 4.55.

4.32 TADS MANUAL BORESIGHT

The purpose of the TADS manual boresight is solely to recapture or center the laser spot. This boresight procedure should not be considered acceptable for normal flight operations. The manual boresight procedure is contained in para 4.55.

4.33 TADS ANTI-ICE

When the pilot or CPG selects anti-ice using the aircraft **UTIL** page **ANTI-ICE SENSOR** button and the helicopter is off the ground, 115 Vac is applied to the TADS shroud window and a shroud frame heater. TADS anti-ice can be selected when the aircraft is on the ground by using the **GND** button.

4.34 FCR DESCRIPTION L

NOTE

The FCR will provide reliable data while maneuvering up to 20° in roll and +20° to -15° in pitch. Flight outside these parameters may result in degraded FCR performance.

The FCR is an integrated radar system with a mast-mounted transmitter and receiver. The FCR detects, locates, and classifies ground and airborne targets and provides terrain profile signatures when operating in limited adverse weather or obscured visibility conditions. The FCR augments the helicopter’s weapon delivery capability through the use of a target acquisition fire control radar, coupled with a Radar Frequency (RF) guided seeker version of the Hellfire missile. A Radar Frequency Interferometer (RFI) is incorporated to provide threat emitter warning, direction finding, and cueing. These coordinates are sorted and sent to the display processor for target symbology presentation on the **FCR** page or **TSD** page. Non-volatile memory is zeroed-out using the **MASTER ZEROIZE** Switch described in chapter 2.

4.34.1 Mast Mounted Assembly (MMA). The MMA (fig 4-33) is mounted to the aircraft on a pedestal tube which contains a derotation assembly. Electrical power and signal/RF transmissions pass through the mast by way of a slipring/rotary joint assembly. The slipring assembly transfers prime power and signal information between the two portions of the assembly as they are rotated with respect to each other. The slipring housing also contains the accelerometer sensor assembly for the pedestal. A rotary joint coupler provides a path for four RF channels. The MMA to aircraft interface is a blindmate connector. The MMA dome and baseplate are made of a honeycomb core sandwiched between carbon graphite fiber/epoxy prepreg composite. The composites reduce weight and provide structural integrity. The MMA stands 32 in. high and weighs 257 lb. The MMA is cooled by air drawn from the surrounding environment.

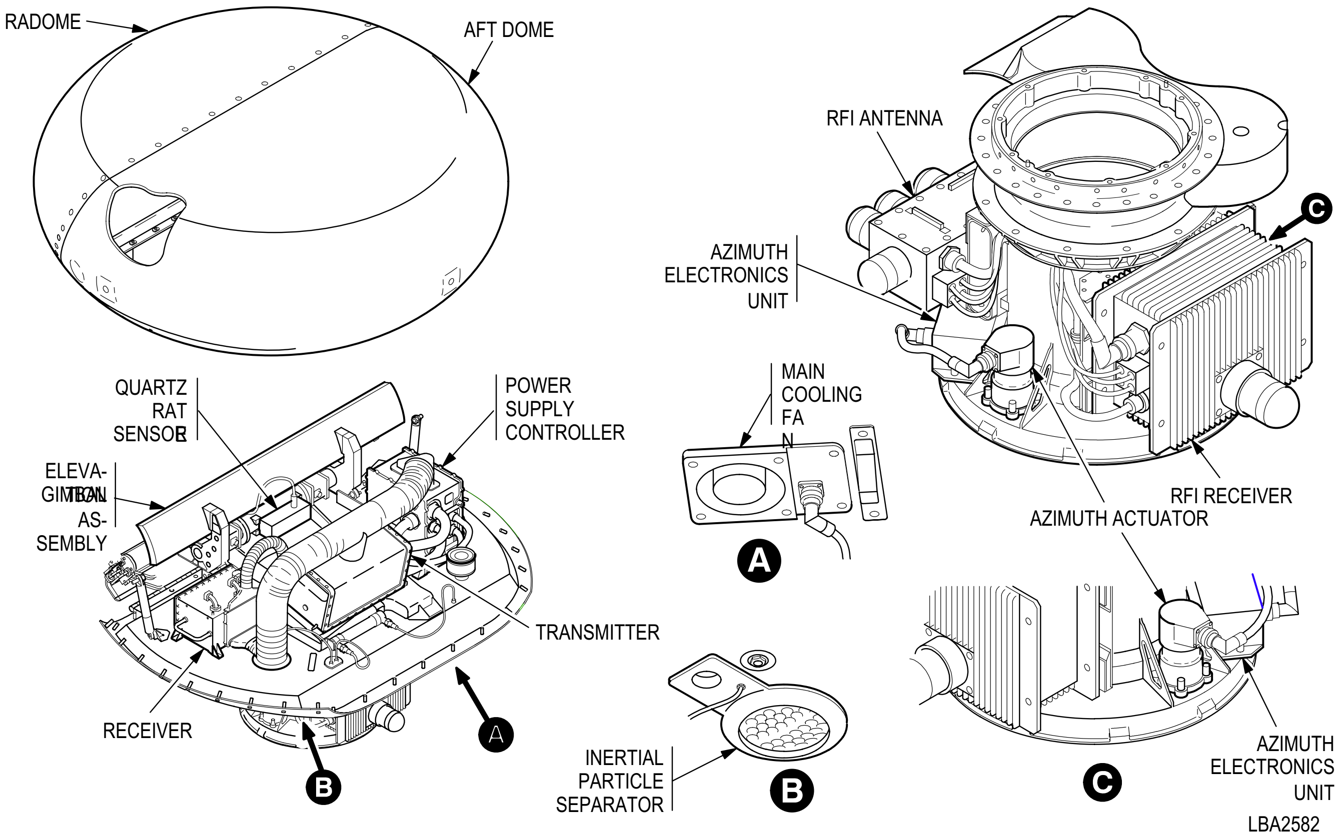


Figure 4-33. MMA Major Components

4.34.2 MMA Components. The MMA is made up of the following major components:

- Power Supply Controller
- Transmitter
- Receiver
- Main Cooling Fan
- Inertial Particle Separator
- Elevation Gimbal Assembly (EGA)
- Quartz Rate Sensor (QRS)
- Radome
- Aft Dome
- Azimuth Actuators
- Azimuth Electronics Unit
- RFI Antenna
- RFI Receiver

4.35 FCR PAGE L

The **FCR** page is used to present the display of radar information and to functionally control much of the FCR and RFI moding. It provides the controls, graphics, and symbols required to operate the selected FCR mode.

4.35.1 FCR Page Selection. The **FCR** page can be accessed in one of three ways in either crew station: 1) selecting the FCR subsystem bezel button, 2) selecting the **FCR** page button from the **MENU** page, or 3) selecting the sight select switch to **FCR**.

4.35.2 FCR Page Formats. The **FCR** page provides information to the aircrew based on the selected mode of the radar: Ground Targeting Mode (GTM), Radar Map (RMAP), Air Targeting Mode (ATM), or Terrain Profiles Mode (TPM). The format of the **FCR** page is displayed in the Plan Position Indicator (PPI) or B Scope format according to the selected FCR mode:

- Ground Targeting Mode (PPI format)
- Radar Map (B Scope format)
- Air Targeting Mode (PPI format)
- Terrain Profiles Mode (PPI format)

4.35.3 FCR Page Formats on ORT HDD/HOD. The **FCR** page is available on the ORT HOD/HDD by the use of the **VID SEL** switch and the **HDD** switch. Selections from the FCR formats ORT HOD/HDD are accomplished solely by use of the display cursor **ENTER** function. Moding of these selections are the same as for **FCR** page operations described in the paragraphs to follow. Control and placement of the display cursor is described in chapter 2.

4.35.4 FCR Page - GTM Format. The GTM format (fig 4-34) is displayed in the PPI format made up of a scan sector outline with partial intensity range arc lines and azimuth tic marks which correspond to each scan size. The scan sector is overlaid onto radar map video. The **FCR** page buttons function identically in either GTM or RMAP format.

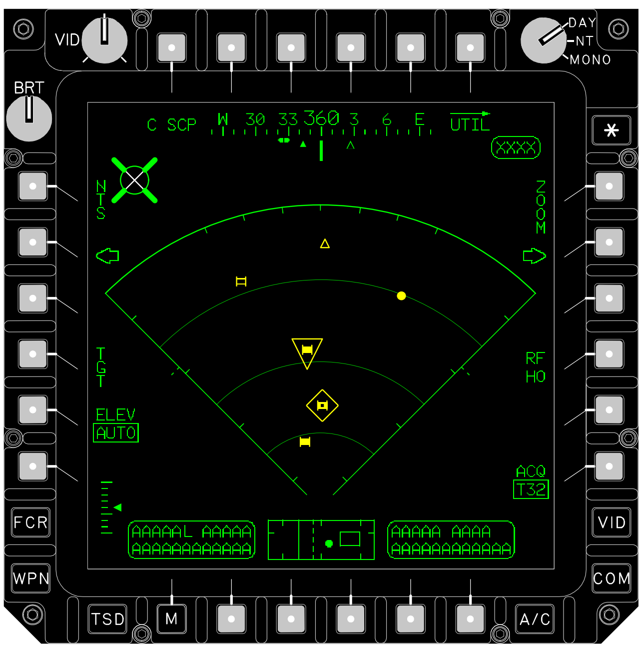


Figure 4-34. FCR Page - GTM Format

a. GTM Scan Sector Symbol. The scan sector symbol is displayed in the mode selected by the crewmember (Wide, Medium, Narrow or Zoom). Current mode is displayed in full intensity with other modes displayed in partial intensity, if applicable. **FCR** Page - GTM Format scan sectors function as follows:

b. FCR Footprint. The GTM targeting scan sectors are displayed in full intensity and are based on the selected scan size: Wide, Medium, Narrow, and Zoom.

1. The wide scan sector symbol represents a 90° scan sector (45° either side of centerline). The wide scan sector displays in partial intensity when any other scan size is selected.

2. The medium scan sector symbol represents a 45° scan sector (22.5° either side of centerline). The wide scan sector displays in partial intensity.

3. The narrow scan sector symbol represents a 30° scan sector (15° either side of centerline). The wide and medium scan sectors displays in partial intensity.

4. The zoom scan sector symbol represents a 15° scan sector (7.5° either side of centerline).The wide, medium and narrow scan sectors displays in partial intensity.

5. RFI tic marks. A single RFI tic mark is displayed along the outer left and right boundary line of the GTM and RMAP wide sector scan symbols. The tic marks represent a reference point 90° left and right of scan centerline relative to the display of RFI threat symbols along the perimeter of the sector scan (helicopter).

6. Arcs and tics. Each arc represents a 2 km distance in even increments (2, 4, 6 and 8) and each tic mark represents a 2 km distance in odd increments (1, 3, 5, and 7).

A view of all scan sector modes is shown in figure 4-35.

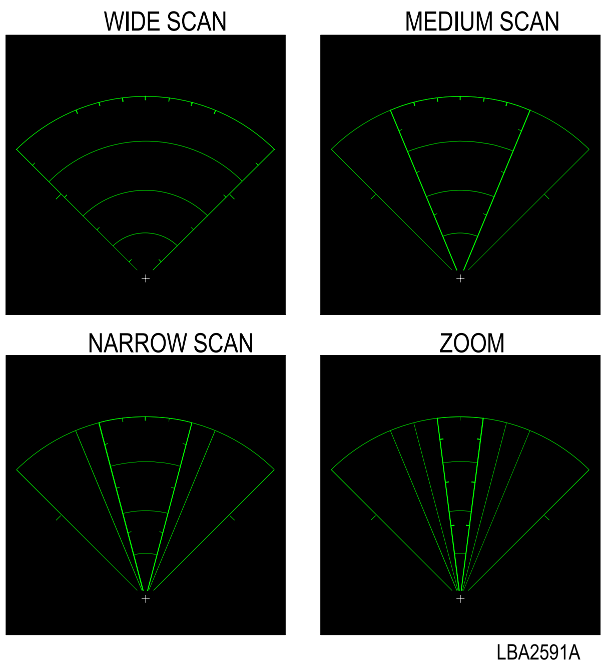


Figure 4-35. GTM Scan Sectors

4.35.5 FCR Page - RMAP Format. The RMAP format (fig 4-36) provides radar information within a B-scope (rectilinear format) scan sector outline with partial intensity range lines and azimuth tic marks which correspond to each scan size. The scan sector is overlaid onto radar map video. The **FCR** page buttons function identically in either GTM or RMAP format.

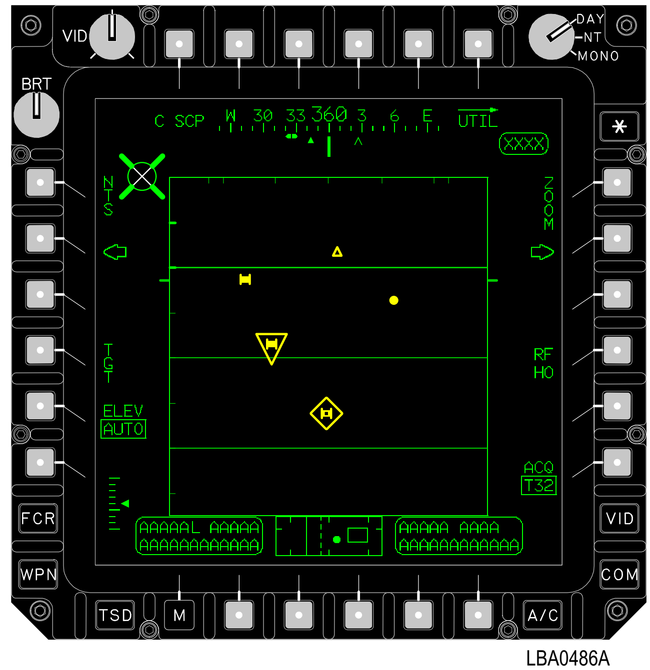


Figure 4-36. FCR Page - RMAP Format

a. RMAP Scan Sector Symbol. The scan sector symbol is displayed in the mode selected by the crewmember (Wide, Medium, Narrow or Zoom). Current mode is displayed in full intensity with other modes displayed in partial intensity, if applicable. FCR Page - RMAP Format scan sectors function as follows:

b. FCR Footprint. The GTM targeting scan sectors are displayed in full intensity and are based on the selected scan size: Wide, Medium, Narrow, and Zoom.

1. The wide scan sector symbol represents a 90° scan sector (45° either side of centerline). The wide scan sector displays in partial intensity when any other scan size is selected.

2. The medium scan sector symbol represents a 45° scan sector (22.5° either side of centerline).The wide scan sector displays in partial intensity.

3. The narrow scan sector symbol represents a 30° scan sector (15° either side of centerline). The wide and medium scan sectors displays in partial intensity.

4. The zoom scan sector symbol represents a 15° scan sector (7.5° either side of centerline). The wide, medium and narrow scan sectors displays in partial intensity.

5. RFI tic marks. A single RFI tic mark is displayed along the outer left and right boundary line of the GTM and RMAP wide sector scan symbols. The tic marks represent a reference point 90° left and right of scan centerline relative to the display of RFI threat symbols along the perimeter of the sector scan (helicopter).

6. Lines and tics. Each line represents 2 km distance in even increments (2, 4, 6 and 8) and each tic mark represents a 2 km distance in odd increments (1, 3, 5, and 7).

A view of all scan sector modes is shown in figure 4-37.

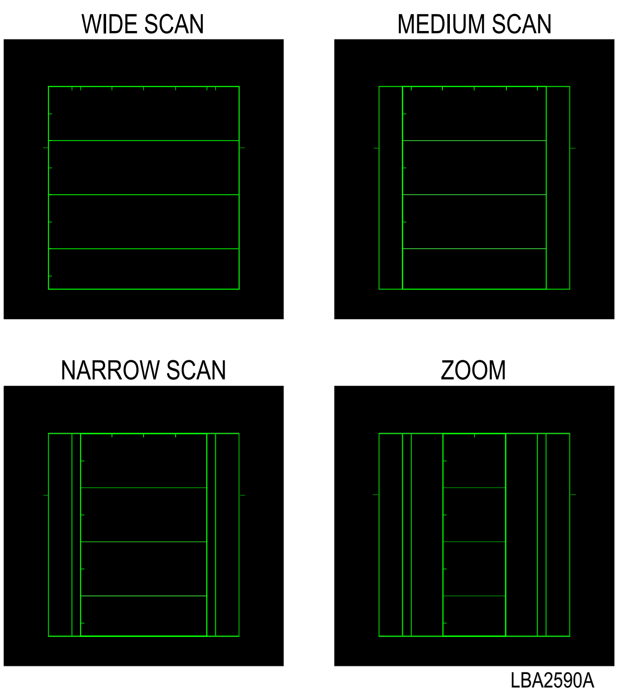


Figure 4-37. RMAP Scan Sectors

4.35.6 FCR Page - GTM/RMAP Format pages. Each of the GTM/RMAP pages contains the following unique buttons:

- T1 **C-SCP** button
- T6 FCR **UTIL** button
- L1 **NTS** button
- L2 Left Arrow button
- L4 **TGT** button
- L5 **ELEV** button
- R1 **ZOOM** button
- R2 Right Arrow button
- R4 **RFHO** button
- R6 **ACQ** button

a. C-SCP Button. The **C-SCP** button is used to call up the C-scope target symbols for display on the flight and weapons symbology format. Selecting the **C-SCP** button will cause the display of virtual FCR target symbols on the HMD in the pilot station, on the HMD and ORT HOD/HDD in the CPG station, and on the MPDs when the appropriate video is selected.

b. FCR UTIL Page Button. The FCR **UTIL** page button is used to access FCR system utility functions.

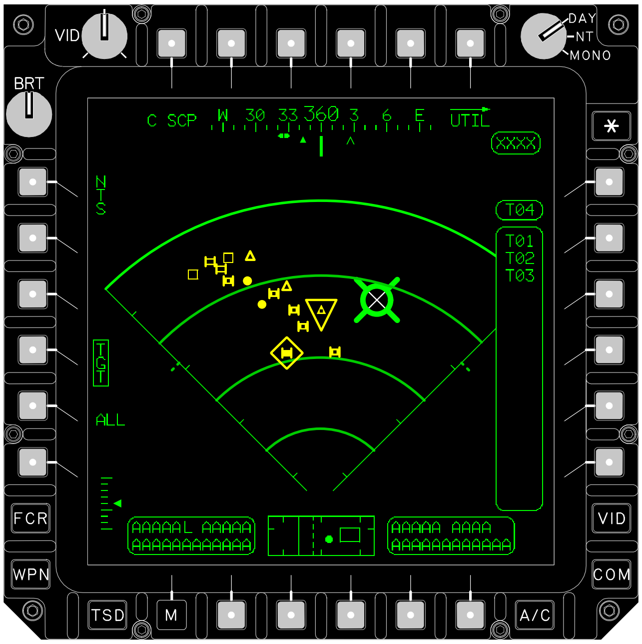
c. NTS Button. The **NTS** button is used to select the next valid target in the priority target list as the NTS target. Selecting an FCR target symbol with the display cursor will designate that target as the FCR NTS. The MPD display cursor will automatically be placed in the active area of this button at the completion of the first scan of a scan burst. This allows rapid NTS target selection using the cursor **ENTER** function. The cursor operation on the **FCR** page is described in chapter 2. This button is only displayed when valid target data is present.

NOTE

If the Pilot's selected sight is **FCR**, the centerline is commanded to the selected acquisition source. If a left/right arrow button is selected, the centerline is offset as described below. To force the centerline back to the acquisition LOS, the Pilot must reselect the **FCR** sight select switch on the collective.

d. Left/Right Arrow Buttons. The left/right arrow buttons are only displayed if the FCR is the selected sight. They are used to rapidly position the FCR centerline to the left or right of the helicopter centerline. Selecting the left or right centerline buttons will cause the FCR centerline to be adjusted to the left or right based on the selected scan size. The centerline will be adjusted to the right or left so as to effect total scan width coverage of the area adjacent to the previously selected area. The FCR centerline will remain heading stabilized at each position until commanded to a new position. If the FCR is slaved, the left/right arrow buttons are barriered in the CPG crewstation. In addition, the **MAN** state allows the antenna azimuth position to be manually adjusted using the **MAN TRK** thumb force controller.

e. TGT Button. The **TGT** button is used for the selection of FCR target data (fig 4-38) to be stored into the permanent Target/Threat file. Selecting the **TGT** button sets the display cursor for selecting/storing any FCR target symbol and calls up the store status window in the right area of the **FCR** page. In addition, it calls up the **ALL** button. Selecting an FCR target symbol with the display cursor will store that target data to the target/threat file. Again selecting the **TGT** button will exit the target select function and return the format to normal operation. This button is only displayed when valid target data is present.



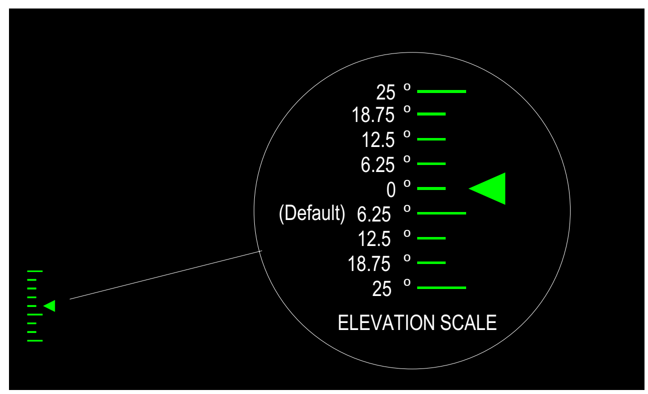
LBA2011A

Figure 4-38. TGT Store Selection

(1) ALL Button. The **ALL** button is used to rapidly store all of the displayed FCR target data. Selecting the **ALL** button stores all of the top priority FCR target data to the target/threat file and calls up a larger status window.

(2) Store Status Window. The store status window provides the file address of the next target to be selected/stored (boxed) and the list of file addresses of targets stored during the current iteration of TGT selection. This data is displayed for reference by the crew member for future use.

f. ELEV Button. Antenna elevation control is selected using the **ELEV** button (fig 4-39) on the FCR page GTM format. Two options are available to the crewmember: **AUTO** or manual. Depressing the **ELEV** button while in the **AUTO** mode will remove the **AUTO** placard and present up and down arrows on the display for manual control. Selecting the up arrow button will cause the antenna position to elevate up one setting or to the next higher setting when starting between settings. Selecting the down arrow button will cause the antenna to move down one setting or to the next lower setting when starting between settings. When the antenna is at the uppermost setting, the up arrow symbol will not be available. Conversely, when the antenna is at the lowest setting, the down arrow symbol will not be available. If TADS power is applied, selecting manual will allow the CPG to slew antenna elevation using the RHG **MAN TRK** control. The degrees shown in figure 4-39 are lower bar elevations. The upper bar elevation will vary with altitude.



LBA2596

Figure 4-39. GTM Elevation Setting

g. Display ZOOM Button. Selection of the **ZOOM** button activates the zoom function. When the display cursor is positioned within the FCR target area, the display cursor symbol is changed to a **ZOOM** cursor (para 2.21.4). Placement of the **ZOOM** cursor represents the area to be zoomed allowing better viewing of target arrays where the targets are in close proximity to each other.

h. RFHO Button. The **RFHO** button is used for rapid transmission of the FCR next-to-shoot (NTS) (fig 4-40) target information via the IDM to another LBA system for engagement. Selecting the **RFHO** button will select the FCR NTS target data for transmission and call up the Subscriber Identifier buttons based on the selected IDM network on the right side of the **FCR** page. Selecting a Subscriber Identifier button will call up the IDM **SEND** button on the right side of the **FCR** page. This button is only displayed when valid target data is present.

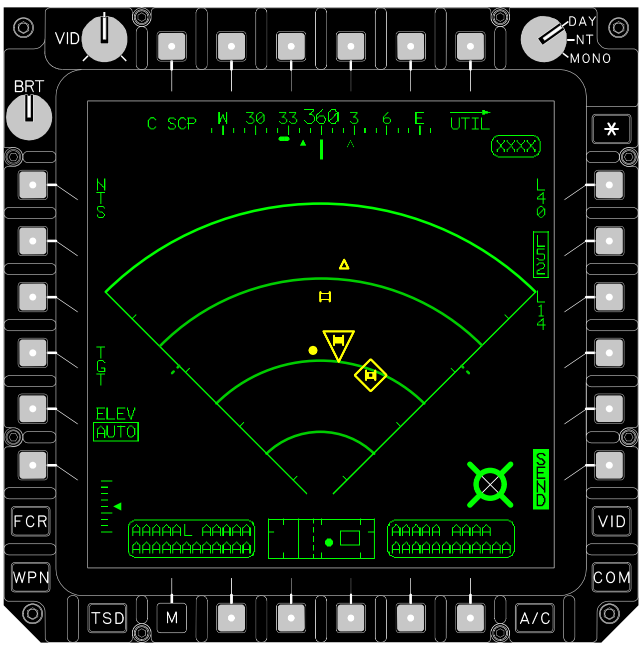


Figure 4-40. RFHO Selection

- T5-T6, R1 - R5 Subscriber buttons
- R6 **SEND** button

(1) Subscriber Identifier Button. The Subscriber Identifier buttons are used to select the desired subscriber to which the RF handover target data will be transmitted.

(2) SEND Button. The **SEND** button is used to activate the IDM and transmit the RF handover target data to the selected subscriber.

(3) ACQ Button. The **ACQ** button is described in Section I of this chapter.

4.35.7 GTM Antenna Elevation Control when MMA is Masked. In automatic elevation control (fig 4-41), antenna elevation is set to cover FCR minimum and maximum range based on radar altimeter altitude. In situations where the FCR is scanning behind a hill or mountaintop, the radar altitude may be such that the automatic setting will not cover the desired area of interest. A suggested method of overcoming this situation requires manual adjustment of antenna elevation and multiple scans to bracket the area of interest.

4.35.8 GTM Manual Elevation Control Operations.

a. Select RMAP with radar video.

b. Set antenna elevation manually to an angle estimated to cover the area of interest or the lowest setting.

c. Conduct a single scanburst and observe RMAP display.

d. Conduct the following steps until RMAP video shows ground returns at minimum range with one elevation setting lower than a blank area presentation.

(1) If the display presents ground returns at minimum range, set the elevation angle up one setting and conduct a single scanburst.

(2) If the minimum range area still displays ground returns, set the elevation angle up one setting and conduct a single scanburst.

(3) If the minimum range area is blank, set the elevation angle down one setting and conduct a single scanburst. A blank area indicates the main beam is set to an angle which does not provide coverage at the minimum range.

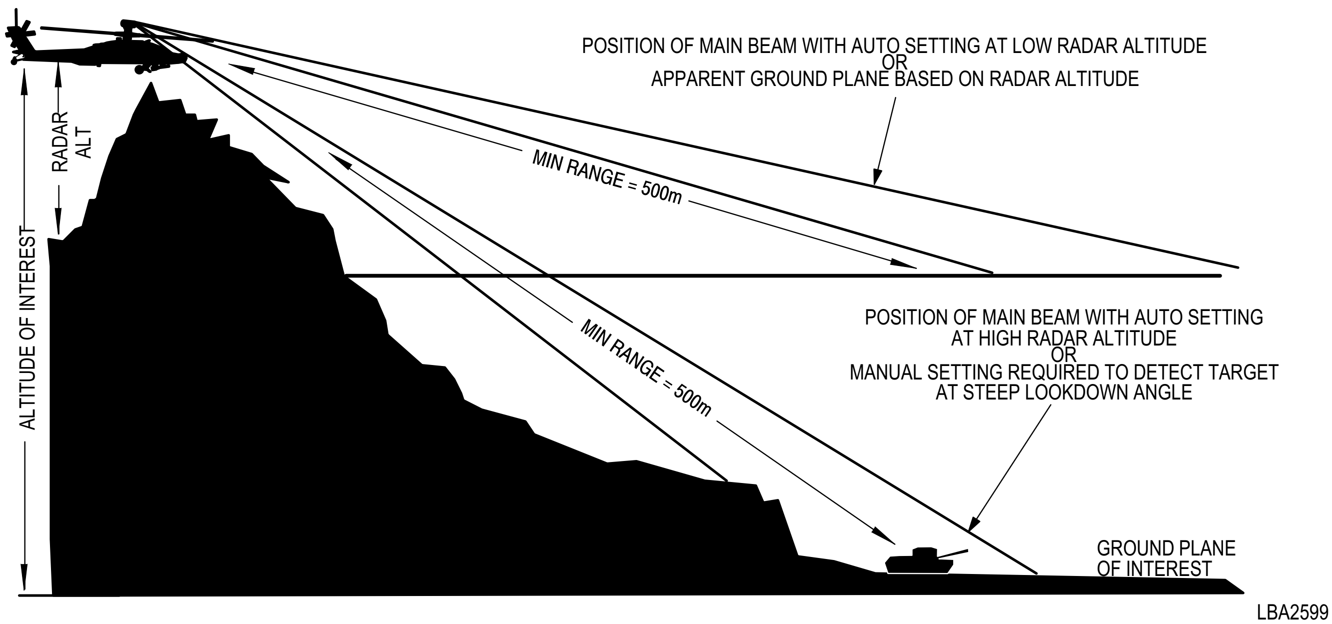


Figure 4-41. Manual Elevation Control Considerations

4.35.9 GTM/RMAP SYMBOLOGY. The following symbols (fig 4-42) are displayed on the GTM and RMAP formats.

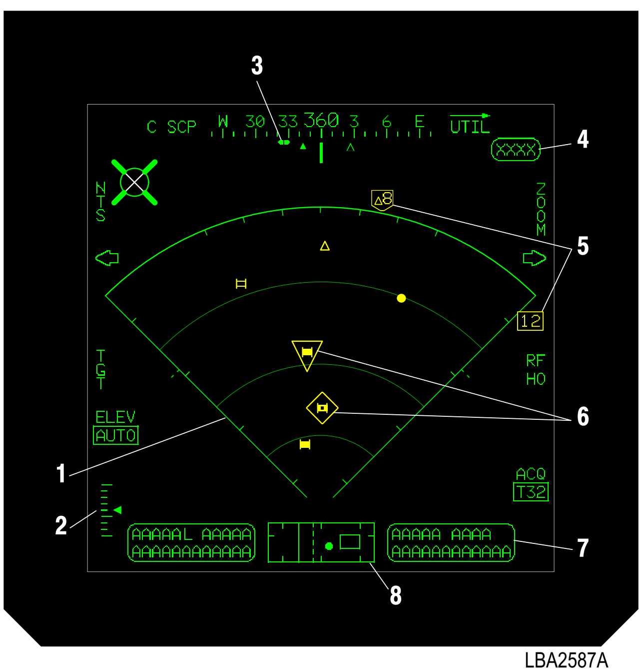


Figure 4-42. GTM/RMAP Symbology

1. Scan Sector Symbol. The scan sector symbol is displayed in the mode selected by the crewmember (Wide, Medium, Narrow or Zoom). Current mode is displayed in full intensity with other modes displayed in partial intensity, if applicable.

2. Elevation Scale. The moving antenna elevation pointer is displayed along the right side of the antenna elevation scale located in the lower left area of the format. The pointer moves up and down along the scale to indicate the elevation setting of the FCR antenna. The long tic mark within the scale provides indications with reference to the zero setting.

3. Heading Scale and Symbols. The heading scale and associated symbols are as described in chapter 2**.**

4. Total Target Count Status Window. The total target count status window appears when targets are selected. It provides a total number of targets selected by the radar within a scanburst. The status window digital readout is from 1 to 1023 in GTM/RMAP.

5. RFI Threat Symbols. RFI threat symbols representing RFI detected emitters are displayed on the periphery of the radar scan sector to indicate the direction to the threat. Up to 10 RFI threat symbols can be displayed at a time.

6. FCR Priority Target Symbols. FCR target priority symbols represent the highest priority targets detected and classified for a scanburst. Up to 16 FCR target symbols can be displayed for any given scanburst (Refer to 4.44.5 for target symbol descriptions).

7. High Action Display. The High Action Display is as described in paragraph 4.16.

8. FOR Symbols. The Field of Regard and associated symbols are described in paragraph 4.14.

4.35.10 FCR Page ATM Format.. The ATM format (fig 4-43) provides radar information within a plan PPI circular sector scan outline with partial intensity range arc lines and azimuth tic marks at 90° increments. The ATM provides the same functional controls as the GTM and RMAP formats except that is does not include the ZOOM button or automatic control of the antenna elevation. In addition, there is no FOR symbology displayed in the ATM format.

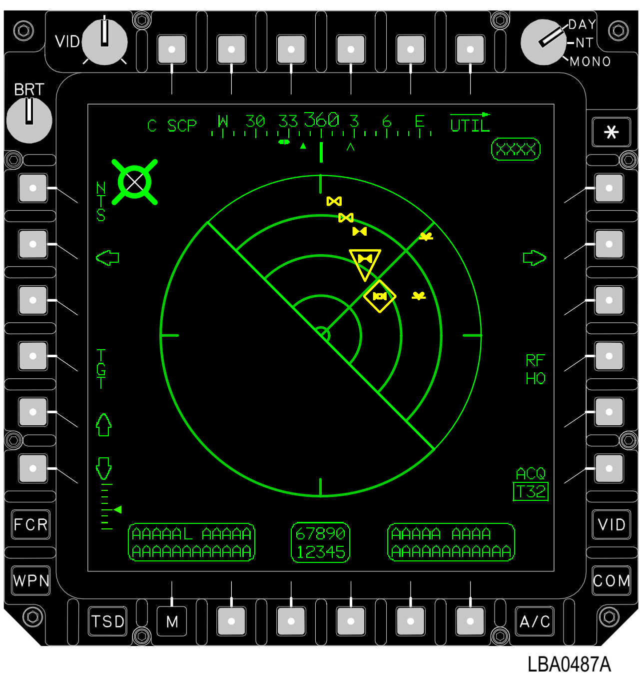


Figure 4-43. FCR Page - ATM Format

4.35.11 ATM Target Processing/Prioritization. ATM target symbols are displayed in any given scan. Target data is displayed and updated as it is detected during the scan to derive priority target characteristics (velocity and classification). The symbols represent the highest priority target detected and classified for that scan. The target classification process is:

- Priority target data, total target count, and total targets are purged at the start of each single scan and updated during the scan.
- Symbols are displayed during the scan.
- NTS is displayed at the end of the first scan and is updated by the WP as target information is prioritized by the FCR.
- RFI target merges are displayed during any scan.

a. ATM Scan Sector Symbol. The ATM scan sector is displayed in full intensity and is based on the selected scan size: Wide, Medium, Narrow, and Zoom. Current mode is displayed in full intensity with other modes displayed in partial intensity, if applicable. FCR Page - ATM Format scan sectors function as follows:

- The wide scan sector symbol represents a 360° scan sector. The wide scan sector remains displayed in partial intensity when any other scan size is selected.
- The medium scan sector symbol represents a 180° scan sector (90° either side of centerline).
- The narrow scan sector symbol represents a 90° scan sector (45° either side of centerline). The wide and medium scan sectors remains displayed in partial intensity.
- The zoom scan sector symbol represents a 45° degree scan sector (22.5° either side of centerline). The wide, medium, and narrow scan sectors remains displayed in partial intensity.
- The ATM blanking symbol will appear whenever the FCR is looking towards the tail section of the aircraft.

A view of all scan sector modes is shown in figure 4-44.

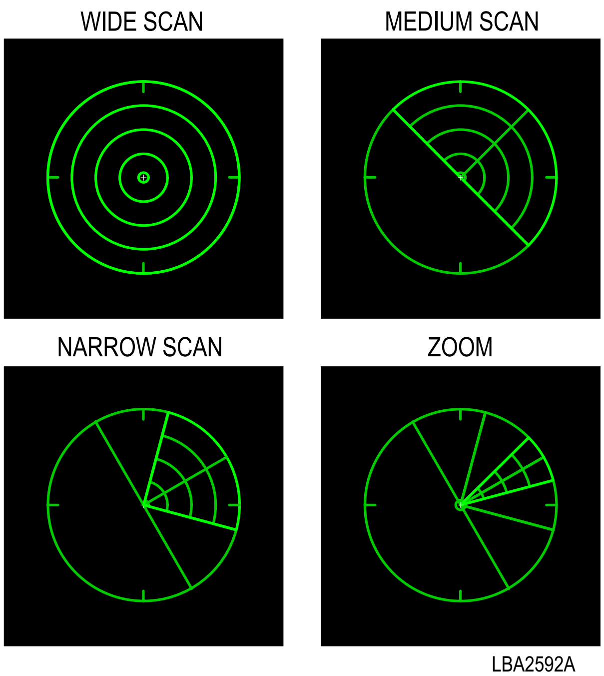


Figure 4-44. ATM Scan Sectors

4.35.12 ATM Elevation Control. The up/down arrow buttons are displayed continuously in the ATM. They are used to manually adjust the antenna elevation up or down incrementally during air targeting. Selecting the up arrow button will cause the antenna position to elevate up one setting or to the next higher setting when starting between settings. Selecting the down arrow button will cause the antenna to move down one setting or to the next lower setting when starting between settings. When the antenna is at the uppermost setting, the up arrow symbol will not be available. Conversely, when the antenna is at the lowest setting, the down arrow symbol will not be available.

Figure 4-45. ATM Elevation Setting

4.35.13 ATM Azimuth Scan Centerline Control. Left (⇦) or right (⇨) FCR page buttons are used to rapidly position the FCR azimuth scan centerline to the left or right of the current FCR azimuth scan centerline. The FCR azimuth scan centerline will be set to the left or right to give total scan width coverage of the area adjacent to the previously selected area. The new centerline selection will be displayed as shown in figure 4-46. The FCR azimuth scan centerline will remain heading stabilized until commanded to a new azimuth position. If TADS power is applied, the CPG can slew antenna azimuth using the RHG **MAN TRK** control. If the FCR is slaved to an acquisition source in the CPG station, manual controls (arrow buttons and **MAN TRK** controller) will be inhibited. Pilot station left or right arrow button selection, after the FCR is sight selected, will deselect FCR slave to the acquisition source. For the pilot to slave the FCR to the acquisition source again, the FCR must be deselected as sight and selected again.

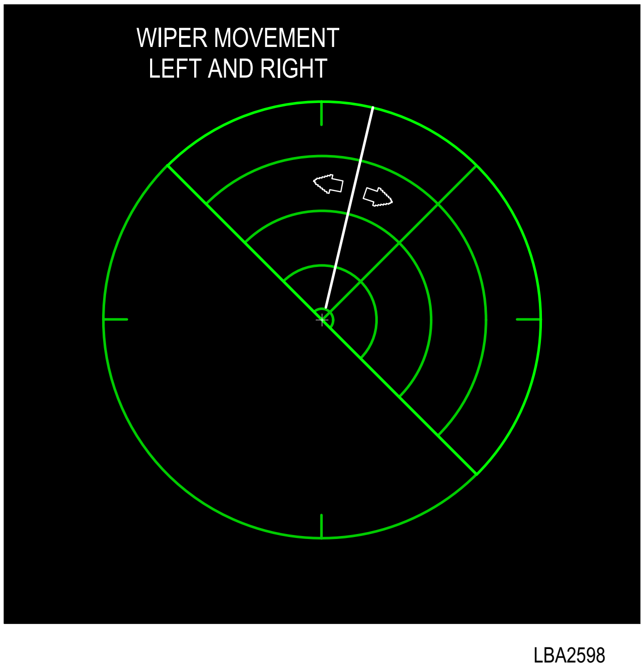


Figure 4-46. ATM Azimuth Scan Centerline Control

4.35.14 ATM Symbology. The ATM scan sector symbology (fig 4-47) is displayed in full intensity and is based on the selected scan size: Wide, Medium, Narrow, and Zoom. Current mode is displayed in full intensity with other modes displayed in partial intensity, if applicable.

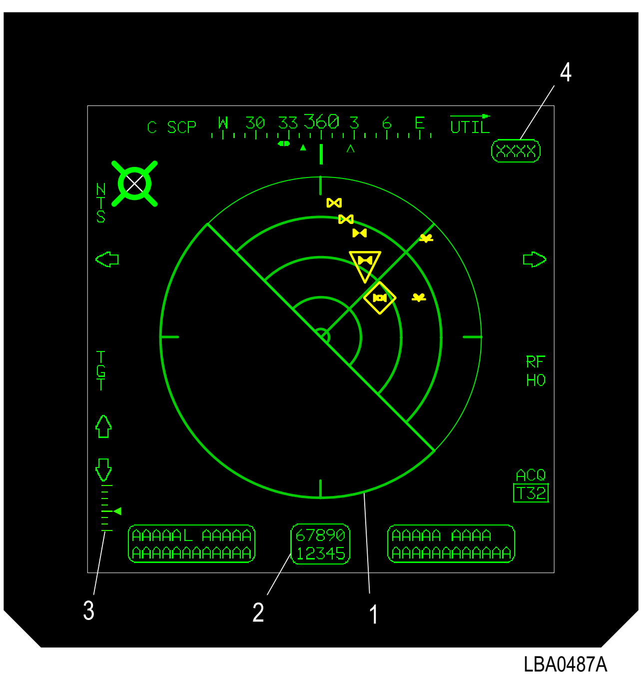


Figure 4-47. ATM Symbology

1. Scan Sector Symbol. The ATM scan sector symbology is displayed in full intensity and is based on the selected scan size: Wide, Medium, Narrow, and Zoom. Current mode is displayed in full intensity with other modes displayed in partial intensity, if applicable.

2. Elevation Altitude Status Window. The elevation altitude status window is displayed in the lower center area of the format. The upper and lower altitude digital readouts represent the upper and lower altitude of FCR coverage at maximum range and is referenced from the aircraft and antenna elevation setting. Each altitude value for digital readout is from -32,767 feet to +32,768 feet, in one foot increments.

3. Elevation Scale. The moving antenna elevation pointer is displayed along the right side of the antenna elevation scale located in the lower left area of the format. The pointer moves up and down along the scale to indicate the elevation setting of the FCR antenna. The long tic mark within the scale provides indications with reference to the zero setting.

4. Total Target Count Status Window. The total target count status window (fig 4-48) appears when targets are detected. It provides a total number of targets detected by the radar within a scanburst. The status window digital readout is from 1 to 1023 in ATM.

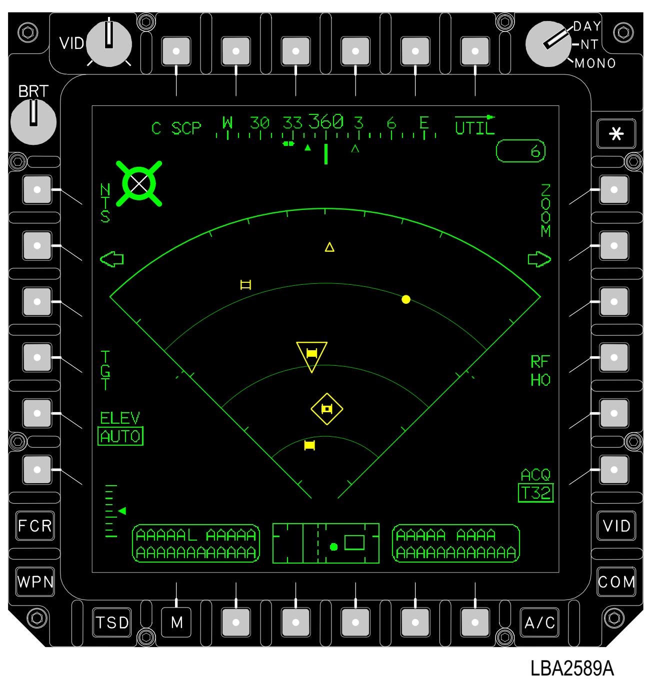


Figure 4-48. Total Target Count Status Window

4.35.15 FCR Page - TPM Format. The TPM format (fig 4-49) provides radar information within a PPI sector scan outline with partial intensity range arc lines. Two scan sector sizes are automatically displayed based on ground speed. The FCR centerline is set to the aircraft centerline in this mode. The scan sector is overlaid onto radar map video converted to shades of gray. Line distances are 100 m, 1000 m, 2000 m, and 2500 m. Obstacle symbols and radar video are displayed in geometric fidelity within a sector scan. The TPM format provides the following selections, status windows, and graphics:

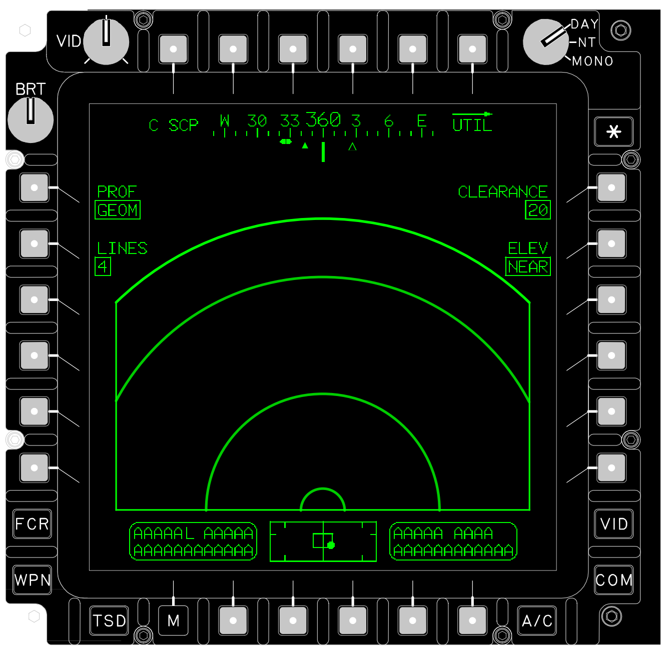


Figure 4-49. FCR Page - TPM Format

4.35.16 TPM Scan Sectors Symbols. The **TPM** scan sectors symbols are displayed in full intensity and are based on the scan size: Wide or Narrow.

a. Scan Sector Modes. The mode of the TPM sector is based on aircraft airspeed.

- The TPM wide format is displayed as a 180° scan sector (90° either side of centerline) when the ground speed decreases below 45 knots and until increasing above 55 knots.
- The TPM narrow format is displayed as a 90° scan sector (45° either side of centerline) when the ground speed increases above 55 knots and until decreasing below 45 knots.
- Arcs. Each arc represents the following: first arc = 100m, second arc = 1000m, third arc = 2000m and fourth arc = 2500m.

A view of all scan sector modes is shown in figure 4-50.

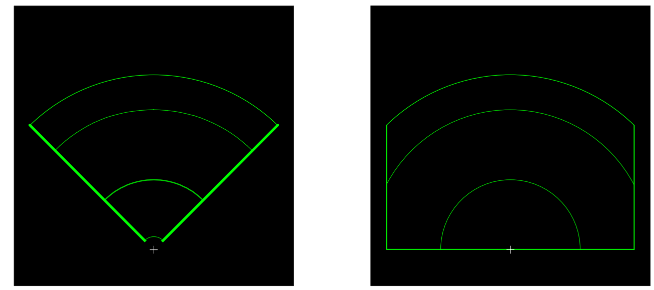


Figure 4-50. TPM Scan Sectors

The FCR page - TPM format contains the following unique buttons:

- T1 **C-SCP** button
- T6 **UTIL** button
- L1 **PROF** button
- L2 **LINES** button
- R1 **CLEARANCE** button
- R2 **ELEV** button

b. C-SCP Button. The **C-SCP** button is used to call up the C-scope radar information for display on the crew member's HMD. Selecting the **C-SCP** button will cause the display of virtual profile lines and obstacle symbols on the HMD in the pilot station and on the HMD and ORT HOD/HDD or TDU in the CPG station.

c. FCR UTIL Page Button. The FCR **UTIL** page button is used to access FCR system utility functions.

d. PROF Button. The **PROF** button is used to select the setting for the display of profile line intervals. Selecting the **PROF** button will call up the profile setting options: **GEOM**, **ARITH**, and **TEST**.

e. LINES Button. The **LINES** button is used to select the number of profile lines displayed when **C SCP** is selected. Selecting the **LINES** button will call up the options: **0**, **1**, **2**, **3**, or **4**.

f. CLEARANCE Button. The **CLEARANCE** button is used to select the clearance plane setting of the TPM. Selecting the **CLEARANCE** button will call up the clearance plane setting options: **20**, **50**, **100**, and **200**. These values represent the number of feet below the helicopter (wheels) at which the clearance plane exists.

g. ELEV Button. The FCR page **ELEV** button alternately selects two different antenna elevation positions to obtain the desired radar information. Pressing the **ELEV** button to select **FAR** sets the antenna elevation at -0.5° to give information for the earliest warning of high terrain out to 2500m. Pressing the **ELEV** button to select **NEAR** sets the antenna elevation at -3° to measure terrain in rain or obtain radar information out to minimum range (approximately 1000m).

4.35.17 TPM Symbology. A view of the TPM Symbology is shown in figure 4-51.

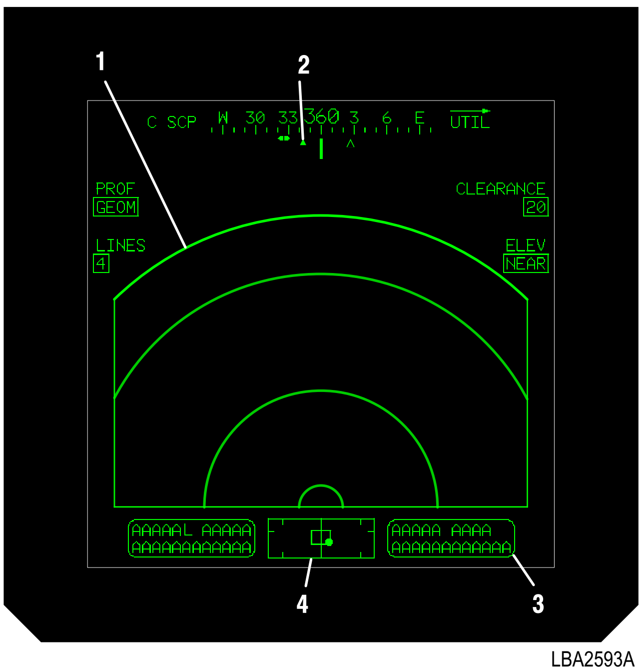


Figure 4-51. TPM Symbology

1. **TPM Scan Sector Symbols**. The scan sector symbology is displayed in full intensity and is based on the selected scan size: Wide or Narrow. The format of the TPM sector is based on aircraft airspeed.

2. **Heading Scale and Symbols**. The heading scale and associated symbols are as described in chapter 2**.**

3. **High Action Display**. The High Action Display is as described in paragraph 4.16.

4. **FOR Symbols**. The Field of Regard and associated symbols are as described in paragraph 4.14.

5. **Total Obstacle Count Status Window**. The total obstacle count status window appears when obstacles are detected.

4.36 FCR UTIL PAGE L

The **FCR UTIL** page (fig 4-52) is used to enable the FCR and RFI, override BIT, and set various FCR and RFI modes. On initial aircraft powerup, the MMA button defaults to the pinned position. Subsequent FCR powerup/powerdown operations are conducted through the FCR or WPN **UTIL** page.

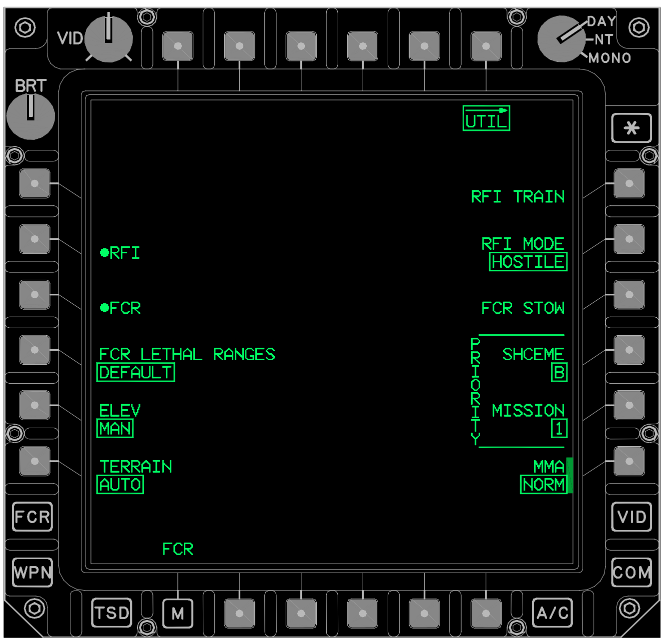


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Figure 4-52. FCR UTIL Page

The FCR UTIL page provides the following unique selections:

- L1 **FCR TEMP ORIDE** button
- L4 **FCR BIT ORIDE** button
- L4 **FCR LETHAL RANGES** button
- L5 **ELEV** button
- L6 **TERRAIN** button
- R1 **RFI TRAIN** button
- R2 **RFI MODE** button
- R3 **FCR STOW** button
- R4 **SCHEME** button
- R5 **MISSION** button
- R6 **MMA** button

CAUTION

Continued operation with the FCR TEMP ORIDE button selected may cause permanent damage to FCR components.

4.36.1 FCR TEMP ORIDE Button. The **FCR TEMP ORIDE** button is used to prevent overtemperature protection shutdown of the FCR when it has been detected in an overtemperature state (FCR HOT). This button is displayed only when an overtemperature state has been detected.

CAUTION

FCR BIT ORIDE selection in extreme cold weather (-10° C or colder) could result in damage to the FCR.

4.36.2 FCR BIT ORIDE Button. The **FCR BIT ORIDE** button is used to override the FCR built-in-test sequence. This button is displayed only when the FCR is in BIT.

4.36.3 FCR LETHAL RANGES Button. The **FCR LETHAL RANGES** button is used to select the desired lethal ranges data to be used by the FCR for target classification. Selecting the **FCR LETHAL RANGES** button alternately toggles between **DEFAULT** and **MODIFIED**. The default data file is resident in the FCR and the modified data file is available from the DTC (if programmed)

4.36.4 ELEV Button. The **ELEV** button is used to set the state of FCR antenna elevation control to **AUTO**. Selecting the **AUTO** state automatically adjusts the elevation value passed to it by the weapon processor for the given acquisition LOS.

4.36.5 RFI TRAIN Button. The **RFI TRAIN** button is used to activate the training mode of the RFI subsystem. Selecting the **RFI TRAIN** button modes the system to provide an on-board emulation of RFI detected emitters for aircrew training exercises. This is a contrived set of threats preprogrammed solely for training purposes.

4.36.6 RFI MODE Button. Refer to Section III, para 4.90.8 for description.

4.36.7 FCR STOW Button. The **FCR STOW** button is used to stow the FCR antenna.

4.36.8 SCHEME Button. The **SCHEME** button is used to select the desired prioritization scheme to be used by the FCR for target classification. Selecting the **SCHEME** button calls up options of **A** through **G**. Three priority schemes are resident in the aircraft (FCR) and another 4 are available from the DTC.

4.36.9 Priority Scheme Selections. FCR target information is prioritized by the FCR and used to direct the selected weapon against targets and to enhance situational awareness in the area of operations. Seven priority schemes are used by the FCR; 3 schemes are resident in the FCR (options A, B, and C), and 4 are available for loading via the DTC (options D through G) if programmed. All priority schemes give higher priority to targets merged with RFI emitters and vary only with respect to how unmerged targets are prioritized. Prestored FCR priority schemes (A, B, and C) are summarized as follows:

a. Priority scheme **A** emphasizes airborne and stationary ground targets.

b. Priority scheme **B** emphasizes stationary ground targets.

c. Priority scheme **C** emphasizes airborne and moving ground targets.

The 4 priority scheme options available for loading through the DTC and are programmed into the DTC via the AMPS. All 7 priority schemes, if loaded, are selectable using the FCR **UTIL** page **SCHME** button.

4.36.10 FCR Lethal Ranges Selections. FCR lethal range data is processed with with the selected priority scheme to determine FCR target priority. One of two lethal range files is used by the FCR; one is resident in the FCR (**DEFAULT** file), and one is available for loading via the DTC (**MODIFIED** file) if programmed. The lethal range is the maximum effective range for the specific threat or target type and is used in the FCR prioritization algorithm to determine if ownship is within lethal range of a given target.

Like priority scheme options D through G, the modified lethal ranges available for loading through the DTC are programmed into the DTC via the AMPS. Modified lethal ranges, if loaded, are selected using the **FCR UTIL** page **FCR LETHAL RANGES** button.

4.36.11 MISSION Button. This button toggles between 1 and 2. It is used to determine which mission is used when loading Priority schemes **D** through **G**. This load takes place when Priority schemes **D** through **G** are selected using the **SCHEME** button. This button will automatically switch to 1 or 2 when the Master, Mission 1, or Mission 2 ALL uploads are commanded.

4.36.12 TERRAIN Button. The **TERRAIN** button is used to select the radar clutter threshold consistent with anticipated terrain or other features in the area of operations.

NOTE

In the Ground Targeting Mode (GTM) only, selecting the reserved terrain selection enables a Moving Target Indicator (MTI) only mode in the FCR P8 software load and subsequent. The Stationary Target Indicator (STI) target detection processing is disabled. This selection will cause an FCR fault message on the UFD/EUFD and an FCR STI FAIL indication on the DMS page. To return to STI detected targets, select any other terrain selection. The new selection will take effect at the beginning of the next scan.

4.36.13 Terrain Sensitivity Setting. The terrain sensitivity setting is selectable using the FCR UTIL page **TERRAIN SENSITIVITY** button. This provides the crewmember the capability to select the proper radar clutter threshold setting for correct processing of STI detections. The crewmember has a choice of 8 selectable sensitivity options that is consistent with the anticipated terrain or other features in the area of operation, These selectable options are found in table 4-19.

Table 4-19. Terrain Sensitivity Settings

OPTION	TERRAIN SELECTION
AUTO	FCR automatically selects terrain.
RESERVED	In the FCR P7 software load and previous, selecting RESERVED, the FCR automatically selects terrain and false alarm control (Pd is not assured). In the FCR P8 software load and subsequent, selecting the RESERVED, enables the MTI only mode and disables the STI.
1	Eastern U.S. coastal plains region.
2	Valleys, mountains, sparse trees.
3	Combination of coastal plains and desert (light vegetation).
4	Similar to setting 3 with different decision thresholds.
5	Desert vegetation and arroyos (water carved gully or channel).
6	Similar to setting 5 with sparse vegetation.

4.37 FCR OPERATION L

The FCR, in combination with the RF missile, provides a fire-and-forget capability. An integrated mast-mounted RFI provides threat emitter warning and azimuth direction finding/cueing. RFI detected emitter signals may be correlated with FCR target data to derive the identity and location of a particular threat. Target information is sent to the weapons processor for the determination of target location coordinates and is used to direct the selected weapon against targets. FCR target information is displayed on the **FCR** page targeting format and the **TSD** page. The **FCR** page targeting format may also be displayed on the ORT HOD/HDD. In addition, the information is processed for the generation of FCR target symbology for overlay onto TADS/PNVS sensor video.

4.38 FCR PAGE CONTROLS L

FCR page controls are dependent upon the states of the sight select function and of the FCR mode function. The following is a general description of controls available:

- When the FCR is not the selected sight in either crew station, selecting the FCR subsystem bezel button or the **FCR** page button from the **MENU** page calls up the **FCR** page in the format as last selected at the FCR mode switch (in either crew station).

- Selecting the sight select switch to **FCR** establishes control of the FCR to that crew station in the mode/format last selected at the FCR mode switch (from either crew station). If the **FCR** page is not currently displayed on either MPD or the ORT HOD/HDD (CPG station) or TDU (CPG station), it is automatically called up on the left MPD (in that crew station). All controls are available. Sight selection of the FCR between the crew stations is based on last-to-select logic.

- When the FCR is the selected sight in the opposite crew station, selecting the FCR subsystem bezel button or the **FCR** button from the **MENU** page calls up the **FCR** page in the format as last selected at the FCR mode switch (in either crew station). Only the FCR **UTIL** page button, the **TGT** button (and associated controls) and the **ACQ** button is available.

4.39 FCR SYSTEM STATUS L

In certain cases, status windows are displayed on the **FCR** page and the FCR **UTIL** page when the FCR is in other than a ready state:

FCR NOT INSTALLED	The FCR is not installed.
FCR NOT POWERED	The FCR is set to OFF.
FCR BIT IN PROGRESS	The FCR is performing BIT.
FCR FAIL	The FCR has been detected as failed.
FCR ZEROIZED	The FCR has been detected as zeroized.

4.40 IDM STATUS

Status windows are also displayed on the **FCR** page and the FCR **UTIL** page when certain IDM transmissions are received:

RF HANDOVER	Valid RF handover target has been received and accepted.
IDM TARGET DATA	Valid FCR target has been received and accepted for display.

4.41 FCR MODES OF OPERATION L

The FCR is employed in one of three operational modes to perform ground targeting (GTM and RMAP), air targeting (ATM), and terrain profiles mode (TPM). Modes are selected using the FCR mode switch on the LHG or collective mission grip. Momentarily positioning the FCR mode switch to **RMAP**, after RMAP is initially selected, displays target symbols without radar video. GTM is the FCR default mode. The last-to-select rule remains in effect for the mode switch. Radar clutter threshold, that is consistent with the anticipated terrain or other features in the area of operation, is selected using the FCR **UTIL** page **TERRAIN** sensitivity button.

4.41.1 FCR Ground Targeting. Ground targeting is accomplished using one of two modes: the Ground Targeting Mode (GTM) or the Radar Map (RMAP). These ground scan modes are used to detect, classify and prioritize both moving and stationary ground targets and low flying air targets. Targets are presented on the targeting format at the current range/azimuth location.

4.41.2 FCR Air Targeting. Air targeting is accomplished using the ATM. It is an air scan mode used to detect, classify and prioritize air targets. Targets are presented on the FCR targeting format at the current range/azimuth location.

WARNING

The terrain profiling mode of the FCR shall not be relied upon for primary pilotage information.

4.41.3 FCR Terrain Profiles. Terrain clearance is accomplished using the TPM. It is a ground scan mode used to provide pilotage information to either the pilot /CPG. It provides an FCR sector ground clearance plane format displayed (fig 4-53) on an MPD or ORT display which is used in conjunction with a terrain profiles format displayed with IHADSS video.

WARNING

Low radar cross section objects such as telephone or power poles or isolated leafless trees cannot be accurately measured by the FCR. The clearance plane should be set to exceed the height of all anticipated hazards.

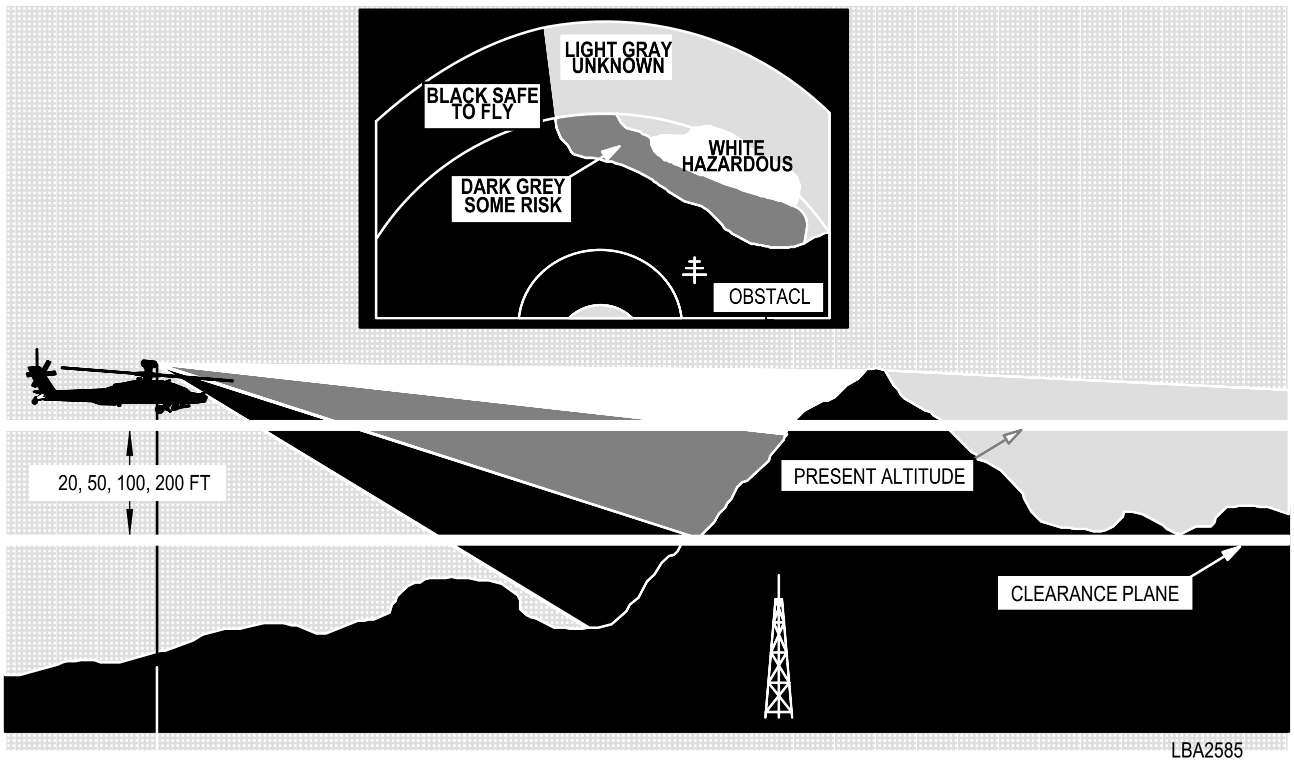

Figure 4-53. FCR Terrain Profiles

a. Clearance Planes. Options of **20**, **50**, **100**, or **200** feet below the helicopter wheels are available for selection. Four shades of gray will be displayed to represent terrain information as follows:

- LIGHT GRAY represents unknown terrain. Terrain has areas in radar shadow or areas where sufficiently accurate measurements CANNOT be made. This can occur in a ring near the radar or in a ring where ground cannot be reached at the radar slant range. A light gray area without a characteristic shadow edge can be an indication of heavy rain or low reflectivity terrain. The FCR is capable of detecting and reporting heavy rain. However, there is no discrete symbology for this information.
- DARK GRAY represents an area that is potentially hazardous and does not guarantee the expected clearance. Terrain measured is between the helicopter present altitude and the clearance plane. Flying into a dark gray area presents some risk depending on TADS/PNVS video quality.
- BLACK represents terrain measured below the selected clearance plane.
- WHITE represents a hazardous area that must be avoided. Terrain measured is above the helicopter wheel height.

b. Profile Lines. Terrain profile data (fig. 4-54) is collected in range intervals that are based on the FCR page profile (**PROF**) button selection. The highest elevation points within a range interval are detected and combined into a single profile line. FCR page range interval selections are geometric (GEOM), arithmetic (ARITH), or TEST. The number of profile lines displayed can be selected using the FCR page **LINES** button. Selecting the **LINES** button will display options; **1**, **2**, **3**, and **4**.

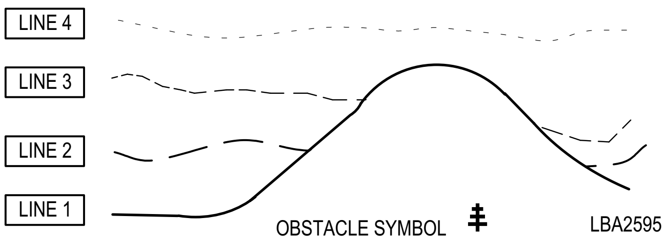

Figure 4-54. Terrain Profile Data

Lines and obstacles are displayed as follows:

Option 0	Display obstacles only
Option 1	Display line 1 with obstacles
Option 2	Display lines 1 and 2 with obstacles
Option 3	Display lines 1, 2, and 3 with obstacles
Option 4	Display lines 1, 2, 3, and 4 with obstacles

Range interval settings are:

GEOM	Line 1	100 - 300 meters
	Line 2	300 - 500 meters
	Line 3	500 - 1000 meters
	Line 4	1000 - 2500 meters
ARITH	Line 1	100 - 700 meters
	Line 2	700 - 1300 meters
	Line 3	1300 - 1900 meters
	Line 4	1900 - 2500 meters
TEST	Line 1	500 meters
	Line 2	1000 meters
	Line 3	1500 meters
	Line 4	2000 meters

4.41.4 TPM Obstacle Symbol. The TPM obstacle symbols represent objects or terrain features which the FCR has derived as obstacles to flight (fig 4-55). These symbols are not displayed in a wiper fashion as with targeting data. The symbols are displayed at one time each time the data is updated at the completion of a TPM scan. TPM obstacle symbols are displayed in YELLOW. A maximum of 64 symbols may be displayed on the FCR page TPM format or IHADSS C-Scope formats at any one time.

Figure 4-55. TPM Obstacle Symbol

4.42 FCR FUNCTIONS L

4.42.1 FCR Scan Size. The FCR scan size default is wide for all targeting modes. If a new scan size is selected, the new scan size selection will be used at the beginning of the next scan. In TPM, the FCR determines scan size based on helicopter ground speed. In cued search, the FCR determines scan size based on the designated emitter frequency and whether the emitter was detected in the coarse or fine area of coverage.

4.42.2 FCR GTM/RMAP Scan. Characteristics of an FCR scanburst depend on the type of scanburst (single or continuous) and the selected scan size. Scan bursts also use multiple detections of moving targets to calculate cross range velocity.

a. Single Scanburst. When the FCR scan switch is momentarily positioned to **S-SCAN** the FCR will complete a single scan or, based on the selected FCR scan size, a scanburst. If the FCR scan switch is momentarily positioned to **S-SCAN** or **C-SCAN** before the scanburst is complete, the FCR will stop the scan, deactivate the transmitter, and return the FCR antenna to the azimuth start position for the selected mode and scan size. In GTM, a near bar and a far bar equals one scan. A single scanburst consists of multiple scans, based on the selected scan size, as listed below:

Scan Size	Number of Scans Per Scanburst
Wide	2
Medium	2
Narrow	3
Zoom	4

b. Continuous Scanburst. When the FCR scan switch is momentarily positioned to **C-SCAN**, the FCR will start a continuous scanburst. Continuous scanburst appears as a series of scanburst. The FCR will continue to scan until the FCR scan switch is momentarily positioned to **C-SCAN** or **S-SCAN** again. When the continuous scanburst is deactivated, the MMA is returned to the start position for the selected mode and scan size.

4.42.3 FCR Display Zoom. Targeting information for any scan size can be viewed at approximately 6:1 zoom display ratio. The border of the zoomed format is displayed in WHITE.

a. RHG ZOOM Switch. If zoom is selected by pressing the RHG **ZOOM** switch, the display zoom area will be centered on the NTS target. The **ZOOM** button will not select zoom if there is no NTS target.

b. FCR Page ZOOM Button. If zoom is selected using the **FCR** page **ZOOM** button, the LHG or collective mission grip **CURSOR** control is used to select the area to be displayed. When the display cursor is positioned within the FCR target area, the display cursor symbol is changed to a WHITE zoom area box with corner to corner cross-hairs. The size of the zoom area box is determined by the selected scan size. If the zoom area box is moved within the area of active button selections, the zoom area box will change to the normal display cursor symbol and cursor enter operation. Pressing the LHG or collective mission grip **CURSOR** control or RHG cursor enter switch will enter the cursor selection and the display will zoom on the designated area. Geometric fidelity with respect to relative target positions (and radar video in RMAP format) is retained in the zoom area format. Deselecting zoom using the **FCR** page **ZOOM** button will return the FCR to the last selected format.

4.43 FCR PAGE SYMBOLOGY L

4.43.1 Scan Wiper Symbol. A scan wiper symbol is displayed within the scan sector on the **FCR** page when the FCR is transmitting. It is displayed in WHITE during single scan bursts and in GREEN during continuous scan.

a. GTM Wiper Symbol. In the GTM PPI format, the scan wiper symbol is displayed as a line and moves right-to-left covering the near bar and left-to-right covering the far bar. The line appears to move or wipe across the scan sector pivoting about the sector origin in conjunction with the actual radar antenna movement.

b. RMAP Wiper Symbol. In the RMAP format, the scan wiper symbol is displayed as a vertical line and moves left to-right-covering the near bar and right-to-left covering the far bar.

c. Near Bar/Far Bar. A bar (sweep) is the movement of the radar from one scan limit to the other. The near bar begins on the left limit of the scan width and sweeps left-to-right through the search area to the right limit. The antenna, during turnaround, adjusts elevation up for far bar and sweeps right-to-left through the search area to the left limit. This completes 1 scan. The radar beamwidth in the near bar overlaps the beamwidth of the far bar. Targets in the overlap area will be scanned twice during a single radar scan. This provides the FCR with more information to be used during the classification/prioritization process and improves P_D.

d. Blanking Symbol. The FCR blanking symbol (fig 4-56) is displayed within the selected scan sector to indicate that the FCR transmitter has been set to **OFF** for system calibration or to avoid scanning directly toward the vertical stabilizer and tailboom. Each side of this polygon is made up of azimuth lines where blanking begin and where blanking ends. The remaining lines of the polygon connect the line end points at the maximum and minimum azimuth lines. Two additional criss-crossing lines are displayed in the last 30% of the polygon to form a large “X” symbol.

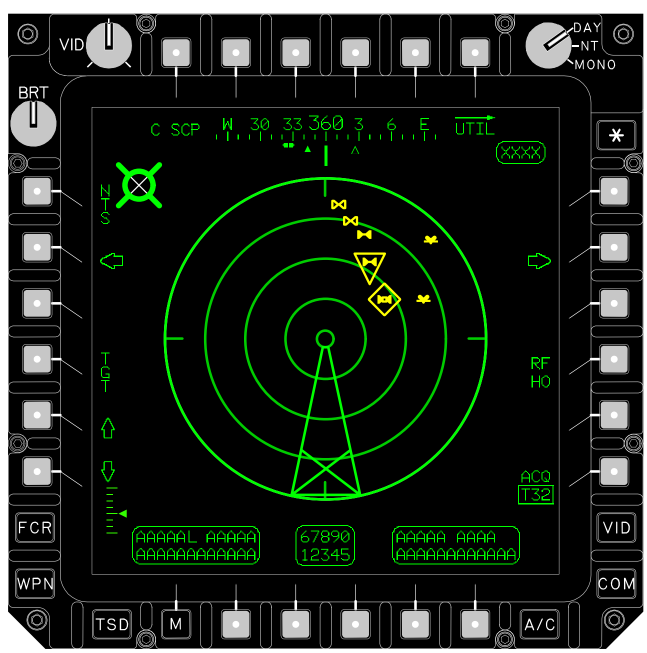

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Figure 4-56. FCR Blanking Symbol

e. ATM Wiper Symbol. In ATM PPI format, the scan wiper symbol appears to move or wipe across the sector scan, pivoting about the center of the sector, with FCR antenna movement. During continuous scanning, the wiper symbol moves back and forth across the scan sector until the FCR is commanded to stop scanning. This symbol is visible in ATM and GTM/RMAP.

f. TPM Wiper Symbol. In TPM PPI format, the scan wiper symbol appears to move or wipe across the sector scan, pivoting about the center of the sector, with FCR antenna movement. As it reaches the right boundary of the selected scan sector it moves back toward the left boundary of the scan sector and continues to cover the entire area in front of the helicopter.

4.43.2 ATM Centerline Symbol. The FCR centerline symbol for ATM is a partial intensity line displayed, when medium, narrow, or zoom scan sizes are selected, within the ATM format. The centerline symbol is not displayed when wide scan is selected. It is a partial intensity line which extends from the first range arc to the outer range arc of the selected scan size. The FCR centerline symbol is dynamic and represents the relative FCR centerline position within the ATM format.

4.44 FCR TARGET INFORMATION L

FCR target information is prioritized by the FCR and used to direct the selected weapon against targets. Seven priority schemes are used by the FCR: 3 schemes are resident in the FCR (options **A** through **C**), 4 are available from the DTC (options **D** through **G**). The information can be processed for FCR target symbology overlay on flight and weapon symbology formats with the **C-SCP** selected. When FCR target data is displayed, switching from RMAP to GTM will display information in the selected format. Selecting ATM or TPM will eliminate all ground targeting data. Eliminated ground targeting data cannot be recalled for display. All target information is sent to the display processor for target symbology presentation on the FCR page (highest priority) or TSD (all targets).

4.44.1 C-SCOPE Processing. FCR target symbology is processed for overlay on the TADS/PNVS video by selecting the FCR page C-SCOPE (fig 4-57) or by pressing the RHG C-SCOPE switch. GTM and ATM provide a target symbol overlay display on TADS/PNVS video in C-scope format on the IHADSS, ORT or TDU. Target symbols are displayed in geometric fidelity over sensor video. Target symbols appear virtual in position on the display as the selected sensor is moved about. Only those symbols within the sensor FOV will appear on the format.

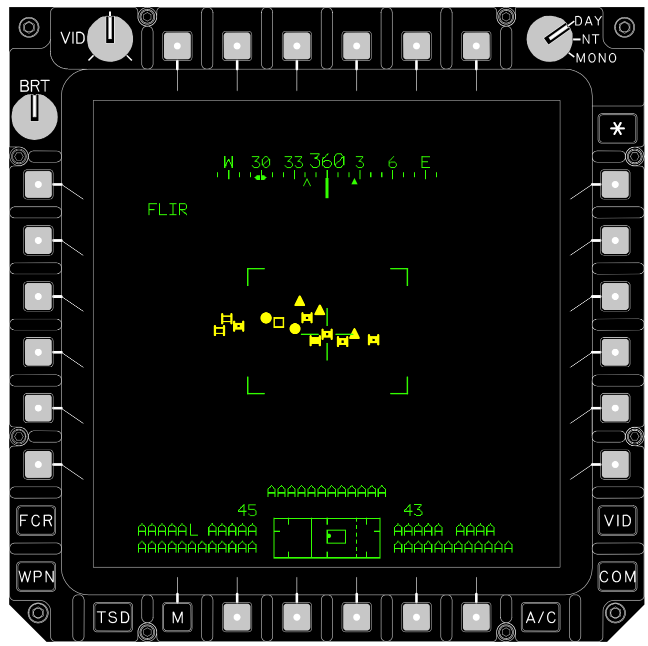

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Figure 4-57. C-Scope Presentation on Weapons Symbology

4.44.2 GTM Target Processing/Prioritization. GTM target symbols are displayed in any given scanburst. Target data is correlated from scan-to-scan during a scanburst to derive priority target characteristics (velocity and classification). Scan-to-scan correlation improves STI detection and classification and Moving Target Indicator (MTI) classification. Scan-to-scan correlation is also used to measure cross range velocity, and differentiate cross range moving targets from stationary targets. When a new scan is commanded, the FCR will clear its target file. Target types and location which are not stored in the threat file are lost. If single scan is selected, targets are correlated from scan-to-scan but not from scanburst-to-scanburst. As soon as a new scanburst is initiated, the priority and total target lists and total target count are cleared, reinitiated, and updated during the scan. In continuous scan, targets are correlated from scan-to-scan and from scanburst-to-scanburst.

4.44.3 Scanbursts. The processing and display of target data is unique to the type of scanburst, single or continuous. The scan burst supports scan-to-scan correlation without appreciably increasing timelines. Scan-to-scan correlation is a process which maintains track of detected targets between each scan. Correlating a burst of scans while keeping the timelines short is referred to as a single scanburst operation. Continuous scanburst operation provides various scan-to-scan correlations.

a. Single Scanburst.

- Priority target data, total target count, total targets, and map are purged at the start of each single scanburst and updated during the scanburst.
- Radar video is generated on the first scan in a wiper fashion.
- Priority target data is correlated from scan to scan.
- NTS is displayed at the end of the first scan and is updated by the WP as target information is prioritized by the FCR.
- To avoid re-engagement, shot-at target data is tagged.
- Stationary target symbols are displayed on the first scan, added during intermediate scans (threats added), and updated for classification during the final scan.
- Symbols are displayed in a wiper fashion during the first and last scan of a scanburst. During intermediate scans, only changes are displayed in azimuth order.
- Moving target symbols are displayed on the first scan and updated for classification during the final scan. Moving air defense units will always be displayed.
- RFI target merges are displayed during any scan.

b. Continuous Scanburst, **first scan**. Target data is displayed essentially the same as during a single scanburst.

c. Continuous Scanburst, **subsequent scans**:

- Priority target data, total target count and total targets are purged at the start of each scanburst and updated during the scanburst.
- Radar video is generated on the first scan in a wiper fashion.
- Priority target data is correlated from scanburst to scanburst.
- NTS is displayed at the end of the first scan and is updated by the WP as target information is prioritized by the FCR.
- To avoid re-engagement, shot-at target data is tagged.
- Stationary target symbols are added and updated for classification during the final scan. Threats are added during any scan.
- Targets blank as they exit the scan sector except for the NTS. NTS will become dashed and partial intensity when NTS is at the edge of sector scan (crew member may select new NTS).

4.44.4 FCR Target Symbols. A maximum of 16 FCR target symbols (fig 4-58) are displayed in any given scan. These symbols represent the highest priority targets detected and classified for that scan or scan burst. Target data is correlated from scan to scan during a scanburst to derive priority target characteristics (velocity and classification). Symbols are displayed in YELLOW by type target, type of anticipated missile launch (LOAL or LOBL), and a condition of moving or stationary. RFI detected emitters which have been correlated with radar target information is displayed by class and type within the scan sector of the format to indicate the threat/target location. Target symbols are dimmed after a period of time to indicate that the target data is stale. Moving target symbols become stale after 5 seconds and stationary target symbols become stale after 30 seconds. Low priority targets are displayed in partial intensity YELLOW on the TSD page as a half-size icon.

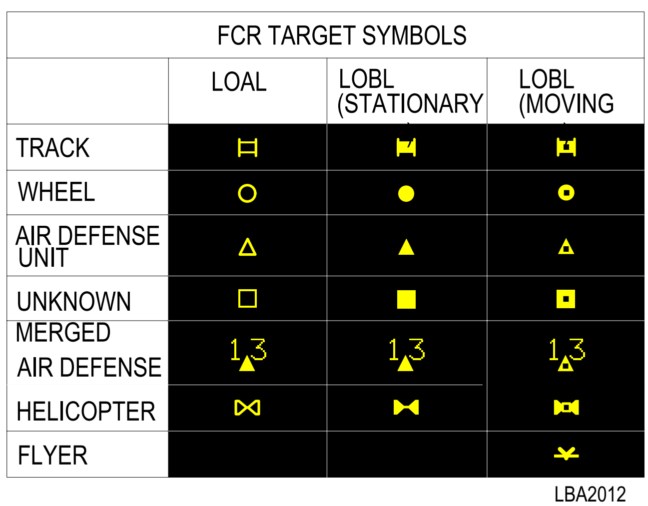

Figure 4-58. FCR Target Symbols

4.44.5 Priority of Fire Symbols. Unique symbols (fig 4-59) are designated to indicate the 2 highest priority targets: the NTS target and the alternate next-to-shoot (ANTS) target. FCR priority of fire indicators include the NTS symbol and the ANTS symbol.

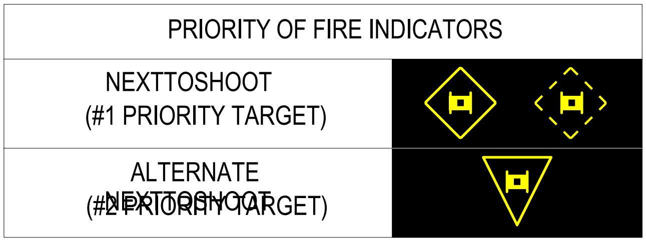

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Figure 4-59. NTS/ANTS Symbols

a. NTS Symbol. The NTS symbol is displayed in YELLOW around the highest priority target symbol within the sector scan to indicate the most significant target or threat information derived by the FCR. It will be initially displayed at the completion of the first scan of a scan burst. In addition, it is displayed around a priority target symbol as selected by the crewmember. The symbol is a dashed symbol when the crewmember has not actioned a weapon system. When FCR is the selected sight and the weapon system is actioned, the NTS target is frozen and the NTS symbol will become solid.

b. ANTS Symbol. The ANTS symbol is displayed in YELLOW concurrently with the NTS symbol to indicate the alternate NTS target, or #2 priority target in the automatic target selection sequence. The ANTS target is updated at the end of each far bar and is not frozen, *i.e.*, may change as per the selected priority scheme algorithm. Once the NTS target is frozen, and a target is detected that out-prioritizes the NTS target, the ANTS symbol will be automatically displayed on that target symbol and flash for 3 seconds. The operator may select the ENTER function to choose this target as the NTS. If the operator has not selected ENTER at the 3 second time limit, the ANTS symbol will remain over the target as it has become the new ANTS target.

4.44.6 Shot-At Symbol. The shot-at icon (fig 4-60) is displayed within the selected scan sector to indicate the locations at which Hellfire missiles have been launched (actual or simulated) by the ownship or received IDM BDA. Shot at target data is stored to the shot target file for display on the **TSD** page as described in chapter 3 and for display on the **FCR** page. This icon provides shot-at information for two situations on the **FCR** page.

- The symbol is displayed beneath target symbols during/after a scan burst and prior to a Hellfire missile launch.
- The symbol is displayed on top of a target symbol following a Hellfire missile launch at that target.

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Figure 4-60. Shot-At Symbol

4.44.7 Priority Fire Zone Symbol. Priority fire (PF) zones are displayed in WHITE as a convex or concave quadrilateral to indicate a geographic area in which target priority is established as highest for the processor prioritization and display. It will be displayed in the GTM mode (not presented in the RMAP mode). Only 1 PF zone will be active and displayed at a time as selected by the crewmember. This zone is constructed on the **TSD** page and displayed on the **FCR** page (described in chapter 3).

4.44.8 No Fire Zone Symbol. No fire (NF) zone is displayed in YELLOW as a convex or concave quadrilateral to indicate a geographic area in which target priority is established as prohibited for the processor prioritization and display. Only 1 NF zone will be active and displayed at a time as selected by the crewmember. This zone will be constructed on the **TSD** page and displayed on the **FCR** page (described in chapter 3).

4.45 RFI OPERATION L

RFI targeting is accomplished using the GTM, RMAP, and ATM modes. It occurs through the normal employment of the FCR or by performing a cued search.

4.45.1 Normal FCR Modes. RFI targeting data is processed and displayed as part of the normal operation of any FCR targeting mode. Uncorrelated RFI threat (outside FCR search area or not merged with a candidate FCR target) symbols are displayed, in azimuth, on the outer periphery of FCR GTM and ATM modes described above. RFI symbols are displayed in full intensity during the period when the RFI emitters are active. RFI symbols will be displayed in partial intensity after the emitters become inactive. The highest priority threat symbol, or #1 emitter as determined by the system, is displayed in conjunction with the RFI Box symbol. RFI emitters, detected within the fine coverage area of the RFI antenna, will be displayed by emitter type modifier symbol. RFI emitters detected within the coarse coverage area of the RFI antenna will be displayed by the type modifier number. Correlated threats are displayed within the selected format scan sector by class and type and threat/target location. Correlation may occur during or following a scan and is a product of target prioritization and priority weight standing. After correlation, an RFI threat symbol displayed on the outer periphery of the scan sector is removed.

4.45.2 Cued Search. The cued search function is used to rapidly position the FCR centerline to the line of bearing of an emitting threat as detected by the RFI. The search may be performed on targets which have been detected within the fine or coarse coverage regions of the RFI antenna to correlate the location of an emitting threat.

If the FCR is operating in ATM and the detected emitter is ground based, the FCR will default to GTM/RMAP to conduct the cued search. If the FCR is operating in GTM/RMAP and the detected emitter is airborne, the FCR will default to ATM to conduct the cued search. An FCR scanburst is completed in an attempt to correlate the location of the emitter as described below. After entering the cued search mode, selecting any FCR control function other than threat selection with the display cursor, rotary threat selection with the **CUED** switch, or activation of the scan switch will cause an exit from the cued search mode and revert to normal FCR control in current mode.

a. Cued Search Using CUED Switch. An FCR cued search is initiated by pressing the LHG or collective mission grip **CUED** switch. This orients the FCR antenna to the highest priority emitter or a selected emitter, sets the appropriate cued search scan size, and conducts a cued search to correlate the location of the RFI detected emitter. When an emitter selected for cued search is a ground vehicle, the FCR is commanded into a GTM mode and the FCR centerline is commanded to the azimuth of that emitter. If the emitter is located beyond the azimuth limits of the GTM (± 90° off the aircraft nose GTM Wide), the FCR will not perform a cued search. If this condition occurs, a **LIMITS** message will be displayed in the Sight Status Field of the HAD for a minimum of 10 seconds unless the FCR is sooner commanded to another function. If a second scanburst is desired, the LHG or collective mission grip FCR scan switch is momentarily positioned to **S-SCAN** to complete another scanburst in an attempt to correlate the location of the emitter. Pressing the **CUED** switch a second time will orient the FCR antenna to the next priority emitter. Continuing to press and release the **CUED** switch will continuously cycle the cued search through the existing list of detected emitters. If the **CUED** switch is pressed during a normal FCR scan, the scanburst will be discontinued and a cued search will be initiated.

b. Cued Search Display Cursor. Selecting a RFI detected target symbol on the periphery of the targeting format using the display cursor will command the FCR centerline to the line of bearing of the selected emitter and set the scan sector to the appropriate cued search scan size. The Selected RFI Box symbol will be displayed in conjunction with the selected threat symbol on each selection. When the LHG or collective mission grip FCR scan switch is momentarily positioned to **S-SCAN** the FCR will complete a scanburst in an attempt to correlate the location of the emitter.

4.45.3 ACQ Select RFI. With TADS or HMD as the selected sight, cueing or slaving to the azimuth of RFI emitters is available for visual target acquisition. Selecting RFI as the ACQ source, provides cueing or slaving of the RFI #1 emitter. If cueing or slaving to other than the #1 emitter is desired, then the emitter must be selected using the CAQ feature on either TSD or ASE top level page. Selection of other than #1 emitter with CAQ enabled, places an inverse video homeplate (selected emitter symbol) over that emitter. The selected emitter symbol is for display reference only, and does not change the ranking of emitters in the RFI emitter list. The selected emitter symbol will be displayed only in the crewstation that has made the selection.

4.45.4 RFI Detected Emitters. RFI threat symbols (fig 4-61) represent jammers and emitters. Up to 10 symbols can be displayed with the highest priority emitter identified by class and type. Friendly RFI emitters are displayed in CYAN and enemy/gray emitters are displayed in YELLOW. The RFI targets are further defined by coarse and fine bearing detection, and emitter classification. Tic marks in the RFI display area indicate the RFI coarse area of coverage in FCR wide scan. Prioritization and display criteria for RFI emitters are described as follows:

- Emitters that indicate immediate danger to the aircraft are always the highest priority.
- Emitters that indicate potential danger to other aircraft are the next lower priority. Sidelobes of a tracking radar that may be illuminating other aircraft are an example of this type.
- Emitters that indicate potential danger to the aircraft are the next lower priority. Surveillance radars are used to locate aircraft and hand over data to missiles. The FCR is an example of this type.
- Any emitter that is known to be associated with the enemy air defense system that is engageable by the immediate helicopter team is the next lower priority.
- Any emitter that is known to be associated with the enemy air defense system that is not engageable by the immediate helicopter team is the next lower priority.

After RFI emitters have ceased radiating for 30 seconds, the symbols will change to partial intensity. After 90 seconds of no transmission receipt, the symbols will blank. Correlated threats are displayed within the selected format scan sector by class, type, and threat/target location. RFI emitters, detected within the fine coverage area of the RFI antenna, will be displayed by emitter type modified symbol. RFI emitters detected within the coarse coverage area will be displayed by the type modifier number.

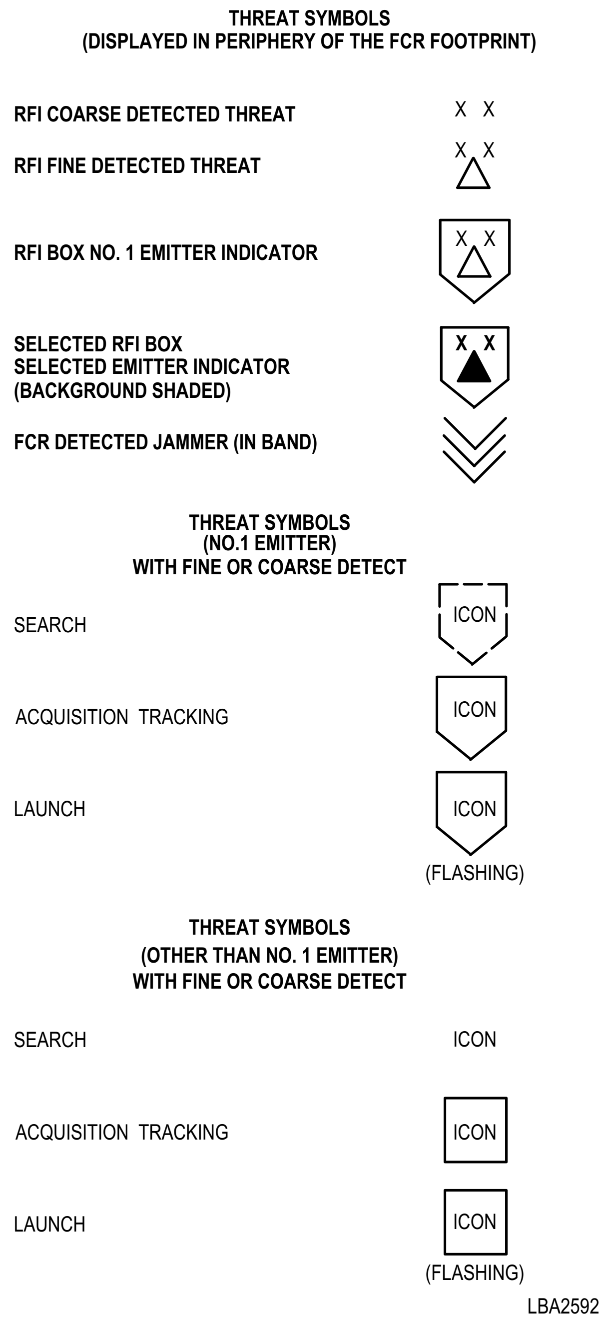


Figure 4-61. RFI Threat symbols

4.45.5 RFI Mode. The RFI can be switched to display all emitter detections or only hostile emitter detections. The **FCR** page RFI **MODE** button is used to select **ALL** or **HOSTILE** detected emitters.

4.45.6 RFI Train Mode. An RFI training mode can be selected using the **RFI TRAIN** button. The RFI training mode produces FCR generated RFI emitters which are displayed and processed the same as real RFI detected emitters.

Cued searches can be performed, and if GTM or ATM targets are displayed, the FCR will attempt to correlate and merge the data. While RFI train is selected, normal RFI operation is inhibited and no real threats will be detected or displayed.

4.46 BORESIGHT POSITION SYNCHRONIZATION (BPS) PAGE

4.46.1 BPS BORESIGHT Page Description. The BPS page (fig 4-62) provides the maintenance pilot with a means of boresighting the rotor system with the FCR scan beam. It also provides the operating crew a means to verify the displayed BPS **OFFSET** value.

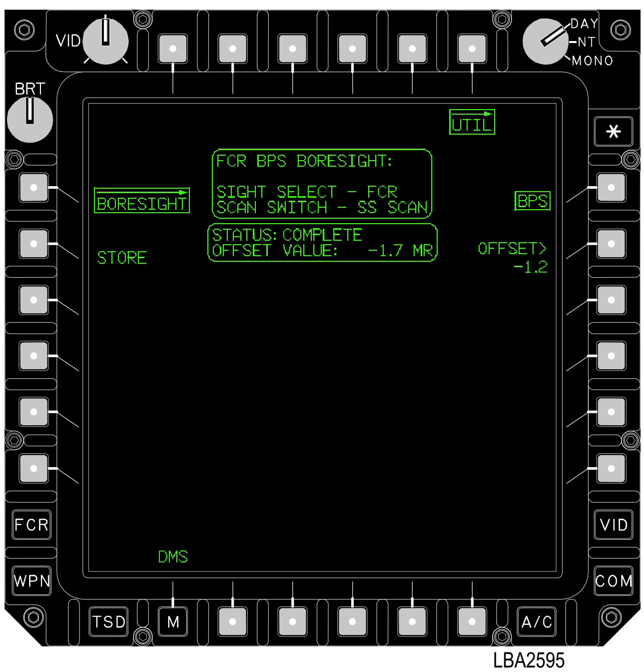


Figure 4-62. BPS Page

The BPS page contains the following unique buttons:

- T6 **UTIL** button
- L2 **STORE** button
- R1 **BPS** button
- R2 **OFFSET** button

4.46.2 STORE Button. The **BPS STORE** button is displayed only when the BPS has provided a valid scan feedback. It allows the crewmember to automatically store the new offset scan value into the WP. Once stored, the new value is displayed at the bottom mode of the **OFFSET** button.

4.46.3 BPS Button. The BPS Button provides the maintenance pilot with a means of conducting the blade position sensor boresight on the aircraft. The BPS mode is an FCR mode that detects the time (angle) of offset between the rotor blade sensor and the FCR beam. The scan calculation characterizes the dynamic interference condition between the rotor blades and the FCR beam. A blade position indicator angle (offset value) can be then provided to the WP, once the crewmember decides to accept the new value. The intended effect is to maximize the overall FCR performance by synchronizing rotor blade position with FCR emission and reception.

4.46.4 Conditions For Use. The BPS boresight can only be performed if certain specified dynamic air data conditions and aircraft sensor conditions are met. These conditions are:

a. The FCR is powered **ON** and operational with BIT complete.

b. The aircraft is between 200 and 300 ft AGL.

c. The aircraft velocities are less than 5 km/hr in all axes.

d. The blade tracker is locked.

e. The radar altimeter is operational and producing valid data.

4.46.5 OFFSET Button. The **BPS OFFSET** button displays the currently stored (last stored) blade position offset value. Depressing the button provides the crewmember with the capability to manually edit the currently stored blade position sensor value via the KU.

4.47 SIGHT SELECTION

The right handgrip (RHG) or collective mission grip sight select switch is a momentary contact switch used to select the helmet mounted display (**HMD**), **TADS**, or **FCR** **L** as the active LOS for weapons processing. The sight select switch also incorporates a **LINK** **L** function. Sight select functions are as follows:

4.47.1 Sight Select HMD. When HMD is the selected sight, HMD is the active line of sight for weapons processing. Selecting any other sight will deselect the HMD.

4.47.2 Sight Select TADS. When TADS is the selected sight in the CPG station, TADS is the active line of sight for weapons processing. Selecting FCR will deselect TADS and the TADS will be commanded to **FXD** unless FCR was linked to TADS. In this case, the TADS LOS will remain at its current position. The TADS position of this switch is not active in the pilot station.

4.47.3 Sight Select FCR **L**. When FCR is the selected sight, FCR (NTS) in that crew station is the active line of sight for weapons processing. This selection also calls up the FCR page targeting format for the selected mode on the left MPD (if not already displayed). Selecting TADS will deselect FCR and the FCR will be commanded to FXD unless TADS was linked to FCR. In this case the FCR (centerline) will remain at its current position. Selection of the FCR from either crew station is based on a last-to-select logic. If accepting an RFHO while sight select is **FCR**, then targeting data will be provided from the IDM data and not ownship radar.

4.47.4 Sight LINK Function **L**. The link function is used to set the FCR centerline to the TADS LOS when the selected sight is TADS or to set the TADS LOS to the FCR NTS LOS when the selected sight is FCR in the CPG station. In the pilot station, it is used only to set the TADS LOS to the FCR NTS LOS. Placing the switch momentarily down to the **LINK** position will toggle the **LINK** mode alternately between ON and OFF in either crew station. The link function operates as described below:

a. If TADS is the selected sight and **LINK** is selected, the FCR azimuth scan centerline is aligned to the TADS LOS. If a single or continuous scanburst is selected, the FCR scan centerline will not follow TADS movement until the scan is complete. A continuous scanburst must be deselected before the scan centerline is realigned to the TADS LOS.

b. If the FCR is the selected sight and **LINK** is selected, the TADS LOS is aligned to the FCR next-to-shoot (NTS) target at the completion of a single scanburst or at the completion of each scanburst within a scanburst. During continuous scanburst, the TADS LOS is set to the FCR NTS target at the completion of a scanburst. When the RF missile seeker is in a track state, the TADS LOS is aligned to the seeker LOS. When no NTS is detected, the **LINK** selection is ignored.

c. f the CPG selected sight is FCR and **LINK** is selected, selecting the RHG **SLAVE** switch allows the CPG to manually offset the TADS LOS from the NTS. This can be used to view the area surrounding the NTS or to keep the target centered when going to narrower Fields of View on the TADS. Re-selecting the RHG **SLAVE** switch forces the TADS back to the NTS position.

d. The link function is ignored when the selected sight is helmet mounted display (HMD) or when both TADS and FCR are sight and acquisition selects.

e. The link function is set to off when a sight or acquisition selection is made that does not comply with the conditions mentioned above.

f. Either crewmember has the ability to **LINK** the FCR or TADS away from the other crewmember. For example, if the CPG's selected sight is TADS and the pilot selects **LINK**, the CPG's sight will automatically change to HMD. If the CPG then reselects TADS, the pilot's link function will be set to off.

g. If the pilot selected sight is FCR and **LINK** is selected, the TADS FOV will automatically change to wide if DVO (ORT only) or DTV is the selected sensor, or medium if FLIR is the selected sensor. Subsequently, sensor and FOV selections can be made by the CPG.

4.48 ACQUISITION SOURCE SELECTION

An acquisition source is selected by the pilot or CPG, using the **WPN** page, the **FCR** page **L**, or **TSD** page **ACQ** button. This selection is independent in each crew station. When an acquisition source is selected, the selected sight can be slaved or provide cueing to the acquisition source LOS/coordinate point. After a sight and an acquisition source are selected, slaving and/or cueing in the CPG station is selected by pressing the RHG **SLAVE** switch. Selecting a different acquisition source or pressing the RHG **SLAVE** switch again in the CPG station deselects slave. In the pilot station, slaving and/or cueing is in effect on selection of an acquisition source. If an invalid acquisition LOS condition is created, the acquisition source is defaulted to **FXD**. Acquisition options are not displayed when that acquisition source is not available (not powered or failed). In addition, an acquisition option will not be displayed when the option is not valid based on the selected sight.

4.48.1 Available Acquisition Sources.

a. Pilot Acquisition Sources. The pilot receives cueing data upon selection of an acquisition source when the sight selected is HMD. The slaving of the FCR is provided when the FCR is the selected sight. Cueing can be turned off in pilot's crewstation via the WPN **UTIL** page. Slaving of the FCR can not be turned off. The pilot may use as an acquisition source:

- PHS - Own HMD (available only when the sight is FCR.)
- GHS - CPG helmet sight.
- SKR - Tracking missile seeker

(1) Hellfire laser seeker is tracking laser energy ei ther ownship or remote designator.

(2) RF Hellfire is tracking a next-to-shoot target.

- RFI - Highest priority RFI detected emitter azimuth.
- FCR - The next-to-shoot target LOS.
- FXD - Fixed forward (centerline of the aircraft with an elevation relative to the airframe of negative 4.9°).
- TADS.
- W01, C51, T01 - One of the stored waypoints hazards, control measures, or target/threat points.

b. CPG Acquisition Sources. The CPG is required to manually "slave" the selected sight to the acquisition LOS via the RHG Slave control. The CPG has the added capability, via a single action, to **LINK** the FCR to the TADS LOS in order to obtain more detail on the acquired target. If the CPG selects (changes) an acquisition source, the slave function is automatically set to off. Slaving and/or cueing will be in effect upon actuating the SLAVE switch to on. The CPG may use as an acquisition source:

- PHS - Pilot's HMD LOS.
- GHS - Own HMD (when it is not the selected sight).
- SKR - Tracking missile seeker.

(1) Hellfire laser seeker is tracking laser energy ei ther ownship or remote designator.

(2) RF Hellfire is tracking a next-to-shoot target.

- RFI - Highest priority RFI detected emitter azimuth.
- FCR - The next-to-shoot target LOS (when the sight is either TADS or HMD).
- FXD - Fixed forward (centerline of the aircraft with an elevation relative to the airframe of negative 4.9°).
- TADS (when it is not the selected sight).
- W01, C51, T01 - One of the stored waypoints, hazards, control measures, or target/threat points.

Both the pilot and CPG have the added feature of being able to LINK the TADS to the FCR LOS via a single action. This feature allows the visual confirmation of targets, helping in the reduction of potential fratricide.

4.48.2 Sight Selection Acquisition Source. The following matrix (table 4-20) provides an indication of what cueing and/or slaving is provided for each crewmember based on the selected sight and the selected acquisition source.

Table 4-20. Sight Selection/Crewstation/Acquisition Source Matrix

Selected Sight	Crewstation	Acquisition Source	Slaving Provided	Cueing Provided	Not Valid/ Not Available	Notes
TADS	PLT	PHS			X	
		GHS			X	
		SKR			X	
		RFI			X	
		FCR			X	
		FXD			X	
		TADS			X	
		Txx			X	
		TRN			X	

Table 4-20. Sight Selection/Crewstation/Acquisition Source Matrix (cont)

Selected Sight	Crewstation	Acquisition Source	Slaving Provided	Cueing Provided	Not Valid/ Not Available	Notes
TADS	CPG	PHS	X	X		1,2
		GHS	X	X		1,2
		SKR	X	X		1,2,7
		RFI	X	X		1,2,8
		FCR	X	X		1,2,9
		FXD	X	X		1,2
		TADS			X	12
		Txx	X	X		12
		TRN	X	X		1,2
FCR	PLT	PHS	X			5
		GHS	X			
		SKR	X			7
		RFI			X	6,8
		FCR			X	10
		FXD	X			
		TADS	X			13
		Txx	X			
		TRN	X			
FCR	CPG	PHS	X			4
		GHS	X			4
		SKR	X			4,7
		RFI			X	14
		FCR			X	10
		FXD	X			11
		TADS	X			4,13
		Txx	X			4
		TRN	X			4
HMD	PLT	PHS			X	
		GHS		X		6
		SKR		X		6,7
		RFI		X		6,8
		FCR		X		6,9
		FXD		X		6
		TADS		X		6
		Txx		X		6
		TRN		X		6

Table 4-20. Sight Selection/Crewstation/Acquisition Source Matrix (cont)

Selected Sight	Crewstation	Acquisition Source	Slaving Provided	Cueing Provided	Not Valid/ Not Available	Notes
HMD	CPG	PHS		X		1,3
		GHS			X	
		SKR		X		1,3,7
		RFI		X		1,3,8
		FCR		X		1,3,9
		FXD		X		1,3
		TADS		X		1,3
		Txx		X		1,3
		TRN		X		1,3

NOTE: TADS is not available for sight selection if either crewmember is using it as a sensor (i.e. NVS MODE switch in NORM or FXD). Pilot can not sight select TADS.

NOTES:

1. When the RHG SLAVE switch is actuated to slaved, cueing dots and the cued LOS reticle will be displayed on the ORT or TEDAC displays and the HMD to provide cueing to the selected acquisition LOS.
2. When the RHG SLAVE switch is actuated to not slaved, the TADS LOS is controlled by the manual tracker and no cueing is displayed.
3. When the RHG SLAVE switch is actuated to not slaved, no cueing is displayed.
4. When the RHG SLAVE switch is actuated to slaved, the FCR centerline will be set to the selected acquisition LOS. When the SLAVE switch is actuated to not slaved, the FCR centerline is controlled by the manual tracker and/or the arrow buttons on the FCR page.
5. When selected, the FCR centerline will be set to the PHS LOS unless the pilot has manually moved the centerline using the MPD arrow buttons on the FCR page.
6. When selected, cueing dots and the cued LOS reticle will be displayed on the HMD providing cueing to the selected acquisition LOS.
7. The tracking priority missile seeker LOS will be the selected acquisition LOS with the tracking priority missile seeker defined as follows: SAL - tracking the priority laser channel, RF - tracking the NTS target, or ATA - uncaged and tracking.
8. The #1 RFI or selected RFI emitter is the selected acquisition LOS, with slaving and/or cueing provided to the azimuth of the RFI emitter and 0° elevation (local horizontal).
9. The FCR NTS is the selected acquisition LOS. If no valid NTS target exists, the slaving and/or cueing is not provided. The data used for the FCR NTS LOS can be derived from autonomous FCR target data or from FCR target data received via the IDM.
10. If FCR is the selected sight or if the FCR is linked to the TADS LOS.When the ORT SLAVE switch is actuated to slaved, the FCR centerline will be set to the FXD forward position.
11. When the RHG SLAVE switch is actuated to not slaved, the FCR centerline will be controlled by the manual tracker and the FCR centerline will be commanded to the start scan position (offset to the left) to reduce the time to start scan.
12. If TADS is the selected sight or the TADS is linked to the FCR NTS LOS.
13. Not available if TADS is linked to the FCR NTS LOS.
14. Cued search is used to rapidly scan RFI detected targets with the FCR.

4.49 RANGE AND RANGE SOURCE SELECTION

The weapons processor uses the last range obtained (laser, FCR L, coordinate point, manual, or automatic). The range will be used by the weapons processor until another valid range source is selected or data from the current range source becomes invalid. A default range is used when no range is in memory or when range cannot be computed from the existing source. An automatic or manual range source can be selected from the weapon page; however, a manual range cannot be entered when FCR is the selected sight. Range and range source is displayed in the HAD on the IHADSS flight and weapons symbology formats as well as the **FCR** page L.

4.49.1 Laser Range. When the CPG fires the laser using the RHG laser trigger, laser becomes the range source. Squeezing the laser trigger switch to the first detent fires 3 burst of laser energy in 1 second for target ranging. Squeezing the laser trigger to the second detent fires a continuous burst of laser energy for target designation and continuous range updates. The display range is 500 to 9999 in 1m increments (XXXX).

4.49.2 Radar Range L. When FCR transmit is activated using the collective mission grip or LHG scan select switch, radar becomes the range source. Radar range is entered when the pilot or CPG activates the FCR scan select switch. The weapons processor uses the NTS target range as pilot or CPG range as appropriate. If the aircraft is equipped with MTADS provisions, and a manual range has been entered, radar range may be reestablished by selecting a NTS target or conducting a new scan. The display range is 0.0 to 9.9 in km and tenths of km increments (RXX.X).

4.49.3 Target Range. Target range is the navigation range from the helicopter present position to a coordinate point. Target range is entered automatically when a coordinate point (TXX, WXX, CXX or [BLK 2 TRN]) is selected as the acquisition source and the RHG **SLAVE** is pressed to select slave. If the aircraft is equipped with MTADS provisions, and a manual range has been entered, target range may be reestablished by again selecting the coordinate point as the acquisition source. The display range is 0.1 to 32.0 in tenths of km increments (NXX.X).

4.49.4 Manual Range Entry. Selecting the WPN page **MANRNG** button and entering a numeric range (manual) or entering an alphabetic letter **A** (automatic) on the KU initially selects a range source for the weapons processor.

a. Manual Range. Entering a numeric range for selected sight ranging on the KU selects an initial range for the weapons processor to use. The range entry is from 100m to 50,000m in 1m increments. The display range is 0.1 to 50.0 in km and tenths of km increments (MXX.X).

b. Automatic Range. Entering **A** on the KU selects automatic range for the weapons processor. The weapons processor calculates range of the selected sight LOS at intercept with the target, which is assumed to be at zero radar altitude. The display range is 0.1 to 50.0 in km and tenths of km increments (AXX.X).

4.49.5 Default Range. A default range is used when no range is in memory at power-up, or when range cannot be computed from the existing source. Default range for the CPG is 3.0 km. Default range for the pilot is 1.5 km. The weapons processor will use the default range until a valid range source is used or until a valid range can be calculated from the original range source.

4.49.6 HMD - Gun Default Range. If the aircraft is equipped with MTADS provisions, range will default to manual range when HMD is the selected sight and the gun system is actioned. If the manual range is zero, the default range for that crew station will be used.

4.50 SIGHT SUBSYSTEM - DEGRADED MODES OF OPERATION

4.50.1 TEU Fail. If the TEU fails, PNVS is commanded to direct mode by the weapons processor. When PNVS is in direct mode, PNVS turret movement is controlled by IHADSS and the PNVS electronic unit (PEU). In PNVS direct, azimuth coverage is limited to ± 75° with degraded LOS accuracy. PNVS turret movement may become erratic beyond ± 75°.

4.50.2 IHADSS Fail. If IHADSS video or position control commands fail, the pilot/CPG NVS MODE switch should be set to FIXED. The PNVS turret is commanded to fixed forward and the PNVS image is displayed on an MPD without azimuth or elevation correction.

4.50.3 IHADSS Single DP Operation. During single DP operation both crewstations share common symbology and imagery on their HMDs. Symbology brightness is controlled by the crewmember whose symbology and imagery is presented on both HMDs. Control of the HMD presentation is as follows: If the **NVS MODE** switch is **OFF** in both crewstations the pilot's symbology and imagery will be presented on both HMDs. If only one crewmember's **NVS MODE** switch is **NORM** or **FIXED**, that crewmember's symbology and imagery will be presented on both HMDs. If both crewmembers' **NVS MODE** switches are **NORM** or **FIXED**, the symbology and imagery of pilot will be displayed. Subsequent selection of the **NVS** switch will select the crewmember's symbology and imagery. The **HMD FORMAT OWNER CUE** (Figure 4-27) will be displayed with the appropriate format while operating in single DP. The **HMD FORMAT OWNER CUE** will flash for three seconds and then remain displayed in a solid message layout when the format ownership is changed and DP operation changes from normal to single. The **HMD FORMAT OWNER CUE** will flash for three seconds when

DP operations changes from single to normal operation and then extinguish. In single DP operation the crewmember viewing the opposite format is inhibited from firing the weapon systems.

MPD VIDEO Page presentation of PILOT HMD or CPG HMD underlay selections will continue to display dual DP format and imagery. Therefore, the MPD may display a video and format that does not match the HMD display. This may be used to the crewmenbers advantage, as it enables the crewmember to observe the video/format of their sensor on the MPD during single DP operation.

4.50.4 PNVS Fail. In the event of a PNVS failure, TADS FLIR can be switched to pilot control as emergency backup. The pilot sets the collective flight control grip night vision select switch to TADS. The TADS assembly is slaved to the pilot helmet LOS and **FOV** is set to **WFOV**. The slew rate of the TADS turret assembly is slower than the PNVS turret assembly.

