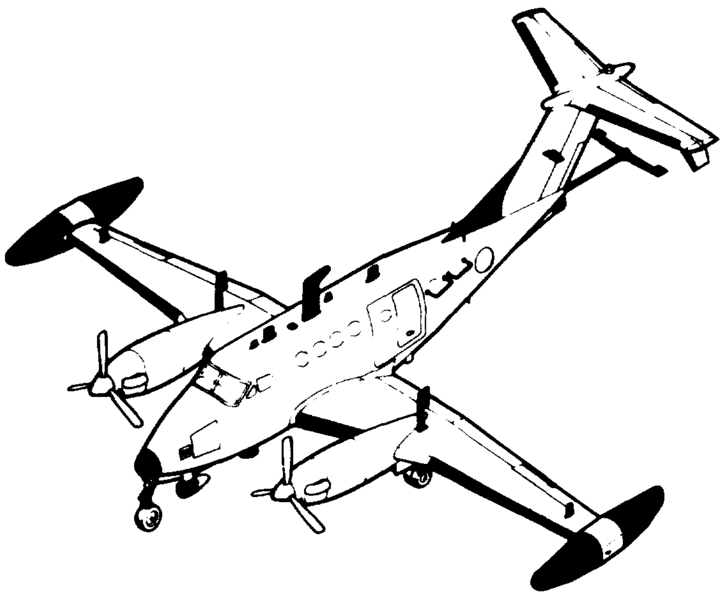
TM 55-1510-221-10

TECHNICAL MANUAL

OPERATOR'S MANUAL FOR ARMY RC-12H AIRCRAFT



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TM 55-1510-221-10
C5

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WASHINGTON, D.C., 28 May 1998

OPERATOR'S MANUAL
FOR
ARMY RC-12H AIRCRAFT

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Operator's Manual For Army RC-12H Aircraft

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5-1 and 5-2	5-1 and 5-2
5-5 and 5-6	5-5 and 5-6
5-9 and 5-10	5-9 and 5-10
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Operator's Manual
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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 injury or death.

NOISE LEVELS

Sound pressure levels in this aircraft during some operating conditions exceed the Surgeon General's hearing conservation criteria, as defined in TM MED 501. Hearing protection devices, such as the aviator helmet or ear plugs shall be worn by all personnel in and around the aircraft during its operation.

STARTING ENGINES

Operating procedures or practices defined in this Technical Manual must be followed correctly. Failure to do so may result in personal injury or loss of life.

Exposure to exhaust gases shall be avoided since exhaust gases are an irritant to eyes, skin and respiratory system.

HIGH VOLTAGE

High voltage is a possible hazard around AC inverters, ignition exciter units, and strobe beacons.

USE OF FIRE EXTINGUISHERS IN CONFINED AREAS

Monobromotrifluoromethane (CF_3Br) is very volatile, but is not easily detected by its odor. Although non toxic, it must be considered to be about the same as other freons and carbon dioxide, causing danger to personnel primarily by reduction of oxygen available for proper breathing. During operation of the fire extinguisher, ventilate personnel areas with fresh air. The liquid shall not be allowed to come into contact with the skin, as it may cause frostbite or low temperature burns because of its very low boiling point.

VERTIGO

The strobe/beacon lights should be turned off during flight through clouds to prevent sensations of vertigo, as a result of reflections of the light on the clouds.

CARBON MONOXIDE

When smoke, suspected carbon monoxide fumes, or symptoms of lack of oxygen (hypoxia) exist, all personnel shall immediately don oxygen masks, and activate the oxygen system.

FUEL AND OIL HANDLING

Turbine fuels and lubricating oils contain additives which are poisonous and readily absorbed through the skin. Do not allow them to remain on skin.

SERVICING AIRCRAFT

When conditions permit, the aircraft shall be positioned so that the wind will carry fuel vapors away from all possible sources of ignition. The fueling unit shall maintain a distance of 20 feet between unit and filler point. A minimum of 10 feet shall be maintained between fueling unit and aircraft.

Prior to refueling, the hose nozzle static ground wire shall be attached to the grounding lugs that are located adjacent to filler openings.

SERVICING BATTERY

Improper service of the nickel-cadmium battery is dangerous and may result in both bodily injury and equipment damage. The battery shall be serviced in accordance with applicable manuals by qualified personnel only.

Corrosive Battery Electrolyte (Potassium Hydroxide). Wear rubber gloves, apron, and face shield when handling batteries. 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.

JET BLAST

Occasionally, during starting, excess fuel accumulation in the combustion chamber causes flames to be blown from the exhausts. This area shall be clear of personnel and flammable materials.

RADIOACTIVE MATERIAL

Instruments contained in this aircraft may contain radioactive material (TB 55-1500-314-25). These items present no radiation hazard to personnel unless seal has been broken due to aging or has accidentally been broken. If seal is suspected to have been broken, notify Radioactive Protective Officer.

RF BURNS

Do not stand near the antennas when they are transmitting.

OPERATION OF AIRCRAFT ON GROUND

At all times during a towing operation, be sure there is a man in the cockpit to operate the brakes.

Personnel should take every precaution against slipping or falling. Make sure guard rails are installed when using maintenance stands.

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

Insure that landing gear control handle is in the DN position.

AUTOPILOT COMPATIBILITY

The RC-12H aircraft is certified with wingtip pods installed. Should the pods be removed, the autopilot system must be replaced with a standard C-12D autopilot. Effected wiring must also be changed.

TECHNICAL MANUAL

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 30 DECEMBER 1988

Operator's Manual
ARMY MODEL RC-12H

REPORTING OR ERRORS AND RECOMMENDING IMPROVEMENTS

You can help Improve this manual. If you find any mistakes or if you know of any way to improve the procedures, please let use know. Mail your letter. DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, U.S. Army Aviation and Missile Command. ATTN: AMSAM-MMC-LS-LP, Redstone Arsenal. AL 35898-5230. A reply will be furnished directly to you. You may also send in your comments electronically to our E-mail address at <ls-lp@redstone.army.mil>, or by fax at (205) 842-6546 or DSN 788-6546. Instructions for sending an Electronic DA Form 2028 may be found at the back of this manual immediately preceding the hard copy DA Forms 2028.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

CHAPTER 1

INTRODUCTION

1-1. GENERAL.

These instructions are for use by the operator(s). They apply to the RC-12H aircraft.

1-2. WARNINGS, CAUTIONS, AND NOTES.

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 RC-12H aircraft under most circumstances. The observance of limitations, performance, and weight/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 AIRCRAFT AT ALL TIMES.

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.

Appendix B is a listing of abbreviations and terms used throughout the manual.

1-6. INDEX.

The index lists, in alphabetical order, every titled paragraph, figure, and table contained in this manual. Chapter 7, Performance Data, has an additional index within the chapter.

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 MATERIEL TO PREVENT ENEMY USE.

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

1-9. FORMS AND RECORDS.

Army aviators flight record and aircraft maintenance records which are to be used by crew members are prescribed in DA PAM 738-751 and TM 55-1600-342-23.

1-10. EXPLANATION OF CHANGE SYMBOLS.

Changes, except as noted below, to the text and tables, including new material on added pages, are indicated by a vertical line in the outer margin extending close to the entire area of the material affected; exception: pages with emergency markings, which consist of black diagonal lines around three edges, may have the vertical line or change symbol placed along the inner margins. Symbols show current changes only. A miniature pointing hand symbol is used to denote a change to an illustration. However, a vertical line in the outer margin, rather than miniature pointing hands, is utilized when there have been extensive changes made to an illustration. Change symbols are not utilized 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 correction changes the meaning of instructive information and procedures.

1-11. AIRCRAFT DESIGNATION SYSTEM.

The designation system prescribed by AR 70-50 is used in aircraft designations as follows:

EXAMPLE RC-12H

R - Modified mission symbol (Reconnaissance)

C - Basic mission and type symbol (cargo)

12 - Design number

H - Series symbol

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 “should” is used to indicate a nonmandatory but preferred method of accomplishment. The word “may” is used to indicate an acceptable method of accomplishment. The word “will” is used to express a declaration of purpose and may also be used where simple futurity is required.

1-13. PLACARD ITEMS.

All placard items (switches, controls, etc.) are shown throughout this manual in capital letters.

CHAPTER 2

AIRCRAFT AND SYSTEMS DESCRIPTION AND OPERATION

Section I. AIRCRAFT

2-1. INTRODUCTION.

The purpose of this chapter is to describe the aircraft and its systems and controls which contribute to the physical act of operating the aircraft. It does not contain descriptions of avionics or mission equipment, covered elsewhere in this manual. This chapter contains descriptive information and does not describe procedures for operation of the aircraft. These procedures are contained within appropriate chapters in the manual. This chapter also contains the emergency equipment installed. This chapter is not designed to provide instructions on the complete mechanical and electrical workings of the various systems; therefore, each is described only in enough detail to make comprehension of that system sufficiently complete to allow for its safe and efficient operation.

2-2. GENERAL.

The RC-12H is a pressurized, low wing, all metal aircraft, powered by two PT6A-41 turboprop engines (fig. 2-1 and 2-11), and has all weather capability. Distinguishable features of the aircraft are the slender, streamlined engine nacelles, an aft rotating boom antenna, mission antennas, wing tip pods, a T-tail and a ventral tin below the empennage. The basic mission of the aircraft is radio reconnaissance. Cabin entrance is made through a stair-type door (fig. 2-2) on the left side of the fuselage.

2-3. DIMENSIONS.

Overall aircraft dimensions are shown in figure 2-3.

2-4. GROUND TURNING RADIUS.

Minimum ground turning radius of the aircraft is shown in figure 2-4.

2-5. MAXIMUM WEIGHTS.

Maximum takeoff gross weight is 15,000 pounds. Maximum landing weight is 15,000 pounds. Maximum ramp weight is 15,090 pounds. Maximum zero fuel weight is 11,500 pounds.

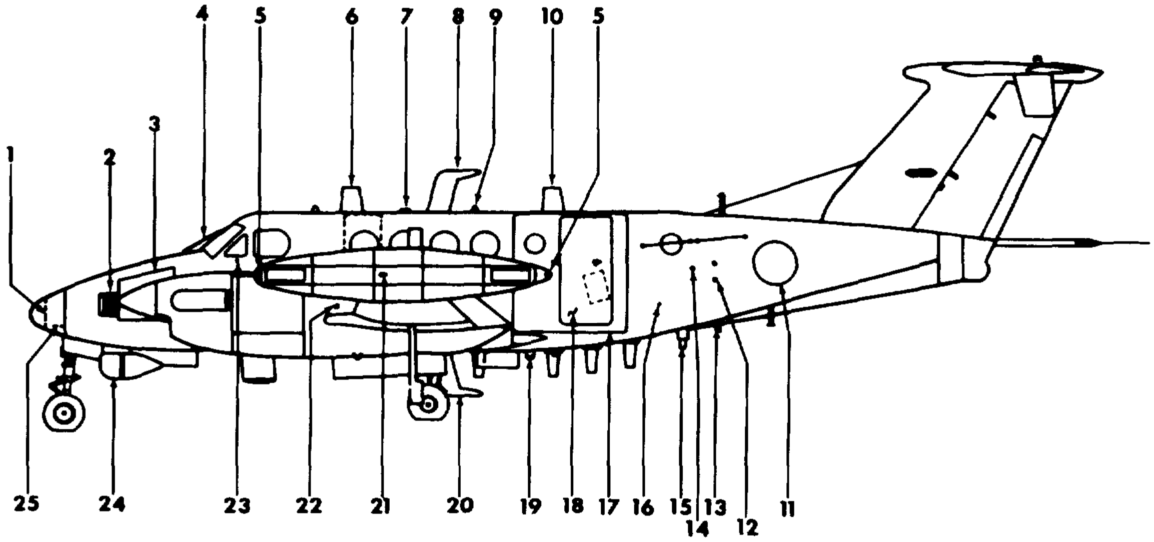
2-6. EXHAUST DANGER AREA.

Danger areas to be avoided by personnel while aircraft engines are being operated on the ground are depicted in figure 2-5. Distance to be maintained with engines operating at idle are also shown. Temperature and velocity of exhaust gases at varying locations aft of the exhaust stacks are shown for maximum power. The danger area extends to 40 feet aft of the exhaust stack outlets. Propeller danger areas are also shown.

2-7. LANDING GEAR SYSTEM.

The landing gear is a retractable, tricycle type, electrically operated by a single DC motor. This motor drives the main landing gear actuators through a gear box and torque tube arrangement, and also drives a chain mechanism which controls the position of the nose gear. Positive down-locks are installed to hold the drag brace in the extended and locked position. The down-locks are actuated by overtravel of the linear jackscrews and are held in position by a spring-loaded overcenter mechanism. The jackscrew in each actuator holds all three gears in the UP position, when the gear is retracted. A friction clutch between the gearbox and the torque shafts protects the motor from electrical overload in the event of a mechanical malfunction. A 150-ampere current limiter, located on the DC distribution bus under the center floorboard, protects against electrical overload. Gear doors are opened and closed through a mechanical linkage connected to the landing gear. The nose wheel steering mechanism is automatically centered and the rudder pedals relieved of the steering load when the landing gear is retracted. Air-oil type shock struts, filled with compressed air and hydraulic fluid, are incorporated with the landing gear. Gear retraction or extension time is approximately six seconds.

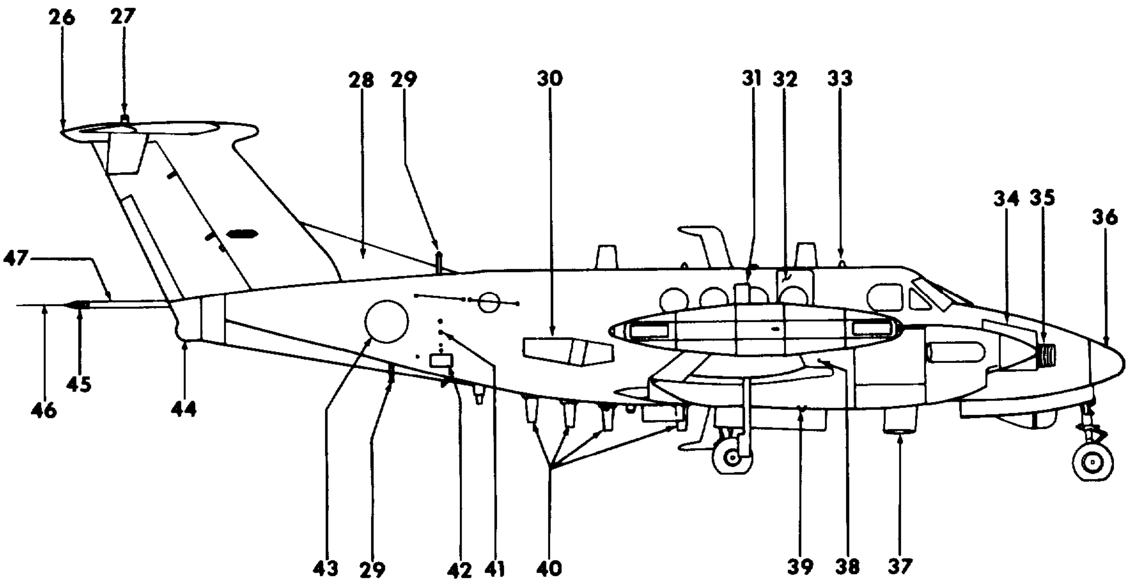
(1.) Landing Gear Control Switch. Landing gear system operation is controlled by a manually actuated, wheel-shaped switch placarded LDG GEAR CONTR - UP - DN, located on the left subpanel (fig. 2-6). The control switch and associated relay circuits are protected by a S-ampere circuit breaker, placarded LANDING GEAR RELAY on the overhead circuit breaker panel (fig. 2-26).



1. Weather radar
2. Air conditioner condenser air outlet
3. Nose avionics compartment access door
4. Windshield wipers
5. AN/APR39 spiral antenna
6. VHF/AM/FM antenna
7. Global positioning system antenna
8. Low band vert bent blade (upper) antenna
9. Transponder antenna
10. VHF comm antenna
11. “P” band antenna
12. Static air source
13. Relief tube drain
14. ELT control switch
15. UHF L-band antenna
16. Emergency light
17. Cargo door
18. Cabin door
19. Strobe light
20. Low band vert bent blade (lower) antenna
21. Navigation light
22. Ice light
23. Outside air temperature gage probe
24. Wide band data link fwd antenna
25. Glideslope antenna

AP 011758

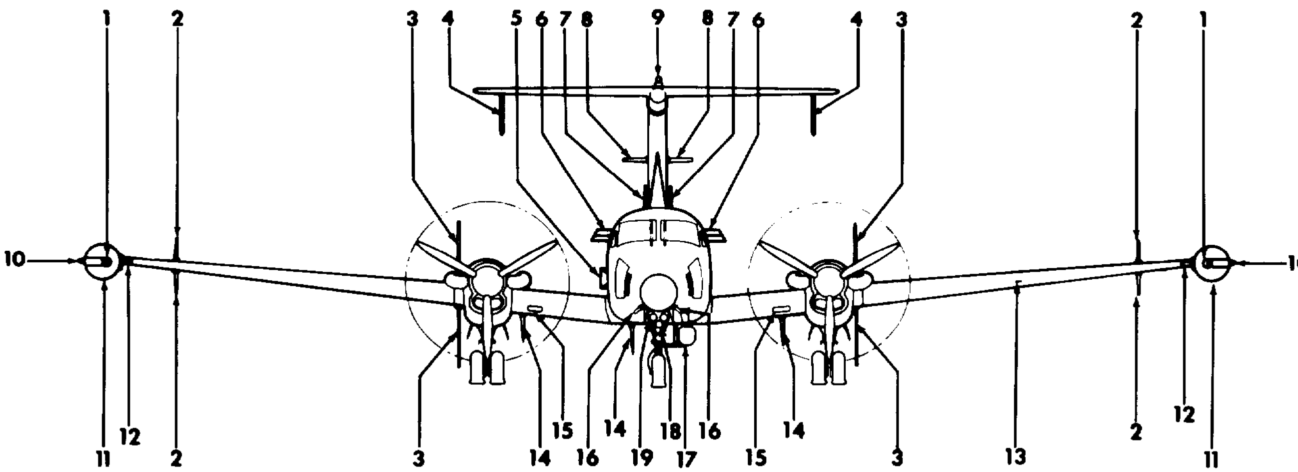
Figure 2-1. General Exterior Arrangement (Sheet 1 of 5)



26. Navigation light
27. Strobe beacon
28. Dorsal fin (ADF sense) antenna
29. AN/APR-44 antenna
30. Flare dispenser
31. Mid-band dipole antenna
32. Emergency entrance/exit hatch
33. TACAN antenna
34. Nose avionics compartment access door
35. Air conditioner condenser air inlet
36. Radome
37. High band vert & horiz antenna
38. Ice light
39. AN/APR-39 blade antenna
40. High band monopole antenna
41. Static air source
42. Oxygen system servicing door
43. “P” band antenna
44. Wide band data link aft antenna
45. Mid-band dipole antenna
46. Static wick
47. Aft rotating boom antenna

AP 011758.1)

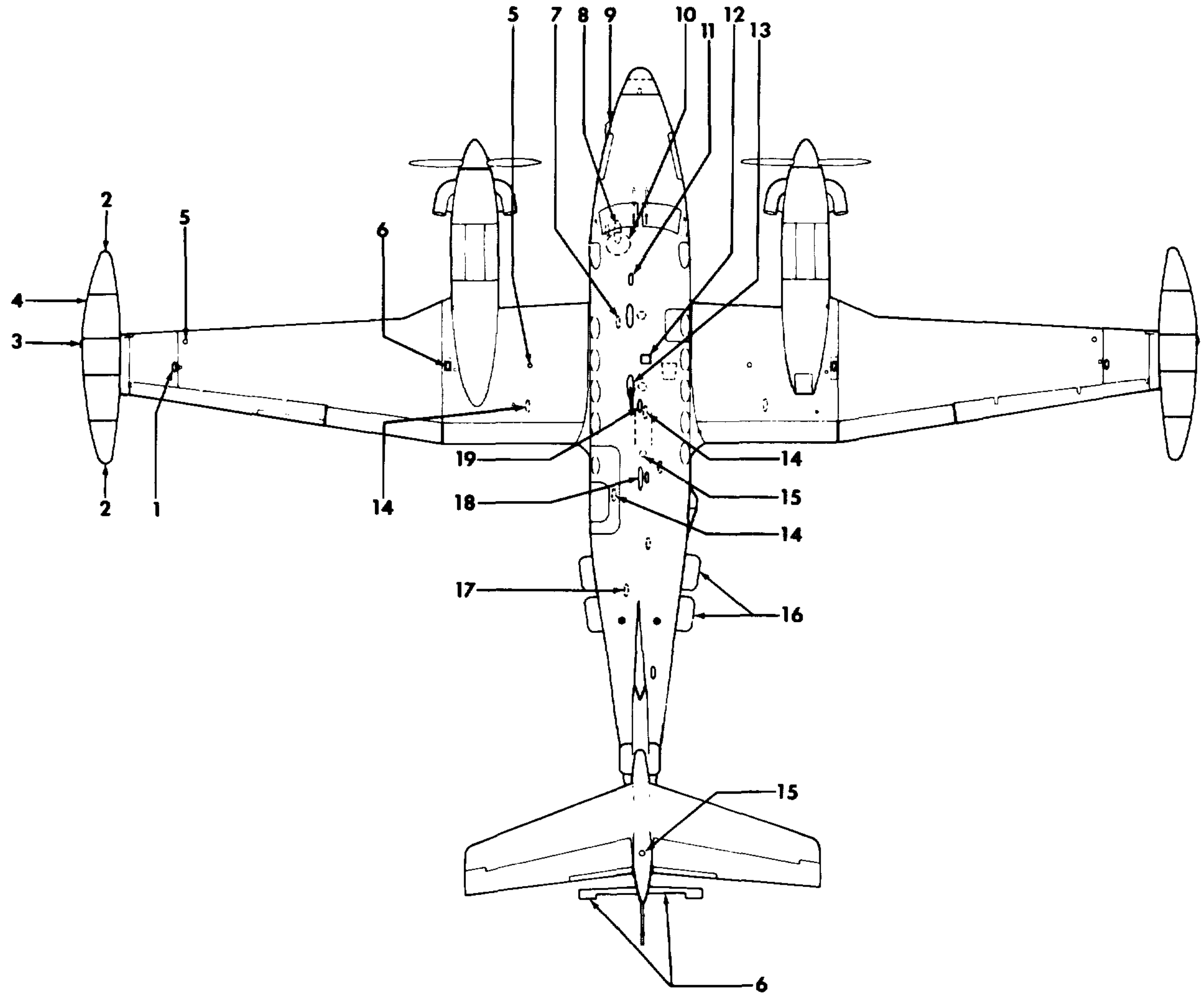
Figure 2-1. General Exterior Arrangement (Sheet 2 of 5)



1. AN/APR-39 spiral antenna
2. UHF comm & intercept antenna
3. Mid-band dipole antenna
4. Tailet
5. Flare dispenser
6. Low band horiz towel bar antenna
7. AN/APR-44 antenna
8. VOR NAV/LOC antenna
9. Strobe antenna
10. Navigation light
11. ELINT & DF antenna pod
12. Recognition light
13. Stall warning vane
14. High band monopole antenna
15. Bleed air heat exchanger air inlet
16. Pitot tube
17. Wide band data link fwd antenna
18. Taxi light
19. Landing lights

AP 011758.2

Figure 2-7. General Exterior Arrangement (Sheet 3 of 5)



1. UHF comm & intercept antenna
2. AN/APR-39 spiral antenna
3. Navigation light
4. ELINT & DF antenna pod
5. Fuel filler cap
6. Mid-band dipole antenna
7. AN/APR-39 antenna
8. Marker beacon antenna
9. Wide band data link antenna
10. High band vert & horiz antenna
11. TACAN antenna
12. GPS antenna
13. Low band vert bent blade antenna (upper)
14. High band monopole antenna
15. Strobe beacon
16. Low band horiz towel bar antenna
17. UHF L-band antenna
18. VHF comm antenna
19. Transponder antenna

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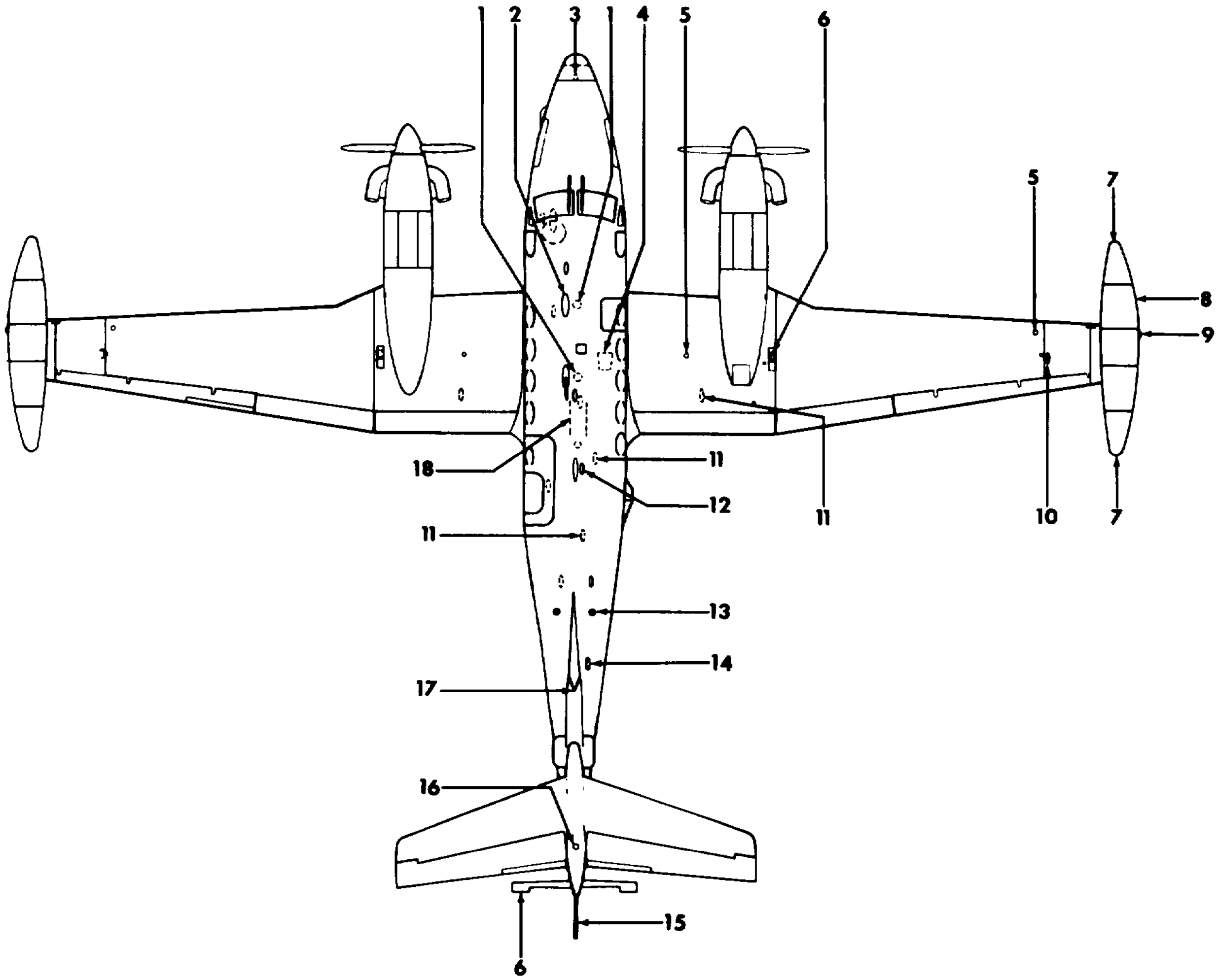
Figure 2-1. General Exterior Arrangement (Sheet 4 of 5)



1. Radio altimeter antenna
2. VHF/AM/FM antenna
3. Glideslope antenna
4. ADF loop antenna
5. Fuel filler cap
6. Mid-band dipole antenna
7. AN/APR-39 spiral antenna
8. ELINT & DF antenna pod
9. Navigation light
10. UHF comm & Intercept antenna
11. High band monopole antenna
12. INS TACAN antenna
13. AN/APR-44 antenna
14. ELT antenna
15. Static wick
16. Strobe beacon
17. Dorsal fin (ADF sense antenna)
18. Strobe dams

AP 011758.4

Figure 2-1. General Exterior Arrangement (Sheet 5 of 5)

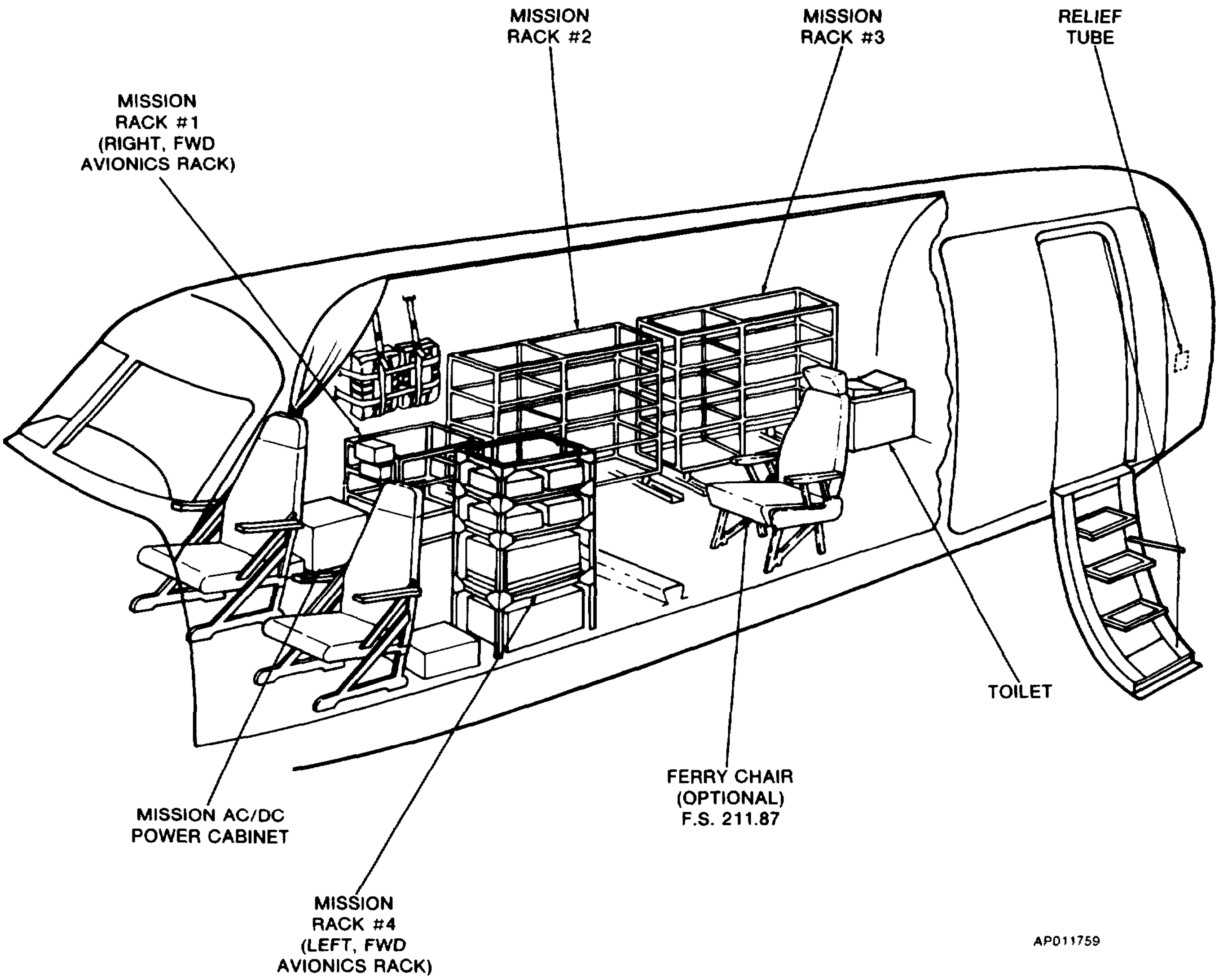


Figure 2-2. General Interior Arrangement

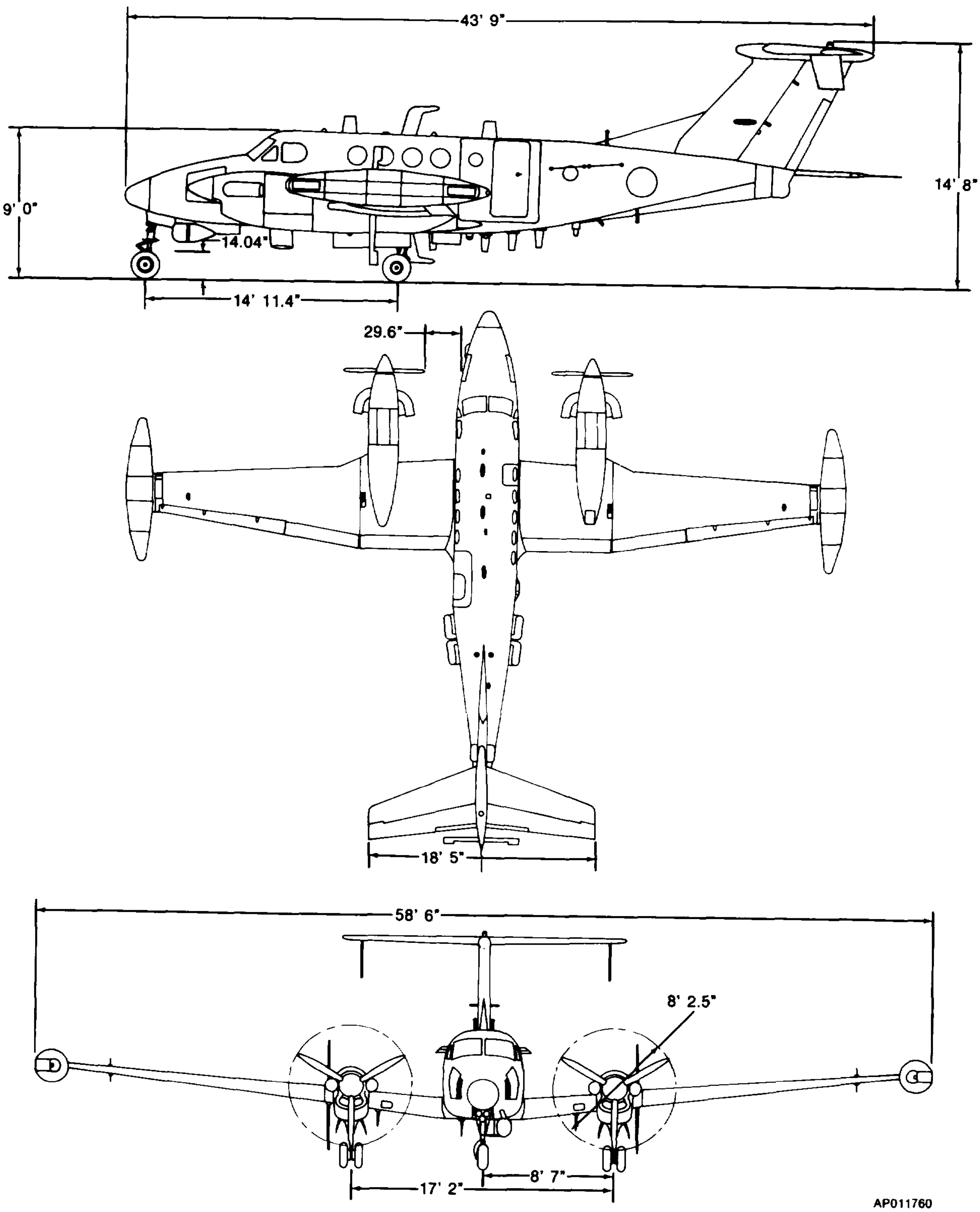


Figure 2-3. Principal Dimensions

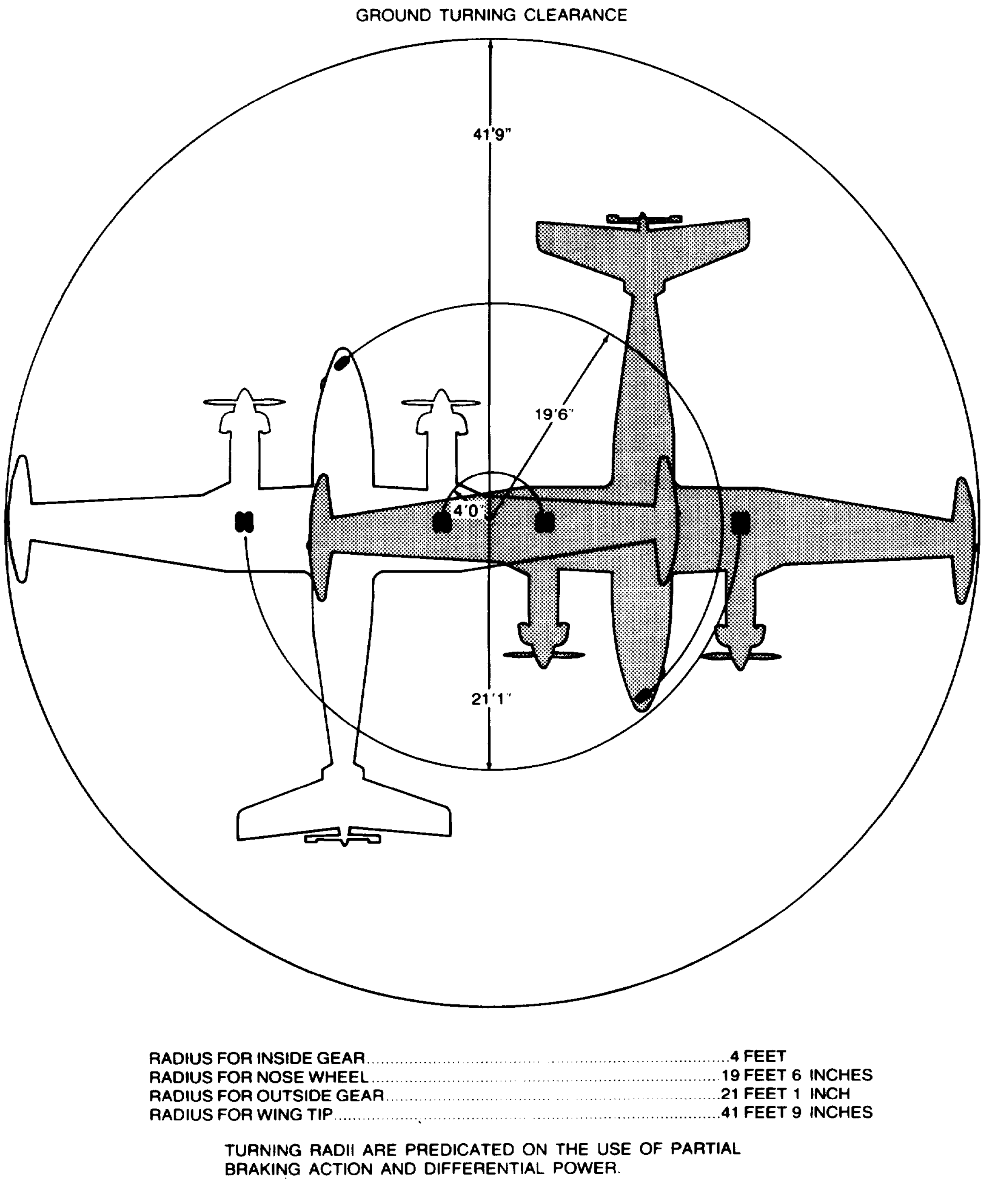


Figure 2-4. Ground Turning Radius

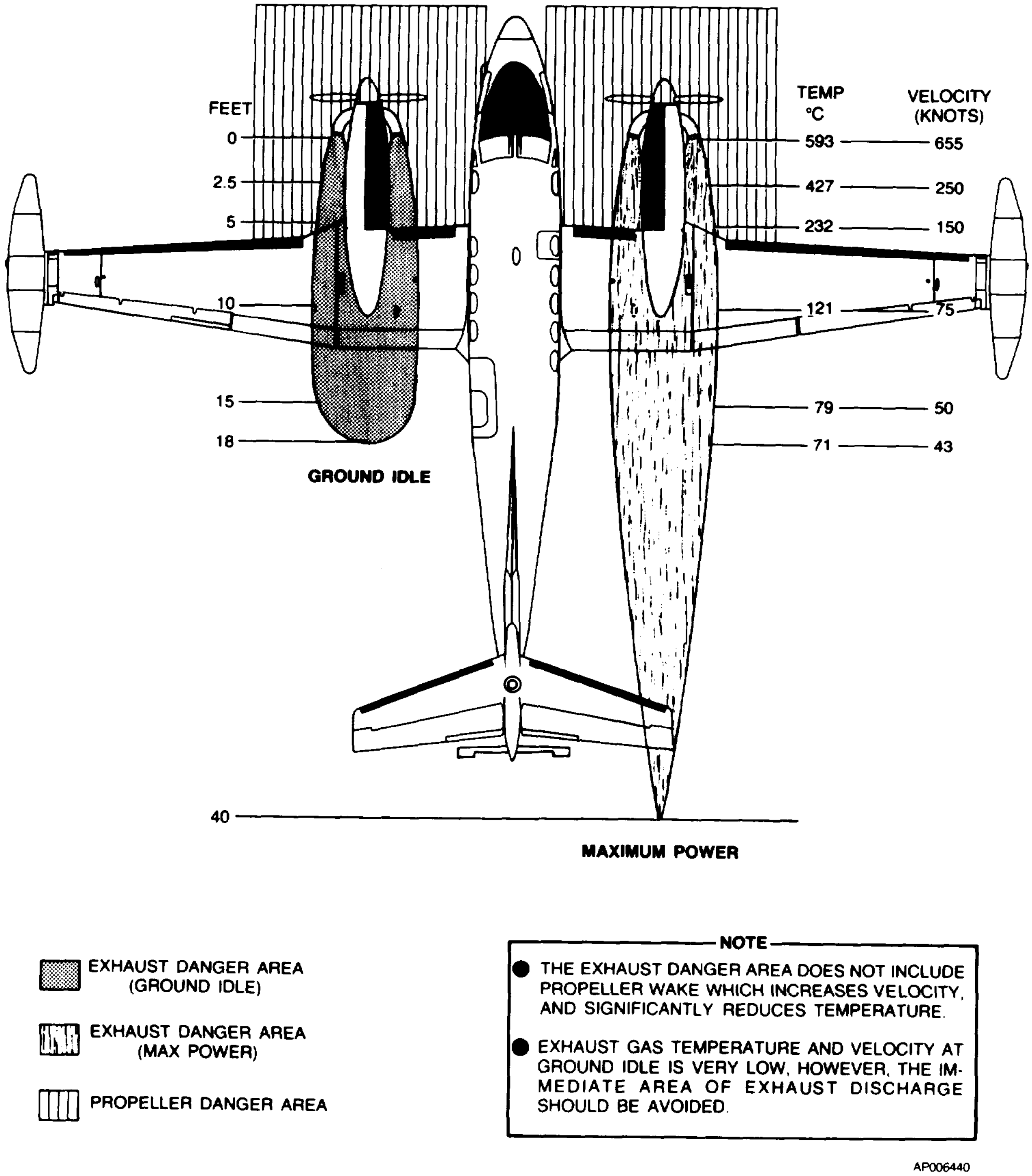


Figure 2-5. Exhaust and Propeller Danger Areas

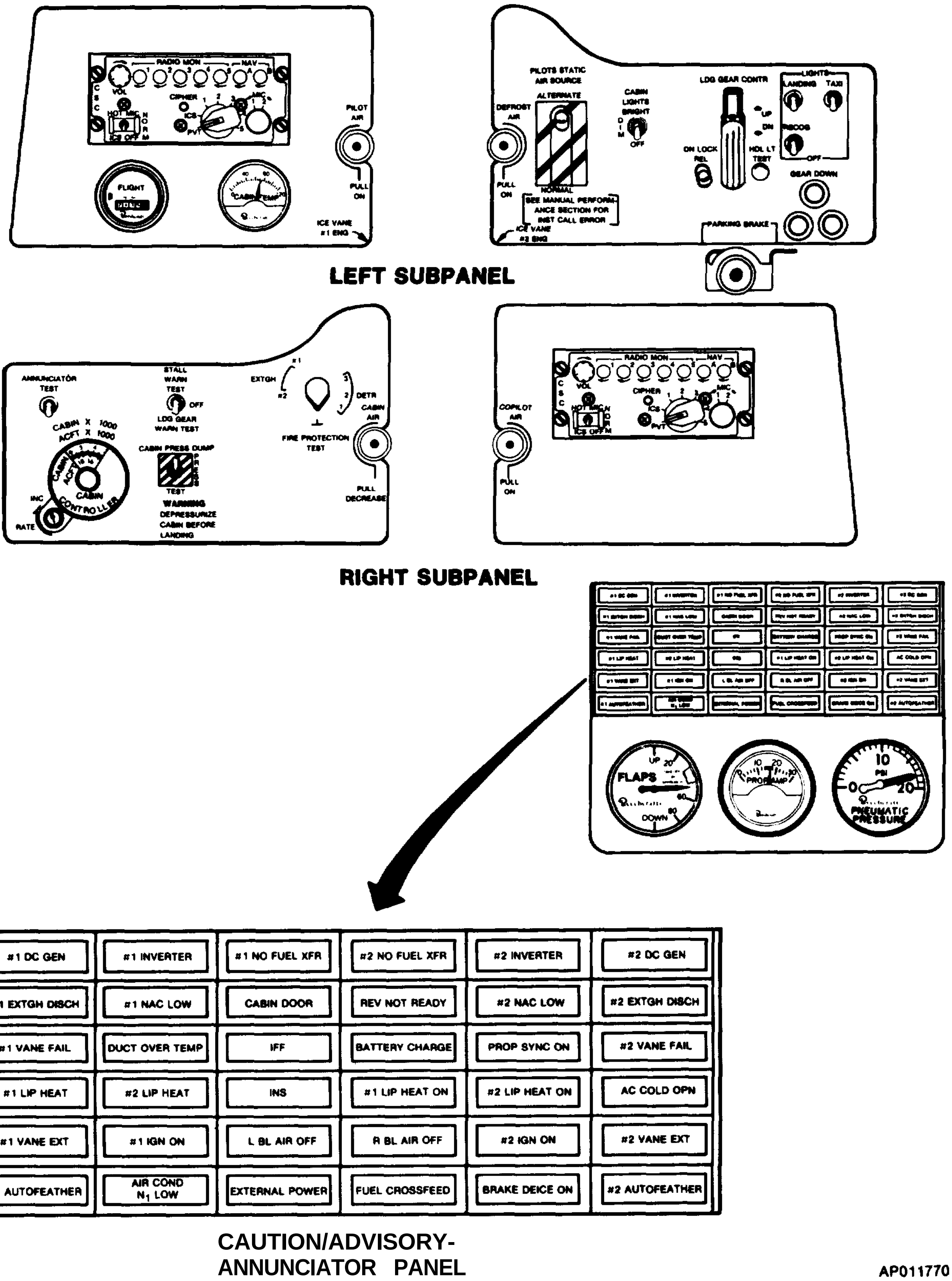


Figure 2-6. Subpanels

a. Landing Gear Down Position-Indicator Lights. Landing gear down position is indicated by three green lights on the left subpanel, placarded GEAR DOWN. These lights may be checked by operating the ANNUNCIATOR TEST switch. The circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR IND, on the overhead circuit breaker panel (fig. 2-26).

b. Landing Gear Position Warning Lights. Two red bulbs, wired in parallel and activated by microswitches independent of the GEAR DOWN position indicator lights, are positioned inside the clear plastic grip on the landing gear control switch. These lights illuminate whenever the landing gear switch is in either the UP or DN position and the gear is in transit. Both bulbs will also illuminate should either or both power levers be retarded below approximately 79 to 81% N_1 when the landing gear is not down and locked. To turn the switch lights OFF during single-engine operation, the power lever for the inoperative engine must be advanced to a position which is higher than the setting of the warning horn microswitch. Extending the landing gear will also turn the lights off. Both red lights indicate the same warning conditions, but two are provided for a fail-safe indication in the event one bulb burns out. The circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR IND, on the overhead circuit breaker panel (fig. 2-26).

