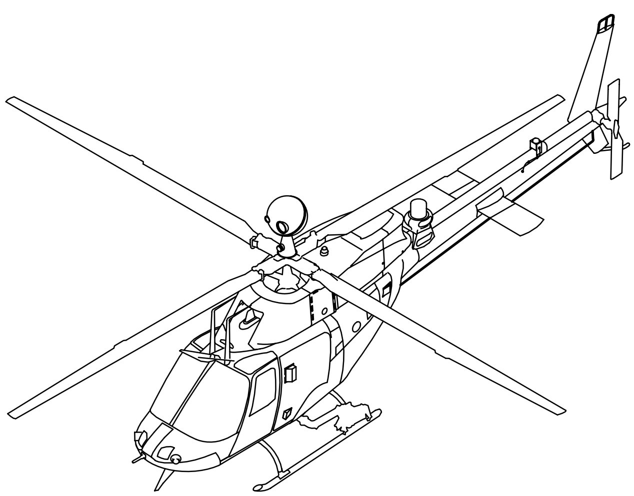
TECHNICAL MANUAL

OPERATOR'S MANUAL FOR ARMY OH-58D HELICOPTER

This manual supersedes TM 1-1520-248-10, dated 30 April 1999, including all changes and TM 1-1520-248-10 CDS4 Supplement, dated 01 November 2000.



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For the Commander:

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General, United States Army
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2-47 and 2-48	2-47 and 2-48
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8-11 through 8-16	8-11 through 8-16
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9-3 through 9-8	9-3 through 9-8
9-19 and 9-20	9-19 and 9-20
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TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 716, CONSISTING OF THE FOLLOWING:

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B blank	0
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2--1 — 2–3	0
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2--5 - 2--12	0
2--13	1
2--14 — 2--16	0
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*Zero in this column indicates an original page.

WARNING PAGE

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.

STARTING ENGINE

Coordinate all cockpit actions with ground observer. Ensure that rotors and blast areas are clear and fire guard is posted if available.

FIRE EXTINGUISHER

Exposure to high concentrations of fire extinguishing agent or toxic fumes produced by the agent should be avoided. The extinguishing agent should not be allowed to come in contact with the skin, as it may cause frostbite or low temperature burns.

GROUND OPERATION

Engine shall be started and operated only by authorized personnel. Reference AR 95-1.

The laser rangefinder/designator (LRF/D) is very dangerous. Looking at the laser beam or its reflection from a shiny surface can cause permanent blindness. Under noncombat conditions, the laser shall be used only in controlled areas and at times specified by a range control officer.

BATTERY ELECTROLYTE

Corrosive Battery Electrolyte (potassium hydroxide). If potassium hydroxide is spilled on clothing or other material, wash immediately with clean water. If spilled on personnel, immediately start flushing the affected area with clean water. Continue washing until medical assistance arrives.

CARBON MONOXIDE

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

HANDLING FUEL, OIL, AND HYDRAULIC FLUIDS

Turbine fuels, lubricating oils and hydraulic fluids contain additives which are poisonous and readily absorbed through the skin. Avoid prolonged or repeated contact with skin. Prolonged contact may cause skin rash or burns. Wash contacted areas of skin after handling.

BATTERY

If battery overheats, do not open battery compartment. Battery fluid will cause burns, and an overheated battery could cause thermal burns and may explode.

NOISE

Sound pressure levels in this helicopter during some operating conditions exceed the Surgeon General's hearing conservation criteria as defined in TB MED 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.

HIGH VOLTAGE

All ground handling personnel must be informed of high voltage hazards when working near the HF antenna.

TOXIC MATERIALS

The basic stinger missile round and captive flight trainer (CFT) contain mercury thallium. If the IR domes should break, do not touch the basic stinger missile round or CFT in the vicinity of the IR dome. This material is toxic to unprotected skin. Avoid all contact with the released material unless protective equipment is being worn, such as a respirator, gloves, and chemical goggles. If the skin or eyes are exposed to the spilled material, immediately flush with large quantities of water. Any person exposed to the released materials should be promptly referred to a physician.

The coolant reservoir, when fully charged, contains high pressure argon gas (up to 6200 psi). When moving or storing the coolant reservoir, the protective collar must be installed to protect the male disconnect coupling from being damaged or broken. When handling the coolant reservoir, extreme care must be taken not to drop, damage, or break any portion of the coolant reservoir. If the coolant reservoir is damaged, high pressure gas could escape causing the coolant reservoir to become a self-propelled projectile.

Personnel must never be positioned immediately in front of a CFT during operation. The front window can blow out causing injury to personnel.

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.
- To avoid potentially dangerous situations, follow all procedural warnings in this text.
- Due to lack of data, structural and aerodynamic effects on the aircraft in the event of a missile/rocket hangfire are unknown.
- Weapons in containers that fall more than 84 inches are considered unsafe and should only be handled by qualified personnel.
- DO NOT load a missile round which has been dropped from two or more feet onto a hard surface.

PYLON 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 pylon stores.

RADIOACTIVE MATERIALS

Self-luminous dials and ignition units contain radioactive materials. If such an instrument or unit is broken or becomes unsealed, avoid personnel contact.

Technical Manual	)	**HEADQUARTERS**
	)	DEPARTMENT OF THE ARMY
No. 1-1520-248-10	)	Washington, D.C., *15 November 2001*

TECHNICAL MANUAL

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), directly to Commander, U.S. Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also send in your comments electronically to our e-mail address: 2028@redstone.army.mil or FAX us at (256) 842-6546/DSN 788-6546.

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TABLE OF CONTENTS (Cont)

CHAPTER 1

INTRODUCTION

1-1. GENERAL.

These instructions are for use by the operator(s). They apply to OH-58D and OH-58D R helicopters.

1-2. WARNINGS, CAUTIONS, AND NOTES DEFINED.

Warnings, cautions, and notes are used to emphasize important and critical instructions and are used for the following conditions.

WARNING

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

CAUTION

An operating procedure, practice, etc. which, if not strictly observed, could result in damage to or destruction of equipment.

NOTE

An operating procedure, condition, etc., which is essential to highlight.

1-3. DESCRIPTION.

This manual contains the best operating instructions and procedures for the OH-58D and OH-58D R helicopters under most circumstances. The observance of limitations, performance, and weight and balance data provided is mandatory. The observance of procedures is mandatory except when modification is required because of multiple emergencies, adverse weather, terrain, etc. Your flying experience is recognized, and therefore, basic flight principles are not included. **THIS MANUAL SHALL BE CARRIED IN THE HELICOPTER AT ALL TIMES.**

The OH-58D and OH-58D R helicopters are designed for use in close combat aerial reconnaissance, intelligence gathering, surveillance, target acquisition, and is armed for self-defense and targets of opportunity. It incorporates a mast mounted sight that enables the crew to perform the mission while remaining at a stand-off range and out of direct line of sight of enemy observation. Used for weapons guidance, the sight laser range finder/designator can designate targets for laser-seeking weapons or can accurately determine distance and direction from the helicopter to an intended target (for self-defense, target handover to an attack helicopter, TAC AIR, or conventional field artillery engagement). It includes provisions for mounting and firing multiple weapons systems. The weapons systems are mounted on a universal weapons pylon which is installed in the intermediate fuselage. The weapons systems are fully integrated into the Control/Display Subsystem. Electronic systems provide communications security, radar warning, accurate navigation data, and aircraft identification. The helicopter is capable of performing these missions day and night, in limited adverse weather, obscured battlefield conditions, and nap-of-the earth (NOE) flight conditions.

The helicopter is powered by an Allison turboshaft engine and has a four blade, foldable main rotor system.

1-4. APPENDIX A, REFERENCES.

Appendix A is a listing of official publications cited within the manual applicable to and available for flight crews.

1-5. APPENDIX B, ABBREVIATIONS AND TERMS.

Definitions of all abbreviations and terms used throughout the manual will be included in Appendix B. Abbreviations used are in accordance with the requirements of MIL-STD-12D unless otherwise defined by the procuring activity.

1-6. APPENDIX C, SPECIAL MISSION.

This appendix contains equipment peculiar to OH-58D special mission helicopters.

1-7. ARMY AVIATION SAFETY PROGRAM.

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

1-8. DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE.

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

1-9. FORMS AND RECORDS. Army aviators flight record and helicopter maintenance records which are to be used by the operators and crewmembers are prescribed in DA PAM 738-751 and TM 55-1500-342-23.

1-10. EXPLANATION OF CHANGE SYMBOLS.

Changes to the text and tables, including new material on added pages, shall be 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 bar or change symbol placed along the outer margins between the text and the diagonal lines. Change symbols show current changes only. Miniature pointing hand symbol is used to denote a change to an illustration. However, a vertical line in the outer margin, rather than a miniature pointing hand, is utilized when there have been extensive changes made to an illustration. Change symbols are not used to indicate changes in the following:

a. Introductory material.

b. Indexes and tabular data where the change cannot be identified.

c. Blank space resulting from the deletion of text, an illustration, or a table.

d. Correction of minor inaccuracies, such as spelling, punctuation, relocation of material, etc., unless such correction changes the meaning of instructive information or procedures.

1-11. SERIES AND EFFECTIVITY CODES.

a. Designator symbol **R** is used in conjunction with text contents, text headings, section headings, and illustration titles to show limited effectivity of the material.

b. If the material applies to all series and configurations, no effectivity symbols will be used. Where practical, descriptive information and illustrations are condensed and combined for multiple configurations to avoid duplication. In some instances where multiple configurations are represented by the same illustration, the illustration may not exactly depict all configurations. For example, between configurations there may be spelling and/or spacing differences in the multi-function displays.

c. The **R** effectivity symbol designates that the material applies to armed OH-58Ds equipped with dedicated left and right MCPUs and Allison 250-C30/R3 engine. The following equipment is also normally installed in **R** equipped aircraft: IDM in place of ATHS, MDU in place of DTS, and RMS.

OH-58Ds without FADEC are identified as (OH-58D) or (CDS2) as applicable. OH-58D Control Display System II is identified as CDS2, OH-58D Control Display System III is identified as CDS3, and OH-58D Control Display System IV is identified as CDS4. The **R** effectivity symbol is applicable to both CDS3- and CDS4-configured aircraft, unless identified as CDS3- or CDS4-peculiar.

1-12. USE OF WORDS SHALL, WILL, SHOULD, AND MAY.

Within this technical manual the word “shall” is used to indicate a mandatory requirement. The word “will” is used to express a declaration of purpose. The word “should” is used to indicate a nonmandatory but preferred method of accomplishment. The word “may” is used to indicate an acceptable method of accomplishment.

CHAPTER 2

HELICOPTER AND SYSTEMS DESCRIPTION AND OPERATION

SECTION I. HELICOPTER

2-1. GENERAL.

a. The helicopter has provisions for a crew of two, consisting of a pilot and a copilot/gunner (CPG) seated side-by-side, with the pilot in the right seat of the crew station. The crew station is equipped with dual controls and necessary flight and mission instrumentation. The basic airframe consists of a fuselage and tailboom.

b. The fuselage houses the crew station and electronic compartments, and serves as a platform for the engine, transmission, and main rotor system. It is supported by a skid type landing gear.

c. The tailboom serves as a platform for the tail rotor gearbox as well as the vertical fin and horizontal stabilizer. The control tubes to the tail rotor, and the tail rotor driveshaft as well as the necessary component wiring, are contained in the tailboom.

d. The main rotor system consists of four composite material blades with folding capabilities. The tail rotor is a two-bladed teetering type system. Above the main rotor system the mast mounted sight (MMS) subsystem contains a television sensor (TVS), a thermal imaging sensor (TIS), a laser rangefinder/designator (LRF/D), and an optical boresight (OBS) unit. These are all contained in a gyro-stabilized turret. Inputs from the mast mounted sight are transmitted to the crew station through the multifunction display (MFD) located on the instrument panel.

2-2. GENERAL ARRANGEMENT.

Figure 2-1 depicts the general arrangement of the helicopter. Items indexed include all access openings, antennas, and other items referred to in the preflight inspection.

2-3. DIMENSIONS.

Figure 2-2 depicts principal dimensions of the helicopter.

2-4. TURNING RADIUS.

Figure 2-3 depicts the turning radius of the helicopter based on a turn about the centerline of the mast.

2-5. GROUND CLEARANCES.

Figure 2-2 depicts the ground clearances of the helicopter.

2-6. DANGER AREAS.

Figure 2-4 depicts the different danger areas of the helicopter. These include danger areas of the main rotor, tail rotor, turbine disintegration area, exhaust heat area, rotor downwash area, high frequency antenna, particle separator blower, laser, missile/rocket and gun trajectory, missile/rocket backblast, weapons/launcher jettison, and IR transmission (heat/noise).

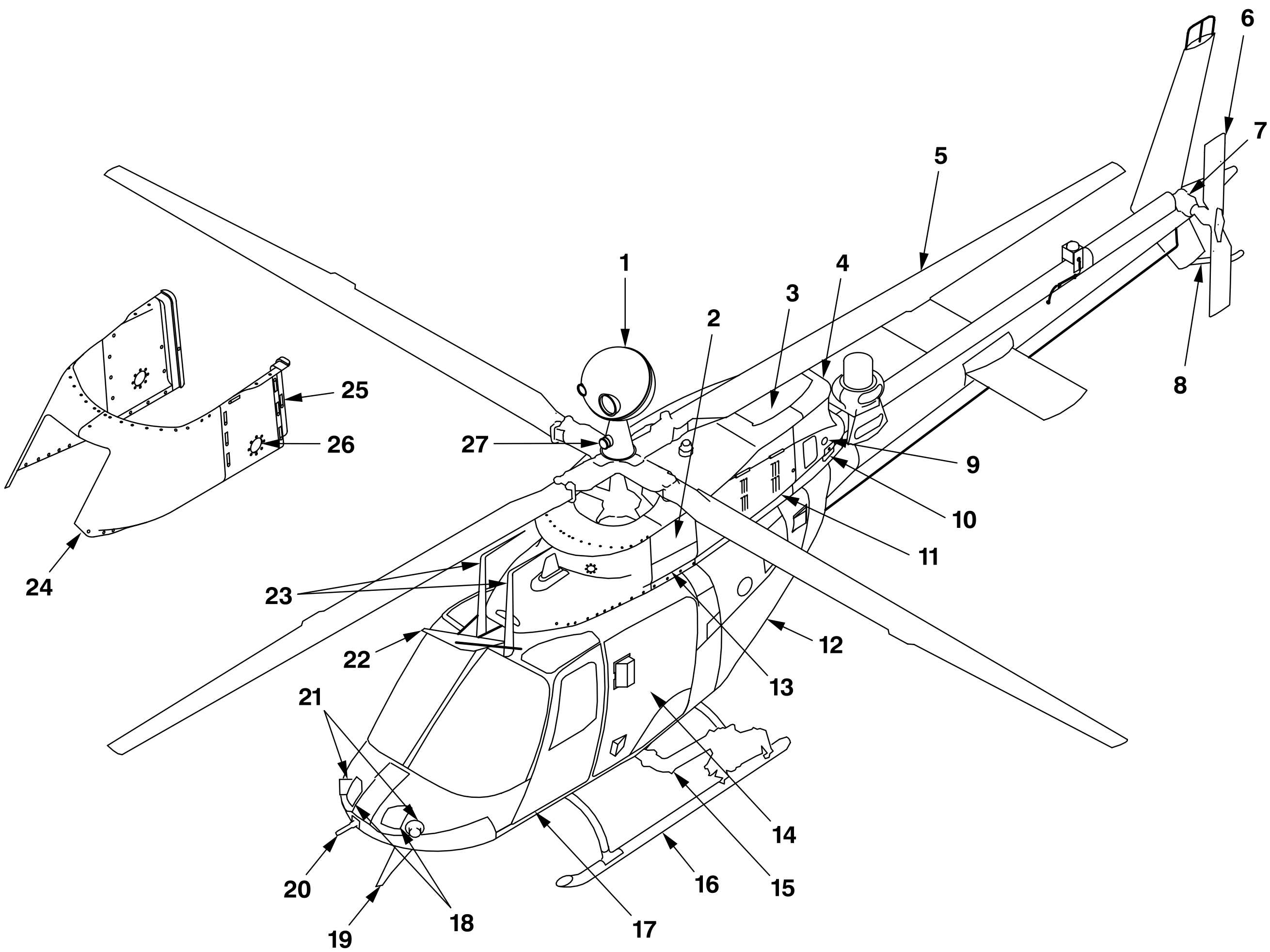
2-7. CREW STATION.

Figure 2-5 depict the crew station of the helicopter. Different components which control some of the helicopter systems are called out and listed.

2-8. LANDING GEAR SYSTEM.

a. Main Landing Gear. The main landing gear system is a fixed skid type. The system is designed to withstand normal and autorotational landing loads at allowable helicopter gross weights and allow landing on rough unimproved terrain. The helicopter can be equipped with either a standard gear or a Multiple Purpose Light Helicopter (MPLH) gear that can be raised and lowered for ease of shipping during rapid deployment operations.

b. Tail Skid. A tail skid is attached to the aft end of the tailboom. It acts as a warning to the pilot of an inadvertent tail low landing and aids in protecting the tail rotor from damage.



1. Mast mounted sight
2. Engine inlet
3. Engine exhaust
4. Oil cooler fan exhaust
5. Main rotor blades
6. Tail rotor blades
7. Tail rotor gearbox
8. Tail skid
9. Engine oil reservoir sight glass
10. Oil tank compartment access door
11. Engine access door
12. Aft electrical compartment
13. Transmission access door
14. Avionics compartment access door
15. Universal weapons pylon (UWP)
16. Landing gear
17. Crew door
18. Ram air grille
19. Wire cutter
20. Pitot tube
21. Radar warning antenna
22. Wire cutter
23. Secondary FM (FM homing) antenna
24. Inlet blast shield
25. Aft removable panel
26. Inspection glass
27. Turret cooling fan screen

Note
Inlet blast shield removed for clarity

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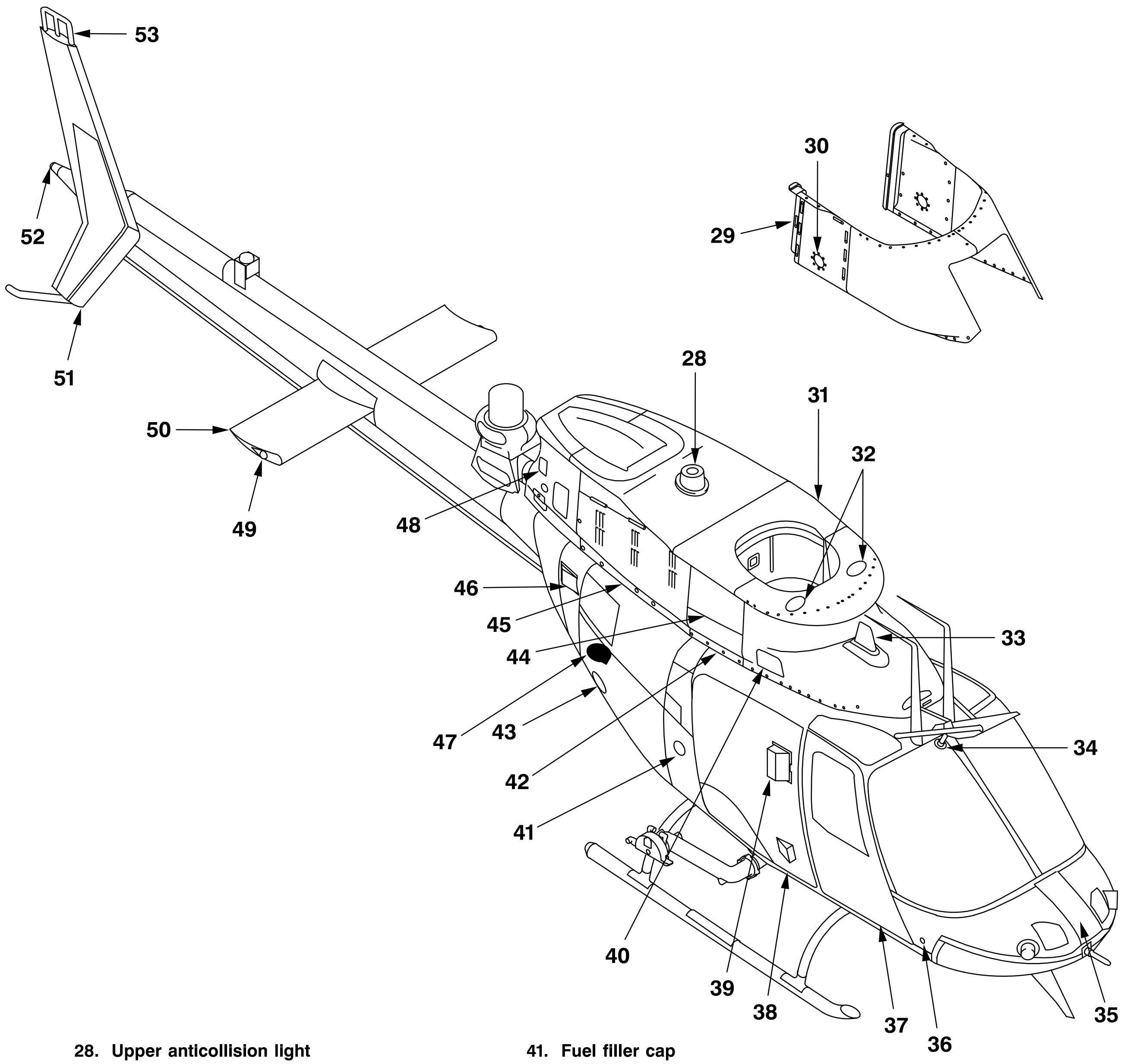
Figure 2-1. General Arrangement (Sheet 1 of 4)



28. Upper anticollision light
29. Aft removable panel
30. Inspection glass
31. Transmission cowling
32. Radar warning antenna (APR-44)
33. IFF antenna
34. Free air temperature (FAT) gage
35. Battery access door
36. Static port
37. Crew door
38. Avionics compartment access door
39. Laser sensor (AVR-2A)
40. Hydraulic servo access door
41. Fuel filler cap
42. Transmission access door
43. AC external power receptacle
44. Engine inlet
45. Engine access door
46. Laser sensor (AVR-2A)
47. Aft radar warning antenna
48. Engine oil filler access door
49. Position light
50. Foldable horizontal stabilizer
51. Pivotable vertical fin
52. Position light
53. VHF FM/VHF AM antenna

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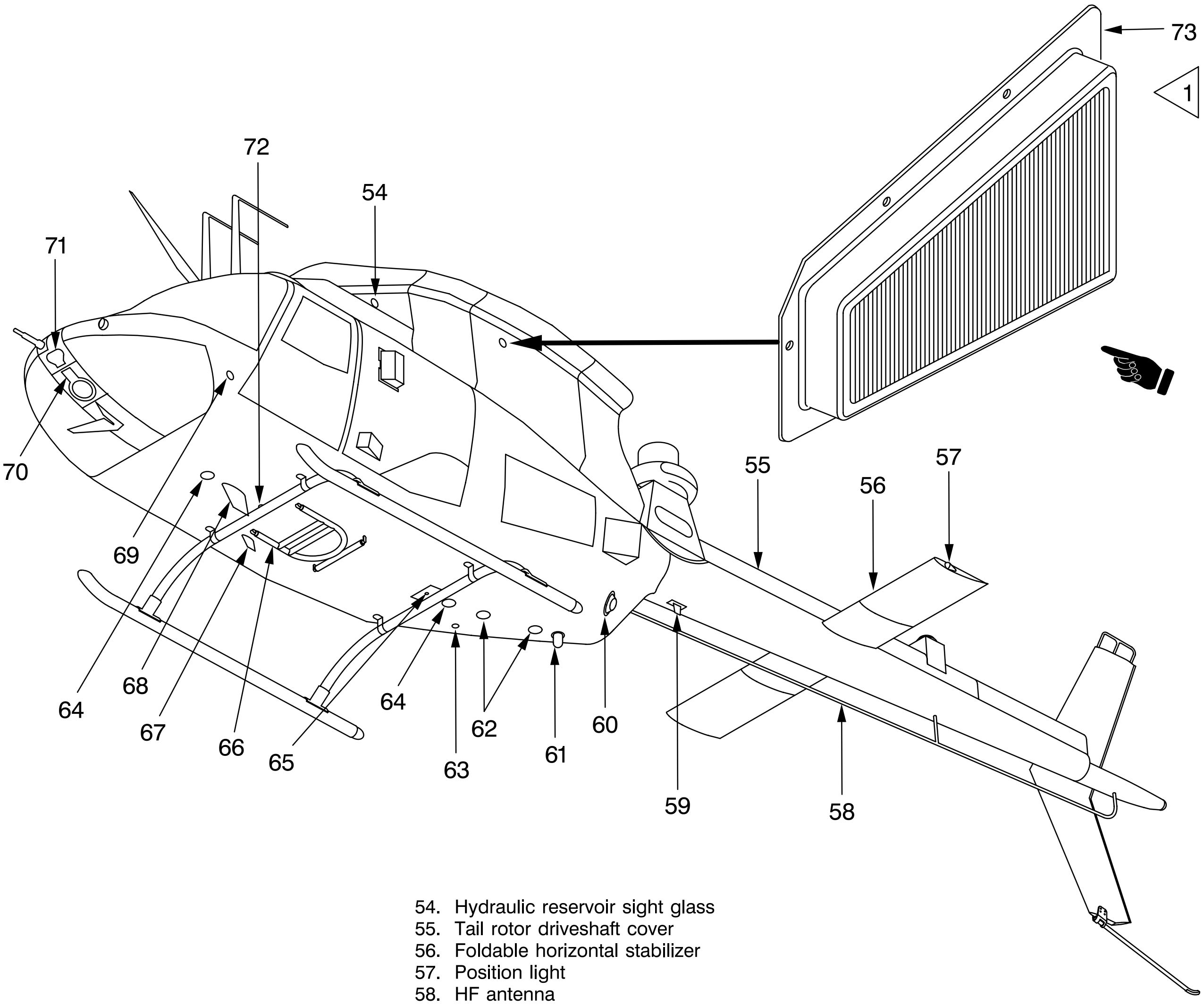
Figure 2-1. General Arrangement (Sheet 2 of 4)



54. Hydraulic reservoir sight glass
55. Tail rotor driveshaft cover
56. Foldable horizontal stabilizer
57. Position light
58. HF antenna
59. IFF antenna
60. Aft radar warning antenna
61. Anticollision light
62. Radar altimeter antenna
63. Air data temp bulb
64. Radar warning antenna (APR-44)
65. Fuel tank sump drain
66. Cargo hook suspension assembly
67. Radar warning antenna
68. UHF antenna
69. Static port
70. Search light
71. DC external power receptacle
72. Weight on gear switch
73. Engine compressor inducer bleed port filter (IBPF)

NOTE

1 EBF equipped only

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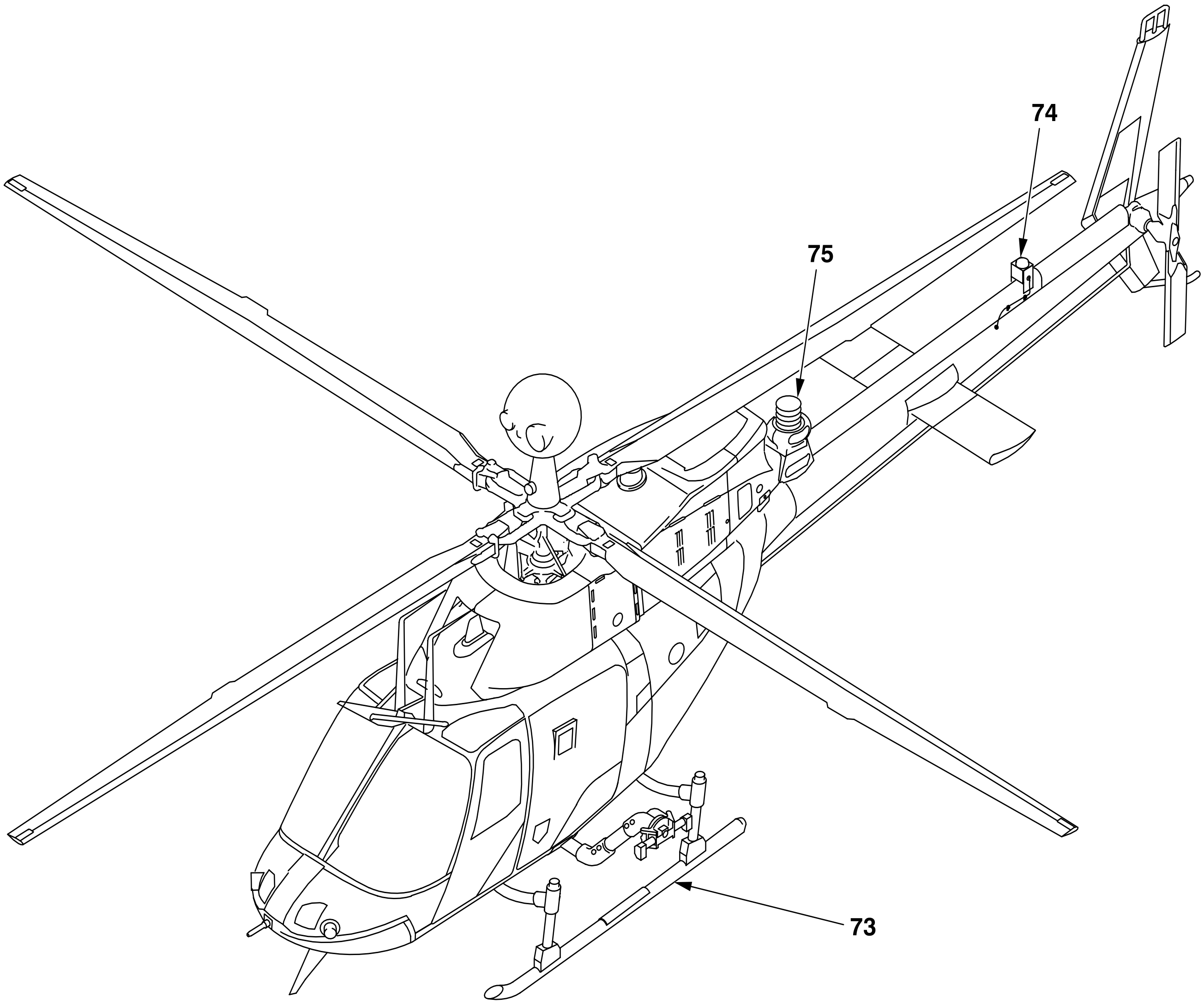
Figure 2-1. General Arrangement (Sheet 3 of 4)



73. Landing gear (MPLH)
74. GPS antenna
75. AN/ALQ-144

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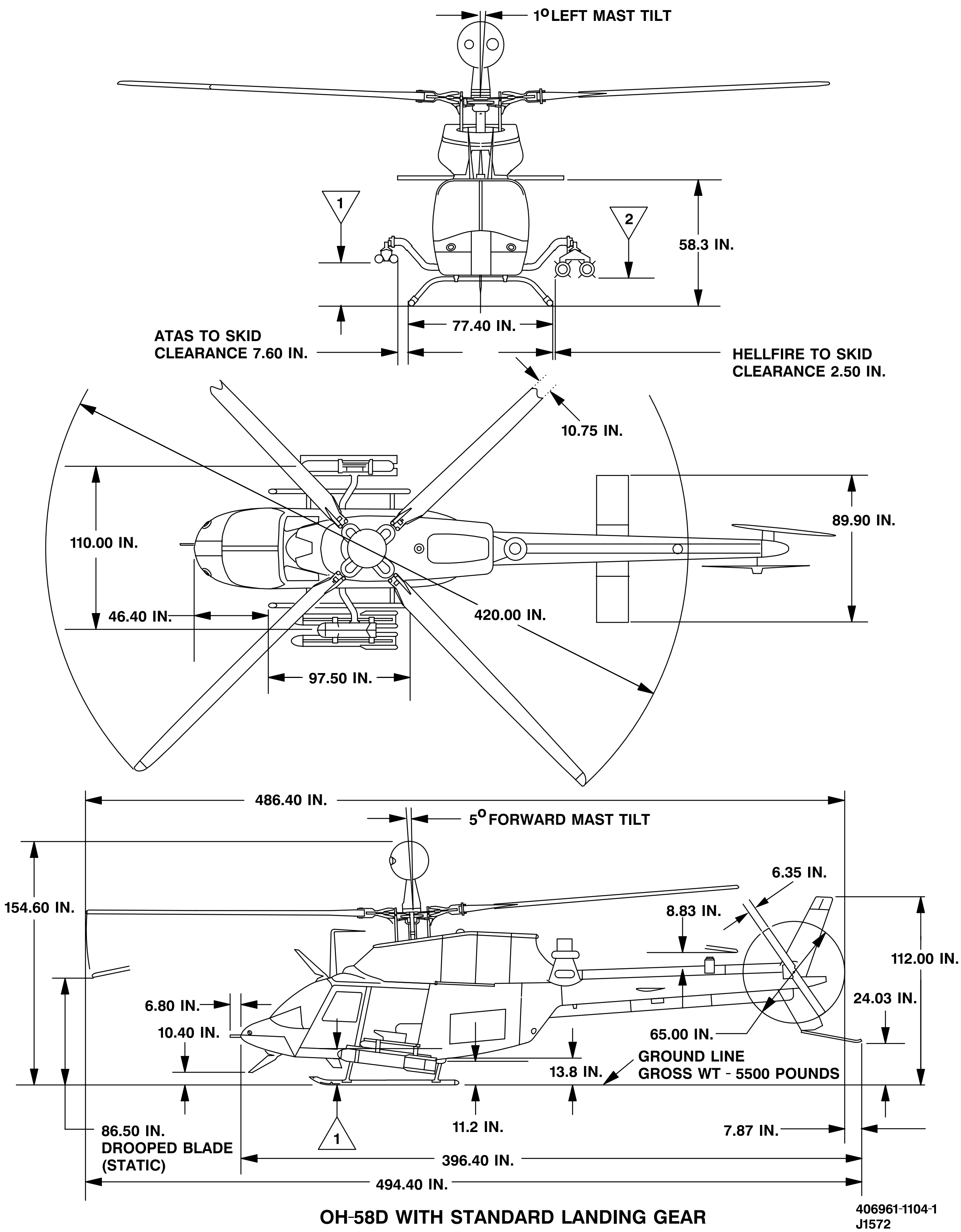
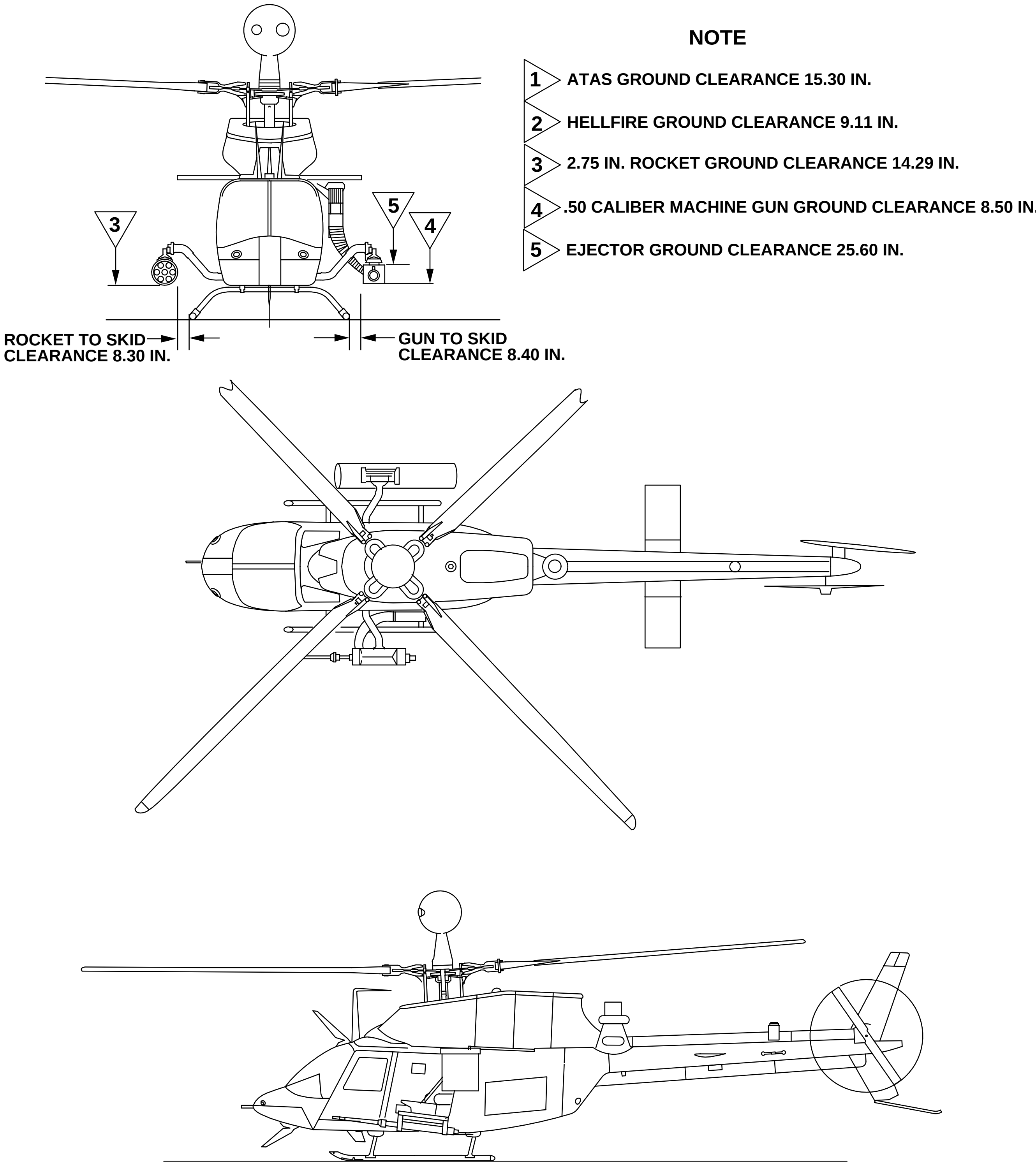
Figure 2-1. General Arrangement (Sheet 4 of 4)



OH-58D WITH STANDARD LANDING GEAR

Figure 2-2. Principal Dimensions and Ground Clearance (Sheet 1 of 4)



OH-58D WITH STANDARD LANDING GEAR

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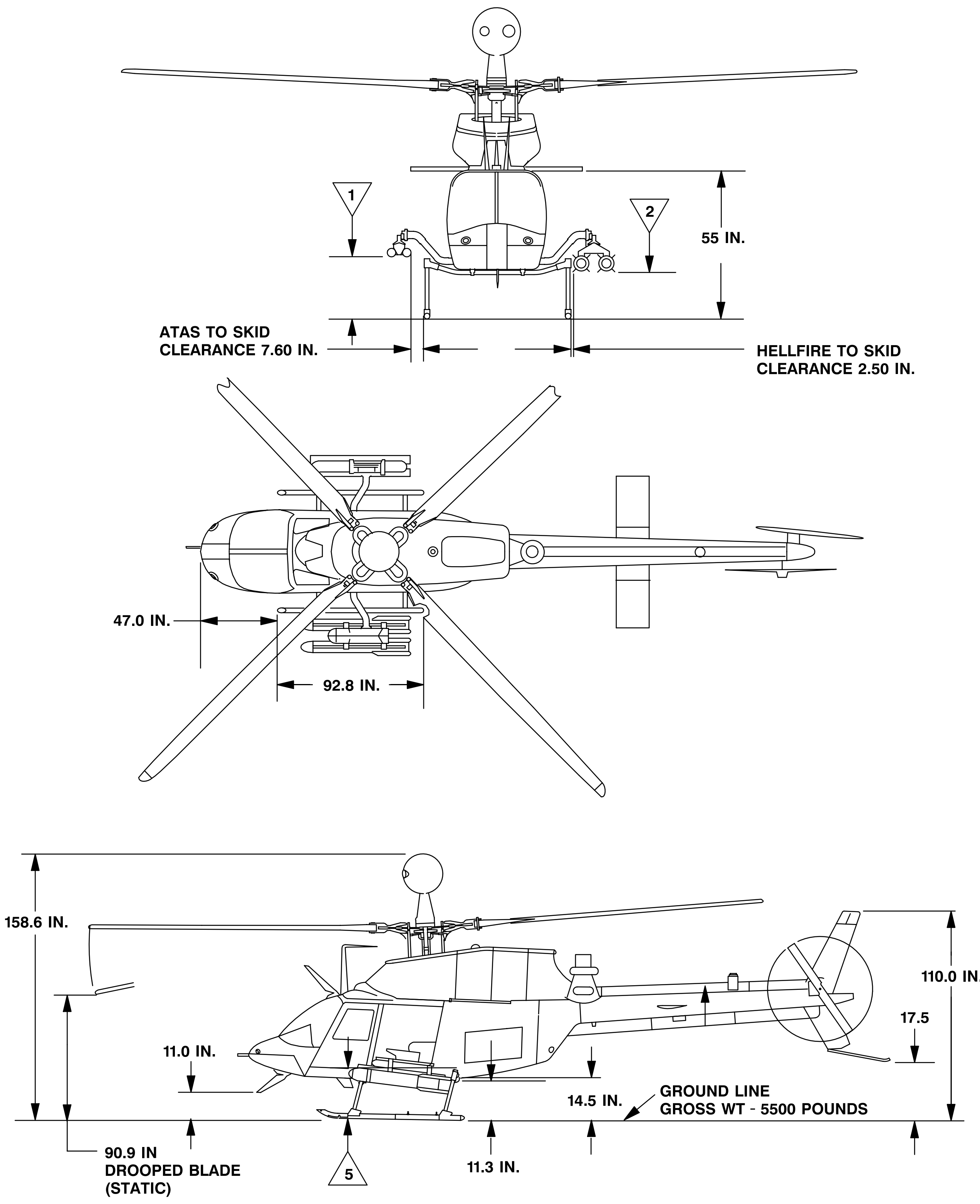
Figure 2-2. Principal Dimensions and Ground Clearance (Sheet 2 of 4)



OH-58D WITH RAPID DEPLOYMENT LANDING GEAR

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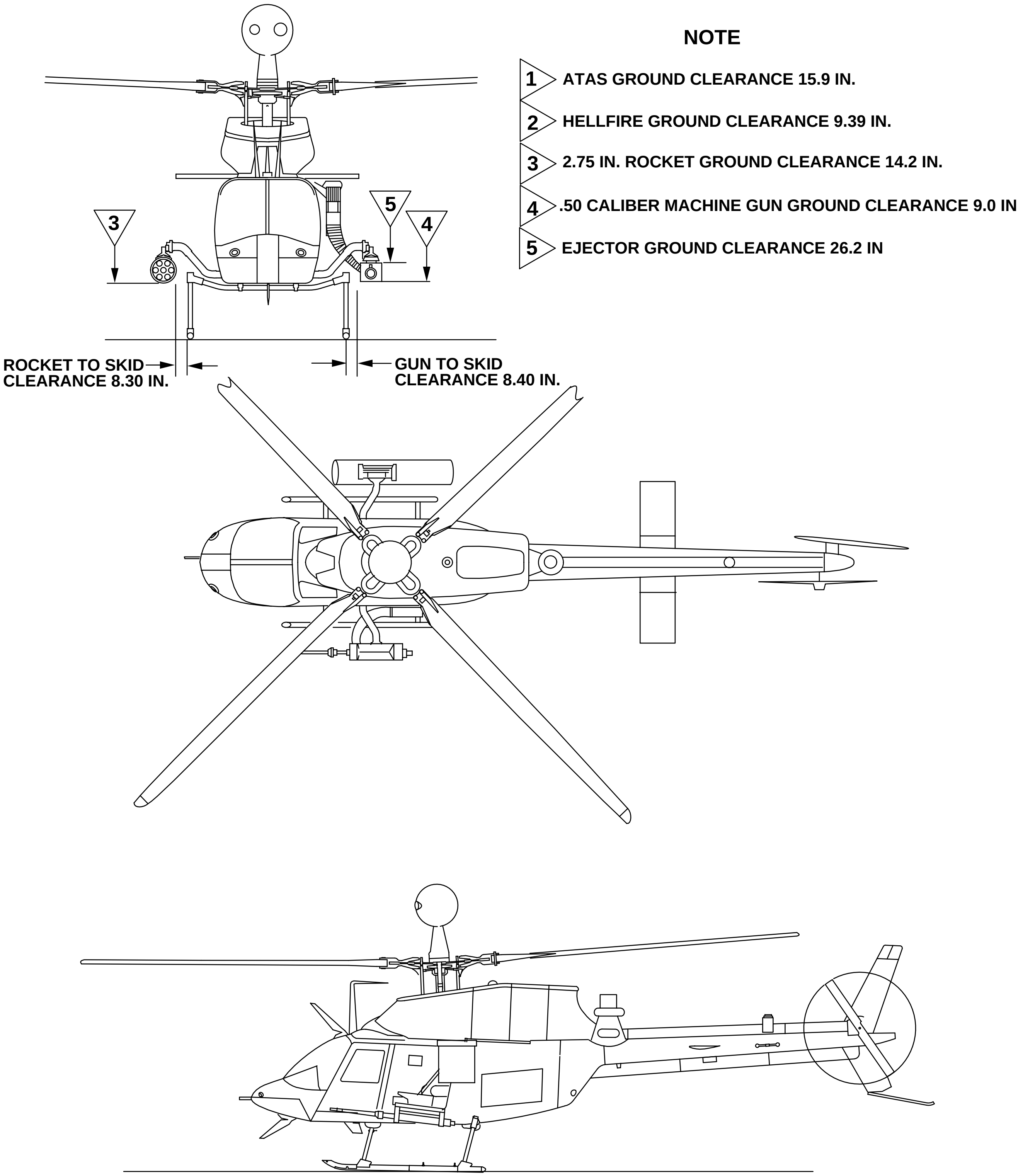
Figure 2-2. Principal Dimensions and Ground Clearance (Sheet 3 of 4)



OH-58D WITH RAPID DEPLOYMENT LANDING GEAR

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Figure 2-2. Principal Dimensions and Ground Clearance (Sheet 4 of 4)

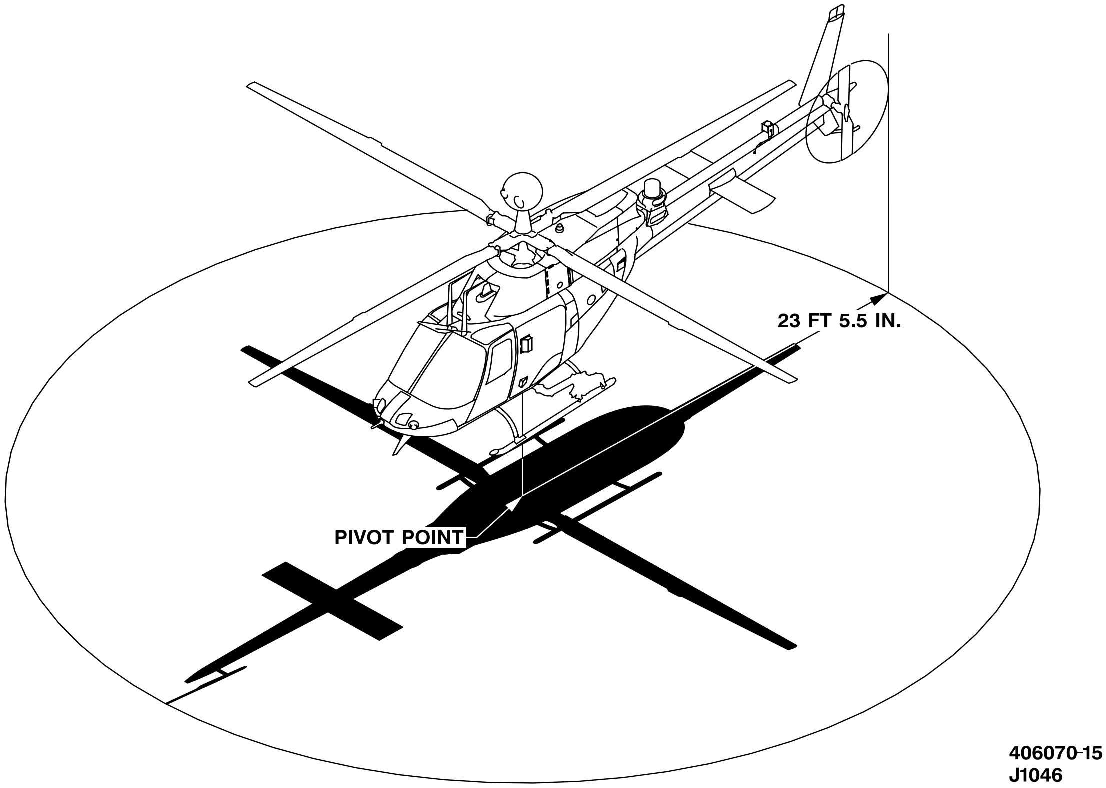


Figure 2-3. Turning Radius

2-9. INSTRUMENTS, PANELS, AND CONSOLES.

a. Instrument Panel and Console. Figures 2-6 and 2-7 depict the pilot and CPG instrument panel and pedestal console. Individual panels, indicators, and display units are indexed for location and identification. These components are described and illustrated in more detail under their respective headings.

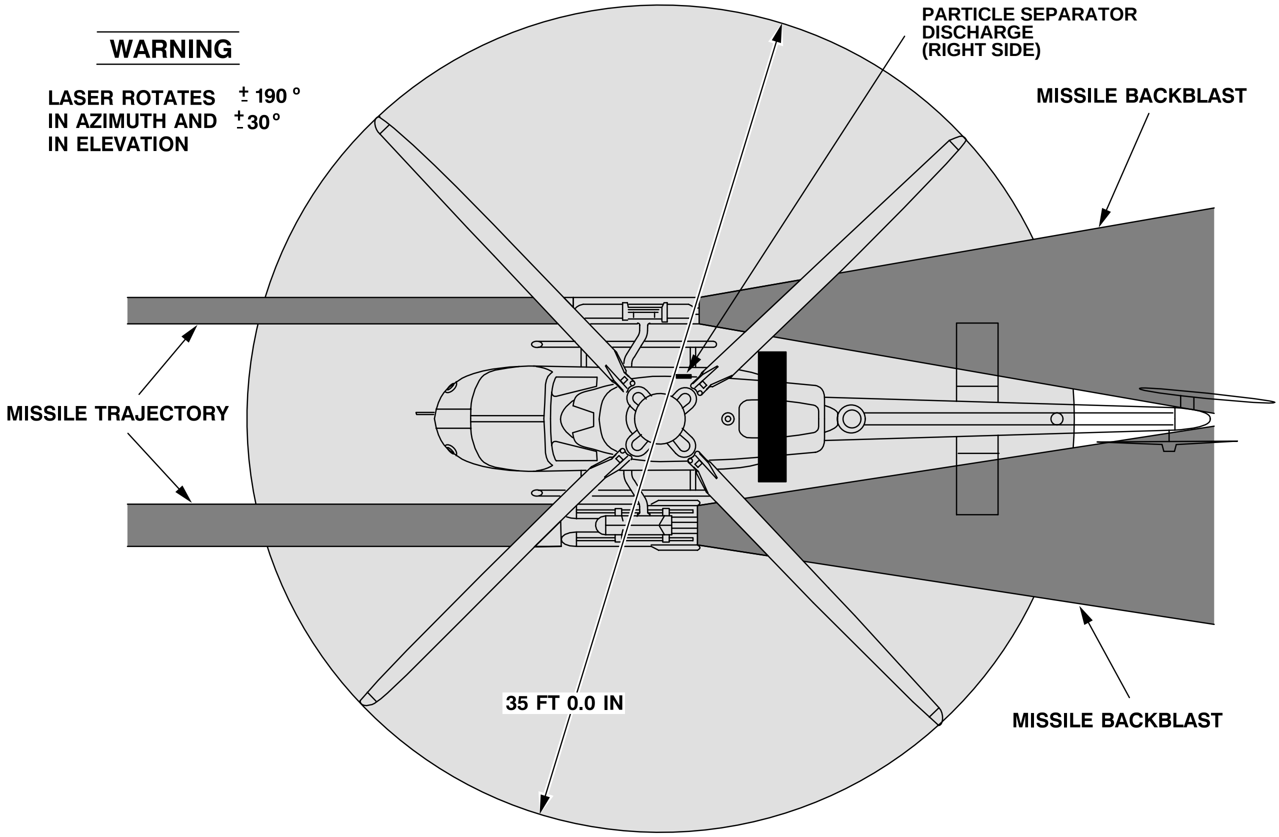
b. Overhead Console Panels and Center Post Circuit Breaker Panel. Figure 2-8 depicts the overhead console panels and center post circuit breaker panel. These panels are covered in detail in Section XI of this chapter.

2-10. CONTROLS.

All controls, except the multifunction keyboard, which are part of the helicopter system, along with their operations and functions, are discussed in detail under respective headings throughout this chapter.

2-11. CONTROL/DISPLAY SUBSYSTEM.

a. Description. The control/display subsystem (CDS) is a data handling and signal processing system which collects data from the avionics, mast mounted sight (MMS), and helicopter subsystems. The CDS transforms the data into digital code,



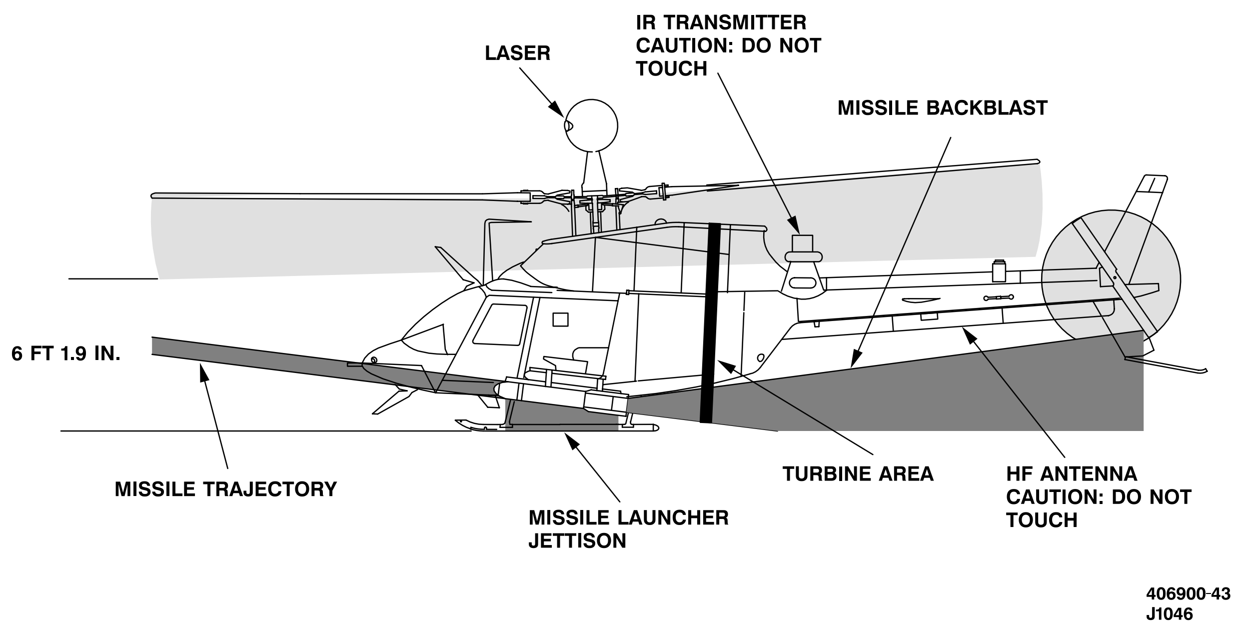
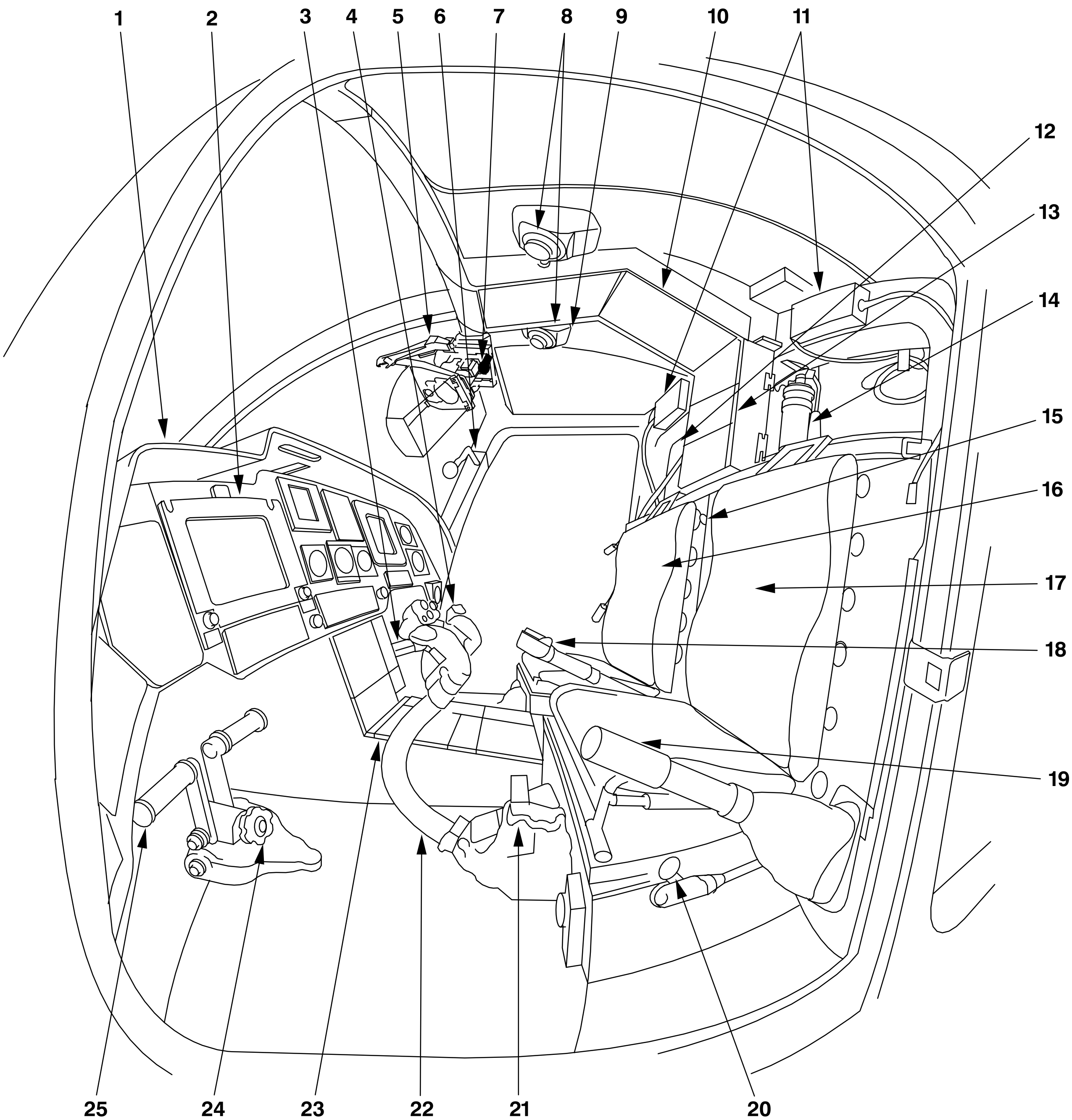


Figure 2-4. Danger Area



1. Glareshield
2. Instrument panel
3. Pilot antitorque pedals
4. Pilot cyclic stick
5. Pilot display unit (PDU)
6. Pilot door jettison lever
7. Fuel shutoff lever
8. Floodlights
9. Battery preheat indicator lights
10. Overhead console
11. NVG power converter
12. (CDS2) Data transfer receptacle with data transfer cartridge (programmable cartridge)
    R Data receptacle unit with data transfer module
13. Center post console
14. Fire extinguisher
15. Utility light
16. Pilot seat
17. CPG seat
18. Pilot collective
19. CPG collective
20. CPG shoulder harness lock
21. CPG cyclic lockout handle
22. CPG cyclic stick
23. Pedestal console
24. CPG antitorque pedal adjustment knob
25. CPG antitorque pedals

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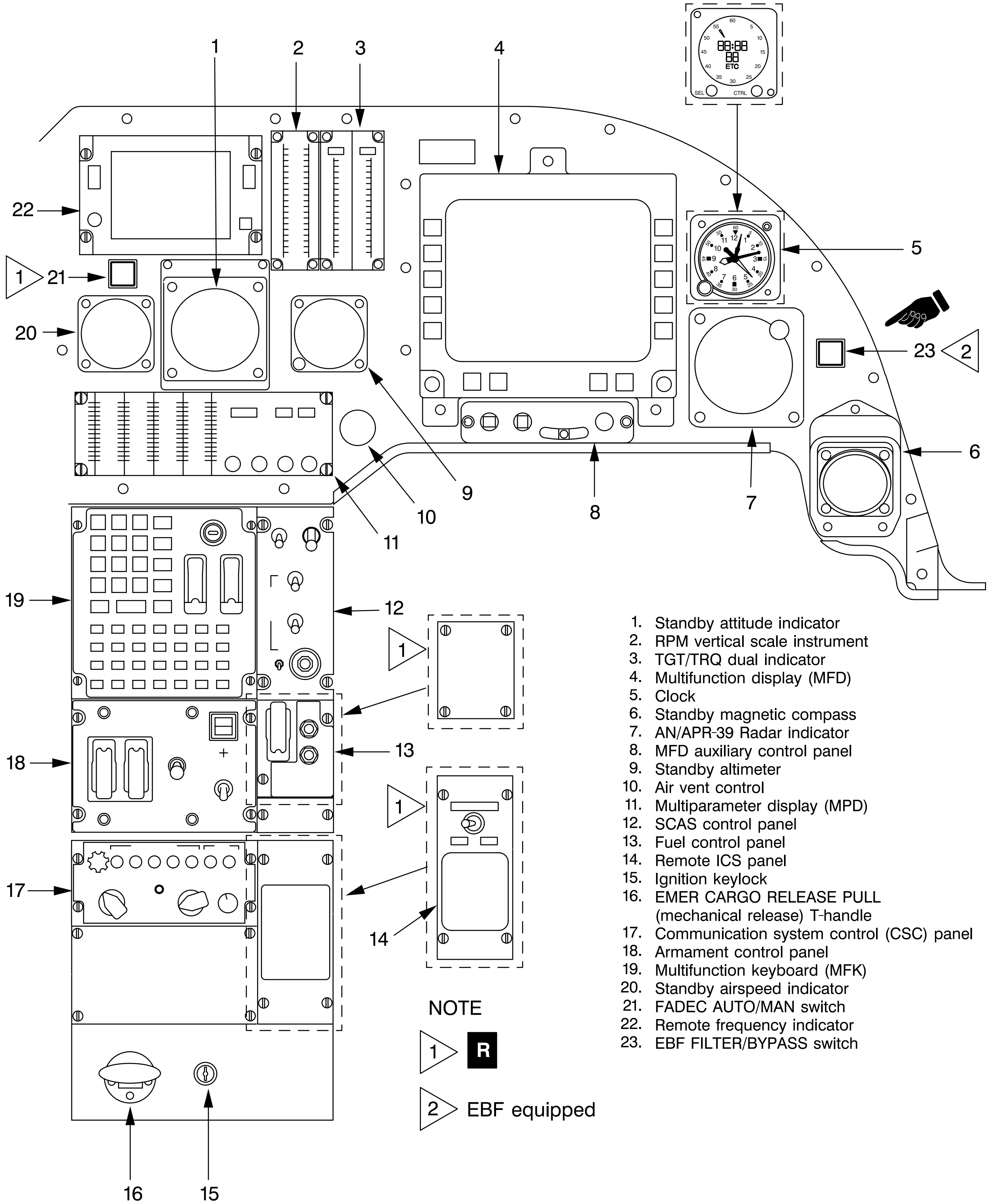
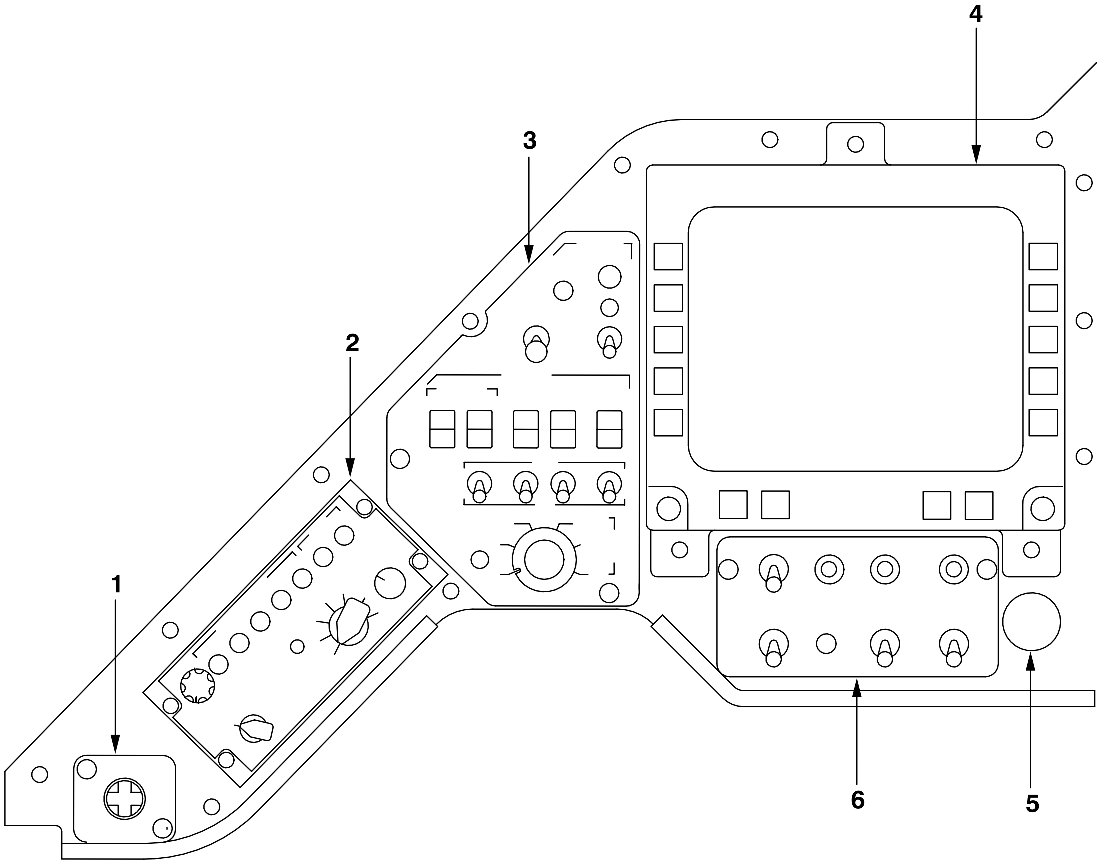
Figure 2-5. Crew Station



1. Standby attitude indicator
2. RPM vertical scale instrument
3. TGT/TRQ dual indicator
4. Multifunction display (MFD)
5. Clock
6. Standby magnetic compass
7. AN/APR-39 Radar indicator
8. MFD auxiliary control panel
9. Standby altimeter
10. Air vent control
11. Multiparameter display (MPD)
12. SCAS control panel
13. Fuel control panel
14. Remote ICS panel
15. Ignition keylock
16. EMER CARGO RELEASE PULL (mechanical release) T-handle
17. Communication system control (CSC) panel
18. Armament control panel
19. Multifunction keyboard (MFK)
20. Standby airspeed indicator
21. FADEC AUTO/MAN switch
22. Remote frequency indicator
23. EBF FILTER/BYPASS switch

Figure 2-6. Pilot Instrument Panel and Console



1. Channel select switch
2. Communication system control (CSC) panel
3. Mast mounted sight system control panel
4. Mulitfunction display (MFD)
5. Air vent control
6. MFD Auxiliary control panel

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Figure 2-7. CPG Instrument Panel

processes, and displays the data to the aircrew on demand. The CDS provides the primary interface control, computations, processing, symbol generation, monitoring, diagnostics, and display for helicopter subsystems. The interfacing is accomplished by means of a digital processor, a multiplex data bus, and associated analog and video interfaces. The CDS retrieves the respective data from memory and displays the data for use by the crew or provides it to the using device. The wide range of computational and logical data processing functions are as follows:

(1) Displays helicopter subsystem data.

(2) Data bus control.

(3) Air data processing.

(4) **(OH-58D)** Airborne target handover system (ATHS) management.

(5) R Improved data modem (IDM) management.

(6) Communication control.

(7) Navigation subsystem management.

(8) Caution, warning, or advisory monitoring.

(9) Engine or transmission monitoring and control.

(10) Subsystem diagnostics.

(11) Mast mounted sight (MMS) control and display.

(12) Symbol generation.

(13) SCAS and heading hold control.

(14) Target and waypoint storage.

The CDS consists of two master controller processor units (MCPUs), two multifunction displays (MFDs), one multifunction keyboard (MFK), and one remote frequency display (RFD).

R The CDS consists of a dedicated right master controller processor unit (R MCPU), a dedicated left master controller processor unit (L MCPU), two multifunction displays (MFDs), one multifunction keyboard (MFK), and one remote frequency display (RFD).

The OH-58D incorporates an integrated system processor (ISP). The ISP interfaces with the following systems (ISP not installed in R aircraft):

(15) Aircraft survivability equipment (ASE).

(16) Armament systems.

(17) ANVIS display symbology system (ADSS).

(18) Airborne video tape recorder (AVTR).

R The R MCPU interfaces with the following systems:

(19) ASE.

(20) Armament systems.

(21) Pilot ADSS.

R The L MCPU interfaces with the following added systems:

(22) CPG ADSS.

(23) AVTR.

b. Controls and Functions. (Fig. 2-9 and 2-10).

c. Operation. Detailed operation of the CDS is covered under the different modes of operation throughout this manual.

2-12. MULTIFUNCTION KEYBOARD.

a. Description. The multifunction keyboard (MFK) (fig. 2-9) is located on the lower console immediately below the multiparameter display panel (11, fig. 2-6), and is accessible by both crewmembers. The keyboard is tied into both MFDs as a source of entering data such as communication frequencies and channels, waypoint identifiers, coordinates, navigation data, WEAPONS PAGE and WEAPONS BIT/SETUP PAGE data, and test mode codes.

b. Controls and Functions (Fig. 2-9).

c. Operation. Detailed operation of the MFK is covered under the different modes of operation throughout this manual.

2-13. INDICATORS.

All indicators, instruments, and warning devices, except the multifunction display, which are part of the helicopter system along with their operations and functions, are discussed in detail under respective headings throughout this chapter.

2-14. MULTIFUNCTION DISPLAY.

a. Description. Two identical multifunction displays (MFD) (fig. 2-10) are mounted on the instrument panel. Each unit may be operated independently of the other allowing separate functions to be performed simultaneously by each crewmember. However, data entry by means of the cursor on the

MFD may be input through the MFK by only one crewmember at a time. This also provides system failure protection in the event of loss of one MFD. A BRT (brightness control) knob is located on the lower left corner of the MFD to control the brightness of the background of the display. A CONT (contrast control) knob is located on the lower right corner of the MFD to control the contrast between the messages and the background of the display.

b. Control and Functions (Fig. 2-10).

c. Operation. All warning, caution and advisory messages are displayed on the MFD. Detailed operation of the MFD is covered under the different modes of operation throughout this manual.

2-15. CREW AND ACCESS DOORS.

WARNING

Inadvertent jettisoning of crew doors is possible if EMERGENCY RELEASE lever is used as a handhold or hand rest during flight.

a. Crew Doors. The left and right crew doors (17 and 37, fig. 2-1) may be jettisoned by means of an EMERGENCY RELEASE lever located immediately forward of each door. Both doors have door latching devices. The right door has provisions for a padlock on the outside and the left door has a locking strap on the inside (Section XVI).

b. Avionics Compartment Access Doors. Two access doors (14 and 38, fig. 2-1) allow access to the electronics equipment in the rear cabin area. Louver type vents are located on the lower center portion of each access door to aid in electrical equipment cooling.

2-16. CREW SEATS.

Crew seats consist of steel tubular frames with stretched webbing covers for the bottom portions. The seat back is a contour shaped cushion attached to the back armor plating with hook and pile type fasteners. This cushion may be adjusted as needed for crew comfort. The crew is protected by armor plated panels from the back, below, and outboard side. The seats are equipped with a seat belt and shoulder harness. An inertia reel system is attached to the shoulder harness to allow free forward body movement during normal operation and automatic locking during violent maneuvers. A shoulder harness lock lever is attached to the side of each seat to allow the crew to manually lock the shoulder harness by moving the lever forward. Lifting the armor plate lock lever and swinging the armor plated panel outward allows the crew easy entrance and exit.

To provide energy attenuation under emergency landing conditions, helicopters with MWO 1-1520-248-50-11 accomplished are equipped with two energy attenuating crew seats. Each seat is equipped with a five-point restraint system which includes lap belts, shoulder harnesses, crotch strap, inertia reel, and a single-point release mechanism.

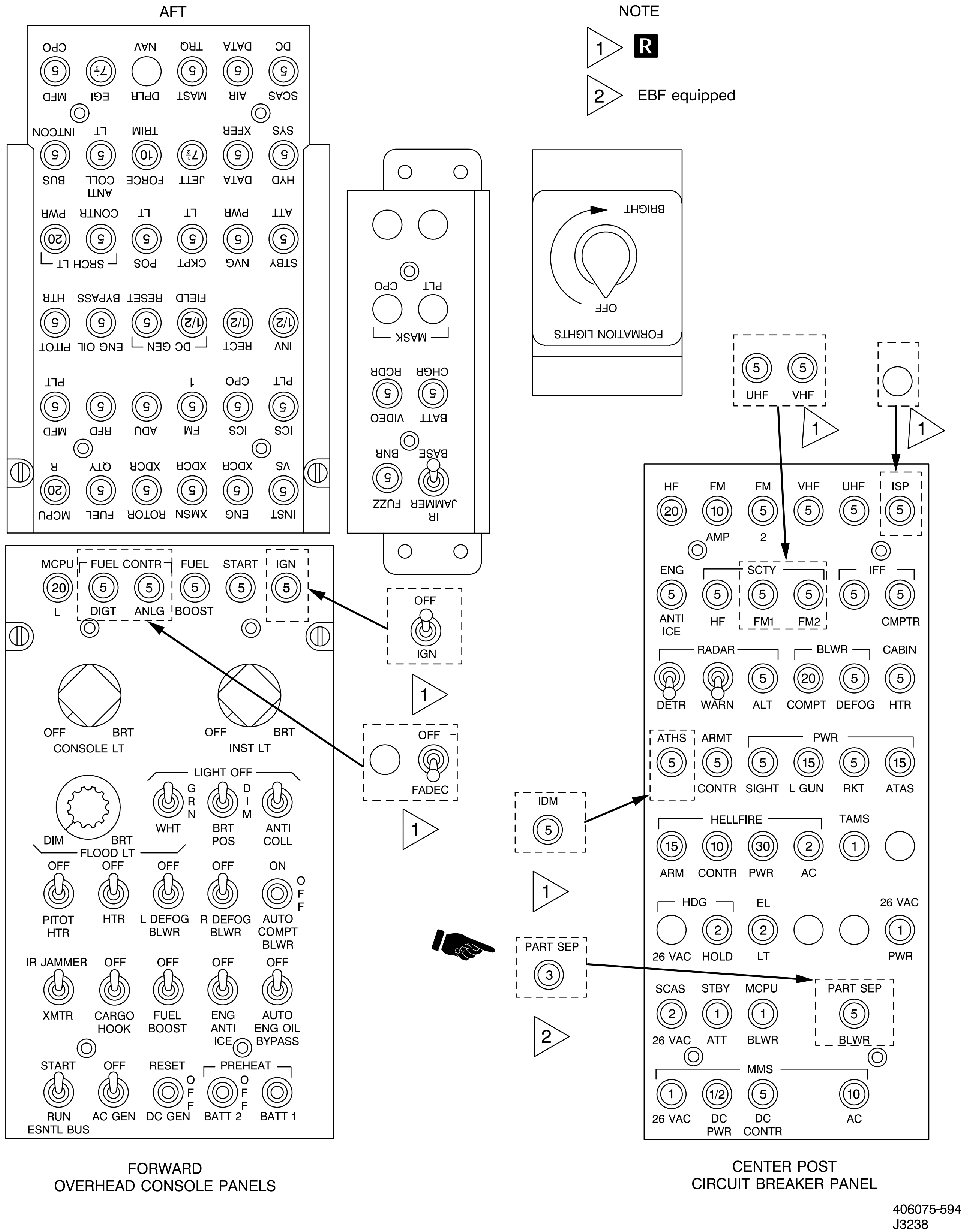
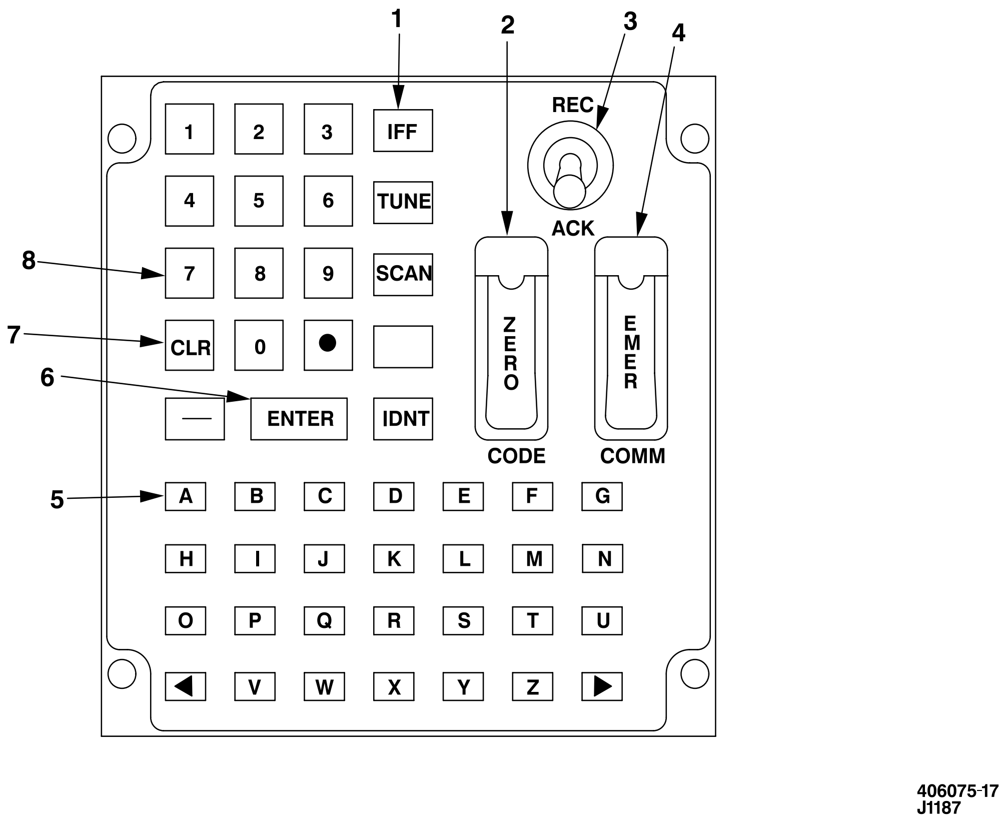


Figure 2-8. Overhead Console Panels and Center Post Circuit Breaker Panel



CONTROL/INDICATOR	FUNCTION
1. Labeled keys:	
a. IFF	Displays page 1 of IFF pages on CPG MFD.
b. TUNE	Initiates the HF radio's self tune mode.
c. SCAN	**(CDS2/CDS3)** Alternately initiates and terminates scanning of HF radio frequencies. Pressing SCAN and **"**4**"** key activates/deactivates HF scan.
	(CDS3) Alternately initiates and terminates scanning of FM-1 and FM-2 radio frequencies. Pressing SCAN and **"**1**"** key activates/deactivates FM-1 scan and **"**5**"** FM-2 scan.
	(CDS4) SCAN button has no function in CDS4.
d. IDNT	Broadcasts identification from IFF computer.
e. Blank	Enters degree, minute, and decimal point symbols in LAT/LON mode of navigation.

Figure 2-9. Multifunction Keyboard (Sheet 1 of 3)

CONTROL/INDICATOR	FUNCTION
2. ZERO CODE switch	Clears (zeroizes) all crypto variables in KY-58, KY-75, EGI and KIT-1C IFF. Waypoint and target coordinates, communication radio frequencies, navigation flight plan, and all other data are cleared from master controller processor unit (MCPU) except transmission attitude measurement system (TAMS), airborne calibration constraints, **(CDS2)** ATHS/R IDM, engine condition data, and present position.

NOTE

Following completion of ZEROIZE, it may be necessary to cycle both right and left MCPU circuit breakers to regain proper MCPU function.

(CDS4) ZERO CODE switch	Causes a zeroize command to be sent to following subsystems: VHF radio, UHF radio, FM-1 radio, FM-2 radio, KY-58 (No. 1 & 2), IDM, Data Transfer Module, and nonvolatile memory (NVM). Emergency radio frequencies are not cleared when ZERO switch engaged. Zeroize status is displayed at top of current MFD display in a box on left side of screen to right of L-3 and L-4 keys. Status display will be one of following: 1. If current status is NOT COMMANDED, nothing will be displayed. 2. If zeroize is in progress, ZERO IN PROGRESS (boxed) is displayed. 3. If zeroize is complete, ZERO CMPLT CYCLE CDS PWR (boxed) is displayed.

NOTE

To ensure proper system operation, power must be cycled to both MCPUs following a zeroize.

3. REC/ACK switch	Three-position (spring-loaded to center) switch. When placed in the ACK (acknowledge) position one time, the warning system audio is silenced and CAUTION is deleted from screen. Placing to ACK position a second time deletes any caution or advisory messages that are displayed. Pressing the switch to the REC position will return any stored caution or advisory messages to the display, up to a total of five cautions and advisories. If more than five messages are active at one time, only five messages will be displayed plus a note of how many more messages are yet to be displayed. Sequential activation of the REC switch will recall the next five messages until all messages have been displayed. A final activation of the REC switch will clear the remaining messages from the screen.

Figure 2-9. Multifunction Keyboard (Sheet 2 of 3)

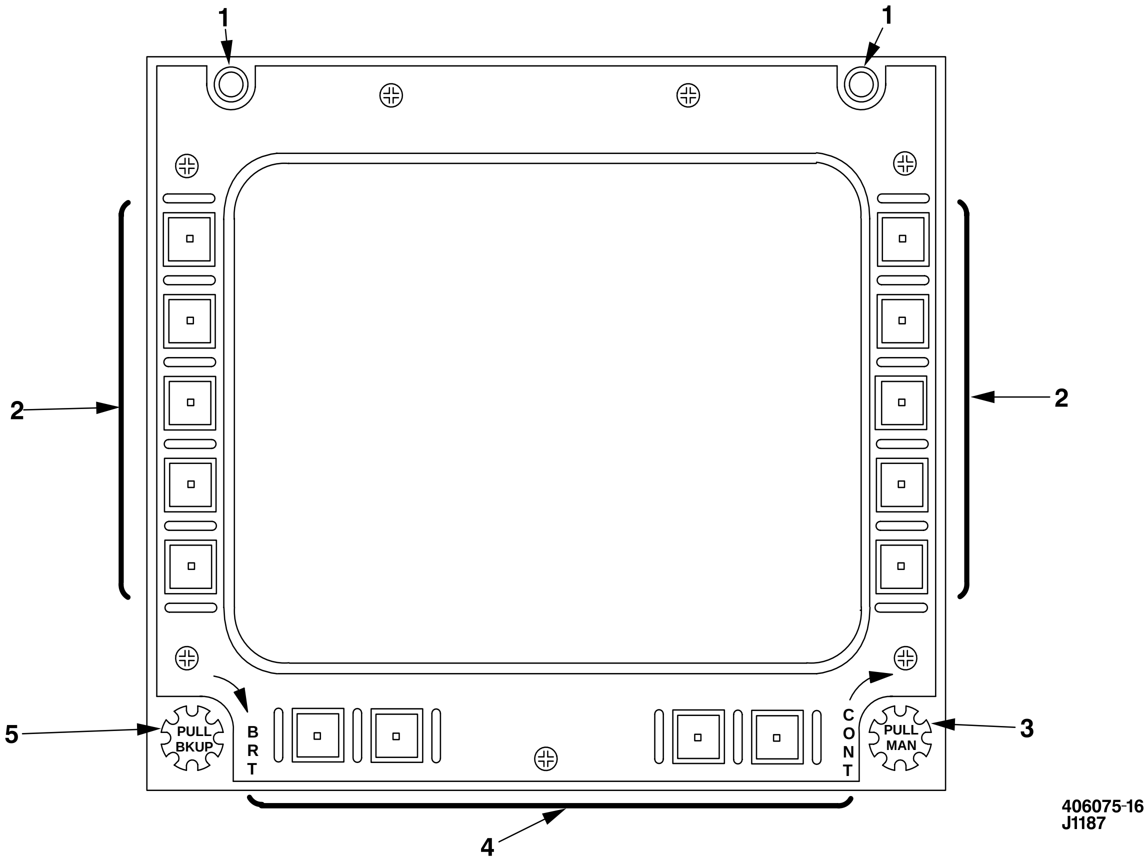
CONTROL/INDICATOR	FUNCTION
4. EMER COMM switch	Places the FM, UHF, and VHF radios in the emergency frequencies of 40.5, 243.0, and 121.5 MHz respectively and transponder to code 7700 NORM.

NOTE

(CDS4) Activating EMER COMM switch has no effect on FM-1 and FM-2 radios. Emergency mode for these radios is controlled using L-2 key on FM-1 or FM-2 SC control page.

5. Alpha keys	Used to enter characters. Space keys are located at lower left and lower right of MFK.
6. ENTER key	Enters into memory of the computer any information that has been typed on the MFK.
7. CLR key	Clears any message that has been typed but not entered into memory.
8. Numeric keys	Used to enter numeric characters. A decimal point is located under the numeric key 9.

Figure 2-9. Multifunction Keyboard (Sheet 3 of 3)



CONTROL/INDICATOR		FUNCTION
1.	Optosensors	Two electronic sensors that measure the average ambient light at the display. Any change in ambient light of 30 percent or more will result in an automatic change in the display brightness.
2.	Line address keys	Ten variable function keys (five on either side of screen). The function of the keys will vary with the change of modes and screen displays. These functions are covered in detail under the operation sections of the different modes of operation. Line address keys are identified as L-1 — L-5 and R-1 — R-5 from top to bottom throughout text to simplify locating a specific key or legend associated with it.
3.	CONT/PULL MAN knob	Turning the knob controls the contrast between the display and the background of the screen. Pulling the knob out overrides the optosensors to give manual control of the display brightness.
4.	Mode select keys	Four keys used for selecting the modes of VSD, HSD, MMS, or COMM or their displayed submodes.
5.	BRT/PULL BKUP knob	Turning the knob controls the brightness of the background of the display. Pulling the knob outward causes the display to repeat information displayed on the opposite MFD.

Figure 2-10. Multifunction Display

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SECTION II. EMERGENCY EQUIPMENT

2-17. EMERGENCY EQUIPMENT.

a. Portable Fire Extinguisher. A portable hand-held, chemical fire extinguisher is mounted on the left side of the center support column, located behind the CPG seat. Refer to Chapter 9 for illustration of location.

b. First Aid Kit. A first aid kit is mounted on the right side of the center support column, located behind the pilot seat. Refer to Chapter 9 for illustration of location.

SECTION III. ENGINE AND RELATED SYSTEMS

2-18. ENGINE.

The helicopter is equipped with an Allison turboshaft engine model T703-AD-700A (250-C30R) or 250-C30R/3 (fig. 2-11 and fig. 2-12). Four major components of the engine are the compressor module, the combustion module, the turbine module, and the power and accessories gearbox. The four major systems are the engine fuel system, engine lubrication system, engine electrical system, and the engine anti-icing system.

a. Compressor Module. The compressor module is a single stage, single entry, centrifugal flow compressor and is directly coupled to a two stage gas producer turbine.

b. Combustion Module. The single combustion module consists of an outer combustion case, a combustion liner, a fuel injector (11), and one igniter plug (10).

c. Turbine Module. The turbine module consists of a two stage gas producer turbine assembly, a two stage power turbine assembly, and an exhaust collector support assembly.

d. Power and Accessories Gearbox. The power and accessories gearbox (3), consists of the gas producer turbine drive geartrain and the power turbine drive geartrain. All engine components, including the engine mounted accessories, are installed on the gearbox. The power and accessories gearbox incorporates two monopole pickup units to sense gas producer turbine and power turbine speed. Accessories driven by the gas producer drivetrain are: pressure/scavenge oil pump, starter-generator (7), OH-58D fuel pump/fuel control, and R HMU (8). The power turbine drivetrain supplies the power output for the main driveshaft (5), tail rotor drive (9), AC generator, and R PMA (17). The gear case serves as the main structural support of the engine through two engine/airframe mounts on the sides of the case.

2-19. ENGINE COOLING.

The engine is cooled by air flowing through the engine and the engine compartment cowling louvers. The cowling louvers permit outside air to enter the engine compartment through both sides, top, and aft cowling.

2-20. INDUCTION SYSTEM.

a. Non-EBF Equipped.

WARNING

Foreign debris is ejected under high pressure from purge blower ducting located at eye level directly above fuel filler cap. Caution must be taken to avoid eye or face injury when engine is running or power is applied to the system.

The engine air induction system consists of an air induction cowl, two particle separator panels, and a fan purge blower. The induction cowl and two particle separator panels form a plenum chamber that supplies clean air for the engine air inlet. The fan purge blower will eject all foreign matter through the fan purge blower ducting.

b. EBF Equipped.

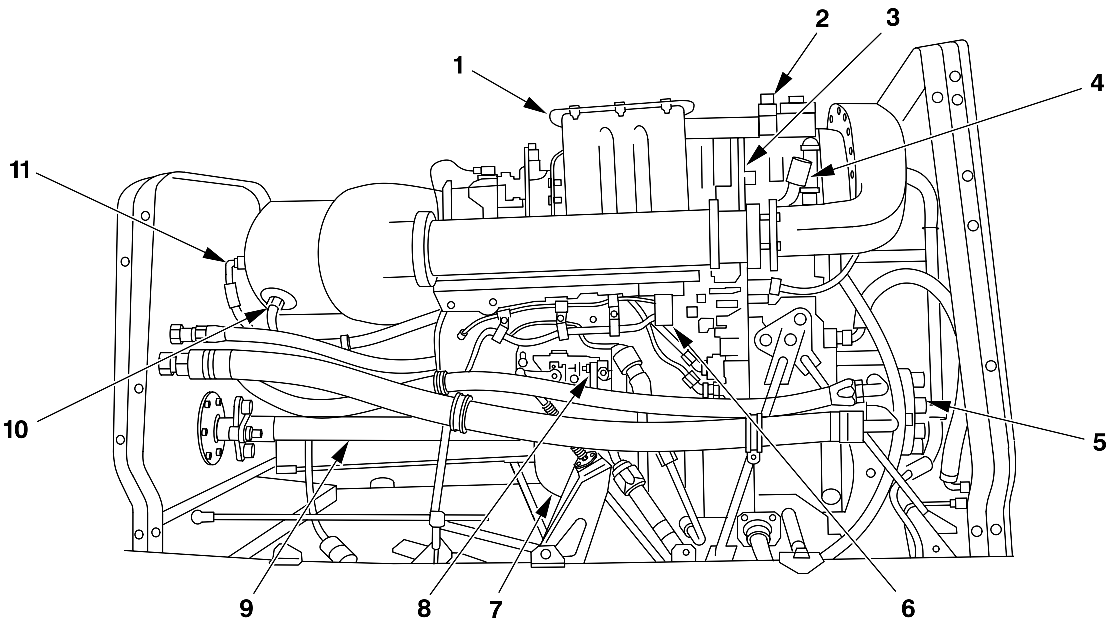
The air induction system consists of an air induction cowl, two engine filters, an integral bypass system, a differential pressure switch, and an electrical system for annunciation to the pilot of filter blockage. The induction cowl, engine filter assemblies, and integral bypass system form a plenum chamber that supplies clean, filtered air for the engine air inlet. The EBF also includes an auxiliary barrier filtration system for the engine compressor inducer bleed flow port, called the inducer/bleed port filter (IBPF).

The EBF system employs an electrically actuated bypass door to permit unfiltered air to enter the inlet plenum should the engine filters become obstructed. An inlet plenum differential pressure switch will illuminate the FILTER segment of the cockpit indicator alerting the pilot to an impending filter clog condition. The differential pressure switch is set at 11 inches of water pressure drop. The FILTER segment alerts the pilot to activate the bypass system prior to the pressure drop across the engine filters exceeding operational limits.

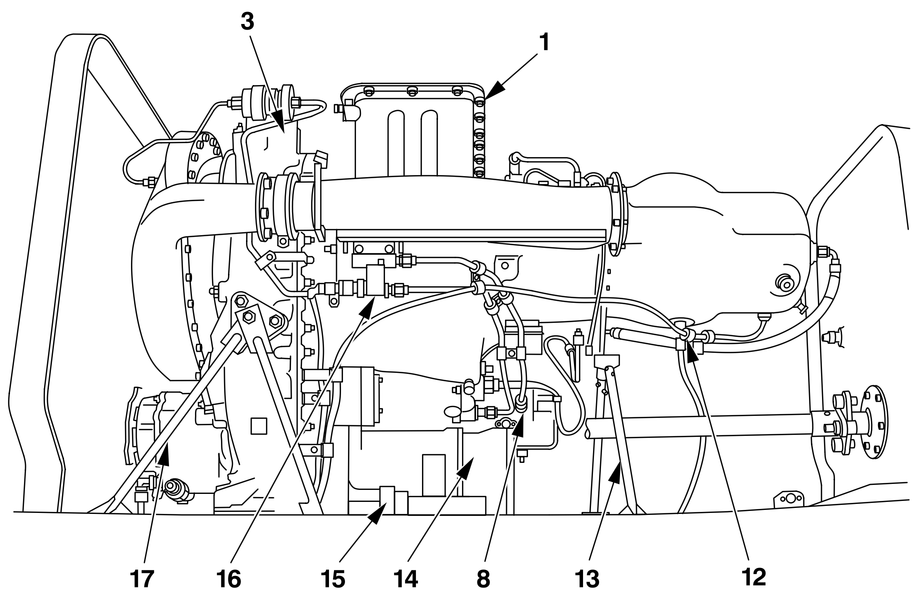
Positive feedback of a bypass open condition is provided to the crew in two ways: the system will illuminate the BYPASS segment of the cockpit switch, triggered by a bypass door position switch, and additionally when the FILTER light goes out, indicating the pressure differential has dropped below 11 inches of water.

System design allows for activation of the system on the ground with power on the aircraft (external/ essential bus to RUN). The cockpit switch can be pressed to actuate the bypass door open, then pressed again to actuate it closed.

The induction cowl is equipped with an inlet blast shield to prevent engine surge due to rocket blast entering the engine inlet under certain rocket firing conditions.



ENGINE, RIGHT SIDE



ENGINE, LEFT SIDE

1. Exhaust
2. Oil bypass indicator
3. Power and accessories gearbox
4. Gas producer (Ng) pickup unit
5. Main driveshaft
6. Anti-icing solenoid valve
7. Starter-generator
8. Fuel control unit
9. Tail rotor drive
10. Igniter plug
11. Fuel injector
12. Combustion chamber drain valve
13. Aft engine mount
14. AC generator (not shown)
15. Fuel filter & filter bypass indicator
16. Np overspeed solenoid
17. Forward engine mount

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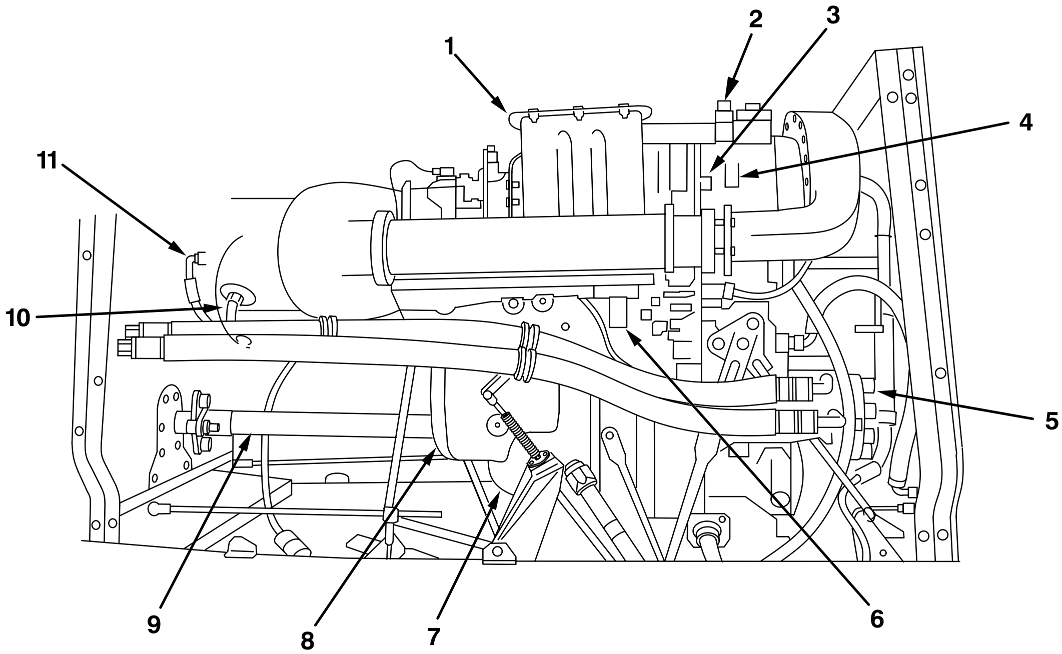
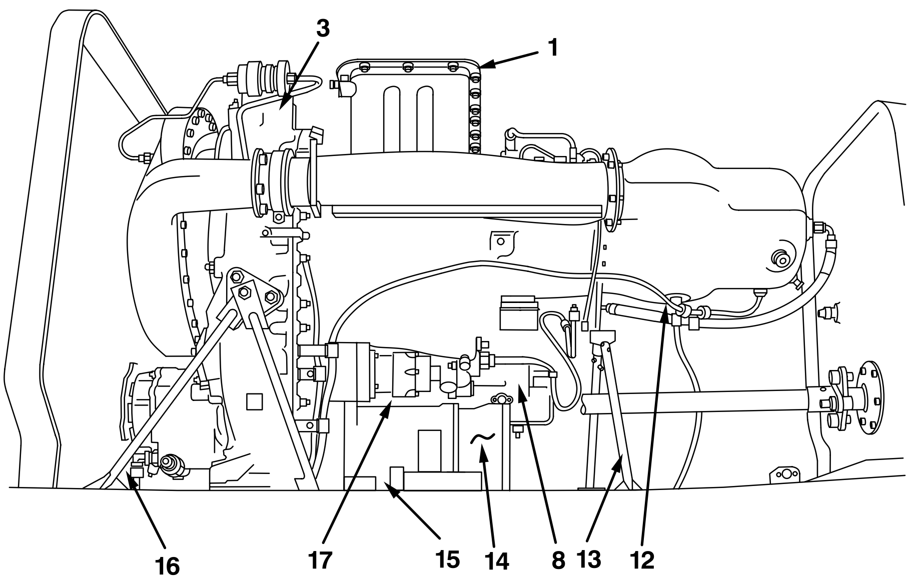
Figure 2-11. Engine T703-AD-700A (250-C30R)



ENGINE, RIGHT SIDE



ENGINE, LEFT SIDE

1. Exhaust
2. Oil bypass indicator
3. Power and accessories gearbox
4. Gas producer (Ng) pickup unit
5. Main driveshaft
6. Anti-icing solenoid valve
7. Starter-generator
8. Hydromechanical unit (HMU)
9. Tail rotor drive
10. Igniter plug
11. Fuel injector
12. Combustion chamber drain valve
13. Aft engine mount
14. AC generator (not shown)
15. Fuel filter & filter bypass indicator
16. Forward engine mount
17. Permanent magnet alternator (PMA)

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Figure 2-12. R Engine (250-C30R/3)

2-21. ENGINE INLET ANTI-ICING SYSTEM.

a. The engine anti-icing system provides anti-icing for the compressor inlet guide vanes and the front bearing support hub. The system uses hot compressed air from the diffuser scroll.

b. Major components of the anti-icing system are the anti-icing air valve mounted on the diffuser scroll, anti-icing solenoid valve mounted on the turbine section firewall shield, and ENG ANTI ICE switch located on the forward overhead console panel (fig. 2-8).

c. The anti-icing system is activated by placing the ENG ANTI ICE switch to the ENG ANTI ICE position. This de-energizes the anti-icing solenoid valve, causing air from the anti-icing air valve to be vented out the solenoid valve. This, in turn, opens the anti-icing air valve allowing hot compressed air from the diffuser to flow to the engine inlet, where it is dispersed through the inlet guide vanes and over the front bearing support hub. In the event of an electrical failure, the system will remain on or will activate to on if the system is off at the time of the failure.

2-22. (OH-58D) ENGINE FUEL SYSTEM. The engine fuel system delivers fuel to the engine for combustion. The major components are the engine driven fuel pump, fuel filter, fuel pressure differential switch, fuel control unit (FCU), and fuel injector (fig. 2-11).

a. Engine Driven Fuel Pump. The engine driven fuel pump is a positive displacement gear-type pump driven by the gas producer section of the engine. It incorporates a single gear-type pumping element. Fuel passing through the pump is delivered to the fuel control unit. The fuel pump is installed on the power and accessory gearbox and is driven by the gas producer turbine. Access to the pump is gained through the right engine access door.

b. Fuel Filter. The fuel filter is mounted on the lower rear portion of the power and accessory gearbox. It consists of an impending bypass indicator, a filter element and a filter bypass valve. The filter can be seen by opening the left engine access door (11, fig. 2-1).

(1) **Impending Bypass Indicator.** The impending bypass indicator is a red button that extends when an impending bypass condition exists. Notify maintenance personnel if indicator extends.

(2) **Filter Element.** The filter element is a 10 micron, disposable filter element.

(3) **Filter Bypass Valve.** The filter bypass valve opens when the filter element becomes clogged, allowing fuel to bypass the filter element.

c. Fuel Pressure Differential Switch. The switch is located on the bottom of the power and accessory gearbox. It activates the FUEL FILTER BYP caution message when the fuel filter is clogged.

d. Fuel Control Unit (FCU). The FCU is mounted on the aft side of the fuel pump. Fuel enters the fuel control unit after passing through the fuel pump. The fuel control unit meters fuel to the combustor section of the engine. The fuel control unit incorporates a PY torquemotor which controls gas producer speed. Fuel entering the fuel control unit passes through an additional filter and is then conveyed to the metering valve. The fuel control unit has a pressure relief valve to protect the system from excessive fuel pressure. A bypass valve maintains a constant pressure differential across the metering valve and bypasses excess fuel back to the fuel pump through an external line connecting the pump bypass inlet to the bypass outlet port of the fuel control.

e. Fuel Injector. The fuel injector is mounted in the aft end of the outer combustion case. The fuel injector sprays metered fuel into the combustion section of the engine where it is mixed with air for combustion.

2-23. (OH-58D) ENGINE CONTROLS. Engine controls consist of the throttle, electronic supervisory control (ESC), fuel control panel, and an RPM trim switch.

a. Throttle. The throttle is a rotating twist grip located on each collective. It establishes fuel flow requirements which determine power turbine speed. The throttle has three primary positions: off, idle, and full open. An IDLE REL button on the pilot collective prevents the throttle from being turned to the off position from idle. When the button is pressed in, the throttle can be rotated from idle to off.

b. Electronic Supervisory Control (ESC). The ESC electronically controls engine operation by evaluating the following discrete inputs: power turbine trim switch selection, NG speed, NP speed, TGT, collective position, pressure altitude, and outside air temperature. The ESC uses these inputs during start and above 96% NP to control NG RPM with the PY torquemotor to vary PY air pressure against PX air pressure in the bellows/fuel metering valve assembly in the fuel control unit (FCU). The ESC operates in the digital or analog mode. Both modes maintain a constant power turbine speed (NP) and provide overspeed protection. The ESC is programmed to continually perform tests of its internal condition and the integrity of incoming signals. If a fault is detected which causes degraded operation of the ESC digital mode, an advisory message of FUEL CONTROL displays on the MFD. Failures that will activate the FUEL CONTROL advisory message are: loss of a single NG or NP monopole signal (the monopole pickups are dual type pickups with two independent coils and each provides an RPM signal), loss of the TGT signal, loss of collective pitch position signal, open or short circuit in the overspeed dump solenoid, and miscellaneous internal failures. The FUEL CONTROL advisory message will also appear during interrogation of the digital mode of the ESC. The FUEL CONT caution message indicates to the pilot that the ESC has switched from the digital (primary) to the analog (backup) mode. A FUEL CONTROL advisory message will also appear. Failures that can activate a FUEL CONT caution message are: loss of 28 Vdc to ESC, loss of both NG signals or both NP signals, a short or open circuit to the PY torquemotor, loss of collective pitch and ambient pressure input simultaneously, and internal failure of the digital mode of the ESC. Faults of the digital mode of the ESC can occur without the corresponding caution or advisory messages. All fault codes are held in memory and can be accessed by interrogating the ESC. The ESC does not have a continuous memory; therefore, once electrical power to the digital mode of the ESC is removed, all fault codes will be lost. Circuit protection is provided by the FUEL CONTR analog and FUEL CONTR DIGT circuit breakers located in the forward overhead console panel (fig. 2-8). If both modes of the ESC fail, the engine can be controlled manually through the use of the throttle.

(1) **Digital Mode.** The digital mode is the normal mode of operation for the ESC. The mode provides for: engine start temperature limiting, NG speed governing, NG acceleration control, NG overspeed protection, NP speed governing, NP trim control, NP acceleration protection, NP overspeed protection, and collective anticipation. In the digital mode, NP overspeed protection will trip at 122% and is rate sensitive. This value is reset lower if NP RPM is increasing rapidly. The amount of reset is determined by acceleration rate. For every 10%/second change in the NP, the NP is reduced by 1%. This is a noncommitting system, i.e., when the overspeed condition is gone, so is the attempt to reduce the NP RPM. In the event of digital mode failure, the ESC will automatically transfer to the analog mode. Manually placing the NORM ANLG BACK UP switch to the ANLG BACK UP position ensures the system is operating in the analog mode only.

CAUTION

Operation in the analog mode will not be considered as normal operations. Flight with a high gross weight/density altitude will cause transients to the extent that the low rotor/high rotor warning message may be activated; therefore, maneuvers that require OGE capability should not be performed. Crews must monitor NR/NP/NG to ensure that they remain within normal operating limits.

(2) **Analog Mode.** The analog mode is the backup mode of operation for the ESC. The analog mode can be selected manually. This is done by placing the NORM ANLG BACK UP switch to the ANLG BACK UP position. This removes power from the digital side of the ESC. There is no indication to the pilot the analog mode has failed. Therefore, caution should be used when first selecting the analog mode. When operating in the analog mode, the following functions are not available: engine start temperature limiting, NP trim control, NP acceleration protection, and collective anticipation. In the analog mode, NP overspeed trips at 113% and is not rate sensitive.

NOTE

Both digital and analog overspeed protection is active when operating in the digital mode.

(3) **Manual Mode.** The manual mode is used in the event of a digital and analog failure or a total loss of electrical power to the ESC. NP speed and power adjustments are controlled by throttle inputs.

c. Fuel Control Panel. The fuel control panel (item 13, fig. 2-6., and fig. 2-13) is located on the right side of the center pedestal. It contains a covered NORM ANLG BACK UP switch and two push type switches labeled DIGITAL and ANALOG.

NOTE

- Any interruption in DC power will erase the memory of the Electronic Supervisory Control (ESC). If a fuel control advisory and/or FUEL CONT caution message is displayed and the situation permits, it is recommended the fuel control bit check be performed and the fault codes recorded prior to turning the battery off. Placing the NORM-ANLG BACK UP switch to the ANLG position will erase the memory.
- With engine operation at 100% RPM, the crew will notice a 2 to 3% increase in RPM if NORM-ANLG BACK UP switch is placed in the ANLG BACK UP position.

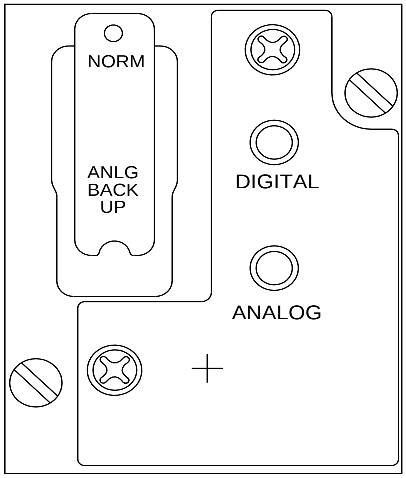

Figure 2-13. Fuel Control Panel

(1) **NORM ANLG BACK UP Switch.** The NORM ANLG BACK UP switch is used to remove DC power from the digital mode of the ESC. With the cover down (NORM position), the digital mode is used to control metered fuel flow. In case of failure of the digital mode, the analog mode will take over control of fuel metering automatically, even with the switch in the NORM position. The ANLG BACK UP position should only be used to test operation of the analog mode or after a digital mode failure. When the analog mode of the ESC assumes control, the digital mode is off line and the caution and advisory will display to advise the crew of the limited capability situation. In the analog mode, the pilot must be aware of the loss of ability to control the RPM through the RPM switch, the loss of droop anticipation, and the loss of RPM surge protection.

(2) **Fuel Control Mode Switching Procedure.**

(a) DIGITAL to ANALOG switching — unrestricted for all flight conditions.

(b) ANALOG to DIGITAL switching — limited to maximum of 60% mast torque.

NOTE

When performing the fuel control overspeed check, holding the DIGITAL or ANALOG test switch continuously will cause a constant fluctuation in engine RPM until the test switch is released.

(3) **DIGITAL Test Switch.** The push-type DIGITAL test switch is used to test the overspeed control of the ESC without the danger of an actual overspeed. Pressing the DIGITAL test switch changes the overspeed reference point from 122% NP to 70% NP. With NP set between 70 and 80%, a droop in TGT, NP, and/or NG should be observed if overspeed protection is operating properly. Activation of the DIGITAL test switch interrogates the ESC for any fault codes and can be done anytime. During the end at the completion of the interrogation, the advisory message will display. If no fault codes are present, the message will display only a few times then delete. If on the FDL bit page, the words IN TEST will display below the fuel control prompt followed by a GO. If fault codes are present, the advisory will display for a longer period of time. When interrogated, the ESC will send fault codes in a coded sequence or pattern given in two-digit numerical combination to the MCPU for interpretation. The first digit indicates the number of long (2 second duration) signals; the second digit indicates the number of short (0.5 second duration) signals. The signals are separated by a one second pause. For example: if the ESC sent a code 33 to the MCPU, this would be three long signals followed by three short signals, taking the MCPU approximately 15 seconds to interpret. Because the ESC sends fault codes out in a time dependent sequence, time before the pilot sees the interpreted codes will vary. If the DIGITAL test switch is held in during testing, it could cause the MCPU to lock into the test mode. If this occurs, a press and release of the test switch should correct the lockup.

(4) **ANALOG Test Switch.** The push-type ANALOG test switch is located below the DIGITAL test switch on the fuel control panel. Pressing the ANALOG test switch changes the overspeed reference point from 113% NP to 70% NP. With NP set between 70 and 80% a droop in TGT, NP, and/or NG should be observed if overspeed protection is operating properly. Unlike the DIGITAL test, the analog test will not display any fault codes. This is due to the absence of a communication link with the digital section of the ESC.

NOTE

- Anomalies within the analog system will not be annunciated to the flight crew due to the absence of a communications link with the digital system.
- Use the digital readout on the MPD when adjusting/setting the NR/NP. The NR vertical scale indicator and the MFD NR backup display may indicate 1% higher than the actual NR, which is shown on the MPD readout.

(5) **RPM Trim Switch.** The power turbine or engine RPM (ENG RPM) trim switch is located on the pilot collective head. The switch is marked +RPM-. The trim switch, with throttle full open, adjusts ENG RPM within the range of 96 to 102%. The RPM switch is effective only in the digital mode.

2-24. R ENGINE FUEL SYSTEM.

a. Full Authority Digital Electronic Control (FADEC) System.

The FADEC system is an electronic control with a hydromechanical backup (manual) mode. The FADEC provides rotor speed governing, engine torque limiting, temperature limiting, automatic start sequencing, automatic flameout detection/relight capability, surge detection/alleviation, and NP and NG speed limiting capability while in automatic mode. NP overspeed protection is the only feature provided in both the automatic and manual mode.

(1) **FADEC System Hardware.**

(a) **Hydromechanical Unit (HMU).** The HMU (8, fig. 2-12) is engine mounted and driven by the NG gear train. It incorporates a fuel metering unit and a fuel pump.

(b) **Electronic Control Unit (ECU).** The ECU is mounted in the aft electrical compartment and controls the engine during automatic mode operation by monitoring, controlling and limiting engine speed, fuel flow, acceleration rate, temperature, torque and other engine parameters. During the engine start sequence, the ECU will drop off line if supplied power drops below 10.3 VDC (at the ECU). The ECU will come back on-line during the start sequence at a supplied power of 12 VDC (at the ECU).

(c) **Permanent Magnet Alternator (PMA).** During normal engine operation an engine-mounted, NP-driven PMA (17, fig. 2-12) provides all required FADEC electrical power at engine speeds above 85% NP. The aircraft will supply ECU power during engine starting and speeds below 85% NP.

NOTE

Turning the FADEC circuit breaker switch to the OFF position at engine speeds below 85% NP may result in intermittent activation of the FADEC FAIL and FADEC MANUAL warning messages and audio tones. With NG speeds below approximately 70% engine may flame out.

(d) **Compressor Inlet Temperature Probe (CIT).** The CIT probe is mounted on the forward wall of the particle separator cowling near the engine water wash line and provides air temperature input to the ECU. This input allows the ECU to adjust fuel schedules based on inlet air temperature.

(e) **NR RPM Transducer.** The NR RPM transducer is located on the aft right side of the transmission case. This input allows the ECU to adjust fuel schedules based on main rotor RPM.

(2) **Automatic Mode.** Upon power-up and successful completion of BIT, the FADEC system will operate in the automatic mode. In this mode, the FADEC control system is an NG rate of acceleration controller that regulates the gas producer acceleration rate and the engine power. The system provides for precise governing and consistent engine acceleration/ deceleration rates regardless of engine condition.

(3) **Manual Mode.** The FADEC system incorporates a hydromechanical manual backup system (manual mode) to provide a get home capability in the event of a critical ECU failure (hard fault). Manual mode selection also energizes the igniters to a continuous ON status to aid in the prevention of flameout. The only FADEC automatic feature available in the manual mode is the NP overspeed protection. In this mode, the pilot's throttle input is tied hydromechanically to the fuel flow metering window in the HMU. The manual mode is engaged by pressing the FADEC AUTO/MAN switch (21, fig. 2-6), located above the standby airspeed indicator on the instrument panel.

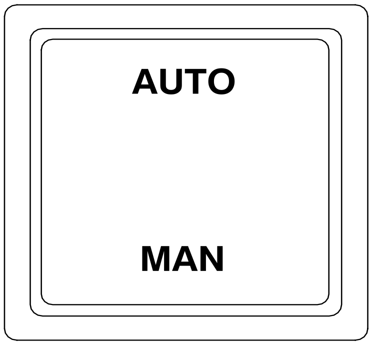

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Figure 2-14. AUTO/MAN switch

CAUTION

To prevent uncontrollable rotor overspeed and damage to drive train components while on the ground, do not switch to manual mode unless the collective is full down and the throttle is at idle.

(4) **Mode Switching.** Mode switching is done by pressing the FADEC AUTO/MAN switch (21, fig. 2-6) and confirming that the desired legend is illuminated. The switch incorporates a spring released latching mechanism. Switching from the manual to automatic mode reinitiates fault detection and clears all current faults from ECU volatile memory (RAM). Non-volatile ECU memory is unaffected. Fault codes displayed by the CDS are also unaffected. These codes are permanently latched and are not cleared until the engine monitor page reset code is input from the keyboard unit.

CAUTION

To prevent a hot start it is critical to visually confirm that the correct legend is illuminated on the AUTO/MAN switch.

(5) **Automatic Start Sequence.** The FADEC system provides automatic sequencing of starter, ignition, and fuel flow during engine starting while in the automatic mode. Fuel flow is automatically adjusted to control NG acceleration rate and limit engine start temperature. The system also provides a hot start abort feature that cuts fuel flow off to prevent an overtemperature condition.

During an automatic start, the starter and igniter are sequenced OFF by the FADEC system when the engine reaches 50% NG speed. The system will cut off fuel flow and re-engage the starter if turbine temperature exceeds limits. The system will motor the starter for up to 60 seconds or until TGT is below 149 °C (300 °F), whichever occurs first. These features are not available in the manual mode.

It is critical for the pilot to monitor engine parameters during starting even though the FADEC system has hot start abort logic. If an incorrect maintenance procedure is used, the ECU may fail because it is unable to reduce fuel flow to the scheduled value. Hot start abort logic is not available with a FADEC fail condition. If no action is taken, the engine can hot start.

(6) **Limit Override Logic.** The FADEC system provides automatic limiting functions including temperature limiting, torque limiting, NG speed limiting, and NP overspeed protection when operated in the automatic mode. The FADEC system incorporates logic to automatically override engine threshold operating limits based on the engine operating condition and when main rotor speed droop exceeds 7%.

(7) **NG Governing System.** The FADEC system interfaces with the engine NG monopole speed sensor to measure gas producer turbine speed. The FADEC system adjusts the engine acceleration schedule based on NG speed, ambient temperature, and pressure. Temperature input is provided by the CIT probe mounted in the particle separator near the compressor inlet. Ambient pressure input is provided by a transducer in the ECU. Fuel flow is scheduled as required to satisfy power demand. The NG mechanical threshold limit is 105%. The NG mechanical override limit is 106%. This feature is not available in the manual mode.

(8) **NP Governing System.** The FADEC system interfaces with the engine NP monopole speed sensor to measure power turbine speed and provide power turbine overspeed protection. The FADEC system governs power turbine speed (NP) in the normal operating range from 95% to 105% NR using the NP trim switch mounted on the pilot collective control head. The FADEC system receives a discrete rotor speed input signal from a rotor speed sensor located on the

right aft transmission housing. This feature is not available in the manual mode.

(9) **Overspeed System.** The FADEC system incorporates an analog NP overspeed control system that is designed to provide overspeed protection due to loss of load events (shaft failures). The NP overspeed system is activated at 124% NP and operational in both the automatic and manual modes.

(10) **TGT System.** The FADEC system continuously monitors engine TGT to prevent steady state or transient temperature limit exceedances. The FADEC system reduces fuel flow to prevent an exceedance. The TGT run threshold limit is 815 °C (1499 °F). The TGT run override limit is 1093 °C (1999 °F). These features are not available in the manual mode.

(11) **Torque System.** Torquemeter oil pressure is measured by a sensor connected to the engine accessory gearbox torque sensing port. This signal provides the FADEC system with the power turbine output torque. The FADEC system will reduce fuel flow to prevent a shaft torque limit exceedance. The power turbine output torque threshold limit is 131%. The torque override limit is 167%. This feature is not available in the manual mode.

(12) **Surge Detection/Avoidance.** The FADEC system detects engine surge events. Without pilot action, the FADEC system will schedule fuel flow for zero acceleration in order to quickly recover from the surge. The system will attempt to avoid another surge by reducing the maximum acceleration schedule in the NG range where the surge occurred. The ECU engine monitoring function will record the number of surges in non-volatile memory and displays them on the FADEC monitor page.

The maximum acceleration schedule is reset to the original schedule when FADEC system power is cycled or when the AUTO/MAN select switch is cycled. This feature is not available in manual mode.

(13) **Flameout Detection/Auto-Relight.** The FADEC system incorporates an automatic relight feature that detects an engine flameout and activates the automatic relight circuitry. The ENGINE OUT warning will be annunciated to the pilot via the CDS. Without pilot action, the FADEC will initiate a restart sequence. This includes scheduling the appropriate restart fuel flow, activating the ignition system and engaging the starter if required. Relight will be detected by the FADEC system and TGT will be limited. The engine should smoothly accelerate back to the commanded operating condition. This feature is not available in the manual mode.

(14) **Fault Monitoring.** The FADEC system incorporates logic and circuitry to perform self diagnostics.

An automatic FADEC power up check exercises all electrical circuitry to assure system functionality and readiness.

b. Engine Fuel System Electrical Components. The electrical components of the engine fuel system are the ECU, AUTO/MAN switch, power turbine rpm trim control, ignition system, Ng and Np monopole pickup units, turbine gas temperature (TGT) measurement components, and Np overspeed solenoid.

c. 10-Micron Fuel Filter. The fuel filter is mounted on the lower rear portion of the power and accessory gearbox and is driven by the gas producer turbine. it consists of an impending bypass indicator, a filter element, and a filter bypass valve. The filter can be seen by opening the left engine access door (11, fig. 2-1).

(1) **Impending Bypass indicator.** The impending bypass indicator is a red button that extends when an impending bypass condition exists. Notify maintenance personnel if indicator extends.

(2) **Filter Element.** The filter element is a 10 micron, disposable filter element.

(3) **Filter Bypass Valve.** The filter bypass valve opens when the filter element is clogged.

d. Fuel Pressure Differential Switch. The switch is located on the bottom of the power and accessory gearbox. It activates the FUEL/FILTER BYP caution message when the fuel filter is clogged.

e. Fuel Injector. The fuel injector is mounted in the aft end of the outer combustion case. The fuel injector sprays metered fuel into the combustion section of the engine where it is mixed with air for combustion.

2-25. OIL SUPPLY SYSTEM.

a. General. The engine oil lubrication system is a circulating dry sump type with an external reservoir and heat exchanger. The major components of the engine oil lubrication system are the engine oil filter assembly, an in-line oil filter assembly, pressure/scavenge oil pump, engine oil tank, engine oil cooler, oil cooler bypass valve, and two electromagnetic chip detector drain plugs.

b. Filter Assemblies.

(1) The internal engine oil filter assembly consists of an oil filter element, impending oil bypass

indicator (2, fig. 2-11), filter bypass valve, and pressure regulating valve. The assembly is located on the upper, left side of the power and accessories gearbox and is accessible from the top of the engine.

(2) The in-line oil filter assembly is located aft of the engine aft firewall on the left side. The in-line oil filter assembly consists of a filter element, oil bypass indicator, and bypass valve. When the filter element becomes clogged, it will give a warning by extending the oil bypass (red) indicator. The indicator extends when a set differential pressure across the filter is exceeded. When in the reset position, the indicator will be hidden from view. If the indicator is extended, it can be reset by pressing in. An extended indicator is not sufficient reason to ground the helicopter.

c. Oil Tank. The engine oil tank is located aft of the engine oil cooler, above the aft fuselage. A sight glass is located on the left side of the tank. Normal oil level is indicated when oil fills the sight glass and the float ball is at the top of the sight glass. Oil grades and specifications are prescribed in Section XV of this chapter.

d. Cooler. The engine oil cooler is located directly aft of the engine and above the oil cooler blower. The oil cooler blower is an integral part of the tail rotor drive system. Air is discharged from the blower upward through the engine oil cooler.

(1) **General.** Engine oil can bypass the oil cooler by two methods. When the engine oil is cold, the oil cooler is bypassed through a valve located on the right side of the oil cooler. This mechanical valve is controlled by the temperature of the oil flowing through it. When the oil is cold, the valve is closed allowing oil to bypass the cooler. The valve starts to open as the oil temperature reaches 71 °C (160 °F). At 81 °C (178 °F) or higher, the valve is completely open allowing oil to flow through the cooler.

(2) **Functional Description.** The second source of oil cooler bypass is the oil cooler bypass valve mounted on the back side of the aft engine firewall. This electrically operated valve is powered through the DC emergency bus and controlled by the ENG OIL BYPASS switch located on the forward overhead console panel (fig. 2-8) in conjunction with engine oil quantity. When the ENG OIL BYPASS switch is in the OFF position, a low engine oil quantity condition will illuminate the LOW OIL QUANTITY ENG caution message on the MFD but the oil cooler will not be bypassed. With the ENG OIL BYPASS switch in the AUTO position, a low engine oil quantity condition will illuminate the LOW OIL QUANTITY ENG and OIL BYP ENG caution lights and the oil cooler will be bypassed. At normal engine oil quantity, placing the ENG OIL BYPASS switch in the AUTO position has no effect on engine oil flow.

e. Chip Detectors. Two electromagnetic chip detectors are located in the engine oil system. The lower chip detector is located at the bottom of the accessory gearbox; the upper chip detector is adjacent to the oil tank return line.

2-26. IGNITION.

The engine ignition system has two basic components, a low voltage, capacitor discharge ignition exciter assembly and a spark igniter lead assembly with a shunted surface gap igniter plug. The ignition exciter is located on the lower left bottom side of the power and accessories gearbox. The igniter plug (10, fig. 2-11) is located on the lower right rear area of the combustion chamber.

2-27. STARTER.

a. Starter Switch. The START switch is located on the pilot collective control head. The switch is spring-loaded and must be positioned and held for engine start. The ignition keylock switch must be in the ON position to complete the starter ignition circuit. Refer to Chapter 8 for switch operation.

b. Starter-Generator. The starter-generator (7, fig. 2-11) is located on the aft right side of the power and accessories gearbox. Access to the starter-generator is gained through the right engine compartment access door. A start counter is provided, for recording each time the exciter is energized, and is located on the lower, left side of the power and accessories gearbox.

2-28. ENGINE INSTRUMENTS AND INDICATORS.

a. Vertical Scale Display Subsystem (VSDS). The VSDS consists of the multiparameter display (MPD), dual tachometer, and TGT/TRQ (turbine gas temperature/mast torque indicators (fig. 2-6). These are vertical scale type displays, either alone or in combination with digital readouts. The vertical scale displays are color coded and have range markings and symbols to show operating limits, cautions limits, and avoidance areas. Refer to Section XIV for additional descriptive data.

b. Turbine (Ng and Np) Speed Monopole Pickup Units. The turbine speed indicating components are two monopole pickup units installed on the power and accessories gearbox. The power turbine (Np) monopole pickup unit is located on top of the power and accessories gearbox. The gas producer (Ng) monopole pickup unit (4, fig. 2-11) is located on the upper right portion of the power and accessories gearbox.

c. Turbine Gas Temperature (TGT) Measurement. Turbine gas temperature (TGT) is measured at four thermocouple probes located around the power turbine section. These signals are processed through the MCPU and MPD and then sent to the TGT indicator where TGT is displayed in degrees Celsius. Signals are also processed through the MCPU to the caution, warning, and advisory system for overtemp conditions.

NOTE

In order for the the TGT caution timers to be reset after the limit threshold is exceeded, TGT must be lowered 30 °C below the threshold. For the 30 minute range, TGT must be reduced below 686 °C to reset the timer. **(CDS2)** For the 5 minute range, TGT must be reduced below 755 °C to reset the timer.

SECTION IV. FUEL SYSTEM

2-29. FUEL SYSTEM.

The fuel system consists of a crash resistant, self-sealing fuel cell, one engine driven fuel pump, one fuel cell mounted priming/boost pump, quantity indication system, emergency shutoff valve, drainage provisions, low level warning system, filter, filter bypass indicator, and breakaway valve. Refer to Section XV for usable fuel. The system incorporates a closed circuit refueling receiver. Fuel grades and specifications are prescribed in Section XV of this chapter.

2-30. CONTROLS AND INDICATORS.

a. Fuel Quantity Indicator. The fuel quantity indicator (FUEL QTY) is located on the MPD (fig. 2-6). Fuel quantity is displayed by a vertical scale and a selectable digital readout indicator. The indicator is powered by the battery emergency bus and protected by the FUEL QTY circuit breaker, which is located on the overhead console circuit breaker panel (fig. 2-8). During a nosedown flight condition, the fuel quantity indicator may indicate high.

b. Fuel Boost Pump. A fuel boost (primer) pump is located in the fuel cell. The pump is activated by placing the FUEL BOOST switch (fig. 2-8) to FUEL BOOST or by activation of the START switch. The system is powered by the battery emergency bus and protected by the FUEL BOOST circuit breaker. The pump pressurizes the fuel inlet line and assists the engine-driven suction pump at its critical operating periods: during start, at very low fuel levels, and during high altitude operation.

c. Emergency Fuel Shutoff Valve. A manually operated emergency fuel shutoff valve is provided to stop fuel flow to the engine. The valve is operated with a fuel shutoff lever (7, fig. 2-5) on the forward right side of the overhead console, adjacent to the right floodlight. The fuel valve is on when the lever is forward (FUEL ON), and off when the lever is to the rear (FUEL OFF).

d. Fuel Low Caution Message. A FUEL LOW caution message will be displayed on the MFD when there is a minimum of 97.5 pounds of fuel remaining. When the fuel is at this low level, the fuel remaining may not be available except when the helicopter is in level or coordinated flight. The FUEL LOW caution message in conjunction with a FUEL BOOST FAIL caution message may indicate impending fuel starvation.

e. Fuel Filter Bypass Caution Message. A FUEL FILTER BYP caution message will be displayed on the MFD when there is an impending bypass condition of the fuel filter.

SECTION V. FLIGHT CONTROL SYSTEM

2-31. FLIGHT CONTROL SYSTEM.

The flight control system is a positive mechanical type, actuated by conventional helicopter controls. Complete controls are provided for both crewmen. The system includes a cyclic control system, a collective control system, a directional antitorque control system, force trim system, and a stability and control augmentation system (SCAS). Hydraulic servoactuators are employed in the control system to prevent feedback forces and reduce pilot fatigue.

2-32. CYCLIC CONTROL SYSTEM.

The cyclic control stick is located forward of each crewmember seat and is the primary attitude control. The pilot cyclic (4, fig. 2-5) is adjustable forward and aft. It is adjusted to the desired position by turning the adjustment knob (2, fig. 2-15). Cyclic position is indicated on the indicator (1) located at the base of the cyclic.

CAUTION

To prevent possible inadvertent contact of pilot cyclic grip with the instrument panel, adjustment of the cyclic will not exceed two complete turns from the full aft position.

The CPG cyclic (22, fig. 2-5) can be engaged or locked out of the flight control system. When engaged, it has a typical dual control function of the flight control system. When in the lockout position, the cyclic is mechanically disconnected from the flight control system at a fixed center position. All electrical switches remain functional. This feature is primarily provided for use when the MMS is being operated. To lock out (disengage) CPG cyclic, push (CYC STK ENGAGE) latch (1, fig. 2-16) downward. To engage, move pilot cyclic to approximately the neutral position and pull upward on CYC STK ENGAGE latch. Verify control movements can be noted through both cyclic controls.

The cyclic grips (fig. 2-15 and 2-16) are located at top of each cyclic.

2-33. COLLECTIVE CONTROL SYSTEM.

WARNING

To ensure full throttle travel when installing CPG collective, alignment notch on collective must be aligned with alignment boss in elbow assembly before tightening knurled nut. Incorrect installation or misalignment will cause an NR and NP droop.

The collective control system is operated by a collective, located to the left of each crewmember seat, and is the primary control for lift. A rotating grip type throttle and a collective control head are located at the forward end of the pilot collective (fig. 2-18). The CPG collective (19, fig. 2-5) is removable. To install, place collective fitting in end of jackshaft and align slots of throttle shaft and notches of collective tube so that screw on throttle grip is up with throttle up. Tighten nut on end of collective to fitting on jackshaft and install retaining pin. The CPG collective incorporates only throttle control. The CPG throttle rotation distance is approximately half that of the pilot throttle rotation distance. Friction can be induced into both pilot and CPG collectives by rotating the friction adjustment knob, located between the pilot and CPG seats.

2-34. TAIL ROTOR CONTROL SYSTEM.

The tail rotor control system is operated by pilot or CPG antitorque pedals (3, 25, fig. 2-5). Pedal adjusters are provided to adjust pedal-to-seat distance for individual comfort.

2-35. FORCE TRIM SYSTEM.

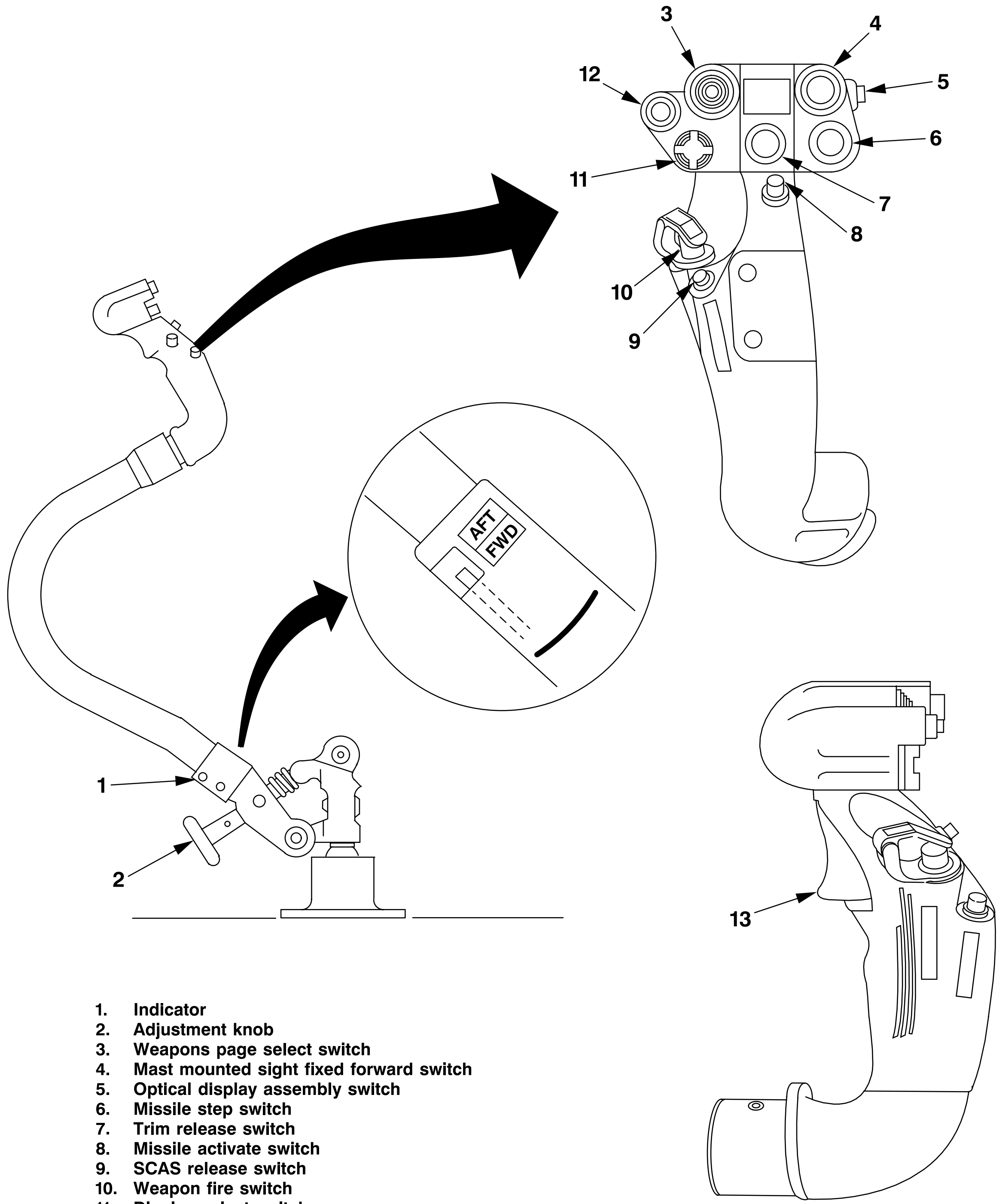
The force trim system is incorporated into the cyclic and tail rotor control systems to provide artificial feel in the flight controls. The force trim system is activated by a FORCE TRIM switch located on the SCAS control panel (fig. 2-17). Force trim being on or off is a pilot option. When heading hold (HDG HLD) is engaged, however, force trim is automatically engaged for tail rotor controls regardless of FORCE TRIM switch position. Force trim may be interrupted by pressing the TRIM REL button on either cyclic grip (7, fig. 2-15 and 10, fig 2-16) to allow repositioning of the cyclic or antitorque controls to a new reference point. The system is protected by a FORCE TRIM circuit breaker and is powered by the battery emergency bus.

2-36. STABILITY AND CONTROL AUGMENTATION SYSTEM (SCAS).

The SCAS is a three-axis (pitch, roll and yaw) flight control augmentation system with a heading hold mode (HHM). This limited authority, rate reference system improves handling qualities by damping the high frequency, short term external inputs to the helicopter while providing the desired response characteristics for pilot inputs. The heading hold mode operates in conjunction with the yaw SCAS system as an aid to maintaining a desired heading.

All yaw channels must be operational before heading hold can be engaged.

Upon failure of a system, a CAUTION message – P/R DISENG, YAW DISENG, or SCAS DISENG – will be displayed and accompanied by an audio tone. The P/R DISENG caution indicates that the pitch axis and/or roll



1. Indicator
2. Adjustment knob
3. Weapons page select switch
4. Mast mounted sight fixed forward switch
5. Optical display assembly switch
6. Missile step switch
7. Trim release switch
8. Missile activate switch
9. SCAS release switch
10. Weapon fire switch
11. Display select switch
12. Hover bob up switch
13. ICS/radio switch

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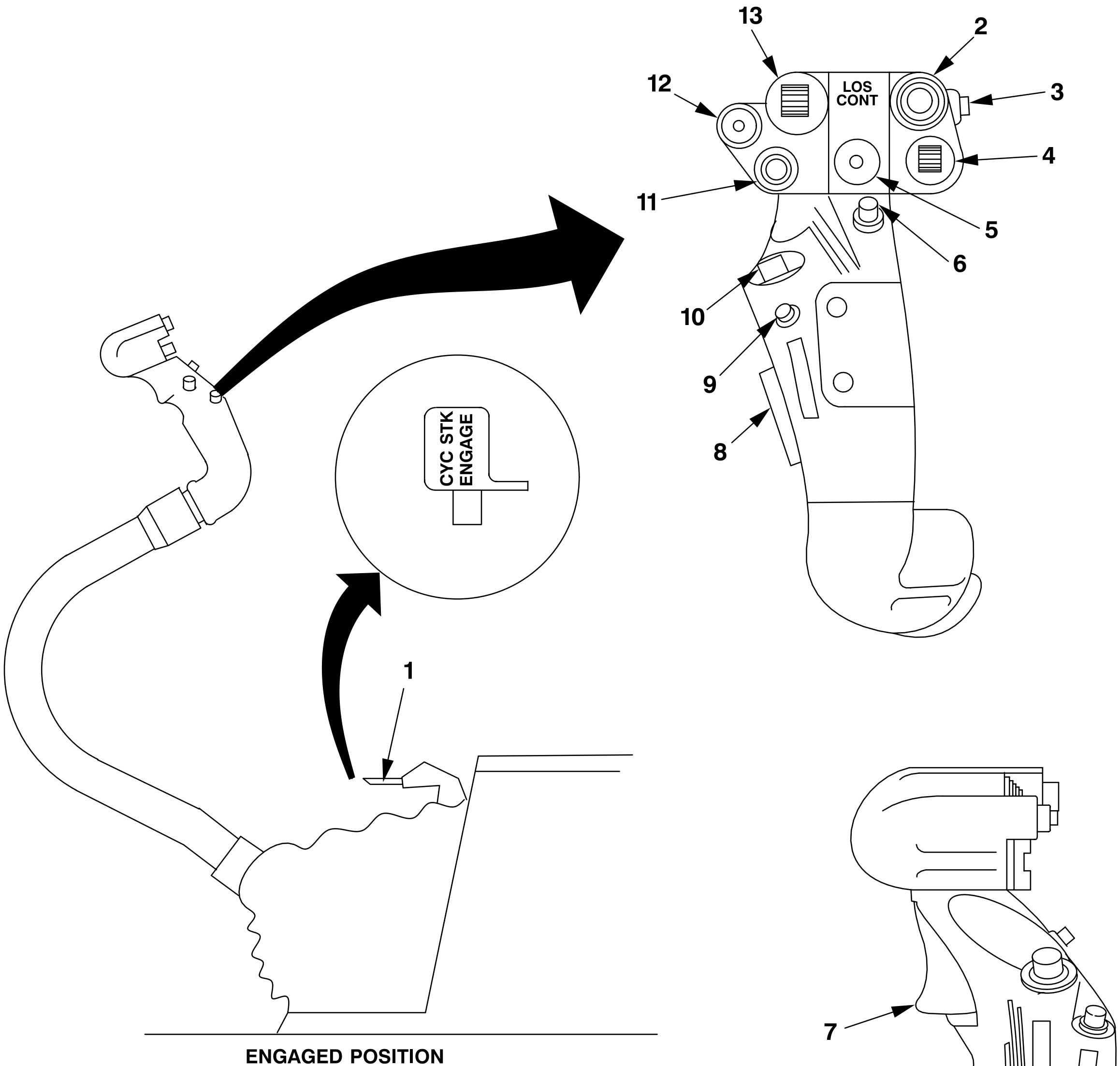
Figure 2-15. Pilot Cyclic Controls and Grip



1. CYC STK ENGAGE latch
2. TV/TIS select
3. (CDS2/CDS3) Frame freeze (CDS4) HOG ON/OFF
4. Nav/target designate
5. LOS cont (control)
6. Manual/slave
7. ICS/radio transmit
8. Point track
9. SCAS release
10. Trim release
11. Area track
12. Laser fire
13. FOV select

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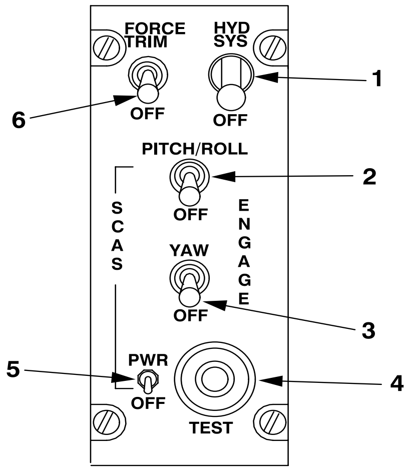
Figure 2-16. CPG Cyclic Controls and Grip



1. Hydraulic system switch
2. Pitch/roll engage switch
3. Yaw SCAS engage switch
4. Preflight test button
5. Power switch
6. Force trim switch

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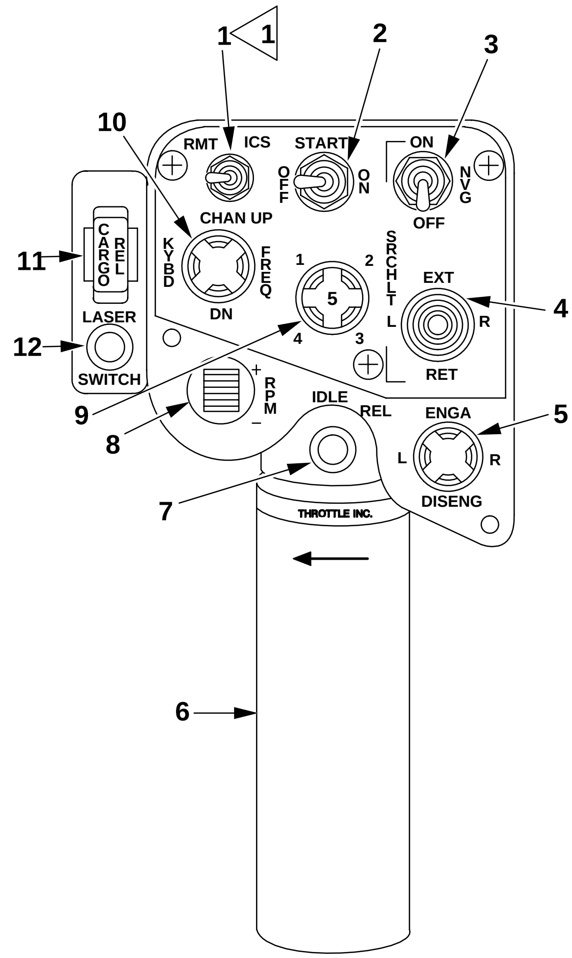
Figure 2-17. Stability and Control Augmentation System (SCAS) Control Panel

axis has failed and disengaged. The YAW DISENG caution indicates that the yaw axis of the SCAS system has failed and disengaged. SCAS DISENG indicates that the entire SCAS system is inoperative. In addition to the caution messages, an advisory message ONE YAW CHAN OFF will be displayed in the event the yaw SCAS system experiences a partial failure. SCAS failure will result in increased pilot workload in the affected channel(s). Upon failure, the failed systems actuator will center and lock to prevent the introduction of erroneous inputs into that channel. The failure protection logic includes a preflight function which validates the SCAS system and isolates faults within the system.

a. Control Panel. The SCAS portion of the control panel (fig. 2-17) includes ENGAGE switches for PITCH/ROLL and YAW channels, a PWR switch, and a TEST switch. The PITCH/ROLL and YAW ENGAGE switches apply power to the respective channels when the PWR switch is in the PWR (up) position.

b. SCAS Release Switch. A SCAS REL switch (9, fig. 2-15 and 2-16) is installed in each cyclic control grip. This switch is used to disengage pitch, roll, and yaw with heading hold mode simultaneously. The system can be re-engaged by the PITCH/ROLL and YAW ENGAGE switches.



NOTE

1 R RMT ICS switch removed.

1. Communication RMT ICS switch
2. START switch
3. Searchlight power switch
4. Searchlight control switch
5. SCAS heading hold ENGA DISENG trim switch
6. Throttle
7. IDLE REL switch
8. RPM trim switch
9. Radio select switch
10. CHAN select switch
11. CARGO REL (electrical) switch
12. AIM-1 LASER switch

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Figure 2-18. Pilot Collective Control Head

c. SCAS Heading Hold ENGA DISENG Trim Switch. A SCAS heading hold ENGA DISENG trim switch (5, fig. 2-18) is located on the pilot collective control head. This is a five-position, center spring-loaded to neutral switch used to control the heading hold mode. Pressing the switch forward to the ENGA position engages the heading hold mode and pressing it rearward to the DISENG position disengages the heading hold. Pressing the switch left (L) or right (R) will trim the helicopter left or right.

2-37. HORIZONTAL STABILIZER.

The horizontal stabilizer (50, fig. 2-1) is located near the center of the tailboom. The horizontal stabilizer aids in trimming the helicopter in level flight and increases usable center-of-gravity range. Provisions have been added to allow the horizontal stabilizer to be folded for easier storage and transportability.

2-38. VERTICAL FIN.

The vertical fin (51, fig. 2-1) incorporates mounting hardware which allows the fin to be rotated, creating a lower vertical profile for easier storage and transportability.

SECTION VI. HYDRAULIC SYSTEM

2-39. HYDRAULIC SYSTEM.

The hydraulic system reduces crew member effort and fatigue by minimizing cyclic, collective, and antitorque control input and feedback forces.

2-40. RESERVOIR AND SIGHT GLASS.

The hydraulic reservoir is located on the cabin roof and is mounted on a bracket, which is forward and left of the transmission. A window is provided on the cowling for inspection of the sight glass. A sight glass is provided to determine when the reservoir needs servicing. Normal fluid level is indicated when hydraulic fluid completely fills sight glass.

2-41. HYDRAULIC FILTERS.

Hydraulic filters are installed for both pressure and return sides of the hydraulic system. When a filter becomes clogged it will give a warning by raising a red indicator button. The red indicator pops out when set differential pressure across the filter is exceeded. Once actuated, the indicator will remain extended until it is reset manually. When the indicator is in the reset position, it will be hidden from view. An access door is provided on right side of the cowling for inspection and servicing.

NOTE

While an extended red indicator indicates an impending filter stoppage, its operation is also affected by low temperature, pressure surges, and excessive vibration.

If indicator is extended, reset by pressing in. If indicator remains in during runup, helicopter is flyable. If indicator extends again, shut down helicopter and make appropriate entry in DA Form 2408-13-1 and 2408-13-1E. Do not fly helicopter until appropriate maintenance action has been accomplished.

2-42. SOLENOID AND SYSTEM RELIEF VALVES.

a. Solenoid Valve. Solenoid valve is designed to provide pressure to the system when it is de-energized. The solenoid valve is de-energized when the HYD SYS switch is in the HYD SYS position or in the event of loss of electrical power to the valve. Placing the HYD SYS switch to the OFF position will energize the valve and pump pressure will be blocked with the system pressure connected back to the reservoir.

b. System Relief Valve. The hydraulic system contains a relief valve located between the pressure and return portions of the hydraulic system. The unit will protect the system from overpressurization in the event of a hydraulic pump malfunction.

2-43. HYDRAULIC SYSTEM SWITCH.

The hydraulic system switch is located on the SCAS control panel (1, fig. 2-17). The switch is labeled HYD SYS and OFF. This switch controls the activation and deactivation of the hydraulic system. The circuit is powered by the DC essential bus and is protected by the HYD SYS circuit breaker on aft overhead console panel (fig. 2-8).

2-44. PRESSURE CAUTION MESSAGE.

The hydraulic system contains a pressure switch located on the pressure manifold. When hydraulic pressure drops below safe operating limits the pressure switch will de-energize, resulting in a LOW HYD PRESS caution message being displayed on the MFD.

SECTION VII. POWER TRAIN SYSTEM

2-45. POWER TRAIN SYSTEM.

The power train system consists of the freewheeling assembly, input driveshaft, transmission and mast assembly, oil cooler fan assembly, tail rotor driveshaft assemblies, and tail rotor gearbox. Also included are the related components such as temperature and pressure indicators, torque indicator, electromagnetic chip detectors, oil pump, and oil filter.

2-46. FREEWHEELING ASSEMBLY.

The freewheeling assembly is mounted on the lower portion of the engine power and accessories gearbox. Its freewheeling mode allows free rotation of the rotor system as well as necessary accessories when power is not being applied by the engine. The freewheeling assembly is equipped with an electromagnetic chip detector.

The chip detector has a fuzz burner capability that can distinguish between a buildup of normal wear particles and larger metal particles due to possible component failure. The chip detector automatically attempts to burn off fuzz accumulations electrically. A CHIPS ENG FREEWHEEL caution message will be displayed on the MFD when contact is made across the chip gap of the chip detector. If the particles exceed the burnoff capability of the chip detector, the caution message will remain. If burnoff is accomplished, the message will be deleted.

NOTE

After three successful burnoffs of a chip detector during any flight, the helicopter shall be reported to maintenance, as soon as practical, for a serviceability check of the freewheeling assembly.

2-47. MAIN DRIVESHAFT.

The main driveshaft transmits engine power from the freewheeling assembly to the transmission. The driveshaft is equipped with nonlubricated flexible couplings at each end to accommodate minor (normal) misalignments between the main transmission and the engine mounted freewheeling unit.

2-48. TRANSMISSION AND MAST ASSEMBLY.

The transmission and mast assembly transfers the engine torque to the main rotor system with a two-stage gear reduction. The assembly is mounted to the roof of the helicopter, forward of the engine, by the pylon assembly. There are two restraint spring assemblies to restrain the pitching motion of the transmission assembly. The transmission is equipped with several sensors and indicators (para. 2-50) to ensure proper operation and give immediate indication of any malfunction.

2-49. TRANSMISSION OIL COOLING SYSTEM.

The oil cooling system is located aft of the engine. It consists of a heat exchanger/blower unit that is shared with the engine oil cooling system. The fan of this unit is attached to the tail rotor driveshaft and forces air through the heat exchanger.

2-50. INDICATORS AND CAUTION MESSAGES.

a. Transmission Oil Pressure Indicating System. An oil pressure transducer is located on the deck aft of the transmission. This transducer transmits a signal to the vertical scale TRANS OIL instrument located on the MPD (fig. 2-6). Power is supplied through the battery emergency bus.

b. Transmission Oil Temperature Indicator. The transmission oil temperature indicator is a vertical scale instrument located on the MPD. It measures transmission oil temperature in degrees Celsius. Power to the instrument is supplied through the battery emergency bus. Signals are received from a temperature sensor located on the oil filter assembly.

c. Transmission Oil Pressure Low Caution Message. When the lower transmission oil pressure limit is reached, a LOW OIL PRESS XMSN caution message will be displayed on the MFD and an audio tone will sound. Signals are received from the oil pressure transducer.

d. Transmission Oil Temperature High Caution Message. When the upper transmission oil temperature limit is exceeded, a HIGH OIL TEMP XMSN caution message will be displayed on the MFD and an audio tone will sound. Signals are received from the oil temperature sensor.

e. Transmission Ten Second Overtorque Limit. When 100% mast torque is exceeded, a HIGH TRQ TIME LIM (nn) caution message will be displayed on the MFD and an audio tone will sound. In the brackets on the right side of the caution message, the time in seconds that the torque has remained in this caution range up to 99 seconds is recorded. When this time exceeds 10 seconds or at any time the torque exceeds 116%, or if cumulative overtorques exceed 10 seconds duration in one hour of operation, a XMSN OVER TRQ warning message will be displayed on the MFD and an audio tone will sound. The warning message will remain on the MFD as long as the warning condition exists, and it cannot be manually removed. The warning message is automatically entered into memory for future recall. Signals for these indications are received from mast torque sensing units located at the upper and lower ends of the main rotor mast.

f. Chip Detector Caution Message. Two electromagnetic chip detectors are mounted on the transmission casing. One is located on top of the transmission case and one is on the lower left side of the case. Both chip detectors have fuzz burner capabilities that distinguish between a buildup of normal wear particles and larger metal particles due to possible component failure. The chip detectors automatically attempt to electrically burn off fuzz accumulations. A CHIPS XMSN UPPER and/or CHIPS XMSN SUMP caution message will be displayed on the MFD when contact is made across the chip gap of either chip detector. If the particles exceed the burnoff capability of the chip detector, the caution message will remain. If burnoff is accomplished, the message will be deleted.

NOTE

After three successful burnoffs of a chip detector during any flight, the helicopter shall be reported to maintenance, as soon as practical, for a serviceability check of the transmission system.

2-51. FILTER BYPASS INDICATOR.

The transmission oil filter is equipped with a pop-out filter bypass indicator. When the main element becomes clogged, the filter button on the end of the filter housing will pop out indicating that oil is bypassing the first element and is being filtered only by the second element. This button cannot be reset unless the filter housing is removed. The primary filter element must be replaced and the secondary element must be cleaned prior to the next flight.

2-52. OIL LEVEL SIGHT GLASS.

The oil level sight glass is located on the right side of the transmission casing and is easily accessible for visual reference. Normal oil quantity is indicated when oil level is within the yellow range of the sight glass. Refer to Servicing Diagram (fig. 2-26).

2-53. TAIL ROTOR DRIVESHAFT SYSTEM.

The tail rotor driveshaft system delivers torque from the freewheeling assembly to the tail rotor gearbox. The system consists of one steel shaft, one steel oil cooler shaft and five aluminum shafts. The shafts are connected at each end by a flexible coupling. The system is supported by six hanger bearings, each being equipped with a grease fitting for lubrication.

2-54. TAIL ROTOR GEARBOX ASSEMBLY.

a. The tail rotor gearbox assembly (7, fig. 2-1) is attached to the aft end of the tailboom. It is a 90-degree gearbox and serves as the final drive for the tail rotor. The gearbox is serviced through a non-vented cap on the top of the case.

b. A sight glass is located at the rear of the case for visual reference of the oil level. Normal oil quantity is indicated when oil level appears at the center of the sight glass. A (fuzz burner) electromagnetic chip detector is located on the lower right side of the casing. The chip detector has a fuzz burner capability that can distinguish between a buildup of normal wear particles and larger metal particles due to possible component failure. The chip detector automatically attempts to burn off fuzz accumulations electrically. A CHIPS T/R GRBX caution message will be displayed on the MFD, and an audio tone will sound when metal particles are picked up by the plug. If the metal particles exceed the burnoff capability of the chip detector, the caution message will remain. If burnoff is accomplished, the message will be deleted.

NOTE

After three successful burnoffs of a chip detector during any flight, the helicopter shall be reported to maintenance, as soon as practical, for a serviceability check of the tail rotor gearbox assembly.

c. A thermoswitch, located on the upper right area of the case, transmits a HIGH TEMP T/R GRBX caution message that will be displayed on the MFD when the temperature of the tail rotor gearbox exceeds allowable limits.

SECTION VIII. ROTORS

2-55. MAIN ROTOR.

The main rotor (fig. 2-19) consists of four composite blades (7) mounted to the yoke (1) to provide a soft-in-plane arrangement. All four blades can be folded back to aid in parking and transporting the helicopter. Each blade is attached to the grip by one bolt (8) and one pin type expandable bolt (4).

2-56. TAIL ROTOR.

The tail rotor system consists of two fiberglass blades mounted to a tail rotor yoke. Power to the system is received through the tail rotor gearbox. Pitch change inputs from the pilot or CPG antitorque pedals are made through a pitch change control tube that slides through the center of the gearbox output shaft. A crosshead on the end of the control tube serves as the attaching point for the pitch change links.

2-57. INDICATORS AND CAUTION MESSAGES.

a. Rotor RPM Indicator (NR). The rotor RPM (NR) indicator (fig. 2-6) is located on the upper center instrument panel. The vertical scale instrument indicates RPM in percent on a scale from 0 to 120%. Indications are received through the battery emergency bus from the lower mast torque meter transducer. A backup system displays a digital readout of the rotor RPM on the MPD (fig. 2-6).

b. Low RPM Rotor Warning Message. The LOW RPM ROTOR warning message will be displayed on both MFDs anytime the lower limit of main rotor RPM is reached. It is accompanied by an audio tone in the crew headsets. The tone is silenced by pressing the REC/ACK switch (located on MFK) to ACK once. The warning message will remain on the MFD until the rotor RPM returns to the normal range when in flight. The warning message is automatically stored in memory for future recall.

c. High RPM Rotor Warning Message. The HIGH RPM rotor warning message appears on both MFDs when the main rotor RPM reaches 107%. It is accompanied by an audio tone in the crew headsets. The audio tone is silenced by pressing the REC/ACK switch (located on MFK) to ACK once. The warning message cannot be deleted by the crew and will remain on the MFD until the rotor RPM returns to the normal range. The warning message is automatically stored in memory for future recall.

d. Multiparameter Display (MPD) Digital Readout. Refer to paragraph 2-86.

SECTION IX. UTILITY SYSTEMS

2-58. WINDSHIELD DEFOGGING/DEFROSTING SYSTEM.

a. Ram Air Defogging.

(1) Ram air for defogging the windshield enters through two air inlet grilles (fig. 2-20), located in the nose section, and is directed to the defog nozzles. The defog nozzles are located at the base of the windshield and direct ram air towards the windshield. Defog blowers are installed in each ram air duct and provide a steady flow of air when ram air flow is insufficient to defog the windshield.

(2) Ram air controls, identified by VENT PULL decals, control the volume of air passing through the defog nozzles. The controls are located on each side of the center console. Each control knob has a self-locking device that holds the control knob in the past position selected. Grasping and pressing the control knob between the thumb and two fingers and pulling releases the lock and increases air volume. To decrease the air volume, push the control knob.

(3) The defog blowers are powered by the DC essential bus and protected by the DEFOG BLWR circuit breaker. Placing the L DEFOG BLWR and R

DEFOG BLWR switches from OFF to the L DEFOG BLWR and R DEFOG BLWR position activates the defog blowers. The DEFOG BLWR circuit breaker and both switches are located on the overhead console (fig. 2-8).

b. Bleed Air Defogging/Defrosting. Distribution ducts carry heated air from the bleed air heating system to the defog nozzles for windshield defogging/ defrosting. Openings in the lower distribution ducts provide bleed air for defogging/defrosting lower crew station windows. Heated air for defrosting/defogging is available whenever the bleed air heating system is activated. Refer to Section X for operation and control of the bleed air heating system.

2-59. PITOT TUBE ANTI-ICE/DE-ICING SYSTEM.

The pitot tube (20, fig. 2-1) is equipped with an electrical heater to prevent ice from forming in the pitot tube. Placing the PITOT HTR switch in the PITOT HTR position activates the heater circuit and causes a PITOT HEAT ON advisory message to be displayed on the MFD. The circuit is powered by the battery emergency bus and is protected by the PITOT HTR circuit breaker. Both the PITOT HTR switch and circuit breaker are located on the overhead console (fig. 2-8).

2-60. MISCELLANEOUS EQUIPMENT.

a. Data Case. A data case is mounted on the lower aft side of the center post.

b. Night Vision Goggles (NVG) Stowage Hooks. NVG stowage hooks are located on an overhead bulkhead in the cockpit behind the pilot and CPG.

c. Map Case. A map case is mounted on the lower left side of instrument panel.

d. Wire Strike Protection System (WSPS). The WSPS consists of two wire cutters (19 and 22, fig. 2-1) installed on the upper and lower portions of the forward fuselage. These cutters are designed to guide a wire toward the base area where the cutting edge is located. The tip of the lower cutter is designed to break away in the event of contact with the ground or a protruding surface, thereby reducing the possibility of airframe damage or deformation.

e. Weight on Gear Switch. A weight on gear switch (72, fig. 2-1) is mounted on the forward landing gear crosstube. The switch senses when the helicopter is on the ground or in flight. The switch is interfaced with the CDS because certain MFD functions can be displayed only when the helicopter is on the ground. IFF also requires this switch interfacing so IFF codes are not zeroized.

SECTION X. HEATING AND VENTILATION

2-61. BLEED AIR HEATING SYSTEM.

a. The bleed air heater (fig. 2-20) is installed in the equipment compartment aft of the electrical shelf and behind the equipment shelf. It is used for cabin heating, and can be used at ambient temperatures up to 35 °C (95 °F).

b. A heater (HTR) switch located in the overhead console activates the system that is protected by the CABIN HTR circuit breaker (fig. 2-8) installed in the center post console.

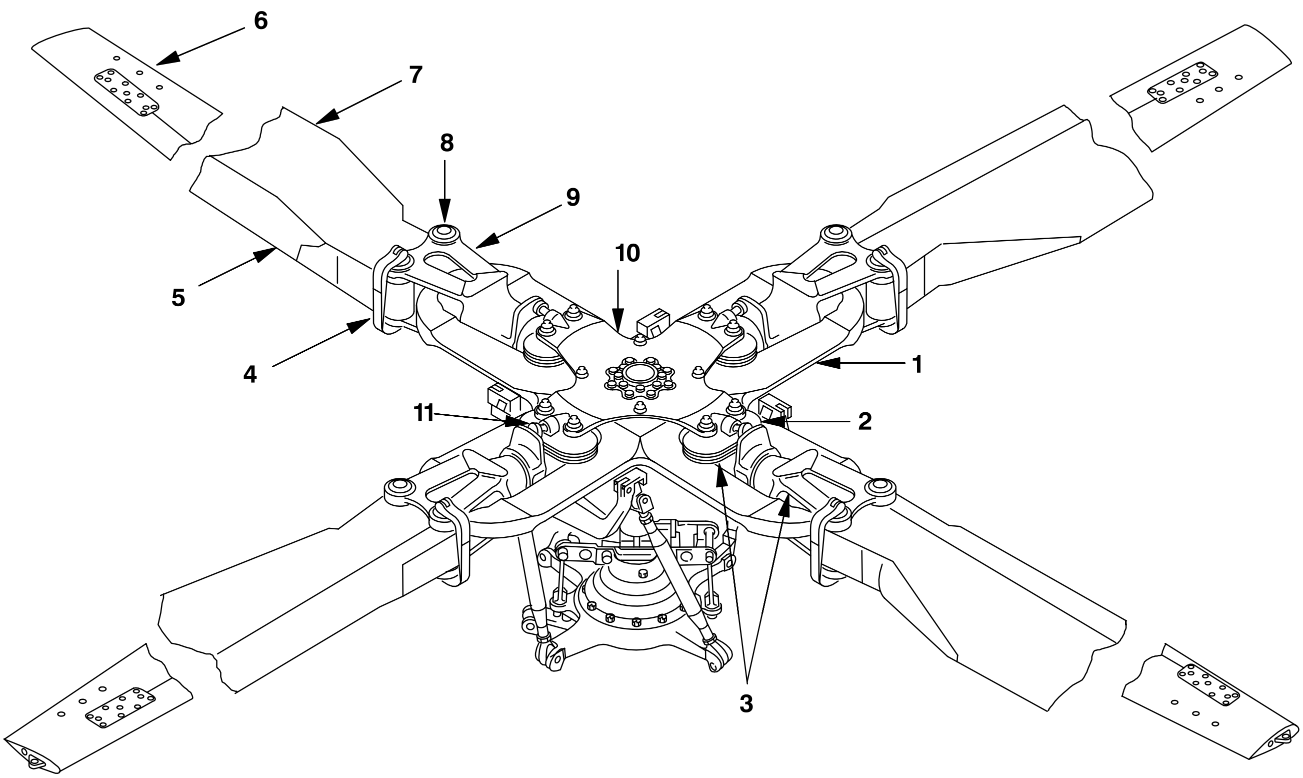
NOTE

Noise from an operating heater will degrade radio and intercom communication and the ability of the pilot and CPG to properly distinguish ATAS acquisition tones.

c. The pilot may adjust air temperature by means of a HEAT control knob (fig. 2-20) located above and aft of the pilot seat on the right side of the center post. This knob operates a control cable in the cabin roof to adjust an air temperature sensor mounted in the heater discharge duct. Adjusting the sensor mixes the fresh air and bleed air to obtain the desired air temperature. Operation is as follows:

(1) HTR switch — HTR.

(2) HEAT control knob — Adjust as desired.



1. Yoke
2. Lead-lag dampers
3. Pitch change bearings
4. Pin type expandable bolt
5. Abrasive strip
6. Cap
7. Blade
8. Bolt
9. Blade grip
10. Plate
11. Upper droop stops

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Figure 2-19. Main Rotor System (Typical)

2-62. VENTILATION SYSTEM.

The ventilation system is an integral part of the heating and defogging system. VENT PULL control knobs (fig. 2-6 and 2-7) open and close the fresh air inlets. Pulling the control knob out opens the fresh air inlet. The defogging/defrosting system blowers (para. 2-58) may be turned on to provide a larger volume of air directed to the windshield and forward cabin area.

2-63. EQUIPMENT COOLING.

An avionics cooling blower (fig. 2-20) is provided to cool the electronic/avionics equipment. The blower has the capacity to adequately cool the electronic/avionics equipment. A three-position COMPT BLWR switch (fig. 2-8) permits the system to be OFF, manually operated in the ON position, and automatically operated by temperature sensors when in the AUTO position. The temperature sensors automatically turn on the cooling blower whenever the equipment compartment temperature reaches 100 °F (38 °C). The avionics cooling blower can also be utilized to rapidly remove smoke and other contaminants from the cabin by pulling air from the crew and equipment compartments and exhausting the air overboard through the aft equipment bay.

SECTION XI. ELECTRICAL POWER SUPPLY AND DISTRIBUTION SYSTEMS

2-64. ELECTRICAL POWER SUPPLY AND DISTRIBUTION SYSTEM (FIG. 2-21).

WARNING

- **(CDS2) Weapons can be inadvertently fired while the aircraft is on the ground if the MASTER switch is in the ARMED position, electrical power is applied to the aircraft and either the Integrated System Processor (ISP) has failed or the ISP circuit breaker is pulled.**
- **R Weapons can be inadvertently fired while the aircraft is on the ground if the MASTER switch is in the ARMED position, electrical power is applied to the aircraft and either the R MCPU has failed or the R MCPU circuit breaker is pulled.**

a. Primary AC Power. Primary AC electrical power for the helicopter systems is provided by a 120/208 Vac, three-phase, 400 Hz, air cooled AC generator. This generator is driven by the engine power turbine (Np) from an engine accessory drive pad.

b. Primary DC Power. Primary DC electrical power for the helicopter systems is provided by two sources. The DC essential bus is powered from a 28 volt, 200 ampere transformer rectifier unit (TRU) and the battery emergency bus is powered by a 28 volt, 200 ampere starter-generator. The TRU is located in the aft electrical compartment and the starter-generator is located on the engine and driven by the engine gas producer turbine (Ng). An additional DC bus, power assured, is powered from the battery emergency bus.

c. Backup Systems. Backup systems for both DC and AC primary power systems are provided. These backup systems ensure that no single electrical failure will cause the loss of any system essential to flight. Automatic switching from primary power to backup is provided. Backup power is provided by the starter-generator. In the event the AC generator fails, the starter-generator input to an inverter will supply AC power. A starter-generator failure results in the TRU assuming the full load imposed by the DC essential bus, battery emergency bus, and power assured bus except for battery charging. In the event of an AC generator failure, the inverter will assume the loads on the 115 Vac essential bus.

d. Starting. Electrical power for starting and emergency power supply is provided by a single 24 volt, 17 ampere battery. This battery is located in the nose of the helicopter (fig. 2-1) and is controlled by the BATT 1 switch in the overhead console. Complete provisions are included for the installation of a second battery. When installed, the second battery is located in the aft electrical compartment and controlled through the BATT 2 switch in the overhead console (fig. 2-8). At ambient temperatures of +5 °F (-15 °C) or less both batteries are in parallel at the initiation of a start and switch to series when the MCPU signals a transfer based on engine Ng. Battery heating at temperatures below –17° (2 °F) is accomplished by momentarily positioning the BATT switch, for the battery to be heated, to the PREHEAT position and releasing. A HEAT ON light, located in the floodlight bracket to the right of the overhead console, will illuminate while the battery is heating. The heating cycle will require 3 to 4 minutes after which the HEAT ON light will extinguish. Allow 2 minutes after heat cycle termination to allow heat transfer inside the battery prior to starting.

CAUTION

The installation and use of the second battery is to provide increased battery starting capacity for cold weather starting. If one battery is depleted and both batteries are placed on line together in parallel, starting capacity may be decreased. Therefore, ensure both batteries are sufficiently charged prior to starting.

Aircraft modified by Army direction from a single to a dual battery installation, without installing a charger-monitor, can sustain damage to the electrical system if batteries are charged simultaneously. After start and before placing the DC GEN switch in the ON position, one of the batteries shall be turned OFF. Once one battery is sufficiently charged, the other can be brought on line for charge. Monitor S-GEN LD% for indication that high charging rate has passed. When S-GEN LD% has dropped to 70% or less, the other battery may be switched on for charging.

e. Power Failures. In the event of total failure of all power generating systems, an 80% fully charged battery will provide 5 to 6 minutes of power to all bus systems. Power to the battery emergency bus alone can be provided for 25 to 30 minutes. The following loads are on the battery emergency bus and will continue to function from battery power after failure of AC and DC generators:

Vertical scale instruments

Standby attitude indicator

Pitot heater

MCPU L

MCPU R

Pilot MFD

MFK

RFD

ICS

The items below will be powered with the ESNTL BUS switch in START. With the ESNTL BUS switch in the RUN position, all DC loads will be powered except the mast mounted sight. However, time on battery power will be greatly reduced. Electrical power is not required for powered flight. Only the standby compass, clock (if not digital), barometric altimeter, and airspeed indicator will continue to operate.

VHF FM No. 1

ADU

R ECU

(OH-58D) ESC

Engine oil bypass

Force trim

Fuel boost

Anticollision light

Starter

Ignition

DC generator reset

Position lights

Searchlight

Cockpit utility lights

Cockpit flood lights

NVG power supplies

Bus interconnect

Engine transducer

Rotor transducer

Transmission transducer

Fuel quantity

Jettison left

Jettison right

f. Failure Analysis. Refer to the following step for a failure analysis when a single electrical subsystem failure occurs. The failed unit(s) are identified by a caution message on the multifunction display.

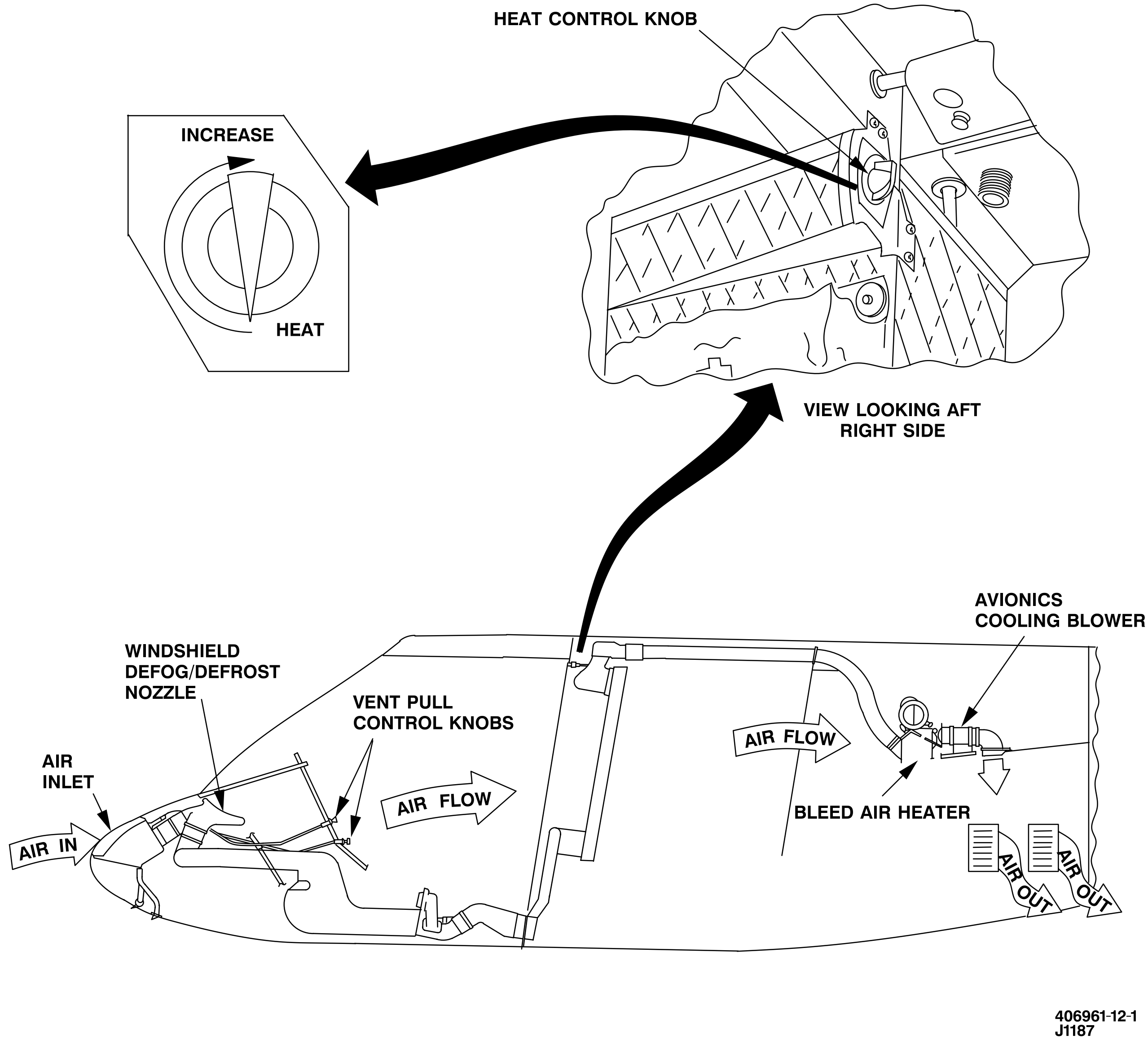

Figure 2-20. Heating, Ventilating, and Avionics Cooling

(1) **AC Generator Failure.**

Caution Messages:
AC GEN FAIL
RECT FAIL

AC generator is isolated.

Rectifier (TRU) is off.

MMS is off.

Particle separator blower is off.

HELLFIRE missile system launcher power lost.

Inverter and starter-generator pick up remaining loads.

(2) **Starter-Generator Failure.**

Caution Messages:
DC GEN FAIL
INV FAIL

Starter-generator isolated.

Inverter off.

No battery charging.

(3) **Inverter Failure.**

Caution Message:
INV FAIL

Inverter isolated.

No loads are shed.

(4) **Battery Failure.**

Caution Message:
HOT BATT 1
HOT BATT 2
(CDS2/CDS3) HOT BATT 1 & 2
(CDS4) HOT BATT 1, 2

No loads are shed.

(5) **TRU Failure.**

Caution Message:
RECT FAIL

DC generator picks up loads.

g. External Power. External power receptacles are provided for application of both AC and DC electrical power while on the ground. With DC external power applied, engine starting and systems checkout may be accomplished. Application of AC external power allows operation and checkout of all AC systems.

2-65. DC ELECTRICAL POWER DISTRIBUTION SYSTEM.

a. DC Power System. The DC power distribution system is divided into bus systems. The three distinct, interrelated systems are the DC power assured bus, battery emergency bus and DC essential bus (fig. 2-21).

b. Transformer Rectifier Unit (TRU). The transformer rectifier unit (TRU) is rated at 200 amperes, 28 Vdc. The TRU is located in the aft electrical compartment. As AC primary power is generated by the AC generator, power is fed to the TRU which converts the AC input to DC primary output. DC output from the TRU energizes the TRU relay and connects the TRU to the DC essential bus. The TRU also provides a secondary source of power to the DC power assured bus and the battery emergency bus.

c. Starter-Generator. With the DC GEN switch in the DC GEN position and starter-generator output at 28 volts, the generator provides power to the battery generator bus and the battery emergency bus. The DC power assured bus relay is in turn energized, connecting the DC power assured bus to the battery emergency bus.

2-66. BATTERY SYSTEM OPERATION.

The battery supplies power to the battery emergency bus when the ESNTL BUS switch (fig. 2-8) is in the START position. When two batteries are installed, either battery will supply bus power. In the event of total generator failure with the ESNTL BUS switch in the RUN position, the battery supplies power to all DC buses. Battery loading can be reduced by placing the ESNTL BUS switch to the START position, thereby eliminating DC power assured and DC essential bus loads from the system.

2-67. DC EXTERNAL POWER SYSTEM OPERATION.

During ground operations, external power may be connected to the electrical system through an external power receptacle (71, fig. 2-1) located on the lower side of the nose. An external DC power sensor monitors external power input and protects aircraft systems from out of tolerance voltages, fluctuations, and spiking. For application of external power, the DC GEN switch must be in the OFF position. The external power relay will then close and allow distribution of external power to all DC buses and the inverter. A GPU rated at 200 ampere, 28 Vdc is required for continuous ground operation and 500 — 750 ampere, 28 Vdc is required for starting. The following are the maximum GPU settings: DC power output —

a. AGPU-DOD model # MEP-360A (TM 55-1730-229-12).

(1) 28 Vdc 700 amps (1000 amps for 30 seconds) with no AC.

(2) 28 Vdc 50 amps from battery chargers with 27.5 kwAC available.

b. MD-3 series generator set (MIL-HANDBOOK-300).

(1) MD-3: 28V at 1500 amps.

(2) MD-3A: 28V at 1500 amps.

(3) MD-3M: 28V at 500 amps.

2-68. AC ELECTRICAL POWER DISTRIBUTION SYSTEM.

a. Primary AC power. The primary AC distribution system feeds AC generator power through the AC generator transfer relay to the TRU, which is controlled by a rectifier remote control circuit breaker (RCCB), and to the essential bus through the inverter relay. The 115 Vac essential bus supplies power to the 26 Vac bus through the 115/26 Vac transformer. Distribution from the Vac buses is controlled by circuit breakers located on the center post circuit breaker panel (fig. 2-8).

b. Secondary AC power. When the AC generator is not operating. AC power is provided by the inverter through the inverter relay to the 115 Vac essential bus.

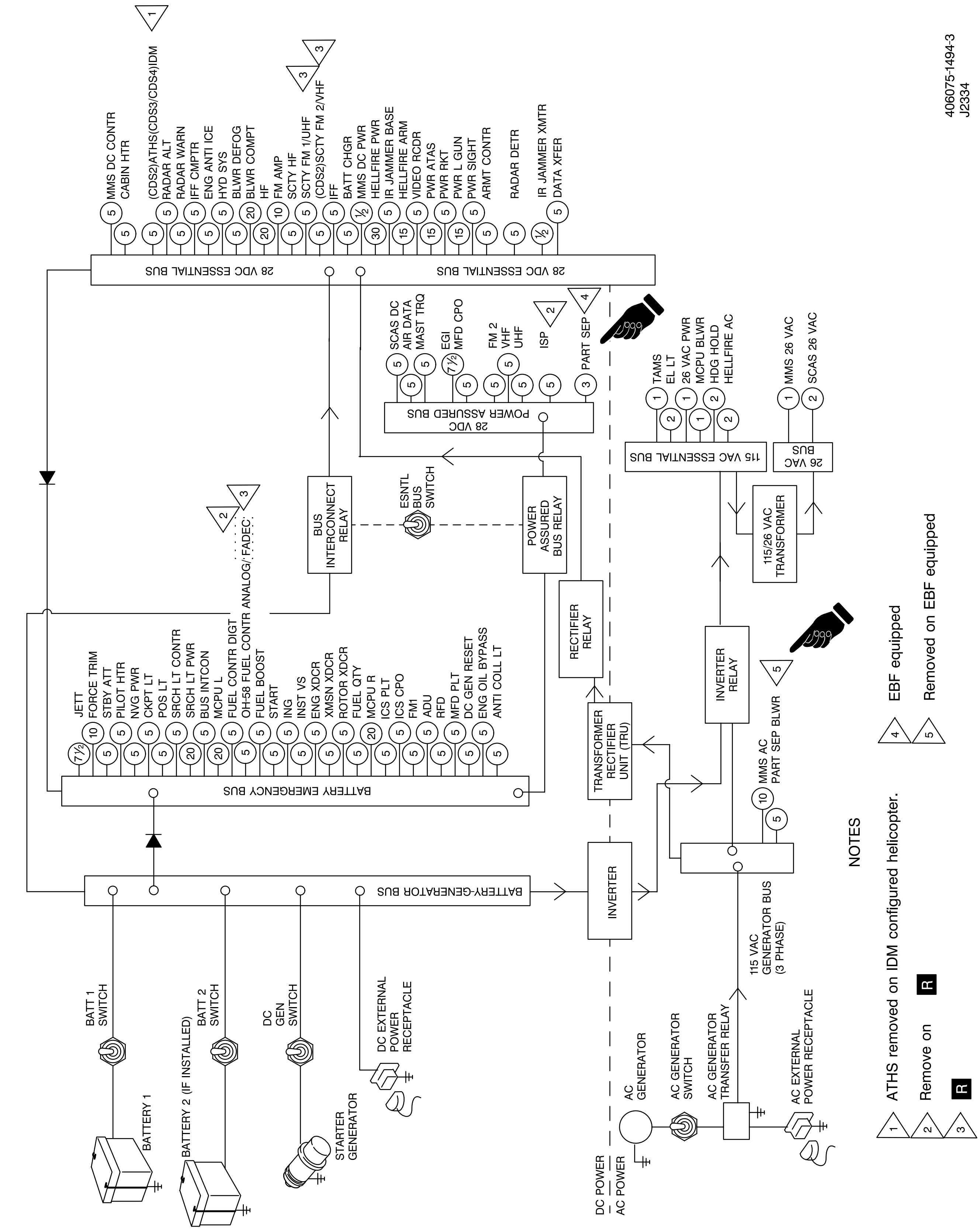

Figure 2-21. Electrical System Schematic

2-69. AC GENERATOR.

At approximately 95% Nr and with the AC GEN switch (fig. 2-8) in the AC GEN position, the engine mounted AC generator provides power to the TRU. The TRU supplies primary DC power to the DC power assured bus, DC essential bus 28 Vdc essential bus and the battery emergency bus.

2-70. INVERTER.

a. Description. A single-phase, 115 Vac, 400 Hz inverter is provided to supply power to the AC essential bus when the AC generator is not supplying power. The inverter is powered by the battery generator bus and is protected by the INV circuit breaker located in the overhead console (fig. 2-8).

b. Operation. The inverter is energized through the BUS INTCON circuit breaker (fig. 2-8) when either external DC power is applied or the DC generator is supplying power. With the BATT 1 switch on, battery power may be applied to the inverter by placing the ESNTL BUS switch to RUN.

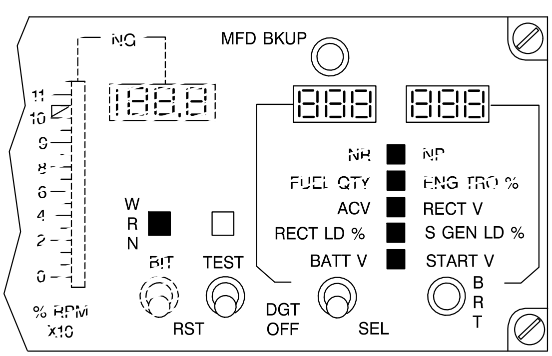

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Figure 2-22. MPD Electrical System Indicators

2-71. AC EXTERNAL POWER RECEPTACLE.

An AC external power receptacle is provided for the application of AC power from an auxiliary AC power unit. The receptacle is located on the lower right side of the aft fuselage. A 10 kVA external power source of three-phase, 120/208 Vac, 400 Hz output is required.

2-72. ELECTRICAL SYSTEMS CONTROLS AND INDICATORS.

a. Electrical Systems Indicator (fig. 2-22). The MPD contains a selectable-parameter digital indicator. Display of AC voltage (ACV), rectifier voltage (RECT V), rectifier load percentage (RECT LD%), starter-generator load percentage (S GEN LD %), battery voltage (BATT V), and starter voltage (START V) may be sequentially selected for display on the MPD by pressing the SEL switch.

b. Electrical Systems Controls (fig. 2-8).

(1) **DC Power Control.** DC power is controlled by the BATT 1 and BATT 2 switches; DC GEN switch; DC GEN FIELD and RESET circuit breakers in the overhead console; and a 9TH CELL circuit breaker (for battery preheat monitoring) located in the forward battery compartment. Distribution of DC power is also controlled by the ESNTL BUS switch.

(2) **AC Power Control.** AC power is controlled by the AC GEN switch, ESNTL BUS switch, and INV and RECT circuit breakers. These controls are located in the overhead console. In addition, 26 Vac power is controlled by a 26 Vac PWR circuit breaker located in the center post console.

(3) **Caution Messages.** In the event of an electrical system failure (or failures), an appropriate message will be displayed on the MFD. The messages which can be displayed are: DC GEN FAIL, AC GEN FAIL, RECT FAIL, INV FAIL, HOT BATT 1, HOT BATT 2, and/or **(CDS2/CDS3)** HOT BATT 1 & 2 or**(CDS4)** HOT BATT 1, 2.

(4) **Advisory Messages.** Advisory messages will be displayed on the MFD to report the status of monitored systems. The advisories which may be displayed are: EXT PWR, to indicate that an external power source is connected; BATT PREHEAT ON, to indicate that the BATT 1 and/or BATT 2 switch(es) have been placed in the PREHEAT position.

SECTION XII. AUXILIARY POWER UNIT (NOT APPLICABLE)

SECTION XIII. LIGHTING

2-73. POSITION LIGHTS.

a. Description. The position lights consist of the three lights (49, 52, and 57, fig. 2-1). A green light is located on the right horizontal stabilizer tip, a red light is located on the left horizontal stabilizer tip, and a white light on the aft end of the tailboom.

b. Operation. Power is supplied to the position lights through the battery emergency bus. The circuit is protected by the POS LT circuit breaker located on the overhead console (fig. 2-8). The position lights are controlled by the POS LT switch also located on the overhead console. This three-position switch permits selection of bright (BRT) in the forward position, DIM in the center position, and LIGHT OFF in the aft position.

2-74. NVG FORMATION LIGHTS.

Six white infrared (IR) NVG-compatible formation lights are mounted on the aircraft. Two forward lights are mounted on the left and right top of the nose section. One is mounted in the lower forward area of the aft electronics bay door. One is mounted aft of the lower anticollision light and just above the tiedown mount. One is mounted on top of the tail cone structural support, and one is mounted on the right side of the fuselage in the avionics bay area. The POS LT circuit breaker (fig. 2-8), located on the aft overhead console panel, protects the circuit for the NVG formation lights. Operation of the NVG formation lights is controlled by the FORMATION LIGHTS rotary switch (fig. 2-8), located next to the overhead console panels. When the knob is rotated just out of the OFF position, the lights are at minimum intensity, when the knob is rotated to the BRT position the lights are at maximum intensity.

2-75. ANTICOLLISION LIGHTS.

a. Description. The anticollision lights consist of two lights (28 and 61, fig. 2-1), one centered on top of the engine cowling, and one centered on the aft underside of the fuselage.

b. Operation. Power is supplied through the battery emergency bus. The circuit is protected by the ANTI COLL LT circuit breaker (fig. 2-8). The anticollision lights are controlled by the ANTI COLL switch (fig. 2-8). The forward or ANTI COLL position turns the lights on and the aft or LIGHT OFF position turns the lights off.

2-76. FLOODLIGHTS.

a. Description. The floodlights consist of two lights (8, fig. 2-5), located on either side of the overhead console. These lights are used to light the cockpit area with either white (CPG side) or green (pilot side).

b. Operation. Power is supplied through the battery emergency bus and the circuit is protected by the CKPT LT circuit breaker (fig. 2-8).

c. Controls. The floodlights have two controls: a dimming rheostat labeled FLOOD LT (fig. 2-8) and a three-position toggle switch. Placing the switch at the forward, or WHT position, turns on the white light. The centered, or GRN position, turns on the NVG light and the aft, or LIGHT OFF position, turns both lights off.

2-77. SEARCHLIGHT.

a. Description. The searchlight (70, fig. 2-1) is a controllable light, located in the underside of the nose section.

b. Operation. The light is controlled by two switches labeled SRCH LT on the pilot collective control head (3, 4, fig. 2-18). The searchlight can be turned on by the three-position toggle switch labeled ON, NVG, OFF. Placing the switch in the ON position turns on the white searchlight. The center, or NVG position, turns on an NVG-compatible light, and the OFF position turns off both lights. The searchlight control switch, labeled EXT, RET, L, R, is center spring-loaded off. The switch controls searchlight direction. The light receives power through the battery emergency bus and is protected by the SRCH LT CONTR and SRCH LT PWR circuit breakers.

2-78. UTILITY LIGHT.

a. Description. A utility light is located between the crewmember seats. This light is removable from the mounting bracket and has an alternate mounting bracket above the CPG seat.

b. Operation. The light is equipped with an on/off, bright-dim rheostat and a momentary on switch. A filter lens provides NVG capability and a focusing ring allows adjusting of light beam from small spot to wide beam. The light receives power from the DC battery emergency bus and is protected by CKPT LT circuit breaker.

2-79. INSTRUMENT LIGHTS.

a. Description. The instrument lights illuminate the system and flight instruments as well as all control panels located on the instrument panel. The lights are NVG-compatible.

b. Operation. They are controlled by the INST LT rheostat control knob located on the overhead console (fig. 2-8). Turning the knob full counterclockwise turns the lights OFF and turning it clockwise increases light intensity, with the BRT position being full intensity. Power to the instrument lights is received through the AC essential bus and the circuit is protected by the EL LT circuit breaker located in the center post circuit breaker panel (fig. 2-8).

2-80. PEDESTAL AND OVERHEAD CONSOLE LIGHTS.

a. Description. The pedestal and overhead console lights illuminate the overhead consoles, center post console, and the pedestal console. These panels are NVG-compatible.

b. Operation. They are controlled by the CONSOLE LT rheostat control knob located on the overhead console. Turning the knob full counterclockwise turns the lights OFF and turning it clockwise increases light intensity, with the BRT position being full intensity. Power to the lights is received through the AC essential bus and the circuit is protected by the EL LT circuit breaker located in the center post circuit breaker panel (fig. 2-8).

2-81. NVG POWER CONVERTER.

a. Description. Two night vision goggles (NVG) power converters (11, fig. 2-5) are located behind the pilot and CPG seats on the upper bulkhead. These power converters are used with ANVIS goggles. When the goggles are plugged into these converters, they receive power from the helicopter using the self-contained batteries as a backup.

b. Operation. Power to the power converters (fig. 2-23) is received through the battery emergency bus and the circuit is protected by the NVG PWR circuit breaker located on the overhead console. The NVG power supply operational check is as follows:

(1) Helicopter DC electrical power — ON.

(2) Pilot NVG power pack batteries — Remove.

(3) Pilot NVG power pack — Connect to pilot helicopter NVG power converter.

(4) Pilot NVG power pack switch — ON.

(5) Pilot helicopter NVG power converter switch — ON. Observe NVG activate.

(6) Pilot helicopter NVG power converter switch — OFF. Observe NVG deactivate.

(7) Pilot helicopter NVG power converter switch — Hold momentarily in TEST, then release. Observe TEST IND light illuminates and then extinguishes.

(8) Pilot NVG power pack switch — OFF.

(9) Pilot NVG power pack batteries — Install.

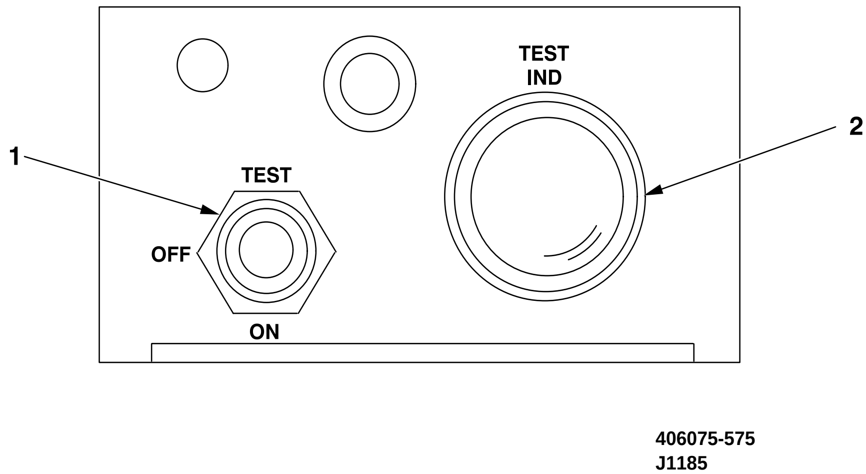
(10) Pilot NVG power pack switch — ON. Observe NVG activate.

(11) Pilot helicopter NVG power converter switch — ON. Observe NVG remain illuminated.

(12) Pilot helicopter NVG power converter switch — OFF. Observe NVG remain illuminated with NVG power pack.

(13) Pilot helicopter NVG power converter switch — ON.

(14) Repeat steps 2 thru 13 for CPG NVG power supply.



CONTROL/INDICATOR		FUNCTION
1.	NVG power converter switch	TEST position activates circuit test. OFF position turns power converter off. ON position activates power converter circuit.
2.	TEST IND light	Light illuminates when test circuits are activated.

Figure 2-23. NVG Power Converter

SECTION XIV. FLIGHT INSTRUMENTS

2-82. FLIGHT INSTRUMENTS/DISPLAYS.

This section contains information on all flight instruments and displays to include primary and secondary flight instruments, other miscellaneous instruments pertaining to flight, and the caution, warning, and advisory system. These displays provide all necessary information for day or night VFR flight and to conduct emergency instrument flight.

a. Primary Flight Displays. All primary flight information is displayed on either MFD when the vertical situation display (VSD) mode is selected (Chapter 3). PITCH and ROLL switches, located on MFD auxiliary control panel (fig. 2-6), adjust attitude indicator display. The basic flight display is an attitude indicator displayed in the center of the screen. Around the attitude indicator is displayed an airspeed indicator, heading indicator, barometric altimeter, radar altimeter, vertical speed indicator, present position readout, and distance to waypoint reading. An air data subsystem is incorporated which compensates for the effects of temperature and barometric pressure to improve the accuracy of the barometric altimeter and airspeed indications on the VSD display. A submode of the VSD is the hover (HVR) mode (Chapter 3). This mode is used to aid in hovering at night or in reduced visibility. Refer to Chapter 3 for detailed description of all instrument readouts of the VSD and HVR modes.

b. Secondary Flight Instruments. Several secondary flight instruments are located on the instrument panel to provide flight reference in the event of a partial or complete failure of the primary instrument system. The secondary flight instrument group contains a standby attitude indicator, standby airspeed indicator, standby altimeter, and standby magnetic compass.

(1) **Standby Attitude Indicator.** A standby attitude indicator (1, fig. 2-6) is located on the instrument panel. An OFF flag is exposed in the event of instrument failure. Power to the instrument is received through the battery emergency bus and the circuit is protected by the STBY ATT circuit breaker located on the overhead console (fig. 2-8). The standby attitude indicator should be caged prior to placing the ESNTL BUS switch in RUN by pulling the PULL TO CAGE knob.

(2) **Standby Airspeed Indicator.** A standby airspeed indicator (20, fig. 2-6) is located to the left of the standby attitude indicator. This instrument measures knots indicated airspeed (KIAS) from 0 to 150 knots. It is operated by the differential between impact and static air pressure and requires no electrical current except for lighting.

(3) **Standby Altimeter.** A standby altimeter (9, fig. 2-6) is located to the right of the standby attitude indicator. This indicator displays altitude MSL, and uses the static air pressure system for measuring altitude. Electrical power for an internal vibrator is received through the 28 Vdc power assured bus and is protected by the AIR DATA circuit breaker (fig. 2-8). Adjusting the barometric pressure setting on this instrument also provides barometric pressure correction for the primary altimeter on the VSD. No system warmup time is required before adjustments can be made; however, electrical power must first be applied from the power assured bus.

(4) **Standby Magnetic Compass.** A standby magnetic compass (6, fig. 2-6) is located on the far right side of the instrument panel. A compass correction card is located adjacent to the compass.

c. Slip Indicator. A slip indicator is located on the pilot MFD auxiliary control panel (8, fig. 2-6) to indicate slip/skid (trim) conditions in flight. This is a ball-in-race type indicator that requires no electrical power.

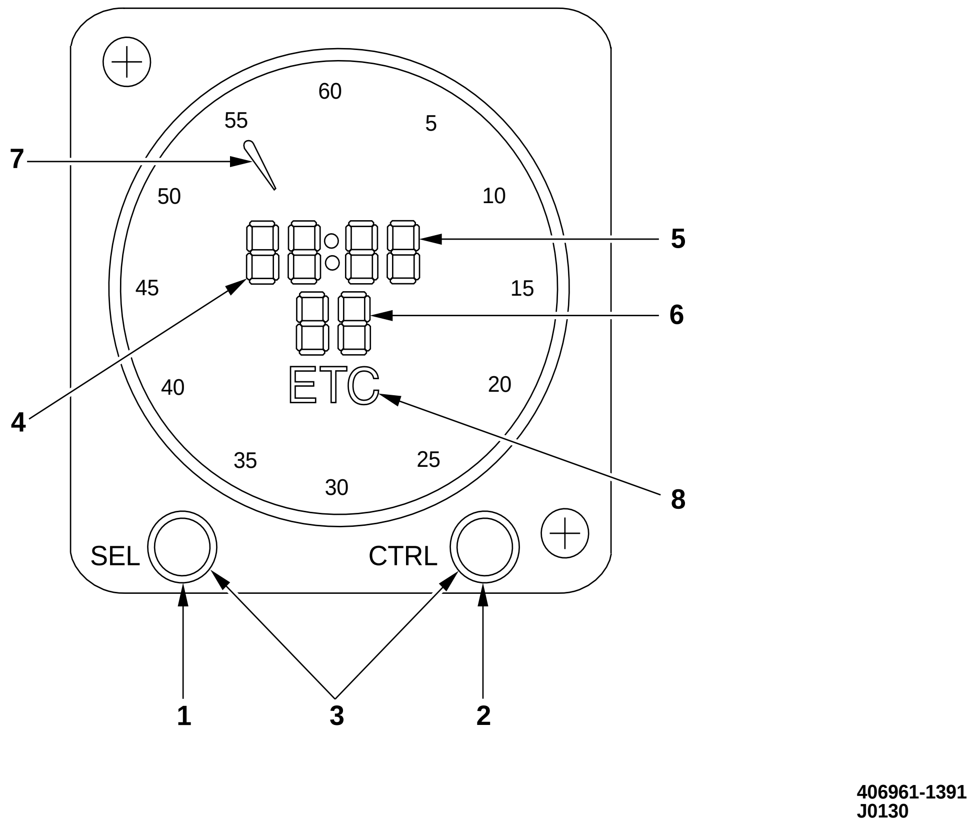
2-83. MISCELLANEOUS INSTRUMENTS.

a. Free Air Temperature Indicator. The free air temperature indicator is located at the top center area of the windshield and displays free air temperature in degrees Celsius.

b. Clock.

An 8-day mechanical clock (5, fig. 2-6) is located on the instrument panel to the right of the pilot MFD. The clock has a push knob in the upper right corner for setting elapsed time and rewind knob in the lower left corner.

A digital quartz time base, electronic clock (5, fig. 2-6) is located on the instrument panel to the right of the pilot MFD. The clock indicates hours, minutes and seconds for clock time and elapsed time modes in six digit, twenty-four hour numeric display in addition to a sweep second, analog indicator (fig. 2-24). The clock includes a keep alive function, provided by an internal battery to keep timing circuits continuously operating while aircraft power is not applied.



CONTROL/INDICATOR	FUNCTION
1. SEL	Set clock mode — Depressed will flash for selection of hours, minutes, and seconds for changes. Returns clock to clock function.
	Clock mode — Depressed to change to elapsed time mode.
	Elapsed time mode — Depressed to change to clock mode.
2. CTRL	Set clock mode — Depressed to increment hours, minutes, and seconds.
	Elapsed mode — Depressed:
	1st time — Starts elapsed timer
	2nd time — Stops elapsed timer
	3rd time — Resets elapsed timer
	4th time — Repeats cycle (starts elapsed timer).
3. SEL CTRL	Pressed simultaneously to set clock.
4. Hours	Two place numerical twenty-four hour display.
5. Minutes	Two place numerical minutes display.
6. Seconds	Two place numerical seconds display.
7. Sweep second hand	Analog indicator for seconds.
8. ETC	Mode indicator — ET for elapsed time or C for clock.

Figure 2-24. Digital Clock

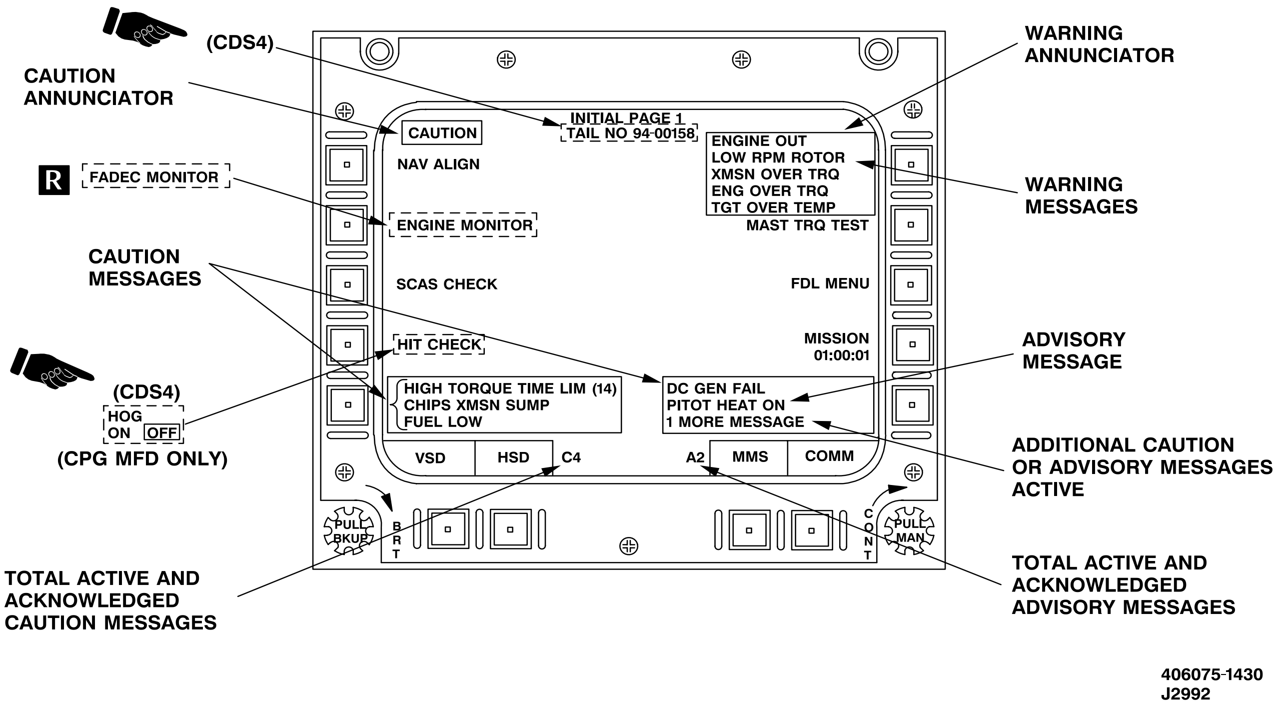


Figure 2-25. Warnings, Cautions, and Advisories

2-84. (CDS2/CDS3) WARNING, CAUTION, AND ADVISORY SYSTEM.

The warning, caution, and advisory system visually and audibly advises the crew of specific faults in the helicopter systems. All warning, caution, and advisory messages are displayed on both MFDs and warnings and cautions are accompanied by an audio tone that is heard through the crew headsets.

a. Warning Function. Warning messages are displayed in a box in the upper right corner of the MFD screen (fig. 2-25). This box will display only when there is an active warning condition. There are seven warning messages that can be displayed:

ENG OVER TRQ

ENGINE OUT

HIGH RPM

(CDS3) LOW FUEL PRES

LOW RPM ROTOR

TGT OVER TEMP

XMSN OVER TRQ

(1) **(CDS3)** In addition there are two warnings for the FADEC system that are displayed as advisories:

FADEC FAIL

FADEC MANUAL

When activated, a unique FADEC audio warning, consisting of a high/low tone is generated. This high/low tone sequence is repeated until acknowledged or the condition has been removed.

(2) Refer to Chapter 9, Emergency Procedures for corrective action for each of these warnings. As a warning condition occurs and the warning is displayed, warning audio will sound. Except for LOW RPM ROTOR, which has a continuous whoop, a continuous 3 bongs per second signal will sound. The audio signal can be silenced by pressing the REC/ACK (recall/acknowledge) switch (3, fig. 2-9) on the MFK to the ACK position. The message will remain displayed on the MFD as long as the warning condition is active. The one exception is when the helicopter is at an ON GROUND condition. On the ground, the LOW RPM ROTOR and ENGINE OUT warnings can be deleted from the screen by pressing the REC/ACK switch a second time. All warning messages are recorded in C/W (Caution/Warning) HISTORY, except when an ON GROUND condition exists. If an ENGINE OUT or **(CDS3)** LOW FUEL PRES condition occurs, the following warnings will not be recorded on C/W HISTORY:

ENG OVER TRQ

TGT OVER TEMP

XMSN OVER TRQ

b. Caution Function. All caution messages are displayed in either of the two boxes that will display across the bottom of the MFD screen (fig. 2-25). These boxes display only when there is an active caution or advisory message that has not been acknowledged or has been recalled. Refer to Chapter 9 Emergency Procedures for a list of, and corrective actions to be taken for, these conditions. When the caution condition occurs, the caution message displays the word CAUTION in the upper left portion of the screen and a one **"**bong**"** per second audio signal will sound in the crew headsets. The total number of active cautions will display to the right of the letter **"**C**"** on the bottom of the screen. Pressing the REC/ACK switch on the MFK (fig. 2-9) one time to the ACK position will delete CAUTION from the screen and silence the audio. Pressing the switch a second time will delete the messages from the screen if there are five or fewer active caution and/or advisory messages. If there are more than five active messages, (number of messages) MORE MESSAGE will display on the last line of the right box. In this case, pressing the REC/ACK switch a second time will display the remaining messages, up to five. This continues until all active messages are displayed. All messages will be stored in memory and can be recalled by pressing the REC/ACK switch to REC position. Caution messages have priority over advisory messages and will precede them on the display list. All caution messages are recorded in C/W HISTORY except when an ON GROUND condition exists. If an ENGINE OUT or **(CDS3)** LOW FUEL PRES warning condition occurs, the following cautions will not be recorded on C/W HISTORY:

AC GEN FAIL

CHIPS ENG FREEWHEEL

CHIPS XMSN SUMP

CHIPS XMSN UPPER

DC GEN FAIL

(OH-58D) FUEL CONT

INV FAIL

RECT FAIL

The following is a complete list of cautions:

AC GEN FAIL

ADU FAIL

CHIPS ENG FREEWHEEL

CHIPS ENG LOWER

CHIPS ENG UPPER

CHIPS T/R GRBX

CHIPS XMSN SUMP

CHIPS XMSN UPPER

DC GEN FAIL

EGI FAIL

* ENG TRQ TIME LIM [ ]

FUEL BOOST FAIL

(OH-58D) FUEL CONT

FUEL FILTER BYP

FUEL LOW

(CDS2) GPS DIVERGENT

HIGH OIL PRESS ENG

HIGH OIL TEMP ENG

HIGH OIL TEMP XMSN

HIGH TEMP T/R GRBX

* HIGH TGT TIME LIM [ ]

HOT BATT 1

HOT BATT 1 & 2

HOT BATT 2

IFF FAIL

IFF MODE 4 FAIL

INS FAIL

INV FAIL

IR JAMMER INOP

(CDS2) ISP FAIL

LEFT MCPU FAIL

(CDS3) LOW ALTITUDE

LOW HYD PRESS

LOW OIL PRESS ENG

LOW OIL PRESS XMSN

LOW OIL QUANTITY ENG

* MAST TRQ TIME LIM [ ]

MISSILE UNLATCHED

OIL BYP ENG

P/R DISENG

RECT FAIL

RIGHT MCPU FAIL

SCAS DISENG

*, ** **(CDS2)** TGT 5 MIN LIM [ ]

*, ** TGT 30 MIN LIM [ ]

(CDS3) WEAPONS FAIL

YAW DISENG

NOTE

- * Brackets next to a caution display the accumulated time in seconds that the limit was exceeded.
- **These TGT cautions have a built-in hysteresis that requires the TGT to be lower than the limit by 30 °C in order to reset the caution timer (a system variation of ±10 °C is possible).

c. Advisory Function. Advisory messages are displayed in a similar manner as caution messages. When an advisory condition occurs, a single "bong" may sound in the crew headsets and the advisory message will be displayed in the box at the bottom of the MFD screen. The one exception, the HDG HLD advisory, is displayed in the upper left corner of the screen and no bong is heard. Pressing the REC/ACK switch to the ACK position will delete the message from the screen. When an advisory has been acknowledged, it will stay in memory as long as the advisory condition exists. The total number of active advisories is displayed to the right of the letter A at the bottom of the screen. Advisories are not recorded in C/W HISTORY.

The following advisory messages can be displayed:

NOTE

* These advisories will generate a single bong advisory tone.

* **(CDS3)** ALARM

* ALARM ONE

(CDS3) ASE FAIL

(CDS2) ATH AUTHENT TABLE LOW

(CDS2) ATH MESSAGE RECEIVED

(CDS2) ATHS FAIL

* **(CDS2)** ATHS QUEUE FULL

BATT PREHEAT ON

CARGO HOOK ARMED

* **(CDS2)** CHECK MESSAGE CHECKALL

* **(CDS2)** CHECK MESSAGE CHECKFIRE

* **(CDS2)** CHECK MESSAGE MAYDAY

CODE NOT ACCEPTED

DTS FAIL

* EGI BATT LOW

ENG ANTI-ICE ON

EXT PWR

* **(CDS3)** FADEC DEGRADE

* **(CDS3)** FADEC MAINT

(CDS3) FM-1 CT FAIL

FM-1 CUE

FM-1 FAIL

(CDS3) FM-1 HUB LOW

(CDS3) FM-1 PT FAIL

(CDS3) FM-2 CT FAIL

FM-2 CUE

FM-2 FAIL

(CDS3) FM-2 HUB LOW

(CDS3) FM-2 PT FAIL

(OH-58D) FUEL CONTROL

* **(CDS3)** GPS DIVERGENT

* GPS FAIL

* HDG HOLD

HF RADIO FAIL

HF RADIO TUNE

* **(CDS3)** HVR DEGRADED

(CDS3) IDM FAIL

IFM FAIL

(CDS3) IMAGE RECEIVED

INVALID COMMAND

KY-75 ALARM

LASER CODE MISMATCH

LAUNCHER SAFED

* LEFT COOLANT LOW

* LEFT LAUNCHER FAIL

* MISSILE ALERT

NOTE

* These advisories will generate a single bong advisory tone.

* MISSILE ALERT — AI

* MISSILE ALERT — SAM

MMS FAIL

MMS VIDEO NOT AVAILABLE

MOIST VTR TAPE

NAV INVALID

NAV NOT ALIGNED

* NAV UPDT REQUIRED

* **(CDS3)** NO AUTO START

NO CODE

* ONE YAW CHAN OFF

PITOT HEAT ON

* P(Y) CODE INVALID

RHE FAIL

* RIGHT COOLANT LOW

* RIGHT LAUNCHER FAIL

(CDS3) RMS FAIL

(CDS3) SCAN NOT AVAILABLE

TACAN FAIL

TACAN INVALID

* **(CDS3)** TACFIRE AUTH TABLE LOW

* **(CDS3)** TACFIRE MSG #

* **(CDS3)** TACFIRE MSG CHKALL

* **(CDS3)** TACFIRE MSG CHKFIRE

* **(CDS3)** TACFIRE MSG MAYDAY

* **(CDS3)** TACFIRE QUEUE FULL

* **(CDS3)** TIMER

* **(CDS2)** TIMER ONE

UHF FAIL

(CDS3) VDU FAIL

VHF FAIL

VTR FAIL

VTR TAPE FULL

WEDGE CONSTANT ZERO

WPN NOT ACTIONED

WPN NOT ARMED

(CDS3) WPN NOT SELECTED

NOTE

All advisory messages are inhibited during start.

2-85. (CDS4) WARNING, CAUTION, AND ADVISORY SYSTEM.

The warning, caution, and advisory system visually and audibly advises the crew of specific faults in the helicopter systems. All warning, caution, and advisory messages are displayed on both MFDs and warnings and cautions are accompanied by an audio tone that is heard through the crew headsets.

a. Warning Function. Warning messages are displayed in a box in the upper right corner of both MFD screens (fig. 2-25). This box will display only when there is an active warning condition. There are eight warning messages that can be displayed, prioritized as follows:

ENGINE OUT

LOW RPM ROTOR

LOW FUEL PRES

FADEC FAIL

HIGH RPM

XMSN OVER TRQ

ENG OVER TRQ

TGT OVER TEMP

(1) In addition there is a ninth warning that is only presented to the crew as a 3-Hz warning tone:

Low Altitude

(2) Refer to Chapter 9, Emergency Procedures, for corrective action for each of these warnings. When a warning condition occurs, the warning is displayed, accompanied by a warning audio. The FADEC FAIL warning consists of a high/low tone. The LOW RPM ROTOR warning consists of a continuous whoop. The audio signal for all other warnings is a continuous 3 bongs per second. The audio signal can be silenced by moving the REC/ACK (recall/acknowledge) switch (3, fig. 2-9) on the MFK to the ACK position. The warning message will remain displayed on the MFD for a minimum of 3 seconds or as long as the warning condition is active. The warning box can be temporarily

removed from the MFD display by holding the REC/ACK switch in the ACK position. When the helicopter is on the ground, the ENGINE OUT, LOW RPM ROTOR, and LOW FUEL PRES warnings can be deleted by pressing the REC/ACK switch a second time.

All warning messages are recorded in C/W (Caution/Warning) HISTORY, except when the helicopter is on the ground. When the ENGINE OUT warning occurs, the following warnings will be inhibited:

ENG OVER TRQ

TGT OVER TEMP

XMSN OVER TRQ

NOTE

The following warnings are inhibited during engine start:

- TGT OVER TEMP (TGT less than 927 °C)
- LOW RPM ROTOR
- HIGH RPM
- XMSN OVER TRQ

b. Caution Function. All caution messages are displayed in either of the two boxes that will display across the bottom of the MFD screen (fig. 2-25). These boxes display only when there is an active caution or advisory message that has not been acknowledged or has been recalled. Refer to Chapter 9, Emergency Procedures, for a list of, and corrective actions to be taken for, these conditions. When the caution condition occurs, the caution message displays the word CAUTION in the upper left portion of the screen and a one “bong” per second audio signal will sound in the crew headsets. For FADEC MANUAL, the FADEC warning tone will sound. The total number of active cautions will display to the right of the letter “C” on the bottom of the screen. Pressing the REC/ACK switch on the MFK (fig. 2-9) one time to the ACK position will delete CAUTION from the screen and silence the audio. Pressing the switch a second time will delete the messages from the screen if there are five or fewer active caution and/or advisory messages. If there are more than five active messages, (number of messages) MORE MESSAGE will display on the last line of the right box. In this case, pressing the REC/ACK switch a second time will display the remaining messages, up to five. This continues until all active messages are displayed. All messages will be stored in memory and can be recalled by pressing the REC/ACK switch to REC position. Caution messages have priority over advisory messages and will precede them on the display list. Caution messages are prioritized and always displayed in their prioritized order. All caution messages, except FADEC MANUAL, are recorded in C/W HISTORY except when an ON GROUND condition exists. If an ENGINE OUT warning condition occurs, the following cautions are inhibited:

AC GEN FAIL

ADU FAIL

CHIPS ENG FREEWHEEL

CHIPS ENG LOWER

CHIPS ENG UPPER

DC GEN FAIL

EGI FAIL

GPS DIVERGENT (advisory message)

IFF FAIL

INS FAIL

INV FAIL

IR JAMMER INOP

RECT FAIL

The following is a complete list of cautions:

NOTE

* Brackets next to a caution display the accumulated time in seconds by which the limit was exceeded.

AC GEN FAIL

ADU FAIL

BATT CHGR FAIL

CHIPS ENG FREEWHEEL

CHIPS ENG LOWER

CHIPS ENG UPPER

CHIPS T/R GEARBOX

CHIPS XMSN SUMP

CHIPS XMSN UPPER

DC GEN FAIL

EGI FAIL

* ENG TRQ TIME LIM [ ]

FADEC MANUAL

FUEL BOOST FAIL

FUEL FILTER BYP

FUEL LOW

HIGH OIL PRESS ENG

HIGH OIL TEMP ENG

HIGH OIL TEMP XMSN

HIGH TEMP T/R GRBX

* HIGH TGT TIME LIM [ ]

HOT BATT 1

HOT BATT 1, 2

HOT BATT 2

IFF FAIL

IFF MODE 4 FAIL

INS FAIL

INV FAIL

IR JAMMER INOP

LEFT MCPU FAIL

LOW HYD PRESS

LOW OIL PRESS ENG

LOW OIL PRESS XMSN

LOW OIL QUANTITY ENG

* MAST TRQ TIME LIM [ ]

MISSILE UNLATCHED

OIL BYP ENG

P/R DISENG

RECT FAIL

RIGHT MCPU FAIL

SCAS DISENG

* TGT 30 MIN LIM [ ]

WPN NOT ACTIONED

WEAPONS FAIL

YAW DISENG

NOTE

- * Brackets next to a caution display the accumulated time in seconds by which the limit was exceeded.
- The following cautions are inhibited during engine start:

AC GEN FAIL

BATT CHGR FAIL

DC GEN FAIL

EGI FAIL

FUEL FILTER BYP

HIGH OIL PRESS ENG

HIGH OIL TEMP ENG

HIGH TEMP T/R GRBX

HOT BATT 1

HOT BATT 2

HOT BATT 1, 2

IFF FAIL

IFF MODE 4 FAIL

INS FAIL

INV FAIL

LEFT MCPU FAIL

LOW HYD PRESS

LOW OIL PRESS ENG

OIL BYP ENG

P/R DISENG

RECT FAIL

RIGHT MCPU FAIL

SCAS DISENG

YAW DISENG

c. Advisory Function. Advisory messages are displayed in a manner similar to caution messages. When an advisory condition occurs, a single “bong” may sound in the crew headsets and the advisory message will be displayed in the box at the bottom of the MFD screen. One exception, HDG HLD, is displayed in the upper left corner of the screen and no bong is heard. Pressing the REC/ACK switch to the ACK position will delete the message from the screen. In addition to the single “bong” tone associated with advisory messages, a missile alert tone is generated whenever the MISSILE ALERT SAM or MISSILE ALERT AI advisory occurs. The missile alert tone consists of a 1259 Hz tone that changes to a lower frequency every 20 milliseconds. This tone changes frequency 10 times and repeats until acknowleged. When an advisory has been acknowledged, it will stay in memory as long as the advisory condition exists. The total number of active advisories is displayed to the right of the letter A at the bottom of the screen. Advisories are not recorded in C/W HISTORY. Advisory messages are prioritized and are always displayed in their prioritized order.

The following is a complete list of advisory messages:

NOTE

* Accompanied by a single ‘bong‘ in crewmember headsets.

AIR MSN REJECTED

AIR MSN X UPDATE

AIR REQST MSN

* ALARM (alarm name)

ARTY MSN X UPDATE

ASE FAIL

BATT PREHEAT ON

BSA UPDATE

C2 MSG RCVED

CARGO HOOK ARMED

CODE NOT ACCEPTED

DTS FAIL

* EGI BATT LOW

ENG ANTI-ICE ON

EXT PWR

* FADEC DEGRADE

* FADEC MAINT

FM-1 CT FAIL

FM-1 CUE

FM-1 FAIL

FM-1 HUB LOW

FM-1 PT FAIL

FM-2 CT FAIL

FM-2 CUE

FM-2 FAIL

FM-2 HUB LOW

FM-2 PT FAIL

GPS DIVERGENT

* GPS FAIL

* HVR DEGRADED

IDM FAIL

IDM NO STARTUP

IDM SHUTDOWN CMPLT

IFM FAIL

* IMAGE RECEIVED

INVALID COMMAND

LASER CODE MISMATCH

LAUNCHER SAFED

LEFT COOLANT LOW

LEFT LAUNCHER FAIL

** MISSILE ALERT

** MISSILE ALERT — AI

** MISSILE ALERT — SAM

MMS FAIL

MOIST VTR TAPE

NAV INVALID

NAV NOT ALIGNED

* NAV UPDT REQUIRED

NET JOIN? — FMx

* NO AUTO START

NO CODE

NO VIXL NET

* ONE YAW CHAN OFF

PITOT HEAT ON

* P(Y) CODE INVALID

RHE FAIL

RIGHT COOLANT LOW

RIGHT LAUNCHER FAIL

RMS FAIL

TACAN FAIL

TACAN INVALID

TACFIRE AUTH TABLE LOW

* TACFIRE MSG NO

* TACFIRE MSG CHKALL

* TACFIRE MQSG CHKFIRE

* TACFIRE MSG MAYDAY

TACFIRE QUEUE FULL

* TIMER (timer name)

UHF FAIL

VDU FAIL

VHF FAIL

VTR FAIL

VTR TAPE FULL

WEDGE CONSTANT ZERO

WPN NOT ACTIONED

WPN NOT ARMED

* Accompanied by a single ‘bong‘ in crewmember headsets.

** Accompanied by missile alert tone.

NOTE

- All advisory messages except the following are inhibited during engine start:

FADEC DEGRADE

FADEC MAINT

NO AUTO START

- If multiple warnings, cautions, and advisories occur at the same time, the priority of tones is as follows:

a. Low RPM rotor

b. Warning tone

c. FADEC tone

d. Missile alert tone

e. Caution tone

f. Advisory tone

2-86. MULTIPARAMETER DISPLAY (MPD).

NOTE

Use the digital readout on the MPD when adjusting/setting the NR/NP. The NR vertical scale indicator and the MFD NR backup display may indicate 1% higher than the actual NR, which is shown on the MPD digital readout.

The MPD (11, fig. 2-6 and fig. 2-22) is located in the lower center area of the instrument panel and contains vertical scale displays for transmission oil pressure and temperature, engine oil pressure and temperature, fuel quantity, and gas producer turbine speed (Ng). The Ng speed is also indicated on a digital display. Two additional digital displays provide readouts for 10 selectable parameters in pairs. Any of the following five pairs of parameters can be displayed as desired by actuating the SEL (select) switch. An indicator light identifies the selected pair of parameters.

1. Rotor speed (NR) and power turbine speed (NP).

2. Fuel quantity (FUEL QTY) and engine torque (ENG TRQ %).

3. AC voltage (ACV) and rectifier voltage (RECT V).

4. Rectifier load (RECT LD %) and starter-generator load (S GEN LD %).

5. Battery voltage (BATT V) and starter voltage (START V).

a. TEST/DGT/OFF Switch. A TEST/DGT/OFF switch allows selection of the subsystem test mode and also permits all digital displays to be de-energized at the operators discretion. When the TEST function is actuated, a test mode is initiated to verify proper subsystem operation. The VSDS subsystem (three units) is functioning properly if all vertical scales go to full deflection and the digital displays indicate all 8’s with exception of the left numeral on the NG display which should indicate **“**1**”**. Also, the WRN indicator and position indicator on the selectable display should illuminate. The test mode may be utilized as a preflight check or whenever verification of subsystem operation is required.

b. WRN Indicator Light. A WRN indicator light is provided to indicate a subsystem malfunction. When the WRN indicator illuminates, the BIT/RST switch should be actuated to RST to see if the fault will clear. If the fault does not clear, maintenance action is required.

c. BIT/RST Switch. Actuation of the BIT/RST switch to BIT will cause coded diagnostic messages to appear on the MPD digital displays that can be used to identify a fault. Diagnostic message codes are identified in the maintenance manual.

d. Transmission Oil (XMSN OIL) Temperature and Pressure Indicators. Vertical scale displays for transmission oil temperature and pressure are located on the MPD (11, fig. 2-6). Temperature and pressure signals are sensed at the transmission and routed to the MPD through the MCPUs.

e. Engine Oil (ENG OIL) Temperature and Pressure Indicators. Vertical scale displays for engine oil temperature and pressure are located on the MPD panel (11, fig. 2-6). Temperature and pressure are sensed from the engine oil system and transmitted to the MPD through the MCPUs. The scale on the left indicates engine oil pressure (ENG OIL P) in pounds per square inch (PSI X10). The scale on the right indicates engine oil temperature (ENG OIL T) in degrees Celsius (°C X10).

f. Fuel Quantity (FUEL QTY) Indicator. A vertical scale display for fuel quantity (FUEL QTY) is located on the MPD panel. The display indicates total fuel (FUEL QTY) in pounds (LBS X100). A digital indication of fuel quantity can also be selected (11, fig. 2-6).

g. Gas Producer Turbine Speed (NG) Indicator. Vertical scale and digital displays for gas producer turbine speed (NG) are located on the MPD panel. Speed signals are sensed by engine-mounted magnetic pickups and transferred to the MPD through the MCPUs. The vertical scale display indicates percent (% RPM X10) rpm of gas producer turbine speed (NG). The digital readout indicates the percent rpm of gas producer turbine speed (11, fig. 2-6).

h. BRT Knob. Turning the brightness control knob adjusts the selected VSDS intensity.

i. Multifunction Display Backup (MFD BKUP). As additional displays to the crew — rotor rpm, ENG TRQ and mast torque — are displayed across the top of the pilot and CPG MFD screens, they can be deactivated by pressing the MFD BKUP switch in the MPD (fig. 2-22).

2-87. RPM VERTICAL SCALE INSTRUMENT.

The RPM vertical scale instrument (2, fig. 2-6) is located on the upper center portion of the instrument panel. The left scale indicates main rotor speed (NR) in percent. Rotor speed signals are received from the mast torque signal processor through the multiparameter display. The right scale indicates power turbine speed (NP) in percent. Digital indications of NR and NP can also be selected (11, fig. 2-6).

2-88. MAST TORQUE (TRQ)/TURBINE GAS TEMPERATURE (TGT) INDICATOR.

The mast torque (TRQ)/turbine gas temperature (TGT) indicator (3, fig. 2-6) is located on the upper center portion of the instrument panel. The indicator has vertical and digital displays for each parameter. Turbine gas temperature (TGT) in degrees Celsius (°C X100) is indicated on the left vertical scale and digital displays.

Turbine gas temperature is sensed at the gas producer drive turbine outlet and routed to the indicator through the MCPUs and MPD. Main rotor mast torque (TRQ) in percent is indicated on the right vertical scale and digital displays. Torque signal is sensed from one upper and two lower mast torque sensors and routed to the indicator through the mast torque signal processor, MCPUs, and MPD.

2-89. ENGINE INSTRUMENTS — WARNING, CAUTION, AND ADVISORY SYSTEM.

Engine related warnings, cautions, and advisories are included in the warning, caution, and advisory system.

SECTION XV. SERVICING, PARKING, AND MOORING

2-90. SERVICING.

a. Servicing Diagram (fig. 2-26).

b. Approved Military Fuels, Oils, Fluids, and Unit Capacities (Table 2-1).

c. Fuel Samples. Fuel samples are taken daily to check for water or other contaminations in fuel. When taking a fuel sample, allow the fuel to settle the prescribed time after refueling. Settling time is one hour per foot of tank depth for jet (JP) fuels.

WARNING

Servicing personnel shall comply with all safety precautions and procedures specified in FM 10-67, Aircraft Refueling Field Manual.

2-91. APPROVED COMMERCIAL FUEL, OILS, AND FLUIDS.

a. Fuels (Table 2-2).

b. Oils (Table 2-3).

c. Fluids (Table 2-4).

NOTE

Color is not to be used as a discriminator when determining the type of fuel, oil, or fluid used when servicing the helicopter.

2-92. TYPES AND USE OF FUELS.

a. Fuel Types. Refer to TB 55-9150-200-24 Engine and Transmission Oils, Fuels, and Additives for Army Aircraft.

(1) **Army Standard Fuels.** JP-8 and JET B MIL-T-5624 are the Army designated primary fuels.

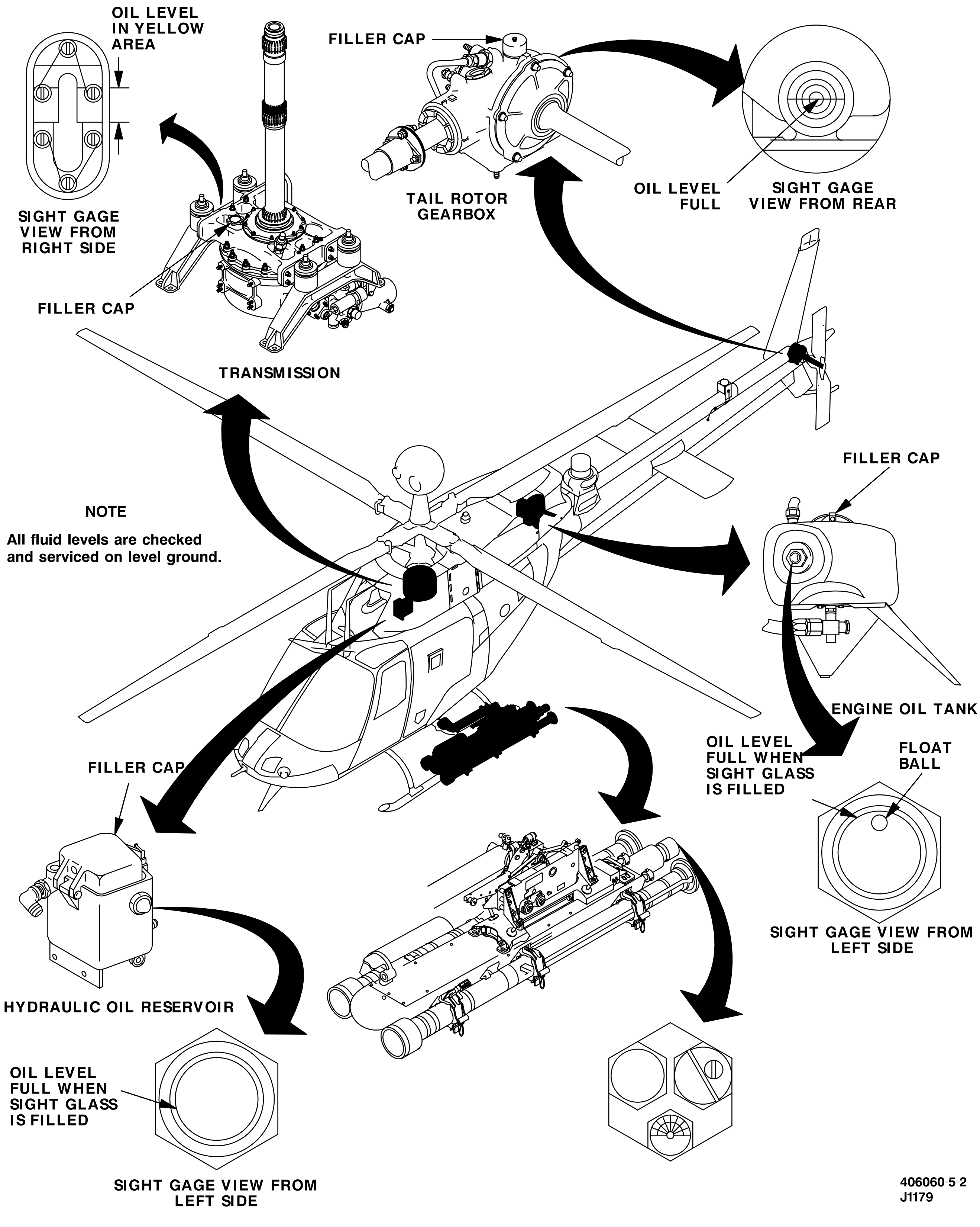
(2) **Alternate Fuels.** JP-5, JET A, and JET A1 are designated as the alternate fuels to be used in this helicopter. JP-5 and JET-A1 contain icing inhibitor blended at the refinery. JET A does not contain icing inhibitor.

(3) **Emergency Fuels.** None approved.

b. Use of Fuels.

(1) When mixing fuels in helicopter fuel cells, or changing from one type of authorized fuel to another, for example, JP-8 to JP-5, it is not necessary to drain the helicopter fuel system before adding the new fuel.

(2) Fuels having the same NATO code number are interchangeable. Jet fuels conforming to ASTM-D-1655 specification may be used when MIL-T-5624 fuels are not available. Engine will operate satisfactorily on either JP-8 or JP-5 type fuels.



NOTE

All fluid levels are checked and serviced on level ground.

Figure 2-26. Servicing Diagram

Table 2-1. Fuel, Oils, Fluids, Specification, and Capacities

SYSTEM	SPECIFICATION	NOTE	CAPACITY
Fuel	MIL-T-83133 (JP-8)	1	112 U.S. Gals. Total 110 U.S. Gals. Usable
Engine Oil	*MIL-L-7808 MIL-L-23699	2,5 3,5	1.5 U.S. Gals.
Transmission Oil	*MIL-L-7808 DOD-L-85734	2,6 4,6	7 U.S. Qts.
Tail Rotor Gearbox Oil	*MIL-L-7808 DOD-L-85734	2,6 4,6	0.38 U.S. Pt.
Hydraulic Fluid Reservoir	MIL-H-5606 MIL-H-83282	7,9 8,9	1.3 U.S. Pts.

WARNING

Contact with hydraulic fluid (MIL-H-83282) liquid or mist can irritate eyes and skin. After any contact with skin, wash contacted area with soap and water. If liquid is swallowed, do not induce vomiting; get immediate medical attention. Wear rubber gloves when handling liquid. If prolonged contact with mist is likely, wear an appropriate respirator. When fluid is decomposed by heating, toxic gases are released.

CAUTION

***Lubrication oil made to MIL-L-7808 by Shell Oil Company under their part number 307, qualification number 7D-1, shall not be used in OH-58 engine or aircraft systems. It contains additives which are harmful to seals in the systems.**

NOTE

If DOD-L-85734 is mixed with MIL-L-23699, the engine/gearbox shall be drained and refilled with the proper lubricant when it becomes available.

NOTE:

1. MIL-T-83133 (JP-8) NATO code is F-34. Alternate fuel is MIL-T-5624 (JP-5), JET A or JET A1, F-44 or F-34 (high flash point).
2. MIL-L-7808 NATO code is O-148.
   For use in ambient temperatures below -18 °C/0 °F.

CAUTION

Under no circumstances shall MIL-L-23699 or DOD-L-85734 oil be used in ambient temperatures below -40 °C/-40 °F.

3. MIL-L-23699 NATO code is O-156.
   For use in ambient temperatures above -40 °C/-40 °F.
4. DOD-L-85734 for use in ambient temperatures above -40 °C/-40 °F.
   DOD-L-85734 oil is a direct replacement for MIL-L-23699, but not for MIL-L-7808.
5. Do not mix MIL-L-7808 and MIL-L-23699 oils, except during an emergency. The engine shall be replaced after 5 hours of operation with mixed oils. An entry on DA Form 2408-13-1 and 2408-13-1-E is required when the oils are mixed.
6. Do not mix MIL-L-7808 and DOD-L-85734 oils, except during an emergency. If oils are mixed, oil shall be drained and system serviced with approved oil within 5 hours of operation.
7. MIL-H-5606 NATO code is H-515.
   For use in ambient temperatures below -40 °C/-40 °F.
8. For use in ambient temperatures above -40 °C/-40 °F.
9. It is not advisable to mix MIL-H-5606 and MIL-H-83282 fluids, except during an emergency. An entry on DA Form 2408-13-1 and 2408-13-1E is required when the fluids are mixed.

(TABLE I.D. 911322)

Table 2-2. Approved Fuels

PRIMARY OR STANDARD FUEL		ALTERNATE FUEL	
US MILITARY FUEL NATO CODE NO.	**JP-8 MIL-T-83133 (F-34)**	**JP-4 (MIL-T-5624) or JP-5 (MIL-T-5624), JET A or JET B F-40 or F-44**	
COMMERCIAL FUEL (ASTM-D-1655)	**JET A-1 NATO F-34**	**JET B**	**JET A**
Atlantic Richfield	Arcojet A-1	Arcojet B	Arcojet A
Richfield Div	Richfield A-1		Richfield A
B.P. Trading	B.P.A.T.K.	B.P.A.T.G.	
Caltex Petroleum Corp.	Caltex Jet A-1	Caltex Jet B	
Cities Service Co.			CITGO A
	Conoco Jet-60		Conoco Jet-50
Gulf Oil	Gulf Jet A-1	Gulf Jet B	Gulf Jet A
EXXON Co., USA	EXXON A-1	EXXON Turbo Fuel B	EXXON A
Mobil Oil	Mobil Jet A-1	Mobil Jet B	Mobil Jet A
Phillips Petroleum		Philjet JP-4	Philjet A-50
Shell Oil	Aeroshell 650	Aeroshell JP-4	Aeroshell 640
Sinclair	Superjet A-1		Superjet A
Standard Oil Co	Jet A-1		Jet A Kerosine
Chevron	Chevron A-1	Chevron B	Chevron A-50
Texaco	Avjet A-1	Texaco Avjet B	Avjet A
Union Oil		Union JP-4	76 Turbine Fuel

APPROVED FOREIGN COMMERCIAL FUELS

FOREIGN FUEL	NATO F-40	NATO F-44
Belgium	BA-PF-2B	
Canada	3GP-22F	3-6P-24e
Denmark	JP-4 MIL-T-5624	
France	Air 3407A	
Germany (West)	VTL-9130-006	UTL-9130-007/UTL-913-010
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

Anti-icing and Biocidal Additive for Commercial Turbine Engine Fuel — The fuel system icing inhibitor shall conform to MIL-I-27686. The additive provides anti-icing protection and also 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 acceptable commercial procedures. This additive (“PRIST” or equivalent) is not available in the Army Supply System, but will be locally procured when needed.

(TABLE I.D. 911323)

Table 2-3. Approved Oils

APPROVED COMMERCIAL MIL-L-7808 TYPE OILS

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
American Oil and Supply Co.	PQ Turbine Oil 8365
Exxon Co. USA	Exxon Turbo Oil 2389
	Esso Turbo Oil 2389
	RM-184A
Mobil Oil Corp.	RM-201A
Stauffer Chemical Co.	E-6825
Royal Lubricants Co.	Royco 807HR
	Royco 808HR
Rohm and Haas Co.	PL-10568

CAUTION

Do not use Shell Oil Co., part No. 307, qualification No. 7D-1 oil (MIL-L-7808). It can be harmful to seals made of silicone.