4.50.4A Video Fail Conditions

a. Frozen Video Frozen video occurs due to loss of video link communications. The result of this failure will be frozen video and a **VIDEO FROZEN** status message. Video will be removed if it remains frozen for more than four seconds.

b. Degraded Video Degraded video occurs when errors are detected in the video signal. The result of this condition may be degradation of all or a portion of the video image and a **VIDEO DEGR** status message. Video will not be removed in this condition.

c. Loss of Bus Communications In the event bus communications is lost, the turret (TADS or PNVS) will move to fixed forward in five seconds. Video will switch to FLIR if DTV or DVO is selected and the sensor will switch to WFOV if not currently selected.

4.50.5 FCR Overtemperature L. The FCR MMA, LPRF, and PSP contain temperature sensors which are located near heat producing or heat sensitive components. When any temperature sensor detects 80-90% of an overheat threshold, an **FCR HOT** message is displayed on the HAD and the DMS page. If the FCR is allowed to operate until the maximum temperature threshold is reached, the FCR will automatically shut down. The FCR overtemperature shutdown can be inhibited by selecting the FCR utility page **FCR TEMP ORIDE** button after receiving the **FCR HOT** message prior to reaching the maximum temperature threshold. With the automatic shutdown inhibited, the FCR will continue to operate (with possible degraded system performance) until permanent damage occurs. If the FCR detects a maximum temperature threshold without override command, the FCR will be powered down by the weapons processor and an **FCR SHUTDOWN HOT** message will be displayed on the DMS page.

4.50.6 FCR Useable Range L. FCR usable range can be reduced by transmitter, receiver, or LPRF failures. Receiver and LPRF failures usually result in an FCR not operational fault. One of the messages described below will be displayed only on the **DMS** page. The transmitter is the highest failure rate item. The transmitter failure rate is dominated by 4 identical multipliers. The multiplier outputs are summed together to produce the desired transmitter power output. Each multiplier has a BIT monitor. If one multiplier is bad, an **FCR RANGE 10% DEGR** message is displayed. If 2 multipliers are bad, an **FCR RANGE 20% DEGR** message is displayed. If three multipliers are bad, an **FCR RANGE 35% DEGR** message is displayed. If all 4 multipliers are bad, the FCR is not operational.

4.50.7 RFI Only Operational with FCR Not Operational L. If the radar fails, the FCR can be configured for RFI only mode operation. To configure the FCR for RFI only operation, the MMA is mechanically pinned to fixed forward and the RFI processor is connected to multiplex bus 3A/B (TM 1-1520-251-CD). When aircraft power is applied, the MMA mode is set to **PINNED** on the **WPN** or FCR **UTIL** page, which subsequently allows selection of the RFI **ON/OFF** button. With RFI selected **ON**, RFI detected emitters will be displayed on the **ASE** page and **TSD** page.The flight crew can select **BIT ORIDE** anytime during the BIT sequence. When FCR **BIT ORIDE** is selected from the FCR utility page, Initiated BIT (IBIT) will only conduct critical item BIT and will terminate early (after a minimum run time of approximately 25 - 45 seconds), and the FCR will go directly to the selected mode of operation. Continuous BIT will still provide notification of FCR functional status but will not detect faults that require intrusive testing. It is recommended that IBIT is selected to run the entire BIT when the situation permits.

4.50.8 FCR BIT Override L. The flight crew can select **BIT ORIDE** anytime during the BIT sequence. When FCR **BIT ORIDE** is selected from the FCR utility page, Initiated BIT (IBIT) will only conduct critical item BIT and will terminate early (after a minimum run time of approximately 25 - 45 seconds), and the FCR will go directly to the selected mode of operation. Continuous BIT will still provide notification of FCR functional status but will not detect faults that require intrusive testing. It is recommended that IBIT is selected to run the entire BIT when the situation permits.

4.50.9 Degraded FCR Modes L. Partial failure of ATM, GTM, or TPM functions, directed by BIT, will cause **FCR MTI DEGR, FCR STI DEGR, FCR STI FAIL**, or **FCR TPM DEGR** messages to be displayed on the DMS page. The FCR will continue to operate without all of the operating mode features available for use.

4.50.10 Degraded FCR Azimuth Servo L. Faults detected in azimuth rate sensing circuits can cause a **FCR AZ SERVO DEGR** message to be displayed on the DMS page. The effects of the degraded azimuth servo condition can be reduced by minimizing yaw motion of the aircraft during scanning. This degraded condition could occur at the same time as a degraded elevation servo (para 4.50.11). If degraded azimuth and elevation servo indications occur at the same time, minimize yaw, pitch, and roll motion of the aircraft during scanning. If the azimuth servo is detected as not operational, a **FCR FAIL** message will be displayed.

4.50.11 Degraded FCR Elevation Servo L. Faults detected in elevation rate sensing circuits can cause a **FCR EL SCAN DEGR** message to be displayed on the DMS page. The effects of the degraded elevation servo condition can be reduced by minimizing pitch and roll motion of the aircraft during scanning. This degraded condition could occur at the same time as a degraded azimuth servo (para 4.50.10). If degraded azimuth and elevation servo indications occur at the same time, minimize yaw, pitch, and roll motion of the aircraft during scanning. If the elevation servo is detected as not operational, a **FCR FAIL** message will be displayed.

4.50.12 FCR to Missile Target Assignment Status L. Faults detected in FCR hardware that could cause azimuth or elevation pointing errors during RF missile target assignments will cause a **FCR HANDOVER DEGR** message to be displayed on the DMS page. This fault could direct the missile (LOBL recommended for this fault condition) to a LOS that will not allow the missile to acquire the target or will direct the missile to acquire the wrong target. The TADS/PNVS LOS should be aligned to the FCR NTS or the tracking seeker LOS for desired target verification.

4.50.13 Potential Jamming of FCR Calibrations L. The effects of a potential jammer on FCR calibrations cause a **FCR CAL JAMMED** message to be displayed on the DMS page. The effect of a potential jammer on calibrations can be reduced by changing the start position of a sector scan. During a circular scan, reposition the aircraft in yaw.

4.50.14 RFI Degraded L. Degraded RFI operation is indicated by an **RFI DEGR** message displayed on the DMS page. When this message is displayed, RFI information may be unreliable.

4.50.15 FCR Functional Loss Messages L. The following **DMS** page fault messages indicate that the **FCR/RFI** has lost some or all operational capability. There may not be a **HAD** message related to functional losses that degrade operation without complete loss of operation. Table 4-21 list the **DMS** page FCR functional loss messages, description, and corrective action (if any) for possible continued operation. Any message displayed while the FCR remains in operation indicates that maintenance should be performed as soon as possible.

Table 4-21. DMS Page FCR Functional Loss Messages L

Message	Description
FCR AZ SERVO DEGR	Indicates that the FCR azimuth scan capability is degraded. Refer to paragraph 4.50.10 for corrective action.
FCR BIT LOG INOP	Indicates that the FCR has lost the ability to store BIT data. FCR mission capabilities are still fully functional.
FCR BIT LOG LIMIT	Indicates that the FCR has reached a BIT data storage limit. FCR mission capabilities are still fully functional.
FCR BPI DEGR	Indicates that the FCR has detected a BPI failure. FCR target information may be unreliable.
FCR CALS DEGR	Indicates that the FCR can not recalibrate. System accuracy will degrade over time.
FCR CAL JAMMED	Indicates that the FCR may be jammed during calibration (para 4.50.13).
FCR FDI DEGR	Indicates that FCR fault detection/isolation capability has been degraded.
FCR EL SCAN DEGR	Indicates that the FCR elevation scan capability is degraded. Refer to paragraph 4.50.11 for corrective action.
FCR FAIL	Indicates that the FCR has been shutdown as non-operational. RFI only operation may be possible (para 4.50.7). Message will be cleared if power is applied to the FCR.
FCR HANDOVER DEGR	Indicates that FCR to missile target assignment is degraded (para 4.50.12).
FCR HOT	Indicates that FCR has detected 80-90% of an overtemperature threshold (para 4.50.5).
FCR INOP ZEROIZED	Indicates that FCR nonvolatile has been zeroized. The FCR is not operational. The FCR PSP nonvolatile memory ECA must be removed and reprogrammed or replaced.

Table 4-21. DMS Page FCR Functional Loss Messages L

Table 4-21. DMS Page FCR Functional Loss Messages

Message	Description
FCR MMA COOL DEGR	Indicates that the FCR MMA cooling fan is not operational. An overtemperature condition could be the result (para 4.50.5).
FCR MTI DEGR	Indicates that MTI is degraded. Moving targets may not be detected or may be shown with the wrong classification. FCR operation in other modes may still be possible (para 4.50.9).
FCR RADAR DEGR	Indicates that any FCR data could be invalid (symbol position in azimuth or elevation, classification, etc.
FCR RANGE 10% DEGR	Indicates that FCR range is 90% of full capability (para 4.50.6).
FCR RANGE 20% DEGR	Indicates that FCR range is 80% of full capability (para 4.50.6).
FCR RANGE 35% DEGR	Indicates that FCR range is 65% of full capability (para 4.50.6).
FCR RESTART DEGR	Indicates that the FCR has lost the ability to initiate a warm start sequence.
FCR SHUTDOWN HOT	Indicates that the FCR has been shutdown as a result of a detected overtemperature condition. Message will be cleared if power is applied to the FCR.
FCR STI DEGR	Indicates that STI is degraded. Stationary targets may not be detected or classified. FCR operation in other modes may still be possible (para 4.50.9).
FCR STI FAIL	Indicates that STI has failed. Stationary targets may not be detected or classified. FCR operation in other modes may still be possible (para 4.50.9).
FCR TPM DEGR	Indicates that TPM is degraded. Obstacle symbol or profile line elevation position may be wrong. FCR operation in other modes may still be possible (para 4.50.9).
FCR VIDEO DEGR	Indicates that FCR RMAP/TPM radar video generation capability is degraded.
FCR VID ZOOM DEGR	Indicates that FCR RMAP radar video may be degraded in display zoom operation.
FCR VOLTAGE DEGR	Indicates that an FCR power supply voltage is out of tolerance. FCR information may be unreliable.
RFI BPI DEGR	Indicates that the RFI has detected a BPI failure. RFI information may be unreliable.
RFI DEGR	Indicates that RFI information may be unreliable (para 4.50.14).
RFI FAIL	Indicates that the RFI is not operational.

4.51 VIDEO SUBSYSTEM

The Video Subsystem provides real time composite video for the MPDs **VIDEO** page and VCR. Composite video is composed of TADS FLIR, TADS DTV, PNVS FLIR with Flight/Weapon format symbology, or FCR L imagery with symbology. The MPDs can display real-time sensor video underneath all other MPD format symbology. Each crew station can select the **VIDEO** page for independent display on either of their MPDs. Either crewmember can access the video recorder controls to select what is to be recorded, to start and stop recording, and to play recorded video. Sensor information does not have to be displayed to be recorded.

Only one sensor can be recorded at a time. Once selected, the video recorder will record the selected system in the format it would be presented to the crewmember.

4.51.1 [BLK 1 **Video Recorder**. The video recorder records 875 line video, and is located in the right aft avionics bay. The recorder controls are available to both crewmembers through the **VCR** page. Tape length control is also available through the LMP.]

4.51.2 [BLK 2 **Video Recorder**. The video recorder records 525 line video, and is located in the right aft avionics bay. The recorder controls are available to both crewmembers through the **VCR** page.]

4.52 CONTROLS AND DISPLAYS

Controls and displays are integrated into the following major Video Subsystem components:

- Video recorder controls
- [BLK 1 Load Maintenance Panel controls]
- Communications Panel controls
- Multipurpose displays (MPDs)

4.52.1 Left Hand Grip. The LHG Video Record pushbutton (fig 4-63) toggles the VCR between its default mode (**STOP** or **STANDBY**), and **RECORD** modes.

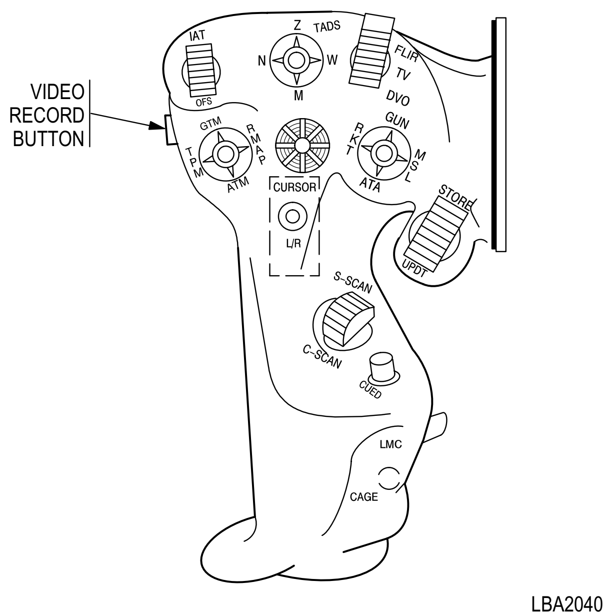


Figure 4-63. Left Hand Grip Control

4.52.2 Video Recorder Controls. Recorder controls are provided through the crew station **VCR** page.

4.52.3 [**BLK 1** **Load Maintenance Panel Controls**. The Load Maintenance Panel can be used by the ground personnel to indicate what tape length has been loaded.]

4.52.4 [**BLK 1** **Communications (COMM) Panel Controls**. The VCR provides a short tone when the crew commands an event mark. This tone and audio playback volume within each headset can be independently controlled with the **VCR** rotary knob on the **COMM** panel. If any radio is operating in a secure mode, no audio is recorded. Monitored radio and other headset audio for the crewmember that selected VCR recording is recorded at a constant volume.]

4.52.5 [**BLK 2** **Communications (COMM) Panel Controls**. Audio playback volume within each headset can be independently controlled with the **VCR** rotary knob on the **COMM** panel. If any radio is operating in a secure mode, no audio is recorded. Monitored radio and other headset audio for the crewmember that selected VCR recording is recorded at a constant volume.]

4.53 VIDEO PAGE

The **VIDEO** page (fig 4-64A) is used to select **VCR** for real-time video display, select **IMAGE** for still pictures, select **G/S** for display optimization, and mode operation for the **VIDEO** page in that crew station. If the **VIDEO** page underlay buttons are set to **NO VIDEO**, and the pilot selects the **VIDEO** page, the pilot's HMD underlay will be selected by default. This gives the pilot the ability to quickly access his active NVS underlay (PNVS or TADS) in the event of HMD failure. If there is no real-time video presented on an MPD, and the CPG selects the **VIDEO** page, the CPG's sight video underlay will be selected by default.

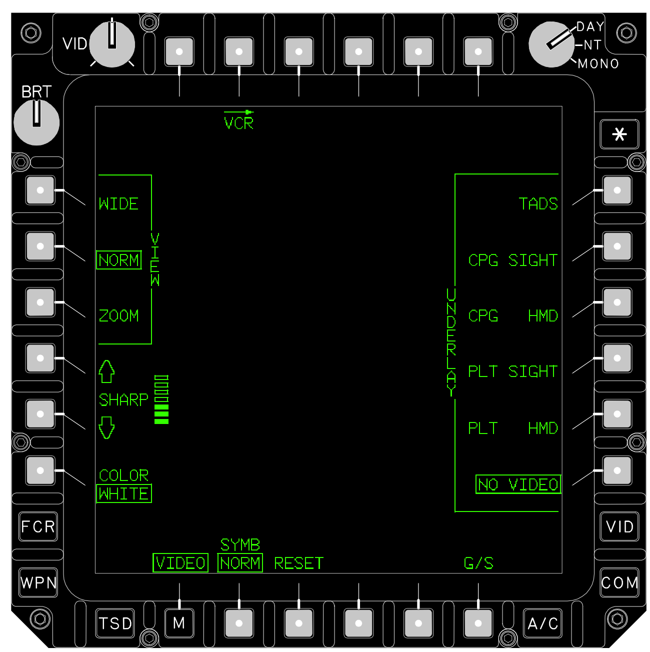


Figure 4-64. [BLK 1 VIDEO Page]

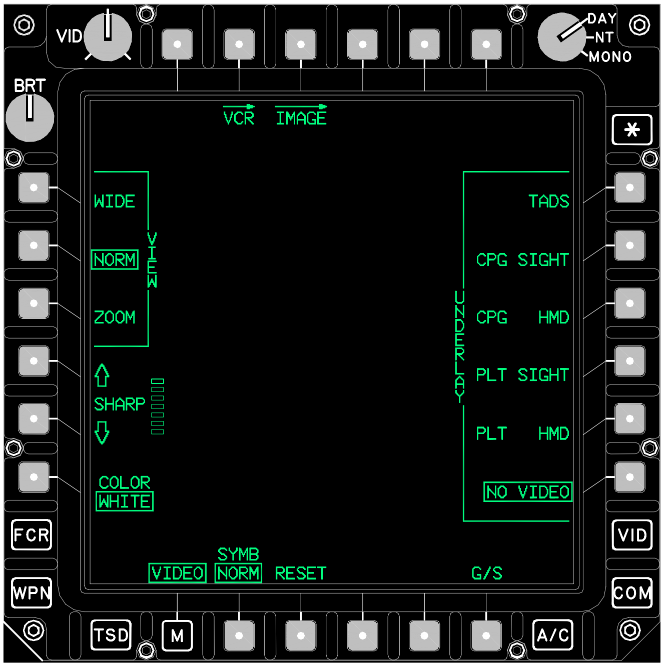


Figure 4-64A. [BLK 2 VIDEO Page]

The following buttons can be found on the **VIDEO** page:

- T2 **VCR** button
- T3 **IMAGE** button
- T6 Video Symbology Select button (**C-FLT**, **P-FLT**, **TADS**, **C-FCR**, or **P-FCR)**
- L1 **VIEW WIDE** Button
- L2 **VIEW NORM**al button
- L3 **VIEW ZOOM** button
- L4 **SHARP** scroll up button
- L5 **SHARP** scroll down button
- L6 **COLOR WHITE/GREEN** button
- R1 **UNDERLAY TADS** button
- R2 **UNDERLAY CPG SIGHT** button
- R3 **UNDERLAY CPG HMD** button
- R4 **UNDERLAY PLT SIGHT** button
- R5 **UNDERLAY PLT HMD** button
- R6 **UNDERLAY NO VIDEO** button
- B2 **SYMB** button
- B3 **RESET** button
- B6 **G/S** (Grayscale) button

4.53.1 VCR Button. The **VCR** button is provided on the **VIDEO** page. Selection of the **VCR** button from the **VIDEO** page calls the **VCR** page.

4.53.1A IMAGE Button. The **IMAGE** button is provided on the **VIDEO** page. Selection of the **IMAGE** button from the **VIDEO** page calls the **IMAGE** page.

4.53.2 Declutter Button. Selection of the **VIDEO** page Video Select button initiates decluttered mode operation on the **VIDEO** page for that crew station.
The button label changes to indicate the video symbolgoy to be selected for presentation. The label is either **C-FLT**, **P-FLT**, **TADS**, **C-FCR**, or **P-FCR**. Pilot or CPG ownership is indicated by the initial P- or C-. TADS is always owned by the CPG, and presents weapons symbology. FLT indicates flight symbology, and FCR indicates FCR targeting symbology. During decluttered mode operation, the display is cleared of all button labels other than the boxed **VIDEO VSEL** button, and abbreviated versions of **VIEW** (**W**, **N**, **Z**) and the **SHARP** buttons presenting video imagery and associated Flight, Weapon, or FCR L symbology. Although the menu button label is not shown when VSEL is selected, the menu button continues to function normally. The default **VIDEO** page presentation is with this button selected.

4.53.3 VIEW Buttons. The **VIEW** buttons provide selection of the video view modes for all non-FCR L video underlay beneath the MPD formats. When FCR symbols are not presented, the **VIEW** buttons also affect FCR video. The default **VIEW** mode is **NORM**, in which the center 75% of the video image is presented. The **WIDE VIEW** presents the center 95% of the image, with black bars filling blank video area on the top and bottom of the underlay. The **ZOOM VIEW** presents a 2:1 electronic zoom of the WIDE image. The **VIEW** buttons are abbreviated to **W**, **N**, and **Z** and their surrounding bracket is removed when **VIDEO VSEL** is selected.

4.53.4 SHARP Buttons. The **SHARP** buttons allow the crew to amplify presentation of fine detail information. The optimal **SHARP** setting may vary with changing sensors or scene content. Applying **SHARP** to video containing noise may make that noise more visible. The default is for no sharpness to be applied. When **VIDEO VSE**L is selected, the scale showing **SHARP** status is removed, but the arrow buttons remain.

4.53.5 COLOR Button. The **COLOR** button allow the crew to choose either green or white video color for that MPD's video underlay. This button's state does not impact the Day/Night/Mono knob or symbology presentation. The default video color is **WHITE**.

4.53.6 DISPLAY Buttons. The **DISPLAY** buttons provide selection of the video source to be displayed (underlaid) beneath the MPD pages. Video underlay is overridden by selection of the VCR playback, and **FCR** page presentation on that MPD. Once these conditions change, the previously selected video underlay returns to that MPD. If the selected sight is **FCR** and FCR is operating in terrain profiles or **RMAP** mode, FCR imagery is presented. During single DP operation, the **VIDEO PAGE** selection of PILOT HMD or CPG HMD will continue to present dual DP display format and imagery (see para 4.50.3).

4.53.7 RESET Button. The reset button allows the crew to quickly return the VIEW, **SHARP**, and **COLOR** buttons to their default conditions of **NORM**, no **SHARP**, and color **WHITE**.

4.53.8 SYMB Button. The **SYMB** button is used to select between **NORM** and **BOOST** to optimize symbol contrast. Video performance is best when set to **NORM**. Setting the **SYMB** button to **BOOST** will darken the video underlay to boost the apparent symbol brightness.

4.53.9 G/S (Grayscale) Button. Selection of the **G/S** button temporarily overrides the VIEW button setting, and presents **VIEW WIDE** video with gray scale bars filling the top and bottom blank video area. If there is currently no video underlay presented, an additional grayscale pattern is generated by the CDP for presentation in the center area. The **G/S** is useful for understanding the affect the **VID** enhancement knob has on video.

4.54 VCR PAGE

The **VCR** page ([**BLK 1** fig 4-65] and [**BLK 2** fig 4-65A]) is used to control the selection of sources for tape recording, and the VCR operating mode controls.
[**BLK 1** During single DP operation, the video recorder is off and not selectable. When in single DP operation, or if the VCR has been identified as failed, the **VCR** page will blank, presenting a center status window stating **VCR NOT AVAILABLE** and showing the VCR power button on L6 as OFF.] [**BLK 2** During single DP operation, the video recorder is not selectable. When in single DP operation, or if the VCR has been identified as failed, the **VCR** page will blank, presenting a center status window stating **VCR NOT AVAILABLE**.]

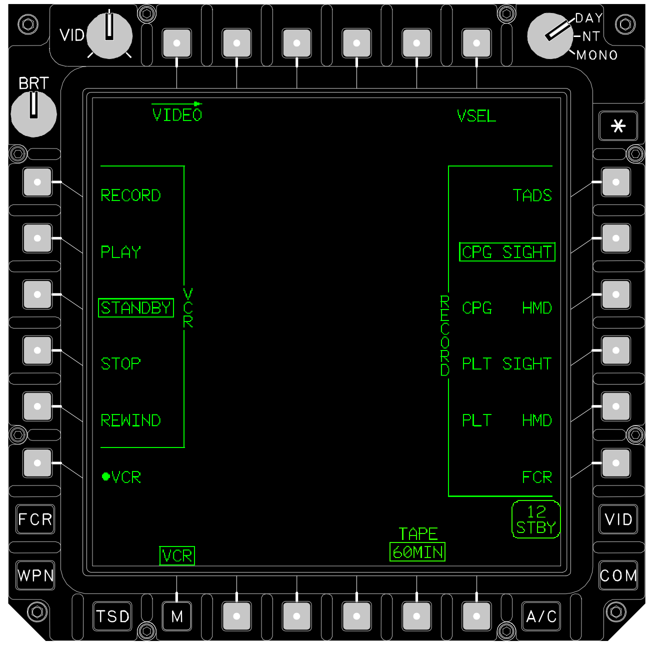


Figure 4-65. [**BLK 1** VCR Page]

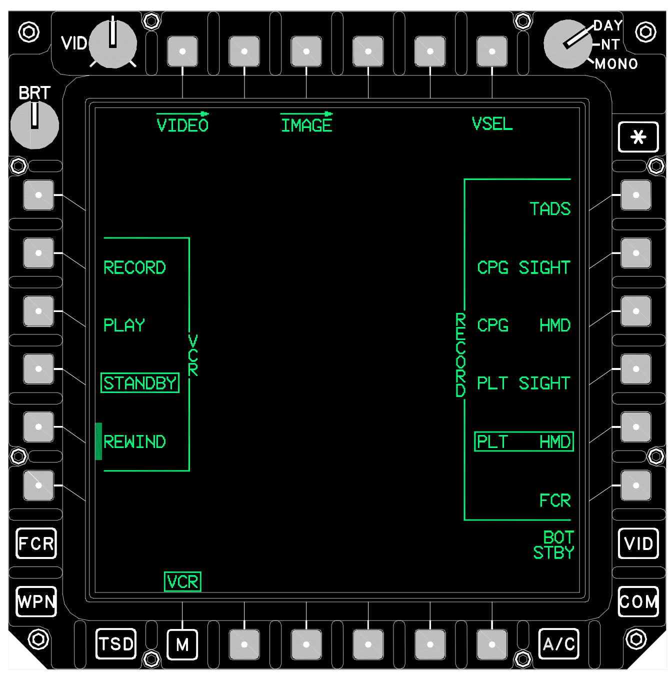


Figure 4-65A. [**BLK 2** VCR Page]

The following selections are found on the **VCR** page (VSEL not selected) for all modes of operation:

- T1 **VIDEO** button
- T6 **VSEL** button
- L1 [**BLK 1** **VCR RECORD** button]
- L2 [**BLK 1** **VCR PLAY** button]
- L2 [**BLK 2** **VCR RECORD** button]
- L3 [**BLK 1** **VCR STANDBY** button]
- L3 [**BLK 2** **VCR PLAY** button]
- L4 [**BLK 1** **VCR STOP** button]
- L4 [**BLK 2** **VCR STANDBY** button]
- L5 **VCR REWIND** button
- B5 [**BLK 1** **TAPE** button]

4.54.1 VIDEO Button. Selection of the **VIDEO** button from the VCR page calls the **VIDEO** page.

4.54.2 VSEL Button. Selection of the VCR **VSEL** (video select) button ([**BLK 1** fig 4-66] and [**BLK 2** fig 4-66A]) selects video and its symbology for primary display, and hides the MPD button labels from display for the selecting crew station. This button is useful for viewing decluttered VCR Playback information on the MPD.

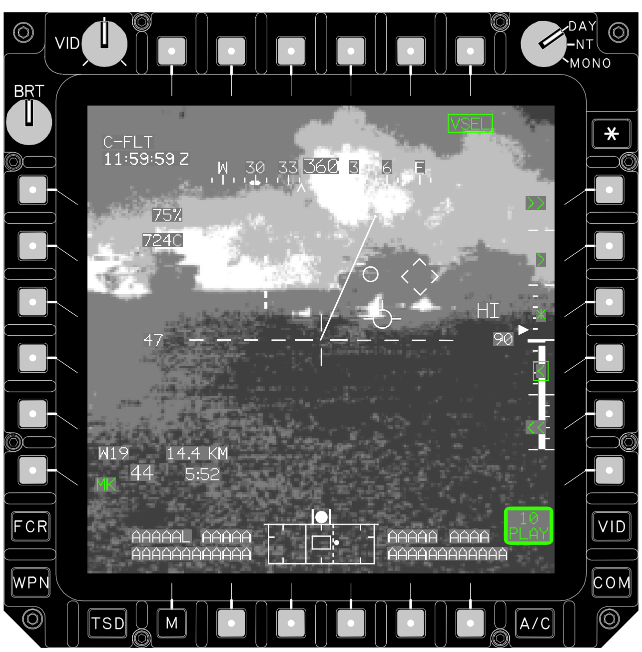


Figure 4-66. [BLK 1 VCR Page, VSEL Selected]

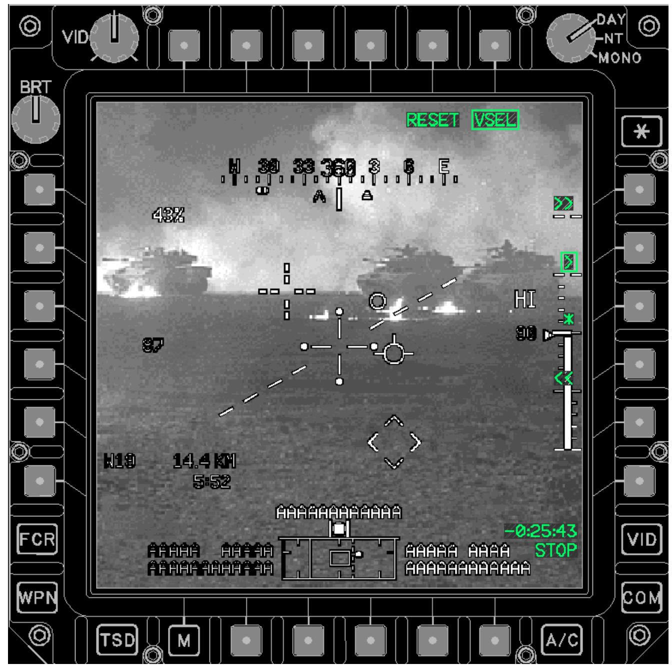


Figure 4-66A. [BLK 2 VCR Page, VSEL Selected]

4.54.3 [**BLK 1** **VCR Mode Buttons.** The VCR mode buttons allow moding of the VCR for **RECORD**, **PLAY**, **STANDBY**, **STOP**, and **REWIND**. They are presented whenever the VCR is available (not failed) during normal DP operations, and the **VCR** page is not operating in decluttered mode. The default selection is **VCR MODE STOP** (the tape is unthreaded) when operating under external power, and **STANDBY** (the tape is threaded), when operating under aircraft power. If at any time the VCR is unable to enter the commanded state, it will enter an unthreaded **STOP** condition from which the crew can send it to **PLAY**, **RECORD**, **REWIND**, or the threaded **STANDBY** condition.]

4.54.3A [**BLK 2** **VCR Mode Buttons.** The VCR mode buttons allow moding of the VCR for **RECORD**, **PLAY**, **STANDBY**, and **REWIND**. They are presented whenever the VCR is available (not failed) during normal DP operations, and the **VCR** page is not operating in decluttered mode. The default selection is **VCR MODE STANDBY** (the tape is unthreaded) when operating under external power, and **STANDBY** (the tape is threaded), when operating under aircraft power. If at any time the VCR is unable to enter the commanded state, it will enter an unthreaded **STOP** condition from which the crew can send it to **PLAY**, **RECORD**, or **REWIND**.]

4.54.4 [BLK 1 **TAPE Length Button**. Selection of the TAPE button toggles between 40 minutes and 60 minutes. Tapes record for approximately twice their labeled length. Tape length can also be set at the Load Maintenance Panel. This button affects the elapsed time indication and does not alter actual recording speed or time available.]

4.54.5 VCR Recording Operations. The following additional selections can be found on the VCR page (fig 4-65) during all VCR modes of operation except PLAY. When commanded, the VCR records the selected image source with its symbology overlay. In addition, the approximate zulu time and a format ownership cue (C-FLT, P-FLT, TADS, C-FCR, or P-FCR) are also recorded in the upper left corner of the format.

- L6 [BLK 1 Mark (**MK**) button (**VCR** ON/OFF button)]
- L6 [BLK 2 Mark (**MK**) button]
- R1 **RECORD TADS** button
- R2 **RECORD CPG SIGHT** button
- R3 **RECORD CPG HMD** button
- R4 **RECORD PLT SIGHT** button
- R5 **RECORD PLT HMD** button
- R6 **RECORD FCR** button L
- B2 **EVENT PAUSE/IGNORE** button

a. RECORD Buttons. Composite video, containing both imagery and flight, weapon, or FCR L symbology is recorded in accordance with the **RECORD** buttons. Zulu time is also recorded in the upper left area of the format. The default selection for these buttons is **RECORD CPG SIGHT**. VCR recording can also be commanded on the left hand grip. See section 4.52.1.

b. [BLK 1 **MARK (MK) Button**. Activation of the **MARK** button marks a particular event on the video tape. An event marker tone (para 4.54.6.c) can be heard at this location when operating in the playback mode.]

b1. [BLK 2 **MARK (MK) Button**. Activation of the **MARK** button marks a particular event on the video tape. (See para 4.54.6.c)]

NOTE

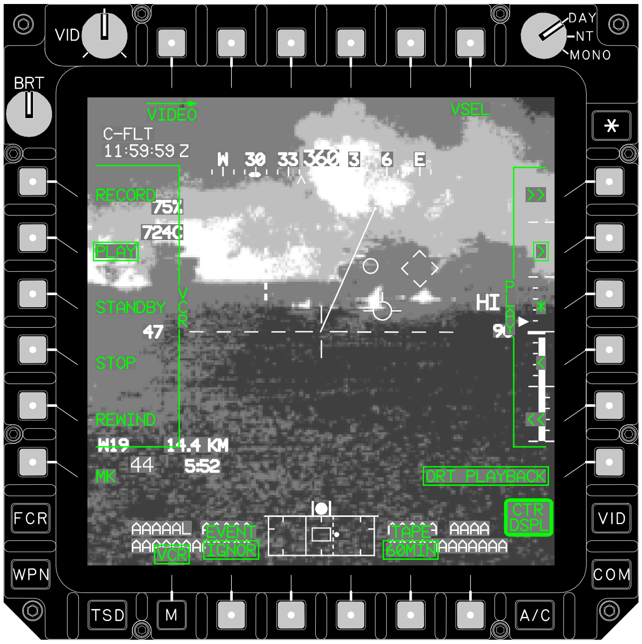
Voice playback may not be audible to crew and/or maintenance personnel following replacement/reinstallation of the CIU until the **VCR** volume ON/OFF knob has been cycled.

4.54.6 VCR Playback Operations. Selecting the **PLAY** button initiates play of video tape at normal speed to any MPD presenting the VCR page. If at the end of the tape, the VCR will mode to [BLK 1 play reverse] [BLK 2 play fast reverse] in response to crewmember play request by selecting the **PLAY** button, labelled **PLAY REVERSE** at that point_in time. The following selections can also be found on the **VCR** page during VCR Playback:

- L6 [BLK 1 Mark (**MK**) button (**VCR** ON/OFF button)]
- L6 [BLK 2 Mark (**MK**) button]
- R1 **PLAY** Fast Forward (**>>**) button
- R2 **PLAY** Forward (**>**) button
- R3 **PLAY** Pause (*****) button
- R4 [BLK 1 **PLAY** Reverse (**<**) button]
- R4 [BLK 2 **PLAY** Reverse (**<<**) button]
- R5 [BLK 1 **PLAY** Fast Reverse (**<<**) button]
- R6 [BLK 1 **ORT PLAYBACK** button (CPG Station Only)]
- R6 [BLK 2 **CTR DISP** button (CPG Station Only)]
- B2 **EVENT PAUSE/IGNORE** button

a. ORT PLAYBACK Button. Selection of this button sends VCR playback to the ORT head-out and head-down displays ([BLK 1 fig 4-67] and [BLK 2 fig 4-67A]) when the VCR page is presented on either CPG MPD.

b. Center Display (CTR DSPL) Button (TEDAC). Selection of the **CTR DSPL** button sends VCR playback to the TDU (fig 4-67A) when the VCR page is presented on either CPG MPD.



LBA3012A

Figure 4-67. [**BLK 1** **CPG VCR Page - Play Mode**]

LBA5072A

Figure 4-67A. [**BLK 2** **CPG VCR Page - Play Mode**]

c. EVENT Button. Selection of the **EVENT** button toggles it between **IGNOR** and **PAUSE**. When set to **PAUSE,** the recorder pauses during tape playback at each event marker. When set to **IGNOR**, the recorder ignores event marks during tape playback.

NOTE

When the VCR is operated in the [**BLK 1** **STBY** Mode] [**BLK 2** **STBY** threaded Mode] , the VCR is commanded to **PLAY** for one second every five minutes (This is an auto-advance command that reduces potential damage to the VCR tape/head.) Any previously recorded audio that is on the tape is subject to being heard by the flight crew for that one-second-time period. (If the respective crewmember's communication (**COMM**) panels VCR volume control knob is pushed in.) To preclude hearing any pre-recorded audio when operating the VCR in the **STBY** mode, pull out the VCR volume control knob.

4.54.7 VCR Standby Operations. **[BLK 1** Selection of the VCR Mode **STANDBY** button sets the VCR to standby. In this mode, the tape is threaded and prepared for recording or playback.]

[**BLK 2** Selection of the VCR Mode **STANDBY** button sets the VCR to either standby or stop depending on the following conditions. In this mode, the tape is threaded and prepared for recording or playback.]

- the aircraft is on the ground
- throttles are in OFF
- TADS is OFF
- PNVS is OFF

If all of the above conditions are met, then the VCR is moded to stop. In this mode, the tape is unthreaded and will require approximately 3 seconds to thread and begin to operate as commanded. Otherwise, selection of the VCR Mode **STANDBY** button sets the VCR mode to standby. In this mode, the tape is threaded and prepared for recording or playback (within half a second).

a. [**BLK 1** **VCR Power Button**. The **VCR** button allows the crew to power the recorder on and off. The VCR will power on automatically unless external power is applied. The VCR will be commanded to **STOP** when the last of the following conditions are met:

- the aircraft is on the ground
- throttles are in OFF
- TADS is OFF
- PNVS is OFF

Prior to shut-down of the aircraft, the crewmember should mode the VCR to **OFF**.]

b. Video Tape Counter. A video tape counter, displaying tape elapsed time or tape position, and VCR mode and error messages is presented in the lower right corner of the **VCR** page. This counter is not removed during decluttered operation. The counter outline is WHITE whenever its interior text strings are white or alternate with white text.

NOTE

Priority for the presentation of the top line Counter messages is:

- **FAIL** (VCR not responding or failed)
- **WET** (alternating with other message)
- **CHK** (Check VCR)
- **BOT** (Beginning of Tape)
- **EOT** (End of Tape)
- Elapsed Time

(1) [**BLK 1** **Top Line**. The elapsed time indication provides the same number for the same tape position consistently (assuming the same tape length selection), and can be used as a reference during playback. When starting from **BOT**, it may take up to 5 minutes for the count to change upon initiating **RECORD** or **PLAY**. The VCR can record when moisture is detected (**WET**). However, continued operation could damage the VCR. **FAIL**, **WET**, and **CHK** are displayed as WHITE in color.]

(2) [**BLK 2** **Top Line**. The elapsed time indication can be used as a reference during playback. The VCR can record when moisture is detected (**WET**). However, continued operation could damage the VCR. **FAIL**, **WET**, and **CHK** are displayed as WHITE in color.]

(3) Bottom Line. The counter also displays a second data field reflecting the state of the recorder:

- **PLAY**
- **RCD**
- [**BLK 1** **STBY**]
- [**BLK 2** **STBY** (VCR mode **STANDBY** - tape threaded)]
- [**BLK 1** **STOP**]
- [**BLK 2** **STOP** (VCR mode indicated as **STANDBY** - tape unthreaded)]
- **RWND**
- [**BLK 1** **OFF**]

If the state is unknown, a WHITE "?" is presented.

c. VCR Real-Time Video Cue. When real-time video underlay is visible on the **VCR** page, the Video Cue data field, located next to the **VIDEO** button or **VIDEO** label on the Menu button, shows which video is being underlaid. This data field is presented to distinguish between playback and real-time video. Real-time video cues are:

- CPG SIGHT (**CPG**)
- PLT SIGHT (**PLT**)
- CPG HMD (**CHMD**)
- PLT HMD (**PHMD**)
- TADS (**TADS**)

4.54A IMAGE PAGE

The **IMAGE** page (fig 4-67B) allows selection of a data frame (scanned image). The image selection is used to view a loaded image (e.g. radar site target).

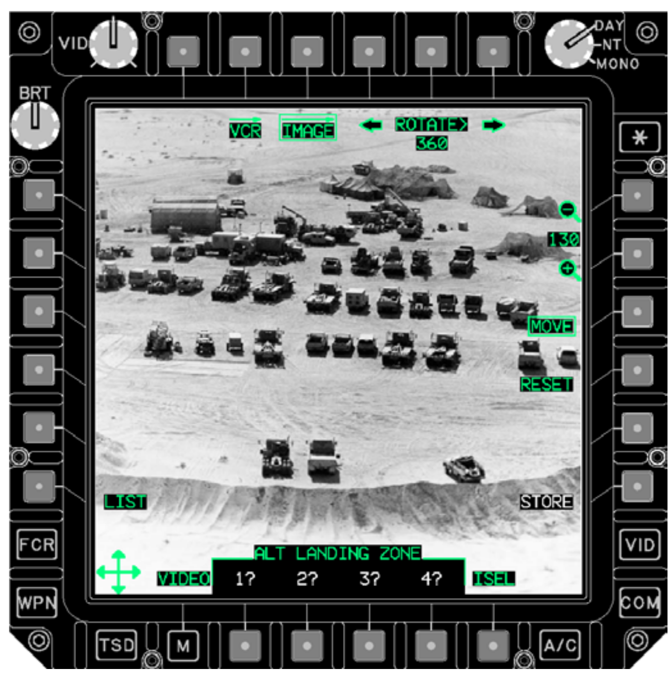


Figure 4-67B. IMAGE Page

The following unique selections are found on the **IMAGE** page (**ISEL** not selected) for all modes of operation:

- T3 **IMAGE** button
- T4 Image **ROTATE** button Left
- T5 Image **ROTATE** Data Entry button
- T6 Image **ROTATE** button Right
- L6 Image **LIST** button
- R1 Image **Zoom** Out button
- R2 Image **Zoom** In button
- R3 Image **MOVE** button
- R4 Image **RESET** button
- R6 Image **STORE** button
- B2 Image view option **1**
- B3 Image view option **2**
- B4 Image view option **3**
- B5 Image view option **4**
- B6 **ISEL** button

4.54A.1 Image ROTATE Button Left. The Image **ROTATE** Button Left (T4) is used to rotate the background image counterclockwise. Selecting the Image **ROTATE** Button Left will cause the image to rotate 1 degree. If the Image **ROTATE** Button Left is selected and held for more than 0.5 seconds, the image will rotate at 40 degrees per second after the initial 1 degree rotation.

4.54A.2 Image ROTATE Data Entry Button. The Image **ROTATE** Data Entry Button (T5) is used to rotate the image via a crewmember input on the KU. Rotation angles from 1 through 360 degrees may be used.

4.54A.3 Image ROTATE Button Right. The Image **ROTATE** Button Right (T6) is used to rotate the background image counterclockwise. Selecting the Image **ROTATE** Button Right will cause the image to rotate 1 degree. If the Image **ROTATE** Button Right is selected and held for more than 0.5 seconds, the image will rotate at 40 degrees per second after the initial 1 degree rotation.

4.54A.4 LIST Button. The **LIST** maintained option button (L6) (fig 4-67C) is used to select which image is to be viewed. When the list button is selected up to 20 image files will be available from the DTC. Page buttons are displayed if more than 10 image files are found on the DTC. The first 22 characters of the individual file names for each image will be displayed. Selection of a file name will load the image.

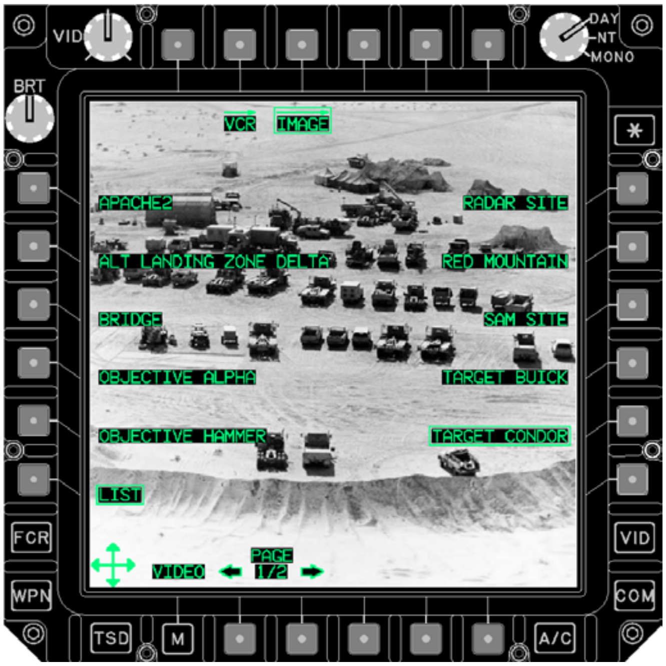


Figure 4-67C. IMAGE Page / LIST Selected

4.54A.6 ZOOM Buttons. The **ZOOM** scroll buttons (R1-R2) are used to zoom the image in or out. Selecting an arrow will fine tune the zoom. Holding the arrow button will change the zoom at a variable rate. Valid zoom range is from 50% to 400%.

4.54A.7 MOVE Button. Selecting the **MOVE** button (R3) allows the crewmember to move the image with the cursor thumb-force controller.

4.54A.8 RESET Button. Selecting the **RESET** button (R4) allows the crewmember to restore the image to the default (non-stored) view. The default view restores the image to 100% zoom, 360 rotation angle (image top to MPD top) and the image will be recentered on the MPD.

4.54A.9 STORE Button. Selecting the **STORE** button (R6) allows the crewmember to store the current image settings (location, rotation, and zoom) into view.

4.54A.10 Image View Buttons. Selecting any of the **Image View** buttons (B2-B5) allows the crew member to select up to 4 stored views of the image. Each view contains a specified zoom factor, location, and rotation of the image. A view is created using the **STORE** button and selecting the store location **1-4**.

4.54A.11 ISEL Button. Selection of the **ISEL** (image select) button (B6) (fig 4-67D) allows the crew member to select a decluttered view of the image. All symbols and controls are removed from the IMAGE page with the exception of the cursor controller symbol and the image view buttons **1-4**.

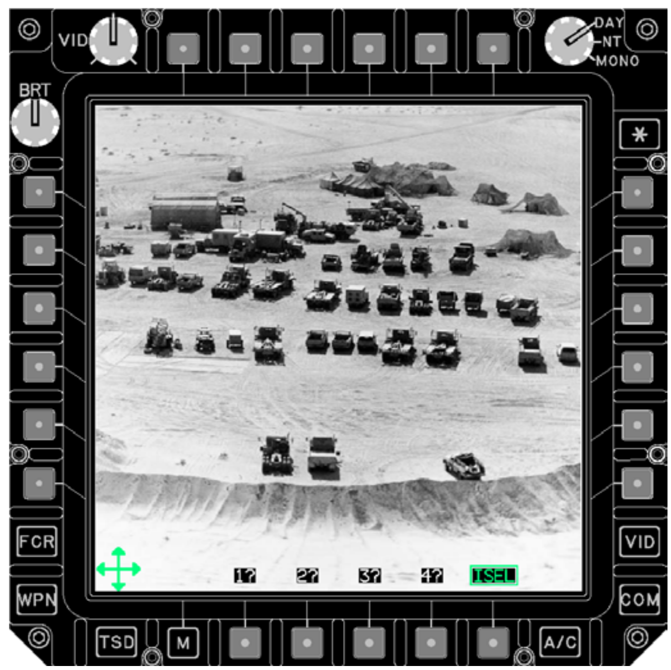


Figure 4-67D. IMAGE Page / ISEL Selected

4.55 SIGHTING SUBSYSTEM OPERATING PROCEDURES

4.55.1 IHADSS Boresight - Pilot and CPG.

WARNING

OFFSET boresight is not authorized.

NOTE

Checks herein are in addition to those listed in chapter 8. Except for safety, chapter 4 does not duplicate chapter 8 checks.

1. Sight select switch - **HMD**.
2. **WPN** page - **GRAYSCALE** button - Select.
3. **BRT** and **CONT** knobs - Adjust as desired.
   a. Sizing and centering - Verify.
   b. Infinity focus - Check.
4. **WPN** Page - **GRAYSCALE** button - Deselect.
5. **SYM BRT** Control (ORT and pilot) or **SYM** brightness (TEDAC) - Adjust as desired.
6. **WPN** page - **BORESIGHT** button - Select.
7. **IHADSS** button - Select.
8. **PRI INT LT** knob - Adjust as desired.
9. HMD reticle - Align with BRU.
10. **PLRT B/S** switch - **B/S** and release.
    B/S NOW button (aircraft equipped with MTADS provisions) - Select.
11. **BORESIGHT** button - Deselect.
12. **PRI INT LT** knob - Adjust as desired.

4.55.2 NVS Operational Check (Pilot and CPG).

1. **NVS MODE** switch - **FIXED** or **NORM.**
2. **GAIN** and **LVL** knob (ORT and pilot) or **GAIN** and **LEV** (TEDAC) - Adjust for optimum image. Verify capability to select the various modes of flight symbology.
3. **PLRT B/S** switch - Check polarity reversal.
4. **NVS MODE** switch - **NORM**.
5. Registration - Check.
   a. Align crewmembers LOS forward to the 12 o'clock position ±5°.
   b. Select a reference object approximately 90 ft in front of the aircraft.
   c. Check registration (alignment differential) between the thermal image and reference object in azimuth and elevation.
   d. The allowable registration error is 1 ft of azimuth at 90 ft. The center open position of the LOS reticle is equivalent to 1 ft at 90 ft.
   e. Unity Magnification - Check. Ensure 1:1 ratio with selected object.
6. Alternate sensor - Check.

4.55.3 TADS Operational Checks - CPG (ORT).

CAUTION

The FLIR zoom field-of-view shall not be activated for more than one minute of continuous operation to prevent excessive after - image or raster burn. Any use of the FLIR zoom FOV will result in some amount of after-image or raster burn. The after-image tends to fade out over operating time in other FLIR FOV's. However, prolonged use of FLIR zoom FOV will result in an increased amount of after image or raster burn.

1. **NVS MODE** switch - **OFF**
2. Sight select switch - **TADS**.
3. **VID SEL** switch - **TADS.**
4. **GS** switch - Press.
5. **BRT** and **CONT** knob - Adjust as desired on heads-up and heads-down displays.
6. **VID SEL** switch - **TADS.**

7. Sensor Select switch - **DTV**.

8. **SLAVE** switch - Press and release to initiate manual track.

9. **MAN TRK** thumbforce controller - Exercise turret.

10. **TADS** FOV switch - Evaluate various **FOV**s.

11. **IAT/OFS** switch - Engage. Check for proper function.

12. Sensor Select switch - **DVO.**

13. TADS FOV switch - Evaluate various **FOV**s. If scene is not vertical in both **FOV**s, perform Pechan Alignment.

14. Sensor Select switch - **FLIR**.

15. **GAIN** and **LVL** knob - Adjust for optimum image then engage **ACM** as desired.

16. **TADS** FOV switch - Select. Evaluate various **FOV**'s.

17. **IAT/OFS** switch - Engage image auto tracker. Check for proper performance.

18. **FLIR PLRT** button - Check polarity.

19. Sensor Select switch - **DTV** or **FLIR**.

NOTE

If Auto Drift Null does not reduce drift to desired level, perform Manual Servo Drift Null Procedure. Manual Servo Drift Null may reduce TADS turret slew rates by up to 50%.

20. Drift null - Perform if required.

4.55.3A TADS Operational Checks - CPG (TEDAC).

CAUTION

The FLIR zoom field-of-view shall not be activated for more than one minute of continuous operation to prevent excessive after - image or raster burn. Any use of the FLIR zoom FOV will result in some amount of after-image or raster burn. The after-image tends to fade out over operating time in other FLIR FOV's. However, prolonged use of FLIR zoom FOV will result in an increased amount of after image or raster burn.

1. **NVS MODE** switch - **OFF**.

2. Sight select switch - **TADS**.

3. **TAD** - selected.

4. **G/S** - selected.

5. **BRT** ans **CON** buttons - adjust as desired.

6. **TAD** - selected.

7. Sensor select switch - **DTV**.

8. **SLAVE** switch - Press and release to initiate manual track.

9. **MAN TRK** thumbforce controller - Exercise turret.

10. **TADS** FOV switch - Evaluate various **FOV**s.

11. **IAT/OFS** switch - Engage. Check for proper function.

12. Sensor Select switch - **FLIR**.

13. **GAIN** and **LEV** knobs - Adjust for optimum image, then engage **ACM** as desired.

14. **TADS** FOV switch - Select. Evaluate various **FOV**'s.

15. **IAT/OFS** switch - Engage image auto tracker. Check for proper performance.

16. **FLIR PLRT** button - Check polarity.

17. Sensor Select switch - **DTV** or **FLIR**.

NOTE

If Auto Drift Null does not reduce drift to desired level, perform Manual Servo Drift Null Procedure. Manual Servo Drift Null may reduce TADS turret slew rates by up to 50%.

18. Drift null - Perform if required.

NOTE

If satisfactory, procedure is complete. If not satisfactory, repeat steps 5 through 14 as required.

4.55.4 TADS Pechan Realignment (ORT).

1. Sight select switch - **TADS**.
2. Sensor Select switch - **DVO**.
3. **TADS FOV switch** - **N**.
4. **TADS** turret - **MANUAL** control.
5. Boresight Enable switch - **UP**.
6. Left Thumbwheel Control - Adjust as required to align horizontal crosshair with horizon.
7. Boresight Enable switch - **CENTER**.
8. **TADS FOV switch** - **W**.
9. Crosshair and horizon - Recheck alignment.

NOTE

If satisfactorily aligned, select desired operating mode. If not satisfactorily aligned, go to step 10.

10. Boresight Enable switch - **UP**.
11. Right Thumbwheel Control - Adjust as required to align horizontal crosshair with horizon.
12. Boresight Enable switch - **CENTER**.
13. **TADS FOV switch** - **N**.
14. NFOV - Reverify alignment.

NOTE

If satisfactory, procedure is complete. If not satisfactory, repeat steps 5 through 14 as required.

4.55.5 TADS Manual Servo Drift Null (ORT).

1. Sight select switch - **TADS**.
2. **SLAVE** switch - Press to verify **TADS** turret slews to fixed forward position by observing dashed reticle in center of display.
3. **SLAVE** switch - Press.
4. Sensor select switch - **DTV** or **FLIR** (for greatest accuracy use **DTV**).
5. **TADS FOV switch** - **N**.
6. Reticle - Aim at easily observed object.
7. Boresight Enable switch - **UP**. Wait 5 seconds then adjust left and right thumbwheel controls for drift null.
8. Boresight Enable switch - **CENTER**.

NOTE

If the manual procedure was accomplished, the auto drift null may may be reactivated by placing the Boresight Enable switch in **UP** position for 2 seconds and then placing it back to **CENTER** position.

4.55.5A TADS Manual Servo Drift Null (TEDAC).

1. Sensor select switch - **FLIR** or **TV**.

2. **TADS** FOV switch - **N**.

3. **SLAVE** switch - Press and release to initiate manual track. Observe TADS drift.

NOTE

To set TEDAC Display Unit (TDU) default brightness and contrast levels, press **AZ/EL** button on TDU.

4. **AZ/EL** button - Press to activate servo drift null. **AZ/EL** will appear boxed above button. After five seconds, **AZ** and **EL** buttons become active.

NOTE

If elevation and azimuth servo drift is not corrected, go to step 5. Otherwise, go to step 7.

5. Adjust **AZ** and **EL** buttons to center target on **TADS** reticle.

6. **AZ/EL** button - Press. **AZ/EL** display box above button will extinguish.

7. **SLAVE** switch - Press to deactivate manual track.

4.55.6 TADS Internal Boresight (ORT).

WARNING

Proper laser safety procedures shall be followed.

NOTE

- Boresighting of the DTV and FLIR occur independently and the actual order is not critical. However, DTV must be boresighted prior to boresighting the DVO.
- Internal boresight errors can develop in flight due to temperature changes within the internal components of the TADS (thermal drift). It is recommended that an internal boresight be accomplished 2 times per 2.5 hour flight. Generally, the more recent the internal boresight, the more accurate the system will be.

1. Sight select switch - **TADS**.
2. **WPN UTIL** - **LASER** on.
3. **WPN** page **- BORESIGHT** - Select.
4. **INTERNAL** - Select. Internal boresight message present - Verify.
5. **LASER** - **ARM**.
6. Sensor select switch - **DTV**.
7. **TADS** FOV switch - **N**.
8. **IAT** polarity switch - **W**.
9. **LRFD** trigger - Press and hold, observe presence of laser spot.
10. Boresight Enable switch - **UP**. Observe tracking gates capture laser spot. Continue to fire laser until tracking gates disappear. If tracking gates fail to capture laser spot, perform manual boresight (para 4.55.9) as required. If tracking gates enter STOP mode, Boresight Enable switch to **CENTER** position, then back to **UP** position**.**
11. Boresight Enable switch - **CENTER**.
12. **LRFD** trigger - Release.

13. **TADS** FOV switch - **Z**.

14. **Z FOV** - Repeat steps 9 through 12, then proceed to step 15.

15. Sensor select switch - **FLIR**.

16. **TADS** FOV switch - **N**.

17. **LVL** - Adjust fully counterclockwise.

18. **GAIN** - Adjust to mid-range.

19. **LRFD** trigger - Press and hold.

    Observe laser spot, and optimize FLIR for white laser spot. If laser spot is not visible, perform FLIR Cue Update Procedure (para 4.55.7).

20. Boresight Enable switch - **UP**. Observe tracking gates capture laser spot. Continue to fire laser until tracking gates disappear. If tracking gates fail to capture laser spot, perform manual boresight (para 4.55.9). If tracking gates enter STOP mode, Boresight Enable switch to **CENTER** position, then back to **UP** position.

21. Boresight Enable switch - **CENTER**.

22. **LFRD** trigger - Release.

23. **TADS** FOV switch - **Z**.

24. **Z FOV** - Repeat steps 19 through 22, then proceed to step 25.

25. Sensor select switch - **DVO**.

26. **TADS** FOV switch - **N**. Observe position of DVO crosshairs. If the DVO crosshairs are not clearly visible, perform DVO CUE update procedure (para 4.55.8). Observe position of DVO crosshairs. If coincident with DTV reticle, go to step 29.

27. Boresight Enable switch - **DOWN**.

28. **DVO BRSIT** - Adjust DVO crosshairs into coincidence with DTV reticle.

29. Boresight Enable switch - **CENTER**.

30. **LASER** - **SAFE**.

31. **BORESIGHT** button - Deselect.

32. WPN **UTIL** Page - Deselect **LASER** if desired.

4.55.6A TADS Internal Boresight (TEDAC).

WARNING

Proper laser safety procedures shall be followed.

1. DTV Boresight NFOV

   a. **WPN** page - **Laser ON**.

   b. **WPN** page - Select **Boresight**.

   c. **TADS BORESIGHT** page - **TADS INTERNAL** - select.

WARNING

Do not allow personnel forward of the TADS interface bulkhead while the laser is being fired. Direct exposure to or reflections from the laser beam could cause blindness or serious eye injury.

NOTE

To set TEDAC Display Unit (TDU) default brightness and contrast levels, press ***** button on TDU.

   d. **LASER** - **ARM**.

   e. Laser Trigger switch - Press and hold at second detent. Verify laser spot is visible on TDU.

   f. **AZ/EL** button - press to enable boresight. **AZ/EL** will appear in box above button.

g. On TDU, observe that the tracker gates capture the laser spot and center it in the display aiming reticle. If laser spot is not centered on the display and cannot be captured by tracking gates, press **AZ/EL** button and continue firing laser. Wait five seconds and adjust **AZ** and **EL** controls to center laser spot in display. Release laser trigger and repeat steps e through i. If tracker enters the STOP mode, press **AZ/EL** switch and repeat steps e through i.

h. When tracker gates disappear, press **AZ/EL** button to disable boresight. **AZ/EL** display box above button will extinguish.

i. Laser trigger - Release.

2. DTV boresight ZFOV.

a. **TADS** FOV switch - **Z**.

b. Repeat steps - 1.e through 1.12 to boresight zoom FOV.

3. FLIR Boresight NFOV.

a. Sensor select switch - **FLIR**.

b. FLIR polarity switch - Press to select white hot.

c. **TADS** FOV switch - **N**.

d. Laser trigger - Press and hold at second detent. Adjust **GAIN** and **LEV** controls for brightest laser spot with least background noise. If laser spot is not visible or if laser spot is visible and cannot be captured in step f below, perform FLIR CUE Update Procedure (para 4.55.7A) and select a different aiming reticle position within the CUE update target boundaries.

e. **AZ/EL** button - Press. **AZ/EL** will appear boxed above switch.

f. On TDU, observe that tracker gates capture laser spot and center it in the display aiming reticle. If laser spot is not centered on the display and cannot be captured by tracking gates, press **AZ/EL** button to enable **AZ/EL** buttons and continue firing the laser. Wait five seconds and adjust **AZ** and **EL** controls to center laser spot in display. Release laser trigger switch and repeat steps d through f. If tracker enters the Stop Mode, press **AZ/EL** switch and repeat steps d through f.

g. When tracking gates disappear, press **AZ/EL** button to disable boresight. **AZ/EL** box above button will extinguish.

h. Laser trigger - Release.

4. FLIR Boresight ZFOV.

CAUTION

FLIR zoom FOV shall not be actuated for more than two minutes of continuous operation in order to prevent excessive raster retention. Permanent damage may occur if it is engaged for more than five minutes.

a. **TADS** FOV switch - **Z**.

b. Repeat steps 3.d through 3.22.

c. **TADS** FOV switch - FOV other than Zoom.

4.55.6B [MT MTADS Internal Boresight].

WARNING

Proper laser safety procedures shall be followed.

NOTE

- Automatic internal boresighting of the DTV and FLIR occur independently with DTV being accomplished prior to FLIR. If an ORT is installed, DTV must be boresighted prior to boresighting the DVO.
- If DTV boresight is complete, then FLIR boresight will be performed. If DTV boresight fails, then FLIR boresight will not be performed.
- When FLIR boresight is complete, the internal boresight is complete.
- Internal boresight errors can develop in flight due to temperature changes within the internal components of TADS (thermal drift). It is recommended that an internal boresight be accomplished 2 times per 2.5 hour flight. A HAD sight status message will be displayed to indicate an internal boresight is required at system powerup and every 50 minutes thereafter.

1. **WPN UTIL** - **LASER** on.
2. **WPN** page **- BORESIGHT** - Select.
3. Sensor select switch - **DTV** or **FLIR**.
4. **INTERNAL** - Select. Internal boresight message present - Verify.
5. Laser **WARNING** and prompts - observe safety procedures and boresight procedure prompts.
6. **LASER** - **ARM**.
7. **LRFD** trigger - Press and hold, observe presence of laser spot on the TDU or ORT HOD. Continue lasing until spot disappears or DTV boresight is complete.
8. Internal Boresight Status - Observe
   a. Verify **DTV BORESIGHT COMPLETE** status.
   b. Continue to monitor **FLIR BORESIGHT IN PROGRESS** - Verify **FLIR BORESIGHT COMPLETE** status.
   c. If unable to successfully complete boresight, exit internal boresight mode.
9. **BORESIGHT** button - Deselect.

4.55.7 FLIR CUE Update Procedure (ORT).

1. Sight select switch - **TADS**.
2. Sensor select switch - **DTV**.
3. **TADS** FOV switch - **W**.
4. **WPN** Page -**BORESIGHT** button - Select.
5. **INTERNAL** button - Select.
6. **SLAVE** switch - Actuate. Verify **INTERNAL BS** message replaced by **CUE UPDT** message.

NOTE

Reticle should appear within the black cross. If not, execute the following steps:

7. Boresight Enable switch - **UP**.

8. DTV reticle - Use thumbforce controller to position within black cross.

9. Boresight Enable switch - **CENTER**.

10. **SLAVE** switch - Actuate. Verify **CUE UPDT** message replaced by **INTERNAL BS**.

11. **WPN** Page - **BORESIGHT** button - Deselect.

4.55.7A FLIR CUE Update Procedure (TEDAC).

1. Sensor select switch - **TV**.

2. **TADS** FOV switch - **W**.

NOTE

To set TEDAC Display Unit (TDU) default brightness and contrast levels, press * button on TDU.

3. **SLAVE** switch - Press to select cue update. Verify that message CUE UPDT is displayed in lower corner of TDU.

NOTE

All four cue update target position indicators may not be visible on the display simultaneously.

4. Observe position of cue update target position indicators around aiming reticle. If aiming reticle is not within boundary line or the laser spot is not visible or not useable during FLIR internal boresight, go to step 6 , If aiming reticle is within boundary line go to step 8.

5. **AZ/EL** button - Press. **AZ/EL** will appear boxed above switch.

NOTE

Do not drive cue update target from the FOV.

6. **MAN TRK** control- Operate to move aiming reticle within cue update target boundary.

7. **AZ/EL** button - Press.

8. **SLAVE** switch - Press to select internal boresight. Verify that INTERNAL BORESIGHT is displayed in lower left corner of TDU.

4.55.8 DVO CUE Update Procedure (ORT).

NOTE

The DVO CUE Update should be accomplished whenever the DVO crosshairs are not visible during Internal Boresight. If the crosshairs are still not visible after accomplishing the DVO CUE Update, then proceed with maintenance troubleshooting. Note that there are symbology indications to the operator.

1. Sight select switch - **TADS**.

2. Sensor select switch - **DVO**.

3. TADS FOV Switch - **W**.

4. **SLAVE** Switch - Press.

5. Manual Thumb Force Controller - Adjust light to center of crosshairs.

6. TADS FOV Switch - **N**.

7. Observe DVO crosshairs. If the visual presentation is still not optimum - fine tune for best presentation with the Thumb Force controller.

8. **SLAVE** Switch - Press.

9. Continue with Internal Boresight.

4.55.9 Manual Boresight (ORT).

NOTE

The manual boresight adjust procedure is used only to recapture or center the laser spot. It is not an acceptable boresight procedure for normal flight operations.

1. Sight select switch - **TADS**.

2. WPN **UTIL** page - **LASER** on.

3. **WPN** Page - **BORESIGHT** button - Select.

4. **INTERNAL** button - Select.

5. **LASER** button - **ARM**.

6. Sensor select switch - **FLIR** or **DTV** as required.

7. **FLIR PLRT** button - **W**hite hot.

8. **TADS** FOV switch - **N**.

9. **GAIN** knob - Adjust to mid-range.

10. **LVL** knob - Adjust fully counterclockwise.

11. **LRFD** trigger - Press and hold. Observe laser spot and optimize **FLIR**.

12. Boresight Enable switch - **UP** for 1 second, then move to **CENTER** position. After 5 seconds the left and right thumbwheel controls will be active; adjust laser spot in elevation and azimuth.

13. **LRFD** trigger - Release.

14. Boresight Enable switch - **CENTER**.

15. **LASER** - **SAFE**.

16. **WPN** Page - **BORESIGHT** button - Deselect.

17. WPN **UTIL** page - Deselect **LASER,** if desired.

4.55.10 TADS Outfront Boresight (ORT).

WARNING

TADS Outfront Boresight validation and adjustment (if necessary) shall be performed prior to using the TADS FLIR imagery for laser or weapons operations, after performing a Cue update, a TADS component change, or if the helicopter experiences an abnormal electrical shutdown.

1. Helicopter - Position on the ground over identified location for this procedure.

NOTE

If on an approved laser firing range, fire laser to obtain range. Otherwise, enter manually the range from the helicopter to the outfront boresight target by selecting **MAN RNG** on **WPN** page and entering range in **KU**.

2. **RANGE** - Enter.

NOTE

If the target is between 0.5 km and 1.5 km, the range entered on the KU must be within 10m. If the target is between 1.5 km and 5 km, the range entered on the KU must be within 50m. If the target is greater than 5 km, the range entered on the KU must be within 1 km.

3. **NFOV FLIR** - Adjust **GAIN** and **LVL**. Observe outfront boresight target for optimum autotracker image. Engage **IAT**. If tracker enters stop mode, disengage **IAT**, then re-engage IAT.

4. Sensor select switch - **DTV**, observe light source.

   If FLIR and DTV reticles do not strike the boresight target in precisely the same spot, perform the following:

WARNING

Do not allow personnel forward of the TADS interface bulkhead while the laser is being fired. Direct exposure to or reflections from the laser beam could cause blindness or serious eye injury.

5. **WPN** Page - **BORESIGHT** button - Select.

6. **OUTFRONT** - Select.

7. Boresight Enable switch - **UP**.

8. Adjust azimuth and elevation knobs to center the target on the reticle.

9. Boresight Enable switch - **CENTER**.

10. **WPN** Page - **BORESIGHT** button - Deselect.

4.55.10A TADS Outfront Boresight (TEDAC).

WARNING

TADS Outfront Boresight validation and adjustment (if necessary) shall be performed prior to using the TADS FLIR imagery for laser or weapons operations, after performing a Cue update, a TADS component change, or if the helicopter experiences an abnormal electrical shutdown.

NOTE

Wait 30 minutes after the FLIR NOT COOLED message on the TEDAC Display Unit (TDU) disappears before performing outfront boresight. This allows the FLIR system to stabilize for a more accurate outfront boresight.

1. NVS switch - **OFF**.
2. **WPN** page **Range** button - enter manual range from helicopter to boresight target on KU.

NOTE

A target, a minimum of 0.5 km away from the helicopter is required. The target must have the same center as viewed in both FLIR and TV sensors.

3. Sight select switch - **TADS.**
4. Sensor select switch -**FLIR**.
5. **FLIR LEV** and **GAIN** knobs - Adjust as necessary.
6. **TADS** FOV switch - **N**.
7. Slave button - Press to enable manual track.
8. Exercise TADS Turret with MAN TRK controller to acquire boresight target.
9. **IAT/OFS** switch - **IA**T. Engage boresight target with auto tracker.
10. Sensor select switch - **TV**.
11. Observe boresight target light source. if not centered on TADS reticle, complete steps 12 through 18.

WARNING

Do not allow personnel forward of the TADS interface bulkhead while the laser is being fired. Direct exposure to or reflections from the laser beam could cause blindness or serious eye injury.

12. **WPN** page - **BORESIGHT** - Select.
13. **WPN** page - **TADS OUTFRONT** - Select.
14. **AZ/EL** button - Press. **AZ/EL** becomes boxed above button.
15. **AZ** and **EL** buttons - adjust to center target on TADS recticle.
16. **AZ/EL** button - Press. **AZ/EL** display box above button will extinguish.
17. **IAT** switch - **OFF**.
18. **WPN** page - **BORESIGHT** - Deselect.

4.55.11 FCR Operational Check L.

NOTE

- Wait for magnetic heading scale to appear before proceeding to power-up the FCR. INU must be aligned before reliable FCR target information is available.
- The FCR will not accept DTU loads for modes and lethal ranges or FCR UTIL page (DTU source) priority schemes D, E F, or G until the FCR has completed power-up BIT and the FCR power button is not OIP.
- This operational check verifies correct operation of the crewstation switches used to employ the FCR. If it is anticipated that both the pilot and CPG will operate the FCR during the mission, then this task should be completed in both crewstations.
- A WEAPONS/SIGHTS DTU load only needs to be performed one time by either the PLT or CPG.

1. **FCR UTIL** page - Select.
2. **MMA** button - **NORM** (1st power up, if pinned, or select FCR or RFI power **ON**).

3. FCR - Verify BIT complete; no faults.

4. DTC - Load WEAPONS/SIGHTS as required.

5. **RFI MODE** button - **Set**.

6. **GND ORIDE** switch - **ON** (if required).

7. FCR **UTIL** page - Enter as required:

   a. Terrain Mode - Select.

   b. Priority Scheme - Select.

8. Sight Select switch - **FCR**.

9. FCR **SCAN** Size - Select **M**, **N**, **Z**, verify changes, return to **W**.

10. FCR **MODE** Switch - Verify ability to select TPM, ATM, and RMAP. (Remain in RMAP.)

11. Left/Right Arrows - Press, verify movement on TSD.
    CPG - **SLAVE** switch press, verify movement with thumb force controller.

12. FCR **SCAN** switch -

    a. Select **CS**, verify with ”wiper blade” and radar video.

    b. SELECT **SS**, verify abort of CS.

    c. Select **SS,** verify with ”wiper blade” and radar video.

13. **LINK** switch -

    a. Select **LINK** and verify FCR **L** message in HAD, and TADS linked to the FCR NTS target.

    b. Terminate **LINK** by sight selecting FCR, TADS, or HMD.

14. **GND ORIDE** switch - **OFF** (if required).

Section II. ARMAMENT SYSTEMS

4.56 GENERAL

This section provides a description of the armament systems and respective operating procedures. It includes a description of weapons components, the controls and displays, systems operation, and armament checklists.

4.57 INTRODUCTION

The armament systems (fig 4-68) provide the aircrew with a means of quick response delivery of ordnance to selected targets. The armament systems provide for weapon selection, control moding, and firing, for close-in, medium and long-range targets. The armament systems are controlled by redundant weapon processors which manage gun, rocket and missile functions. The weapon systems consists of the following:

- M139 Area Weapons System (AWS) (M230E1 Automatic Gun)
- Rocket Management Subsystem (2.75 Inch Aerial Rocket)
- Longbow Hellfire Modular Missile System
- Wing Stores Pylon Subsystem

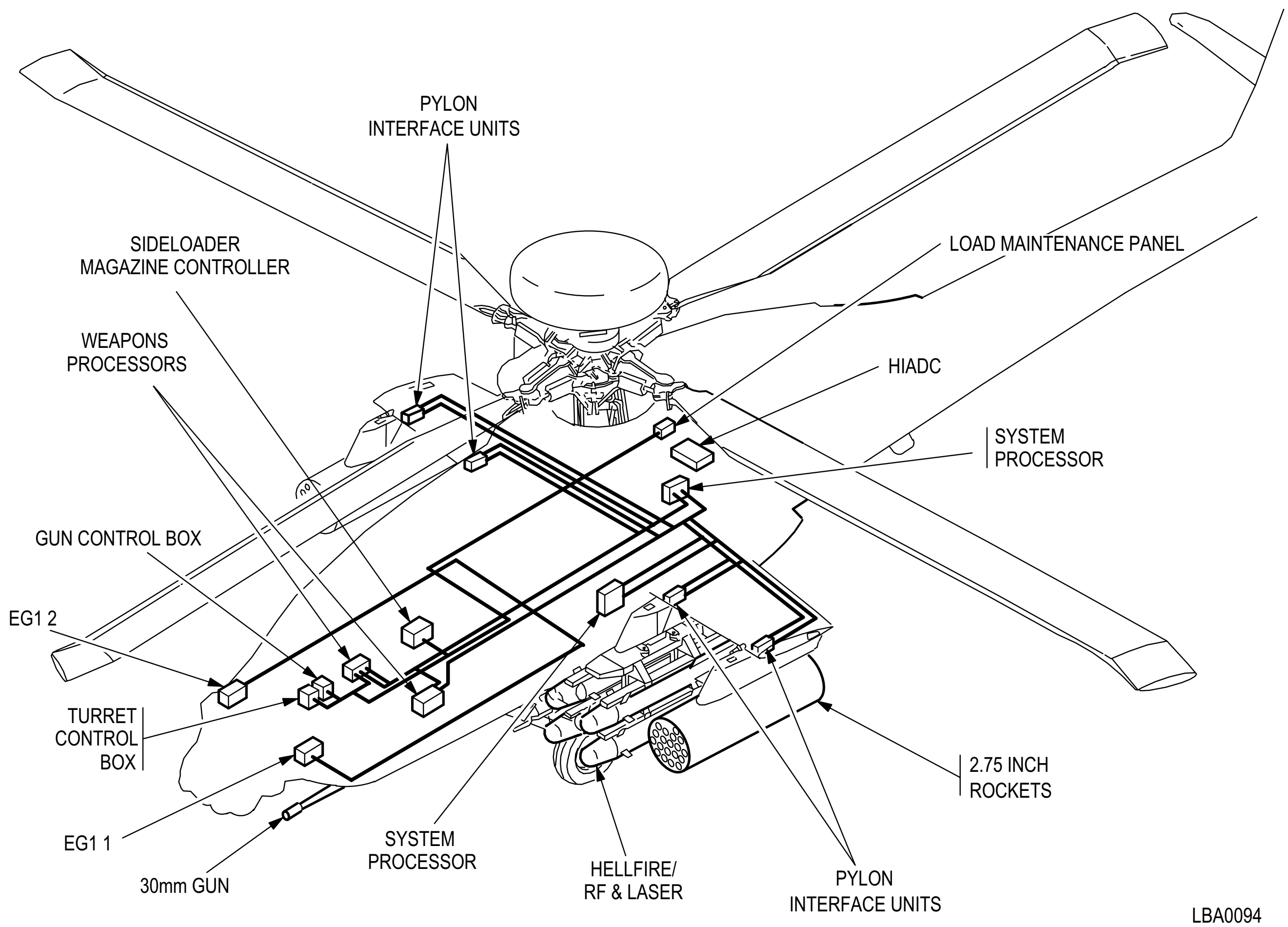


Figure 4-68. Armament Systems

4.58 ARMAMENT SYSTEM ARCHITECTURE

4.58.1 PRIMARY POWER CONTROL. Prime power is applied to the Hellfire weapon stations when the subsystem is enabled via the WPN **UTIL** page. The gun prime power is applied during aircraft powerup and the rocket subsystem does not require prime power. The weapon subsystem enable/disable functions on the WPN **UTIL** page allow for positive safeing of the weapons suite for rearming or other activities that require absolute safeing measures.

4.58.2 Arm Power Control. Weapon stations are armed only after a weapon is selected, via the WAS, and the aircraft has been armed from the **ARMAMENT** panel **A/S** button.

a. The SP controls the application of arm power independent of the WP, in that the aircraft must be armed as determined by the SP, before WP station arm power requests are acted upon.

b. Station arm power is applied via the ELCs under SP control. Electromagnetic relays are used for all weapon power load switching. The SP determines the aircraft state based on the **ARMAMENT** panel selections and the squat switch. The SP commands the ELCs to apply station arm power when requested by the WP.

c. The WP requests station arm power, via the SP, when the aircraft is armed and a weapon is selected and arming constraints are satisfied. Station arm power is used for rocket and missile squib ignition as well as gun bolt-pulse relay control.

4.58.3 System Processor (SP). The SP provides the **SAFE/ARM** control and the corresponding primary power and arm power control to the weapons.

4.58.4 Embedded Global Positioning Inertial Navigation System (EGI). The EGI provides aircraft position, attitudes, rates, and accelerations to the WP for use in ballistic computations and weapons constraint calculations.

4.58.5 Air Data System (ADS). The ADS provides air data to the WP for use in computing ballistics and weapon constraint calculations.

4.58.6 Pylon Interface Units (PIU). Each pylon contains one PIU. The PIU communicates via the MUX bus to control pylon positioning and control, status information and management of pylon stores.

4.58.7 Weapons Processor (WP). During normal operation, one WP actively provides weapon computations and control while the second WP is maintained in a readiness state. The WP performs the tasks of weapon initialization, selection, inventory, moding, positioning, and firing for all aircraft weapons.

CAUTION

There is no indication in the cockpit when the SQUAT ORIDE switch is in the AIR position. The possibility exists that the AWS could inadvertently be driven into the ground.

4.58.8 Load Maintenance Panel (LMP). The LMP (fig 4-69) provides the ground crew with the capability to manually enter and display AWS and external stores munitions load data. The LMP provides the aircrew the capability to check/verify rocket type within each of the rocket zones and gun rounds loaded on pre-flight. A weapon load page is provided on the MPD to permit aircrews to modify (override) the LMP zone inventory in the event an entry error is made by the load crew during munition loading or LMP failure occurs. The LMP also permits positioning of the pylons to either +4° (Up) or -5° (down) positions for munitions loading.

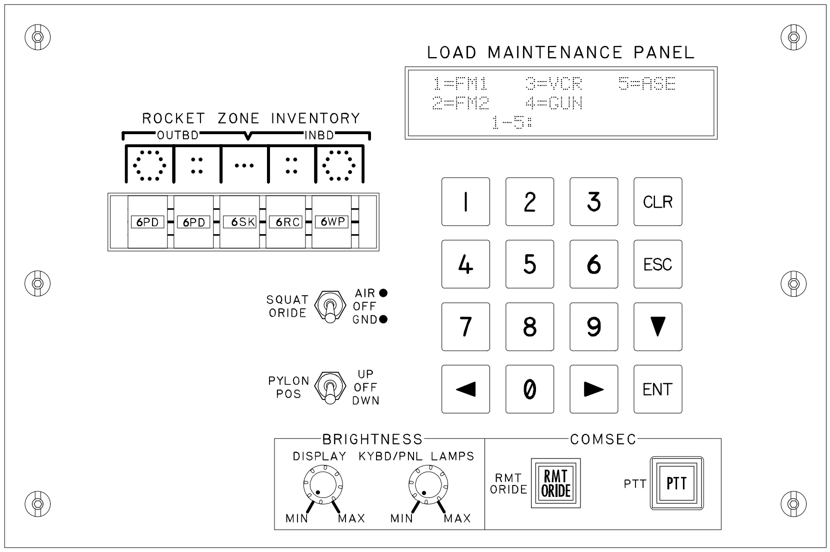


Figure 4-69. Load Maintenance Panel

4.59 ARMAMENT PANEL

The **ARMAMENT** Panel (fig 4-70) is located on the instrument panel in both crew stations.

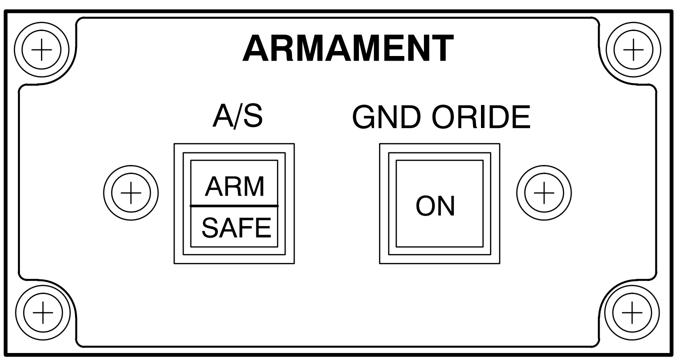


Figure 4-70. ARMAMENT Panel

4.59.1 ARM/SAFE (A/S) Button. The **A/S** button is a lighted pushbutton used to control **ARM/SAFE** power of the aircraft. The button controls application of power to weapon firing circuits. Activating the **A/S** button from either crew station will mode the aircraft status alternately between **SAFE** and **ARM**. The button light indicates **SAFE** or **ARM** as appropriate in both crew stations. On aircraft powerup, the default setting is **SAFE**. There is no OFF position for the **ARM/SAFE** button.

4.59.2 Ground Override (GND ORIDE). The **GND ORIDE** button is a lighted pushbutton used to override squat switch inhibits when on the ground. Activating the **GND ORIDE** button enables **ARM/SAFE** control in all modes and the button light indicates **ON** in both crew stations. Activating the button a second time will mode the **GND ORIDE** button to **OFF** and extinguish the **ON** indicator.

4.60 CYCLIC CONTROL GRIP

The following weapons system controls are located on the cyclic control grip (fig 4-71) in each crew station.

4.60.1 Weapon Action Switch (WAS). The WAS is a five-position spring-loaded switch. Placing the switch momentarily to a desired position selects (actions) a weapon for firing. Reselecting the actioned weapon will deselect the weapon. If a weapon has been selected, actioning an alternate weapon will deselect the current selection and action the newly selected weapon.

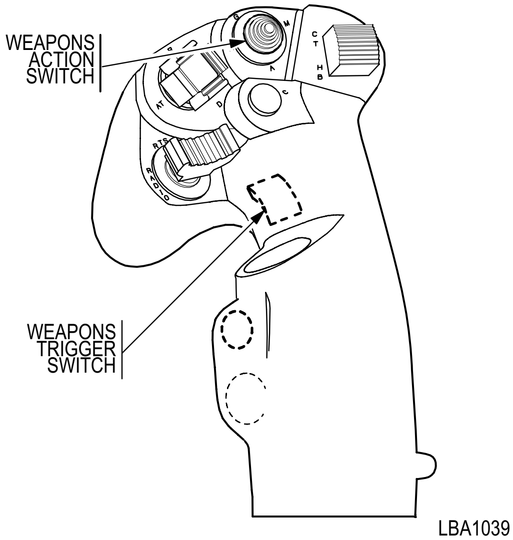


Figure 4-71. Cyclic Control Grip

a. **WAS Selections**. WAS selections are as follows:

- **G** (Gun). Actions the AWS and slaves the gun to the selected sight.
- **M** (Missile). Actions the Hellfire missile system; allows the pylons to articulate and displays the launch constraints symbol.
- **A** (Air-To-Air). Growth position; not active.
- **R** (Rocket). Actions the Rocket Management Subsystem; allows the pylons to articulate and displays the rocket steering symbol.

b. **WAS Logic**. A weapon can be actioned from either crewstation via the cyclic. Additionally, the CPG can action weapons via the LHG. The last crewmember to action a weapon has control of that weapon. Exception: If the CPG has rockets actioned via the ORT/TEDAC WAS and the pilot actions rockets, cooperative moding is in effect. The active LOS will be the CPG's LOS. The CPG's rocket moding selections will be active in cooperative mode. The pilot's type, quantity, and penetration selections will default to the CPG's selections.

4.60.2 Weapons Trigger Switch. The weapons trigger switch is a three position, two detent, guarded switch used to fire an actioned weapon. The switch is active when the **A/S** switch is in the **ARM** position. Pressing the trigger to the first detent will fire a weapon if no inhibits exist. Pressing the trigger to the second detent will override weapons performance inhibits and fire a weapon. Safety constraints can never be overridden.

4.61 COLLECTIVE CONTROL

Weapon switches on the collective control grip (fig 4-72) include the emergency stores jettison (**JETT)** switch on the flight control grip and the missile advance (**MSL ADV**) switch on the mission control grip.

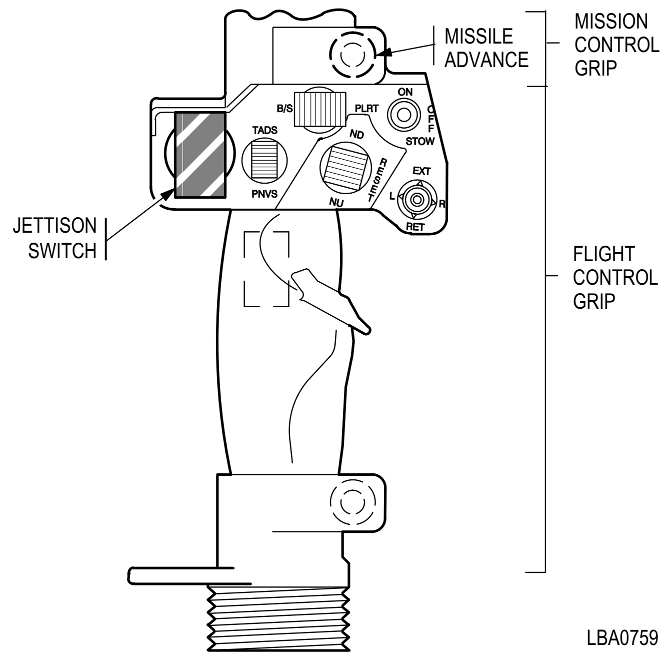


Figure 4-72. Collective Control Grips

4.61.1 Missile Advance (MSL ADV) Switch. The **MSL ADV** switch is used to manually advance or select the next missile in the firing sequence. When the Hellfire missile system is actioned in the manual mode, the **MSL ADV** switch on the collective mission grip is active. When the **SAL** missile mode is **NORM** or **RIPL**, the **MSL ADV** switch is not active.

4.62 ORT/TEDAC HANDGRIPS

Armament system controls located on the ORT/TEDAC LHG (fig 4-73) include the WAS and the weapons trigger switch. The **MSL ADV** switch is located on the ORT/TEDAC RHG. (fig 4-74)

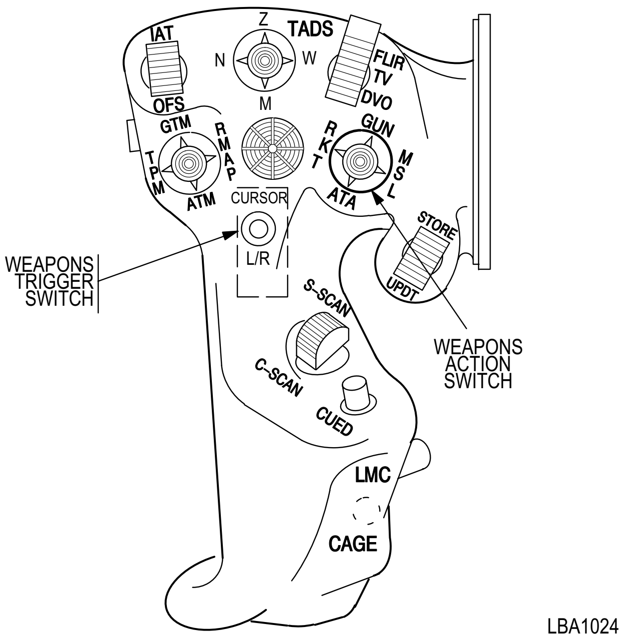


Figure 4-73. LHG

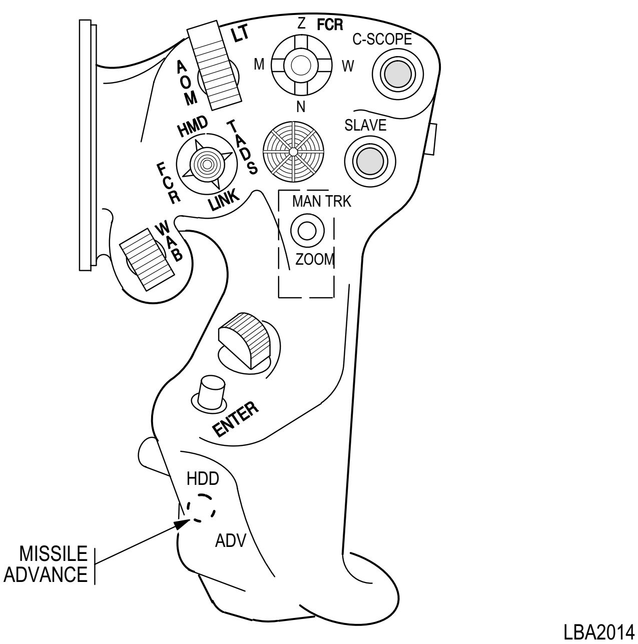


Figure 4-74. RHG

4.62.1 Weapon Action Switch (WAS). The WAS is a 5-position spring-loaded switch used to select a weapon for firing:

- **GUN** (Gun)
- **MSL** (Missile)
- **RKT** (Rocket)
- **ATA** (Air to Air) (Inactive)

Functionally it is identical to the WAS located on the cyclic control grip.

4.62.2 Weapons Trigger Switch. Functionally, this weapons trigger switch is identical to the trigger switch located on the cyclic control grip.

4.62.3 Missile Advance (MSL ADV) Switch. Functionally, this **MSL ADV** switch is the same as the **MSL ADV** switch located on the collective control grip.

4.63 WEAPONS (WPN) PAGE

The **WPN** page (fig 4-75) is used to functionally control sight and weapons moding. Various sight and weapons subsystem status windows, icons, and control selections are included on the format to reduce workload and enhance situational awareness. Sight subsystem descriptions are provided in Section I. The WPN page contains the following weapons buttons:

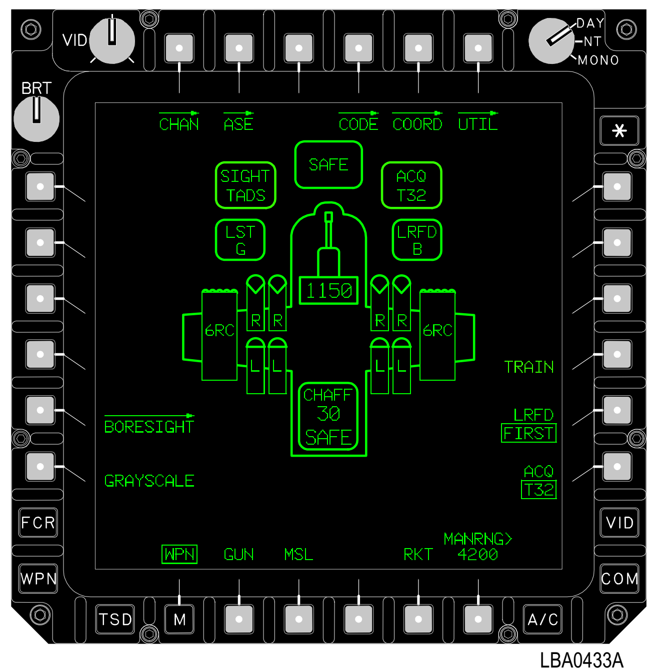


Figure 4-75. WPN Page

- T1 Missile **CHAN** button
- T6 WPN **UTIL** button
- B2 **GUN** button
- B3 **MSL** button
- B5 **RKT** button

4.63.1 CHAN Button. The missile **CHAN** button is used to access missile channels and stored laser codes for missile channel coding.

4.63.2 WPN UTIL Button. The WPN **UTIL** button is used to access weapons subsystem utility functions.

4.63.3 TRAIN Button. The **TRAIN** button is used to activate and deactivate the weapon training mode (refer to paragraph 4.74.7). The **TRAIN** button is displayed with a barrier when armament control is in the ARM state or when a weapon system is actioned in either crew station. This button is not available when the Tactical Engagement Simulation System (TESS) is enabled.

4.63.4 AKI Button. The **AKI** button is used to set the Aircraft Kill Indicator (AKI) to off in order to avoid crew disorientation when operating at night in heavy obscuration (i.e., fog, dust, precipitation, etc.). It is displayed only when operating in the TESS mode with an active kill, hit, or near miss casualty indication (external AKI flashing light activated).

4.63.5 GUN Button. The **GUN** button is used to access gun system controls and system status. Selecting the **GUN** button causes the gun icon to become inverse video and calls up the gun controls around the edges of the display (fig 4-76).

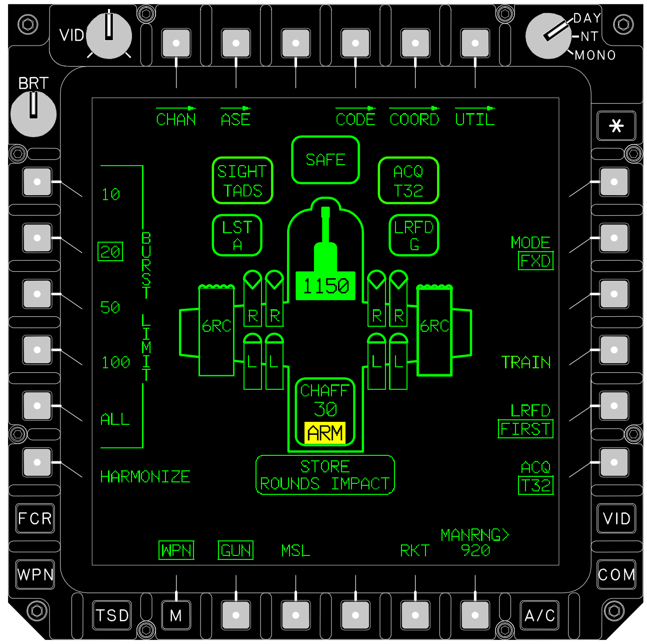


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Figure 4-76. Gun System Controls

a. MODE Button. The gun **MODE** button is used to select operational mode of the gun system: **NORM** or **FXD**. The **NORM** mode allows the gun to follow the selected sight while the **FXD** mode fixes the gun to the centerline of the aircraft. Gun mode selections are independent in each crew station.

b. BURST LIMIT Buttons. **BURST LIMIT** defines the number of rounds to be fired with each trigger pull: **10**, **20**, **50**, **100**, or **ALL**. Burst limit selections will not exceed turret control box burst limit selection.

c. HARMONIZE Button. The **HARMONIZE** button is used to perform the gun system dynamic harmonization procedure. This function is provided only in the CPG crew station.

d. Gun Icon and Rounds Counter. The gun rounds counter displays within the gun icon and will decrease in real time to reflect the number of rounds remaining as the gun is fired. When all rounds have been fired, the gun symbol displays zero.

e. Gun FAIL Indicator. The gun **FAIL** indicator is displayed in YELLOW within the gun icon when the gun system is detected to be in a fail state. The **FAIL** status is displayed in place of the rounds counter.

4.63.6 MSL Button. The **MSL** button is used to access missile system controls and system status. Selecting the **MSL** button causes all missile icons to become inverse video and calls up missile controls around the edges of the display (figs 4-77 and 4-80). If the sight is FCR L, the display switches to an **RF** missile format even if there are no **RF** missiles available. The page provides missile code and status within the missile icons as described below.

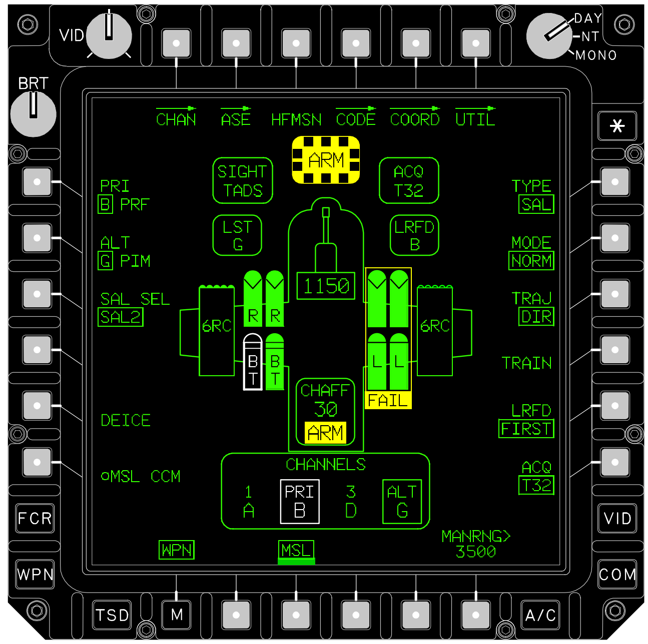

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Figure 4-77. SAL Missile System Controls

- L1 **PRI** button
- L2 **ALT** button
- L3 **SAL SEL** button
- L5 **DEICE** button
- L6 **MSL CCM** button
- R1 **TYPE** button
- R2 **MODE** button
- R3 **TRAJ** button

a. PRI Button. The **PRI** button is used to designate the priority missile channel for coding SAL missiles. Priority channel is common to both crewstations. Selecting the **PRI** button will provide the channel options as set up on the **CHAN** page. **PRI** button must be selected before selecting **ALT**. A **PIM** (pulse interval modulation) or **PRF** (pulse repetition frequency) label is displayed adjacent to the button label to indicate the type of laser code in the priority channel.

b. ALT Button. The **ALT** button is used to designate the alternate missile channel for coding SAL missiles. Alternate channel is common to both crewstations. Selecting the **ALT** button will provide the channel options as set up on the **CHAN** page. A **PIM** (pulse interval modulation) or **PRF** (pulse repetition frequency) label is displayed adjacent to the button label to indicate the type of laser code in the alternate channel.

c. SAL SEL Button. The **SAL SEL** button is used to select the type of SAL missile when in the **SAL** missile format: **AUTO**, **SAL1**, and **SAL2**. For missile system operations Basic Hellfire missiles will be identified as SAL 1 missiles and Hellfire II missiles will be identified as SAL 2 missiles. SAL 1 missiles are only capable of PRF laser code operation. SAL 2 missiles are capable of both PRF and PIM laser code operations. The **AUTO** allows for automatic selection of a SAL 1 or SAL 2 missile. If the code type is PRF the missile system will select SAL 2 missiles first, if available, over SAL 1 missiles. If the code type is PIM the system will select only SAL 2. The **SAL1** selection allows for firing of only SAL 1 missiles. The **SAL2** selection allows for firing of only SAL 2 missiles.

d. DEICE Button. The missile **DEICE** button is used to manually de-ice SAL missile seekers in preparation for missile launch. The **DEICE** button (L5) is only presented when the aircraft state is **ARM** and the missile system is actioned. Selecting the button causes the selected missile seeker's protective de-ice cover to jettison.

e. MSL CCM Button. The **MSL CCM** button is used to enable the counter-countermeasures within the SAL missile.

f. TYPE Button. The missile **TYPE** button is used to set the desired missile type: **SAL** or **RF**. Missile **TYPE** selections are independent in each crewstation.

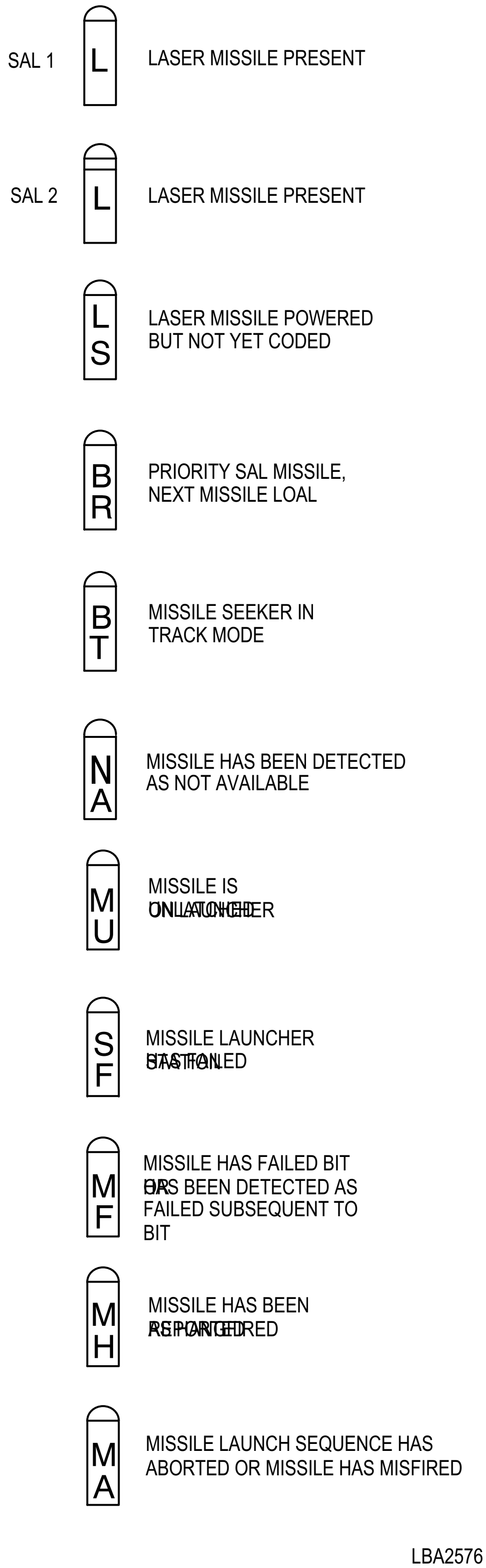
g. MODE Button. The missile **MODE** button is used to select the operational mode of the missile system in the **SAL** missile format: **NORM**, **RIPL**, and **MAN**. The **NORM** allows for firing missiles coded to the priority (PRI) channel. The **RIPL** mode allows for firing of missiles coded to both the priority channel and the alternate channel. The **MAN** mode allows selection of a single missile for firing. **SAL** missile mode selections are common to both crew stations.

h. TRAJ Button. The **TRAJ** button is used to select the desired missile launch trajectory: **DIR**, **HI**, or **LO**. **DIR** is used when the aircraft has direct line of sight to the target. **HI**/**LO** are used when a high altitude trajectory is required. Trajectory mode selections are independent in each crew station.

i. SAL Missile Status Window. The SAL missile status window in the lower center area of the format indicates the current status of missile channel coding and priority/alternate channel selections for all 4 SAL missile channels. The priority channel label, laser code and box are displayed in WHITE.

j. SAL Missile Icons. When the missile system inventory detects SAL missiles present on the launcher rails, unique SAL missile icons (fig 4-78) display to reflect this condition. Missile type, status, and fault condition information is displayed within the icon symbol. Icons may be displayed in normal or inverse video depending on whether the **MSL** button is selected or the missile system is actioned. The icon will be displayed in WHITE and flash between a bold and normal line when that missile is selected as the next missile to be launched in the firing sequence, regardless of these selections.

k. RF Missile Icons. When the missile system inventory detects RF missiles present on the launcher rails, unique RF missile icons (fig 4-79) display to reflect this condition. Missile type, status, and fault condition information is displayed within the icon symbol. Icons may be displayed in normal or inverse video depending on whether the **MSL** button is selected or the missile system is actioned. The icon will be displayed in WHITE, normal video when that missile is selected as the next missile to be launched in the firing sequence, regardless of these selections.



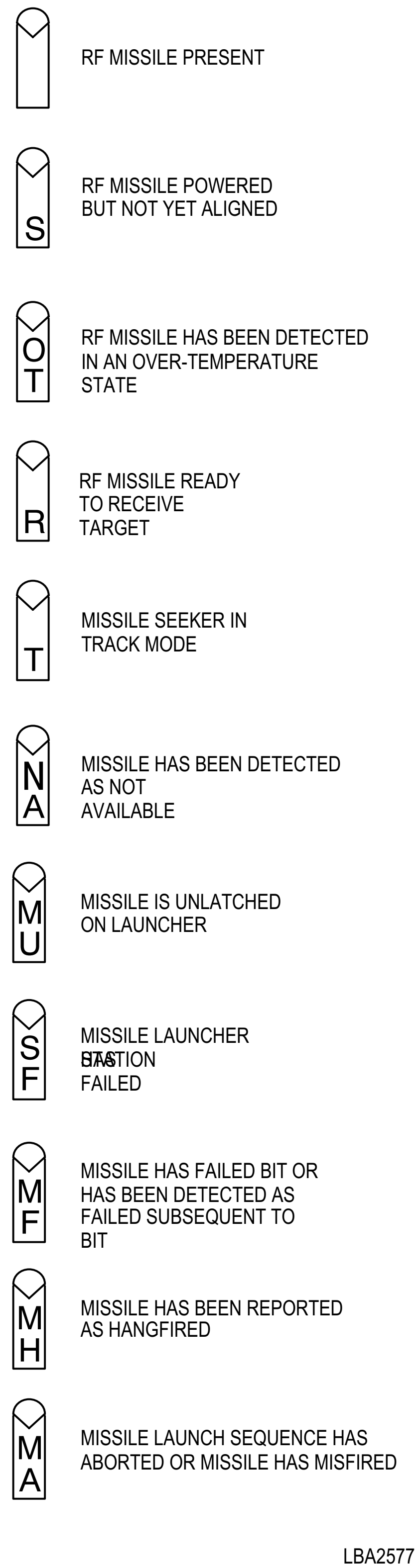


Figure 4-78. SAL Missile Icons and Status Messages

Figure 4-79. RF Missile Icons and Status Messages

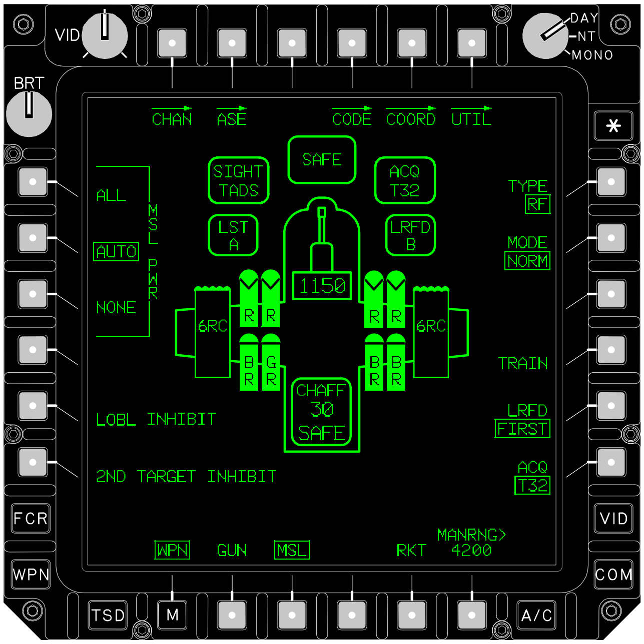


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Figure 4-80. RF Missile System Controls

- L1 - L3 **MSL PWR** buttons
- L5 **LOBL INHIBIT** button
- L6 **2ND TARGET INHIBIT** button
- R2 **MODE** button
- R4 **TRAIN** button

l. MSL PWR Buttons. **MSL PWR** buttons are used to select the desired method of RF missile management: **ALL**, **AUTO**, and **NONE**. Selecting the **ALL** button commands power to all RF missiles. Selecting the **AUTO** button automatically manages power to the missiles to prevent overheating. The number of missiles powered is based on the total missile inventory (table 4-22) available.

Table 4-22. MSL Available/MSL PWR (AUTO MODE)

Missiles Available	Missiles Powered
8 or more	4
4-7	2
2-3	1
1	0*

* Unless missiles are actioned, then 1 is powered.

Selecting the **NONE** button removes power to all RF missiles. When the RF missile **MODE** is **MAN** the **MSL PWR** buttons are not displayed. **MSL PWR** selection is common to both crew stations.

m. LOBL INHIBIT Button. The Lock On Before Launch **LOBL INHIBIT** button inhibits the RF missile seeker from transmitting and attempting to track the selected target while on the rail during an RF engagement. **LOBL INHIBIT** selection is common to both crew stations.

n. 2ND TARGET INHIBIT Button. The **2ND TARGET INHIBIT** button is used to prevent secondary target information from being handed over from the FCR to the primary RF missile during a stationary target engagement. **2ND TARGET INHIBIT** is common to both crew stations.

o. MODE Button. The **MODE** button is used to determine how control of power to the RF missiles will occur. The **MODE** button toggles between **NORM** and **MAN** modes and will power the RF missiles according to **MSL PWR** selection. The **MAN MODE** allows the operator to use the Manual Advance (**MAN ADV**) switch to to select and power a single RF missile for firing. It also allow the crew to manually advance through the RF missiles to select a desired missile for power application. When the **MAN MODE** is selected, the **MSL PWR** selection is removed. RF missile **MODE** is common to both crew stations.

p. Missile Launcher Rail Icons. Missile launcher rail icons (fig 4-81) indicate launcher present and missile inventory status. Like the individual missiles icons, the launcher rail icons become inverse video when selected or when the missile system is actioned.

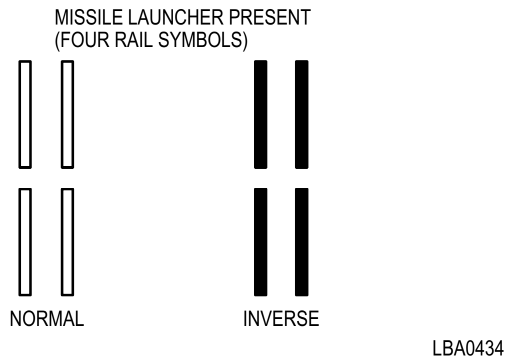


Figure 4-81. Missile Launcher Rail Icons

q. Missile Launcher FAIL/SAFE/BIT/LOAD Icons. Unique missile launcher status icons (fig 4-82) are displayed under certain conditions: the WHITE launcher **SAFE** icon is displayed when the launcher **SAFE/ARM** switch is in the **SAFE** position; the WHITE launcher **BIT** icon is displayed when launcher IBIT is in progress; the WHITE launcher **LOAD** icon is displayed when the loading of keyword(s) to the launcher is in progress; the YELLOW **FAIL** icon is displayed when a fail condition is detected that affects missile operation. These icons are displayed around the missile icons of the affected launcher.

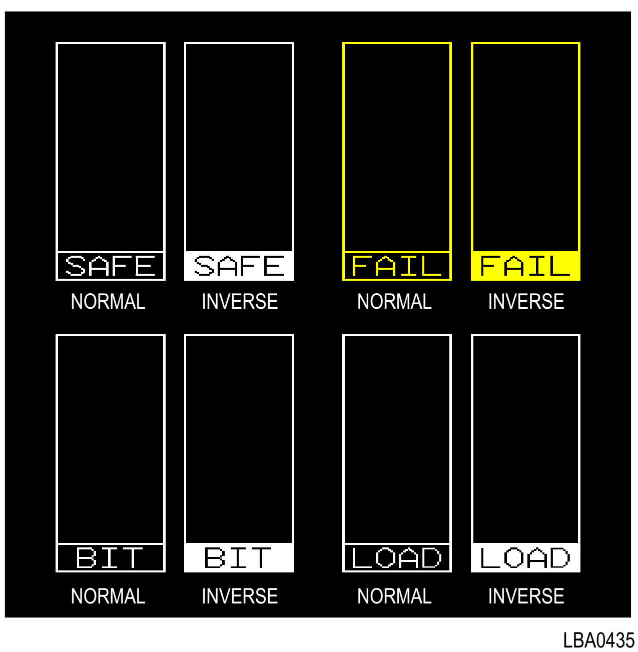


Figure 4-82. Missile Launcher Status Icons

4.63.7 RKT Button. The **RKT** button is used to access rocket system controls and system status. Selecting the **RKT** button causes the rocket launcher icons to become inverse video and calls up the rocket system controls around the edges of the display (fig 4-83).