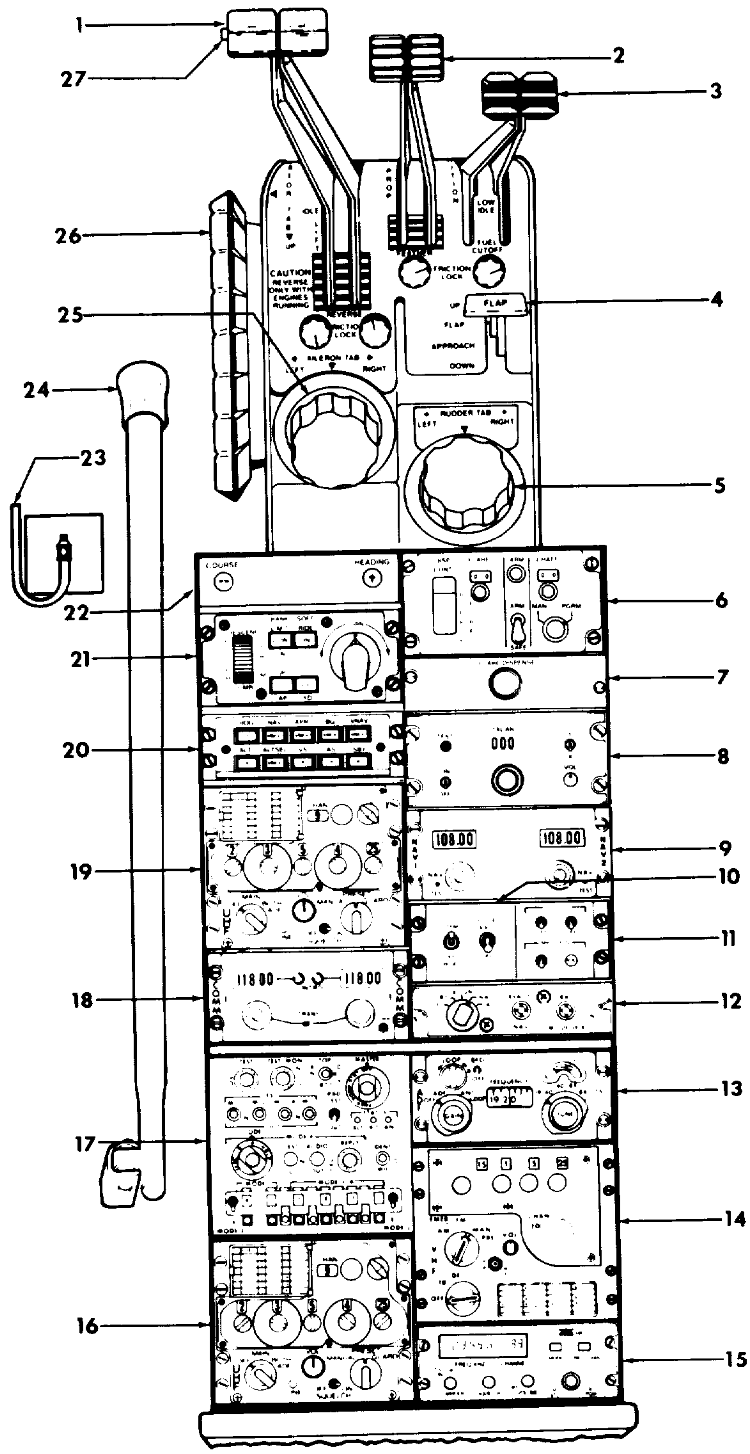
c. Landing Gear Warning Light Test Button. A test button, placarded HDL LT TEST, is located on the left subpanel. Failure of the landing gear switch to illuminate red, when this test button is pressed, indicates two defective bulbs or a circuit fault. The circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR RELAY CONTROL, on the overhead circuit breaker panel (fig. 2-26).

d. Landing Gear Warning Horn. When either power lever is retarded below approximately 79 to 81 N, when the landing gear is not down and locked or if the flaps are extended beyond 40% and the landing gear is not down and locked, a warning horn located in the overhead control panel will sound intermittently. To prevent the warning horn from sounding during long descents or an ILS approach, a pressure differential "Q" switch is connected into the copilot's static line. The switch prevents the warning horn from sounding until airspeed drops below 140 KIAS. An altitude sensing switch is installed in series with the 140 KIAS "Q" switch which prevents the warning horn from sounding after climbing through 12,500 feet MSL. The horn will be engaged when the aircraft descends through 10,500 MSL. The warning horn circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR WARN, on the overhead circuit breaker panel (fig. 2-26).

e. Landing Gear Warning Horn Test Switch. The landing gear warning horn may be tested by the test switch on the right subpanel (fig. 2-6). The switch, placarded STALL WARN TEST - OFF - LDG GEAR WARN TEST, will sound the landing gear warning horn and illuminate the landing gear position warning lights when moved to the momentary LDG GEAR WARN TEST position. The circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR WARN, on the overhead circuit breaker panel (fig. 2-26).

f. Landing Gear Safety Switches. A safety switch on each main landing gear shock strut controls the operation of various aircraft systems that function only during flight or only during ground operation. These switches are mechanically actuated whenever the main landing gear shock struts are extended (normally after takeoff), or compressed (normally after landing). The safety switch on the right main landing gear strut activates the landing gear control circuits, cabin pressurization circuits and the flight hour meter flight time function on the copilot's clock when the strut is extended. This switch also activates a down-lock hook, preventing the landing gear from being raised while the aircraft is on the ground. The hook, which unlocks automatically after takeoff, can be manually overridden by pressing down on the red button, placarded DN LOCK REL located adjacent to the landing gear switch. If the override is used and the landing gear control switch is raised, power will be supplied to the warning horn circuit and the horn will sound. The safety switch on the left main landing gear strut activates the left and right engine ambient air shutoff valves when the strut is extended.

g. Landing Gear Alternate Engage Handle. During manual landing gear extension, the landing gear motor must be disengaged from the landing gear drive mechanism. This is accomplished by a manually-operated clutch disengage lever (fig. 2-7) located adjacent to the landing gear alternate extension handle (fig. 2-7). To disengage the clutch, pull the alternate engage handle up and turn clockwise. To engage the clutch, turn the alternate engage handle counterclockwise and release.



1. Power levers
2. Propeller levers
3. Condition levers
4. FLAP cover
5. Rudder trim
6. Flare dispenser control panel
7. Flare dispenser switch
8. TACAN Control panel
9. NAV 1/NAV 2 control panel
10. Elev trim & rudder boost switches
11. Marker beacon audio control panel
12. Mode selector unit
13. ADF control panel
14. VHF AM/FM control panel
15. HF command set control panel (KHF-950)
16. No. 2 UHF command set
17. Transponder control panel
18. VHF AM control panel
19. No. 1 UHF command set
20. Flight director mode select panel (MS 500)
21. Autopilot pitch and turn control
22. No. 1 HSI course and heading knobs
23. Emergency landing gear alternate engage handle
24. Emergency landing gear extension ratchet handle
25. Aileron tab control and position indicator
26. Elevator tab control and position Indicator
27. Go-around button

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Figure 2-7. Control Pedestal

CAUTION

Continued pumping of handle after GEAR DOWN position indicator lights (3) are illuminated could damage the drive mechanism, and prevent subsequent gear retraction.

h. Landing Gear Alternate Extension Handle. Manual landing gear extension is provided through a manually powered system as a backup to the electrically operated system. Before manually extending the gear, make certain that the landing gear switch is in the down position with the LANDING GEAR RELAY circuit breaker pulled. Pulling up on the alternate engage handle, located on the floor, and turning it clockwise will lock it in that position. When the alternate engage handle is pulled, the motor is electrically disconnected from the system and the alternate drive system is locked to the gearbox and motor. When the alternate drive is locked in, the chain is driven by a continuous action ratchet which is activated by pumping the landing gear alternate extension handle adjacent to the alternate engage handle.

(1.) After a manual landing gear extension has been made, do not stow the handle, move any landing gear controls, or reset any switches or circuit breakers. The gear cannot be retracted manually.

(2.) After a practice manual extension, the alternate handle may be stowed and the landing gear retracted electrically. Rotate the alternate engage handle counterclockwise and push it down. Stow the handle, push in the LANDING GEAR RELAY circuit breaker on the overhead circuit breaker panel and retract the gear in the normal manner with the landing gear switch. Refer to Chapter 9 for emergency gear extension procedures.

i. Tires. The aircraft is equipped with dual 22 x 6.75 - 10 tubeless, 8-ply rated, rim-inflation tires on each main gear. The nose gear is equipped with a single 22 x 6.75 - 10, 8-ply rated, tubeless, rim-inflated tire.

j. Steerable Nose Wheel. The aircraft can be maneuvered on the ground by the steerable nose wheel system. Direct linkage from the rudder pedals (fig. 2-8) to the nose wheel steering linkage allows the nose wheel to be turned 12° to the left of center or 14° to the right. When rudder pedal steering is augmented by the main wheel braking action, the nose wheel can be deflected up to 48° either side of center. Shock loads which would normally be transmitted to the rudder pedals are absorbed by a spring mechanism in the steering linkage. Retraction of the landing gear automatically centers the nose wheel and disengages the steering linkage from the rudder pedals.

k. Wheel Brake System. The main wheels are equipped with multiple-disc hydraulic brakes actuated by master cylinders attached to the rudder pedals at the pilot's and copilot's position. Braking is permitted from either set of rudder pedals. Brake fluid is supplied to the system from the reservoir in the nose compartment. The toe brake sections of the rudder pedals are connected to the master cylinders which actuate the system for the corresponding wheels. No emergency brake system is provided. Repeated and excessive application of brakes, without allowing sufficient time for cooling to accumulate between applications, will cause a loss of braking efficiency, possible failure of brake or wheel structure, possible blowout of tires, and in extreme cases may cause the wheel and brake assembly to be destroyed by fire.

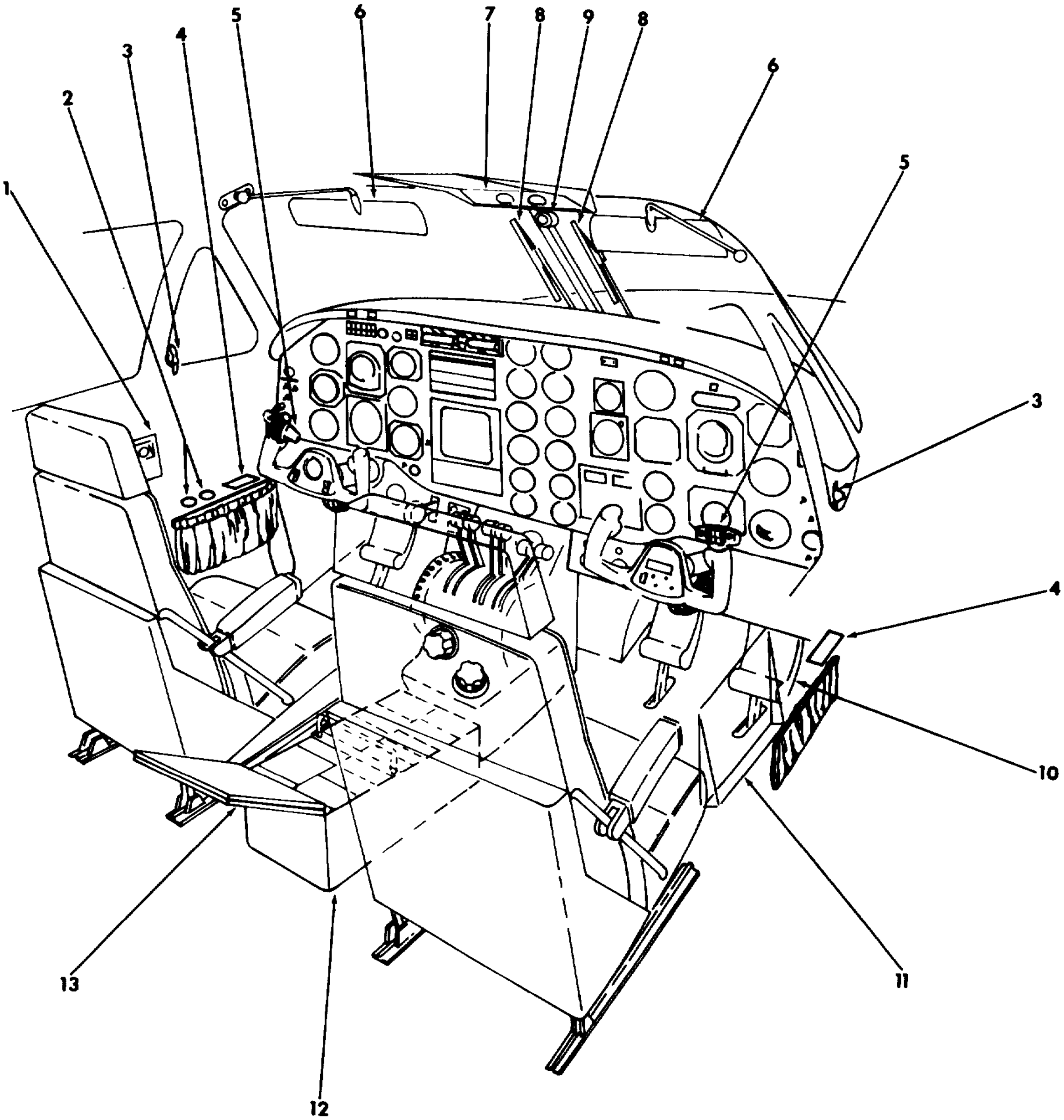
2-8. PARKING BRAKE.

Dual parking brake valves are installed below the cockpit floor. Both valves can be closed simultaneously by pressing both brake pedals to build up pressure, then pulling out the handle placarded PARKING BRAKE, on the left subpanel. Pulling the handle full out sets the check valves in the system and any pressure being applied by the toe brakes is maintained. Parking brakes are released when the brake handle is pushed in. The parking brake may be set from either cockpit position. Parking brakes shall not be set during flight.

2-9. ENTRANCE AND EXIT PROVISIONS.

NOTE

Two keys are provided in the loose tools and equipment bag. Both keys will fit the locks on the cabin door, emergency hatch, tailcone access door and the right and left nose avionics compartment doors.



1. Free air temperature gage
2. Oxygen system pressure gages
3. Storm window lock
4. Oxygen regulator control panel
5. Control wheel
6. Sun visor
7. Overhead circuit breaker and control panel
8. Windshield wiper
9. Magnetic compass
10. Rudder pedals
11. Mission control panel
12. Pedestal extension
13. Assist step

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Figure 2-8. Cockpit

a. Cabin Door.

CAUTION

Structural damage may be caused if more than one person is on the cabin door at a time. The door is weight limited to 300 pounds or less.

A swing-down door (fig. 2-9), hinged at the bottom, provides a stairway for normal and emergency entrance and exit. Two of the steps are movable and fold flat against the door in the closed position. A step folds down over the door sill when the door opens to provide a platform (step) for door seal protection. A plastic encased cable provides support for the door in the open position, a handhold, and a convenience for closing the door from inside. A hydraulic damper permits the door to lower gradually during opening. A rubber seal around the door seals the pressure vessel while the aircraft is in flight. The door locking mechanism is operated by either of the two mechanically interconnected handles, one inside and the other outside the door. When either handle is rotated, three rotating cam-type latches on either side of the door capture posts mounted on the cargo door. In the closed position, the door becomes an integral part of the cargo door. A button adjacent to the door handle must be depressed before the handle can be rotated to open the door. A bellows behind the button is inflated when the aircraft is pressurized to prevent accidental unlatching and/or opening of the door. A small round window just above the second step permits observation of the pressurization safety bellows. A placard adjacent to the window instructs the operator that the safety lock arm is in position around the bellows shaft which indicates a properly locked door. Pushing the red button adjacent to the window will illuminate the inside door mechanism. A CABIN DOOR annunciator light on the caution/advisory panel will illuminate if the door is not closed and all latches fully locked. The cabin door opening is 21.5 inches wide by 50.0 inches high.

b. Cargo Door. A swing-up door (fig. 2-9) hinged at the top, provides cabin access for loading cargo or bulky items. After initial opening force is applied, gas springs will completely open the cargo door automatically. The door is counterbalanced and will remain in the open position. A door support rod is used to hold the door in the open position, and to aid in overcoming the pressure of the gas spring assemblies when closing the door. Once closed, the gas springs apply a closing force to assist in latching the door. A rubber seal around the door seals the pressure vessel while in flight. The door locking mechanism is operated only from inside the aircraft, and is operated by two handles, one in the bottom forward portion of the door and the other in the upper aft portion of the door. When the upper aft handle is operated per placard instructions, two rotating cam-type latches on the forward side of the door and two on the aft side rotate, capturing posts mounted on the fuselage side of the door opening. The bottom handle, when operated per placard instructions, actuates four pin lug latches across the bottom of the door. A button on the upper aft handle must be pressed before the handle can be released to open or latch the door. A latching lever on the bottom handle must be lifted to release the handle before the lower latches can be opened. These act as additional aids in preventing accidental opening or unlatching of the door. The cabin and cargo doors are equipped with dual sensing circuits to provide the crew remote indication of cabin/cargo door security. An annunciator light placarded CABIN DOOR will illuminate if the cabin or cargo door is open and the BATT switch in ON. If the battery switch is OFF, the annunciator will illuminate only if the cargo door is not securely closed and latched. The cargo door sensing circuit receives power from the hot battery bus. The cargo door opening is 52.0 inches wide by 52.0 inches high.

CAUTION

Insure that the cabin door is closed and locked. Operating the cargo door while the cabin door is open may damage the door hinge and adjacent structure.

(1.) Opening cargo door.

CAUTION

Avoid side loading of the gas springs to prevent damage to the mechanism.

1. Handle access door (lower forward corner of door) -Unfasten and open.
2. Handle - Lift hook and move to OPEN position.
3. Handle access door - Secure.
4. Handle access door (upper aft corner of door) - Unfasten and open.
5. Handle - Press button and lift to OPEN position then latch in place.

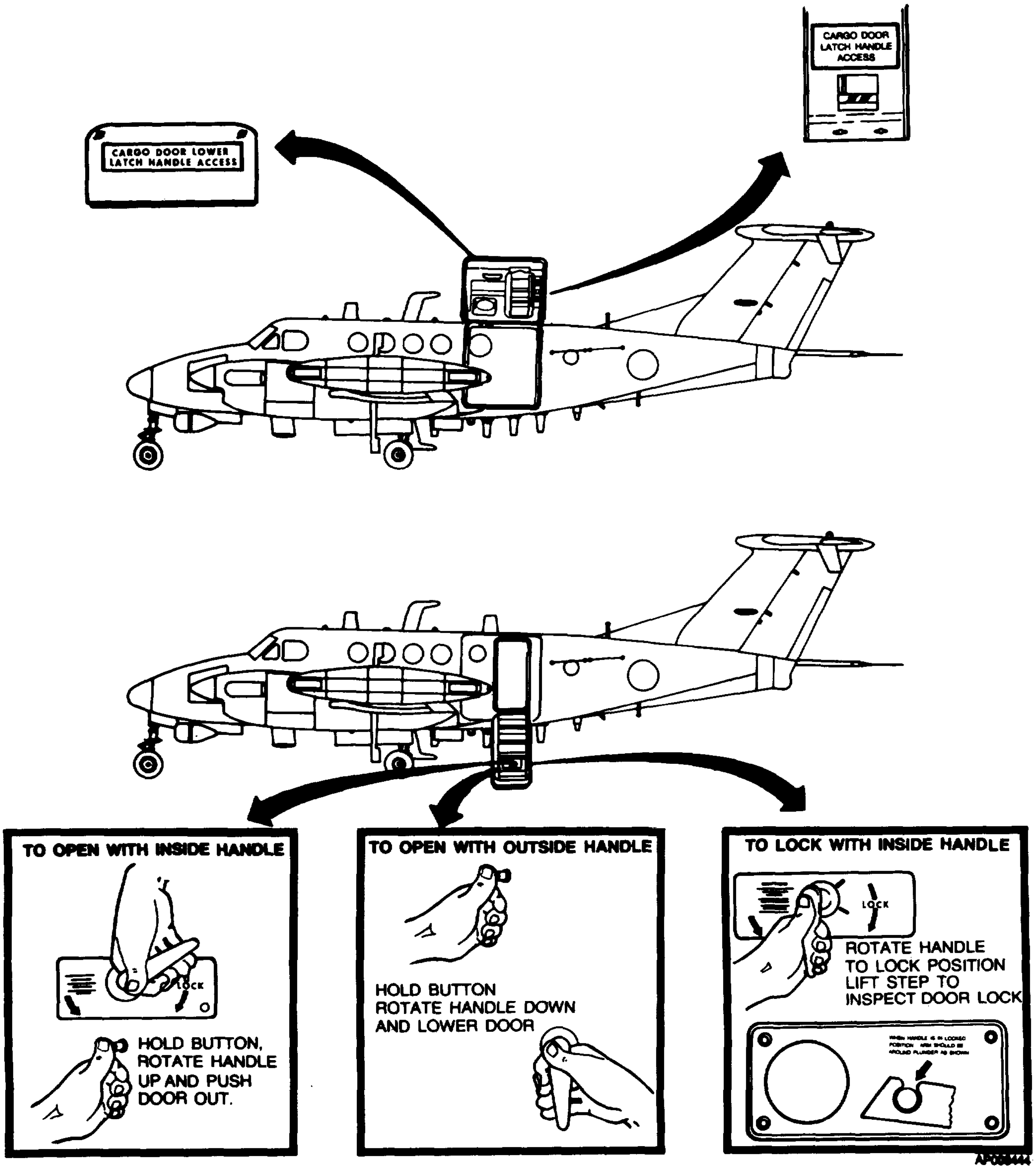


Figure 2-9. Cabin and Cargo Doors

6. Handle access door - Secure.
7. Door support rod - Attach one end to cargo door ball stud (on forward side of door).
8. Support rod detent pin - Check in place.
9. Cabin door sill step - Push out on and allow cargo door to swing open. Gas springs will automatically open the door.
10. Door support rod - Attach free end to ball stud on forward fuselage door frame.

(2.) Closing cargo door.

CAUTION

Avoid side loading of the gas springs to prevent damage to the mechanism.

1. Door support rod - Detach from fuselage door frame ball stud, then firmly grasp free end of rod while exerting downward force to overcome the pressure of gas spring assemblies. Then remove support rod from door as gas spring assemblies pass over-center position.
2. Cargo door - Pull closed, using finger hold cavity in fixed cabin door step.
3. Handle access door (upper aft corner of door) - Unfasten and open.
4. Handle - Press button and pull handle down until it latches in closed position.
5. Handle access door - Secure.
6. Handle access door (lower forward comer of door) -Unfasten and open.
7. Handle - Move to full forward position.
8. Safety hook - Check locked in position by pulling aft on handle.
9. Handle access door - Secure.

c. Cabin Emergency Hatch. The cabin emergency hatch, placarded EXIT - PULL, is located on the right cabin sidewall just aft of the copilot's seat. The hatch may be released, from the inside with a pull-down handle. A flush mounted pull out handle allows the hatch to be released from the outside. The hatch is of the non-hinged plug type, which removes completely from the frame when the latches are released. The hatch can be key locked from the inside, to prevent opening from the outside. The inside handle will unlatch the hatch whether or not it is locked, by overriding the locking mechanism. The keylock should be unlocked prior to flight to allow removal of the hatch from the outside in the event of an emergency. The key remains in the lock when the hatch is locked and can be removed only when the hatch is unlocked. The key slot is in the vertical position when the hatch is unlocked. Removal of the key from the lock before flight assures the pilot that the hatch can be removed from the outside if necessary.

d. Cabin Door Caution Light. As a safety precaution, two illuminated MASTER CAUTION lights, on the glare shield and a steadily illuminated CABIN DOOR yellow caution annunciator light on the caution/advisory panel indicate the cabin door is not closed and locked. This circuit is protected by 5-ampere circuit breakers placarded ANN PWR and ANN IND, located on the overhead circuit breaker panel (fig. 2-26).

2-10. WINDOWS.

a. Cockpit Window. The pilot and copilot have side windows, a windshield and storm windows, which provide visibility from the cockpit. The storm windows may be opened on the ground or during unpressurized flight.

b. Cabin Windows. The outer cabin windows have two-ply construction, are of the pressure type and are integral parts of the pressure vessel. All cabin windows are painted over except for the window farthest aft on the right side and the window farthest aft on the left side. All unpainted windows have flaps which may be raised to permit visibility or lowered to black out the windows.

2-11. SEATS.

a. Pilot and Copilot Seats. The pilot and copilot seats (fig. 2-10) are separated from the cabin by movable curtains. The controls for vertical height adjustment and fore and aft travel are located under each seat. The forward and aft adjustment handle is located beneath the bottom front inboard corner of each seat. Pulling up on the handle allows the seat to move fore or aft. The height adjustment handle is located beneath the bottom front outboard corner of each seat. Pulling up on the handle, allows the seat

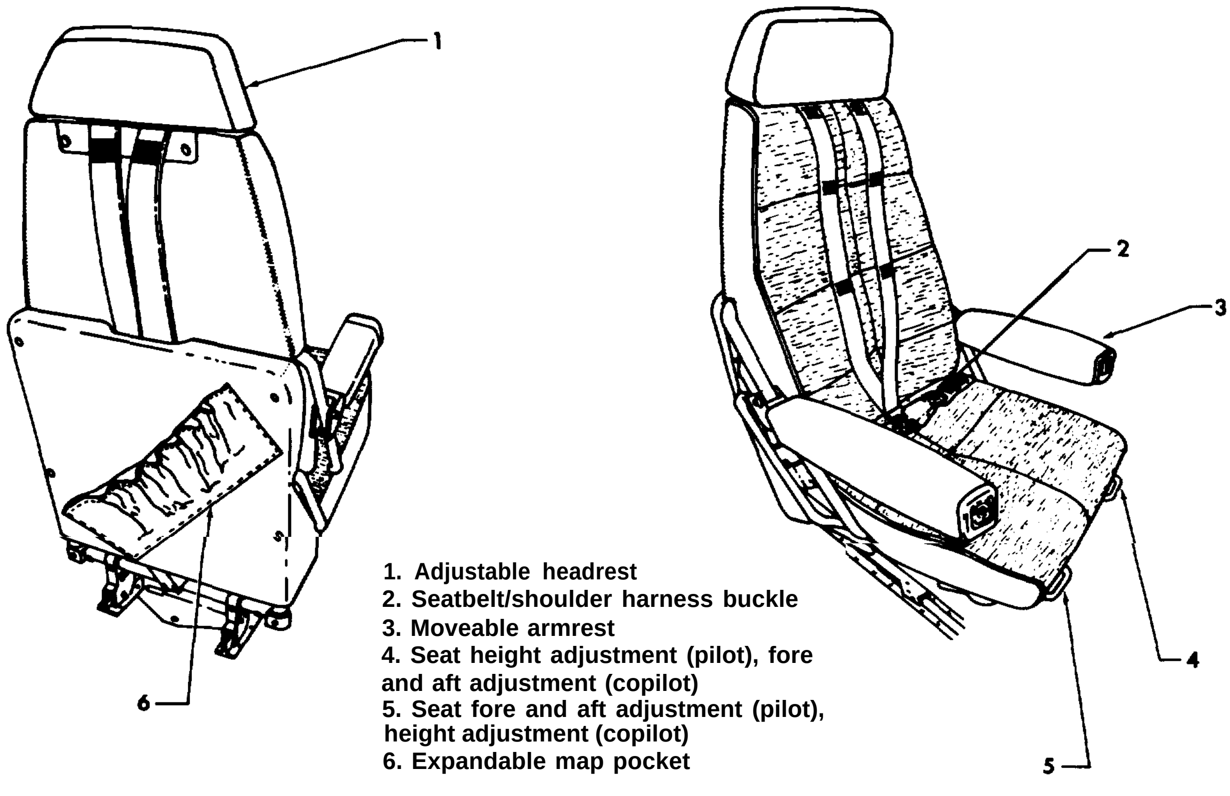


Figure 2-10. Pilot and Copilot Seats

to move up and down. Both seats have adjustable headrests and armrests which will raise and lower for access to the cockpit. Handholds on either side of the overhead panels and a fold-away protective pedestal step are provided for pilot and copilot entry into the cockpit. For the storage of maps and the operator's manual, pilot and copilot seats have an inboard-slanted, expandable pocket affixed to the lower portion of the seat back. Pocket openings are held closed by shock cord tension.

b. Pilot and Copilot Seat Belts and Shoulder Harnesses. Each pilot and copilot seat is equipped with a lap-type seat belt and shoulder harness connected to an inertia reel. The shoulder harness belt is of the "Y" configuration with the single strap being contained in an inertia reel attached to the base of the seatback. The two straps are worn with one strap over each shoulder and fastened by metal loops into the seat belt buckle. The spring loading at the inertia reel keeps the harness snug but will allow normal movement required during flight operations. The inertia reel is designed with a locking device that will secure the harness in the event of sudden forward movement or an impact action.

Section II. EMERGENCY EQUIPMENT

2-12. DESCRIPTION.

The equipment covered in this section includes all emergency equipment, except that which forms part of a complete system. For example, landing gear system, etc. Chapter 9 describes the operation of emergency exits and location of all emergency equipment.

2-13. FIRST AID KITS.

Four first aid kits are included in the survival kit.

2-14. HAND-OPERATED FIRE EXTINGUISHER.

WARNING

Repeated or prolonged exposure to high concentrations of monobromotrifluoromethane (CF_3Br) or decomposition products should be avoided. The liquid shall not be allowed to come into contact with the skin, as it may cause frost bite or low temperature burns because of its very low boiling point.

One hand-operated fire extinguisher is mounted below the pilot's seat and a second extinguisher is located on the left cabin sidewall, aft of the cabin door. They are of the monobromotrifluromethane (CF_3Br) type. The extinguisher is charged to a pressure of 150 to 170 PSI and emits a forceful stream. Use an extinguisher with care within the limited area of the cabin to avoid severe splashing.

NOTE

Engine tire extinguisher systems are described in Section III.

2-15. SURVIVAL KITS.

Tie-down provisions for a survival raft and kit are provided just forward of the toilet on the right hand side of the cabin (fig. 2-2).

Section III. ENGINES AND RELATED SYSTEMS

2-16. ENGINES.

The aircraft is powered by two PT6A-41 turboprop engines (fig. 2-11). The engine has a three stage axial, single stage centrifugal compressor, driven by a single stage reaction turbine. The power turbine, a two stage reaction turbine, counter-rotating with the compressor turbine, drives the output shaft. Both the compressor turbine and the power turbine are located in the approximate center of the engine with their shafts extending in opposite directions. Being a reverse flow engine, the ram air supply enters the lower portion of the nacelle and is drawn in through the aft protective screens. The air is then routed into the compressor. After it is compressed, it is forced into the annular combustion chamber, and mixed with fuel that is sprayed in through 14 nozzles mounted around the gas generator case. A capacitance discharge ignition unit and two spark igniter plugs are used to start combustion. After combustion, the exhaust passes through the compressor turbine and two stages of power turbine then is routed through two exhaust ports near the front of the engine. A pneumatic fuel control system schedules fuel flow to maintain the power set by the gas generator power lever. The accessory drive at the aft end of the engine provides power to drive the fuel pumps, fuel control, the oil pumps, the refrigerant compressor (right engine), the starter-generator, and the turbine tachometer transmitter. The reduction gearbox forward of the power turbine provides gearing for the propeller and drives the propeller tachometer transmitter, the propeller overspeed governor, and the propeller governor.

2-17. ENGINE COMPARTMENT COOLING.

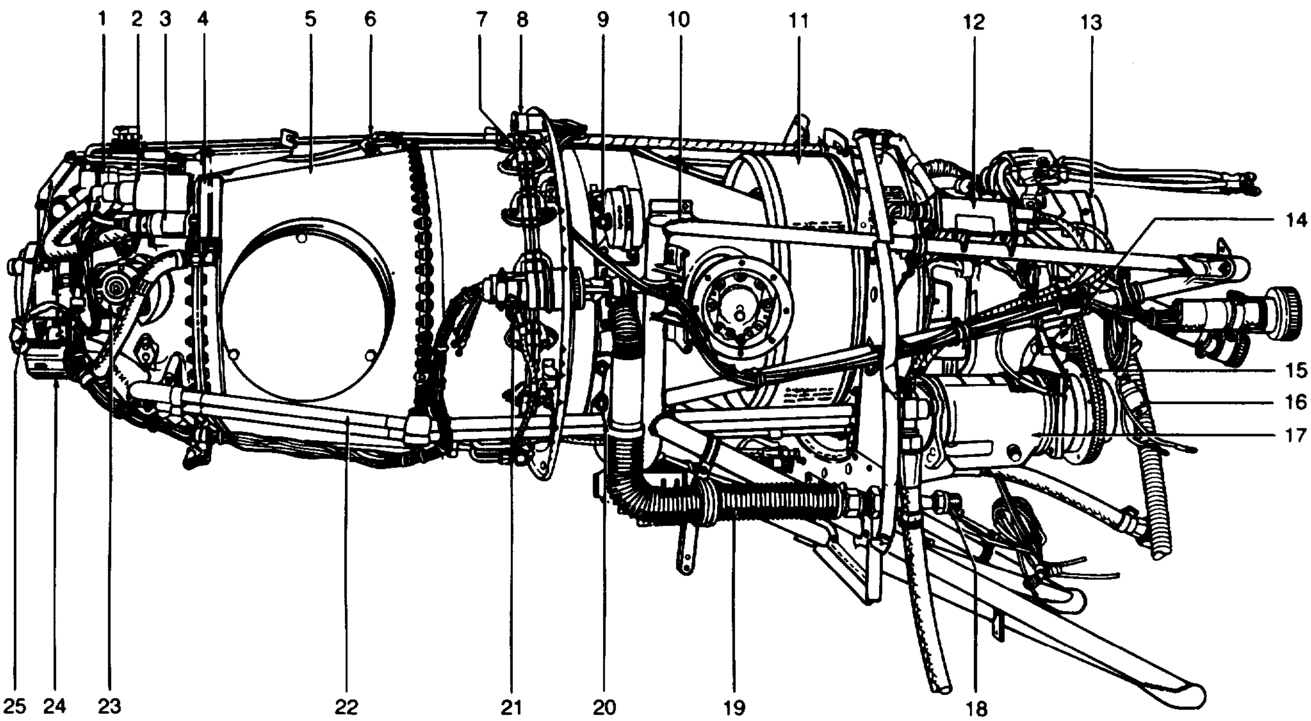
The forward engine compartment including the accessory section is cooled by air entering around the exhaust stack cutouts, the gap between the propeller spinner and forward cowling, and exhausting through ducts in the upper and lower aft cowling.

2-18. AIR INDUCTION SYSTEMS - GENERAL.

Each engine and oil cooler receives ram air ducted from an air scoop located within the lower section of the forward nacelle. Special components of the engine induction system protect the power plant from icing and foreign object damage.

2-19. FOREIGN OBJECT DAMAGE CONTROL.

The engine has an integral air inlet screen designed to obstruct objects large enough to damage the compressor.



1. Primary prop governor
2. Torque pressure transmitter
3. Torque pressure switch
4. Torque pressure manifold
5. Exhaust duct
6. TGT temperature probe
7. Fuel flow divider manifold
8. Fire detector
9. Engine mount bolt
10. Engine mount truss assembly
11. Engine air intake screen
12. Ignition exciter
13. Starter-generator
14. Fuel boost pump
15. Air conditioner compressor drive belt (#2 engine only)
16. Fire detector
17. Air conditioner compressor (#2 engine only)
18. Bleed air adapter
19. Bleed air line
20. Engine mount
21. Ignition exciter plug
22. Oil scavenge tubes
23. Overspeed governor
24. Prop deice brush block bracket
25. Prop reverse linkage lever

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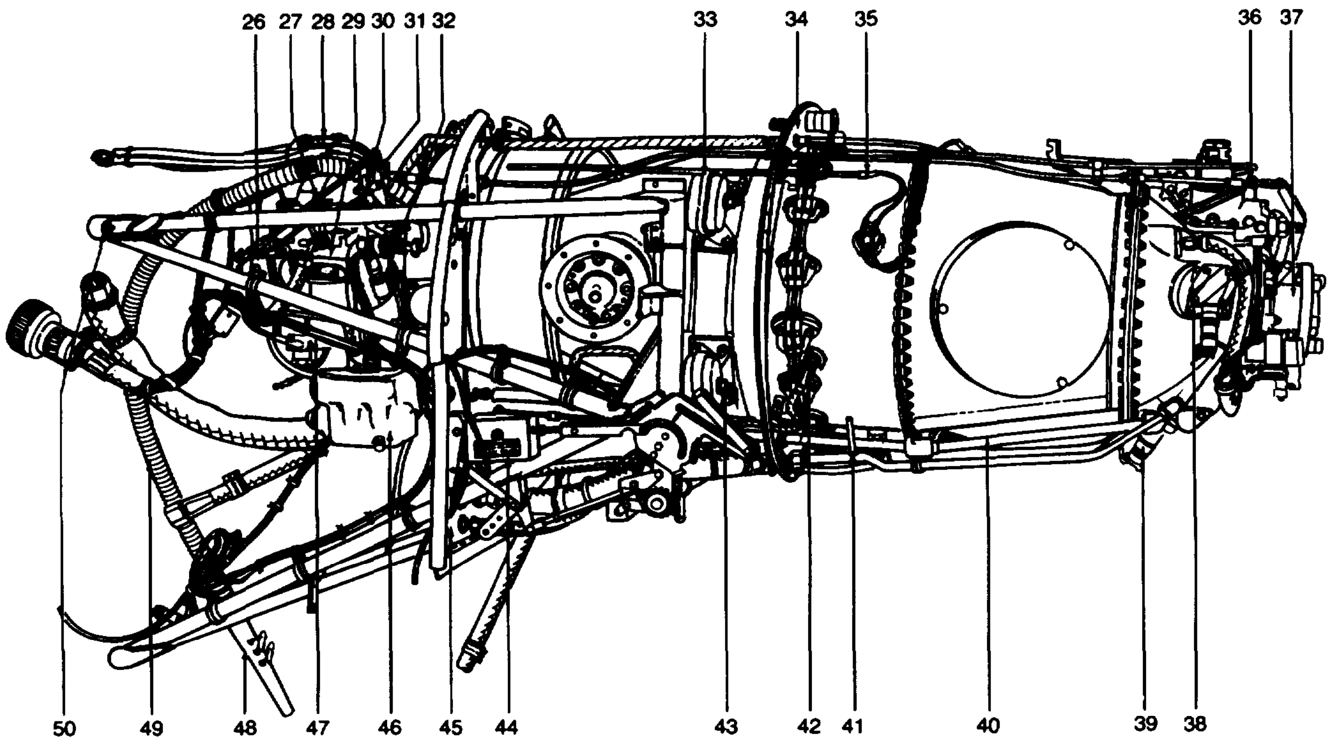
Figure 2-11. PT6A-41 Engine (Sheet 1 of 2)



26. Fuel control unit
27. Fuel control unit control rod
28. Starter generator leads
29. Engine driven fuel pump
30. Power control lever
31. Prop interconnect linkage (aft)
32. Oil pressure transducer
33. Engine mount
34. Fireshield
35. Trim resistor thermocouple
36. Prop interconnect linkage (fore)
37. Prop shaft
38. Tach generator
39. Chip detector
40. Oil pressure tube
41. Fire extinguisher line
42. Ignition exciter plug
43. Engine mount bolt
44. Linear actuator
45. Engine baffle and seal assy
46. Fuel/oil heater
47. Tach-generator (aft)
48. Drain manifold
49. Overhead breather tube
60. Engine truss mounting bolt

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Figure 2-11. PT6A-41 Engine (Sheet 2 of 2)

2-20. ENGINE ICE PROTECTION SYSTEMS.

a. Inertial Separator.