APPROVED COMMERCIAL MIL-L-23699 TYPE OILS

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
American Oil and Supply Co.	PQ Turbine Lubricant 5247/6423/6700/7731/8878/ 9595/9596/9597
Bray Oil Co.	Brayco 899/899-G/899-S/899-D
Castrol Oil Co.	Castro 205
Chevron International Oil Co., Inc.	Chevron Jet Engine Oil 5
Drew Chemical Corp.	STO-21919/STO-21919A/STD6530
W. R. Grace and Co. (Hatco Chemical Div.)	HAHTCOL 3211/3611
Humble Oil and Refining Co.	Esso Turbo Oil 2380
	Enco Turbo Oil 2380
	2395 Turbo Oil (WS-6459)
	2392 Turbo Oil
	2393 Turbo Oil
Mobil Oil Corp.	Mobil Jet II/RM-139A
	Mobil Jet Oil 254
	Avrex S Turbo 260
	Avrex S Turbo 265
Royal Lubricants Co.	Royco 899 (C-915)/899SC/Stauffer Jet II
Shell Oil Co.	Aeroshell Turbine Oil 500
	Shell Aircraft Turbine 551
Shell International Petroleum Co., Ltd.	Aeroshell Turbine Oil 550
Shell Oil Co., of California	Chevron Jet Engine Oil 5
Stauffer Chemical Co.	Stauffer 6924/Jet II
Texaco, Inc.	SATO 7377/7730 Starjet S

APPROVED COMMERCIAL DOD-L-85734 TYPE OILS

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
Royal Lubricants Co.	Royco Turbine Oil 555
EXXON Company, USA	Exxon Turbo Oil 25
Shell International Petroleum Co., Ltd.	Aeroshell Turbine Oil 555

(TABLE I.D. 922261)

Table 2-4. Approved Fluids

APPROVED COMMERCIAL MIL-H-5606 TYPE FLUIDS

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
American Oil and Supply Co.	"PO"4226
Bray Oil Co.	Brayco 757B
	Brayco 756C
	Brayco 756D
	Brayco 756E
Castrol Oils, Inc.	Castrol Hyspin A
Humble Oil and Refining Co.	Univis J41
Exxon Co.	Univis J41
Mobil Oil Corp.	Mobil Aero HFB
Pennsylvania Refining Co.	Petrofluid 5606B
	Petrofluid 4607
Royal Lubricants Co.	Royco 756C
	Royco 756D
	DS-437
Standard Oil Co. of Calif.	PED 3565
	PED 3337
Texaco, Inc.	TL-5874
Stauffer Chemical Co.	Stauffer Aero Hydroil 500
MZF Associates	25606
Union Carbide Corp.	FP-221

APPROVED COMMERCIAL MIL-H-83282 TYPE FLUIDS

MANUFACTURER'S NAME	MANUFACTURER'S DESIGNATION
Brayco Oil Co.	Brayco Micronic 882
Mobil Oil Corp.	XRM-230A
Mobil Oil Corp.	XRM-231A
Royal Lubricants Co.	Royco 782
Hanover Chemical Industries, Inc.	Hanover R-2
Hanover Processing Co.	HF-832

WARNING

Prolonged contact with hydraulic fluid (MIL-H-83282) liquid or mist can irritate eyes and skin. After any contact with skin, wash contacted area with soap and water. If liquid is swallowed, do not induce vomiting; get immediate medical attention. Wear rubber gloves when handling liquid. If prolonged contact with mist is likely, wear an appropriate respirator. When fluid is decomposed by heating, toxic gases are released.

NOTE

Mixing of hydraulic fluids is authorized only in emergency situations. An entry in the remarks section of DA Form 2408-13-1 and 2408-13-1E is required.

(TABLE I.D. 922262)

2-93. CLOSED CIRCUIT REFUELING (POWER OFF OR RAPID).

1. Grounding cables — Connect.

2. Fireguard — Posted.

3. Filler cap — Remove.

CAUTION

Ensure that servicing vehicle pressure is not above 125 psi while refueling.

4. Closed circuit refueling module — Close and latch.

5. Fuel hose nozzle — Insert into fuel cell receptacle and lock into closed circuit refueling module.

6. Automatic nozzle lever — ON or FLOW. Fuel flow will automatically shut off when fuel reaches within one-half inch of spillover. Just prior to shutoff, fuel flow may cycle several times as maximum fuel level is reached. The gage on the servicing unit will indicate when fuel flow stops.

7. Automatic nozzle lever — OFF or NO FLOW when fuel flow stops.

8. Fuel hose nozzle — Unlock and remove.

9. Filler cap — Secure.

10. Grounding cables — Disconnect.

11. Record on helicopter servicing records.

2-94. GRAVITY OR OPEN PORT REFUELING (POWER OFF AND RAPID).

1. Grounding cables — Connect.

2. Fireguard — Posted.

3. Filler cap — Remove.

4. Fuel servicing pressure — Check 125 psig maximum.

5. Closed circuit refueling module — Open.

6. Fuel hose nozzle — Insert into fuel cell receptacle.

WARNING

To prevent fuel spillage, exercise extreme caution when filling fuel cell, as there is no automatic shutoff of fuel flow.

7. Fill fuel cell.

8. Fuel hose nozzle — Remove.

9. Filler cap — Secure.

10. Grounding cables — Disconnect.

11. Record on helicopter servicing records.

2-95. ENGINE OIL SYSTEM SERVICING.

The engine oil system may be serviced at the oil tank reservoir. Access to filler cap of oil tank is located on right side, aft of the oil cooler. The oil level sight gage may be checked with the cowling installed through a small round window located on the left side of the helicopter and aft of the oil cooler (fig. 2-1). If oil level appears low and the engine has been shut down longer than 15 minutes the following steps shall be completed prior to servicing.

WARNING

If the following procedures are not followed prior to servicing the engine oil system, the opportunity exists to over service the system and allow an excessive amount of oil to accumulate within the accessory gearbox. This condition may cause aerated oil due to gear meshing and inadequate air-oil separation. This could result in a HIGH OIL TEMPERATURE ENGINE, LOW OIL PRESSURE ENGINE, and/or LOW OIL QUANTITY ENGINE indication/condition which if not properly diagnosed immediately will cause engine damage or possible engine failure.

1. Start and run helicopter until operating temperatures are within normal ranges.

2. Ensure battery is charged.

3. Shut down helicopter.

4. Recheck oil level.

2-96. TRANSMISSION OIL SYSTEM SERVICING.

The transmission oil system may be serviced by adding oil to the transmission through the transmission oil filler port, located on top of the transmission and forward of the mast.

CAUTION

DO NOT mix MIL-L-7808 and DOD-L-85734 oil except in an emergency. If oils are mixed, oil shall be drained and system serviced with approved oil within 5 hours of operation.

a. Check oil level by observing sight gage on the transmission. When checking oil level, ensure helicopter is parked on a relatively level area with engine shut down.

NOTE

When oil is visible in the yellow area of the sight gage, it is not required to service the transmission; however, if oil is not visible in the yellow area, add oil to center level of the sight gage.

b. Service with approved lubricating oil (table 2-1) and record on helicopter servicing records.

2-97. TAIL ROTOR GEARBOX SERVICING.

The tail rotor gearbox may be serviced through the oil filler port, located on top of the gearbox. Oil level may be checked by observing the sight gage, located on the aft, bottom part of the gearbox.

CAUTION

DO NOT mix MIL-L-7808 and DOD-L-85734 oil except in an emergency. If oils are mixed, oil shall be drained and system serviced with approved oil within 5 hours of operation.

a. Check oil level by observing sight gage on gearbox with helicopter parked on level ground with engine shut down. When properly serviced, the oil level will be in the center of the sight gage.

NOTE

Excessive oil leakage may occur if gearbox is overfilled. When servicing the gearbox, allow oil level to stabilize for correct indication on sight gage.

b. Service gearbox to normal capacity with approved lubricating oil (table 2-1) and record on helicopter servicing records.

2-98. HYDRAULIC OIL SYSTEM SERVICING.

The hydraulic reservoir may be serviced by removing the forward cowling, removing the hydraulic reservoir cover lock pin and adding hydraulic oil to the system at the hydraulic reservoir. The hydraulic oil level may be checked by observing the hydraulic reservoir sight glass (54, fig. 2-1) through a window located on the left side of the forward cowling.

a. Servicing. Check hydraulic fluid level by observing sight gage. Proper fluid level is when hydraulic fluid level is indicated by the sight glass being completely filled with fluid.

CAUTION

DO NOT mix MIL-H-5606 and MIL-H-83282.

b. Service hydraulic reservoir as required with approved hydraulic fluid (table 2-1). Record on helicopter servicing records.

2-99. GROUND HANDLING.

Two tow rings are provided on the forward portion of each landing gear skid for attachment of a standard helicopter tow bar. Helicopter is towed on ground handling wheel assemblies mounted on the landing gear skids.

NOTE

For installation requirements of access doors, panels, fairings, and covers for towing, refer to TM 1-1520-248-23.

2-100. PROTECTIVE COVERS AND TIEDOWNS.

Protective covers and tiedowns are furnished as loose equipment and are used for parking or mooring of helicopter. Additional equipment such as ropes, cable, clevises, ramp tiedowns, or dead-man tiedowns will be required during mooring.

a. Protective Covers.

(1) **Engine Inlet and Pitot Tube Cover.** Engine inlet protective covers and a pitot tube protective cover are provided to prevent entrance of dust, etc., into engine inlet and pitot system when helicopter is parked.

(2) **Engine Exhaust Ejector Protective Cover.** A single engine exhaust ejector protective cover is provided for the exhaust ejector to prevent foreign objects entering the exhaust ejector when the helicopter is parked. This cover slides into the end of the exhaust ejector.

b. Tiedowns. The main rotor tiedown kit for nonfolded blades consists of four sock assemblies and a wand. The nylon mesh sock assemblies include a removal loop tiedown line. Each tiedown line includes two tiedown rings and a snap hook. The wand is used to install sock assemblies on the main rotor blade tips. Install tiedowns as follows:

CAUTION

- **To prevent damage to main rotor blades or hub assembly, use only tiedown assemblies 406-070-300-101 and 406-070-301-101 and procedures described in this chapter.**
- **Maximum tiedown load applied vertically at the blade tip shall not exceed 60 pounds.**

(1) Position blades at 45 degree angle to fuselage to secure tiedown lines to forward and aft crosstubes. Blades may be rotated forward or rearward.

(2) Install sock on main rotor blade as follows:

NOTE

Securing rings are preadjusted to give forward and aft blades moderate tension when secured to the helicopter tiedown points. Tie down forward blades with tiedown assemblies that have flags labeled FWD BLADES, and aft blades with assemblies that have flags labeled AFT BLADES.

(a) With sock secured to wand, install sock on end of main rotor blade.

(b) After sock is installed, extend tiedown line to crosstube, pass snap hook around forward crosstube for forward blades and aft crosstubes for aft blades. Secure snap hook to rings.

(c) Install the remaining three socks in the same manner. All blades must be tied down when blades are being secured.

NOTE

The above procedure is for unfolded blades. Procedures for main rotor blade folding and securing folded blades is described in Chapter 1 of TM 1-1520-248-23.

2-101. MOORING HELICOPTER.

Mooring of helicopter shall be accomplished in accordance with TM 1-1520-248-23.

SECTION XVI. HELICOPTER SECURITY SYSTEM

2-102. HELICOPTER SECURITY SYSTEM.

Door locking devices and an ignition keylock switch are installed to prevent unauthorized use of the helicopter.

a. Left Crew Door Locking Devices. The left crew door is secured with a locking strap. The strap is fastened to the door frame at one end, looped through the door handle, then secured back to the door frame. This immobilizes the door handles and latching devices.

b. Right Crew Door Locking Device. The right crew door is locked from the outside with a hasp and padlock. The hasp is riveted to the door post and the padlock is inserted in the hasp.

c. Ignition Switch. An ignition switch is installed in the pedestal. When the switch is in the OFF position the starter circuit cannot be energized. In the ON position the switch allows normal operation of the starter circuit.

CHAPTER 3

AVIONICS

SECTION I. GENERAL

3-1. GENERAL.

a. This chapter covers the avionics equipment configuration. It includes a description of the avionics equipment, its technical characteristics, capabilities, and locations. For detailed information on the MFK and MFD, refer to Chapter 2, Section I. For mission avionics equipment, refer to Chapter 4, Mission Equipment.

b. Due to the operational connections among many of the avionics systems, some components 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 Chapters 2 and 4.

3-2. AVIONICS EQUIPMENT CONFIGURATION.

Refer to table 3-1, Avionics Equipment Configuration, for an avionics systems list.

3-3. POWER SOURCE.

Refer to Chapter 2, Section XI, Electrical Power Supply and Distribution System, for electrical power source information for each avionic component.

TABLE 3-1. AVIONICS EQUIPMENT CONFIGURATION

	NOMENCLATURE	USE	RANGE
1.	Communication System Control (CSC) C-11746/ ARC	Interphone for pilot and CPG, integrates all communication equipment, controls volume of all radios.	Stations within helicopter.
2.	VHF-FM Radio Set — AN/ ARC-186 (FM-1)	Two-way voice communication in frequency range of 30.000 to 87.975 MHz.	Line of sight.
3.	UHF-AM Radio Set — HAVE QUICK AN/ARC-164 (UHF)	Two-way voice communication in frequency range of 225.000 to 399.975 MHz.	Line of sight.
4.	VHF-AM Radio Set — AN/ ARC-186 (VHF)	Two-way voice communication in frequency range of 116.000 to 151.975 MHz.	Line of sight.
5.	HF Radio Set — AN/ARC-199 (HF)	Two-way voice communication in frequency range of 2.0000 to 29.9999 MHz.	Varies with ionospheric conditions.
6.	VHF-FM Radio Set — AN/ ARC-186 (FM-2)	Two-way voice communication in frequency range of 30.000 to 87.975 MHz.	Line of sight.

TABLE 3-1. AVIONICS EQUIPMENT CONFIGURATION (Cont)

	NOMENCLATURE	USE	RANGE
11.	**(CDS2)** KY-58-2 Communication Security Set — TSEC/KY-58	Provides secure two-way voice communication for UHF, VHF, or FM-2 radio.	N/A
12.	**R** KY-58-2 Communication Security Set — TSEC/KY-58	Provides secure two-way voice communication for VHF radio.	N/A
13.	KY-75 Communication Security Set — TSEC/KY-75	Provides secure two-way voice communication for HF radio.	N/A
14.	Transponder set — AN/APX-100	Transmits a coded reply for interrogator systems.	Line of sight.
15.	Radar Detecting Set — AN/APR-39A(V)1	Provides visible and audible warning in radar environment.	Line of sight.
16.	Radar Warning Set — AN/APR-44	Provides visible and audible warning in radar environment.	Line of sight.
17.	Laser Detecting Set AN/AVR-2A	Provides visible and audible warning of laser designating or ranging equipment.	Line of sight.
18.	**(CDS2)** Airborne Target Handover System (ATHS)	Provides two digital communication links through the radios to other compatible devices.	N/A

TABLE 3-1. AVIONICS EQUIPMENT CONFIGURATION (Cont)

	NOMENCLATURE	USE	RANGE
19.	Embedded Global Positioning System/Inertial Navigation System (EGI)	Measures pitch, roll, heading, angular velocity, linear velocity, and acceleration. Combines this information with position data provided by the GPS satellites.	N/A
20.	**R** Improved Data Modem (IDM)	Provides two digital communication links through the radios to other compatible devices.	N/A
21.	Infrared (IR) Jammer Countermeasures Set — AN/ALQ-144	Provides countermeasures against infrared heat seeking missiles.	Line of sight.

SECTION II. COMMUNICATIONS

3-4. COMMUNICATION SYSTEM.

The communication system provides two way communications between the crewmembers and allows the crew to communicate outside the helicopter through five communication radios. Radio selection and audio volume are controlled through the communication system control (CSC) panel (fig. 3-2). Radio selections are also made with the radio select switch located on the pilot collective control head (fig. 3-3). The channel and frequency to which each radio is tuned is displayed on the RFD (fig. 3-1). Setting the desired frequencies and modes into the radios is accomplished using the MFK and MFD. These procedures are described in detail later in this section. Communication security for the five radios is provided through two KY-58 units and one KY-75 unit. **R** Communication security for the five radios is provided through two KY-58 units for the UHF and VHF radios; one KY-75 unit provided for the HF radio and FM radio security is embedded into the AN/ARC-201D radio. All audio signals are transmitted and received through the crewmembers headsets. A ground crew ICS switch, labeled REMOTE ICS (fig. 3-4), is located on the lower pedestal console and a receptacle is located on each pylon and in the forward battery compartment to enable the crew to communicate with maintenance and armament personnel while the helicopter is on the ground. Refer to figure 2-1 for location of communication system antennas.

NOTE

(CDS4) The ARC-220 radio is the only HF radio recognized by CDS4 software. If ARC-220 is not installed on the helicopter, MFD displays that normally provide HF radio control or status will either have the applicable bezel legends blanked or, if a legend is present, the bezel will not function.

3-5. REMOTE FREQUENCY DISPLAY (RFD).

The RFD (fig. 3-1) is mounted in the upper center area of the instrument panel. The unit serves as a frequency display for the five communication radios. The screen displays the present channel number, frequency, and cipher or plain mode, and identifies to which radio each crewmember is tuned for transmission. The RFD is tied into the MFDs and the MFK through the MCPUs. Plain or cipher modes are selected for the transceiver currently set for transmitting by the pilot or CPG CIPH switch (3) located on either side of the RFD screen. The display screen (4) is a liquid crystal display that is readable under all lighting conditions and is NVG compatible. Lighting of the display is controlled by a BRT (brightness control) knob (6) located on the left side of the unit face. A TEST switch (5), located on the lower right portion of the RFD, has two functions: changing input from one MCPU to another and providing evidence of proper RFD display. In the event of an MCPU failure, press the TEST switch to provide alternate MCPU inputs to the RFD. This function is provided as a backup in the event of one MCPU failure.

3-6. COMMUNICATION SYSTEM CONTROL (CSC) PANEL.

a. Description. Two CSC panels are located in the helicopter. The pilot CSC panel is located on the lower pedestal console and the CPG CSC panel is located on the extreme left side of the instrument panel. The CSC panels are used in conjunction with the RFD (fig. 3-1). See figure 3-2 for a detailed description of CSC panel controls.

b. Controls and Function. Refer to figure 3-2 for controls and functions of the CSC panel.

c. Operation. During battery start, with the battery switch in BATT 1 position and the ESNTL BUS switch in START, power is applied to the CSC units and FM-1.

(1) Power is supplied to the other four radios and COMSEC units when one of the following occurs:

(a) The DC generator comes on line.

(b) External DC or AC power is applied.

(c) When battery power only is used and the ESNTL BUS switch is set to the RUN position.

NOTE

Ensure that the MIC switch is in the proper position for the type of microphone being used.

(2) Press in all required RADIO MON knobs to activate the audio of the communication radios and adjust volume as desired. During prestart, if hands off communications are required between crewmembers, place the rotary switches of both CSC panels in the HOT MIC position (fig. 3-2) or the VOX ON position may be selected. For normal intercom operations, place the rotary switch to the NORM position and set the transmit selector switch to the ICS position. This will allow intercommunications with the cyclic transmit or floor mike switches.

(3) The maintenance crew stations at the nose and left and right pylons are monitored at the pilot and CPG stations when the CPG rotary switch is in NORM, HOT MIC, or VOX ON position. Placing the CPG rotary switch to the ICS OFF position turns off the audio from the crew station. Audio volume of the intercom system is controlled with the VOL knob of each CSC panel.

(4) Transmitting functions for the pilot and CPG crew stations differ. The pilot has the option of selecting a radio for transmit by use of the transmit selector switch on his CSC panel (fig. 3-2) or the radio select switch on his collective control head (fig. 3-3). The CPG can only select radios for transmit with the transmit selector switch on his CSC panel.

(5) Selecting a radio for transmit selects the frequency displayed on the RFD screen (fig. 3-1) for the corresponding radio number. Tuning the selector switch to 1, 2, 3, 4, or 5 sets the pilot to transmit on the corresponding radio when either the cyclic transmit switch is pressed to the full detent or the floor mike switch is pressed.

(6) Radios may be selected for transmit using the radio select switch on the pilot collective control head (fig. 3-3).

3-7. CSC SWITCHES — PILOT COLLECTIVE CONTROL HEAD.

a. Description. There are two switches on the pilot collective control head that are tied into the communication system. These switches give the pilot the ability to select radios without removing hands from flight controls. These switches are the CHAN select switch and radio select switch.

b. Controls and Functions. Refer to figure 3-2 for functions of the CSC switches on the pilot collective control head.

c. Operation. The operation of these switches is covered in detail in the procedural step sections for each radio beginning with paragraph 3-10.

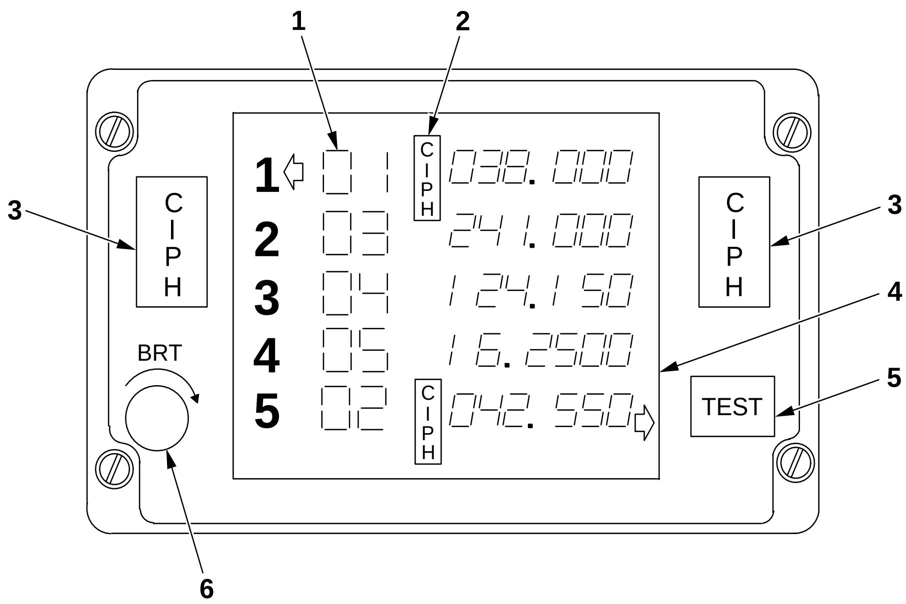
3-8. TRANSMIT SWITCHES AND SELECT KNOB — PILOT/CPG CYCLIC GRIP AND FOOT OPERATED.

a. Description. There are two switches on the pilot cyclic grip that are tied into the communication system. The DSPL SEL switch allows the pilot to call up the COMM or FREQ pages on the MFD without taking his hands off the controls. The ICS/RADIO switch is used for transmitting on the intercom or radios. The CPG cyclic is equipped with the same ICS radio switch. The function of these switches is covered in figure 3-5. A foot-operated mike switch (pilot and CPG) is located at each side of the center console, between the center console and cyclic control stick. The depressed position of the foot-operated switch keys the radio or interphone selected.

b. Controls and Function. Refer to figure 3-5 for functions of the ICS/RADIO switch and DSPL SEL switch on the pilot cyclic grip.

3-9. AUDIO DISTRIBUTION UNIT (ADU).

The audio distribution unit is located in the avionics compartment forward of the fuel cell above the Embedded Global Positioning System/Inertial Navigation System (EGI) unit and provides distribution of all radio and ICS audio signals. The ADU interfaces with the Control Display Subsystem (CDS), COMSEC, and ATHS/(IDM). Circuit protection is provided by a circuit breaker located in the overhead circuit breaker panel. In the event of an ADU failure, an ADU FAIL CAUTION message is displayed on the MFD and the only communication that may be available is through FM-1 radio. All warning, caution, and advisory audio is also disabled.



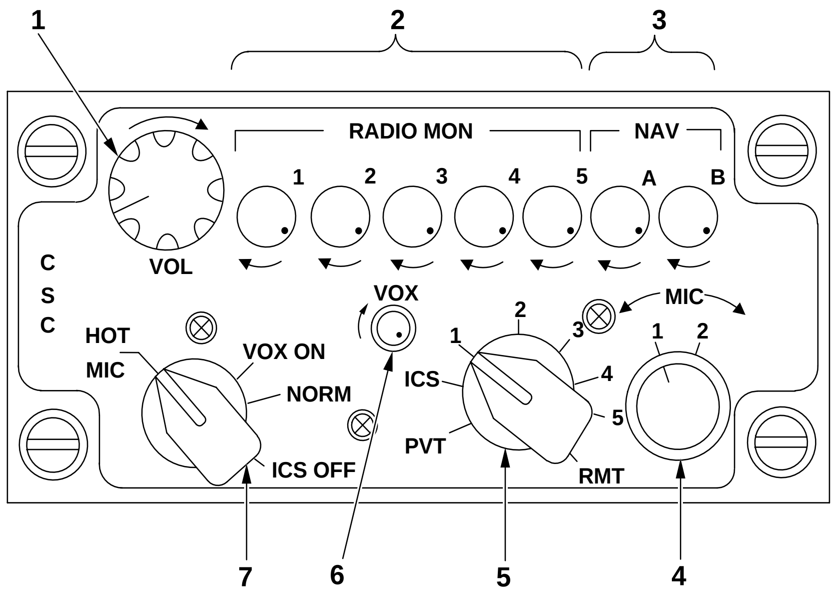
CONTROL/INDICATOR	FUNCTION
1. Channel indicator	
M1-M5	Indicates manual frequency selected and the radio number it is assigned to.
01-17	Indicates channel selected, channels are assigned 17 per radio. HF has 9 transmit and 9 receive channels.
C	Indicates cue frequency selected on FM-1 or FM-2 when an AN/ARC-201 is installed.
FH	Indicates frequency hopping.
AJ	Indicates anti-jam mode.
EM	Indicates emergency mode.
FS	Indicates frequency scan.

Figure 3-1. Remote Frequency Display (RFD) (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
2. CIPH Indicator	Appears adjacent to frequency when CIPH mode is selected. CIPH deletes from display when CIPH mode is deselected.
3. CIPH switches	When the upper left switch is pressed, the transceiver controlled by the CPG becomes encoded. When the upper right switch is pressed, the transceiver controlled by the pilot becomes encoded. CIPH deletes from display when cipher mode is deselected.
4. Display screen	Displays channel and frequency to which each radio is tuned. Arrows indicate which radio each crewmember has selected for transmit.
5. TEST switch	Momentary pressing changes input from one MCPU to the other. Holding the switch down will display a test pattern to confirm proper operation of the display.
6. BRT control rheostat	The rheostat is labeled BRT. Turning the BRT control knob in a clockwise direction increases the back-lighting intensity. Turning the BRT control knob in a counterclockwise direction decreases the back-lighting intensity.

Figure 3-1. Remote Frequency Display (RFD) (Sheet 2 of 2)



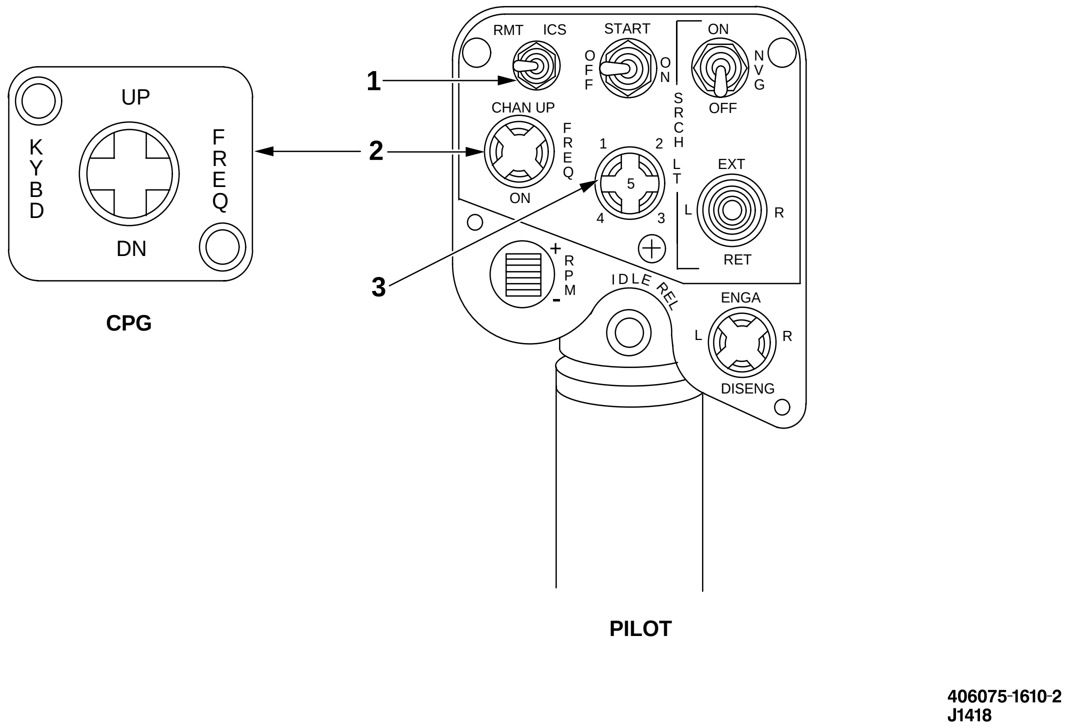
CONTROL/INDICATOR	FUNCTION
1. VOL control knob	Rotating volume control knob regulates audio output level of the ICS. Turning the knob clockwise increases volume, counterclockwise decreases volume.
2. RADIO MON switches	Control audio signal of communication radios to the crewmember headsets, 1 (FM-1), 2 (UHF), 3 (VHF), 4(HF), 5 (FM-2). Pushing knobs in turns audio to associated, radio ON. Pulling outward turns audio OFF. Turning knobs clockwise increases volume, counterclockwise decreases volume.
3. NAV switches	A. Controls audio volume of ATAS signal. B. Adjusts radar warning and laser detection audio volume R B. Adjusts TACAN audio volume.
4. MIC switch	When dynamic mike is being used, this switch is to be used in the “1” position. When the tempest mike is being used, this switch is to be used in the “2” position.

Figure 3-2. Communication System Control (CSC) Panel (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
5. Transmit selector switch	Controls radio transmission of the respective crewmember. The PVT position is not connected. The ICS position allows intercommunication with the use of the cyclic transmit switches or floor mike switches. Position 1 through 5 allows transmission on the respective radio when the cyclic transmit switch is pressed to full detent or when the floor mike switch is pressed. RMT position has no function on CPG ICS. R If the pilot ICS is in the RMT position, the five-position radio select switch on collective becomes a hands-on way of selecting a radio.
6. VOX Control	Allows adjustment of threshold required to transmit while operating in VOX on.
7. Rotary Switch	
HOT MIC	Allows hands off communication.
VOX ON	Allows voice activated communication.
NORM	Allows normal communication with both CSC panels set to NORM.
ICS OFF	Two-way cockpit communication is disabled.

Figure 3-2. Communication System Control (CSC) Panel (Sheet 2 of 2)



CONTROL/INDICATOR	FUNCTION
1. Communication RMT/ ICS switch (Not installed on R helicopters)	A two-position switch that allows the pilot two ways of selecting the radio that is to control transmission. In the RMT (remote) position, transmitter selection is controlled with the radio select switch on the collective control head. In the ICS position, transmitter selection is controlled with the transmit selector switch of the CSC control panel. Communication radios cannot be monitored with RMT/ICS switch in RMT position and transmit selector switch in PVT or ICS position.
2. CHAN select switch — Pilot collective head and CPG CSC panel	A four-position, center spring-loaded to neutral switch that works in conjunction with the MFD, MFK, and RFD. Pressing the switch to the CHAN UP position changes the channel number and frequency of the radio currently selected for transmitting to the next higher channel and frequency stored on the frequency list. If the COMM page is being displayed, pressing the switch to the right or FREQ position, brings up the Frequency page with channel numbers and call signs for the selected radio on the MFD.

Figure 3-3. CSC Switches (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
	Pressing the switch to the DN (down) position changes it to the next lower channel and frequency stored.
	Pressing the switch to the left, or KYBD (keyboard), position activates the keyboard, if a manual frequency is currently selected on the RFD, to allow the entry of manual channels and frequencies for the radios selected for transmitting.
3. Radio select switch	A five-position switch that is used to select a radio for transmit. Pressing to the 1 (upper left) position selects FM-1, 2 (upper right) selects UHF, 3 (lower right) selects VHF, 4 (lower left) selects HF, and pressing straight down on 5 (center position) selects FM-2. As a radio is selected, an arrow will appear beside the frequency of that radio on the MFD. This arrow will point to the right or left indicating that the pilot or CPG respectively is selected to transmit on that radio.

Figure 3-3. CSC Switches (Sheet 2 of 2)

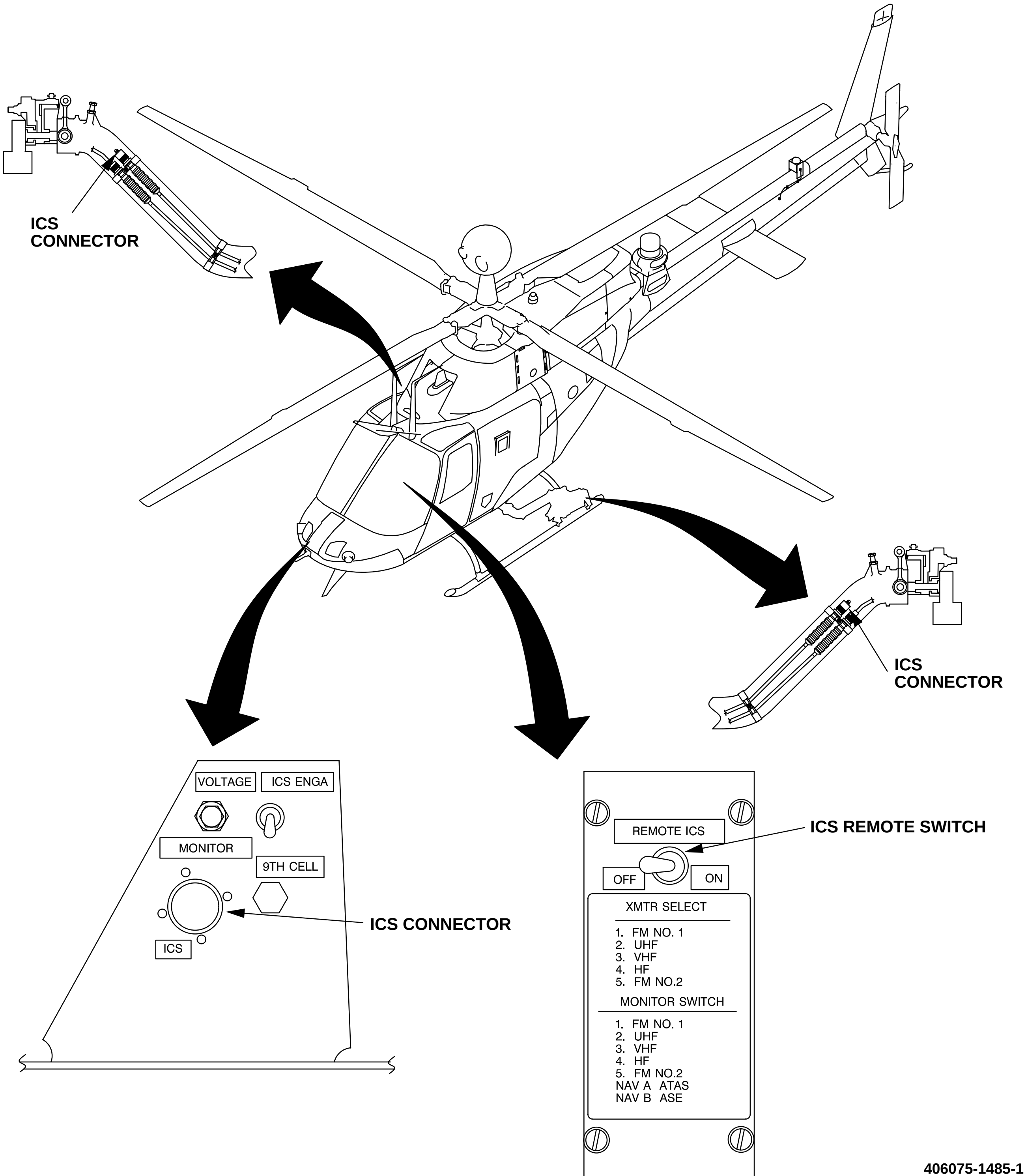
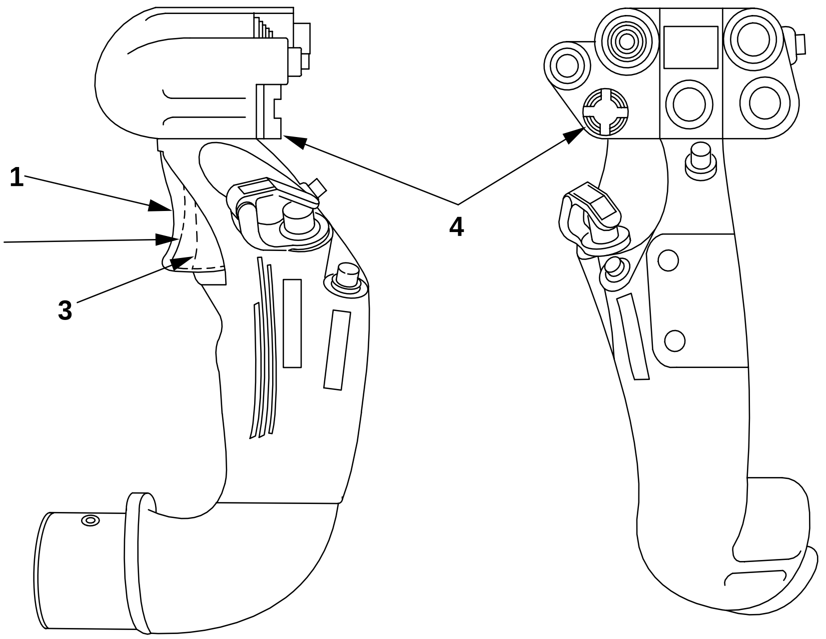


Figure 3-4. R Ground Crew ICS Switch and Receptacles



CONTROL/INDICATOR	FUNCTION
1. ICS/RADIO switch — Normal position	No transmitting; interphones function only when HOT MIKE switch is ON (fig. 3-2), or if the VOX ON has been selected.
2. ICS/RADIO switch — First detent	Keys interphones only, regardless of position of transmit selector switch.
3. ICS/RADIO switch — Full detent	Transmits on radio selected for transmit on CSC or radio select switch on pilot collective control head (fig. 3-3).
4. DSPL SEL switch (pilot cyclic only)	Four-position, center spring-loaded switch that changes Display pages between COMM/FREQ (right), VSD/HVR (left), HSD/FPLN (down), and MMS (up).

NOTE

Operation of CPG cyclic transmit switch is identical.

Figure 3-5. Pilot Cyclic Grip Communications Switches

3-10. RADIO OPERATIONS — FM-1, FM-2, HF, VHF, OR UHF RADIOS.

The following pages of this section contain procedures for operation of the five communication radios. The operation of each radio is covered under one generic procedure except where operation may be unique to a particular radio.

3-11. HAVE QUICK RADIO SET AN/ARC-164.

a. Description.

The UHF/AM Radio set is produced in two versions: the basic HAVE QUICK (basic HQ) and HAVE QUICK II (HQ II). HAVE QUICK series radios provide a jam-resistant capability for air-to-air and air-to-ground communications. Operation in the Anti-Jamming (AJ) mode is accomplished using synchronized precision clocks, programmed frequency switching patterns, uniform frequency hop rates, and common entry into the net. The various versions retain the standard single frequency UHF voice/digital normal (NORM) mode of operation and are backwards compatible. HQ II is an improvement on the basic HQ radio using most of the same components. The new system was designed to counter the near-term jamming threat, correct known deficiencies in the basic HQ system and enhance the radio's operability. HQ II provides the following improvements:

1. Makes more frequencies available for hopping.
2. Provides more uniform frequency distribution.
3. Corrects the problems of midnight madness and net rollover.
4. Improves compatibility with Vinson systems (KY-58).
5. Adds date information to the Time-of-Day (TOD).
6. Adds capability for electronic insertion of the Multiple-Word-of-Day (MWOD).

The HQ II is compatible with the basic HQ radio. The HQ II is a dual modification consisting of the non-NATO and NATO radios. The non-NATO radio provides the six improvements listed above. The NATO radio has these improvements plus electronic fill capability.

There are three ways of identifying the HQ II from the basic HQ Radio/Transmitter (RT):

(1) The HQ is an RT-1145F. The HQ II is an RT-1614.

(2) On the UHF Radio Control page (fig. 3-6) the word DATE will be displayed at L-3 directly above the WOD/NET.

(3) The NATO radio has a fill connector on the face of the radio.

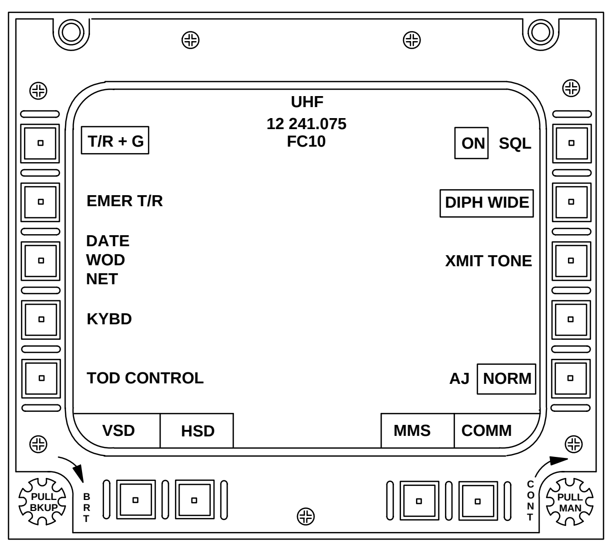
b. Operation.

Common frequencies must be entered into all HAVE QUICK radios. Time synchronization is provided to the radio by an external time distribution system. A Time-of-Day (TOD) signal must be received from the time distribution system or EGI each time the radio is turned on. The hopping pattern and hopping rate are determined by the aircrew inserted Word-of-Day (WOD) basic HQ or Multiple-Word-of-Day (MWOD) HQ II. The WOD/MWOD is a multi-digit code, common to all HAVE QUICK UHF radios of the same version in the same net. Prerequisites for AJ mode operations are as follows:

(1) Common frequencies (Hopset).

(2) Time synchronization (TOD).

(3) Common hopping pattern (TSK).



406075-732
J0546

Figure 3-6. UHF Radio Control Page — HQ

(4) Common hopping rate (Speed).

(5) Common net identification (NET).

NOTE

- An HQ II radio can accept a basic HQ WOD; however, a basic HQ radio cannot accept an MWOD (backwards compatibility).
- A communications channel, in the AJ mode, is defined by a net number (NET) instead of a single frequency as in the NORM mode.
- T/R+G GUARD monitor is operational during AJ operation. To transmit on GUARD frequency select NORM and EMER T/R or press MFK EMER button.

The UHF HAVE QUICK radio series must be initialized before operating in the AJ mode. This consists of entering the WOD/MWOD, TOD, and NET data. WOD/MWOD is entered by accessing the COMM page (fig. 3-7) then selecting the UHF Radio Control page (fig. 3-6). WOD/NET or DATE/WOD/NET will be displayed at L-3. WOD/NET denotes basic HQ or DATE/WOD/NET denotes HQ II.

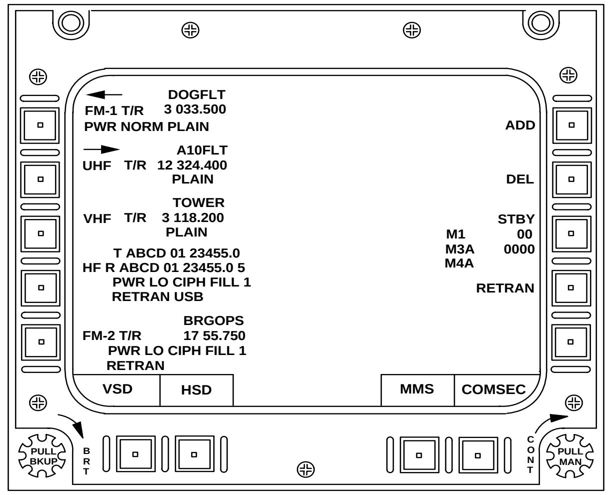
NOTE

In HQ II the DATE information (numeric calendar day-of-month) must be entered first. The WOD/MWOD instructions/frequencies are entered in the six preset channels; 20 through 15. After completion of the WOD/MWOD entries the cursor will move to the NET position. At that point NET number/instructions may be entered.

The universal time-of-day (TOD) is normally entered before flight, but it is possible to enter it in flight. Momentary depression of the TONE key transmits the timing synchronization information (1167 Hz tone) in both NORM and AJ modes from a radio with TOD. Continued depression of the TONE key will cause generation of a 1020 Hz tone following the TOD signal. A complete TOD message is transmitted in the NORM mode. An abbreviated time synchronization update is transmitted in the AJ mode. TOD is also available from EGI by using the EGI sync feature.

NOTE

During IDM operations on a HAVE QUICK net baud rate should be 600 or less, block should be double and preamble should be 3.0 or higher.



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J0546

Figure 3-7. COMM Page

The HQ II allows selection of two separate groups of 1,000 nets. Both groups of nets are referred to as frequency managed A-nets or FMA-nets.

The expanded memory board (EMB) modification will accept up to six days of word-of-day (WOD) creating a multiple-word-of-day (MWOD). EMB radios will automatically reset themselves to the next day's key when operated past 2400 hours ZULU.

The HQ II system has the same conferencing options as the basic HQ radio. This option is determined by the WOD element in Channel 19 instead of the NET number. All training and combat WODs are configured to have conferencing available.

NOTE

Conferencing must be disabled for digital and secure traffic.

NET SELECTION: The last two digits tell the radio how it is to function. The following are examples of combat nets:

00 — Operate as a basic HQ

25 — HQ II NATO Hopset

50 — HQ II non-NATO Hopset

75 — Not Used (Interrupted Fault Tone).

The following are examples of training nets:

00 — Basic HQ Training

25 — HQ II Training

50/75 — Not Used (Fault Tone).

Additional information is required for which WOD to use on a particular day. Successive pressing of the L-3 key will cause the cursor to toggle between DATE, WOD, and NET. Since the HQ II WODs are identified by a specific date, the radio must have the current date entered into the system. This information can be entered in two ways:

1. Insert the current day, using the MFK, to the right of the DATE and press the ENTER key on the MFK.

2. Receive a HQ II TOD which contains date information.

In the training mode, the HQ II can hop on 16 frequencies which provide 16 NETS for training use. These NETS are called frequency managed training nets or FMT-nets. These frequencies are stored in non-volatile memory in the RT and need only be loaded once. Aircrews now use command codes to load WOD information into the RT processor. This allows insertion of MWODs. The WOD 20 with cursor must be displayed when entering one of these command codes at L-3. Input the command code selected at WOD 20 to the scratch pad and press the ENTER key.

VERIFY/OPERATE — Allows the radio to be placed in the OPERATE mode and enabling radio communication. If the radio is in a mode other than OPERATE, you will not be able to transmit in either NORM or AJ modes. To check if a particular day's WOD has already been loaded into the radio, press L-3 and toggle the cursor to DATE. Using the MFK, enter the numerical date (07) followed by the letter V (07V) and press the ENTER key.

3-12. ENTERING WOD/MWOD INTO UHF HAVE QUICK RADIOS.

If all users in the UHF NET are HAVE QUICK equipped, you are the first operator of the day and there are no Combat WODs loaded, accomplish the following:

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) will display.

2. UHF key or collective frequency select switch if UHF is selected — Press. UHF radio frequency list will display (fig. 3-8).

3. R-5 key — Press. UHF Radio Control page (fig. 3-6) will display.

4. DATE/WOD/NET key — Press. Cursor will display to right of DATE.

NOTE

Basic HQ radio will have no date entry function and only one set of WODs.

5. Enter two-digit date using MFK — Numbers will appear to right of DATE.

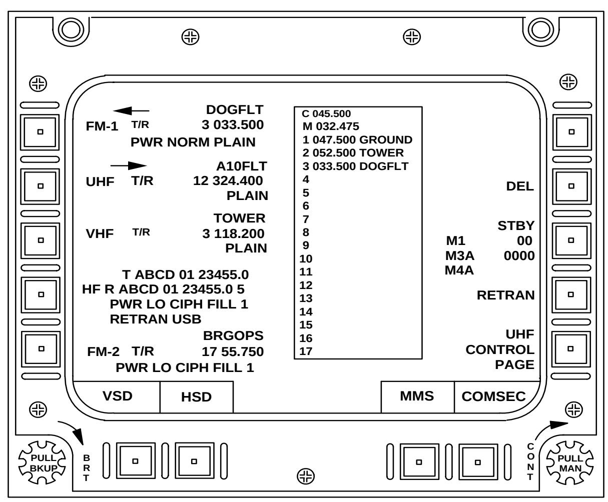


Figure 3-8. COMM Page (Frequency List Displayed)

6. ENTER key on MFK — Press. Display will blink, 20 will appear to right of WOD and cursor will be displayed to right of 20.

NOTE

- This indicates acceptance of the date tag by the radio.
- WOD channel storage is not the same as the preset channels for other radios stored in the non-volatile memory of the MCPU. The WOD/MWOD is stored directly into the UHF HAVE QUICK radio.
- The hundredths/thousandths digits in the channel 20 WOD element programs the frequency hop rate with 00 being the slowest and 75 being the fastest.
- WOD/MWOD instruction for IDM data transmission must end in .X00 or .X25.

7. Using MFK, enter WOD 20 frequency — WOD 20 data entered and channel number decrements to 19 with a beep denoting acceptance of 20 data.

NOTE

- The NET number/instruction combination follows: NET identification is the ones and tens to the left of the decimal and the ones to the right (00.0XX); the ability to utilize conferencing is the tenths and hundredths to the right (XX.X00). 00, 50, and 75 enable conferences, 25 disables conferencing.
- IN HQ II, the conferencing capability is controlled with the Channel 19 frequency/ instruction. Conferencing instructions are the same as HQ BASIC (tenths and hundredths to the right of the decimal) with 00, 50, and 75 enabling and 25 disabling.

8. Using MFK enter WOD data — A beep will be heard after each entry thru 15, where a double beep will denote a complete WOD acceptance. The cursor will move to the DATE line with the next consecutive date displayed. If the date displayed is acceptable, pressing the MFK ENTER key will move the cursor to the WOD line and the process is repeated with the new WOD until all WODs are entered.

NOTE

If fewer than six (6) WOD/MWODs are desired — press MFK ENTER key twice and cursor will move to net.

9. Using MFK enter NET data — NET data will appear to right of NET. Upon entry of data, cursor and date will be removed from MFD to storage in the RT.

10. KYBD — Press. Cursor will appear to right of L-4. Using MFK enter frequency on which TOD signal is transmitted. Reference RFD (fig. 3-1) or select frequency from preset channels on display.

NOTE

If automatic TOD signal is available, press TOD SYNC; if predetermined time is used, press TOD SYNC 5 seconds prior; in all other situations call for TOD on designated frequency and press TOD SYNC. If a tone is not heard within 60 seconds, repeat process.

11. TOD SYNC — Press. Listen for a tone denoting synchronization.

12. BAND — Press. Selects one of four phases DIPH WIDE, BASE WIDE, BASE NAR, or DIPH NAR for conferencing.

NOTE

- In the AJ mode, selecting certain net numbers causes the bandwidth to automatically go to narrow.
- If digital data is to be transmitted in the AJ mode, 00 or 25 speed is to be selected with the bandwidth in narrow.

13. AJ/NORM — Press. Select AJ boxed. DATE followed by a cursor will appear. Enter the date desired and press the MFK ENTER key. RFD UHF will display AJ with the NET

number. The DATE function is not available with basic HQ.

NOTE

- A solid tone indicates time synchronization was not accomplished or volatile memory not loaded; cycling tone indicates not in AJ mode or lack of 0's in tens and ones.
- A short, high-pitched tone followed by a low-pitched tone indicates the presence of TOD.

3-13. EMERGENCY START-UP OF TOD CLOCK (SELF-GENERATED TOD).

NOTE

WOD must be loaded prior to emergency start of TOD clock. Self-generated TOD limits users to communications in AJ mode among individuals who received their TOD from the self-generated unit.

1. Load WOD.
2. On MFD with UHF Radio Control page displayed (fig. 3-6) TOD CONTROL key — Press. SELF TOD key (fig. 3-9) — Press.
3. Press XMIT TONE key — Dual frequency should be heard in headset.

NOTE

No tones will be heard when the TOD is generated. To preclude an inadvertent transmission of this new time, release the TONE key prior to releasing the TOD SYNC key. Transmit this TOD signal to any other radio requiring mutual communications in the AJ mode.

3-14. EGI TOD TRANSFER.

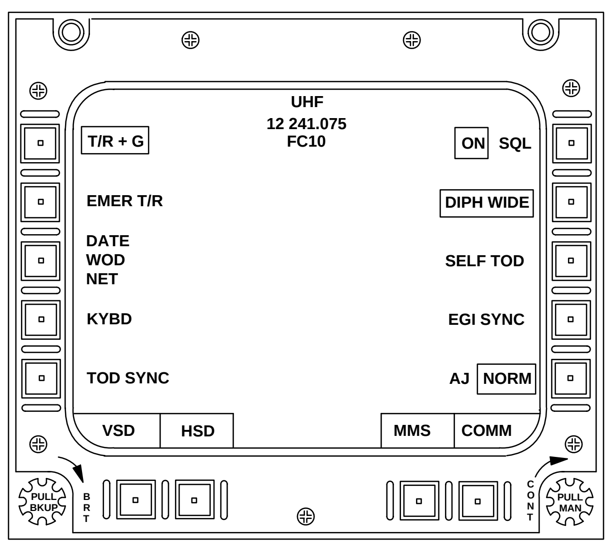
On the UHF Radio Control page (fig. 3-9), R-4 initiates the transfer of Precision Time/Time Increment data from the EGI to the UHF HAVE QUICK radio. The transfer requires approximately 3 seconds to complete and is indicated by the legend EGI SYNC being boxed.

NOTE

- While an EGI TOD transfer is in progress, the TOD sync function and the AJ/Normal mode control are disabled. Both functions are restored to normal operation when the EGI TOD transfer is completed.
- The EGI TOD transfer function is disabled if the EGI time is invalid or inaccurate.
- The EGI TOD transfer function is disabled if EGI is a NOGO or AJ mode is active.

3-15. TOD RECEPTION NORM MODE.

1. AJ/NORM key — Press. Select NORM boxed.
2. RFD UHF frequency — Display frequency TOD is being transmitted on.
3. TOD SYNC key — Press. A dual tone (1167 Hz changing to 1020 Hz) will be heard upon receipt of TOD.



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J0546

Figure 3-9. UHF Radio Control Page — HQ

3-16. AN/ARC-201 SINCGARS VHF-FM RADIO.

The AN/ARC-201 Single Channel Ground and Airborne Radio System (SINCGARS) provides single channel and frequency hopping in the VHF/FM band 30.000 to 87.975 MHz in 0.025 MHz intervals. The AN/ARC-201 is a remote controlled receiver-transmitter (RT) used in MIL-STD-1553B data bus aircraft. The RT is controlled by the aircraft control and display system (CDS). Provisions for two radios (FM-1 and FM-2) are provided in the aft electrical compartment. The single channel mode provides normal VHF/FM operation for voice, digital and secure communication in conjunction with KY-58 VINSON equipment. FH mode is used to counter enemy jamming and directional finding equipment through a Data Rate Adapter (CD-3885/ARC-201(V)). Operation of the data rate adapter is automatic with no operator interface. The SINCGARS radios are powered by the 28 Vdc essential bus and circuit protection is provided by the FM-1 and FM-2 circuit breakers.

NOTE

When replacing the AN/ARC-186 radio with an AN/ARC-201 FM radio, a CV-3885 Data Rate Adapter must also be installed.

3-17. AN/ARC-201 SINCGARS SINGLE CHANNEL OPERATION.

Operation of the AN/ARC-201 VHF FM radio is controlled from the FM-1 — FM-2 Radio Control page (Fig. 3-10). The area at the top of the Control page displays radio status information on four lines. The first line provides the title of the page FM-1 or FM-2. The second line indicates whether the radio is in RETRANS or blank. The third line displays the channel number and associated frequency. The fourth line displays the six character identifier for that channel.

NOTE

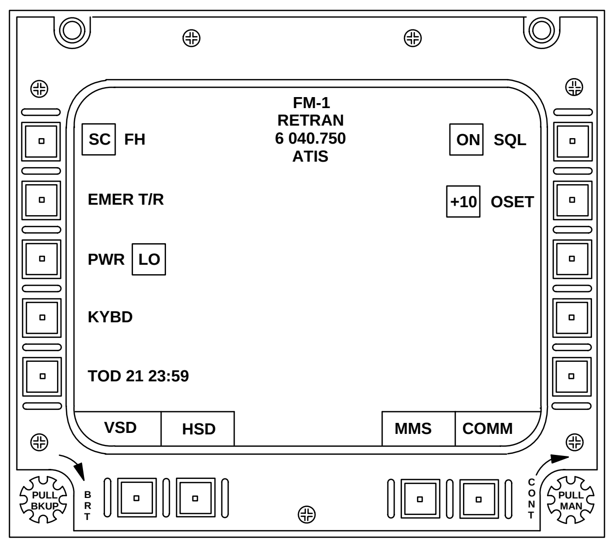
After power is applied to the SINCGARS AN/ARC-201 radio, line address keys are unusable for approximately 1 minute while the radio does self-test and frequency preset initiation.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.
2. L-1/L-5 — Press to select FM-1 or FM-2 and frequency list (fig. 3-8).
3. R-5 — Press to select FM-1 or FM-2 Radio Control page (fig. 3-10).
4. SC/FH key — Press to select single channel — SC.
5. EMER T/R key — Toggles between current frequency and emergency frequency 40.50.
6. PWR key — Press to select IFM power level: NORM, LO, MED, HI.

NOTE

The IFM HI power setting cannot be selected until enabled from the Ground Set-Up page.

7. KYBD key — Press to activate MFK for entering radio channels from frequency list or manual frequencies.
8. TOD key — No function in SC.
9. SQL key — Toggles squelch between on and off.



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J0546

Figure 3-10. FM-1 — FM-2 Radio Control Page (SC Mode)

10. OSET key — Used to select a frequency offset for current preset or manual frequency. OSET may be required when dissimilar radio sets are being used and local interference is encountered. OSET is not normally used and should be set to 0. Options available are 0, +5, -5, +10, -10. Offsets are in kHz. For example, 50.400 would become 50.405 if +5 were selected.

3-18. AN/ARC-201 SINCGARS FREQUENCY HOPPING OPERATION.

1. The frequency hopping (FH) mode is an electronic counter-countermeasure (ECCM) technique used to counter enemy jamming and direction finding equipment. The receiver transmitter (RT) changes frequency more than 100 times per second. It can hop among 2320 individual frequencies. Both the transmitting and receiving FH radio jump in an identical sequence. In order to function in the FH mode the RT needs the following data:

   a. Transmission Security (TSEC) variable. This variable determines sequence of frequencies. This variable can only be loaded via the fill connector on the radio set in the aft electrical compartment and will not be transmitted with the Electronic Remote Fill (ERF).

   b. FH sync time, to synchronize the transmitting and receiving radios. This time is established by the master net control station and is received with the ERF. When aircraft power is turned off, the RT clock is kept running for 24 hours. After 24 hours, the clock is turned off to preserve the holding battery life. All fill data is retained (TSEC variable, hopset and lockout sets).

NOTE

Fill batteries for the AN/ARC-201 are located on top of the unit requiring removal to replace. The batteries (BA 5372) are the same as the KY-58 fill batteries. Problems can arise tuning stored HSET/LSET frequencies (indicated by the text XXX NO HSET or XXX ERR) when weak batteries are installed.

   c. A hopset (HSET) to identify the frequencies used by the net. Hopset is received/transmitted with the ERF.

   d. Lockout set (LSET), if required, to identify frequencies that will not be used by any nets. Received/transmitted with the ERF.

   e. A net identification (ID) to determine a start point for frequency hopping (e.g., 310 or 350). Received/transmitted with the ERF.

2. In the FH mode the audio signal is converted into a digital data stream prior to being transmitted. The data stream is interleaved (transmitted out of sequence). This spreads the signal over several frequency hops and reduces the degradation that could be caused by jamming. At the receive end, the process is reversed to recover the original audio. When the RT is first keyed, a synchronizing signal is transmitted prior to the interleaved message. When the receiving RT detects the signal, it decodes it and adjusts its timing circuitry with the transmitting RT. When the transmitting RT is unkeyed, an end of message code is sent twice. This tells the receiving RT to return to its passive receive or idle mode. While in this idle or passive mode the RT searches for the synchronizing signal at the beginning of a transmission. When an RT receives a message, it automatically adjusts its clock toward the transmitting RT clock. This adjustment can be a maximum of one-half second for each received message. The normal search procedure allows the receiving RT clock to be off by plus or minus 4 seconds and still be in sync. When the late entry mode is selected, the search procedure is changed to permit a plus or minus 59 second difference. Late entry sync data is included with the regular synchronizing signal at a maximum of once every 30 seconds for the net. The RT also checks the cue frequency during passive receive for any activity. When an RF signal with a 150 Hz squelch tone on the RF cue frequency is detected, an advisory FM-1 cue or FM-2 cue will appear. This procedure will allow a station to alert a frequency hopping net to step down to single channel to make contact.

3. The Net Control Station (NCS) uses the frequency hopping-master or CONTROL mode. It differs from FH MEMBER in two

ways. The NCS is the time standard for the net, and the NCS RT is the only one that can transmit ERF data. The NCS RT does not adjust its clock with a received message. When the NCS is an active net number, all the net member RT clocks will be synchronized with the NCS RT clock. All the required FH data, except the TSEC variable, may be sent from the NCS to net members using ERF. A typical net opening will use the cold start procedure. Operation in the cold start mode is the same as normal FH operation except that the RT hops on a single frequency. The frequency used is the one in the SC manual frequency (M1/M5).

3-19. AN/ARC-201 SINCGARS FREQUENCY HOPPING CONTROL PAGES.

Operation of the AN/ARC-201 VHF FM radio in the frequency hopping (FH) mode is controlled from the FM-1 — FM-2 Radio Control page (fig. 3-11). The area at the top center of the page displays radio status information on four lines. The first line indicates which radio, FM-1 or FM-2, is selected. The second line indicates whether the radio is in the RETRANS mode or is blank. The third line displays channel number, the legend NET, and the three-digit net identification. The fourth line will indicate CONTROL or MEMBER as selected on FM-1 Radio Control page 1. NO TSEC will display on this line if no TSEC variable has been loaded and stored.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.

2. L-1/L-5 — Press to select FM-1 or FM-2 and frequency list (fig. 3-8).

3. R-5 — Press to select FM-1 or FM-2 Radio Control page 1 (fig. 3-11).

4. SC/FH key — Press to select frequency hopping (FH).

5. TOD key (L-5) — Press to display the time of day (TOD) currently in the radio along with a cursor. The TOD displayed may be retained by pressing ENTER on the MFK. Otherwise, enter a new TOD by entering the day, hour, and minutes in the format DDHHMM (e.g., 231430). Pressing ENTER on the MFK starts the internal clock, and should be done as accurately as possible according to unit SOP (local or zulu time). When entered the time will be removed from the display. TOD will be received from the Net Control Station (NCS) with the ERF.

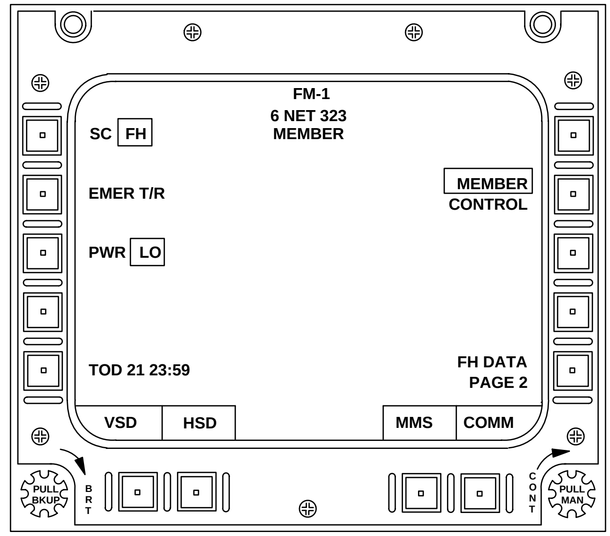

Figure 3-11. FM-1 — FM-2 Radio Control Page 1 (FH Mode)

NOTE

(CDS3/CDS4) If the EGI is powered up and has acquired a satellite, FM-1 and FM-2 can obtain ZULU time by typing a TOD of 00 00:00 on the MFK and pressing ENTER. Pressing TOD again will cause the radio to display the correct ZULU time.

6. MEMBER/CONTROL key (R-2) — Toggles between MEMBER and CONTROL. If MEMBER is selected, the radio will be a member of the FH net. If CONTROL is selected, the radio will be the controller/NCS. Only one controller/NCS should be operating per net.

7. FH DATA PAGE 2 (R-5) — Only available in FH mode. Selects FM-1 or FM-2 Radio Control page 2 (fig. 3-12 and 3-13), which is used to enter initializing data for the RT in the FH mode.

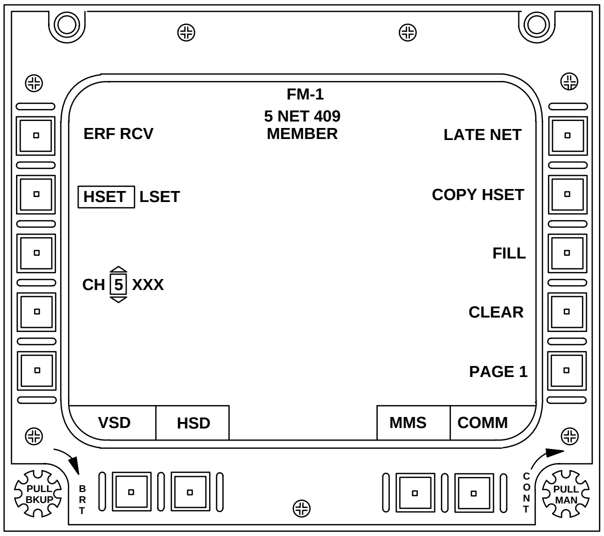

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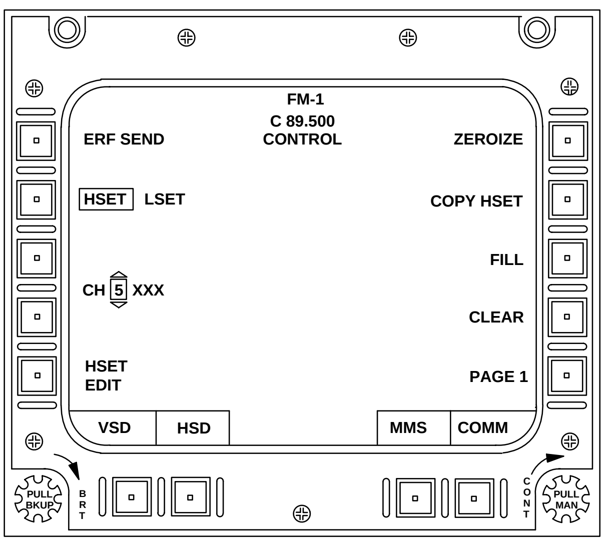
Figure 3-12. FM-1 — FM-2 Radio Control Page 2 (FH Mode — Member)



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J1257

Figure 3-13. FM-1 — FM-2 Radio Control Page 2 (FH Mode — Control)

8. ERF SEND/ERF RECV (L-1) — Allows the RT to either transmit or receive FH data based on whether MEMBER or CONTROL is selected on FM-1 or FM-2 Radio Control page 1. If MEMBER is selected, ERF RECV will appear. To receive ERF, appropriate manual frequency must be entered in SC mode, channel M selected, and tuned COLD. When pressed, ERF RECV will be boxed. When the ERF is received, the text will change to SAVE HSET. The HSET can be saved by again pressing L-1 which changes the text to STORE CH= and a cursor. Enter a channel number (1 thru 6). The legend changes to a boxed ERF RECV. When the RT has stored the channel, the box around ERF RECV goes away. If CONTROL is selected, the ERF SEND legend is replaced by RETRIEVE CH= and a cursor. To send ERF, appropriate manual frequency must be entered in SC, channel M selected, and tuned COLD. Select a channel number (1 thru 6) to retrieve an HSET channel for sending. When entered, the legend changes to SENDING. SENDING will remain on screen until complete or until 12 seconds have elapsed (whichever occurs first). If the ERF transmission is unsuccessful, ERR will appear.

9. HSET/LSET (L-2) — Toggles between HSET and LSET.

NOTE

- After copying hopsets to a blank channel, the display will indicate NO HOPSET XXX even though the HOPSET is valid. A channel up/down action (L-3/L-4) will cause the proper message to be displayed.
- If hopsets are copied to a channel not currently being displayed, accessing that channel will cause the proper indication to appear.
- If hopsets are copied to a channel not currently being displayed, accessing that channel will cause the proper indication to appear.

10. CH key (L-3/L-4) — Increases/decreases the displayed channel number (manual and 1 thru

6) and displays the associated LSET (1 thru 8) channel code/net identification.

NOTE

This channel number is not to be confused with the operational frequency channel of the radio. This channel is for storage of the frequency hopping parameters only.

11. HSET EDIT (L-5) — Only available when CONTROL is selected on FM-1 or FM-2 Radio Control page 1 and HSET is selected on FM-1 or FM-2 Radio Control page 2. This allows controller to change an existing channel code or create a new channel code. When pressed a cursor will appear. The last two digits of the channel displayed between L-3/L-4 can then be entered/changed, followed by pressing ENTER on the MFK. Valid entries are 00 — 99. Once accepted the new identifier will be displayed next to the channel number at L-3/L-4.

NOTE

While LATE NET is boxed, transmission by other members of the net causes the radio's time to synchronize.

12. ZEROIZE/LATE NET (R-1) — ZEROIZE clears all data stored in the RT, including all preset SC frequencies and FH data. When pressed ZEROIZE will flash; press R-1 again to ZEROIZE. ZEROIZE is only available when the helicopter is on the ground. LATE NET allows the RT containing all fill data, but whose clock is out of sync, to join a net. To activate LATE NET, select appropriate FH channel (L-3/L-4) and press R-1; LATE NET will box until the RT has received a new time sync. LATE NET is only available when helicopter is off the ground.

13. COPY HSET (R-2) — Allows one channel to be copied to another. When pressed display will change to FROM CH=, a stored channel is entered from the MFK, the cursor changes to TO CH=, and desired destination channel is entered from the MFK.

14. FILL (R-3) — Allows TSEC, HSET, and LSET variables to be loaded to the RT while the helicopter is on the ground. To load, connect fill device to RT, select desired variable on fill device, and turn fill device power on. Press R-3, which will box FILL, and allow the RT to interrogate fill device. The TSEC variable is loaded by selecting manual (M) channel at L-3/L-4 and pressing FILL. Once TSEC variable is loaded, legend COLD will appear adjacent to channel indicator when M channel is selected. If an HSET is interrogated, then that HSET will be stored with displayed HSET channel number. If an LSET is interrogated, then LSET channel number associated with LSET will be stored and displayed. After completion, turn fill device power off and remove from RT. FH will not function if fill device is left attached to RT.

15. CLEAR (R-4) — Clears individual channels. When pressed, display changes to CH=; select channel to be cleared and enter on MFK.

NOTE

ERR will appear adjacent to R-4 if current HSET channel is entered.

3-20. AN/ARC-201 SINCGARS LOADING/ COMMUNICATION PROCEDURES.

To load TSEC and HSET/LSET variables and initiate communication checks, proceed with the following:

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.

2. L-1/L-5 — Press to select FM-1 or FM-2 and display frequency list (fig. 3-8).

3. R-5 — Press to select FM-1 or FM-2 Radio Control page 1 (fig. 3-11).

4. L-4 — Press to enter manual frequency.

NOTE

A frequency must be entered into manual channel and displayed on RFD. A preset frequency from preset list cannot be used.

5. L-1 — Press to select FH.

6. R-5 — Press to select FM-1 or FM-2 Radio Control page 2 (fig. 3-12 or 3-13) .

7. Ensure fill device is off; connect device to radio.

8. Turn fill device on and select FILL position.

9. R-3 — Press to select FILL. When FILL unboxes, turn power on fill device to OFF and disconnect.

10. L-3/L-4 — Press to cycle channel and return to channel M. Channel should display M and COLD.

11. L-1 — Press to select ERF RECV. ERF RECV will box and RT is now ready to receive ERF from NCS.

NOTE

ERF procedures can be done in plain text or cipher mode.

12. When NCS sends the ERF, display at L-1 will change to SAVE ERF.

13. L-1 — Press to SAVE ERF. Legend will change to STORE CH= and a cursor. Enter channel (1 — 6) to store ERF.

14. L-3/L-4 — Press to select channel just stored. The display will show TUNING, and when tuned, a three-digit net designation (e.g., 350) will display. The RFD (fig. 3-1) will also display net designation.

15. Complete communication check with NCS.

3-21. AN/ARC-201 SINCGARS LATE NET ENTRY.

Late net entry allows members to join a net that is already operating. The type of entry is based entirely on data that is currently stored in the RT. If you were temporarily out of a net, for example, shutdown for refueling, the passive net entry will allow entry with no workload on the NCS. To enter an alternate net requires that the RT only be loaded with the correct TRANSEC variable. This Cue and ERF method does require coordination with the NCS.

a. Passive Net Entry.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.

2. L-1/L-5 — Press to select FM-1 or FM-2 and frequency list (fig. 3-8).

3. R-5 — Press to select FM-1 or FM-2 Radio Control page 1 (fig. 3-11).

4. L-4 — Press to enter the manual frequency.

5. L-1 — Press to select FH.

6. L-5 — Press to select TOD. If correct, TOD displayed may be retained by pressing ENTER on MFK. Otherwise, enter a new TOD by entering DDHHMM (e.g., 231430). Pressing ENTER on the MFK starts the internal clock, and should be done as accurately as possible according to unit SOP (local or zulu time).

7. R-5 — Press to select FM-1 or FM-2 Radio Control page 2 (fig. 3-12 or 3-13).

8. L-3/L-4 — Channel up/down, then back to tune desired net.

NOTE

If TOD has not drifted more than plus or minus 4 seconds, automatic re-entry into net should occur.

9. R-1 — Press to select LATE NET. The legend LATE NET will replace ZEROIZE at R-1 once the aircraft is off the ground. The legend LATE NET will remain boxed until the radio has synchronized into the net.

NOTE

LATE NET commands the RT to permit a plus or minus 59 second difference.

10. Contact NCS to report into the net.

b. Cue and ERF Procedure.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.

2. L-1/L-5 — Press to select FM-1 or FM-2 and frequency list (fig. 3-8).

3. R-1 — Press to add cue frequency. Enter C using MFK followed by frequency and identifier (if desired).

4. CHAN switch (on pilot collective or CPG instrument panel) — Press up or down until C

is displayed in channel block of RFD (fig. 3-1).

5. RFD — Check radio is set to plain text (non-secure).

6. Transmit on cue frequency for 4 to 5 seconds.

7. CIPH switch (RFD) — Press at once to return to cipher text if this is a secure net and await response.

8. Repeat cue procedure after 15 seconds until cue call is answered.

NOTE

Cue calls go through only when the net is quiet. Because you do not know when the net is quiet, the solution is to repeat your cue call until you get an answer.

9. When cue call is answered, follow NCS instructions for NET entry and receiving and ERF.

10. Once the ERF is stored, you are ready to enter net.

3-22. ENTERING A FREQUENCY INTO MEMORY OR CHANGING A STORED FREQUENCY SELECT FM-1, FM-2, VHF, OR UHF.

NOTE

The RMT/ICS switch on pilot collective head must be in RMT before remote selection of RFD displays.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) will display.

2. Radio — Select by pressing radio select switch on pilot collective control head (fig. 3-3) or rotating transmit selector knob on CSC panel (fig. 3-2) to desired radio position. Arrow on COMM page will move to appropriate radio line. This also sets up selected radio to accept new data.

3. L-1 — Press. The frequency list will be displayed in the center of the MFD (fig. 3-8).

NOTE

The frequency list has 18 preset channels including a manual channel assigned to each radio. The ARC-201s have an additional CUE channel. The HF has one manual and nine preset channels.

4. ADD Key — Press. Cursor will display at bottom of radio list.

5. Channel number — Enter using MFK. Channel number will display.

NOTE

Channel number selected may be an unused channel or any channel currently assigned to any radio, except a channel currently in use. That channel and its assigned frequency will drop from the list of assigned frequencies of that radio.

6. ENTER key — Press using MFK. Cursor will display to the right of channel number.

7. Frequency desired — Enter on MFK, pressing first two digits, decimal point, and last three digits. Frequency will display.

NOTE

It is not necessary to enter a zero (0) before the first two digits. Also, system will assume zeros for digits after decimal point if nothing is entered.

8. ENTER key — Press. Cursor will move to the right one space.

NOTE

If no identifier is to be entered, press ENTER key.

9. Identifier (if desired) — Enter up to four alphanumeric characters using MFK. Identifier will display to the right of frequency.

10. ENTER key — Press. Channel number, frequency and identifier will move into numeric sequence in radio selected and cursor will display in blank space at bottom of selected radio list.

11. To enter additional frequencies into any radio memory, repeat steps 4 through 10.

3-23. R AN/ARC-201D SINCGARS VHF-FM RADIO.

The AN/ARC-201D Single Channel Ground and Airborne Radio System (SINCGARS) provides single channel, frequency hopping, and secure operation in the VHF/FM band 30.000 to 87.975 MHz in 0.025 MHz intervals. The AN/ARC-201D is a remote controlled receiver-transmitter (RT) used in MIL-STD-1553B data bus aircraft. The RT is controlled by the aircraft control and display system (CDS). Provisions for two radios (FM-1 and FM-2) are provided in the aft electrical compartment. The single channel mode provides normal VHF/FM operation for voice, digital and secure communication. FH mode is used to counter enemy jamming. The SINCGARS radios are powered by the 28 Vdc essential bus and circuit protection is provided by the FM-1 and FM-2 circuit breakers.

3-24. (CDS3) AN/ARC-201D SINCGARS SINGLE CHANNEL OPERATION.

Operation of the AN/ARC-201D VHF FM radio is controlled from the FM-1 — FM-2 Radio Control page (Fig. 3-14). The area at the top of the control page displays radio status information on four lines. The first line provides the title of the page FM-1 or FM-2. The second line indicates whether the radio is in RETRANS or blank. The third line displays the channel number and associated frequency. The fourth line displays the six character identifier for that channel.

NOTE

After power is applied to the SINCGARS AN/ARC-201D radio, line address keys are unusable for approximately 1 minute while the radio does self-test and frequency preset initiation.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.

2. L-1/L-5 — Press to select FM-1 or FM-2 and frequency list (fig. 3-8).

3. R-5 — Press to select FM-1 or FM-2 Radio Control page (fig. 3-14).

4. SC/FH key — Press to select single channel — SC.

5. EMER T/R key — Toggles between current frequency and emergency frequency 40.50 MHz.

6. PWR key — Press to select IFM power level: NORM, LO, MED, HI.

NOTE

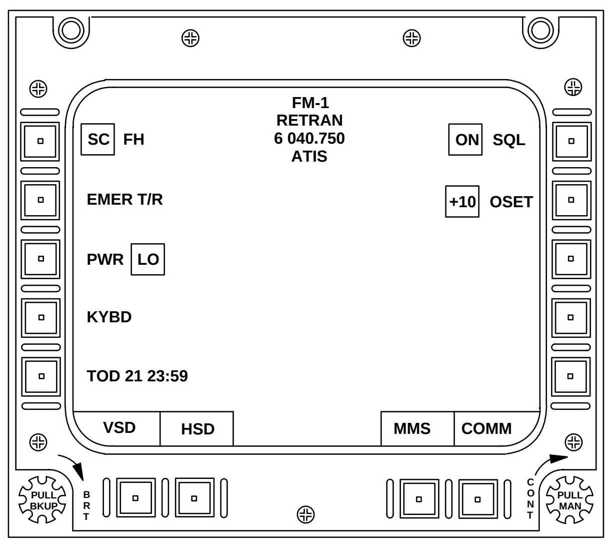
The IFM HI power setting cannot be selected until enabled from the Ground Set-Up page.

7. KYBD key — Press to activate MFK for entering radio channels from frequency list or manual frequencies.

8. TOD key — No function in SC.

9. SQL key — Toggles squelch between on and off.

10. OSET key — Used to select a frequency offset for current preset or manual frequency. OSET may be required when dissimilar radio sets are being used and local interference is encountered. OSET is not normally used and should be set to 0. Options available are 0,



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J0546

Figure 3-14. (CDS3) FM-1 — FM-2 Radio Control Page (SC Mode)

+5, -5, +10, -10. Offsets are in kHz. For example, 50.400 would become 50.405 if +5 were selected.

3-25. (CDS4) AN/ARC-201D SINCGARS SINGLE CHANNEL OPERATION.

Operation of the AN/ARC-201 VHF FM radio is controlled from the FM-1 — FM-2 Radio Control page (Fig. 3-15). The area at the top of the control page displays radio status information on five lines. The first line provides the title of the page, FM-1 or FM-2. The second line indicates radio RETRAN status. The line is blank if RETRAN status is OFF. RETRAN will be displayed if RETRAN status is ON. The third line displays the current channel number and frequency. The fourth line displays the channel identifier for that channel. The fifth line consists of the text BUSY if the radio is busy or displays one of the following special display data:

BLANK (No Text)	L8
CUE	FILL CMPLT
BIT GO	FILLING
CLR GO	ERROR
STO GO	NO TOD
SEND GO	NO FILL
LATE NET	BAD FILL
LSET MEM	NO KEYS
HSET MEM	NO KEY
L7/L8	REC ERR
L7	SEVERE

NOTE

After power is applied to the SINCGARS AN/ARC-201D radio, line address keys are unusable for approximately 1 minute while the radio does self-test and frequency preset initiation.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.

2. L-1/L-5 — Press to select FM-1 or FM-2 and frequency list (fig. 3-8).

3. R-5 — Press to select FM-1 or FM-2 Radio Control page (fig. 3-15).

4. SC/FH/FH-M key — Press to select single channel — SC.

5. EMER T/R key — Toggles between current frequency and emergency frequency 40.50 MHz.

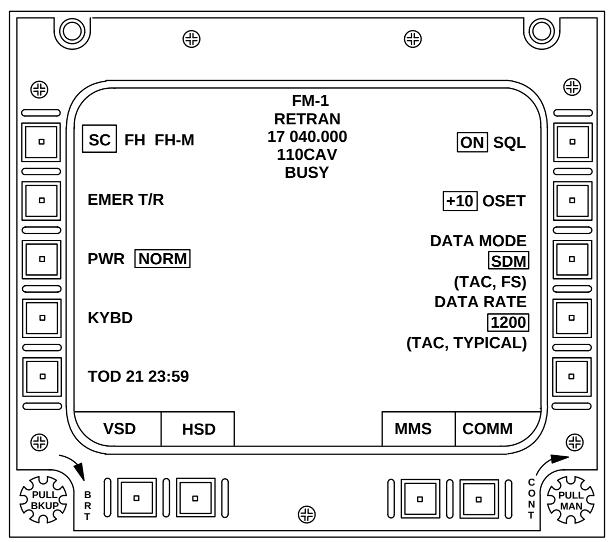
6. PWR key — Press to select IFM power level: NORM, LO, MED, HI.

7. KYBD key — Press to activate MFK for entering radio channels from frequency list or manual frequencies.

8. TOD key — L-5 is used to display or change the current TOD in the radio. Pressing L-5 will display the TOD along with a cursor.

   a. To retain the current/displayed TOD, press ENTER on the MFK. The TOD remains displayed until the FM-1 Control Page is exited or for 30 seconds.

   b. To enter a new TOD, enter days, hours, and minutes in the format DDHHMM (DD=days - 01 to 31 inclusive, HH=hours - 00 to 23 inclusive, and MM=minutes - 00 to 59 inclusive). CDS will supply the spaces and colons (:); however, operator must enter all leading and trailing zeros. Press ENTER on MFK after the data is entered. The CDS



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J3164

Figure 3-15. (CDS4) FM-1 — FM-2 Radio Control Page (SC Mode)

sends the data to the radio and removes the time from the display. Entering all zeros causes the radio to read time from the GPS. To display the new TOD, press L-5 again.

9. SQL key — Toggles squelch between on or off.

10. OSET key — Used to select a frequency offset for current preset or manual frequency. OSET may be required when dissimilar radio sets are being used and local interference is encountered. OSET is not normally used and should be set to 0. Options available are 0, +5, -5, +10, -10. Offsets are in kHz. For example, 50.400 would become 50.405 if +5 were selected.

11. DATA MODE key — Pressing R-3 toggles DATA MODE between SDM and EDM modes. When in the SDM mode, legend consists of text DATA MODE on line 1, SDM (boxed) on line 2, and (TAC, FS) on line 3. In the EDM/PCKT mode, legend consists of DATA MODE on line 1, EDM (boxed) on line 2, and text TI on line 3.

12. DATA RATE key — Pressing R-4 cycles through various data rates available for the mode selected at R-3. In SDM mode, the legend consists of the following:

DATA RATE (line 1)	
XXXX (line 2)	XXXX=600, 1200, 4800, 16K, AD1, or AD2
YYYYYYYYYYY (line 3)	YYYYYYYYYYY=1200, 2400, 4800, 9600, or PCKT

3-26. R AN/ARC-201D SINCGARS FREQUENCY HOPPING OPERATION.

1. The frequency hopping (FH) mode is an electronic counter-countermeasure (ECCM) technique used to counter enemy jamming and direction finding equipment. The receiver transmitter (RT) changes frequency more than 100 times per second. It can hop among 2320 individual frequencies. Both the transmitting and receiving FH radio jump in an identical sequence. In order to function in the FH mode the RT needs the following data:

a. Transmission Security (TSEC) variable. This variable determines sequence of frequencies. This variable can only be loaded via the fill connector for the radio set in the aft electrical compartment and will not be transmitted with the Electronic Remote Fill (ERF).

b. FH sync time, to synchronize the transmitting and receiving radios. This time is established by the master net control station and is received with the ERF. When aircraft power is turned off, the RT clock is kept running for 24 hours. After 24 hours, the clock is turned off to preserve the holding battery life. All fill data is retained (TSEC variable, hopset, and lockout sets).

NOTE

- Fill batteries for the AN/ARC-201D are located in the aft electrical compartment on the front of radio and are labeled HUB (hold up battery). The batteries (BA 5372) are the same as the KY-58 fill batteries.
- Five C cell batteries are in the battery box located in the aft electrical compartment.
- Batteries only maintain COMSEC fills and TOD. TSEC and HOPSET are stored in nonvolatile memory, regardless of whether batteries are used.

c. A hopset (HSET) to identify the frequencies used by the net. Hopset is received/transmitted with the ERF.

d. Lockout set (LSET), if required, to identify frequencies that will not be used by any nets. Received/transmitted with the ERF.

e. A net identification (ID) to determine a start point for frequency hopping (e.g., 310 or 350). Received/transmitted with the ERF.

2. In the FH mode the audio signal is converted into a digital data stream prior to being transmitted. The data stream is interleaved (transmitted out of sequence). This spreads the signal over several frequency hops and reduces the degradation that could be caused by jamming. At the receive end, the process is reversed to recover the original audio. When the RT is first keyed, a synchronizing signal is transmitted prior to the interleaved

message. When the receiving RT detects the signal, it decodes it and adjusts its timing circuitry with the transmitting RT. When the transmitting RT is unkeyed, an end of message code is sent twice. This tells the receiving RT to return to its passive receive or idle mode. While in this idle or passive mode the RT searches for the synchronizing signal at the beginning of a transmission. When an RT receives a message, it automatically adjusts its clock toward the transmitting RT clock. This adjustment can be a maximum of one-half second for each received message. The normal search procedure allows the receiving RT clock to be off by plus or minus 4 seconds and still be in sync. When the late entry mode is selected, the search procedure is changed to permit a plus or minus 59 second difference. Late entry sync data is included with the regular synchronizing signal at a maximum of once every 30 seconds for the net. The RT also checks the cue frequency during passive receive for any activity. When an RF signal with a 150 Hz squelch tone on the RF cue frequency is detected, an advisory FM-1 cue or FM-2 cue will appear. This procedure will allow a station to alert a frequency hopping net to step down to single channel to make contact.

3. The Net Control Station (NCS) uses the frequency hopping-master or CONTROL mode. It differs from FH MEMBER in two ways. The NCS is the time standard for the net, and the NCS RT is the only one that can transmit ERF data. The NCS RT does not adjust its clock with a received message. When the NCS is an active net number, all the net member RT clocks will be synchronized with the NCS RT clock. All the required FH data, except the TSEC variable, may be sent from the NCS to net members using ERF. A typical net opening will use the cold start procedure. Operation in the cold start mode is the same as normal FH operation except that the RT hops on a single frequency. The frequency used is the one in the SC manual frequency (M1/M5).

3-27. (CDS3) AN/ARC-201D SINCGARS FREQUENCY HOPPING CONTROL PAGES.

Operation of the AN/ARC-201D VHF FM radio in the frequency hopping (FH) mode is controlled from the FM-1 — FM-2 Radio Control page (fig. 3-16). The area at the top center of the page displays radio status information on four lines. The first line indicates which radio, FM-1 or FM-2, is selected. The second line indicates whether the radio is in the RETRANS mode or is blank. The third line displays channel number, the legend NET, and the three-digit net identification. The fourth line will indicate CONTROL or MEMBER as selected on FM-1 Radio Control page 1. NO TSEC will display on this line if no TSEC variable has been loaded and stored.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.

2. L-1/L-5 — Press to select FM-1 or FM-2 and frequency list (fig. 3-8).

3. R-5 — Press to select FM-1 or FM-2 Radio Control page 1 (fig. 3-16).

4. SC/FH key — Press to select frequency hopping (FH).

5. TOD key (L-5) — Press to display the time of day (TOD) currently in the radio along with a cursor. The TOD displayed may be retained by pressing ENTER on the MFK. Otherwise,

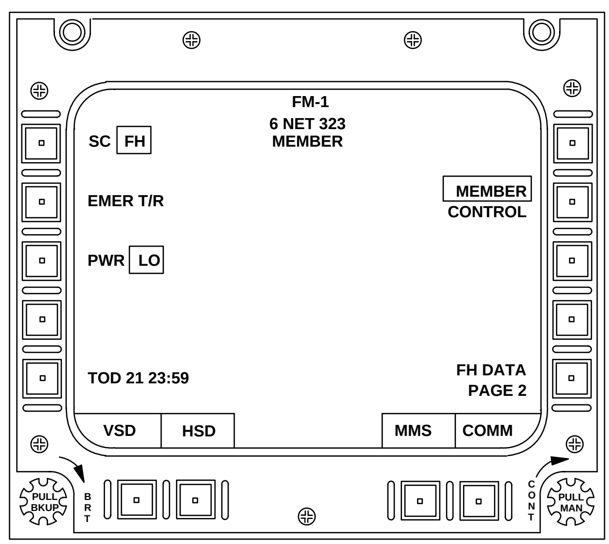

Figure 3-16. (CDS3) FM-1 — FM-2 Radio Control Page 1 (FH Mode)

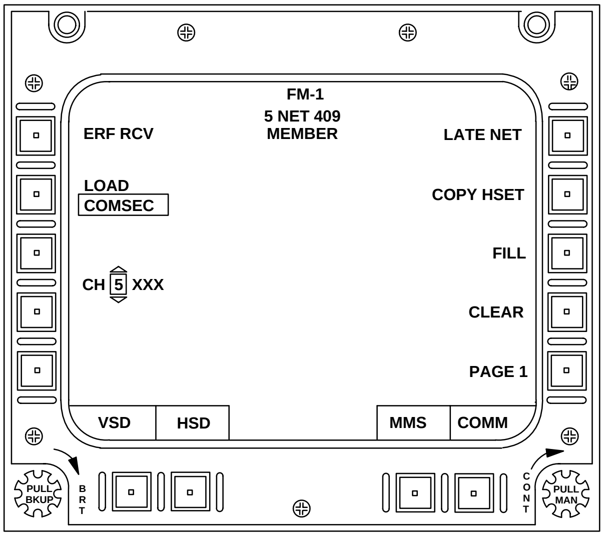

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Figure 3-17. (CDS3) FM-1 — FM-2 Radio Control Page 2 (FH Mode - Member)

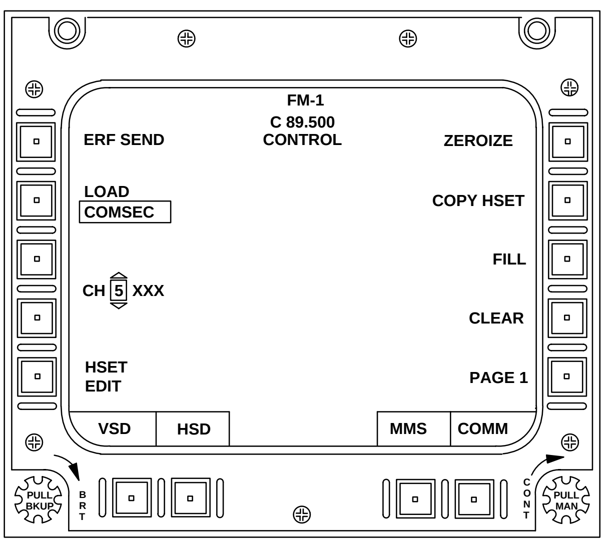

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Figure 3-18. (CDS3) FM-1 — FM-2 Radio Control Page 2 (FH Mode - Control)

enter a new TOD by entering the day, hour, and minutes in the format DDHHMM (e.g., 231430). Pressing ENTER on the MFK starts the internal clock, and should be done as accurately as possible according to unit SOP (local or zulu time). When entered the time will be removed from the display. TOD will be received from the Net Control Station (NCS) with the ERF.

NOTE

If the EGI is powered up and has acquired a satellite, FM1 and FM2 can obtain ZULU time by typing a TOD of 00 00:00 on the MFK and pressing ENTER. Pressing TOD again will cause the radio to display the correct ZULU time.

6. MEMBER/CONTROL key (R-2) — Toggles between MEMBER and CONTROL. If MEMBER is selected, the radio will be a member of the FH net. If CONTROL is selected, the radio will be the controller/NCS. Only one controller/NCS should be operating per net.

7. FH DATA PAGE 2 (R-5) — Only available in FH mode. Selects FM-1 or FM-2 Radio Control page 2 (fig. 3-17 and 3-18), which is used to enter initializing data for the RT in the FH mode.

8. ERF SEND/ERF RECV (L-1) — Allows the RT to either transmit or receive FH data based on whether MEMBER or CONTROL is selected on FM-1 or FM-2 Radio Control page 1. If MEMBER is selected, ERF RECV will appear. To receive ERF, appropriate manual frequency must be entered in SC mode, channel M selected, and tuned COLD. The channel number of an already established net may also be used. When pressed, ERF RECV will be boxed. When the ERF is received, the text will change to SAVE HSET. The HSET can be saved by again pressing L-1 which changes the text to STORE CH= and a cursor. Enter a channel number (1 thru 6). The legend changes to a boxed ERF RECV. When the RT has stored the channel, the box around ERF RECV goes away. After performing an ERF STORE the FM radio will automatically tune to the channel the received hopset was stored to. This allows the pilot to verify what hopset was received. When another channel is desired following an

ERF STORE, manually tune the radio to the desired FH channel. If CONTROL is selected, the ERF SEND legend is replaced by RETRIEVE CH= and a cursor. To send ERF, appropriate manual frequency must be entered in SC, channel M selected, and tuned COLD. The channel number of an already established net may also be used. Select a channel number (1 thru 6) to retrieve an HSET channel for sending. When entered, the legend changes to SENDING. SENDING will remain on screen until complete or until 12 seconds have elapsed, whichever occurs first. If the ERF transmission is unsuccessful, ERR will appear.

NOTE

When helicopter is on the ground the legend for L-2 is LOAD COMSEC or LOAD MODE 23.

9. LOAD (L-2) — Toggles among COMSEC, HSET, LSET, and MODE 23.

NOTE

- L-2 must be selected to determine whether the radio will be expecting an HSET, TSEC, or COMSEC fill.
- If hopsets are copied to a channel not currently being displayed, accessing that channel will cause the proper indication to appear.

10. CH key (L-3/L-4) — Increases/decreases the displayed channel number (manual and 1 thru 6) and displays the associated channel code/ net identification.

NOTE

This channel number is not to be confused with the operational frequency channel of the radio. This channel is for storage of the frequency hopping parameters only.

11. HSET EDIT (L-5) — Only available when CONTROL is selected on FM-1 or FM-2 Radio Control page 1 and HSET is selected on FM-1 or FM-2 Radio Control page 2. This allows the controller to change an existing channel code or create a new channel code. When pressed a cursor will appear. All three digits of the channel displayed between L-3/ L-4 can then be entered/changed, followed by pressing ENTER on the MFK. Valid entries are 000 — 999. Once accepted the new identifier will be displayed next to the channel number at L-3/L-4.

NOTE

While LATE NET is boxed, transmission by other members of the net causes the radio's time to synchronize.

12. ZEROIZE/LATE NET (R-1) — ZEROIZE clears all data stored in the RT, including all preset SC frequencies and FH data. When pressed ZEROIZE will flash; press R-1 again to ZEROIZE. ZEROIZE is only available when the helicopter is on the ground. LATE NET allows the RT containing all fill data, but whose clock is out of sync, to join a net. To activate LATE NET, select appropriate FH channel (L-3/L-4) and press R-1; LATE NET will box until the RT has received a new time sync. LATE NET is only available when helicopter is off the ground.

13. COPY HSET (R-2) — Allows one channel to be copied to another. When pressed display will change to FROM CH=, a stored channel is entered from the MFK, the cursor changes to TO CH=, and desired destination channel is entered from the MFK.

14. FILL (R-3) — Allows TSEC, HSET, COMSEC, and LSET variables to be loaded to the RT while the helicopter is on the ground. To load, connect fill device to RT, select desired variable on fill device, and turn fill device power on. Press R-3, which will box FILL, and allow the RT to interrogate fill device. The TSEC variable is loaded by selecting manual (M) channel at L-3/L-4 and pressing FILL. Once TSEC variable is loaded, legend COLD will appear adjacent to channel indicator when M channel is selected. If an HSET is interrogated, then that HSET will be stored with displayed HSET channel number. If an LSET is interrogated, then LSET channel number associated with LSET will be stored and displayed. If a COMSEC is loaded, the variable will be stored in the radio on the selected channel. After completion, turn fill device power off and remove from RT. FH will not function if fill device is left attached to RT.

15. CLEAR (R-4) — Clears individual channels. When pressed, display changes to CH=; select channel to be cleared and enter on MFK.

NOTE

ERR will appear adjacent to R-4 if current HSET channel is entered.

3-28. (CDS4) AN/ARC-201D SINCGARS FREQUENCY HOPPING CONTROL PAGES.

NOTE

Control mode is called FH-M (frequency-hopping — master).

Operation of the AN/ARC-201 VHF FM radio in the frequency-hopping — member (FH) or frequency-hopping — master mode is controlled from the FM-1 — FM-2 Radio Control page (fig. 3-19). The area at the top center of the page displays radio status information on five lines. The first line indicates which radio, FM-1 or FM-2, is selected. The second line indicates radio RETRAN status. The line is blank if RETRAN status is OFF. RETRAN will be displayed if RETRAN status is ON. The third line displays current channel number and HSET. The data is in the form C NET HHHHHHH (C=channel number - 1-6 or M and HHHHHHH=current HSET - 000-999, COLD, or NO TSEC). The fourth line displays the channel identifier. The fifth line consists of the text BUSY if the radio is busy or displays one of the following special data displays:

BLANK (No Text)	L8
CUE	FILL CMPLT
BIT GO	FILLING
CLR GO	ERROR
STO GO	NO TOD
SEND GO	NO FILL
LATE NET	BAD FILL
LSET MEM	NO KEYS
HSET MEM	NO KEY
L7/L8	REC ERR
L7	SEVERE

The FH frequency list is displayed (boxed) in the center of the page.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.
2. L-1/L-5 — Press to select FM-1 or FM-2 and frequency list (fig. 3-8).
3. R-5 — Press to select FM-1 or FM-2 Radio Control page 1 (fig. 3-19).
4. SC/FH/FM-M key — Press to select frequency hopping (FH).
5. TOD key (L-5) — Press to display the time of day (TOD) currently in the radio along with a cursor. The TOD displayed may be retained by pressing ENTER on the MFK. Otherwise, enter a new TOD by entering the day, hour, and minutes in the format DDHHMM (e.g., 231430). Pressing ENTER on the MFK starts the internal clock, and should be done as accurately as possible according to unit SOP (local or zulu time). When entered, the time will be removed from the display. TOD will be

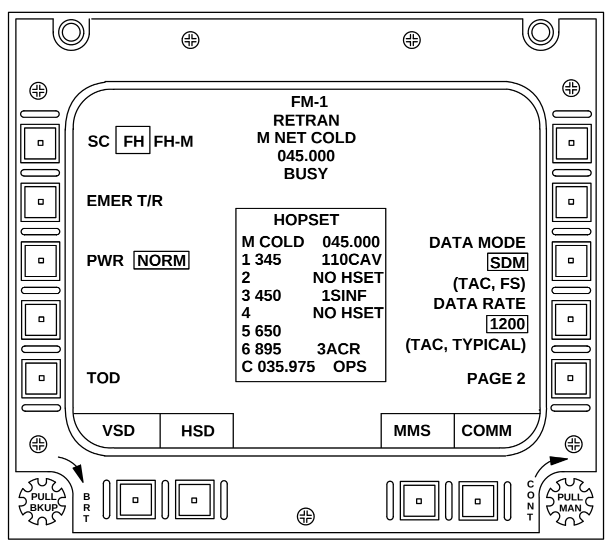

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Figure 3-19. (CDS4) FM-1 — FM-2 Radio Control Page 1 (FH Mode)

received from the Net Control Station (NCS) with the ERF.

NOTE

If the EGI is powered up and has acquired a satellite, FM1 and FM2 can obtain ZULU time by typing a TOD of 00 00:00 on the MFK and pressing ENTER. Pressing TOD again will cause the radio to display the correct ZULU time.

6. R-2 — Not used for CDS4 (operating mode, member or master, is selected at L-1).

7. DATA MODE Key (R-3) — Pressing R-3 toggles the DATA MODE between the SDM and EDM modes. When in the SDM mode, the legend consists of the text DATA MODE on line 1, SDM (boxed) on line 2, and the text TAC, FS on line 3. In the EDM mode, the legend consists of the text DATA MODE on line 1, EDM (boxed) on line 2, and the text TI on line 3.

8. DATA RATE Key (R-4) — Pressing R-4 cycles through the various data rates available for the mode selected using R-3. When R-3 is in the SDM mode, the legend consists of the following:

DATA RATE (line 1)	
XXXX (line 2)	XXXX = 600, 1200, 4800, 16K, AD1, or AD2
YYYYYYYYYYY (line 3)	YYYYYYYYYYY = 1200, 2400, 4800, 9600, or PCKT

9. FH DATA PAGE 2 (R-5) — Only available in FH mode. Selects FM-1 or FM-2 Radio Control page 2 (fig. 3-20), which is used to enter initializing data for the RT in the FH mode.

10. ERF SEND/ERF RECV (L-1) — Allows the RT to either transmit or receive FH data based on whether MEMBER, CONTROL, or FH-M is selected on FM-1 or FM-2 Radio Control page 1. If MEMBER is selected, ERF RECV will appear. To receive ERF, appropriate manual frequency must be entered in SC mode, channel M selected, and tuned COLD. The channel number of an already established net may also be used. When pressed, ERF RECV

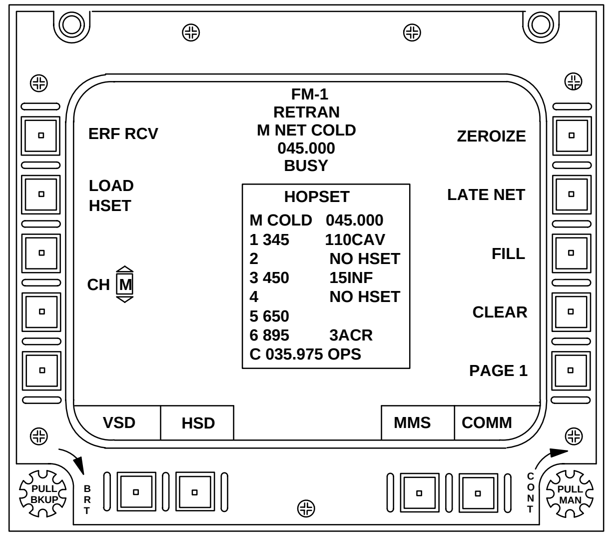

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Figure 3-20. (CDS4) FM-1 — FM-2 Radio Control Page 2

will be boxed. When the ERF is received, the text will change to SAVE HSET. The HSET can be saved by again pressing L-1 which changes the text to STORE CH= and a cursor. Enter a channel number (1 thru 6). The legend changes to a boxed ERF RECV. When the RT has stored the channel, the box around ERF RECV goes away. After performing an ERF STORE the FM radio will automatically tune to the channel the received hopset was stored to. This allows the pilot to verify which hopset was received. When another channel is desired following an ERF STORE, manually tune the radio to the desired FH channel. If CONTROL or FH-M is selected, the ERF SEND legend is replaced by RETRIEVE CH= and a cursor. To send ERF, appropriate manual frequency must be entered in SC, channel M selected, and tuned COLD. The channel number of an already established net may also be used. Select a channel number (1 thru 6) to retrieve an HSET channel for sending. When entered, the legend changes to SENDING. SENDING will remain on screen until complete or until 12 seconds have elapsed (whichever occurs first). If the ERF transmission is unsuccessful, ERR will appear.

NOTE

When helicopter is on the ground the legend for L-2 is LOAD COMSEC or LOAD MODE 23.

11. LOAD (L-2) — Toggles between COMSEC, HSET, LSET, and MODE 23.

NOTE

- L-2 must be selected to determine whether the radio will be expecting an HSET, TSEC, or COMSEC fill.
- If hopsets are copied to a channel not currently being displayed, accessing that channel will cause the proper indication to appear.

12. CH key (L-3/L-4) — Increases/decreases the displayed channel number (manual and 1 thru 6) and displays the associated channel code/ net identification.

NOTE

This channel number is not to be confused with the operational frequency channel of the radio. This channel is for storage of the frequency hopping parameters only.

13. L-5 — Not used for CDS4 (HSET EDIT function on COMM page (fig. 3-21) at R-1 when FH or FH-M mode is selected).

NOTE

While LATE NET is boxed, transmission by other members of the net causes the radio's time to synchronize.

14. ZEROIZE (R-1) — clears all data stored in the RT, including all preset SC frequencies and FH data. When pressed ZEROIZE will flash; press R-1 again to ZEROIZE. ZEROIZE is only available when the helicopter is on the ground.

15. LATE NET (R-2) — allows the RT containing all fill data, but whose clock is out of sync, to join a net. To activate LATE NET, select appropriate FH channel (L-3/L-4) and press R-2; LATE NET will box until the RT has received a new time sync. LATE NET is only available when helicopter is off the ground. (COPY HSET function now resides on the COMM page (fig. 3-21) at R-2 when FH or FH-M selected.)

16. FILL (R-3) — Allows TSEC, HSET, COMSEC, and LSET variables to be loaded to the RT while the helicopter is on the ground. To load, connect fill device to RT, select desired variable on fill device, and turn fill device power on. Press R-3, which will box FILL and allow the RT to interrogate fill device. The TSEC variable is loaded by selecting manual (M) channel at L-3/L-4 and pressing FILL. Once TSEC variable is loaded, legend COLD will appear adjacent to channel indicator when M channel is selected. If an HSET is interrogated, then that HSET will be stored with displayed HSET channel number. If an LSET is interrogated, then LSET channel number associated with LSET will be stored and displayed. If a COMSEC is loaded, the variable will be stored in the radio on the selected channel. After completion, turn fill

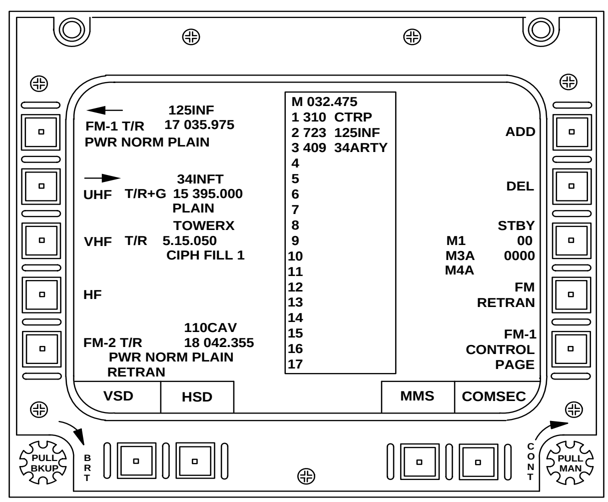

Figure 3-21. (CDS4) COMM Page (Frequency List Displayed)

device power off and remove from RT. FH will not function if fill device is left attached to RT.

17. CLEAR (R-4) — Clears individual channels. When pressed, display changes to CH=; select channel to be cleared and enter on MFK.

NOTE

ERR will appear adjacent to R-4 if current HSET channel is entered.

3-29. R AN/ARC-201D SINCGARS LOADING/ COMMUNICATION PROCEDURES.

To load TSEC and HSET/LSET variables and initiate communication checks, proceed with the following:

NOTE

Radio must be in cipher mode to load HSET, TSEC, and COMSEC variables.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.
2. L-1/L-5 — Press to select FM-1 or FM-2 and display frequency list (fig. 3-8).
3. R-5 — Press to select FM-1 or FM-2 Radio Control page 1 (**(CDS3)** fig. 3-16 or **(CDS4)** fig. 3-19).
4. L-4 — Press to enter manual frequency.

NOTE

A frequency must be entered into manual channel and displayed on RFD. A preset frequency from preset list cannot be used.

5. L-1 — Press to select FH.
6. R-5 — Press to select FM-1 or FM-2 Radio Control page 2 (**(CDS3)** fig. 3-17 or 3-18 or **(CDS4)** fig. 3-20).
7. L-2 — Press to select HSET.
8. Ensure fill device is off and connect to radio.
9. Turn fill device on and select FILL position using L-3 or L-4.
10. R-3 — Press to select FILL. When FILL unboxes, turn power on fill device to OFF and disconnect.
11. L-3/L-4 — Press to cycle channel and return to channel M. Channel should say M and COLD.
12. L-1 — Press to select ERF RECV. ERF RECV will box and RT is now ready to receive ERF from NCS.

NOTE

ERF procedures can be done in plain text or cipher mode.

13. When NCS sends the ERF, display at L-1 will change to SAVE ERF.
14. L-1 — Press to SAVE ERF. Legend will change to STORE CH= and a cursor. Enter channel (1 — 6) to store ERF.
15. L-3/L-4 — Press to select channel just stored. The display will show TUNING, and when tuned, a three-digit net designation (e.g., 350) will display. The RFD (fig. 3-1) will also display net designation.
16. Complete communication check with NCS.

3-30. R AN/ARC-201D SINCGARS LATE NET ENTRY.

Late net entry allows members to join a net that is already operating. The type of entry is based entirely on data that is currently stored in the RT. If you were temporarily out of a net, for example, shutdown for refueling, the passive net entry will allow entry with no workload on the NCS. To enter an alternate net requires that the RT only be loaded with the correct TRANSEC variable. This Cue and ERF method does require coordination with the NCS.

a. Passive Net Entry.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.
2. L-1/L-5 — Press to select FM-1 or FM-2 and display frequency list (fig. 3-8).
3. R-5 — Press to select FM-1 or FM-2 Radio Control page 1 (**(CDS3)** fig. 3-16 or **(CDS4)** fig. 3-19).

4. L-4 — Press to enter the manual frequency.

5. L-1 — Press to select FH.

6. L-5 — Press to select TOD. If correct, TOD displayed may be retained by pressing ENTER on MFK. Otherwise, enter a new TOD by entering DDHHMM (e.g., 231430). Pressing ENTER on the MFK starts the internal clock, and should be done as accurately as possible according to unit SOP (local or zulu time).

7. R-5 — Press to select FM-1 or FM-2 Radio Control page 2 (**(CDS3)** fig. 3-17 or 3-18 or **(CDS4)** fig. 3-20).

8. L-3/L-4 — Channel up/down, then back to tune desired net.

NOTE

If TOD has not drifted more than plus or minus 4 seconds, automatic re-entry into net should occur.

9. R-1 — Press to select LATE NET. The legend LATE NET will replace ZEROIZE at R-1 once the aircraft is off the ground. The legend LATE NET will remain boxed until the radio has synchronized into the net.

10. **(CDS4)** R-2 — Press to select LATE NET. Pressing R-2 boxes LATE NET legend and places radio in late net entry mode. While LATE NET is boxed, transmissions by other members of the net allow the radio time to synchronize. Pressing R-2 again turns off late net and removes box from legend.

NOTE

LATE NET commands the RT to permit a plus or minus 59 second difference.

11. Contact NCS to report into the net.

b. Cue and ERF Procedure.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) displays.

2. L-1/L-5 — Press to select FM-1 or FM-2 and frequency list (fig. 3-8).

3. R-1 — Press to add cue frequency. Enter C using MFK followed by frequency and identifier (if desired).

4. CHAN switch (on pilot collective or CPG instrument panel) — Press up or down until C is displayed in channel block of RFD (fig. 3-1).

5. RFD — Check radio is set to plain text (non-secure).

6. Transmit on cue frequency for 4 to 5 seconds.

7. CIPH switch (RFD) — Press at once to return to cipher text if this is a secure net and await response.

8. Repeat cue procedure after 15 seconds until cue call is answered.

NOTE

Cue calls go through only when the net is quiet. Because you do not know when the net is quiet, the solution is to repeat your cue call until you get an answer.

9. When cue call is answered, follow NCS instructions for NET entry and receiving and ERF.

10. Once the ERF is stored, you are ready to enter net.

3-31. ENTERING A FREQUENCY INTO MEMORY OR CHANGING A STORED FREQUENCY SELECT FM-1, FM-2, VHF, OR UHF.

NOTE

The transmit select switch on the CSC must be in RMT before remote selection of RFD displays.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) will display.

2. Radio — Select by pressing radio select switch on pilot collective control head (fig. 3-3) or rotating transmit selector knob on the CSC panel (fig. 3-2) to desired radio position.

Arrow on COMM page will move to appropriate radio line. This also sets up selected radio to accept new data.

3. L-1 — Press. The frequency list will be displayed in the center of the MFD (fig. 3-8).

NOTE

The frequency list has 18 preset channels including a manual channel assigned to each radio. The ARC-201Ds have an additional CUE channel. The HF has one manual and nine preset channels.

4. ADD Key — Press. Cursor will display at bottom of radio list.

5. Channel number — Enter using MFK. Channel number will display.

NOTE

Channel number selected may be an unused channel or any channel currently assigned to any radio, except a channel currently in use. That channel and its assigned frequency will drop from the list of assigned frequencies of that radio.

6. ENTER key — Press using MFK. Cursor will display to the right of channel number.

7. Frequency desired — Enter on MFK, pressing first two digits, decimal point, and last three digits. Frequency will display.

NOTE

- **(CDS3)** It is not necessary to enter a zero (0) before the first two digits. Also, system will assume zeros for digits after decimal point if nothing is entered.
- **(CDS4)** These system functions automatically occur after ENTER is pressed:

System automatically enters a zero for the first character.
System automatically enters a decimal after the third character.
If entry only has three numbers, system adds three zeros to the end.

If entry only has four numbers, system adds two zeros to the end.

If the fifth character is 2, 5, or 7, the system appends 5 as the last digit. If the fifth character is not 2, 5, or 7, the system appends one zero to the end.

8. ENTER key — Press. Cursor will move to the right one space.

NOTE

If no identifier is to be entered, press ENTER key.

9. Identifier (if desired) — Enter up to four alphanumeric characters using MFK. Identifier will display to the right of frequency.

10. ENTER key — Press. For channels C and 1 — 6 cursor moves to the right. Using MFK, type “T” or “S”. “S” adds that frequency to the SCAN list. When scanning, the selected frequencies are monitored sequentially until a frequency has traffic. The radio remains tuned to the traffic frequency. If a “T” is beside a frequency, then every other frequency tuned to during the scan will be that frequency.

11. To use the scan function for FM-1 or FM-2, select radio 1 or 2 using the CSC transmit select switch. Press SCAN on the MFK. The radio is now scanning on the established frequencies. Press the SCAN button again to stop scanning.

NOTE

(CDS4) SCAN button has no function.

12. ENTER key — Press. Channel number, frequency and identifier will move into numeric sequence in radio selected and cursor will display in blank space at bottom of selected radio list.

13. To enter additional frequencies into any radio memory, repeat steps 4 through 12.

3-32. MANUALLY SETTING RADIO FOR OPERATION: SELECT FM-1, FM-2, VHF, OR UHF.

NOTE

The transmit select switch on the CSC panel must be in RMT before remote selection of RFD displays.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) will display.

2. Radio — Select by pressing radio select switch on pilot collective control head (fig. 3-3) or rotating transmit selector knob on the CSC panel (fig. 3-2) to desired radio position. Arrow on COMM page will move to appropriate radio line.

3. L-1/L-2/L-3/L-5 — Press to display frequency list (3-8).

4. R-5 — Press. Selected Radio Control page will display.

NOTE

- Channel and frequency shown on selected Radio Control page will be the same as displayed on the RFD.
- For emergency transmission, press EMER T/R key. ON will display to the right, the appropriate emergency frequency will display at top of page, and the selected radio is automatically tuned to the appropriate emergency frequency. To deselect, press EMER T/R key again.
- FM-1 and FM-2 share a common power amplifier. LO, MED, and HIGH modes are run through this amplifier. If LO, MED, or HIGH power is selected for one FM radio, the other FM will automatically set to NORM and not utilize the power amplifier. When setting a power mode, always use the lowest power setting required for efficient operation. In the event of amplifier failure, the caution message IFM FAIL will display on the MFD and only normal power will be available.

5. PWR key — Press until desired power displays in PWR box.

NOTE

(CDS2/CDS3) FM radio HIGH power cannot be selected unless amplifier has been programmed prior to flight. Access to program the amplifier is gained through the FDL menu. Power will sequence to NORM, LO, MED, and HIGH each time key is pressed.

6. SQL key — Press to set squelch to desired mode. Mode will alternate between OFF and ON each time key is pressed.

7. OSET key — Used to select a frequency offset for current preset or manual frequency. OSET may be required when dissimilar radio sets are being used and local interference is encountered. OSET is not normally used and should be set to 0. Options available are 0, +5, -5, +10, -10. Offsets are in kHz. For example, 50.400 would become 50.405 if +5 were selected.

8. If desired frequency is displayed, selected radio is set.

9. If desired frequency is not displayed, but is stored in frequency list, go to step 12.

10. If desired frequency is not stored in memory or channel number is not known, go to step 15.

NOTE

Channel number must be known to call up a stored frequency. Channel numbers and frequencies are listed on FREQ page.

11. KYBD key — Press. Cursor will replace KYBD.

12. Channel number — Enter on MFK. Channel number will display in entry space.

13. ENTER key — Press. Channel number, frequency, and identifier will display at top of page and on RFD. Cursor will be replaced by KYBD and radio will be tuned to that frequency. The selected radio is now set for operation. Steps 14 through 16 may be omitted.

14. KYBD key — Press. Cursor will replace KYBD.

15. Frequency desired — Enter on MFK by pressing first two digits, decimal point, and last three digits. Frequency entered will display. Verify frequency displayed is correct.

NOTE

- **(CDS3)** It is not necessary to enter a zero (0) before the first two digits. Also, system assumes zeros for digits after decimal point if nothing is entered.
- **(CDS4)** These system functions automatically occur after ENTER is pressed:

System automatically enters a zero for the first character.
System automatically enters a decimal after the third character.
If entry only has three numbers, system adds three zeros to the end.
If entry only has four numbers, system adds two zeros to the end.
If the fifth character is 2, 5, or 7, the system appends 5 as the last digit. If the fifth character is not 2, 5, or 7, the system appends one zero to the end.

16. ENTER key — Press.

NOTE

The procedure loads a manual frequency. M1 or M5 (frequency entered) will display at top of page and on RFD. Frequency will replace manual frequency listed on FREQ page. KYBD will return to radio and is now set for operation.

3-33. CHANGING STORED FREQUENCY USING REMOTE CONTROL SELECT FM-1, FM-2, UHF, OR VHF.

NOTE

The transmit select switch on the CSC must be in RMT before remote selection of RFD displays.

1. Radio — Select radio desired by pressing radio select switch on pilot collective control head (fig. 3-3) or rotating transmit selector switch on the CSC panel (fig. 3-2) to desired radio position. Arrow pointing to crewmember tuning radio will move to selected radio line on RFD.

2. Pilot cyclic DSPL SEL switch (fig. 3-5) — Press to right. COMM page (fig. 3-7) will display.

3. CHAN switch — Press up or down until desired channel is selected. Selected channel and frequency displays on RFD (fig. 3-1) and that frequency is set for transmit.

NOTE

The frequency list has 18 preset channels including a manual channel assigned to each radio. The ARC-201Ds have an additional CUE channel. The HF has one manual and nine preset channels.

4. L-1 thru L-5 — Press. FREQ list for selected radio displays (fig. 3-8).

5. ADD key — Press. Cursor will display.

6. Enter channel and frequency as desired.

7. ENTER key — Press. New frequency will be displayed next to channel number entered and that frequency is set for transmit.

3-34. CHANGING MANUAL FREQUENCY USING RFD AND REMOTE CONTROL SELECT FM-1, FM-2, VHF, OR UHF.

NOTE

The transmit select switch on the CSC must be in RMT before remote selection of RFD displays.

1. Radio — Select by placing radio select switch on the pilot collective control head (fig. 3-3) to desired position or rotating transmit selector switch on the CSC panel (fig. 3-2) to position desired. Arrow pointing to crewmember tuning selected radio will move to desired radio line on RFD (fig. 3-1).

2. CHAN switch (on pilot collective or CPG instrument panel) — Press up or down until M1 is displayed in channel block of RFD. M1

(last manual frequency entered) will be displayed for radio desired.

3. CHAN switch — Press to KYBD position.

4. Frequency number — Enter using MFK.

NOTE

Entering a manual channel frequency can be accomplished from the radio CONTROL PAGE by selecting the keyboard key and entering the desired frequency.

5. ENTER key — Press. Frequency selected will be manually tuned into radio and replaces previous manual frequency. Manual frequency entered is now set for transmitting.

3-35. COMSEC MODE FOR FM-1, FM-2, UHF, AND VHF RADIOS.

NOTE

KY #1 is dedicated to the UHF radio. KY #2 is dedicated to the VHF radio. FM-1 and FM-2 have built-in COMSEC functions.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) will display.

2. COMSEC key — Press. COMSEC page (fig. 3-22) will display.

NOTE

- For KY-58 operations, use VHF or UHF keys R-1 — R-4.
- For ARC-201D operations use L-1 — L-4.

3. FILL SEL key — Press until desired fill number displays in box. Fill number will sequence from numbers 1 through 6 as key is pressed.

NOTE

Time delay function must be enabled for FM retransmission in the secure mode.

4. T/DELAY key — Press if required. Display alternates between OFF and ON to indicate when time delay function is enabled.

3-36. COMSEC UNIT (KY-58) LOADING PROCEDURE (UHF AND VHF RADIOS).

NOTE

Ground power unit (GPU) should be connected for loading Crypto-Net Variables (CNV) into COMSEC units, or battery voltage may become too low for a successful engine start.

1. GPU — Connected.

2. COMM key — Press.

3. COMSEC key — Press.

4. Select radio 2 (UHF) or radio 3 (VHF) using the transmit select switch on the CSC panel (fig. 3-2).

5. RFD (fig. 3-1) — Press CIPH button. Check CIPHER flag displays by UHF or VHF radio selected on RFD.

6. COMSEC unit — Select appropriate COMSEC unit (No. 1 or No. 2) loading in the avionics compartment. Forward COMSEC unit is COMSEC unit No. 2 (VHF).

7. OVERRIDE/NORMAL switch — OVERRIDE.

8. COMSEC PWR switch — ON.

9. VOLUME knob — Full clockwise.

10. COMSEC unit FILL select switch — Z ALL, then Z1 — 5.

11. COMSEC unit MODE selector switch — LD.

12. KYK-13 — Install on appropriate COMSEC unit.

13. KYK-13 PWR switch — ON.

14. COMSEC unit FILL select switch — Set to desired position to be filled.

15. ICS/RADIO switch — Press to full detent. Check for a single beep in headset and red indicator light should flash on the KYK-13 indicating CNV is loaded.

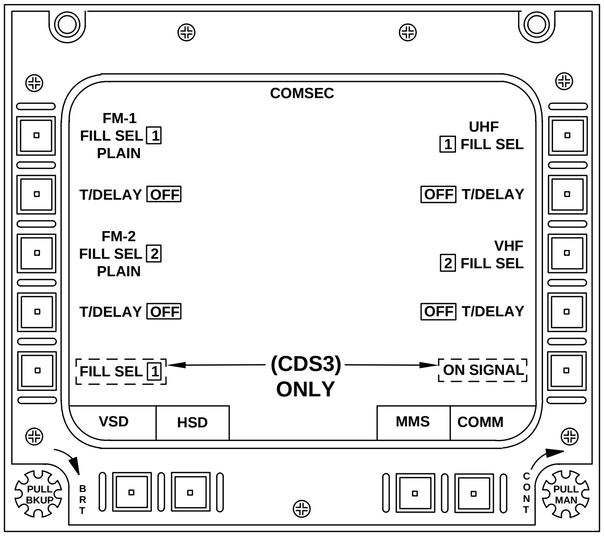

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Figure 3-22. COMSEC Page

16. Steps 12 through 15 — Repeat until all desired CNVs are loaded.

17. KYK-13 PWR switch — OFF.

18. Remove KYK-13 from COMSEC unit.

19. COMSEC unit MODE selector switch — C.

20. OVERRIDE/NORMAL — NORMAL.

21. On COMSEC page (fig. 3-22), select desired channel number to transmit in cipher mode.

22. Communication Check — Complete. If communication check fails, repeat loading procedure.

3-37. (CDS3) SETTING FM-1 AND FM-2 FOR RETRANSMISSION USING TWO FREQUENCIES.

NOTE

FM-1 and FM-2 frequency spread must be at least 3 MHz across the band for retransmission to be accomplished.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) will display.

2. FM-1 key — Press to select FM-1 and frequency list (fig. 3-8).

3. R-5 — Press to display FM-1 Radio Control page 1 (fig. 3-16).

4. Desired frequency for FM-1 — Enter using procedures in paragraph 3-32.

5. Repeat steps 1 through 4 for FM-2.

6. COMM key — Press. COMM page (fig. 3-7) will display.

7. RETRAN key — Press. RETRAN page will display.

8. FM-1 key — Press. Box will appear around FM-1.

9. FM-2 key — Press. Box will appear around FM-2.

10. CIPH switch on RFD — Press (as required) for desired cipher mode. Both FM radios will operate in cipher mode when the cipher mode is selected.

3-38. (CDS4) SETTING FM-1 AND FM-2 FOR RETRANSMISSION.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) will display.

2. Press FM RETRAN (R-4) to activate FM retransmission mode (when active legend at R-4 is boxed).

3-39. COMSEC LOADING PROCEDURES FOR FM-1 AND FM-2.

1. Select radio 1 (FM-1) or radio 5 (FM-2) using the transmit select switch on the CSC panel (fig. 3-2).

2. Press CIPH button on the RFD (fig. 3-1). Verify CIPHER FLAG is displayed by FM-1 or FM-2.

3. COMM key — Press.

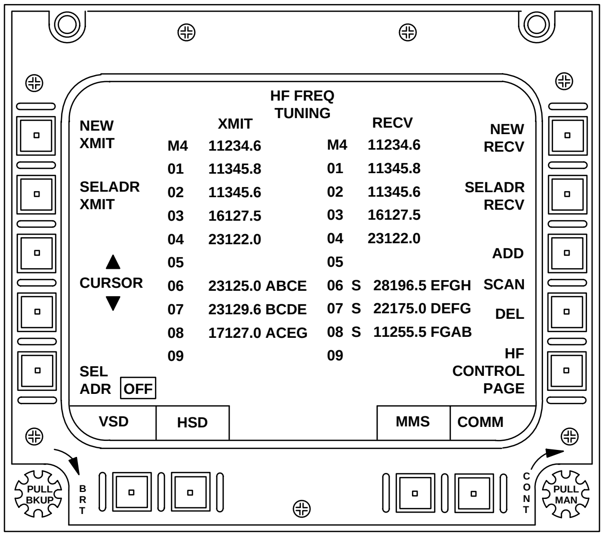

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Figure 3-23. HF FREQ Page

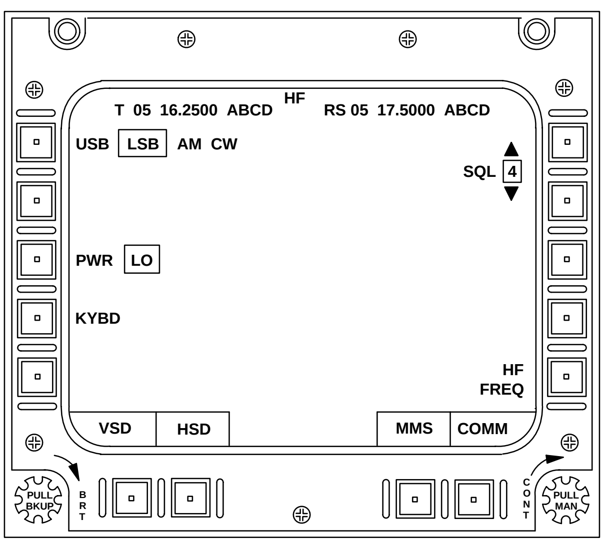

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Figure 3-24. HF Control Page

4. FM-1 or FM-2 key — Press.
5. FM-1 or FM-2 CONTROL PAGE key — Press.
6. L-1 key — Press to box FH.
7. PAGE 2 key — Press.
8. LOAD key — Press until COMSEC is boxed.
9. L-3/L-4 key — Press to channel up or down to the desired channel to be filled.
10. Connect the KYK-13 to FM-1 or FM-2, turn it on, and select the channel which contains the desired fill.
11. FILL key — Press. Box will appear around FILL until the load is complete.
12. PAGE 1 key — Press.
13. L-1 key — Press to select SC (single channel).
14. COMM key — Press.
15. COMSEC key — Press.
16. Select the channel that contains the desired fill for FM-1 or FM-2. Perform communication check.

3-40. HF RADIOS.

NOTE

(CDS4) HF radio not functional.

3-41. MANUALLY SETTING RADIO FOR OPERATION — HF.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) will display.
2. HF key — Press to display HF FREQ page (fig. 3-23).
3. HF CONTROL PAGE key — Press. HF Control page (fig. 3-24) will display.

NOTE

Channel and frequency shown on HF Control page will be the same as displayed on the RFD.

4. BAND key — Press until desired band is selected (USB normal). Band will alternate

between USB, LSB, AM, and CW each time key is pressed.

5. PWR key — Press until desired power is selected (MED normal). Power setting will alternate between LO, MED, AND HI each time key is pressed.

NOTE

High power cannot be selected if the option has been selected on the GROUND SETUP page IFM/HF PWR key.

6. SQL keys — Press as necessary to set squelch level. Squelch value will range from 0 to 15 as SQL keys are pressed.

7. If desired frequency is displayed, HF is set.

8. If desired frequency is not displayed but is stored in memory, go to step 10.

9. If desired frequency is not stored in memory or channel number is not known, go to step 11.

NOTE

- Channel number must be known to call up a stored frequency. Channel numbers and frequencies are listed on HF FREQ page.
- Manual frequencies and channels 01 through 04 are dedicated to simplex operation (single frequency for transmit and receive). Channels 05 through 09 are dedicated to half duplex operation (separate frequency for transmit and receive).

10. CHAN switch — Press up or down until desired channel is displayed at top of HF Control page. ADV HF RADIO TUNE message will display at bottom of display while radio is tuning. Channel number, frequency, and address code, if used, will display at top of page and on RFD. HF radio is now set for operation. Steps 11 through 13 may be disregarded.

11. KYBD key — Press. Cursor will replace KYBD.

NOTE

Simplex mode can only be entered on manual channel.

12. Frequency desired — Enter on MFK pressing first two digits, decimal, and last four digits. Frequency selected will display.

NOTE

System will assume zeros for digits after decimal point if nothing is entered.

13. ENTER key — Press. M4 (frequency entered) will display at top of page and on RFD (fig. 3-1). This frequency will replace manual frequency listed on HF FREQ page (fig. 3-23) and KYBD will return to HF Control page (fig. 3-24). The HF radio is now set for operation.

3-42. ENTERING A FREQUENCY INTO MEMORY OR CHANGING A STORED FREQUENCY — HF — SIMPLEX (CHANNELS 02 THROUGH 04).

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) will display.

2. Radio — Select HF by pressing radio select switch on pilot collective control head (fig. 3-3) to position 4 or rotating transmit select switch on the CSC panel (fig. 3-2) to position 4. Arrow on COMM page will move to HF line.

3. HF key — Press. HF FREQ page (fig. 3-23) will display.

4. NEW XMIT key — Press. Cursor will display next to first unused channel or channel 05 if all channels are used. Keyboard is activated.

5. CURSOR keys — Press as required to move cursor to desired channel.

6. Frequency desired — Enter on MFK, pressing first two digits, decimal, and last four digits. Frequency will display in XMIT and RECV

columns as it is entered. Verify frequency displayed is correct.

NOTE

It is not necessary to enter a zero (0) before the first two digits. Also, system will assume zeros for digits after decimal point if nothing is entered.

7. ENTER key — Press. New frequency is entered into memory.

8. To enter additional simplex frequencies into HF memory, repeat steps 5 through 7.

3-43. ENTERING A FREQUENCY INTO MEMORY OR CHANGING A STORED FREQUENCY — HF — HALF DUPLEX (CHANNELS 05 THROUGH 09).

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) will display.

2. Radio — Select HF by pressing radio select switch on pilot collective control head (fig. 3-3) to position 4 or rotating transmit select switch on the CSC panel (fig. 3-2) to position 4. Arrow on COMM page will move to HF line.

3. HF key — Press to display HF FREQ page (fig. 3-23).

4. NEW XMIT key — Press. Cursor will display next to first unused channel or channel 05 if all channels are used. Keyboard is activated to enter transmitting frequency.

5. CURSOR keys — Press as required to move cursor to desired channel.

6. XMIT frequency desired — Enter on MFK, pressing first two digits, decimal point, and last four digits. Frequency will display in XMIT column as it is typed.

NOTE

It is not necessary to enter a zero (0) before the first two digits. Also, system will assume zeros for digits after decimal point if nothing is entered.

7. ENTER key — Press. New frequency is entered into memory.

8. SELADR XMIT key — Press to activate keyboard for entering selective address code, transmit. Cursor will display to the right of frequency.

9. Selective address code, transmit — Enter on MFK. Code will display in XMIT column to the right of frequency.

NOTE

Valid address codes consist of any four letters between A and M in any order. No letter may be used twice.

10. NEW RECV key — Press. Cursor will move to RECV column. Keyboard is activated to enter receiving frequency.

11. RECV frequency desired — Enter on MFK, pressing first two digits, decimal, and last four digits. Frequency will display in RECV column as it is typed.

NOTE

It is not necessary to enter a zero (0) before the first two digits. Also, system will assume zeros for digits after decimal point if nothing is entered.

12. ENTER key — Press. New frequency is entered into memory.

13. SELADR RECV key — Press to activate keyboard for entering selective address code, receive. Cursor will display to the right of receiver frequency.

14. Selective address code, receive — Enter on MFK. Code will display in RECV column to the right of receive frequency.

NOTE

Valid address codes consist of any four letters between A and M in any order. No letter may be used twice.

15. SCAN ADD and SCAN DEL key — Press as required to add or delete receiver scan function to that frequency. S will display or be removed from the left of channel number.

16. SEL ADD key — Press as required to override (OFF) or initiate (ON) use of selective address function. ON and OFF will alternate next to SEL ADD key each time key is pressed.

NOTE

Once SEL ADD mode has been entered and the radio keyed, the mode cannot be reentered until another radio command (channel up/down, scan, tune) has been given.

3-44. CHANGING FREQUENCY USING MANUAL FREQUENCY ENTRY, RFD, AND REMOTE CONTROL HF.

NOTE

The transmit select switch on the CSC must be in RMT before remote selection of RFD displays.

1. Radio — Select HF by placing radio select switch on pilot collective control head (fig. 3-3) to position 4, or rotating transmit selector switch on the CSC panel (fig. 3-2) to position 4. Arrow pointing to crewmember tuning HF radio will move to HF line on RFD (fig. 3-1).

2. CHAN switch — Press up or down until M is displayed in channel block of RFD. M4 (last manual frequency entered) will be displayed for HF.

3. CHAN switch — Press to KYBD position. MFK is activated to enter new frequency into HF.

4. Frequency number — Enter on MFK, pressing first two digits, decimal point and last four digits. Frequency will display on RFD as it is typed.

NOTE

It is not necessary to enter a zero (0) before the first two digits. Also, system will assume zeros for digits after decimal point if nothing is entered.

5. ENTER key — Press. Frequency selected will be manually tuned into HF replacing previous manual frequency. Manual frequency entered is now set for transmitting and receiving.

3-45. SETTING KY-75 FOR USE WITH HF RADIO.

1. COMM key (or DSPL SEL switch) — Press. COMM page (fig. 3-7) will display.

2. COMSEC key — Press. COMSEC page (fig. 3-22) will display.

3. Radio — Select HF by placing radio select switch on pilot collective control head (fig. 3-3) to position 4 or rotating transmit selector switch on the CSC panel (fig. 3-2) to position 4. HF will display at lower center of screen.

NOTE

For HF operations, use keys under HF heading in lower left and lower right portions of the MFD screen.

4. FILL SEL key — Press until desired fill number displays in box. Fill number will alternate between 1, 2, and 3 each time key is pressed.

5. SIGNAL key — Press as required. Mode will alternate between SIGNAL OFF and SIGNAL ON each time key is pressed, HF is now set to be put in cipher mode for secure operations.

SECTION III. NAVIGATION

3-46. NAVIGATION SYSTEM.

This section provides information on the Embedded Global Positioning System/Inertial Navigation System (EGI). The navigation system provides the navigation modes, functions, and displays. Navigation is performed through the CDS using the EGI, radar altimeter, and the laser range finder/designator (LRF/D). Navigation information is displayed on the two MFDs through the various display modes. An important function of the navigation system is the capability of storing waypoint and target information for making flight plan routes and capability of changing these routes as a mission may change.

3-47. NAVIGATION SUBSYSTEM FUNCTIONS.

3-48. ENROUTE NAVIGATION.

Provides point-to-point guidance from helicopter takeoff to destination using information provided by the data bus which consists of the following:

a. Aircraft heading, attitude, and position.

b. Bearing and range to selected destinations and navigational waypoints.

c. Aircraft ground track and groundspeed indicated in kilometers per hour or nautical miles per hour if in LAT/LON.

d. Drift corrected steering data to selected waypoints.

e. Aircraft angular velocities.

3-49. POSITION FIXING.

Accurately provides the helicopter present position in Military Grid Reference System (MGRS) coordinates and latitude/longitude coordinates, and altitude in meters and feet above mean sea level (MSL).

3-50. TARGET LOCATION, ALTITUDE, AND BEARING.

Provides target location in latitude and longitude or MGRS coordinates and altitude in meters or feet above MSL with the accuracy required by mission requirements when range, bearing, and declination to target is provided to the navigation subsystem from MMS.

3-51. KNOWN LANDMARK POSITION UPDATING.

Provides the capability of updating the helicopter position and altitude with range, bearing, and declination to a known landmark or prestored waypoint provided by the MMS or by direct observation.

3-52. SYSTEM ALIGNMENT CAPABILITIES.

Provides the capability of alignment on the ground using automatic GPS alignment, manual data entry or stored waypoint data. A stored heading alignment may be accomplished, providing the aircraft has not been moved from its position and orientation at the last previous time of system shutdown. It also provides the capabilities of airborne and shipboard alignment. Alignment modes may be selected and executed manually.

3-53. EGI SYSTEM DESCRIPTION.

The EGI is located in the left-side avionics compartment and is hard mounted to the helicopter. The EGI is a self-contained, all-attitude navigation system that provides outputs of linear and angular acceleration, linear and angular velocity, position, attitude (roll, pitch, and platform azimuth), magnetic and true heading, altitude, body angular rates, time tags, and Universal Time Coordinated (UTC) synchronized time. The EGI receives power from the 28 Vdc power assured bus. Circuit protection is provided by a circuit breaker located on the aft overhead console circuit breaker panel (see figure 2-8).

The main functional components of the EGI are the System Processor Module, the Inertial Measurement Module, the Embedded GPS Receiver Module, and the Power Supply Module. Navigational data, GPS satellite system ephemeris and almanac data, and system security data are stored in non-volatile memory (NVM). NVM is provided a keep-alive voltage from a replaceable battery located in the battery compartment on the front of the EGI.

3-54. INITIAL PAGE 1.

The INITIAL PAGE 1 (fig. 3-25) displays on the MFD whenever power is applied to the CDS during start or when INIT button on pilot (fig. 2-6) or CPG auxiliary panel (fig. 2-7) is pressed. Navigation system alignment, control, and mode of operation are accessed by pressing the NAV ALIGN key to call up the NAV ALIGN page. All warning, caution, and advisory messages are active with all navigation displays.

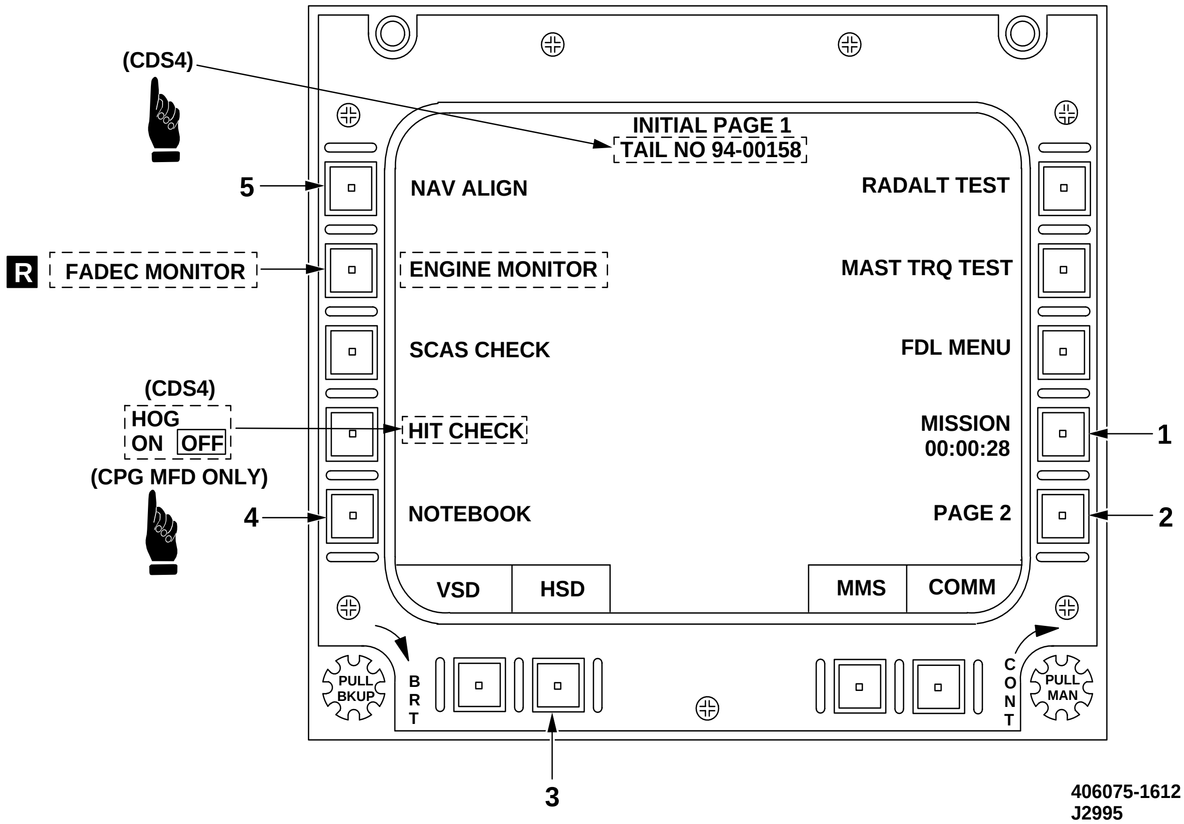
3-55. NAV ALIGN PAGE (UTM).

The NAV ALIGN page (UTM) (fig. 3-26 and fig. 3-27) is called up from the INITIAL PAGE 1. This page is used to control and align the navigation system. The NAV ALIGN page UTM is used when eight-digit MGRS coordinates are to be used for alignment. This mode allows entry of present position grid coordinates, datum, and elevation in meters. Allowance for entry of ships magnetic heading (required ONLY for SHIP ALGN) is also provided. Three methods of alignment may be chosen: MANUAL, FAST, and SHIP ALGN. AUTO align is automatically selected by the system upon power up and will execute a standard, 4-minute alignment. The automatic alignment mode is indicated by the boxed text AUTO to the left of R-1 and the presence of the text GC ALIGN or IF ALIGN at the bottom center of the NAV ALIGN page (no position data is displayed on the NAV ALIGN page during an AUTO align process). Completion of alignment is indicated by disappearance of both the box around the text AUTO and the text at the bottom center of the NAV ALIGN page.

MANUAL align is user selectable both during and after the AUTO align process, and will execute a standard, 4-minute alignment using data entered by the user at the POS, DATUM, and ELEV keys. Alignment is indicated by the boxed text MANUAL to the left of R-1 and appearance of the text GC ALIGN or IF ALIGN at the bottom center of the NAV ALIGN page. Completion of alignment is indicated by disappearance of both the box around the text MANUAL and the text at the bottom center of the NAV ALIGN page.

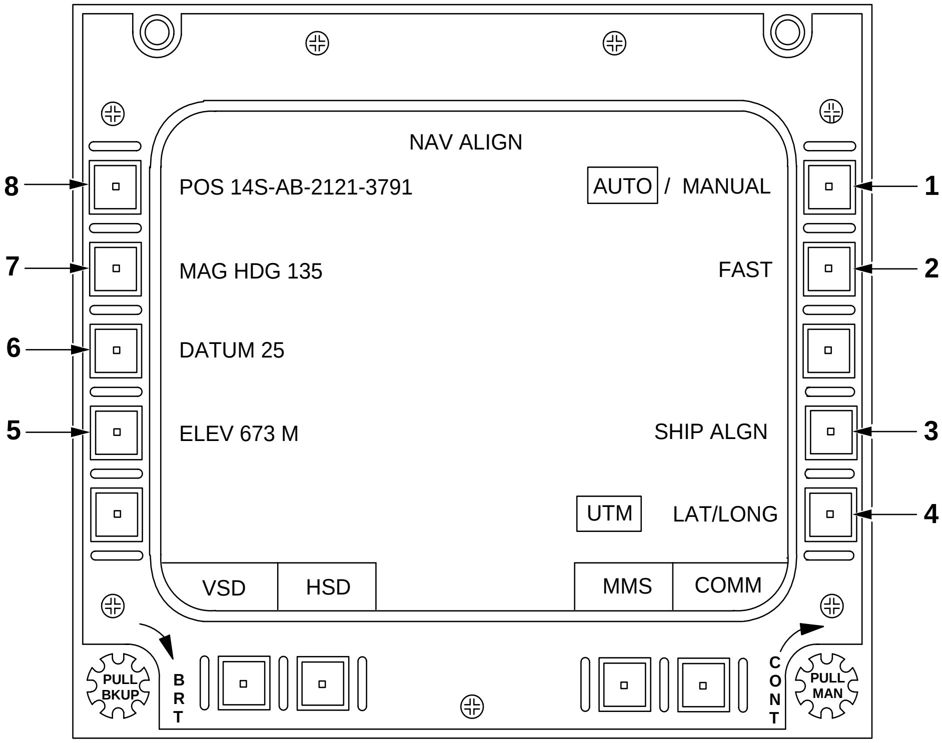
FAST align is user selectable during the AUTO align process and will execute a 30-second alignment to the most recently stored aircraft position, provided that the aircraft has not been moved from that position. Alignment is indicated by the boxed text FAST to the left of R-2 and appearance of the text SH ALIGN at the bottom center of the NAV ALIGN page. The required aircraft position is stored immediately prior to aircraft shutdown (from ground idle) by inputting the MFD displayed present position into the POS field on the NAV ALIGN page and selecting MANUAL align.

SHIP ALGN is also user selectable both during and after the AUTO align process and is intended to allow for system alignment when engaged in shipboard operations. The magnetic heading of the vessel is input in the MAG HDG field on the MFD, and then the SHIP ALGN key is pressed (SHIP ALGN will not function without a vessel magnetic heading value). The system will enter the SHIP ALGN mode, as indicated by the appearance of the text IF ALIGN at the bottom center of the NAV ALIGN page. Completion of alignment is indicated by disappearance of the text at the bottom center of the NAV ALIGN page.



CONTROL/INDICATOR	FUNCTION
1. Clock timer key	Calls up CLOCK TIMER page. Selected source (ZULU, MISSION, LOCAL, or TIMER1) is displayed above time data.
2. PAGE 2 key	Calls up INITIAL PAGE 2.
3. HSD key	Calls up Horizontal Situation Display (HSD) page.
4. NOTEBOOK key	Calls up NOTEBOOK page if data transfer module/map data unit (DTM/MDU) is installed.
5. NAV ALIGN key	Calls up navigation system alignment (NAV ALIGN) page.

Figure 3-25. INITIAL PAGE 1



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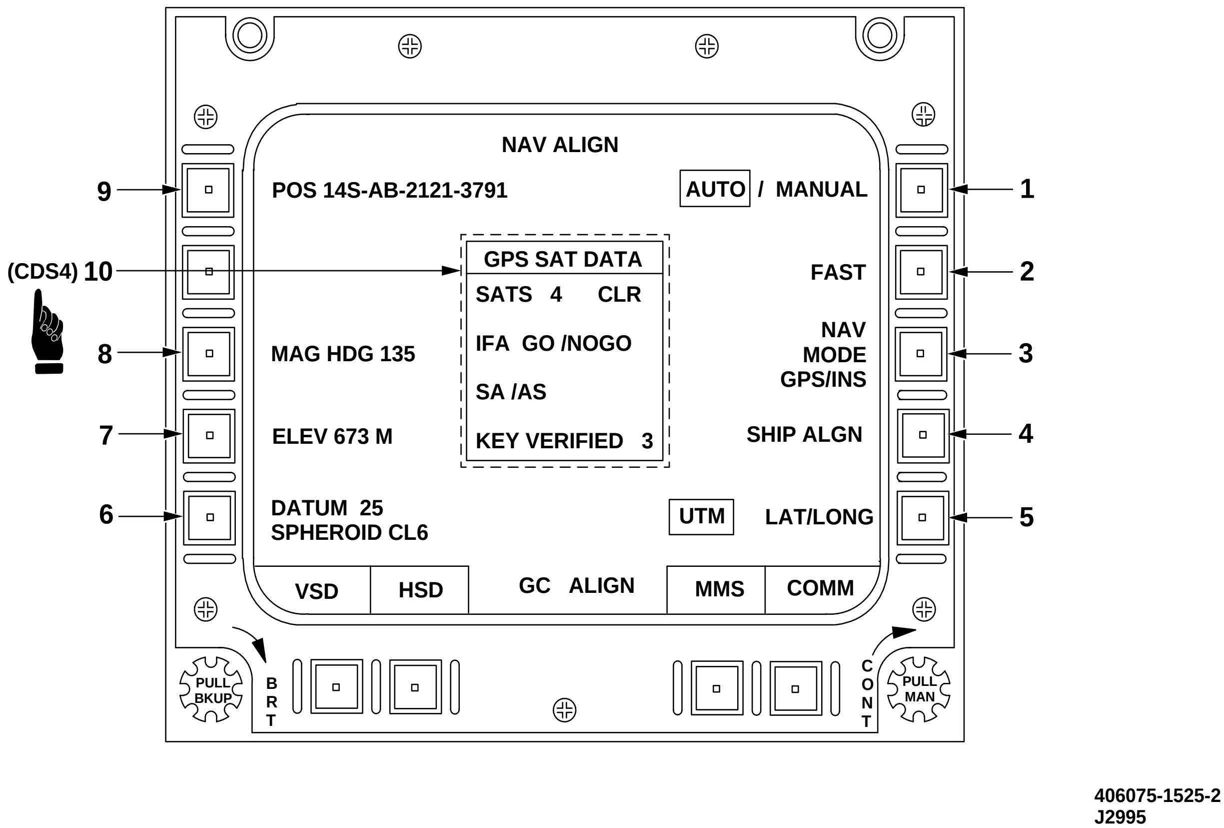
	CONTROL/INDICATOR	FUNCTION
1.	AUTO/MANUAL key	Activates a manually initiated, 4-minute alignment. “AUTO” is boxed during normal system start-up.
2.	FAST key	Activates fast align mode using stored heading from last mission or defaults to standard 4-minute alignment.
3.	SHIP ALGN key	Activates shipboard alignment based on ships magnetic heading.
4.	UTM LAT/LONG key	Toggles between UTM and LAT/LONG with the active mode boxed. When changing between UTM and LAT/LONG, inaccurate navigation data may be displayed. To correct problem, verify the correct DATUM entry was made on NAV ALIGN page. If problem still exists, from HSD page cycle NEXT WPT/ LAST WPT.
5.	ELEV key	Activates keyboard to accept entry of elevation of present position in meters. Elevation in feet may be entered by entering an F after the elevation.

Figure 3-26. (CDS2) NAV ALIGN Page-UTM (Sheet 1 of 2)

(Cont)

	CONTROL/INDICATOR	FUNCTION
6.	DATUM key	Activates keyboard to accept entry of local map datum code, or datum last entered will be displayed. These datums are located in the legend area at the bottom of tactical maps. Refer to Table 3-3 for world datum locations.
7.	MAG HDG key	Activates keyboard to accept entry of ships magnetic heading in degrees.
8.	POS key	Activates keyboard to accept entry of present position coordinates. A WPT/TGT ID may be entered in lieu of position data. The WPT/TGT position data will automatically be used. NAV ALIGN data from the DTS will also be used during mission loading.

Figure 3-26. (CDS2) NAV ALIGN Page-UTM (Sheet 2 of 2)



	CONTROL/INDICATOR	FUNCTION
1.	AUTO/MANUAL key	Activates a manually initiated, 4-minute alignment. "AUTO" is boxed during normal system start-up.
2.	FAST key	Activates fast align mode using stored heading from last mission or defaults to standard 4-minute alignment.
3.	NAV MODE key	Calls up NAV MODE SELECT page to allow for the change of the EGI mode of operation. Displays currently selected mode (GPS/INS, GPS, INS, TAC HSI, or TAC MAP).
4.	SHIP ALGN key	Activates shipboard alignment based on ships magnetic heading.
5.	UTM LAT/LONG key	Toggles between UTM and LAT/LONG with the active mode boxed. When changing between UTM and LAT/LONG, inaccurate navigation data may be displayed. To correct problem, verify the correct DATUM entry was made on NAV ALIGN page. If problem still exists, from HSD page cycle NEXT WPT/ LAST WPT.

Figure 3-27. R NAV ALIGN Page-UTM (Sheet 1 of 3)

(Cont)

	CONTROL/INDICATOR	FUNCTION
6.	DATUM/SPHEROID key	Activates keyboard to accept entry of local map datum code, or datum last entered will be displayed. These datums are located in the legend area at the bottom of tactical maps. Refer to Table 3-2 for world datum locations. After datum is entered the spheroid will automatically be displayed on the pilots MFD.
7.	ELEV key	Activates keyboard to accept entry of elevation of present position in meters. Elevation in feet may be entered by entering an F after the elevation.
8.	MAG HDG key	Activates keyboard to accept entry of ships magnetic heading in degrees.
9.	POS key	Activates keyboard to accept entry of present position coordinates. A WPT/ TGT ID may be entered in lieu of position data. The WPT/TGT position data will automatically be used. NAV ALIGN data from the DTS will also be used during mission loading.
	(CDS4)	
10.	GPS SAT DATA Display	GPS satellite data is displayed in the box in the center of the page. The box contains five lines of data that display the following:
	Line 1	Displays GPS SAT DATA.
	Line 2	Displays the number of satellites being tracked and the quality of the signal. It consists of the following line of text: SATS X AAA a. X indicates the total number of satellites being tracked that are either in State 3 or State 5. States 3 and 5 are defined as follows: (1) State 3: Unclear signal from manmade or natural disruption. Lock on code but no carrier signal. (2) State 5: Clear signal. Lock on code and carrier signal. b. The character string AAA is one of the following: (1) Advisory is false. (2) DEGRADED - At least one satellite in State 3 is being tracked and the GPS FAIL advisory is false. (3) Fail advisory is false. c. If the GPS FAIL advisory is true, line 2 will only display text SATS.
	Line 3	Displays text IFA GO/NOGO. a. GO is boxed if the EGI is in the alignment mode, GPS FAIL is false, and the SATS status (Line 2) is CLR. b. NOGO is boxed if the EGI is in the alignment mode, GPS FAIL is false, and the SATS status (Line 2) is DEGRADED. c. GO/NOGO is blanked if GPS FAIL advisory is true. d. Text line is blanked if/when alignment is complete.

Figure 3-27. R NAV ALIGN Page-UTM (Sheet 2 of 3)

(Cont)

CONTROL/INDICATOR	FUNCTION
Line 4	Displays text SA/AS. a. SA is boxed if the SATS status is CLR, EGI is not operating in the ALL Y Code mode, and the GPS FAIL advisory is false. b. AS is boxed if the SATS status is either DEGRADED or blank, EGI is operating in the ALL Y Code mode, and GPS FAIL advisory is false. c. SA/AS is boxed if the SATS status is CLR, EGI is operating in the ALL Y Code mode, and GPS FAIL is false. d. Nothing will be boxed if the SATS status is DEGRADED or blank, EGI is not operating in the ALL Y Code mode, and GPS FAIL is true.
Line 5	Displays status for the key mode. Text consists of a status message and a single number to the right of the status message. This number indicates the number of key mode status messages that are true. If more than one key mode status message is true, the messages will be displayed in a rotary mode and each message will be displayed for 3 seconds. The following messages may be displayed: a. KEY VERIFIED. Daily key in use has been verified. b. KEY UNVERIFIED. Daily key in use has not been verified. c. KEY INVALID. Daily key in use is invalid. d. FAILED KEY. Failed parity. e. 2 HOUR ALERT. Current key expires in 2 hours or less. f. GPS FAILED. GPS failed.

Figure 3-27. R NAV ALIGN Page-UTM (Sheet 3 of 3)

If the helicopter leaves the ground (or the ships deck) prior to completion of alignment, the system will enter the in-flight alignment mode, indicated by appearance of the text IF ALIGN at the bottom center of the NAV ALIGN page. The in-flight alignment mode is designed to get the helicopter in the air as quickly as possible after system power up. SCAS may be engaged, and takeoff may be accomplished immediately after pitch, roll, and heading data appear on the VSD page. System alignment will be accomplished in the air.

NOTE

Shipboard and in-flight alignments are dependent on the availability of accurate position information updates to the system during the alignment process. Normally, GPS will provide this data. In the event that GPS is unavailable, manual updates may be entered by the pilot on the HSD page.

3-56. NAV ALIGN PAGE (LAT/LONG).

The NAV ALIGN page (LAT/LONG) (fig. 3-28 and 3-29) serves the same function as the NAV ALIGN page UTM and is used when latitude and longitude are to be used for navigation. This mode allows entry of latitude north or south and longitude east or west in degrees, minutes, tenths, and hundredths, and elevation in feet. When NAV ALIGN data is entered in LAT/LONG format, data will not be retained in nonvolatile memory after shutdown.

3-57. NAV ALIGN PROCEDURES.

NOTE

The EGI will automatically begin a standard 4-minute alignment. No user action is required unless a new alignment position is desired.

Set as follows:

1. NAV ALIGN — Select.
2. UTM or LAT/LONG — Select as required.
3. POS — Enter,
   or
   LAT, LONG — Enter.
4. MAG HDG — Required for SHIP ALGN only.
5. DATUM — Enter (See Table 3-2).
6. ELEV — Enter.
7. MANUAL align — Select and press as desired.
8. FAST align — Select and press as desired.

NOTE

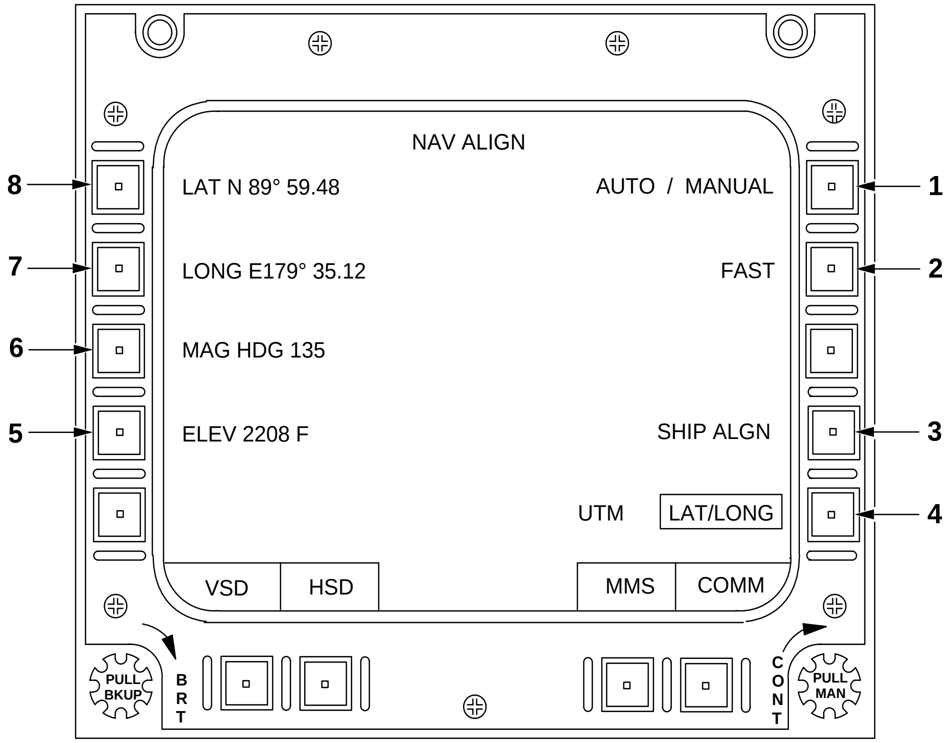
If FAST align is to be used, the aircrafts last present position must be stored immediately prior to shutdown from ground idle and the aircraft must not be moved from that position prior to the next system power up.

9. SHIP ALGN — As required.

Table 3-2. Horizontal reference datums

ID #	Datum Title	Spheroid
1	Adindan	Clarke 1880
2	ARC 1950	Clarke 1880
3	Australian Geodetic 1984	Australian National
4	Bukit Rimpah	Bessel
5	Camp Area Astro	International
6	Djakarta	Bessel
7	European 1950	International
8	Geodetic Datum 1949	International
9	Ghana	WGS 84
10	Guam 1963	Clarke 1866
11	Gunung Segara	Bessel
12	Gunung Serindung	WGS 84
13	Herat North	International
14	Hjorsey 1955	International
15	Hu-Tzu-Shan	International
16	Indian	Everest
17	Ireland 1965	Modified Airy
18	Kertau (Malayan Revised Triangulation)	Modified Everest
19	Liberia 1964	Clarke 1880
21	Luzon	Clarke 1866
22	Merchich	Clarke 1880
23	Montjong Lowe	WGS 84
24	Nigeria (Minna)	Clarke 1880
25	North American 1927 (CONUS)	Clarke 1866
26	North American (Alaska and Canada)	Clarke 1866
27	Old Hawaiian, Maui	International
28	Old Hawaiian, Oahu	International
29	Old Hawaiian, Kauai	International
30	Ordnance Survey of Great Britain 1936	Airy
31	Qornoq	International
32	Sierra Leone	WGS 84
33	South American (Provisional 1956)	International
34	South American (Corrego Alegre)	International
35	South American (Campo Inchauspe)	International
36	South American (Chua Astro)	International
37	South American (Yacare)	International
38	Tananrive Observatory 1925	International
39	Timbalai	Bessel
40	Tokyo	Bessel
41	Voirol	WGS 84
42	Special Datum, Indian Special	Everest
43	Special Datum, Luzon Special	Clarke 1866
44	Special Datum, Tokyo Special	Bessel
45	Special Datum, WGS84 Special	WGS 84
46	WGS 72	WGS 72
47	WGS 84	WGS 84

(TABLE I.D. 911465)



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J0860

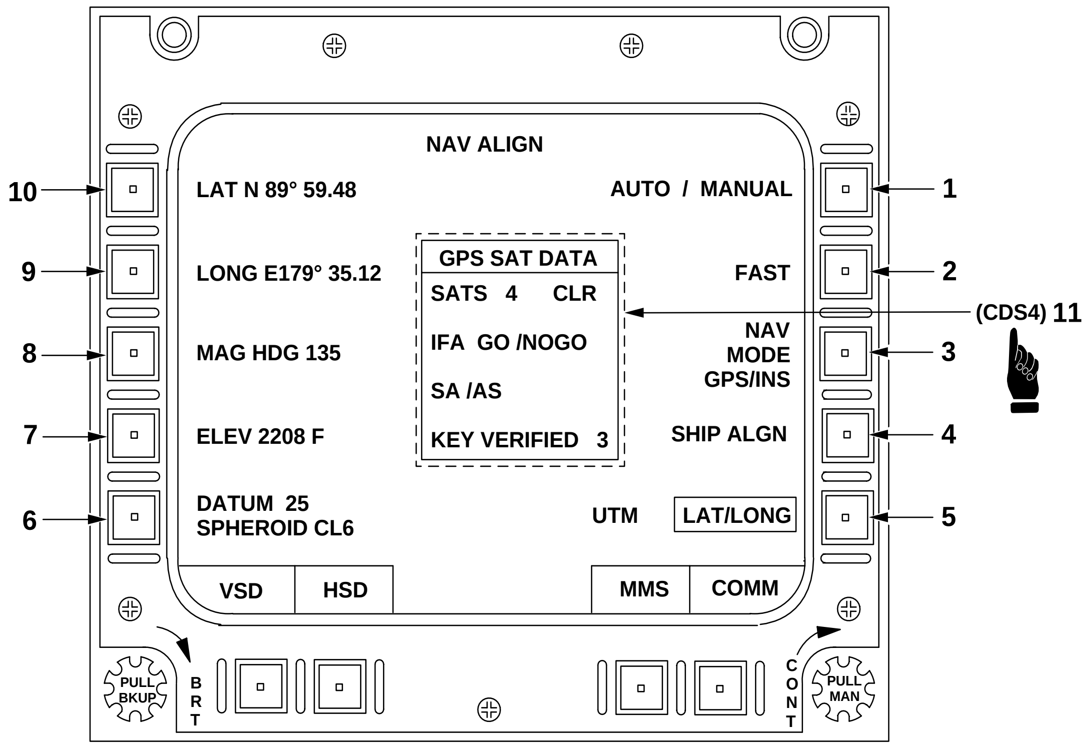
	CONTROL/INDICATOR	FUNCTION
1.	AUTO/MANUAL key	Activates a manually initiated, 4-minute alignment. "AUTO" is boxed during normal system start-up.
2.	FAST key	Activates fast align mode using stored heading from last mission or defaults to standard 4-minute alignment.
3.	SHIP ALGN key	Activates shipboard alignment based on ships magnetic heading.
4.	UTM LAT/LONG key	Toggles between UTM and LAT/LONG with the active mode boxed. When changing between UTM and LAT/LONG, inaccurate navigation data may be displayed. To correct problem, verify the correct DATUM entry was made on NAV ALIGN page. If problem still exists, from HSD page cycle NEXT WPT/ LAST WPT.
5.	ELEV key	Activates keyboard to accept entry of elevation of present position in meters. Elevation in meters may be entered by entering an M.
6.	MAG HDG key	Activates keyboard to accept entry of ships magnetic heading in degrees.

Figure 3-28. (CDS2) NAV ALIGN Page-LAT/LONG (Sheet 1 of 2)

(Cont)

	CONTROL/INDICATOR	FUNCTION
7.	LONG key	Activates keyboard to accept entry of longitude of present position in degrees, minutes, and hundredths of minutes; east or west.
8.	LAT key	Activates keyboard to accept entry of latitude of present position in degrees, minutes, and hundredths of minutes; north or south.

Figure 3-28. (CDS2) NAV ALIGN Page-LAT/LONG (Sheet 2 of 2)



	CONTROL/INDICATOR	FUNCTION
1.	AUTO/MANUAL key	Activates a manually initiated, 4-minute alignment. “AUTO” is boxed during normal system start-up.
2.	FAST key	Activates fast align mode using stored heading from last mission or defaults to standard 4-minute alignment.
3.	NAV MODE key	Calls up NAV MODE SELECT page to allow for the change of the EGI mode of operation. Displays currently selected mode (GPS/INS, GPS, INS).
4.	SHIP ALGN key	Activates shipboard alignment based on ships magnetic heading.
5.	UTM LAT/LONG key	Toggles between UTM and LAT/LONG with the active mode boxed. When changing between UTM and LAT/LONG, inaccurate navigation data may be displayed. To correct problem, verify the correct DATUM entry was made on NAV ALIGN page. If problem still exists, from HSD page cycle NEXT WPT/ LAST WPT.

Figure 3-29. R NAV ALIGN Page-LAT/LONG (Sheet 1 of 3)

(Cont)

	CONTROL/INDICATOR	FUNCTION
6.	DATUM/SPHEROID key	Activates keyboard to accept entry of local map datum code, or datum last entered will be displayed. These datums are located in the legend area at the bottom of tactical maps. Refer to Table 3-3 for world datum locations. After datum is entered the spheroid will automatically be displayed on the pilot MFD.
7.	ELEV key	Activates keyboard to accept entry of elevation of present position in meters. Elevation in meters may be entered by entering an M.
8.	MAG HDG key	Activates keyboard to accept entry of ships magnetic heading in degrees.
9.	LONG key	Activates keyboard to accept entry of longitude of present position in degrees, minutes, and hundredths of minutes; east or west.
10.	LAT key	Activates keyboard to accept entry of latitude of present position in degrees, minutes, and hundredths of minutes; north or south.
	(CDS4)	
11.	GPS SAT DATA Display	GPS satellite data is displayed in the box in the center of the page. The box contains five lines of data that display the following:
	Line 1	Displays GPS SAT DATA.
	Line 2	Displays the number of satellites being tracked and the quality of the signal. It consists of the following line of text: SATS X AAA a. X indicates the total number of satellites being tracked that are either in State 3 or State 5. States 3 and 5 are defined as follows: (1) State 3: Unclear signal from manmade or natural disruption. Lock on code but no carrier signal. (2) State 5: Clear signal. Lock on code and carrier signal. b. The character string AAA is one of the following: (1) Advisory is false. (2) DEGRADED - At least one satellite in State 3 is being tracked and the GPS FAIL advisory is false. (3) Fail advisory is false. c. If the GPS FAIL advisory is true, line 2 will only display text SATS.
	Line 3	Displays text IFA GO/NOGO. a. GO is boxed if the EGI is in the alignment mode, GPS FAIL is false, and the SATS status (Line 2) is CLR. b. NOGO is boxed if the EGI is in the alignment mode, GPS FAIL is false, and the SATS status (Line 2) is DEGRADED. c. GO/NOGO is blanked if GPS FAIL advisory is true. d. Text line is blanked if/when alignment is complete.

Figure 3-29. R NAV ALIGN Page-LAT/LONG (Sheet 2 of 3)

(Cont)

CONTROL/INDICATOR	FUNCTION
Line 4	Displays text SA/AS. a. SA is boxed if the SATS status is CLR, EGI is not operating in the ALL Y Code mode, and the GPS FAIL advisory is false. b. AS is boxed if the SATS status is either DEGRADED or blank, EGI is operating in the ALL Y Code mode, and GPS FAIL advisory is false. c. SA/AS is boxed if the SATS status is CLR, EGI is operating in the ALL Y Code mode, and GPS FAIL is false. d. Nothing will be boxed if the SATS status is DEGRADED or blank, EGI is not operating in the ALL Y Code mode, and GPS FAIL is true.
Line 5	Displays status for the key mode. Text consists of a status message and a single number to the right of the status message. This number indicates the number of key mode status messages that are true. If more than one key mode status message is true, the messages will be displayed in a rotary mode and each message will be displayed for 3 seconds. The following messages may be displayed: a. KEY VERIFIED. Daily key in use has been verified. b. KEY UNVERIFIED. Daily key in use has not been verified. c. KEY INVALID. Daily key in use is invalid. d. FAILED KEY. Failed parity. e. 2 HOUR ALERT. Current key expires in 2 hours or less. f. GPS FAILED. GPS failed.

Figure 3-29. R NAV ALIGN Page-LAT/LONG (Sheet 3 of 3)

3-58. CLOCK TIMER PAGE.

The CLOCK TIMER page (fig. 3-30) allows the operator to select the appropriate time display for the mission. The operator may choose to display ZULU time provided by the GPS, MISSION time, LOCAL time or a count down timer. TIMER1 causes an advisory when its time has counted down to zero. ALARM1 causes an advisory when MISSION/LOCAL time matches alarm time.

3-59. SETTING MISSION TIME OR LOCAL TIME.

Set as follows:

1. MISSION key — Press.
2. MFK — Enter a valid time (defaults to 00:00:00)

   or

   Enter letter “O” followed by a positive or negative offset in hours to ZULU (label will change from MISSION to LOCAL). If valid offset is entered, the operator will no longer be allowed to enter MISSION time.

3-60. SETTING TIMER 1.

1. TIMER1 key — Press.
2. MFK — Enter a meaningful advisory message to the timer label and press ENTER.
3. MFK — Enter time in minutes and seconds to count down to.
4. ENTER key — Press to start timer. Press again to stop timer.

3-61. SELECTING TIME DISPLAY.

1. SELECT up key — Press to move selection box up.

2. SELECT down key — Press to move selection box down.

3. Boxed label — ZULU, MISSION/LOCAL, or TIMER1 will be displayed on INITIAL PAGE 1.

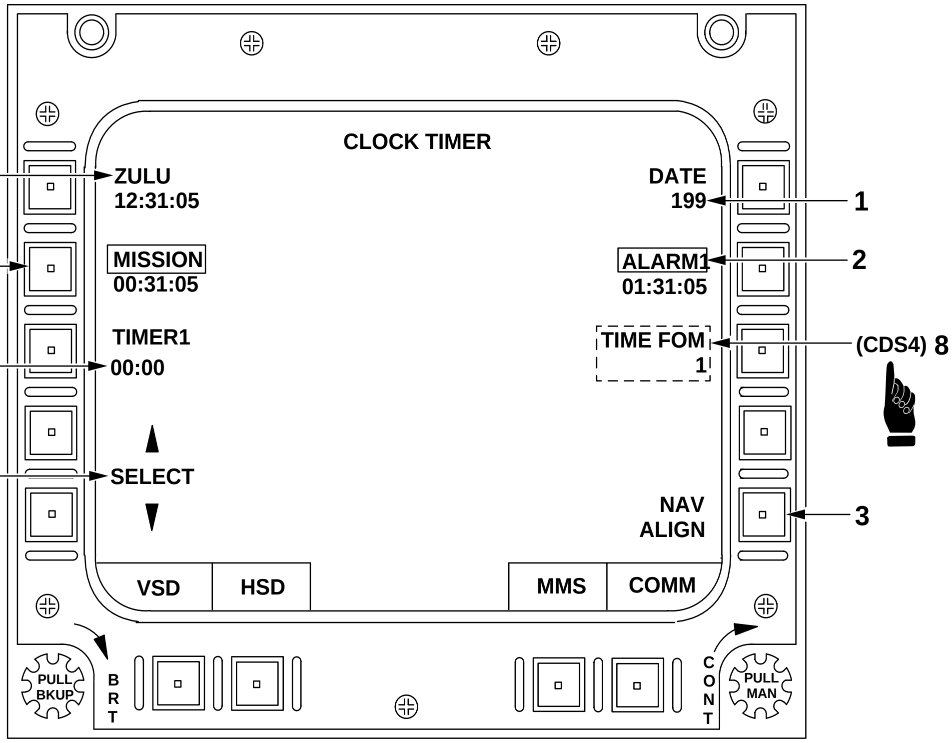
3-62. SETTING ALARM 1.

1. ALARM1 key — Press.

2. MFK — Enter a meaningful advisory message for ALARM1.

3. MFK — Enter time for alarm to be initiated.

4. ENTER key — Press to turn alarm on. Press again to turn alarm off.



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J2995

CONTROL/INDICATOR	FUNCTION
1. DATE	Displays Julian date acquired from GPS.
2. ALARM1	Settable alarm clock function used with MISSION/LOCAL time.
3. NAV ALIGN key	Calls up the NAV ALIGN page.
4. SELECT	Causes ZULU, MISSION/LOCAL, or TIMER1 to be displayed on INITIAL PAGE 1.
5. TIMER1	Count down timer.
6. MISSION key	Allows entry of a mission time to be used as a count up time. Entering an offset to ZULU causes label to change to LOCAL, with local time displayed.
7. ZULU	Displays ZULU time acquired from GPS.
8. **(CDS4)** TIME FOM	The EGI provides the TIME FOM display at R-3. TIME FOM is display-only and cannot be entered by the operator. If EGI not operational, display at R-3 is blank.

Figure 3-30. CLOCK TIMER Page

3-63. WAYPOINT (WPT) LIST PAGE.

The waypoint (WPT) LIST page (fig. 3-31) is actually six separate pages that serve as a directory of the 30 navigation waypoints and 30 targets that can be stored in memory. Each page displays the present position and ten waypoints. Each successive page is called up using the NEXT PAGE key (R-3). Each waypoint line has an alphanumeric identifier of up to four characters, the coordinates, and the elevation of the waypoint. The present position of the helicopter is constantly being updated and displayed on the triple zero line of each WPT LIST page. Any changes to this waypoint list are made through the NEW WAYPOINT pages.

NOTE

A seventh WPT LIST page is accessible only when a TACAN radio is installed, and displays 10 TACAN stations in a manner similar to the other six pages.

3-64. NEW WAYPOINT UTM PAGE.

The NEW WAYPOINT UTM page (fig. 3-32) is called up to enter data on the WPT LIST page. It can be called up through the FLIGHT PLAN, BFLD LIST, or WPT LIST page when UTM has been selected. This page allows the entry of the waypoint designator, coordinates, and elevation through the MFD. Each waypoint entered may be selected as a prepoint location (five maximum) by pressing the PREPOINT key on the right side of the MFD. The text PREPOINT to the left of the PREPOINT key (R-3) will be boxed, indicating that the waypoint is also designated as a PREPOINT location. As each waypoint is entered, the page is cleared to accept the entry of the next waypoint by pressing the STORE key on the lower right side of the MFD.

NOTE

If the PREPOINT buffer is full, the text PREPOINT will not box. If a new waypoint is desired for designation as a PREPOINT location, a previously designated waypoint must first be removed from the PREPOINT buffer. This is accomplished by accessing the waypoint to be removed via the NEW WAYPOINT page, and pressing the PREPOINT key on the right side of the MFD. This action will cause the text PREPOINT to be unboxed, and then the waypoint is stored as normal.

3-65. NEW WAYPOINT LAT/LON PAGE.

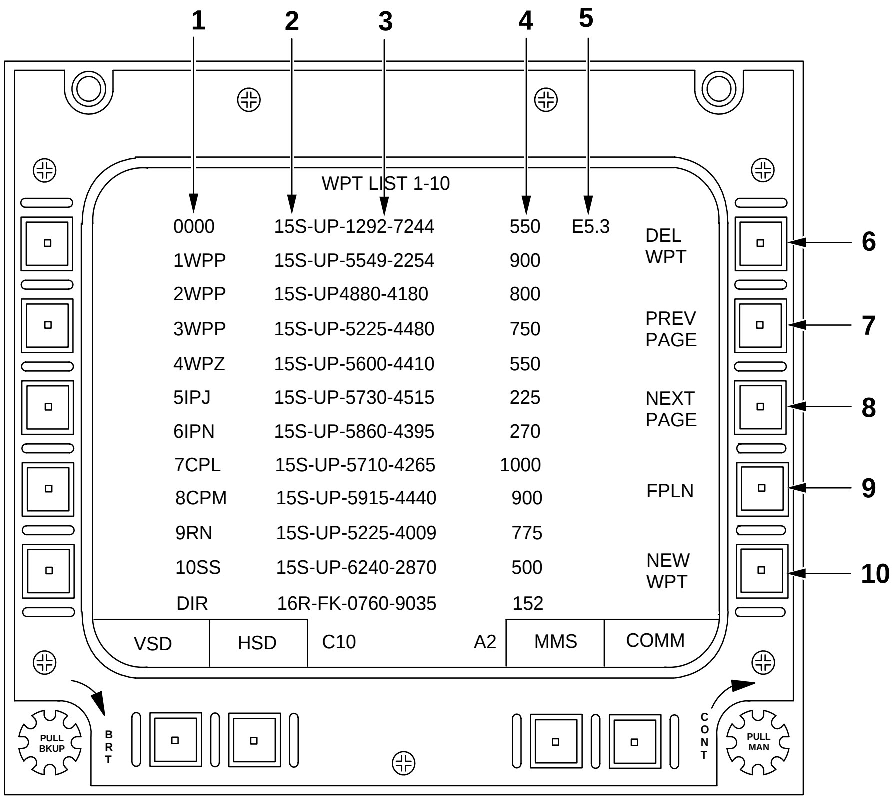
The NEW WAYPOINT LAT/LON page (fig. 3-33) serves the same functions as the NEW WAYPOINT UTM page. This page is used when latitude and longitude coordinates are used in navigation, and allows all waypoint information to be entered in LAT/LON terms.

3-66. FLIGHT PLAN PAGE.

(CDS2) The FLIGHT PLAN page (fig. 3-34) is used to assemble and display a list of waypoints that make up the flight plan route displayed on the HSD page. This page can be called up from any other page by pressing the HSD key two times. If the HSD page is displayed, pressing the FPLN key once will call up the FLIGHT PLAN page. This page may also be called up by pressing the FPLN key on the right side of the WPT LIST or BFLD page. Up to 20 legs may be stored on a flight plan route. Using the various keys of this page and the MFK, waypoints may be added to the end of a flight plan, inserted between existing waypoints, changed, or deleted.

R The FLIGHT PLAN page (fig. 3-34) is used to assemble and display a list of waypoints that make up the flight plan route displayed on the HSD page. This page can be called up from any other page by pressing the HSD key, the RMS key, and the FPLN key. If the HSD page is displayed, pressing the RMS key then the FPLN key will call up the FLIGHT PLAN page. This page may also be called up by pressing the FPLN key on the right side of the WPT LIST page. Up to 20 legs may be stored on a flight plan route. Using the various keys of this page and the MFK, waypoints may be added to the end of a flight plan, inserted between existing waypoints, changed, or deleted.

The entire flight plan may be deleted by pressing the DEL FPLN key. The DEL FPLN label will then flash. Pressing the DEL FPLN key again will clear the flight plan from the display. Any changes of the flight plan made through the FLIGHT PLAN page are also reflected on the HSD page.



WAYPOINT LIST

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J0447

	CONTROL/INDICATOR	FUNCTION
1.	Waypoint identifiers	One- to four-character identifier assigned to each waypoint or target.
2.	Zone identifier	Three-digit UTM zone identifier.
3.	Coordinates	Eight-digit coordinates of location of waypoints entered.
4.	Elevation	Elevation of waypoints shown in feet for LAT/LONG and meters for UTM. Elevation must be entered for waypoints where prepoint MMS or offset navigation updates modes are to be used.
5.	MAG VAR	Magnetic variation for present position.

Figure 3-31. Waypoint (WPT) LIST Page (Sheet 1 of 2)

(Cont)

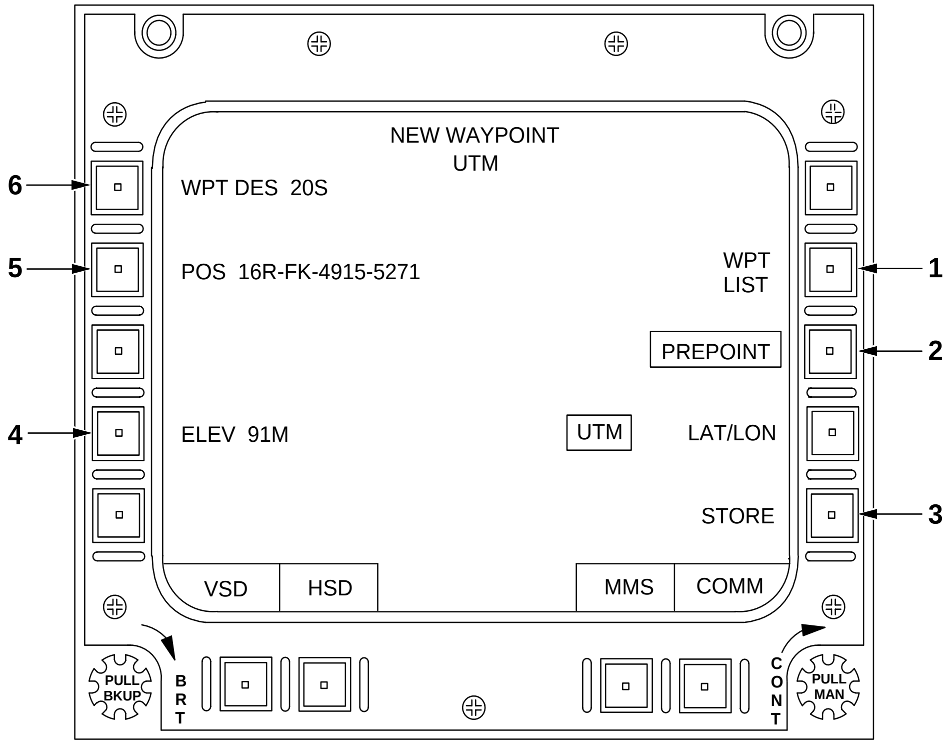
	CONTROL/INDICATOR	FUNCTION
6.	DEL WPT key	Causes cursor to display allowing data entry.
	WPT Data entered:	
	1-60	Deletes WPT/TGT
	WPT/TGT ID	Deletes WPT/TGT
	TGT	Deletes all TGTs
	WPT	Deletes all WPTs
	ALL	Deletes all WPTs/TGTs
7.	PREV PAGE key	Causes previous WPT LIST page to display.
8.	NEXT PAGE key	Causes next WPT LIST page to display.
9.	FPLN key	Causes FLIGHT PLAN page to display.
10.	NEW WPT key	Causes NEW WAYPOINT page to display.

Figure 3-31. Waypoint (WPT) LIST Page (Sheet 2 of 2)

3-67. BATTLEFIELD GRAPHICS LIST PAGE.

The BATTLEFIELD GRAPHICS LIST page (fig. 3-35) can be called up from the FLIGHT PLAN page (fig. 3-34) by pressing the BFLD LIST key. Using the various keys of this page and the MFK, up to 40 waypoints (including blanks) may be added to the battlefield graphics list, inserted between existing waypoints, changed, or deleted.

The BATTLEFIELD GRAPHICS LIST page may be deleted by pressing the DEL LIST key. The DEL LIST label will then flash. Pressing the DEL LIST key again will clear the battlefield graphics list from the display. After the initial activation of the DEL LIST key (while the label is flashing), recovery can be made by pressing any other key. Any changes of the battlefield graphics list made through the BATTLEFIELD GRAPHICS LIST page are also reflected on the HSD page.



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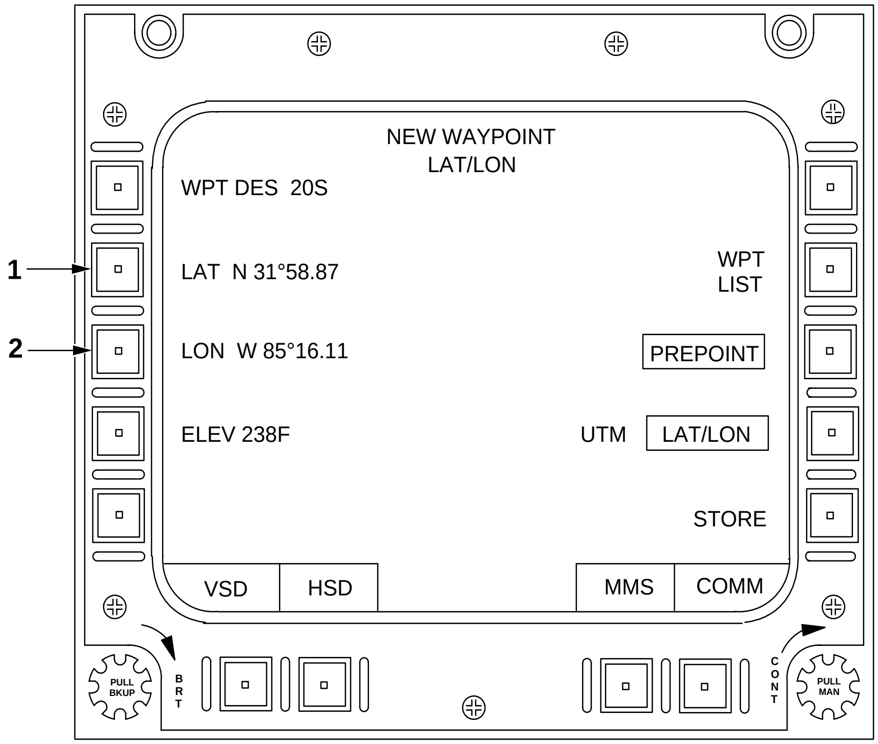
J0320

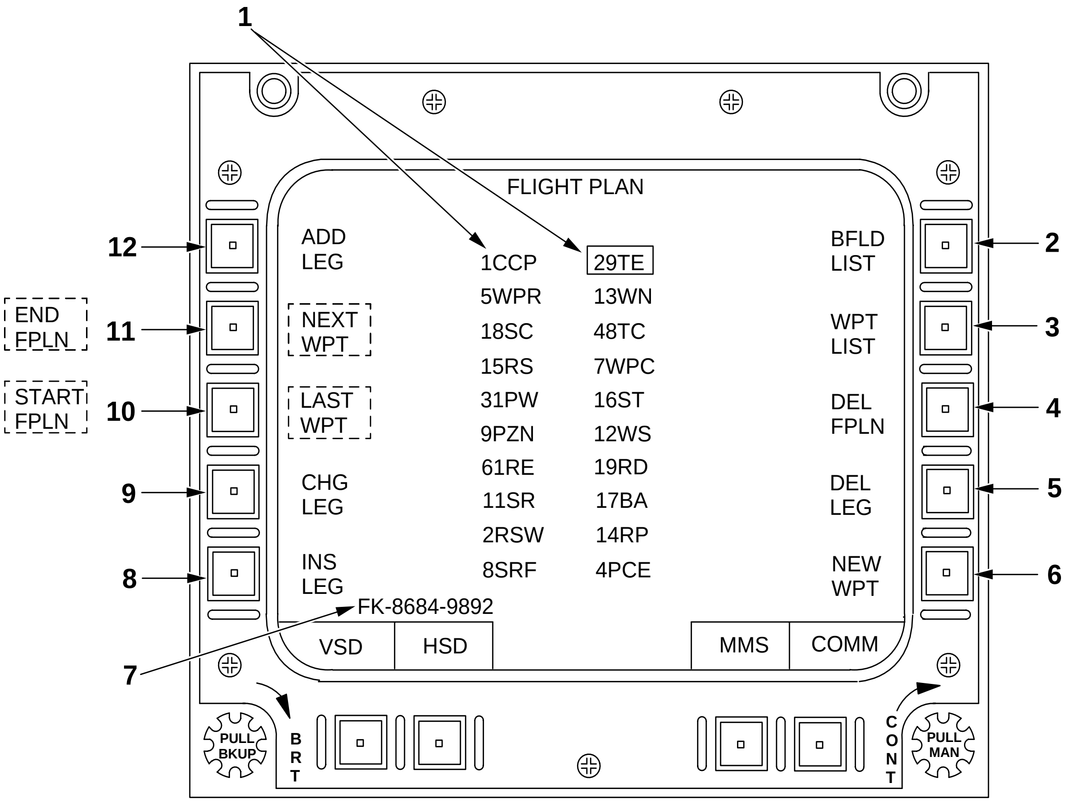
	CONTROL/INDICATOR	FUNCTION
1.	WPT LIST key	Calls up WPT LIST page.
2.	PREPOINT key	Pressing boxes legend and designates waypoint as one of five preselected prepoint locations. Press again to unbox legend.
3.	STORE key	Stores new waypoint in waypoint list.
4.	ELEV key	Activates MFK to accept entry of elevation of waypoint in meters. Elevation in feet may be entered by entering an F after the elevation.
5.	POS key	Activates MFK for entry of waypoint coordinates.
6.	WPT DES key	Activates MFK to accept entry of identifier if one other than the automatic fill is desired.

Figure 3-32. NEW WAYPOINT UTM Page



	CONTROL/INDICATOR	FUNCTION
1.	LAT key	Activates MFK to enter new latitude coordinates in degrees, minutes, and hundredths of minutes.
2.	LON key	Activates MFK to enter new longitude coordinates in degrees, minutes, and hundredths of minutes.

Figure 3-33. NEW WAYPOINT LAT/LON Page



FLIGHT PLAN

406075-35
J0320

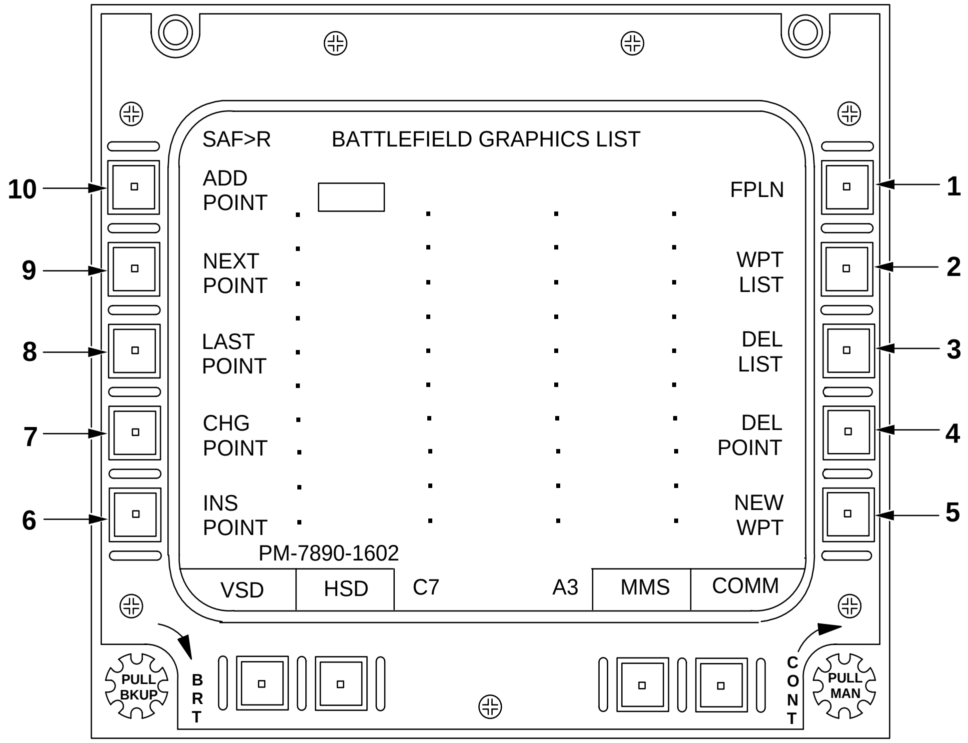
CONTROL/INDICATOR		FUNCTION
1.	Waypoint identifiers	One- to four-character identifiers of waypoints of flight plan in the order that the route is to be flown. Box indicates the selected/current waypoint.
2.	BFLD LIST key	Selects BATTLEFIELD GRAPHICS LIST page.
3.	WPT LIST key	Calls up WPT LIST page.
4.	DEL FPLN key	Pressing key once will cause the DEL FPLN label to flash. Pressing the key again will cause the flight plan to delete. After the initial activation of the DEL FPLN key (while the label is flashing), recovery can be made and termination of the DEL FPLN request can be made by pressing any other key.
5.	DEL LEG key	Pressing key will delete leg of flight plan that is marked with cursor box.
6.	NEW WPT key	Calls up NEW WAYPOINT page.

Figure 3-34. FLIGHT PLAN Page (Sheet 1 of 2)

(Cont)

	CONTROL/INDICATOR	FUNCTION
7.	Present position	Continuously updated position shown in eight-digit UTM or LAT/LONG.
8.	INS LEG key	Activates MFD for entry of a waypoint from the waypoint list. The waypoint will be inserted immediately after waypoint marked with cursor box.
9.	CHG LEG key	Activates MFK for entry of a waypoint from the waypoint list. Waypoint will replace waypoint marked with cursor box.
10.	LAST WPT/START FPLN key	Accesses the last waypoint. It causes the current waypoint to be decremented to the previous waypoint in the flight plan sequence. Once the first flight plan leg has been accessed, START FPLN will display instead of LAST WPT. The box enclosing the current waypoint is moved up to identify the new current waypoint.
11.	NEXT WPT/END FPLN key	Accesses the next waypoint. It causes the current waypoint to be incremented to the next waypoint in the flight plan sequence. Once the last flight plan leg has been accessed, END FPLN will display instead of NEXT WPT. The box enclosing the current waypoint is moved down to identify the new current waypoint.
12.	ADD LEG key	Pressing key moves cursor box to the next available space below the last waypoint in the flight plan.

Figure 3-34. FLIGHT PLAN Page (Sheet 2 of 2)



	CONTROL/INDICATOR	FUNCTION
1.	FPLN key	Calls up FLIGHT PLAN page.
2.	WPT LIST key	Calls up WPT LIST page.
3.	DEL LIST key	Pressing key once will cause the DEL LIST label to flash. Pressing the key again will cause the battlefield graphics list to delete. After the initial activation of the DEL LIST key (while the label is flashing), recovery can be made and DEL LIST request can be terminated by pressing any other key.
4.	DEL POINT key	Pressing key will delete point of battlefield graphics list that is marked with cursor box.
5.	NEW WPT key	Calls up NEW WAYPOINT page.
6.	INS POINT key	Activates MFD for entry of a waypoint from the waypoint list. The waypoint will be inserted immediately after waypoint marked with cursor box.

Figure 3-35. BATTLEFIELD GRAPHICS LIST (Sheet 1 of 2)

(Cont)

	CONTROL/INDICATOR	FUNCTION
7.	CHG POINT key	Activates MFK for entry of a waypoint from the waypoint list. New waypoint will replace waypoint marked with cursor box.
8.	LAST POINT key	Accesses the last waypoint. It causes the current waypoint to be decremented to the previous waypoint in the battlefield graphics list sequence. Once the last battlefield graphics list point has been accessed, START LIST will display. The box enclosing the current waypoint is moved down to identify the new current waypoint.
9.	NEXT POINT key	Accesses the next waypoint. It causes the current waypoint to be incremented to the next waypoint in the battlefield graphics list sequence. Once the last battlefield graphics list point has been accessed, END LIST will display. The box enclosing the current waypoint is moved down to identify the new current waypoint.
10.	ADD POINT key	Activates MFK to accept entry of waypoints coordinates.

Figure 3-35. BATTLEFIELD GRAPHICS LIST (Sheet 2 of 2)

3-68. HORIZONTAL SITUATION DISPLAY PAGE.

The Horizontal Situation Display (HSD) page (fig. 3-36 and fig. 3-37) is the basic page for navigation. It is called up by pressing the HSD key at the bottom of any page or pressing the DSPL SEL switch on the pilot cyclic grip down one time. The HSD page displays a compass rose that represents an area of up to approximately 48 kilometers (26 nautical miles) across. The helicopter position is represented by a cross at the center of the display. The flight plan is displayed to scale, positioned on the MFD relative to the position of the helicopter. Navigational information for the next waypoint to be flown to is displayed in the upper left and right corners of the MFD. An open caret, on the compass rose, points to the bearing to the next waypoint in the flight plan. All navigational information can refer to the last waypoint passed by pressing the LAST WPT key. The NAV UPD key allows the crew to periodically update the navigation system to correct for any errors that may have accumulated. The HSD page has four scales, 1:50,000, 1:100,000, 1:250,000, and 1:500,000 that are alternately selected with the SCL SEL key. A map offset submode may be selected by pressing the MAP OSET key on the right side of the screen.

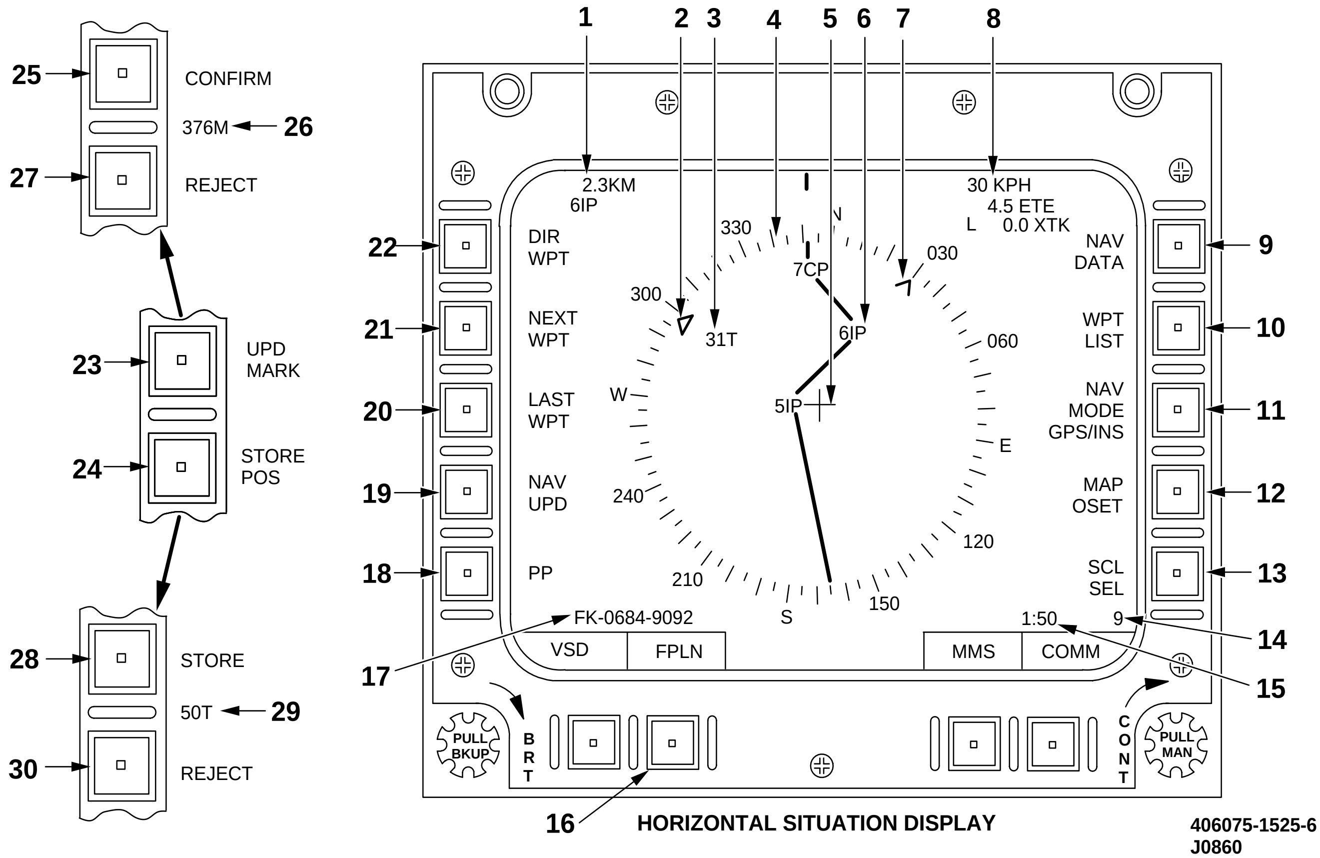
3-69. NAV MODE SELECT PAGE.

NOTE

- In the P(Y) ONLY mode, the GPS receiver within the EGI uses only the satellite signals from the Precise Positioning Service (PPS).
- When the P(Y) ONLY mode is not selected, GPS navigates using military PPS signals as well as commercial signals known as the Selective Positioning Service (SPS).

(CDS2) The NAV Mode Select page (fig. 3-38) is called up by pressing the NAV MODE key on the right side of the HSD page. The purpose of this page is to change the mode of operation. One of three modes of operation may be selected by pressing the corresponding key. The three EGI solution sources that may be selected are GPS/INS, GPS, or INS. The EGI can be commanded to accept P(Y) code only.

R The NAV MODE SELECT page (fig. 3-39) is called up by pressing the NAV MODE key on the right side of the NAV ALIGN page. The purpose of this page is to change the mode of operation. One of three modes of operation may be selected by pressing the corresponding key. The three EGI solution sources that may be selected are GPS/INS, GPS, or INS. The EGI can be commanded to accept P(Y) code only.



CONTROL/INDICATOR		FUNCTION
1.	Waypoint distance	Displays distance to waypoint listed. This waypoint can be the next waypoint in the flight plan by pressing NEXT WPT key, the previous waypoint in the flight plan by pressing LAST WPT, or a direct waypoint when it is entered.
2.	MMS bearing indicator	Indicates line-of-sight bearing of the mast mounted sight.
3.	Target waypoint	Indicates any stored targets within the range of those waypoints entered as waypoint 31 through 60.
4.	Compass rose	360° scale that rotates to give helicopter heading at the top of the display. The inside edge of the compass rose encircles the flight plan route according to selected map scale.
5.	Helicopter symbol	Stationary cross at the center of the display that represents the helicopter position relative to the flight plan route displayed.

Figure 3-36. (CDS2) Horizontal Situation Display (HSD) Page (Sheet 1 of 3)

(Cont)

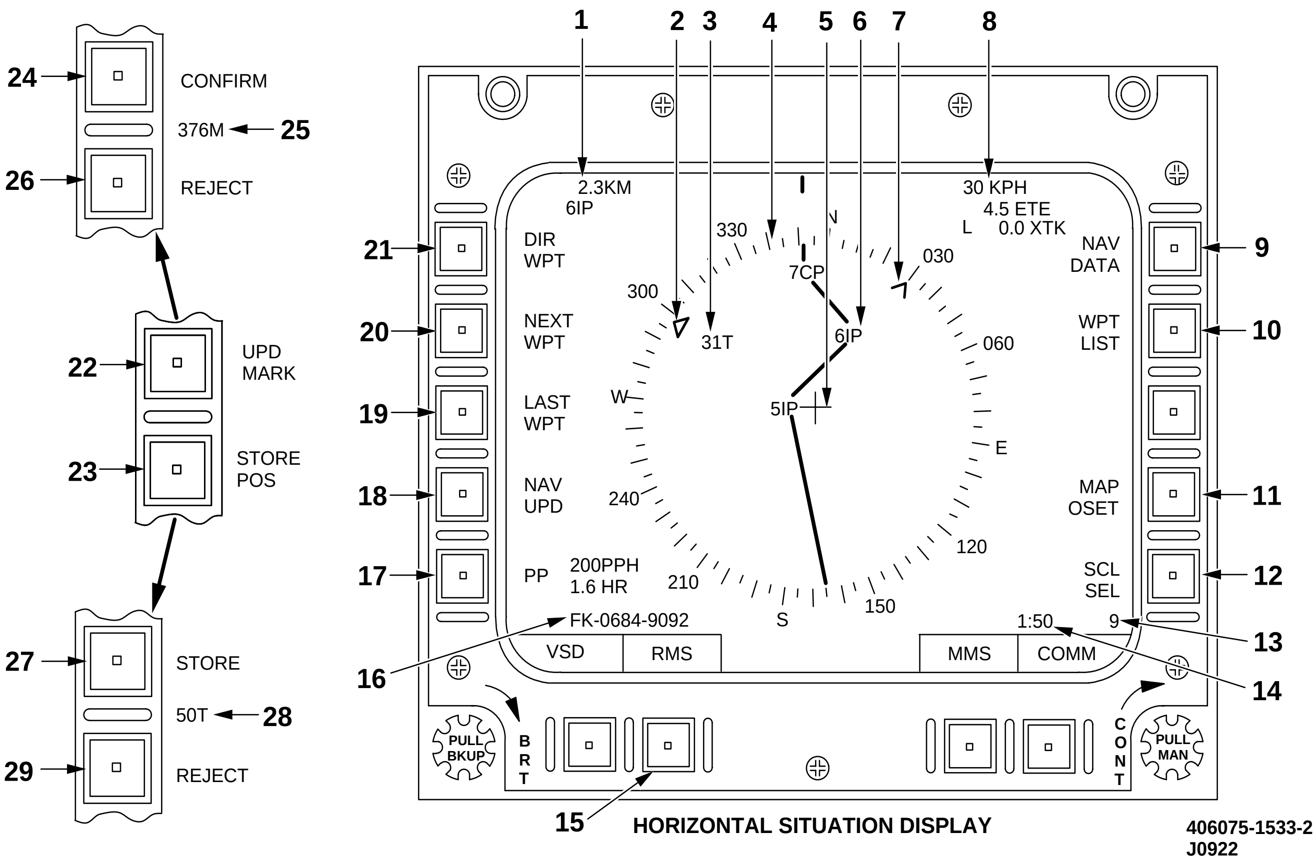
	CONTROL/INDICATOR	FUNCTION
6.	Flight plan route	Preselected waypoints connected by straight lines that represent flight plan displayed to scale as it is listed on the FLIGHT PLAN page. Route moves in relation to helicopter symbol.
7.	Bearing caret	Indicates magnetic bearing to the next waypoint in the flight plan.
8.	Navigational data	Optional display called up by pressing NAV DATA key which displays (KPH for UTM and KTS for LAT/LONG), estimated time enroute (ETE) in minutes and tenths for both modes, and crosstrack distance (XTK) in kilometers for UTM and nautical miles for LAT/LONG.
9.	NAV DATA key	Calls up and deletes navigational data in upper right corner of display.
10.	WPT LIST key	Calls up WPT LIST page.
11.	NAV MODE key	Calls up NAV Mode Select page to allow for the change of the EGI mode of operation. Displays currently selected mode (GPS/INS, GPS, INS).
12.	MAP OSET key	Calls up Map Offset page.
13.	SCL SEL key	Alternates display scales 1:50,000, 1:100,000, 1:250,000, or 1:500,000 each time key is pressed.
14.	Figure of merit	The navigation figure of merit (FOM) displays in the lower right corner. The FOM indicates to the operator the expected navigation system position accuracy. The FOM is not displayed when the navigation system is declared invalid. The FOM consists of a single digit, 1 through 9. 1 is best and 9 is worst.
15.	Scale indication	Indicates display scale that is presently displayed. Scale is changed with SCL SEL key.
16.	FPLN key	Calls up FLIGHT PLAN page to display.
17.	Present position	Indicates present position of the helicopter in UTM or LAT/LONG coordinates. Not displayed if EGI is in an alignment.
18.	PP key	Calls up or deletes display of present position coordinates.
19.	NAV UPD key	Pressing key redefines NAV UPD and PP keys as UPD MARK and STORE POS respectively. See callouts 20 thru 27 for paging sequence to navigational updating and store position modes.
20.	LAST WPT key	Accesses the last waypoint. It causes the current waypoint to be decremented to the previous waypoint in the flight plan sequence. The box enclosing the current waypoint is moved up to identify the new current waypoint on the FLIGHT PLAN page.

Figure 3-36. (CDS2) Horizontal Situation Display (HSD) Page (Sheet 2 of 3)

(Cont)

	CONTROL/INDICATOR	FUNCTION
21.	NEXT WPT key	Accesses the next waypoint. It causes the current waypoint to be incremented to the next waypoint in the flight plan sequence. The box enclosing the current waypoint is moved down to identify the new current waypoint on the FLIGHT PLAN page.
22.	DIR WPT key	Calls up NEW WAYPOINT page to enter a direct waypoint for a new destination enroute while maintaining current flight plan in memory.
23.	UPD MARK key	Displays after NAV UPD is pressed. Press this key to compare system coordinates with actual coordinates when directly over a selected waypoint. When the error is less than 300 meters, the system will update automatically and key will revert back to original display. If the error is greater than 300 meters. CONFIRM and REJECT keys will replace UPD MARK and STORE POS respectively with the amount of error displayed between the two keys. If error is greater than 1000 meters, then 999 + will be displayed.
24.	STOR POS key	Activation of this key initiates the target position store and address key label changes from STORE POS to REJECT.
25.	CONFIRM key	Displays after UPD MARK key is pressed replacing that key if the resulting error between the system coordinates and actual coordinates is more than 300 meters. If the error magnitude displayed between CONFIRM and REJECT is acceptable, press CONFIRM and the updated information is entered and the key reverts back to NAV UPD.
26.	Detected error	The error detected between the system coordinates and the actual coordinates of the waypoint measured in meters.
27.	REJECT key	Displays after UPD MARK key is pressed, replacing STORE POS if the resulting error between the system coordinates and actual coordinates is more than 300 meters. If the error magnitude displayed between CONFIRM and REJECT is not acceptable, press the REJECT key. This will revert the key back to PP.
28.	STORE key	Displays after STORE POS key is pressed replacing UPD MARK. If it is desired to place the present position of the helicopter into memory, press the STORE key. Present position will be stored in the next available storage register as displayed and key will revert back to NAV UPD.
29.	Store register	Displays after STORE POS key is pressed. It depicts the next available storage register on the Waypoint List page. This is where the present position will be stored if the STORE key is pressed.
30.	REJECT key	Displays after STORE POS key is pressed replacing STORE POS. This key is pressed to reject position storage and to revert the key back to PP.

Figure 3-36. (CDS2) Horizontal Situation Display (HSD) Page (Sheet 3 of 3)



	CONTROL/INDICATOR	FUNCTION
1.	Waypoint distance	Displays distance to waypoint listed. This waypoint can be the next waypoint in the flight plan by pressing NEXT WPT key, the previous waypoint in the flight plan by pressing LAST WPT, or a direct waypoint when it is entered.
2.	MMS bearing indicator	Indicates line-of-sight bearing of the mast mounted sight.
3.	Target waypoint	Indicates any stored targets within the range of those waypoints entered as waypoint 31 through 60.
4.	Compass rose	360° scale that rotates to give helicopter heading at the top of the display. The inside edge of the compass rose encircles the flight plan route according to selected map scale.
5.	Helicopter symbol	Stationary cross at the center of the display that represents the helicopter position relative to the flight plan route displayed.

Figure 3-37. R Horizontal Situation Display (HSD) Page (Sheet 1 of 4)

(Cont)

	CONTROL/INDICATOR	FUNCTION
6.	Flight plan route	Preselected waypoints connected by straight lines that represent flight plan displayed to scale as it is listed on the Flight Plan page. Route moves in relation to helicopter symbol.
7.	Bearing caret	Indicates magnetic bearing to the next waypoint in the flight plan.
8.	Navigational data	Optional display called up by pressing NAV DATA key which displays (KPH for UTM and KTS for LAT/LONG), estimated time enroute (ETE) in minutes and tenths for both modes, and crosstrack distance (XTK) in kilometers for UTM and nautical miles for LAT/LONG.
9.	NAV DATA key	Calls up and deletes navigational data in upper right corner of display.
10.	WPT LIST key	Calls up WPT LIST page.
11.	MAP OSET key	Calls up Map Offset page.
12.	SCL SEL key	Alternates display scales 1:50,000, 1:100,000, 1:250,000, or 1:500,000 each time key is pressed.
13.	Figure of merit	The navigation figure of merit (FOM) displays in the lower right corner. The FOM indicates to the operator the expected navigation system position accuracy. The FOM is not displayed when the navigation system is declared invalid. The FOM consists of a single digit, 1 through 9. 1 is best and 9 is worst.
14.	Scale indication	Indicates display scale that is presently displayed. Scale is changed with SCL SEL key.
15.	RMS key	Calls up Rotorcraft Mapping System (RMS) main page.
16.	Present position	Indicates present position of the helicopter in UTM or LAT/LONG coordinates.
17.	PP key	Calls up or deletes display of present position coordinates, fuel burn rate, and fuel time remaining.
18.	NAV UPD key	Pressing key redefines NAV UPD and PP keys as UPD MARK and STORE POS respectively. See callouts 20 thru 27 for paging sequence to navigational updating and store position modes.
19.	LAST WPT key	Accesses the last waypoint. It causes the current waypoint to be decremented to the previous waypoint in the flight plan sequence. The box enclosing the current waypoint is moved up to identify the new current waypoint on the FLIGHT PLAN page.

Figure 3-37. R Horizontal Situation Display (HSD) Page (Sheet 2 of 4)

(Cont)

	CONTROL/INDICATOR	FUNCTION
20.	NEXT WPT key	Accesses the next waypoint. It causes the current waypoint to be incremented to the next waypoint in the flight plan sequence. The box enclosing the current waypoint is moved down to identify the new current waypoint on the FLIGHT PLAN page.
21.	DIR WPT key	Calls up NEW WAYPOINT page to enter a direct waypoint for a new destination enroute while maintaining current flight plan in memory.
22.	UPD MARK key	Displays after NAV UPD is pressed. Press this key to compare system coordinates with actual coordinates when directly over a selected waypoint. When the error is less than 300 meters, the system will update automatically and key will revert back to original display. If the error is greater than 300 meters. CONFIRM and REJECT keys will replace UPD MARK and STORE POS respectively with the amount of error displayed between the two keys. If error is greater than 1000 meters, then 999 + will be displayed.
23.	STOR POS key	Activation of this key initiates the target position store and address key label changes from STORE POS to REJECT.
24.	CONFIRM key	Displays after UPD MARK key is pressed replacing that key if the resulting error between the system coordinates and actual coordinates is more than 300 meters. If the error magnitude displayed between CONFIRM and REJECT is acceptable, press CONFIRM and the updated information is entered and the key reverts back to NAV UPD.
25.	Detected error	The error detected between the system coordinates and the actual coordinates of the waypoint measured in meters.
26.	REJECT key	Displays after UPD MARK key is pressed, replacing STORE POS if the resulting error between the system coordinates and actual coordinates is more than 300 meters. If the error magnitude displayed between CONFIRM and REJECT is not acceptable, press the REJECT key. This will revert the key back to PP.
27.	STORE key	Displays after STORE POS key is pressed replacing UPD MARK. If it is desired to place the present position of the helicopter into memory, press the STORE key. Present position will be stored in the next available storage register as displayed and key will revert back to NAV UPD.

Figure 3-37. R Horizontal Situation Display (HSD) Page (Sheet 3 of 4)

(Cont)

	CONTROL/INDICATOR	FUNCTION
28.	Store register	Displays after STORE POS key is pressed. It depicts the next available storage register on the WPT LIST page. This is where the present position will be stored if the STORE key is pressed.
29.	REJECT key	Displays after STORE POS key is pressed replacing STORE POS. This key is pressed to reject position storage and to revert the key back to PP.

Figure 3-37. R Horizontal Situation Display (HSD) Page (Sheet 4 of 4)

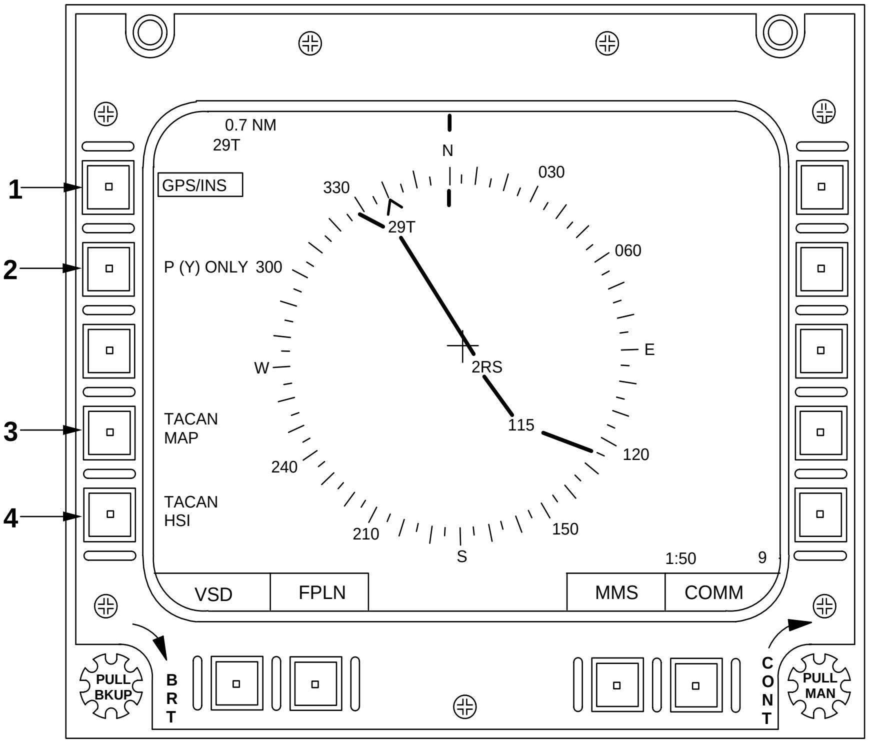
3-70. MAP OFFSET PAGE.

The Map Offset page (fig. 3-40 and fig. 3-41) is an optional submode of the HSD page. It is called up by pressing the MAP OSET key on the right side of the HSD. The purpose of this function is to expand the display distance forward of the helicopter. When the MAP OSET key is pressed, the helicopter symbol shifts to the bottom center of the display and the compass rose is expanded. This increases the display distance forward of the helicopter position from approximately 2.5 kilometers (1.5 nautical miles) to 5 kilometers (3 nautical miles) on the 1:50,000 scale, from 5 kilometers (3 nautical miles) to 10 kilometers (5.5 nautical miles) on the 1:100,000 scale, from 12 kilometers (6.5 nautical miles) to 24 kilometers (13 nautical miles) on the 1:250,000 scale, and from 24 kilometers (13 nautical miles) to 48 kilometers (26 nautical miles) on the 1:500,000 scale. The MAP OSET key legend changes to MAP CNTR when in the map offset mode. Pressing the MAP CNTR key returns the screen to the normal HSD mode, and MAP OSET returns to the key legend.

3-71. DIRECT WAYPOINT PAGE.

This mode allows the crew to deviate from the flight plan being used to fly directly to a new waypoint without changing prestored flight plan. The Direct Waypoint page (fig. 3-42 and fig. 3-43) is an optional submode of the HSD page and is a quick method for flying to a waypoint which is not listed in the current flight plan. It is called up by pressing the DIR WPT key on the top left corner of the HSD page. The DIR WPT page looks similar to the NEW WPT page. If the waypoint to be directly flown to is already in the waypoint list, entering its identifier and storing it is all that is necessary to initiate the direct waypoint function. If the waypoint is not already listed in the waypoint list, then a similar data entry procedure (identifier, coordinates, elevation, etc.) as would be accomplished for a new waypoint must be completed on the DIR WPT page.

Upon storing this data, the direct waypoint function would be initiated. This is indicated by the replacement of the flight plan depiction on the HSD page with that of the direct waypoint selected and the replacement of the DIR WPT label on the top left of the HSD page with the return to flight plan (RTN FPLN) label. When the direct waypoint mode is no longer needed, press the RTN FPLN key to return to the normal HSD page. When the normal HSD page returns, distance and bearing data to the next waypoint will automatically be displayed relative to the position of the aircraft. The WPT LIST pages will display the selected direct waypoint coordinates at the bottom of each page.



406075-1525-8
J0860

	CONTROL/INDICATOR	FUNCTION
1.	GPS/INS key	Activation of this key will select the EGI navigation mode and will select one of the three EGI navigation solutions (GPS, INS, GPS/INS).

NOTE

While in the P(Y) ONLY mode, the GPS receiver within the EGI uses only satellite signals from the Precise Positioning Service (PPS). When the P(Y) ONLY mode is not selected, the GPS navigates using both military PPS signals as well as commercial signals known as Selective Positioning Service (SPS).

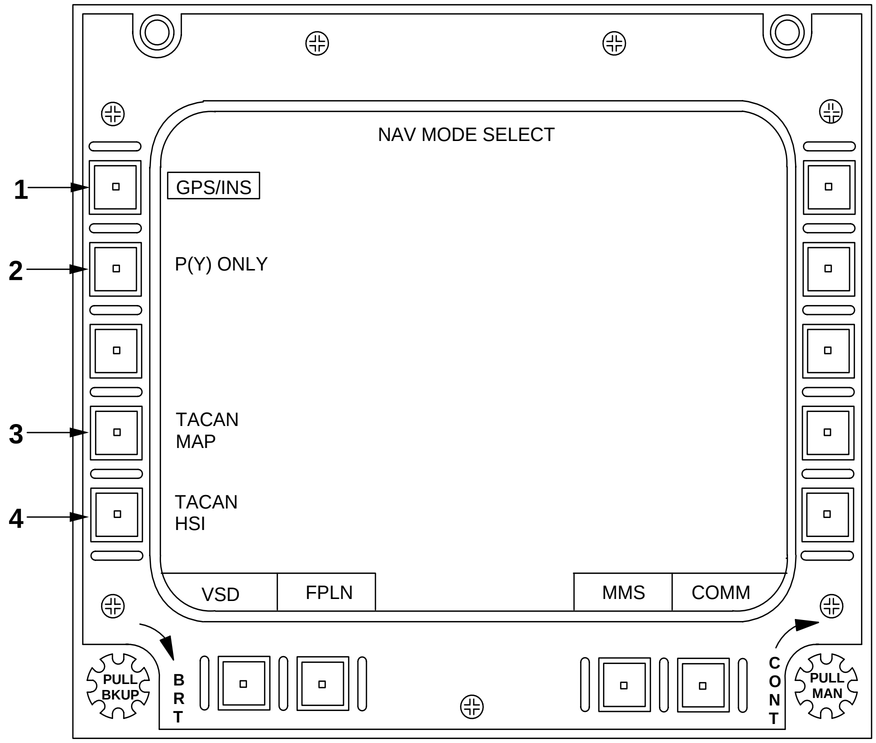
2.	P(Y) ONLY key	Toggles between mixed mode and P(Y) ONLY mode.

NOTE

The TACAN MAP and TACAN HSI keys are inactive if TACAN is not installed.

3.	TACAN MAP key	Activates the TACAN MAP page and sets the navigation mode to TACAN MAP.
4.	TACAN HSI key	Activates the TACAN HSI page and sets the navigation mode to TACAN HSI.

Figure 3-38. NAV Mode Select Page



406075-1573-18
J1257

CONTROL/INDICATOR		FUNCTION
1.	GPS/INS key	Activation of this key will select the EGI navigation mode and will select one of the three EGI navigation solutions (GPS, INS, GPS/INS).

NOTE

While in the P(Y) ONLY mode, the GPS receiver within the EGI uses only satellite signals from the Precise Positioning Service (PPS). When the P(Y) ONLY mode is not selected, the GPS navigates using both military PPS signals as well as commercial signals known as Selective Positioning Service (SPS).

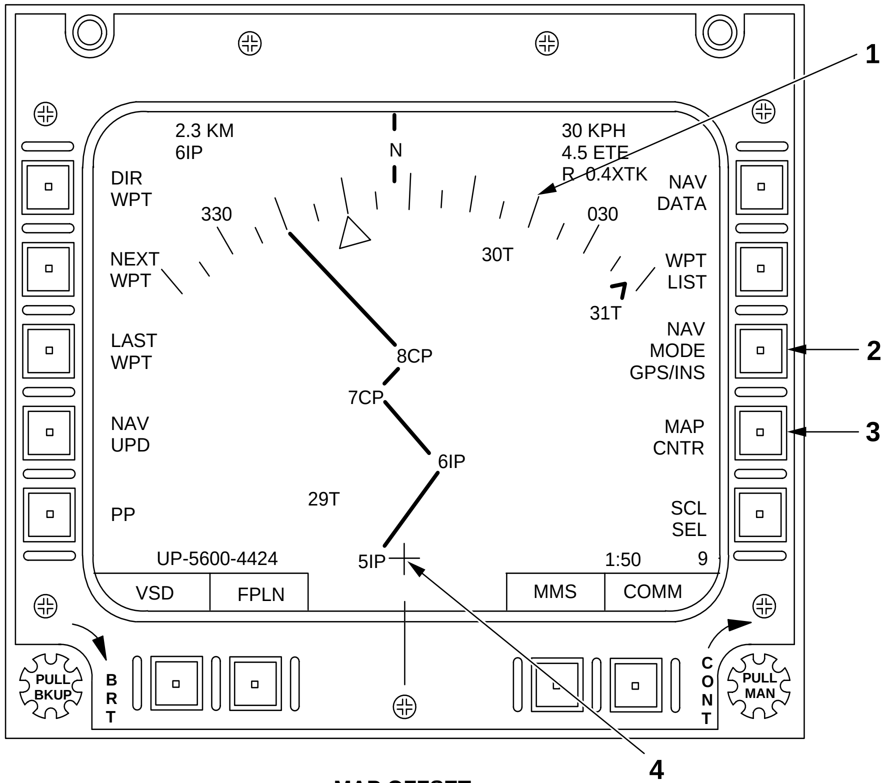
2.	P(Y) ONLY key	Toggles between mixed mode and P(Y) ONLY mode.

NOTE

The TACAN MAP and TACAN HSI keys are inactive if TACAN is not installed.

3.	TACAN MAP key	Activates the TACAN MAP page and sets the navigation mode to TACAN MAP if TACAN is installed.
4.	TACAN HSI key	Activates the TACAN HSI page and sets the navigation mode to TACAN HSI if TACAN is installed.

Figure 3-39. R NAV MODE SELECT Page

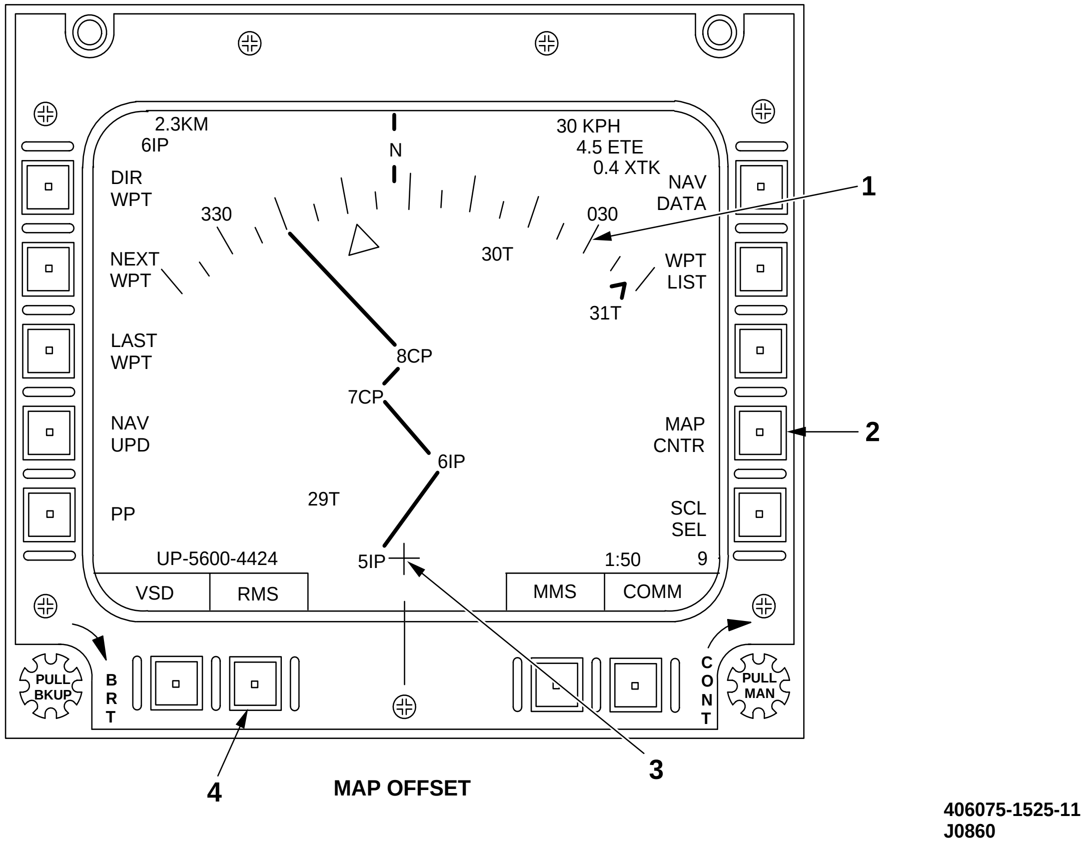


MAP OFFSET

406075-1525-10
J0860

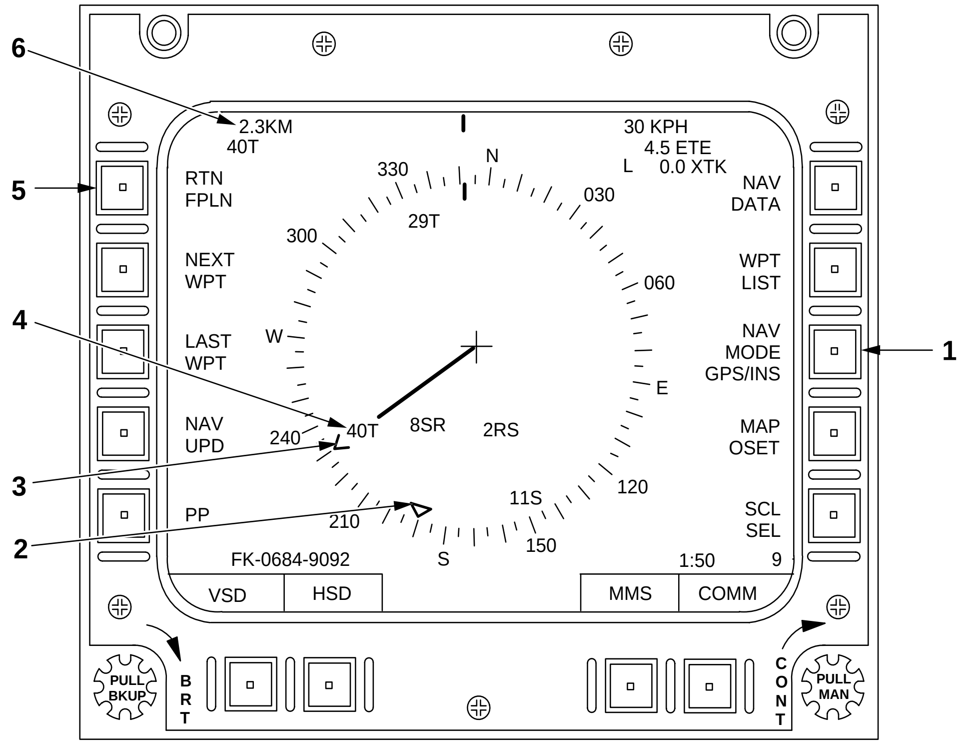
	CONTROL/INDICATOR	FUNCTION
1.	Compass rose	Scale that displays 40° left and right of heading of the helicopter. Inside edge of scale is scaled to map distance selected.
2.	NAV MODE key	Calls up NAV Mode Select page. Displays currently selected mode (GPS/INS, GPS, INS, TAC MAP, or TAC HSI).
3.	MAP CNTR key	Calls up basic HSD page.
4.	Helicopter symbol	Stationary cross at bottom of display that represents the helicopter position relative to the flight plan route displayed.

Figure 3-40. Map Offset Page



CONTROL/INDICATOR		FUNCTION
1.	Compass rose	Scale that displays 40° left and right of heading of the helicopter. Inside edge of scale is scaled to map distance selected.
2.	MAP CNTR key	Calls up basic HSD page.
3.	Helicopter symbol	Stationary cross at bottom of display that represents the helicopter position relative to the flight plan route displayed.
4.	RMS key	Calls up Rotorcraft Mapping System (RMS) main page.

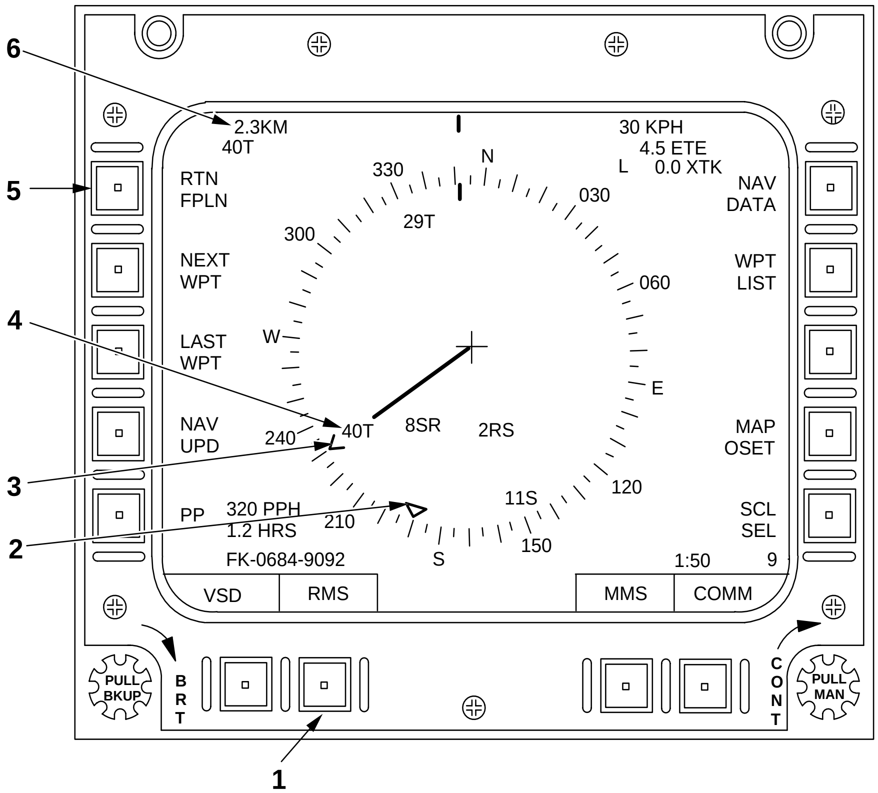
Figure 3-41. R Map Offset Page



406075-1490-6
J0447

	CONTROL/INDICATOR	FUNCTION
1.	NAV MODE key	Calls up NAV Mode Select page. Displays currently selected mode (GPS/INS, GPS, INS, TAC MAP, or TAC HSI).
2.	MMS bearing indicator	Indicates line-of-sight bearing of the mast mounted sight.
3.	Waypoint bearing caret	Indicates magnetic bearing to the waypoint displayed.
4.	Direct waypoint	Indicates position and ID of direct waypoint called up.
5.	RTN FPLN key	Calls up flight plan.
6.	Direct waypoint ID and distance	Displays identifier of stored waypoint coordinates of nonstored waypoint and distance to that waypoint from present position. When Direct Waypoint page is initially called up, cursor appears in this space, signifying MFK is activated for entry of direct waypoint.

Figure 3-42. HSD Page with Direct Waypoint Activated



406075-1525-12
J0860

	CONTROL/INDICATOR	FUNCTION
1.	RMS key	Calls up RMS main page.
2.	MMS bearing indicator	Indicates line-of-sight bearing of the mast mounted sight.
3.	Waypoint bearing caret	Indicates magnetic bearing to the waypoint displayed.
4.	Direct waypoint	Indicates position and ID of direct waypoint called up.
5.	RTN FPLN key	Calls up flight plan.
6.	Direct waypoint ID and distance	Displays identifier of stored waypoint coordinates of nonstored waypoint and distance to that waypoint from present position. When Direct Waypoint page is initially called up, cursor appears in this space, signifying MFK is activated for entry of direct waypoint.

Figure 3-43. R HSD Page with Direct Waypoint Activated

3-72. NAVIGATION UPDATE.

NOTE

The EGI is normally updated automatically and continuously from GPS data in the GPS/INS mode of operation. Therefore, manual updating is allowed only if the EGI is being operated in the INS mode.

Navigation update is a submode of the HSD page. This function allows the navigation system to compare system calculated coordinates with actual coordinates when over a selected waypoint and correct for errors. Update is accessed from HSD page (fig. 3-36 and fig. 3-37).

a. Navigation System Updating. The NAV system allows the operator to correct system errors by manually "updating" the EGI's present position in the INS mode of operation. As the helicopter moves, errors in velocity and acceleration measurement cause present position accuracy to slowly drift. By updating the system, the crew indicates where a known landmark actually is and the NAV system assumes any difference in NAV coordinates must be errors in the system.

The updating process is necessary to achieve the target locating accuracy required to deliver weapons. When operating in the INS mode, manual updates MUST be performed at intervals of no greater than 10 minutes. When the system is shut down after a flight, the error corrections are stored and carried over to the next flight.

b. Flyover Update. Flyover updating involves positioning the helicopter over a landmark whose coordinates are known and marked on the MFD. The landmark is always assumed to be the NEXT WAYPOINT in the flight plan. After selecting NAV UPD on the HSD, at the instant the helicopter is over the waypoint, press UPD MARK.

The best procedure for FLYOVER updating is to hover over a surveyed waypoint at the lowest practical altitude achievable. Flying over the waypoint while pressing UPD MARK is acceptable but is far less accurate and is much more susceptible to error. If hovering above the desired waypoint is not possible, the slowest practical airspeed should be utilized. This will minimize the error associated with attempting to update the system while in motion over the desired waypoint. If surveyed waypoints are not available, use a map to locate waypoints. Any error in map reading will cause an equal amount of navigation error. Remember that other battlefield elements may be able to provide surveyed positions such as artillery units and units with GPS receivers.

c. Offset System Updating. Offset updating involves positioning the helicopter in a hover at some distance (no closer than 500 meters) from a landmark whose coordinates are known and marked on the MFD, and employing the laser/designator in the MMS to obtain range and direction information from the helicopter to the desired landmark. The landmark is always assumed to be the current MMS PREPOINT.