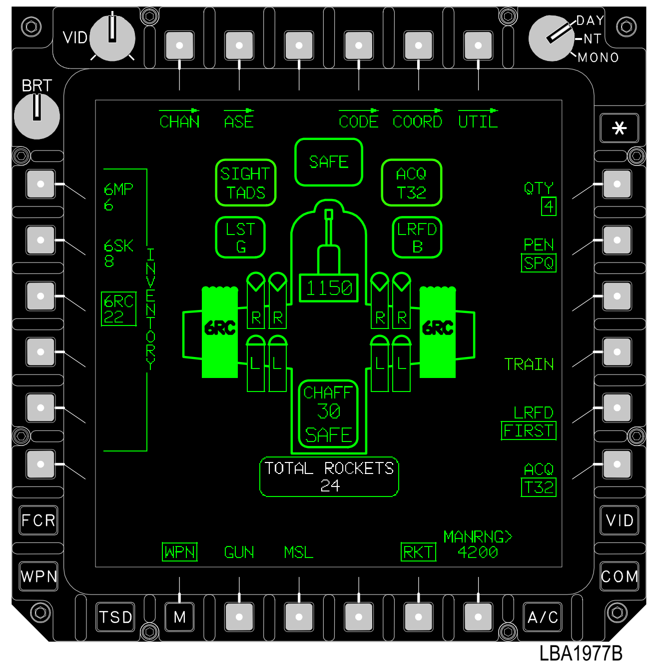


Figure 4-83. Aerial Rocket System Controls

- L1 - L5 **INVENTORY** Buttons
- R1 **QTY** button
- R2 **PEN** button

a. INVENTORY Buttons. The **INVENTORY** buttons are used to select the desired rocket warhead and type to be fired. Rocket **INVENTORY** type and warhead selections are independent in each crew station.

b. QTY Button. The **QTY** button is used to select the desired number of rocket pairs to be fired with each trigger pull: **1**, **2**, **4**, **8**, **12**, **24**, and **ALL**. When **QTY** is **1**, a single rocket will be fired with each trigger pull. For the remaining **QTY** options, rockets will be fired in pairs with each trigger pull. Rocket Quantity selections are independent in each crew station.

c. PEN Button. The **PEN** button is used to select the desired warhead fuse penetration setting. The **PEN** button displays when warheads which require a penetration selection, such as RC4 or 6RC (M433 fuze), are loaded. Warhead penetration selections are independent in each crew station.

d. Total Rockets Status Window. The **TOTAL ROCKETS** status window in the inventory format area indicates the total rockets remaining for the type warhead selected when the total and available quantities are not equal. This status window is displayed in WHITE.

e. Rocket Launcher Icons. Rocket launcher icons are displayed at the appropriate station. The inventory type and warhead selected is presented within the launcher icons.

f. Rocket Launcher Degraded Icons. When the rocket system has been detected as degraded, a YELLOW **DEGR** icon will be displayed around the rocket launcher icon.

g. Rocket Launcher Fail Icons. When the rocket system has been detected as failed, the station will be unavailable and a YELLOW **FAIL** icon will be displayed around the rocket launcher icon.

4.63.8 ARM/SAFE Status Window. The **ARM/SAFE** status window displayed in the upper area of the **WPN** page provides the current aircraft status: **SAFE** or **ARM**. It is displayed in GREEN when the status is **SAFE**; it is displayed in YELLOW when the status is **ARM**. Cross-hatch symbol coding is added to the status window when a weapon is actioned (fig 4-84). **ARM/SAFE** status is common to both crew stations.

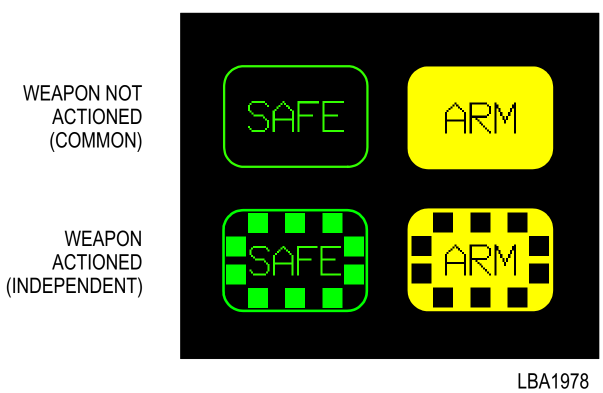


Figure 4-84. ARM/SAFE Status Window

4.63.9 Weapon Actioned Format. When a weapon is actioned for firing, the respective weapon controls will be available as previously discussed, and all icons associated with the actioned weapon will become inverse video. Weapon system buttons (**GUN**, **RKT**, **MSL**) are not available when a weapon has been actioned. WAS status is independent in each crewstation.

4.63.10 CHAFF Status. The **CHAFF** status displayed in the center area of the **WPN** page provides the remaining number of chaff cartridges decremented by the system processor and the current chaff dispenser status: **SAFE** or **ARM**. The dispenser status is displayed in GREEN when the status is **SAFE**; it is displayed in YELLOW when the status is **ARM**.

4.64 WPN UTILITY (UTIL) PAGE

The WPN **UTIL** page (Pilot) (fig 4-85) is used to enable weapon systems and provide access to the **LOAD** page. Although many utility functions may be premoded by use of the Data Transfer Cartridge (DTC), this page provides access to utility functions while in flight. The CPG's WPN **UTIL** page (fig 4-85) provides the same functions. Sight subsystem control descriptions are provided in Section I.

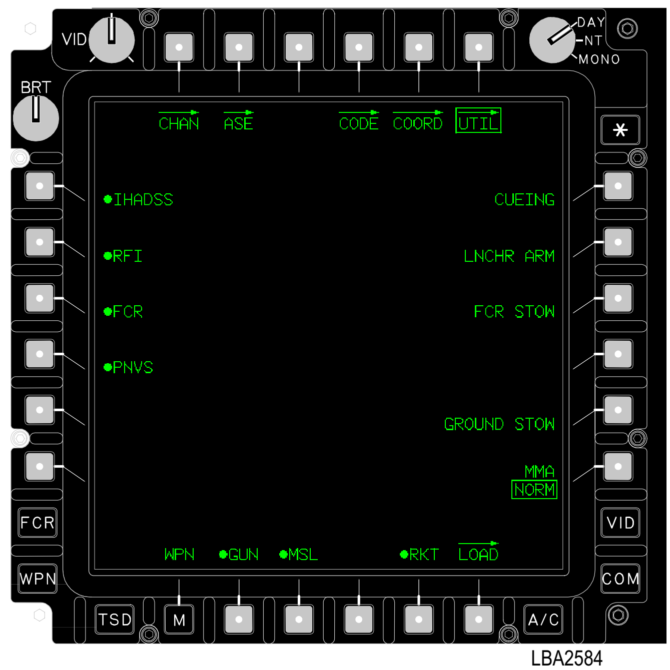


Figure 4-85. WPN UTIL Page (Pilot)

- T6 WPN **UTIL** button
- R2 **LNCHR ARM** button
- R5 **GROUND STOW** button
- B2 **GUN** On/Off button
- B3 **MSL** On/Off button
- B5 **RKT** On/Off button
- B6 **LOAD** button

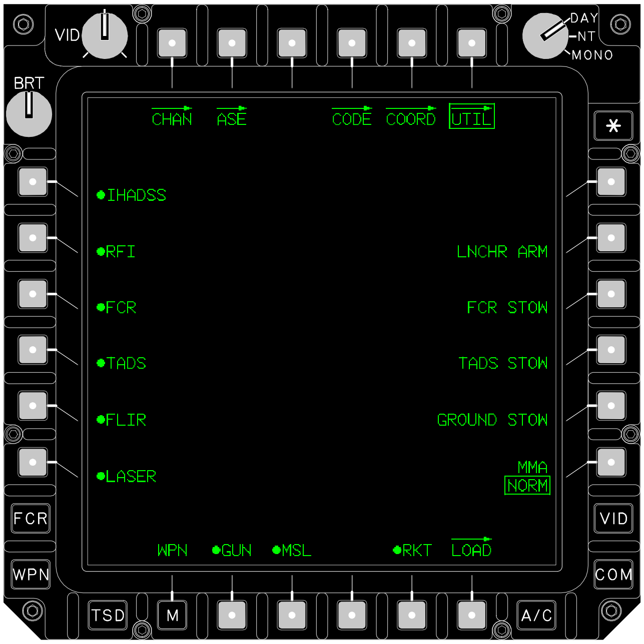


Figure 4-86. WPN UTIL Page (CPG)

4.64.1 LNCHR ARM Button. The **LNCHR ARM** button is used to arm the Hellfire missile launchers. Selecting this button will command the Remote Launcher Safe/Arm switch on all Hellfire missile launchers to the **ARM** position.

4.64.2 GROUND STOW Button. The **GROUND STOW** button is used to stow the wing pylons to achieve optimum ground clearance.

4.64.3 GUN Button. The **GUN** button is used to enable/disable the gun system.

4.64.4 MSL Button. The **MSL** button is used to to enable/disable the missile system.

4.64.5 RKT Button. The **RKT** button is used to enable/disable the aerial rocket system.

4.64.6 LOAD Button. The **LOAD** button is used to access the controls required to manually override the data loaded at the maintenance load panel.

4.64.7 Casualty Status Window. The casualty status window is displayed in the upper area of the format to provide the casualty indication status and the opposing weapon type/identification code for the most recent engagement event when operating in the TESS mode. This status window is displayed only when a casualty status is active (figure 4-95). The casualty "INDICATION" status shall be one of three messages:

- "NEAR MISS"
- "HIT"
- "KILL"

The opposing "WPN IDCODE" shall be one of 37 two-digit codes in a range from 00 to 36. The aircrew must refer to the appropriate technical manual for the description of these codes.

4.65 WEAPONS LOAD PAGE

The weapons **LOAD** page (fig 4-87) is used to access the **GUN ROUNDS** and **RKT INV** zone buttons to manually override the data loaded at the LMP or the DTC. The weapons **LOAD** page provides the following button selections:

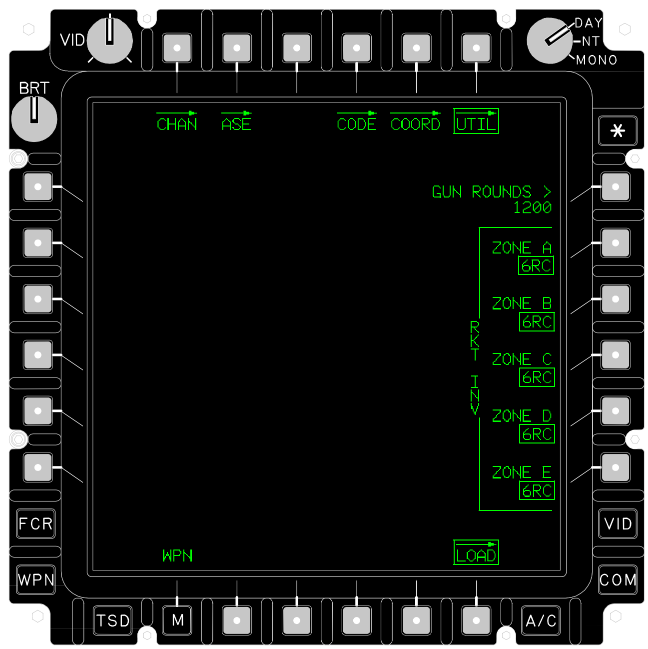


Figure 4-87. LOAD Page

- R1 **GUN ROUNDS** button
- R2 - R6 **RKT INV ZONE** buttons

4.65.1 GUN ROUNDS Button. The **GUN ROUNDS** button is used to manually enter the number of rounds loaded. This entry overrides the value entered at the LMP. The range value entry will be from 0 to 1200 rounds in 1 round increments.

4.65.2 RKT INV Buttons. The **RKT INV** buttons (fig 4-88) are used to select the desired rocket type and warhead for a particular zone. Selecting one of these buttons calls up the **RKT** Launcher **ZONE** status window and all inventory options:

- **L1 PD7 button**
- **L2 RA7 button**
- **L3 IL7 button**
- **L4 SK7 button**
- **L5 MP7 button**
- **L6 FL7 button**
- **R1 6PD button**
- **R2 6RC button**
- **R3 6IL button**
- **R4 6SK button**
- **R5 6MP button**
- **R6 6FL button**

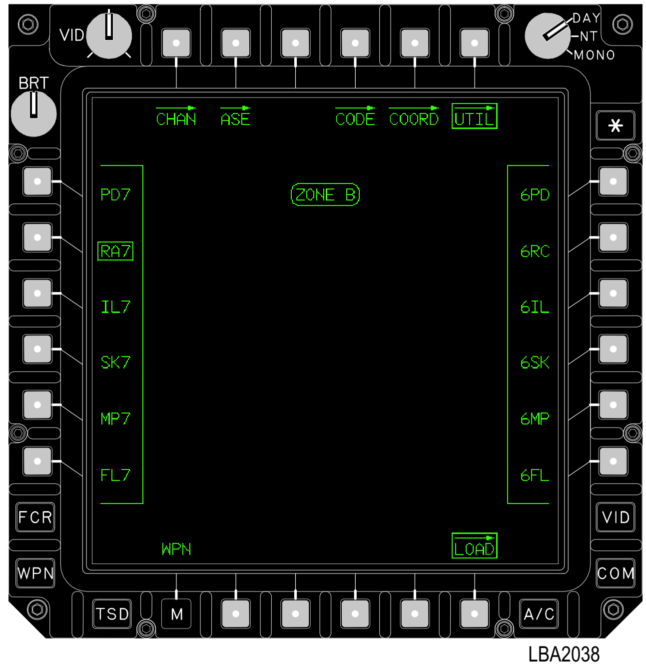


Figure 4-88. RKT INV Page

4.65.3 RKT Zone Inventory. Rocket Zone Inventory is displayed in figure 4-89.

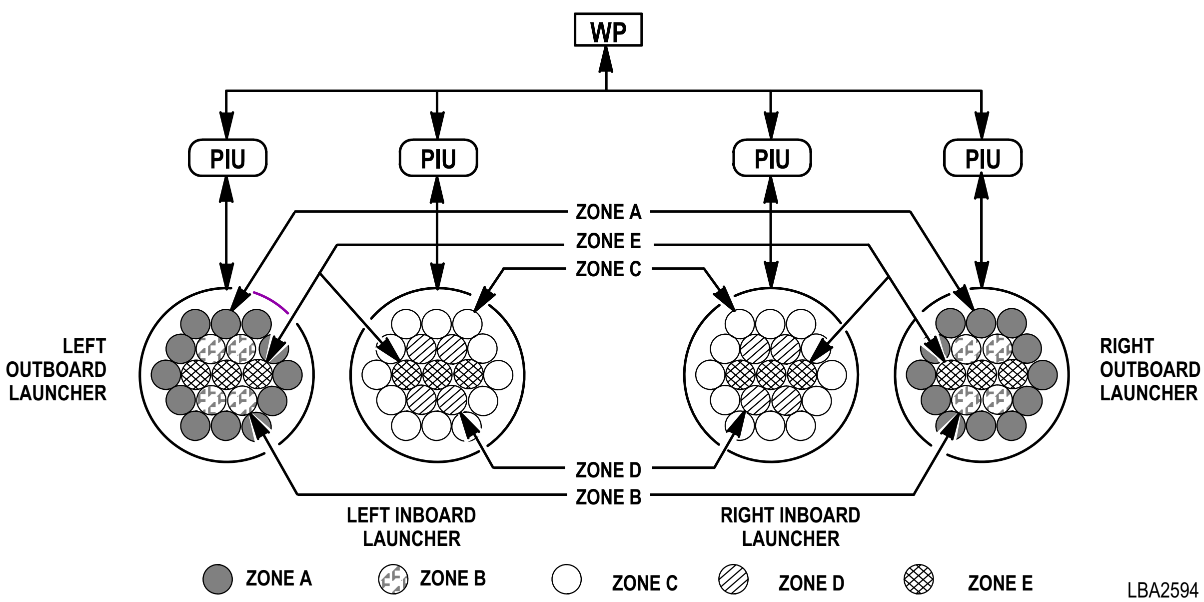
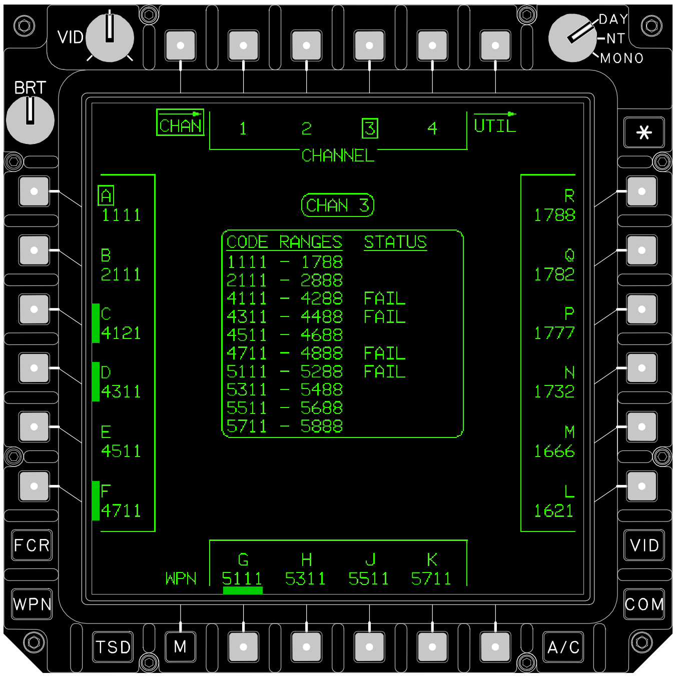


Figure 4-89. Rocket Zone Inventory

4.66 MISSILE CHANNEL (CHAN) PAGE

The missile **CHAN** page (fig 4-90) is used to select the laser codes to be loaded into the four missile channels.



LBA1980

Figure 4-90. CHAN Page

The **CHAN** page provides the following button selections:

- T2 - T5 **CHANNEL** buttons
- L1 - L6 **CHAN** Code buttons
- R1 - R6 **CHAN** Code buttons
- B2 - B5 **CHAN** Code buttons

4.66.1 CHANNEL Buttons. The missile **CHANNEL** buttons are used to code SAL missile channels 1 through 4 using **CHANNEL** option buttons. Selecting the desired channel determines to which missile channel subsequent **CHAN** Code selections apply.

4.66.2 CHAN Code Buttons. The missile **CHAN** Code buttons are used to select the code for the current missile channel as indicated by the selected **CHANNEL** option button. A missile **CHAN** code button will be displayed with a barrier when that code is not available.

4.66.3 Code Range and Keyword Status Window. The information displayed in this status window is described in paragraph 4.9.5.

4.67 AREA WEAPON SYSTEM (AWS) DESCRIPTION

The AWS consists of the M230E1 30mm Automatic Gun, Gun Control Box, Gun Turret, Turret Control Box, and ammunition handling system.

4.67.1 M230E1 30mm Automatic Gun. The M230E1 is an externally powered, chain driven weapon mounted in a hydraulically driven turret which is mounted on the underside of the helicopter forward fuselage. Gun major components are: receiver assembly, index drive assembly, bolt carrier assembly, forward track assembly, recoil mechanisms, drive motor, flash suppressor, and barrel. It incorporates positive cook-off safety (open bolt) and double ram prevention. The rate of fire is 625 ±25 rounds per minute. The gun turret is capable of azimuth movement of 86° left or right of the helicopter centerline, +11° elevation (+9° elevation within ±10° of centerline), and -60° depression.

4.67.2 Ammunition Handling System. The ammunition handling system receives and stores 30mm linkless ammunition and delivers the rounds through fixed and flexible feed chutes to the 30mm gun on demand. The ammunition handling systems maximum capacity is 1200 rounds. The amount of rounds will be reduced with the installation of the IAFS. The quantity will be approximately 94 rounds, with the 130 gal fuel cell, if utilizing the uploader/downloader or approximately 58 rounds using the sideloader. The 100 gal fuel cell includes a 242 round ammunition storage magazine, making the maximum capacity about 300 rounds. The system can accommodate a variety of 30mm ammunition including high explosive dual purpose (HEDP M789), ADEN/DEFA, HEI (M799), and TP (M788).

4.68 AWS SYSTEM OPERATION

CAUTION

The AWS will continue to follow IHADSS LOS when operating in NVS FIXED mode.

NOTE

In the event of power loss, the gun is spring driven to +11° elevation to prevent dig-in during landing.

The AWS can be directed by either crewmember in the **NORM** mode when the active sight is HMD, TADS or FCR **L**. The system can also be employed in the FIXED (+6° in elevation) mode which aligns the gun forward in azimuth to the helicopter centerline. The software limit is 4200 meters.

WARNING

Failure to adhere to the published gun duty cycle may result in a catastrophic failure, **loss of aircraft**, **injury or death**.

The gun duty cycle is as follows:

- Six 50 round bursts with 5 seconds between bursts followed by a 10 minute cooling period.
- For **BURST LIMITER** settings other than 50, the cycle can be generalized as no more than 300 rounds fired within 60 seconds before allowing the gun to cool for 10 minutes, after which the cycle may be repeated.

4.68.1 Sideloader/Magazine Controller (S/MC). The S/MC (fig 4-91) is an LRU with control features provided for direct operator interface during loading operations. The S/MC is mounted in the RH FWD Avionics Bay adjacent to the Loader Assembly for one-man operation.

The S/MC performs three distinct ammunition handling system functions:

- counting of 30mm rounds
- control of the Carrier Drive Assembly
- control the Loader Assembly for uploading and downloading 30mm ammunition

The S/MC provides the discrete interface link between the Turret Control Box, Carrier Drive, LH and RH tensioners, GSE Loader, Loader Assembly, and Weapons Processor.

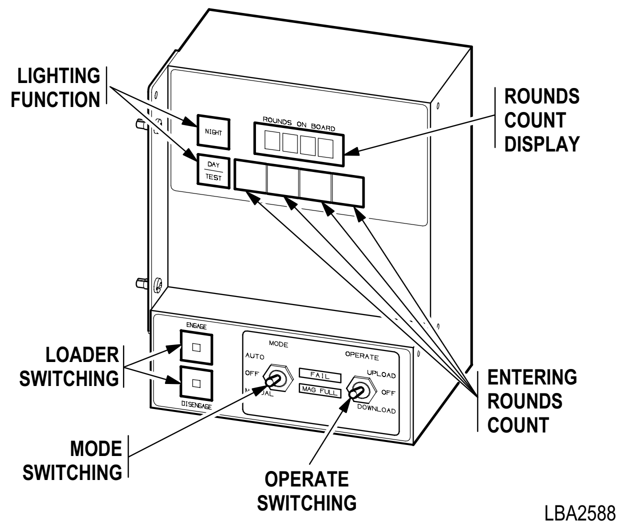


Figure 4-91. Sideloader/Magazine Controller

The S/MC operational interface can be grouped into five functional areas:

a. Lighting functions. When powered, the S/MC sets display lighting to the maximum night time intensity. Successive button pushes of the **NIGHT** button will sequentially cycle the intensity to the minimum night time intensity in five steps, and then back to the maximum intensity on the sixth button press. A momentary press of the **DAY/TEST** button provides maximum display lighting intensity for readability under direct sun light. Pressing the **NIGHT** button after selecting **DAY** lighting will return the display intensity to the maximum night time intensity. Pressing and holding the **DAY/TEST** button for longer than 3 seconds will initiate a lamp test routine which illuminates all display segments, legend lamps, and indicators to confirm that all lighting circuits are functional. When the squat switch status indicates that the aircraft is airborne, the S/MC disables the display indicators to extend service life.

b. Rounds Count Management. Four momentary push button switches are used for manually editing the displayed numeric value of rounds count which is stored in the S/MC non-volatile memory. This data is not downloaded to the aircraft and must be loaded via the LMP or **LOAD** page.

c. Loader Switching. This function is provided by two momentary push buttons labeled **ENGAGE** and **DISENGAGE.** These push buttons provide for the automatic set-up and shut-down of loading operations. Their use requires that the **MODE** Switch be placed in the **AUTO** position and the **OPERATE** Switch be placed in the **OFF** position.

d. MODE Switching. This three position latching toggle switch provides three command modes. Center position is **OFF**, prohibiting any S/MC loading operations. The down position is used for **MANUAL** operations which is used only as needed by the operator to address non-standard operating conditions. The up position is the **AUTO** mode for which Sideloader system use is optimized. In the **AUTO** mode, the operator is freed from control inputs while uploading of ammunition is accomplished. Downloading in all operating modes requires the operator to maintain pressure on the **OPERATE** toggle switch, in the downward direction, to accomplish the **DOWNLOAD** operation.

e. OPERATE Switching. This three position toggle switch provides three operational states. Center position is **OFF**, prohibiting all Loader Assembly operations except **AUTO ENGAGE** and **DISENGAGE**. The **DOWNLOAD** position operates the Sideloader system in the download direction as long as the operator maintains pressure on the toggle switch. The toggle switch latches in the up (**UPLOAD**) position only during **AUTO MODE** operation. While in the **MANUAL MODE**, operator pressure must be maintained in either the **UPLOAD** or **DOWNLOAD** position for continued operation.

4.68.2 Turret Control Box. The TCB serves as the gun turret assembly controller performing BIT, mode control, and turret servo loop closure in response to commands received from the Weapons Processors. The TCB provides intermediate power outputs to the Gun Control Box (GCB) as well as the Train Rate Sensor (TRS) and elevation actuator located in the gun turret assembly. The TCB outputs arming and firing signals to the GCB to control gun firing. The TCB also processes bolt position status from the GCB to derive rounds decrement status which is output to the Weapons Processors.

4.69 WING STORES PYLON SUBSYSTEM DESCRIPTION

The Wing Stores Pylon Subsystem consists of four pylon assemblies, a Selectable Stores Jettison panel, and an Emergency Jettison button.

4.69.1 Wing Store Pylons. The wing store pylon consists of a pylon frame, the ejector rack, Pylon Interface Unit (PIU), pylon actuator, and pylon fairings. The ejector rack contains attaching lugs for securing the store to the pylon and the ballistic ejector for stores jettison. The PIU provides the interface between the weapons processor and pylon discrete signals. The pylons can be articulated in elevation by hydraulic power in response to pointing commands from the weapons processor. The pylons are equipped with hydraulic and electrical quick-disconnect provisions and contain electrical aircraft interfaces for the 2.75 in. Aerial Rocket Subsystem, auxiliary fuel tanks, Hellfire Modular Missile System and servo control of rack position.

4.69.2 Wing Stores Jettison. Each pylon is equipped with an electrically operated ballistic ejector circuit to jettison the attached wing store. Refer to Chapter 2, paragraph 2.28 for operation.

4.70 WING STORES PYLON SUBSYSTEM OPERATION

The weapons processor commands the pylons to the required elevation angles for the various fire control modes. The modes include ground stow, flight stow, and articulation mode.

4.70.1 Ground Stow. The ground stow mode commands the pylons to a stow position (-5°) so that the wing stores are parallel with the ground (level terrain). The ground stow mode is automatically commanded when the squat switch indicates **GROUND** and either a rocket launcher or a hellfire launcher is present. The pylons can be manually ground stowed while in flight using the WPN **UTIL** page.

4.70.2 Flight Mode. The flight mode commands the pylons to a single fixed position (+4°). The flight mode is automatically commanded ON at takeoff when the squat switch indicates airborne for more than 5 seconds.

4.70.3 Articulation. In flight the pylons remain in the flight mode until missiles or rockets are actioned. Pylons are independently controlled through a range of +4° to -15° in elevation.

4.71 AERIAL ROCKET SUBSYSTEM DESCRIPTION

The 2.75 in. Aerial Rocket Subsystem consists of lightweight rocket launchers mounted on any of the four wing stations. Remote fuzing capability is incorporated and accommodates use of both penetration and air burst fuze types. Penetration fuzes permit use of variable detonation timing to defeat bunkers and targets masked by forest canopy. Air burst fuzes permit deployment of payloads at optimum range and height offsets.

4.71.1 Rocket Launcher. The M261 lightweight rocket launcher consists of 19 tubes in a cylindrical configuration and a hardback with 14 inch lug spacing. Each tube contains a mechanical detent for holding the rocket until fired. Two electrical interface connectors are provided: one for providing firing signals to the rocket motor igniters and the other for externally setting the rockets fuze circuitry.

4.71.2 2.75 Inch Folding Fin Aerial Rockets. The rocket system is compatible with the MK-66 rocket type. Available warhead and rocket motor types are listed below:

MK-66 Rocket Motor/Warheads

- 6PD - Point Detonation, High Explosive
- 6RC - Penetration, High Explosive
- 6MP - Time, Multi-purpose Submunition
- 6IL - Time, Illumination
- 6SK - Time, Smoke
- 6FL - Flechette

4.72 AERIAL ROCKET SUBSYSTEM OPERATION

CAUTION

Firing of 2.75 inch Hydra-70 rocket configuration (fuse/warhead/motor) flight conditions as follows:

- **Use of the MK66 MOD 2 rocket motor is prohibited.**
- **Rockets with jericho nozzles are prohibited.**
- **Do not use a MK66 rocket motor which has been continuously stored above 140° F (60° C).**
- **Discard any rocket which has been dropped.**
- **M439/M261/MK66 at ranges less than 1000 meters and/or speeds greater than 90 kts are not authorized.**
- **When forward airspeed exceeds 10 KTAS, do not use M229/M423 warhead/fuse combination for engagement of targets under 450 ft distance, and ensure the line of fire is clear of obstruction (trees/buildings) for at least 450 ft. When at a hover or forward airspeed is less than 10 KTAS, engagement distance and the requirement for line of fire to be clear of obstruction may be reduced to 350 ft. Firing this combination with the ballistics for the M151 warhead will result in reduced rocket range.**
- **Firing MK66 in a hover or low speed at a height of less than 7 ft AGL, and for all other flight conditions of 5 ft AGL, is not authorized.**
- **Do not fire rockets with the M433 fuse in situations where they might fly closer than 51m from other airborne helicopters. This restriction comes from Safety of Usage Message, U. S. Army Industrial Operations Command (SOUM IOC) #2-97.**
- **Due to the possibility of surging the engines, do not fire rockets from inboard stations. Fire no more than pairs with two outboard launchers every three seconds, or fire with only one outboard launcher installed without restrictions (ripples permitted). These are the only conditions permitted.**

NOTE

- Re-inventory and attempting to fire 6MP, 6FL, and 6SK rocket types, after a NO-FIRE event is not recommended due to significant impact on accuracy. The rockets should not be used for at least 10 days to allow the M439 fuse to reset.
- The minimum range to target when firing Flechette rocket is 800 meters. The effective range with MK66 rocket motors is 1 to 3 Km. Effectiveness is reduced with ranges greater than 3 Km.

The Aerial Rocket Subsystem can be employed independently by either crewmember or in the cooperative mode when the active sight is HMD, TADS, or FCR **L**. The subsystem permits the crewmember to select the warhead and quantity desired. Articulating wing pylons move in elevation based on the selected sight and weapons processor ballistics calculations, while the crewmember aligns helicopter heading based on steering symbols provided on cockpit displays.

4.73 LONGBOW HELLFIRE MODULAR MISSILE SYSTEM DESCRIPTION

The Longbow Hellfire Modular Missile System is the primary weapon on the AH-64D. The system consists of missile launchers mounted on any of the four wing pylons. The system employs SAL 1 and SAL 2 and RF Hellfire missiles. The SAL portion of the missile system is capable of both PRF and PIM laser code operation.

4.73.1 Missile Launcher. The M299 missile launcher consists of a hardback, a removable Launcher Electronics Assembly (LEA), and four missile rails. The launcher is capable of firing all Hellfire missile types.

4.73.2 Hellfire Missile. The missile is comprised of four major assemblies; the guidance section, the warhead group, the control section, and the propulsion section. Currently the missile system employs two types of SAL missiles:

- Basic (SAL 1)
- Hellfire II (SAL 2)

The SAL 1 missile is capable of only PRF laser codes. SAL 2 missiles are capable of both PRF and PIM laser codes.

4.74 LONGBOW HELLFIRE MODULAR MISSILE SYSTEM OPERATION

4.74.1 Target Designation Modes. Laser target designation may be autonomous or remote. Autonomous is when the target is designated by the aircraft. Remote is when the target is designated by a remote laser source.

4.74.2 Missile Launch Types. The aircrew has the capability of two types of missile launches; Lock-On-Before Launch (**LOBL**) where the missile is tracking prior to launch, and Lock-On-After Launch (**LOAL**) where the missile acquires and tracks the target after launch.

4.74.3 RF Missile Loading. Loading of RF missiles should be balanced between both sides of the aircraft, primarily on outboard launchers. This allows automatic missile firing selection from alternating sides of the aircraft to minimize the possibility of missile radars from interfering with each other. Outboard launcher loading also minimizes missile-to-target masking by the aircraft fuselage by selecting missiles from alternating sides. Missile-to-target masking by the fuselage increases crew workload associated with keeping missiles within launch constraints.

4.74.4 RF Missile Transfer Alignment. Transfer alignment (transfer of aircraft inertial data to missile inertial platform) occurs automatically, whether in-flight or not, at missile powerup with no pilot action required. The “R” in the missile icon on the **WPN** page indicates that the missile is ready to receive the target.

4.74.5 RF Missile Target Handover. The missile receives targeting information, to include North, East, and Down data, from the acquisition source:

- TADS
- FCR
- IDM

Handover will occur when the WAS is actioned during a scan or if WAS is actioned prior to a scan, handover will occur after the first scanburst of the scan is completed.

4.74.6 RF Missiles Launch. RF missiles may be launched after target acquisition using targeting data from the FCR L or the aircraft’s fire control system, TADS, and targeting data received through the IDM. Automatic missile firing selection from alternating sides of the aircraft is performed by the WP to minimize the possibility of missile radars from interfering with each other. Targets will be assigned by the WP to missiles on opposite sides of the aircraft, with only one missile per side possessing a target at any given time. If missiles are only present on one side, only one missile will be assigned a target.

NOTE

Operation of tactical missiles is not possible while the training mode is enabled. All tactical missile icons will be coded as **NA** on the **WPN** page.

4.74.7 TRAIN Mode. The **TRAIN** mode enacts a software component (Training Mission Emulator [TME]) loaded in the missile launcher that provides the capability of simulating missile operations. The TME can simulate the functioning of 4 RF missiles for each launcher. The TME emulates the missile control decision making process, replicates the missile launch mode selection processing, target acquisition and tracking function, BIT routines and thermal management characteristics (fig 4-92). During simulated Hellfire missile launch, rocket launch, or if gun fire occurs, the Communications Interface Unit will provide the respective weapons launch/firing audio effect. for additional **TRAIN** mode functionality, refer to paragraph 4.76.

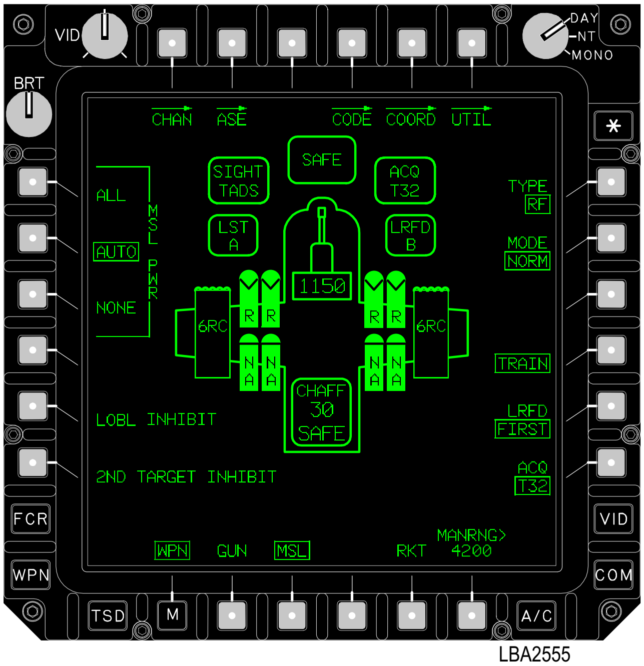


Figure 4-92. WPN Page with TRAIN ON

a. Training Mode BIT Functions. The training mode will replicate PBIT and IBIT functions with appropriate delays built in for simulation accuracy. IBIT may be initiated when the system has completed PBIT and is not actioned. IBIT can be commanded on an aircraft power up, but will not function until PBIT is complete.

b. Thermal Management. A training mode missile is allowed an elapsed **ON** time of 30 minutes. If this time is exceeded, an overtemperature (**OT**) symbol will appear on the affected missile icon on the **WPN** page. The timer can be reset by turning the missile **OFF** and then back **ON**.

c. TME Operational Sequence.

NOTE

The **TRAIN** button is not displayed until missile power is applied.

(1) Missile system power is selected in the normal manner.

(2) When in the training mode, empty launcher rails will indicate an RF missile present and rails with SAL training missiles installed will indicate SAL missiles present. Tactical missiles will indicate **NA.**

(3) Upon actioning the missile system, the TME transitions to the prelaunch mode and target assignments from the FCR are passed to the firing missile. In the prelaunch mode the TME will replicate target acquisition and tracking characteristics.

(4) HAD Messages and **WPN** page icons will be displayed in conjunction with the TME track processing.

(5) A centered "**T**" (fig 4-93) will be displayed in the missile constraints box when the training mode is enabled and the weapon system is actioned.

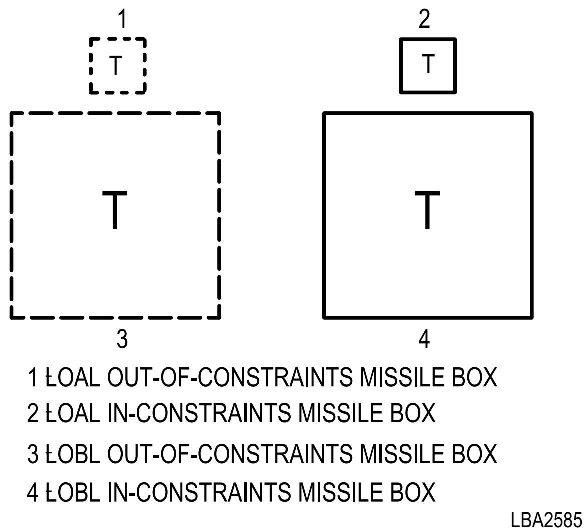


Figure 4-93. Missile Constraints Boxes (Training Mode)

(6) The weapon inhibit field will display "**SAFE**" when the training mode and missile system is actioned and the weapon system is safed. Upon arming the weapon system, the weapon inhibit field will change to "**TRAINING**".

(7) Upon determining that the firing missile has met all prelaunch constraints, it will notify the WP, which will display the "in constraints" box on the weapons symbology display. The trigger may then be actioned to initiate launch commands. The training mode will display a successful launch by signalling the WP to blank the firing missile icon from the **WPN** page. The WP will also cause the target on the FCR page to change to the "shot at" icon.

(8) Successive target engagements may then proceed as per the tactical system design.

4.75 TACTICAL ENGAGEMENT SIMULATION SYSTEM (TESS)

The TESS is an interactive simulation system that allows aircrew training for all of the AH-64D sight and weapons systems. The system provides real time casualty assessment (RTCA) for force-on-force (FOF) training for Combat Training Center-Instrumentation (CTC-I) and home station instrumentation (HSI). The TESS will interface with the ground instrumentation at CTCs and HSI. TESS is apportioned into two component systems. The A Kit is comprised of modifications to the AH-64D software and fixed hardware required to interface with the removable B-Kit. The B-kit contains an eye safe laser rangefinder/MILES laser designator that physically replaces the TADS laser rangefinder/designator and laser spot tracker. The eye safe laser rangefinder and MILES laser designator functionally replace the TADS laser rangefinder/designator. Laser spot tracking is simulated during TESS training. The B kit also adds a TADS internal boresight adapter. Simulated weapons inventory is used to provide realistic interaction between aircrew, aircraft and targets. TESS incorporates the capability to interact with ground based After Action Review (AAR), Executive Control (EXCON), and targeting systems. Information is provided from the aircraft systems to the B Kit for processing and transmission to the ground instrumentation systems. The ground instrumentation system elements can provide real-time status display, administrative control, data archiving, target position tracking, and real time casualty assessment (RTCA) of targets. If the TESS electronic control unit (TECU) is installed without the TESS training missile (TTM), the aircraft enters a live fire instrumentation configuration and transmits tactical weapon event data to the TECU for recording and transmission to ground instrumentation systems.When the TECU is installed without the TTM, the aircraft will enter a live fire instrumentation configuration that will be used for training. When in this configuration, the Weapons Processor will transmit tactical weapon event data to the TECU for recording and transmission to ground instrumentation systems.

4.75.1 Simulated Weapons Inventory. For TESS training, weapon stores inventory is simulated by administrative input to the TECU and subsequent transmission to the Weapons Processor. Simulated inventory is uploaded upon TESS B kit power up and by subsequent administrative input. If any Hellfire missile or rocket is detected during the initial stores inventory or if a gun rounds inventory of greater than 0 is stored, a**“LIVE AMMO”** indication will be displayed in the HAD weapon inhibit field and TESS training will not be enabled. The specific type ammunition will be indicated on the UFD. Gun rounds count and rocket type entries are only changed by administrative input to the TECU and subsequent transmission to the Weapons Processor or by simulated gun/rocket fire. Simulated inventory is not considered in aircraft gross weight and performance calculations.

4.75.2 Symbology/HAD Indications. A centered **“T”** (fig 4-94) will be displayed in the Hellfire constraints and rocket steering cursor symbols when TESS training is enabled and either of these weapons are actioned. The HAD weapon inhibit field will display “**SAFE**” when the training mode and missile system is actioned and the weapon system is safed. Upon arming the weapon system, the weapon inhibit field will change to “**TRAINING**”.

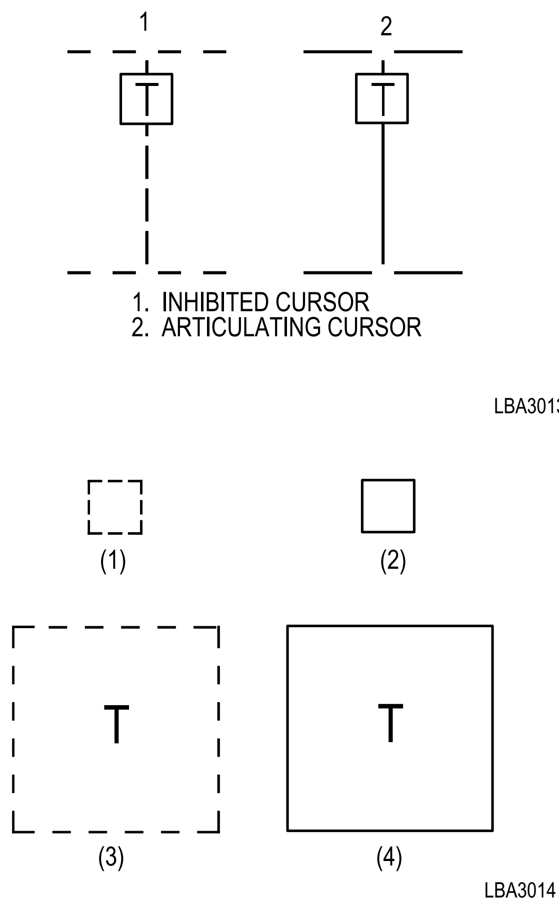


Figure 4-94. TESS Training Indication

4.75.3 Weapons Effects. When during TESS training a simulated Hellfire missile launch, rocket launch, or gun fire occurs, the communications interface unit (CIU) will provide the respective weapon launch/firing audio effect and the TESS B kit will provide an external visual effect (firing flash).

4.75.4 Real Time Casualty Assessment. During TESS training the TECU determines, either from the laser warning receiver (LWR) or administrative input, that an RTCA event has occurred, the TECU will transmit the RTCA status (hit, near miss or kill) and a weapon ID code to the aircraft and the following will occur:

- The CIU will provide the aircrew with an RTCA audio effect (tone with voice messages):

  "ding, YOU HAVE BEEN KILLED"

  "ding, YOU HAVE BEEN HIT"

  "ding, NEAR MISS"

- The RTCA status will be displayed on the UFD (hit and near miss for 8 seconds, kill continously):

  "SIM KILL"

  "SIM KILL"

  "SIM KILL"

- The RTCA status and weapon ID code will be made available on the WPN UTIL Page (Fig 4-95).

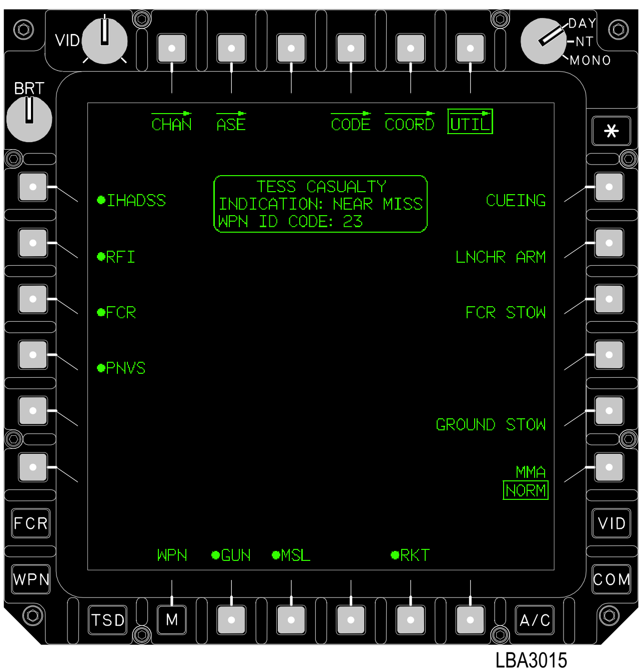


Figure 4-95. RTCA Status on WPN UTIL Page

- If a kill status is received, the aircraft will be inhibited from firing any weapon.
- The TTM will power the external aircraft kill indicator (AKI) to indicate the RTCA status.
- In the event the flashing AKI creates a hazard to flight due to adverse weather conditions, the capability to turn off the AKI is available to the aircrew via the WPN Page **AKI** button (R4) (fig 4-96). The weapons **TRAIN** button is not available when TESS is enabled.

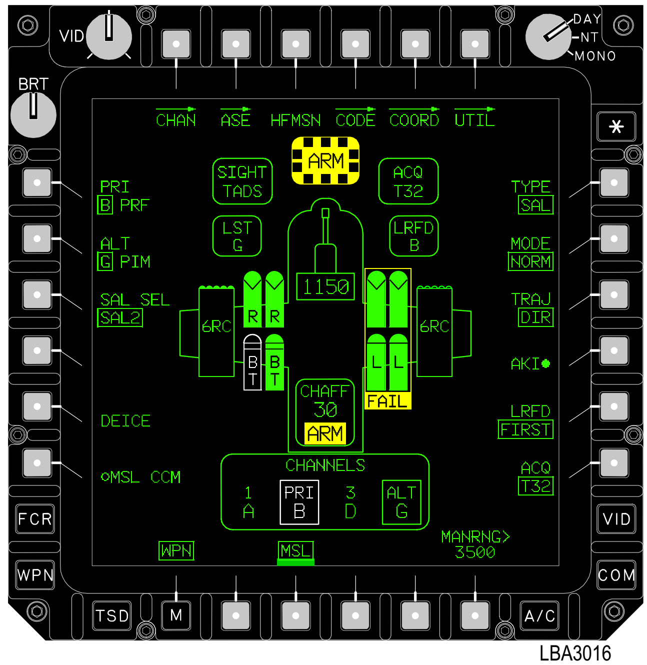


Figure 4-96. AKI Button on WPN Page

When during TESS training the TECU determines that an RTCA kill event has been revoked by administrative input of a resurrect or reset status, the TECU will transmit the resurrect or reset command to the aircraft and the following will occur:

- The CIU will provide the aircrew with resurrect or reset audio effect:

  "SIMULATION IS RESET"

  "SIMULATION IS RESURRECTED"

- The RTCA status will be removed from the UFD.
- The RTCA status and weapon ID code will be removed from the WPN **UTIL** Page.
- The resurrect or reset status will be displayed on the UFD for 8 seconds:
- "SIM RESET" - TESS has commanded the aircraft to a reset state.
- "SIM RESURR" - TESS has commanded the aircraft to a resurrect state.
- The aircraft will be permitted to fire any weapon.

- The TTM will power off the external AKI.
- If a resurrect is received, the TECU will update the weapon stores inventory with the same inventory that was available before the kill was processed.
- If a reset is received, the TECU will update the weapon stores inventory with the initial inventory that was available upon power up.

4.76 WEAPON TRAINING MODE

The weapon training mode is an emulation of weapon systems operation that allows aircrew training for all AH-64D weapon systems. The weapon training mode is activated and deactivated using the **TRAIN** button (R4) on the **WPN** page (Fig 4-97). This mode is not available when TESS is enabled. The aircrew can enter and exit the weapon training mode only when the armament control is in **SAFE** and no weapon system is actioned. Weapon systems operations in the weapon training mode are as per the tactical design. Any faults or failures experienced by the systems will impact the weapon systems operation in the training mode as it does in the tactical mode.

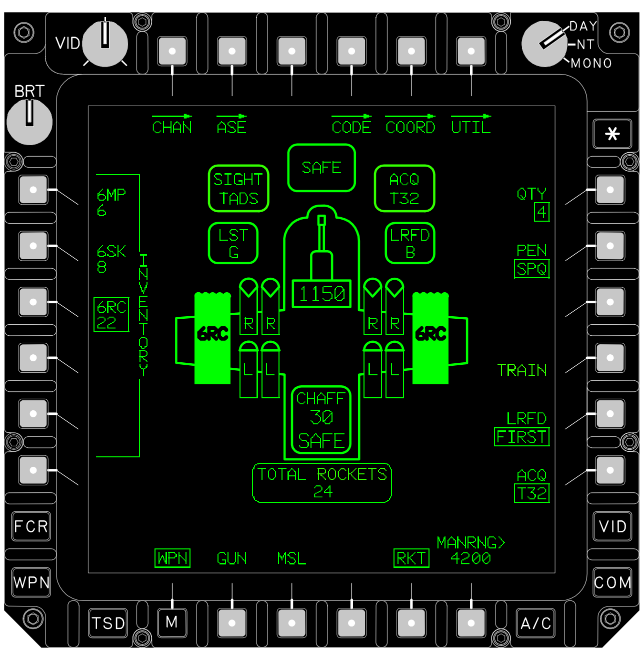


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Figure 4-97. WPN Page TRAIN Button

4.76.1 Simulated Weapons Inventory. The armament subsystem will adopt the following simulated weapon inventory when the weapon training mode is selected for use:

- 19 rockets for each installed and inventoried M260 launcher
- 888 gun rounds

Resident Hellfire launchers will be placed in the TME mode resulting in the simulation of RF missiles on each launch rail in which no missile was inventoried during initial missile inventory. The TME operation is described in paragraph 4.74.7.

Simulated inventories will decrement in response to valid firing requests. Inventories are restored each time the weapon training mode is activated. When SAL training missiles are installed on a Hellfire launcher, all tactical missiles will be made unavailable. Simulated inventories are not considered in aircraft gross weight and performance calculations. A data entry change to the gun rounds count or the use of rocket 'spoofing' devices will adversely impact aircraft gross weight.

4.76.2 Symbology/HAD. A centered **"T"** will be displayed in the Hellfire constraints and rocket steering cursor symbols when operating in the weapon training mode and either of these weapons are actioned (same as TESS, Figure 4-94). The HAD weapon inhibit field will display "**SAFE**" when in the training mode, a weapon system is actioned and the armament control set to **SAFE**. Upon setting the armament control to **ARM**, the weapon inhibit field will change to "**TRAINING**".

4.76.3 Sound Effects. When operating in the weapon training mode, and a simulated Hellfire missile launch, rocket launch, or gun fire occurs, the communications interface unit (CIU) will provide the respective weapon launch/firing audio effect.

4.76.4 Safety Considerations. The weapon training mode may be operated with live ammunition at the weapon stations. As such, the weapon training mode employs multiple safety features to minimize hazards associated with its use:

- Application of arm power to weapon stations is inhibited by both the SPs and WPs when the weapon training mode is active. In addition, existing continuous BIT algorithms ensure that arm power and discrete firecommands are absent at these stations when the weapon training mode is in use. Detection of hazardous conditions via CBIT results in non-availability of the affected weapon station.
- Launch events are simulated; no tactical launch/firing command are issued to stores or to the gun when the weapon training mode is in use.
- The crew interface imposes a barrier on the weapon **TRAIN** button to minimize the potential for inadvertent entry into the weapon training mode during a live-fire engagement. Likewise, the barrier logic minimizes the potential for accidental exit of the weapon training mode during a simulated engagement.

4.77 WEAPONS OPERATIONAL CHECK

NOTE

Weapons initialization is used to verify go/no-go status of the weapons using fault indications and symbolic messages. It also places the weapons in a condition that will require minimal switch selection prior to engagement.

1. **SIGHT SELECT** - (pilot - **HMD)** (CPG - **TADS)**.
2. **GND ORIDE** switch - **ON** (required on ground).
3. **ARM/SAFE** switch - **ARM**. (Arm power and indications verified by both pilot and CPG.)
4. **ARM/SAFE** switch - **SAFE**.
5. CPG **WAS** - **GUN**. (Observe HAD messages and **WPN** page configuration/fault indications.)
6. PLT **WAS** - **GUN**. (Observe HAD messages and **WPN** page configuration/fault indications.)
7. CPG ORT WAS - **RKT**. (Observe HAD messages and **WPN** page configuration/fault indications.)
8. PLT **WAS** - **RKT**. (Both seats observe COOP HAD messages and **WPN** page configuration/fault indications.)
9. CPG **WAS** - **MSL**. (Observe HAD messages and **WPN** page configuration/fault indications.)
10. Pilot **WAS** - **MSL**. (Observe HAD messages and **WPN** page configuration/fault indications.)
11. **GND ORIDE** switch - **OFF**.

4.78 AWS OPERATING PROCEDURES

WARNING

- **If 300 or more rounds have been fired in the preceding ten minutes, and a stoppage occurs, personnel must remain clear of the aircraft for 30 minutes. Aircraft crewmembers should remain in the aircraft and continue positive gun control.**
- **Failure to adhere to the published gun duty cycle may result in a catastrophic failure, loss of aircraft, injury or death.**

4.78.1 M230E1, 30mm Gun - FIRE GUN.

1. **WPN** page - Select.
2. **GUN** button - Select.
3. **GUN MODE** and **BURST LIMIT** buttons - Select As desired.
4. Sight Select switch - Select as desired.
5. Target - Acquire and track.
6. WAS - **GUN**.
7. **A/S** button - **ARM**.
8. Range - Establish to target.
9. HAD messages - Observe.
10. Weapons trigger switch - Press, continue to fire as required.
11. WAS - Deselect as desired.
12. **A/S** button - As desired.

4.78.2 M230E1, 30mm Gun - Dynamic Harmonization (CPG Only).

NOTE

Harmonization procedures should be accomplished between 500 to 1000 meters from the target.

1. **WPN** page - Select.
2. **GUN** button - Select.
3. **HARMONIZE** button- Select.
4. Sight Select switch - **TADS**.
5. Target - Auto track in **NFOV** DTV/FLIR.
6. WAS - **GUN**.
7. **A/S** button - **ARM**.
8. Range to target - Establish Laser or Manual.
9. Weapons trigger switch - Press. Observe Mean Point of Impact (MPI) of rounds.
10. **MAN TRK** thumbforce controller - Position dashed reticle over MPI.
11. **STORE/UPDATE** switch - Store.
12. **GUN DH NOT VALID** status window - Verify not displayed. If present repeat steps 3 through 12.
13. WAS - Deselect as desired.
14. **A/S** button - As desired.
15. Sight Select switch - Select as desired.

4.79 AERIAL ROCKET SUBSYSTEM OPERATING PROCEDURES

4.79.1 Fire Rockets - COOPERATIVE MODE.

1. **WPN** page - Select.
2. **INVENTORY** button - As desired (CPG).
3. **QTY** button - As desired (CPG).
4. **PEN** button - As desired (CPG).
5. Sight Select switch - Select as desired.
6. CPG - Acquire and track target.
7. ORT WAS - **RKT**.
8. Pilot WAS - **RKT**.
9. **A/S** button - **ARM**.
10. Range - Establish to target.
11. Pilot - Align rocket steering cursor.
12. HAD messages - Observe.
13. Pilot Weapons trigger switch - Press.
14. ORT WAS - Deselect as desired.
15. Pilot WAS - Deselect as desired.
16. **A/S** button - As desired.

4.79.2 Fire Rockets - PILOT OR CPG ONLY MODE.

1. **WPN** page - Select.
2. **INVENTORY** button - As desired.
3. **QTY** button - As desired.
4. **PEN** button - As desired.
5. Sight Select switch - Select as desired.
6. Target - Acquire and track.
7. WAS - **RKT**.
8. **A/S** button - **ARM**.
9. Range - Establish to target.
10. Rocket steering cursor - Align.
11. HAD messages - Observe.
12. Weapons trigger switch - Press.
13. WAS - Deselect as desired.
14. **A/S** button - As desired.

4.80 LONGBOW HELLFIRE MISSILE SYSTEM OPERATING PROCEDURES

NOTE

If FCR was sight selected during this procedure, ensure the **MSL TYPE** option is reset to SAL.

4.80.1 SAL Missile Engagement (NORMAL-LOBL).

1. **WPN** page - Select.
2. **MSL** button - Select.
3. **TYPE** button - **SAL**.
4. **PRI** button - Select primary channel as desired.
5. **ALT** button - Select alternate channel as desired.
6. **SAL SEL** button - Select type of SAL missile as desired.
7. **MODE** button - **NORM** or **MAN**.
8. WAS - **MSL**.
9. **A/S** button - **ARM**.
10. **WPN** page or AND - Observe for missile selection, coding, and ready status.
11. Target - Lase, observe for proper missile track status.
12. Pilot - Establish aircraft in constraints.
13. HAD messages - Observe.

NOTE

If performance constraint criteria are not met, the 2nd detent of the weapons trigger switch may be used to override constraint inhibits and fire missile. Safety inhibits cannot be overridden.

14. Weapons trigger switch - Press.
15. **LRFD** trigger - Release on missile impact.
16. WAS - Deselect as desired.
17. **A/S** button - As desired.

4.80.2 SAL Missile Engagement (NORMAL-LOAL).

1. **WPN** page - Select.
2. **MSL** button - Select.
3. **TYPE** button - **SAL**.
4. **PRI** button - Select primary channel as desired.
5. **ALT** button - Select alternate channel as desired.
6. **SAL SEL** button - Select type of SAL missile as desired.
7. **MODE** button - **NORM** or **MAN**.

NOTE

If trajectory is set to **LO** or **HI**, ensure that ACQ select is the desired target.

8. **TRAJ** button - Select as desired.
9. WAS - **MSL**.
10. **A/S** button - **ARM**.
11. **WPN** page or AND - Observe for missile selection, coding, and ready status.
12. Aircraft - Establish in constraints.
13. HAD messages - Observe.

NOTE

If performance constraint criteria are not met, the 2nd detent of the weapons trigger switch may be used to override constraint inhibits and fire missile. Safety inhibits cannot be overridden.

14. Weapons trigger switch - Press.
15. Target - Lase or call for remote designator in adequate time for terminal guidance.
16. WAS - Deselect as desired.
17. **A/S** button - As desired.

4.80.3 SAL Missile Engagement (RIPPLE-LOBL).

1. **WPN** page - Select.
2. **MSL** button - Select.
3. **TYPE** button - **SAL**.
4. **PRI** button - Select primary channel as desired.

5. **ALT** button - Select alternate channel as desired.
6. **SAL SEL** button - Select type of SAL missile as desired.
7. **MODE** button - **RIPL**.
8. **TRAJ** button - Select as desired.
9. WAS - **MSL**.
10. **A/S** button - **ARM**.
11. **WPN** page or AND - Observe for missile selection, coding, and ready status.
12. Pilot - Establish aircraft in constraints.
13. HAD messages - Observe.

NOTE

If performance constraint criteria are not met, the 2nd detent of the weapons trigger switch may be used to override constraint inhibits and fire missile. Safety inhibits cannot be overridden.

14. Weapons trigger switch - Press and release.
15. Target - Lase and continue lasing until missile impact.
16. Pilot - Establish aircraft in constraints for alternate channel.
17. HAD messages - Observe.
18. Weapons trigger switch - Press and release.
19. Target - Lase or call for terminal guidance.

NOTE

Execute steps 12 through 19 until desired number of missiles has been fired.

20. WAS - Deselect as desired.
21. **A/S** button - As desired.

4.80.4 SAL Missile Engagement (RIPPLE-LOAL).

1. **WPN** page - Select.
2. **MSL** button - Select.
3. **TYPE** button - **SAL**.
4. **PRI** button - Select primary channel as desired.
5. **ALT** button - Select alternate channel as desired.
6. **SAL SEL** button - Select type of SAL missile as desired.
7. **MODE** button - **RIPL**.
8. **TRAJ** button - Select as desired.
9. WAS - **MSL**.
10. **A/S** button - **ARM**.
11. **WPN** page or AND - Observe for missile selection, coding, and ready status.
12. Pilot - Establish aircraft in constraints.
13. HAD messages - Observe.

NOTE

If performance constraint criteria are not met, the 2nd detent of the weapons trigger switch may be used to override constraint inhibits and fire missile. Safety inhibits cannot be overridden.

14. Weapons trigger switch - Press and release.
15. Target - Lase or call for terminal guidance.
16. Pilot - Establish aircraft in constraints for alternate channel.
17. HAD messages - Observe.
18. Weapons trigger switch - Press and release.
19. Target - Lase or call for terminal guidance.

NOTE

Execute steps 12 through 19 until desired number of missiles has been fired.

20. WAS - Deselect as desired.
21. **A/S** button - As desired.

4.80.5 RF Missile Engagement (Sight FCR L).

1. **WPN** page - Select.WAS
2. **MSL** button - Select.
3. **TYPE** button - **RF**.
4. **MSL PWR** button - As desired.
5. **2nd TARGET INHIBIT** button - As desired.
6. **LOBL INHIBIT** button - As desired.
7. Sight Select switch - Select **LINK** if visual identification desired.
8. WAS - **MSL**.
9. **A/S** button - **ARM**.
10. **WPN** page or AND - Observe for missile selection, coding, and ready status.
11. Aircraft - Establish in constraints.
12. HAD messages - Observe.

NOTE

If performance constraint criteria are not met, the 2nd detent of the weapons trigger switch may be used to override constraint inhibits and fire missile. Safety inhibits cannot be overridden.

13. Weapons trigger switch - Press and release.
14. WAS - Deselect as desired.
15. **A/S** button - As desired.

4.80.6 RF Missile Engagement (Sight - TADS).

1. Sight Select switch - **TADS**.
2. **WPN** page - Select.
3. **MSL** button - Select.
4. **TYPE** button - **RF**.
5. **MSL PWR** button - As desired.
6. **2nd TARGET INHIBIT** button - As desired.
7. **LOBL INHIBIT** button - As desired.
8. WAS - **MSL**.
9. **A/S** button - **ARM**.
10. Target - Track and lase target for at least 3 seconds or until HAD message **TARGET DATA?** blanks.
11. Aircraft - Establish in constraints.
12. HAD messages - Observe.

NOTE

If performance constraint criteria are not met, the 2nd detent of the weapons trigger switch may be used to override constraint inhibits and fire missile. Safety inhibits cannot be overridden.

13. Weapons trigger switch - Press and release.
14. WAS - Deselect as desired.
15. **A/S** button - As desired.

4.80.7 RFHO Send.

1. NTS - Desired target.
2. **RFHO** button - Select.
3. Zone Member Callsign button - Select.
4. **SEND** button - Select.

4.80.8 RF Missile Engagement (RFHO).

1. UFD - Observe **RFHO** advisory.
2. **TSD** page - Select.
3. **REC** button - Select.
4. TSD page - Observe target and NTS symbol.
5. Pilot - Establish aircraft in position for launch.
6. Sight Select switch - **FCR**.
7. **WPN** page - Select.
8. **TYPE** button - Verify default to **RF**.
9. WAS - **MSL**.
10. **A/S** button - **ARM**.
11. **WPN** page or AND - Observe for missile selection, coding, and ready status.
12. Pilot - Establish aircraft in constraints.

NOTE

If performance constraint criteria are not met, the 2nd detent of the weapons trigger switch may be used to override constraint inhibits and fire missile. Safety inhibits cannot be overridden.

13. Weapon trigger switch - Press and release.
14. WAS - Deselect as desired.
15. **A/S** button - As desired.

4.80.9 RFI Only Operation - Pinned MMA.

1. Manually rotate MMA until forward alignment mark is aligned with pedestal alignment mark.

NOTE

MMA movement may be required to engage locking pin.

2. Press locking pin detent and push locking pin until spring is compressed. Hold locking and release detent. Verify MMA will not move and locking pin remains engaged.
3. FCR **UTIL** page - Verify **PINNED**.
4. **RFI** button - **ON**.

4.80.10 Rapid Rearming.

1. **WPN UTIL** page - **MSL, RKT, GUN** - **OFF.**
2. **A/S** button - **SAFE**.
3. **GND ORIDE** button - **OFF.**
4. **TAIL WHEEL** button - **LOCK**.
5. **PARK BRAKE** - Set.
6. Armament and pylon safety pins - Installed.
7. Launcher A/S switch(es) - **SAFE**.
8. IDM auto transmit - Disable
   a. **SET** page **IDM INHBT** - Select, **IDM INHIBIT** advisory is displayed.

   or **BLK 1** perform b,c, and d.

   b. **AUTO REPLY** - Off.
   c. **AUTO ACK** - Off.
   d. TACFIRE Net - Not tuned.
9. **HF RADIO** - Disable auto radio transmission capability.
   a. **HF RADIO GND OVRD** - Off.

   or

   b. **HF RADIO SILENT** - On.
10. Rearming - Monitor.
11. Launcher A/S switch(es) - **ARM**.
12. IDM auto transmit capability - Set as required.
   a. **SET** page **IDM INHBT** - Deselect as required: **IDM INHIBIT** advisory is not displayed and **IDM INHIBIT** button is non OIP.

   or **BLK 1** perform b,c, and d.

   b. **AUTO REPLY** - Set as required.
   c. **AUTO ACK** - Set as required.
   d. TACFIRE Net - Set as required.
13. **HF RADIO** - Set as required.
   a. **HF RADIO GND OVRD** - On or Off.

   and/or

   b. **HF RADIO SILENT** - On or Off.

4.80.11 Armament Safing and Postflight Procedures.

WARNING

- **Do not preflight or postflight until armament systems are safe**.
- **During preflight and after all live fires, when the AWS has been used, the barrel will be inspected by the crew for cracks.**

If armament system has been used, check as follows:

1. Right EFAB - Open. Check feed system for rounds.
2. Gun chute assembly - Check for rounds.
3. Bolt status indicator - **FEED** (green range).
4. Transfer door - Open. Check bolt is to rear, no rounds in transfer assembly, and chamber clear.
5. Transfer door - Secure.
6. AWS - General condition and security. Check for leaks and proper piston index groove indication.
7. Launcher **ARM/SAFE** switches - **SAFE**.
8. Wing stores pylon - Check for unexpended ordnance.
9. Armament and pylon safety pins - Install.

Section III. ACTIVE AND PASSIVE DEFENSE EQUIPMENT

4.81 INTRODUCTION

INTRODUCTION. Active and Passive Defense Equipment (fig 4-98) consists of active countermeasures and electronic passive threat detection as well as airframe features such as armor, IR paint, and the Wire Strike Protection System (WSPS). This section describes the Active and Passive Defense Subsystems that are operated from dedicated controls and the MPD. There is no power up BIT for the ASE equipment.

4.81.1 Passive Defense Subsystems. The Passive Defense Subsystems consists of the following components:

- AN/APR-39A(V)4 Radar Signal Detecting Set
- AN/AVR-2A Laser Signal Detecting Set
- AN/APR-48A Radar Frequency Interferometer (RFI)

4.81.2 Active Defense Subsystems. The Active Defense Subsystems consists of the following components:

- AN/ALQ-136(V)5 Radar Jammer
- AN/ALQ-144A(V)3 Infrared Jammer (IRJAM)
- M-141 Chaff Dispenser (CHAFF)

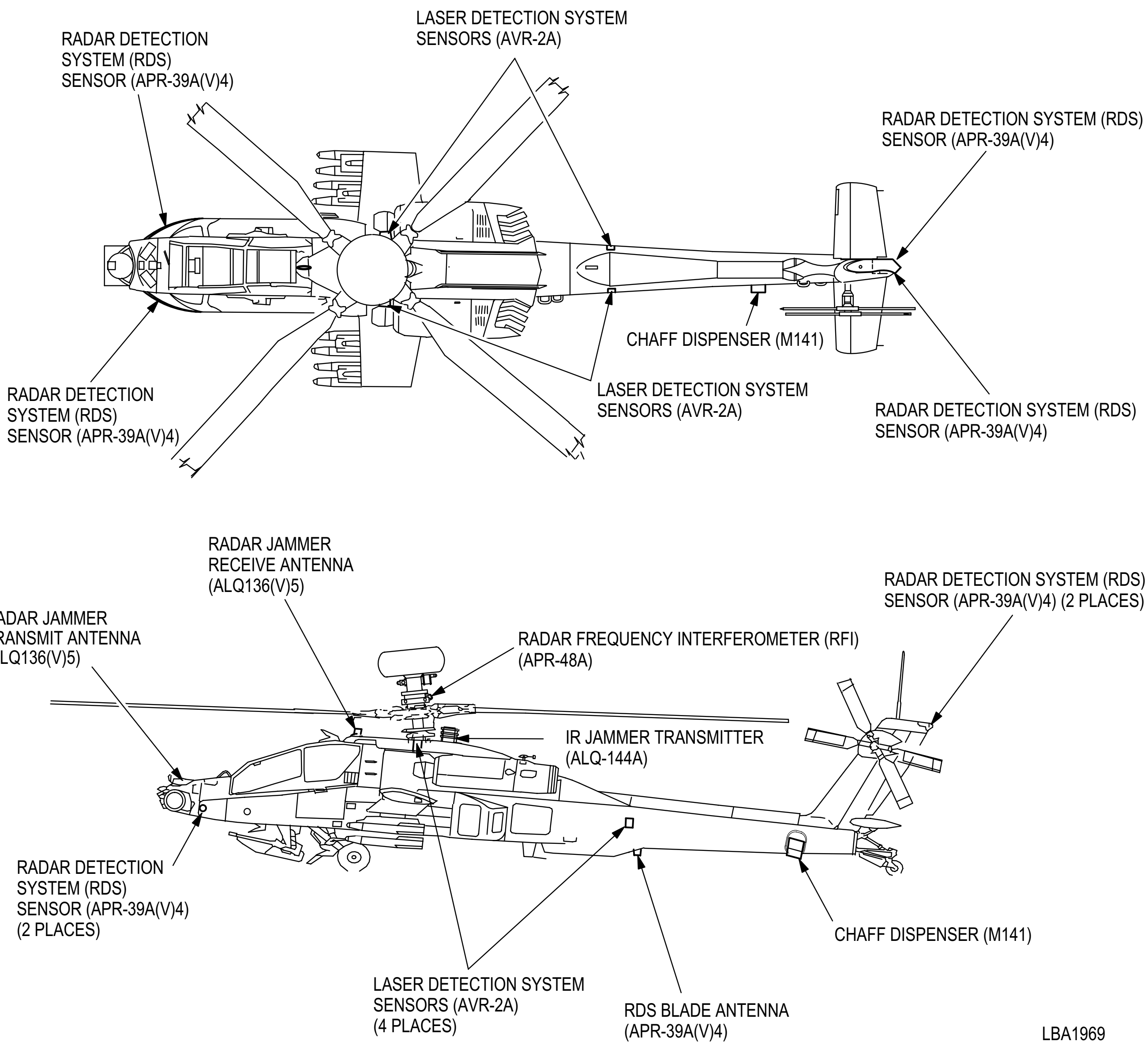


Figure 4-98. ASE Equipment Locations

4.82 AN/APR-39A(V)4 RADAR SIGNAL DETECTING SET

CAUTION

To prevent damage to the receiver detector crystals, assure that the radar warning set antennas are at least 60 meters from active ground radar antennas or 6 meters from active airborne radar antennas. Allow an extra margin for new, unusual, or high power emitters.

4.82.1 System Description. The AN/APR-39A(V)4 Radar Signal Detecting Set (RSDS) is a passive electronic warfare system that provides visual and aural indications of the presence of and bearing to active radar transmitters. The system is omnidirectional and provides for the detection, identification, classification, and prioritization of pulse and pulse doppler radar emitters and also supplies moding and bearing information about these emitters. The RSDS detects those pulse radar signals usually associated with hostile fire control radars operating in the C/D and E-M frequency bands. These pulse radar signals are seen as potential threats to the helicopter and are displayed as symbols on the MPDs. The system also generates computer-synthesized voice threat messages for audible indications of potential threats. These voice threat messages, heard over the Intercommunications System (ICS), and the display symbols, seen on the MPDs, occur simultaneously to indicate the type of threat, threat mode, and its relative bearing to the helicopter. The system consists of a digital processor, two radar receivers (one forward and one aft), four hi-band spiral antenna-detectors (two forward and two aft), and a lo-band blade antenna. The RSDS employs a removable User Data Module (UDM) which is mounted in the top of the digital processor. The UDM contains the classified portion of the system Operational Flight Program (OFP) and the classified Emitter Identification Data (EID) files. The EID files contain the threat library which includes threat signal parametric data.

4.82.2 System Operation. The RSDS uses the four hi-band antenna-detectors and the lo-band (C/D) blade antenna to receive RF energy from pulse radars. Each of the three spiral elements within an antenna-detector receive RF signals in their respective band and supply it to the detector circuits. A radar warning receiver track file that is transferred from the digital processor to the display processors contains threat information from up to 10 RLWR detected emitters and includes the following data:

- Threat Count
- Threat Priority
- Threat Type
- New Threat Signal - Bold for 3 Seconds
- Threat Signal No Longer Detected - Ghosted for 10 Seconds
- Threat Mode (Search, Acquisition, Track, or Lock-On/Launch)
- Correlated C/D bank Threat
- Threat Azimuth

In addition, the digital processor also generates a corresponding computer-synthesized voice threat message which is sent to the communication interface unit for dissemination to the pilot and CPG headsets. Selection and volume control of this audio is provided by the communication control panel in each crewstation. If the received signal parameters do not match a threat in the EID files, the digital processor generates the threat data for a “U” to indicate an unknown threat. The digital processor also processes threat data inputs from the laser detecting set AN/AVR-2A for display on the MPDs and annunciation over the ICS. When dense signal environments cause the system to operate in a degraded (reduced sensitivity) mode, the system informs the operator with the voice message “Threat Detection Degraded,” heard over the ICS. When the system sensitivity returns to normal, the voice message “Threat Detection Restored” will be enunciated over the ICS.

4.83 AN/AVR-2A LASER SIGNAL DETECTING SET

4.83.1 AN/AVR-2A Laser Detecting Set (LDS) System Description. The AN/AVR-2A Laser Detecting Set (LDS) is a passive electronic warfare system that detects, locates, and identifies hostile laser-aided weapon threats fired from both airborne and ground-based platforms. The LDS is a frequency extension of the RSDS and interfaces with the RSDS to function as an integrated Radar Laser Warning Receiver (RLWR). The system detects optical radiation illuminating the helicopter, processes this laser data into laser threat messages, and sends these messages to the RSDS digital processor. The digital processor processes these inputs to provide for both visual and aural threat indications for the system. The LDS can also be used with both the RSDS and the Air-to-Ground Engagement System (AGES) to provide an engagement simulation system, in the operational training mode. The system is composed of five components: four laser sensor units and an Interface Unit Comparator (IUC). The four sensor units are strategically located around the helicopter with two mounted forward, facing forward and two mounted aft, facing aft. Each sensor unit provides a 100° Field-Of-View (FOV) and ±45° of coverage in elevation. This configuration provides for 360° coverage in azimuth and ±45° in elevation about the helicopter with substantial overlap. Each sensor unit contains four separate laser detectors. They are located under a special optical window and supply coverage of three different spectral regions: Electro-Optical (EO) bands I, II, and III. Two detectors are employed in the band III region, the band IIIA and band IIIB detectors, to provide the required band III detection coverage.

4.83.2 System Operation. The sensor units perform the actual laser detection function for the system and contain the necessary electronics to process detected laser signals. If a validated laser signal is detected, a threat message containing the laser type (band I, II, or III) is sent to the IUC for processing. Each sensor unit contains optical and electrical Built-In Test (BIT) electronics to perform a self-test upon command from the IUC. When a self-test command is received, the sensor unit disables detection of all externally generated signals and performs a self-test. When the self-test is completed, the appropriate pass or fail message is sent to the IUC for processing and normal operation is resumed. The IUC is located in the LH aft avionics bay. It is mounted just forward of the RSDS digital processor with which it directly interfaces. The IUC provides the control and timing necessary for the interface with the sensor units. It also provides the interface with the RSDS. The LDS was designed to operate in conjunction with the RSDS, therefore, being an integral part of the RSDS. The IUC provides the majority of the wiring interface between the RSDS and the associated helicopter systems. If the IUC is removed from the helicopter, a jumper box must be installed in the system or an alternate connector configuration employed to permit the RSDS to operate. The LDS employs a removable User Data Module (UDM) which is mounted in the face of the IUC. The UDM contains the classified operational software required for tactical operation of the system. This software gets downloaded into volatile memory within the sensor units during system power-up and initialization, and the sensor units then become classified. When system power is removed, the sensor units zeroize the classified software and become unclassified components. The removal of system power and the UDM for the IUC effectively declassifies the system. The LDS has the capability to operate in two modes, training and tactical. In the training mode, the system operates with AGES in the Multiple Integrated Laser Engagement System (MILES) to provide the crewmembers with a realistic combat tactical training system that closely simulates the effect of weapon engagements.

a. Training. During training operation, the LDS operates as a detecting system in a MILES environment and the operating software within the LDS does not recognize .904 micron gallium arsenide (GaAs) MILES laser hits as actual laser threats.

b. Tactical. During tactical operation, the LDS detects, identifies, and characterizes three different types of optical signals. Each sensor unit provides laser threat detection in three different spectral bands; band I, band II, and band III. When a sensor unit detects optical, coherent radiation within its FOV, it provides band and pulse characteristics as laser threat data to the IUC. The IUC further processes this threat data, thus comparing received signal characteristics with stored parameters. It then determines the existence of a laser threat, threat type, and Angle-Of-Arrival (AOA) (quadrant resolution only).

This threat data is sent as laser threat messages to the RSDS digital processor for manipulation to provide visual threat indications on the MPD ASE and TSD pages and aural voice threat messages over the helicopter ICS. Both the visual and aural threat indications provide threat type and relative position information to the crewmembers.

4.84 AN/APR-48A RADAR FREQUENCY INTERFEROMETER (RFI)

4.84.1 System Description. The AN/APR-48A Radar Frequency Interferometer (RFI) is a passive Electronic Support Measure (ESM) system that provides for the detection, acquisition, identification, classification, location, and prioritization of radar emitters. The system detects and processes pulse, pulse doppler, and Continuous Wave (CW) radar signals operating in a currently classified frequency range. The RFI is primarily an offensive system providing narrow FOV target cueing for onboard and offboard sights/sensors for the accurate and timely employment of weapons. It also supplies highly effective defensive threat warning capability for the ASE suite. The high sensitivity of the system provides for not only main beam signal detection, but also sidelobe and/or backlobe signal detection as well. The system is designed to detect Low Probability of Intercept (LPI) signals and to detect the threat long before it detects the helicopter. It is capable of threat acquisition well beyond threat lethal range and provides for masked detection of threats based on its mounting location above the rotor mast. The RFI provides for 360° coverage about the helicopter for coarse DF and instantaneous 90° coverage for precision fine DF. The coarse DF routing employs amplitude DF techniques and utilizes four coarse DF antenna elements, comparing the amplitude of adjacent antenna channels to determine signal AOA. The system utilizes a five antenna baseline for the phase interferometry to perform the accurate fine DF routine Pulse Spacing (PS).

- Scan Type
- Scan Rate
- Time In Main Beam (TIMB)

4.84.2 System Operation. The identification processing allows for the handling of multi-beam emitters that output more than one type of RF signal either simultaneously or on a time scheduled basis. The RFI correlates these signals so that only one threat ID is displayed with its corresponding moding information (search, acquisition, track, lock-on/launch, etc.) on the MPD. The sophisticated signal processing allows for the detection and identification of frequency and Pulse Repetition Interval (PRI) agile emitters. The RFI processor controls the RFI receiver and the RFI antenna to detect and classify threats. It develops both coarse and fine azimuth locations of emitters, based on aspect angle and threat frequency. The RFI antenna consists of two array sets; a coarse array set and a fine array set. The coarse array provides 360° coverage in azimuth about the helicopter, while the fine array phase antennas are switched to forward, left, or right channels for Intermediate Frequency (IF) processing. The RFI receiver measures pulse parameters from four inputs received from the RFI antenna providing 360° coverage. The system performs accurate parametric data measurement for precise, unambiguous identification and classification of detected emitters. The threat parametric data scrutinized by the processor for detected signals includes:

- Frequency
- Bandwidth
- Pulse Width (PW)

The emitter acquisition process involves the evaluation of received pulse parameters and the sorting of these pulse parameters into emitters. Once emitter parameter measurement is complete, the emitters are identified utilizing a threat library stored on the UDM. The system must then resolve multiple matches and perform the correlation of multiple signals emanating from one emitter. The UDM is mounted in the face of the RFI processor. It contains the classified portion of the operational software, a Dwell Sequence Monitor Table (DSMT), and an Emitter ID table (EIDT). The DSMT controls the sequence of RF band monitoring, with each entry in the table containing a frequency band at which to dwell, a length of time in which to dwell, and the number of sort windows. The EIDT accommodates 100 threat entries with each entry containing the following information:

- RF, PRI, Sigma PRI, PW Limits (8 Specific Parameters)
- Parametric Volume (Ambiguity Resolver)
- Priority
- Identification Code
- Flags (Hostile/Friendly, Airborne, CW, etc.)

4.85 AN/ALQ-136(V)5 RADAR JAMMER COUNTERMEASURES SET (RJAM)

4.85.1 System Description. The AN/ALQ-136(V)5 Radar Jammer Countermeasures Set (RJAM) is an active Electronic Counter Measure (ECM) system designed to protest the helicopter against certain Anti-Aircraft Artillery (AAA) and Surface-to-Air Missile (SAM) threats. It is a self-contained system that receives, detects, analyzes, and processes those pulse radar signals usually associated with hostile fire control radars, and initiates the appropriate jamming in an attempt to effectively counter the detected threats. The RJAM system consists of a Receiver/Transmitter (R/T) and two antennas; one antenna used for reception and one antenna used for transmission. The system performs effectively as both a detection system and a jamming system for pulse radar threats. The receive antenna receives pulse radar signals and supplies them to the R/T receiver circuits via a special low-loss coaxial cable. The receiver processes this Radio Frequency (RF) energy and extracts the video (pulses) from it. This video is filtered, limited, amplified, and detected, and provided to the processor section of the R/T for analysis. The processor compares the resultant video with the stored threat signal parameters to determine whether the received signal originated from a threat. These signal parameters include:

- Pulse Width
- Pulse Spacing
- Pulse Repetition Interval
- Signal Strength
- Modulation Type
- Center Frequency

If it is determined that a threat exists, the processor queries the stored jamming parameters table for the appropriate jamming profile. If one exists, the jamming parameters are extracted, to include center frequency, modulation type, and jamming technique, and sent to the transmitter section. The transmitter section generates the appropriate jamming signals and applies them to the transmit antenna for radiation via another low-loss coaxial cable. The System can detect, process, and jam multiple threats in a multiplex fashion using one set of antennas; however, the current system configuration only provides for forward sector coverage for pulse radar threats.

WARNING

The AN/ALQ-136(V)5 system poses a potential RF radiation hazard to personnel due to its operating frequency range and transmitter output power. When the system is powered up, personnel should remain clear of the transmit antenna by a minimum of 10 feet to prevent overexposure to high frequency RF radiation and its corresponding effects.

4.85.2 System Operation. The system radiates during self-test (at a reduced power setting) and when stimulated by a threat signal while in the operate mode. The RJAM receiver/transmitter contains a WAR/TNG switch which is located on the face of the unit. The switch is a lever-locked, two position switch which is safety wired in the desired position.

a. Training. In a training environment, the switch is safety wired in the TNG position. With TNG selected, the system provides very limited frequency band coverage, utilizes non-operational test programs, and generates unclassified, non-operational jamming signals. The primary purpose of the training mode is to exercise the system in a peacetime environment without compromising its actual operational capability, which is classified.

b. Tactical. In a wartime environment, the switch is safety wired in the WAR position. With WAR selected, the system provides full-up operational capability to include complete frequency band coverage, operational ECM programs, and actual jamming signals.

4.86 AN/ALQ-144A(V)3 INFRARED JAMMER COUNTERMEASURES SET (IRJAM)

WARNING

Do not continuously look at the infrared countermeasures transmitter during operation, or for a period of 1 minute from a distance of less than 3 feet. Skin exposure to countermeasure radiation for longer than 10 seconds at a distance less than 4 inches shall be avoided.

CAUTION

- **The infrared countermeasures set (IR Jammer) should be operated for a minimum of 15 minutes after energizing the system, otherwise life of the source may be drastically shortened.**
- **The IR jammer can be damaged if the IR jammer is not turned off for one minute via the MPD prior to removing power from the aircraft.**

4.86.1 System Description. The AN/ALQ-144A(V)3 Infrared Jammer (IRJAM) is an active infrared countermeasure set that operates as an omnidirectional IR transmitter to jam heat-seeking IR missiles. The system consists of an IR transmitter located on the fairing immediately aft of the rotor mast. The transmitter consists of an IR source, low and high speed modulators, covert window, and housing. The transmitter generates IR energy, modulates it, and then passes it through the covert window in the form of invisible IR energy. The transmission of unwanted wavelengths of electromagnetic energy, such as visible light, is blocked by the covert windows. The radiation is modulated mechanically at low and high frequencies. This IR energy is used to confuse IR seeking missiles.

4.86.2 System Operation. The transmitter requires approximately a 1 minute warm-up period. The IR jammer is equipped with the following switches and indicators which can be accessed and observed when the BIT indicator panel is removed from the transmitter. **RST/FXD/SWP** Switch - allows the operator to reset the BIT indicators (**RST**), select fixed (**FXD**) frequency mode of operation, and select sweep (**SWP**) frequency mode of operation. After using this switch to reset the BIT indicators, ensure that the switch is set to the required jam program mode (**FXD** or **SWP**).

Jam Program Selector Switch - this thumb wheel switch selects the jam program for transmitter operation. Jam Program Indicator - this indicator displays the selected jam program through an opening in the wall of the card cage. Elapsed Time Indicator - this indictor monitors the operation time of the unit and provides a digital readout in hours.

4.87 M141 GENERAL PURPOSE AIRCRAFT DISPENSER (CHAFF)

WARNING

Avoid exposure to high concentrations of chaff; **high concentrations of chaff can cause temporary irritation to eyes and throat**.

4.87.1 System Description. The M141 General Purpose Aircraft Dispenser (CHAFF) is an active ECM system designed to protect the helicopter from AAA, SAM, and Airborne Intercept (AI) radar threats. The system can dispense up to 30 chaff cartridges (MI) as a countermeasure against radar guided weapons systems. The chaff system is basically composed of three components, the dispenser assembly, the payload module, and the chaff safety switch.

a. Dispenser Assembly. The dispenser assembly consists of a breech plate, sequencer switch module, and a chaff/flare select switch. The breech plate contains 30 contact pins and 15 spring grounding clips, which mate with the impulse cartridges when a payload module is installed. The contact pins are wired to the sequencer switch electrical connector. The breech plate also contains 2 guide pins and 2 fastener receptacles to align and secure the payload module to the dispenser assembly. The sequencer switch module converts dispense signals to 1 dispenser breech plate contact pin to electrically fire the impulse cartridge. The sequencer switch contains 2 rotary stepping switches, 2 circuit cards, and 2 electrical connectors. The rotary stepping switch resets to its initial starting sequence when a payload module is installed, the safety pin is removed, and electrical power is applied to the dispenser assembly.

b. Payload Module. The payload module consists of a molded fiberglass block with compartments for 30 cartridges and a metal retainer plate. The block also contains 2 quick disconnect bolts to secure the payload module to the dispenser assembly. The retainer plate is to be installed after the cartridges are loaded. The retainer plate fits onto the front of the block and is secured by 2 retaining screws. The retainer plate contains slots to permit the impulse cartridges to mate with the breech plate contact pins and grounding clips to enable electrical contact to fire the cartridges.

c. Chaff Safety Switch. The chaff safety switch is located on the tailboom about 3 inches forward of the chaff dispenser and provides another means of safing the system to prevent inadvertent expenditure of impulse/ chaff cartridges. When the safety pin is installed in the switch, chaff arm power is disconnected from the chaff dispenser and the chaff test connector. When the safety pin is removed from the switch, arm power is distributed to both the dispenser and the test connector. The SP serves as the primary processing center for the chaff dispenser system management control. The SP monitors direct status inputs from the cyclic chaff dispense switches and controls the firing of chaff based on these inputs. The SP receives chaff control selections made on the MPDs from the DP via MUX bus channel 1. It controls arm power to the chaff dispenser and monitors arm power status through ELC #1.

4.87.2 System Operation. The M141 system can dispense chaff in 1 of 2 modes of operation: manual or program. In the **MANUAL** mode, the system dispenses one chaff cartridge when either of the chaff dispense switches is actioned. The programming of the chaff burst/salvo settings can be accomplished on the MPD **ASE UTIL** page or can be uploaded into the system via the DTC. Regardless of the selected mode, the dispensing of chaff cartridges must be manually initiated by one of the crewmembers, thus requiring crewmember interaction and the latency associated with that interaction.

4.88 DEDICATED CONTROLS

The passive defense subsystem interfaces with 2 dedicated controls that augment the MPD format controls. The **RLWR** volume control on the **COMM** panel and the chaff dispense position on the cyclic.

4.88.1 COMM Panel - RLWR Volume Control. The **RLWR** volume control (fig 3-5) provides independent volume control of the RLWR voice messages, allowing the crew the capability to set the audio output to a comfortable level. This volume control knob cannot be pulled to disable audio.

4.88.2 CHAFF (C) Button. The CHAFF **(C)** button (fig 4-99) is located on both the pilot and CPG cyclic grips. If the CHAFF is armed, chaff can be dispensed by depressing the CHAFF **(C)** button.

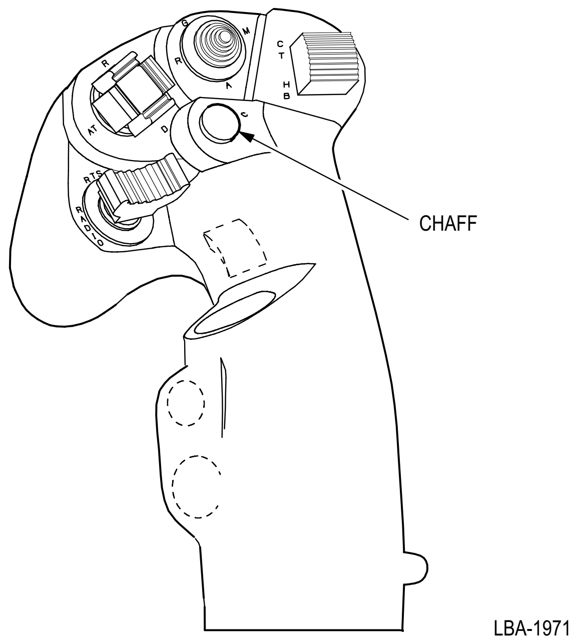


Figure 4-99. Cyclic Grip-Chaff Dispense Button

4.89 AIRCRAFT SURVIVABILITY EQUIPMENT (ASE) PAGE

The **ASE** page (figs [**BLK 1** 4-100] and [**BLK 2** 4-100A]) can be accessed from the **MENU** page, **TSD UTIL** page, or the **WPN** page.

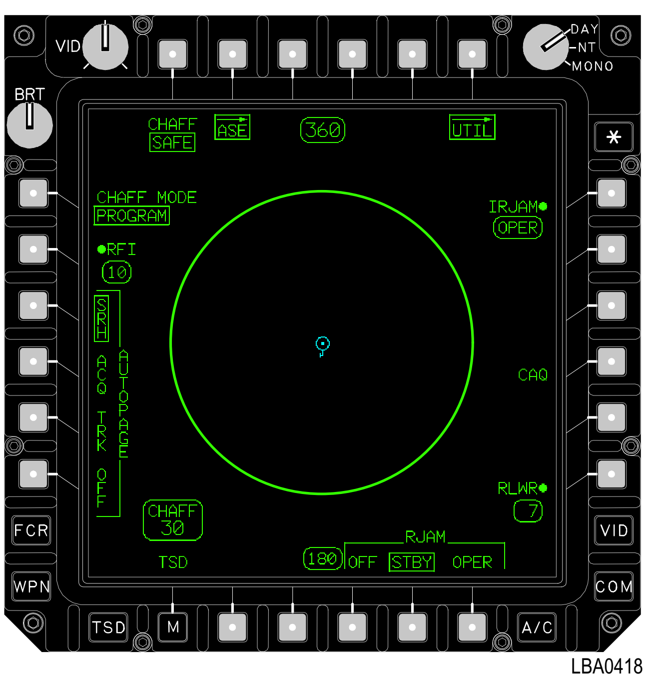


Figure 4-100. [**BLK 1** ASE Page]

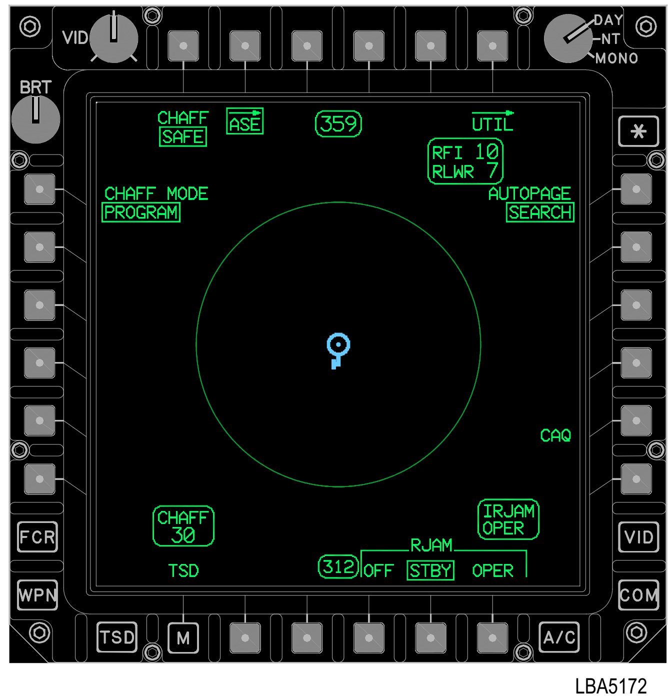


Figure 4-100A. [**BLK 2** ASE Page]

The **ASE** page contains the following unique buttons:

- T1 **CHAFF** button
- T2 **ASE** button
- T6 ASE **UTIL** button
- L1 **CHAFF MODE** button
- L2 [**BLK 1** **RFI** button]
- L3 [**BLK 1** **AUTOPAGE SRH** button]
- L4 [**BLK 1** **AUTOPAGE ACQ** button]
- L5 [**BLK 1** **AUTOPAGE TRK** button]
- L6 [**BLK 1** **AUTOPAGE OFF** button]
- R1 [**BLK 1** **IRJAM** button]
- R4 [**BLK 1** **CAQ** button]
- R6 [**BLK 1** **RLWR** button]
- R1 [**BLK 2** **AUTOPAGE** button]
- R5 [**BLK 2** **CAQ** button]
- B4 **RJAM OFF** button
- B5 **RJAM STBY** button
- B6 **RJAM OPER** button

4.89.1 CHAFF Button. The **CHAFF** button modes the chaff dispense system between **SAFE** and **ARM.** Chaff **SAFE/ARM** status is also displayed on the **WPN** and ASE **UTIL** pages.

4.89.2 ASE Button. The **ASE** button displays the **ASE** page. The **ASE** page presents RFI and RLWR threat indications, as well as subsystem controls.

4.89.3 ASE UTIL Button. The ASE **UTIL** button displays the ASE **UTIL** page and presents chaff program controls and other utility controls.

4.89.4 CHAFF MODE Button. The **CHAFF MODE** button modes the chaff dispense system between **PROGRAM** and **MANUAL**. The **PROGRAM** mode provides the ability to dispense chaff cartridges according to a predetermined program when the chaff dispense switch is actioned. The **MANUAL** mode will dispense one chaff cartridge each time the chaff dispense switch is actioned.

4.89.5 [BLK 1 **RFI Button**. The **RFI** button is only presented when the FCR is powered **ON**. The **RFI** button powers the RFI **ON** or **OFF**. Powering the RFI **ON** enables up to ten detected RFI threats to be displayed on the outside of the ASE footprint and in the status window. RFI **ON/OFF** is also presented on the FCR **UTIL** page and WPN **UTIL** page.]

4.89.6 [BLK 1 **AUTOPAGE SRH Button**. The **AUTOPAGE SRH** button sets the ASE Autopaging threshold to search. ASE Autopage triggering occurs when a new RLWR is detected in the search mode or a threat transitions to a higher mode.]

4.89.7 [BLK 1 **AUTOPAGE ACQ Button**. The **AUTOPAGE ACQ** button sets the ASE Autopaging threshold to acquisition. ASE Autopage triggering occurs when a new RLWR is detected in the acquisition mode or a threat transitions to a higher mode.]

4.89.8 [BLK 1 **AUTOPAGE TRK Button**. The **AUTOPAGE TRK** button sets the ASE Autopaging threshold to track. ASE Autopage triggering occurs when a new RLWR threat is detected in the track mode or a threat transitions to a higher mode.]

4.89.9 [BLK 1 **AUTOPAGE OFF Button**. The **AUTOPAGE OFF** button sets the ASE Autopaging to **OFF**.]

4.89.10 [BLK 1 **IRJAM Button**. The **IRJAM** button powers the IR Jammer **ON** or **OFF**. When powered on, the IR Jammer will begin to function after a one minute warm-up period. While in the warm up mode, the status window will reflect **WARM**, then change to **OPER** when complete. If the **IRJAM** is not installed, the **IRJAM** button is not displayed.]

4.89.11 CAQ Select Button. It is barriered when the RFI is powered **OFF** or sight selected is **FCR**.

4.89.11A [BLK 2 **AUTOPAGE Button**. The **AUTOPAGE** button is used to select the state or condition of an acquiring threat system which causes autopaging of threat warning information.] The available selections are:

- **SEARCH**
- **ACQUISITION**
- **TRACK**
- **OFF**

4.89.12 [BLK 1 **RLWR Button**. The **RLWR** button powers the **RLWR ON** or **OFF**. Powering the **RLWR ON** enables up to seven detected RLWR threats to be displayed on the inside of the ASE footprint and in the status window.]

4.89.13 RJAM OFF Button. The RJAM **OFF** button powers the Radar Jammer **OFF**.

NOTE

RJAM **STBY** and **OPER** are not present when RJAM is **OFF** on the TSD and VIDEO pages.

4.89.14 RJAM STBY Button. The **RJAM STBY** button sets the Radar Jammer in the standby mode for warm-up period of 3 minutes. A deselected **JAM** button is presented on the **TSD** and **VIDEO** pages which can be used to mode the RJAM between standby and operate. Selecting the **OFF** button will interrupt the standby mode warm up period.

4.89.15 RJAM OPER Button. The **RJAM OPER** button sets the Radar Jammer in the operate mode. A selected **JAM** button is presented on the **TSD** and **VIDEO** pages which can be used to mode the RJAM between operate and standby. The system processor reverts the RJAM back to standby if operate is selected before the warm up period.

4.89.15A [BLK 2 **Combined Emitter Status Window**. The **Combined Emitter** status window displays the number of emitters reported from the RFI (up to 10) and the number of emitters reported from the RWR or RLWR (up to 7). The RFI, RWR or RLWR line is not displayed if the equipment is not installed or power on. If none of these boxes are power on, then the status window is not displayed.]

4.89.16 CHAFF Status Window. The **CHAFF** status window displays the remaining number of chaff cartridges decremented by the system processor. It is also displayed on the **WPN** page.

4.89.16A [**BLK 2** **IRJAM Status Window**. The **IRJAM** status window displays the state of the IR Jammer (OPER or WARM). This status window is not displayed if the IR Jammer is not installed or off.]

4.89.17 ASE Footprint. The ASE footprint is the circular area in the center of the **ASE** page. It is used to segregate the RLWR and RFI threat indications. RLWR threat indications appear on the inside of the ASE footprint and RFI threat indications appear on the outside of the ASE footprint. A rectangular threat footprint is also displayed on the **TSD** page to segregate RLWR and RFI threat indications.

4.89.18 RLWR or RFI Threat Indications. The RLWR/RFI threat indications are displayed on the ASE footprint. The symbology presented will identify the threats, show the threat bearings relative to the ownship, and indicate the mode of the threats (i.e. search, acquisition, track, or launch). Friendly emitters are displayed in CYAN and enemy/gray emitters are displayed in YELLOW. Threat indications are also displayed on the **TSD** page.

4.89.19 Radar Jammer Icon. The Radar Jammer Icon is displayed as a flashing lightening bolt in the center of the Ownship Icon whenever the Radar Jammer is transmitting.

4.89.20 Display Freeze Cue. The line through the A/C Heading Status Window and the Next WPT Heading Status Window indicates the ASE Symbology is not updating with respect to the aircraft. Reference Chapter 3, Section III.

4.89.21 A/C Heading Map Freeze Cue. Reference Chapter 3, Section III.

4.89.22 Ownship Icon. Reference Chapter 3, Section III.

4.89.23 Deleted.

4.89.24 Next WPT Heading Map Freeze Cue. Reference Chapter 3, Section III.

4.89.25 ASE Symbology. The symbology presented (fig 4-101) will identify the threats, show the threat bearings relative to the ownship, and indicate the mode of the threats (i.e. search, acquisition, track, or launch). Threat mode icons are displayed in YELLOW. These icons will be displayed on the ASE footprint of the **ASE** page and **TSD** page. RFI icons are displayed on the outside of the footprint and RLWR icons are displayed inside the footprint. The FCR page only displays RFI icons (para.4.45.1).

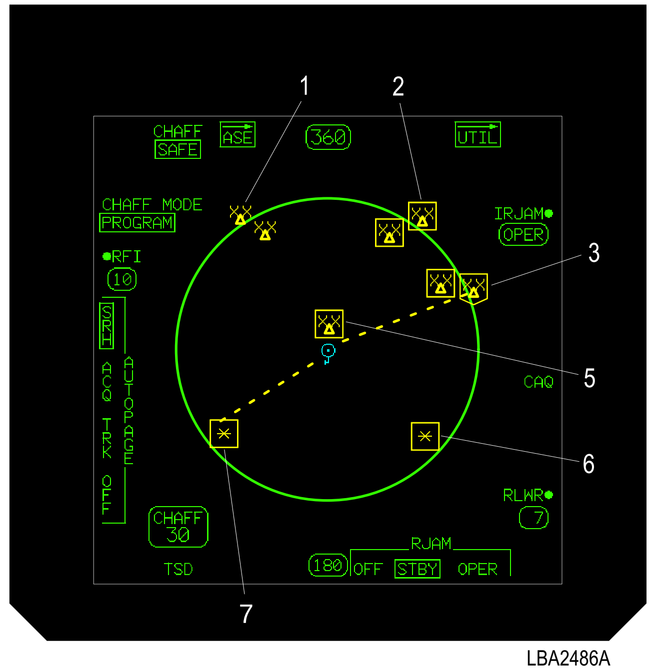


Figure 4-101. ASE Symbology

RWR and Other Than No.1 Emitter RFI Mode Icons.

1. Search Mode. The search mode is identified by the target symbol being unboxed.

2. Acquisition Mode. The acquisition mode is identified by the target symbol being boxed.

3. Tracking Mode. The tracking mode is identified by the symbol being boxed and a dashed line between Ownship and target symbol.

4. Launch Mode. The launch mode is identified by the flashing box around the target symbol.

5. Uncorrelated RWR Detect. Identified by icon being oriented directly in front of ownship. Displays same as others (may or may not be boxed) but bearing unknown.

Laser Warning Receiver Mode Icons.

6. Ranging. Identified by icon being boxed.

7. Designating. Identified by the icon being boxed with dashed line between Ownship and target symbol.

8. Beaming. Identified by the flashing box around the icon.

4.89.26 Load Maintenance Panel. Chaff inventory is performed by the system processor and can be manually updated by the ground crew via the load maintenance panel or the air crew via the MPD. The ground crew enters the **CHAFF** option from the display main menu via the load maintenance panel key pad. After the ground crew enters the number of loaded chaff cartridges (0-30) and enter via the key pad, the load maintenance panel transmits the new chaff count to the system processor representing the cartridge count via the load maintenance panel serial link. The system processor monitors and updates the display processor and load maintenance panel with cartridge count status.

4.90 ASE UTIL PAGE

The ASE **UTIL** Page (figs [BLK 1 4-102] and [BLK 2 4-102A]) is as depicted below and is used to configure the ASE Subsystem:

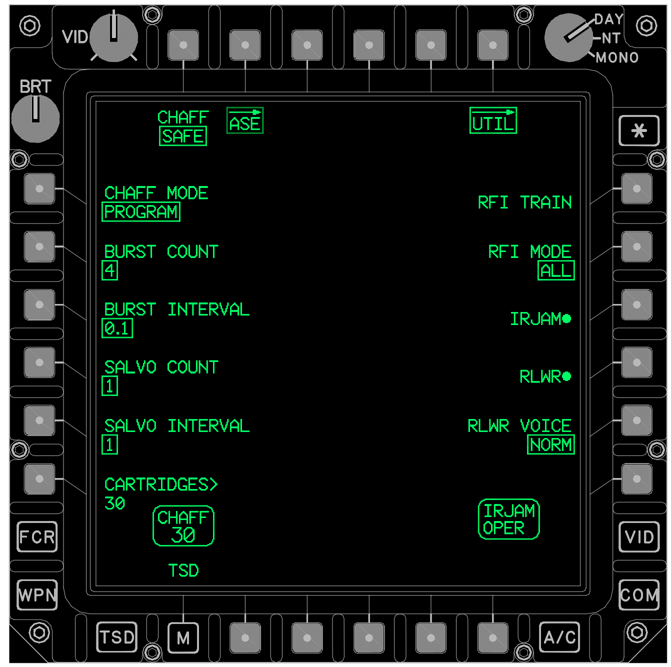


Figure 4-102A. [BLK 2 ASE UTIL Page]

The ASE **UTIL** page contains the following unique buttons:

- L2 **BURST COUNT** button
- L3 **BURST INTERVAL** button
- L4 **SALVO COUNT** button
- L5 **SALVO INTERVAL** button
- L6 **CARTRIDGES** button
- R1 **RFI TRAIN** button
- R2 **RFI MODE** button
- R3 [**BLK 2** **IRJAM** button]
- R4 [**BLK 2** **RLWR** button]
- R5 **RLWR VOICE** button

NOTE

BURST COUNT, **BURST INTERVAL**, **SALVO COUNT**, and **SALVO INTERVAL** buttons are present if **CHAFF MODE** is set to **PROGRAM**.

4.90.2 BURST COUNT Button. The **BURST COUNT** button enables programming of **1**, **2**, **3**, **4**, **6**, or **8** chaff cartridges to be fired per salvo.

4.90.3 BURST INTERVAL Button. The **BURST INTERVAL** button enables programming of **0.1**, **0.2**, **0.3**, or **0.4** tenths of seconds between chaff bursts.

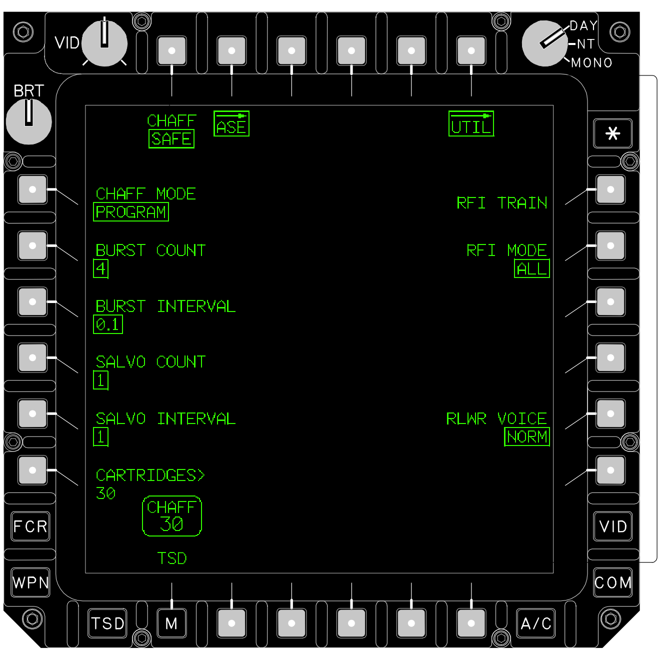


Figure 4-102. [BLK 1 ASE UTIL Page]

4.90.4 SALVO COUNT Button. The **SALVO COUNT** button enables programming of **1**, **2**, **4**, **8**, or **CONTINUOUS** salvos per activation of the Chaff Dispense switch.

4.90.5 SALVO INTERVAL Button. The **SALVO INTERVAL** button enables programming of **1**, **2**, **3**, **4**, **5**, **8**, or **RANDOM** time intervals in seconds, between salvos. **RANDOM** is actually a pseudo random sequence set at 3, 5, 2, and 4 seconds.

4.90.6 CARTRIDGES Button. The Chaff **CARTRIDGES** button provides a means to enter a number from 0 to 30, indicating the number of cartridges loaded into the M-141 Chaff Dispenser through the KU. This is an alternative to entering the data via the Load Maintenance Panel (LMP).

4.90.7 RFI TRAIN Button. The **RFI TRAIN** button is only presented when the RFI is powered on. **RFI TRAIN** modes the RFI system to the training mode. **RFI TRAIN** is also presented on the FCR **UTIL** page.

4.90.8 RFI MODE Button. The **RFI MODE** button is only presented when the RFI is powered on. **RFI MODE** modes the RFI system to display **ALL** or **HOSTILE** threats. **RFI MODE** is also presented on the FCR **UTIL** page.

4.90.8 [**BLK 2** **IRJAM Button**. The **IRJAM** button powers the IR Jammer **ON** or **OFF**. When powered on, the IR Jammer will begin to function after a one minute warm-up period. While in the warm up mode, the status window will reflect **WARM**, then change to **OPER** when complete. If the **IRJAM** is not installed, the **IRJAM** button is not displayed.]

4.90.9 [**BLK 2** **RLWR Button**. The **RLWR** button powers the **RLWR ON** or **OFF**. Powering the **RLWR ON** enables up to seven detected RLWR threats to be displayed on the inside of the ASE footprint and in the status window.]

4.90.10 RLWR VOICE Button. The **RLWR VOICE** button modes the RLWR system between **NORM** or **TERSE** voice messages.

4.91 DISPENSER KIT OPERATION

CAUTION

Operation is totally independent of aircraft ARM/SAFE power.

1. CARTRIDGES - Set for number of chaff cartridges in payload module.
2. CHAFF MODE - Program - Select **BURST COUNT**, **BURST INTERVAL**, **SALVO COUNT**, and **SALVO INTERVAL** - As desired.
3. CHAFF - **ARM**.
4. Chaff Dispense button - Press and release.
5. CHAFF - **SAFE**.

4.92 ASE OPERATIONAL CHECK

1. **WPN ASE** page - Power **ON ASE** systems as desired.
2. **DMS IBIT** page - Perform IBITs and verify “**NO FAULTS FOUND**” for:
   a. RJAM.
   b. RLWR.
3. UFD - Check WCA for advisories.

CHAPTER 5
OPERATING LIMITS AND RESTRICTIONS

Section I. GENERAL

5.1 PURPOSE

This chapter identifies operating limits and restrictions that will be observed during ground and flight operations.

5.2 GENERAL

The operating limitations set forth in this chapter are the direct results of design analysis, test and operational experiences. Normal, transient and maximum limits are displayed via the MPDs to the crew with corresponding digital readouts, vertical scales, timers and color coding. Compliance with restrictions and limits outlined in this chapter will allow the pilot to safely perform the assigned missions and to derive maximum utility from the aircraft. See current Interim Statement of Airworthiness Qualification (ISAQ) for additional limitations/restrictions.

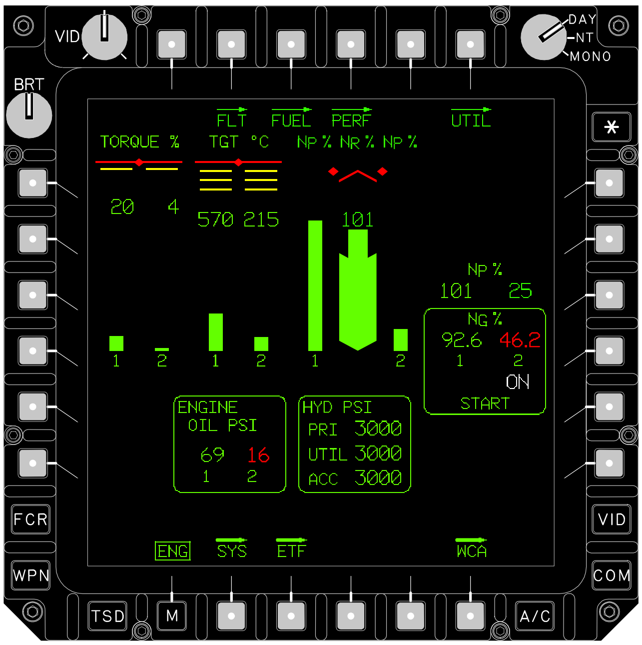
5.2.1 Exceeding Operational Limits. Any time an operational limit is exceeded, an appropriate entry shall be made on DA Form 2408-13-1. Entry will state what limit or limits were exceeded, range, time beyond limit and any additional data that would aid maintenance personnel in the maintenance action that may be required. The DMS provides engine performance evaluation and fault detection.

5.2.2 Minimum Crew Requirements. The minimum crew required to fly the helicopter is a pilot and a copilot. A technical observer may be authorized to occupy the CPG station during ground maintenance at the discretion of the commander.

Section II. SYSTEM LIMITS

5.3 INSTRUMENT MARKINGS

5.3.1 Instrument Marking Code. Operating limitations and ranges are illustrated by graphic symbols and color coding of systems instruments on the **ENG** page (fig 5-1).



LBA-3036

Figure 5-1. ENG Page Ground Format

Digital readouts are color coded according to normal (GREEN), cautionary (YELLOW), maximum (RED) operating ranges of the system. Readouts are displayed in WHITE when data is not in a valid range. Systems indications displayed with a vertical tape incorporate color coding and shape coding (width of the tape) to delineate the normal, cautionary, maximum operating ranges of the system. Tapes are displayed in three different widths and colors based on the current operating range:

- Narrow: entire tape is GREEN; indicates safe or normal range of operation.
- Medium: entire tape is YELLOW; indicates range when special attention should be given to operation.
- Wide: entire tape is RED; indicates the limit above or below which continued operation is likely to cause damage or shorten component life.