CAUTION

> After the ice vanes have been manually extended, they may be mechanically actuated only. No electrical extension or retraction shall be attempted as damage to the actuator may result. Linkage in the nacelle area must be reset prior to operation of the electric system.

An inertial separation system is built into each engine air inlet to prevent moisture particles from entering the engine inlet plenum under icing conditions. A movable vane and a bypass door are lowered into the airstream when operating in visible moisture at 5°C or colder, by energizing electrical actuators with the switches, placarded ICE VANE - RETRACT - EXTEND, located on the overhead control panel. A mechanical backup system is provided, and is actuated by pulling the T-handles just below the pilot's subpanel placarded ICE VANE - No. 1 ENG - No. 2 ENG. Decrease airspeed to 160 knots or less to reduce forces for manual extension. Normal airspeed may then be resumed.

(1.) The vane deflects the ram airstream slightly downward to introduce a sudden turn in the airstream to the engine, causing the moisture particles to continue on undeflected, because of their greater momentum, and to be discharged overboard.

(2.) While in the icing flight mode, the extended position of the vane and bypass door is indicated by green annunciator lights, No. 1 VANE EXT and No. 2 VANE EXT.

(3.) In the non-ice protection mode, the vane and bypass door are retracted out of the airstream by placing the ice vane switches in the RETRACT position. The green annunciator lights will extinguish. To assure adequate oil cooling, retraction should be accomplished at 15°C and above. The vanes should be either extended or retracted; there are no intermediate positions.

(4.) If for any reason the vane does not attain the selected position within 15 seconds, a yellow No. 1 VANE FAIL or No. 2 VANE FAIL light illuminates on the caution/advisory panel. In this event, the manual backup system should be used. When the vane is successfully positioned with the manual system, the yellow annunciator lights will extinguish. During manual system use, the electric motor switch position must match the manual handle position for a correct annunciator readout.

b. Engine Air Inlet Deice System.

(1.) Description. Hot engine exhaust gas is utilized for heating the air inlet lips to prevent the formation of ice. Hot exhaust gas is picked up inside each engine exhaust stack and carried by plumbing to the inlet lip. The gas flows through the inside of the lip to the bottom where it is allowed to escape.

(2.) Fuel heater. An oil-to-fuel heat exchanger, located on the engine accessory case, operates continuously and automatically to heat the fuel sufficiently to prevent ice from collecting in the fuel control unit. Each fuel control unit is protected against ice. Fuel control heat is automatically turned on for all engine operations.

2-21. ENGINE FUEL CONTROL SYSTEM.

a. Description. The basic engine fuel system consists of an engine driven fuel pump, a fuel control unit, a fuel flow divider, a dual fuel manifold and fourteen fuel nozzles. The fuel flow divider acts as a drain valve to clear residual fuel after engine shutdown.

b. Fuel Control Unit. One fuel control unit is mounted on the accessory case of each engine. This unit is a hydro-pneumatic metering device which determines the proper fuel schedule for the engine to produce the amount of power requested by the relative position of its power lever. The control of developed engine power is accomplished by adjusting the engine compressor turbine (N_1) speed. N_1 speed is controlled by varying the amount of fuel injected into the combustion chamber through the fuel nozzles. Engine shutdown is accomplished by moving the appropriate condition lever to the full aft FUEL CUTOFF position, which shuts off the fuel supply.

2-22. POWER LEVERS.

CAUTION

> Moving the power levers into reverse range without the engines running may result in damage to the reverse linkage mechanism.

Two power levers are located on the control pedestal (fig. 2-7). These levers regulate power in the reverse, idle, and forward range, and operate so that forward movement increases engine power. Power control is accomplished through adjustment of the N_1 speed governor in the fuel control unit. Power is increased when N_1 RPM is increased. The power levers also control propeller reverse pitch. Distinct movement (pulling up and then aft on the power lever) by the pilot is required for reverse thrust. Placarding beside the lever travel slots reads POWER. Upper lever travel range is designated INCR (increase), supplemented by an arrow pointing forward. Lower travel range is marked IDLE, LIFT and REVERSE. A placard below the lever slots reads: CAUTION REVERSE ONLY WITH ENGINES RUNNING.

2-23. CONDITION LEVERS.

Two condition levers are located on the control pedestal (fig. 2-7). Each lever starts and stops the fuel supply, and controls the idle speed for its engine. The levers have three placarded positions: FUEL CUTOFF, LO IDLE, and HIGH IDLE. In the FUEL CUTOFF position, the condition lever controls the cutoff function of its engine-mounted fuel control unit. From LO IDLE to HIGH IDLE, they control the governors of the fuel control units to establish minimum fuel flow levels. LO IDLE position sets the fuel flow rate to attain 52 to 55% (at sea level) minimum N_1 and HIGH IDLE position sets the rate to attain 70% minimum N_1. The power lever for the corresponding engine can select N_1 from the respective idle setting to maximum power. An increase in low idle N_1 will be experienced at high field elevation.

2-24. FRICTION LOCK KNOBS.

Four friction lock knobs (fig. 2-7) are located on the control pedestal to adjust friction drag. One knob is below the propeller levers, one below the condition levers, and two under the power levers. When a knob is rotated clockwise, friction restraint is increased opposing movement of the affected lever as set by the pilot. Counterclockwise rotation of a knob will decrease friction drag thus permitting free and easy lever movement. Two FRICTION LOCK placards are located on the pedestal adjacent to the knobs.

2-25. ENGINE FIRE DETECTION SYSTEM.

a. Description. A flame surveillance system is installed on each engine to detect external engine fire and provide alarm to the pilot. Both nacelles are monitored, each having a control amplifier and three detectors. Electrical wiring connects all sensors and control amplifiers to DC power and to the cockpit visual alarm units. In each nacelle, one detector monitors the forward nacelle, a second monitors the upper accessory area, and a third the lower accessory area. Fire emits an infrared radiation that will be sensed by the detector which monitors the area of origin. Radiation exposure activates the relay circuit of a control amplifier which causes signal power to be sent to cockpit warning systems. An activated surveillance system will return to the standby state after the fire is out. The system includes a functional test switch and has circuit protection through the FIRE DETR circuit breaker. Warning of internal nacelle fire is provided as follows: the red MASTER WARNING lights on the glareshield illuminate accompanied by the illumination of a red warning light in the appropriate fire control T-handle placarded No. 1 FIRE PULL or No. 2 FIRE PULL (fig. 2-29). Fire detector circuits are protected by a single 5-ampere circuit breaker, placarded FIRE DETR, located on the overhead circuit breaker panel (fig. 2-26).

b. Fire Detection System Test Switch. One rotary switch placarded FIRE PROTECTION TEST on the copilot's subpanel is provided to test the engine fire detection system. Before checkout, battery power must be on and the FIRE DETR circuit breaker must be in. Switch position DETR 1, checks the area forward of the air intake of each nacelle, including circuits to the cockpit alarm and indication devices. Switch position DETR 2, checks the circuits for the upper accessory compartment of each nacelle. Switch position DETR 3, checks the circuits for the lower accessory compartment of each nacelle. Each numbered switch position will initiate the cockpit indications previously described.

c. Erroneous Fire Detection System Indications. During ground test of the engine fire detection system, an erroneous indication of system fault may be encountered if an engine cowling is not closed properly, or if the aircraft is headed toward a strong external light source. In this circumstance, change the aircraft heading to enable a valid system check.

2-26. ENGINE FIRE EXTINGUISHER SYSTEM.

a. Description. The fire extinguisher system utilizes an explosive squib, connected to a valve which, when opened, allows the distribution of the pressurized extinguishing agent through a plumbing network of spray nozzles strategically located in the fire zones of the engines.

b. Fire Pull Handles. The tire control T-handles, which are used to arm the extinguisher system are centrally located on the pilot's instrument panel (fig. 2-29), immediately below the glareshield. These controls receive power from the hot battery bus. The fire detection system will indicate an engine fire by illuminating the master fault warning light on the pilot's and copilot's glareshield and the respective No. 1 FIRE PULL or No. 2 FIRE

PULL lights in the fire control T-handles. Pulling the fire control T-handle will electrically arm the extinguisher system and close the fuel firewall shut-off valve for that particular engine. This will cause the red light in the PUSH TO EXTINGUISH switch and the respective red No. 1 FUEL PRESS or No. 2 FUEL PRESS light on the warning annunciator panel to illuminate. Pressing the lens of the PUSH TO EXTINGUISH switch (after lifting one side of its spring-loaded clear plastic guard) will fire the squib, expelling all the agent in the cylinder at one time. The respective yellow caution light, No. 1 EXTGH DISCH or No. 2 EXTGH DISCH on the caution/advisory annunciator panel and the master fault caution lights on the glareshield will illuminate and remain illuminated, regardless of the master switch position, until the squib is replaced.

c. Fire Extinguisher System Test Switch. A rotary test switch, placarded FIRE PROTECTION TEST, is located on the copilot's subpanel. The test functions, placarded EXTGH - No. 1 - No. 2, are arranged on the left side of the switch and provide a test of the pyrotechnic cartridge circuitry. During preflight, the pilot should rotate the test switch through the two positions and verify the illumination of the green SQUIB OK light on the PUSH TO EXTINGUISH switch and the corresponding yellow No. 1 or No. 2 EXTGH DISCH light on the caution/advisory annunciator panel.

d. Fire Extinguishing System Supply Cylinder Gages. A gage, calibrated in PSI, is mounted on each supply cylinder for determining the level of charge and should be checked during preflight (Table 2-1).

2-27. OIL SUPPLY SYSTEM.

CAUTION

Maximum allowable oil consumption is one quart per 10 hours of engine operation.

a. The engine oil tank is integral with the air-inlet casting located forward of the accessory gearbox. Oil for propeller operation, lubrication of the reduction gearbox and engine bearings is supplied by an external line from the high pressure pump. Two scavenge lines return oil to the tank from the propeller reduction gearbox. A non-congealing external oil cooler keeps the engine oil temperature within the operating limits. The capacity of each engine oil tank is 2.3 U.S. gallons. The total system capacity for each engine, which includes the oil tank, oil cooler, lines, etc., is 3.5 U.S. gallons. The oil level is indicated by a dipstick attached to the oil filler cap. Oil grade, specification and servicing points, are described in Section IX, Servicing the warning annun.

b. The oil system of each engine is coupled to a heat exchanger unit (radiator) of tin-and-tube design. These exchanger units are the only airframe mounted part of the oil system and are attached to the nacelles below the engine air intake. Each heat exchanger incorporates a thermal bypass which assists in maintaining oil at the proper temperature range for engine operation.

2-28. ENGINE CHIP DETECTION SYSTEM.

A magnetic chip detector is installed in the bottom of each engine nose gearbox to warn the pilot of oil contamination and possible engine failure. The sensor is an electrically insulated gap immersed in the oil, functioning as a normally-open switch. If a large metal chip or a mass of small particles bridge the detector gap, a circuit is completed, sending a signal to illuminate a red annunciator panel indicator light placarded No. 1 CHIP DETR or No. 2 CHIP DETR and the MASTER WARNING lights. Chip detector circuits are protected by two 5-ampere circuit breakers, placarded No. 1 CHIP DETR and No. 2 CHIP DETR on the overhead circuit breaker panel (fig. 2-26).

2-29. ENGINE IGNITION SYSTEM.

a. Description. The basic ignition system consists of a solid state ignition exciter unit, two igniter plugs, two shielded ignition cables, pilot controlled IGNITION AND ENGINE START switches and the ENG AUTO IGN switch. Placing an IGNITION AND ENGINE START switch to ON (forward) will cause the respective igniter plugs to spark, igniting the fuel/air mixture sprayed into the combustion

Table 2-1. Engine Fire Extinguisher Gage Pressure

TEMP °C	-40	-29	-18	-06	04	16	27	38	48
PSI	190 to 240	220 to 275	250 to 315	290 to 365	340 to 420	390 to 480	455 to 550	525 to 635	605 to 730

chamber by the fuel nozzles. The ignition system is activated for ground and air starts, but is switched off after combustion light up.

b. Ignition and Engine Start Switches. Two three-position toggle switches, placarded IGNITION AND ENGINE START, are located on the overhead control panel (fig. 2-12). These switches will initiate starter motoring and ignition in the ON position, or will motor the engine in the STARTER ONLY position. The ON switch position completes the starter circuit for engine rotation, energizes the igniter plugs for fuel combustion, and activates the No. 1 IGN ON or No. 2 IGN ON light on the annunciator panel. In the center position the switch is OFF. Two 5-ampere circuit breakers on the overhead circuit breaker panel, placarded IGNITOR CONTR No. 1 and No. 2, protect ignition circuits. Two 5-ampere circuit breakers on the overhead circuit breaker panel, placarded START CONTR No. 1 and No. 2, protect starter control circuits (fig. 2-26).

2-30. AUTOIGNITION SYSTEM.

If armed, the autoignition system automatically provides combustion re-ignition of either engine should accidental flameout occur. The system is not essential to normal engine operation, but is used to reduce the possibility of power loss due to icing or other conditions. Each engine has a separate autoignition control switch and a green indicator light placarded No. 1 IGN ON or No. 2 IGN ON, on the annunciator panel. Autoignition is accomplished by energizing the two igniter plugs in each engine.

NOTE

The system should be turned OFF during extended ground operation to prolong the life of the igniter plugs.

a. Autoignition Switches. Two switches, located on the overhead control panel (fig. 2-12) placarded ENG AUTO IGN-ARM control the autoignition systems. The ARM position initiates a readiness mode for the autoignition system of the corresponding engine. The OFF position disarms the system. Each switch is protected by a corresponding START CONTR No. 1 or No. 2 5-ampere circuit breaker on the overhead circuit breaker panel (fig. 2-26).

b. Autoignition Lights. If an armed autoignition system changes from a ready condition to an operating condition (energizing the igniter plugs in the engine) a corresponding green annunciator panel light will illuminate. The annunciator panel light is placarded No. 1 IGN ON or No. 2 IGN ON and indi-

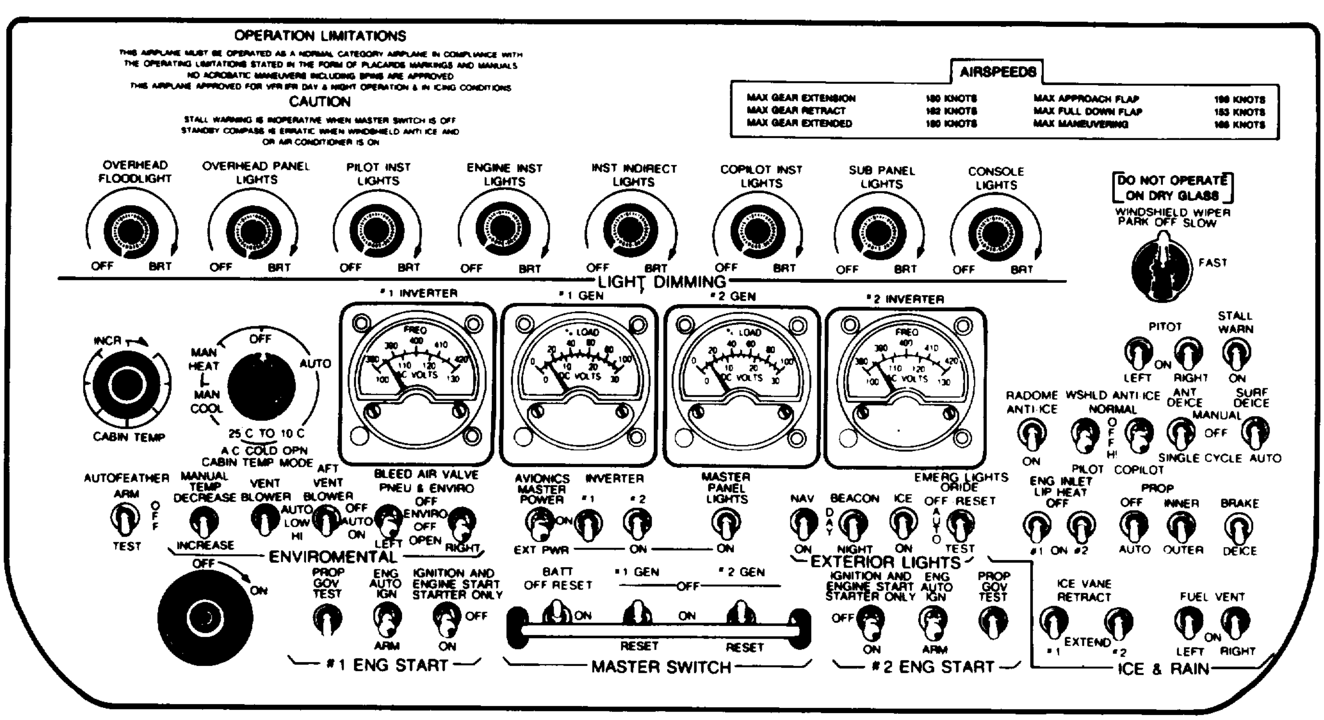

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Figure 2-12. Overhead Control Panel

cates that the igniters are energized. The autoignition system is triggered from a ready condition to an operating condition when engine torque drops below approximately 20%. Therefore, when an autoignition system is armed, the igniters will be energized continuously during the time when an engine is operating at a level below approximately 20% torque. The autoignition lights are protected by 5-ampere IGNITOR CONTR No. 1 or No. 2 circuit breakers, located on the overhead circuit breaker panel (fig. 2-26).

2-31. ENGINE STARTER-GENERATORS.

One starter-generator is mounted on each engine accessory drive section. Each is able to function either as a starter or as a generator. In the starter function, 28 volts DC is required to power rotation. In the generator function, each unit is capable of 400 amperes DC output. When the starting function is selected, the starter control circuit receives power through the respective 5-ampere START CONTR circuit breaker on the overhead circuit breaker panel from either the aircraft battery or an external power source. When the generating function is selected, the starter-generator provides electrical power. For additional description of the starter-generator system, refer to Section IX.

2-32. ENGINE INSTRUMENTS.

The engine instruments are vertically mounted near the center of the instrument panel (fig. 2-29).

a. Turbine Gas Temperature Indicators. Two TGT gages on the instrument panel are calibrated in degrees Celsius (fig. 2-29). Each gage is connected to thermocouple probes located in the hot gases between the turbine wheels. The gages register the temperature present between the compressor turbine and power turbine for the corresponding engine.

b. Engine Torquemeters. Two torquemeters on the instrument panel indicate torque applied to the propeller shafts of the respective engines (fig. 2-29). Each gage shows torque in percent of maximum using 2 percent graduations and is actuated by an electrical signal from a pressure sensing system located in the respective propeller reduction gear case. Torquemeters are protected by individual 0.5-ampere circuit breakers placarded TORQUE METER No. 1 or No. 2 on the overhead circuit breaker panel (fig. 2-26).

c. Turbine Tachometers. Two tachometers on the instrument panel register compressor turbine RPM (N_1) for the respective engine (fig. 2-29). These indicators register turbine RPM as a percentage of maximum gas generator RPM. Each instrument is slaved to a tachometer generator attached to the respective engine.

d. Oil Pressure/Oil Temperature Indicators. Two gages on the instrument panel register oil pressure in PSI and oil temperature in °C (fig. 2-29). Oil pressure is taken from the delivery side of the main oil pressure pump. Oil temperature is transmitted by a thermal sensor unit which senses the temperature of the oil as it leaves the delivery side of the oil pressure pump. Each gage is connected to pressure transmitters installed on the respective engine. Both instruments are protected by 5-ampere circuit breakers, placarded OIL PRESS and OIL TEMP No. 1 or No. 2, on the overhead circuit breaker panel (fig. 2-26).

e. Fuel Flow Indicators. Two gages on the instrument panel (fig. 2-29) register the rate of flow for consumed fuel as measured by sensing units coupled into the fuel supply lines of the respective engines. The fuel flow indicators are calibrated in increments of hundreds of pounds per hour. Both circuits are protected by 0.5-ampere circuit breakers placarded FUEL FLOW No. 1 or No. 2, on the overhead circuit breaker panel (fig. 2-26).

Section IV. FUEL SYSTEM

2-33. FUEL SUPPLY SYSTEM.

The engine fuel supply system (fig. 2-13) consists of two identical systems sharing a common fuel management panel (fig. 2-14) and fuel crossfeed plumbing (fig. 2-15). Each fuel system consists of five interconnected wing tanks, a nacelle tank, and an auxiliary inboard fuel tank. A fuel transfer pump is located within each auxiliary tank. Additionally, the system has an engine-driven boost pump, a standby fuel pump located within each nacelle tank, a fuel heater (engine oil-to-fuel heat exchanger unit), a tank vent system, a tank vent heating system and interconnecting wiring and plumbing. Refer to Section IX for fuel grades and specifications. Fuel tank capacity is shown in table 2-2. Gravity feed fuel flow is shown in figure 2-16.

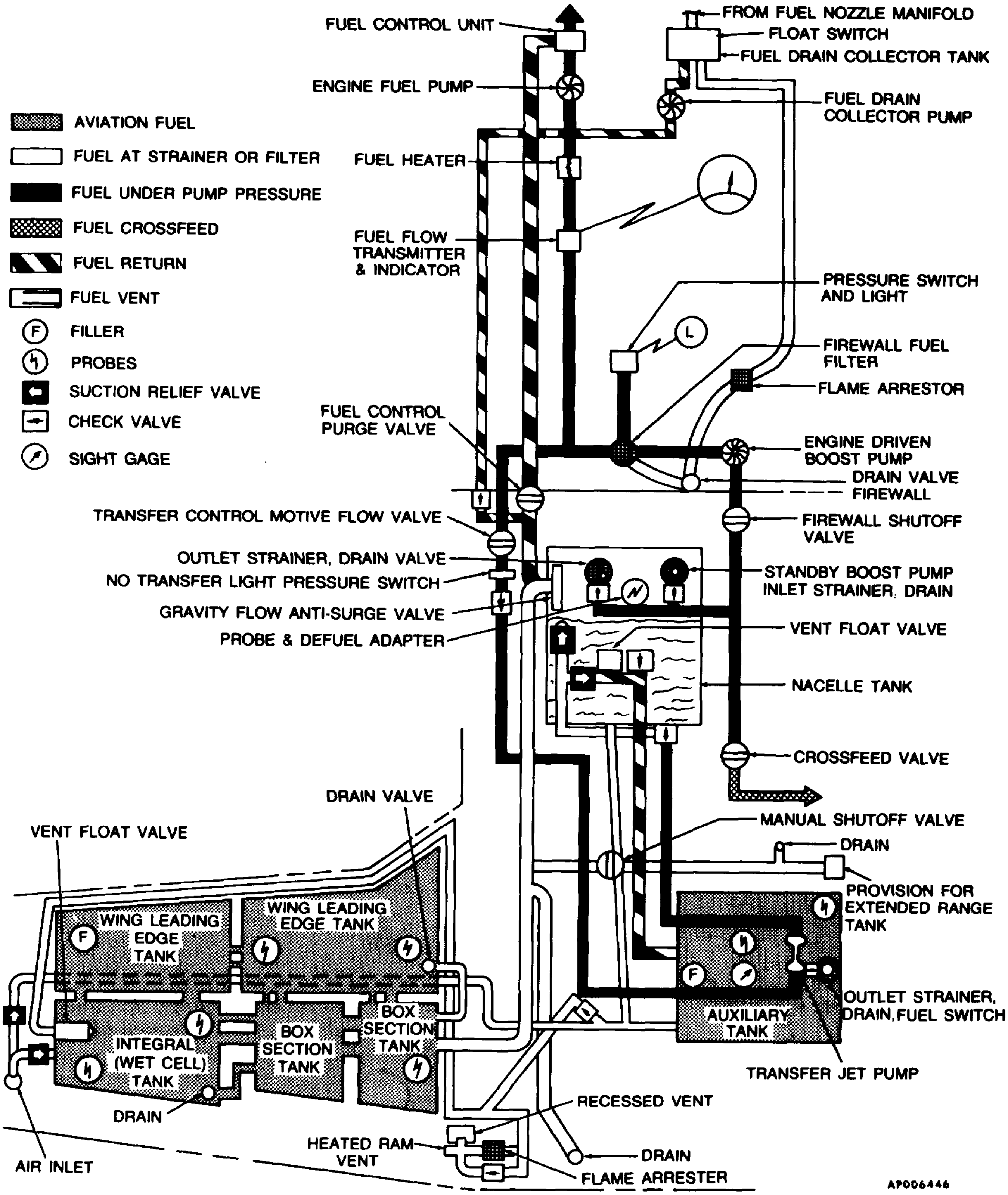
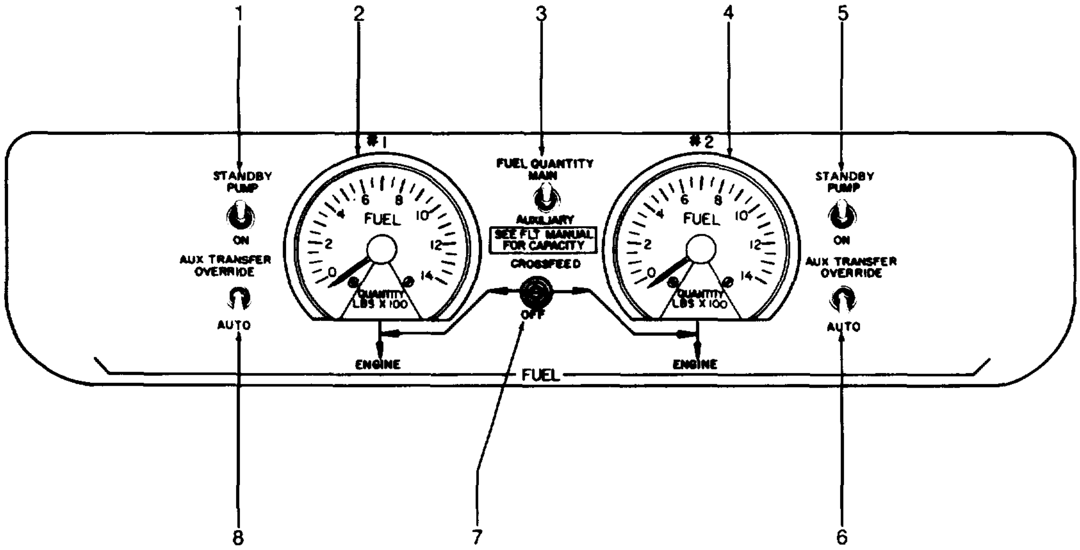


Figure 2-13. Fuel System Schematic



1. STANDBY PUMP switch (#1 engine)
2. FUEL quantity indicator (#1 engine)
3. FUEL QUANTITY gaging system control switch
4. FUEL quantity indicator (#2 engine)
5. STANDBY PUMP switch (#2 engine)
6. AUX TRANSFER OVERRIDE switch (#2 engine)
7. CROSSFEED valve switch
8. AUX TRANSFER OVERRIDE switch (#1 engine)

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Figure 2-14. Fuel Management Panel

a. Engine Driven Boost Pumps.

CAUTION

Engine operation using only the engine-driven primary (high pressure) fuel pump without standby pump or engine-driven boost pump fuel pressure is limited to 10 cumulative hours. This condition is indicated by illumination of either the No. 1 or No. 2 FUEL PRESS warning annunciator lights and the simultaneous illumination of both MASTER WARNING lights. Refer to Chapter 9. All time in this category shall be entered on DA Form 2408-13 for the attention of maintenance personnel.

A gear-driven boost pump, mounted on each engine supplies fuel under pressure to the inlet of the engine-driven primary high-pressure pump for engine starting and all normal operations. Either the engine-driven boost pump or standby pump is capable of supplying sufficient pressure to the engine-driven primary high-pressure pump and thus maintain normal engine operation.

b. Standby Fuel Pumps. A submerged, electrically-operated standby fuel pump, located within each nacelle tank, serves as a backup unit for the engine-driven boost pump. The standby pumps are switched off during normal system operations. A standby fuel pump will be operated during crossfeed operation to pump fuel from one system to the opposite engine. The correct pump is automatically selected when the CROSSFEED switch is activated. Each standby fuel pump has an inertia switch included in the power supply circuit. When subjected to a 5 to 6 G shock loading, as in a crash situation, the inertia switch will remove electrical power from the standby fuel pumps. The standby fuel pumps are protected by two 10-ampere circuit breakers placarded STANDBY PUMP No. 1 or No. 2, located the overhead circuit breaker panel (fig. 2-26) and four 5-ampere circuit breakers (2 each in parallel) on the hot battery bus.

c. Fuel Transfer Pumps. The auxiliary tank fuel transfer system automatically transfers the fuel from the auxiliary tank to the nacelle tank without pilot action. Motive flow to a jet pump mounted in the auxiliary tank sump is obtained from the engine fuel plumbing system downstream from the engine driven boost pump and routed through the transfer control motive flow valve. The motive flow valve is energized to the open position by the control system

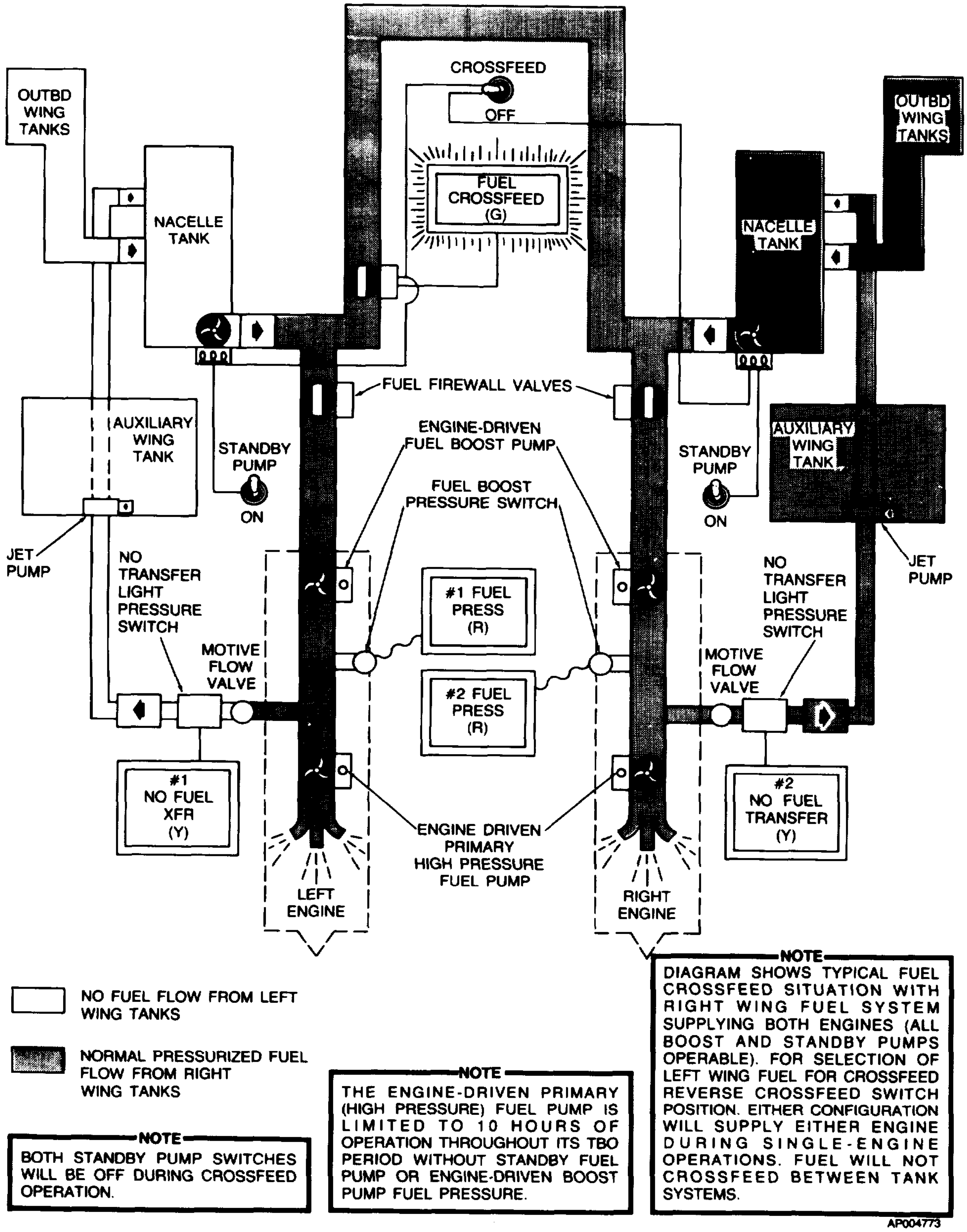
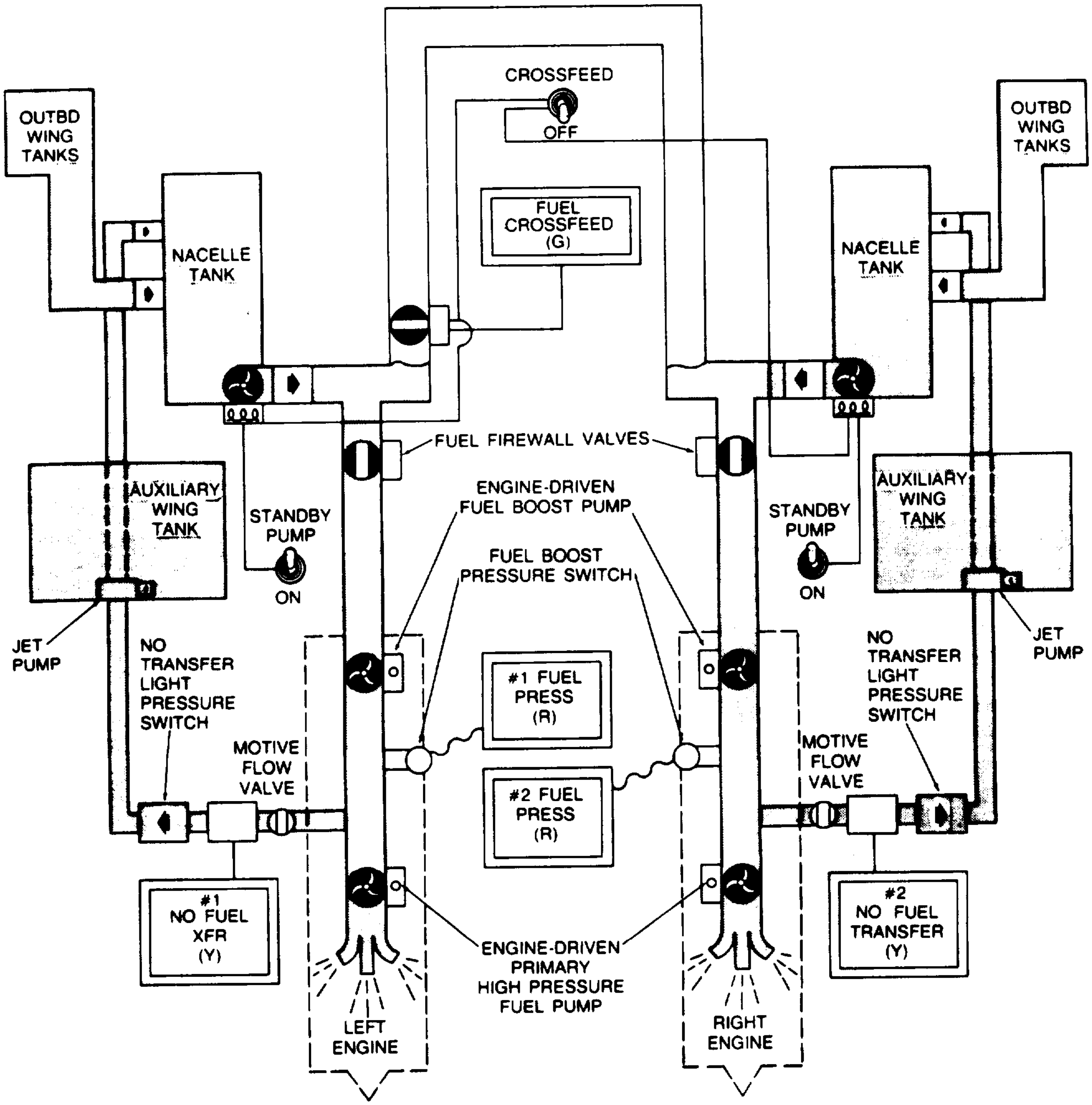


Figure 2-15. Crossfeed Fuel Flow



NOTE

IN THE EVENT THAT AN ENGINE DRIVEN BOOST PUMP FAILS, PRESSURE CAN BE MAINTAINED BY PLACING THE RESPECTIVE STANDBY PUMP SWITCH TO ON.

NOTE

THE ENGINE-DRIVEN PRIMARY (HIGH PRESSURE) FUEL PUMP IS LIMITED TO 10 HOURS OF OPERATION, THROUGHOUT ITS TBO PERIOD, WITHOUT STANDBY FUEL PUMP OR ENGINE-DRIVEN BOOST PUMP FUEL PRESSURE.

NOTE

THE SYSTEM WILL GRAVITY FEED FUEL ONLY TO ITS RESPECTIVE BOOST PUMP, I.E., LEFT OR RIGHT. FUEL WILL NOT GRAVITY FEED THROUGH THE CROSSFEED SYSTEM.

Figure 2-16. Gravity Feed Fuel Flow

Table 2-2. Fuel Quantity Data

	TANKS	NUMBER	GALLONS	**POUNDS
LEFT ENGINE	Wing Tanks	5	135	877.5
	Nacelle Tank	1	57	370.5
	Auxiliary Tank	1	79	513.5
RIGHT ENGINE	Wing Tanks	5	135	884.0
	Nacelle Tank	1	57	370.5
	Auxiliary Tank	1	79	513.5
	*TOTALS	14	542	3523.0

* Unusable fuel quantity and weight (4 gallons, 26 pounds) not included in totals.
** Fuel weight is based on standard day conditions at 6.5 pounds per U.S. gallon. Total fuel system capacity is 542 gallons (usable).

to transfer auxiliary fuel to the nacelle tank to be consumed by the engine during the initial portion of the flight. When an engine is started, pressure at the engine driven boost pump closes a pressure switch which, after a 30 to 50 second tie delay to avoid depletion of fuel pressure during starting, energizes the motive flow valve. When auxiliary fuel is depleted, a low level float switch de-energizes the motive flow valve after a 30 to 60 second time delay provided to prevent cycling of the motive flow valve due to sloshing fuel. In the event of a failure of the motive flow valve or the associated control circuitry, the loss of motive flow pressure when there is still fuel remaining in the auxiliary fuel tank is sensed by a pressure switch and float switch, respectively, which illuminates a caution annunciator light placarded No. 1 NO FUEL XFR or No. 2 NO FUEL XFR. During engine start, the pilot should note that the NO FUEL XFR lights extinguish 30 to 50 seconds after engine start. The NO FUEL XFR lights will not illuminate if auxiliary tanks are empty. A manual override is incorporated as a backup for the automatic transfer system. This is initiated by placing the AUX TRANSFER switch, located on the FUEL management panel to the OVERRIDE position. This will energize the transfer control motive flow valve. The transfer systems are protected by 5-ampere circuit breakers placarded AUXILIARY TRANSFER No. 1 or No. 2, located on the overhead circuit breaker panel (fig. 2-26), 2.0 inches high.

NOTE

In turbulence or during maneuvers, the NO FUEL XFR lights may momentarily illuminate after the auxiliary fuel has completed transfer.

d. Fuel Gaging System. The total fuel quantity in the left or right main system or left or right auxiliary tank is measured by a capacitance type fuel gaging system. Two fuel gages, one for the left and one for the right fuel system, read fuel quantity in pounds. Refer to Section IX for fuel capacities and weights. A maximum of 3% error may be encountered in each system. However, the system is compensated for fuel density changes due to temperature excursions. In addition to the fuel gages, yellow No. 1 NAC LOW or No. 2 NAC LOW lights on the caution/advisory annunciator panuminate when there is approximately 20 minutes of fuel per engine remaining (on standard day, at sea level, normal cruise power consumption rate). The fuel gaging system is protected by individual 5-ampere circuit breakers placarded QTY IND and QTY WARN No. 1 or No. 2, located on the overhead circuit breaker panel (fig. 2-26). A mechanical spiral float gage is installed in each auxiliary fuel tank to provide an indication of fuel level when servicing the tank. The gage is installed on the auxiliary fuel tank cover, adjacent to the filler neck (fig. 2-13). A small sight window in the upper wing skin permits observation of the gage.

e. Fuel Management Panel. The fuel management panel is located on the cockpit overhead between the pilot and copilot. It contains the fuel gages, standby fuel pump switches, the crossfeed valve switch and a fuel gaging system control switch and transfer control switches are also installed.

(1.) Fuel gaging system control switch. A switch on the fuel management panel (fig. 2-14) placarded FUEL QUANTITY, MAIN - AUXILIARY, controls the fuel gaging system. When in the MAIN position the fuel gages read the total fuel quantity in the left and right wing fuel system. When in the AUXILIARY position the fuel gages read the fuel quantity in the left and right auxiliary tanks only.

(2.) Standby fuel pump switches. Two switches, placarded STANDBY PUMP - ON located on the fuel management panel (fig. 2-14) control a submerged fuel pump located in the corresponding nacelle tank. During normal aircraft operation both switches are off so long as the engine-driven boost pumps function and during crossfeed operation. The loss of fuel pressure, due to failure of an engine driven boost pump will illuminate the MASTER WARNING lights on the glareshield and will illuminate the No. 1 FUEL PRESS or No. 2 FUEL PRESS on the warning annunciator panel. Turning ON the STANDBY PUMP will extinguish the FUEL PRESS lights. The MASTER WARNING lights must be manually cleared.

NOTE

Both standby pump switches shall be off during crossfeed operation.

(3.) Fuel transfer control switches. Two switches on the fuel management panel (fig. 2-14), placarded AUX TRANSFER OVERRIDE - AUTO control operation of the fuel transfer pumps During normal operation both switches are in AUTO which allows the system to be automatically actuated by fuel flow to the engine. If either transfer system fails to operate, the fault condition is indicated by two illuminated MASTER CAUTION lights on the glareshield and a steadily illuminated yellow No. 1 NO FUEL XFR or No. 2 NO FUEL XFR light on the caution annunciator panel.