Execute an MMS PREPOINT to the desired landmark, and then POINT TRACK the landmark. Select the desired laser code. Operate the DESIG switch on the CPG cyclic grip (fig. 3-44) to the up position momentarily to place the NAV system into the offset update mode. With the system in the offset update mode and the MMS point tracking the desired landmark, fire the laser/designator to obtain valid range

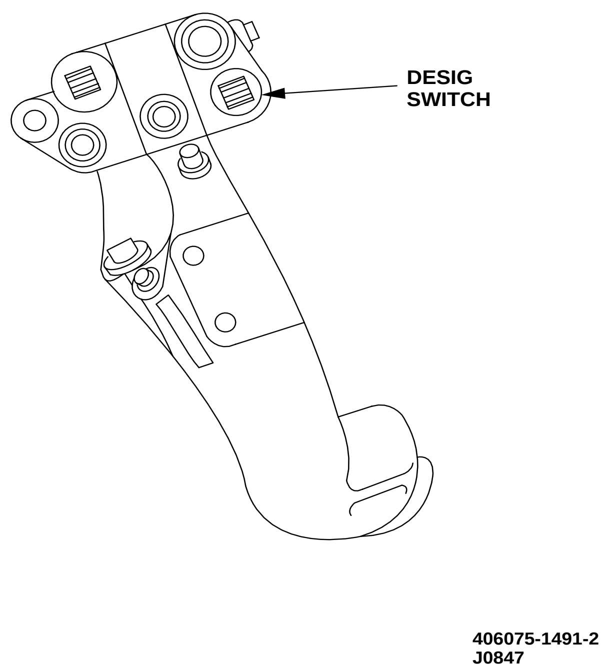


Figure 3-44. CPG Cyclic Grip

and direction data from the helicopter to the desired landmark.

NOTE

If MMS laser code is RNG and DESIG switch is activated, "RNG MODE" is displayed in MMS status block and offset update mode is inhibited if the EGI mode is BLENDED (INS/GPS).

d. Accept/Reject Criteria. The operator is given the choice of accepting or rejecting navigation updates when the navigation system error exceeds 300 meters. This function is to protect the navigation system in the event of operator error.

ACCEPT the update if:

Coordinates are correct and you have found the right landmark.

REJECT the update if:

(1) The coordinates are wrong.

(2) The wrong waypoint is selected in the flight plan.

(3) The system has been updated recently and has been performing well (it is probably wise to reject an update with large error in this case).

3-73. HOVER MODE.

The hover mode is a submode of the VSD page (fig. 3-45). The hover mode is entered from the VSD page by pressing the HVR key on the MFD or pressing the DSPL SEL switch on the pilot cyclic grip to the left one time. This mode displays the same data as the VSD, except the attitude presentation is replaced by a reference crosspoint, acceleration cue, and velocity vector. Inputs for this display are taken from the EGI. The primary function of this display is to give the pilot a hover movement reference. The reference crosspoint represents the helicopter and is stationary at the center of the screen. The acceleration cue shows direction and magnitude of the horizontal movement of the helicopter.

3-74. HOVER BOB-UP MODE.

a. The hover bob-up mode (fig. 3-46) is a submode of the hover mode and can only be called up from that mode. This mode is identical to the hover mode except that it also displays a position box. The position box depicts a desired position over the ground. As the helicopter moves away from the desired position, the position box will move away from the reference crosspoint. The distance represented from the reference crosspoint to the edge of the display is approximately 44 feet laterally. This mode is entered from the hover mode by pressing the BOB UP button on the pilot cyclic grip.

b. The amount of helicopter position error (box drive) is affected by navigation system accuracies. Prolonged flights in INS mode without updates will increase this error. Because the position box is subject to error, it should not be used as a sole position reference and is not adequate for obstacle avoidance.

3-75. ENTERING INITIAL LOCATION COORDINATE AND ELEVATION INFORMATION INTO SYSTEM.

NOTE

When helicopter is shut down, NAV ALIGN is lost.

1. INIT button — Press on MFD auxiliary panel located below MFD. INITIAL PAGE 1 will display.

2. NAV ALIGN key — Press on MFD. NAV ALIGN page will display.

NOTE

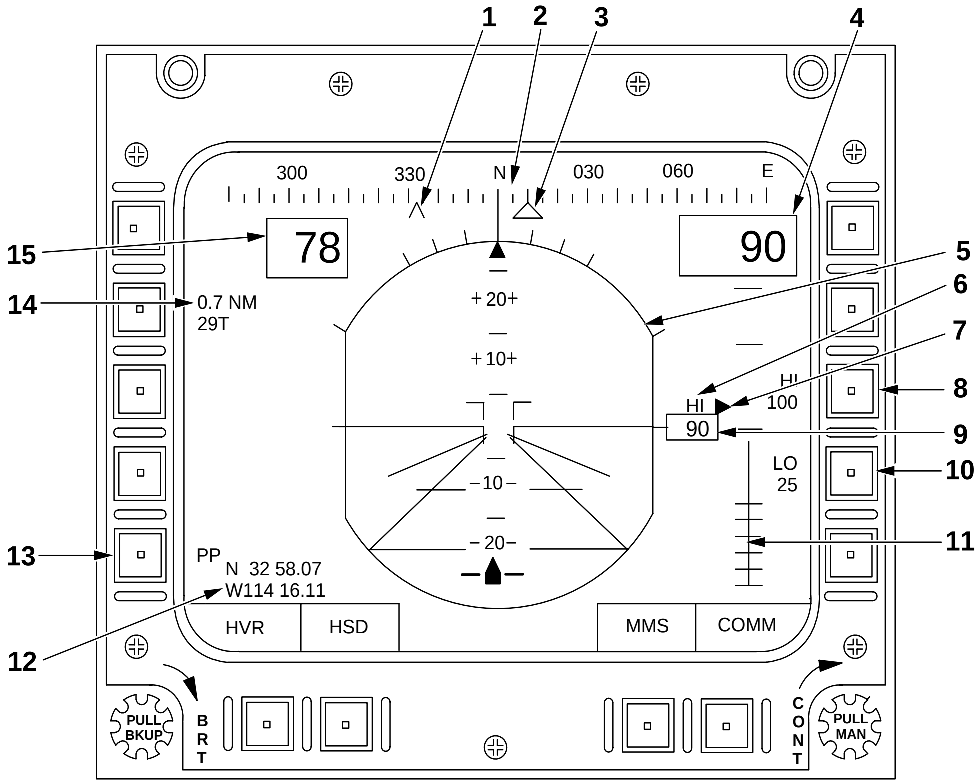
This procedure uses UTM coordinates. The basic procedure is the same for LAT/LONG coordinates, substituting LAT/LONG data for UTM.

3. POS block — Check for correct current location.

NOTE

The EGI will automatically begin a standard 4-minute alignment to the aircraft present position. No user action is required unless new alignment position is desired.

4. UTM LAT/LONG key — Press as required to place system in desired mode. Box indicating mode will alternate between UTM and LAT/LONG each time key is pressed.



VERTICAL SITUATION DISPLAY

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J1139

	CONTROL/INDICATOR	FUNCTION
1.	Waypoint bearing caret	Indicates bearing to the next waypoint in the flight plan or direct waypoint if selected. Not displayed if EGI heading is unreliable.
2.	Magnetic heading tape	Displays magnetic heading 90° left and right of the nose of the helicopter. Helicopter heading is indicated at the center of the tape at the zero bank mark of the attitude indicator. Not displayed if EGI heading is unreliable.
3.	MMS bearing indicator	Indicates line-of-sight bearing of the mast mounted sight. Not displayed if EGI heading is unreliable.
4.	Barometric altimeter	Displays barometric altitude, MSL, of helicopter in 10-foot increments. Altimeter settings are made on standby altimeter. If signal is lost from pitot-static system, display will blank.
5.	Attitude indicator	Displays pitch and roll attitude reference.
6.	HI/LO	Displays a warning (HI/LO) when the limits set with the HI or LO altitude warning keys are exceeded.

Figure 3-45. Vertical Situation Display (VSD) Page (Sheet 1 of 2)

(Cont)

	CONTROL/INDICATOR	FUNCTION
7.	Rate of climb indicator	Displays vertical rate of climb of helicopter up to ± 1000 feet per minute. Cursor travels up and down radar altimeter scale with the 100 foot mark being zero rate of climb.
8.	HI altitude warning key	Pressing key activates MFK for entering desired upper altitude (AGL) limit. The designated altitude is displayed left of key. When altitude limit is exceeded, display will flash.
9.	Radar altimeter readout	Displays digital readout of altitude, AGL, from 0 to 1425 feet as detected by the radar altimeter. Going above 1425 feet or a failure of the radar altimeter will cause the display to go blank.
10.	LO altitude warning key	Pressing key activates MFK for key entering desired lower altitude (AGL) limits. The designated altitude is displayed left of the key. When altitude limit is exceeded, display will flash and a 3 Hz audio tone will sound in the headset.
11.	Radar altimeter scale	Vertical scale readout of altitude, AGL, from 0 to 200 feet as detected by the radar altimeter. Tape indicator blanks from scale above 200 feet and reappears descending through 180 feet.

WARNING

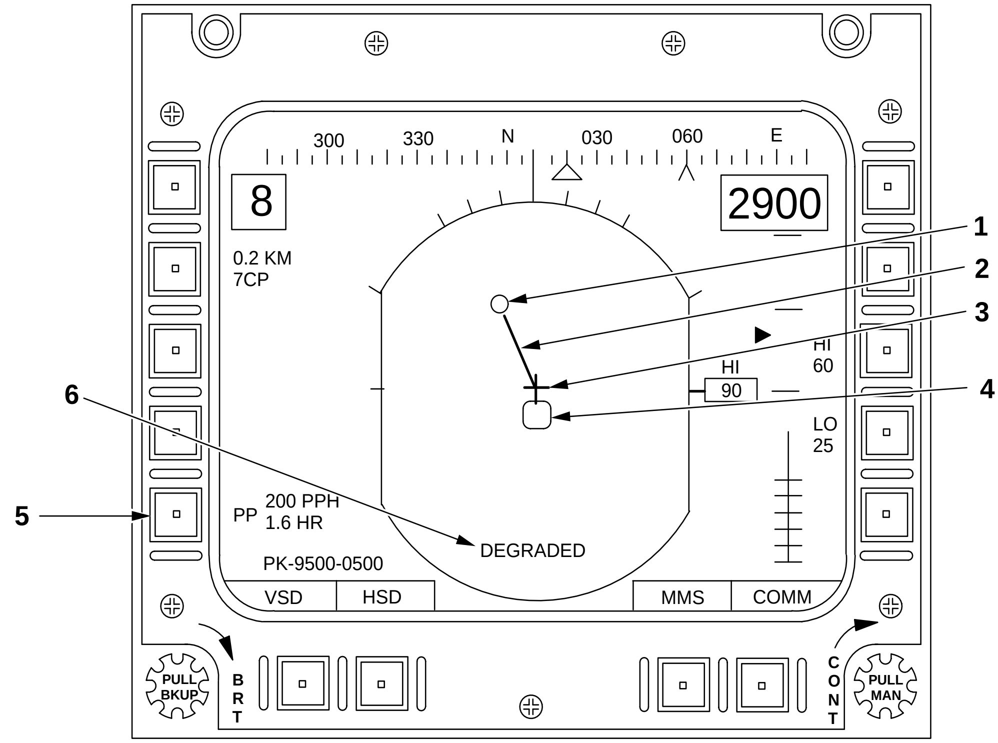
The radar altimeter is not an obstacle warning radar. During NOE or terrain operations, visual contact with the ground is mandatory. Radar altimeter signal is taken directly under the helicopter. LO altitude warning at altitudes less than 50 feet may not occur early enough to allow for corrective action when banking the helicopter or crossing rapidly rising terrain.

12.	Present position	Continuously updated present position shown in eight-digit UTM or LAT/LONG. Not displayed when EGI is aligning.
13.	PP key	Calls up or deletes display of present position coordinates.
14.	Waypoint distance	Displays designator number of and distance to waypoint listed. This is the waypoint selected on the flight plan for navigation to a direct waypoint if selected.
15.	Airspeed indicator	Displays knots indicated airspeed (KIAS) of the helicopter.

NOTE

The pilot may overlay MMS Video while in the VSD mode (paragraph 4-2). To initiate MMS Video overlay on the VSD, activate the MMS mode switch on the pilots MFD or activate the Display Select Switch twice. (MMS turret control remains with the CPG.) Symbology and video intensity switches on the CPG Auxiliary Panel. To exit MMS/VSD overlay mode, MMS mode switch or Display Select Switch is activated again (one time).

Figure 3-45. Vertical Situation Display (VSD) Page (Sheet 2 of 2)



HOVER BOB-UP

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J3062

	CONTROL/INDICATOR	FUNCTION
1.	Acceleration cue	Shows rate of acceleration.
2.	Velocity vector	Shows velocity and direction of movement of helicopter. Full scale to the edge of the screen is approximately 7 knots.
3.	Reference crosspoint	Stationary crosshairs at the center of the display that represent the helicopter.
4.	Position box (bob-up mode only)	Depicts desired or starting position over the ground and represents approximately 8 feet.
5.	PP key	Calls up or deletes display of present position coordinates. R Fuel burn rate and time remaining.
6.	R DEGRADED (bob-up mode only)	Displayed when NAV mode is not in GPS/INS or NOV FOM > 1.

Figure 3-46. Hover Bob-Up Mode Page

5. POS key — Press. System is activated to accept new Coordinates. Enter three digit alphanumeric UTM zone identifier followed by the two alpha and eight numeric coordinates of the alignment position. Coordinates will display in POS block of MFD.

6. ENTER key — Press. Coordinates will be entered into memory.

7. DATUM key — Press if datum has changed or is not entered. System is activated to accept new datum.

NOTE

Ensure datum is entered before aligning system.

8. ENTER key — Press. Datum code will be entered into memory.

NOTE

The system will assume the elevation entered in UTM is in meters unless the elevation is followed by an F. In that case, the system will automatically convert the data entered in feet to meters. In LAT/ LONG, elevation is assumed to be entered in feet unless followed by an M. In that case, the systems will automatically convert the data entered in meters to feet. System does not assume zeros. Each digit must be entered up to four digits (five digits for feet entry).

9. ELEV key — Press. System is activated to accept new elevation.

10. Elevation — Enter on MFK. Elevation will display in ELEV block as typed.

11. ENTER key — Press. Elevation in meters will be entered into memory.

12. MANUAL align — Select and press as desired.

13. FAST align — Select and press as desired.

NOTE

If fast align is to be used, the aircraft's last present position must be stored immediately prior to shutdown from ground idle AND the aircraft must not be moved from that position prior to the next system power up.

14. MAG HDG — Required for SHIP ALGN only. Enter magnetic heading of naval vessel.

15. SHIP ALGN — Select and press after entering MAG HDG.

3-76. ENTERING WAYPOINT INTO WAYPOINT LIST.

1. HSD key — Press. HSD page will display.

2. WPT LIST key — Press. WPT LIST page will display.

3. NEW WPT key — Press. NEW WAYPOINT page will display.

NOTE

System will automatically fill WPT DES with numerical identifier of next available waypoint register. Alpha identifier should be added. If no numeric value is displayed, all waypoint registers are filled, and numeric identifier must be entered. When a previously used numeric identifier is used, its coordinates are replaced by the newly entered coordinates.

4. WPT DES key — Press and enter as required.

5. POS key — Press and enter as required.

NOTE

If different grid zone is to be used, enter the alphanumeric identifier on the MFK using two numeric characters and one alpha character, then press ENTER.

6. ELEV key — Press and enter as required.

7. STORE key — Press. Waypoint is entered in list. Subsequent waypoints are entered in similar manner.

3-77. CHANGING EXISTING WAYPOINT DATA.

1. HSD key — Press. HSD page will display.

2. WPT LIST key — Press. WPT LIST page will display.

3. NEW WPT key — Press. NEW WAYPOINT page will display.

4. WPT DES key — Press. System is activated to accept desired waypoint designator.

5. Waypoint designator — Enter waypoint to be changed on MFK. Identifier will display in WPT DES block as typed.

NOTE

For ease of data entry, it is only necessary to enter the one- or two-digit numeric portion of the designator to recall stored waypoint data.

6. ENTER key — Press. System is set to accept new coordinates for waypoint designator.

NOTE

Only data to be changed needs to be entered by proceeding to the appropriate instructions below. If the waypoint elevation is to be changed, the POS data need not be altered.

7. POS key — Press. If position information is to be changed. Cursor will display to the right of grid zone identifier of POS block.

8. Eight digit coordinates — Enter on MFK using two alpha and eight numeric characters. Coordinates will display in POS block as typed.

9. ENTER key — Press. Location is entered into memory and entered on waypoint list.

10. ELEV key — Press. If elevation information is to be changed. Cursor will display to the right of ELEV.

11. Waypoint elevation — Enter in meters on MFK. Elevation will display in ELEV block as typed.

12. ENTER key — Press. Location is placed into memory and placed on waypoint list.

13. ENTER key — Press. Variation is placed into memory and placed on waypoint list.

3-78. ENTERING WAYPOINT INTO FLIGHT PLAN.

1. HSD key — Press. HSD page will display.

2. FPLN key — Press. FLIGHT PLAN page will display.

3. ADD LEG key — Press to enter waypoint.

4. ADD LEG key — Press again to enter subsequent waypoints.

5. Procedure complete — Select MFD page desired for flight.

3-79. R ROTORCRAFT MAPPING SYSTEM (RMS) DISPLAY PAGES.

NOTE

The VIDEO SYM INTEN MFD switch on the MMS control panel will adjust overlay legend display from black to white.

RMS is a real time digital map system and provides the ability to display map data with selected display features. The RMS includes a dedicated circuit card within the Right Master Controller Processor Unit (R MCPU), a Map Data Unit (MDU) and four RMS display pages. The system uses data generated with the aviation mission planning station (AMPS) and stored on the data transfer module (DTM). It includes the capability to overlay symbology as well as elevation bands over the digital map image and provides for moving map displays complete with waypoints, targets, battlefield graphics, cultural features, flight plan maps, and other mission data. The RMS display pages are activated from the HSD page (figure 3-37), the Map Offset page (figure 3-41), or the Direct Waypoint page (figure 3-43). Refer to figure 3-47 for a flow chart of the RMS pages. There are four RMS display pages: the RMS Page, Normal Mode (figure 3-48), the RMS Page, SLEW Mode (figure 3-49), the RMS Setup Page (figure 3-50), and the RMS Feature Selection Page (figure 3-51).

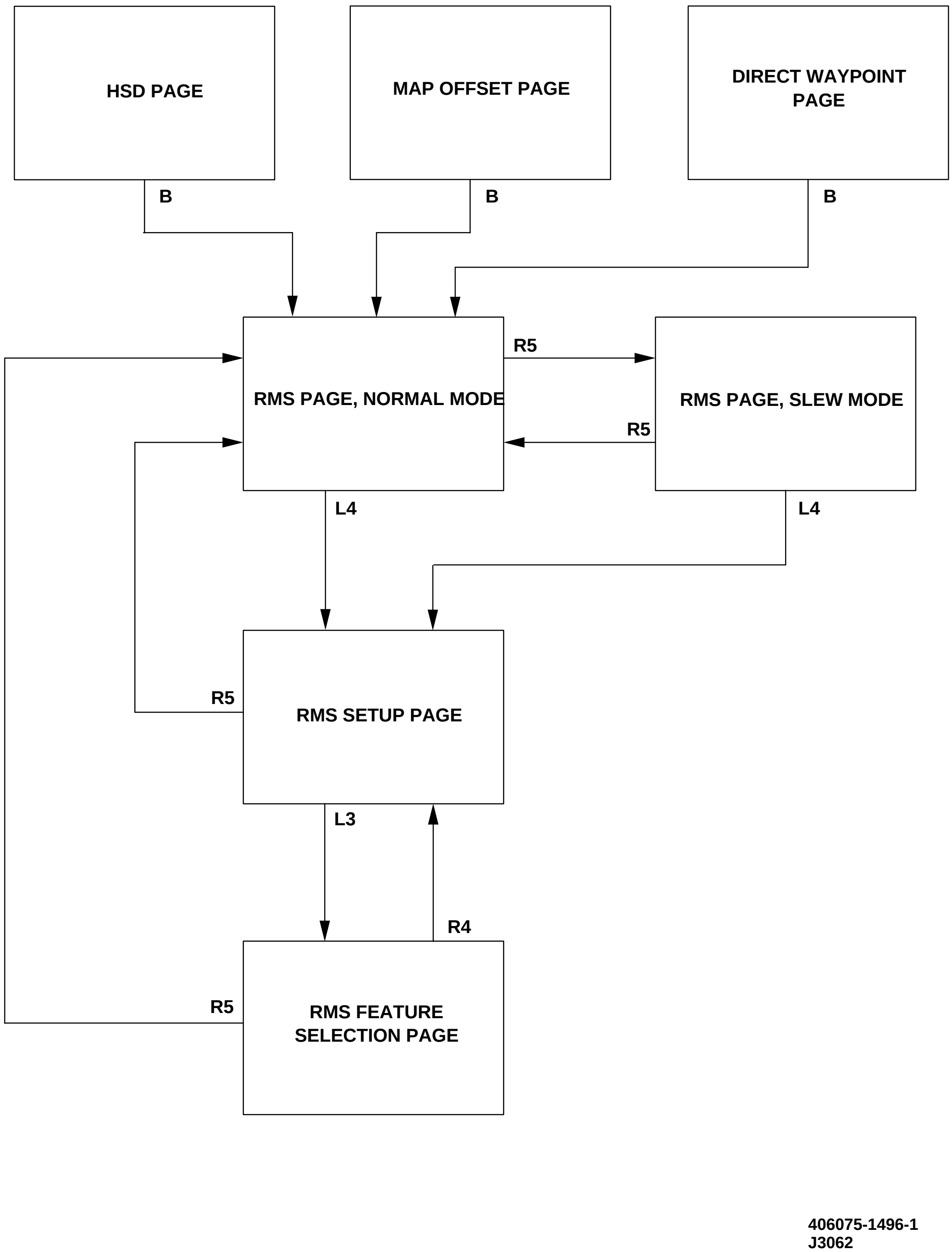
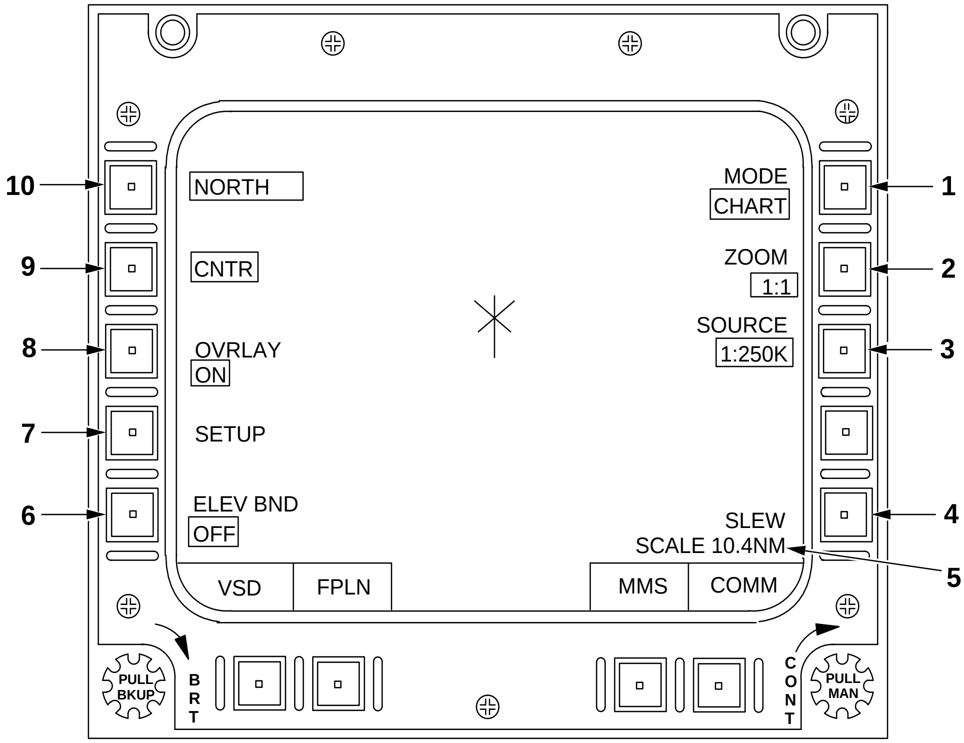


Figure 3-47. RMS Display Pages Flow Chart



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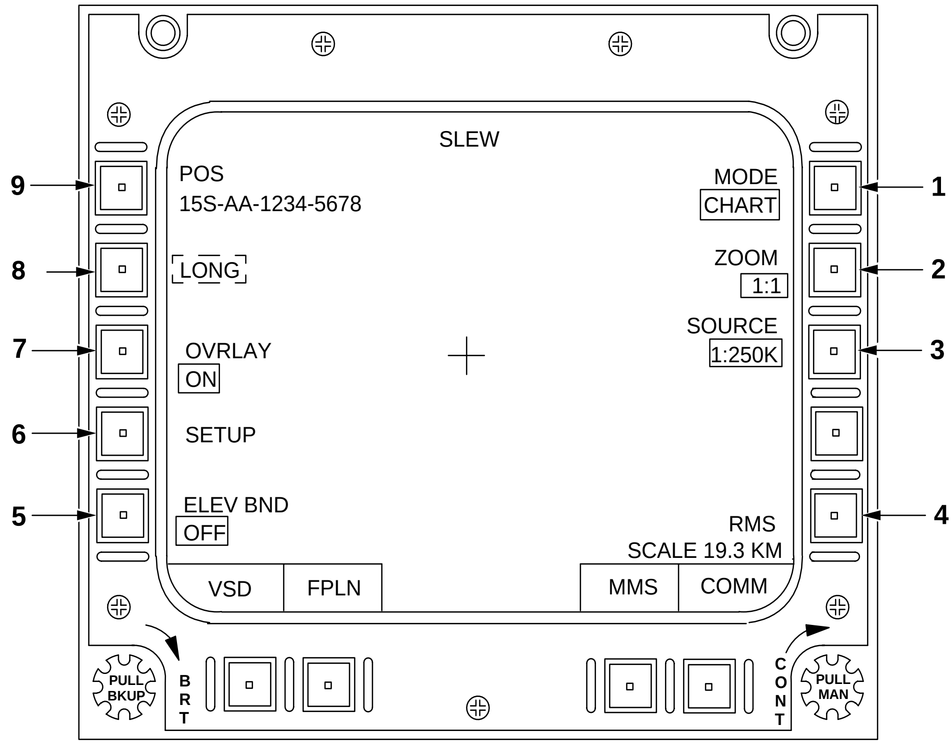
CONTROL/INDICATOR		FUNCTION
1.	MODE key	Selects one of the following modes: CHART, Digital Terrain Elevation Data (DTED), DATA or NONE.
2.	ZOOM key	Provides a map ZOOM factor capability (1:1, 1.125:1, 1.25:1, 1.375:1, 1.5:1, 1.625:1, 1.75:1, 1.875:1 and 2:1) from 100% to 200% in nine steps. If either DATA or NONE is selected with the MODE key, there is no ZOOM factor information displayed and the R-2 key has no function.
3.	SOURCE key	Selects one of six map scales (1:2M, 1:1M, 1:500k, 1:250k, 1:100k, and 1:50k. If no digitized map data is available for the selected map scale, then a blank screen is displayed.
4.	SLEW/RMS key	Allows for selection of the basic display mode, either SLEW or RMS. When SLEW mode is active, the legend reads RMS; when normal RMS mode is active, the legend reads SLEW.

Figure 3-48. RMS Page, Normal Mode (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR		FUNCTION
5.	SCALE factor	The selected scale represents the distance in nautical miles (LAT/LONG Mode) or kilometers (UTM Mode) displayed along the horizontal length of the MFD.
6.	ELEV BND key	Selects enhanced elevation banding (gray scale coloring) for the elevation data available from DTED data. If DTED is not selected this key has no function. The default at power-on is OFF.
7.	SETUP key	Calls up the RMS setup page.
8.	OVRLAY key	Selects whether overlays are displayed on the map. Selection of which overlays are displayed is determined using the RMS SETUP and RMS FEATURE SELECT pages. Default at power-on is ON. If either DATA or NONE is selected with the MODE key, there is no legend and the L-3 key has no function.
9.	CNTR/OSET key	Selects either CNTR or OSET for map displacement mode with the aircraft symbol either centered on the map (CNTR) or displayed downward on the map (OSET). If either DATA or NONE is selected with the MODE key, there is no legend and the L-2 key has no function.
10.	NORTH/HDG key	Selects orientation of either north up (NORTH) or HEADING up (HDG). If either DATA or NONE is selected with the MODE key, there is no legend and the L-1 key has no function.

Figure 3-48. RMS Page, Normal Mode (Sheet 2 of 2)



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J3062

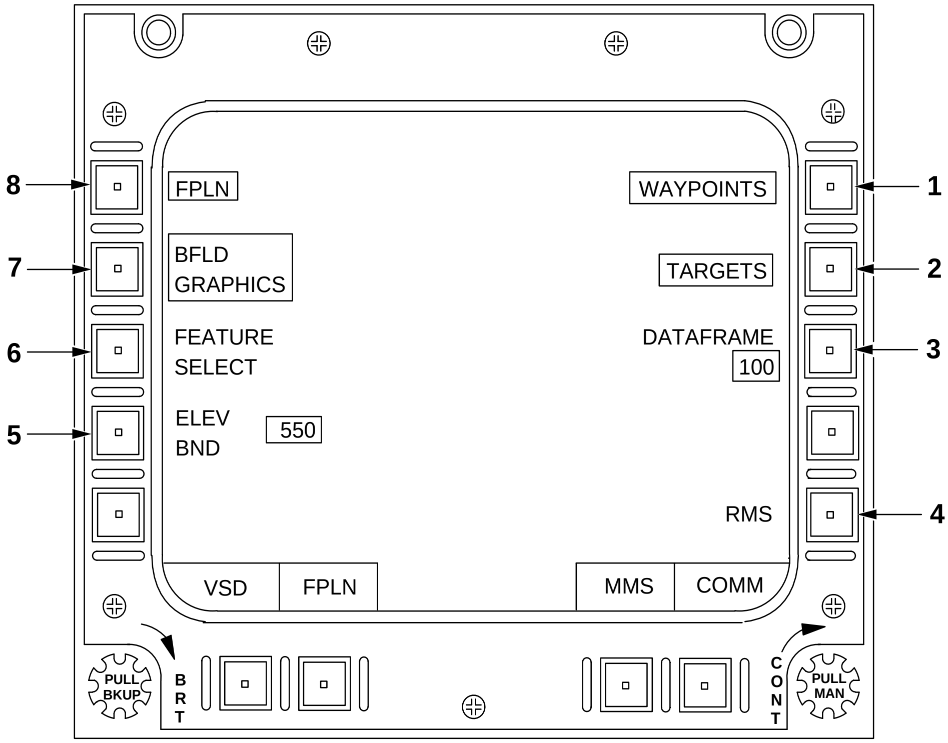
CONTROL/INDICATOR		FUNCTION
1.	MODE key	Selects one of the following modes: CHART, Digital Terrain Elevation Data (DTED), DATA or NONE.
2.	ZOOM key	Provides a map ZOOM factor capability (1:1, 1.125:1, 1.25:1, 1.375:1, 1.5:1, 1.625:1, 1.75:1, 1.875:1 and 2:1) from 100% to 200% in nine steps. If either DATA or NONE is selected with the MODE key, there is no ZOOM factor information displayed and the R-2 key has no function.
3.	SOURCE key	Selects one of six map scales (1:2M, 1:1M, 1:500k, 1:250k, 1:100k, and 1:50k. If no digitized map data is available for the selected map scale, then a blank screen is displayed.
4.	RMS/SLEW key	Allows for selection of the basic display mode, either SLEW or RMS. When SLEW mode is active, the legend reads RMS; when normal RMS mode is active, the legend reads SLEW.

Figure 3-49. RMS Page, SLEW Mode (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR		FUNCTION
5.	ELEV BND key	Selects enhanced elevation banding (gray scale coloring) for the elevation data available from DTED data. If DTED is not selected this key has no function. The default at power-on is OFF.
6.	SETUP key	Calls up the RMS setup page.
7.	OVRLAY key	Selects whether overlays are displayed on the map. Selection of which overlays are displayed is determined using the RMS SETUP and RMS FEATURE SELECT pages. Default at power-on is ON. If either DATA or NONE is selected with the MODE key, there is no legend and the L-3 key has no function.
8.	LONG key	Allows for the display/entry of the SLEW longitude when the selected navigation coordinate system is Lat/Long.
9.	POS/LAT key	Allows for the display/entry of the position information (either the full UTM position or latitude). The current SLEW position/SLEW latitude is displayed below the legend.

Figure 3-49. RMS Page, SLEW Mode (Sheet 2 of 2)



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J3062

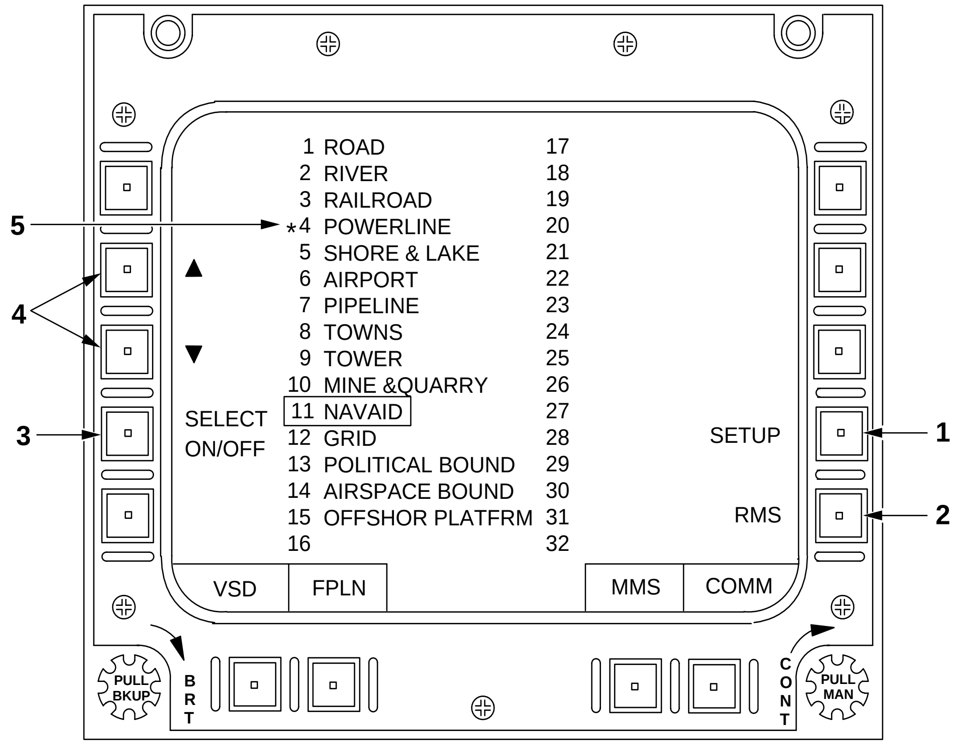
CONTROL/INDICATOR		FUNCTION
1.	WAYPOINTS key	Determines whether the waypoints are included as part of the overlay displayed on the RMS page.
2.	TARGETS key	Determines whether the targets are included as part of the overlay displayed on the RMS page.
3.	DATAFRAME key	Allows for display/entry of the Data Frame that is used when DATAFRAME is selected on the RMS page. The current value is displayed in a boxed area below DATAFRAME legend. The valid entry range is 1 to 100 inclusive.
4.	RMS key	Calls up the RMS page.
5.	ELEV BND key	Allows for the display/entry of the elevation bands value that is used when ELEV BND is enabled on the RMS page. The current value is displayed in a boxed area below the ELEV BND legend. The valid range is 1 to 99999.

Figure 3-50. RMS Setup Page (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR		FUNCTION
6.	FEATURE SELECT key	Calls up the RMS feature selection page.
7.	BFLD GRAPHICS key	Determines whether the battlefield graphics (BFLD GRAPHICS) are included as part of the overlays displayed on the RMS page.
8.	FPLN key	Determines whether the flight plan (FPLN) stick map is included as part of the overlays display on the RMS page. Depending upon the selected scale and zoom factors when FPLN stick map is displayed, the associated waypoint numbers may be truncated to just a numerical display, or truncated in their entirety. If the DIR WPT mode is activated while the flight plan is one of the selected options, the flight plan stick map is removed and the DIR WPT mode is displayed in its place. When the DIR WPT mode is deactivated, the flight plan overlay is returned to its previous state.

Figure 3-50. RMS Setup Page (Sheet 2 of 2)



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J0523

CONTROL/INDICATOR		FUNCTION
1.	SETUP key	Calls up the RMS SETUP Page.
2.	RMS key	Calls up the RMS Page.
3.	SELECT key	Selects the currently boxed feature on the Feature List for display when overlay is active on the RMS Page, or deselects the boxed feature for display. Those features in the list that have an asterisk to the left of the feature text are included for display.
4.	Function keys L2 and L3	Move the location of the selection box to select desired features. Pressing L2 moves the box up and pressing L3 moves the box down.
5.	Asterisk	Indicates selected features.

Figure 3-51. RMS Feature Selection Page

SECTION IV. TRANSPONDER

3-80. TRANSPONDER SET.

a. Description. The AN/APX-100 IFF transponder set provides an automatic response when properly challenged by surface and airborne radar equipment. Control of the transponder is gained by pressing the IFF key on the MFK or the IFF key on the MFD when the COMM page is displayed. All control functions are then performed using the MFD and MFK. Page 2 of the IFF pages displays the controls for the various mode tests. These tests may be conducted while the helicopter is on the ground or in flight with the transponder set to NORM. All individual tests can be run simultaneously. A GO or NO GO will display when a test sequence has completed.

b. Controls and Function (fig. 3-52 and 3-53).

c. Preflight Checks.

(1) IFF key (on MFK or COMM page) — Press.

(2) Desired transponder code — Select.

(3) STBY/NORM key — Press to display NORM.

(4) PAGE 2 key — Press.

(5) M1 TEST key — Press.

(6) M2 TEST key — Press.

(7) M3 TEST key — Press.

(8) M4 TEST key — Press.

(9) MC TEST key — Press.

(10) After GO is displayed adjacent to each line, PAGE 1 key — Press.

(11) STBY/NORM key — Press to display STBY.

d. Operation.

(1) IFF key (on MFK or COMM page) — Press.

(2) STBY/NORM key — Press to display NORM.

(3) M1 key — Press to toggle ON or OFF as desired.

(4) M2 key — Press to toggle ON or OFF as desired.

(5) M3A + C key — Press to toggle ON or OFF as desired.

(6) If data is to be entered for Mode 1 or Mode 3 A + C, KYBD key — Press and enter data using MFK.

(7) MODE 4 — Press to toggle ON or OFF as desired.

NOTE

Transmitting or being interrogated in CODE A momentarily displays a flashing IFF message at lower edge of each MFD. Transmitting in CODE A and being interrogated in CODE B activates an audio visual signal and vice versa.

(8) MODE 4 CODE key — Press to toggle A or B as required.

(9) MODE 4 HOLD key — Press to set as desired.

(10) AUD VIS key — Press to toggle desired response to an interrogation.

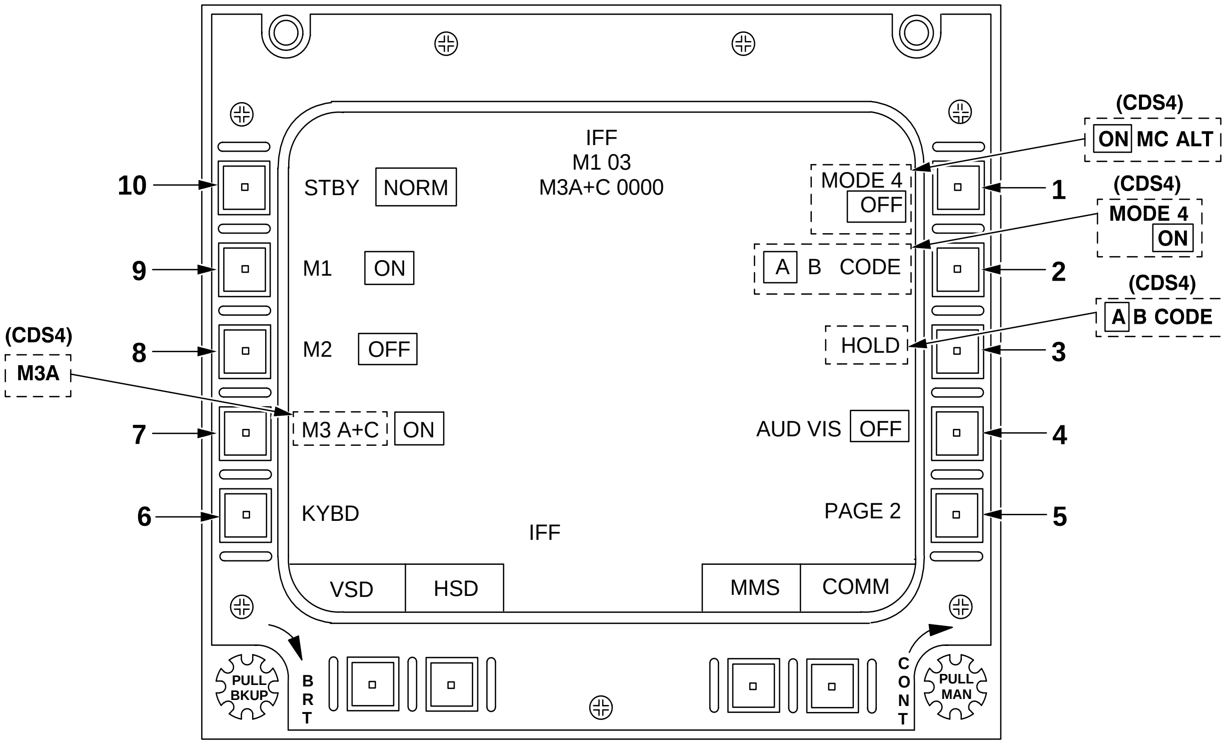
NOTE

If Kit 1C is not installed, the display should be toggled to OFF. AUD VIS should be toggled to OFF to eliminate IFF CAUTION displaying during flight.

(11) PAGE 2 key — Press.

(12) MC ALT key — Press to toggle ON or OFF as desired.

(13) ANT key — Press to set as desired.



NOTE

IFF, at bottom of IFF pages, may flash momentarily as radar interrogates transponder signal with AUD VIS selected.

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J1428

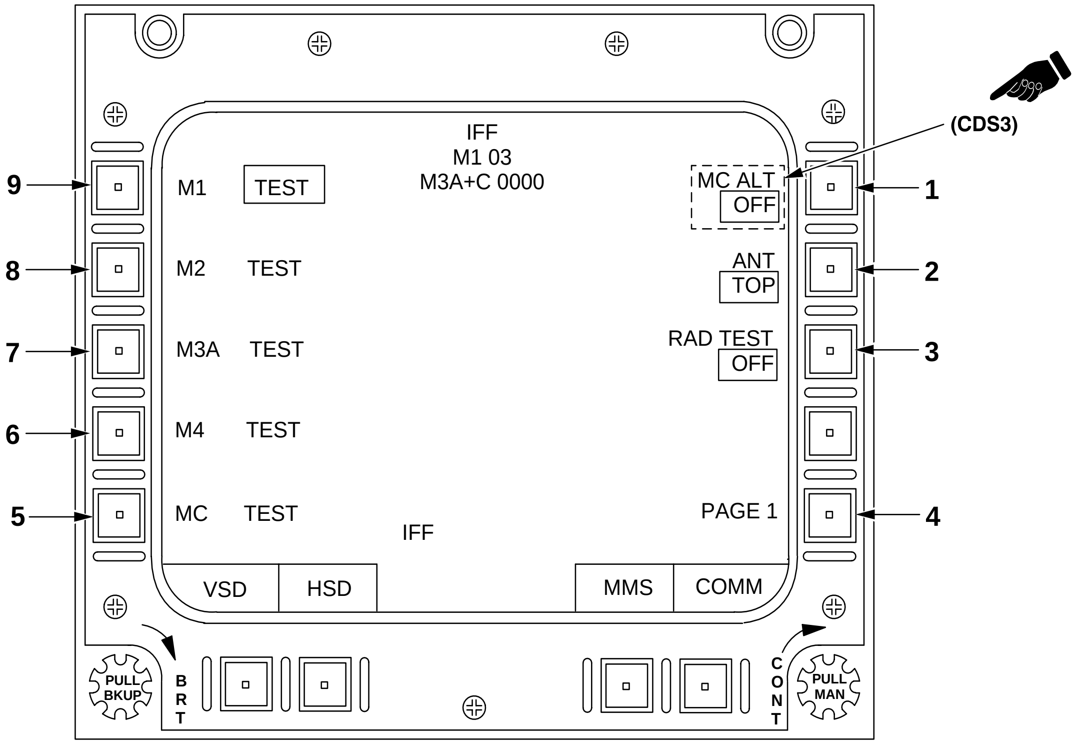
	CONTROL/INDICATOR	FUNCTION
1.	MODE 4 ON/OFF key	Selects mode 4 ON or OFF condition.
	(CDS4) MC ALT key	Selects ON or OFF condition for altitude reporting to a Mode C interrogation.
2.	A/B CODE key	Selects mode 4 code A or B.
	(CDS4) MODE 4 ON/OFF key	Selects mode 4 ON or OFF condition.
3.	HOLD key	Selects hold for the mode 4 function.
	(CDS4) A/B CODE key	Selects mode 4 code A or B.
4.	AUD/VIS/OFF key	Selects the method whereby mode 4 interrogation will be reported.
5.	PAGE 2 key	Selects page 2 of IFF Display pages.
6.	KYBD key	Accepts MFK input for M1 and M3.

Figure 3-52. IFF Display Page 1 (Sheet 1 of 2)

(Cont)

	CONTROL/INDICATOR	FUNCTION
7.	**(CDS2/CDS3)** M3 A+C ON/ OFF key	Selects mode 3 ON or OFF condition.
	(CDS4) M3A key	Selects mode 3 ON or OFF condition.
8.	M2 ON/OFF key	Selects mode 2 ON or OFF condition.
9.	M1 ON/OFF key	Selects mode 1 ON or OFF condition.
10.	STBY/NORM key	Selects standby (warmup) or normal receiver condition.

Figure 3-52. IFF Display Page 1 (Sheet 2 of 2)



NOTE

IFF, at bottom of IFF pages, may flash momentarily as radar interrogates transponder signal with AUD VIS selected.

406075-397-2
J1428

	CONTROL/INDICATOR	FUNCTION
1.	**(CDS3)** MC ALT key	Selects ON or OFF condition for altitude reporting to a mode C interrogation.
2.	ANT key	Selects antenna to be monitored.
3.	RAD TEST key	Selects ON or OFF conditions for test of radiation portion of mode 4.
4.	PAGE 1 key	Returns display to PAGE 1.
5.	MC key	Initiates mode C self-test.
6.	M4 key	Initiates mode 4 self-test.
7.	M3A key	Initiates mode 3 self-test.
8.	M2 key	Initiates mode 2 self-test.
9.	M1 key	Initiates mode 1 self-test.

Figure 3-53. IFF Display Page 2

SECTION V. (CDS2) ENGINE HISTORY PAGES

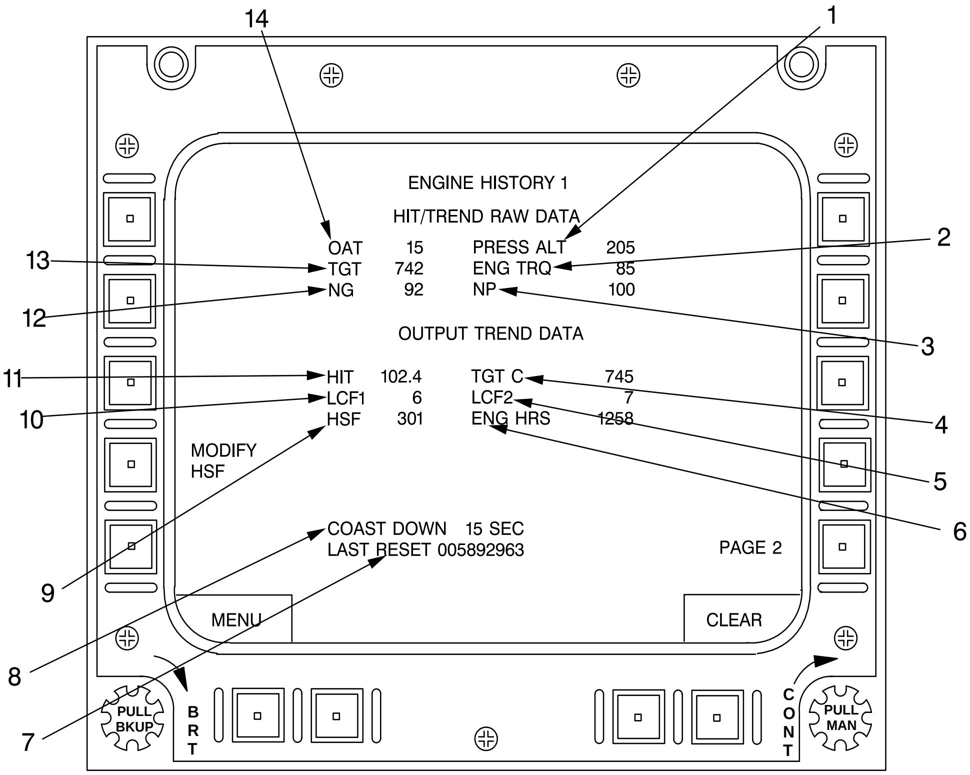
3-81. ENGINE HISTORY PAGES.

ENGINE HISTORY Pages (Fig. 3-54 and Fig. 3-55) display maximum engine values and trend data gathered from trend data and other engine data such as the number of engine starts while the helicopter is on the ground. This data is gathered from engine start to shutdown and is periodically stored in Non-Volatile Memory (NVM). The ENGINE HISTORY data is maintained until specifically cleared. The data is cleared by maintenance personnel entering specific codes identified by unit SOP.

The ENGINE HISTORY Page(s) are accessed from the FDL MENU Page by pressing L-3. The ENGINE HISTORY display consists of two pages. Pressing R-5 key on either of the pages selects the next page. The page number is shown at the top of the display after the text ENGINE HISTORY. An exit to the FDL MENU is made by pressing the mode select button labeled MENU or the INIT button on the MFD auxiliary control panels.

a. ENGINE HISTORY Page 1. This page lists data collected during the HIT check and output trend data.

b. ENGINE HISTORY Page 2. This page lists peak values and limits exceeded.



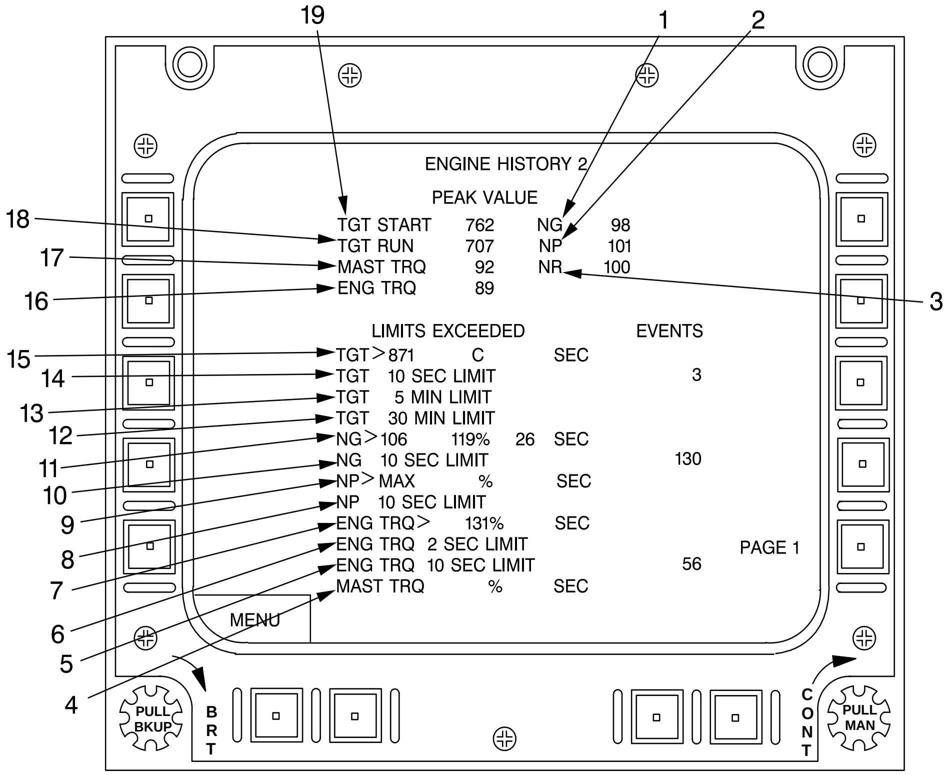
CONTROL/INDICATOR	FUNCTION
1. PRESS ALT	During HIT check, ambient pressure altitude is displayed in feet.
2. ENG TRQ	During HIT check, average engine torque (ENG TRQ) is displayed as a percentage.
3. NP	During HIT check, average power turbine speed (NP) is displayed as a percentage.
4. TGT C	Corrected TGT during HIT check is displayed in degrees Celsius.
5. LCF 2	Displays number of times NG has traversed the range of 85% NG to 95% NG.
6. ENG HRS	Total engine running time is displayed in hours and tenths of hours.
7. LAST RESET	The date/code that the last ENGINE HISTORY reset (clear) was performed is displayed.
8. COAST DOWN	Time taken for the engine to slow to a stop is recorded. The engine must be shut down and the aircraft must be on the ground. Time is recorded in seconds while NG goes from 30% to 10%.

Figure 3-54. (CDS2) ENGINE HISTORY Page 1 (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
9. HSF	Hot section factor (HSF) displays a count which is a function of time and turbine gas temperature (TGT). The number of counts per second increases as TGT increases.
10. LCF 1	Low cycle fatigue (LCF) 1 displays number of times NG has traversed the range of 50% NG to 95% NG.
11. HIT	The result of HIT check is displayed as a percentage.
12. NG	During HIT check, average turbine gas generator speed (NG) is displayed as a percentage.
13. TGT	During HIT check, average turbine gas temperature (TGT) is displayed in degrees Celsius.
14. OAT	During HIT check, outside air (ambient) temperature is displayed in degrees Celsius.

Figure 3-54. (CDS2) ENGINE HISTORY Page 1 (Sheet 2 of 2)



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CONTROL/INDICATOR	FUNCTION
1. NG	Peak turbine gas generator speed (NG) is displayed as a percentage. No limit needs to be exceeded for NG to be displayed.
2. NP	Peak power turbine speed (NP) is displayed as a percentage. No limit needs to be exceeded for a percentage to be displayed.
3. NR	Peak main rotor speed (NR) is displayed as a percentage.
4. MAST TRQ	If mast torque (MST TRQ) exceeds 100%, the peak value is displayed. The CDS records time spent in each of five overtorque segments. Time is displayed for the segment in which the peak value appears.
5. ENG TRQ 10 SEC LIMIT	Each time ENG TRQ exceeds 112.6% for 10 seconds, a counter increments by one. Total count is displayed.
6. ENG TRQ 2 SEC LIMIT	Each time ENG TRQ exceeds 121.6% for 2 seconds, a counter increments by one. Total count is displayed.
7. ENG TRQ>131%	If engine torque (ENG TRQ) exceeds 131%, time above the limit is displayed along with peak ENG TRQ.

Figure 3-55. (CDS2) ENGINE HISTORY Page 2 (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
8. NP 10 SEC LIMIT	Each time NP exceeds the lower variable limit for 10 seconds, a counter increments by one. Total count is displayed.
9. NP>MAX	Two setpoint limits for power turbine speed (NP) vary according to engine torque. Normal operating conditions for NP are below both limits. If both limits are exceeded, time above the lower limit is displayed along with the NP percentage above the upper limit.
10. NG 10 SEC LIMIT	Each time NG exceeds 105% for 10 seconds, a counter increments by one. Total count is displayed.
11. NG>106	If turbine gas generator speed (NG) exceeds 106%, time above that limit is displayed along with peak NG.
12. TGT 30 MIN LIMIT	If TGT exceeds 716 °C for more than 30 consecutive minutes, a counter increments by one. Total count is displayed.
13. TGT 5 MIN LIMIT	If TGT exceeds 785 °C for 5 consecutive minutes, a counter increments by one. Total count is displayed.
14. TGT 10 SEC LIMIT	If TGT exceeds 802 °C for 10 seconds, a counter increments by one. Total count is displayed.
15. TGT>871C	If TGT exceeds 871 °C, time above that limit is displayed along with the peak TGT.
16. ENGINE TRQ	Peak engine torque (ENG TRQ) is displayed as a percentage. No limit needs to be exceeded for ENG TRQ to be displayed.
17. MAST TRQ	Peak engine torque (MAST TRQ) is displayed as a percentage. No limit needs to be exceeded for MAST TRQ to be displayed.
18. TGT RUN	Maximum TGT during post-start running conditions is displayed in degrees Celsius. No limit needs to be exceeded for TGT RUN to be displayed.
19. TGT START	Maximum TGT during an engine start is displayed in degrees Celsius. No limit needs to be exceeded for TGT START to be displayed.

Figure 3-55. (CDS2) ENGINE HISTORY Page 2 (Sheet 2 of 2)

SECTION VI. R ENGINE HISTORY PAGES

3-82. ENGINE HISTORY PAGES.

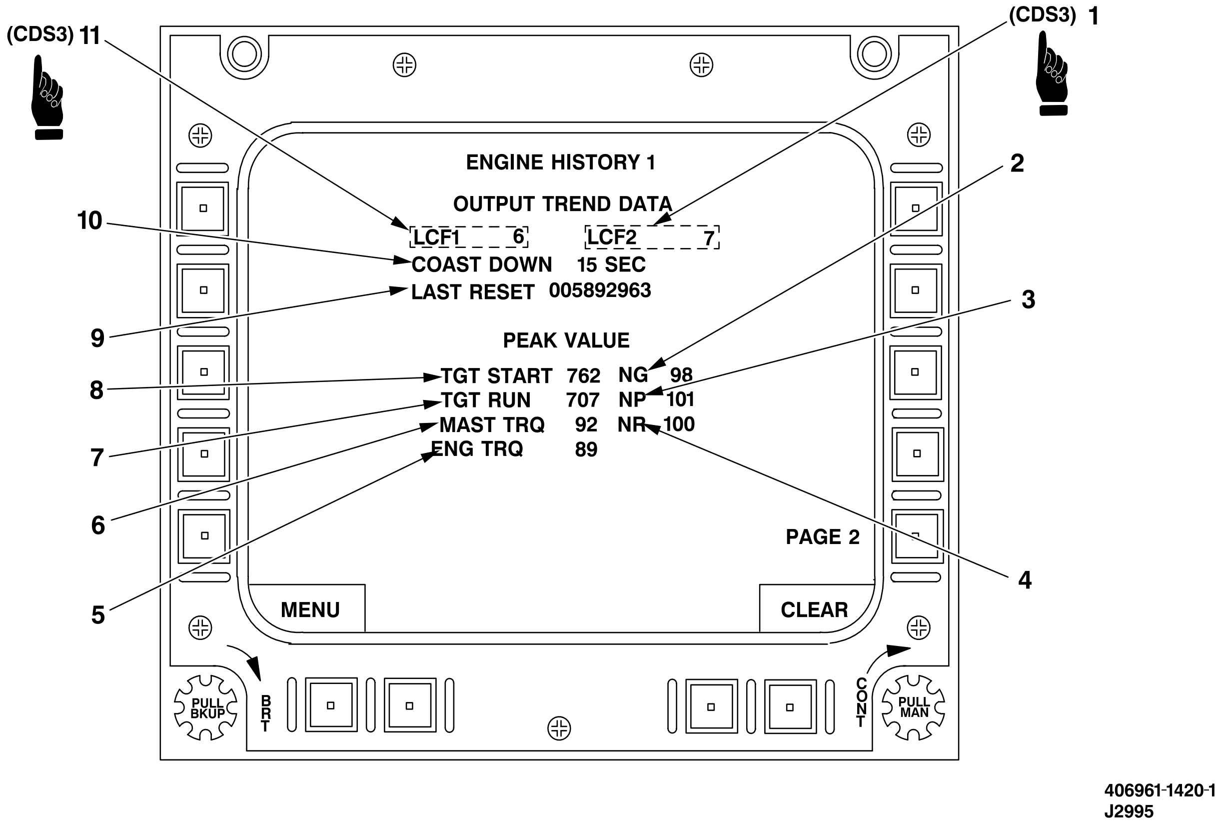
ENGINE HISTORY Pages (Fig. 3-56, Fig. 3-57, and Fig. 3-58) display maximum engine values, trend data, and other engine data such as the number of engine starts while the helicopter is on the ground. This data is gathered from engine start to shutdown, and is periodically stored in Non-Volatile Memory (NVM). The ENGINE HISTORY data is maintained until specifically cleared. The data is cleared by maintenance personnel entering specific codes identified by unit SOP.

The ENGINE HISTORY Page(s) are accessed from the FDL MENU Page by pressing L-4. The ENGINE HISTORY display consists of three pages. Pressing R-5 key on any of the pages selects the next page. The page number is shown at the top of the display after the text ENGINE HISTORY. An exit to the FDL MENU is made by pressing the mode select button labeled MENU or the INIT button on the MFD auxiliary control panels.

a. ENGINE HISTORY Page 1. Output trend and peak value data are displayed to provide engine performance trends. The date of the LAST RESET (cleared) is also shown.

b. ENGINE HISTORY Page 2. This page lists items that have exceeded limits.

c. ENGINE HISTORY Page 3. This page lists FADEC HISTORY, MAINTENANCE CODES, and MODIFY ENG STARTS.



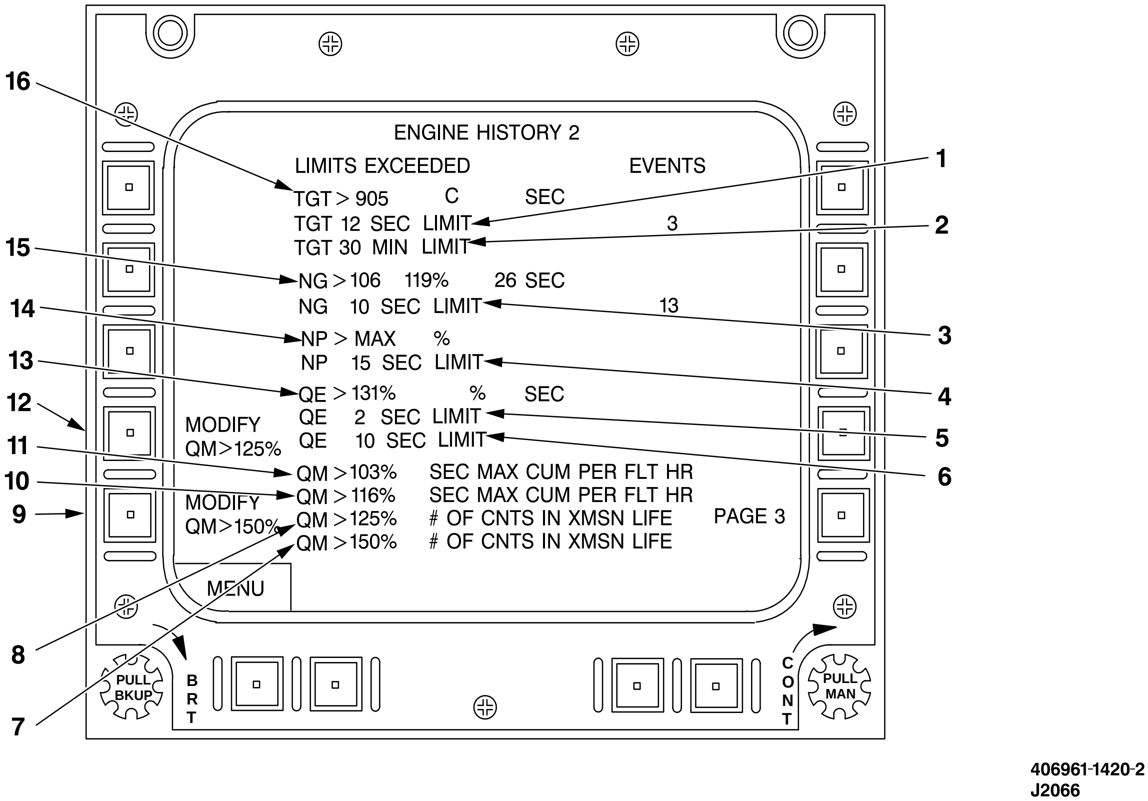
CONTROL/INDICATOR	FUNCTION
1. **(CDS3)** LCF 2	LCF 2 displays number of times NG has traversed range of 85% NG to 95% NG.
2. NG	Peak turbine gas generator speed (NG) is displayed as a percentage. No limit need to exceeded for NG to be displayed.
3. NP	Peak power turbine speed (NP) is displayed as a percentage, if limit exceeded.
4. NR	Peak main rotor speed (NR) is displayed as a percentage.
5. ENG TRQ	Peak engine torque (ENG TRQ) is displayed as a percentage. No limit need be exceeded for ENG TRQ to display.
6. MAST TRQ	Peak mast torque (MAST TRQ) is displayed as a percentage. No limits need be exceeded for MAST TRQ to display.
7. TGT RUN	Maximum TGT during post-start running conditions is displayed in degrees Celsius. No limit need be exceeded for TGT RUN to display.
8. TGT START	Maximum TGT during engine start is displayed in degrees Celsius. No limit need be exceeded for TGT START to display.

Figure 3-56. R ENGINE HISTORY Page 1 (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
9. LAST RESET	The code that the last engine history reset (clear) was performed is displayed.
10. COAST DOWN	The time taken for the engine to slow to a stop is recorded. The engine must be shut down and the aircraft must be on the ground. Time is recorded in seconds while NG goes from 30% to 10%
11. **(CDS3)** LCF 1	Low cycle fatigue (LCF) 1 displays the number of times NG has traversed the range of 50% NG to 95% NG.

Figure 3-56. R ENGINE HISTORY Page 1 (Sheet 2 of 2)



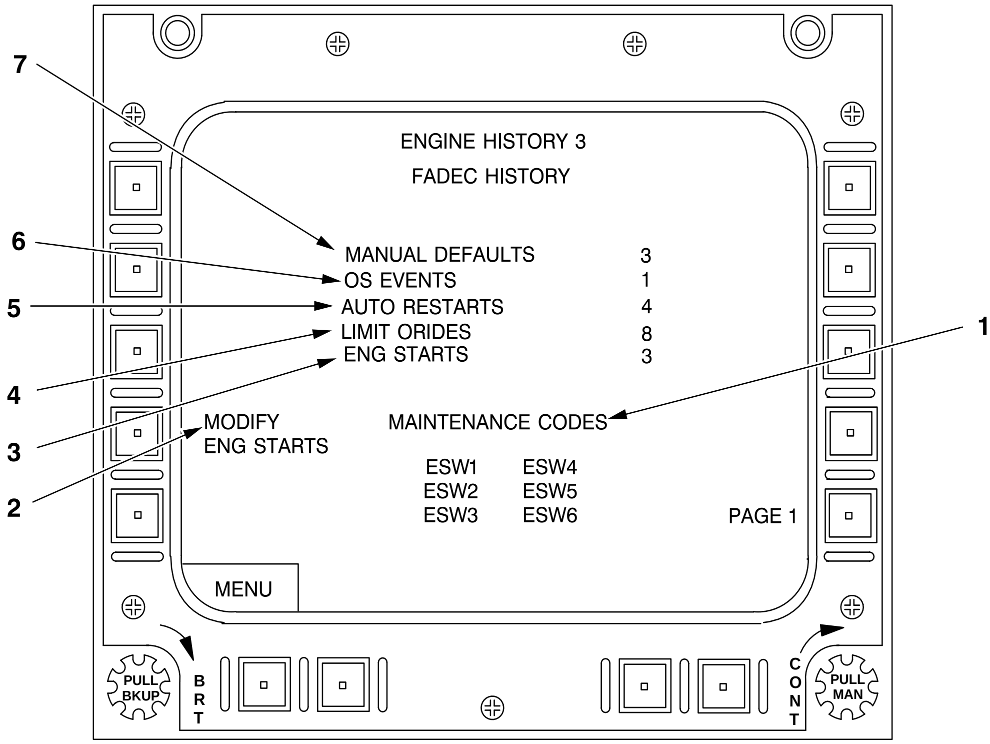
CONTROL/INDICATOR	FUNCTION
1. TGT 12 SEC LIMIT	If TGT exceeds 802 °C for 12 seconds, a counter increments by one. Total count is displayed.
2. TGT 30 MIN LIMIT	If TGT has exceeded 716 °C for more than 30 consecutive minutes, a counter increments by one. Total count is displayed.
3. NG 10 SEC LIMIT	Each time NG exceeds 105% for 10 seconds, a counter increments by one. Total count is displayed.
4. NP 15 SEC LIMIT	Each time NP exceeds the lower variable limit for 15 seconds, a counter increments by one. Total count is displayed.
5. QE 2 SEC LIMIT	Each time QE exceeds 121.6% for 2 seconds, a counter increments by one. Total count is displayed.
6. QE 10 SEC LIMIT	Each time QE exceeds 112.6% for 10 seconds, a counter increments by one. Total count is displayed.
7. QM > 150%	Each time QM exceeds 150% a counter increments by one. Total count is displayed for life of transmission.

Figure 3-57. R ENGINE HISTORY Page 2 (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
8. QM > 125%	Each time QM exceeds 125% a counter increments by one. Total count is displayed for life of transmission.
9. MODIFY QM > 150%	Pressing L-5 displays the cursor next to the L-5 legend allowing the operator to enter a number between 0 - 99 for the QM > 150% counter. After pressing the ENTER key on the MFK, the number is displayed next to the text # OF COUNTS IN XMSN LIFE. If an invalid entry is made, the entry is blanked, the cursor reappears and the text ERR is displayed.
10. QM > 116%	If mast torque (QM) exceeds 116%, the highest accumulated exceedance time within any 60 minute period, since last cleared, will be displayed.
11. QM > 103%	If mast torque (QM) exceeds 103%, the highest accumulated exceedance time within any 60 minute period, since last cleared, will be displayed.
12. MODIFY QM > 125%	Pressing L-4 displays the cursor next to the L-4 legend allowing the operator to enter a number between 0 - 99 for the QM > 125% counter. After pressing the ENTER key on the MFK, the number is displayed next to the text # OF COUNTS IN XMSN LIFE. If an invalid entry is made, the entry is blanked, the cursor reappears and the text ERR is displayed.
13. QE > 131%	If engine torque (QE) exceeds 131%, time above the limit is displayed along with peak QE.
14. NP > MAX	Two set point limits for power turbine speed (NP) vary according to engine torque. Normal operating conditions for NP are below both limits. If the upper limit is exceeded, then the NP percentage is displayed.
15. NG > 106	If turbine gas generator speed (NG) exceeds 106%, time above that limit is displayed along with peak percentage NG above the upper limits.
16. TGT > 905	If TGT exceeds 905 °C, time above that limit is displayed along with the peak TGT.

Figure 3-57. R ENGINE HISTORY Page 2 (Sheet 2 of 2)



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CONTROL/INDICATOR	FUNCTION
1. MAINTENANCE CODES	Provides a hexadecimal representation of six Engine Status Words (ESW). Each ESW is presented as a four-character (alphanumeric) word in hexadecimal format (Example: 0C30). These maintenance codes are stored in memory and are shown each time ENGINE HISTORY Page 3 is displayed until the maintenance codes are either cleared using CLEAR on ENGINE HISTORY Page 1 or the engine is started.
2. MODIFY ENG STARTS	Pressing the L-4 bezel displays the cursor next to the L-4 legend. This allows the operator to enter a number (0 to 9999) for the engine starts. After pressing enter on the keyboard, the number is displayed next to the text ENG STARTS. If an invalid entry is made, the entry is blanked, the cursor reappears and the text ERR is displayed.
3. ENG STARTS	This event counter is incremented by one for each attempted engine start.
4. LIMIT ORIDES	This event counter is incremented once each time an engine limit is overridden.
5. AUTO RESTART	This event counter is incremented once each time an automatic engine restart occurs.

Figure 3-58. R ENGINE HISTORY Page 3 (Sheet 1 of 2)

(Cont)

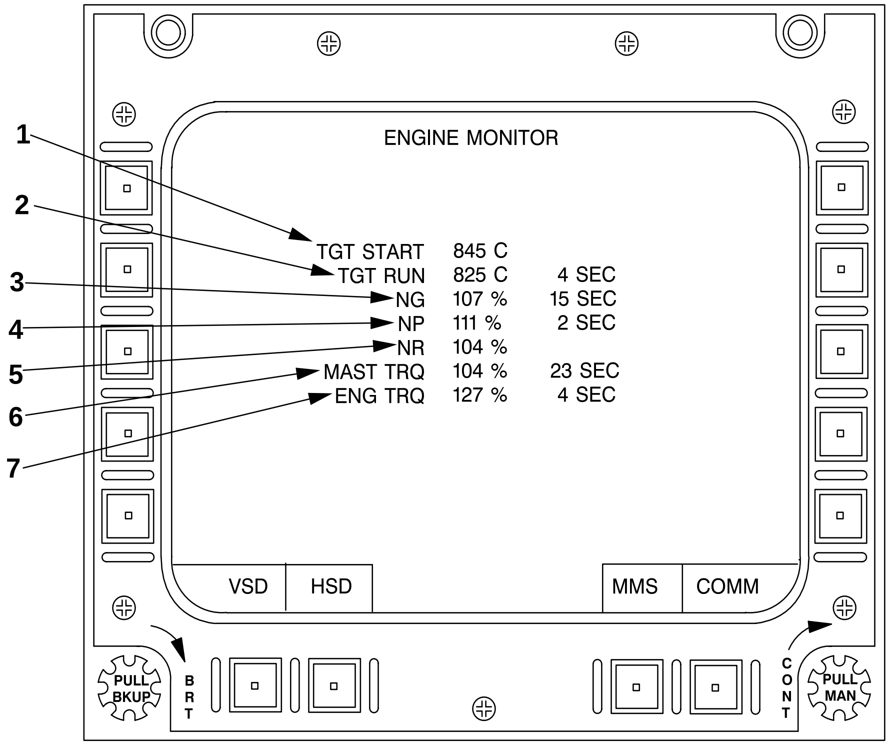
CONTROL/INDICATOR	FUNCTION
6. OS EVENTS	This event counter is incremented once for each engine overspeed event.
7. MANUAL DEFAULTS	This event counter is incremented once each time the FADEC system enters the manual mode.

Figure 3-58. R ENGINE HISTORY Page 3 (Sheet 2 of 2)

SECTION VII. (CDS2) ENGINE MONITOR PAGE

3-83. ENGINE MONITOR PAGE.

The ENGINE MONITOR Page (Fig. 3-59) displays the maximum values recorded for seven engine parameters. These values are recorded from the last time the page was cleared. If value exceeds a predefined limit, the number of seconds the limit was exceeded is displayed until cleared (even over successive flights). An exit from this page is made by pressing MFD mode select buttons, pilot cyclic grip display select switch, or the INIT button on the pilot or CPG MFD auxiliary control panel.



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CONTROL/INDICATOR	FUNCTION
1. TGT START	Maximum turbine gas temperature during an engine start, including aborted starts, is displayed in degrees Celsius.
2. TGT RUN	Maximum turbine gas temperature during regular running conditions and the time above the lower limit (716 °C) is displayed if TGT exceeds 767.8 °C. Otherwise, only the maximum TGT is displayed.
3. NG	Peak turbine gas generator speed (NG) (highest value since last clearing) is displayed as a percentage. If the NG exceeds 106%, time above the limit is displayed in seconds. Otherwise, the time is not displayed.
4. NP	Two setpoint limits for power turbine speed (NP) vary according to engine torque. Normal NP operating conditions are below both limits. If the lower of the two limits is exceeded for more than 10 seconds, peak NP is displayed as a percentage. If both lower and upper limits are exceeded, the percentage and time above the upper limit is displayed in seconds.
5. NR	Peak main rotor speed is displayed at all times as a percentage.
6. MAST TRQ	Peak transmission mast torque (MAST TRQ) (highest since last clearing) is displayed as a percentage. Time (seconds) is displayed only if above the limit (103%).

Figure 3-59. (CDS2) ENGINE MONITOR Page (Sheet 1 of 2)

(Cont)

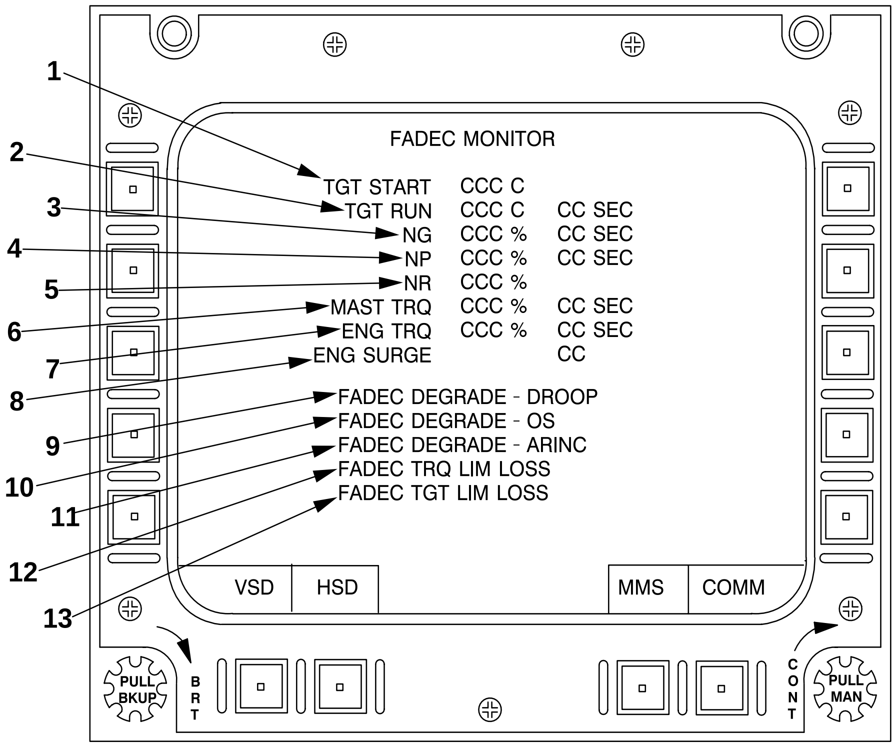
CONTROL/INDICATOR	FUNCTION
7. ENG TRQ	Peak engine output torque (ENG TRQ) (highest since last clearing) is displayed as a percentage. If ENG TRQ exceeds 121.6%, the time above the limit is displayed in seconds.

Figure 3-59. (CDS2) ENGINE MONITOR Page (Sheet 2 of 2)

SECTION VIII. R FADEC MONITOR PAGE

3-84. FADEC MONITOR PAGE.

The FADEC MONITOR Page (Fig. 3-60) displays the maximum values recorded for seven engine parameters. These values are recorded from the last time the page was cleared. If a value exceeds a predefined limit, the number of seconds the limit was exceeded is displayed until cleared (even over successive flights). It also displays the FADEC degrade decipher flags and engine surges. An exit from this page is made by pressing MFD mode select buttons, pilot's cyclic grip display select switch, or the INIT button on the pilot or CPG MFD auxiliary control panel. The FADEC data is provided to the CDS by both an ARINC-429 communications bus and hardwired discretes. This data is then processed by the CDS for display.



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CONTROL/INDICATOR	FUNCTION
1. TGT START	Maximum turbine gas temperature (TGT) during an engine start, including aborted starts, is displayed in degrees Celsius.
2. TGT RUN	Maximum turbine gas temperature (TGT) during regular running conditions and the time above the lower limit (716 °C) is displayed if TGT exceeds 767.8 °C. Otherwise, only the maximum TGT is displayed.
3. NG	Peak turbine gas generator speed (NG) (highest value since last clearing) is displayed as a percentage. If the NG exceeds 106%, time above the limit is displayed in seconds. Otherwise, the time is not displayed.
4. NP	Two setpoint limits for power turbine speed (NP) vary according to engine torque. Normal NP operating conditions are below both limits. If the lower of the two limits is exceeded for more than 15 seconds, or if upper limit is exceeded, then NP is displayed as a percentage along with the time in seconds spent above the lower limit.
5. NR	Peak main rotor speed (NR) is displayed at all times as a percentage.
6. MAST TRQ	Peak transmission mast torque (MAST TRQ) (highest since last clearing) is displayed as a percentage. Time (seconds) is displayed only if above the limit (103%).

Figure 3-60. R FADEC MONITOR Page (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
7. ENG TRQ	Peak engine output torque (ENG TRQ) (highest since last clearing) is displayed as a percentage. If ENG TRQ exceeds 131%, the time above the limit is displayed in seconds.
8. ENG SURGE	This event counter monitors the number of engine surge events. The counter increments each time a latched surge event indication occurs. The counter does not increment for engine surges which occur subsequent to a latched surge event indication unless the latched indication has been reset either by power down of the ECU or transition from manual to auto mode.
9. FADEC DEGRADE - DROOP	Activation of this advisory occurs when the FADEC system has detected a fault that will result in possible rotor droop.
10. FADEC DEGRADE - OS	Activation of this advisory occurs when the FADEC system has detected a fault that results in a loss of the FADEC OVERSPEED limiting system.
11. FADEC DEGRADE - ARINC	Activation of this advisory occurs when the CDS determines a problem with the ARINC communication bus. This message is an indication that the CDS or FADEC system has detected a loss of the ARINC bus.
12. FADEC TRQ LIM LOSS	Activation of this advisory occurs when the FADEC system has detected a fault that results in a loss of the FADEC engine torque limiting feature.
13. FADEC TGT LIM LOSS	Activation of this advisory occurs when the FADEC system has detected a fault that results in a loss of the FADEC TGT limiting feature.

Figure 3-60. R FADEC MONITOR Page (Sheet 2 of 2)

CHAPTER 4

MISSION EQUIPMENT

SECTION I. MISSION AVIONICS

4-1. GENERAL.

(CDS2) Mission avionics consists of the Mast Mounted Sight (MMS) Subsystem, Airborne Target Handover System (ATHS), Airborne Video Tape Recorder (AVTR), Data Transfer System (DTS), ANVIS Display Symbology Subsystem (ADSS), and Electronic Countermeasures (radar/laser detecting, warning, and jamming equipment).

R Mission avionics consists of the Mast Mounted Sight (MMS) Subsystem, Improved Data Modem (IDM), Airborne Video Tape Recorder (AVTR), Data Transfer System (DTS), ANVIS Display Symbology Subsystem (ADSS), and Electronic Countermeasures (radar/laser detecting, warning, and jamming equipment).

CAUTION

Operation of the mast mounted sight by unqualified personnel may cause equipment damage.

4-2. MAST MOUNTED SIGHT (MMS) SUBSYSTEM.

WARNING

To avoid permanent eye injury, avoid direct eye exposure to AIM-1/MLR Laser (if installed) beam. The laser contains a Class IIIb invisible radiation source.

NOTE

Do not use excessive force on LOS CONT switch.

The MMS provides the ability to search, detect, recognize, track, locate, and designate ground targets in both day and night environments. The subsystem is used with the cockpit control and display system (CDS) and embedded global positioning system/inertial navigation system (EGI). The MMS is also used to hand over and cue target data. Targets are detected, acquired, and tracked using either the thermal imaging sensor (TIS) for infrared sensing during darkness and poor visibility or a television sensor (TVS) during daylight operations. In addition to these two sensor subsystems, a laser rangefinder/designator (LRF/D) is provided. The LRF/D is used for target designation and range for targeting or navigation waypoint determination.

a. MMS Description. The MMS consists of three major components: turret assembly, central power supply, and system processor.

(1) **Turret Assembly.** The MMS Turret Assembly (MTA) includes a platform assembly, a payload assembly, and an upper shroud. The stabilized, vibration-damped sensor support structure contained in the platform assembly is capable of movement in three axes. The payload assembly, which is mounted on the sensor support structure, includes a TIS, TVS, and LRF/D which are used to acquire and track targets or for target ranging and designation. The mast support post contains a thermal conditioning unit (TCU) for cooling components in the MTA.

(2) **Central Power Supply.** The Mast Mounted Sight Central Power Supply (MCPS) accomplishes the following:

Converts normal helicopter power (115 Vac, 3-phase, 400 Hz and 28 Vdc power) to the various voltages used throughout the MMS.

Performs switching functions controlling power to both AC and DC loads.

Provides control voltages for positioning both the payload assembly and the outer shroud.

(3) **System Processor.** The system processor controls signal flow among all MMS components, CPG cyclic grip controls, and video controls. The processor also acts as an interface between the MMS sensors, MCPS, and the control and display system. There are two configurations of the system processor: the MMS system processor (MSP) and the improved MMS system processor (IMSP).

b. Functional Description — MMS.

(1) The CPG controls the subsystem through the MMS control panel (fig. 4-1), MFD (fig. 4-2 and 4-3), cyclic grip control (fig. 4-4), and the multifunction keyboard (MFK). The MFD displays the screen acquired by either the TVS or TIS. By using the line-of-sight control (LOS CONT) switch on the CPG cyclic control, the turret is directed to point in any desired direction, ±30° in elevation and ±190° in azimuth,

relative to the fuselage reference plane. The MMS can automatically search for targets and be slaved to the fixed forward position. The LOS can also be prepointed to navigation waypoints provided by the master controller processor unit (MCPU). An acquired target can be tracked manually or automatically. As an aid to the operator, the MFD displays information and status in the form of reticles, symbols, and alphanumeric data. The MMS continually displays the azimuth and elevation of line-of-sight (LOS) in a digital output. The data is used by the MCPU in conjunction with data supplied from the LRF/D and EGI to compute battlefield coordinates of targets and waypoints.

(2) The MMS provides a boresight mode of operation which aligns the LOS of the TVS and TIS to the LRF/D and TVS which share the same optics. The boresight procedure may be performed any time after power is applied to the MMS; however, it might be necessary to wait up to 15 minutes before TIS video is clear enough for an adequate boresight of the TIS.

(3) The video tracker system (VTS) processes the TVS or TIS image data to acquire and maintain track. If the VTS loses lock-on, the MMS enters a coast mode automatically for up to 10 seconds while attempting to reacquire the target. Should reacquisition not occur, the MMS directs the tracker to change to manual track.

(4) Laser firing is controlled by the MMS. Laser firing is inhibited when the laser is directed into the tail rotor, the weight on gear switch senses the helicopter has landed, the CPG MFD fails, TIS and FR FRZ are selected, or TIS is selected and TIS INTEG is switched on. Inhibited indications are: (1) IMPEND LSR INHBT and (2) LSR INHBT. In the event laser system operating temperatures exceed 160 °F, the system will automatically shut down unless the operator uses the TEMP ORID line address key to prevent shutdown. The TEMP ORID key is displayed on any MMS page, but only when the condition exists. If shutdown is allowed to occur, the operator can still use the TEMP ORID key to restart laser operation. This is an emergency procedure and will result in severe damage to the laser system. Continuous operation of the laser for extended periods will not cause an overheat condition. Overheat condition will occur only in the event of a system component failure.

(5) Condition and status of MMS equipment is determined by built-in test (BIT) and fault detection location system (FDLS) functions that detect and report equipment malfunctions. Condition and operational status are displayed on the MFDs. In the event of MMS failure, an advisory message, MMS FAIL, will be displayed on pilot and CPG MFD. Advisory messages associated with the MMS are displayed only on the CPG MFD in the MMS status block. Refer to Table 4-1 for a list of advisories. Advisories are continuously displayed sequentially, one at a time, and for approximately 2 seconds.

c. MMS Symbology (fig. 4-2 and 4-3).

d. MMS Controls and Indicators. The primary operator of the MMS is the CPG. The pilot has limited control as provided by the MMS FXD FWD switch on the pilot cyclic grip (fig. 4-5). All other operations can be accomplished only by the CPG (fig. 4-1 through 4-4 and 4-6 through 4-11).

4-3. OFFSET UPDATE.

Offset updating is similar to flyover updating except the MMS is used to specify the locations of the waypoint.

4-4. TARGET LOCATE.

WARNING

Target locate function shall not be performed while in the direct waypoint mode on aircraft configured with version 7.0 software (CDS2). Failure to comply can result in calling fire upon yourself.

The target locate function uses MMS LOS angles, laser range, and helicopter present position to compute the location coordinates of targets. Target location accuracy is dependent upon NAV system and MMS pointing accuracy.

4-5. MANUAL DRIFT COMPENSATION (MDC).

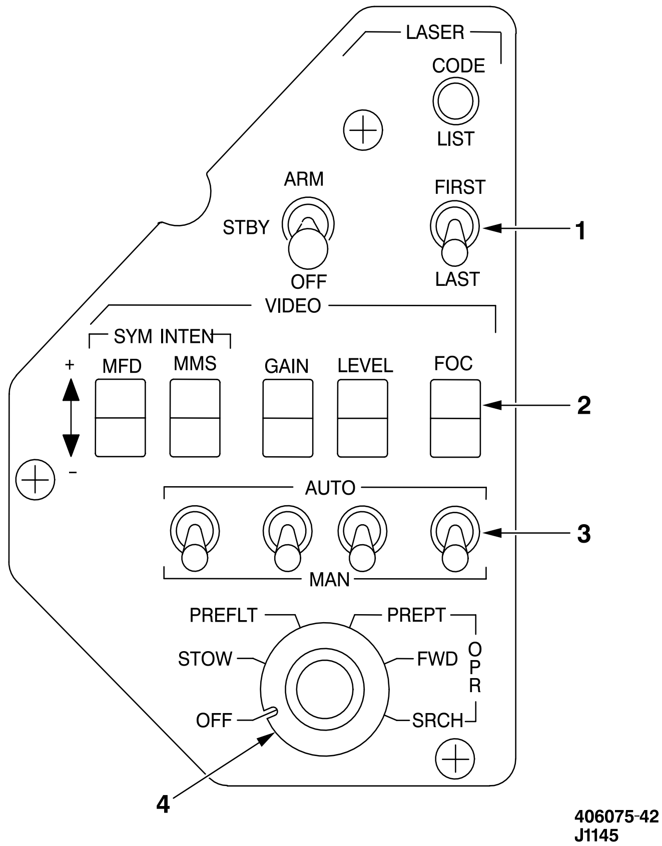
The MDC function eliminates unwanted drift in the MMS LOS. From time to time it will be necessary to do this task as the gyros change their performance characteristics. This drift will be noticed most easily when the MMS is switched from a fixed LOS (FWD or PREPT) to manual track.

4-6. MMS MULTIFUNCTION DISPLAY LINE ADDRESS KEYS.

The pilot and CPG have line address keys that control and affect MMS operation (fig. 4-10 through 4-17).

NOTE

For standardization in procedures, “press” is used to denote a pressing and releasing action unless “press and hold” is specified.



CONTROL/INDICATOR	FUNCTION
1. LASER switches:	
CODE LIST switch	Displays laser codes entered into memory or allows entry of new codes or changing of existing codes.
FIRST/LAST switch:	
FIRST	Activates LRF/D for range-findings of targets in open terrain or in front of cluttered terrain.
LAST	Activates LRF/D for range-finding of targets in or behind cluttered terrain.
ARM/STBY/OFF switch	
ARM	Arms LRF/D system providing that all interlocks are complete.
STBY	Applies power to the LRF/D system.
OFF	Removes power from the LRF/D system.

Figure 4-1. MMS Control Panel (Sheet 1 of 3)

(Cont)

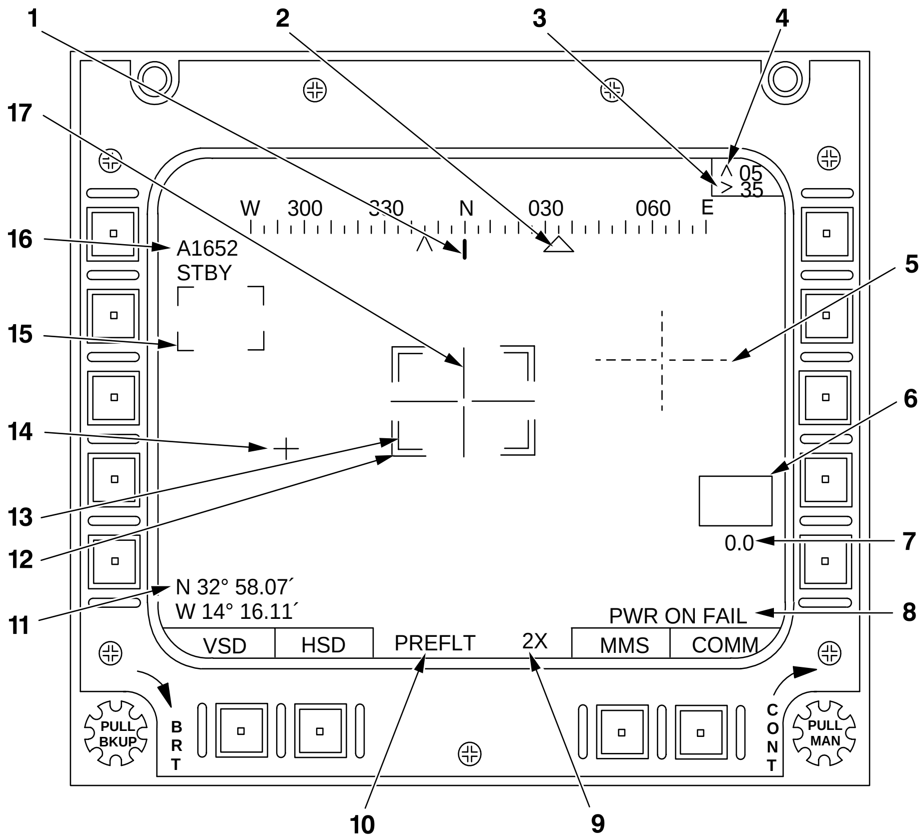
CONTROL/INDICATOR	FUNCTION
2. VIDEO switches:	
SYM INTEN MFD	Increases (+) and decreases (-) illumination intensity of symbols presented on MFD other than MMS. Symbols will be white in the (+) range and black in the (-) range.
SYM INTEN MMS	Increases (+) and decreases (-) illumination intensity of MMS symbols presented on MFD. Symbols will be white in the (+) range and black in the (-) range.
GAIN	Increases (+) and decreases (-) TIS video data contrast.
LEVEL	Increases (+) and decreases (-) TVS/TIS video data brightness.
FOC	Adjust focus of selected sensor video image.
3. VIDEO AUTO/MAN switches:	
SYM INTEN MMS AUTO/MAN	
AUTO	Reserves polarity of MMS symbology (i.e., white to black or black to white).
MAN	Allows intensity of MMS symbology on MFD to be adjusted manually.
GAIN AUTO/MAN (TIS only)	
AUTO	Enables automatic TIS GAIN to operate about a set point selected on the manual gain switch.
MAN	Enables manual TIS GAIN switch to increase (+) or decrease (-) TIS video contrast.
LEVEL AUTO/MAN (TIS only)	
AUTO	Initiates a midrange level setting.
MAN	Enables manual level switch to increase (+) or decrease (-) video data brilliance.
FOC AUTO/MAN	
AUTO	Momentary switch to provide automatic focus adjustment of the selected image on MFD in narrow field of view only.
MAN	Allows manual focus adjustment of selected sensor image on MFD by FOC switch.
LEVEL AUTO/MAN (TVS only)	
AUTO	Enables automatic level adjustment for the TVS.
MAN	Enables manual level switch to increase or decrease video brilliance.

Figure 4-1. MMS Control Panel (Sheet 2 of 3)

(Cont)

CONTROL/INDICATOR	FUNCTION
4. Mode selector switch:	
OFF	Removes electrical power from MMS.
STOW	Drives MMS turret to point aft from any position. Stores data constants and diagnostic data in nonvolatile memory.
PREFLT	Displays tests on MFD allowing automatic MMS readiness test and setup.
OPR	
PREPT	The MMS LOS is slaved to a target previously selected and stores in memory. Waypoint numbers are displayed next to PPT key.
FWD	The MMS LOS is slaved to a fixed forward position, normally 0° azimuth, 0° elevation. The LOS can be slewed by the LOS CONT switch for forward trim, but slew rate is slower than normal.
SRCH	The MMS LOS is slaved to scan over present scan limits.

Figure 4-1. MMS Control Panel (Sheet 3 of 3)



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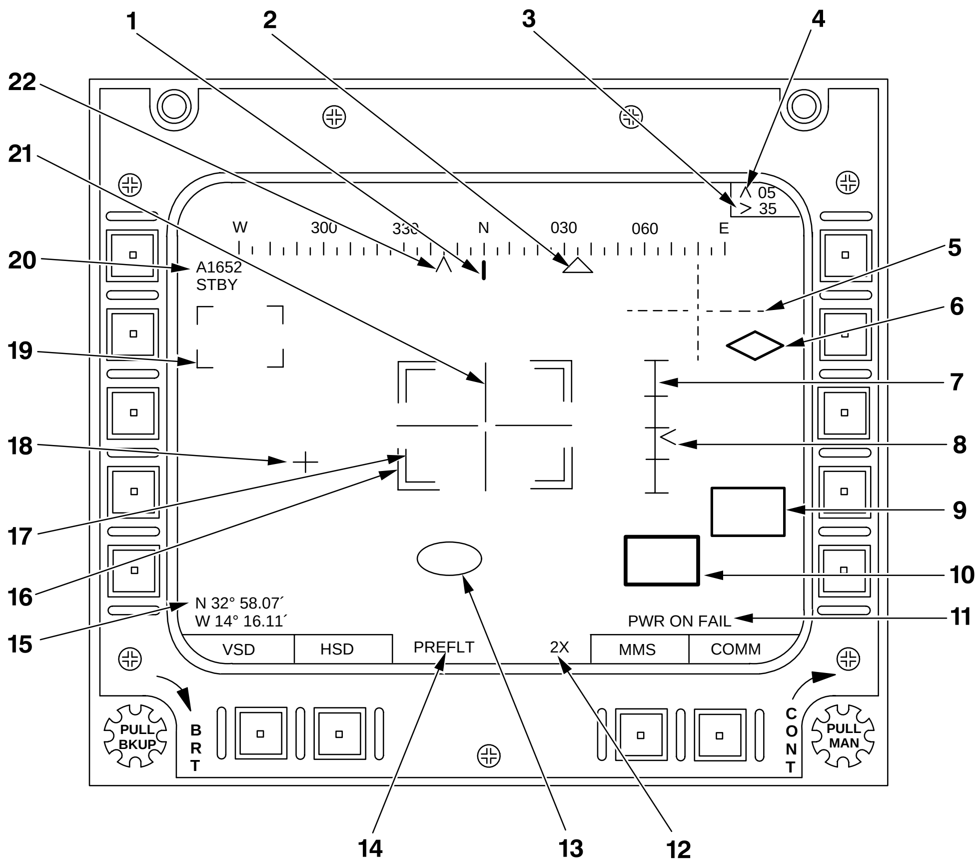
CONTROL/INDICATOR	FUNCTION
1. Lubber Line	Represents aircraft compass heading.
2. MMS bearing indicator	Displays compass bearing of MMS LOS.
3. Azimuth caret and numerals	Direction and degree of MMS lateral LOS offset from fuselage reference.
4. Elevation caret and numerals	Direction and degree of MMS vertical LOS offset from fuselage reference.
5. Prepoint reticle	Appears over a preselected target.
6. Target acquisition gate	Shows area being used by TVS or TIS to attempt to track a target.
7. HELLFIRE TOF	HELLFIRE time of flight. Displayed if HELLFIRE is installed.
8. MMS sensor/turret status block	Reports status of MMS turret.

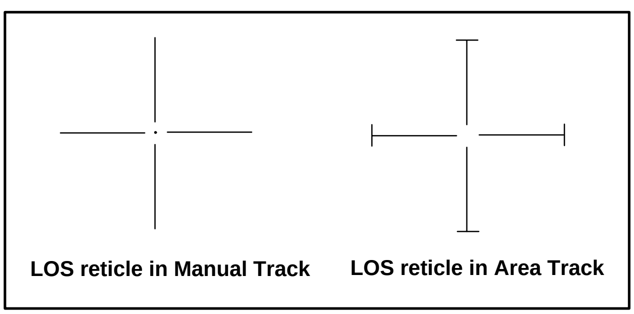
Figure 4-2. Composite CDS and MSP/MMS Multifunction Display Symbology (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
9. Magnification indicator	Indicates degree of magnification in TIS only.
10. MMS operational mode status block	Indicates present function of MMS selected by MMS mode select switch or TRK switches.
11. Present position block	Continuously updated report of helicopter current position.
12. NFOV limit TIS	Indicates the edge of field of view when placed in NFOV mode.
13. NFOV limit TVS	Indicates the edge of field of view when placed in NFOV mode.
14. Laser hit point reticle	Selects and permits LOS to be directed to an offset and represents laser hit point when joined with LOS reticle.
15. Trackable target (lock on) gate	Appears around designated target and indicates MMS and LOS lock on.
16. Laser status block	Upper portion displays selected laser code. Lower position displays laser system status (STBY/ARM).
17. LOS reticle	Represents LOS of MMS optics and laser hit point.

Figure 4-2. Composite CDS and MSP/MMS Multifunction Display Symbology (Sheet 2 of 2)





*LOS reticle in all modes except Area Track and Manual Track.

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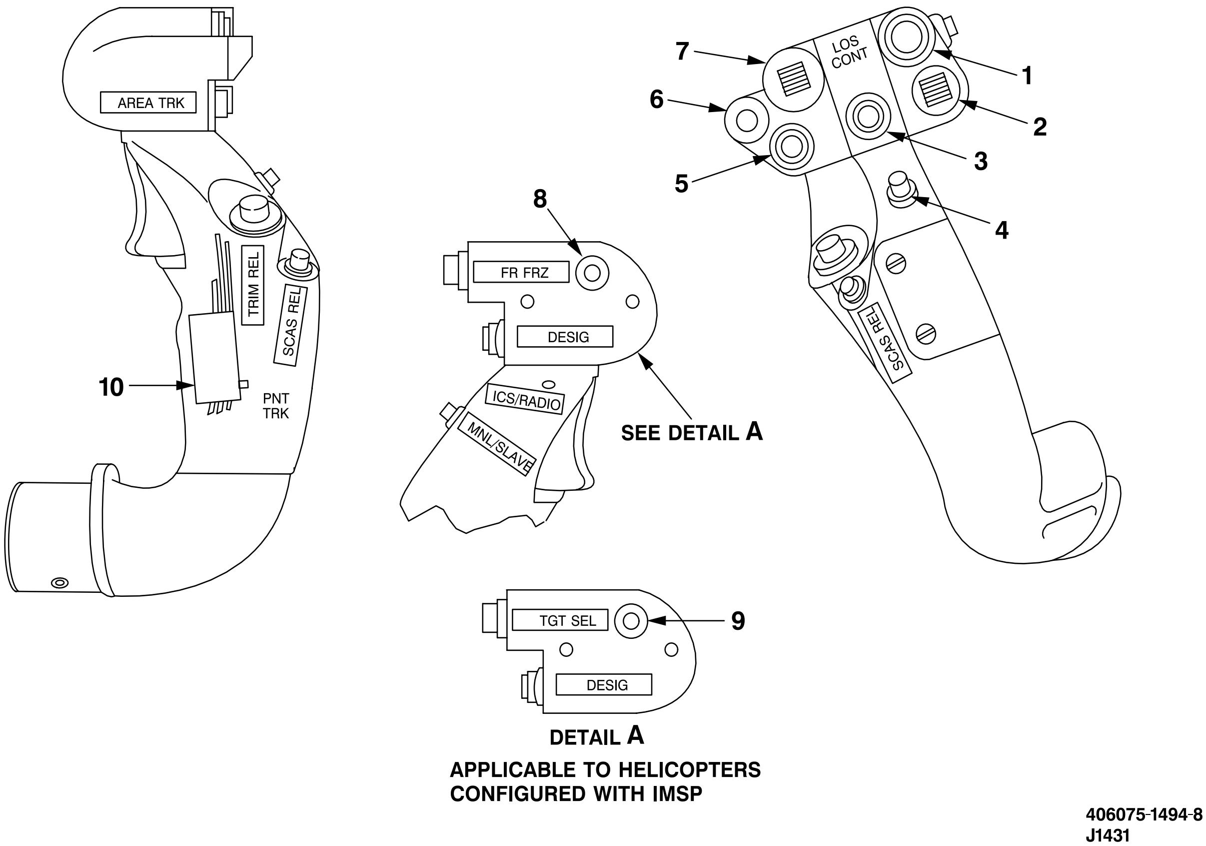
Figure 4-3. Composite CDS and IMSP/MMS Multifunction Display Symbology (Sheet 1 of 2)

CONTROL/INDICATOR	FUNCTION
1. Lubber Line	Represents aircraft compass heading.
2. MMS bearing indicator	Displays compass bearing of MMS LOS.
3. Azimuth caret and numerals	Direction and degree of MMS lateral LOS offset from fuselage reference.
4. Elevation caret and numerals	Direction and degree of MMS vertical LOS offset from fuselage reference.
5. Prepoint reticle	Appears over a preselected target.
6. Acquisition cursor	Symbol used to attempt to track (acquire) a target.
7. Scale	Appears when VIDEO switches on control panel are set to manual and VIDEO rocker switches GAIN, LEVEL, and FOC are actuated. Bottom of scale represents 0% and top 100% of adjustment range.
8. Scale cursor	Indicates adjustment value.
9. Secondary target gate	Appears around secondary targets being tracked by MMS.
10. Transition gate	Appears around transition target being tracked by MMS.
11. MMS status block	Reports status of MMS.
12. Magnification indicator block	Indicates degree of magnification [1X(blank), 2X, or 4X] in TIS and TVS.
13. Autocue	Appears as moving target indicator around potential targets.
14. MMS operational mode status block	Indicates the current operating mode of MMS.
15. Present position block	Displays continuously updated report of helicopter current position.
16. NFOV limit TIS	Indicates the edge of field of view when placed in NFOV mode.
17. NFOV limit TVS	Indicates the edge of field of view when placed in NFOV mode.
18. Laser hit point reticle	Selects and permits LOS to be directed to an offset and represents laser hit point when joined with LOS reticle.
19. Primary target gate	Appears around primary target being tracked by MMS and indicates MMS lock-on.
20. Laser status block	Upper portion displays selected laser code. Lower position displays laser system status (STBY/ARM).
21. LOS reticle	Represents LOS of MMS optics and laser hit point. See inset for symbol of LOS reticle when in Manual Track and Area Track.
22. Waypoint bearing indicator	Displays bearing of aircraft.

Figure 4-3. Composite CDS and IMSP/MMS Multifunction Display Symbology (Sheet 2 of 2)



CONTROL/INDICATOR	FUNCTION
1. TV/TIS	Selects desired sensor image to be displayed on CPG MFD.
2. DESIG	Indicates whether lasing is for offset navigation update or target locate designation. Down for target locate, up for offset navigation update.
3. LOS CONT	Permits manual positioning of the MMS LOS in direction switch is moved. The direction of vertical movement can be reversed by making an entry on the MFK. Power up constants will default to constants previously set.
4. MNL/SLAVE	Selects operating mode set by MMS mode select switch, if manual track is being used. Selects manual track while in any other OPR mode.

Figure 4-4. CPG Cyclic Grip Controls (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
5. AREA TRK	Locks MMS LOS on total scene being displayed.
6. LASER	Fires laser providing that all interlock requirements have been satisfied.
7. FOV SEL	Controls field-of-view and zoom level for TV and TIS as follows: Pressing switch up selects WIDE FOV. Pressing switch down selects narrow FOV. Once FOV is selected, additional presses in the same direction (up or down) cause the zoom level to change from 1X to 2X and back to 1X for the MMS, or from 1X to 2X to 4X and back to 1X for the IMSP. When the FOV is changed from wide to narrow or narrow to wide, the zoom level does not change.
8. FR FRZ	Stops (freezes) the image movement on MFD at last scene displayed (TIS) only.
9. TGT SEL*	Selects transition target.
10. PNT TRK	Locks MMS LOS on target which is at center of display.

* On helicopters configured with IMSP.

Figure 4-4. CPG Cyclic Grip Controls (Sheet 2 of 2)

TABLE 4-1. MMS ADVISORIES

ADVISORY	MEANING
BRK LOCK	Mast mounted sight system processor video tracker is no longer tracking target.
BRST	Displays when automatic boresight (AUTO BRST) is in process.
BRST COMPLETE	Displays when automatic boresight (AUTO BRST) is complete. It does NOT imply a successful boresight.
COOLANT LOW	Displays when cooling unit fails BIT.
DSC FAIL*	MMS BIT (built-in test) has detected a failure in the digital scan converter. If TIS video is not usable, the DSC may be reset by turning TIS power OFF (Preflight Mode, Setup page, R-2) for 10 seconds and back on.
IMPEND BRK LOCK	MSP video tracker is losing target. Operating the LOS control with this message present will cause the MMS to revert to track acquisition mode.
IMPEND LSR INHBT	MMS line of sight is approaching tail rotor where laser firing is inhibited.
INVALID STORE	Displays if improper STOW procedure is used. Mission data for that MMS power cycle may be lost if MMS is powered off when invalid store message displays.
LASER FAIL	MMS BIT has detected a failure in the laser rangefinder. An MMS diagnostics should be performed before further use of the laser.
LSR ENERGY LOW	Laser output energy is sensed to be low.
LSR HOT	Laser has been shut down. May be overridden, if necessary, but damage to laser may occur.
LSR HOT WRN	High temperature in laser and system may shut down. Continued laser firing and/or placing laser in temperature override may damage laser.
LSR INHBT	Laser is inhibited from firing. MMS LOS is in line with tail rotor area.
MMS FAIL	MMS BIT has detected line replaceable units (LRU) failure in one or more BIT tests. To determine if there has been an MMS failure, an MMS diagnostics should be performed.
NAV UPD FAIL	NAV UPDATE perceived error is so large that EGI will not accept update without confirmation.
PWR ON FAIL	MMS has failed a portion of the power on diagnostics. An additional message will be alternately displayed identifying the failed LRU.
REBORESIGHT	Displays whenever power is applied to MMS. Displays when one of the sensors (TVS, TIS) has experienced a temperature change which is great enough to require an AUTO BRST.
STORE COMPLETE	Displays whenever MMS has completed its STOW process. The MMS may now be powered down.
TAMS FAIL	Transmission attitude measurement system (TAMS) failure; except MMS pointing errors. Perform TAMS system BIT from BIT page to determine failed components.

TABLE 4-1. MMS ADVISORIES (Cont)

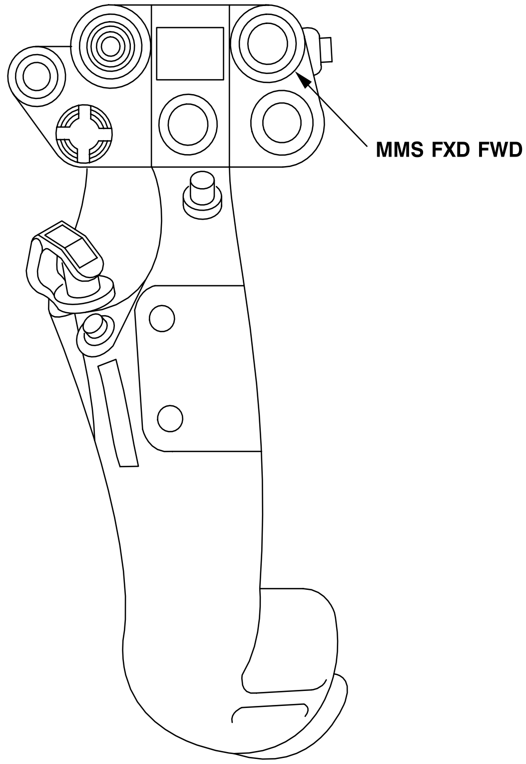
ADVISORY	MEANING
TGT LOC FAIL	Range data from one laser pulse to another is not consistent and will not be accepted.
TIS FAIL	MMS BIT has detected a failure in the TIS LRU. An MMS diagnostics should be performed to determine if the TIS has failed.
TIS FREEZE*	Operator has selected frame freeze. Deselect, as desired, by using frame freeze switch on CPG cyclic.
TIS HOT	TIS detectors are not cooled down to operating temperature. TIS takes 10 — 15 minutes to cool down.
TRACKER FAIL	MMS BIT has detected a video tracker subsystem (VTS) failure in MSP or a sensor processor subsystem (SPS) failure in IMSP. MMS diagnostics should be performed.
TURRET FAIL	MMS BIT has detected a turret or upper shroud failure. AN MMS diagnostics should be performed to determine if the mast turret assembly has failed.
TV FAIL	MMS BIT has detected a failure in the TVS. An MMS diagnostics should be performed to determine if TVS has failed.
VPS FAIL**	MMS BIT has detected a failure in the video processor subsystem (VPS). MMS diagnostics should be performed.
WEDGE CONST ZERO	Default values are being used for MMS data constants. Maintenance assistance is needed to load accurate data.
RNG MODE**	LASER mode is RNG and DESIG switch is activated for TARGET LOCATE or OFFSET NAV UPDATE mode.

NOTE

MMS failure status words will sometimes display without a true component failure. Some of these failures can be activated by improper preflight or STOW procedures of the MMS. Follow correct preflight and stow procedures for the MMS to minimize false failures.

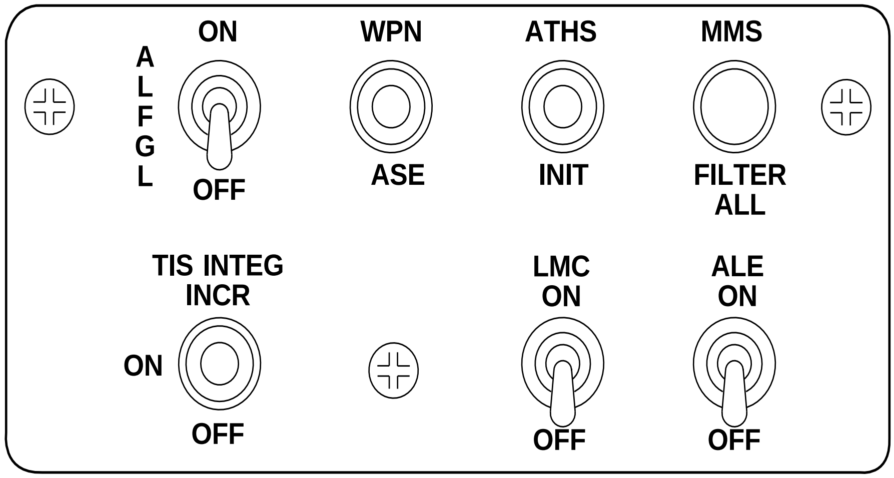
*MSP/MMS configuration only.

**IMSP/MMS configuration only.



CONTROL/INDICATOR	FUNCTION
MMS FXD FWD switch	Selects and deselects override of all CPG directional commands to MMS. Slews MMS LOS to fixed forward position (typically 0° azimuth, 0° elevation) and selects TIS, white hot and wide field of view.

Figure 4-5. Pilot Cyclic Grip Controls



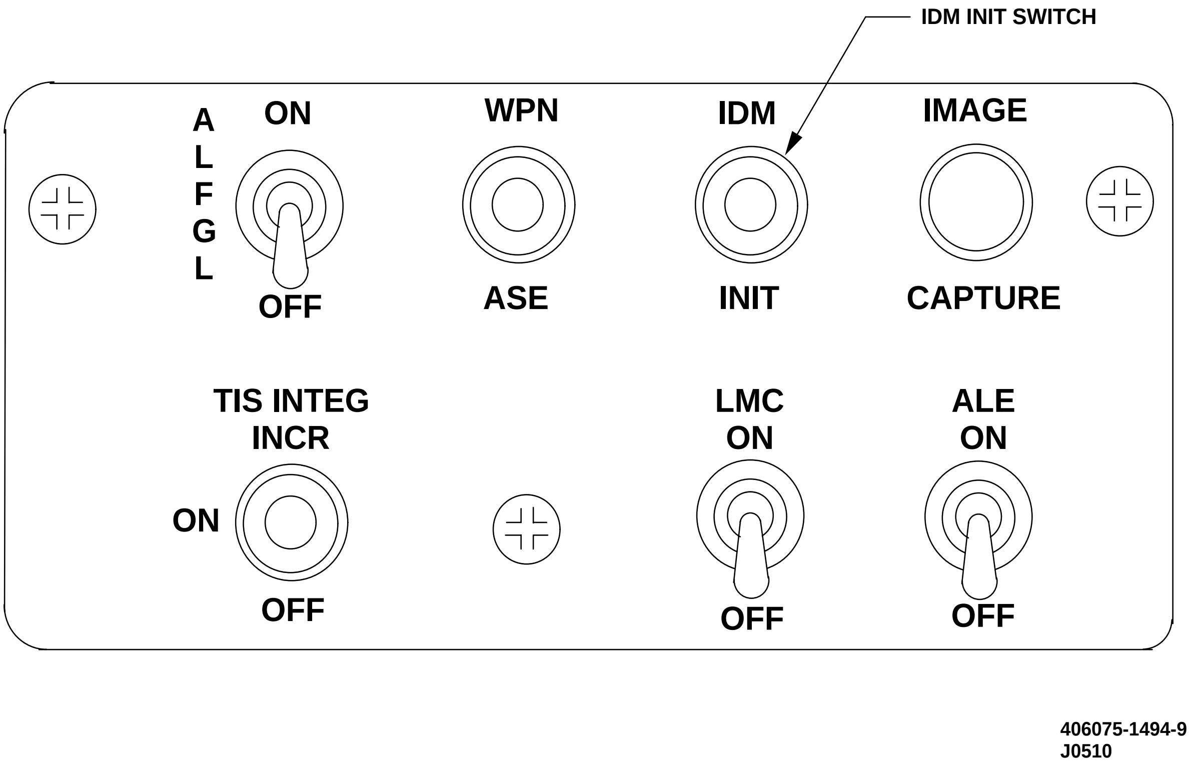
CONTROL/INDICATOR	FUNCTION
ALFGL	Allows operator to see more detail in scenes with high variation in temperature.
WPN/ASE	UP: 1st Toggle — WEAPONS PAGE. 2nd Toggle — CPG left VSD Sparse page. 3rd Toggle — CPG right VSD Sparse page. DOWN: Aircraft Survivability Equipment page. If any other page is displayed on CPG's MFD and the WPN/ASE switch is activated, the CPG's WEAPONS PAGE will be displayed.

Figure 4-6. (CDS2) CPG Auxiliary Panel (Typical) (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
ATHS/INIT	Up position displays Airborne Target Handover Top page on MFD.
	Down position displays INITIAL PAGE on MFD.
MMS FILTER ALL	Not used.
	NOTE
	The higher the TIS increment the more the scene will blur with motion.
TIS INTEG	Initiates integration function which permits several frames produced by the Thermal Imaging Sensor (TIS) to be integrated, enhancing displayed data. INTEG changes the number of frames integrated into a single TIS image. TIS INTEG is used when the TIS picture has excessive noise such as when a high gain setting is used (i.e., a scene with very little temp variation, rainy day). TIS INTEG will reduce the noise but can cause blurring of the scene when the LOS is moved. Disabled on helicopters with IMSP.
	Turn TIS INTEG on. Select TIS integrate increment until noise level is as desired.
LMC	Activate Linear Motion Compensation (LMC) to aid manual tracking.
	LMC Should be used when manually designating a target. This feature reduces the effect of random helicopter movement on manual designation accuracy. LMC may be left on.
ALE	Automatic Leveling Equalization (ALE) allows the system processor to equalize the output levels of the TIS detectors. Activate this switch when horizontal lines appear on TIS imagery of a bland (low contrast) scene or a scene with uniform temperatures.
	During the first 50 seconds after the TIS is powered up, this switch has no effect. Thereafter, ALE may be manually enabled by the switch as required to eliminate horizontal lines. After horizontal lines are no longer apparent, ALE should be disabled.
OFF	Disables ALE.

Figure 4-6. (CDS2) CPG Auxiliary Panel (Sheet 2 of 2)



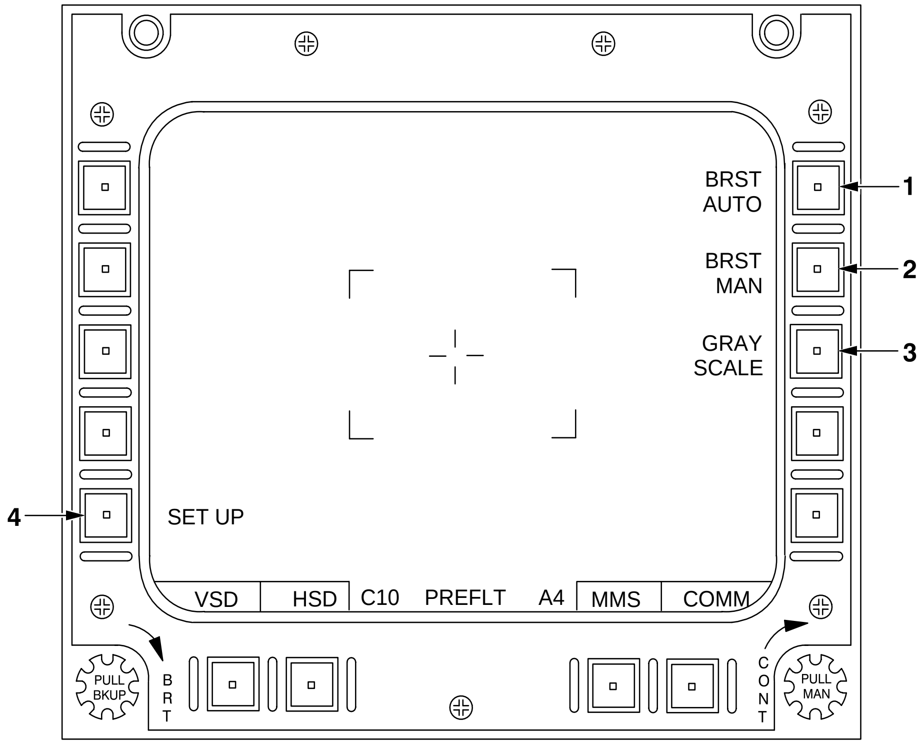
CONTROL/INDICATOR	FUNCTION
ALFGL	Allows operator to see more detail in scenes with high variation in temperature.
WPN/ASE	UP: 1st Toggle — WEAPONS PAGE. 2nd Toggle — CPG left VSD Sparse page. 3rd Toggle — CPG right VSD Sparse page. DOWN: Aircraft Survivability Equipment page. If any other page is displayed on CPG’s MFD and the WPN/ASE switch is activated, the CPG’s WEAPONS PAGE will be displayed.

Figure 4-7. R CPG Auxiliary Panel (Typical) (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
IDM/INIT	Up position displays IDM Index page or last IDM page accessed.
	Down position displays INITIAL PAGE 1 on MFD.
IMAGE CAPTURE	Freezes image on screen for VIXL transmission.
	NOTE
	The higher the TIS increment the more the scene will blur with motion.
TIS INTEG	Initiates integration function which permits several frames produced by the Thermal Imaging Sensor (TIS) to be integrated, enhancing displayed data. INTEG changes the number of frames integrated into a single TIS image. TIS INTEG is used when the TIS picture has excessive noise such as when a high gain setting is used (i.e., a scene with very little temperature variation, rainy day). TIS INTEG will reduce the noise but can cause blurring of the scene when the LOS is moved. Disabled on helicopters with IMSP.
	Turn TIS INTEG on. Select TIS integrate increment until noise level is as desired.
LMC	Activate Linear Motion Compensation (LMC) to aid manual tracking.
	LMC Should be used when manually designating a target. This feature reduces the effect of random helicopter movement on manual designation accuracy. LMC may be left on.
ALE	Automatic Leveling Equalization (ALE) allows the system processor to equalize the output levels of the TIS detectors. Activate this switch when horizontal lines appear on TIS imagery of a bland (low contrast) scene or a scene with uniform temperatures.
	During the first 50 seconds after the TIS is powered up, this switch has no effect. Thereafter, ALE may be manually enabled by the switch as required to eliminate horizontal lines. After horizontal lines are no longer apparent, ALE should be disabled.
OFF	Disables ALE.

Figure 4-7. R CPG Auxiliary Panel (Sheet 2 of 2)



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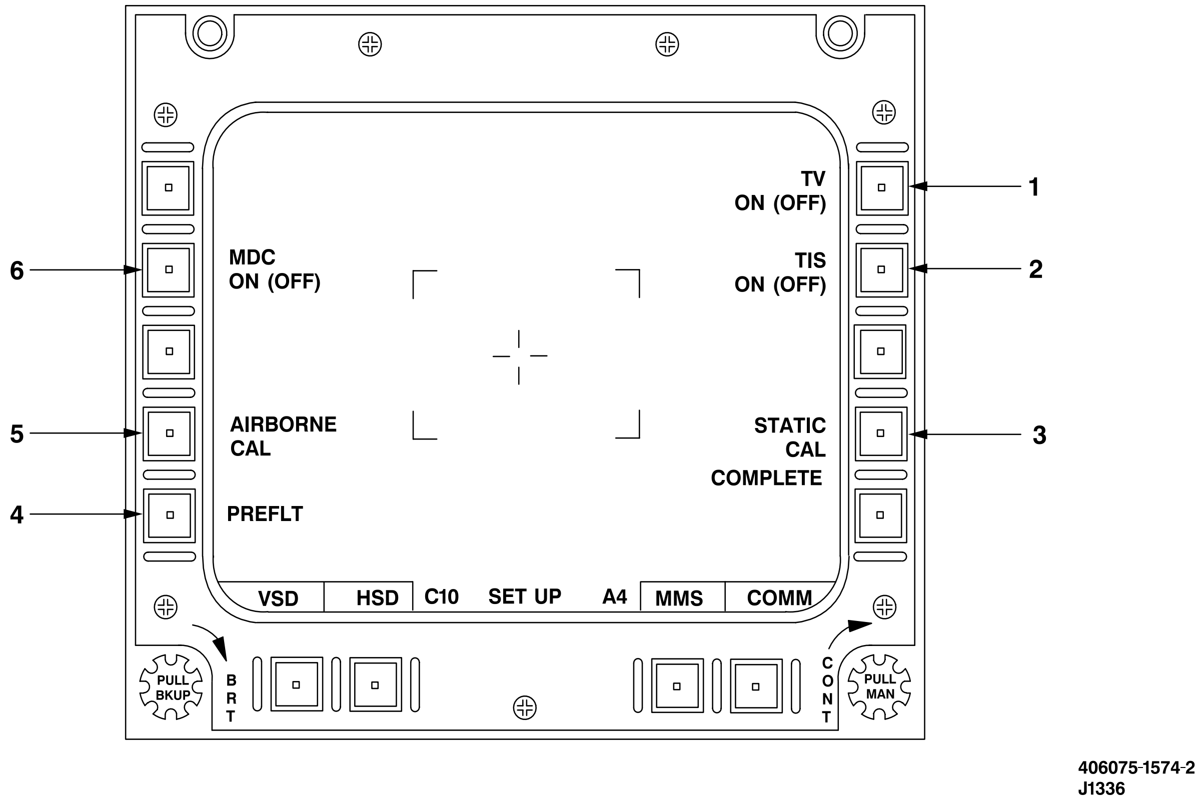
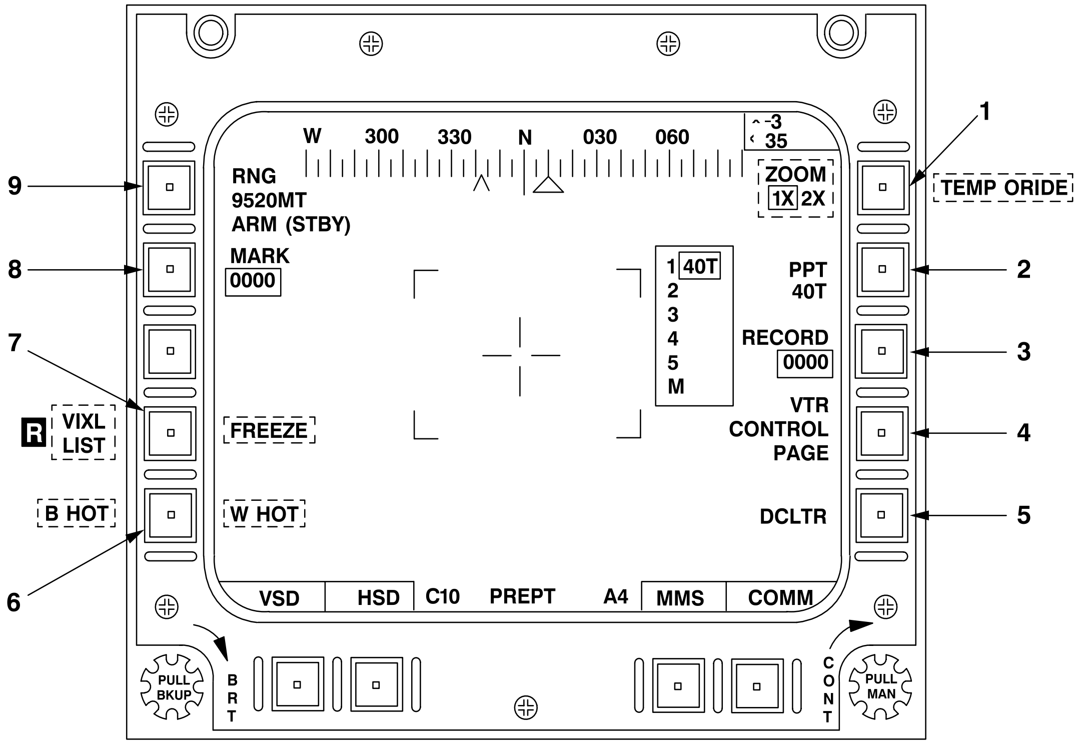
CONTROL/INDICATOR	FUNCTION
1. BRST AUTO key	Initiates automatic boresight sequence.
2. BRST MAN key	Initiates manual boresight. Reticle is manually aligned, using LOS CONT switch.
3. GRAY SCALE key	Displays a graphic image for MFD brightness and contrast adjustments.
4. SET UP key	Returns MFD to Setup page.

Figure 4-8. MMS Preflight Page



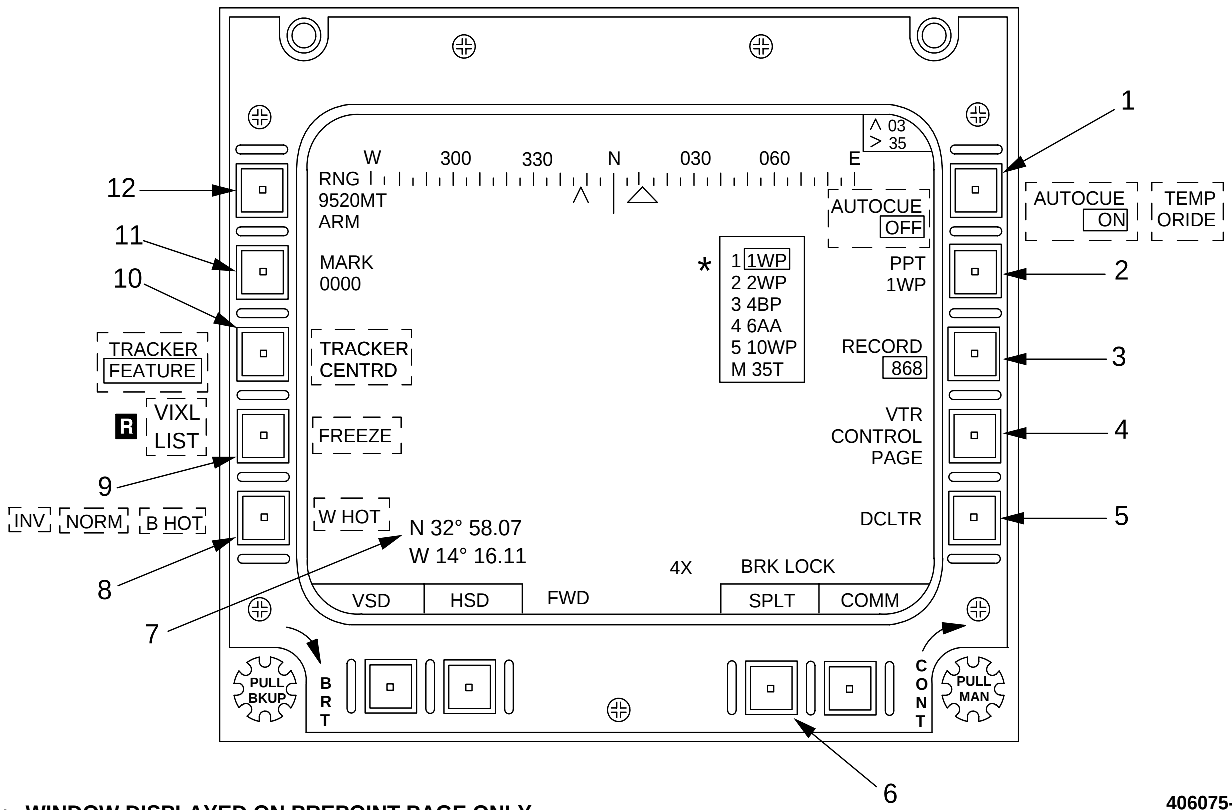
CONTROL/INDICATOR	FUNCTION
1. TV ON/OFF key	Turns on (off) TV sensor.
2. TIS ON/OFF key	Turns on (off) TIS sensor.
3. STATIC CAL key	Initiates static calibration.
4. PREFLT key	Returns MFD to Preflight page.
5. AIRBORNE CAL key	Initiates calibration while airborne.
6. MDC ON/OFF key	Manual drift compensation. Enables/disables gyro calibration functions.

Figure 4-9. MMS Setup Page



CONTROL/INDICATOR	FUNCTION
1. ZOOM 1X2X/TEMP ORIDE key	Selects image magnification. TEMP ORIDE replaces ZOOM, if LASER HOT message is displayed, to allow override of automatic shutdown of laser.
2. PPT key	Displays prepoint waypoint list numbers of waypoint or target, or enables MFK for entry of desired PPT Waypoint list.
3. RECORD key	Activates airborne video tape recorder (AVTR) record functions.
4. VTR CONTROL PAGE key	Selects AVTR control page.
5. DCLTR key	First press — Removes MFD symbology.
	Second press — Removes all symbology.
	Third press — Displays all symbology.
6. W HOT/B HOT key	Selects manner in which TIS video image is displayed.
7. R VIXL LIST/FREEZE key	Selects VIXL LIST page or FREEZE if VDU or VTR is inoperable.
8. MARK key	Marks stored location on tape.
9. Laser code status key	Selects range only mode or desired designation code and reports status of laser.

Figure 4-10. Prepoint (PREPT) Page



* WINDOW DISPLAYED ON PREPOINT PAGE ONLY.

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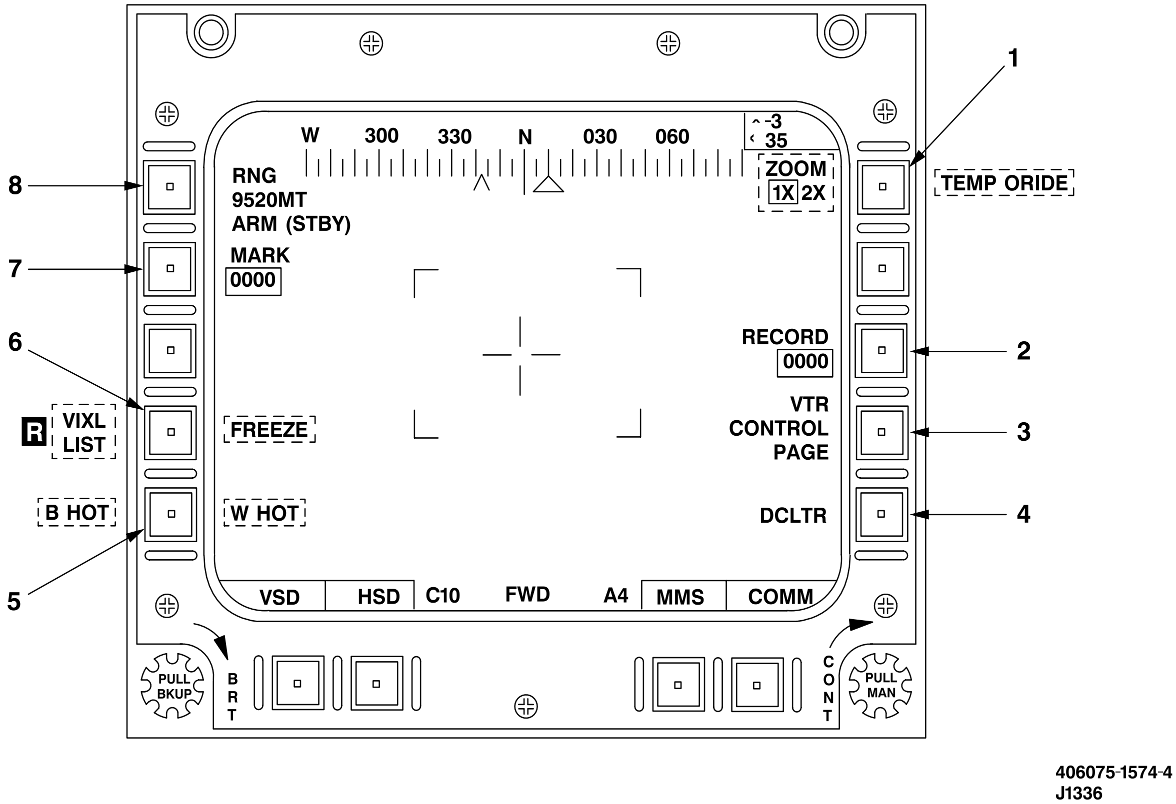
CONTROL/INDICATOR	FUNCTION
1. AUTOCUE/TEMP ORIDE key	Selects or deselects the display of cues around potential targets. TEMP ORIDE replaces AUTOCUE, if LASER HOT message is displayed, to allow override of automatic shutdown of laser.
2. PPT key	Displays prepoint waypoint list numbers of waypoint or target, or enables the MFK for entry of desired PPT Waypoint.
3. RECORD key	Activates airborne video tape recorder (AVTR) record functions.
4. VTR CONTROL PAGE key	Selects AVTR Control page.
5. DCLTR key	First press — Removes MFD symbology. Second press — Removes all symbology. Third press — Displays all symbology.

Figure 4-11. Prepoint (PREPT) Page (IMSP/MMS Configuration) (Sheet 1 of 2)

(Cont)

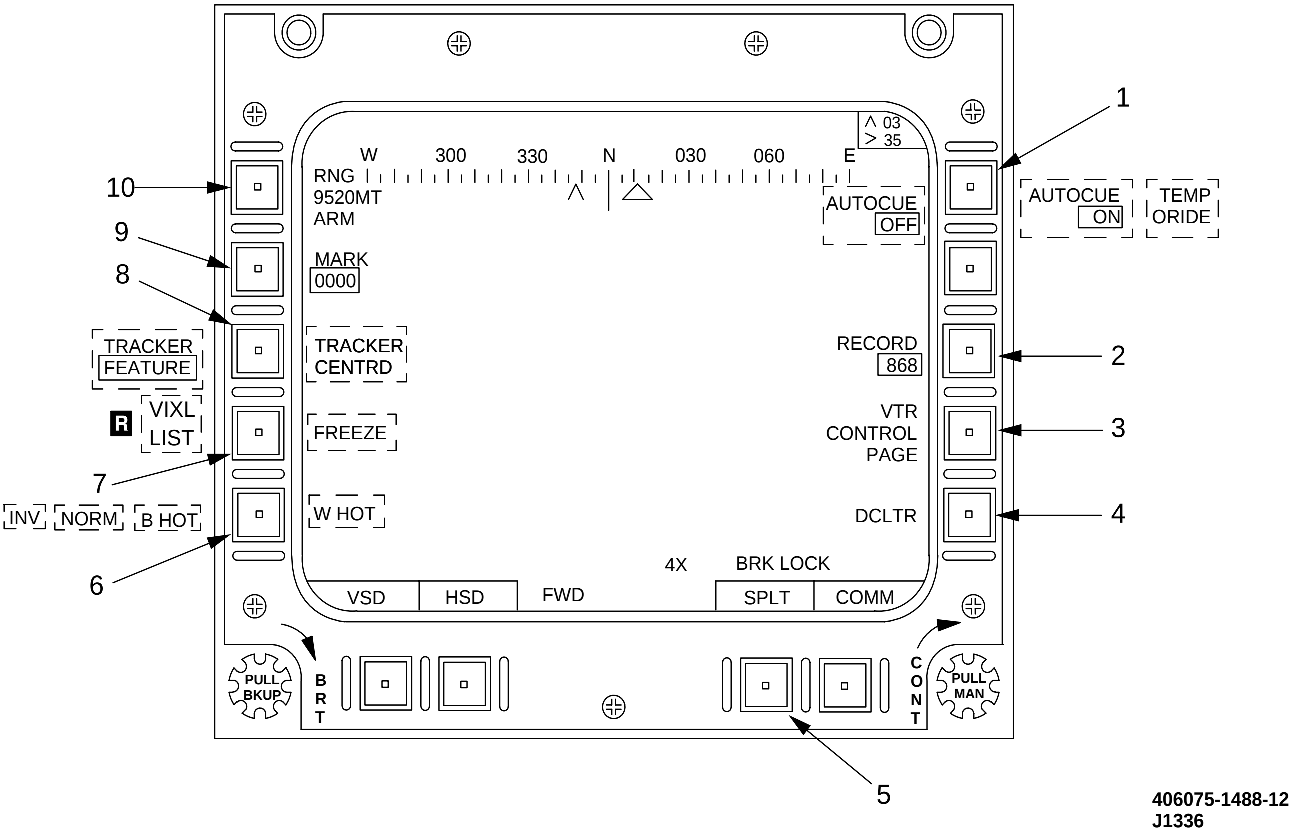
CONTROL/INDICATOR	FUNCTION
6. SPLT/MMS key	Selects or deselects the display of a split screen (TIS and TVS videos are displayed at the same time).
7. Present position	Displays continuously updated report of helicopter current position.
8. W HOT/B HOT/NORM/INV key	Selects manner in which video image is displayed — white hot, black hot, normal, or inverted.
9. R VIXL LIST/FREEZE key	Selects the VIXL LIST page or FREEZE if VDU or VTR is inoperable.
10. TRACKER CENTRD/ TRACKER FEATURE key	Selects centroid or feature mode.
11. MARK key	Marks stored location on tape.
12. Laser code status key	Selects range only mode or desired designation code and reports status of laser.

Figure 4-11. Prepoint (PREPT) Page (IMSP/MMS Configuration) (Sheet 2 of 2)



CONTROL/INDICATOR	FUNCTION
1. ZOOM 1X2X/TEMP ORIDE key	Selects image magnification. TEMP ORIDE replaces ZOOM, if LASER HOT message is displayed, to allow override of automatic shutdown of laser.
2. RECORD key	Activates airborne video tape recorder (AVTR) record functions.
3. VTR CONTROL PAGE key	Selects AVTR control page.
4. DCLTR key	First press — Removes MFD symbology.
	Second press — Removes all symbology.
	Third press — Displays all symbology.
5. W HOT/B HOT key	Selects manner in which TIS video image is displayed.
6. R VIXL LIST/FREEZE key	Selects VIXL LIST page or FREEZE if VDU or VTR is inoperable.
7. MARK key	Marks stored location on tape.
8. Laser code status key	Selects range only mode or desired designation code and reports status of laser.

Figure 4-12. Forward Page



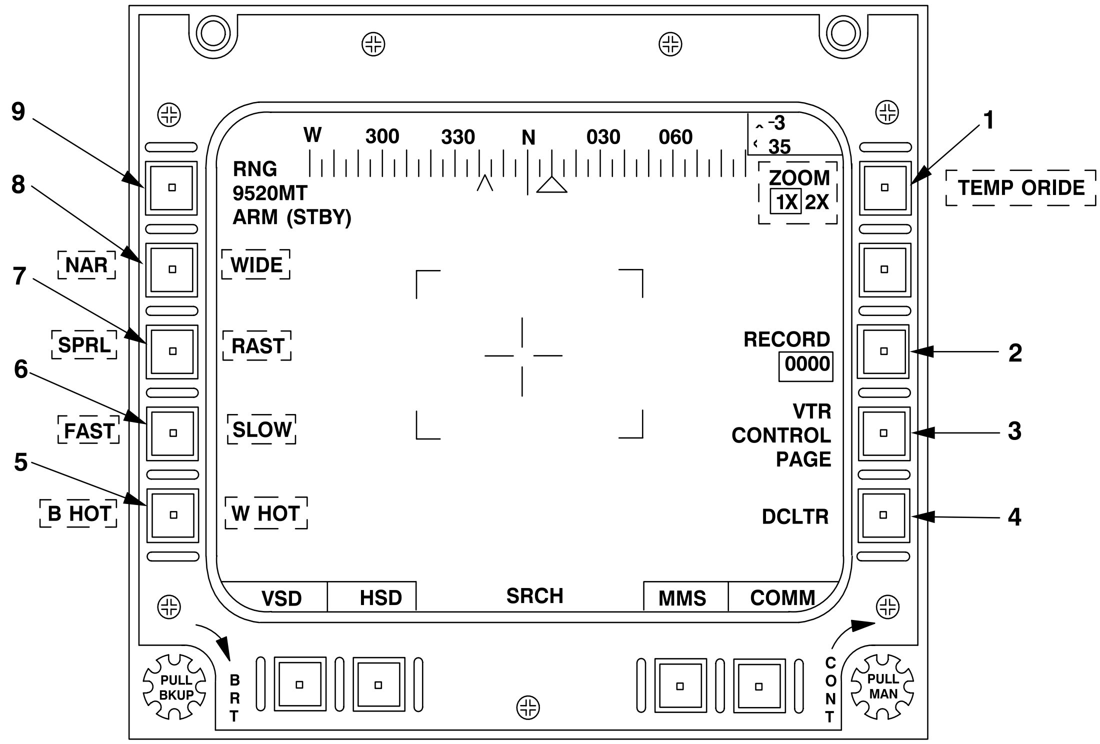
CONTROL/INDICATOR	FUNCTION
1. AUTOCUE/TEMP ORIDE key	Selects or deselects the display of cues around potential targets. TEMP ORIDE replaces AUTOCUE, if LASER HOT message is displayed, to allow override of automatic shutdown of laser.
2. RECORD key	Activates airborne video tape recorder (AVTR) record functions.
3. VTR CONTROL PAGE key	Selects AVTR Control page.
4. DCLTR key	First press — Removes MFD symbology.
	Second press — Removes all symbology.
	Third press — Displays all symbology.
5. SPLT/MMS key	Selects or deselects the display of a split screen (TIS and TVS videos are displayed at the same time).

Figure 4-13. Forward Page (IMSP/MMS Configuration) (Sheet 1 of 2)

(Cont)

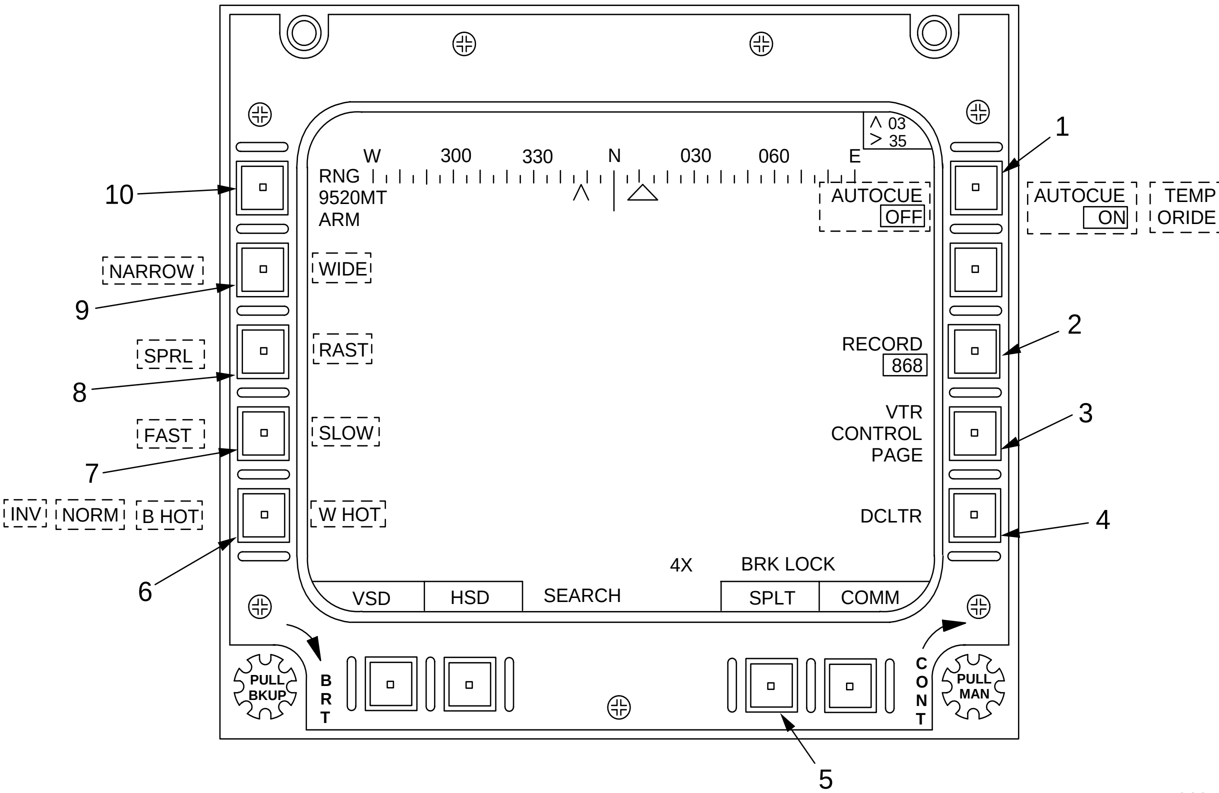
CONTROL/INDICATOR		FUNCTION
6.	W HOT/B HOT/NORM/INV key	Selects manner in which video image is displayed: white hot, black hot, normal, or inverted.
7.	R VIXL LIST/FREEZE key	Selects the VIXL LIST page or FREEZE if VDU or VTR is inoperable.
8.	TRACKER CENTRD/ TRACKER FEATURE key	Selects centroid or feature mode.
9.	MARK key	Marks stored location on tape.
10.	Laser code status key	Selects range only mode or desired designation code and reports status of laser.

Figure 4-13. Forward Page (IMSP/MMS Configuration) (Sheet 2 of 2)



CONTROL/INDICATOR		FUNCTION
1.	ZOOM 1X2X/TEMP ORIDE key	Selects image magnification. TEMP ORIDE replaces ZOOM, if LASER HOT message is displayed, to allow override of automatic shutdown of laser.
2.	RECORD key	Activates airborne video tape recorder (AVTR) record functions.
3.	VTR CONTROL PAGE key	Selects AVTR control page.
4.	DCLTR key	First press — Removes MFD symbology.
		Second press — Removes all symbology.
		Third press — Displays all symbology.
5.	W HOT/B HOT key	Selects manner in which TIS video image is displayed.
6.	SLOW/FAST key	Dwell rate of selected sensor. Selects desired scanning rate.
7.	RAST/SPRL key	MMS scan characteristics. Selects desired scanning rate.
8.	WIDE/NAR key	Search scanning mode. Selects desired mode.
9.	Laser code status key	Selects range only mode or desired designation code and reports status of laser.

Figure 4-14. Search Page



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CONTROL/INDICATOR	FUNCTION
1. AUTOCUE/TEMP ORIDE key	Selects or deselects the display of cues around potential targets. TEMP ORIDE replaces AUTOCUE, if LASER HOT message is displayed, to allow override of automatic shutdown of laser.
2. RECORD key	Activates airborne video tape recorder (AVTR) record functions.
3. VTR CONTROL PAGE key	Selects AVTR Control page.
4. DCLTR key	First press — Removes MFD symbology.
	Second press — Removes all symbology.
	Third press — Displays all symbology.
5. SPLT/MMS key	Selects or deselects the display of a split screen (TIS and TVS videos are displayed at the same time).

Figure 4-15. Search Page (IMSP/MMS Configuration) (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
6. W HOT/B HOT/NORM/INV key	Selects manner in which video image is displayed: white hot, black hot, normal, or inverted.
7. SLOW/FAST key	Dwell rate of selected sensor. Selects desired scanning rate.
8. RAST/SPRL key	MMS scan characteristics. Selects desired scanning rate.
9. WIDE/NARROW key	Search scanning mode. Selects desired mode.
10. Laser code status key	Selects range only mode or desired designation code and reports status of laser.

Figure 4-15. Search Page (IMSP/MMS Configuration) (Sheet 2 of 2)

4-7. BEFORE STARTING ENGINE — MMS SWITCHES SET — CPG.

CAUTION

- **When MMS is operating but not being used, the sight shall be slaved FWD to prevent the payload assembly from contacting and damaging the azimuth and elevation stops.**
- **Turn MMS mode select switch off if MMS fails to respond to control commands.**

1. LASER ARM/STBY/OFF switch — OFF.
2. FIRST/LAST switch — As desired.
3. VIDEO MMS SYM INTEN toggle switch — MAN.
4. VIDEO GAIN toggle switch — As desired.
5. VIDEO LEVEL toggle switch — AUTO.
6. OPR mode select switch — OFF.
7. ALFGL switch — OFF.
8. TIS INTEG switch — OFF.
9. LMC switch — OFF.
10. ALE switch — OFF.

4-8. ENGINE RUNUP — MMS STARTUP CHECKS — CPG.

1. MMS key — Press.

NOTE

- MMS runup requires 3-phase AC power from the AC generator or external AC power. Prior to turning the MMS on, verify required power is available.
- When MMS power is turned on, the system immediately checks the output of the LOS CONT switch on the CPG cyclic control grip and supplies an opposite bias in order to zeroize the LOS output. Pressing the LOS switch during the first 5 seconds after power turn-on may induce an error into the bias calculation and cause the MMS to drift.

2. OPR mode select switch — FWD. Allow MMS to stabilize.
3. MNL/SLAVE switch — Press. Observe MMS slews FWD.
4. Laser codes — Check; enter as required.
5. Laser ARM/STBY/OFF switch — STBY
6. MMS current laser code — Select appropriate code as required.

4-9. TIS MANUAL SETUP PROCEDURES.

1. MFD contrast and brightness — Adjust as desired.
2. Reposition MMS LOS to bland background.
3. Manually reduce GAIN to full negative (minimum of 10 seconds), simultaneously activate ALE until horizontal lines are reduced to a minimum.
4. Realign MMS LOS to a high contrast background.
5. Adjust GAIN to positive until desired target definition is achieved.
6. Manually or automatically adjust FOCUS to desired clarity.

4-10. MMS MANUAL BORESIGHT.

A manual boresight is recommended prior to the first automatic boresight on a power cycle, when LOS reticle shifts off target upon FOV or sensor change, or when a REBORESIGHT message remains after automatic boresight. If any of the previous conditions exists, accomplish a manual boresight as follows:

NOTE

- If required, TIS setup procedures should be performed prior to boresighting to obtain proper TIS picture.
- MMS is boresighted automatically in TV NFOV and TIS NFOV only. Manual boresighting can be accomplished in wide or narrow. Each sensor should be boresighted in WFOV prior to NFOV
- Only one sensor FOV can be boresighted at a time in BRST MAN. To boresight each, it is necessary to deselect BRST MAN, select the other sensor and/or FOV, then reselect BRST MAN.

1. OPR mode select switch — PREFLT.
2. LASER ARM/STBY/OFF switch — ARM.
3. TV/TIS switch — Select desired sensor.
4. FOV SEL switch — Select desired field of view.
5. BRST MAN key — Press. Resolution target appears for approximately 6 seconds then disappears. Check clear and in focus.
6. LASER fire switch — Press and hold. Adjust LOS reticle until it is centered over the laser spot by adjusting the LOS CONT switch. Then release LASER fire switch.
7. BRST MAN — Press to deselect manual boresight.
8. Repeat steps 3. through 7. as required to boresight each sensor and field of view.
9. LASER ARM/STBY/OFF switch — Set as required.

4-11. MMS AUTOMATIC BORESIGHT.

NOTE

- If required, TIS setup procedures should be performed prior to boresighting to obtain proper TIS picture.
- TIS HOT message may remain as an advisory message. Disregard if TIS picture meets operational requirements.

1. FOV SEL switch — Select narrow field of view for both TV and TIS sensors.
2. OPR mode select switch — PREFLT.
3. LASER ARM/STBY/OFF switch — ARM.
4. BRST AUTO key — Press. Resolution targets for each sensor appear for approximately 6 seconds each then disappear. Check clear and in focus.
5. LASER fire switch — Press and hold before second resolution target disappears.
6. TV and TIS — Verify laser spot size (TV: 1/16 - 1/8 inch, TIS: 2-3 lines for MSP, 3-4 lines for IMSP). Verify target gate displays sizes and tracks laser spot. There should be no jitter of gate and spot should be centered in gate (fig. 4-16 and 4-17).

NOTE

Repeat a manual boresight; then repeat automatic boresight procedure if hot spot is shifted from center position or target gate does not size and track laser spot. MMS maintenance is required if laser spot displays incorrectly (too large or small).

7. BRST COMPLETE message — Appears in status block.
8. LASER fire switch — Release.
9. LASER ARM/STBY/OFF switch — Set as required.

NOTE

After selecting an operational mode, if the REBORESIGHT message remains, accomplish a manual boresight.

4-12. MMS PILOT SWITCHES.

Pilot MMS mode select key enables pilot to view video from MMS. TVS/TIS line address will permit sensor selection independent of CPG selection. If pilot and CPG view different sensors, pilot MFD will not include

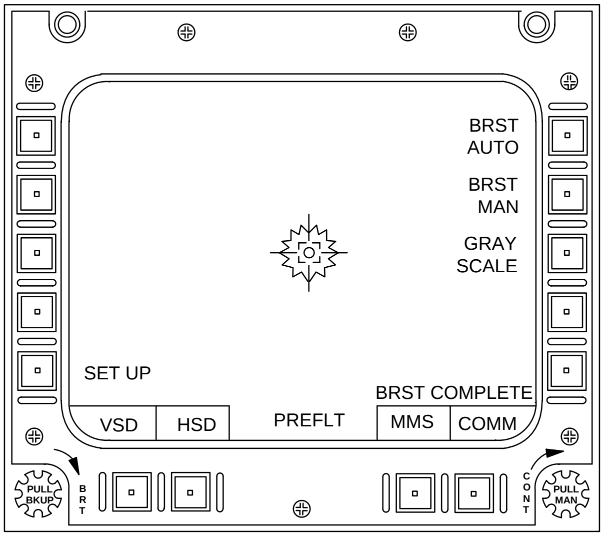

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Figure 4-16. Acceptable Track Gate/Spot Relationship TV Spot

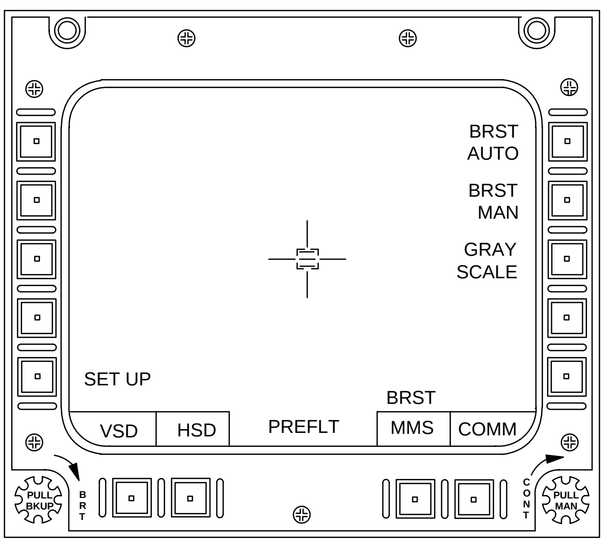

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Figure 4-17. Acceptable Track Gate/Spot Relationship TIS Spot

MMS symbology. Pilot MMS FXD FWD switch will select and deselect override of all CPG directional commands to MMS turret. When FXD FWD is selected, MMS LOS is slewed to a position fixed at 0° azimuth and 0° elevation to fuselage reference plane. In addition, TIS W HOT wide field of view is selected.

1. MMS FXD FWD switch — Press.

2. MMS FXD FWD switch — Press again to deselect.

CAUTION

Do not use excessive force on LOS CONT switch as calibration could be adversely affected.

4-13. TIS WINDOW HEATER.

If TIS window heater is causing image distortion because of extreme cold, disable window heaters as follows:

1. INIT button — Press.

2. PAGE 2 — Press.

3. MMS WINDOW HEATER — Press.

4-14. MMS WINDOW HEATER OPERATION.

Each sensor window in the upper shroud is electrically heated to 105 °F (41 °C) when power is applied to the MMS. After a 10-minute purge at that temperature, the TVS window is regulated at 10° above the turret internal air temperature and the TIS window heater is automatically turned OFF. The TIS window heater is normally OFF, because the optical characteristics of the window will change while heat is applied and this can affect designation accuracy. The operator can reheat the TIS window by keyboard entry or by selecting the MMS WINDOW HEATER switch on INITIAL PAGE 2. If the operator reactivates the window heat, the TIS window heater will automatically shut off when the temperature reaches turret air temperature plus 10°.

NOTE

When the window heater cycles ON, a defocusing effect is likely to occur. This effect will last from 2 to 10 seconds until the heater cycles OFF.

4-15. MMS STOW PROCEDURES.

NOTE

In order to save the MMS boresight and diagnostic data, place MMS in the stow position. When the data is saved, an MMS message on the MMS page will appear stating STORE COMPLETE. Turn MMS off before reducing throttle to idle. The AC generator will drop off line when the rotor speed is reduced below 91 percent.

1. MMS key — Press.

2. MMS mode select switch — STOW. MMS turret rotates to aft viewing position.

3. After 1 to 3 minutes, MFD displays — STORE COMPLETE.

CAUTION

Do not place MMS mode select switch to OFF until STORE COMPLETE is displayed.

4. MMS mode select switch — OFF.

4-16. PREPOINT (PREPT) OPERATING PROCEDURES.

1. MMS key — Press.

2. MMS mode select switch — PREPT.

3. PPT key — Press. List displayed

4. Using MFK, enter desired waypoint number into list.

5. To observe this target location, MNL/SLAVE switch — Press.

4-17. MMS FORWARD (FWD) MODE OPERATING PROCEDURES.

1. MMS key — Press.

2. MMS mode select switch — FWD.

3. MNL/SLAVE switch — PRESS.

4. LOS CONT switch — Trim LOS as desired.

4-18. MMS SEARCH (SRCH) MODE PROCEDURES.

NOTE

The search pattern, once selected, will remain directly related to the azimuth/ elevation pointer, regardless of helicopter heading or attitude.

1. MMS key — Press.

2. MMS mode select switch — SRCH.

3. LOS CONT switch — Aim LOS at desired search area.

4. RAST/SPRL key — As desired.

5. SLOW/FAST key — As desired.

6. MNL/SLAVE switch — Press.

7. When target is acquired on MFD, MNL/ SLAVE switch — Press.

8. LOS CONT switch — Maneuver switch to track target with LOS reticle.

4-19. MMS AREA TRACK PROCEDURES.

1. MMS key — Press.

2. MMS mode select switch — FWD, PREPT, or SRCH.

3. MNL/SLAVE switch — PRESS.

4. FOV SEL switch — Select desired field of view.

5. LOS CONT switch — Maneuver MMS LOS to track desired scene.

6. AREA TRK switch — Press.

NOTE

From this mode of operation, a further selection of Acquire-on-the-Move, point track, or a return to Manual Track may be accomplished.

4-20. MMS ACQUIRE-ON-THE-MOVE TO POINT TRACK PROCEDURES.

1. Area track procedures — Accomplish.
2. PNT TRK switch — Press.
3. LOS CONT switch — Maneuver to place acquisition box over target.
4. When acquisition box is centered over target, LOS CONT switch — Release.
5. PNT TRK switch — Press.

4-21. POINT TRACK PROCEDURES.

1. MMS key — Press.
2. MMS mode select switch — FWD, PREPT, or SRCH.
3. MNL/SLAVE switch — Press to enter manual track.
4. LOS CONT switch — Maneuver switch to place LOS reticle over target then release.
5. PNT TRK switch — Press.

4-22. OFFSET ACQUIRE PROCEDURES.

1. Point track procedures — Accomplish.
2. PNT TRK switch — Press.
3. LOS CONT switch — Move laser hitpoint to desired point off target.

4-23. OFFSET TRACK PROCEDURES.

1. Point track procedures — Accomplish.
2. PNT TRK switch — Press.

NOTE

- Return to point track may be accomplished by pressing PNT TRK switch a second time.
- Procedures in paragraphs 4-24 through 4-28 are for the IMSP/MMS configuration.
- To return to manual track, from any tracker mode, press MNL/SLAVE switch.

4-24. AREA TRACK PROCEDURES — IMSP/MMS.

1. MMS key — Press.
2. MMS mode select switch — FWD, PREPT, or SRCH.
3. MNL/SLAVE switch — PRESS.
4. FOV SEL switch — Select field of view (wide, wide 2X, wide 4X, narrow, narrow 2X, or narrow 4X).
5. Select preferred modes (MFD keys):

SPLT/MMS — Split screen.
AUTOCUE ON/OFF — Display cues around potential targets.
FREEZE — Freeze frame. (Not an option if mode select switch is set to SRCH.)
W HOT/B HOT (TIS) — Change polarity.
NORM/INV (TVS) — Change polarity.

6. LOS CONT switch — Actuate to track desired scene.
7. LOS CONT switch — Release.
8. AREA TRK switch — Press.

NOTE

- From Area Track, you can go to Acquire-on-the-Move, Procedure or Offset Area Track Procedure.
- In Area Track (if there are secondary targets), you can move transition target gate (press TGT SEL switch) or turn transition target into primary target and go to Point Track (press PNT TRK switch).

4-25. ACQUIRE-ON-THE-MOVE PROCEDURES — IMSP/MMS.

1. Area track or point track procedures — Accomplish.

2. AREA TRK switch — Press to display acquisition cursor.

3. LOS CONT switch — Actuate to place acquisition cursor over target.

4. When acquisition cursor is over target, LOS CONT switch — Release.

5. Repeat steps 2 through 4 to acquire more targets. (MMS can track up to six targets.)

NOTE

- In Acquire-on-the-Move, you can turn transition target into primary target and go to Point Track (press PNT TRK switch).
- When Acquire-on-the-Move is entered from Point Track, you can turn transition target into secondary target and return to Point Track (press TGT SEL switch); or when entered from Area Track, you can return to Area Track (press TGT SEL switch).

4-26. POINT TRACK PROCEDURES — IMSP/MMS.

1. MMS key — Press.

2. MMS mode select switch — FWD, PREPT, or SRCH.

3. MNL/SLAVE switch — Select manual.

4. FOV SEL switch — Select field of view (wide, wide 2X, wide 4X, narrow, narrow 2X, or narrow 4X).

5. Select preferred modes (MFD keys):

SPLT/MMS — Split screen.
AUTOCUE ON/OFF — Display cues around potential targets.
TRACKER CENTRD/FEATURE — Select centroid of feature. (Not an option if mode select switch is set to SRCH.)
FREEZE — Freeze frame. (Not an option if mode select switch is set to SRCH.)
W HOT/B HOT (TIS) — Change polarity.
NORM/INV (TVS) — Change polarity.

6. LOS CONT switch — Actuate to place LOS reticle over target.

7. When LOS reticle is over target, LOS CONT switch — Release.

8. PNT TRK switch — Press.

NOTE

- From Point Track, you can go to Acquire-on-the-Move, Procedure or Offset Point Track Procedure.
- In Point Track, you can move transition target gate (press TGT SEL switch) or turn transition target into primary target (press PNT TRK switch).

4-27. OFFSET POINT TRACK PROCEDURES — IMSP/MMS.

1. Point track procedures — Accomplish.

2. If transition target gate appears on MFD: TGT SEL switch — Press until transition target gate disappears.

3. PNT TRK switch — Press to display laser hit point reticle.

4. LOS CONT switch — Actuate to place laser hitpoint reticle at desired point off target.

5. PNT TRK switch — Press.

NOTE

From Offset Point Track, you can return to Point Track (press PNT TRK switch) or go to Acquire-on-the-Move Procedure.

4-28. OFFSET AREA TRACK PROCEDURES — IMSP/MMS.

1. Area track procedures — Accomplish.

2. If transition target gate appears on MFD: TGT SEL switch — Press until transition target gate disappears.

3. PNT TRK switch — Press to display laser hit point reticle.

4. LOS CONT switch — Actuate to place laser hitpoint reticle at desired point off target.

5. PNT TRK switch — Press.

NOTE

From Offset Area Track, you can return to Area Track (press PNT TRK switch) or go to Acquire-on-the-Move Procedure.

4-29. LASER RANGEFINDING PROCEDURES.

CAUTION

Damage to the laser range receiver may occur (depending on target responsivity) at laser ranges less than 500 meters. Therefore, the use of the laser on targets at less than 500 meters is not recommended.

NOTE

For maximum accuracy, laser ranging/designating must be accomplished in narrow field of view and point track.

1. Manual point track procedures — Accomplish.
2. LASER ARM/STBY/OFF switch — STBY.
3. Verify laser code in RNG.
4. LASER ARM/STBY/OFF switch — ARM.
5. FIRST/LAST switch — As desired.
6. LASER fire switch — Press. Range to target (in meters) will flash adjacent to RNG.

NOTE

In the range-only mode, the laser fires a single pulse each time the LASER fire switch is pressed.

7. LASER ARM/STBY/OFF switch — As desired.

4-30. LASER TARGET LOCATE DESIGNATION PROCEDURES.

WARNING

Target locate function shall not be performed while in direct waypoint mode on aircraft configured with version 7.0 software (CDS2). Failure to comply can result in calling fire upon yourself.

1. Point track procedures — Accomplish.
2. LASER ARM/STBY/OFF switch — ARM.
3. FIRST/LAST switch — As desired.
4. RNG/laser code key — Select desired code.
5. DESIG switch — Press down.
6. LASER fire switch — Press and hold 3 to 5 seconds then release.
7. If range and target coordinates are considered acceptable, STORE key — Press. Target coordinates will be stored in the displayed target storage register.
8. If range and coordinates are not acceptable, REJECT key — Press.
9. LASER ARM/STBY/OFF switch — As desired.

NOTE

R If LASER mode is RNG and DESIG switch is activated, RNG MODE is displayed in MMS status block and TARGET LOCATE mode is inhibited.

4-31. LASER OFFSET NAVIGATION UPDATE PROCEDURES.

1. MMS mode key — Press.
2. DESIG switch — Press up.
3. Laser status key — Select a laser code authorized for this purpose that does not interfere with laser guided weapons in the area. The system defaults to RNG laser code on subsystem activation. RNG laser code is not acceptable to offset updating.
4. PPT key — Verify correct waypoint is selected or enter as required.
5. LASER FIRST/LAST switch — As desired.
6. Point track procedures — Accomplish.
7. LASER ARM/STBY/OFF switch — ARM.

8. LASER fire switch — Press and hold 3 to 5 seconds then release.

NOTE

- If navigation error is greater than 300 meters, the system will not automatically update.
- NAV updates are not allowed in GPS or GPS/INS modes.

9. If CONFIRM — REJECT appears, proceed as follows:

   a. If range and coordinates are considered acceptable, CONFIRM key — Press.

   b. If range and coordinates are not acceptable, REJECT key — Press. Repeat steps 4 through 9.

10. LASER ARM/STBY/OFF switch — As desired.

NOTE

- Offset update mode must be exited prior to using flyover update.
- If NAV update fail message appears and flyover update is desired, exit offset update mode by pressing MMS mode key.

4-32. AIRBORNE CALIBRATION.

Airborne calibration (airborne cal) is a flight calibration required to correct pointing errors in EGI, TAMS, and MMS subsystems. Its function is to compare commanded and actual LOS angles and compute error terms that are used during PREPOINT, TARGET LOCATE, OFFSET UPDATE, and MFD weapons engagement.

A valid airborne calibration is essential for maintaining the required accuracy on the weapons steering cue present on the pilots MFD. It is especially critical during ATAS engagements where the steering cue and the ATAS seeker box must be overlapped for seeker acquisition of the target. HMS is also critical in that the HELLFIRE seeker cue and MMS LOS must be coincident for constraints to be met.

The following describes the airborne calibration procedure including a means to evaluate the validity of the correction factors.

NOTE

- Airborne calibration should be checked for proper accuracy on every flight. Airborne calibration is performed only if prepoint target is not visible in narrow field of view.
- Surveyed locations are much better than ones whose coordinates are read from a map.

1. Target waypoint — Enter and select as fly-to waypoint in the flightplan.
2. Ensure the navigation system is accurate.
3. Helicopter — Position at a hover at least 3 km from target being used with the target visible in the MMS.
4. MMS mode select switch — PREFLT.
5. SETUP key — Press.
6. AIRBORNE CAL key — Press to display the AIRBORNE CALIBRATION page (fig. 4-18).
7. CLEAR key — Press as required to eliminate existing airborne cal values.
8. STORE key — Press as required.
9. TV or TIS narrow field-of-view — Select and point track the target.
10. Target — Position helicopter to put target greater than 90° to the right of helicopter.
11. TGT RIGHT key — Press.
12. Target — Perform a right pedal turn at no more than 5° per second to position helicopter to put target greater than 90° to the left of helicopter.
13. TGT LEFT — Press.
14. STORE key — Press to load these values in nonvolatile memory.
15. MMS mode select switch — PREPT. Prepoint the target with wide field of view selected and

verify airborne cal accuracy by verifying that the target is within narrow field of view area.

NOTE

- Failures of airborne cal are usually very obvious. When step 15 is completed and the target is not even close, sequence through the flight plan back to correct target and repeat airborne cal beginning at step 3.
- If step 15 reveals the target is close but not within narrow FOV or if an azimuth error exists but elevation is good, an EGI heading error could be the cause. In this event, repeat the entire airborne cal beginning at step 1.

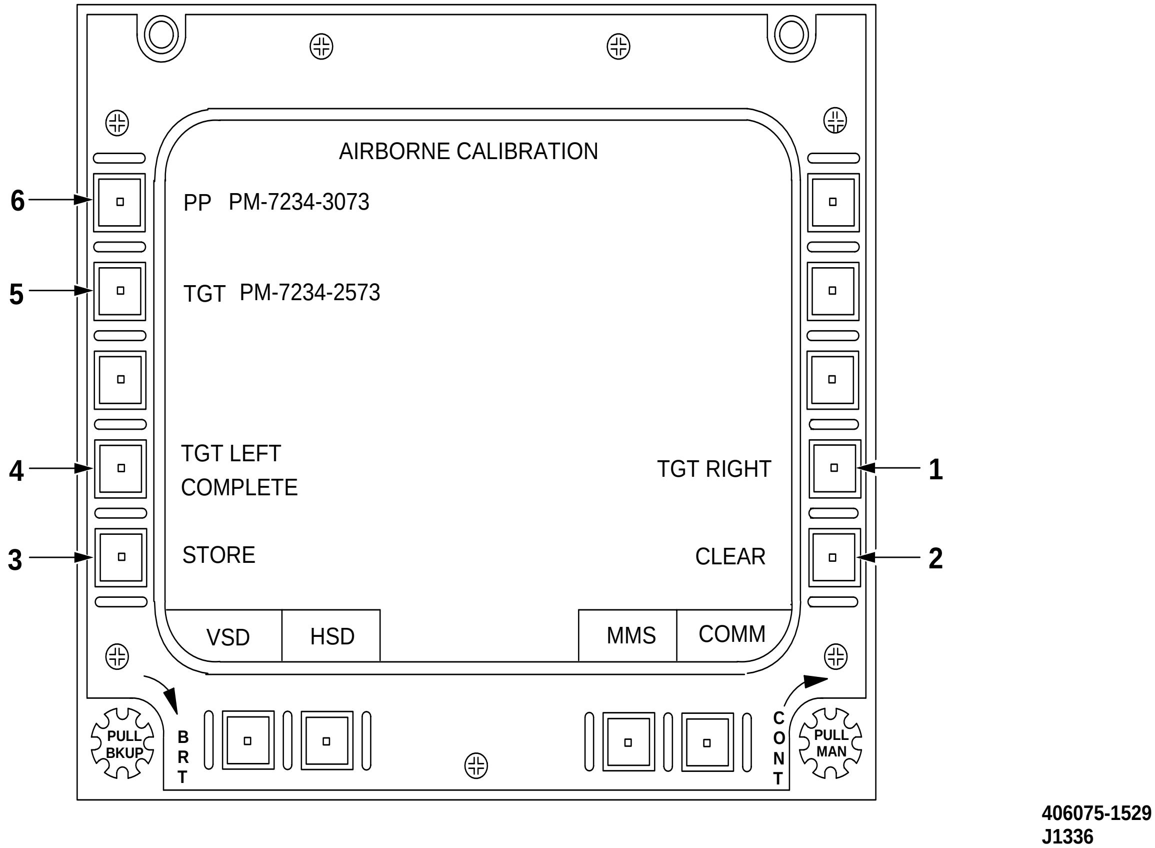
4-33. MANUAL DRIFT COMPENSATION.

1. MMS mode select switch — PREFLT.
2. SETUP key — Press.
3. MDC key — Press to ON.

CAUTION

Ten to 200 seconds can be used and the longer sample will provide more accurate data. During the sampling period, the MMS LOS will continue to drift. Do not allow MMS to contact stops.

4. MDC key — Press to OFF.
5. MMS mode select switch — FWD.
6. MNL/SLAV switch — Press as necessary to enter FWD mode.
7. MNL/SLAV switch — Press to enter manual track mode.
8. LOS drift — Check. If the drift had not been corrected, call maintenance.



CONTROL/INDICATOR	FUNCTION
1. TGT RIGHT key	Initiates calibration with target to right of helicopter.
2. CLEAR key	Sets the default values for the airborne calibration into memory replacing any previous values stored.
3. STORE key	Stores the calibration value into non-volatile memory.
4. TGT LEFT key	Initiates calibration with target to left of helicopter.
5. TGT key	Key has no function. Displays coordinates of airborne calibration location.
6. PP key	Key has no function. Legend displays present position.

Figure 4-18. AIRBORNE CALIBRATION Page

4-34. AIRBORNE VIDEO TAPE RECORDER.

The Airborne Video Tape Recorder (AVTR) is a video tape recorder with ability to record and play back MMS video as well as any CDS page and associated symbology.

a. AVTR Description. The AVTR consists of a video tape recorder and the CDS interface for system control and operation. Power is provided by 28 Vdc essential bus and circuit protection is provided by VIDEO RCDR circuit breaker located on the auxiliary circuit breaker panel. Power is supplied to the AVTR when power is applied to the aircraft.

b. AVTR Controls and Functions. The system is controlled by MFD line address keys, by pushing circuit breakers in, and monitored through CDS interface. The signal provided by the CDS and MMS video is then recorded and played back as selected by the aircrew. Refer to fig. 4-19 through 4-21 for controls and functions. Refer to table 4-2 for variations in operation between the THOMPSON TRT and PRECISION ECHO AVTR.

c. AVTR Operation. The AVTR records and plays back MMS video or any CDS display. AVTR control legends are displayed in any MMS operation mode except when declutter is pressed or NAV offset on target locate functions are selected.

NOTE

- **(CDS2)** If ISP fails, the AVTR is not operational.
- **R** If L MCPU fails, the AVTR is not operational.
- AVTR can only record and playback images on the CPGs MFD.
- The AVTR keys are still active when 2X zoom is selected even though legends with those keys are not displayed.
- Pressing any mode select key (VSD, HSD, etc.) will return to 1X.
- TEMP ORID will replace ZOOM/AUTO CUE legend, if LASER HOT displays, to allow aircrew to override automatic shutdown of laser. ZOOM legend will display again once TEMP ORID is activated.

1. MMS — Place in any operational mode.

NOTE

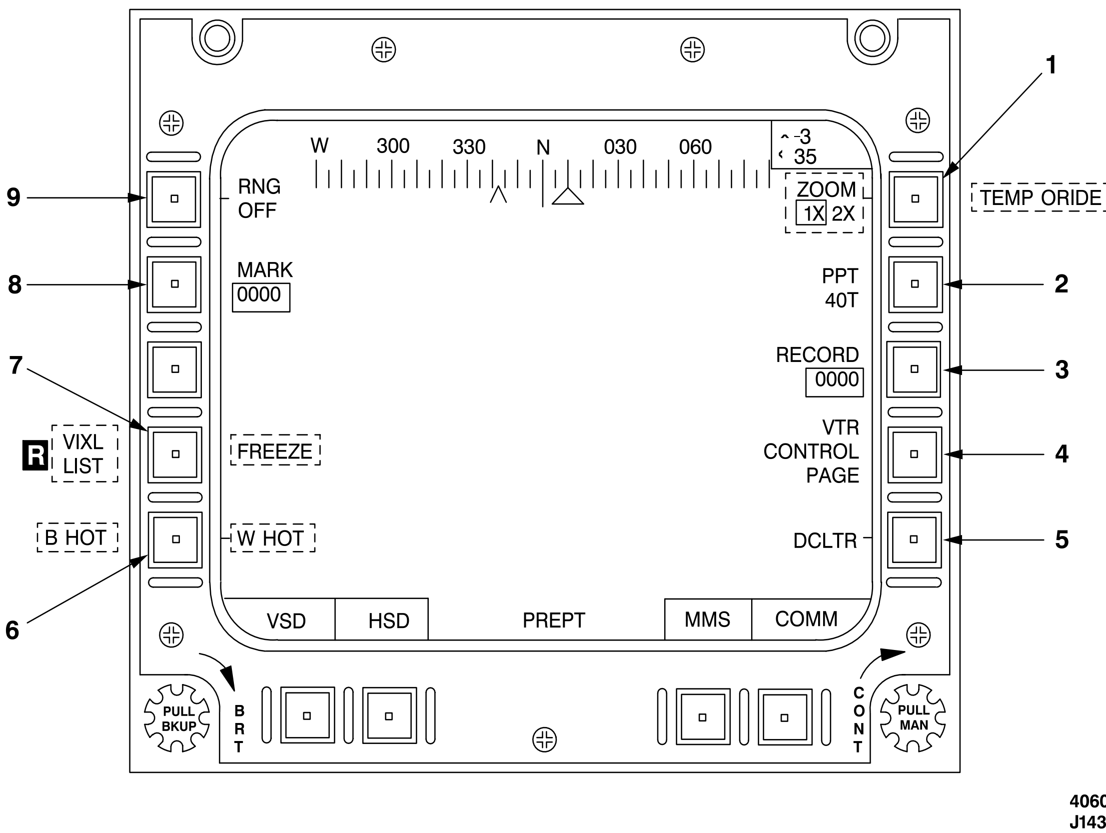
- MARK function is lost in MMS search mode.
- Functions of the AVTR command keys will be boxed when that command is selected.

2. ZOOM key — Press to select zoom.

NOTE

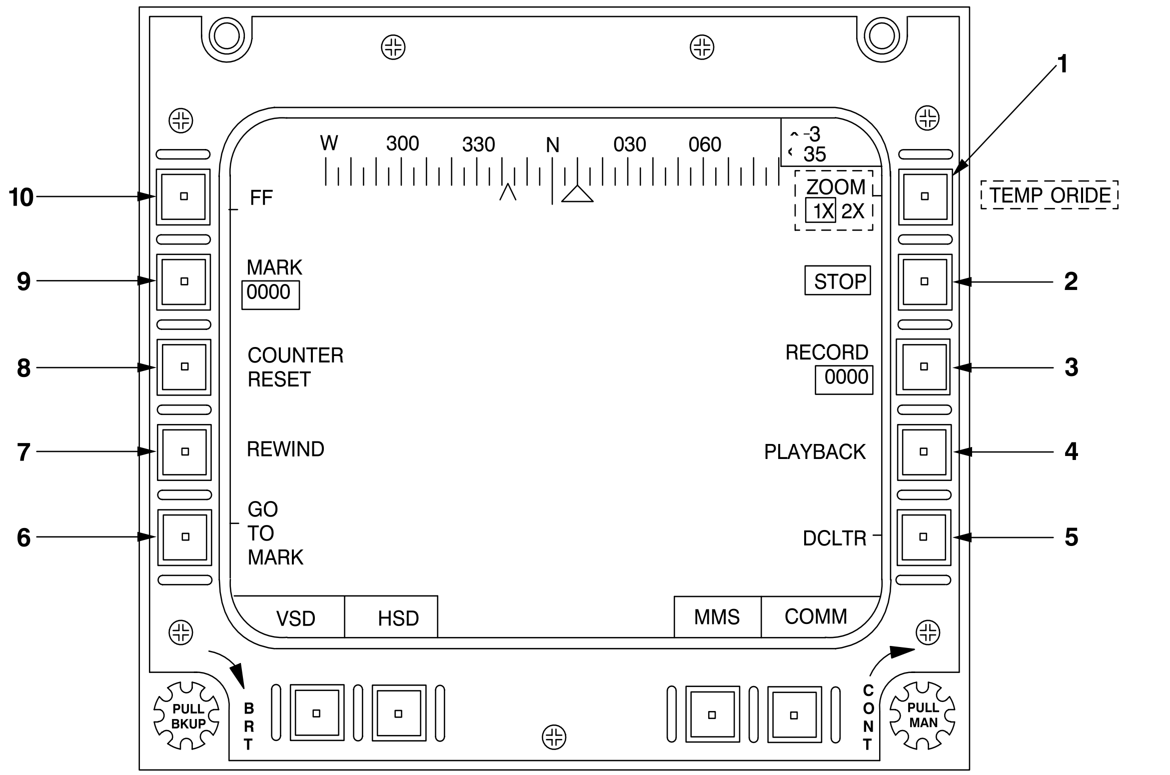
- VTR TAPE FULL will display to indicate end of tape when RECORD function is selected.
- CASSETTE NOT LOADED will display opposite RECORD key when video cassette has not been loaded in AVTR.
- Functions of the AVTR command keys will be boxed when that command is selected.

3. RECORD key — Press to record MMS video or MFD pages. RECORDING displays opposite key.
4. VTR CONTROL PAGE key — Press to select AVTR Control page. VTR CONTROL PAGE displays.
5. FF key — Press to select AVTR fast forward function.
6. STOP key — Press to stop AVTR recording event.
7. PLAYBACK key — Press to review last recorded AVTR event.
8. GO TO MARK — Press to position tape to preselected mark.
9. REWIND key — Press to select AVTR rewind function.
10. COUNTER RESET key — Press to reset AVTR counter to zero.



CONTROL/INDICATOR	FUNCTION
1. ZOOM/TEMP ORIDE key	**(CDS2)** ISP/**R** L MCPU function. (Not available with IMSP installed.)
2. PPT key	MMS function.
3. RECORD key	Activates AVTR record functions.
4. VTR CONTROL PAGE key	Selects AVTR Control page.
5. DCLTR key	MMS function.
6. W HOT/B HOT key	MMS function.
7. **(CDS2)** FREEZE/**R** VIXL LIST key	MMS function.
8. MARK key	Used to mark stored location on tape.
9. Laser code status key	MMS function.

Figure 4-19. MMS Page With AVTR Controls



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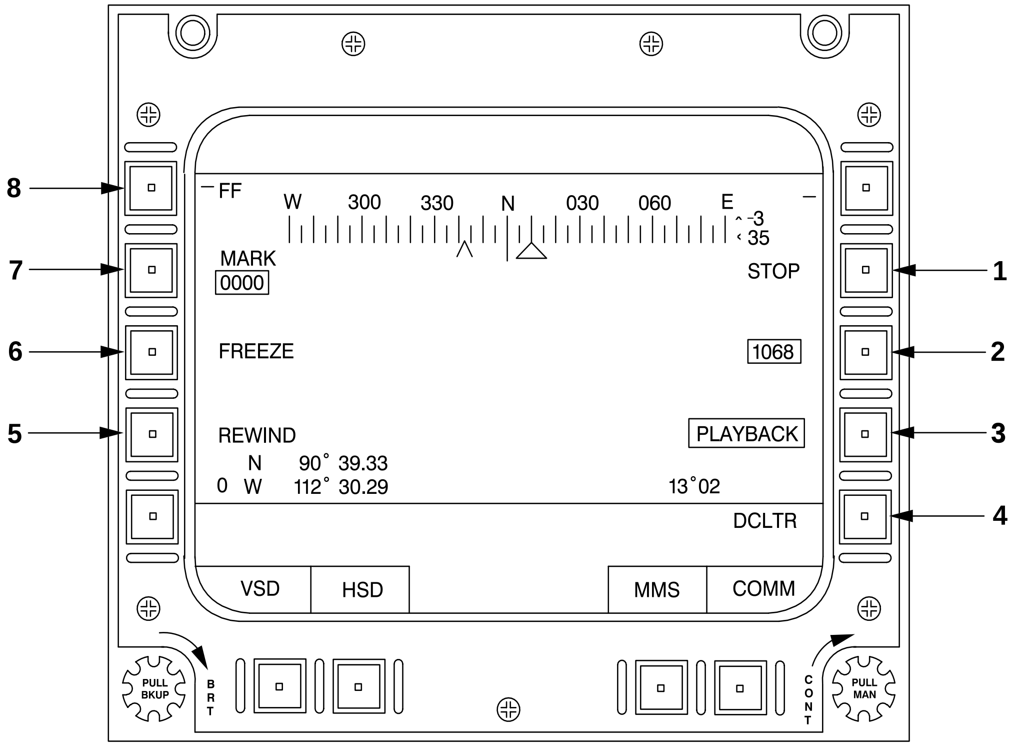
CONTROL/INDICATOR	FUNCTION
1. ZOOM/TEMP ORIDE key	**(CDS2)** ISP/R L MCPU function. If laser overheats, ZOOM is replaced with TEMP ORIDE. (Not available with IMSP installed.)
2. STOP key	Stops AVTR fast forward, rewind, and record functions.
3. RECORD key	Activates AVTR record functions.
4. PLAYBACK key	Activates AVTR playback function.
5. DCLTR key	MMS function.
6. GO TO MARK key	Advances AVTR to marked position.
7. REWIND key	Selects AVTR rewind function.
8. COUNTER RESET key	Resets AVTR tape counter.
9. MARK key	Used to mark stored location on tape.
10. FF key	Activates AVTR fast forward function.

Figure 4-20. AVTR Control Page



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CONTROL/INDICATOR	FUNCTION
1. STOP key	Stops AVTR fast forward, rewind, and record functions.
2. Tape Counter key	Boxed numerals indicate current tape count.
3. PLAYBACK key	Activates AVTR playback function.
4. DCLTR key	CDS function.
5. REWIND key	Selects AVTR rewind function.
6. FREEZE key	Activates AVTR frame freeze function.
7. MARK key	Used to mark stored location on tape.
8. FF key	Selects AVTR fast forward function.

Figure 4-21. AVTR Control Page In Playback Mode

11. MARK key — Press to select tape mark function. MARK is used to mark a stored location on tape to which tape can later be positioned.

NOTE

- While in playback mode displayed image size is reduced differentiating it from the larger image displayed with live video.
- AVTR tape must be manually unthreaded before the tape can be removed from AVTR.

d. AVTR Tape Insertion.

(1) Thompson TRT:

(a) Open door.

(b) Insert tape.

(c) Close door.

(2) Precision Echo:

(a) Open door.

(b) Insert tape.

(c) Depress locking lever.

(d) Verify cassette carriage has latched down.

(e) Close door.

NOTE

- The Thompson TRT unit will thread automatically if power is present.
- The Precision Echo unit will thread automatically if power is present, provided the manual unthread command is not still being initiated. If the unthread command is still present, cycle the VTR C/B or access the MFD VTR page and initiate the stop command, to thread the tape.

e. AVTR Tape Removal.

1. Verify AVTR door is closed.
2. Ensure electrical power is supplied to aircraft.
3. Ensure ESSENTIAL BUS is in RUN.
4. Access INITIAL PAGE 2.

NOTE

This step is essential when operating a Precision Echo VTR.

5. Initiate MANUAL UNTHREAD by pressing L-2 and then waiting 30 seconds prior to opening AVTR door.

CAUTION

To prevent damage to carriage and tape, do not pry carriage assembly up and attempt manual removal of jammed AVTR tape.

NOTE

Electrical power may be removed at this point if necessary.

6. Open AVTR door and ensure AVTR tape is up or forward and in unthreaded position. If AVTR tape is not in up or forward and unthreaded position, notify Maintenance.
7. Remove AVTR tape by pushing red ejection button or green release lever.

4-35. (CDS2) DATA TRANSFER SYSTEM.

The Data Transfer System (DTS) enables crew to rapidly load CDS with required mission data prior to flight. The DTS can program CDS memory with following:

1. Aircrew checklist.
2. Initial position coordinates.
3. 30 Waypoints and 30 targets, 10, TACAN stations with elevation, magnetic variation, and nav frequency or channel TACAN mode, channel and ID.
4. Flight plan of up to 20 waypoints.
5. Battlefield graphics list of up to 40 waypoints.
6. Prepoint List.

TABLE 4-2. OH-58D AVTR COMPARISON MATRIX

VTR FUNCTION	THOMPSON TRT 406-377-003-101	PRECISION ECHO 406-377-003-103
MFD Video Synchronization	Proper Sync.	Does not sync. as well in fast and rewind search modes.
Video Output of Unrecorded Tape	Generates random noise signal (ISP expects signal at all times).	**"**Blank**"** video output, i.e., there is no signal. Signal ISP is always expecting a signal, the interface between the ISP and VTR may lock up. **NOTE:** Will not receive **"**VTR FAIL**"** advisory.
Tape Unthread	Unthreads automatically when VTR door is opened with power on.	Only means of unthread is via CDS **"**UNTHREAD**"** command from cockpit.
Tape Eject	Unthread via CDS command or by VTR door (Power on A/C.) Press red button.	Unthread via CDS command, activates release lever.
Video Frame Counter	**"**Linear**"** counter used. Counter will increment/decrement on unrecorded tape in fast forward, rewind, or play modes.	**"**Frame**"** counter used. If unrecorded tape passes into passes into tape counter, counter will not increment/ decrement.
Tape Speed Rewind/Fast Forward with 2 Hour Tape	Approx. 3 minutes end-to end.	Approx. 6 minutes end-to-end.

7. For each FM radio:

   a. Manual channel frequency.

   b. Cue channel frequency and ID (SINCGARS only). For 17 presets, frequency and ID (shared between FM-1 and FM-2).

   c. Radio mode.

8. For the UHF radio:

   a. Manual channel frequency and ID. For 17 presets, frequency, and ID.

   b. Radio mode.

   c. Up to six WODs, including dates (for HQII).

9. For the VHF radio:

   a. Manual channel frequency.

   b. For 17 presets, frequency, and ID.

10. For the HF radio:

   a. XMIT manual frequency.

   b. XMIT frequency for channels 1-9.

   c. RECV manual frequency.

   d. RECV frequency for channels 1-9.

   e. Selective addresses for all channels.

   f. Radio mode.

   g. Scan list.

11. IFF modes and 3/A code.

12. The pilot may at any time store all current mission data into one of the three storage locations in the DTS.

13. Laser codes A through H.

14. For ATHS:

   a. Net definitions for eight nets.

b. Subscriber lists for each net.

c. Transmit/receive authentication codes and line number.

d. Current net assignments.

e. Authentication subscriber data.

15. For weapons:

a. Gun rounds count.

b. ATAS uncage mode.

c. HELLFIRE primary/alternate laser code.

d. HELLFIRE missiles per code.

e. Rocket types per zone.

f. Rocket fuze/cue distances (airburst and contact).

a. DTS Description. The DTS consists of a ground station, a data transfer cartridge (DTC), and data transfer receptacle (DTR) in the helicopter. Power is provided by 28 Vdc essential bus and circuit protection is provided by DATA XFER circuit breaker located on the center post circuit breaker panel.

b. DTS Controls and Functions. The system is controlled by MFD keys and monitored through the CDS interface. See fig. 4-22 for controls and functions.

c. DTS Mission Loading.

NOTE

Data may be loaded and stored while on the ground or in flight, although weapons data and initial position data will not be transferred during an in-flight load.

1. INIT PAGE 1 key — Press. INITIAL PAGE 1 displays.

2. INIT PAGE 2 key — Press. INITIAL PAGE 2 displays.

3. DATA LOADER TRANSFER key — Press. DL TRANSFER page displays.

NOTE

A boxed LOAD FAIL will display in the center of the LOAD MISSION page if data loading is unsuccessful.

4. LOAD MISSION (1, 2, 3) keys — Press as required to load mission data 1, 2, or 3.

d. DTS Mission Storing.

NOTE

- Ensure that an operational battery is installed in the data cartridge before installation in the aircraft. If no internal battery power is available, the mission store function of aircraft data to the data cartridge cannot be accomplished. No “DTS FAIL” message will be displayed under these conditions.
- STORE FAIL will display if data storing is unsuccessful.

1. STORE DATA IN MISSION 1, 2, or 3 keys — Press as required to store mission data.

2. STORE key — Press.

3. MFK — Enter required identifier for selected stored data keys.

4-36. R DATA TRANSFER SYSTEM.

The Data Transfer System (DTS) enables crew to rapidly load CDS with required mission data prior to flight. The DTS can program CDS memory with the following:

1. Aircrew checklist.

2. Initial position coordinates.

3. 30 Waypoints, 30 targets, 10 TACAN stations with elevation, magnetic variation, and navigation frequency or channel TACAN mode, channel and ID.

4. Flight plan of up to 20 waypoints.

5. Battlefield graphics list of up to 40 waypoints.

6. Prepoint List.

7. For each FM radio:
   a. Manual channel frequency.
   b. Cue channel frequency and ID (SINCGARS only). For 17 presets, frequency and ID (shared between FM-1 and FM-2).
   c. Radio mode.
8. For the UHF radio:
   a. Manual channel frequency and ID. For 17 presets, frequency, and ID.
   b. Radio mode.
   c. Up to six WODs, including dates (for HQII).
9. For the VHF radio:
   a. Manual channel frequency.
   b. For 17 presets, frequency, and ID.
10. For the HF radio:
    a. XMIT manual frequency.
    b. XMIT frequency for channels 1-9.
    c. RECV manual frequency.
    d. RECV frequency for channels 1-9.
    e. Selective addresses for all channels.
    f. Radio mode.
    g. Scan list.
11. IFF modes and 3/A code.
12. The pilot may at any time store all current mission data into one of the three storage locations in the MDU.
13. Laser codes A through H.
14. For IDM:
    a. Net definitions for eight nets.
    b. Subscriber lists for each net.
    c. Transmit/receive authentication codes and line number.
    d. Current net assignments.
    e. Authentication subscriber data.
15. For weapons:
    a. Gun rounds count.
    b. ATAS uncage mode.
    c. HELLFIRE primary/alternate laser code.
    d. HELLFIRE missiles per code.
    e. Rocket types per zone.
    f. Rocket fuze/cue distances (airburst and contact).

a. DTS Description. The DTS consists of a ground station, a data transfer module (DTM), and data receptacle unit (DRU) in the helicopter. (The combination of the DRU, with the DTM plugged in to it, is also referred to as the Map Data Unit (MDU).) Power is provided by 28 Vdc essential bus and circuit protection is provided by DATA XFER circuit breaker located on the aft overhead console panel.

b. DTS (MDU) Controls and Functions. The DTS (MDU) is controlled by MFD keys and monitored through the CDS interface. See fig. 4-22 for controls and functions.

c. DTS (MDU) Mission Loading.

NOTE

- Data may be loaded and stored while on the ground or in flight, although weapons data and initial position data will not be transferred during an in-flight load.
- RMS map data stored in the DTS (MDU) is available to the CDS for operation of the RMS but is not downloaded to the aircraft.

1. INIT button — Press. INITIAL PAGE 1 displays.
2. INIT PAGE 2 key — Press. INITIAL PAGE 2 displays.
3. DATA LOADER TRANSFER key — Press. DL TRANSFER page displays.

NOTE

A boxed LOAD FAIL will display in the center of the LOAD MISSION page if data loading is unsuccessful.

4. LOAD MISSION (1, 2, 3) keys — Press as required to display LOAD MISSION 1, 2, or 3 page (fig. 4-23).
5. Select desired mission load data.

6. LOAD key — Press to initiate loading.

d. DTS (MDU) Mission Storing.

NOTE

STORE FAIL will display if data storing is unsuccessful.

1. STORE DATA IN MISSION 1, 2, OR 3 keys — Press as required to display STORE MISSION 2 page (fig. 4-24).

2. Select desired mission store data.

3. STORE key — Press to initiate store.

4. MFK — Enter required identifier for selected stored data keys.

4-37. NOTEBOOK.

The NOTEBOOK page presents the aircrew with an additional scratchpad for data entry and information display. The NOTEBOOK page (fig. 4-25) is accessed by pressing the L-5 NOTEBOOK key on the INITIAL PAGE 1. With the manipulations of a data edit bar and cursor, lines of text are entered, deleted, or inserted into a field display by MFK or ground station. The edit bar and cursor are positioned using the line address keys along the left side of the MFD. The NOTEBOOK permits entry of 44 characters on 10 lines of text on 20 pages.

4-38. ANVIS DISPLAY SYMBOLOGY SUBSYSTEM.

The ANVIS Display Symbology Subsystem (ADSS) provides the pilot and CPG wearing night vision devices with VSD displays superimposed on the real world imagery.

a. (CDS2) ADSS Description. The ADSS consists of ISP drive electronics and two Optical Display Assemblies (ODA) which mount on ANVIS night vision devices. ADSS provides three modes of VSD displays: Normal, Hover, and Hover Bob-up.

b. R ADSS Description. The ADSS consists of MCPU drive electronics and two Optical Display Assemblies (ODA) which mount on ANVIS night vision devices. ADSS provides three modes of VSD displays: Normal, Hover, and Hover Bob-up.

NOTE

- **(CDS2)** If the ISP fails, ADSS is not available.
- R If the MCPUs fail, ADSS is not available.

c. ADSS Controls and Functions. The system is controlled by MFD keys and cyclic switches. See fig. 4-26 for test pattern and fig. 4-27, 4-28, and 4-29 for controls and functions.

WARNING

If the -903 version of the ODA is being used, failure to remove ANVIS neck cord prior to operation of ADSS may prevent egress from the aircraft in an emergency.

d. ADSS Operation.

1. INIT button — Press. INITIAL PAGE 1 displays.

2. PAGE 2 key — Press. INITIAL PAGE 2 displays.

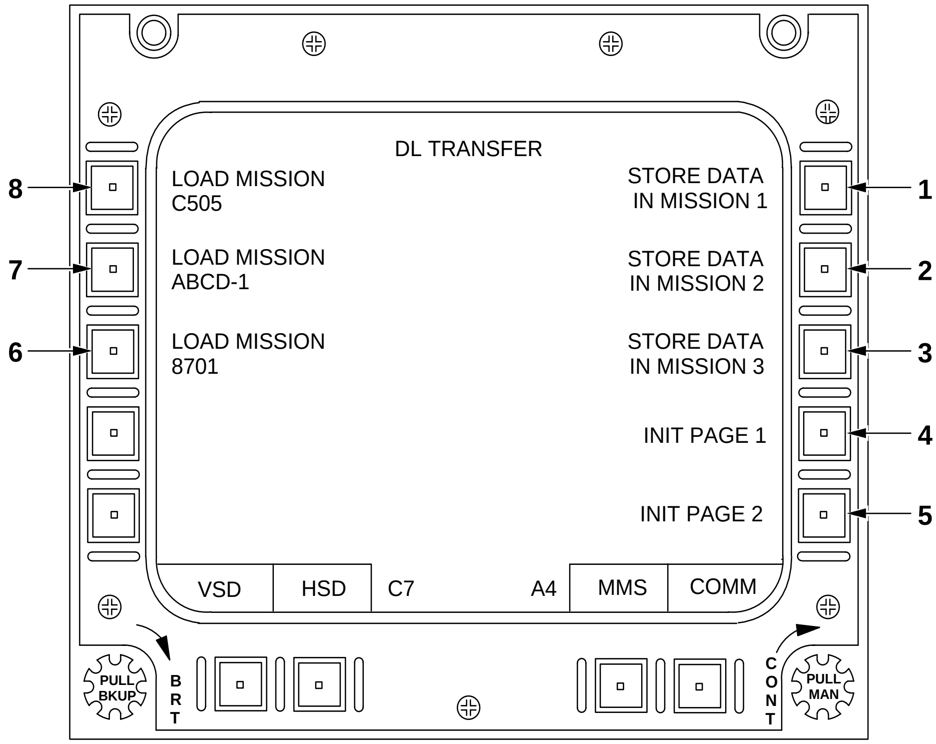
3. Pilot cyclic ODA switch — Press to activate ADSS ODA display. CPG ODA is activated by default.

4. ADSS ODA TEST key — Press. Test pattern displays in ODA. Check all lines of test pattern display. An absent line indicates ODA display failure.

5. ADSS ODA TEST key — Press to delete test pattern.

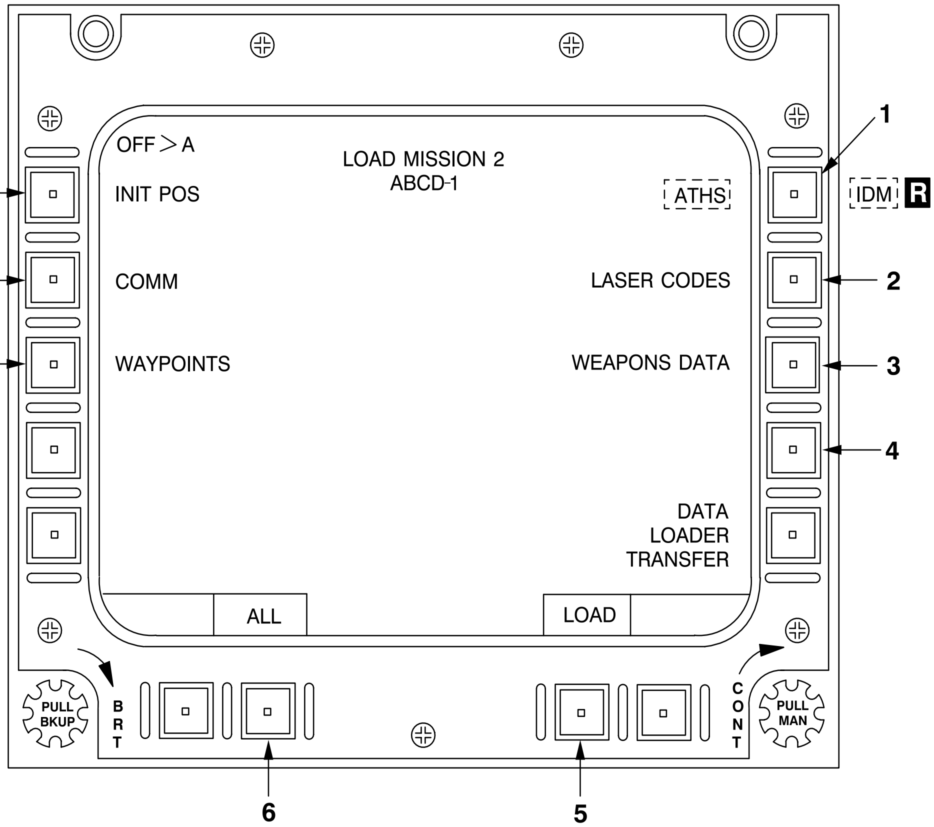
NOTE

Pilot ODA display brightness can be controlled with the ADSS brightness select switch located on pilot cyclic. Successive presses of this switch cycle pilot ODA from OFF, to preset brightness, to maximum brightness, to OFF. The preset brightness level is the level indicated and adjusted on INITIAL PAGE 2.



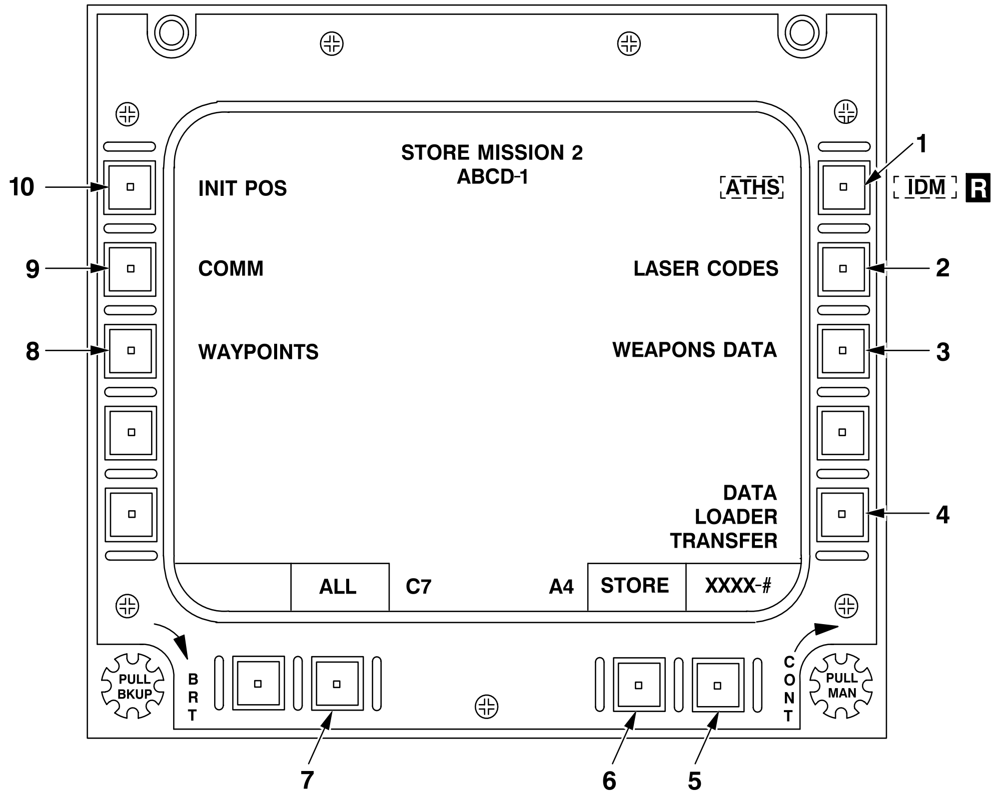
CONTROL/INDICATOR	FUNCTION
1. STORE DATA IN MISSION 1 key	Calls up STORE MISSION 1 page.
2. STORE DATA IN MISSION 2 key	Calls up STORE MISSION 2 page.
3. STORE DATA IN MISSION 3 key	Calls up STORE MISSION 3 page.
4. INIT PAGE 1 key	Calls up INITIAL PAGE 1.
5. INIT PAGE 2 key	Calls up INITIAL PAGE 2.
6. LOAD MISSION key	Calls up LOAD MISSION 3 page.
7. LOAD MISSION key	Calls up LOAD MISSION 2 page.
8. LOAD MISSION key	Calls up LOAD MISSION 1 page.

Figure 4-22. DL TRANSFER Page



CONTROL/INDICATOR	FUNCTION
1. **(CDS2)** ATHS key	Selects/deselects ATHS data for loading.
R IDM key	Selects/deselects IDM data for loading.
2. LASER CODES key	Selects/deselects laser data for loading.
3. WEAPONS DATA key	Selects/deselects WEAPONS data for loading.
4. DATA LOADER TRANSFER key	Selects/deselects DATA LOADER TRANSFER page.
5. LOAD key	Initiates loading of selected data.
6. ALL key	Selects data for loading. Individual lines may be deselected using line address keys.
7. WAYPOINTS key	Selects/deselects WPT and TGT data for loading.
8. COMM key	Selects/deselects communication data for loading.
9. INIT POS key	Selects/deselects initial position coordinates for loading.

Figure 4-23. LOAD MISSION 2 Page



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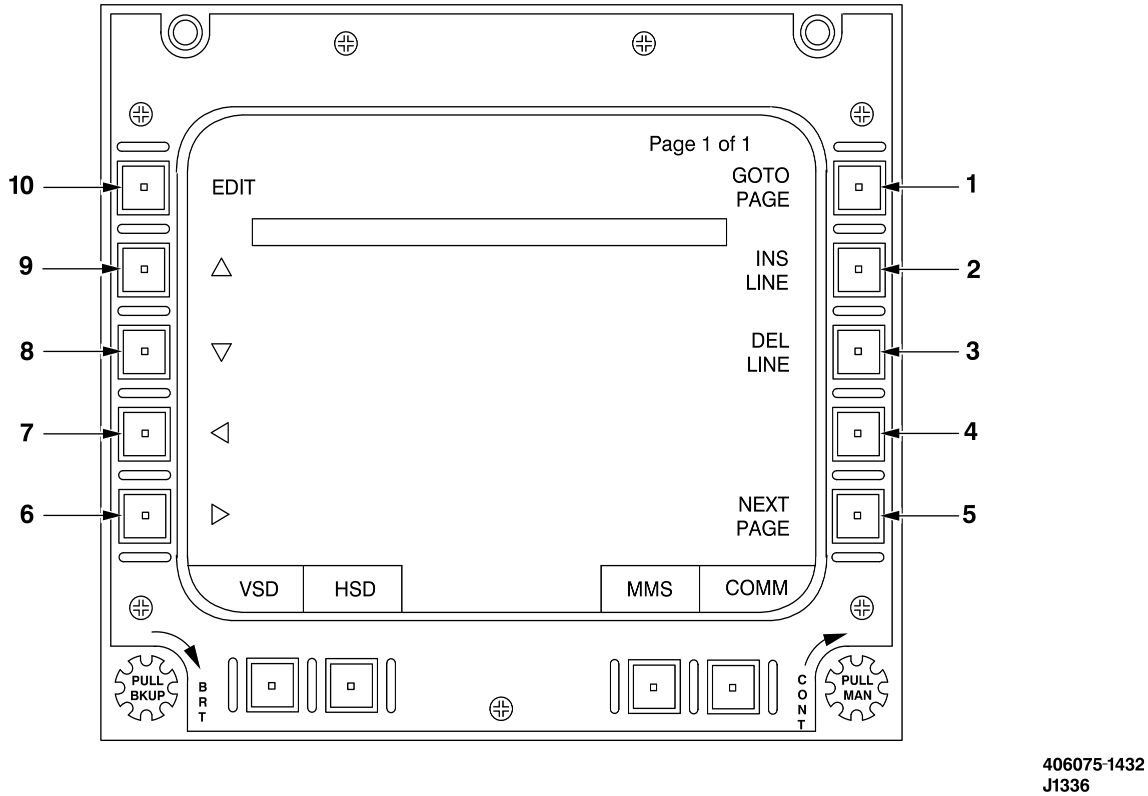
CONTROL/INDICATOR	FUNCTION
1. **(CDS2)** ATHS key	Selects/deselects ATHS data for storage.
R IDM key	Selects/deselects IDM data for storage.
2. LASER CODES key	Selects/deselects laser data for storage.
3. WEAPONS DATA key	Selects/deselects WEAPONS data for storage.
4. DATA LOADER TRANSFER key	Selects DATA LOADER TRANSFER page.
5. STORE ID key	Allows the mission identifier to be input. Only displays in the store mission mode.
6. STORE key	Initiates storage of selected data.
7. ALL key	Selects all data for storage.
8. WAYPOINTS key	Selects/deselects WPT data for storage.
9. COMM key	Selects/deselects communication data for storage.
10. INIT POS key	Selects/deselects initial position coordinates for storage.

Figure 4-24. STORE MISSION 2 Page



CONTROL/INDICATOR	FUNCTION
1. GOTO PAGE key	Selects NOTEBOOK page identified by entered number.
2. INS LINE key	Inserts line of text into text field.
3. DEL LINE key	Deletes line of text from text field.

NOTE

The legend PREV PAGE is not displayed on page 1.

CONTROL/INDICATOR	FUNCTION
4. PREV PAGE key	Accesses previous NOTEBOOK page.
5. NEXT PAGE key	Accesses next NOTEBOOK page.
6. → key	Moves cursor right.
7. ← key	Moves cursor left.
8. ∇ key	Moves edit bar down text field.
9. Δ key	Moves edit bar up text field.
10. EDIT key	Activates cursor bar for editing.

Figure 4-25. (CDS2) NOTEBOOK Page

NOTE

CPG ODA display brightness can be controlled from INITIAL PAGE 2 with R-1 and R-2 keys. R-1 turns on ODA and increases display brightness through eight settings. R-2 decreases display brightness and turns ODA off. Function is the same for pilot ODA when INITIAL PAGE 2 is accessed from pilot MFD.

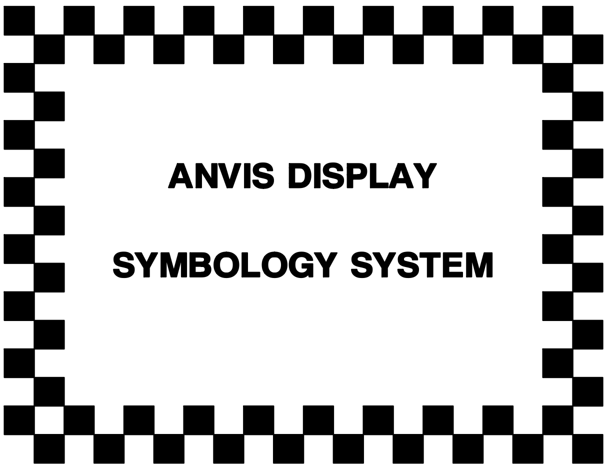


Figure 4-26. ADSS ODA Test Pattern

6. Press ODA switch to select ODA display brightness as desired.

NOTE

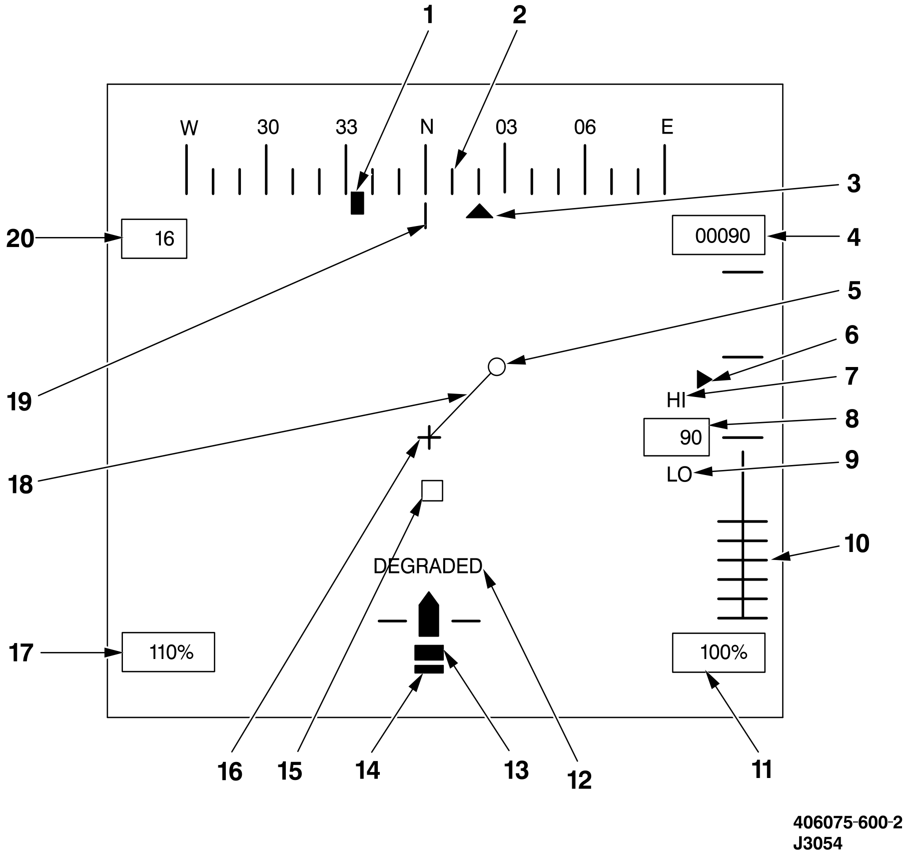
Pilot and CPG processing are independent of each other, except that only the pilot has control of Hover Bob-Up mode. (See fig. 4-29.)

7. ADSS DECLUTTER key — Press to select no declutter level, level 1 declutter, or level 2 declutter, as desired.

   a. Level 1 declutter removes analog radar altitude, rate of climb, and analog scale.

   b. Level 2 declutter also removes the barometric altitude, indicated airspeed, torque and torque box, Hover Bob-up position box, and all weapon symbology.

8. **(CDS4)** Weapon Symbology — Weapon symbology from the MFD is also displayed on the ODA (fig. 4-28). This symbology is removed at level 2 declutter.



CONTROL/INDICATOR	FUNCTION
1. Bearing to waypoint pointer	Indicates bearing to navigational waypoint.
2. Magnetic heading tape	Displays magnetic heading 90° left and right of the helicopter centerline.
3. MMS bearing indicator	Indicates line-of-sight bearing of the mast mounted sight.
4. Barometric altimeter	Displays barometric altitude, MSL, of the helicopter in increments of 10 feet.
5. Acceleration cue	Shows rate of acceleration.
6. Vertical speed indicator	Indicates rate of climb or descent with middle scale line representing 0, and maximum deflection either above or below zero represents a rate of 1000 feet per minute.

Figure 4-27. ADSS ODA Hover and Hover Bob-Up Display (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
7. HI indicator	Flashes when maximum value input is exceeded. Refer to Chapter 3 for setting input values.
8. Radar altimeter readout	Displays the digital readout of altitude (AGL) in 1-foot increments up to 200 feet and 5-foot increments to 1500 feet.
9. LO indicator	Flashes when aircraft drops below minimum value input. Refer to Chapter 3 for setting input values.
10. Radar altimeter scale	Vertical scale readout of altitude (AGL) from 0 to 200 feet.
11. Mast torque indicator	Displays digital readout of mast torque. Indication will be boxed when the mast torque is equal to or greater than 100%.
12. R DEGRADED (bob-up mode only)	Displays when NAV mode is not in GPS/INS or NAV FOM > 1.
13. Turn and slip	Indicates trim and turn rate.
14. Caution bar	Displays and flashes below turn and slip indicator when caution message displays on MFD.
15. Position box (bob-up mode only)	Depicts desired or starting position over the ground.
16. Reference crosspoint	Stationary crosshairs at the center of the display represent the helicopter.
17. Engine torque indicator	Displays digital readout of engine torque. Indication will be boxed when the engine torque is equal to or greater than 110%.
18. Velocity vector	Shows speed and direction of helicopter movement.
19. Lubber line	Represents the nose of the aircraft in relation to magnetic heading tape.
20. Airspeed indicator	Displays knots indicated airspeed (KIAS) of the helicopter.

Figure 4-27. ADSS ODA Hover and Hover Bob-Up Display (Sheet 2 of 2)

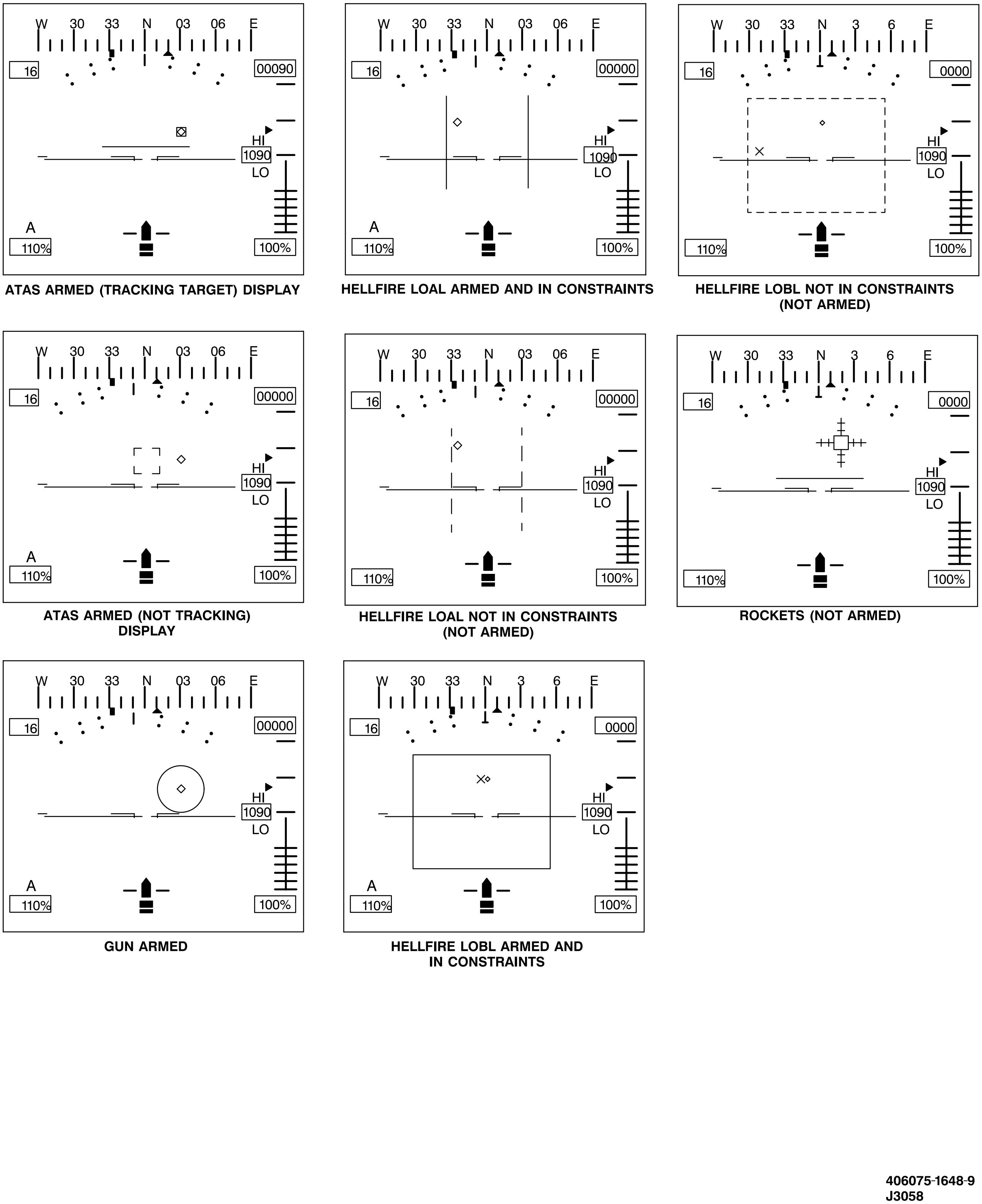


Figure 4-28. (CDS4) ADSS ODA Weapon Symbology

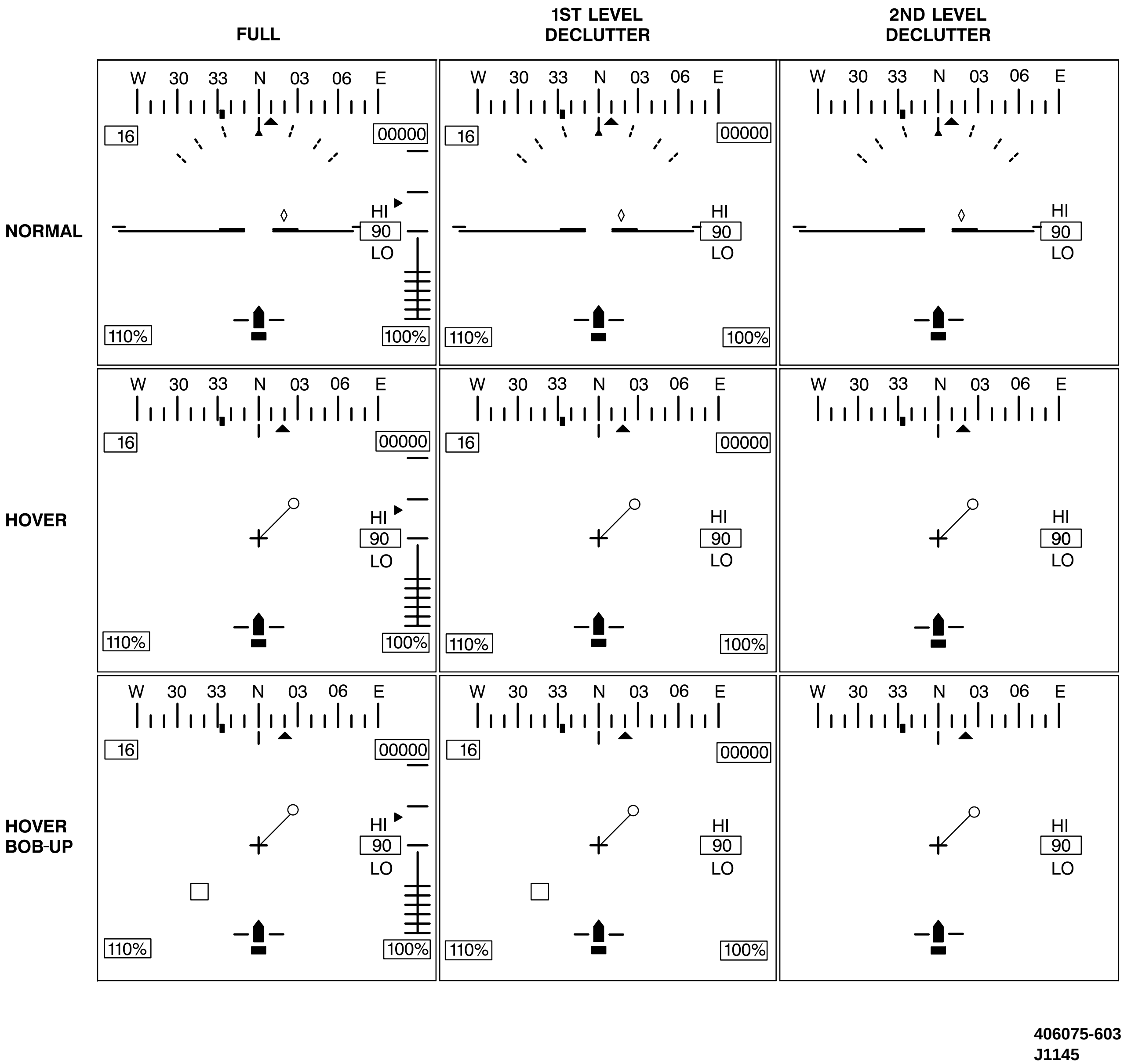


Figure 4-29. ADSS Full and Decluttered Levels

4-39. R VIDEO IMAGE CROSSLINK SYSTEM.

The video image crosslink (VIXL) system provides the capability to capture and store CDS display images, including MMS, from the CPGs MFD and to transmit and receive captured images from and to other VIXL equipped platforms/facilities. The operator can transmit or receive these images at any time during the mission. The total elapsed time from picture initiation to display on the receiving end is approximately 20 seconds.

The VIXL system utilizes the FM-1 radio for transmission/reception purposes. The VIXL system consists of the Video Downlink/Uplink (VDU) (circuit card internal to the left MCPU) and two display pages, the VIXL Image Display page (fig. 4-30) and the VIXL LIST PAGE (fig. 4-31).

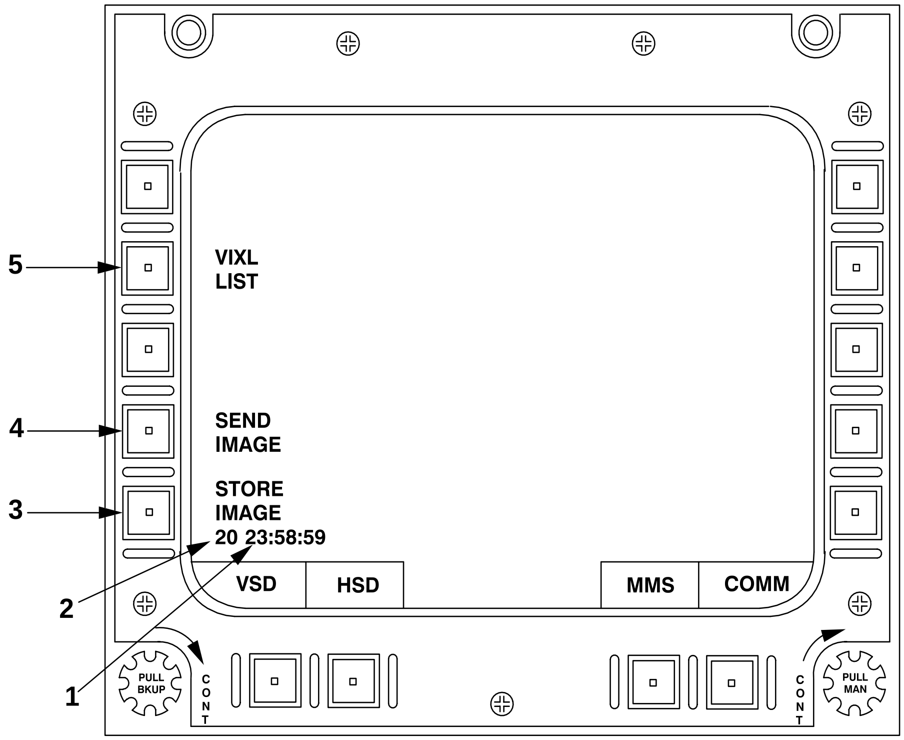
In order to transmit and receive, the error correction must be the same on both the sending and receiving end and the cipher mode must be selected on the FM-1 radio. If the VDU is operational, pressing the IMAGE CAPTURE switch on the CPG Auxiliary Panel (fig. 4-7) will freeze the image displayed on the MFD and overlay the image with the VIXL Image Display page. The VIXL LIST PAGE lists up to 20 stored images. An image is listed as of the time it was captured.

NOTE

- When VIXL images are stored or previewed they will not record on VTR tape.

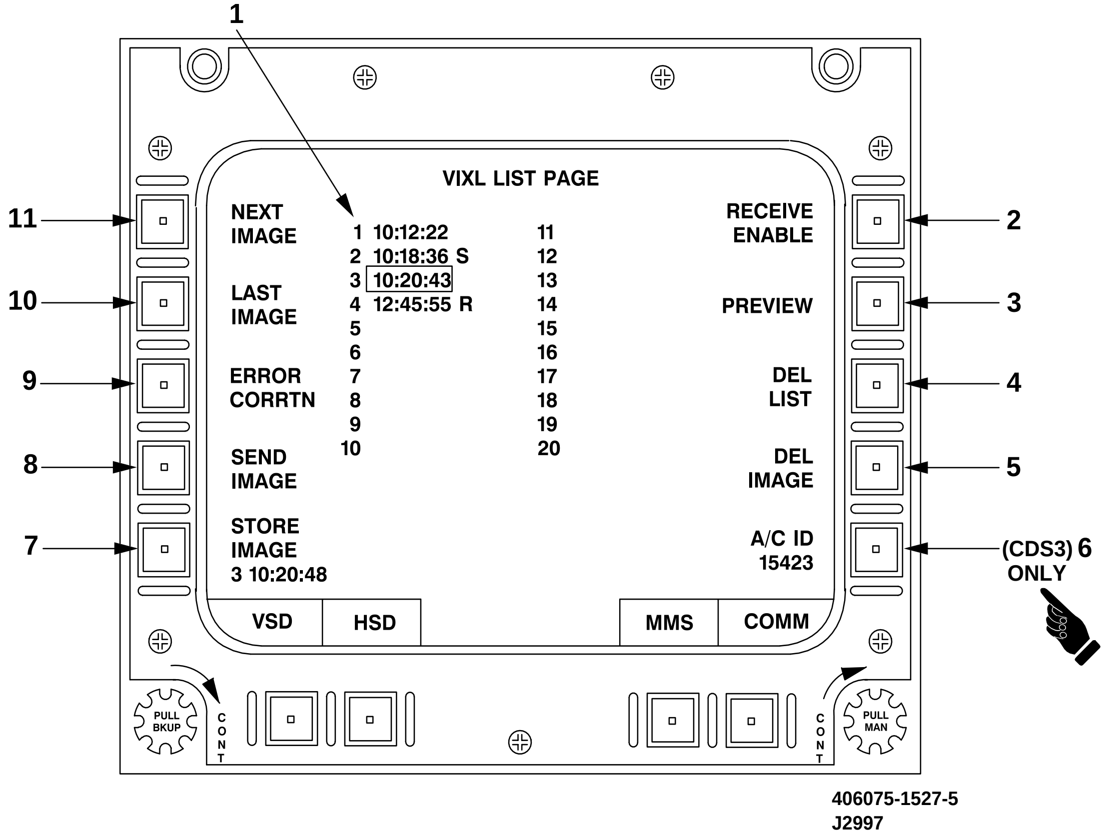
- When VIXL images are being sent or when RECEIVE ENABLE is boxed, the FM 1 radio cannot be used for voice communications (voice reception and transmission are physically inhibited by the radio).

- **(CDS4)** If at least one of the FM-1 SC or FH channels has not been defined as the VIXL NET, and a VIXL SEND or RECEIVE function is initiated, the advisory NO VIXL NET is displayed for 3 seconds. If the VIXL NET has been assigned, the CDS automatically tunes to the VIXL channel for both RECEIVE and SEND functions. This includes switching from SC to FH mode or vice versa. Upon completion of the SEND or RECEIVE function, FM-1 radio returns to its previous state.



CONTROL/INDICATOR	FUNCTION
1. TIME ID	Represents the time an image was captured or received.
2. LOCATION ID	Represents the store location in the VIXL list.
3. STORE IMAGE key	Stores displayed image to the VIXL list.
4. SEND IMAGE key	Transmits captured image via the FM-1 radio.
5. VIXL LIST key	Calls up VIXL LIST PAGE.

Figure 4-30. R VIXL Image Display Page



CONTROL/INDICATOR	FUNCTION
1. VIXL List	Stores up to 20 images identified by the time of capture followed by an indicator (R or S) that indicates that the image was either received or sent. An asterisk * indicates the image has not been previewed.
2. RECEIVE ENABLE key	Boxes legend and configures the system to receive an image.
3. PREVIEW key	Calls up the image identified by the selection box in the VIXL list and overlays it with the VIXL Image Display page.
4. DEL LIST key	Pressing twice will delete all images in the VIXL List.

Figure 4-31. R VIXL LIST PAGE (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
5. DEL IMAGE key	Deletes boxed image in the VIXL List.
6. **(CDS3)** A/C ID key	Allows for an aircraft identifier which will be annotated to the captured image.
(CDS4) R-5	Key has no function. Legend is blank.
7. STORE IMAGE key	Stores last displayed image to the VIXL list.
8. SEND IMAGE key	Transmits boxed image in VIXL List.
9. ERROR CORRTN key	Controls the state of the error correction selection. Pressing will box legend and enable error correction. Pressing again will unbox legend and disable error correction.

NOTE

In order to transmit and receive using the error correction mode, both the receiving and sending ends must be configured for the same error correction mode and the cipher mode must be selected on the FM-1 radio.

CONTROL/INDICATOR	FUNCTION
10. LAST IMAGE key	Moves selection box down in VIXL List. Legend will change to START LIST when box is in the first location.
11. NEXT IMAGE key	Moves selection box up in VIXL List. Legend will change to END LIST when box is in the last location.

Figure 4-31. R VIXL LIST PAGE (Sheet 2 of 2)

4-40. RADAR DETECTING SET AN/APR-39A(V)1.

a. Description. The radar detecting set AN/APR-39A(V)1 provides the pilot with a visual and aural warning when hostile fire control threat is encountered. The equipment responds to hostile fire control radars but nonthreat radars are generally excluded. The equipment also receives missile guidance radar signals and when the signals are time coincident with a radar tracking signal, the equipment identifies the combination as an activated hostile surface-to-air missile (SAM) radar system. The visual and aural warnings alert the pilot of potential threat so that evasive maneuvers may be initiated.

b. Controls and Functions (fig. 4-32).

c. Operation.

(1) WPN ASE or WEAPON SEL switch — Position to ASE.

(2) ASE SET-UP/BIT page — Verify appears on CPG MFD.

NOTE

- The user defined module (UDM) must be installed in the AN/APR-39A(V)1 prior to aircraft power up. If the UDM is not installed, the radar warning indicator will display a “p” after an initial BIT. An audio message will annunciate “APR-39 failure.” Any subsequent strobe displays on the indicator should be considered unreliable.
- If the AN/APR-39A(V)1 radar detecting system is not installed, the legend to the right of the L-1 will be blank.

(3) PULSE RADAR WARN PWR — OFF. Verify displayed on the first line to the right of L-1.

(4) FULL and TERSE — Verify displayed on the third line to the right of L-1.

NOTE

AN/APR-39A(V)I mode is controlled by L-1. Successive presses of L-1 causes the AN/APR-39A mode to toggle between FULL and TERSE modes.

(5) RADAR WARN circuit breaker switch — RADAR. Verify that the legend to the right of L-1 changes to PULSE RADAR WARN PWR — ON; APR-39 POWER UP should be heard and AVR-2A PWR ON should also be present, if installed.

NOTE

Allow one minute for system warmup.

(6) R-1 — Press to initiate system BIT.

(7) **R** SELF-TEST SET VOLUME 1 through 12 — Verify synthetic voice count is heard on the headset.

(8) NAV B volume control knob — Adjust audio level while count is taking place and verify proper volume control operation.

(9) RWR system indicator — Verify indicator displays the numbers of operational flight program (OFP) and emitter identification data (EID).

NOTE

If a receiver fault is noted, the faulty receiver is shown as two triangles, representing the right and left channels of that receiver. The symbols for the faulty channel or channels will be flashing.

(10) Indicator — Verify forward and aft receivers triangles appear at 6 and 12 o’clock.

(11) Asterisk — Verify appearance in all four quadrants along with the system receiver status. They represent the AVR-2A sensors. A faulty AN/AVR-2A quadrant is shown as a flashing asterisk.

(12) APR-39 OPERATIONAL — Heard on the ICS headset at the end of a successful self-test operation.

(13) APR-39 FAILURE — Heard on the ICS headset at the end of an unsuccessful self-test operation.

(14) “+” symbol — After completion of self-test, should be displayed at the center of the indicator.

(15) L-1 — Select TERSE.