Graphic symbols are displayed (fig 5-2) in conjunction with each vertical tape to provide instrument limit markings:

- RED horizontal bar and diamond symbols indicate the maximum operating limit.
- YELLOW horizontal bar indicates the beginning of a sub-range cautionary operating range.

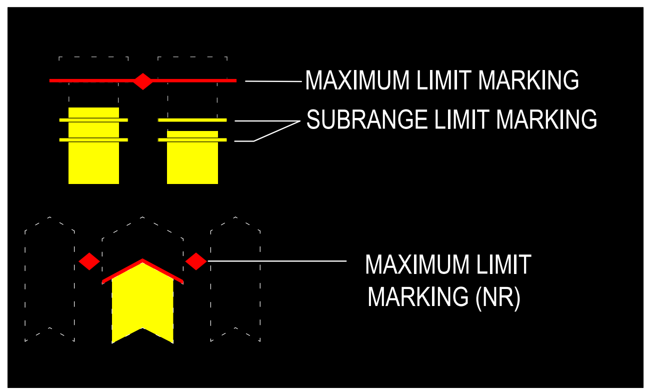


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Figure 5-2. Instrument Limit Marking Symbols

5.3.2 Rotor Speed (N_R) Limitations. Main rotor speed (**N_R %**) (fig 5-3) is displayed as a vertical tape and a digital readout (within the tape) on the **ENG** page. The N_R instrument graphic is displayed in conjunction with the N_P instrument of both engines. The following limits and their associated symbols apply to N_R.

LIMIT - N_R (%) Digital Readout	
110	Maximum (>110 RED)
106-110	Transient operation (YELLOW)
106	High rotor warning annunciated
95-105	Normal operation (GREEN)
0-94	Transient operation (RED)

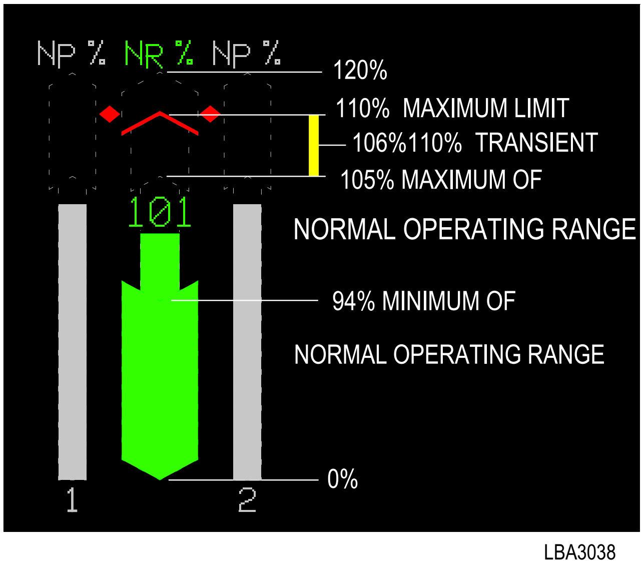

Figure 5-3. N_R Vertical Tapes

5.3.3 Engine Lubrication System. Engine oil (**ENGINE OIL**) pressure (**PSI**) is displayed as digital readouts on the **ENG** and aircraft **SYS** pages. Engine lubrication oil pressure digital readout limitations during stabilized power settings are as follows:

NOTE

It is normal for oil pressure to be high during first start when oil is cold. Oil pressure should return to normal after 5 minutes operation at idle speed. During these 5 minutes, do not accelerate above ground idle speed until oil pressure can be held at or below maximum limit throughout acceleration.

LIMITS - ENGINE1 OR 2 OIL PRESSURE (PSI)	
120	Maximum (>120 RED w/box)
23-120	Normal operation (GREEN)
23	Minimum, PWR LVR at **IDLE** <23 RED

5.3.4 Hydraulic Systems. Primary (**PRI**) utility (**UTIL**), and accumulator (**ACC**) hydraulic (**HYD**) pressure (**PSI**) are displayed as digital readouts on the **ENG** and aircraft **SYS** pages. The limits for all hydraulic systems digital readouts are as follows:

LIMITS - HYDRAULIC PRESSURE	
>3400	Transient operation permitted for 5 seconds (YELLOW). (≥ 5 seconds RED w/box)
3310 - 3400	Transient - operation permitted for 5 minutes (YELLOW) (≥ 5 minutes RED w/box)
2750 - 3300	Normal operation (GREEN)
1260	Minimum (<1260 RED w/box)

Section III. POWER LIMITS

5.4 ENGINE POWER LIMITATIONS

The following limitations present absolute limitations for the pneumatic engine starter and engine(s) power regardless of the atmospheric conditions. For variation in power available with temperature and pressure altitude, refer to the charts in the Performance Data Chapter (Chapter 7 for 701 and Chapter 7A for 701C engines).

5.4.1 Engine Starter Limitations. The pneumatic starter is capable of making the number of consecutive start cycles listed below, when exposed to the environmental conditions specified, with an interval of at least 60 seconds between the completion of one cycle and the beginning of the next cycle. A starting cycle is the interval from start initiation and acceleration of the output drive shaft, from zero rpm, to starter dropout. The 60 second delay between start attempts applies when the first attempt is aborted for any reason and it applies regardless of the duration of the first attempt. If motoring is required for an emergency, the 60 second delay does not apply.

a. Engine Starts At Ambient Temperatures of 61 °F (16 °C) and Below. Two consecutive start cycles may be made, followed by a 3 minute rest period, followed by two additional consecutive start cycles. A 30 minute rest period is then required before any additional starts.

b. Engine Starts At Ambient Temperatures Above 61 °F (16 °C). Two consecutive start cycles may be made. A 30 minute rest period is then required before any additional starts.

c. Dual Engine Starts. Dual engine starts are prohibited.

5.4.2 Engine Temperature Limitations (701 and 701C engines). Engine Turbine Gas Temperature (**TGT °C**) is displayed (figs 5-4, 5-5, 5-6, 5-7) as a vertical tape and a digital readout (within the tape) for each engine on the **ENG** page. The configuration of the instrument graphic is based upon the type engines installed and current mode of operation, dual engine (DE) or single engine (SE). The following limits and their associated symbols apply to TGT limitations.

a. 701 701 Engine.

NOTE

Each engine incorporates a steady state TGT limiter control which limits engine operation according to the following indicated TGT values:
Dual Engine: 860 +/- 12 (848-872)° C
Single Engine: 917 +/- 12 (905-929)° C
The limit value within these ranges can change over a period time.

LIMITS - 701 TGT (°C) DIGITAL READOUT	
965	Maximum (> 965 RED)
920-965	Single engine transient, 12 second limit (YELLOW)
865-919	Single engine contingency, 2.5 minute limit (YELLOW)
869	Maximum during start
808-864	Intermediate rated power, 30 minute limit (YELLOW)
807	Maximum continuous power
0-807	Normal operation (GREEN)

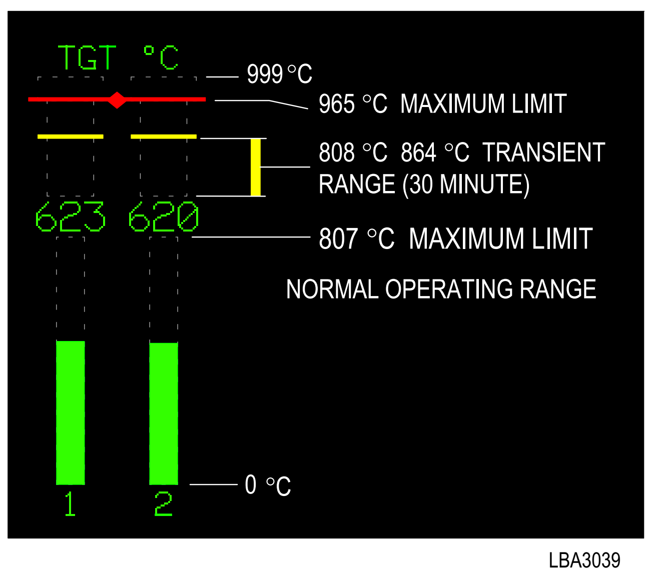

Figure 5-4. DE, 701 TGT Vertical Tapes

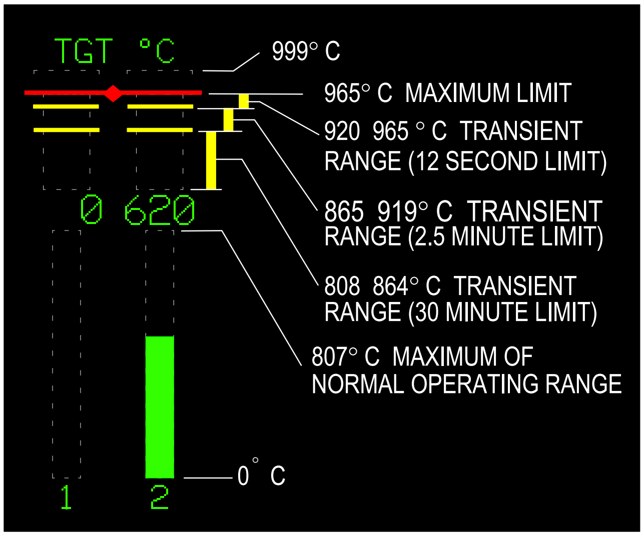

Figure 5-5. SE, 701 TGT Vertical Tapes

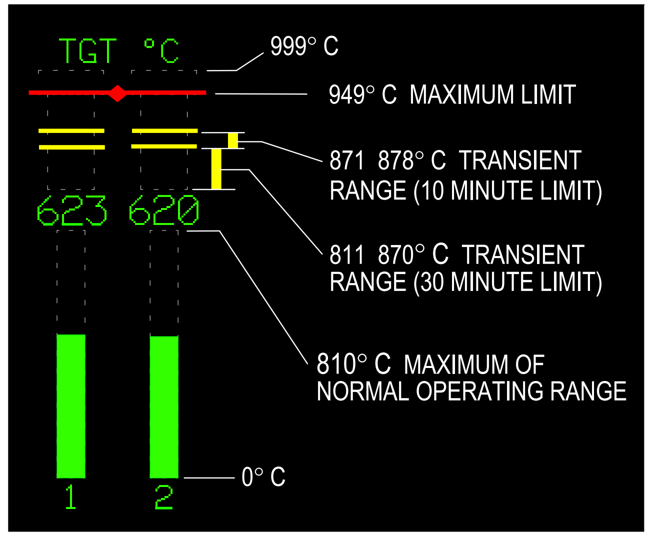

Figure 5-6. DE, 701C TGT Vertical Tapes

b. 701C 701C Engine.

NOTE

Each engine incorporates a steady state TGT limiter control which limits engine operation according to the following indicated TGT values:
Dual Engine: 867 +/- 12 (855-879)° C
Single Engine: 896 +/- 12 (884-908)° C
The limit value within these ranges can change over a period time.

LIMITS - 701C TGT (°C) DIGITAL READOUT	
949	Maximum (>949 RED)
897-949	Single engine transient, 12 second limit (YELLOW)
879-896	Single engine contingency, 2.5 minute limit (YELLOW)
871-878	Intermediate rated power, 10 minute limit (YELLOW)
851	Maximum during start
811-870	Intermediate rated power, 30 minute limit (YELLOW)
810	Maximum continuous power
0-810	Normal operation (GREEN)

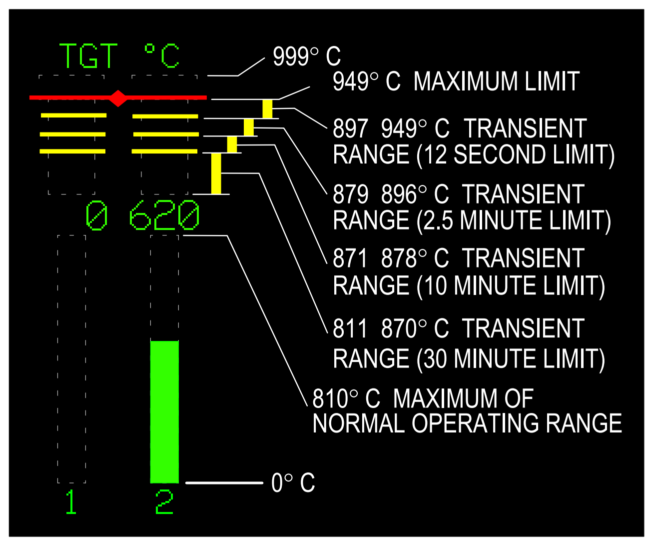

Figure 5-7. SE, 701C TGT Vertical Tapes

5.4.3 Engine Power Turbine Speed, (N_P). Engine power turbine speed (**N_P %**) is displayed (fig 5-8) as a vertical tape and a digital readout for each engine on the **ENG** page. The N_P digital readouts are displayed separately from the vertical tapes. The following limits and their associated symbols apply to engine N_P:

NOTE

- It is not abnormal to observe a **N_P1** and **N_P2** speed split during autorotation descent when the engines are fully decoupled from the transmission. A speed increase from 101% reference to 103% is possible for 701C only.
- Maximum **N_P** vertical tape indication is 120 %.

LIMITS - ENGINE1 OR 2 N_P (%) Digital Readouts	
121	Maximum (>121 RED w/box).
115	Engine overspeed annunciated
106-121	Transient operation, 12 seconds (YELLOW, w/box at 107).
0-105	Normal operation (GREEN)

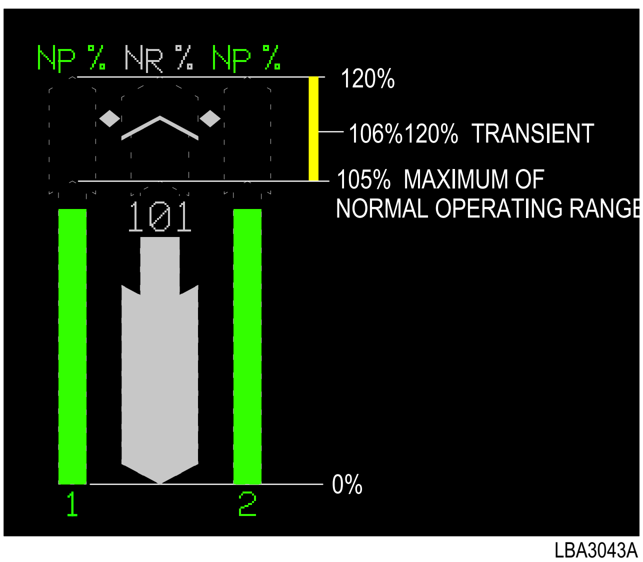

Figure 5-8. N_P Vertical Tapes

5.4.4 Engine Gas Generator (N_G) Limitations. Engine gas generator speed (**N_G %**) is displayed as a digital readout for each engine on the **ENG** page. The following limits apply to engine N_G:

LIMITS - ENGINE1 OR 2 N_G (%) DIGITAL READOUT	
105.1	Maximum (>105.1 RED)
102.3-105.1	Transient 12 second limit (YELLOW)
63.1-102.2	Normal operation (GREEN)
63	Minimum engine out warning annunciated (<63.0 RED w/box).

5.4.5 Engine Torque. Engine torque (**TORQUE %**) is displayed (figs 5-9 thru 5-12) as a vertical tape and a digital readout for each engine on the **ENG** page. The configuration of the instrument graphic is based upon main rotor speed (N_R) and the current mode of operation, dual engine (DE) or single engine (SE). The following limits and their associated symbols apply to engine torque limitations:

LIMITS - TORQUE (%) DIGITAL READOUT WITH N_R LESS THAN 50%	
30	Maximum (>30 RED)
0-30	Normal operation (GREEN).

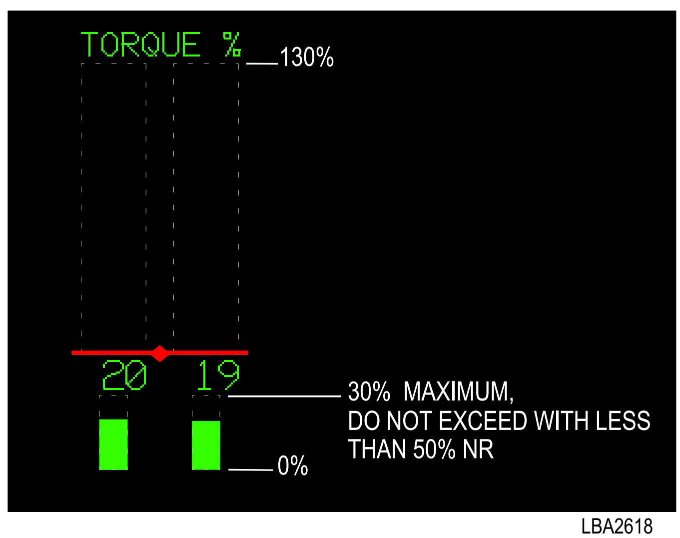

Figure 5-9. Torque Vertical Tapes, N_R below 50%

LIMITS - TORQUE (%) DIGITAL READOUT WITH N_R LESS THAN 90%	
70	Maximum (>70 RED)
0-70	Normal operation (GREEN).

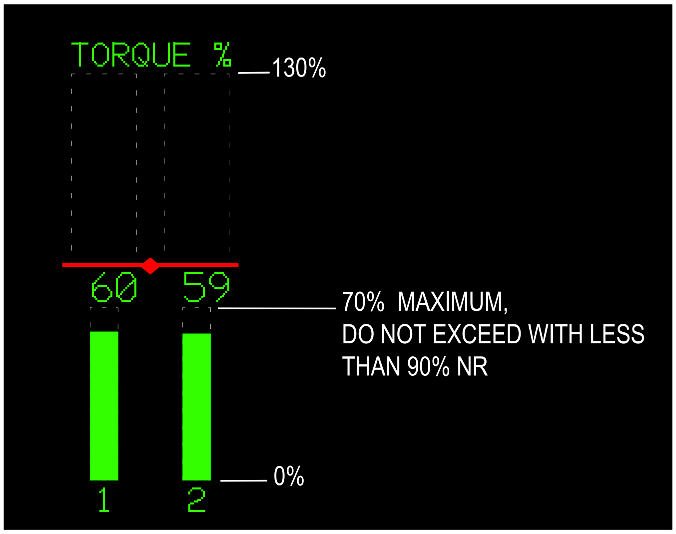

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Figure 5-10. Torque Vertical Tapes, N_R 50%-90%

LIMITS - TORQUE (%) DIGITAL READOUT DUAL ENGINE	
115	Maximum (>115 RED)
101-115	Transient 6 second limit (YELLOW).
0-100	Normal operation (GREEN).

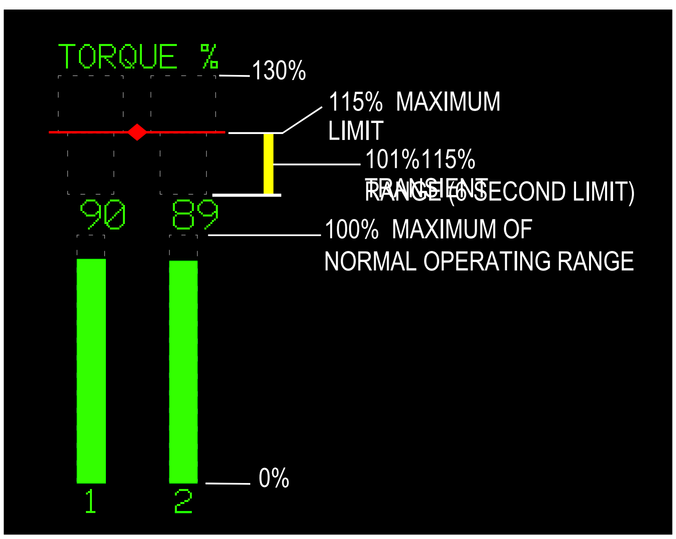

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Figure 5-11. Torque Vertical Tapes, DE

LIMITS - TORQUE (%) DIGITAL READOUT SINGLE ENGINE	
125	Maximum (>125 RED)
123-125	Transient 6 second limit (YELLOW).
111-122	Single engine contingency, 2.5 minute limit (YELLOW).
110	Single engine maximum continuous power (GREEN).
0-110	Normal operation (GREEN).

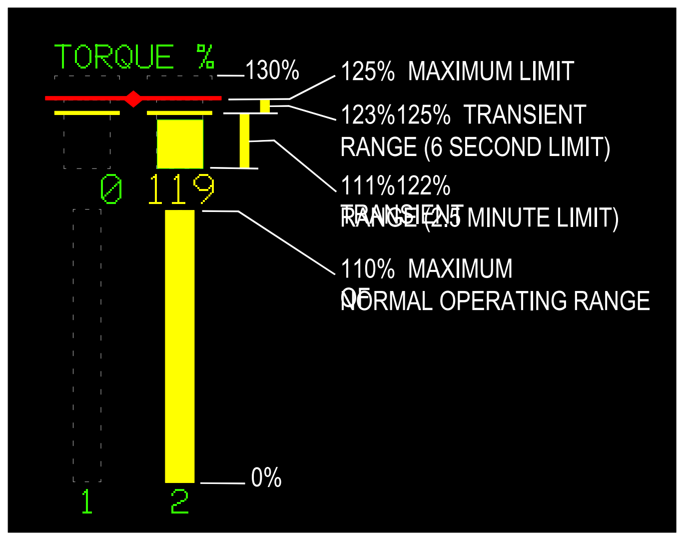

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Figure 5-12. Torque Vertical Tapes, SE

5.5 AUXILIARY POWER UNIT (APU) OPERATING LIMITS

CAUTION

Avoid prolonged operation at 94% - 96% N_R with the APU running. The APU clutch will oscillate from engaged to disengaged. This creates high loads on the clutch and shall be avoided.

5.5.1 APU Operating Limitations. APU operation is prohibited during normal flight. After a fault or aborted start, wait 30 seconds after compressor has stopped before attempting another start. After 2 consecutive start attempts, wait 20 minutes before third start attempt. No more than 3 start attempts are permitted in one hour.

CAUTION

Do not operate the APU for more than 5 minutes at a main transmission oil temperature of 120 - 130° C. Shut down APU to prevent damaging accessory gearbox components.

5.5.2 Extended APU Ground Operations. During prolonged ground operations greater than 30 minutes, observe **XMSN TEMP 1** and **XMSN TEMP 2** on the **SYS** page. If the temperatures exceed 130° C (266° F) the APU shall be shutdown and the transmission fluid allowed to cool for 30 minutes prior to resuming APU ground operations; or transmission fluid may be cooled by operating an engine with rotor turning. There is no requirement to remove transmission side panels during extended APU ground operations. However, the transmission fluid will not get as hot under high ambient temperature conditions if the side panels are removed.

Section IV. LOADING LIMITS

5.6 CENTER OF GRAVITY LIMITS

Center of gravity limits for the helicopter to which this manual applies and instructions for computation of center of the gravity are contained in Chapter 6.

5.7 WEIGHT LIMITATIONS

The aircraft maximum gross weight is 20,260 pounds, except for non-tactical ferry flights, which may not exceed 23,000 pounds.

Section V. AIRSPEED LIMITS

5.8 AIRSPEED OPERATING LIMITS

See figure 5-13 to determine the Never Exceed Velocity (V_{NE}) as a function of weight, altitude and temperature. Additional airspeed limits listed below.

5.8.1 Airspeed Limits For Autorotation. Maximum airspeed for autorotation is 145 KTAS.

5.8.2 Airspeed Limits With One Engine Inoperative. Maximum airspeed with one engine inoperative is the greater of:

a. 67% of V_{NE} determined from figure 5-13 using the GROSS WEIGHT line.

b. The speed for minimum power determined from the Chapter 7 701 or Chapter 7A 701C cruise charts using the MAX END/MAX R/C lines.

5.8.3 Maximum Airspeeds During Manual Stabilator Operations. Maximum airspeeds are based on stabilator position. The stabilator position and nominal airspeed restrictions are displayed on the **FLT** page, **FLT SET** page, as well as the **SYS** page, as described in paragraph 2.68.

5.8.4 Maximum Rearward/Sideward Flight Speed. Maximum rearward/sideward flight speed is 45 KTAS for all gross weights.

5.8.5 Maximum Airspeed for Searchlight Extension. The searchlight is designed for operation (extend/retract/rotate) at speeds up to 90 knots. However, as long as operation is not attempted, the lighthead can be left in any extended position at speeds up to 200 knots.

5.8.6 Maximum Airspeed with Symmetrically Loaded External Fuel Tanks (2 or 4) Installed. Maximum airspeed with symmetrically loaded external fuel tanks (2 or 4) installed is 130 KTAS.

5.8.7 Maximum Airspeed for Stores Jettison. Jettison of external armament stores is not authorized except for emergency conditions and then only from unaccelerated flight during:

a. Maximum airspeed for stores jettison is 130 KTAS.

b. Hover to 45 KTAS (minimize side slip, if possible).

c. 45 to 130 KTAS (ball centered, if possible).

5.8.8 Maximum Airspeed for External Tanks Jettison. Jettison of external fuel tanks is not authorized except for emergency conditions and then only from airspeeds less than 100 KTAS. Jettison from level flight if possible, and if not, jettison at an airspeed which minimizes the rate of descent at the time of jettison.

5.8.9 Airspeed Operating Limits Chart. Referring to figure 5-13, sheet 1, note that a FAT scale and pressure altitude scale are provided in the upper grid and a weight scale and true airspeed scale on the lower grid. Using the observed FAT and altitude obtained from the aircraft instruments and the calculated aircraft weight, enter the chart as directed in the chart example. Determine maximum true airspeed at the left side of the lower grid. To determine the maximum indicated airspeed, refer to figure 5-13, sheet 2 and enter as directed in the chart example with the KTAS and density altitude determined from figure 5-13, sheet 1.

AIRSPEED OPERATING LIMITS

101% ROTOR RPM
LEVEL FLIGHT

EXAMPLE 1

WANTED

MAXIMUM ALLOWED TRUE AIRSPEED AND DENSITY ALTITUDE

KNOWN

PRESSURE ALTITUDE = 6000 FEET
FAT = 10°C
GROSS WEIGHT = 21,000 POUNDS

METHOD

ENTER AT 6000 FEET PRESSURE ALTITUDE
MOVE RIGHT TO FAT = 10°C
MOVE DOWN TO 21,000 POUND GROSS WEIGHT OR MACH LIMIT FAT, WHICHEVER IS ENCOUNTERED FIRST. MOVE LEFT AT 21,000 LB LINE AND READ TRUE AIRSPEED = 150 KNOTS
MOVE DOWN, READ DENSITY ALTITUDE = 6800 FEET

EXAMPLE 2

WANTED

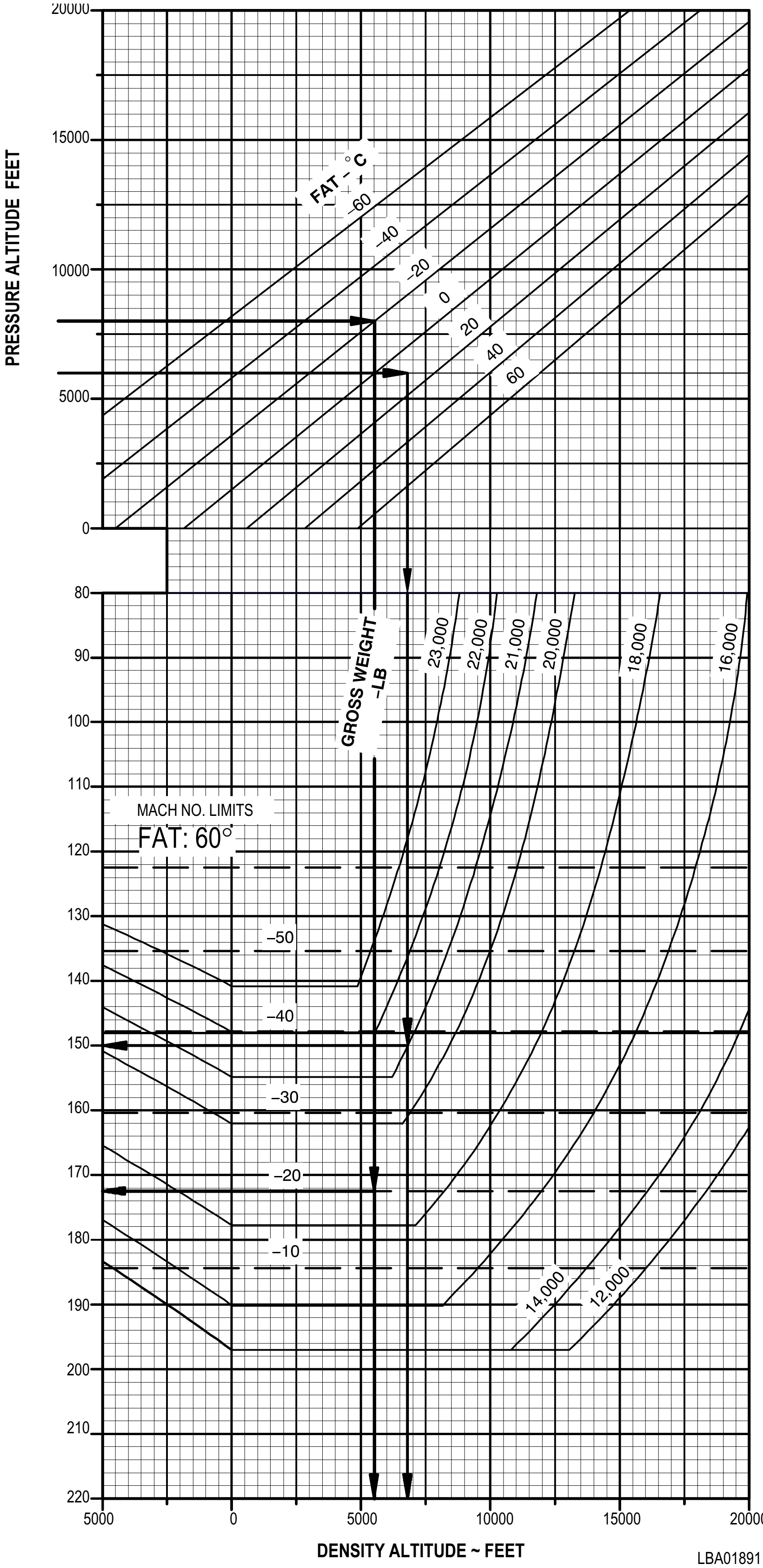
MAXIMUM ALLOWED TRUE AIRSPEED AND DENSITY ALTITUDE

KNOWN

PRESSURE ALTITUDE = 8000 FEET
FAT = 20°C
GROSS WEIGHT = 18,000 POUNDS

METHOD

ENTER AT 8000 FEET PRESSURE ALTITUDE
MOVE RIGHT TO FAT = 20°C
MOVE DOWN TO 18,000 POUND GROSS WEIGHT OR MACH LIMIT FAT, IN THIS CASE, THE MACH LIMIT FAT LINE IS ENCOUNTERED FIRST. MOVE LEFT AT 20°C LINE AND READ TRUE AIRSPEED = 172 KNOTS
MOVE DOWN, READ DENSITY ALTITUDE = 5500 FEET



AIRSPEED OPERATING LIMITS AH64D

DATA BASIS: DERIVED FROM FLIGHT TEST

Figure 5-13. Airspeed Operating Limits Chart (Sheet 1 of 2)

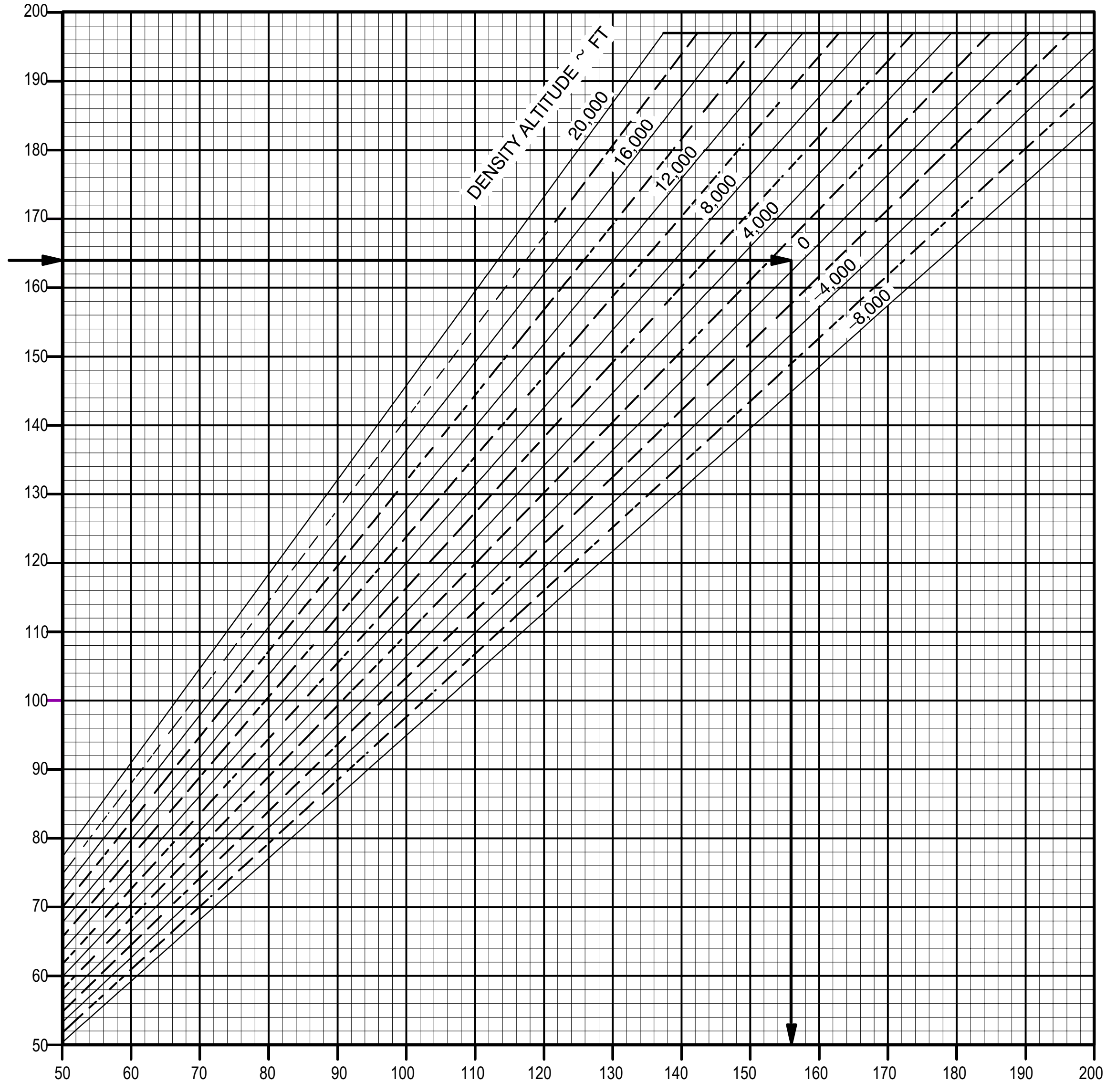
AIRSPEED CONVERSION

AIRSPEED CONVERSION AH-64D

EXAMPLE

ON SHEET 2 ENTER AT
164 KNOTS TRUE AIRSPEED
AND MOVE TO RIGHT TO 1500
FEET DENSITY ALTITUDE.
MOVE DOWN, READ INDICATED
AIRSPEED = 156 KNOTS.

NOTE: DASHED LINES ON CHART REPRESENT THE NEXT 2000 FT INCREMENT OF D.A. (POSITIVE AND NEGATIVE)



DATA BASIS: DERIVED FROM FLIGHT TEST

LBA01892

Figure 5-13. Airspeed Operating Limits Chart (Sheet 2 of 2)

Section VI. MANEUVERING LIMITS

5.9 MANEUVERING LIMITS

For normal load factors, refer to figure 5-14. Intentional maneuvers beyond attitudes ± 30° in pitch or ± 60° in roll are prohibited.

5.9.1 Prevent Excessive Tail Rotor Loads. Avoid large pedal step inputs in arresting right hovering/low speed yawing turns greater than 60°/second. This is to prevent excessive tail rotor drive system loads.

5.9.2 Flight with Canopy Enclosure Open. Flight, hovering flight and air taxiing with the canopy enclosure open are prohibited, except for smoke/fume elimination.

5.9.3 Landing Limits. Do not complete a landing on terrain which produces a pitch attitude change from a hover greater than 7° nose up or 12° nose down; or a roll attitude greater than 10°.

5.9.4 External Tanks. With external fuel tanks (2 or 4) containing fuel, symmetrically installed, the following restrictions apply:

a. Normal load factor of 2 Gs shall not be exceeded.

b. Maneuvers are limited to those required to takeoff, climb to optimum altitude, heading/course corrections, obstacle avoidance, descend and land.

c. 230 gal external fuel tanks shall be in the flight stow position (4° nose-up) with respect to the waterline (WL).

d. Rapid and step-shaped pedal inputs in excess of 1/2 in. shall be avoided.

e. Operation of the aircraft with the 230-gallon Extended Range Fuel System (ERFS) is prohibited during operations where hostile fire is highly probable.

Section VII. ENVIRONMENTAL RESTRICTIONS

5.10 ENVIRONMENTAL RESTRICTIONS

5.10.1 Flight into Turbulence. Flight into known or forecast extreme turbulence or into known severe turbulence is prohibited.

5.10.2 Flight In Icing Conditions. Intentional flights into moderate icing conditions are prohibited. Flight into known or forecast trace or light icing conditions is authorized and not considered a hazard unless the condition is encountered for an extended period (over one hour).

5.10.3 Flight In Instrument Meteorological Conditions. The aircraft is not qualified for IMC flight. The back-up flight instruments are required to be installed and operational for all flights.

5.10.4 Rotor Limitations - Start and Stop Limits. Maximum wind velocity for rotor start or stop is 45 knots.

Section VIII. OTHER LIMITS

5.11 WING STORES CONFIGURATION

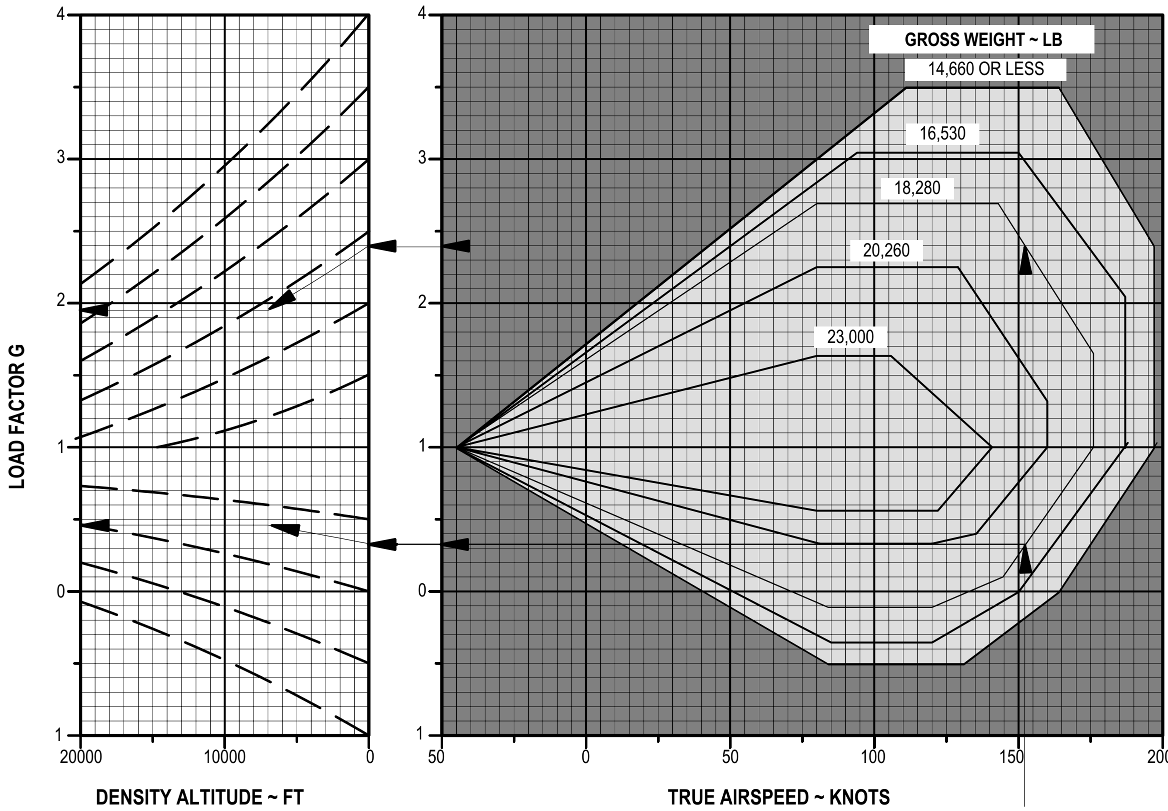
For authorized wing stores configurations refer to Chapter 7 701 or 7A 701C, figure 7-26 701 or 7A-28 701C.

5.12 USE OF FORCE TRIM.

Force trim will not be selected **OFF** except in a failed or partial failed mode.

FLIGHT ENVELOPE

FLIGHT ENVELOPE
AH64D



EXAMPLE

WANTED

MAXIMUM AND MINIMUM LOAD FACTOR

KNOWN

GROSS WEIGHT = 18,280 POUNDS
DENSITY ALTITUDE = 7000 FEET
AIRSPEED = 152.5 KTAS

METHOD

ENTER AT V = 152.5 KTAS. MOVE UP TO UPPER AND LOWER ENVELOPE BOUNDARIES FOR GROSS WEIGHT = 18,280 POUNDS.
MOVE LEFT TO DENSITY ALTITUDE OF ZERO FEET.
SLIDE TO LEFT ALONG DASHED LINES TO 7000 FEET DENSITY ALTITUDE.
MOVE LEFT TO LOAD FACTOR SCALE, READ MAX G = 1.96, MIN G = 0.46.

DATA BASIS: DERIVED FROM FLIGHT TEST

LBA0191

Figure 5-14. Flight Envelope Chart

CHAPTER 6
WEIGHT/BALANCE AND LOADING

Section I. GENERAL

6.1 INTRODUCTION

This chapter provides information required for helicopter loading and computing weight and balance.

6.1.1 Extent Of Coverage. This chapter contains sufficient instructions and data so that an aviator, knowing the basic weight and moment of the helicopter, can compute any combination of weight and balance using the prescribed Army charts and forms.

6.1.2 Helicopter Class. Army AH-64D Apache helicopter is in Class 2. Additional directives governing weight and balance of Class 2 aircraft forms and records are contained in AR 95-1, DA PAM 738-751 and TM 55-1500-342-23.

6.1.3 Helicopter Bays and Stations. The helicopter has many bays; most of them contain electronic or other equipment. Figure 6-1 shows the general location of the major bays and equipment. The boundaries of all bays and a listing of the equipment in each bay are provided in the helicopter records Chart A - Basic Weight Checklist, DD form 365-1. The bays of primary concern to pilot, when loading, are the crew stations, left aft storage bay, survival kit bay and left and right flyaway kit bays. These bays may contain personal items or extra equipment not accounted for in the basic weight (para 6.2.1). Any additional items must be entered on the Weight and Balance Form F (DD365-4).

a. CPG Crew Station. The CPG station extends from fuselage station 35.5 to station 115.0. The CPG nominal centroid is at fuselage station 82.2, but the seat can be adjusted so the CPG centroid can vary from fuselage station 81.9 to 82.8. This produces a small moment variation and should be ignored.

b. Pilot Crew Station. The pilot station extends from fuselage station 115.0 to station 168.0. The pilot nominal centroid is at fuselage station 143.3, but the seat can be adjusted so the pilot centroid can vary from fuselage station 142.8 to 143.8. This produces a small moment variation and should be ignored.

NOTE

When loading these two bays, check for exceeding the aft CG limit.

c. Left Aft Equipment Storage Bay. The aft storage bay is on the left side from fuselage station 280.0 to station 310.0 and can be loaded to 15 pounds per square foot with a capacity of 60 pounds. The floor area is approximately 4.2 square feet and the volume is approximately 12.1 cubic feet. Floor tiedown fittings are in place to accommodate the flyaway kit.

d. Survival Equipment Stowage Bay. The survival equipment stowage bay is reached from either side. From fuselage station 310.0 to station 340.0, it can be loaded to 15 pounds per square foot with a capacity of 100 pounds. A single concentrated load of 45 pounds with a load density of 45 pounds per square foot may be carried. The floor area is approximately 7.8 square feet and the volume is approximately 21.4 cubic feet. Floor tiedown fittings are in place to accommodate the survival kit.

e. Flyaway Storage Bays. The Flyaway Storage Bays are located on the left and right sides of the aircraft from fuselage stations 155.0 to 189.0. The bays have a load capacity of 33.5 pounds per bay. The floor area is approximately 2 square feet with a volume of 3.5 cubic feet per bay. There are no tie down fittings in the bays. The bays are capable of removal from the aircraft.

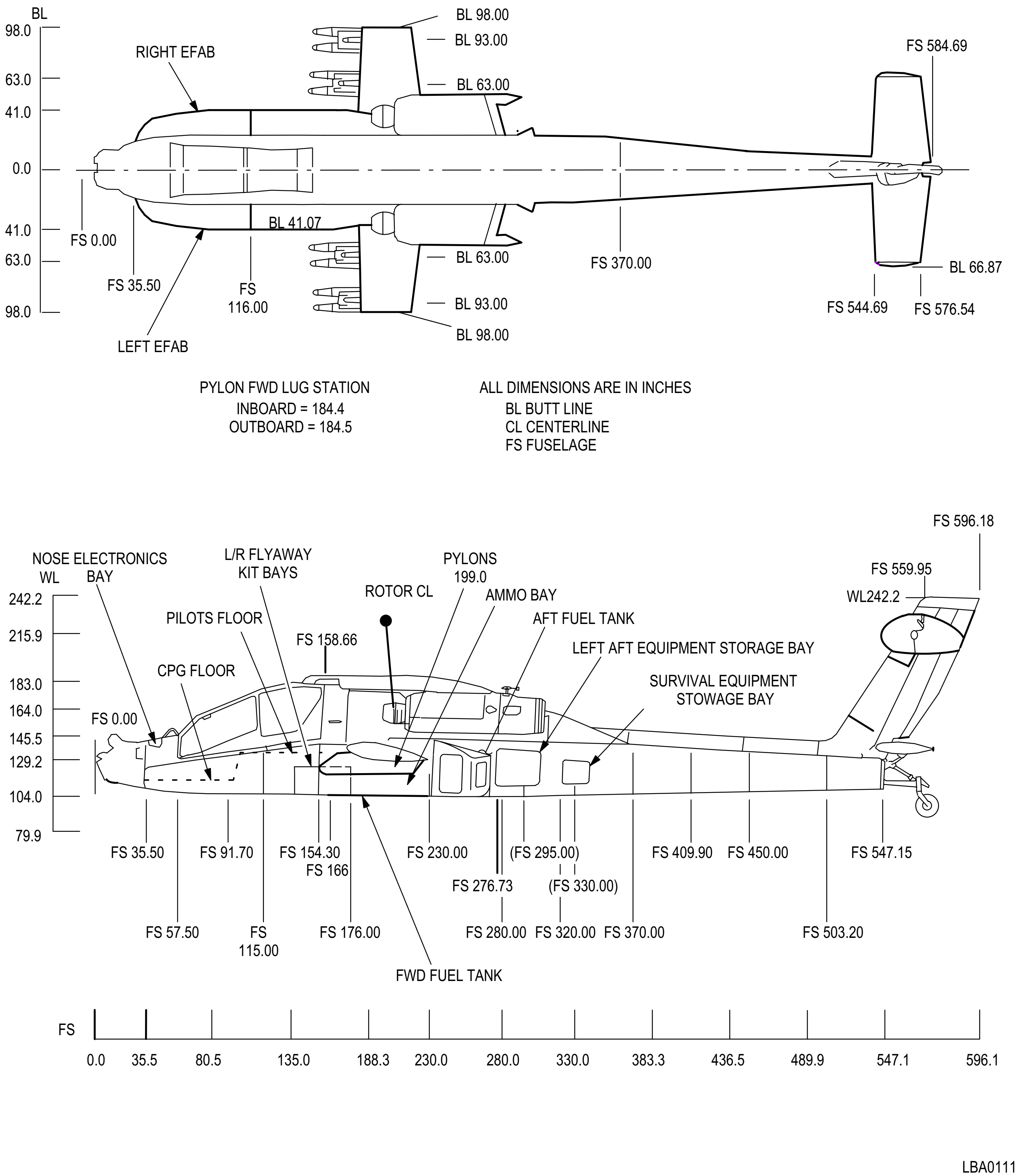


Figure 6-1. Station Diagram

Section II. WEIGHT AND BALANCE

6.2 WEIGHT AND BALANCE

This section contains information needed to compute the weight and balance for an individual helicopter by using the prescribed standard charts and forms.

6.2.1 Weight Definitions. The three major terms used when defining helicopter weight: basic weight, operating weight and gross weight are described in the following paragraphs.

NOTE

> The basic weight of the helicopter will vary with mission requirements and structural modifications such as addition or removal of Longbow kit, wing pylons, peculiar kits, 30mm gun, turret, ammo handling system, etc. A continuing record of an individual helicopter's basic weight is maintained on Chart C - Basic Weight and Balance Record, DD Form 365-3.

a. Basic Weight. The normal basic weight of this helicopter includes wing pylons, all fixed operating equipment, 30mm gun, all oil and trapped fuel. It is only necessary to add the variables or expendables to these items for the missions. Basic weight can be entered into the DTC via the AMPS and then loaded into the aircraft system via the DTU.

b. Operating Weight. The operating weight of the helicopter is the basic weight plus those variables which remain substantially constant for a particular mission. These items include crew, baggage, rocket launchers, Hellfire launchers, any emergency or extra equipment that may be required.

c. Gross Weight. The gross weight is the total weight of the helicopter and its contents.

6.2.2 Balance Definitions. The seven major terms used when defining helicopter balance: reference datum, arm, moment, average arm, basic moment, center of gravity (CG) and CG limits are described in the following paragraphs.

a. Reference Datum. The reference datum is an imaginary vertical plane from which all horizontal distances are measured (in inches) for balance purposes.

b. Arm. For balance purposes, the term Arm is the horizontal distance (in inches) from the reference datum to the center of gravity of a given item. For special cases, Arm can be determined from Figure 6-1. For the AH-64D Apache helicopter, Arm and Fuselage Station (FS) are the same.

NOTE

> Throughout this chapter, moment/100 figures have been rounded off to the nearest whole number. When moments from other sources are being used, they must be divided by 100 and rounded off.

c. Moment. Moment is the weight of an item multiplied by its Arm. For the AH-64D Apache helicopter, moment divided by 100 (moment/100) is used to simplify calculations by reducing the number of digits.

d. Average Arm. Average Arm is the Arm obtained by adding the weights and the moments of a number of items and dividing the total moment by the total weight.

e. Basic Moment. Basic moment is the sum of the moments of all items making up the basic weight with respect to the helicopter reference datum.

f. Center of Gravity (CG). CG is the point about which the helicopter would balance if suspended. Distance from the reference datum is found by dividing the total moment by the gross weight of the helicopter.

g. CG Limits. The CG limits are the extremes of movement to which the helicopter CG can travel without endangering controllability or structural integrity. The CG of the loaded helicopter must remain within these limits at takeoff, throughout flight and during landing. The forward and aft CG limits are displayed on the **PERF** page (para 7.2.8 701 or 7A.2.8 701C. The actual CG will be displayed under **CG** and a vertical bar will move between the limits in direct proportion to the actual **CG**.

6.2.3 Chart C - Basic Weight and Balance Record, DD Form 365-3. Chart C is a continuous history of the basic weight and moment resulting from structural and equipment changes in service. At all times, the last weight and moment/100 entries are considered the current weight and balance status of the basic helicopter.

6.2.4 Loading Data. The loading data in this chapter is intended to provide information necessary to work loading problems for the helicopter. From this data, weight and moment/100 are obtained for all variable load items and are added to the current basic weight and moment/100 from Chart C (DD Form 365-3) to determine the gross weight moment/100 using Form F (DD Form 365-4). The effect on helicopter CG of expending the fuel and armament in logical sequence may be checked by subtracting the weight and moment/100 of each item from the takeoff gross weight and moment/100; then, checking the new moment (or helicopter CG) with the CG limits chart. This check should be made to determine if the CG will remain within limits during the entire flight. Refer to paragraph 6.2.1 for helicopter CG management.

6.2.5 Weight and Balance Clearance Form F, DD Form 365-4. Form F is the summary of the actual disposition of the load in the helicopter. It records the balance status of the helicopter step-by-step. It serves as a work sheet on which to record weight and balance calculations and any corrections that must be made to ensure that the helicopter will be within weight and CG limits throughout the mission. There are two versions of this form: Transport and Tactical. Each was designed to provide for the respective loading arrangement of these two types of aircraft. The general use and fulfillment of either version is the same.

6.2.6 CG Management. This paragraph contains fuel management methods that can be used to maintain CG limits in flight and during the expending of external stores for some helicopter configurations. Table 6-1 lists CG shift as stores are expended. When the storage bays are used for miscellaneous equipment, it is possible to cause an aft CG condition.

a. Fuel Loading. The helicopter takeoff CG can be moved by loading either tank with more fuel than the other. Example: to move the CG forward, fill the forward tank (1012 pounds of JP-4) and reduce fuel load in the aft tank depending on CG shift required. For some missions, it may be necessary to reduce the stowed weight.

b. Table of Expendables. The table of expendables (table 6-1) provides a guide for quick definition of intermediate flight CG as stores/fuel are expended at various gross weights and at forward and aft CG limits. Table 6-1 eliminates calculation of intermediate CG when the helicopter is well within limits. When flight limits are doubtful or when operation is close to CG limits, a detailed calculation must be made to determine any CG limit violation.

c. Fuel Management. The following example presents normal CG/fuel management where each fuel tank supplies an engine. This procedure prevents drastic helicopter CG shifts as fuel is expended. Refer to Chapter 2 for fuel system details.

Table 6-1. Helicopter CG Movement When Load Items are Expended

Aircraft Gross Weight		When Aircraft CG Near Fwd CG Limit			When Aircraft CG Near Aft CG Limit		
Expended Items	Qty	14000	15000	17650	14000	15000	17650
Ammo	100	+0.32	+0.30	+0.27	+0.34	+0.31	+0.28
Ammo	200	+0.30	+0.28	+0.26	+0.33	+0.30	+0.28
Ammo	320	+0.29	+0.27	+0.25	+0.33	+0.30	+0.28
Rockets 27.1 lb	38		+0.90	+0.79		+1.01	+0.99
H-F Missiles (4 SAL, 4 RF)	8		+0.66	+0.58		+0.78	+0.75
Chaff	30	-0.21	-0.20	-0.16	-0.21	-0.20	-0.17
* Fuel	500 lb per tank		-1.80			+1.85	
Fuel	1000 lb per tank			**-1.60			+3.15

NOTE

- A plus (+) means aircraft CG moves aft and negative (-) means forward CG movement.
- *The above fuel values represent the total fuel on board such that the 500 lb (1000 lb or full) in each tank is the starting point and the expended fuel is 500 lb (1000 lb or full), leaving zero fuel in each tank.
- ** Limited to minimum 500 lbs when 1000 lbs fuel in forward tank in order not to exceed forward CG limit.
- ** Limited to minimum 500 lbs when 1000 lbs fuel in forward tank in order not to exceed forward CG limit.

EXAMPLE:

Using Table 6-1, refer to Expended Items column and look across the “Fuel 500 lb per tank” row. Note that fuel expended at the aircraft gross weight of 15,000 at forward CG limit, produces an aircraft CG shift of a negative 1.80 in. (or movement in the forward direction); and at aft CG limit, produces an aircraft CG shift of a positive 1.85 in. (or movement in the aft direction). When the helicopter CG is at the combined fuel CG (202.8 in.), expending fuel will produce a zero shift. This is true only when the forward fuel tank remains in the lower portion of the L-shape tank.

When filling the forward tank into the upper portion of the L-shape, the combined fuel expended CG moves aft to 212.4 in. which means that the helicopter will always shift forward during fuel burn-off in this area.

Refer to the 1000 lb fuel expended each tank line in Table 6-1. Note that fuel expended at 17,650 lbs gross weight at aft CG limit is +3.15 in. This is correct when total 2,000 lbs of fuel is expended, but this includes a helicopter CG shift forward during initial fuel burn-off due to the forward L-shaped tank.

Section III. FUEL AND OIL

6.3 OIL MOMENTS

Oil is shown in basic weight, Chart F (DD 365-4). Entries are not required.

6.4 FUEL WEIGHT AND MOMENT

When the actual or planned fuel loading (pounds or gallons) and type is known, the total fuel weight and moment/100 can be determined from the fuel moment Table 6-2. The data presents JP-4, JP-5, and JP-8 fuel quantity.

6.4.1 Fuel Moments. The forward fuel moment calculations are complicated by the L-shape of the tank. Consider the tank being filled from empty to 132.8 gal.; the fuel CG remains constant at 150.6 in. From 132.8 gal. to full (156 gal.), the CG of the total fuel moves aft linearly to 153.4 in. at capacity. The aft fuel CG is constant at 255 in.

WARNING

- **An increase in the risk of post-crash fire exists if a mishap occurs after tanks are pressurized. Crash worthiness of the fuel system is reduced by external fuel tanks, which are designed for FERRY MISSION ONLY. External fuel tank installation is prohibited for use in tactical missions.**
- **Extended Range Fuel System (ERFS) tanks do not have any ballistic protection and are vulnerable to high-speed projectiles. Projectiles passing through a fueled ERFS tank can generate a fuel driven fuselage fire and or cause the tank to detonate with the potential for losing both thw aircrew and aircraft.**

CAUTION

With external tanks installed, it will be necessary to carefully plan the wing store configurations including fuel transfer from external tanks, expending weapons, and possible jettison of wing stores, to ensure the lateral center-of-gravity remains within limits throughout the flight. When determining allowable wing stores, zero lateral C.G. should be assumed for aircraft operating weight (basic weight plus crew weight).

6.4.2 Wing Auxiliary Fuel and Tanks. The auxiliary fuel tanks are normally installed on the wing pylons in sets of 2 or 4 and are for extending the helicopter ferry range. Plumbing from the fuselage to the tank is provided with each tank. Each tank has a capacity of approximately 230 gal.. Table 6-3 lists the weight and moment/100 of each fuel tank, wing plumbing and fuel for JP-4, JP-5, and JP-8. Note that the data is given for one tank, wing plumbing and indicated fuel so that any combination can be determined. The table can be used for inboard and outboard locations because the small moment/100 differences can be ignored. Remember to add the tank and specific fuel together for one location, then multiply by 2 or 4 depending on the number of tanks carried. Add wing plumbing for 2 or 4 tanks as appropriate.

Table 6-2. Main Tanks - Fuel Loading (sheet 1 of 3)

JP-4 Density = 6.5 lb/gal (See sheet 1)

JP-5 Density = 6.8 lb/gal (See sheet 2)

JP-8 Density = 6.7 lb/gal (See sheet 3)

Fuel: JP-4

Forward Tank

Weight (lb)	Moment 100	U.S. Gallons JP-4
50	75	7.7
100	151	15.4
150	226	23.1
200	301	30.8
250	377	38.5
300	452	46.2
350	527	53.8
400	602	61.5
450	678	69.2
500	753	76.9
550	828	84.6
600	904	92.3
650	979	100.0
700	1054	107.7
750	1130	115.4
800	1205	123.1
850	1281	130.8
900	1365	138.5
950	1450	146.2
1000	1535	153.8
1012	1555	155.7

Aft Tank

Weight (lb)	Moment 100	U.S. Gallons JP-4
50	127	7.7
100	255	15.4
150	382	23.1
200	510	30.8
250	637	38.5
300	765	46.2
350	892	53.8
400	1020	61.5
450	1147	69.2
500	1275	76.9
550	1402	84.6
600	1530	92.3
650	1657	100.0
700	1785	107.7
750	1912	115.4
800	2040	123.1
850	2167	130.8
900	2295	138.5
950	2422	146.2
1000	2550	153.9
1050	2677	161.5
1100	2805	169.2
1150	2932	176.9
1200	3060	184.6
1250	3187	192.3
1300	3315	200.0
1350	3442	207.7
1400	3570	215.4
1430	3646	220.0

Table 6-2. Main Tanks - Fuel Loading (sheet 2 of 3)

Fuel: JP-5

Forward Tank

Weight (lb)	Moment / 100	U.S. Gallons JP-5
50	75	7.4
100	151	14.7
150	226	22.1
200	301	29.4
250	377	36.8
300	452	44.1
350	527	51.5
400	602	58.8
450	678	66.2
500	753	73.5
550	828	80.9
600	904	88.2
650	979	95.6
700	1054	102.9
750	1130	110.3
800	1205	117.6
850	1280	125.0
900	1358	132.4
950	1443	139.7
1000	1528	147.1
1058	1623	155.7

Aft Tank

Weight (lb)	Moment / 100	U.S. Gallons JP-5
50	127	7.4
100	255	14.7
150	382	22.1
200	510	29.4
250	637	36.8
300	765	44.1
350	892	51.5
400	1020	58.8
450	1147	66.2
500	1275	73.5
550	1402	80.9
600	1530	88.2
650	1657	95.6
700	1785	102.9
750	1912	110.3
800	2040	117.6
850	2167	125.0
900	2295	132.4
950	2422	139.7
1000	2550	147.1
1050	2677	154.4
1100	2805	161.8
1150	2932	169.1
1200	3060	176.5
1250	3187	183.8
1300	3315	191.2
1350	3442	198.5
1400	3570	205.9
1450	3697	213.2
1496	3815	220.0

Table 6-2. Main Tanks - Fuel Loading (sheet 3 of 3)

Fuel: JP-8

Forward Tank

Weight (lb)	Moment / 100	U.S. Gallons JP-8
50	75	7.5
100	151	14.9
150	226	22.4
200	301	29.9
250	377	37.3
300	452	44.8
350	527	52.2
400	602	59.7
450	678	67.2
500	753	74.6
550	828	82.1
600	904	89.6
650	979	97.0
700	1054	104.5
750	1130	111.9
800	1205	119.4
850	1280	126.9
900	1360	134.3
950	1455	141.8
1000	1530	149.3
1043	1603	155.7

Aft Tank

Weight (lb)	Moment / 100	U.S. Gallons JP-8
50	127	7.4
100	255	14.9
150	382	22.4
200	510	29.9
250	637	37.3
300	765	44.8
350	892	52.2
400	1020	59.7
450	1147	67.2
500	1275	74.6
550	1402	82.1
600	1530	89.6
650	1657	97.0
700	1785	104.5
750	1912	111.9
800	2040	119.4
850	2167	126.9
900	2295	134.3
950	2422	141.8
1000	2550	149.3
1050	2677	156.7
1100	2805	164.2
1150	2932	171.6
1200	3060	179.1
1250	3187	186.6
1300	3315	194.0
1350	3442	201.5
1400	3570	209.0
1450	3697	216.4
1474	3758	220.0

Table 6-3. Wing Auxiliary Tanks and Fuel

JP-4 Density = 6.5 lb/gal

JP-5 Density = 6.8 lb/gal

JP-8 Density = 6.7 lb/gal

Auxiliary Fuel Tanks

Item	Weight Each (lb)	Moment / 100
Auxiliary Fuel Tanks (each)	140.0	268
Wing Tank Plumbing		
2 Tanks	16.0	35
4 Tanks	20.0	43

Fuel : JP-4 (6.5 lb/gal)

Condition*	Weight (lb)	Moment (in-lb/100)	U.S. Gallons
Tank Full	1495.0	2906	230.0
Tank 3/4 Full	1121.3	2180	172.5
Tank 1/2 Full	747.5	1453	115.0
Tanks 1/4 Full	373.8	727	57.5

* Tank at 0° (level) attitude

Fuel : JP-5 (6.8 lb/gal)

Condition*	Weight (lb)	Moment (in-lb/100)	U.S. Gallons
Tank Full	1564.0	3040	230.0
Tank 3/4 Full	1173.0	2280	172.5
Tank 1/2 Full	782.0	1520	115.0
Tanks 1/4 Full	391.0	760	57.5

* Tank at 0° (level) attitude

Fuel : JP-8 (6.7 lb/gal)

Condition*	Weight (lb)	Moment (in-lb/100)	U.S. Gallons
Tank Full	1541.0	2996	230.0
Tank 3/4 Full	1155.8	2247	172.5
Tank 1/2 Full	770.5	1498	115.0
Tanks 1/4 Full	385.3	749	57.5

* Tank at 0° (level) attitude

NOTE

- Weight and moment are shown for one tank with fuel; and must be doubled for 2 inboard or multiplied by 4 when inboard and outboard stations are used.
- Add wing tank plumbing for 2 tanks or 4 tanks as appropriate.

Table 6-3A. Internal Auxiliary Fuel System Tank and Fuel

JP-4 Density = 6.5 lb/gal

JP-5 Density = 6.8 lb/gal

JP-8 Density = 6.7 lb/gal

Auxiliary Fuel Tank

Item	Weight Each (lb)	Moment / 100
Auxiliary Fuel Tank	220.8	454

Fuel : JP-4 (6.5 lb/gal)

Condition*	Weight (lb)	Moment (in-lb/100)	U.S. Gallons
Tank Full	845.0	1741	130.0
Tank 3/4 Full	633.8	1304	97.5
Tank 1/2 Full	422.5	870	65.0
Tank 1/4 Full	211.3	435	32.5

* Tank at 0° (level) attitude

Fuel : JP-5 (6.8 lb/gal)

Condition*	Weight (lb)	Moment (in-lb/100)	U.S. Gallons
Tank Full	884.0	1821	130.0
Tank 3/4 Full	663.0	1366	97.5
Tank 1/2 Full	442.0	911	65.0
Tank 1/4 Full	221.0	455	32.5

* Tank at 0° (level) attitude

Fuel : JP-8 (6.7 lb/gal)

Condition*	Weight (lb)	Moment (in-lb/100)	U.S. Gallons
Tank Full	871.0	1795	130.0
Tank 3/4 Full	653.3	1346	97.5
Tank 1/2 Full	435.5	897	65.0
Tank 1/4 Full	217.8	449	32.5

* Tank at 0° (level) attitude

Table 6-3B. Internal Auxiliary Fuel and Ammo System Installation, Fuel, and Ammo

Combo Pack Assembly Installation

Item	Weight (lb)	Moment / 100
Combo Pack Assembly, Fuel Hoses (2), and Nitrogen Hose	320.6	651

Fuel: JP-4 (6.5 lb/gal)

Tank at Level Attitude	Weight (lb)	Moment (in-lb/100)	U.S. Gallons
Tank Full	643.5	1349	99.0
Tank 3/4 Full	482.6	999	74.3
Tank 1/2 Full	321.8	666	49.5
Tank 1/4 Full	160.9	333	24.8

Fuel: JP-5 (6.8 lb/gal)

Tank at Level Attitude	Weight (lb)	Moment (in-lb/100)	U.S. Gallons
Tank Full	673.2	1411	99.0
Tank 3/4 Full	504.9	1045	74.3
Tank 1/2 Full	336.6	697	49.5
Tank 1/4 Full	168.3	348	24.8

Fuel: JP-8 (6.7 lb/gal)

Tank at Level Attitude	Weight (lb)	Moment (in-lb/100)	U.S. Gallons
Tank Full	663.3	1390	99.0
Tank 3/4 Full	497.5	1030	74.3
Tank 1/2 Full	331.7	687	49.5
Tank 1/4 Full	165.8	343	24.8

Ammo (Aluminum)

Combo Ammo Container and Flex Chute	Rounds	Weight (lb)	Moment (in-lb/100)
Ammo	100	77.0	109
Ammo	200	154.0	254
Ammo	300	231.0	400

Section IV. PERSONNEL

6.5 GENERAL

Personnel provisions consist of the pilot and CPG located in the cockpit.

6.6 PERSONNEL WEIGHT

When aircraft are operated at critical gross weights, the exact weight of each individual occupant plus equipment should be used. If weighting facilities are not available, or if the tactical situation dictates, a crewmember with no equipment, compute weight according to each individuals estimate.

6.6.1 Personnel Moments. Correct weight of each crew member, including all equipment and any personal items stored in the crew station, should be used. If weighing facilities are not available, then use the best estimate available. Table 6-4 presents the crew CG with the seat in its nominal location.

Table 6-4. Crew Weight

Crew Member	Copilot Station		Pilot Station	
Weight Including Equipment (lb)	Nominal Arm (in.)	Moment (in.-lb/100)	Nominal Arm (in.)	Moment (in.-lb/100)
100	82.2	82	143.3	143
110	82.2	90	143.3	158
120	82.2	99	143.3	172
130	82.2	107	143.3	186
140	82.2	115	143.3	201
150	82.2	123	143.3	215
160	82.2	132	143.3	229
170	82.2	140	143.3	244
180	82.2	148	143.3	258
190	82.2	156	143.3	272
200	82.2	164	143.3	287
210	82.2	173	143.3	301
220	82.2	181	143.3	315
230	82.2	189	143.3	330
240	82.2	197	143.3	344
250	82.2	206	143.3	358

Section V. MISSION EQUIPMENT

6.7 MISSION EQUIPMENT

Aircraft mission equipment includes pylons, Hellfire missiles and launchers, 2.75-in. rockets and launchers, 30mm ammunition and chaff cartridges. External fuel tanks are delineated in paragraph 6.4.2. All electronic mission equipment is part of basic weight and may be found in Chart A (Form DD 365-1).

6.7.1 Pylons. The wing pylons should be included on Chart A (Form DD 365-1) as part of the basic weight. Check Charts A and C (Form DD 365-3) to ensure this has been done. If pylons are installed and they are not listed on Chart A, they should be listed on Chart C and A and included in the basic weight from this date on.

6.7.2 Missile Launchers. Figure 6-2 presents the M-299 Longbow Hellfire launchers in pairs, weight and moment/100. Double the weight and moment/100 when 4 launchers are used.

6.7.3 Longbow Hellfire Semi-Active Laser (SAL) Missiles. The present SAL dummy missile (M34), tactical laser seeker training missile (M36) and tactical missile (AGM 114) weigh the same. Table 6-5 lists the SAL weight and moment/100 of each SAL missile accumulated to a capacity of four missiles per launcher. When a pair of inboard launchers are filled to capacity, double the (missile no. 4) weight and moment/100. When 4 launchers are used, multiply the numbers by 4.

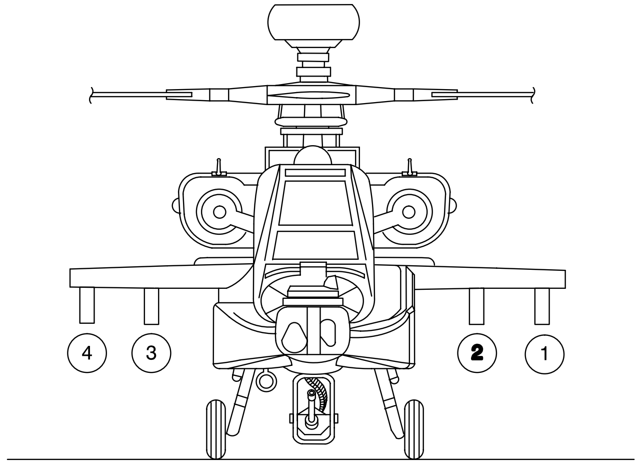
6.7.4 Longbow Hellfire Radar Frequency (RF) Missiles. The present RF dummy missile, tactical RF training missile and tactical RF missile weigh the same. Table 6-6 lists the RF weight and moment/100 of each RF missile accumulated to a capacity of 4 missiles per launcher. When a pair of inboard launchers are filled to capacity, double the (missile no. 4) weight and moment/100. When 4 launchers are used, multiply the numbers by 4.

6.7.5 Rocket Launchers. Figure 6-2 presents the M261 2.75-in. rocket launchers in pairs, weight and moment/100. Double the weight and moment/100 when 4 launchers are used.

6.7.6 Rockets (2.75-in.). Table 6-7 lists all authorized 2.75-in. rockets weight and moment/100. Select the correct type of rocket and multiply the weight and moment/100 times total rockets loaded for each type. The table is presented so that any combination or mix can be easily determined for a launcher.

6.7.7 Ammunition. Table 6-8 presents the M788 or M789 30mm linkless aluminum case ammunition accumulated weight and moment/100 to a capacity of 1200 rounds. Approximately 99 rounds are in the right chute and the remainder is in the magazine. A note on the table allows conversion of the table numbers to ADEN or DEFA ammunition.

6.7.8 Chaff Dispenser/Laser Warning Sensors. The helicopter survivability equipment is a kit. It is added to the helicopter as dictated by mission requirements. The electronic equipment, controls and supports are part of the basic weight and are listed in Chart A (Form DD 365-1). Tables 6-9 and 6-10 list the chaff dispenser empty and full with 30 chaff (M1) cartridges and the forward and aft laser warning sensors. These values are to be used on Form F (DD 365-4) when chaff is on board.



ITEM	STATIONS	WEIGHT OF PAIR (LBS)	MOMENT (IN.LB/100)
M299 LONGBOW HELLFIRE LAUNCHERS	2 & 3 OR 1 & 4	286.0	542.46
M261 ROCKET LAUNCHERS	2 & 3 OR 1 & 4	173.6	340.12
AUXILIARY FUEL TANKS	2 & 3	280.0	539
AUXILIARY FUEL TANKS	1, 2, 3, 4	560.0	1078

Figure 6-2. External Stores and Stations

Table 6-5. Longbow HELLFIRE SAL C/K Missile Loading

Dummy Missile	1	99.0	188.82
Training Missile	1	99.0	188.82
Missile	1	99.0	188.82
Missile	2	198.0	377.64
Missile	3	297.0	566.46
Missile	4	396.0	755.28

Table 6-6. Longbow HELLFIRE RF Missile Loading

Item	Qty	Inboard Station 2, 3 or Outboard Station 1, 4	
		Accum Weight (lb)	Moment (in.-lb/100)
Missile	1	106.0	201.5
Missile	2	212.0	403.0
Missile	3	318.0	604.5
Missile	4	424.0	806.0

Table 6-7. 2.75-Inch Rocket Loading

NOTE

When computing weight and balance, crewmember must remember to multiply each rocket type weight (lb) and moment (in.-lb/100) by the quantity of that rocket type loaded onboard the aircraft. Failure to do so will result in incorrect CG calculations. The SP calculates total rocket weight based upon rocket type (i.e: 6PD, 6RC) rather than warhead types (M151, M229 or M274). The weight calculation is based on LMP settings, unless the load settings are altered in either crew station.

Rocket Type	Rocket Nomenclature	Inboard Station 2, 3 or Outboard Station 1, 4	
		Weight (lb) per rocket	Moment (in.-lb/100) per rocket
Dummy	Dummy MK66 Rocket	23.0	44.80
6PD	MK66 Rocket Motor with Point Detonation, High Explosive Warhead	23.0	44.80
6RC	MK66 Rocket Motor with Penetration, High Explosive Warhead	24.0	46.44
6IL	MK66 Rocket Motor with Time, Illumination Warhead	24.3	46.18
6SK	MK66 Rocket Motor with Time, Smoke Warhead	22.5	43.42
6MP	MK66 Rocket Motor with Time, Multi-purpose Submunition Warhead	27.4	51.96
6FL	MK66 Rocket Motor with Flechette Warhea	27.5	52.05
PD7	CRV7 Rocket Motor with Point Detonation, High Explosive Warhead	22.1	42.69
RA7	CRV7 Rocket Motor with Armor Piercing, Point Detonation, High Explosive Warhead	25.8	49.26
IL7	CRV7 Rocket Motor with Time, Illumination Warhead	23.5	44.08
SK7	CRV7 Rocket Motor with Time, Smoke Warhead	21.6	41.44
MP7	CRV7 Rocket Motor with Time, Multi-purpose SubmunitionWarhead	26.6	49.86
FL7	CRV7 Rocket Motor with Flechette Warhead	20.0	38.68

Table 6-8. Ammunition Loading for M788 or M789 30mm Rounds (Aluminum Cartridges)

NOTE

When ADEN (brass cartridges) are used, multiply weight and moment by 1.354. When DEFA (steel cartridges) are used, multiply weight and moment by 1.343.

Number of Rounds	Weight (lb)	Moment (in.-lb/100)	Number of Rounds	Weight (lb)	Moment (in.-lb/100)
50	38.5	42	650	500.5	988
100	77.0	110	700	539.0	1063
150	115.5	189	750	577.5	1146
200	154.0	269	800	616.0	1221
250	192.5	346	850	654.5	1304
300	231.0	427	900	693.0	1379
350	269.5	504	950	731.5	1462
400	308.0	585	1000	770.0	1537
450	346.5	662	1050	808.5	1620
500	385.0	744	1100	847.0	1696
550	423.5	819	1150	885.5	1778
600	462.0	905	1200	924.0	1868

Table 6-9. Chaff Dispenser and Cartridges/Laser Warning Sensors ASE Equipment

Item	Weight (lb)	Moment (in.-lb/100)
IR Jammer	28.0	63.2
Radar Jammer	44.0	45.6
Radar Warning Receiver	14.3	44.6
Laser Warning Receiver with forward and aft sensors	19.2	58.3
Forward Laser Warning Sensors (2 ea)	9.0	19
AFT Laser Warning Sensors (2 ea)	9.0	34
Chaff Dispenser M141 (Empty)	9.0	44.8

Table 6-10. Chaff Dispenser Cartridges

Number of Rounds	Weight (lb)	Moment (in.-lb/100)
30 Chaff Cartridges	10.0	49

Section VI. CARGO LOADING

6.8 CARGO LOADING

CAUTION

To prevent damage to helicopter, all cargo must be securely tied down.

There are four stowage bays on the helicopter; left-aft storage bay, survival equipment stowage bay, left flyaway kit bay and right flyaway kit bay. The left aft storage bay contains the flyaway equipment kit which consists of:

- Tiedown and mooring kit
- Main rotor tiedown assembly
- Main rotor blade tiedown pole assembly
- Safety pins and stowage pouch
- Protective covers kit

The survival equipment stowage bay, left flyaway kit bay and right flyaway kit bay, may carry a survival equipment kit and/or personal equipment. The flyaway equipment kit and survival equipment kit are basic weight items and are listed on Chart A (DD 365-1). Personal items or extra equipment that has not been identified as basic weight must be entered on Form F.

6.8.1 Extra Cargo. All extra cargo should be weighed so that exact weight and moments are used for the weight and balance computations. If weighing facilities are not available, weight should be estimated in terms of probable maximum weight to reduce the possibility of exceeding the aft CG limit. Tables 6-11 and 6-12 provide quick reference lists of accumulative weight and moment of extra cargo in the stowage bays.

NOTE

All calculated moments must be divided by 100 before being entered on Form F.

Table 6-11. Storage Bay and Survival Equipment Stowage Bay

Left Aft Equipment Storage Bay		Survival Equipment Stowage Bay	
Accum. Wt. (lb)	Moment (in.-lb/100)	Accum. Wt. (lb)	Moment (in.-lb/100)
5	15	5	17
15	44	15	50
30	89	30	101
45	133	45	151
50	148	50	168
60*	177	65	218
		80	268
		90	302
		95	318
		100*	335
*Max. Load 60lb. @15 lb/ft^2		*Max. Load 100lb. @15 lb/ft^2	

Table 6-12. Flyaway Kit Bays

Left Flyaway Kit Bay		Right Flyaway Kit Bay	
Accum. Wt. (lb)	Moment (in.-lb/100)	Accum. Wt. (lb)	Moment (in.-lb/100)
5	9	5	8
10	17	10	17
15	26	15	25
20	34	20	33
25	43	25	41
30	52	30	50
33.5*	58	33.5*	55
*Max. Load 33.5lb. @15 lb/ft2		*Max. Load 33.5lb.@15 lb/ft2	
Moment is based on FS 172		Moment is based on FS 173	

Section VII. ALLOWABLE LOADING

6.9 ALLOWABLE LOADING

This section contains information needed to determine whether the helicopter loading (gross weight and moment combination) will fall within the helicopter center of gravity limits.

6.9.1 Center of Gravity Parameters. The normal forward CG limit is at fuselage station 201.0 inches to 23,000 pounds. The normal aft CG limit is at fuselage station 207.0 inches to 14,660 pounds and a straight taper from 207.0 to 202.2 inches from 14,660 to 23,000 pounds.

6.9.2 Center of Gravity Limits Chart. The normal center of gravity limits chart is shown in Figure 6-3. All flight CGs must remain within these limits. This chart is used in conjunction with Chart F (DD 365-4) as follows:

1. Load the helicopter to takeoff condition and determine takeoff CG (Form F).
2. Check CG limits using the chart (fig 6-3). If CG limits are exceeded, then the loading must be revised. Refer to paragraph 6.2.1, subparagraph f (center of gravity management) for guidance.
3. After the takeoff CG limits are satisfied, determine estimated landing weight and CG (Form F).
4. Check CG limits using the chart (fig 6-3). If CG limits are exceeded, then the loading must be revised. Refer to paragraph 6.2.1, subparagraph f (center of gravity management) for guidance.
5. When either takeoff or landing CG is close to the CG limits, further analysis is required to determine if intermediate flight conditions will exceed limits. Refer to paragraph 6.2.1, subparagraph f (center of gravity management) for guidance.

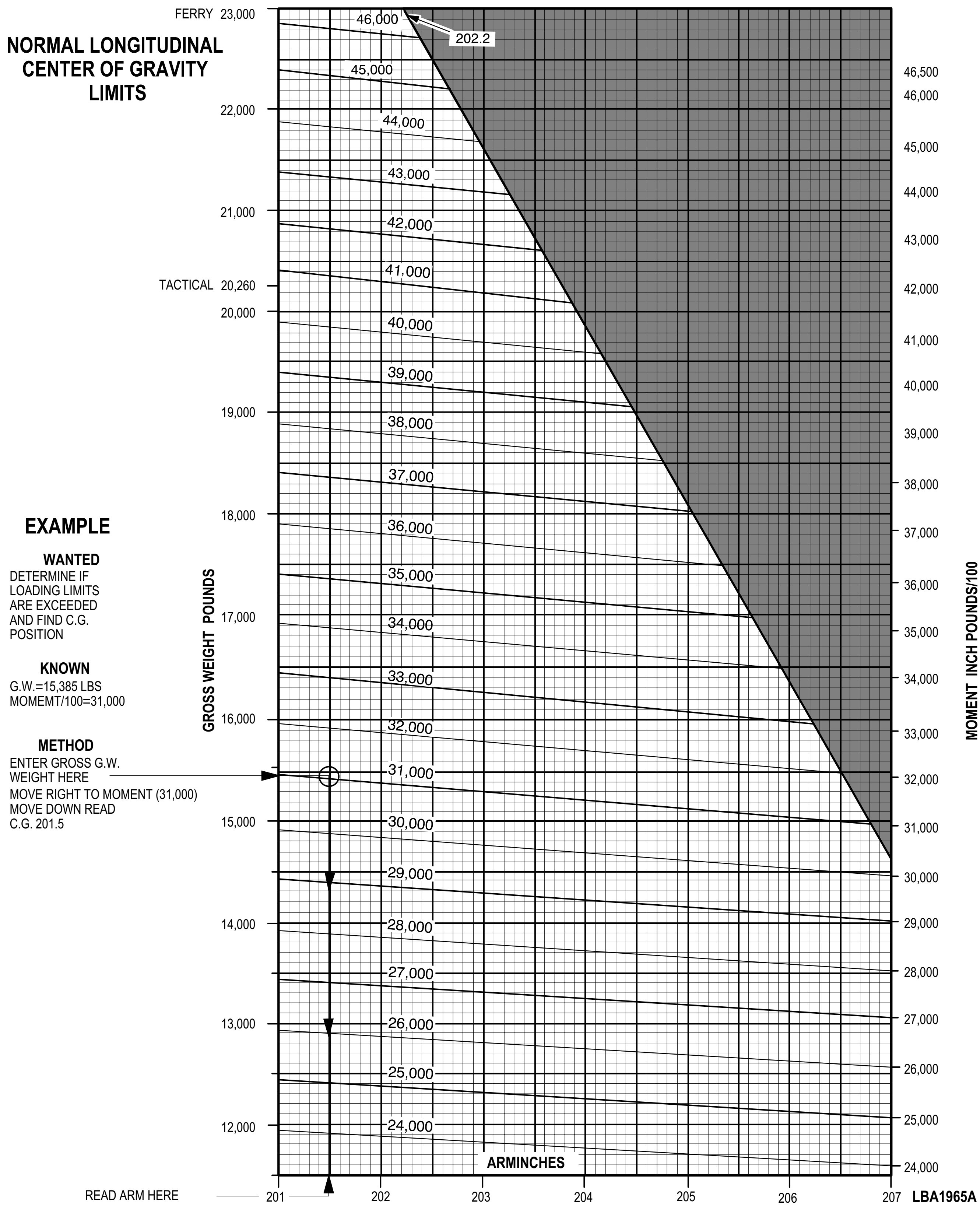


Figure 6-3. Center of Gravity Limits

CHAPTER 7A
PERFORMANCE DATA FOR AH-64D HELICOPTERS EQUIPPED WITH T700-GE-701C ENGINES

Section I. INTRODUCTION

NOTE

This chapter contains performance data for helicopters equipped with T-700-GE-701C 701C engines. Performance data for helicopters equipped with T-700-GE-701 701 engines is contained in Chapter 7.

7A.1 PERFORMANCE DATA

The purpose of this chapter is to provide the best available performance data for the AH-64D helicopter equipped with 701C 701C engines. Regular use of this information will allow maximum safe use of the helicopter. Although maximum performance is not always required, regular use of the information in this chapter is recommended for the following reasons:

- Knowledge of performance margins will allow better decisions when unexpected conditions or alternate missions are encountered.
- Situations requiring maximum performance will be readily recognized. Familiarity with the data will allow performance to be computed easily and quickly.
- Experience will be gained in accurately estimating the effects of conditions for which data is not presented.

NOTE

The information is primarily intended for mission planning and is most useful when planning operations in unfamiliar areas or at extreme conditions. The data may also be used in flight, to establish unit or area standing operating procedures, and to inform ground commanders of performance/risk trade-offs.

Performance data can be obtained by using the PERFORMANCE (**PERF**) page or the performance charts contained in this chapter.

WARNING

Do not rely on parameters displayed on the PERF page for flight critical performance information until validated by hover power check.

7A.2 PERF PAGE

The **PERF** page (fig 7A-1]) displays both dynamic and projected performance parameters and operating limitations. Parameters include engine performance, fuel consumption data, and weight and balance information. The **PERF** page displays all the controls and information required to operate the functions of the performance system. The **PERF** page is accessed by selecting the **PERF** button depicted at the top of the **ENG**, **FLT**, **FUEL**, and **UTIL** pages or directly from the **MENU** page. Buttons display the status of Pressure Altitude (**PA**), Free Air Temperature (**FAT**), and Gross Weight (**GWT**). The page information will display data based on these conditions and the **PERFORMANCE (PERF) MODE** selection. Selection of any other page will freeze the latest entries to the **PERF** page display. Uncompleted entries will be cleared (cancelled). Selection of the **PERF** label at any time during uncompleted entries will clear (cancel) any uncompleted entries and return the format to the **MENU** page. All data entries will be made through the keyboard inputs or loaded from the DTU.

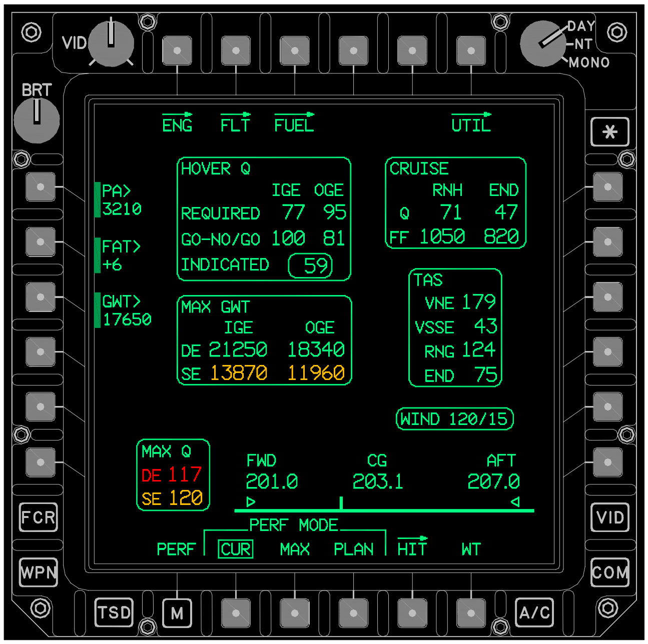


Figure 7A-1. MPD PERF Page (MPD)

The following selections are available on the **PERF** page depending upon **PERF MODE** selection:

- T1 **ENG** button
- T2 **FLT** button
- T3 **FUEL** button
- T6 **UTIL** button
- L1 **PA** button
- L2 **FAT** button
- L3 **GWT** button
- B1 **MENU** button
- B2 PERF MODE **CUR** button
- B3 PERF MODE **MAX** button
- B4 PERF MODE **PLAN** button
- B5 **HIT** button

7A.2.1 PERF MODE. The **PERF MODE** controls the system calculations being accomplished and consists of three modes of operation, Current **(CUR)**, Maximum **(MAX)**, and **PLAN**. Each mode has page buttons, data fields, and control buttons, some of which are not displayed under certain conditions.

a. CUR Button. The **CUR** perf mode selection displays current conditions. Performance data displayed in the **CUR** perf mode reflect the anti-ice on or off condition based on the current state of the anti-ice system. Buttons that are not selectable in the **CUR** perf mode are:

- L1 **PA** button
- L2 **FAT** button
- L3 **GWT** button

b. MAX Button. The **MAX** perf mode selection displays projected performance indications in digital representations according to the input of forecast data by the aircrew through the DTU or Keyboard Unit (KU). Required entries include: forecast **PA**, forecast **FAT**, and forecast **GWT**.

c. PLAN Button. The **PLAN** perf mode selection will provide the same information as **MAX** perf mode. The **PLAN** information is loaded from either the DTU or the KU. The DTU is loaded through the AMPS. If the system for automatic input fails, manual input can be accomplished through the **PLAN** perf mode.

7A.2.2 Hover Torque (HOVER Q) Status Window. The current hover torque **REQUIRED** in percent per engine is indicated for both In Ground Effect (**IGE**) and Out of Ground Effect (**OGE**) conditions based on the current conditions of **PA**, **FAT**, and **GWT**. The current indicated engine torque is displayed in a status window below these digital readouts for real-time comparison. Indicated torque will be the greater of the two engines. The indicated torque is displayed in color according to operating ranges as described for the **ENG** page. Go-No/Go torque is calculated on the maximum allowable dual engine gross weight (para 7A.2.4) and it is based on the 5 ft line.

7A.2.3 CRUISE Status Window. The following items are calculated based on the data of **PA**, **FAT**, and **GWT**.

a. Torque (Q) Status. The estimated torque is displayed as indicated percentage torque per engine for both the maximum range (**RNG**) and maximum endurance (**END**) based on the current conditions of **PA**, **FAT**, and **GWT**. Range for torque estimate will be from 20 to 100%, in 1% increments.

b. Fuel Flow (FF) Status. The estimated fuel flow will be displayed in total pounds per hour for both engines. It will be displayed for both maximum range (**RNG**) and maximum endurance (**END**) based on the current conditions of **PA**, **FAT**, and **GWT**. Range will be from 400 to 1,400 lb/hr in 10 lb increments.

7A.2.4 Maximum Gross Weight (MAX GWT) Status Window. The maximum allowable gross weight for the conditions of **PA**, **FAT**, and torque available will be given in pounds. The maximum gross weight readout is displayed in YELLOW when exceeded by the current aircraft gross weight (**GWT**). Gross weight range will be 11,000 to 23,000 lbs in 10 lb increments. Weights will be for Dual Engine (**DE**), Single Engine (**SE**), for both **IGE** hover or **OGE** hover.

7A.2.5 True Airspeed (TAS) Status Window. The current **TAS** parameters and limitations will be indicated in knots based on the current conditions of **PA**, **FAT**, and **GWT**. Parameters will include TAS velocity not to exceed (**VNE**), minimum TAS to maintain safe single engine (**VSSE**) flight, TAS at which the aircraft should cruise in order to attain maximum **RNG**, and TAS at which the aircraft should cruise in order to attain the maximum fuel **END** or rate of climb. TAS range is from 0 through 250 kts in 1 kt increments. See Airspeed Limits (Chapter 5, Section V) for specific values

7A.2.6 Maximum Torque (MAX Q) Status Window. The current engine **MAX Q** available (30 minute limit) in percent per engine for **DE** and **SE** operation is indicated based on the current conditions of **PA**, **FAT**, and **GWT**. **MAX Q** available range is from 0 to 130% in 1% increments. The current engine **MAX Q** available in percent per engine for **DE** and **SE** operation is indicated based on the current conditions of **PA**, **FAT**, and **GWT**. Digital readouts indicate the actual maximum torque available derived from dual engine 10 minute limit and single engine 2.5 minute limit chart data. Readouts are displayed in color according to dual and single engine torque limits:

DE
0-100 GREEN
101-115 YELLOW
>115 RED
SE
0-110 GREEN
111-125 YELLOW
>125 RED

MAX Q available range is from 0 to 130% in 1% increments.

7A.2.7 WIND Status Window. The **WIND** condition will be displayed in the **CUR** perf mode to indicate direction (heading in degrees) from which the wind is coming and the speed in kts when wind speed is greater than 5 knots, otherwise, the label “CALM” is displayed. When N_R is less than 50% and wind speed is greater than 45 knots, wind speed is displayed in YELLOW.

- Range for direction: 1 to 360° in 1° increments.
- Range for wind speed: 0 to 99 knots in 1 knot increments.

NOTE

Forward CG will not be displayed forward of 201.0

7A.2.8 Center of Gravity (CG) Status. The forward and aft CG limits are displayed along the horizontal bar in the **CUR** perf mode. The actual CG will be displayed under **CG** and a vertical bar will move horizontally along the line in direct proportion to the actual **CG**. The horizontal bar can be displayed off the page such that it cannot be seen. This happens at a CG of 207.8

7A.2.9 Weight (WT) Button. The **WT** button is used to call up the weight data entry buttons. This button is displayed only in the **CUR** mode (Figure 7A-2).

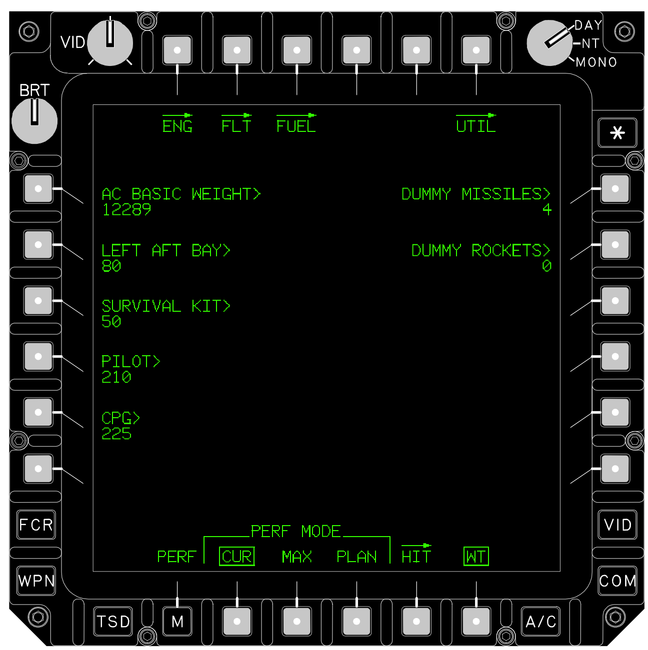


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Figure 7A-2. PERF Page with WT Selected

- L1 **AC BASIC WT/MOMENT** button
- L2 **LEFT AFT BAY** button
- L3 **SURVIVAL KIT** button
- L4 **PILOT** button
- L5 **CPG** button
- R1 **DUMMY MISSILES** button
- R2 **DUMMY ROCKETS** button

a. AC BASIC WT/MOMENT Button. The **AC BASIC WEIGHT** data entry button is used for manual entry of basic weight/moment when data from the DTC and/or default basic weight/moment is not accurate. This button is displayed only when the **WT** button is selected. The bottom mode of this button indicates the aircraft basic weight or moment currently being used by the system for performance calculations. These values are stored in memory and will be updated only when weight data is uploaded from the DTC. A default value is only used during the first initialization of the SP or when the weight data in memory is corrupted. The button is displayed in WHITE when the default value is being used. The default value for aircraft with a -701 engine without a FCR is 12,275 lbs; the default value for aircraft with a -701C engine with a FCR is 12,836 lbs. Upon completion of the basic weight entry, the button will reconfigure to the **MOMENT** data entry. Once both the **AC BASIC WEIGHT** and **MOMENT** data entries are complete, the data will be sent to the SP and the button will reconfigure to the **AC BASIC WEIGHT** data entry.

b. LEFT AFT BAY Button. The **LEFT AFT BAY** button is used for manual entry of weight in the left aft bay when data from the DTC and/or default left aft bay weight is not accurate. This button is displayed only when the **WT** button is selected. The bottom mode of this button will indicate the left aft bay weight currently being used by the system for performance calculations. It is displayed in WHITE when it is the powerup default value (0 lbs).

c. SURVIVAL KIT Button. The **SURVIVAL KIT** button is used for manual entry of weight in the survival kit bay when data from the DTC and/or default survival kit bay weight is not accurate. This button is displayed only when the **WT** button is selected. The bottom mode of this button will indicate the survival kit bay weight currently being used by the system for performance calculations. It is displayed in WHITE when it is the powerup default value (0 lbs).

d. PILOT Button. The **PILOT** button is used for manual entry of weight for the pilot when data from the DTC and/or default pilot weight is not accurate. This button is displayed only when the **WT** button is selected. The bottom mode of this button will indicate the pilot weight currently being used by the system for performance calculations. It is displayed in WHITE when it is the powerup default value (235 lbs).

e. CPG Button. The **CPG** button is used for manual entry of weight for the CPG when data from the DTC and/or default pilot weight is not accurate. This button is displayed only when the **WT** button is selected. The bottom mode of this button will indicate the CPG weight currently being used by the system for performance calculations. It is displayed in WHITE when it is the powerup default value (235 lbs).

f. DUMMY MISSILES Button. The **DUMMY MISSILES** button is used to manually enter the number of “dummy missiles” (M34) loaded on the wing store HF launchers. This button is displayed only when the **WT** button is selected. The range value entry is from 0 to 16 missiles. Dummy missiles are not detectable by the system and, as such, are not accounted for in aircraft gross weight calculations. This data entry is used by the SP to include the weight of dummy missiles in gross weight calculations. The value is stored in memory and will be updated only when manually entered.

g. DUMMY ROCKETS Button. The **DUMMY ROCKETS** button is used to manually enter the number of “dummy rockets” loaded in the wing store rocket launchers. This button is displayed only when the **WT** button is selected. The range value entry is from 0 to 76 rockets. Dummy rockets are not detectable by the system and, as such, are not accounted for in aircraft gross weight calculations. This data entry is used by the SP to include the weight of dummy rockets in gross weight calculations. The value is stored in memory and will be updated only when manually entered.

7A.3 ETF PAGE

The engine torque factor (**ETF**) page is used to perform the maximum power check for the 701C engine. The purpose of this check is to determine the ETF for each engine. The torque factor method of performing the maximum power check provides an accurate indication of available power by incorporating ambient temperature effects into the power available calculation. The intent of the ETF is to provide the system a numerical health value upon which performance computations can be derived using performance algorithms and tables within the system processors. This maintenance procedure is described in TM 1-2840-248-23.

Selecting the **ETF** page button (B3) displays the ETF page with the button controls necessary to initiate the power check and the **701C TORQUE FACTOR** status window which contains current ETF/ATF values; aircraft (**ACFT**), engine 1 (**ENG1**), and engine 2 (**ENG2**) (fig 7A-3).

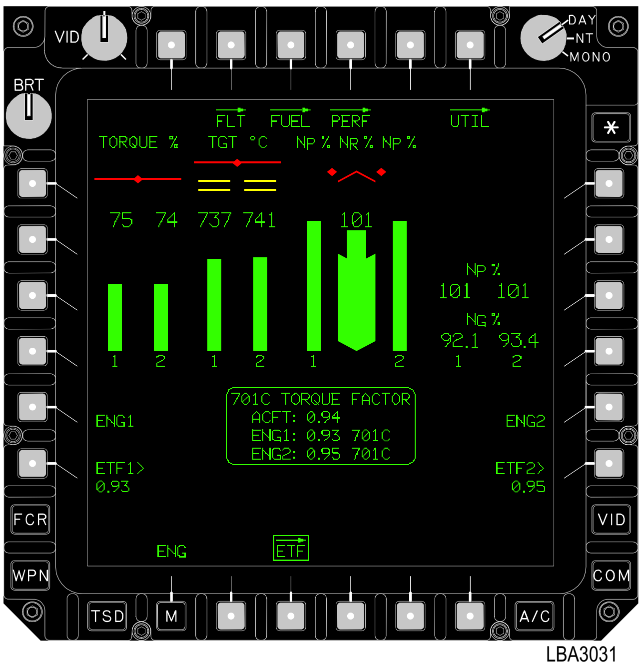

Figure 7A-3. ETF Page

The following selections are available on the **ETF** page:

- T2 **FLT** button
- T3 **FUEL** button
- T4 **PERF** button
- T6 **UTIL** button
- L5 **ENG1** button
- L6 **ETF1** button
- R5 **ENG2** button
- R6 **ETF2** button
- B3 **ETF** button

7A.3.1 Engine 1 and 2 Buttons. The **ENG1** and **ENG2** buttons are used to select an engine for the maximum power check. Selecting the **ENG1** or **ENG2** button sets the system for a maximum power check and then displays the **TOPPING CHECK** status window for the selected engine; pressure altitude (**PA**) and free air temperature (**FAT**). This selection also displays the **LAST** and **TEST** buttons at the bottom of the format (fig 7A-4).

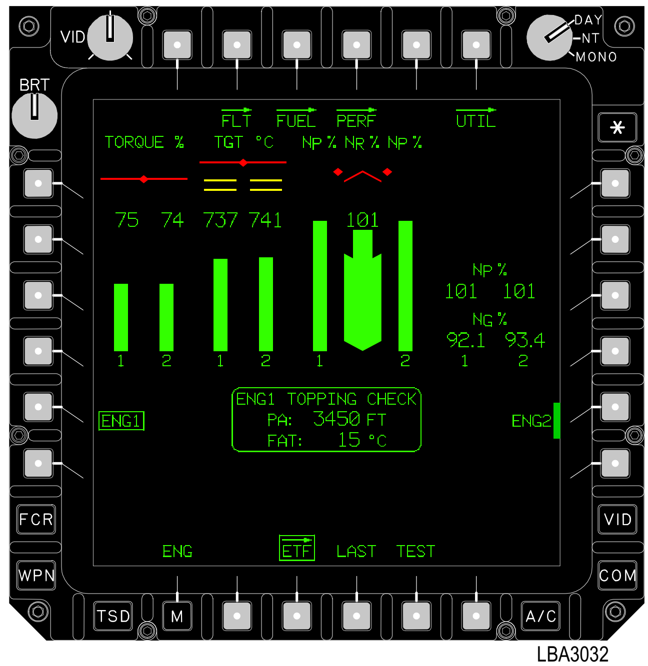

Figure 7A-4. ENG1 Selected

7A.3.2 LAST Topping Check Button. The **LAST** button (B4) is used to call up the last test results. Selecting the **LAST** button displays the **LAST TOPPING CHECK** status window which contains a list of engine and ambient conditions of the last maximum power check performed on the selected engine (fig 7A-5):

- date (**MM/DD/YY**)
- engine **TORQUE**
- Target Torque Value (**TTV**)
- indicated airspeed (**IAS**)
- engine **TGT**, **NG**, and **NP**
- **PA** and **FAT**

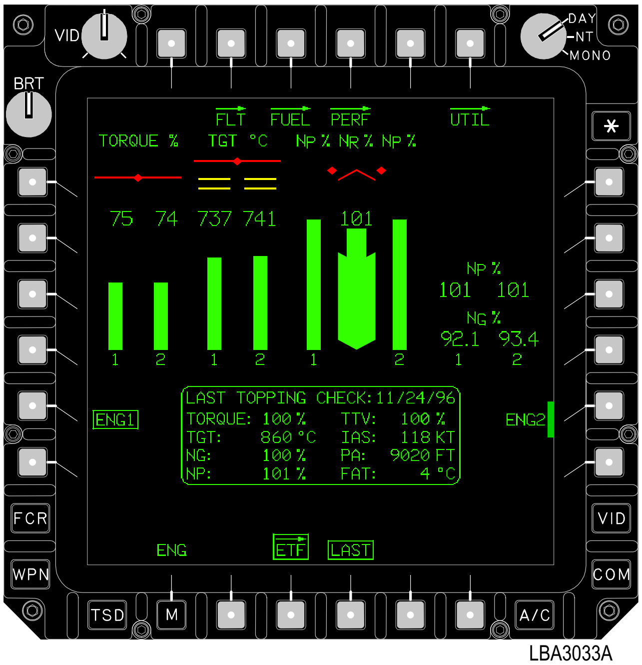

Figure 7A-5. LAST Selected

7A.3.3 Engine TEST Button.

The **TEST** button (B5) is used to initiate a test once flight parameters are achieved. Selecting the **TEST** button commands the SP to perform power check calculations to derive the ETF for the selected engine. Results of the test are displayed as either the **TOPPING CHECK ABORTED** status window (fig 7A-6) or the **TOPPING CHECK COMPLETE** status window (fig 7A-7).

a. Test Aborted Indication. An aborted test will display the **RESET** button (B6) and the **ENG1** or **ENG2 TOPPING CHECK TEST ABORTED, DATA NOT VALID** status window which is displayed to provide an indication that the engine test was aborted due to invalid data (fig 7A-6).

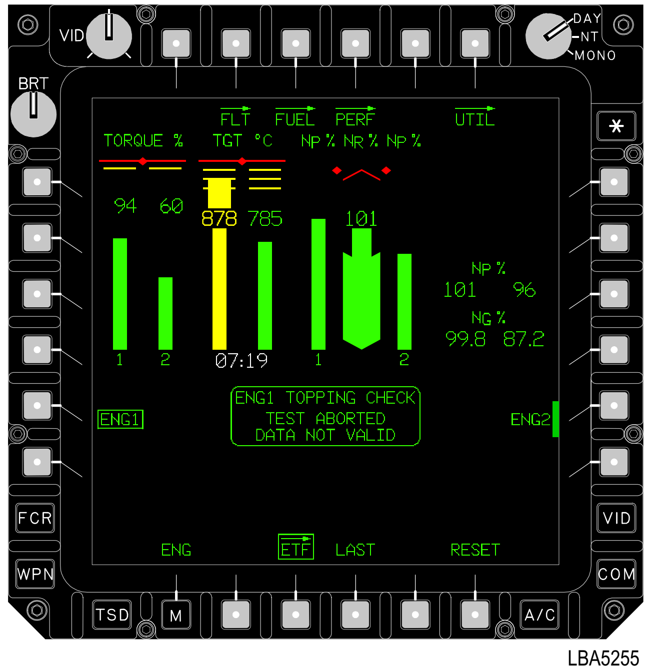

Figure 7A-6. Test Aborted Indication

b. Test Complete Indication. A completed test will display the **STORE** and **RESET** buttons (B5, B6) and the **ENG1** or **ENG2 TOPPING CHECK TEST COMPLETE** status window which contains current data for a valid test performed on the selected engine (fig 7A-7):

- **ETF1** or **ETF2 PASS/FAIL** indication with ETF value and difference value from last check
- **ATF1** or **ATF2 PASS/FAIL** indication with ATF value and difference value from last check
- Engine **TORQUE**, Target Torque Value (**TTV**), indicated airspeed (**IAS**), engine **TGT**, $\mathbf{N_G}$, and $\mathbf{N_P}$, **PA** and **FAT**

7A.3.4 STORE Button.

The power check **STORE** button (B5) is used to store the test values. Selecting the **STORE** button commands the SP to store test data for the selected engine in non-volatile memory and in the maintenance data recorder (MDR). In addition, this selection returns the format to the top level **ETF** page.

7A.3.5 RESET Button. The power check **RESET** button (B6) is provided as an alternative to storing test data. Selecting the **RESET** button returns the format to the former state (prior to performing the test).

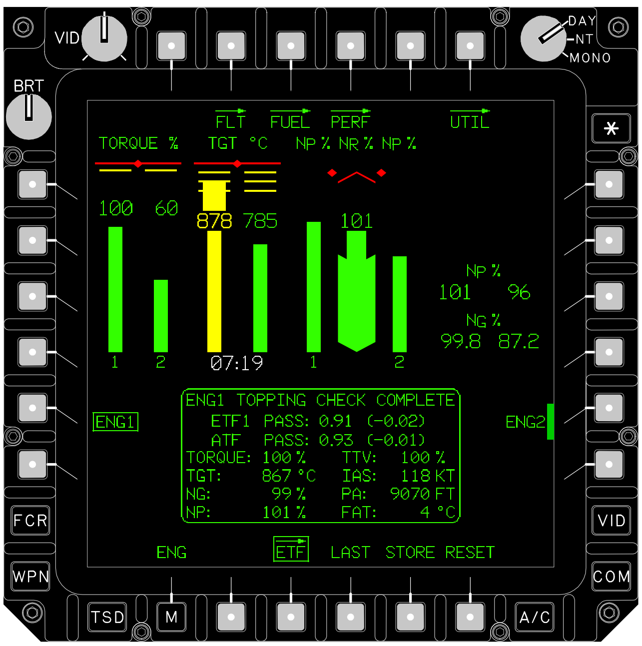

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Figure 7A-7. Test Complete Indication

7A.4 PERFORMANCE DATA - GENERAL

The data presented covers the maximum range of conditions and performance that can reasonably be expected. In each area of performance, the effects of altitude, temperature, gross weight and other parameters relating to that phase of flight are presented. In addition to the presented data, judgment and experience will be necessary to accurately determine performance under a given set of circumstances. The conditions for the data are listed under the title of each chart. The effects of different conditions are discussed in the text accompanying each phase of performance. Where practical, data is presented at conservative conditions. However, NO GENERAL CONSERVATISM HAS BEEN APPLIED.

7A.5 LIMITS

CAUTION

Exceeding operational limits can cause permanent damage to critical components and can decrease performance, cause immediate failure, or failure on a subsequent flight.

Applicable limits are shown on the charts as ***bold*** lines. Performance generally deteriorates rapidly beyond limits. If limits are exceeded, minimize the amount and time. Enter the maximum value and time beyond limits on DA Form 2408-13-1 so proper maintenance action can be taken.

7A.6 USE OF CHARTS

7A.6.1 Chart Explanation. The first page of each section describes the chart or charts in that section, and explains how each chart is used.

7A.6.2 Reading the Charts. The primary use of each chart is given in the example and a guideline is provided to help you follow the route through the chart. The use of a straight edge (ruler or page edge) and a hard fine-point pencil is recommended to avoid cumulative errors. The majority of the charts provide a standard pattern for use as follows: Enter first variable on top left scale, move right to second variable, deflect down at right angles to third variable, deflect left at right angles to fourth variable, and deflect down, etc., until final variable is read out at final scale. In addition to the primary use, other uses of each chart are explained in the text accompanying each set of performance charts. Correct operating limits can also be found in Chapter 5. Abbreviations and symbols used in the charts are listed in Appendix B.

NOTE

An example of an auxiliary use of the performance charts follows: Although the hover chart is primarily arranged to find the torque required to hover, maximum wheel height for hover can also be found by entering torque available as torque required. In general, any single variable can be found if all others are known. Also, the trade-offs between two variables can be found. For example, at a given density altitude and pressure altitude, you can find the maximum gross weight capability as free air temperature changes.

7A.7 SPECIFIC CONDITIONS

The data presented is accurate only for specific conditions listed under the title of each chart. Variables for which data is not presented, but which may affect that phase of performance, are discussed in the text. Where data is available or reasonable estimates can be made, the amount that each variable affects performance is given.

7A.8 GENERAL CONDITIONS

In addition to the specific conditions, the following general conditions are applicable to the performance data:

7A.8.1 Rigging. All airframe and engine controls are assumed to be rigged within allowable tolerances.

7A.8.2 Pilot Technique. Normal pilot technique is assumed. Control movements should be smooth and continuous.

7A.8.3 Aircraft Variation. Variations in performance between individual helicopters are known to exist. The majority of variation can be accounted for through the use of Engine Torque Factors and Aircraft Torque Factors.

7A.8.4 Instrument Variation. The data shown in the performance charts does not account for instrument inaccuracies or malfunctions.

7A.8.5 Configurations. Except as otherwise noted, all data is for the primary mission configuration consisting of the basic helicopter configured with Aircraft Survival Equipment (ASE) plus a pylon and a fully loaded hellfire missile launcher on each inboard stores station, and no pylons or stores on outboard stations.

7A.9 PERFORMANCE DISCREPANCIES

Regular use of this chapter will also allow monitoring instruments and other helicopter systems for malfunction, by comparing actual performance with planned performance. Knowledge will also be gained concerning the effects of variables for which data is not provided, thereby increasing the accuracy of performance predictions.

7A.10 TEMPERATURE CONVERSION

A temperature conversion chart (fig 7A-8) is included in the section for the purpose of converting Fahrenheit (F) temperatures to Celsius (C).

7A.11 ABBREVIATIONS

Appendix B is a list of abbreviations and symbols used on the charts in this chapter, as well as throughout the entire operators manual. For units of measure, the same abbreviation applies to either the singular or plural form of the unit.