(4.) Fuel crossfeed switch. The fuel crossfeed valve is controlled by a 3-position switch (fig. 2-14), located on the fuel management panel, placarded CROSSFEED - OFF. Under normal flight conditions the switch is left in the OFF position. During emergency single engine operation, it may become necessary to supply fuel to the operative engine from the fuel system on the opposite side. The crossfeed system is placarded for fuel selection with a simplified diagram on the overhead fuel control panel. Place the standby fuel pump switches in the off position when crossfeeding. A lever lock switch, placarded CROSSFEED, is moved from the center OFF position to the left or to the right, depending on direction of fuel flow. This opens the crossfeed valve and energizes the standby pump on the side from which crossfeed is desired. During crossfeed operation with firewall fuel valve closed, auxiliary tank fuel will not crossfeed. When the crossfeed mode is energized, a green FUEL CROSSFEED light on the caution/advisory panel will illuminate. Crossfeed system operation is described in Chapter 9. The crossfeed valve is protected by a 5-ampere circuit breaker placarded CROSSFEED located on the overhead circuit breaker panel (fig. 2-26).

f. Firewall Shutoff Valves.

CAUTION

Do not use the fuel firewall shutoff valve to shut down an engine, except in an emergency. The engine-driven high-pressure fuel pump obtains essential lubrication from fuel flow. When an engine is operating, this pump may be severely damaged (while cavitating) if the firewall valve is closed before the condition lever is moved to the FUEL CUT-OFF position.

The fuel system incorporates a fuel line shutoff valve mounted on each engine firewall. The firewall shutoff valves close automatically when the fire extinguisher T-handles on the instrument panel are pulled out. The firewall shutoff valves receive electrical power from the main buses and also from the hot battery bus which is connected directly to the battery. The valves are protected by circuit breakers placarded FIREWALL VALVE No. 1 or No. 2 on the overhead circuit breaker panel (fig. 2-26) and FIREWALL SHUTOFF No. 1 or No. 2 on the hot battery bus circuit breaker board.

g. Fuel Tank Sump Drains. A sump drain wrench is provided in the aircraft loose tools to simplify draining a small amount of fuel from the sump drain.

(1.) There are five sump drains and one filter drain in each wing (Table 2-3).

(2.) An additional drain for the extended range fuel system line extends through the bottom of the wing center section adjacent to the fuselage. Anytime the extended range system is in use, a part of the preflight inspection would consist of draining a small amount of fuel from this drain to check for fuel contamination. Whenever the extended range system is removed from the aircraft and the fuel line is capped off in the fuselage, the remaining fuel in the line shall be drained.

h. Fuel Drain Collector System. Each engine is provided with a fuel drain collector system to return fuel dumped from the engine during clearing and shutdown operations back into its respective nacelle tank. The system draws power from the No. 4 feeder bus. Fuel transfer is completely automatic. Fuel from the engine flow divider drains into a collector tank mounted below the aft engine accessory sec-

Table 2-3. Fuel Sump Drain Locations

NUMBER	DRAINS	LOCATION
1	Leading Edge Tank	Outboard of nacelle, underside of wing
1	Integral Tank	Underside of wing, forward of aileron
1	Firewall Fuel Filter	Underside of cowling forward of firewall
1	Sump Strainer	Bottom center of nacelle forward of wheel well
1	Gravity Feed Line	Aft of wheel well
1	Auxiliary Tank	At wing root, just forward of the flap

tion. An internal float switch actuates an electric scavenger pump which delivers the fuel to the fuel purge line just aft of the fuel purge shutoff valve. A check valve in the line prevents the backflow of fuel during engine purging. The circuit breaker for both pumps is located in the fuel section of the overhead circuit breaker panel; placarded SCAVENGER PUMP. A vent line, plumbed from the top of the collector tank, is routed through an inline flame arrestor and then downward to a drain manifold on the underside of the nacelle.

i. Fuel Vent System. Each fuel system is vented through two ram vents located on the underside of the wing adjacent to the nacelle. To prevent icing of the vent system, one vent is recessed into the wing and the backup vent protrudes out from the wing and contains a heating element. The vent line at the nacelle contains an inline flame arrestor.

j. Engine Oil-to-Fuel Heat Exchanger. An engine oil-to-fuel heat exchanger, located on each engine accessory case, operates continuously and automatically to heat the fuel delivered to the engine sufficiently to prevent the freezing of any water which it might contain. The temperature of the delivered fuel is thermostatically regulated to remain between 21°C and 32°C.

2-34. FUEL SYSTEM MANAGEMENT.

a. Fuel Transfer System. When the auxiliary tanks are filled, they will be used first. During transfer of auxiliary fuel, which is automatically controlled, the nacelle tanks are maintained full. A check valve in the gravity feed line from the outboard wing prevents reverse fuel flow. Normal gravity transfer of the main wing fuel into the nacelle tanks will begin when auxiliary fuel is exhausted. The system will gravity feed fuel only to its respective nacelle tank, i.e. left or right (fig. 2-16). Fuel will not gravity feed through the crossfeed system.

b. Operation With Failed Engine-Driven Boost Pump or Standby Pump. Two pumps in each fuel system provide inlet head pressure to the engine-driven primary high-pressure fuel pump. If crossfeed is used, a third pump, the standby fuel pump from the opposite system, will supply the required pressure. Operation under this condition will result in an unbalanced fuel load as fuel from one system will be supplied to both engines while all fuel from the system with the failed engine driven and standby boost pumps will remain unused. A triple failure, which is highly unlikely, would result in the engine driven primary pump operating without inlet head pressure. Should this situation occur, the affected engine can continue to operate from its own fuel supply on its engine-driven primary high-pressure fuel pump.

2-35. FERRY FUEL SYSTEM.

Provisions are installed for connection to long range fuel cells.

Section V. FLIGHT CONTROLS

2-36. DESCRIPTION.

The aircraft's primary flight control systems consist of conventional rudder, elevator and aileron control surfaces. These surfaces are manually operated from the cockpit through mechanical linkage using a control wheel for the ailerons and elevators, and adjustable rudder/brake pedals for the rudder. Both the pilot and copilot have flight controls. Trim control for the rudder, elevator and ailerons is accomplished through a manually actuated cable-drum system for each set of control surfaces. The autopilot has provisions for controlling the position of the ailerons, elevators, and rudder. Chapter 3 describes the operation of the autopilot system.

2-37. CONTROL WHEELS

Elevator and aileron control surfaces are operated by manually actuating either the pilot's or copilot's control wheel. Switches are installed in the outboard grip of each wheel to operate the elevator trim tabs. A microphone switch, a chaff dispense switch, and an autopilot/yaw damp/electric trim disconnect switch are also installed in the outboard grip of each wheel. A transponder ident switch is installed on top of the inboard grip of each control wheel. These control wheels (fig. 2-17) are installed - on each side of the instrument subpanel. A manually wound 8-day clock is installed in the center of the pilot's control wheel, and a digital electric clock is installed in the center of the copilot's control wheel. A map light switch, and a pitch synchronization and control wheel steering switch are mounted adjacent to the clock in each control wheel.

2-38. RUDDER SYSTEM.

a. Rudder Pedals. Aircraft rudder control and nose wheel steering is accomplished by actuation of the rudder pedals from either pilot's or copilot's station (fig. 2-8). The rudder pedals may be individually adjusted in either a forward or aft position to provide adequate leg room for the pilot and copilot. Adjustment is accomplished by depressing the lever alongside the rudder pedal arm and moving the pedal forward or aft until the locking pin engages in the selected position.

b. Yaw Damp System. A yaw damp system is provided to aid the pilot in maintaining directional stability and increase ride comfort. The system may be used at any altitude and is required for flight above 17,000 feet. It must be deactivated for takeoff and landing. The yaw damp system is a part of the autopilot. Operating instructions for this system are contained in Chapter 3. The system is controlled by a YAW DAMP switch adjacent to the ELEV TRIM switch on the pedestal extension.

c. Rudder Boost System. A rudder boost system is provided to aid the pilot in maintaining directional control resulting from an engine failure or a large variation of power between the engines. Incorporated in the rudder cable system are two pneumatic rudder boosting servos which actuate the cables to provide rudder pressure to help compensate for asymmetrical thrust.

(1.) During operation, a differential pressure valve accepts bleed air pressure from each engine. When the pressure varies between the bleed air systems, the shuttle in the differential pressure valve moves toward the low pressure side. As the pressure difference reaches a preset tolerance, a switch closes on the low pressure side which activates the rudder boost system. This system is designed only to help compensate for asymmetrical thrust. Appropriate trimming is to be accomplished by the pilot. Moving either or both of the bleed air valve switches on the overhead control panel to PNEU & ENVIRO - OFF position will disengage the rudder boost system.

NOTE

Condition levers must be in LOW IDLE position to perform rudder boost check.

(2.) The system is controlled by a switch located on the extended pedestal placarded RUDDER BOOST (on) - OFF (fig. 2-7), and is to be turned on before flight. A preflight check of the system can be performed during the run-up by retarding the power on one engine to idle and advancing power on the opposite engine until the power difference between the engines is great enough to activate the switch to turn on the rudder boost system. Movement of the appropriate rudder pedal (left engine idling, right rudder pedal moves forward) will be noted when the switch closes, indicating the system is functioning properly for low engine power on that side. Repeat the check with opposite power settings to check for movement of the opposite rudder pedal. The system is protected by a 5-ampere circuit breaker placarded RUDDER BOOST, located on the overhead circuit breaker panel (fig. 2-26).

NOTE

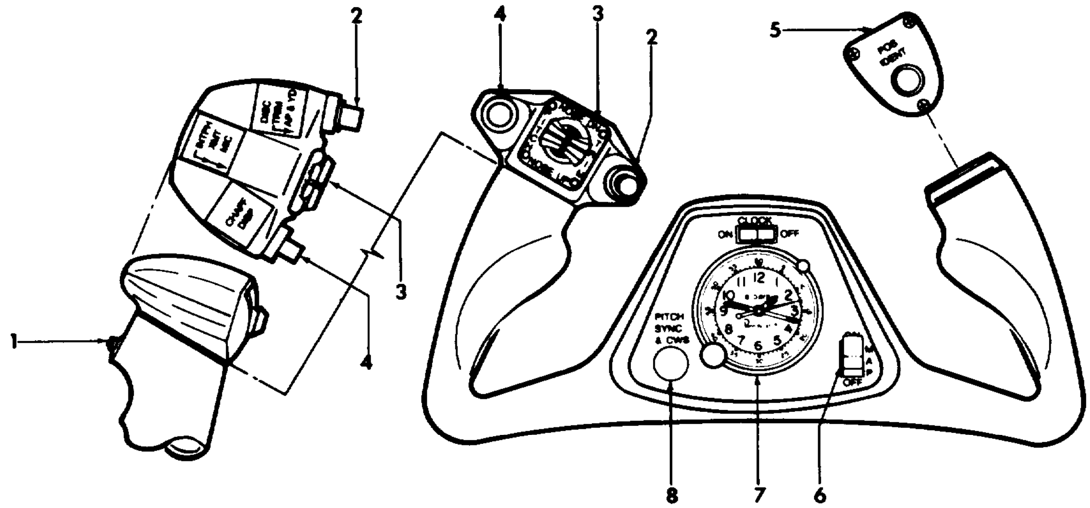
With brake deice on, rudder boost may be inoperative.

2-39. FLIGHT CONTROLS LOCK.

CAUTION

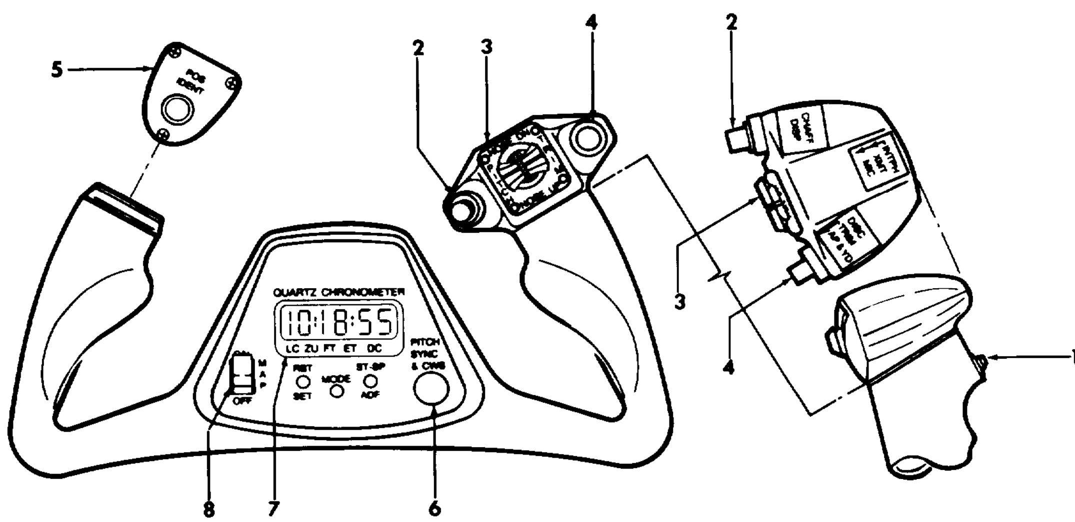
Remove control locks before towing the aircraft or starting engines. Serious damage could result in the steering linkage if towed by a tug with the rudder lock installed.

Positive locking of the rudder, elevator and aileron control surfaces, and engine controls (power levers, propeller levers, and condition levers) is provided by a removable lock assembly (fig. 2-18) consisting of two pins, and an elongated U-shaped strap interconnected by a chain. Installation of the control locks is accomplished by inserting the U-shaped strap around the aligned control levers from the



(Pilot)

1. Microphone, intercom, transmit switch
2. Trim, autopilot, yaw damp disconnect switch
3. Pitch-trim switches
4. Chaff dispense switch
5. Transponder ident switch
6. Map light
7. Eight day clock
8. Pitch synchronization and control wheel steering switch



(Copilot)

1. Microphone, intercom, transmit switch
2. Chaff dispense switch
3. Pitch-trim switches
4. Trim, autopilot, yaw damp diconnect switch
5. Transponder ident switch
6. Pitch synchronization and control wheel steering switch
7. Digital clock
8. Map light

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Figure 2- 17. Control Wheels

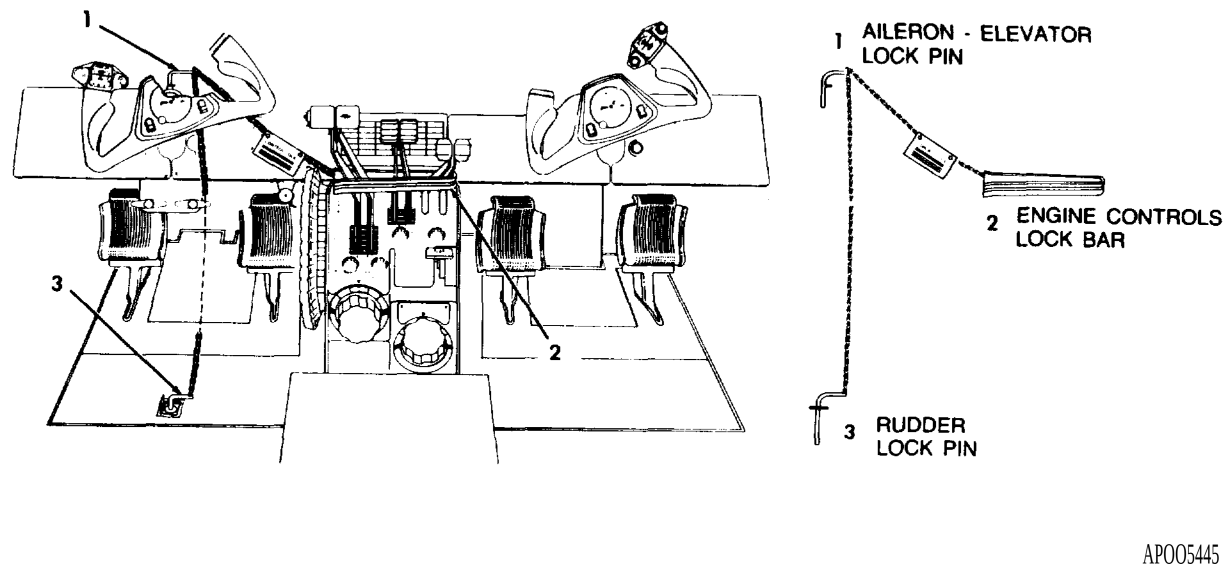


Figure 2- 18. Control Locks

copilot's side; then the aileron/elevator locking pin is inserted through a guide hole in the top of the pilot's control column assembly, thus locking the control wheel. The rudder is held in a neutral position by an L-shaped pin which is installed through a guide hole in the floor aft of the pilots rudder pedals. The rudder pedals must be centered to align the hole in the rudder bellcrank with the guide hole in the floor. Remove the locks in reverse order, i.e., rudder pin, control column pin, and power control clamp.

2-40. TRIM TABS.

Trim tabs are provided for all flight control surfaces. These tabs are manually activated, and are mechanically controlled by a cable-drum and jackscrew actuator system, except the right aileron tab which is of the fixed bendable type. Elevator and aileron trim tabs incorporate neutral, non-servo action, i.e., as the elevators or ailerons are displaced from the neutral position, the trim tab maintains an "as adjusted" position. The rudder trim tab incorporates anti-servo action, i.e., as the rudder is displaced from the neutral position the trim tab moves in the same direction as the control surface. This action increases control pressure as rudder is deflected from the neutral position.

a. Elevator Trim Tab Control. The elevator trim tab control wheel placarded ELEVATOR TAB -DOWN, UP, is on the left side of the control pedestal and controls a trim tab on each elevator (fig. 2-7). The amount of elevator tab deflection, in degrees from a neutral setting, is indicated by a position arrow.

b. Electric Elevator Trim. The electric elevator trim system is controlled by an ELEV TRIM - ON - OFF/RESET switch located on the pedestal, dual element thumb switches on the control wheels, a trim disconnect switch on each control wheel and a circuit breaker on the overhead circuit breaker panel. The ON - OFF/RESET switch must be in the ON position to operate the system. The dual element thumb switch is moved forward for trimming nose down, aft for nose up, and when released returns to the center (off) position. Any activation of the trim system through the copilot's trim switch can be over ridden by activation of the pilot's switch. Operating the pilot's and copilot's switches in opposing directions simultaneously results in the pilot having priority.

A preflight check of the switches should be accomplished before flight by moving the switches individually on both control wheels. No one switch alone should operate the system; operation of elevator trim should occur only by movement of pairs of switches. The trim system disconnect is a bi-level, pushbutton, momentary type switch, located on the outboard grip of each control wheel. Depressing the switch to the first of two levels disconnects the autopilot and yaw damp system, and the second level disconnects the electric trim system. The system can be reset by moving the ELEV TRIM switch toggle on the pedestal (fig. 2-7) to OFF RESET position, then back to ELEV TRIM (on) again.

c. Aileron Trim Tab Control. The aileron trim tab control, placarded AILERON TAB - LEFT, RIGHT, is on the control pedestal and will adjust the left aileron trim tab only (fig. 2-7). The amount of aileron tab deflection, from a neutral setting, as indicted by a position arrow, is relative only and is not in degrees. Full travel of the tab control moves the trim tab 7-1/2 degrees up and down.

d. Rudder Trim Tab Control. The rudder trim tab control knob, placarded RUDDER TAB -LEFT, RIGHT, is on the control pedestal, and controls adjustment of the rudder trim tab (fig. 2-7). The amount of rudder tab deflection, in degrees from a neutral setting, is indicated by a position arrow.

2-41. WING FLAPS.

The all-metal slot-type wing flaps are electrically operated and consist of two sections for each wing. These sections extend from the inboard end of each aileron to the junction of the wing and fuselage. During extension, or retraction, the flaps are operated as a single unit, each section being actuated by a separate jackscrew actuator. The actuators are driven through flexible shafts by a single, reversible electric motor. Wing flap movement is indicated in percent of travel by a flap position indicator on the forward control pedestal. Full flap extension and retraction time is approximately 11 seconds. The flap control switch is located on the control pedestal. No emergency wing flap actuation system is provided. With flaps extended beyond the APPROACH position, the landing gear warning horn will sound, unless the landing gear is down and locked. The circuit is protected by a 20-ampere circuit breaker, placarded FLAP MOTOR, located on the overhead circuit breaker panel (fig. 2-26).

a. Wing Flap Control Switch. Flap operation is controlled by a three-position switch with a flap-shaped handle on the control pedestal (fig. 2-7). The handle of this switch is placarded FLAP and switch positions are placarded: FLAP - UP, APPROACH, and DOWN. The amount of downward extension of the flaps is established by position of the flap switch, and is as follows: UP - 0%, APPROACH - 40%, and DOWN -100%. Limit switches, mounted on the right inboard flap, control flap travel. The flap control switch, limit switch, and relay circuits are protected by a 5-ampere circuit breaker, placarded FLAP CONTR located on the overhead circuit breaker panel (fig. 2-26). Flap positions between UP and APPROACH cannot be selected. For intermediate flap positions between APPROACH and DOWN, the APPROACH position acts as an off position. To return the flaps to any position between full DOWN and APPROACH, place the flap switch to UP and when desired flap position is obtained, return the switch to the APPROACH detent. In the event that any two adjacent flap sections extend 3 to 5 degrees out of phase with the other, a safety mechanism is provided to discontinue power to the flap motor.

b. Wing Flap Position Indicator. Flap position in percent of travel from “0“ percent (UP) to 100 percent (DOWN), is shown on an indicator, placarded FLAPS located on the control pedestal (fig. 2-7). The approach and full down or extended flap position is 14 and 34 degrees, respectively. The flap position indicator is protected by a 5-ampere circuit breaker, placarded FLAP CONTR, located on the overhead circuit breaker panel (fig. 2-26).

Section VI. PROPELLERS

2-42. DESCRIPTION.

A three-blade aluminum propeller is installed on each engine. The propeller is of the full feathering, constant speed, counterweighted, reversible type, controlled by engine oil pressure through single action, engine driven propeller governors. The propeller is flange-mounted to the engine shaft. Centrifugal counterweights, assisted by a feathering spring, move the blades toward the low RPM (high pitch) position and into the feathered position. Governor boosted engine oil pressure moves the propeller to the high RPM (low pitch) hydraulic stop and reverse position. The propellers have no low RPM (high pitch) stops; this allows the blades to feather after engine shutdown. Low pitch propeller position is determined by the low pitch stop which is a mechanically actuated, hydraulic stop. Beta and reverse blade angles are controlled by the power levers in the beta and reverse range.

2-43. FEATHERING PROVISIONS.

Both manual and automatic propeller feathering systems are provided. Manual feathering is accomplished by pulling the corresponding propeller lever aft past a friction detent. To unfeather, the propeller lever is pushed forward into the governing range. An automatic feathering system, will sense loss of torque and will feather an unpowered propeller. Feathering springs will feather the propeller when it is not turning.

a. Automatic Feathering. The automatic feathering system provides a means of immediately dumping oil from the propeller servo to enable the feathering spring and counterweights to start feathering action of the blades in the event of an engine failure. Although the system is armed by a switch on the overhead control panel, placarded AUTOFEATHER - ARM - OFF - TEST, the completion of the arming phase occurs when both power levers are advanced above 90% N_1 - at which time both indicator lights on the caution/advisory annunciator panel indicate a fully armed system. The annunciator panel lights are green and are placarded No.1 AUTOFEATHER (left engine) and No.2 AUTOFEATHER (right engine). The system will remain inoperative as long as either power lever is retarded below 90% N_1 position, unless TEST position of the AUTOFEATHER SWITCH is selected to disable the power lever limit switches. The system is designed for use only during takeoff and landing and should be turned off when establishing cruise climb. During takeoff or landing, should the torque for either engine drop to an indication between 16 - 21%, the autofeather system for the opposite engine will be disarmed. Disarming is confirmed when the No.1 AUTOFEATHER or No.2 AUTOFEATHER annunciator light of the opposite engine becomes extinguished. If torque drops further, to a reading between 9 and 14%, oil is dumped from the servo of the affected propeller allowing a feathering spring to move the blades into the feathered position. Feathering also causes the No.1 AUTOFEATHER or No.2 AUTOFEATHER annunciator light of the feathered propeller to extinguish. At this time, both the No.1 AUTOFEATHER and No.2 AUTOFEATHER lights are extinguished, the propeller of the defective engine has feathered, and the propeller of the operative engine has been disarmed from the autofeathering capability. Only manual feathering control remains for the second propeller.

b. Propeller Autofeather Switch. Autofeathering is controlled by an AUTOFEATHER switch on the overhead control panel (fig. 2-12). The three-position switch is placarded ARM, OFF and TEST, and is spring loaded from TEST to OFF. The ARM position is used only during takeoff and landing. The TEST position of the switch, enables the pilot to check readiness of the autofeather systems, below 88% to 92% N_1, and is for ground checkout purposes only.

c. Autofeather Lights. Two green lights on the caution/advisory annunciator panel are placarded AUTOFEATHER No. 1 and AUTOFEATHER No.2. When illuminated, the lights indicate that the autofeather system is armed. Both lights will be extinguished if either propeller has been autofeathered or if the system is disarmed by retarding a power lever. Autofeather circuits are protected by one 5-ampere circuit breaker placarded AUTO FEATHER, located on the overhead circuit breaker panel (fig. 2-26).

2-44. PROPELLER GOVERNORS.

Two governors, a constant speed governor, and an overspeed governor, control propeller RPM. The constant speed governor, mounted on top of the reduction housing, controls the propeller through its entire range. The propeller control lever operates the propeller by means of this governor. If the constant speed governor should malfunction and request more than 2000 RPM, the overspeed governor cuts in at 2080 RPM and dumps oil from the propeller to keep the RPM from exceeding approximately 2080 RPM. A solenoid, actuated by the PROP GOV TEST switch located on the overhead control panel (fig. 2-12), is provided for resetting the overspeed governor to approximately 1830 to 1910 RPM for test purposes. If the propeller sticks or moves too slowly during a transient condition causing the propeller governor to act too slowly to prevent an overspeed condition, the power turbine governor, contained within the constant speed governor housing, acts as a fuel topping governor. When the propeller reaches 106% of N_2 RPM, the fuel topping governor limits the fuel flow to the gas generator, reducing N_1 RPM, which in turn prevents the propeller RPM from exceeding approximately 2120 RPM. During operation in the reverse range, the power turbine governor is reset to approximately 95% of propeller RPM before the propeller reaches a negative pitch angle. This insures that the engine power is limited to maintain a propeller RPM of somewhat less than that of the constant speed governor setting. The constant speed governor therefore, will always sense an underspeed condition and direct oil pressure to the propeller servo piston to permit propeller operation in beta and reverse ranges.

2-45. PROPELLER TEST SWITCHES.

Two two-position switches on the overhead control panel (fig. 2-12), are provided for operational testing of the propeller systems. Placarding above the switches reads PROP GOV TEST. Each switch controls test circuits for the corresponding propeller. In the test position, the switches are used to test the function of the corresponding overspeed governor. Refer to Chapter 8, for test procedure. Propeller test circuits are protected by one 5-ampere circuit breaker placarded PROP GOV located on the overhead circuit breaker panel (fig. 2-26).

2-46. PROPELLER SYNCHROPHASER.

a. Operation. The propeller synchrophaser automatically matches the RPM of the right propeller (slave propeller) to that of the left propeller (master propeller) and maintains the blades of one propeller at a predetermined relative position with the blades of the other propeller. To prevent the right propeller from losing excessive RPM if the left propeller is feathered while the synchrophaser is on, the synchrophaser has a limited range of control from the manual governor setting. Normal governor operation is unchanged but the synchrophaser will continuously monitor propeller RPM and reset the governor as required. A magnetic pickup mounted in each propeller overspeed governor and adjacent to each propeller deice brush block transmits electric pulses to a transistorized control box installed forward of the pedestal. The right propeller RPM and phase will automatically be adjusted to correspond to the left. To change RPM, adjust both propeller controls at the same time. This will keep the right governor setting within the limiting range of the left propeller. If the synchrophaser is on but is unable to adjust to the right propeller to match the left, the actuator has reached the end of its travel. To recenter, turn the switch off, synchronize the propellers manually, and turn the switch back on.

b. Control Box. The control box converts any pulse rate differences into correction commands, which are transmitted to a stepping type actuator motor mounted on the right engine cowl forward support ring. The motor then trims the right propeller governor through a flexible shaft and trimmer assembly to exactly match the left propeller. The trimmer, installed between the governor control arm and the control cable, screws in or out to adjust the governor while leaving the control lever setting constant. A toggle switch installed adjacent to the synchrophaser turns the system on. With the switch off, the actuator automatically runs to the center of its range of travel before stopping to assure normal function when used again. To operate the system, synchronize the propeller in the normal manner and turn the synchrophaser on. The system is designed for in-flight operations and is placarded to be off for take-off and landing. Therefore, with the system on and the landing gear extended, the master caution lights will illuminate and a yellow light on the caution/advisory annunciator panel, PROP SYNC ON, will illuminate.

c. Synchroscope. The propeller synchroscope, provides an indication of synchronization of the propellers. If the right propeller is operating at a higher RPM than the left, the face of the synchroscope, a black and white cross pattern, spins in a clockwise rotation. Left, or counterclockwise, rotation indicates a higher RPM of the left propeller. This instrument aids the pilot in obtaining complete synchronization of propellers. The system is protected by a 5-ampere circuit breaker placarded PROP SYNC, located on the overhead circuit breaker panel (fig. 2-26).

2-47. PROPELLER LEVERS.

Two propeller levers on the control pedestal (fig. 2-7), placarded PROP, are used to regulate propeller speeds. Each lever controls a primary governor, which acts to regulate propeller speeds within the normal operation range. The full forward position of the levers is placarded TAKEOFF, LANDING AND REVERSE - and also HIGH RPM. The full aft position of the levers is placarded FEATHER. When a lever is placed at HIGH RPM, the propeller may attain a static RPM of 2,000 depending upon power lever position. As a lever is moved aft, passing through the propeller governing range, but stopping at the feathering detent, propeller RPM will correspondingly decrease to the lowest limit. Moving a propeller lever aft past the detent into FEATHER will feather the propeller.

2-48. PROPELLER REVERSING.

CAUTION

Do not move the power levers into reverse range without the engine running. Damage to the reverse linkage mechanisms will occur.

CAUTION

Propeller reversing on unimproved surfaces should be accomplished carefully to prevent propeller erosion from reversed airflow and, in dusty conditions, to prevent obscuring the operator's vision.

CAUTION

To prevent an asymmetrical thrust condition, propeller levers must be in HIGH RPM position prior to propeller reversing.

The propeller blade angle may be reversed to shorten landing roll. To reverse, propeller levers must be positioned at HIGH RPM (full forward), and the power levers are lifted up to pass over the IDLE detent, then pulled aft into REVERSE setting. One yellow caution light, placarded REV NOT READY, on the caution/advisory annunciator panel, alerts the pilot not to reverse the propellers. This light illuminates only when the landing gear handle is down, and if propeller levers are not at HIGH RPM (full forward). This circuit is protected by a 5-ampere circuit breaker, placarded LANDING GEAR RELAY, located on the overhead circuit breaker panel (fig. 2-26).

2-49. PROPELLER TACHOMETERS.

Two tachometers on the instrument panel register propeller speed in hundreds of RPM (fig. 2-29). Each indicator is slaved to a tachometer generator unit attached to the corresponding engine.

Section VII. UTILITY SYSTEMS

2-50. DEFROSTING SYSTEM.

a. Description. The defrosting system is an integral part of the heating and ventilation system. The system consists of two warm air outlets connected by ducts to the heating system. One outlet is just below the pilot's windshield and the other is below the copilot's windshield. A push-pull control, placarded DEFROST AIR, on the pilot's subpanel, manually controls airflow to the windshield. When pulled out, defrosting air is ducted to the windshield. As the control is pushed in, there is a corresponding decrease in airflow.

b. Automatic Operation.

1. Vent blower switches - As required.
2. Cabin temperature mode selector switch - AUTO.
3. Cabin temperature control rheostat - As required.
4. Cabin air, copilot air, pilot air, and defrost air controls - As required.

c. Manual Operation.

1. Pilot air, copilot air - IN.
2. Cabin air and defrost air controls - Out
3. Cabin temperature mode selector switch - MAN HEAT.
4. Cold air outlets - As required.
5. Manual temperature switch - As required.

d. Manual Operation. If the automatic temperature control should fail to operate, the temperature (of defrost air and cabin air) may be controlled manually by setting the CABIN TEMP MODE control switch to MANUAL COOL position, then using the MANUAL TEMP DECREASE-INCREASE switch to set the desired temperature. This control is located on the overhead control panel (fig. 2-l 2).

2-51. SURFACE DEICING SYSTEM.

a. Description. Ice accumulation is removed from each inboard and outboard wing leading edge, both horizontal stabilizers, the taillets, and certain mission antennas by the flexing of deicer boots which are pneumatically actuated. Bleed air from the engine compressor is used to inflate the deicer boots and to supply vacuum, through the ejector system, for boot hold down during flight. A pressure regulator protects the system from over inflation. When the system is not in operation, a distributor valve applies vacuum to the boots for hold down. A selector switch allows automatic single cycle operation or manual operation. To assure operation of the system in the event of failure of one engine, a check valve is incorporated in the bleed air line from each engine to prevent loss of pressure through the compressor of the inoperative engine.

Wing ice lights allow the crew to detect ice formations. Ice protection of the engine is provided by inertial separation. Automatically cycled electrothermal anti-icing boots are installed on the propeller blades. The engine air inlet leading edge lip is anti-iced by engine exhaust bleed. The fresh air inlets are located in sheltered areas and require no deice protection.

CAUTION

Operation of the surface deice system in ambient temperatures below -40°C can cause permanent damage to the deice boots.

b. Operation.

(1.) Deice boots are intended to remove ice after it has formed rather than prevent its formation. For the most effective deicing operation, allow at least l/2 inch of ice to form on the boots before attempting ice removal. Very thin ice may crack and cling to the boots instead of shedding.

NOTE

Never cycle the system rapidly, this may cause the ice to accumulate outside the contour of the inflated boots and prevent ice removal.

(2.) A three position switch on the overhead control panel placarded SURF DEICE MANUAL - OFF - SINGLE CYCLE AUTO, controls the deicing operation. The switch is spring loaded to return to the OFF position from SINGLE CYCLE AUTO or MANUAL. When the SINGLE CYCLE AUTO position is selected, the distributor valve opens to inflate the wing boots. After an inflation period of approximately 6 seconds, an electronic timer switches the distributor to deflate the wing boots and a 4 second inflation begins in the horizontal stabilizer boots. When these boots have inflated and deflated, the cycle is complete.

(3.) If the switch is held in the MANUAL position, the boots will inflate simultaneously and remain inflated until the switch is released. The switch will return to the OFF position when released. After the cycle, the boots will remain in the vacuum hold down condition until again actuated by the switch.

(4.) Either engine is capable of providing sufficient bleed air for all requirements of the surface deicer system. Check valves in the bleed air and vacuum lines prevent backflow through the system during single-engine operation. Regulated pressure is indicated on a gage, placarded PNEUMATIC PRESSURE, located on the copilots subpanel.

2-52. ANTENNA DEICING SYSTEM.

a. Description. The antenna deice system removes ice accumulation from the dipole mission antennas. The system consists of two ejector distributor valves, a regulator, manifold, and flexible tubing. Control is accomplished through a timing circuit and an antenna deice switch located on the overhead control panel (fig. 2-12). Erosion resistant tape is applied to the surface of mission blade antennas not having deice boots.

b. Antenna Deice System Switch. The antenna deice system is controlled by a switch placarded ANT DEICE, SINGLE - OFF - MANUAL located on the overhead control panel (fig. 2-12). The switch is spring loaded to return to the OFF position from the SINGLE or MANUAL position. When the switch is set to the single position, the system will run through one timed inflation-deflation cycle. When the switch is held in the MANUAL position the boots will inflate and remain inflated until the switch is released.

c. Forward Wide Band Data Link Antenna Radome Anti-Ice. The forward wide band data link antenna radome anti-ice system utilizes engine bleed air to prevent the formation of ice on the radome. The system is controlled by a switch placarded RADOME located on the overhead control panel. The circuit is protected by a circuit breaker placarded RADOME, located on the overhead circuit breaker panel (fig. 2-26).

d. *Operation.*

(1.) Deice boots are intended to remove ice after it has formed rather than prevent its formation. For the most effective deicing operation, allow at least l/8 to l/4 inch of ice to form on the boots before attempting ice removal. Very thin ice may crack and cling to the boots instead of shedding.

NOTE

Never cycle the system rapidly, this may cause the ice to accumulate outside the contour of the inflated boots and prevent ice removal.

2-53. PROPELLER ELECTROTHERMAL ANTI-ICE SYSTEM.

a. Description. Electrothermal anti-ice boots are cemented to each propeller blade to prevent ice formation or to remove the ice from the propellers. Each thermal boot consists of one outboard and one inboard heating element, and receives electrical power from the deice timer. This timer sends current to all propeller deice boots and prevents the boots from overheating by limiting the time each element is energized. Four intervals of approximately 30 seconds each complete one cycle. Current consumption is monitored by a propeller ammeter on the copilot's subpanel. Two 20-ampere circuit breakers placarded PROP ANTI-ICE LEFT and RIGHT and 5-ampere propeller control circuit breaker placarded CONTR on the overhead circuit breaker panel (fig. 2-26), protect the propeller electrothermal deice system during manual operation. A 25 ampere circuit breaker placarded PROP AUTO, protects the system in automatic operation.

b. Automatic Operation. A control switch on the overhead control panel placarded PROP - OFF - AUTO is provided to activate the automatic system. A deice ammeter above the pedestal registers the amount of current (14 to 18 amperes) passing through the system being used. During AUTO operation, power to the timer will be cut off if the current rises above 25 amperes. Current flows from the timer to the brush assembly and then to the slip rings installed on the spinner backing plate. The slip rings carry the current to the deice boots on the propeller blades. Heat from the boots reduces the grip of the ice which is then thrown off by centrifugal force, aided by the air blast over the propeller surfaces. Power to the two heating elements on each blade, the inner and outer element, is cycled by the timer in the following sequence: right propeller outer element, right propeller inner element, left propeller outer element, left propeller inner element. Loss of one heating element circuit on one side does not mean that the entire system must be turned off. Proper operation can be checked by noting the correct level of current usage on the ammeter. An intermittent flicker of the needle approximately each 30 seconds indicates switching to the next group of heating elements by the timer.

c. Manual Operation. The manual propeller deice system is provided as a backup to the automatic system. A control switch located on the overhead control panel, placarded PROP - INNER - OUTER, controls the manual override relays. When the switch is in the OUTER position, the automatic timer is overridden and power is supplied to the outer heating elements of both propellers simultaneously. The switch is of the momentary type and must be held in position until the ice has been dislodged from the propeller surface. After deicing with the outer elements, the switch is to be held in the INNER position to perform the same function for the inner elements of both propellers. The loadmeters will indicate approximately a 5% increase of load per meter when manual propeller deice is operating. The propeller deice ammeter will not indicate any load in the manual mode of operation.

2-54. PITOT AND STALL WARNING HEAT SYSTEM.

CAUTION

Pitot heat should not be used for more than 15 minutes while the aircraft is on the ground. Overheating may damage the heating elements.

a. Pitot Heat. Heating elements are installed in both pitot masts, located on the nose. Each heating element is controlled by an individual switch placarded PITOT - ON - LEFT or RIGHT, located on the overhead control panel (fig. 2-12). It is not advisable to operate the pitot heat system on the ground except for testing or for short intervals of time to remove ice or snow from the mast. Circuit protection is provided by two 7 l/2 ampere circuit breakers, placarded PITOT HEAT, on the overhead circuit breaker panel (fig. 2-26). The "true airspeed temp probe" heat control circuit is also protected by this circuit breaker. If either left or right pitot heat is on, the" true airspeed temp probe" heat will be on.

NOTE

The "TRUE AIRSPEED TEMP PROBE" is connected to the autopilot air data computer.

CAUTION

The heating elements protect the stall warning lift transducer vane and face plate from ice, however, a buildup of ice on the wing may change or disrupt the airflow and prevent the system from accurately indicating an imminent stall.

b. Stall Warning Heat. The lift transducer is equipped with anti-icing capability on both the mounting plate and the vane. The heat is controlled by a switch located on the overhead control panel placarded STALL WARN. The level of heat is minimal for ground operation but is automatically increased for flight operation through the landing gear safety switch. Circuit protection is provided by a 15-ampere circuit breaker, placarded STALL WARN, on the overhead circuit breaker panel (fig. 2-26).

2-55. STALL WARNING SYSTEM.

The stall warning system consists of a transducer, a lift computer, a warning horn, and a test switch. Angle of attack is sensed by aerodynamic pressure on the lift transducer vane located on the left wing leading edge. When a stall is imminent, the output of the transducer activates a stall warning horn. The system has preflight test capability through the use of a switch placarded STALL WARN TEST - OFF - LDG GEAR WARN TEST on the right subpanel. Holding this switch in the STALL WARN TEST position actuates the warning horn by moving the transducer vane. The circuit is protected by a 5-ampere circuit breaker, placarded STALL WARN, on the overhead circuit breaker panel.

2-56. BRAKE DEICE SYSTEM.

a. Description. A heated-air brake deice system may be used in flight with gear retracted or extended, or on the ground. When activated, hot air is diffused by means of a manifold assembly over the brake discs on each wheel. Manual and automatic controls are provided. There are two primary occasions which require brake deicing. The first is when an aircraft has been parked in a freezing atmosphere allowing the brake systems to become contaminated by freezing rain, snow, or ice, and the aircraft must be moved or taxied. The second occasion is during flight through icing conditions with wet brake assemblies presumed to be frozen, which must be thawed prior to landing to avoid possible tire damage and loss of directional control. Hot air for the brake deice system comes from the compressor stage of both engines obtained by means of a solenoid valve attached to the bleed air system which serves both the surface deice system and the pneumatic systems operation.

b. Operation. A switch on the overhead control panel, placarded BRAKE DEICE, controls the solenoid valve by routing power through a control module box under the aisleway floorboards. When the switch is on, power from a 5-ampere circuit breaker on the overhead circuit breaker panel is applied to the control module. A lo-minute timer limits operation and avoids excessive wheel well temperatures when the landing gear is retracted. The control module also contains a circuit to the green BRAKE DEICE ON annunciator light, and has a resetting circuit interlocked with the gear uplock switch. When the system is activated, the BRAKE DElCE ON light should be monitored and the control switch selected OFF after the light extinguishes - otherwise, on the next gear extension the system will restart without pilot action. The control switch should also be selected OFF, if deice operation fails to self-terminate after 10 minutes. If the automatic timer has terminated brake deicer operation after the last retraction of the landing gear, the landing gear must be extended in order to obtain further operation of the system.

(1.) The L BL AIR FAIL or R BL AIR FAIL annunciator lights may momentarily illuminate during simultaneous operation of the surface deice and brake deice systems at low N_1 speeds. If the lights immediately extinguish, they may be disregarded.