(16) R-1 — Press to initiate self-test.

(17) SELF-TEST SET VOLUME 5 through 1 — Verify synthetic voice short count heard on the ICS headset.

(18) Display — Verify symbology same as in FULL mode.

NOTE

- **(CDS2)** If the ISP fails the AN/APR-39A(V)1 will default to FULL mode. Audio will be present but at reduced amplitude. ASE SET-UP/BIT page will display whatever was present at the time the ISP failed.
- R If the R MCPU fails the AN/APR-39A(V)1 will default to FULL mode. Audio will be present but at reduced amplitude. ASE SET-UP/BIT page will display whatever was present at the time the R MCPU failed.

4-41. AN/APR-44 RADAR WARNING SYSTEM.

a. Description. The AN/APR-44 radar warning system is used to detect continuous wave (CW) radar signals, both ground (SAM threat) and airborne interceptor (AI), aimed at the helicopter. Radar detection is indicated by tone in the headset and display of the SAM/AI advisory message on the MFD. The system consists of four antennas, two receivers, a low bypass filter, and a CDS interface. The system is powered by 28 Vdc essential bus and circuit protection is provided by the RADAR DETR circuit breaker switch.

b. Controls and Functions (fig. 4-32).

c. Operation.

NOTE

- **(CDS2)** If the ISP fails the AN/APR-44 will default to ON. Audio will still be present but at reduced amplitude. No advisories will display with the ISP failed.
- R If the R MCPU fails the AN/APR-44 will default to ON. Audio will still be present but at reduced amplitude. No advisories will display with the R MCPU failed.

(1) RADAR DETR circuit breaker switch — RADAR. Allow 1 minute warmup.

(2) CW RADAR WARN PWR — Check ON displays.

(3) NAV B volume — **(CDS2)** Adjust as required. R Adjust on ASE page.

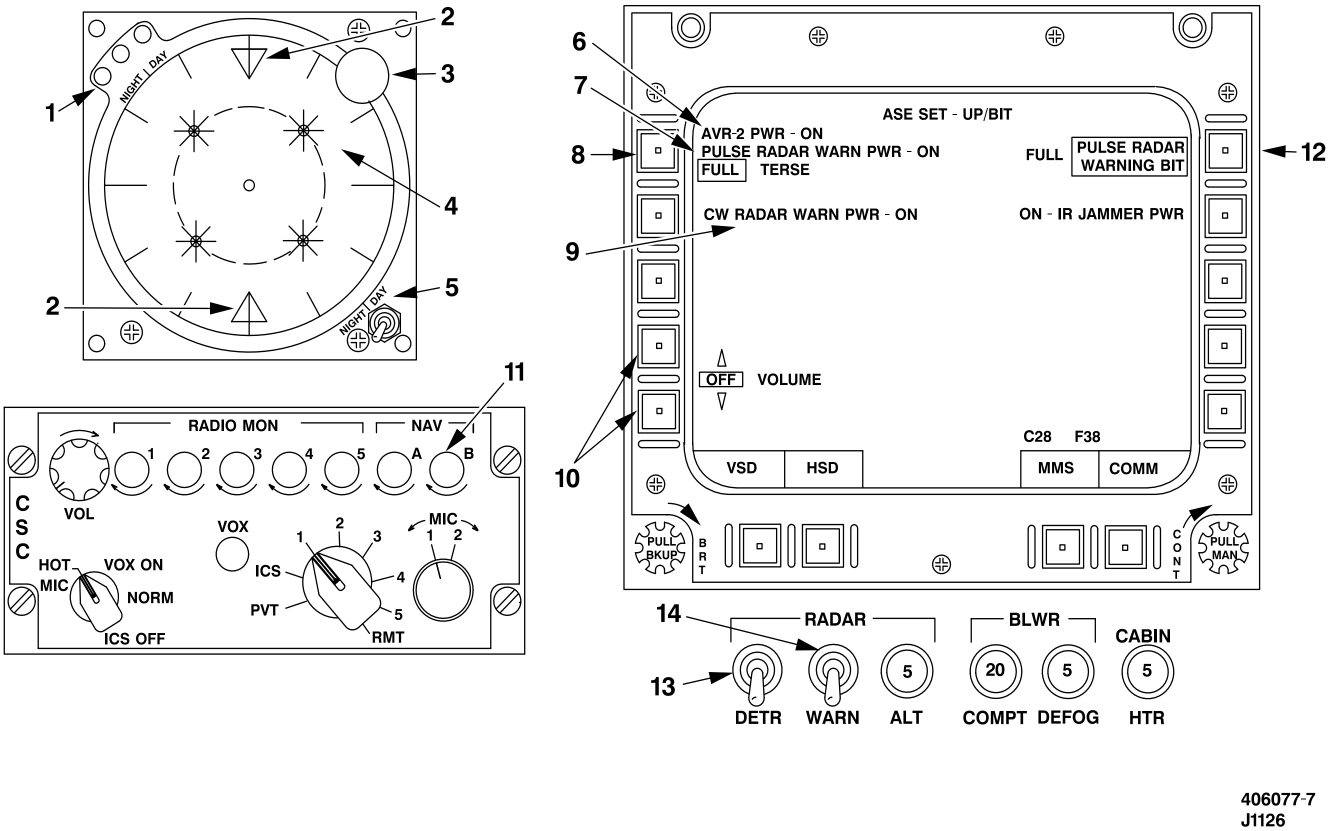
(4) Headset — Verify low pitch tone followed by brief high pitch tone and momentary display of MISSILE ALERT — AI and MISSILE ALERT — SAM advisories.

4-42. AN/AVR-2A LASER DETECTING SET.

a. Description. The laser detecting set detects, identifies, and characterizes laser energy in four 100-degree overlapping fields-of-view around the aircraft. The fields-of-view also extend 45-degrees above and below each sensor. Detected energy signals are processed into threat messages and are transmitted to the AN/APR-39 for display. The display indicates the direction of the threat to the crew. An aural warning is also transmitted through the headsets. The AN/AVR-2A receives power from the 28 Vdc essential bus. Circuit protection is provided by the RADAR WARN circuit breaker switch.

NOTE

- **(CDS2)** If the ISP fails the AN/AVR-2A will operate in the backup default mode. While operating in the default mode the AVR-2A will continue to provide normal function with the following exceptions: Current system power status will not be displayed on the ASE SET-UP/BIT page. Aural warning will be reduced in amplitude.
- R If the R MCPU fails the AN/AVR-2A will operate in the backup default mode. While operating in the default mode the AVR-2A will continue to provide normal function with the following exceptions: Current system power status will not be displayed on the ASE SET-UP/BIT page. Aural warning will be reduced in amplitude.
- If the AN/AVR-2A is not attached to the AN/APR-39, all four quadrant symbols will be flashing. This is a normal indication and does not affect system performance or self-test.
- AN/AVR-2A faults are displayed on the indicator, but do not cause an APR-39 FAILURE message.



	CONTROL/INDICATOR	FUNCTION
1.	MA (missile alert) lamps	Flashes to indicate a missile threat.
2.	Triangles	Represent forward and aft receivers.
3.	BRIL Control	Adjusts indicator illumination.
4.	ASTERISK Symbology	Represent AVR-2A sensor quadrants.
5.	NIGHT/DAY switch	Used to change intensity of lamps for night vision goggle compatibility.
6.	AVR-2 PWR	Indicates power ON or OFF.
7.	PULSE RADAR WARN PWR	Indicates power ON or OFF.

Figure 4-32. Radar Detector AN/APR-39A(V)1, Radar Warning AN/APR-44, and Laser Detector AN/AVR-2A Controls and Indicators (Sheet 1 of 2)

(Cont)

	CONTROL/INDICATOR	FUNCTION
8.	L-1	FULL provides specific threat type, threat position, and threat mode or status. TERSE provides general threat type, threat position, and threat mode or status. TERSE cuts down audio distractions and would be used in dense signal environments.
9.	CW RADAR WARN PWR	Indicates power ON or OFF.
10.	R L-4 and L-5 Volume controls	Adjust radar warning and laser detector audio volume.
11.	**(CDS2)** NAV B Volume control	Adjusts radar warning and laser detector audio volume.
12.	PULSE RADAR WARNING BIT	Initiates BIT.
13.	RADAR DETR switch	Switched to DETR removes power from radar detector system.
14.	RADAR WARN switch	Switched to WARN removes power from radar warning and laser warning systems.

Figure 4-32. Radar Detector AN/APR-39A(V)1, Radar Warning AN/APR-44, and Laser Detector AN/AVR-2A Controls and Indicators (Sheet 2 of 2)

b. Controls and Functions (fig. 4-32).

The AN/AVR-2A LDS system and the AN/APR-39A(V)1 RDR system operate as an integrated system. The AN/AVR-2A LDS system does not have its own circuit breaker and receives its power from the AN/APR-39A(V)1 circuit breaker such that the AN/AVR-2A is ON whenever the AN/APR-39A(V)1 is ON. The AN/AVR-2A shares the AN/APR-39A(V)1 RDR system's control and display. Both systems are self-test simultaneously. The results of the combined self-test are displayed on the AN/APR-39A(V)1 RDR display indicator.

c. Operation.

(1) RADAR WARN switch — RADAR. Allow 1 minute warmup.

(2) AVR-2 PWR — Check ON displays.

(3) PULSE RADAR WARNING BIT switch — Press. Four asterisks will appear simultaneously. A faulty AN/AVR-2A quadrant is shown as a flashing asterisk. No audio announcement is associated with the AN/AVR-2A self-test.

(4) BRIL control — Rotate, check indicator illumination.

(5) Volume — Adjust as required.

4-43. AN/ALQ-144 IR JAMMER COUNTERMEASURES SET.

a. Description. The IR countermeasures set protects the aircraft from infrared heat seeking missiles. The AN/ALQ-144 transmitter generates IR energy, modulates it, then passes it through the covert window in the form of invisible IR energy.

WARNING

- **High voltage, sufficient to cause injury or death, is used in the operation of this equipment. Make sure personnel observe safety precautions.**
- **Operation of the AN/ALQ-144 set generates high noise levels, particularly if used in enclosed areas. Protective ear muffs or plugs should be used if operating the AN/ALQ-144 set for extended periods.**
- **Some surfaces of the T-1360 transmitter operate at temperatures approximately 140 °F (60 °C) higher than local ambient, and care should be taken to avoid inadvertent contact. The radiating portion of the T-1360 transmitter should not be viewed continuously during operation for any period exceeding 1 minute from any distance of less than 3 feet.**

b. AN/ALQ-144 IR Jammer Set Controls and Indicators (fig. 4-33).

c. Operation.

WARNING

Do not continuously look at the infrared countermeasure transmitter (fig. 2-2) during operation, or for a period of over 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.

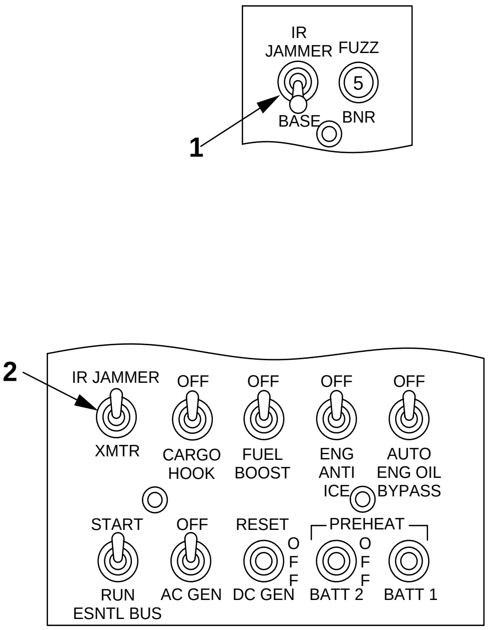
CAUTION

The AN/ALQ-144 set should remain on for a minimum of 15 minutes; otherwise, life of the source may be drastically shortened.

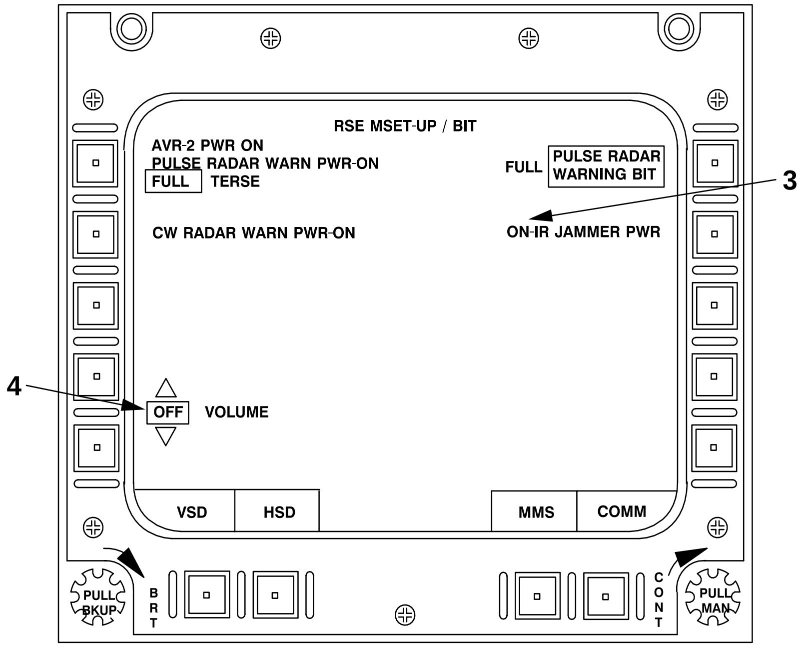
NOTE

- The AN/ALQ-144 is an active IR countermeasure system that is separate from the AN/APR-44 radar warning system.
- The area adjacent to R-2 is unused for text entry. Pressing R-2 does not affect the IR jammer. The system is either on or off; all actions are automatic.

1. IR JAMMER BASE switch — IR JAMMER.
2. IR JAMMER XMTR switch — XMTR.
3. Allow 1-minute warmup.
4. IR JAMMER PWR — Check ON displays.
5. IR JAMMER XMTR switch — BASE.
6. Allow 1-minute cool down.
7. IR JAMMER PWR — Check OFF displays.
8. IR JAMMER PWR — Check INOP advisory displays.



OVERHEAD CONSOLE PANELS



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	CONTROL/INDICATOR	FUNCTION
1.	IR JAMMER BASE switch	Switched to IR JAMMER allows electrical power to IR JAMMER base.
2.	IR JAMMER XMTR switch	Switched to XMTR powers IR JAMMER XMTR. Switched to IR JAMMER for cool down and power OFF.
3.	IR JAMMER PWR “MFD display”	Indicates AN/ALQ-144 system:
		OFF — Power removed from AN/ALQ-144.
		ON — AN/ALQ-144 system operational.
4.	L-4 and L-5 volume control	Adjusts radar warning and laser detector audio volume.

Figure 4-33. AN/ALQ-144 IR Jammer Set Controls and Indicators

SECTION II. ARMAMENT

4-44. ARMAMENT SYSTEMS.

The OH-58D armament system consists of the following assemblies and subsystems:

1. Pilot cyclic grip switches.
2. CPG auxiliary control panel.
3. MFD Weapons Displayed.
4. Pilot display unit (PDU).
5. Armament control panel (ACP)
6. Two universal weapon pylons (UWP).
7. .50 caliber machine gun weapon system.
8. 2.75-inch rocket system.
9. Air-To-Air Stinger (ATAS) missile system.
10. HELLFIRE missile system.

4-45. PILOT CYCLIC GRIP SWITCHES.

Pilot cyclic grip switches (fig. 4-34) allow the pilot to access the CDS and input weapons system commands.

4-46. CPG AUXILIARY CONTROL PANEL.

The CPG auxiliary control panel (fig. 4-35 and fig. 4-36) allows the CPG to access WEAPON and ASE pages.

4-47. MFD WEAPONS DISPLAYS.

WARNING

- **To ensure the aircraft is not allowed to drift into nearby obstacles, the pilot shall divide his attention between MFD symbology and outside aircraft clearance.**
- **When performing MFD weapons engagements, both crewmembers may inadvertently focus their attention inside the cockpit at the same time. The pilot shall divide his attention between the MFD symbology and maintaining aircraft obstacle avoidance.**

MFD Weapons Displays include; Weapons BIT and setup pages, Weapons VSDs and Weapons Sparse VSDs. The Weapons BIT and Setup pages are used to program and test each of the installed weapon systems. The Weapons VSDs and Weapons Sparse VSDs provide weapon status and targeting symbology for each of the installed weapon systems.

(CDS4) Normal VSD weapons pages are no longer available for display.

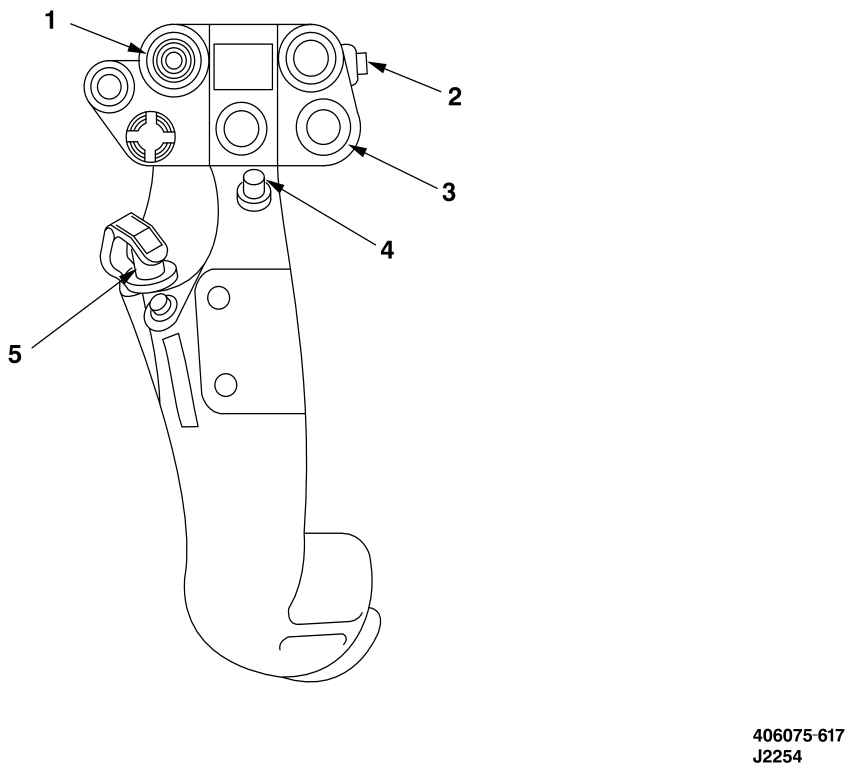
4-48. PILOT DISPLAY UNIT.

WARNING

Use of NVG goggles is prohibited when the PDU is installed.

a. The Pilot Display Unit (PDU) (fig. 4-37) is mounted to the helicopter airframe above the pilots windshield. The PDU can be adjusted vertically for differing pilot eye levels. The PDU control panel has a BRT knob which allows pilot to adjust display brightness and a TEST button which initiates the built-in test (BIT) of the PDU and Electronics Unit (EU). The PDU provides symbology (fig. 4-38) and weapon system status for ATAS and symbology only for 2.75-inch rocket and .50 caliber machine gun weapon systems.

b. During BIT, the word TEST (fig. 4-39) will be displayed on the PDU while BIT is in progress. The BIT will take approximately 5 seconds. A successful BIT will be indicated by the word PASS being displayed on the PDU. An unsuccessful BIT will be indicated by the word FAIL being displayed along with a list of the failed components. The weapon symbology should follow in 5 seconds even if the BIT is unsuccessful.



CONTROL/INDICATOR	FUNCTION
1. WEAPON SEL switch	If the same weapons system is installed on both sides of the helicopter, the WEAPON SEL switch may be moved to either side to select the system.
Left position selected	Selects left weapon system and calls up normal weapon VSD page for weapon currently mounted on the left side of the aircraft. A second selection of the left position will cause the VSD to change to sparse. Subsequent selections will toggle between normal and sparse displays. After first selection, the weapon will be armed by the AEU if the MASTER switch is in the ARMED position.
Right position selected	Selects right weapon system and calls up normal weapon VSD page for weapon currently mounted on the right side of the aircraft. A second selection of the right position will cause the VSD to change to sparse. Subsequent selections will toggle between normal and sparse displays. After first selection, the weapon will be armed by the AEU if the MASTER switch is in the ARMED position.

Figure 4-34. Pilot Cyclic Grip Controls/Indicators (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
Forward position selected	Calls up WEAPONS PAGE.
Aft position selected	Calls up ASE PAGE.
2. ODA switch	Steps through ODA brightness levels starting with preset level selected on INITIAL PAGE 2 to full brightness to OFF.
3. MSL STEP switch	

NOTE

Once an ATAS missile has been sequenced by pressing the MSL STEP switch; the ATAS system does not recognize that the missile is present for firing. To regain that missile, cycle the MASTER switch to OFF and back to ARMED.

CONTROL/INDICATOR	FUNCTION
ATAS	Overrides automatic missile selection allowing next missile to be selected.
HELLFIRE	Overrides automatic missile selection allowing manual selection if manual HELLFIRE launch mode is selected on VSD.
4. MSL ACTVT switch	
ATAS	
First time pressed	Spins up missile gyro and begins cooling seeker head. MFD and PDU displays change to show missile activation.
Second time pressed	Deselects missile.
5. WPN-FIRE switch	
GUN	
1st detent	Fires up to 1.0 second burst each time pressed and held.
2nd detent	Fires continuously until released.
ATAS	
1st detent	Select uncage position.
2nd detent	Starts firing sequence and fires missile. Missile symbol will go away and next missile will spin up.
HELLFIRE	
1st detent	No function in HELLFIRE Mode.
2nd detent	Launches missile and missile present symbology will disappear from fired missile.
2.75 ROCKETS	
1st detent	No function.
2nd detent	Fires rocket(s)

Figure 4-34. Pilot Cyclic Grip Controls/Indicators (Sheet 2 of 2)

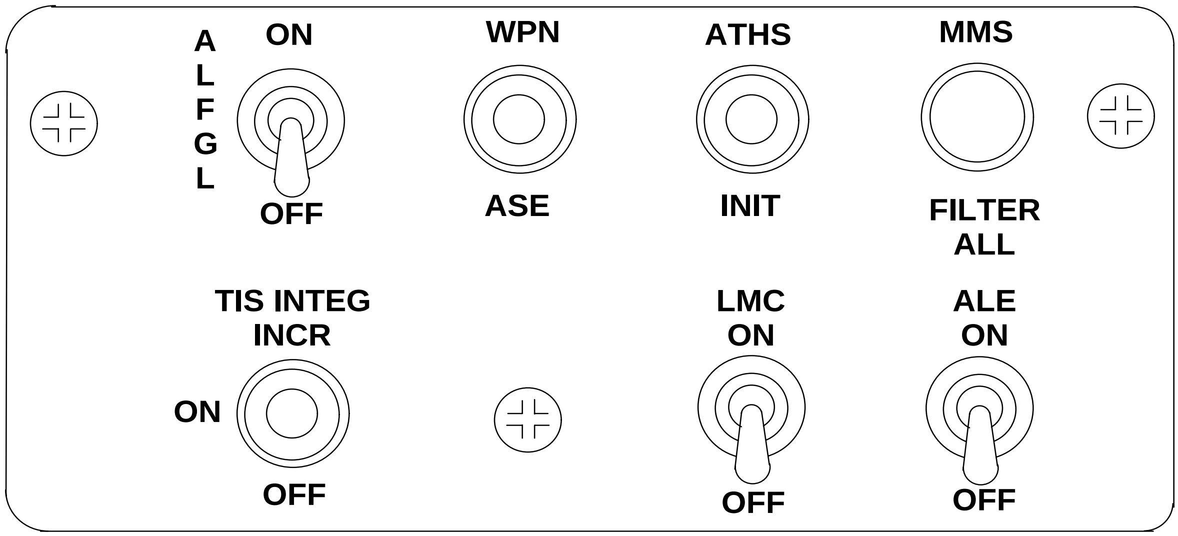


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Figure 4-35. (CDS2) CPG Auxiliary Control Panel

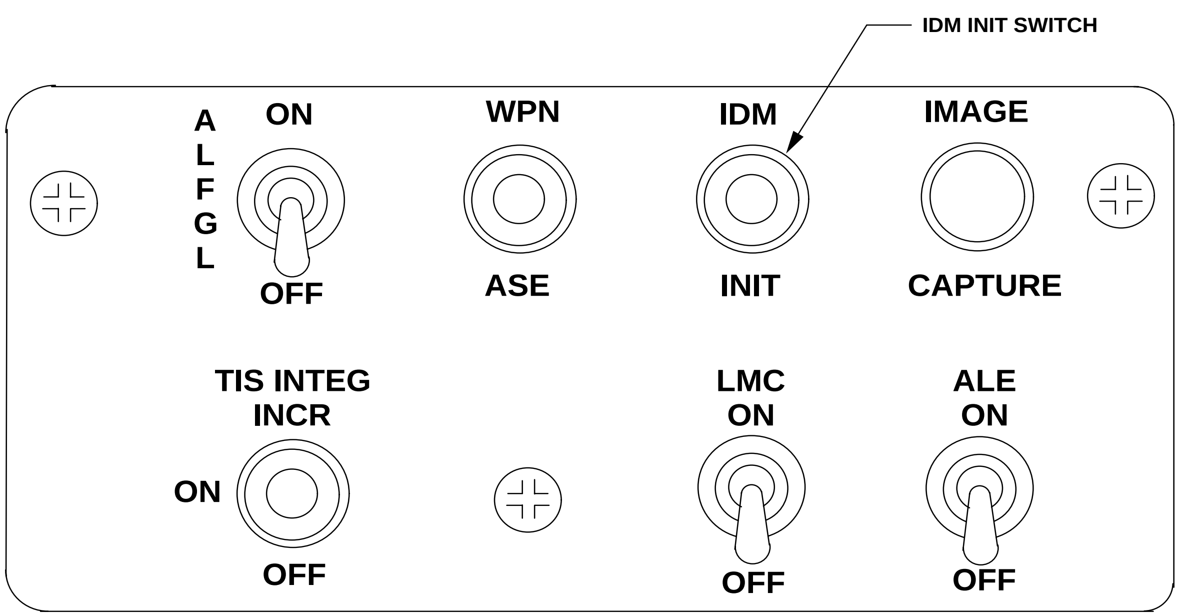

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Figure 4-36. R CPG Auxiliary Control Panel

4-49. PDU PROCEDURES.

4-51. ENGINE RUNUP.

1. MASTER switch — STBY.
2. Weapon symbology — Displays within 20 seconds.
3. PDU height and brightness — Adjust to desired level.
4. PDU TEST button — Press.
5. PDU display — Verify:
   a. TEST appears.
   b. PASS appears.
   c. Weapon symbology appears.

4-52. ARMAMENT CONTROL PANEL.

WARNING

- **(CDS2) Weapons may be inadvertently fired while the aircraft is on the ground if the MASTER switch is in the ARMED position, electrical power is applied to the aircraft, and either the Integrated System Processor (ISP) has failed or the ISP circuit breaker is pulled.**
- **R Weapons may be inadvertently fired while the aircraft is on the ground if the MASTER switch is in the ARMED position, electrical power is applied to the aircraft, and either the right master controller processor unit (R MCPU) has failed or the R MCPU circuit breaker is pulled.**

The ACP (fig. 4-40) allows arming and safing of all weapon systems. The final arm signal/power is provided by selecting the weapon system with the WEAPON SEL switch. The ACP is located on the center pedestal and receives power from the DC essential bus, circuit protection is provided by the ARMT CONTR circuit breaker located on the aft center circuit breaker panel.

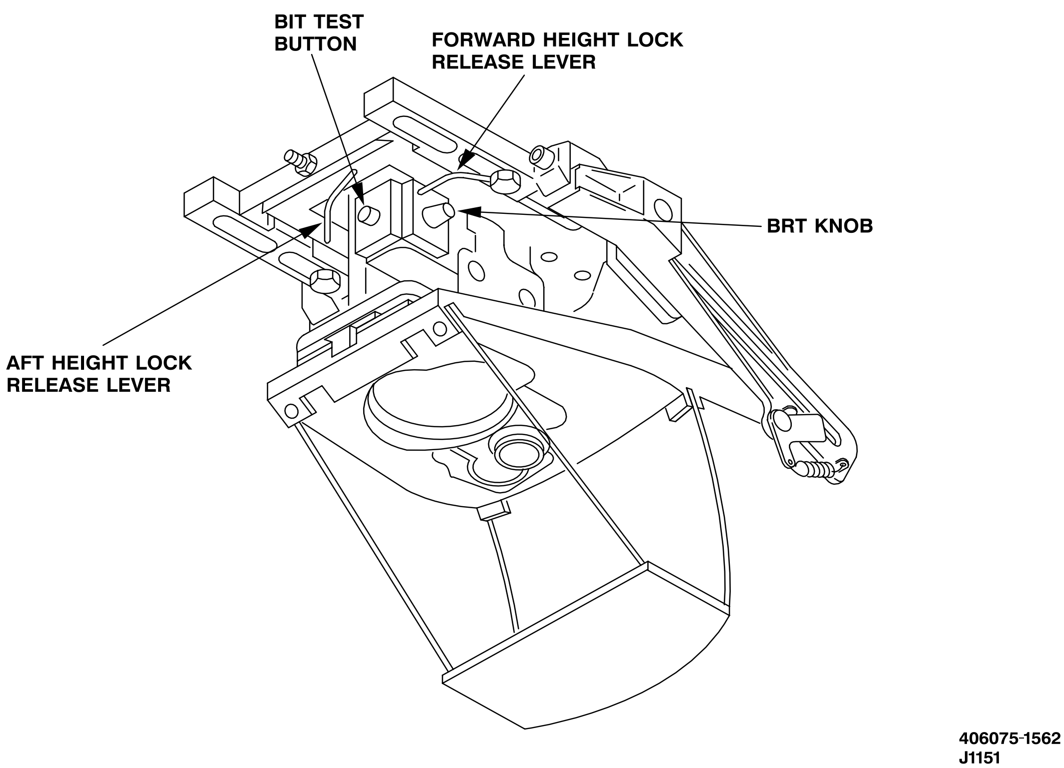


Figure 4-37. Pilot Display Unit (PDU)

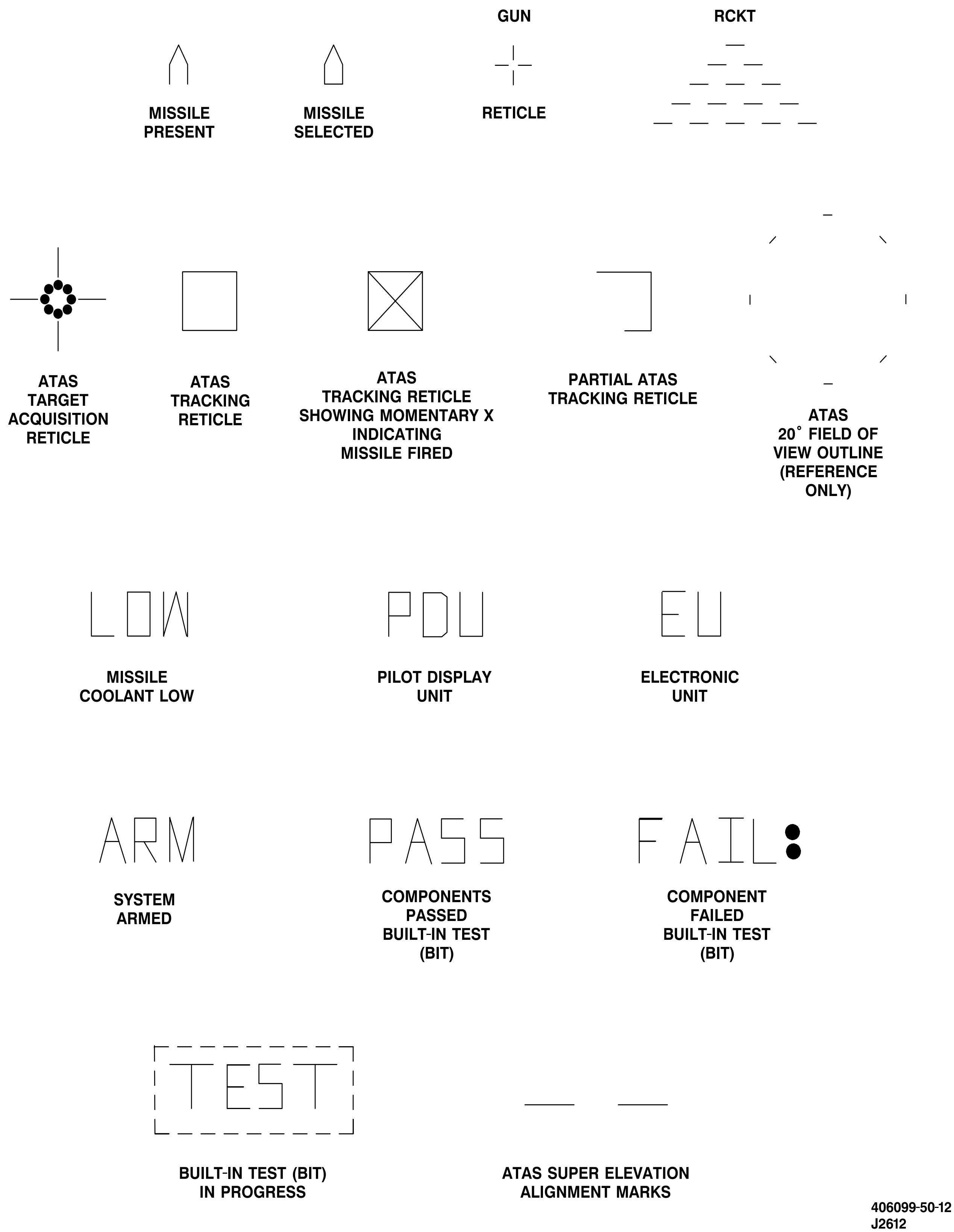


Figure 4-38. PDU Symbology

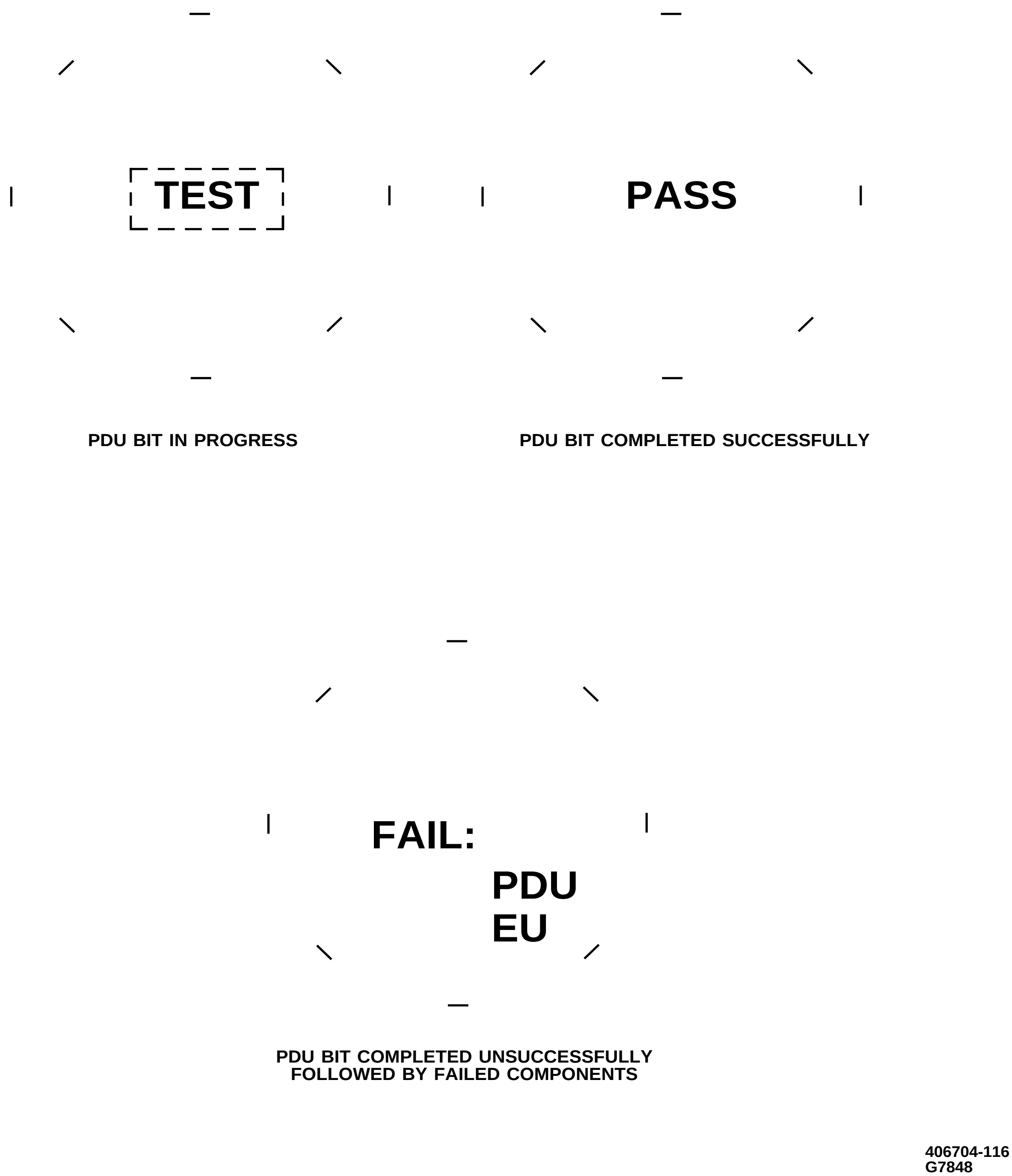
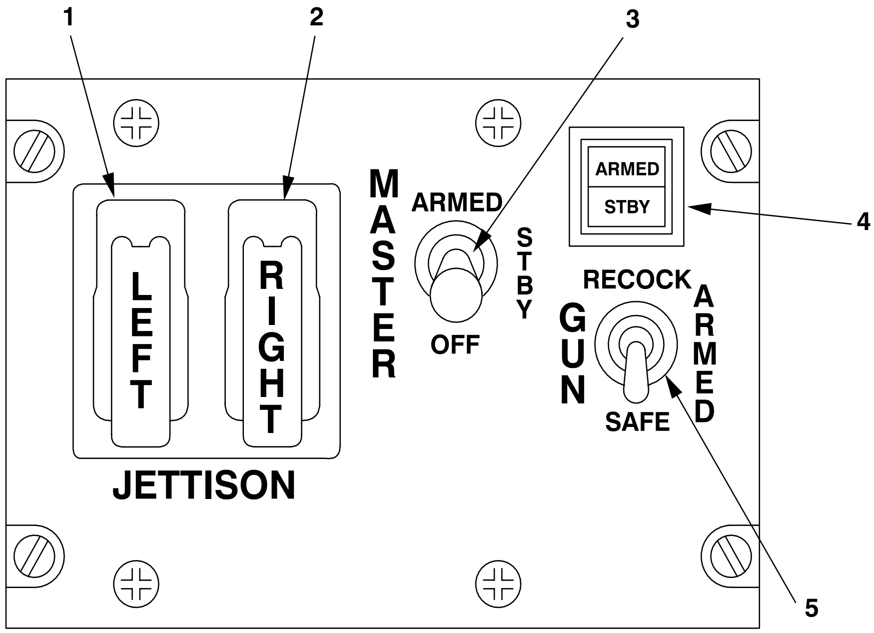


Figure 4-39. PDU BIT Sequence



CONTROL/INDICATOR	FUNCTION
1. LEFT JETTISON	Jettisons left weapon system. When the gun is installed, the jettison system will be electrically and mechanically prevented from firing.
2. RIGHT JETTISON	Jettisons right weapon system.
3. MASTER control switch	The MASTER switch must be in the STBY or ARMED position prior to selecting a weapon system with the WEAPON SEL switch to complete the firing circuit.
OFF	All armament circuits de-energized.
STBY	Energizes armament circuits except weapon firing circuits. Energizes GUN switch for recocking or safing.

Figure 4-40. Armament Control Panel (ACP) Controls/Indicators (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
ARMED	Energizes the selected weapon firing circuit when ARMED is indicated on the ACP and MFD. To arm the gun the GUN switch must also be placed in the ARMED position.
4. ARMED/STBY indicator	
ARMED	Illuminates when MASTER switch is in the ARMED position.
STBY	Illuminates when MASTER switch is in the STBY position.
5. GUN switch	SAFE and RECOCK positions will not function unless MASTER switch is placed in STBY or ARMED.
SAFE	Extracts round from chamber and secures bolt in the aft position.
RECOCK	Recocks gun cycling bolt aft ejecting a round then moving forward feeding another round into the chamber.
ARMED	Arms gun circuits when MASTER switch is ARMED, weapon is selected, and ARMED is indicated on the ACP and MFD.

Figure 4-40. Armament Control Panel (ACP) Controls/Indicators (Sheet 2 of 2)

4-53. UNIVERSAL WEAPONS PYLON.

Expandable bolts and quick-disconnect electrical connectors provide for quick removal and installation of the universal weapons pylon (UWP) (fig. 4-41). One UWP is installed in each side of the intermediate fuselage.

The universal weapons pylon features a hinge fitting which allows the pylon to be folded reducing space required for storage and transport.

The ejector racks provide attaching points for weapons systems and contain impulse cartridges which allow malfunctioning weapons to be jettisoned.

4-54. .50 CALIBER MACHINE GUN WEAPON SYSTEM.

WARNING

To avoid permanent eye injury, avoid direct eye exposure to AIM-1/MLR Laser (if installed) beam. The laser contains a Class IIIb invisible radiation source.

CAUTION

The maximum single burst which may be fired without danger of cookoff is 150 rounds.

The .50 caliber machine gun system (fig. 4-42) consists of a .50 caliber machine gun, an ammunition feed and storage system, and the necessary controls and components to operate the system. It is capable of recocking and safing the gun while airborne. The system is powered by the 28 Vdc essential bus. Circuit protection is provided by the LGUN PWR and ARMT CONTR circuit breakers located on the aft centerpost circuit breaker panel. This system is not jettisonable. The machine gun is an air-cooled, belt-fed, recoil operated, electronically controlled weapon. The gun is mounted in a fixed position to the UWP on the left side of the helicopter. It is capable of firing 750 - 850 rounds per minute at a maximum effective range of 2000 meters.

a. Ammunition Feed and Storage System. The system consists of an ammunition storage can and a flexible feed chute. The storage can is mounted to hard points on the left side of the fuselage. The ammunition feed and storage system holds approximately 500 rounds. The ammunition is gravity fed through the flexible feed chute to the gun.

b. Weapon Controls. Weapon controls are shown in figure 4-42. Control/indicator functions are shown in figures 4-43, 4-44, and 4-45.

c. Weapon Configuration. The .50 caliber machine gun system can be configured for operation by bumping the WEAPON SEL switch up, selecting the WEAPONS PAGE (fig. 4-46). The CPG can call up the WEAPONS PAGE by positioning the WPN/ASE switch momentarily to the WPN position on the CPG auxiliary panel. Pressing L-3 causes the legend to blank and a cursor to appear. A number between 0 and 999 can be entered at the cursor. Pressing ENTER will display the number entered on the gun symbol representing the number of rounds loaded for the mission.

d. Burst Restrictions.

(1) After any combination of bursts not exceeding 50 rounds in one minute, no restriction.

(2) After any single burst of 150 rounds or consecutive bursts totaling 150 rounds, a 10-minute cooling is required. Examples:

Two 75 round bursts may be fired
or
One 100 round burst and one 50 round burst may be fired

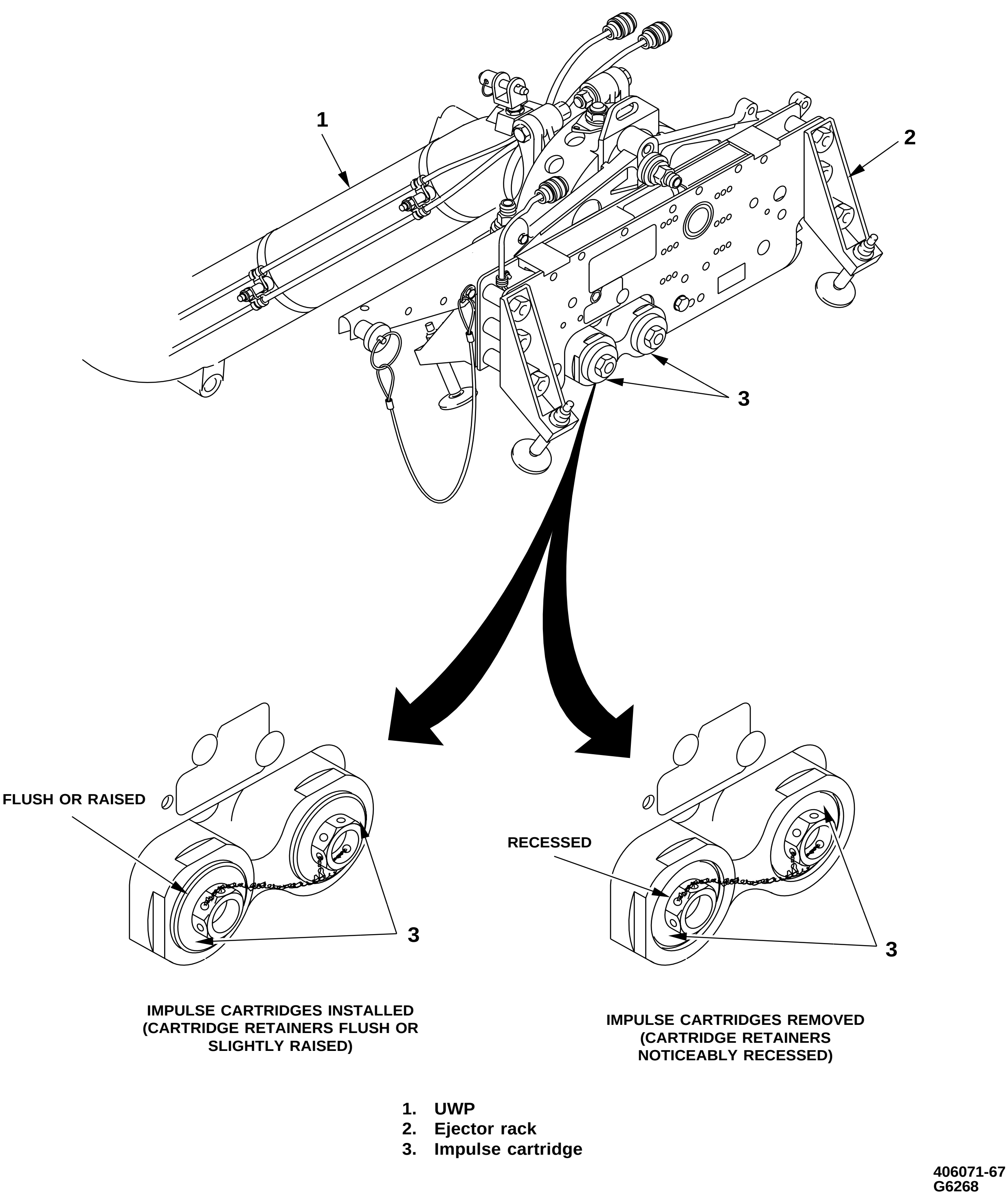
e. Operation.

Paragraphs 4-55 through 4-61 contain the procedural steps necessary to operate the system.

f. (CDS2) ISP or R R MCPU Failure. (CDS2) ISP or R R MCPU failure will cause the system to default allowing the gun to be operated in the backup mode. While operating in the backup mode the following default conditions will apply:

1. The first detent on the WPN-FIRE switch is not operational.

2. RECOCK and SAFE remain functional.



1. UWP
2. Ejector rack
3. Impulse cartridge

Figure 4-41. Universal Weapons Pylon (UWP)

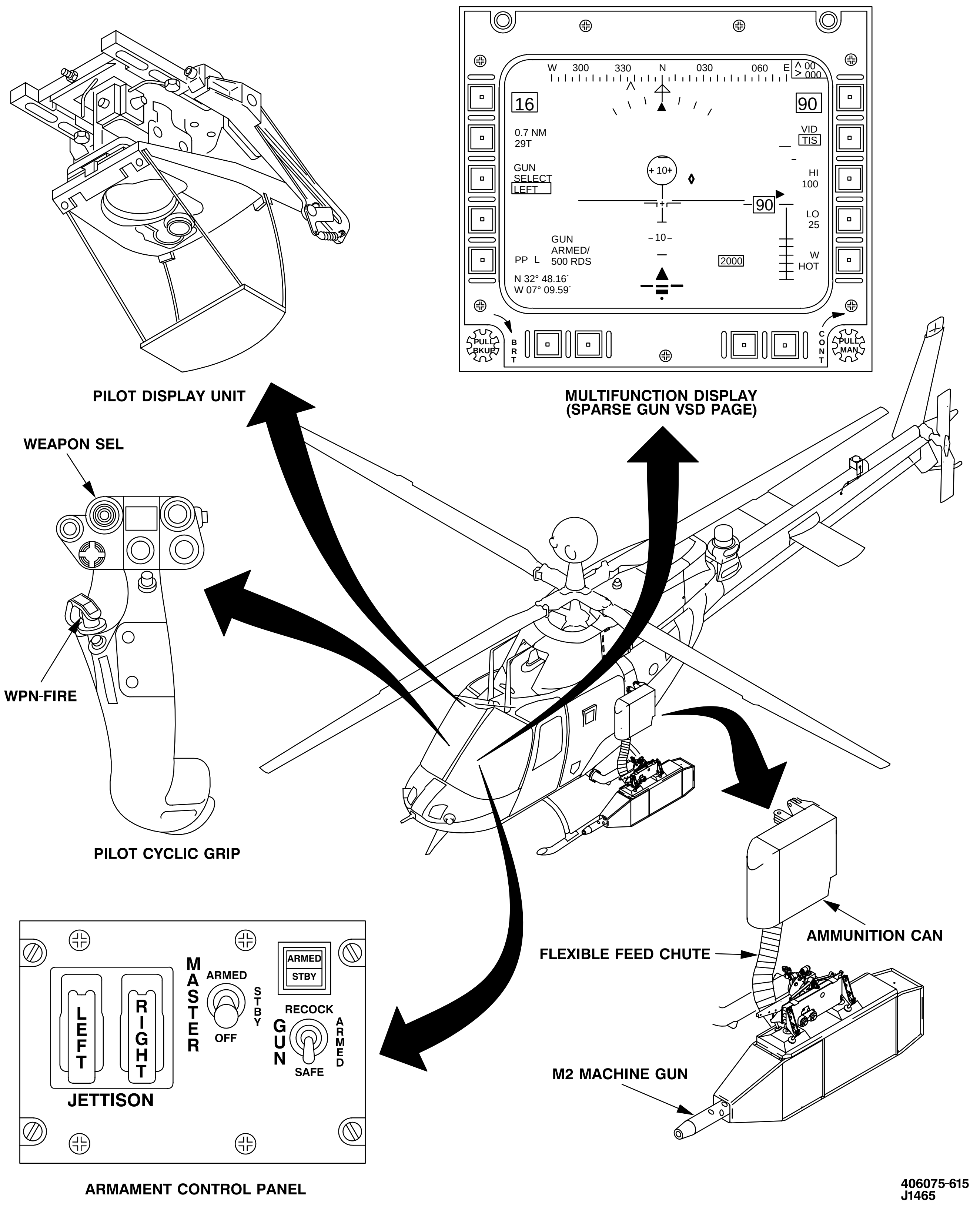
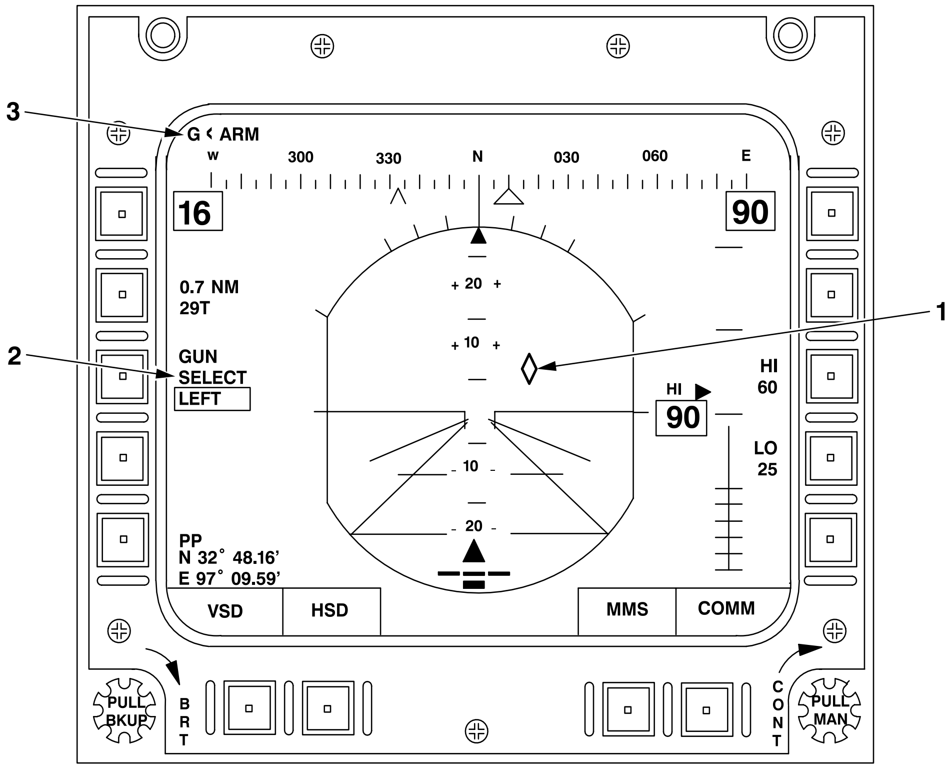


Figure 4-42. .50 Caliber Machine Gun Weapon System



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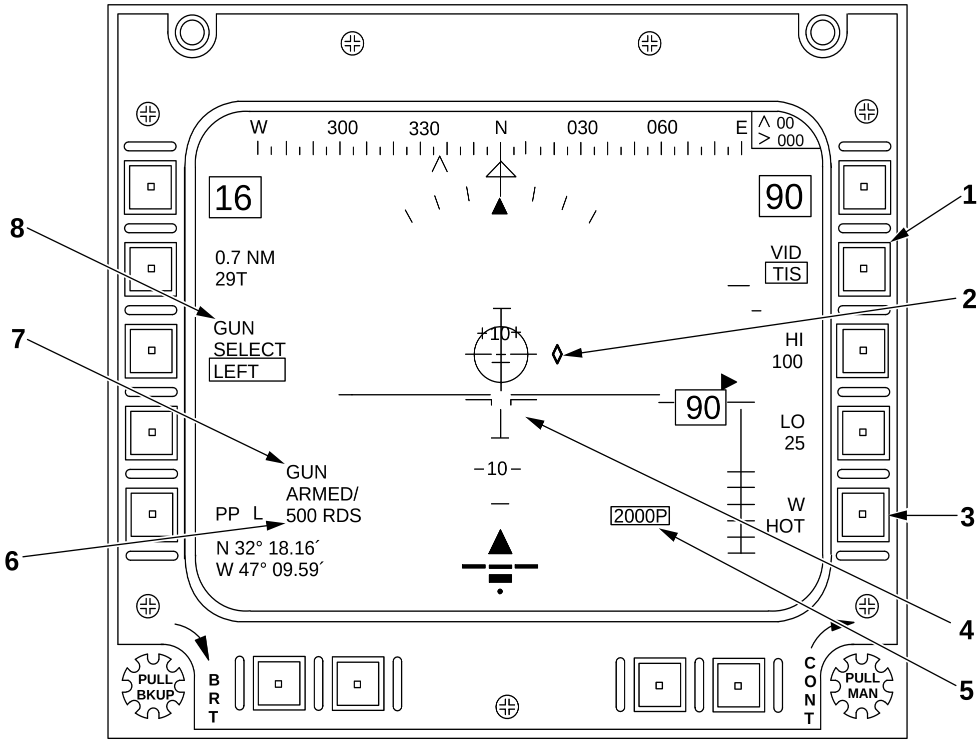
CONTROL/INDICATOR	FUNCTION

NOTE

(CDS4) Normal VSD weapons pages are no longer available for display.

1. MMS LOS Cue	Shows MMS azimuth and elevation orientation.
2. GUN SELECT	Has no function.
3. WEAPONS STATUS	Indicates OFF, SAF, ARM or STBY.

Figure 4-43. .50 Caliber Machine Gun Normal VSD



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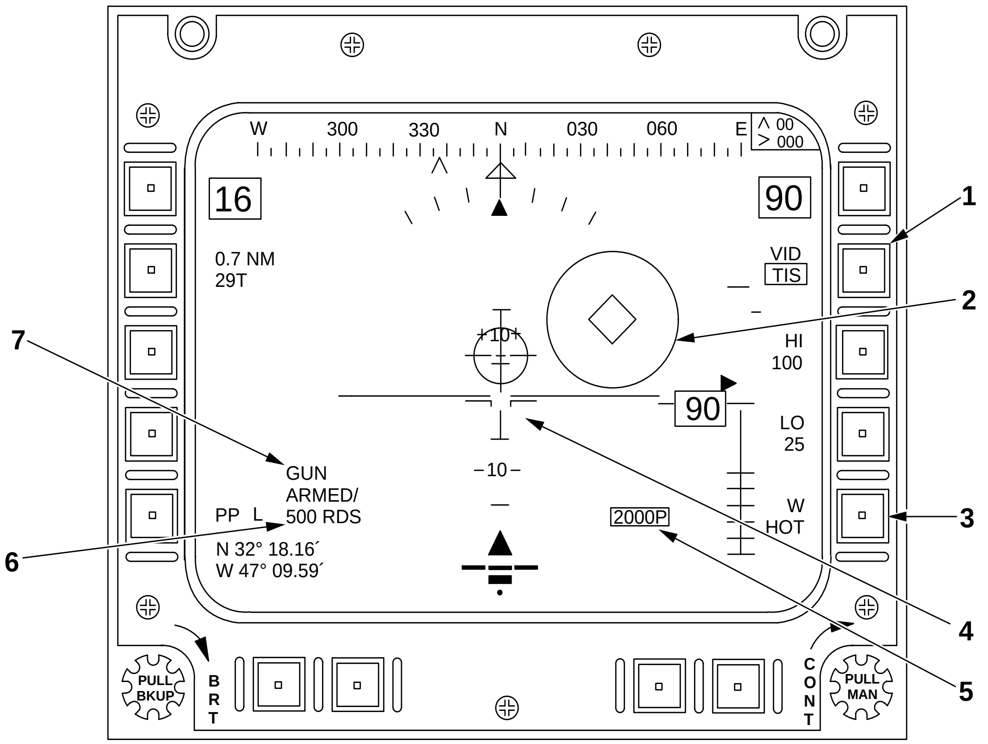
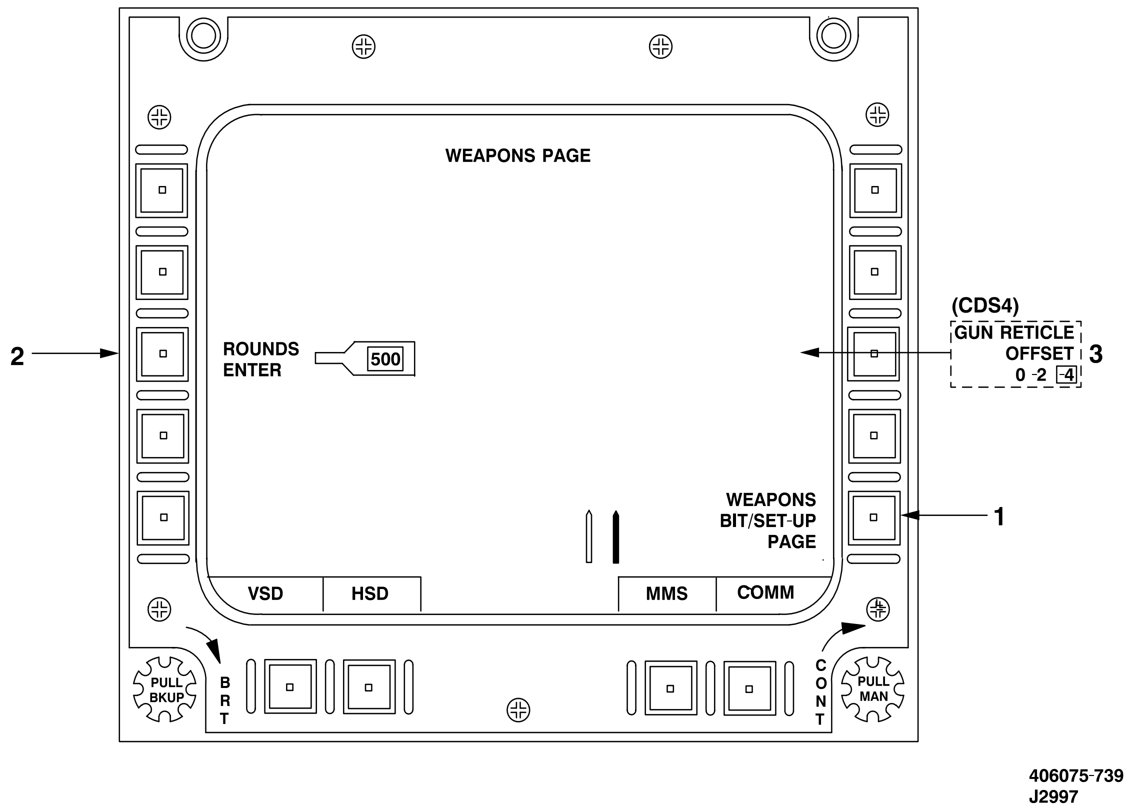
CONTROL/INDICATOR	FUNCTION
1. VID key	Selects video background source for sparse VSD. Toggles between OFF, TV, and TIS. With TIS selected white hot or black hot may be selected at R-5.
2. MMS LOS Cue	Shows MMS azimuth and elevation orientation.
3. W HOT/B HOT/NORM/INV key	When TIS is selected, toggles between W HOT and B HOT. With TV selected at R-2, on IMSP/MMS configuration, toggles between NORM (normal video) and INV (inverted video).
4. Gun reticle	Gun reticle for SPARSE VSD.
5. Range-to-target	Displays boxed when range is current and available. Source is “L” Laser range, “P” prepoint range, “N” distance to direct fly-to-wpt.
6. Rounds remaining	Indicates number of rounds remaining. Based on total length of time WPN–FIRE switch is pressed.
7. Weapon Status	Indicates OFF, SAFED, ARMED or STBY.
8. GUN SELECT	Indicates gun is selected.

Figure 4-44. (CDS2/CDS3) .50 Caliber Machine Gun Sparse VSD



CONTROL/INDICATOR	FUNCTION
1. VID key	Selects video background source for sparse VSD. Toggles between OFF, TV, and TIS. With TIS selected white hot or black hot may be selected at R-5.
2. MMS LOS Steering Cue	Shows MMS azimuth and elevation orientation. An engagement circle is centered on steering cue. Horizontal and vertical movements are limited by steering cue limitations. Any portion of engagement circle outside steering cue limitations is blanked.
3. W HOT/B HOT/NORM/INV key	When TIS is selected, toggles between W HOT and B HOT. With TV selected at R-2, on IMSP/MMS configuration, toggles between NORM (normal video) and INV (inverted video).
4. Gun reticle	Gun reticle for SPARSE VSD. Vertical position of gun reticle is determined by Gun Offset selected on BIT/SET-UP page.
5. Range-to-target	Display is boxed if current laser range is being used. If last valid laser range is used, display is not boxed. Display is boxed while laser if firing and for 5 seconds after laser firing has stopped. Source is “L” Laser range, “P” prepoint range, “N” distance to direct fly-to-wpt.
6. Rounds remaining	Indicates number of rounds remaining. Based on total length of time WPN–FIRE switch is pressed.
7. Weapon Status	Indicates OFF, SAFED, ARMED or STBY.

Figure 4-45. (CDS4) .50 Caliber Machine Gun Sparse VSD



CONTROL/INDICATOR	FUNCTION
1. WEAPONS BIT/SET-UP PAGE key	Selects WEAPONS BIT/SET-UP PAGE. No input required for gun.
2. ROUNDS ENTER key	Allows entry of the number of rounds loaded.
(CDS4)	
3. GUN RETICLE	Allows selection of gun reticle offset from 0 to -2 to -4 and back to 0. Current offset value is boxed. Legend blank and key inop if gun not installed.

Figure 4-46. .50 Caliber Machine Gun WEAPONS PAGE

4-55. .50 CALIBER MACHINE GUN PROCEDURES.

CAUTION

The maximum single burst which may be fired without danger of cookoff is 150 rounds.

4-56. EXTERIOR CHECK — PREFLIGHT.

4-57. INTERMEDIATE FUSELAGE — LEFT SIDE — AREA 6.

WARNING

Anytime gun is loaded, personnel should avoid passing in front of the gun.

1. Ejector rack — Check.
2. Ammunition can — Check.

O 3. Ammunition — Properly loaded.

4. Ammunition can cover — Closed and locked.
5. Feed chute — Check.
6. Electrical connectors — Secure.
7. Cover — Open.
8. Bolt — Forward.
9. Feed mechanism — Aligned.
10. First round — Curved portion against stripper with double loop link toward gun.
11. Cover — Closed and locked.
12. Gun — Check.
13. Feed chute — Check.

4-58. ENGINE RUNUP.

1. MASTER SWITCH — STBY.
2. PDU BIT — Accomplish.
3. WEAPON SEL switch — Select WEAPONS PAGE.
4. L-3 — Press. Enter number of rounds loaded.
5. WEAPONS SEL switch — Select gun.

O 6. GUN switch — RECOCK (strips first round out and chambers round).

NOTE

Ground personnel should hold up round and link to indicate proper ammunition feeding.

4-59. INFLIGHT PROCEDURES.

1. CPG.

a. Target — Track with MMS as desired.

NOTE

Range may be estimated.

b. Laser range finding — Complete as desired.

c. GUN switch — ARMED.

d. MASTER switch — ARMED.

e. Pitch attitude — Estimate required pitch change, if required. Advise pilot of recommended pitch attitude as necessary.

2. PILOT.

a. WEAPON SEL switch — Select gun.

b. Align helicopter to target and required pitch attitude.

c. WPN-FIRE switch — Press as desired.

3. CPG.

a. GUN switch — SAFE.

b. Verify MFD displays STBY (for approximately 3 seconds) then SAFED.

WARNING

If MFD display does not change from STBY to SAFED, GUN bolt should be considered to be in FWD position. GUN circuit breaker or gun fuze may be open. If MASTER switch is placed in STBY with gun switch in SAFE position, MFD will display SAFED regardless of bolt position. Refer to MALFUNCTION — .50 CALIBER MACHINE GUN for possible gun cookoff.

c. MASTER switch — Set as required.

4-60. (CDS2) ISP/R R MCPU FAILURE — BACKUP MODE OPERATION.

1. WEAPON SEL switch — Select gun.
2. GUN switch — ARMED.
3. MASTER switch — ARMED.
4. WPN-FIRE switch — Press to second detent.

4-61. MALFUNCTION — .50 CALIBER MACHINE GUN.

NOTE

Gun malfunctions fall into two categories: those that can be cleared by recocking such as the misfire, hangfire, and doublefeeds, and those that require the gun to be safed such as cookoff.

1. Misfire/Hangfire/Doublefeed.

a. MASTER switch — STBY.

b. GUN switch — RECOCK.

c. Continue with in-flight procedures — As desired.

2. Cookoff.

a. GUN switch — SAFE.

b. Verify MFD displays STBY (for approximately 3 seconds) then SAFED.

WARNING

If MFD display does not change from STBY to SAFED, GUN bolt should be considered to be in FWD position. GUN circuit breaker or gun fuze may be open. Reset GUN circuit breaker if required. Verify MFD displays SAFED. If MASTER switch is placed in STBY with gun switch in SAFE position, MFD will display SAFED regardless of bolt position.

c. MASTER switch — STBY or OFF. Allow gun to cool.

NOTE

Gun cooling time is dependent upon the ambient temperature and relative wind available for cooling the barrel.

d. MASTER switch — ARMED.

e. GUN switch — ARMED.

f. Continue with in-flight procedures — As desired.

4-62. ROCKET WEAPON SYSTEM — 2.75-INCH.

The 2.75-inch weapon system (fig. 4-47) is a light anti-personnel assault weapon. It is capable of air-to-air or air-to-ground delivery. It allows fuze selections and can fire rockets one at a time, in pairs, or ripple. Rockets may be segregated into zones or fired until the supply is exhausted when ALL is selected. The system is comprised of one or two 7-shot rocket launcher(s) and the necessary components, software, and switches to operate the system. The rocket launcher(s) can be jettisoned using the JETTISON switches located on the ACP. The weapon is electrically controlled and powered by the 28 Vdc essential bus. Circuit protection is provided by the RKT PWR and ARMT CONTR circuit breakers located on the aft centerpost circuit breaker panel. The rocket launcher(s) are mounted on the ejector rack. They may be installed on one or both sides. Symmetrical loading is not required.

a. Weapon Controls. Weapon controls are shown in figure 4-47. Control/indicator functions are shown in figures 4-48 and 4-49.

b. Weapon Configuration. The 2.75-inch rocket system can be configured for operation by pressing the WEAPON SEL switch up selecting the WEAPONS PAGE. The CPG can call up the WEAPONS PAGE by positioning the WPN/ASE switch momentarily to the WPN position on the CPG auxiliary panel. The WEAPONS PAGE (fig. 4-50) allows rockets to be configured using the line address keys associated with the displayed legend and the MFK. The remainder of the configuration is accomplished on the WEAPONS BIT/SET-UP PAGE (figures 4-51 and 4-52). While entering any of the data, pressing ENTER without entering a new value will cause the system to default to the previously entered value. Figures 4-53 and 4-54 show zones, firing sequence, and firing mode selections.

c. OPERATION. Paragraphs 4-63 through 4-70 contain the procedural steps necessary to operate the system.

d. (CDS2) ISP FAILURE. ISP failure will cause the system to default allowing the system to be operated in the backup mode. The following default conditions will exist while operating in the backup mode:

WARNING

Air burst rockets will default to detonate at minimum range. Do not fire air burst rockets.

1. Fuzing will be CONTACT SUPERQUICK.

2. Zone will be ALL.

3. One firing impulse per press of the WPN-FIRE switch.

e. R R MCPU FAILURE. R MCPU failure will cause the system to default allowing the system to be operated in the backup mode. The following default conditions will exist while operating in the backup mode:

1. Fuzing will be AIRBURST 2250 meters.

2. Zone will be ALL.

3. One firing impulse per press of the WPN-FIRE switch.

4-63. ROCKET PROCEDURES — 2.75 INCH.

4-64. EXTERIOR CHECK — 2.75 INCH ROCKET.

4-65. INTERMEDIATE FUSELAGE.

1. Ejector rack — Check; impulse cartridges installed.

O 2. Rockets — As required.

3. Launcher — Check. Check lanyard attached.

4. Electrical connectors — Check.

O 5. Fuze umbilical — Connected.

4-66. ENGINE RUNUP.

1. MASTER switch — STBY.

O 2. PDU BIT — Accomplish.

3. WEAPON SEL switch — Select WEAPONS PAGE.

4. R-5 — Press to select WEAPONS BIT/SET-UP PAGE.

5. R-4 — Press to select ROCKET TYPES by ZONE MENU.

6. Warhead — Enter ZONE A type followed by ZONE B type.

7. R-5 — Press to return to WEAPONS PAGE.

8. L-4 — press to enter AIRBURST FUZE/CUE DISTANCE as required.

9. L-5 — Press to enter CONTACT FUZE/CUE DISTANCE as required.

10. Rocket sparse VSD — Select.

11. MODE — Select as required.

12. ZONE — Select as required.

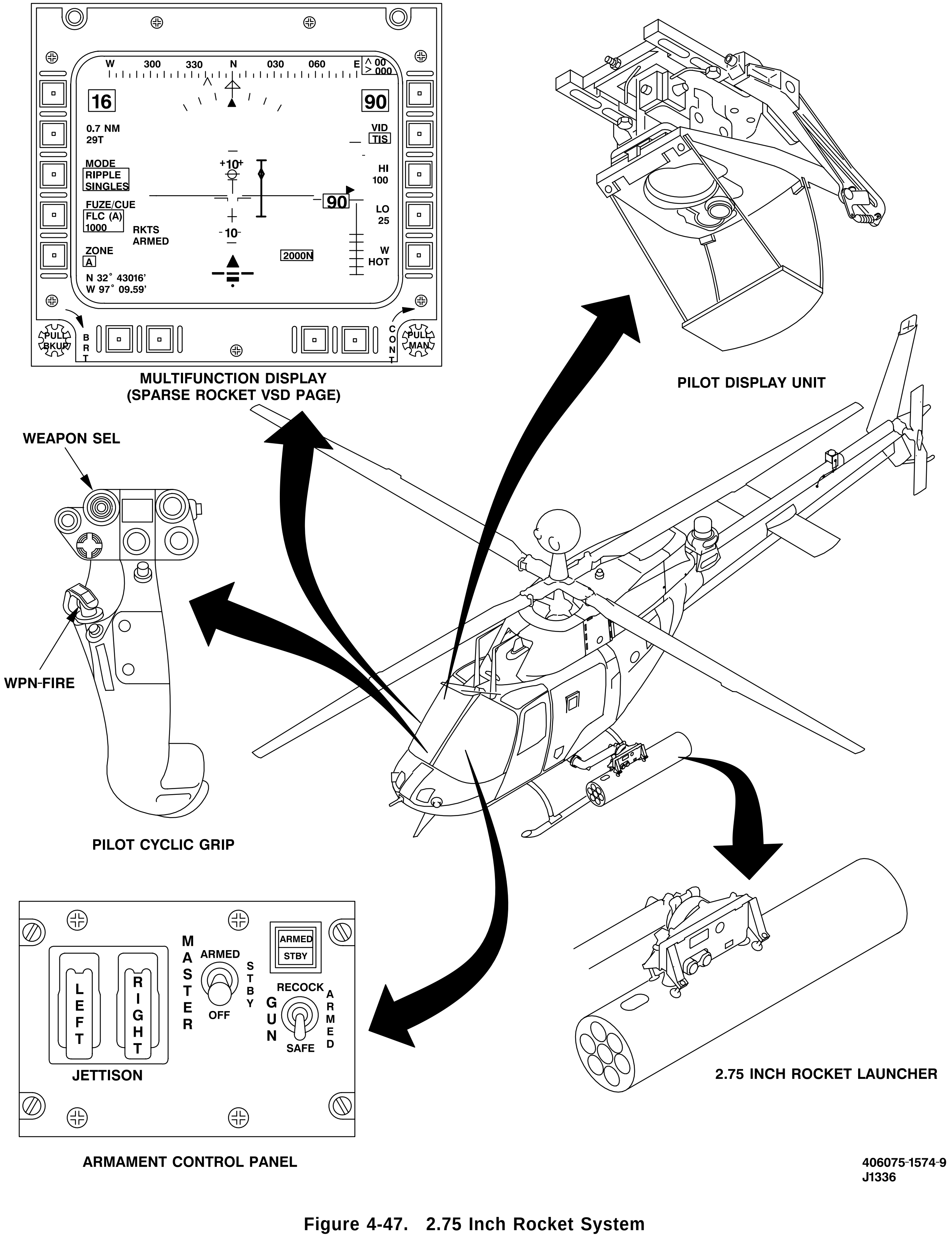
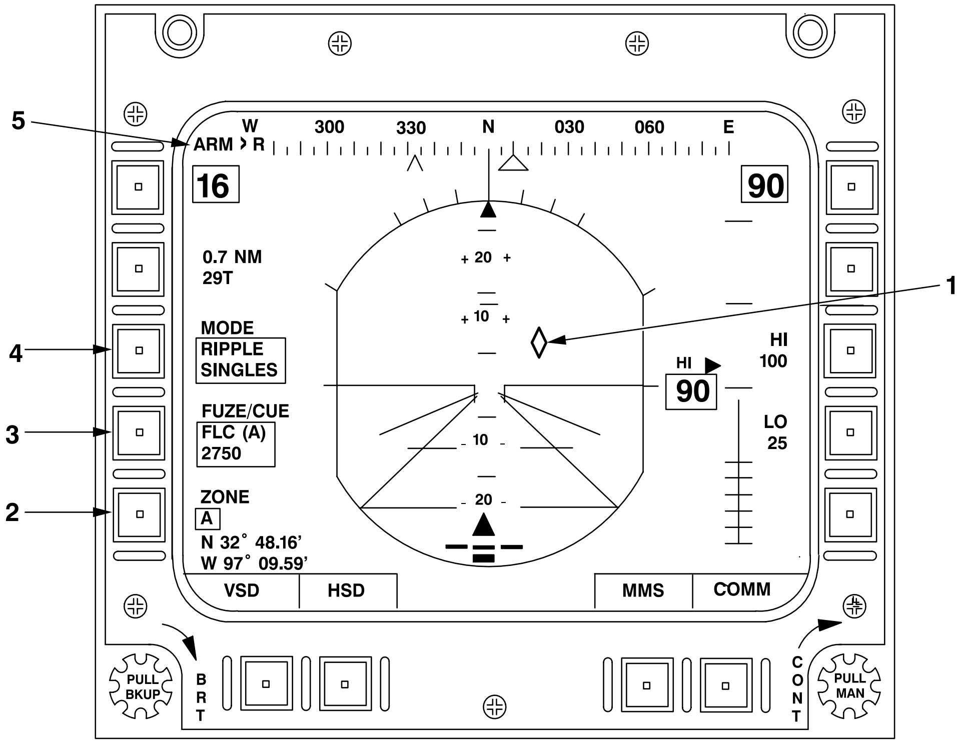


Figure 4-47. 2.75 Inch Rocket System



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J1336

CONTROL/INDICATOR	FUNCTION

NOTE

(CDS4) Normal VSD weapons pages are no longer available for display.

1. MMS LOS Cue — Shows MMS azimuth and elevation orientation.

2. ZONE key — Selects ALL, A, B. Selection of zone also changes FUZE to display current rockets selected for the indicated zone. If ALL selected, then ZONE A FUZE is the default display.

3. FUZE/CUE key — Data entry fields for rocket fuze distance. Airburst data enters initial setting for rockets with airburst fuzes. Contact data enters initial setting for rockets with contact fuzes.

4. MODE key — Selects firing mode for 2.75-inch rockets:

One launcher installed:

SINGLES/SINGLES: Fires one rocket in selected zones(s) per press of WPN-FIRE switch.

Figure 4-48. 2.75-inch Rocket Normal VSD (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
	RIPPLE/SINGLES: Fires rockets in selected zone(s) continuously per press of WPN-FIRE switch until zone(s) is expended or WPN-FIRE switch is released.
	Two launchers installed:
	SINGLES/SINGLES: Fires one rocket in selected zone(s) per press of WPN-FIRE switch. Subsequent presses of WPN-FIRE switch alternate launchers.
	SINGLES/PAIRS: Fires rockets in pairs from both launchers simultaneously in selected zones.
	RIPPLE/SINGLES: Fires rockets from selected zone(s) continuously from alternating launchers until zone is expended or WPN-FIRE switch is released.
	RIPPLE/PAIRS: Fires rockets in pairs from both launchers simultaneously in selected zone(s) until zone(s) is expended or WPN-FIRE switch is released.
5. WEAPON STATUS	Indicates OFF, SAF or ARM.

Figure 4-48. 2.75-inch Rocket Normal VSD (Sheet 2 of 2)

4-67. IN-FLIGHT PROCEDURES.

1. CPG.

a. Target — Track with MMS as desired.

NOTE

Range may be estimated.

b. Laser range finding — Complete as desired.

c. WPN/ASE switch — Select rocket sparse weapons VSD.

d. ZONE key — Select zone as required.

e. FUZE/CUE key — Enter fuze and cue data as required.

f. MODE key — Select firing mode as required.

g. MASTER switch — ARMED.

2. PILOT.

a. WEAPON SEL switch — Select rocket sparse weapons VSD.

b. ZONE — Verify as required.

c. FUZE/CUE data — Verify as required.

d. MODE — Verify as required.

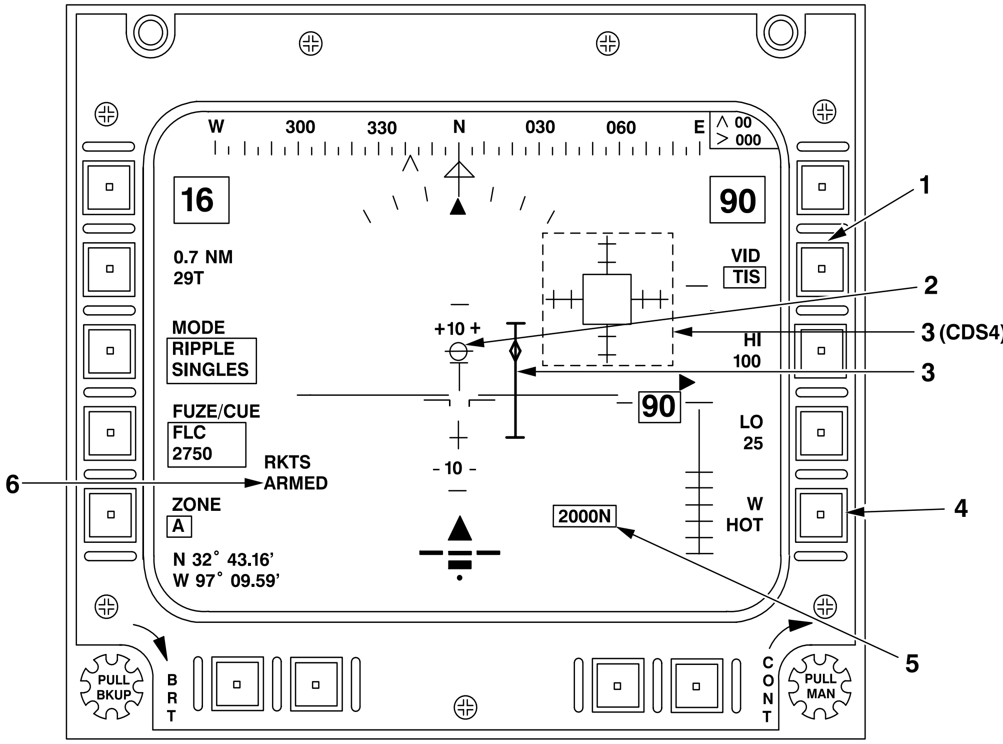
NOTE

Rocket ranges up to 8000m are now possible to enter and get a displayed pitch attitude cue (PAC) for contact rockets. However, at approximately 7600m the PAC is displayed at +30° pitch. At 8000m the PAC exceeds the maximum pitch attitude of +30° by 3-5° (depending on rocket type). Rocket engagements (simulated or actual) at ranges above 7000m require extreme nose high attitudes (in excess of +20°). Ranges above approximately 7600m (depending on rocket type) require pitch attitudes in excess of +30°.

e. Position helicopter to properly align weapons symbology.

f. WPN-FIRE switch — Press to second detent.

3. MASTER switch — Set as required.



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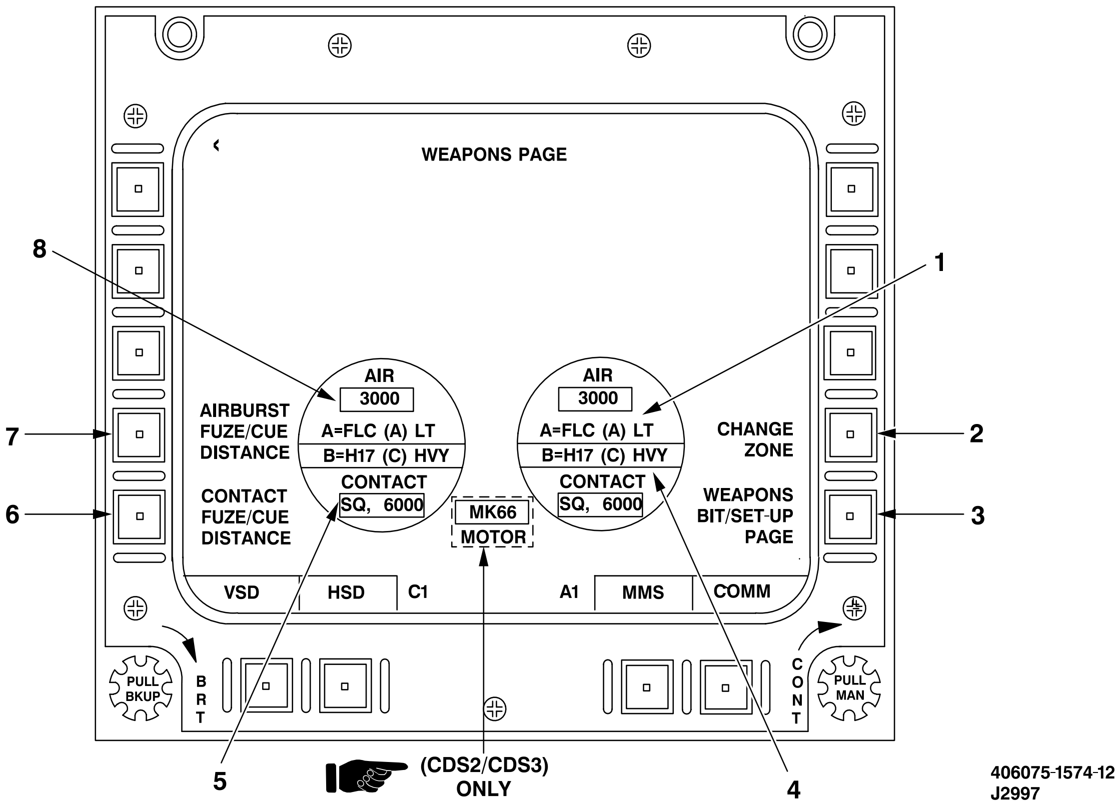
J3054

CONTROL/INDICATOR	FUNCTION
1. VID key	Selects video background source for sparse VSD. Toggles between OFF, TV, and TIS.
2. Pitch Attitude Cue	Based on rocket type and cue range specified on WEAPONS PAGE.
3. Rocket Steering Cue	Centerline reference on display.
	(CDS4) Cue has horizontal and vertical axes.
4. W HOT/B HOT/ NORM/INV key	When TIS is selected, toggles between W HOT and B HOT. With TV selected at R-2, on IMSP/MMS configuration, toggles between NORM (normal video) and INV (inverted video).
5. Range-to-target	Displays boxed when range is current and available. Source is “L” Laser range, “P” prepoint range, “N” distance to direct fly-to-wpt.
	R Range will remain boxed if range is current and selected FUZE/CUE source is same as range displayed. Source is “L” laser range, “P” prepoint range, “N” distance to direct fly-to-wpt.
	(CDS4) Range is boxed if if current laser range is being displayed. Range not boxed if last valid laser range is used. Display is boxed while laser is firing and for 5 seconds after laser firing is stopped. Source is “L” laser range, “P” prepoint range, “N” distance to direct fly-to-wpt.
6. Weapons Status	Indicates rockets are OFF, SAFED or ARMED.

Figure 4-49. 2.75-inch Rocket Sparse VSD



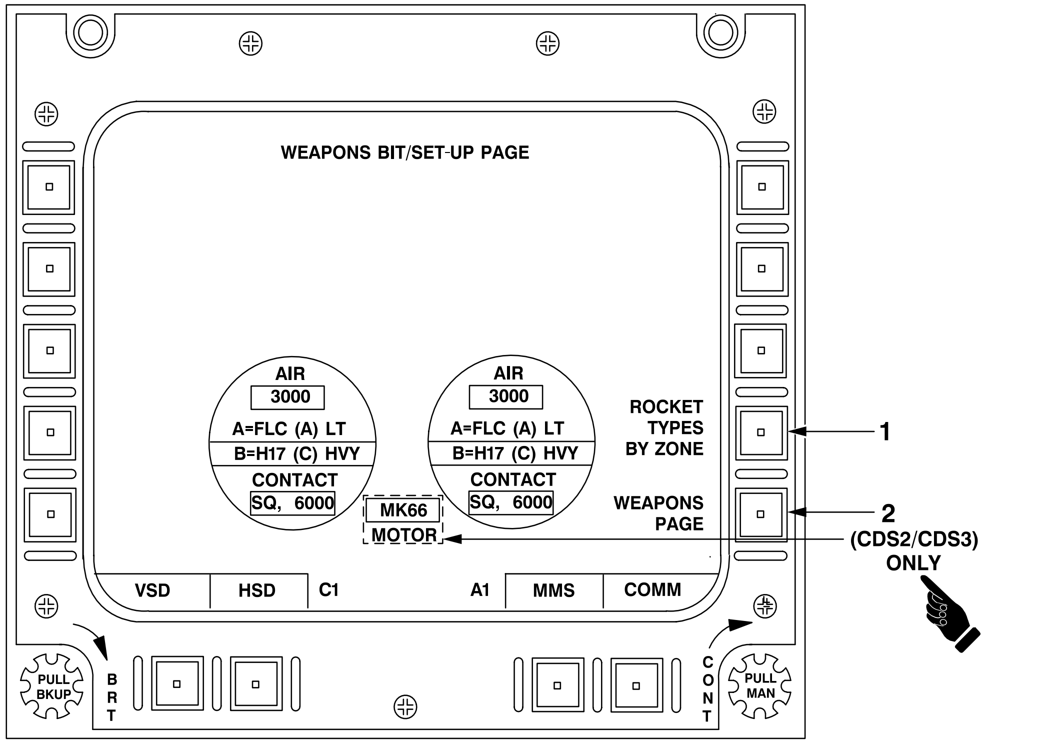
CONTROL/INDICATOR	FUNCTION
1. Warhead data	Select rocket warhead by zone.
2. CHANGE ZONE key	Toggles rocket zones between A, B, and ALL with the active mode boxed.
3. WEAPONS BIT/SET-UP PAGE key	Selects WEAPONS BIT/SET-UP PAGE.
4. Zone data	Selected zone boxed.
5. CONTACT	Contact fuzing and cue distance data.

Figure 4-50. 2.75-inch Rocket WEAPONS PAGE (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
6. CONTACT FUZE/CUE DISTANCE key	Activation of the L-5 key allows entry of the contact fuze data. Select S, B, or a number from 10 through 45. If no selection is made the last selected value is used. Following selection of enter on the MFK, the selected value is entered in the box below "CONTACT" in the rocket symbol. Also the legend at L-5 key is changed to accept "CONTACT CUE" entry. Select L, N, or a number from 500 through 8000. If no entry the last selected value is used. After selection of enter on the MFK, the selected value is entered in the box below "CONTACT" and to the right of the "CONTACT FUZE" data. The contact fuze data is rounded down to the nearest 250 increment. Numbers between 3000 and 8000 are rounded to the nearest 500 meter increment.
7. AIRBURST FUZE/CUE DISTANCE key	Data entry fields for rocket fuze distance. Airburst data enters initial setting for rockets with airburst fuzes. Enter number between 500 and 3,000 in 250 meter increments or 3,000 to 6,000 in 500 meter increments. Number between allowed increments will be rounded down to the nearest allowed and displayed. R Number between allowed increments will be rounded to the nearest allowed increment and displayed. Entering L defaults FUZE/CUE to laser RANGE only. Entering N defaults FUZE/CUE to DIR WPT.
8. AIR	Airburst fuzing and cueing data. Displayed adjacent to type of rocket.

Figure 4-50. 2.75-inch Rocket WEAPONS PAGE (Sheet 2 of 2)



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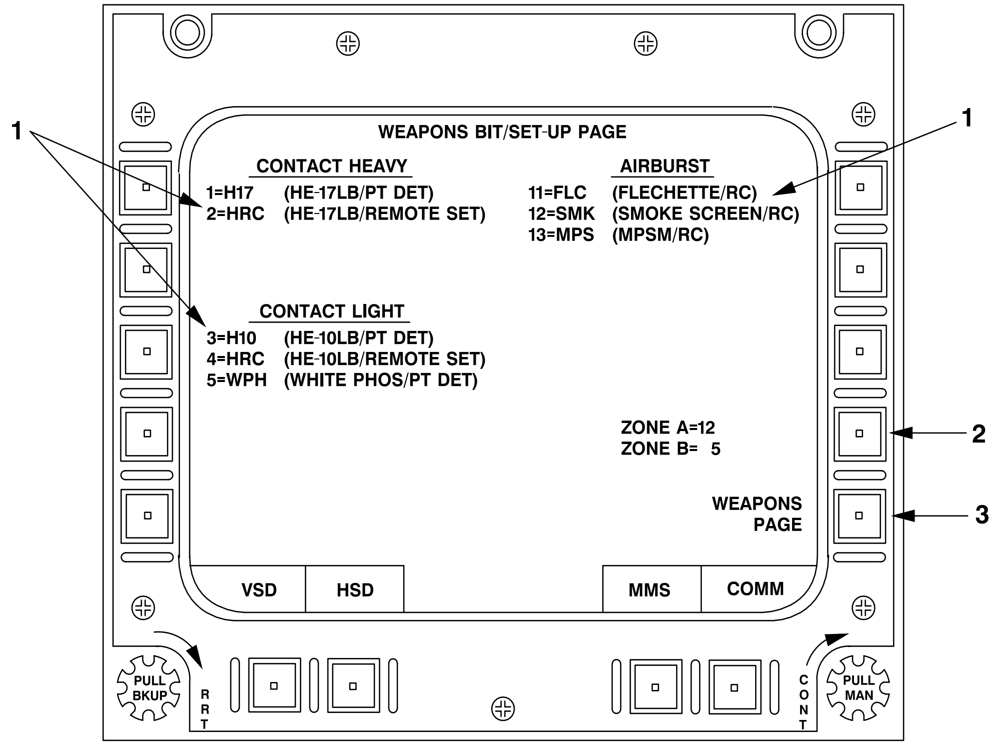
J2997

CONTROL/INDICATOR	FUNCTION
1. ROCKET TYPES BY ZONES key	Selects Rocket types menu.
2. WEAPONS PAGE key	Selects WEAPONS PAGE.

Figure 4-51. 2.75-inch Rocket WEAPONS BIT/SET-UP PAGE



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J0924

CONTROL/INDICATOR	FUNCTION
1. Warhead data	Lists warhead selections for entry.
2. ZONE A/B	Enter number from warhead data selection for ZONE A. Pressing ENTER on the MFK allows for warhead data selection for ZONE B.
3. WEAPONS PAGE key	Selects WEAPONS PAGE.

Figure 4-52. 2.75-inch Rocket WEAPONS BIT/SET-UP PAGE with Rocket Set-up Code

(TWO LAUNCHERS INSTALLED)

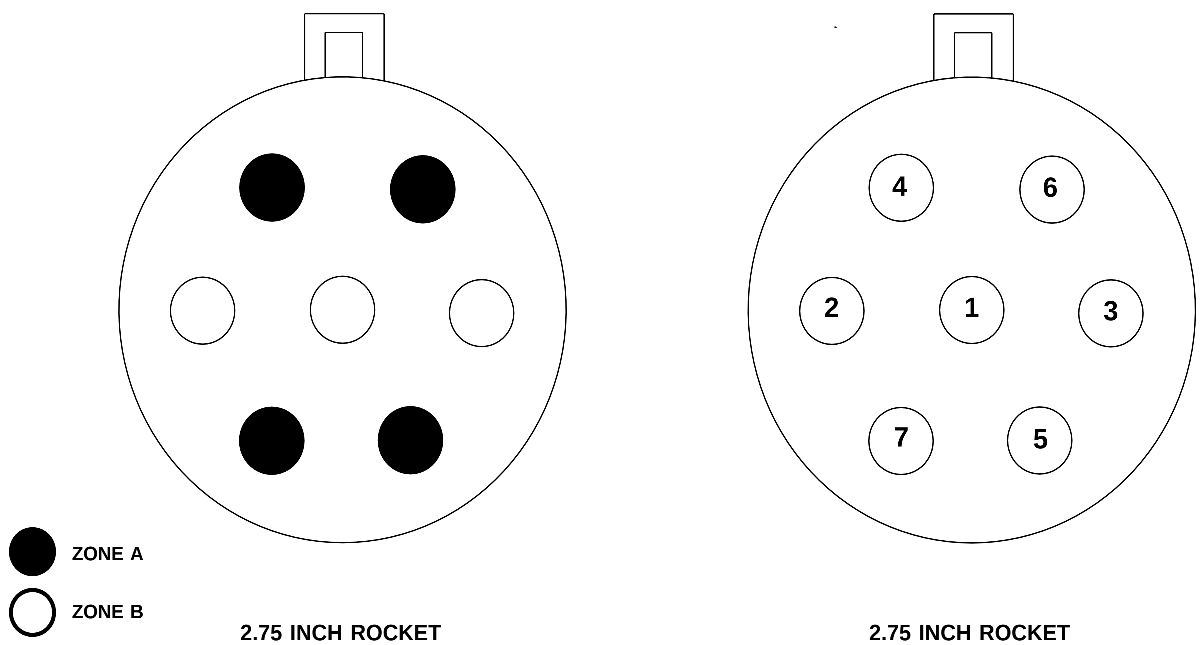
RIPPLE SINGLES	RIPPLE PAIRS	SINGLES SINGLES	SINGLES PAIRS

(ONE LAUNCHER INSTALLED)

RIPPLE SINGLES	SINGLES SINGLES

406947-30
G7219

Figure 4-53. Rocket Firing Mode Selections



2.75 INCH ROCKET
LAUNCHER ZONES

2.75 INCH ROCKET
FIRING SEQUENCE

406947-28
G7216

Figure 4-54. Rocket Launcher Zones and Firing Sequence

4-68. MALFUNCTIONS — 2.75-INCH ROCKET.

4-69. MISFIRE — 2.75-INCH ROCKET.

Indication: A misfire is a rocket that has been fired but the launch motor does not ignite.

Proceed as follows:

1. Position the aircraft so that rocket is oriented downrange for a period of 10 minutes.
2. Upon landing the aircraft — Notify explosive ordnance disposal.

4-70. (CDS2) ISP/R R MCPU FAILURE — BACKUP MODE OPERATION.

1. MASTER switch — ARMED.
2. WEAPON SEL switch — Select rockets.
3. WPN-FIRE switch — Press to second detent.

4-71. AIR-TO-AIR STINGER.

The Air-to-Air Stinger (ATAS) missile system (fig. 4-55) is an air-to-air, heat seeking missile system capable of launching missiles primarily at airborne targets. It provides defensive and limited air-to-air combat capability. ATAS is comprised of one or two launchers containing up to two missiles each, and the necessary components, software, and switches to operate the system. The ATAS launcher(s) can be jettisoned using the JETTISON switches located on the ACP. The weapon is electrically controlled and powered by the 28 Vdc essential bus. Circuit protection is provided by the ATAS PWR and ARMT CONTR circuit breakers located on the aft centerpost circuit breaker panel. The ATAS launcher(s) are mounted on the ejector rack. They may be installed on one or both sides. Symmetrical loading is not required.

On helicopters equipped with Block 1 IEA, an automatic seeker recage function is provided. This allows the pilot to maintain the WPN-FIRE switch in the first detent while the system evaluates and recages the seeker if signal threshold drops below a given level. In this way the system will reject cloud edge, terrain, and other false targets without the pilot having to release the detent. This function works with any Stinger missile. Additionally, the Block 1 missile will receive a tailored data load from the IEA which orients the missile vertically and eliminates the need to superelevate the helicopter prior to missile launch. All other visual and audio firing constraints apply. Basic, Post, and RMP missiles still require the helicopter be super elevated before missile launch. Therefore, it is imperative during preflight the crew inspects for missile type (if loaded), or during hot re-arm the crew is briefed by armament personnel on which missile type is uploaded.

R Stinger missile seeker slaving mode is available. This mode of acquiring a target drives the missile's seeker to the MMS LOS when SLAVING ON is selected, prior to uncaging the missile. This feature decreases pilot workload and acts to shorten the acquisition timeline during ATAS engagements. Slaving mode defaults to OFF at power down.

a. Weapon Controls. Weapon controls are shown in figure 4-55. Control/indicator functions are shown in figures 4-56 and 4-57.

b. Weapon Configuration. The ATAS system can be configured for operation by bumping the WEAPON SEL switch up selecting the WEAPONS PAGE (fig. 4-58). The CPG can call up the WEAPONS PAGE by positioning the WPN/ASE switch momentarily to the WPN position on the CPG panel.

NOTE

To completely check ATAS system, BIT must be performed on both the MFD and PDU (if installed).

c. ATAS BIT. The BIT for the ATAS system can be initiated either on the PDU or the MFD. The source of the information and where it is displayed will depend on which source is used to initiate the BIT. Figure 4-59 displays the control/indicator functions.

(1) The PDU BIT results will be displayed on the PDU. A successful BIT will be indicated by the word PASS being displayed on the PDU. An unsuccessful BIT will be indicated by the word FAIL being displayed along with a list of the failed components.

(2) Initiating the ATAS BIT causes the ATAS BIT MFD display to be boxed. ATAS BIT will unbox and the BIT results will appear adjacent to L-5 when the BIT is complete. A successful BIT will be indicated by displaying IEA GO. An unsuccessful BIT will be indicated by displaying IEA NO GO. If any launcher fails BIT (fig. 4-60), the launcher fail message is displayed by placing an X over the missile symbols.

(a) The number of missiles are indicated by a display of a like number of missile symbols without an X over the symbol.

(b) If there are no missiles installed, or the launcher is not installed, the status section for that launcher is blank.

d. (CDS2) ISP/R R MCPU Failure. (CDS2) ISP/R R MCPU failure causes the system to default allowing the ATAS to be operated in the backup mode. The following default conditions will exist while operating in the backup mode:

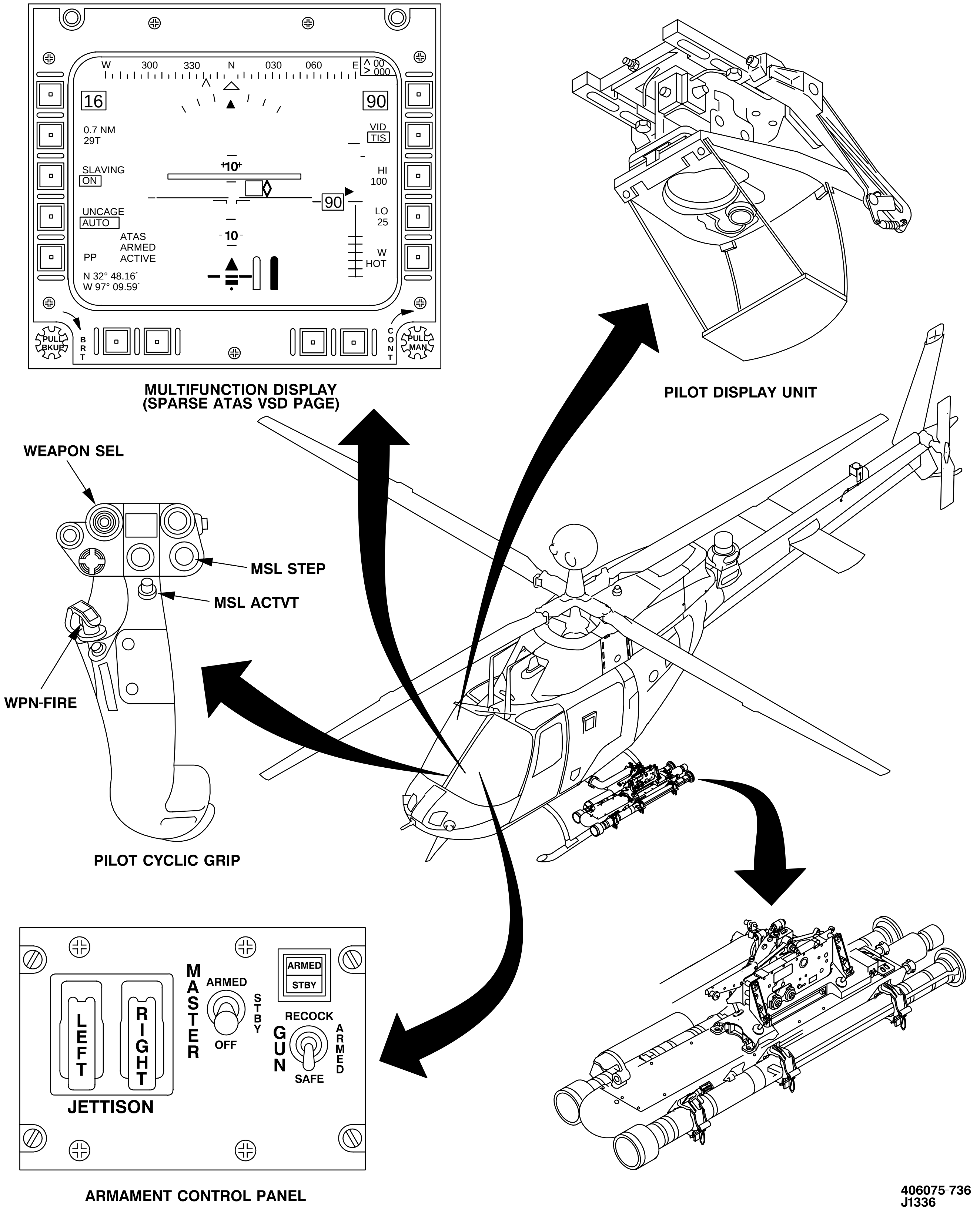
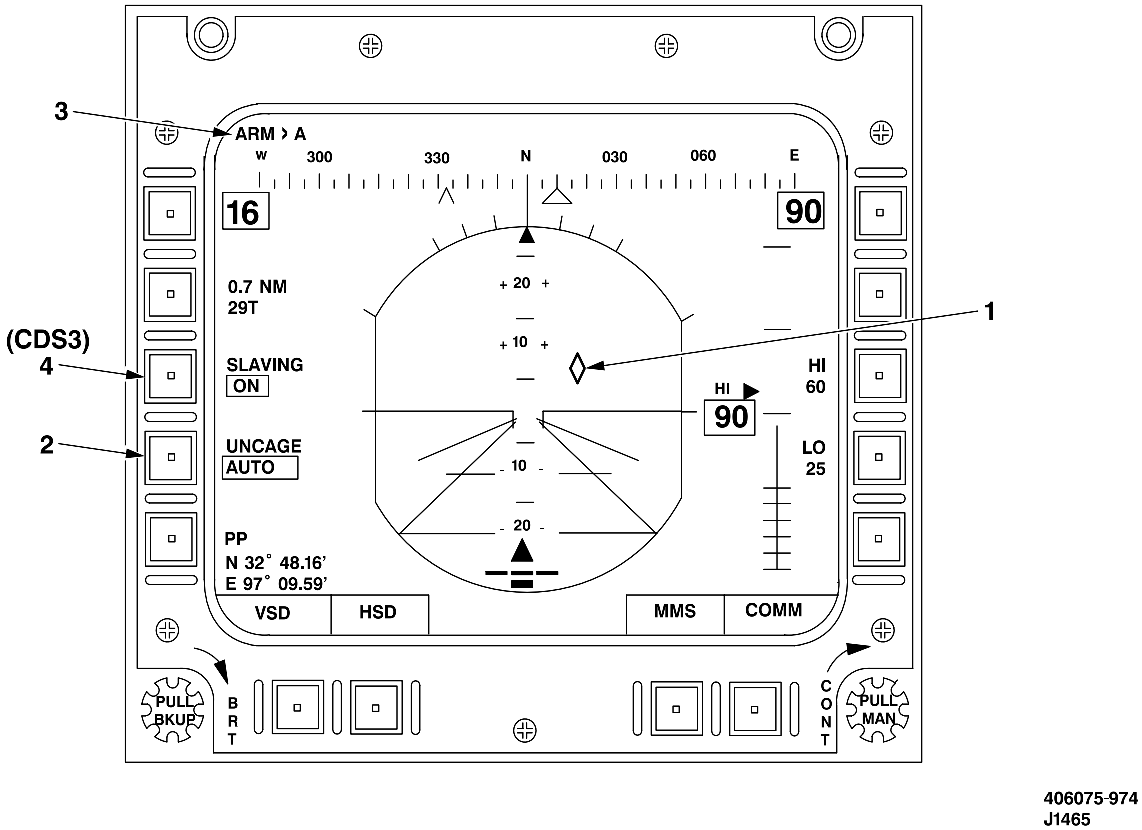


Figure 4-55. ATAS Weapon System



CONTROL/INDICATOR	FUNCTION

NOTE

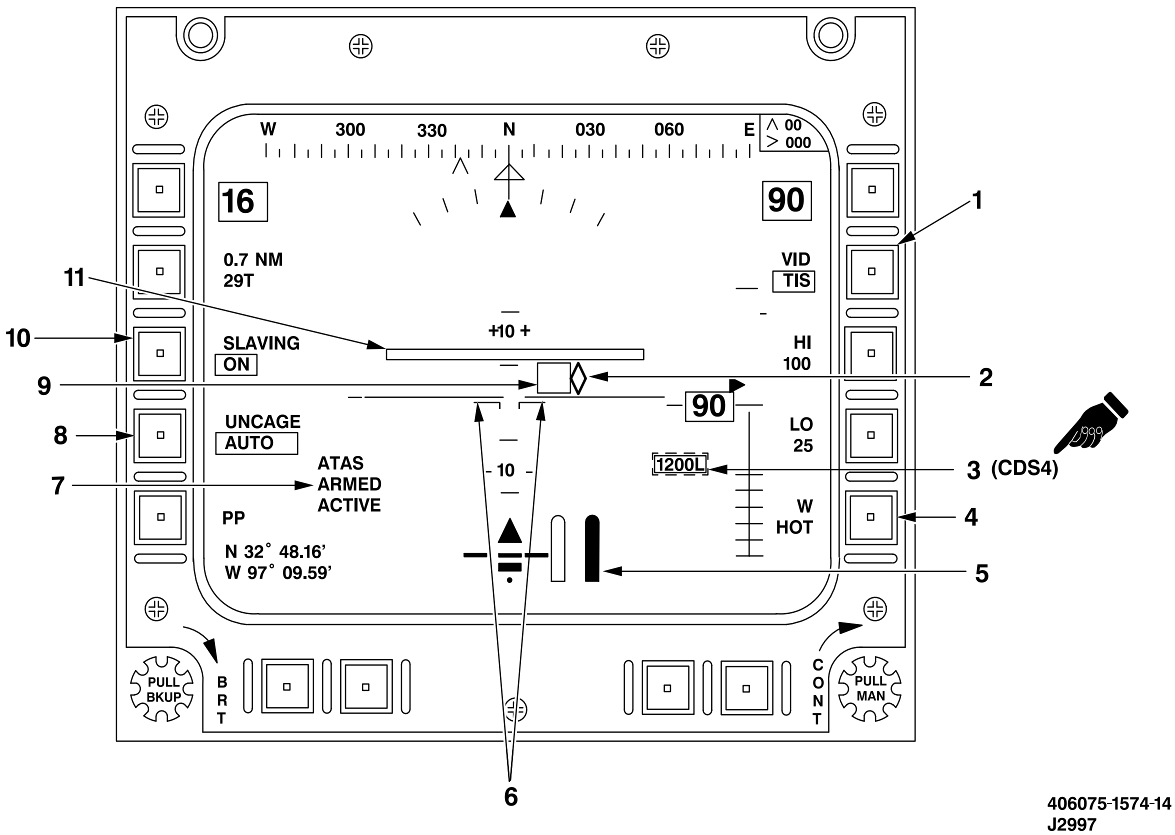
(CDS4) Normal VSD weapons pages are no longer available for display.

1.	MMS LOS Cue	Shows MMS azimuth and elevation orientation.
2.	UNCAGE key	Selects AUTO/MANUAL mode.
3.	WEAPONS STATUS	Indicates OFF, SAF or ARM.

(CDS3)

4.	SLAVING key	Selects ON/OFF for seeker slaving to the MMS.

Figure 4-56. Normal ATAS VSD



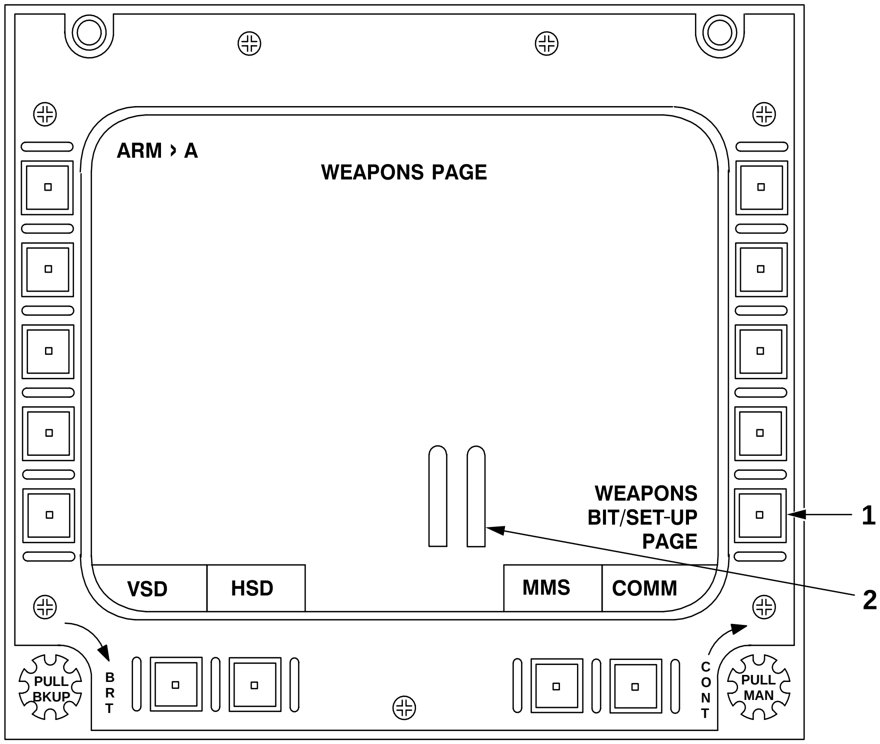
CONTROL/INDICATOR	FUNCTION
1. VID key	Selects video source toggling between OFF, TV, and TIS.
2. MMS LOS Cue	Shows MMS azimuth and elevation orientation relative to the reference indicator.
3 **(CDS4)** Range-to-Target	Range to target is boxed if current laser range is being displayed. Range is not boxed if last valid laser range is used. Display is boxed while laser is firing and for 5 seconds after laser firing is stopped. Source is "L" laser range, "P" prepoint range, and "N" distance to direct fly-to-wpt.
4. W HOT/B HOT/NORM/INV key	With TIS selected, toggles between W HOT and B HOT. With TV selected at R-2, on IMSP/MMS configuration, toggles between NORM (normal video) and INV (inverted video).

Figure 4-57. ATAS Sparse VSD (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
5. ATAS Missile symbology	Displays current missile status. An open missile indicates missile present. A solid missile indicates missile has been selected and is active. A cross through a launcher pair indicates it is bad.
6. Helicopter Reference Symbol	Reference point to which the superelevation bar is aligned during the superelevation maneuver.
7. Weapon Status	Indicates SAFED/ARMED. ACTIVE displays when pilot cyclic MSL ACTVT switch is pressed.
8. UNCAGE key	Selects AUTO/MANUAL Mode.
9. Tracking reticle	Displays when seeker is uncaged as enabled by pressing Uncage/Fire switch to first detent. Tracking reticle appears and either overlays or is adjacent to MMS LOS cue. Tracking reticle moves with MMS LOS cue if missile is locked onto target being tracked by MMS. Conversely, independent movement indicates missile is not tracking same object as MMS.
10. R SLAVING key	Selects SLAVING ON/OFF.
11. Super elevation cue	Displays after WPN-FIRE switch has been depressed to first detent and missile has locked on target.

Figure 4-57. ATAS Sparse VSD (Sheet 2 of 2)



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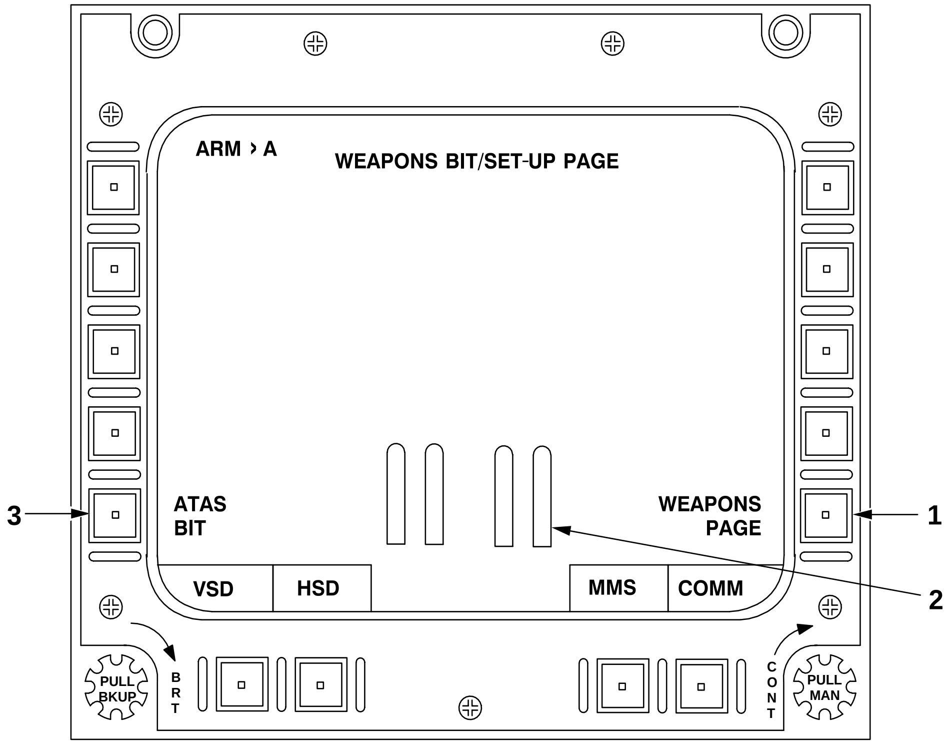
J1151

CONTROL/INDICATOR	FUNCTION
1. WEAPONS BIT/SET-UP PAGE key	Selects WEAPONS BIT/SET-UP PAGE.
2. Missile symbology	Indicates missile presence and launcher status. If symbol is shaded in, the missile is active. Any launchers that have failed the BIT are indicated by crossing out the failed launcher.

Figure 4-58. ATAS WEAPONS PAGE



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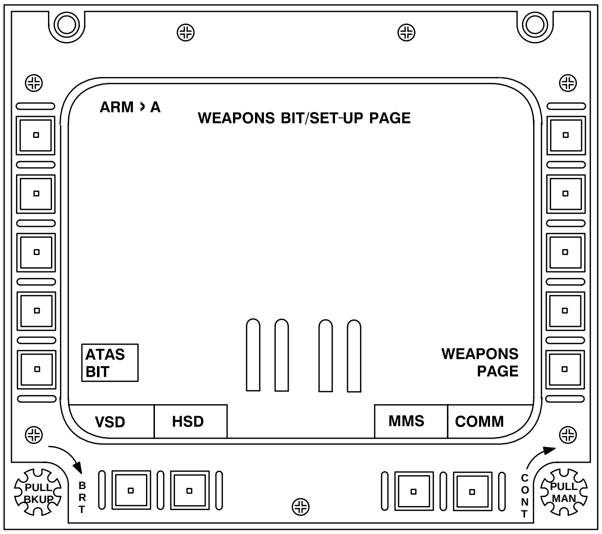
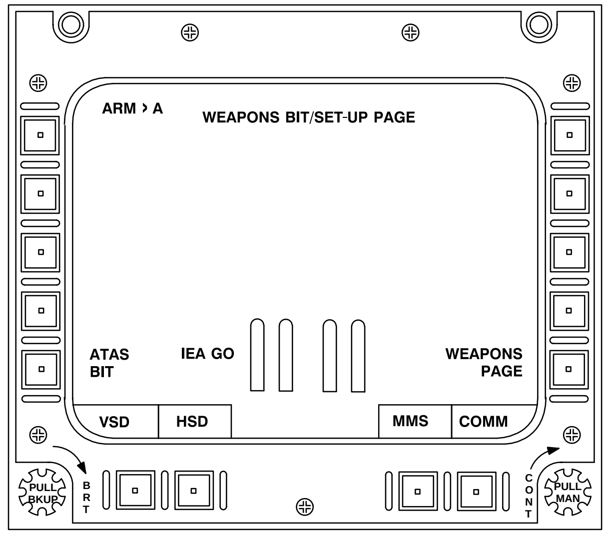
J1151

CONTROL/INDICATOR	FUNCTION
1. WEAPONS PAGE key	Selects WEAPONS PAGE.
2. Missile Status	Indicates number of missiles and launcher status. If symbol is shaded in, the missile is active. Any launchers that have failed the BIT are indicated by crossing out the failed launcher.
3. ATAS BIT key	Initiates ATAS BIT. ATAS BIT boxes to show BIT in progress. Status is shown to the right of the ATAS BIT legend.

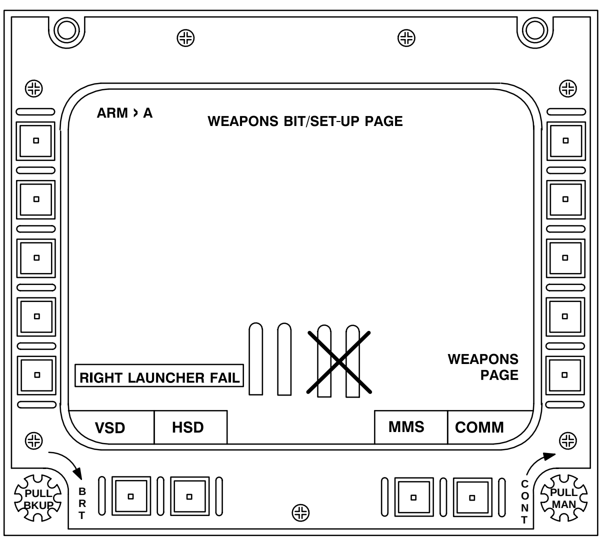
Figure 4-59. ATAS WEAPONS BIT/SET-UP PAGE



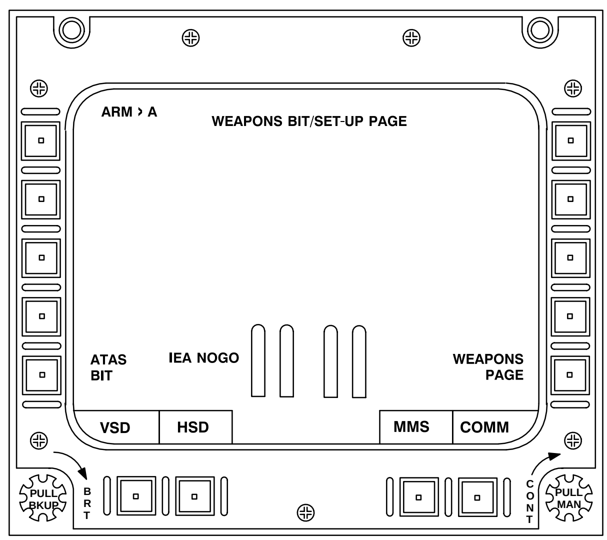
ATAS BIT IN PROGRESS



SUCCESSFUL ATAS BIT



SUCCESSFUL ATAS BIT
(WITH LAUNCHER FAILURE)



UNSUCCESSFUL ATAS BIT

406075-32
J1151

Figure 4-60. ATAS BITs

(1) The MMS method of engagement will not be available.

(2) AUTO will be selected.

(3) Missile step not available.

e. Operation.

Paragraphs 4-72 through 4-79 contain the procedural steps necessary to operate the system. ATAS launch sequence is shown in figure 4-61.

4-72. ATAS PROCEDURES.

4-73. EXTERIOR FUSELAGE CHECK — ATAS.

4-74. INTERMEDIATE FUSELAGE.

WARNING

Do not touch the vicinity of the IR dome if it is cracked or shattered (basic CFT and missile only); mercury thallium liquid may have been released. This material is toxic to unprotected skin. Avoid all contact with the released material unless protective equipment is worn, such as: a respirator, impervious protective gloves, and chemical goggles. If the skin or eyes are exposed to the spilled material, immediately flush with water. Any person exposed to the released material should be promptly referred to a physician.

1. Ejector rack — Check; impulse cartridges installed.

2. Coolant bottle — Check for 4500 to 6000 psi. If less than 3500 psi, coolant bottle must be recharged.

3. Missile launcher — Check.

O 4. Missile — Check as follows:

O a. Blowout disk — Check.

b. Electrical connections — Check.

c. Humidity indicator — Check (green).

O d. IR cover — Remove.

e. Seeker head — Check.

f. Missile type — Record missile type installed on each store station as BLOCK 1 or all-other Stinger. See WARNING in In-Flight Procedures paragraph on how to positively identify Block 1 missiles.

4-75. ENGINE RUNUP.

1. MASTER switch — STBY.

O 2. PDU BIT — Accomplish.

3. WEAPON SEL switch — Select WEAPONS PAGE.

4. R-5 — Press to select WEAPONS BIT/SET-UP PAGE.

5. ATAS BIT — Press.

4-76. IN-FLIGHT PROCEDURES.

a. RMP MISSILE.

WARNING

ATAS missiles are not to be launched when ambient temperature exceeds 140 °F. The missile could deflagrate when the motor ignites.

CAUTION

To prevent damage to Captive Flight Trainer (CFT) or missiles, do not exceed 5 minutes of continuous activation for the basic MSL and 3 minutes for the RMP MSL.

1. CPG.

NOTE

- MMS prepoint should be checked prior to using the MMS method of engagement. If the prepoint target is not in the MMS NFOV, an Airborne Calibration should be performed.
- Estimated range must be within missile's capability.
- The CPG should monitor missile tone during the engagement process, alerting the pilot to momentary breakups in tone. Breakups in tone indicate that the missile has a marginal track of the target and should not be fired. This is particularly important during the superelevation maneuver.

a. Target — Establish target track with MMS.

b. Laser range finding — Complete as desired.

c. WPN/ASE switch — Select ATAS sparse weapons VSD.

d. **R** SLAVING key — Select seeker slaving mode as required.

e. UNCAGE key — Select uncage mode as required.

f. MASTER switch — ARMED.

2. Pilot.

a. WEAPON SEL switch — Select ATAS.

b. R SLAVING mode — Verify as required.

c. UNCAGE mode — Verify as required.

d. MSL ACTVT switch — Press.

e. Maneuver helicopter to place MMS LOS cue (diamond) over the weapons reference symbol (cross at center of display).

f. R If Slaving is enabled, place weapons reference symbol to within 6 degrees of MMS LOS cue.

NOTE

The seeker slaving mode, when equipped and enabled, allows the pilot to acquire without meticulous alignment of the helicopter (hence missile) to the target. Aligning the weapons reference symbol to within 6 degrees of the MMS LOS cue prior to pressing the WPN-FIRE switch to the first detent is normally adequate to acquire the target. Firing constraints remain unchanged in the seeker slaving mode.

g. WPN-FIRE switch — Press to first detent and hold to uncage missile seeker.

NOTE

Noise from an operating heater will degrade radio and intercom communication and the ability of the pilot and CPG to properly distinguish ATAS acquisition tones.

h. Verify — Tracking reticle stable with MMS LOS cue.

i. Verify — ATAS audio tone.

NOTE

- Do not activate missile until target has been identified and engagement is imminent. A fully charged coolant bottle (6000 psi) will provide forty 45-second engagements. Do not exceed 5 minutes of continuous activation for the basic MSL and 3 minutes for the RMP MSL.
- Low pressure (less than 3500 psi) in the coolant bottle causes LOW to display on the PDU on the side of the PDU on which the launcher is located, and a LEFT COOLANT LOW or RIGHT COOLANT LOW advisory to display on the MFD.
- Exact coincidence may not occur. However, helicopter movement resulting in stabilized relative position of MMS LOS CUE and tracking reticle indicates that the missile and the MMS are tracking the same target.
- Momentary breakups in tone indicate that the missile has a marginal track on the target and should not be fired.

j. Pitch attitude — Super-elevate the helicopter until the superelevation bar aligns with the top of the helicopter reference symbol. Verify that an uninterrupted high tone is present.

k. WPN-FIRE switch — Press and hold for one second.

3. MASTER switch — Set as required.

b. BLOCK 1 MISSILE.

WARNING

- **Stinger missile types (Block 1 and RMP) shall not be mixed in any mission load-out. It is absolutely imperative that the aircrew is aware of which Stinger missile type has been uploaded. Firing an RMP missile without superelevation may result in the missile's early contact with the ground and subsequent debris striking the helicopter. Block 1 missiles are stenciled with 1/2-inch yellow block letters (Block 1) on the exterior of the tube. The Block 1 stencil is approximately mid-way between the sight frame and aft end of the tube.**
- **A Block 1 MSL shall not be fired if the pitch ladder indicates the helicopter nose is pitched down more than 5 degrees because terrain impact is possible.**
- **ATAS missiles are not to be launched when ambient temperature exceeds 140 °F. The missile could deflagrate when the motor ignites.**

CAUTION

To prevent damage to the captive flight trainer (CFT) or missiles, do not exceed 3 minutes of continuous activation for the Block 1 MSL.

1. CPG.

NOTE

- Superelevation is not required when firing a Block 1 missile. However, all other visual and audio constraints apply.
- MMS prepoint should be checked prior to using the MMS method of engagement. If the prepoint target is not in the MMS NFOV, an Airborne Calibration should be performed.
- Estimated range must be within missile's capability.
- The CPG should monitor missile tone during the engagement process, alerting the pilot to momentary breakups in tone. Breakups in tone indicate that the missile has a marginal track of the target and should not be fired. This is particularly important during the 2 seconds immediately before firing a Block 1 missile.
- The CPG should monitor the pitch ladder during the engagement process, alerting the pilot if the helicopter nose is pitched down more than 5 degrees. If this condition exists, the missile shall not be fired.

   a. Target — Establish target track with MMS.

   b. Laser range finding — Complete as desired.

   c. WPN/ASE switch — Select ATAS sparse weapons VSD.

   d. R SLAVING key — Select seeker slaving mode as required.

   e. UNCAGE key — Select uncage mode as required.

   f. MASTER switch — ARMED.

2. Pilot.

   a. WEAPON SEL switch — Select ATAS.

   b. R SLAVING mode — Verify as required.

   c. UNCAGE mode — Verify as required.

   d. MSL ACTVT switch — Press.

   e. Maneuver helicopter to place MMS LOS cue (diamond) over the weapons reference symbol (cross at center of display), while maintaining a minimum 10-foot AGL hover.

NOTE

The seeker slaving mode, when equipped and enabled, allows the pilot to acquire without meticulous alignment of the helicopter (hence missile) to the target. Aligning the weapons reference symbol to within 6 degrees of the MMS LOS cue prior to pressing the WPN-FIRE switch to the first detent is normally adequate to acquire the target. Firing constraints remain unchanged in the seeker slaving mode.

   f. R If Slaving is enabled, place weapons reference symbol to within 6 degrees of MMS LOS cue.

g. WPN-FIRE switch — Press to first detent and hold to uncage missile seeker.

NOTE

Noise from an operating heater will degrade radio and intercom communication and the ability of the pilot and CPG to properly distinguish ATAS acquisition tone.

h. Verify — Tracking reticle stable with MMS LOS cue.

i. Verify — ATAS audio tone.

NOTE

- Do not activate missile until target has been identified and engagement is imminent. A fully charged coolant bottle (6000 psi) will provide forty 45-second engagements. Do not exceed 5 minutes of continuous activation for the basic MSL and 3 minutes for the RMP and Block 1 MSL.
- Low pressure (less than 3500 psi) in the coolant bottle causes LOW to display on the PDU on the side of the PDU on which the launcher is located, and a LEFT COOLANT LOW or RIGHT COOLANT LOW advisory to display on the MFD.
- Exact coincidence may not occur. However, helicopter movement resulting in stabilized relative position of MMS LOS CUE and tracking reticle indicates that the missile and the MMS are tracking the same target.
- Momentary breakups in tone indicate that the missile has a marginal track on the target and should not be fired.
- Superelevation is not required when firing a Block 1 missile. However, all other visual and audio constraints apply.

j. Pitch attitude — Check pitch ladder to ensure that helicopter nose is not pitched down more than 5 degrees before firing. Verify that an uninterrupted high tone is present.

k. WPN-FIRE switch — Press and hold for one second.

3. MASTER switch — Set as required.

4-77. BEFORE LEAVING HELICOPTER PROCEDURES.

1. Ejector rack safety pin(s) — Install.
2. IR cover(s) — Install on remaining missile(s).

4-78. MALFUNCTION — ATAS MISFIRE.

A misfire is a missile that has been fired but the launch motor does not ignite.

NOTE

After pressing the WPN-FIRE switch to the second detent and releasing it, the missile symbol on the MFD and/or the PDU will disappear or the missile will be deselected (unshaded on the MFD, no underline on the PDU) without accompanying launch motor ignition. This indicates a misfire has occurred.

Proceed as follows:

1. Position the aircraft so that the missile is oriented downrange for a period of 10 minutes after attempting to fire.
2. Upon landing the aircraft — Notify armament personnel who will download the missile after 10 minutes have elapsed since misfire occurred. Missile is now the responsibility of the Explosive Ordnance Disposal (EOD) personnel.

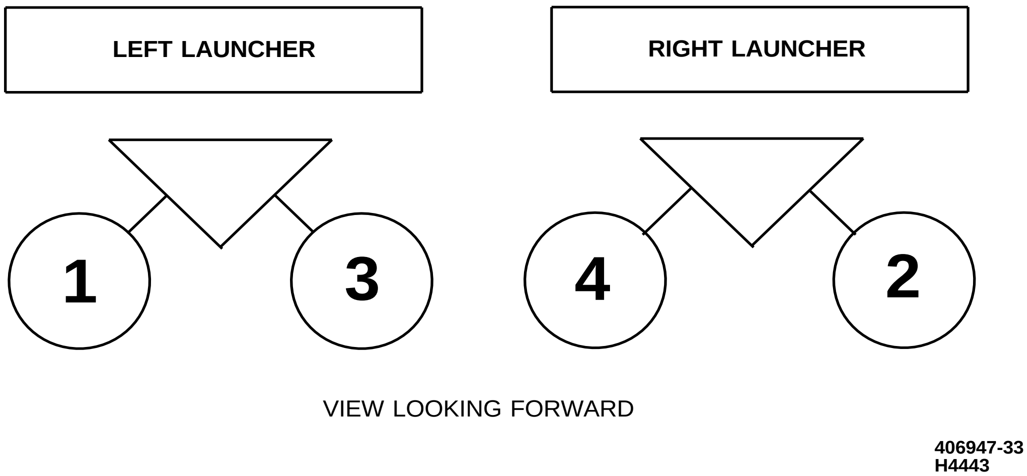


Figure 4-61. ATAS Missile Launch Sequence

4-79. (CDS2) ISP/R R MCPU FAILURE — BACKUP MODE OPERATION.

WARNING

ATAS missiles shall not be launched when ambient temperature exceeds 140 °F (60 °C). The missile could deflagrate when the motor ignites.

1. CPG.

a. MASTER switch — ARMED.

2. Pilot.

NOTE

- Estimated range must be within missile capability.
- The CPG should monitor missile tone during the engagement process for momentary breakups in tone. Breakups in tone indicate that the missile has a marginal track of the target and should not be fired. This is particularly important during the superelevation maneuver.

a. WEAPON SEL switch — Select ATAS.

NOTE

- Do not activate missile until target has been identified and engagement is imminent. A fully charged coolant bottle (6000 psi) will provide forty 45-second engagements.
- Low pressure (less than 3500 psi) in the coolant bottle causes LOW to display on the PDU on the side of the PDU that the launcher is located.

b. MSL ACTVT switch — Press.

c. Maneuver helicopter to ensure target is centered inside ATAS target acquisition reticle.

d. WPN-FIRE switch — Press to first detent and hold.

NOTE

- Exact coincidence may not occur. A displaced tracking reticle which moves with the target, accompanied by a high uninterrupted tone, indicates missile track.
- Momentary breakups in tone indicate that the missile has a marginal track on the target and should not be fired.

e. Verify — Tracking reticle coincident with target, uninterrupted high missile tone.

f. Pitch attitude — Super-elevate helicopter until bottom of tracking reticle meets superelevation lines on PDU or superelevation cue is aligned with the top of the aircraft reference symbol on the MFD. Verify high uninterrupted tone.

g. WPN-FIRE switch — Press and hold for one second.

3. CPG MASTER switch — STBY.

4-80. HELLFIRE MISSILE SYSTEM.

The HELLFIRE missile system (HMS) (fig. 4-62) is an air-to-surface, laser guided missile system. The system is capable of launching four HELLFIRE missiles at targets identified by ground or airborne designators. The system has a continuous or on-call built-in test (BIT) designed to verify operational integrity. The missile is a point target weapon designed to destroy armored or reinforced targets. It is comprised of one or two launchers containing up to two missiles each, and the necessary components, software, and switches to operate the system. The HELLFIRE launchers can be jettisoned using the JETTISON switches located on the ACP. The weapon system except for the launcher is electrically controlled and powered by the 28 Vdc essential bus. The HELLFIRE launcher uses one phase of the 115 Vac generator 3-phase essential bus. Circuit protection is provided by the HELLFIRE ARM, HELLFIRE CONTR, HELLFIRE PWR, HELLFIRE AC, and the ARMT CONTR circuit breakers located on the aft centerpost circuit breaker panel. The HELLFIRE launcher(s) are mounted on the ejector rack. They may be installed on one or both sides. Symmetrical loading is not required.

NOTE

In the event of an AC generator failure, the HMS launcher loses AC power and no missiles can be launched.

a. Weapon Controls.

Weapon controls are shown in figure 4-62. Control/ indicator functions are shown in figures 4-63 and 4-64.

b. Weapon Configuration.

The HELLFIRE missile system can be configured for operation by pressing the WEAPON SEL switch up selecting the WEAPONS PAGE (fig. 4-65). The CPG can call up the WEAPONS PAGE by positioning the WPN/ASE switch momentarily to the WPN position on the CPG panel.

c. HELLFIRE BIT.

The HELLFIRE BIT is selected by pressing L-1 on the WEAPONS BIT/SET-UP PAGE (fig. 4-66). The HELLFIRE BIT routine checks the remote HELLFIRE Electronics (RHE), the launchers, and the missiles. The RHE will test only the components that are present. RHE GO (BIT passed) or RHE NO-GO (BIT failed) will be displayed next to HELLFIRE BIT on the MFD. If RHE GO is displayed and no error messages are seen under the missile symbol the HMS has successfully passed BIT.

(1) If any launcher fails BIT, the launcher fail message is displayed by placing an X over the missile symbols.

(2) Missile BIT checks and displays the status and inventory of all installed missiles. The missiles are spun up and tested, which takes approximately 30 seconds at nominal temperatures. At cold temperatures, the test time may increase up to 47 seconds. If the missiles pass BIT, then the inventory of missiles installed is displayed in the position that the missiles are located on the helicopter.

(3) If the missile fails BIT, the message BF is displayed directly under that missile symbol. In the event of a BF indication, and if time allows, the missile may be unseated and reseated on the launcher after the system has been powered down. BIT can then be rerun.

(4) Missile BIT status is displayed beneath each missile symbol and is continuously monitored for changes. The following additional FAIL messages may be displayed during BIT:

(a) MF — Displays if the RHE has detected the missile as failing after it was selected for spin up, the missile battery has failed, the missile failed to accept a laser code, or if the missile failed to uncage.

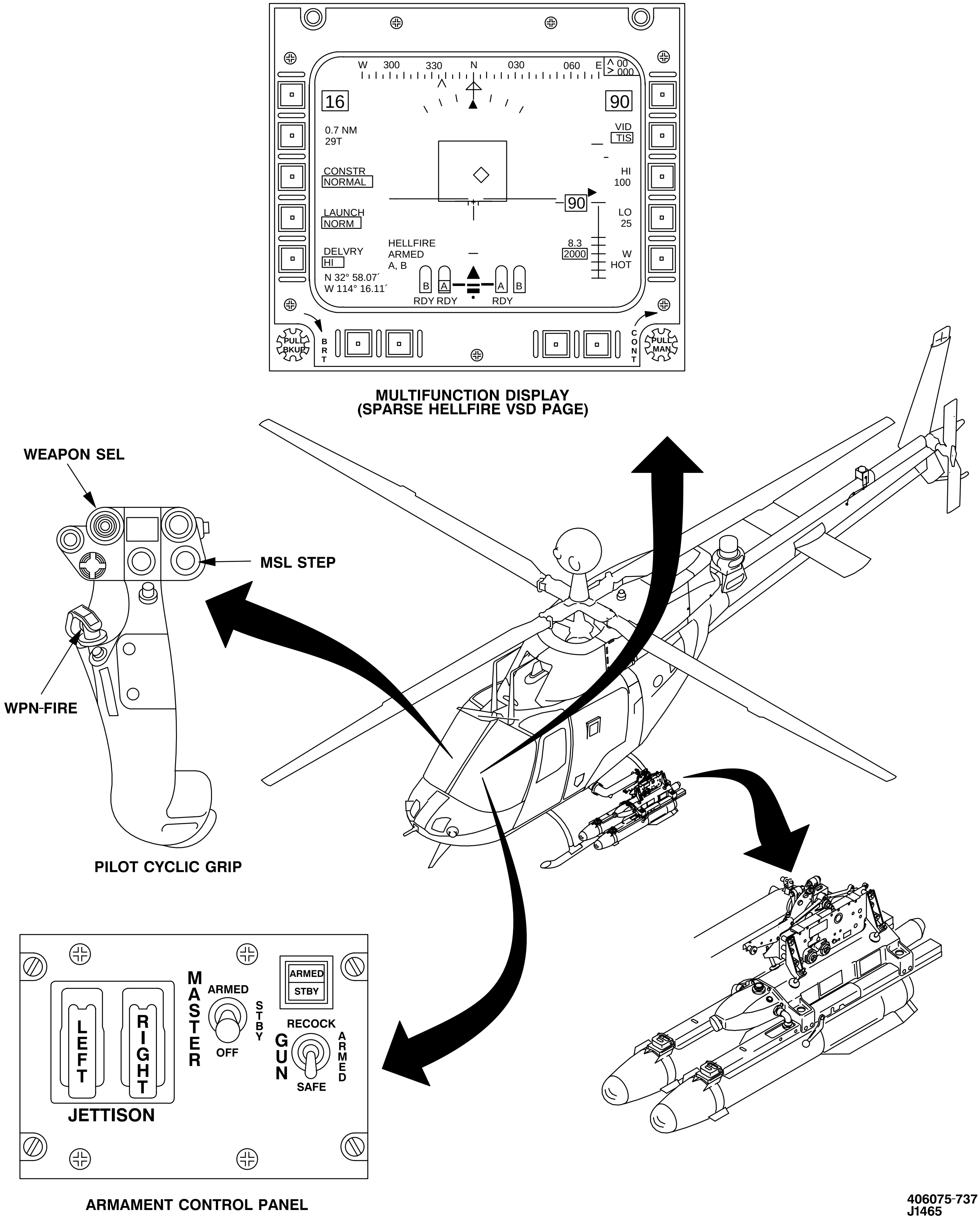
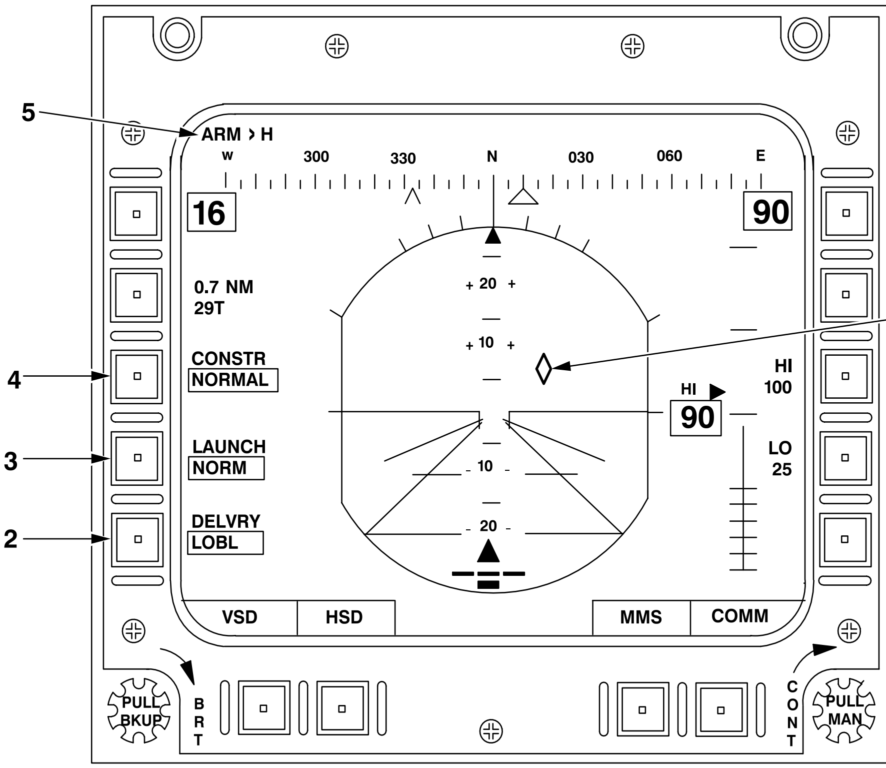


Figure 4-62. HELLFIRE Missile System (HMS)



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CONTROL/INDICATOR	FUNCTION

NOTE

(CDS4) Normal weapons VSD pages are no longer available for display.

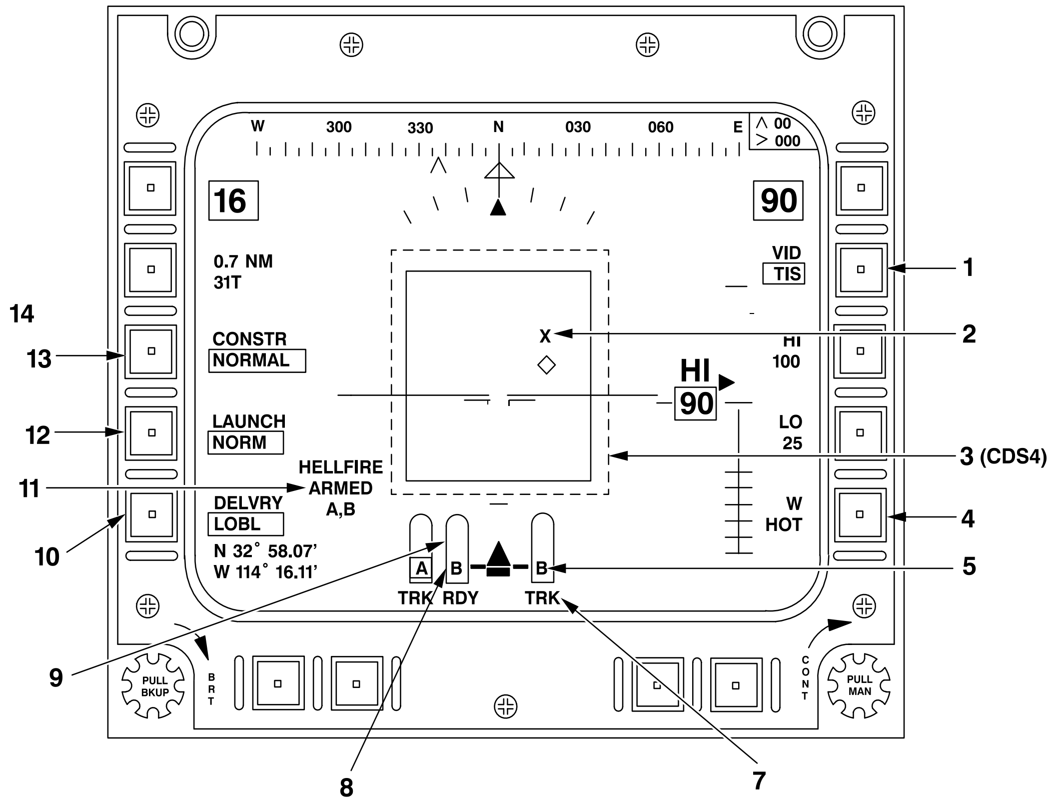
1. MMS LOS Cue	Shows MMS azimuth and elevation orientation.
2. DELVRY key	Selects delivery modes for HELLFIRE missiles (rotary function). LOBL — Missile acquires and locks on coded laser energy prior to launch. LO — Missile trajectory low profile to clear terrain mask and locks on coded laser energy as missile closes with target. HI — Missile trajectory high profile clears terrain mask and locks on coded laser energy as missile closes with target. DIR — Missile trajectory direct when ceiling is too low for successful LOBL firing.
3. LAUNCH key	Selects launch sequence for HELLFIRE missiles (rotary function). STBY — System in standby. MAN — Missile is manually selected for firing. NORM — Missiles step in normal sequence when fired. RIPL — Missiles are fired in rapid succession with alternating laser codes.

Figure 4-63. Normal HELLFIRE VSD (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
4. CONSTR key	Selects HELLFIRE missile constraints (toggle function). NORMAL — HELLFIRE launches when in constraint. ORIDE — HELLFIRE may be launched when safety constraints are met.
5. WEAPONS STATUS	Indicates OFF, SAF or ARM.

Figure 4-63. Normal HELLFIRE VSD (Sheet 2 of 2)



CONTROL/INDICATOR	FUNCTION
1. VID key	Allows selection of video background source for the HELLFIRE sparse VSD. Toggles between OFF, TV, and TIS.
2. HELLFIRE seeker cue	Indicates HELLFIRE seeker position.
3. HELLFIRE constraints box	Displays HELLFIRE constraints.
	LOAL azimuth constraint drivers are prioritized as follows: 1. MMS LOS, with MMS mode select switch in PREPT. 2. Heading to DIR WPT, if in DIR WPT navigation mode.
	LOAL range constraint drivers are prioritized as follows: 1. Current laser range (boxed). 2. Distance to PREPT waypoint with MMS mode select switch in PREPT and MMS slaved to PREPT (Prepoint, Prepoint). 3. Distance to DIR WPT, when in DIR WPT navigation mode.
	LOBL azimuth constraint driver. MMS LOS, when receiving properly coded laser energy.
(CDS4)	LOBL/LOAL constraints box size doubled. Constraints box now represents 20° (LOBL) and 7.5° (LOAL).

NOTE

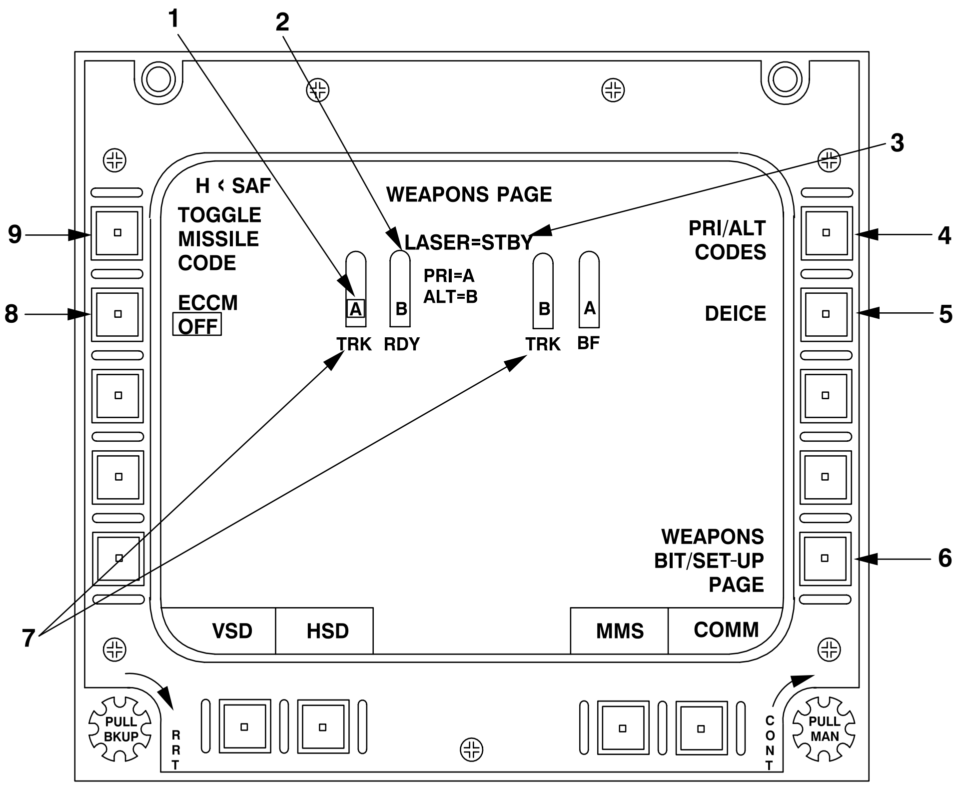
R Range constraint drivers do not apply. Proper range to the target should be confirmed by the crew.

Figure 4-64. HELLFIRE Sparse VSD (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION
4. W HOT/B HOT/NORM/INV key	When TIS is selected, toggles between W HOT and B HOT. With TV selected at R-2, on IMSP/MMS configuration, toggles between NORM (normal video) and INV (inverted video).
5. Laser Code	Displays laser code selected for missile.
6. Range to target	Displayed boxed if current range. **“**L**”** indicates laser range; **“**P**”** indicates prepoint range; **“**N**”** indicates distance to direct fly to waypoint. **(CDS4)** Range is boxed if current laser range is being displayed. Range is not boxed if last valid laser range is used. Display is boxed while laser is firing and for 5 seconds after laser firing has stopped.
7. HELLFIRE missile status	Displays current missile status. Blank — Missile not selected. SEL — Missile selected. RDY — Missile ready. TRK — Missile tracking. BF — Missile failed BIT. MF — Missile failed/Missile battery failed/Missile failed to accept laser code/Missile failed to uncase. UNL — Missile unlatched. SF — Remote terminal bad/Station failed. HF — Hangfire in progress/Missile hangfired.
8. Missile selected box	Indicates missile selected for firing.
9. Missile symbology	Indicates missile presence.
10. DELVRY key	Selects delivery modes for HELLFIRE missiles (rotary function). LOBL — Missile acquires and locks on coded laser energy prior to launch. LO — Missile trajectory low profile to clear terrain mask and locks on coded laser energy as missile closes with target. HI — Missile trajectory high profile clears terrain mask and locks on coded laser energy as missile closes with target. DIR — Missile trajectory direct when ceiling is too low for successful LOBL firing.
11. Status and PRI/ALT laser codes	Indicates primary and alternate codes. If no codes are present, only the comma will be displayed. Also provides status (ARMED, SAFE, or OFF).
12. LAUNCH key	Selects launch sequence for HELLFIRE missiles (rotary function). STBY — System in standby. MAN — Missile is manually selected for firing. NORM — Missiles step in normal sequence when fired. RIPL — Missiles are fired in rapid succession with alternating laser codes.
13. CONSTR key	Selects HELLFIRE missile constraints (toggle function). NORMAL — HELLFIRE launches when in constraint. ORIDE — HELLFIRE may be launched without meeting launch constraints.
14. HELLFIRE time-of-flight	Indicates missile time-of-flight based on pressure altitude and temperature.

Figure 4-64. HELLFIRE Sparse VSD (Sheet 2 of 2)



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CONTROL/INDICATOR	FUNCTION
1. Laser Code	Indicates laser code assigned for the missile.
2. Missile Symbology	Indicates missile presence.
3. Laser	Indicates MMS laser status/code. PRI=Primary Missile Code. ALT=Alternate Missile Code.
4. PRI/ALT CODES key	When pressed legend blanks and is replaced by a cursor allowing laser codes to be entered for priority assignment.

NOTE

PRI/ALT displays only if launch mode is in STBY.

5. DEICE key	When pressed DEICE will box and protective domes on missiles will jettison.

Figure 4-65. HELLFIRE WEAPONS PAGE (Sheet 1 of 2)

(Cont)

CONTROL/INDICATOR	FUNCTION

NOTE

DEICE displays only if DELVRY mode is LOBL.

6.	WEAPONS BIT/SET-UP PAGE key	Selects WEAPONS BIT/SET-UP PAGE.
7.	MSL STATUS	OFF-ECCM disabled. Blank — Missile not selected. SEL — Missile selected. RDY — Missile ready. TRK — Missile tracking. BF — Missile failed BIT. MF — Missile failed/Missile battery failed/Missile failed to accept laser code/Missile failed to uncase. UNL — Missile unlatched. SF — Remote terminal bad/Station failed. HF — Hangfire in progress/Missile hangfired.
8.	ECCM key	Toggles ECCM ON or OFF.

NOTE

ECCM disables only if launch mode is not in STBY.

9.	TOGGLE MISSILE CODE key	Toggles switching primary and alternate laser codes and missile selected.

Figure 4-65. HELLFIRE WEAPONS PAGE (Sheet 2 of 2)

(b) UNL — Displays if the RHE has detected this missile as unlatched on the launcher rail.

(c) SF — Displays if the RHE has detected the missile launch station for that missile has failed, or if the remote terminal is bad.

(5) In addition to the missile status display as a direct result of the BIT, the following missile status messages may be displayed:

(a) SEL — Displays if the missile has been selected from inventory and is in the process of being made ready. This may take up to 30 seconds.

(b) RDY — Displays if the missile has completed spin up, has been coded with a laser code and is in a ready condition.

(c) A — Displays if the missile has been coded with laser code A, or any other laser code selected through H, and has been selected by the RHE as the next missile to be launched.

(d) TRK — Displays when the missile has locked on a coded laser spot, is tracking the laser energy, and the RHE has selected the missile as the next missile to be launched.

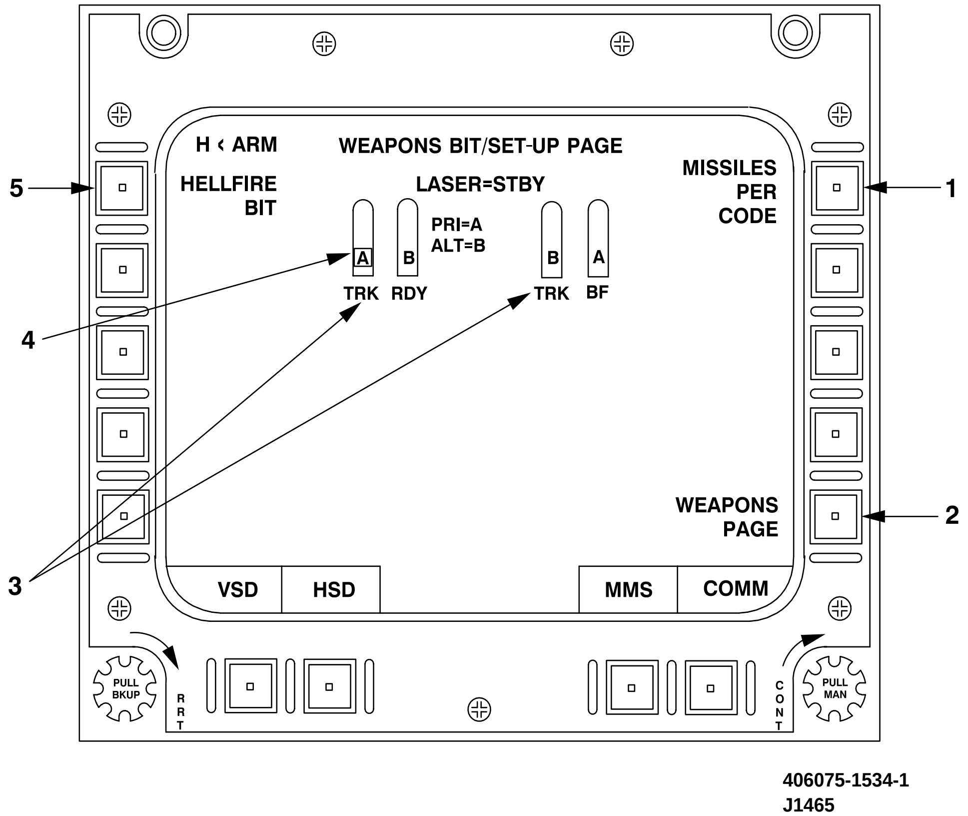
(e) HF — Displays if the missile is in the process of hangfiring or has hangfired.

(6) Laser status is displayed on both WEAPONS PAGE and WEAPONS BIT/SET-UP PAGE.

(a) LASER A — Displays when laser code A has been assigned to the laser designator. If the designator is OFF, in Standby, or in the RANGE mode, this is annunciated.

(b) PRI A — Displays when laser code A has been selected as the primary laser code.

(c) ALT B — Displays when laser code B has been selected as the alternate laser code.



CONTROL/INDICATOR	FUNCTION
1. MISSILE PER CODE key	When pressed legend will blank allowing up to three missiles to be assigned per code.
2. WEAPONS PAGE key	Selects WEAPONS PAGE.
3. MSL STATUS	OFF-ECCM disabled.
	Blank — Missile not selected. SEL — Missile selected. RDY — Missile ready. TRK — Missile tracking. BF — Missile failed BIT. MF — Missile failed/Missile battery failed/Missile failed to accept laser code/Missile failed to uncase. UNL — Missile unlatched. SF — Remote terminal bad/Station failed. HF — Hangfire in progress/Missile hangfired.
4. BOX	Indicates next missile selected for firing.
5. HELLFIRE BIT key	Initiates HELLFIRE BIT.

Figure 4-66. HELLFIRE WEAPONS BIT/SET-UP PAGE

(d) PRI/ALT 1212 — Displays when the primary or alternate laser code has been designated 1212 as a manual code.

b. (CDS2) ISP Failure. The HMS is not functional when the ISP has failed.

R R MCPU Failure. The HMS is not functional when the R MCPU has failed.

4-81. HELLFIRE PROCEDURES.

4-82. EXTERIOR FUSELAGE CHECK — HELLFIRE.

4-83. INTERMEDIATE FUSELAGE.

1. Ejector rack — Check; impulse cartridge installed.

2. Missile launcher — Check as follows:

   a. SAFE/ARM switch — SAFE.

   b. Umbilical connector — Check connected to launcher. Pullaway cable connected to rack and connector.

   c. Missiles — Check missile security on rail and that holdback release handle is in the LATCH position.

3. Rails — Check as follows:

   a. Grounding straps — Check.

   b. Electrical cover plate — Down (If missile not installed).

CAUTION

If only one missile is loaded on a launcher, the missile shall be loaded on the outboard launcher rail.

   c. Missile load configuration — Per mission requirements.

   d. Swaybrace and jamnuts — Check.

O 4. Missiles — Check as follows:

WARNING

If deice cover (environmental protective cover) is installed, aircraft doors must be installed and vents placed in the closed position to prevent injury to personnel from shattered frangible dome.

   a. Seeker dome — Clean and undamaged.

   b. Deice dome cover — Check dome cover installation on missiles and harness connection to launcher rail.

   c. Strakes/wings/control surfaces — Check.

   d. Missile body — Check.

4-84. ENGINE RUNUP.

1. MASTER switch — STBY.

2. WEAPON SEL switch — Select WEAPONS PAGE.

NOTE

- The laser codes are entered into the system from the MFK onto the Laser Code List page on the MMS. No two addresses should have the same laser code.
- When entering codes into the HMS the first digit must be 1; the second, third, and fourth digits can be any number from 1 through 8. The system will not accept the numbers 9 and 0.

3. R-1 — Press to enter PRI/ALT laser codes.

4. R-5 — Press to select WEAPONS BIT/SET-UP PAGE.

5. R-1 — Press to enter MISSILE PER CODE data.

NOTE

If the number of missiles per code entered is greater than the number of missiles available, an INVALID COMMAND advisory will be displayed.

6. L-1 — Press to perform HELLFIRE BIT.

4-85. IN-FLIGHT PROCEDURES — LOBL/ LOAL (AUTONOMOUS/REMOTE).

1. CPG.

   a. Target handover — Coordinate as required.

   b. Target — Track/Locate/Prepoint as required.

   c. WPN/ASE switch — Press as required to display HELLFIRE Sparse VSD.

   d. CONSTR key — NORMAL.

   e. LAUNCH key — Select mode as required.

NOTE

With one missile installed on the outboard rail, selecting NORM will result in an INVALID COMMAND advisory due to attempting to select the inboard missile first. With only one missile loaded, select MAN or scroll through selections and back to NORM to select the outboard missile on the primary code.

   f. DELVRY key — Select mode as required.

   g. Constraints driver(s) — Set as required.

   h. MASTER switch — ARMED.

2. Pilot.

   a. WEAPON SEL switch — Select HELLFIRE sparse VSD.

   b. CONSTR — NORMAL.

   c. LAUNCH mode — Verify as required (MAN/NORM/RIPL).

   d. DELVRY mode — Verify as required (DIR/LO/HI/LOBL).

   e. Missile symbol — Displays RDY and proper laser code (priority channel).

   f. Constraints box — Displayed as required.

3. CPG/Remote designator — Lase target as required.

NOTE

Except for AGM-114F missiles, if properly coded laser energy is present at the missile seeker, the RHE will automatically default to LOBL.

4. Pilot.

   a. Position and orient helicopter as required.

NOTE

- For LOBL engagements, CONSTR ORIDE may be required if the MMS LOS is not in coincidence with the HELLFIRE missile seeker cue due to inaccurate MMS airborne calibration. Ensure the missile is locked on target and not on backscatter before firing with CONSTR ORIDE selected.
- For LOAL engagements, CONSTR ORIDE may be required based on the tactical situation. Ensure the aircraft is properly oriented toward the target before firing with CONSTR ORIDE selected.

   b. Verify the missile is properly tracking laser energy (LOBL) and within constraint requirements.

   c. WPN-FIRE switch — Press to second detent.

   d. Steps a. through c. — Repeat as required.

5. MASTER switch — Set as required.

SECTION III. CARGO HANDLING

4-85. TAKEOFF. EXTERNAL CARGO HOOK OPERATIONS.

NOTE

Better directional control may be realized by avoiding relative winds from the right front quadrant while performing external cargo operations.

1. Hover helicopter at sufficient height to allow crewmember to discharge static electricity and to attach sling to cargo hook.

2. Ascend vertically directly over cargo, then slowly lift cargo from surface.

3. Pedals — Check for adequate directional control.

4. Hover power — Check TORQUE required to hover with external load.

5. Take off into wind, if possible, allowing adequate sling load clearance over obstacles.

4-86. IN-FLIGHT OPERATION. EXTERNAL CARGO HOOK OPERATIONS.

NOTE

- Control movement should be made smoothly and kept to a minimum to prevent oscillation of sling load.
- The EMER CARGO RELEASE PULL handle will function regardless of CARGO RELEASE switch position.

1. AIRSPEED — Within limits for adequate controllability of helicopter load combination.

2. Flight path — Required to avoid flight with external load over any person, vehicle, or structure.

4-87. BEFORE LANDING (CPG/PILOT AS REQUIRED).

1. LASER OFF/STBY/ARM switch — As required.

2. MMS — Stowed as required.

3. ACP — Switches set.

NOTE

If helicopter is landed with heading hold engaged, heading hold may attempt to correct small heading errors and will drive pedal to stop if left unguarded.

O 4. IR JAMMER XMTR switch — IR JAMMER.

4-88. DESCENT AND LANDING. EXTERNAL CARGO OPERATIONS.

1. Flight path and approach angle — As required for wind direction and obstacle clearance.

2. Execute approach to hover with cargo clear of the surface.

3. When stabilized at a hover, descend slowly until cargo contracts surface.

4. Maintain tension on sling.

5. Cyclic CARGO RELEASE switch — Press to release sling from hook.

SECTION IV. (CDS2) AIRBORNE TARGET HANDOVER SYSTEM (ATHS)

4-89. GENERAL.

4-90. ATHS MISSION CAPABILITIES.

The ATHS provides the capability 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 unit retains all mission essential data in nonvolatile storage and can store up to 12 previously received messages for later recall. The system also provides the capability to request and execute airborne fire missions specifying either HELLFIRE or standard ordnance and request and provide the required coordination to execute a remote HELLFIRE mission. The aircrew can also request and execute artillery fire missions as Forward Artillery Aerial Observer (FAAO); transmit spot situation, battle damage assessments, and casualty reports. Team leader capabilities allow for receiving and handing over fire requests to the best weapon systems available to execute the mission; commanding of team/unit movement with preset parameters; retention of lists of preplanned battle positions, FARP locations, etc., for later review or transmission; and maintenance of current position, weapon status, and aircraft status of all team members.

4-91. PHYSICAL DESCRIPTION.

The ATHS is composed of a single line replaceable unit (LRU) that receives information from the mast mounted sight (MMS), CPG multifunction display (MFD), multifunction keyboard (MFK), and other sensors. The processed information is displayed on the CPG MFD. ATHS information is transmitted to, and received from, other ATHS equipped vehicles and the artillery TACFIRE/FIST system using onboard radios. The ATHS is not a transmitter, but supplies a signal to a selectable radio and sends digital data as though it were voice. Traffic can also be passed to, and received from, handheld data message devices (DMD's). This system provides the ability to format complex messages such as artillery fire requests, reports, emergency broadcasts, automatic reporting of status, movement commands, and general free text messages with automatic or manual authentication.

4-92. OPERATIONAL DESCRIPTION.

To select the ATHS mode of operation, the CPG presses the ATHS switch on the CPG auxiliary panel (fig. 4-67). This causes the MFD to display any waiting messages, as evidenced by the advisory ATH MESSAGE RECEIVED, if appropriate, or the page which was last displayed during a previous operation. Pressing the ATHS switch a second time displays the ATHS Top Menu page. The line address keys on either side of the MFD are used to activate step to subpages or change a field of information. The fifth key on the right side (SEND) transmits the displayed information over the selected radio to a similarly equipped receiving vehicle. When manual entry of information is required, an arrow will appear which points away from the associated line key to signify that operator input must be made using the MFK (the ENTER key is not required). If only limited choices are available and rapid selectivity is required, an arrow will be present beside the key field of information pointing upward. Pressing this line key will scroll through each available option. Advisories will display in the caution/advisory block when a message has been received (ATH MESSAGE RECEIVED), when the ATHS has failed (ATH FAIL), and when either of the authentication tables has less than 20 available lines remaining (ATH TABLE LOW). For functions and descriptions of ATHS Top Menu page, see fig 4-68.

4-93. START PAGES — DESCRIPTION.

The Start pages are used to initialize the ATHS for later use. The pages maintain the files for communication, location, GO/NO GO test, time, and authentication. Communication subscriber identifiers are entered as ORIGIN (ORIG), TEAM (TM), and BROADCAST (BC). Additionally, a ZEROIZE key is provided in the Start pages. This ZEROIZE key clears all data and table entries from ATHS. Also included in these pages are the six message presets, the six movement presets, and the bulk data load.

4-94. START PAGES — OPERATION.

a. Start Page 1/2. There are several fields requiring entries on this page: ORIG, TEAM, AND BC. The originator (ORIG) is the aircraft/observer/crew subscriber identifier and is in the SOI. It is a one digit identifier (any letter or number). The TEAM identifier is a single digit that defines the team of which the originator is a part. A team is a group of subscribers having the same NET data and the same team number/letter. A team can be as few aircraft as two, the team leader and another digital communication type aircraft, or a team could be platoon or company size. Several messages are automatically addressed to the team and allow the team leader to effectively control his TEAM. The BC identifier is a single digit that defines the broadcast net of which the subscriber (originator) is a part. A broadcast is defined as a group of teams with the same net data and the same broadcast number/letter. If a unit had two teams working the same area, or for command and control from the company commander, all aircraft should have the same broadcast number/letter. If a unit had two teams working the same area, or for command and control from the company commander, all aircraft should have the same broadcast identifier so that all aircraft can receive instructions/notifications at the same time. All subscribers who enter the same identifier in the team and/or broadcast address will receive general transmissions sent to the identifier. The team and broadcast identifier must also be placed on a defined net prior to entry on Start page 1/2.

b. Start Page 2/2. This page defines all the parameters for the NETS and subscribers (SUBS). It is also the page where the automatic authentication tables (AUTH) can be accessed, enabled, and filled from the current SOI. The six preset messages (MSGS) and movements (MVMT) can only be programmed through the use of this page. Bulk data (BULK) transfer is also controlled/accessed through this page. This page is the major programming page for the ATHS. All of the permission planning data is entered on this page.

(1) **NETS.** A successful transmission requires that the sender and receiver be defined by the same net data. The net data parameters are a selection of TACFIRE or AIR NET, single block, double block, a selection of baud rate, the radio, the preamble duration, the monitor duration, and what authentication mode will be used.

(a) **Net Selection.** — Eight nets are available to be selected as either an AIR NET or TACFIRE NET (air elements can “talk” on a TACFIRE NET but TACFIRE will not get all required data if defined in an AIR NET). All aircraft working together in the same team/broadcast should select AIR NET. If there is a requirement for an aircraft to “talk” to artillery, the artillery should be defined in a separate TACFIRE NET.

(b) **Block (BLK) Selection.** — Select between single (SGL) block or double (DBL) block type of transmission. Single block sends each segment of data once per SEND. Double block sends each data segment twice per SEND and can be used when atmospheric conditions or reception are poor.

(c) **BAUD Rate Selection.** — Select between transmission rates of data bits (BAUD rate). Range: 75 bits per second (bps) — very slow; 150 bps; 300 bps; 600 bps; 1200 bps. If a TACFIRE net is selected, the only options are 1200 bps and 600 bps. The slower rates for the AIR nets are to be used only if reception is poor at high rates. The slower the baud rate the longer the transmission. The baud rate for the TACFIRE nets defaults to 1200 bps automatically.

(d) **RADIO Selection.** — Select between the type of radio desired. The radio numbers (1 thru 4) correspond to the same numbers as the intercom positions: 1 = FM-1, 2 = UHF, 3 = VHF, 4 = FM-2. ATHS will automatically select the radio for the transmission to a subscriber by how that subscriber is defined. ATHS will not select frequency. Prior to an ATHS transmission the sender should verify that the radio is tuned to the proper frequency. TACFIRE nets are normally set on radio 1. Air nets can be any of the radio selections.

(e) **Preamble (PRE) Select.** — An interval between 0.1 second and 4.0 seconds may be selected. A minimum preamble of 0.4 second is required when transmitting through crypto equipment. The preamble is used as on-air time for a link to be established between the sending and receiving units prior to the message being sent. The longer the preamble, the longer the on-air time.

(f) **Monitor (MON) Select.** — A time from 0.5 second to 9.9 seconds or OFF may be selected. The monitor time is the selected time that ATHS listens for interfering traffic prior to transmitting. If more than 15 seconds have elapsed after the SEND key has been pressed, the ATHS will reset automatically and SEND must be pressed again. Voice transmission has priority over a digital transmission; therefore, the ATHS will wait until the airway is clear of voice traffic if a monitor time has been selected.

(g) **Authentication (AUTH) Select.** — Select between MANUAL authentication or NONE. If MANUAL is selected, an operator input of the transmission authenticator is required each time transmission is attempted. If NONE is selected, no authentication is required. This function automatically displays NONE due to use of automatic authentication. Manual authentication is normally only used in air-to-air or air-to-ground communication but not air-to-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.

(2) **Subscribers (SUBS).** Subscriber net assignments are required. Each net can be made up of 10 common subscribers (a section or platoon for example). Team and broadcast identifiers must be included in a subscriber net for the ATHS to recognize them, i.e., team and broadcast cannot be entered on Start page 1/2 until defined in the subscriber nets. The originator is automatically in all of the defined subscriber nets. A TACFIRE subscriber must be in a TACFIRE net. As the message originator, a subscriber from any defined net may be selected and ATHS will automatically set to that net data. However, a subscriber using another set of net data would not be able to establish contact without resetting net data to match the originator. Should SUB appear, it signifies that the subscriber selected as the destination is not defined in the subscriber list.

(3) **Authentication.** Automatic authentication tables are accessed from this page. There are two tables, one transmit and one receive, that hold 100 authentications each. In the event the number of authentications remaining reaches 20 or less, the advisory message ATH TABLE LOW will display on the MFD. This must be loaded prior to each mission if they have been depleted or the SOI has changed. As an authentication is used, it is automatically deleted and the computer steps to the next code. The table can only be used on nets that have been selected as NONE on the authentication select on the Net Parameter page. If, when using automatic authentication, usually only with TACFIRE, the transmit or receive line sequence becomes incorrect, transmission of an authentication synchronization message is required (see MSG/FREE TEXT). By transmitting this message, the TACFIRE operator can see the anticipated next table line and adjust the computer. A not acknowledged (NAK) will appear; however, momentarily normal digital communication should be restored with the authentication tables in proper sequence.

(4) **Preset Messages.** There are six preset free text messages that can be programmed prior to the start of a mission to aid in response time for transmissions. There are six preset movement packages that can be programmed for establishing phase lines, assembly areas, FARP locations, etc. These 6 preset movement messages consist of 2 lines of 15 characters each for a total of 30 characters.

(5) **BULK Data Load.** Bulk data load can be used by a team member who did not preprogram the ATHS prior to flight or for an ATHS that needs to be reprogrammed while in flight. The data that can be bulk loaded from another ATHS consists of: subscribers/nets, preset messages, preset movement messages, receive automatic authentication table, and transmit automatic authentication table.

4-95. ATHS INITIALIZATION.

Initialize the ATHS as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page (Fig. 4-67).
2. START key — Press.
3. Paging (1/2) key — Press.
4. TEST key — Press. Enter a T using MFK; GO or NO GO will display on MFD.
5. NETS key — Press to access and complete Net Data pages. Enter prompts as follows:

   a. TFR AIR NET key — Press to scroll type or net desired adjacent to NET number.

   b. BLK key — Press to scroll between SGL and DBL. Leave as desired.

   c. BAUD key — Press to select desired baud rate.

   d. RADIO key — Press to select radio which will be used for transmitting and receiving.

   e. S key — The time required to transmit will display.

   f. PRE key — Press to access Preamble Entry page and press PREAMBLE — SEC key. Enter desired preamble length of 0.1 to 4.0 seconds using MFK.

NOTE

L-3 (OFF) can be pressed to disable monitor function.

   g. MON key — Press if required to access Monitor Entry page and press MONITOR — SEC key. Enter time of from 0.5 to 9.9 seconds using MFK.

   h. AUTH key — Press to scroll between MANUAL or NONE.

i. NETS — Set up each of the eight pages as required for each net to be used by repeating steps a. through h.

j. Paging key — Press as required to return to Start page 2/2.

6. SUBS key — Press and proceed as follows:

a. NET 1, NET 2 and/or NET 3 keys(s) — Press as desired to activate desired net and enter subscriber identifier(s).

b. Paging key — Press as required to access subpages and enter identifiers. Page through 3/3 to return to Start page.

NOTE

NETS can be reviewed off SUBS page by pressing the adjacent R key.

7. AUTH key — Press and proceed as follows:

a. SUBS key — Subscriber is displayed or press key and enter desired subscriber using MFK.

b. XMT LINE — Current transmit authentication table line will be displayed. To change, press key and enter desired line.

c. RCV LINE — Current receive authentication table line will be displayed. To change, press key and enter desired line using MFK.

d. MODE key — Press once to activate authentication tables. Press again to scroll among XMT, BOTH or RCV.

e. TABLE key — Press to access transmit or receive table index.
   (1) Select desired transmit table line.
   (2) Press key adjacent to line number. Enter transmit authentication code from SOI.
   (3) Paging key — Press to sequence to Start page.

8. MSGS key — If desired, press to access Message Present Entry pages. Press paging key as required to return to Start page.

9. MVMT key — If desired, press to access Preset Movement Message pages. Enter

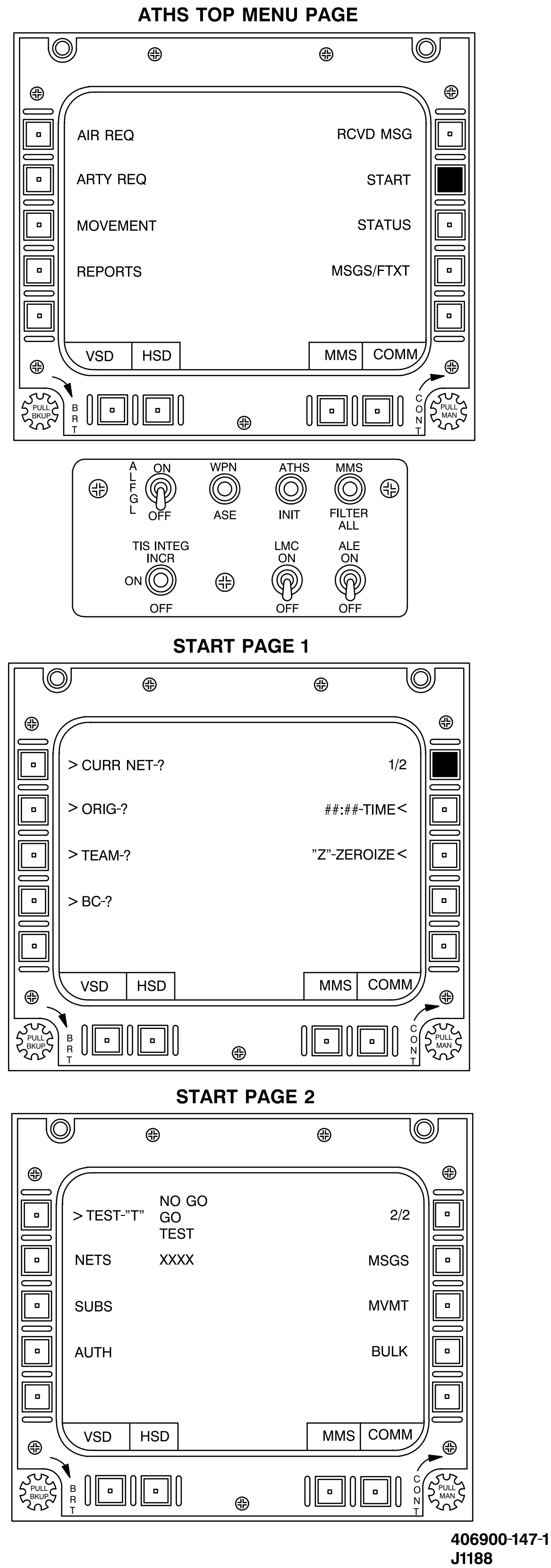


Figure 4-67. ATHS Initialization Pages

movement commands on subpages. Press paging key as required to return to Start page.

10. Select ATHS — Press. Then select Start page 1/2.

a. CURR NET key — Enter current net number.

b. ORIG key — Enter subscriber identifier.

c. TEAM key — Enter team number.

d. BC key — Enter broadcast number.

NOTE

Time of day is automatically input by GPS.

e. TIME key — Enter current time of day.

11. BULK key — Press if it is desired to upload another operator ATHS. Select BULK on Start page 2.

a. Enter Destination ID by pressing L-1.

b. Press L-2 to access Bulk Data Select page. Making a selection causes a default back to Bulk Data Summary page.

c. SEND; then scroll to next page. Utilize the SCROLL-SEND procedure until all desired data has been sent.

d. COMPLT — Send CMPLT message when finished with bulk data transmission.

4-96. AIR REQUEST PAGES.

a. Description. The Air Request (AIR REQ) list can store up to eight fire mission requests. The three Index pages display observer mission number, type of ordnance, firing element (subscriber) to which request was sent, and mission status. This list is for originating mission requests. Incoming new missions are stored in the Received Message file. Stepping through the mission list is accomplished by pressing the paging (upper right) key on the MFD. Accessing a stored Air Mission Request Summary page is accomplished by pressing the left key adjacent to desired mission. Complete mission information will display. Initiating a new mission request is accomplished by pressing a NEW key of an available mission number on the Air Request list, selecting air mission type, entering the required parameters, receiving the summary, and transmitting the data.

b. Types of air missions are as follows:

(1) Remote HELLFIRE wherein the number of rounds to be fired is requested and guidance is by other than the launching element.

(2) At My Command/Target (AMC/TGT) wherein the target type and strength is defined for the firing element. The firing element determines ordnance to be fired on the requestor’s command.

(3) At My Command/Ordnance (AMC/ORD) wherein ordnance type and number of rounds are specified to the firing element by the observer and is to be fired upon command of the observer.

(4) When Ready/Target (WR/TGT) wherein the target type and strength is given to the firing element which then fires choice of ordnance when ready.

(5) When Ready/Ordnance (WR/ORD) wherein the type of ordnance and suggested number of rounds are specified by the observer and are to be fired by the firing element when ready.

4-97. STORING OR EXECUTING AIR MISSION FIRE REQUEST.

To store or execute an air mission fire request, proceed as follows:

1. Target locate steps — Accomplish as required.

2. ATHS switch — Press as required to display ATHS Top Menu page.

3. AIR REQ key — Press.

4. Line (1-8) — Select mission number on which mission is to be entered. NEW key — Press.

5. MSN TYPE — Press appropriate key.

6. As pages sequence, press appropriate key to input desired mission.

7. Air Mission Summary page — Review and change parameters as required.

To execute an immediate fire request, proceed as follows:

8. On Air Mission Summary page, SEND key — Press.

9. ATHS switch — Press and repeat steps 1 through 8 above for each net as required.

To recall and send a stored mission, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. AIR REQ key — Press.

3. Desired mission (1-8) line number — Select.

4. On Air Mission Summary page, SEND key — Press.

   a. Remote HELLFIRE (REMOTE HLFR) mission request. The paging required for a simplified request is depicted in fig. 4-68.

   b. The Mission Status will change from REQUESTED to ACCEPTED, READY, FIRE, and SHOT. At completion of mission an END OF MISSION message should be sent.

   c. A generic Air Mission Summary page is shown in fig. 4-69.

4-98. ARTILLERY REQUEST PAGES.

a. Description. The mission data contained in the ATHS is formatted to be consistent with the TACFIRE Artillery Fire Direction Center (FDC) system and associated forward observer digital message devices (DMD). Artillery mission command selection is initially entered on the ARTY Mission Summary page automatically as REQ. Upon receipt of the TACFIRE FDC message-to-observer (MTO), the mission command will automatically change to FIRE. A READY command will be displayed if the Battery Computer System (BCS) is online with TACFIRE. Target position (range and bearing from the helicopter) is automatically calculated. By pressing the TGT PSN (target position) key, the operator can manually enter the UTM grid, range, bearing, and altitude of the target on subpages if required.

The Artillery Request List stores two active artillery missions and two preplanned mission requests on the Preplanned Mission List subpage. Accessing either active mission is accomplished by pressing the M1 or M2 key on the ARTY REQ List page. To review a preplanned mission, pressing the PPLN LIST key on

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Figure 4-68. Air Request Pages

the Preplanned Mission List page will cause the Preplanned Mission Summary page to display.

NOTE

In order to store a preplanned mission, a preplan request must be executed and stored as a standard artillery preplan request. Then the mission must be inserted into preplan list.

Initiating a new artillery mission request is accomplished by pressing the NEW key of an available mission number, selecting artillery mission type, following prompts through the subpages, reviewing Summary page, and transmitting data.

b. Types of artillery mission requests are as follows:

(1) NEW TGT wherein the observer defines target type and strength.

(2) Known Point (KNPT) wherein the observer defines a point which is a location previously identified and numbered, known both to the requestor and to the artillery FDC. The requestor then provides target type and strength.

(3) QUICK wherein the requestor enters only a known point. All other data is known by the artillery FDC.

(4) Preplanned (PPLN) wherein the observer provides type of fire request (either Final Protective Fire (FPF) or Copperhead (CPHD) guided munitions). Only one FPF can be preplanned at a time; however, both preplanned missions can be Copperhead. The requestor then provides target position and known point number.

(5) Illumination (ILLUM) wherein the observer provides target position and known point number. Included in this mission type is the ability for the observer to format a coordinated mission by using both active mission (M1 and M2) files.

(6) Copperhead (CPHD) wherein the target position is defined as NEW or Known Point and point number is provided to the firing element.

4-99. PREPLANNED FIRE REQUESTS.

To insert a preplanned fire request, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. ARTY REQ key — Press.

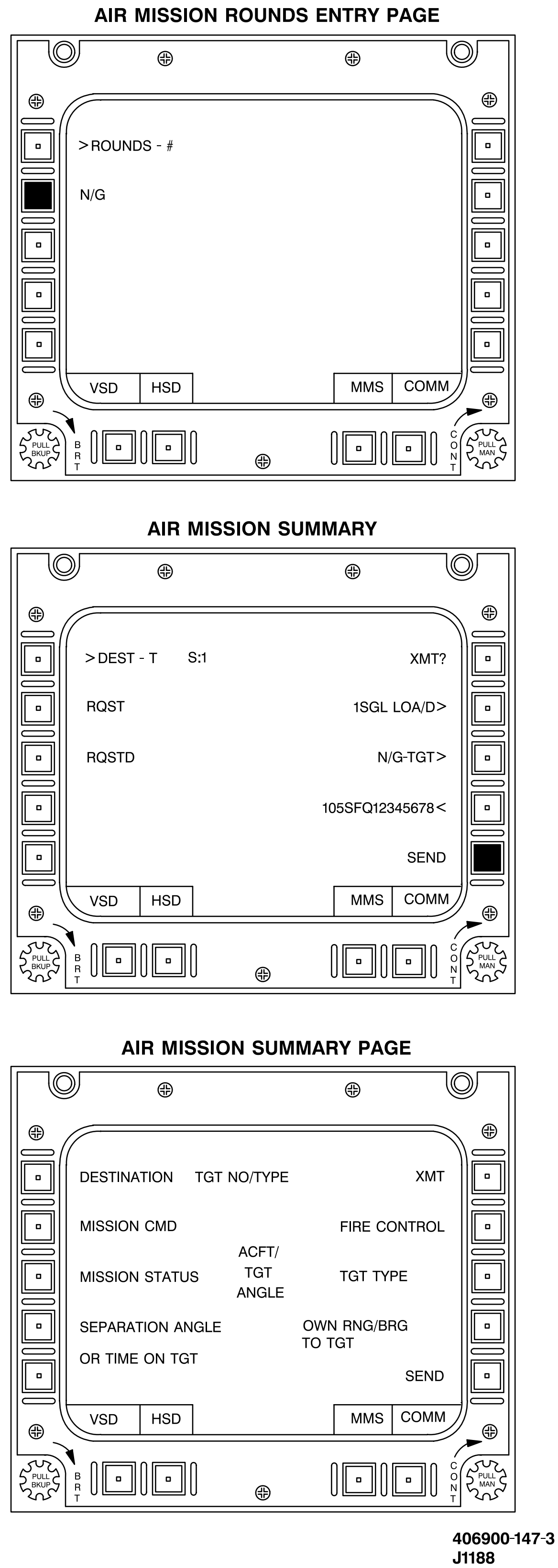


Figure 4-69. Air Mission Summary Pages

3. On line opposite mission to be replaced. NEW key — Press.

4. PPLN request key — Press.

5. Mission type — Select either FPF or CPHD as desired.

6. Target position or known point number — Enter as appropriate.

7. ARTY Mission Summary page will appear — Press SEND. Wait for preplanned MTO then continue.

8. ATHS switch — Press to return to ATHS Top Menu page.

9. ARTY REQ key — Press.

10. PPLN LIST key — Press.

11. P1 or P2 — Press NEW as desired.

12. L-2 — Press on Preplan Insertion pages.

13. Repeat steps 1. through 12. to insert a second preplanned mission.

NOTE

If the PPLN mission is requested as M1, it can only be stored as P1.

4-100. NEW ARTILLERY FIRE MISSION REQUEST.

To initiate a new fire mission, proceed as follows:

1. Target locate steps — Accomplish as required.

2. ATHS switch — Press as required to display ATHS Top Menu page.

3. ARTY REQ key — Press.

4. NEW key opposite mission (M1 or M2) to be replaced — Press.

5. Mission type — Press applicable key and enter required parameters on subsequent pages until all data is inserted.

6. Review mission on Summary page and make changes as required.

7. SEND key — Press.

8. New Artillery Fire Mission Request (simplified) is depicted in fig. 4-70.

9. A generic Artillery Mission Summary page is shown in fig. 4-71.

4-101. COPPERHEAD FIRE MISSION — ACTIVE AND PREPLANNED.

To accomplish a Copperhead fire mission, proceed as follows (fig. 4-70).

1. Target locate steps — Accomplish.

2. ATHS switch — Press as required to display ATHS Top Menu page.

3. ARTY REQ key — Press.

4. To accomplish in active mission, M1 or M2 key — Press as desired.

5. CPHD — Press.

6. STR — Enter as desired.

7. TGT POSITION — Enter as required.

8. On Mission Summary page, SEND key — Press (fig. 4-72).

4-102. MOVEMENT COMMAND COMMUNICATIONS.

The Movement pages allow position instructions to be transmitted without voice communication. The ATHS operator can issue directions to specific or all team members to MOVE TO, HOLD AT, rendezvous (RDZV) at; or inform team members MOVING TO or HOLDING AT a location. The locations can be preset to allow rapid communication. In addition, the Movement pages allow automatic transmission of current position through MY POSITION key and free text communication through the OTHER key.

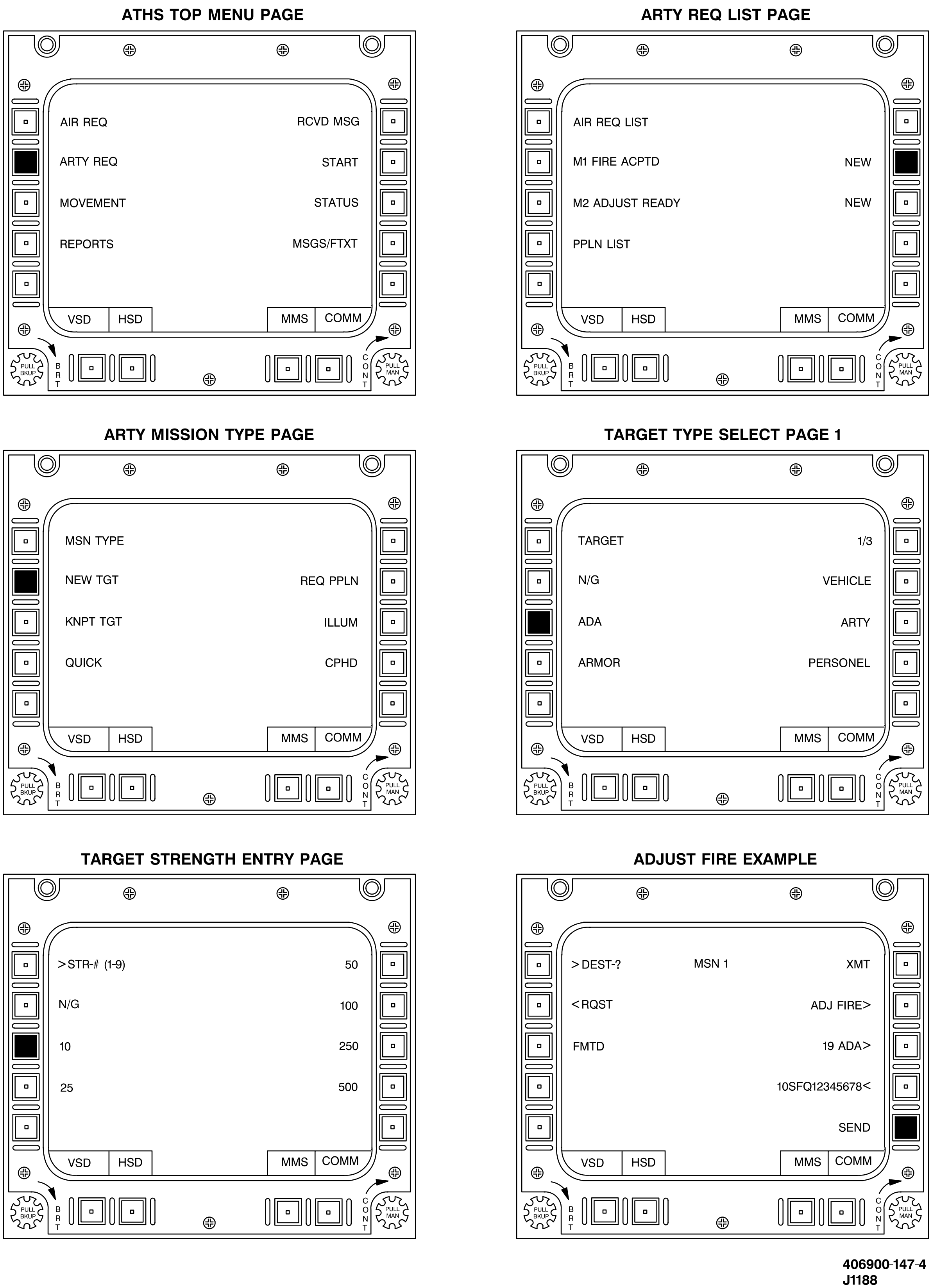


Figure 4-70. Artillery Request Pages

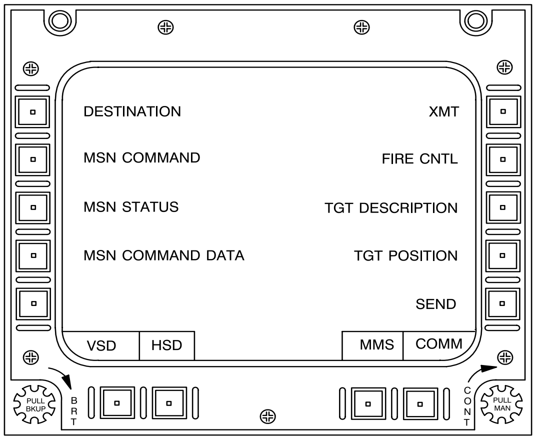


Figure 4-71. Artillery Mission Summary Page

4-103. MOVEMENT COMMAND TRANSMISSION.

Transmit movement commands as follows (fig. 4-73):

1. ATHS switch — Press as required to display ATHS Top Menu page.
2. MOVEMENT key — Press.
3. Appropriate movement type key — Press.
4. Appropriate destination select key — Press.

NOTE

Pressing OTHER key will display Freetext Message Entry page where a manual entry can be made using MFK.

5. Mission Summary page — Review and change as required.
6. SEND key — Press (fig. 4-73).

4-104. REPORT COMMUNICATIONS.

The Reports pages (fig. 4-74) allow the observer to provide various information to team and net members such as: Situation/status (SIT/STATUS) which reports the observers own situation, SPOT which reports target activity, ARTY to provide intelligence reports to artillery units, BDA to report battle damage assessments, CAS to report casualty assessments, and REQUEST to request a report from another subscriber.

4-105. SITUATION/STATUS (SIT/STATUS).

Report Transmission. To transmit observers situation and/or status, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.
2. REPORTS key — Press.
3. SIT/STATUS key — Press.
4. Activity to report — Press appropriate keys.
5. Report Summary page — Review and change as required.
6. SEND key — Press.

4-106. SPOT REPORT TRANSMISSION.

To transmit a spot report, proceed as follows (fig. 4-74):

1. Target locate steps — Accomplish as required.
2. ATHS switch — Press as required to display ATHS Top Menu page.
3. REPORTS key — Press.
4. SPOT key — Press.
5. TARGET type — Press appropriate key.
6. Target strength (STR) — Press appropriate key.
7. Target (TGT) ACTIVITY — Select as desired. If MOVING is selected, proceed to step 8. If STATIONARY is selected, proceed to step 10.

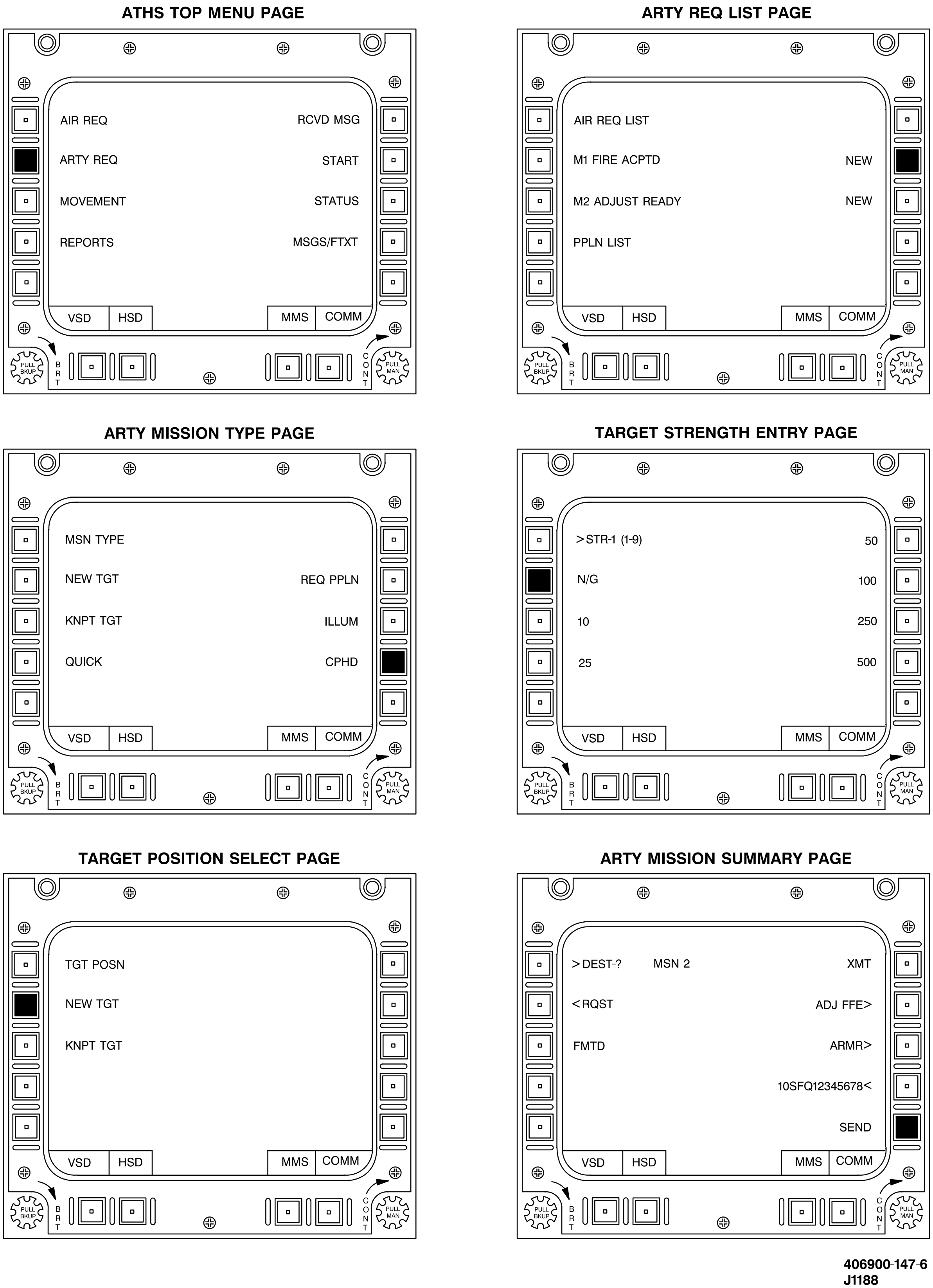


Figure 4-72. Artillery Fire Request Pages

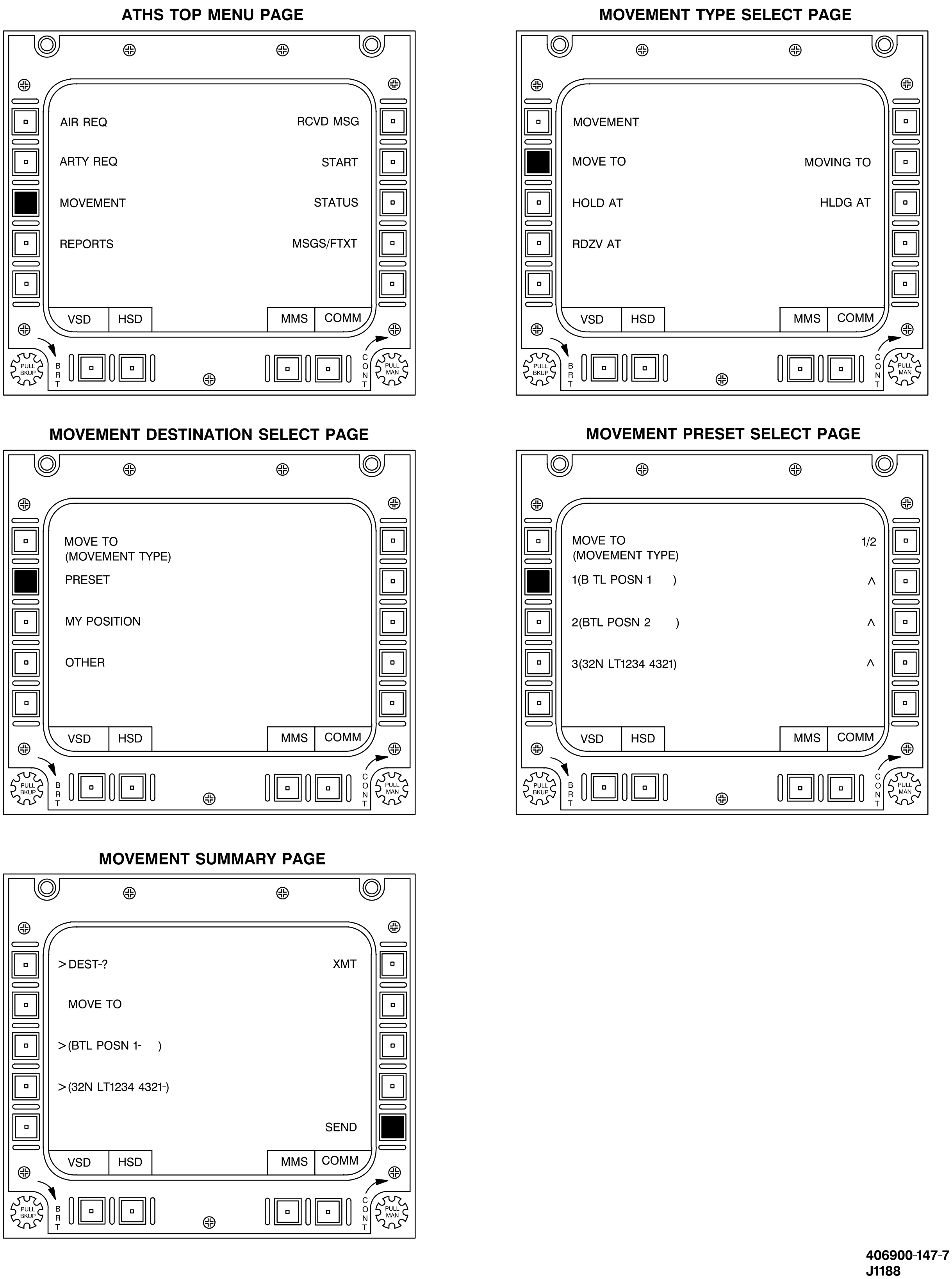


Figure 4-73. Movement Pages

8. Target direction — Press appropriate key.

9. Target speed — Press appropriate key.

10. Mission Summary page — Review and change as required.

11. SEND key — Press.

4-107. BATTLE DAMAGE ASSESSMENT (BDA) REPORT TRANSMISSION.

To provide battle damage assessments, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. REPORTS key — Press.

3. BDA key — Press.

4. BDA Summary page — Press appropriate key and manually enter information using MFK.

5. SEND key — Press.

4-108. CASUALTY (CAS) REPORT TRANSMISSION.

To provide casualty reports, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. REPORT key — Press.

3. CAS key — Press.

4. CAS Summary page — Press appropriate key and manually enter information using MFK.

5. SEND key — Press.

4-109. ARTILLERY (ARTY) TRANSMISSIONS.

Two types of artillery reports can be formatted and transmitted. These allow transmitting an artillery intelligence report and the establishment and transmission of an artillery fire plan.

To transmit an artillery intelligence (ATI) report, proceed as follows:

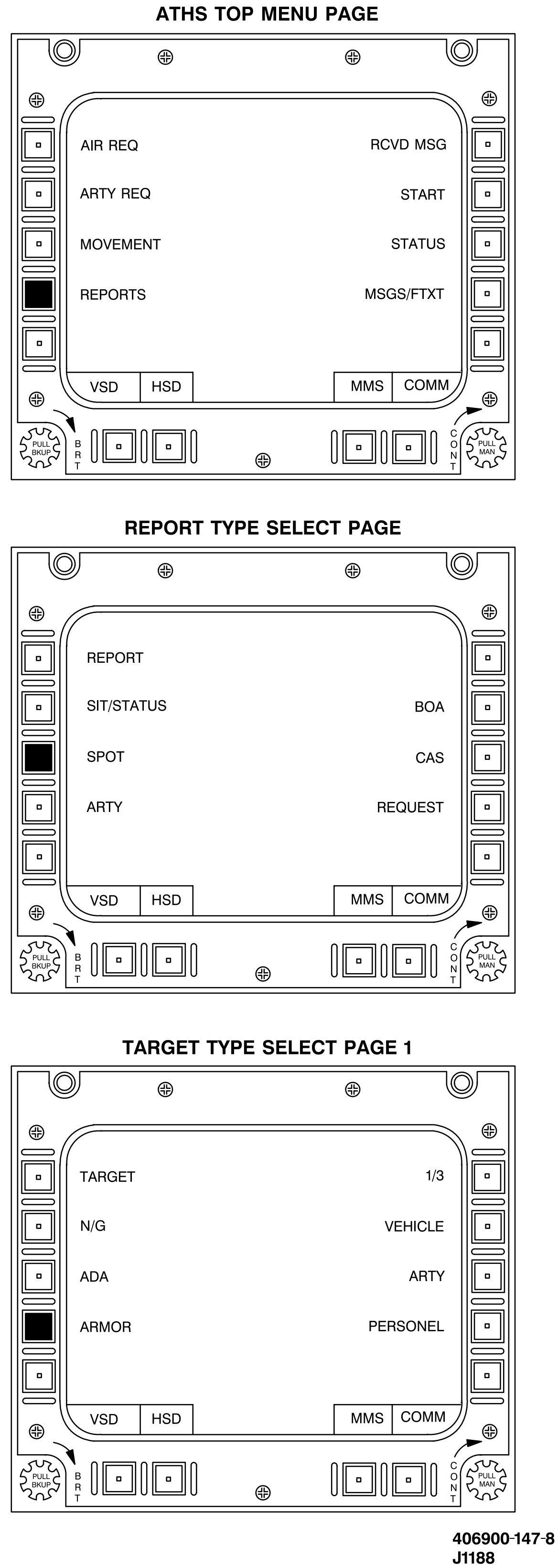


Figure 4-74. Report Pages (Sheet 1 of 2)

1. ATHS switch — Press as required to display ATHS Top Menu page.
2. REPORTS key — Press.
3. ARTY key — Press.
4. ATI key — Press.
5. Target type — Press appropriate key.
6. Target strength — Press appropriate key.
7. ATI Summary page — Review and change as required.
8. REL — Scroll through reliability option until desired option is displayed.
9. SEND key — Press.

Establish and transmit an artillery fire plan as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.
2. REPORTS key — Press.
3. ARTY key — Press.
4. PLAN key — Press.
5. Target type — Press appropriate key.
6. Target strength — Press appropriate key.
7. Fire Plan Summary page — Enter a six character fire plan name using MFK.
8. CONFIRMED/SUSPECTED key — Press to display choice.
9. Reference vertical (RV) key — Scroll through option to desired display.
10. Review and change Summary page as desired.
11. SEND key — Press to transmit report.

4-110. REPORT REQUESTING FROM ANOTHER SUBSCRIBER.

To request a report from another subscriber, proceed as follows:

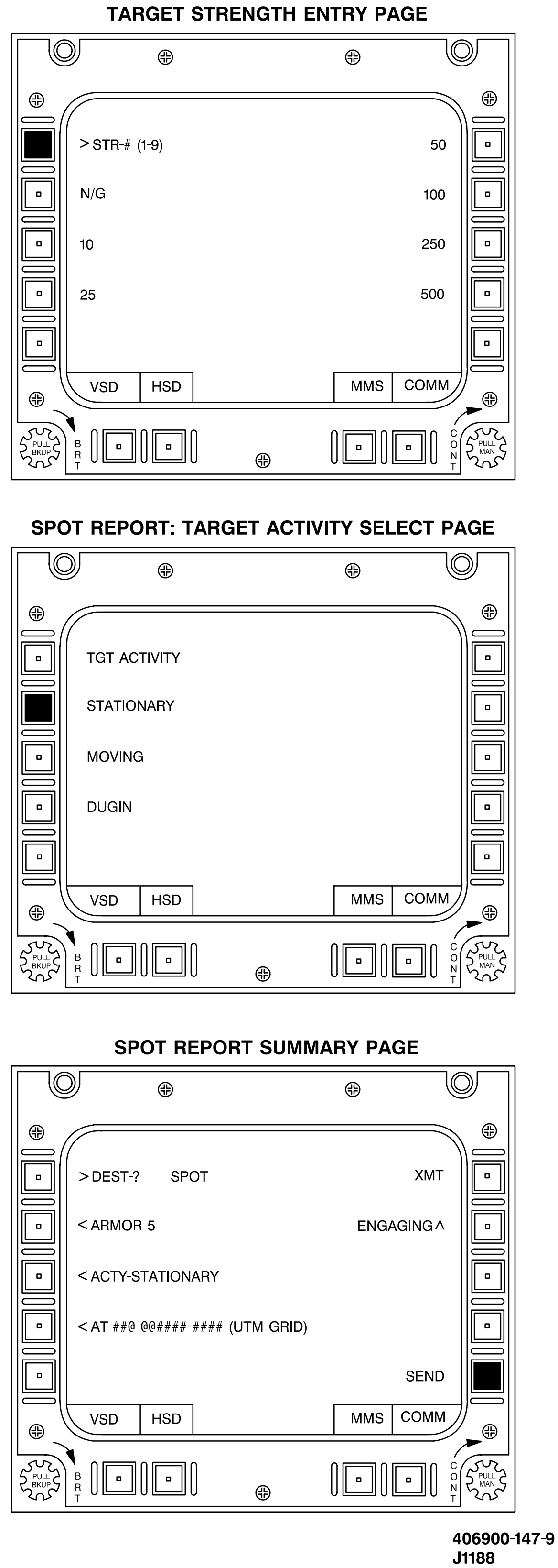


Figure 4-74. Report Pages (Sheet 2 of 2)

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. REPORTS key — Press.

3. REQ key — Press.

4. On Report Request Select page — Press appropriate key to designate type of report desired.

5. DEST– key on Summary page — Press and enter subscriber identifier from which report is desired using MFK.

6. Request Report Summary page — Review and change as required.

7. SEND key — Press to transmit request.

4-111. STATUS PAGES.

The Status pages (fig. 4-75) provide a means whereby the observer can provide information concerning his own weapons (OWN WPNS), own present position (OWN PPSN), or request information concerning a particular subscribers weapons or position status. The Present Position (PPSN) page includes location in UTM, altitude, and fuel remaining. The OWN WPNS page reports observers laser code to subscribers and provides weapons status. The remaining Status pages provide similar options for subscribers to provide information to the observer. The weapons format will depend upon whether the subscriber is defined in an AIR NET or a TACFIRE NET. The Subscriber pages will be automatically updated upon receipt of a situation/status report.

4-112. OWN STATUS.

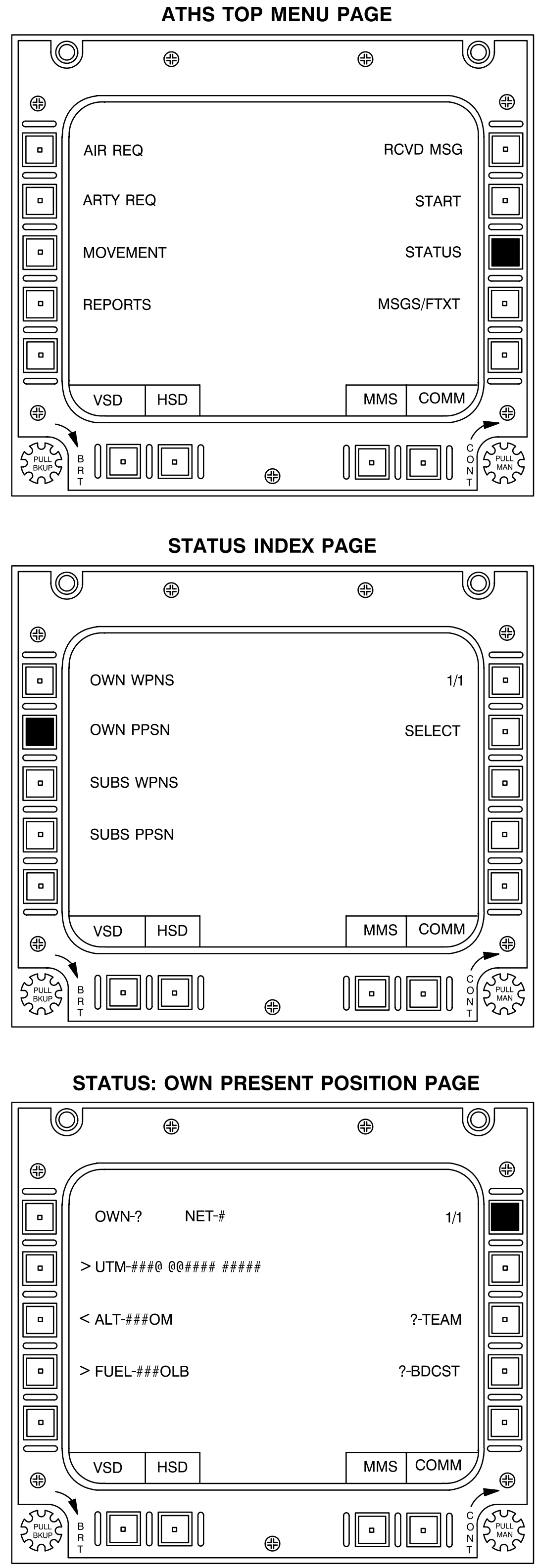
To review own status, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. STATUS key — Press.

3. OWN WPNS or OWN PPSN key — Press as desired.

4. For OWN WPNS entry, laser designator code — Enter using MFK and press paging select key (1/1) to return to Status Index page.



406900-147-10
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Figure 4-75. Status Pages

4-113. OWN PPSN ENTRY.

1. Present position is entered automatically. To change, enter coordinates using MFK and UTM key — Press.

2. ALT key — Press. Enter altitude in meters or enter N/G.

3. Paging select key (1/1) — Press to return to Status Index page (fig. 4-75).

4-114. WEAPONS STATUS — ALL SUBSCRIBERS.

To obtain subscriber weapons status, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. STATUS key — Press.

3. SUBS WPNS key — Press. Review weapons status of net subscribers as ATHS automatically sequences from the first subscriber in NET 1 to the last subscriber in NET 8.

4. Paging key — Press to return to Status Index page.

4-115. PRESENT POSITION STATUS — ALL SUBSCRIBERS.

To obtain present position information on all net subscribers, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. STATUS key — Press.

3. SUBS PPSN key — Press.

NOTE

- Subscriber status will begin with the first subscriber in NET 1 and display, in order, through the last subscriber in NET 8 as paging key is pressed.
- UTM — R/B key can be alternately pressed to display UTM grid coordinates or range and bearing of subscriber status being displayed.

4. If desired, return to Status Index page by pressing paging key once more after last subscriber status is displayed.

4-116. WEAPONS/PRESENT POSITION STATUS — SINGLE SUBSCRIBER.

To obtain the status of a single subscriber, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. STATUS key — Press.

3. SELECT key — Press.

4. SUB key — Press. Enter desired subscriber identifier using MFK. Present Position page will display.

5. Paging key — Press to review weapons status.

6. Weapons status paging key — Press to return to Status Index page.

4-117. FREE TEXT/PRESET MESSAGE PAGES.

The Free Text/Preset Message pages (fig. 4-76) allow the observer to compose and transmit any message up to 36 characters (two lines) at any time. Also, these pages allow messages to be composed and stored for subsequent recall and transmission at the appropriate time. The Top Message page includes a MAYDAY for rapid MAYDAY broadcasts, a CHECK ALL message for a rapid cease fire broadcast, and an authentication synchronization message to align the FDC codes to the ATHS codes. The free text and preset messages contain the same information. The free text/preset messages are automatically addressed to the team subscriber identifier. The MAYDAY message is addressed to the broadcast subscriber identifier, and contains the MAYDAY message and own present position. The Authentication Synchronization (AUTH) message is addressed to the broadcast subscriber identified in the Start pages with whom the automatic authentication is to occur (normally TACFIRE). If, after transmission, a NAK is returned, the tables are out of synchronization. TACFIRE will still get the message and change tables to match the observers. TACFIRE will call back once synchronization has been accomplished.

4-118. FREE TEXT MESSAGE COMPOSITION AND TRANSMISSION.

To compose and transmit a free text message, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.
2. MSGS/FTXT key — Press.
3. DEST– key — Enter subscriber identifier using MFK.
4. FREE TEXT key — Press to scroll between TEST and DATA as required.
5. Message — Enter any message up to 36 characters long using MFK.
6. SEND key — Press to transmit message (fig. 4-76).

4-119. PRESET MESSAGE TRANSMISSION.

To transmit any of up to six preset messages entered during ATHS initialization, proceed as follows:

1. ATHS switch — Press to display ATHS Top Menu page.
2. MSGS/FTXT key — Press.
3. Select message to be transmitted by pressing key adjacent to appropriate message number.
4. DEST– key — Press and enter subscriber identifier.
5. SEND key — Press.
6. To return to ATHS Top Menu page, ATHS switch — Press.

4-120. CHECK ALL MESSAGE TRANSMISSION.

To broadcast a cease fire message to all subscribers, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.
2. MSGS/FTXT key — Press.
3. CHECK ALL key — Press.
4. Broadcast identifier is automatically inserted to change: DEST– key — Press and enter identifier using MFK.

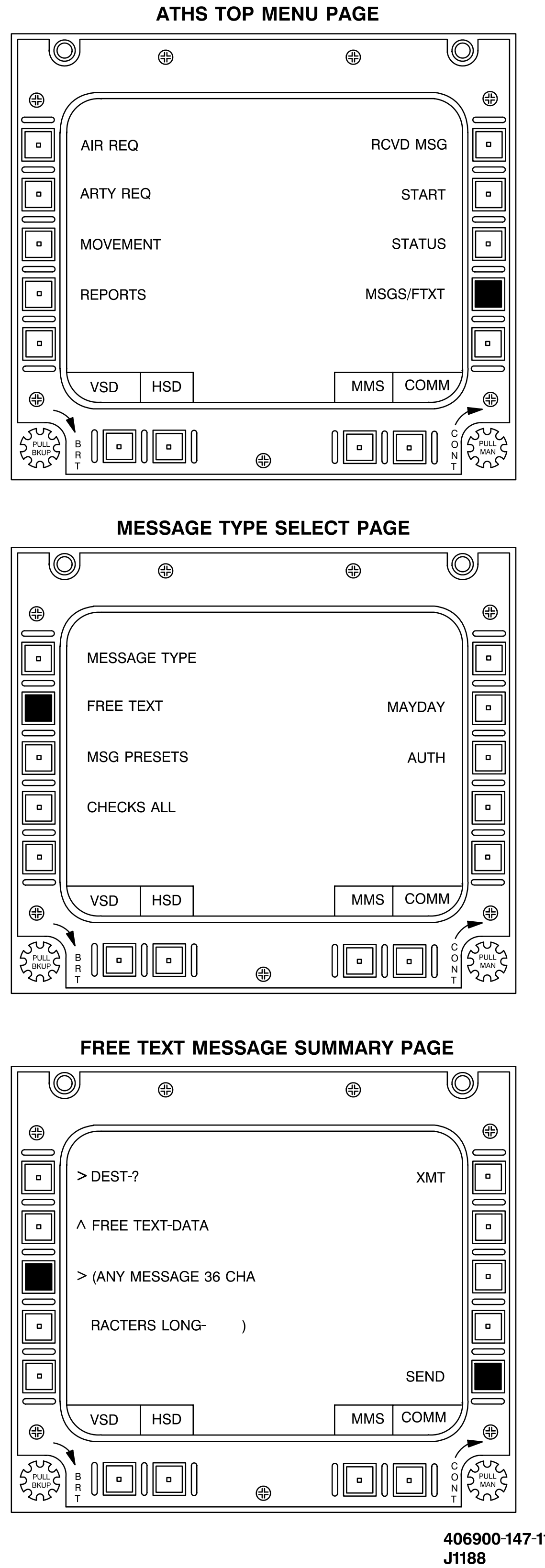

Figure 4-76. Free Text/Preset Message Pages

5. SEND key — Press.

4-121. MAYDAY MESSAGE TRANSMISSION.

To broadcast a MAYDAY message, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. MSGS/FTXT key — Press.

3. MAYDAY key — Press.

4. To change broadcast identifier, DEST– key — Press. Enter identifier using MFK.

5. To change present position in UTM grid, POSITION key — Press. Enter UTM using MFK.

6. SEND key — Press.

4-122. AUTHENTICATION SYNCHRONIZATION TRANSMISSION.

To broadcast an Authentication Synchronization transmission, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. MSGS/FTXT key — Press.

3. AUTH key — Press.

4. DEST– key — Press. Enter identifier of subscriber with which automatic authentication is desired.

5. When desired, SEND key — Press.

NOTE

If authentication tables between sender and receiver are not synchronized, a NAK will be returned. Sender should not retransmit. Receiver should change table positions and transmit to original sender with tables synchronized.

4-123. RECEIVED MESSAGES.

The received message function of the ATHS allows the observer to access the received message list to review new messages. It also allows the observer to review and delete any previously received messages, to include received fire requests. When an ATHS message is received, it will be stored in the RCVD MSGS index and an ATHS MESSAGE advisory will appear on the MFD. Twelve messages can be stored for review and deletion when desired, except for situation/status reports which are automatically deleted upon review. Messages received while the RCVD MSGS index is full will not be accepted, and the received advisory will not be displayed. When a message is received an acknowledge (ACK) is automatically transmitted back to the message originator with no operator action required. Messages received which are not recognizable, improperly addressed (net data incorrect), or unprocessable will be ignored. The originator will not have an ACK displayed and an ATH MESSAGE will not be displayed to the receiver. A message received which is acceptable, but from an originator not defined in the subscriber list, will be stored and an advisory displayed; however, an ACK will not be transmitted back. A message received addressed to the Team or Broadcast identifiers will be stored and an advisory displayed but an ACK will not be sent to the originator. The RCVD MSG index will show the message number, the identifier of the sender, a three character identifier of message type, a six character field indicating the message content, and the status of the message. If the message has been reviewed, delete (DEL) will appear next to the right hand key line; if not yet reviewed, NEW will appear. Another function of the received messages is that it allows the observer to leave the ATHS pages and still be able to manage a fire mission. The Fire Mission Summary pages will be automatically updated upon the receipt of new mission commands. Received free text and movement messages can be deleted on the page that they are reviewed. If delete is selected, the system will return to the Received Message Index page. Situation/status reports are automatically deleted after they have been reviewed and the information is stored in the Status pages.

4-124. REVIEWING RECEIVED MESSAGE INDEX.

To review a received message, proceed as follows:

1. ATHS switch — Press as required to display ATHS Top Menu page.

2. RCVD MSG — Press to display received message index.

3. Message to be reviewed — Select by pressing key adjacent to appropriate message number.

4. Delete message as appropriate.

4-125. GLOSSARY — ATHS.

The following is a list of mnemonics used by the ATHS system.

MNEMONIC	INTERPRETATION
1 RND	One Round
3 RND	Three Rounds
ACK	Acknowledge
ACTY	ACTIVITY Operational check in progress
ADA	Air Defense Artillery
A/D	Add or Drop (in Meters)
ADJ FIRE	Adjust Fire
AIRCRAFT	Aircraft
ALT	Altitude in Meters
AMC AF	At My Command — Adjust Fire
AMC DEST	At My Command — Destruction
AMC FFE	At My Command — Fire For Effect
AMC REG	At My Command — Registration
AMC RPT	At My Command — Repeat
AMC/RFFE	At My Command — Repeat Fire For Effect
AMMO	Ammunition
ANTITANK	Antitank Munitions
APC	Armored Personnel Carrier
APERS	Antipersonnel
ARTY	Artillery
ASSEMBLY	Assembly — Staging or Collecting Areas
ASSIGN KNPT	Assign Knownpoint
ASSY	Assembly
AT GUN	Antitank Gun

MNEMONIC	(Cont) INTERPRETATION
ATI	Artillery Intelligence
ATI GEO1	Artillery Target Intelligence — Geographic Coordinates Report Number 1
ATI GEO2	Artillery Target Intelligence Geographic Coordinates Report Number 2
ATI GRID	Artillery Target Intelligence Grid Coordinate Report
ATI POLAR	Artillery Target Intelligence Polar Coordinate Report
ATTITUDE	Attitude or Orientation of Target
AUF	Adjusting Unit of Fire
AUTH 01	Authentication One
BC	Broadcast
BLDG	Building
BN	Battalion
BOAT	Boat
BPS	Bits Per Second
BRG EQPT	Bridge Equipment
BRIDGE	Bridge
BUILDING	Building
BURN	Burning
CAL	Caliber in Millimeters
CAS	Casualty
CEOI	Communications Electronics Operating Instructions
CEN	Center — Command Post
CENTER	Center — Center Platoon of a Firing Battery
CHECK FIRE	Cease Firing (Emergency)
CLASS I	Class I — Rations (Food)
CLASS II	Class II — Material (Supplies)

(Cont)

MNEMONIC	INTERPRETATION
CLGP	Cannon Launched Guided Projectile
CMD	Command
CMPLT	Complete
CNO	Cannot Observe
CNO/AF	Cannot Observe/Adjust Fire
CNO/FFE	Cannot Observe/Fire For Effect
CNO/RFFE	Cannot Observe/Repeat Fire For Effect
COMPSD MSG	Composed Message
CONCRETE	Concrete
CONT ILL	Continuous Illumination
CONTROL	Control
CORD ILL	Coordinated Illumination
COVER	Cover — Under Overhead Cover
CP	Concrete Piercing
CPHD	Copperhead Guided Munitions
CURR	Current
D	Data
DBL	Double Block Mode
DC AF	Danger Close — Adjust Fire
DC FFE	Danger Close — Fire For Effect
DEFILE	Defilade (in a Depression or Valley)
DELAY	Delay — Fuze Setting
DEST	Destruction or Destroyed
DEST AF	Destruction Adjust Fire
DEST/DC	Destruction/Danger Close
DEST/REG	Destruction/Registration

(Cont)

MNEMONIC	INTERPRETATION
DEST/TOT	Destruction/Time On Target
DIR	Direction (In Mils)
DIR ERR	Direction Error (In Mils)
DIST	Distance (In Meters)
DMD	Digital Message Device
DN	Down
DNA	Do Not Adjust
DNC	Do Not Combine
DNO	Did Not Observe
DNO TGT	Did Not Observe Target
DOP	Degree of Protection (Personnel)
DRAW TGT	Draw Target
DROP	DROP (Decrease in Range in Meters)
DSPL DLY	Display Delay
DSPO	Disposition
DUGIN	Dug In (In Foxholes)
EAST	Easting Coordinates
ENTRY NO	Entry Number
EOM	End of Mission
EOM RAT	End of Mission — Record As Target
EOM & SUR	End of Mission & Surveillance
EQUIP	Equipment
EST	Eastern
EW	Electronic Warfare
EXC	Excellent (Information Reliability)
FAIR	FAIR (Target Identification Not Certain)

(Cont)

MNEMONIC	INTERPRETATION
FERRY	Ferry
FFE	Fire For Effect
FIRE	Commence Firing (Cancels Check Fire)
FIRE FPF	Fire — Final Protective Fire
FIRE TGT NO	Fire On Target Number
FL TRACE	Front Line Trace
FMTD	Formatted
FO COMD	Forward Observer Command
FOOT PON	Foot Pontoon — Bridge
FORWARD	Forward
FR GRID	Fire Request Grid
FR LASER	Fire Request — Laser
FR POLAR	Fire Request — Polar
FR QUICK	Fire Request — Quick
FR SHIFT	Fire Request — Shift
FREETEXT	Plain Text Message
FUZE	Fuze
GAS NONP	Gas — Nonpersistent
GAS PERS	Gas — Persistent
GOOD	Good (Identification of Target — Moderately Reliable)
GRID	Grid — UTM Coordinates
GUIDANCE	Guidance
HB	Highburst
HB/MPI	Highburst/Mean Point of Impact
HC SMX	White Smoke
HE	High Explosive

(Cont)

MNEMONIC	INTERPRETATION
HEAVY	Heavy Artillery (177MM to 250MM)
HE/DELAY	High Explosive/Delay (Fuze)
HELICOPTER	Helicopter
HE/Q	High Explosive/Quick (Fuze)
HE/TIME	High Explosive/Time Delay (Fuze)
HE/VT	High Explosive/Variable Time (Fuze)
HE/WP	High Explosive/White Phosphorus
HIGH/DC	High Angle/Danger Close
HIGH/REG	High Angle/Registration
HIGH/TOT	High Angle/Time On Target
HILL	Hill
HLDG	Holding
HVY MGUN	Heavy Machine Gun
HVY MSL	Heavy Missile
HVY WHEEL	Heavy Wheeled Vehicles
ICM	Improved Conventional Munitions
IGN RD	Ignore Round
ILL 1 GUN	Illumination 1 Gun
ILL 2 GUN	Illumination 2 Gun
ILL 2 GUN D	Illumination 2 Gun Deflection Spread
ILL 2 GUN R	Illumination 2 Gun Range Spread
ILLUM	Illumination
INFANTRY	Infantry
INTEGRATE	Integrated into a single TIS image.
JUNCTION	Junction
KBD BELL	Keyboard Bell — Volume 0 to 7

(Cont)

MNEMONIC	INTERPRETATION
KNPT	Knownpoint
LA	Left Above
LAST PNT	Last Point
LATITUDE	Latitude in Degrees, Minutes and Seconds
LB	Left Below
LDG STRP	Landing Strip
LFT	Left
LMC	Activates Linear Motion Compensation
LONGITUDE	Longitude in Degrees, Minutes and Seconds
LOST	Lost (Failed to Observe Last Round)
LOST BT	Lost Burst
LOST TGT	Lost Target
LOUDSPKR	Loudspeaker
LOW/DC	Low Angle/Danger Close
LOW/REG	Low Angle/Registration
LOW/TOT	Low Angle/Time on Target
LT MGUN	Light Machine Gun
LT MSL	Light Missile
LT WHEEL	Light Wheeled Vehicle (Jeeps)
M1	Mission 1
M2	Mission 2
MASNRY	Masonry
MDM MSL	Medium Missile
ME	Method of Engagement
MEDIUM	Medium
MPI	Mean Point of Impact

(Cont)

MNEMONIC	INTERPRETATION
MSG TYPES	Message Types
MSN	Mission
MSN INFO	Mission Information
MSN NO	Mission Number
MTO	Message to Observer
MVMT	Movement
NAK	Not Acknowledged
NEUT	Neutralized
NEUTBURN	Neutralized and Burning
N/G	Not Given
NONE	None — No Disposition Given
NO PREF	No Preference
NORTH	Northing Coordinates
NO UNITS	Number of Units
NO VOL	Number of Volleys
OBSD ERR	Observed Error
OBSN	Observation
OBSR LOC	Observer Location
OBS VA	Observe Vertical Angle
OK BT	O.K. Burst
OK TGT	O.K. Target
OP	Observation Post
OPNL CHECK	Operational Check
ORIG	Origin
PAC	Pitch Attitude Cue
PE	Probable Error

(Cont)

MNEMONIC	INTERPRETATION
PERS	Personnel
PPLN	Preplanned
PPSN	Present Position
PRAND	Standing On First Volley; Prone On Subsequent Volleys
PREAMBLE	Message Lead In
PREC REG	Precision Registration
PRED PNT	Predict Point (Laser Range Mode)
PRONE	Prone on First and Subsequent Volleys
PROVER	Prone on First Volley; Covered on Subsequent Volleys
PRUG	Prone on First Volley; Dug (or Digging in on Subsequent Volleys)
PSN	Position
PTL OIL	Petroleum Oil
QUICK	Fuze Setting — Quick
RA	Right Above
RAD/LGTH	Radius/Length (In Meters)
RAILROAD	Railroad
RAT	Record As Target
RB	Right Below
RCLR	Recoilless Rifle
RCRD REG PT	Record As Registration Point
RCRD TI REG PT	Record As Time Registration Point
RDR REG	Radar Registration
RDZV	Rendezvous
RECON	Reconnaissance
REF DIR	Reference Direction
REF VA	Reference Vertical Angle

(Cont)

MNEMONIC	INTERPRETATION
REG AF	Registration Adjust Fire
REG NEXT LOT	Register Next Lot (of Powder)
REGT	Regiment
REL	Reliability
RELBIL	Reliability
RESECT	Resection
RKTMSL	Rocket Missile
R/L	Right or Left (In Meters)
RNDS	Number of Rounds that Impacted
SA LASER	Subsequent Adjustment With Laser
SEQ NO	Sequence Number
SF ADJ	Shell Fuze Adjustment
SF 1ST	Shell Fuze for First Volley
SF SUBQ	Shell/Fuze for Subsequent Volleys
SHELL/FZ	Shell/Fuze
SHELREP	Shell Report
SHFT	Shift
SHOT	Shot — Round Fired
SITE	Site — Position or Location
SLT	Searchlight
SLT DIST	Slant Distance
SNG	Single
SOI	Security Operating Instructions
SPECIAL	Special — Target Types
SPLASH	Round Impact
STA TGT	Stationary Target

(Cont)

MNEMONIC	INTERPRETATION
STD	Standard
STEEL	Steel — Construction Material
SUB	Subscriber
SUBQ ADJ	Subsequent Adjustment
T	Test
T/D	Type of Data
TFR	TACFIRE
TGT	Target
TGT NO	Target Number
TIME	Time (Hours and Minutes)
TIME FLT	Time of Flight
TIME RPT	Time Report
TNO	Try Number
TOT	Time on Target
TRILAT	Trilateration
TROOPS	Troops
TRP & ARM	Troops and Armor
TRP MECH	Troops Mechanized
TRP & VEH	Troops and Vehicles
TYPE REG	Type of Registration
U/D	Up/Down (In Meters)
UNK	Unknown
UP	UP — Changes in Height of Bursts
USE GT	Use Gun Target Line
VA	Vertical Angle
VA ERR	Vertical Angle Error (In Mils)

(Cont)

MNEMONIC	INTERPRETATION
VCORR	Vertical Correction
VEH	Vehicle
VEH PON	Vehicle Pontoon
VERY HVY	Very Heavy
WKPTY	Work Party
WOODEN	Wooden Construction Material
WP/DELAY	White Phosphorus With Delay Fuze
WPN	Weapon(s)
WP/Q	White Phosphorus with Quick Fuze
WP/TI	White Phosphorus with Time Fuze
WR/AF	When Ready/Adjust Fire
WR/FFE	When Ready/Fire For Effect
WR/RFFE	When Ready/Repeat For Fire Effect
XMIT BLK	Transmit Block
XMIT RATE	Transmit Rate
YES	Affirmative

SECTION V. (CDS3) IMPROVED DATA MODEM (IDM)

4-126. GENERAL.

4-127. IDM MISSION CAPABILITIES.

The IDM provides the capability 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 unit retains all mission essential data in nonvolatile storage and can store up to 12 previously received messages for later recall. The system also provides the capability to request and execute airborne fire missions specifying either HELLFIRE or standard ordnance and request and provide the required coordination to execute a remote HELLFIRE mission. The aircrew can also request and execute artillery fire missions as Forward Artillery Aerial Observer (FAAO); transmit spot situation, battle damage assessments, and casualty reports. Team leader capabilities allow for receiving and handing over fire requests to the best weapon systems available to execute the mission; commanding of team/unit movement with preset parameters; retention of lists of preplanned battle positions, FARP locations, etc., for later review or transmission; and maintenance of current position, weapon status, and aircraft status of all team members.

4-128. PHYSICAL DESCRIPTION.

The IDM is composed of a single line replaceable unit (LRU) that receives information from the mast mounted sight (MMS), CPG multifunction display (MFD), multifunction keyboard (MFK), and other sensors. The processed information is displayed on the CPO MFD. IDM information is transmitted to, and received from, other IDM equipped vehicles and the artillery TACFIRE/ FIST system using onboard radios. The IDM is not a transmitter, but supplies a signal to a selectable radio and sends digital data as though it were voice. Traffic can also be passed to, and received from, handheld data message devices (DMD's). This system provides the ability to format complex messages such as artillery fire requests, reports, emergency broadcasts, automatic reporting of status, movement commands, and general free text messages with automatic or manual authentication.

4-129. OPERATIONAL DESCRIPTION.

To select the IDM mode of operation, the CPG presses the IDM switch on the CPG auxiliary panel (fig. 4-77). This causes the MFD to display any waiting messages, as evidenced by a received message advisory, if appropriate, or the page which was last displayed during a previous operation. Pressing the IDM switch a second time displays the IDM Index page. The line address keys on either side of the MFD are used to activate step to subpages or change a field of information. When manual entry of information is required, an arrow will appear which points away from the associated line key to signify that operator input must be made using the MFK (the ENTER key is not required). If only limited choices are available and rapid selectivity is required, an arrow will be present beside the key field of information pointing upward. Pressing this line key will scroll through each available option. Advisories will display in the caution/advisory block when a message has been received, when the IDM has failed (IDM FAIL), and when either of the authentication tables has less than 20 available lines remaining (LOW). For functions and descriptions of IDM Index page, see fig 4-78.

4-130. RAPID FUNCTION. Rapid at L-5 appears on every page of IDM. The RAPID function provides direct access to any one of the following five operational IDM pages.

Summary Page of Highest Priority Received Message
Airborne Mission Summary Page
Artillery Mission Summary Page
Mayday Message Summary Page
Quick Menu Page.

4-131. START PAGES — DESCRIPTION.