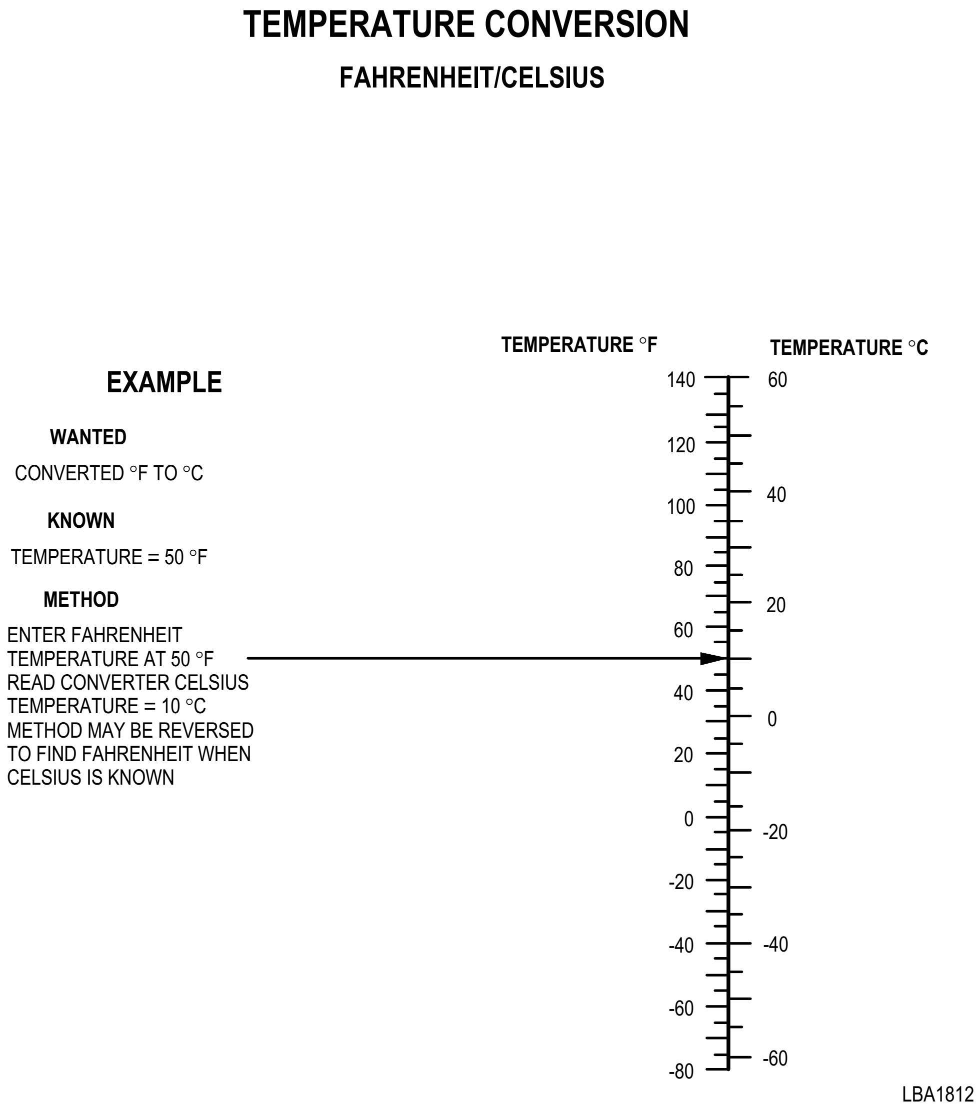


Figure 7A-8. Temperature Conversion Chart

Section II. MAXIMUM TORQUE AVAILABLE

7A.12 DESCRIPTION

The maximum torque available charts (figs 7A-9 and 7A-10) show the maximum torque available per engine for 30-minute operation and 10-minute operation at various conditions of pressure altitude and Free Air Temperature (FAT). Both single and dual-engine operation limits are shown.

Figure 7A-11 shows the maximum torque available for 2.5-minute operation when one engine is inoperative; only single engine operation limits are shown.

The torque factor charts (figs 7A-12 and 7A-13) provide an accurate indication of available power for the engines installed in each individual aircraft.

7A.13 USE OF CHARTS

The primary use of the charts is illustrated by the example. To determine the maximum torque available, it is necessary to know pressure altitude and FAT. Enter the left side of either the 30-minute chart, 10-minute chart, or the 2.5-minute chart at the known FAT and move right to the known pressure altitude, and then move down and read the maximum torque available. This is torque per engine. For dual-engine operation, if the torque per engine exceeds the two-engine limit, the maximum torque available must be reduced to the two-engine limit.

7A.14 CONDITIONS

These charts are based on 101% rotor rpm, zero airspeed, JP-8 fuel and ENG INLET ANTI-ICE system **OFF**. With ENG INLET ANTI-ICE system **ON**, available torque is reduced by as much as 20.4% for 30-minute operation and 19.2% for 10-minute operation. For example, if the value from the 30-minute chart is 90%, with ANTI-ICE **ON**, torque available would be 90 - 20.4 = 69.6%.

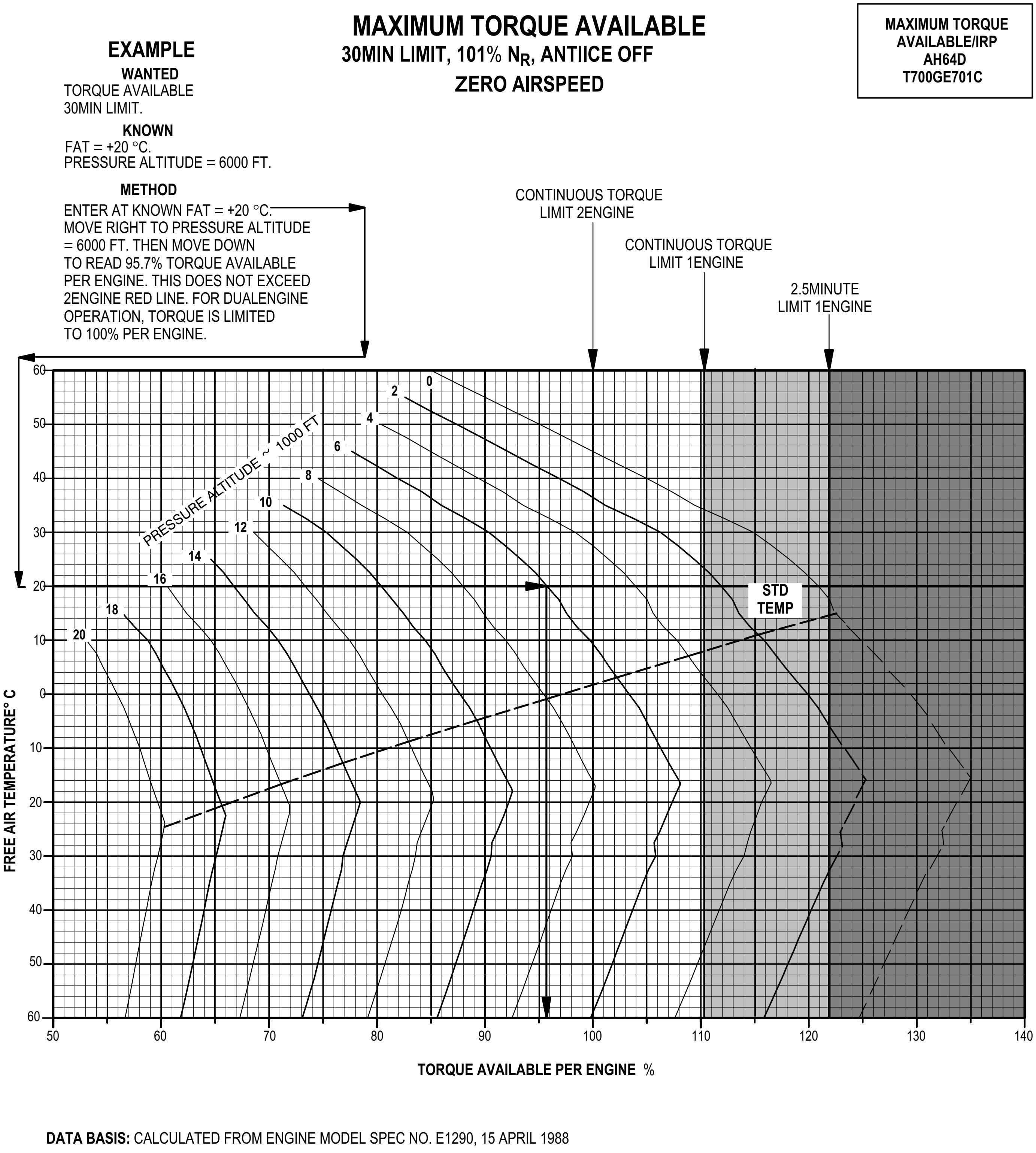


Figure 7A-9. Maximum Torque Available Chart - 30-Minute Limit 701C

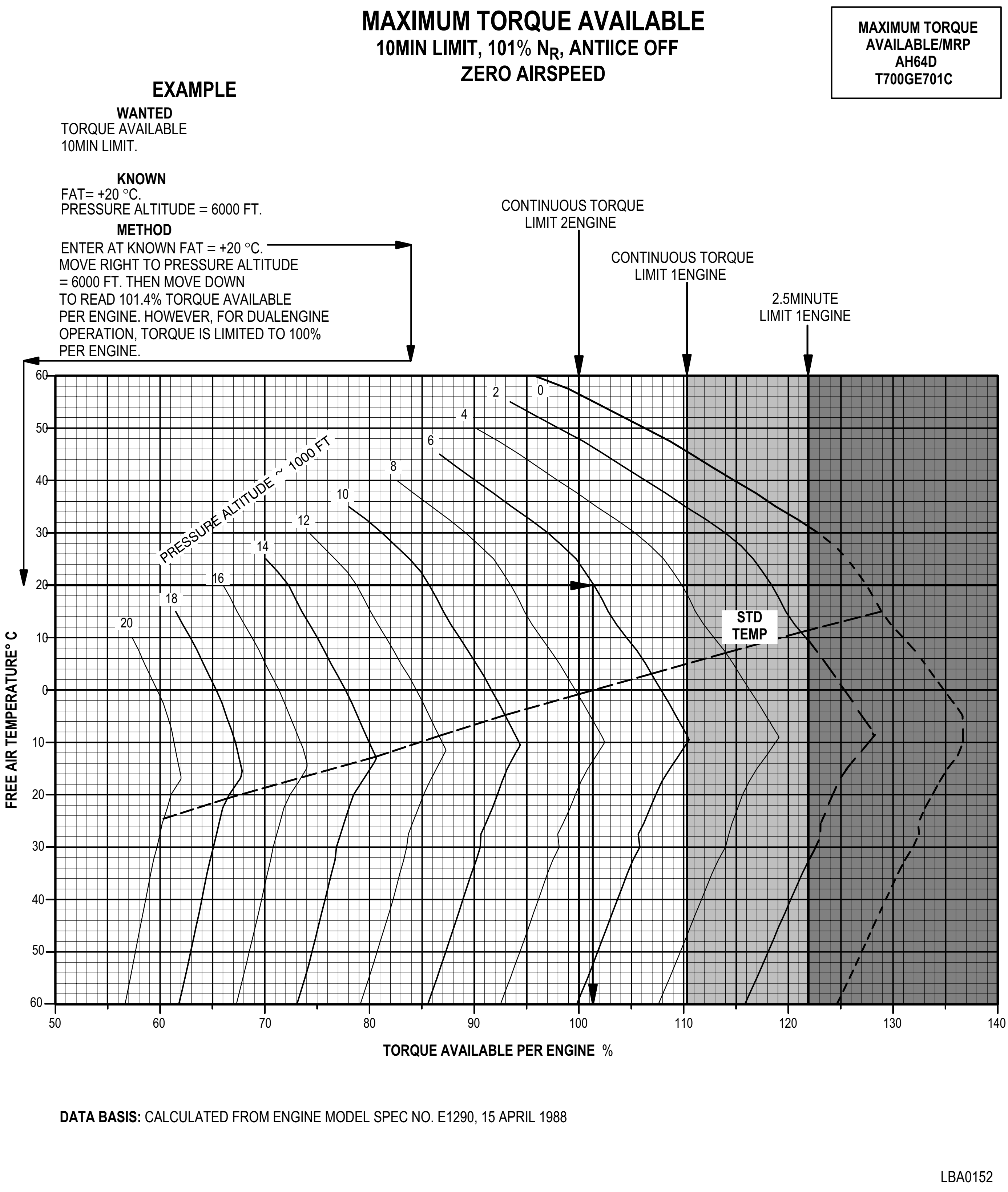


Figure 7A-10. Maximum Torque Available Chart - 10-Minute Limit 701C

MAXIMUM TORQUE AVAILABLE/OEI
AH64D
T700GE701C

SINGLE ENGINE MAXIMUM TORQUE AVAILABLE

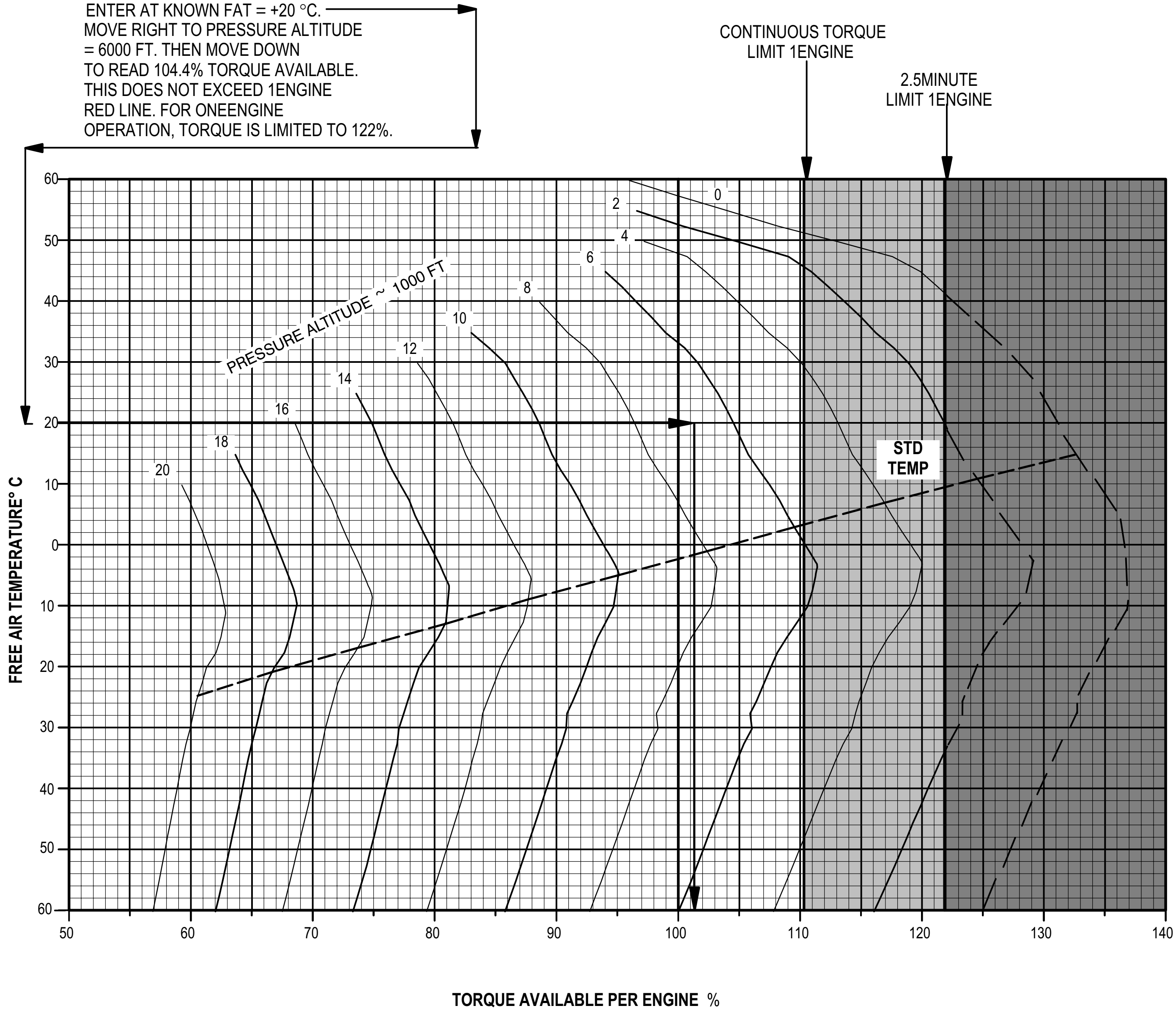
2.5MIN LIMIT, 101% N_R, ANTIICE OFF
ZERO AIRSPEED

EXAMPLE

WANTED
TORQUE AVAILABLE
2.5MIN LIMIT

KNOWN
FAT = +20 °C.
PRESSURE ALTITUDE = 6000 FT.

METHOD
ENTER AT KNOWN FAT = +20 °C.
MOVE RIGHT TO PRESSURE ALTITUDE
= 6000 FT. THEN MOVE DOWN
TO READ 104.4% TORQUE AVAILABLE.
THIS DOES NOT EXCEED 1ENGINE
RED LINE. FOR ONEENGINE
OPERATION, TORQUE IS LIMITED TO 122%.



DATA BASIS: CALCULATED FROM ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA1146

Figure 7A-11. Maximum Torque Available Chart - 2.5 Minute Limit 701C

TORQUE FACTOR
T700-GE-701C ENGINE, 101% RPM

TORQUE FACTOR AH64D T700GE701C

EXAMPLE

WANTED

TORQUE RATIO AND MAXIMUM TORQUE AVAILABLE 30MIN LIMIT

KNOWN

ATF = .95
PRESSURE ALTITUDE = 6000 FT
FAT = + 20 °C

METHOD

TO OBTAIN TORQUE RATIO

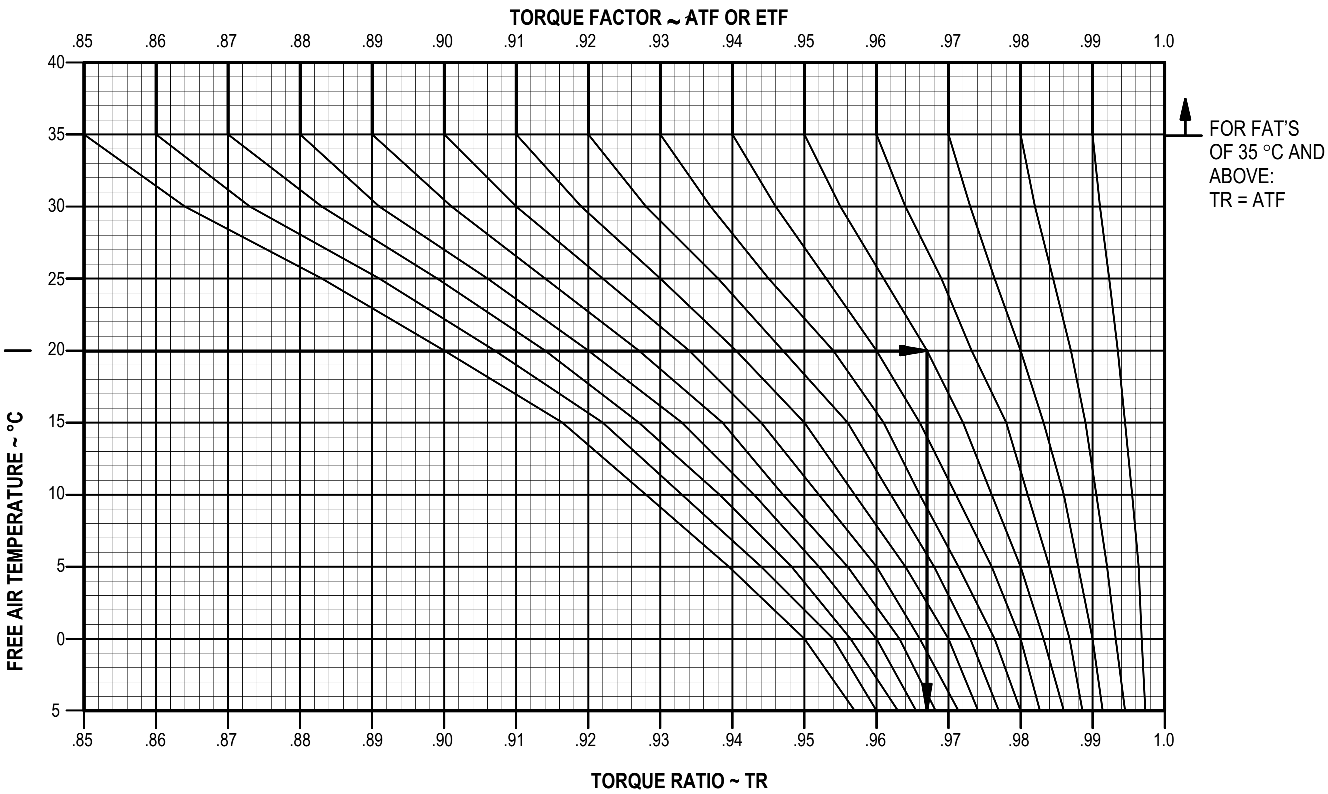
1. ENTER TORQUE FACTOR CHART AT KNOWN FAT
2. MOVE RIGHT TO THE ATF VALUE
3. MOVE DOWN, READ TORQUE RATIO = .967

TO CALCULATE MAXIMUM TORQUE AVAILABLE:

4. ENTER MAXIMUM TORQUE AVAILABLE CHART 30 MIN LIMIT (FIGURE 7A9) AT KNOWN FAT
5. MOVE RIGHT TO KNOWN PRESSURE ALTITUDE
6. MOVE DOWN, READ SPECIFICATION TORQUE = 95.7%

TO OBTAIN ACTUAL TORQUE VALUE AVAILABLE FROM THE TORQUE CONVERSION CHART (FIGURE 7A13):

7. ENTER TORQUE CONVERSION CHART AT % TORQUE OBTAINED FROM 30MIN LIMIT CHART
8. MOVE UP TO TORQUE RATIO OBTAINED FROM TORQUE FACTOR CHART
9. MOVE LEFT, READ MAXIMUM TORQUE AVAILABLE = 92.5%



DATA BASE: CALCULATED

LBA2558B

Figure 7A-12. Torque Factor Chart 701C

Use or disclosure of this information is subject to the restriction(s) on the title page of this document.

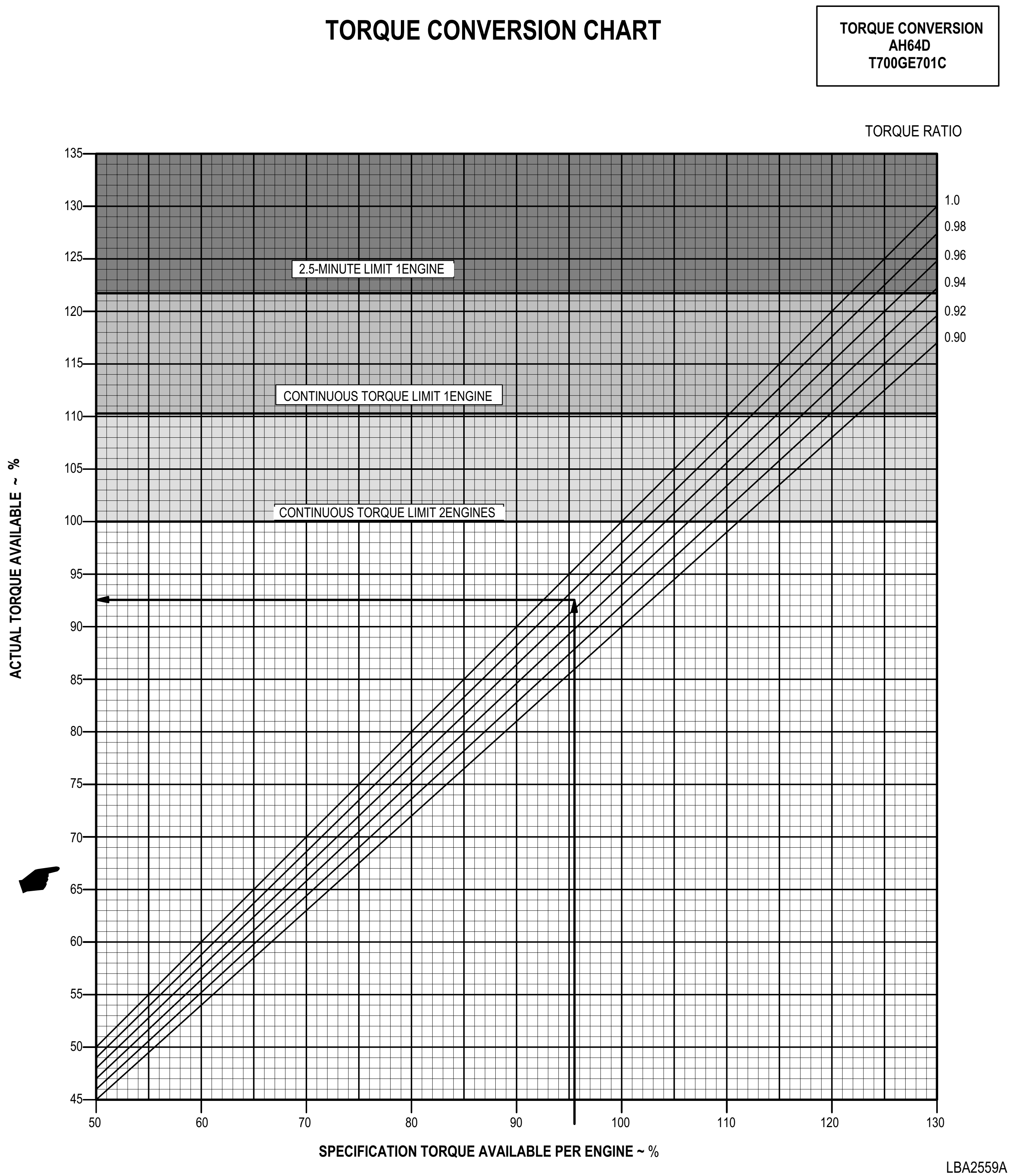


Figure 7A-13. Torque Conversion Chart 701C

Section III. HOVERING CEILING

7A.15 DESCRIPTION

The hover ceiling chart (fig 7A-14) presents the maximum gross weight for hover at various conditions of pressure altitude, Free Air Temperature (FAT), and wheel height, using maximum torque available, 30-minute limit.

The hover ceiling chart (fig 7A-15) presents the maximum gross weight for hover at various conditions of pressure altitude, Free Air Temperature (FAT), and wheel height, using maximum torque available, 10-minute limit.

7A.16 USE OF CHART

The primary use of the chart is illustrated by the example. To determine the maximum gross weight for hover, it is necessary to know the pressure altitude, FAT, and desired wheel height. Enter the appropriate power available chart at the pressure altitude, move right to the FAT, move down to the desired wheel height, and then move left and read maximum gross weight.

7A.17 CONDITIONS

The hover ceiling chart is based on maximum torque available 30-minute limit, ATF = 1.0, 101% rotor RPM, and ENG INLET anti-ice system **OFF**. For ENG INLET ANTI-ICE system **ON**, use dashed lines. Applicable configuration is all external stores except auxiliary fuel tanks. For the four auxiliary tank configuration, reduce the maximum gross weight for hover as calculated from the hover ceiling chart by 10.8 lbs for each 1000 lbs of gross weight. See example below:

HOVER CEILING

EXAMPLE I

WANTED

MAXIMUM GROSS WEIGHT FOR HOVER AT 10-FOOT WHEEL HEIGHT, 30-MINUTE LIMIT TORQUE AVAILABLE, FOR ENGINE INLET ANTI-ICE OFF AND ON

KNOWN

PRESSURE ALTITUDE = 10,000 FEET

FAT = -10 °C

WHEEL HEIGHT = 10 FEET

METHOD

ENTER PRESSURE ALTITUDE SCALE AT 10,000 FT

MOVE RIGHT TO -10 °C FAT, SOLID LINE FOR ANTI-ICE OFF, DASHED LINE FOR ANTI-ICE ON

MOVE DOWN TO 10 FEET WHEEL HEIGHT

MOVE LEFT TO READ GROSS WEIGHT FOR HOVER:

ANTI-ICE OFF, HOVER GW = 17,680 LB

ANTI-ICE ON, HOVER GW = 15,850 LB

WITH 4 EXT TANKS INSTALLED

ANTI-ICE OFF

HOVER GW = 17,680 - 10.8 (17,680/1000)
= 17,490 LB

EXAMPLE II

WANTED

MAXIMUM GROSS WEIGHT FOR HOVER AT 10-FOOT WHEEL HEIGHT, 10-MINUTE LIMIT TORQUE AVAILABLE, FOR ENGINE INLET ANTI-ICE OFF AND ON

KNOWN

PRESSURE ALTITUDE = 10,000 FEET

FAT = -10 °C

WHEEL HEIGHT = 10 FEET

METHOD

ENTER PRESSURE ALTITUDE SCALE AT 10,000 FT

MOVE RIGHT TO -10 °C FAT, SOLID LINE FOR ANTI-ICE OFF, DASHED LINE FOR ANTI-ICE ON

MOVE DOWN TO 10 FEET WHEEL HEIGHT

MOVE LEFT TO READ GROSS WEIGHT FOR HOVER:

ANTI-ICE OFF, HOVER GW = 18,220 LB

ANTI-ICE ON, HOVER GW = 16,500 LB

WITH 4 EXT TANKS INSTALLED

ANTI-ICE OFF

HOVER GW = 18,220 - 10.8 (18,220/1000)
= 18,020 LB

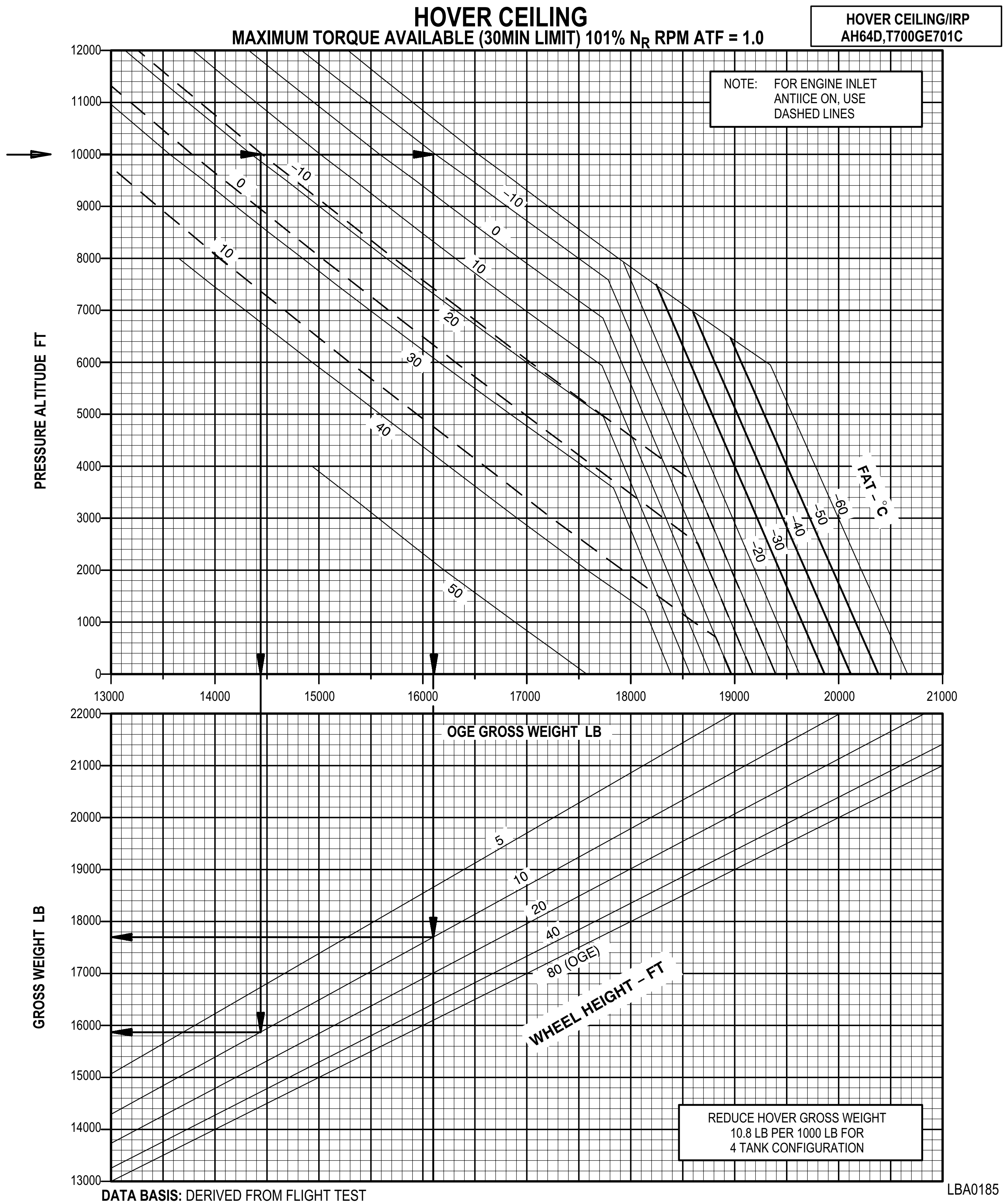


Figure 7A-14. Hover Ceiling Chart - 30 Minute Limit 701C

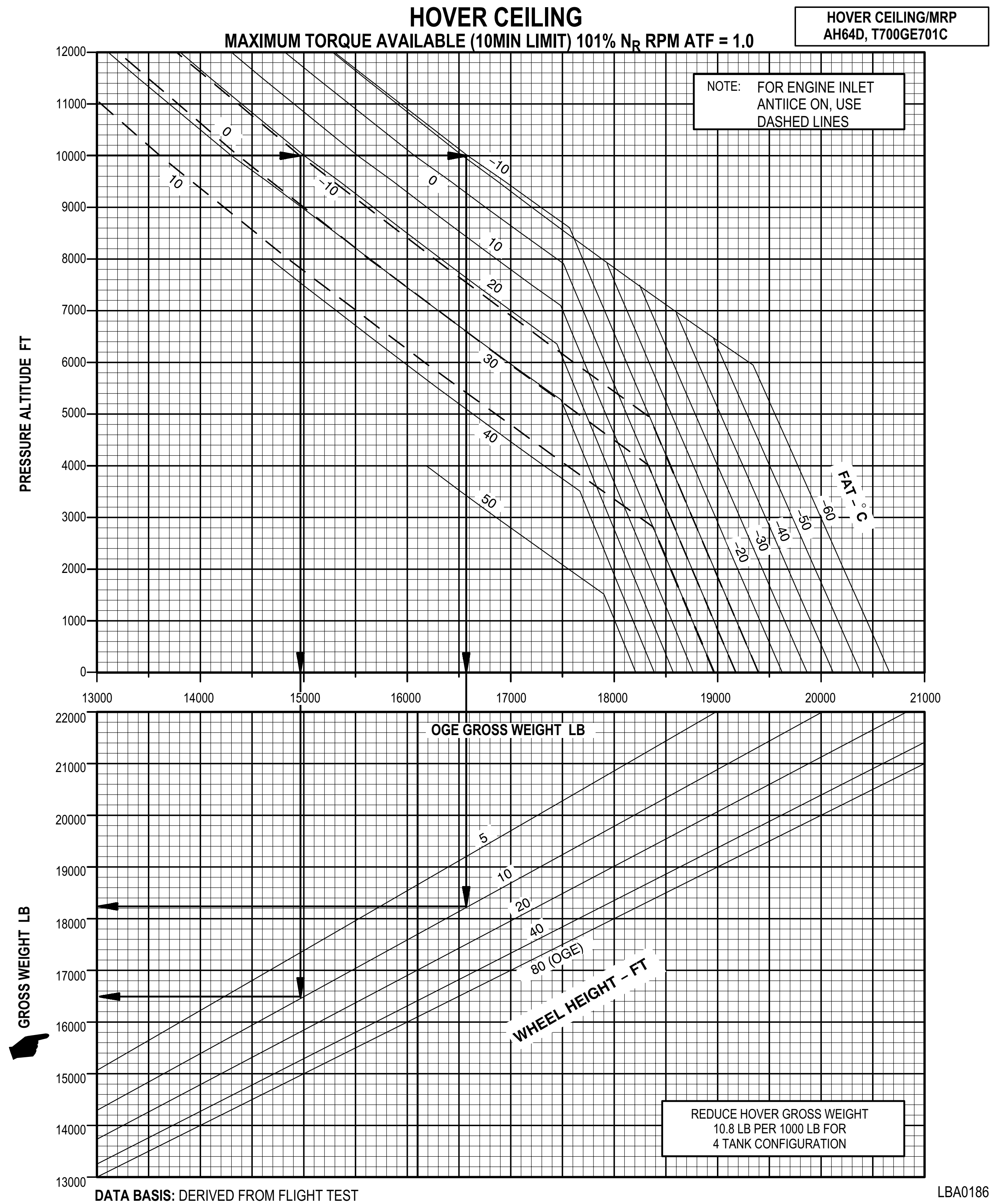


Figure 7A-15. Hover Ceiling Chart - 10 Minute Limit 701C

Section IV. HOVER

7A.18 DESCRIPTION

The hover chart (fig 7A-16) present the torque required to hover at various conditions of pressure altitude, Free Air Temperature (FAT), gross weight, wheel height, and with or without external tanks.

7A.19 USE OF CHART

7A.19.1 Chart Explanation. The primary use of the chart is illustrated by the example. To determine the torque required to hover, it is necessary to know the pressure altitude, FAT, gross weight, and desired wheel height. Enter the upper right grid at the known pressure altitude, move right to the FAT, move down to the gross weight, move left to the desired wheel height, and then move up and read the torque required to hover.

7A.19.2 Maximum Hover Height. In addition to its primary use, the hover chart may be used to predict the maximum hover height. This capability is needed for use of the takeoff chart. To determine maximum hover height, it is necessary to know pressure altitude, FAT, gross weight, and maximum torque available. Enter the known pressure altitude, move right to the FAT, move down to the gross weight, then move left to intersection with maximum torque available and read wheel height. This wheel height is the maximum hover height.

7A.19.3 Maximum Gross Weight. The hover chart may also be used to determine the maximum gross weight for hover at a given wheel height, pressure altitude, and FAT condition. Enter at the known pressure altitude, move right to the FAT, then move down to the bottom of the lower grid and read density altitude. Now enter upper left grid at maximum torque available, move down to wheel height, and then move right to density altitude and read gross weight. This is the maximum gross weight at which the helicopter will hover.

7A.20 CONDITIONS

The hover chart is based on calm wind, level surface, and 101% rotor RPM.

HOVER

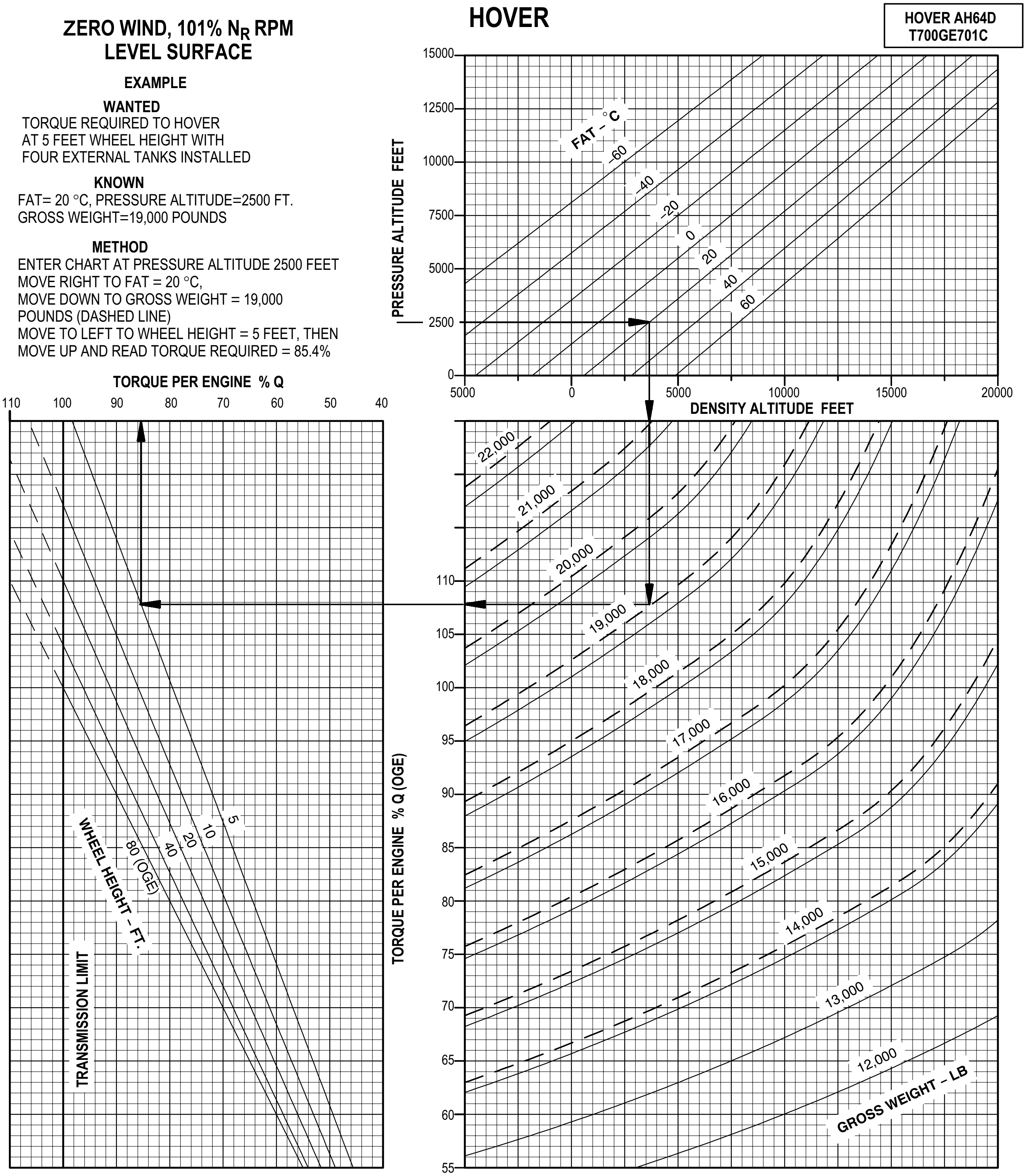
ZERO WIND, 101% N_R RPM
LEVEL SURFACE

EXAMPLE

WANTED
TORQUE REQUIRED TO HOVER
AT 5 FEET WHEEL HEIGHT WITH
FOUR EXTERNAL TANKS INSTALLED

KNOWN
FAT= 20 °C, PRESSURE ALTITUDE=2500 FT.
GROSS WEIGHT=19,000 POUNDS

METHOD
ENTER CHART AT PRESSURE ALTITUDE 2500 FEET
MOVE RIGHT TO FAT = 20 °C,
MOVE DOWN TO GROSS WEIGHT = 19,000
POUNDS (DASHED LINE)
MOVE TO LEFT TO WHEEL HEIGHT = 5 FEET, THEN
MOVE UP AND READ TORQUE REQUIRED = 85.4%



DATA BASIS: DERIVED FROM FLIGHT TEST

NOTE: USE DASHED LINES FOR 4 EXTERNAL TANKS INSTALLED
USE SOLID LINES FOR NO EXTERNAL TANKS INSTALLED

Figure 7A-16. Hover Chart 701C

Section V. CRUISE

7A.21 DESCRIPTION

The cruise charts (figs 7A-17 thru 7A-27) present the level flight torque required and total fuel flow at various conditions of airspeed, pressure, pressure altitude, Free Air Temperature (**FAT**), and gross weight. Cruise charts are provided for pressure altitudes from sea level to 16,000 feet in 2000-foot increments. **FAT** range from -50° C to +60° C in 10° C increments. In addition to basic cruise information, maximum endurance, and maximum rate of climb. Change in torque with change in frontal area information is presented in the upper left corner of each chart.

7A.22 USE OF CHARTS

The primary use of the charts are illustrated by the examples. To use the charts, it is usually necessary to know the planned pressure altitude, estimated FAT, planned cruise speed, TAS and gross weight. First select the proper chart on the basis of pressure altitude and FAT. Enter the chart at the cruise airspeed, IAS move right and read TAS, move left to the gross weight, move down and read torque required, and then move up and read associated fuel flow. Maximum performance conditions are determined by entering the chart where the maximum range line or the maximum rate-of-climb intersect the gross weight line; then read airspeed, fuel flow, and torque required. Normally sufficient accuracy can be obtained by selecting the chart nearest the planned cruise attitude and FAT or, more conservatively, by selecting the chart with the next higher altitude and FAT. If greater accuracy is required, interpolation between altitudes and/or temperatures is permissible. To be conservative, use the gross weight chart at the beginning of the cruise flight. For greater accuracy on long flights, however, it is preferable to determine cruise information for several flight segments to allow for the decreasing gross weight.

7A.22.1 Airspeed. True and indicated airspeeds are presented at the opposite sides of each chart. On any chart, obtain indicated airspeed (or vice versa) by reading directly across the chart without regard for the other chart information.

7A.22.2 Torque. Since pressure altitude and FAT are fixed for each chart, torque required varies according to gross weight and airspeed. The torque required and the torque limits shown on these charts are for dual-engine operation. The torque available shown on these charts are maximum continuous torque available, maximum torque available, 30-minutes maximum torque available, 10-minute limit, and maximum torque available single engine limit, when less than the two-engine transmission limit. These torque lines are the minimum torque available at the engine turbine gas temperature limits specified in Chapter 5. Higher torque than that represented by these lines may be used if it is available without exceeding the limitations presented in Chapter 5. The limit torque line shown on these charts is for the dual engine transmission limit and is defined as 100% torque. An increase or decrease in torque required because of a drag area change is calculated by adding or subtracting the change in torque from the torque change (△Q) curve on the chart, and then reading the new fuel flow total.

7A.22.3 Fuel Flow. Fuel flow scales are provided opposite the torque scales. On any chart, torque may be converted directly to fuel flow without regard to other chart information. Sea level ground fuel flow at flat pitch and 101% N_P is approximately 555 pounds per hour.

7A.22.4 Maximum Range. The maximum range lines indicate the combinations of gross weight and airspeed that will produce the greatest flight range per pound of fuel under zero wind conditions.

7A.22.5 Maximum Endurance and Rate of Climb. The maximum endurance and rate of climb lines indicate the combinations of gross weight and airspeed that will produce the maximum endurance and the maximum rate of climb. The torque required for level flight at this condition is a minimum, providing a minimum fuel flow (maximum endurance) and a maximum torque change available for climb (maximum rate of climb).

7A.22.6 Change in Frontal Area. Since the cruise information is given for the primary mission configuration, adjustments to torque should be made when operating with alternative wing-stores configurations. To determine the change in torque, first obtain the appropriate multiplying factor from the drag chart (figure 7A-28), then enter the cruise chart at the planned cruise speed TAS, move right to the broken △Q line, and move up and read △Q. Multiply △Q by the multiplying factor to obtain change in torque, then add or subtract change in torque from torque required for the primary mission configuration. Enter the cruise chart at resulting torque required, move up, and read fuel flow. If the resulting torque required exceeds the governing torque limit, the torque required must be reduced to the limit. The resulting reduction in airspeed may be found by subtracting the change in torque from the limit torque; then enter the cruise chart at the reduced torque, and move up to the gross weight. Move left or right to read TAS or IAS. To determine the airspeed for maximum range for alternative wing stores configuration, reduce the value from the cruise chart by 2 knots for each 5 square feet increase in drag area, ΔF, or increase maximum range airspeed 2 knots for each 5 square feet reduction in drag area. For example, for 16 Hellfire configuration ΔF = 7.6 square feet, from (figure 7A-28). Therefore, maximum range airspeed would be reduced by 2/5 x 7.6 = 3.04 knots, or approximately 3 knots.

7A.23 CONDITIONS

The cruise charts are based on 101% rotor RPM, ENG INLET ANTI-ICE switch **OFF**, JP-8 fuel, and dual engine operation. Engine inlet anti-ice effects are as follows:

7A.23.1 ENG INLET ANTI-ICE ON. With ENG INLET ANTI-ICE **ON**, fuel flow will increase between approximately 65 pounds per hour at 30% torque and 85 pounds per hour at 100% torque. Maximum torque available 30-minute limit could be reduced by as much as 20.4%, and maximum torque available 10-minute limit could be reduced by as much as 19.2%.

CRUISE

PRESSURE ALTITUDE SEA LEVEL

101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C

EXAMPLE

WANTED

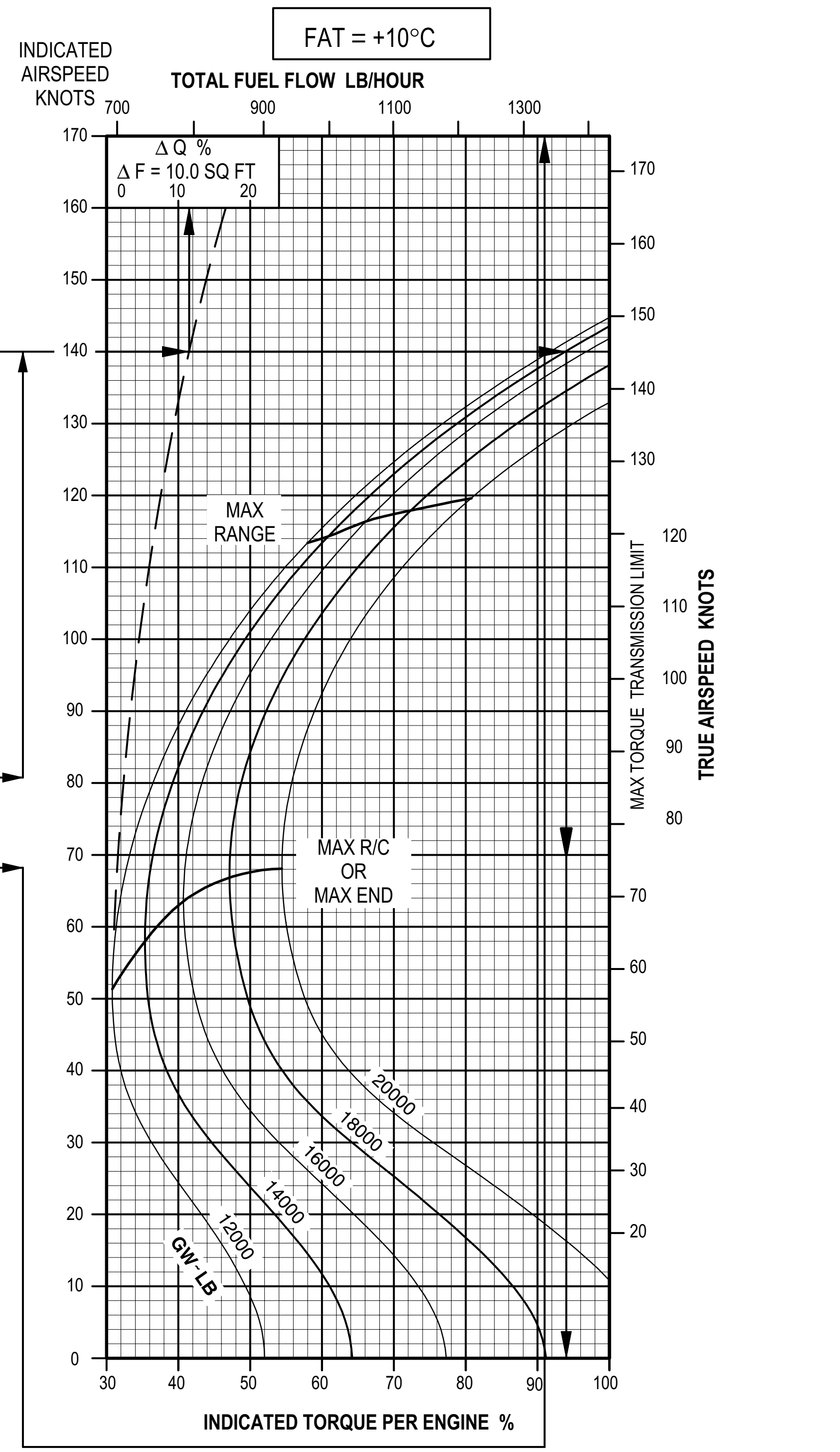
TORQUE REQUIRED AND FUEL FLOW FOR 76 ROCKET CONFIGURATION

KNOWN

PRESSURE ALTITUDE=S.L., FAT = +10 °C.
GW = 14,000 LB. 4 LOADED ROCKET LAUNCHERS (76 ROCKETS), IAS = 140 KT

METHOD

FROM DRAG CHART (FIG 7A-28) OBTAIN MULTIPLYING FACTOR = 0.27
ENTER CRUISE CHART AT IAS = 140 Kt
MOVE RIGHT TO BROKEN D Q LINE
MOVE UP TO READ D Q = 11.5%
MULTIPLY D Q BY MULTIPLYING FACTOR TO GET CHANGE IN TORQUE = 3.1
REENTER CRUISE CHART AT IAS = 140 Kt
MOVE RIGHT TO GW = 14,000 LB
MOVE DOWN AND READ INDICATED TORQUE PER ENGINE=94.0 %
TORQUE REQUIRED = 94.0 3.1 = 90.9%
REENTER CRUISE CHART AT 91%
MOVE UP AND READ FUEL FLOW = 1335 LB/HR.



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC No. DARCOMCP22202701A, DATED 15 JANUARY 1987

LBA0195

Figure 7A-17. Cruise Chart, Example 701C

CRUISE

PRESSURE ALTITUDE SEA LEVEL

101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C

FAT=+10°C

EXAMPLE I

WANTED

TORQUE REQUIRED, AIRSPEED, AND FUEL FLOW FOR MAXIMUM RANGE.

KNOWN

PRESSURE ALTITUDE = SL, FAT=+10 °C, AND GROSS WEIGHT = 14,000 POUNDS.

METHOD

AT THE INTERSECTION OF THE MAXIMUM RANGE LINE AND THE 14,000 POUND LINE
MOVE LEFT, READ IAS = 114 KT.
MOVE RIGHT, READ TAS = 120 KT.
MOVE UP, READ TOTAL FUEL FLOW = 1000 LB/HR.
MOVE DOWN, READ INDICATED TORQUE/ENGINE = 61%.

EXAMPLE II

WANTED

TORQUE REQUIRED, AIRSPEED, AND FUEL FLOW FOR MAXIMUM ENDURANCE.

KNOWN

PRESSURE ALTITUDE = SL, FAT = +10 °C, AND GROSS WEIGHT = 14,000 POUNDS.

METHOD

AT THE INTERSECTION OF THE MAXIMUM RANGE LINE AND THE 14,000 POUND LINE
MOVE LEFT, READ IAS = 58 KT.
MOVE RIGHT, READ TAS = 64 KT.
MOVE UP, READ TOTAL FUEL FLOW = 740 LB/HR.
MOVE DOWN, READ INDICATED TORQUE/ENGINE = 35%.

EXAMPLE III

(INTERPOLATION NOT ILLUSTRATED)

WANTED

TORQUE REQUIRED, AIRSPEED, AND FUEL FLOW, AND TORQUE.

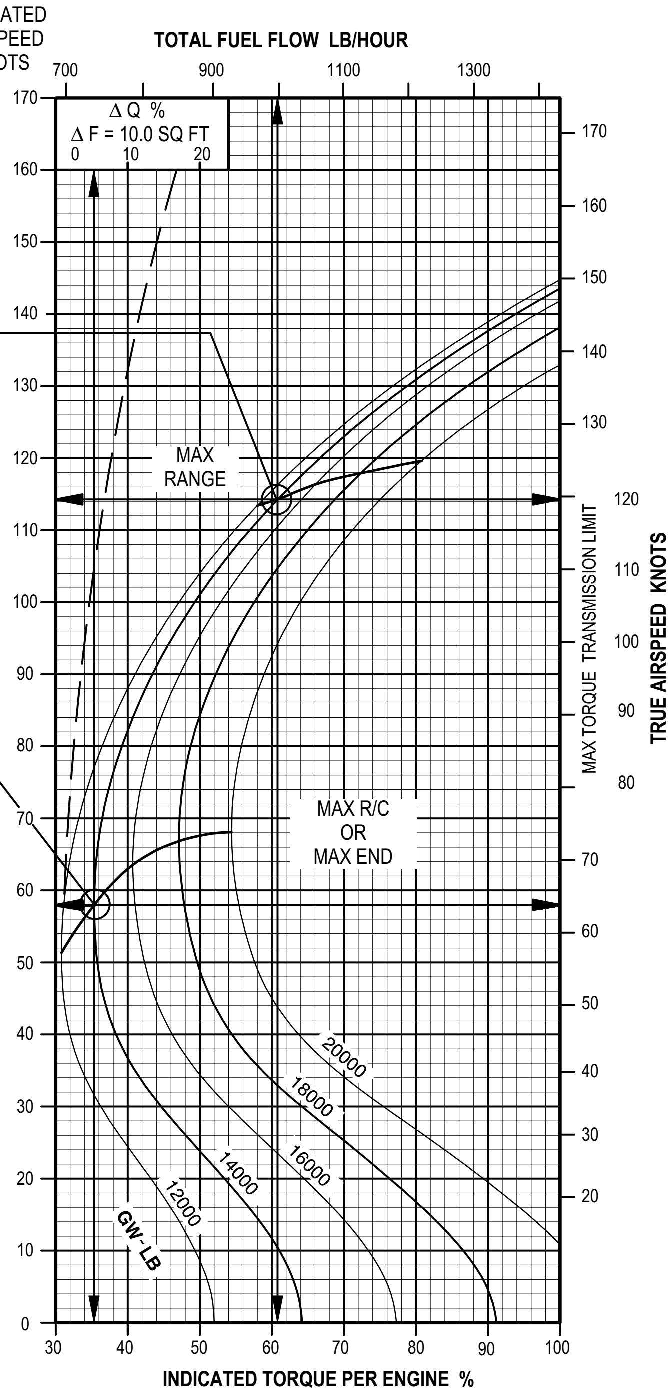
KNOWN

PRESSURE ALTITUDE = 1000 FEET FAT = +15 °C, AND GROSS WEIGHT = 14000 POUNDS.

METHOD

READ AIRSPEED, TORQUE, AND FUEL FLOW FOR EACH ADJACENT ALTITUDE AND FAT, THEN INTERPOLATE BETWEEN FAT AND ALTITUDE AS FOLLOWS:

ALTITUDE	SEA LEVEL		2000 FEET		SOLUTION: 1000 FEET
FAT	20	10	20	10	15
TORQUE	35	35	35	35	35
FUEL FLOW	740	740	720	715	730
IAS	58	58	59	59	58.5
TAS	65	64	68	67	66



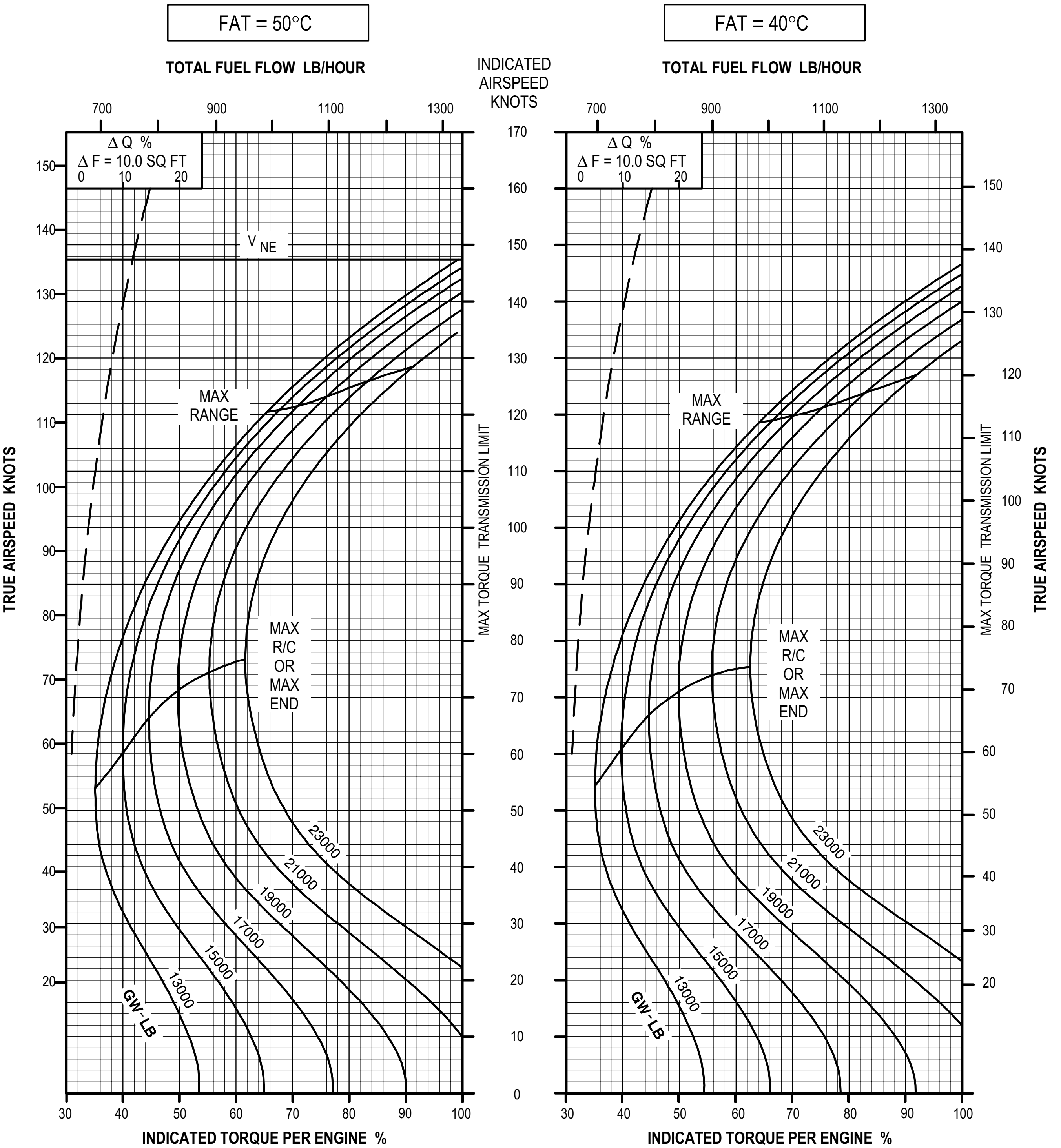
DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC No. DARCOMCP22202701A, DATED 15 JANUARY 1987

LBA0196

Figure 7A-18. Cruise Chart, Sea Level, +10°C Example 701C

CRUISE
PRESSURE ALTITUDE SEA LEVEL
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



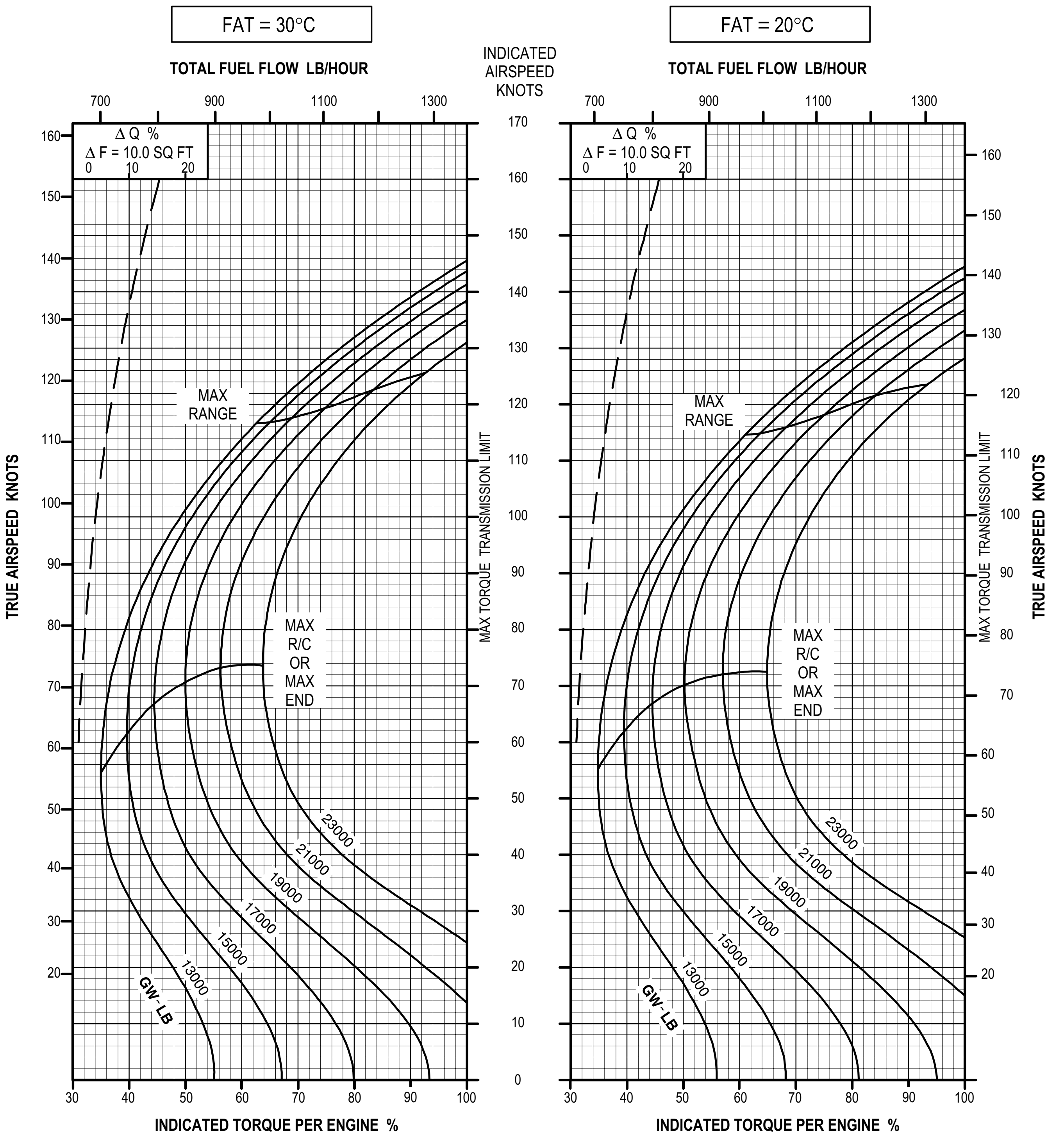
DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0197

Figure 7A-19. Cruise Chart, Sea Level, -50°C and -40°C (sheet 1 of 6) 701C

CRUISE
PRESSURE ALTITUDE SEA LEVEL
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



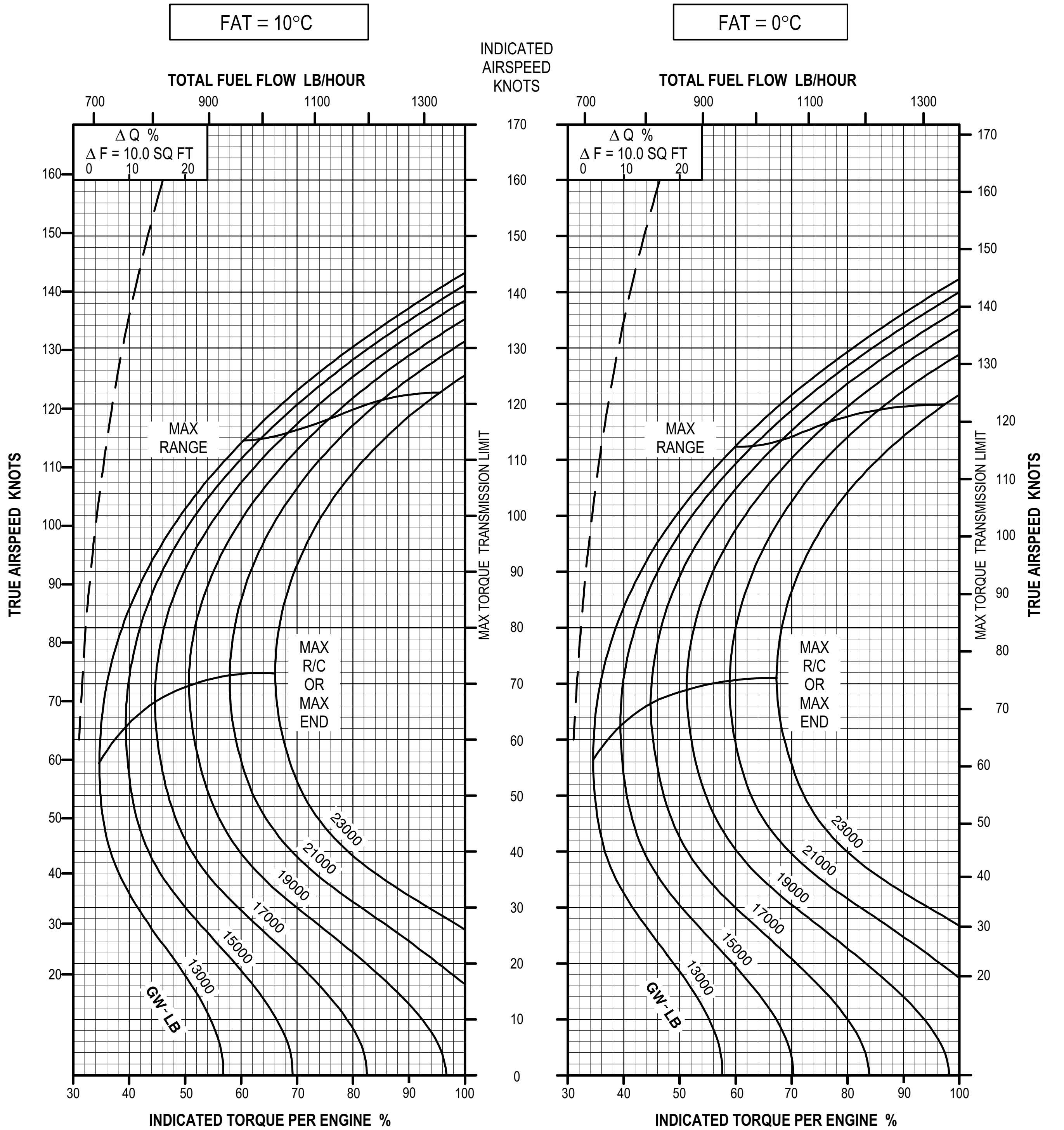
DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0198

Figure 7A-19. Cruise Chart, Sea Level, -30°C and -20°C (sheet 2 of 6) 701C

CRUISE
PRESSURE ALTITUDE SEA LEVEL
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0199

Figure 7A-19. Cruise Chart, Sea Level, -10°C and 0°C (sheet 3 of 6) 701C

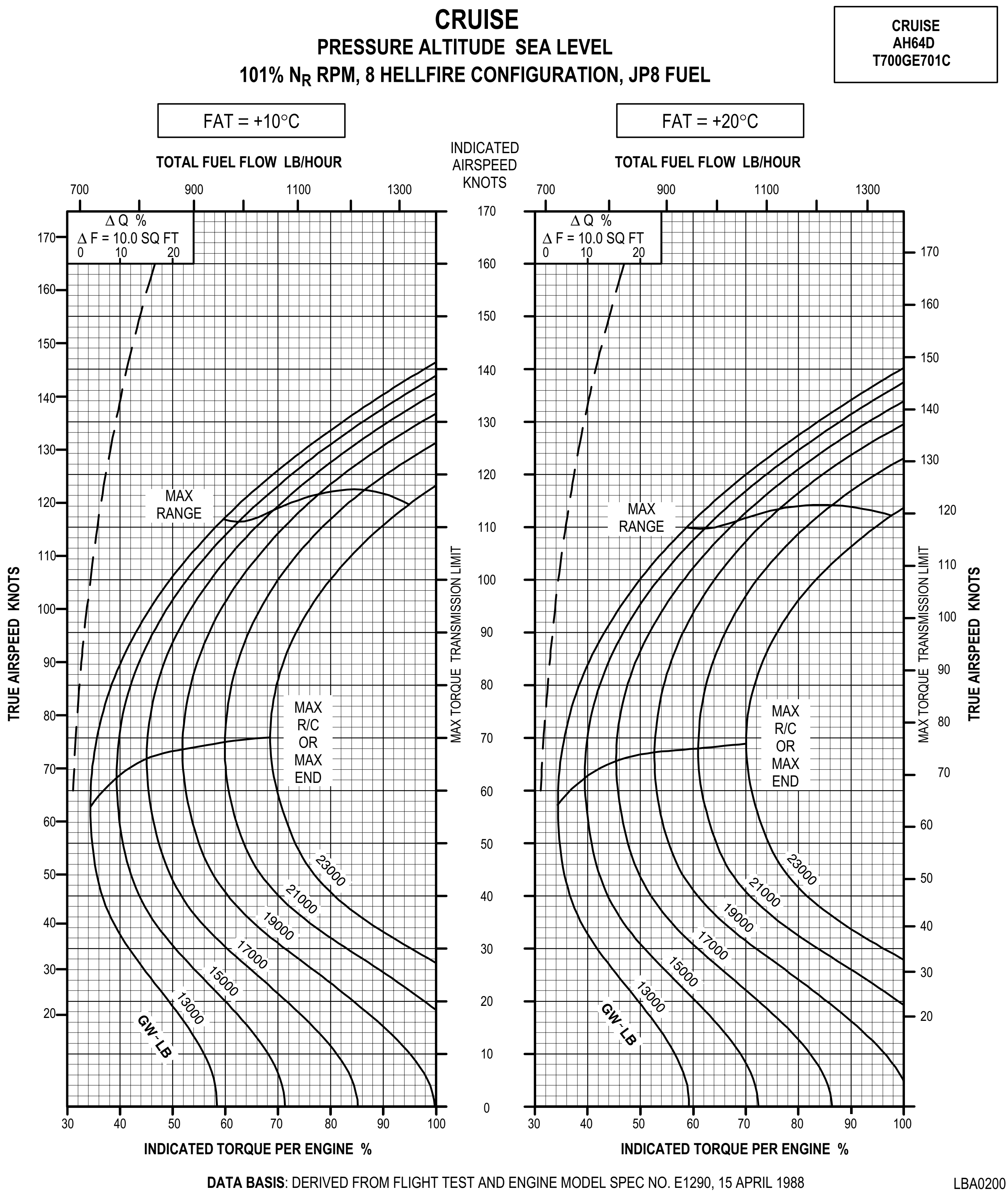


Figure 7A-19. Cruise Chart, Sea Level, +10°C and +20°C (sheet 4 of 6) 701C

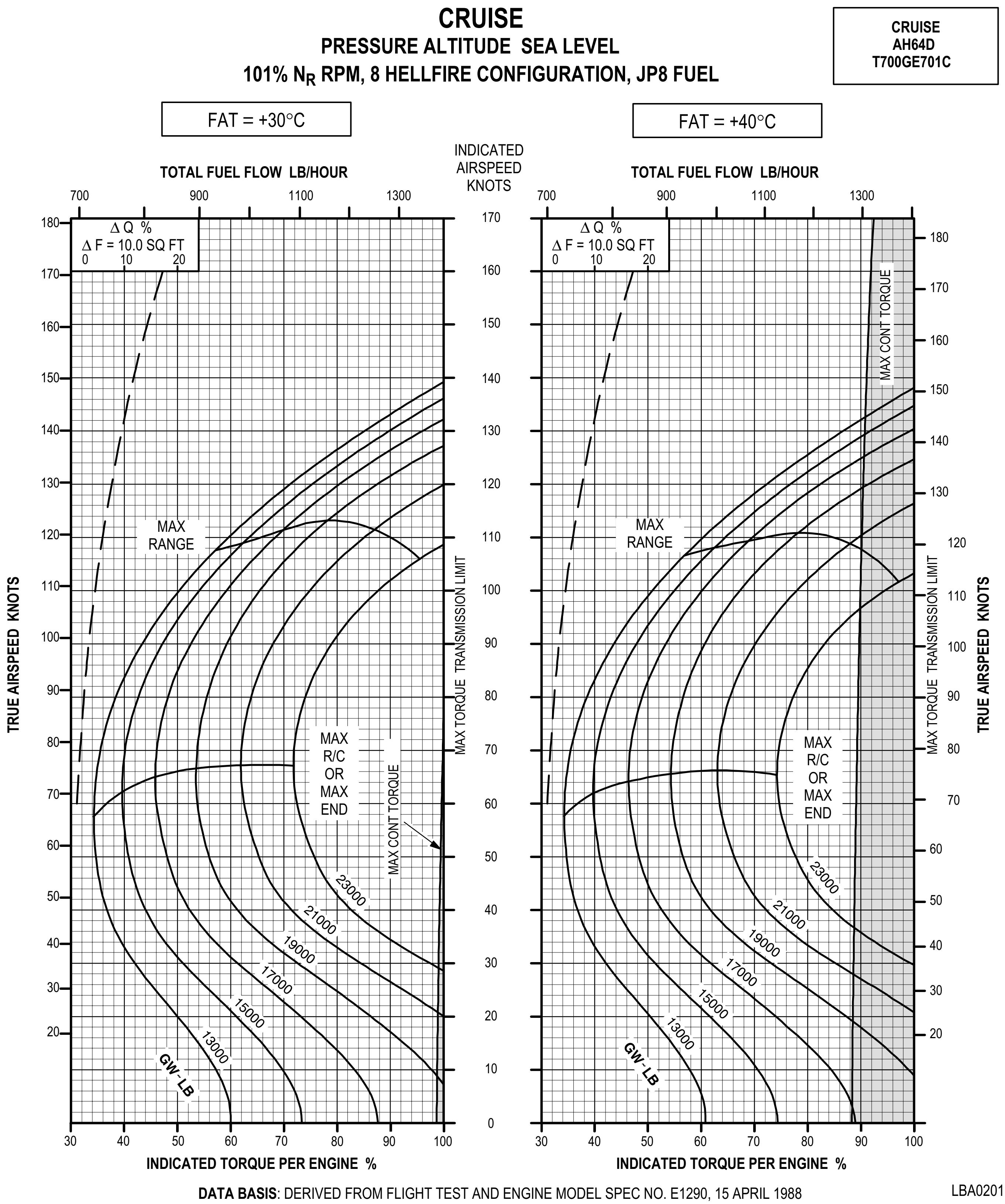


Figure 7A-19. Cruise Chart, Sea Level, +30°C and +40°C (sheet 5 of 6) 701C

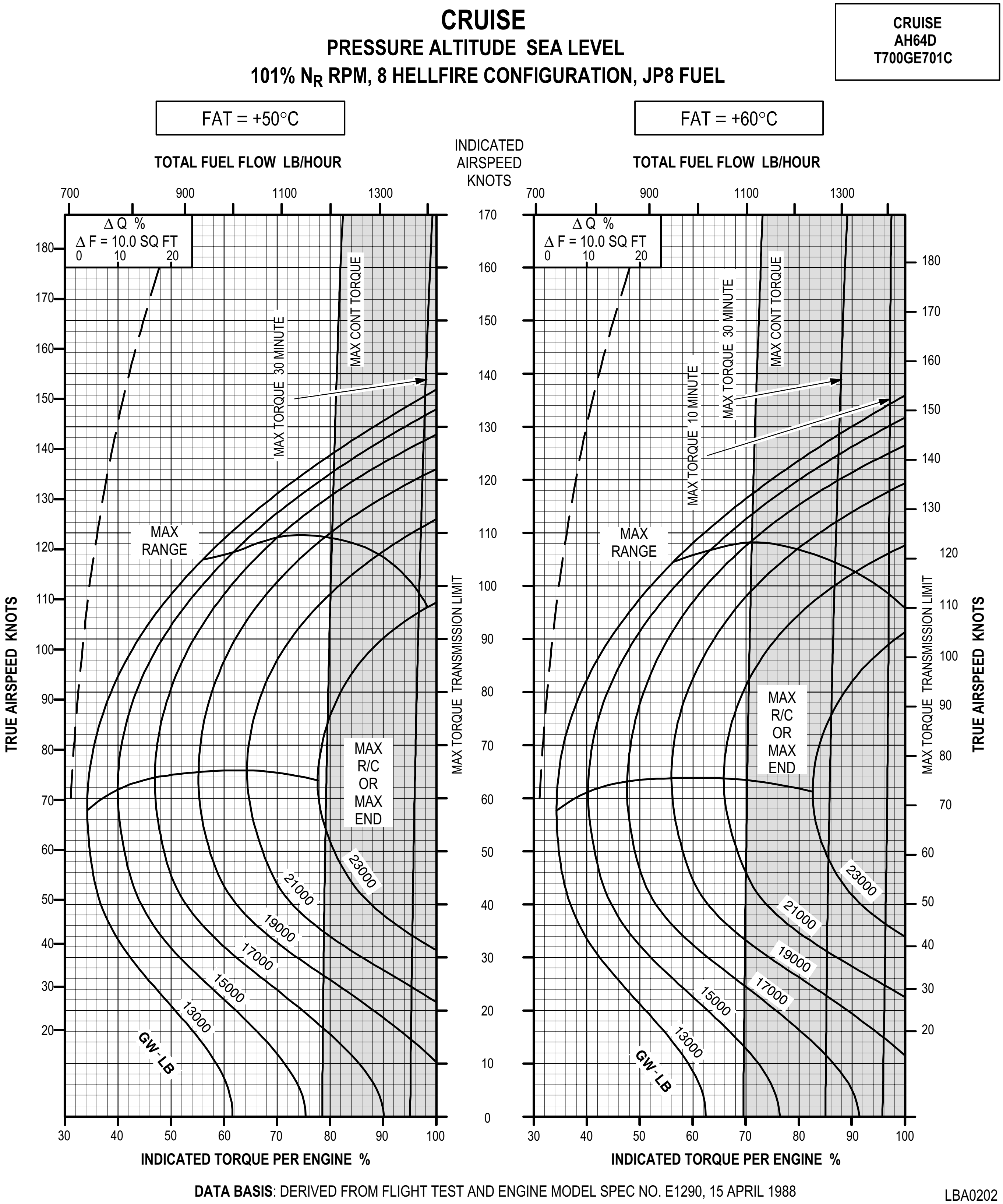
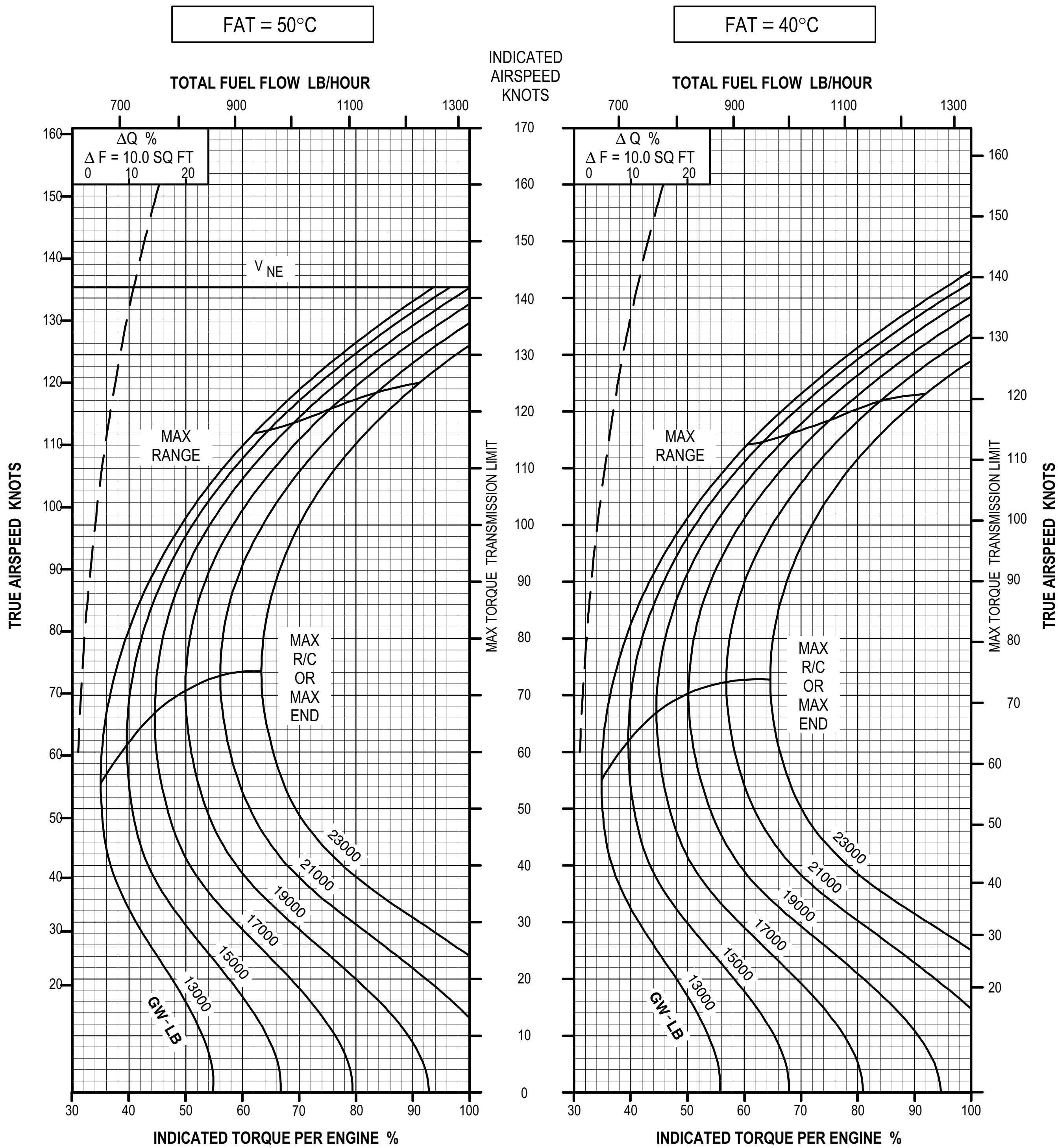


Figure 7A-19. Cruise Chart, Sea Level, +50°C and +60°C (sheet 6 of 6) 701C

CRUISE
PRESSURE ALTITUDE 2000 FEET
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0203

Figure 7A-20. Cruise Chart, 2,000 Feet, -50°C and -40°C (sheet 1 of 6) 701C

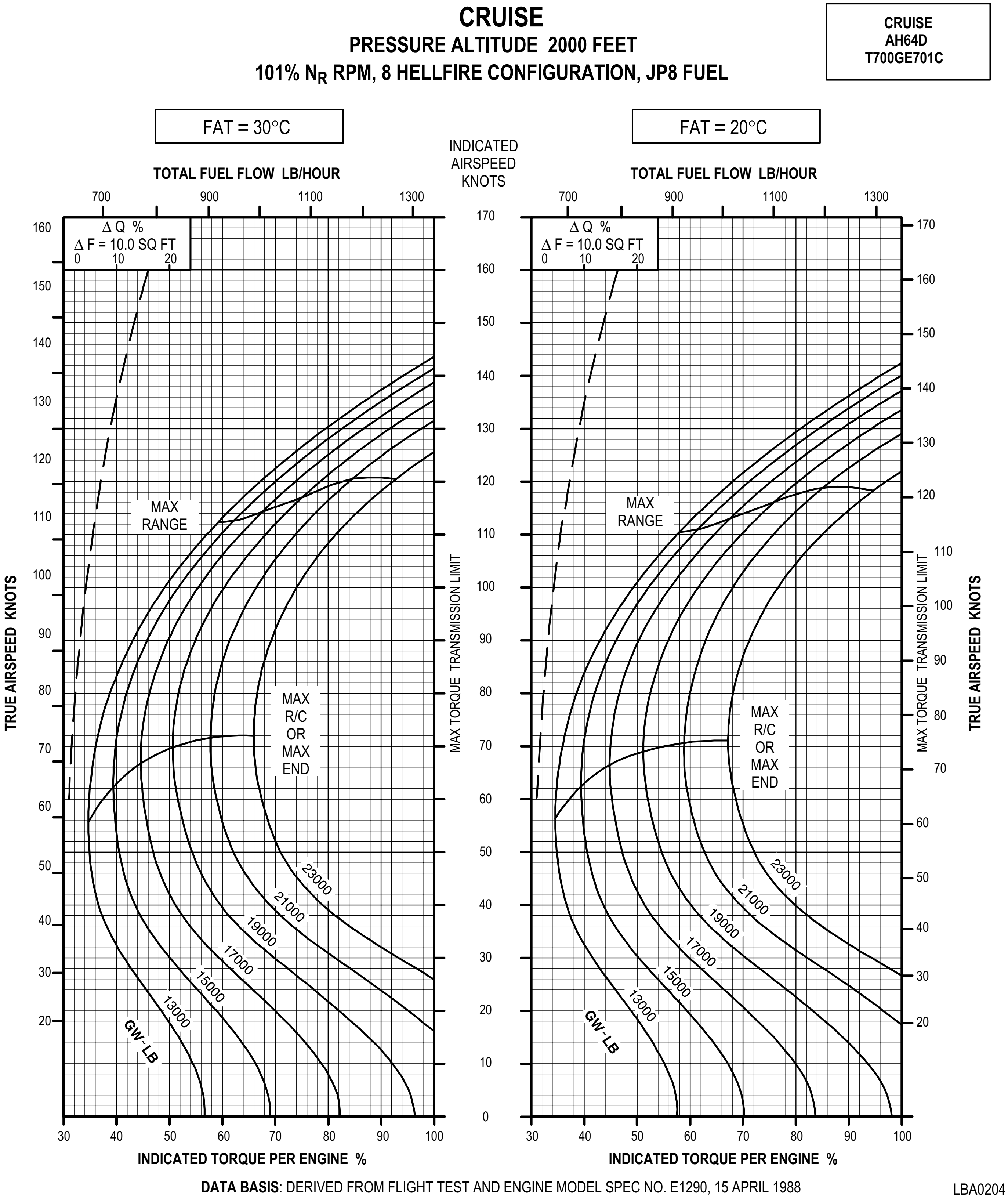
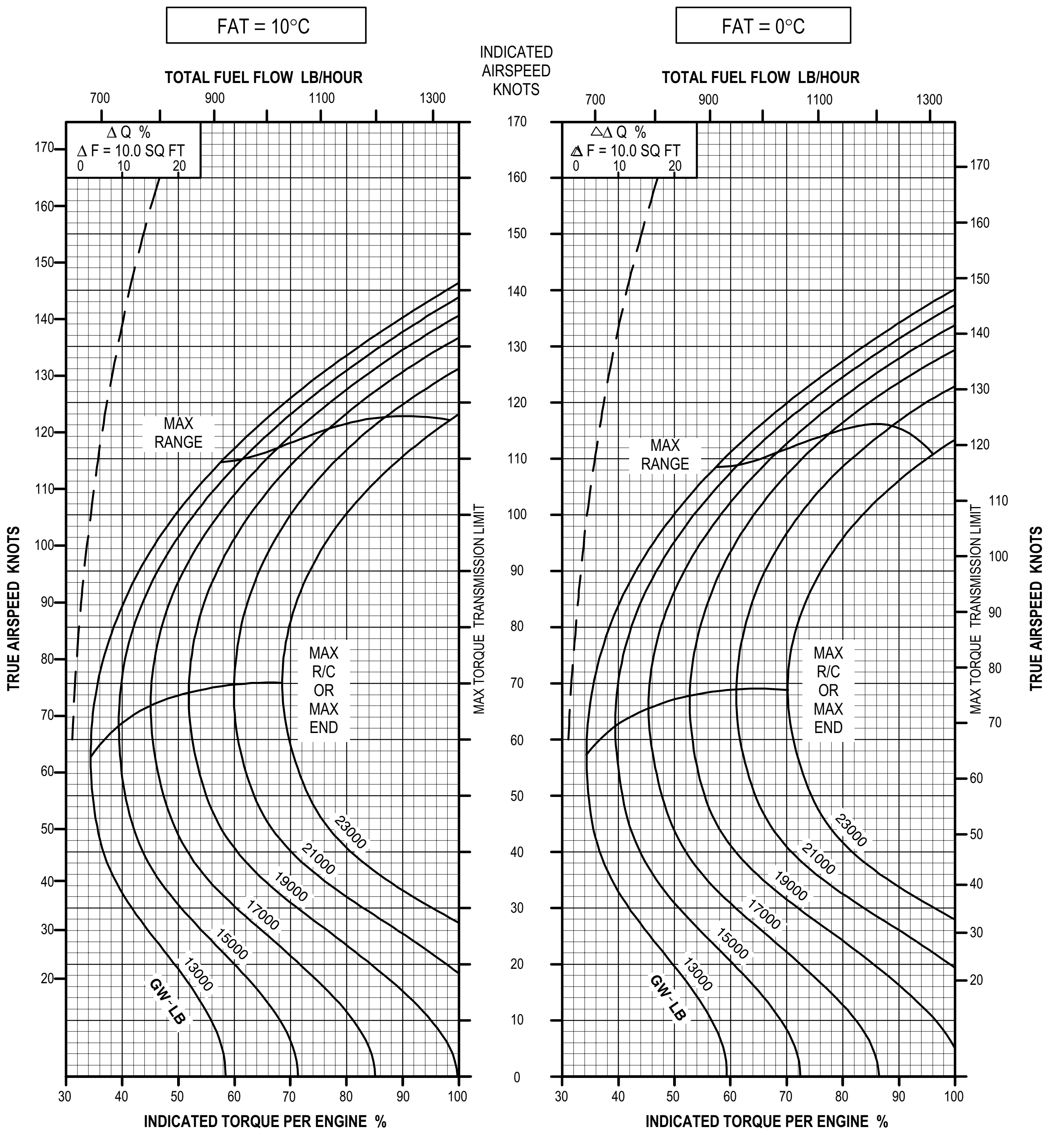


Figure 7A-20. Cruise Chart, 2,000 Feet, -30°C and -20°C (sheet 2 of 6) 701C

CRUISE
PRESSURE ALTITUDE 2000 FEET
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0205

Figure 7A-20. Cruise Chart, 2,000 Feet, -10°C and 0°C (sheet 3 of 6) 701C

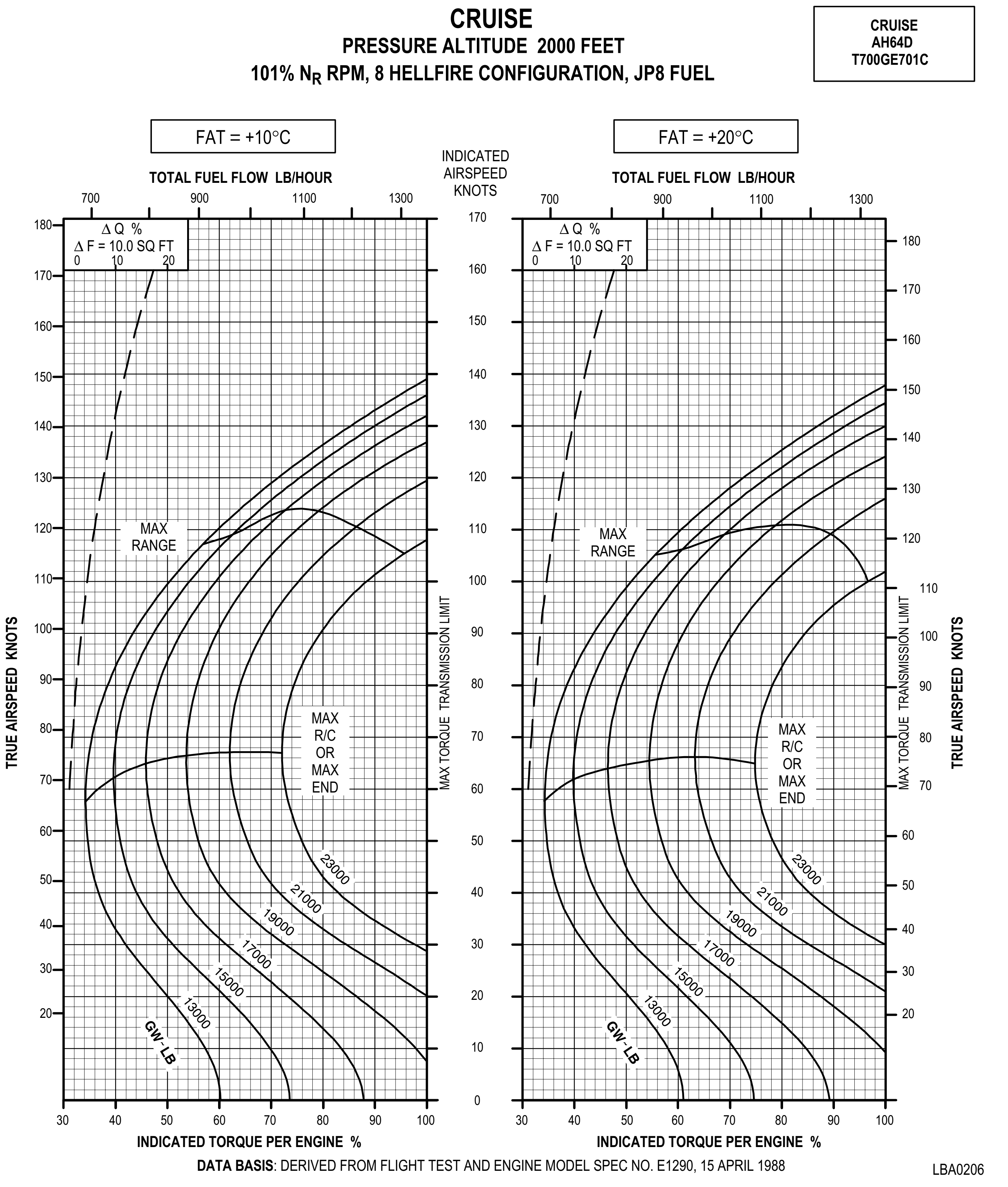


Figure 7A-20. Cruise Chart, 2,000 Feet, +10°C and +20°C (sheet 4 of 6) 701C

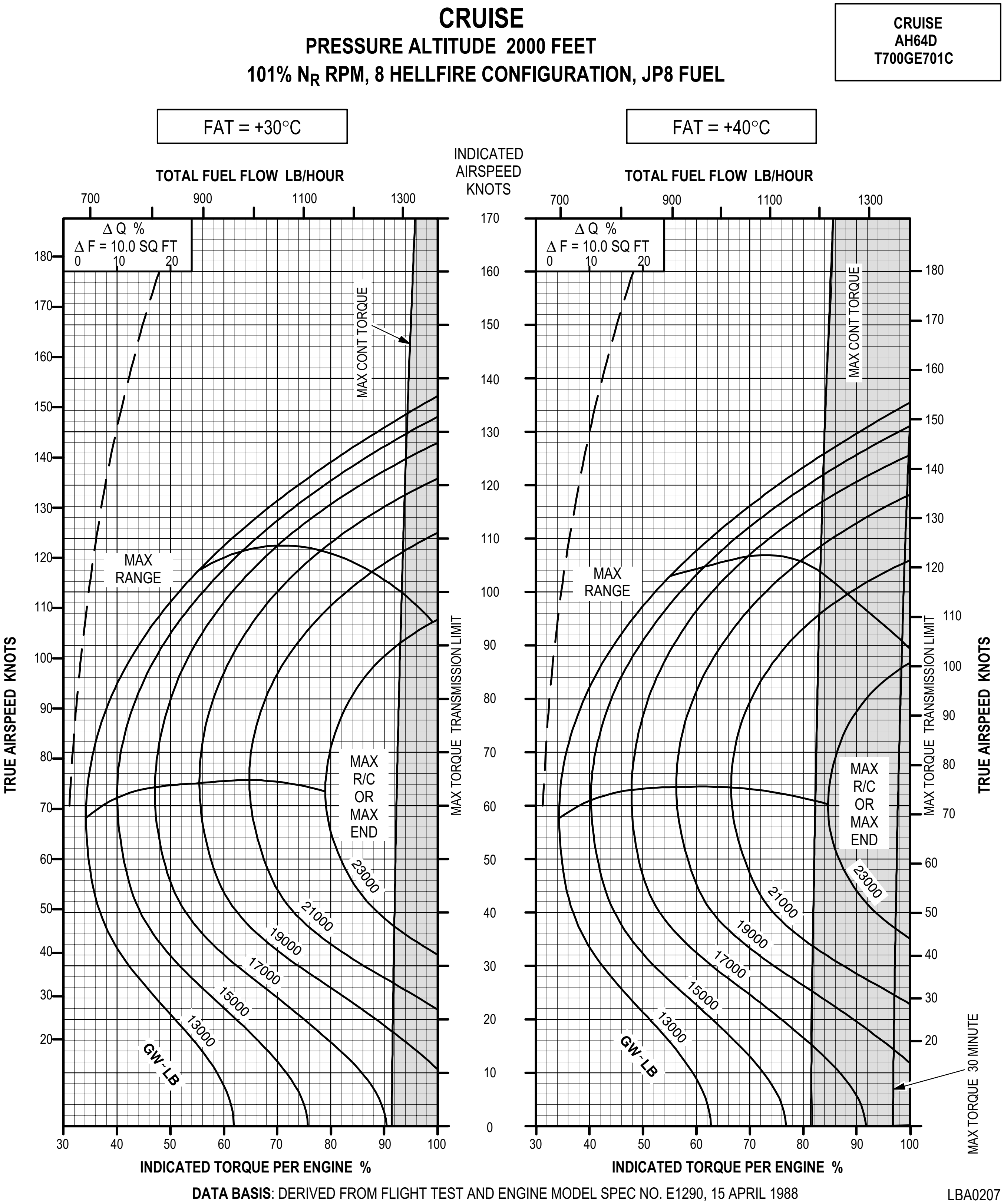


Figure 7A-20. Cruise Chart, 2,000 Feet, +30°C and +40°C (sheet 5 of 6) 701C

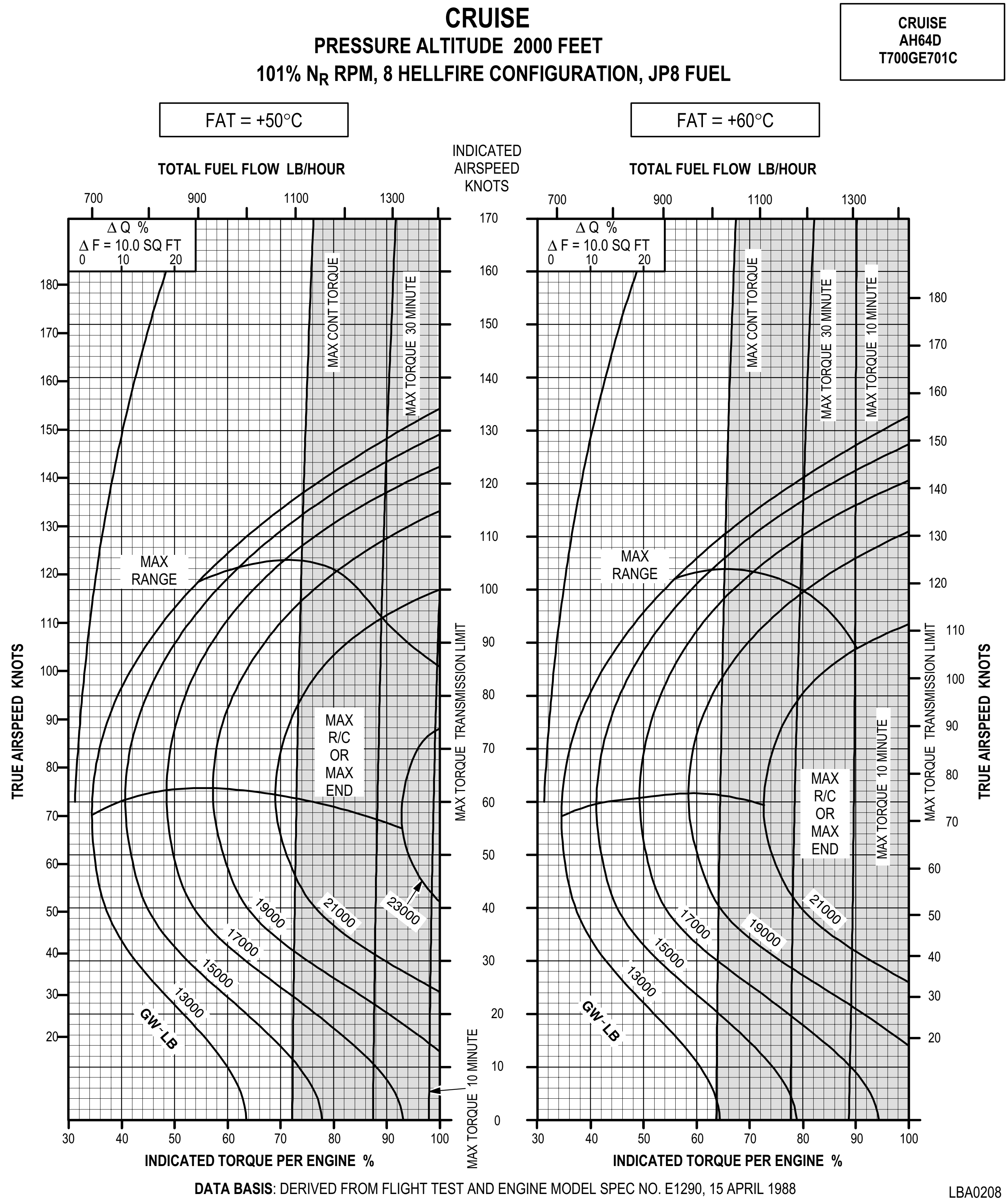


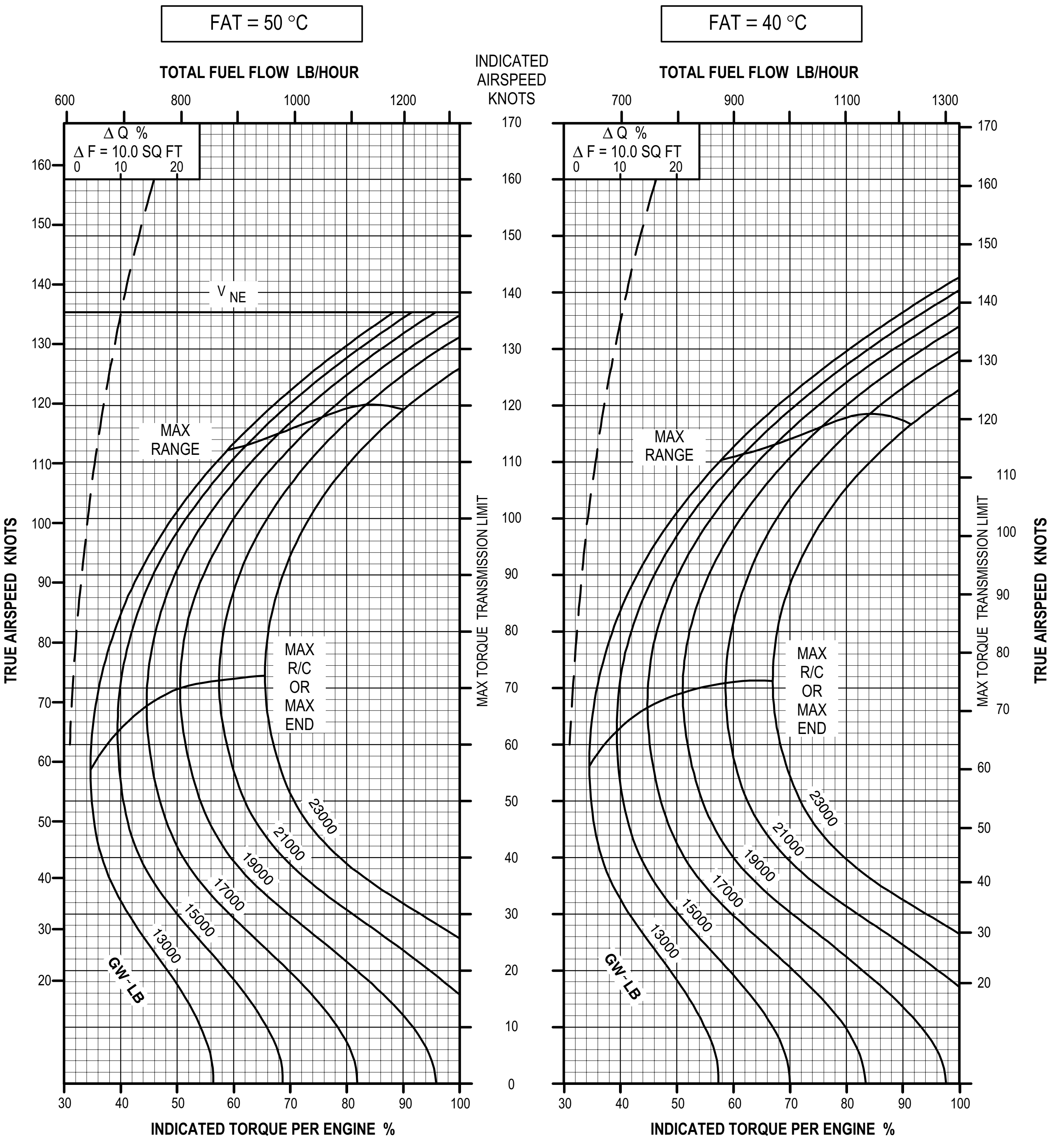
Figure 7A-20. Cruise Chart, 2,000 Feet, +50°C and +60°C (sheet 6 of 6) 701C

CRUISE

PRESSURE ALTITUDE 4000 FEET

101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0243

Figure 7A-21. Cruise Chart, 4,000 Feet, -50°C and -40°C (sheet 1 of 6) 701C

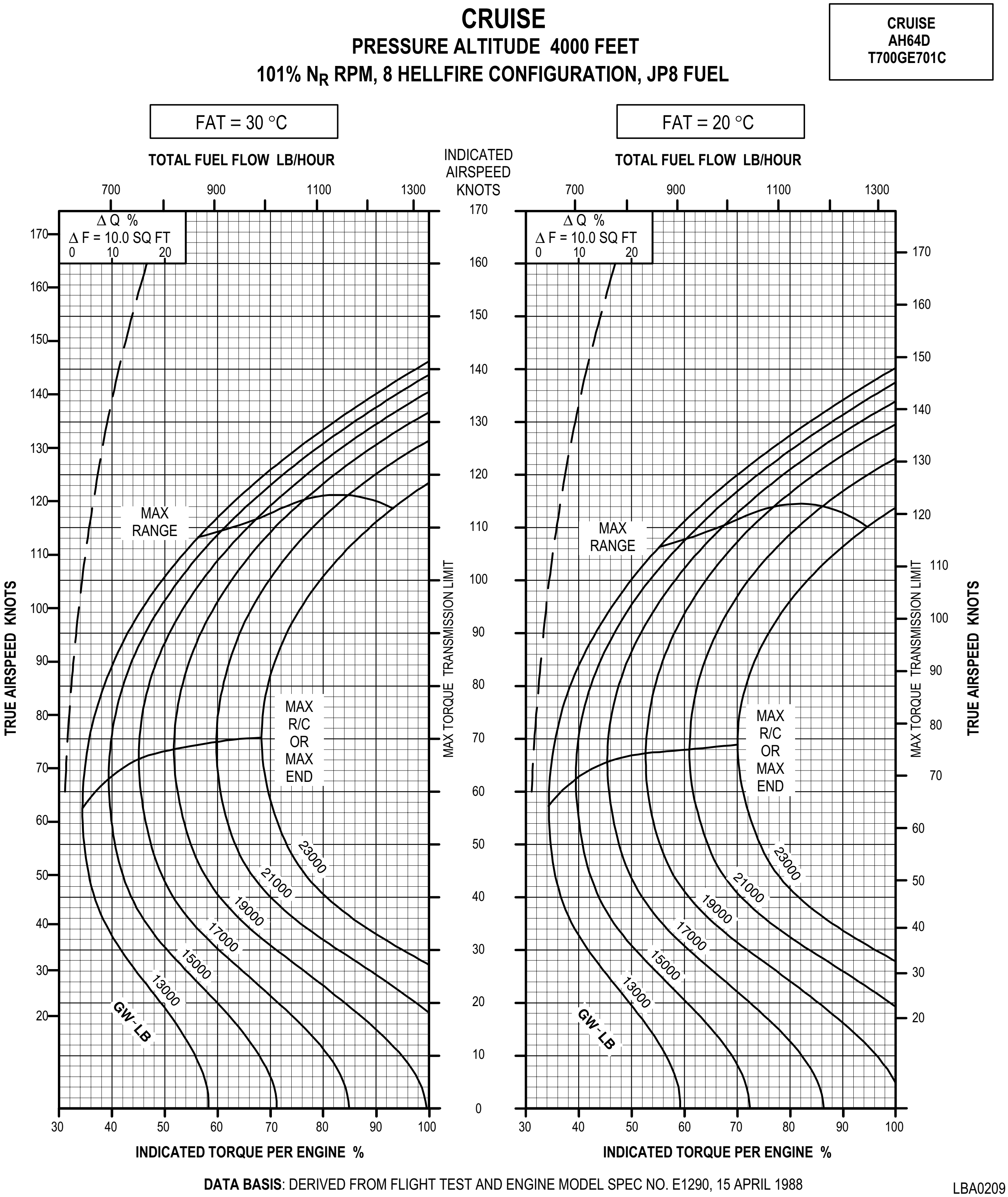
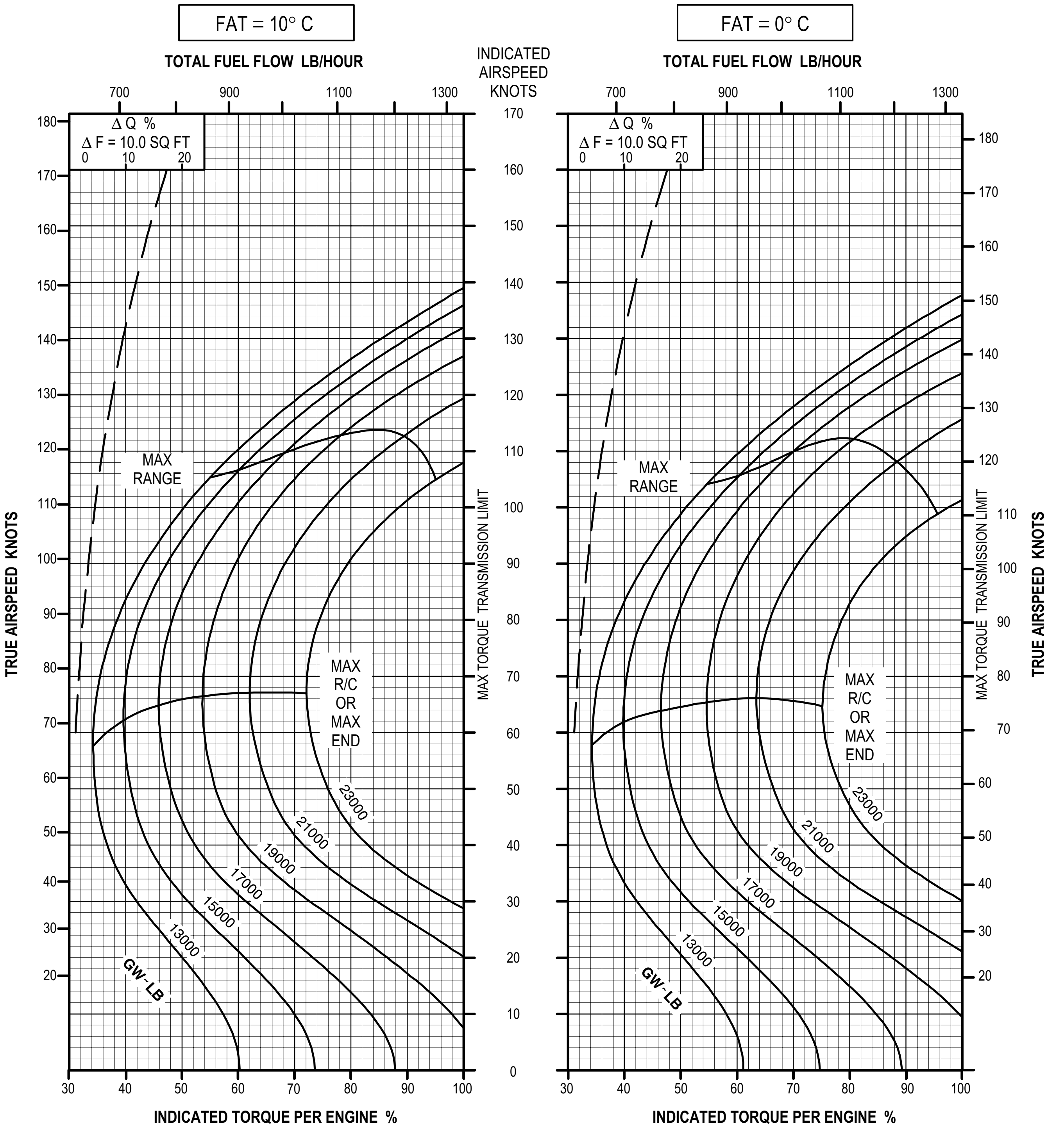