(2.) During certain ambient conditions, use of the brake deice system may reduce available engine power, and during flight will result in a TGT rise of approximately 20°C. Appropriate performance charts should be consulted before brake deice system use. If specified power cannot be obtained without exceeding limits, the brake deice system must be selected off until after takeoff is completed. TGT limitations must also be observed when setting climb and cruise power. The brake deice system is not to be operated above 15°C ambient temperature. The system is not to be operated for longer than 10 minutes (one deicer cycle) with the landing gear retracted. If operation does not automatically terminate after approximately 10 minutes following gear retraction, the system must be manually selected off. During periods of simultaneous brake deice and surface deice operation, maintain 85% N_1 or higher. If inadequate pneumatic pressure is developed for proper surface deicer boot inflation, select the brake deice system off. Both sources of pneumatic bleed air must be in operation during brake deice system use. Select the brake deice system off during single-engine operation. Circuit protection is provided by a 5-ampere circuit breaker, placarded BRAKE DEICE, on the overhead circuit breaker panel (fig. 2-26).

2-57. FUEL SYSTEM ANTI-ICING.

a. Description. An oil-to-fuel heat exchanger, located on each engine accessory case, operates continuously and automatically to heat the fuel sufficiently to prevent freezing of any water in the fuel. No controls are involved. Two external fuel vents are provided on each wing. One is recessed to prevent ice formation; the other is electrically heated and is controlled by two toggle switches on the overhead control panel placarded FUEL VENT ON, LEFT and RIGHT (fig. 2-12). They are protected by two 5-ampere circuit breakers, placarded FUEL VENT HEAT, RIGHT or LEFT, located on the overhead circuit breaker panel (fig. 2-26). Each fuel control unit is protected against ice. The pneumatic governor for each fuel control unit is electrically heated, and protected by two 7 1/2-ampere circuit breakers located on the overhead circuit breaker panel placarded FUEL CONTR HEAT, LEFT or RIGHT (fig. 2-26).

CAUTION

To prevent overheat damage to electrically heated anti-ice jackets, the FUEL VENT heat switches should not be turned ON unless cooling air will soon pass over the jackets.

b. Normal Operation. For normal operation, switches for the FUEL VENTS anti-ice circuits are turned ON as required during the BEFORE TAKE-OFF procedures (Chapter 8).

2-58. WINDSHIELD ELECTROTHERMAL ANTI-ICE SYSTEM.

a. Description. Both pilot and copilot windshields are provided with an electrothermal anti-ice system. Each windshield is part of an independent electrothermal anti-ice system. Each system is comprised of the windshield assembly with heating wires sandwiched between glass panels, a temperature sensor attached to the glass, an electrothermal controller, two relays, a control switch, and two circuit breakers. Two switches, placarded WSHLD ANTI-ICE NORMAL - OFF - HI - PILOT, COPILOT, located on the overhead control panel (fig. 2-l 2) control system operation. Each switch controls one electrothermal windshield system. The circuits of each system are protected by a 5-ampere circuit breaker and a 50-ampere circuit breaker which are not accessible to the flight crew. The 50-ampere circuit breakers are located in the power distribution panel under the floor ahead of the main spar. The 5-ampere circuit breakers are located on panels forward of the instrument panel.

b. Normal Operation. Two levels of heat are provided through the three position switches placarded NORMAL in the aft position, OFF in the center position, and HI after lifting the switch over a detent and moving it to the forward position. In the NORMAL position, heat is provided for the major portion of each windshield. In the HI position, heat is provided at a higher watt density to a smaller portion of the windshield. The lever lock feature prevents inadvertent switching to the HI position during system shutdown.

2-59. PRESSURIZATION SYSTEM.

a. Description. A mixture of bleed air from the engines, and ambient air, is available for pressurization to the cabin at a rate of approximately 10 to 17 pounds per minute. The flow control unit of each engine controls the bleed air from the engine to make it usable for pressurization by mixing ambient air with the bleed air depending upon aircraft altitude and ambient temperature. On takeoff, excessive pressure bumps are prevented by landing gear safety switch actuated solenoids incorporated in the flow control units. These solenoids, through a time delay, stage the input of ambient air flow by allowing ambient air flow introduction through the left flow control unit first, ten seconds later, air flow through the right flow control unit. The bleed air switches, located on the overhead control panel (fig. 2-12) operate an integral electric solenoid which controls the bleed air to the firewall shutoff valves.

b. Pressure Differential. The pressure vessel is designed for a normal working pressure differential of 6.0 PSI, which will provide a cabin pressure altitude of 3870 feet at an aircraft altitude of 20,000 feet, and a nominal cabin altitude of 9840 feet at an aircraft altitude of 31,000 feet.

c. Cabin Altitude and Rate-of-Climb Controller. A control panel is installed on the copilot's side of the subpanel (fig, 2-6) for operation of the system. A knob, placarded INC RATE controls the rate of change of pressurization. A control, placarded CABIN CONTROLLER is used to set the desired cabin altitude. For proper cabin pressurization, the CABIN CONTROLLER should be set 500 feet above cruise altitude. For landing select 500 feet above field pressure altitude. The selected altitude is displayed on a mechanically coupled dial above the control, placarded CABIN ALT-FT. Mechanically coupled to the cabin altitude dial, placarded ACFTX 1000. This dial indicates the maximum altitude the aircraft may be flown at to maintain the desired cabin altitude without exceeding the design pressure differential. A switch, placarded CABIN PRESS DUMP-PRESS-TEST, is provided to control pressurization. The switch is spring loaded to the PRESS position. In the DUMP position, the safety valve will be opened and the cabin will be depressurized to the aircraft altitude. In the PRESS position, cabin altitude is controlled by the CABIN CONTROLLER control. In the TEST position, the landing gear safety switch is bypassed to enable testing of the pressurization system on the ground. Operating instructions are contained in Chapter 8.

d. Cabin Rate-of-Climb Indicator. An indicator, placarded CABIN CLIMB, is installed on the copilot's side of the instrument panel (fig. 2-29). The cabin rate-of-climb controller is calibrated in thousands-of-feet per-minute change in cabin altitude.

e. Cabin Altitude Indicator. An indicator, placarded CABIN ALT, is installed in the instrument panel (fig. 2-29) above the cabin rate-of-climb indicator. The longer needle indicates aircraft altitude in thousands-of-feet on the outside dial. The shorter needle indicates pressure differential in PSI on the inner dial. Maximum differential is 6.1 PSI.

f. Outflow Valve. A pneumatically operated outflow valve, located on the aft pressure bulkhead, maintains the selected cabin altitude and rate-of-climb commanded by the cabin rate-of-climb and altitude controller on the copilot's instrument panel. As the aircraft climbs, the controller modulates the outflow valve to maintain a selected cabin rate of climb and increases the cabin differential pressure until the maximum cabin pressure differential is reached. At a cabin altitude of 12,500 feet a pressure switch mounted on the back of the overhead control panel completes a circuit to illuminate a red warning annunciator light, ALT WARN, to warn of operation requiring oxygen. This light is protected by a 5-ampere breaker, placarded PRESS CONTR.

g. Pressurization Safety Valve. Before takeoff, the safety valve is open with equal pressure between the cabin and the outside air. The safety valve closes on liftoff if the CABIN PRESS CONTR switch on the instrument panel is in the PRESS mode. The safety valve adjacent to the outflow valve provides pressure relief in the event of failure of the outflow valve. This valve is also used as a dump valve and is opened by vacuum which is controlled by a solenoid valve operated by the cabin pressure dump switch adjacent to the controller. It is also wired through a landing gear safety switch. If either of these switches is open, or the vacuum source or electrical power is lost, the safety valve will close to atmosphere except at maximum differential pressure of 6.1 PSI. A negative pressure relief diaphragm is also incorporated into the outflow and safety valves to prevent outside atmospheric pressure from exceeding cabin pressure during rapid descent.

h. Drain. A drain in the outflow valve static control line is provided for removal of accumulated moisture. The drain is located behind the lower sidewall upholstery access panel in the baggage section of the aft compartment.

i. Flow Control Unit. A flow control unit forward of the firewall in each nacelle controls bleed air flow and the mixing of ambient air to make up the total air flow to the cabin for pressurization, heating, and ventilation. The bleed air switches located on the overhead control panel (fig. 2-12) operates an integral electric solenoid which controls the bleed air to the firewall shutoff valves. A normally open solenoid operated by the landing gear safety switch controls the introduction of ambient air flow to the cabin on takeoff.

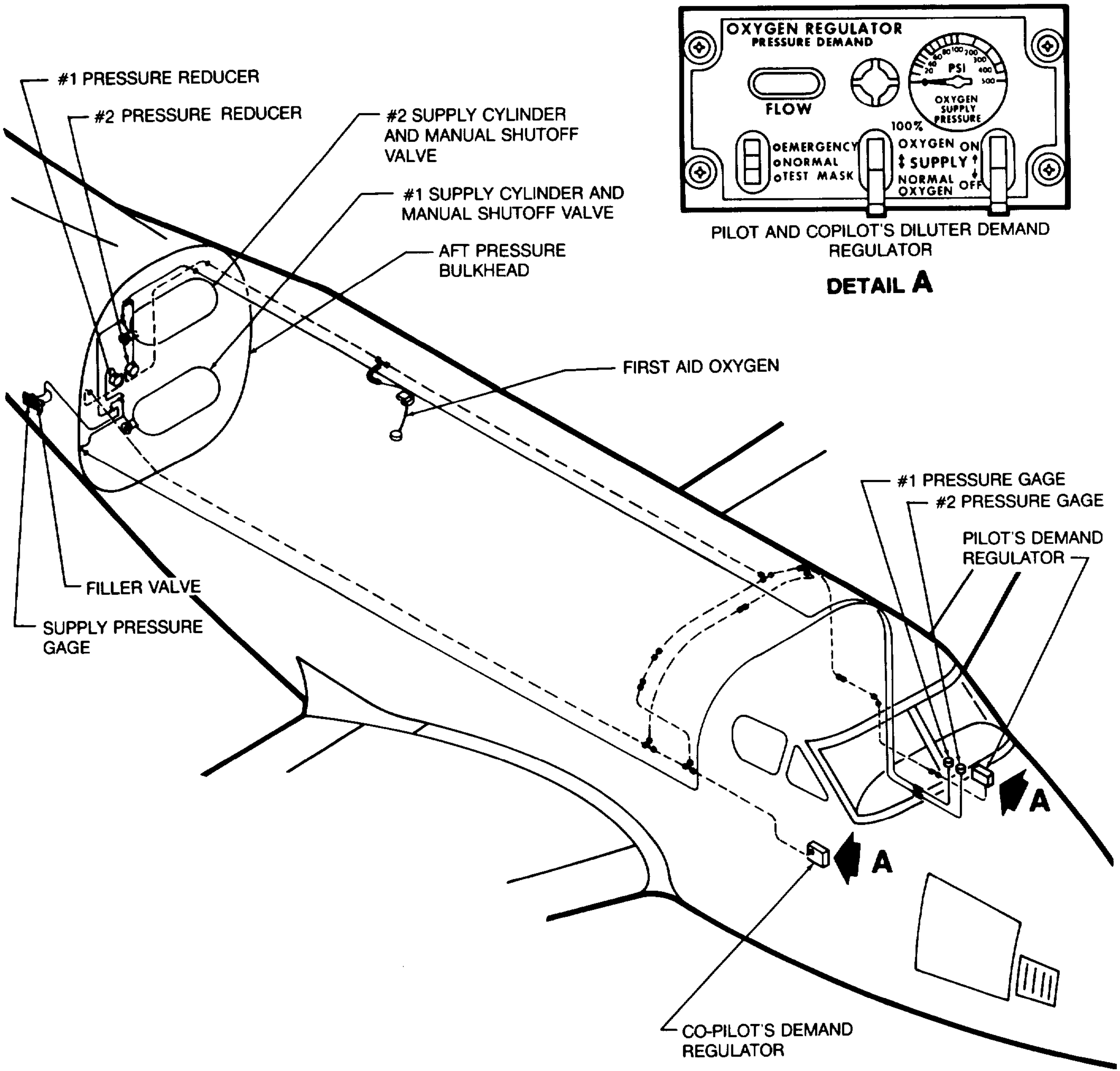
(1.) The unit receives bleed air from the engine into an ejector which draws ambient air into the nozzle of the venturi. The mixed air is then forced into the bleed air line routed to the cabin.

(2.) Bleed air flow is controlled automatically. When the aircraft is on the ground, circuitry from the landing gear safety switch prevents ambient air from entering the flow control unit to provide maximum heating.

(3.) The bleed air firewall shutoff valve in the control unit is a spring loaded, bellows operated valve that is held in the open position by bleed air pressure. When the electric solenoid is shut off, or when bleed air diminishes on engine shutdown (in both cases the pressure to the firewall shutoff valve is cut off), the firewall valve closes.

2-60. OXYGEN SYSTEM.

a. Description. The oxygen system (fig. 2-19) is provided primarily as an emergency system, however, the system may be used to provide supplemental (first aid) oxygen. Two 70 cubic foot capacity oxygen supply cylinders charged with aviator's breathing oxygen are installed in the unpressurized portion of the aircraft behind the aft pressure bulkhead. The pilot and copilot positions are equipped with diluter demand type regulators, which mix the proper amount of oxygen for a given amount of air at altitude. Also a first aid oxygen mask is provided in the cabin. Oxygen system pressure is shown by two gages placarded OXYGEN SUPPLY PRESSURE, located aft of the pilot's oxygen regulator control panel. Two pressure reducers, located in the unpressurized portion of the aircraft behind the aft bulkhead, lower the pressure in the system to 400 PSI, and route oxygen to the regulator control panels. Both cylinders are interconnected, so refilling can be accomplished through a single tiller valve located on the aft right side of the fuselage exterior. A pressure gage is mounted in conjunction with the filler valve, and each cylinder has a pressure gage. Table 2-4 shows oxygen flow planning rates vs altitude. Table 2-5 shows oxygen duration capacities of the system.



--------------LOW PRESSURE SYSTEM

HIGH PRESSURE SYSTEM

APOO6599

Figure 2- 19. Oxygen System Schematic

Table 2-4. Oxygen Flow Planning Rates vs Altitude
(All Flows In LPM Per Mask At NTPD)

CABIN PRESSURE ALTITUDE IN FEET	CREW MASK NORMAL (DILUTER DEMAND) (1)	CREW MASK 100% (1)	PASSENGER MASK
3 1,000	-0-(2)	4.2	3.7 (3)
30,000	-0-(2)	4.4	3.7 (3)
29,000	-0-(2)	4.7	3.7 (3)
28,000	-0-(2)	5.0	3.7 (3)
27,000	-0-(2)	5.3	3.7 (3)
26,000	-0-(2)	5.6	3.7 (3)
25,000	-0-(2)	5.9	3.7
24,000	-0-(2)	6.2	3.7
23,000	-0-(2)	6.6	3.7
22,000	-0-(2)	6.9	3.7
2 1 ,000	-0-(2)	7.2	3.7
20,000	3.6	7.6	3.7
19,000	3.9	7.9	3.7
18,000	4.2	8.3	3.7
17,000	4.5	8.7	3.7
16,000	4.8	9.1	3.7
15,000	5.1	9.5	3.7
14,000	5.4	10.0	3.7
13,000	5.8	10.4	3.7
12,000	6.1	10.9	3.7
11,000	6.5	11.3	3.7
10,000	6.9	11.9	3.7

NOTES:
(1) Based on minute volume of 20 LPM-BTPS (Body Temperature and Pressure Saturated).
(2) Use 100% oxygen at or above 20,000 feet.
(3) Not recommended for other than emergency descent use above 25,000 feet.

If average climb or descent flows are desired, add the values between altitudes and divide by the number of values used.

For example, to determine the average rate for a uniform descent between 25,000 feet and 15,000 feet perform the following.

(5.9 + 6.2 + 6.6 + 6.9 + 7.2 + 7.6 + 3.9 + 4.2 + 4.5 + 4.8 + 5.1) ÷ 11 = 5.7 LPM

This method is preferred over averaging the extremes an some flow characteristics vary in such a way as to yield as incorrect answer.

Table 2-5. Oxygen Duration In Minutes 140 Cubic Foot System

	CABIN PRESSURE ALTITUDE	CREW MASK CONDITION	TOTAL FLOW LPM-NTPD	DURATION IN MINUTES (1)
TWO MAN CREW	3 1,000	100%	8.4	384.0
	25,000	100%	11.8	273.3
	20,000	100%	15.2	212.2
	20,000	NORMAL	7.4	448.0
	15,000	100%	19.0	169.7
	15,000	NORMAL	10.2	316.2
	10,000	100%	23.8	135.5
TWO MAN CREW PLUS ONE PASS	10,000	NORMAL	13.8	233.7
	3 1,000	100%	12.1	266.6
	25,000	100%	15.5	208.1
	20,000	100%	18.9	170.0
	20,000	NORMAL	10.9	295.9
	15,000	100%	22.7	142.1
	15,000	NORMAL	13.9	232.1
	10,000	100%	27.5	117.3
	10,000	NORMAL	17.5	184.3

(1) For 100% capacity of useable oxygen, 3,226 L.

2-61. OXYGEN DURATION EXAMPLE PROBLEM

WANTED

Duration in minutes of oxygen at 100% capacity.

KNOWN

Two man crew plus one passenger, cabin pressure altitude = 15,000 feet, crew masks, normal, 100% capacity.

METHOD

Find “two man crew plus one pass” line, move right then down to 15,000 - “normal” read “232.1” minutes.

WANTED

Duration of oxygen for previous example data at 84% of capacity.

KNOWN

232.1 minutes duration at l00%, 84% capacity, total aircraft flow = 13.9 LPM.

METHOD

Multiply 232.1 X 0.84 = 194.9 minutes. or Multiply 3,226 X 0.84 = 2709.8, divide by 13.9 LPM = 194.9 minutes.

WANTED

Duration of oxygen for complement at other cabin pressure altitude, at less than 100% capacity.

KNOWN

Cylinder at 84% capacity, 100% capacity = 3,226 L, cabin pressure altitude = 21,000 feet.

1 crew mask = 7.2 LPM (100%) 1 passenger mask = 3.7 LPM

METHOD

Multiply 3,226 L X 0.84 = 2.709.8 L, multiply 2 crew X 7.2 LPM = 14.4 LPM, multiply 1 passenger X 3.7 LPM, add 14.4 LPM crew plus 3.7 LPM passenger = 18.1 LPM. Divide 3,226 L by 18.1 LPM = 178.2 minutes.

2-62. OXYGEN CYLINDER CAPACITY EXAMPLE PROBLEM

WANTED

a. Percent of capacity at known pressure and temperature.

b. Pressure when temperature decreases.

STABILIZED CYLINDER TEMPERATURE

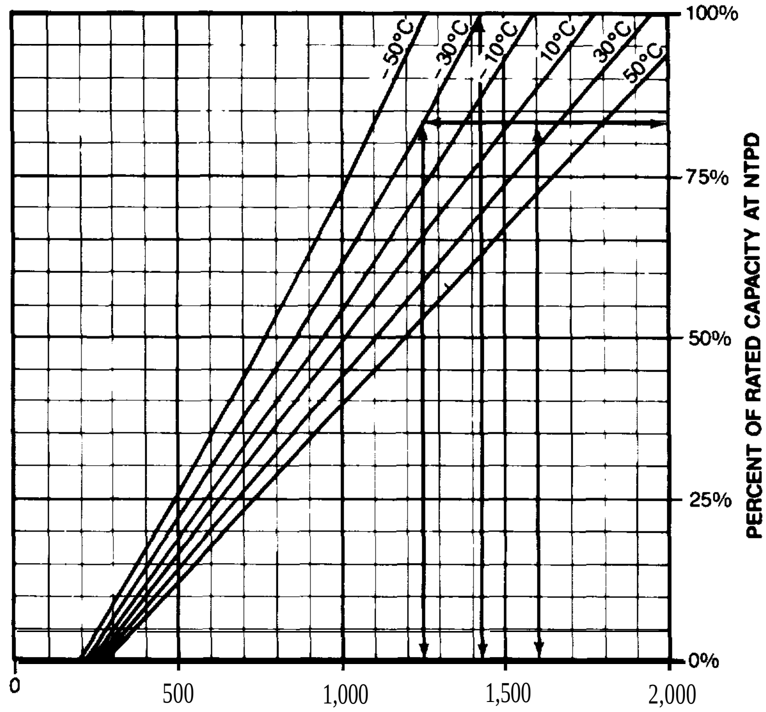


Figure 2-20. Cylinder Capacity vs Pressure and Temperature

KNOWN

Pressure = 1,600 PSIG stabilized cylinder temperature is estimated at 20º C decreased stabilized cylinder temperature is estimated at -30º C.

METHOD

a. Enter 1600 PSIG move up to 20º C line, move right to 84%.

b. Move left on 84% line to -30º C line, move down to 1250 PSIG.

WANTED

100% capacity pressure at known temperature.

KNOWN

Temperature = -30º C.

METHOD

Move left along 100% line to -30º C line and move down to 1420 PSIG.

(1.) Regulator control panels. Each regulator control panel contains a blinker-type flow indicator, a 500 PSI pressure gage, a red emergency pressure control lever placarded EMERGENCY - NORMAL - TEST MASK, a white diluter control lever placarded 100% OXYGEN - NORMAL OXYGEN, and a green supply control lever placarded ON - OFF. The diluter control lever selects either normal or 100% oxygen, but acts to select only when the emergency pressure control lever is in the NORMAL position.

CAUTION

When not in use, the diluter control lever should be left in the 100% OXYGEN position to prevent regulator contamination.

(2.) The emergency pressure control lever has three positions. Two positions control oxygen consumption for the individual using oxygen, and the remaining position serves for testing hose and mask integrity. In the EMERGENCY position, the control lever causes 100% oxygen to be delivered at a safe, positive pressure. In the NORMAL position, the lever allows delivery of normal or 100% oxygen, depending upon the selection of the diluter control lever. In TEST MASK position, 100% oxygen at positive pressure is delivered to check hose and mask integrity.

(3.) The 500 PSI oxygen pressure gage provided on the oxygen control panels should never

indicate over 400 PSI. If the pressure exceeds 400 PSI, a malfunction of the pressure reducer is indicated. Whenever oxygen is inhaled, a blinker-vane slides into view within the flow indicator window, showing that oxygen is being released. When oxygen is exhaled, the blinker vane vanishes from view.

NOTE

Check to insure that the OXYGEN SUPPLY PRESSURE gage registers adequate pressure before each flight. When oxygen is in use, a check of the supply pressure should be made at intervals during flight to note the quantity available and to approximate the supply duration. The outside temperature is reduced as an aircraft ascends to higher altitudes. Oxygen cylinders thus cooled by temperature change will show a pressure drop. This type of drop in pressure will raise again upon return to a lower or warmer altitude. A valid cause for alarm would be the rapid loss of oxygen pressure when the aircraft is in level flight or descending; should this condition arise, descend as rapidly as possible to altitude which does not require the use of oxygen.

WARNING

Pure oxygen will support combustion. Do not smoke while oxygen is in use.

WARNING

If any symptoms occur suggestive of the onset of hypoxia, immediately set the emergency pressure control lever to the EMERGENCY position and descend below 10,000 feet. Whenever carbon monoxide or other noxious gas is present or suspected, set the dilutor control lever to 100% OXYGEN and continue breathing undiluted oxygen until the danger is past.

e. Oxygen masks. Oxygen masks for the pilot and copilot are provided as personal equipment. To connect a mask into the oxygen system, the individual connects the line attached to the mask to the flexible hose which is attached to the cockpit sidewall. The microphone in the oxygen mask is provided with a cord for connecting with the microphone jack. To test mask and hose integrity, the individual places the supply control lever on the regulator control panel to the ON position, puts on and adjusts his mask, selects TEST MASK position, and checks for leaks.

f. Normal Operation. Oxygen pressure is maintained at all times to the regulator control panels if the cylinder shut-off valves are on and if there is pressure in the cylinders. Each individual places the supply lever (green) on his regulator control panel to the ON position, and the diluter lever (white) to the NORMAL OXYGEN position.

g. Emergency Operation. For emergency operation, the affected crew member selects the EMERGENCY position of the emergency pressure control lever (red) on his regulator control panel. This selection provides 100% oxygen at a positive pressure, regardless of the position of the diluter control lever on his panel.

h. First Aid Operation. A first aid oxygen mask is installed in the aft cabin area as a supplemental or emergency source of oxygen. The mask is stowed behind an overhead cover placarded FIRST AID OXYGEN -PULL. Removing the cover allows the mask to drop out of the container, exposing a manual control valve, which releases oxygen to the mask when placed in the ON position. After using the mask, the manual valve in the container must be turned OFF before stowing the mask and replacing the cover.

2-63. WINDSHIELD WIPERS.

a. Description. Two electrically operated windshield wipers, are provided for use at takeoff, cruise and landing speed. A rotary switch (fig. 2-12) placarded WINDSHIELD WIPER, located on the overhead control panel, selects mode of windshield wiper operation. An information placard above the switch states: DO NOT OPERATE ON DRY GLASS. Function positions on the switch, as read clockwise, are placarded: PARK - OFF - SLOW - FAST. When the switch is held in the spring-loaded PARK setting, the blades will return to their normal inoperative position on the glass, then, when released, the switch will return to OFF position terminating windshield wiper operation. The FAST and SLOW switch positions are separate operating speed settings for wiper operation. The windshield wiper circuit is protected by one lo-ampere circuit breaker, placarded WSHLD WIPER, located on the overhead circuit breaker panel (fig. 2-26).

CAUTION

Do not operate windshield wipers on dry glass. Such action can damage the linkage as well as scratch the windshield glass.

b. Normal Operation. To start, turn WINDSHIELD WIPER switch to FAST or SLOW speed, as desired. To stop, turn the switch to the PARK position and release. The blades will return to their normal inoperative position and stop. Turning the switch only to the OFF position will stop the windshield wipers, without returning them to the normal inactive position.

2-64. FERRY CHAIR.

For ferry purposes, a forward facing chair with a lap belt is attached to floor tracks at fuselage station 211.87 (fig. 2-2).

2-65. CIGARETTE LIGHTERS AND ASH TRAYS.

The pilot and copilot have individual cigarette lighters and ash trays mounted in escutcheons outboard of their seats. The cigarette lighters are protected by a 5-ampere circuit breaker, placarded CIGAR LIGHTER, on the overhead circuit breaker panel (fig. 2-26).

2-66. CHEMICAL TOILET.

a. Description. A side-facing chemical toilet (figure 2-2) is installed in the aft cabin area. Two hinged lid half-sections must be raised to gain access to the toilet. Waste is stored within a removable container located below the seat in the cabinet assembly. This non-flushing system uses a dry chemical preparation to deodorize the stored waste. A toilet tissue dispenser is contained in a slide-out compartment on the forward side of the toilet cabinet. A box of disposable waste container liners and a box of chemical deodorant packets are also stored in the cabinet.

b. Operation. During use, a removable, throwaway plastic liner is attached to the waste container. After use, dry chemical deodorant obtained from the storage cabinet is deposited on the waste and the hinged lid sections are closed over the cavity. After each flight, the waste container must be removed, emptied, relined, replaced in the cabinet and other toilet items are resupplied as needed,

2-67. SUN VISORS.

CAUTION

When adjusting the sun visors, grasp only by the top metal attachment to avoid damage to the plastic shield.

A sun visor is provided for the pilot and copilot respectively (fig. 2-8). Each visor is manually adjustable. When not needed as a sun shield, each visor may be manually rotated to a position flush with the top of the cockpit so that it does not obstruct view through the windows.

2-68. RELIEF TUBE.

One relief tube is provided, located immediately aft of the cabin door on the left side of the fuselage.

Section VIII. HEATING, VENTILATION, COOLING, AND ENVIRONMENTAL Control System

2-69. HEATING SYSTEM.

a. Description. Warm air for heating the cockpit and mission avionics compartments and warm windshield defrosting air is provided by bleed air from both engines. Engine bleed air is combined with ambient air in the heating and pressurization flow control unit in each nacelle. If the mixed bleed air is too warm for cockpit comfort, it is cooled by being routed through an air-to-air heat exchanger located in the forward portion of each inboard wing. If the mixed bleed air is not too warm, the air-to-air heat exchangers are bypassed. The mixed bleed air is then ducted to a mixing plenum, where it is mixed with cabin recirculated air. The warm air is then ducted to the cockpit outlets, windshield defroster outlets, and to the floor outlets in the mission avionics compartment. The environmental system is shown in figure 2-21. placarded WSHLD W1

(1.) Bleed airflow control unit. A bleed air flow control unit, located forward of the firewall in each engine nacelle controls the flow of bleed air and the mixing of ambient air to make up the total airflow to the cabin for heating, windshield defrosting, pressurization and ventilation. The unit is fully pneumatic except for an integral electric solenoid firewall shutoff valve, controlled by the bleed air switches located on the overhead control panel (fig.

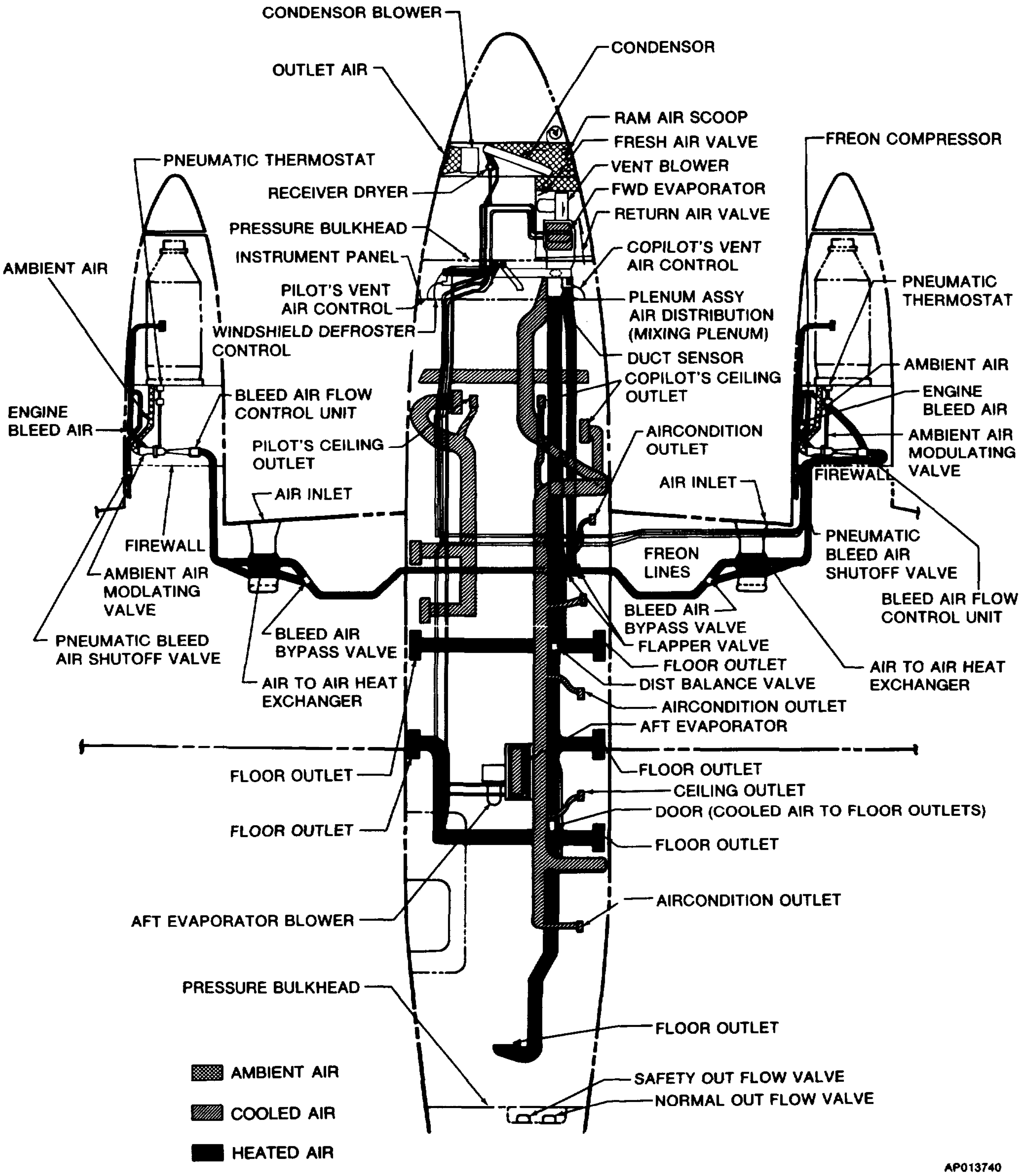


Figure 2-2 1. Environmental System

2-l 2) and a normally open solenoid valve operated by the right landing gear safety switch.

(2.) Pneumatic bleed air shutoff valve. A pneumatic shutoff valve is provided in each nacelle to control the flow of bleed air to the surface, antenna and brake deice systems. These valves are controlled by the bleed air valve switches located on the overhead control panel (fig. 2-12).

(3.) Bleed air valve switches. The bleed air flow control unit shutoff valve and pneumatic bleed air shutoff valves are controlled by two switches placarded BLEED AIR VALVE - OPEN - ENVIRO OFF - PNEU & ENVIRO OFF, located on the overhead control panel (fig. 2-12). When set to the open position, both the environmental flow control unit shutoff valve and the pneumatic shutoff valve are open; when set to the ENVIRO OFF position, the environmental flow control unit shutoff valve is closed, and the pneumatic bleed air valve is open; in the PNEU & ENVIRO OFF position, both are closed. For maximum cooling on the ground, turn the bleed air valve switches to the ENVIRO OFF position.

(4.) Cabin temperature mode selector switch. A switch placarded CABIN TEMP MODE - MAN COOL - MAN HEAT -OFF - AUTO - A/C COLD OPN - -25°C to 10°C located on the overhead control panel, controls cockpit and mission avionics compartment heating and air conditioning. When the cabin temperature mode selector switch is set to the AUTO position, the heating and air conditioning systems are automatically controlled. Control signals from the temperature control box are transmitted to the bleed air heat exchanger bypass valves. Here the temperature of the air flowing to the cabin is regulated by the bypass valves controlling the amount of air bypassing the heat exchangers. When the temperature of the cabin has reached the temperature setting of the cabin temperature control rheostat, the automatic temperature control allows hot air to bypass the air-to-air exchangers admitting hot air into the cabin. When the bypass valves are in the fully closed position, allowing no air to bypass the heat exchangers, the air conditioner begins to operate, providing additional cooling. When the cabin temperature mode selector switch is set to the A/C COLD OPN position, the air conditioning system is in continuous operation. The cabin temperature control rheostat, in conjunction with the cabin temperature control sensor, provides regulation of cockpit and mission equipment compartment temperature. Bleed air heat is added as required to maintain the temperature selected by the cabin temperature control rheostat.

(5.) Cabin temperature control rheostat. A control knob placarded CABIN TEMP - INCR, located on the overhead control panel (fig. 2-12), provides regulation of cabin temperature when the cabin temperature mode selector switch is set to the AUTO or the A/C COLD OPN position. A temperature sensing unit in the cabin, in conjunction with the setting of the cabin temperature control rheostat, initiates a heat or cool command to the temperature controller for the desired cockpit or mission avionics compartment environment.

(6.) Manual temperature control switch. A switch placarded MANUAL TEMP - INCR - DECR, located on the overhead control panel (fig. 2-12), controls cockpit and mission avionics compartment temperature with the cabin temperature mode selector switch set to the MAN HEAT positions. The manual temperature control switch controls cockpit and mission avionics temperature by providing a means of manually changing the amount that the bleed air bypass valves are opened or closed. To increase cabin temperature the switch is held to the INCR position. To decrease cabin temperature, the switch is held to the DECR position. Approximately 30 seconds per valve is required to drive the bypass valves to the fully open or fully closed position. Only one valve moves at a time.

(7.) Forward vent blower switch. The forward vent blower is controlled by a switch placarded VENT BLOWER - AUTO - LO - HI, located on the overhead control panel (fig. 2-12). In the auto position the fan will run at low speed except when the cabin temperature mode selector switch is set to the OFF position, in this case the blower will not operate.

(8.) Aft vent blower switch. The aft vent blower is controlled by a switch placarded AFT VENT BLOWER - OFF - AUTO - ON, located on the overhead control panel (fig. 2-l 2). The single speed blower operates automatically through the cabin temperature mode selector switch when the aft vent blower switch is placed in the AUTO position. The blower runs continuously when the switch is placed in the ON position, In the OFF position, the blower will not operate.

b. Automatic Heating Mode.

1. Bleed air valve switches - OPEN, LEFT and RIGHT.
2. Cabin temperature mode selector switch - AUTO.
3. Cabin temperature control rheostat - As required.
4. Cabin, cockpit and defrost air knobs - As required

c. *Manual heating mode.*

1. Bleed air valve switches - OPEN, LEFT and RIGHT.
2. Cabin temperature mode selector switch - MAN HEAT.
3. Vent blower switches - As required.
4. Manual temperature switch - As required.
5. Cabin, cockpit and defrost air knobs - As required.

2-70. AIR CONDITIONING SYSTEM.

a. Description. Cabin air conditioning is provided by a refrigerant gas vapor cycle refrigeration system consisting of a belt driven, engine mounted compressor, installed on the No.2 engine accessory pad, refrigerant plumbing, N_1 speed switch, high and low pressure protection switches, condenser coil, condenser-under-pressure switch, condenser blower, forward and aft evaporator, receiver-dryer, expansion valve and a bypass valve. The plumbing from the compressor is routed through the right inboard wing leading edge to the fuselage and then forward to the condenser coil, receiver-dryer, expansion valve, bypass valve, and forward evaporator, which are located in the nose of the aircraft. A 7 1/2-ampere circuit breaker placarded AIR COND CONTR, located on the overhead control panel (fig. 2-12), protects the compressor clutch circuit.

(1.) Forward evaporator. The forward evaporator and blower supplies the cockpit, forward ceiling outlets, and forward floor outlets. The forward evaporator blower has a high speed which can be selected by setting the VENT BLOWER switch, located on the overhead control panel (fig. 2-12), to the HI position. The forward vent blower is protected by a circuit breaker on the DC power distribution panel, located below the aisleway floor forward of the main spar.

(2.) Aft evaporator. The aft evaporator and blower are located in the fuselage center aisle equipment bay aft of the rear spar. Environmental air is circulated through the evaporator in either manual or automatic control mode. The rear evaporator supplies the aft ceiling outlets, rear floor outlets, and toilet compartment. Rear evaporator blower is protected by a circuit breaker on the DC power distribution panel located below the aisleway floor forward of the main spar.

(3.) High and low pressure limit switches. High and low pressure limit switches are provided to prevent compressor operation beyond operational limits. When the low or high pressure switches are activated, compressor operation will be terminated. When compressor operation has been terminated by limit switch activation, the system should be thoroughly checked before returning it to service.

(4.) Thermal sense switch. A thermal sense switch is installed on the forward evaporator. This sense switch actuates a hot gas bypass valve which bypasses a portion of the refrigerant from the forward evaporator, thereby preventing icing of the evaporator.

(5.) Condenser blower. A vane-axial blower draws air through the condenser on the ground as well as in flight. The current limiter for the blower is located on the DC distribution panel below the aisleway floor forward of the main spar. When the cabin temperature mode selector switch is set to the A/C COLD OPN position, the condenser blower will be off, and will remain off until the condenser blower control high pressure switch senses a compressor discharge pressure equal to the pressure it is set to. The condenser blower will then remain in operation until the low pressure switch senses that the system pressure has dropped to the pressure it is set to.

(6.) Air conditioning cold operation bypass valve. Selecting the A/C COLD OPN mode on the cabin temperature mode selector switch permits the operation of the air conditioning system by overriding the refrigerant low pressure switch. This allows the air conditioning system to operate in the manual mode. Starting the compressor in this optional mode at low ambient temperature will decrease the operational life of the compressor by five hours each time the air conditioning system is started using this mode (A/C COLD OPN). If the air conditioning system has been operating in the normal mode during flight, and due to decreasing ambient temperatures make it necessary to switch to the A/C cold operation mode, there will be no degradation in the mean time between failure for the compressor.

(7.) Air conditioner cold operation advisory annunciator light. A green advisory annunciator light placarded A/C COLD OPN, located on the caution/advisory annunciator panel (fig. 2.6), illuminates when the air conditioning system is operating in cold mode, or when ambient temperatures require switching to cold mode if air conditioning system operation is to be continued.

b. *Normal Operation.*

(1.) Automatic cooling mode.

1. Bleed air valve switches - OPEN, LEFT and RIGHT.
2. Cabin temperature mode selector switch - AUTO.

3. Cabin temperature control rheostat - As required.

4. Cabin, cockpit and defrost air knobs - As required.

(2.) Manual cooling mode.

1. Bleed air valve switches - OPEN, LEFT and RIGHT.

NOTE

For maximum cooling on the ground, set the bleed air valve switches to the ENVIRO OFF position.

2. Cabin temperature mode selector switch - MAN COOL.

(3.) Air conditioning cold operation mode. (Used if ambient temperature is between 10°C and -25° C).

NOTE

Setting the cabin temperature mode selector switch to the A/C COLD OPN position at ambient temperatures below -25°C may cause the air conditioning system to exceed the compressor low pressure limit switch setting, terminating compressor operation, and thereby rendering the system inoperative for the remainder of the flight.

1. Bleed air valve switches - OPEN, LEFT and RIGHT.

2. Cabin temperature mode selector switch - A/C COLD OPN.

3. Cabin temperature control rheostat - As required.

4. Cabin, cockpit and defrost air knobs - As required.

2-71. UNPRESSURIZED VENTILATION.

Ventilation is provided by two sources. One source is through the bleed air heating system in both the pressurized and unpressurized mode. The second source of ventilation is obtained from ram air through the condenser section in the nose through a check valve in the vent blower plenum. Ventilation from this source is in the unpressurized mode only with the CABIN PRESS DUMP switch in the DUMP position. The check valve closes during pressurized operation. Ram air ventilation is distributed through the main ducting system to all outlets. Ventilation air, ducted to each individual eyeball cold air outlet, can be directionally controlled by moving the ball in the socket. Volume is regulated by twisting the outlet to open or close the valve.

2-72. ENVIRONMENTAL CONTROLS.

An environmental control section on the overhead control panel (fig. 2-12) provides for automatic or manual control of the system. This section contains all the major controls of the environmental function including bleed air valve switches, a vent blower control switch, an aft vent blower switch, a manual temperature switch for control of the heat exchanger valves, a cabin temperature level control, and the cabin temp mode selector switch for selecting automatic heating or cooling or manual heating or cooling. Four additional manual controls on the main instrument subpanels may be utilized for partial regulation of cockpit comfort when the cockpit partition door is closed and the cabin comfort level is satisfactory.

a. Heating Mode.

(1.) If the cockpit is too cold:

1. Pilot and copilot air knobs - As required.

2. Defrost air knob - As required.

3. Cabin air knob - Pull out in small increments. Allow 3 -5 minutes after each adjustment for system to stabilize.

(2.) If the cockpit is too hot:

1. Cabin air knob - As required.

2. Pilot and copilot air knobs - In as required.

3. Defrost air knob - In as required.

b. Cooling Mode:

(1.) If the cockpit is too cold:

1. Pilot and copilot air knob - In as required.

2. Defrost air knob - In as required.

3. Overhead cockpit outlets - As required.

(2.) If the cockpit is too hot:

1. Pilot and copilot air knobs - Out as required.

2. Cabin air knob. Close in small increments. Allow 3 - 5 minutes after each adjustment for system to stabilize. If CABIN AIR knob is completely closed before obtaining satisfactory cockpit comfort, it may be necessary to place the aft vent blower switch in the ON position to activate the aft evaporator to recirculate cabin air.

c. Automatic Mode Control. When the AUTO mode is selected on the cabin temperature mode selector switch, the heating and air conditioning systems are automatically controlled. When the temperature of the cabin has reached the selected setting, the automatic temperature control allows heated air to bypass the air-to-air exchangers in the wing center section. By-pass air is hot. Heat exchanger air is cooled to approximately 30°F above ambient (outside) air. The warm bleed air is mixed with the cooled air. The rear evaporator picks up recirculated cabin air only.