The Start pages are used to initialize the IDM for later use. The pages maintain the files for communication, location, GO/NO GO test, time, and authentication. Communication subscriber identifiers are entered as ORIGIN (ORIG), TEAM (TM), and BROADCAST (BC). Additionally, a ZEROIZE key is provided in the Start pages. This ZEROIZE key clears all data and table entries from IDM. Also included in these pages are the six message presets, the six movement presets, and the bulk data load.

4-132. START PAGES — OPERATION.

a. Start Page 1/3. There are several fields requiring entries on this page: ORIG, TEAM, AND BC. The originator (ORIG) is the aircraft/observer/crew subscriber identifier and is in the SOI. It is a two-digit identifier (from 00 to 3I). The TEAM identifier consists of two digits that define the team of which the originator is a part. A team is a group of subscribers having the same NET data and the same team number/letter. A team can be as few aircraft as two, the team leader and an other digital communication type aircraft, or a team could be platoon or company size. Several messages are automatically addressed to the team and allows the team leader to effectively control his TEAM. The BC identifier is two digits that define the broadcast net of which the subscriber (originator) is a part. A broadcast is defined as a group of teams with the same net data and the same broadcast number/letter. If a unit had two teams working the same area or, for command and control from the company commander, all aircraft should have the same broadcast number/ letter. If a unit had two teams working the same area or, for command and control from the company commander, all aircraft should have the same broadcast identifier so that all aircraft can receive instructions/notifications at the same time. All subscribers who enter the same identifier in the team and/or broadcast address will receive general transmissions sent to the identifier. The team and broadcast identifier must also be placed on a defined net prior to entry on Start page 1/3.

b. Start Page 2/3. This page defines all the parameters for the NETS and subscribers (SUBS). It is also the page where the automatic authentication tables (AUTH) can be accessed, enabled, and filled from the current SOI. The six preset messages (MSGS) and movements (MVMT) can only be programmed through the use of this page. Bulk data (BULK) transfer is also controlled/accessed through this page. This page is the major programming page for the IDM. All of the permission planning data is entered on this page.

(1) **NETS.** A successful transmission requires that the sender and receiver be defined by the same net data. The net data parameters are a selection of TACFIRE or AIR NET, single block, double block, a selection of baud rate, the radio, the preamble duration, the monitor duration, and what authentication mode will be used.

(a) **Net Selection.** — Eight nets are available to be selected as either an AIR NET or TACFIRE NET (air elements can “talk” on a TACFIRE NET but TACFIRE will not get all required data if defined in an AIR NET). All aircraft working together in the same team/broadcast should select AIR NET. If there is a requirement for an aircraft to “talk” to artillery, the artillery should be defined in a separate TACFIRE NET.

(b) **Block (BLK) Selection.** — Select between single (SGL) block or double (DBL) block type of transmission. Single block sends each segment of data once per SEND. Double block sends each data segment twice per SEND and can be used when atmospheric conditions or reception are poor.

(c) **BAUD Rate Selection.** — Select between transmission rates of data bits (BAUD rate). Range: 75 bits per second (bps) — very slow; 150 bps; 300 bps; 600 bps; 1200 bps. If a TACFIRE net is selected, the only options are 1200 bps and 600 bps. The slower rates for the AIR nets are to be used only if reception is poor at high rates. The slower the baud rate the longer the transmission. The baud rate for the TACFIRE nets defaults to 1200 bps automatically.

(d) **RADIO Selection.** — Select between the type of radio desired. The radio numbers (1 thru 4) correspond to the same numbers as the intercom positions: 1 = FM-1, 2 = UHF, 3 = VHF, 4 = FM-2. HF cannot be used with the IDM. IDM will automatically select the radio for the transmission to a subscriber by how that subscriber is defined. IDM will not select frequency. Prior to an IDM transmission the sender should verify that the radio is tuned to the proper frequency. TACFIRE nets are normally set on radio 1. Air nets can be any of the radio selections.

(e) **Preamble (PRE) Select.** — An interval between 0.1 second and 9.9 seconds may be selected. A minimum preamble of 0.4 seconds is required when transmitting through crypto equipment. The preamble is used as on-air time for a link to be established between the sending and receiving units prior to the message being sent. The longer the preamble, the longer the on-air time.

(f) **Monitor (MON) Select.** — A time from 0.5 seconds to 9.9 seconds or OFF may be selected. The monitor time is the selected time that IDM listens for interfering traffic prior to transmitting. If more than 15 seconds have elapsed after the SEND key has been pressed, the IDM will reset automatically and SEND must be pressed again. Voice transmission has priority over a digital transmission; therefore, the IDM will wait until the airway is clear of voice traffic if a monitor time has been selected.

(g) **Authentication (AUTH) Select.** — Select between MANUAL authentication or NONE. If MANUAL is selected, an operator input of the transmission authenticator is required each time transmission is attempted. If NONE is selected, no authentication is required. This function automatically displays NONE due to use of automatic authentication. Manual authentication is normally only used in air-to-air or air-to-ground communication but not air-to-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.

(2) **Subscribers (SUBS).** Subscriber net assignments are required. Each net can be made up of 15 common subscribers (a section or platoon for example). Team and broadcast identifiers must be included in a subscriber net for the IDM to recognize them, i.e., team and broadcast cannot be entered on Start page 1/3 until defined in the subscriber nets. The originator is automatically in all of the defined subscriber nets. A TACFIRE subscriber must be in a TACFIRE net. As the message originator, a subscriber from any defined net may be selected and IDM will automatically set to that net data. However, a subscriber using another set of net data would not be able to establish contact without resetting net data to match the originator. Should SUB appear, it signifies that the subscriber selected as the destination is not defined in the subscriber list.

NOTE

Because the IDM expands the number of subscribers per net to 15 (ATHS supports only 9) two-digit subscriber IDs must be entered (i.e., - 00 - 0Z, 10 - 1Z, etc.). To communicate with ATHS or TACFIRE subscribers, the originator and destination subscriber IDs must be in the range 00-0Z. In other words, if an ATHS-equipped platform has selected a subscriber ID of "A", a subscriber "0A" should be entered in the appropriate net. In addition, an originator ID on the IDM-equipped aircraft must be within the range 00-09, 0A-0Z. (In the example given "0A" should be the originator chosen for the IDM-equipped aircraft since the ATHS-equipped platform has this subscriber ID.)

(3) **Authentication.** Automatic authentication tables are accessed from this page. There are two tables, one transmit and one receive, that hold 100 authentications each. In the event the number of authentications remaining reaches 20 or less, the advisory message AUTH LOW will display on the MFD. This must be loaded prior to each mission if they have been depleted or the SOI has changed. As an authentication is used, it is automatically deleted and the computer steps to the next code. The table can only be used on nets that have been selected as NONE on the authentication select on the net parameter page. If, when using automatic authentication, usually only with TACFIRE, the transmit or receive line sequence becomes incorrect, transmission of an authentication synchronization message is required (see MSG/FREE TEXT). By transmitting this message, the TACFIRE operator can see the anticipated next table line and adjust the computer. A not acknowledged (NAK) will appear; however, momentarily normal digital communication should be restored with the authentication tables in proper sequence.

(4) **Preset Messages.** There are six preset messages that can be programmed prior to the start of a mission to aid in response time for transmissions. There are six preset movement packages that can be programmed for establishing phase lines, assembly areas, FARP locations, etc. These 6 preset movement messages consist of 2 lines of 15 characters each for a total of 30 characters.

(5) **BULK Data Load.** Bulk data load can be used by a team member who did not preprogram the IDM prior to flight or for an IDM that needs to be reprogrammed while in flight. The data that can be bulk loaded from another IDM consists of: subscribers/nets, preset messages, preset movement messages, receive automatic authentication table, and transmit automatic authentication table.

c. START Page 3/3. This page allows for configuration of the RAPID function and the Serialization Subscriber function. The AUTO SHOT function is displayed but is not functional in this installation. The Start 3/3 page is used to program the programmable RAPID function. The L-1 key allows the operator to select one of five options to provide quick access to various pages. The five options are as follows: LAST MSG, AIR MSN, ARTY MSN, MAYDAY, and MENU.

(1) LAST MSG (Last Message) programs the RAPID key to display the highest priority new message when activated.

(2) AIR MSN (Air Mission) programs the RAPID key to access the currently selected pre-programmed AIR MISSION SUMMARY page.

(3) ARTY MSN (Artillery Mission) programs the RAPID key to access the currently selected pre-programmed ARTILLERY MISSION SUMMARY page.

(4) MAYDAY programs the RAPID key to access the MAYDAY SUMMARY page.

(5) MENU programs the RAPID key to access the RAPID page. The operator is presented with the four previously discussed functions.

4-133. IDM INITIALIZATION.

Initialize the IDM as follows:

1. IDM switch — Press as required to display IDM Index page (Fig 4-77).

2. START key — Press.

3. Paging (1/3) key — Press.

4. TEST key — Press. Enter a T using MFK; GO or NO GO will display on MFD.

5. NETS key — Press to access and complete NET Data pages. Enter prompts as follows:

   a. TFR/AIR NET key — Press to scroll type or net desired adjacent to NET number.

   b. BLK key — Press to scroll between SGL and DBL. Leave as desired.

   c. BAUD key — Press to select desired baud rate.

   d. RADIO key — Press to select radio which will be used for transmitting and receiving.

   e. R-1 key — The time required to transmit will display.

   f. PRE key — Press to access Preamble Entry page and press PREAMBLE — SEC key. Enter desired preamble length of 0.1 to 9.9 seconds using MFK.

NOTE

L-3 (OFF), on the MONITOR page, can be pressed to disable monitor function.

   g. MON key — Press if required to access Monitor Entry page and press MONITOR — SEC key. Enter time of from 0.5 to 9.9 seconds using MFK.

   h. AUTH key — Press to scroll between MANUAL or NONE.

   i. NETS — Set up each of the eight pages as required for each net to be used by repeating steps a. through h.

   j. R-1 key — Press as required to return to Start page 2/3.

6. SUBS key — Press and proceed as follows:

NOTE

During send operations the user will be prompted to select which net to transmit on if the subscriber ID is entered in more than one NET.

   a. NET key — Press as desired to activate desired net and enter subscriber identifier(s).

   b. R-1 key — Press as required to access subpages and enter identifiers. Press to sequence to return to Start page.

7. AUTH key — Press and proceed as follows:

NOTE

Subscriber must already be entered in subscriber list.

   a. SUBS key — Subscriber is displayed or press key and enter desired subscriber using MFK.

   b. XMT LINE — Current transmit authentication table line will be displayed. To change, press key and enter desired line.

   c. RCV LINE — Current receive authentication table line will be displayed. To change, press key and enter desired line using MFK.

   d. MODE key — Press once to activate authentication tables. Press again to scroll between XMT, BOTH or RCV.

   e. TABLE key — Press to access transmit or receive table index.
      (1) Select desired transmit table line.
      (2) Press key adjacent to line number. Enter transmit authentication code from SOI.
      (3) R-1 key — Press to sequence to Start page.

8. MSGS key — If desired, press to access Message Present Entry pages. Press R-1 key as required to return to Start page.

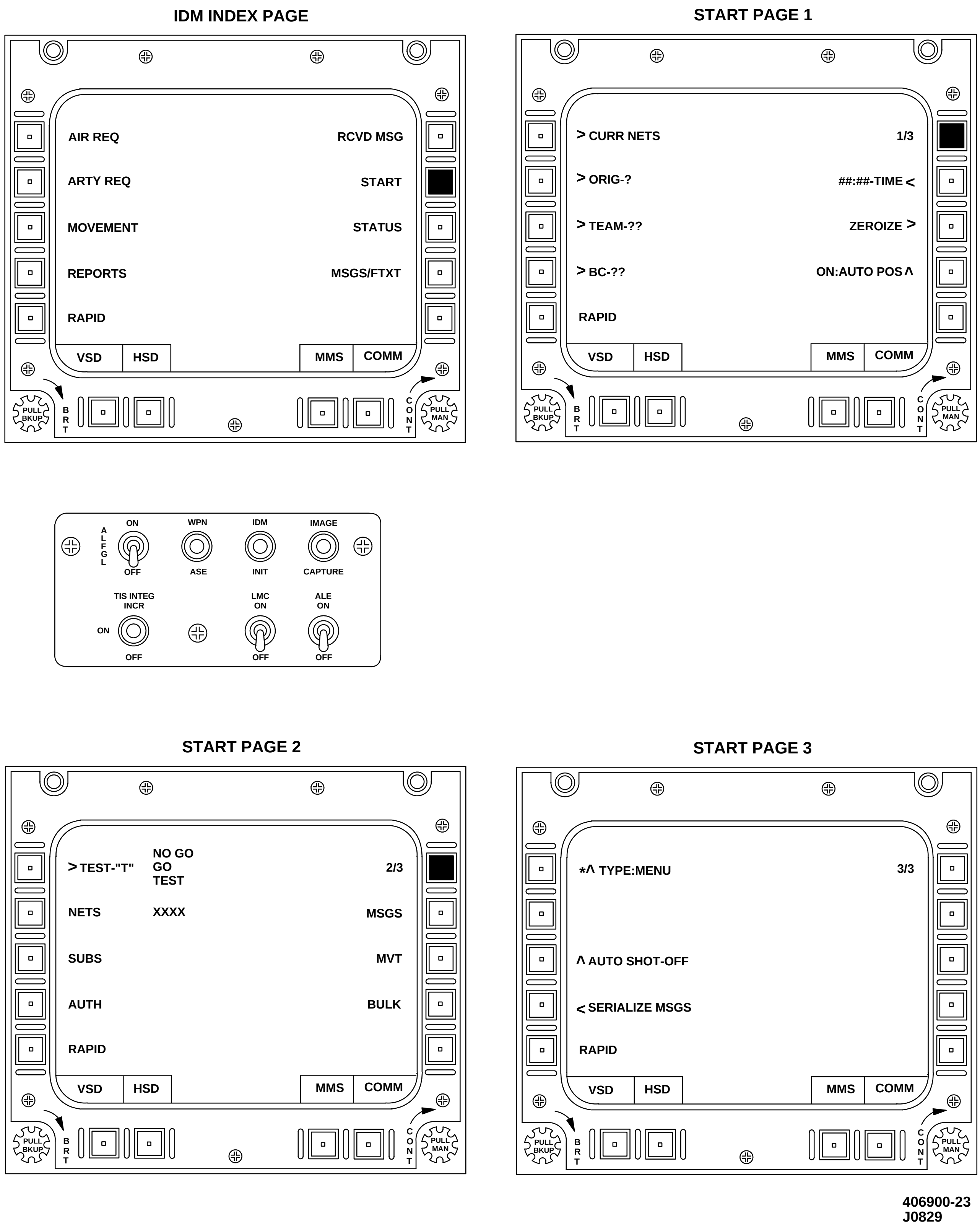

Figure 4-77. IDM Initialization Pages

9. MVT key — If desired, press to access Preset Movement Message pages. Enter movement commands on subpages. Press R-1 key as required to return to Start page.

10. BULK key — Press if it is desired to upload another operator IDM.

a. Enter Destination ID by pressing L-1.

b. Press L-2 to access Bulk Data Select page. Making a selection causes a default back to Bulk Data Summary page.

c. SEND; then scroll to next page. Utilize the SCROLL-SEND procedure until all desired data has been sent.

d. COMPLETE — Send COMPLETE message when finished with bulk data transmission.

11. IDM switch — Press.

a. Start key — Press.

b. Paging key — Press to display 3/3.

c. L-1 key — Press to scroll through Rapid function selections. Select desired function.

d. L-3 key — Press to toggle between AUTO SHOT on and off. AUTO SHOT does not function in this installation.

e. L-4 key — Press to access Serialization Subscriber Assignment page.

(1) L-1 key — Press to toggle between XMT and NONE.

(2) L-2 key — Press to enter desired subscribers.

(3) L-4 key — Press to scroll through subscribers to read initial serialization count of messages.

(4) R-4 key — Press to edit/enter initial serialization count of messages.

(5) R-1 key — Press to return to Start page 3/3.

12. Select IDM — Press. Then select Start page 1/3.

a. CURR NETS key — Press.

NOTE

RADIO selection at L-4 selects the NET transmission radio. The radio selected to receive net traffic need not be the same.

b. RADIO 1 through RADIO 4 keys — Press one of the keys and use the MFK to type in the desired net number for each radio to receive.

c. RTN key — Press.

d. ORIG key — Enter subscriber identifier.

e. TEAM key — Enter team number.

f. BC key — Enter broadcast number.

NOTE

Time of day is automatically input by GPS.

g. TIME key — Enter current time of day only if GPS fails.

4-134. AIR REQUEST PAGES.

a. Description. The Air Request (AIR REQ) list can store up to eight air mission fire requests. The three index pages display observer mission number, type of ordnance, firing element (subscriber) to which request was sent, and mission status. This list is for originating mission requests. Incoming new missions are stored in the Received Message file. Stepping through the mission list is accomplished by pressing the paging (upper right) key on the MFD. Accessing a stored Air Mission Request Summary page is accomplished by pressing the left key adjacent to desired mission. Complete mission information will display. Initiating a new mission request is accomplished by pressing a NEW key of an available mission number on the Air Request list, selecting air mission type, entering the required parameters, receiving the summary, and transmitting the data.

b. Types of air missions are as follows:

(1) HELLFIRE wherein the number of rounds to be fired is requested and guidance is by other than the launching element.

(2) OTHER ORDNANCE wherein there are seven selections, NO PREF, ATGM, GUN, HE, ILLUM, SMOKE, and CHAFF.

(3) NO PREF.

4-135. STORING OR EXECUTING AIR MISSION FIRE REQUEST.

To store an air mission fire request, perform steps 1 through 7.

1. Target locate steps — Accomplish as required.
2. IDM switch — Press as required to display IDM Index page.
3. AIR REQ key — Press.
4. Line (1-8) — Select mission number on which mission is to be entered. NEW key — Press.
5. MSN TYPE — Press appropriate key.
6. As pages sequence, press appropriate key.
7. Air Mission Summary page — Review and change parameters as required.

To execute a fire request, perform steps 8 and 9.

8. On Air Mission Summary page, SEND key — Press.
9. IDM switch — Press and repeat steps 1 through 8 above for each net as required.

To recall and send a stored mission, perform steps 10 through 14.

10. IDM switch — Press as required to display IDM Index page.
11. AIR REQ key — Press.
12. Desired mission (1-8) line number — Select.
13. R-1 key — Press to display Air Mission Summary page.
14. On Air Mission Summary page, SEND key — Press.

NOTE

- Remote HELLFIRE (REMOTE HLFR) mission request. The paging required for a simplified request is depicted in fig. 4-78.
- The Mission Status will change from REQUESTED to ACCEPTED, READY, FIRE, and SHOT. At completion of mission an END OF MISSION message should be sent.
- A generic Air Mission Summary page is shown in fig. 4-79.

4-136. ARTILLERY REQUEST PAGES.

a. Description. The mission data contained in the IDM is formatted to be consistent with the TACFIRE Artillery Fire Direction Center (FDC) system and associated forward observer digital message devices (DMD). Artillery mission command selection is initially entered on the ARTY Mission Summary page automatically as REQ. Upon receipt of the TACFIRE FDC message-to-observer (MTO), the mission command will automatically change to FIRE. A READY command will be displayed if the Battery Computer System (BCS) is online with TACFIRE. Target position (range and bearing from the helicopter) is automatically calculated. By pressing the TGT PSN (target position) key, the operator can manually enter the UTM grid, range, bearing, and altitude of the target on subpages if required.

The Artillery Request List stores two active artillery missions and two preplanned mission requests on the Preplanned Mission List subpage. Accessing either active mission is accomplished by pressing the M1 or M2 key on the ARTY REQ list page. To review a preplanned mission, pressing the PPLN LIST key on the Preplanned Mission List page will cause the Preplanned Mission Summary page to display.

NOTE

In order to store a preplanned mission, a preplan request must be executed and stored as a standard artillery preplan request. Then the mission must be inserted into preplan list.

Initiating a new artillery mission request is accomplished by pressing the NEW key of an available mission number, selecting artillery mission type, following prompts through the subpages, reviewing Summary page, and transmitting data.

b. Types of artillery mission requests are as follows:

(1) NEW TGT wherein the observer defines target type and strength.

(2) Known Point (KNPT TGT) wherein the observer defines a point which is a location previously

identified and numbered, known both to the requestor and to the artillery FDC. The requestor then provides target type and strength.

(3) QUICK wherein the requestor enters only a known point. All other data is known by the artillery FDC.

(4) Preplanned (REQ PPLN) wherein the observer provides type of fire request (either Final Protective Fire (FPF) or Copperhead (CPHD) guided munitions). Only one FPF can be preplanned at a time; however, both preplanned missions can be Copperhead. The requestor then provides target position and known point number.

(5) Copperhead (CPHD) wherein the target position is defined as NEW or Known Point and point number is provided to the firing element.

4-137. ARTILLERY FIRE REQUESTS.

There are three types of artillery fire requests — preplanned, new, and Copperhead.

4-138. PREPLANNED FIRE REQUESTS.

To insert a preplanned fire request, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. ARTY REQ key — Press.

3. On line opposite mission to be replaced. NEW key — Press.

4. REQ PPLN key — Press.

5. Mission type — Select either FPF or CPHD as desired.

NOTE

If KNPT TGT is selected, entry of two-digit KNPT number is required.

6. KNPT TGT or NEW TGT — Select as appropriate.

7. ARTY Mission Summary page will appear — Press SEND. Wait for preplanned MTO then continue.

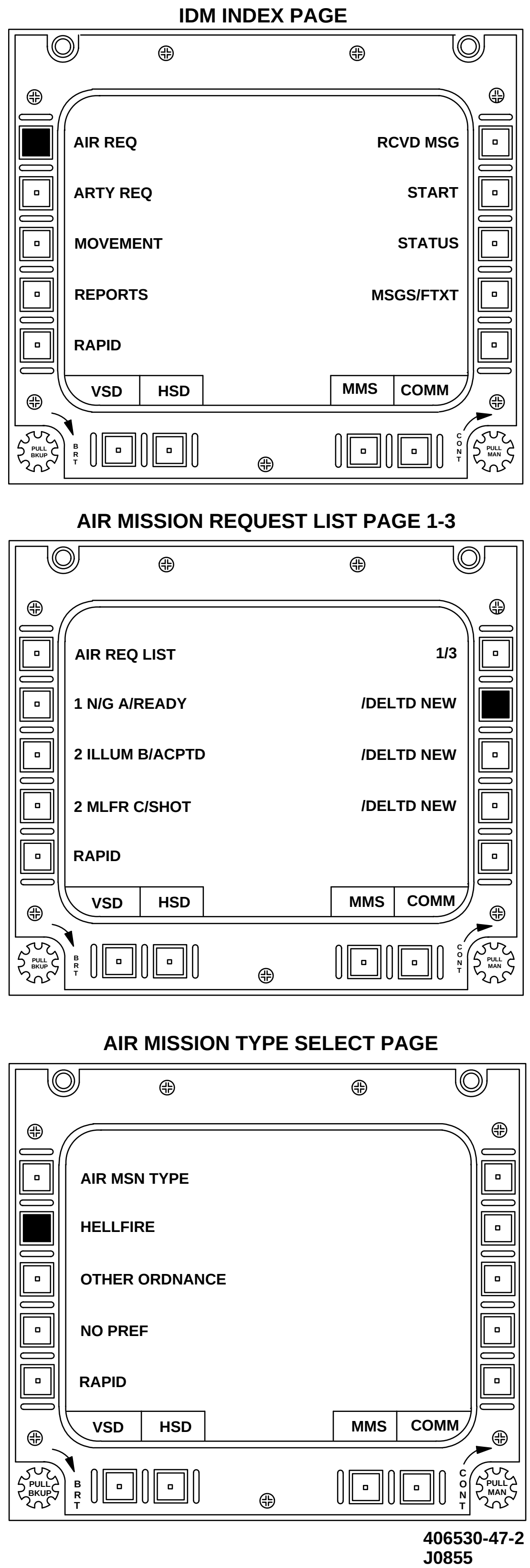

Figure 4-78. Air Request Pages

8. IDM switch — Press to return to IDM Index page.

9. ARTY REQ key — Press.

10. PPLN LIST key — Press.

11. P1 or P2 — Press NEW as desired.

12. L-2 — Press on Preplan Insertion pages.

13. Repeat steps 1 through 12 to insert a second preplanned mission.

NOTE

If the PPLN mission is requested as M1, it can only be stored as P1.

4-139. NEW ARTILLERY FIRE MISSION REQUEST.

To initiate a new fire mission, proceed as follows:

1. Target locate steps — Accomplish as required.

2. IDM switch — Press as required to display IDM Index page.

3. ARTY REQ key — Press.

4. NEW key opposite mission (M1 or M2) to be replaced — Press.

5. Mission type — Press applicable key and enter required parameters on subsequent pages until all data is inserted.

6. Review mission on Summary page and make changes as required.

7. SEND key — Press.

NOTE

- New Artillery Fire Mission Request (simplified) is depicted in fig. 4-80.
- A generic Artillery Mission Summary page is shown in fig. 4-81.

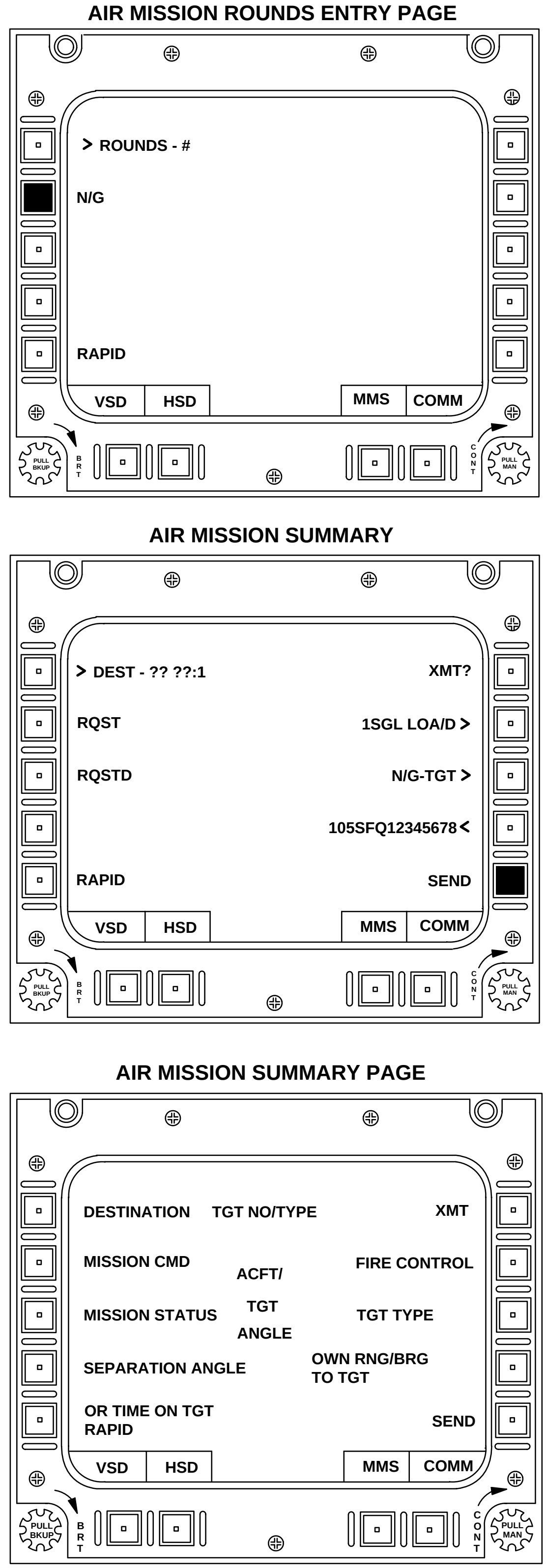

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Figure 4-79. Air Mission Summary Pages

4-140. COPPERHEAD FIRE MISSION — ACTIVE AND PREPLANNED.

To accomplish a Copperhead fire mission, proceed as follows (fig. 4-82).

1. Target locate steps — Accomplish.
2. IDM switch — Press as required to display IDM Index page.
3. ARTY REQ key — Press.
4. To accomplish in active mission, M1 or M2 key — Press as desired.
5. CPHD — Press.

NOTE

If KNPT TGT is selected, entry of two-digit KNPT number is required.

6. NEW TGT or KNPT TGT — Select as appropriate.
7. ARTY Mission Summary page will appear — Review ARTY Mission Summary page and change as required.
8. SEND key — Press (fig. 4-80).

4-141. MOVEMENT COMMAND COMMUNICATIONS.

The Movement pages allow position instructions to be transmitted without voice communication. The IDM operator can issue directions to specific or all team members to MOVE TO, HOLD AT, rendezvous (RDZV) at; or inform team members MOVING TO or HLDG AT a location. The locations can be preset to allow rapid communication. In addition, the Movement pages allow automatic transmission of current position through MY POSITION key and free text communication through the OTHER key.

4-142. MOVEMENT COMMAND TRANSMISSION.

Transmit movement commands as follows (fig. 4-83):

1. IDM switch — Press as required to display IDM Index page.
2. MOVEMENT key — Press.
3. Appropriate movement type key — Press.
4. Appropriate destination select key — Press.

NOTE

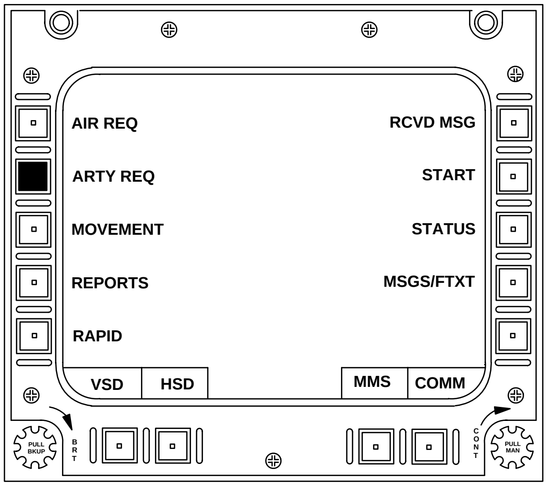
Pressing OTHER key will display Freetext Message Entry page where a manual entry can be made using MFK.

5. Mission Summary page — Review and change as required.
6. SEND key — Press (fig. 4-83).

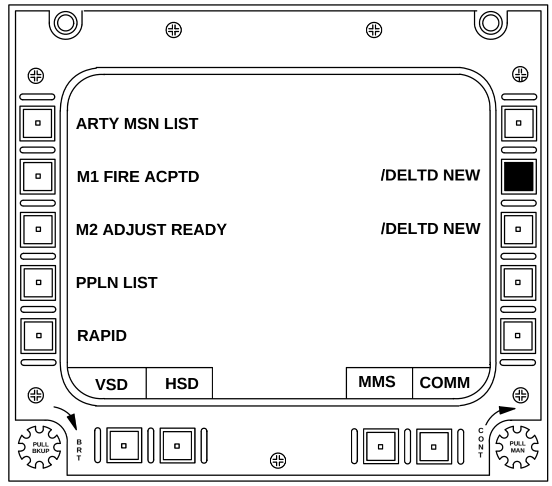
4-143. REPORT COMMUNICATIONS.

The Reports pages (fig. 4-84) allow the observer to provide various information to team and net members such as: Situation/status (SIT/STATUS) which reports the observers own situation, SPOT which reports target activity, ATI to provide intelligence reports to artillery units, BDA to report battle damage assessments, CAS to report casualty assessments, NEG SPOT, and REQUEST to request a report from another subscriber.

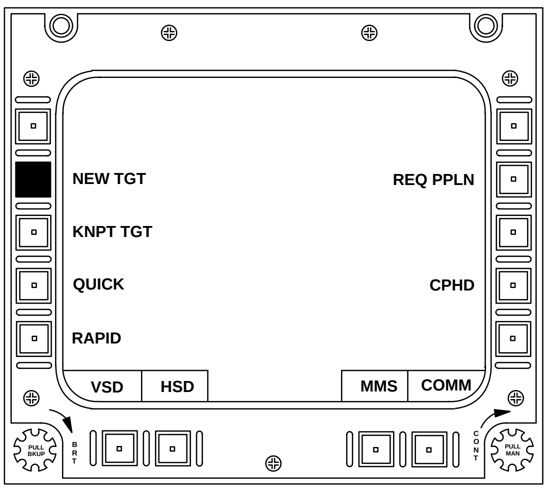
IDM INDEX PAGE



ARTY REQ LIST PAGE



ARTY MISSION TYPE PAGE



ADJUST FIRE EXAMPLE

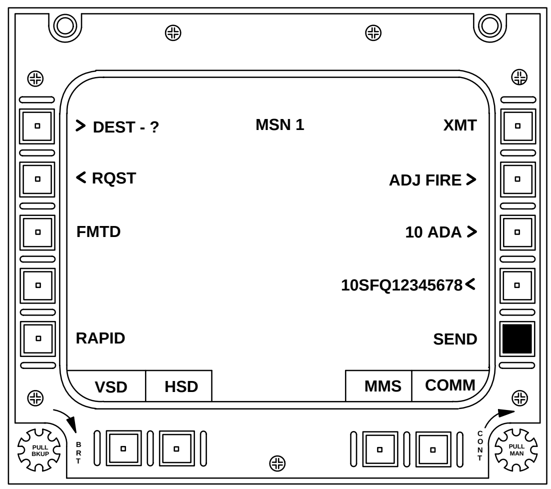


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Figure 4-80. Artillery Request Pages

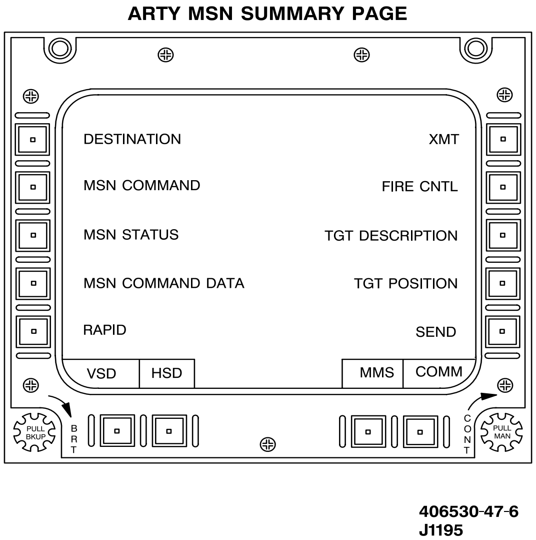


Figure 4-81. Artillery Mission Summary Page

4-144. SITUATION/STATUS (SIT/STATUS).

Report Transmission. To transmit observers situation and/or status, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. REPORTS key — Press.
3. Activity to report — Press appropriate keys.
4. Report Summary page — Review and change as required.
5. SEND key — Press.

4-145. SPOT REPORT TRANSMISSION.

To transmit a spot report, proceed as follows (fig. 4-84):

1. Target locate steps — Accomplish as required.
2. IDM switch — Press as required to display IDM Index page.
3. REPORTS key — Press.
4. SPOT key — Press.

NOTE

Three different target types may be entered for each SPOT report.

5. TARGET type — Press appropriate key.
6. Target strength (STR) — Press appropriate key.
7. R-1 key — Press.
8. ALT key — Press as desired.
9. Target (TGT) ACTIVITY — Select as desired. If MOVING is selected, proceed to step 10. If STATIONARY is selected, proceed to step 11.
10. Target direction — Press appropriate key.
11. R-1 key — Press.
12. Mission Summary page — Review and change as required.
13. SEND key — Press.

4-146. BATTLE DAMAGE ASSESSMENT (BDA) REPORT TRANSMISSION.

To provide battle damage assessments, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. REPORTS key — Press.
3. BDA/CAS key — Press.
4. BDA Summary page — Press appropriate key and manually enter information using MFK.
5. SEND key — Press.

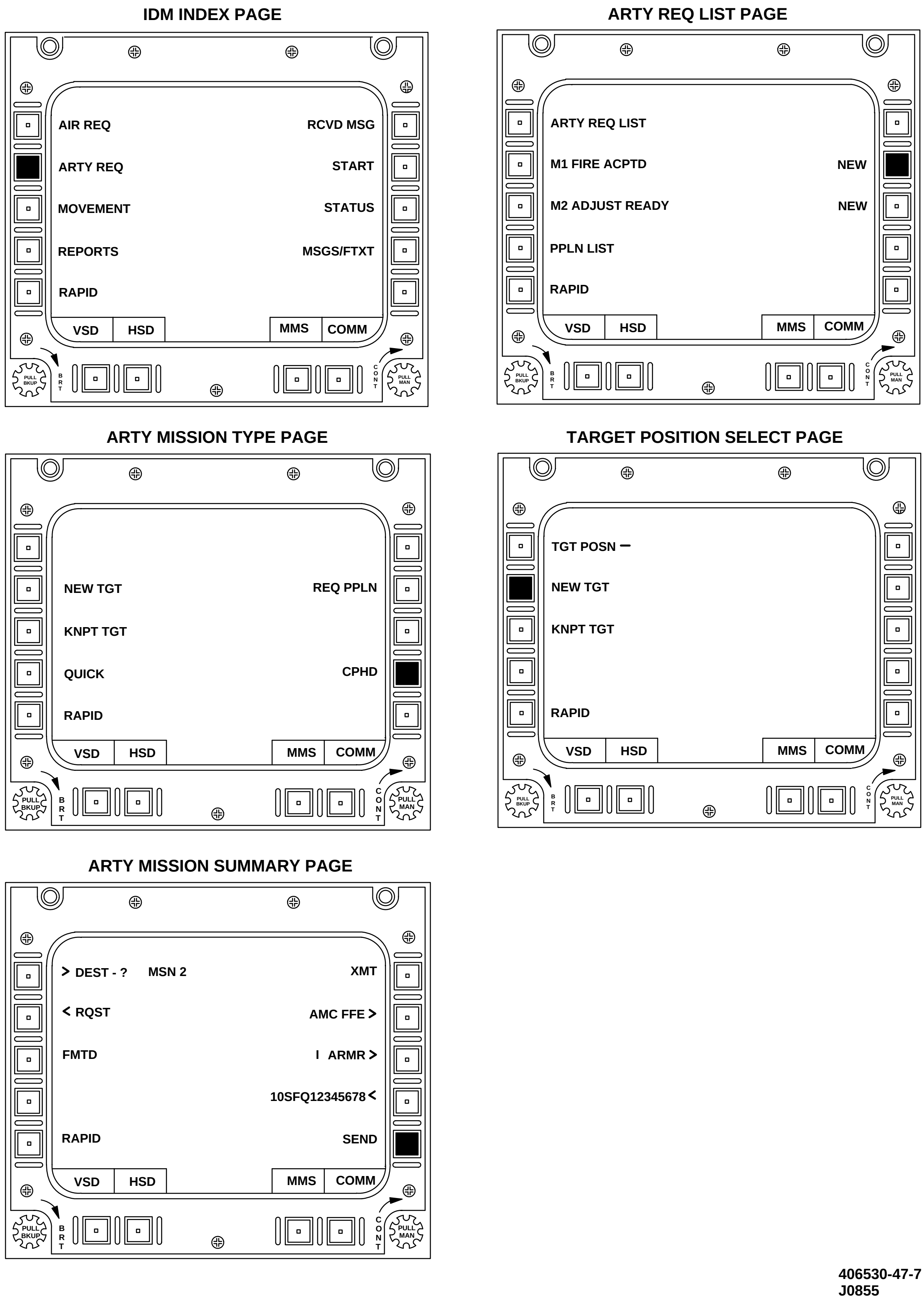
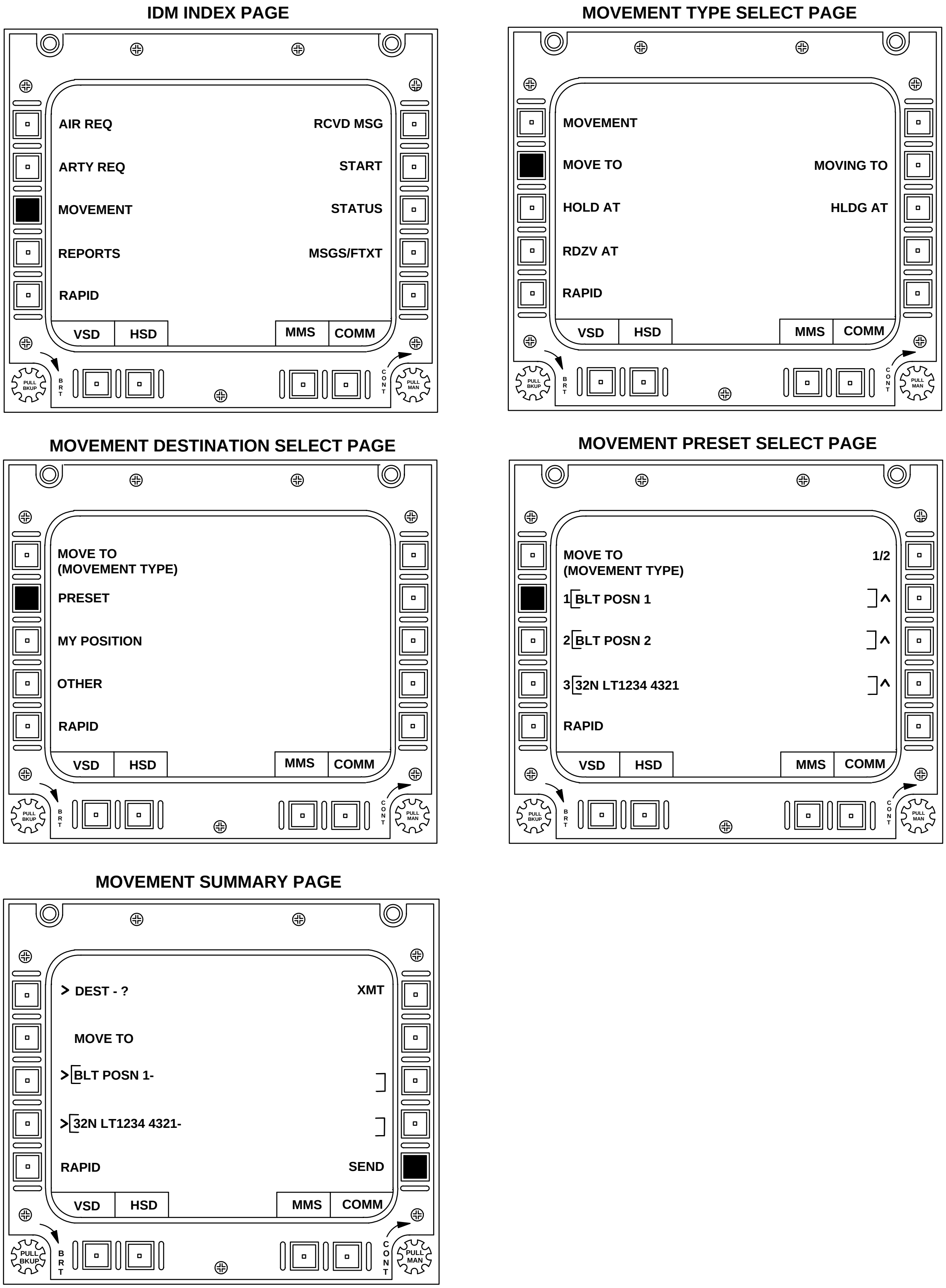


Figure 4-82. Artillery Fire Request Pages



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J0855

Figure 4-83. Movement Pages

4-147. CASUALTY (CAS) REPORT TRANSMISSION.

To provide casualty reports, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. REPORT key — Press.
3. BDA/CAS key — Press.
4. CAS Summary page — Press appropriate key and manually enter information using MFK.
5. SEND key — Press.

4-148. ARTILLERY INTELLIGENCE REPORT (ATI) TRANSMISSIONS.

To transmit an artillery intelligence (ATI) report, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. REPORTS key — Press.
3. ATI key — Press.
4. REL — Scroll through reliability option until desired option is displayed.
5. Target type — Press appropriate key.
6. Target strength — Press appropriate key.
7. R-1 key — Press.
8. RAD/LGTH, WIDTH, and ATTITUDE keys — Press as appropriate.
9. R-1 key — Press.
10. ATI Summary page — Review and change as required.
11. SEND key — Press.

4-149. REPORT REQUESTING FROM ANOTHER SUBSCRIBER.

To request a report from another subscriber, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. REPORTS key — Press.

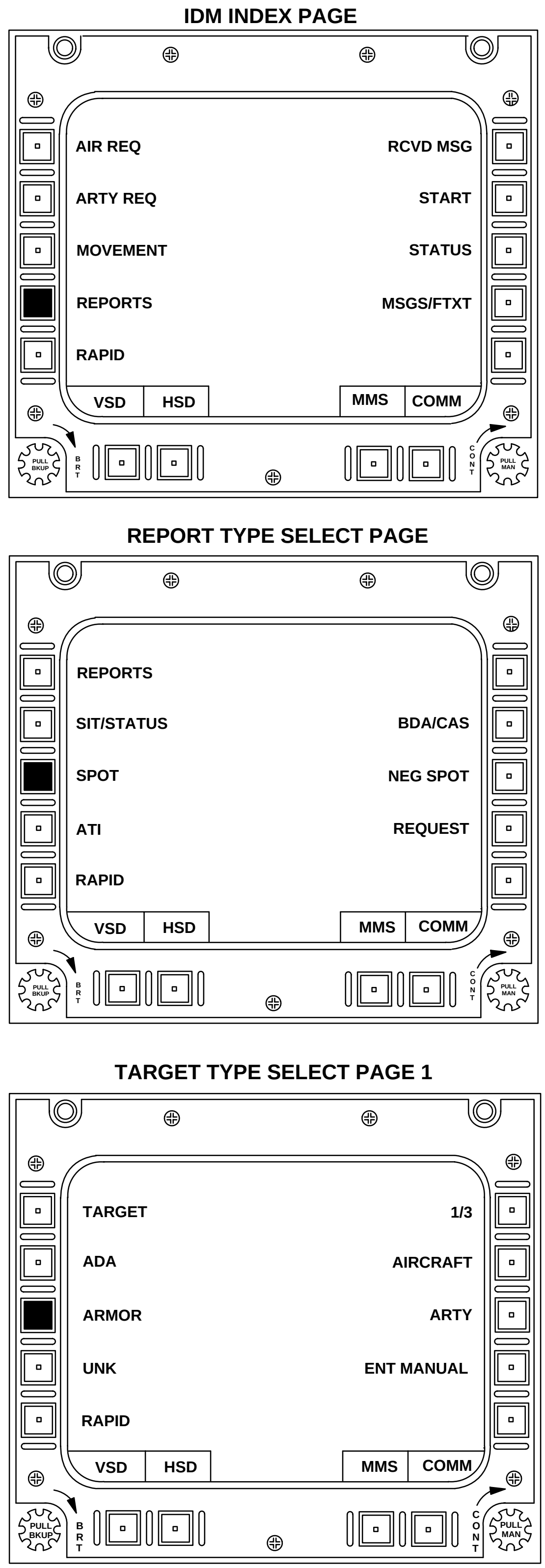

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Figure 4-84. Report Pages (Sheet 1 of 2)

3. REQUEST key — Press.

4. On Report Request Select page — Press appropriate key to designate type of report desired.

5. DEST– key on Summary page — Press and enter subscriber identifier from which report is desired using MFK.

6. Request Report Summary page — Review and change as required.

7. SEND key — Press to transmit request.

4-150. STATUS PAGES.

The Status pages (fig. 4-85) provide a means whereby the observer can provide information concerning his own weapons (OWN WPNS), own present position (OWN PPSN), or request information concerning a particular subscribers weapons or position status. The Present Position (PPSN) page includes location in UTM, altitude, and fuel remaining. The OWN WPNS page reports observers laser code to subscribers and provides weapons status. The remaining Status pages provide similar options for subscribers to provide information to the observer. The weapons format will depend upon whether the subscriber is defined in an AIR NET or a TACFIRE NET. The Subscriber pages will be automatically updated upon receipt of a situation/status report.

4-151. OWN STATUS.

To review own status, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. STATUS key — Press.

3. OWN WPNS or OWN PPSN key — Press as desired.

4. For OWN WPNS entry, laser designator code — Enter using MFK and press paging select key (1/1) to return to Status Index page.

4-152. OWN PPSN ENTRY.

1. Present position is entered automatically. To change, enter coordinates using MFK and UTM key — Press.

2. ALT key — Press. Enter altitude in meters or enter N/G.

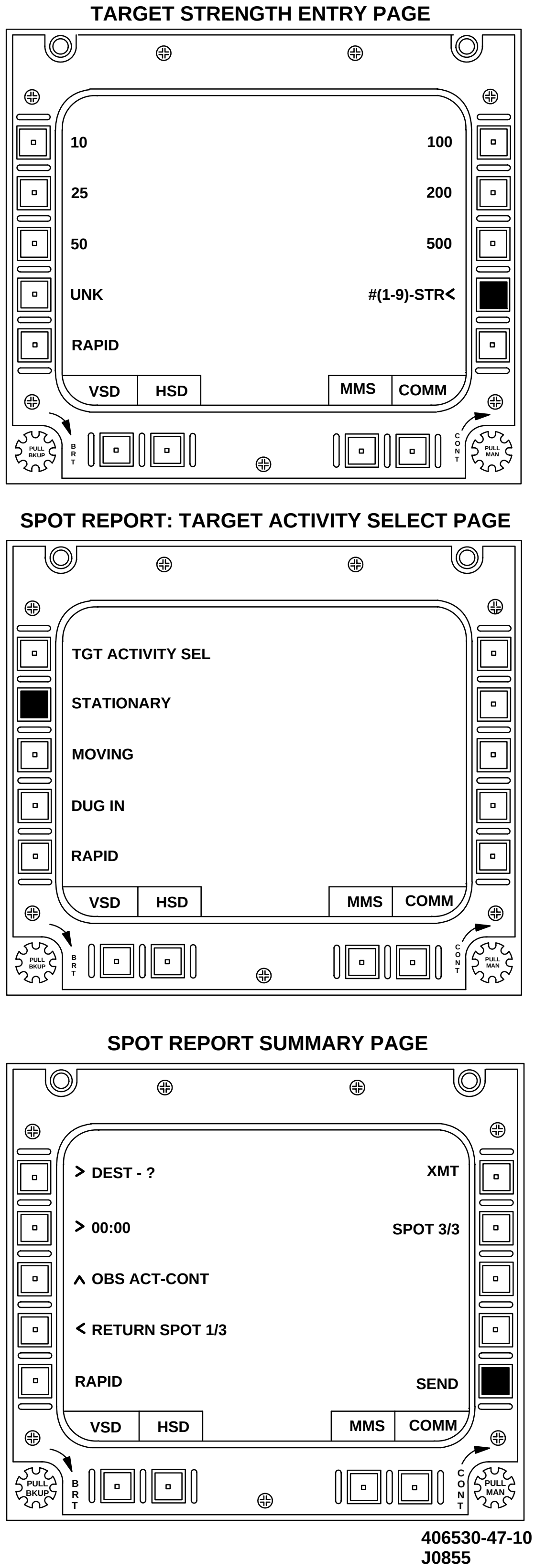

Figure 4-84. Report Pages (Sheet 2 of 2)

3. FUEL key — Press and enter.

4. Paging select key (1/1) — Press to return to Status Index page (fig. 4-85).

4-153. WEAPONS STATUS — ALL SUBSCRIBERS.

To obtain subscriber weapons status, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. STATUS key — Press.

3. SUBS WPNS key — Press. Review weapons status of net subscribers as IDM automatically sequences from the first subscriber in NET 1 to the last subscriber in NET 8.

4. Paging key — Press to return to Status Index page.

4-154. PRESENT POSITION STATUS — ALL SUBSCRIBERS.

To obtain present position information on all net subscribers, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. STATUS key — Press.

3. SUBS PPSN key — Press.

NOTE

- Subscriber status will begin with the first subscriber in NET 1 and display, in order, through the last subscriber in NET 8 as paging key is pressed.
- UTM key can be alternately pressed to display UTM grid coordinates or range and bearing of subscriber status being displayed.

4. If desired, return to Status Index page by pressing paging key once more after last subscriber status is displayed.

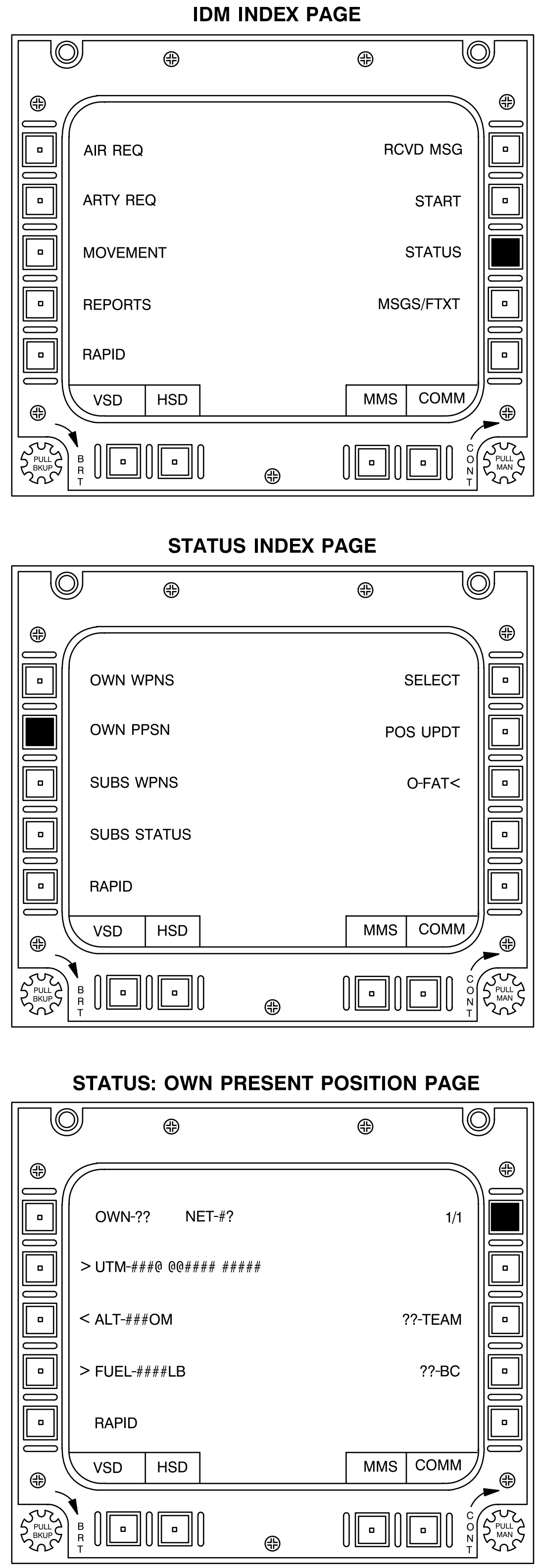

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Figure 4-85. Status Pages

4-155. WEAPONS/PRESENT POSITION STATUS — SINGLE SUBSCRIBER.

To obtain the status of a single subscriber, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. STATUS key — Press.
3. SELECT key — Press.
4. SUB- key — Press. Enter desired subscriber identifier using MFK. Present Position page will display.
5. Paging key — Press to review weapons status.
6. Weapons status paging key — Press to return to Status Index page.

4-156. SUBSCRIBER POSITION STATUS.

1. IDM switch — Press as required to display IDM Index page.
2. STATUS key — Press.
3. POS UPDT key — Press.
4. SUBS POSITION key — Press and review.
5. Repeat steps 1 through 3.
6. SUBS NET key — Select appropriate NET.
7. Repeat steps 4 and 5 as desired.
8. Summary page — Review and select destination.
9. SEND key — Press.

4-157. FREE TEXT/PRESET MESSAGE PAGES.

The Free Text/Preset Message pages (fig. 4-86) allow the observer to compose and transmit any message up to 36 characters (two lines) at any time. Also, these pages allow messages to be composed and stored for subsequent recall and transmission at the appropriate time. The top message page includes a MAYDAY for rapid MAYDAY broadcasts, a CHECKFIRE message for a rapid cease fire broadcast, an authentication synchronization message to align the FDC codes to the IDM codes, and cancel checkfire message. The free text and preset messages contain the same information. The free text/preset messages are automatically addressed to the team subscriber identifier. The MAYDAY message is addressed to the broadcast subscriber identifier, and contains the MAYDAY message and own present position. The Authentication Synchronization (AUTH) message is addressed to the broadcast subscriber identified in the Start pages with whom the automatic authentication is to occur (normally TACFIRE). If, after transmission, an NAK is returned, the tables are out of synchronization. TACFIRE will still get the message and change tables to match the observers. TACFIRE will call back once synchronization has been accomplished.

4-158. FREE TEXT MESSAGE COMPOSITION AND TRANSMISSION.

To compose and transmit a free text message, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. MSGS/FTXT key — Press.
3. DEST– key — Enter subscriber identifier using MFK.

NOTE

When FREE TEXT - TEST is used for communication check, data is not required.

4. FREE TEXT key — Press to scroll between TEST and DATA as required.
5. Message — Enter any message up to 36 characters long using MFK.
6. SEND key — Press to transmit message (fig. 4-86).

4-159. PRESET MESSAGE TRANSMISSION.

To transmit any of up to six preset messages entered during IDM initialization, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. MSGS/FTXT key — Press.
3. MSG PRESETS key — Press.
4. Select message to be transmitted by pressing key adjacent to appropriate message number.

5. DEST– key — Press and enter subscriber identifier.

6. SEND key — Press.

7. To return to IDM Index page, IDM switch — Press.

4-160. CHECKFIRE MESSAGE TRANSMISSION.

To broadcast a cease fire message to all subscribers, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. MSGS/FTXT key — Press.

3. CHECKFIRE key — Press.

4. Broadcast identifier is automatically inserted to change: DEST- key — Press and enter identifier using MFK.

5. SEND key — Press.

6. To return to IDM Index page, IDM switch — Press.

4-161. MAYDAY MESSAGE TRANSMISSION.

To broadcast a MAYDAY message, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. MSGS/FTXT key — Press.

3. MAYDAY key — Press.

4. To change broadcast identifier, DEST– key — Press. Enter identifier using MFK.

5. To change present position in UTM grid, POSITION key — Press. Enter UTM using MFK.

6. SEND key — Press.

7. To return to IDM Index page, IDM switch — Press.

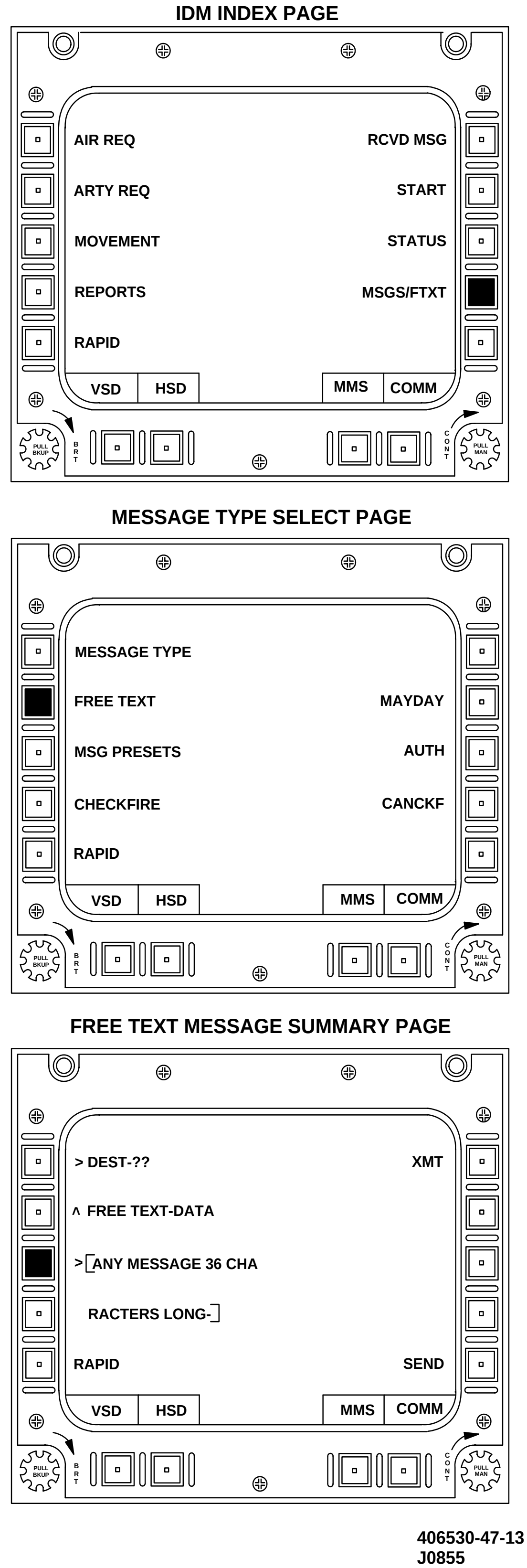

Figure 4-86. Free Text/Preset Message Pages

4-162. AUTHENTICATION SYNCHRONIZATION TRANSMISSION.

To broadcast an Authentication Synchronization transmission, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. MSGS/FTXT key — Press.
3. AUTH key — Press.
4. DEST– key — Press. Enter identifier of subscriber with which automatic authentication is desired.
5. When desired, SEND key — Press.

NOTE

If authentication tables between sender and receiver are not synchronized, an NAK will be returned. Sender should not retransmit. Receiver should change table positions and transmit to original sender with tables synchronized.

4-163. CANCEL CHECKFIRE MESSAGE TRANSMISSION.

To broadcast a cancel checkfire message, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. MSGS/FTXT key — Press.
3. CANCKF key — Press.
4. DEST– key — Press. Enter identifier of subscriber as desired.
5. SEND key — Press.
6. To return to IDM Index page, IDM switch — Press.

4-164. RECEIVED MESSAGES.

The received message function of the IDM allows the observer to access the received message list to review new messages. It also allows the observer to review and delete any previously received messages, to include received fire requests. When an IDM message is received, it will be stored in the RCVD MSGS index and an IDM MESSAGE advisory will appear on the MFD. Twelve messages can be stored for review and deletion when desired, except for situation/status reports which are automatically deleted upon review. Messages received while the RCVD MSGS index is full will not be accepted, and the received advisory will not be displayed. When a message is received an acknowledge (ACK) is automatically transmitted back to the message originator with no operator action required. Messages received which are not recognizable, improperly addressed (net data incorrect), or unprocessable will be ignored. The originator will not have an ACK displayed and an IDM MESSAGE will not be displayed to the receiver. A message received which is acceptable, but from an originator not defined in the subscriber list, will be stored and an advisory displayed; however, an ACK will not be transmitted back. A message received addressed to the Team or Broadcast identifiers will be stored and an advisory displayed but an ACK will not be sent to the originator. The RCVD MSG index will show the message number, the identifier of the sender, a three character identifier of message type, a six character field indicating the message content, and the status of the message. If the message has been reviewed, delete (DEL) will appear next to the right hand key line; if not yet reviewed, NEW will appear. Another function of the received messages is that it allows the observer to leave the IDM pages and still be able to manage a fire mission. The Fire Mission Summary pages will be automatically updated upon the receipt of new mission commands. Received free text and movement messages can be deleted on the page that they are reviewed. If delete is selected, the system will return to the Received Message Index page. Situation/status reports are automatically deleted after they have been reviewed and the information is stored in the Status pages.

4-165. REVIEWING RECEIVED MESSAGE INDEX.

To review a received message, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. RCVD MSG — Press to display received message index.
3. Message to be reviewed — Select by pressing key adjacent to appropriate message number.
4. Delete message as appropriate.

4-166. GLOSSARY — IDM.

The following is a list of mnemonics used by the IDM system.

MNEMONIC	INTERPRETATION
1 RND	One Round
3 RND	Three Rounds
ACK	Acknowledge
ACTY	ACTIVITY Operational check in progress
ADA	Air Defense Artillery
A/D	Add or Drop (in Meters)
ADJ FIRE	Adjust Fire
AIRCRAFT	Aircraft
ALT	Altitude in Meters
AMC AF	At My Command — Adjust Fire
AMC DEST	At My Command — Destruction
AMC FFE	At My Command — Fire For Effect
AMC REG	At My Command — Registration
AMC RPT	At My Command — Repeat
AMC/RFFE	At My Command — Repeat Fire For Effect
AMMO	Ammunition
ANTITANK	Antitank Munitions
APC	Armored Personnel Carrier
APERS	Antipersonnel
ARTY	Artillery
ASSEMBLY	Assembly — Staging or Collecting Areas
ASSIGN KNPT	Assign Knownpoint
ASSY	Assembly
ATGM	Antitank Guided Missile

(Cont)

MNEMONIC	INTERPRETATION
AT GUN	Antitank Gun
ATI	Artillery Intelligence
ATI GEO1	Artillery Target Intelligence Geographic Coordinates Report Number 1
ATI GEO1	Artillery Target Intelligence Geographic Coordinates Report Number 2
ATI GRID	Artillery Target Intelligence Grid Coordinate Report
ATI POLAR	Artillery Target Intelligence Polar Coordinate Report
ATTITUDE	Attitude or Orientation of Target
AUF	Adjusting Unit of Fire
AUTH 01	Authentication One
BC	Broadcast
BLDG	Building
BN	Battalion
BOAT	Boat
BPS	Bits Per Second
BRG EQPT	Bridge Equipment
BRIDGE	Bridge
BUILDING	Building
BURN	Burning
CAL	Caliber in Millimeters
CAS	Casualty
CEOI	Communications Electronics Operating Instructions
CEN	Center — Command Post
CENTER	Center — Center Platoon of a Firing Battery
CHECK FIRE	Cease Firing (Emergency)
CLASS I	Class I — Rations (Food)

(Cont)

MNEMONIC	INTERPRETATION
CLASS II	Class II — Material (Supplies)
CLGP	Cannon Launched Guided Projectile
CMD	Command
CMPLT	Complete
CNO	Cannot Observe
CNO/AF	Cannot Observe/Adjust Fire
CNO/FFE	Cannot Observe/Fire For Effect
CNO/RFFE	Cannot Observe/Repeat Fire For Effect
COMPSD MSG	Composed Message
CONCRETE	Concrete
CONTROL	Control
COVER	Cover — Under Overhead Cover
CP	Concrete Piercing
CPHD	Copperhead Guided Munitions
CURR	Current
D	Data
DBL	Double Block Mode
DC AF	Danger Close — Adjust Fire
DC FFE	Danger Close — Fire For Effect
DEFILE	Defilade (in a Depression or Valley)
DELAY	Delay — Fuze Setting
DEST	Destruction or Destroyed
DEST AF	Destruction Adjust Fire
DEST/DC	Destruction/Danger Close
DEST/REG	Destruction/Registration
DEST/TOT	Destruction/Time On Target

(Cont)

MNEMONIC	INTERPRETATION
DIR	Direction (In Mils)
DIR ERR	Direction Error (In Mils)
DIST	Distance (In Meters)
DMD	Digital Message Device
DN	Down
DNA	Do Not Adjust
DNC	Do Not Combine
DNO	Did Not Observe
DNO TGT	Did Not Observe Target
DOP	Degree of Protection (Personnel)
DRAW TGT	Draw Target
DROP	DROP (Decrease in Range in Meters)
DPLY DLY	Display Delay
DSPO	Disposition
DUGIN	Dug In (In Foxholes)
EAST	Easting Coordinates
ENTRY NO	Entry Number
EOM	End of Mission
EOM RAT	End of Mission — Record As Target or Record As Target Knownpoint
EOM & SUR	End of Mission & Surveillance
EQUIP	Equipment
EST	Eastern
EW	Electronic Warfare
EXC	Excellent (Information Reliability)
FAIR	Target Identification Not Certain
FAT	Free Air Temperature

(Cont)

MNEMONIC	INTERPRETATION
FERRY	Ferry
FFE	Fire For Effect
FIRE	Commence Firing (Cancels Check Fire)
FIRE FPF	Fire — Final Protective Fire
FIRE TGT NO	Fire On Target Number
FL TRACE	Front Line Trace
FMTD	Formatted
FO COMD	Forward Observer Command
FOOT PON	Foot Pontoon — Bridge
FORWARD	Forward
FPF	Final Protective Fire
FR GRID	Fire Request Grid
FR LASER	Fire Request — Laser
FR POLAR	Fire Request — Polar
FR QUICK	Fire Request — Quick
FR SHIFT	Fire Request — Shift
FREETEXT	Plain Text Message
FUZE	Fuze
GAS NONP	Gas — Nonpersistent
GAS PERS	Gas — Persistent
GOOD	Good (Identification of Target — Moderately Reliable)
GRID	Grid — UTM Coordinates
GUIDANCE	Guidance
GUN	Gun
HB	Highburst
HB/MPI	Highburst/Mean Point of Impact

(Cont)

MNEMONIC	INTERPRETATION
HC SMX	White Smoke
HE	High Explosive
HEAVY	Heavy Artillery (177MM to 250MM)
HE/DELAY	High Explosive/Delay (Fuze)
HELICOPTER	Helicopter
HE/Q	High Explosive/Quick (Fuze)
HE/TIME	High Explosive/Time Delay (Fuze)
HE/VT	High Explosive/Variable Time (Fuze)
HE/WP	High Explosive/White Phosphorus
HIGH/DC	High Angle/Danger Close
HIGH/REG	High Angle/Registration
HIGH/TOT	High Angle/Time On Target
HILL	Hill
HLDG	Holding
HVY MGUN	Heavy Machine Gun
HVY MSL	Heavy Missile
HVY WHEEL	Heavy Wheeled Vehicles
ICM	Improved Conventional Munitions
IGN RD	Ignore Round
ILLUM	Illumination
INFANTRY	Infantry
INTEGRATE	Integrated into a single TIS image.
JUNCTION	Junction
KBD BELL	Keyboard Bell — Volume 0 to 7
KNPT	Knownpoint
LA	Left Above

(Cont)

MNEMONIC	INTERPRETATION
LAST PNT	Last Point
LATITUDE	Latitude in Degrees, Minutes and Seconds
LB	Left Below
LDG STRP	Landing Strip
LFT	Left
LMC	Activates Linear Motion Compensation
LONGITUDE	Longitude in Degrees, Minutes and Seconds
LOST	Lost (Failed to Observe Last Round)
LOST BT	Lost Burst
LOST TGT	Lost Target
LOUDSPKR	Loudspeaker
LOW/DC	Low Angle/Danger Close
LOW/REG	Low Angle/Registration
LOW/TOT	Low Angle/Time on Target
LT MGUN	Light Machine Gun
LT MSL	Light Missile
LT WHEEL	Light Wheeled Vehicle (Jeeps)
M1	Mission 1
M2	Mission 2
MASNRY	Masonry
MDM MSL	Medium Missile
ME	Method of Engagement
MEDIUM	Medium
MPI	Mean Point of Impact
MSG TYPES	Message Types
MSN	Mission

(Cont)

MNEMONIC	INTERPRETATION
MSN INFO	Mission Information
MSN NO	Mission Number
MTO	Message to Observer
MVT	Movement
NAK	Not Acknowledged
NEG	Negative
NEUT	Neutralized
NEUTBURN	Neutralized and Burning
N/G	Not Given
NONE	None — No Disposition Given
NO PREF	No Preference
NORTH	Northing Coordinates
NO UNITS	Number of Units
NO VOL	Number of Volleys
OBSD ERR	Observed Error
OBSN	Observation
OBSR LOC	Observer Location
OBS VA	Observe Vertical Angle
OK BT	O.K. Burst
OK TGT	O.K. Target
OP	Observation Post
OPNL CHECK	Operational Check
ORIG	Origin
PAC	Pitch Attitude Cue
PE	Probable Error
PERS	Personnel

(Cont)

MNEMONIC	**INTERPRETATION**
PPLN	Preplanned
PPSN	Present Position
PRAND	Standing On First Volley; Prone On Subsequent Volleys
PREAMBLE	Message Lead In
PREC REG	Precision Registration
PRONE	Prone on First and Subsequent Volleys
PROVER	Prone on First Volley; Covered on Subsequent Volleys
PRUG	Prone on First Volley; Dug (or Digging in on Subsequent Volleys)
PSN	Position
PTL OIL	Petroleum Oil
QUICK	Fuze Setting — Quick
RA	Right Above
RAD/LGTH	Radius/Length (In Meters)
RAILROAD	Railroad
RAT	Record As Target
RB	Right Below
RCLR	Recoilless Rifle
RCRD REG PT	Record As Registration Point
RCRD TI REG PT	Record As Time Registration Point
RDR REG	Radar Registration
RDZV	Rendezvous
RECON	Reconnaissance
REF DIR	Reference Direction
REF VA	Reference Vertical Angle
REG AF	Registration Adjust Fire
REG NEXT LOT	Register Next Lot (of Powder)

(Cont)

MNEMONIC	INTERPRETATION
REGT	Regiment
REL	Reliability
RELBIL	Reliability
RESECT	Resection
RKT/MSL	Rocket Missile
R/L	Right or Left (In Meters)
RNDS	Number of Rounds that Impacted
SA LASER	Subsequent Adjustment With Laser
SEQ NO	Sequence Number
SF ADJ	Shell Fuze Adjustment
SF 1ST	Shell Fuze for First Volley
SF SUBQ	Shell/Fuze for Subsequent Volleys
SHELL/FZ	Shell/Fuze
SHELREP	Shell Report
SHFT	Shift
SHOT	Shot — Round Fired
SITE	Site — Position or Location
SLT	Searchlight
SLT DIST	Slant Distance
SNG	Single
SOI	Security Operating Instructions
SPECIAL	Special — Target Types
SPLASH	Round Impact
SPT	Spot
STA TGT	Stationary Target
STD	Standard

(Cont)

MNEMONIC	INTERPRETATION
STEEL	Steel — Construction Material, Type of Bridge
SUB	Subscriber
SUBQ ADJ	Subsequent Adjustment
T	Test
T/D	Type of Data
TFR	TACFIRE
TGT	Target
TGT NO	Target Number
TIME	Time (Hours and Minutes)
TIME FLT	Time of Flight
TIME RPT	Time Report
TNO	Try Number
TOT	Time on Target
TRILAT	Trilateration
TROOPS	Troops
TRP & ARM	Troops and Armor
TRP MECH	Troops Mechanized
TRP & VEH	Troops and Vehicles
TYPE REG	Type of Registration
U/D	Up/Down (In Meters)
UNK	Unknown
UP	UP — Changes in Height of Bursts
USE GT	Use Gun Target Line
VA	Vertical Angle
VA ERR	Vertical Angle Error (In Mils)
VCORR	Vertical Correction

(Cont)

MNEMONIC	INTERPRETATION
VEH	Vehicle
VEH PON	Vehicle Pontoon
VERY HVY	Very Heavy
WKPTY	Work Party
WOODEN	Wooden Construction Material
WP/DELAY	White Phosphorus With Delay Fuze
WPN	Weapon(s)
WP/Q	White Phosphorus with Quick Fuze
WP/TI	White Phosphorus with Time Fuze
WR/AF	When Ready/Adjust Fire
WR/FFE	When Ready/Fire For Effect
WR/RFFE	When Ready/Repeat For Fire Effect
XMIT BLK	Transmit Block
XMIT RATE	Transmit Rate
YES	Affirmative

SECTION VI. (CDS4) IMPROVED DATA MODEM (IDM)

4-167. PHYSICAL DESCRIPTION.

The IDM is composed of a single line replaceable unit (LRU) that receives information from the mast mounted sight (MMS), CPG multifunction display (MFD), multifunction keyboard (MFK), and other sensors. The processed information is displayed on the CPG MFD. IDM information is transmitted to, and received from, other IDM equipped vehicles and the artillery TACFIRE/ Joint Variable Message Format (JVMF) system using onboard radios. The IDM is not a transmitter, but supplies a signal to a selectable radio and sends digital data as though it were voice. Traffic can also be passed to, and received from, handheld data message devices (DMD's). This system provides the ability to format complex messages such as artillery fire requests, reports, emergency broadcasts, automatic reporting of status, movement commands, and general free text messages with automatic or manual authentication.

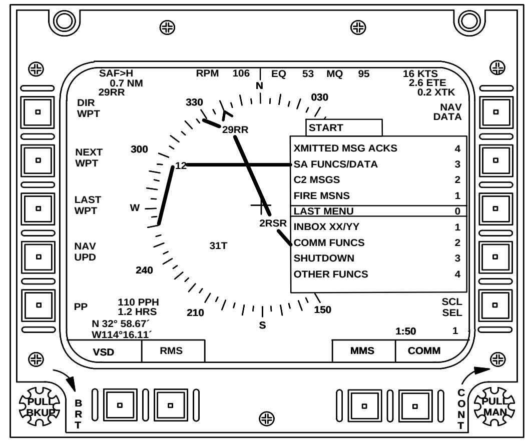

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Figure 4-87. HOG Pop-up Menu

4-168. OPERATIONAL DESCRIPTION.

Using IDM, the CDS supports two protocols: TACFIRE and JVMF. Both protocols require that the IDM be initialized using the Hands-On General User Interface (HOG). In keeping with crew task separation guidelines, only the CPG is provided the means to access and control the IDM (both TACFIRE and JVMF protocols). The FM-1 and FM-2 radios can be configured for both TACFIRE and JVMF protocols. This configuration process occurs as part of IDM initialization. In addition to initializing both TACFIRE and JVMF, the HOG provides a graphical interface to the JVMF protocol. This interface provides the CPG with the means to communicate using MFD, cockpit switches, RMS, IDM, DTS, FM radios, CDS software, and Aviation Mission Planning Station (AMPS).

4-169. HANDS-ON GENERAL USER INTERFACE (HOG).

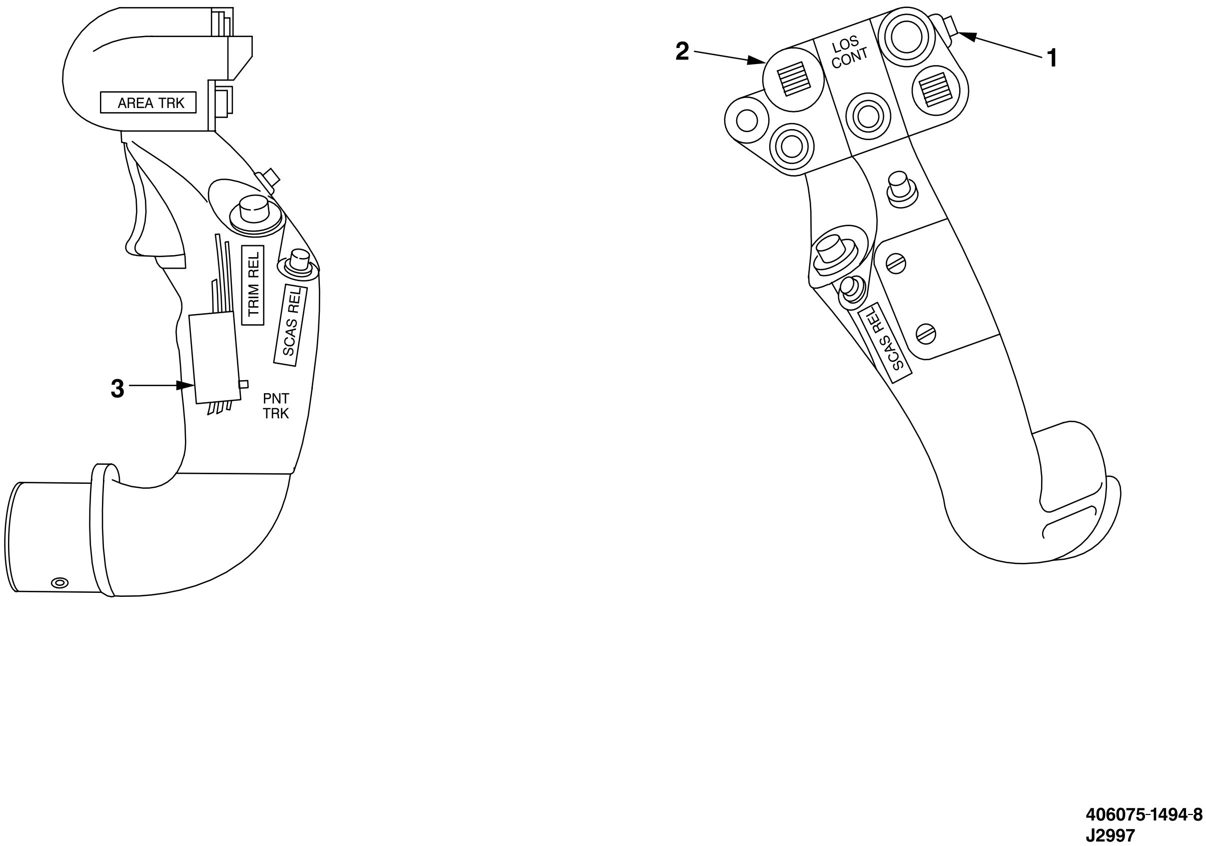
Using the HOG, the CPG can initialize and shut down the IDM as well as initiate JVMF responses and actions. When activated, HOG provides a series of pop-up displays and the capability to control the various displays and initiate responses. HOG displays are not available if left IMCPU fails.

a. Displays. The HOG displays are pop-up menus overlaid on the current MFD display (fig. 4-87). Typically, the display box will contain a list of options, a selection window, and a number (indicates number of up or down switch actions required, from the default location (0), to make that selection). Using the appropriate cyclic switch, the CPG can move the selection box up or down, accept/confirm a selection, and enter/edit text. Many pages contain the selection BACK or SHUTDOWN. BACK causes the display to return to the previous page. SHUTDOWN initiates the IDM shutdown procedure.

b. Control Switches. The CPG selects HOG ON/ OFF by pressing L-4 on Initial Page 1. When HOG is active, ON will be boxed. The following CPG cyclic switches provide HOG control (fig. 4-88)

4-170. IDM INITIALIZATION.

Digital communication using either TACFIRE or JVMF requires that IDM be initialized before either capability is functional. Initialize the IDM as follows:



SWITCH		FUNCTION
1.	MMS Freeze Frame Switch	Causes HOG pop-up window to be displayed on CPG MFD. MMS Wide/ Narrow FOV and MMS Point Track switches change from supporting MMS to supporting HOG. Pressing this switch again restores their MMS functionality and removes HOG pop-up window.
2.	MMS Wide FOV Switch	Each activation causes HOG selection window to move up to next available list item.
	MMS Narrow FOV Switch	Each activation causes HOG selection window to move down to next available list item.
3.	MMS Point Track Switch	Confirms option boxed by HOG selection window and initiates action.

Figure 4-88. CPG Cyclic Switches

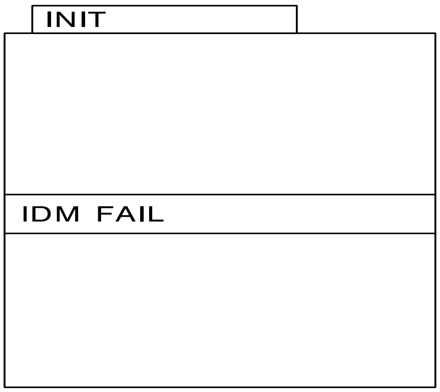


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Figure 4-89. IDM FAIL Indication

CAUTION

Perform manual shutdown of IDM before removing power.

1. On CPG MFD INITIAL PAGE 1, select HOG ON (boxed).
2. On CPG cyclic, press MMS Freeze Frame switch.

NOTE

If IDM FAIL displays when HOG is accessed, HOG displays are not available (fig. 4-89)

3. INIT–DB/DF. This is the initial HOG window displayed on the CPG MFD. First four lines of data, described below, identify the databases currently stored in nonvolatile memory (NVM) (fig. 4-90).

LOAD DB – loads database currently stored in NVM.
RETAIN CURRENT – retains data currently stored in NVM and identified on the first lines of HOG display.
LOAD DFLTS – loads a different set of Target Type, Target Qty, and Nature of Operations default selections. This procedure is normally only done once per theater of operation and requires entry of a password established at AMPS.

4. OPERATION. Select RETAIN CURRENT to display the OPERATION page. Select NON-EXERCISE or EXERCISE option. Either selection will cause initialization process to continue and displays the INIT-TIME window (fig. 4-90).
5. INIT-TIME. Select how date and time are to be entered. Time can be entered either manually, or using GPS-provided data. If manual option selected, a valid time entry is in the form HHMMSS. A valid date entry is in the form YYYYMMDD (fig. 4-90).
6. INIT-PROTO. Identifies the protocols to be used with FM-1 and FM-2 radios. Accept default configuration or elect another from those displayed (fig. 4-90). Options are available as follows:

TI & TAC – Tactical Internet and TACFIRE.

TI & FS – Tactical Internet and Fire Support Internet.

FS & TAC – Fire Support Internet and TACFIRE.

TAC ONLY – TACFIRE Only.

For all except INIT-TAC option, system displays INIT-CONFIG page (step 7). If INIT-TAC option selected, INIT-INPROG page (step 10) is displayed. After radio-to-protocol configuration complete, CONFIRM selection.

7. INIT-CONFIG. These pages identify current Tactical Identifiers (TACID) for Tactical Internet and Fire Support nets and provide the means to confirm or edit the TACID selection. TACID is tied to a Unit Reference Number (URN), IP address, and related information that uniquely identifies aircraft and crew. TACID is similar to subscriber in TACFIRE. Each platform is assigned a TACID to uniquely identify it on the net. To change TACID, CPG selects affected radio, causing applicable TACID page to be displayed (fig. 4-90).
8. XX TACID. This page provides a list of TACIDs assigned to this network. Selection of desired identifier displays the XX CONFIG window with the new selection. This selection defines operators TACID for the given network.
9. INIT-PASSWD. Successful entry of a password without appended characters gives access to unclassified data. For classified access, appropriate appended characters must be added to password. Successful entry of password displays INIT-INPROG window.

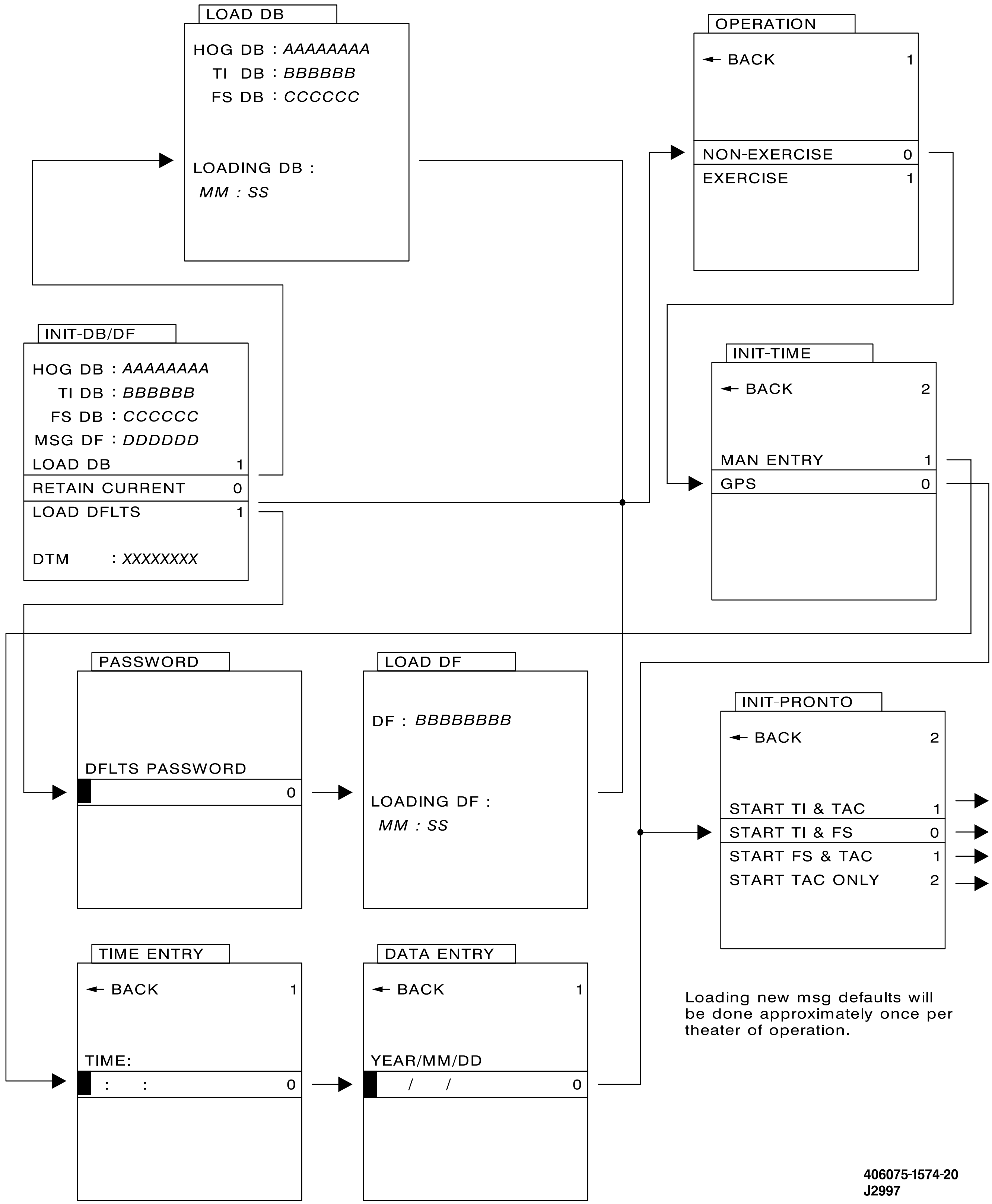

Figure 4-90. IDM Initialization Thread (Sheet 1 of 3)

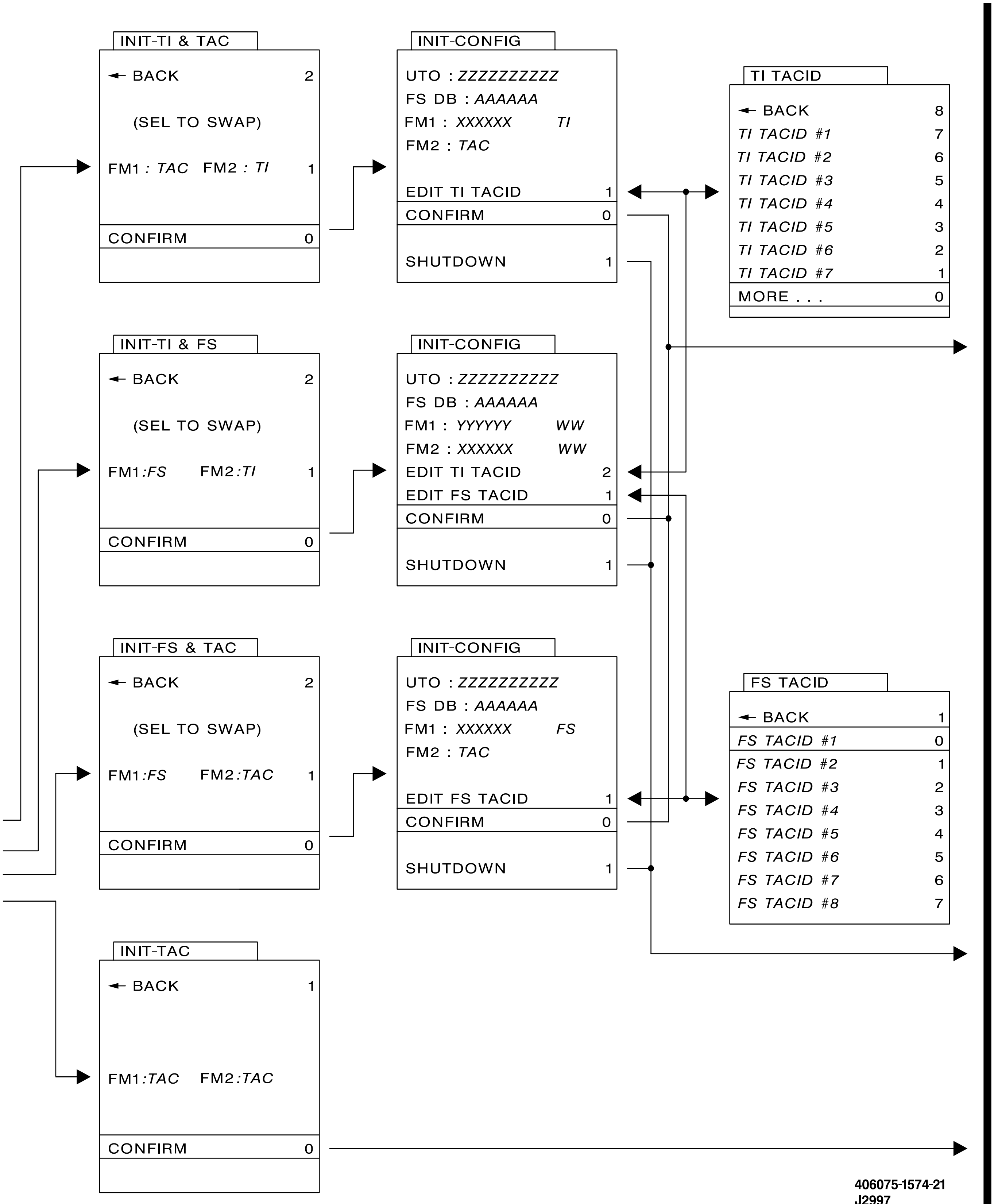

Figure 4-90. IDM Initialization Thread (Sheet 2 of 3)

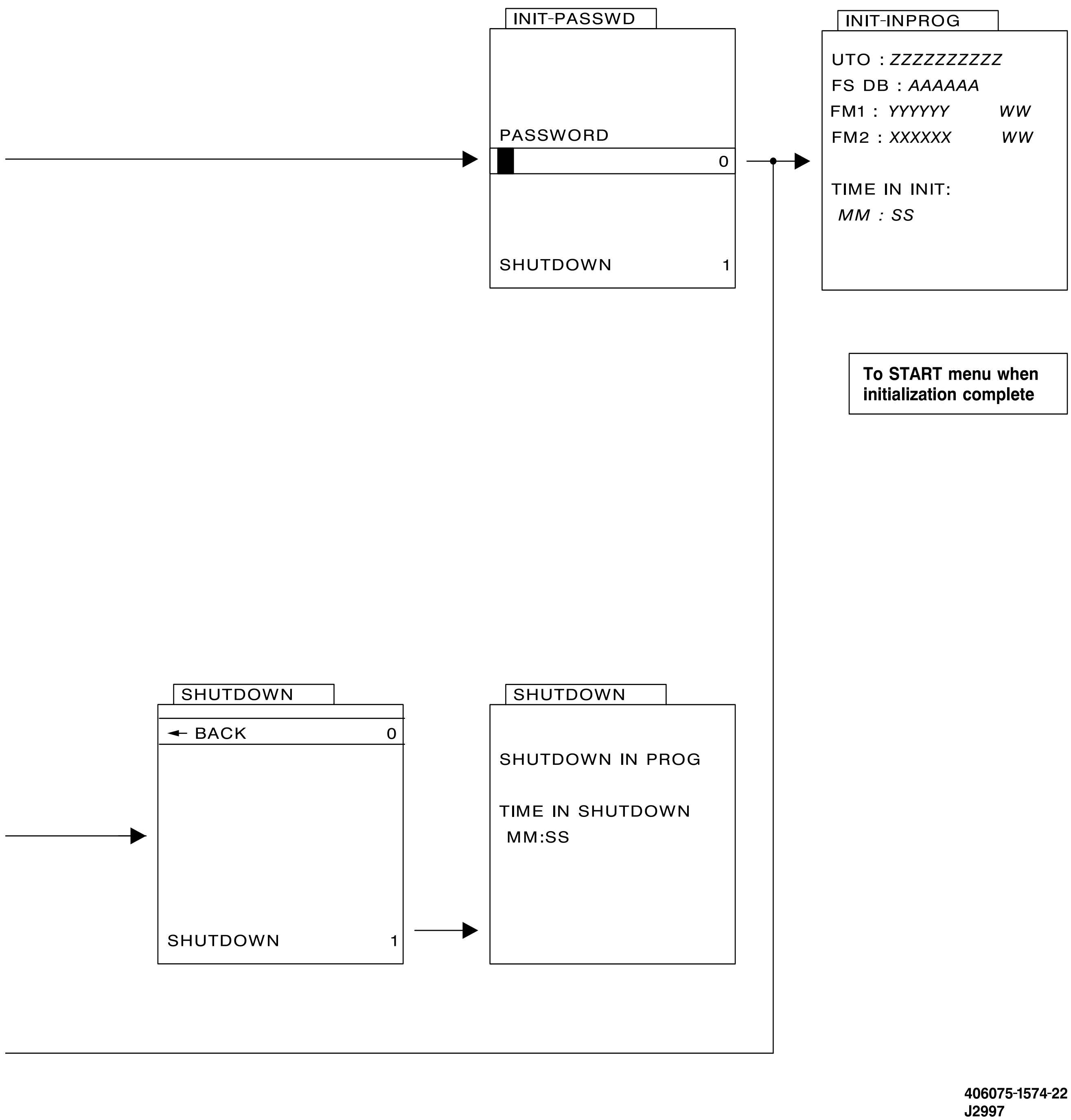

Figure 4-90. IDM Initialization Thread (Sheet 3 of 3)

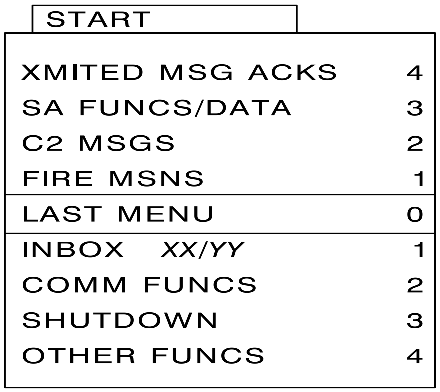

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Figure 4-91. HOG Start Menu

10. INIT-INPROG. Indicates IDM is being configured as specified during initialization process. Completion of initialization process is indicated by display of HOG START window (Fig. 4-91). Refer to TACFIRE STARTUP or JVMF paragraphs for specific procedures.

4-171. TACFIRE OVERVIEW.

The IDM provides the capability 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 unit retains all mission essential data in nonvolatile storage and can store up to 12 previously received messages for later recall. The system also provides the capability to request and execute airborne fire missions specifying either HELLFIRE or standard ordnance and request and provide the required coordination to execute a remote HELLFIRE mission. The aircrew can also request and execute artillery fire missions as Forward Artillery Aerial Observer (FAAO); transmit spot situation, battle damage assessments, and casualty reports. Team leader capabilities allow for receiving and handing over fire requests to the best weapon systems available to execute the mission; commanding of team/unit movement with preset parameters; retention of lists of preplanned battle positions, FARP locations, etc., for later review or transmission; and maintenance of current position, weapon status, and aircraft status of all team members.

4-172. TACFIRE START-UP.

After IDM initialization, pressing the IDM switch on CPG auxiliary panel displays TACFIRE page most recently accessed (fig. 4-92). Pressing IDM switch again displays TACFIRE Index page (fig. 4-93). Pressing any mode key, except MMS, removes the TACFIRE Page display. Pressing the MMS MODE key displays TACFIRE MMS Page.

a. Rapid Function (L-5). Legend is either RAPID or STORE. Pressing L-5 when legend is RAPID sends a RAPID control command to the IDM, causing the RAPID page to be displayed. If IDM detects display characteristics containing a UTM coordinate, legend is changed to STORE. Pressing L-5 when legend is STORE causes any UTM coordinate contained on lines 1 through 4 to be stored to the Target List. Targets are stored in order from line 1 to line 4. Last coordinate stored is also added to Prepoint List in manual position. The RAPID function provides direct access to any one of the following five operational IDM pages.

Summary Page of Highest Priority Received Message
Airborne Mission Summary Page
Artillery Mission Summary Page
Mayday Message Summary Page
Quick Menu Page.

b. Send Function (R-5). SEND is only displayed at R-5 when IDM indicates a SEND condition is valid. If SEND condition is valid, pressing R-5 causes a SEND command to be initiated.

c. MMS TACFIRE Page. If MMS FORWARD, PREPOINT, or SEARCH page is displayed on CPG MFD when IDM switch is activated, TACFIRE MMS page is displayed. This page can also be accessed by pressing MMS mode key on any TACFIRE page. This page is identical to a TACFIRE page except, MMS video is present and firing of laser is allowed. The following data can be displayed on a TACFIRE MMS page:

MMS Rotary Advisories.
MMS Line of Sight.
MMS Mode Status.
HELLFIRE Time of Flight.
TV/TIS Zoom Level.
MMS Azimuth and Elevation display.
Heading Tape.
Lubber Line.
Bearing-To-Waypoint Arrow.
MMS Azimuth Indicator.

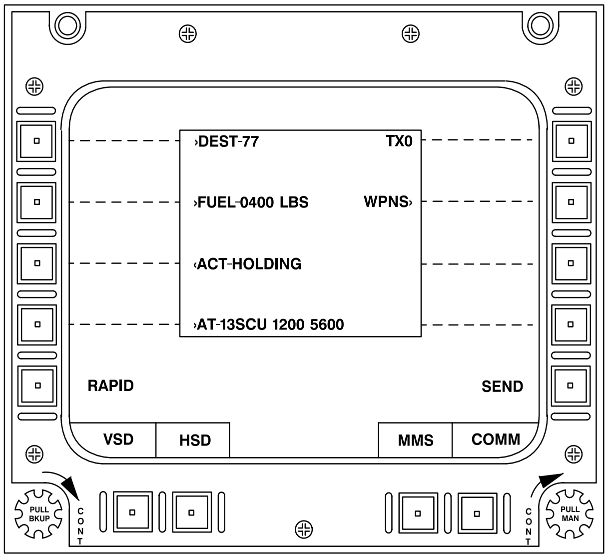

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Figure 4-92. Sample TACFIRE page

4-173. START PAGES — DESCRIPTION.

The Start pages are used to configure TACFIRE for later use. The pages maintain the files for communication, location, GO/NO GO test, time, and authentication. Communication subscriber identifiers are entered as ORIGIN (ORIG), TEAM (TM), and BROADCAST (BC). Additionally, a ZEROIZE key is provided in the Start pages. This ZEROIZE key clears all data and table entries from IDM. Also included in these pages are the six message presets, the six movement presets, and the bulk data load.

4-174. START PAGES — OPERATION.

a. Start Page 1/3. There are several fields requiring entries on this page: ORIG, TEAM, AND BC. The originator (ORIG) is the aircraft/observer/crew subscriber identifier and is in the SOI. It is a two-digit identifier (from 00 to 31). The TEAM identifier consists of two digits that define the team of which the originator is a part. A team is a group of subscribers having the same NET data and the same team number/letter. A team can be as few aircraft as two, the team leader and another digital communication type aircraft, or a team could be platoon or company size. Several messages are automatically addressed to the team and allow the team leader to effectively control his TEAM. The BC identifier is two digits that define the broadcast net of which the subscriber (originator) is a part. A broadcast is defined as a group of teams with the same net data and the same broadcast number/letter. If a unit had two teams working the same area, or for command and control from the company commander, all aircraft should have the same broadcast number/ letter. If a unit had two teams working the same area, or for command and control from the company commander, all aircraft should have the same broadcast identifier so that all aircraft can receive instructions/notifications at the same time. All subscribers who enter the same identifier in the team and/or broadcast address will receive general transmissions sent to the identifier. The team and broadcast identifier must also be placed on a defined net prior to entry on Start page 1/3.

b. Start Page 2/3. This page defines all the parameters for the NETS and subscribers (SUBS). It is also the page where the automatic authentication tables (AUTH) can be accessed, enabled, and filled from the current SOI. The six preset messages (MSGS) and movements (MVMT) can only be programmed through the use of this page. Bulk data (BULK) transfer is also controlled/accessed through this page. This page is the major programming page for the IDM. All of the premission planning data is entered on this page.

(1) **NETS.** A successful transmission requires that the sender and receiver be defined by the same net data. The net data parameters are a selection of TACFIRE or AIR NET, single block, double block, a selection of baud rate, the radio, the preamble duration, the monitor duration, and what authentication mode will be used.

(a) **Net Selection.** — Eight nets are available to be selected as either an AIR NET or TACFIRE NET (air elements can “talk” on a TACFIRE NET but TACFIRE will not get all required data if defined in an AIR NET). All aircraft working together in the same team/broadcast should select AIR NET. If there is a requirement for an aircraft to “talk” to artillery, the artillery should be defined in a separate TACFIRE NET.

(b) **Block (BLK) Selection.** — Select between single (SGL) block or double (DBL) block type of transmission. Single block sends each segment of data once per SEND. Double block sends each data segment twice per SEND and can be used when atmospheric conditions or reception are poor.

(c) **BAUD Rate Selection.** — Select between transmission rates of data bits (BAUD rate). Range: 75 bits per second (bps) — very slow; 150 bps; 300 bps; 600 bps; 1200 bps. If a TACFIRE net is selected, the only options are 1200 bps and 600 bps. The slower rates for the AIR nets are to be used only if reception is poor at high rates. The slower the baud rate the longer the transmission. The baud rate for the TACFIRE nets defaults to 1200 bps automatically.

(d) **RADIO Selection.** — Select between the type of radio desired. The radio numbers (1 thru 4) correspond to the same numbers as the intercom positions: 1 = FM-1, 2 = UHF, 3 = VHF, 4 = FM-2. HF cannot be used with the IDM. IDM will automatically select the radio for the transmission to a subscriber by how that subscriber is defined. IDM will not select frequency. Prior to an IDM transmission the sender should verify that the radio is tuned to the proper frequency. TACFIRE nets are normally set on radio 1. Air nets can be any of the radio selections.

(e) **Preamble (PRE) Select.** — An interval between 0.1 second and 9.9 seconds may be selected. A minimum preamble of 0.4 second is required when transmitting through crypto equipment. The preamble is used as on-air time for a link to be established between the sending and receiving units prior to the message being sent. The longer the preamble, the longer the on-air time.

(f) **Monitor (MON) Select.** — A time from 0.5 second to 9.9 seconds or OFF may be selected. The monitor time is the selected time that IDM listens for interfering traffic prior to transmitting. If more than 15 seconds have elapsed after the SEND key has been pressed, the IDM will reset automatically and SEND must be pressed again. Voice transmission has priority over a digital transmission; therefore, the IDM will wait until the airway is clear of voice traffic if a monitor time has been selected.

(g) **Authentication (AUTH) Select.** — Select between MANUAL authentication or NONE. If MANUAL is selected, an operator input of the transmission authenticator is required each time transmission is attempted. If NONE is selected, no authentication is required. This function automatically displays NONE due to use of automatic authentication. Manual authentication is normally only used in air-to-air or air-to-ground communication but not air-to-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.

(2) **Subscribers (SUBS).** Subscriber net assignments are required. Each net can be made up of 15 common subscribers (a section or platoon for example). Team and broadcast identifiers must be included in a subscriber net for the IDM to recognize them, i.e., team and broadcast cannot be entered on Start page 1/3 until defined in the subscriber nets. The originator is automatically in all of the defined subscriber nets. A TACFIRE subscriber must be in a TACFIRE net. As the message originator, a subscriber from any defined net may be selected and IDM will automatically set to that net data. However, a subscriber using another set of net data would not be able to establish contact without resetting net data to match the originator. Should SUB appear, it signifies that the subscriber selected as the destination is not defined in the subscriber list.

NOTE

Because the IDM expands the number of subscribers per net to 15 (ATHS supports only 9) two-digit subscriber IDs must be entered (i.e., - 00 - 0Z, 10 - 1Z, etc.). To communicate with ATHS or TACFIRE subscribers, the originator and destination subscriber IDs must be in the range 00-0Z. In other words, if an ATHS-equipped platform has selected a subscriber ID of "A", a subscriber "0A" should be entered in the appropriate net. In addition, an originator ID on the IDM-equipped aircraft must be within the range 00-09, 0A-0Z. (In the example given "0A" should be the originator chosen for the IDM-equipped aircraft since the ATHS-equipped platform has this subscriber ID.)

(3) **Authentication.** Automatic authentication tables are accessed from this page. There are two tables, one transmit and one receive, that hold 100 authentications each. In the event the number of authentications remaining reaches 20 or less, the advisory message AUTH LOW will display on the MFD. This must be loaded prior to each mission if they have been depleted or the SOI has changed. As an authentication is used, it is automatically deleted and the computer steps to the next code. The table can only be used on nets that have been selected as NONE on the authentication select on the net parameter page. If, when using automatic authentication, usually only with TACFIRE, the transmit or receive line sequence becomes incorrect, transmission of an authentication synchronization message is required (see MSG/FREE TEXT). By transmitting this message, the TACFIRE operator can see the anticipated next table line and adjust the computer. A not acknowledged (NAK) will appear; however, momentarily normal digital

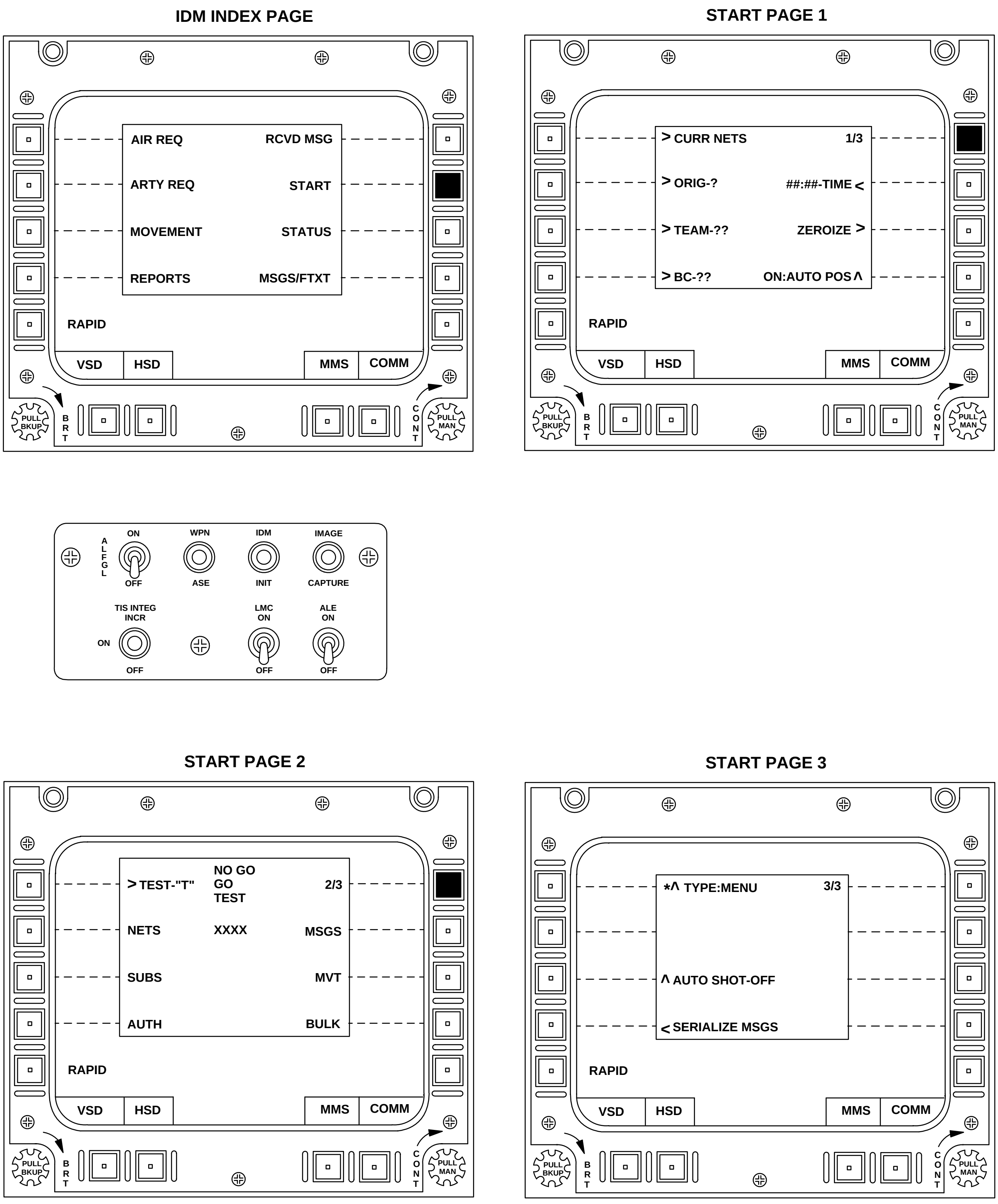

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Figure 4-93. TACFIRE Start pages

communication should be restored with the authentication tables in proper sequence.

(4) **Preset Messages.** There are six preset messages that can be programmed prior to the start of a mission to aid in response time for transmissions. There are six preset movement packages that can be programmed for establishing phase lines, assembly areas, FARP locations, etc. These 6 preset movement messages consist of 2 lines of 15 characters each for a total of 30 characters.

(5) **BULK Data Load.** Bulk data load can be used by a team member who did not preprogram the IDM prior to flight or for an IDM that needs to be reprogrammed while in flight. The data that can be bulk loaded from another IDM consists of: subscribers/nets, preset messages, preset movement messages, receive automatic authentication table, and transmit automatic authentication table.

c. START Page 3/3. This page allows for configuration of the RAPID function and the Serialization Subscriber function. The AUTO SHOT function is displayed but is not functional in this installation. The Start 3/3 page is used to program the programmable RAPID function. The L-1 key allows the operator to select one of five options to provide quick access to various pages. The five options are as follows: LAST MSG, AIR MSN, ARTY MSN, MAYDAY, and MENU.

(1) LAST MSG (Last Message) programs the RAPID key to display the highest priority new message when activated.

(2) AIR MSN (Air Mission) programs the RAPID key to access the currently selected pre-programmed AIR MISSION SUMMARY page.

(3) ARTY MSN (Artillery Mission) programs the RAPID key to access the currently selected pre-programmed ARTILLERY MISSION SUMMARY page.

(4) MAYDAY programs the RAPID key to access the MAYDAY SUMMARY page.

(5) MENU programs the RAPID key to access the RAPID page. The operator is presented with the four previously discussed functions.

4-175. TACFIRE CONFIGURATION.

Initialize the IDM as follows:

1. IDM switch — Press as required to display IDM Index page (Fig 4-94).
2. START key — Press.
3. Paging (1/3) key — Press.
4. TEST key — Press. Enter a T using MFK; GO or NO GO will display on MFD.
5. NETS key — Press to access and complete NET Data pages. Enter prompts as follows:

a. TFR/AIR NET key — Press to scroll type or net desired adjacent to NET number.

b. BLK key — Press to scroll between SGL and DBL. Leave as desired.

c. BAUD key — Press to select desired baud rate.

d. RADIO key — Press to select radio which will be used for transmitting and receiving.

e. R-1 key — The time required to transmit will display.

f. PRE key — Press to access Preamble Entry page and press PREAMBLE — SEC key. Enter desired preamble length of 0.1 to 9.9 seconds using MFK.

NOTE

L-3 (OFF), on the MONITOR page, can be pressed to disable monitor function.

g. MON key — Press if required to access Monitor Entry page and press MONITOR — SEC key. Enter time of from 0.5 to 9.9 seconds using MFK.

h. AUTH key — Press to scroll between MANUAL or NONE.

i. IDM switch on CPG auxiliary control panel — Press.

j. R-2 key — Press.

k. R-1 key — Press to select Start page 2/3.

l. NETS — Set up each of the eight pages as required for each net to be used by repeating steps a. through k.

m. R-1 key — Press as required to return to Start page 2/3.

6. SUBS key — Press and proceed as follows:

NOTE

During send operations the user will be prompted to select which net to transmit on if the subscriber ID is entered in more than one NET.

a. NET key — Press as desired to activate desired net and enter subscriber identifier(s).

b. R-1 key — Press as required to access subpages and enter identifiers. Press to sequence to return to Start page.

7. AUTH key — Press and proceed as follows:

NOTE

Subscriber must already be entered in subscriber list.

a. SUBS key — Subscriber is displayed or press key and enter desired subscriber using MFK.

b. XMT LINE — Current transmit authentication table line will be displayed. To change, press key and enter desired line.

c. RCV LINE — Current receive authentication table line will be displayed. To change, press key and enter desired line using MFK.

d. MODE key — Press once to activate authentication tables. Press again to scroll between XMT, BOTH or RCV.

e. TABLE key — Press to access transmit or receive table index.
   (1) Select desired transmit table line.
   (2) Press key adjacent to line number. Enter transmit authentication code from SOI.
   (3) R-1 key — Press to sequence to Start page.

8. MSGS key — If desired, press to access Message Present Entry pages. Press R-1 key as required to return to Start page.

9. MVT key — If desired, press to access Preset Movement Message pages. Enter movement commands on subpages. Press R-1 key as required to return to Start page.

10. BULK key — Press if it is desired to upload another operator IDM.

a. Enter Destination ID by pressing L-1.

b. Press L-2 to access Bulk Data Select page. Making a selection causes a default back to Bulk Data Summary page.

c. SEND; then scroll to next page. Utilize the SCROLL-SEND procedure until all desired data has been sent.

d. COMPLETE — Send COMPLETE message when finished with bulk data transmission.

11. IDM switch — Press.

a. Start key — Press.

b. Paging key — Press to display 3/3.

c. L-1 key — Press to scroll through Rapid function selections. Select desired function.

d. L-3 key — Press to toggle between AUTO SHOT on and off. AUTO SHOT does not function in this installation.

e. L-4 key — Press to access Serialization Subscriber Assignment page.
   (1) L-1 key — Press to toggle between XMT and NONE.
   (2) L-2 key — Press to enter desired subscribers.
   (3) L-4 key — Press to scroll through subscribers to read initial serialization count of messages.
   (4) R-4 key — Press to edit/enter initial serialization count of messages.
   (5) R-1 key — Press to return to Start page 3/3.

12. Select IDM — Press. Then select Start page 1/3.

a. CURR NETS key — Press.

NOTE

RADIO selection at L-4 selects the NET transmission radio. The radio selected to receive net traffic need not be the same.

b. RADIO 1 through RADIO 4 keys — Press one of the keys and use the MFK to type in the desired net number for each radio to receive.

c. RTN key — Press.

d. ORIG key — Enter subscriber identifier.

e. TEAM key — Enter team number.

f. BC key — Enter broadcast number.

NOTE

Time of day is automatically input by GPS.

g. TIME key — Enter current time of day only if GPS fails.

4-176. AIR REQUEST PAGES.

a. Description. The Air Request (AIR REQ) list can store up to eight fire mission requests. The three index pages display observer mission number, type of ordnance, firing element (subscriber) to which request was sent, and mission status. This list is for originating mission requests. Incoming new missions are stored in the Received Message file. Stepping through the mission list is accomplished by pressing the paging (upper right) key on the MFD. Accessing a stored Air Mission Request Summary page is accomplished by pressing the left key adjacent to desired mission. Complete mission information will display. Initiating a new mission request is accomplished by pressing a NEW key of an available mission number on the Air Request list, selecting air mission type, entering the required parameters, receiving the summary, and transmitting the data.

b. Types of air missions are as follows:

(1) HELLFIRE wherein the number of rounds to be fired is requested and guidance is by other than the launching element.

(2) OTHER ORDNANCE wherein there are seven selections, NO PREF, ATGM, GUN, HE, ILLUM, SMOKE, and CHAFF.

(3) NO PREF.

4-177. STORING OR EXECUTING AIR MISSION FIRE REQUEST.

To store an air mission fire request, perform steps 1 through 7.

1. Target locate steps — Accomplish as required.
2. IDM switch — Press as required to display IDM Index page.
3. AIR REQ key — Press.
4. Line (1-8) — Select mission number on which mission is to be entered. NEW key — Press.
5. MSN TYPE — Press appropriate key.
6. As pages sequence, press appropriate key.
7. Air Mission Summary page — Review and change parameters as required.

To execute a fire request, perform steps 8 and 9.

8. On Air Mission Summary page, SEND key — Press.
9. IDM switch — Press and repeat steps 1 through 8 above for each net as required.

To recall and send a stored mission, perform steps 10 through 14.

10. IDM switch — Press as required to display IDM Index page.
11. AIR REQ key — Press.
12. Desired mission (1-8) line number — Select.
13. R-1 key — Press to display Air Mission Summary page.

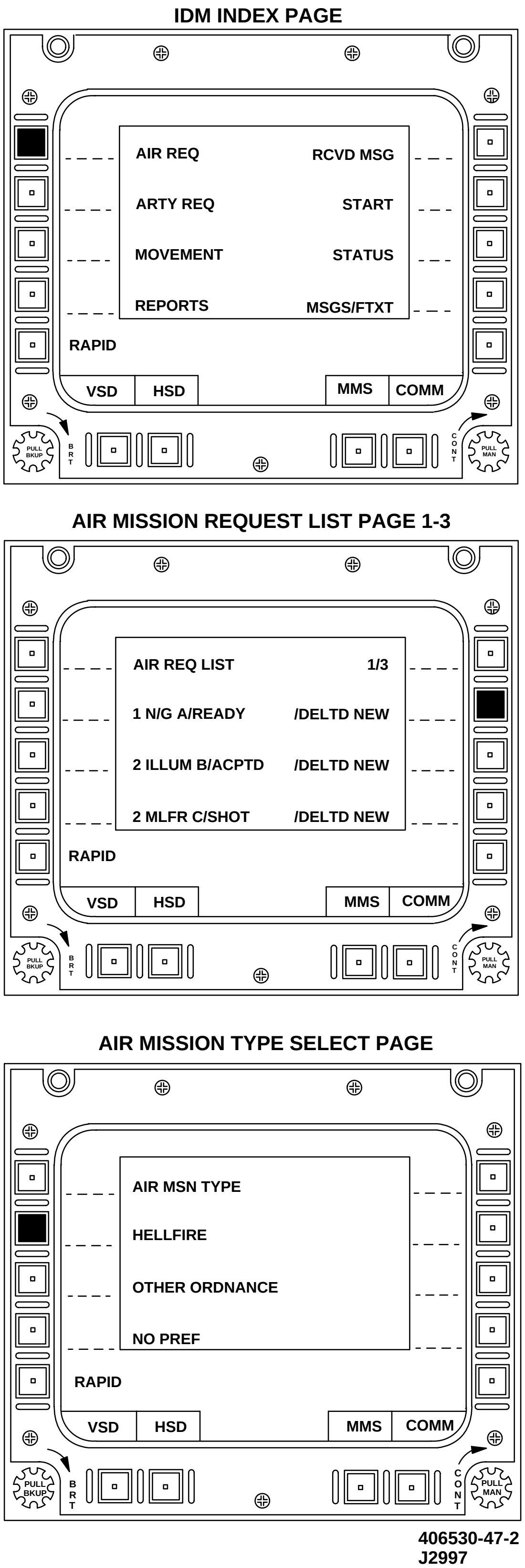

Figure 4-94. Air Request Pages

14. On Air Mission Summary page, SEND key — Press.

NOTE

- Remote HELLFIRE (REMOTE HLFR) mission request. The paging required for a simplified request is depicted in fig. 4-94.
- The Mission Status will change from REQUESTED to ACCEPTED, READY, FIRE, and SHOT. At completion of mission an END OF MISSION message should be sent.
- A generic Air Mission Summary page is shown in fig. 4-95.

4-178. ARTILLERY REQUEST PAGES.

a. Description. The mission data contained in the IDM is formatted to be consistent with the TACFIRE Artillery Fire Direction Center (FDC) system and associated forward observer digital message devices (DMD). Artillery mission command selection is initially entered on the ARTY Mission Summary page automatically as REQ. Upon receipt of the TACFIRE FDC message-to-observer (MTO), the mission command will automatically change to FIRE. A READY command will be displayed if the Battery Computer System (BCS) is on-line with TACFIRE. Target position (range and bearing from the helicopter) is automatically calculated. By pressing the TGT PSN (target position) key, the operator can manually enter the UTM grid, range, bearing, and altitude of the target on subpages if required.

The Artillery Request List stores two active artillery missions and two preplanned mission requests on the Preplanned Mission List subpage. Accessing either active mission is accomplished by pressing the M1 or M2 key on the ARTY REQ list page. To review a preplanned mission, pressing the PPLN LIST key on the Preplanned Mission List page will cause the Preplanned Mission Summary page to display.

NOTE

In order to store a preplanned mission, a preplan request must be executed and stored as a standard artillery preplan request. Then the mission must be inserted into preplan list.

Initiating a new artillery mission request is accomplished by pressing the NEW key of an available

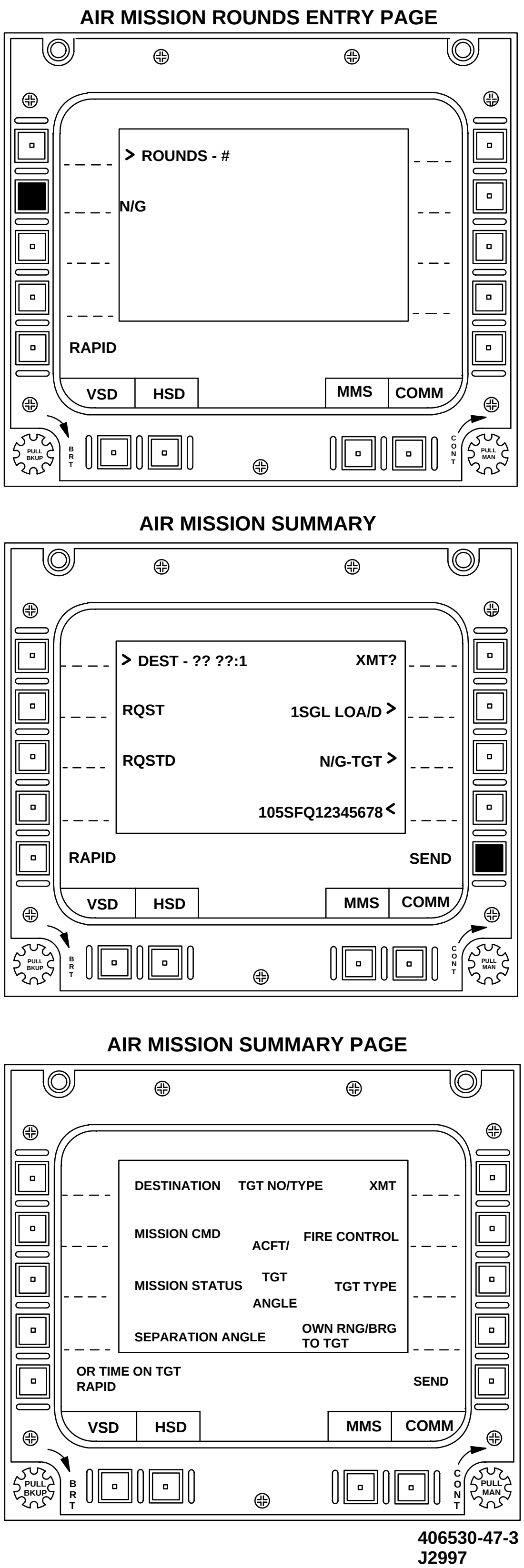

Figure 4-95. Air Mission Summary Pages

mission number, selecting artillery mission type, following prompts through the subpages, reviewing Summary page, and transmitting data.

b. Types of artillery mission requests are as follows:

(1) NEW TGT wherein the observer defines target type and strength.

(2) Known Point (KNPT TGT) wherein the observer defines a point which is a location previously identified and numbered, known both to the requestor and to the artillery FDC. The requestor then provides target type and strength.

(3) QUICK wherein the requestor enters only a known point. All other data is known by the artillery FDC.

(4) Preplanned (REQ PPLN) wherein the observer provides type of fire request (either Final Protective Fire (FPF) or Copperhead (CPHD) guided munitions). Only one FPF can be preplanned at a time; however, both preplanned missions can be Copperhead. The requestor then provides target position and known point number.

(5) Copperhead (CPHD) wherein the target position is defined as NEW or Known Point and point number is provided to the firing element.

4-179. ARTILLERY FIRE REQUESTS.

There are three types of artillery fire requests — preplanned, new, and Copperhead.

4-180. PREPLANNED FIRE REQUESTS.

To insert a preplanned fire request, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. ARTY REQ key — Press.

3. On line opposite mission to be replaced. NEW key — Press.

4. REQ PPLN key — Press.

5. Mission type — Select either FPF or CPHD as desired.

NOTE

If KNPT TGT is selected, entry of two-digit KNPT number is required.

6. KNPT TGT or NEW TGT — Select as appropriate.
7. ARTY Mission Summary page will appear — Press SEND. Wait for preplanned MTO then continue.
8. IDM switch — Press to return to IDM Index page.
9. ARTY REQ key — Press.
10. PPLN LIST key — Press.
11. P1 or P2 — Press NEW as desired.
12. L-2 — Press on Preplan Insertion pages.
13. Repeat steps 1 through 12 to insert a second preplanned mission.

NOTE

If the PPLN mission is requested as M1, it can only be stored as P1.

4-181. NEW ARTILLERY FIRE MISSION REQUEST.

To initiate a new fire mission, proceed as follows:

1. Target locate steps — Accomplish as required.
2. IDM switch — Press as required to display IDM Index page.
3. ARTY REQ key — Press.
4. NEW key opposite mission (M1 or M2) to be replaced — Press.
5. Mission type — Press applicable key and enter required parameters on subsequent pages until all data is inserted.
6. Review mission on Summary page and make changes as required.
7. SEND key — Press.

NOTE

- New Artillery Fire Mission Request (simplified) is depicted in fig. 4-96.
- A generic Artillery Mission Summary page is shown in fig. 4-97.

4-182. COPPERHEAD FIRE MISSION — ACTIVE AND PREPLANNED.

To accomplish a Copperhead fire mission, proceed as follows (fig. 4-98).

1. Target locate steps — Accomplish.
2. IDM switch — Press as required to display IDM Index page.
3. ARTY REQ key — Press.
4. To accomplish in active mission, M1 or M2 key — Press as desired.
5. CPHD — Press.

NOTE

If KNPT TGT is selected, entry of two-digit KNPT number is required.

6. NEW TGT or KNPT TGT — Select as appropriate.
7. ARTY Mission Summary page will appear — Review ARTY Mission Summary page and change as required.
8. SEND key — Press (fig. 4-98).

4-183. MOVEMENT COMMAND COMMUNICATIONS.

The Movement pages allow position instructions to be transmitted without voice communication. The IDM operator can issue directions to specific or all team members to MOVE TO, HOLD AT, rendezvous (RDZV) at; or inform team members MOVING TO or HLDG AT a location. The locations can be preset to allow rapid communication. In addition, the Movement pages allow automatic transmission of current position through MY POSITION key and free text communication through the OTHER key.

4-184. MOVEMENT COMMAND TRANSMISSION.

Transmit movement commands as follows (fig. 4-99):

1. IDM switch — Press as required to display IDM Index page.
2. MOVEMENT key — Press.
3. Appropriate movement type key — Press.
4. Appropriate destination select key — Press.

NOTE

Pressing OTHER key will display Freetext Message Entry page where a manual entry can be made using MFK.

5. Mission Summary page — Review and change as required.
6. SEND key — Press (fig. 4-99).

4-185. REPORT COMMUNICATIONS.

The Report pages (fig. 4-100) allow the observer to provide various information to team and net members such as: Situation/status (SIT/STATUS) which reports the observers own situation, SPOT which reports target activity, ATI to provide intelligence reports to artillery units, BDA to report battle damage assessments, CAS to report casualty assessments, NEG SPOT, and REQUEST to request a report from another subscriber.

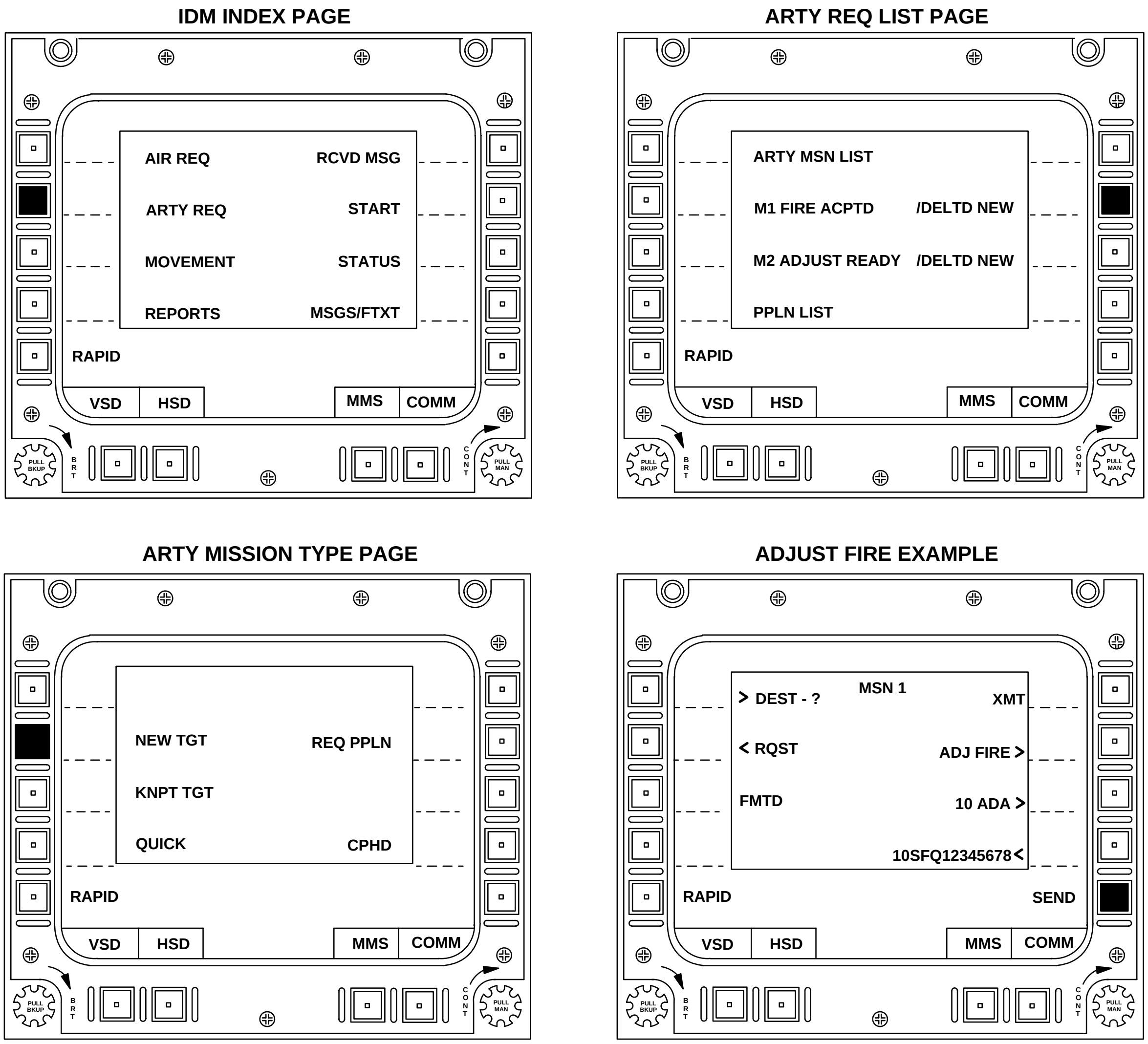

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Figure 4-96. Artillery Request Pages

ARTY MSN SUMMARY PAGE

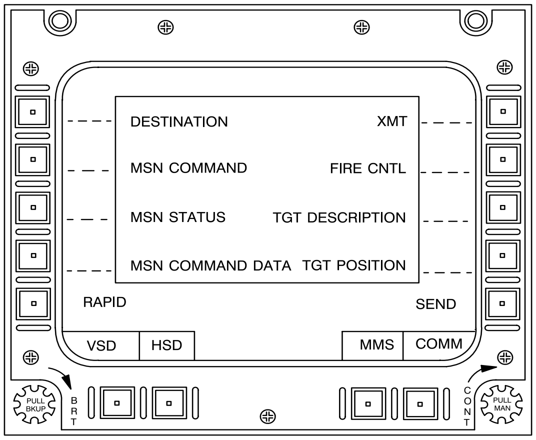

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Figure 4-97. Artillery Mission Summary Page

4-186. SITUATION/STATUS (SIT/STATUS).

Report Transmission. To transmit observers situation and/or status, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. REPORTS key — Press.
3. Activity to report — Press appropriate keys.
4. Report Summary page — Review and change as required.
5. SEND key — Press.

4-187. SPOT REPORT TRANSMISSION.

To transmit a spot report, proceed as follows (fig. 4-101):

1. Target locate steps — Accomplish as required.
2. IDM switch — Press as required to display IDM Index page.
3. REPORTS key — Press.
4. SPOT key — Press.

NOTE

Three different target types may be entered for each SPOT report.

5. TARGET type — Press appropriate key.
6. Target strength (STR) — Press appropriate key.
7. R-1 key — Press.
8. ALT key — Press as desired.
9. Target (TGT) ACTIVITY — Select as desired. If MOVING is selected, proceed to step 10. If STATIONARY is selected, proceed to step 11.
10. Target direction — Press appropriate key.
11. R-1 key — Press.
12. Mission Summary page — Review and change as required.
13. SEND key — Press.

4-188. BATTLE DAMAGE ASSESSMENT (BDA) REPORT TRANSMISSION.

To provide battle damage assessments, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. REPORTS key — Press.
3. BDA/CAS key — Press.
4. BDA Summary page — Press appropriate key and manually enter information using MFK.
5. SEND key — Press.

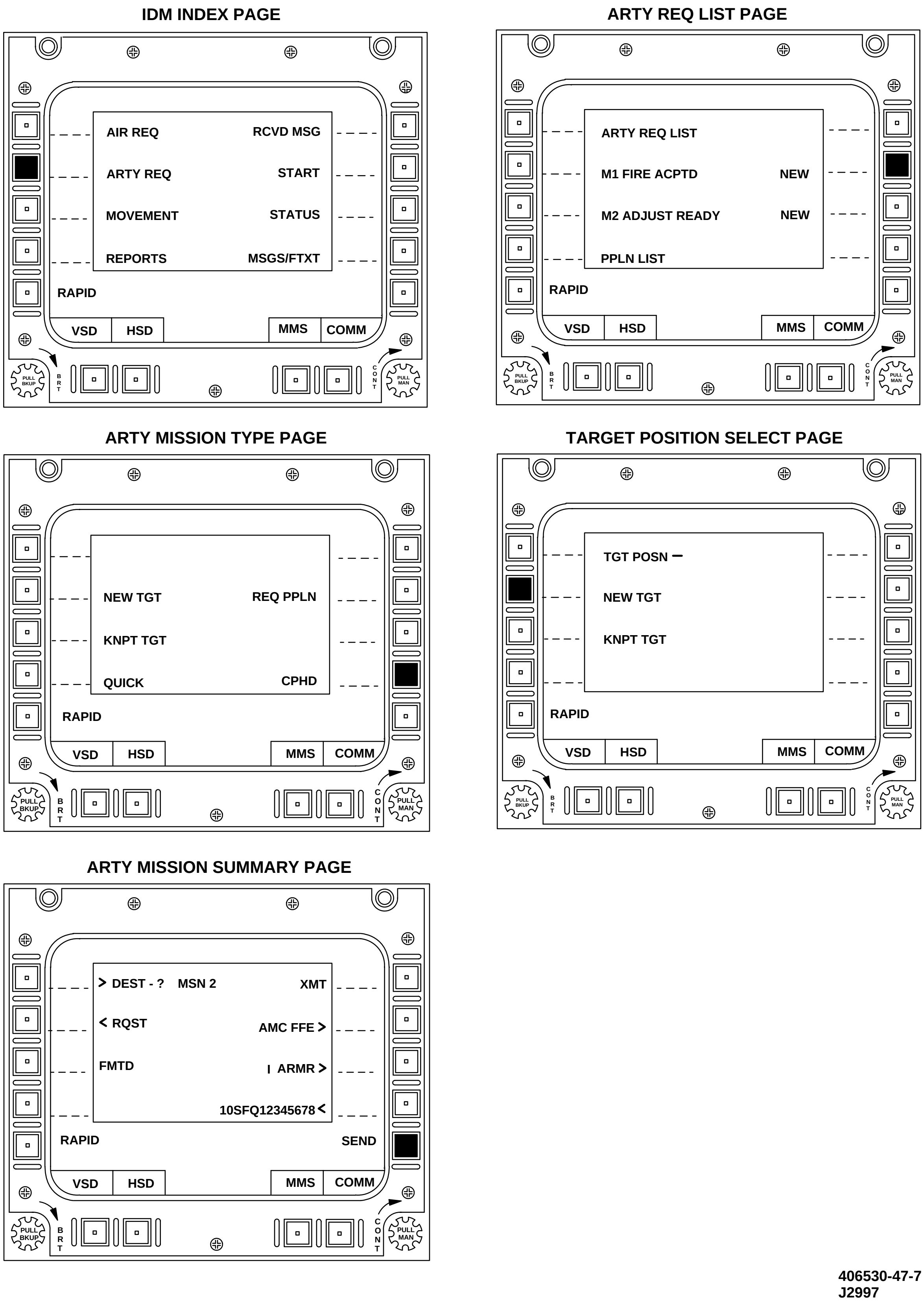

Figure 4-98. Artillery Fire Request Pages

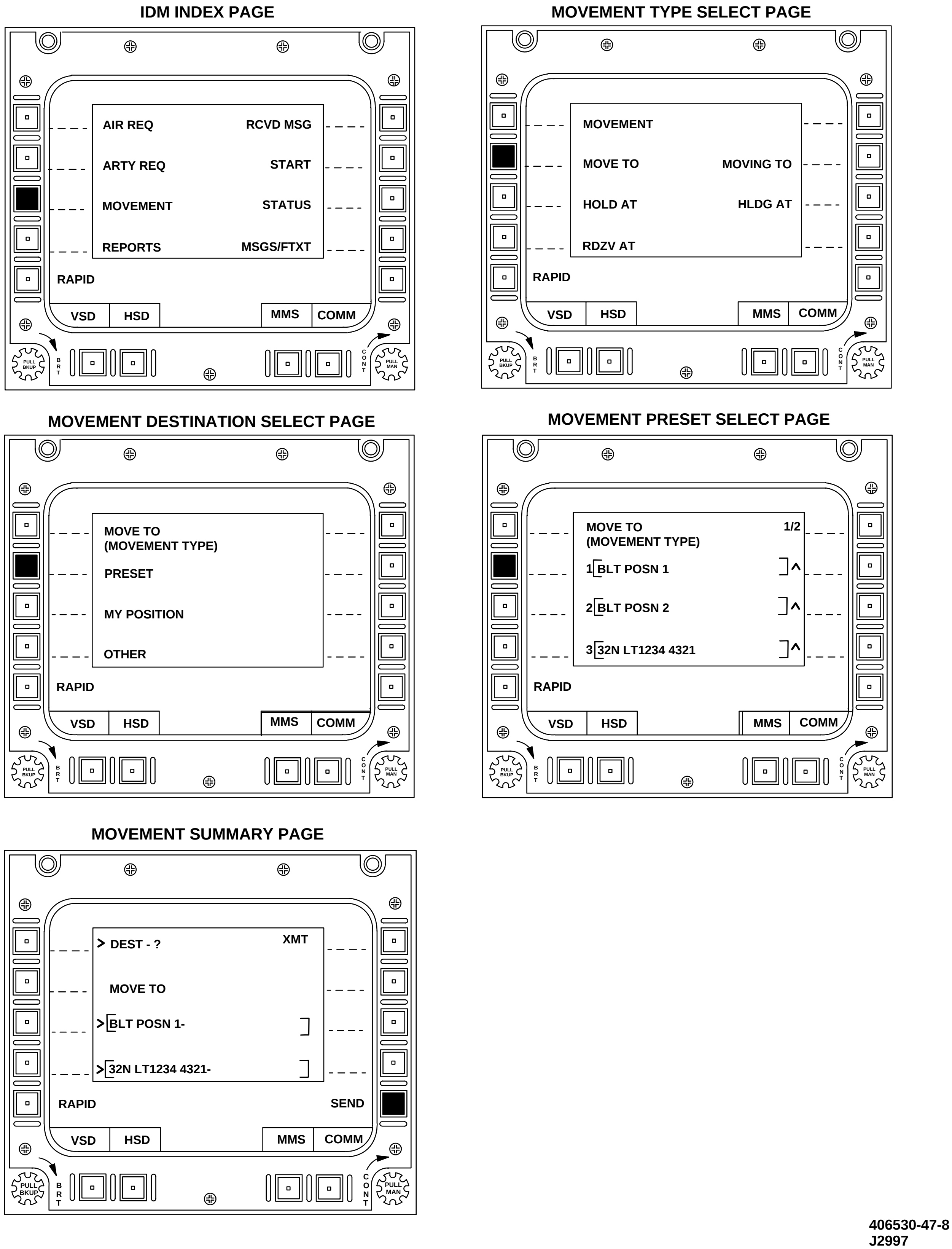

Figure 4-99. Movement Pages

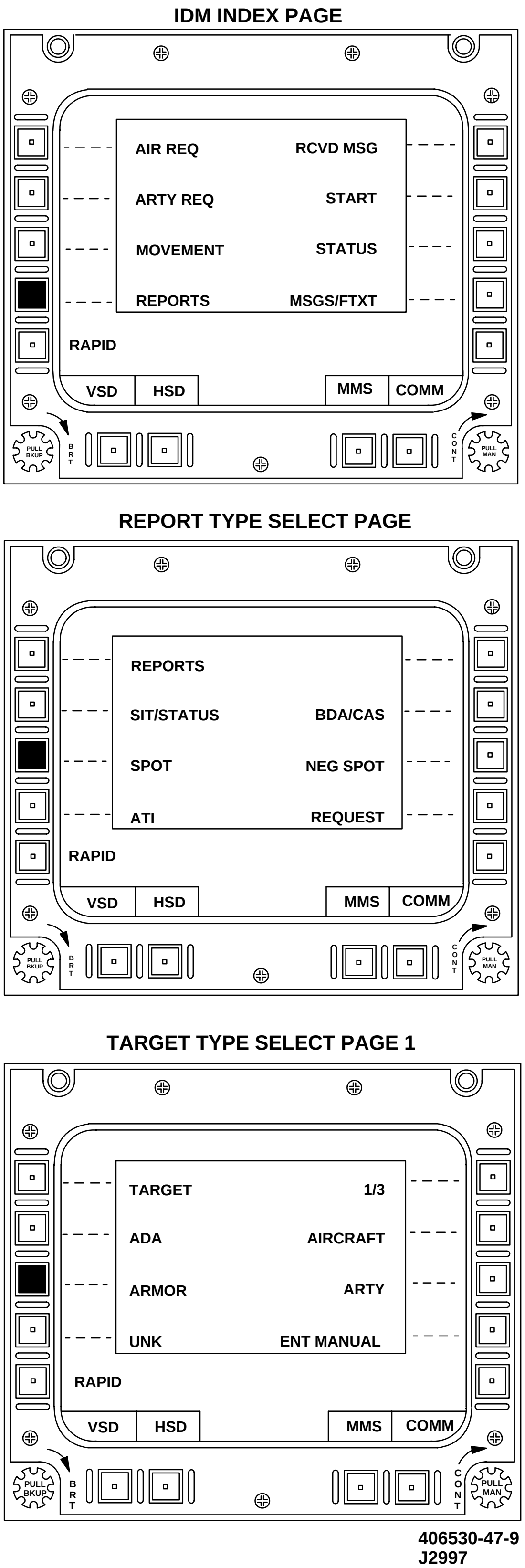

Figure 4-100. Report Pages (Sheet 1 of 2)

4-189. CASUALTY (CAS) REPORT TRANSMISSION.

To provide casualty reports, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. REPORT key — Press.
3. BDA/CAS key — Press.
4. CAS Summary page — Press appropriate key and manually enter information using MFK.
5. SEND key — Press.

4-190. ARTILLERY INTELLIGENCE REPORT (ATI) TRANSMISSIONS.

To transmit an artillery intelligence (ATI) report, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. REPORTS key — Press.
3. ATI key — Press.
4. REL — Scroll through reliability option until desired option is displayed.
5. Target type — Press appropriate key.
6. Target strength — Press appropriate key.
7. R-1 key — Press.
8. RAD/LGTH, WIDTH, and ATTITUDE keys — Press as appropriate.
9. R-1 key — Press.
10. ATI Summary page — Review and change as required.
11. SEND key — Press.

4-191. REPORT REQUESTING FROM ANOTHER SUBSCRIBER.

To request a report from another subscriber, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. REPORTS key — Press.

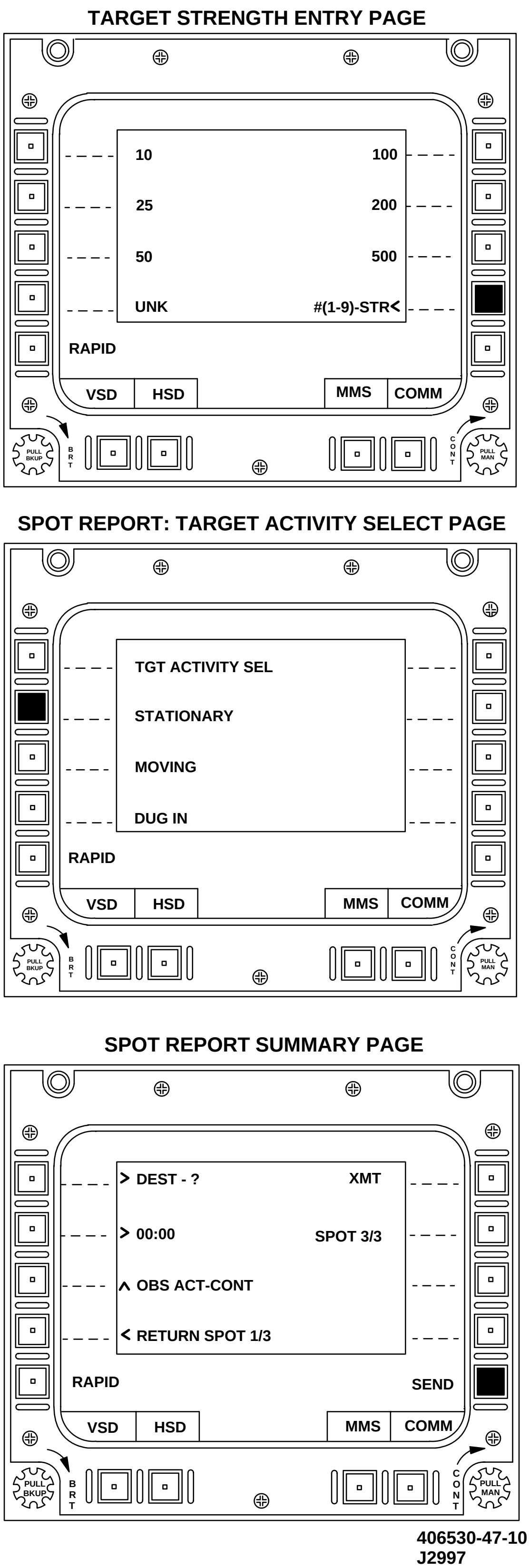

Figure 4-100. Report Pages (Sheet 2 of 2)

3. REQUEST key — Press.

4. On Report Request Select page — Press appropriate key to designate type of report desired.

5. DEST– key on Summary page — Press and enter subscriber identifier from which report is desired using MFK.

6. Request Report Summary page — Review and change as required.

7. SEND key — Press to transmit request.

4-192. STATUS PAGES.

The Status pages (fig. 4-101) provide a means whereby the observer can provide information concerning his own weapons (OWN WPNS), own present position (OWN PPSN), or request information concerning a particular subscribers weapons or position status. The Present Position (PPSN) page includes location in UTM, altitude, and fuel remaining. The OWN WPNS page reports observers laser code to subscribers and provides weapons status. The remaining Status pages provide similar options for subscribers to provide information to the observer. The weapons format will depend upon whether the subscriber is defined in an AIR NET or a TACFIRE NET. The Subscriber pages will be automatically updated upon receipt of a situation/status report.

4-193. OWN STATUS.

To review own status, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. STATUS key — Press.

3. OWN WPNS or OWN PPSN key — Press as desired.

4. For OWN WPNS entry, laser designator code — Enter using MFK and press paging select key (1/1) to return to Status Index page.

4-194. OWN PPSN ENTRY.

1. Present position is entered automatically. To change, enter coordinates using MFK and UTM key — Press.

2. ALT key — Press. Enter altitude in meters or enter N/G.

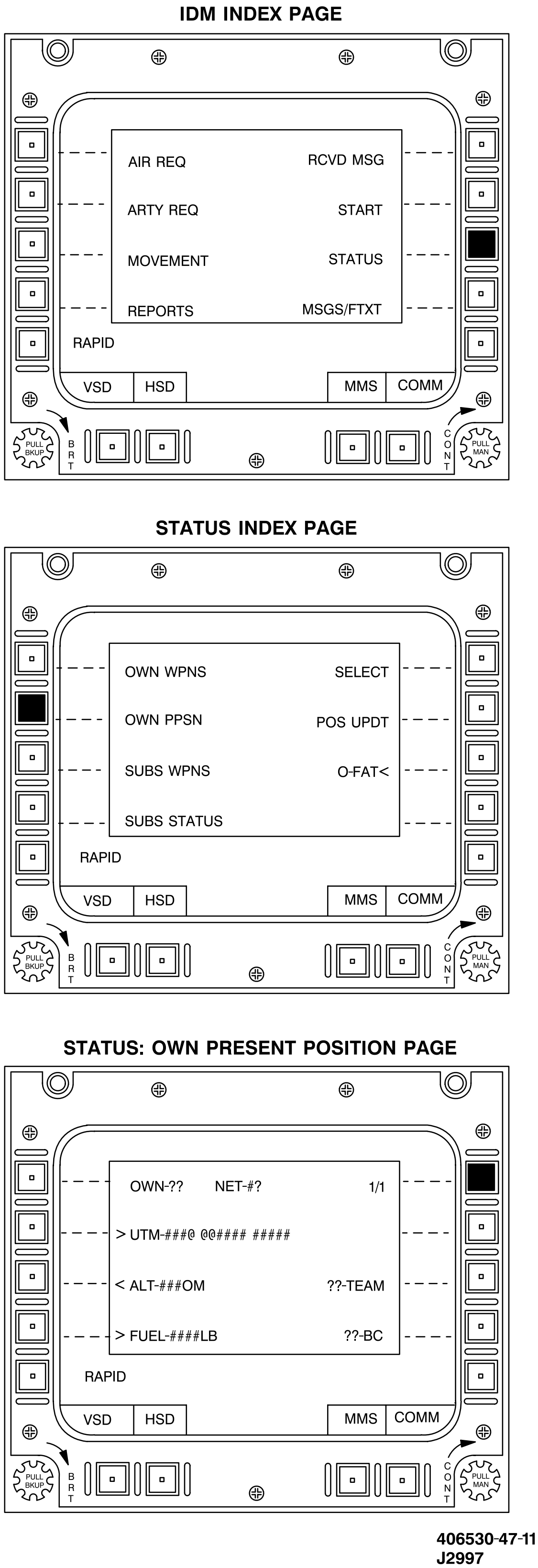

Figure 4-101. Status Pages

3. FUEL key — Press and enter.

4. Paging select key (1/1) — Press to return to Status Index page (fig. 4-101).

4-195. WEAPONS STATUS — ALL SUBSCRIBERS.

To obtain subscriber weapons status, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. STATUS key — Press.

3. SUBS WPNS key — Press. Review weapons status of net subscribers as IDM automatically sequences from the first subscriber in NET 1 to the last subscriber in NET 8.

4. Paging key — Press to return to Status Index page.

4-196. PRESENT POSITION STATUS — ALL SUBSCRIBERS.

To obtain present position information on all net subscribers, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. STATUS key — Press.

3. SUBS PPSN key — Press.

NOTE

- Subscriber status will begin with the first subscriber in NET 1 and display, in order, through the last subscriber in NET 8 as paging key is pressed.
- UTM key can be alternately pressed to display UTM grid coordinates or range and bearing of subscriber status being displayed.

4. If desired, return to Status Index page by pressing paging key once more after last subscriber status is displayed.

4-197. WEAPONS/PRESENT POSITION STATUS — SINGLE SUBSCRIBER.

To obtain the status of a single subscriber, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. STATUS key — Press.
3. SELECT key — Press.
4. SUB– key — Press. Enter desired subscriber identifier using MFK. Present Position page will display.
5. Paging key — Press to review weapons status.
6. Weapons status paging key — Press to return to Status Index page.

4-198. SUBSCRIBER POSITION STATUS.

1. IDM switch — Press as required to display IDM Index page.
2. STATUS key — Press.
3. POS UPDT key — Press.
4. SUBS POSITION key — Press and review.
5. Repeat steps 1 through 3.
6. SUBS NET key — Select appropriate NET.
7. Repeat steps 4 and 5 as desired.
8. Summary page — Review and select destination.
9. SEND key — Press.

4-199. FREE TEXT/PRESET MESSAGE PAGES.

The Free Text/Preset Message pages (fig. 4-102) allow the observer to compose and transmit any message up to 36 characters (two lines) at any time. Also, these pages allow messages to be composed and stored for subsequent recall and transmission at the appropriate time. The top message page includes a MAYDAY for rapid MAYDAY broadcasts, a CHECKFIRE message for a rapid cease fire broadcast, an authentication synchronization message to align the FDC codes to the IDM codes, and cancel checkfire message. The free text and preset messages contain the same information. The free text/preset messages are automatically addressed to the team subscriber identifier. The MAYDAY message is addressed to the broadcast subscriber identifier, and contains the MAYDAY message and own present position. The Authentication Synchronization (AUTH) message is addressed to the broadcast subscriber identified in the Start pages with whom the automatic authentication is to occur (normally TACFIRE). If, after transmission, an NAK is returned, the tables are out of synchronization. TACFIRE will still get the message and change tables to match the observers. TACFIRE will call back once synchronization has been accomplished.

4-200. FREE TEXT MESSAGE COMPOSITION AND TRANSMISSION.

To compose and transmit a free text message, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. MSGS/FTXT key — Press.
3. DEST– key — Enter subscriber identifier using MFK.

NOTE

When FREE TEXT – TEST is used for communication check, data is not required.

4. FREE TEXT key — Press to scroll between TEST and DATA as required.
5. Message — Enter any message up to 36 characters long using MFK.
6. SEND key — Press to transmit message (fig. 4-102).

4-201. PRESET MESSAGE TRANSMISSION.

To transmit any of up to six preset messages entered during IDM initialization, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. MSGS/FTXT key — Press.
3. MSG PRESETS key — Press.
4. Select message to be transmitted by pressing key adjacent to appropriate message number.

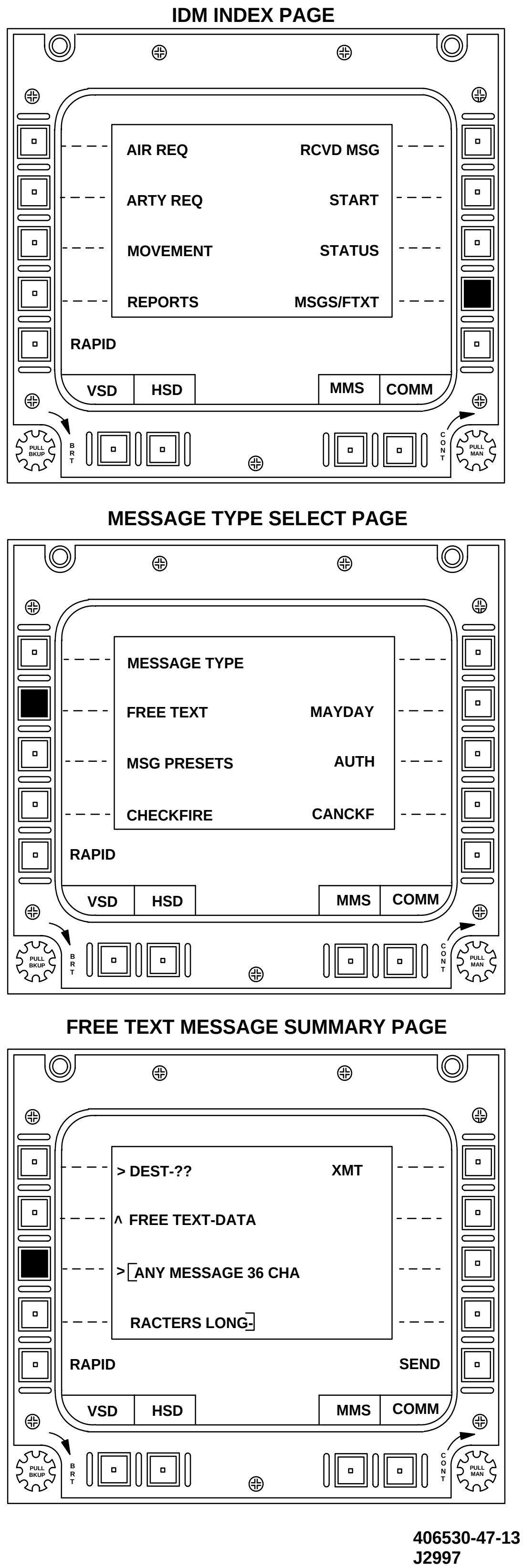

Figure 4-102. Free Text/Preset Message Pages

5. DEST– key — Press and enter subscriber identifier.

6. SEND key — Press.

7. To return to IDM Index page, IDM switch — Press.

4-202. CHECKFIRE MESSAGE TRANSMISSION.

To broadcast a cease fire message to all subscribers, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. MSGS/FTXT key — Press.

3. CHECKFIRE key — Press.

4. Broadcast identifier is automatically inserted to change: DEST– key — Press and enter identifier using MFK.

5. SEND key — Press.

6. To return to IDM Index page, IDM switch — Press.

4-203. MAYDAY MESSAGE TRANSMISSION.

To broadcast a MAYDAY message, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.

2. MSGS/FTXT key — Press.

3. MAYDAY key — Press.

4. To change broadcast identifier, DEST– key — Press. Enter identifier using MFK.

5. To change present position in UTM grid, POSITION key — Press. Enter UTM using MFK.

6. SEND key — Press.

7. To return to IDM Index page, IDM switch — Press.

4-204. AUTHENTICATION SYNCHRONIZATION TRANSMISSION.

To broadcast an Authentication Synchronization transmission, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. MSGS/FTXT key — Press.
3. AUTH key — Press.
4. DEST– key — Press. Enter identifier of subscriber with which automatic authentication is desired.
5. When desired, SEND key — Press.

NOTE

If authentication tables between sender and receiver are not synchronized, an NAK will be returned. Sender should not retransmit. Receiver should change table positions and transmit to original sender with tables synchronized.

4-205. CANCEL CHECKFIRE MESSAGE TRANSMISSION.

To broadcast a cancel checkfire message, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. MSGS/FTXT key — Press.
3. CANCKF key — Press.
4. DEST– key — Press. Enter identifier of subscriber as desired.
5. SEND key — Press.
6. To return to IDM Index page, IDM switch — Press.

4-206. RECEIVED MESSAGES.

The received message function of the IDM allows the observer to access the received message list to review new messages. It also allows the observer to review and delete any previously received messages, to include received fire requests. When an IDM message is received, it will be stored in the RCVD MSGS index and an IDM MESSAGE advisory will appear on the MFD. Twelve messages can be stored for review and deletion when desired, except for situation/status reports which are automatically deleted upon review. Messages received while the RCVD MSGS index is full will not be accepted, and the received advisory will not be displayed. When a message is received an acknowledge (ACK) is automatically transmitted back to the message originator with no operator action required. Messages received which are not recognizable, improperly addressed (net data incorrect), or unprocessable will be ignored. The originator will not have an ACK displayed, and an IDM MESSAGE will not be displayed to the receiver. A message received which is acceptable, but from an originator not defined in the subscriber list, will be stored and an advisory displayed; however, an ACK will not be transmitted back. A message received addressed to the Team or Broadcast identifiers will be stored and an advisory displayed but an ACK will not be sent to the originator. The RCVD MSG index will show the message number, the identifier of the sender, a three character identifier of message type, a six character field indicating the message content, and the status of the message. If the message has been reviewed, delete (DEL) will appear next to the right hand key line; if not yet reviewed, NEW will appear. Another function of the received messages is that it allows the observer to leave the IDM pages and still be able to manage a fire mission. The Fire Mission Summary pages will be automatically updated upon the receipt of new mission commands. Received free text and movement messages can be deleted on the page that they are reviewed. If delete is selected, the system will return to the Received Message Index page. Situation/status reports are automatically deleted after they have been reviewed and the information is stored in the Status pages.

4-207. REVIEWING RECEIVED MESSAGE INDEX.

To review a received message, proceed as follows:

1. IDM switch — Press as required to display IDM Index page.
2. RCVD MSG — Press to display received message index.
3. Message to be reviewed — Select by pressing key adjacent to appropriate message number.
4. Delete message as appropriate.

JVMF Message List

Name	Situation Supported	Input Processing (Rcvd Msgs Only)	Notes
System Coordinated Msg	BSA registration	N/A	No CDS interface, automatically generated by IDM
Free Text	C2 and FS	Manual	Transmit/Receive
Info Request Message	C2	Manual	Transmit/Receive
Check Fire	FS	N/A	Transmit only
Call for Fire	FS	N/A	Transmit only
Observer Mission Update	FS	N/A	Receive only
On-Call Fire Command	FS	N/A	Transmit only
MTO	FS	Auto	Receive only
EOM&S	FS	N/A	Transmit only
Subsequent Adjust	FS	Auto	Transmit/Receive
Observer Readiness	C2 and FS	N/A	Transmit only
Airborne Fire Mission	FS	Auto	Transmit/Receive
SPOT Report	C2	Manual	Transmit/Receive
Position Report	C2	Auto	Transmit/Receive
SITREP	C2	Auto	Transmit/Receive
Orders (FRAGO)	C2	Manual	Receive/Forward

Note: Messages listed as Auto, under Input Processing, are automatically obtained from the IDM.

4-208. JOINT VARIABLE MESSAGE FORMAT (JVMF).

4-209. OVERVIEW.

The JVMF functionality is accessed through HOG function and associated displays (screens). HOG screens shown contain both italicized and non-italicized text. Italicized text represents data taken from one of the loaded databases. Non-italicized text represents text that is hard-coded in the software as part of the display page. In support of CDS4 Phase 1, a total of 16 messages are provided. Together IDM and HOG capabilities provide digital capability to transmit and/or receive these messages (refer to JVMF message list). JVMF displays support three situations:

Battlefield Situational Awareness (BSA).

Command and Control (C2).

Fire Support (FS).

JVMF functionality is divided into threads and display pages. Additionally, several advisories are provided to increase crew awareness of situation changes.

a. Threads. Threads are grouped by functionality, e.g., INITIALIZATION, START, C2 MESSAGES, etc. The following is a list of JVMF threads that are addressed:

INITIALIZATION

START

SHUTDOWN

C2 MSGS

FIRE MISSIONS

COMM FUNC

OTHER FUNC

SEND

INBOX

ACKS

SA FUNCTIONS/DATA

MESSAGE DEFAULTS

b. Pop-up Displays. Pop-up displays are HOG menus overlaid on all MFD screen displays (fig. 4-87).

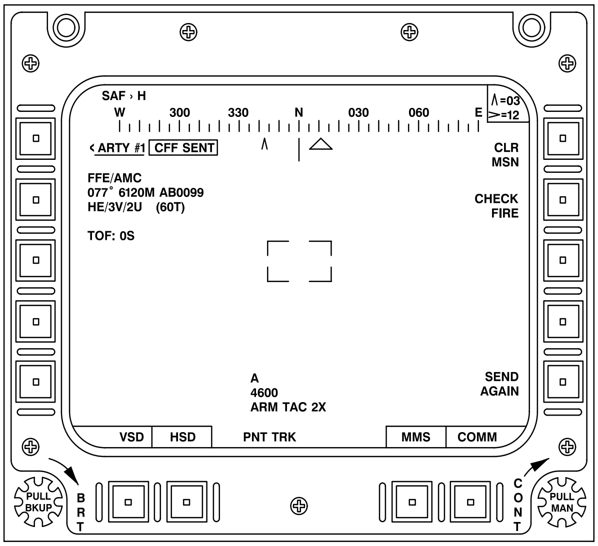

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Figure 4-103. ARTY MSN Page (Sample)

c. Mission Summary Pages. Mission summary pages (fig. 4-103) provide the CPG interface during a JVMF mission. These pages are automatically displayed whenever a call-for-fire is initiated or can be called up via HOG. Mission summary pages incorporate MFD bezel push-button control and HOG pop-up control. The following mission summary pages are available:

ARTY MSN x Page – with or without MMS display data.
AIR MSN x Page – with or without MMS display data.
(x = Mission 1 or 2)

d. JVMF Advisories. The following is a list of the advisory messages that are displayed on the MFD. These messages are displayed for approximately 3 seconds.

C2 MSG RCVED.
ARTY MSN x UPDATE.
AIR RQST MSN.
AIR MSN x UPDATE.
AIR MSN REJECTED.
NET JOIN? – FM-X.
BSA UPDATE.
AIR MSN REJECTED.
(x = Mission 1 or 2)

e. MMS Display Data. The following is a list of MMS data that can be displayed on the JVMF display pages:

MMS Rotary Advisories.
MMS Line of Sight.
MMS Mode Status.
TV/TIS Zoom Level.
MMS Azimuth and Elevation Display.
Heading Tape.
Lubber Line.
Bearing-to-Waypoint Arrow.
MMS Azimuth Indicator.
MMS Video.
Laser Armed Status.
Laser Range.
MMS Laser Range Designator.

4-210. START THREAD.

The START menu provides primary user interface to the JVMF messaging system following IDM initialization. The START thread capabilities are shown in figure 4-104.

4-211. ACKS THREAD.

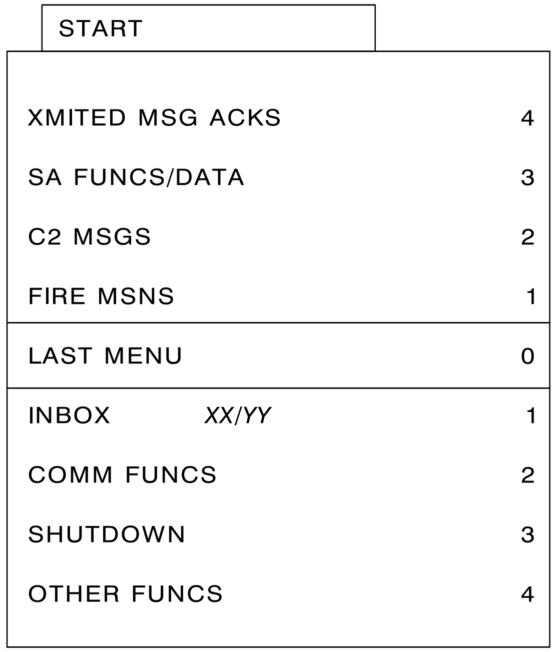
Select XMITED MSG ACKS from the START menu to display the ACKS thread (fig. 4-105). Use the ACKS thread to view acknowledgments for messages that have been sent.

a. ACKS.

(1) Originator TACID number.
(2) Message type.
(3) R – Indicates a message that was sent with an Operator Reply requested.
(4) M – Indicates a message that was sent with a Machine Acknowledge requested.
(5) O – Indicates that a message was sent with an Operator Acknowledge requested.
(6) * – Indicates that the requested acknowledgment has been received.

b. ACKS RQSTD. When the operator selects one of the messages from the ACKS display, this overlay is displayed, providing the following information:

1. At the top of the display are three boxes that provide information regarding the precedence, classification, and the acknowledgment type.



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MENU ITEM	FUNCTION
1. XMITED MSG ACKS	Displays ACKS thread.
2. SA FUNCS/DATA	Displays ORDERS thread.
3. C2 MSGS	Displays REPORTS thread.
4. FIRE MSNS	Displays FIRE MISSIONS thread.
5. LAST MENU	Displays LAST MENU.
6. INBOX	Displays INBOX thread.
7. COMM FUNCS	Displays COMM FUNC thread.
8. SHUTDOWN	Displays SHUTDOWN thread.
9. OTHER FUNCS	Displays OTHER FUNCS thread.

Figure 4-104. HOG Start Menu

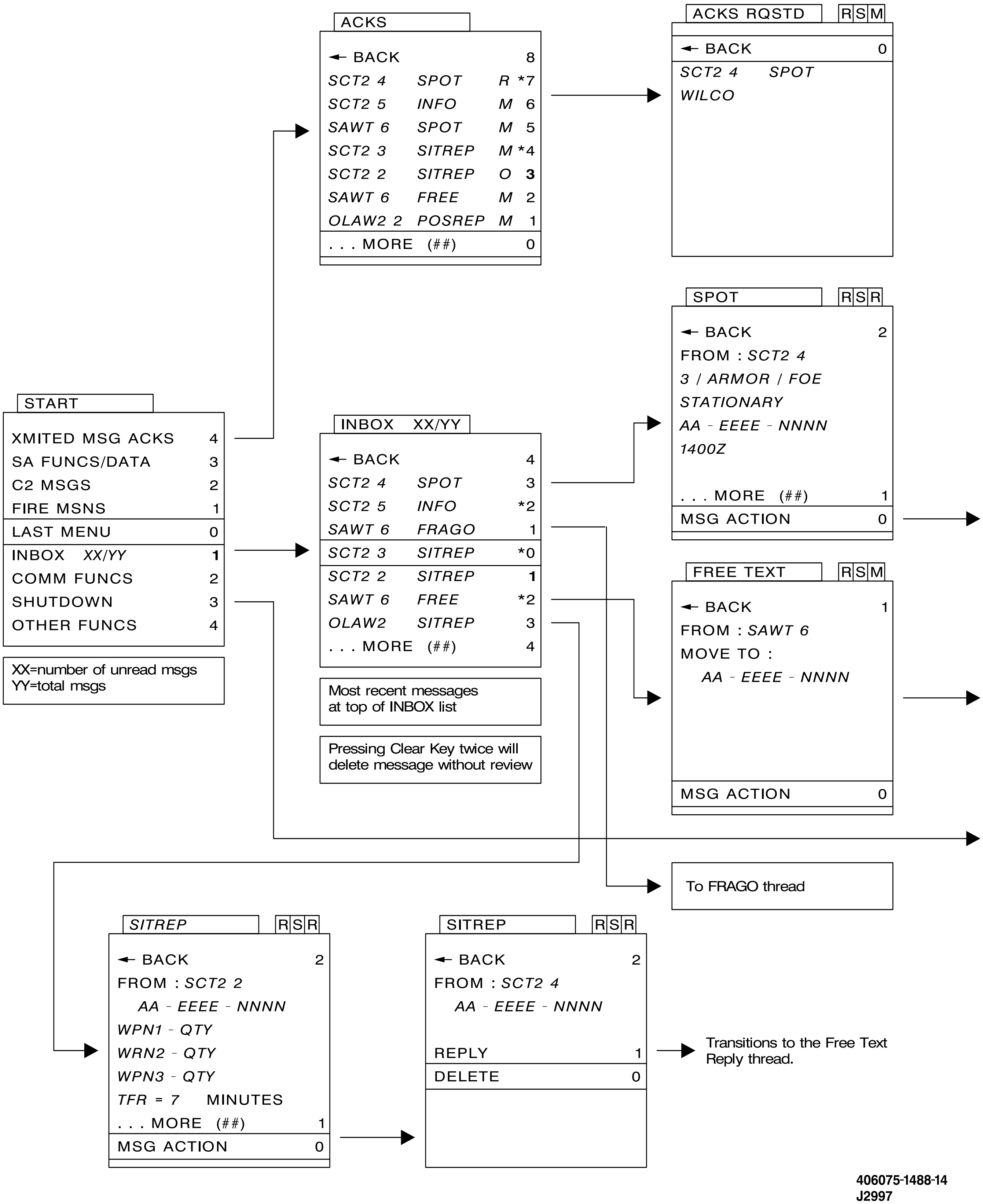

Figure 4-105. START, ACKS, INBOX, and SHUTDOWN Threads (Sheet 1 of 2)

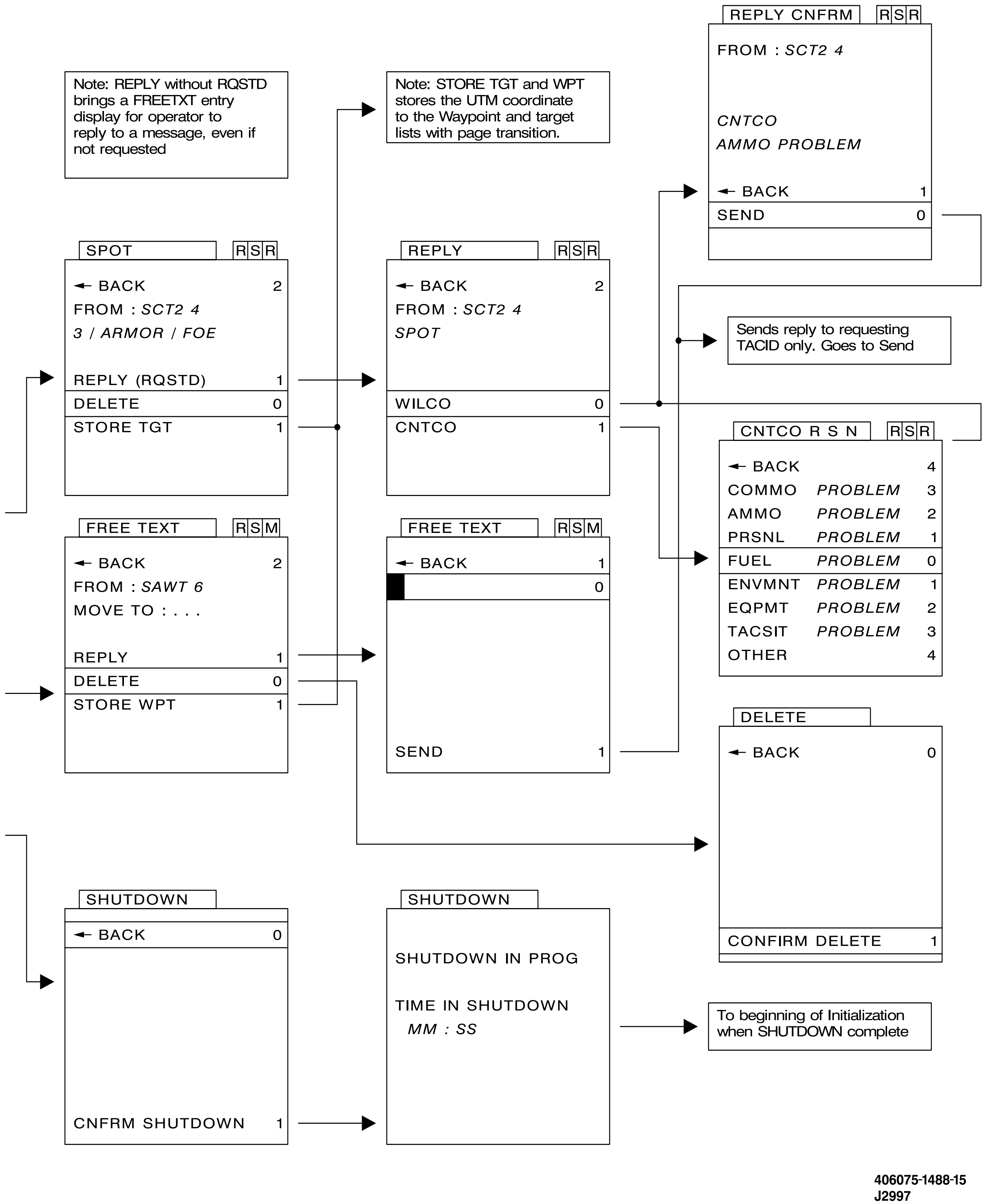

Figure 4-105. START, ACKS, INBOX, and SHUTDOWN Threads (Sheet 2 of 2)

a. The left-most box identifies the precedence of the message.
   (1) R = Routine.
   (2) I = Immediate.
   (3) F = Flash.
   (4) U = Urgent.

b. The middle box identifies the message classification.
   (1) C = Confidential.
   (2) S = Secret.
   (3) U = Unclassified.

c. The right-most box identifies the acknowledgment type.
   (1) M = Machine.
   (2) O = Operator.
   (3) R = Operator reply.

2. Originator TACID.

3. Message Type.

4. Receipt/Compliance element.

5. CANTCO Reason Code, if applicable.

4-212. INBOX THREAD.

Select INBOX XX/YY from the START menu to display the INBOX thread (fig. 4-105). Use the INBOX thread to select and display INBOX messages.

a. INBOX XX/YY Pop-up. The INBOX pop-up displays up to seven messages, in chronological order, and for each message provides the TACID, message type, and an asterisk if the message has not been reviewed. The XX/YY indicates the number of messages that have not been read (XX) and the total number of messages (YY).

1. Press the clear key on the MFK twice to delete the boxed message without review.

2. Selecting a message for review displays that message in the appropriate INBOX for that type of message. Five types of messages can be accessed from the INBOX pop-up: SPOT, FREE TXT, SITREP, INFO RQST, or FRAGO.

b. INBOX (Message Type) Pop-up (e.g., SPOT). The message type is identified in the title box of a message. The display provides following information and options:

1. To the right of the overlay title, the message precedence, classification, and acknowledgment type are displayed.

2. The TACID and message text are provided in the main section of the display. If the complete message cannot be viewed on one page, the next to last line displays the text MORE followed by the number of pages remaining to be reviewed in parentheses.

3. The last line contains the text MSG ACTION. Selecting this option displays MSG ACTION pop-up.

c. MSG ACTION Pop-up. The MSG ACTION pop-up contains the title (which is the message type), message precedence, classification and acknowledgment type, originator TACID, line of text that is dependent upon the message type being displayed, the option REPLY, the option DELETE, and for some messages types the option STORE WPT.

1. Line of Text. The information contained on the line of text is dependent upon the type of message displayed. Information for each message type is as follows:

   a. SPOT. Contains the quantity observed, target generic type, and comments.

   b. FREE TXT. Contains the first 16 characters of the original message.

   c. SITREP. Contains the Unit Grid.

   d. FRAGO. See paragraph d. below.

   e. INFO RQST. Provides two options; SITREP and POSREP.
      (1) SITREP – initiates an information request for a situation report. TACID is automatically entered and the display transitions to the SEND overlay.
      (2) POSREP – initiates an information request for a position report. TACID is automatically entered and the display transitions to the SEND overlay.

2. REPLY. The REPLY option appears as either REPLY (RQSTD) or REPLY. Selection of REPLY without (RQSTD) provides a FREE TXT pop-up that allows the operator to reply to the message, even when a reply was not requested. Selection of the REPLY (RQSTD) option provides a new pop-up titled REPLY.

a. REPLY (RQSTD). Select one of two available options; WILCO or CNTCO. Selection of the WILCO option displays the REPLY CNFRM pop-up. Selection of the CNTCO option displays the CNTCO RSN pop-up.

b. REPLY (Not Requested). If the REPLY (not requested) option is selected, the FREE TXT data entry pop-up is displayed.

c. REPLY CNFRM. Confirm that the message is correct. Selecting SEND confirms the information and the SEND pop-up is displayed.

d. CNTCO RSN. Select a reason why the replying aircraft cannot accept the requested mission. Selection of the applicable reason displays the REPLY CNFRM pop-up.

3. DELETE. This overlay provides the capability to delete the message from the INBOX and IDM. Select CONFIRM DELETE to delete the message and return the display to the INBOX XX/YY page.

4. STORE WPT. The text STORE has either the text WPT or TGT displayed to its right. Select this option to store the waypoint or target to the Waypoint or Target List pages.

5. FREE TXT (Data Entry) Pop-up. Select the cursor option to activate the data entry mode in order to input a maximum of two lines of text, each with 16 characters. Select SEND to display the SEND pop-up.

d. FRAGO. The FRAGO message is a text format of the JVMF Field Order message. When a FRAGO message is selected from the INBOX XX/YY pop-up, the FRAGO SUMMARY overlay is displayed. Each FRAGO display has the title FRAGO and the message precedence, classification, and acknowledgment type. Additionally, the FRAGO message type is identified on the center of the first line.

1. FRAGO SUMMARY. The FRAGO summary (fig. 4-106) allows the operator to view the message originator, overlay type, and the FRAGO identification. This display also allows the selection and review of the REORG, 5 PARA DATA/ANNEXES, COMMENTS, and MSG ACTION displays. Lines 2 through 6 of the Summary contain the following information.

a. Line 2 – Operation ID and the Oplan/Opord Name.

b. Line 3 – FRAGO ID number.

c. Line 4 – TAC Order Originator and Order Orginator Year/Month/Day.

d. Line 5 – Overlay Type, Major Revision Serial Number, Minor Revision Serial Number, URN Overlay Originator, and Overlay Year/Month/Day.

e. Line 6 – Reorganization Indicator, UTR Execution Status Request, and UTR Execution Status.

NOTE

Transition to the next display is dependent on which option is selected.

2. FRAGO REORG. The REORG display allows the operator to view the parent organization and platforms assigned to that organization. This page provides the following information:

a. Line 2. – Effective Year/Month/Date and effective Hour:Minute.

b. Line 3. – Delayed Year/Month/Date and delayed Hour:Minute

c. Line 4. – Selection of the COMMENTS option displays the COMMENTS overlay.

d. Line 5. – Selection of the PARENT option toggles through the parent organizations provided in the messages. The x of the (x of y) indicated the number of related repeats of the parent data. The y of the (x of y) is the total number of repeats. Maximum number of repeats is 50.

e. Line 6. – Selection of the SUB UNIT option toggles through the SUB UNIT data available for the parent identified. The a of the (a of b) indicated the number of selected subunits relative to the number of repeats. The b of the (a of b) is the total number of repeats for the selected parent.

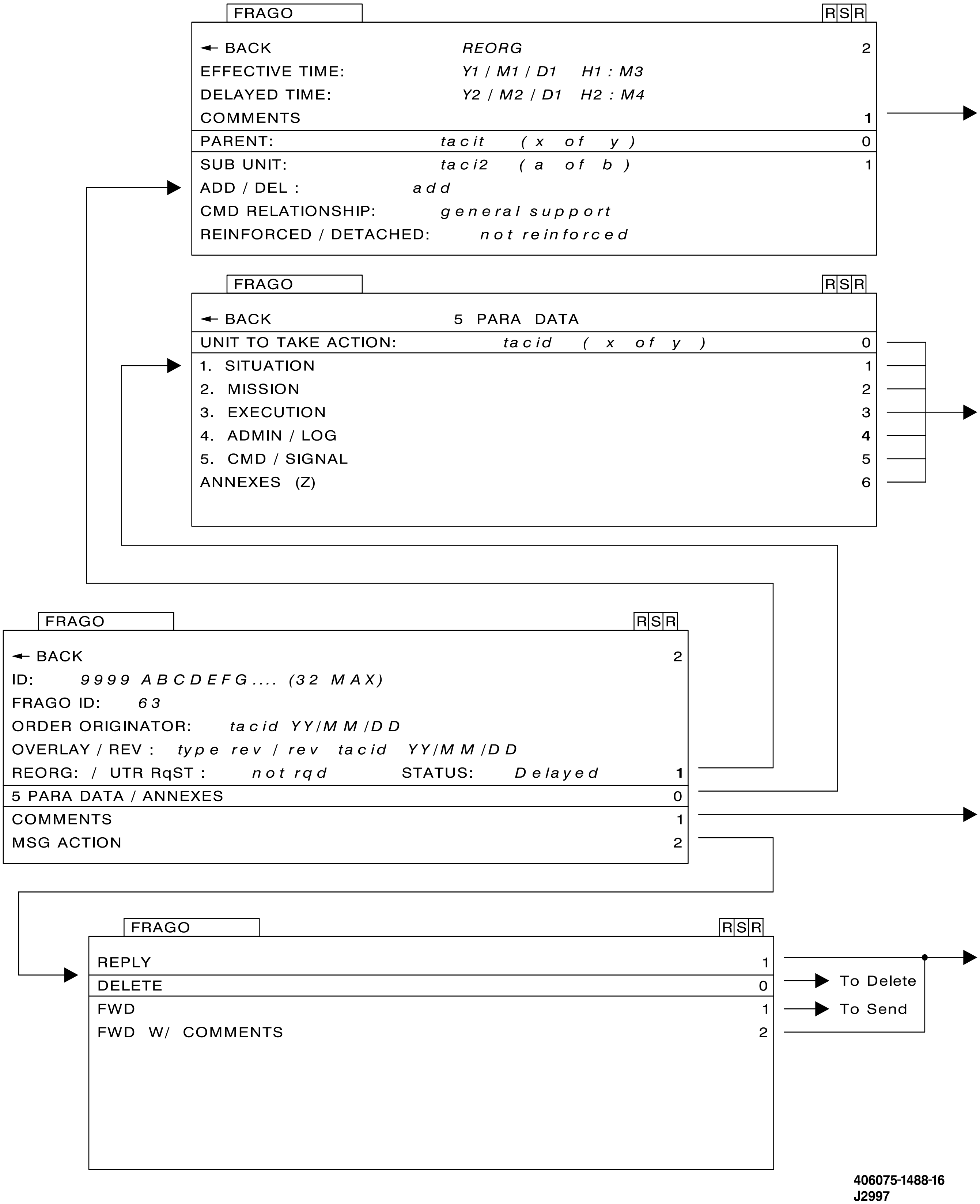

Figure 4-106. FRAGO Thread (Sheet 1 of 4)

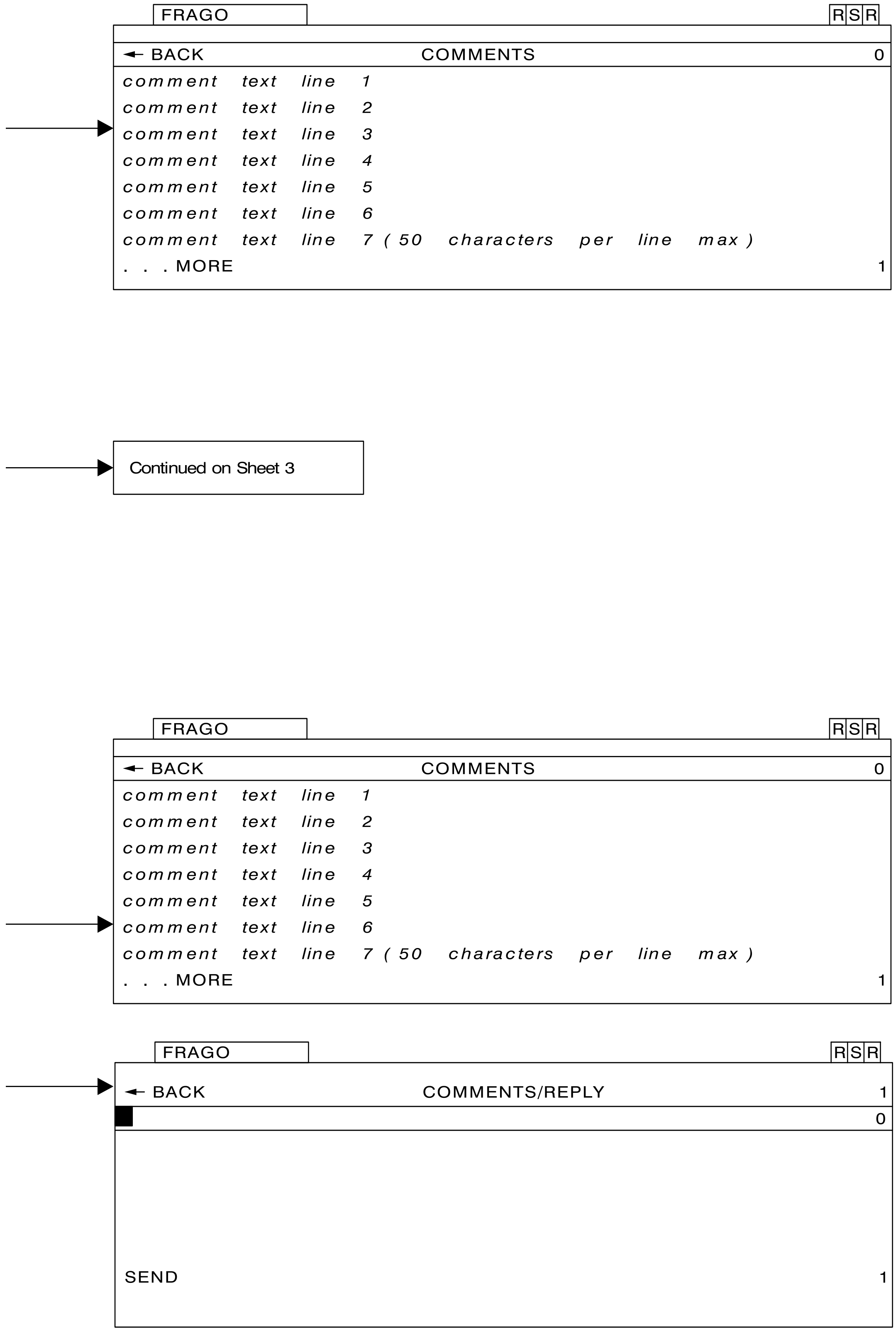

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Figure 4-106. FRAGO Thread (Sheet 2 of 4)

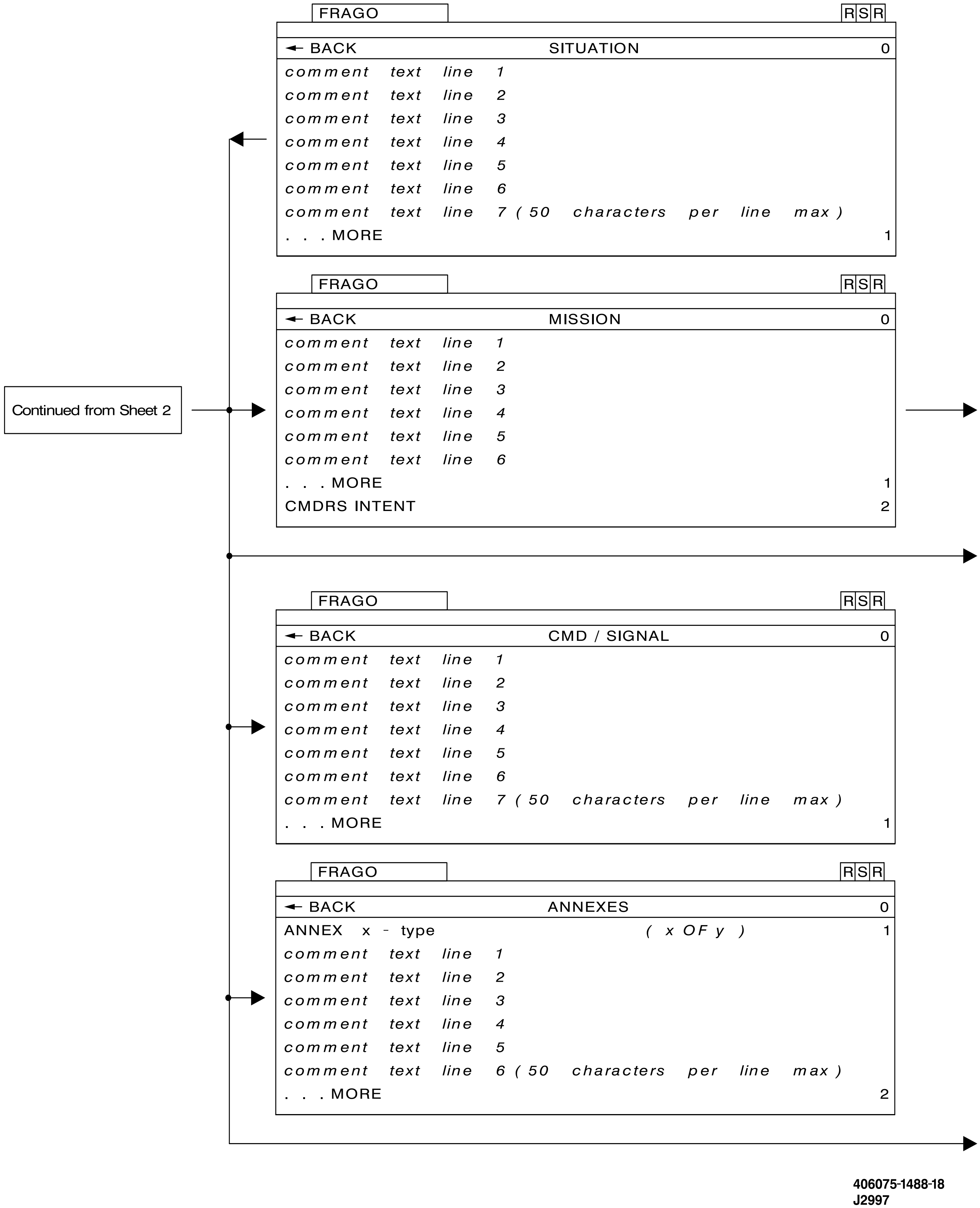

Figure 4-106. FRAGO Thread (Sheet 3 of 4)

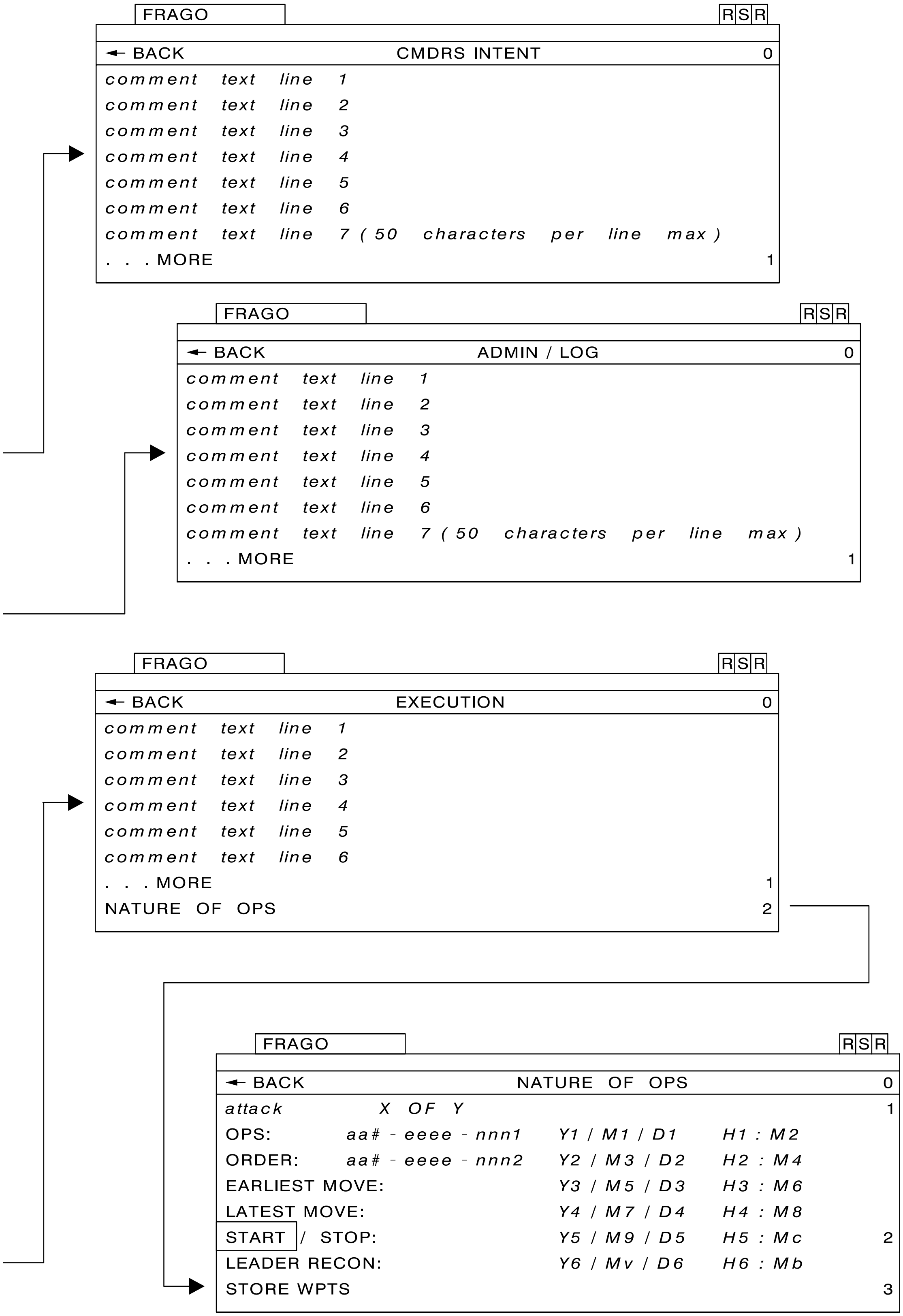

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Figure 4-106. FRAGO Thread (Sheet 4 of 4)

f. Line 7. – Add/Delete indicator of SUB UNIT to PARENT relationship established by the reorganization.

g. Line 8. – Command relationship of the SUB UNIT to the PARENT.

h. Line 9. – Reinforced/Detached status of the SUB UNIT to the PARENT.

3. FRAGO REORG COMMENTS. This overlay provides a textual display of the message REORG comments.

4. FRAGO 5 PARA DATA. This overlay (fig. 4-104) provides the capability to select the UNIT TO TAKE ACTION number and access the following FRAGO paragraphs: SITUATION, MISSION, EXECUTION, ADMIN/LOG, CMD/SIGNAL, and ANNEXES.

a. The UNIT TO TAKE ACTION option toggles through the units contained in the message.

b. The SITUATION, MISSION, EXECUTION, ADMIN/LOG, or CMD/SIGNAL option displays the related pop-up.

c. The ANNEXES option displays the ANNEXES overlay. The number enclosed in parentheses represents the number of annexes contained in the message.

d. SITUATION Pop-up. The SITUATION overlay (fig. 4-106) provides a textual display of the situation data contained in the message.

e. MISSION Pop-up. The MISSION overlay (fig. 4-106) provides a textual display of the mission data contained in the message.

f. CMDRS INTENT Overlay. The CMDRS INTENT overlay (fig. 4-106) provides a textual display of the commander intent data contained in the message.

g. EXECUTION Overlay. The EXECUTION overlay (fig. 4-106) provides a textual display of the execution data contained in the message.

h. NATURE OF OPS Overlay. This display (fig. 4-106) provides a view to the Nature of Operation dates and times related to the FRAGO 5 PARA DATA. This overlay provides the following information and options:

(1) Line 2. – Toggles through the NATURE OF OPS available for review. The x of the (x of y) is the number of repeats. The y of the (x of y) is the total number of TACIDs related to the number of repeats. Maximum number of TACIDs is 4.

(2) Line 3. – OPS GRID. Year/Month/Day and Hour:Minute for the repeat number of a subsection to the repeated field in the repeated message.

(3) Line 4. – ORDER GRID. Year/Month/Day and Hour:Minute for the repeat number of a subsection to the repeated field in the repeated message.

(4) Line 5. – Earliest Move (Year/Month/Day and Hour:Minute).

(5) Line 6. – Latest Move (Year/Month/Day and Hour:Minute).

(6) Line 7. – START/STOP (Year/Month/Day and Hour:Minute for start or stop time).

(7) Line 8. – Leader RECON (Year/Month/Day and Hour:Minute).

(8) Line 9. – Initiates the function to store the OPS GRID and ORDER GRID to the Waypoint List. Completion of this task transitions the display back to the FRAGO 5 PARA DATA pop-up.

i. ADMIN/LOG Overlay. The ADMIN/LOG overlay (fig. 4-106) provides a textual display of the administrative and logistics data contained in the message.

j. CMD/SIGNAL. The CMD/SIGNAL overlay (fig. 4-106) provides a textual display of the command/signal data contained in the message.

k. ANNEXES. This overlay (fig. 4-106) allows the operator to review the data for each of the annexes contained in the message. The following data and options are provided on this display:

(1) Line 1. – Type annex being displayed. The x of the (x of y) is the TACID number of the TACIDs related to the number of repeats. The y of the (x of y) is the total number of TACIDs related to the number of repeats.

(2) Lines 2 through 7. – Each page displays up to six lines of data with a maximum of 50 characters per line. If the text MORE is displayed on the bottom line, this indicates that another page of comments is available and selection of that option displays that page.

l. FRAGO COMMENTS. This pop-up (fig. 4-106) is part of the FRAGO COMMENTS thread. Appearance and function are identical to FRAGO REORG COMMENTS overlay.

m. FRAGO MSG ACTION. This overlay (fig. 4-106) provides the operator a means to replay, delete, and forward FRAGO messages. The following options are provided on this display:

(1) REPLY. – The REPLY option appears as either REPLY (RQSTD) or REPLY.

(a) REPLY (RQSTD). Select WILCO or CNTCO. Selection of the WILCO option displays the REPLY CONFIRM pop-up. Selection of the CNTCO option displays the CNTCO RSN pop-up.

(b) REPLY (Not Requested). If the REPLY (not requested) option is selected, the FRAGO MSG ACTION COMMENTS/REPLY pop-up (fig. 4-106) is displayed.

(2) DELETE. – Select this option to delete the message from the INBOX and IDM. Accept CONFIRM DELETE to delete the message and return the display to the INBOX XX/YY page.

(3) FWD. – Select this option to display the SEND overlay page.

(4) FWD W/COMMENTS. – Select this option to display the FRAGO MSG ACTION COMMENTS/REPLY pop-up (fig. 4-106).

n. FRAGO MSG ACTION COMMENTS/REPLY. This pop-up (fig. 4-106) provides the capability to send comments to the originator of the FRAGO message and to forward the message with or without comments to other addresses.

(1) Comments of up to 200 characters are allowed.

(2) SEND forwards the the comments to the originator using the SEND pop-up.

4-213. SHUTDOWN THREAD.

Select SHUTDOWN from the HOG START menu to display the SHUTDOWN thread (fig. 4-105).

1. Select CNFRM SHUTDOWN to initiate IDM shutdown.

2. SHUTDOWN IN PROGRESS displays, along with time expired since shutdown was initiated.

3. Successful shutdown indicated by display of INITIAL PAGE 1 with HOG INIT - DB/DF overlay (fig. 4-90).

4-214. C2 MESSAGES THREAD.

Select C2 MSGS from the START menu to display the C2 MESSAGES thread. The Command and Control (C2) thread (fig. 4-107) provides the capability to select message type, compose content, and transmit messages. Select one of the following message types:

- OBSTAT
- OWN POS
- SPOT
- SITREP
- FREETXT
- INFO RQST

1. OBSTAT. Select OBSTAT (fig. 4-107) to generate and send Observer Status report, which indicates cloud height and visibility in the immediate area.

a. VISIBILITY. Select a visibility option. The option selected is displayed on the OBSTAT page.

b. CLOUD HEIGHT. Select the cloud height. The option selected is displayed on the OBSTAT page.

c. SEND. Select SEND to transmit the message (refer to SEND THREAD paragraph).

2. OWN POS. This option causes a position report to be generated and the display to be automatically transitioned to the SEND pop-up. (Refer to SEND THREAD paragraph.)

3. SPOT. Select SPOT to generate and send the SPOT Report, which includes the following information:

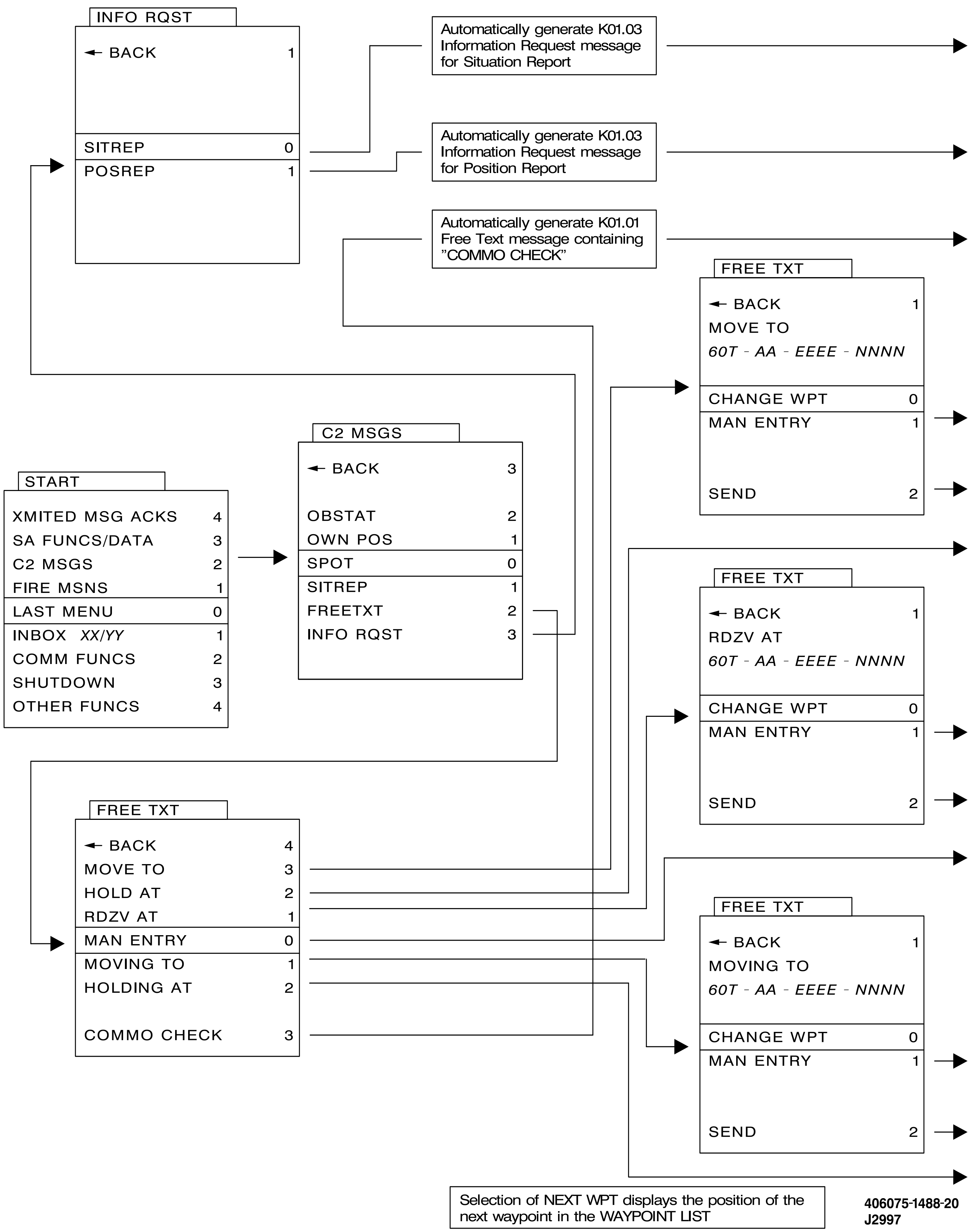

Figure 4-107. C2 Messages Thread (Sheet 1 of 4)

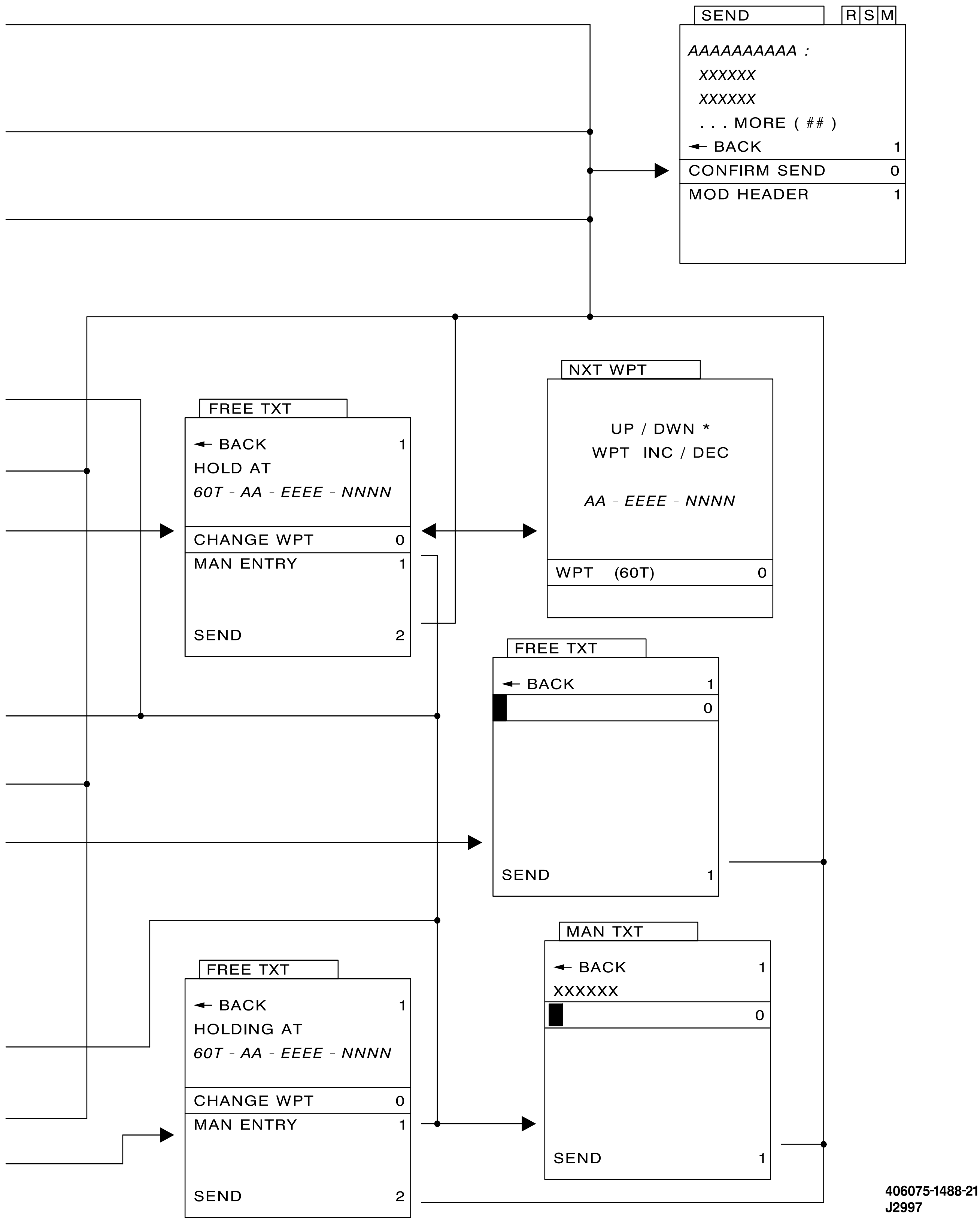

Figure 4-107. C2 Messages Thread (Sheet 2 of 4)

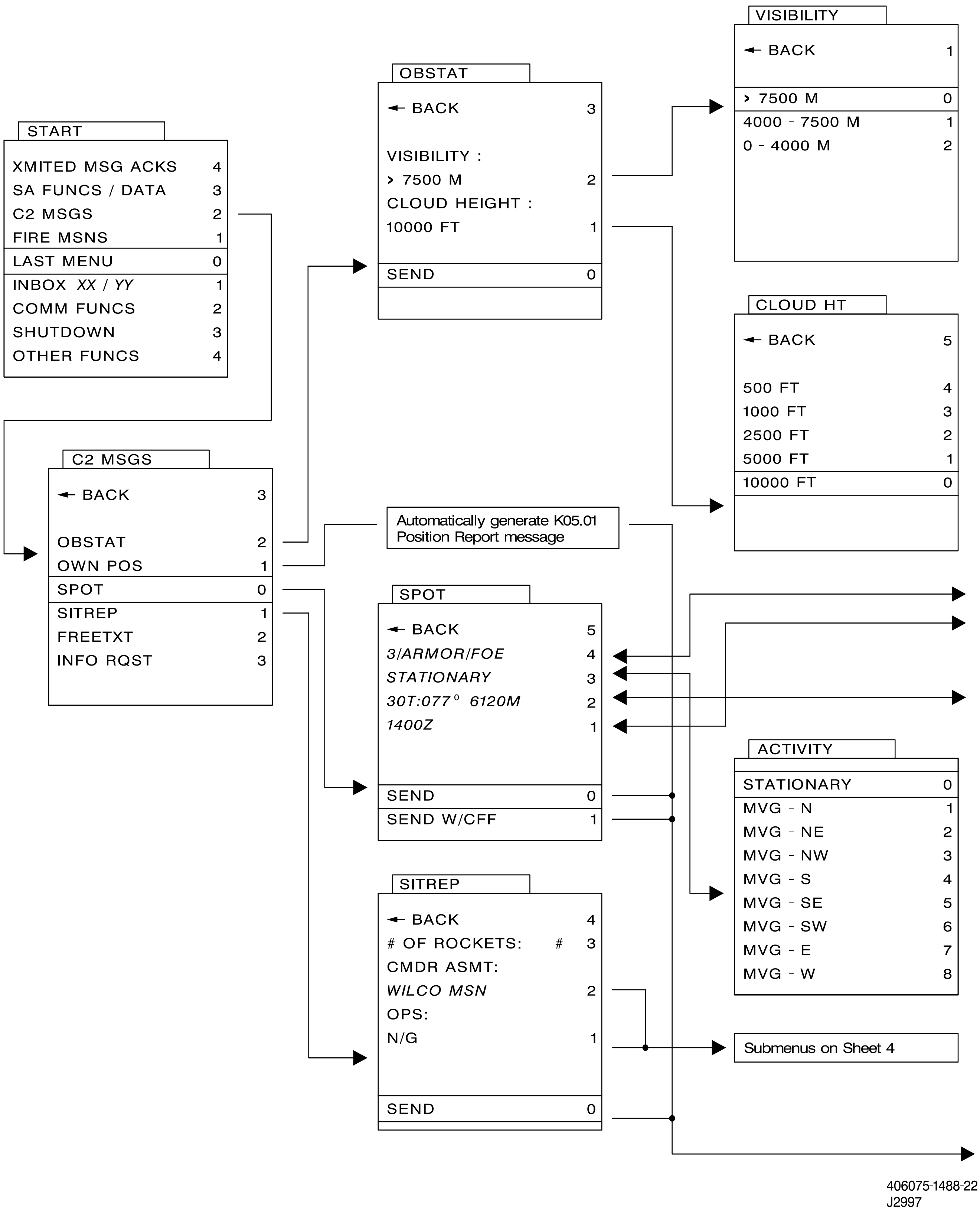

Figure 4-107. C2 Messages Thread (Sheet 3 of 4)

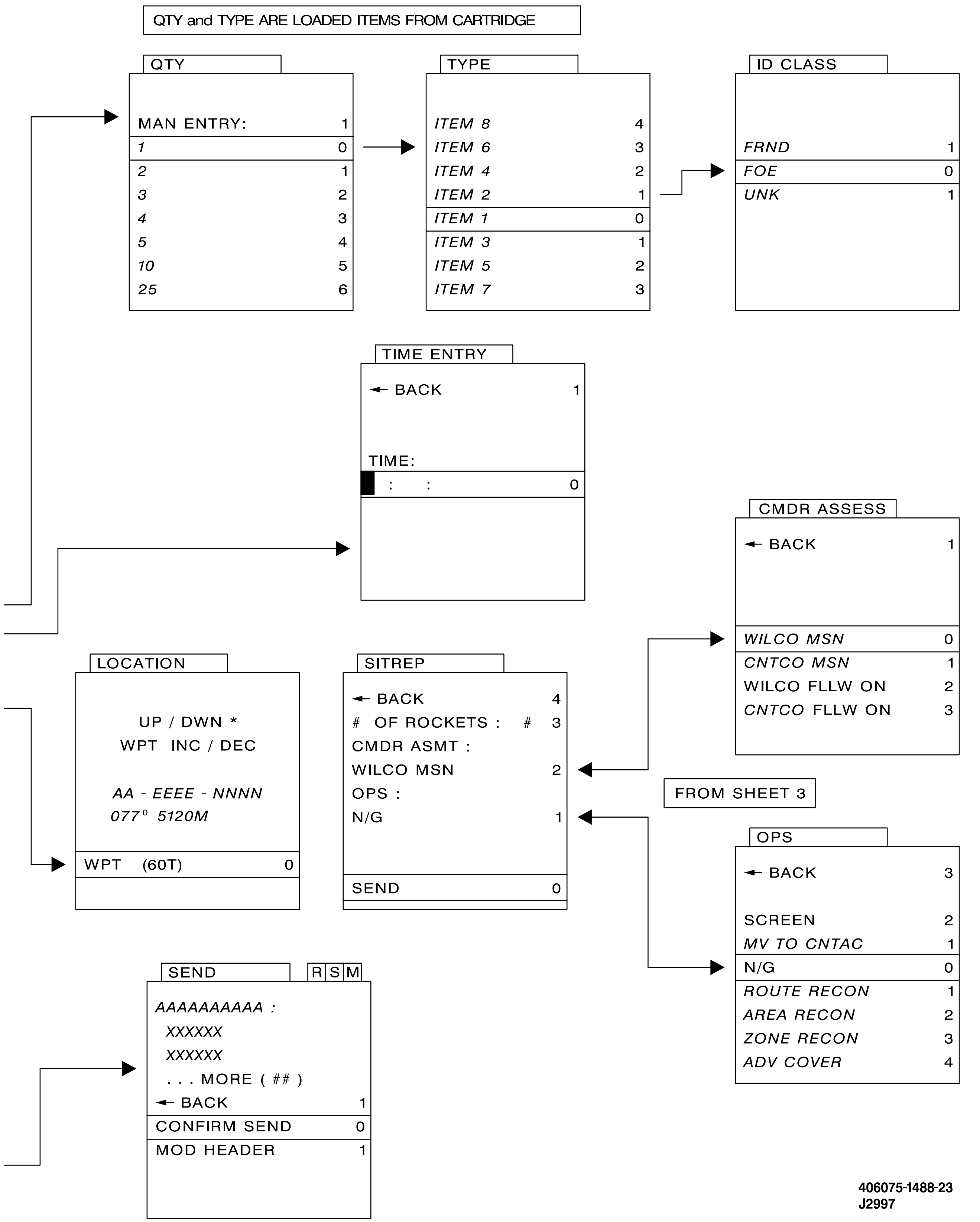

Figure 4-107. C2 Messages Thread (Sheet 4 of 4)

a. Line 2. Quantity observed, target type, and identification class. Selection of this option transitions the display to the SPOT QTY pop-up.

b. Line 3. Activity of the element and direction it is moving, if applicable. Selection of this option transitions to the SPOT ACTIVITY overlay.

c. Line 4. This line contains the prepoint identifier for the current prepoint and represents the default target location. Selection of this option displays the SPOT LOCATION overlay and provides the capability to change the target location. Following a target locate function, the current prepoint is equal to the result of the target locate.

d. Line 5. The time this observation was made. Select this option to display the TIME ENTRY overlay.

e. SEND. Select this option to transmit the message.

f. SEND W/CFF. Select to initiate the transmission of the message. This option also commands the CDS to data fill the target type, quantity, elevation, latitude, longitude, and other information that pertains to the Call For Fire Message into either the ARTY #1 or ARTY #2 (in that order) database.

g. SPOT QTY. Select one of the seven fixed options or manually enter the quantity (fig. 4-107). Normally, the fixed entries are determined by the data provided by the message defaults loaded from the DTS at initialization. If the DTS data is not available, the defaults are: MAN ENTRY=(1), 1=(0), 3=(1), 5=(2), 10=(3), 25=(4), 50=(5), and 100=(6). Selection of the MAN ENTRY option activates the MFK data entry allowing the CPG to enter up to three numbers.

h. SPOT TYPE. The target TYPE that is to be sent with the SPOT report is provided using this overlay (fig. 4-107). The default entries list on the overlay when no DTS input is available is: FIXED WING=(4), HELO=(3), ASSY=(2), PRSNL=(1), ARMOR=(0), VHCLS=(1), ARTY=(2), ADA=(3), AND MORTAR=(4). Selections from this page transition the display to the ID CLASS overlay.

i. ID CLASS. Indicate whether the target is a friend (FRND), FOE, or unknown (UNK) (fig. 4-107). Selection of one of these options transitions back to the SPOT display.

j. SPOT ACTIVITY. Select from the available options to describe the enemy's activity (fig. 4-107). Selection of a option from this page transitions the display to the SPOT overlay.

k. SPOT LOCATION. Select the waypoint to be referenced in the SPOT report. When this overlay is activated, the default waypoint is the current prepoint. If a different waypoint is desired, select this waypoint by using the MMS FOV switch to increment/decrement the waypoint identifier. Selection of the WPT option transitions the display to the SPOT overlay.

4. SITREP. Select SITREP (fig. 4-107) to accept or change selected items. The following options and information is provided on this display.

a. Line 2. Select # OF ROCKETS to activate MFK entry and enter the number of rockets. Valid entry is 0 to 14.

b. Line 3. This line is hard text and reads CMDR ASMT.

c. Line 4. Select to display the Commander Assessment (CMDR ASMT) overlay. The option selected on the SPOT CMDR ASMT overlay is displayed on this line.

d. Line 5. This line is hard text and reads OPS.

e. Line 6. Select this option to display the Nature of Operation (OPS) overlay. The option selected on the SPOT OPS overlay is displayed on this line.

f. SEND. Select this option to initiate transmission of the message.

g. SITREP CMDR ASMT. This page (fig. 4-107) provides four options that can be used to update the SITREP message. Selection of an option transitions the display back to the SPOT overlay.

h. SITREP OPS. The Nature of Operations page (fig. 4-107) provides seven options that can be used to update the SITREP message. Selection of an option transitions the display back to the SITREP overlay. If the DTS does not contain a valid options list, the default entries are: BACK=(4), ATTACK=(3), DEFEND=(2), SCREEN=(1), N/G=(0), MOVE to CONTACT=(1), ZONE RECON=(2), AREA RECON=(3), and ROUTE RECON=(4).

5. FREE TXT. Select FREE TXT (fig. 4-107) to display the following five options: MOVE TO, HOLD AT, RDZV AT, MOVING TO, and HOLDING AT. Also provided is a manual FREE TXT entry overlay and an option to initiate communication check (COMMO CHECK).

a. FREE TXT (Specific). This overlay (fig. 4-107) provides a capability to send a free text message describing what needs to be done with respect to a given waypoint. This page contains the following options and data.
   (1) Line 2. – Contains text that indicates which option was selected from the FREE TXT overlay. For example, if the MOVE TO option was selected, this line would read MOVE TO.
   (2) Line 3. – Identifies the selected waypoint identifier and its UTM coordinates.
   (3) CHANGE WPT. – Select this option to display the NXT WPT overlay.
   (4) MAN ENTRY. – Select this option to display the MAN TXT manual entry display.
   (5) SEND. – Select this option to initiate the transmission of the message.
   (6) NXT WPT. – This page (fig. 4-107) provides the capability to change the waypoint to which this message refers. When this overlay is displayed, the MFK entry mode is activated allowing the operator to enter the identifier of the desired waypoint. Selection of change waypoint returns the displayed overlay to the previous displayed FREE TXT overlay.
   (7) MAN TXT. – Enter a free text message that is associated with the commanded text displayed on line 2 of the previous FREE TXT message. Upon entry to this page, the MFK entry mode is activated. Select SEND to go to the SEND overlay.

b. FREE TXT MAN ENTRY. This overlay allows a free text message of up to 112 characters to be prepared and SENT. Upon entry to this overlay, the MFK entry mode is activated. Selection of the cursor allows entry of the keyboard data. Select SEND to go to the SEND overlay.

c. COMMO CHECK. Selection of this option initiates a FREE TXT message with COMMO CHECK. There is no overlay associated with this option. The message is automatically generated and the display transitions to the SEND overlay.

6. INFO RQST. Select INFO RQST to request SITREP and POSREP information.

a. SITREP. Select SITREP to generate a situation report. The TACIDs are automatically entered and the display transitions to the SEND overlay.

b. POSREP. Select POSREP to generate a position report. The TACIDs are automatically entered and the display transitions to the SEND overlay.

4-215. FIRE MISSIONS THREAD.

Select FIRE MSNS from the START menu to display FIRE MSNS thread (fig. 4-108). The fire missions thread provides the operator with the capability to select the type of fire mission, configure the fire mission, and access the JVMF Mission Summary Pages.

1. FIRE MSNS. This overlay (fig. 4-108) provides the capability to select and view the active fire mission threads if the mission has not been activated. If an activated fire mission is selected, the HOG overlay is blanked and the appropriate JVMF Mission Summary Page is displayed on the CPG MFD. The FIRE MSNS overlay provides the following functionality.

a. ARTY #1 or #2. Transitions the HOG display to either the ARTY MENU overlay if the mission has not been activated or the JVMF Mission Summary Page if the mission has been activated.

b. LAST. Transitions the display to last selected Fire Mission. Overlay displayed is dependent on whether the mission is activated or not activated.

c. AIR #1 or #2. Transitions the HOG display to either the AIR MENU overlay if the mission has not been activated or the JVMF Summary Page if the mission has been activated.

2. ARTY MENU. The ARTY MENU (fig. 4-108) overlay provides access to select and define the artillery mission. This overlay provides six methods of fire from which to choose.

COPPERHEAD MISSION

IMMEDIATE SUPPRESSION (IMED SUPR)

FIRE FOR EFFECT/WHEN READY (FFE/WR) MISSION

FIRE FOR EFFECT/AT MY COMMAND (FFE/AMC) MISSION

ADJUST FIRE/WHEN READY (AF/WR) MISSION

ADJUST FIRE/AT MY COMMAND (AF/AMC) MISSION

Selection of one of these options sets the method of fire, method of control, fire mission priority, and transitions the display to the ARTY #N overlay. N is either 1 or 2 for mission 1 or mission 2 and was selected from the previous menu.

a. ARTY #N. This overlay (fig. 4-108) provides the interface that allows the operator to select the type, quantity, location and type of projectile for a given target. Also provided are the capabilities to select the firing urgency and when the shot is to be fired.

(1) Line 2. – Indicates the method of fire, method of control, and fire mission priority. Selection of this option transitions the display to the ARTY CONTROL overlay.

(2) Line 3. – Contains the observed target azimuth, observed target range, and waypoint target number. Selection of this option transitions the display to the ARTY TGT LOC overlay.

(3) Line 4. – Displays the target quantity and generic type. Selection of this overlay transitions the display to the ARTY TGT QTY overlay.

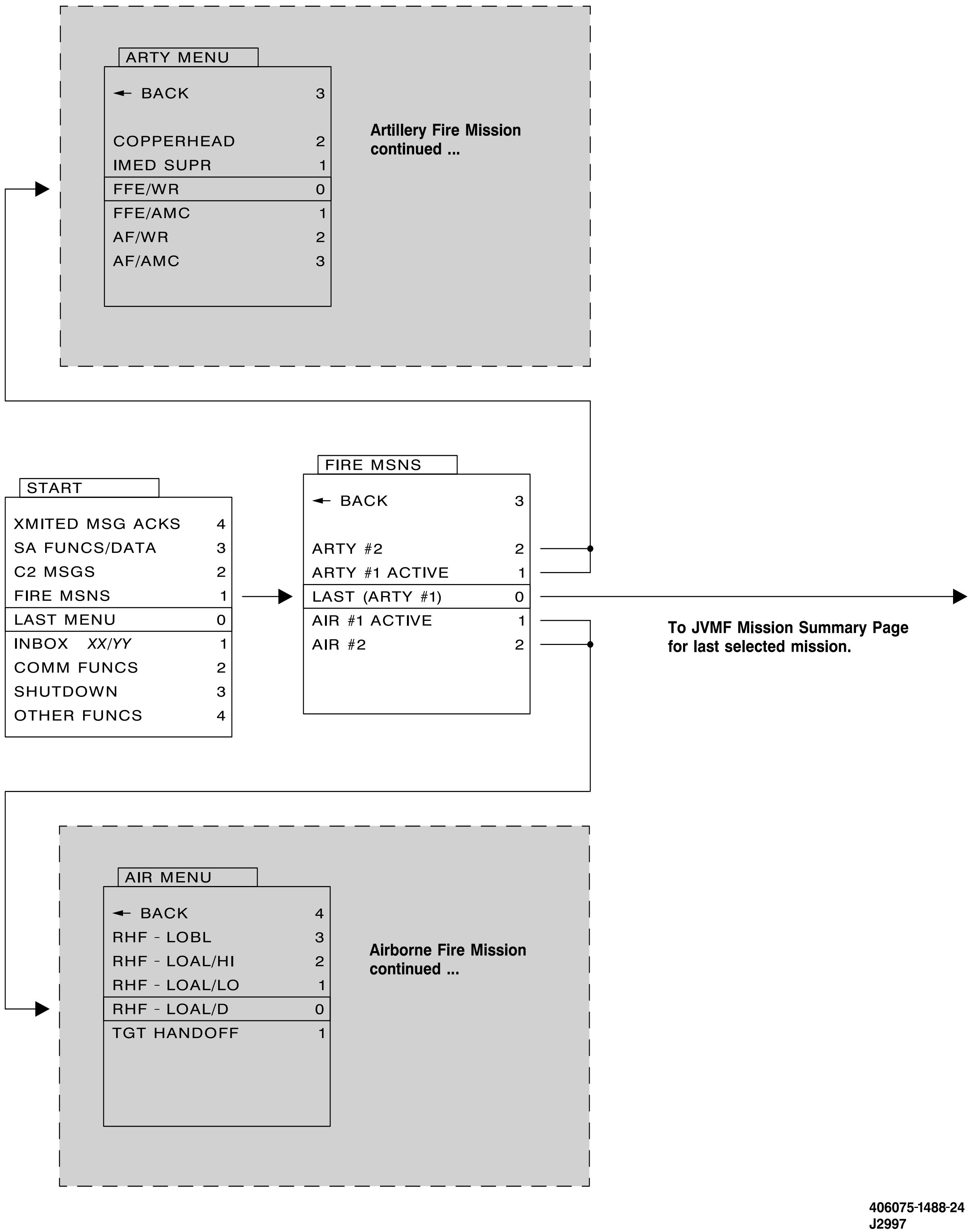

Figure 4-108. Fire Missions Thread (Sheet 1 of 6)

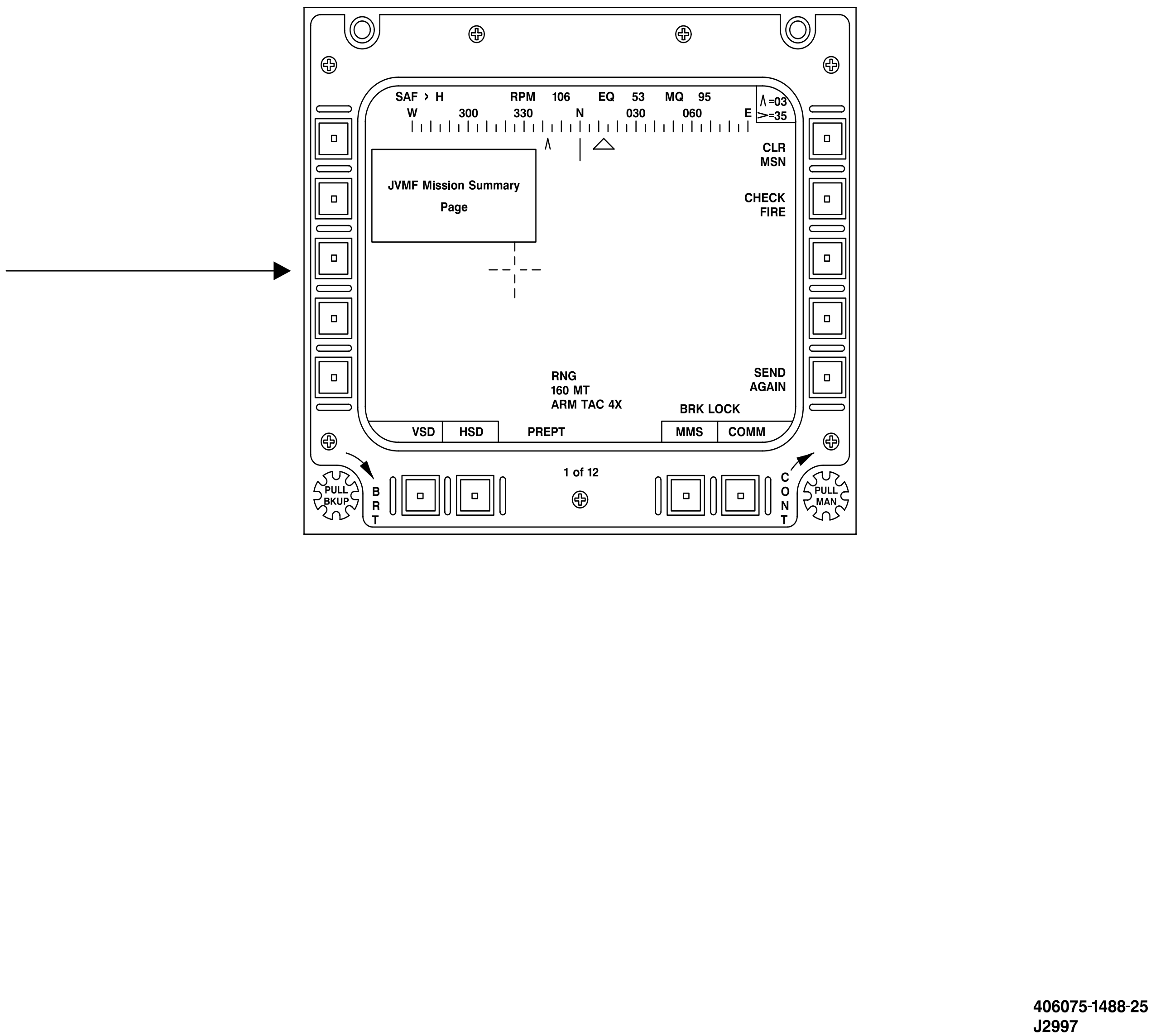

Figure 4-108. Fire Missions Thread (Sheet 2 of 6)

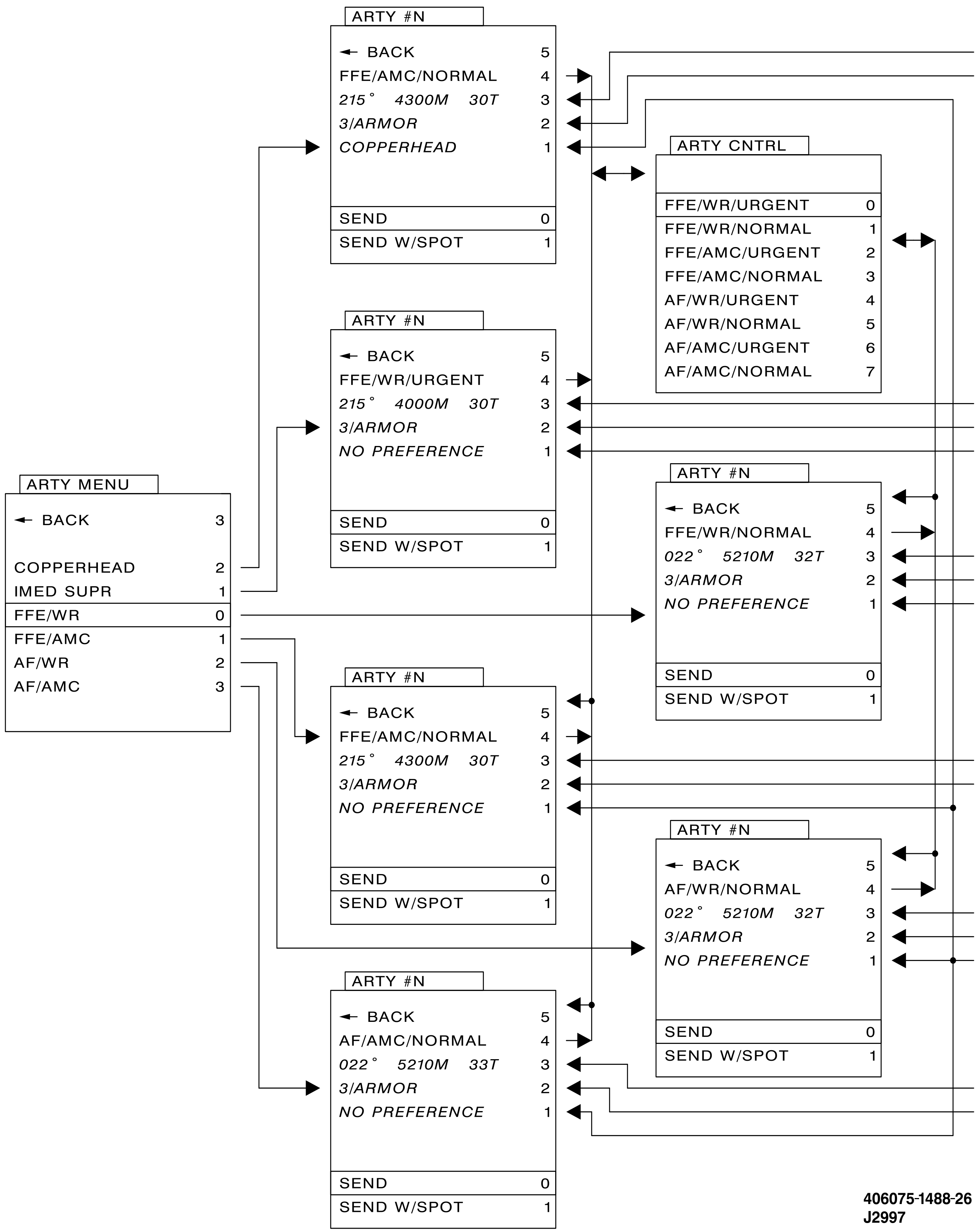

Figure 4-108. Fire Missions Thread - ARTY (Sheet 3 of 6)

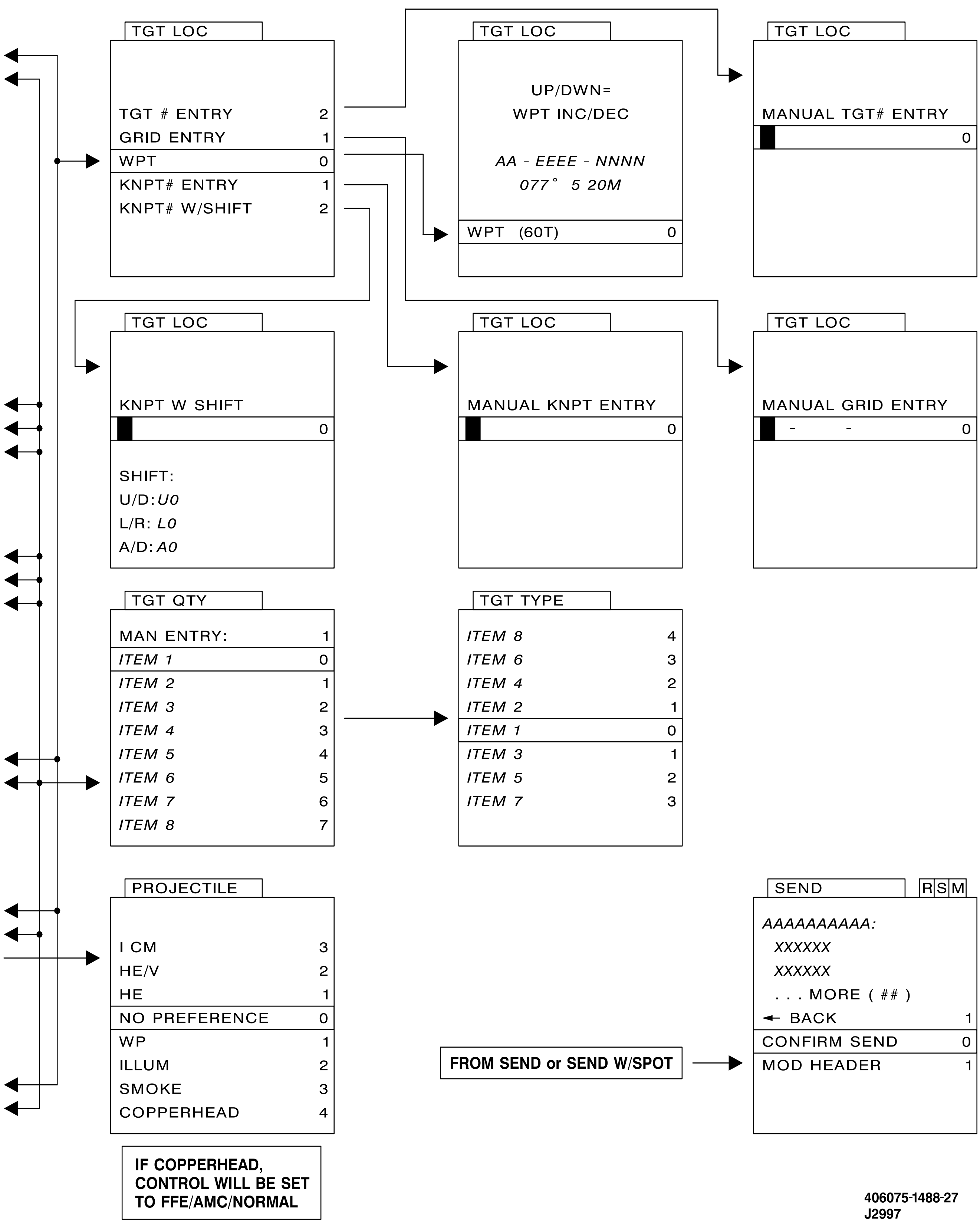

Figure 4-108. Fire Missions Thread - ARTY (Sheet 4 of 6)

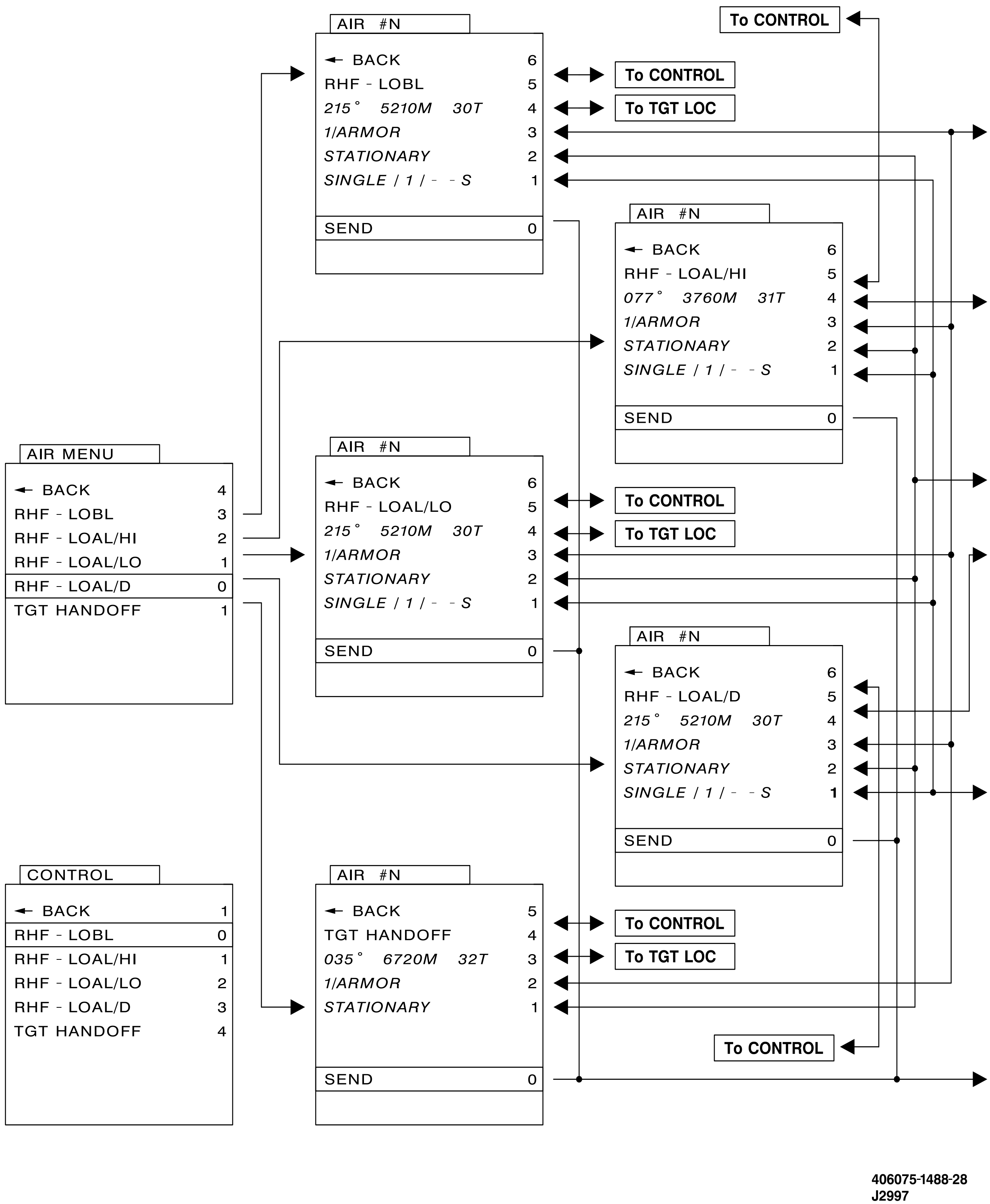

Figure 4-108. Fire Missions Thread - Airborne (Sheet 5 of 6)

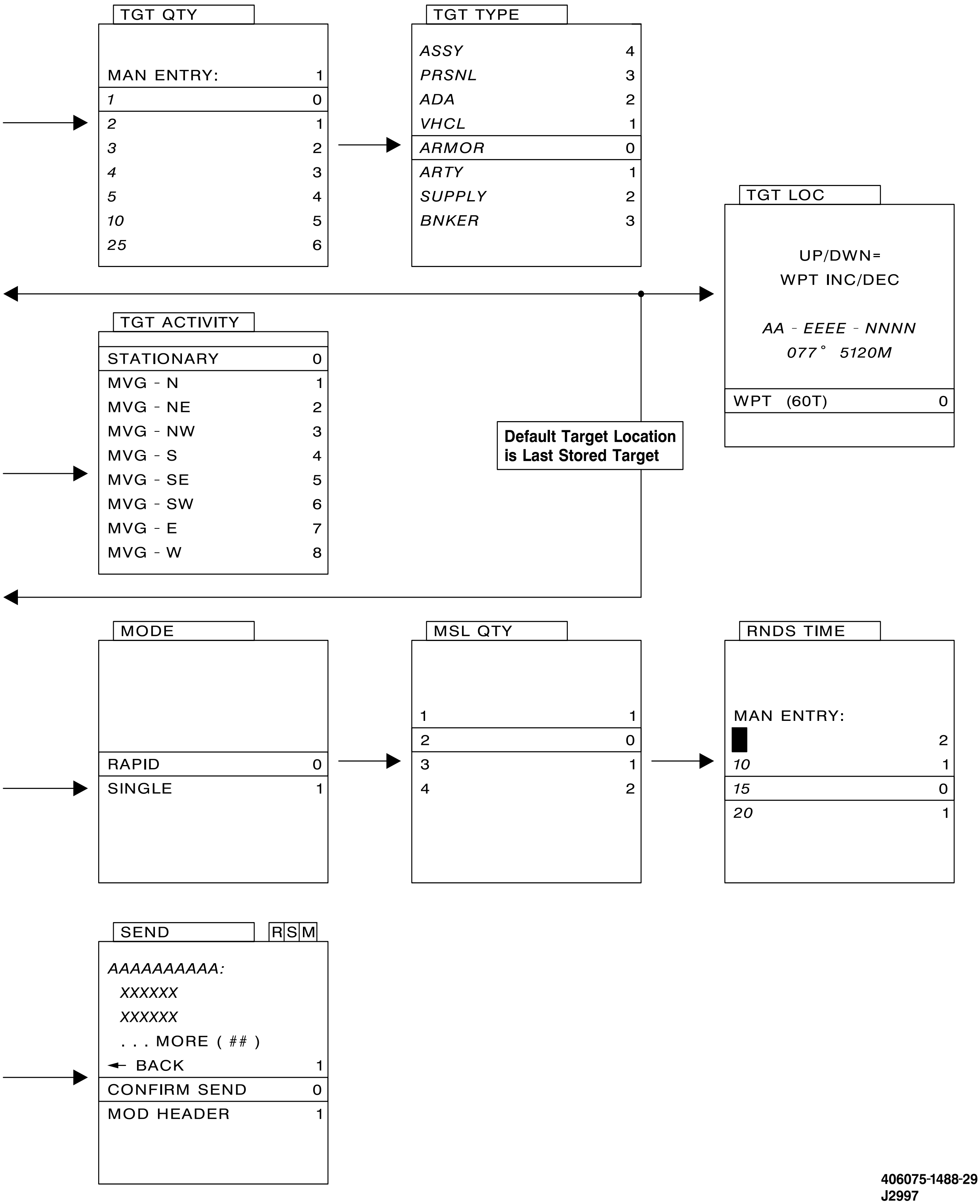

Figure 4-108. Fire Missions Thread - Airborne (Sheet 6 of 6)

(4) Line 5. – Identifies the FFE projectile or the FFE fuze. Selection of this option transitions the display to the ARTY PROJECTILE overlay.