Figure 7A-21. Cruise Chart, 4,000 Feet, -30°C and -20°C (sheet 2 of 6) 701C

CRUISE
PRESSURE ALTITUDE 4000 FEET
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0210

Figure 7A-21. Cruise Chart, 4,000 Feet, -10°C and 0°C (sheet 3 of 6) 701C

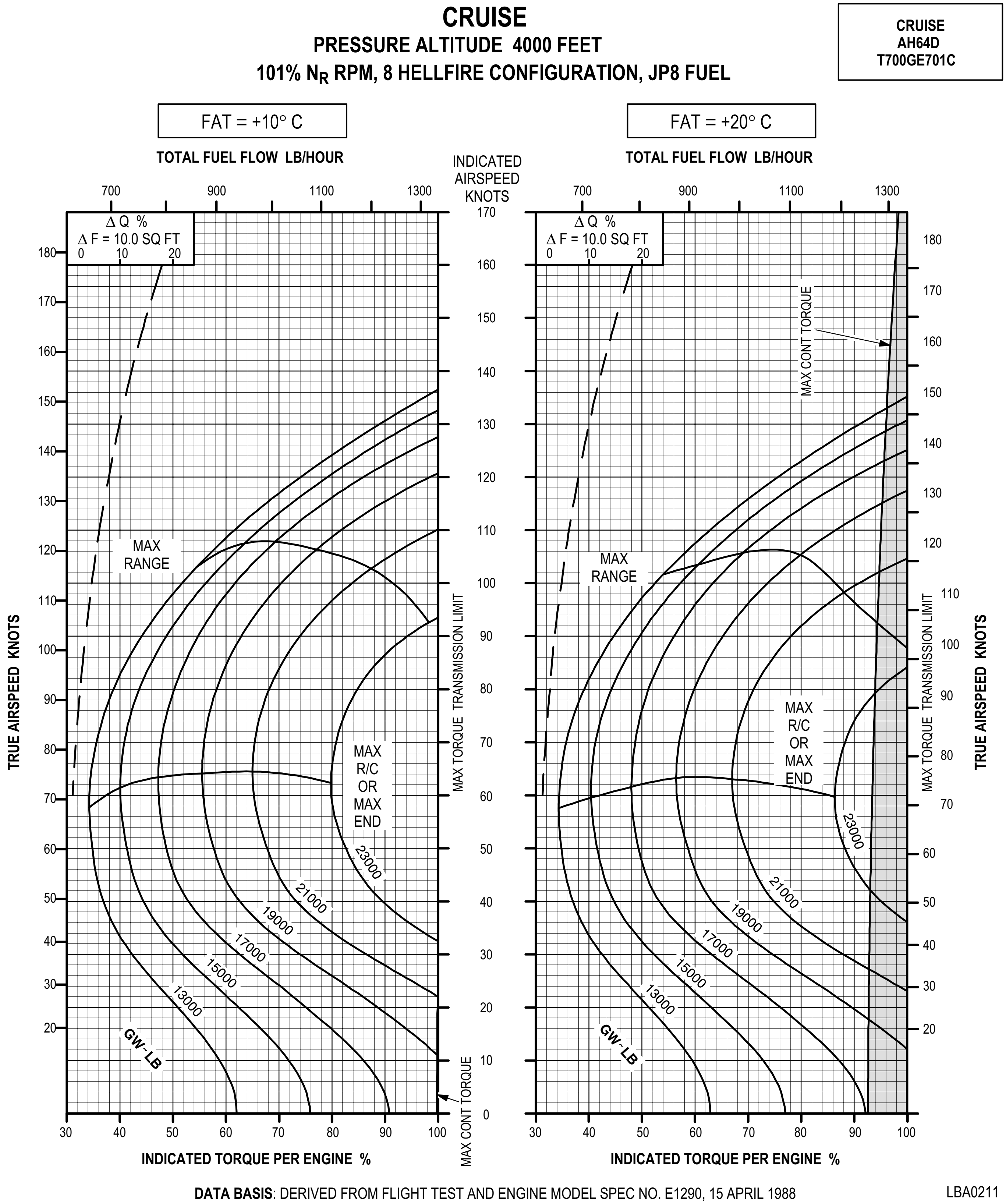


Figure 7A-21. Cruise Chart, 4,000 Feet, +10°C and +20°C (sheet 4 of 6) 701C

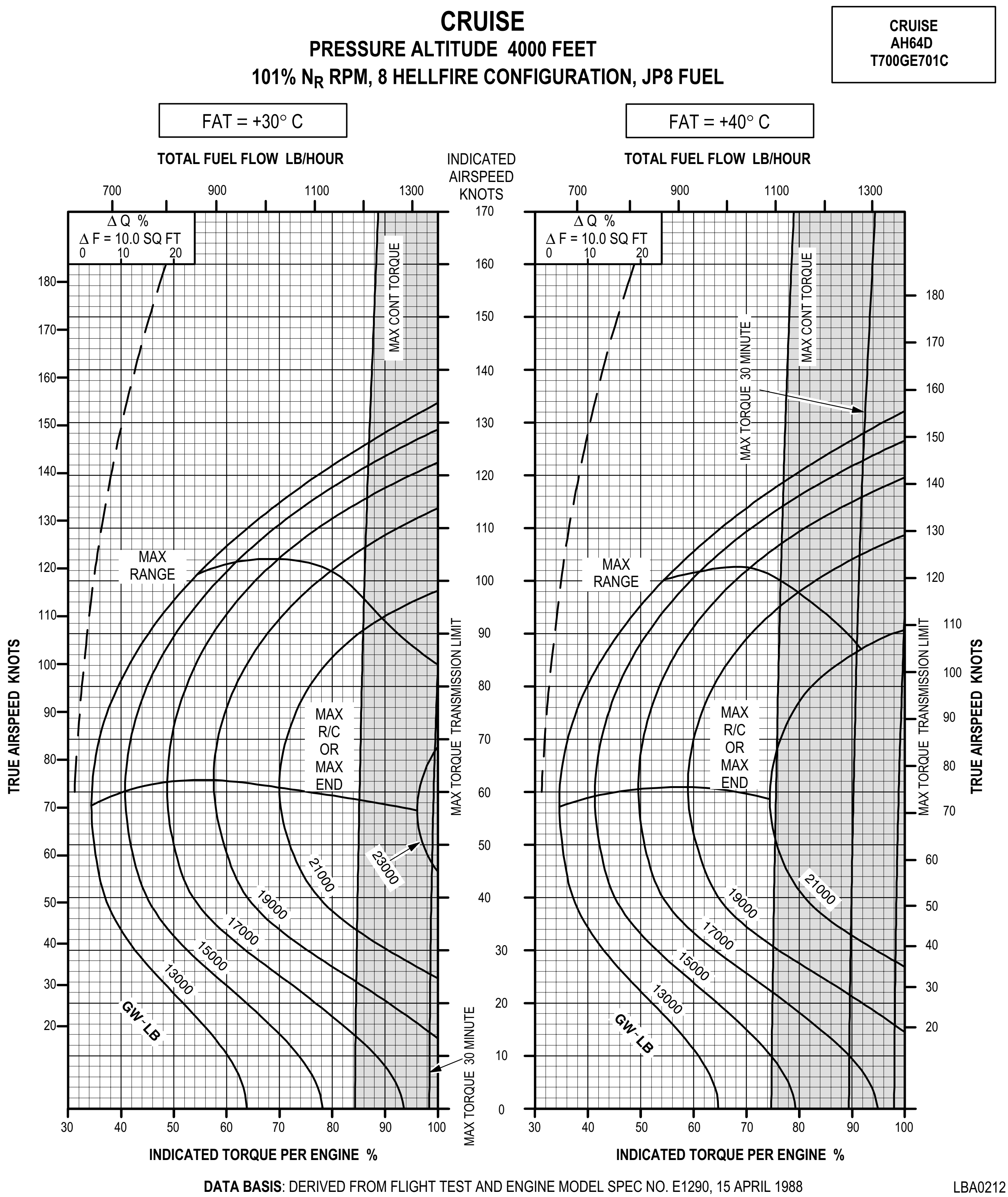


Figure 7A-21. Cruise Chart, 4,000 Feet, +30°C and +40°C (sheet 5 of 6) 701C

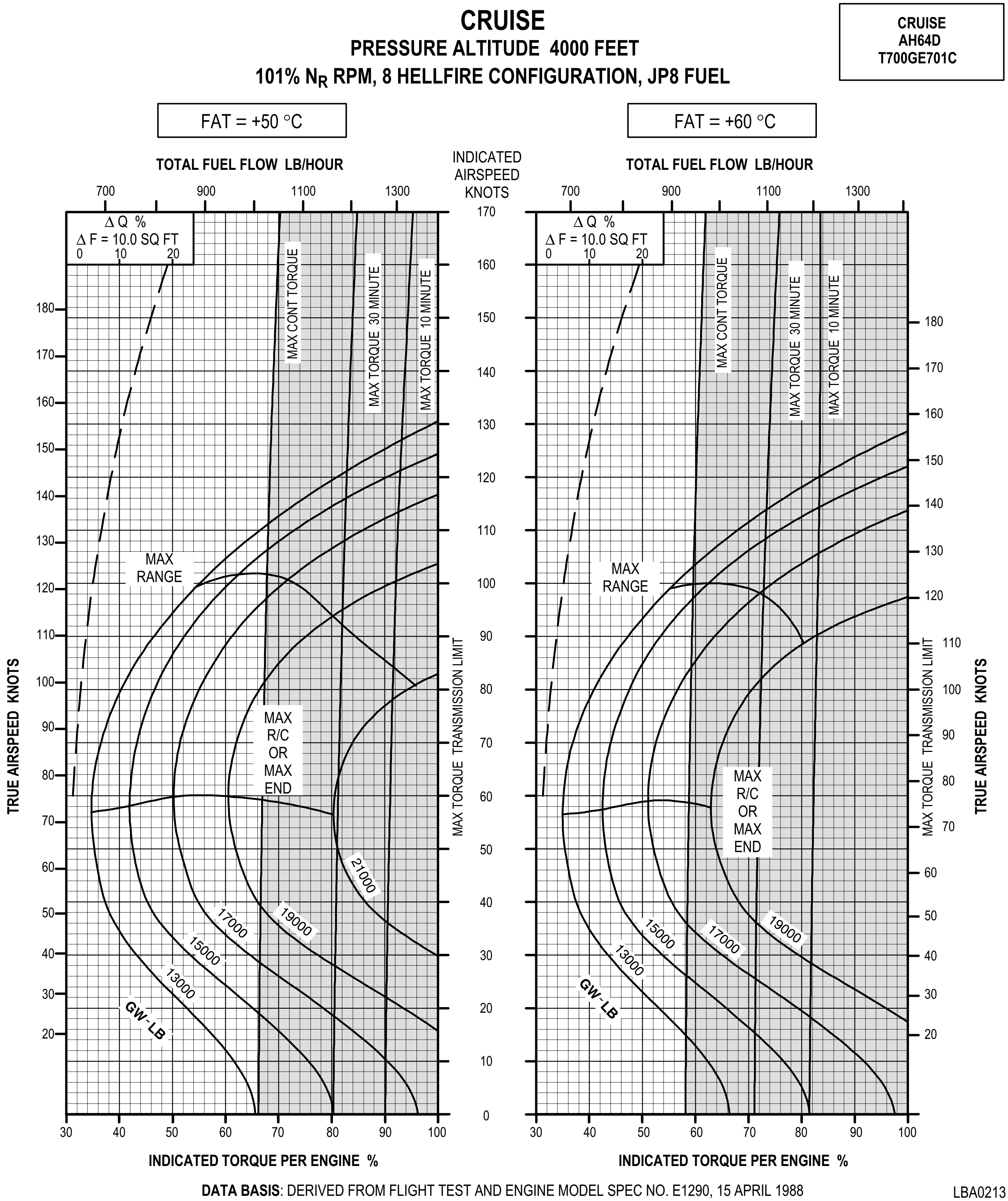


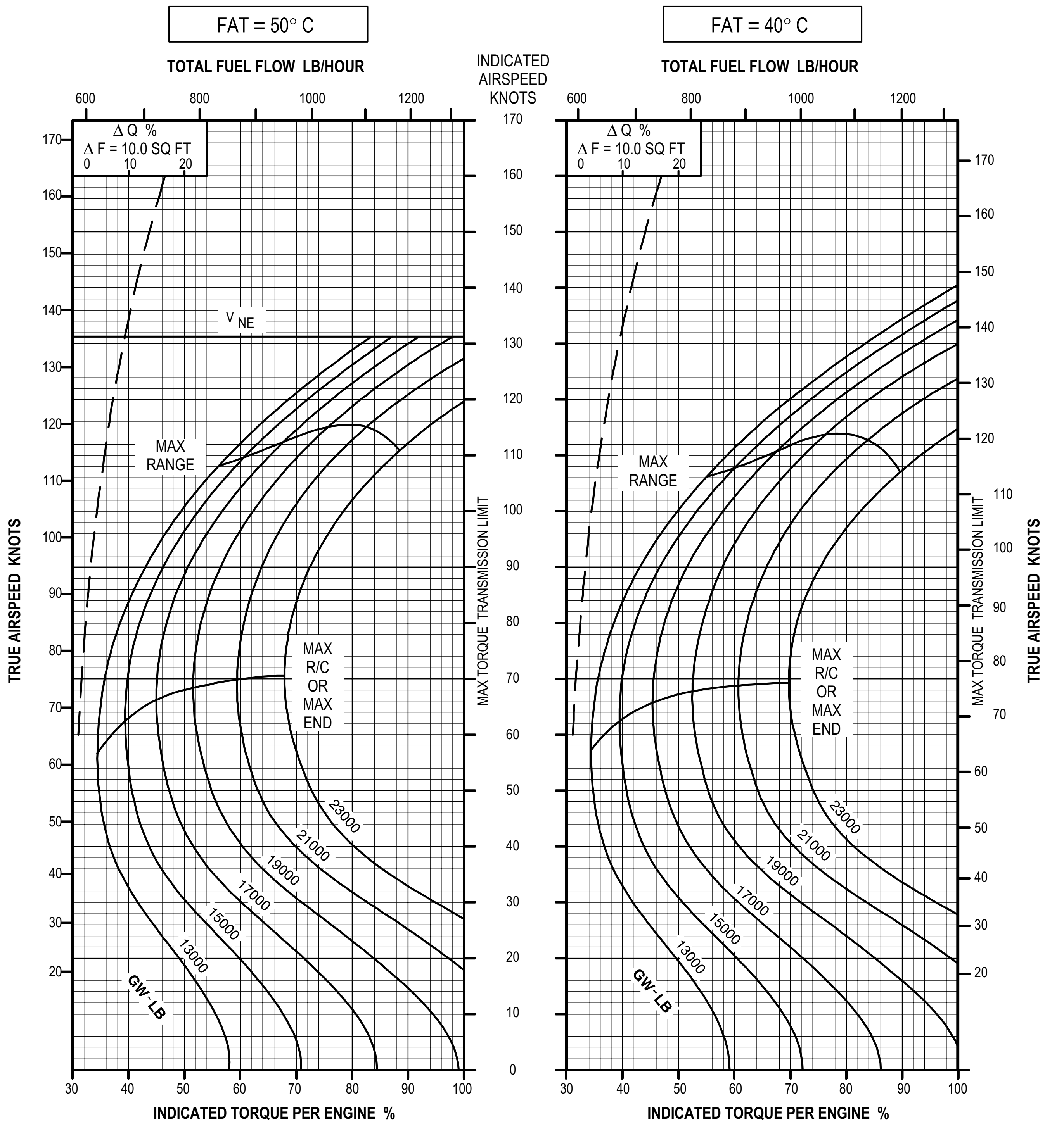
Figure 7A-21. Cruise Chart, 4,000 Feet, +50°C and +60°C (sheet 6 of 6) 701C

CRUISE

PRESSURE ALTITUDE 6000 FEET

101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0214

Figure 7A-22. Cruise Chart, 6,000 Feet, -50°C and -40°C (sheet 1 of 5) 701C

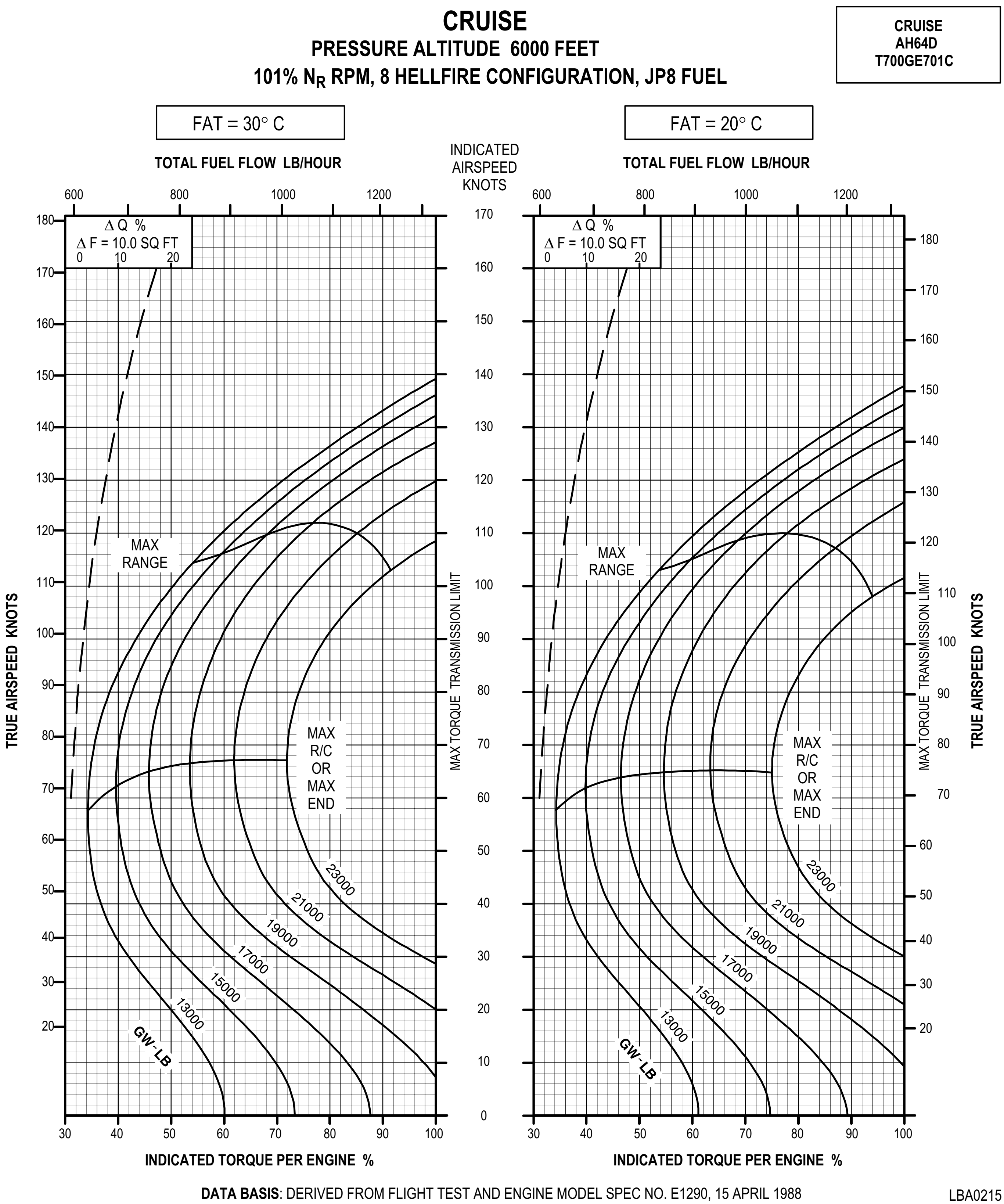


Figure 7A-22. Cruise Chart, 6,000 Feet, -30°C and -20°C (sheet 2 of 5) 701C

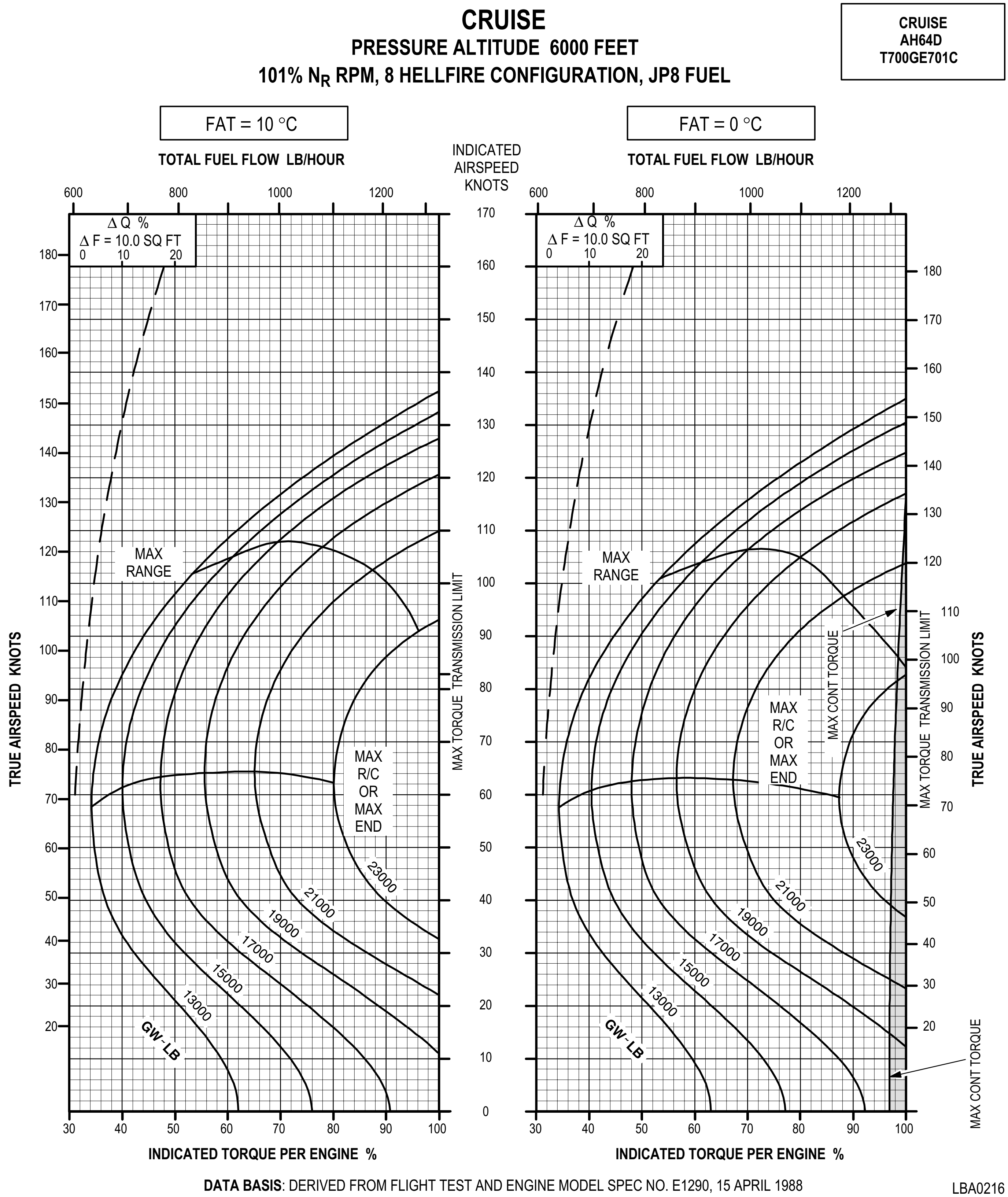


Figure 7A-22. Cruise Chart, 6,000 Feet, -10°C and 0°C (sheet 3 of 5) 701C

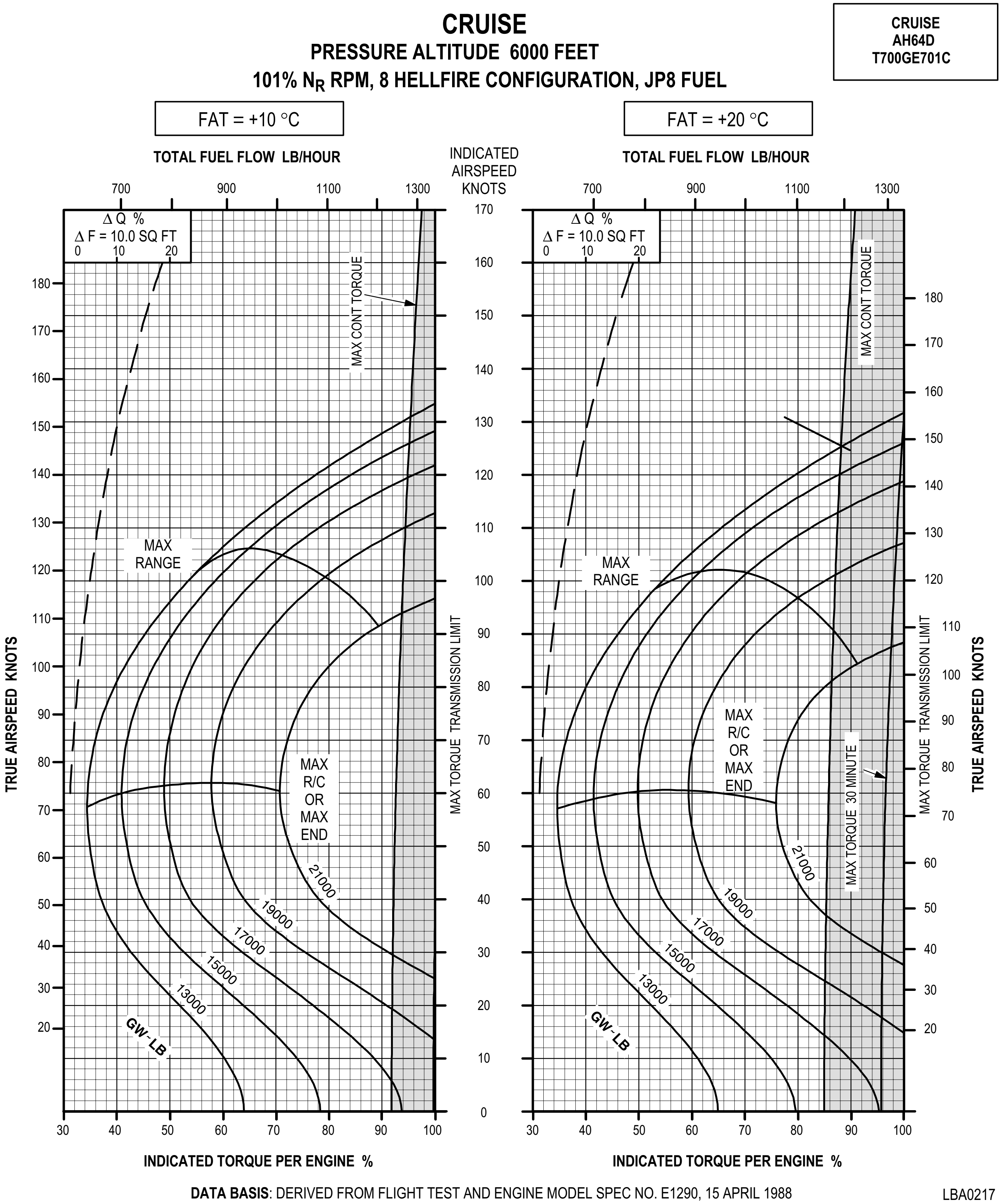


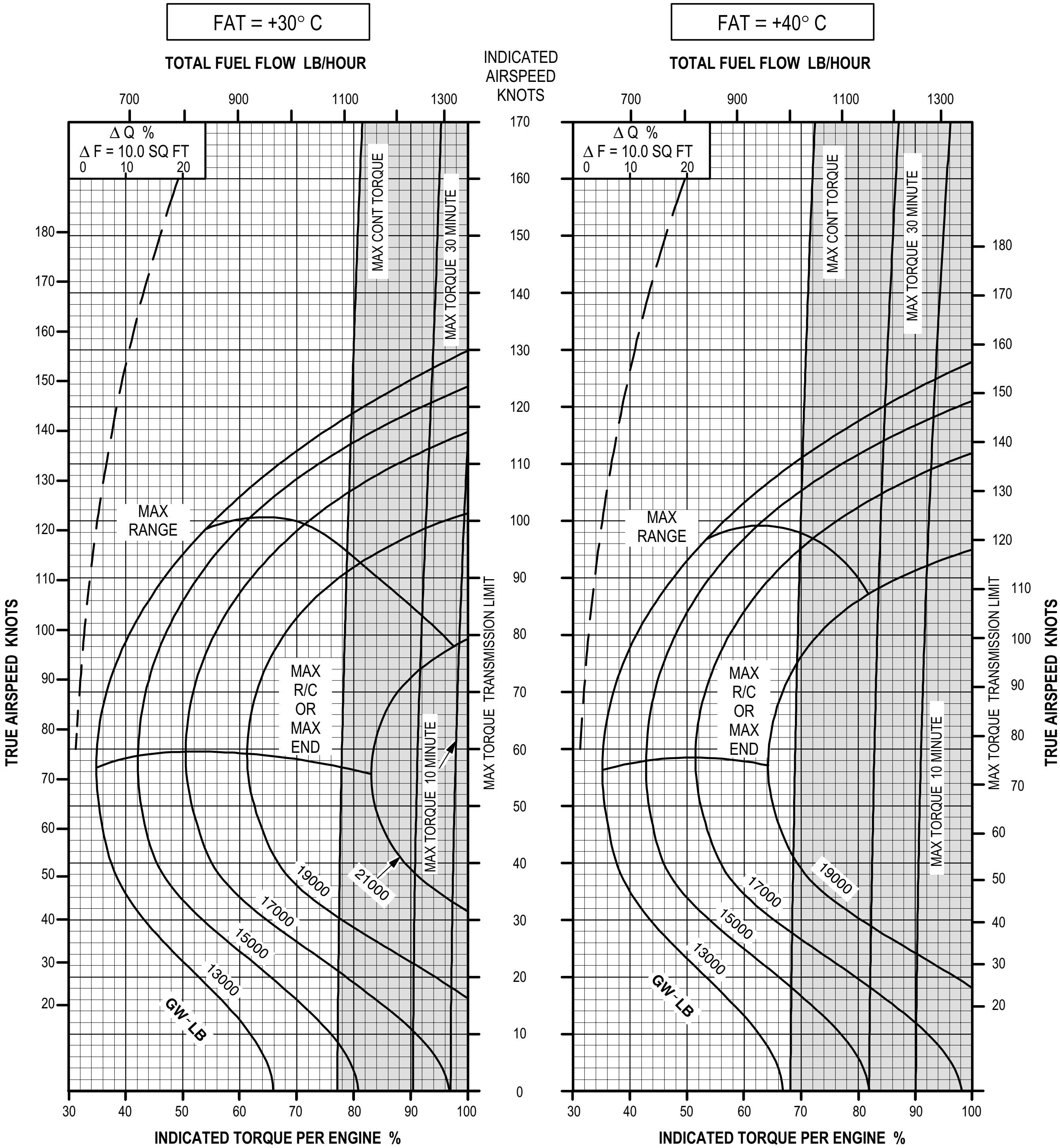
Figure 7A-22. Cruise Chart, 6,000 Feet, +10°C and +20°C (sheet 4 of 5)) 701C

CRUISE

PRESSURE ALTITUDE 6000 FEET

101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



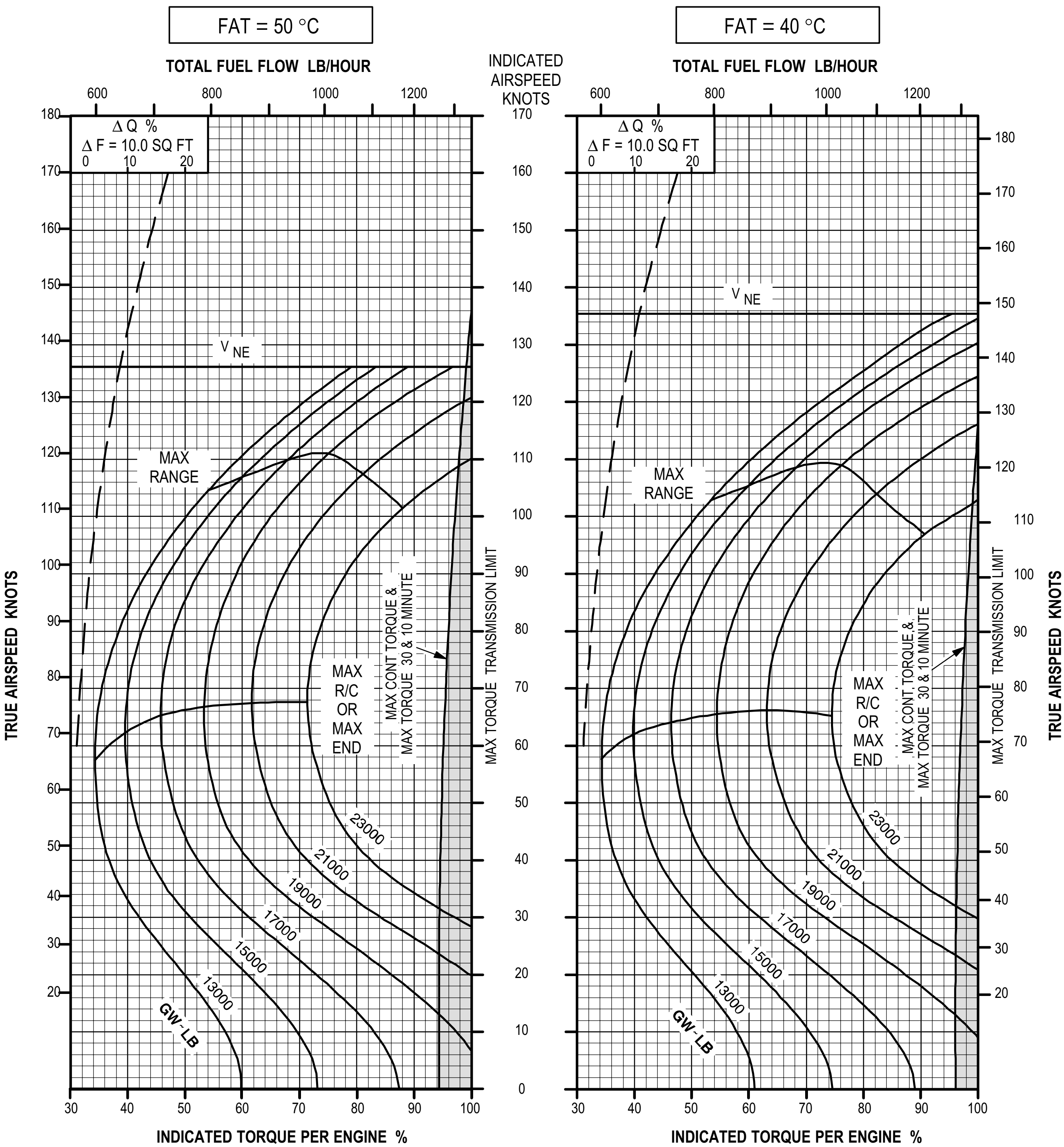
DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0218

Figure 7A-22. Cruise Chart, 6,000 Feet, +30°C and +40°C (sheet 5 of 5) 701C

CRUISE
PRESSURE ALTITUDE 8000 FEET
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0219

Figure 7A-23. Cruise Chart, 8,000 Feet, -50°C and -40°C (sheet 1 of 5) 701C

CRUISE
PRESSURE ALTITUDE 8000 FEET
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

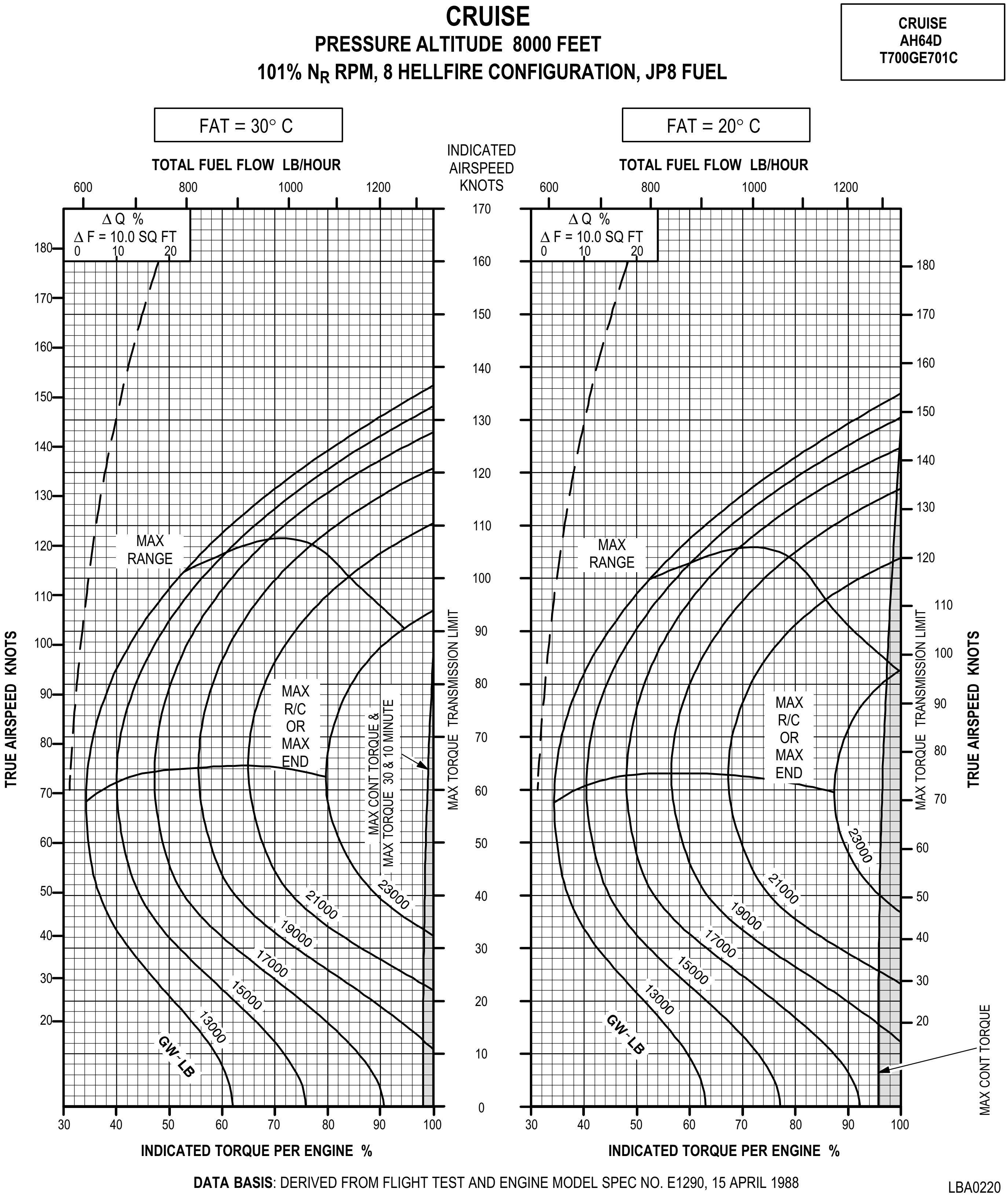


Figure 7A-23. Cruise Chart, 8,000 Feet, -30°C and -20°C (sheet 2 of 5) 701C

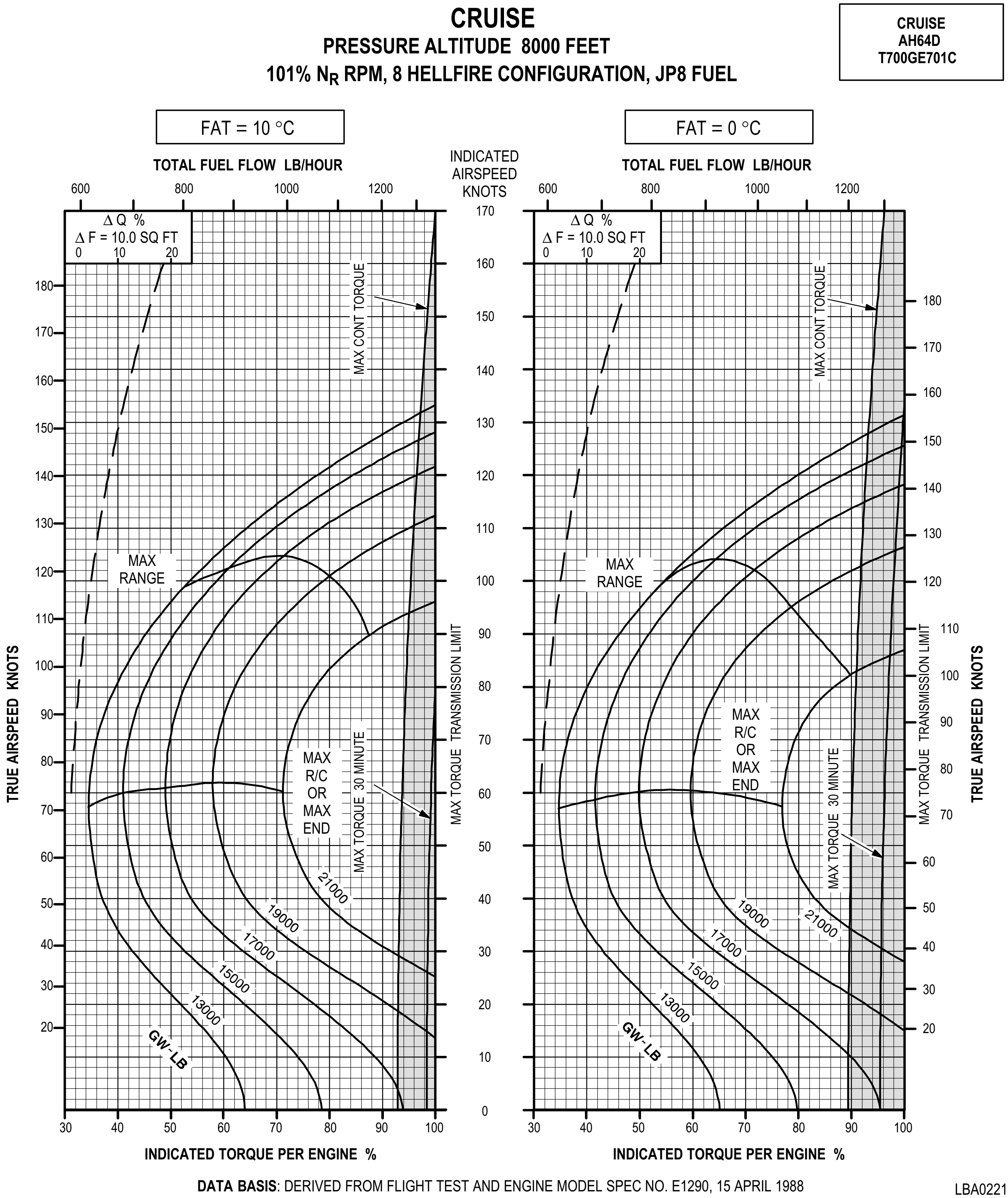


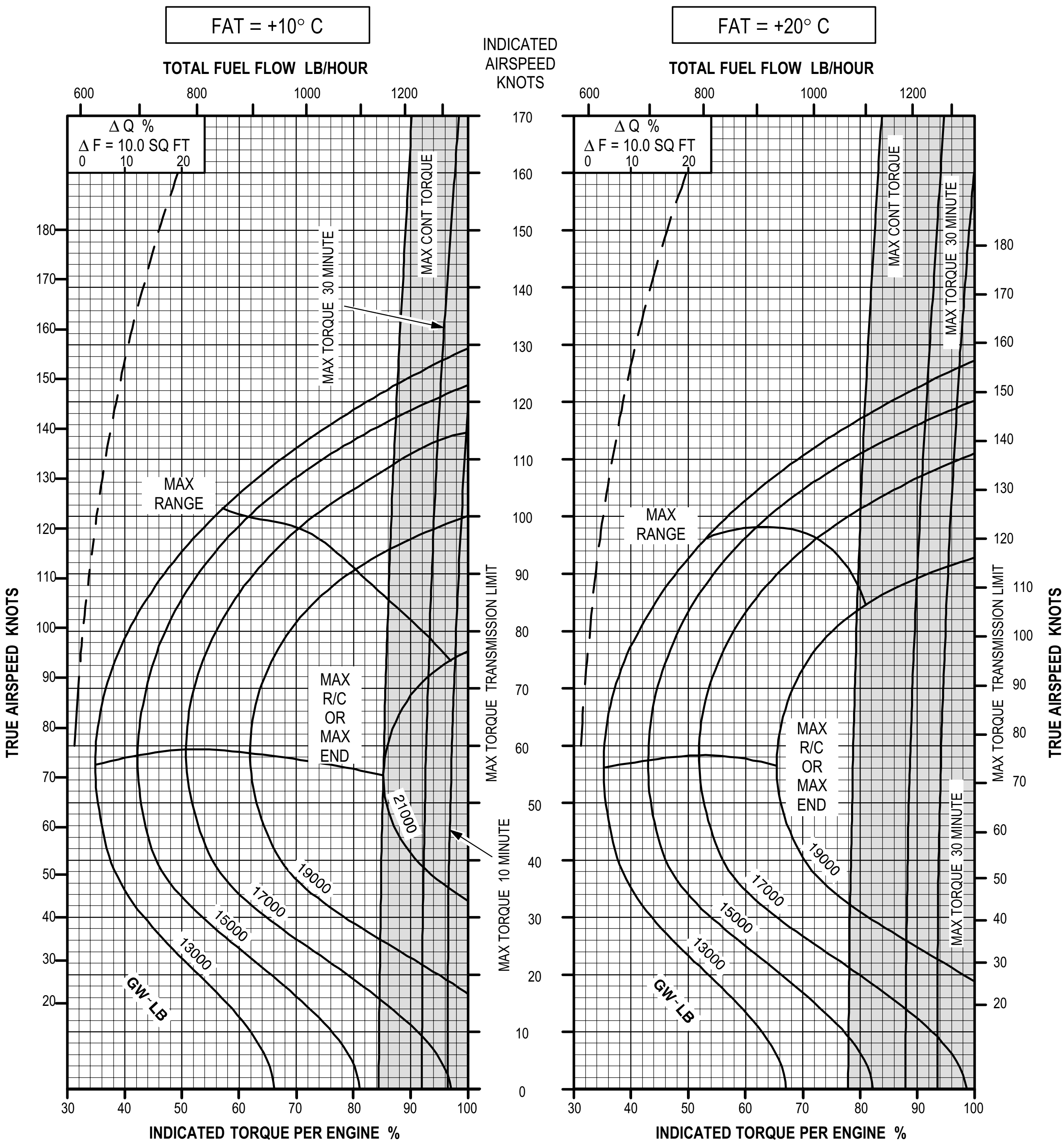
Figure 7A-23. Cruise Chart, 8,000 Feet, -10°C and 0°C (sheet 3 of 5) 701C

CRUISE

PRESSURE ALTITUDE 8000 FEET

101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0222

Figure 7A-23. Cruise Chart, 8,000 Feet, +10°C and +20°C (sheet 4 of 5) 701C

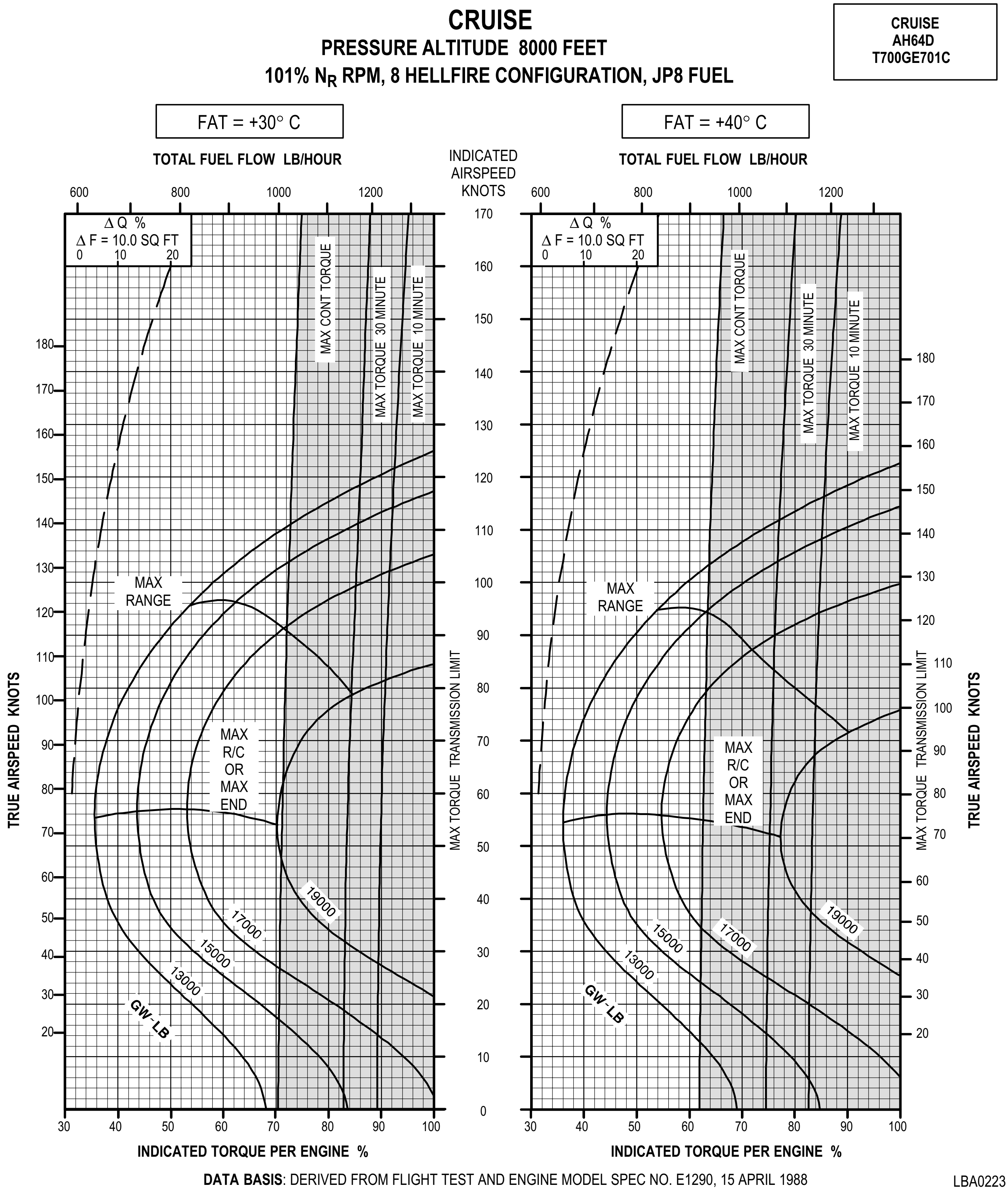


Figure 7A-23. Cruise Chart, 8,000 Feet, +30°C and +40°C (sheet 5 of 5) 701C

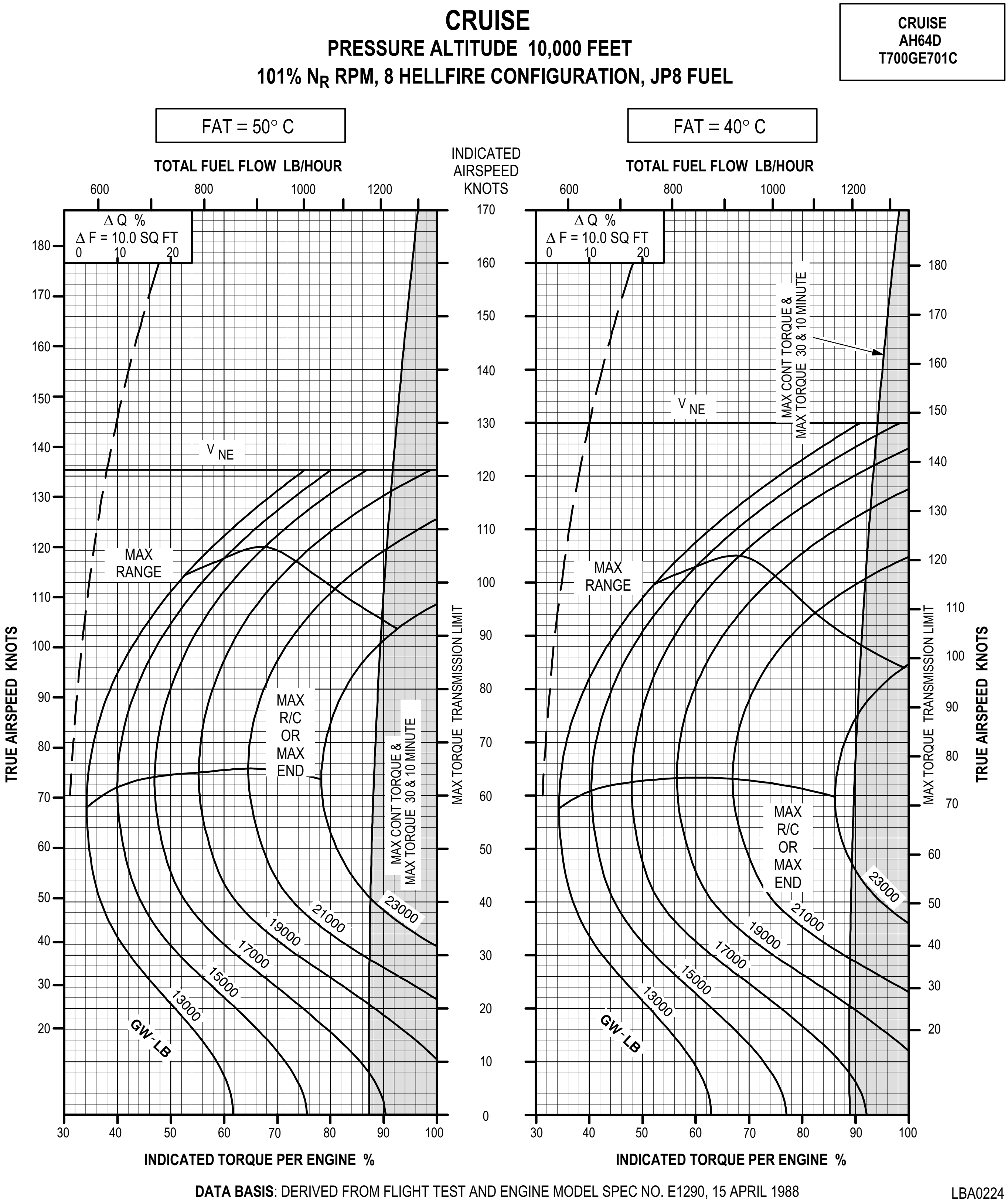


Figure 7A-24. Cruise Chart, 10,000 Feet, -50°C and -40°C (sheet 1 of 5) 701C

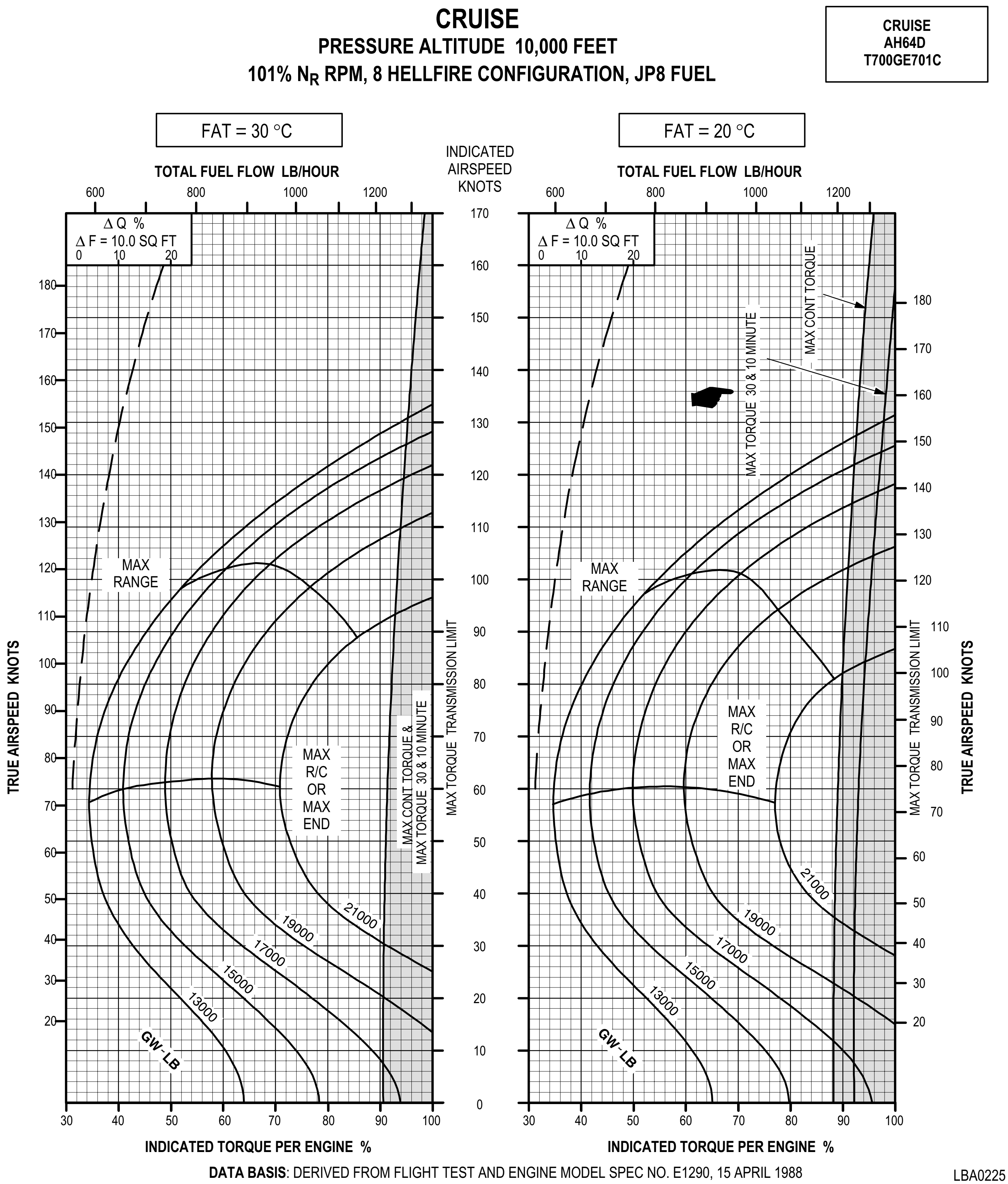
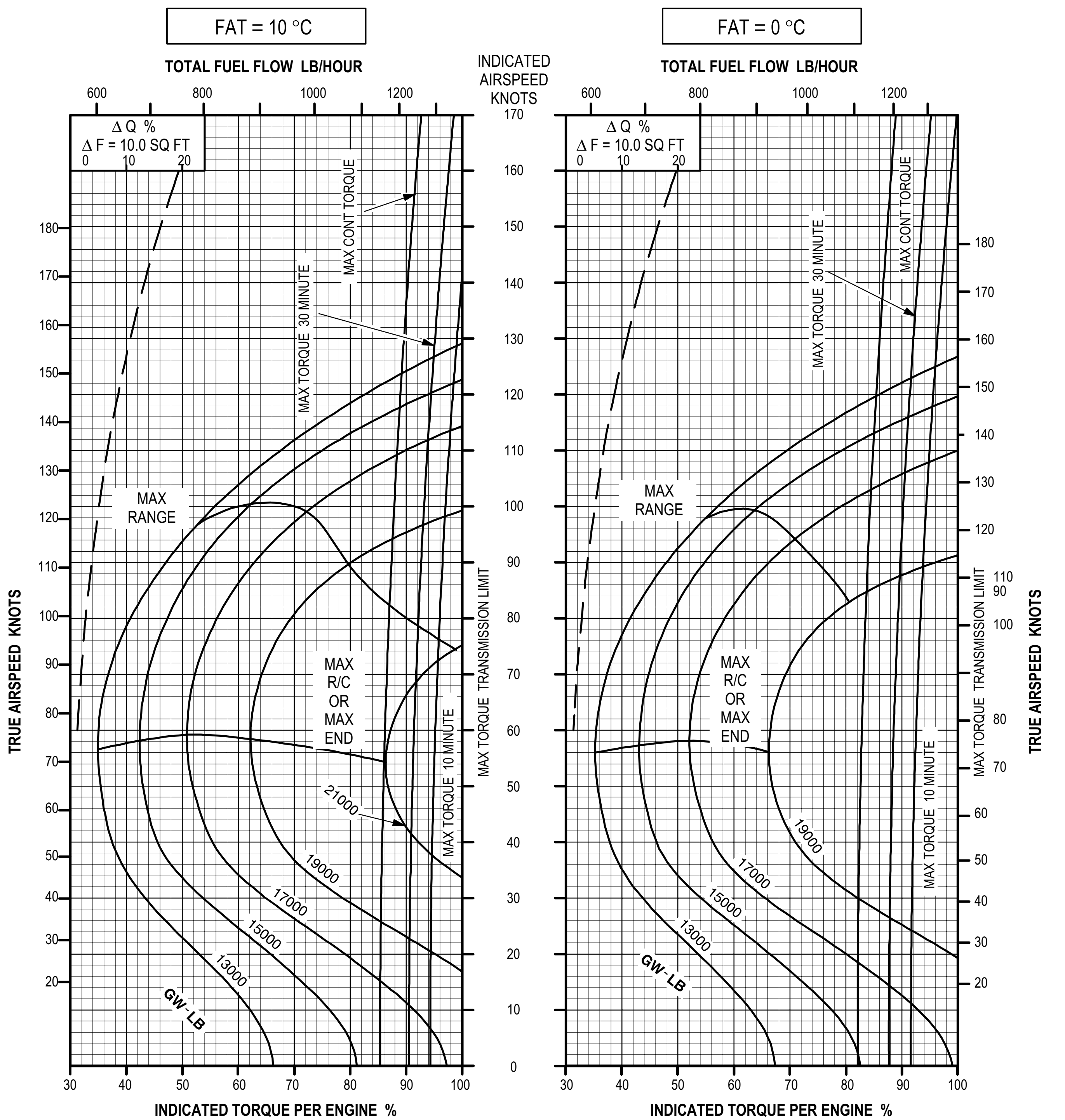


Figure 7A-24. Cruise Chart, 10,000 Feet, -30°C and -20°C (sheet 2 of 5) 701C

CRUISE
AH64D
T700GE701C

CRUISE
PRESSURE ALTITUDE 10,000 FEET
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0226

Figure 7A-24. Cruise Chart, 10,000 Feet, -10°C and 0°C (sheet 3 of 5) 701C

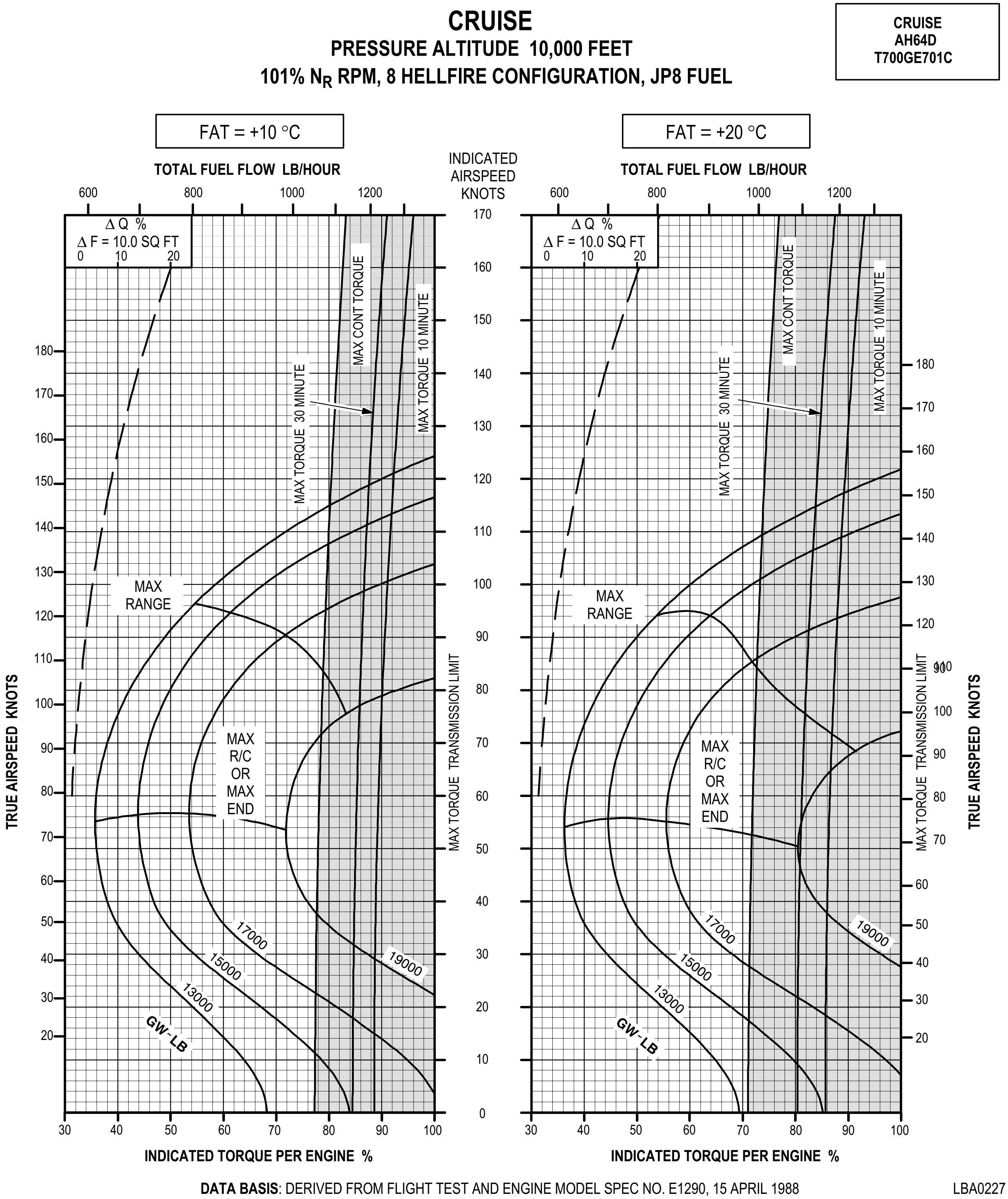


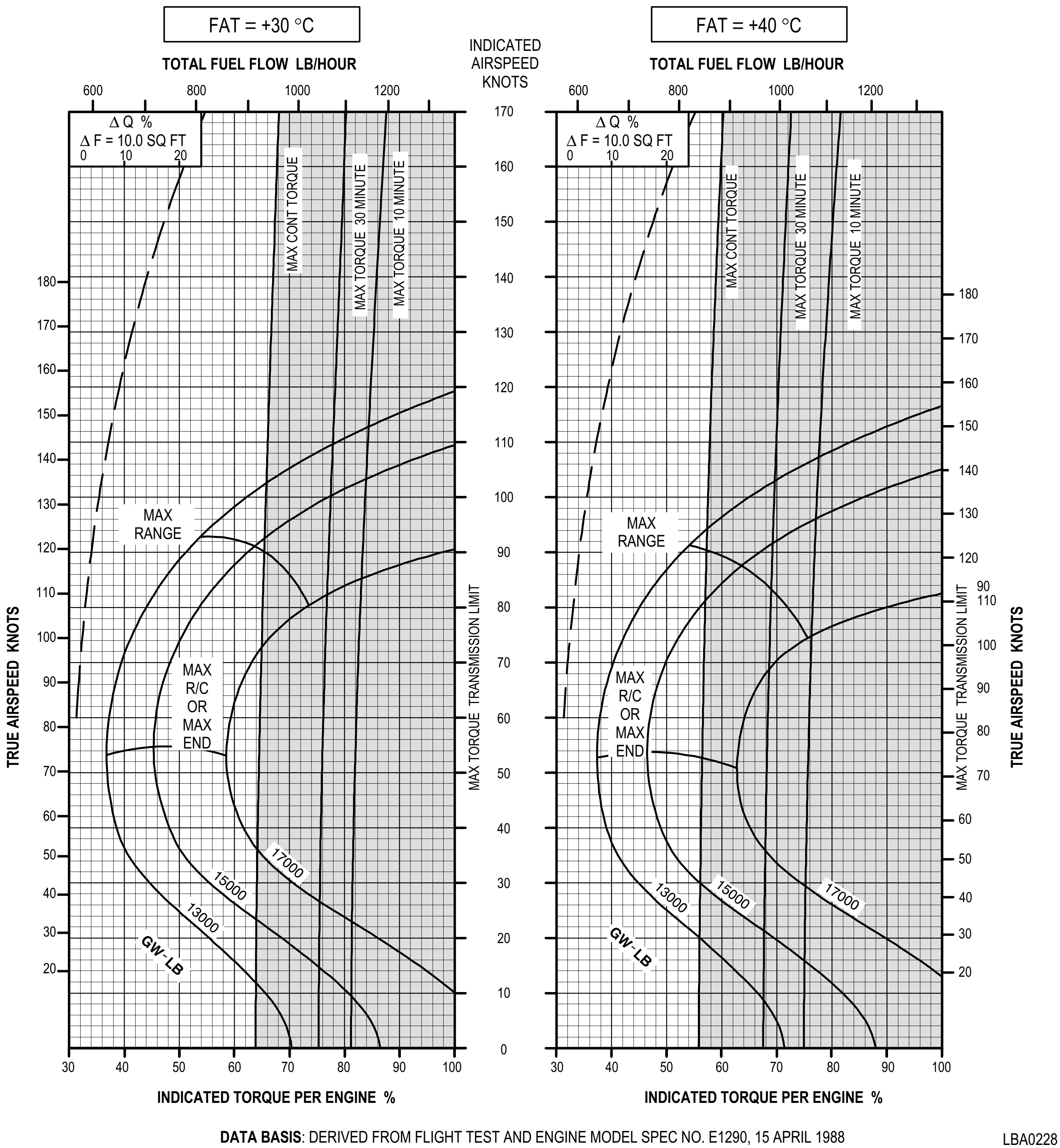
Figure 7A-24. Cruise Chart, 10,000 Feet, +10°C and +20°C (sheet 4 of 5) 701C

CRUISE

PRESSURE ALTITUDE 10,000 FEET

101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

Figure 7A-24. Cruise Chart, 10,000 Feet, +30°C and +40°C (sheet 5 of 5) 701C

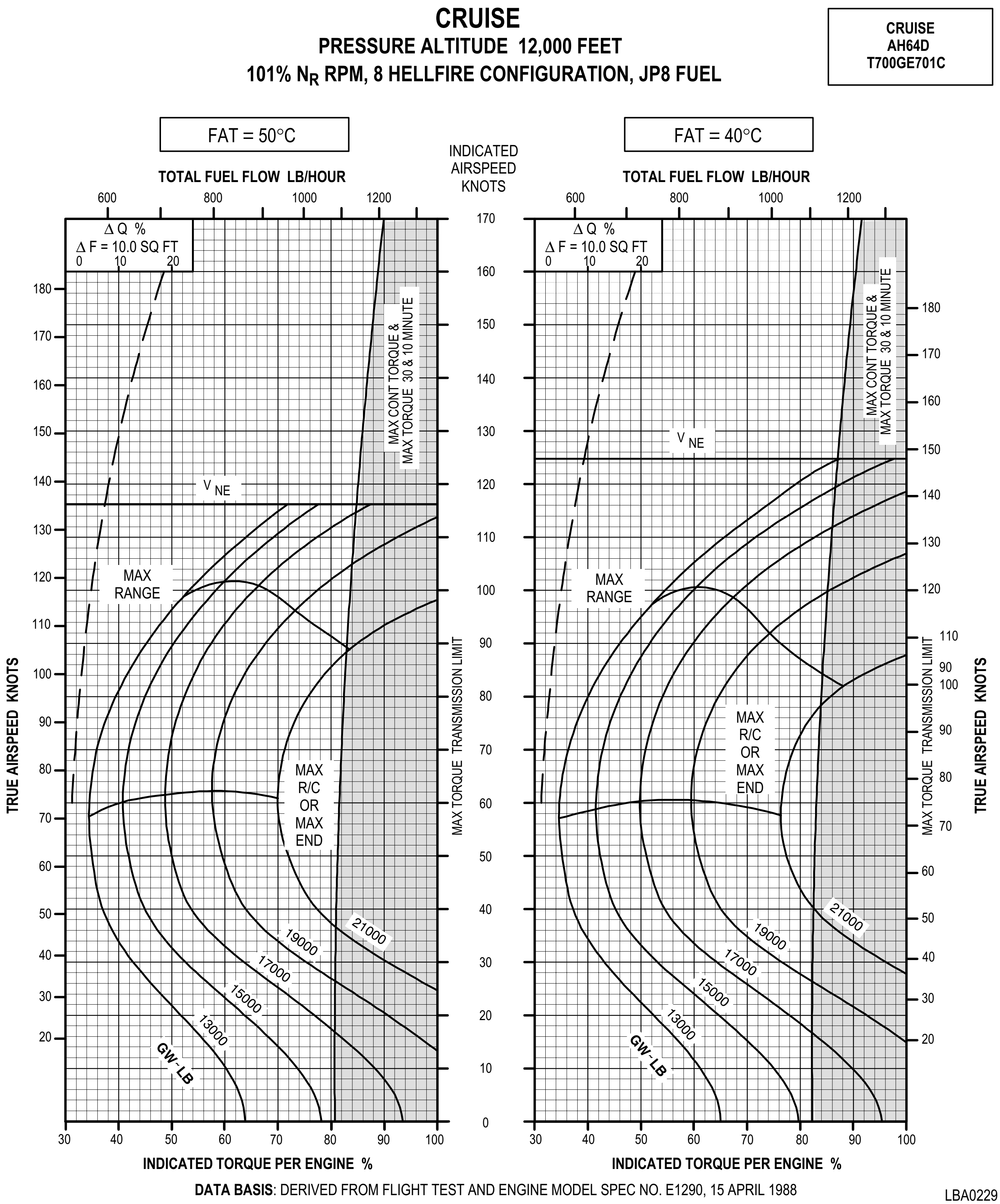


Figure 7A-25. Cruise Chart, 12,000 Feet, -50°C and -40°C (sheet 1 of 5) 701C

CRUISE
PRESSURE ALTITUDE 12,000 FEET
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C

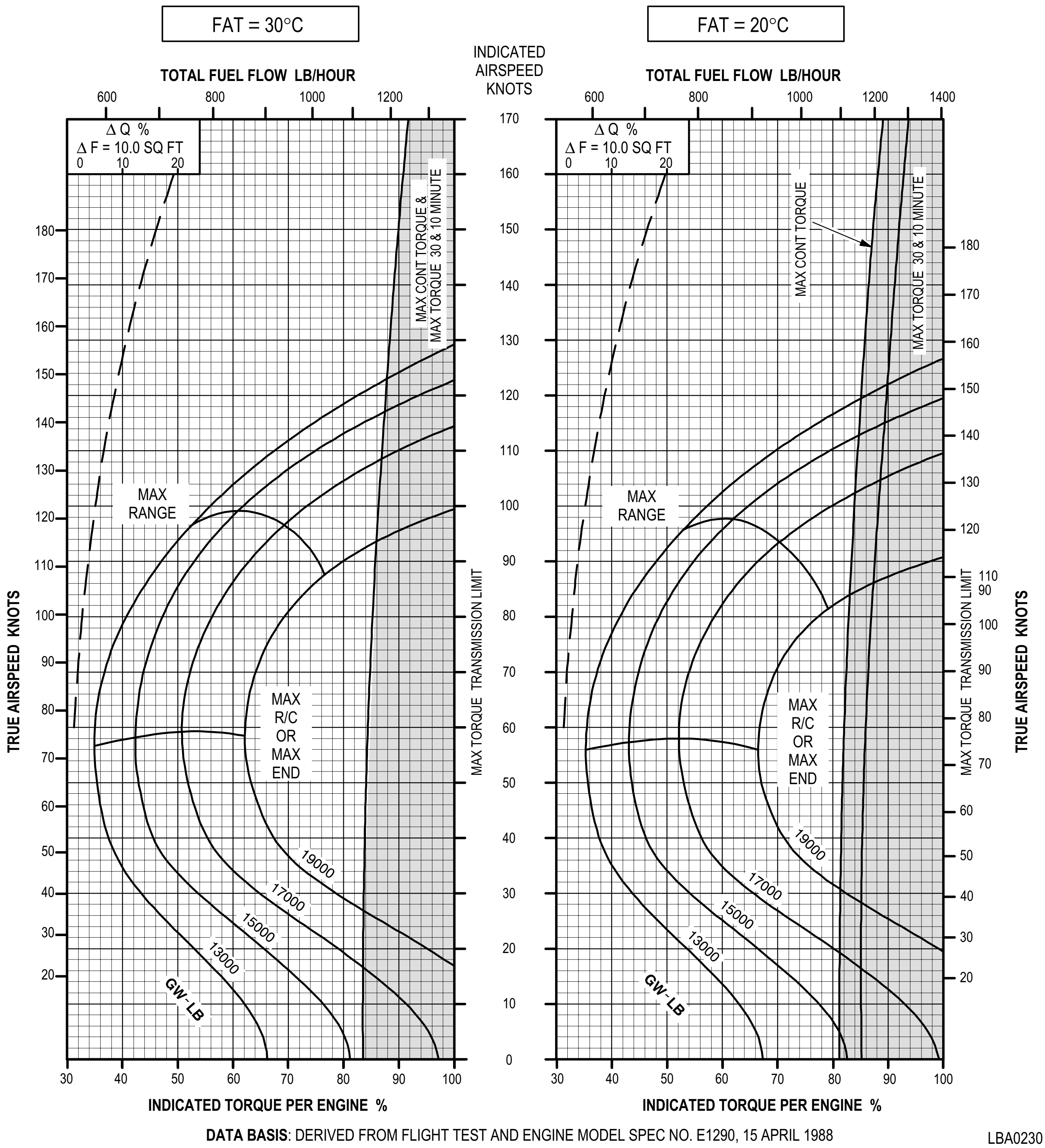


Figure 7A-25. Cruise Chart, 12,000 Feet, -30°C and -20°C (sheet 2 of 5) 701C

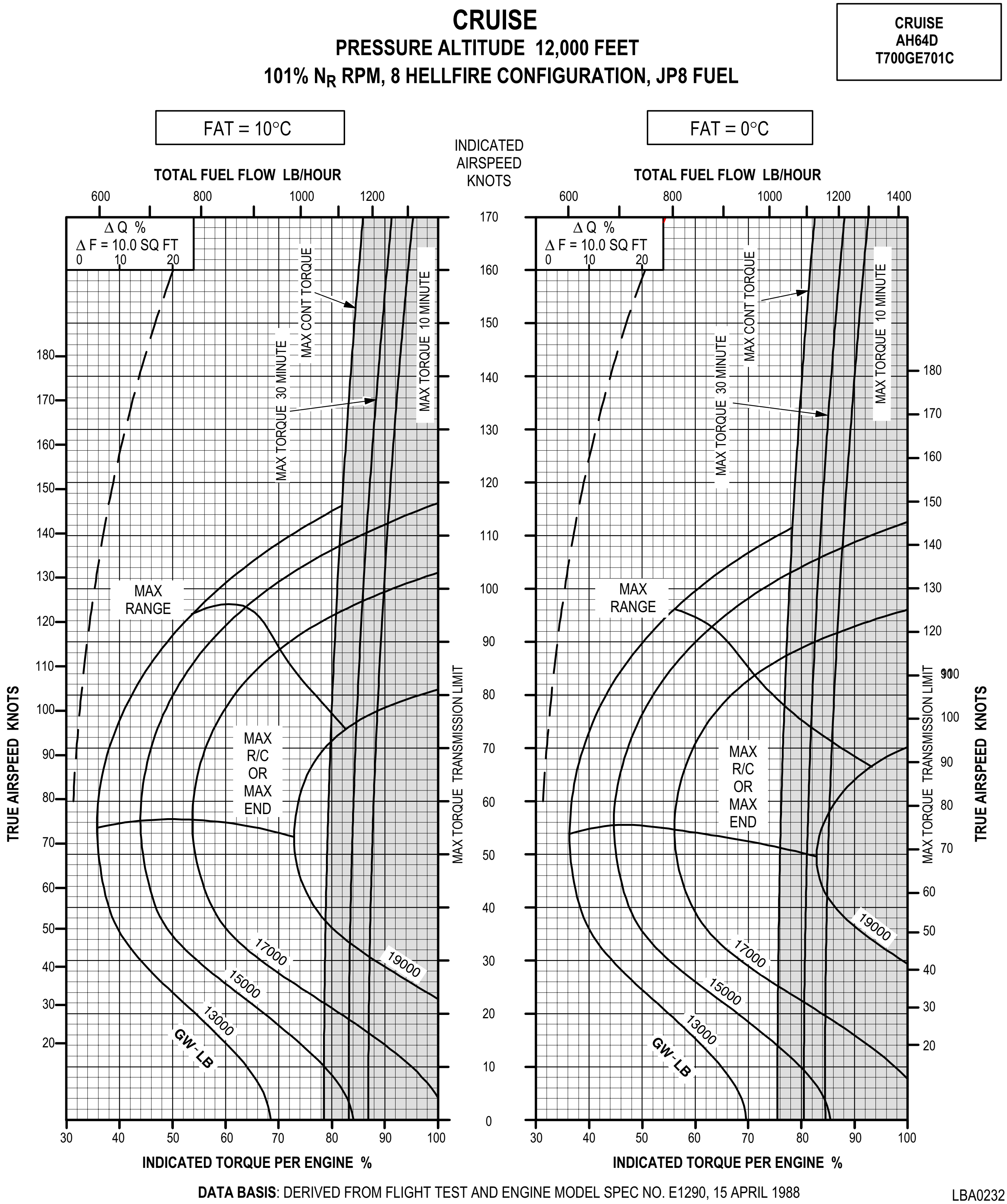


Figure 7A-25. Cruise Chart, 12,000 Feet, -10°C and 0°C (sheet 3 of 5) 701C

CRUISE
PRESSURE ALTITUDE 12,000 FEET
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

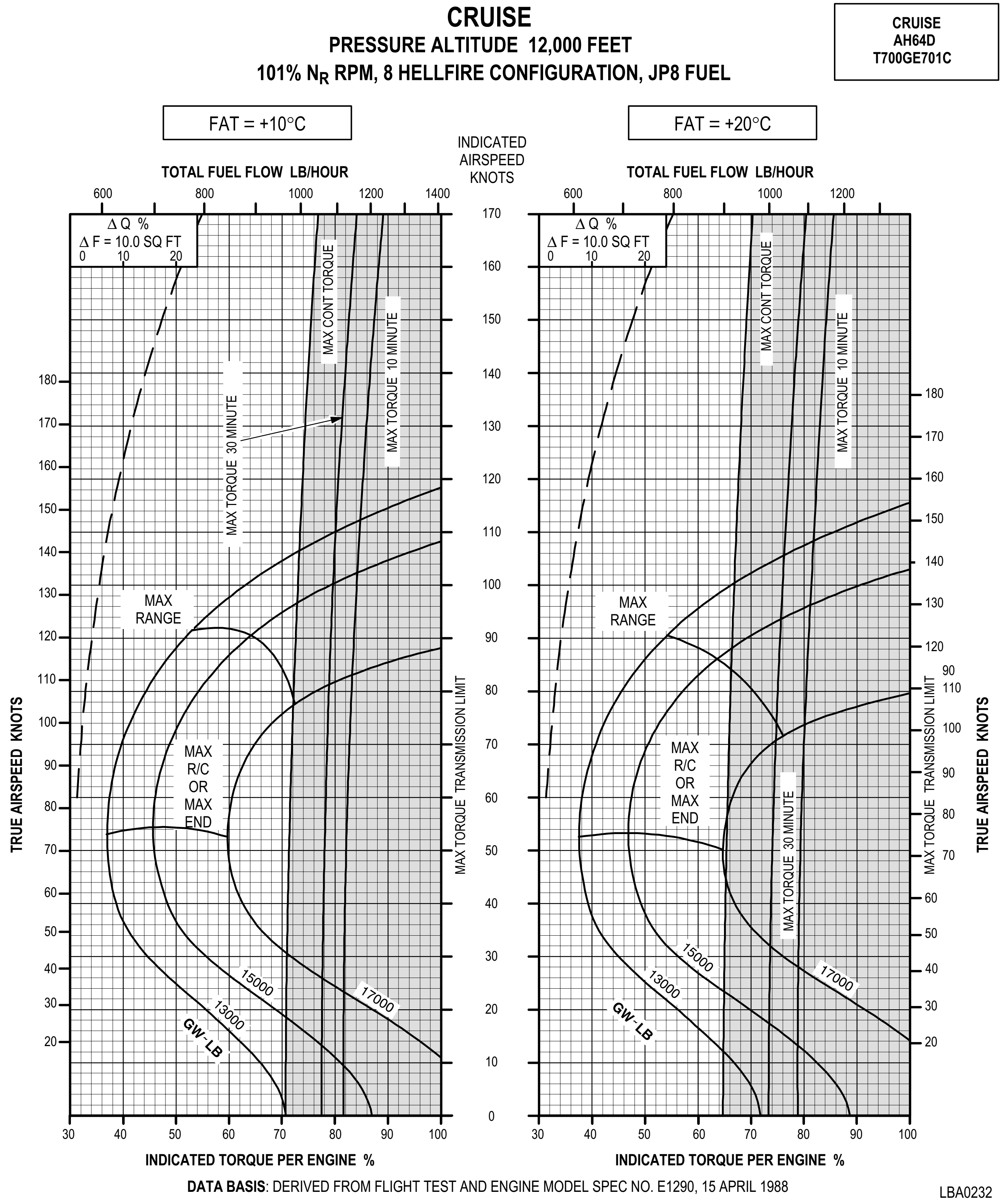
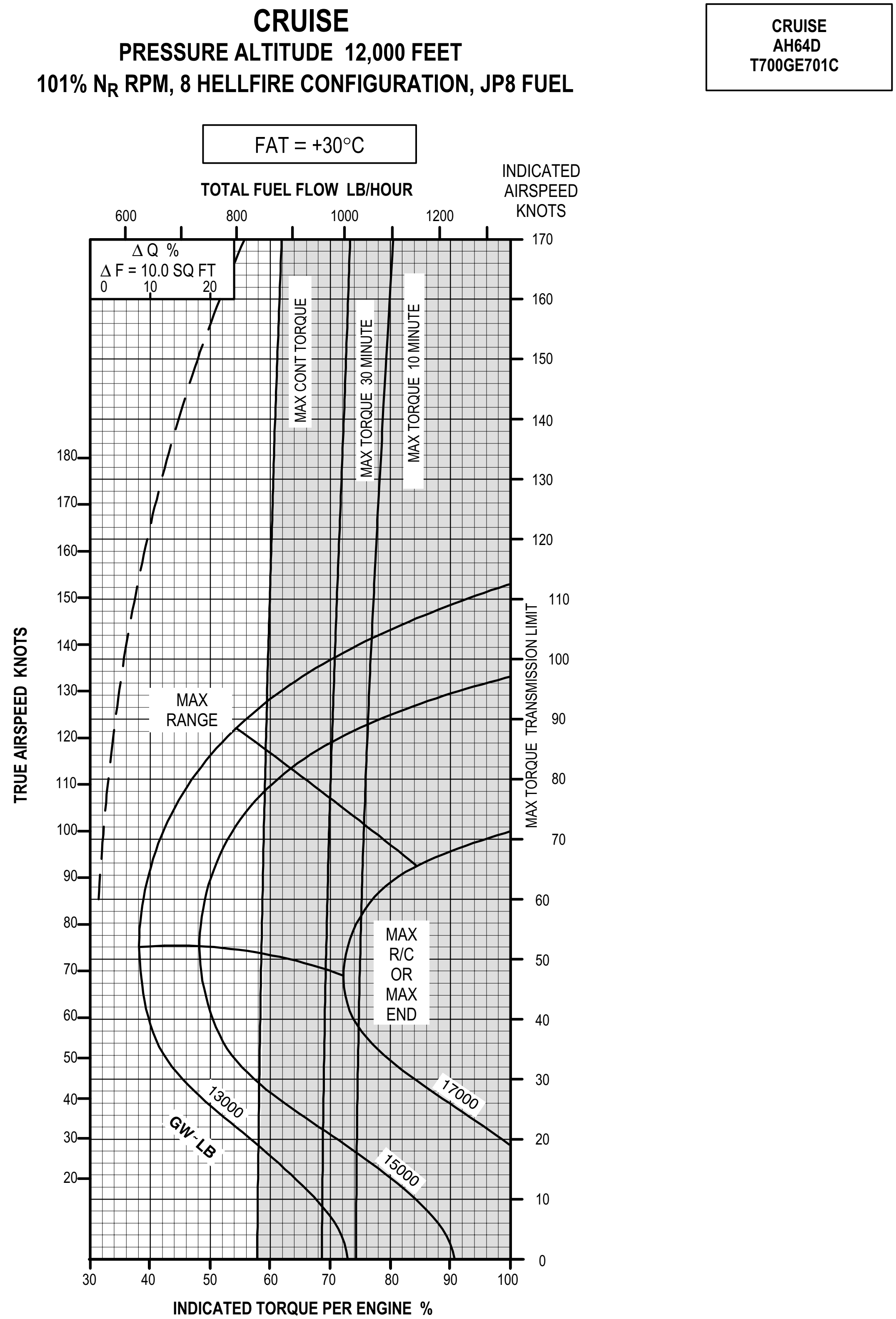


Figure 7A-25. Cruise Chart, 12,000 Feet, +10°C and +20°C (sheet 4 of 5) 701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0233

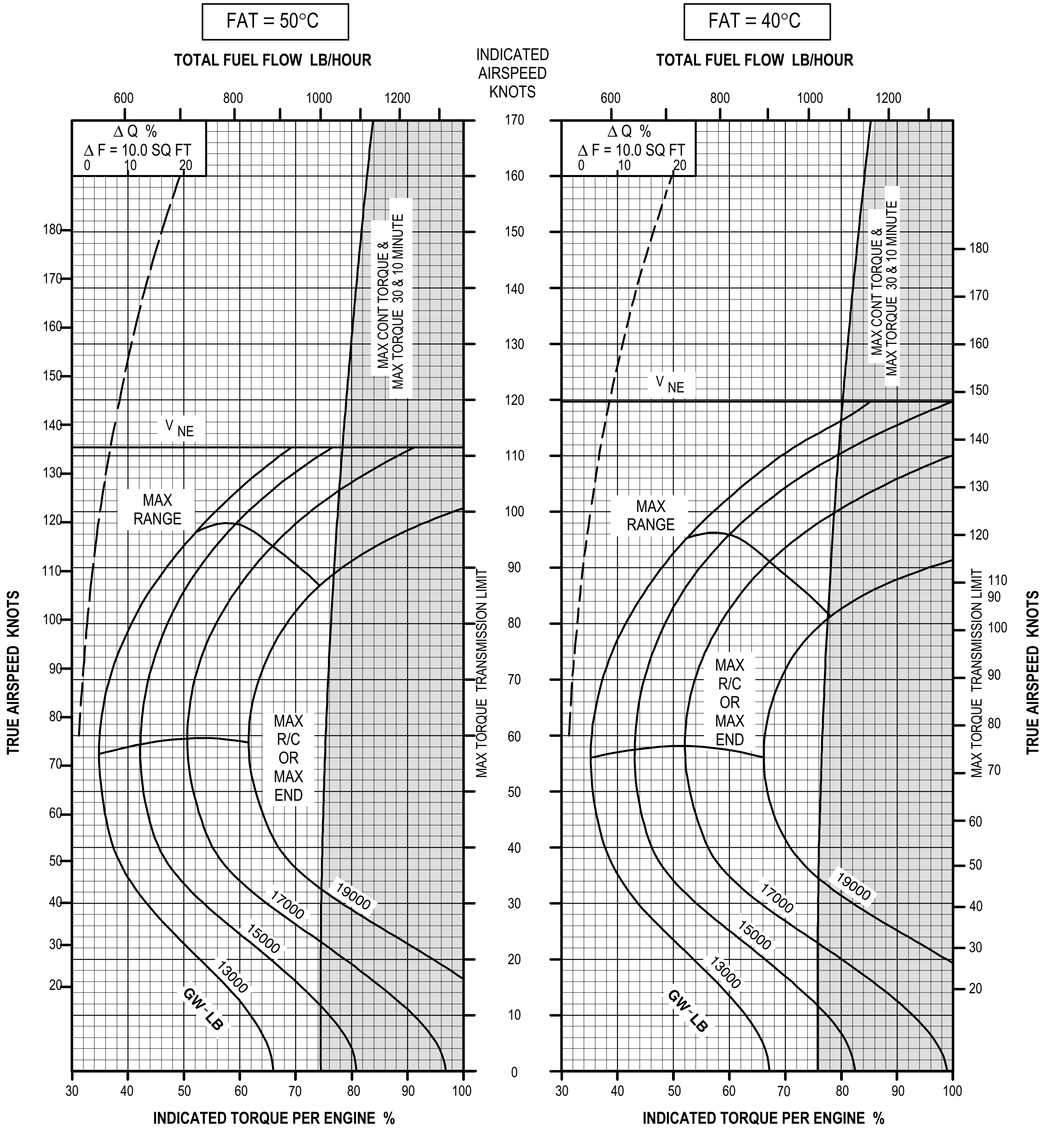
Figure 7A-25. Cruise Chart, 12,000 Feet, +30°C (sheet 5 of 5) 701C

CRUISE

PRESSURE ALTITUDE 14,000 FEET

101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0234

Figure 7A-26. Cruise Chart, 14,000 Feet, -50°C and -40°C (sheet 1 of 5) 701C

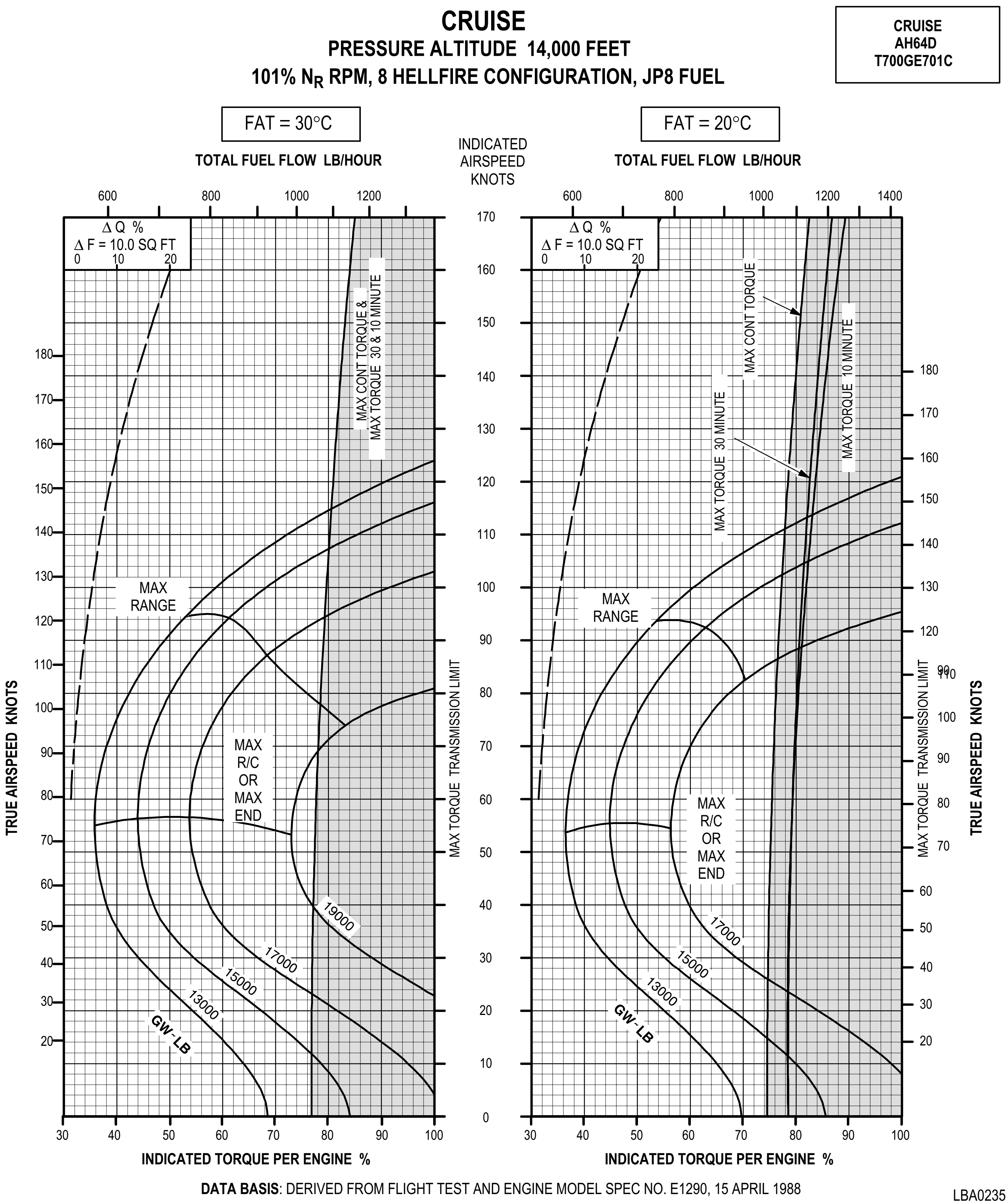
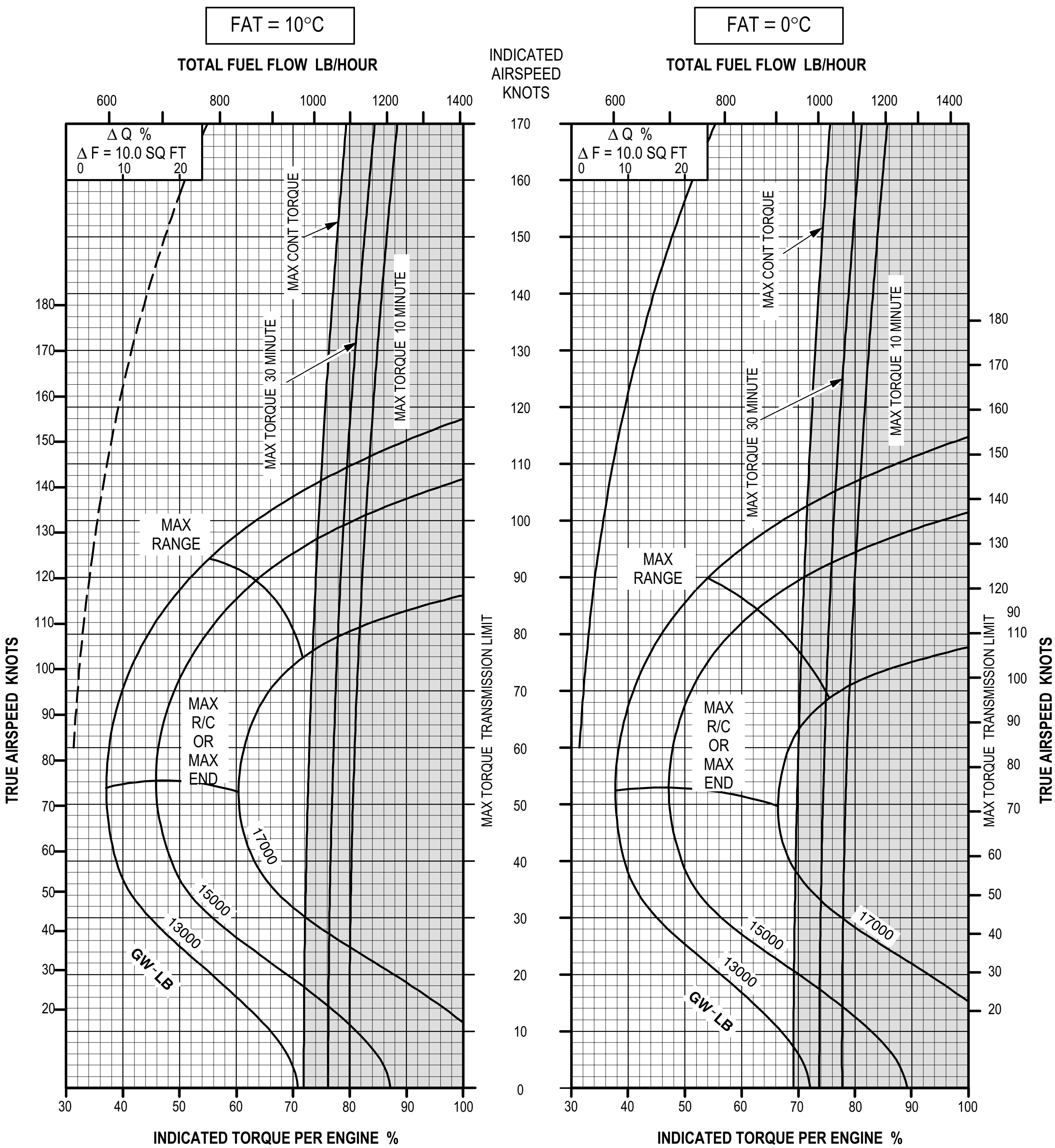


Figure 7A-26. Cruise Chart, 14,000 Feet, -30°C and -20°C (sheet 2 of 5) 701C

CRUISE
PRESSURE ALTITUDE 14,000 FEET
101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0236

Figure 7A-26. Cruise Chart, 14,000 Feet, -10°C and 0°C (sheet 3 of 5) 701C

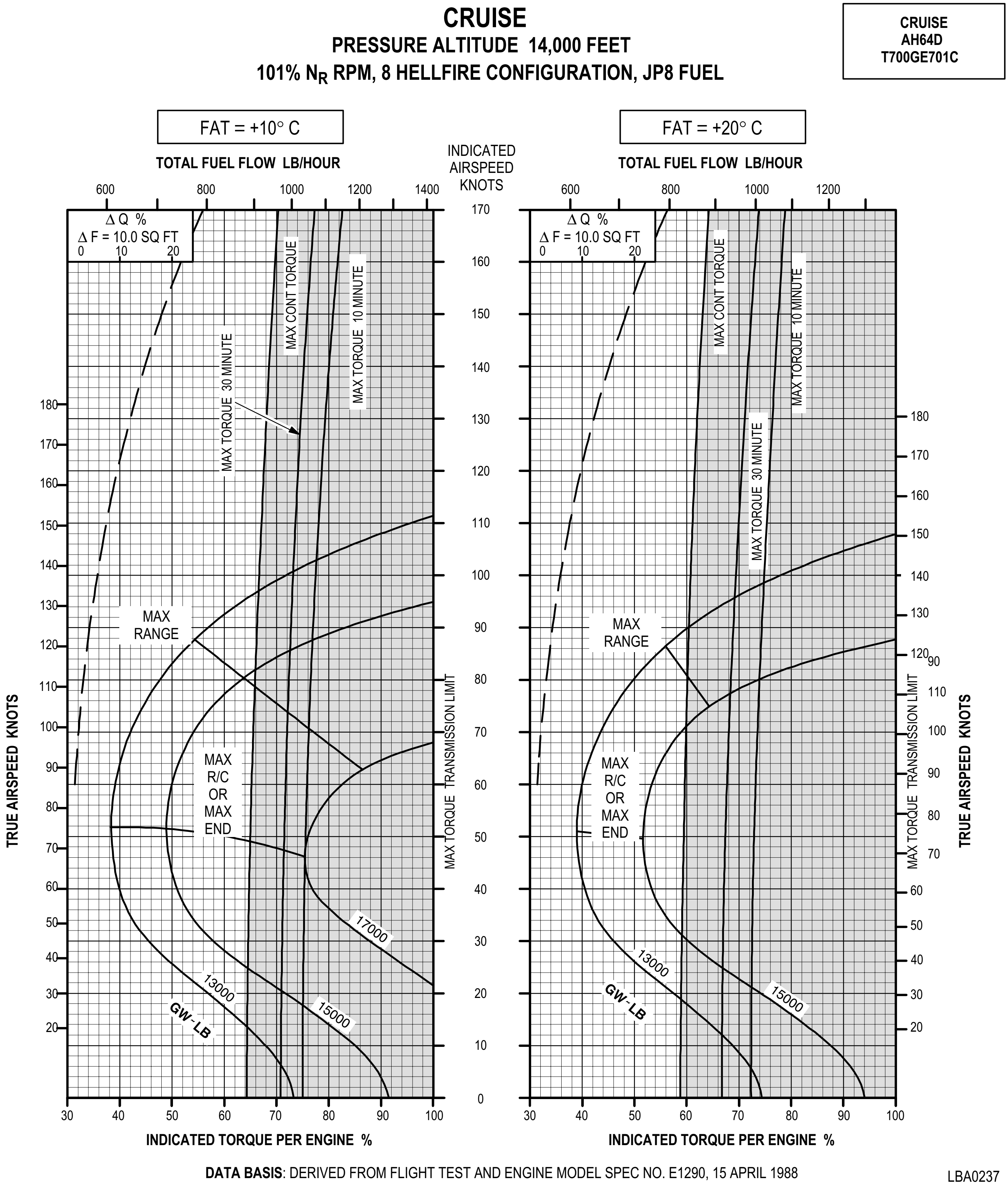
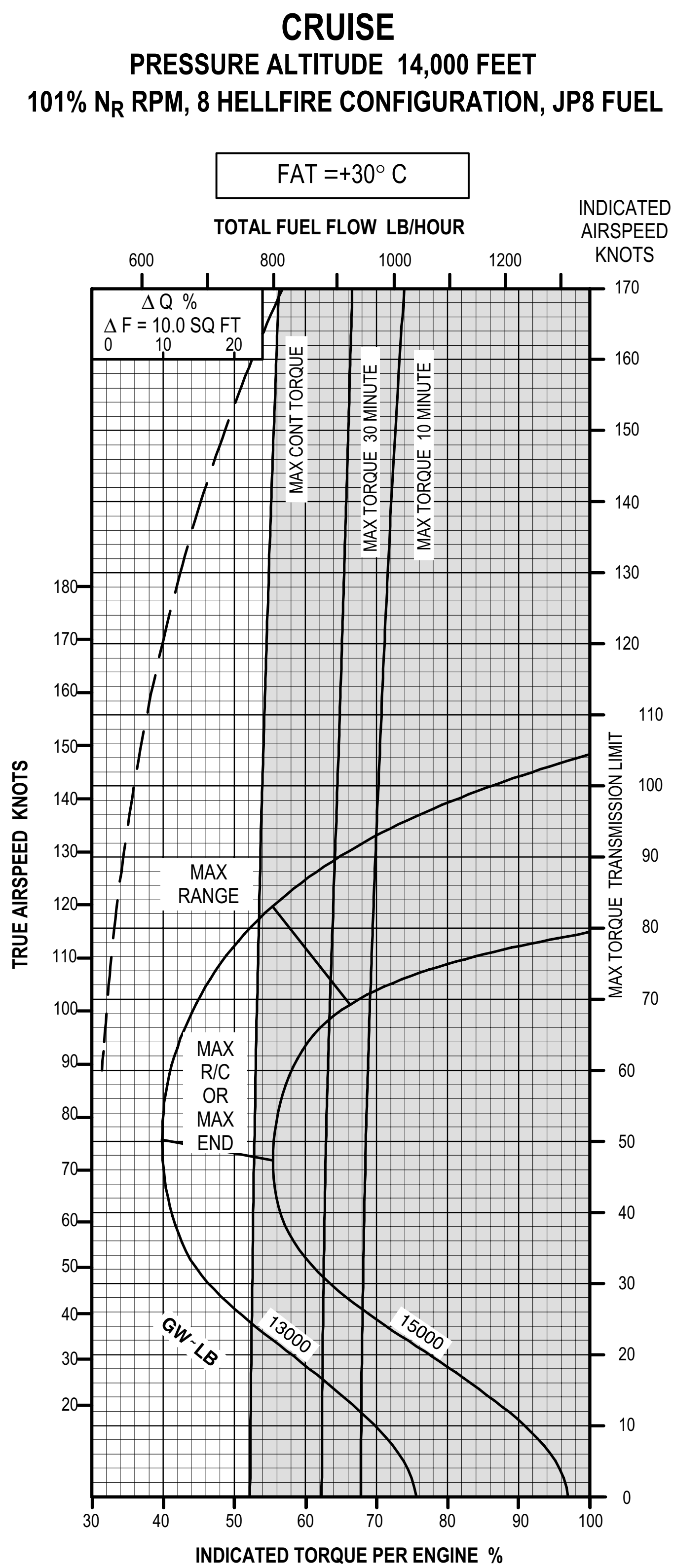


Figure 7A-26. Cruise Chart, 14,000 Feet, +10°C and +20°C (sheet 4 of 5) 701C

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0238

Figure 7A-26. Cruise Chart, 14,000 Feet, +30°C (sheet 5 of 5) 701C

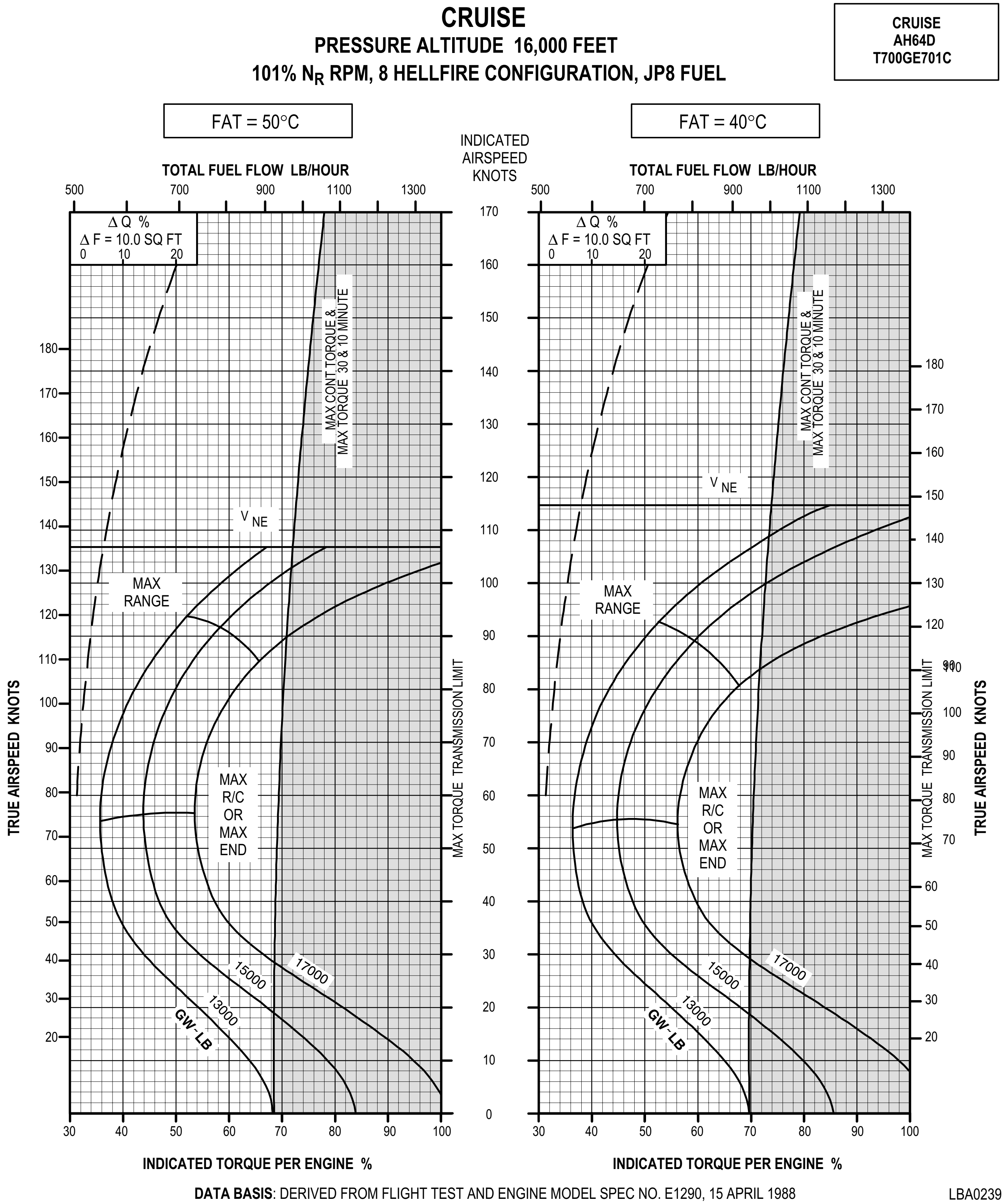


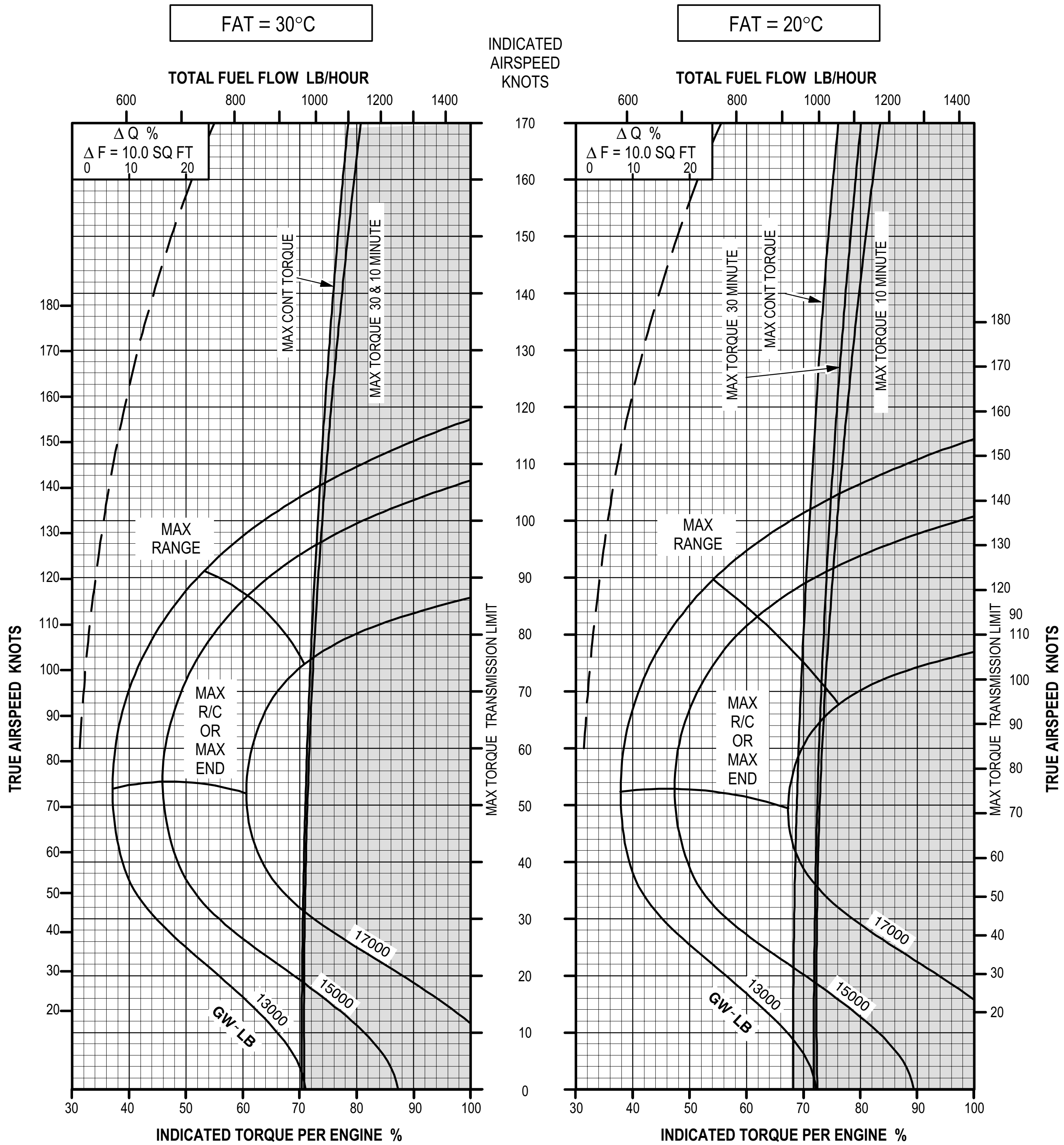
Figure 7A-27. Cruise chart, 16,000 Feet, -50°C and -40°C (sheet 1 of 4) 701C

CRUISE

PRESSURE ALTITUDE 16,000 FEET

101% N_R RPM, 8 HELLFIRE CONFIGURATION, JP8 FUEL

CRUISE
AH64D
T700GE701C



DATA BASIS: DERIVED FROM FLIGHT TEST AND ENGINE MODEL SPEC NO. E1290, 15 APRIL 1988

LBA0240

Figure 7A-27. Cruise chart, 16,000 Feet, -30°C and -20°C (sheet 2 of 4) 701C

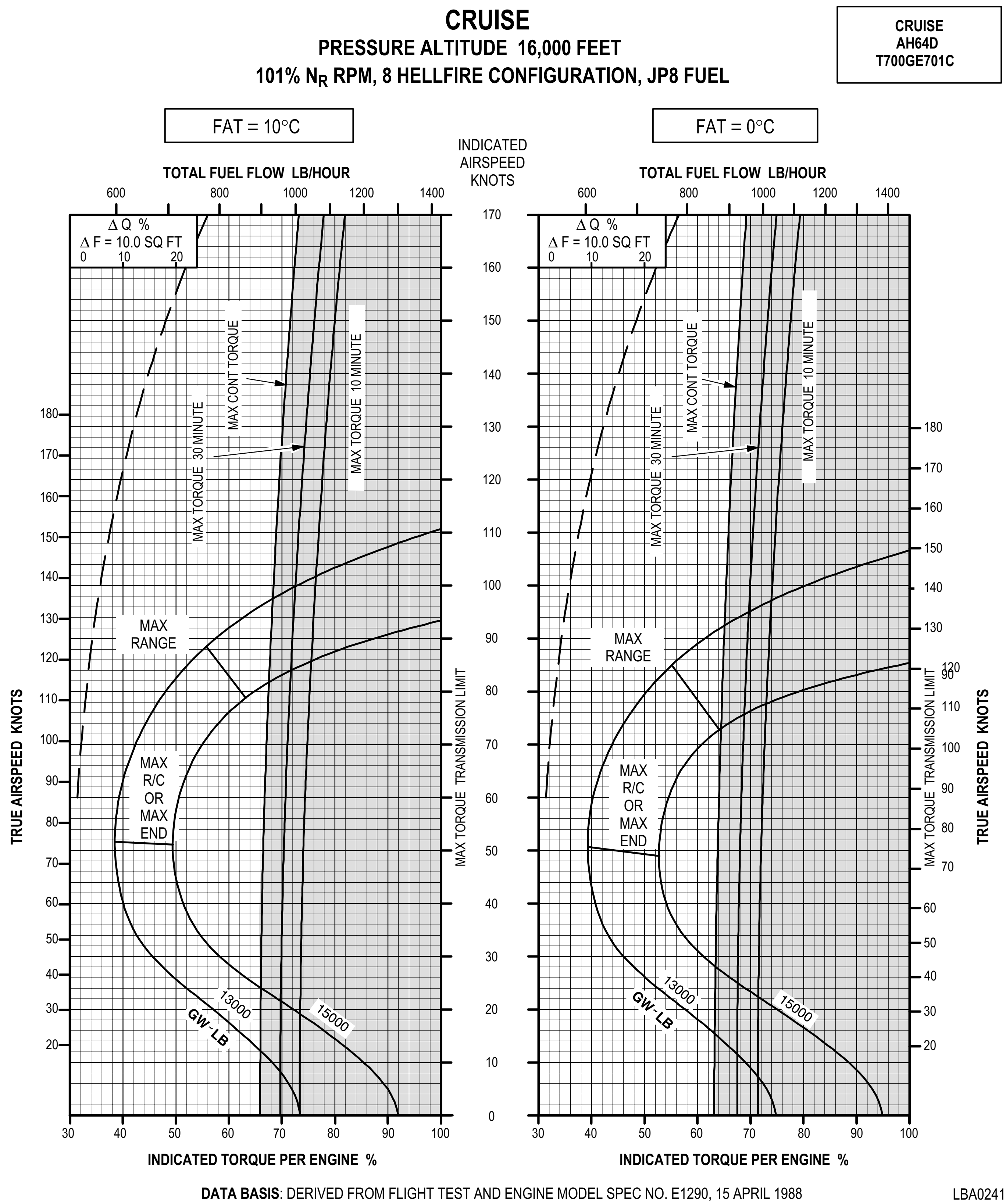


Figure 7A-27. Cruise Chart, 16,000 Feet, -10°C and 0°C (sheet 3 of 4) 701C

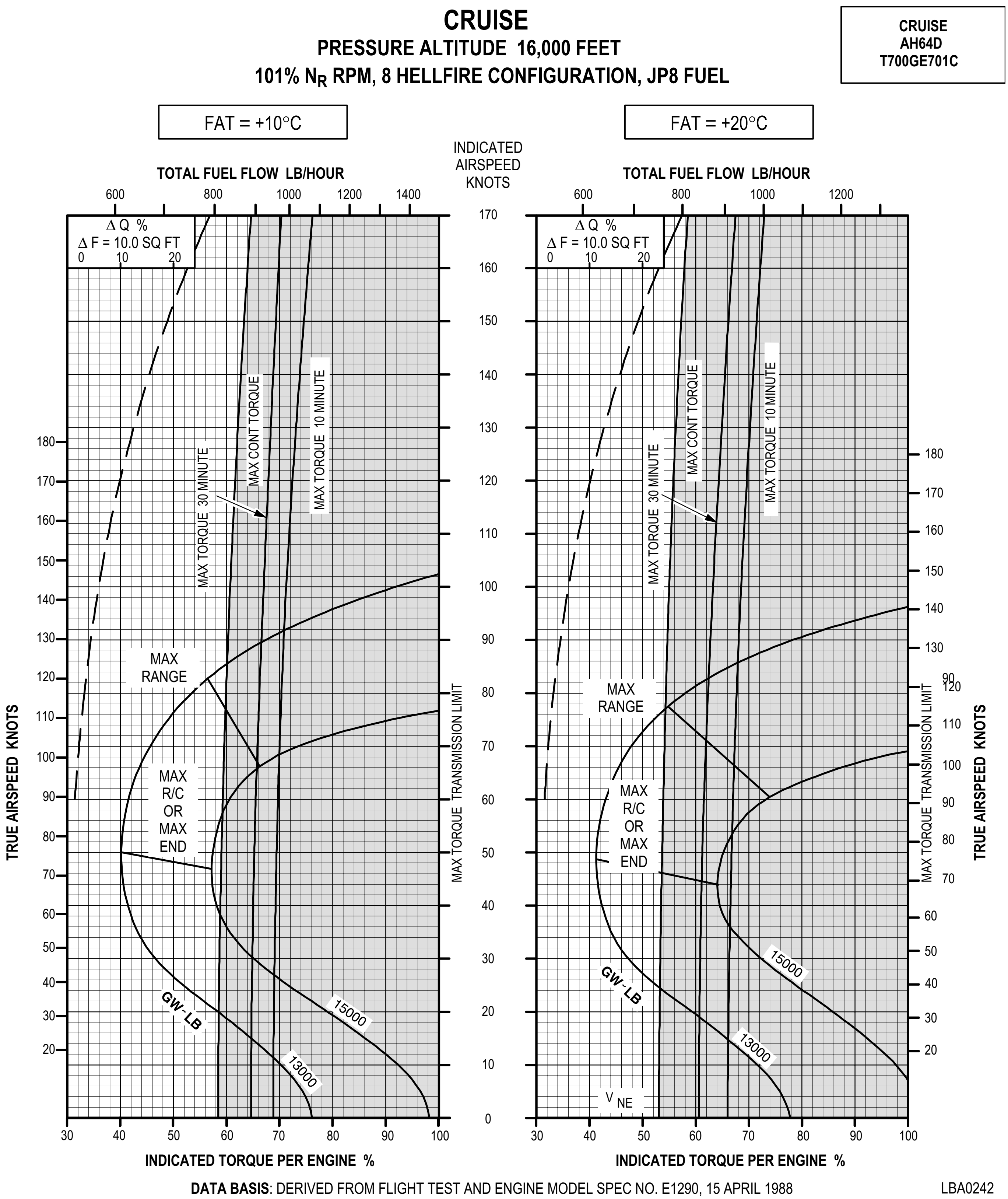


Figure 7A-27. Cruise Chart, 16,000 Feet, +10°C (sheet 4 of 4) 701C

Section VI. DRAG

7A.24 DESCRIPTION

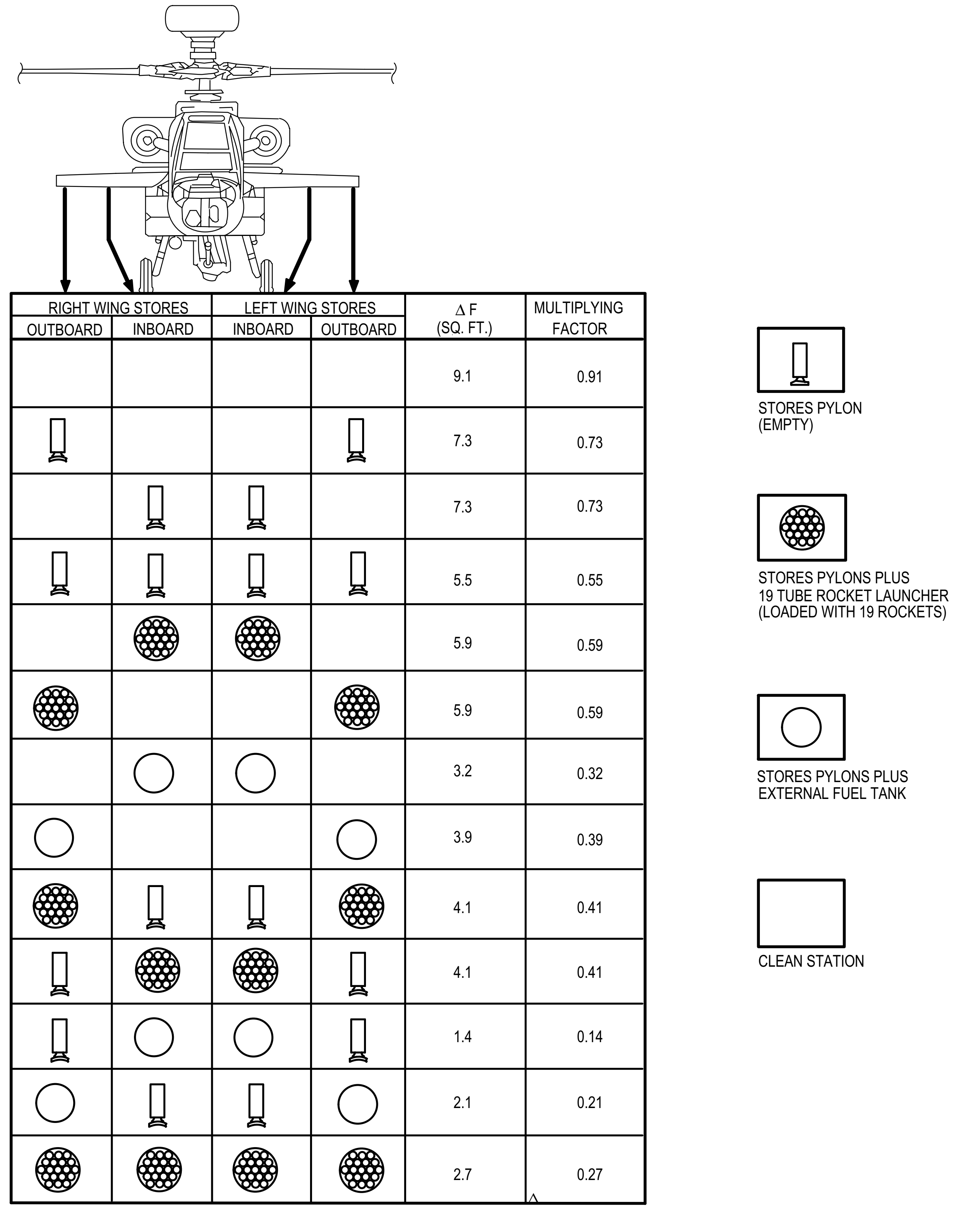
The drag chart (fig 7A-28) shows the change in frontal area (∆F) for each wing-stores combination that can be installed on the helicopter. The baseline configuration (primary mission) consists of one pylon and one full Hellfire launcher on each inboard stores station. The baseline configuration includes the Wire Strike Protection System (WSPS), Aircraft Survivability Equipment (ASE) and Fire Control Radar (FCR) kit.