NOTE

The automatic mode control works as described, when the cabin is being cooled by bleed air. However, when the cabin is heated with bleed air and the selected temperature is reached, hot bleed air routes through the heat exchanger for cooling in order to maintain the desired temperature.

(1.) When the automatic control drives the environmental system from a heat mode to a cooling mode, the bypass valves close. When the left bypass valve reaches a fully closed position, the refrigeration system will begin cooling, provided the right engine N_1 speed is above 65%. When the bypass valve is opened to a position approximately 30° from full open, the refrigeration system will turn Off.

(2.) The CABIN TEMP - INCR control provides regulation of the temperature level in the automatic mode. A temperature sensing unit in the cabin, in conjunction with the control setting, initiates a heat or cool command to the temperature controller for desired cockpit and cabin environment.

d. Manual Mode Control. With the cabin temperature mode selector in the MAN HEAT or MAN COOL position, regulation of the cabin temperature is accomplished manually with the MANUAL TEMP switch.

(1.) In the MAN HEAT mode, the automatic system is overridden and the system is controlled by opening and closing the bypass valves (two) with the MANUAL TEMP - INCR - DECR switch. To increase cabin temperature, hold the switch at the INCR position, to decrease cabin temperature, hold the switch in the DECR position. Allow approximately 30 seconds per valve to drive the bypass valves to the fully open or fully closed position. Only one valve moves at a time.

(2.) With the cabin temperature selector switch in the MAN COOL position, the automatic temperature control system is bypassed. When the left bypass valve reaches a fully closed position, the refrigeration system will begin cooling, provided the right engine N_1 speed is above 65%. When the bypass valve is opened to a position approximately 30° from full open, the refrigeration system will turn off. Hold the MANUAL TEMP switch in the DECR position approximately one minute to fully close air-to-air heat exchanger bypass valves.

(3.) Bleed air entering the cabin is controlled by bleed air valve switches placarded BLEED AIR VALVE - OPEN - ENVIRO OFF -PNEU & ENVIRO OFF. When the switch is in the OPEN position, the environmental flow control unit and the pneumatic valve are open. When the switch is in the ENVIRO OFF position, the environmental flow control unit is closed and the pneumatic bleed air valve is open; in the PNEU & ENVIRO OFF position, both are closed. For maximum cooling on the ground, turn the bleed air valve switches to the ENVIRO OFF position.

(4.) The forward vent blower is controlled by a switch placarded VENT BLOWER - AUTO - LOW - HI. The HI and LOW positions regulate the blower to two speeds of operation. IN the AUTO position, the fan will run at low speed except when the CABIN TEMP mode selector switch is placed in the OFF position. In the OFF position, the blower will not operate.

(5.) The aft vent blower is controlled by a switch placarded AFT VENT BLOWER - OFF - AUTO - ON. The single speed blower operates automatically through the CABIN TEMP mode selector when the AFT VENT BLOWER switch is placed in the AUTO position. The blower runs continuously when the switch is placed in the ON position. In the OFF position, the blower will not operate.

Section IX. ELECTRICAL POWER SUPPLY AND DISTRIBUTION SYSTEM

2-73. DESCRIPTION.

The aircraft employs both direct current (DC) and alternating current (AC) electrical power. The DC electrical power supply (fig. 2-22) is the basic power system energizing most aircraft circuits. Electrical power is used to start the engines, to power the landing gear and flap motors, and to operate the standby fuel pumps, ventilation blower, lights and electronic equipment. AC power is obtained from DC power through inverters. The single phase AC power system is shown in figure 2-23, and the three phase AC power system is shown in figure 2-24. The three sources of DC power consist of one 20 cell 34-ampere/hour battery and two 400-ampere starter-generators. DC power may be applied to the aircraft through an external power receptacle on the underside of the right wing leading edge just outboard of the engine nacelle (refer to Section XII for GPU requirements). The starter-generators are controlled by generator control units. The output of each generator passes through a cable to the respective generator bus (fig. 2-22). Other buses distribute power to aircraft DC loads, and derive power from the generator buses. The generators are paralleled to balance the DC loads between the two units. When one of the generating systems is not on- line, and no fault exists, all aircraft DC requirements may be supplied either by the other on-line generating system, or by an external power source, but not by both. Most DC distribution buses are connected to both generator buses but have isolation diodes to prevent power crossfeed between the generating systems, when connection between the generator buses is lost. Thus, when either generator is lost because of a ground fault, the operating generator will supply power for all aircraft DC loads except those receiving power from the inoperative generator's bus which cannot be crossfed. When a generator is not operating, reverse current and over-voltage protection is automatically provided. Two inverters operating from DC power produce the required single-phase AC power. Three phase AC electrical power for inertial navigation system and mission avionics is supplied by two DC powered mission inverters. AC power may be applied through an external power receptacle located on the left nacelle. The mission power system is shown in figure 2-25.

2-74. DC POWER SUPPLY.

One nickel-cadmium battery furnishes DC power when the engines are not operating. This 24-volt, 34-ampere/hour battery, located in the right wing center section, is accessible through a panel on the top of the wing. DC power is produced by two engine-driven 28 volt, 400-ampere starter-generators. Controls and indicators associated with the DC supply system are located on the overhead control panel (fig. 2-12) and consist of a single battery switch (BATT), two generator switches (No.1 GEN and No.2 GEN), and two volt-loadmeters.

a. Battery Switch. A switch, placarded BATT (fig. 2-12) is located on the overhead control panel under the MASTER SWITCH. The BATT switch controls DC battery power to the aircraft bus system through the battery relay, and must be ON to allow external power to enter aircraft circuits. When the MASTER SWITCH is placed down, the BATT switch is forced OFF.

NOTE

With battery or external power removed from the aircraft electrical system, due to fault, power cannot be restored to the system until the BATT switch is moved to OFF/RESET, then ON.

b. Generator Switches. Two switches (fig. 2-12), placarded No. 1 GEN and No.2 GEN are located on the overhead control panel under the MASTER SWITCH. The toggle switches control electrical power from the designated generator to paralleling circuits and the bus distribution system. Switch positions are placarded RESET, ON and OFF. RESET is forward (spring-loaded back to ON), ON is center, and OFF is aft. When a generator is removed from the aircraft electrical system, due either to fault or from placing the GEN switch in the OFF position, the affected unit cannot have its output restored to aircraft use until the GEN switch is moved to RESET, then ON.

c. Master Switch. All electrical current may be shut off using the MASTER SWITCH gangbar (fig. 2-12) which extends above the battery and generator switches. The MASTER SWITCH gangbar is moved forward when a battery or generator switch is turned on. When moved aft, the bar forces each switch to the OFF position.

d. Volt-Loadmeters. Two meters (fig. 2-12), on the overhead control panel display voltage readings and show the rate of current usage from left and right generating systems. Each meter is equipped with a spring-loaded pushbutton switch which when manually pressed will cause the meter to indicate main bus voltage. Each meter normally shows the output amperage reading from the respective generator, unless the pushbutton switch is pressed to obtain the bus voltage reading. Current consumption

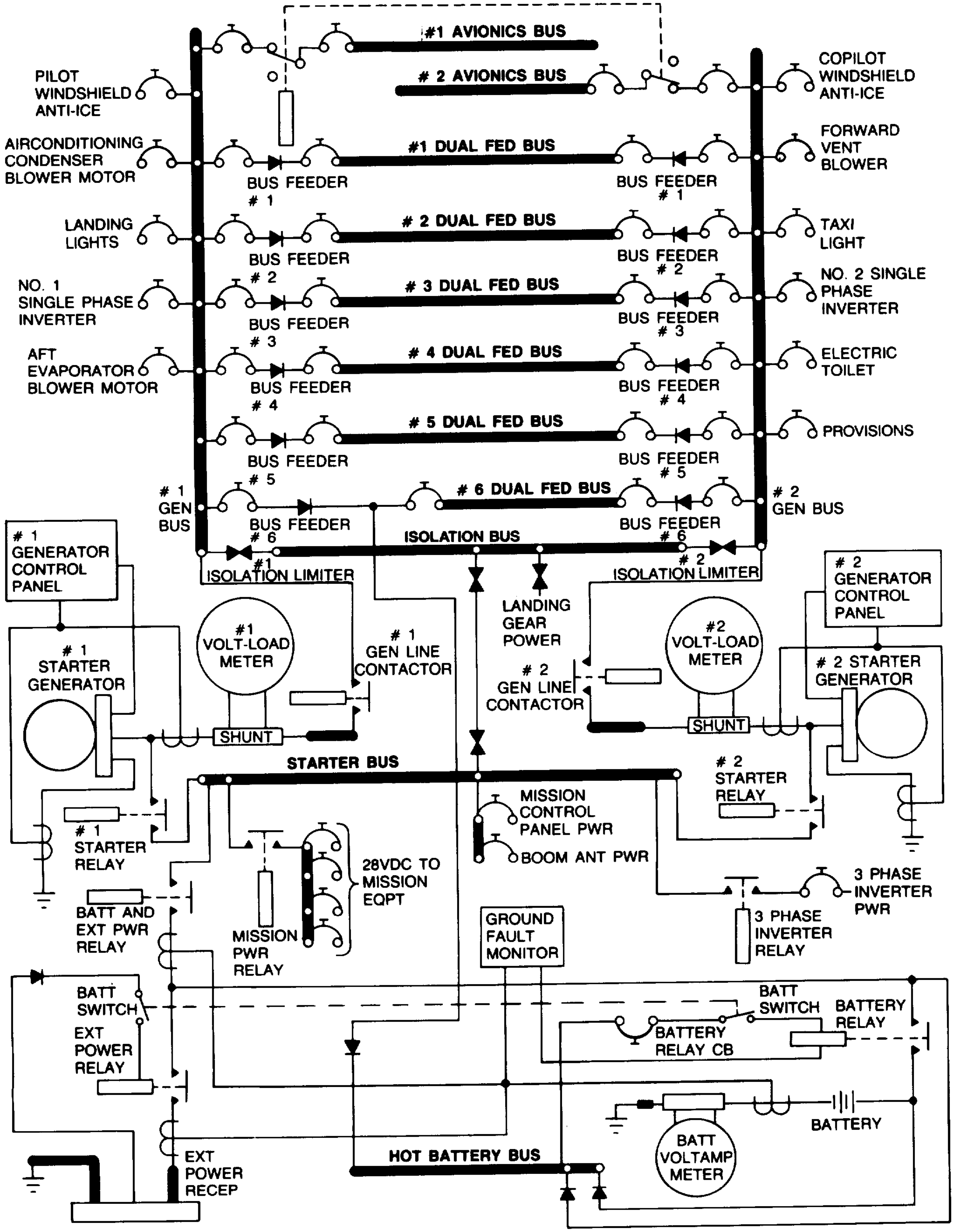


Figure 2-22. DC Electrical System (Sheet 1 of 3)

#1 AVIONICS BUS

HF RCVR	PILOT AUDIO	AFCS DIRECT
#1 VHF	TRANSPONDER	AP PWR
#1 VOR	UHF	VHF/AM/FM
#1 RMI	TACAN	
	INS CONTROL	

#2 AVIONICS BUS

#2 VOR	COPILOT AUDIO	SERVO DC
ADF	RADAR	RADIO RELAY
#2 RMI	RADAR-NAV	COPILOT ALT
		BU VOW

#1 DUAL FED BUS

ANN IND	STALL WARN	LEFT BLEED AIR WARN
#1 CHIP DETR	LANDING GEAR IND	#1 AUXILIARY TRANSFER
#1 QTY IND	#1 STANDBY PUMP	RADOME ANTI-ICE
#1 QTY WARN	#1 OIL PRESS	#1 ENG AIR SCOOP HEAT
#1 OIL TEMP		

#2 DUAL FED BUS

ANN PWR	FIRE DETR	RIGHT BLEED AIR WARN
#2 CHIP DETR	LANDING GEAR WARN	#2 AUXILIARY TRANSFER
#2 QTY IND	#2 STANDBY PUMP	#2 ENG AIR SCOOP HEAT
#2 QTY WARN	X2 OIL PRESS	ENG AIR SCOOP HEAT MONITOR
#2 OIL TEMP		
BATT CHARGE		

#3 DUAL FED BUS

WSHLD WIPER	LEFT PROP ANTI-ICE	PROP ANTI-ICE AUTO
SURF DEICE	LEFT FUEL VENT HEAT	LEFT FUEL CONTR HEAT
LEFT PITOT HEAT	#1 FIREWALL VALVE	#1 PRESS WARN
CROSSFEED	#1 ICE VANE CONTR	#1 IGNITOR CONTR
#1 START CONTR		
PROP SYNC		

X4 DUAL FED BUS

STALL WARN HEAT	RIGHT PROP ANTI-ICE	PROP ANTI-ICE CONTR
BRAKE DEICE	RIGHT FUEL VENT HEAT	RIGHT FUEL CONTR HEAT
RIGHT PITOT HEAT	#2 FIREWALL VALVE	#2 PRESS WARN
#2 START CONTR	#2 ICE VANE CONTR	#2 IGNITOR CONTR
AUTOFEATHER	PROP GOV	
HF POWER	SCAVENGER PUMP	

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Figure 2-22. DC Electrical System (Sheet 2 of 3)

#5 DUAL FED BUS

ELEC TRIM
LANDING GEAR RELAY
ICE LIGHTS
INST INDIRECT LIGHTS
TEMP CONTR

FLAP MOTOR
BCN LIGHTS
LANDING LIGHTS
LEFT BLEED AIR CONTR
PROVISIONS

PILOT TURN & SLIP
SUBPANEL & CONSOLE LIGHTS
RECOGNITION LIGHTS
AIR COND CONTR

#6 DUAL FED BUS

RUDDER BOOST
EMERG LIGHTS
OVHD LIGHTS
PRESS CONTR
CIGAR LIGHTER
AVIONICS MASTER CONTR

FLAP CONTR
FLT INST LIGHTS
RIGHT BLEED AIR CONTR
TAXI LIGHT

COPILOT TURN & SLIP
NAV LIGHTS
CABIN LIGHTS
CARGO DOOR HEAT

HOT BATTERY BUS

#1 FIREWALL SHUTOFF VALVE
#1 ENGINE FIRE EXTINGUISHER
#1 STANDBY FUEL PUMP
TRANSPONDER

CABIN LIGHT
BATTERY RELAY

#2 FIREWALL SHUTOFF VALVE
#2 ENGINE FIRE EXTINGUISHER
#2 STANDBY FUEL PUMP
CRYTO HOLD

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Figure 2-22. DC Electrical System (Sheet 3 of 3)

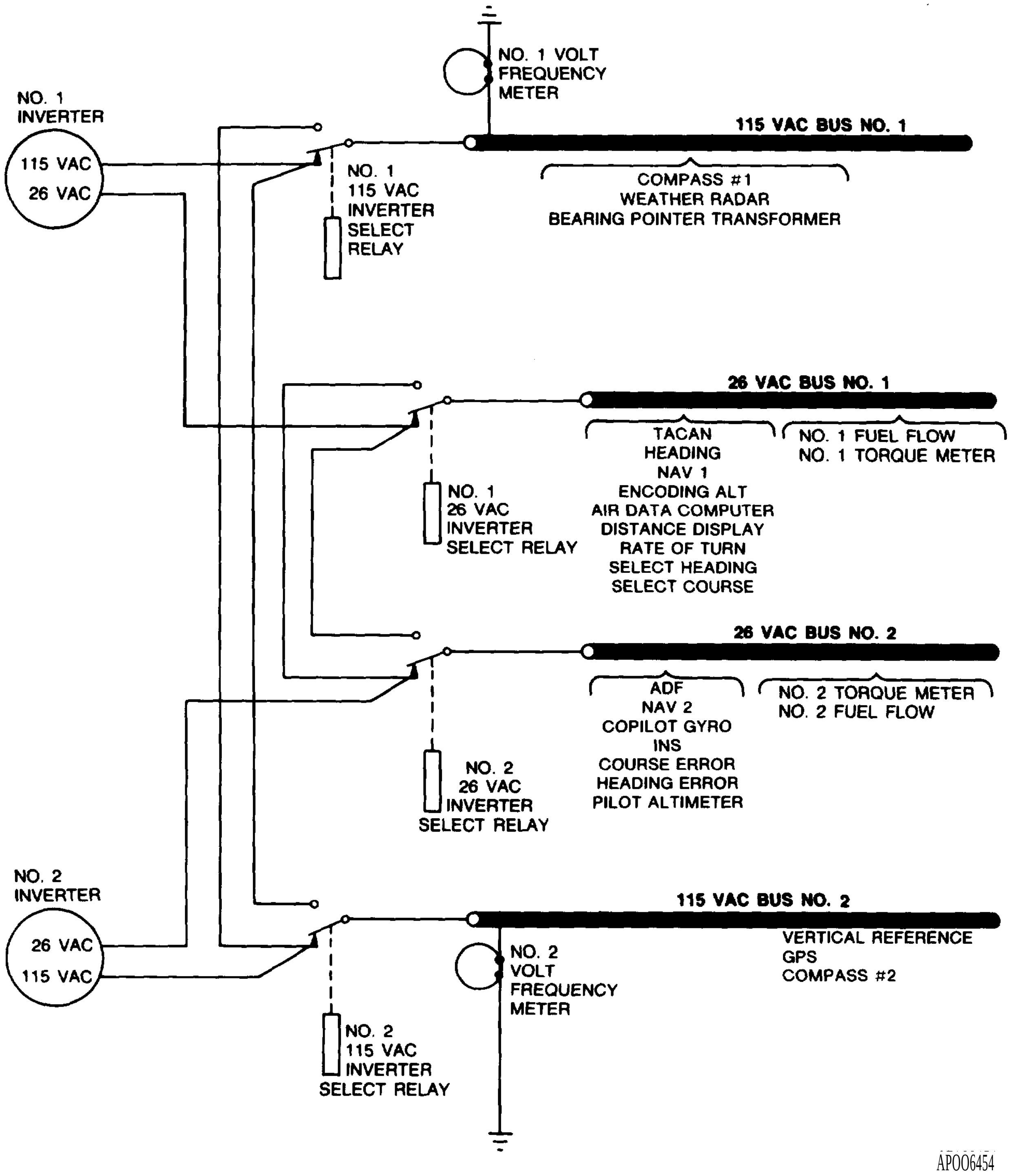


Figure 2-23. Single Phase AC Electrical System

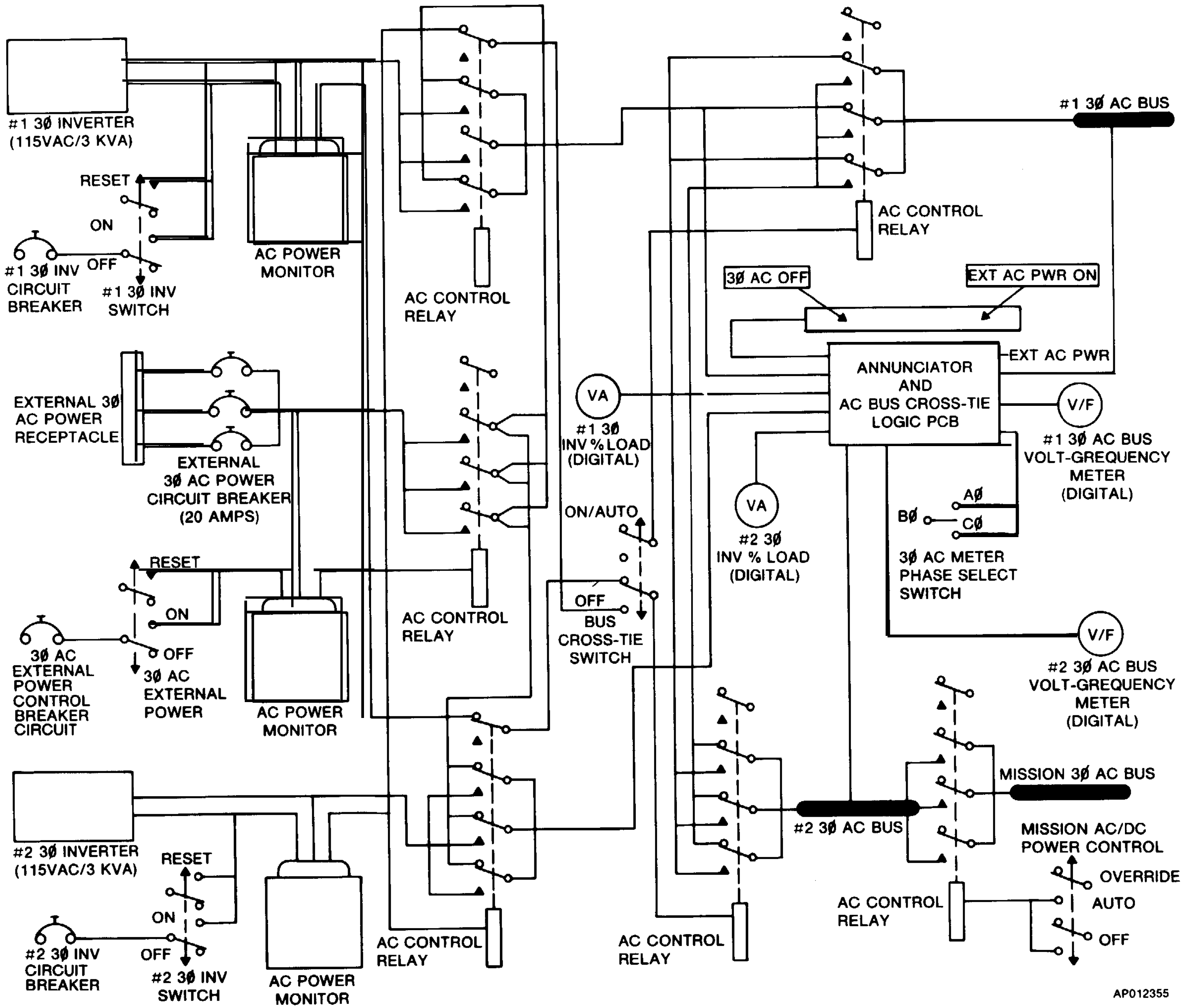


Figure 2-24. Three Phase AC Electrical System

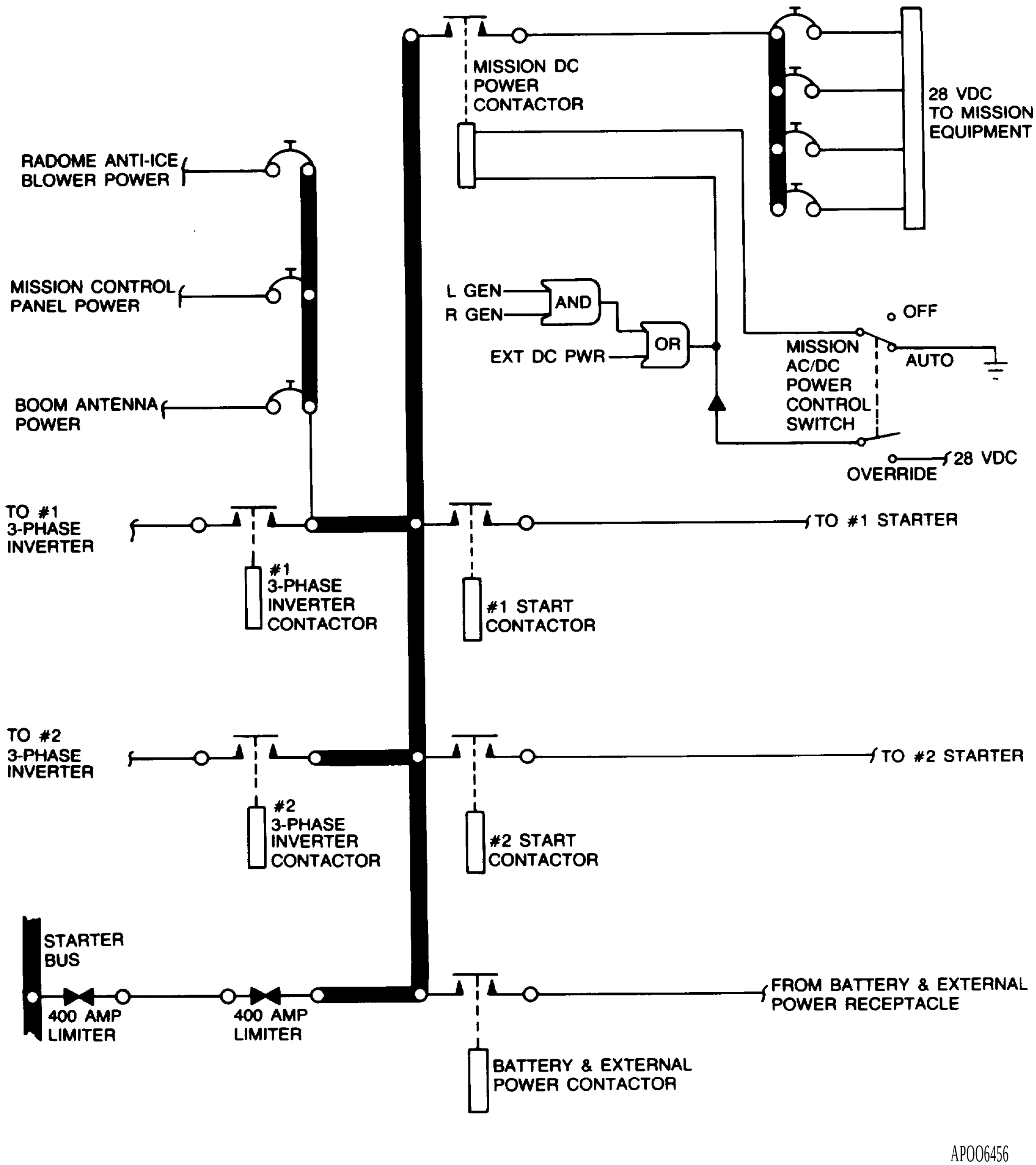


Figure 2-25. Mission Equipment DC Power System

is indicated as a percentage of total output amperage capacity for the generating system monitored.

e. Battery Volt-Amp Meter. The mission control panel (fig. 4-l), located on the right inside fuselage sidewall adjacent to the copilot's seat, has a battery-amperage meter that displays battery voltage on the left side of the meter and battery current on the right side of the meter. Minimum battery voltage for engine start is 22 VDC.

f. Battery Monitor. Nickel-cadmium battery overheating will cause the battery charge current to increase if thermal runaway is imminent. The aircraft has a charge-current sensor which will detect a charge current. The charge current system senses battery current through a shunt in the negative lead of the battery. Any time the battery charging current exceeds approximately 7 amperes for 6 seconds or longer, the yellow BATTERY CHARGE annunciator light and the master fault caution light will illuminate. Following a battery engine start, the caution light will illuminate approximately six seconds after the generator switch is placed in the ON position. The light will normally extinguish within two to five minutes, indicating that the battery is approaching a full charge. The time interval will increase if the battery has a low state of charge, the battery temperature is very low, or if the battery has previously been discharged at a very low rate (i.e., battery operation of radios or lights for prolonged periods). The caution light may also illuminate for short intervals after landing gear and/or flap operation. If the caution light should illuminate during normal steady-state cruise, it indicates that conditions exist that may cause a battery thermal runaway. If this occurs, the battery switch shall be turned OFF and may be turned back ON only for gear and flap extension and approach to landing. Battery may be used after a 15 to 20 minute cool down period.

g. Generator Out Warning Lights. Two caution/advisory annunciator panel lights inform the pilot when either generator is not delivering current to the aircraft DC bus system. These lights are placarded No.1 DC GEN and No.2 DC GEN. Illumination of the two MASTER CAUTION lights and either fault light indicates that either the identified generator has failed or voltage is not sufficient to keep it connected to the power distribution system.

CAUTION

The GPU shall be adjusted to regulate at 28 volts maximum to prevent damage to the aircraft.

h. DC External Power Source. External DC power can be applied to the aircraft through an external power receptacle on the underside of the right wing leading edge just outboard of the engine nacelle. The receptacle is installed inside of the wing structure and is accessible through a hinged access panel. DC power is supplied through the DC external power plug and applied directly to the battery bus after passing through the external power relay. Turn off all external power while connecting the power cable to, or removing it from, the external power supply receptacle. The holding coil circuit of the relay is energized by the external power source when the BATT switch is in the ON position. The GPU shall be adjusted to regulate at 28 volts maximum to prevent damage to the aircraft battery.

i. Security Keylock Switch, The aircraft has a security keylock switch (fig. 2-12) installed on the overhead control panel, placarded OFF - ON. The switch is connected to the battery relay circuit and must be ON when energizing the battery master power switch. The key cannot be removed from the lock when in the ON position.

j. Circuit Breakers. The overhead circuit breaker panel (fig. 2-26) contains circuit breakers for most aircraft systems. The circuit breakers on the panel are grouped into areas which are placarded as to the general function they protect. A DC power distribution panel is mounted beneath the aisleway floor forward of the main spar. This panel contains higher current rated circuit breakers and is not accessible to the flight crew under normal conditions.

2-75. AC POWER SUPPLY.

a. Single Phase AC Power Supply. AC power for the aircraft is supplied by inverter units, numbered No. 1 and No.2 (fig. 2-23) which obtain operational current from the DC power system. Both inverters are rated at 750 volt-amperes and provide single-phase output only. Each inverter provides 115 volt and 26 volt, 400 Hz AC output. The inverters are protected by circuit breakers mounted on the DC power distribution panel beneath the aisleway floor. Controls and indicators of the AC power system are located on the overhead control panel and on the caution/advisory annunciator panel.

(1.) AC Power WARNING/CAUTION Lights. Illumination of the two MASTER CAUTION lights and the illumination of an annunciator caution light No.1 INVERTER or No.2 INVERTER indicates an inverter failure.

(2.) Instrument AC Light. A red warning light and two MASTER WARNING lights located

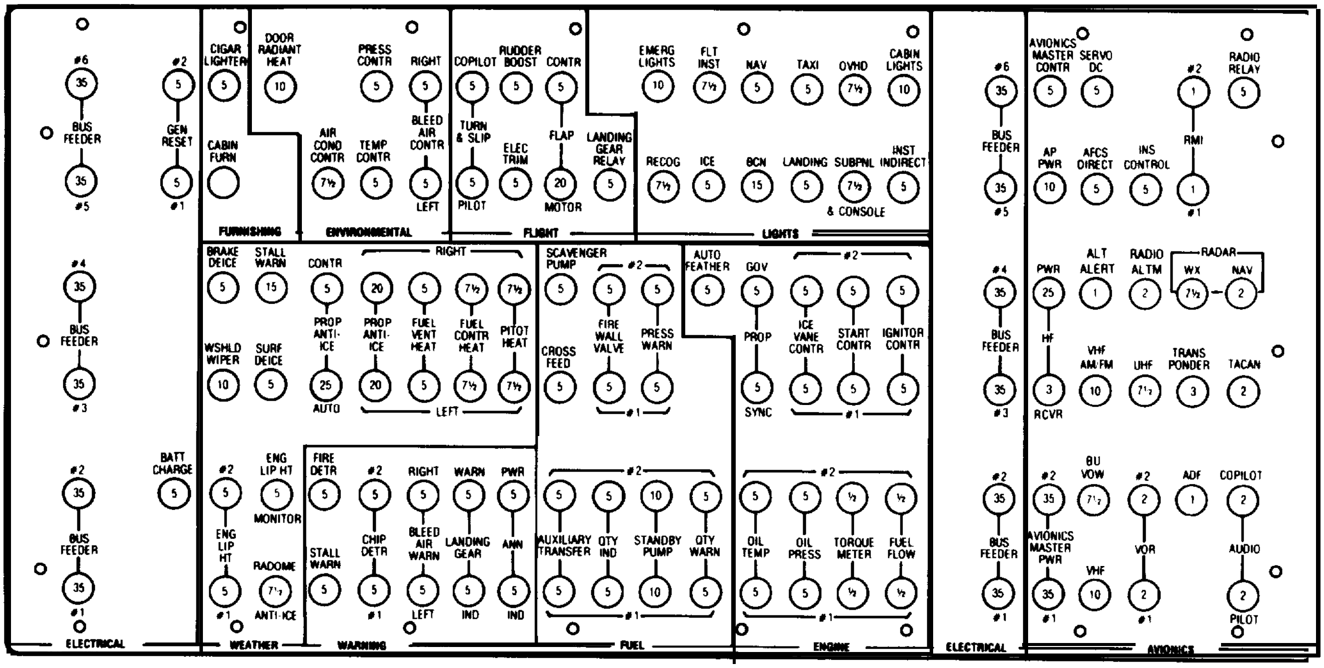


Figure 2-26. Overhead Circuit Breaker Panel

on the warning annunciator panel, placarded INST AC, will illuminate if all instrument AC busses should fail.

(3.) Inverter Control Switches. Two switches, placarded INVERTER No.1 and No.2 on the overhead control panel (fig. 2-12) give the pilot control of the single-phase AC inverters.

(4.) Volt-Frequency Meters. Two volt-frequency meters (fig. 2-12) are mounted in the overhead control panel to provide monitoring capability for both 115 VAC buses. Normal display on the meter is shown in frequency (Hz). To read voltage, press the button located in the lower left corner of the meter. Normal output of the inverters will be indicated by 115 VAC and 400 Hz on the meters.

b. Three Phase AC Power Supply. Three phase AC electrical power for operation of the inertial navigation system and mission avionics is supplied by two DC powered 3000 volt-ampere solid state three phase inverters.

(1.) Three phase inverter control switches. Two three position switches placarded #1 INV-OFF-ON-RESET and NO. 2 INV-OFF-ON-RESET, located on the mission control panel (fig. 4-1) controls three phase inverter operation.

(2.) Three phase volt/frequency meters. Two three phase volt/frequency meters, mounted on the mission control panel (fig. 4-l), monitor and display the voltage and frequency outputs of the three phase inverters.

(3.) Three phase loadmeters. Two three phase loadmeters, mounted on the mission control panel (fig. 4-l), monitors inverter output level.

(4.) Three phase AC off annunciator light. An indicator light placarded 3!zsl! AC OFF, located on the misson annunciator panel (fig. 4-l), indicates a problem with one of the three phase AC power busses.

(5.) Three phase AC external power. External three phase AC power for operation of the inertial navigation system or mission equipment, can be applied to the aircraft through an external power receptacle located on the underside of the left wing leading edge just outboard of the engine nacelle (fig. 2-l). The receptacle is installed inside the wing structure and is accessible through a hinged access panel. The AC electrical system is automatically isolated from the external power source if the external power is over or under voltage, over or under frequency, or has an improper phase sequence.

(a.) External AC power annunciator Light. An annunciator light placarded EXT AC PWR ON, located on the mission annunciator panel (fig. 4-1) indicates that external AC power is connected to the 3 phase buses. The EXTERNAL POWER annunciator in the advisory annunciator panel indicates that an AC GPU plug is mated to the AC external power receptacle.

(b.) External AC power control switch. A switch placarded EXT POWER-OFF-ON-RESET, located on the mission control panel (fig. 4-l), controls application of three phase AC power to the aircraft.

Section X. LIGHTING

2-76. EXTERIOR LIGHTING.

a. Description. Exterior lighting (fig. 2-27) consists of a navigation light on the aft end of the aft section of the vertical stabilizer, one navigation light on the outside of each wing tip pod, two strobe beacons, one on top of the vertical stabilizer and one on the underside of the fuselage center section, dual landing lights and a taxi light mounted on the nose gear assembly, a recognition light located in each wing tip, and two ice lights, one light flush mounted in each nacelle, positioned to illuminate along the leading edge of each outboard wing.

b. Navigation Lights. The navigation lights are protected by a 5-ampere circuit breaker placarded NAV on the overhead circuit breaker panel (fig. 2-26). Control of the lights is provided by a switch placarded NAV-ON on the overhead control panel (fig. 2-l 2).

c. Strobe Beacons. The strobe beacons are dual intensity units. They are protected by a 15-ampere circuit breaker placarded BCN on the overhead circuit breaker panel (fig. 2-26). Control of the lights is provided by a switch placarded BEACON - DAY - NIGHT (fig. 2-12). Placing the switch in the DAY position will activate the high intensity white section of the strobe lights for greater visibility during daytime operation. Placing the switch in the NIGHT position activates the lower intensity red section of the strobe lights.

d. Landing/Taxi Lights. Dual landing lights and a single taxi light are mounted on the nose gear assembly. The lights are controlled by switches, placarded LANDING and TAXI, located in the LIGHTS section of the pilot's subpanel. The landing light circuit is protected by a 5-ampere circuit breaker placarded LANDING, located on the overhead circuit breaker panel (fig. 2-26). The taxi light circuit is protected by a 5-ampere circuit breaker placarded TAXI, located on the overhead circuit breaker panel (fig. 2-26). Landing/Taxi lights are turned off when the landing gear is retracted. The landing lights and taxi light power circuits are protected by 35-ampere and 15-ampere circuit breakers, respectively, on the DC power distribution panel located below the aisleway floor forward of the main spar.

e. Ice Lights. The ice lights circuit is protected by a 5-ampere circuit breaker placarded ICE on the overhead circuit breaker panel (fig. 2-26). Control of the lights is provided by a switch placarded ICE - ON on the overhead control panel (fig. 2-12). Prolonged use during ground operation may generate enough heat to damage the lens.

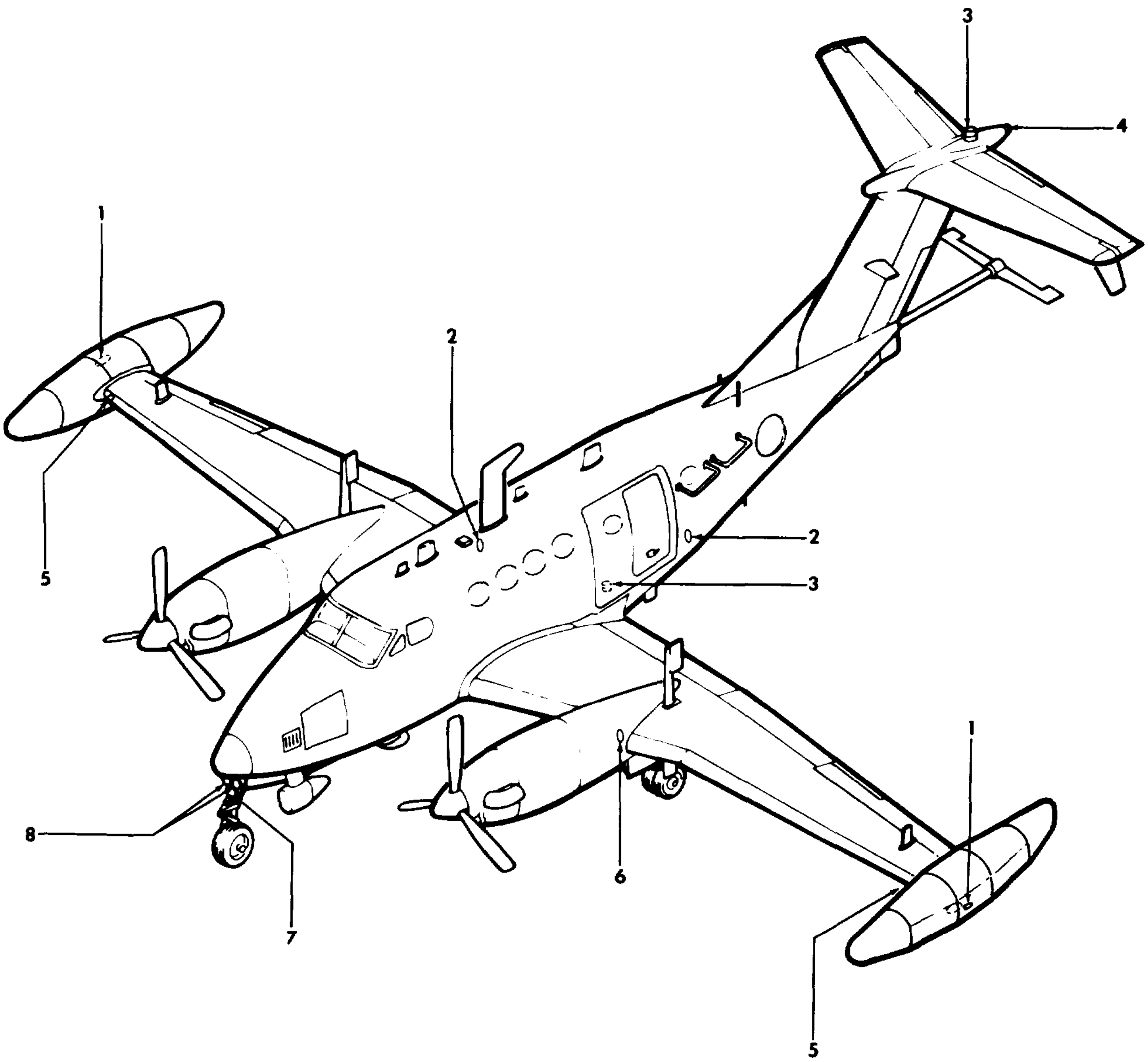
f. Recognition Lights. A switch placarded RECOG - ON, located in the pilot's subpanel LIGHTS section (fig. 2-6), controls the white recognition light in each wing tip. When requested, this steady, bright light is used for identification in the traffic pattern. The recognition lights circuit is protected by a 7 l/2 ampere RECOG circuit breaker located on the overhead circuit breaker panel (fig. 2-26).

2-77. INTERIOR LIGHTING.

Lighting systems are installed for use by the pilot and copilot. The lighting systems in the cockpit are provided with intensity controls on the overhead control panel. A switch placarded MASTER PANEL LIGHTS - ON, on the overhead control panel (fig. 2-12), provides overall on-off control for all engine instrument lights, pilot and copilot instrument lights, overhead panel lights, console and subpanel lights and the outside air temperature light.

a. Cockpit Lighting.

(1.) Flight instrument lights. Each individual flight instrument contains internal lamps for illumination. The circuit is protected by a 7 l/2-ampere circuit breaker placarded FLT INST on the overhead circuit breaker panel (fig. 2-26). Control is provided by two rheostat switches placarded PILOT INST LIGHTS - OFF - BRT and COPILOT INST LIGHTS - OFF - BRT on the overhead control panel (fig. 2- 12). Turning the control clockwise from OFF turns the lights on and increases their brilliance.



1. Wing navigation light
2. Emergency light
3. Strobe beacon
4. Tail navigation light
5. Recognition lights
6. Ice light
7. Taxi light
6. Landing lights

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Figure 2-27. Exterior Lighting

(2.) Instrument indirect fights. Three lights are mounted in the glareshield overhang along the top edge of the instrument panel and provide overall instrument panel illumination. The circuit is protected by a 5-ampere circuit breaker placarded INST INDIRECT on the overhead circuit breaker panel (fig. 2-26). Control is provided by a rheostat switch placarded INST INDIRECT LIGHTS - OFF - BRT on the overhead control panel (fig. 2-12). Turning the control clockwise from OFF turns the lights on and increases their brilliance.