(5) SEND. – Select this option to initiate transmission of the message. When the SEND overlay is displayed from the FIRE MSNS thread, the JVMF Mission Summary Page is displayed after the CONFIRM SEND option is selected.

(6) SEND W/SPOT. – Select this option to initiate the transmission of the message. This option also generates a SPOT message that is sent to the currently selected recipients. When the SEND W/SPOT overlay is selected from the FIRE MISSIONS thread, the JVMF Mission Summary Page is displayed after the CONFIRM SEND option is selected.

b. ARTY CONTROL. This overlay (fig. 4-108) provides the means to change the method of fire, method of control, and fire mission priority for the currently selected fire mission. Selection of an option from this overlay replaces the ARTY CONTROL overlay with the previously displayed ARTY #N overlay and changes line 2 to reflect the option selected on the ARTY CONTROL pop-up.

c. ARTY TGT LOC. This overlay (fig. 4-108) is used to change the target as well as select the method by which the new target is identified.

(1) Line 1. – Select this option to display the TGT Number Manual Target Entry pop-up.

(2) Line 2. – This option transitions the display to the TGT LOC Manual Grid Entry overlay.

(3) Line 3. – This option provides the capability to select a target using its waypoint identifier. This capability is provided by displaying the TGT LOC Waypoint Entry overlay.

(4) Line 4. – This option transitions the display to the TGT LOC Manual Known Point Entry pop-up display.

(5) Line 5. – This option transitions the display to the TGT LOC Manual Known Point W/Shift Entry pop-up display.

(6) Manual Target Entry. – This overlay provides the capability to change the target by manually entering a target number. A valid entry consists of the text AA#### (valid entry form is two letters followed by four numbers). Upon entry to this page the MFK entry mode is activated and a cursor is displayed so that data can be entered. Completion of a valid entry (pressing MFK ENTER key) accepts the data and changes the HOG display to the previously displayed ARTY #N overlay.

(7) Manual Grid Entry. – This overlay provides the capability to change the target by manually entering a target grid. A valid entry consists of the text AA-EEEE-NNNN (A = letter in range C to X (except I and O), E and N = numbers in range 0000-9999). Upon entry to this page the MFK entry mode is activated and a cursor is displayed so that data can be entered. Completion of a valid entry (pressing the MFK ENTER key) accepts the data and changes the HOG display to the previously displayed ARTY #N overlay.

(8) Waypoint Entry. – This overlay provides the capability to change the target by entering a waypoint identifier. Upon entry to this page the MFK entry mode is activated and a cursor is displayed so that data can be entered. Completion of a valid entry (pressing MFK ENTER key) accepts the data and changes the HOG display to the previously displayed ARTY #N overlay.

(9) Manual Known Point Entry. – This overlay provides the capability to change the target by entering a known point. A valid entry consists of a number in the range 0-99. Upon entry to this page the MFK entry mode is activated and a cursor is displayed so that data can be entered. Completion of a valid entry (pressing MFK ENTER key) accepts the data and changes the HOG display to the previously displayed ARTY #N overlay.

(10) Manual Known Point W/Shift. – This overlay provides the capability to change the target by entering a known point with a shift entry. Upon entry to this page the MFK entry mode is activated and a cursor is displayed so that data can be entered. A valid entry for the known point is a number in the range 0-99.

(a) Completion of a valid known point entry (pressing MFK ENTER key) accepts the data and moves the cursor to the right of the text U/D allowing the operator to enter a valid vertical shift (a number in the range ±9999);

(b) The cursor then advances to the next line and is positioned to the right of the text L/R, allowing the operator to enter a valid lateral shift (a number in the range ±4095);

(c) The cursor then advances to the next line and is positioned to the right of the text A/D, allowing the operator to enter a valid range shift (a number in the range ±4095).

(d) After the required data is entered the CPG must press the Point Track switch to accept the data and change the HOG display back to the previously displayed ARTY #N overlay.

d. ARTY TGT QTY. Enter target quantity manually or select one of the available options (fig. 4-108).

e. ARTY TGT TYPE. Select a target type from the available options to transition the display back to the ARTY #N overlay. The options displayed on this overlay are normally obtained from the DTS cartridge. If DTS data is not valid, the following defaults are used: FIXED WING=(4), HELO=(3), ASSY=(2), PRSNL=(1), ARMOR=(0), VHCLS=(1), ARTY=(2), ADA=(3), and MORTAR=(4).

f. ARTY PROJECTILE. Select the projectile type from this overlay (fig. 4-108). Selection of an option transitions the display back to the ARTY #N overlay. If the COPPERHEAD option is selected, ARTY CONTROL is automatically set to FFE/AMC/NORMAL.

3. AIR MENU. The AIR MENU (fig. 4-108) overlay provides access to select and define the air mission. This overlay provides the capability to either choose one of four Remote HELLFIRE (RHF) missions or to select Target Handoff mode. Selection of any of the options transitions the display to the AIR #N overlay (N = 1 or 2 for mission 1 or mission 2 and was selected from the previous menu).

a. AIR #N. This overlay (fig. 4-108) provides the interface that allows the operator to select type, quantity, location, and activity for a given target.

(1) Line 2. – Indicates the RHF Mission Indicator (RHF) and Lock Mode Designator or Target Handoff. Select this option to transition the display to the AIR CONTROL overlay.

(2) Line 3. – Contains the prepoint bearing, prepoint range, and last target identifier. Select this option to transition the display to the AIR TGT LOC overlay.

(3) Line 4. – Displays the target quantity and generic type. Select this option to transition the display to the AIR TGT LOC overlay.

(4) Line 5. – Indicates target activity and course. Select this option to transition the display to the AIR TGT ACTIVITY overlay.

(5) Line 6. – Select this option to transition the display to the MODE overlay. This is not a valid option for the Target Handoff mode.

(6) SEND. – Initiates the transmission of the message. When the SEND overlay is displayed from the FIRE MISSIONS thread, the JVMF Mission Summary Page is displayed after the CONFIRM SEND option is selected.

b. AIR CONTROL. This overlay (fig. 4-108) provides the means to select the HF Mission Lock Designator. Select an RHF option from this overlay to set the Mission Lock Designator to the selected mode and replace the ARTY CONTROL overlay with the previously displayed ARTY #N overlay. Select TGT HANDOFF option to set the Mission Lock Designators to null and replace the AIR CONTROL overlay with the previously displayed AIR #N overlay.

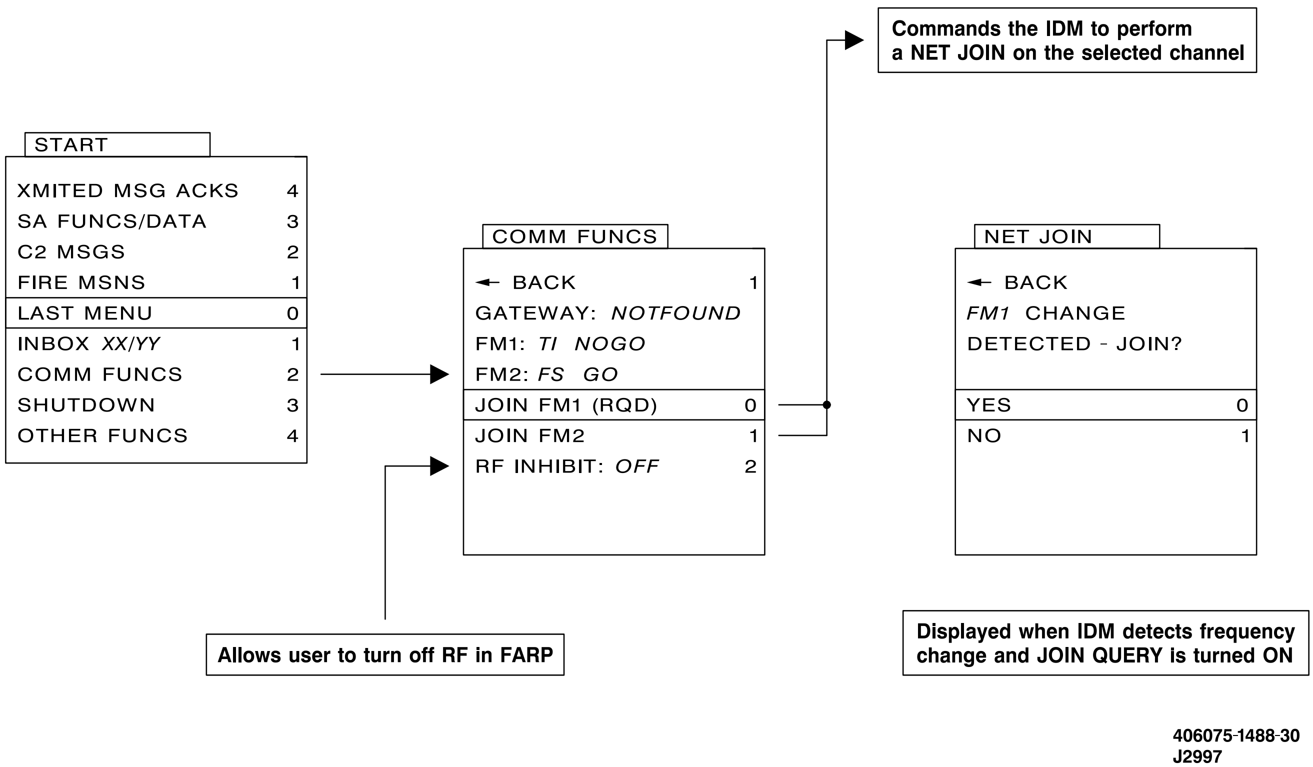

Figure 4-109. Communications Functions Thread

c. AIR TGT LOC. Enter a waypoint identifier as a target location (fig. 4-108). Completion of a valid entry (pressing MFK ENTER key) accepts the data and changes the HOG display to the previously displayed AIR #N overlay. The default target location is the last stored target.

d. AIR TGT QTY. Enter the target quantity manually or select one of the available options (fig. 4-108). The display transitions to the TARGET TYPE overlay.

e. AIR TGT TYPE. Select a target type (fig. 4-108). The display returns to the AIR #N overlay.

f. AIR TGT ACTIVITY. This overlay (fig. 4-108) provides the operator with a capability to describe the target's activity. The display provides eight moving (MVG) options with a direction element and one stationary option. Select option to transition the display back to AIR #N overlay.

g. AIR EMPLOYMENT DESIGNATOR. This overlay (fig. 4-108) provides the capability to set the disbursement mode: SINGLE or RAPID. Selection of SINGLE mode transitions the display to the AIR #N overlay. Selection of the RAPID mode transitions the display to the MSL QTY (missile quantity) overlay.

h. MSL QTY. Select the desired missile quantity for the air mission (fig. 4-108). Select a fixed option or manually enter a number in the range 1-60. The display transitions to the AIR #N overlay.

4-216. COMMUNICATIONS FUNCTIONS THREAD.

Select COMM FUNCS from the START menu to display the Communications Functions thread. The Communications Functions thread allows the operator to observe the net status of the FM-1 and FM-2 radios as well as determine the status of the Gateway. This thread also provides a means to join the nets monitored by FM-1 and FM-2 radios.

1. COMM FUNCS. This overlay (fig. 4-109) provides the following information and capabilities:

a. GATEWAY. Displays the status FOUND or NOTFOUND. A Gateway is associated with the Tactical Internet only.

b. FM-1. Displays the net status of the FM-1 radio. Status consists of TI (Tactical Internet), FS (Fire Support Net), or TAC (TACFIRE) plus the radio's net join status (GO or NOGO).

c. FM-2. This option provides the same capability for FM-2 as described in the previous paragraph for FM-1.

d. JOIN FM-1. If the FM-1 radio has not been joined to the net, the text (RQD) is displayed to the right of the text JOIN FM-1; otherwise it is blanked. Selecting this option initiates the JOIN command. There is no separate overlay display associated with this option.

e. JOIN FM-2. This option provides the same capability for the FM-2 radio as was described in the previous paragraph for FM-1.

f. RF INHIBIT. Selection of this option toggles the status of the RF INHIBIT command between ON and OFF, providing the crew with the capability to inhibit any RF transmissions during a refueling or covert operation. There is no separate overlay display associated with this option.

2. NET JOIN. The NET JOIN overlay (fig. 4-109) is displayed whenever the HOG system is active, i.e., the Freeze Frame switch has been toggled to the on position and at least one of the FM radios has not been joined to the net. If either or both of the nets monitored by the FM-1 and FM-2 radios has not been joined at the completion of the initialization process, then this overlay is displayed instead of the START overlay. This display provides the operator with two options for joining the net – YES or NO.

If either the FM-1 or both the FM-1 and FM-2 radios has not been joined to its net, the display indicates on lines two and three that the FM-1 radio has not been joined to the net with the text FM1 CHANGE on line two and DETECTED – JOIN? on line three.

If only the FM-1 radio has not been joined to its net and either the YES or the NO option has been selected, the HOG display transitions to the START overlay.

If both radios have not been joined to their nets and either the YES or the NO option has been selected, the NET JOIN overlay changes to reflect that the FM-2 radio is not joined to its net by changing FM1 to FM2. Selection of either the YES or the NO option a second time transitions the HOG display to the START overlay.

If only the FM-2 radio has not been joined to its net when the NET JOIN overlay is activated, the text indicates that the FM-2 radio is not joined to its net.

4-217. SA FUNCTIONS/DATA THREAD.

Select SA FUNCS/DATA from the START menu to display the Situational Awareness (SA) Functions/Data thread. This thread provides the ability to review friendlies information in the database and to configure the Filters and Advisory capabilities. The SA overlay is accessed through the START overlay (fig. 4-110).

1. TACID (DATABASE). This overlay (fig. 4-110) provides the capability to view friendlies information that is active within the database. The information displayed on the DATABASE overlay is displayed on the RMS Page and the active icon associated with the information flashes. As this overlay is one of the few overlays without a BACK option, the operator must press a mode select button or the INIT switch to display another page. The following information and options are provided on this overlay.

a. Title Block. Contains the TACID associated with the information displayed.

b. Line 1. Contains the Zulu time of the message.

c. Line 2. Contains UTM coordinates.

d. Line 3. Contains course and unit speed (KPH).

e. Line 4, 5, and 6. Identify the type of weapon and the quantity of each. The type of weapon is one of the following: HF (HELLFIRE), ATAS, 50CAL, ROCKETS, and other. The quantity is a number.

f. Line 7. Displays any comments provided by the message originator.

g. NEXT. displays the information for the next TACID in the database.

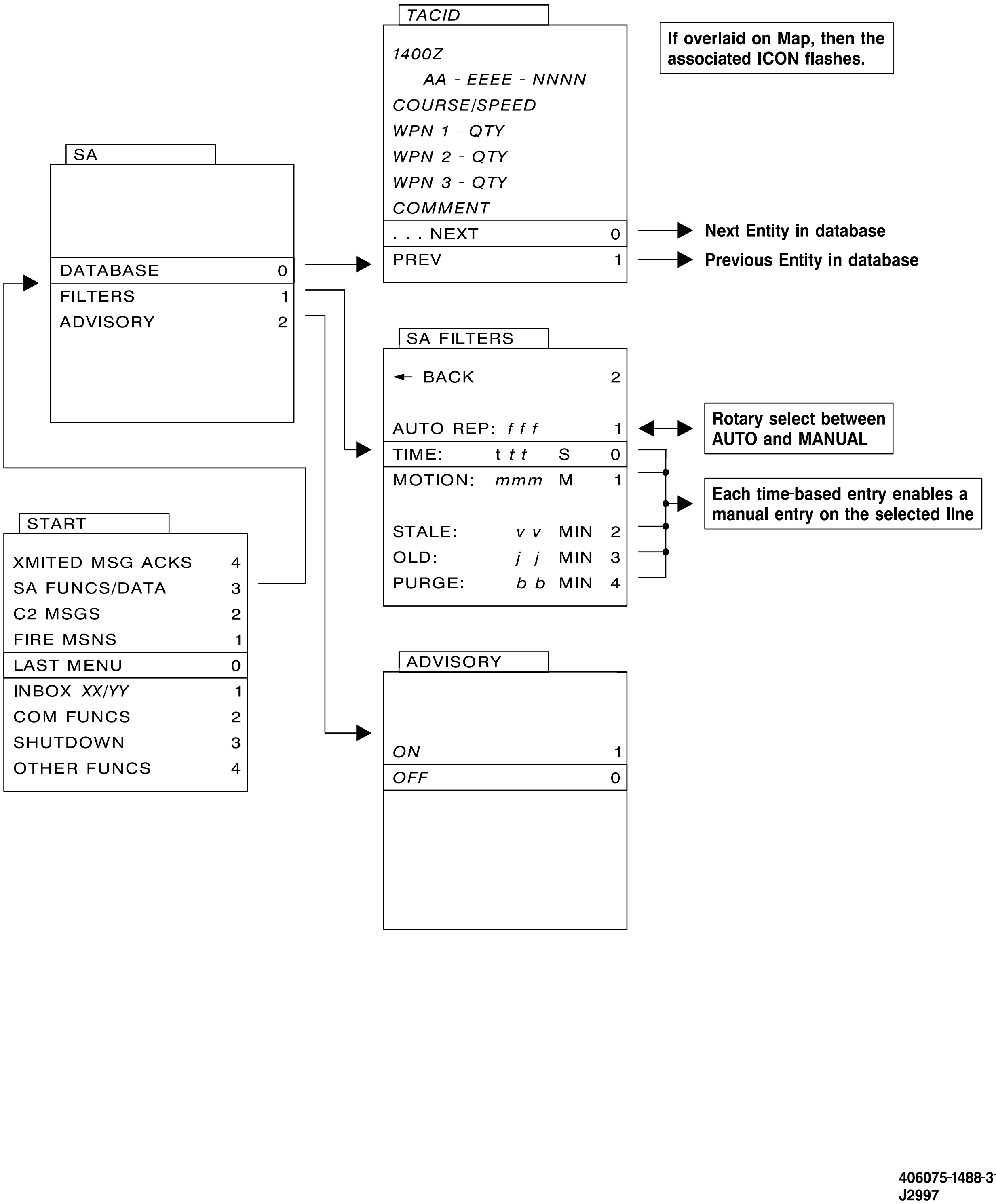

Figure 4-110. SA Functions/Data Thread

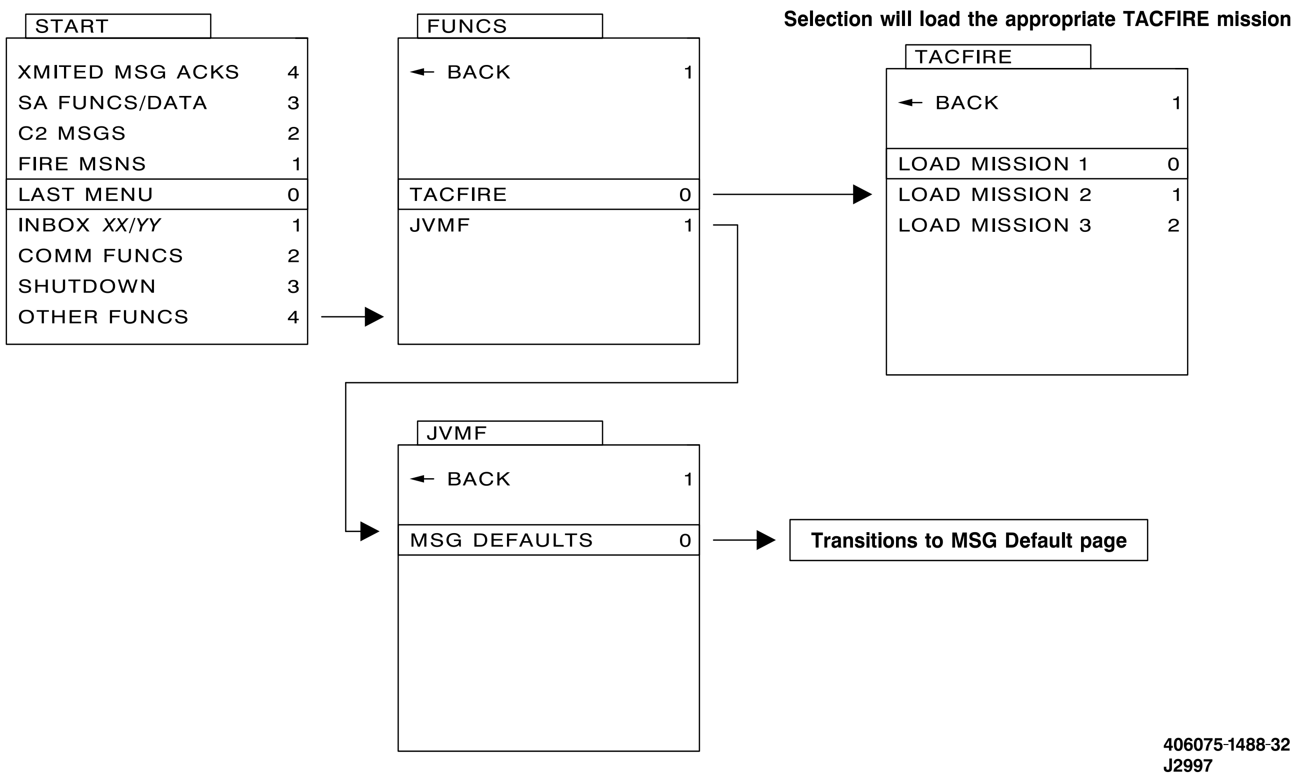

Figure 4-111. OTHER FUNCTIONS Thread

h. PREV. Displays the information for the previous TACID that was displayed.

2. SA FILTERS. This overlay (fig. 4-110) allows the operator to configure the auto reporting and the filters that are to be used when new SA reports are received. The following options are provided with this overlay.

a. AUTO REP. Select recipient of the automatically generated SA position report from the following options:

(1) AUTO – generates an SA report based on the constraints provided on lines three and four.

(2) MANUAL – requires the operator to initiate the report using C2 Position Report.

b. TIME (Line 3) and MOTION (Line 4). These options allow the operator to set how often the SA report is to be automatically generated, between 1 and 999 seconds. On line 3, the operator sets, in seconds, how often the update report is to be transmitted. A valid entry is a number in the range 1-999 seconds. Using line 4, the operator can set a constraint that requires an SA report whenever his position changes by X number of meters. A valid entry is a number in the range 1-999 meters.

c. STALE (Line 5), OLD (Line 6), and PURGE (Line 7). These options allow the operator to configure how the SA data received is tagged and stored. On Line 5, the operator sets in minutes how long the data is stored before it is tagged STALE. On Line 6, the operator sets in minutes how long the data is stored before it is tagged OLD. On Line 7, the operator sets in minutes how long the data is stored before it is PURGED. A valid entry is a number in the range 1-99.

4-218. OTHER FUNCTIONS.

Select OTHER FUNCS from the START menu to display the OTHER FUNCTIONS thread (fig. 4-111). This menu overlay provides the capability to load a specific TACFIRE Mission or to edit the various JVMF Default Message overlays.

a. TACFIRE. Select the TACFIRE option to display the TACFIRE loads page to load one of the three TACFIRE Missions stored on the DTS cartridge. After the mission load is completed, the display returns to the START overlay.

b. JVMF. Selection of the JVMF option displays the JVMF overlay (fig. 4-111). This overlay allows the operator to display the MSG DFLTS overlay.

4-220. MESSAGE DEFAULTS THREAD.

This overlay provides access to the seven message default pages. This overlay is displayed when the MSG DFLTS option on the JVMF overlay is selected (fig. 4-112).

1. OBSTAT. Select OBSTAT to set the defaults that appear on the OBSTAT overlay. The Cloud Height and Visibility sub-menus for the MSG DFLTS are identical to the C2 MESSAGES OBSTAT sub-menus. Selection of the RECIPIENTS option displays the NET SELECT overlay.

2. AIR MSNS. Select AIR MSNS to display the AIR DFLT overlay. This overlay allows the operator to set the defaults that appear on the AIR MENU overlay. The sub-menus for the AIR MSNS are identical to the Fire Support AIR MENU sub-menus. Selection of the RECIPIENTS options displays the NET SELECT overlay.

3. ARTY MSNS. Select ARTY MSNS to set the defaults that appear on the ARTY MENU overlays. The sub-menus for the ARTY MSN are identical to the Fire Support ARTY MENU sub-menus. Selection of the RECIPIENTS options displays the NET SELECT overlay.

4. SPOT. Select SPOT to set the defaults that appear on the SPOT DFLT overlays. The sub-menus for the SPOT DFLT overlays are identical to the C2 MESSAGES SPOT sub-menus. Selection of the RECIPIENTS options displays the NET SELECT overlay.

5. SITREP. Select SITREP to manually enter the NUMBER OF ROCKETS default (0-14). Select the OPS option to display the OPS overlay. The sub-menus for the SITREP DFLT OPS overlay are identical to the C2 MESSAGES SITREP OPS overlay sub-menus. Selection of the RECIPIENTS options displays the NET SELECT overlay.

6. FREETXT. Select this option to display the FREE DFLT overlay. The FREE DFLT overlay only allows the operator to change the RECIPIENT defaults. Selection of the RECIPIENTS options displays the NET SELECT overlay.

7. INFO RQST. Select this option to change the RECIPIENTS defaults. Selection of the RECIPIENTS options displays the NET SELECT overlay.

8. RECIPIENTS. Selection of the RECIPIENTS option from any of the MSG DFLTS overlays, displays the NET SELECT overlay and allows the operator to select the message recipients for either the TI or FS net.

a. NET SELECT. Selection of either the TI or FS option transitions the display to the NET SELECT RECIPIENTS overlay. The number of recipients selected is displayed to the right of the text TI and FS. Each message type has its own recipient list. For example, the SPOT message could have a default of five recipients selected for any message transmitted on the TI and, the SITREP message could have a default of 11 recipients. The default selections for either list can contain the same or different selections. Selection of the option BACK transitions the display back to the MOD HEADER overlay if this page was accessed from the SEND menu, and back to the active defaults RECIPIENTS if selected from a MSG DFLTS menu.

b. RECIPIENTS. This overlay displays the TI TACID list if the TI option is selected from the NET SELECT overlay, and the FS TACID list is displayed if the FS option is selected. A total of 16 recipients can be selected for either of the two options (TI and FS). An asterisk is displayed to the left of each TACID that is selected as an active recipient. Selecting a TACID a second time removes the recipient from the active list.

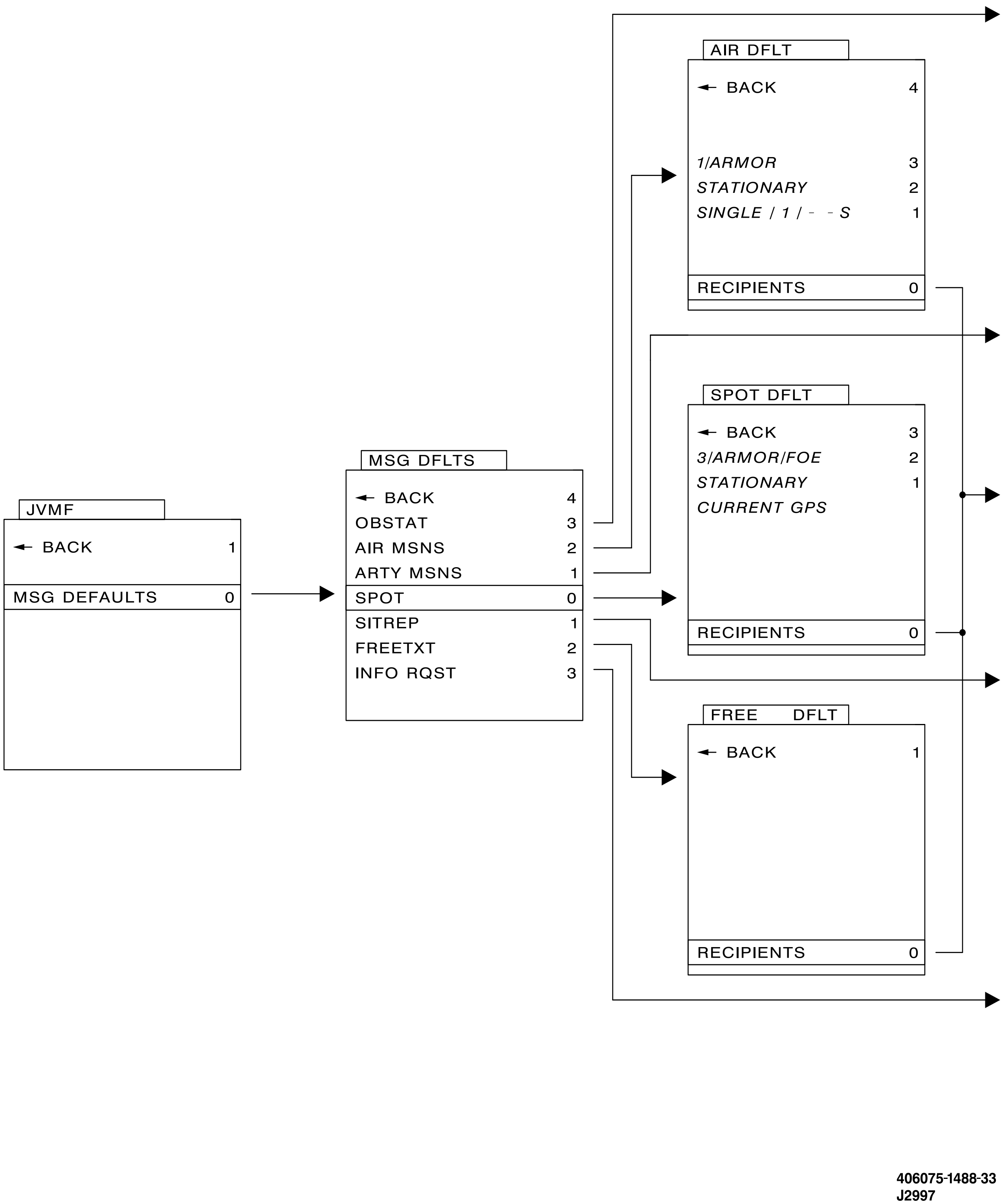

Figure 4-112. MESSAGE DEFAULTS Thread (Sheet 1 of 2)

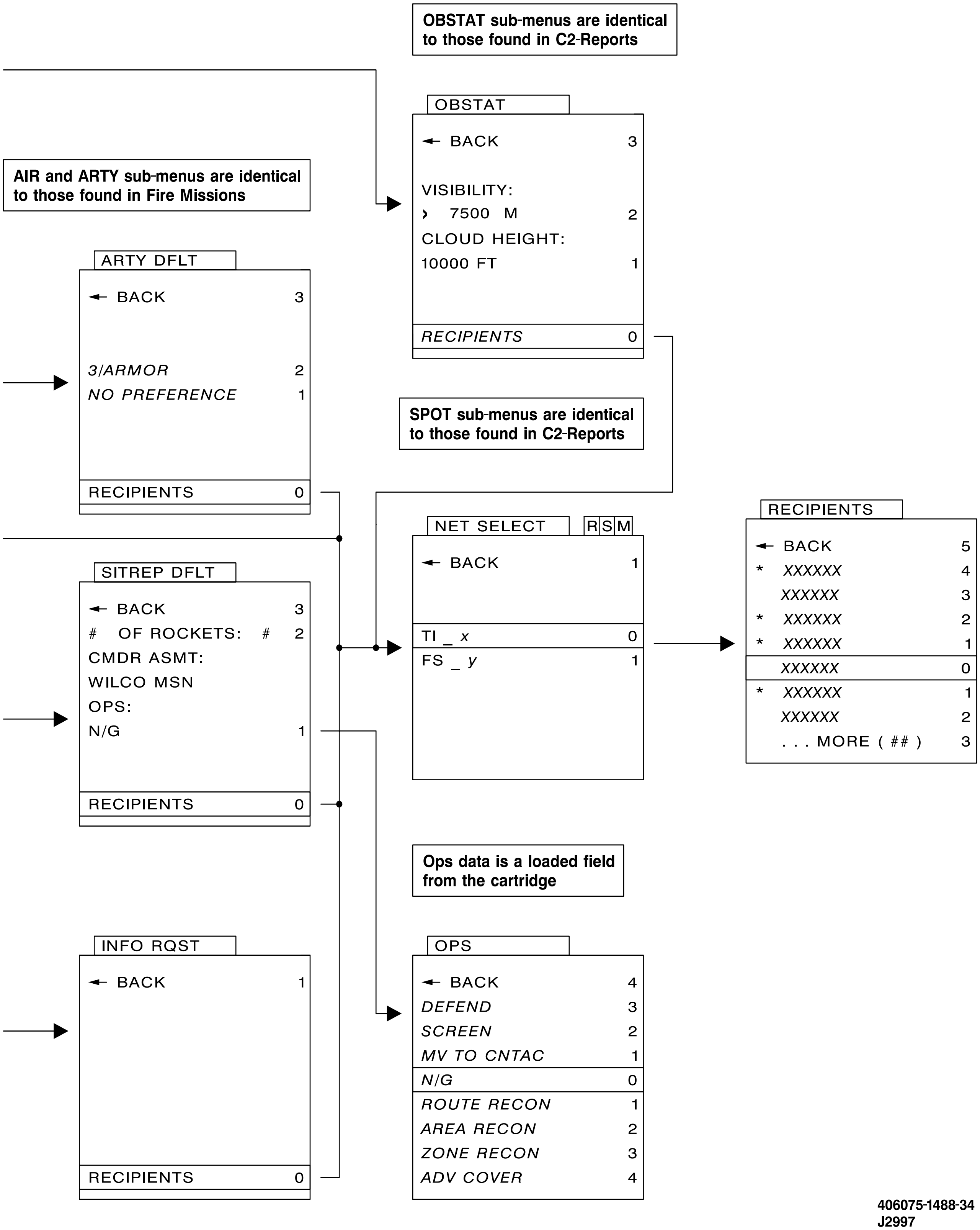

Figure 4-112. MESSAGE DEFAULTS Thread (Sheet 2 of 2)

4-221. SEND THREAD.

The SEND (fig. 4-113) overlay is selected from many of the other overlays and provides the operator with the capability to modify the message header prior to the message being sent. The SEND overlay provides the following displays and options.

1. Line 1. Message type.

2. Lines 2 and 3. Recipient TACIDs.

3. Line 4. MORE (XX) when more TACIDs remain to be displayed (XX = number not shown).

4. CONFIRM SEND. Initiates the command to SEND the message and transitions the HOG display to the START Page. If the CONFIRM SEND option was selected from one of the FS overlays, the HOG display transitions to the respective ARTY or AIR Mission Summary Page.

5. MOD HEADER. Displays the MOD HEADER overlay. This display provides the capability to modify the recipients list, message precedence, message classification, and message acknowledge. The message header contains three boxes located to the right of the title block at the top of most HOG displays. These boxes are only displayed after the SEND command is initiated and on messages that have been received. The leftmost box is the message's precedence, the center box is the message's classification, and the rightmost box is the message's acknowledge type.

a. RECIPIENTS. Select this option to display the NET SELECT overlay. Refer to Message Defaults Thread paragraph for a description of NET SELECT.

b. PRECEDENCE. The precedence overlay allows the operator to change the message's precedence: Immediate (I), Routine (R), Flash (F), or Priority (P). The selected option is displayed in the header.

NOTE

To enter any classification other than Unclassified, the operator must have entered a password with appended characters; otherwise the selection results in no action.

c. CLASSIFICATION. This overlay is used to set the message classification: Unclassified (U), Confidential (C), or Secret (S). The selected option is displayed in the header.

d. ACKNOWLEDGE. This overlay allows the operator to select the type of acknowledgment required for the message: MACHINE Acknowledge (M), OPERATOR Acknowledge (O), or OPERATOR REPLY (R). The selected option is displayed in the header.

4-222. MISSION SUMMARY PAGES.

The Mission Summary pages provide access to controls and displays for both artillery (ARTY) and air missions. These pages are automatically displayed after sending a Call For Fire (CFF) message or can be displayed using HOG functionality. The JVMF provides up to four different mission pages: ARTY #1, ARTY #2, AIR #1, and AIR #2.

1. **ARTY Mission Summary Pages**

a. Artillery Mission Summary Page Without Control. The typical Artillery Mission Page without the control function is shown in Figure 4-114.

(1) **L-1**. – Selects which Mission Summary page is displayed. Pressing L-1 toggles the display from ARTY #1 to ARTY #2 to AIR #1 to AIR #2 and back to ARTY #1. If any of the pages are not active, the text INACTIVE is displayed to the right of the mission page number. The legend at L-1 consists of the following text: ARTY #x SSSSSSS AAA where

— x = Mission number: 1 or 2.
— SSSSSSS = Mission status: CFF SENT, CKFIRE, EOM SENT, SHIFT SENT, RFFE SENT, RNDS CMP, SHOT, READY, MSN CMPLT, SPLASH, ACCEPTED, FIRE SENT, or INACTIVE.
— AAA = ACK. Indicates that a machine acknowledgment to the message sent has been received and the mission status was one of the following: CFF SENT, CHKFIRE SENT, EOM SENT, SHIFT SENT, and RFFE SENT. Otherwise, this text string is blanked.

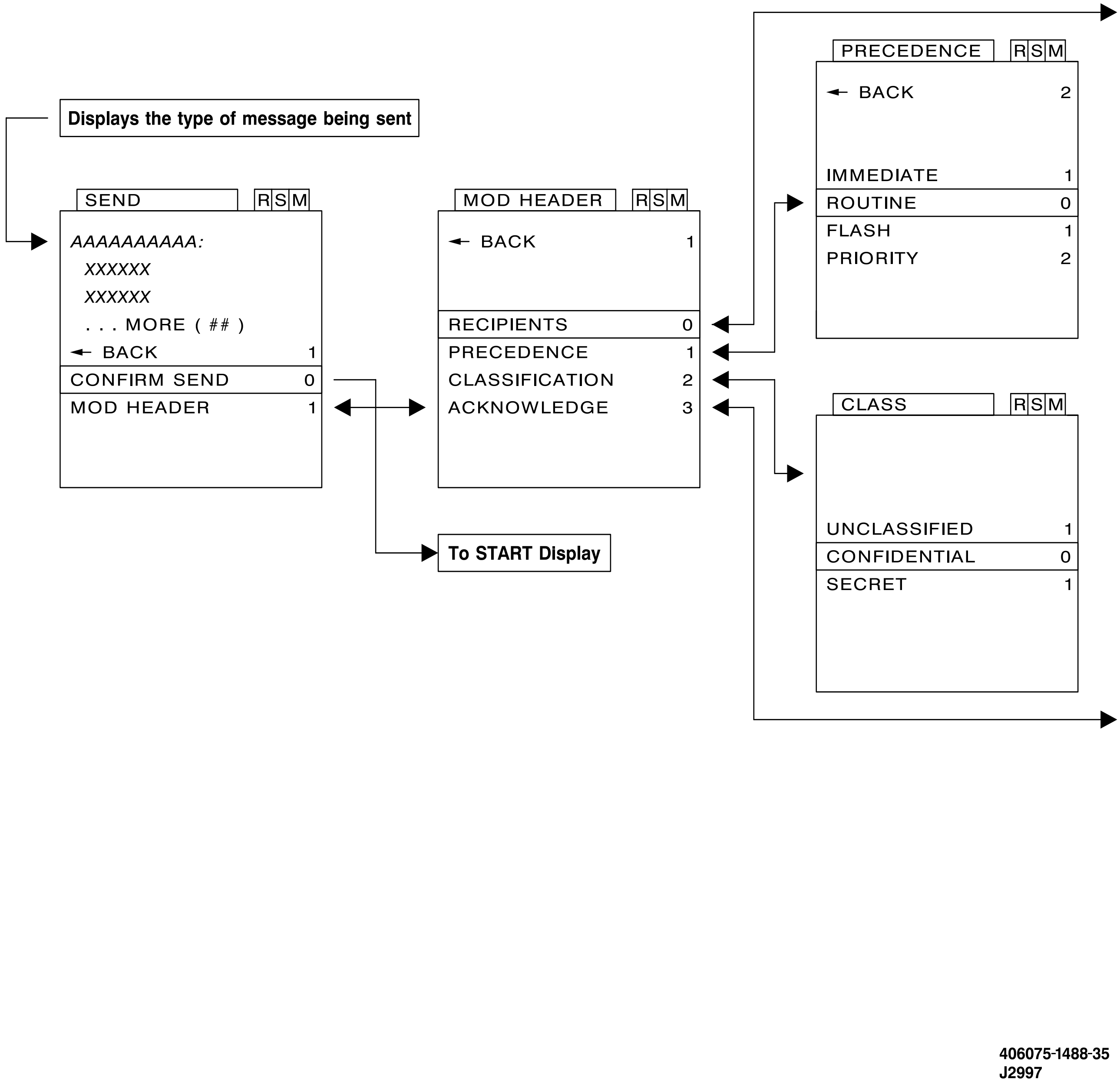

Figure 4-113. SEND Message Thread (Sheet 1 of 2)

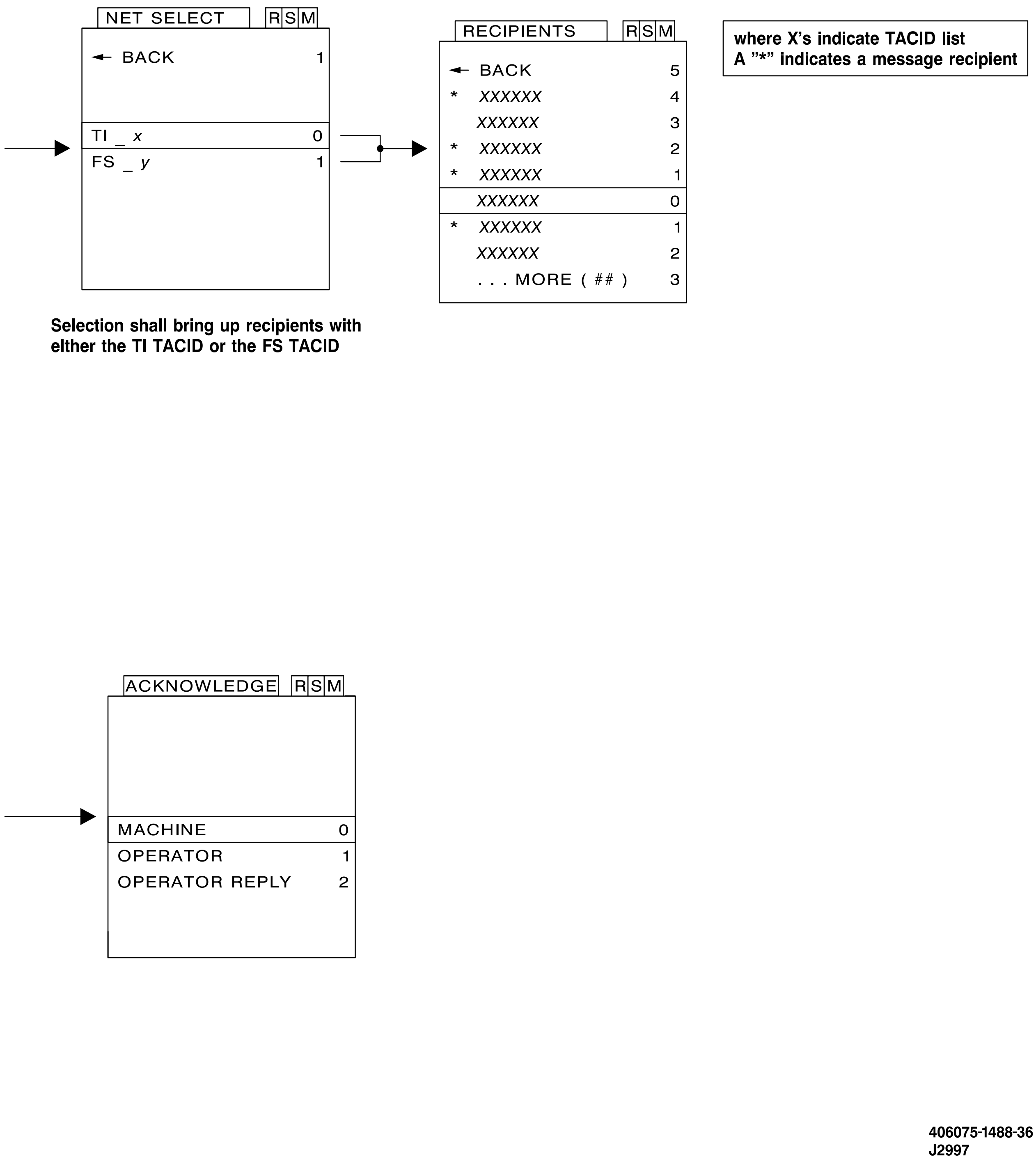

Figure 4-113. SEND Message Thread (Sheet 2 of 2)

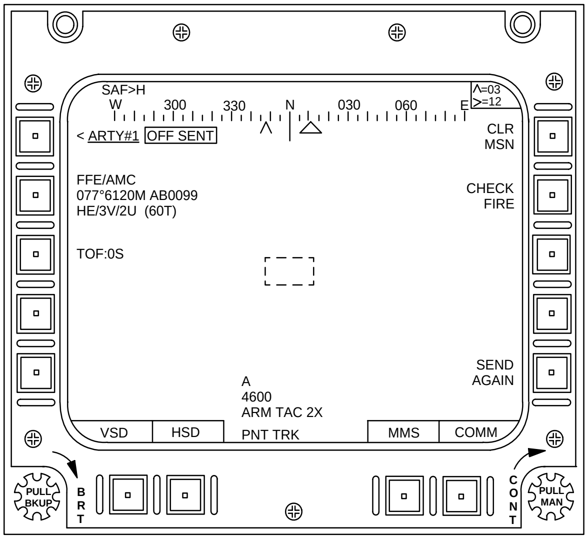

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Figure 4-114. ARTY MSN Without Control

(2) **L-2**. Contains four lines of text.

— Line 1 – is displayed in the form ZZZ/LLL (ZZZ=method of fire and LLL=method of control).

— Line 2 – is displayed in the form XXX°YYYYAANNNN (XXX=target azimuth in degrees, YYYY=target range in meters, AA=target number alpha, and NNNN=target number numeric).

— Line 3 – is displayed in the form PP/NN/VV (##T) (PP=FFE projectile, NN=number of volleys, VV=number of units, and (##T)=waypoint number).

— Line 4 – is separated from line 3 by a blank line and displays the time of flight in seconds and is shown in the form TOF:XXXXS (XXXX=number (in range the of 0000-9999) and S=seconds)

(3) **L-3, L-4,** and **L-5**. These keys have no legend or function.

(4) **CLR MSN (R-1)**. Clears the current mission (mission displayed). Pressing R-1 causes the legend to flash at a 2-Hz rate. Pressing the key again boxes the legend for approximately 3 seconds and initiates the clear mission command. Pressing R-1 when the legend is boxed results in no action.

(5) **CHECK FIRE (R-2)**. If the current mission is active, the legend consists of the text CHECK FIRE. If the mission is not active, the legend is blank. Pressing R-2 changes the legend to CHECK TGT. If R-2 is not pressed a second time within 3 seconds, the legend returns to CHECK FIRE. If R-2 is pressed within 3 seconds, a Checkfire Message is sent and the legend changes to CANCEL CHECK EOM. Additionally, the message status at L-1 changes to CHKFIRE SENT. Pressing R-2 when the legend is CANCEL CHECK EOM returns the legend to CHECK FIRE, initiates a CANCEL CHKFIRE EOM (End of MISSION) message, and changes the status at L-1 to EOM SENT. Pressing R-1 causes this legend to be blanked.

(6) **R-3**. When this page is initially displayed, the R-3 legend is blank and has no function. When R-2 is pressed and its legend is CHECK TGT, the R-3 legend consists of the text CHECK ALL. If R-3 is pressed within 3 seconds of pressing R-2, a Checkall Message is sent and the R-3 legend changes to CANCEL CHECK ADJUST. Additionally, the status at L-1 changes to CHKFIRE SENT and a Checkfire All command is initiated. If R-3 is not pressed within 3 seconds of pressing R-2, the legend is blanked and no action is initiated. Pressing R-3 when the legend is CANCEL CHECK ADJUST blanks the legend, changes the status at L-1 to RNDS CMPLT, and sends a Cancel Checkfire Adjust message.

(7) **R-4**. This key has no function or legend.

(8) **SEND AGAIN (R-5)**. Press R-5 to retransmit the last mission message. When R-5 is pressed the legend is boxed for 5 seconds. This legend is only present on those displays where the mission status indicates that a message has been sent and has not received an acknowledgment.

b. Artillery Mission Summary Page With Control. When the mission requires that a fire control action be initiated by the crew, the mission summary page changes to provide this control capability. The type of control is dependent on the mission status at L-1. If the status is either READY, SHOT, SPLASH, or RNDS CMPLT a box containing the text CONTROL is displayed below the TOF legend at L-2 (ARTY MSN with Control, fig. 4-115). When the mission summary page is displayed with the legend CONTROL, pressing the Freeze Frame switch causes the control box to change (ARTY MSN (CONTROL/READY) and ARTY MSN (CONTROL RNDS CMP), fig. 4-115). If the mission status is READY, the CONTROL box appears as shown in Figure 4-115 (ARTY MSN (CONTROL/READY)). If the mission status is SHOT, SPLASH, or RNDS CMPLT, the CONTROL box is as shown in Figure 4-115 (ARTY MSN (CONTROL/ RNDS CMP)). Pressing the Freeze Frame switch a second time changes the CONTROL box to only the single line of text CONTROL and displays the HOG START overlay. If the CONTROL box is not displayed when the Freeze Frame switch is pressed, the HOG START overlay is displayed. The other HOG switches function the same whether the HOG overlays or JVMF Mission Summary Pages are displayed.

(1) **ARTY MSN (CONTROL/READY)**. When the fire support element has indicated with the appropriate message that they are READY to commence firing and the operator has activated the CONTROL box with the Freeze Frame switch, the CPG must send the command to commence firing. To issue the FIRE command, the CPG uses the HOG function and selects the FIRE option (ARTY MSN (CONTROL/READY), fig. 4-115) when ready for the fire support element to commence firing. When the FIRE command is initiated, the mission status at L-1 changes to FIRE SENT and the appropriate FIRE message is sent.

(2) **ARTY MSN (CONTROL/SHOT, SPLASH, or RNDS CMPLT)**. The firing element will issue SHOT and SPLASH messages to status the execution of the fire mission. After the firing element has fired the required rounds, they must transmit a RNDS CMPLT message. This is indicated by the mission status displaying RNDS CMPLT. When the RNDS CMPLT message is received and the CPG presses the Point Track switch, the display transitions to that shown in Figure 4-115 (ARTY MSN (CONTROL/RNDS CMP)). This display provides the operators three options: EOM&S, RFFE, and SHIFT.

(a) EOM&S. – When this option is selected, the mission summary page changes to that shown in Figure 4-115 (ARTY MSN with EOM&S Selected).

(b) The HOG overlay allows the operator to send a EOM message with or without an estimate of the number killed in action (KIA) or surveillance report.

(c) Select KIA to enter a KIA estimate in the range 1-999. Pressing the MFK ENTER key causes the selection box to move to the SEND option.

(d) Select N/G (Not Given), NTRLZED (Neutralized), BURNING, DSTRYED (Destroyed). The selection displays to the right of the text SRVL and moves the box to the SEND option. Press the Point Track switch to send the message.

(e) Select SEND to transmit the message. The mission status at L-1 indicates EOM SENT and the CONTROL box and HOG overlay displays are blanked.

(3) **RFFE**. Select RFFE (Repeat Fire For Effect) to retransmit the message. The mission status at L-1 indicates RFFE SENT and the CONTROL box and HOG overlay displays are blanked.

(4) **SHIFT**. Select SHIFT to change the CONTROL box to that shown in Figure 4-115 (ARTY MSN with SHIFT Selected). This CONTROL box allows the operator to send a message with data that allows the artillery unit to make the required adjustments. The CONTROL box allows the operator to either lase where the rounds landed (LASE RND option) or to designate the target's new position (LASE TGT option).

(a) If the LASE RND option is selected, the CONTROL box changes to indicate that the LASE RND option has been selected (ARTY MSN - SHIFT LASE RND Option, Figure 4-115) and the HOG capability is disabled providing MMS control. The CPG now designates where the rounds impacted. The coordinates of the designated area and the target number are displayed at the lower left corner of the MFD above the MODE A and B buttons after the laser designation is completed.

(b) Upon completion of the laser designation task, the CPG must press the Freeze Frame switch to activate the Control capability. When the Control capability is activated, the CONTROL box changes to provide additional options (ARTY MSN - SHIFT LASE Pop-up, fig. 4-115). These options allow the operator to send a message with the lased coordinates, go to the laser designation mode, or abort the current effort. If SEND is selected, the mission status changes to SHIFT SENT and the CONTROL box shown in Figure 4-115 (ARTY MSN (CONTROL/RNDS CMP)) is displayed. If LASE AGAIN is selected, the display returns to that shown in Figure 4-115 (ARTY MSN with SHIFT Selected). If ABORT is selected, display changes to reflect CONTROL box shown in Figure 4-115 (ARTY MSN (CONTROL/RNDS CMP)).

c. Typical ARTY Mission Example. Figure 4-116 provides an example of a typical ARTY Fire Mission. This example shows how a mission starts with a Call For Fire message, progresses through the events that occur, and finishes with the mission complete message. Each MFD display represents a separate event.

(1) **Event 1**. A Call For Fire message has been transmitted.

(2) **Event 2**. A machine generated acknowledgment (ACK) has been received.

(3) **Event 3**. The mission has been accepted. The message also indicates how the mission is to be accomplished, e.g., type and number weapon.

(4) **Event 4**. The ARTY unit has indicated that they have configured their weapon and are waiting for the command to commence initiate firing. (Note the CONTROL box.)

(5) **Event 5**. The operator has pressed the Freeze Frame switch to display the Control options.

(6) **Event 6**. The Fire Command has been sent.

(7) **Event 7**. A machine generated acknowledgment (ACK) has been received.

(8) **Event 8**. The ARTY unit has commenced firing.

(9) **Event 9**. The ARTY unit has sent a message indicating that all artillery rounds should now be hitting the target.

(10) **Event 10**. A message has been received that indicates all rounds have been fired. (Note that CONTROL has been turned over to the crew.)

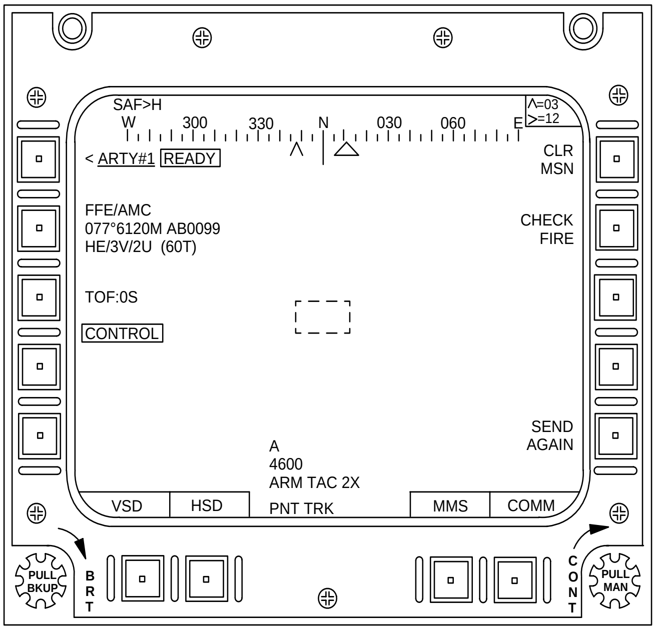
(11) **Event 11**. The operator has pressed the Freeze Frame switch to display the Control options.

(12) **Event 12**. The operator has selected the EOM&S option.

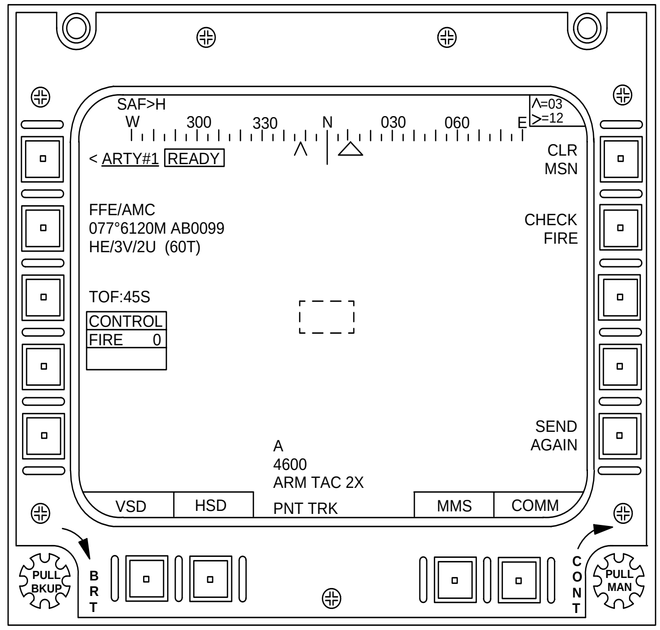
(13) **Event 13**. The operator has sent an EOM message.

(14) **Event 14**. A machine generated acknowledgment (ACK) has been received.

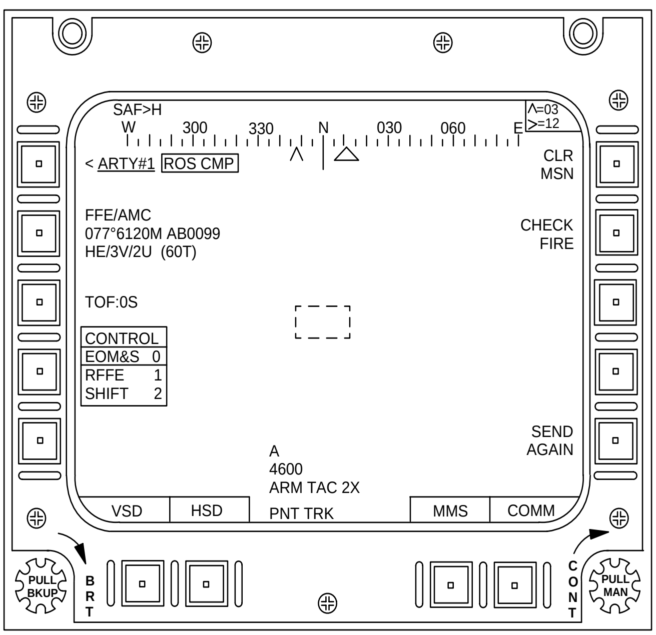
(15) **Event 15**. The CDS has confirmed that the mission is complete. At this point the operator clears the mission (R-1), making the mission buffer available for a new mission.



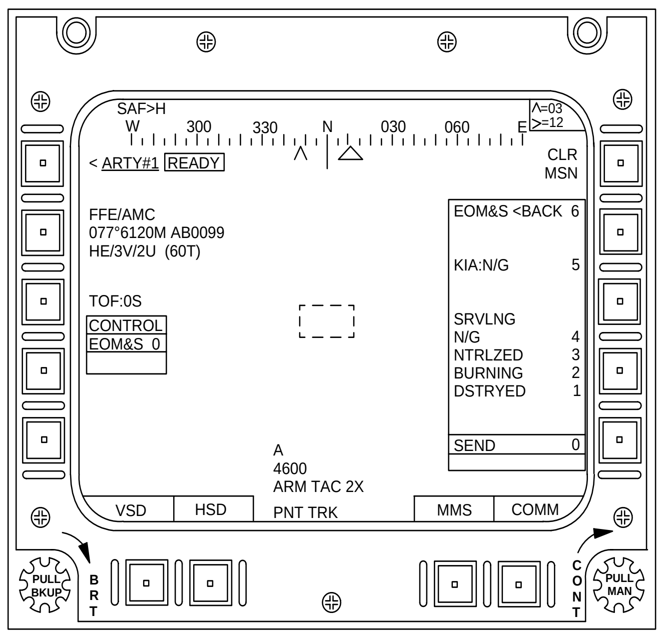
ARTY MSN with Control



ARTY MSN (CONTROL/READY)



ARTY MSN (CONTROL/RNDS CMP)



ARTY MSN with EOM&S Selected

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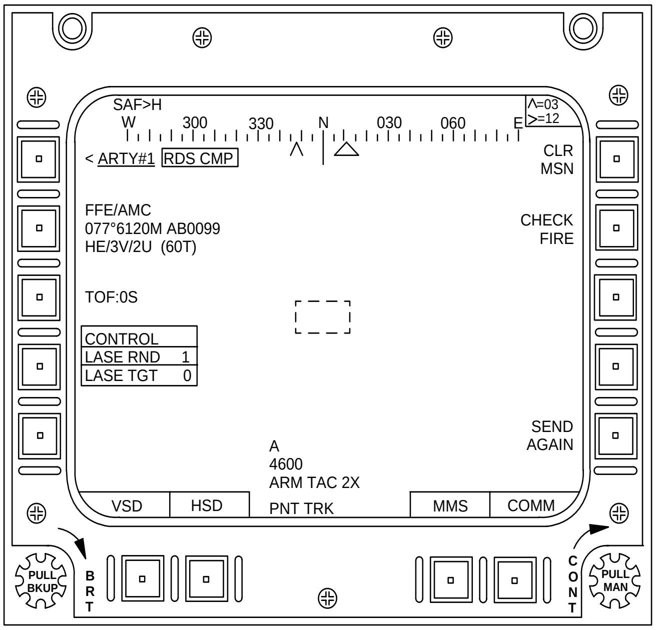
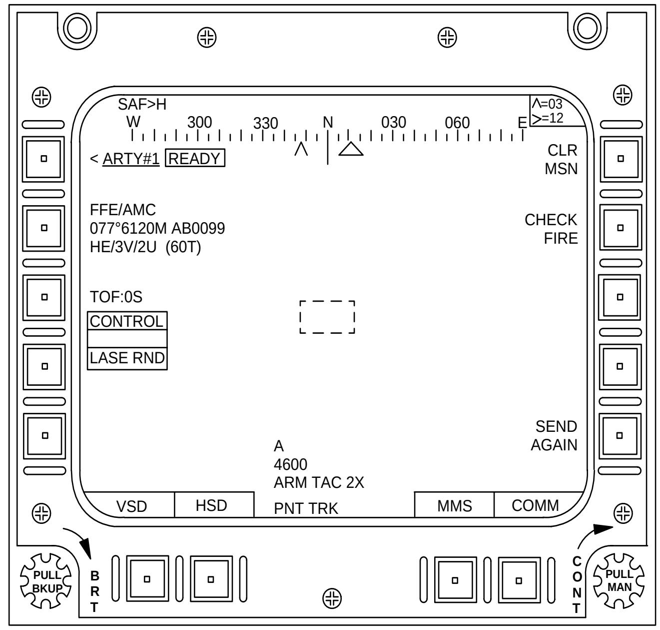
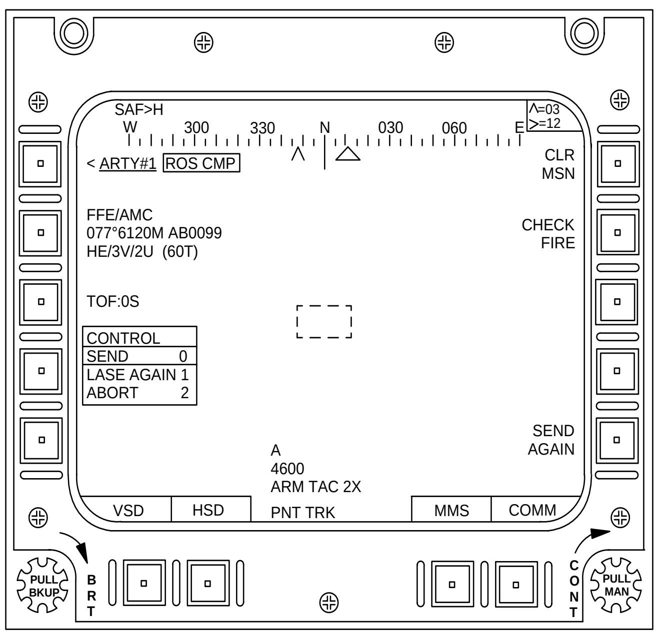
Figure 4-115. Artillery Mission Summary Pages With Control (Sheet 1 of 2)



ARTY MSN with SHIFT Selected



ARTY MSN-SHIFT LASE RND Option



ARTY MSN-SHIFT LASE Pop-up

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Figure 4-115. Artillery Mission Summary Pages With Control (Sheet 2 of 2)

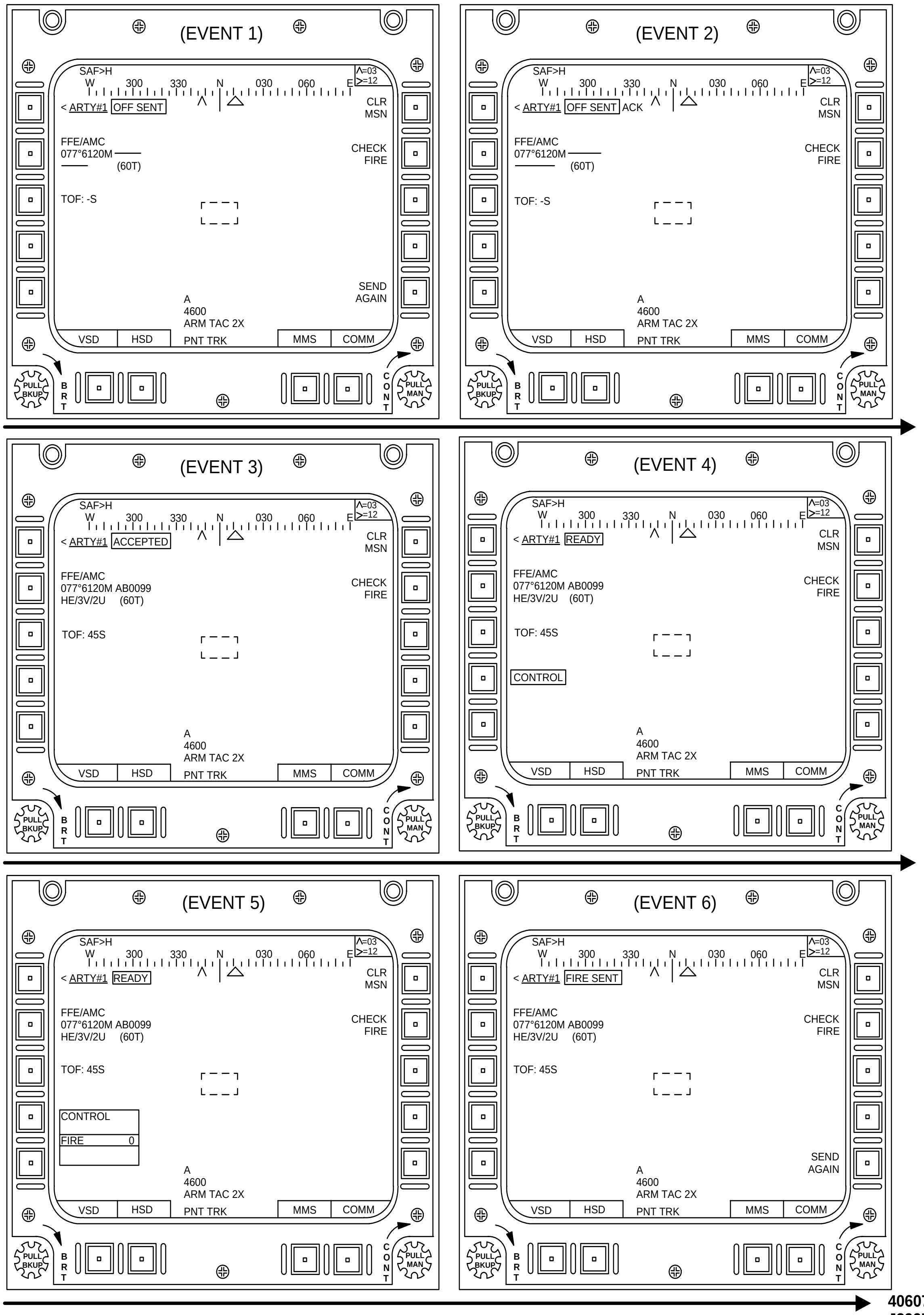

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Figure 4-116. Sample ARTY Fire Mission (Sheet 1 of 3)

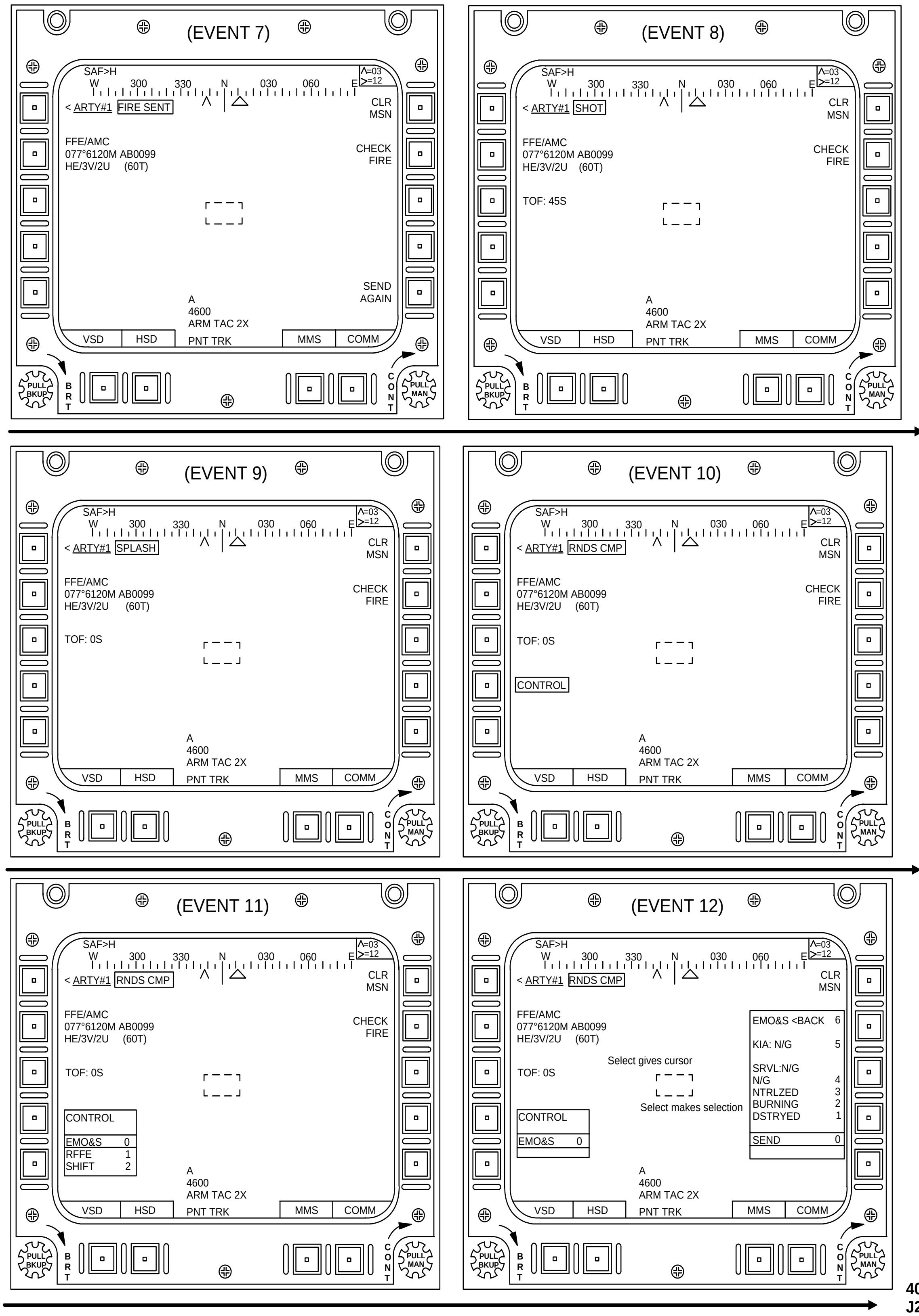

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Figure 4-116. Sample ARTY Fire Mission (Sheet 2 of 3)

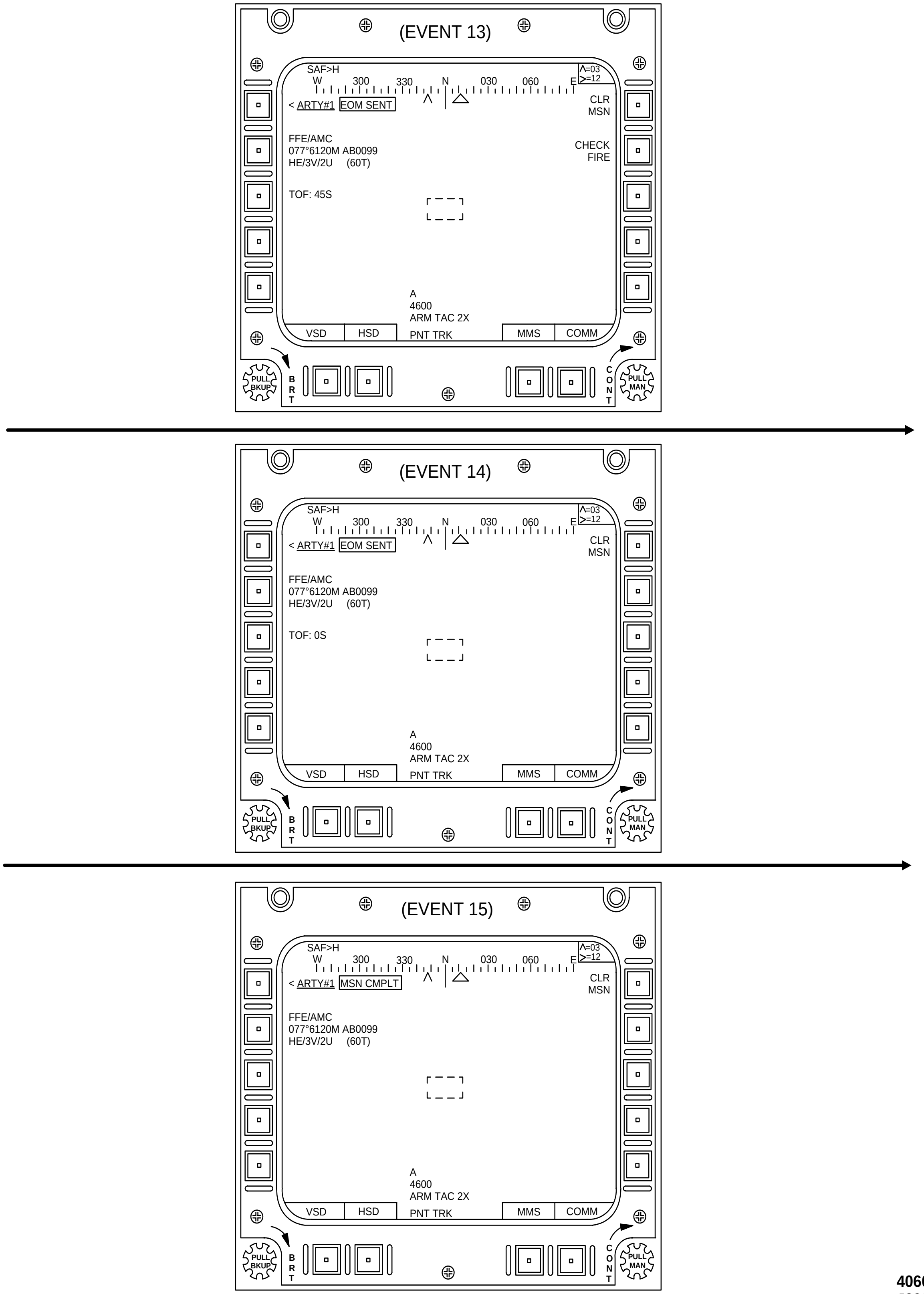

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Figure 4-116. Sample ARTY Fire Mission (Sheet 3 of 3)

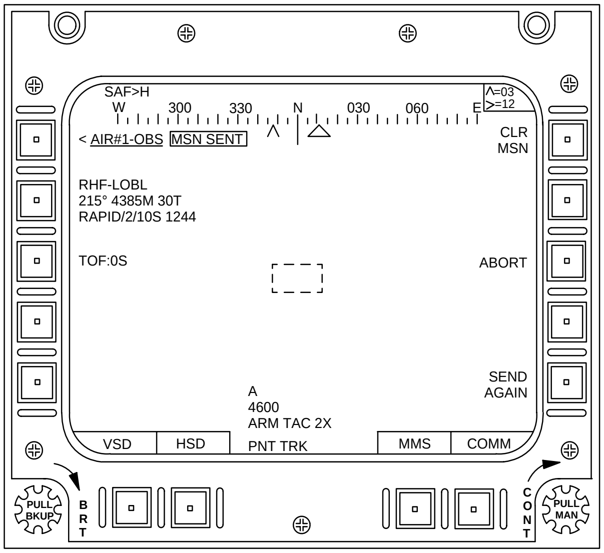

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Figure 4-117. AIR MSN Without Control

2. **AIR Mission Summary Pages**. The following describes the CDS capability with respect to the JVMF AIR mission support.

a. <u>AIR Mission Summary Page Without Control</u>. The AIR mission capability supports two roles: Observer (OBS) and Shooter (SHTR). The AIR mission Summary Page without the Control function is shown in Figure 4-117.

(1) **L-1**. The L-1 legend provides the capability to select which Mission Summary Page is displayed. Pressing L-1 toggles the display from ARTY #1 to ARTY #2 to AIR #1 to AIR #2 and back to ARTY #1. If a mission page is not active, the text INACTIVE is displayed to the right of the mission page number. The legend (AIR mission) consists of the following text: AIR #x - RRRR SSSSSSSSS AAA.

— x = Mission number: 1 or 2.
— RRRR = Role/Mission - OBS or SHTR.
— SSSSSSSSS = Mission status: OBS role - MSN SENT, ACCEPTED, READY, FIRE SENT, SHOT and EOM SENT, SHTR role - MSN RCVD, ACCEPT SENT, READY SENT, FIRE, SHOT SENT, and EOM.
— AAA = ACK. Indicates that a machine acknowledgment to the message sent has been received and the mission status was one of the following: OBS role - MSN SENT, ACCEPTED, READY, FIRE SENT, EOM SENT, and ABORT SENT; SHTR role - ACCEPT SENT, READY SENT, ABORT SENT, REJECT SENT, and SHOT SENT. Otherwise this text string is blanked.

(2) **L-2**. Contains four lines of text.

— Line 1 – is displayed in the form xxxx/yyyy (xxxx=Mission Indicator and yyyy=Lock Mode Designator).
— Line 2 – is displayed in the form ddd°rrrrM (xxT) (ddd=target azimuth in degrees, rrrr=target range in meters, and xx (xx t)=waypoint number).
— Line 3 – is displayed in the form zzzzz/n/ttS CCCC (zzzz=HF Employment Indicator, n=number of munitions, tt=firing interval in seconds, and CCCC=Laser Code).
— Line 4 – is separated from line 3 by a blank line and displays the time of flight (tt) in seconds and is shown in the form TOF:ttS (tt=number (in the range 0000-9999) and S=seconds)

(3) **L-3, L-4,** and **L-5**. These keys have no legend or function.

(4) **CLR MSN (R-1)**. This key clears the current mission (mission displayed). Pressing R-1 causes the legend to flash at a 2-Hz rate. Pressing R-1 again boxes the legend for approximately 3 seconds and initiates the clear mission command. Pressing R-1 when the legend is boxed results in no action.

(5) **R-2**. This key has no legend or function.

(6) **R-3**. Function is dependent on which role is active.

(a) If the OBS role is active, the legend consists of the text ABORT and is always displayed, unless the mission status at L-1 is EOM SENT and a machine acknowledgment has been received. If this last condition is true, the legend is blanked.

(b) When the SHTR role is active, the ABORT legend is only present if the mission is active, and after the mission has been accepted by the SHTR.

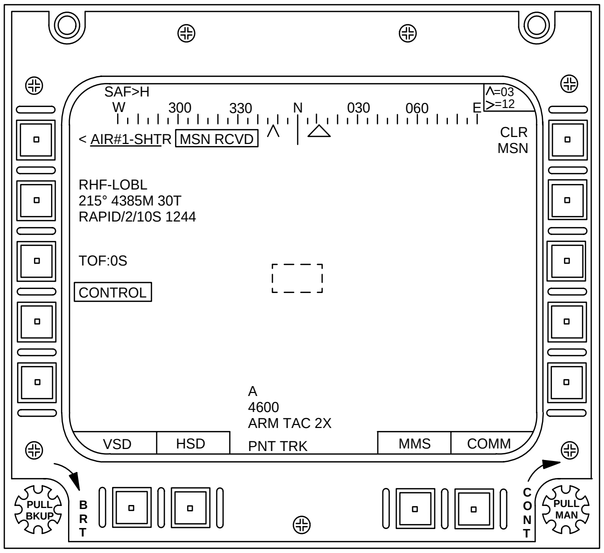

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Figure 4-118. AIR MSN With Control

(c) If the ABORT legend is present when R-3 is pressed, the ABORT message is transmitted, ABORT is boxed for approximately 3 seconds, and the mission status changes to ABORT SENT. When the mission status is ABORT SENT, R-3 legend is blanked.

(7) **R-4**. This key has no legend or function.

(8) **SEND AGAIN (R-5)**. The legend at R-5 contains the text SEND AGAIN. When R-5 is pressed, the last mission message is retransmitted and the legend is boxed for 5 seconds. This legend is only present on those displays where the mission status indicates that a message has been sent and no acknowledgment received.

b. AIR MSN With Control. The CONTROL box (fig. 4-118) is displayed on the mission summary page when the mission status is READY, SHOT, or TOF=0 and the role is OBS. If the role is SHTR, the CONTROL box is displayed if the mission status is MSN RCVD, FIRE, or ACCEPT SENT and a machine ACK has been received. When the mission summary page contains the CONTROL box, pressing the Freeze Frame switch causes the CONTROL box to change (AIR MSN With Control/Freeze Frame, fig. 4-119). The appearance of the CONTROL box display is also dependent on mission status (AIR MSN Control Box Displays, fig. 4-119). Pressing the Freeze Frame switch a second time changes the CONTROL box to only the single line of text CONTROL and displays the HOG START overlay. Pressing the Freeze Frame switch a third time blanks the START overlay. If the CONTROL box is not displayed when the Freeze Frame switch is pressed, the HOG START overlay is displayed. The other HOG switches function the same whether the HOG overlays or JVMF Mission Summary Pages are displayed.

(1) **Observer Role**.

(a) Pressing the Freeze Frame switch when the single line CONTROL box is displayed and the mission status is READY initiates the following:

— The FIRE control option is provided and
— if selected, the mission status changes to FIRE SENT and
— the FIRE message is transmitted.

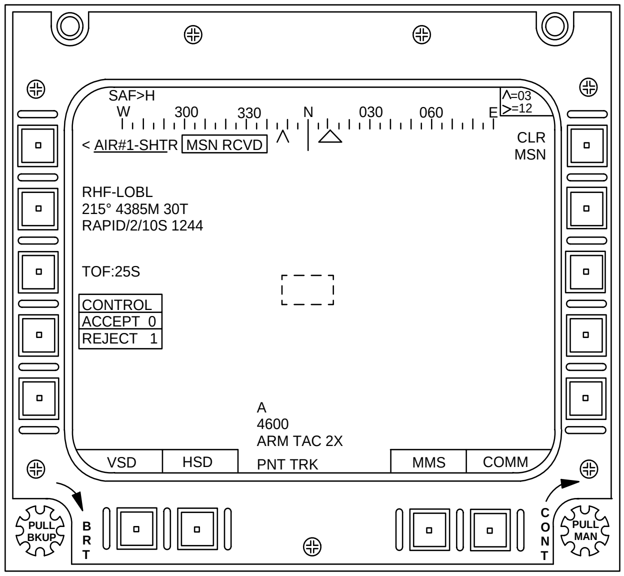
(b) Pressing the Freeze Frame switch when the single line CONTROL box is displayed and the mission status is SHOT and the machine generated ACK has been received initiates the following:

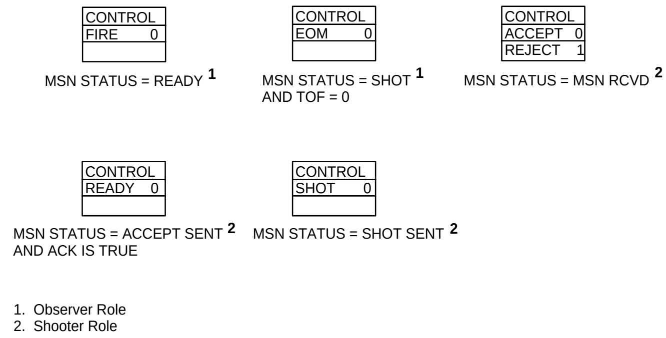
— The EOM control option is provided and
— if selected, the mission status changes to EOM SENT and
— the EOM message is transmitted.

(2) **Shooter Role**.

(a) Pressing the Freeze Frame switch when the single line CONTROL box is displayed and the mission status is MSN RCVD initiates the following:

— The ACCEPT/REJECT control option is provided and
— if selected, the mission status changes to either ACCEPT SENT or REJECT SENT, based on the selection and
— the ACCEPT or REJECT message is transmitted.





AIR MSN Control Box Displays

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Figure 4-119. AIR MSN With Control/Freeze Frame

(b) Pressing the Freeze Frame switch when the single line CONTROL box is displayed and the mission status is ACCEPT SENT and the machine generated ACK has been received initiates the following:

— The READY control option is provided and
— if selected, the mission status changes to READY SENT and
— the READY message is transmitted.

(c) Pressing the Freeze Frame switch when the single line CONTROL box is displayed and the mission status is FIRE initiates the following:

— The SHOT control option is provided and
— if selected, the mission status changes to SHOT SENT and
— the SHOT message is sent.

c. Typical AIR Mission Example. Figure 4-120 provides an example of a typical AIR Fire Mission. This example shows the mission interface between the observer's and shooter's role and starts with generation of a mission need, progresses through the events that occur, and finishes with the mission complete message. Each MFD displayed represents a separate event.

(1) **Observer 1**. A mission request (MSN SENT) message has been transmitted.

(2) **Observer 2**. The Observer has received a machine generated acknowledgment (ACK) from the shooter.

(3) **Shooter 1**. The Shooter has received a mission request (MSN RCVD) from the Observer.

(4) **Shooter 2**. The Shooter has pressed the Freeze Frame switch to display the full CONTROL box. The Shooter must now determine whether to accept or reject the mission.

(5) **Shooter 3**. The Shooter has accepted the mission and has transmitted an accept (ACCEPT SENT) message.

(6) **Observer 3**. The Observer has received the accept (ACCEPTED) mission message from the Shooter.

(7) **Shooter 4**. The Shooter has received a machine generated acknowledgment (ACK) from the Observer.

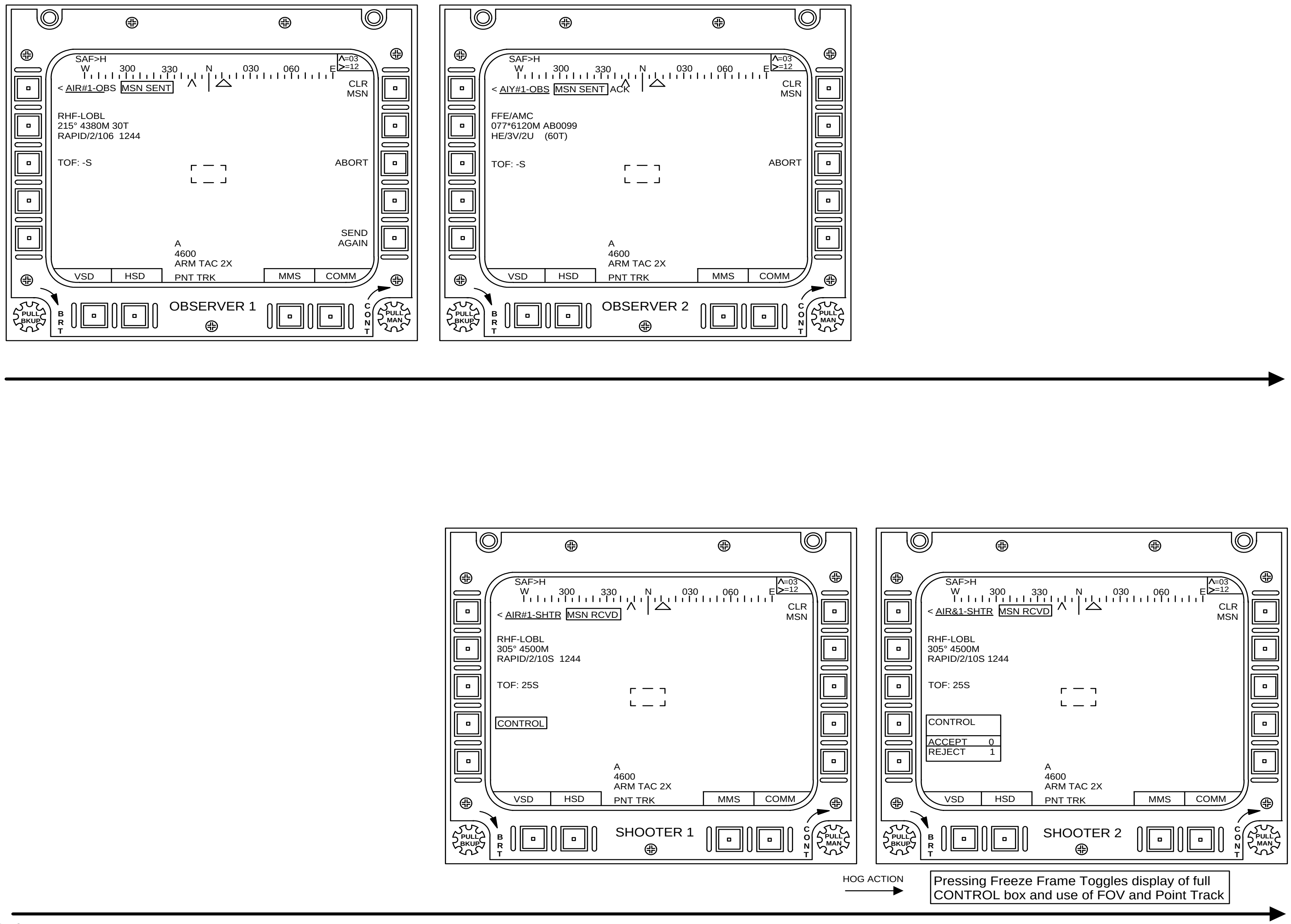

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Figure 4-120. Sample AIR MSN (Sheet 1 of 6)

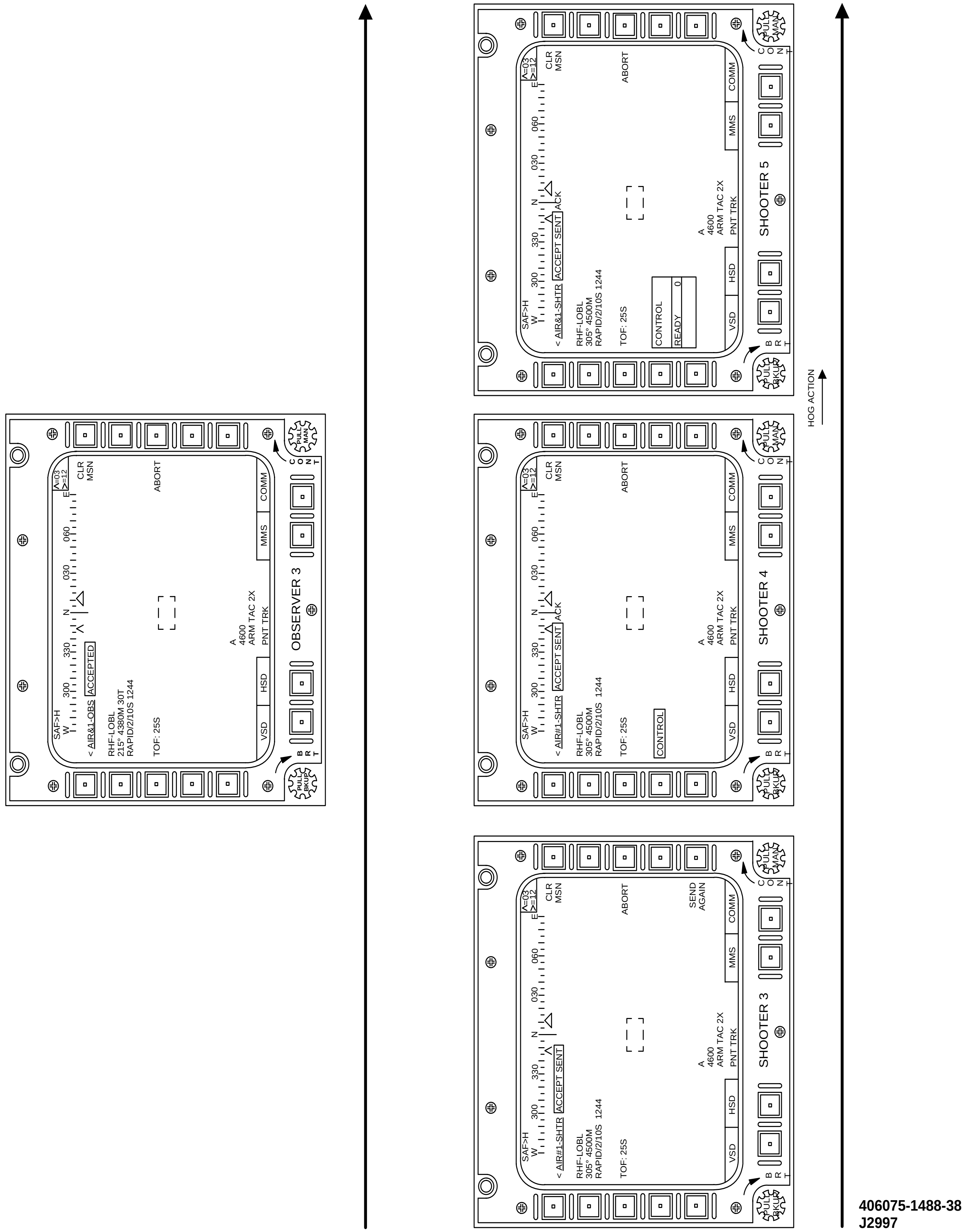

Figure 4-120.   Sample AIR MSN (Sheet 2 of 6)

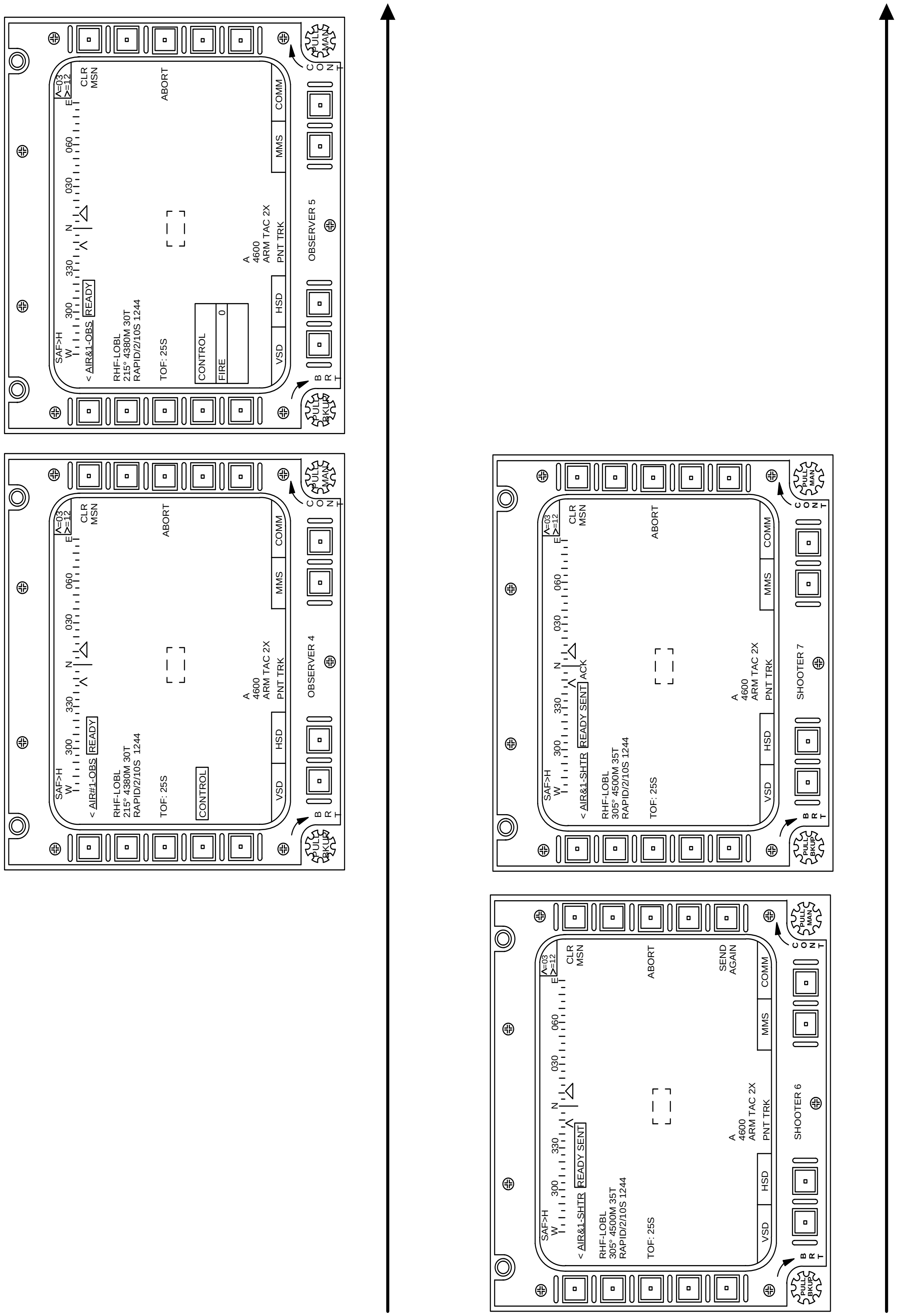

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Figure 4-120. Sample AIR MSN (Sheet 3 of 6)

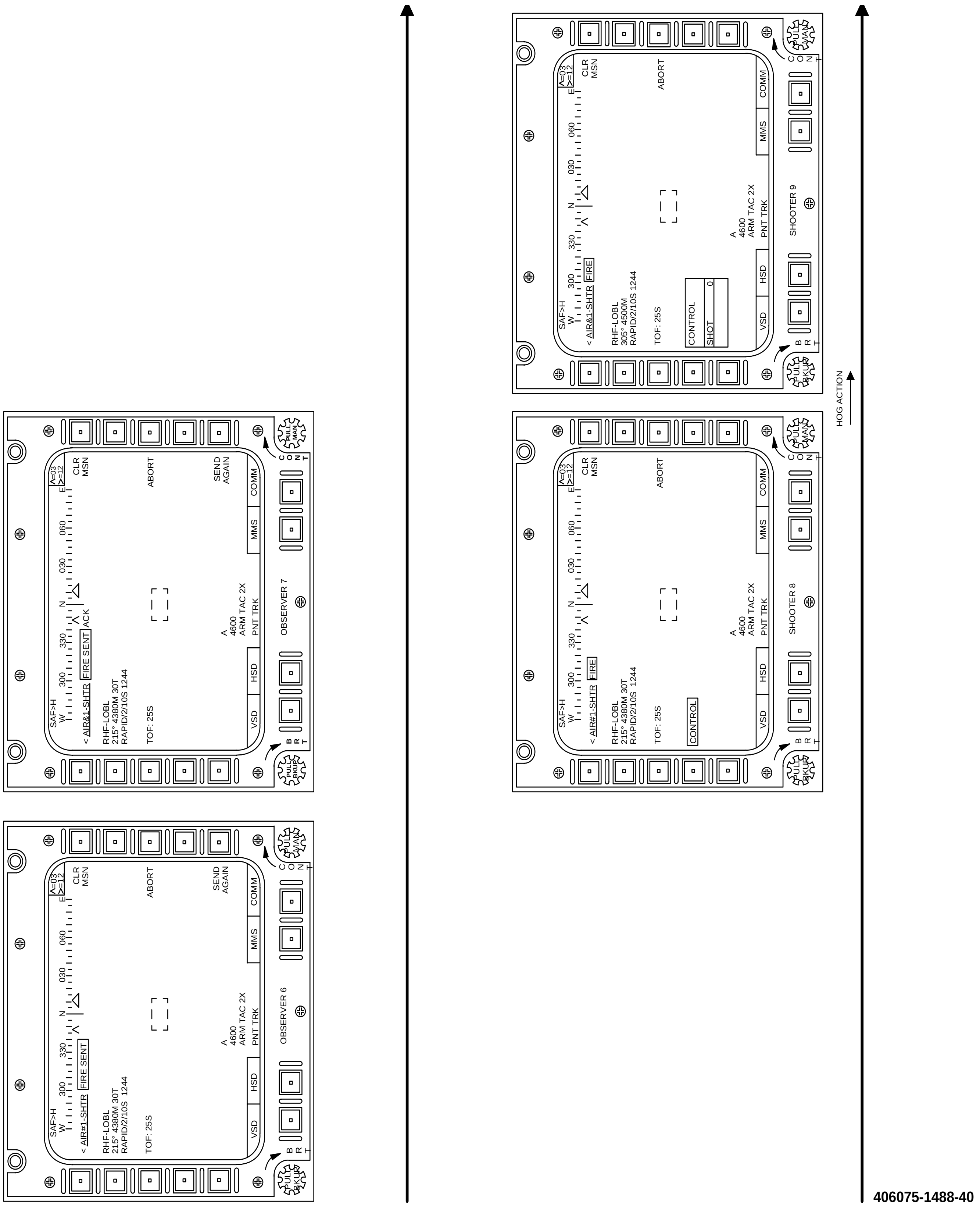

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Figure 4-120. Sample AIR MSN (Sheet 4 of 6)

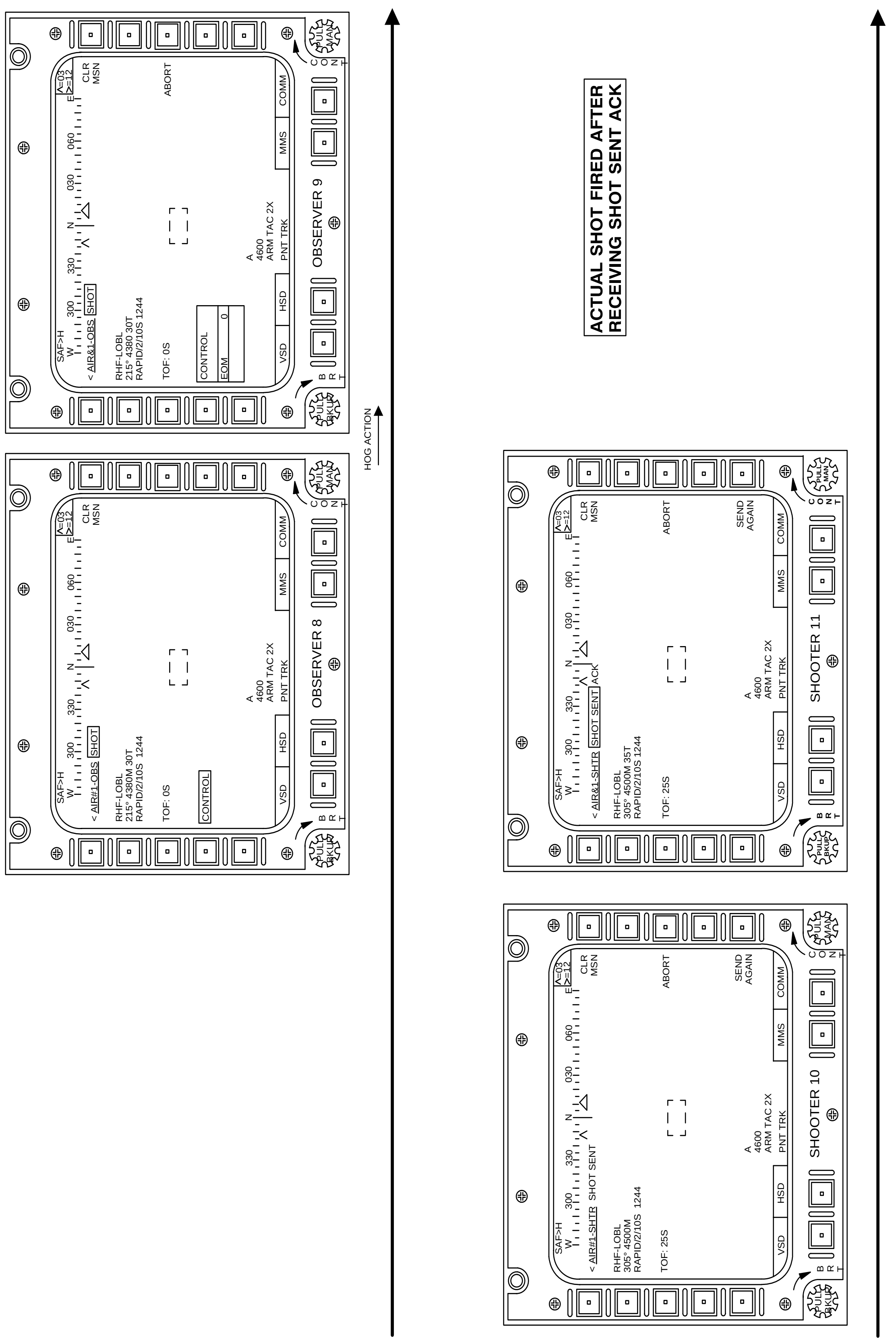

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Figure 4-120. Sample AIR MSN (Sheet 5 of 6)

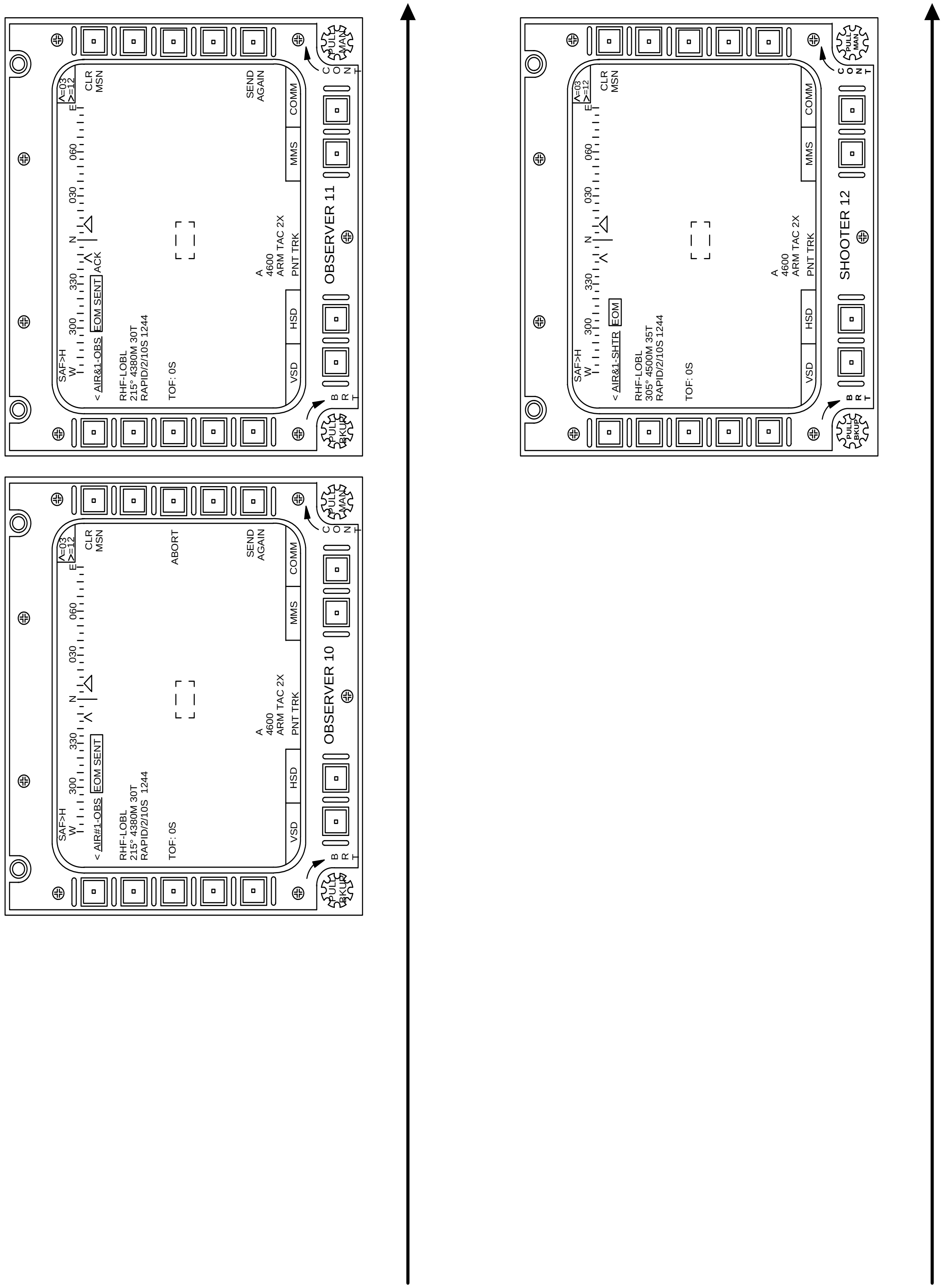

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Figure 4-120. Sample AIR MSN (Sheet 6 of 6)

(8) **Shooter 5**. The Shooter has pressed the Freeze Frame switch to display the full CONTROL box. The Shooter must configure his weapons for firing and send the READY message when ready.

(9) **Shooter 6**. The Shooter has transmitted a ready (READY SENT) message to the Observer.

(10) **Observer 4**. The Observer has received the ready (READY) mission message from the Shooter.

(11) **Shooter 7**. The Shooter has received a machine generated acknowledgment (ACK) from the Observer.

(12) **Observer 5**. The Observer has pressed the Freeze Frame switch to display the full CONTROL box. The Observer must direct the Shooter when to commence fire.

(13) **Observer 6**. The Observer has transmitted a fire (FIRE SENT) message to the Shooter.

(14) **Observer 7**. The Observer has received a machine generated acknowledgment (ACK) from the Shooter.

(15) **Shooter 8**. The Shooter has received a FIRE message from the Observer.

(16) **Shooter 9**. The Shooter has pressed the Freeze Frame switch to display the full CONTROL box. The Observer must direct when to commence firing.

(17) **Shooter 10**. The Shooter has transmitted a SHOT (SHOT SENT) message to indicate he is ready to commence firing.

(18) **Observer 8**. The Observer has received the SHOT message from the Shooter.

(19) **Shooter 11**. The Shooter has received a machine generated acknowledgment (ACK) from the Observer. At this point the Shooter actually fires the weapon.

(20) **Observer 9**. The Observer has pressed the Freeze Frame switch to display the full CONTROL box.

(21) **Observer 10**. The Observer has transmitted an end of mission (EOM SENT) message to the Shooter.

(22) **Observer 11**. The Observer has received a machine generated acknowledgment (ACK) from the Shooter.

(23) **Shooter 12**. The Shooter has received an EOM message from the Observer.

4-223. GLOSSARY — TACFIRE.

The following is a list of TACFIRE mnemonics.

MNEMONIC	INTERPRETATION
1 RND	One Round
3 RND	Three Rounds
ACK	Acknowledge
ACTY	ACTIVITY Operational check in progress
ADA	Air Defense Artillery
A/D	Add or Drop (in Meters)
ADJ FIRE	Adjust Fire
AIRCRAFT	Aircraft
ALT	Altitude in Meters
AMC AF	At My Command — Adjust Fire
AMC DEST	At My Command — Destruction
AMC FFE	At My Command — Fire For Effect
AMC REG	At My Command — Registration
AMC RPT	At My Command — Repeat
AMC/RFFE	At My Command — Repeat Fire For Effect
AMMO	Ammunition
AMPS	Aviation Mission Planning Station
ANTITANK	Antitank Munitions
APC	Armored Personnel Carrier
APERS	Antipersonnel
ARTY	Artillery
ASSEMBLY	Assembly — Staging or Collecting Areas
ASSIGN KNPT	Assign Knownpoint
ASSY	Assembly

(Cont)

MNEMONIC	INTERPRETATION
ATGM	Antitank Guided Missile
AT GUN	Antitank Gun
ATI	Artillery Intelligence
ATI GEO1	Artillery Target Intelligence Geographic Coordinates Report Number 1
ATI GEO1	Artillery Target Intelligence Geographic Coordinates Report Number 2
ATI GRID	Artillery Target Intelligence Grid Coordinate Report
ATI POLAR	Artillery Target Intelligence Polar Coordinate Report
ATTITUDE	Attitude or Orientation of Target
AUF	Adjusting Unit of Fire
AUTH 01	Authentication One
BC	Broadcast
BLDG	Building
BN	Battalion
BOAT	Boat
BPS	Bits Per Second
BRG EQPT	Bridge Equipment
BRIDGE	Bridge
BUILDING	Building
BURN	Burning
CAL	Caliber in Millimeters
CAS	Casualty
CEOI	Communications Electronics Operating Instructions
CEN	Center — Command Post
CENTER	Center — Center Platoon of a Firing Battery
CHECK FIRE	Cease Firing (Emergency)

(Cont)

MNEMONIC	INTERPRETATION
CLASS I	Class I — Rations (Food)
CLASS II	Class II — Material (Supplies)
CLGP	Cannon Launched Guided Projectile
CLR	Clear
CMD	Command
CMPLT	Complete
CNO	Cannot Observe
CNO/AF	Cannot Observe/Adjust Fire
CNO/FFE	Cannot Observe/Fire For Effect
CNO/RFFE	Cannot Observe/Repeat Fire For Effect
COMPSD MSG	Composed Message
CONCRETE	Concrete
CONTROL	Control
COVER	Cover — Under Overhead Cover
CP	Concrete Piercing
CPHD	Copperhead Guided Munitions
CURR	Current
D	Data
DBL	Double Block Mode
DC AF	Danger Close — Adjust Fire
DC FFE	Danger Close — Fire For Effect
DEFILE	Defilade (in a Depression or Valley)
DELAY	Delay — Fuze Setting
DEST	Destruction or Destroyed
DEST AF	Destruction Adjust Fire
DEST/DC	Destruction/Danger Close

(Cont)

MNEMONIC	**INTERPRETATION**
DEST/REG	Destruction/Registration
DEST/TOT	Destruction/Time On Target
DIR	Direction (In Mils)
DIR ERR	Direction Error (In Mils)
DIST	Distance (In Meters)
DMD	Digital Message Device
DN	Down
DNA	Do Not Adjust
DNC	Do Not Combine
DNO	Did Not Observe
DNO TGT	Did Not Observe Target
DOP	Degree of Protection (Personnel)
DRAW TGT	Draw Target
DROP	DROP (Decrease in Range in Meters)
DPLY DLY	Display Delay
DSPO	Disposition
DUGIN	Dug In (In Foxholes)
EAST	Easting Coordinates
ENTRY NO	Entry Number
EOM	End of Mission
EOM RAT	End of Mission — Record As Target or Record As Target Knownpoint
EOM & SUR	End of Mission & Surveillance
EQUIP	Equipment
EST	Eastern
EW	Electronic Warfare
EXC	Excellent (Information Reliability)

(Cont)

MNEMONIC	INTERPRETATION
FAIR	Target Identification Not Certain
FAT	Free Air Temperature
FERRY	Ferry
FFE	Fire For Effect
FIRE	Commence Firing (Cancels Check Fire)
FIRE FPF	Fire — Final Protective Fire
FIRE TGT NO	Fire On Target Number
FL TRACE	Front Line Trace
FMTD	Formatted
FO COMD	Forward Observer Command
FOOT PON	Foot Pontoon — Bridge
FORWARD	Forward
FPF	Final Protective Fire
FR GRID	Fire Request Grid
FR LASER	Fire Request — Laser
FR POLAR	Fire Request — Polar
FR QUICK	Fire Request — Quick
FR SHIFT	Fire Request — Shift
FREETEXT	Plain Text Message
FUZE	Fuze
GAS NONP	Gas — Nonpersistent
GAS PERS	Gas — Persistent
GOOD	Good (Identification of Target — Moderately Reliable)
GPS	Global Positioning System
GRID	Grid — UTM Coordinates
GUIDANCE	Guidance

(Cont)

MNEMONIC	INTERPRETATION
GUN	Gun
HB	Highburst
HB/MPI	Highburst/Mean Point of Impact
HC SMX	White Smoke
HE	High Explosive
HEAVY	Heavy Artillery (177MM to 250MM)
HE/DELAY	High Explosive/Delay (Fuze)
HELICOPTER	Helicopter
HE/Q	High Explosive/Quick (Fuze)
HE/TIME	High Explosive/Time Delay (Fuze)
HE/VT	High Explosive/Variable Time (Fuze)
HE/WP	High Explosive/White Phosphorus
HIGH/DC	High Angle/Danger Close
HIGH/REG	High Angle/Registration
HIGH/TOT	High Angle/Time On Target
HILL	Hill
HLDG	Holding
HOG	Hands-On General User Interface
HVY MGUN	Heavy Machine Gun
HVY MSL	Heavy Missile
HVY WHEEL	Heavy Wheeled Vehicles
ICM	Improved Conventional Munitions
IFA	In Flight Alignment
IGN RD	Ignore Round
ILLUM	Illumination
INFANTRY	Infantry

(Cont)

MNEMONIC	INTERPRETATION
INTEGRATE	Integrated into a single TIS image.
JUNCTION	Junction
JVMF	Joint Variable Message Format
KBD BELL	Keyboard Bell — Volume 0 to 7
KNPT	Knownpoint
LA	Left Above
LAST PNT	Last Point
LATITUDE	Latitude in Degrees, Minutes and Seconds
LB	Left Below
LDG STRP	Landing Strip
LFT	Left
LMC	Activates Linear Motion Compensation
LONGITUDE	Longitude in Degrees, Minutes and Seconds
LOST	Lost (Failed to Observe Last Round)
LOST BT	Lost Burst
LOST TGT	Lost Target
LOUDSPKR	Loudspeaker
LOW/DC	Low Angle/Danger Close
LOW/REG	Low Angle/Registration
LOW/TOT	Low Angle/Time on Target
LT MGUN	Light Machine Gun
LT MSL	Light Missile
LT WHEEL	Light Wheeled Vehicle (Jeeps)
M1	Mission 1
M2	Mission 2
MASNRY	Masonry

(Cont)

MNEMONIC	INTERPRETATION
MDM MSL	Medium Missile
ME	Method of Engagement
MEDIUM	Medium
MPI	Mean Point of Impact
MSG TYPES	Message Types
MSN	Mission
MSN INFO	Mission Information
MSN NO	Mission Number
MTO	Message to Observer
MVT	Movement
NAK	Not Acknowledged
NEG	Negative
NEUT	Neutralized
NEUTBURN	Neutralized and Burning
N/G	Not Given
NONE	None — No Disposition Given
NO PREF	No Preference
NORTH	Northing Coordinates
NO UNITS	Number of Units
NO VOL	Number of Volleys
OBSD ERR	Observed Error
OBSN	Observation
OBSR LOC	Observer Location
OBS VA	Observe Vertical Angle
OK BT	O.K. Burst
OK TGT	O.K. Target

(Cont)

MNEMONIC	INTERPRETATION
OP	Observation Post
OPNL CHECK	Operational Check
ORIG	Origin
PAC	Pitch Attitude Cue
PE	Probable Error
PERS	Personnel
PPLN	Preplanned
PPSN	Present Position
PRAND	Standing On First Volley; Prone On Subsequent Volleys
PREAMBLE	Message Lead In
PREC REG	Precision Registration
PRONE	Prone on First and Subsequent Volleys
PROTO	Protocol
PROVER	Prone on First Volley; Covered on Subsequent Volleys
PRUG	Prone on First Volley; Dug (or Digging in on Subsequent Volleys)
PSN	Position
PTL OIL	Petroleum Oil
QUICK	Fuze Setting — Quick
RA	Right Above
RAD/LGTH	Radius/Length (In Meters)
RAILROAD	Railroad
RAT	Record As Target
RB	Right Below
RCLR	Recoilless Rifle
RCRD REG PT	Record As Registration Point
RCRD TI REG PT	Record As Time Registration Point

(Cont)

MNEMONIC	INTERPRETATION
RDR REG	Radar Registration
RDZV	Rendezvous
RECON	Reconnaissance
REF DIR	Reference Direction
REF VA	Reference Vertical Angle
REG AF	Registration Adjust Fire
REG NEXT LOT	Register Next Lot (of Powder)
REGT	Regiment
REL	Reliability
RELBIL	Reliability
RESECT	Resection
RKT/MSL	Rocket Missile
R/L	Right or Left (In Meters)
RNDS	Number of Rounds that Impacted
SA LASER	Subsequent Adjustment With Laser
SEQ NO	Sequence Number
SF ADJ	Shell Fuze Adjustment
SF 1ST	Shell Fuze for First Volley
SF SUBQ	Shell/Fuze for Subsequent Volleys
SHELL/FZ	Shell/Fuze
SHELREP	Shell Report
SHFT	Shift
SHOT	Shot — Round Fired
SITE	Site — Position or Location
SLT	Searchlight
SLT DIST	Slant Distance

(Cont)

MNEMONIC	INTERPRETATION
SNG	Single
SOI	Security Operating Instructions
SPECIAL	Special — Target Types
SPLASH	Round Impact
SPT	Spot
STA TGT	Stationary Target
STD	Standard
STEEL	Steel — Construction Material, Type of Bridge
SUB	Subscriber
SUBQ ADJ	Subsequent Adjustment
T	Test
T/D	Type of Data
TACFIRE	Tactical Fire
TFR	TACFIRE
TGT	Target
TGT NO	Target Number
TIME	Time (Hours and Minutes)
TIME FLT	Time of Flight
TIME RPT	Time Report
TNO	Try Number
TOT	Time on Target
TRILAT	Trilateration
TROOPS	Troops
TRP & ARM	Troops and Armor
TRP MECH	Troops Mechanized
TRP & VEH	Troops and Vehicles

(Cont)

MNEMONIC	INTERPRETATION
TYPE REG	Type of Registration
U/D	Up/Down (In Meters)
UNK	Unknown
UP	UP — Changes in Height of Bursts
USE GT	Use Gun Target Line
VA	Vertical Angle
VA ERR	Vertical Angle Error (In Mils)
VCORR	Vertical Correction
VEH	Vehicle
VEH PON	Vehicle Pontoon
VERY HVY	Very Heavy
WKPTY	Work Party
WOODEN	Wooden Construction Material
WP/DELAY	White Phosphorus With Delay Fuze
WPN	Weapon(s)
WP/Q	White Phosphorus with Quick Fuze
WP/TI	White Phosphorus with Time Fuze
WR/AF	When Ready/Adjust Fire
WR/FFE	When Ready/Fire For Effect
WR/RFFE	When Ready/Repeat For Fire Effect
XMIT BLK	Transmit Block
XMIT RATE	Transmit Rate
YES	Affirmative

SECTION VII. OH-58D ATHS CHECKLIST

4-223. ZEROIZE. (Clears all entered data from ATHS.)

1. ATHS switch — Press.

2. START — Press.

3. ZEROIZE — Press to access Zeroization page.

   a. L-1 — Press to activate keyboard.

   b. Press "Z" on MFK to Zeroize, or...

   c. To abort zeroizing — Press paging key.

4-224. ATHS INITIALIZATION.

1. ATHS switch — Press.

2. START — Press.

3. Paging key (1/2) — Press to access Start page 2/2.

4. TEST-GO...Press — (enter T through MFK for self test).

5. NETS — Press to select 8 Net pages.

   a. TFR/AIR NET — Scroll to select TFR or AIR.

   b. BLK — Select SGL or DBL.

   c. BAUD — Select rate.

   d. RADIO — Select 1 through 4.

   e. PRE — Press for Preamble page.
      (1) On Preamble page — Select PREAMBLE and enter time.
      (2) On Monitor page — Select MONITOR and enter time, or select OFF.

   f. AUTH — Select MANUAL or NONE.

   g. Paging key — Press to go to next page.

NOTE

Set up each of the remaining Net pages as needed by repeating steps a. through g. Pressing the paging key on Net page 8/8 causes a return to Start page 2/2.

6. SUBS — Press to select 3 Subscriber pages.

   a. Select NET(s) to be used.

      Enter subscriber ID onto each net to be used (A-Z, 0-9).

   b. Page forward to access SUBS pages 2/3 3/3.
      (1) On page 3/3, enter automatic authentication ID.
      (2) On page 3/3, press paging key and return to Start page 2/2.

7. AUTH — Press to access Authentication Control Entry page.

   a. Select SUB — If not visible, enter desired subscriber's ID.

   b. Select XMT LINE — Change if automatic authentication line number is not as desired.

   c. Select RCV LINE — Same as for XMT LINE.

   d. MODE key — Press once to activate authentication tables. Press again to scroll between XMT, BOTH or RCV.

   e. Select XMT TABLE. Starting on desired line, enter transmit authentication code from SOI. Page forward as needed to access Authentication Control Entry page.

   f. Select RCV TABLE. Follow same directions as for XMT TABLE. Page again to return to Start page 2/2.

8. MSGS — Press to access Message Preset Entry pages 1-6. Press L-3 to activate keyboard. Enter free text message up to 36 characters in length. Six preset messages may be set up. Formulate messages and page through as needed. (MFD defaults to Start page 2/2 when exiting page 6/6).

9. MVMT — Press to access 6 each Movement Preset Entry pages. Press L-2 and/or L-3 on each Preset page to enable keyboard. Enter up to 15 characters per line. Formulate messages and page through as needed. (Operator defaults to Start page 2/2 when exiting page 6/6).

10. Select ATHS switch — Then select Start page 1/2.

a. CURR NET — Enter CURRENT NET number.

b. ORIG — Enter ORIGIN (Originator's) identifier.

c. TEAM — Enter TEAM identifier.

d. BDCST — Enter BROADCAST identifier.

NOTE

If helicopter is equipped with EGI, time of day is automatically input by GPS.

e. TIME — Enter TIME using 24 hour format.

11. BULK — Press to access Bulk Data Summary page.

On Bulk Data Summary page:

a. Enter Destination ID by pressing L-1 and specifying subscribers ID on MFK.

b. Press L-2 to access Bulk Data Select page. Making a selection causes a default back to Bulk Data Summary page.

c. SEND; then scroll to next page by pressing L-3. Utilize the **"**SCROLL-SEND**"** procedure until all desired data has been sent.

d. CMPLT. Send CMPLT message when finished with bulk data transmission.

4-225. ARTILLERY REQUEST.

1. PREPLANNED (FPF & CPHD Only)

a. To enter or select a preplanned request:

(1) Select ATHS switch (accesses ATHS Top Menu page).
(2) Select ARTY REQ (selects Artillery Mission pages).
(3) Select NEW — Next to present mission to be replaced.
(4) Select REQ PPLN — Choose preplan mode.
(5) Select FPF or CPHD (Only one FPF allowed).
(6) ARTY Summary page appears... Press SEND.
(7) Preplanned MTO from FDC accepts PPLN request.
(8) Select ATHS switch.
(9) Select ARTY REQ.
(10) Select PPLN LIST.
(11) Press NEW P1 or P2 to designate the desired preplanned mission number.
(12) Press L-2 to insert PPLN request.

b. To enter a second preplanned request — repeat all of the previous steps listed in a. above.

2. NEW — ARTY FIRE MSN RQST.

a. Locate target using MMS for automatic entry of coordinates.

b. Select ATHS switch.

c. Select ARTY REQ.

d. Select NEW (Next to mission to be replaced).

e. Mission Type — Select NEW TGT, KNPT TGT, QUICK, REQ PPLN, ILLUM, or CPHD.

f. TARGET TYPE — Select one of 17 targets.

g. Select TARGET STRENGTH.

h. Select TARGET ACTIVITY.

i. ...TARGET MOVING direction automatically selected if TARGET ACTIVITY was selected as MOVING.

j. ...If MOVING, then enter speed in kph using MFK.

k. Review/Change Mission Summary page.

l. SEND key — Press.

NOTE

A Copperhead is fired from an artillery 155 MM gun.

3. COPPERHEAD Fire Mission (Active and Preplanned).

a. Locate target using MMS.

b. Select ATHS switch.

c. Select ARTY REQ.

d. Select NEW (Next to mission to be replaced).

e. Select CPHD.

f. Select STRENGTH (number of Copperheads to be fired).

g. TARGET POSITION — Select NEW or KNPT.

h. Review/Change Mission Summary page.

i. SEND key — Press.

4. Selection of ILLUM and QUICK Artillery Mission types follow the same procedures as in step 3. above except a KNPT where, after specifying known point number, send Summary page.

4-226. AIR REQUEST (8 AERIAL FIRE MISSION REQUESTS ARE AVAILABLE).

1. Storing or executing a NEW Air Mission Fire Request.

a. Locate target using MMS.

b. Select ATHS switch.

c. Select AIR REQ.
(1) AIR REQUEST List page — Select Mission 1 through 8 from AIR REQ List (pages 1-3) by pressing NEW.
(2) On MSN TYPE page — Select REMOTE HLFR, AMC/TGT, AMC, ORD, WR/TGT, or WR/ORD.
(3) Make appropriate selections as needed.
(4) Review/Change Mission Summary page.

d. To execute an Immediate Fire Request, Press SEND while on the Summary page. (Mission will also be stored at this time).

e. To enter other missions, proceed to step 1 above.

2. Recalling a stored AIR MISSION:

a. Select ATHS switch.

b. Select AIR REQ.

c. Select desired mission number (1-8) from pages 1, 2, or 3.

d. Review/Change Mission Summary page.

e. SEND key — Press.

NOTE

HELLFIRE missiles are normally fired from aircraft.

3. REMOTE HELLFIRE request.

a. Select ATHS switch.

b. Select AIR REQ.

c. Select NEW — On Air Mission Request List page — Select 1 through 8.

d. Select REMOTE HLFR.

e. Select NUMBER OF ROUNDS — Enter N/G or a number (0-9) from MFK.

f. Review/Change Mission Summary page.

g. SEND key — Press.

h. COMPLETE — SEND EOM message upon mission completion.

NOTE

In a REMOTE HLFR mission, the Observer's Mission Status will change from REQUESTED to ACCEPTED to READY to FIRE to SHOT upon receipt of firing element transmission.

4-227. RECEIVED MESSAGES.

1. To Review a Received Message:

a. Select ATHS switch.

b. Select RCVD MSG.

c. To review a selected message — press appropriate key.

d. If appropriate — DELETE reviewed message to clear out Received Message Buffer to make room for other incoming messages.

2. NEW messages must be reviewed before they can either be deleted or kept.

3. Received Messages are indicated by the advisory...ATH MESSAGE RECEIVED.

NOTE

Selecting OTHER allows the entry of free text messages.

4-228. MOVEMENT.

To Transmit Movement Messages:

a. Select ATHS switch.

b. Select MOVEMENT.

c. Select Type of Movement.

d. Select Destination (PRESET, MY POSITION, OTHER). (Selecting OTHER allows the entry of free text messages).

e. Review/Change Summary page.

f. SEND key — Press.

4-230. REPORTS.

1. To transmit own Situation/Status:

a. Select ATHS switch.

b. Select REPORTS.

c. Select SIT.

d. Select activity to report.

e. Review/Change Summary page.

f. SEND key — Press.

2. To transmit SPOT Report:

a. Locate Target using MMS.

b. Select ATHS switch.

c. Select REPORTS.

d. Select SPOT.

e. Select TARGET TYPE.

f. Select TARGET STRENGTH.

g. Select TARGET ACTIVITY. (If target is moving, then select MVG. If target is not moving then default is directly to summary page).

h. Review/Change Summary page.

i. SEND key — Press.

3. To transmit BDA Report:

a. Select ATHS switch.

b. Select REPORTS.

c. Select BDA.

d. Manually enter BDA data to Summary page.

e. Review/Change Summary page.

f. SEND key — Press.

4. To transmit CAS REPORT:

a. Select ATHS switch.

b. Select REPORTS.

c. Select CAS.

d. Manually enter CAS data to Summary page.

e. Review/Change Summary page.

f. SEND key — Press.

5. To transmit ATI REPORT:

a. Select ATHS switch.

b. Select REPORTS.

c. Select ARTY.

d. Select ATI.

e. Select TARGET TYPE.

f. Select TARGET STRENGTH.

g. Select REL Option.

h. Review/Change Summary page.

i. SEND key — Press.

6. To transmit PLAN (Arty Fire Plan):

a. Select ATHS switch.

b. Select REPORTS.

c. Select ARTY.

d. Select TARGET TYPE.

e. Select TARGET STRENGTH.

f. Manually enter six character Fire Plan Name.

g. Select CONFIRMED/SUSPECTED.

h. Select RV Option.

i. Review/Change Summary page.

j. SEND key — Press.

7. To request a REPORT:

a. Select ATHS switch.

b. Select REPORTS.

c. Select REQ.

d. Select REPORT TYPE (On report requests Select page).

e. Select DEST — (Enter Subscriber's ID).

f. Review/Change Summary page.

g. SEND key — Press.

4-231. STATUS.

1. To Review OWN STATUS:

a. Select ATHS switch.

b. Select STATUS.

c. Select OWN WPNS or OWN PPSN.
   (1) For OWN WPNS — Enter Laser Designator Code and Press R-1.
   (2) For OWN STATUS — Select ALT — Enter Alt in Meters or N/G and Press R-1.

d. Review OWN STATUS (selected through Status Index page).

2. To Review OTHER Subscribers Status:

a. Select ATHS switch.

b. Select STATUS.

c. Select SUB WPNS or SUB PSN. (Used for specific subscribers.)

d. Review STATUS of selected subscribers.

SECTION VIII. R OH-58D IDM CHECKLIST

4-232. ZEROIZE. (Clears all entered data from IDM.)

1. IDM switch — Press.
2. START — Press.
3. ZEROIZE — Press to access Zeroization page.
   a. L-1 — Press to activate keyboard.
   b. Press "Z" on MFK to Zeroize, or...
   c. To abort zeroizing — Press paging key.

4-233. IDM INITIALIZATION.

1. IDM switch — Press.
2. START — Press.
3. Paging key (1/3) — Press to access Start page 2/3.
4. TEST-GO...Press — (enter T through MFK for self test).
5. NETS — Press to select 8 Net pages.
   a. TFR/AIR NET — Scroll to select TFR or AIR.
   b. BLK — Select SGL or DBL.
   c. BAUD — Select rate.
   d. RADIO — Select 1 through 4.
   e. PRE — Press for Preamble page.
      (1) On Preamble page — Select PREAMBLE and enter time.
      (2) On Monitor page — Select MONITOR and enter time, or select OFF.
   f. AUTH — Select MANUAL or NONE.
   g. Paging key — Press to go to next page.

NOTE

Set up each of the remaining Net pages as needed by repeating steps a. through g. Pressing the paging key on Net page 8/8 causes a return to Start page 2/3.

6. SUBS — Press to select SUB NET ASGNMTS 1/9 page.
   a. R-1 key — Scroll to select NET(s) to be used.

      Enter up to 15 subscriber IDs onto each net to be used (A-Z, 0-9).

NOTE

IDs must contain two digits (00-0Z, 10-1Z, etc). ATHS and TACFIRE subscribers, due to the limitations of these systems, will always be in the range 00-0Z.

   b. Page forward to access SUBS pages 2/9 9/9.
      (1) On page 9/9, enter automatic authentication ID.
      (2) On page 9/9, press paging key and return to Start page 2/3.
7. AUTH — Press to access Authentication Control Entry page.
   a. Select SUB — If not visible, enter desired subscriber's ID.
   b. Select XMT LINE — Change if automatic authentication line number is not as desired.
   c. Select RCV LINE — Same as for XMT LINE.
   d. MODE key — Press once to active authentication tables. Press again to scroll between XMT, BOTH or RCV.
   e. Select XMT TABLE. Starting on desired line, enter transmit authentication code from SOI. Page forward as needed to access Authentication Control Entry page.
   f. Select RCV TABLE. Follow same directions as for XMT TABLE. Page again to return to Start page 2/3.
8. MSGS — Press to access Message Preset Entry pages 1-6. Press L-3 to activate keyboard. Enter free text message up to 36 characters in length. Six preset messages may be set up. Formulate messages and page through as needed. (MFD defaults to Start page 2/3 when exiting page 6/6.)

9. MVMT — Press to access 6 each Movement Preset Entry pages. Press L-2 and/or L-3 on each Preset page to enable keyboard. Enter up to 15 characters per line. Formulate messages and page through as needed. (Operator defaults to Start page 2/3 when exiting page 6/6).

10. Select IDM switch — Then select Start page 1/3.

  a. CURR NETS — Press.

  b. RADIO 1 through RADIO 4 keys — Press one of the keys and use the MFK to type in the desired net number for each radio.

  c. RTN — Press.

  d. ORIG — Enter ORIGIN (Originator's) identifier.

  e. TEAM — Enter TEAM identifier.

  f. BDCST — Enter BROADCAST identifier.

NOTE

Time of day is automatically input by GPS if functioning.

  g. TIME — Enter TIME using 24 hour format.

  h. R-1 key — Press.

11. BULK — Press to access Bulk Data Summary page.

On Bulk Data Summary page:

  a. Enter Destination ID by pressing L-1 and specifying subscribers ID on MFK.

  b. Press L-2 to access Bulk Data Select page. Making a selection causes a default back to Bulk Data Summary page.

  c. SEND; then scroll to next page by pressing L-3. Utilize the "SCROLL-SEND" procedure until all desired data has been sent.

  d. COMPLETE/R-4 key — Press to send COMPLETE message when finished with bulk data transmission.

12. IDM switch — Press.

  a. Start key — Press.

  b. Paging key — Press to display Start page 3/3.

  c. L-1 key — Press to scroll through Rapid function selections. Select desired function.

  d. L-3 key — Press to toggle between AUTO SHOT on and off. AUTO SHOT does not function in this installation.

  e. L-4 key — Press to access Serialization Subscriber Assignment page.
    (1) L-1 key — Press to toggle between XMT and NONE.
    (2) L-2 key — Press to enter desired subscribers.
    (3) L-4 key — Press to scroll through subscribers to read initial serialization count of messages.
    (4) R-4 key — Press to edit/enter initial serialization count of messages.
    (5) R-1 key — Press to return to START page 3/3.

4-234. ARTILLERY REQUEST.

1. PREPLANNED (FPF & CPHD Only).

  a. To enter or select a preplanned request:
    (1) Select IDM switch (accesses IDM Index page).
    (2) Select ARTY REQ (selects Artillery Mission pages).
    (3) Select NEW — Next to present mission to be replaced.
    (4) Select REQ PPLN — Choose preplan mode.
    (5) Select FPF or CPHD (Only one FPF allowed).

NOTE

If KNPT TGT is selected, entry of two-digit KNPT number is required.

    (6) Select NEW TGT or KNPT TGT as desired.
    (7) ARTY Summary page appears... Press SEND.

(8) Preplanned MTO from FDC accepts PPLN request.
(9) Select IDM switch.
(10) Select ARTY REQ.
(11) Select PPLN LIST.
(12) Press NEW P1 or P2 to designate the desired preplanned mission number.
(13) Press L-2 to insert PPLN request.

b. To enter a second preplanned request — repeat all of the previous steps listed in a. above.

2. NEW — ARTY FIRE MSN RQST.

a. Locate target using MMS for automatic entry of coordinates.

b. Select IDM switch.

c. Select ARTY REQ.

d. Select NEW (Next to mission to be replaced).

e. Mission Type — Select NEW TGT, KNPT TGT, QUICK, REQ PPLN, or CPHD.

NOTE

Fire control method will default to AMC FFE.

f. Select fire control method.

g. TARGET TYPE — Select one of 15 targets.

NOTE

Strength defaults to 1 ARMR.

h. Select TARGET STRENGTH.

i. R-1 key — Press.

j. Select TGT RAD/LGTH, WIDTH, and ATTITUDE.

k. R-1 key — Press.

l. Review/Change Mission Summary page.

m. SEND key — Press.

NOTE

A Copperhead is fired from an artillery 155 MM gun.

3. COPPERHEAD Fire Mission (Active and Preplanned).

a. Locate target using MMS.

b. Select IDM switch.

c. Select ARTY REQ.

d. Select NEW (Next to mission to be replaced).

e. Select CPHD.

NOTE

If KNPT TGT is selected, entry of two-digit KNPT number is required.

f. Select NEW TGT or KNPT TGT as desired.

g. Select STRENGTH if number of Copperheads to be fired is greater than one.

h. Review/Change Mission Summary page.

i. SEND key — Press.

4. To send a suppression mission (Quick).

Selection of the QUICK Artillery Mission type follows the same procedures as in step 3. above except a KNPT or TGT number must be specified. After specifying KNPT or TGT number, send Summary page.

4-235. AIR REQUEST (8 AERIAL FIRE MISSION REQUESTS ARE AVAILABLE).

1. Storing or executing a NEW Air Mission Fire Request.

a. Locate target using MMS.

b. Select IDM switch.

c. Select AIR REQ.
(1) AIR REQUEST List page — Select Mission 1 through 8 from AIR REQ List (pages 1-3) by pressing NEW.

(2) On MSN TYPE page — Select HELLFIRE, OTHER ORDNANCE, or NO PREF.
(3) Make appropriate selections as needed.
(4) Review/Change Mission Summary page.

d. To execute an Immediate Fire Request, Press SEND while on the Summary page. (Mission will also be stored at this time.)

e. To enter other missions, proceed to step 1 above.

2. Recalling a stored AIR MISSION:

a. Select IDM switch.

b. Select AIR REQ.

c. Select desired mission number (1-8) from pages 1, 2, or 3.

d. Review/Change Mission Summary page.

e. SEND key — Press.

NOTE

HELLFIRE missiles are normally fired from aircraft.

3. REMOTE HELLFIRE request.

a. Select IDM switch.

b. Select AIR REQ.

c. Select NEW — On Air Mission Request List page — Select 1 through 8.

d. Select HELLFIRE.

e. Make appropriate selections as needed.

NOTE

- Number of rounds will default to one and be displayed next to laser code.
- If more than one missile per code is needed, laser code must be input again followed by number of missiles.

f. Review/Change Mission Summary page.

g. SEND key — Press.

h. COMPLETE — SEND EOM message upon mission completion.

NOTE

In a HELLFIRE mission, the Observer's Mission Status will change from REQUESTED to ACCEPTED to READY to FIRE to SHOT upon receipt of firing element transmission.

4-236. RECEIVED MESSAGES.

1. To Review a Received Message:

a. Select IDM switch.

b. Select RCVD MSG.

c. To review a selected message — Press appropriate key.

d. If appropriate — DELETE reviewed message to clear out Received Message Buffer to make room for other incoming messages.

2. NEW messages must be reviewed before they can either be deleted or kept.

3. Received Messages are indicated by the advisory...IDM MESSAGE RECEIVED.

NOTE

Selecting OTHER allows the entry of free text messages.

4-237. MOVEMENT.

To Transmit Movement Messages:

a. Select IDM switch.

b. Select MOVEMENT.

c. Select Type of Movement.

d. Select Destination (PRESET, MY POSITION, OTHER). (Selecting OTHER allows the entry of free text messages).

e. Review/Change Summary page.

f. SEND key — Press.

4-238. REPORTS.

1. To transmit own Situation/Status:

a. Select IDM switch.

b. Select REPORTS.

c. Select SIT/STATUS.

d. Select activity to report.

e. Review/Change Summary page.

f. SEND key — Press.

2. To transmit SPOT Report:

a. Locate Target using MMS.

b. Select IDM switch.

c. Select REPORTS.

d. Select SPOT.

e. Select TARGET TYPE.

f. Select TARGET STRENGTH.

g. R-1 key — Press to select TARGET ACTIVITY.

h. R-1 key — Press.

i. Review/Change Summary page.

j. SEND key — Press.

3. To transmit BDA Report:

a. Select IDM switch.

b. Select REPORTS.

c. Select BDA.

d. Manually enter BDA data to Summary page.

e. Review/Change Summary page.

f. SEND key — Press.

4. To transmit CAS REPORT:

a. Select IDM switch.

b. Select REPORTS.

c. Select CAS.

d. Manually enter CAS data to Summary page.

e. Review/Change Summary page.

f. SEND key — Press.

5. To transmit ATI REPORT:

a. Select IDM switch.

b. Select REPORTS.

c. Select ATI.

d. Select RELY Option.

e. Select TARGET TYPE.

f. Select TARGET STRENGTH.

g. Review/Change Summary page.

h. SEND key — Press.

6. To request a REPORT:

a. Select IDM switch.

b. Select REPORTS.

c. Select REQUEST.

d. Select REPORT TYPE (On report requests Select page).

e. Select DEST — (Enter Subscriber's ID).

f. Review/Change Summary page.

g. SEND key — Press.

4-239. STATUS.

1. To review OWN STATUS:

a. Select IDM switch.

b. Select STATUS.

c. Select OWN WPNS or OWN PPSN.

(1) For OWN WPNS — Enter Laser Designator Code and Press R-1.

(2) For OWN STATUS — Select ALT — Enter Alt in Meters or N/G and Press R-1.

d. Review OWN STATUS (selected through Status Index page).

2. To review OTHER Subscribers Status:

a. Select IDM switch.

b. Select STATUS.

c. Select SUB WPNS or SUB PSN. (Used for specific subscribers).

d. Review STATUS of selected subscribers.

CHAPTER 5

OPERATING LIMITS AND RESTRICTIONS

SECTION I. GENERAL

5-1. PURPOSE.

This chapter identifies or refers to all important operating limits and restrictions that shall 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 operating experiences. Compliance with these limits will allow the pilot to safely perform the assigned missions and derive maximum utility from the helicopter.

5-3. EXCEEDING OPERATIONAL LIMITS.

Anytime an operational limit is exceeded, an appropriate entry shall be made on DA Form 2408-13-1 and 2408-13-1E. Entry shall state what limit or limits were exceeded and any additional data (i.e., range and time beyond limits) that would aid maintenance personnel in performing the required maintenance action.

5-4. MINIMUM CREW REQUIREMENTS.

The minimum crew required to fly the helicopter is one pilot whose station is in the right seat. An additional qualified crewmember is required when aircraft mission equipment is employed.

SECTION II. SYSTEM LIMITS

5-5. INSTRUMENT MARKINGS (FIGURE 5-1).

a. Instrument Marking Codes. White wedge-shaped symbols indicate the limit above or below which continuous operation is likely to cause damage or shortened life. The YELLOW/WHITE markings indicate the range when special attention should be given to the operation covered by the display.

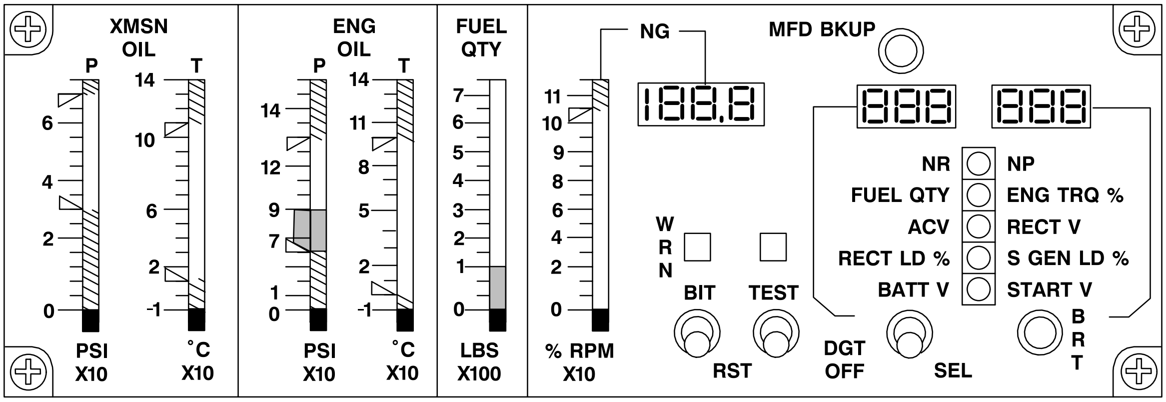
The S marking by the TGT display indicates the maximum momentary (1 second) temperature during start. (OH-58) The T marking on the TGT display indicates the maximum transient temperature during continuous operation (per TM 55-2840-256-23).

b. Vertical Scales. The scales have blue, green, and red light segments for NP and TRQ and blue, green, yellow, and red light segments for NR and TGT. When power is applied, a blue segment at the bottom of the scale will illuminate if the instrument is operational. As the input signals increase, segments will illuminate as each scale marking is passed. For instance, as NR input passes 97%, the segment between 97 and 98% will illuminate; or as TGT input passes 680 °C, the green segment between 680 and 700 °C will illuminate. When the input signals reach a precautionary area or maximum operating limit, a yellow or red segment, respectively, will illuminate. The yellow segment for NR will illuminate by 100%. The red segment for NP, TRQ, and TGT will illuminate by 107%, 100%, and 802 °C. As input signals decrease, light segments extinguish. The first red segment above the green segments will illuminate at or just below the respective maximum limit. The correponding digital display and MFD should be checked to determine whether a limit has been exceeded.

c. Numerical Limitations. For limitations where a number is duplicated in two successive ranges, the number that is duplicated is included in the lower range. To enter the higher range the displayed/recorded value must exceed the duplicate number. For example, for engine torque 0 - 100% Continuous, 100 - 112 30 minute limit. A displayed/recorded value of 100% is included in the continuous range; any value exceeding 100% is in the 30 minute range.

5-6. ROTOR LIMITATIONS.

Autorotation limitations are based on collective full down, throttle at idle, or below. After autorotation touchdown, the pilot shall smoothly center the cyclic and reduce the collective to the full down position. The pilot shall avoid abrupt, large aft cyclic movements which can cause unnecessary high main rotor yoke flapping loads with low rotor speed on the ground.



XMSN OIL P (TRANSMISSION OIL PRESSURE)

70 PSI Maximum
30 to 70 PSI Normal
30 PSI Minimum

XMSN OIL T (TRANSMISSION OIL TEMPERATURE)

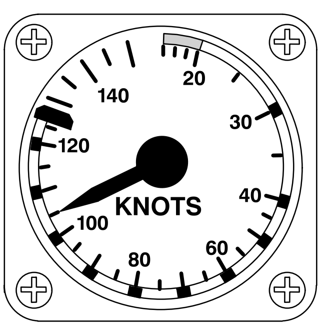
110 °C Maximum
15 to 110 °C Normal
15 °C Minimum

ENG OIL P (ENGINE OIL PRESSURE)

130 PSI Maximum
115 to 130 PSI Above 94% NG
90 to 130 PSI 78 to 94% NG
50 to 130 PSI Idle to 78% NG
50 PSI Minimum

NOTES

- During cold weather starts, engine and transmission oil pressure may exceed MPD range. If this occurs, MPD will display full scale, WRN light will flash, and an error code will be displayed. Remain at engine idle until normal range is attained (2 minutes maximum at extreme temperatures)
- F4 and F5 error codes indicate abnormal signal inputs. Display of these codes during start does not dictate maintenance action.
- Pilot monitoring of oil pressure is limited to operating in the green band of the MPD and checking pressure vs NG.



ENG OIL T (ENGINE OIL TEMPERATURE)

107 °C Maximum
0 to 107 °C Normal
0 °C Minimum

FUEL QTY (FUEL QUANTITY)

0 to 100 Lbs low fuel

NOTE

FUEL LOW caution message comes on at 97.5 lbs. Vertical scale display is yellow below 100 lbs.

NG (GAS PRODUCER)

107% 10-Second transient
105% Maximum continuous
63 to 105% Continuous

ENG TRQ (ENGINE TORQUE)

R 121 to 131% 2-Second transient
112 to 121% 10-Second transient
100 to 112% 30-Minute limit
0 to 100% Continuous

AIRSPEED

125 KIAS Maximum VNE-refer to fig 5-2
0 to 125 KIAS Normal operation

NOTE

Airspeed indication system is unreliable below 20 knots.

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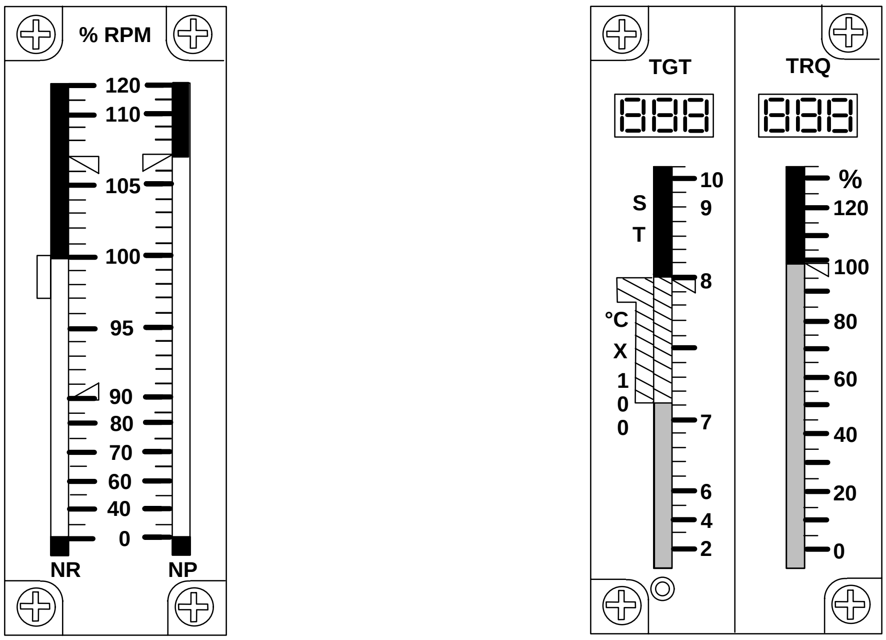
Figure 5-1. Instrument Markings (Sheet 1 of 2)



NOTE

Reduced rotor RPM will be accompanied by a proportional reduction in tail rotor RPM which may adversely affect directional control, particularly at high density-altitude and high gross weight conditions.

% RPM - NR (ROTOR)

TRANSIENT

107 to 125% 5-second transient

CONTINUOUS OPERATION

AUTOROTATION

107% Maximum

90% Minimum

POWERED FLIGHT

107% Maximum
100% Normal
93% Minimum

%RPM - NP (POWER TURBINE)

107 to 119% 15-Second transient
107% Maximum
100% Normal

TGT (TURBINE GAS TEMPERATURE)

STARTING

S 927°C Maximum momentary peak no more than 1 second
802 to 927°C 10-Second transient
R 843 to 927°C 10-Second transient

NORMAL OPERATION

802 to 871°C 12-Second transient
785 to 802°C 5-Minute limit
716 to 785°C 30-Minute limit
0 to 716°C Continuous

R NORMAL OPERATION

802 to 905°C 12-Second transient
716 to 802°C 30-Minute limit
0 to 716°C Continuous

TRQ (MAST TORQUE)

100 to 116% 10 Second transient (no more than 10 seconds accumulated per flight hour)
0 to 100% Continuous

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Figure 5-1. Instrument Markings (Sheet 2 of 2)

SECTION III. POWER LIMITS

5-7. ENGINE LIMITATIONS.

The engine limitations consists of torque (ENG TRQ %), turbine gas temperature (TGT), and rpm (NG and NP). Additionally, excessive torque or TGT will be indicated by associated WARNING messages on MFD's, these messages, peak values, and duration are recorded in CDS memory.

5-8. FUEL OPERATION LIMITS.

Standard fuel is JP-8; no restrictions are imposed.

NOTE

> Engine starting difficulties (longer cranking times and/or higher TGT) may be encountered at ambient temperatures below + 5 °C (41 °F).

5-9. STARTER LIMITS.

Starter engagement shall not exceed the times specified in the following schedule:

External	Battery Starts
40 sec ON	60 sec ON
30 sec OFF	60 sec OFF
40 sec ON	60 sec ON
30 sec OFF	60 sec OFF
40 sec ON	60 sec ON
30 min OFF	30 min OFF
(cool down)	(cool down)

SECTION IV. LOADING LIMITS

5-10. CENTER-OF-GRAVITY LIMITS.

Center-of-gravity limits for the aircraft to which this manual applies and instructions for computation of the center of gravity are contained in Chapter 6.

5-11. WEIGHT LIMITATIONS.

a. Maximum Gross Weight. The maximum gross weight for the helicopter is 5500 pounds.

b. Towing Weight Limitations. The spread restraint strap must be installed at gross weights above 4100 pounds over rough terrain and above 4500 pounds over smooth, prepared surfaces.

c. Cargo Hook Load Limitations. Maximum cargo hook structural loading is 1300 pounds.

SECTION V. AIRSPEED LIMITS

5-12. AIRSPEED LIMITATIONS.

a. Forward — The speed for any and all maneuvers shall not exceed the level flight velocities as stated on the airspeed operating chart (fig. 5-2).

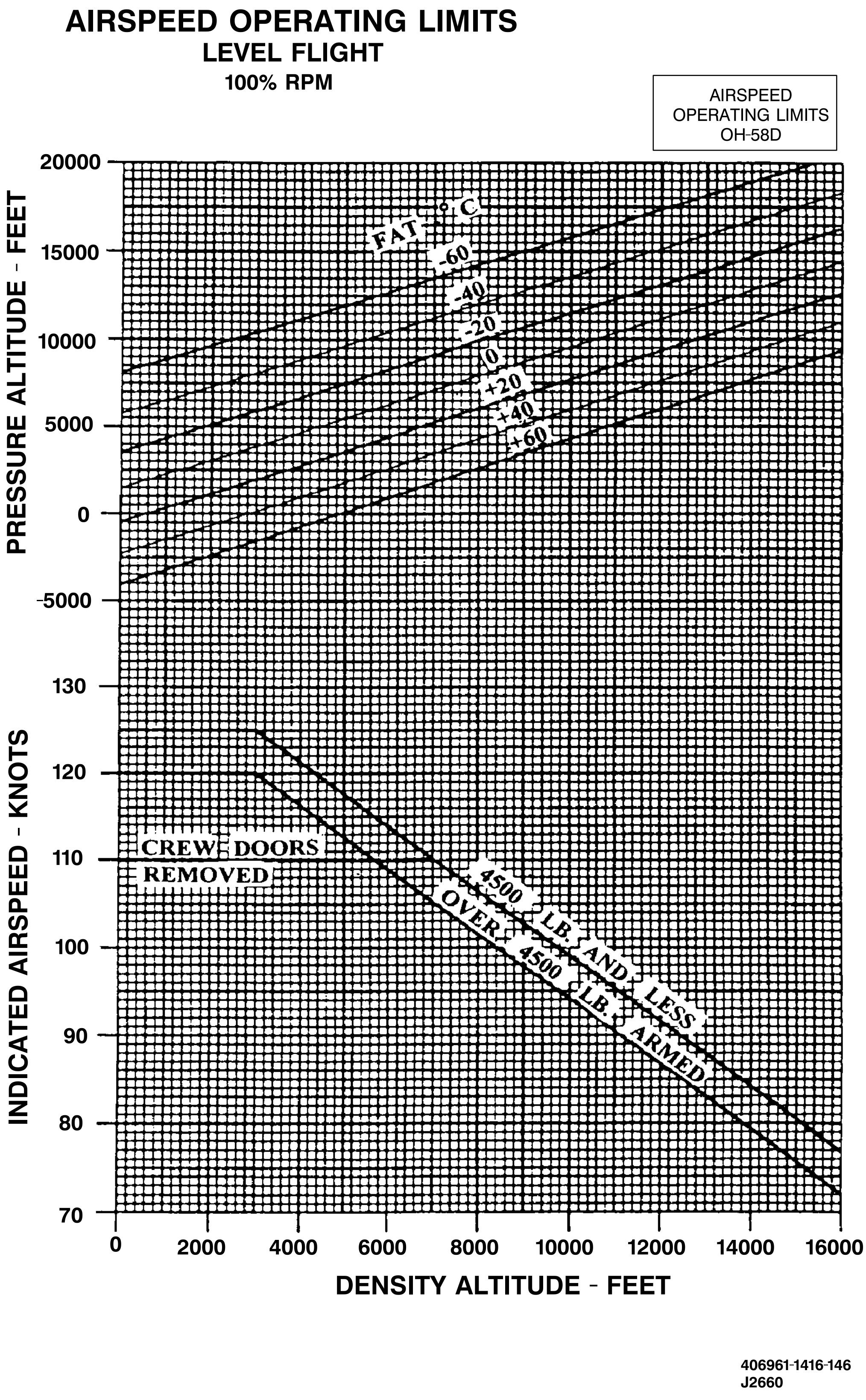
b. Sideward and rearward — Maximum sideward and rearward airspeed is 35 knots; however, this may be reduced by lateral CG imbalances. Lateral CG condition is determined by tables 6-5 and 6-6 and applied to wind limitations on figure 5-3.

5-13. FLIGHT WITH DOORS REMOVED.

a. The helicopter shall not be flown with only one crew door removed.

b. The helicopter shall not be flown with either avionics compartment access door removed.

c. For flight with crew doors removed, Vne is 110 KIAS (fig. 5-2).



EXAMPLE

WANTED

INDICATED AIRSPEED

KNOWN

4500 LB GROSS WEIGHT
PRESSURE ALTITUDE=7500 FT
FAT=-20°C

METHOD

ENTER PRESSURE ALTITUDE
MOVE RIGHT FAT
DROP DOWN TO V_{NE} LINE
MOVE LEFT, READ 117.5 KNOTS
INDICATED AIRSPEED

Figure 5-2. Airspeed Operating Limits

5-14. EXTERNAL CARGO LOAD AIRSPEED LIMITATIONS.

WARNING

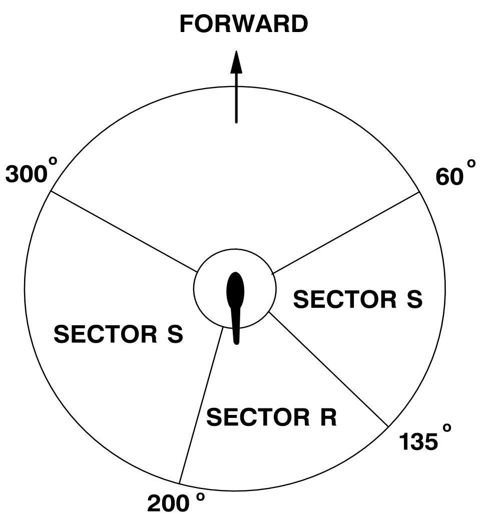
Actual airspeed limitation for a given external load will be determined by handling characteristics affected by size, weight and shape of cargo.

NOTE

Information on cargo hook is provided for information only and will not be applicable until use is authorized.

a. For flight with external load on cargo hook, Vne is 80 KIAS.

b. Lightweight, high drag loads require a swivel connector between the cargo hook and the sling to prevent unstable oscillations in flight above 20 KIAS.



SIDEWARD AND REARWARD AIRSPEED/WIND LIMITS

NOTE

REFER TO TABLES 6-5 AND 6-6 FOR CONDITIONS A THROUGH C.

Condition A: 35 KNOTS SIDEWARD AND REARWARD

Condition B: 35 KNOTS SIDEWARD (SEE DIAGRAM: SECTOR S)
20 KNOTS REARWARD (SEE DIAGRAM: SECTOR R)

Condition C: 20 KNOTS SIDEWARD AND REARWARD
(SECTORS S AND R)

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Figure 5-3. Sideward and Rearward Airspeed/Wind Limits

SECTION VI. MANEUVERING LIMITS

5-15. PROHIBITED MANEUVERS.

WARNING

Rapid full left pedal inputs at airspeeds above 90 KIAS may induce flight control changes such that the tail rotor blades may come in contact with the tailboom. This could result in separation of the aft section of the tailboom and subsequent loss of control of the helicopter.

a. Flight maneuvers causing a negative “g” load are prohibited.

b. The speed for any and all maneuvers shall not exceed the level flight velocities as stated on the airspeed operating limits chart (fig. 5-2).

c. Aerobatic maneuvers are prohibited.

NOTE

Aerobatic flight is defined to be any intentional maneuver involving an abrupt change in the aircraft's attitude, an abnormal attitude (pitch or roll angles greater than ± 30 or ± 60 degrees respectively), or abnormal acceleration not necessary for normal flight.

d. Main rotor torque is limited to 95% in forward flight above 60 Kts. airspeed.

5-16. SLOPE LANDING OR TAKEOFF LIMITATIONS.

a. Nose downslope — 5 degrees.

b. Left or right skid, or nose, Upslope - limits are dependent on lateral CG condition as determined by tables 6-5 and 6-6. for Area A, 10 degrees; for Area B & C, 5 degrees.

SECTION VII. ENVIRONMENTAL RESTRICTIONS

5-17. ENVIRONMENTAL RESTRICTIONS.

a. This helicopter is restricted to visual flight conditions.

b. Intentional flight into icing conditions is prohibited.

c. Cover plate shall be installed for flight when MMS is removed regardless of environmental conditions.

d. The OH-58D has not been tested in a cold weather environment. Until such testing is conducted, the following limitations apply:

(1) If the free air temperature (FAT) is below -17 °C (2 °F), external power should be used for starting the aircraft.

(2) Battery preheat or a warm battery will be used for all battery starts when the FAT is below -17 °C (2 °F).

5-18. WIND LIMITATIONS.

a. Engine starting — 45 knots maximum.

b. Maximum crosswind and tailwind for hover is 35 knots, hover this may be reduced by lateral CG imbalances. Lateral CG condition is determined by tables 6-5 and 6-6 and applied to wind limitations on figure 5-3.

c. Maximum tailwind for hover without inlet blast shields installed is 20 knots.

d. Heading hold engaged — 35 knots maximum.

5-19. TURBULENCE.

a. Intentional flight into severe or extreme turbulence is prohibited.

b. Intentional flight into moderate turbulence is prohibited when the weather report or forecast is based on fixed wing aircraft above 12,500 pounds gross weight.

c. Intentional flight into moderate turbulence is permitted when the weather report or forecast is based on rotary-wing aircraft or fixed wing aircraft under 12,500 pounds gross weight.

CHAPTER 6

WEIGHT/BALANCE AND LOADING

SECTION I. GENERAL

6-1. GENERAL.

Sections I through V contain sufficient instructions and data so that the pilot, knowing the basic weight and moment of the helicopter, can compute any combination of weight and balance.

6-2. CLASSIFICATION OF HELICOPTER.

The OH-58D helicopter is in class 1. Additional directives governing forms and records for weight and balance computations on class 1 helicopters are contained in AR 95-1, TM 55-1500-342-23 and DA PAM 738-751.

6-3. HELICOPTER STATION DIAGRAMS.

Helicopter compartment and station diagram (fig. 6-1) show the helicopter reference datum lines, fuselage stations, buttlines, and waterlines. The primary purpose of the figure is to aid personnel in the computation of helicopter weight/balance and loading.

6-4. LOADING CHARTS AND TABLES.

a. Information. The loading data contained in this chapter is intended to provide information necessary to work loading problems.

b. Use. Figures and tables contained in this chapter provide weight and moment of all useful load items. These are added to the current basic weight and moment to calculate the gross weight and longitudinal or lateral center of gravity.

(1) The calculated gross weight and longitudinal center of gravity are checked on the longitudinal center-of-gravity limits chart (fig. 6-5) to determine if the helicopter is within gross weight and center-of-gravity limitations.

(2) The gross weight and lateral center of gravity are checked on the lateral center-of-gravity limits chart (fig. 6-6) to determine if the helicopter is within gross weight and center-of-gravity limitations.

(3) The effect on center of gravity by the expenditures in flight of such items as fuel, armament, etc., may be calculated by subtracting the weight and moments of the expended items. Check the new calculated gross weight and center of gravity on the gross weight and center-of-gravity limitations chart.

SECTION II. WEIGHT AND BALANCE

6-5. WEIGHT AND BALANCE RECORDS.

The weight and balance records consist of the 365 series forms. All these forms are maintained in the helicopter historical record file, record of weight and balance personnel, basic weight checklist, helicopter weighing record, and basic weight and balance of required mission equipment installed on the helicopter.

a. DD Form 365-3, Chart C-Basic Weight and Balance Record. The Basic Weight and Balance Record reflects a continuous history of the basic weight, moment, and center of gravity (cg) resulting from structural and equipment changes in service. At all times, the last weight, moment, and cg entry is considered the current weight and balance status of the helicopter.

b. DD Form 365-4, Weight and Balance Clearance Form F. The form F is used to derive the gross weight and cg of any aircraft. The form F furnishes a record of the aircraft weight and balance status at each step of the loading process. It serves as a worksheet to record weight and balance calculations and any corrections that must be made to ensure that the aircraft will be within weight and cg limits. Instructions for filling out the form are given in TM 55-1500-342-23.

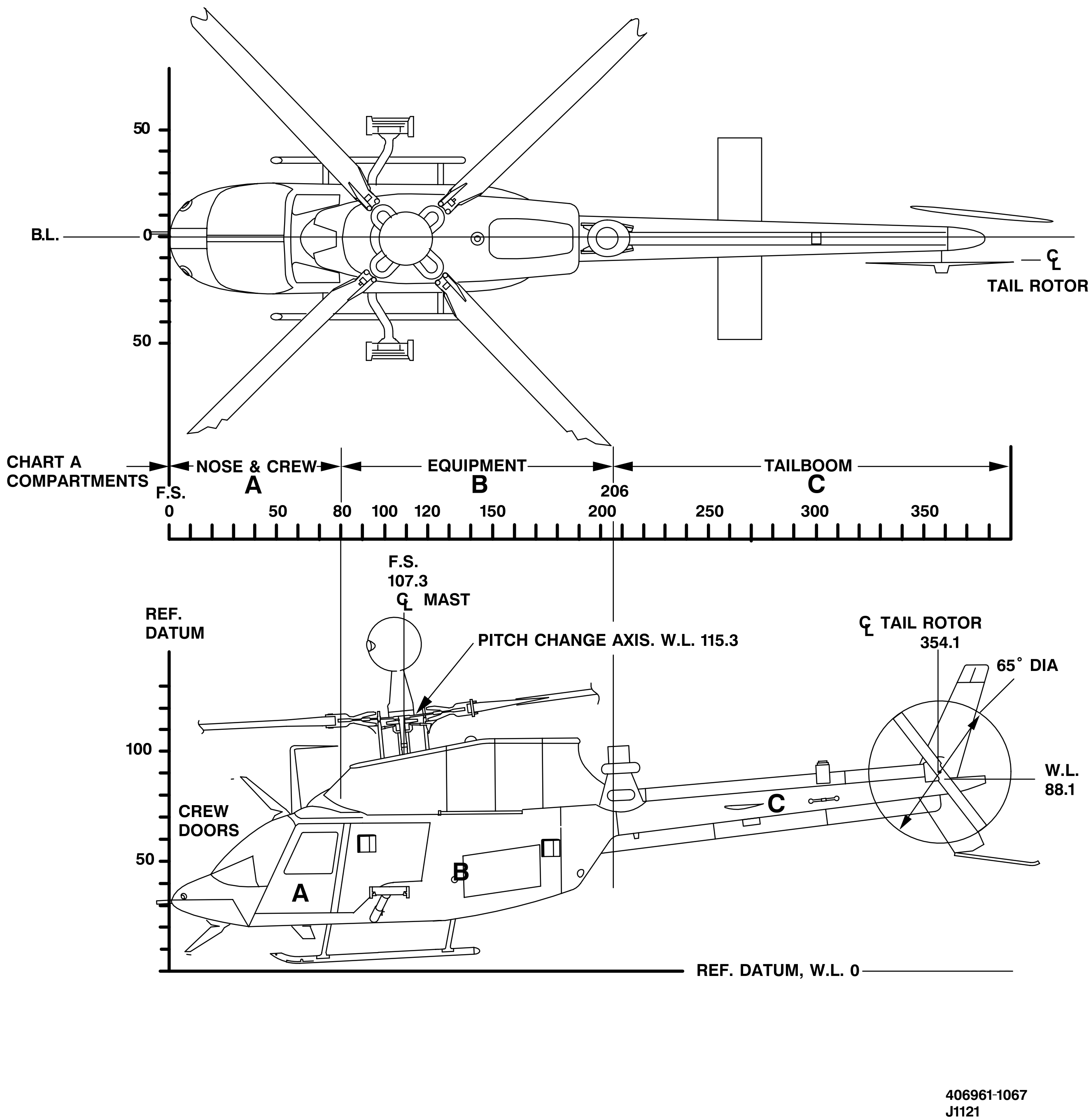


Figure 6-1. Helicopter Compartment and Station Diagram

SECTION III. FUEL/OIL

6-6. FUEL QUANTITY DATA.

For a given weight of fuel, there is a very small variation in fuel moment with change in fuel specific weight. Fuel moments should be determined from figure 6-2. Use the scale for the specific weight closest to that of the fuel being used.

The full tank usable fuel weight will vary depending upon fuel specific weight. The aircraft fuel gage system was designed for use with JP-4, but does tend to compensate for other fuels and provide acceptable readings. When possible, the weight of fuel onboard should be determined by direct reference to the aircraft fuel gage.

The following information is provided to show the general range of fuel specific weights to be expected. Specific weight of fuel will vary depending on fuel temperature. Specific weight of fuel will decrease as fuel temperature rises and increase as fuel temperature decreases at the rate of approximately 0.1 lb/gal for each 15 °C change. Specific weight may also vary between lots of the same type fuel at the same temperature by as much as 0.5 lb/gal. The following approximate fuel specific weights at 15 °C may be used for most mission planning.

FUEL TYPE	SPECIFIC WEIGHT
JP-4	6.5 lb/gal
JP-5	6.8 lb/gal
JP-8	6.7 lb/gal
JET-A	6.8 lb/gal
JET-A1	6.7 lb/gal

6-7. OIL QUANTITY DATA.

For weight and balance purposes, engine oil is considered part of basic helicopter weight.

SECTION IV. PERSONNEL

6-8. PERSONNEL MOMENT.

a. Personnel loading of the helicopter consists of the pilot and copilot/gunner (CPG). Refer to Crew Longitudinal Moment Chart (fig. 6-3) to compute pilot and CPG longitudinal moments and Crew Lateral Moment Chart (fig. 6-4) to compute pilot and CPG lateral moments.

b. When helicopter is to be operated near weight or center-of-gravity limits, the exact weight of each individual crewmember and items stored in the crew station should be used. If weighing facilities are not available, or the tactical situation dictates otherwise, or if the loading condition is known not to be near the limits, compute personnel loading according to each individual estimate.

SECTION V. CENTER OF GRAVITY

6-9. CENTER OF GRAVITY.

a. General. This section contains the longitudinal and lateral helicopter center-of-gravity (cg) charts. The cg charts are used in combination with the loading charts (figures 6-2 through 6-6), the mass properties tables (tables 6-1 through 6-4) DD Form 365-3 (Chart C-Basic Weight and Balance Record), and DD Form 365-4 (Weight and Balance Clearance Form F) to aid the pilot in computing the gross weight and cg of the helicopter.

b. Longitudinal Center-of-Gravity Chart. The longitudinal center-of-gravity chart (fig. 6-5) is a graphics-type table with gross weight as a vertical scale and the moment arm fuselage station as the horizontal scale. All allowable points from minimum flying weight (3350 lbs) to maximum gross weight (5500 lbs) and from most forward cg station 106.5 to most aft cg station 113.0 are depicted. Longitudinal moments (total moment/100) are shown on the chart as diagonal lines. The chart is used to determine that gross weight and cg are within limitations using the pre-computations on DD Form 365-4, (Form F - Weight and Balance Clearance). An example of how to apply the weights and moments from Form F to determine helicopter cg is shown on the chart. For loading of weapons system, mission equipment, and cargo refer to tables 6-1 and 6-3.

c. Lateral Center-of-Gravity Chart. The lateral center-of-gravity limits charts (fig. 6-6) are graphics-style tables with gross weight as the vertical scale and moment arm (lateral cg - bl) as the horizontal scale.

Within the flight limits these are regions of restricted flight and takeoff/landing capabilities. For loading of weapons system, mission equipment, and cargo see tables 6-2 and 6-4.

(1) All useful load conditions will remain within the flight limits of ± 4.0 inches with all combinations of armament (including jettison of one side), fuel and crew loading as long as the maximum crew weight differential is 65.0 lbs.

FUEL LOADING

FUEL MOMENT

EXAMPLE

WANTED

WEIGHT AND MOMENT FOR GIVEN QUANTITY OF USABLE FUEL

KNOWN

107.7 U.S. GALLONS OF JP-4 FUEL

METHOD

ENTER AT 107.7 GALLONS ON JP-4 SCALE. MOVE RIGHT TO READ WEIGHT 700 POUNDS. CONTINUE RIGHT TO INTERSECT DIAGONAL LINE. THEN PROJECT DOWN TO READ 793 ON MOMENT/100 SCALE.

EXAMPLE

WANTED

WEIGHT AND MOMENT FOR A GIVEN QUANTITY OF USABLE FUEL

KNOWN

107.7 U.S. GALLONS OF JP-8/JP-5 FUEL

METHOD

ENTER AT 107.7 GALLONS ON JP-8/JP-5 SCALE. MOVE LEFT TO READ WEIGHT 732 POUNDS. INTERSECT DIAGONAL LINE. THEN PROJECT DOWN TO READ 829 ON MOMENT/100 SCALE.

NOTE

THIS CHART PRESENTS FUEL MOMENT AS A FUNCTION OF WEIGHT UTILIZING A SINGLE CURVE FOR ALL FUEL TYPES. GALLON EQUIVALENT SCALES ARE BASED ON NOMINAL DENSITIES AT 15°C.

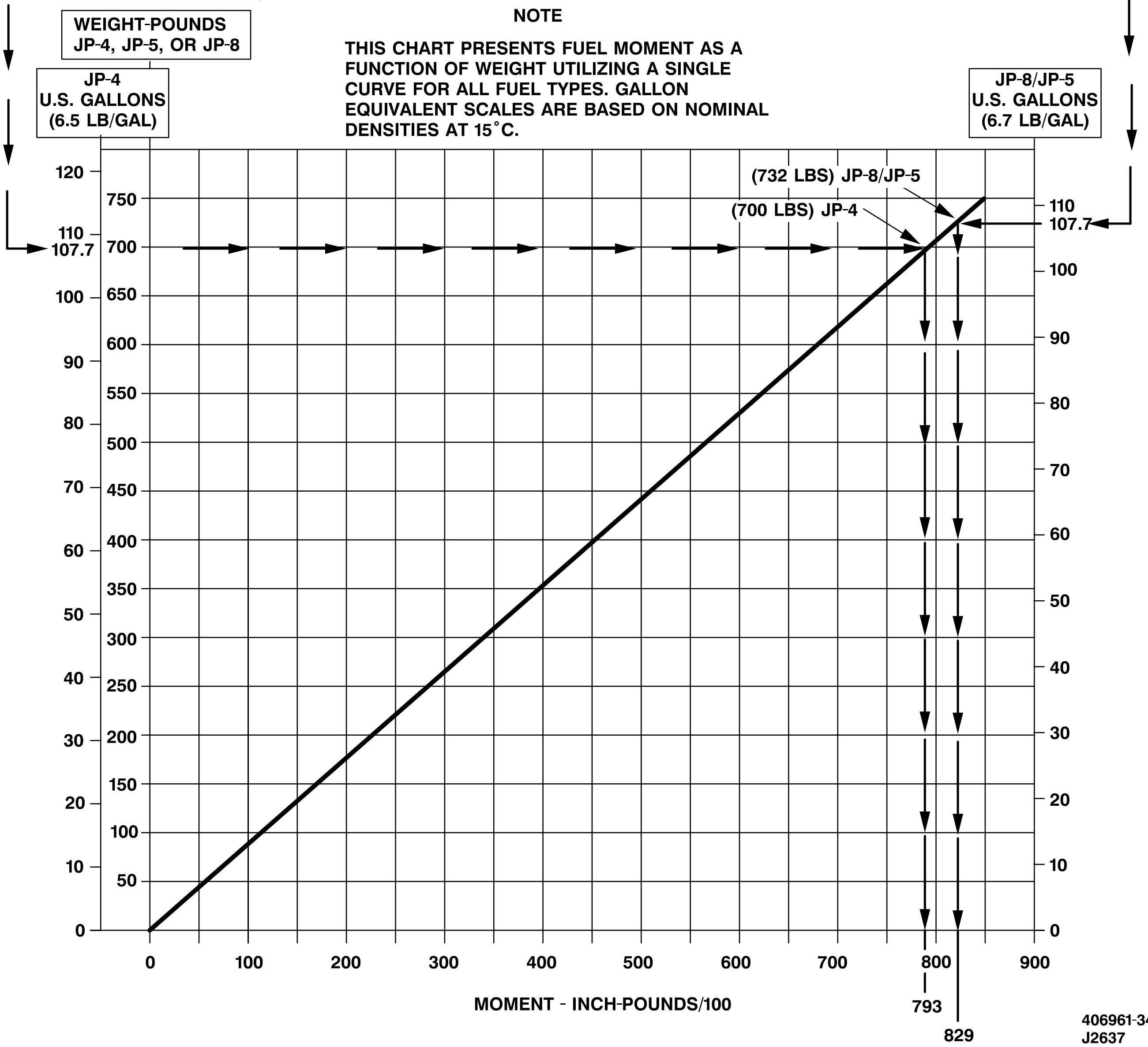


Figure 6-2. Fuel Moment Chart

CREW LONGITUDINAL MOMENT CHART

MOMENT FOR PERSONNEL

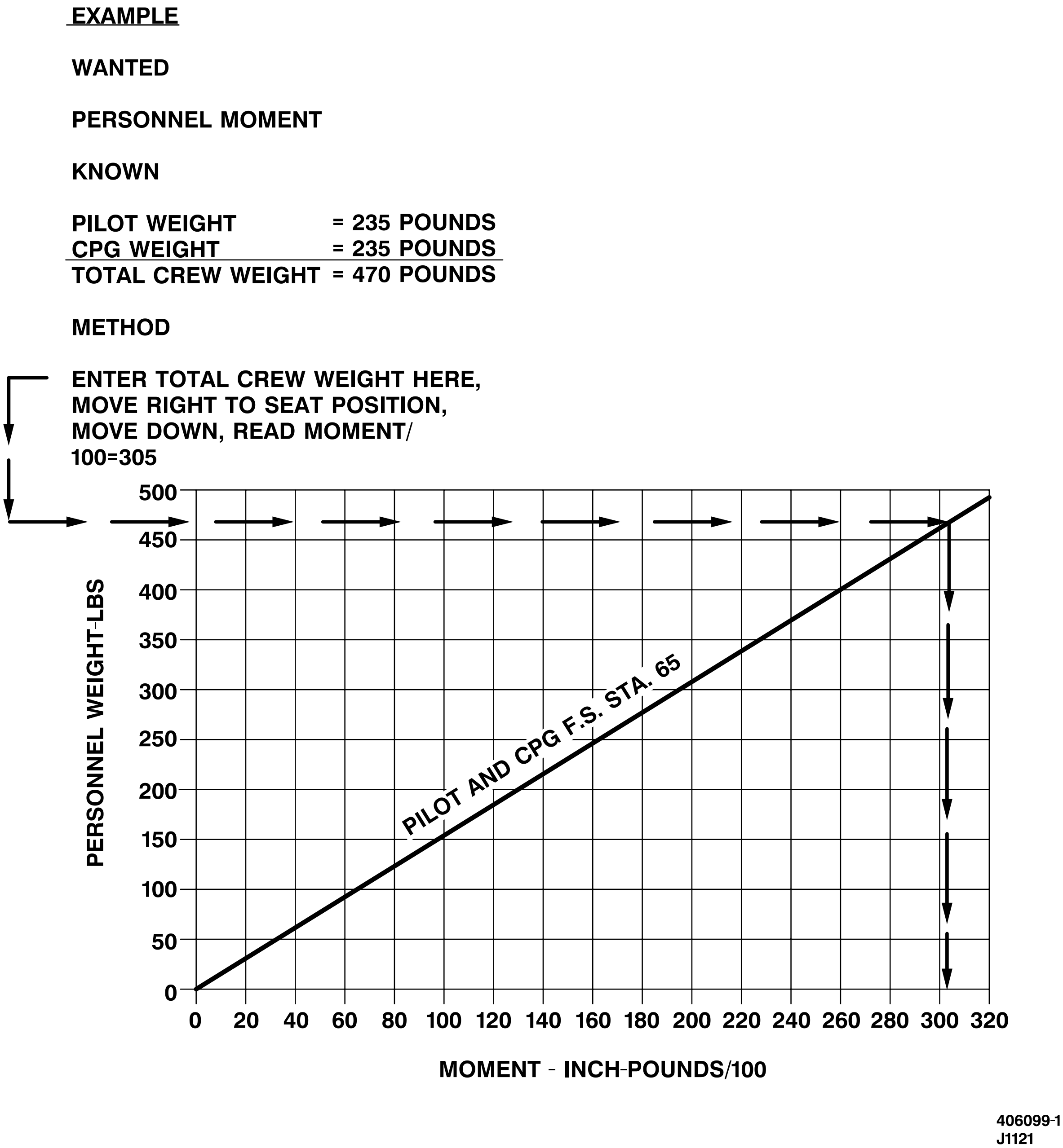
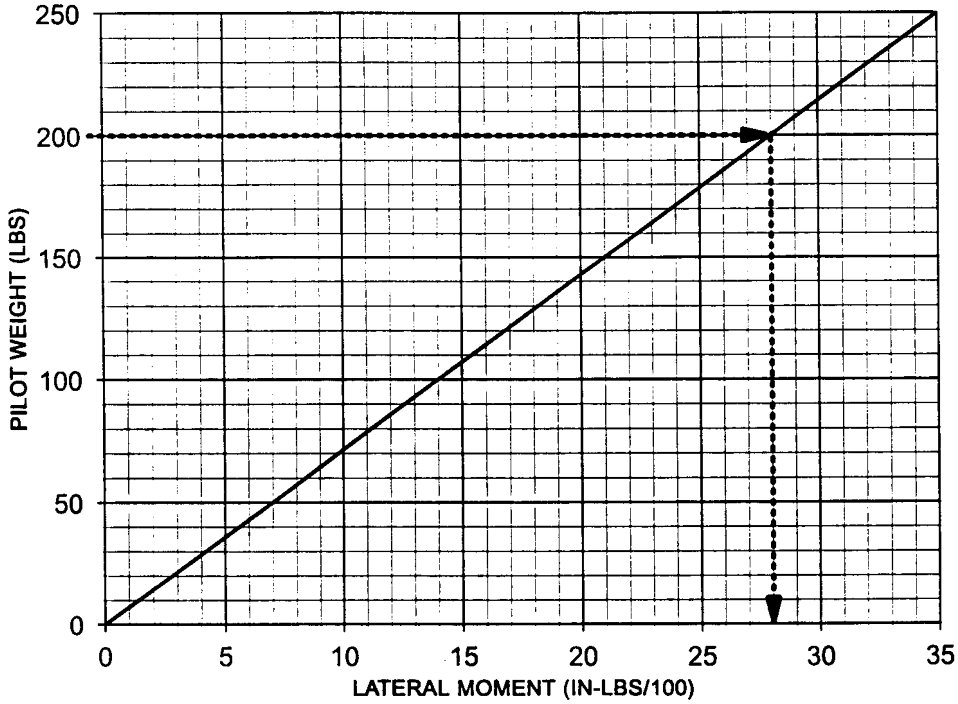


Figure 6-3. Crew Longitudinal Moment Chart

CREW LATERAL MOMENT CHART
PILOT



EXAMPLE

WANTED:
Lateral moment for pilot.

KNOWN:
Pilot weight of 200 pounds.

METHOD:
Move right from 200 pounds to pilot moment line.
Move down to read 28 inch-pounds/100.

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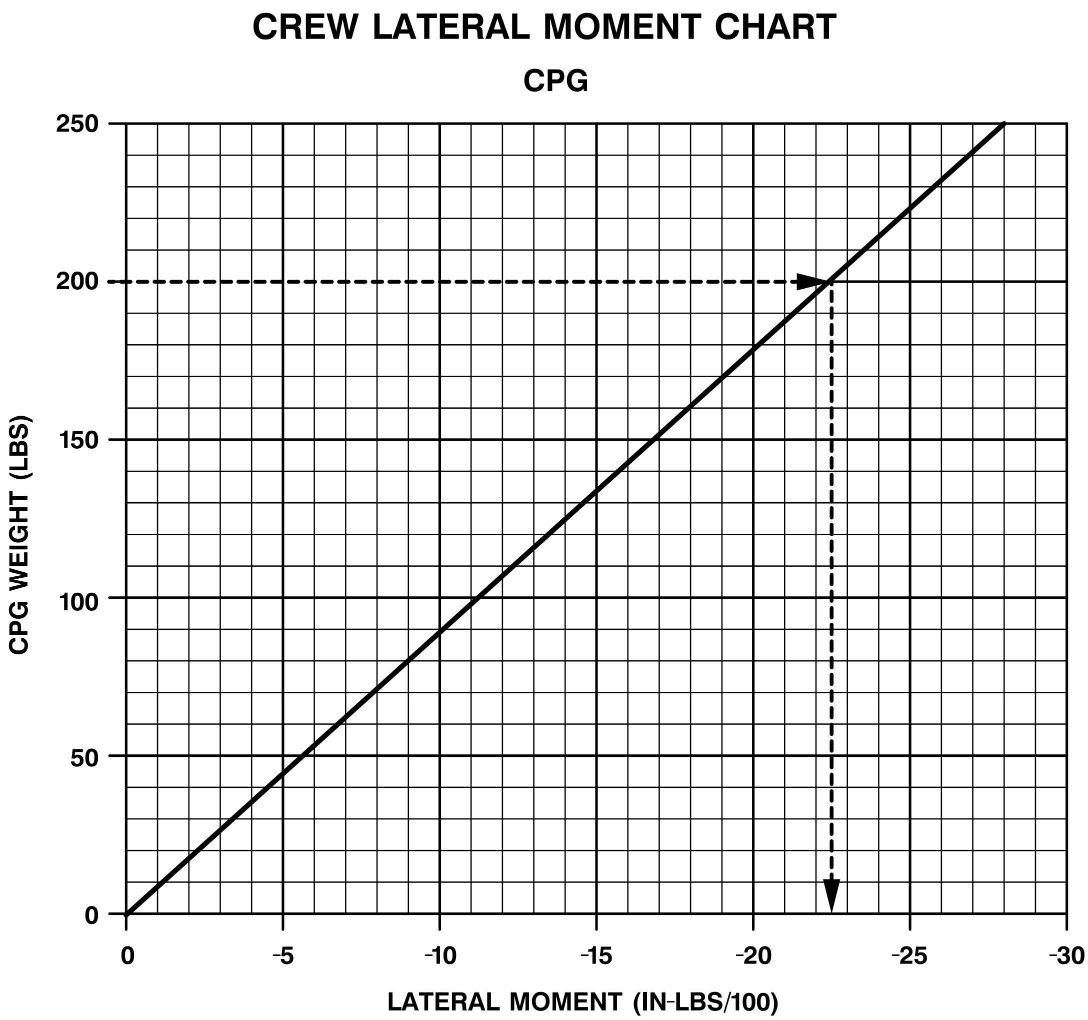
H5260

Figure 6-4. Crew Lateral Moment Chart (Sheet 1 of 2)



EXAMPLE

WANTED:
Lateral moment for CPG.

KNOWN:
CPG weight of 200 pounds.

METHOD:
Move right from 200 pounds to CPG moment line.
Move down to read -22.6 inch-pounds/100.

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J1121

Figure 6-4. Crew Lateral Moment Chart (Sheet 2 of 2)

CENTER-OF-GRAVITY LIMITS

EXAMPLE

WANTED:

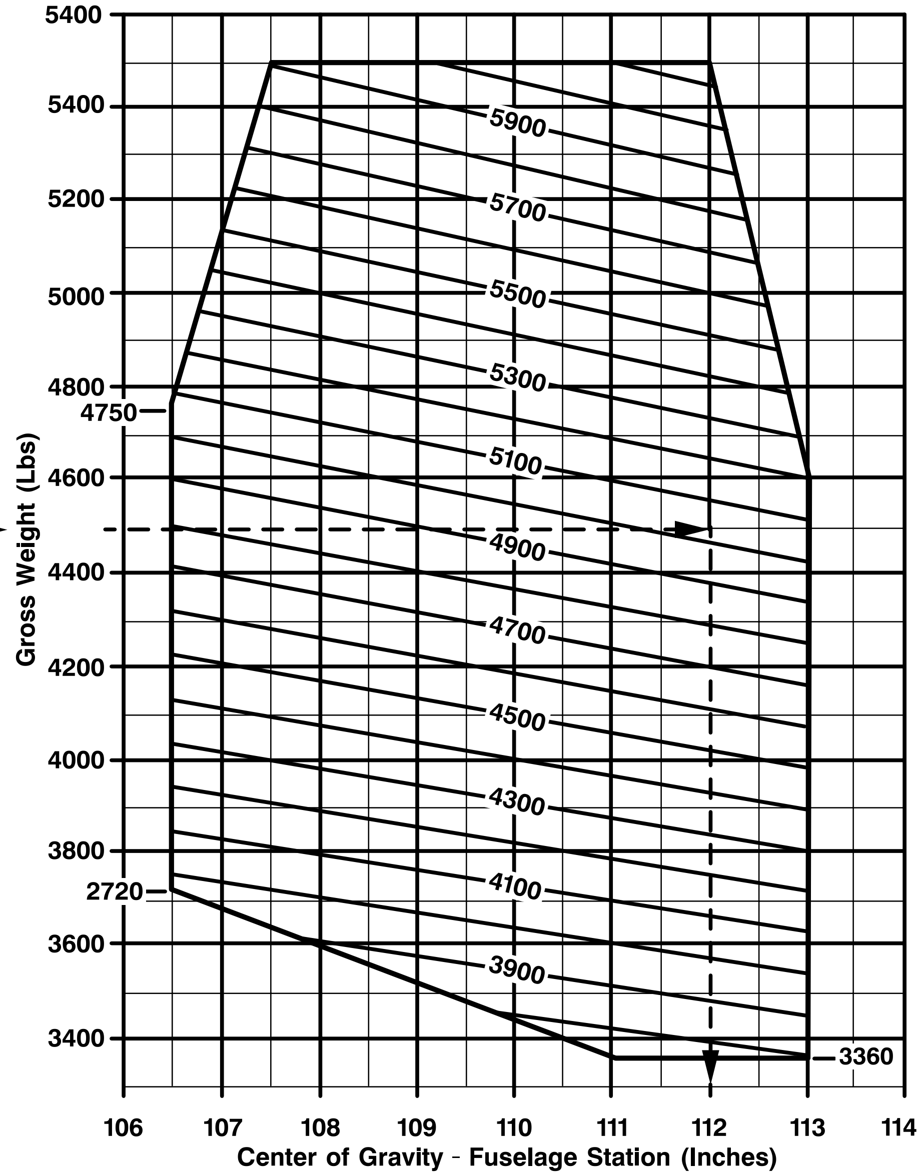
Determine if Center of Gravity for known weight is within CG flight limitations.

KNOWN:

Gross weight = 4500 pounds
Moment/100 = 5040 inch-pounds
(From DD Form 365-4)

METHOD
Enter gross weight here
Move right to diagonal moment line. From this point move down to read Center of Gravity if desired.

NOTE: Diagonal moment lines are moment/100



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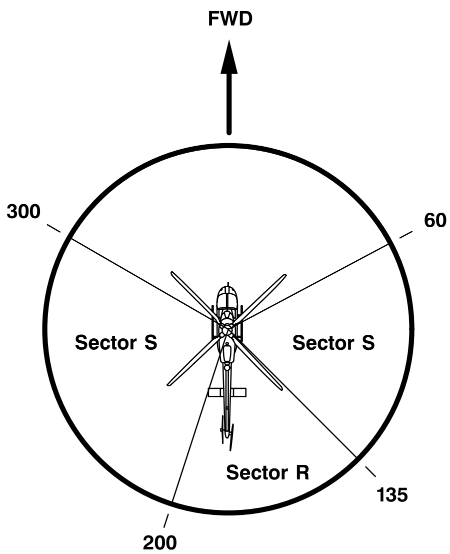
J1938

Figure 6-5. Longitudinal Center-of-Gravity Limits Chart

Diagram 1.



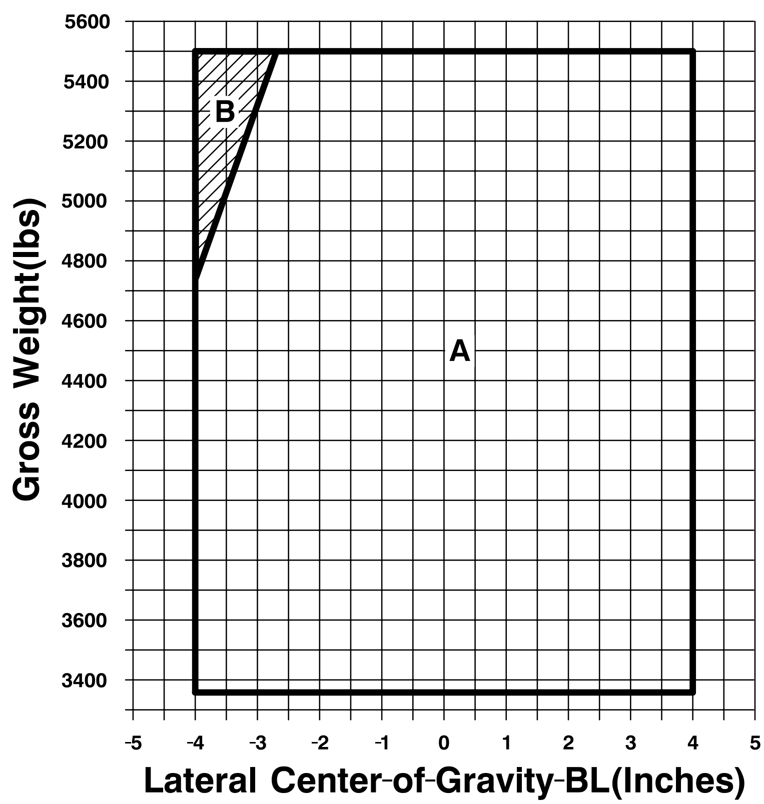
Condition A: 35 Knots sideward & rearward (Azimuth 60 to 300 degrees)
10 degrees slope takeoff & landings

Condition B: 35 Knots sideward (See Diagram 1 Sector S)
20 Knots rearward (See Diagram 1 Sector R)
5 degrees slope takeoff & landings

NOTE: All rearward flights without scoops are limited to 20 Knots.

LATERAL CENTER-OF-GRAVITY LIMITS

BELOW 2000 FT WITH SCOOPS



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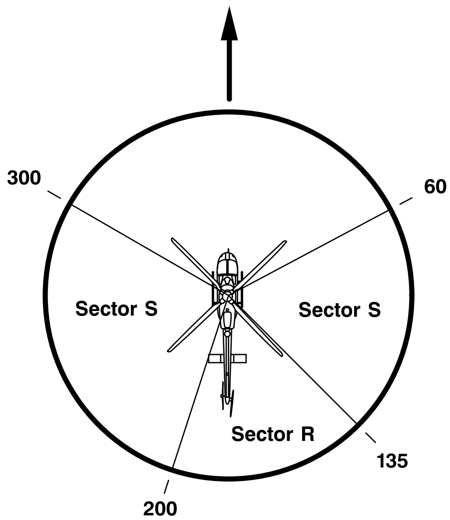
J1160

Figure 6-6. Lateral Center-of-Gravity Limits Chart (Sheet 1 of 2)

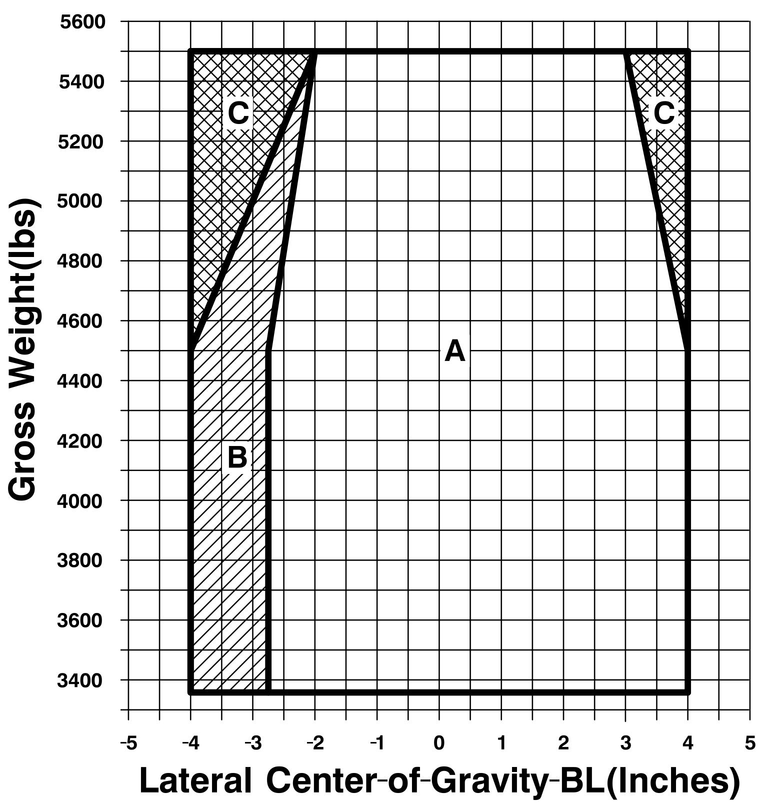
Diagram 1.



Condition A: 35 Knots sideward & rearward (Azimuth 60 to 300 degrees)
10 degrees slope takeoff & landings
Condition B: 35 Knots sideward (See Diagram 1 Sector S)
20 Knots rearward (See Diagram 1 Sector R)
5 degrees slope takeoff & landings
Condition C: 20 Knots sideward & rearward (Azimuth 60 to 300 degrees)
5 degrees slope takeoff & landings
NOTES: All rearward flights without scoops are limited to 20 Knots.
For conditions A, B, or C, refer to tables 6-7 and 6-8.

LATERAL CENTER-OF-GRAVITY LIMITS

ABOVE 2000 FT PA



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J2789

Figure 6-6. Lateral Center-of-Gravity Limits Chart (Sheet 2 of 2)

OH-58D — MASS PROPERTIES
ARMAMENT USEFUL LOAD ITEMS

TABLE 6-1. WEAPON SYSTEMS LONGITUDINAL LOADING

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LONGITUDINAL CG (IN)	MOMENT/100 (IN-LB)
.50 CALIBER MACHINE GUN (LEFT ONLY)			
MACHINE GUN	142.8	102.1	146
AMMO CAN	20.4	120.3	25
CHUTE	6.5	105.5	7
HARNESS	1.8	101.0	2
.50 CAL AMMO — 24 RDS (CHUTE CAPAC)	8.0	105.5	8
△1 .50 CAL AMMO — 100 RDS	33.4	115.5	39
△1 .50 CAL AMMO — 200 RDS	66.8	118.5	79
△1 .50 CAL AMMO — 300 RDS	100.2	119.5	120
△1 .50 CAL AMMO — 400 RDS	133.6	119.8	160
△1 .50 CAL AMMO — 500 RDS	167.0	120.2	201
AIR-TO-AIR STINGER (ATAS)			
MISSILE SIGHT SUBSYSTEM			
ATAS PDU (1)	6.4	54.5	3
ATAS PDU MOUNT (1)	4.3	54.4	2
MSS ELECTRONICS UNIT (1)	5.0	109.4	5
(LEFT OR RIGHT):			
LAUNCHER (1) (W/O TUBES)	36.2	95.8	35
LAUNCHER TUBE (1) (INBOARD)	5.2	90.1	5
LAUNCHER TUBE (1) (OUTBOARD)	5.2	90.1	5
LAUNCHER TUBES (2)	10.4	90.1	9
LAUNCHER ADAPTER (1)	15.3	104.6	16
HARNESS (1)	4.7	94.2	4
MISSILE (1) (INBOARD)	22.4	95.2	21
MISSILE (1) (OUTBOARD)	22.4	95.2	21
MISSILE (2)	44.8	95.2	43
ELEC COMP AND MOUNT (1)	11.6	100.8	12
(LEFT AND RIGHT):			
LAUNCHER (2) (W/O TUBES)	72.4	95.8	69
LAUNCHER TUBE (1) (INBOARD)	5.2	90.1	5
LAUNCHER TUBE (1) (OUTBOARD)	5.2	90.1	5
LAUNCHER TUBE (2) (IN- OR OUTBD)	10.4	90.1	9

TABLE 6-1. WEAPON SYSTEMS LONGITUDINAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LONGITUDINAL CG (IN)	MOMENT/100 (IN-LB)
LAUNCHER TUBE (3) (2 IN-, 1 OUTBD)	15.7	90.1	14
LAUNCHER TUBE (3) (1 IN-, 2 OUTBD)	15.7	90.1	14
LAUNCHER TUBE (4)	20.9	90.1	19
LAUNCHER ADAPTER (2)	30.6	104.6	32
HARNESS (2)	9.4	94.2	9
MISSILE (1) (INBOARD)	22.4	95.2	21
MISSILE (1) (OUTBOARD)	22.4	95.2	21
MISSILE (2) (IN- OR OUTBD)	44.8	95.2	43
MISSILE (3) (2 IN-, 1 OUTBD)	67.3	95.2	64
MISSILE (3) (1 IN-, 2 OUTBD)	67.3	95.2	64
MISSILE (4)	89.7	95.2	85
ELEC COMP AND MOUNT (1)	11.6	100.8	12
HELLFIRE			
(LEFT OR RIGHT):			
LAUNCHER (1)	93.0	97.8	91
HARNESS (1)	4.5	93.6	4
MISSILE (1) (INBOARD)	99.6	98.6	98
MISSILE (1) (OUTBOARD)	99.6	98.6	98
MISSILE (2)	199.2	98.6	196
REMOTE HF ELECT UNIT (1)	10.0	123.2	12
(LEFT AND RIGHT):			
LAUNCHER (2)	186.0	97.8	182
HARNESS (2)	9.0	93.6	8
MISSILE (1) (INBOARD)	99.6	98.6	98
MISSILE (1) (OUTBOARD)	99.6	98.6	98
MISSILE (2) IN- OR OUTBOARD)	199.2	98.6	196
MISSILE (3) (2 IN-, 1 OUTBD)	298.8	98.6	295
MISSILE (3) (1 IN-, 2 OUTBD)	298.8	98.6	295
MISSILE (4) (IN- OR OUTBD)	398.4	98.6	393
REMOTE HF ELECT UNIT (1)	10.0	123.2	12
HYDRA 70 2.75 INCH ROCKET SYSTEM			
(LEFT OR RIGHT):			
M260 LAUNCHER (1)	34.3	104.9	36
HARNESS (1)	2.1	94.3	2
ROCKET REMOTE UNIT (1)	5.5	102.7	6
(LEFT AND RIGHT)			
M260 LAUNCHER (2)	68.6	104.9	72

TABLE 6-1. WEAPON SYSTEMS LONGITUDINAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LONGITUDINAL CG (IN)	MOMENT/100 (IN-LB)
HARNESS (2)	4.2	94.3	4
ROCKET REMOTE UNIT (1)	5.5	102.7	6
ROCKETS (WARHEAD/FUZE/MOTOR): MULTIPURPOSE/RC:			
(LEFT OR RIGHT):			
M261/M439/MK66 (1)	27.1	97.7	26
M261/M439/MK66 (2)	54.2	97.7	53
M261/M439/MK66 (3)	81.3	97.7	79
M261/M439/MK66 (4)	108.4	97.7	106
M261/M439/MK66 (5)	135.5	97.7	132
M261/M439/MK66 (6)	162.6	97.7	159
M261/M439/MK66 (7)	189.7	97.7	185
(LEFT AND RIGHT):			
M261/M439/MK66 (1)	27.1	97.7	26
M261/M439/MK66 (2)	54.2	97.7	53
M261/M439/MK66 (3)	81.3	97.7	79
M261/M439/MK66 (4)	108.4	97.7	106
M261/M439/MK66 (5)	135.5	97.7	132
M261/M439/MK66 (6)	162.6	97.7	159
M261/M439/MK66 (7)	189.7	97.7	185
M261/M439/MK66 (8)	216.8	97.7	212
M261/M439/MK66 (9)	243.9	97.7	238
M261/M439/MK66 (10)	271.0	97.7	265
M261/M439/MK66 (11)	298.1	97.7	291
M261/M439/MK66 (12)	325.2	97.7	318
M261/M439/MK66 (13)	352.3	97.7	344
M261/M439/MK66 (14)	379.4	97.7	371
HE-17 LB/PT DET:			
(LEFT OR RIGHT):			
M229/M423/MK66 (1)	30.4	96.0	29
M229/M423/MK66 (2)	60.7	96.0	58
M229/M423/MK66 (3)	91.1	96.0	87
M229/M423/MK66 (4)	121.4	96.0	117
M229/M423/MK66 (5)	151.8	96.0	146
M229/M423/MK66 (6)	182.1	96.0	175
M229/M423/MK66 (7)	212.5	96.0	204
(LEFT AND RIGHT):			
M229/M423/MK66 (1)	30.4	96.0	29

TABLE 6-1. WEAPON SYSTEMS LONGITUDINAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LONGITUDINAL CG (IN)	MOMENT/100 (IN-LB)
M229/M423/MK66 (2)	60.7	96.0	58
M229/M423/MK66 (3)	91.1	96.0	87
M229/M423/MK66 (4)	121.4	96.0	117
M229/M423/MK66 (5)	151.8	96.0	146
M229/M423/MK66 (6)	182.1	96.0	175
M229/M423/MK66 (7)	212.5	96.0	204
M229/M423/MK66 (8)	242.8	96.0	233
M229/M423/MK66 (9)	273.2	96.0	262
M229/M423/MK66 (10)	303.5	96.0	291
M229/M423/MK66 (11	333.9	96.0	321
M229/M423/MK66 (12)	364.2	96.0	350
M229/M423/MK66 (13)	394.6	96.0	379
M229/M423/MK66 (14)	424.9	96.0	408
FLECHETTE — 10/LB/RC:			
(LEFT OR RIGHT):			
△2 WDU 4A/A/MK66 (1)	22.7	103.4	23
△2 WDU 4A/A/MK66 (2)	45.3	103.4	47
△2 WDU 4A/A/MK66 (3)	68.0	103.4	70
△2 WDU 4A/A/MK66 (4)	90.6	103.4	94
△2 WDU 4A/A/MK66 (5)	113.3	103.4	117
△2 WDU 4A/A/MK66 (6)	135.9	103.4	141
△2 WDU 4A/A/MK66 (7)	158.6	103.4	164
(LEFT AND RIGHT):			
△2 WDU 4A/A/MK66 (1)	22.7	103.4	23
△2 WDU 4A/A/MK66 (2)	45.3	103.4	47
△2 WDU 4A/A/MK66 (3)	68.0	103.4	70
△2 WDU 4A/A/MK66 (4)	90.6	103.4	94
△2 WDU 4A/A/MK66 (5)	113.3	103.4	117
△2 WDU 4A/A/MK66 (6)	135.9	103.4	141
△2 WDU 4A/A/MK66 (7)	158.6	103.4	164
△2 WDU 4A/A/MK66 (8)	181.2	103.4	187
△2 WDU 4A/A/MK66 (9)	203.9	103.4	211
△2 WDU 4A/A/MK66 (10)	226.5	103.4	234
△2 WDU 4A/A/MK66 (11)	249.2	103.4	258

TABLE 6-1. WEAPON SYSTEMS LONGITUDINAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LONGITUDINAL CG (IN)	MOMENT/100 (IN-LB)
2 WDU 4A/A/MK66 (12)	271.8	103.4	281
2 WDU 4A/A/MK66 (13)	294.5	103.4	305
2 WDU 4A/A/MK66 (14)	317.1	103.4	328
ILLUMINATION/RC:			
(LEFT OR RIGHT):			
M257/M442/MK66 (1)	24.2	99.0	24
M257/M442/MK66 (2)	48.4	99.0	48
M257/M442/MK66 (3)	72.7	99.0	72
M257/M442/MK66 (4)	96.9	99.0	96
M257/M442/MK66 (5)	121.1	99.0	120
M257/M442/MK66 (6)	145.3	99.0	144
M257/M442/MK66 (7)	169.5	99.0	168
(LEFT AND RIGHT):			
M257/M442/MK66 (1)	24.2	99.0	24
M257/M442/MK66 (2)	48.4	99.0	48
M257/M442/MK66 (3)	72.7	99.0	72
M257/M442/MK66 (4)	96.9	99.0	96
M257/M442/MK66 (5)	121.1	99.0	120
M257/M442/MK66 (6)	145.3	99.0	144
M257/M442/MK66 (7)	169.5	99.0	168
M257/M442/MK66 (8)	193.8	99.0	192
M257/M442/MK66 (9)	218.0	99.0	216
M257/M442/MK66 (10)	242.2	99.0	240
M257/M442/MK66 (11)	266.4	99.0	264
M257/M442/MK66 (12)	290.6	99.0	288
M257/M442/MK66 (13)	314.9	99.0	312
M257/M442/MK66 (14)	339.1	99.0	336
WHITE PHOSPHOROUS — 10 LB/PT DET:			
(LEFT OR RIGHT):			
M156/M423/MK66 (1)	23.0	103.7	24
M156/M423/MK66 (2)	45.9	103.7	48
M156/M423/MK66 (3)	68.9	103.7	71
M156/M423/MK66 (4)	91.8	103.7	95
M156/M423/MK66 (5)	114.8	103.7	119
M156/M423/MK66 (6)	137.7	103.7	143
M156/M423/MK66 (7)	160.7	103.7	167

TABLE 6-1. WEAPON SYSTEMS LONGITUDINAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LONGITUDINAL CG (IN)	MOMENT/100 (IN-LB)
(LEFT AND RIGHT):			
M156/M423/MK66 (1)	23.0	103.7	24
M156/M423/MK66 (2)	45.9	103.7	48
M156/M423/MK66 (3)	68.9	103.7	71
M156/M423/MK66 (4)	91.8	103.7	95
M156/M423/MK66 (5)	114.8	103.7	119
M156/M423/MK66 (6)	137.7	103.7	143
M156/M423/MK66 (7)	160.7	103.7	167
M156/M423/MK66 (8)	183.6	103.7	190
M156/M423/MK66 (9)	206.6	103.7	214
M156/M423/MK66 (10)	229.5	103.7	238
M156/M423/MK66 (11)	252.5	103.7	262
M156/M423/MK66 (12)	275.4	103.7	286
M156/M423/MK66 (13)	298.4	103.7	310
M156/M423/MK66 (14)	321.3	103.7	333
HE — 10 LB/PT DET:			
(LEFT OR RIGHT):			
M151/M423/MK66 (1)	23.0	103.7	24
M151/M423/MK66 (2)	45.9	103.7	48
M151/M423/MK66 (3)	68.9	103.7	71
M151/M423/MK66 (4)	91.8	103.7	95
M151/M423/MK66 (5)	114.8	103.7	119
M151/M423/MK66 (6)	137.7	103.7	143
M151/M423/MK66 (7)	160.7	103.7	167
(LEFT AND RIGHT):			
M151/M423/MK66 (1)	23.0	103.7	24
M151/M423/MK66 (2)	45.9	103.7	48
M151/M423/MK66 (3)	68.9	103.7	71
M151/M423/MK66 (4)	91.8	103.7	95
M151/M423/MK66 (5)	114.8	103.7	119
M151/M423/MK66 (6)	137.7	103.7	143
M151/M423/MK66 (7)	160.7	103.7	167
M151/M423/MK66 (8)	183.6	103.7	190
M151/M423/MK66 (9)	206.6	103.7	214
M151/M423/MK66 (10)	229.5	103.7	238
M151/M423/MK66 (11)	252.5	103.7	262
M151/M423/MK66 (12)	275.4	103.7	286
M151/M423/MK66 (13)	298.4	103.7	310
M151/M423/MK66 (14)	321.3	103.7	333

TABLE 6-1. WEAPON SYSTEMS LONGITUDINAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LONGITUDINAL CG (IN)	MOMENT/100 (IN-LB)
HE — 10 LB/PT DET HI-PERFORM:			
(LEFT OR RIGHT):			
M151/M427/MK66 (1)	23.0	103.7	24
M151/M427/MK66 (2)	45.9	103.7	48
M151/M427/MK66 (3)	68.9	103.7	71
M151/M427/MK66 (4)	91.8	103.7	95
M151/M427/MK66 (5)	114.8	103.7	119
M151/M427/MK66 (6)	137.7	103.7	143
M151/M427/MK66 (7)	160.7	103.7	167
(LEFT AND RIGHT):			
M151/M427/MK66 (1)	23.0	103.7	24
M151/M427/MK66 (2)	45.9	103.7	48
M151/M427/MK66 (3)	68.9	103.7	71
M151/M427/MK66 (4)	91.8	103.7	95
M151/M427/MK66 (5)	114.8	103.7	119
M151/M427/MK66 (6)	137.7	103.7	143
M151/M427/MK66 (7)	160.7	103.7	167
M151/M427/MK66 (8)	183.6	103.7	190
M151/M427/MK66 (9)	206.6	103.7	214
M151/M427/MK66 (10)	229.5	103.7	238
M151/M427/MK66 (11)	252.5	103.7	262
M151/M427/MK66 (12)	275.4	103.7	286
M151/M427/MK66 (13)	298.4	103.7	310
M151/M427/MK66 (14)	321.3	103.7	333

NOTES:

△1 Includes 24 rounds chute ammunition.

△2 Fuze integral with warhead. No separate designator assigned.

△3 Launcher front lug is at FS 93.0, 22.3 inches aft of launcher front edge, at FS 70.7. Aft lug is at FS 107.0.

OH-58D — MASS PROPERTIES
ARMAMENT USEFUL LOAD ITEMS

TABLE 6-2. WEAPON SYSTEMS LATERAL LOADING

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LATERAL CG (IN)	MOMENT/100 (IN-LB)
.50 CALIBER MACHINE GUN (LEFT ONLY)			
MACHINE GUN	142.8	-51.3	-73
AMMO CAN	20.4	-31.7	-6
CHUTE	6.5	-36.2	-2
HARNESS	1.8	-36.9	-1
.50 CAL AMMO — 24 RDS (CHUTE CAPAC)	8.0	-36.2	-3
△1 .50 CAL AMMO — 100 RDS	33.4	-32.8	-11
△1 .50 CAL AMMO — 200 RDS	66.8	-32.2	-22
△1 .50 CAL AMMO — 300 RDS	100.2	-32.1	-32
△1 .50 CAL AMMO — 400 RDS	133.6	-32.0	-43
△1 .50 CAL AMMO — 500 RDS	167.0	-31.9	-53
AIR-TO-AIR STINGER (ATAS)			
MISSILE SIGHT SUBSYSTEM			
ATAS PDU (1)	6.4	14.0	1
ATAS PDU MOUNT (1)	4.3	14.0	1
MSS ELECTRONICS UNIT (1)	5.0	12.8	1
(LEFT OR RIGHT)(LATERAL C.G. ±):			
LAUNCHER (1) (W/O TUBES)	36.2	51.6	19
LAUNCHER (1)(INBOARD)	5.2	47.6	2
LAUNCHER (1)(OUTBOARD)	5.2	55.6	3
LAUNCHER TUBES (2)	10.4	51.6	5
LAUNCHER ADAPTER (1)	15.3	51.6	8
HARNESS (1)	4.7	36.9	2
MISSILE (1)(INBOARD)	22.4	47.6	11
MISSILE (1)(OUTBOARD)	22.4	55.6	12
MISSILE (2)	44.8	51.6	23
ELEC COMP AND MOUNT (1)(ONLY LOC)	11.6	13.4	2
(LEFT AND RIGHT):			
LAUNCHER (2) (W/O TUBES)	72.4	0.0	0
LAUNCHER TUBE (1) (INBOARD ±)	5.2	47.6	2
LAUNCHER TUBE (1) (OUTBOARD ±)	5.2	55.6	3
LAUNCHER TUBE (2) (IN- OR OUTBD)	10.4	0.0	0

TABLE 6-2. WEAPON SYSTEMS LATERAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LATERAL CG (IN)	MOMENT/100 (IN-LB)
LAUNCHER TUBE (3) (2 IN-, 1 OUTBD ±)	15.7	18.5	3
LAUNCHER TUBE (3) (1 IN-, 2 OUTBD ±)	15.7	15.9	2
LAUNCHER TUBE (4)	20.9	0.0	0
LAUNCHER ADAPTER (2)	30.6	0.0	0
HARNESS (2)	9.4	0.0	0
MISSILE (1) (INBOARD ±)	22.4	47.6	11
MISSILE (1) (OUTBOARD ±)	22.4	55.6	12
MISSILE (2) (IN- OR OUTBD)	44.8	0.0	0
MISSILE (3) (2 IN-, 1 OUTBD ±)	67.3	18.5	12
MISSILE (3) (1 IN-, 2 OUTBD ±)	67.3	15.9	11
MISSILE (4)	89.7	0.0	0
ELEC COMP AND MOUNT (1)(ONLY LOC)	11.6	13.4	2
HELLFIRE			
(LEFT OR RIGHT)(LATERAL C.G. ±):			
LAUNCHER (1)	93.0	51.6	48
HARNESS (1)	4.5	36.9	2
MISSILE (1) (INBOARD)	99.6	45.2	45
MISSILE (1) (OUTBOARD)	99.6	58.1	58
MISSILE (2)	199.2	51.6	103
REMOTE HF ELECT UNIT (1)(ONLY LOC)	10.0	-6.6	-1
(LEFT AND RIGHT):			
LAUNCHER (2)	186.0	0.0	0
HARNESS (2)	9.0	0.0	0
MISSILE (1) (INBOARD ±)	99.6	45.2	45
MISSILE (1) (OUTBOARD ±)	99.6	58.1	58
MISSILE (2) IN- OR OUTBOARD)	199.2	0.0	0
MISSILE (3) (2 IN-, 1 OUTBD ±)	298.8	19.4	58
MISSILE (3) (1 IN-, 2 OUTBD ±)	298.8	15.1	45
MISSILE (4) (IN- OR OUTBD)	398.4	0.0	0
REMOTE HF ELECT UNIT (1)(ONLY LOC)	10.0	-6.6	-1
HYDRA 70 2.75 INCH ROCKET SYSTEM			
(LEFT OR RIGHT)(LATERAL C.G. ±):			
M260 LAUNCHER (1)	34.3	51.6	18
HARNESS (1)	2.1	36.9	1
ROCKET REMOTE UNIT (1)(ONLY LOC)	5.5	4.4	0
(LEFT AND RIGHT):			
M260 LAUNCHER (2)	68.6	0.0	0

TABLE 6-2. WEAPON SYSTEMS LATERAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LATERAL CG (IN)	MOMENT/100 (IN-LB)
HARNESS (2)	4.2	0.0	0
ROCKET REMOTE UNIT (1)(ONLY LOC)	5.5	4.4	0
ROCKETS (WARHEAD/FUZE/MOTOR): MULTIPURPOSE/RC:			
(LEFT OR RIGHT)(LATERAL C.G. ±):			
M261/M439/MK66 (1)	27.1	51.6	14
M261/M439/MK66 (2)	54.2	51.6	28
M261/M439/MK66 (3)	81.3	51.6	42
M261/M439/MK66 (4)	108.4	51.6	56
M261/M439/MK66 (5)	135.5	51.6	70
M261/M439/MK66 (6)	162.6	51.6	84
M261/M439/MK66 (7)	189.7	51.6	98
(LEFT AND RIGHT):			
M261/M439/MK66 (1) (±)	27.1	51.6	14
M261/M439/MK66 (2)	54.2	0.0	0
M261/M439/MK66 (3) (±)	81.3	17.2	14
M261/M439/MK66 (4)	108.4	0.0	0
M261/M439/MK66 (5) (±)	135.5	10.3	14
M261/M439/MK66 (6)	162.6	0.0	0
M261/M439/MK66 (7) (±)	189.7	7.4	14
M261/M439/MK66 (8)	216.8	0.0	0
M261/M439/MK66 (9) (±)	243.9	5.7	14
M261/M439/MK66 (10)	271.0	0.0	0
M261/M439/MK66 (11) (±)	298.1	4.7	14
M261/M439/MK66 (12)	325.2	0.0	0
M261/M439/MK66 (13) (±)	352.3	4.0	14
M261/M439/MK66 (14)	379.4	0.0	0
HE-17 LB/PT DET:			
(LEFT OR RIGHT)(LATERAL C.G. ±):			
M229/M423/MK66 (1)	30.4	51.6	16
M229/M423/MK66 (2)	60.7	51.6	31
M229/M423/MK66 (3)	91.1	51.6	47
M229/M423/MK66 (4)	121.4	51.6	63
M229/M423/MK66 (5)	151.8	51.6	78
M229/M423/MK66 (6)	182.1	51.6	94
M229/M423/MK66 (7)	212.5	51.6	110
(LEFT AND RIGHT):			
M229/M423/MK66 (1)(±)	30.4	51.6	16

TABLE 6-2. WEAPON SYSTEMS LATERAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LATERAL CG (IN)	MOMENT/100 (IN-LB)
M229/M423/MK66 (2)	60.7	0.0	0
M229/M423/MK66 (3) (±)	91.1	17.2	16
M229/M423/MK66 (4)	121.4	0.0	0
M229/M423/MK66 (5) (±)	151.8	10.3	16
M229/M423/MK66 (6)	182.1	0.0	0
M229/M423/MK66 (7) (±)	212.5	7.4	16
M229/M423/MK66 (8)	242.8	0.0	0
M229/M423/MK66 (9) (±)	273.2	5.7	16
M229/M423/MK66 (10)	303.5	0.0	0
M229/M423/MK66 (11) (±)	333.9	4.7	16
M229/M423/MK66 (12)	364.2	0.0	0
M229/M423/MK66 (13) (±)	394.6	4.0	16
M229/M423/MK66 (14)	424.9	0.0	0
FLECHETTE — 10/LB/RC:			
(LEFT OR RIGHT)(LATERAL C.G. ±):			
△2 WDU 4A/A/MK66 (1)	22.7	51.6	12
△2 WDU 4A/A/MK66 (2)	45.3	51.6	23
△2 WDU 4A/A/MK66 (3)	68.0	51.6	35
△2 WDU 4A/A/MK66 (4)	90.6	51.6	47
△2 WDU 4A/A/MK66 (5)	113.3	51.6	58
△2 WDU 4A/A/MK66 (6)	135.9	51.6	70
△2 WDU 4A/A/MK66 (7)	158.6	51.6	82
(LEFT AND RIGHT):			
△2 WDU 4A/A/MK66 (1) (±)	22.7	51.6	12
△2 WDU 4A/A/MK66 (2)	45.3	0.0	0
△2 WDU 4A/A/MK66 (3) (±)	68.0	17.2	12
△2 WDU 4A/A/MK66 (4)	90.6	0.0	0
△2 WDU 4A/A/MK66 (5) (±)	113.3	10.3	12
△2 WDU 4A/A/MK66 (6)	135.9	0.0	0
△2 WDU 4A/A/MK66 (7) (±)	158.6	7.4	12
△2 WDU 4A/A/MK66 (8)	181.2	0.0	0
△2 WDU 4A/A/MK66 (9) (±)	203.9	5.7	12
△2 WDU 4A/A/MK66 (10)	226.5	0.0	0
△2 WDU 4A/A/MK66 (11) (±)	249.2	4.7	12

TABLE 6-2. WEAPON SYSTEMS LATERAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LATERAL CG (IN)	MOMENT/100 (IN-LB)
2 WDU 4A/A/MK66 (12)	271.8	0.0	0
2 WDU 4A/A/MK66 (13) (±)	294.5	4.0	12
2 WDU 4A/A/MK66 (14)	317.1	0.0	0
ILLUMINATION/RC:			
(LEFT OR RIGHT)(LATERAL C.G. ±):			
M257/M442/MK66 (1)	24.2	51.6	12
M257/M442/MK66 (2)	48.4	51.6	25
M257/M442/MK66 (3)	72.7	51.6	37
M257/M442/MK66 (4)	96.9	51.6	50
M257/M442/MK66 (5)	121.1	51.6	62
M257/M442/MK66 (6)	145.3	51.6	75
M257/M442/MK66 (7)	169.5	51.6	87
(LEFT AND RIGHT):			
M257/M442/MK66 (1) (±)	24.2	51.6	12
M257/M442/MK66 (2)	48.4	0.0	0
M257/M442/MK66 (3) (±)	72.7	17.2	12
M257/M442/MK66 (4)	96.9	0.0	0
M257/M442/MK66 (5) (±)	121.1	10.3	12
M257/M442/MK66 (6)	145.3	0.0	0
M257/M442/MK66 (7) (±)	169.5	7.4	12
M257/M442/MK66 (8)	193.8	0.0	0
M257/M442/MK66 (9) (±)	218.0	5.7	12
M257/M442/MK66 (10)	242.2	0.0	0
M257/M442/MK66 (11) (±)	266.4	4.7	12
M257/M442/MK66 (12)	290.6	0.0	0
M257/M442/MK66 (13) (±)	314.9	4.0	12
M257/M442/MK66 (14)	339.1	0.0	0
WHITE PHOSPHOROUS — 10 LB/PT DET:			
(LEFT OR RIGHT)(LATERAL C.G. ±):			
M156/M423/MK66 (1)	23.0	51.6	12
M156/M423/MK66 (2)	45.9	51.6	24
M156/M423/MK66 (3)	68.9	51.6	36
M156/M423/MK66 (4)	91.8	51.6	47
M156/M423/MK66 (5)	114.8	51.6	59
M156/M423/MK66 (6)	137.7	51.6	71
M156/M423/MK66 (7)	160.7	51.6	83

TABLE 6-2. WEAPON SYSTEMS LATERAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LATERAL CG (IN)	MOMENT/100 (IN-LB)
(LEFT AND RIGHT):			
M156/M423/MK66 (1) (±)	23.0	51.6	12
M156/M423/MK66 (2)	45.9	0.0	0
M156/M423/MK66 (3) (±)	68.9	17.2	12
M156/M423/MK662 (4)	91.8	0.0	0
M156/M423/MK66 (5) (±)	114.8	10.3	12
M156/M423/MK66 (6)	137.7	0.0	0
M156/M423/MK66 (7) (±)	160.7	7.4	12
M156/M423/MK66 (8)	183.6	0.0	0
M156/M423/MK66 (9) (±)	206.6	5.7	12
M156/M423/MK66 (10)	229.5	0.0	0
M156/M423/MK66 (11) (±)	252.5	4.7	12
M156/M423/MK66 (12)	275.4	0.0	0
M156/M423/MK66 (13) (±)	298.4	4.0	12
M156/M423/MK66 (14)	321.3	0.0	0
HE — 10 LB/PT DET:			
(LEFT OR RIGHT)(LATERAL C.G. ±):			
M151/M423/MK66 (1)	23.0	51.6	12
M151/M423/MK66 (2)	45.9	51.6	24
M151/M423/MK66 (3)	68.9	51.6	36
M151/M423/MK66 (4)	91.8	51.6	47
M151/M423/MK66 (5)	114.8	51.6	59
M151/M423/MK66 (6)	137.7	51.6	71
M151/M423/MK66 (7)	160.7	51.6	83
(LEFT AND RIGHT):			
M151/M423/MK66 (1) (±)	23.0	51.6	12
M151/M423/MK66 (2)	45.9	0.0	0
M151/M423/MK66 (3) (±)	68.9	17.2	12
M151/M423/MK66 (4)	91.8	0.0	0
M151/M423/MK66 (5) (±)	114.8	10.3	12
M151/M423/MK66 (6)	137.7	0.0	0
M151/M423/MK66 (7) (±)	160.7	7.4	12
M151/M423/MK66 (8)	183.6	0.0	0
M151/M423/MK66 (9) (±)	206.6	5.7	12
M151/M423/MK66 (10)	229.5	0.0	0
M151/M423/MK66 (11) (±)	252.5	4.7	12
M151/M423/MK66 (12)	275.4	0.0	0
M151/M423/MK66 (13) (±)	298.4	4.0	12
M151/M423/MK66 (14)	321.3	0.0	0

TABLE 6-2. WEAPON SYSTEMS LATERAL LOADING (Cont)

WPNS SYS/USEFUL LOAD ITEM	WT (LB)	LATERAL CG (IN)	MOMENT/100 (IN-LB)
HE — 10 LB/PT DET HI-PERFORM:			
(LEFT OR RIGHT)(LATERAL C.G. ±):			
M151/M427/MK66 (1)	23.0	51.6	12
M151/M427/MK66 (2)	45.9	51.6	24
M151/M427/MK66 (3)	68.9	51.6	36
M151/M427/MK66 (4)	91.8	51.6	47
M151/M427/MK66 (5)	114.8	51.6	59
M151/M427/MK66 (6)	137.7	51.6	71
M151/M427/MK66 (7)	160.7	51.6	83
(LEFT AND RIGHT):			
M151/M427/MK66 (1) (±)	23.0	51.6	12
M151/M427/MK66 (2)	45.9	0.0	0
M151/M427/MK66 (3) (±)	68.9	17.2	12
M151/M427/MK66 (4)	91.8	0.0	0
M151/M427/MK66 (5) (±)	114.8	10.3	12
M151/M427/MK66 (6)	137.7	0.0	0
M151/M427/MK66 (7) (±)	160.7	7.4	12
M151/M427/MK66 (8)	183.6	0.0	0
M151/M427/MK66 (9) (±)	206.6	5.7	12
M151/M427/MK66 (10)	229.5	0.0	0
M151/M427/MK66 (11) (±)	252.5	4.7	12
M151/M427/MK66 (12)	275.4	0.0	0
M151/M427/MK66 (13) (±)	298.4	4.0	12
M151/M427/MK66 (14)	321.3	0.0	0

NOTES:

△1 Includes 24 rounds chute ammunition.