7A.25 USE OF CHART

To determine the (∆F) and the associated multiplying factor, it is necessary to know what combination of stores is installed. Enter the chart at the top, move down to the illustration that matches the desired combination, and then move right and read ∆F and the multiplying factor. Use the multiplying factor and data in Section V, Cruise to determine the resulting change in torque.

7A.26 CONDITIONS

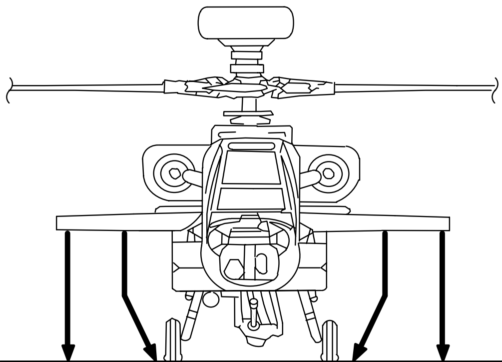
The drag chart is based on the primary mission configuration having zero change in frontal area.



FOR FCR KIT (MMA, RFI AND DEROTATION UNIT) REMOVAL, ADD+8.1 SQ. FT. TO F AND +0.81 TO MULTIPLYING FACTOR.

LBA0050

Figure 7A-28. Drag Chart and Authorized Armament Configurations (Sheet 1 of 2) 701C



RIGHT WING STORES		LEFT WING STORES		Δ F	MULTIPLYING
OUTBOARD	INBOARD	INBOARD	OUTBOARD	(SQ. FT.)	FACTOR
EXTERNAL FUEL TANK	EXTERNAL FUEL TANK	EXTERNAL FUEL TANK	EXTERNAL FUEL TANK	+2.0	+0.20
HELLFIRE MISSILE LAUNCHER			HELLFIRE MISSILE LAUNCHER	1.4	0.14
	HELLFIRE MISSILE LAUNCHER	HELLFIRE MISSILE LAUNCHER		0 (BASELINE)	0 (BASELINE)
HELLFIRE MISSILE LAUNCHER	STORES PYLON (EMPTY)	STORES PYLON (EMPTY)	HELLFIRE MISSILE LAUNCHER	+0.4	+0.04
STORES PYLON (EMPTY)	HELLFIRE MISSILE LAUNCHER	HELLFIRE MISSILE LAUNCHER	STORES PYLON (EMPTY)	+1.8	+0.18
19 TUBE ROCKET LAUNCHER	HELLFIRE MISSILE LAUNCHER	HELLFIRE MISSILE LAUNCHER	19 TUBE ROCKET LAUNCHER	+3.2	+0.32
HELLFIRE MISSILE LAUNCHER	19 TUBE ROCKET LAUNCHER	19 TUBE ROCKET LAUNCHER	HELLFIRE MISSILE LAUNCHER	+1.8	+0.18
HELLFIRE MISSILE LAUNCHER	HELLFIRE MISSILE LAUNCHER	HELLFIRE MISSILE LAUNCHER	HELLFIRE MISSILE LAUNCHER	+7.6	+0.76

FOR FCR KIT (MMA, RFI AND DEROTATION UNIT) REMOVAL, ADD +8.1 SQ. FT. TO ΔF AND +0.81 TO MULTIPLYING FACTOR.

STORES PYLON (EMPTY)

STORES PYLONS PLUS HELLFIRE MISSILE LAUNCHER (LOADED WITH 4 MISSILES)

STORES PYLONS PLUS 19 TUBE ROCKET LAUNCHER (LOADED WITH 19 ROCKETS)

STORES PYLONS PLUS EXTERNAL FUEL TANK

CLEAN STATION

LBA0051

Figure 7A-28. Drag Chart and Authorized Armament Configurations (Sheet 2 of 2) 701C

Section VII. CLIMB-DESCENT

7A.27 DESCRIPTION

The climb-descent chart (fig 7A-29) shows the change in torque (above and below the torque required for level flight under the same configuration, gross weight, and atmospheric conditions) to obtain a desired rate of climb or descent.

7A.28 USE OF CHART

7A.28.1 Primary Use. The primary use of the chart is illustrated by the example. To determine the change in torque, it is necessary to know the gross weight and the desired rate of climb or descent. Enter the chart at the desired rate of climb or descent, move right to the known gross weight, and then move down and read the torque change. This torque change must be added to (for climb) or subtracted from (for descent) the torque required for level flight (obtained from the appropriate cruise chart) to obtain a total climb or descent torque.

7A.28.2 Alternate Use. By entering the chart with a known torque change, and moving up to the known gross weight and then left, the corresponding rate of climb or descent can also be obtained.

7A.29 CONDITIONS

The climb-descent chart is based on 101% rotor RPM.

CLIMB DESCENT

CLIMBDESCENT
AH64D
T700GE701C

EXAMPLE

WANTED

CALIBRATED TORQUE CHANGE FOR DESIRED RATE OF CLIMB OR DESCENT

KNOWN OR ESTIMATED

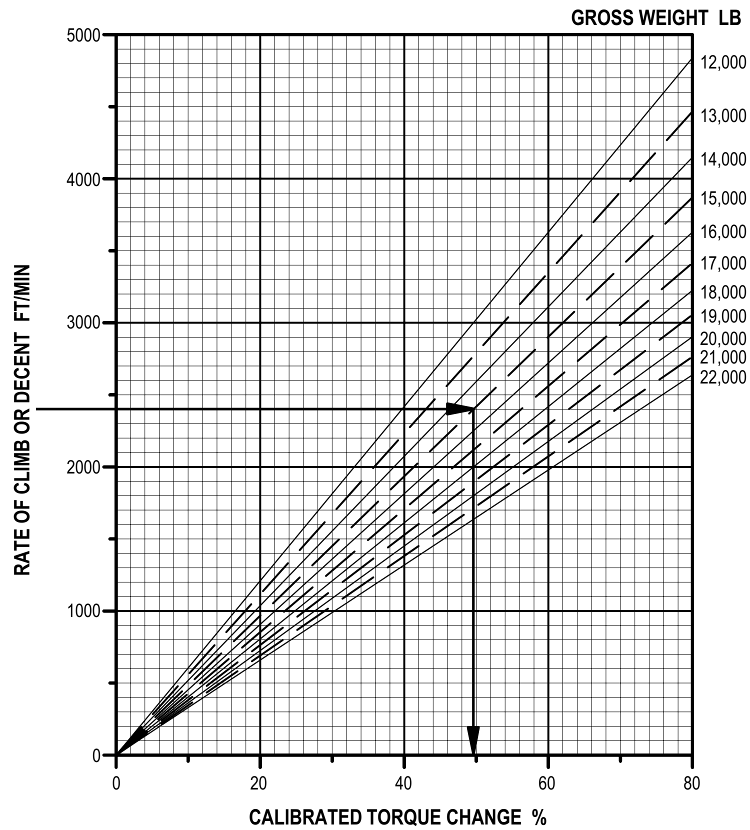
GROSS WEIGHT = 15,000 LB
DESIRED R/C = 2400 FT/MIN

METHOD

ENTER R/C HERE
MOVE RIGHT TO GROSS WEIGHT,
MOVE DOWN, READ CALIBRATED
TORQUE CHANGE = 49.6%

REMARK

TORQUE CHANGE IS THE DIFFERENCE BETWEEN TORQUE USED DURING CLIMB OR DESCENT AND THE TORQUE REQUIRED FOR LEVEL FLIGHT AT THE SAME CONDITIONS (ALTITUDE, TEMPERATURE, AIRSPEED, CONFIGURATION, ETC)



DATA BASIS: DERIVED FROM FLIGHT TEST

LBA0151

Figure 7A-29. Climb - Descent Chart 701C

Use or disclosure of this information is subject to the restriction(s) on the title page of this document.

CHAPTER 8
NORMAL PROCEDURES

Section I. CREW DUTIES/RESPONSIBILITIES

8.1 CREW DUTIES AND RESPONSIBILITIES

8.1.1 Pilot. The pilot in command is responsible for all aspects of mission planning, preflight, and operation of the helicopter. He will assign duties and functions to the other crewmember as required. Prior to or during preflight, the pilot will brief the copilot/gunner on items pertinent to the mission; e.g., performance data, monitoring of instruments, communications, and emergency procedures.

8.1.2 Copilot/Gunner. The copilot/gunner must be familiar with the pilot duties. The copilot/gunner will assist the pilot as directed.

8.2 CREW BRIEFING

A crew briefing shall be conducted to ensure a thorough understanding of individual and team responsibilities. The briefing should include, but not be limited to, copilot/gunner and ground crew responsibilities and the coordination necessary to complete the mission in the most efficient manner. A review of visual signals is desirable when ground guides do not have direct voice communications link with the crew. Crew briefing shall be conducted IAW TC 1-251.

8.3 AVIATION LIFE SUPPORT EQUIPMENT (ALSE)

All aviation life support equipment required for mission shall be checked.

Section II. OPERATING PROCEDURES AND MANEUVERS

8.4 OPERATING PROCEDURES AND MANEUVERS

This section deals with normal procedures. It includes all steps necessary for safe, efficient operation of the helicopter from the time a preflight check begins until the flight is completed and the helicopter is parked and secured. Unique feel, helicopter characteristics, and reaction of the helicopter during various phases of operation and the techniques and procedures used for taxiing, taking off, climbing, etc., are described, including precautions to be observed. Your flying experience is recognized; therefore, basic flight principles are avoided.

8.5 MISSION PLANNING

Mission planning begins when the mission is assigned and extends to the preflight check of the helicopter. It includes, but is not limited too, checks of operating limits and restrictions, weight, balance and loading, performance, publications, flight plan, and crew briefing. The pilot shall ensure compliance with the contents of this manual that are applicable to the mission. Mission related information may be transferred to the aircraft by using the DTC.

8.6 SYMBOLS DEFINITION

Symbols appear to the left of and immediately preceding a procedural step to indicate performance of the step is mandatory. Placarded items such as switch or control/display labels appear in bold uppercase type. The following symbols appear:

*** - Prior to takeoff for all thru- flights**.

O - Indicates performance of step is required if installed or available.

★- Indicates a detailed procedure for this step is included in TM 1-1520-251-CL, **Performance Data section**.

8.7 AMPLIFIED CHECKLIST

Normal procedures are given primarily in checklist format and amplified as necessary in accompanying paragraph form, when a detailed description of a procedure or maneuver is required. A condensed version of the amplified checklist, omitting all explanatory text, is contained in the AH-64D Operators Checklist (TM 1-1520-251-CL). To provide for easier cross-referencing, the procedural steps in the checklist are numbered to coincide with the corresponding numbered steps in this manual.

8.8 PREFLIGHT CHECK

The pilot walk-around and interior checks are outlined in the following procedures. The preflight check is not intended to be a detailed mechanical inspection. The steps that are essential for safe helicopter operation are included. The preflight may be made as comprehensive as conditions warrant at the discretion of the Pilot in Command.

8.9 BEFORE EXTERIOR CHECK

WARNING

- **Do not preflight or postflight until armament systems are safe**.
- **All jettison safety pins shall be installed when the helicopter is on the ground**. **Safety pins shall be removed prior to flight**. **Failure to do so will prevent jettison of wing stores**.

*1. Covers, locking devices, tie-downs and grounding cables removed and stowed - Check.

2. Cockpit General - Check as follows:

   a. Key in **MSTR IGN** - **OFF**.

   b. Interior **CANOPY JETTISON** pins installed - Check.

   c. First aid kits installed - Check.

   d. [BLK 2 ELT - Check battery condition.]

   e. [BLK 2 ELT - **ARM**.]

   f. Canopy - Check.

   g. Loose equipment secured - Check.

   h. Required publications - As required by DA PAM 738-751; locally required forms and publications.

3. Fuel sample taken before first flight of the day - Check.

8.10 EXTERIOR CHECK

The exterior check (fig 8-1) begins at the aircraft right side lower fuselage and proceeds in a clockwise direction around the aircraft.

8.10.1 Right Side - Underside Fuselage (Area 1).

1. 30mm automatic gun and turret - Check the following:

   a. Feed Chute - Check.

   b. Gun condition and security - Check

2. Searchlight - Check.

8.10.2 Right Side - Lower Center Fuselage (Area 2).

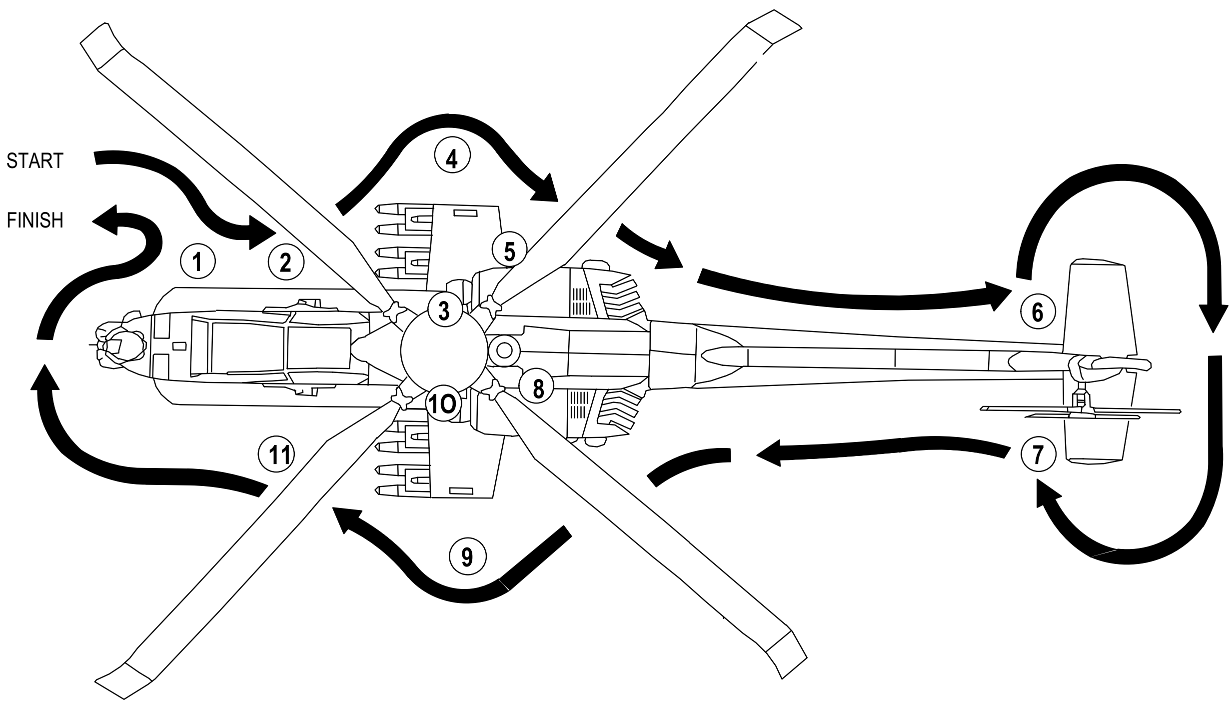
1. Radar warning antenna - Check.
2. Extended forward avionics bay - Check.
3. Right main landing gear - Check.
4. Static port unobstructed - Check.
5. Portable fire extinguisher - Check.

*6. Refueling panel - Check and secure door.

*7. Forward gravity fuel cap secure - Check.

*8. Single point fuel access secure - Check.

9. Battery - Connected.



EXTERIOR CHECK

AREA 1	RIGHT SIDE	UNDERSIDE FUSELAGE	AREA 7	LEFT SIDE	AFT FUSELAGE/EMPENNAGE
AREA 2	RIGHT SIDE	LOWER CENTER FUSELAGE	AREA 8	LEFT SIDE	REAR CENTER FUSELAGE
AREA 3	RIGHT SIDE	MAST AREA	AREA 9	LEFT SIDE	LOWER CENTER FUSELAGE AND WING
AREA 4	RIGHT SIDE	LOWER CENTER FUSELAGE AND WING	AREA 10	LEFT SIDE	MAST AREA
AREA 5	RIGHT SIDE	REAR CENTER FUSELAGE	AREA 11	LEFT SIDE	LOWER CENTER FUSELAGE AND NOSE AREA
AREA 6	RIGHT SIDE	AFT FUSELAGE/EMPENNAGE			

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Figure 8-1. Exterior Inspection Diagram

***8.10.3 Right Side - Mast Area (Area 3)**.

1. Main transmission - Check the following:

   a. Oil level - Check.

   b. Bypass indicator - Check.

2. Engine nose gearbox - Check the following:

   a. Oil level - Check.

   b. Oil cap secure - Check.

   c. Cowling secure - Check.

   d. Engine air inlet unobstructed - Check.

   e. Oil bypass button - Check.

3. Engine oil level - Check and secure door.
4. Right hand ADS probe - Check.
5. Nacelle access doors secure - Check.
6. Upper flight controls and swashplate - Check.
7. Main rotor head and blades - Check.
8. Strap Pack - Check.
9. Inspect upper and lower sides of each main rotor blade root fitting for debond/displacement, debond repair, application of sealant, and removed or cracked fiberglass overlay.

8.10.4 Right Side - Lower Center Fuselage and Wing (Area 4).

1. Wing - Check.

2. Pitot tube unobstructed - Check.

3. Formation light condition - Check.

4. Pylons - Check.

NOTE

When icing conditions exist, or are predicted, and Hellfire operations are expected, the launcher **ARM**/**SAFE** switch located on each Hellfire launcher must be manually placed in the **ARM** position prior to liftoff. It is possible for this switch to be rendered inoperative by icing.

O 5. HELLFIRE - Check the following:

   a. Launcher **ARM/SAFE** switch - As required.

   b. Launcher forward and aft attach lugs are secure to rack and swaybrace bolts are firmly against launcher swaybrace pads - Check.

   c. Electrical harness securely connected to launcher - Check.

   d. Stores jettison quick-disconnect lanyard is attached to electrical connector and rack - Check.

   e. Each missile is seated and hold-back latch is locked - Check.

   f. Environmental cover - Check.

NOTE

Check Load Maintenance Panel to verify rocket zone loading in addition to physical check.

O 6. Rockets - Check the following:

   a. Launcher forward and aft attach lugs are secure to rack and swaybrace bolts are firmly against launcher - Check.

   b. Launcher exterior and tube interior conditions - Check.

   c. Electrical harness connected securely to launcher - Check.

   d. Jettison quick-disconnect lanyard attached to connector plug and rack - Check.

   e. Rocket loading - Check and note number and zones of rocket loading.

   f. Igniter arms are rotated down and condition of igniter arms - Check.

   g. Environmental cover - Check.

WARNING

At locations where pressurized air line is installed, ensure the smaller line is installed on the aft fitting of the external fuel tank. Failure to do so could result in fuel migration into the PAS manifold and venting into both crew stations creating a health hazard.

O 7. External fuel tanks - Check.

8. Ammunition bay panel secure - Check.
9. Aft evaporator access - Check and secure door.
10. Aft R/EFAB - Check and secure door.

8.10.5 Right Side - Rear Center Fuselage (Area 5).

1. Nacelle fire louvers open - Check.

*2. APU oil level - Check and secure door.

*3. Aft gravity fuel cap secure - Check.

4. Nacelle lighting - Check the following:

   a. Anti-collision light - Check.

   b. Navigation light - Check.

5. Aft avionics bay - Check and secure door.

6. IR suppressor/engine exhaust - Check.

7. APU exhaust - Check.

*8. Utility hydraulic manifold - Check the following:

   a. Hydraulic fluid level - Check.

   b. Filter bypass button - Check.

*9. Utility hydraulic accumulator - Check 2600 psi minimum.

10. Survival equipment stowage compartment - Check and secure door.

11. External power receptacle - Check.

12. Belly antennas - Check.

8.10.6 Right Side - Aft Fuselage/Empennage (Area 6).

1. Aft tailboom - Check.

2. Antennas - Check.

3. Stabilator - Check.

4. Tail landing gear - Check.

8.10.7 Left Side - Aft Fuselage/Empennage (Area 7).

1. Navigation light - Check.

2. Stabilator - Check.

*3. Tail rotor - Check the following:

   a. Control linkage - Check.

   b. Hub - Check.

   c. Blades - Check.

4. FM-AM whip antenna - Check.

5. GPS antenna - Check.

6. Radar warning antenna - Check.

7. Aft tailboom - Check.

8.10.8 Left Side - Rear Center Fuselage (Area 8).

O 1. Chaff dispenser - Check.

2. Transmission deck catwalk doors secure - Check.

3. Survival equipment stowage compartment - Check and secure door.

4. IR suppressor/engine exhaust - Check.

5. Aft stowage bay - Check and secure door.

6. Nacelle fire louvers open - Check.

7. Fire extinguisher disc visible - Check.

8. Ammunition bay panel secure - Check.

9. Aft L/EFAB - Check and secure door.

10. Aft evaporator access - Check and secure door.

11. Nacelle lighting - Check the following:

    a. Anti-collision light - Check.

    b. Navigation light - Check.

8.10.9 Left Side - Lower Center Fuselage and Wing (Area 9).

1. Wing - Check.

2. Pitot tube unobstructed - Check.

3. Formation light condition - Check.

4. Pylons - Check.

NOTE

When icing conditions exist, or are predicted, and Hellfire operations are expected, the launcher **ARM**/**SAFE** switch located on each Hellfire launcher must be manually placed in the **ARM** position prior to liftoff. It is possible for this switch to be rendered inoperative by icing.

O 5. HELLFIRE - Check the following:

a. Launcher **ARM/SAFE** switch - As required.

b. Launcher forward and aft attach lugs are secure to rack and swaybrace bolts are firmly against launcher swaybrace pads - Check.

c. Electrical harness securely connected to launcher - Check.

d. Stores jettison quick-disconnect lanyard is attached to electrical connector and rack - Check.

e. Each missile is seated and hold-back latch is locked - Check.

f. Environmental cover - Check.

NOTE

Check Load Maintenance Panel to verify rocket zone loading in addition to physical check.

O 6. Rockets - Check the following:

a. Launcher forward and aft attach lugs are secure to rack and swaybrace bolts are firmly against launcher - Check.

b. Launcher exterior and tube interior conditions - Check.

c. Electrical harness connected securely to launcher - Check.

d. Jettison quick-disconnect lanyard attached to connector plug and rack - Check.

e. Rocket loading - Check and note number and zones of rocket loading.

f. Igniter arms are rotated down and condition of igniter arms - Check.

g. Environmental cover - Check.

WARNING

At locations where pressurized air line is installed, ensure the smaller line is installed on the aft fitting of the external fuel tank. Failure to do so could result in fuel migration into the PAS manifold and venting into both crew stations creating a health hazard.

O 7. External fuel tanks - Check.

*8.10.10 Left Side - Mast Area (Area 10).

1. Main transmission - Check the following:

a. Oil level - Check.

b. Bypass Indicator - Check.

2. Primary hydraulic manifold - Check the following:

a. Hydraulic fluid level - Check.

b. Filter bypass button - Check.

3. Engine nose gearbox - Check the following:

a. Oil level - Check.

b. Oil cap secure - Check.

c. Cowling secure - Check.

d. Engine air inlet unobstructed - Check.

e. Oil bypass button - Check.

4. Left hand ADS probe - Check.

5. Engine oil level - Check and secure door.

6. Nacelle access doors secure - Check.

7. Upper flight controls and swashplate - Check.

8. Main rotor head and blades - Check.

O 9. Mast mounted assembly L - Check the following:

a. Derotation Unit - Check.

b. RFI - Check.

c. Radome/aft dome - Check.

d. Locking pin - As desired.

10. Strap pack - check.

8.10.11 Left Side - Lower Center Fuselage and Nose Area (Area 11).

1. Canopy - Check.
2. **CANOPY JETTISON** pin removed and stowed - Check.
3. FAT gauge extension secure - Check.
4. Static port unobstructed - Check.
5. AWS hydraulic accumulator - Check (55 psi).
6. Left main landing gear - Check.
7. Static ground cable - Check.
8. Extended forward avionics bay - Check.
9. Radar warning antenna - Check.

NOTE

When icing conditions exist, ensure that TADS/PNVS gear teeth are free of ice.

10. TADS/PNVS turrets - Check.

8.11 INTERIOR CHECK - PILOT

*1. Canopy door - Check, then as desired.

*2. Loose equipment - Secured.

3. Seat adjusted to design eye position - Check.

*4. Restraint harness - Fasten and adjust.

5. Inertia reel lock - Check.

6. Pedals - Check and adjust.

*7. **PARK BRAKE** - Set.

8. **CHOP** button - Guard down.

9. **STORES JETTISON** Panel - Check.

*10. **POWER** levers - **OFF**.

11. Engine **START** switches - **OFF**.

*12. **RTR BRK** - **OFF**.

13. **EMERGENCY** Panel - Check:

    a. **EMER HYD** - **OFF**.

    b. **ZEROIZE** - Check in aft position.

14. **NVS MODE** switch - **OFF**.

*15. **CANOPY JETTISON** pin removed and stowed - Check.

16. Video panel - Check.

17. **MASTER ZEROIZE** switch - Guard down and lockwired (0.020 copper).

18. Standby flight instruments - Check:

    a. Attitude indicator - CAGE.

    b. Airspeed Indicator - Check.

    c. Altimeter - Check.

    d. Magnetic Compass - Check.

19. DTC installed and door secured.

20. **COMM** panel switches - As desired.

*21. HDU - Check and adjust as required.

22. **WIPER** control - **OFF**.

*8.12 BEFORE STARTING APU - PILOT

CAUTION

To prevent heat damage to the System Processor (SP), the APU must be started within one minute of the initiation of battery operations when FAT is > 43 °C, within three minutes when FAT is between 32 °C and 43 °C, and within 20 minutes when FAT is < 32 °C.

1. **MSTR IGN** switch - **BATT** (**EXT** if external power is to be used).
2. Searchlight - As required.
3. Utility light - As desired.
4. **TAIL WHEEL** button - Verify locked.
5. ICS system - Check.
6. **EXT LT/INTR LT** panel **PRESS-TO-TEST** button illuminates all signal lights - Check.
7. **MSTR WARN**, **MSTR CAUT**, and UFD/EUFD - Check.
8. **FIRE DET/EXTG** panel **TEST** switch - Test as follows:
   a. Position **1**: - **MSTR WARN**, **ENG 1**, **APU**, and **ENG 2 FIRE** buttons are illuminated and voice warning system is activated. [**BLK 1** **DECK FIRE** (UFD)]/[**BLK 2** **AFT DECK FIRE** (EUFD)] warning message appears.
   b. Position **2**: - **MSTR WARN**, **ENG 1**, **APU**, and **ENG 2 FIRE** and **DISCH** buttons are illuminated and voice warning system is activated.[**BLK 1** **DECK FIRE** (UFD)]/[**BLK 2** **AFT DECK FIRE** (EUFD)] warning message appears.

*8.13 STARTING APU - PILOT

WARNING

To prevent injury to personnel, ensure pylons/stabilator are clear prior to starting APU.

1. Fire guard (if available) - Posted. APU exhaust area clear.
2. APU - Start as follows:
   a. **APU** push button - Press.
   b. UFD/EUFD - Monitor.
3. **MSTR IGN** switch - **BATT** (if external power was used).
4. External power disconnected - Check, advisory extinguished.

*8.14 AFTER STARTING APU - PILOT

1. Canopy door - Closed.
2. **EXT LT/INTR LT** panel - As desired.
3. KU**,** MPD, and UFD/EUFD knobs - As desired.
4. ECS system - Verify air flow and set temperature as desired.

NOTE

Some thru-flight data will be lost unless the THRU-FLIGHT button is selected within one minute of power up.

5. DTC - Select load.
6. EGI - Verify keys as required.
7. FLT **SET** page - As desired for the following:
   a. Altimeters - Set to field elevation or current QNH barometric pressure.
   b. **RAD ALT** - Set **HI/LO** as desired.
8. **DMS** Menu page - Systems configuration - As required for mission:
   a. Mission subsystem pages - Configure.
   b. Aircraft subsystem pages - Configure.
   c. Communications subsystem pages - Configure.
   d. [**BLK 2** ELT check- Perform.]

★9. IHADSS boresight - Perform.

★10. NVS operational check - As required.

★11. FCR **L** Operational check (may be performed by the CPG) - As required.

★12. Weapons Operational Checks - As required.

★13. ASE Operational Checks - As required.

WARNING

Do not start engines with BUCS engaged. BUCS can become engaged when a mistrack between the controls and the actuator is sensed. This commonly happens when external power is applied to the aircraft without hydraulic power. BUCS engagements may be cleared by applying hydraulic power and completing a FLT CNTRLS IBIT.

*8.15 BEFORE STARTING ENGINES - PILOT

1. **NVS MODE** switch - As desired.
2. Standby attitude indicator - Uncaged.
3. A/C **(ENG) (SYS**) page - Check.
4. **ENG** page - Check.
5. Perform control sweep and trim check.

*8.16 BUCS TEST - PILOT/CPG

1. **RTR BRK** switch - **BRK**.
2. Collective friction - OFF (both crewstations).
3. Stabilator Area - Check clear.
4. **POWER** levers - **OFF**.
5. **DMS IBIT** page - Select.

NOTE

Maintenance action is required after two consecutive failures of the Flight Controls IBIT.

6. **ACFT/COM-FLT CNTRLS-PRFLT** - Select. Follow **IBIT** instructions until test is complete.
7. **RTR BRK** switch - **OFF**.
8. Flight Controls - Adjust as required.

CAUTION

The Pilot will ensure that both EGIs have aligned properly and are displaying the same position, attitude and heading, POSITION CONFIDENCE values, valid DATE, TIME and GPS tracking. This will prevent the erroneous velocity data signals from the EGIs being sent to the Flight Management Computer (FMC), which should prevent an uncommanded scheduling of the Stabilator.

*8.17 EGI OPERATIONAL CHECK - PILOT/CPG

1. **TSD** and **FLT** page - Select.
2. Verify heading, attitude and position.
3. **TSD UTIL** page - Select. Note current **POSITION CONFIDENCE** value, verify current **DATE** and **TIME**.
4. HDU - Verify normal velocities.
5. Secondary EGI - Select as **PRIMARY**. Note **POSITION CONFIDENCE** value, verify current **DATE** and **TIME**.
6. **FLT** page - Verify heading and attitude.
7. HDU - Verify normal velocities.
8. **TSD** page - Select.
9. **PP** button - Select. Verify position.
10. **TSD UTIL** page. Select EGI with lowest **POSITION CONFIDENCE** value as primary.

NOTE

If one or both of the EGIs displays a position error greater than one nautical mile from the aircraft's known position or if the **DATE** and **TIME** is incorrect, perform the on ground manual reset and alignment procedure. Longitude and latitude are displayed in degrees, minutes and 100ths of minutes; one minute equates to approximately one mile.

*8.18 ON GROUND MANUAL RESET AND ALIGNMENT PROCEDURES

1. Current position - load into KU.
2. **INU1** and **INU2** - Reset. Check **TSD** page for the **HDG** selection displayed.
3. **PSN** - Select.
4. **POS** - Select.
5. KU **ENTER** button - Press.

NOTE

If **HDG** selection is not displayed or is removed while the current position data is being entered, perform an **INU1** and **INU2** reset and then quickly (within one minute) re-enter the current position.

6. **UPT** - Select.
7. **TIME** - Select. Enter current Zulu time.
8. **DATE** - Select. Enter current Zulu date.

*8.19 STARTING ENGINES - PILOT

CAUTION

The T700-GE-701C 701C engine exhibits inconsistent starting capability above 6000 feet density altitude (inflight and ground). Starts above this density altitude may be unsuccessful and require an abort because of exceeding temperature limits.

1. Area - Clear.
2. Fire guard (if available) - Posted.

CAUTION

During a rotor brake lock start, if rotor blades begin to rotate: Set RTR BRK switch to - OFF.

3. **RTR BRK** switch - **OFF** or **LOCK**.
4. **EXT LT** - As required.

CAUTION

- **If engine 1 or 2 start advisory remains displayed after 66%-68% N_G: Position ENG START switch to IGN ORIDE, then OFF.**
- **Prior to advancing POWER levers, ensure that both engines are stabilized (N_P, N_G, Torque% and Oil PSI).**
- **While advancing POWER levers to FLY, ensure that both engines indicate a rise in TORQUE% to confirm that the sprag clutches are engaged.**
- **If an engine indicates near 0% TORQUE, retard POWER lever of affected engine to OFF.**
- **TGT must be less than 150° C 701 or 80° C 701C before moving power lever to IDLE.**

★5. First Engine - Start as follows:

a. Normal Start (COLD ENGINE - 4 hours since last shutdown).

(1) **START** switch - **START**.

(2) **POWER** lever - **IDLE**, at first indication of N_G increase.

(3) **ENG OIL PRESS** - Monitor.

(4) **TGT** - Monitor.

(5) N_G - Monitor.

(6) **MSTR WARN, MSTR CAUT**, and UFD/EUFD - Monitor.

b. Normal Start (WARM ENGINE 701C - Less than 4 hours since last shutdown. Inflight restarts do not need to utilize a warm start procedure).

(1) **START** switch - **IGN OVRD**. Allow N_G speed to increase to 18 to 20% then **OFF**. Once the first engine is placed to the **OFF** position, motoring of the second engine is permitted.

(2) **START** switch - **START** after N_G decreases below 5%.

CAUTION

TGT must be less than 150° C 701 or 80° C 701C before moving power lever to IDLE.

(3) **POWER** lever - **IDLE**.

(4) **ENG OIL PRESS** - Monitor.

(5) **TGT** - Monitor.

(6) **N_G** - Monitor.

(7) **MSTR WARN**, **MSTR CAUT**, and UFD/EUFD - Monitor.

CAUTION

Sufficient IPAS air is required for a successful 2nd engine start. Ensure the APU, external air source, or opposite engine at 95% N_G is supplying sufficient IPAS air.

★6. Second Engine - Start.

a. Same as first - Start.

b. Cross engine start.

(1) **ENG** page - Select.

(2) Collective - Increase to attain 95% N_G on the engine supplying the IPAS air.

(3) Cold or Warm engine start - Perform.

(4) Collective - Reduce to flat pitch after starter dropout.

7. **RTR BRK** switch - **OFF**.

8. **POWER** levers - Advance both **POWER** levers smoothly to **FLY** and ensure that both **TORQUE** indications increase simultaneously.

9. **N_P** and **N_R** - Verify 101%.

10. **MSTR WARN**, **MSTR CAUT**, and UFD/EUFD - Monitor.

11. **APU** - Off.

8.20 INTERIOR CHECK - COPILOT/GUNNER

0.1. [BLK 2 ELT - Remove shorting plug, and stow lanyard.]

*1. Canopy door - Check, then as desired.

*2. Loose equipment - Secured.

3. Seat adjusted to design eye position - Check.

*4. Restraint harness - Fasten and adjust.

5. Inertia reel lock - Check.

6. Pedals - Adjust and check.

7. Collective switches - As required.

8. **CHOP** button - Guard down.

*9. **STORES JETTISON** Panel - Check.

10. **NVS MODE** switch - **OFF**.

11. **EMERGENCY** Panel - Check:

a. **EMER HYD** - **OFF**

b. **ZEROIZE** - Check in aft position.

*12. **CANOPY JETTISON** pin removed and stowed - Check.

13. KU, MPD, and UFD/EUFD knobs - As desired.

14. **MASTER ZEROIZE** switch - Guard down and lockwired (0.020 copper).

15. **ORT RHG LT** switch - **OFF**.

16. **WIPER** control - **OFF**.

17. **COMM** panel switches - As desired.

18. Processor Control Panel switch - As required.

*19. HDU - Check and adjust as required.

*8.21 BEFORE STARTING APU - COPILOT/GUNNER

1. Utility light - As desired.

2. **EXT LT**/**INTR LT** panel **PRESS-TO-TEST** button illuminates all signal lights - Check.

3. **MSTR WARN**, **MSTR CAUT**, and UFD/EUFD - Check.

4. **FIRE DET/EXTG** panel **TEST** switch - Test as follows:

a. Position **1**: - **MSTR WARN**, **ENG 1**, **APU**, and **ENG 2 FIRE** buttons are illuminated and voice warning system is activated.
[The BLK 1 UFD will display **DECK FIRE**]
[The BLK 2 EUFD will display **AFT DECK FIRE**].

b. Position **2**: - **MSTR WARN**, **ENG 1**, **APU**, and **ENG 2 FIRE** and **DISCH** buttons are illuminated and voice warning system is activated.
[The BLK 1 UFD will display **DECK FIRE**]
[The BLK 2 EUFD will display **AFT DECK FIRE**].

*8.22 AFTER STARTING APU - COPILOT/GUNNER

1. Canopy door - Closed.

2. **INTR LT** panel - As desired.

3. KU, MPD, and UFD/EUFD knobs - As desired.

4. ECS system - Verify air flow and set temperature as desired.

5. **DMS** Menu page - Systems configuration - As required for mission.
   a. Mission subsystem pages - Configure.
   b. Aircraft subsystem pages - Configure.
   c. Communications subsystem pages - Configure.
   d. Boresight values - Verify.

NOTE

Steps 6 through 10 may be performed in any order.

★6. IHADSS boresight - Perform.

★7. NVS Operational Check - As required.

★8. TADS Operational checks - As required.

★9. TADS boresight - As required.

★10. FCR **L** Operational check (may be performed by pilot) - As required.

★11. Weapons Operational Checks - As required.

★12. ASE Operational Checks - As required.

*8.23 BEFORE TAXI CHECK

1. Armament and pylon safety pins - Removed.
2. Chocks and external ICS cords - Removed.

NOTE

When conducting **AUTO HIT** checks, data is automatically taken by the system as follows:

- FAT, Pressure ALT, and TGT values are constantly read when the Calculate HIT button is pushed and are averaged over a 2 second time period.
- TGT margin values are computed automatically.

★3. **HIT**/**ANTI-ICE** checks - This step may be performed at any time prior to the first flight of the day. Perform the following performance checks:
   a. Position helicopter into prevailing wind.

NOTE

If ECS is in the heating mode, select A/C **UTIL** page and deselect **BLEED AIR 1** and **2**.

   b. Set engine **ANTI-ICE** to **OFF**.
   c. **POWER** levers - Set to **FLY**. Verify **N_P/N_R** is **101%**.
   d. Retard **POWER** lever on engine not being checked to **IDLE**.
   e. Increase collective pitch to **60% TORQUE** and hold for at least 30 seconds.

NOTE

If conducting **AUTO** HIT check perform step f. If conducting manual HIT check perform step g.

f. **AUTO** HIT check:

(1) A/C **PERF** page - Select **HIT**.

(2) **ENG 1** button - Select. Check **TORQUE 60%**, N_P/N_R **RPM 101%** and **TGT** stabilized.

(3) **CALCULATE HIT** button - Select.

(4) MPD - Note **PASS/FAIL**.

(5) Aircraft HIT log - Record as necessary.

(6) A/C **UTIL** Page - Select.

(7) **ANTI-ICE INLET** - **ON**. Note TGT increase of at least 50° C.

(8) **ANTI-ICE INLET** - **OFF**. Note TGT decreases to approximate initial value.

(9) **POWER** lever, non-test engine - **FLY**. Verify torque matching.

(10) Repeat step f. for **ENG 2**.

g. Manual HIT check.

NOTE

When using TGT reference table, FAT must be rounded up and pressure altitude must be rounded off to the nearest value.

(1) Record date, A/C hours, FAT, pressure altitude, and TGT on HIT log sheet in helicopter logbook. Manually calculate and record HIT check TGT margin.

(2) A/C **UTIL** Page - Select.

(3) **ANTI-ICE INLET** - **ON**. Note TGT increase of at least 50° C.

(4) **ANTI-ICE INLET** - **OFF**. Note TGT decreases to approximate initial value.

(5) **POWER** lever, non-test engine - **FLY**. Verify torque matching.

(6) If TGT margin is within acceptance limits engine performance is satisfactory. If margin is 5° C or less from the limit, make appropriate entry in remarks section of DA form 2408-13-1.

(7) Repeat step g. for **ENG 2**.

h. If TGT margin is out of limits, repeat check. Ensure that all procedures are followed.

i. If TGT margin is still out of limits, do not fly the helicopter. Make appropriate entry in remarks section of DA form 2408-13-1.

4. Bleed Air - **ON**.

CAUTION

- **To prevent damage to the engines, the engine anti-ice system shall be manually activated when the aircraft is flown in visible moisture and Free Air Temperature (FAT) is less than +41° F / +5° C.**
- **When operating at high power settings, ensure anti-ice is in the manual mode. Failure of the anti-ice/detector during high power settings could result in severe N_P/N_R droop.**

5. Anti-Ice - As required.

6. **EXT LT** panel - As required.

7. Searchlight - As required.

8. **PARK BRAKE** - Release.

NOTE

If the **UNLOCK** pushbutton fails to illuminate, taxi forward a short distance while making light pedal inputs.

9. **TAIL WHEEL** button - **UNLOCK** (note that **UNLOCK** pushbutton illuminates).

*8.24 TAXI CHECK

1. Wheel brakes - Check.
2. **ENG** page - Check.
3. **FLT** page - Check.
4. Pilot standby instruments - Check.

8.25 TAXI

CAUTION

- **Excessive cyclic displacement with low power settings will result in droop stop pounding.**
- **If forward cyclic inputs appear excessive while taxiing, increase collective as necessary. Appropriate collective setting is a function of cyclic displacement and surface conditions.**
- **Excessive forward cyclic displacement with low power settings will result in high strap pack loads.**

*8.26 BEFORE TAKEOFF CHECK

1. Weapons subsystem - Check the following:
   a. **A/S** button - **SAFE**.
   b. **GND ORIDE** button - **OFF**.
   c. Weapons not actioned - Verify.
2. **TAIL WHEEL** button - Lock.
3. **PARK BRAKE** -As desired.
4. **POWER** Levers - to **FLY**.
5. Systems - Check as follows:
   a. Fuel page options - as desired.
   b. Fuel quantity - Check.
   c. UFD/EUFD - Note cautions/advisories - Check.
   d. Engine and flight instrumentation - Check.
   e. **ASE** - As required.
   f. XPNDR - as desired.

NOTE

Anytime the load or environmental conditions increase significantly (1,000 pounds gross weight, 5° C, or 1,000 feet PA), the aircrew will perform additional power checks.

6. Power check - Perform (Validate **PERF** page).

8.27 STABILATOR OPERATION

The stabilator is normally operated in the automatic mode. However, the following additional modes are available to the pilot that can improve helicopter flight characteristics during certain maneuvers:

8.27.1 NOE/A Mode. Should the pilot desire to improve over-the-nose visibility for landings or during NOE flight, the NOE/A mode may be engaged at any time. However, stabilator will not schedule until TAS ‹ 80 kts.

8.27.2 Manual Mode. The manual mode is used for positioning the stabilator to help minimize airframe vibrations when hovering in crosswinds or tail winds.

8.28 BEFORE LANDING CHECK

1. Weapons systems - Safe.
   a. **A/S** button - **SAFE**.
   b. **GND ORIDE** button - **OFF**.
   c. Weapons not actioned - Verify.
2. **ASE** - As required.
3. **TAIL WHEEL** button - Lock.
4. **PARK BRAKE** - As required.

8.29 SLOPE/ROUGH TERRAIN LANDING

For slope landings and all ground operations, avoid using combinations of excessive cyclic and low collective settings. Where minimum collective is used, maintain cyclic near neutral position and avoid abrupt cyclic inputs. If cyclic pitch is required, increase collective slightly to avoid hitting the droop stops and possible rotor blade to fuselage contact.

CAUTION

Care shall be exercised when operating the helicopter on rough terrain to prevent damage to the underside antennae.

NOTE

Prior to landing, external stores may be placed in the ground stow position by selecting the **GROUND STOW** button on the **WPN UTIL** page.

8.30 AFTER LANDING CHECK

1. **TAIL WHEEL** button - As required.
2. Exterior lights - As required.
3. Avionics - As required.

8.31 ENGINE SHUTDOWN (APU) - PILOT

NOTE

APU may be started at any time when the aircraft is on the ground.

1. APU - Start as follows:

CAUTION

If the APU is inoperative go to ENGINE SHUTDOWN (EXT PWR) PILOT/CPG. Failure to comply will result in loss of operating systems displays and indicating systems during shutdown.

   a. **APU** button - press **ON**.

   b. UFD/EUFD - Monitor for APU advisories.

2. **TAIL WHEEL** button - Lock.
3. **PARK BRAKE** - Set.

CAUTION

If an engine is shut down from above idle without being cooled for two minutes at IDLE and it is necessary to restart the engine, the restart should be accomplished within five minutes after shutdown. If the restart cannot be accomplished within five minutes, the engine shall be allowed to cool for four hours before attempting an engine restart.

4. **POWER** levers - **IDLE**.

4a. [BLK 2 ELT check - Perform.]

5. **XPNDR** page **MODE 4 HOLD** - as desired.
6. DMS **FAULT** page - Check for exceedences.
7. Standby attitude indicator - Cage.
8. **NVS MODE** switch - **OFF**.
9. **ACM** switch - **OFF**.
10. **PNVS** button - **OFF**.
11. **POWER** levers - **OFF**. (After engines have cooled at idle for 2 minutes.)
12. **TGT** - Monitor.
13. **RTR BRK** switch - **BRK**. (Below 50% $\mathbf{N_R}$.)
14. Stabilator - Set to **ZERO**.
15. Searchlight - **OFF**.
16. **RTR BRK** switch - **OFF**. (When rotor stops.)
17. **EXT LT/INTR LT** panel switches - **OFF**.
18. DTC - Remove and secure door.
19. **APU** button - **OFF**.
20. **MSTR IGN** switch - **OFF**.
21. **MSTR IGN** key - Remove.
22. **CANOPY JETTISON** pin - Install.

8.32 ENGINE SHUTDOWN (APU) - COPILOT/ GUNNER

1. **NVS MODE** switch - **OFF**.
2. **ACM** switch - **OFF**.
3. **TADS** button - **OFF**.
4. **FCR** button L - **OFF**.
5. [BLK 1 **VCR** button - **OFF**]
   [BLK 2 **VCR** button - **STBY**.]
6. [BLK 2 **MASTER SHUTDOWN** - Select.]
7. **INTR LT** panel switch - **OFF**.
8. **CANOPY JETTISON** pin - Install.

8.33 ENGINE SHUTDOWN (EXT PWR) - PILOT/CPG

1. **NVS MODE** switch - **OFF**.
2. **ACM** switch - **OFF**.
3. **TADS** button - **OFF**.
4. **FCR** button L - **OFF**.
5. **VCR** button - **STBY**.
6. [BLK 2 **MASTER SHUTDOWN** - Select.]
7. **PNVS** button - **OFF**.
8. **TAIL WHEEL** button - Lock.
9. **PARK BRAKE** - Set.
10. External Air and Electrical power sources - Connected.
11. External power advisory - Displayed.
12. **MSTR IGN** switch - **OFF** for 2 seconds, then to **EXT** position.
13. **GEN 1** button - **OFF**.
14. **GEN 2** button - **OFF**.
15. **POWER** levers - **IDLE**.
16. [BLK 2 ELT check - Perform.]
17. DMS **FAULT** page - Check for exceedences.
18. Standby attitude indicator - Cage.
19. **POWER** levers - **OFF**. (After engines have cooled at idle for 2 minutes.)
20. **TGT** - Monitor.
21. **RTR BRK** switch - **BRK**. (Below 50% $\mathbf{N_R}$.)
22. Stabilator - Set to **ZERO**.
23. Searchlight - **OFF**.
24. **RTR BRK** switch - **OFF**. (When rotor stops.)
25. **EXT LT**/**INTR LT** panel switches - **OFF**.
26. DTC - Remove and secure door.
27. **MSTR IGN** switch - **OFF**.
28. **MSTR IGN** key - Remove.
29. **CANOPY JETTISON** pin - Install (both crewstations).

8.34 BEFORE LEAVING THE HELICOPTER

1. [BLK 2 ELT Install shorting plug.]
2. External canopy jettison, armament and pylon safety pins - Installed.
3. Chocks - Installed.
4. Post-flight inspection - Completed.

NOTE

If any of the following flight conditions are experienced, an entry in DA Form 2408-13-1 is required:

- Flown in loose grass environment.
- Operated within 10 nm of salt water.
- Exposed to radioactivity.
- Operated within 200 nm of volcanic area.

5. Aircraft forms and records - Completed.
6. Secure helicopter - As required.

Section III. INSTRUMENT FLIGHT

8.35 INSTRUMENT METEOROLOGICAL CONDITIONS

This helicopter is not qualified for flight in instrument meteorological conditions.

8.36 INSTRUMENT FLIGHT PROCEDURES

Refer to FLIP, AR 95-1, FAR Part 91 and FM 1-240.

Section IV. FLIGHT CHARACTERISTICS

8.37 FLIGHT CHARACTERISTICS - GENERAL

The safe maximum operating airspeed range is described in Chapter 5, Section V.

8.37.1 Transient Torque. The AH-64 exhibits a phenomenon, (Transient Torque), that is most evident in maneuvering flight. This is a result of the change in coefficient of lift and drag between the advancing and retreating half of the rotor system being applied by the pilot during maninipulation of the cyclic flight controls. In powered flight, engine torque changes manifested by the rotor system are evidenced through the ECU/DEC response of directing the HMU to provide either more or less fuel as appropriate in order to maintain N_R. As airspeed, gross weight and DA are increased, the the evidence of transient torque becomes more pronounced. Pilots should coordinate lateral cyclic applications with apporpriate collective application to prevent exceeding aircraft limitations, For example: With a rapid application of either left lateral cyclic or left pedal, a rapid torque increase will occur, followed by a decrease in torque. With a rapid application of either right lateral cyclic or right pedal, a torque decrease will occur followed by an even greater increase in torque when left lateral cyclic/left pedal is rapidly applied from the right roll/yaw condition.

Uncompensated rapid cyclic application could result in any of the following:

- Dual or single engine overtorque
- Low Rotor
- Np droop
- Loss of altitude

Section V. ADVERSE ENVIRONMENTAL CONDITIONS

8.38 ADVERSE ENVIRONMENTAL CONDITIONS

This section covers special precautions and procedures to be followed during the various weather and climatic conditions that may be encountered. This material is additional to that already covered in other chapters regarding the operation of various helicopter systems.

NOTE

HIT/A-ICE checks while operating in adverse conditions (e.g., dust, desert, coastal beach area, dry river bed) may be deferred (5 flight hours maximum) at the discretion of the pilot in command until a suitable location is reached.

8.38A TADS/PNVS ADVERSE WEATHER OPERATIONS

CAUTION

During aircraft power up the TADS/PNVS components are susceptible to damage when either heat or cold soaked at temperatures below 40° F (4.4° C) or above 85° F (29.4° C). After electrical power is applied to the aircraft it is necessary to override the automatic TADS/PNVS power up sequence to lessen the probability of system degradation from occurring.

When operating in adverse environmental conditions, the following procedure is recommended:

1. Automatic TADS/PNVS power up sequence - Override (after APU start).

2. ECS cockpit temperature above 44° F (4.4° C) - Set.

3. Cockpit temperatures between 40° F (4.4° C) and 85° F (29.4° C) for ten minutes - Stabilize.

4. TADS and then PNVS power up sequence - Reinitiate.

8.39 COLD WEATHER OPERATIONS

Helicopter operation in cold weather or an arctic environmemt presents no unusual problems if the flight crew is aware of various changes that occur in low temperature conditions.

8.39.1 Cockpit Fogging.

Cockpit fogging has been encountered on the ground and in flight when heating is commanded.

WARNING

The fogging of the canopy and all other glass surfaces in the cockpit can create possible simultaneous loss of outside visibility and electro-optical sensors during all flight conditions. This condition can result in crew disorientation, loss of control, and/or obstacle impact.

The following procedures should be used during all flight modes and ground operations when environmental conditions when temperatures are between 40° F and 70° F (4.5° C and 21° C) and greater than 70 percent relative humidity.

1. Set the cockpit temperature to 60° F (16° C) and select **DEFOG OFF**.

2. Select **CANOPY ANTI-ICE ON** for the remainder of the flight.

CAUTION

If a crew member must change the cockpit set temperature, change the temperature in one cockpit at a time. To prevent the possibility of both cockpit transparencies fogging at the same time, do not change both cockpits simultaneously.

Should fogging occur, lower the cockpit set temperature below indicated return temperature to enable the cooling mode. Keep the cockpit set temperature at the new setting until the flight is complete.

1. Ensure the CANOPY ANTI-ICE is ON.

2. Select DEFOG ON. If canopy fogging is not visibly reduces, turn DEFOG OFF.

8.40 COLD WEATHER PREFLIGHT

8.40.1 Ice or Snow. If ice or snow is found in engine inlets and exhaust, remove as much as possible by hand and thaw engine out with hot air before attempting to start. Actuate **POWER** levers for freedom of movement before starting main engine.

CAUTION

Fuel draining from the affected component after several minutes of heat application does not necessarily indicate that all ice has melted. Ice may still remain in the unit and it could be a serious hazard to flight operations. Heat should be applied for a short time after fuel begins to flow from the drain and the drainage should be checked frequently until it is evident that all water has been removed.

8.40.2 Free Flowing Fuel. If fuel flows freely from drains in the tanks, it can be assumed that the system is free of ice. Any indication that flow is restricted is cause for application of heat.

8.40.3 Frozen Water in Sumps. If water collected in sumps has frozen (indicated by a lack of flow from drain), apply heat liberally and open drain frequently. Catch fuel and check for globules of water in the fuel. Continue sampling until fuel is free of all water globules.

CAUTION

Ice removal shall never be done by scraping or chipping. Remove ice by applying heat or de-ice liquid.

8.40.4 Ice and Snow Removal. In addition to doing a normal preflight in Section II, the rotor head, main rotor blade, tail rotor, and flight controls should be free of all ice and snow. Failure to remove snow and ice accumulations while on the ground can result in serious aerodynamic and structural effects in flight. Check that all fuel tank vents, static ports, pitot tubes, engine inlets, APU air inlet, ECS air inlet, and heat exchangers are free of snow and ice; and that tires, landing gear struts, and the hydraulic accumulator are properly serviced.

CAUTION

It is recommended that the tail rotor teetering bearings warm-up procedure be accomplished as the last item of the exterior check during the flight crew preflight inspection. Between -20° C (-4° F) and -32° C (-26° F) the helicopter must be started and the tail rotor must be turning within 5 minutes of teeter bearing warm-up. Below -32° C (-26° F), elapsed time is reduced to 2 minutes. At a temperature of -32° C (-26° F) or below, the tail rotor must be cycled by an applied force no greater than 75 lb.

8.40.5 Tail Rotor Teetering Bearings. The tail rotor teetering bearings are made of elastomeric material which require special warm-up procedures prior to operation in cold weather flights. One member of the crew should apply a teetering motion by manually pushing back and forth at the tip of the tail rotor blade until the blade has reached its teetering stops. When the blade can be pushed to the stop, the bearing has been sufficiently warmed up. At -20° C (-4° F), a final applied force of less than 75 lb is expected to reach the stops. Based on achieving a final applied force of 75 lb to reach the stops, the blades must be cycled 1 time at -32° C (-26° F), 5 times at -42° C (-44° F) and 10 times at -54° C (-65° F).

8.41 CONTROL EXERCISE

To eliminate droop stop wear (in the event the main rotor blades move through a pitch change while resting on the droop stop), the flight crew should observe the following: At a temperature of -42° C (-44° F) or below and with a rotor speed of 101% N_R, flat pitch, maintain neutral cyclic position for 1 minute. Then move the cyclic forward 1/2 in. (0.500) and hold for 1 minute. Move the cyclic forward additional 1/2 in. (0.500) and hold for 1 minute. Return flight controls to centered, neutral position. The total procedure requires 3 minutes after reaching normal rotor RPM and can be accomplished simultaneously with the engine warm-up procedures.

8.42 ENGINE OIL SYSTEM CHARACTERISTICS

8.42.1 Initial Oil Pressure During Cold Weather. It is normal for engine oil pressure to be high during initial starts when oil is cold. Run engine at idle until oil pressure is within normal operating limits. Oil pressure should return to the normal range within 5 minutes. During these 5 minutes, do not accelerate above ground idle speed until oil pressure can be held to maximum limit throughout acceleration. However, time required for warm-up will depend on temperature of the engine and lubrication system.

8.42.2 Cold Weather Start Characteristics. During starts in extremely cold weather near -54° C (-65° F), the following oil pressure characteristics are typical:

a. Oil pressure may remain at zero from 20 to 30 seconds after initiating the start. Abort start if oil pressure does not register within 1 minute of initiating start.

b. Once oil pressure begins to indicate on the MPD, it will increase rapidly and go over 120 psig limit. The pressure will decrease as oil temperature rises. This condition is considered normal. The time for oil pressure to decrease to 120 psig or below will depend on the severity of the ambient temperature.

8.42.3 Oil Filter Bypass. The system monitors for oil filter bypass when a positive engine run status is received. An engine (1 or 2) oil filter bypass advisory occurs when the system processor receives a positive bypass indication. The UFD/EUFD advisory normally occurs when starting an engine with oil below normal operating temperatures because of the relatively high oil viscosity and/or the amount of contamination in the oil filter. The UFD/EUFD advisory reads **OIL** (**1** or **2**) **BYP**. When oil temperature reaches about 38° C (100° F) during engine warm-up, the advisory should go off.

8.43 ENGINE WARM-UP

At temperatures between -17° C (1° F) and -43° C (-45° F), warm up engines during engine run-up for 3 minutes at **IDLE**. The power levers should reman at **IDLE** until the NGB temperatures indicate 20° C or above.

8.44 LIGHTNING STRIKES

8.44.1 Lightning Strikes - Possible Results. Lightning strikes may result in loss of the engine Digital Electronic Control (DEC) and helicopter electrical power. The high voltages passing through the helicopter wiring can produce secondary effects causing degradation to the mission equipment.

8.44.2 Lightning Strike Causes Loss of Power. If a lightning strike occurs where all helicopter electrical power and engine ECU 701/DEC 701C are lost, both engines will go immediately to maximum power output, as if in **LOCKOUT**. The flight crew shall have to react immediately to retard the **POWER** levers to **IDLE** and enter autorotation. The pilot could then advance the **POWER** levers, restoring power. Because of the high probability that all engine instruments will be inoperative, the pilot will rely solely on rotor and engine sounds and general helicopter handling.

8.45 GROUND OPERATIONS DURING HIGH WINDS

WARNING

The maximum wind velocity for rotor start or stops is 45 kts from any direction. Ground operation of the aircraft in winds greater than 45 kts may cause the main rotor blades to contact the fuselage or the aircraft to roll over.

8.45.1 Surface Winds Above 45 Knots Anticipated. If surface winds above 45 kts are anticipated, ground operations should cease and the helicopter should be hangared or moored in accordance with TM1-1520-Longbow/Apache. If the helicopter cannot be hangared or moored and sufficient time exists to shut the aircraft down prior to winds exceeding 45 kts, then do so. Ensure rotor blades are positioned to the 45° point displacement and lock the rotor brake prior to shutting down the APU.

8.45.2 Surface Winds Above 45 Knots Inadvertently Encountered. If surface winds above 45 kts are inadvertently encountered during ground operations, the following procedure is recommended:

1. Aircraft - Head into the wind.
2. $\mathbf{N_P/N_R}$ - 101%.
3. **TAIL WHEEL** button - LOCK.
4. **PARKING BRAKE** - Set.
5. Stabilator - **AUTO**.
6. Cyclic and Collective - Adjust as required.

8.46 TURBULENCE OPERATIONS

The following procedure is recommended:

1. Airspeed - Adjust as follows:
2. For moderate turbulence, airspeed should be less than 150 KTAS.

8.47 ICING OPERATIONS

8.47.1 Preflight/Run-up. Prior to flight in below freezing temperatures, special care should be taken to insure that all necessary anti-ice systems are operational.

NOTE

- Anti-ice systems should be activated prior to flight in potential icing conditions.
- Prolonged operation of the anti-ice systems while on the ground may result in damage.

a. Anti-Ice. The system monitors for automatic anti-ice operation and for manual operation through an MPD input.

8.47.2 Anti-Ice Cautions and Advisories. The following UFD/EUFD cautions and advisories are provided to indicate icing conditions and anti-ice system status:

a. Engine Anti-Ice Fail. The system begins monitoring for anti-ice failure when a positive engine run status is received by the system processor. When the system processor detects an anti-ice system failure, the UFD/EUFD caution will read **ENG** (**1** or **2**) **A-ICE**.

b. Severe Icing Conditions. The system begins monitoring for severe icing when generator power is applied. When the system processor detects severe icing conditions, the UFD/EUFD caution will read **ICE SEVERE**.

c. Canopy Anti-Ice Fail. The system begins monitoring for canopy anti-ice failure when generator power is applied. When the system processor detects canopy anti-ice failure, the UFD/EUFD caution will read **CANOPY A-ICE**.

d. Ice Detect Fail. The system begins monitoring for ice detection failure when generator power is applied. When the system processor detects ice detection failure, the UFD/EUFD caution will read **ICING DETECT**.

8.47.3 Effects of Icing on Aircraft Performance. The main and tail rotor blades will accumulate ice. The effects of the ice accumulation are unknown. Asymmetric shedding of ice from the main rotor will increase helicopter vibrations.

8.48 DESERT AND HOT WEATHER OPERATIONS

Refer to FM 1-202, Environmental Flight.

CHAPTER 9
EMERGENCY PROCEDURES

Section I. HELICOPTER SYSTEMS

9.1 HELICOPTER SYSTEMS

This section describes the helicopter system emergencies that may reasonably be expected to occur and presents the procedures to be followed. Emergency operation of mission equipment is contained in this chapter, insofar as its use affects safety of flight. Emergency messages are provided by Up Front Display (UFD)/Enhanced Up Front Display (EUFD) format and Master Warning (**MSTR WARN**) and Master Caution (**MSTR CAUT**) illuminated pushbuttons. Emergency procedures are given in Multipurpose Display (MPD) format and checklist form when applicable. A condensed version checklist of these procedures is contained in the condensed checklist, TM 1-1520-251-CL.

9.2 IMMEDIATE ACTION EMERGENCY STEPS

NOTE

- The urgency of certain emergencies requires immediate and instinctive action by the pilot. The most important single consideration is helicopter control. All procedures are subordinate to this requirement.
- When continued flight is in question, due to a loss of rotor RPM or reduction of available power (as a result of equipment malfunctions or environmental conditions), the immediate corrective action should be to adjust collective to maintain Nr within limits and jettisoning of the aircraft wing stores. This should be done as the immediate means of reducing power requirement by approximately 1% torque per 200 lbs. of weight reduction.
- The Master Warning and Master Caution (**MSTR WARN** and **MSTR CAUT**) illuminated buttons should be reset after each malfunction to allow systems to respond to subsequent malfunctions. It is always possible that a caution light will unnecessarily illuminate. Whenever possible, check the caution or advisory message against the A/C **SYS** page or **DMS FAULT** page to verify that a malfunction has actually occurred. If time permits, during response to emergency situations, the crew must consider transmitting a Mayday call, selecting **XPNDR** button on emergency panel and locking shoulder harness.

WARNING

In the event of a procedural difference between the written and displayed checklists, the steps in this chapter shall take precedence.

Those steps that must be performed immediately in an emergency situation are underlined. These steps must be performed without reference to the checklist. When the situation permits, confirm steps accomplished and complete non-critical steps from the displayed or written checklist. If the **ENG** page is displayed on either MPD, and the DTC checklist procedures are loaded, emergency procedures will automatically be displayed. If neither MPD has the **ENG** page displayed, the system will automatically page to the **ENG** page in response to all aircraft warning messages that have voice message capability.

9.3 DEFINITION OF EMERGENCY TERMS

9.3.1 Land Without Delay. The term <u>LAND WITHOUT DELAY</u> is defined as a landing in which the primary consideration is continued control of the aircraft and survival of the occupants. It is meant to be more urgent than Land As Soon As Possible. The situation may not permit the aircrew to continue to maneuver the aircraft to a suitable landing area (e.g., open field). If maneuvering to an open area is not practical, then the crew must make the decision to land in an area that will have the least amount of negative impact on crew survivability. (e.g. Over dense forest, select an area with the smallest trees, in a mountainous area, choose an area with the least amount of slope).

9.3.2 Land as Soon as Possible. The term <u>LAND AS SOON AS POSSIBLE</u> is defined as landing at the nearest suitable landing area (e.g., open field) without delay. The primary consideration is to ensure the survival of occupants.

9.3.3 Land As Soon As Practicable. The term LAND AS SOON AS PRACTICABLE is defined as landing at a suitable landing area. The primary consideration is the urgency of the emergency.

9.3.4 Autorotate. The term AUTOROTATE is defined as adjusting the flight controls as necessary to establish an autorotational descent and landing.

9.3.5 Emergency Engine Shutdown.

CAUTION

- **When shutting down an engine that has malfunctioned in flight, it is important to identify the malfunctioning engine to avoid shutting down the wrong engine.**
- **Monitor TGT after shutdown. If TGT rises above 540 °C, or there is evidence of combustion as indicated by a rapid rise in TGT, place the engine START switch in IGN OVRD position and motor engine until TGT decreases below 540 °C.**

The term EMER ENG SHUTDOWN is defined as engine shutdown without delay. Engine shutdown in flight is usually not an immediate action item unless a fire exists. Before attempting an engine shutdown, identify the affected engine by checking engine-out warning messages on the UFD/EUFD and observe the MPD **ENG** instrument page for **TGT**, **N_P**, **N_G**, **TORQUE $_{\%}$**, and engine oil pressure (**OIL PSI**) indicators.

POWER lever (affected engine) - **OFF**.

9.3.6 Wing Stores Jettison. The term WING STORES JETTISON is defined as jettisoning any or all of the wing stores as appropriate using one of three methods listed in para. 9.26.1. The method to be used will be determined by the aircrew depending on the situation at the time of the emergency.

9.4 AFTER EMERGENCY ACTION

After a malfunction of equipment has occurred, appropriate emergency actions have been taken and the helicopter is on the ground, an entry will be made in the Remarks Section of DA Form 2408-13-1 describing the malfunction. Ground and flight operations will be discontinued until corrective action has been taken.

9.5 EMERGENCY EXIT AND ENTRANCE

WARNING

- **Activation of the canopy removal system when combustible fuel/vapors are present in the cockpit can result in an explosion/fire. An explosion/fire can also occur if the aircraft has rolled on its side and fuel vapors have gathered on the ground adjacent to the canopy side panels. The crewmembers survival knife may be used to fracture the canopy side panel as an alternate means of egress.**
- **Continuing to twist the canopy jettison handle while trying to push may cause the actuator to jam and thereby prevent operation of the canopy severance system. If the canopy jettison does not occur on the first attempt, ensure the handle is in the 90° position, and push again. A push force of 140 - 150 lb may be required to overcome the jam and initiate canopy jettison.**
- **In the event that canopy jettison does not occur when the canopy removal system is actuated, the personal survival knife should be used to fracture the canopy panel and permit egress.**
- **In all cases of canopy jettison, remain clear of canopy side panels to avoid high velocity canopy fragments.**
- **If emergency egress is required before the rotor blades have stopped, ensure MSTR IGN - BATT and cyclic remains centered to prevent rotors from striking personnel/ground.**

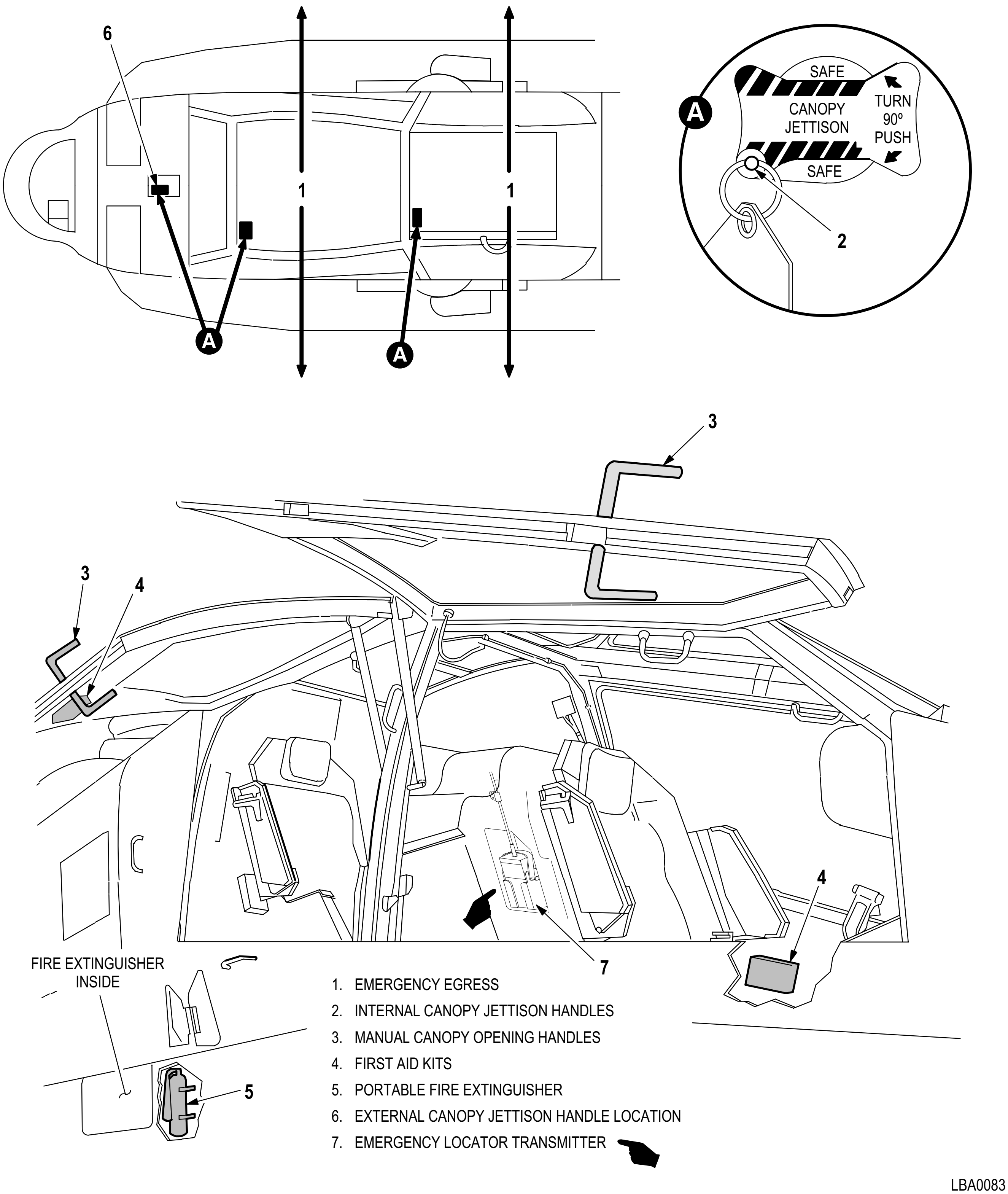

Figure 9-1. Emergency Equipment and Emergency Exits

9.5.1 Emergency Egress. Emergency exits and equipment (fig 9-1) permit emergency egress by the pilot and CPG from the helicopter. If possible, use the manual canopy opening handles to open the canopy and exit the aircraft. The transparent portion of the four canopy side panels can be jettisoned by turning any one of three **CANOPY JETTISON** handles 90° and pushing . This will initiate canopy side panel jettison. If emergency egress becomes necessary, proceed as follows:

1. Helmet visors - Down.
2. Area around helicopter - Clear of personnel.
3. **CANOPY JETTISON** handle - Turn 90°, release, then push to jettison canopy.

9.6 ENGINE POWER LOSS - PARTIAL OR COMPLETE ENGINE MALFUNCTION OR POWER-LIMITING

WARNING

Prior to movement of either POWER lever, it is imperative that the malfunctioning engine and the corresponding POWER lever be identified.

9.6.1 Flight Characteristics. The flight characteristics and the required crewmember control response after a dual engine failure are similar to those during a normal power-on descent. Full control of the helicopter can be maintained during autorotational descent. When one engine has failed, completely or partially, the helicopter can often maintain altitude and airspeed until a suitable landing site can be selected. Whether or not this is possible becomes a function of such combined variables as aircraft weight, density altitude, and airspeed at the time of the engine failure. The jettisoning of wingstores will immediately reduce an aircraft's gross weight and correspondingly reduce power requirements. Crewmember response time and control technique may be additional factors.

9.6.2 Engine Failure and Engine Power Loss: General. The various conditions under which an engine may fail or experience a power loss, prevent a standard procedure for all cases. A thorough knowledge of both emergency procedures and flight characteristics will enable the pilot to respond correctly and automatically in an emergency. Engines may fail partially or performance limit. The degree of the failure/ amount of power loss is factored into crewmember response. The engine instruments often provide ample warning of an impending failure by deviating from normal indications. An impending engine TGT limiter activation will not provide any cues prior to functioning. Engine failure is normally indicated by a rapid drop in **N_G**, **N_P**, torque, **TGT**, oil pressure and the symbolic torque value on the MPD/HMD displays flashing. Performance limiting will continue to display normal **Ng** and oil pressure indications; as power demand increases, **Np** and **N_R** will collectively decay and the **TGT** will remain at the engine limiter setting; torque indications will vary as a result of collective manipulation. Engine failure is annunciated by a voice message **ENGINE 1** (or) **2** out as applicable, [BLK 1 **ENG1 OUT/ENG2 OUT** (UFD)] [BLK 2 **ENGINE 1 OUT/ENGINE 2 OUT** (EUFD] messages, MPD message **ENGINE 1** (or) **2 OUT**, and flashing **MSTR WARN** lighted push button. The MPD will autopage to the **ENG** Page if not already displayed.

A partial engine power loss may follow certain mechanical failures, such as an ECU/DEC malfunction, or an operator may make a power demand that exceeds an engine's performance capability. An engine's performance may be environmentally limited (high temp, high-pressure altitude/high gross weight) as a result of **TGT**, fuel flow and **NG/MACH**. When a loss of rotor RPM/performance limitation is encountered, the pilot on the controls should immediately adjust the collective to maintain **N_R** within limits; and as conditions warrant, jettison the aircraft wing stores. The jettisoning of wing stores will immediately reduce the aircraft's gross weight and correspondingly reduce power requirements. Additionally, at low speeds the pilot on the controls should coordinate flight into the prevailing wind. When practical, consideration may be given to making a right banking turn or a right pedal turn to aid in reducing the immediate power requirements.

A left banking turn or left pedal turn will require more power. Proper use and understanding of the **PERF** page and the application of **PERF** calculations will significantly reduce the potential for engine performance limiting. Caution must be exercised when operating close to an engine performance limit. For example, when operating near the dual engine **TGT** limiter setting, a gust of wind from aircraft's rear or left, or an activation of the engine anti-ice could result in a reduction of available engine power. The aircrew should not engage any hold modes when operating near the dual engine limiter setting.

The reduction required in collective after engine failure will vary with the altitude and airspeed at the time of failure. For example, the collective should not be reduced when an engine fails while the helicopter is hovering below 15 ft. During cruise flight, when altitude and airspeed permit a significant reduction in collective pitch, N_R can be restored to 101% before landing. During single-engine flight or during autorotation, airspeed should be kept at the optimum (fig 9-2). Engine failure accompanied by an explosion or loud noise would indicate engine damage, and there is a possibility that an attempt to restart the engine would result in a fire.

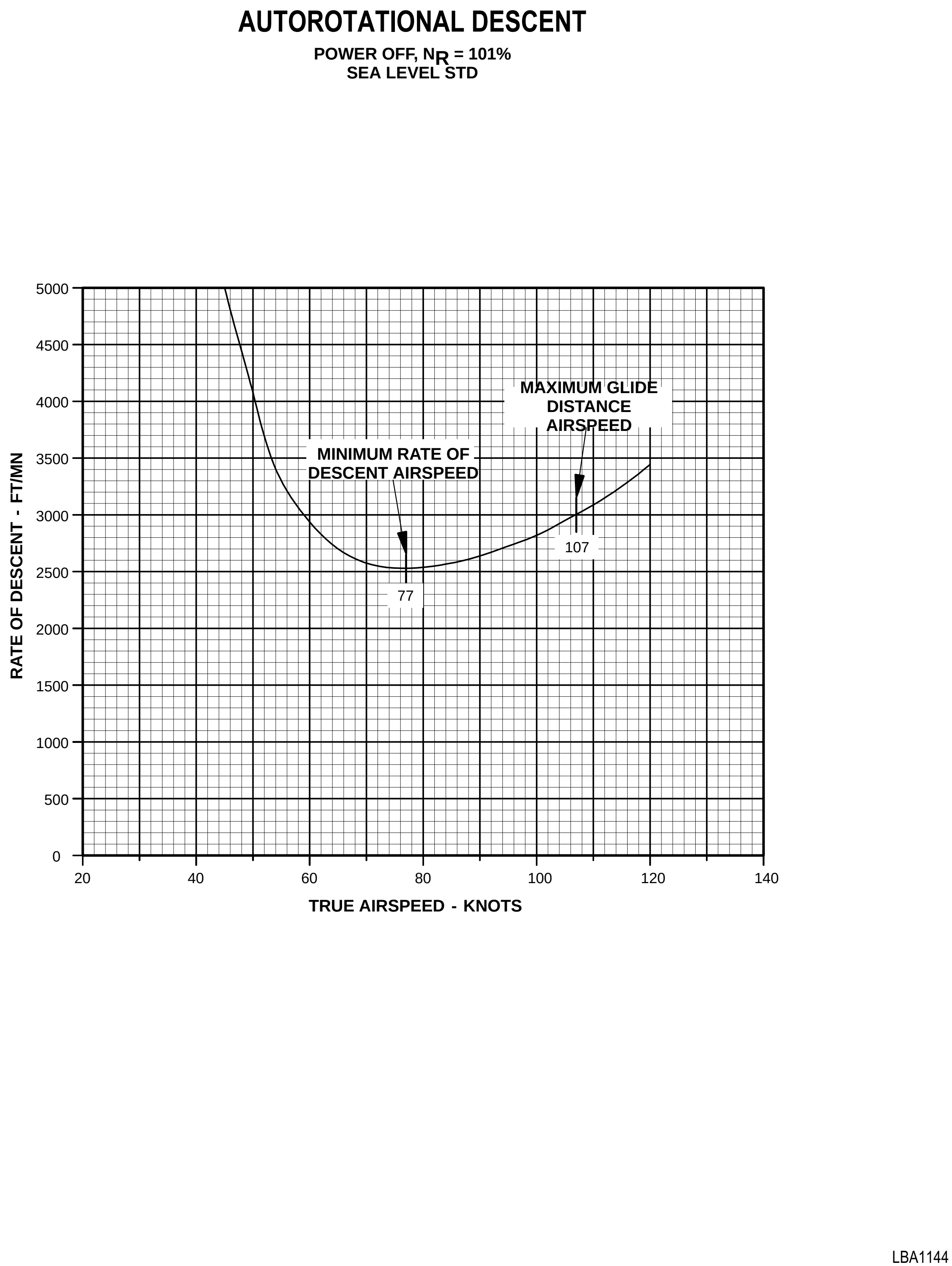

Figure 9-2. Autorotative Glide Chart

9.6.3 Single-Engine Failure: **General**. Proper response to an engine failure depends on various factors: density altitude, airspeed, aircraft weight, single-engine performance, and environmental conditions. The unshaded region in the height velocity diagrams (figs 9-3) represent the air speed and wheel height combinations that will permit a safe landing in event of an engine failure with average pilot alertness, skill, and reaction time. The avoid, shaded, region represents hazardous airspeed and wheel-height combinations from which a single engine landing would be extremely difficult without some degree of aircraft damage or crewmember injury. Crewmember alertness, correct recognition and subsequent actions are essential to perform a single engine landing. Crewmember actions should be based on the following general guidelines:

- At low density altitude and low airspeed, it may be necessary to lower the collective only enough to maintain N_R in the normal range.
- At higher density altitude the collective may be lowered significantly to increase Nr to the normal range.
- When hovering in ground effect, the collective should be used only as required to cushion the landing, primary consideration is in maintaining a level attitude.
- In forward flight at low altitude (as in takeoff or landing), when a single-engine capability to maintain altitude does not exist, a decelerating attitude will initially be required to prepare for landing.
- If airspeed is low and altitude above the obstacles is sufficient, the helicopter should be placed in an accelerating attitude to gain sufficient airspeed for single-engine fly-away to a selected landing site.
- When the power available during single-engine operation will not support continued flight, the crew should jettison external wing stores as an immediate means of reducing power requirements.

9.7 SINGLE ENGINE FAILURE - LOW ALTITUDE/LOW AIRSPEED AND CRUISE

A voice message will announce **ENGINE 1 OUT** (or) **ENGINE 2 OUT**. The [**BLK 1** UFD will display **ENG1 OUT/ENG2 OUT**]. The [**BLK 2** EUFD will display **ENGINE 1 OUT/ENGINE 2 OUT**.]

1. WING STORES JETTISON - As appropriate.
2. LAND AS SOON AS PRACTICABLE.

9.8 ENGINE RESTART DURING FLIGHT

WARNING

- **A failed engine should not be restarted unless it can be determined that it is reasonably safe to do so**.
- **When attempting to restart ENG1 following a single engine failure, a malfunctioning crossfeed valve could cause the remaining engine (ENG2) to fail.**

NOTE

- After an engine failure in flight, an engine restart may be attempted.
- Inflight restarts do not need to utilize a warm start procedure.

9.9 DUAL ENGINE FAILURE: GENERAL

WARNING

In the event of an inadvertent activation of the engine chop switch, **initial indications from N_P and N_R could be interpreted as a dual engine failure**. **Engine chop is annunciated by a voice message ENGINE CHOP**, **UFD/EUFD**, **and MPD messages ENG CHOP/ENGINE CHOP and engine idle indications for N_G, TGT, and N_P**.

9.9.1 Both Engines Fail. If both engines fail, immediate action is required to make a safe autorotation descent. The altitude and airspeed at which a two-engine failure occurs will dictate the action to be taken. After the failure, main rotor rpm will decay rapidly and the aircraft will yaw to the left. Unless a two-engine failure occurs near the ground, it is mandatory that autorotation be established immediately. During cruise at airspeeds to V_{NE}, reduce collective immediately to regain N_R and then adjust as required to maintain rpm. The cyclic should be adjusted as necessary to attain and maintain the desired airspeed of 77 to 107 KTAS. In autorotation, as airspeed increases above 70 - 80 KTAS, the rate of descent and glide distance increase significantly. Below 70 KTAS, the rate of descent will also increase, but glide distance decreases. Autorotation during an out of trim condition will increase the rate of descent and decrease the glide distance. A landing area must be selected immediately after both engines fail, and control inputs must be made to fly to the intended site. Throughout the descent, adjust collective as necessary to maintain N_R within normal range. At high gross weights, the rotor may tend to overspeed and the collective must be used to maintain the desired rotor rpm. N_R should be maintained at or slightly above 101% to allow ample rpm before touchdown, and heading maintained by pedals.

9.9.2 Momentary RPM Increase. Main rotor rpm will increase momentarily when the cyclic is moved aft with no change in collective pitch setting. An autorotation rpm of approximately 101% provides for a good rate of descent. N_R above 101% may result in a higher than desired rate of descent. At 75 to 125 ft AGL, use aft cyclic to decelerate. This reduces airspeed and rate of descent and causes an increase in N_R. The degree of increase depends upon the amount and rate of deceleration. Ground contact should be made with some forward speed. If a rough landing area is selected, a more pronounced deceleration is necessary and touchdown speed should approach zero. It is possible that during the autorotative approach, the situation may require additional deceleration. In that case, it is necessary to assume a landing attitude at a higher altitude than normal. Should both engines fail at low airspeed, initial collective reduction may be necessary to maintain N_R within normal range. In some instances at low altitude or low airspeed, settling may be so rapid that little can be done to avoid a hard-impact landing. In that case, it is critical to maintain a level landing attitude. Cushion the landing with remaining collective as helicopter settles to the ground.

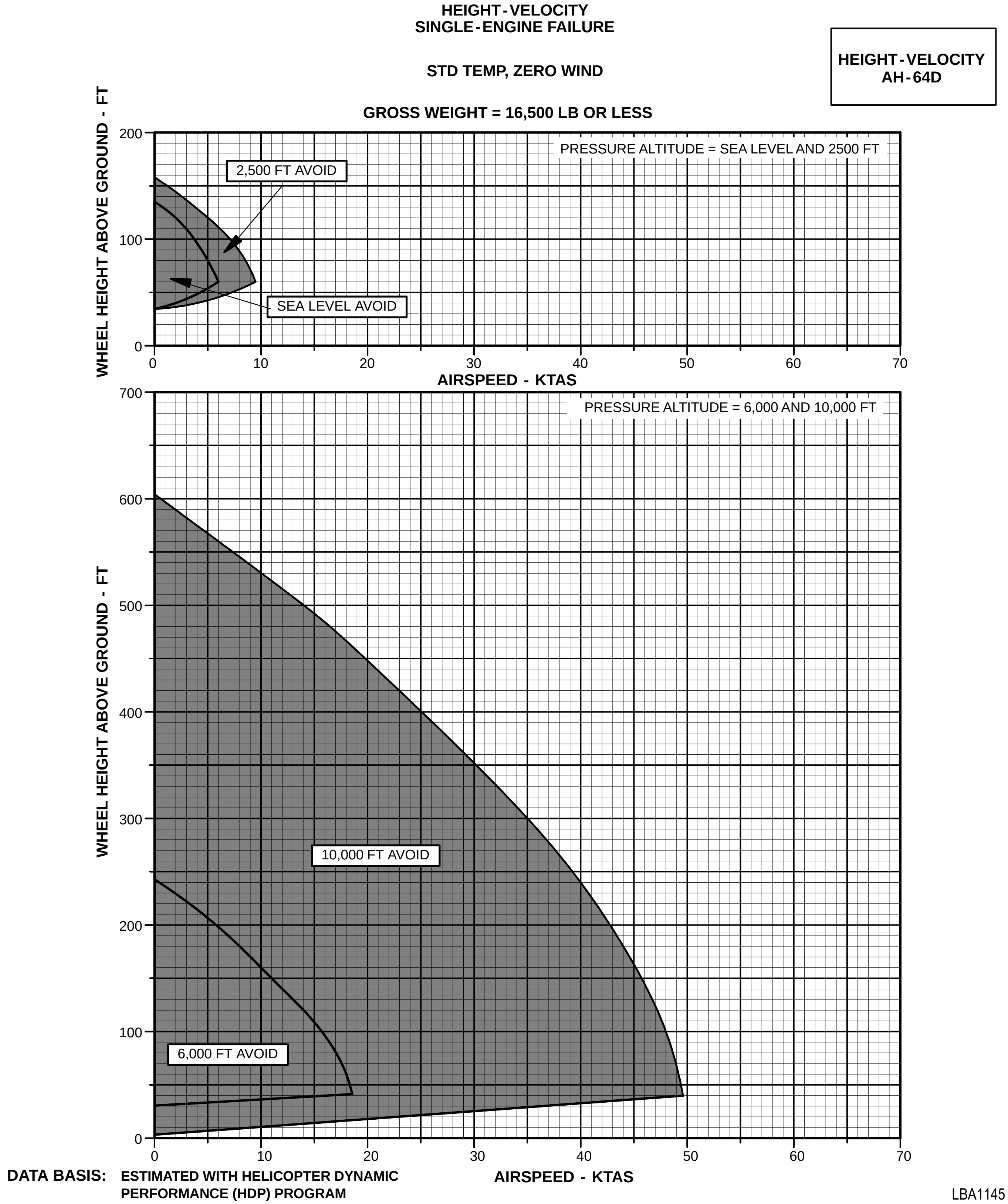

Figure 9-3. Height Velocity Plots (Sheet 1 of 3)

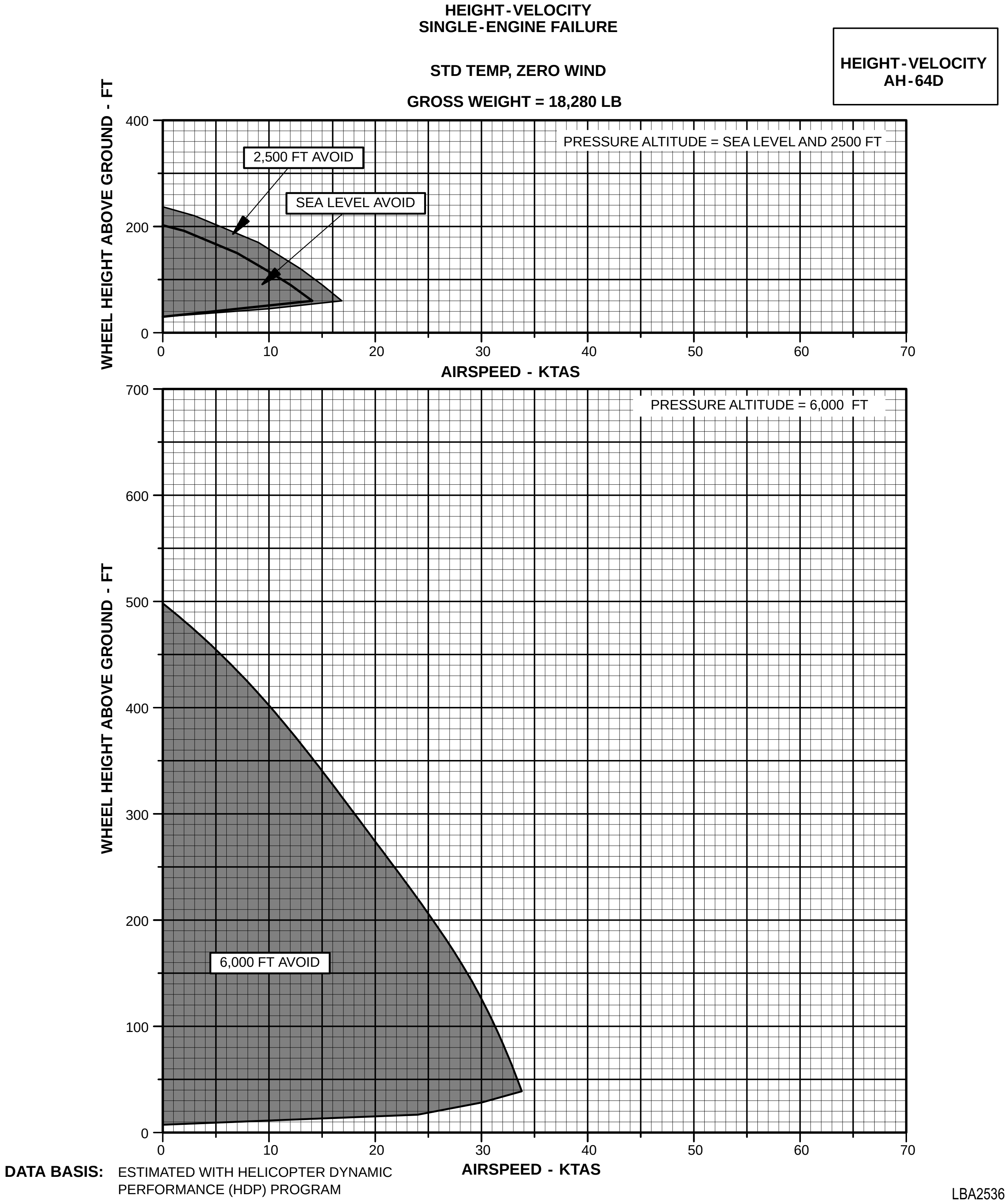

Figure 9-3. Height Velocity Plots (Sheet 2 of 3)

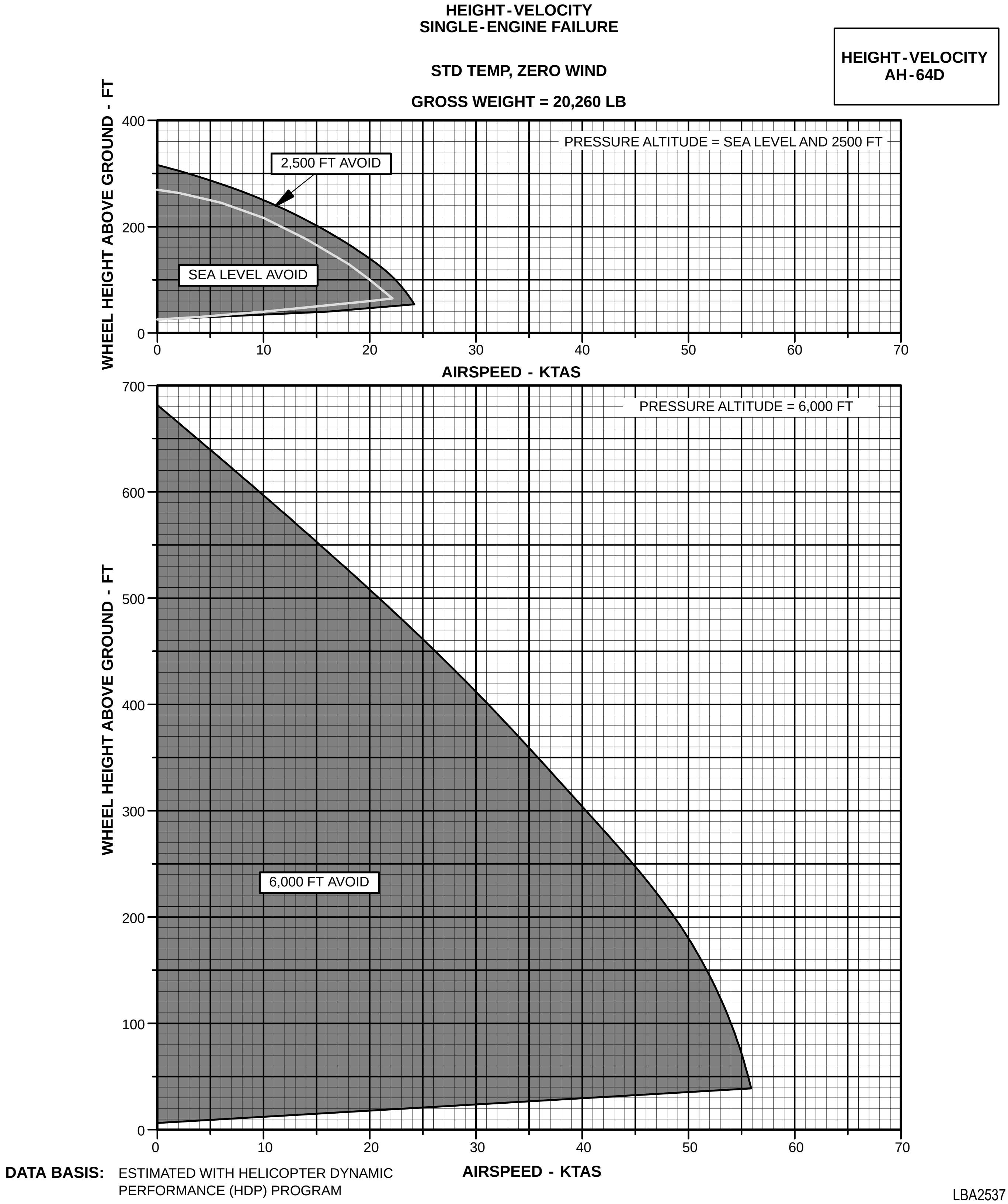

Figure 9-3. Height Velocity Plots (Sheet 3 of 3)

9.10 DUAL ENGINE FAILURE - LOW ALTITUDE/LOW AIRSPEED AND CRUISE

A voice message will announce **ENGINE 1 OUT** and **ENGINE 2 OUT**. The [BLK 1 UFD will display **ENG1 OUT** and **ENG2 OUT**.] The [BLK 2 EUFD will display **ENGINE 1 OUT** and **ENGINE 2 OUT**.]

CAUTION

With the POWER levers in FLY, resetting the CHOP button will cause an erroneous engine 1 out and engine 2 out warning to be activated.

1. AUTOROTATE.
2. **CHOP** button - Reset only if an engine chop warning message is present.
3. WING STORES JETTISON - As appropriate.

9.11 ENGINE 1 OR 2 OVERSPEED - N_P FAILED HIGH

A voice message will announce **ENGINE 1 OVERSPEED** or **ENGINE 2 OVERSPEED**. The [BLK 1 UFD will display **ENG1 OVSP** or **ENG2 OVSP**.] The [BLK 2 EUFD will display **ENGINE 1 OVERSPEED** or **ENGINE 2 OVERSPEED**.]

1. Collective - Adjust to maintain N_R within limits.

   If condition persists:

2. **POWER** lever (affected engine) - Retard to equalize torque.
3. LAND AS SOON AS PRACTICABLE.