(3.) Engine instrument lights. Each individual engine instrument contains internal lamps for illumination. The circuit is protected by a 7 l/2- ampere circuit breaker placarded FLT INST on the overhead circuit breaker panel (fig. 2-26). Control is provided by a rheostat switch placarded ENGINE INST LIGHTS OFF BRT on the overhead control panel (fig. 2-12). Turning the control clockwise from OFF turns the lights on and increases their brilliance.

NOTE

The floodlight is connected to the hot battery bus and will not be turned off by the battery switch; therefore, it must be turned OFF when the aircraft is shutdown to prevent discharging the battery.

(4.) Flood light. A single overhead flood light is installed. It provides overall illumination of the entire cockpit area. The circuit is protected by a 5-ampere circuit breaker mounted beneath the battery and connected to the emergency battery bus. Control is provided by a rheostat switch placarded - OVERHEAD FLOODLIGHT-OFF-BRT on the overhead control panel (fig. 2-12). Turning the control clockwise from OFF turns the light on and increases its brilliance.

(5.) Overhead panel lights. Lamps on the overhead circuit breaker panel, control panel, and fuel management panel are protected by a 7 1/2-ampere circuit breaker placarded OVHD on the overhead circuit breaker panel (fig. 2-26). Control is provided by a rheostat switch placarded OVERHEAD PANEL LIGHTS - OFF - BRT on the overhead control panel (fig. 2-12). Turning the control clockwise from OFF turns the lights on and increases their brilliance.

(6.) Subpanel and console lights. Lights on the pilot's and copilot's subpanels, console edge lighted panels, mission control panel, and pedestal extension panels are protected by a 7 l/2-ampere circuit breaker placarded SUBPNL & CONSOLE on the overhead circuit breaker panel (fig. 2-26). Control is provided by two rheostat switches placarded SUBPANEL or CONSOLE LIGHTS - OFF - BRT on the overhead control panel (fig. 2- 12). Turning the control clockwise from OFF turns the lights on and increases their brilliance.

(7.) Outside air temperature light. Two post lights are mounted adjacent to the outside air temperature gage on the left cockpit sidewall trim panel. The circuit is protected by a 71/2-ampere circuit breaker placarded FLT INST on the overhead circuit breaker panel (fig. 2-26). Control is provided by a pushbutton switch adjacent to the gage. No intensity control is provided.

b. Cabin Lighting.

(1.) Threshold and spar cover lights. A threshold light is installed just above floor level on the left side of the cabin just inside the cabin door. A spar cover light is installed on the left side of the sunken aisle immediately aft of the main spar cover. Both circuits are protected by a 5-ampere circuit breaker mounted beneath the battery and connected to the emergency battery bus. Both lights are controlled by the switch mounted adjacent to the threshold light. If the lights are illuminated, closing the cabin door will automatically extinguish them.

(2.) Cabin aisle lights. Three cabin aisle lights are installed in the cabin aisle. Control is provided by the CABIN LIGHTS switch on the right subpanel. Control is provided by the CABIN LIGHT switch on the right subpanel.

(3.) Cabin spot lights. A spot light is mounted to each cabin aisle light. Each spot light is individually controlled by a rheostat placarded OFF-ON-BRT on the back of the light. There is a momentary ON switch in the center of the rheostat. Each light is capable of producing a red or white spotlight by turning the selector on the front of the light. To remove the light from the stationary position, pull down on the light. The light is connected to the light housing by an 11 inch coiled cord that extends to approximately 50 inches.

(4.) Cabin door latching mechanism light. A light is provided to check the cabin door latching mechanism. It is controlled by a red pushbutton switch located adjacent to the round observation window, which is just above the second step.

2-78. EMERGENCY LIGHTING.

a. Description. An independent battery operated lighting system is installed. The system is actuated automatically by shock, such as a forced landing. It provides adequate lighting inside and outside the fuselage to permit the crew to read instruction placards and locate exits. An inertia switch, when subjected to a 2 G shock, will illuminate interior lights in the cockpit, forward and aft cabin areas, and exterior lights aft of the emergency exit and aft of the cabin door. The battery power source is automatically recharged by the aircraft electrical system.

b. Operation. An emergency lights override switch, located on the overhead control panel (fig. 2-12), is provided to turn the system off if it is accidentally actuated. The switch is placarded EMERG LIGHTS ORIDE OFF - RESET - AUTO - TEST. Should the system accidentally actuate, the emergency lights will illuminate. Placing the switch in the momentary OFF RESET position will extinguish the lights. To test the system, place the switch in the TEST position. The lights should illuminate. Moving the switch to the OFF - RESET position will turn the system off and reset it.

Section Xl. FLIGHT INSTRUMENTS

2-79. PITOT AND STATlC SYSTEM.

a. Description, The pitot and static system (fig. 2-28) supplies static pressure to two airspeed indicators, the copilot altimeter, the air data computer (ADC), two vertical velocity indicators, and also ram air to the airspeed indicators and the ADC. This system consists of two pitot masts (one located on each side of the lower portion of the nose), static air pressure ports in the aircraft's exterior skin on each side of the aft fuselage, and associated system plumbing. The pitot mast is protected from ice formation by internal electric heating elements.

b. Alternate Static Air Source. An alternate static air line, which terminates just aft of the rear pressure bulkhead, provides a source of static air for the pilot's instruments in the event of source failure from the pilot's static air line. A control on the pilot's subpanel placarded PILOTS STATIC AIR SOURCE, may be actuated to select either the NORMAL or ALTERNATE air source by a two position selector valve. The valve is secured in the NORMAL position by a spring clip. Refer to Chapter 7 for airspeed indicator and altimeter calibration information when using the alternate air source.

2-80. TURN-AND-SLIP INDICATORS.

Turn-and-slip indicators are installed separately on the pilot and copilot sides of the instrument panel (fig. 2-29). These indicators are gyroscopically operated. They use DC power and are protected by 5-ampere circuit breakers placarded TURN & SLIP PILOT or COPILOT on the overhead circuit breaker panel (fig. 2-26).

2-81. AIRSPEED INDICATORS.

Airspeed indicators are installed separately on the pilot and copilot sides of the instrument panel (fig. 2-29). These indicators require no electrical power for operation, The indicator dials are calibrated in knots from 40 to 300. A striped pointer automatically displays the maximum allowable airspeed at the aircraft's present altitude.

2-82. COPILOT'S ENCODING ALTIMETER.

The copilot's altimeter on the upper right side of the instrument panel (fig. 2-29) is a self-contained unit consisting of a precision pneumatic altimeter combined with an altitude encoder. The display face indicates while, simultaneously, the encoder transmits pressure altitude information to the INS and GPS. Altitude is displayed by a 10,000 foot counter, a 1000 foot counter, a 100 foot counter, and a single needle pointer which indicates hundreds of feet on a circular scale in 20 foot intervals. The needle pointer is also coupled to the 100 foot drum counter so that both move at the same time. Below an altitude of 10,000 feet, a diagonal striped symbol will appear on the 10,000 foot counter. A barometric pressure setting knob is provided to insert the desired altimeter setting in inches Hg or millibars. If AC power to the altitude encoder is lost, an OFF flag will appear in the upper center portion of the instrument face to indicate that the encoder is inoperative and the system is not reporting altitude to ground stations.

2-83. PILOT'S ALTlMETER INDICATOR.

The pilot's altimeter, on the upper left side of the instrument panel (fig. 2-29), is a servoed unit under control of the Air Data Computer and is part of the Flight Director/Autopilot System. It lacks encoding capability, but displays altitude as described for the copilot's instrument. Operating instructions are provided in chapter 3. When the BAR0 knob is adjusted to ground supplied instructions, the updated altitude pressure is routed to the Air Data Computer. The ADC recomputes all data on hand, sends corrected altitude pressure information to the Flight Director and autopilot, sends servo commands to correct the display on the pilot's

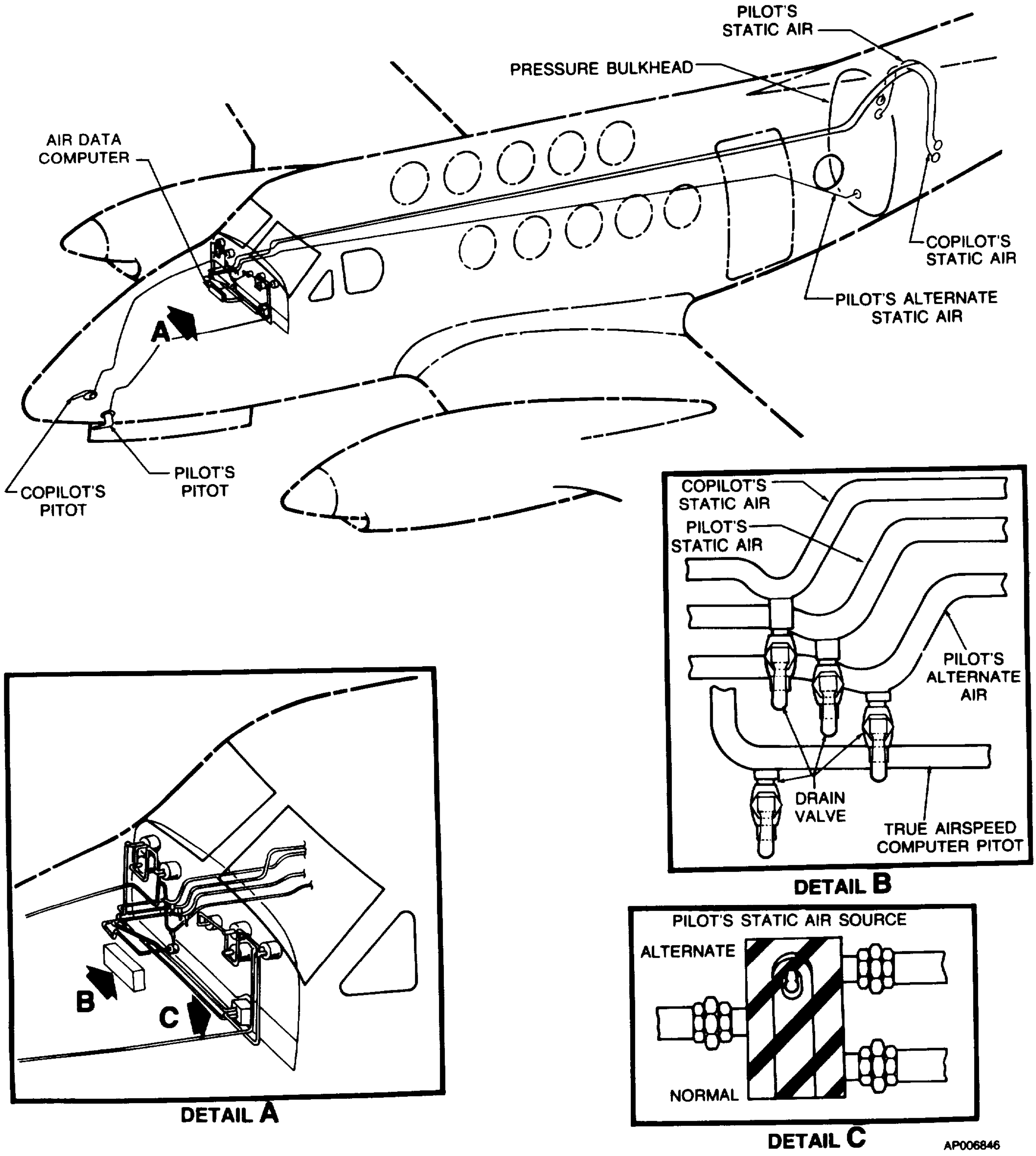
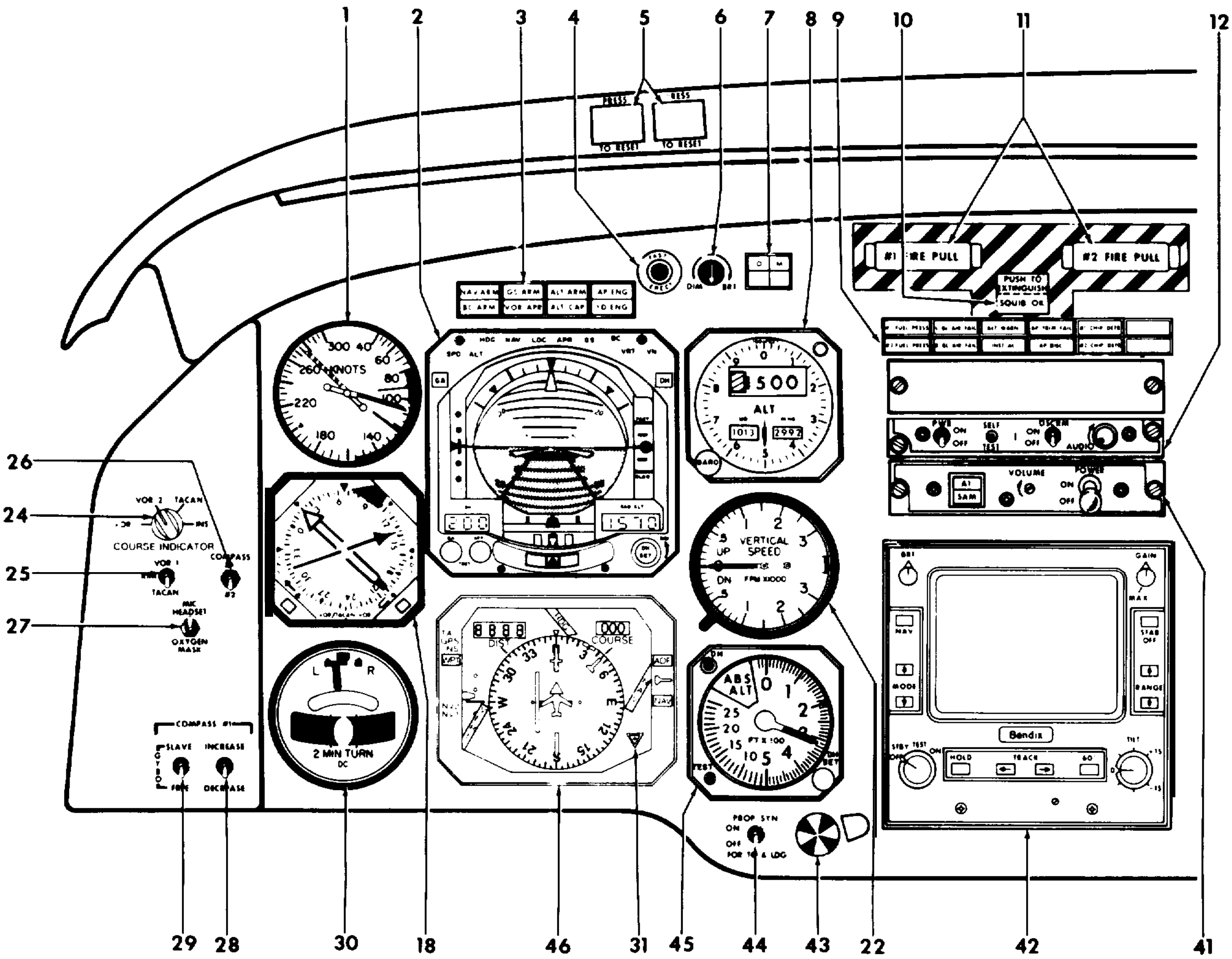


Figure 2-28. Pitot and Static System



1. Airspeed indicator
2. Attitude director indicator
3. Flight director annunciator panel
4. Gyro fast erect switch
5. Master caution/warning annunciator
6. Marker beacon dimmer control
7. Marker beacon indicator lights
8. Pilot's altimeter
9. Warning annunciator panel
10. Push-to-exinguish/squib OK annunciators
11. Fire pull handles
12. Radar warning control panel (AN/APR-39)
13. Torque indicators
14. Prop Tachometers
15. Turbine gas temperature indicators
16. Radar signal detecting set indicator (AN/APR-39)
17. Accelerometer
18. RMI
19. Copilot's gyro horizon indicator
20. Altitude select controller
21. Copilot's altimeter
22. Vertical speed indicator

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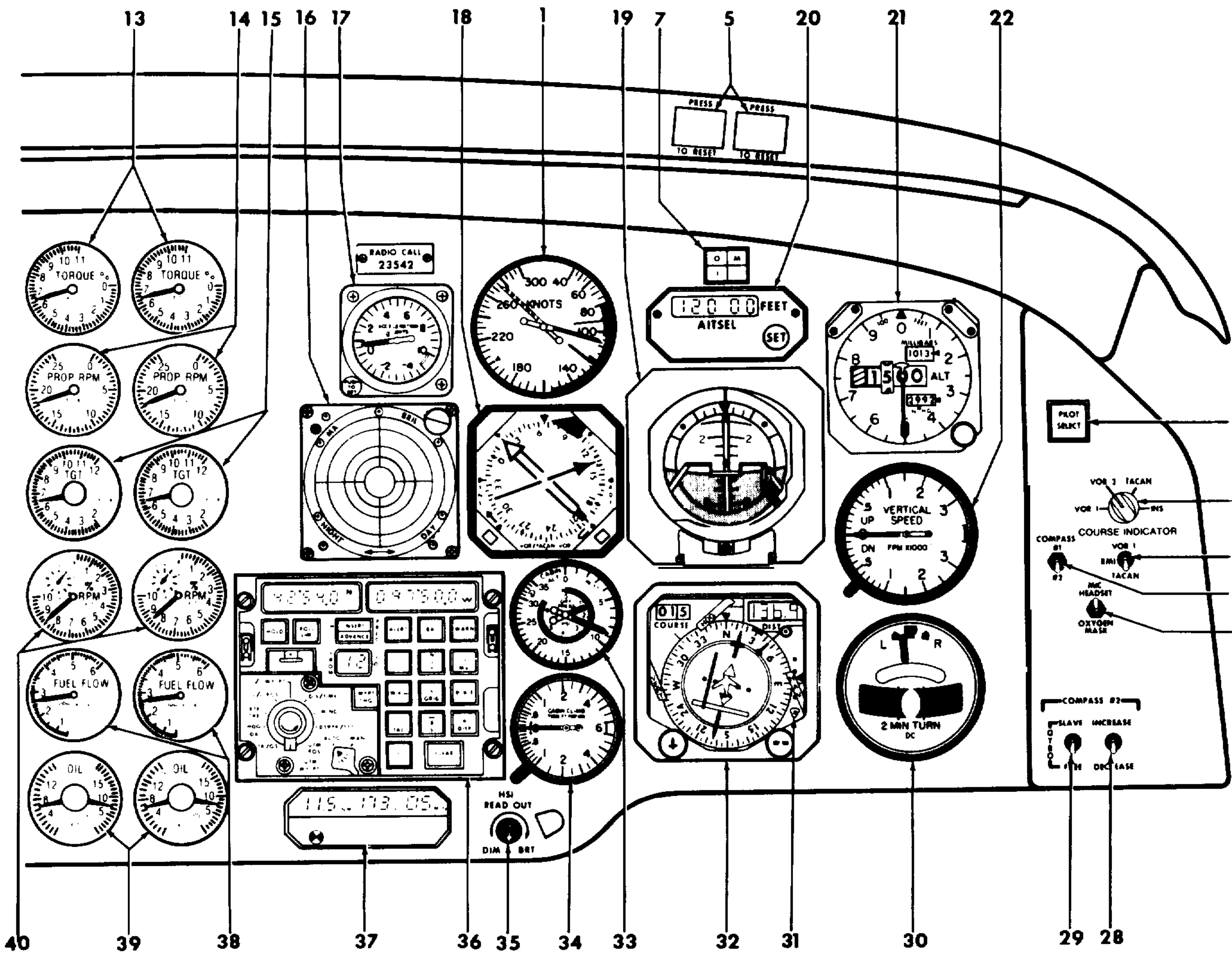
Figure 2-29. Instrument Panel (Sheet 1 of 2)



23. PILOT SELECT annunciator
24. Course indicator selector switch
25. RMI select switch
26. Compass #1 and #2 switch
27. Microphone select switch
28. Gyro INCREASE-DECREASE switch
29. Gyro SLAVE-FREE switch
30. Turn & slip indicator
31. Compass sync annunciator
32. Copilot's horizontal situation indicator
33. Cabin altitude indicator
34. Cabin rate-of-climb indicator
35. HSI readout dim control
36. INS control display Indicator
37. TACAN range indicator
38. Fuel flow gages
39. Oil pressure and temp gages
40. Turbine tachometers
41. Radar warning control panel (AN/APR-44)
42. Weather radar indicator
43. Propellers synchroscope
44. Propeller synchronizer switch
45. Radio altimeter indicator
46. Pilot's horizontal situation indicator

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Figure 2-29. Instrument Panel (Sheet 2 of 2) altimeter, and supplies altitude information to the transponder.

2-84. VERTICAL VELOCITY INDICATORS.

Vertical velocity indicators are installed separately on the pilot and copilot sides of the instrument panel (fig. 2-29). They indicate the speed at which the aircraft ascends or descends based on changes in atmospheric pressure. The indicator is a direct reading pressure instrument requiring no electrical power for operation.

2-85. ACCELEROMETER.

The accelerometer, located on the instrument panel registers and records positive and negative G loads imposed on the aircraft. One hand moves in the direction of the G load being applied while the other two, one for positive G loads and one for negative G loads, follow the indicating pointer to its maximum travel. The recording pointers remain at the respective maximum travel positions of the G's being applied, providing a record of maximum G loads encountered. Depressing the push-to-reset knob at the lower left comer of the instrument allows the recording pointers to return to the normal position.

2-86. OUTSIDE AIR TEMPERATURE (OAT) GAGE.

The outside air temperature gage, mounted outboard of the pilot's seat, (fig. 2-8), indicates the outside air temperature in degrees Celsius.

2-87. STANDBY MAGNETIC COMPASS.

WARNING

Inaccurate indications on the standby magnetic compass will occur while windshield heat and/or air conditioning is being used.

The standby magnetic compass is located below the overhead fuel management panel and to the right of the windshield divider. It may be used in the event of failure of the compass system, or for instrument cross check. Readings should be taken only during level flight since errors may be introduced by turning or acceleration. A compass correction chart indicating deviation is located on the magnetic compass.

2-88. MISCELLANEOUS INSTRUMENTS.

a. Annunciator Panels. Three annunciator panels are installed. One is a warning panel with red fault identification lights, and the others are caution/advisory panels with yellow and green identification lights. The warning panel is mounted near the center of the instrument panel below the glareshield (fig. 2-29) and one caution/advisory panel is located on the center subpanel (fig. 2-6). The mission annunciator panel is located on the copilot's sidewall. Some normal flight operations involve indications from the mission control panel (fig. 4-l). Illumination of a red warning light signifies the existence of a hazardous condition requiring immediate corrective action.

Table 2-6. Warning Annunciator Panel Legend

WARNING ANNUNCIATOR		
NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION
NO.1 FUEL PRESS	RED	Fuel pressure failure on left side
NO.2 FUEL PRESS	RED	Fuel pressure failure on right side
L BL AIR FAIL	RED	Left bleed air warning line has melted or failed, indicating possible loss of No.1 engine bleed air
R BL AIR FAIL	RED	Right bleed air warning line has melted or failed, indicating possible loss of No. 2 engine bleed air
ALT WARN	RED	Cabin altitude exceeds 12,500 feet
INST AC	RED	No AC power to engine instruments
AP TRIM FAIL	RED	Trim inoperative or running opposite direction commanded
NO.1 CHIP DETR	RED	Contamination of No.1 engine oil detected
NO.2 CHIP DETR	RED	Contamination of No.2 engine oil detected
AP DISC	RED	Autopilot has disengaged.

Table 2- 7. Caution/Advisory Annunciator Panel Legend (Sheet 1 of 2)

CAUTION/ADVISORY ANNUNCIATOR		
NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION
No.1 DC GEN	Yellow	No.1 engine generator off the line
No. 1 INVERTER	Yellow	No. 1 inverter inoperative
REV NOT READY	Yellow	Propeller levers are not in the high RPM, low pitch position, with the landing gear extended
No.2 INVERTER	Yellow	No.2 inverter inoperative
No.2 DC GEN	Yellow	No.2 engine generator off line
No.1 EXTGH DISCH	Yellow	No. 1 engine fire extinguisher discharged
No.1 NAC LOW	Yellow	No.1 engine has 20 minutes fuel remaining at sea level, normal cruise power consumption rate
CABIN DOOR	Yellow	Cabin/door open or not secure
No.2 NAC LOW	Yellow	No.2 engine has 20 minutes fuel remaining at sea level, normal cruise power consumption rate
No.2 EXTGH DISCH	Yellow	No.2 engine fire extinguisher discharged
No. 1 VANE FAIL	Yellow	No.1 engine ice vane malfunction. Ice vane has not attained proper position
BATTERY CHARGE	Yellow	Excessive charge rate on battery
PROP SYNC ON	Yellow	Synchrophaser turned on with landing gear extended
No.2 VANE FAIL	Yellow	No.2 engine ice vane malfunction. Ice vane has not attained proper position
DUCT OVERTEMP	Yellow	Excessive bleed air temperature in environmental heat ducts
IFF	Yellow	Transponder fails to reply to a valid mode 4 interogation
No.1 NO FUEL XFR	Yellow	Auxiliary fuel tank on side of No. 1 engine not transferring fuel into nacelle tank
No.2 NO FUEL XFR	Yellow	Auxiliary fuel tank on side of No.2 engine not transferring fuel into nacelle tank
No.1 LIP HEAT	Yellow	Failure of lip heat valve to conform to selected position or in transit
No.2 LIP HEAT	Yellow	Failure of lip heat valve to conrom to selected position or in transit
INS	Yellow	Inertial navigation system's cooling fan is off or an INS malfunction that illuminates the WARN annunciator on the CDU
No.1 LIP HEAT ON	Green	No.1 engine air scoop heat switch is on
No.2 LIP HEAT ON	Green	No.2 engine air scoop heat switch is on
A/C COLD OPN	Green	Air conditioner is operating in cold mode, or ambient temperatures require switching to cold mode if air conditioner operation is to be continued
No.1 VANE EXT	Green	No. 1 ice vane extended
FUEL CROSSFEED	Green	Crossfeed valve open
AIR COND N, LOW	Green	No.2 engine RPM too low for air conditioning load
No.2 VANE EXT	Green	No.2 ice vane extended
No.1 IGN ON	Green	No.1 engine ignition/start switch on No.1 engine autoignition switch armed and engine torque below 20 percent

Table 2-7. Caution/Advisory Annunciator Panel Legend (Sheet 2 of 2)

CAUTION/ADVISORY ANNUNCIATOR		
NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION
L BL AIR IFF	Green	Left environmental bleed air valve closed
EXTERNAL POWER	Green	External power connector plugged in
R BL AIR OFF	Green	Right environmental bleed air valve closed
No.2 IGN ON	Green	No.2 engine ignition/start switch on, No.2 engine autoignition switch armed and engine torque below 20 percent
No. 1 AUTOFEATHER	Green	No.1 engine autofeather armed with power levers advanced above 90% N_1
No.2 AUTOFEATHER	Green	No.2 engine autofeather armed with power levers advanced above 90% N_1
BRAKE DEICE ON	Green	Brake deice system activated

a. Annunciator Panels. Three annunciator panels are installed. One is a warning panel with red fault identification lights, and the others are caution/advisory panels with yellow and green identification lights. The warning panel is mounted near the center of the instrument panel below the glareshield (fig. 2-29) and one caution/advisory panel is located on the center subpanel (fig. 2-6). The mission annunciator panel is located on the copilot's sidewall. Some normal flight operations involve indications from the mission control panel (fig. 4-l). Illumination of a red warning light signifies the existence of a hazardous condition requiring immediate corrective action. A yellow caution light signifies a condition other than hazardous requiring pilot attention. A green advisory light indicates a functional situation. Table 2-6, 2-7, and 2-8 provides a list of causes for illumination of the individual annunciator lights. In frontal view both panels present rows of small, opaque rectangular indicator lights. Word printing on each indicator identifies the monitored function, situation, or fault condition, but cannot be read until the light is illuminated. The bulbs of all annunciator panel lights are tested by activating the ANNUNCIATOR TEST switch, located on the right subpanel near the caution/advisory panel. The system is protected by two 5-ampere circuit breakers placarded ANN PWR and ANN IND on the overhead circuit breaker panel (fig. 2-26). The annunciator system lights are dimmed when the MASTER PANEL LIGHTS switch is ON and the pilot's flight instrument lights are illuminated. The lights are automatically reset to maximum brightness if:

(1.) The main aircraft power (both DC generators) are OFF.

(2.) The INST INDIRECT LIGHTS switch is rotated clockwise.

(3.) The MASTER PANEL LIGHTS switch is off.

(4.) The MASTER PANEL LIGHTS switch is ON and the PILOT INST LIGHTS switch is OFF.

(5.) Master warning light (red). A MASTER WARNING light is provided for both the pilot and the copilot and is located on each side of the glareshield (fig. 2-29). Any time a warning light illuminates, the MASTER WARNING light will illuminate, and will stay illuminated until the MASTER WARNING light is pressed to reset the circuit. If a new condition occurs, the light will be reactivated, and the applicable annunciator panel light will illuminate.

(6.) Master caution light (yellow). A MASTER CAUTION light is provided for both the pilot and copilot located adjacent to the MASTER WARNING LIGHT. Whenever a caution light illuminates, the MASTER CAUTION will illuminate, and will stay illuminated until the condition is corrected and/or the MASTER CAUTION light is pressed to reset the circuit. If a new condition occurs, the light will be reactivated and the appropriate annunciator panel lights will illuminate.

b. Clocks. One manually-wound 8-day clock is mounted in the center of the pilot's control wheel and an electric digital clock is mounted in the center of the copilot's control wheel.

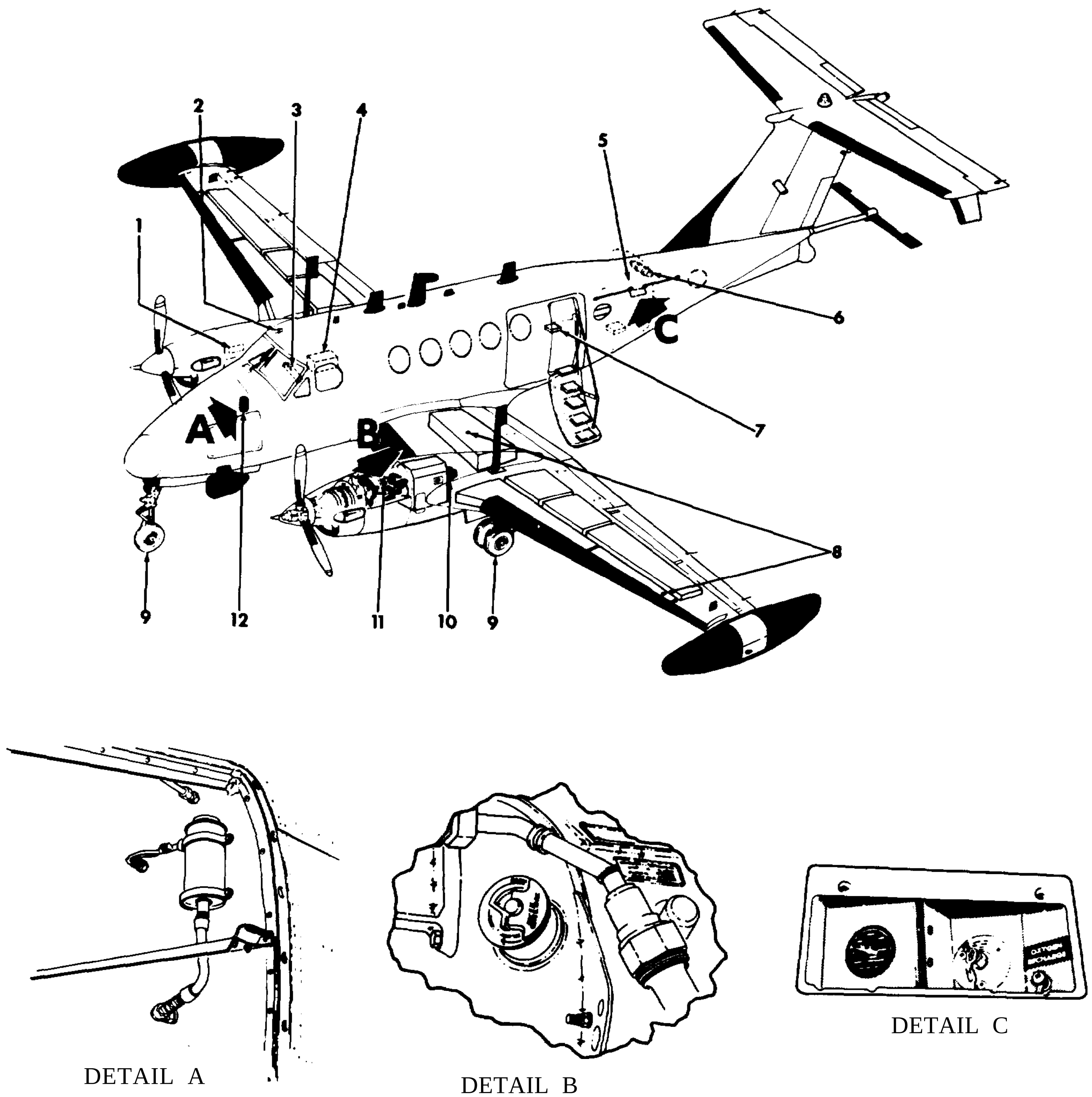
Table 2-8. Mission Control Panel Annunciator Legend

MISSION ANNUNCIATOR		
NOMENCLATURE	COLOR	CAUSE FOR ILLUMINATION
MSN OVERTEMP	Yellow	Mission equipment is overheating.
CRYPT0 ALERT	Yellow	Coded messages being received.
PWR SPLY FAULT	Yellow	Mission power out of tolerance.
CALL	Yellow	Reciving transmission on VOW.
3ø AC OFF	Yellow	Three phase AC power fault.
BAT FEED FAULT	Yellow	Ground fault detected in battery or external power line.
MISSION POWER	Yellow	Mission power is off.
LINK MODE	Yellow	WBDL fault in link or contact.
RADOME HOT	Yellow	Radome heat is too high.
LINK SYNC	Yellow	WBDL has synchronization fault.
SPCL EQPT OVRD	Yellow	Mission power switch is in override.
DIPLEXER PRESS	Yellow	Diplexer has lost pressurization.
TWTA STANDBY	Yellow	WBDL is in standby mode.
ANT MALF	Yellow	Boom antenna is out of position.
NO INS UPDATE	Yellow	INS update is not in process.
TDOA OVERTEMP	Yellow	TDOA equipment is overheating.
LB PS OVERTEMP	Yellow	LB PS equipment is overheating.
TDOA FAULT	Yellow	TDOA system has fault.
LB PS FAULT	Yellow	LB PS has fault.
ELINT FAULT	Yellow	ELINT system has fault.
ANT STOWED	Green	Boom antenna is in horizontal position.
ANT OPERATE	Green	Boom antenna is in vertical position.
RADOME HEAT	Green	Radome heat is on.
MISION AC ON	Green	Mission AC power is on.
INS UPDATE	Green	INS update in process.
TDOA PWR ON	Green	TDOA power is on.
MISSION DC ON	Green	Mission DC power is on.
WAVE GUIDE	Green	Wave guide is pressurized.
EXT AC PWR ON	Green	External AC power is on.
EXT DC PWR ON	Green	External DC power is on.

Section XII. SERVICING, PARKING, AND MOORING

2-89. GENERAL.

The following paragraphs include the procedures necessary to service the aircraft except lubrication. The lubrication requirements of the aircraft are covered in the aircraft maintenance manual. Table 2-9, 2-10, 2-11 and 2-12 are used for identification of fuel, oil, etc. used to service the aircraft. The servicing instructions provide procedures and precautions necessary to service the aircraft.



1. Air conditioning compressor
2. External power receptacle
3. Hand fire extinguisher
4. Battery 24 VDC
5. Oxygen system filler
6. Oxygen cyilnders 2 (64 cu ft bottles)
7. Electric toilet
8. Fuel filler cap (typical left and right)
9. Landing gear tires
10. Engine fire extinguisher
11. Engine oil filler cap (typical left and right)
12. Wheel brake fluid reservoir

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Figure 2-30. Servicing Locations

Table 2-9. Approved Military Fuels, Oil, Fluids, and Unit Capacities.

SYSTEM	SPECIFICATION	CAPACITY
Fuel	MIL-T-5624 (JP4 and JP-5)	546 U.S. Gals.
Engine Oil	MIL-L-23699	14 U.S. Quarts per engine
Hydraulic Brake System	MIL-H-5606	1 U.S. Pint
Oxygen System	MIL-O-27210	128 Cubic Feet
Toilet Chemical	Monogram DG-19	3 Ounces

2-90. FUEL HANDLING PRECAUTIONS.

Table 2-2, Fuel Quantity Data, lists the quantity and capacity of fuel tanks in the aircraft. Service the fuel tanks after each flight to keep moisture out of the tanks and to keep the bladder type cells from drying out. Observe the following precautions:

WARNING

During warm weather open fuel caps slowly to prevent being sprayed with fuel.

WARNING

When aviation gasoline is used in a turbine engine, extreme caution should be used when around the combustion chamber and exhaust area to avoid cuts or abrasions. The exhaust deposits contain lead oxide which will cause lead poisoning.

CAUTION

Proper procedures for handling JP-4 and JP-5 fuel cannot be over stressed. Clean, fresh fuel shah be used and the entrance of water into the fuel storage or aircraft fuel system must be kept to a minimum.

CAUTION

When conditions permit, the aircraft shall be positioned so that the wind will carry the fuel vapors away from all possible sources of ignition. The fuel vehicle shall be positioned to maintain a minimum distance of 10 feet from any part of the aircraft, while maintaining a minimum distance of 20 feet between the fueling vehicle and the fuel filler point.

a. Shut off unnecessary electrical equipment on the aircraft, including radar and radar equipment. The master switch may be left on, to monitor fuel quantity gages, but shall not be moved during the fueling operation. Do not allow operation of any electrical tools, such as drills or buffers, in or near the aircraft during fueling.

b. Keep fuel servicing nozzles free of snow, water, and mud at all times.

c. Carefully remove snow, water, and ice from the aircraft fuel filler cap area before removing the fuel filler cap (fig. 2-30). Remove only one aircraft filler cap at any one time, and replace each one immediately after the servicing operation is completed.

d. Wipe all frost from fuel filler necks before servicing.

e. Drain water from fuel tanks, filter cases, and pumps prior to first flight of the day. Preheat, when required, to insure free fuel drainage.

f. Avoid dragging the fueling hose where it can damage the soft, flexible surface of the deicer boots.

g. Observe NO SMOKING precautions.

h. Prior to transferring the fuel, insure that the hose is grounded to the aircraft.

i. Wash off spilled fuel immediately

j. Handle the fuel hose and nozzle cautiously to avoid damaging the wing skin.

k. Do not conduct fueling operations within 100 feet of energized airborne radar equipment or within 300 feet of energized ground radar equipment installations.

l. Wear only nonsparking shoes near aircraft or fueling equipment, as shoes with nailed soles or metal heel plates can be a source of sparks.

Table 2- 10. Approved Fuels

SOURCE	PRIMARY OR STANDARD FUEL	ALTERNATE FUEL	
US MILITARY FUEL	JP4 (MIL-T-5624)	JP-5 (MIL-T-5624)	
NAT0 Code No.	F-40 (Wide Cut Type)	F-44 (High Flash Type)	
COMMERCIAL FUEL	JET B	JET A	JET A-l
ASTM-D-l 655)	American JP-4	American Type A	NATO F-34
American Oil Co.	American JP-4	American Type A	
Atlantic Richfield	Arcojet B	Arcojet A	Arcojet A-1
Richfield Div.		Richfield A	Richfield A-1
B.P. Trading	B.P.A.T.G.		B.P.A.T.K.
Caltex Petroleum Corp.	Caltex Jet-B		Caltex Jet A-1
Cities Service Co.		CITGO A	
Continental Oil Co.	Conoco JP-4	Conoco Jet-50	Conoco Jet-60
Gulf Oil	Gulf Jet B	Gulf Jet A	Gulf Jet A-1
EXXON Co. USA	EXXON Turbo Fuel B	EXXON A	EXXON A-1
Mobil Oil	Mobil Jet B	Mobil Jet A	Mobil Jet A-1
Phillips Petroleum	Philjet JP-4	Philjet A-50	
Shell Oil	Aeroshell JP-4	Aeroshell 640	Aeroshell 650
Sinclair		Superjet A	Superjet A-1
Standard Oil Co.		Jet A Kerosene	Jet A-1 Kerosene
Chevron	Chevron B	Chevron A-50	Chevron A- 1
Texaco	Texaco Avjet B	Avjet B	Avjet A-1
Union Oil	Union JP-4	76 Turbine Fuel	
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/UTL9130-010	
Greece	JP-4 MIL-T-5624		
Italy	AA-M-C-1421	AMC-143	
Netherlands	JP-4 MIL-T-5624	D. Eng RD 2493	
Norway	J P-4 M IL-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-L-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-L-27686 shall be added to commercial fuel, not containing an icing inhibitor, during refueling operations, regardless of ambient temperatures. Refueling operations shall be accomplished in accordance with accepted commercial procedures.

Table 2-11. Standard Alternate and Emergency Fuels

ENGINE	ARMY STANDARD FUEL	ALTERNATE TYPE	EMERGENCY FUEL	
			TYPE	*MAX. HOURS
PT6A	MIL-T-5624 Grade JP-4	MIL-T-5624 Grade JP-5	MIL-G-5572 Any AV Gas	150
* Maximum operating hours with indicated fuel between engine overhauls (TBO).				

2-91. FILLING FUEL TANKS.

WARNING

Prior to removing the fuel tank filler cap, the hose nozzle static ground wire shall be attached to the grounding lugs that are located adjacent to the filler opening.

Fill tanks as follows:

a. Attach bonding cables to aircraft.

b. Attach bonding cable from hose nozzle to ground socket adjacent to fuel tank being filled.

CAUTION

Do not insert fuel nozzle completely into fuel cell due to possible damage to bottom of fuel cell. Nozzle should be supported and inserted straight down to prevent damage to the anti-siphon valve.

c. Fill main tank before filling respective auxiliary tanks unless less than a full fuel load is desired.

d. Secure applicable fuel tank filler cap. Make sure latch tab on cap is pointed aft.

e. Disconnect bonding cables from aircraft.

2-92. DRAINING MOISTURE FROM FUEL SYSTEM.

To remove moisture and sediment from the fuel system, 12 fuel drains are installed (plus one for the ferry system, when installed).

2-93. FUEL TYPES.

Approved fuel types are as follows:

a. Army Standard Fuels. Army standard fuel is JP-4.

b. Alternate Fuels, Army Alternate fuels are JP-5 and JP-8.

C. Emergency Fuel. Avgas is emergency fuel and subject to 150 hour time limit.

2-94. USE OF FUELS.