△2 Fuze integral with warhead. No separate designator assigned.

△3 Launcher front lug is at FS 93.0, 22.3 inches aft of launcher front edge, at FS 70.7. Aft lug is at FS 107.0.

TABLE 6-3. MISSION EQUIPMENT LONGITUDINAL LOADING

MISSION EQUIPMENT	WT (LB)	LONGITUDINAL CG (IN)	MOMENT/100 (IN-LB)
NIGHT VISION GOGGLES:			
NIGHT VISION GOGGLES — LEFT	2.0	65.0	1.3
NIGHT VISION GOGGLES — RIGHT	2.0	65.0	1.3
OPTICAL DISPLAY ASSY:			
OPTICAL DISPLAY ASSY — LEFT	0.4	65.0	0.3
OPTICAL DISPLAY ASSY — RIGHT	0.4	65.0	0.3
NBC MASKS WITH BLOWER SUPT:			
NBC MASKS WITH BLOWER SUPT — LEFT	13.3	82.4	11.0
NBC MASKS WITH BLOWER SUPT — RIGHT	13.3	82.4	11.0
CARGO HOOK:			
CARGO HOOK	32.3	112.6	36.4
MAXIMUM CARGO ON HOOK	2000.0	110.0	2200.0
RAPID DEPLOYMENT LANDING GEAR:			
△1 RAPID DEPLOYMENT LANDING GEAR	61.4	98.5	60.5
NOSE SUB-BATTERY BALLAST WEIGHT	20.0 ±1	15.0	3.0

NOTES:

△1 Adjustment to basic landing gear.

TABLE 6-4. MISSION EQUIPMENT LATERAL LOADING

MISSION EQUIPMENT	WT (LB)	LATERAL CG (IN)	MOMENT/100 (IN-LB)
NIGHT VISION GOGGLES:			
NIGHT VISION GOGGLES — LEFT	2.0	-11.3	-0.2
NIGHT VISION GOGGLES — RIGHT	2.0	14.0	0.3
OPTICAL DISPLAY ASSY:			
OPTICAL DISPLAY ASSY — LEFT	0.4	-11.3	-0.0
OPTICAL DISPLAY ASSY — RIGHT	0.4	14.0	0.1
NBC MASKS WITH BLOWER SUPT:			
NBC MASKS WITH BLOWER SUPT — LEFT	13.3	-13.9	-1.8
NBC MASKS WITH BLOWER SUPT — RIGHT	13.3	13.9	1.8
CARGO HOOK:			
CARGO HOOK	32.3	-1.7	-0.5
MAXIMUM CARGO ON HOOK	2000.0	0.0	0.0
RAPID DEPLOYMENT LANDING GEAR:			
⚠1 RAPID DEPLOYMENT LANDING GEAR	61.4	0.6	0.4
NOSE SUB-BATTERY BALLAST WEIGHT	20.0 ±1	1.0	0.2

NOTES:

1 Adjustment to basic landing gear.

Table 6-5. Lateral Loading Combinations (Below 2000 Feet PA)

Crew	Left Weapon	Left Ammo	Right Weapon	Right Ammo	Gross Wt	Condition
Up to +65 Left or Right	Any or Jettison	Any or Jettison	Any or Jettison	Any or Jettison	All	A
More than +65 Left	Any or Jettison	Any or Jettison	Any or Jettison	Any or Jettison	$<$ 5100	A
More than +65 Left	Any	Fully Loaded	Jettison	Jettison	$>$ 5100	B
More than +65 Right	Any or Jettison	Any or Jettison	Any or Jettison	Any or Jettison	All	A

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Table 6-6. Lateral Loading Combinations (Above 2000 Feet PA)

Crew	Left Weapon	Left Ammo	Right Weapon	Right Ammo	Gross Wt	Condition
Up to +65 Left	Hellfire	Fully Loaded	Any	Expended	$<$ 5150	B
Up to +65 Left	Hellfire	Fully Loaded	Any	Expended	$>$ 5150	C
Up to +65 Left	Hellfire	Fully Loaded	Jettisoned	Jettisoned	$<$ 4900	B
Up to +65 Left	Hellfire	Fully Loaded	Jettisoned	Jettisoned	$>$ 4900	C
Up to +65 Left	.50 cal Gun	Fully Loaded	Any	Expended	All	B
Up to +65 Left	.50 cal Gun	Fully Loaded	Jettisoned	Jettisoned	$<$ 5150	B
Up to +65 Left	.50 cal Gun	Fully Loaded	Jettisoned	Jettisoned	$>$ 5150	C
Up to +65 Left	Rocket	Fully Loaded	Any	Expended	All	A
Up to +65 Left	Rocket	Fully Loaded	Jettisoned	Jettisoned	All	B
Up to +65 Left	ATAS	Fully Loaded	Any	Expended or Jettisoned	All	A
More than +65 Left	Any	Fully Loaded	Any	Expended or Jettisoned	$<$ 4500	B
More than +65 Left	Any	Fully Loaded	Any	Expended or Jettisoned	$>$ 4500	C
Up to +65 Right	Any	Expended or Jettisoned	Any	Fully Loaded	All	A
More than +65 Right	Any	Expended or Jettisoned	Any	Fully Loaded	$<$ 4500	A
More than +65 Right	Any	Expended or Jettisoned	Any	Fully Loaded	$>$ 4500	C

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CHAPTER 7

PERFORMANCE DATA

SECTION I. INTRODUCTION

7-1. PURPOSE.

The purpose of this chapter is to provide the best available performance data for the OH-58D with a T703-AD-700A (250-C30R) or OH-58D **R** with a 250-C30R/3 engine. Regular use of this information will enable you to receive maximum safe utilization from the helicopter. The information provided in this chapter 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. Although maximum performance is not always required, regular use of this chapter is recommended for the following reasons.

a. Knowledge of your performance margin will allow you to make better decisions when unexpected conditions or alternate missions are encountered.

b. Situations requiring maximum performance will be more recognized.

c. Familiarity with the data will allow performance to be computed more easily and quickly.

d. Experience will be gained in accurately estimating the effects of variables for which data are presented.

7-2. 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, your judgement and experience will be necessary to accurately obtain 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. All performance data presented is within the applicable limits of the helicopter.

7-3. LIMITS.

Applicable limits are shown on the charts. Performance generally deteriorates rapidly beyond limits. If limits are exceeded, minimize the amount and time. Enter the maximum value and time above limits on DA Form 2408-13-1 or 2408-13-1E so proper maintenance action can be taken.

7-4. USE OF CHART.

a. Chart Explanation. The first page of each section describes the chart(s) and explains its uses.

b. Reading the Charts. The primary use of each chart is given in an example to help you follow the route through the chart. The use of of a straight edge (rule 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 the second variable, reflect down at right angles to the third variable, reflect left at right angles to the fourth variable, reflect down, etc., until the final variable is read out at the final scale. In addition to the primary use, other uses of each chart are explained in the text accompanying each set of performance charts.

NOTE

An example of an auxiliary use of the charts referenced above is as follows: Although the hover chart is primarily arranged to find torque required to hover, by entering torque available as required, maximum skid height for hover can be found. In general, any single variable can be found if all others are known. Also, the tradeoffs between two variables can be found. For example, at a given FAT and pressure altitude, you can find the maximum gross weight capability as free air temperature changes.

7-5. DATA BASIS.

The type of data used in each performance chart is generally based on one of the four categories;

a. Flight Test Data. Data obtained by flight test of the helicopter by experienced flight test personnel at precise conditions using sensitive calibrated instruments.

b. Derived From Flight Test. Flight test data obtained on a similar rather than the same helicopter and series. Generally small corrections will have been made.

c. Calculated Data. Data based on tests, but not on flight test of the complete helicopter.

d. Estimated Data. Data based on estimates using aerodynamics theory or other means but not verified by flight test.

7-6. 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 will be given.

7-7. GENERAL CONDITIONS.

In addition to the specified conditions, the following general conditions are applicable to the performance data.

a. Rigging. All airframe and engine controls are assumed to be rigged within allowable tolerances.

b. Pilot Technique. Normal pilot technique is assumed. Control movements should be smooth and continuous.

c. Helicopter Variations. Variations in performance between individual helicopters are known to exist; however, they are considered to be small and cannot be individually accounted for.

d. Instrument Variations. The data shown in the performance charts do not account for instrument inaccuracies or malfunctions.

7-8. PERFORMANCE DISCREPANCIES.

Regular use of this chapter will allow you to monitor instruments and other helicopter systems for malfunctions by comparing actual performance with planned performance. Knowledge will also be gained concerning the effects of variables for which data are not provided thereby increasing the accuracy of performance predictions.

7-9. DEFINITIONS OF ABBREVIATIONS.

a. Abbreviations and symbols used on the charts in this chapter are covered in Appendix B and conform to those established in Military Standard MIL-STD-12, which is periodically revised to reflect current changes in abbreviations usage. Accordingly, it may be noted that certain previously established definitions have been replaced by more current abbreviations and symbols.

b. For units of measure, the same abbreviation applies to either the singular or plural form of the unit.

c. Capitalization and punctuation of abbreviations varies, depending upon the context in which they are used. In general, lower case abbreviations are used in text material, whereas abbreviations used in illustrations appear in full capital letters. Periods do not usually follow abbreviations; however, periods are used with abbreviations that could be mistaken for whole words if the period were omitted.

7-10. TEMPERATURE CONVERSION.

The temperature conversion chart (figure 7-1) is arranged so that degrees Celsius can be converted quickly and easily by reading Celsius and looking directly across the chart for Fahrenheit equivalence and vice versa.

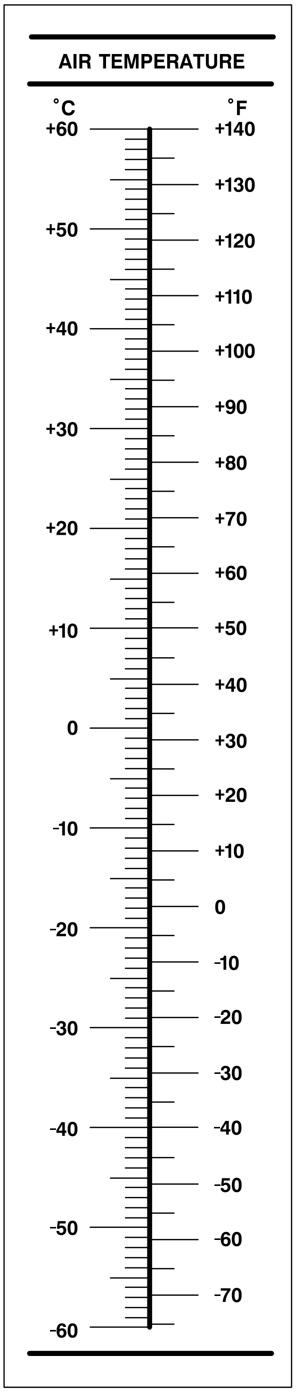

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Figure 7-1. Temperature Conversion Chart

SECTION II. PERFORMANCE PLANNING (NOT APPLICABLE)

SECTION III. MAST TORQUE AVAILABLE OH-58D (T703-AD-700A/250-C30R)

7-11. DESCRIPTION.

The maximum torque available charts (fig. 7-2, sheets 1 through 3) show the effects of altitude and temperature on mast torque and engine torque. Both pressure altitude and FAT affect engine power production. The chart shows power available data at 5 minute, 30 minute, and continuous operation power ratings in terms of the allowable torque as recorded by the torquemeter (%Q). Note that the power output capability of the T703-AD-700A (250-C30R) engine can exceed the transmission structural limit (100%Q) under certain conditions. All %Q data shown in this chapter is for mast torque.

Prolonged IGE hover may increase engine inlet temperature as much as 10 °C; therefore, a 10 °C higher FAT must be used to correct for this condition.

7-12. USE OF CHART.

Primary use of the chart is illustrated by the example. In general, to determine the maximum torque available, it is necessary to know the pressure altitude and temperature.

7-13. CONDITIONS.

The chart is based on NR, NP 100 percent, and JP-4 fuel, with bleed air heater and anti-ice off. Reduce torque available 3 percent if bleed air heater is on, 3.5 percent if anti-ice is on, and 6.5 percent if both systems are on. No reduction will occur if torque available is transmission limited.

NOTE

Fuel grade JP-8/JP-5 will yield the same nautical miles per pound as JP-4. Using JP-8/JP-5 will only result in increased fuel weight

MAXIMUM TORQUE AVAILABLE (5 MINUTE OPERATION)
WITH DIFFUSER , ANTI-ICE OFF & BLEED AIR HEATER OFF
100% RPM

MAXIMUM
TORQUE
OH-58D
T703-AD-700A

EXAMPLE

WANTED

MAST TORQUE

KNOWN

PRESSURE ALTITUDE=10000 FT
FAT=25°C

METHOD

ENTER FAT
MOVE RIGHT TO PRESSURE ALTITUDE
MOVE DOWN
READ 75% MAST TORQUE

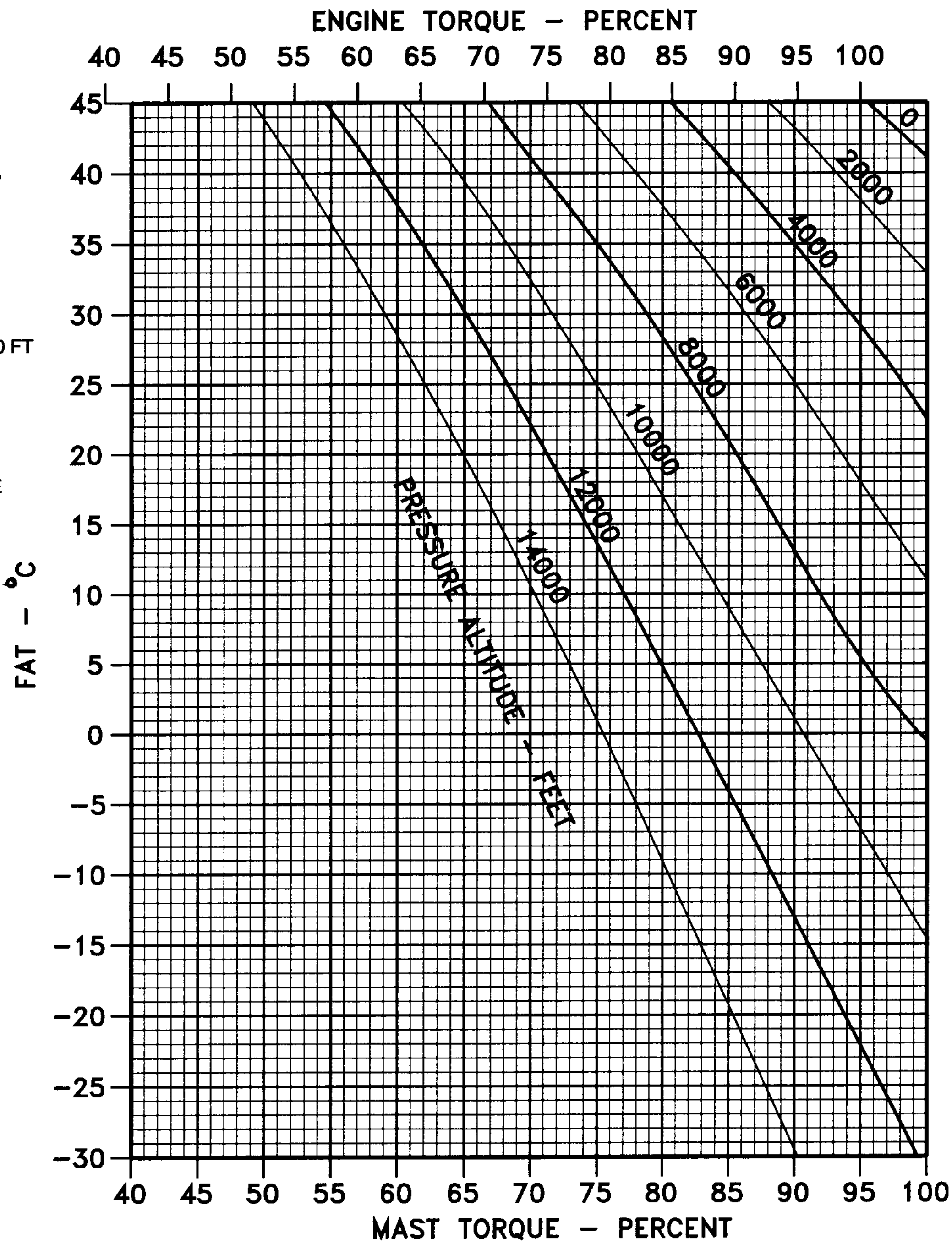

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Figure 7-2. Maximum Torque Available Chart (5 Minute Operation) (Sheet 1 of 3)

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)
WITH DIFFUSER, ANTI-ICE OFF & BLEED AIR HEATER OFF
100% RPM

MAXIMUM TORQUE
OH-58D
T703-AD-700A

EXAMPLE

WANTED

MAST TORQUE

KNOWN

PRESSURE ALTITUDE=6000 FT
FAT=30°C

METHOD

ENTER FAT
MOVE RIGHT TO PRESSURE ALTITUDE
MOVE DOWN
READ 81% MAST TORQUE

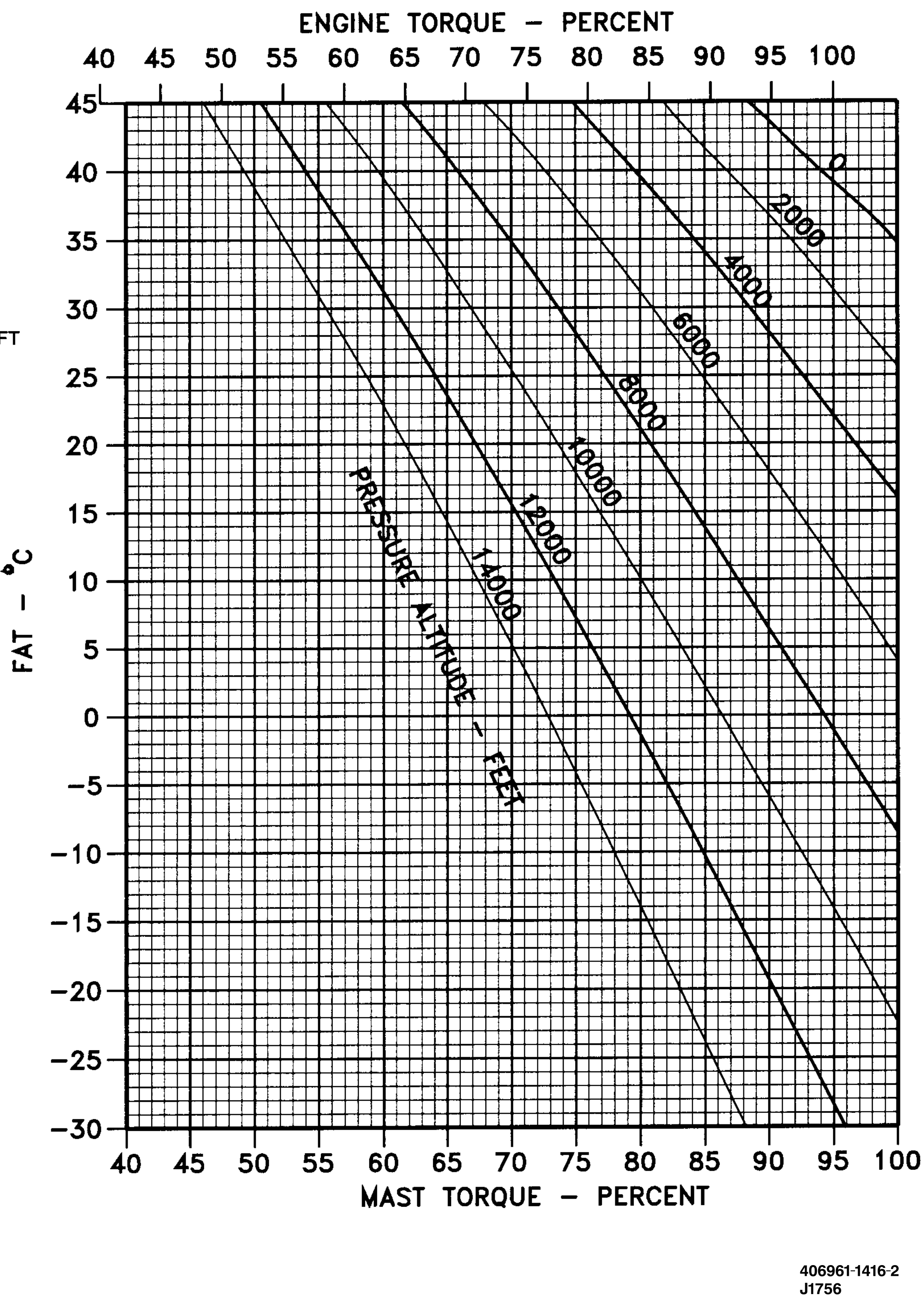

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Figure 7-2. Maximum Torque Available Chart (30 Minute Operation) (Sheet 2 of 3)

MAXIMUM TORQUE AVAILABLE (CONTINUOUS OPERATION)
WITH DIFFUSER, ANTI-ICE OFF & BLEED AIR HEATER OFF
100% RPM

MAXIMUM
TORQUE
OH-58D
T1703-AD-700A

EXAMPLE

WANTED

MAST TORQUE

KNOWN

PRESSURE ALTITUDE=4000 FT
FAT=25°C

METHOD

ENTER FAT
MOVE RIGHT TO PRESSURE ALTITUDE
MOVE DOWN
READ 71% MAST TORQUE

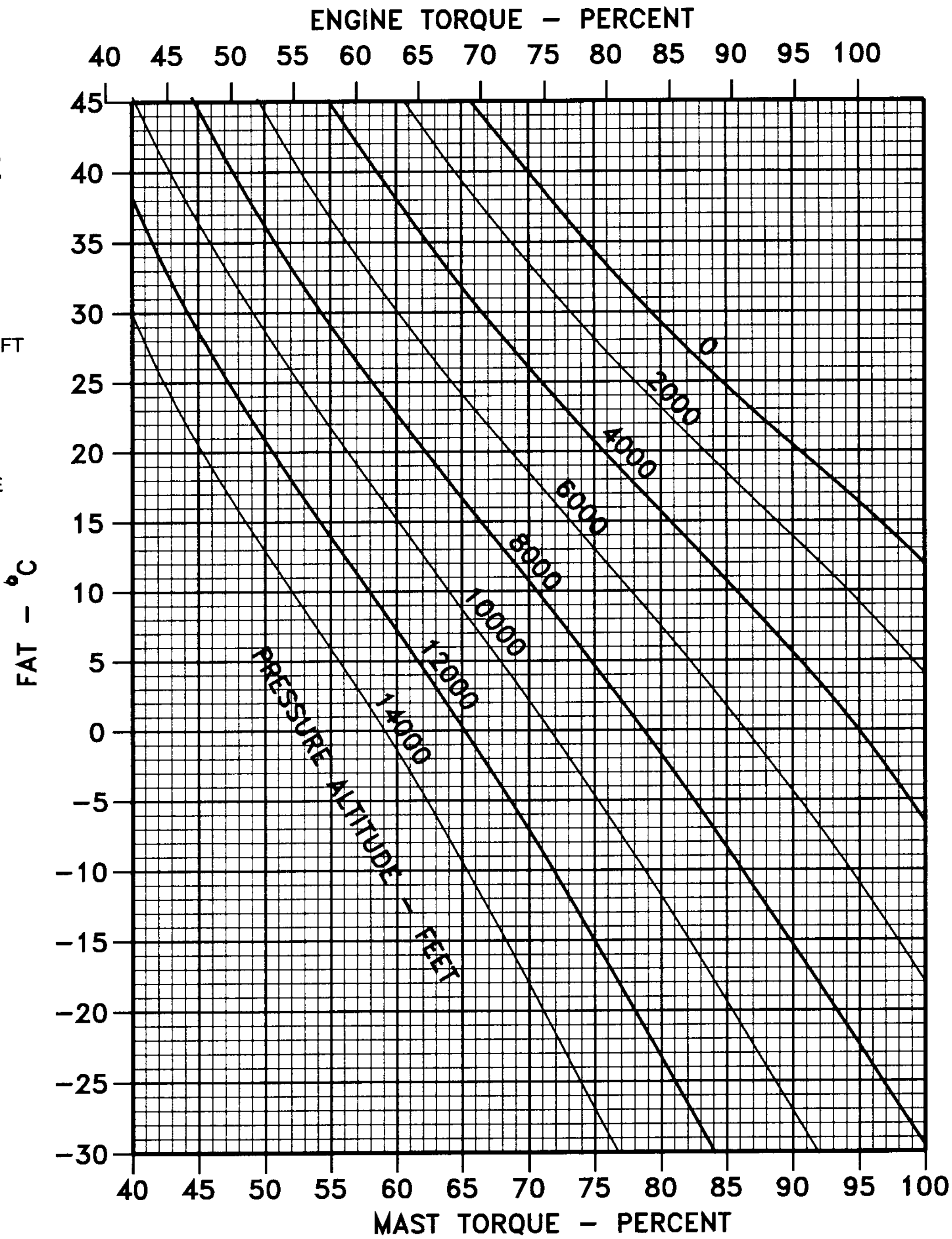

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Figure 7-2. Maximum Torque Available Chart (Continuous Operation) (Sheet 3 of 3)

SECTION IV. HOVER OH-58D (T703-AD-700A/250-C30R)

7-14. DESCRIPTION.

The hover charts (fig. 7-3 and 7-4) show hover ceiling and the torque required to hover respectively at various altitudes, ambient temperatures, gross weights, and skid heights. Maximum skid height for hover can also be obtained by using the torque available (fig. 7-2). The directional control capability is adequate to 35 knots for all azimuths.

7-15. USE OF CHART.

a. The primary use of the charts is illustrated by the examples. In general, to determine the hover ceiling or the torque required to hover, it is necessary to know the pressure altitude, temperature, gross weight, and the desired skid height.

b. In addition to its primary use, the hover chart, (fig. 7-4) can also be used to determine the predicted maximum hover height. To determine maximum hover height, proceed as follows:

(1) Enter chart at appropriate pressure altitude.

(2) Move right to FAT.

(3) Move down to gross weight.

(4) Move left to intersection with maximum mast torque available obtained from figure 7-2.

(5) Read predicted maximum skid height. The height is the maximum hover height.

7-16. CONDITIONS.

The hover charts are based upon calm wind conditions, a level ground surface, and the use of 100 percent rotor rpm. Controllability during downwind hovering, crosswinds, and rearward flight is adequate in wind conditions in accordance with para 5-12.

EXAMPLE

WANTED

MAXIMUM GROSS WEIGHT TO HOVER

KNOWN

SKID HEIGHT = 3 FEET
PRESSURE ALTITUDE = 14,000 FEET
FAT = 10°C
30 MINUTE TORQUE AVAILABLE AT 100% RPM

METHOD

ENTER OAT SCALE AT 10°C
MOVE RIGHT TO 14,000 FEET PRESSURE ALTITUDE
MOVE DOWN, READ MAXIMUM GROSS WEIGHT TO HOVER = 4550 LB

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HOVER CEILING
MAXIMUM TORQUE AVAILABLE (5 MINUTE OPERATION)
100% RPM

HOVER
CEILING
OH-58D
T703-AD-700A

EXAMPLE

WANTED

GROSS WEIGHT

KNOWN

PRESSURE ALTITUDE=6000 FT
FAT=+35°C
SKID HEIGHT=OGE

METHOD

ENTER FAT
MOVE RIGHT TO PRESSURE ALTITUDE
DROP DOWN, READ 4600 POUNDS

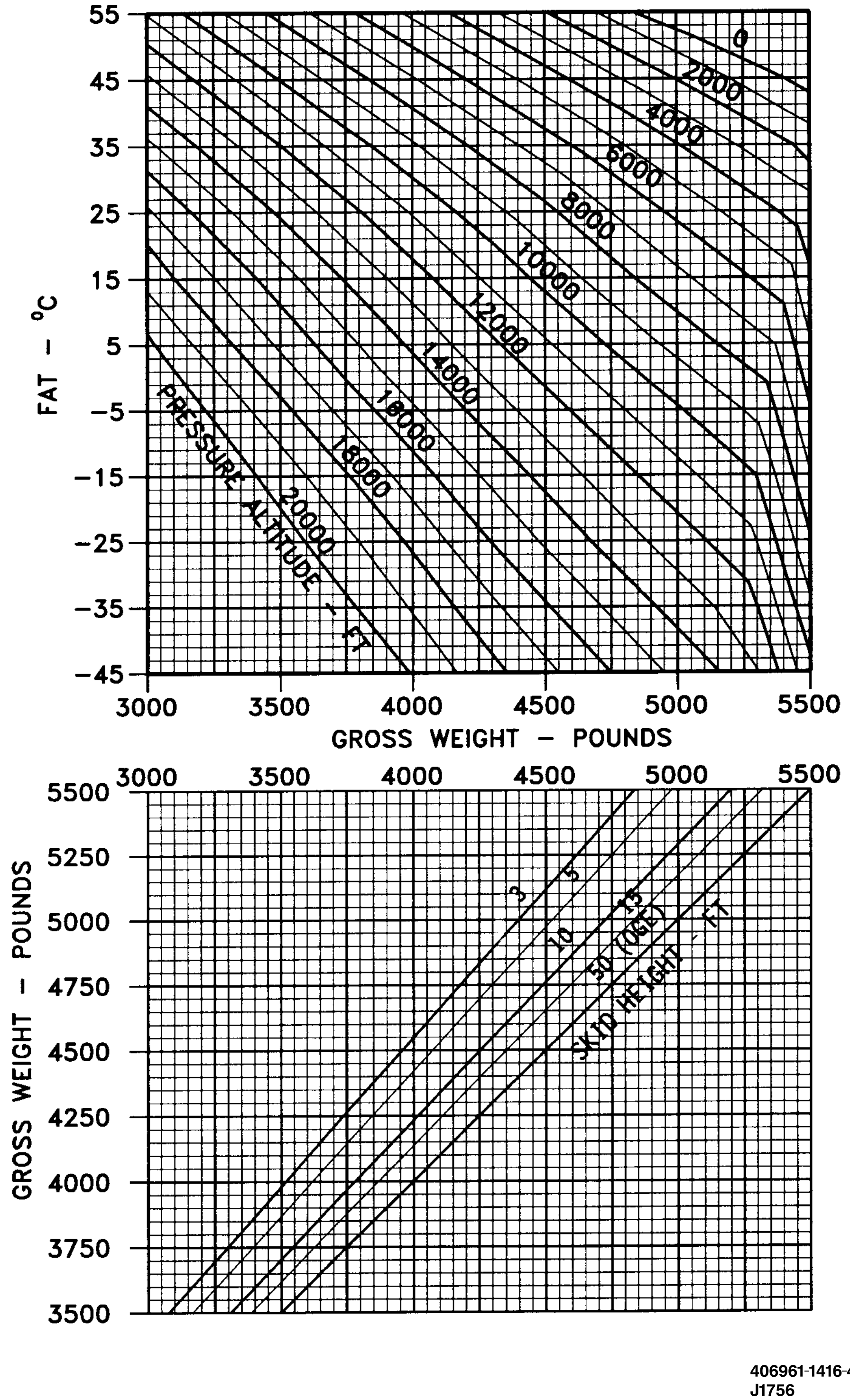

Figure 7-3. Hover Ceiling Charts (5 Minute Operation)(Sheet 1 of 2)

HOVER CEILING
MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)
100% RPM

HOVER CEILING
OH-58D
T703-AD-700A

EXAMPLE

WANTED

GROSS WEIGHT

KNOWN

PRESSURE ALTITUDE=6000 FT
FAT=+35°C
SKID HEIGHT=OGE

METHOD

ENTER FAT
MOVE RIGHT TO PRESSURE ALTITUDE
DROP DOWN, READ 4390 POUNDS

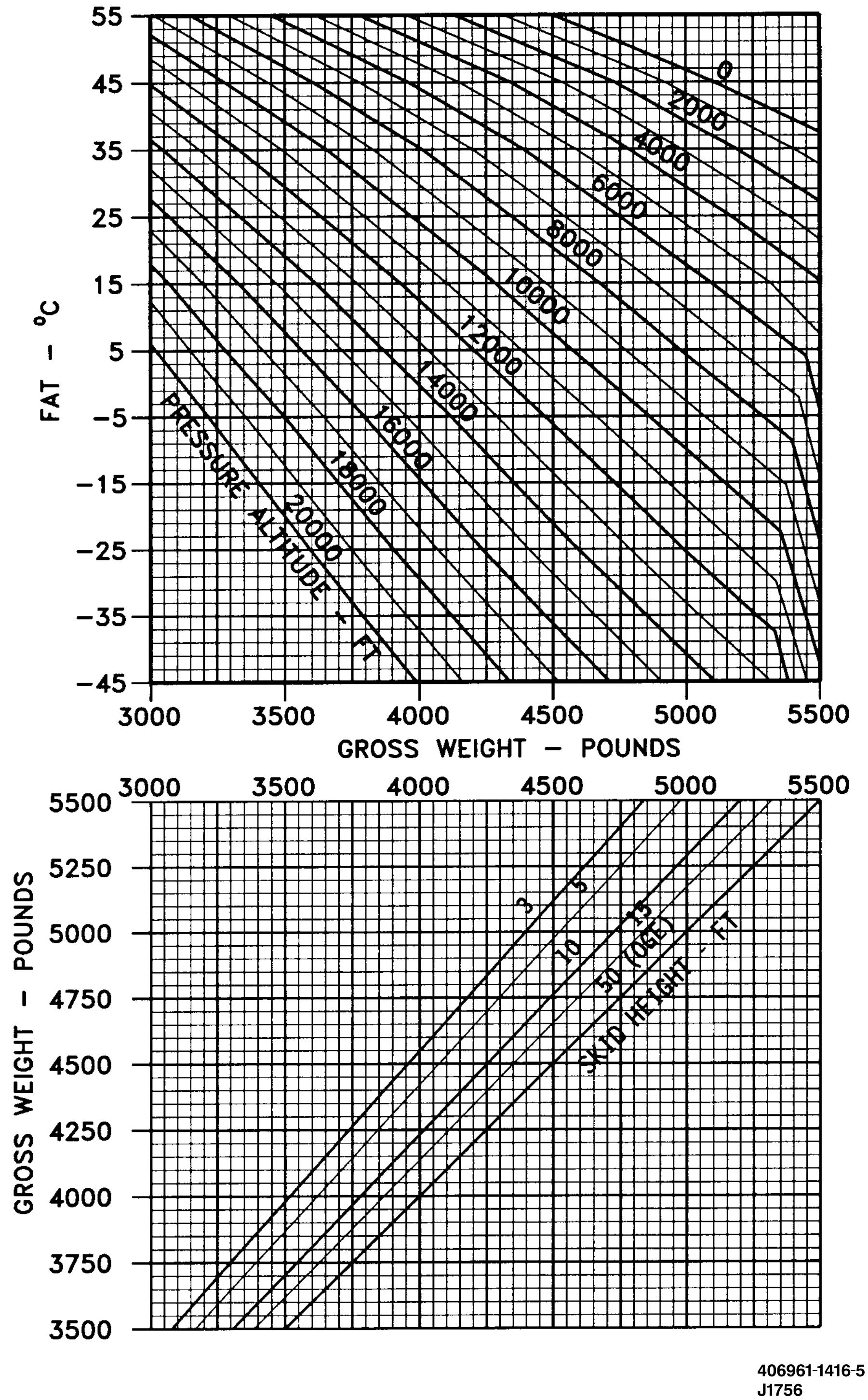

Figure 7-3. Hover Ceiling Charts (30 Minute Operation)(Sheet 2 of 2)

HOVER POWER REQUIRED
LEVEL SURFACE & CALM WIND
100% RPM

HOVER POWER REQUIRED
OH-58D
T703-AD-700A

EXAMPLE

WANTED

TORQUE REQUIRED TO HOVER

KNOWN

PRESSURE ALTITUDE = 9500 FEET
FAT = 0°C
GROSS WEIGHT = 4250 POUNDS
DESIRED SKID HEIGHT = 5 FEET

METHOD

ENTER PRESSURE ALTITUDE
MOVE RIGHT TO FAT
DROP DOWN TO 4250 LB GROSS WEIGHT
MOVE LEFT TO 5 FT SKID HEIGHT
DROP DOWN, READ 66%Q REQUIRED

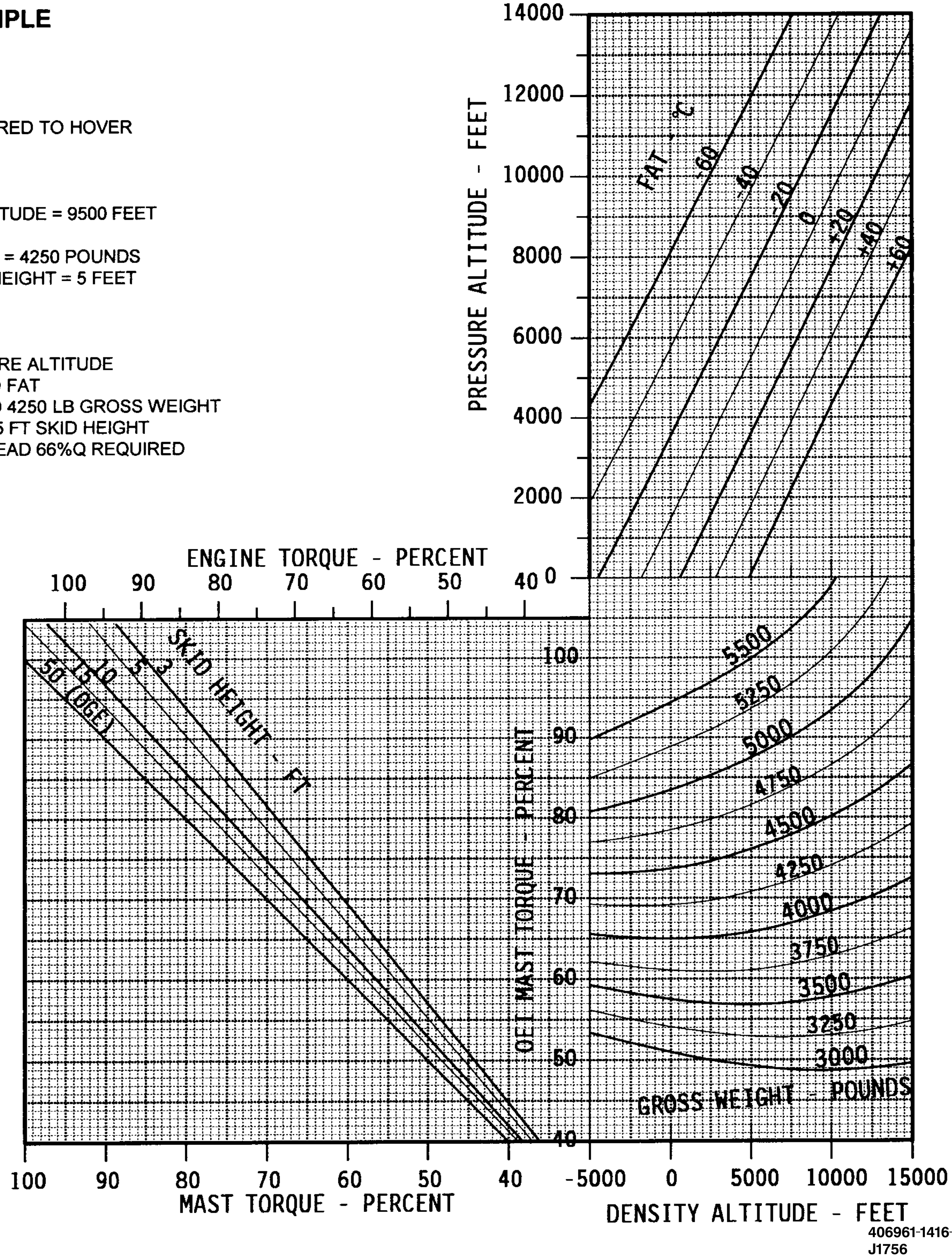

Figure 7-4. Hover Power Required Chart

SECTION V. CRUISE OH-58D (T703-AD-700A/250-C30R)

7-17. DESCRIPTION.

The cruise charts (fig. 7-5, sheets 1 through 23) show the mast torque and fuel flow required for level flight at various pressure altitudes, airspeeds, and gross weights at 100% rpm. Actual mast torque required and fuel flow for hover and low speed flight conditions (speed less than 40 KTAS) will be slightly greater than that shown on the cruise charts. The hover power required charts (fig. 7-4) should be used to determine mast torque required to hover.

NOTE

The cruise charts are basically arranged by FAT groupings. Figure 7-5, sheets 1 thru 23, are based upon operation with basic configuration. Each chart has a line that represents a ten square foot equivalent flat plate drag area. This allows quick determination of Delta %Q for other than basic configurations.

7-18. USE OF CHARTS.

The primary use of the charts is illustrated by the example provided. The first step for chart use is to select the proper chart, based upon the pressure altitude and anticipated free air temperature. Normally, sufficient accuracy can be obtained by selecting the chart nearest to the planned cruising altitude and FAT, or the next higher altitude. If greater accuracy is required, interpolation between altitudes and/or temperatures will be required (see example on page 7-14). You may enter the charts on any side (TAS, IAS, mast torque, or fuel flow), move vertically or horizontally to the gross weight, then to the other three parameters. Maximum performance conditions are determined by entering the chart where the maximum range or maximum endurance and rate of climb lines intersect the appropriate gross weight, then read airspeed, fuel flow, and %Q mast torque. For conservatism, use the gross weight at the beginning of cruise flight. For greater accuracy on long flights, it is preferable to determine cruise information for several flights segments in order to allow for decreasing fuel weights (reduced gross weight). The following parameters contained in each chart are further explained as follows:

a. Airspeed. True and indicated airspeeds are present at opposite sides of each chart. On any chart indicated airspeed can be directly converted to true airspeed (or vice versa) by reading directly across the chart without regard for other chart information. Maximum permissible airspeed (Vne) limits appear as red lines on some charts. If no red line appears, (Vne) is above the limits of the chart.

b. Mast Torque (%Q). Since pressure altitude and temperature are fixed for each chart, mast torque varies according to gross weight and airspeed. For pilot convenience, all power is presented in terms of mast torque.

c. Fuel Flow. Fuel flow scales are provided opposite the torque scales. On any chart, torque may be converted directly to fuel flow without regard for other chart information. All fuel flows are presented for bleed air heater and anti-ice off. Add 2 percent fuel flow (about 6 lb/hr) for heater on and increase fuel flow 3 percent (approximately 9 lb/hr) for anti-ice on. If both are operating, add 5 percent fuel flow (about 15 lb/hr) to chart values.

d. Maximum Range. The maximum range lines indicate the combinations of weight and airspeed that will produce the greatest flight range per gallon of fuel under zero wind conditions. When a maximum range condition does not appear on a chart, it is because the maximum range speed is beyond the maximum permissible speed (Vne); in such cases, use cruising speed Vne to obtain maximum range.

e. Maximum Endurance and Rate of Climb. The maximum endurance and rate of climb lines indicate the airspeed for minimum torque required to maintain level flight for each gross weight, FAT, and pressure altitude. Since minimum torque will provide minimum fuel flow, maximum flight endurance will be obtained at the airspeeds indicated.

7-19. CONDITIONS.

The cruise charts are based upon operation at 100% engine rpm, 716 °C, and basic inlet configuration (without inlet blast shield).

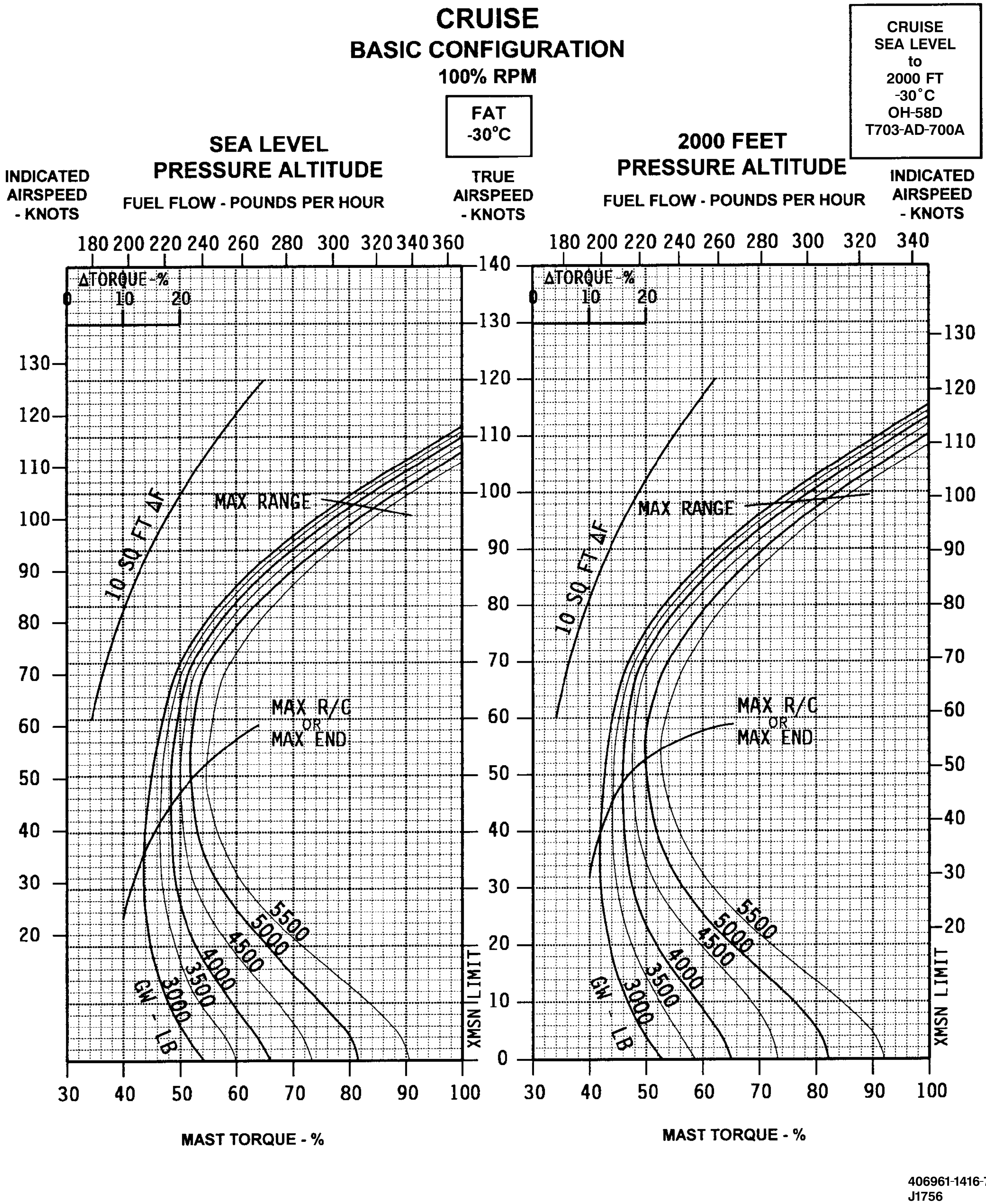

Figure 7-5. Cruise Chart, FAT -30 °C, Sea Level to 2000 Feet (Sheet 1 of 23)

EXAMPLE - Cruise Chart - 5,000 Feet

WANTED

ENGINE TORQUE REQUIRED FOR LEVEL FLIGHT, FUEL FLOW, INDICATED AIRSPEED

KNOWN

BASIC CONFIGURATION
GROSS WEIGHT = 5000 LB
PRESSURE ALTITUDE = 5000 FEET
FAT = -30°C
DESIRED TRUE AIRSPEED = 80 KNOTS

METHOD (INTERPOLATE)

ENTER AIRSPEED AT 80 KNOTS
READ TORQUE, FUEL FLOW AND IAS ON EACH
ADJACENT ALTITUDE AND/OR FAT, TO INTERPOLATE
BETWEEN ALTITUDE AND/OR FAT

ALTITUDE, FEET	4000 FEET	6000 FEET	5000 FEET
FAT, °C	-30	-30	-30
ENGINE TORQUE, %Q	66	62	64
FUEL FLOW, LB/HR	244	234	239
IAS, KNOTS	76.4	75	75.7

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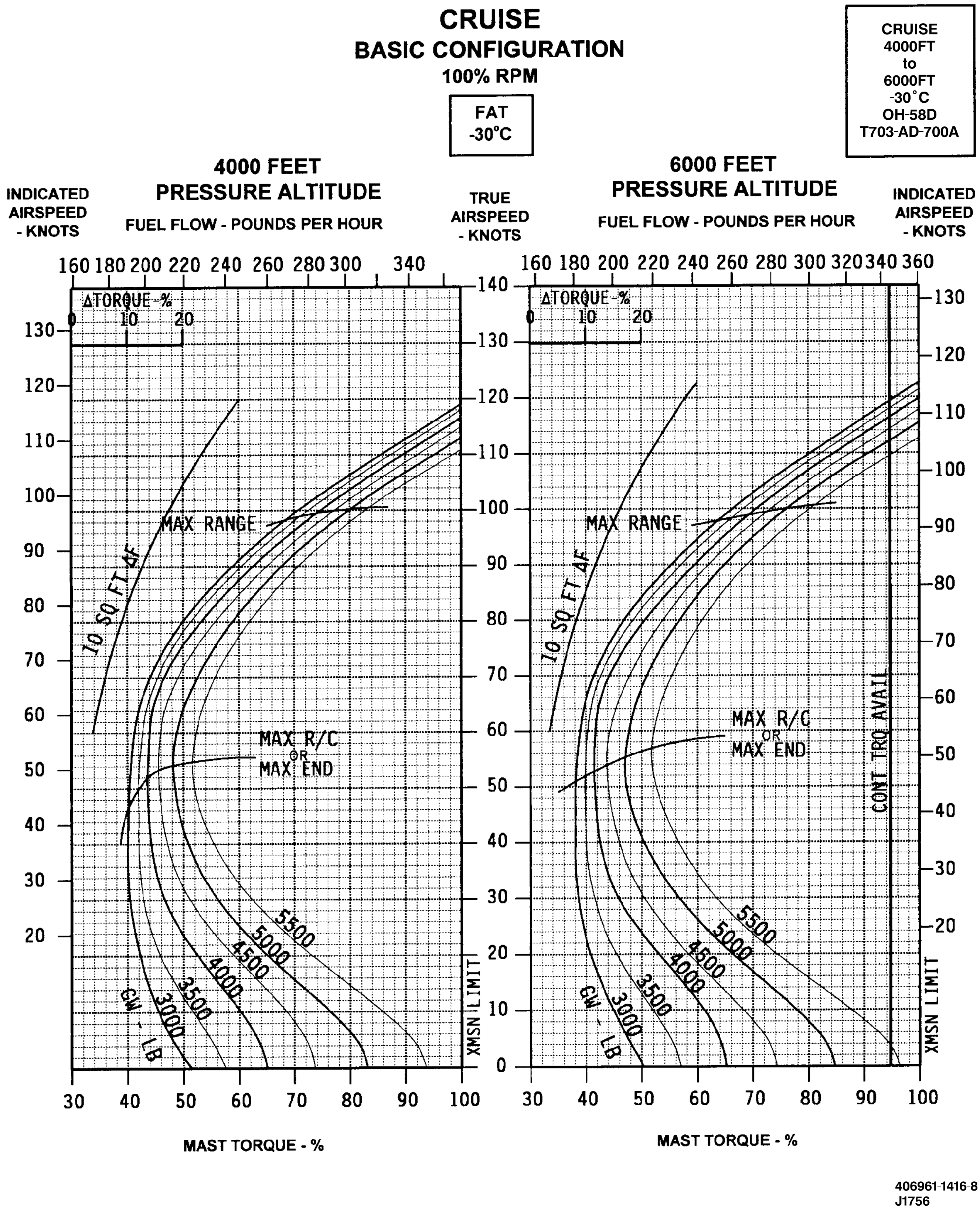

Figure 7-5. Cruise Chart, FAT -30 °C, 4000 to 6000 Feet (Sheet 2 of 23)

EXAMPLE ‑ Cruise Chart ‑ 8,000 Feet

WANTED

SPEED FOR MAXIMUM RANGE,
MAST TORQUE REQUIRED, FUEL FLOW AT MAXIMUM
RANGE AND SPEED FOR MAXIMUM ENDURANCE

KNOWN

BASIC CONFIGURATION, FAT = ‑30°C
PRESSURE ALTITUDE = 8000 FEET
GROSS WEIGHT = 5000 LB

METHOD

LOCATE (‑30°C FAT, 8000 FEET) CHART

FIND INTERSECTION OF 5000 LB GROSS WEIGHT LINE
WITH THE MAXIMUM RANGE LINE
TO READ SPEED FOR MAXIMUM RANGE:
MOVE RIGHT, READ TAS = 102 KNOTS AND
MOVE LEFT, READ IAS = 92 KNOTS

TO READ FUEL FLOW REQUIRED:
FIND INTERSECTION OF 5000 LB GROSS WEIGHT LINE
WITH THE MAXIMUM RANGE LINE
MOVE UP, READ FUEL FLOW = 289 LB/HR

TO READ MAST TORQUE REQUIRED:
FIND INTERSECTION OF 5000 LB GROSS WEIGHT LINE
WITH THE MAXIMUM RANGE LINE
MOVE DOWN, READ MAST TORQUE = 76%Q

TO READ SPEED FOR MAXIMUM ENDURANCE:
FIND INTERSECTION OF 5000 LB GROSS WEIGHT LINE
WITH THE MAXIMUM ENDURANCE LINE
MOVE RIGHT, READ TAS = 54.8 KNOTS AND
MOVE LEFT, READ IAS = 48 KNOTS

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CRUISE
BASIC CONFIGURATION
100% RPM

FAT -30°C

CRUISE 8000FT to 10000 FT -30°C OH-58D T703-AD-700A

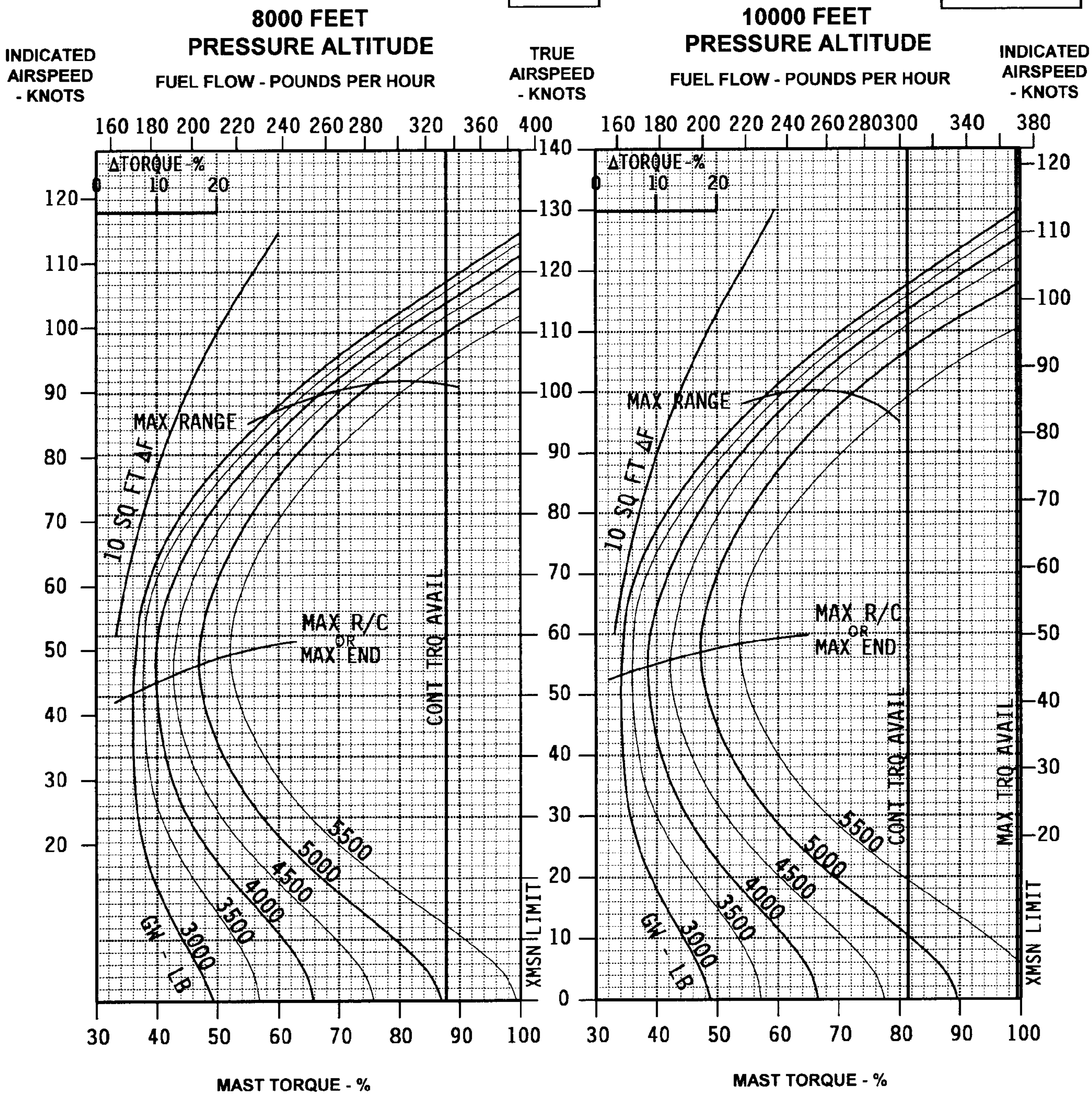

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Figure 7-5. Cruise Chart, FAT -30 °C, 8000 to 10000 Feet (Sheet 3 of 23)

EXAMPLE CHANGE IN DRAG - Cruise Chart-12,000 Feet

WANTED

ADDITIONAL MAST TORQUE REQUIRED
AND FUEL FLOW FOR EXTERNAL DRAG
CONFIGURATION

KNOWN

ΔF FOR EXTERNAL DRAG CONFIGURATION
ΔDRAG = -0.8 SQUARE FEET
GROSS WEIGHT = 4500 LB
PRESSURE ALTITUDE = 12000 FEET
FAT = -30°C
TRUE AIRSPEED = 110 KNOTS

METHOD

ENTER TRUE AIRSPEED AT 110 KNOTS
MOVE LEFT TO 4500 LB GROSS WEIGHT LINE
MOVE UP TO FUEL FLOW SCALE, READ 290 LB/HR
MOVE DOWN TO MAST TORQUE SCALE, READ 77%Q

ENTER TRUE AIRSPEED AT 110 KNOTS
MOVE LEFT TO 10 SQ FT ΔF LINE
MOVE UP TO ΔTORQUE SCALE, READ 17%ΔQ

DIVIDE -0.8 SQ FT BY 10 SQ FT TO OBTAIN -0.08%ΔQ
MULTIPLY 17%ΔQ TIMES -0.08%ΔQ TO OBTAIN ΔQ
(17 X (-0.08)ΔQ = 1.4ΔQ
ADD INITIAL TORQUE AND ΔTORQUE TO OBTAIN FINAL TORQUE
((77 + (-1.4))%Q = 75.6%Q

ENTER MAST TORQUE SCALE AT 75.6%Q
MOVE UP TO FUEL FLOW SCALE, READ 283 LB/HR

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CRUISE
BASIC CONFIGURATION
100% RPM

FAT
-30°C

CRUISE
12000 FT
to
14000 FT
-30°C
OH-58D
T704-AD-700A

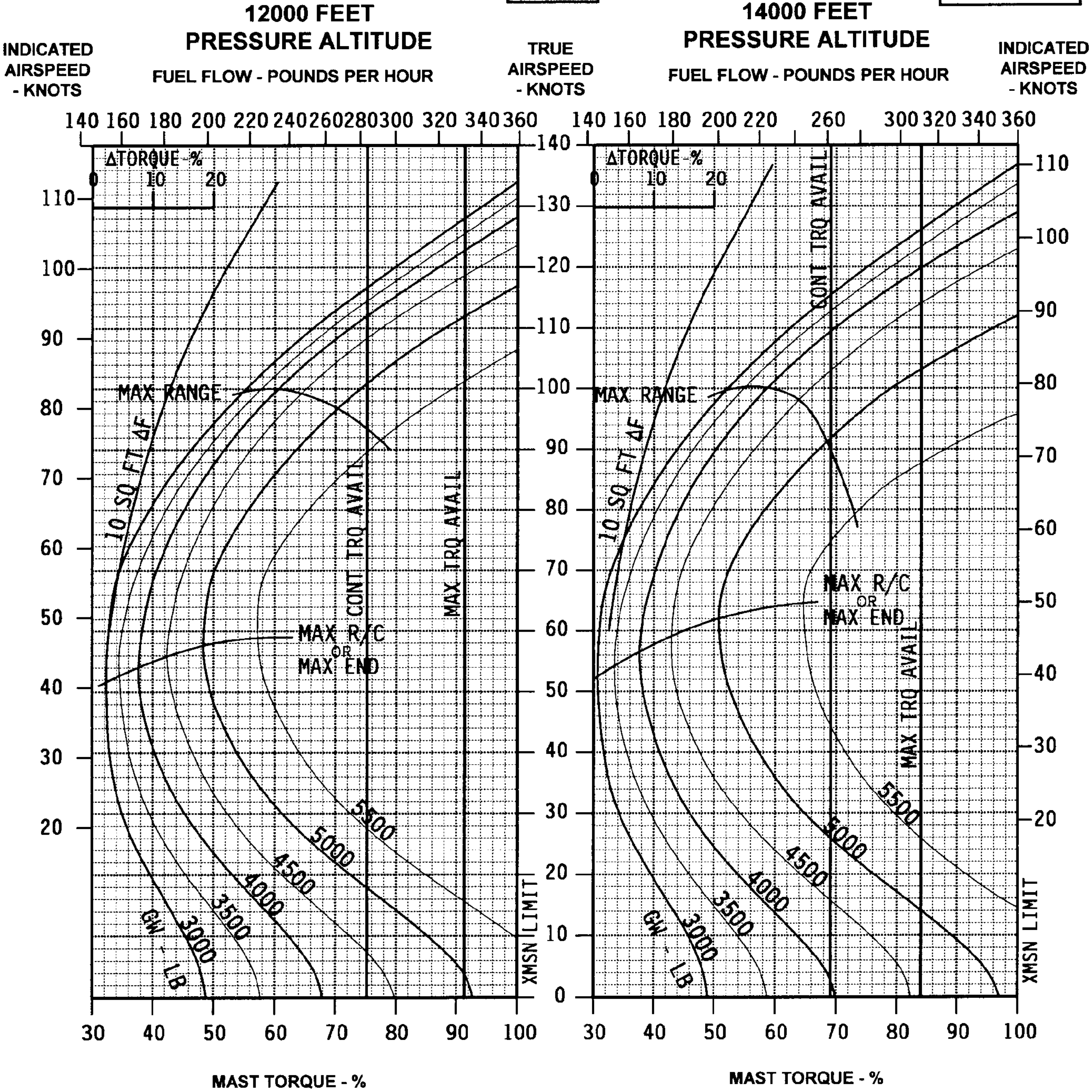

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Figure 7-5. Cruise Chart, FAT -30 °C, 12000 to 14000 Feet (Sheet 4 of 23)

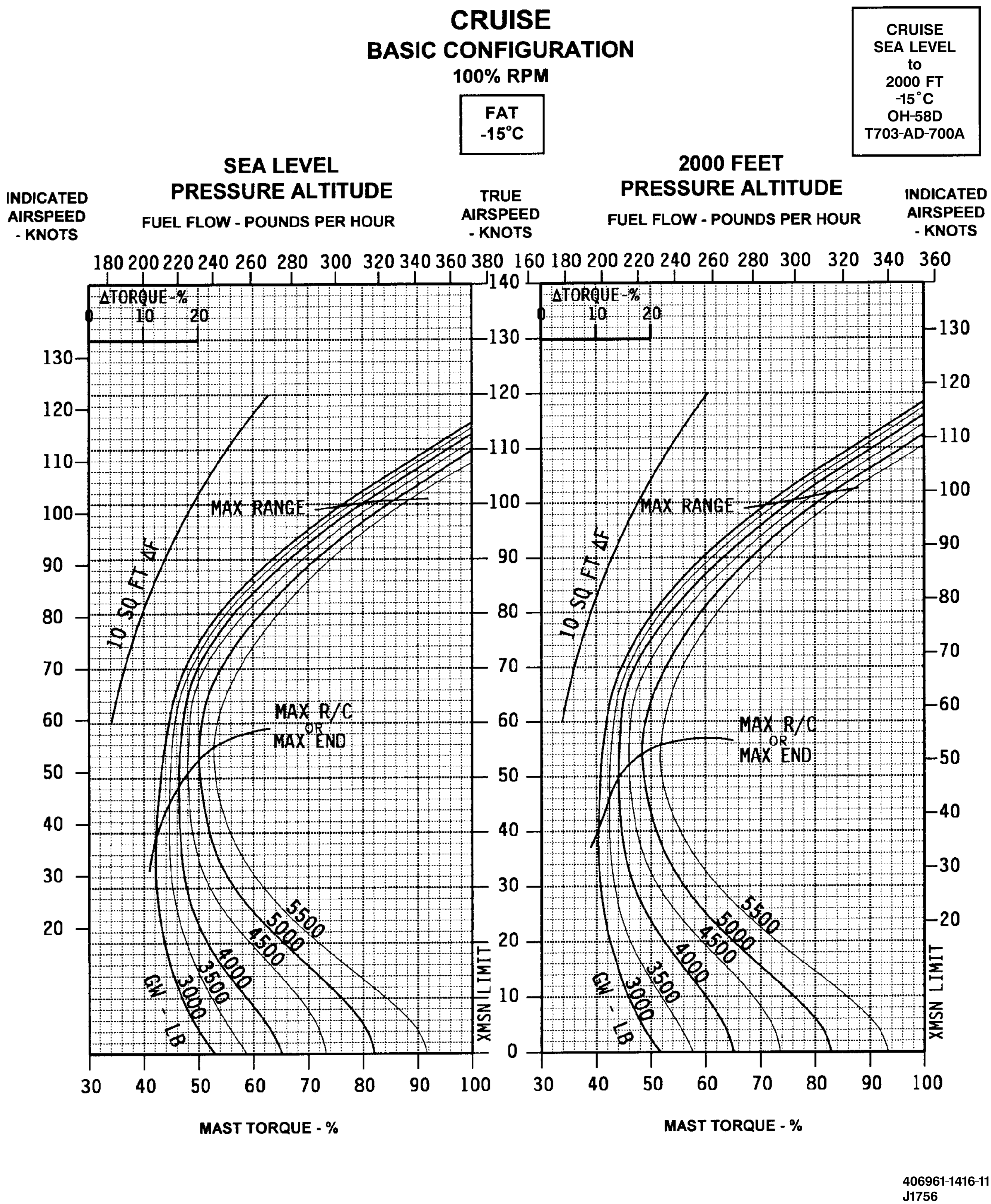

Figure 7-5. Cruise Chart, FAT -15 °C, Sea Level to 2000 Feet (Sheet 5 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT
-15°C

CRUISE
4000 FT
to
6000 FT
-15°C
OH-58D
T703-AD-700A

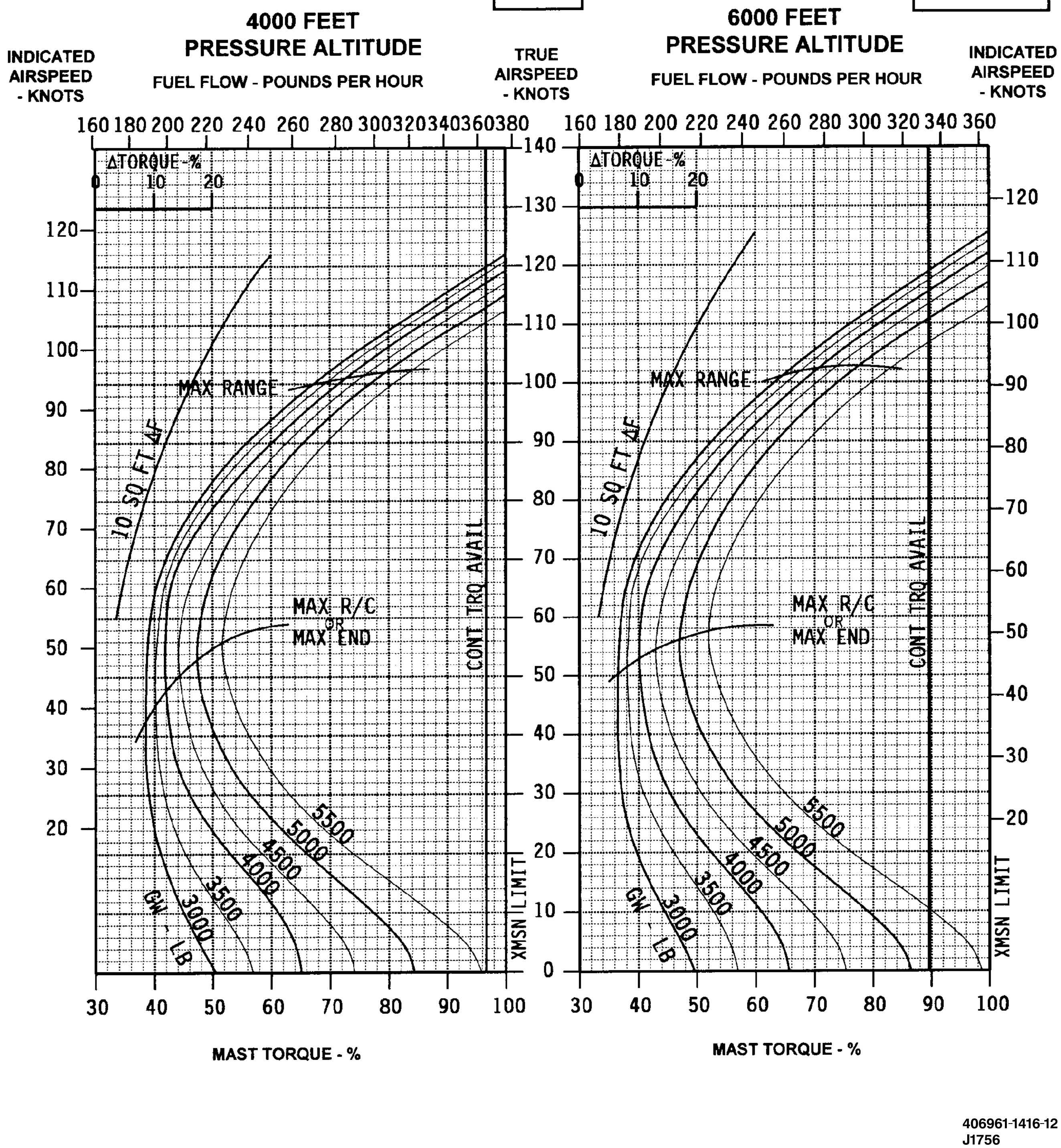

Figure 7-5. Cruise Chart, FAT -15 °C, 4000 to 6000 Feet (Sheet 6 of 23)

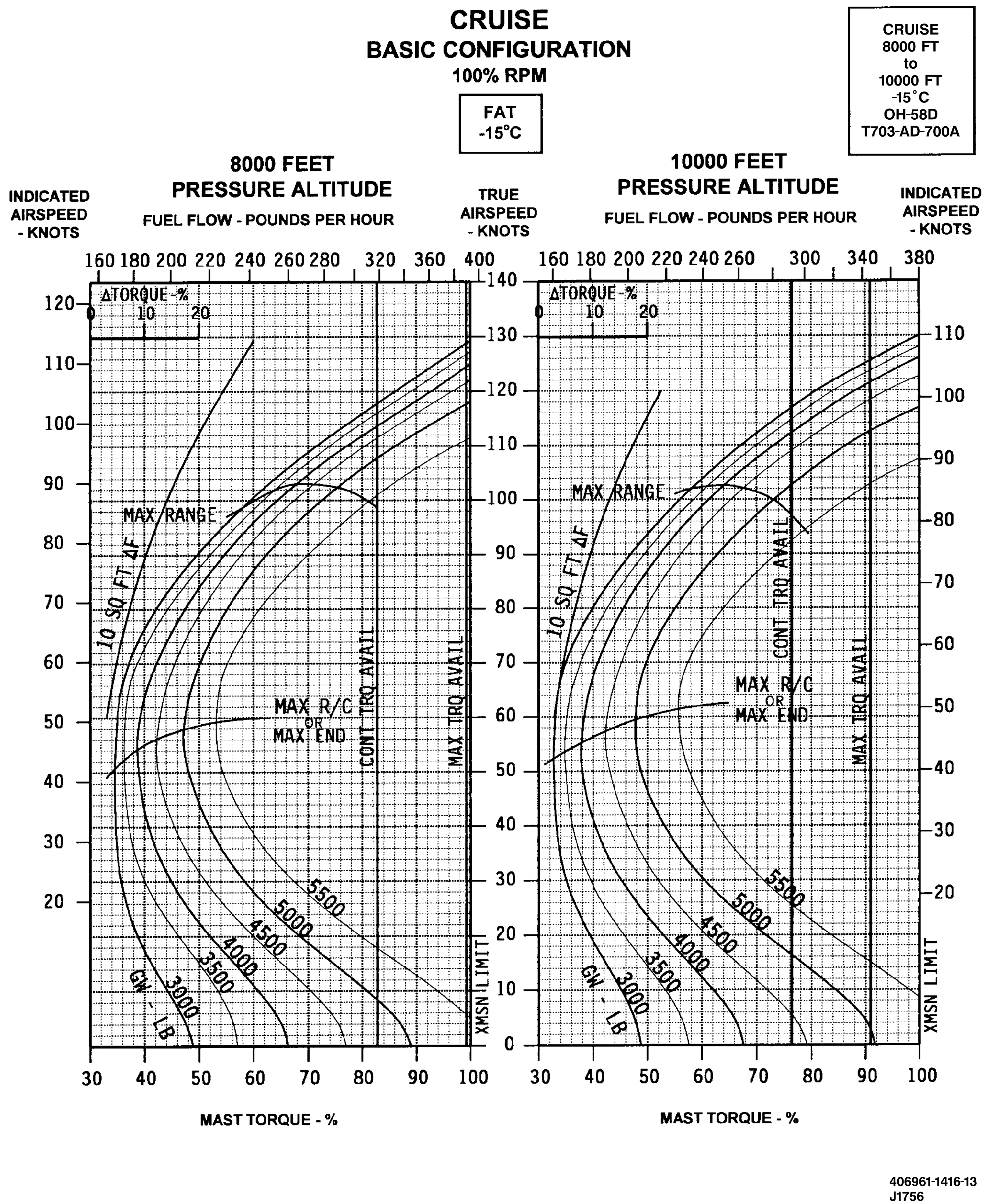

Figure 7-5. Cruise Chart, FAT -15 °C, 8000 to 10000 Feet (Sheet 7 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT -15°C

CRUISE 12000 FT to 14000 FT -15°C OH-58D T703-AD-700A

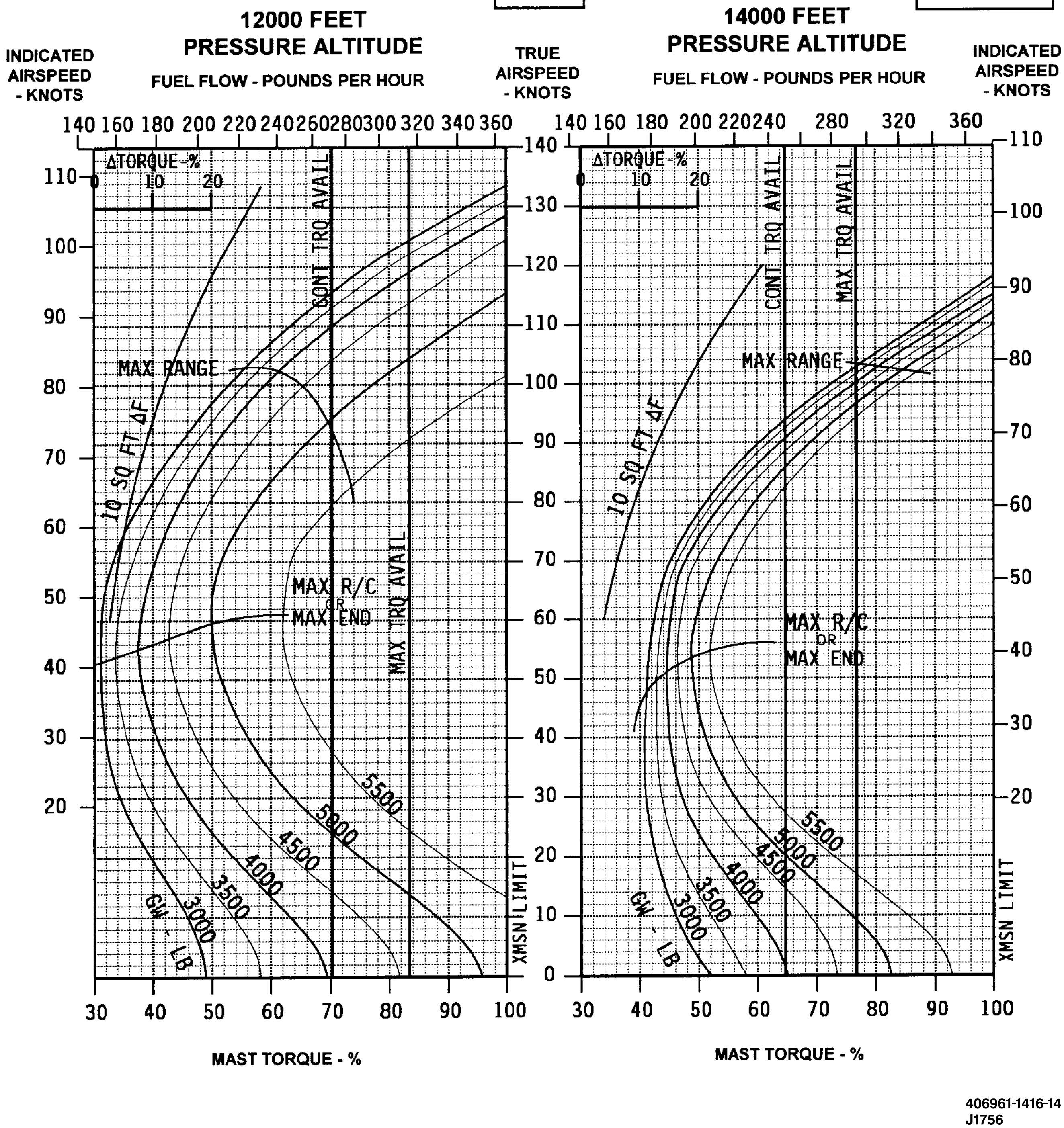

Figure 7-5. Cruise Chart, FAT -30 °C, 12000 to 14000 Feet (Sheet 8 of 23)

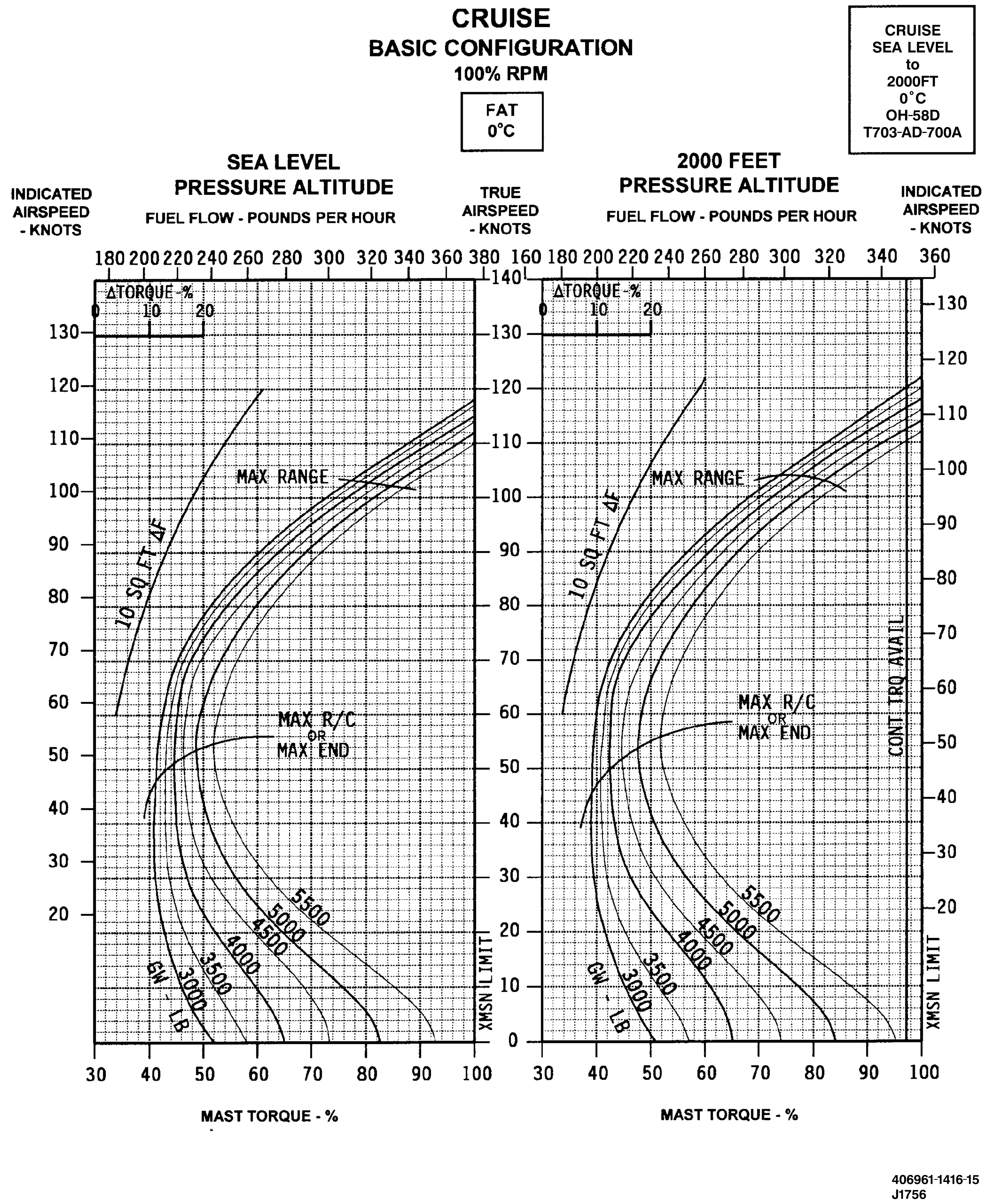

Figure 7-5. Cruise Chart, FAT 0 °C, Sea Level to 2000 Feet (Sheet 9 of 23)

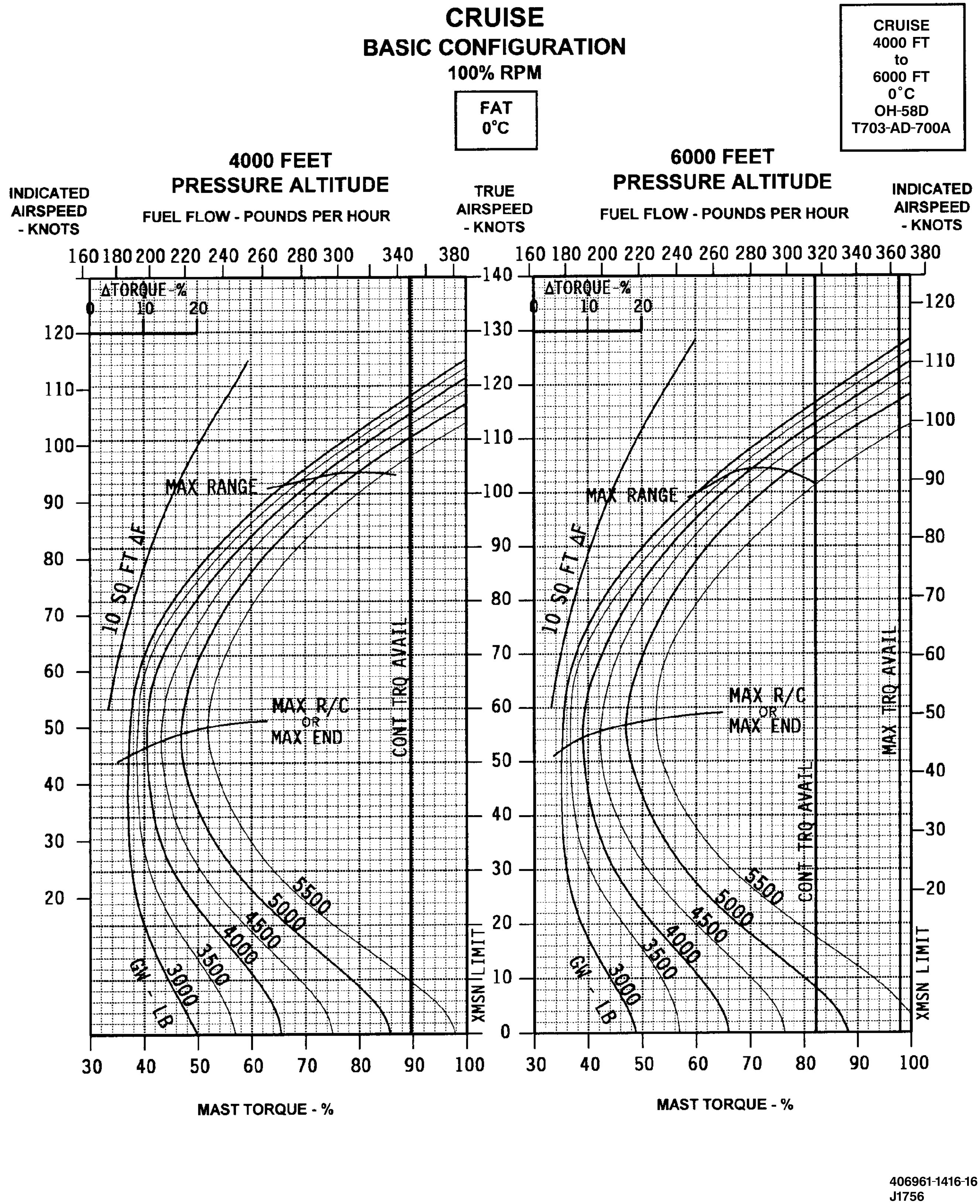

Figure 7-5. Cruise Chart, FAT 0 °C, 4000 to 6000 Feet (Sheet 10 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT 0°C

CRUISE 8000 FT to 10000 FT 0°C OH-58D T703-AD-700A

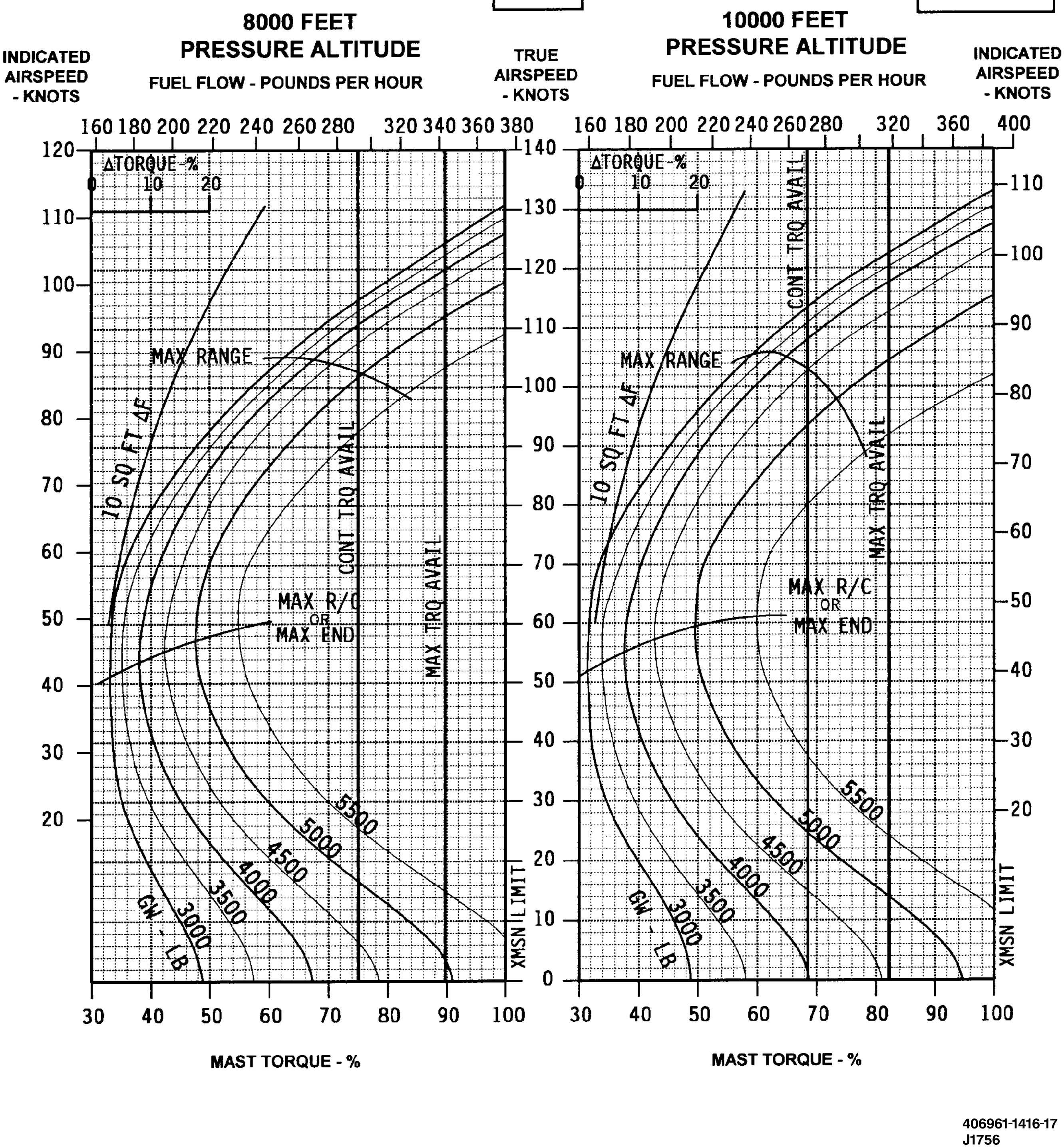

Figure 7-5. Cruise Chart, FAT 0 °C, 8000 to 10000 Feet (Sheet 11 of 23)

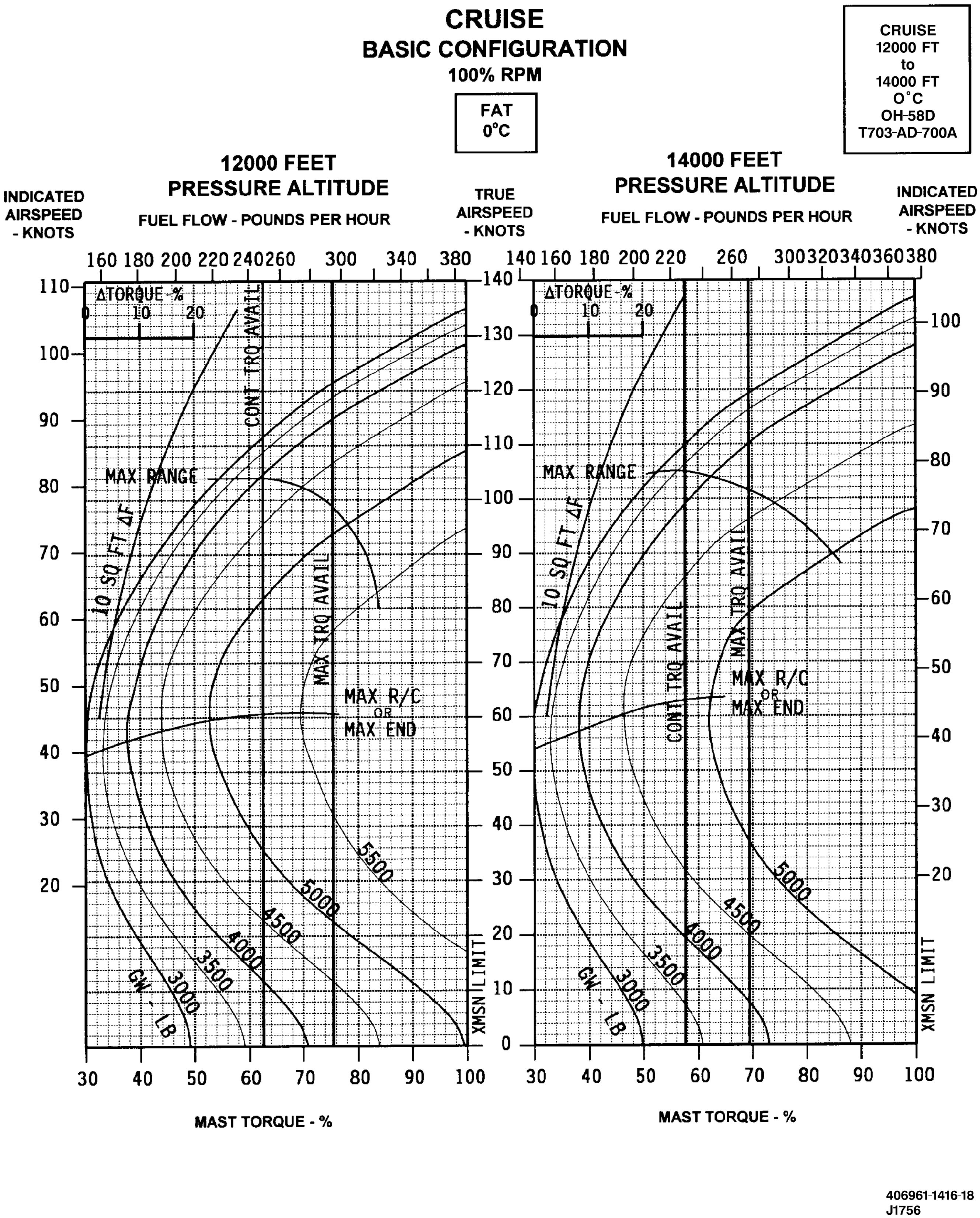

Figure 7-5. Cruise Chart, FAT 0 °C, 12000 to 14000 Feet (Sheet 12 of 23)

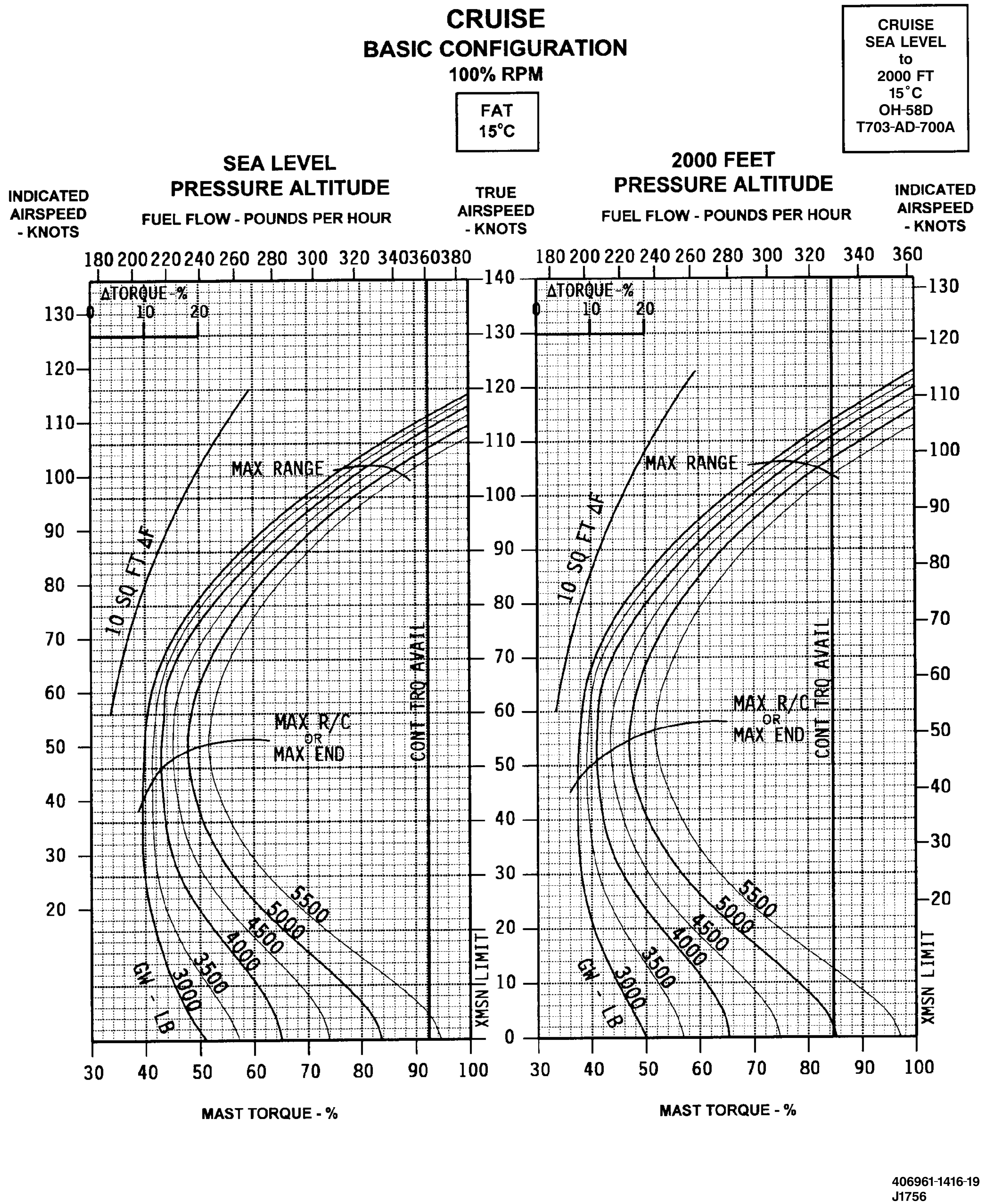

Figure 7-5. Cruise Chart, FAT +15 °C, Sea Level to 2000 Feet (Sheet 13 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT 15°C

CRUISE 4000 FT to 6000 FT 15°C OH-58D T703-AD-700A

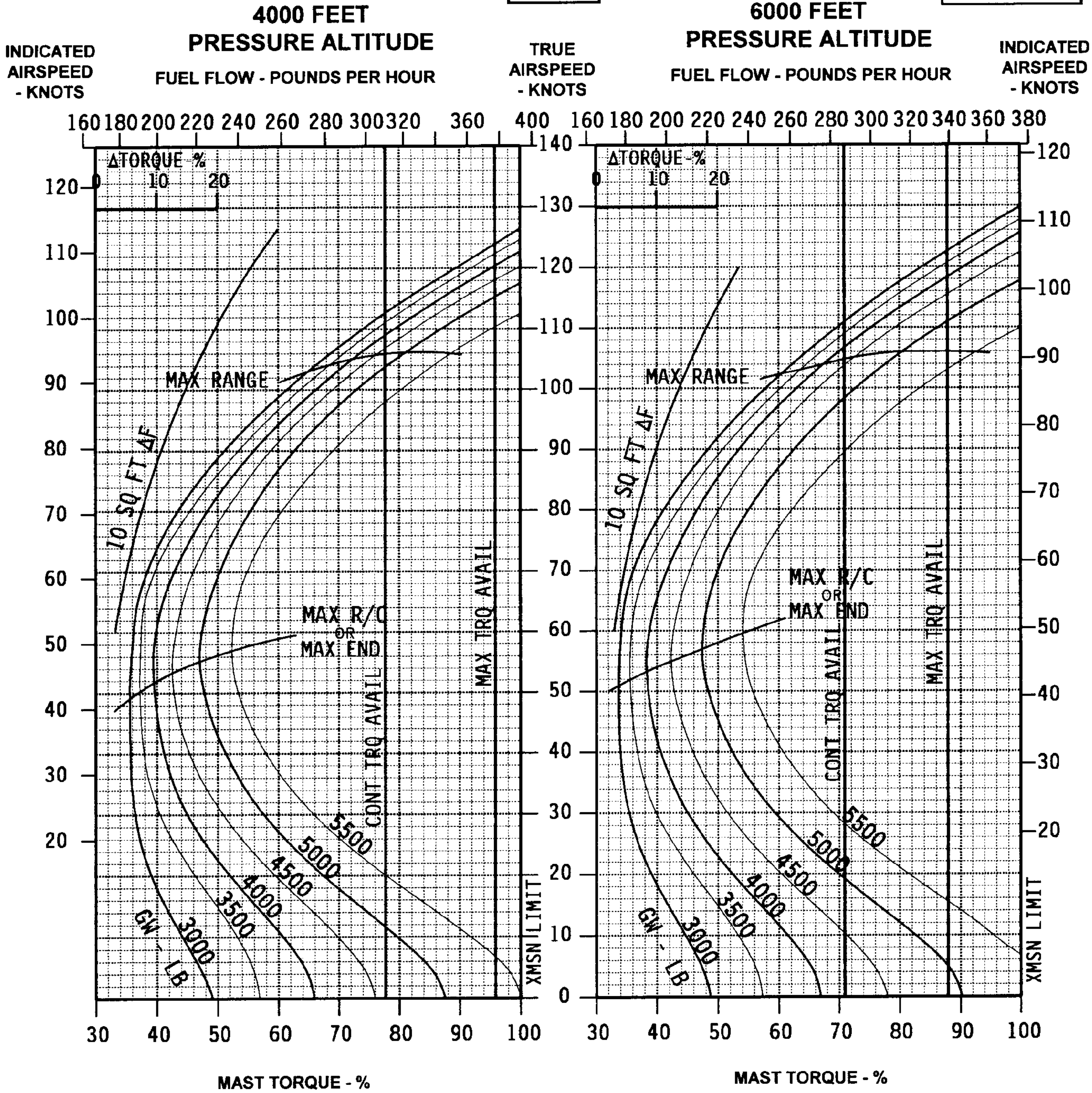

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Figure 7-5. Cruise Chart, FAT +15 °C, 4000 to 6000 Feet (Sheet 14 of 23)

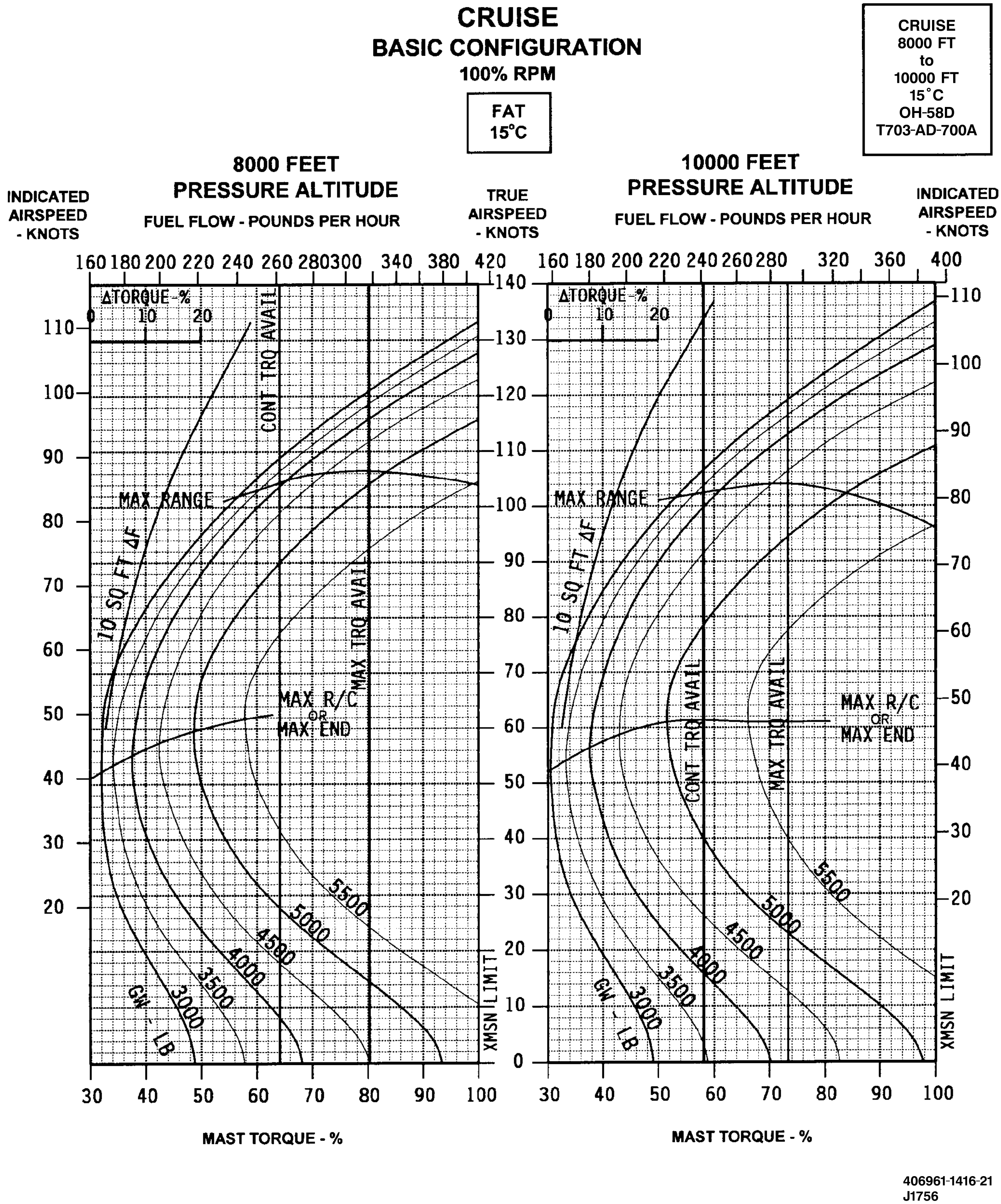

Figure 7-5. Cruise Chart, FAT +15 °C, 8000 to 10000 Feet (Sheet 15 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT 15°C

CRUISE 12000 FT to 14000 FT 15°C OH-58D T703-AD-700A

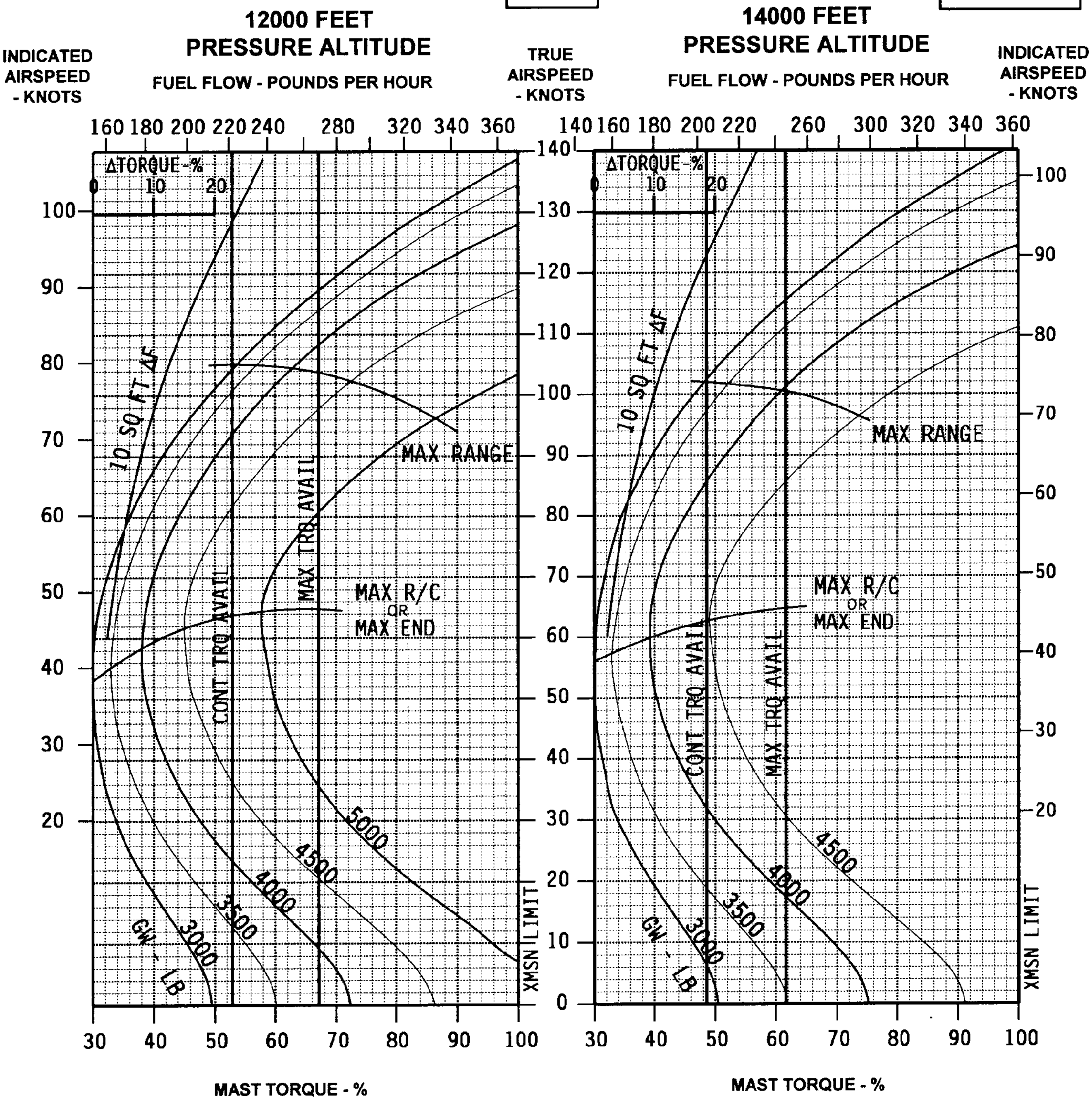

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Figure 7-5. Cruise Chart, FAT +15 °C, 12000 to 14000 Feet (Sheet 16 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT
30°C

CRUISE
SEA LEVEL
to
2000 FT
30°C
OH-58D
T703-AD-700A

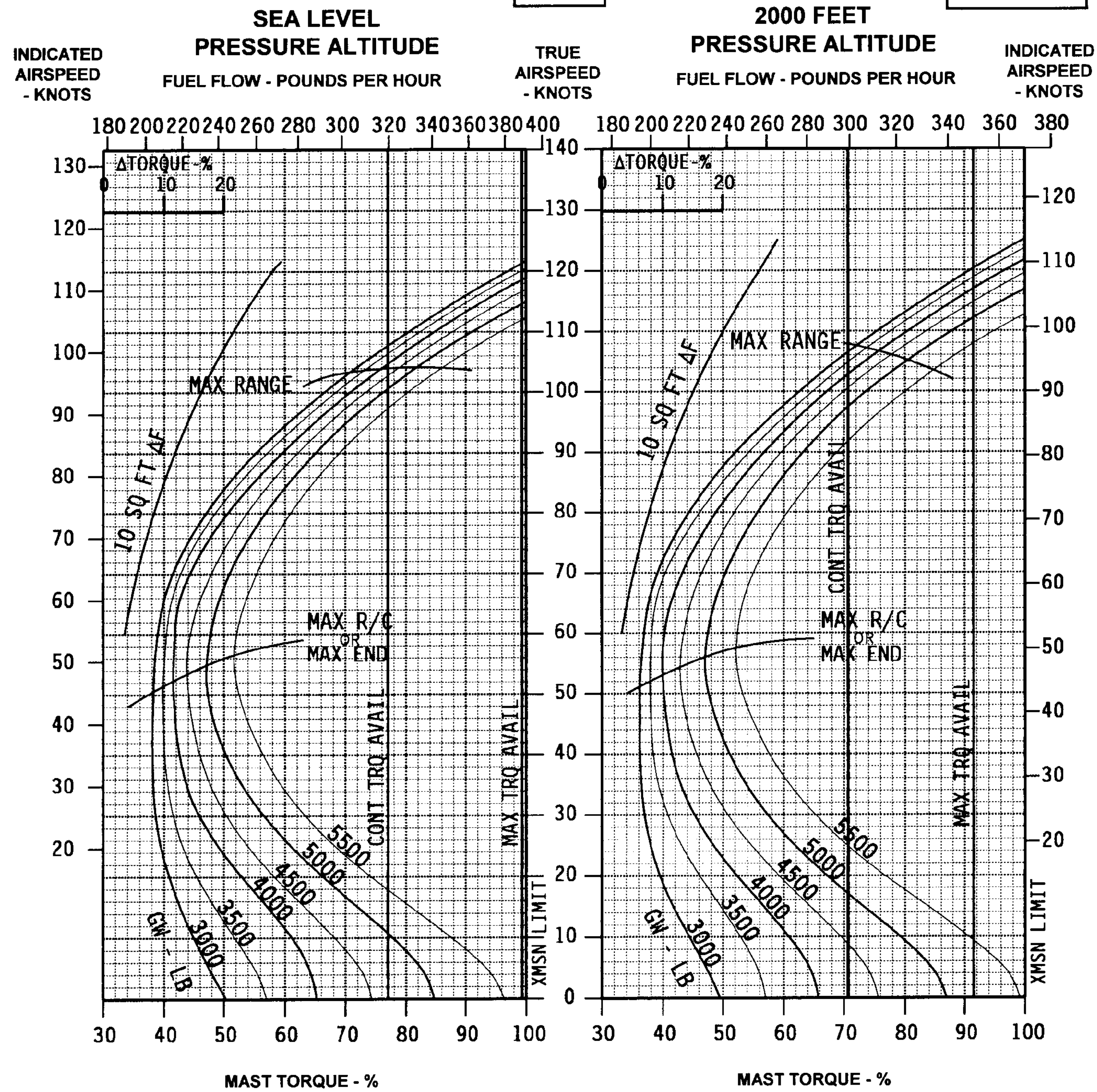

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Figure 7-5. Cruise Chart, FAT +30 °C, Sea level to 2000 Feet (Sheet 17 of 23)

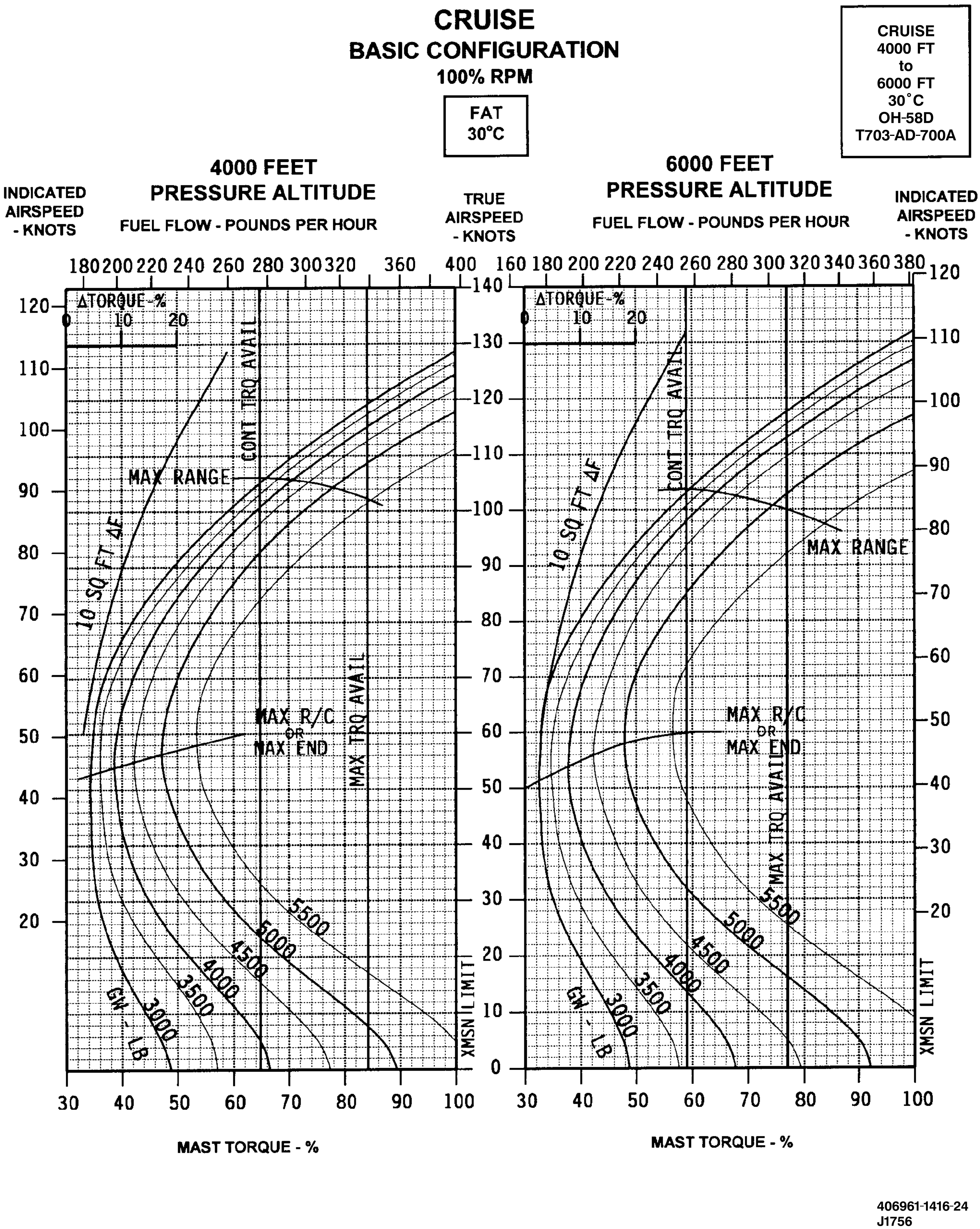

Figure 7-5. Cruise Chart, FAT +30 °C, 4000 to 6000 Feet (Sheet 18 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT 30°C

CRUISE 8000 FT to 10000 FT 30˚C OH-58D T703-AD-700A

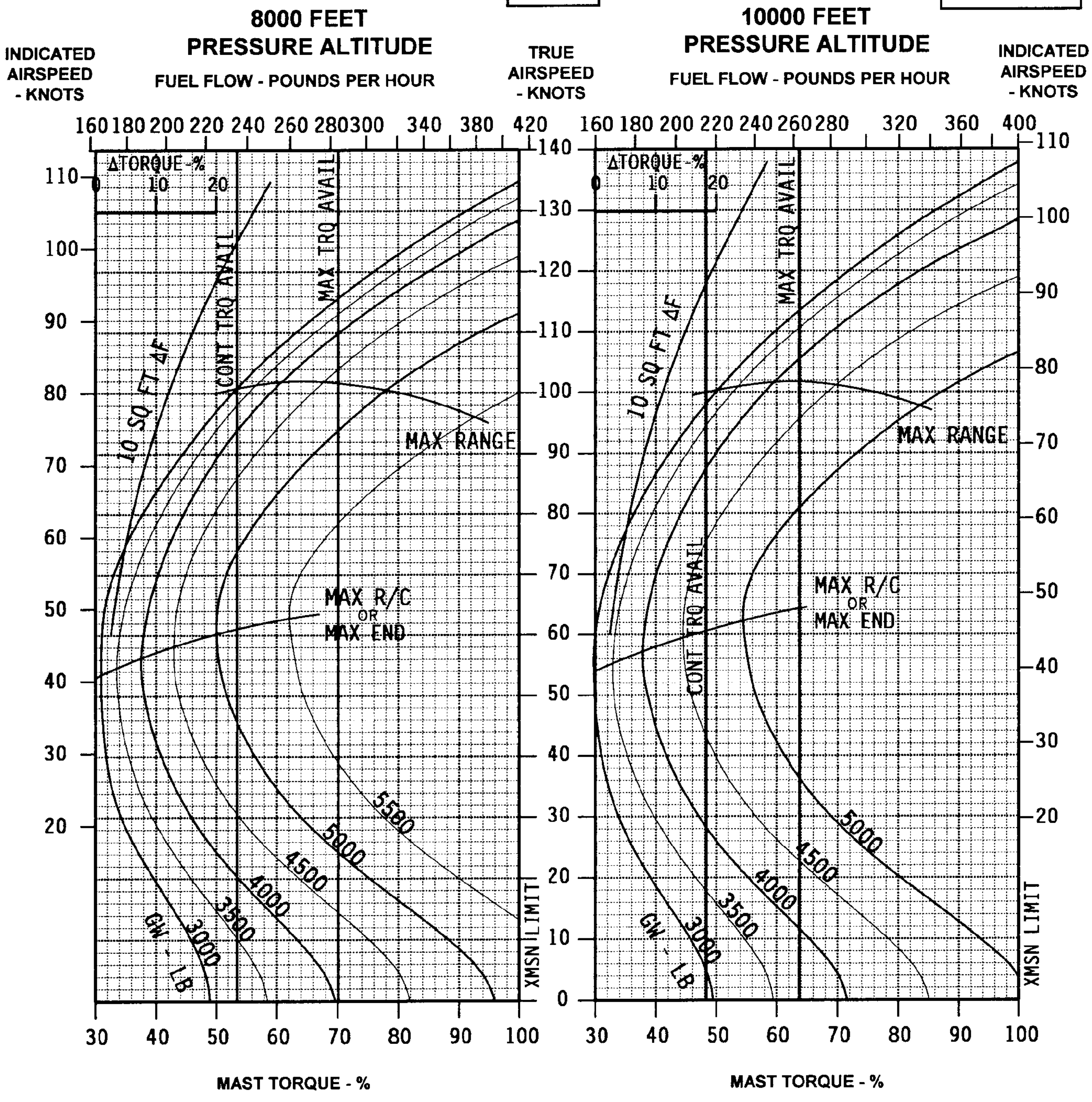

Figure 7-5. Cruise Chart, FAT +30 °C, 8000 to 10000 Feet (Sheet 19 of 23)

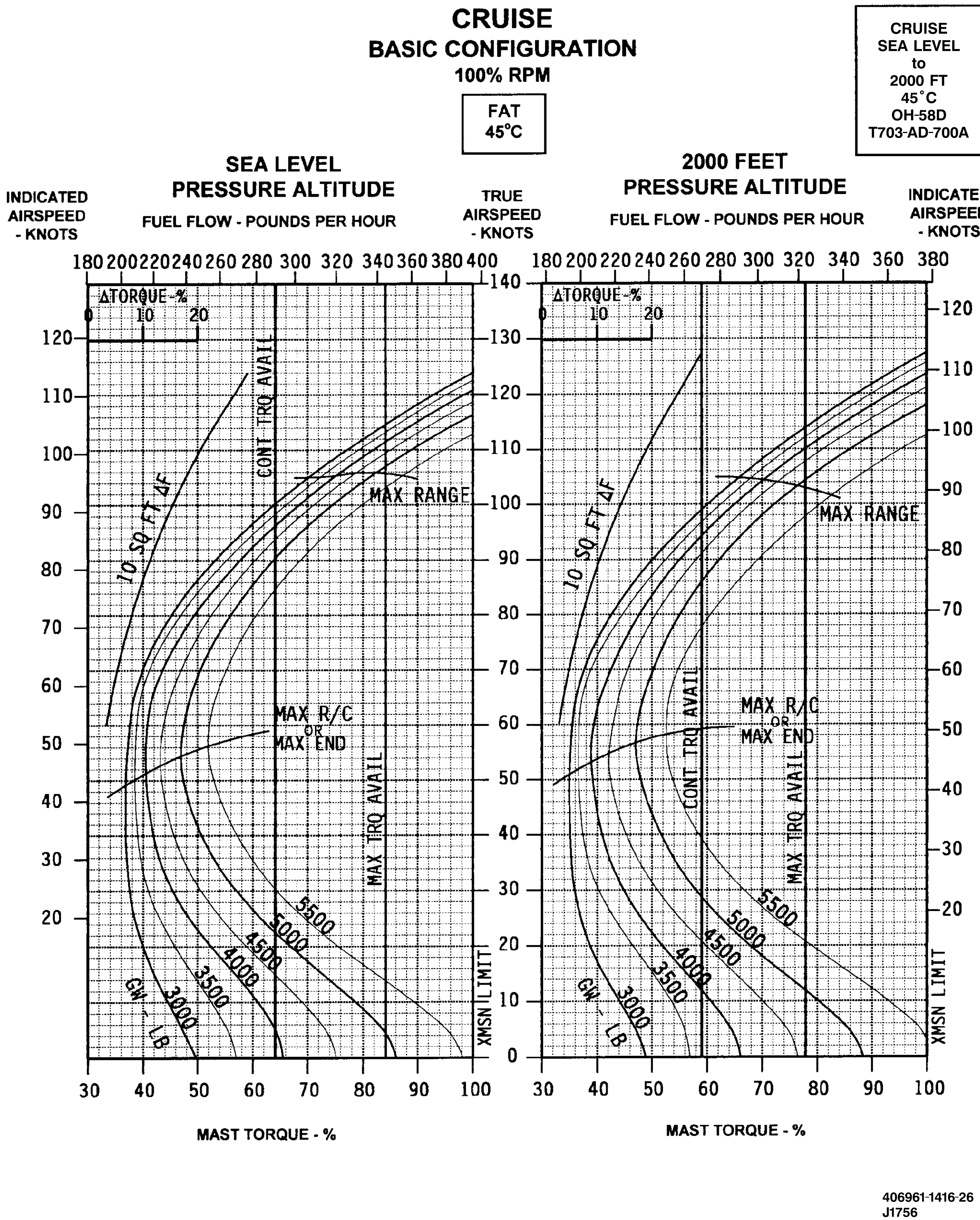

Figure 7-5. Cruise Chart, FAT +45 °C, Sea level to 2000 Feet (Sheet 20 of 23)

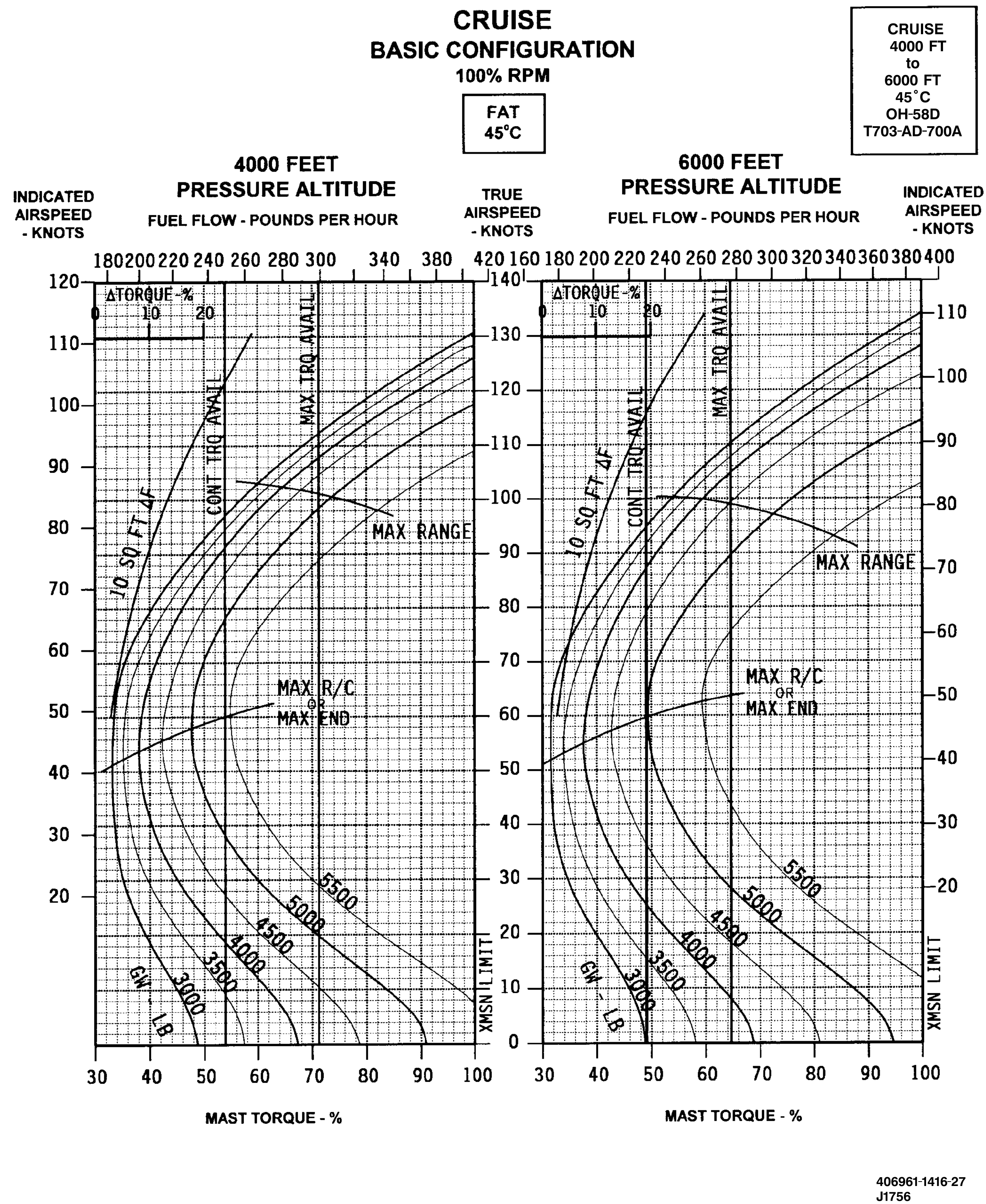

Figure 7-5. Cruise Chart, FAT +45 °C, 4000 to 6000 Feet (Sheet 21 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT
55°C

CRUISE
SEA LEVEL
to
2000 FT
55°C
OH-58D
T703-AD-700A

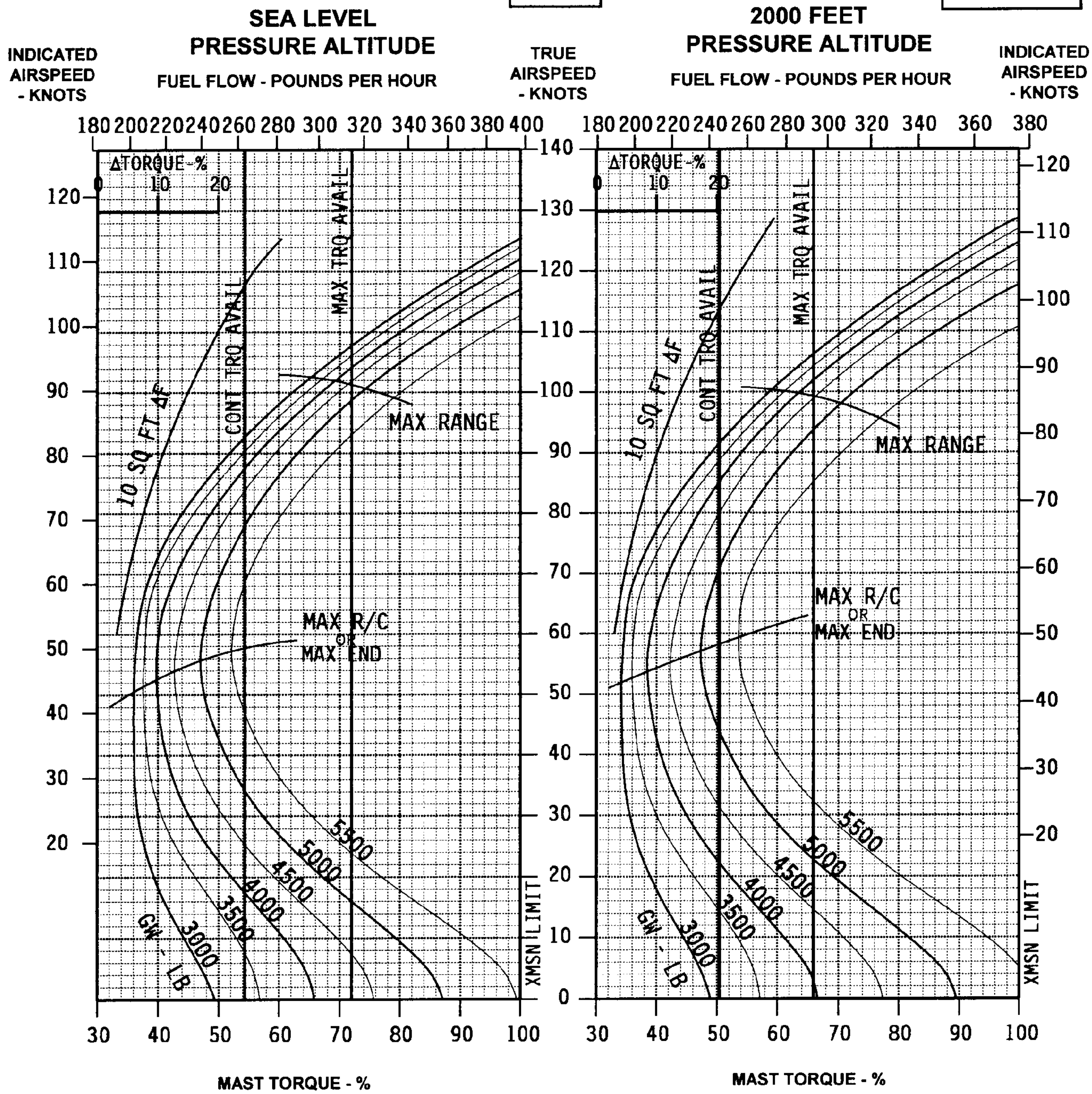

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Figure 7-5. Cruise Chart, FAT +55 °C, Sea Level to 2000 Feet (Sheet 22 of 23)

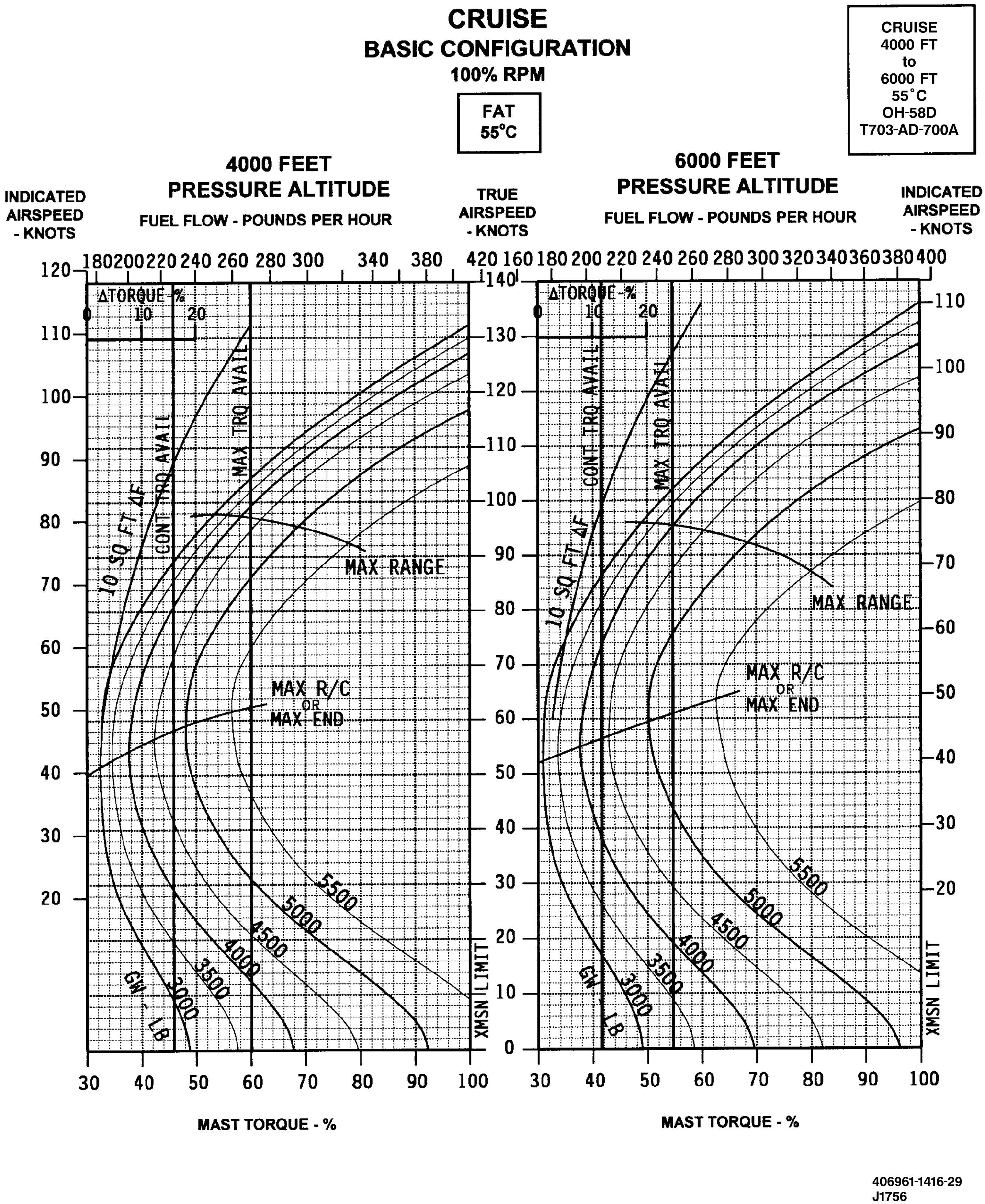

Figure 7-5. Cruise Chart, FAT +55 °C, 4000 to 6000 Feet (Sheet 23 of 23)

SECTION VI. DRAG OH-58D (T703-AD-700A/250-C30R)

7-20. DESCRIPTION.

The drag chart (fig. 7-6) shows the basic configuration or the equivalent flat plate drag area changes for additional helicopter modifications. The cruise charts depict the basic (baseline) configuration which includes the drag for the mast mounted sight, a universal weapon pylon with ejector racks on both sides, a 7 shot rocket pod on right side, a .50 caliber machine gun and ammo magazine on left side, and a standard landing gear, and both crew doors installed.

7-21. USE OF CHART.

This chart is used to adjust cruise charts for appropriate torque and fuel flow due to equivalent flat plate drag area change (ΔF). Examples of change in torque required due to equivalent flat plate drag area change (ΔF) from primary (baseline) configuration to an external load configuration and increase in drag area due to external cargo load are shown below.

7-22. CONDITIONS.

The drag chart is based upon level aircraft attitude and 100% NR and NP.

EXAMPLE A

WANTED

CHANGE IN TORQUE REQUIRED DUE TO EQUIVALENT FLAT PLATE DRAG AREA CHANGE (ΔF) FROM PRIMARY (BASELINE) CONFIGURATION TO AN EXTERNAL LOAD CONFIGURATION

KNOWN

PRIMARY CONFIGURATION
ΔF DRAG AREA CHANGE = 12 SQ FT
TRUE AIRSPEED = 100 KNOTS
PRESSURE ALTITUDE = SEA LEVEL
FAT = 0°C

METHOD

ENTER DRAG AREA CHANGE AT 12 SQ FT
MOVE RIGHT TO 100 KNOT TRUE AIRSPEED LINE
MOVE DOWN TO SEA LEVEL PRESSURE ALTITUDE LINE
MOVE LEFT TO 0°C FREE AIR TEMPERATURE LINE
MOVE DOWN MAST TORQUE SCALE, READ CHANGE IN TORQUE = 21.5%Q

EXAMPLE B

WANTED

INCREASE IN DRAG AREA DUE TO EXTERNAL CARGO LOAD

KNOWN

SHAPE OF EXTERNAL CARGO LOAD = CUBE
FRONTAL AREA OF EXTERNAL CARGO LOAD = 10 SQ FT

METHOD

ENTER DRAG CHART AT THE CUBE SYMBOL
MOVE DOWN TO 10 SQ FT LINE
MOVE RIGHT, READ INCREASED DRAG AREA = 9.2 SQ FT

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DRAG

DRAG
OH-58D
T703-AD-700A

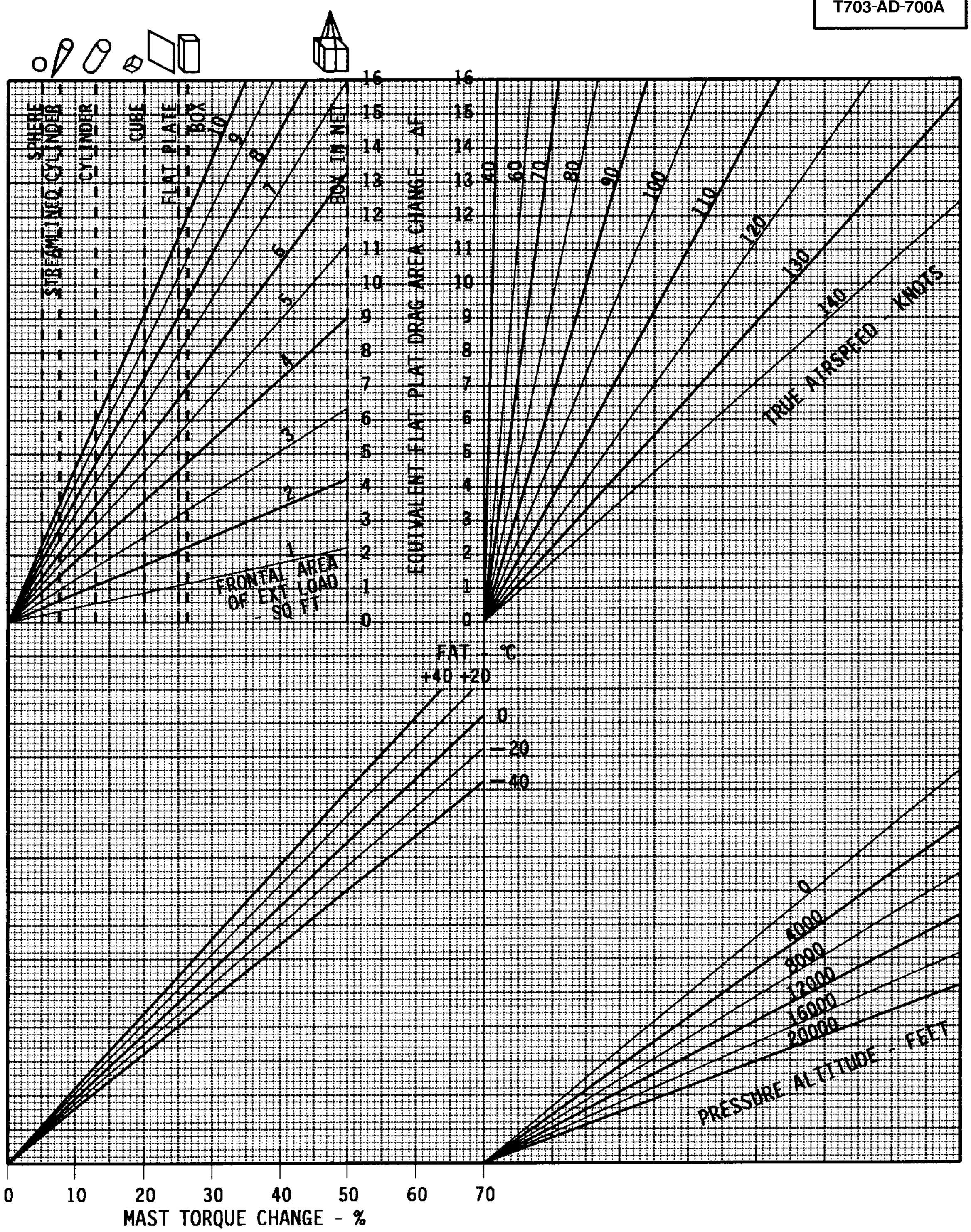

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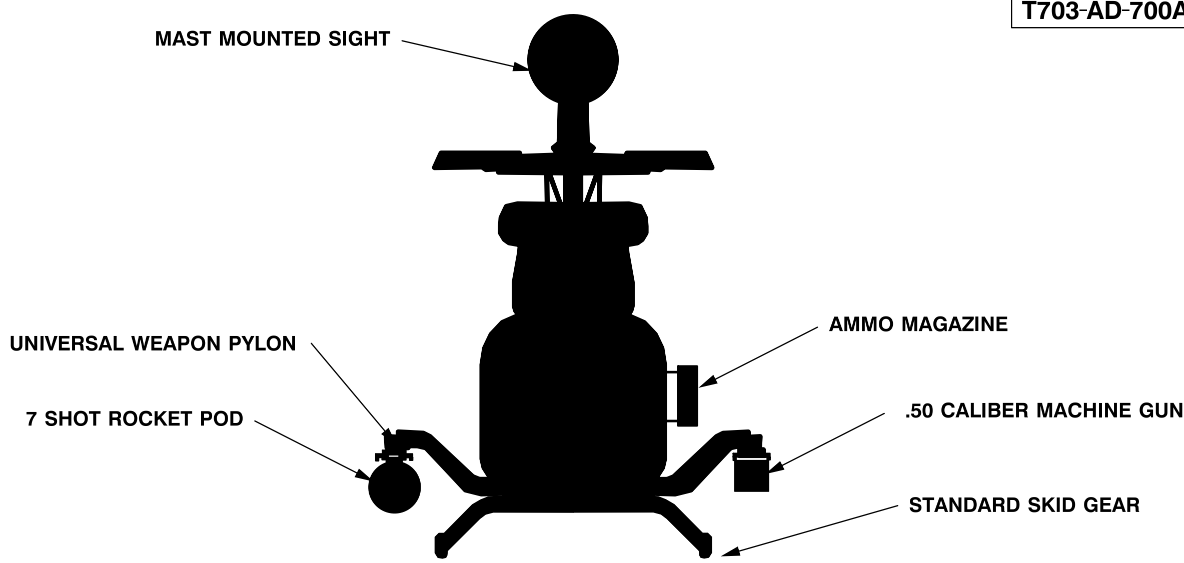
Figure 7-6. Drag Chart (Sheet 1 of 2)

DRAG

DRAG
OH-58D
T703-AD-700A



ITEM	△F-SQ FT	DESCRIPTION	REF
1	0	OH-58D(I) ARMED CONFIGURATION*	BASELINE
2	-2.9	MAST MOUNTED SIGHT	MMS
3	+1.2	QUICK DEPLOYMENT GEAR (ABOVE STANDARD GEAR)	QDG
4	-2.0	UNIVERSAL WEAPONS PYLON (PER SIDE)	UWP
5	-3.0	.50 CALIBER MACHINE GUN AND AMMO MAGAZINE**	50CMG
6	±0.8	7 SHOT ROCKET POD***(PER SIDE)	7SRP
7	+1.5	2 HELLFIRE MISSILES***(PER SIDE)	HM
8	+1.0	2 AIR-TO-AIR STINGER MISSILES***(PER SIDE)	ATAS
9	+1.0	CREW DOORS OFF	CDO
10	+0.2	ALQ-144 JAMMER	ALQ
11	+1.8	AVR-2 LASER RECEIVER	AVR-2

* THE OH-58D BASIC CONFIGURATION INCLUDES THE DRAG FOR THE MAST MOUNTED SIGHT, A UNIVERSAL WEAPON PYLON WITH EJECTOR RACKS ON BOTH SIDES, A 7 SHOT ROCKET POD ON RIGHT SIDE, A .50 CALIBER MACHINE GUN, AMMO MAGAZINE ON LEFT SIDE, A STANDARD LANDING GEAR AND BOTH CREW DOORS INSTALLED.

** LEFT SIDE ONLY

*** EITHER SIDE

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Figure 7-6. Drag Chart (Sheet 2 of 2)

SECTION VII. CLIMB-DESCENT OH-58D (T703-AD-700A/ 250-C30R)

7-23. CLIMB-DESCENT CHART.

The climb-descent chart (fig. 7-7 and 7-8) show the change in torque above or below torque required for level flight under the same gross weight and atmospheric conditions to obtain a given rate of climb or descent.

7-24. USE OF CHART.

The primary uses of the chart are illustrated by the chart examples.

a. The torque change obtained from the grid scale must be added to (for climb) or subtracted from (for descent) the torque required for level flight in order to obtain a total climb or descent torque. The torque required for level flight is obtained from the appropriate cruise chart.

b. By entering the bottom of the grid with a known torque change, moving upward to the gross weight, and then left, the corresponding rate of climb or descent may also be obtained.

7-25. CONDITIONS.

The climb-descent chart is based on the use of 100% rpm. The rate of climb (descent presented is for steady state conditions and rpm bleed could increase (decrease) rate of climb (descent) shown.

EXAMPLE

WANTED

MAXIMUM RATE OF CLIMB AT MAXIMUM CONTINUOUS POWER

KNOWN

BASIC CONFIGURATION
GROSS WEIGHT = 5000 LB
PRESSURE ALTITUDE = 12,000 FEET
FAT = -15°C

METHOD

LOCATE APPROPRIATE CRUISE CHART (FIGURE 7-5, SHEET 8)
FIND INTERSECTION OF 5000 POUND GROSS WEIGHT LINE WITH THE MAXIMUM RATE OF CLIMB LINE
MOVE DOWN, READ MAST TORQUE (0 TO 40 KTAS) REQUIRED = 50.2%Q
MOVE RIGHT, DETERMINE CONTINUOUS MAST TORQUE (0 TO 40 KTAS) AVAILABLE = 80.8%Q
EXCESS MAST TORQUE (0 TO 40 KTAS) AVAILABLE = (80.8 - 50.2) = 30.6%Q

ENTER MAST TORQUE SCALE OF CLIMB-DESCENT CHART AT 30.6%Q
MOVE UP TO 5000 POUND GROSS WEIGHT LINE
MOVE LEFT TO RATE OF CLIMB OR DESCENT SCALE,
READ RATE OF CLIMB = 1030 FT/MIN

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CLIMB - DESCENT

100% RPM

CLIMB-DESCENT OH-58D T703-AD-700A/250-C30R

EXAMPLE

WANTED

Δ MAST TORQUE CHANGE FOR DESIRED RATE OF CLIMB OR DESCENT

KNOWN

GROSS WEIGHT = 4500 POUNDS
DESIRED RATE OF CLIMB = 1200 FT/MIN

METHOD

ENTER RATE OF CLIMB AT 1200 FT/MIN
MOVE RIGHT TO GROSS WEIGHT
DROP DOWN AND READ 32% Δ MAST TORQUE CHANGE

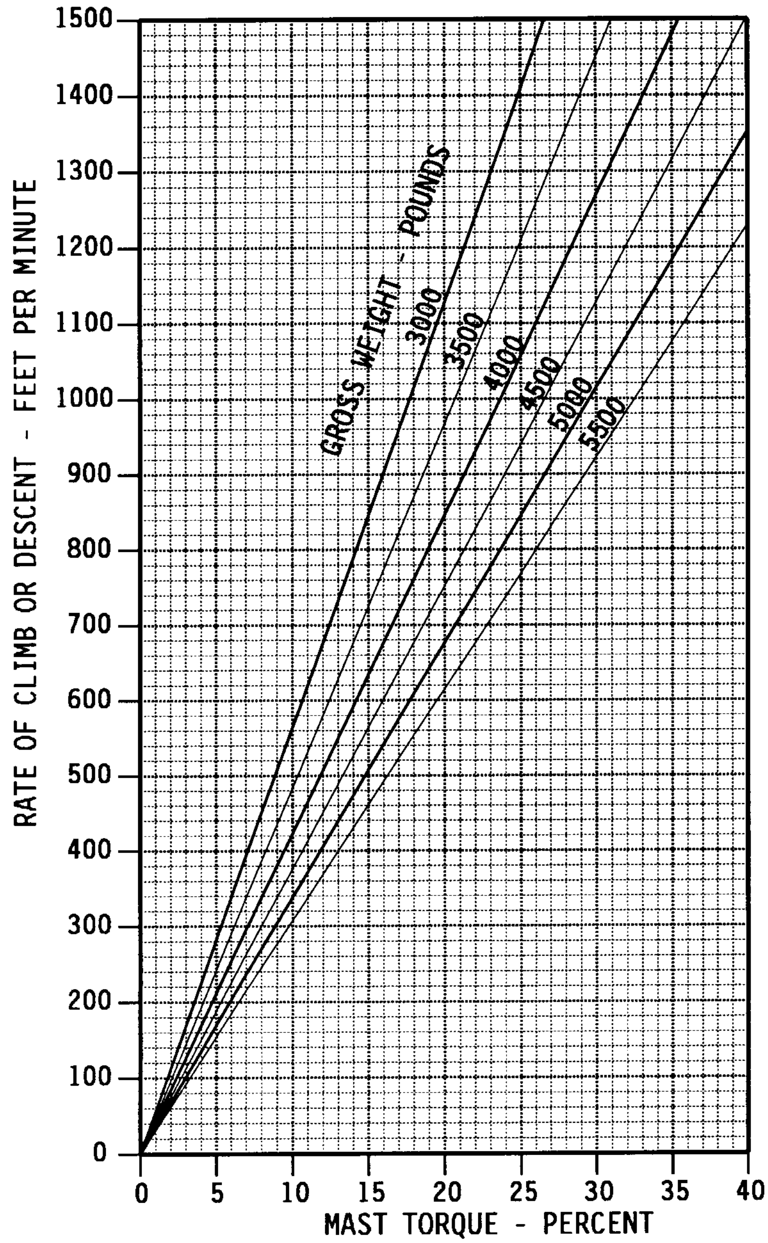

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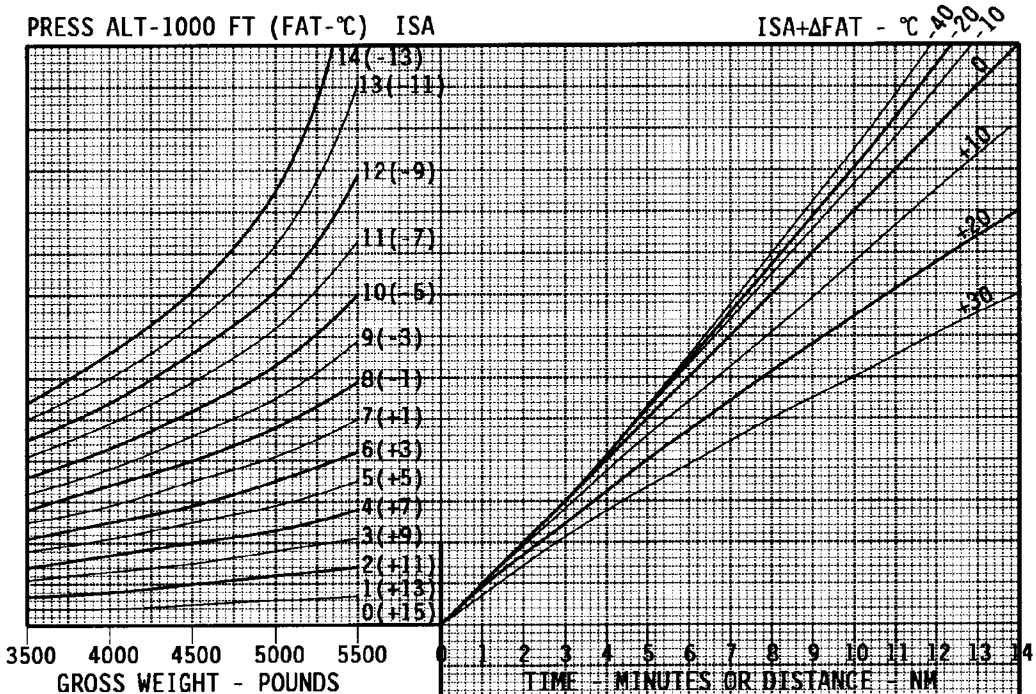
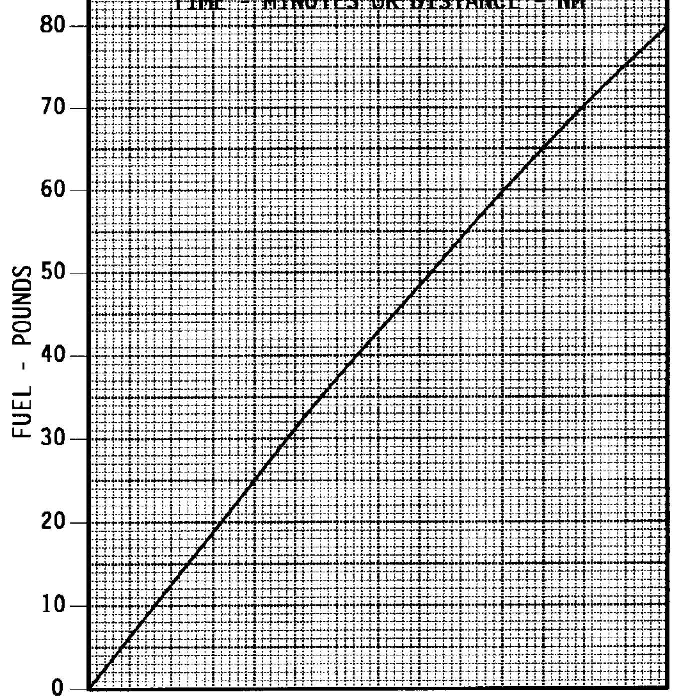
Figure 7-7. Climb-Descent Chart

CLIMB PERFORMANCE
30 MINUTE POWER

CLIMB PERFORMANCE
OH-58D
T703-AD-700A/250-C30R





EXAMPLE

WANTED

TIME, DISTANCE AND FUEL

KNOWN

GROSS WEIGHT = 4750 LB
INITIAL ALTITUDE = 7000 FT
FAT AT INITIAL ALTITUDE = 21°C
FINAL ALTITUDE = 11000 FT

METHOD

ENTER GROSS WEIGHT SCALE AT 4750 LB
MOVE UP TO INITIAL ALTITUDE,READ ISA FAT=1°C
CALCULATE Δ FAT (INITIAL FAT LESS ISA FAT)
OR (21°C − 1°C)= 20°C ΔFAT
MOVE RIGHT TO ISA+20°C LINE
DROP DOWN, READ: TIME = 4.8 MIN
DISTANCE = 4.8 NM
CONTINUE DOWN TO FUEL LINE,
MOVE LEFT, READ 30 POUNDS
RE-ENTER GROSS WEIGHT
MOVE UP TO FINAL ALTITUDE
MOVE RIGHT TO ISA+20°C, DROP DOWN
READ: TIME = 8.6 MIN AND DISTANCE = 8.6 NM
CONTINUE DOWN TO FUEL LINE
MOVE LEFT, READ 53 POUNDS
CALCULATE TIME, DISTANCE AND FUEL(FINAL ALTITUDE VALUES LESS INITIAL ALTITUDE VALUES)
TIME:(8.6−4.8) = 3.8 MIN, DISTANCE:(8.6−4.8)=3.8 NM
FUEL:(53−30) = 23 LB

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Figure 7-8. Climb Performance Chart

SECTION VIII. FUEL FLOW OH-58D (T703-AD-700A/250-C30R)

7-26. FLAT PITCH FUEL FLOW CHART.

The flat pitch fuel flow chart (fig. 7-9) shows the fuel flow at flat pitch.

7-27. USE OF CHART.

The primary use of the chart is illustrated by the example. To determine the flat pitch fuel flow, it is necessary to know pressure altitude and free air temperature. Enter at the pressure altitude, move right to FAT then move down and read fuel flow. Refer to the cruise charts to obtain fuel flow for cruise power conditions.

7-28. CONDITIONS.

This chart is based upon the use of JP-8 fuel and 100% rpm.

FLAT PITCH FUEL FLOW

JP-8 FUEL

FLAT PITCH FUEL FLOW OH-58D T703-AD-700A/250-C30R

EXAMPLE

WANTED

FLAT PITCH FUEL FLOW

KNOWN

PRESSURE ALTITUDE = 8600 FEET
FAT = 0 °C

METHOD

ENTER PRESSURE ALTITUDE
MOVE RIGHT TO FAT
DROP DOWN, READ 134 LB/HR
FLAT PITCH FUEL FLOW

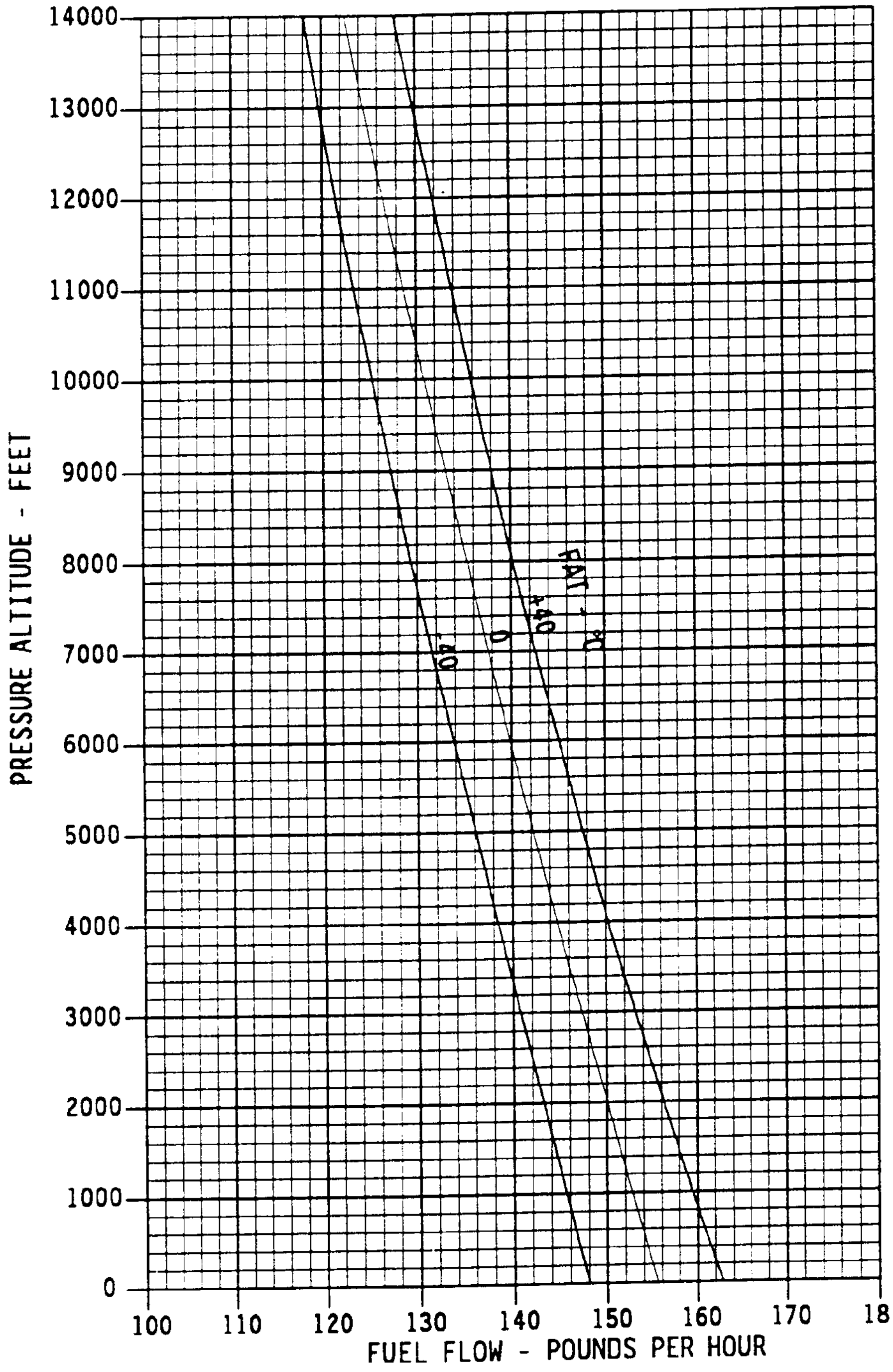

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Figure 7-9. Flat Pitch Fuel Flow Chart

7-29. FUEL FLOW VS TORQUE CHART.

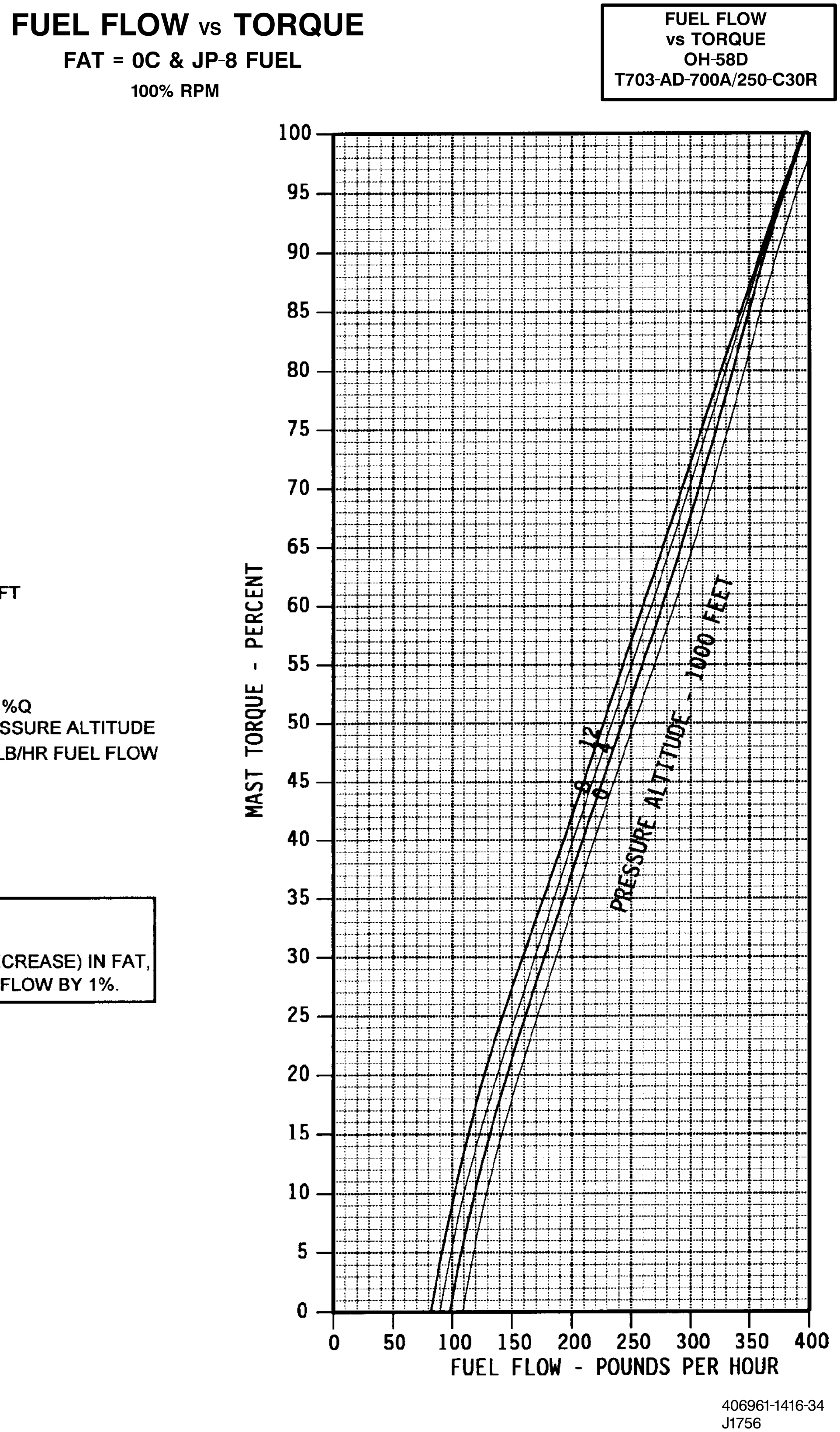
The fuel flow for this helicopter (particle separator installed) is presented in figure 7-10. Fuel flow vs torque shows fuel flow in pounds-per-hour versus torquemeter %Q for pressure altitudes from sea level to 12,000 feet and for 0 °C free air temperature.

7-30. USE OF CHART.

The primary use of this chart is illustrated by the examples to determine fuel flow. It is necessary to know the mast torque (%Q) and the FAT as well as the pressure altitude. Fuel flow will increase about 2 percent with the bleed air heater on and 3 percent with anti-ice on. When both systems are on, increase fuel flow 5 percent. Also a range or endurance penalty should be accounted for when working cruise chart data. A fairly accurate rule-of-thumb to correct fuel flow for temperatures other than 0 °C FAT is to increase (decrease) fuel flow one percent for each 10 °C increase (decrease) in FAT.

7-31. CONDITIONS.

The chart is based on JP-8 fuel, 100% rpm and bleed air heater and anti-ice off.



EXAMPLE

WANTED

FUEL FLOW

KNOWN

MAST TORQUE = 61%Q
PRESSURE ALTITUDE = 8000 FT
FAT = 0°C

METHOD

ENTER TORQUE SCALE AT 61%Q
MOVE RIGHT TO 8000 FT PRESSURE ALTITUDE
MOVE DOWN AND READ 280 LB/HR FUEL FLOW

NOTE:

FOR EACH 10° INCREASE (DECREASE) IN FAT, INCREASE (DECREASE FUEL FLOW BY 1%.

Figure 7-10. Fuel Flow vs Torque Chart

SECTION IX. MAST TORQUE AVAILABLE OH-58D R (250-C30R/3)

7-32. DESCRIPTION.

The maximum torque available chart (fig. 7-11, sheets 1 and 2) shows the effects of altitude and temperature on mast torque and engine torque. Both pressure altitude and FAT affect engine power production. The chart shows power available data at 30 minute and continuous operation power ratings in terms of the allowable torque as recorded by the torquemeter (%Q). Note that the power output capability of the 250-C30R/3 engine can exceed the transmission structural limit (100%Q) under certain conditions. All %Q data shown in this chapter is for mast torque.

Prolonged IGE hover may increase engine inlet temperature as much as 10 °C; therefore, a 10 °C higher FAT must be used to correct for this condition.

7-33. USE OF CHART.

Primary use of the chart is illustrated by the example. In general, to determine the maximum torque available, it is necessary to know the pressure altitude and temperature.

7-34. CONDITIONS.

The chart is based on NR, NP 100 percent, and JP-8 fuel, with bleed air heater and anti-ice off. Reduce torque available 3 percent if bleed air heater is on, 3.5 percent if anti-ice is on, and 6.5 percent if both systems are on. No reduction will occur if torque available is transmission limited.

NOTE

Fuel grade JP-8/JP-5 will yield the same nautical miles per pound as JP-4. Using JP-8/JP-5 will only result in increased fuel weight.

MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)
ANTI-ICE OFF & BLEED AIR HEATER OFF
100% RPM

MAXIMUM
TORQUE
OH-58D
250-C30R/3

EXAMPLE

WANTED

MAST TORQUE

KNOWN

PRESSURE ALTITUDE=12,000 FT
FAT=25° C

METHOD

ENTER FAT AT 25°C
MOVE RIGHT TO PRESSURE ALTITUDE
MOVE DOWN
READ 74.% MAST TORQUE

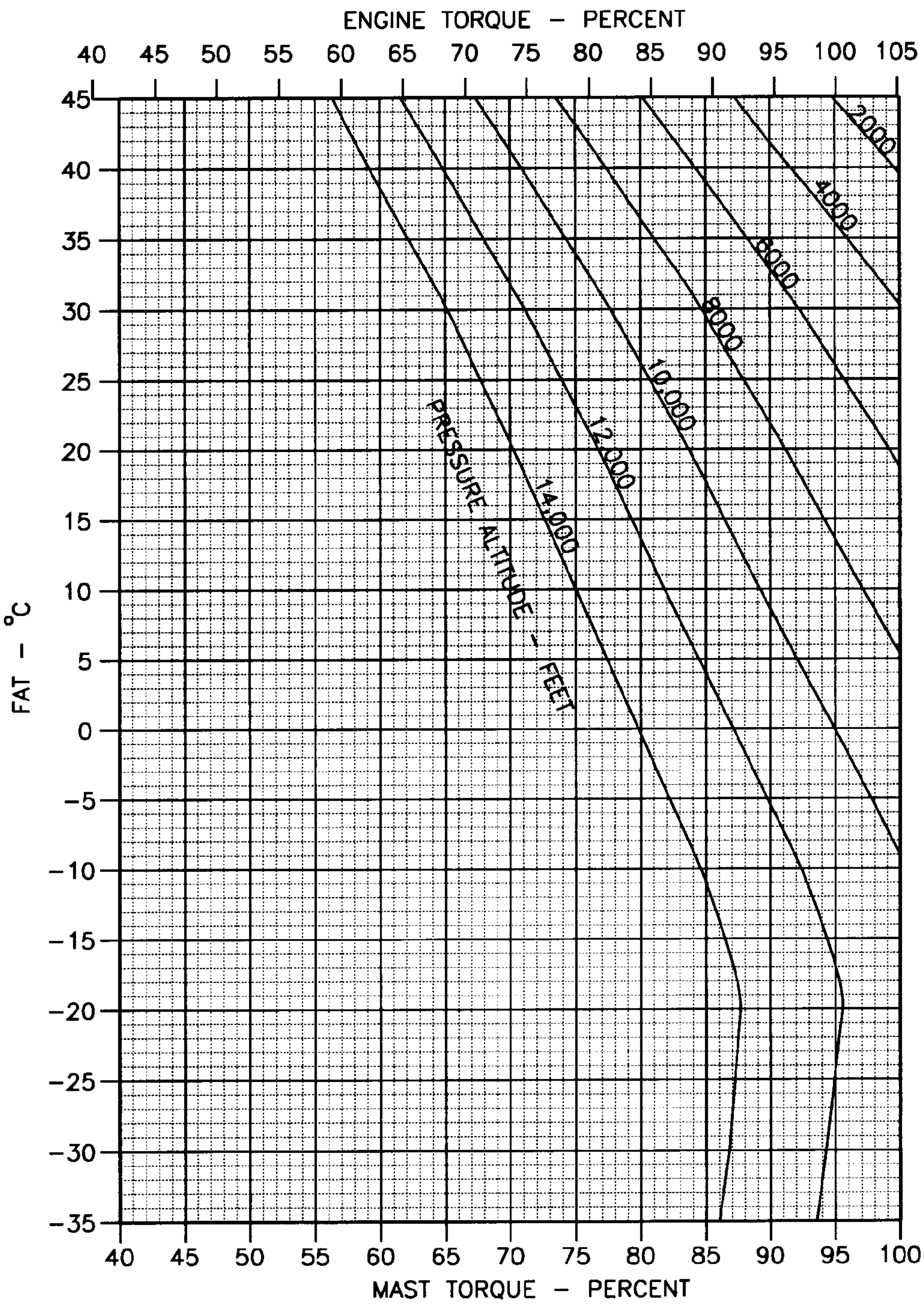


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Figure 7-11. Maximum Torque Available Chart (30 Minute Operation) (Sheet 1 of 2)

MAXIMUM TORQUE AVAILABLE (CONTINUOUS OPERATION)

ANTI-ICE OFF & BLEED AIR HEATER OFF

100% RPM

MAXIMUM TORQUE OH-58D 250-C30R/3

EXAMPLE

WANTED

MAST TORQUE

KNOWN

PRESSURE ALTITUDE=8000 FT
FAT=25° C

METHOD

ENTER FAT AT 25°C
MOVE RIGHT TO PRESSURE ALTITUDE
MOVE DOWN
READ 66.5% MAST TORQUE

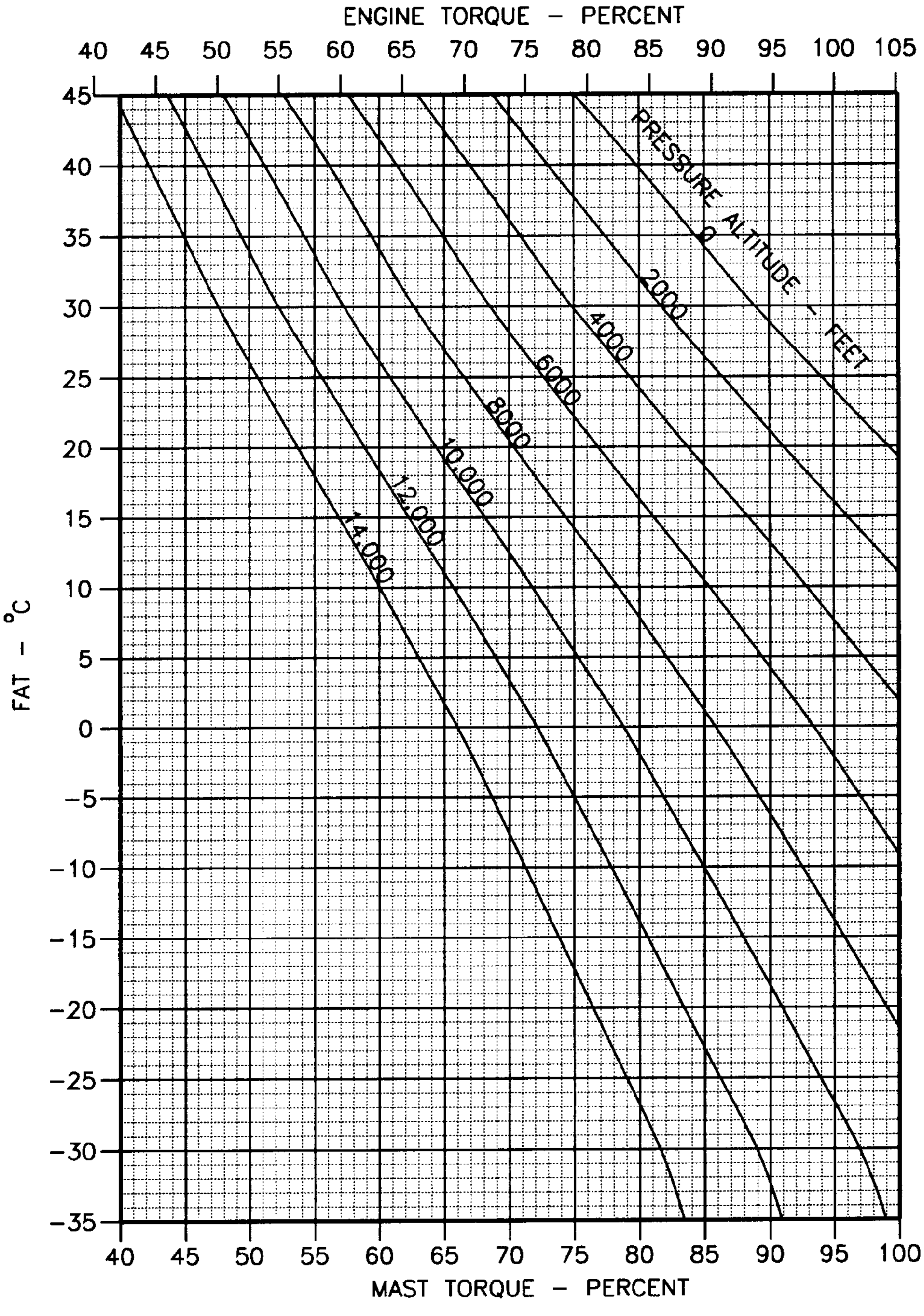

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Figure 7-11. Maximum Torque Available Chart (Continuous Operation) (Sheet 2 of 2)

SECTION X. HOVER OH-58D R (250-C30R/3)

7-35. DESCRIPTION.

The hover charts (figures 7-12 through 7-14, sheets 1 through 4) show hover ceiling and the torque required to hover respectively at various altitudes, ambient temperatures, gross weights, and skid heights. Maximum skid height for hover can also be obtained by using the torque available (fig. 7-11). The directional control capability is adequate to 35 knots for all azimuths.

7-36. USE OF CHART.

a. The primary use of the charts is illustrated by the examples. In general, to determine the hover ceiling or the torque required to hover, it is necessary to know the pressure altitude, temperature, gross weight, and the desired skid height.

b. In addition to its primary use, the hover chart (fig. 7-14) can also be used to determine the predicted maximum hover height. To determine maximum hover height, proceed as follows:

(1) Enter chart at appropriate pressure altitude.

(2) Move right to FAT.

(3) Move down to gross weight.

(4) Move left to intersection with maximum mast torque available obtained from figure 7-11.

(5) Read predicted maximum skid height. The height is the maximum hover height.

7-37. CONDITIONS.

The hover charts are based upon clam wind conditions, a level ground surface, and the use of 100 percent rotor rpm. Controllability during down wind hovering, crosswinds, and rearward flight is adequate in wind conditions in accordance with para 5-12.

EXAMPLE

WANTED

MAXIMUM GROSS WEIGHT TO HOVER

KNOWN

SKID HEIGHT = 3 FEET
PRESSURE ALTITUDE = 14,000 FEET
FAT = 10°C
30 MINUTE TORQUE AVAILABLE AT 100% RPM

METHOD

ENTER OAT SCALE AT 10°C
MOVE RIGHT TO 14,000 FEET PRESSURE ALTITUDE
MOVE DOWN, READ MAXIMUM GROSS WEIGHT TO HOVER = 4550 LB

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HOVER CEILING
MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)
OUT OF GROUND EFFECT
100% RPM

HOVER CEILING OH-58D 250-C30R/3

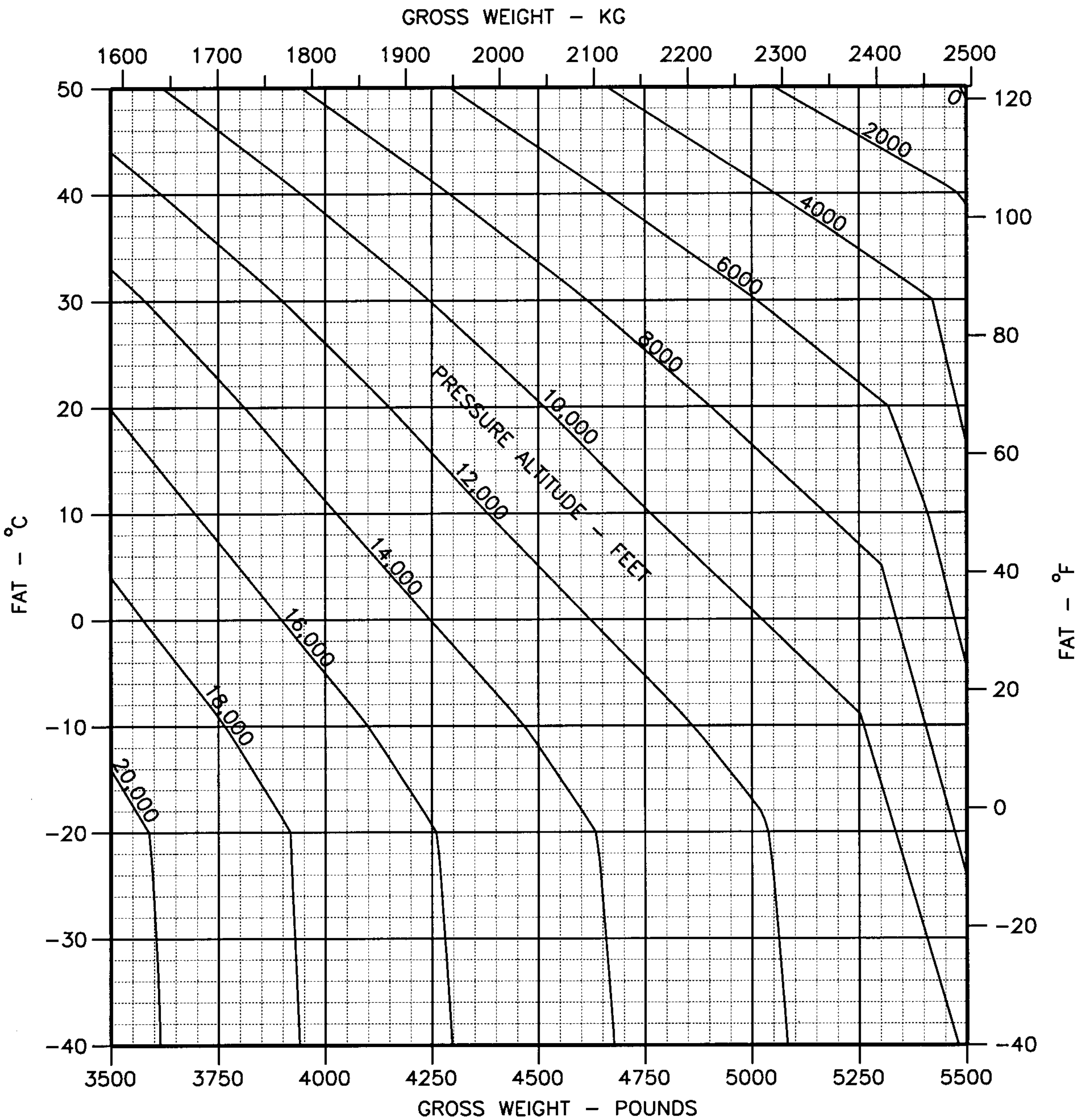

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Figure 7-12. Hover Ceiling Chart, 30 Minute Operation (Out of Ground Effect)(Sheet 1 of 2)

HOVER CEILING
MAXIMUM TORQUE AVAILABLE (30 MINUTE OPERATION)
3 FT SKID HEIGHT
100% RPM

HOVER
CEILING
OH-58D
250-C30R/3

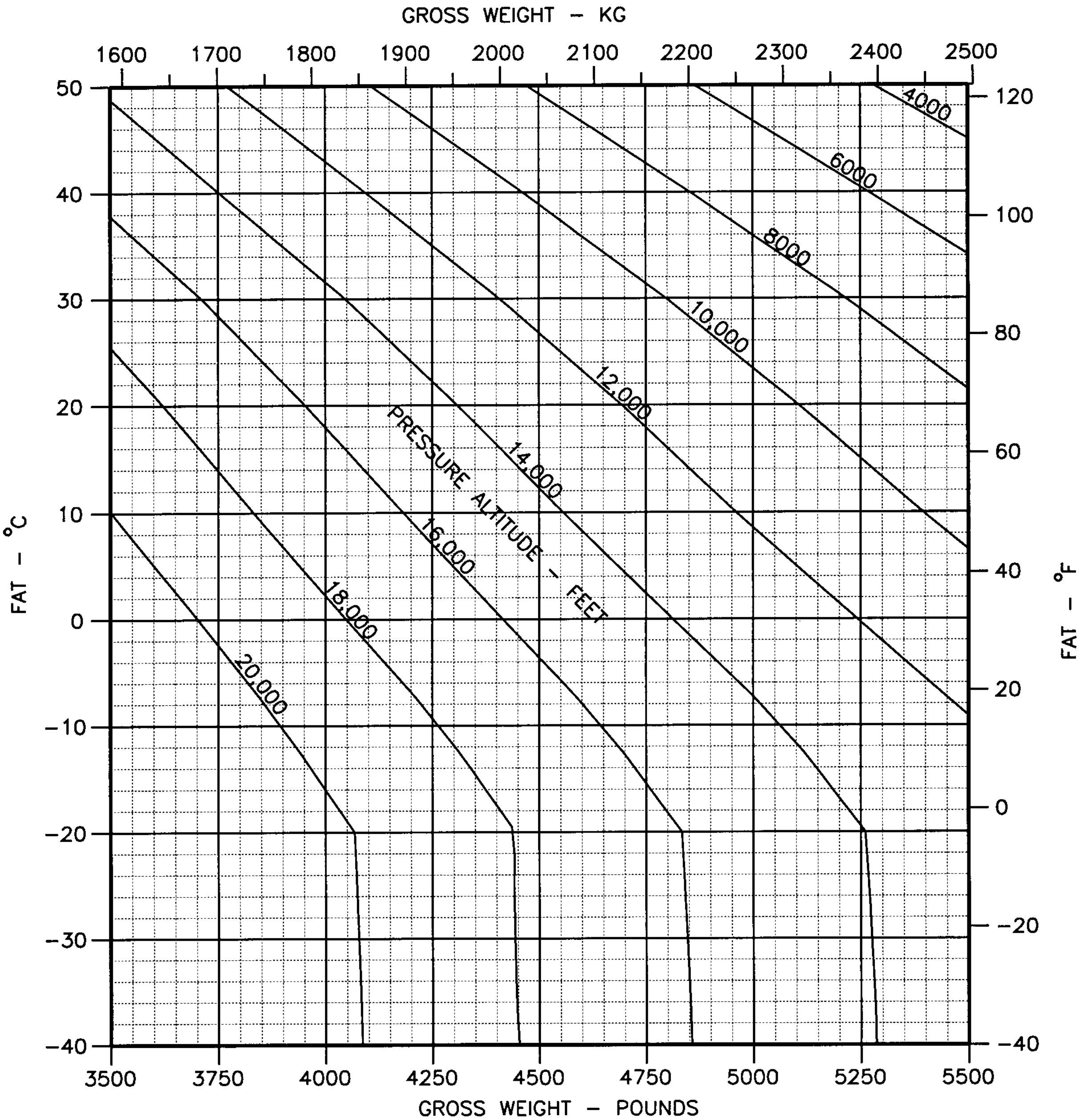

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Figure 7-12. Hover Ceiling Chart, 30 Minute Operation (3 Ft Skid Height)(Sheet 2 of 2)

HOVER CEILING
MAXIMUM TORQUE AVAILABLE (CONTINUOUS OPERATION)
OUT OF GROUND EFFECT
100% RPM

HOVER CEILING OH-58D 250-C30R/3

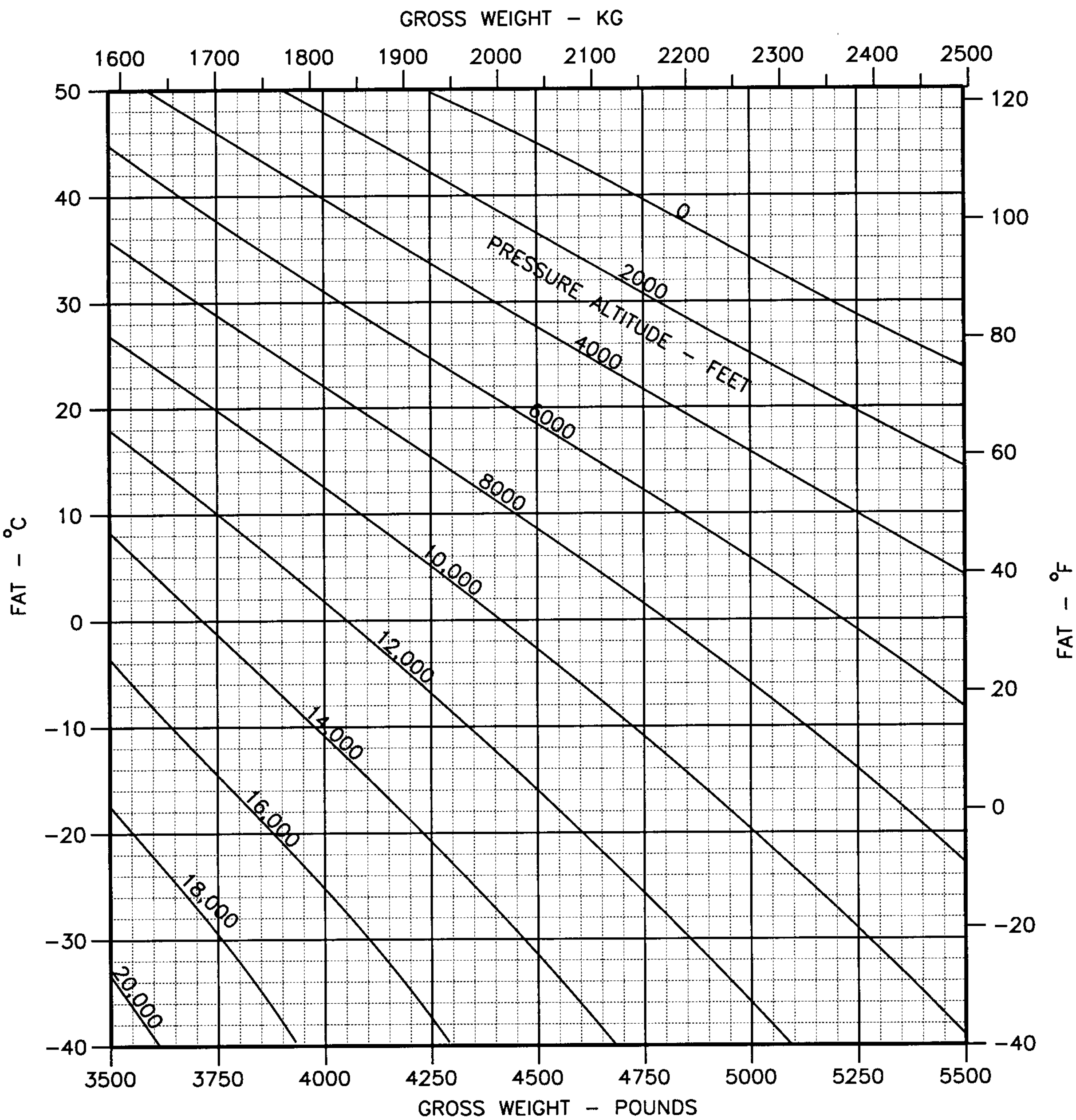

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Figure 7-13. Hover Ceiling Chart, Continuous Operation (Out of Ground Effect)(Sheet 1 of 2)

HOVER CEILING
MAXIMUM TORQUE AVAILABLE (CONTINUOUS OPERATION)
3 FT SKID HEIGHT
100% RPM

HOVER CEILING OH-58D 250-C30R/3

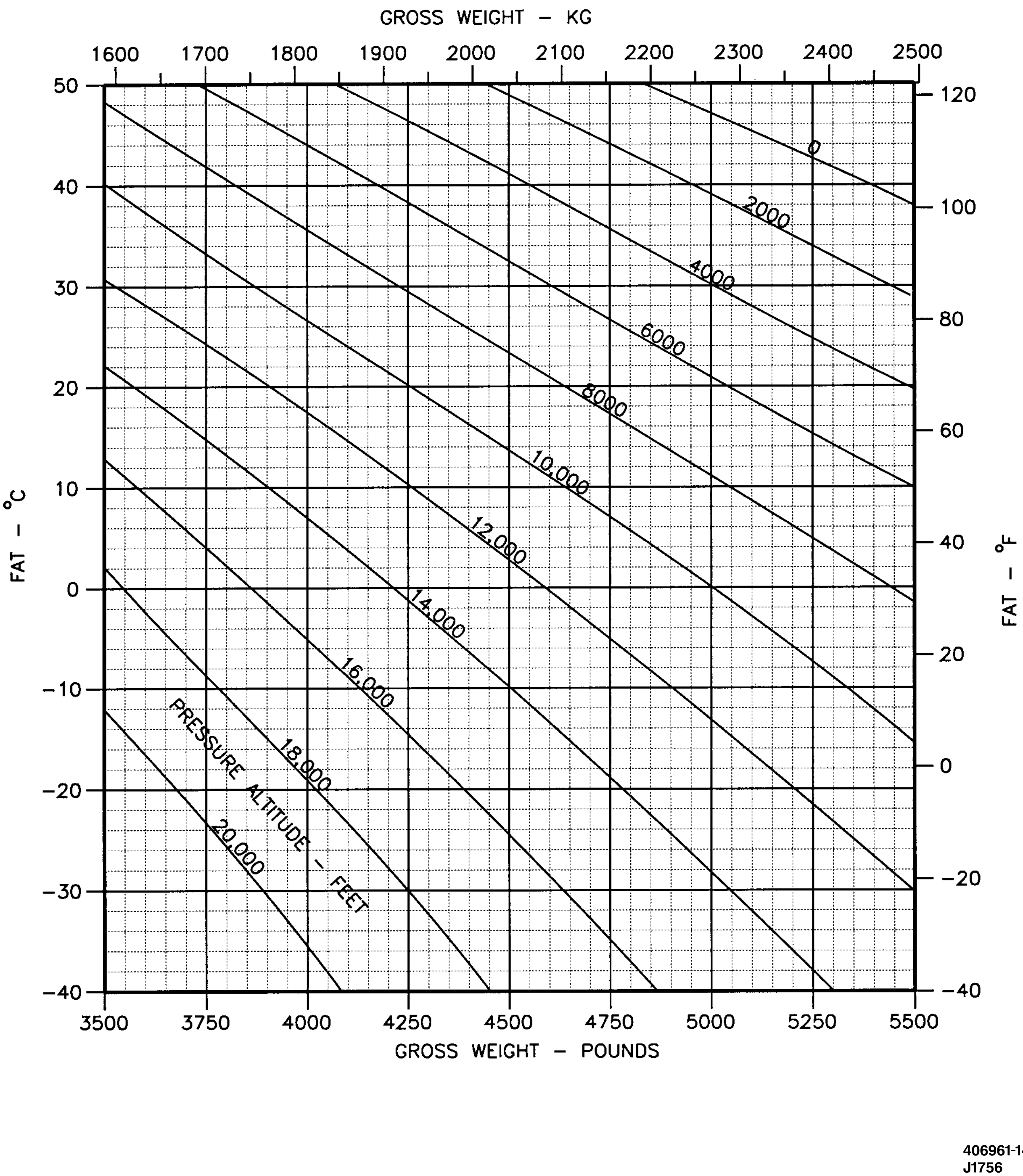

Figure 7-13. Hover Ceiling Chart, Continuous Operation (3 Ft Skid Height)(Sheet 2 of 2)

EXAMPLE - Hover Power Required Chart

WANTED

MAXIMUM GROSS WEIGHT FOR HOVERING OUT OF GROUND EFFECT

KNOWN

FAT = 30°C
PRESSURE ALTITUDE = 6000 FEET
MAST TORQUE = 80 PERCENT

METHOD

ENTER FAT SCALE AT 30°C
MOVE RIGHT TO 6000 FEET PRESSURE ALTITUDE
DROP DOWN TO 80 PERCENT MAST TORQUE LINE
DETERMINE PERCENTAGE BETWEEN 4500 LB LINE AND 4750 LINE = 15%
DETERMINE Δ MAXIMUM GROSS WEIGHT = (.15 X 250 LB) = 37.5 LB
MAXIMUM GROSS WEIGHT FOR HOVERING = (4500 + 37.5) = 4537.5 LB

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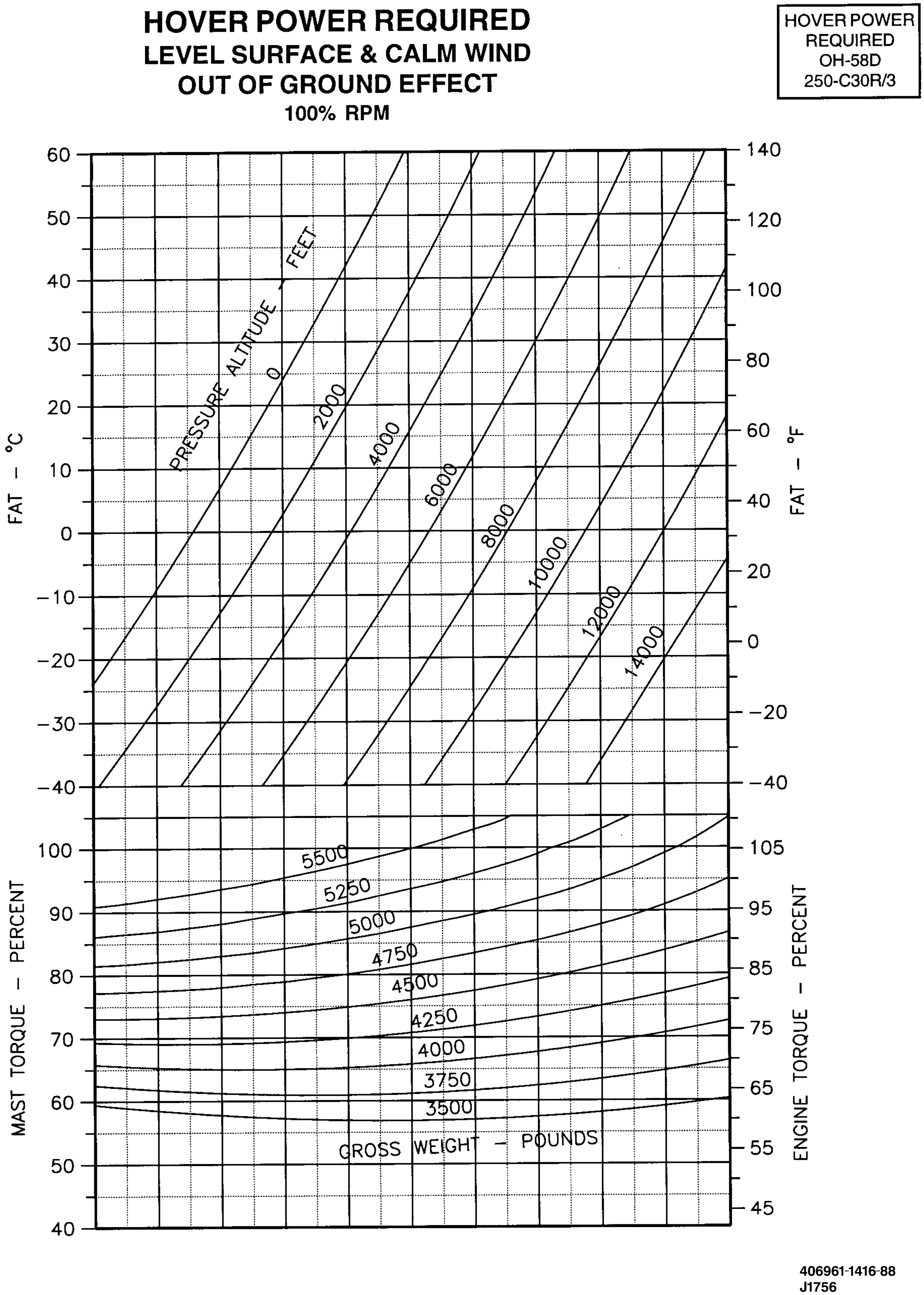

Figure 7-14. Hover Power Required Chart (Out of Ground Effect)(Sheet 1 of 2)

HOVER POWER REQUIRED
LEVEL SURFACE & CALM WIND
3 FT SKID HEIGHT
100% RPM

HOVER POWER REQUIRED
OH-58D
250-C30R/3

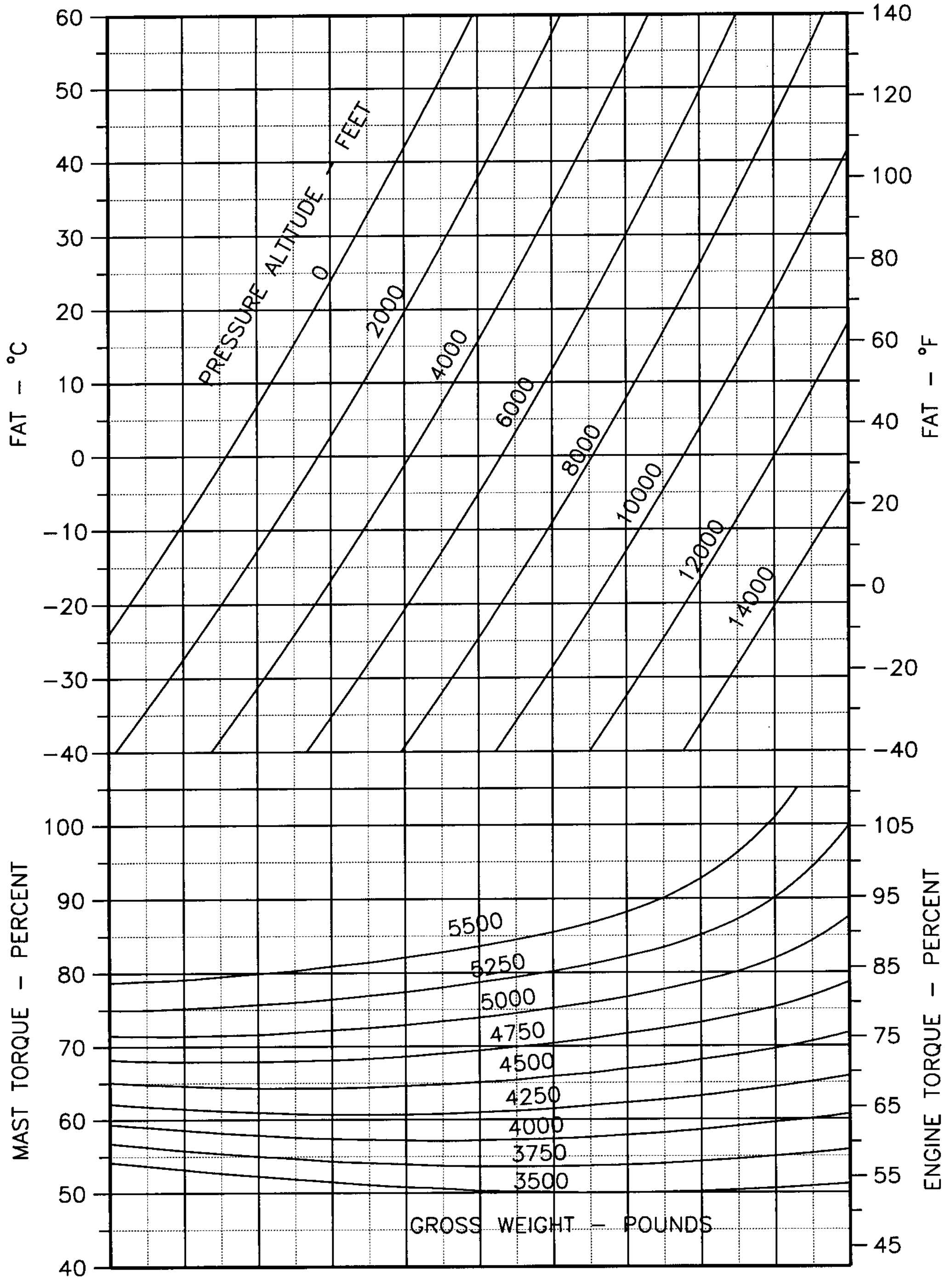

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Figure 7-14. Hover Power Required Chart (3 Ft Skid Height)(Sheet 2 of 2)

SECTION XI. CRUISE OH-58D(R) (250-C30R/3)

7-38. DESCRIPTION.

The cruise charts (fig. 7-15, sheets 1 thru 23) show the mast torque and fuel flow required for level flight at various pressure altitudes, airspeeds, and gross weights at 100% rpm. Actual mast torque required and fuel flow for hover and low speed flight conditions (speed less than 40 KTAS) will be slightly greater than that shown on the cruise charts. The hover power required charts (fig. 7-14) should be used to determine mast torque required to hover.

NOTE

The cruise charts are basically arranged by FAT groupings. Figure 7-15, sheets 1 thru 23, are based upon operation with basic configuration. Each chart has a line that represents a 10 square foot equivalent flat plate drag area. This allows quick determination of Delta %Q for other than basic configurations.

7-39. USE OF CHARTS.

The primary use of the charts is illustrated by the example provided. The first step for chart use is to select the proper chart, based upon the pressure altitude and anticipated free air temperature. Normally, sufficient accuracy can be obtained by selecting the chart nearest to the planned cruising altitude and FAT, or the next higher altitude. If greater accuracy is required, interpolation between altitudes and/or temperatures will be required (see example on page 7-62). You may enter the charts on any side (TAS, IAS, mast torque, or fuel flow), move vertically or horizontally to the gross weight, then to the other three parameters. Maximum performance conditions are determined by entering the chart where the maximum range or maximum endurance and rate of climb lines intersect the appropriate gross weight, then read airspeed, fuel flow, and mast torque (%Q). For conservatism, use the gross weight at the beginning of cruise flight. For greater accuracy on long flights, it is preferable to determine cruise information for several flights segments in order to allow for decreasing fuel weights (reduced gross weight). The following parameters contained in each chart are further explained as follows:

a. Airspeed. True and indicated airspeeds are present at opposite sides of each chart. On any chart indicated airspeed can be directly converted to true airspeed (or vice versa) by reading directly across the chart without regard for other chart information. Maximum permissible airspeed (Vne) limits appear as red lines on some charts. If no red line appears, Vne is above the limits of the chart.

b. Mast Torque (%Q). Since pressure altitude and temperature are fixed for each chart, mast torque varies according gross weight and airspeed. For pilot convenience, all power is presented in terms of mast torque.

c. Fuel Flow. Fuel flow scales are provided opposite the torque scales. On any chart, torque may be converted directly to fuel flow without regard for other chart information. All fuel flows are presented for bleed air heater and anti-ice off. Add 2 percent fuel flow (about 6 lb/hr) for heater on and increase fuel flow 3 precent (approximately 9 lb/hr) for anti-ice on. If both are operating, add 5 percent fuel flow (about 15 lb/hr) to chart values.

d. Maximum Range. The maximum range lines indicate the combinations of weight and airspeed that will produce the greatest flight range per gallon of fuel under zero wind conditions. When a maximum range condition does not appear on a chart, It is because the maximum range speed is beyond the maximum permissible speed (Vne); in such cases, use cruising speed Vne to obtain maximum range.

e. Maximum Endurance and Rate of Climb. The maximum endurance and rate of climb lines indicate the airspeed for minimum torque required to maintain level flight for each gross weight, FAT, and pressure altitude. Since minimum torque will provide minimum fuel flow, maximum flight endurance will be obtained at the airspeeds indicated.

7-40. CONDITIONS.

The cruise charts are based upon operation at 100% engine rpm, 801 °C, and basic inlet configuration (without inlet blast shield).