9.12 ENGINE ALTERNATOR MALFUNCTION

CAUTION

- 701 - **Complete failure of the alternator or of the winding providing N_G speed signal will activate the MSTR WARN light and engine 1 out or engine 2 out voice message and UFD/EUFD messages. The pilot shall check the N_R on ENG page and be prepared to carry out the actions for a high side failure. Thereafter, refer to TGT and engine oil PSI, along with engine fuel PSI and nose gearbox oil PSI messages.**
- 701C - **Following a complete failure of an alternator, operation of the corresponding engine and all indications from engine instruments will be normal, except that N_G indications will be lost and will activate the MSTR WARN light and engine 1 out or engine 2 out voice message and UFD/EUFD messages.**

The engine alternator has three windings, providing power for engine ignition, aircraft N_G speed indication, and electrical control system operation. A failure of the ignition winding would result in loss of electrical power to the ignition circuitry which would be detected by inability to start the engine. A failure of the winding providing N_G speed indication signal would not affect actual engine operation; however, the pilot would have no N_G indication. A failure of the winding providing electrical power to the engine ECU 701 is the most severe and requires immediate action by the pilot. The immediate indication to the pilot may be the affected engine accelerating to maximum power. There will also be a loss of N_p and torque indication. If this failure is due to a complete loss of the alternator, then no N_G indication will be present either. The engine TGT will still be indicating because it is not acted upon by the ECU 701; however, TGT limiting will no longer be available. N_p overspeed protection will be present because aircraft power is supplied for that function. If an alternator failure is suspected and the affected engine accelerates to maximum power, proceed as in **ENGINE 1** or **2 OVERSPEED - Np FAILED HIGH**.

9.13 LOW RPM ROTOR - N_P FAILED LOW

NOTE

Advancing the **POWER** lever of the engine with low torque and TGT to **LOCKOUT** disables the automatic temperature limiting for that engine. The engine must be controlled manually to ensure that it does not exceed operating limits.

LOW ROTOR RPM indications may be the result of one or both 701 or 701C engines having entered a performance-limiting condition. Refer to paragraph 9.6.2 **Engine Failure and Engine Power Loss** for procedural information.

A voice message will announce **ROTOR RPM LOW**. The [BLK 1 UFD will display **LOW RTR**.] The [BLK 2 EUFD will display **LOW ROTOR RPM**.]

1. Collective - Adjust to maintain N_R within limits.

   If condition persists:

2. **POWER** lever (affected engine) - **LOCKOUT** and then retard to equalize torque output of both engines.

   If manual control is not possible:

3. **POWER** lever (affected engine) - **IDLE**.
4. LAND AS SOON AS PRACTICABLE.

If continued flight is not possible, proceed as in paragraph **9.7 SINGLE ENGINE FAILURE**.

9.14 ENGINE COMPRESSOR STALL

An engine compressor stall is normally recognized by a noticeable bang or popping noise and possible aircraft yaw. These responses are normally accompanied by a rapid increase in **TGT** and fluctuations in N_G, **TORQUE**, and N_P readings for the affected engine. In the event of a compressor stall:

1. Collective - Reduce.

   If condition persists:

2. **POWER** lever (affected engine) - Retard.

   If **TGT** decreases and there is no further evidence of a stall;

3. **POWER** lever (affected engine) - **FLY**.

   If stall condition recurs:

4. **POWER** lever (affected engine) - **IDLE**.
5. LAND AS SOON AS PRACTICABLE.

9.15 ROTORS, TRANSMISSIONS, AND DRIVE SYSTEMS

WARNING

Pilot situational awareness is critical in the successful accomplishment of these procedures. The low inertia rotor system, coupled with high rates of descent during vertical autorotation, may not provide the pilot with adequate reaction time and cushioning pitch. Activation of the CHOP button or reduction of the POWER levers prior to reduction of the collective will result in a rapid decay of rotor rpm. Successful completion of an out-of-ground effect hovering autorotation is doubtful.

CAUTION

If engine chop is used to minimize main rotor torque, increasing collective pitch without first retarding POWER levers to IDLE may cause engine acceleration and uncommanded yaw.

9.15.1 Tail Rotor Malfunctions. These procedures represent a best estimate of helicopter reactions and crew procedures. The most critical consideration in responding to any tail rotor malfunction is that the crewmember correctly interprets the nature and extent of the problem. Tail wheel shall be locked during all landings.

9.15.2 Loss of Tail Rotor Thrust - General. Loss of tail rotor thrust occurs when there is a break in the drive system; for example, a severed drive shaft. The nose of the helicopter will turn to the right. If the helicopter is in forward flight, there will be a right roll of the fuselage along the longitudinal axis, and the nose of the helicopter may pitch downward. This downward pitch will be more pronounced if a tail rotor component has been separated from the helicopter. In some cases, depending on the severity of the right rotation, powered flight to an acceptable landing site may be accomplished by maintaining or increasing airspeed. The degree of sideslip and amount of roll may be varied by changing airspeed and by varying collective pitch. Neither, however, can be completely eliminated.

9.15.3 Loss of Tail Rotor Thrust in Cruise Flight.

WARNING

If airspeed is allowed to approach effective translational lift, the sideslip angle may become quite severe and helicopter control may be lost.

a. Continued Flight Possible. At cruise airspeeds, it may be possible that level flight at some stabilized yaw angle can be maintained. The degree of sideslip will depend on the airspeed and power required to maintain flight. Some left cyclic should be used to stop the slow right turn induced by the loss of thrust. Care should be taken to avoid slowing the helicopter. The airspeed indicator may not provide useful information once the sideslip is established, but true airspeed, yaw angle, engine torque, and rate of climb or descent should provide cues necessary to maintain flight. If yaw angle becomes excessive, reduce power and lower the nose to retain adequate airspeed. A minimum of 90 KTAS during a shallow approach to a roll on landing should be maintained until approximately 10 to 20 ft above the touchdown point. Begin a gradual deceleration to arrive at approximately 5 to 10 ft above touchdown as the yaw angle begins to increase (to the right). At this point, retard the **POWER** levers as necessary to align the helicopter fuselage with the landing direction. Care should be taken to use minimum collective pitch to cushion the landing during touchdown. After touchdown, the wheel brakes should be used to maintain heading and the collective should be lowered to minimize torque effect

1. Airspeed - 90 KTAS minimum (until 10 to 20 ft above touchdown).
2. WING STORES JETTISON - As appropriate.
3. **POWER** levers - Retard as necessary (5 to 10 ft above touchdown).

b. Continued Flight Not Possible. If powered flight is not possible at an airspeed sufficient to maintain helicopter control, enter autorotation, and power levers off. In autorotation, the sideslip and roll angles can be significantly reduced by maintaining a sufficient high airspeed to allow the fuselage to streamline. A roll-on landing during touchdown will minimize the required pitch application and should be used if terrain permits.

1. AUTOROTATE.
2. **POWER** levers - **OFF** (prior to touchdown).
3. WING STORES JETTISON - As appropriate.

9.15.4 Loss of Tail Rotor Thrust at Low Airspeed/Hover. Loss of tail rotor thrust at slow speed may result in extreme yaw angles and uncontrolled rotation to the right. Immediate collective pitch reduction should be initiated to reduce the yaw and begin a controlled rate of descent. If the helicopter is high enough above the ground, an attempt should be made to increase airspeed to streamline the helicopter. This may permit continued flight with a stabilized and manageable yaw angle. If this increase does reduce yaw, proceed as outlined for Loss of Tail Rotor Thrust in Cruise Flight - Continued Flight Possible. If the aircraft cannot be accelerated into forward flight, initiate a power-on descent. Collective should be adjusted so that an acceptable compromise between rate of turn and rate of descent is maintained. At approximately 5 to 10 ft above touchdown, perform a hovering autorotation by **POWER** levers - **OFF**.

NOTE

Continuous right rotation during descent and touchdown can be expected.

1. Collective - Reduce.
2. **POWER** levers - **OFF** (5 to 10 ft above touchdown).

9.15.5 Tail Rotor Fixed Pitch Malfunction. A fixed pitch failure may be evidenced by slow, intermittent, or no response to pedal input or no pedal movement. A left or right yaw may be apparent.

a. In-Ground Effect. If a failure occurs during in-ground-effect hover, reaction may vary from adjusting collective and **POWER** levers during a left rotation to activating the **CHOP** button to stop a right rotation. In any case, the primary concern should be to land the aircraft with as little yaw rate as possible.

- If the aircraft has an uncontrolled turn to the left, a reduction in the **POWER** levers coordinated with an increase in collective may slow or stop the rotation so that a controlled power on descent to landing can be accomplished.
- If the aircraft is not turning, a slight reduction in collective pitch will begin a descent. During the descent, a slight rotation to the left may be present; increasing collective just prior to touchdown should stop the rotation.
- If the aircraft has an uncontrolled turn to the right, reduce collective to begin descent. At approximately 5 to 10 ft AGL, perform a hovering autorotation by **CHOP** button - Press or **POWER** Levers - **OFF**.

b. Out-of-Ground Effect.

- If little or no right rotation or if left rotation is experienced and control can be maintained, the aircraft should be accelerated into forward flight and perform approach and landing appropriate to power setting and condition of flight at time of failure.
- If the aircraft cannot be accelerated into forward flight, initiate a power-on descent. Collective should be adjusted so that an acceptable compromise between rate of turn and rate of descent is maintained. At approximately 5 to 10 ft above touchdown, perform a hovering autorotation by **CHOP** button - Press or **POWER** levers **OFF**.

9.15.6 Main Transmission Input Drive Clutch Failure. An input drive clutch malfunction is most likely to occur during engine start or when an engine **POWER** lever is advanced. Indications may include:

- Erratic torque indication on affected engine.
- Complete loss of torque indication on affected engine.
- N_P of affected engine exceeding N_R.

If the failure is a sudden disengagement, the torque of the opposite engine will double as it attempts to carry the load. A sudden high torque input drive clutch engagement may cause severe engine and/or drive train damage. A sudden engagement is indicated by a loud noise and/or sudden increase in engine torque. Should an input drive clutch malfunction occur, perform the following:

CAUTION

- **When a clutch fails to disengage, damage to the affected engine will result (due to lack of oil pressure) if both engines are not shutdown simultaneously.**
- **When a clutch fails to engage, do not shut down both engines simultaneously. Damage may result if there is sudden engagement.**

a. In Flight.

1. **POWER** lever (affected engine) - **IDLE**.

If $\mathbf{N_P}$ (affected engine) is below $\mathbf{N_R}$ (indicating the clutch is disengaged).

2. EMER ENG SHUTDOWN (affected engine).
3. LAND AS SOON AS PRACTICABLE.

If $\mathbf{N_P}$ (affected engine) does not drop below $\mathbf{N_R}$ (indicating the clutch has failed to disengage).

4. LAND AS SOON AS POSSIBLE.
5. EMER ENG(S) SHUTDOWN (both engines simultaneously).

b. On Ground. (with indications that a clutch has failed to engage).

1. EMER ENG SHUTDOWN (affected engine only).

2. Check N_G is less then 10% (affected engine).

3. Normal engine shutdown - Perform.

c. On Ground. (with indications that a clutch has failed to disengage).

EMER ENG(S) SHUTDOWN (both engines simultaneously).

9.16 FIRES

NOTE

- The **FIRE** switches will remain illuminated until the sensors no longer detect a fire. For a crewstation to discharge or reset the system, that crewstation **FIRE** pushbutton must be armed/dearmed.
- Signals sent from the Signal Processor (SP) will automatically turn off the Air Particle Separator (APS) blower under ALL fire detection conditions. ”AFT DECK FIRE”, ”ENGINE 1 (or) 2 FIRE”, and ”APU FIRE” preventing smoke ingestion into the ECS fresh air system via the APS blower inlet.
- The **PRI** bottle should be selected first; in the event of a malfunction or failure to extinguish the fire, select **RES**.
- If APU is running, accomplish an APU shutdown prior to evacuating the aircraft.

The safety of the helicopter occupants is the primary consideration when a fire occurs. **On the ground**, **it is essential that the engine(s) be shut down**, **the crew evacuated**, **and fire fighting begin immediately**. If time permits, a MAYDAY radio call should be made before electrical power is **OFF** to expedite assistance from fire fighting equipment and personnel. If airborne, the most important single action that can be taken by the crew is to land the helicopter. If time permits, a radio call should be made to expedite assistance from fire fighting personnel. Consideration should be given to jettisoning external stores prior to landing.

WARNING

Prior to moving PWR lever or pressing any ENG FIRE button, **either achieve a safe single engine airspeed or prepare for a single engine landing**.

9.16.1 Engine Fire - In Flight. If an **ENG1** or **ENG2 FIRE** push button on the **FIRE DET/EXT** panel illuminates, a voice message will announce **ENGINE 1 (**or) **ENGINE 2 ON FIRE**. When the fire is confirmed:

1. EMER ENG SHUTDOWN (affected engine) - when conditions permit.

2. Illuminated **ENG FIRE** button - Press and **RDY** light illuminates.

3. **FIRE DISCH** button(s) - Press.

4. LAND AS SOON AS POSSIBLE.

9.16.2 APU Compartment Fire. **If fire is observed in APU compartment**, **a voice message will announce APU FIRE**.

a. On Ground:

1. **APU - OFF**..

2. Illuminated **APU FIRE** button - Press and **RDY** light illuminates.

3. **FIRE DISCH** button(s) - Press.

b. In Flight:

1. Illuminated **APU FIRE** button - Press and **RDY** light illuminates.

2. **FIRE DISCH** button(s) - Press.

3. LAND AS SOON AS POSSIBLE.

9.16.3 Deck Fire. If fire is observed in the deck area or if the **AFT DECK FIRE** warning is annunciated which will activate an **AFT DECK FIRE** voice message. The UFD/EUFD will display an aft deck fire message.

LAND AS SOON AS POSSIBLE.

9.16.4 Engine Fire On Ground. If an engine fire is detected while aircraft is on the ground, a voice message will announce **ENGINE 1** or **2 FIRE** and pushbuttons illuminate. When fire is confirmed:

1. EMER ENG(S) SHUTDOWN.

2. Illuminated **ENG FIRE** button - Press and **RDY** light illuminates.

3. **FIRE DISCH** button(s) - Press.

9.16.5 Fuselage Fire On Ground. If a fuselage fire is observed and a fire warning has not been annunciated:

1. EMER ENG(S) SHUTDOWN.

2. **APU** - OFF (If applicable).

9.16.6 Electrical Fire In Flight. Prior to shutting off all electrical power, the pilot must consider the equipment that is essential to a particular flight environment which will be affected; e.g., flight instruments, flight controls, etc. With electrical power off, engine anti-ice is automatically **ON**. If an immediate landing cannot be made, the defective circuit may be isolated by selectively turning off electrical equipment.

1. **GEN1** and **GEN2** - **OFF** (**SYS** page).

2. LAND AS SOON AS POSSIBLE.

9.16.7 Smoke and Fume Elimination.

1. Airspeed - Slow to 20 KTAS maximum.

2. Canopy door (affected crewstation) - Open to intermediate position.

3. LAND AS SOON AS POSSIBLE.

9.16.8 Aborting Engine Start.

WARNING

701C Aborted engine starts may cause fuel to collect in the engine nacelle. Subsequent engine starts may be attempted only after the nacelle door/work platform is opened and the nacelle inspected for fuel. If during the initial start an abnormal TGT rise was evident, or fuel is evident in the nacelle, the ignition system shall be checked IAW standard maintenance procedures.

CAUTION

Abort start for any of the following reasons:

- **If it becomes apparent that TGT will exceed 869° C 701 or 851° C 701C before N_G idle speed (63% or more) is attained**.
- **If TGT does not increase within 45 seconds after moving POWER lever to IDLE**.
- **If no N_P within 45 seconds after moving POWER lever to IDLE (unless rotor is locked)**.
- **If positive oil pressure indication does not occur within 45 seconds after moving POWER lever to IDLE**.
- **If engine 1 or 2 start advisory is removed prior to attaining 52% N_G**.

ABORT START PROCEDURES are as follows:

1. **POWER** lever - **OFF**.
2. **ENG START** switch - **IGN ORIDE** for 30 seconds or until TGT is below 540° C.

9.17 ELECTRICAL SYSTEM MALFUNCTIONS

NOTE

- In the event of an In-Flight electrical system malfunction, the power interrupt protection may cause blanking of one or more MPDs for as long as 6 seconds. When on the ground during an electrical system malfunction, MPD blanking may occur up to 12 seconds in duration due to increased BIT cycle.
- Failure or reset of the number two (2) generator may result in **BUCS FAIL** caution and **FMC DISENGAGE** and a loss of one or more channels of SAS. After completing the Generator Fail emergency procedure (**GEN RESET**), reset the **BUCS FAIL** and the **FMC DISENGAGE** by re-engaging the affected SAS channels. If the **BUCS FAIL** is not associated with the **GEN FAIL** or the reset, the pilot should assume other problems have occurred and complete the **BUCS FAIL** emergency procedure.
- A battery charged to 80% will normally supply the battery busses for approximately 12 minutes at 25° C. Time will decrease accordingly if the temperature is increased or decreased from 25° C.

9.17.1 Both Generators Fail/Complete Loss Of Electrical Power.

1. **GEN1** and **GEN2** - Reset Pilot **GEN RST** panel.

   If condition persists:

2. LAND AS SOON AS POSSIBLE.

9.17.2 Single Generator and Single RTRU Failure.

1. Affected **GEN1** or **GEN2** - Reset Pilot **GEN RST** panel.

   If condition persists:

2. LAND AS SOON AS PRACTICABLE.

9.17.3 Dual TRU Failure (Transformer Rectifier 1 and Transformer Rectifier 2).

When a dual TRU failure occurs, a number of Cautions and Advisories will be displayed on the UFD. These may include BUCS FAIL and FMC FAIL. Conduct Emergency Procedures for the displayed UFD Cautions in order of importance. All DC services will be lost, except those provided by the battery. Charging of the battery will no longer be conducted. The aircrew can expect the following:

a. TADS/PNVS and HDU's will be inoperative.

b. All navigational functions will be lost.

c. Some primary flight information will be lost (altitude, heading and airspeed).

d. FMC functions will be lost.

e. Stabilator control will be lost.

f. Primary crewstation lighting will be lost.

g. Engine Anti-Ice will activate.

h. The Keyboard Unit will be inoperative.

i. The crew will be able to transmit and receive on the pre set radio frequencies but will not be able to input new frequencies with the Keyboard Unit.

j. WP's will be inoperative and weapons systems will not be functional.

k. The ECS will be inoperative.

l. The ice detector will be inoperative.

m. The left and right pitot heater will be inoperative.

LAND AS SOON AS PRACTICABLE.

9.18 HYDRAULIC SYSTEM MALFUNCTIONS

WARNING

- **Immediate emergency action must follow failure of both hydraulic systems. Any hesitation could result in loss of helicopter control.**
- **With emergency hydraulic power in use, flight control inputs and elevated G loading must be kept to an absolute minimum.**
- **Hydraulic power availability is a function of the frequency and magnitude of the control inputs and G loading placed on the aircraft. In static conditions the hydraulics will bleed down in approximately 6 minutes. If the controls are moved continuously at an approximate 1hz rate this may be as little as 30 to 41 seconds.**
- **The amount of control movement may be reduced to zero depending on the severity and location of hydraulic fluid loss within the utility hydraulic system.**
- **Once the EMERG HYD pushbutton is pressed ON, it must remain ON. Flight control loss will occur when emergency accumulator pressure drops to approximately 1650 psi.**
- **Failure of both primary and secondary drives to the accessory gearbox would result in the complete loss of all AC power and the failure of both the Primary Hydraulic System and the Utility Hydraulic System. All electrical systems, sights, communications, and lighting equipment not powered by the emergency bus would be lost. The crew must activate the Emergency Hydraulics and land without delay.**

9.18.1 Primary Hydraulic Pressure Low and Utility Hydraulic Pressure Low. The UFD/EUFD will display hydraulic fail message.

1. **EMERG HYD** button – Press **ON**.
2. LAND WITHOUT DELAY..
3. EMER ENG(S) SHUTDOWN.

9.18.2 Primary Hydraulic Pressure Low and Utility Hydraulic Level Low. In the event of a **PRI HYD PSI** failure and **UTIL HYD LVL** condition, hydraulic power to the Tail Rotor (T/R) servo may be lost. This may require a landing in accordance with **T/R FIXED PITCH MALFUNCTION**. The UFD/EUFD will display **TAIL RTR/TAIL ROTOR HYD**.

LAND AS SOON AS POSSIBLE.

9.19 EMERGENCY LANDING IN WOODED AREAS (POWER OFF)

AUTOROTATE – Apply full collective to decay rotor rpm as helicopter settles.

9.20 DITCHING (POWER ON)

WARNING

- **Activation of the canopy jettison system with the cockpit partially full or submerged full of water will generate a pressure wave that may result in crew injury and/or death.**
- **If the canopy jettison system has not been activated prior to ditching in water, the external water pressure may cause the canopies to implode (collapse inward) as the aircraft sinks beyond 2 - 3 meters. The cockpit will flood almost immediately and the aircraft will begin to descend rapidly in an uncontrolled manner; canopy sections may also block the egress route.**

CAUTION

If the canopy jettison system is operated underwater, the canopies are likely to implode (collapse inward) due to the external water pressure. This may hinder egress and/or block escape routes.

The decision to ditch the helicopter will be made by the pilot when an emergency makes further flight unsafe.

1. Approach to hover.
2. Canopies – **JETTISON** prior to entering water.
3. Pilot shoulder harness – Lock.
4. CPG – Exit helicopter.
5. Hover downwind to a safe distance.
6. **POWER** levers – **OFF**.
7. Perform hovering autorotation – Apply full collective to decay rpm as helicopter settles.
8. Cyclic – Position in direction of roll.
9. Exit when main rotor has stopped.

9.21 DITCHING (POWER OFF)

If autorotational landing over water becomes necessary:

1. AUTOROTATE – Apply full collective to decay rotor rpm as helicopter settles.
2. Canopies – **JETTISON** prior to entering water.
3. Cyclic – Position in direction of roll.
4. Exit when main rotor has stopped.

9.22 FLIGHT CONTROL MALFUNCTIONS

9.22.1 Failure of Components. Failure of components within the flight control system may be indicated through varying degrees of feedback, binding, resistance, sloppiness or abnormal control responses. These conditions should not be mistaken for the malfunction of the stabilization equipment.

9.22.2 BUCS FAIL.

WARNING

- **Activation of one of the BUCS FAIL cautions in–flight shall signal a flight control emergency. It can mean either a failure within the system or a mistrack between the crewstation controls. The CPG should only activate the BUCS trigger select if the pilot is incapable of maintaining control of the aircraft.**
- **If BUCS has been activated, attempt to land as far away from any known transmitters as practical.**

1. LAND AS SOON AS POSSIBLE.
2. APU ON.
3. EMER ENG(S) SHUTDOWN.

9.22.3 BUCS ON. Activation of the **BUCS ON** caution informs the crew that the BUCS system is now in use to control one or more flight control axes. The system is a non–redundant fly–by–wire system and long duration flights should not be attempted.

1. LAND AS SOON AS POSSIBLE.
2. APU ON.
3. EMER ENG(S) SHUTDOWN.

9.22.4 Main Rotor Components.

WARNING

Danger exists that the main rotor system could collapse or separate from the aircraft after landing. A decision must be made whether occupant egress occurs before or after the rotor has stopped.

Imminent failure of the main rotor components may be indicated by a sudden increase in main rotor vibration and/or unusual noise. Severe changes in lift characteristics and/or balance condition can occur due to blade strikes, skin separation, shift or loss of balance weights or other material. Malfunction may result in severe main rotor flapping. If the main rotor system malfunctions, proceed as follows:

1. LAND AS SOON AS POSSIBLE.
2. EMER ENG(S) SHUTDOWN.

During ground operations any abnormal control inputs required to maintain desired fuselage attitude may be indicative of a problem. If this condition occurs, complete a normal engine shutdown.

9.22.5 EGI IN–FLIGHT MISALIGNMENT.

CAUTION

In flight, depending on airspeed, an uncommanded scheduling down of the stabilator can generate significant aircraft pitch changes and decelerative forces. The instinctive aft cyclic input applied will begin to slow the aircraft. However, a reduction in collective generates an additional pitch down moment which aggravates the situation and should be avoided.

NOTE

- Dual in–flight EGI alignments are prohibited.
- Single in–flight alignments are authorized on the secondary EGI, however, level unaccelerated flight with a constant heading must be maintained.

Section II. MISSION EQUIPMENT

9.26 MISSION EQUIPMENT FAILURE

CAUTION

Do not jettison Hellfire missile if a hangfire is in progress.

9.26.1 Wing Stores Jettison.

a. Selected Armament Wing Stores.

1. Airspeed - 130 KTAS maximum.
2. Selected **STORES JETTISON** buttons - Press to **ARM**.
3. **JETT** button - Press.

b. All Armament Wing Stores:

1. Airspeed - 130 KTAS maximum.
2. Collective **JETT** button - Press.

c. External Fuel Wing Stores:

1. Airspeed - 100 KTAS maximum.
2. Selected **STORES JETTISON** buttons - Press to **ARM**.
3. **JETT** button - Press.

9.26.2 PNVS/IHADSS.

WARNING

If night NOE, reaction to the following malfunctions must be immediate. Exit the NOE environment immediately.

NOTE

During rolling maneuvers, a phenomena known as AC coupling may degrade the PNVS imagery. Generally, this image degradation will worsen as the bank angle is increased. To reduce the adverse effects of AC coupling the pilot should reduce the amount of sky visible within the PNVS field of view by viewing the terrain below the horizon.

a. PNVS Failure.

NOTE

Switch over to the TADS WFOV FLIR image should occur in about 3 seconds. TADS slew rates noticeably slower in azimuth than PNVS. Some gain and level adjustment is usually necessary for optimum image.

NVS select switch (Pilot) - **TADS**.

b. IHADSS/HDU Failure or [BLK 2 IHADSS STALE]. If necessary, the following procedure will enable the flight crew to fly an MPD fixed panel mounted display.

1. **NVS MODE** switch - **FIXED**.
2. **NVS** select switch - **TADS** or **PNVS**.
3. MPD VID - PLT or CPG HMD (as necessary).

9.26.3 TADS TEU Failure. When the TEU fails, the PNVS is commanded to direct mode by the weapons processor. If the TEU completely fails, operation of the TADS is severely limited. The TADS cannot be selected as a sight or a NVS sensor. Laser ranging is inhibited by TADS. The LINK function is not available. Some partial TEU failures will allow the TADS to continue in the currently selected mode, but will not allow changes to the TADS modes of operation. The AND may blank, depending on the particular failure and whether the TADS is in the OIP configuration. If the PNVS is **ON**, it will be commanded to the Direct mode and **PNVS DIRECT** will be displayed on the HAD. In this mode, the PNVS turret movement is controlled by IHADSS and the PNVS Electronics Unit (PEU). Direct mode limits the azimuth movement of the PNVS to +/- 75° and the accuracy is degraded. In PNVS direct, the PNVS turret cannot be commanded to fixed forward using the pilot/CPG **NVS MODE** switch. When shutting down the aircraft, the PNVS turret will not stow properly until the TEU is repaired.

9.26.4 IHADSS Single DP Operation.

WARNING

- **Do not perform targeting operations with HMD as the selected sight when your HMD presents information for the opposite crewmember**.
- **While conducting IHADSS operations during single DP failure, the possibility of IHADSS video going stale increases. If the IHADSS video goes stale, refer to paragraph 9.26.2 PNVS/IHADSS.**

During single DP operation both crewstations share common symbology and imagery on their HMDs. Symbology brightness is controlled by the crewmember whose symbology and imagery is presented on both HMDs. Control of the HMD presentation is as follows: If the **NVS MODE** switch is **OFF** in both crewstations the pilot's symbology and imagery will be presented on both HMDs. If only one crewmember's **NVS MODE** switch is **NORM** or **FIXED**, that crewmember's symbology and imagery will be presented on both HMDs. If both crewmember's **NVS MODE** switches are **NORM** or **FIXED**, the symbology and imagery of the pilot will be displayed.

[**BLK 2** During single DP operations, if the active DP is detected of having stale data, a caution will be displayed and the DP will not be allowed to reset until the other DP is successfully reset and back online. LEFT or RIGHT MPD STALE, or IHADSS/ORT STALE cautions will be displayed on the UFD/EUFD to inform the crew of any possible stale data displayed.]

If, during single DP operation, the IHADSS video and format of the crewmember on the controls changes to the video and format of the crewmember not on the controls.

1. **NVS SELECT** Switch - Reselect (PNVS or TADS).

or

2. Crewmember (not on controls) - Assume control.

9.26.5 Dual DP Failure. Following a dual Display Processor failure, the aircraft will continue to function normally except for displayed items as follows:

a. MPDs non-operational.

b. KUs non-operational.

c. HDUs non-operational.

d. Center display non-operational.

LAND AS SOON AS POSSIBLE.

9.26.6 Single SP Failure. If the failed SP is primary, and the **PROCESSOR SELECT** switch is in **AUTO**, the other SP will automatically assume the role of primary SP. If the **PROCESSOR SELECT** switch is in any position other than **AUTO**, the CPG must manually select the opposite SP if an SP failure has occurred. If the **PROCESSOR SELECT** switch is in **AUTO** and there are symptoms of an unsuccessful automatic switchover, the CPG must manually select an SP (select the last known secondary SP, or **SP2** if not known). If the symptoms do not clear, the CPG must manually select the other SP. Symptoms of an unsuccessful switchover include the following:

a. The **SP1** and **SP2** lights on the **PROCESSOR SELECT** panel are both **ON**.

b. Several different types of dynamic data is displayed on the MPD and/or UFD/EUFD displays (e.g., time of day, engine performance data, etc.) are frozen.

c. The MPD and/or UFD/EUFD displays become erratic or blank.

9.26.7 Dual SP Failure. Following a dual System Processor failure, the aircrew can expect the following:

a. Primary flight controls will operate as an independent hydraulic/mechanical system. FMC disengages and stabilator reverts to MAN mode. Force trim will remain in last set ON/OFF state. Manual stabilator controls will be fully functional without position symbology.

b. All hydraulic systems will continue to operate, including the emergency function.

c. Both engines will continue to operate with full control capability.

d. Fire Detection/Extinguishing panel status and controls (including fuel shutoff and engine shutdown) are fully operational.

e. All backup (standby) instruments are fully functional.

f. All interior and exterior lighting controls (including searchlight) are fully operational.

g. Stores jettison capability is fully operational.

h. Canopy de-fog and Windshield wipers are fully operational.

i. ICS remains fully functional. Radios remain operational at last selected state. Radios can be RTS'd but crew cannot tell by visual cues for proper radio selection. Transponder will continue to operate in last set state, but Mode C altitude reporting is not updated. **EMERGENCY GUARD** and **XPNDR** remain in last set state.

j. Aircraft ARM/SAFE state remains in last commanded selection. Actioned and ARMED weapons remain in last selected state; Crew must de-WAS weapon to safe weapons. Weapons degradation is severe (no inhibits available) and firing is not recommended.

k. Fuel system, ECS system, Anti-Ice systems and IPAS bleed valves will continue to operate but will remain at last commanded state.

NOTE

Attempting to change **NVS MODE** will result in extreme NVS system degradation.

l. If TADS /PNVS were operating in **NVS NORM** at the time of failure, they will continue to function and provide imagery without flight symbology. HDUs will continue to function but without flight symbology. ORT will display video in the last commanded state. NVS will remain in the last commanded state.

m. MPDs function in a degraded mode due to no data update, missing data, or lack of control functions (paging is available).

n. Except for fire warning lights, loss of all W/C/A notification including voice messages.

o. KUs and UFD/EUFDs non-operational.

p. ARC-164 and IDM cannot be zeroized.

q. CHAFF dispenser is not available.

<u>LAND AS SOON AS POSSIBLE</u>.

Section III. WARNING/CAUTION/ADVISORY MESSAGES

9.27 WARNING CONDITION INDICATIONS

Most warning conditions are indicated by a flashing illuminated **MSTR WARN** pushbutton and messages on the UFD/EUFD and MPD. Other warning conditions are indicated by lighted push buttons on Fire Detection panel. All Warnings, are accompanied by a voice message given through the aircrew headset. Tables 9-1 and 9-2 outline the WARNING conditions, MPD and UFD/EUFD displays, and voice messages, as applicable, that have been defined for the aircraft. Table 9-3 contains CAUTION condition indications and appropriate corrective actions. Table 9-4 contains ADVISORY condition indications and appropriate corrective actions.

CAUTION

Delays of up to three seconds could be encountered between the onset of a Master Caution/Warning and autopage occurring. Instant flight page access is available by pushing down on the CYCLIC SYMBOLOGY MODE SELECT switch. Aircraft control remains the highest priority in the conduct of any emergency procedure.

NOTE

- During maneuvering flight, a momentary reduction of oil pressure may occur in the main transmission and engine nose gearboxes causing a low oil pressure caution indication. As long as the caution condition is cleared within 10 seconds after returning to stable flight, no action is required.

- During approaches, maneuvering flight and other areas of 4/rev vibration, the **GRBX VIB/GEARBOX VIBRATION** caution condition may be indicated. As long as the caution condition is cleared within 10 seconds after exiting the 4/rev environment, no action is required.

- **HIGH RTR, ENG CHOP**, emergency procedures are not displayed on the **ENG** page. All other WARNING, emergency procedures are displayed on the ENG page.

Table 9-1. UFD/EUFD Warnings, MPD Warnings, and Voice Messages

UFD WARNING EUFD WARNING	MPD WARNING	*VOICE MESSAGE*
[BLK 1 DECK FIRE] **[BLK 2 AFT DECK FIRE]**	**AFT DECK FIRE**	*AFT DECK FIRE*
[BLK 1 ENG CHOP] **[BLK 2 ENGINE CHOP]**	**[BLK 1 ENG CHOP]** **[BLK 2 ENGINE CHOP]**	*ENGINE CHOP*
[BLK 1 ENG1 OUT] **[BLK 2 ENGINE 1 OUT]**	**[BLK 1 ENG1 OUT]** **[BLK 2 ENGINE 1 OUT]**	*ENGINE 1 OUT*
[BLK 1 ENG2 OUT] **[BLK 2 ENGINE 2 OUT]**	**[BLK 1 ENG2 OUT]** **[BLK 2 ENGINE 2 OUT]**	*ENGINE 2 OUT*
[BLK 1 ENG1 OVSP] **[BLK 2 ENGINE 1 OVERSPEED]**	**[BLK 1 ENG1 OVSP]** **[BLK 2 ENGINE 1 OVERSPEED]**	*ENGINE 1 OVERSPEED*
[BLK 1 ENG2 OVSP] **[BLK 2 ENGINE 2 OVERSPEED]**	**[BLK 1 ENG2 OVSP]** **[BLK 2 ENGINE 2 OVERSPEED]**	*ENGINE 2 OVERSPEED*

Table 9-1. UFD/EUFD Warnings, MPD Warnings, and Voice Messages - continued

UFD WARNING EUFD WARNING	MPD WARNING	*VOICE MESSAGE*
[BLK 1 HIGH RTR] [BLK 2 HIGH ROTOR RPM]	HIGH ROTOR RPM	*ROTOR RPM HIGH*
[BLK 1 HYD FAIL] [BLK 2 HYDRAULIC FAIL]	[BLK 1 HYD FAILURE] [BLK 2 HYDRAULIC FAIL]	*HYDRAULIC FAILURE*
[BLK 1 LOW RTR] [BLK 2 LOW ROTOR RPM]	LOW ROTOR RPM	*ROTOR RPM LOW*
[BLK 1 TAIL RTR] [BLK 2 TAIL ROTOR HYD]	TAIL ROTOR HYD	*TAIL ROTOR HYDRAULIC FAILURE*

Table 9-2. Dedicated Warning Lights, MPD Warning, and Voice Messages

FIRE WARNING LIGHT	MPD WARNING	*VOICE MESSAGE*
APU “FIRE”	APU FIRE	*APU FIRE*
ENG 1 “FIRE”	ENGINE 1 FIRE	*ENGINE 1 FIRE*
ENG 2 “FIRE”	ENGINE 2 FIRE	*ENGINE 2 FIRE*

9.28 CAUTION CONDITION INDICATIONS

Cautions are indicated by illumination of the **MSTR CAUT** push button, messages displayed on the UFD/EUFD and MPD, and a set of alternating tones. The alternating tone pattern will be repeated every 10 seconds until the caution has been acknowledged by actioning the **MSTR CAUT** push button, or until the cause of the caution has been corrected. Table 9-3 outlines the caution condition messages and corrective action for each that have been defined for the aircraft.

NOTE

A caution/warning that is Information/System status shows condition of that system component. Mission accomplishment may be degraded. Mission requirements will dictate further actions.

Table 9-3. UFD/EUFD Cautions, MPD Cautions, and Corrective Actions

UFD CAUTION EUFD CAUTION	MPD CAUTION	CORRECTIVE ACTION
[BLK 1 ACC OIL PSI] [BLK 2 ACC OIL PSI LOW]	ACC OIL PSI LOW	APU only: Shutdown as soon as possible. In flight: LAND AS SOON AS PRACTICABLE.
AFT FUEL LOW	AFT FUEL LOW	LAND AS SOON AS PRACTICABLE.
APU ON	APU ON	APU button - Press.
[BLK 2 AUTO/MAN STAB FAIL]	[BLK 2 AUTO/MAN STAB FAIL]	LAND AS SOON AS PRACTICABLE
[BLK 1 BOOST PUMP] [BLK 2 BOOST PUMP FAILURE]	BOOST PUMP FAILURE	Information System Status

Table 9-3. UFD/EUFD Cautions, MPD Cautions, and Corrective Actions - continued

UFD CAUTION EUFD CAUTION	MPD CAUTION	CORRECTIVE ACTION
BUCS FAIL	**BUCS FAIL**	Refer to paragraph 9.22.2 **BUCS FAIL**
[BLK 1 BUCS FAIL C] **[BLK 2 BUCS FAIL COLL]**	**BUCS FAIL COLL**	Refer to paragraph 9.22.2 **BUCS FAIL**
[BLK 1 BUCS FAIL P] **[BLK 2 BUCS FAIL PITCH]**	**BUCS FAIL PITCH**	
[BLK 1 BUCS FAIL R] **[BLK 2 BUCS FAIL ROLL]**	**BUCS FAIL ROLL**	
[BLK 1 BUCS FAIL Y] **[BLK 2 BUCS FAIL YAW]**	**BUCS FAIL YAW**	
[BLK 2 BUCS ON]	**[BLK 2 BUCS ON]**	
[BLK 2 BUCS ON CPG COLL]	**[BLK 2 BUCS ON CPG COLL]**	
[BLK 2 BUCS ON CPG PITCH]	**[BLK 2 BUCS ON CPG PITCH]**	
[BLK 2 BUCS ON CPG ROLL]	**[BLK 2 BUCS ON CPG ROLL]**	
[BLK 2 BUCS ON CPG YAW]	**[BLK 2 BUCS ON CPG YAW]**	
[BLK 2 BUCS ON PLT COLL]	**[BLK 2 BUCS ON PLT COLL]**	
[BLK 2 BUCS ON PLT PITCH]	**[BLK 2 BUCS ON PLT PITCH]**	
[BLK 2 BUCS ON PLT ROLL]	**[BLK 2 BUCS ON PLT ROLL]**	
[BLK 2 BUCS ON PLT YAW]	**[BLK 2 BUCS ON PLT YAW]**	
[BLK 1 CANOPY A-ICE] **[BLK 2 CANOPY A-ICE FAIL]**	**CANOPY A-ICE FAIL**	Information System Status
ECS AFT FAIL	**ECS AFT FAIL**	Information System Status
ECS FAIL	**ECS FAIL**	Information System Status
ECS FWD FAIL	**ECS FWD FAIL**	Information System Status
[BLK 1 ENG1 A-ICE] **[BLK 2 ENG 1 A-ICE FAIL]**	**ENG 1 A-ICE FAIL**	Information System Status
[BLK 1 ENG2 A-ICE] **[BLK 2 ENG 2 A-ICE FAIL]**	**ENG 2 A-ICE FAIL**	Information System Status

Table 9-3. UFD/EUFD Cautions, MPD Cautions, and Corrective Actions - continued

UFD CAUTION EUFD CAUTION	MPD CAUTION	CORRECTIVE ACTION
[BLK 1 ENG1 CHIPS] **[BLK 2 ENGINE 1 CHIPS]**	**ENGINE 1 CHIPS**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 ENG2 CHIPS] **[BLK 2 ENGINE 2 CHIPS]**	**ENGINE 2 CHIPS**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 ENG1 FUEL PSI] **[BLK 2 ENG 1 FUEL PSI LOW]**	**ENG 1 FUEL PSI LOW**	Achieve safe single engine airspeed. LAND AS SOON AS PRACTICABLE.
[BLK 1 ENG2 FUEL PSI] **[BLK 2 ENG 2 FUEL PSI LOW]**	**ENG 2 FUEL PSI LOW**	Achieve safe single engine airspeed. LAND AS SOON AS PRACTICABLE.
Both **ENG 1 FUEL PSI** and **ENG 2 FUEL PSI** displayed	Both **ENG 1 FUEL PSI** and **ENG 2 FUEL PSI** displayed	<u>**FUEL** page, **BOOST** button - Press **ON**</u>. <u>LAND AS SOON AS POSSIBLE.</u>
[BLK 2 ENG 1 OIL BYPASS]	**ENG 1 OIL BYPASS**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 2 ENG 2 OIL BYPASS]	**ENG 2 OIL BYPASS**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 ENG1 OIL PSI] **[BLK 2 ENG 1 OIL PSI LOW]**	**ENG 1 OIL PSI LOW**	<u>EMERG ENGINE SHUTDOWN</u> when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 ENG2 OIL PSI] **[BLK 2 ENG 2 OIL PSI LOW]**	**ENG 2 OIL PSI LOW**	<u>EMERG ENGINE SHUTDOWN</u> when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 FUEL XFER] **[BLK 2 FUEL XFER FAILURE]**	**FUEL XFER FAILURE**	Evaluate fuel remaining per fuel cell.
[BLK 1 FUEL 1 BYPASS] **[BLK 2 ENG 1 FUEL BYPASS]**	**ENG 1 FUEL BYPASS**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 FUEL 2 BYPASS] **[BLK 2 ENG 2 FUEL BYPASS]**	**ENG 2 FUEL BYPASS**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 FMC DISENG] **[BLK 2 FMC DISENGAGED]**	**FMC DISENGAGED**	Information System Status
FMC FAIL	**FMC FAIL**	Information System Status
[BLK 1 FWD FUEL LOW] **[BLK 2 FORWARD FUEL LOW]**	**FORWARD FUEL LOW**	LAND AS SOON AS PRACTICABLE.
[BLK 1 GEN1 FAIL] **[BLK 2 GENERATOR 1 FAIL]**	**GENERATOR 1 FAIL**	**GEN RST** panel - **GEN 1**.

Table 9-3. UFD/EUFD Cautions, MPD Cautions, and Corrective Actions - continued

UFD CAUTION EUFD CAUTION	MPD CAUTION	CORRECTIVE ACTION
[BLK 1 GEN2 FAIL] **[BLK 2 GENERATOR 2 FAIL]**	**GENERATOR 2 FAIL**	**GEN RST** panel - **GEN 2**.
Both **[BLK 1 GEN1 FAIL]** **[BLK 2 GENERATOR 1 FAIL]** and **[BLK 1 GEN2 FAIL]** **[BLK 2 GENERATOR 2 FAIL]** displayed	Both **GENERATOR 1 FAIL** and **GENERATOR 2 FAIL** displayed	Refer to **Both Generators Fail** (para 9.17.1)
[BLK 1 GRBX TEMP] **[BLK 2 GEARBOX TEMP HIGH]**	**GEARBOX TEMP HIGH**	LAND AS SOON AS PRACTICABLE.
[BLK 1 GRBX VIB] **[BLK 2 GEARBOX VIBRATION]**	**GEARBOX VIBRATION**	<u>LAND AS SOON AS POSSIBLE</u>.
[BLK 1 GRBX1 CHIPS] **[BLK 2 GEARBOX 1 CHIPS]**	**GEARBOX 1 CHIPS**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 GRBX2 CHIPS] **[BLK 2 GEARBOX 2 CHIPS]**	**GEARBOX 2 CHIPS**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 GRBX1 OIL HOT] **[BLK 2 GEARBOX 1 OIL HOT]**	**GEARBOX 1 OIL HOT**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 GRBX2 OIL HOT] **[BLK 2 GEARBOX 2 OIL HOT]**	**GEARBOX 2 OIL HOT**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 GRBX1 OIL PSI] **[BLK 2 GRBX 1 OIL PSI LOW]**	**GRBX 1 OIL PSI LOW**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 GRBX2 OIL PSI] **[BLK 2 GRBX 2 OIL PSI LOW]**	**GRBX 2 OIL PSI LOW**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
ICING SEVERE	**ICING SEVERE**	Verify or turn on anti-ice system.
IRJAM FAIL	**IRJAM FAIL**	Information System Status
[BLK 1 MAG TRIM OFF] **[BLK 2 MAG FORCE TRIM OFF]**	**MAG FORCE TRIM OFF**	Turn Force Trim ON.
[BLK 2 MAIN XMSN CHIPS	**MAIN XMSN CHIPS**	<u>LAND AS SOON AS POSSIBLE</u>.
MODE4 CAUTION	**MODE4 CAUTION**	Information System Status
[BLK 2 MSN DATA INVALID	**MSN DATA INVALID**	Information System Status
[BLK 2 LEFT MPD STALE	**CIPM1 STALE FAIL**	Information System Status

Table 9-3. UFD/EUFD Cautions, MPD Cautions, and Corrective Actions - continued

UFD CAUTION EUFD CAUTION	MPD CAUTION	CORRECTIVE ACTION
[BLK 2 RIGHT MPD STALE]	**CIPM2 STALE FAIL**	Information System Status
[BLK 2 IHADSS/ORT STALE	**MIPM STALE FAIL**	Refer to **PNVS/IHADSS** (para 9.26.2)
[BLK 1 OIL 1 BYPASS]	**ENG 1 OIL BYPASS**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 1 OIL 2 BYPASS]	**ENG 2 OIL BYPASS**	**POWER** lever - **IDLE** when conditions permit. LAND AS SOON AS PRACTICABLE.
[BLK 2 PASSWORD RE ENTER]	**PASSWORD RE ENTER**	Manually enter the username/password TI login on the KU.
PRI HYD BYP	**PRI HYD BYP**	LAND AS SOON AS PRACTICABLE.
[BLK 1 PRI HYD LVL] **[BLK 2 PRI HYD LEVEL LOW]**	**PRI HYD LEVEL LOW**	LAND AS SOON AS PRACTICABLE.
[BLK 1 PRI HYD PSI] **[BLK 2 PRI HYD PSI LOW]**	**PRI HYD PSI LOW**	<u>LAND AS SOON AS POSSIBLE</u>.
[BLK 1 REFUEL VALVE] **[BLK 2 REFUEL VALVE OPEN]**	**REFUEL VALVE OPEN**	Information System Status
[BLK 1 RECT1 FAIL] **[BLK 2 RECTIFIER 1 FAIL]**	**RECTIFIER 1 FAIL**	Information System Status
[BLK 1 RECT2 FAIL] **[BLK 2 RECTIFIER 2 FAIL]**	**RECTIFIER 2 FAIL**	Information System Status
Both **[BLK 1 RECT1 FAIL]** **[BLK 2 RECTIFIER 1 FAIL]** and **[BLK 1 RECT2 FAIL]** **[BLK 2 RECTIFIER 2 FAIL]** displayed	Both **RECTIFIER 1 FAIL** and **RECTIFIER 2 FAIL** displayed	LAND AS SOON AS PRACTICABLE.
RJAM FAIL	**RJAM FAIL**	Information System Status
[BLK 1 RTR BRK ON/LK] **[BLK 2 ROTOR BRAKE ON/LK]**	**ROTOR BRAKE ON/LK**	<u>**RTR BRK** switch - **OFF**</u>. <u>LAND AS SOON AS POSSIBLE</u>.
[BLK 1 STAB FAIL]	**[BLK 1 AUTO/MAN STAB FAIL]**	LAND AS SOON AS PRACTICABLE.
[BLK 2 TI-IDM DISABLE]	**TI-IDM DISABLE**	Information System Status
UTIL HYD BYP	**UTIL HYD BYP**	LAND AS SOON AS PRACTICABLE.
[BLK 1 UTIL HYD LVL] **[BLK 2 UTIL HYD LEVEL LOW]**	**UTIL HYD LEVEL LOW**	LAND AS SOON AS PRACTICABLE.

Table 9-3. UFD/EUFD Cautions, MPD Cautions, and Corrective Actions - continued

UFD CAUTION EUFD CAUTION	MPD CAUTION	CORRECTIVE ACTION
[BLK 1 UTIL HYD PSI] **[BLK 2 UTIL HYD PSI LOW]**	**UTIL HYD PSI LOW**	LAND AS SOON AS POSSIBLE.
[BLK 1 XFEED1 VALVE] **[BLK 2 XFEED 1 VALVE FAIL]**	**XFEED 1 VALVE FAIL**	Achieve safe single engine airspeed. If CAUTION message extinguishes, continue mission. If CAUTION message remains, be prepared for a single engine flame-out. LAND AS SOON AS PRACTICABLE.
[BLK 1 XFEED2 VALVE] **[BLK 2 XFEED 2 VALVE FAIL]**	**XFEED 2 VALVE FAIL**	Achieve safe single engine airspeed. If CAUTION message extinguishes, continue mission. If CAUTION message remains, be prepared for a single engine flame-out. LAND AS SOON AS PRACTICABLE.
[BLK 1 XMSN CHIPS]	**MAIN XMSN CHIPS**	LAND AS SOON AS POSSIBLE.
[BLK 1 XMSN1 OIL HOT] **[BLK 2 XMSN 1 OIL HOT]**	**XMSN 1 OIL HOT**	LAND AS SOON AS PRACTICABLE.
[BLK 1 XMSN2 OIL HOT] **[BLK 2 XMSN 2 OIL HOT]**	**XMSN 2 OIL HOT**	LAND AS SOON AS PRACTICABLE.
Both **[BLK 1 XMSN1 OIL HOT]** **[BLK 2 XMSN 1 OIL HOT]** and **[BLK 1 XMSN2 OIL HOT]** **[BLK 2 XMSN 2 OIL HOT]** displayed	Both **XMSN 1 OIL HOT** and **XMSN 2 OIL HOT** displayed	LAND AS SOON AS POSSIBLE.
[BLK 1 XMSN1 OIL PSI] **[BLK 2 XMSN 1 OIL PSI LOW]**	**XMSN 1 OIL PSI LOW**	LAND AS SOON AS PRACTICABLE.
[BLK 1 XMSN2 OIL PSI] **[BLK 2 XMSN 2 OIL PSI LOW]**	**XMSN 2 OIL PSI LOW**	LAND AS SOON AS PRACTICABLE.
Both **[BLK 1 XMSN1 OIL PSI]** **[BLK 2 XMSN 1 OIL PSI LOW]** and **[BLK 1 XMSN2 OIL PSI]** **[BLK 2 XMSN 2 OIL PSI LOW]** displayed	Both **XMSN 1 OIL PSI LOW** and **XMSN 2 OIL PSI LOW** displayed	LAND AS SOON AS POSSIBLE.

9.29 ADVISORY CONDITION INDICATIONS

NOTE

The display of a message that is "Information/System status" shows condition of components. Mission accomplishment may be affected. Mission requirements will dictate further actions. Advisory conditions (table 9-4) that require crew interaction are indicated by messages on the UFD/EUFD and MPD. Flight control advisories are annunciated with a tone which is given once and will stop without crewmember interaction. All other advisories that may be displayed on the UFD and MPD are for information/system status only.

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
[BLK 2 #1 FUEL SNSR FAIL]	#1 FUEL SNSR FAIL	Information System Status
[BLK 2 #2 FUEL SNSR FAIL]	#2 FUEL SNSR FAIL	Information System Status
[BLK 2 *AIRBORNE FIRE MSN]	*AIRBORNE FIRE MSN	Information System Status
[BLK 2 *BDA REPORT]	*BDA REPORT	Information System Status
[BLK 2 *FCR TGT REPORT]	*FCR TGT REPORT	Information System Status
[BLK 2 *FIELD ORDERS]	*FIELD ORDERS	Information System Status
[BLK 2 *FREE TEXT]	*FREE TEXT	Information System Status
[BLK 2 *INFO REQUEST]	*INFO REQUEST	Information System Status
[BLK 2 *MSG TO OBSERVER]	*MSG TO OBSERVER	Information System Status
[BLK 2 *OBSERVER MSN UPDT]	*OBSERVER MSN UPDT	Information System Status
[BLK 2 *PP REPORT]	*PP REPORT	Information System Status
[BLK 2 *SITREP]	*SITREP	Information System Status
[BLK 2 *SPOT REPORT]	*SPOT REPORT	Information System Status
[BLK 1 ACCUM PSI] [BLK 2 ACCUM OIL PRES LO]	ACCUM OIL PRES LO	Information System Status
[BLK 1 AFT FAB HOT] [BLK 2 AFT LFAB HOT]	AFT LFAB HOT	Information System Status

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action - continued

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
[BLK 1 AFT FAB HOT] [BLK 2 AFT RFAB HOT]	AFT RFAB HOT	Information System Status
AICE MAN	AICE MAN	Information System Status
[BLK 2 AIRBORNE FIRE MSN]	AIRBORNE FIRE MSN	Information System Status
[BLK 1 AIR RQST T] [BLK 2 AIR FIRE RQST TAC]	AIR FIRE RQST TAC	Information System Status
[BLK 1 ALT DRIFT] [BLK 2 ALTITUDE DRIFT]	ALTITUDE DRIFT	Information System Status
ANTI-ICE ON	ANTI-ICE ON	Information System Status
[BLK 1 APU CMD FAIL] [BLK 2 APU COMMAND FAIL]	None	Information System Status
APU ECU FUEL	None	Information System Status
[BLK 1 APU ECU IGN] [BLK 2 APU ECU IGNITOR]	None	Information System Status
[BLK 1 APU ECU PTO] [BLK 2 APU ECU PTO CLUTCH]	None	Information System Status
APU ECU STOP	None	Information System Status
[BLK 1 APU ECU STRT] [BLK 2 APU ECU STARTER]	None	Information System Status
[BLK 1 APU EGT] [BLK 2 APU EGT TEMP]	None	Information System Status
APU FAIL	[BLK 1 APU FAILURE] [BLK 2 APU FAIL]	Information System Status
[BLK 1 APU FUEL VLV] [BLK 2 APU FUEL VALVE]	None	Information System Status
[BLK 1 APU LO OILP] [BLK 2 APU LO OIL PRESS]	None	Information System Status
[BLK 1 APU NO IGN] [BLK 2 APU NO IGNITION]	None	Information System Status
APU OIL SW	None	Information System Status
APU ON	APU ON	Information System Status

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action - continued

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
[BLK 1 APU OVRCUR] [BLK 2 APU OVERCURRENT]	None	Information System Status
[BLK 1 APU OVRSPD] [BLK 2 APU OVERSPEED]	None	Information System Status
[BLK 1 APU OVRTMP] [BLK 2 APU OVERTEMP]	None	Information System Status
[BLK 1 APU PWR ON] [BLK 2 APU POWER ON]	**APU POWER ON**	Information System Status
[BLK 1 APU RPMDECR] [BLK 2 APU RPM DECREASE]	None	Information System Status
APU START	**APU START**	Information System Status
APU STOP	**APU STOP**	Information System Status
[BLK 1 ARTY INTL T] [BLK 2 ARTY INTELGRID TAC]	**[BLK 1 ARTY INTL T] [BLK 2 ARTY INTELGRID TAC]**	Information System Status
[BLK 1 ARTY RQST T] [BLK 2 ARTY FIRE RQST TAC]	**ARTY FIRE RQST TAC**	Information System Status
[BLK 1 ATHS MSG] [BLK 2 ATHS MESSAGE]	**[BLK 1 ATHS] [BLK 2 ATHS MESSAGE]**	Information System Status
[BLK 1 ATHS TABLE] [BLK 2 ATHS TABLE LOW]	**ATHS TABLE LOW**	Information System Status
ATS1 HANG	**ATS1 HANG**	Information System Status
ATS2 HANG	**ATS2 HANG**	Information System Status
[BLK 1 ATTHLD FAIL] [BLK 2 ATTITUD HOLD FAIL]	**ATTITUD HOLD FAIL**	Information System Status
[BLK 1 ATT HOLD] [BLK 2 ATTITUDE HOLD]	**ATTITUDE HOLD**	Information System Status
[BLK 1 AUTO STAB] [BLK 2 AUTO STAB FAIL]	**[BLK 1 AUTO STAB FAILURE] [BLK 2 AUTO STAB FAIL]**	**RESET** button - Press.
[BLK 1 BARHLD FAIL] [BLK 2 BAR ALT HOLD FAIL]	**BAR ALT HOLD FAIL**	Information System Status

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action - continued

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
[BLK 1 BAR HOLD] [BLK 2 BAR ALT HOLD]	BAR ALT HOLD	Information System Status
BATTERY	BATTERY	Information System Status
BDA QUERY	BDA QUERY	Information System Status
[BLK 1 BDA RESPONS] [BLK 2 BDA RESPONSE]	BDA RESPONSE	Information System Status
[BLK 1 BDA RPT] [BLK 2 BDA REPORT]	BDA REPORT	Information System Status
[BLK 1 BDA RPT T] [BLK 2 BDA REPORT TAC]	BDA REPORT TAC	Information System Status
[BLK 1 BLD AIR HOT] [BLK 2 BLEED AIR HOT]	BLEED AIR HOT	Identify High TGT Engine and turn OFF affected bleed air.
[BLK 1 BLD AIR OFF] [BLK 2 BLEED AIR OFF]	BLEED AIR OFF	Information System Status
[BLK 1 BLD AIR1]	ENG1 BLD AIR FAIL	Information System Status
[BLK 1 BLD AIR2]	ENG2 BLD AIR FAIL	Information System Status
[BLK 2 BULK MESSAGE TAC]	BULK MESSAGE TAC	Information System Status
CANOPY OPEN	CANOPY OPEN	Identify and close appropriate canopy.
CHARGER	CHARGER	Information System Status
[BLK 2 CIU FALLBACK]	CIU FALLBACK	Information System Status
[BLK 2 CMDS DEGRADED]	CMDS DEGRADED	Information System Status
[BLK 2 CMWS DEGRADED]	CMWS DEGRADED	Information System Status
[BLK 2 CPG UFD HOT]	CPG UFD HOT	Information System Status
[BLK 2 CTR TANK EMPTY]	CTR TANK EMPTY	Information System Status
[BLK 2 CTR XFER FAIL]	CTR XFER FAIL	Information System Status
CTRLM	CTRLM	Information System Status
[BLK 2 DTC WRITE COMPLETE]	DTC WRITE COMPLETE	Information System Status
[BLK 2 DTC WRITING]	DTC WRITING	Information System Status
[BLK 1 ECS DGR] [BLK 2 ECS DEGRADED]	ECS DEGRADED	Information System Status

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action - continued

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
[BLK 1 ECS DGR AFT] [BLK 2 ECS DEGRADED AFT]	ECS DEGRADED AFT	Information System Status
[BLK 1 ECS DGR FWD] [BLK 2 ECS DEGRADED FWD]	ECS DEGRADED FWD	Information System Status
ECS OFF	ECS OFF	Information System Status
EFABS HOT	EFABS HOT	Information System Status
[BLK 1 ELC APU BST] [BLK 2 ELC APU BOOST PUMP]	None	Information System Status
ELC APU ECU	None	Information System Status
[BLK 1 ELC APU FUEL] [BLK 2 ELC APU FUEL VALVE]	None	Information System Status
ELC APU PTO	None	Information System Status
[BLK 1 ELC APU STRT] [BLK 2 ELC APU STARTER]	None	Information System Status
[BLK 2 ENG1 BLD AIR FAIL]	ENG1 BLD AIR FAIL	Information System Status
[BLK 2 ENG2 BLD AIR FAIL]	ENG2 BLD AIR FAIL	Information System Status
[BLK 1 ENG 1 ORIDE] [BLK 2 ENG1 OVER-RIDE]	ENG1 OVERRIDE	Information System Status
[BLK 1 ENG 2 ORIDE] [BLK 2 ENG2 OVER-RIDE]	ENG2 OVERRIDE	Information System Status
[BLK 1 ENG1 PWR] [BLK 2 ENGINE 1 PWR FAIL]	ENGINE 1 PWR FAIL	Information System Status
[BLK 1 ENG2 PWR] [BLK 2 ENGINE 2 PWR FAIL]	ENGINE 2 PWR FAIL	Information System Status
[BLK 1 ENG1 PWR OK] [BLK 2 ENGINE 1 POWER OK]	ENGINE 1 POWER OK	Information System Status
[BLK 1 ENG2 PWR OK] [BLK 2 ENGINE 2 POWER OK]	ENGINE 2 POWER OK	Information System Status
[BLK 1 ENG1 START] [BLK 2 ENGINE 1 START]	ENGINE 1 START	Information System Status

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action - continued

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
[BLK 1 ENG2 START] [BLK 2 ENGINE 2 START]	ENGINE 2 START	Information System Status
[BLK 2 ENTR INU 1 BRST]	ENTR INU 1 BRST	Information System Status
[BLK 2 ENTR INU 2 BRST]	ENTR INU 2 BRST	Information System Status
[BLK 1 EXT PWR] [BLK 2 EXT PWR DOOR OPEN]	EXT PWR DOOR OPEN	Close the external power door.
[BLK 1 EXT1 EMPTY] [BLK 2 EXTERNAL 1 EMPTY]	EXTERNAL 1 EMPTY	Information System Status
[BLK 1 EXT2 EMPTY] [BLK 2 EXTERNAL 2 EMPTY]	EXTERNAL 2 EMPTY	Information System Status
[BLK 1 EXT3 EMPTY] [BLK 2 EXTERNAL 3 EMPTY]	EXTERNAL 3 EMPTY	Information System Status
[BLK 1 EXT4 EMPTY] [BLK 2 EXTERNAL 4 EMPTY]	EXTERNAL 4 EMPTY	Information System Status
[BLK 1 FALLBACK]	CIU FALLBACK	Information System Status
FARM QUERY	FARM QUERY	Information System Status
[BLK 1 FARM RPT] [BLK 2 FARM REPORT]	FARM REPORT	Information System Status
[BLK 1 FARM RPT T] [BLK 2 FARM REPORT TAC]	FARM REPORT TAC	Information System Status
FCR FAULT	FCR FAULT	Information System Status
[BLK 1 FCR TGT RPT] [BLK 2 FCR TGT REPORT]	[BLK 1 FCR TGT RPT] [BLK 2 FCR TGT REPORT]	Information System Status
[BLK 2 FIELD ORDERS]	FIELD ORDERS	Information System Status
FM1 CUE	FM1 CUE	Information System Status
FM2 CUE	FM2 CUE	Information System Status
[BLK 1 FMC DISENG] [BLK 2 FMC DISENGAGED]	FMC DISENGAGED	Information System Status
[BLK 1 FREE TEXT T] [BLK 2 FREE TEXT TAC]	FREE TEXT TAC	Information System Status

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action - continued

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
[BLK 1 FUEL CHECK] [BLK 2 FUEL CHK COMPLETE]	[BLK 1 FUEL CHECK] [BLK 2 FUEL CHK COMPLETE]	Information System Status
[BLK 1 FUEL P SNSR]	#1 FUEL SNSR FAIL	Information System Status
[BLK 1 FUEL P SNSR]	#2 FUEL SNSR FAIL	Information System Status
[BLK 1 FWD FAB HOT] [BLK 2 FWD LFAB HOT]	FWD LFAB HOT	Information System Status
[BLK 1 FWD FAB HOT] [BLK 2 FWD RFAB HOT]	FWD RFAB HOT	Information System Status
[BLK 1 GO FALLBACK] [BLK 2 GO CIU FALLBACK]	GO CIU FALLBACK	Information System Status
[BLK 2 HF KY FAIL]	HF KY FAIL	Information System Status
[BLK 2 HF KY BYPASS ENBLD]	HF KY BYPASS ENBLD	Information System Status
HOVER DRIFT	HOVER DRIFT	Information System Status
[BLK 1 ICING] [BLK 2 ICING DETECTED]	ICING DETECTED	Verify or turn on anti-ice system.
[BLK 2 IDM FAULT]	IDM FAULT	Information System Status
[BLK 2 IDM INHIBIT]	IDM INHIBIT	Information System Status
[BLK 1 IDM MSG]	ALL IDM/SOI	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	AREAS FILE	Information System Status
[BLK 1 IDM MSG]	SOI AUTH	Information System Status
[BLK 1 IDM MSG]	SOI C/S & FREQ	Information System Status
[BLK 1 IDM MSG]	SOI EXPND	Information System Status
[BLK 1 IDM MSG]	SOI SUFFIX 1/2	Information System Status
[BLK 1 IDM MSG]	SOI SUFFIX 2/2	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	CTRLM FILE	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	CURR MISSION	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	FCR PRI SCHEME	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	FREE TEXT	Information System Status
[BLK 1 IDM MSG]	IDM CONFIG 1/3	Information System Status

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action - continued

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	LASER CODES	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	LINES FILE	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	MISSION 1	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	MISSION 2	Information System Status
[BLK 1 IDM MSG]	NET MEMBRS 2/3	Information System Status
[BLK 1 IDM MSG]	PRESETS 3/3	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	ROUTE	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	ROUTE FILE	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	TGT/THRT FILE	Information System Status
[BLK 1 IDM MSG] [BLK 2 IDM MESSAGE]	WPT/HZD FILE	Information System Status
[BLK 2 IDM PASSWORD RESPNS]	IDM PASSWORD RESPNS	Information System Status
[BLK 2 IDM SECURITY MSG TX]	IDM SECURITY MSG TX	Information System Status
[BLK 2 IFF MODE4 REPLY]	[BLK 2 IFF MODE4 REPLY]	Information System Status
[BLK 1 IGN1 ON] [BLK 2 IGN 1 FAILED ON]	[BLK 1 IGN 1 FAILURE ON] [BLK 2 IGN 1 FAILED ON]	Perform Abort Start Procedure.
[BLK 1 IGN2 ON] [BLK 2 IGN 2 FAILED ON]	[BLK 1 IGN 2 FAILURE ON] [BLK 2 IGN 2 FAILED ON]	Perform Abort Start Procedure.
[BLK 2 INFO REQUEST]	INFO REQUEST	Information System Status
[BLK 1 INU SEA TYP] [BLK 2 INU SEA TYPE]	INU SEA TYPE	Information System Status
[BLK 1 INU 1 BRST]	ENTR INU 1 BRST	Information System Status
[BLK 1 INU 2 BRST]	ENTR INU 2 BRST	Information System Status
[BLK 2 IR JAMMER DEGRADED]	IR JAMMER DEGRADED	Information System Status
[BLK 1 L EXT XFER] [BLK 2 L EXT XFER FAIL]	L EXT XFER FAIL	Information System Status
[BLK 1 LIVE ATAM]	TESS LIVE ATA MSL	Information System Status

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action - continued

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
[BLK 1 LIVE HF MSL]	TESS LIVE HF MSL	Information System Status
[BLK 1 LIVE ROCKET]	TESS LIVE ROCKET	Information System Status
[BLK 1 LIVE ROUND]	TESS LIVE ROUND	Information System Status
[BLK 1 LSR KEYWORD] [BLK 2 LASER KEYWORD FAIL]	LASER KEYWORD FAIL	Information System Status
[BLK 1 MAN STAB ON] [BLK 2 MANUAL STAB ON]	MANUAL STAB ON	Information System Status
[BLK 1 MAYDAY T] [BLK 2 MAYDAY REPORT TAC]	MAYDAY REPORT TAC	Information System Status
[BLK 1 MDR FULL] [BLK 2 MDR MEMORY FULL]	MDR MEMORY FULL	Information System Status
[BLK 1 MDR MEM LOW] [BLK 2 MDR MEMORY LOW]	MDR MEMORY LOW	Information System Status
[BLK 1 MODE4 REPLY]	IFF MODE4 REPLY	Information System Status
[BLK 1 MOVE CMD T] [BLK 2 MOVE COMMAND TAC]	MOVE COMMAND TAC	Information System Status
MPD HOT	MPD HOT	Reduce crewstation ECS temperature; and reduce MPD brightness as much as practicable.
[BLK 2 MSG TO OBSERVER]	MSG TO OBSERVER	Information System Status
[BLK 1 MSG 2 OBS T] [BLK 2 MSG TO OBSERVER TAC]	MSG TO OBSERVER TAC	Information System Status
NAV FAULT	NAV FAULT	Information System Status
[BLK 1 NEG SPOT T] [BLK 2 NEG SPOT RPT TAC]	NEG SPOT RPT TAC	Information System Status
[BLK 2 NET JOIN REQUIRED]	NET JOIN REQUIRED	Information System Status
NF ZONE	NF ZONE	Information System Status
[BLK 2 OBSERVER MSN UPDT]	OBSERVER MSN UPDT	Information System Status
[BLK 1 OBSRV RDY T] [BLK 2 OBSERVER READY TAC]	OBSERVER READY TAC	Information System Status
PF/NF ZONE	PF/NF ZONE	Information System Status
PF ZONE	PF ZONE	Information System Status

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action - continued

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
PIM FAULT	PIM FAULT	Information System Status
[BLK 2 PLT UFD HOT]	PLT UFD HOT	Information System Status
PP QUERY	PP QUERY	Information System Status
[BLK 1 PP QUERY T] [BLK 2 PP QUERY TAC]	PP QUERY TAC	Information System Status
PP RESPONSE	PP RESPONSE	Information System Status
[BLK 1 PP RPT] [BLK 2 PP REPORT]	PP REPORT	Information System Status
[BLK 1 PP RPT T] [BLK 2 PP REPORT TAC]	PP REPORT TAC	Information System Status
[BLK 1 RADHLD FAIL] [BLK 2 RAD ALT HOLD FAIL]	RAD ALT HOLD FAIL	Information System Status
[BLK 1 RAD HOLD] [BLK 2 RAD ALT HOLD]	RAD ALT HOLD	Information System Status
[BLK 1 R EXT XFER] [BLK 2 R EXT XFER FAIL]	R EXT XFER FAIL	Information System Status
[BLK 2 RADAR JAMMER ON]	RADAR JAMMER ON	Information System Status
RFHO	RFHO	Information System Status
RFI FAULT	RFI FAULT	Information System Status
[BLK 2 RJAM FAIL]	RJAM FAIL	Information System Status
[BLK 1 RTR BRK ON] [BLK 2 ROTOR BRAKE ON]	ROTOR BRAKE ON	Information System Status
[BLK 1 SAS SATURAT] [BLK 2 SAS SATURATED]	SAS SATURATED	Re-trim aircraft.
[BLK 2 SEEKING TI]	SEEKING TI	Information System Status
[BLK 1 SIM HIT]	TESS SIM HIT	Information System Status
[BLK 1 SIM KILL]	TESS SIM KILL	Information System Status
[BLK 1 SIM MISS]	TESS SIM NEAR MISS	Information System Status
[BLK 1 SIM RESET]	TESS SIM RESET	Information System Status
[BLK 1 SIM RESURR]	TESS SIM RESURRECT	Information System Status
[BLK 2 SITREP]	SITREP	Information System Status
[BLK 2 SPOT REPORT]	SPOT REPORT	Information System Status
[BLK 1 SPOT RPT T] [BLK 2 SPOT REPORT TAC]	SPOT REPORT TAC	Information System Status

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action - continued

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
[BLK 2 TAIL WHEEL LOCK SEL]	TAIL WHEEL LOCK SEL	Information System Status
[BLK 2 TAIL WHEEL UNLK SEL]	TAIL WHEEL UNLK SEL	Information System Status
TESS FAIL	TESS FAIL	Information System Status
TESS FAULT	TESS FAULT	Information System Status
[BLK 2 TESS LIVE ATA MSL]	TESS LIVE ATA MSL	Information System Status
[BLK 2 TESS LIVE GUN AMMO]	TESS LIVE GUN AMMO	Information System Status
[BLK 2 TESS LIVE HF MSL]	TESS LIVE HF MSL	Information System Status
[BLK 2 TESS LIVE ROCKET]	TESS LIVE ROCKET	Information System Status
[BLK 1 TESS NO GPS] [BLK 2 TESS NO GPS TRACK]	TESS NO GPS TRACK	Information System Status
[BLK 2 TESS SIM HIT]	TESS SIM HIT	Information System Status
[BLK 2 TESS SIM KILL]	TESS SIM KILL	Information System Status
[BLK 2 TESS SIM NEAR MISS]	TESS SIM NEAR MISS	Information System Status
[BLK 2 TESS SIM RESURRECT]	TESS SIM RESURRECT	Information System Status
[BLK 2 TESS SIM RESET]	TESS SIM RESET	Information System Status
[BLK 1 TESS STORES] [BLK 2 TESS STORES ERROR]	[BLK 1 TESS STORES] [BLK 2 TESS STORES ERROR]	Information System Status
TGT/THRT	TGT/THRT	Information System Status
[BLK 1 TW LOCK SEL]	TAIL WHL LOCK SEL	Information System Status
[BLK 1 TW UNLK SEL]	TAIL WHL UNLK SEL	Information System Status
[BLK 1 UPDT HDG] [BLK 2 UPDATE HEADING]	UPDATE HEADING	Information System Status
[BLK 1 UPDT POSN] [BLK 2 UPDATE POSITION]	UPDATE POSITION	Information System Status
[BLK 1 WPT APRCH] [BLK 2 WPT APPROACHING]	WPT APPROACHING	Information System Status

Table 9-4. UFD/EUFD Advisory, DMS Advisory, and Corrective Action - continued

UFD ADVISORY EUFD ADVISORY	DMS ADVISORY	CORRECTIVE ACTION
[BLK 1 WPT PASSED] [BLK 2 WAYPOINT PASSSED]	[BLK 1 WPT PASSED] [BLK 2 WAYPOINT PASSSED]	Information System Status
WPT/HZD	WPT/HZD	Information System Status
[BLK 1 XMIT NAK F1] [BLK 2 XMIT NAK FM1]	XMIT NAK FM1	Information System Status
[BLK 1 XMIT NAK F2] [BLK 2 XMIT NAK FM2]	XMIT NAK FM2	Information System Status
[BLK 1 XMIT NAK UH] [BLK 2 XMIT NAK UHF]	XMIT NAK UHF	Information System Status
[BLK 1 XMIT NAK VH] [BLK 2 XMIT NAK VHF]	XMIT NAK VHF	Information System Status

APPENDIX A
REFERENCES

AR 70-50	Designating and Naming Defense Equipment Military Aerospace Vehicles
AR 95-1	Aviation Flight Regulations
AR 95-13	Safety Procedures for Operation and Movement of Army Aircraft on the Ground
AR 385-40	Accident Reporting and Records
AR 385-63	Policies and Procedures for Firing Ammunition for Training, Target Practice and Combat
AR 385-95	Army Aviation Accident Prevention
DA PAM 40-501	Hearing Conservation
DA PAM 738-751	Functional Users Manual for the Army Maintenance Management System -Aviation (TAMMS-A)
FAR Part 91	Federal Air Regulations, General Operating and Flight Rules
FLIP	Flight Information Publication
FM 1-202	Environmental Flight
FM 1-203	Fundamentals of Flight
FM 1-230	Meteorology for Army Aviators
FM 1-240	Instrument Flying and Navigation for Army Aviators
FM 1-300	Flight Operations Procedures
FM 1-302	Aviation Life Support Equipment (ALSE) for Army Aircrews
FM 10-68	Aircraft Refueling
FM 10-69	Petroleum Supply Point Equipment and Operations
TB11-5895-1632-10	Improved Data Modem (IDM) MD-1295/A Operator’s Manual
TB MED 524	Occupational and Environmental Health: Control of Hazards from Laser Radiation
TM 1-1520-Longbow/Apache	Interactive Electronic Technical Manual (IETM)
TM 1-1520-251-CL	Operators Checklist for Army AH-64D Helicopter
TM 3-4240-312-12&P	Operator’s and Unit Maintenance Manual for Mask, Chemical - Biological: Aircraft, M43

TM 9-1095-206-23&P	Operator's Aviation Unit Maintenance and Aviation Intermediate Maintenance Manual (Including Repair Parts and Special Tools Lists) for Dispenser, General Purpose, Aircraft: M130
TM 11-5810-262-10	Operating Procedures for Communications Security Equipment TSEC/KY-58 in Aircraft Operations
TM 11-5841-281-12	Operator's and Organizational Maintenance Manual: Doppler Navigation Set
TM 11-5841-283-12	Aviation Unit Maintenance Manual for Radar Signal Detecting Set
TM 11-5865-200-12	Operator's and Aviation Unit Maintenance Manual Aviation Unit Maintenance (AVUM) Countermeasures Sets
TM 11-5895-1199-12	Operator's and Organizational Maintenance for Mark-XII IFF System
TM 55-1500-342-23	Army Aviation Maintenance Engineering Manual: Weight and Balance
TM 55-6600-200-20	Marking of Instruments and Interpretation of Markings
TM 55-9150-200-25	Engine and Transmission Oils, Fuels, and Additives for Army Aircraft
TM 750-244-1-5	Procedures for the Destruction of Aircraft and Associated Equipment to Prevent Enemy Use

APPENDIX B
ABBREVIATIONS AND TERMS

A

A	Automatic Range
AADS	Airspeed And Direction Sensor
A/C	Aircraft (Aircraft System)
A/S	Arm/Safe
A-ICE	Anti-Ice (Fault Code)
AAA	Air Defense Gun
ABR	Abbreviation
AC	Alternating Current
ACC	Accumulator
ACCEL	Accelerometer/Acceleration
ACCPT	Accept
ACK	Acknowledge
ACM	Automatic Control Mode
ACQ	Acquisition
ACT	Active
ADF	Automatic Direction Finder
ADS	Air Data System
AFAPD	Air Force Application Program Development
AFATDS	Advanced Field Artillery Tactical Data System
AFDCT	Air Force Digital
AGL	Above Ground Level
AGPU	Aviation Ground Power Unit
ALE	Automatic Link Establishment
ALT	Alternate, or Alternate Missile Channel Altitude
AM	Amplitude Modulation
AMPS	Aviation Mission Planning Station
AND	Alphanumeric Display
ANTS	Alternate Next-To-Shoot
APRCH	Approaching
APU	Auxiliary Power Unit
ARDD	Automatic Roller Detent Decoupler
ARTY	Artillery
ARITH	Arithmetic
AS	Airspeed
ASE	Aircraft Survivability Equipment
ATA	Air-to-Air
ATC	Air Traffic Control
ATHS	Airborne Target Handover System
ATK	Attack
ATM	Air Targeting Mode
ATS	Air Turbine Starter
ATS1	Air Turbine Starter 1
ATS2	Air Turbine Starter 2
AUD	Audio
AUS	Australian
AUTH	Authentication
AUTO	Automatic
AUX	Auxiliary
AWS	Area Weapon System
AZ	Azimuth

ABBREVIATIONS AND TERMS (cont)

B

B	Black
B/W	Black over White
B1 - B6	Designators for bottom row bezel push buttons
BARO	Barometric
BATT	Battery
BCST	Broadcast
BDA	Battle Damage Assessment
BDE	Brigade
BDI	Blade De-ice
BIT	Built In Test
BKS	Backspace
BLD	Bleed
BN	Battalion
BNK	Bunker Fuzing
BOT	Beginning Of Tape
	Bottom
BRK	Brake
BRSIT	Boresight
BRT	Brightness
BRU	Boresight Reticule Unit
BUCS	Back-Up Control System
BX	Box
BYP	Bypass

C

C	Celsius
C/S	Call Sign
CAL	Calibration
CATA	Cooperative Air-to-Air
CAUT	Caution
CBIT	Continuous Built-in-Test
CBP	Circuit Breaker Panel
CBR	Chemical/Biological/Radiological
CCM	Counter-counter Measure
CCP	Communication Check Point
CDRL	Contract Data Requirements List
CEOI	Communication Electronics Operating Instruction
CEP	Checklist, Emergency Procedures
CFR	Code of Federal Regulations
CG	Center of Gravity
CGUN	CPG Gun
CHAN	Channel
CHK	Check
CIPM	Color Image Processing Module
CIU	Communications Interface Unit
CKT	Circuit
CKU	CPG Keyboard Unit
CL	Checklist
CL0	CL0 Clark 1880
CL6	CL6 Clark 1886
CLM	CPG LMFD
CLR	Clear
CMSL	CPG Missile
CNV	Crypto Net Variable
COL	Collision
COLL	Collective

ABBREVIATIONS AND TERMS (cont)

C (cont)

COMM	Communication
COMM PANEL	Communication Panel
COMSEC	Communication Security
CON	Contrast
COOP	Cooperative
COORD	Coordinate
CPG	Copilot/Gunner
CRM	CPG RMFD
CSMA	Carrier Sense Multiple Access
CT	Crotale
CTR	Center
CTRLM	Control Measure
CUF	CPG UFD
CURR	Current

D

DAP	Display Adjust Panel
dB	Decibels
DC	Direct Current
DCL	Declutter
DCU	Data Control Unit
DE	Dual Engine
DEC	Digital Electronic Control
DECR	Decrease
DEGR	Degraded
DEL	Delete
DEU	Display Electronics Unit
DH	Dynamic Harmonization
DIR	Direct
	Directional
DISCH	Discharge
DIV	Division
DMD	Data Message Device
DMS	Data Management System
DP	Display Processor
	Dual Purpose Warhead
DP1	Display Processor #1
DP2	Display Processor #2
DPLR	Doppler
DRA	Data Rate Adapter
DRVS	Doppler Radar Velocity Sensor
DSA	Defense Security Agency
DSENG	Disengage
DSPL	Display
DTC	Data Transfer Cartridge
DTM	Data Transfer Module
DTR	Data Transfer Receptacle
DTU	Data Transfer Unit
DTV	Day Television
DVO	Direct View Optics
DVS	Doppler Velocity Sensor
DWG	Drawing
DWN	Down

ABBREVIATIONS AND TERMS (cont)

E

E1	Engine 1
E2	Engine 2
ECCM	Electronic Counter Counter-Measure
ECS	Environmental Control System
ECU	Electronic Control Unit
EDC	Error Detection and Correction
EDT	Edit
EEU	EPMS Electronics Unit
EFAB	Extended Forward Avionics Bay
EGI	Embedded Global Positioning Inertial Navigation System
EGT	Exhaust Gas Temperature
EL	Elevation
ELC	Electrical Load Controller
ELC1	EPMS Load Controller 1
ELC2	EPMS Load Controller 2
ELT	Emergency Locator Transmitter
EMER	Emergency
ENDR	Endurance
ENG	Engine
ENG1	Engine 1
ENG2	Engine 2
ENTR	Enter
EOCCM	Electro-Optical Counter Counter Measure
EOT	End of Tape
EPLRS	Enhanced Position Location Reporting System
EPMS	Electrical Power Management System
ERF	ECCM Remote Fill
ERR	Error
ESC	Escape
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
ETE	Estimated Time Enroute
EUFD	Enhanced Up Front Display
EXPND	Expander
EXT	External, Exterior
EXT1	External Tank 1
EXT2	External Tank 2
EXTG	Extinguish

F

F	Fahrenheit
FAAO	Field Artillery Aerial Observer
FBCB2	Force Battlefield Command for Brigade and Below
FED	Forward Entry Device
FM	Frequency Modulation (on UFD)
FARM	Fuel, Ammo, Rockets, and Missiles
FARP	Forward Arming and Refueling Point
FAT	Free Air Temperature
FC	Flight Control(s)
FCR	Fire Control Radar
FDI	Fault Detection and Isolation
FDMU	Flight Data Memory Unit
FEBA	Forward Edge of the Battle Area
FEC	Forward Error Correction
FFAR	Folding Fin Aerial Rocket
FFL	Fuel Flow

ABBREVIATIONS AND TERMS (cont)

F (cont.)

FH	Frequency Hopping
FH/M	Frequency Hopping/Master
fL	Footlamberts
FL	Flechette Warhead
FLET	Forward Line of Enemy Troops
FLOT	Forward Line of Own Troops
FLIR	Forward Looking Infrared
FS	Fire Support
FSE	Fire Support Element
FLR	FCR Lethal Ranges
FLT	Flight
FLTR	Filter
FM	Frequency Modulation
FMC	Flight Management Computer
FOC	Focus
FOR	Field Of Regard
FORM	Formation
FOV	Field of View
FPV	Flight Path Vector
FREQ	Frequency
FRICT	Friction
FSK	Frequency Shift Key
FT	Feet
FTEST	FCR Test
FWD	Forward
FXD	Fixed

G

G	Force of Gravity (32.2 fps^2)
GCU	Generator Control Unit
GEN	Generator
GEN1	Generator 1
GEN2	Generator 2
GEOM	Geometric
GFE	Government Furnished Equipment
GHS	Gunner Helmet Sight
GND	Ground
GPM	Gallons/Minute
GPS	Global Positioning System
GPU	Ground Power Unit
GRB2	Gearbox 2
GRBX	Gearbox
G-S	Ground Stow
GTM	Ground Targeting Mode
GUV	Group User Variable Group Unique Variable
GWT	Gross Weight

H

H	Hazard (HXX)
HAD	High Action Display
HADS	Helicopter Air Data System
HDD	Head Down Display
HDG	Heading
HDU	Helmet Display Unit

ABBREVIATIONS AND TERMS (cont)

H (cont.)

HF	HELLFIRE High Frequency
HFM	HELLFIRE Missile
HFTOF	HELLFIRE Time of Flight
HI	High
HIDAC	High Integrated Air Data Computer
HIT	Health Indicator Test
HMD	Helmet Mounted Display
HMU	Hydromechanical Unit
HO	Handover
HOD	Head Out Display
HPSM	High Power Switching Module
HQ1	Have Quick 1
HQ2	Have Quick 2
HRS	Hours
HSP	Hot Start Prevention
HST	History
HTR	Heater (Fault Code)
HYD	Hydraulic
Hz	Hertz (1 per second)

I

IAFS	Internal Auxiliary Fuel System
IAS	Indicated Airspeed
IAT	Image Auto Track
IBIT	Initiated Built-in-Test
IBS	Internal Boresight
ICS	Intercommunication System
ID	IDM Subscriber
IDENT	Identification
IDM	Improved Data Modem
IFF	Identification Friend or Foe
IFM	Improved Frequency Modulation
IGE	In-Ground-Effect
IGN	Ignition
IGN1	Ignition Engine 1
IGN2	Ignition Engine 2
IHADSS	Integrated Helmet And Display Sight System
IHU	Integrated Helmet Unit
IL	Illumination Warhead
IMC	Instrument Meteorological Conditions
IMU	Inertial Measurement Unit
IN	Inches of Mercury
INBD	Inboard
INC	Increase Internet Control Card
INH	Inhibit
INS CHAR	Insert Character
INT	International
INTL	Internal
INTR	Interior
INU	Inertial Navigation Unit
IP	Internet Protocol
IPAS	Integrated Pressurized Air System
IRIS	Infrared Imaging System
IRJAM	Infrared Jammer

ABBREVIATIONS AND TERMS (cont)

J

JAM	Jammer
JETT	Jettison
JVMF	Joint Variable Message Format

K

K	Kilo
kHz	Kilohertz (1000 per second)
KM	Kilometer
KN/NM	Knots/Nautical Mile
KTAS	Knots True Airspeed
KU	Keyboard Unit
KVA	KiloVolt Ampere
KY-58	Encryption Unit
KYBD	Keyboard (LMP)

L

L	Left
L1 - L6	Designators for left column bezel pushbuttons
LASER	Light Amplification by Stimulated Emission of Radiation
LAT	Latitude
lb	Pound
LBA	Longbow Apache
LCL	Local
LD	Line Of Departure
LDU	Lighting Distribution Unit
LED	Light Emitted Diode
LH	Left Hand
LHG	Left Hand Grip
LK	Lock
LL	Low Level
LMC	Linear Motion Compensation
LMPD	Left MPD
LMP	Load Maintenance Panel
LNCH	Launcher/Launch
LNET	Longbow Net
LO	Low
LOAL	Lock On After Launch
LOBL	Lock On Before Launch
LOG	Logarithmic
LONG	Longitude
LOS	Line of Sight
LRFD	Laser Range Finder Designator
LRM	Line Replaceable Module
LST	Laser Spot Tracker
LRU	Line Replaceable Unit
LT	Laser Tracker Light
LVDT	Linear Variable Displacement Transducer
LVL	Level, Leveling
LWR	Laser Warning Receiver
LWT	Left Wing Tip
LZ	Landing Zone

ABBREVIATIONS AND TERMS (cont)

M

M	Manual Range (MXX.X)
	Medium (TADS FOV Selection)
M	Menu (fixed action button on MFD bezel)
MAI	Modified Airy
MAINT	Maintenance
MAN	Manual
MAX	Maximum
MCG	Multi-Cast Group
mB	Millibar
MDCT	Marine Digital Communication Terminal
MEAS	Measure
MEV	Modified Everest
MGRS	Military Grid Reference System
MHz	Megahertz
MIC	Microphone
MILSPEC	Military Specification
MIL-STD	Military Standard
MIN	Minimum
	Minutes
MIPM	Monochrome Image Processing Module
MISC	Miscellaneous
MM	Air-to-air Missile
MMA	Mast Mounted Assembly
MOPP	Mission Oriented Protective Posture
MP	Multi-Purpose Warhead
MPD	Multipurpose Display
MPNVS	Modernized PNVS
MPS	Mission Planning Station
mR	Milliradians
MS	Multistate
MSG	Message
MSL	Missile Mean Sea Level
MSLS	Missiles
MSN	Mission
MSN1	Mission 1
MSN2	Mission 2
MSTR	Master
MTADS	Modernized TADS
MTF	Maintenance Test Flight
MTL	Master Load
MTOC	Main Table Of Contents
MTT	Multi-Target Tracker
MUX	Multiplex
MWOD	Multiple Word Of Day

N

N	Narrow (TADS FOV Selection)
	Navigation Range, (NXX:X)
NAV	Navigation
NB	Normal Band
NBC	Nuclear / Biological /Chemical
ND	Nose Down
NDB	Non-directional Beacon
NF	No Fire Zone
NFOV	Narrow FOV
Ng	Gas Generator Speed
NIU	Nitrogen Inerting Unit
NM	Nautical Mile
NO	Number

ABBREVIATIONS AND TERMS (cont)

N (cont)

NOE/A	Nap-Of-the-Earth/Approach
NOM	Nominal
NORM	Normal
Np	Power Turbine Speed
N_R	Main Rotor Speed
NSA	National Security Agency
NT	Night
NTS	Next-To-Shoot
NU	Nose Up
NVM	Non-Volatile Memory
NVIS	Night Vision Imaging System
NVS	Night Vision System

O

OAT	Outside Air Temperature
OBS	Outfront Boresight
OCR	On-Call Request
ODAS	Omni-Directional Airspeed Sensor
ODV	Overspeed Drain Valve
OFS	Offset
OGE	Out-of-Ground-Effect
OIP	Operation In Progress
OPR	Operate
OPS	Overspeed Protection System
ORIDE	Override
ORT	Optical Relay Tube
OUTBD	Outboard
OVSP	Overspeed
OWN	Ownship

P

PA	Pressure Altitude
PAC	Power Amplifier Coupler
PBIT	Power on Built-in-Test
PC	Position Confidence
PCMCIA	Personal Computer Memory Card International Association
PD	Point Detonate Warhead
PERF	Performance
PEU	PNVS Electronics Unit
PF	Priority Fire Zone
PHS	Pilot Helmet Sight
PIU	Processor Interface Unit
	Pylon Interface Unit
PKU	Pilot KU
PL	Page List
	PSI Low
PLM	Pilot LMFD
PLRT	Polarity
PLT	Pilot
PM	Pre-Planned Message
PNL	Panel
PNVS	Pilot Night Vision Sensor
POS	Positive
POSN	Position
PP	Present Position
	Passage Point
PPI	Plan Position Indicator
PRESS	Pressure

ABBREVIATIONS AND TERMS (cont)

P (cont.)

PREV	Previous
PRFLT	Preflight
PRI	Primary, Priority
PRM	Pilot RMFD
PROC	Procedure
PROG	Progress
PRSET	Presets
PSI	Pounds per Square Inch
PTO	Power Takeoff
PTT	Press To Talk
PUF	Pilot UFD
PWR	Power
PYLN	Pylon

Q

Q	Torque

R

R	Radar Range (Rnn.n) Right
R1 - R6	Designators for right column MFD bezel push buttons
RAD	Radio(s)
RAD ALT	Radar Altimeter
RALT	Radar Altimeter
RAM	Random Access Memory
RC	Remote Fuzed High Explosive
RCD	Record
RCDR	Recorder
RCVR	Receiver
RDR	Radar
RDY	Ready
REC	Receive
RECT	Rectifier
REJCT	Reject
REN	Rename
RF	Radio Frequency
RFD	Rangefinder Designator
RFHO	RF Handover
RFI	Radar Frequency Interferometer
RFJ	Radio Frequency Jammer
RH	Right Hand
RHG	Right Hand Grip
RIPL	Ripple
RJAM	Radar Jammer
RKT	Rocket
RKTS	Rockets
RLW	Radar Laser Warning
RLWR	Radar Laser Warning Receiver
RMAP	Radar Map
RMPD	Right MPD
RMP	Reprogrammable Micro Processor
RNDS	Rounds
RNG	Range
RPLY	Reply
RPT	Report
RST	Reset

ABBREVIATIONS AND TERMS (cont)

R (cont.)

RSV	Reserve
RTCL	Reticle
RTE	Route
RTM	Route Menu
RTOF	Rocket Time Of Flight
RTR	Rotor
RTS	Radio Transmit Select
RVDT	Rotary Variable Displacement Transducer
RVS	Reverse
RVW	Review
RWND	Rewind
RWR	Radar Warning Receiver
RWT	Right Wing Tip
RX	Receive

S

S	Surveillance Fixed Wing
SA	Situational Awareness
SAL	Semi-Active Laser
SAM	Surface to Air Missile
SANUC	Scene Assisted None Uniformity Correction
SAS	Stability Augmentation (Sub)System
SC	Single Channel
	Scale
SDD	Subsystem Design Document
SE	Single Engine
SEC	Second
SEG	Segment
SEL	Select
SENS	Sensitivity
SEU	Sight Electronics Unit
SFR	Specific Fuel Range
SHA	Shot-At
SIG	Signal
SIM	Simulated
SIP	Software Improvement Program
SINC	SINCGARS
SINCGARS	Single Channel Ground and Airborne Radio System
SK	Smoke Warhead
SKR	Seeker
SOI	Signal Operating Instructions
SOV	Shut Off Valve
SP	System Processor
SP1	System Processor 1
SP2	System Processor 2
SPAD	Shear Pin Actuated Decoupler
SPD	Speed
SPQ	Super Quick Fuzing
SQL	Squelch
SRCH	Search
SSU	Sensor Surveying Unit
ST	Stores/Store (Target Store)
STAB	Stabilator
STBY	Standby
STO	Store
SUB	Subscriber
SUFFX	Suffix

ABBREVIATIONS AND TERMS (cont)

S (cont.)

SVA	Selector Valve Assembly
SWS	Switches
SYM	Symbology/Symbol
SYS	System

T

T	Target/Threat (TXX)
T1 - T6	Designators for top row MFD bezel push buttons
TACFIRE	Tactical Fire
TADS	Target Acquisition Designation Sight
TAS	True Airspeed
TBD	To Be Determined
TDC	Time-Dispersive Coding
TEMP	Temperature
TESS	Tactical Engagement Simulation System
TFL	Through Flight
TGT	Target
TGT	Turbine Gas Temperature
TI	Tactical Internet
TICD	Tactical Internet Controller Device
THRT	Threat
TNET	TACFIRE Net
TOC	Tactical Operations Center
TDC	Time Dispersal Coding
TOD	Time of Day
TOF	Time Of Flight
TOT	Total
TPM	Terrain Profiles Mode
TRAJ	Trajectory
TRANSEC	Transmission Security
TRGT	Target
TRK	Track(er)
TRNG	Training
TRP	Target Reference Point
TRU	Transformer Rectifier Unit
TRU1	Transformer Rectifier Unit 1
TRU2	Transformer Rectifier Unit 2
TSD	Tactical Situation Display
TSET	Training Set
TV	Television
TX	Transmit
TYP	Type

U

UAB	Underwater Acoustic Beacon
UFD	Up-Front Display
UH	Ultra High Frequency (UFD only)
UHF	Ultra High Frequency
UPT	Update
URB	Utility Relay Box
URN	Unit Reference Number
UTC	Universal Coordinated Time
UTL	Utility
UTM	Universal Transverse Mercator
UTO	Unit Task Organization

ABBREVIATIONS AND TERMS (cont)

V

V/RET	Visor Retract
VCCS	Vapor Cycle Cooling System
VCR	Video Cassette Recorder
VERS	Version
VH	Very High Frequency (UFD only)
VHF	Very High Frequency
VIB	Vibration
VID	Video
VLV	Valve (Fault Code)
VNE	Velocity-Not-to-Exceed
VO	View Only
VOX	Voice Transmit
VRTR	Voltage Regulated Transformer Rectifier
VSSE	Velocity Safe Single Engine

W

W	Waypoint (WXX)
	White
	Wide
W72	World GEO System 72
W84	World GEO System 84
WAR	War Office
W/B	White over Black
WARN	Warning
WAS	Weapons Action Switch
WB	Wide Band
WCA	Warning/Caution/Advisory
WDAY	Word Day
WFOV	Wide Field Of View
WHT	White
WOD	Word of Day
WP	White Phosphorus Warhead
	Weapons Processor
WP1	Weapons Processor 1
WP2	Weapons Processor 2
WPN	Weapon/Weapon System
WPT	Waypoint
WPTHZ	Waypoint Hazard
WSPS	Wire Strike Protection System

X

XX	(Test Symbol)
XFEED	Crossfeed
XFEED1	Crossfeed Engine 1
XFEED2	Crossfeed Engine 2
XFER	Transfer
XMIT	Transmit
XMSN	Transmission
XMSN1	Transmission 1
XMSN2	Transmission 2
XPNDR	Transponder
XSTART	Cross Start (Fault Code)

ABBREVIATIONS AND TERMS (cont)

Y

Z

Z	Zoom Zulu	ZN	Zone

APPENDIX C
TWO LETTER IDENTIFIERS AND SYMBOLS

ID	SYMBOL	LINE SYMBOL NAME
BL		Unit Boundary Line
FB		Forward Edge of Battle Area
FE		Forward Line of Enemy Troops
FO		Forward Line of Own Troops
FS		Fire Support Coordination Line
LD		Line of Departure
PL		Phase Line

ID	SYMBOL	AREA SYMBOL NAME
EA		Engagement Area

ID	SYMBOL	ZONE SYMBOL NAME
NF		NF Zone
PF		PF Zone

ID	SYMBOL	WAYPOINT & HAZARD SYMBOL NAME
CC	00 CC	Communication Check Point
LZ	00 LZ	Landing Zone
PP	00 PP	Passage Point
RP	00 RP	Release Point
SP	00 SP	Start Point
TO	00	Tower - Over 1000' AGL

ID	SYMBOL	WAYPOINT & HAZARD SYMBOL NAME (cont)
TU	00	Tower - Under 1000' AGL
WL	00	Wires - Power Transmission Lines
WP	00	Waypoint
WS	00	Wires - Telephone and Electric

ID	SYMBOL	CONTROL MEASURES SYMBOL NAME
AB	AAA	Friendly Airborne
AD	AAA	Friendly Air Defense
AH	AAA	Friendly Attack Helicopter
AM	AAA	Friendly Armor
AS	AAA	Friendly Air Assault
AV	AAA	Friendly Air Cavalry
CA	AAA	Friendly Armored Cavalry
CF	AAA	Friendly Chemical
DC	AAA D C	Friendly Decontamination
EN	AAA	Friendly Engineer
FG	AAA	Friendly General Army Helicopter
FI	AAA	Friendly Infantry
FL	AAA	Friendly Field Artillery

ID	SYMBOL	CONTROL MEASURES SYMBOL NAME (cont)
FU	AAA	Friendly Unit ID
FW	AAA EW	Friendly Electronic Warfare
HO	AAA	Friendly Hospital Aid Station
MA	AAA	Friendly Aviation Maintenance
MD	AAA	Friendly Medical
MI	AAA	Friendly Mechanized Infantry
TC	AAA TOC	Friendly Tactical Operations Center
WF	AAA	Friendly Fixed Wing
CE	AAA	Enemy Chemical
DE	AAA D C	Enemy Decontamination
EA	AAA	Enemy Armor
EB	AAA	Enemy Airborne
EC	AAA	Enemy Armored Cavalry
ED	AAA	Enemy Air Defense
EE	AAA	Enemy Engineer
EF	AAA	Enemy Field Artillery
EH	AAA	Enemy Hospital/ Aid Station
EI	AAA	Enemy Infantry
EK	AAA	Enemy Attack Helicopter
EM	AAA	Enemy Mechanized Infantry
ES	AAA	Enemy Air Assault
ET	AAA TOC	Enemy Tactical Operations Center

ID	SYMBOL	CONTROL MEASURES SYMBOL NAME (cont)
EU	AAA	Enemy Unit ID
EV	AAA	Enemy Air Cavalry
EX	AAA	Enemy Medical
HG	AAA	Enemy General Army Helicopter
ME	AAA	Enemy Aviation Maintenance
WE	AAA	Enemy Fixed Wing
WR	AAA EW	Enemy Electronic Warfare
AA	AA 00	Assembly Area
AG	AAA	Airfield - General
AI	AAA I	Airfield - Instrumented
AL	AAA	Lighted Airport
AP	ACP 00	Air Control Point
BD	X	Brigade
BN	I I	Battalion
BP	BP 00	Battle Position
BR	00	Bridge or Gap
CO	I	Company
CP	00 CP	Checkpoint
CR	X X X	CORPS
DI	X X	Division
F1	AA0	Artillery Fire Registration/ Concentration Point - Part 1
F2	000	Artillery Fire Registration/ Concentration Point - Part 2

ID	SYMBOL	CONTROL MEASURES SYMBOL NAME (cont)
FA	FAA 00	Forward Assembly Area
FC	AAA 00	FARP - Fuel and Ammunition
FF	AAA 00	FARP - Fuel Only
FM	AAA 00	FARP Ammunition Only
GL	AAA	Ground Lights/ Small Town
GP	| | |	Regiment/ Group
HA	HA 00	Holding Area
ID	AAA	IDM Subscriber
BE	AAA	Nondirectional Beacon (NDB)
NB		Nuclear, Biological, and Chemical Contaminated Area
RH	00	Railhead - point
US	XXXX	US Army

ID	SYMBOL	TARGETS & THREATS SYMBOL NAME
TG	T ###	Target ID
GU		Generic ADU
1	1	SA-1 ADU
2	2	SA-2 ADU
3	3	SA-3 ADU
4	4	SA-4 ADU

ID	SYMBOL	TARGETS & THREATS SYMBOL NAME (cont)
5	5	SA-5 ADU
6	6	SA-6 ADU
7	7	SA-7 ADU
8	8	SA-8 ADU
9	9	SA-9 ADU
10	1 0	SA-10 ADU
11	1 1	SA-11 ADU
12	1 2	SA-12 ADU
13	1 3	SA-13/19 ADU
14	1 4	SA-14 ADU
15	1 5	SA-15 ADU
16	1 6	SA-16 ADU
17	1 7	SA-17 ADU
S6	S 6	ADU
ZU	Z U	ZSU-23/4 ADU
AS	A S	ASIPDE ADU
83	8 3	M1983 ADU
HK	H K	HAWK/IHAWK ADU
RO	R O	ROLAND ADU
AA	A A	AAA (> 57mm) ADU
C2	C 2	CSA-21/X ADU
CT	C T	CROTALE ADU

ID	SYMBOL	TARGETS & THREATS SYMBOL NAME (cont)
RA	R A	RAPIER ADU
GT	G T	Towed Air Defense Gun (› 57mm)
GS	G S	Self-Propelled Air Defense Gun (‹ 57mm)
TR	##	Target Acquisition Radar
U	U	Unknown ADU
SA	S A	Towed Multi-vehicle SAM ADU
SP	S P	Self-Propelled SAM ADU
70	7 0	RBS-70 ADU
SR	##	Battlefield Surveillance Radar
NV	N V	Naval ADU
G1	G 1	Growth 1 ADU
G2	G 2	Growth 2 ADU
G3	G 3	Growth 3 ADU
G4	G 4	Growth 4 ADU
PT	P T	M1M-104 PATRIOT ADU
ST	S T	STINGER or LAW-ADS ADU
RE	R E	REDEYE ADU
CH	C H	CHAPARRAL ADU
TC	T C	TIGERCAT Towed Multi-vehicle SAM ADU
SD	S D	SPADA Towed Multi-vehicle SAM ADU

ID	SYMBOL	TARGETS & THREATS SYMBOL NAME (cont)
BH	B H	BLOODHOUND Towed Multi-vehicle SAM ADU
SS	S S	SHORTS STARSTREAK ADU
JA	J A	SHORTS JAVELIN ADU
BP	B P	SHORTS BLOWPIPW ADU
SM	S M	SAMP ADU
SC	S C	SATCP ADU
SH	S H	SHAHINE/R440 ADU
GP	G P	GEPARD Towed ADG (≺57mm)
VU	V U	VULCAN Towed ADG (≺57mm)
MK	M K	Marconi MARKSMAN ADU
SB	S B	SABRE ADU
AX	A X	AMX-13 ADU
AD	A D	Friendly ADU

ID	SYMBOL	GROWTH SYMBOLS
Z1		(Growth, Friendly)
Z2		(Growth, Friendly)
Z3		(Growth, Friendly)
Z4		(Growth, Enemy)
Z5		(Growth, Enemy)
Z6		(Growth, Enemy)

ID	SYMBOL	SA SYMBOLS
N/A		(SA, Friendly) Blue
N/A		(SA, Enemy) Red
N/A		(SA, Enemy ADA) Red
N/A		(SA, Unknown) Yellow
N/A		(SA, Unknown ADA) Yellow

APPENDIX D
Radar Frequency Interferometer (RFI) Detected and Fire Control Radar (FCR) Merged Symbols

Table D-1. Radar Frequency Interferometer (RFI) Detected Symbols

TYPE	FINE DETECTION	COARSE DETECTION
2S6 ADU	S △ 6	S 6
ZSU 23-4 ADU	Z △ U	Z U
ASPIDE ADU	A △ S	A S
SA-6 ADU	△ 6	6
SA-8 ADU	△ 8	8
SA-11 ADU	1 △ 1	1 1
SA-12 ADU	1 △ 2	1 2
SA-13/19 ADU	1 △ 3	1 3
SA-15 ADU	1 △ 5	1 5
SA-17 ADU	1 △ 7	1 7
M1983/M1994 ADU	8 △ 3	8 3
HAWK/IHAWK ADU	H △ K	H K
ROLAND ADU	R △ O	R O
AAA (> 57mm) ADU	A △ A	A A
CSA-21/X ADU	C △ 2	C 2
CROTALE ADU	C △ T	C T

Table D-1. Radar Frequency Interferometer (RFI) Detected Symbols (cont)

TYPE	FINE DETECTION	COARSE DETECTION
RAPIER ADU	R △ A	R A
Self-Propelled Air Defense Gun (< 57mm)	G △ S	G S
Target Acquisition Radar	T △ R	T R
Towed Multi-vehicle SAM ADU	S △ A	S A
Unknown ADU	△ U	U
Self-Propelled SAM ADU	S △ P	S P
RBS-70 ADU	7 △ 0	7 0
Battlefield Surveillance Radar	S △ R	S R
Naval ADU	N △ V	N V
ATG Missile	A △ T	A T
ATA Missile	M △ M	M M
TEST	X △ X	X X
Growth 1 ADU	G △ 1	G 1
Growth 2 ADU	G △ 2	G 2
Growth 3 ADU	G △ 3	G 3
Growth 4 ADU	G △ 4	G 4

Table D-2. Fire Control Radar (FCR) Merged Symbols

TYPE	STATIONARY LOAL	MOVING LOBL	STATIONARY LOBL
2S6 Air Defense Unit (ADU)	S △ 6	S ▲ 6	S ▲ 6
ZSU-23/4 ADU	Z △ U	Z ▲ U	Z ▲ U
ASPIDE ADU	A △ S	N A	A ▲ S
SA-6 ADU	△ 6	N A	▲ 6
SA-8 ADU	△ 8	▲ 8	▲ 8
SA-11 ADU	1 △ 1	N A	1 ▲ 1
SA-12 ADU	1 △ 2	N A	1 ▲ 2
SA-13 ADU	1 △ 3	N A	1 ▲ 3
SA-15 ADU	1 △ 5	1 ▲ 5	1 ▲ 5
SA-17 ADU	1 △ 7	N A	1 ▲ 7
M1983/M1994 ADU	8 △ 3	N A	8 ▲ **3**
HAWK/IHAWK ADU	H △ K	N A	H ▲ K
ROLAND ADU	R △ O	N A	R ▲ **O**
AAA (› 57mm) ADU	A △ A	N A	A ▲ A
CSA-21/X ADU	C △ 2	N A	C ▲ 2
CROTALE ADU	C △ T	N A	C ▲ T
RAPIER ADU	R △ A	N A	R ▲ A
Towed Air Defense Gun (› 57mm	G △ T	N A	G ▲ T
Self-Propelled Air Defense Gun (‹ 57mm)	G △ S	N A	G ▲ S
Target Acquisition Radar	T △ R	N A	T ▲ R

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Table D-2. Fire Control Radar (FCR) Merged Symbols (cont)

TYPE	STATIONARY LOAL	MOVING LOBL	STATIONARY LOBL
Towed Multi-vehicle SAM ADU	S △ A	N A	S ▲ A
Air To Ground (ATG) Missile	A △ T	A ▲ T	A ▲ T
Air To Air (ATA) Missile	N A	M ▲ M	N A
RBS-70 ADU	7 △ 0	N A	7 ▲ 0
Battlefield Surveillance Radar	S △ R	N A	N A
Naval ADU	N △ V	N A	N A
Test	X △ X	N A	N A
Self-Propelled SAM ADU	S △ P	S ▲ P	S ▲ P
Growth 1 ADU	G △ 1	G ▲ 1	G ▲ 1
Growth 2 ADU	G △ 2	G ▲ 2	G ▲ 2
Growth 3 ADU	G △ 3	G ▲ 3	G ▲ 3
Growth 4 ADU	G △ 4	G ▲ 4	G ▲ 4
Fixed Wing Blue	N A	V B	N A
Fixed Wing Grey	N A	V G	N A
Fixed Wing Red	N A	V R	N A

ALPHABETICAL INDEX

B

F

Subject Page No.

Subject Page No.

J

M

U

X

By Order of the Secretary of the Army:

ERIC K. SHINSEKI
General, United States Army
Chief of Staff

Official:

Joel B. Hudson

JOEL B. HUDSON
Acting Administrative Assistant to the
Secretary of the Army
0205309

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To be distributed in accordance with initial distribution number (IDN) 313360, requirements for TM 1-1520-251-10.

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From:	"Whomever" whomever@avma27.army.mil
To:	2028@redstone.army.mil
Subject	DA Form 2028

1. ***From:*** Joe Smith
2. *Unit:* home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** MO
6. ***Zip:*** 77777
7. ***Date Sent:*** 19-OCT-93
8. ***Pub no:*** 55-2840-229-23
9. ***Pub Title:*** TM
10. ***Publication Date:*** 04-JUL-85
11. *Change Number:* 7
12. *Submitter Rank:* MSG
13. ***Submitter FName:*** Joe
14. *Submitter MName:* T
15. ***Submitter LName:*** Smith
16. ***Submitter Phone:*** 123-123-1234
17. ***Problem:*** 1
18. *Page:* 2
19. *Paragraph:* 3
20. *Line:* 4
21. *NSN:* 5
22. *Reference:* 6
23. *Figure:* 7
24. *Table:* 8
25. *Item:* 9
26. *Total:* 123
27. ***Text:***

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of the for, see AR 25-35; the proponent agency is ODISC4	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	**DATE** 8/30/02
TO: *(Forward to proponent of the publication or form) (Include ZIP Code)* Commander, U.S. Army Aviation and Missile Command Attn: AMSAM-MMC-MA-NP Redstone Arsenal, AL 35898	**FROM:** *(Activity and location) (Include ZIP Code)* SP4 John Doe F Troop 5th Ca. 1st Taining Bldg. Fort Knox, Kentucky 12345-6789	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 1-1520-251-10	29 Mar 2002	Technical Manual Operator's Manual for Helicopter, Attack, AH-64D Longbow Apache.

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON
1	WP0005 PG 3		1			Test or Corrective Action column should identify a different WP number.

EXAMPLE

**Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENTION	SIGNATURE
MSG, Jane Q. Doe, SFC	788-1234	

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE
Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP RedstoneArsenal, 35898	MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	8/30/02

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENTION	SIGNATURE

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of the for, see AR 25-35; the proponent agency is ODISC4	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	**DATE**
TO: *(Forward to proponent of the publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 1-1520-251-10	29 Mar 2002	Technical Manual, Operator's Manual for Helicopter, Attack, AH-64D Longbow Apache.

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

**Reference to line numbers within the paragraph or subparagraph.*

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TO: (*Forward direct to addressee listed in publication*)	**FROM:** *(Activity and location) (Include ZIP Code)*	**DATE**

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENTION	SIGNATURE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigrams = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounces
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*
inches	centimeters	2.540
feet	meters	.305
yards	meters	.914
miles	kilometers	1.609
square inches	square centimeters	6.452
square feet	square meters	.093
square yards	square meters	.836
square miles	square kilometers	2.590
acres	square hectometers	.405
cubic feet	cubic meters	.028
cubic yards	cubic meters	.765
fluid ounces	milliliters	29.573
pints	liters	.473
quarts	liters	.946
gallons	liters	3.785
ounces	grams	28.349
pounds	kilograms	.454
short tons	metric tons	.907
pound-feet	newton-meters	1.356
pound-inches	newton-meters	.11296

To change	*To*	*Multiply by*
ounce-inches	newton-meters	.007062
centimeters	inches	.394
meters	feet	3.280
meters	yards	1.094
kilometers	miles	.621
square centimeters	square inches	.155
square meters	square feet	10.764
square meters	square yards	1.196
square kilometers	square miles	.386
square hectometers	acres	2.471
cubic meters	cubic feet	35.315
cubic meters	cubic yards	1.308
milliliters	fluid ounces	.034
liters	pints	2.113
liters	quarts	1.057
liters	gallons	.264
grams	ounces	.035
kilograms	pounds	2.205
metric tons	short tons	1.102

Temperature (Exact)

° F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	° C

PIN: 076606-000