CRUISE
BASIC CONFIGURATION
100% RPM

FAT -30°C

CRUISE SEA LEVEL to 2000 FT -30°C OH-58D 250-C30R/3

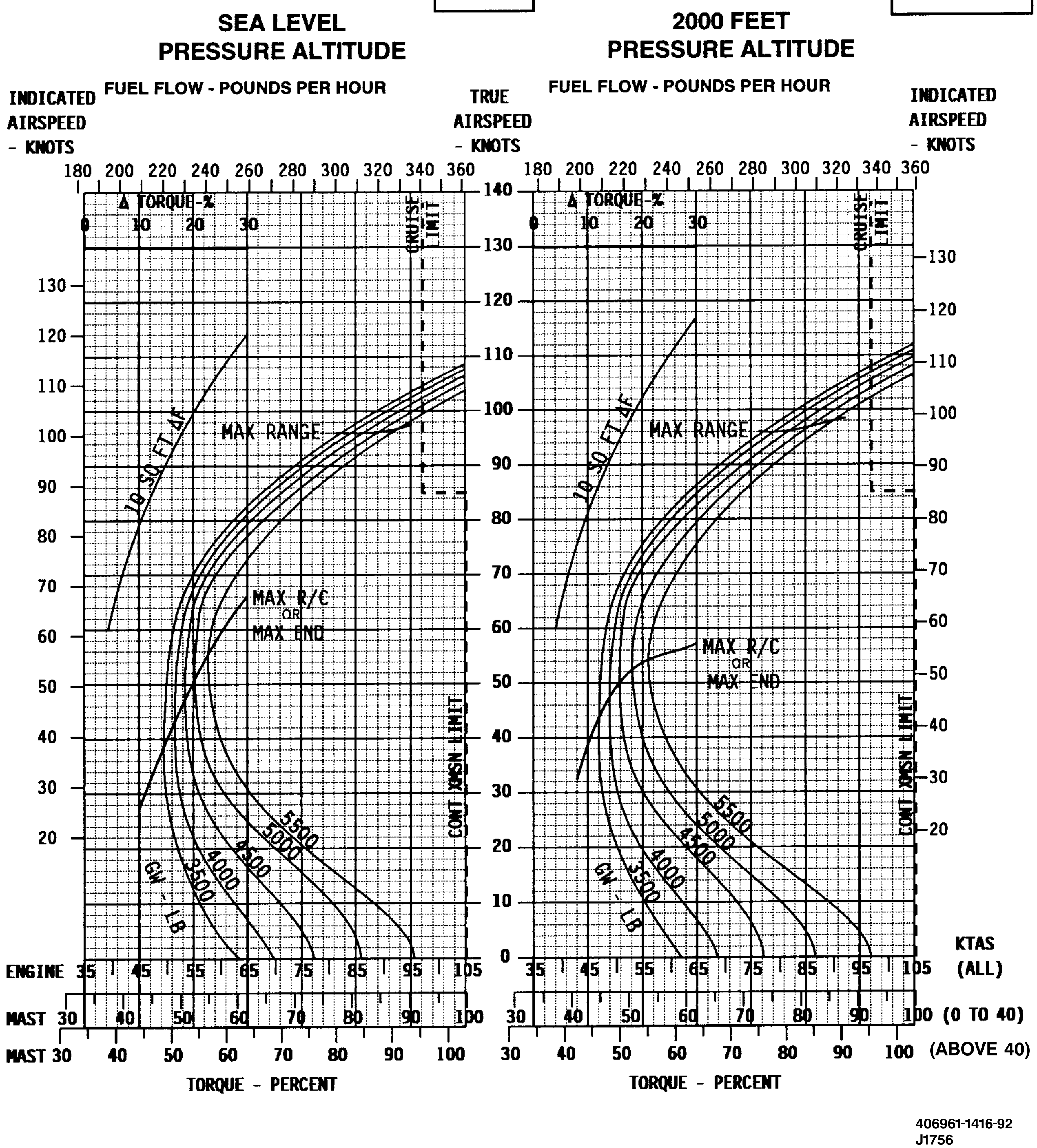

Figure 7-15. Cruise Chart, FAT -30 °C, Sea Level to 2000 Feet (Sheet 1 of 23)

EXAMPLE - Cruise Chart - 5,000 Feet

WANTED

ENGINE TORQUE REQUIRED FOR LEVEL FLIGHT, FUEL FLOW, INDICATED AIRSPEED

KNOWN

BASIC CONFIGURATION
GROSS WEIGHT = 5000 LB
PRESSURE ALTITUDE = 5000 FEET
FAT = -30°C
DESIRED TRUE AIRSPEED = 80 KNOTS

METHOD (INTERPOLATE)

ENTER AIRSPEED AT 80 KNOTS
READ TORQUE, FUEL FLOW AND IAS ON EACH
ADJACENT ALTITUDE AND/OR FAT, TO INTERPOLATE
BETWEEN ALTITUDE AND/OR FAT

ALTITUDE, FEET	4000 FEET	6000 FEET	5000 FEET
FAT, °C	-30	-30	-30
ENGINE TORQUE, %Q	66	62	64
FUEL FLOW, LB/HR	244	234	239
IAS, KNOTS	76.4	75	75.7

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CRUISE
BASIC CONFIGURATION
100% RPM

FAT
-30°C

CRUISE
4000 FT
to
6000 FT
-30°C
OH-58D
250-C30R/3

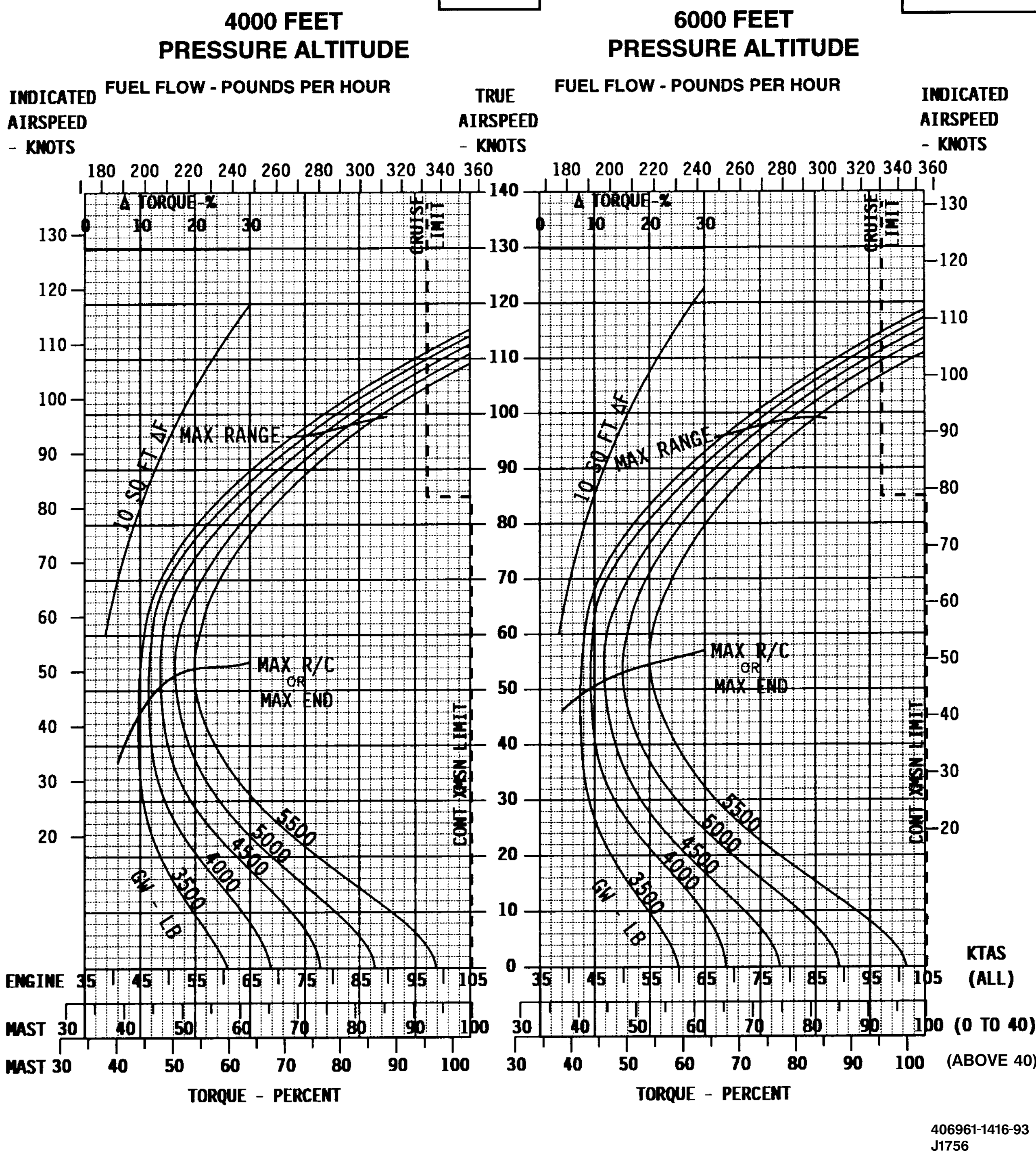

Figure 7-15. Cruise Chart, FAT -30 °C, 4000 to 6000 Feet (Sheet 2 of 23)

EXAMPLE - Cruise Chart - 8,000 Feet

WANTED

SPEED FOR MAXIMUM RANGE,
MAST TORQUE REQUIRED, FUEL FLOW AT MAXIMUM
RANGE AND SPEED FOR MAXIMUM ENDURANCE

KNOWN

BASIC CONFIGURATION, FAT = -30°C
PRESSURE ALTITUDE = 8000 FEET
GROSS WEIGHT = 5000 LB

METHOD

LOCATE (-30°C FAT, 8000 FEET) CHART

FIND INTERSECTION OF 5000 LB GROSS WEIGHT LINE
WITH THE MAXIMUM RANGE LINE
TO READ SPEED FOR MAXIMUM RANGE:
MOVE RIGHT, READ TAS = 102 KNOTS AND
MOVE LEFT, READ IAS = 92 KNOTS

TO READ FUEL FLOW REQUIRED:
FIND INTERSECTION OF 5000 LB GROSS WEIGHT LINE
WITH THE MAXIMUM RANGE LINE
MOVE UP, READ FUEL FLOW = 289 LB/HR

TO READ MAST TORQUE REQUIRED:
FIND INTERSECTION OF 5000 LB GROSS WEIGHT LINE
WITH THE MAXIMUM RANGE LINE
MOVE DOWN, READ MAST TORQUE = 76%Q

TO READ SPEED FOR MAXIMUM ENDURANCE:
FIND INTERSECTION OF 5000 LB GROSS WEIGHT LINE
WITH THE MAXIMUM ENDURANCE LINE
MOVE RIGHT, READ TAS = 54.8 KNOTS AND
MOVE LEFT, READ IAS = 48 KNOTS

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J1756

CRUISE
BASIC CONFIGURATION
100% RPM

CRUISE
8000 FT
to
10000 FT
-30°C
OH-58D
250-C30R/3

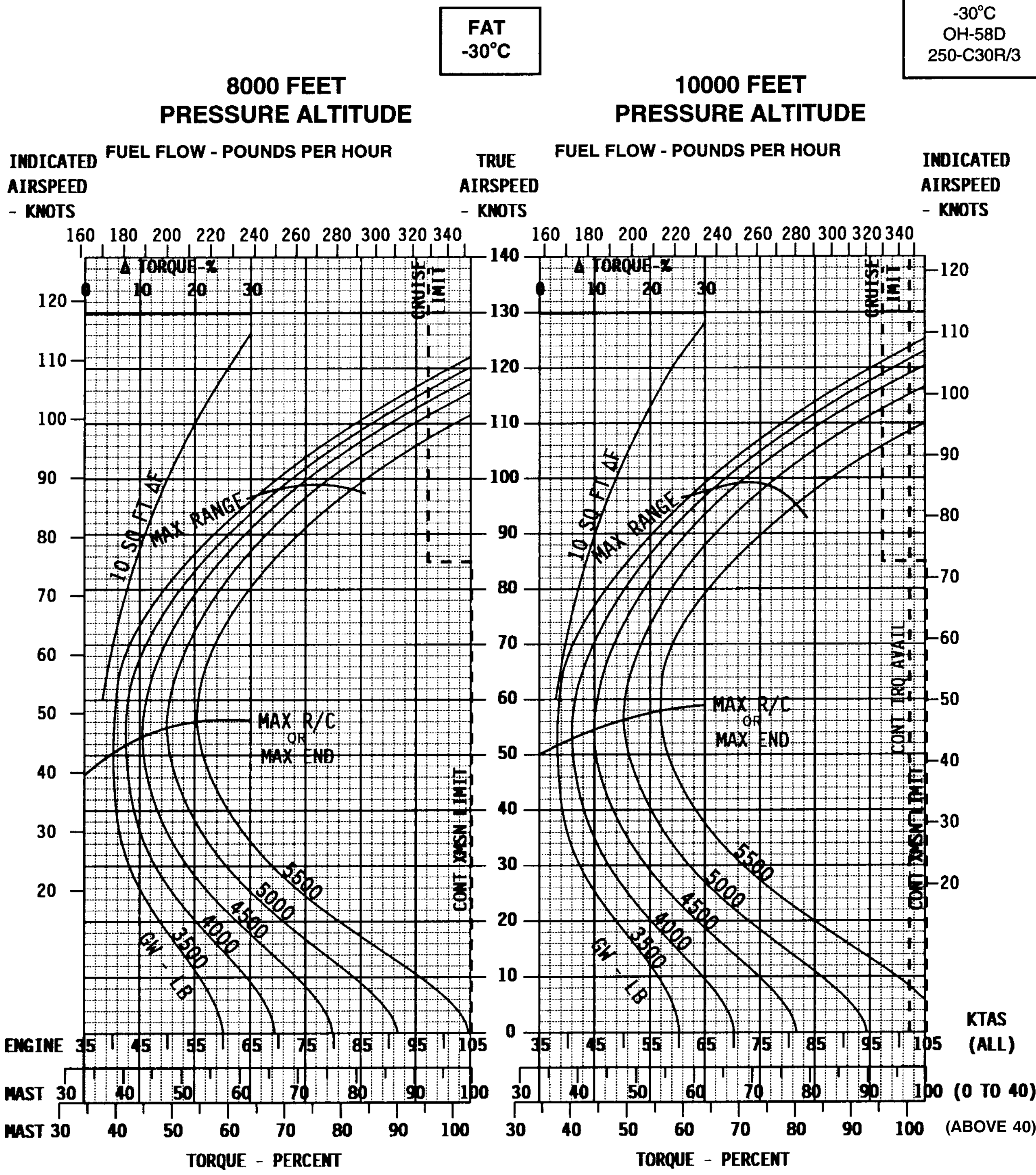

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Figure 7-15. Cruise Chart, FAT -30 °C, 8000 to 10000 Feet (Sheet 3 of 23)

EXAMPLE CHANGE IN DRAG -
Cruise Chart-12,000 Feet

WANTED

ADDITIONAL MAST TORQUE REQUIRED
AND FUEL FLOW FOR EXTERNAL DRAG
CONFIGURATION

KNOWN

ΔF FOR EXTERNAL DRAG CONFIGURATION
ΔDRAG = -0.8 SQUARE FEET
GROSS WEIGHT = 4500 LB
PRESSURE ALTITUDE = 12000 FEET
FAT = -30°C
TRUE AIRSPEED = 110 KNOTS

METHOD

ENTER TRUE AIRSPEED AT 110 KNOTS
MOVE LEFT TO 4500 LB GROSS WEIGHT LINE
MOVE UP TO FUEL FLOW SCALE, READ 290 LB/HR
MOVE DOWN TO MAST TORQUE SCALE, READ 83%Q

ENTER TRUE AIRSPEED AT 110 KNOTS
MOVE LEFT TO 10 SQ FT ΔF LINE
MOVE UP TO ΔTORQUE SCALE, READ 17%ΔQ

DIVIDE -0.8 SQ FT BY 10 SQ FT TO OBTAIN -0.08%ΔQ
MULTIPLY 17%ΔQ TIMES -0.08%ΔQ TO OBTAIN ΔQ
(17 X (-0.08)ΔQ = 1.4ΔQ
ADD INITIAL TORQUE AND ΔTORQUE TO OBTAIN FINAL TORQUE
((83 + (-1.4))%Q = 81.6%Q

ENTER MAST TORQUE SCALE AT 81.6%Q
MOVE UP TO FUEL FLOW SCALE, READ 278 LB/HR

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J2437

CRUISE
BASIC CONFIGURATION
100% RPM

FAT
-30°C

CRUISE
12000 FT
to
14000 FT
-30°C
OH-58D
250-C30R/3

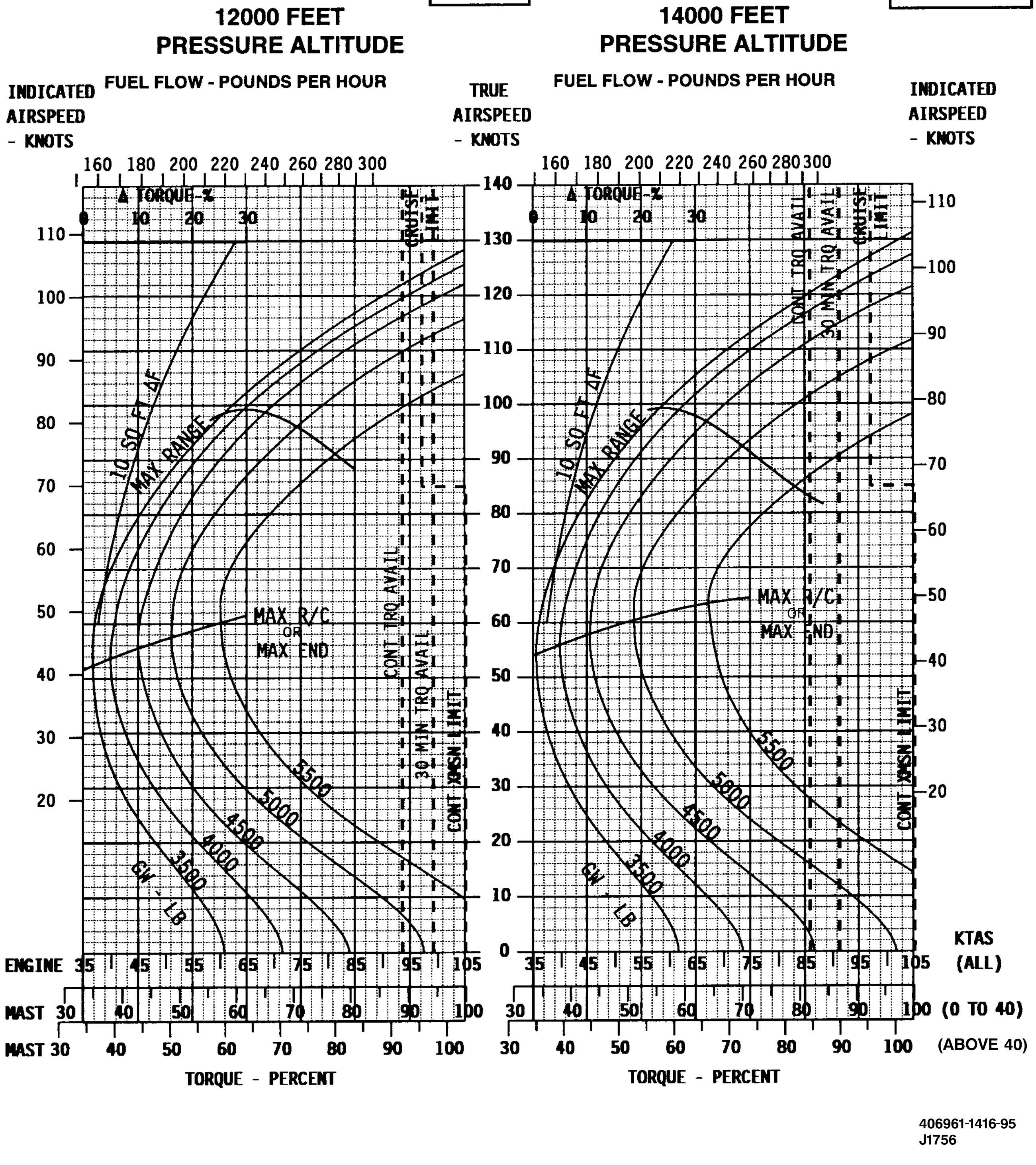

Figure 7-15. Cruise Chart, FAT -30 °C, 12000 to 14000 Feet (Sheet 4 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT
-15°C

CRUISE
SEA LEVEL
to
2000 FT
-15°C
OH-58D
250-C30R/3

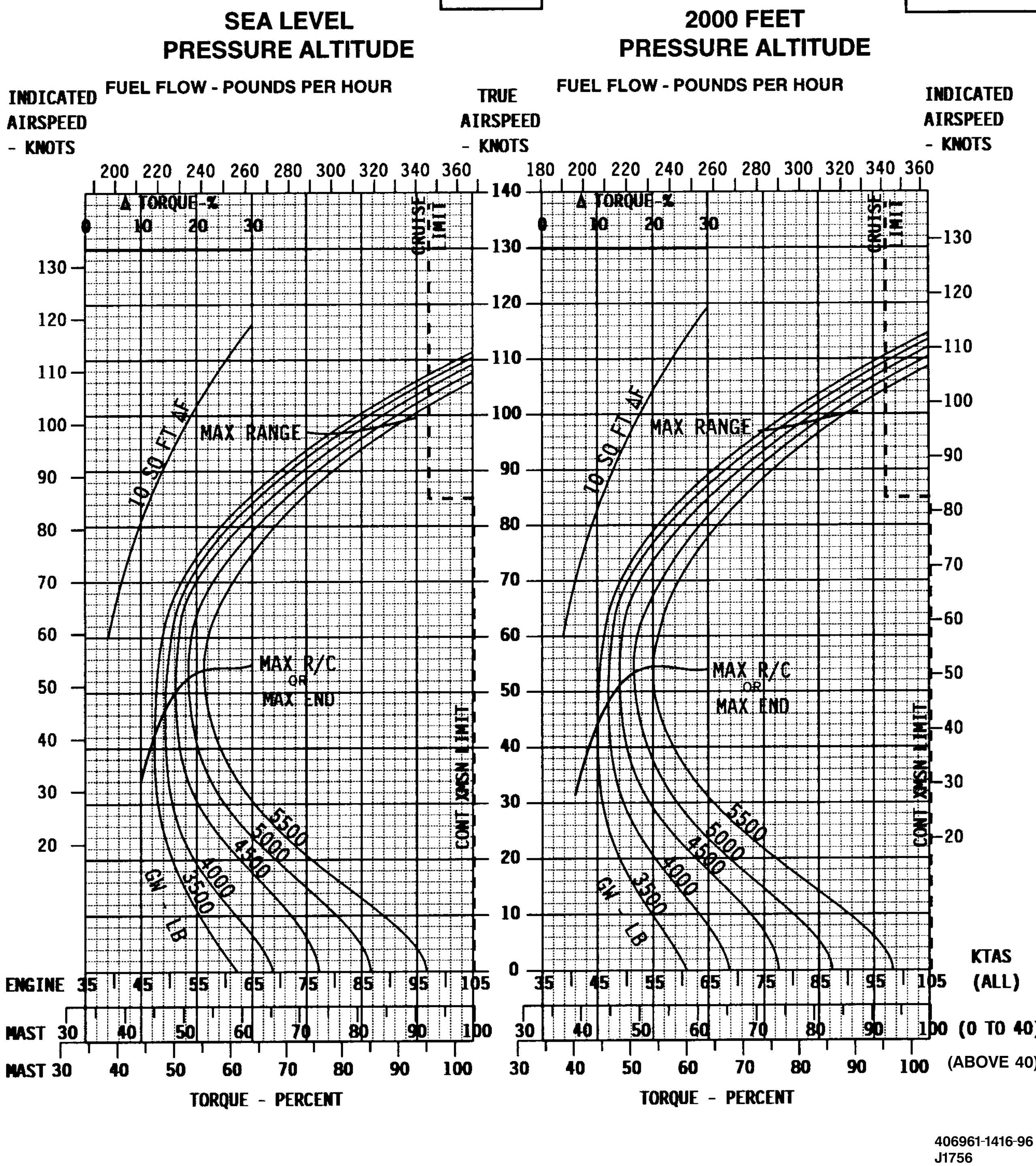

Figure 7-15. Cruise Chart, FAT -15 °C, Sea Level to 2000 Feet (Sheet 5 of 23)

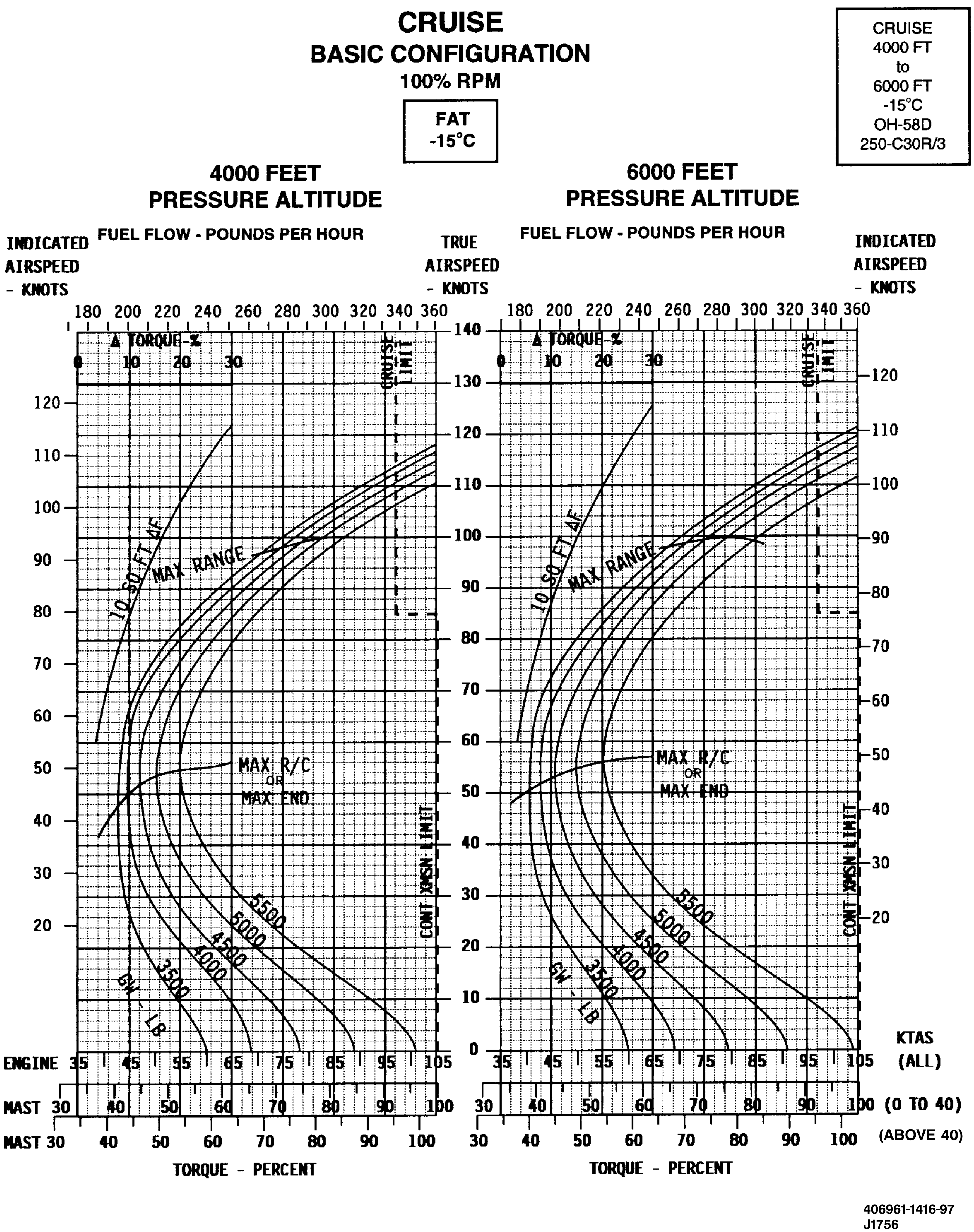

Figure 7-15. Cruise Chart, FAT -15 °C, 4000 to 6000 Feet (Sheet 6 of 23)

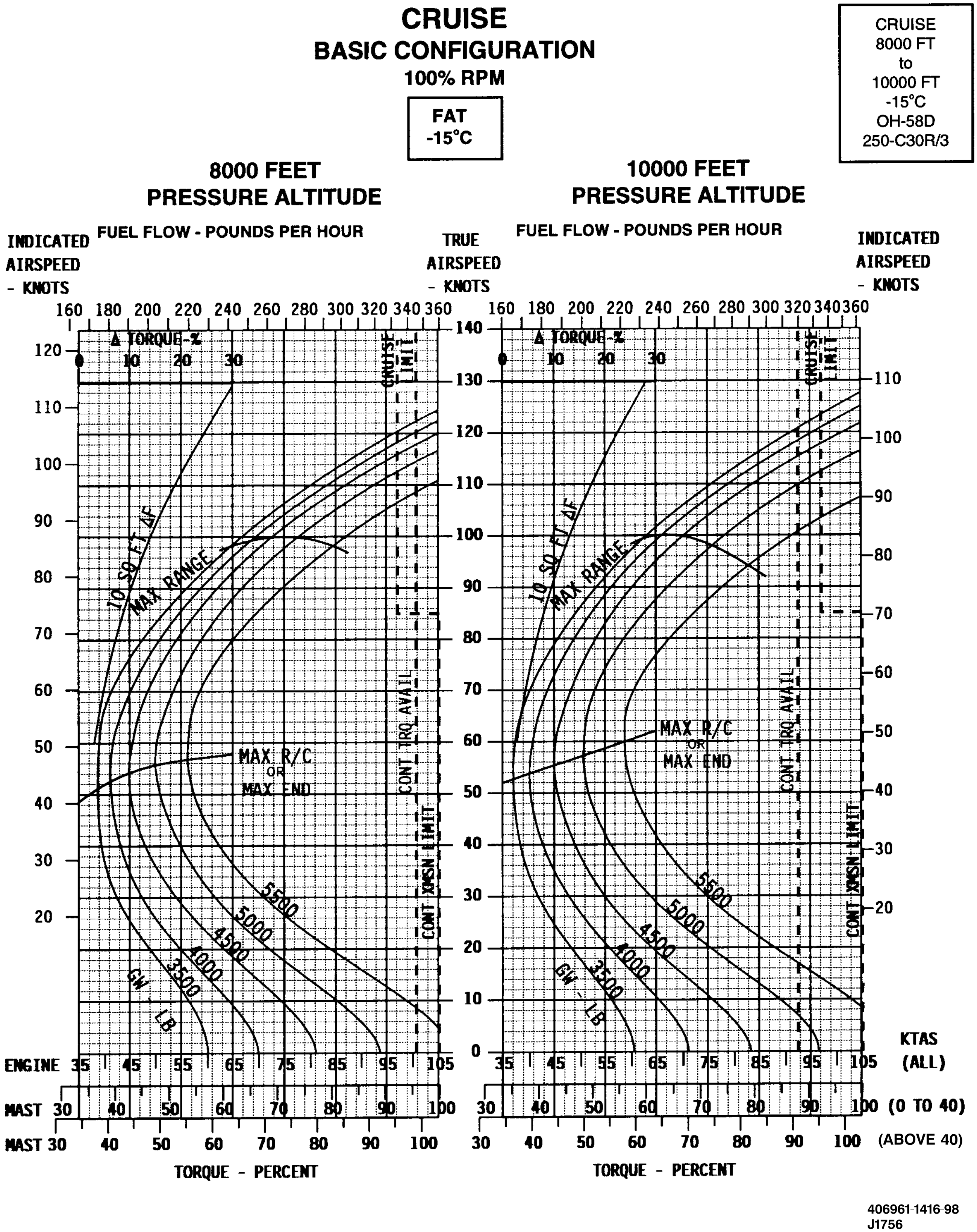

Figure 7-15. Cruise Chart, FAT -15 °C, 8000 to 10000 Feet (Sheet 7 of 23)

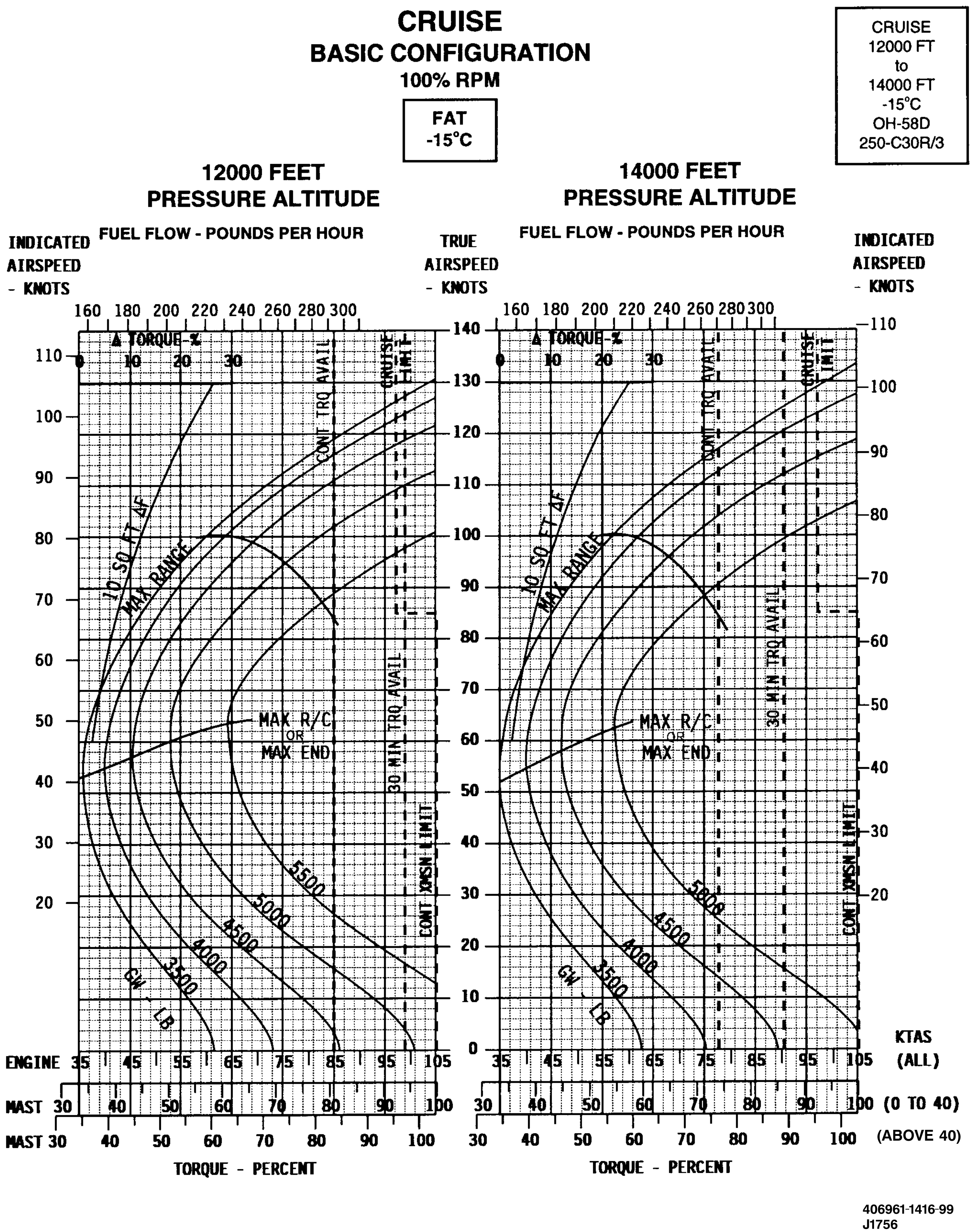

Figure 7-15. Cruise Chart, FAT -15 °C, 12000 to 14000 Feet (Sheet 8 of 23)

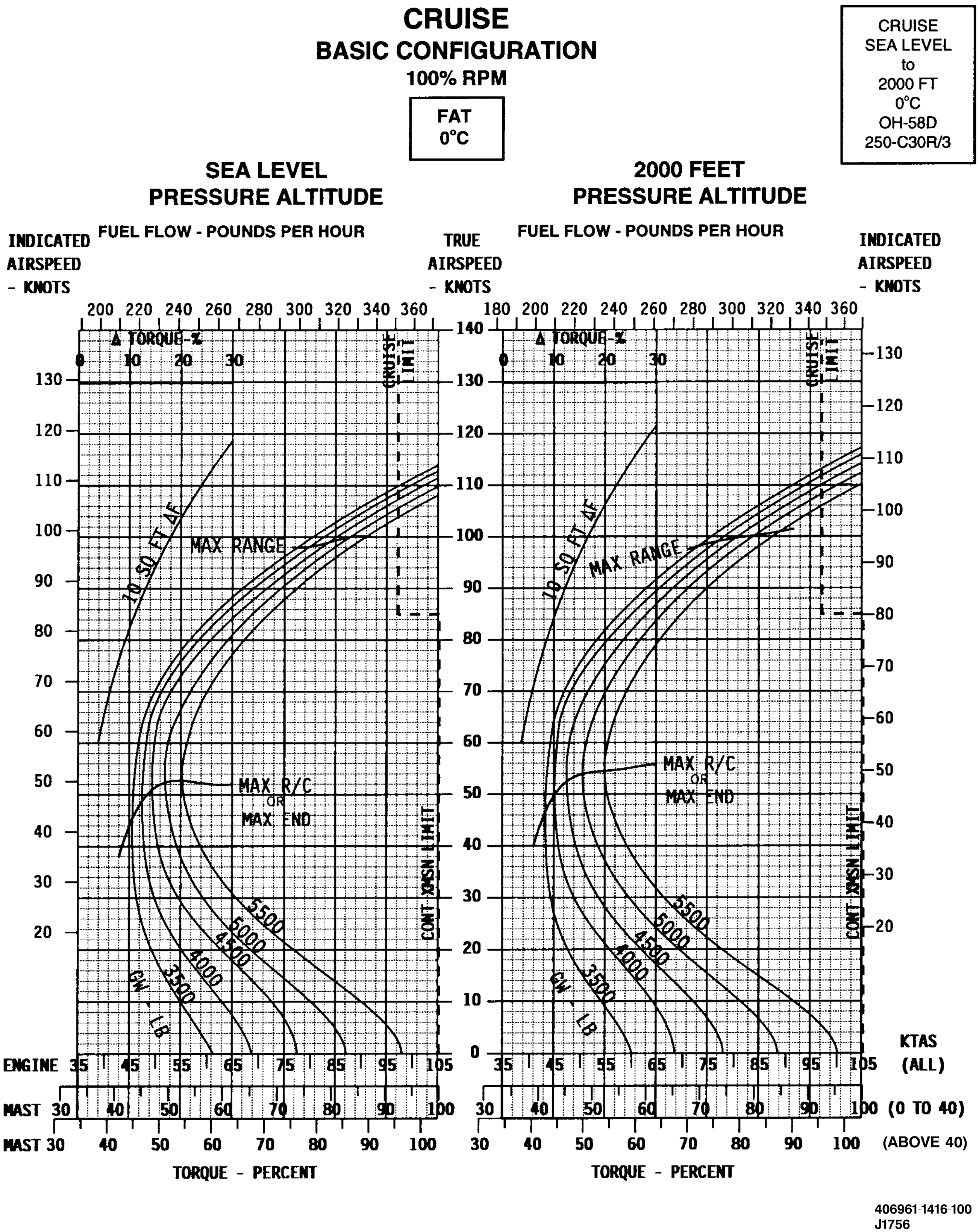

Figure 7-15. Cruise Chart, FAT 0 °C, Sea Level to 2000 Feet (Sheet 9 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT 0°C

CRUISE 4000 FT to 6000 FT 0°C OH-58D 250-C30R/3

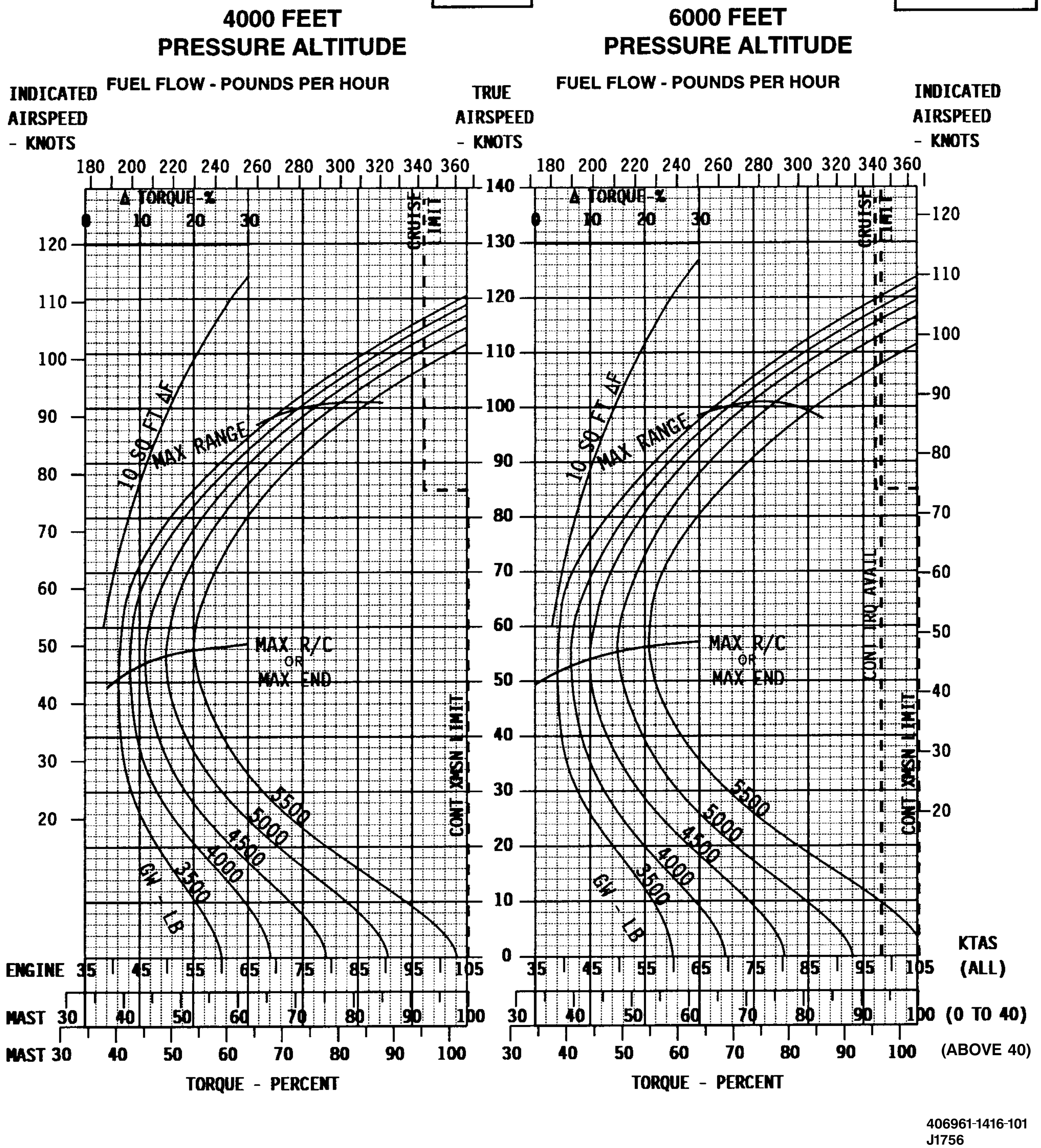

Figure 7-15. Cruise Chart, FAT 0 °C, 4000 to 6000 Feet (Sheet 10 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT
0°C

CRUISE
8000 FT
to
10000 FT
0°C
OH-58D
250-C30R/3

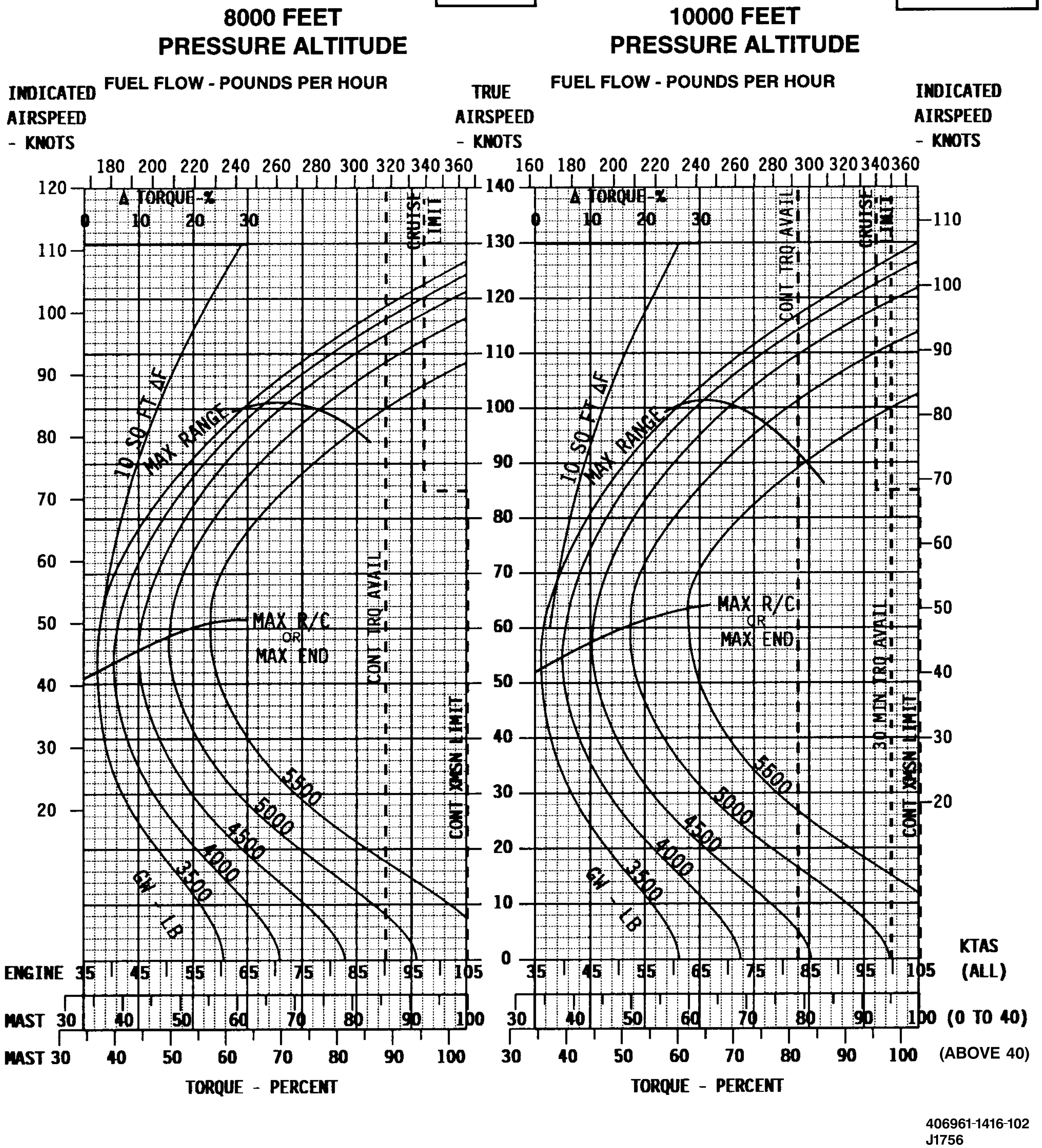

Figure 7-15. Cruise Chart, FAT 0 °C, 8000 to 10000 Feet (Sheet 11 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT
0°C

CRUISE
12000 FT
to
14000 FT
0°C
OH-58D
250-C30R/3

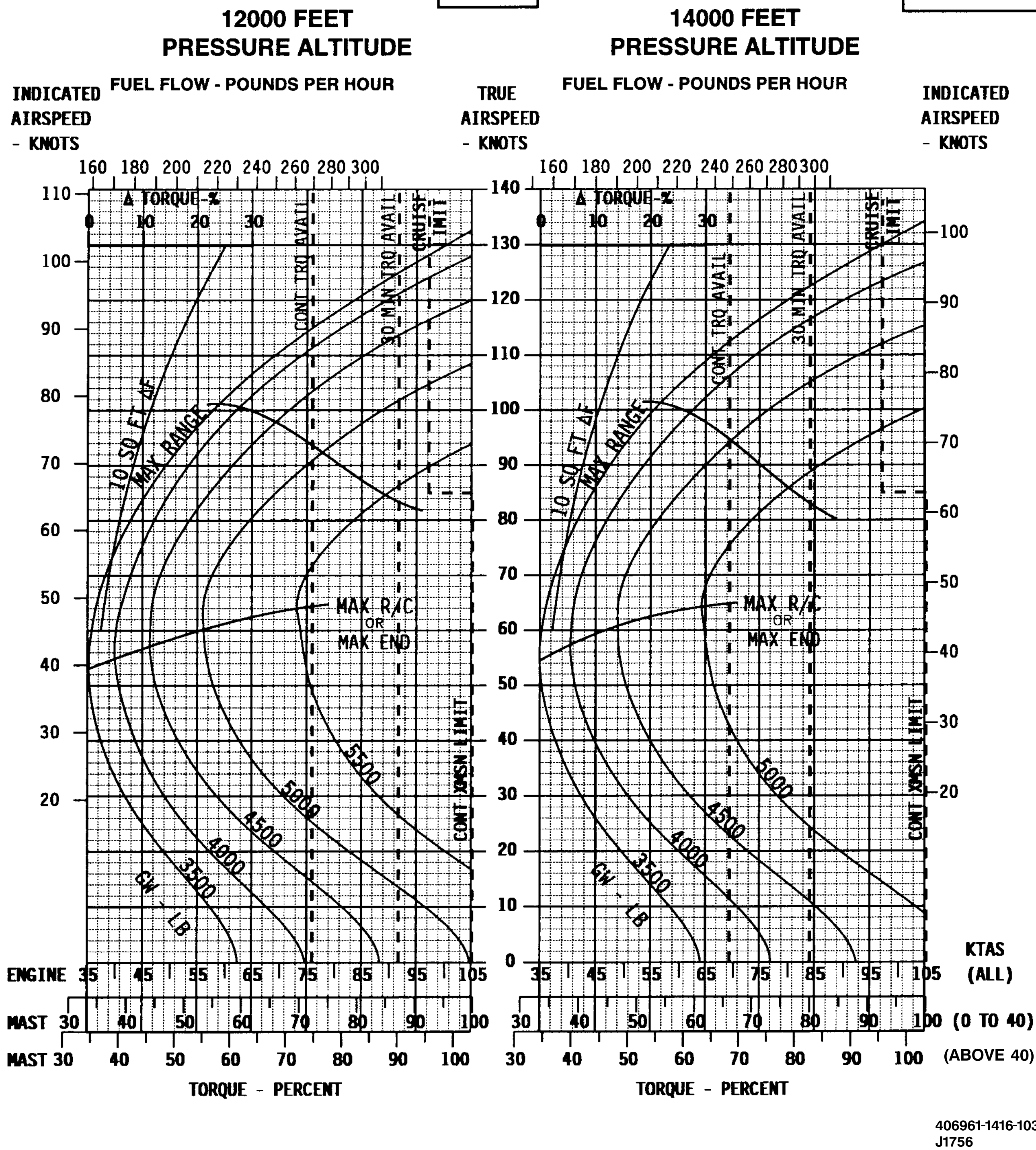

Figure 7-15. Cruise Chart, FAT 0 °C, 12000 to 14000 Feet (Sheet 12 of 23)

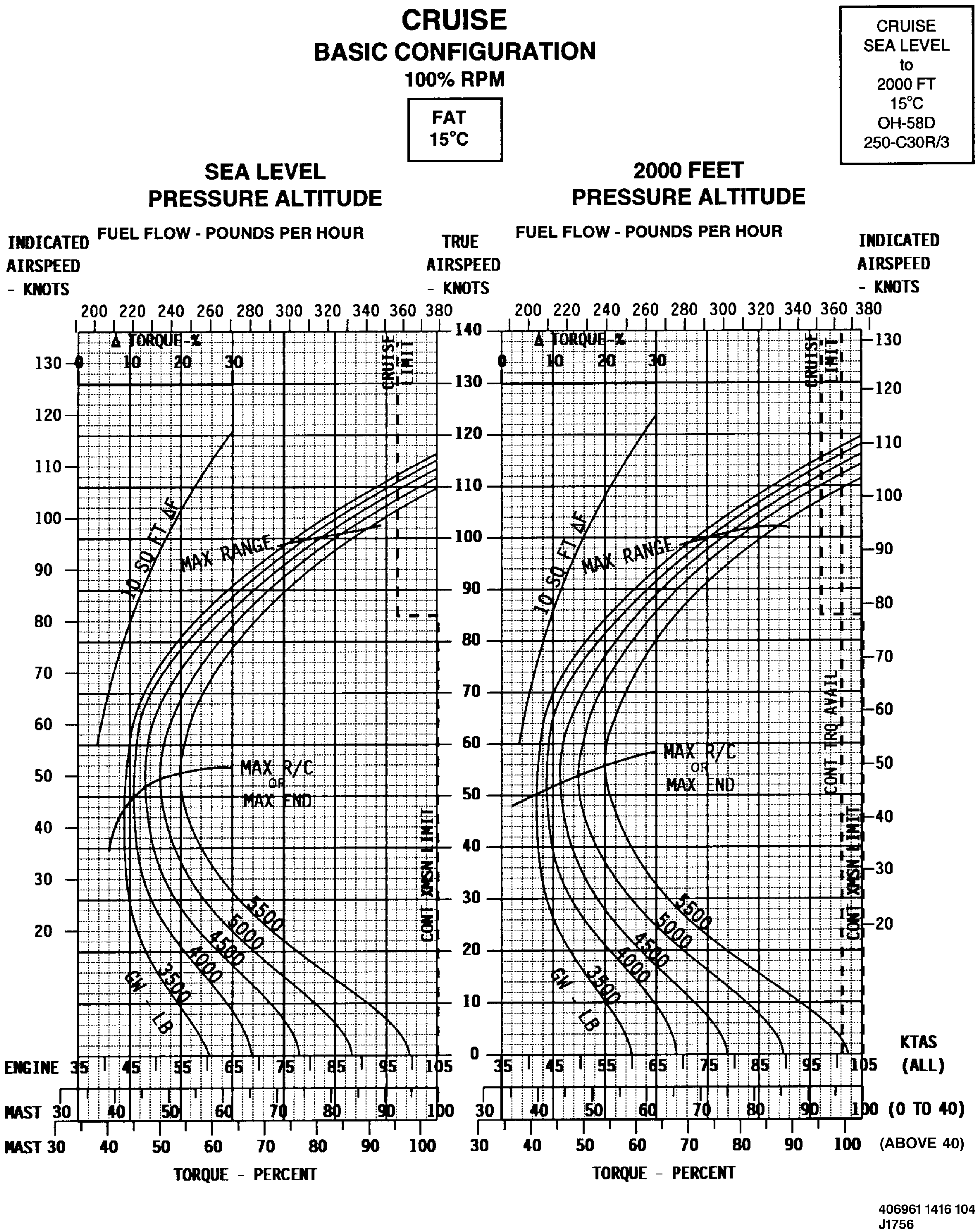

Figure 7-15. Cruise Chart, FAT +15 °C, Sea Level to 2000 Feet (Sheet 13 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT
15°C

CRUISE
4000 FT
to
6000 FT
15°C
OH-58D
250-C30R/3

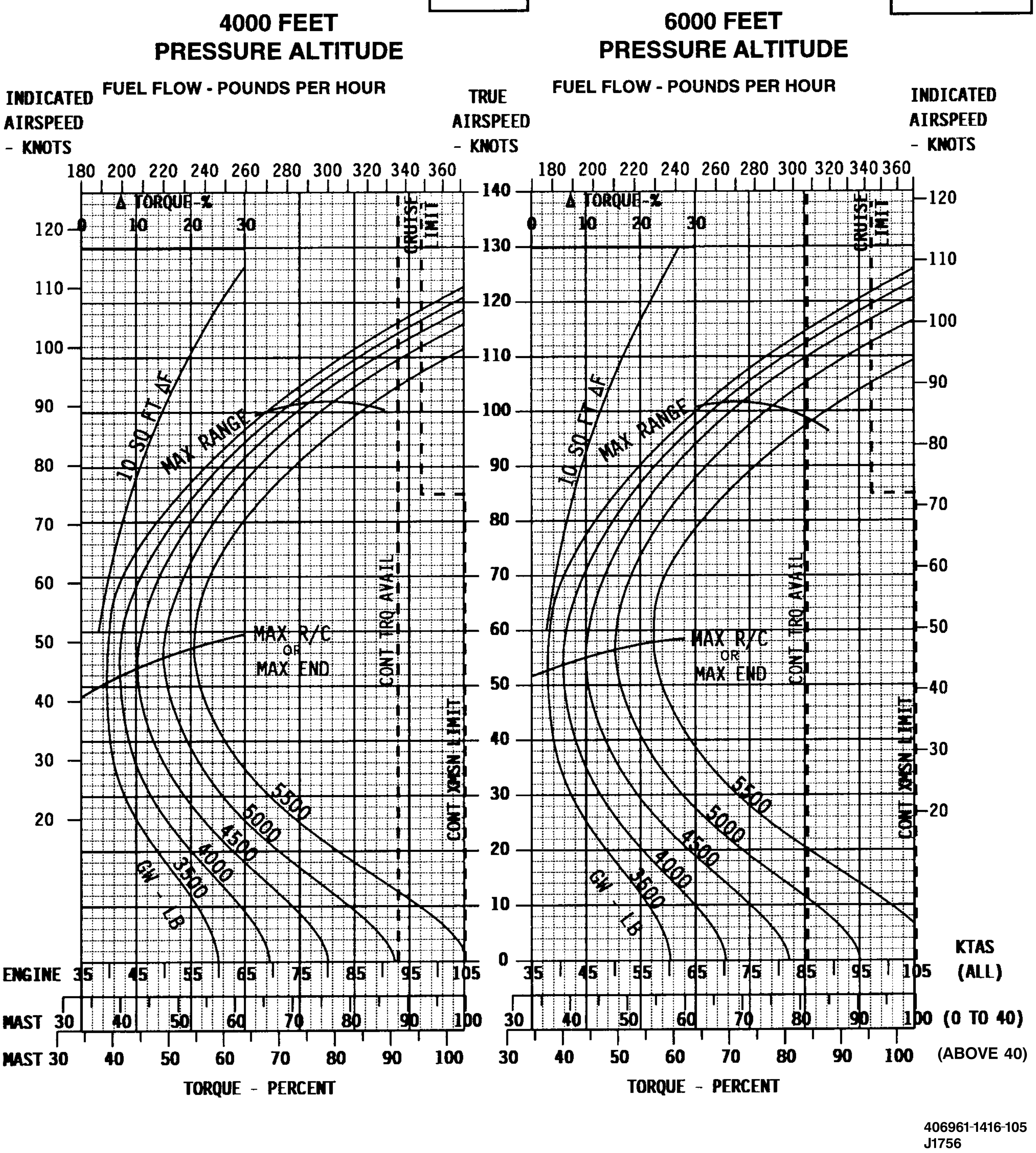

Figure 7-15. Cruise Chart, FAT +15 °C, 4000 to 6000 Feet (Sheet 14 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

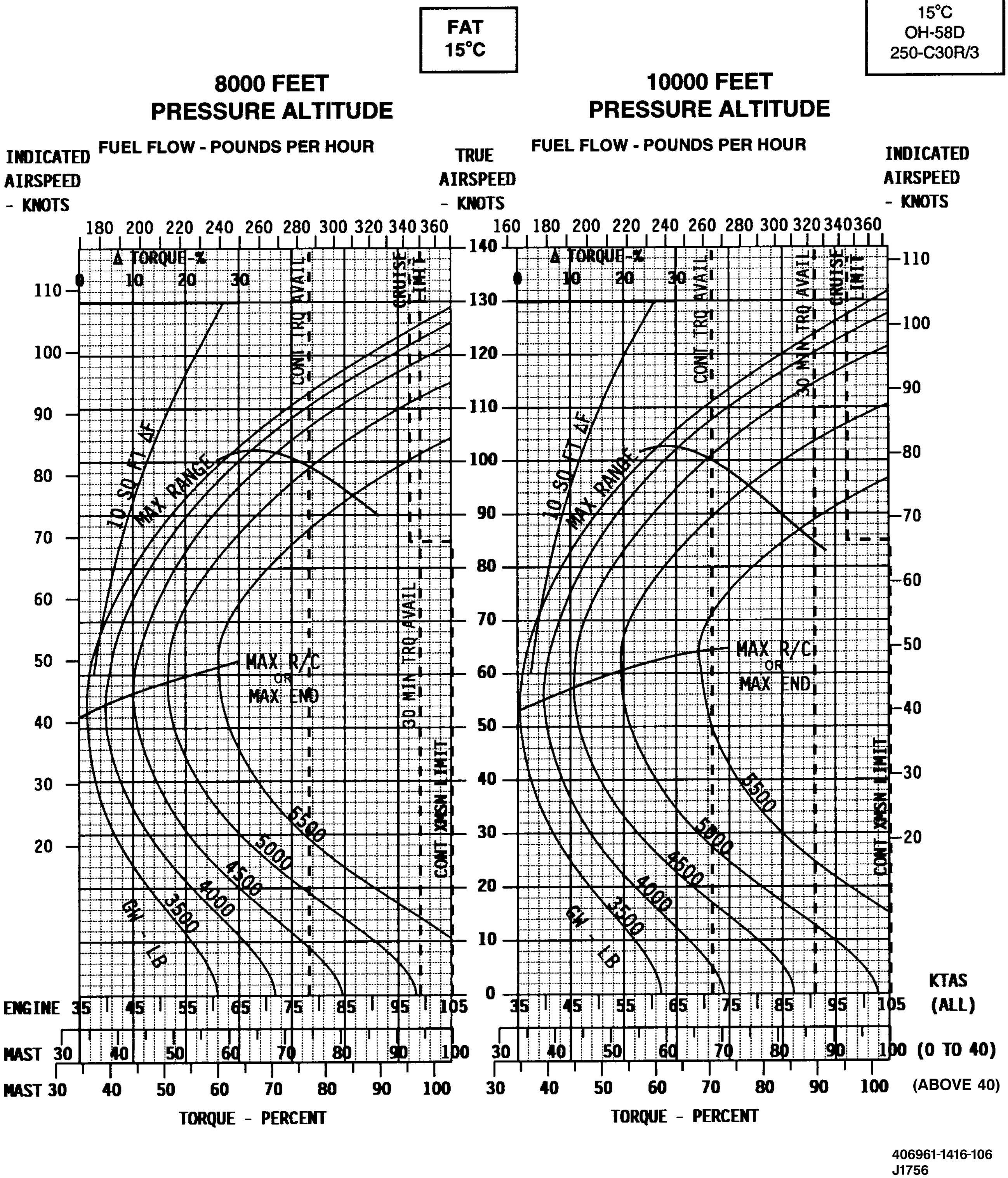

Figure 7-15. Cruise Chart, FAT +15 °C, 8000 to 10000 Feet (Sheet 15 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT 15°C

CRUISE 12000 FT to 14000 FT 15°C OH-58D 250-C30R/3

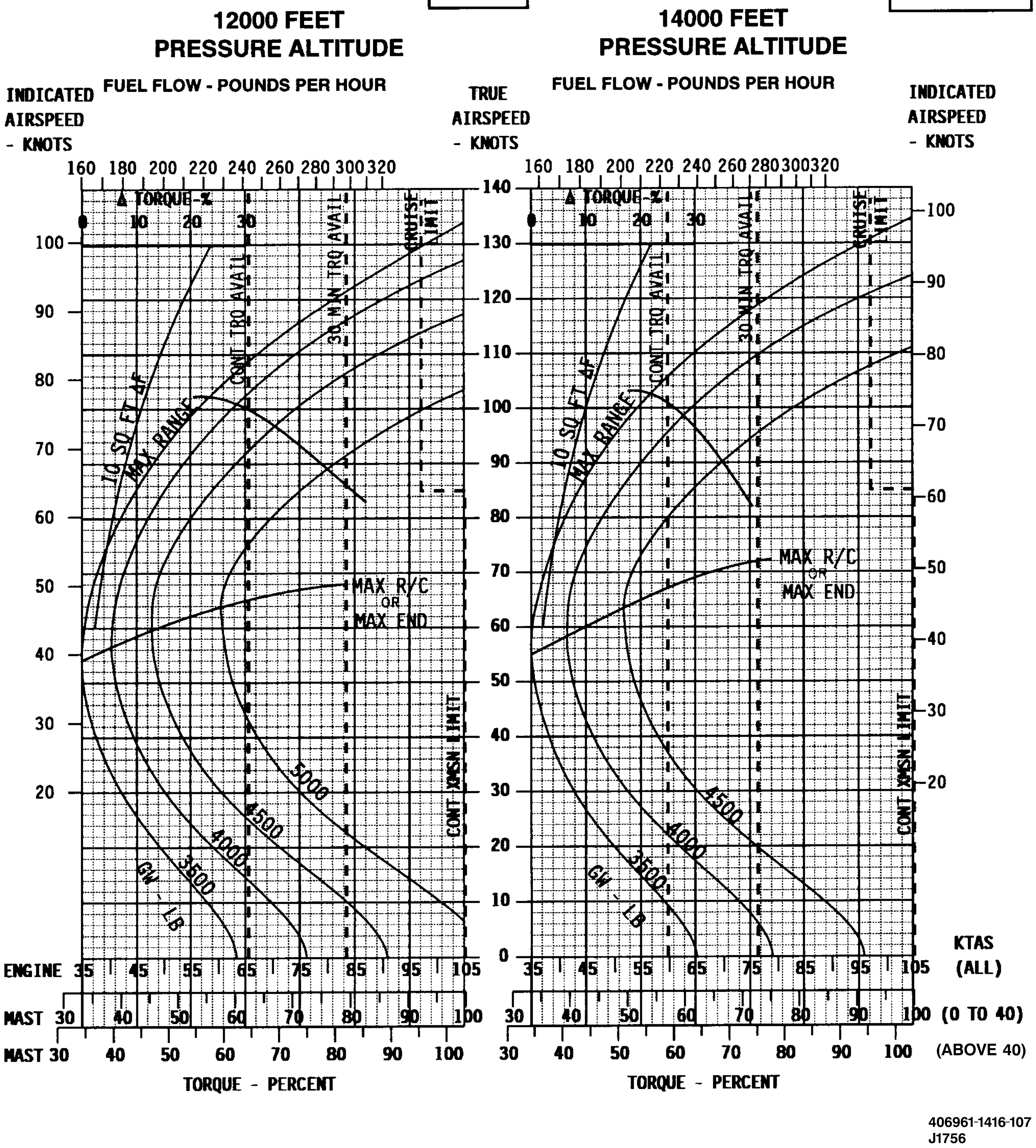

Figure 7-15. Cruise Chart, FAT +15 °C, 12000 to 14000 Feet (Sheet 16 of 23)

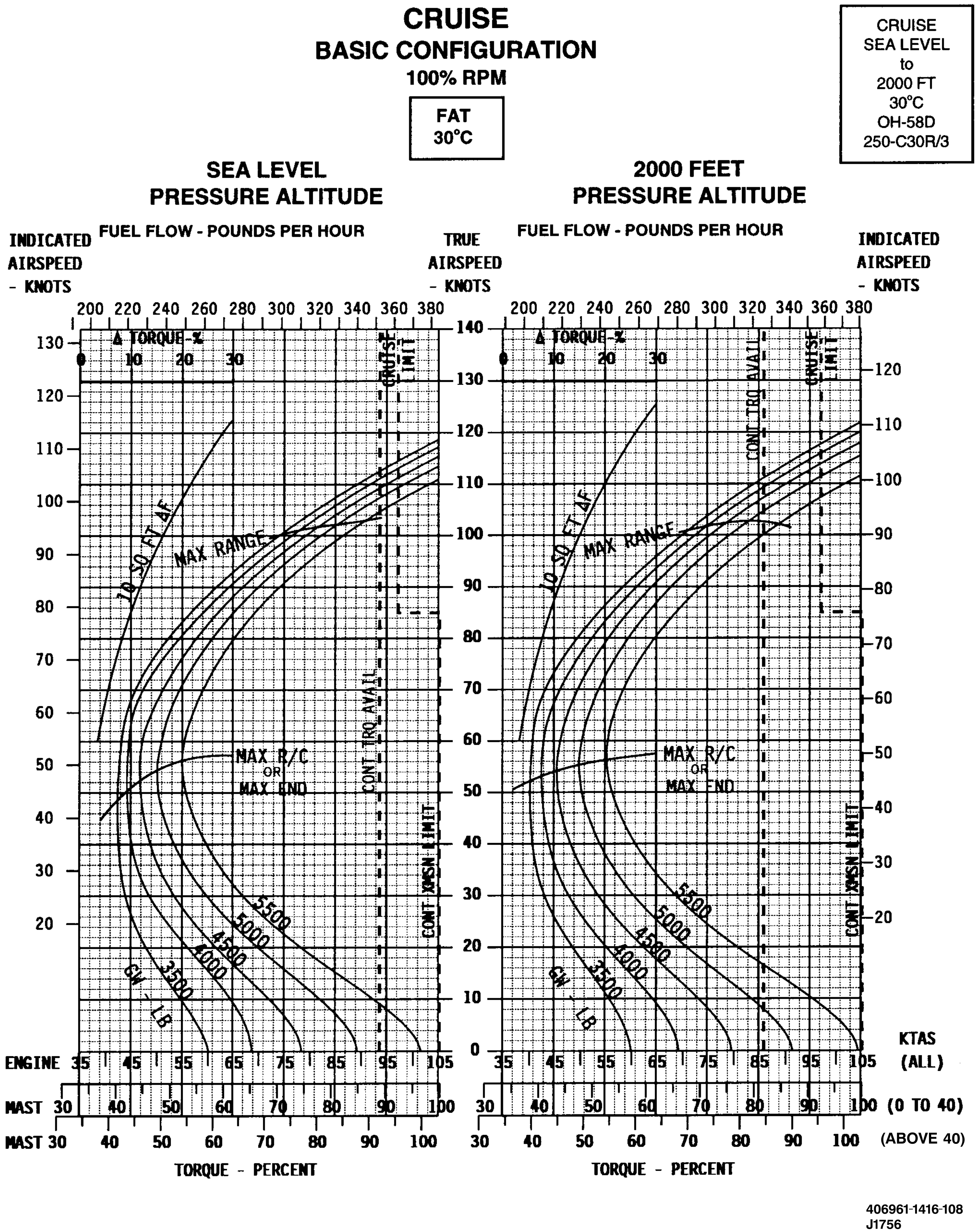

Figure 7-15. Cruise Chart, FAT +30 °C, Sea Level to 2000 Feet (Sheet 17 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT
30°C

CRUISE
4000 FT
to
6000 FT
30°C
OH-58D
250-C30R/3

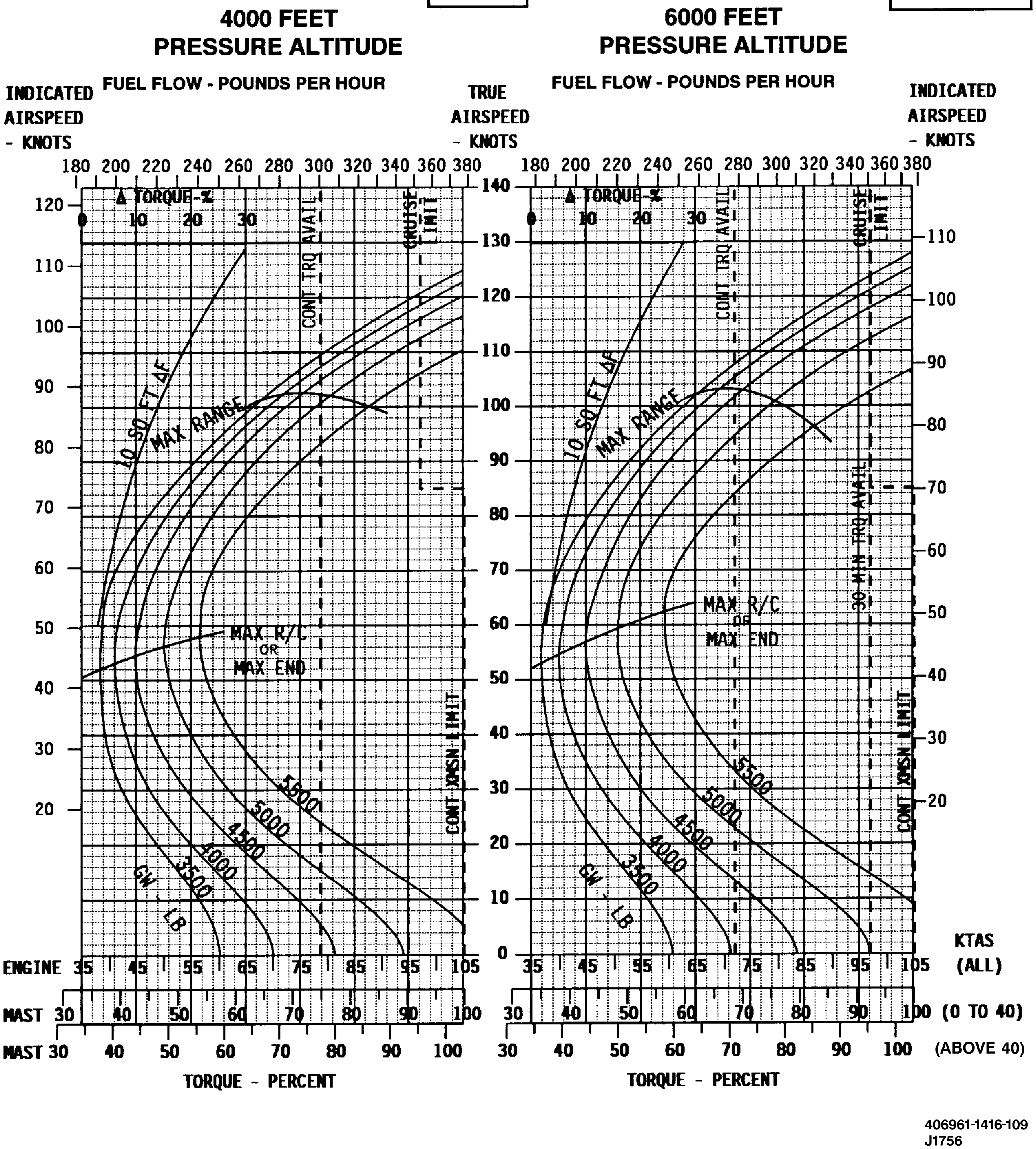

Figure 7-15. Cruise Chart, FAT +30 °C, 4000 to 6000 Feet (Sheet 18 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT 30°C

CRUISE 8000 FT to 10000 FT 30°C OH-58D 250-C30R/3

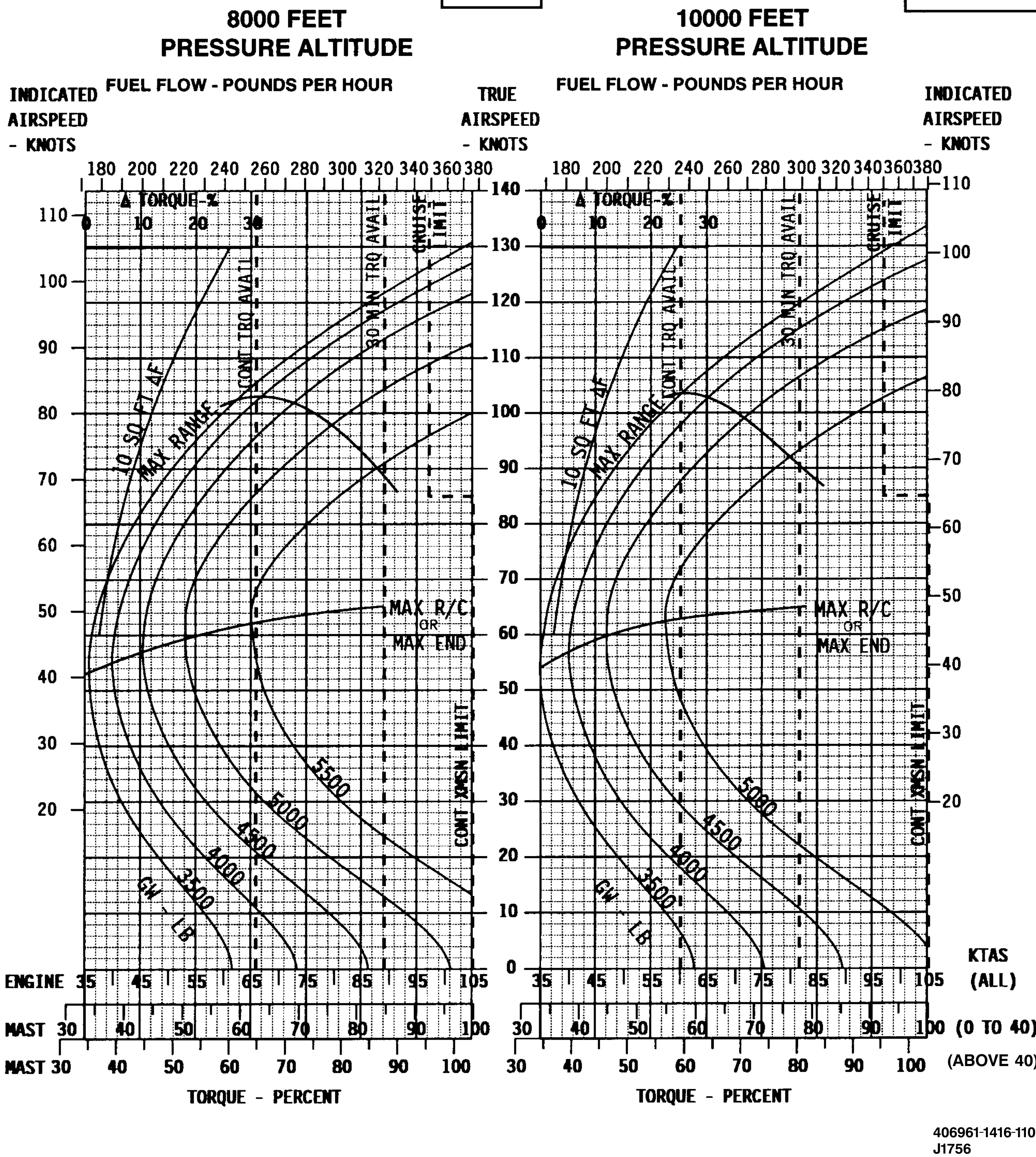

Figure 7-15. Cruise Chart, FAT +30 °C, 8000 to 10000 Feet (Sheet 19 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT 45°C

CRUISE SEA LEVEL to 2000 FT 45°C OH-58D 250-C30R/3

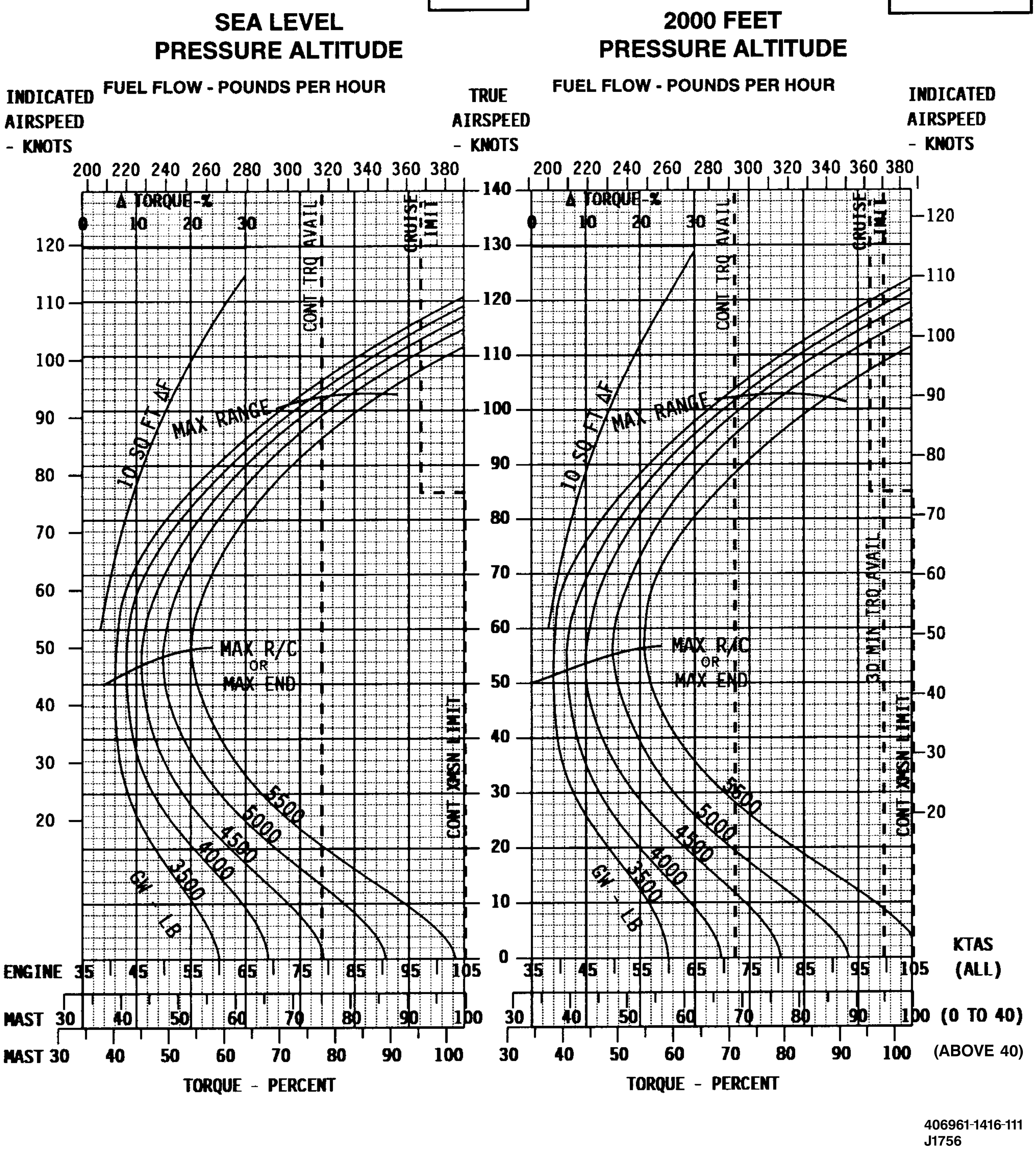

Figure 7-15. Cruise Chart, FAT +45 °C, Sea Level to 2000 Feet (Sheet 20 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT 45°C

CRUISE 4000 FT to 6000 FT 45°C OH-58D 250-C30R/3

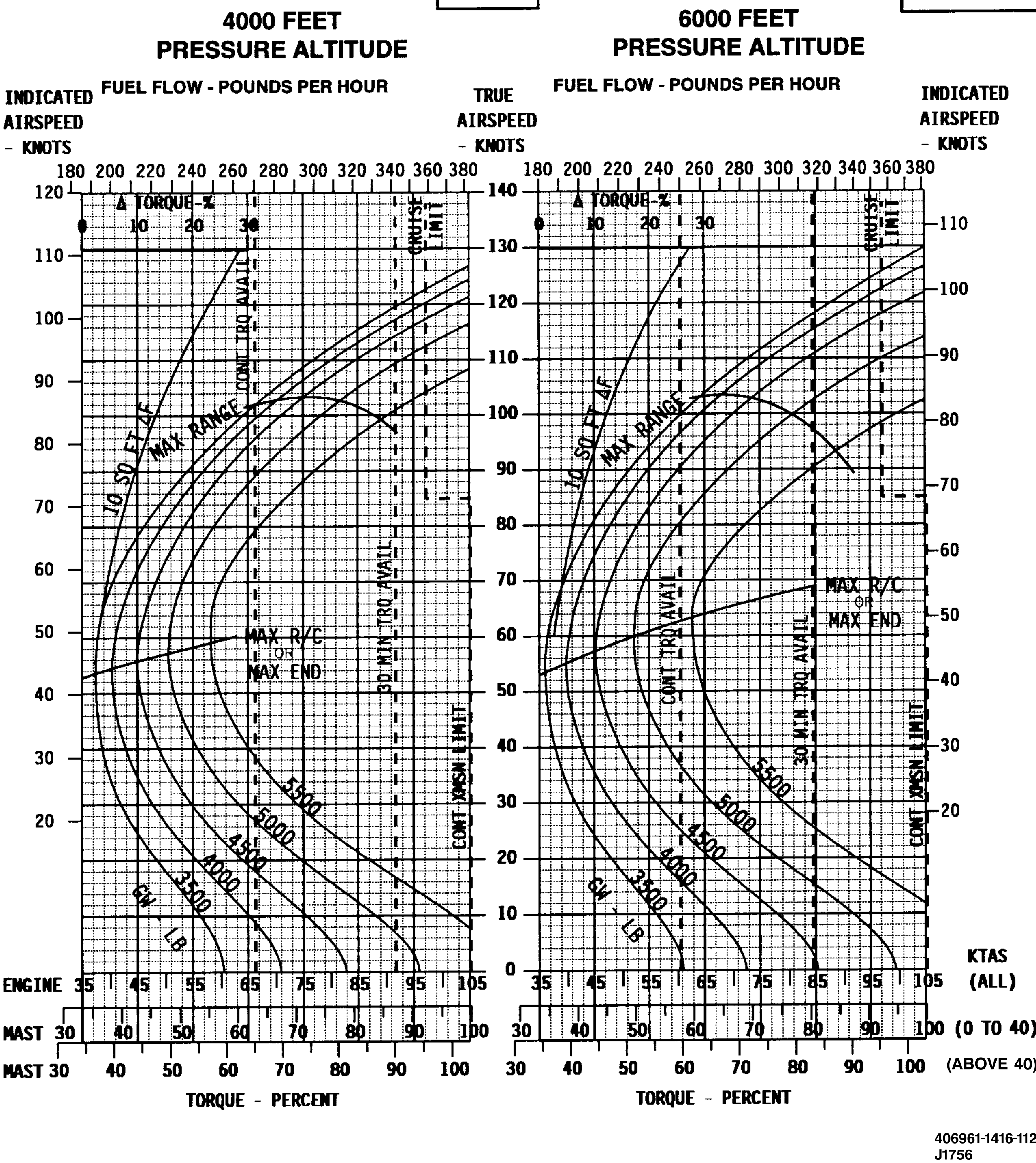

Figure 7-15. Cruise Chart, FAT +45 °C, 4000 to 6000 Feet (Sheet 21 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT
55°C

CRUISE
SEA LEVEL
to
2000 FT
55°C
OH-58D
250-C30R/3

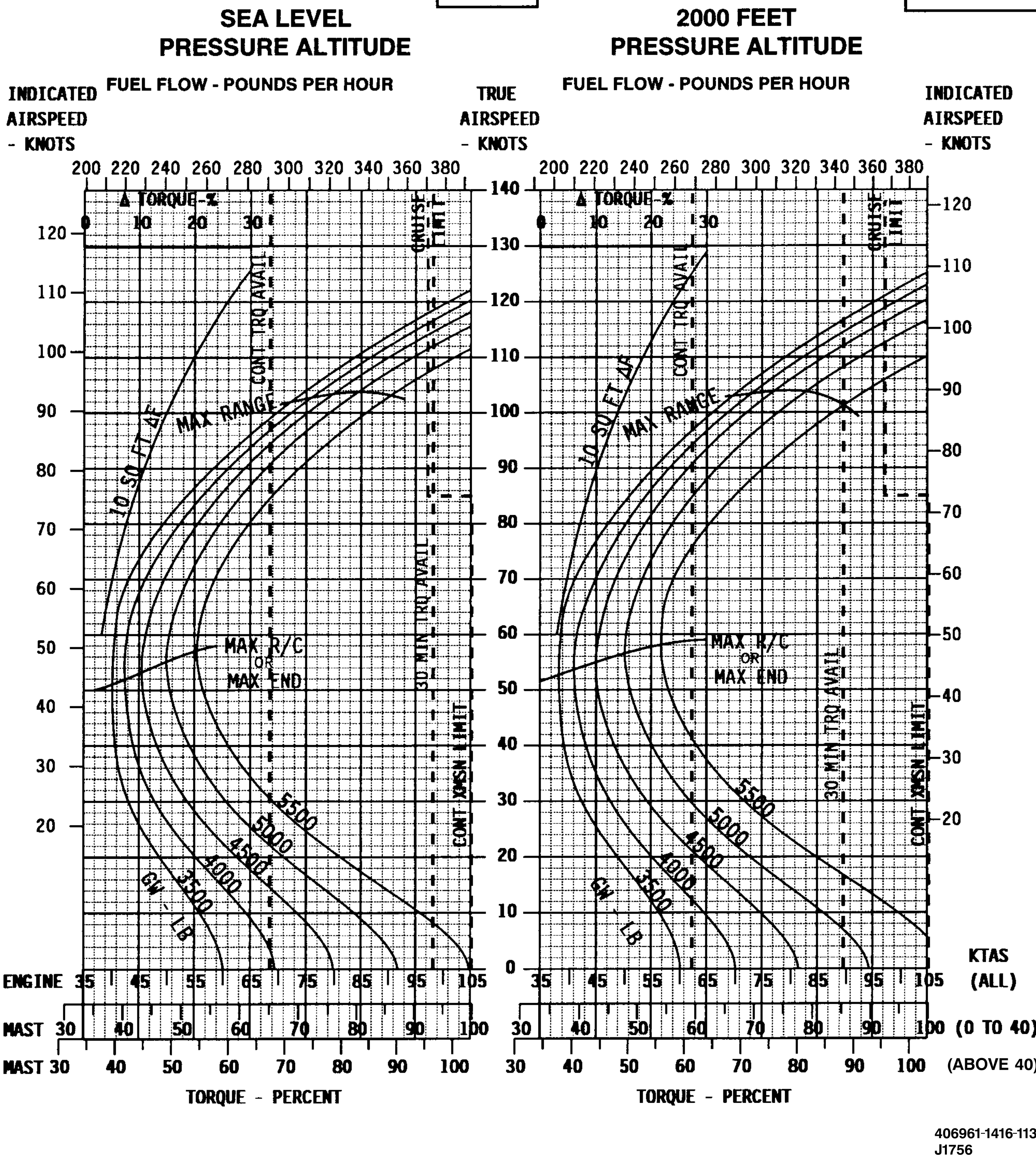

Figure 7-15. Cruise Chart, FAT +55 °C, Sea Level to 2000 Feet (Sheet 22 of 23)

CRUISE
BASIC CONFIGURATION
100% RPM

FAT 55°C

CRUISE 4000 FT to 6000 FT 55°C OH-58D 250-C30R/3

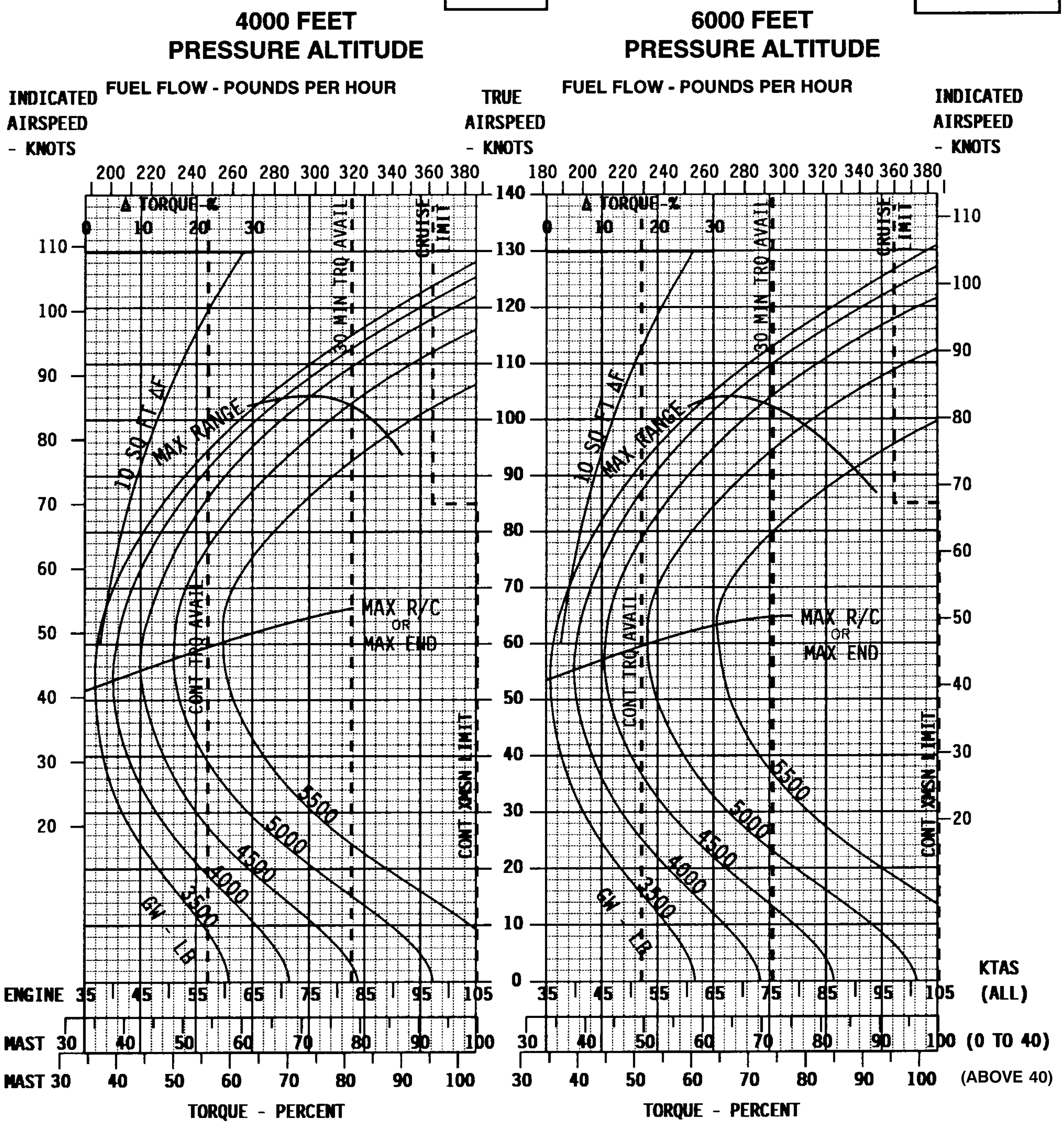

Figure 7-15. Cruise Chart, FAT +55 °C, 4000 to 6000 Feet (Sheet 23 of 23)

SECTION XII. DRAG OH-58D R (250-C30R/3)

7-41. DESCRIPTION.

The drag chart (fig. 7-16) shows the basic configuration or the equivalent flat plate drag area changes for additional helicopter modifications. The cruise charts depict the basic (baseline) configuration which includes the drag for the mast mounted sight, a universal weapon pylon with ejector racks on both sides, a 7 shot rocket pod on right side, a .50 caliber machine gun and ammo magazine on left, and a standard landing gear and both crew doors installed.

7-42. USE OF CHART.

This chart is used to adjust cruise charts for appropriate torque and fuel flow due to equivalent flat plate drag area change (ΔF). Examples of change in torque required due to equivalent flat plate drag area change (ΔF) from primary (baseline) configuration to an external load configuration and increase in drag area due to external cargo load are shown below.

7-43. CONDITIONS.

The drag chart is based upon level aircraft attitude and 100% NR and NP.

EXAMPLE A

WANTED

CHANGE IN TORQUE REQUIRED DUE TO EQUIVALENT FLAT PLATE DRAG AREA CHANGE (ΔF) FROM PRIMARY (BASELINE) CONFIGURATION TO AN EXTERNAL LOAD CONFIGURATION

KNOWN

PRIMARY CONFIGURATION
ΔF DRAG AREA CHANGE = 12 SQ FT
TRUE AIRSPEED = 100 KNOTS
PRESSURE ALTITUDE = SEA LEVEL
FAT = 0°C

METHOD

ENTER DRAG AREA CHANGE AT 12 SQ FT
MOVE RIGHT TO 100 KNOT TRUE AIRSPEED LINE
MOVE DOWN TO SEA LEVEL PRESSURE ALTITUDE LINE
MOVE LEFT TO 0°C FREE AIR TEMPERATURE LINE
MOVE DOWN MAST TORQUE SCALE, READ CHANGE IN TORQUE = 21.5%Q

EXAMPLE B

WANTED

INCREASE IN DRAG AREA DUE TO EXTERNAL CARGO LOAD

KNOWN

SHAPE OF EXTERNAL CARGO LOAD = CUBE
FRONTAL AREA OF EXTERNAL CARGO LOAD = 10 SQ FT

METHOD

ENTER DRAG CHART AT THE CUBE SYMBOL
MOVE DOWN TO 10 SQ FT LINE
MOVE RIGHT, READ INCREASED DRAG AREA = 9.2 SQ FT

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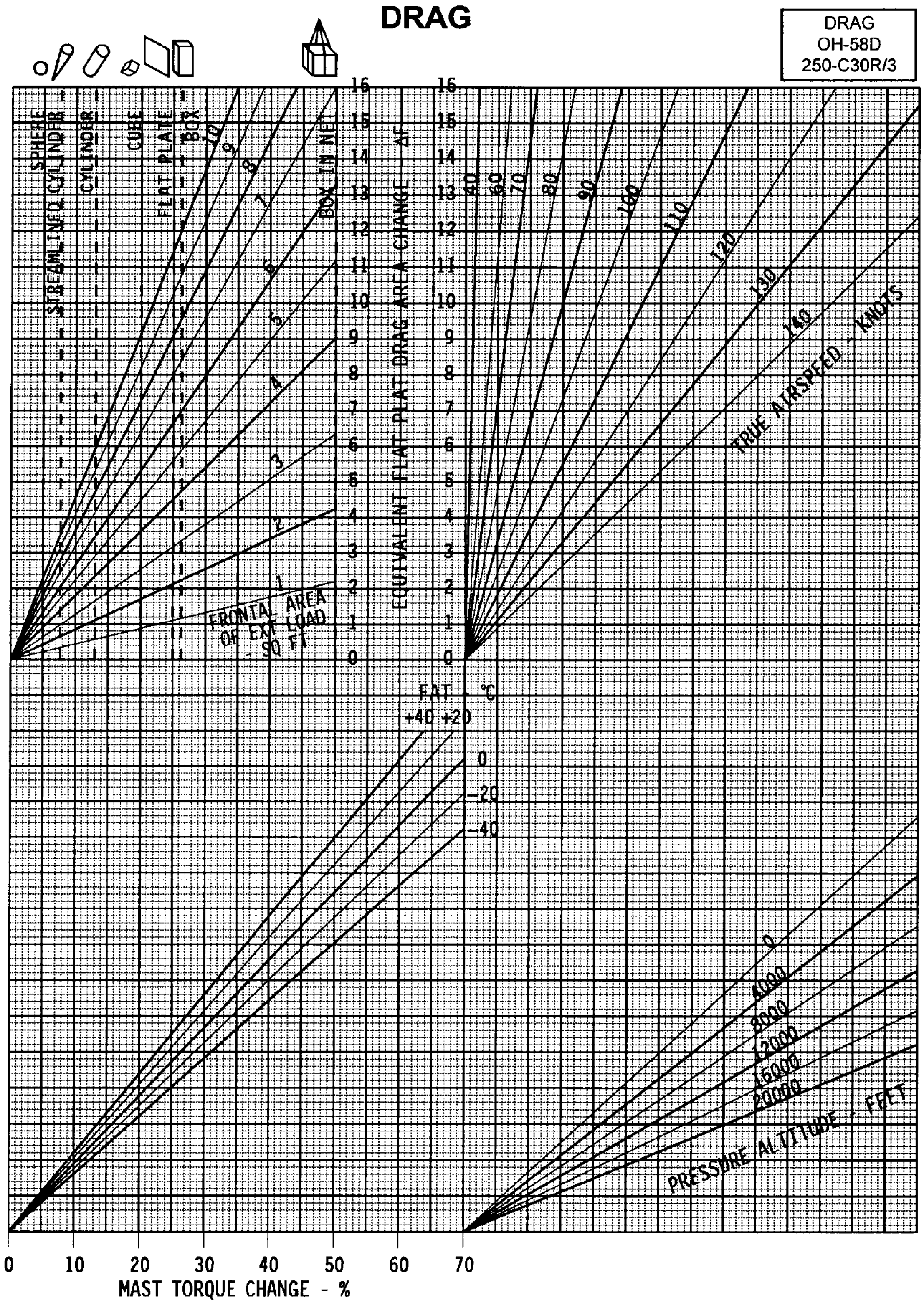
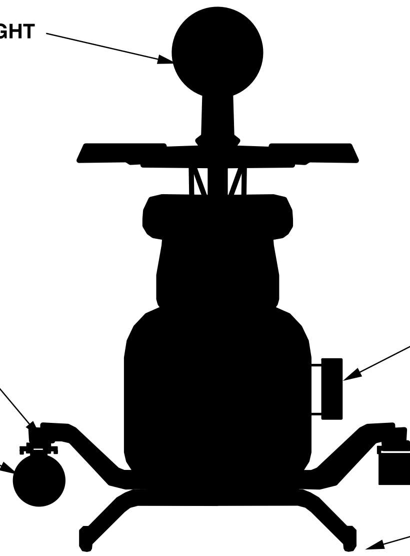


Figure 7-16. Drag Chart (Sheet 1 of 2)

DRAG OH-58D 250-C30R/3

DRAG



ITEM	△F-SQ FT	DESCRIPTION	REF
1	0	OH-58D ARMED CONFIGURATION*	BASELINE
2	-2.9	MAST MOUNTED SIGHT	MMS
3	+1.2	QUICK DEPLOYMENT GEAR (ABOVE STANDARD GEAR)	QDG
4	-2.0	UNIVERSAL WEAPONS PYLON (PER SIDE)	UWP
5	-3.0	.50 CALIBER MACHINE GUN AND AMMO MAGAZINE**	50CMG
6	±0.8	7 SHOT ROCKET POD***(PER SIDE)	7SRP
7	+1.5	2 HELLFIRE MISSILES***(PER SIDE)	HM
8	+1.0	2 AIR-TO-AIR STINGER MISSILES***(PER SIDE)	ATAS
9	+1.0	CREW DOORS OFF	CDO
10	+0.2	ALQ-144 JAMMER	ALQ
11	+1.8	AVR-2 LASER RECEIVER	AVR-2

* THE OH-58D BASIC CONFIGURATION INCLUDES THE DRAG FOR THE MAST MOUNTED SIGHT, A UNIVERSAL WEAPON PYLON WITH EJECTOR RACKS ON BOTH SIDES, A 7 SHOT ROCKET POD ON RIGHT SIDE, A .50 CALIBER MACHINE GUN, AMMO MAGAZINE ON LEFT SIDE, A STANDARD LANDING GEAR AND BOTH CREW DOORS INSTALLED.

** LEFT SIDE ONLY

*** EITHER SIDE

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Figure 7-16. Drag Chart (Sheet 2 of 2)

SECTION XIII. CLIMB-DESCENT OH-58D R (250-C30R/3)

7-44. CLIMB-DESCENT CHART.

The climb-descent chart (fig. 7-17 and 7-18) shows the change in torque above or below torque required for level flight under the same gross weight and atmospheric conditions to obtain a given rate of climb or descent.

7-45. USE OF CHART.

The primary uses of the chart are illustrated by the chart examples.

a. The torque change obtained from the grid scale must be added to (for climb) or subtracted from (for descent) the torque required for level flight in order to obtain a total climb or descent torque. The torque required for level flight is obtained from the appropriate cruise chart.

b. By entering the bottom of the grid with a known torque change, moving upward to the gross weight, and then left, the corresponding rate of climb or descent may also be obtained.

7-46. CONDITIONS.

The climb-descent chart is based on the use of 100% rpm. The rate of climb (descent presented is for steady state conditions) and rpm bleed could increase (decrease) rate of climb (descent) shown.

EXAMPLE

WANTED

MAXIMUM RATE OF CLIMB AT MAXIMUM CONTINUOUS POWER

KNOWN

BASIC CONFIGURATION
GROSS WEIGHT = 5000 LB
PRESSURE ALTITUDE = 12,000 FEET
FAT = -15°C

METHOD

LOCATE APPROPRIATE CRUISE CHART (FIGURE 7-33, SHEET 8)
FIND INTERSECTION OF 5000 POUND GROSS WEIGHT LINE WITH THE MAXIMUM RATE OF CLIMB LINE
MOVE DOWN, READ MAST TORQUE (0 TO 40 KTAS) REQUIRED = 50.2%Q
MOVE RIGHT, DETERMINE CONTINUOUS MAST TORQUE (0 TO 40 KTAS) AVAILABLE = 80.8%Q
EXCESS MAST TORQUE (0 TO 40 KTAS) AVAILABLE = (80.8 - 50.2) = 30.6%Q

ENTER MAST TORQUE SCALE OF CLIMB-DESCENT CHART AT 30.6%Q
MOVE UP TO 5000 POUND GROSS WEIGHT LINE
MOVE LEFT TO RATE OF CLIMB OR DESCENT SCALE,
READ RATE OF CLIMB = 1030 FT/MIN

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CLIMB - DESCENT

100% RPM

CLIMB - DESCENT
OH-58D
250-C30R/3

EXAMPLE

WANTED

Δ MAST TORQUE CHANGE FOR DESIRED RATE OF CLIMB OR DESCENT

KNOWN

GROSS WEIGHT = 4500 POUNDS
DESIRED RATE OF CLIMB = 1200 FT/MIN

METHOD

ENTER RATE OF CLIMB AT 1200 FT/MIN
MOVE RIGHT TO GROSS WEIGHT
DROP DOWN AND READ 32% Δ MAST
TORQUE CHANGE

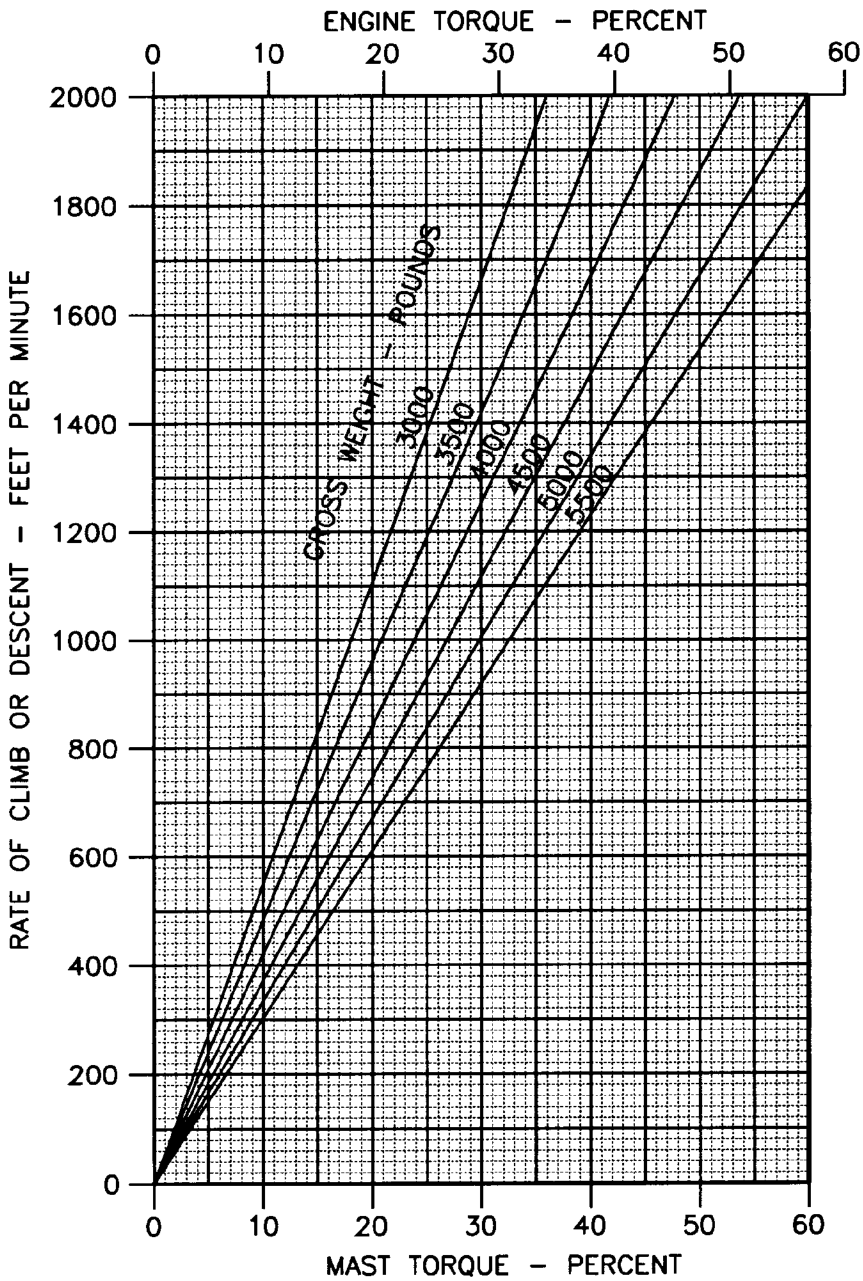

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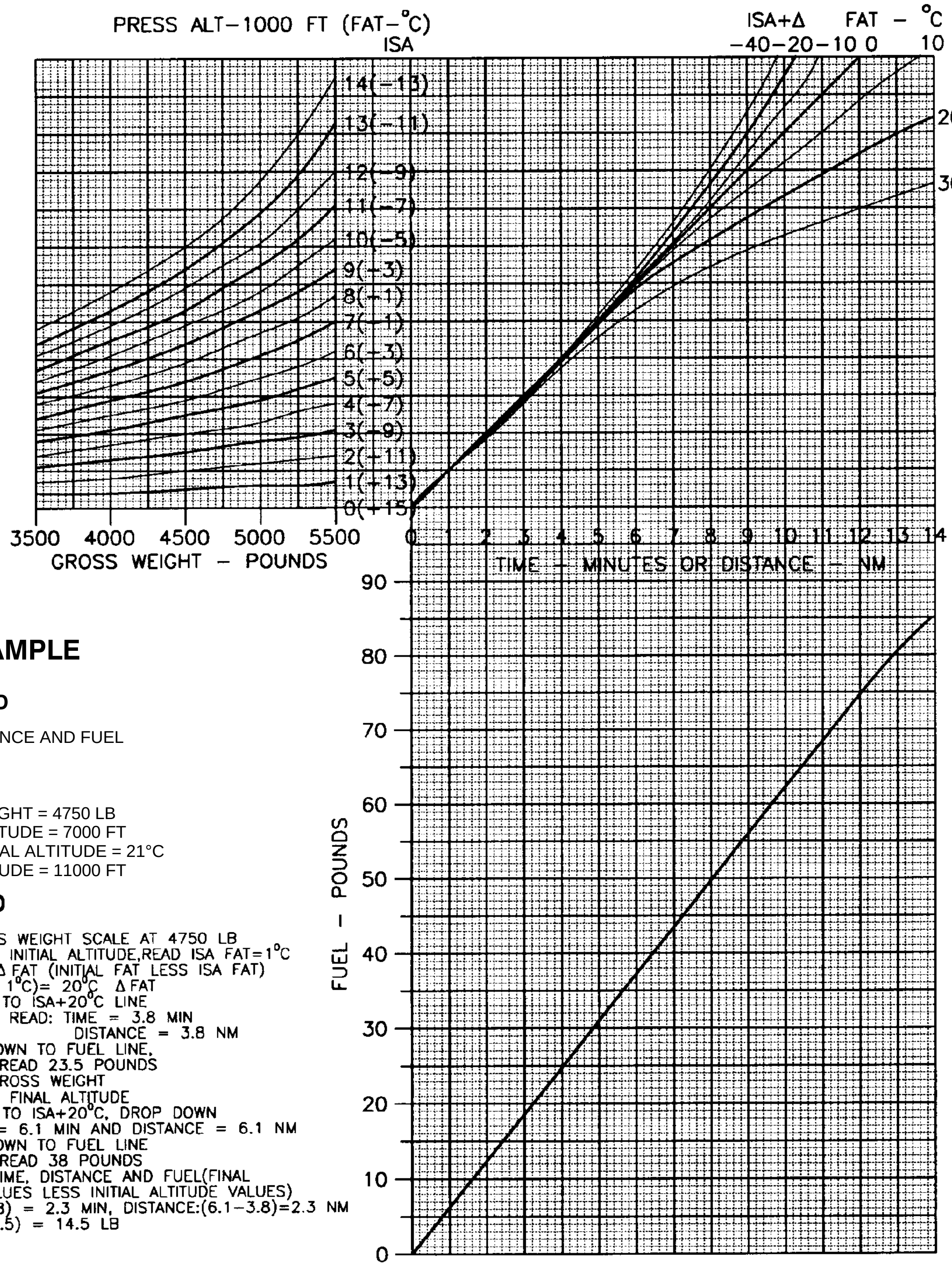
Figure 7-17. Climb-Descent Chart

CLIMB PERFORMANCE
30 MINUTE POWER

CLIMB PERFORMANCE
OH-58D
250-C30R/3



EXAMPLE

WANTED

TIME, DISTANCE AND FUEL

KNOWN

GROSS WEIGHT = 4750 LB
INITIAL ALTITUDE = 7000 FT
FAT AT INITIAL ALTITUDE = 21°C
FINAL ALTITUDE = 11000 FT

METHOD

ENTER GROSS WEIGHT SCALE AT 4750 LB
MOVE UP TO INITIAL ALTITUDE,READ ISA FAT=1°C
CALCULATE Δ FAT (INITIAL FAT LESS ISA FAT)
OR (21°C – 1°C)= 20°C Δ FAT
MOVE RIGHT TO ISA+20°C LINE
DROP DOWN, READ: TIME = 3.8 MIN
DISTANCE = 3.8 NM
CONTINUE DOWN TO FUEL LINE,
MOVE LEFT, READ 23.5 POUNDS
RE-ENTER GROSS WEIGHT
MOVE UP TO FINAL ALTITUDE
MOVE RIGHT TO ISA+20°C, DROP DOWN
READ: TIME = 6.1 MIN AND DISTANCE = 6.1 NM
CONTINUE DOWN TO FUEL LINE
MOVE LEFT, READ 38 POUNDS
CALCULATE TIME, DISTANCE AND FUEL(FINAL ALTITUDE VALUES LESS INITIAL ALTITUDE VALUES)
TIME:(6.1–3.8) = 2.3 MIN, DISTANCE:(6.1–3.8)=2.3 NM
FUEL:(38–23.5) = 14.5 LB

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Figure 7-18. Climb Performance Chart

SECTION XIV. FUEL FLOW OH-58D R (250-C30R/3)

7-47. FLAT PITCH FUEL FLOW CHART.

The flat pitch fuel flow chart (fig. 7-19) shows the fuel flow at flat pitch.

7-48. USE OF CHART.

The primary use of the chart is illustrated by the example. To determine the flat pitch fuel flow, it is necessary to know pressure altitude and free air temperature. Enter at the pressure altitude, move right to FAT then move down and read fuel flow. Refer to the cruise charts to obtain fuel flow for cruise power conditions.

7-49. CONDITIONS.

This chart is based upon the use of JP-8 fuel and 100% rpm.

FLAT PITCH FUEL FLOW

JP-8 FUEL

FLAT PITCH FUEL FLOW OH-58D 250-C30R/3

EXAMPLE

WANTED

FLAT PITCH FUEL FLOW

KNOWN

PRESSURE ALTITUDE = 9000 FEET
FAT = 0°C

METHOD

ENTER PRESSURE ALTITUDE AT 9000 FEET
MOVE RIGHT TO 0°C FAT
DROP DOWN AND READ 124 FLAT PITCH FUEL FLOW

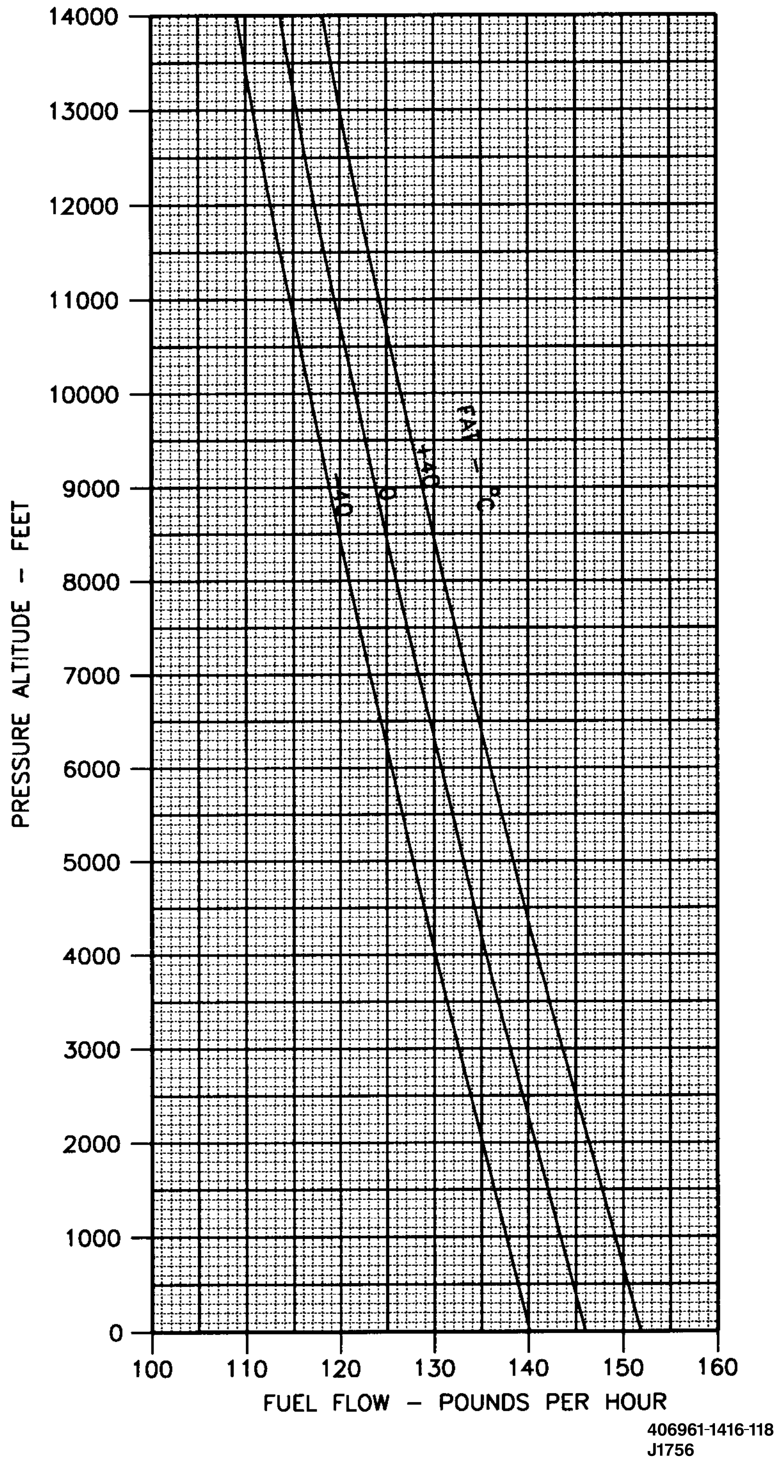

Figure 7-19. Flat Pitch Fuel Flow Chart

7-50. FUEL FLOW VS TORQUE CHART.

The fuel flow for this helicopter is presented in figure 7-20. Fuel flow vs torque shows fuel flow in pounds-per-hour versus torquemeter (%Q) for pressure altitudes from sea level to 12,000 feet and for 0°C free air temperature.

7-51. USE OF CHART.

The primary use of this chart is illustrated by the examples to determine fuel flow. It is necessary to know the mast torque (%Q) and the FAT as well as the pressure altitude. Fuel flow will increase about 2 percent with the bleed air heater on and 3 percent with anti-ice on. When both systems are on, increase fuel flow 5 percent. Also a range or endurance penalty should be accounted for when working cruise chart data. A fairly accurate rule-of-thumb to correct fuel flow for temperatures other than 0°C FAT is to increase (decrease) fuel flow one percent for each 10°C increase (decrease) in FAT.

7-52. CONDITIONS.

The chart is based on JP-8 fuel, 100% rpm and bleed air heater and anti-ice off.

FUEL FLOW vs TORQUE

FAT = 0° C & JP-8 FUEL

100% RPM

FUEL FLOW vs TORQUE OH-58D 250-C30R/3

EXAMPLE

WANTED

FUEL FLOW

KNOWN

MAST TORQUE = 60%Q
PRESSURE ALTITUDE = 10,000 FT
FAT = 0°C

METHOD

ENTER TORQUE SCALE AT 60%Q
MOVE RIGHT TO 10,000 FT
PRESSURE ALTITUDE
MOVE DOWN AND READ 228 LB/HR
FUEL FLOW

NOTE:

FOR EACH 10° INCREASE (DECREASE) IN FAT, INCREASE (DECREASE) FUEL FLOW BY 1%.

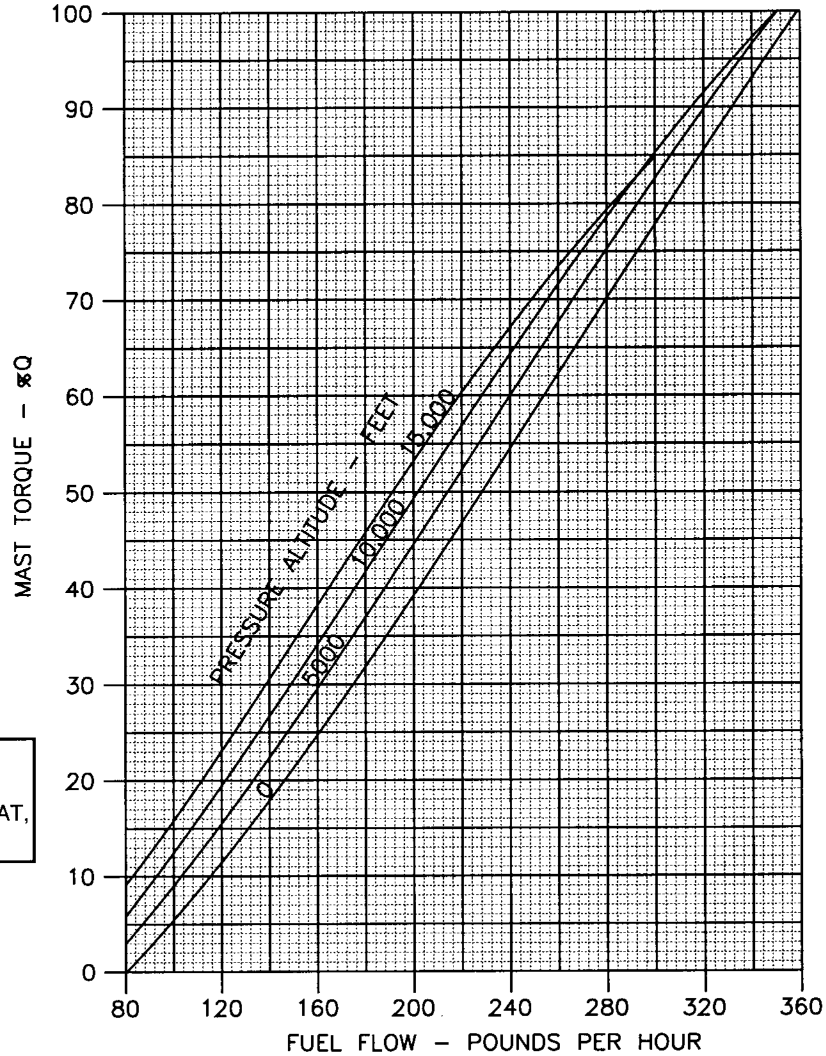

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Figure 7-20. Fuel Flow vs Torque Chart

CHAPTER 8

NORMAL PROCEDURES

SECTION I. MISSION PLANNING

8-1. 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 to, checks of operating limits and restrictions; weight, balance and loading; performance; publications; flight plan; and crew and passenger briefings. The pilot shall ensure compliance with the contents of this manual which are applicable to the mission.

8-2. AVIATION LIFE SUPPORT EQUIPMENT.

All aviation life support equipment required for mission, e.g., helmets, gloves, survival vests, survival kits, etc., shall be checked.

8-3. CREW DUTIES/RESPONSIBILITIES.

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 CPG on items pertinent to the mission; e.g., performance data, monitoring of instruments, communications, and emergency procedures.

a. 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, the responsibilities of each crewmember to include groundcrew, 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 voice communication with the crew.

WARNING

When a passenger is being carried, the cyclic stick shall be locked and the collective shall be removed to prevent inadvertent manipulation of the controls.

b. Passenger Briefing. The following is a guide that should be used in accomplishing required passenger briefings; items that do not pertain to a specific mission may be omitted.

(1) Crew introduction.

(2) Equipment.

(a) Personal to include ID tags.

(b) Professional.

(c) Survival.

(3) Flight data.

(a) Route.

(b) Altitude.

(c) Time enroute.

(d) Weather.

(4) Normal procedures.

(a) Entry/exit of helicopter and danger areas.

(b) Seating.

WARNING

Demonstrate to passenger how and where loose carry-on equipment will be secured. Demonstrate to passenger how seat belts and shoulder harnesses are to be used and how they are to be secured when exiting.

(c) Seat belts.

(d) Movement in the helicopter.

(e) Internal communication.

(f) Security of equipment.

(g) Smoking.

(h) Oxygen.

(i) Refueling.

(j) Weapons/Laser.

(k) Protective masks.

(l) Parachutes.

(m) Ear protection.

(n) Aviation life support equipment (ALSE).

(5) Emergency procedures.

(a) Emergency exits.

(b) Emergency equipment.

(c) Emergency landing/ditching procedures.

(d) Bail out.

(e) Survival.

(f) Recovery.

SECTION II. OPERATING PROCEDURES AND MANEUVERS

8-4. OPERATING PROCEDURES AND MANEUVERS.

This section deals with normal procedures and includes all steps necessary to ensure safe, efficient operation of the helicopter from the time a preflight begins until the flight is completed and the helicopter is parked and secured. Your flying experience is recognized; therefore, basic flight principles are avoided. Only the duties of the minimum crew necessary for the actual operation of the helicopter are included. Additional crew duties are covered as necessary in Section I, CREW DUTIES. Mission equipment checks are contained in Chapter 4, MISSION EQUIPMENT. Procedures specifically related to instrument flight that are different from normal procedures are covered in this section, following normal procedures. Descriptions of functions, operations, and effects of controls are covered in Section IV, FLIGHT CHARACTERISTICS, and are repeated in this section only when required for emphasis. Checks that must be performed under adverse environmental conditions, such as desert and cold-weather operations, supplement normal procedures checks in this section and are covered in Section V, ADVERSE ENVIRONMENTAL CONDITIONS.

8-5. SYMBOLS DEFINITION.

The symbol “O” shall be used to indicate “if installed.” Those duties which are normally the responsibility of the CPG will be indicated by a circle around the step number; i.e., 4.. Starter and IGN SYS circuit breakers — In. The symbol star “★” indicates that a detailed procedure for this step is included in the performance section of the condensed checklist.

The symbol asterisk “*” indicates that performance of the step is mandatory for all thru-flights. The asterisk applies only to checks performed prior to takeoff. Placarded items appear in uppercase.

8-6. CHECKLIST.

Normal procedures are given primarily in checklist form 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 operators checklist. To provide for easier cross-referencing, the procedural steps in the checklist are numbered to coincide with the corresponding numbered steps in this manual. The thru-flight checklist, consisting of only the steps having an asterisk, may be used for subsequent flights on the same day or for the first flight of the day in combat operations when authorized by the commander.

8-7. 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 (fig. 8-1). The preflight may be made as comprehensive as conditions warrant at the discretion of the pilot.

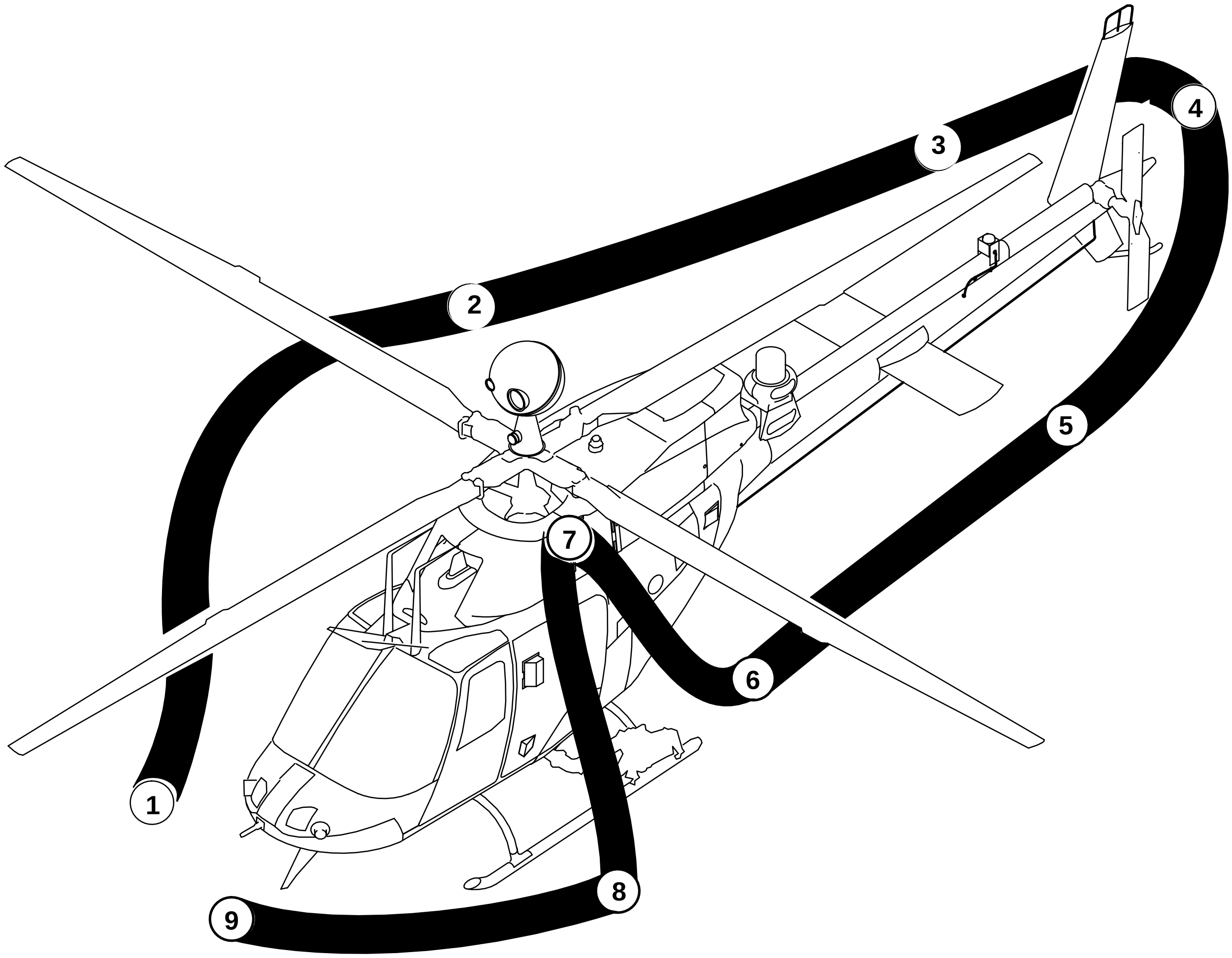


Figure 8-1. Exterior Check Diagram

8-8. BEFORE EXTERIOR CHECK.

WARNING

Do not preflight until armament systems are safe.

O* 1. Weapons systems — Safe.

a. Ejector rack — Pins installed.

b. Weapon system load status — Verify.

c. HELLFIRE launcher SAFE/ARM switch — SAFE.

d. MASTER ARM switch — OFF.

e. Jettison switches — Covers down.

* 2. LASER ARM/STBY/OFF switch — OFF.

3. Publications — Check as required; DA Forms, 2408 series, DD Form 1896, 365-4 (Form F), compass card, operator's manual (-10), checklist (-CL), and locally required forms, records, and publications.

* 4. Covers, locking devices, tiedowns, and grounding cables — Removed as required and secure.

5. Main rotor blades — Check.

* 6. Ignition keylock switch — On.

WARNING

- **(CDS2) Weapons can be inadvertently fired while the aircraft is on the ground if the MASTER switch is in the ARMED position, electrical power is applied to the aircraft, and either the Integrated System Processor (ISP) has failed or the ISP circuit breaker is pulled.**
- **R Weapons can be inadvertently fired while the aircraft is on the ground if the MASTER switch is in the ARMED position, electrical power is applied to the aircraft, and either the R MCPU has failed or the R MCPU circuit breaker is pulled.**

7. Cockpit (power on) — Check as follows:

a. R IGN circuit breaker switch — OFF.

b. FUEL BOOST switch — OFF.

c. ESNTL BUS switch — START.

d. BATT 1 switch — BATT 1.

WARNING

To prevent eye damage, do not look directly at NVG searchlight when light is on.

e. Lights — Check if use is anticipated. (Search, anticollision, position, IR search, and interior).

f. MPD — Check battery voltage (21 volts minimum required for a battery start), and fuel quantity.

g. Caution, warning, and advisory messages — Review and acknowledge.

h. **(CDS2)** ENGINE MONITOR/R FADEC MONITOR and ENGINE HISTORY pages — Check; record faults or values that exceed limitations, if any.

i. NVG power converters — Check and test if use is anticipated,

j. BATT 1 switch — OFF.

8. Cockpit right side — Check as follows;

a. **(CDS2)** DTR/R DRU — DTC/DTM, install as required.

b. First aid kit — Check.

c. Pilot seat, seat belt, shoulder harness, and armor side panel — Check.

d. Flight controls — Check and adjust.

CAUTION

To prevent possible inadvertent contact of pilot cyclic grip with instrument panel, the maximum allowable pilot cyclic adjusting limits are as follows:

(1) AFT position — Full AFT.
(2) FWD position — From full AFT position, a forward allowable setting of two complete turns of the adjustment knob.

8-9. EXTERIOR CHECK (FIG. 8-1).

8-10. FORWARD FUSELAGE — RIGHT SIDE — AREA 1.

O 1. Crew door — Check; condition, emergency release mechanism, and hinges. Ensure jettison rod is extended a minimum of 0.5 inch through hinge.

2. Static port — Check.

CAUTION

Absence of lateral rocking motion about aft crosstube center mounting bolt could result in ground resonance and airframe structural damage.

3. Landing gear — Check crosstubes, skid, skid shoes, and weight on gear switch. Check aft crosstube mount and check lateral rocking motion about the aft center mounting bolt by applying light oscillating pressures at the aft upper intermediate fuselage.

4. Underside of fuselage — Check; condition, antennas, and cargo suspension assembly (if installed).

5. Fuel sample — Drain and check for contamination.

8-11. INTERMEDIATE FUSELAGE — RIGHT SIDE — AREA 2.

O★* 1. Weapons system — Check.

2. UWP — Check.

CAUTION

Cargo shall not be placed in avionics compartment.

3. Avionics compartment — Check as follows: (if accessible).

a. Electrical and avionics components cables and connectors — Check.

b. Inertia reel — Check.

c. Access door — Check and secure.

O d. AVR-2A forward sensor unit — Check.

4. Fuel — Check; cap secure.

* 5. Hydraulic servos and flight controls — Check; check hydraulic filter buttons, SCAS actuators, and IFF antenna connectors. Secure door.

6. Transmission cowling — Check; cowling for damage and security, and inlet blast shield (if installed) for condition and obstructions.

* 7. Transmission — Check; lines, cables, and connections for condition and leaks, transmission oil level. EBF bypass door closed. Ensure bypass door area is clear (snow/ice, etc.). Secure door.

O 8. Particle separator or engine barrier filter system (if installed) — Check condition and unobstructed.

* 9. Engine compartment — Check lines, cables, and connections for condition and leaks, and overall condition of engine components. Secure door.

10. Fuselage — Check; condition, drain lines and vents, AC external power receptacle, lights, AVR-2A aft sensor unit, if installed, and antennas.

11. Oil tank — Check; tank condition and filler cap secure.

8-12. TAILBOOM — RIGHT SIDE — AREA 3.

* 1. Tailboom — Check condition as other items are checked:

O a. AN/ALQ-144 IR Jammer Transmitter and mount — Check; condition, security, electrical cables, and covert windows for cleanliness.

b. Driveshaft cover — Check; condition and security.

c. Antennas — Check.

d. Horizontal stabilizer — Check condition, expandable bolts, and position light.

8-13. TAILBOOM — AFT — AREA 4.

* 1. Tailboom — Check; condition as other items are checked:

a. Vertical fin — Check; condition and antenna connections.

b. Tail skid — Check; condition and security.

c. Lights — Check.

* 2. Tail rotor gearbox — Check condition, oil level, filler cap secure, and electrical connections.

* 3. Tail rotor — Check.

8-14. TAILBOOM — LEFT SIDE — AREA 5.

* 1. Tailboom — Check condition as other items are checked:

a. Driveshaft cover — Check condition and security.

b. Antennas — Check.

c. Horizontal stabilizer — Check condition, expandable bolts, and position light.

O d. AN/ALQ-144 IR Jammer Transmitter and mount — Check; condition, security, electrical cables, and covert windows for cleanliness.

8-15. INTERMEDIATE FUSELAGE — LEFT SIDE — AREA 6.

1. Oil cooler fan exhaust — Check.

CAUTION

Prior to servicing engine oil, refer to procedures contained in paragraph 2-95 to preclude over-servicing and engine damage or possible engine failure.

* 2. Engine oil level — Check.

3. Oil tank compartment — Check; oil cooler blower, driveshaft, oil lines, and oil filter bypass indicator button in. Secure door.

4. Fuselage — Check; condition, lights, AVR-2A aft sensor unit, if installed, antennas, and heater vent.

CAUTION

To prevent damage to electrical components all equipment placed in aft electrical compartment shall be clear of electrical components and properly secured.

5. Aft electrical compartment — Check; **(OH-58D)** ESC/ **(OH-58D(R))** ECU connections and PA sensing port unobstructed, condition and connections on electrical avionic components, circuit breakers in, aft battery connected (if installed), AVTR tape installed as desired and secure loose equipment. Secure door.

* 6. Engine compartment — Check; lines, cables and connectors for condition and leaks, fuel filter bypass indicator and engine oil filter bypass indicator buttons in, and overall condition of engine components. Secure door.

* 7. Transmission — Check; lines, cables, and connections for condition and leaks, transmission oil filter bypass indicator button in. EBF bypass door closed. Ensure bypass door area is clear (snow/ice, etc.). Secure door.

O 8. Particle separator or engine barrier filter system (if installed) — Check; condition and unobstructed.

* 9. Hydraulic reservoir — Check fluid level. Secure door.

10. Transmission cowling — Check; cowling for damage and security, and inlet blast shield (if installed) for condition and obstructions.

8-16. FUSELAGE — TOP — AREA 7.

1. Engine exhaust — Check.
2. Anticollision light — Check.
3. Engine inlet plenum window — Check condition.
4. Hydraulic reservoir — Check; condition, filler cap secure.
5. Hydraulic servos and flight controls — Check.
6. Transmission oil filler — Check cap secure.

* 7. Swashplate and flight controls — Check.

* 8. Main rotor system — Check.

O* 9. MMS — Check; temperature tape within ± 10 °C of ambient temperature or within +60 °C if MMS has been operating, turret vent screens, coolant filler cap, condition of sensor windows, and security of upper should. If MMS is not installed check cover plate installed.

8-17. FORWARD FUSELAGE — LEFT SIDE — AREA 8.

CAUTION

Cargo shall not be placed in avionics compartment.

1. Avionics compartment — Check as follows: (if accessible)
   a. Electrical and avionics components, cables, and connectors — Check.
   b. Inertia reel — Check.
   c. Access door — Check and secure.

O d. AVR-2A forward sensor unit — Check.

2. UWP — Check.

O★* 3. Weapons systems — Check.

4. Landing gear — Check; crosstubes, skid, skid shoes, and aft crosstube mount.
5. Underside of fuselage — Check; condition, antennas, and cargo suspension assembly (if installed).

O 6. Crew door — Check; condition, emergency release mechanism, and hinges. Ensure jettison rod is extended a minimum of 0.5 inch through hinge.

7. Cockpit left side — Check as follows:
   a. Fire extinguisher — Check.
   b. CPG seat, seat belt shoulder harness and armor side panel — Check. Secure seat belt and shoulder harness if seat is not used.

WARNING

If the CPG cyclic is to be used as a flight control, the cyclic shall be engaged.

   c. Flight controls — Check as follows:
      (1) CPG collective — Secure or remove as required.
      (2) CPG cyclic — Engage/disengage as required.
      (3) CPG pedals — Adjust as required.

8-18. FUSELAGE — FRONT — AREA 9.

1. Static port — Check.
2. Fuselage — Check condition as other items are checked:
   a. Upper antennas — Check.
   b. Upper wire cutter — Check.
   c. Windshield and deflector assembly — Check.
   d. Battery compartment — Check; circuit breakers in as required, battery cable connected, vent lines, and battery compartment door. Secure door.
   e. Ram air grille — Check.

O f. AN/APR-39 forward antennas — Check.

   g. IR position lights — Check.

h. Pitot tube — Check.

i. DC external power receptacle — Check; door secure.

j. Searchlight — Check.

k. Drain lines and vents — Check.

l. Lower wire cutter — Check.

m. Chin bubbles — Check.

n. Fuselage underside — Check.

3. Crew and passenger briefing — Complete. Refer to crew and passenger briefings in Section I, CREW DUTIES.

8-19. BEFORE STARTING ENGINE — PILOT (CPG REFER TO PARAGRAPH 8-20).

* 1. Seat belt, shoulder harness, inertia reel — Fasten and check.

2. Overhead panel equipment and switches — Check and set as follows:

a. Utility light — as required.

b. Circuit breakers — In as appropriate/set as follows:

O (1) RADAR DETR switch — **(CDS2)** WARN (down/off). **(CDS3/CDS4)** As desired.

O (2) RADAR WARN switch — RADAR (up/on).

O (3) IR JAMMER BASE circuit breaker switch — IR JAMMER (ON).

O (4) IR JAMMER XMTR circuit breaker switch — IR JAMMER (OFF).

(5) R FADEC circuit breaker switch — FADEC.

* (6) R IGN circuit breaker switch — IGN.

c. FORMATION LIGHTS switch — As desired.

d. CONSOLE LT switch — As desired.

e. INST LT switch — As desired.

f. FLOOD LT switches — As desired.

* g. POS lights switch — As required.

* h. ANTI-COLL lights switch — ANTI-COLL.

i. PITOT HTR switch — OFF.

j. HTR switch — OFF.

k. L DEFOG BLWR switch — OFF.

l. R DEFOG BLWR switch — OFF.

m. COMPT BLWR switch — AUTO.

n. CARGO HOOK circuit breaker switch — OFF.

* o. FUEL BOOST switch — FUEL BOOST.

p. ENG ANTI ICE switch — OFF.

q. ENG OIL BYPASS switch — OFF.

r. ESNTL BUS switch — START.

s. AC GEN switch — OFF.

t. DC GEN switch — OFF.

O u. BATT 2 switch — OFF or PREHEAT as required.

v. BATT 1 switch — OFF or PREHEAT as required.

w. Fuel valve handle — ON (forward).

x. Free air temperature (FAT) gage — Check; note FAT.

O y. PDU — Check and adjust.

3. Instrument panel instruments and switches — Check and set as follows:

a. RFD — Check.

b. RPM, TGT, and TRQ vertical scale instruments — Check.

c. MFD — Check.

d. MFD auxiliary control panel — Check; Slip indicator full of fluid.

e. Clock — Check.

O f. Radar detector indicator — Check.

g. Magnetic compass — Full of fluid.

NOTE

Do not adjust standby altimeter until DC power has been applied.

h. Standby flight instruments — Check.

i. **R** FADEC AUTO/MAN switch — Check.

j. MPD — Check.

k. MFK — Check; ZERO and EMER switch covers down.

NOTE

If gun is installed, and rounds are not loaded, place GUN switch in the ARMED position.

l. ACP — Check and set switches as required.

m. CSC control panel — Set as desired.

n. **R** External RMT/ICS switch — As desired.

O o. **(OH-58D)** Fuel control panel — Check, cover down.

p. SCAS control panel — Check and set switches as follows:
(1) SCAS PWR — OFF.
(2) FORCE TRIM — FORCE TRIM
(3) HYD SYS — HYD SYS.

4. Flight controls and switches — Check and set as follows:

a. Antitorque pedals — Check; freedom of movement, full travel, and pedals centered.

b. Cyclic — Neutral, friction as required.

c. Collective — Down and unobstructed, friction as required, and switches set as required.

d. Throttle — Check; full travel, idle detent, and return to closed position.

O* 5. BATT 2 switch — BATT 2.

* 6. BATT 1 switch — BATT 1.

WARNING

When helicopter is loaded with rockets, do not use external power. Electromagnetic interference from external source may cause accidental firing of rockets.

* 7. GPU — Connect as required (DC only).

* 8. Caution, warning, and advisory messages and audio — Check; audio activated, caution, warning, and advisory messages review and acknowledge.

* 9. **R** FADEC AUTO/MAN switch — Check AUTO.

10. MPD — Test and set; switches as follows:

a. TEST/DGT OFF — TEST. Verify all segments and digits are displayed on vertical scales and MPD.

b. MPD SEL — Select BATT V - START V position.

c. BRT — Set as desired.

8-20. BEFORE STARTING ENGINE — CPG (AS REQUIRED).

* 1. Seat belt, shoulder harness, and inertia reel — Fasten and check.

2. Instrument panel instruments and switches — Check and set as follows:

a. CSC control panel — Set as desired.

★ b. MMS switches — Set.

c. MFD — Check.

3. Flight controls — Check; engage/disengage cyclic as required, collective unobstructed.

8-21. (OH-58D) ENGINE START.

* 1. Fireguard — Posted (if available).

* 2. Rotor blades — Clear and untied.

★* 3. Engine start — Accomplish as follows:

CAUTION

- **DO NOT attempt start if BATT V is less than 21 volts.**
- **BATT V may go below 14 volts during the initial starting cycle; however, BATT V must be at least 14 volts prior to advancing the throttle. If after advancing the throttle the BATT V decreases to less than 14 volts, abort the start.**
- **If the TGT does not begin to rise by 18% NG, abort start.**
- **To prevent damage to engine if the FUEL CONT caution message is displayed on the MFD, do not start the engine.**
- **To prevent damage to engine if auto acceleration occurs when the throttle is opened, abort start.**
- **To prevent damage to engine if it becomes apparent that temperature limits will be exceeded before 50% NG is attained, abort the start.**

a. START switch — Press and hold. Start time.

b. BATT V — Check for a minumum of 14 volts prior to advancing throttle.

c. TGT — 150 °C or less.

d. Throttle — Advance slowly at 12% NG and modulate throttle to maintain TGT within limits. Slowly advance to idle after TGT has decreased from initial peak.

e. TGT — Increasing and within limits.

f. ENG oil pressure — Check.

g. Rotor blades — Turning by **25% NG.**

h. START switch — Release at **50% NG.**

i. NG — Check stabilized at idle **(63 to 65%).**

NOTE

For cold temperature starts, if ENG OIL and/or XMSN OIL pressures are above limits, or ENG OIL and/or XMSN OIL temperatures are below limits, do not accelerate engine above idle.

* 4. XMSN OIL pressure and ENG OIL pressure — Within limits.

8-22. R ENGINE START (AUTOMATIC MODE).

* 1. Fireguard — Posted (if available).

* 2. Rotor blades — Clear and untied.

★* 3. Engine start — Accomplish as follows:

a. AUTO/MAN switch — Check AUTO.

CAUTION

- **DO NOT attempt start if BATT V is less than 21 volts.**
- **To prevent a hot start if the NO AUTO START advisory is displayed on the MFD, do not attempt an automatic start unless message is deleted when throttle is advanced to the idle detent.**

NOTE

The START SWITCH must be activated within 60 seconds of advancing the throttle or the engine will not start. This is a safety feature to prevent inadvertent automatic starting of the engine. Clearing of this safety feature requires the pilot to place the throttle in the cutoff position, cycle the FADEC circuit breaker switch OFF then ON, then reinitiate the start sequence.

b. Throttle — Open to idle detent.

CAUTION

- **BATT V may go below 14 volts during the initial starting cycle; however, BATT V must be at least 14 volts by time NG reaches 10%. If this requirement is not met or BATT V decreases below 14 volts after 10% NG, abort the start to prevent the possibility of a hot start.**
- **If TGT does not begin to rise by 18% NG, abort the start.**
- **To prevent damage to engine, if it becomes apparent that temperature limits will be exceeded before 50% NG is attained, abort start.**
- **If starter is still engaged at idle (indicated by START V not near 0), the throttle must be closed and after TGT is below 200 °C the battery switch(es) must be turned off to prevent engine damage.**

NOTE

For cold temperature starts if ENG OIL and/or XMSN OIL pressures are above limits or ENG OIL and/or XMSN OIL temperatures are below limits, do not accelerate engine above idle.

c. START switch — Press for 2 seconds then release.

d. BATT V — Check for 14 volts or greater.

e. TGT — Increasing and within limits.

f. ENG oil pressure — Check.

g. Rotor blades — Turning by 25% NG.

h. START V — Decreased to near 0 at 50 % NG.

i. NG — Check stabilized at idle (63 to 65%).

* j. XMSN OIL pressure and ENG OIL pressure — Within limits.

8-23. ENGINE RUNUP — PILOT (CPG REFER TO PARAGRAPH 8-24).

CAUTION

To prevent damage to the DC charging system; when second battery is installed, do not initially charge both batteries simultaneously.

O* 1. BATT 2 switch — OFF.

NOTE

When external DC power is applied to the aircraft, the ESNTL BUS switch should be placed in the RUN position prior to placing the DC GEN switch in the DC GEN position.

* 2. DC GEN switch — DC GEN.

* 3. AC GEN switch — AC GEN.

* 4. ESNTL BUS switch — RUN.

* 5. Standby flight instruments — Set as follows:

a. Standby attitude indicator — Uncaged and set.

b. Standby altimeter — Set.

O* 5. **(EBF)** FILTER/BYPASS switch — Check FILTER and/or BYPASS light — Off.

* 6. GPU — Disconnect (if used).

7. DTS/MDU — Mission load as required.

NOTE

STBY ALT must indicate greater than sea level for EGI to align properly.

* 8. NAV ALIGN — Initiate as required.

9. RADALT — Check, set HI/LO as desired, note indication of less than 5 feet, verify 1000 ± 100 feet when RADALT TEST is selected, and verify that the altitude reading returns to initial indication.

10. R FADEC system — Check as follows:

a. FADEC AUTO/MAN switch — Press.

b. FADEC AUTO/MAN switch — Verify MAN is displayed.

c. FADEC audio tone — Audible through headset.

d. FADEC MAN message — Displayed on MFD.

e. FADEC AUTO/MAN switch — Press to select AUTO, verify audio tone and MFD message are removed and AUTO displayed on FADEC AUTO/MAN switch.

11. MPD BIT/RST switch — Check as follows:

a. Move switch to BIT position. Verify WRN indicator illuminates, PN followed by numbers displays, and after 5 seconds ERR displays followed by a number if an error(s) is detected.

b. Move switch to RST position and release.

O 12. **(OH-58D)** ESC — Check as follows:

a. INIT switch — Press.

b. FDL MENU key — Press.

c. BIT key — Press.

d. DIGITAL fuel control overspeed test button — Press and release.

e. BIT codes — Record if any and notify maintenance.

CAUTION

To prevent structural damage to the mast, limit cyclic movements to 2 inches maximum displacement from center position on ground run.

13. Flight controls — Check cyclic, collective, and antitorque pedals for freedom of movement and tip path plane for correlation with cyclic movement.

* 14. Caution, warning, and advisory messages — Review.

* 15. Throttle — Open.

NOTE

For the purpose of setting and/or adjusting the rotor speed (NR) or the power turbine speed (NP), use the digital readout on the multiparameter display (MPD) (item 13, fig. 2-11). Readouts from the NR vertical scale and from the MFD NR backup display may indicate one percent higher than the actual NR. The actual NR is displayed on the MPD.

* 16. RPM trim switch — Adjust to 100% NR.

* 17. SCAS — Engage as follows:

a. SCAS PWR switch — PWR.

b. PITCH/ROLL switch — Engage.

c. YAW switch — Engage.

18. ENG ANTI ICE — Check, if use is anticipated, as follows: Place switch in ENG ANTI ICE position and check for rise in TGT, then to OFF and check for decrease in TGT.

19. PITOT HTR — Check, if use is anticipated, as follows: Place switch in PITOT HTR position and check for rise in S GEN LD%, then OFF; check for decrease in S GEN LD%.

O ★ * 20. Weapons systems — Initialize and check as required.

O 21. ASE — Check as required.

O 22. ADSS — Check symbology and set if use is anticipated.

O* 23. Dual battery charging — Complete as follows:

a. MPD SEL — select RECT LD% - S GEN LD%, verify S GEN LD% is less than 70%.

b. BATT 2 switch — BATT 2.

O* 24. Grounding cable and ejector rack pins — Remove.

8-24. ENGINE RUNUP — CPG/PILOT.

NOTE

The following steps shall be performed as required by mission.

1. DTS/MDU — Mission load as required.

NOTE

Barometic altitude information is provided to the EGI during the alignment process; however, the EGI will not align if the standby altimeter indicates less than sea level.

* 2. NAV align — Initiate as required.

O 3. ASE — Switches on as required.

4. Avionics — Configure as required:

   a. IFM — Set to HI as required

   b. Communication radios — Check; program frequencies, configure secure equipment, and configure frequency hopping equipment.

   c. Transponder — Program and check.

O★*5. MMS startup checks — Complete as required.

O 6. AVTR — Initialize and set as desired.

7. Navigation systems — Configure as required.

   a. Waypoints — Check/load.

   b. R RMS — Configure.

   c. Flight plan — Check/construct.

   d. Battlefield graphics — Check/construct.

8. **(CDS2)** ATHS/**(CDS3)** IDM — Configure as required.

★ 9. **(CDS4)** IDM — Initialize as required.

O★*10. Weapons systems — Initialize and check as required.

O 11. ASE — Check as required.

O★ 12. MMS boresight — Complete as required.

8-25. BEFORE TAKEOFF.

* 1. Avionics — As required.

* 2. NR — 100%.

* 3. R FADEC AUTO/MAN switch — AUTO.

* 4. Systems — Check; engine, transmission, electrical, and fuel systems indications. Review cautions and advisories.

O* 5. ACP — Switches set.

WARNING

If the CPG cyclic is to be used as a flight control, the cyclic shall be engaged.

* 6. CPG cyclic — Engaged as required.

* 7. Crew, passengers, mission equipment, seat belts, and armor side panels — Check.

8-26. HOVER CHECK.

1. Engine and transmission instruments — Check.

2. Power assurance check — Perform on the first flight of the day as follows:

   a. HTR and ENG ANTI ICE switches — OFF.

   b. Aircraft stabilized, 3 foot hover, into the wind.

   c. Note TGT, FAT and ENG TRQ %.

   d. Enter Power Assurance Chart (fig. 8-2) at FAT and move up to indicated TGT, then across to current pressure altitude, then down to engine torque.

NOTE

- **(OH-58D)** If the indicated ENG TRQ % is less than value shown on the Power Assurance Chart, the engine may not meet the performance data contained in this manual. This would indicate a NO GO criterion. An entry shall be made on the DA FORM 2408-13-1/1E and the aircraft shall not be flown until maintenance is performed.
- R Refer to current Airwortheness Release.

1. Flight instruments — Check and set.
2. Hover power check — Accomplish as required.

8-27. THRU FLIGHT CHECK.

8-28. TAKEOFF.

8-29. NORMAL.

Refer To FM 1-203, Fundamentals of Flight.

8-30. BEFORE LANDING (CPG/PILOT AS REQUIRED).

1. LASER OFF/STBY/ARM switch — As required.

O 2. MMS — Stowed as required.

3. ACP — Switches set.

4. Landing light — Set as required.

O 5. IR JAMMER switch — Set as required.

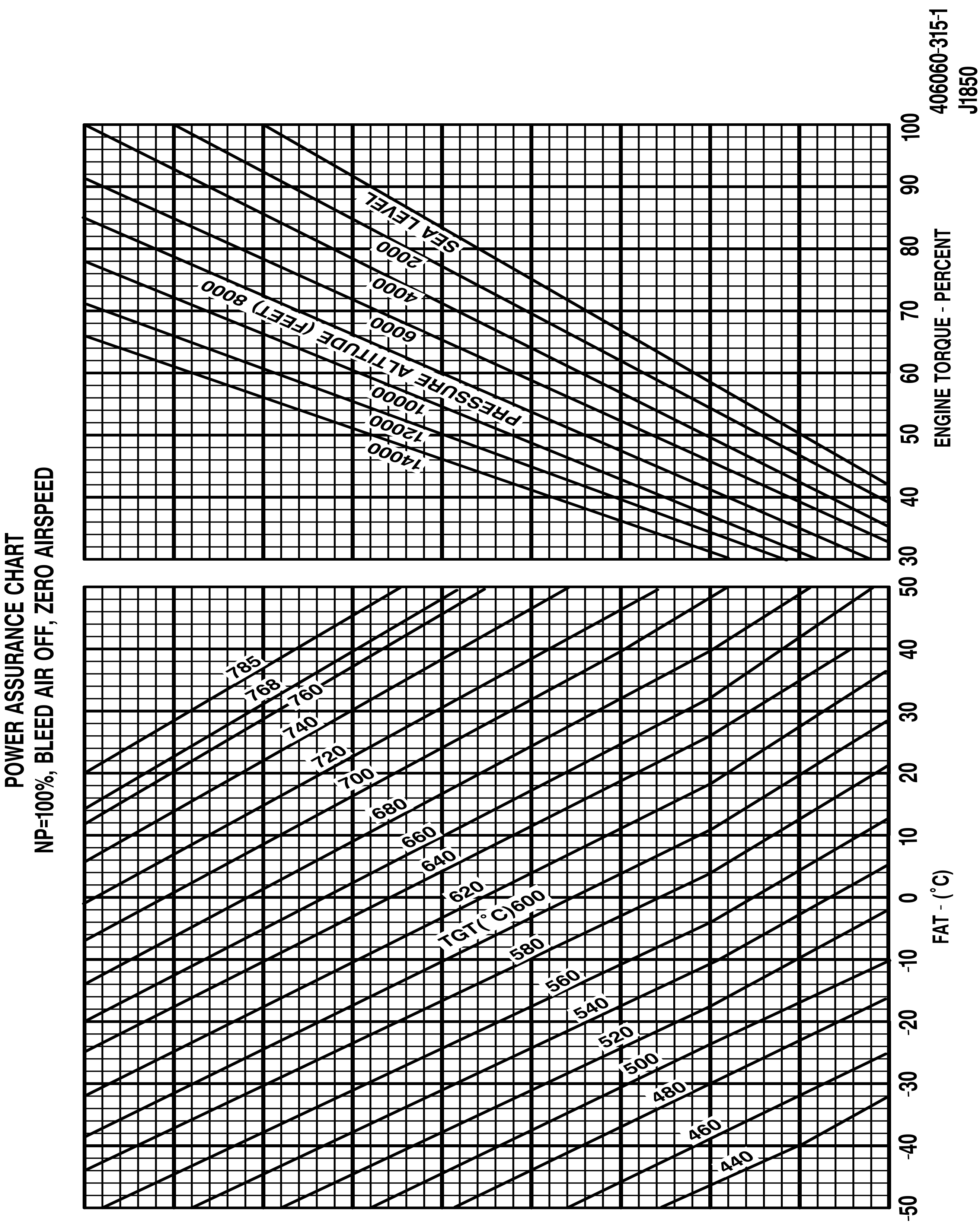


Figure 8-2. Power Assurance Charts (T703-AD-700A/250-C30R)(Sheet 1 of 2)

Chart Deleted

Figure 8-2. R Power Assurance Charts (250-C30R/3)(Sheet 2 of 2)

8-31. AFTER LANDING CHECK.

1. Landing light — OFF as required.
2. Transponder — STBY as required.
3. ASE — Set as required.

8-32. ENGINE SHUTDOWN.

1. Flight controls — Cyclic centered, pedals neutral, collective down.
2. FORCE TRIM switch — FORCE TRIM.
3. Present position — Store or record as required.

O 4. AVTR — STOP.

NOTE

To prevent loss of MMS volatile data, place MMS mode select switch to OFF before reducing the throttle to idle.

O 4.1. **(EBF)** FILTER/BYPASS switch — Check. If illuminated a DA Form 2408-13-1/E entry is required to notify maintenance personnel.

5. MMS — OFF.
6. **(CDS4)** IDM — Shut down.
7. Throttle — Reduce to idle for 2 minutes.
8. BATT 1/BATT 2 — Check as follows:

a. MPD SEL — Select RECT LD %/ — S GEN LD %.

b. BATT 1 switch — OFF.

c. MPD — Check S GEN LD % and note indication.

O d. BATT 2 switch — OFF. Check S GEN LD % for a decrease which should not exceed 3%.

e. BATT 1 switch — BATT 1. Check S GEN LD % increase should not exceed 3%.

NOTE

Fluctuations of 3% or less indicate a fully charged battery.

9. AC GEN switch— OFF.

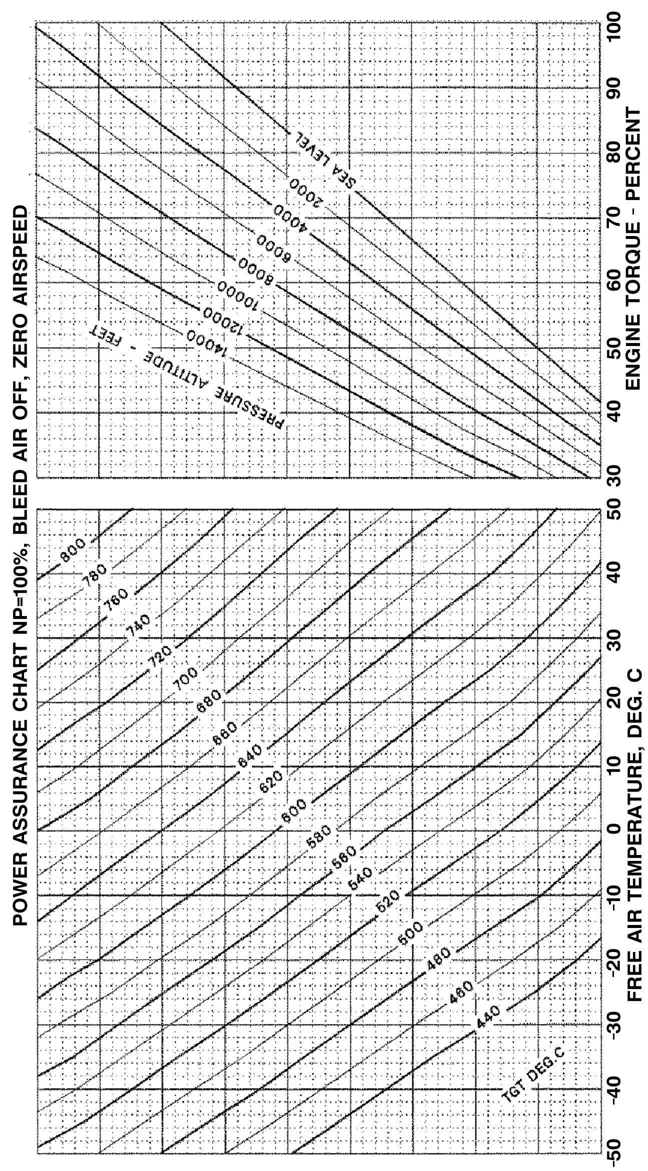


Figure 8-2. R Power Assurance Chart (250-C30R/30 (Sheet 2 of 2)

10. FUEL BOOST switch — OFF.

O 11. ASE — Off as follows:

a. RADAR DETR switch — DETR (OFF).

b. RADAR WARN switch — WARN (OFF).

c. IR JAMMER XMTR switch — IR JAMMER (OFF).

12. Standby attitude indicator — Caged.

13. SCAS PWR — OFF.

14. **(CDS2)** DTS/R MDU — Mission store as desired.

15. **(CDS2)** ENGINE MONITOR/R FADEC MONITOR and ENGINE HISTORY pages — Check and record faults or values that exceed limitations.

16. **(OH-58D)** ESC — Check as follows:

a. INIT switch — Press.

b. FDL MENU key — Press.

c. BIT key — Press.

d. DIGITAL fuel control overspeed test button — Press and release.

e. BIT codes — Record if any and notify maintenance

O 17. AVTR — MANUAL UNTHREAD, as required.

NOTE

Successful completion of OS TEST will result in engine shutdown.

18. R OS TEST — Perform (first flight of the day) as follows:

a. INIT key — Press.

b. FDL MENU key — Press.

c. OS TEST key — Press (two times within 15 seconds).

d. Throttle — Closed by 30% NG.

CAUTION

If TGT rises above 400 °C (indicating a residual fire in the engine) engage START switch until TGT is less than 200 °C.

19. Throttle — Closed and monitor TGT.

20. Overhead switches — Set; off except battery, required lights, and the following:

a. COMPT BLWR switch — AUTO.

b. ESNTL BUS switch — START when NG is less than 10%.

21. R IGN circuit breaker switch — OFF.

NOTE

R Do not proceed with the following steps until NG is indicating zero percent, or the FADEC HMU pistons may not park.

22. Battery and light switches — OFF, when main rotor blades stop turning.

23. Ignition keylock switch — OFF, remove key as required.

CAUTION

To prevent damage to honeycomb panel under crew member doorframe, do not drop seat belt against side of aircraft.

O 24. Doors — Close immediately after exiting aircraft.

8-33. BEFORE LEAVING HELICOPTER.

1. Walk-around — Complete, Checking the following:

O a. Ejector rack pins — Installed.

O b. Weapons systems — Check, verify ammunition load status.

c. Check aircraft for damage, fluid leaks, fluid levels, and bypass indicators.

O d. AVTR tape — Remove as desired.

e. DTS/MDU cartridge — Remove as required.

2. DA Forms — Complete as required to include the following conditions:

a. Operation within 10 NM of salt water.

b. Operation within 200 NM of a volcanic area.

c. Operation in heavy rain.

3. Main rotor blades — Tie down as required.

4. Secure helicopter as required.

SECTION III. INSTRUMENT FLIGHT

8-34. INSTRUMENT FLIGHT — GENERAL.

WARNING

Flight into instrument meteorological conditions has not been demonstrated in this aircraft.

This helicopter is restricted to visual flight conditions. Flight into instrument meteorological conditions will be conducted on an emergency basis only. Flight handling, stability characteristics, and range are the same during instrument flight as for visual flight.

SECTION IV. FLIGHT CHARACTERISTICS

8-35. FLIGHT CHARACTERISTICS.

The flight characteristics of this helicopter, in general, are similar to other single-rotor helicopters.

Upper droop stop contact of the main rotor system may occur during touchdown and ground run portions of autorotational landings when rotor RPM is low (below 64%) and collective pitch is applied. Upper droop stop contact is not, in itself, hazardous, but is an indicator of a condition that could potentially be damaging. Depending upon the severity of the upper droop stop contact, the crew may feel several rapid sharp vibrations through the airframe and flight controls. If severe upper droop stop contact occurs, the crew may experience lateral oscillations in the airframe. The combination of allowing rotor RPM to go below 64%, the failure to smoothly reduce the collective pitch to the full down position, and application of aft cyclic during the ground run, can result in excessive coning, damaging the upper droop stops and causing stress damage to the main rotor blades. If upper droop stop contact occurs, this should be recorded on the DA Form 2408-13-1/-1E so that maintenance personnel can perform an inspection before continuing flight.

SECTION V. ADVERSE ENVIRONMENTAL CONDITIONS

8-36. ADVERSE ENVIRONMENTAL CONDITIONS. The following paragraphs provide information relative to operation under adverse environmental conditions (snow, ice, rain, turbulent air, extreme cold, hot weather, desert, mountainous, and high altitude operations) at maximum gross weights, etc. Checklists are provided only to cover specific procedures that are characteristic of all weather operations. Unless otherwise provided, the checklists in Section II are sufficient for operations in adverse environmental conditions.

NOTE

Use the hover page velocity vector for a standby hover reference when brown out or white out conditions are likely to occur.

8-37. COLD WEATHER OPERATIONS.

Operation of the helicopter in cold weather or an arctic environment presents no unusual problems if the operators are aware of those changes that do take place and conditions that may exist because of the lower temperatures and freezing moisture.

(OH-58D) Engine auto (spontaneous) acceleration is a state of continuous engine acceleration that can occur during cold weather starting after the introduction of fuel (opening of throttle). Engine acceleration is faster than acceleration during normal start and does not correspond to the throttle position for a modulated start.

a. Inspection. The pilot must be more thorough in the walk-around inspection when temperatures have been at or below 0 °C (32 °F). Water and snow may have entered many parts during operations or in periods when the helicopter was parked unsheltered. This moisture often remains to form ice which will immobilize moving parts or damage structure by expansion and will occasionally foul electrical circuitry. Protective covers afford adequate protection against rain, freezing rain, sleet, and snow when installed on a dry helicopter prior to precipitation. Since it is not practicable to completely cover an unsheltered helicopter, those parts not protected by covers and those adjacent to cover overlap and joints require closer attention, especially after a blowing snow or freezing rain. Accumulation of snow and ice should be removed prior to flight. Failure to do so can result in hazardous flight, due to aerodynamic and center of gravity disturbances as well as the introduction of snow, water, and ice into internal moving parts and electrical systems. The pilot should be particularly attentive to the main and tail rotor systems and their exposed control linkages.

b. Before Exterior Check 0 °C (32 °F) and Below. Perform check as specified in Section II.

c. Exterior Check 0 °C (32 °F) and Below. Perform exterior check as outlined in Section II, plus the following checks:

CAUTION

Check that all surfaces and controls are free of ice or snow.

NOTE

Contraction of the fluids in the helicopter system at extreme low temperature causes indication of low levels. A check made just after the previous shutdown and carried forward to the walk-around check is satisfactory, if no leaks are in evidence. Filling when the system is cold-soaked will reveal an over-full condition immediately after flight, with the possibility of forced leaks at seals.

(1) Main rotor — Check free of ice and snow.

(2) Engine.

(a) Inspect inlet for possible accumulations of snow, slush, or ice.

(b) Inspect the engine plenum chamber through the Plexiglass window (a flashlight may be required). Remove snow, slush, or ice, paying particular attention to the firewalls, rear face of the particle separator, bottom corners, and protruding surfaces such as guide vanes, etc.

(c) Before Starting Engine 0 °C (32 °F) and Below Perform check as specified in Section II.

CAUTION

The installation and use of the second battery is to provide increased battery starting capacity for cold weather starting. If one battery is depleted and both batteries are placed on line together in parallel, starting capacity may be decreased. Therefore, ensure both batteries are sufficiently charged prior to starting.

NOTE

- GPU should be connected (if available) for all cold weather starts.
- Using battery preheat or warm battery engine starts on single battery power can be accomplished in ambient temperatures to -31 °C (-24 °F). With a second battery installed, engine starts to -45 °C (-49 °F) can be accomplished.
- If a battery start must be attempted when the helicopter and battery have been cold-soaked at temperatures below -17 °C (2 °F), preheat battery by placing BATT switch to PREHEAT. After HEAT ON indicator extinguishes, wait 1.5 to 2 minutes before attempting start. Preheating engine will result in a faster starter cranking speed which tends to reduce the hot-start hazard by assisting the engine to reach self-sustaining speed.

(d) **Engine Start 0 °C (32 °F) and Below.** Perform check as outlined in Section II.

CAUTION

(OH-58D) Engine auto (spontaneous) acceleration, caused by pressure line freezing in the fuel control unit, can occur when the following conditions are met:

1. Ambient temperature of -12 °C (+10 °F) or lower.

2. Relative humidity of 45 percent or higher.

3. The helicopter has not been hangared before flight or has otherwise been allowed to cold soak.

NOTE

During cold-weather starting, the engine oil pressure gage may exceed the maximum limit. The engine should be warmed up at engine idle until the engine oil pressure indication is below 130 psi.

WARNING

- **Control system checks should be performed with extreme caution when helicopter is parked on snow and ice. There is reduction in ground friction holding the helicopter stationary, controls are sensitive, and response is immediate.**
- **When firing a HELLFIRE missile AGM-114A at temperatures below freezing, severe ice fog may be formed by the missile exhaust plume. This ice fog can obscure crew visibility and also interfere with autonomous designation.**

(e) **Engine Runup 0 °C (32 °F) and Below.** Perform the check as outlined in Section II.

(f) **Inflight Procedures 0 °C (32 °F) and Below.** Perform checks as outlined in Section II. There are no unusual flight operational characteristics in cold weather operations.

NOTE

The ENG ANTI ICE switch should be activated (ENG ANTI ICE position) when operating in visible moisture at FAT 5 °C (41 °F) or below.

8-38. SNOW OPERATIONS.

WARNING

- **Aft inlet shield panels shall be removed for snow flight.**
- **Ensure EBF bypass door is clear of ice or snow accumulation.**

There are no unusual flight operational characteristics in snow operations. Refer to FM 1-202, Environmental Flight, for snow takeoff and landing technique.

8-39. DESERT AND HOT WEATHER OPERATIONS.

CAUTION

Aft inlet blast shield panels may be removed as required for operations in blowing sand, grass and other debris.

There are no unusual flight characteristics in desert and hot weather operations. Refer to FM 1-202, Environmental Flight, for operational technique.

NOTE

- **(EBF)** Minimize operations in sandy/dusty environments to preclude clogging the engine barrier filters.
- **(Non-EBF)** Minimize ground operations below 100 percent NP in sandy and dusty environments due to the loss of 3 phase AC power to the Particle Separator Blower.
- Avoid extended periods of hovering with aircraft headed downwind in order to minimize engine oil temperature increases. If engine oil temperature approaches the maximum limit, adjust aircraft heading into the wind to prevent HIGH OIL TEMP ENG caution message.

8-40. TURBULENCE AND THUNDERSTORMS.

Flight in thunderstorms and heavy rain which accompanies thunderstorms should be avoided. If turbulence and thunderstorms are encountered inadvertently, use the following procedures:

1. Check that seat belts and shoulder harnesses are tightened.

2. PITOT HTR switch — PITOT HTR.

3. Airspeed — Adjust to maintain a penetration speed corresponding to minimum torque required; maximum endurance airspeed.

NOTE

After aircraft has been operated in the above condition, an entry is required on the DA Form 2408-13-1 or 2408-13-1E.

4. Radios — Turn volume down on any radio equipment badly affected by static.

5. At night — Turn interior lights to full bright to minimize blinding effect of lightning.

6. Maintain a level attitude and constant power setting. Airspeed fluctuations should be expected and disregarded.

7. Maintain the original heading, turning only when necessary.

8. The barometric altimeter is unreliable due to differential barometric pressures within the storm. An indicated gain or loss of several hundred feet is not uncommon and should be allowed for when determining minimum safe altitude.

8-41. LIGHTNING STRIKE.

a. Although the possibility of a lightning strike is remote, the helicopter could sustain lightning damage.

NOTE

Avoid flight in or near thunderstorms.

b. Simulated lightning strike tests (on other helicopters) indicate that lightning strikes may damage rotors and/or rotor systems. The degree of damage will depend on the magnitude of the charge and point of contact. Catastrophic structural failure is not anticipated; however, evidence of damage to hub bearings, blade aft section, trim tabs, and blade tips was demonstrated. Also, adhesive bond separations occurred between the blade spar and aft section between the spar and leading edge abrasive strip. Such damage can aerodynamically produce severe structural vibration and serious control problems.

c. Abnormal operating noises almost always accompany rotor damage. Loudness and pitch of noise are not valid indicators of the magnitude of damage.

8-42. ICING CONDITIONS.

a. Intentional flight in any known icing condition is prohibited. If icing conditions are encountered during flight, every effort should be made to vacate the icing environment.

b. If icing conditions become unavoidable, the pilot should open the filter bypass door if the FILTER segment illuminates (EBF equipped), turn on the pitot heat, cabin heater, left and right defog blowers, and the engine anti-ice system.

c. During flights in icing, the following conditions may be experienced:

NOTE

If the windshield defrosters fail to keep the windshield clear of ice, the side windows may be used for visual reference during landing.

(1) Obscured forward field of view, due to ice accumulation on the windshield and chin bubbles.

(2) Vibrations ranging from mild to severe caused by asymmetrical ice shedding from the main rotor system. The severity of the vibration will depend upon the temperatures and the amount of ice accumulation on the blades, when the ice shed occurs. The possibility of an asymmetric ice shed occurring increases as the outside air temperature decreases.

(3) An increase in torque required to maintain a constant airspeed and altitude due to ice accumulation on the rotor system.

(4) Possible degradation of the ability to maintain autorotational rotor speed within operating limits. If a torque increase is required above the cruise torque setting used prior to entering icing conditions, it may not be possible to maintain autorotational rotor speed within operational limits, should an engine failure occur.

WARNING

Ice shed from the rotor blades and/or other rotating components presents a hazard to personnel during landing and shutdown. Ground personnel should remain well clear of the helicopter during landing and shutdown and crewmembers should not exit the aircraft until the rotor has stopped turning.

d. Control activity cannot be depended upon to remove ice from the main rotor system. Vigorous control movements should not be made in an attempt to reduce low-frequency vibrations caused by asymmetrical shedding of ice from the main rotor blades. These movements may induce a more asymmetrical shedding of ice, further aggravating helicopter vibration levels.

8-43. FLIGHT IN VICINITY OF SALT WATER.

Flight within 10 nautical miles of salt water will require an entry on DA Form 2408-13-1 or 2408-13-1E to alert maintenance personnel.

8-44. FLIGHT IN VICINITY OF VOLCANIC ACTIVITY.

Flight within 200 nautical miles of volcanic activity will require an entry on DA Form 2408-13-1 or 2408-13-1E to alert maintenance personnel.

CHAPTER 9

EMERGENCY PROCEDURES

SECTION I. HELICOPTER SYSTEMS

9-1. HELICOPTER SYSTEMS. This section describes the helicopter systems 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 procedures are given in checklist form when applicable. A condensed version of these procedures is contained in the condensed checklist, TM 1-1520-248-CL.

Tables 9-1 through 9-3 provide a complete list of Warning, Caution, and Advisory messages and required actions for CDS2 and CDS3.

Tables 9-4 through 9-6 provide a complete list of Warning, Caution, and Advisory messages and required actions for CDS4.

9-2. IMMEDIATE ACTION EMERGENCY STEPS.

Those steps that must be performed immediately in an emergency are underlined. These steps must be performed without reference to the checklist. When the situation permits, non-underlined steps will be accomplished with use of the checklist. If time permits during a critical emergency, transmit a MAYDAY call, set transponder to emergency, jettison external stores/ external cargo (if appropriate), and lock shoulder harnesses.

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.

9-3. DEFINITION OF EMERGENCY TERMS.

For the purpose of standardization, the following definitions shall apply:

a. The term LAND AS SOON AS POSSIBLE is defined as executing a landing at the nearest suitable landing area (e.g., open field) without delay. (The primary consideration is to assure the survival of the occupants.)

b. The term LAND AS SOON AS PRACTICABLE is defined as executing a landing at a suitable landing area. (The primary conslderatlen Is the urgency of the emergency.)

c. The term AUTOROTATE is defined as adjusting the flight controls as necessary to establish an autorotational descent and landing.

d. The term EMER SHUTDOWN is defined as engine shutdown without delay as follows.

1. <u>Throttle — Close.</u>

2. <u>FUEL VALVE handle — OFF.</u>

WARNING

Complete loss of DC power will result in a loss of rotor RPM indications.

NOTE

Before turning the battery switch off durrng in-flight emergencies requiring EMER SHUTDOWN, the pilot should consider MAYDAY call, transponder emergency, and the possible adverse effects of total electrical failure. The loss of all CDS indications will occur.

3. <u>BATT switches OFF.</u>

TABLE 9-1. (CDS2/CDS3) WARNING MESSAGES AND ACTIONS REQUIRED

WARNING	ACTION
ENGINE OUT	Verify condition, Autorotate.
ENG OVER TRQ	Verify condition, LAND AS SOON AS POSSIBLE.
(CDS3) FADEC FAIL	Refer to FADEC failure emergency procedure.
(CDS3) FADEC MANUAL	Refer to FADEC failure emergency procedure.
HIGH RPM	Verify condition, Adjust collective.
(CDS3) LOW FUEL PRES	LAND AS SOON AS SOON POSSIBLE.
LOW RPM ROTOR	Verify condition, Adjust collective.
TGT OVER TEMP	Verify condition, LAND AS SOON AS POSSIBLE.
XMSNOVERTRQ	Verify condition, LAND AS SOON AS POSSIBLE.

TABLE 9-2. (CDS2/CDS3) CAUTION MESSAGES AND ACTIONS REQUIRED

CAUTION	ACTION
AC GEN FAIL	Refer to emergency procedure.
ADU FAIL	Refer to emergency procedure.
BATT CHGR FAIL	Information/system status.
CHIPS ENG FREEWHEEL	If no successful burnoff - LAND AS SOON AS POSSIBLE.
CHIPS ENG LOWER	LAND AS SOON AS POSSIBLE.
CHIPS ENG UPPER	LAND AS SOON AS POSSIBLE.
CHIPS T/R GRBX	If no successful burnoff LAND AS SOON AS POSSIBLE.
CHIPS XMSN SUMP	If no successful burnoff - LAND AS SOON AS POSSIBLE.
CHIPS XMSN UPPER	If no successful burnoff - LAND AS SOON AS POSSIBLE.
DC GEN FAIL	Refer to emergency procedure.
EGI FAIL	Refer to emergency procedure.
* ENG TRQ TIME LIM [ ]	Adjust collective.
FUEL BOOST FAIL	Refer to emergency procedure.
FUEL CONT	Refer to emergency procedure.
FUEL FILTER BYP	LAND AS SOON AS POSSIBLE.
FUEL LOW	LAND AS SOON AS PRACTICABLE.
GPS DIVERGENT	Refer to emergency procedure.
HF RADIO FAIL	Information/system status.
HIGH OIL PRESS ENG	LAND AS SOON AS PRACTICABLE.

TABLE 9-2. (CDS2/CDS3) CAUTION MESSAGES AND ACTIONS REQUIRED (Cont)

CAUTION	ACTION
HIGH OIL TEMP ENG	Refer to emergency procedure.
HIGH OIL TEMP XMSN	LAND AS SOON AS POSSIBLE.
HIGH TEMP T/R GRBX	LAND AS SOON AS POSSIBLE.
*HIGH TGT TIME LIM [ ]	Adjust collective.
HOT BATT 1	Refer to emergency procedure.
HOT BATT 2	Refer to emergency procedure.
HOT BATT 1 & 2	Refer to emergency procedure.
(CDS3) HOT BATT 1, 2	Refer to emergency procedure.
IFF FAIL	Information/system status.
IFF MODE 4 FAIL	Information/system status.
INS FAIL	Information/system status.
INV FAIL	Information/system status.
IR JAMMER INOP	Information/system status.
(CDS2) ISP FAIL	Information/system status.
LEFT MCPU FAIL	Refer to emergency procedure.
(CDS3) LOW ALTITUDE	Information/system status.
LOW HYD PRESS	Refer to emergency procedure.
LOW OIL PRESS ENG	LAND AS SOON AS POSSIBLE.
LOW OIL PRESS XMSN	LAND AS SOON AS POSSIBLE.
LOW OIL QUANTITY ENG	LAND AS SOON AS POSSIBLE.
*MAST TRQ TIME LIM [ ]	Adjust collective.
MISSILE UNLATCHED	Refer to emergency procedure.
OIL BYP ENG	LAND AS SOON AS POSSIBLE.
P/R DISENG	Refer to SCAS failure emergency procedure.
RECT FAIL	Information/system status.
RIGHT MCPU FAIL	Refer to emergency procedure.
SCAS DISENG	Refer to SCAS failure emergency procedure.
(CDS2) * TGT 5 MIN LIM [ ]	Adjust collective
* TGT 30 MIN LIM []	Adjust collective
(CDS3) WEAPONS FAIL	Information/system status.
YAW DISENG	Refer to SCAS failure emergency procedure.

*The time displayed in brackets is a cumulative time not dependent on a given time period. Up to 99 seconds can be displayed.

TABLE 9-3. (CDS2/CDS3) ADVISORY MESSAGES AND ACTIONS REQUIRED

ADVISORY	ACTION
ALARM ONE LABEL	Information/system status.
(CDS3) ALARM	Information/system status.
(CDS3) ASE FAIL	Information/system status.
(EBF) BYPASS (segment light)	Information/system status.
CARGO HOOK ARMED	Information/system status.
CODE NOT ACCEPTED	Information/system status.
DATA LOADER FAIL	Information/system status.
DTS FAIL	Information/system status.
EGI BATT LOW	Refer to emergency procedure.
(CDS3) FADEC DEGRADE	Information/system status.
(CDS3) FADEC MAINT	FADEC requires maintenance action.
(EBF) FILTER (segment light)	Refer to emergency procedure.
FUEL CONTROL	Information/system status.
GPS FAIL	Information/system status.
(CDS3) GPS DIVERGENT	Refer to emergency procedure.
(CDS3) HVR DEGRADED	Information/system status.
IFM FAIL	Information/system status.
(CDS3) IMAGE RECEIVED	Information/system status.
(CDS3) INVALID COMMAND	Information/system status.
LASER CODE MISMATCH	Information/system status.
LAUNCHER(S) SAFED	Information/system status.
LEFT COOLANT LOW	Information/system status.
LEFT LAUNCHER FAIL	Information/system status.
MISSILE ALERT	Information/system status.
MISSILE ALERT – AI	Information/system status.
MISSILE ALERT – SAM	Information/system status.
MMS FAIL	Information/system status.
MMS VIDEO NOT AVAIL	Information/system status.
MOIST VTR TAPE	Information/system status.
(CDS3) NO AUTO START	A detected failure may hinder auto start.
NO CODE	Information/system status.
P(Y) CODE INVALID	Information/system status.
RHE FAIL	Information/system status.
RIGHT COOLANT LOW	Information/system status.

TABLE 9-3. (CDS2/CDS3) ADVISORY MESSAGES AND ACTIONS REQUIRED (Cont)

ADVISORY	ACTION
RIGHT LAUNCHER FAIL	Information/system status.
(CDS3) RMS FAIL	Information/system status.
TIMER ONE LABEL	Information/system status.
(CDS3) TIMER	Information/system status.
(CDS3) VDU FAIL	Information/system status.
VTR FAIL	Information/system status.
VTR HEAD CONTAMINATED	Information/system status.
VTR TAPE FULL	Information/system status.
(CDS3) WEAPONS FAIL	Refer to emergency procedure.
WEDGE CONSTANT ZERO	Information/system status.
WPN NOT ACTIONED	FADEC requires maintenance action.
WPN NOT ARMED	Refer to emergency procedure.
WPN NOT SELECTED	Information/system status.

TABLE 9-4. (CDS4) WARNING MESSAGES AND ACTIONS REQUIRED

WARNING	ACTION
LOW ALTITUDE*	Information/system status.
ENGINE OUT	Verify condition, Autorotate.
ENG OVER TRQ	Verify condition, LAND AS SOON AS POSSIBLE.
FADEC FAIL	Refer to FADEC failure emergency procedure.
HIGH RPM	Verify condition, Adjust collective.
LOW FUEL PRES	LAND AS SOON AS POSSIBLE.
LOW RPM ROTOR	Verify condition, Adjust collective.
TGT OVER TEMP	Verify condition, LAND AS SOON AS POSSIBLE.
XMSN OVER TRQ	Verify condition, LAND AS SOON AS POSSIBLE.

NOTE

*This warning is not displayed in the warning box. It is only indicated by sounding of 3-Hz warning tone.

TABLE 9-5. (CDS4) CAUTION MESSAGES AND ACTIONS REQUIRED

CAUTION	ACTION
AC GEN FAIL	Refer to emergency procedure.
ADU FAIL	Refer to emergency procedure.
BATT CHGR FAIL	Information/system status.
CHIPS ENG FREEWHEEL	If no successful burnoff · LAND AS SOON AS POSSIBLE.
CHIPS ENG LOWER	LAND AS SOON AS POSSIBLE.
CHIPS ENG UPPER	LAND AS SOON AS POSSIBLE.
CHIPS T/R GRBX	If no successful burnoff · LAND AS SOON AS POSSIBLE.
CHIPS XMSN SUMP	If no successful burnoff · LAND AS SOON AS POSSIBLE.
CHIPS XMSN UPPER	If no successful burnoff · LAND AS SOON AS POSSIBLE.
DC GEN FAIL	Refer to emergency procedure.
EGI FAIL	Refer to emergency procedure.
*ENG TRQ TIME LIM [ ]	Adjust collective.
FADEC MANUAL	Refer to FADEC failure emergency
FUEL BOOST FAIL	Refer to emergency procedure.
FUEL CONT	Refer to emergency procedure.
FUEL FILTER BYP	LAND AS SOON AS POSSIBLE.
FUEL LOW	LAND AS SOON AS PRACTICABLE.
HIGH OIL PRESS ENG	LAND AS SOON AS PRACTICABLE.
HIGH OIL TEMP ENG	Refer to emergency procedure.
HIGH OIL TEMP XMSN	LAND AS SOON AS POSSIBLE.
HIGH TEMP T/R GRBX	LAND AS SOON AS POSSIBLE.
*HIGH TGT TIME LIM [ ]	Adjust collective.
HOT BATT 1	Refer to emergency procedure.
HOT BATT 2	Refer to emergency procedure.
HOT BATT 1, 2	Refer to emergency procedure.
IFF FAIL	Information/system status.
IFF MODE 4 FAIL	Information/system status.
INS FAIL	Information/system status.
INV FAIL	Information/system status.
IR JAMMER INOP	Information/system status.
LEFT MCPU FAIL	LAND AS SOON AS POSSIBLE.
LOW HYD PRESS	Refer to emergency procedure.
LOW OIL PRESS ENG	LAND AS SOON AS POSSIBLE.
LOW OIL PRESS XMSN	LAND AS SOON AS POSSIBLE.

TABLE 9-5. (CSD4) CAUTION MESSAGES AND ACTIONS REQUIRED (Cont)

CAUTION	ACTION
LOW OIL QUANTITY ENG	LAND AS SOON AS POSSIBLE.
*MAST TRQ TIME LIM [ ]	Adjust collective.
MISSILE UNLATCHED	Refer to emergency procedure.
OIL BYP ENG	LAND AS SOON AS POSSIBLE.
P/R DISENG	Refer to SCAS failure emergency procedure.
RECT FAIL	Information/system status.
RIGHT MCPU FAIL	Refer to emergency procedure.
SCAS DISENG	Refer to SCAS failure emergency procedure.
*TGT 30 MIN LIM [ ]	Adjust collective.
WEAPONS FAIL	Information/system status.
YAW DISENG	Refer to SCAS failure emergency procedure.

NOTE

*Brackets display accumulated time, in seconds, by which limit was exceeded.

TABLE 9-6. (CDS4) ADVISORY MESSAGES AND ACTIONS REQUIRED

ADVISORY	ACTION
AIR MSN REJECTED	Information/system status.
AIR MSN X UPDATE	Information/system status.
AIR RQST MSN	Information/system status.
ARTY MSN X UPDATE	Information/system status.
ALARM (alarm name)	Information/system status.
ASE FAIL	Information/system status.
BATT PREHEAT ON	Information/system status.
BSA UPDATE	Information/system status.
(EBF) BYPASS (segment light)	Information/system status.
C2 MSG RECVED	Information/system status.
CARGO HOOK ARMED	Information/system status.
CODE NOT ACCEPTED	Information/system status.
DATA LOADER FAIL	Information/system status.
DTS FAIL	Information/system status.
EGI BATT LOW	Refer to emergency procedure.
ENG ANTI-ICE ON	Information/system status.
EXT PWR	Information/system status.

TABLE 9-6. (CDS4) ADVISORY MESSAGES AND ACTIONS REQUIRED (Cont)

ADVISORY	ACTION
FADEC DEGRADE	Information/system status.
FADEC MAINT	FADEC requires maintenance action.
(EBF) FILTER (segment light)	Refer to emergency procedure.
FM 1 CUE	Information/system status.
FM 1 CT FAIL	Information/system status.
FM 1 FAIL	Information/system status.
FM 1 HUB LOW	Information/system status.
FM 1 PT FAIL	Information/system status.
FM 2 CUE	Information/system status.
FM 2 CT FAIL	Information/system status.
FM 2 FAIL	Information/system status.
FM 2 HUB LOW	Information/system status.
FM 2 PT FAIL	Information/system status.
GPS FAIL	Information/system status.
GPS DIVERGENT	Refer to emergency procedure.
HVR DEGRADED	Information/system status.
IFM FAIL	Information/system status.
IDM FAIL	Information/system status.
IDM NO STARTUP	Information/system status.
IDM SHUTDOWN CMPLT	Information/system status.
IMAGE RECEIVED	Information/system status.
INVALID COMMAND	Information/system status.
LASER CODE MISMATCH	Information/system status.
LAUNCHER SAFED	Information/system status.
LEFT COOLANT LOW	Information/system status.
LEFT LAUNCHER FAIL	Information/system status.
MISSILE ALERT	Information/system status.
MISSILE ALERT – AI	Information/system status.
MISSILE ALERT – SAM	Information/system status.
MMS FAIL	Information/system status.
MOIST VTR TAPE	Information/system status.
NAV INVALID	Information/system status.
NAV NOT ALIGNED	Information/system status.
NAV UPDT REQUIRED	Information/system status.
NET JOIN – FMx	Information/system status.
NO AUTO START	A detected failure may hinder auto start.
NO CODE	Information/system status.
NO VIXL NET	Information/system status.

TABLE 9-6. (CDS4) ADVISORY MESSAGES AND ACTIONS REQUIRED (Cont)

ADVISORY	ACTION
ONE YAW CHANNEL OFF	Information/system status.
P(Y) CODE INVALID	Information/system status.
PITOT HEAT ON	Information/system status.
RHE FAIL	Information/system status.
RIGHT COOLANT LOW	Information/system status.
RIGHT LAUNCHER FAIL	Information/system status.
RMS FAIL	Information/system status.
TACAN FAIL	Information/system status.
TACAN INVALID	Information/system status.
TACFIRE AUTH TABLE LOW	Information/system status.
TACFIRE MSG CHKALL	Information/system status.
TACFIRE MSG CHKFIRE	Information/system status.
TACFIRE MSG MAYDAY	Information/system status.
TACFIRE MSG NO	Information/system status.
TACFIRE QUEUE FULL	Information/system status.
TIMER (timer name)	Information/system status.
UHF FAIL	Information/system status.
VDU FAIL	Information/system status.
VHF FAIL	Information/system status.
VTR FAIL	Information/system status.
VTR TAPE FULL	Information/system status.
WEDGE CONSTANT ZERO	Information/system status.
WPN NOT ACTIONED	Information/system status.
WPN NOT ARMED	Information/system status.

e. The term FADEC MANUAL OPERATION is defined as manually controlling the RPM with the collective and throttle as necessary as follows:

1. Throttle - Reduce.
2. AUTO/MAN switch - MAN (when appropriate for the situation, if not already in MAN).
3. Collective - Adjust to maintain RPM within limits.
4. Throttle and collective - Adjust to maintain RPM within limits.
5. LAND AS SOON AS PRACTICABLE.

If engine RPM cannot be maintained within limits:

6. LAND AS SOON AS POSSIBLE.

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 shall be made in the Remarks section of DA Form 2408-13-1 and 2408-13-1 E describing the malfunction. Ground and flight operations shall be discontinued until corrective action has been taken.

9-5. EMERGENCY EQUIPMENT.

A fire extinguisher is mounted on left side of center post behind the CPG seat. A first aid kit is mounted on the right side of the center post behind the pilot seat (fig. 9-1).

9-6. EMERGENCY EXITS.

Emergency exits are shown in fig, 9-1. Emergency exit release handles are yellow. To exit the aircraft in the event of an emergency, first attempt to open doors, If doors will not open, use emergency jettison handles. If doors will not jettison, break Plexiglass to exit the aircraft.

9-7. ENGINE MALFUNCTION — PARTIAL OR COMPLETE POWER LOSS.

WARNING

Do not respond to the RPM audio and/or display on MFD and/or MPD without first confirming engine failure by observing one or more of the other indications. Normal indications signify that the engine is functioning properly and that there is a malfunction in the engine or rotor sensing system(s).

a. Indications. The indications of an engine malfunction, either a partial power loss or complete power loss, are a left yaw (caused by the reduction in torque applied to the main rotor), a drop in engine RPM (NG) and (NP), a drop in rotor RPM (NR), LOW RPM ROTOR warning message on MFD, low RPM audio, ENGINE OUT warning message on MFD, engine out audio alarm, and a change in engine noise.

b. Flight Characteristics. The characteristics and reactions in this helicopter without power are similar to those during a normal powered descent. Full control can be maintained with the helicopter in autorotational descent. Main rotor RPM decays rapidly unless collective is lowered immediately; deceleration attitude and altitude are critical.

c. Partial Power Condition. Under partial power conditions, the engine may operate smoothly at reduced power or it may operate erratically with intermittent surges of power. In instances where a power loss is experienced without accompanying power surging, the helicopter may be flown at reduced power to a favorable landing area. Under this condition, the pilot should always be prepared for a complete power loss. In the event a partial power condition is accompanied by erratic engine operation or power surging, and flight is to be continued, the throttle may be adjusted in an attempt to correct the surging condition. If flight is not possible, close the throttle completely and complete an autorotational landing.

d. Complete Power Loss. When the crew experiences an engine failure, immediate action is required to make a safe autorotative descent and landing. Flight conducted within the caution area of the height velocity diagram (fig. 9-2) exposes the helicopter to a high probability of damage despite the best effort of the pilot.

The altitude and airspeed at which the 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 and begin to descend. At gross weights above 5000 Ibs, serious consideration should be given to jettisoning the armament stores. During cruise at airspeeds to VNE, reduce collective immediately to regain NR and then adjust as necessary to maintain rotor RPM. The collective should be adjusted as necessary to maintain rotor RPM. The cyclic should be adjusted as necessary to attain and maintain airspeed in the optimum range (fig. 9-3). normally between 55 and 80 KIAS. Sixty-five knots provides an optimum balance between minimum rate of descent airspeed and that required for maximum glide.

A landing area must be selected immediately after an engine failure and control inputs made to fly to the intended site. Every effort must be made to land in an area that will afford a safe touchdown into the wind, as wind direction will have a pronounced effect on autorotational success.

Throughout the descent, adjust collective as necessary to maintain NR within normal range. At high gross weights, the rotor will rapidly overspeed and the collective must be used to maintain the desired rotor RPM (fig. 5-1). NR should be maintained at or slightly above 100% to allow ample rpm before touchdown, and desired trim maintained by pedals. Main rotor rpm will increase momentarily when the cyclic is moved aft with no change in collective pitch setting. An autorotative rpm of approximately 100% provides for a good rate of descent. NR significantly above or below 100% will result in a higher than desired rate of descent.

At approximately 100 feet AGL, use cyclic to decelerate. This reduces airspeed and rate of descent and causes an increase in NR. The degree of increase depends upon the amount and rate of deceleration. An increase in NR can be beneficial at this point. More inertial energy in the rotor system will be available to be used to cushion the landing.

Ground contact should be made with minimum forward speed. Some ground run is permissible when landing to a prepared surface (runway or hard-surfaced road), but if the only available landing area is a rough sod field, a more pronounced deceleration is necessary and touchdown speed should approach zero. In that case, it is necessary to decelerate at a higher altitude and assume a landing attitude from a vertical descent. Initial collective pitch-application may vary from 15-25 feet AGL, depending upon rate of descent and landing attitude. All available collective pitch should be used to effect the softest landing possible. A hard landing should be expected when operating at high gross weights or high density altitude.

e. Low Airspeed and Low Altitude. Under low airspeed and low altitude conditions, the deceleration capability is limited. Initial collective reduction may vary after an engine malfunction, dependent upon the altitude and airspeed at the time of occurrence. For example, collective pitch must not be decreased when an engine failure occurs at a hover in ground effect; whereas, during cruise flight conditions, altitude and airspeed are sufficient for a significant reduction in collective pitch, thereby allowing rotor rpm to be maintained in the safe operating range during autorotational descent.

Pilots should avoid using the collective pitch to extend glide distance because of the reduction in rpm available for the touchdown. In some instances at low altitude or low airspeed (and/or high gross weight), settling may be so rapid that little can be done to avoid a hard-impact landing. In that case, it is critical to maintain aircraft control and assume a safe landing attitude prior to touchdown. Cushion the landing with all remaining collective as the helicopter settles to the ground.

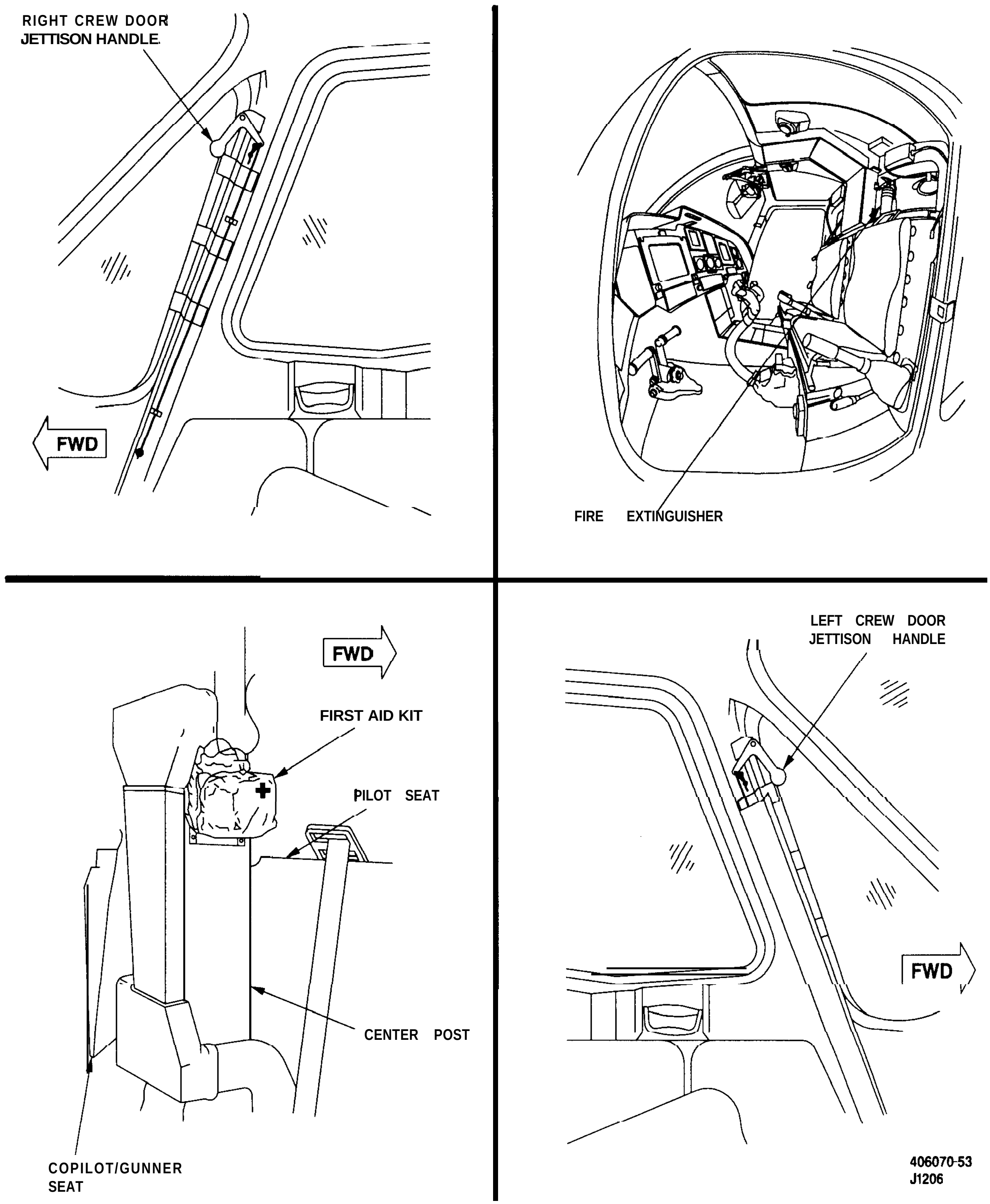


Figure 9-1. Emergency Exits and Equipment

HEIGHT VELOCITY DIAGRAM

100% RPM

HEIGHT VELOCITY DIAGRAM

EXAMPLE

WANTED

INDICATED AIRSPEED

KNOWN

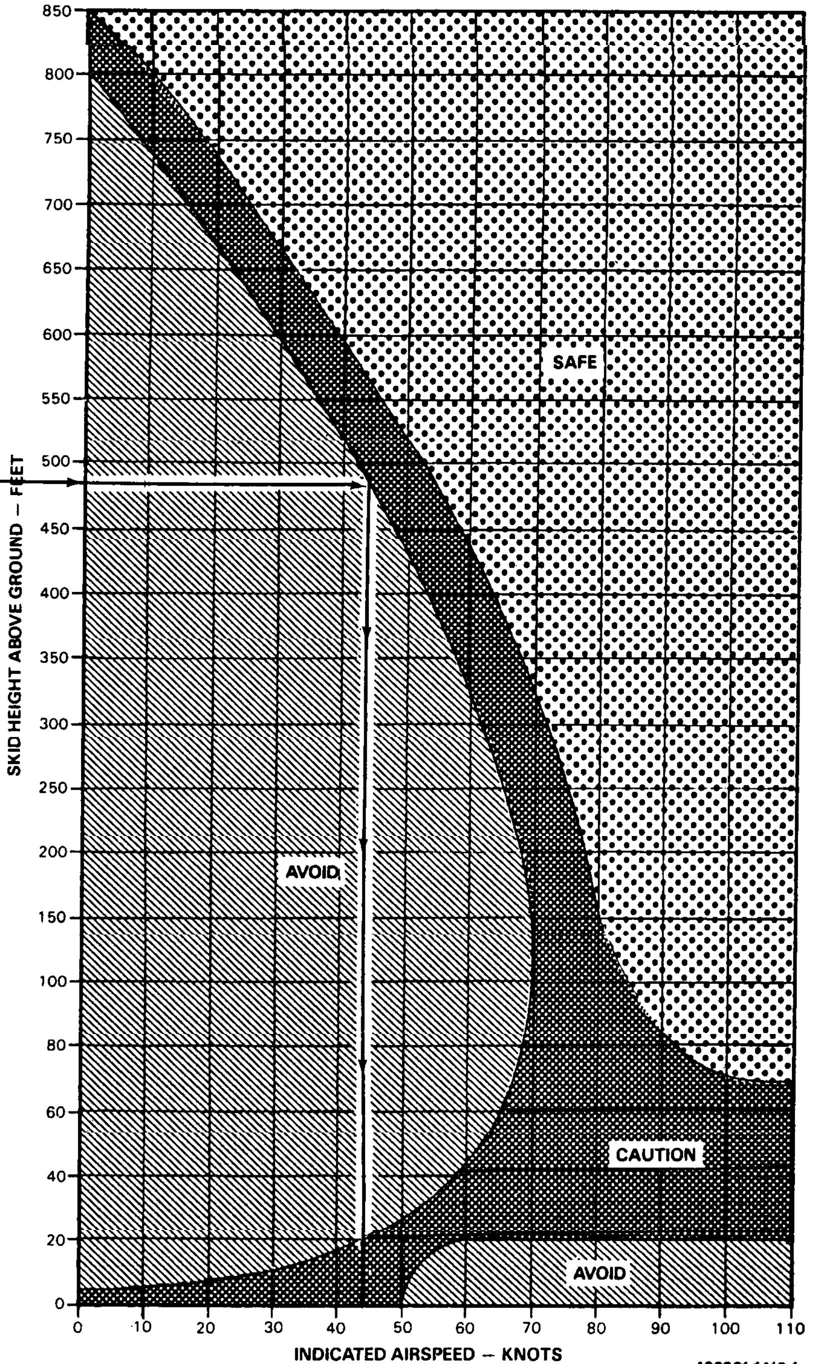
SKID HEIGHT ABOVE GROUND = 485 FEET

METHOD

ENTER SKID HEIGHT HERE
MOVE RIGHT TO MINIMUM INDICATED AIRSPEED TO AVOID HEIGHT VELOCITY RESTRICTIONS
MOVE DOWN, READ 44.0 KNOTS INDICATED AIRSPEED

WARNING

COLLECTIVE DELAYS USED TO ESTABLISH THIS CHART VARIED FROM NO DELAY TO A MAXIMUM OF 1.0 SECONDS, WHICH ARE SIGNIFICANTLY LESS THAN THE TWO SECOND DELAYS NORMALLY USED TO ESTABLISH HEIGHT VELOCITY DIAGRAMS



DATA BASIS: DERIVED FROM CONTRACTOR FLIGHT TEST, DECEMBER 1984

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J2862

Figure 9-2. Height Velocity Diagram (Sheet 1 of 3)

HEIGHT VELOCITY DIAGRAM

100% RPM

HEIGHT
VELOCITY DIAGRAM

EXAMPLE

WANTED

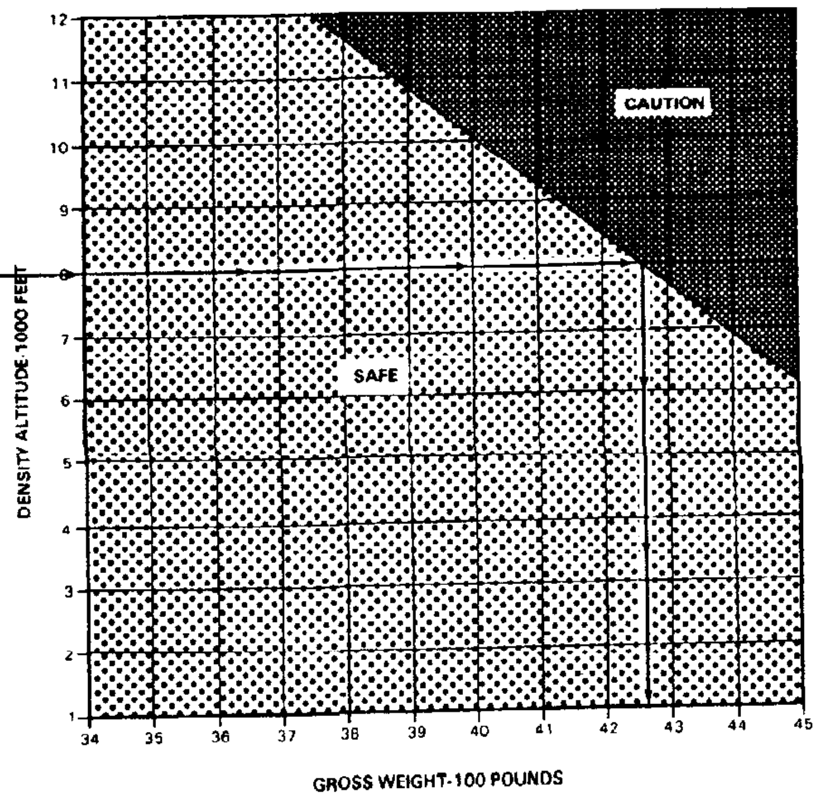
GROSS WEIGHT LIMIT FOR SAFE HEIGHT VELOCITY OPERATION

KNOWN

DENSITY ALTITUDE = 8000 FEET

METHOD

ENTER DENSITY ALTITUDE HERE
MOVE RIGHT TO MAXIMUM SAFE HEIGHT VELOCITY LINE
DROP DOWN, READ GROSS WEIGHT = 4260 POUNDS



DATA BASIS: DERIVED FROM CONTRACTOR FLIGHT TEST, DECEMBER 1984

406961-1416-2
J2862

Figure 9-2. Height Velocity Diagram (Sheet 2 of 3)

HEIGHT VELOCITY DIAGRAM

100% RPM

HEIGHT
VELOCITY DIAGRAM

EXAMPLE

WANTED

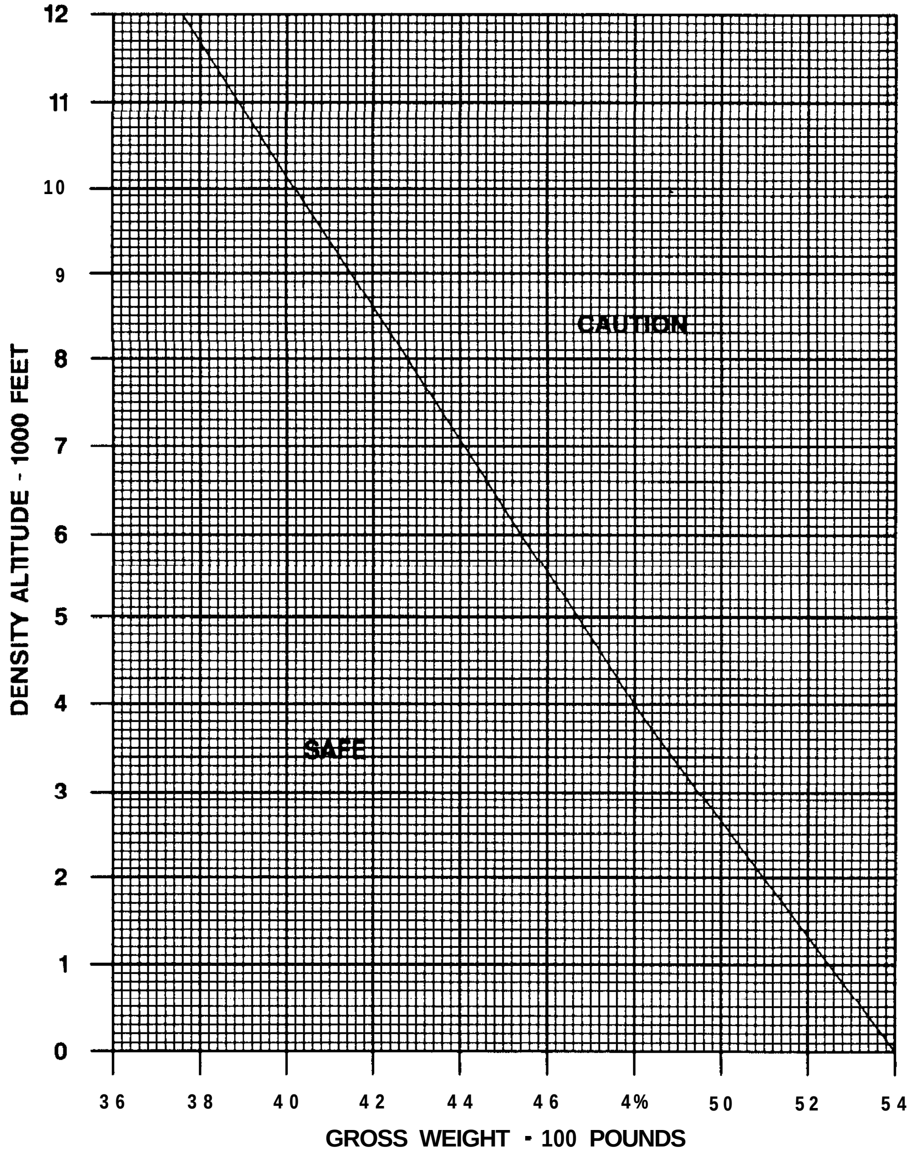
GROSS WEIGHT LIMIT FOR
SAFE HEIGHT VELOCITY
OPERATION

KNOWN

DENSITY ALTITUDE = 8000 FT

METHOD

ENTER DENSITY ALTITUDE
MOVE RIGHT TO MAXIMUM
SAFE HEIGHT VELOCITY
LINE
DROP DOWN, READ
GROSS WEIGHT = 4260 LB



DATA BASIS: PRELIMINARY FLIGHT TEST, APRIL 1991

406961-1416-121
J2862

Figure 9-2. Height Velocity Diagram (Sheet 3 of 3)

9-8. MINIMUM RATE OF DESCENT - POWER OFF.

The Power-off minimum rate of descent is attained at an indicated airspeed of **55 knots and 100% NR** (standard day/sea level). See figure 9-3 for maximum glide distance.

9-9. MAXIMUM GLIDE DISTANCE - POWER OFF.

The maximum glide distance is attained at an indicated airspeed of **80 knots** and **100% NR** (standard day/sea level). See figure 9-3 for maximum glide distance.

9-10. ENGINE FAILURE - HOVER.

AUTOROTATE.

9-11. ENGINE FAILURE - LOW ALTITUDE/ LOW AIRSPEED DURING TAKEOFF OR CRUISE.

1. AUTOROTATE.
2. EMER SHUTDOWN.- Accomplish during descent if time permits.

9-12. ENGINE RESTART - DURING FLIGHT.

After an engine flameout, in flight, an engine restart may be attempted within ten seconds without closing the throttle. The throttle can be left in the open position because NG speed should still be above minimum starting speed and fuel flow will be on the normal acceleration schedule. Because the exact cause of engine flameout cannot be determined, the decision to attempt the start will depend upon the altitude and lime available, rate of descent, potential landing area, and crew assistance available.

WARNING

Under ideal conditions, approximately one minute is required to regain powered flight from the time the attempted start is begun.

If the decision is made to attempt an in-flight start:

1. Attempt start.
2. LAND AS SOON AS POSSIBLE. After the engine is started and powered flight is re-established, perform a power-on approach and landing without delay.

9-13. R ENGINE RESTART - DURING FLIGHT (FADEC AUTOMATIC MODE).

After an engine flameout in flight the FADEC system in the AUTO mode (only) will Initiate a restart sequence without pilot action.

1. Establish autorotational descent.
2. LAND AS SOON AS POSSIBLE - After the engine is started and powered flight is reestablished, perform a power-on approach and landing without delay.

9-14. ENGINE COMPRESSOR STALL.

Engine compressor stall is characterized by a sharp rumble or a series of loud sharp reports, severe engine vibration, and a rapid rise in TGT, depending on the severity of the surge. After engine compressor stall, maneuvers requiring rapid or maximum power application should be avoided. Should engine compressor stall occur:

CAUTION

(OH-58D) To prevent engine damage caused by compressor stalls or engine surges, do not rapidly increase collective or throttle when in analog mode.

1. Collective - Reduce.
2. ENG ANTI ICE and HTR switches - ON.
3. LAND AS SOON AS POSSIBLE.

R The FADEC automatic mode will, without pilot action, alleviate the stall condition. The FADEC will adjust the fuel schedule to avoid further stall occurrence. Occurrence of a compressor stall will increment the ENG SURGE entry on the FADEC monitor page.

9-15. (OH-58D) ENGINE OVERSPEED.

Engine overspeed will be indicated by a right yaw, rapid increase in rotor (NR), gas producer (NG), and engine rpm (NP), and an increase in engine and rotor noise. If an engine overspeed is experienced:

1. Collective - Increase to load the rotor and sustain engine/rotor rpm below the maximum operating limit.
2. Throttle - Adjust until normal operating rpm is attained.

3. LAND AS SOON AS POSSIBLE - Perform a power-on approach and landing by controlling the rpm manually with the throttle.

If rpm cannot be controlled manually:

4. AUTOROTATE when over safe landing area.

5. EMER SHUTDOWN - Accomplish during descent if time permits.

9-16. R ENGINE OVERSPEED.

Engine overspeed will be indicated by a right yaw, rapid increase in rotor (NR), gas producer (NG), and engine RPM (NP), and an increase in engine and rotor noise. Additionally if the overspeed reaches the trip point of 124% NP the overspeed solenoid in the HMU will reduce the fuel flow to minimum flow until NP is reduced to the lower threshold of 118% NP. Engine speed (NP) will then oscillate between the lower threshold and the overspeed trip point until pilot action is taken to correct the cause of the overspeed. If an engine overspeed is experienced:

1. Collective - Increase to load the rotor and sustain engine/rotor RPM below the maximum operating limit.

2. FADEC MANUAL operation - Perform.

If RPM can not be controlled manually:

3. AUTOROTATE when over a safe landing area.

4. EMER SHUTDOWN - Accomplish during descent if time permits.

9-17. ENGINE UNDERSPEED.

1. Collective - Adjust to establish rotor rpm within limits.

2. Throttle - Check open.

3. RPM ± trim switch - Increase (+).

If underspeed condition still exists:

CAUTION

Operation in the analog mode will not be considered as normal operations. Flight with a high gross weight/density altitude can cause transients to the extent that the LOW RPM ROTOR/HIGH RPM warning messages may be activated; therefore, maneuvers that require NOE flight and OGE hover capability should not be performed. Crews must monitor NR/NP/NG to ensure that they remain within normal operation limits.

4. NORM-ANLG BACKUP switch ANLG BACKUP position.

5. Throttle and collective - Adjust to maintain rotor rpm within limits.

6. LAND AS SOON AS PRACTICABLE.

If engine rpm cannot be maintained within limits.

7. LAND AS SOON AS POSSIBLE.

9-18. R ENGINE UNDERSPEED.

1. Collective -- Adjust to establish rotor RPM within limits.

2. Throttle - Check open.

3. RPM ± trim switch - Increase (+).

If underspeed condition still exists:

4. FADEC MANUAL OPERATION -- Perform.

9-19. ENGINE SURGES/FUEL CONT CAUTION MESSAGE/UNEXPLAINED ENGINE FLUCTUATIONS.

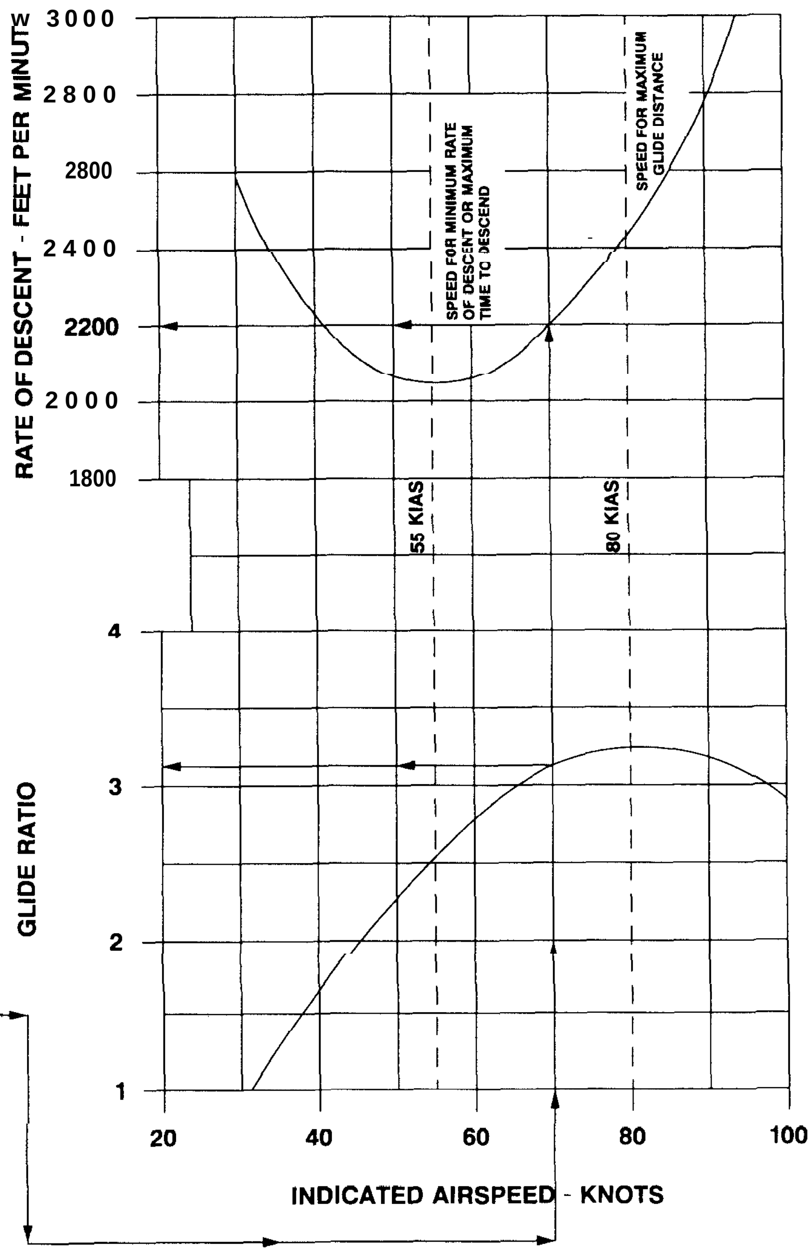
Fluctuations of NR, NP, and NG can occur due to a complete or partial failure of the digital mode of the Electronic Supervisory Control (ESC). Fluctuations may present themselves as small variations in engine and rotor indications while surges may be rapid increases/ decreases that result in large variations with noticeable changes in engine noise and aircraft reactions. These

AUTOROTATIONAL GLIDE CHARACTERISTICS

POWER OFF
100% RPM

AUTOROTATIONAL GLIDE OH-58D

NOTE: AUTOROTATIONAL DESCENT PERFORMANCE IS A FUNCTION OF AIRSPEED AND IS ESSENTIALLY UNAFFECTED BY DENSITY ALTITUDE AND GROSS WEIGHT.



EXAMPLE

WANTED

GLIDE RATIO AND RATE OF DESCENT

KNOWN

AIRSPEED = 70 KIAS
ROTOR RPM = 395

METHOD

ENTER INDICATED AIRSPEED HERE
MOVE UP TO GLIDE RATIO LINE
MOVE LEFT. READ GLIDE RATIO = 3.12
CONTINUE UP 70 KIAS TO RATE OF DESCENT LINE ON UPPER GRAPH.
MOVE LEFT. READ RATE OF DESCENT = 2200 RPM.

DATA BASIS: ESTIMATED DATA AND CALCULATED DATA, OCTOBER 1984

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J1756

Figure 9-3. Autorotational Glide Characteristics Chart

failures may or may not be accompanied by a FUEL CONTROL advisory/FULE CONT caution message.

CAUTION

- **Maneuvers requiring OGE Hover Power should not be performed in the analog mode due to slower engine response and recovery times.**

- **Operation in the analog mode will not be considered as normal operations. Flight with a high gross weight/density altitude will cause transients to the extent that the low rotor/high rotor warning messages may be activated. Rapid transient maneuveres, rearward flight, and rocket firing should be avoided.**

NOTE

In event of a FUEL CONT message, the ESC should automatically switch to the analog backup mode.

In event of a FUEL CONT caution message or engine fluctuations/surging, proceed as follows:

1. NORM-ANLG BACKUP switch -- ANLG BACKUP position.
2. LAND AS SOON AS PRACTICABLE

If engine surges continue, proceed as follows:

3. NORM-ANLG BACKUP switch - NORM position.
4. RPM ± trim switch - Increase (+) to obtain maximum rpm.
5. Throttle - Reduce to **98% NP.**
6. LAND AS SOON AS POSSIBLE.

If fluctuations/surges are not controlled:

7. AUTOROTATE.
8. EMER SHUTDOWN. Accomplish during descent if time permits.

9-20. R FADEC FAILURE.

FADEC failures will be indicated to the pilot via the FADEC FAIL audio tone and the FADEC FAIL and/or FADEC MANUAL messages on the MFD. The FADEC may fail to fixed fuel flow condition or under certain remote instances, the FADEC automatically fails to MANUAL. In this case the FADEC FAIL message will be accompanied by a FADEC MANUAL message and the AUTO/MAN switch may illuminate MAN.

a. Fixed Fuel Flow. In the event of an ECU failure, the FADEC will fail at a fixed fuel flow rate that is the same as the fuel flow rate required by the engine at the time of failure. A FADEC failure that results in a fixed fuel flow will be indicated by the FADEC FAIL audio tone, a FADEC FAIL message and the AUTO/MAN switch remaining in the AUTO mode. Depending on altitude, airspeed and the amount of power applied at the time of failure, the aircraft may be operated in the fixed fuel flow condition until the pilot is prepared to make the switch to manual mode.

WARNING

Failure to switch to manual mode will cause main rotor RPM to droop/ overspeed as collective Is increased/ decreased.

b. Fail to Manual Mode. In the event that the FADEC automatically fails to the manual mode, the HMU will default to the maximum fuel flow attainable after the HMU pistons engage. This is because the throttle is in the full open position when The FADEC automatically switches to the manual mode. System failures that will drive the FADEC to automatically switch to the manual mode are:

(1) Total and complete loss of all electrical power (simultaneous failure of AC generator, DC generator, battery, and PMA, or a specific ECU internal connection failure).

(2) Open or short failure of the FADEC AUTO/ MAN switch.

(3) Failure of the AUTOMATIC/MANUAL solenoid valve, in the HMU.

CAUTION

The FADEC MANUAL mode is designed for power modulation upon selection/ECU failure. When performing FADEC MANUAL operations, the pilot must coordinate throttle and collective inputs. Failure to do so may result in engine overspeed, overtemp, overtorque, or inadvertent activation of the NP overspeed protection system. The pilot must also rate limit throttle movement to prevent engine surges as the engine is not self-recoverable from stall in the FADEC MANUAL mode.

Pilot procedures for both failure, fixed fuel flow and fail to manual mode are the same.

FADEC MANUAL OPERATION – Perform.

9-21. R FADEC DEGRADE.

In the event of a FADEC DEGRADE advisory message, the mode and extent of degradation (Table 9-7) may be determined in flight by accessing the FADEC MONITOR page.

TABLE 9-7 R FADEC DEGRADE MESSAGES

MESSAGE	DEFINITION
FADEC DEGRADE OS	FADEC system has detected a fault that results in a loss of the FADEC OVERSPEED limited system.
FADEC DEGRADE DROOP	FADEC system has detected a fault that will result in possible rotor droop.
FADEC TRQ LIM LOSS	FADEC system has detected a fault that results in a loss of the FADEC engine torque limiting system
FADEC TGT LIM LOSS	FADEC system has detected a fault that results in a loss of the FADEC TGT limiting feature.
FADEC DEGRADE ARINC	CDS determines that ARINC bus interface is degraded.

NOTE

In the event of FADEC DEGRADE message, determine impact on the aircraft/crew mission effectiveness and decide to continue or abort the mission.

9-22. R FADEC MANUAL START.

FADEC manual start is available in the event emergency evacuation of helicopter is necessary and FADEC automatic start is not working.

1. FADEC AUTO/MAN switch – MAN.
2. Throttle – Check closed.
3. Collective – Full down.
4. BATTERY – ON.
5. FUEL BOOST switch – FUEL BOOST.
6. START switch – Press and hold for 10 seconds to engage the manual mode pistons.
7. TGT – 150 degrees C or less.

CAUTION

During a manual start, the starter switch must be pressed until NG reaches 50%. Releasing the switch at any time will disengage the starter.

8. START switch – Press and hold.
9. BATT V START V – Check.
10. Throttle – Advance slowly at 10 to 12% NG and modulate throttle to maintain TGT within limits.
11. ENG oil pressure – Check.
12. Rotor blades – Turning by 25% NG.
13. START switch – Release at 50% NG.
14. XMSN OIL pressure and ENG OIL pressure - Within limits.

9-23. HIGH OIL TEMP ENG CAUTION MESSAGE.

LAND AS SOON AS POSSIBLE.

9-23.1 (EBF EQUIPPED) FILTER SEGMENT LIGHT ILLUMINATION (INTERMITTENT OR STEADY).

CAUTION

Operating aircraft with the filter bypass door open channels unfiltered air directly into the engine intake. Engine damage and power loss will result if solid airborne particles are present. Longer operation and/or heavier airborne particulate will result in increased engine damage and increased power loss.

1. Filter bypass door – Open, if desired.
2. LAND AS SOON AS PRACTICABLE.

If a high TGT or other abnormal engine parameter is associated with the FILTER segment light illumination:

3. Filter bypass door – Open.
4. LAND AS SOON AS POSSIBLE.

9-24. ROTORS, TRANSMISSION, AND DRIVE SYSTEM MALFUNCTIONS.

9-25. TAIL ROTOR FAILURE AND DIRECTIONAL CONTROL MALFUNCTIONS.

Because of the many malfunctions that can occur, it is not possible to provide a solution for every emergency. The success in coping with a given malfunction depends upon quick analysis and the selection of the proper emergency procedure. The following discussion of malfunctions includes probable effects and corrective actions to be taken.

9-26. COMPLETE LOSS OF TAIL ROTOR THRUST.

This situation involves a break in the drive system, such as a severed driveshaft, causing the tail rotor to lose power.

a. Powered flight.

(1) Indications:

(a) Abnormal vibrations.

(b) Pedal input has no effect on helicopter trim.

(c) Nose of the helicopter turns to the right (left sideslip).

(d) Left roll of fuselage along the longitudinal axis.

WARNING

Helicopter sideslip may become uncontrollable and will begin to spin on its vertical axis at airspeeds below 40 knots. Degree of roll and sideslip may be varied by varying throttle and/or collective. Autorotation may be the only option.

(2) Procedures:

(a) If a safe landing area is not immediately available, continue powered flight to suitable landing area at or above minimum rate of descent autorotational airspeed.

(b) When landing area is reached, make a power on run-on landing.

(c) Use airspeed above minimum rate of descent airspeed.

(d) If landing area is suitable for run-on landing, accomplish touchdown with airspeed as required for directional control.

b. Power off (Autorotation).

(1) Indication: Pedal input has no effect on trim.

(2) Procedures:

(a) Maintain airspeed above minimum rate of descent alrspeed.

(b) If run-on landing is possible, complete autorotation with a touchdown airspeed as required for directional control.

(c) If run-on landing is not possible, start to decelerate from 100 feet altitude so that forward groundspeed is at a minimum when the helicopter reaches 10 to 20 feet; execute the termination with a rapid collective pull just prior to touchdown in a level attitude with minimum groundspeed.

9-27. FIXED TAIL ROTOR PITCH SETTINGS.

This is a malfunction involving a loss of control resulting in a fixed tail rotor pitch setting. Whether the nose of the helicopter yaws left or right is dependent upon the amount of pedal applied at the time of the malfunction. Regardless of pedal input applied by the pilot, a constant amount of tail rotor thrust will be delivered at all times during flight.

a. Reduced power (low torque).

(1) Indication: The nose of the helicopter will turn right when power is applied.

(2) Procedure: If helicopter control can be maintained in powered flight, the best solution is to maintain control with power and accomplish a run-on landing as soon as practicable.

b. Increased power (high torque).

(1) indication: The nose ot the helicopter will turn left when power is reduced.

(2) Procedures: .

(a) Maintain control with power and airspeed between 40 and 70 knots.

(b) If needed, reduce engine rpm manually to 98% NP.

(c) Continue powered flight to a suitable landing area where a run-on landing can be accomplished.

c. Hover.

(1) Indication: Helicopter heading cannot he controlled with pedals.

(2) Procedures:

(a) If the tail rotor pitch is fixed in a left pedal applied position, gradually decrease collective pitch and land helicopter.

(b) If total loss of tail thrust or fixed right pedal applied is experienced, close the throttle immediately and accomplished an autorotational landing.

9-28. LOSS OF TAIL ROTOR COMPONENTS.

The severity of this situation is dependent upon the amount of weight lost. Any loss of this nature will result in a forward center of gravity shift, requiring aft cyclic.

a. Indications:.

(1) Varying degrees of right yaw depending on power applied and airspeed at time of failure,

(2) Forward CG shift.

(3) Abnormal vibrations.

b. Procedures:.

(1) Enter autorotative descent (power off).

(2) Maintain airspeed above minimum rate of descent airspeed.

(3) If run-on landing is possible complete autorotation with a touchdown airspeed as required for directional control.

(4) If run-on landing is not possible, start to decelerate from about 100 feet altitude so that forward groundspeed is at a minimum when the helicopter reaches 10 to 20 feet: execute the termination with a rapid collective pull just prior to touchdown in a level attitude with minimum ground speed.

9-29. MAIN DRIVESHAFT FAILURE.

Failure of the main driveshaft will be evidenced by a Sudden increase in engine rpm (NP), decrease in rotor Rpm (NR), and left yaw. In addition, the LOW RPM ROTOR warning message will be displayed and Accompanying audio warning will sound. In the event of Main driveshaft failure:

NOTE

The engine must continue to operate in order to provide tail rotor control.

1. AUTOROTATE – Throttle full open.
2. EMER SHUTDOWN after landing.

9-30. CLUTCH FAILS TO DISENGAGE.

A clutch failing to disengage in flight will be indicated by rotor rpm decaying with engine rpm as the throttle is reduced when entering autorotation. This condition results in total loss of autorotational capability. If a failure occurs:

1. Throttle – Open.
2. LAND AS SOON AS POSSIBLE.

9-31. CLUTCH FAILS TO RE-ENGAGE.

During recovery from autorotation descent, clutch malfunction may occur and will be indicated by a decrease in NR with NP remaining constant. If failure occurs:

1. AUTOROTATE.
2. EMER SHUTDOWN.

9-23. FIRE.

WARNING

Toxic fumes of the extinguishing agent may cause injury. Liquid agent may cause frostbite or low-temperature burns.

The safety of helicopter occupants is the primary consideration in the event a fire occurs; therefore, it is imperative that every effort be made by the flight crew to extinguish the fire. On the ground, it is essential that the engine be shut down, crew evacuated, and fire fighting begun immediately. Time permitting, a MAYDAY call should be transmitted before electrical power is turned off to expedite assistance from airfield fire fighting equipment and personnel. If the helicopter is in flight when the fire occurs, the most important action is to land the helicopter.

9-33. ABORT START/HOT START/RESIDUAL FIRE.

During engine starting or shutdown if any limits are exceeded or if it becomes apparent that limits may be exceeded, proceed as follows:

CAUTION

R To prevent engine damage, do not depend on the FADEC system to monitor the starter automatically during an aborted start. In a low battery voltage condition, the ECU may not operate properly.

NOTE

R During engine starting the FADEC system monitors engine parameters and will automatically abort the start if it becomes apparent that TGT limits may be exceeded. It will continue to motor the starter for 60 seconds or until TGT is below 149 °C.

Abort sequence begins at 843 °C for most operations. However, it will begin at 913 °C if pressure attitude is greater than 10000 feet or if residual TGT is greater than 82.2 °C at initiation of engine start.

1. Throttle – Close.
2. START switch – ON and hold until TGT is less than 200 °C.

9-34. ENGINE/FUSELAGE/ELECTRICAL FIRE - GROUND.

EMER SHUTDOWN.

9-35. ENGINE/FUSELAGE/FIRE – LOW/ CRUISE ALTITUDE.

If a fire is observed during flight, prevailing circumstances such as: VMC, IMC, night, altitude, and landing areas available must be considered in order to determine whether to execute a power-on or power-off landing.

a. If power-on landing:

1. LAND AS SOON AS POSSIBLE.

2. EMER SHUTDOWN after landing.

b. If power-off landing:

1. AUTOROTATE.

2. EMER SHUTDOWN. Accomplish during descent if time permits.

9-36. ELECTRICAL FIRE FLIGHT.

Prior to shutting off all electrical power, the pilot must consider the equipment that is essential to a particular flight environment that will be encountered, e.g., flight instruments, fuel boost pump, and automatic fuel control systems.

In the event of electrical fire or suspected electrical fire In flight:

1. AC and DC GEN switches – OFF.

2. LAND AS SOON AS POSSIBLE.

3. EMER SHUTDOWN after landing.

9-37. SMOKE AND FUME ELIMINATION.

Smoke and/or toxic fumes within the cockpit/cabin area May be exhausted as follows:

CAUTION

To prevent damage to helicopter, do not jettison doors in flight above effective translational lift.

1. VENT PULL knobs – PULL.

2. R and L DEFOG BLWR switches – ON.

3. COMPT BLWR switch – ON.

9-38. FUEL BOOST PUMP FAILURE.

In the event of fuel boost pump failure, FUEL BOOST FAIL caution message will display. Proceed as follows:

1. FUEL BOOST switch – OFF.

2. Descend below 8,000 feet PA.

3. LAND AS SOON AS PRACTICABLE.

9-39. ELECTRICAL SYSTEM MALFUNCTIONS.

WARNING

(CDS2) Complete loss of DC power will result in loss of rotor rpm I ndications and the loss of ESC fuel control system. Therefore, engine rpm will rapidly increase and, if not controlled, exceed operating limits.

9-40. (OH-58D) COMPLETE LOSS OF ELECTRICAL POWER.

In the event all electrical power is lost (loss of battery, AC generator, or TRU, and DC generator output), Powered flight is possible. However, NP will increase Rapidly due to loss of both digital and analog fuel Controls. NP cannot be monitored with manual control Of the throttle due to the loss of systems instruments.

NOTE

R During a complete electrical failure the FADEC system will continue to operate and control engine RPM if the PMA is functioning properly.

LAND AS SOON AS POSSIBLE.

9-41. DC GENERATOR FAILURE – NO OUTPUT.

A DC generator failure will be evidenced by the MFD Displaying the caution message DC GEN FAIL. In the Event of a DC generator failure, proceed as follows:

1. DC GEN FIELD and DC GEN RESET circuit breakers – Check in.

2. DC GEN switch – RESET then DC GEN. Do not hold the switch in the RESET position.

If generator output is not restored, or if generator goes Off the line again:

3. DC GEN switch — OFF.

4. LAND AS SOON AS PRACTICABLE.

NOTE

Following loss of the DC generator, battery charging does not occur. Whenever the throttle is reduced below 91% NP the TRU is off line and all DC systems are powered by the battery. Low battery power may result in loss of all CDS indications, loss of (CDS2) ESC fuel control system and inability to motor the starter in the event of a residual fire on shutdown.

9-42. HOT BATT 1, HOT BATT 2, OR HOT BATT 1 & 2 CAUTION MESSAGE(S).

WARNING

If battery(ies) overheat(s) or emit(s) noxious fumes, do not open battery compartment door(s) until cooldown has occurred. Battery fluid will cause chemical burns, and an overheated battery can cause thermal burns and may explode.

In the event of battery overheat:

1. Affected BATT switch — OFF. If condition is corrected, flight may be continued with the affected battery switch off.

If condition is not corrected, proceed as follows:

2. LAND AS SOON AS POSSIBLE.

3. EMER SHUTDOWN after landing.

9-43. AC GEN FAIL CAUTION MESSAGE.

In the event of AC generator failure:

1. AC GEN switch — OFF, then AC GEN.

If generator output is not restored or generator fails again:

2. AC GEN switch — OFF.

3. LAND AS SOON AS PRACTICABLE.

9-44. INV FAIL CAUTION MESSAGE.

NOTE

With inverter power off, all AC powered equipment to include instrument lighting, and SCAS will be lost at NP speeds below 91%.

9-45. AUDIO DISTRIBUTION UNIT (ADU) FAILURE.

A failure of the ADU will be evidenced by a failure of all communication radios except FM-1, including **(CDS2)** ATHS, COMSEC, and retransmission. Caution/warning advisory tones and pilot remote function will also fail.

In the event of ADU failure:

1. Transmit and receive on plain FM-1.

2. LAND AS SOON AS PRACTICABLE.

9-46. EGI FAILURE.

A failure of EGI is indicated when EGI FAIL displays on the MFD, the VSD pitch, roll and heading data displays go blank, and SCAS disengages. If a failure of EGI is indicated, perform the following:

1. EGI DC circuit breaker — Out.

2. EGI DC circuit breaker — In.

3. Last known present position — Enter.

4. Execute a MANUAL EGI alignment.

If EGI functionality is not restored or fails again:

5. EGI DC circuit breaker — Out.

Flight may be continued utilizing standby instruments for aircraft attitude and heading information.

9-47. EGI BATT LOW.

A low EGI battery voltage condition is indicated when EGI BATT LOW displays on the MFD. If a low EGI battery voltage condition is indicated, It will be necessary to replace at least one EGI battery prior to removal of DC power from the system or the EGI almanac data will be lost.

9-48. GPS DIVERGENT.

Appearance of the GPS DIVERGENT message indicates there exists a significant difference between the combined INS/GPS navigation solution position and the stand alone GPS position data.

If abnormal system operation continues:

1. INS mode of navigation Select. Compare reported position to that of a known waypoint as soon as possible.

If position error is evident:

2. Manual update — Perform to correct the INS drift.

If position is not observed:

3. GPS mode of navigation -- Select.

If position error is observed:

4. INS mode of navigation — Reselect and continue flight operations.

9-49. (CDS2/CDS3) LEFT MCPU/RIGHT MCPU FAILURE.

An MCPU failure will be evidenced when LEFT MCPU FAIL or RIGHT MCPU FAIL displays on the unaffected MFD. An automatic reset function provides a built-in reset in the event of an MCPU failure. If an MCPU failure occurs without an automatic reset, perform the following:

1. MCPU L/R circuit breaker -- Out.
2. MCPU L/R circuit breaker — In. Check MFD for MCPU caution message.

If MCPU is not recovered:

3. LAND AS SOON AS POSSIBLE.

9-50. (CDS4) LEFT MCPU/RIGHT MCPU FAILURE.

GROUND

An MCPU failure will be evidenced when LEFT MCPU FAIL or RIGHT MCPU FAIL displays on the unaffected MFD. An automatic reset function provides a built-in reset in the event of an MCPU failure. If an MCPU failure occurs without an automatic reset, perform the following:

1. MCPU L/R circuit breaker — Out.
2. MCPU L/R circuit breaker — In. Check MFD for MCPU caution message.

If MCPU is not recovered:

3. Maintenance action is required to recover failed MCPU prior to flight.

IN-FLIGHT

An MCPU failure will be evidenced when LEFT MCPU FAIL or RIGHT MCPU FAIL displays on the unaffected MFD. An automatic reset function provides a built-in reset in the event of a right MCPU failure. The left MCPU does not have an automatic in-flight reset function. If the left MCPU fails in flight, perform the following:

1. LAND AS SOON AS POSSIBLE.

NOTE

In the event of an MCPU failure, the EGI may reset. After MCPU function is restored, the EGI will perform an in-flight alignment unless the aircraft is landed and a manual alignment is performed.

9-51. MPD WARNING LIGHT ILLUMINATION IN FLIGHT.

1. BIT RST switch — RST.

If WRN illuminates again:

2. BIT check — Accomplish.

If an error code displays:

3. LAND AS SOON AS PRACTICABLE.

9-52. AIR DATA SYSTEM FAILURE.

A failure of the air data system will be evidenced by failure of airspeed and barometric altitude indications on the MFDs. As a result, navigation system will be unreliable. Standby instruments (airspeed and altimeter) will be unaffected. Therefore:

LAND AS SOON AS PRACTICABLE.

9-53. HYDRAULIC SYSTEM MALFUNCTION.

9-54. LOW HYD PRESS CAUTION MESSAGE.

It is possible that the LOW HYD PRESS caution message could be displayed without the presence of control feedback. In the event this condition occurs, select an area which will permit a run-on landing with power and:

LAND AS SOON AS PRACTICABLE.

9-55. HYDRAULIC POWER FAILURE.

1. Airspeed — Adjust as necessary to attain the most comfortable level of control movements.

NOTE

Abrupt collective changes, up or down, will cause increased pilot workload, especially with roll attitude. Loss of hydraulic power will result in loss of SCAS, thereby resulting in a deterioration in flying qualities.

2. HYD SYS circuit breaker — Out; check for restoration of hydraulic power.

If hydraulic power is not restored:

3. HYD SYS circuit breaker — In.
4. HYD SYS switch — OFF.

WARNING

Do not return the HYD SYS switch to the HYD SYS position for the remainder of the flight. This prevents any possibility of a surge in the hydraulic system creating sudden, unexpected control movements.

5. Land as soon as practicable at an area which will permit a run-on landing at an airspeed slightly above effective translational lift.

9-56. LANDING AND DITCHING.

9-57. LANDING IN TREES.

A landing in trees should be made when no other landing area is available. In addition to accomplishing engine failure emergency procedures, select a landing area containing the least number of trees of minimum height. Decelerate to minimum forward speed at treetop level and descend into the trees vertically. Apply all remaining collective prior to the main rotor contacting the trees.

9-58. DITCHING — POWER ON.

If ditching becomes necessary with power available, accomplish an approach to a hover above the water and:

1. Doors — Jettison at a hover.
2. CPG or passenger — Exit.
3. Hover a safe distance away from personnel.
4. AUTOROTATE. Apply all remaining collective as the helicopter enters the water. Maintain a level attitude as the helicopter sinks and until it begins to roll. Apply cyclic in the direction of the roll.
5. Pilot — Exit when the main rotor stops.

9-59. DITCHING — POWER OFF.

In the event power is lost and ditching becomes imminent, accomplish engine failure emergency procedures and proceed as follows:

1. <u>AUTOROTATE — Decelerate to minimum forward speed</u> as helicopter nears the water. Apply all remaining collective as the helicopter enters the water. Maintain a level attitude as the helicopter sinks and until it begins to roll. Apply cyclic in the direction of roll.
2. <u>Doors — Jettison</u> as the helicopter enters the water.
3. <u>CPG or passenger and pilot — Exit</u> when main rotor stops.

9-60. FLIGHT CONTROL.

9-61. FLIGHT CONTROL MALFUNCTIONS.

Failure of flight control components may be indicated by varying degrees of feedback, binding, resistance, or sloppiness. If one or more of these symptoms occur, it should not be mistaken for hydraulic power failure. Should a flight control malfunction occur:

1. <u>LAND AS SOON AS POSSIBLE.</u>
2. <u>EMER SHUTDOWN after landing.</u>

9-62. STABILITY AND CONTROL AUGMENTATION SYSTEM (SCAS) FAILURE.

Failure of the SCAS system will be evidenced by display of the P/R DISENG, YAW DISENG, and/or SCAS DISENG caution(s). In the event of a P/R or yaw SCAS failure, or both, the respective actuator(s) will center and lock within approximately 0.5 second. When a failure is detected, the respective channel will move to the OFF position, disabling the affected axis (or axes). In the event a failure occurs at a time when an actuator is not centered, a slight bump will be felt by the operator through the flight control as the actuator centers. SCAS failure will result in an increase in pilot workload but continued flight is possible.

In the event of a SCAS disengagement, proceed as follows:

1. Affected SCAS channel Attempt to reengage.

If SCAS cannot be reengaged:

2. LAND AS SOON AS PRACTICABLE.

9-63. LIGHTNING STRIKE.

LAND AS SOON AS POSSIBLE.

9-64. IN-FLIGHT WIRE STRIKE.

LAND AS SOON AS POSSIBLE.

SECTION II. MISSION EQUIPMENT

9-65. MISSILE UNLATCHED.

1. Avoid nose low attitudes and excessive bank angles.
2. LAND AS SOON AS PRACTICABLE.

9-66. MISFIRE — 2.75-INCH ROCKET.

A misfire is a rocket that has been fired but the launch motor does not ignite.

Proceed as follows:

1. Position the aircraft so that rocket is oriented downrange for a period of 10 minutes.
2. Upon landing the aircraft Notify explosive ordnance disposal.

9-67. ROCKET/MISSILE — HANGFIRE.

A hangfire is an event when a rocket or missile motor ignites and produces thrust but hangs up on/in the launcher and does not separate from the helicopter. The resulting missile thrust is transferred to the helicopter and may cause control difficulty and potential structural damage. HELLFIRE missile thrust lasts for approximately 2.5 seconds. Control of the aircraft is crucial during this period and recovery is dependent upon altitude and obstacles. Failure to immediately counter missile thrust with control inputs may cause loss of aircraft control.

WARNING

Activation of Jettison switch during missile hangfire may cause missile launcher package to veer off course, possibly into the aircraft or rotor disk.

CAUTION

If a HELLFIRE launcher is jettisoned with a single missile on the inboard launcher rail, the launcher may contact the landing gear skid tube.

In the event of missile hangfire proceed as follows:

1. JETTISON switches(es) — Activate. (Only in event of residual fire.)
2. LAND AS SOON AS POSSIBLE.

9-68. RUNAWAY GUN.

Gun continues to fire after WPN-FIRE switch is released.

Proceed as follows:

1. Orient gun in a safe direction.
2. MASTER switch STBY.
3. Allow gun to fire out.
4. Gun switch — SAFE.

9-69. CARGO HOOK FAILS TO RELEASE ELECTRICALLY.

In the event that cargo hook will not release sling when CARGO RELEASE switch is pressed, proceed as follows:

1. Maintaln tension on sling.
2. Pull EMER CARGO RELEASE handle.

APPENDIX A

REFERENCES

AR 385-40	Accident Reporting and Records
AR 70-50	Designating and Naming Defense Military Aerospace vehicles
AR 95-1	Flight Regulations
DA FORM 2408-13-1	Aircraft Inspection and Maintenance Record
DA FORM 2408-13-1E	Aircraft Inspection and Maintenance Record
DA PAM 40-501	Hearing Conservation
DA PAM 738-751	Functional Users Manual for The Army Maintenance Management System - Aviation (TAMMS-A)
DOD FLIP	DOD Flight Information Publication (Enroute)
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 10-67-1	Concepts and Equipment of Petroleum
MIL-STD-12D	Abbreviations for Use on Drawings, and in Specifications, Standards and Technical Documents.
TB 55-9150-200-24	Engine and Transmission Oils, Fuels, and Additives for Army Aircraft
TM 1-1520-248-CL	Operators' and Crewmembers' Checklist, for Army Model OH-58D Helicopter
TM 1-1520-248-MTF	Maintenance Test Flight Manual, for Army Model OH-58D Helicopter
TM 9-1005-213-10	Operators Manual, for Machine Guns Caliber .50; Browning M2, Heavy Barrel Flexible, W/E
TM 9-1055-460-13&P	Operators, Aviation Unit, and Intermediate Maintenance Manual for Hydra 70 Rocket Launchers
TM 9-5855-253-10	Operators Manual for Night Sight Set, Infrared, AN/UAS-11
TM 9-6920-475-13	Maintenance Instructions Aviation Unit and Intermediate Maintenance including Repair Parts and Special Tools List for Training Equipment Dummy Guided Missile, M34; Guided Missile, Training M36 and Fixture, Launch Shoe Alignment HELLFIRE Modular Missile System

TM 11-5841-291-12	Operators and Organizational Maintenance Manual for the Radar Warning Systems AN/APR-44(V)1 and AN/APR-44(V)3
TM 11-5841-294-12	Operator and Aviation Unit Maintenance Manual for Radar Signal Detecting Set AN/APR-39A(V)1
TM 11-5841-301-12	Operators' and Aviation Unit Maintenance Manual for AN/AVR-2A Laser Detecting Set
TM 55-1500-342-23	Army Aviation Maintenance Engineering Manual for Weight and Balance
TM 750-244-1-5	Procedures for the Destruction of Aircraft and Associated Equipment to Prevent Enemy Use

APPENDIX B

ABBREVIATIONS AND TERMS

SYMBOLS

°	Degrees
ΔF	Increment of equivalent flat plate drag area
%Q	Percent torque

A

A	Advisory
AC	Alternating current
A/C	Aircraft
ACK	Acknowledge
ACP	Armament control panel
ACTVT	Activate
ACV	Alternating current voltage
ADSS	ANVIS display symbology system
ADU	Audio distribution unit
ADV	Advisory(ies)
AEU	Armament electronics unit
AGL	Above ground level
AI	Airborne interceptor
AJ	Antijamming
ALE	Automatic leveling equalization
ALFGL	Automatic low frequency gain limiting
ALGN	Align
ALT	Altitude, altimeter, alternate
AM	Amplitude modulation
AMP	Amplifier
AMPS	Aviation mission planning station
ANLG	Analog
ANTI COLL LT	Anticollision light
ANVIS	Aviators night vision imaging system
ARMT	Armament
ARTY	Artillery
AS	Antispoofing
ASE	Aircraft survivability equipment
ATAS	Air-to-air stinger
ATH	Airborne target handover
ATHS	Airborne target handover system

ATT	Attitude
AUD VIS	Audio visual
AUTH, AUTHENT	Authentication
AUTO	Automatic, autonomous
AUX	Auxiliary
AVTR	Airborne video tape recorder

B

BATT	Battery
BF	Bit failure
BFLD	Battlefield
B HOT	Black hot
BIT	Built-in test
BKUP	Back up
BL	Buttock line
BLK	Block
BLWR	Blower
BNR	Burner
BRIL	Brilliance
BRK	Break
BRST	Boresight
BRT	Bright
BYP	Bypass

C

C	Celsius, caution, cue
CABS	Cockpit air bag system
CAL	Calibrate, caliber
CAS	Calibrated airspeed
CB	Circuit breaker
CBID	Combat identifier
CDS	Control and display subsystem
CEOI	Communications electronics operating instructions
CFT	Captive flight trainer
CG	Center of gravity
CH	Channel
CHAN	Channel
CHG	Change
CIPH	Cipher
CIT	Compressor inlet temperature
CKPT	Cockpit
CL	Centerline

CLR	Clear
CNTL	Control
CNTR	Center
CNV	Crypto-net variable
COLL	Collective, collision
COMM	Communication
COMPT	Compartment
COMPTR	Computer
COMSEC	Communication security
CONT	Continuous
CONT, CONTR	Contrast, control, controller
COORD	Coordinates
CORRTN	Correction
CPHD	Copperhead
CPG	Copilot/gunner
CRT	Cathode ray tube
CSC	Communication system control
CT	Cipher text
CYC	Cyclic
C/W	Caution/Warning

D

DC	Direct current
DCLTR	Declutter
DD	Day date
DEL	Delete
DECR	Decrease
DEFOG	Defogger
DELVRY	Delivery
DEL FPLN	Deletes flight plan
DES	Designator, designation
DESIG	Designation
DEST	Destination
DET	Detect
DETR	Detector
DIGT	Digital
DIPH	Diphase
DIR	Direct
DISCR	Discriminate
DISENG	Disengage
DL	Data loader
DN	Down
DRU	Data receptacle unit

DSC	Digital scan converter
DSPL SEL	Display select
DTED	Digital terrain elevation data
DTM	Data transfer module
DTR	Data transfer receptacle
DTS	Data transfer system
DTU	Data transfer unit

E

EBF	Engine barrier filter
ECCM	Electronic countermeasure
ECU	Electronic control unit
EGI	Embedded global positioning system/inertial navigation system
EHP	Engine history page
EID	Emitter identification data
ELEV	Elevation
EL LT	Electroluminescence
EM	Emergency mode
EMB	Expanded memory board
EMER	Emergency
EMER T/R	Emergency transmit/receive
END	Endurance
ENG	Engine
ENGA	Engage
EOM	End of mission
ERF	Electronic remote fill
ESC	Electronic supervisory control
ESNTL	Essential
ESW	Engine status word
ETE	Estimated time enroute
EQ	Engine torque
EU	Electronics unit
EXT	Extend, external

F

F	Fahrenheit
FADEC	Full authority digital electronic control
FAT	Free air temperature
FCU	Fuel control unit
FDL	Fault detection location
FH	Frequency hopping
FLT	Flight
FM	Frequency modulation

FMT-NETS	Frequency managed training net
FOC	Focus
FOM	Figure of merit
FOV	Field of view
FPLN	Flight plan
FPM	Feet per minute
FREQ	Frequency
FS	Fuselage station, frequency scan
FT	Foot
FT/MIN	Feet per minute
FWD	Forward
FXD	Fixed

G

GAL	Gallon
GAL/HR	Gallons per hour
GC ALIGN	EGI alignment
GEN	Generator
GLLD	Ground laser location designator
GPS	Global positioning system
GPU	Ground power unit
GRBX	Gearbox
GRN	Green
GRWT	Gross weight
GW	Gross weight

H

HDG	Heading
HDG HLD	Heading hold
HF	High frequency, hang fire, HELLFIRE
HHM	Heading hold mode
HI	High
HIT	Health indicator test
HLFR	HELLFIRE
HMS	HELLFIRE missile system
HMU	Hydromechanical unit
HOG	Hands-on general user interface
HP	Horsepower
HQ	HAVEQUICK
HR	Hour
HSD	Horizontal situation display
HSET	Hop setting

HSI	Horizontal situation indicator
HTR	Heater
HVR	Hover
HYD	Hydraulic
HZ	Hertz

I

IAS	Indicated airspeed
ICS	Intercommunication system
ID	Identification, identifier
IDM	Improved data modem
IDNT	Identify
IEA	Interface electronics assembly
IF ALIGN	In-flight alignment
IFF	Identification friend or foe
IFM	Improved FM (amplifier)
IGE	In ground effect
IGN	Ignition
IMPEND	Impending
IMSP	Improved mast mounted sight system processor
IN	Inch
IN HG	Inches of mercury
INCR	Increase
IND	Indicator
INHBT	Inhibit
INIT	Initial
INOP	Inoperative
INS	Inertial navigation system, insert
INST LT	Instrument light
INTCON	Interconnect
INTEG	Integrate
INTEN	Intensity
INV	Inverter, inverse
IR	Infrared
ISP	Integrated system processor

J

JETT	Jettison
JVMF	Joint variable messaging format

K

KCAS	Knots calibrated airspeed
KIAS	Knots indicated airspeed
KM	Kilometers
KNPT	Known point
KPH	Kilometers per hour
KTAS	Knots true airspeed
KTS	Knots
KYBD	Keyboard

L

L	Left
LAT	Latitude
LAT/LON	Latitude/longitude
LBS	Pounds
LB/HR	Pounds per hour
LCF	Low cycle fatigue
LD	Load
LGTH	Length
LIM	Limit
LMC	Linear motion compensation
LO	Low
LOAL	Lock-on after launch
LOBL	Lock-on before launch
LOC	Locate
LON	Longitude
LONG	Longitude
LOS	Line of sight
LOS CONT	Line of sight control
LRF/D	Laser rangefinder/designator
LSB	Lower side band
LSET	Lockout set
LSR	Laser
LT	Light

M

M	Manual
MA	Missile alert, activity
MAG	Magnetic
MAN	Manual
MAX	Maximum
MCPS	Mast mounted sight central power supply

MCPU	Master controller processor unit
MEC	Mechanical
MED	Medium
MDC	Manual drift control
MDU	Map data unit
MEM	Memory
MF	Missile failure
MFD	Multifunction display
MFK	Multifunction keyboard
MGRS	Military grid reference system
MHz	Megahertz
MIB	Management information base
MIC	Microphone
MIN	Minute, Minimum
MM	Millimeter
MMS	Mast mounted sight
MNL	Manual
MON	Monitor
MPD	Multiparameter display
MPLH	Multiple purpose light helicopter
MPSM	Multi-purpose submunition
MQ	Mast torque
MSG	Message
MSGS	Messages
MSL	Mean sea level, Missile
MSP	Mast mounted sight system processor
MSS	Missile sight system
MT	Multiple targets
MTA	Mast turret assembly
MUX	Multiplex
MVMT	Movement
MVT	Movement
MWOD	Multiple word of the day

N

N	North
NAR	Narrow
NATO	North Atlantic Treaty Organization
NAV	Navigate, navigation
NAV UPD	Navigation update
NBC	Nuclear, biological, and chemical protection system
NCS	Net control station
NET	Network

NFOV	Narrow field of view
NG, Ng	Gas producer speed
NM	Nautical mile
NO	Number
NOE	Nap of the earth
NORM	Normal
NP, Np	Power turbine speed
NR, Nr	Rotor speed
NVG	Night vision goggles
NVM	Non-volatile memory

O

OBS	Optical boresight system
ODA	Optical display assembly
OFP	Operational flight program
OGE	Out of ground effect
OPR	Operate
ORIDE	Override
ORIG	Originator
OS	Overspeed
OSET	Offset

P

PART SEP	Particle separator
PDU	Pilot display unit
PLA	Power lever angle
PLT	Pilot
PMA	Permanent magnet alternator
PNT TRK	Point track
POS	Position
PP	Present position
PPT	Prepoint
P/R	Pitch/roll
PREFLT	Preflight
PREPT	Prepoint
PRESS	Pressure
PREV	Previous
PRHT	Preheat
PRI	Primary
PSIG	Pounds per square inch gage
PT	Plain text

PVT	Private
PWR	Power

Q

QTY	Quantity

R

R	Right, receive
RAD	Radius
RAD ALT	Radar altimeter
RALT	Radar altimeter
RAST	Raster
RCCB	Remote control circuit breaker
RCDR	Recorder
RCV	Receive
R/C	Rate of climb
R/D	Rate of descent
RDR	Radar detecting receiver
RDY	Ready
REC	Recall, receiver
RECT	Rectifier
RECV	Receive
REJ	Reject
REL	Release
RET	Retract
RETRAN	Retransmit
RFD	Remote frequency display
RHE	Remote HELLFIRE electronics
RKT	Rocket
RLG	Ring laser gyroscope
RMP	Reprogrammable microprocessor
RMS	Rotorcraft mapping system
RMT	Remote
RNG	Range
RPM	Revolutions per minute
RST	Reset
RT	Radio transmitter
RTN	Return
RWR	Radar warning receiver

S

SA	Situation awareness, Selective availability
SAM	Surface-to-air missile
SAT(S)	Satellite(s)
SC	Single channel
SCAS	Stability and control augmentation system
SCL	Scale
SCTY	Security
SEC	Seconds
SEL	Select
SEU	Sight electronics unit
SF	Station failure
S GEN	Starter generator
SH ALIGN	Stored heading alignment
SHP	Shaft horsepower
SINCGARS	Single channel ground/air radio system
SIP	SINCGARS improvement program
SIT	Situation
SLAV	Slave
SPEC	Specifications
SPRL	Spiral
SPS	Sensor processor subsystem
SQ FT	Square feet
SQL	Squelch
SRCH	Search
SRCH LT	Search light
STA	Station
START	Starter
STBY	Standby
STK	Stick
STOR	Store
STR	Strength
SUBS	Subscribers
SYMB	Symbology
SYNC	Synchronize
SYS	System

T

T	Time, test
TAC	Tactical
TACFIRE	Tactical fire direction
TAMS	Transmission attitude measurement system

TAS	True airspeed
TCU	Thermal conditioning unit
TEMP	Temperature
TEMP ORID	Temperature override
TGT	Target, turbine gas temperature
TIS	Thermal imaging sensor
TIS INTEG	Thermal imaging sensor integrator
TOD	Time of day
TOF	Time of flight
TRANS	Transmit, transmission
T/R	Transmit/receive, tail rotor
T/R+G	Transmit/receive and receive guard
TRK	Track
TRQ	Torque
TRU	Transformer rectifier unit
TSEC	Transmission security
TV	Television
TVS	Television sensor, television system

U

UHF	Ultra high frequency
UNL	Unlatched
UPD	Update
UPDT	Update
USB	Upper side band
UTC	Universal time coordinated synchronized time
UTM	Universal transverse mercator
UWP	Universal weapons pylon

V

V	Volts
VAC	Volts alternating current
VAR	Variation
VDC	Volts direct current
VDU	Video downlink/uplink
VEL	Velocity
VFR	Visual flight rules
VHF	Very high frequency
VID	Video
VIXL	Video image crosslink
VNE	Velocity, never exceed (airspeed limitation)

VOL	Volume
VOX	Voice activated communication
VPS	Video processor subsystem
VSD	Vertical situation display
VSDS	Vertical scale display subsystem
VTR	Video tape recorder
VTS	Video tracker system

W

WARN	Warning
WFOV	Wide field of view
W HOT	White hot
WHT	White
WL	Water line
WOD	Word of the day
WPN	Weapon
WPT	Waypoint
WRN	Warning
WSPS	Wire strike protection system

X

XDCR	Transducer
XFER	Transfer
XMIT	Transmit
XMSN	Transmission
XMT	Transmit
XMTR	Transmitter
XTK	Crosstrack

APPENDIX C

SPECIAL MISSION

C-1. GENERAL.

This appendix provides description and operating procedures for those systems peculiar to the OH-58D Special Mission helicopter.

C-2. RESCUE LADDERS.

1. Description. Two rescue ladders are provided. A ladder is located on each side weapons pylon arm. The ladders are stowed in a metal housing. A mechanical release cable for each ladder is routed forward to release handles located on each side of the center console at the instrument panel intersect.

2. Operation. The rescue ladders are released by pulling the release handle located on each side of the center console. Refer to TM 1-1520-248-23, Chapter 2.

C-3. ACOUSTIC BEACON.

A salt water activated, battery powered acoustic beacon is mounted on the aft side of the CPG seat bulkhead. Refer to TM 1-1520-248-23.

C-4. WEIGHT ON GEAR INTERRUPT SWITCH.

A weight on gear interrupt switch is located directly above the pilot MFD. The switch is labeled NORM/ INTERPT. When the switch is in the INTERPT position, continuous navigation alignment may be accomplished when operating aboard ship.

C-5. BASEBAND/DIPHASE SWITCH.

The baseband/diphase switch is located adjacent to the weight on gear interrupt switch. The switch allows a frequency switch for Army/Navy channels as required.

C-6. AN/ARN-153 TACAN.

1. Description. The AN/ARN-153 TACAN navigation set is located in the aft electrical compartment. The system operates through the Multifunction Displays. An antenna is mounted on the lower center section of the helicopter. A TACAN circuit breaker is located on the auxiliary overhead circuit breaker panel.

2. Operation. DATA NOT AVAILABLE.

ALPHABETICAL INDEX

Subject — **Paragraph Figure, Table Number**

A

A (Cont)

Subject	Paragraph Figure, Table Number

C (Cont)

Subject	Paragraph Figure, Table Number

C (Cont)

D

E

Subject	Paragraph Figure, Table Number

E (Cont)

Subject	Paragraph Figure, Table Number

L (Cont)

M

Subject	Paragraph Figure, Table Number

M (Cont)

Subject	Paragraph Figure, Table Number

M (Cont)

O (Cont)

Subject	Paragraph Figure, Table Number

P (Cont)

Q

R

R (Cont)

S

By Order of the Secretary of the Army:

Official:

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

Joel B. Hudson

JOEL B. HUDSON
Administrative Assistant to the
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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.

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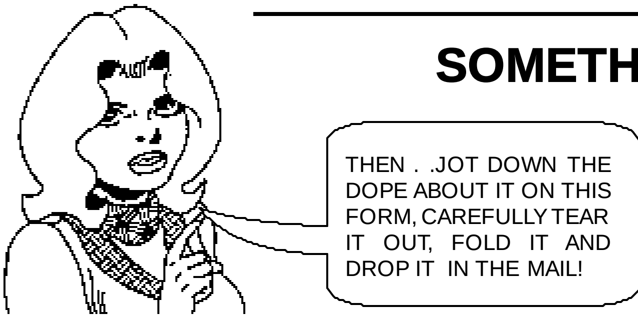

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PFC John DOE
CO A 3rd Engineer Bn
Ft. Leonardwood, MO 63108

DATE SENT

10 January 1999

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 1–1520–248-10	30 December 1998	Operator's manual OH58D Helicopter

BE EXACT PIN–POINT WHERE IT IS — **IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:**

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	
6	2-1 a			In line 6 of paragraph 2–1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.
81		4-3		Callout 16 on figure 4–3 is pointed at a bolt. In key to figure 4–3, item 16 is called a shim. Please correct one or the other

EXAMPLE

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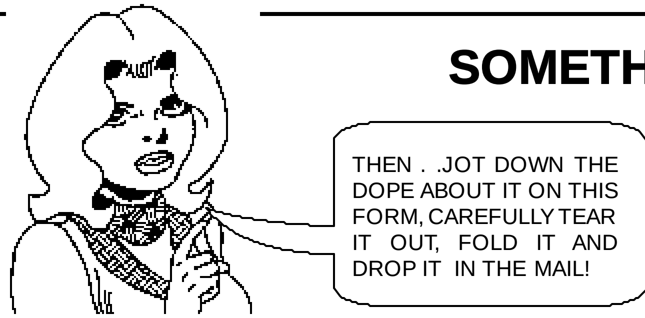

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TEAR ALONG PERFORATED LINE

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 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 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 milliters = .34 fl. ounce
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*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 077452-002