Fuel is used as follows:

a. *Fuel limitations.* There is no special limitation on the use of Army standard fuel, but certain limitations are imposed when alternate or emergency fuels are used. For the purpose of recording, fuel mixtures shall be identified as to the major component of the mixture, except when the mixture contains leaded gasoline. The use of any fuels other than standard will be entered in the FAULTS/ REMARKS column of DA Form 2408-13, Aircraft Maintenance and Inspection Record, noting the type of fuel, additives, and duration of operation.

b. *Use of Kerosene Fuels.* The use of kerosene fuels (JP-5 type) in turbine engines dictates the need for observance of special precautions. Both ground starts and air restarts at low temperature may be more difficult due to low vapor pressure. Kerosene fuels having a freezing point of minus 40 degrees C (minus 40 degrees F) limit the maximum altitude of a mission to 28,000 feet under standard day conditions.

c. *Mixing of Fuels in Aircraft Tanks.* When changing from one type of authorized fuel to another, for example JP-4 to JP-5, it is not necessary to drain the aircraft fuel system before adding the new fuel.

d. Fuel Specifications. Fuel 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. This usually occurs during cross-country flights where aircraft using NATO F-44 (JP-5) are refueling with NATO F-40 (JP-4) or Commercial ASTM Type B fuels. Whenever this condition occurs, the engine operating characteristics may change in that lower operating temperature, slower acceleration, lower engine speed, easier starting, and shorter range may be experienced. The reverse is true when changing from F-40 (JP-4) fuel to F-44 (JP-5) or Commercial ASTM Type A-l fuels. Most commercial turbine engines will operate satisfactorily on either kerosene or JP-4 type fuel. The difference in specific gravity may possibly require fuel control adjustments; if so, the recommendations of the manufacturers of the engine and airframe are to be followed.

2-95. SERVICING OIL SYSTEM

An integral oil tank occupies the cavity formed between the accessory gearbox housing and the compressor inlet case on the engine. The tank has a calibrated oil dipstick and an oil drain plug. Avoid spilling oil. Any oil spilled must be removed immediately. Use a cloth moistened in solvent to remove oil. Overfilling may cause a discharge of oil through the accessory gearbox breather until a satisfactory level is reached. Service oil system as follows:

1. Open the access door on the upper cowling to gain access to the oil filler cap and dipstick.

CAUTION

A cold oil check is unreliable. If possible, check oil within 10 minutes after engine shutdown. If over 10 minutes have elapsed, motor the engine (starter only) for 15-20 seconds, then recheck. If over 10 hours have elapsed, start the engine and run for 2 minutes, then recheck. Add oil as required. Do not overfill.

2. Remove oil filler cap.
3. Insert a clean funnel, with a screen incorporated, into the filler neck.
4. Replenish with oil to within 1 quart below MAX mark or the MAX COLD on dipstick (cold engine). Fill to MAX or MAX HOT (hot engine).
5. Check oil filler cap for damaged preformed packing, general condition and locking.

CAUTION

Insure that oil filler cap is correctly installed and securely locked to prevent loss of oil and possible engine failure.

6. If oil level is over 2 quarts low, motor or run engine as required, and service as necessary.
7. Install and secure oil tiller cap.
8. Check for any oil leaks.

2-96. SERVICING HYDRAULIC BRAKE SYSTEM RESERVOIR.

1. Gain access to brake hydraulic system reservoir.
2. Remove brake reservoir cap and till reservoir to washer on dipstick with hydraulic fluid.
3. Install brake reservoir cap.

2-97. INFLATING TIRES.

Inflate tires as follows:

1. Inflate nose wheel tires to a pressure between 55 and 60 PSI.
2. Inflate main wheel tires to a pressure between 73 and 77 PSI.

2-98. SERVICING THE CHEMICAL TOILET.

The toilet should be serviced during routine ground maintenance of the aircraft following any usage. The waste storage container should be removed, emptied, its disposable plastic liner replaced, and the container replaced in the toilet cabinet. Toilet paper, waste container plastic liners, and dry chemical deodorant packets should also be resupplied within the toilet cabinet as needed.

2-99. SERVICING THE AIR CONDITIONING SYSTEM.

Servicing the air conditioning system consists of checking and maintaining the correct refrigerant level, compressor oil level, belt tension and condition, system leak detection, and replacement of the evaporator air filters. It is imperative that the maintenance of the air conditioning system, except for filter replacement, be accomplished only by qualified refrigerant system technicians. Flexible fiberglass filters cover the evaporator coils and should be replaced after 300 hours of operation. Install filters as follows:

a. *Forward Evaporator Filter Replacement:*

1. Remove the access door in the nose wheel well keel under the refrigerant plumbing.

2. Pull the filter down and out of the retaining springs on the evaporator coil.

3. Fold the new filter to insert it through the access doors. The filter; must be carefully inserted between the coil assembly and the refrigerant plumbing under the retaining springs.

4. Install the access doors.

b. Aft Evaporator Filter Replacement.

1. Remove the carpet and floor panel behind the rear spar, and remove the cover of the evaporator plenum.

2. Remove the old filter from behind the retaining springs on the evaporator coil.

3. Insert the new filter between the retainer springs and the evaporator coil.

4. Install the plenum cover, floor panel, and carpet.

c. Anti-icing, Deicing and Defrosting Protection. The aircraft is protected in subfreezing weather by spraying the surfaces (to be covered with protective covers) with defrosting fluid. Spraying defrosting fluid on aircraft surfaces before installing protective covers will permit protective covers to be removed with a minimum of sticking. To prevent freezing rain and snow from blowing under protective covers and diluting the fluid, insure that protective covers are fitted tightly. As a deicing measure, keep exposed aircraft surface wet with fluid for protection against frost.

NOTE

Do not apply anti-icing, deicing and defrosting fluid to exposed aircraft surfaces if snow is expected. Melting snow will dilute the defrosting fluid and form a slush mixture which will freeze in place and become difficult to remove.

2-100. ANTI-ICING, DEICING AND DEFROSTING TREATMENT.

Use undiluted anti-icing, deicing, and defrosting fluid (MIL-A-8243) to treat aircraft surfaces for protection against freezing rain and frost. Spray aircraft surface sufficiently to wet area, but without excessive drainage. A fine spray is recommended to prevent waste. Use diluted, hot fluid to remove ice accumulations.

1. Remove frost or ice accumulations from aircraft surfaces by spraying with diluted anti-icing, deicing, and defrosting fluid mixed in accordance with table 2-12.

2. Spray diluted, hot fluid in a solid stream (not over 15 gallons per minute). Thoroughly saturate aircraft surface and remove loose ice. Keep a sufficient quantity of diluted, hot fluid on aircraft surface coated with ice to prevent liquid layer from freezing. Diluted, hot fluid should be sprayed at a high pressure, but not exceeding 300 PSI.

3. When facilities for heating are not available and it is deemed necessary to remove ice accumulations from aircraft surfaces, undiluted defrosting fluid may be used. Spray undiluted defrosting fluid at 15 minute

Table 2-12. Recommended Fluid Dilution Chart

AMBIENT TEMPERATURE (°F)	PERCENT DEFROSTING FLUID BY VOLUME	PERCENT WATER BY VOLUME	FREEZING POINT OF MIXTURE (“F) (APPROXIMATE)
30° and above	20	80	10°
20°	30	70	0°
10°	40	60	-15°
0°	45	55	-25°
-10°	50	50	-35°
-20°	55	45	-45°
-30°	60	40	-55°

NOTES:
1. Use anti-icing and deicing fluid (MIL-A-8243) or commercial fluids.
2. Heat Mixture to a temperature of 82° to 93°C (180° to 200°F).

intervals to assure complete coverage. Removal of ice accumulations using undiluted defrosting fluid is expensive and slow.

4. If tires are frozen to ground, use undiluted defrosting fluid to melt ice around tire. Move aircraft as soon as tires are free.

2-101. APPLICATION OF EXTERNAL POWER.

CAUTION

Before connecting the power cables from the external power source to the aircraft, insure that the GPU is not touching the aircraft at any point. Due to the voltage drop in the cables, the two ground systems will be of different potentials. Should they come in contact while the GPU is operating, arcing could occur. Turn off all external power while connecting the power cable to, or removing it from the external power supply receptacle. Be certain that the polarity of the external power source is the same as that of the aircraft before it is connected. 3inimum GPU requirement is 400 amperes continuous and 1800 amperes for one tenth of a second.

An external power source is often needed to supply the electric current required to properly ground service the aircraft electrical equipment and to facilitate starting the aircraft's engines. An external DC power receptacle is installed on the underside of the right wing leading edge just outboard of the engine nacelle. An external AC Power receptacle is installed on the underside of the left wing leading edge just outboard of the engine nacelle.

2-102. SERVICING OXYGEN SYSTEM.

The oxygen system furnishes breathing oxygen to the pilot, copilot and first aid position Oxygen cylinder location is shown in figure 2-19.

a. Oxygen System Safety Precautions.

WARNING

Keep fire and heat away from oxygen equipment. Do not smoke while working with or near oxygen equipment, and take care not to generate sparks with carelessly handled tools when working on the oxygen system.

(1.) Keep oxygen regulators, cylinders, gages, valves, fittings, masks, and all other components of the oxygen system free of oil, grease, gasoline, and all other readily combustible substances. The utmost care shall be exercised in servicing, handling, and inspecting the oxygen system.

(2.) Do not allow foreign matter to enter oxygen lines.

(3.) Never allow electrical equipment to come in contact with the oxygen cylinder.

(4.) Never use oxygen from a cylinder without first reducing its pressure through a regulator.

b. Replenishing Oxygen System.

1. Remove oxygen access door on outside of aircraft (fig. 2- 19).
2. Remove protective cap on oxygen system filler valve.
3. Attach oxygen hose from oxygen servicing unit to filler valve.

WARNING

If the oxygen system pressure is below 200 PSI, do not attempt to service system. Make an entry on DA Form 2408-13.

4. Insure that supply cylinder shutoff valves on the aircraft are open.
5. Slowly adjust the valve position so that pressure increases at a rate not to exceed 200 PSIG per minute.
6. Close pressure regulating valve on oxygen servicing unit when pressure gage on oxygen system indicates the pressure obtained using the Oxygen System Servicing Pressure Chart (fig. 2-31).

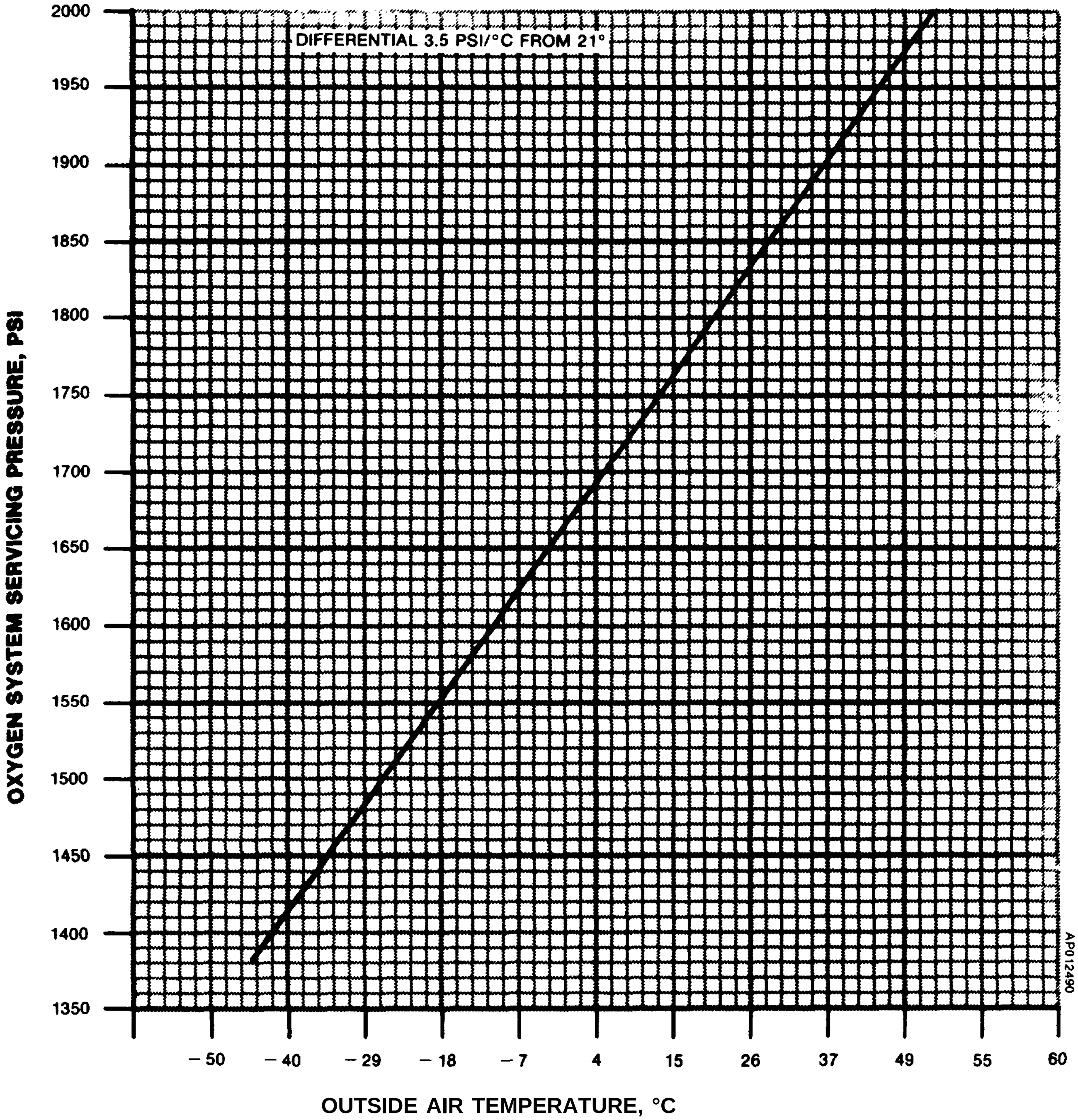


Figure 2-31. Oxygen System Servicing Pressure

NOTE

To compensate for loss of aircraft cylinder pressure as the oxygen cools to ambient temperature after recharging, the cylinder should be charged initially to approximately 10% over prescribed pressure. Experience will determine what initial pressure should be used to compensate for the subsequent pressure loss upon cooling. A small top-off will create little heat. A complete recharge will create substantial heating.

The final stabilized cylinder pressure should be adjusted for ambient temperature per figure 2-31.

7. Disconnect oxygen hose from oxygen servicing unit and tiller valve.
8. Install protective cap on oxygen filler valve.
9. Install oxygen access door.

2-103. GROUND HANDLING.

Ground handling covers all the essential information concerning movement and handling of the aircraft while on the ground. The following paragraphs give, in detail, the instructions and precautions necessary to accomplish ground handling functions. Parking, covers, ground handling and towing equipment are shown in figure 2-32.

a. General Ground Handling Procedure. Accidents resulting in injury to personnel and damage to equipment can be avoided or minimized by close observance of existing safety standard and recognized ground handling procedures. Carelessness or insufficient knowledge of the aircraft or equipment being handled can be fatal. The applicable technical manuals and pertinent directives should be studied for familiarization with the aircraft, its components, and the ground handling procedures applicable to it, before attempting to accomplish ground handling.

b. Ground Handling Safety Practice. Aircraft equipped with turboprop engines require additional maintenance safety practices. The following list of safety practices should be observed at all times to prevent possible injury to personnel and/or damaged or destroyed aircraft:

(1.) Keep intake air ducts free of loose articles such as rags, tools, etc.

(2.) Stay clear of exhaust outlet areas.

(3.) During ground runup, make sure the brakes are firmly set.

(4.) Keep area fore and aft of propellers clear of maintenance equipment.

(5.) Do not operate engines with control surfaces in the locked position.

(6.) Do not attempt towing or taxiing of the aircraft with control surfaces in the locked position.

(7.) When high winds are present, do not unlock the control surfaces until prepared to properly operate them.

(8.) Do not operate engines while towing equipment is attached to the aircraft, or while the aircraft is tied down.

(9.) Check the nose wheel position. Unless it is in the centered position, avoid operating the engines at high power settings.

(10.) Hold control surfaces in the neutral position when the engines are being operated at high power settings.

(11.) When moving the aircraft, do not push on propeller deicing boots. Damage to the heating elements may result.

c. Moving Aircraft on Ground. Aircraft on the ground shall be moved in accordance with the following:

(1.) Taxiing. Taxiing shall be in accordance with chapter 8.

CAUTION

When the aircraft is being towed, a qualified person must be in the pilot's seat to maintain control by use of the brakes. When towing, do not exceed nose gear turn limits. Avoid short radius turns, and always keep the inside or pivot wheel turning during the operation. Do not tow aircraft with rudder locks installed, as severe damage to the nose steering linkage can result. When moving the aircraft backwards, do not apply the brakes abruptly. Tow the aircraft slowly, avoiding sudden stops, especially over snowy, icy, rough, soggy, or muddy terrain. In arctic climates, the aircraft must be towed by the main gears, as an immense breakaway load, resulting from ice, frozen tires, and stiffened grease in the wheel bearings may damage the nose gear.

CAUTION

Do not tow or taxi aircraft with deflated shock struts.

(2.) Towing. Towing lugs are provided on the upper torque knee fitting of the nose strut. When it is necessary to tow the aircraft with a vehicle, use the vehicle tow bar. In the event towing lines are necessary, use towing lugs on the main landing gear. Use towing lines long enough to clear nose and/or tail by at least 15 feet. This length is required to prevent the aircraft from overrunning the towing vehicle or fouling the nose gear.

d.. Ground Handling Under Extreme Weather Conditions. Extreme weather conditions necessitate particular care in ground handling of the aircraft. In hot, dry, sandy, desert conditions, special attention must be devoted to finding a firmly packed parking and towing area. If such areas are not available, steel mats or an equivalent solid base must be provided for these purposes. In wet, swampy areas, care must be taken to avoid bogging down the aircraft. Under cold, icy, arctic conditions, additional mooring is required, and added precautions must be taken to avoid skidding during towing operations. The particular problems to be encountered under adverse weather conditions and the special methods designed to avoid damage to the aircraft are covered by the various phases of the ground handling procedures included in this section of general ground handling instructions. (Refer to TM 55-1500-204-25/1.)

2-104. PARKING.

Parking is defined as the normal condition under which the aircraft will be secured while on the ground. This condition may vary from the temporary expedient of setting the parking brake and chocking the wheels to the more elaborate mooring procedures described under Mooring. The proper steps for securing the aircraft must be based on the time the aircraft will be left unattended, the aircraft weights, the expected wind direction and velocity, and the anticipated availability of ground and air crews for mooring and/or evacuation. When practical head the aircraft into the wind, especially if strong winds are forecast or if it will be necessary to leave the aircraft overnight. Set the parking brake and chock the wheels securely. Following engine shutdown, position and engage the control locks.

NOTE

Cowlings and loose equipment will be suitably secured at all times when left in an unattended condition.

a. The parking brake system for the aircraft incorporates two lever-type valves, one for each wheel brake. Both valves are closed simultaneously by pulling out the parking brake handle. Operate the parking brake as follows:

1. Depress both brakes.
2. Pull parking brake handle out. This will cause the parking brake valves to lock the hydraulic fluid under pressure in the parking brake system, thereby retaining braking action.
3. Release brake pedals.

CAUTION

Do not set parking brakes when the brakes are hot during freezing ambient temperatures. Allow brakes to cool before setting parking brakes.

4. To release the parking brakes push in on the parking brake handle.

b. The control lock (fig. 2-18) holds the engine and propeller control levers in a secure position. It also holds the elevators and rudder at neutral position and the ailerons in a staggered attitude, one slightly "up" and the other slightly "down". Install the control locks as follows:

1. With engine and propeller control levers in secure position, slide lock onto control pedestal to prevent operation of levers.
2. Install elevator and aileron lockpin vertically through pilot's control column to lock control wheel.
3. Install rudder lock pin through flapper door forward of pilot's seat, making sure rudder is in neutral position.
4. Reverse steps 1 through 3 above to remove control lock. Store control lock.

2-105. INSTALLATION OF PROTECTIVE COVERS.

The crew will insure that the aircraft protective covers are installed.

2-106. MOORING.

The aircraft is moored to insure its immovability, protection, and security under various weather

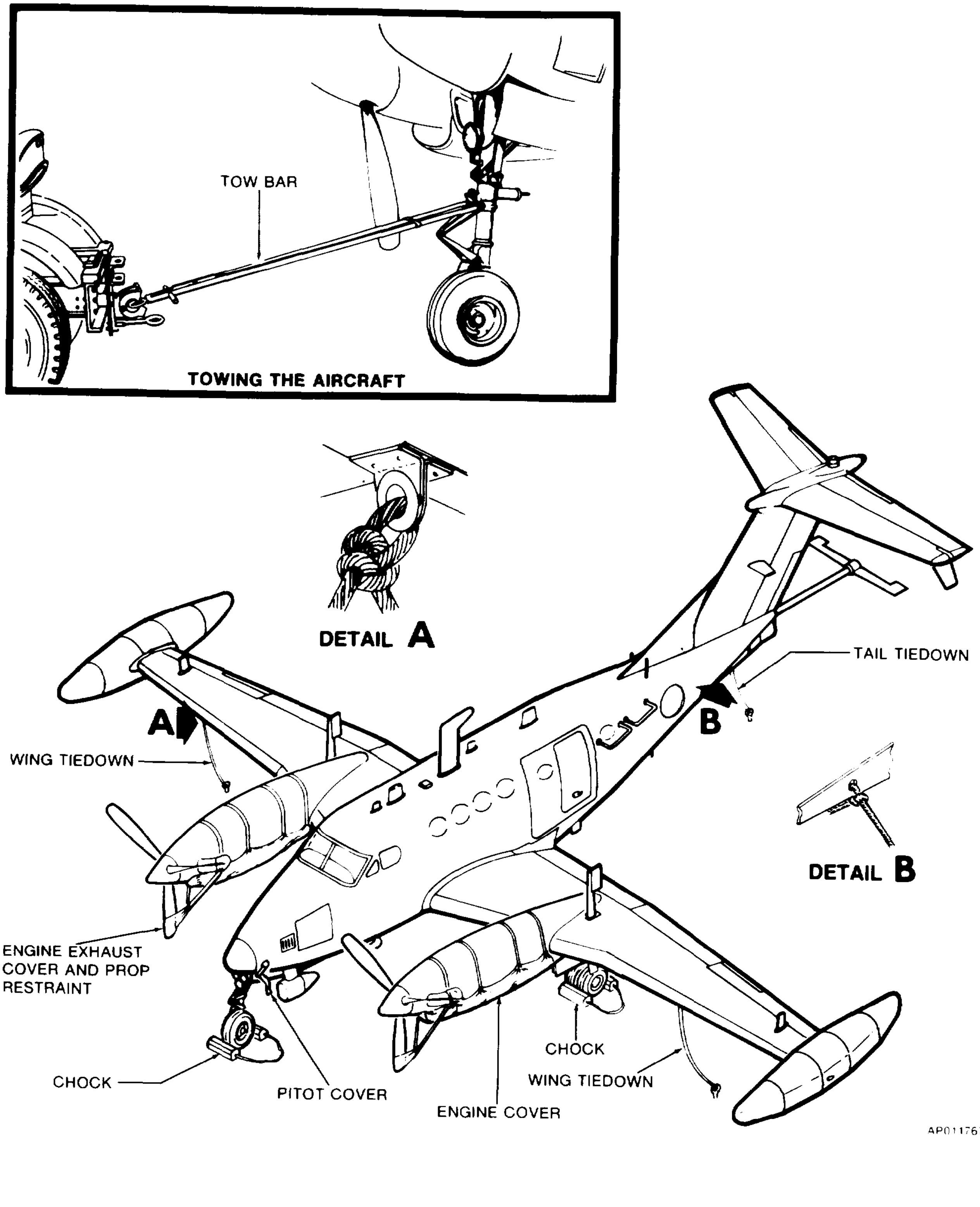


Figure 2-32. Parking, Covers, Ground Handling, and Towing Equipment

conditions. The following paragraphs give, in detail, the instructions for proper mooring of the aircraft.

a. Mooring Provisions. Mooring points (fig. 2-33) are provided beneath the wings and tail. Additional mooring cables may be attached to each landing gear. General mooring equipment and procedures necessary to moor the aircraft, in addition to the following, are given in TM 55-1500-204-25/1.

(1.) Use mooring cables of 1/4 inch diameter aircraft cable and clamp (clip-wire rope), chain or rope 3/8 inch diameter or larger. Length of the cable or rope will be dependent upon existing circumstances. Allow sufficient slack in ropes, chains, or cable to compensate for tightening action due to moisture absorption of rope or thermal contraction of cable or chain. Do not use slip knots. Use bowline knots to secure aircraft to mooring stakes.

(2.) Chock the wheels.

b. Mooring Procedures for High Winds. Structural damage can occur from high velocity winds; therefore, if at all possible, the aircraft should be moved to a safe weather area when winds above 75 knots are expected. Moored aircraft condition is shown in figure 2-33. If aircraft must be secured use the following steps:

1. After aircraft is properly located, place nose wheel in centered position. Head aircraft into the wind, or as nearly so as is possible within limits determined by locations of fixed mooring rings. When necessary, a 45 degree variation of direction is considered to be satisfactory. Locate each aircraft at slightly more than wing span distance from all other aircraft. Position nose mooring point approximately 3 to 5 feet downwind from ground mooring anchors.

2. Deflate nose wheel shock strut to within 3/4 inch of its fully deflated position.

3. Fill all fuel tanks to capacity, if time permits.

4. Place wheel chocks fore and aft of main gear wheels and nose wheel. Tie each pair of chocks together with rope or join together with wooden cleats nailed to chocks on either side of wheels. Tie ice grip chocks together with rope. Use sandbags in lieu of chocks when aircraft is moored on steel mats. Set parking brake as applicable.

5. Accomplish aircraft tiedown by utilizing mooring points shown in figure 2-33. Make tiedown with 1/4 inch aircraft cable, using two wire rope clips or bolts, and a chain tested for a 3000 pound pull. Attach tiedowns so as to remove all slack. (Use a 3/4-inch or larger manila rope if cable or chain tiedown is not available.) If rope is used for tiedown, use anti-slip knots, such as bowline knot, rather than slip knots. in the event tiedown rings are not available on hard surfaced areas, move aircraft to an area where portable tiedowns can be used. Locate anchor rods at point shown in figure 2-33. When anchor kits are not available, use metal stakes or deadman type anchors, providing they can successfully sustain a minimum pull of 3000 pounds.

6. In event nose position tiedown is considered to be of doubtful security due to existing soil condition, drive additional anchor rods at nose tiedown position. Place padded work stand or other suitable support under the aft fuselage tiedown position and secure.

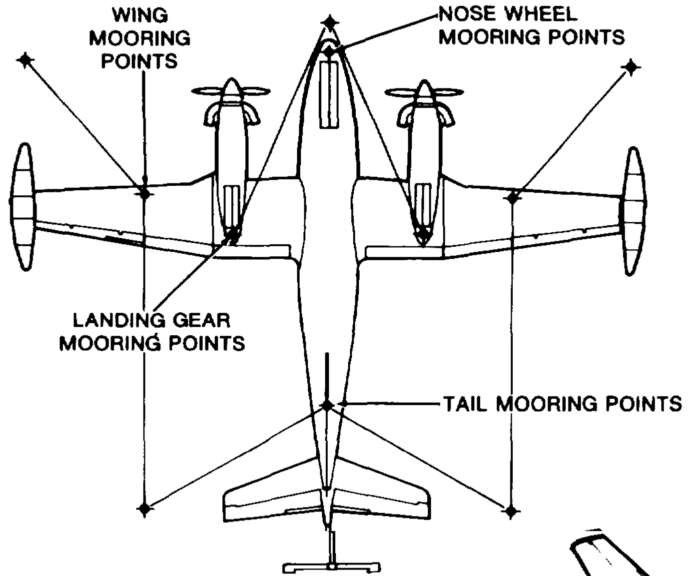
7. Place control surfaces in locked position and trim tab controls in neutral position. Place wing flaps in up position.

8. The requirements for dust excluders, protective covers, and taping of openings will be left to the discretion of the responsible maintenance officer or the pilot of the transient aircraft (fig. 2-32).

9. Secure propellers to prevent windmilling (fig. 2-32).

10. Disconnect battery.

11. During typhoon or hurricane wind conditions, mooring security can be further increased by placing sandbags along the wings to break up the aerodynamic flow of air over the wing, thereby reducing the lift being applied against the mooring by the wind. The storm appears to pass two times, each time with a different wind direction. This will necessitate turning the aircraft after the first passing. sli.After high winds, inspect aircraft for visible signs of structural damage and for evidence of damage from flying objects. Service nose shock strut and reconnect battery.



NOTE

IF STRONG WINDS ARE ANTICIPATED OR AIRCRAFT IS TO BE LEFT UNATTENDED, PROPELLER RESTRAINT, PITOT MAST, AND INTAKE COVERS MUST BE INSTALLED, AND THE FLIGHT CONTROLS LOCK ENGAGED.

BEFORE TOWING, THE PROPELLER RESTRAINT MUST BE INSTALLED WITH ONE PROPELLER BLADE IN THE DOWN POSITION AS SHOWN.

THE USE OF DOUBLE OR SINGLE MOORING POINTS FOR NOSE AND/OR WING TIEDOWNS IS DETERMINED BY LOCAL OPTION DEPENDING ON TYPE AND AVAILABILITY OF AIRCRAFT SECURING EQUIPMENT.

USE ROPE ONLY (NYLON TYPE IF AVAILABLE) FOR NOSE TIEDOWN (DETAIL A). ATTACH ROPE(S) TO AIRCRAFT AND GROUND MOORING POINTS IN A MANNER THAT WILL PREVENT ROPE DAMAGE TO AIRCRAFT COMPONENTS.

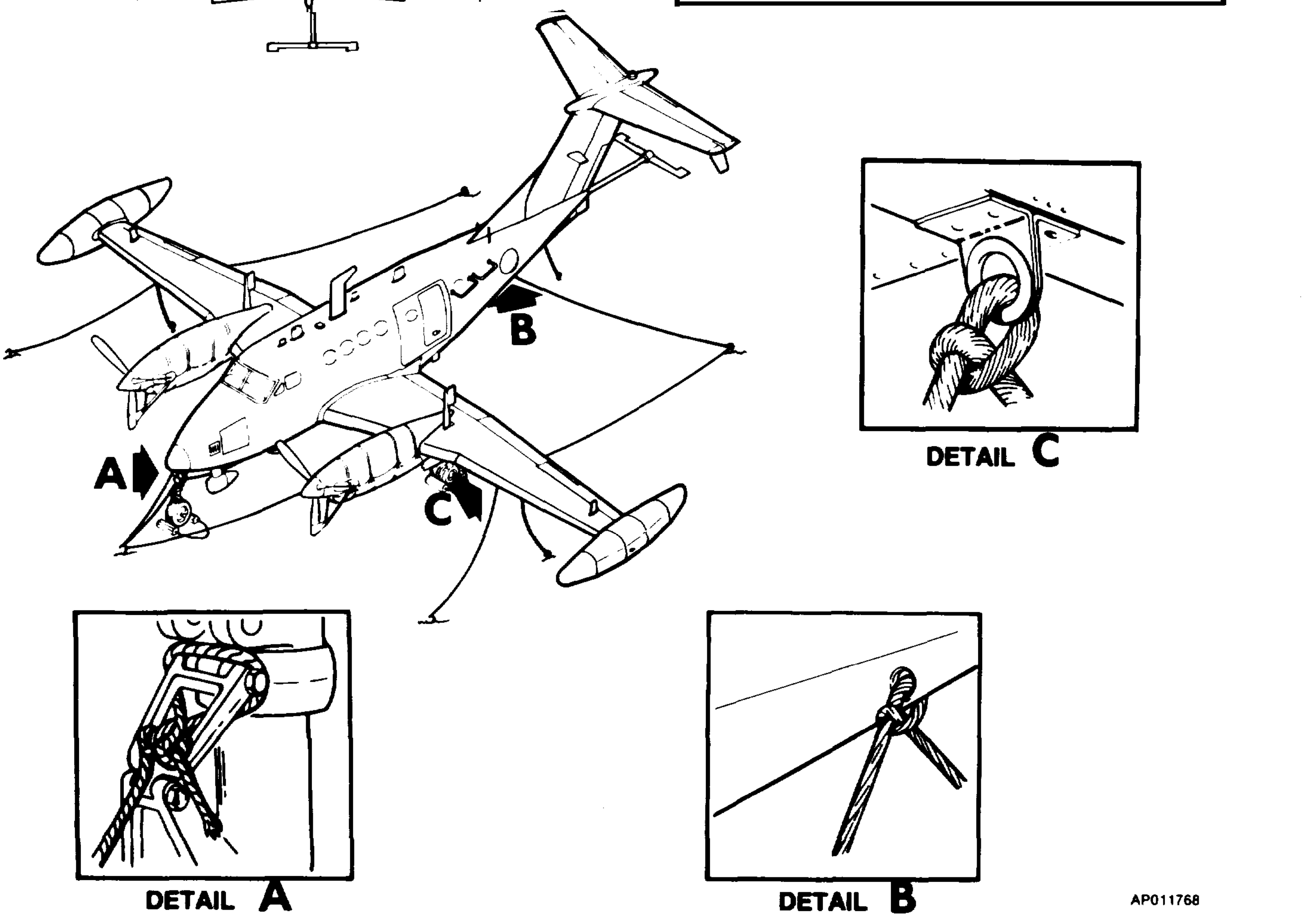


Figure 2-33. Mooring the Aircraft

CHAPTER 3

AVIONICS

Section I. GENERAL

3-1. INTRODUCTION.

Except for mission avionics, this chapter covers all avionics equipment installed in the RC-12H aircraft. It provides a brief description of equipment covered, the technical characteristics and locations. It covers systems and controls and provides the proper techniques and procedures to be employed when operating the equipment. For more detailed operational information consult the vendor manuals that accompany the aircraft loose tools.

3-2. AVIONICS EQUIPMENT CONFIGURATION.

The aircraft avionics covered consists of three groups of electronic equipment. The communication group consists of the interphone, UHF command, backup VOW, VHF/AM-FM, VHF command and HF command systems. The navigation group provides the pilot and copilot with the instrumentation required to establish and maintain an accurate flight course and position, and to make an approach on instruments under Instrument Meteorological Conditions (IMC). The navigation group includes equipment for determining altitude, attitude, position, destination, range and bearing, heading reference, groundspeed, and drift angle. The transponder and radar group includes an identification, position, emergency tracking system, a radar system to locate potentially dangerous weather areas, and a radar system to differentiate between friendly and unfriendly search radar.

NOTE

All avionics equipment require a 3-minute warmup period. The weather radar has an automatic time delay of 3 to 4 minutes.

3-3. POWER SOURCE.

a. DC Power. DC power for the avionics equipment is provided by four sources: the aircraft battery, left and right generators, and external power. Power is routed through two 50-ampere circuit breakers to the avionics power relay which is controlled by the AVIONICS MASTER POWER switch on the overhead control panel (fig. 2-12). Individual system circuit breakers and the associated avionics busses are shown in fig. 2-22. With the switch in the ON (forward) position, the avionics power relay is de-energized and power is applied through both the AVIONICS MASTER POWER No. 1 and No.2 circuit breakers to the individual avionics circuit breakers on the overhead circuit breaker panel (fig. 2-26). In the OFF (aft) position, the relay is energized and power is removed from avionics equipment. When external power is applied to the aircraft, the avionics power relay is normally energized, removing power from the avionics equipment. To apply external power to the avionics equipment, move the AVIONICS MASTER POWER switch to the EXT PWR position. This will de-energize the avionics power relay and allow power to be applied to the avionics equipment.

b. Single-Phase AC Power. AC power for the avionics equipment is provided by two inverters. The inverters supply 115-volt and 26-volt single-phase AC power when operated by the INVERTER No. 1 or No.2 switches (fig. 2-12). Either inverter is capable of powering all avionics equipment requiring AC power. AC power from the inverters is routed through fuses in the nose avionics compartment.

c. Three-Phase AC Power. Three phase AC electrical power for operation of the inertial navigation system and mission avionics is supplied by two DC powered 3000 volt-ampere solid state three phase inverters. The three phase inverters are controlled by two three-position switches located on the mission control panel (fig. 4-1) placarded No. 1 INV - OFF - ON - RESET and #2 INV - OFF - ON - RESET.

Section II. COMMUNICATIONS

3-4. DESCRIPTION.

The communications equipment group consists of an interphone system connected to individual audio control panels for the pilot and copilot which interface with VHF, UHF, BU VOW, VHF AM-FM and HF communication units.

3-5. MICROPHONES, SWITCHES AND JACKS.

Boom and oxygen mask microphones can be utilized in the aircraft.

a. *Microphone Switches.* The pilot and copilot are provided with individual microphone control switches, placarded INTPH-XMIT-MIC, attached to respective control wheels. A foot-actuated microphone switch is also positioned on the floorboards forward of each pilot's seat.

b. *Controls and Functions.*

(1.) Microphone control wheel switches (fig. 2-17). Keys selected facility.

(a.) INTPH (depressed to first detent). Keys interphone facility, disregards position of transmitter selector switch.

(b.) XMIT (depressed full down). Keys facility selected by transmitter select switch.

(2.) Floorboard microphone switches. Controls connection of selected microphone to audio system.

(a.) Held depressed. Connects selected microphone to audio system.

(b.) Released. Disconnects selected microphone from audio system.

c. *Microphone jack selector switches.* Two switches, placarded MIC HEADSET - OXYGEN MASK, are located on the extreme left and extreme right of the instrument panel (fig. 2-29). These switches provide a means of selecting whether the headset microphone jack or the oxygen mask microphone jack is connected to the audio system.

d. *Controls and Functions.*

(I.) MIC HEADSET - OXYGEN MASK switch. Selects microphone jack to connect to audio system.

(a.) MIC HEADSET. Connects headset microphone to audio system.

(b.) OXYGEN MASK. Connects microphone in oxygen mask to audio system.

3-6. AUDIO CONTROL PANELS.

a. Description. Separate but identical audio control panels (fig. 3-1), serve the pilot and copilot. The controls and switches of each panel provide the user with a means of selecting desired reception and transmission sources, and also a means to control the volume of audio signals received for interphone, communication and navigation systems. The user selects between the UHF, VHF, BU VOW, VHF AM-FM and HF transceivers. The audio control panels are protected by respective 2-ampere AUDIO PILOT and AUDIO COPILOT circuit breakers located on the overhead circuit breaker panel (fig. 2-26).

b. *Controls and Functions.*

(I.) Master VOL control. Controls sidetone volume to headset. Also serves as final volume adjustment for received audio from any source before admission to headset.

(2.) Radios audio monitor controls. Each is combination rotary control and on-off push-pull switch, permitting both receiver selection and volume adjustment.

(a.) No. 1. On connects user's headset to audio from VHF-AM transceiver No. 1.

(b.) No.2. On connects user's headset to audio from the VHF/AM/FM transceiver.

(c.) No.3. On connects user's headset to audio from No. 1 UHF transceiver in use.

(d.) No.4. On connects user's headset to audio from HF or VOW transceivers.

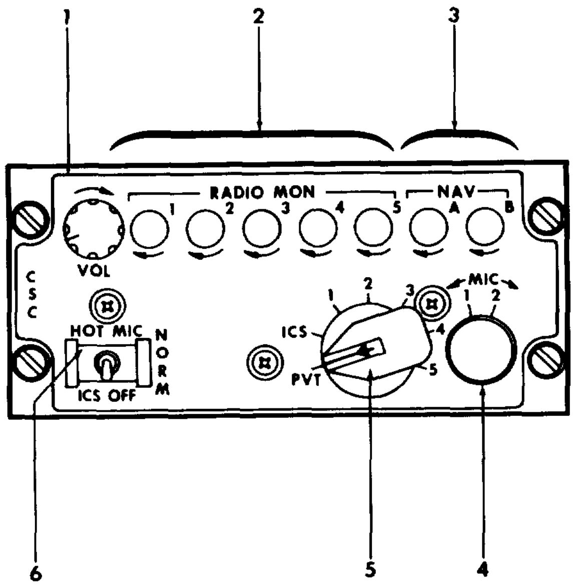
(e.) No.5 On connects user's headset to audio from No. 2 UHF (BU VOW) transceiver.

(3.) NAV receiver audio monitor controls. Combination volume control and "ON-OFF" switches for NAV receivers.

(a.) NAV-A. On connects user's headset to audio from VOR-1, VOR-2 or marker beacon set in use.

(b.) NAV-B. On connects user's headset to audio from TACAN or ADF set in use.

(4.) Microphone impedence select switch. Two-position, thumb-actuated switch. Enables selec-



1. Master VOL control
2. Radios audio monitor controls
3. NAV receivers audio monitor controls
4. MIC impedence select switch
5. Transmitter-interphone select switch
6. ICS select switch

AP 006966

Figure 3-1. Audio Control Panel (Typical Pilot, Copilot)

tion of interface circuit with best impedence match to microphone used.

(a.) The impedance of MIC 1 position is 5 Ohms.

(b.) The impedance of MIC 2 position is 150 Ohms.

(5.) Transmitter-interphone selector switch. Connects microphone and headset to selected radio transmitter or interphone line routing received audio to headset. Bypasses control of respective receiver audio switch.

(a.) PVT. Position not used.

(b.) ICS. Activates pilot-to-copilot intercom.

(c.) No.1. Permits audio reception from VHF-AM No. 1 transceiver. Routes key and microphone signals to VHF-AM No. 1 transceiver.

(d.) No.2. Permits audio reception from VHF/AM/FM transceiver. Routes key and microphone signals to VHF/AM/FM transceiver.

(e.) No.3. Permits audio reception from No. 1 UHF transceiver. Routes key and mic signals to No. 1 UHF transceiver.

(f.) No.4. Permits audio reception from HF or VOW transceivers. Routes key or microphone signals to transceiver.

(g.) No.5 Permits audio reception from No. 2 UHF (BU VOW). Routes key and and microphone signals to transceiver.

(6.) ICS select switch. Controls activation of microphones.

(a.) HOT MIC. Admits speech to interphone system without need to key selected microphone.

(b.) NORM. Blocks speech from interphone system unless selected microphone is keyed.

(c.) ICS OFF. Deactivates interphone system.

c. *Normal Operation.*

(1.) Turn-on procedure: Both audio control panels are activated when electrical power is applied to aircraft.

NOTE

It is presumed the AVIONICS MASTER POWER switch is ON, and that normally used avionics circuit breakers remain set. The circuit breakers of routinely used avionic systems are normally left set.

(2.) Receiver operating procedure:

1. Receiver audio switches (audio control panel) - As required.
2. Master volume control (audio control panel) - Do not use. (Adjust volume control of system being used.)

NOTE

Audio select switches and volume controls are routinely left in positions of normal use.

3. Move each receiver audio switch ON then OFF, separately, to verify audio presence in headphones for each system. Adjust volume.

(3.) Transmitter operating procedure:

1. Transmitter-interphone selector switch (audio control panel) - Set for transceiver desired.
2. Microphone jack selector switch (instrument panel, fig. 2-29) - As desired.
3. Control wheel microphone switch (control wheel) - XMIT.
4. Microphone switch (floorboard) - Depress to transmit.

(4.) Intercommunication procedure:

1. Transmitter-interphone selector switch (audio control panel) - ICS.
2. Microphone jack selector switch (instrument panel, fig. 2-29) - As desired.
3. ICS select switch (audio control panel, fig. 3-1) - As desired (NORM-HOT MIC-ICS OFF).
4. If HOT MIC is selected - Talk when ready.
5. If NORM microphone is selected - Depress microphone switch and transmit.
6. If ICS OFF is selected intercom function is switched off.
7. Volume control (selected transceiver) - Set for comfort.

d. Emergency Operation. Not applicable.

e. Shutdown Procedure.

1. AVIONICS MASTER POWER switch (overhead control panel, fig. 2-12) - OFF.
2. Leave controls and circuit breakers positioned for normal operation.

3-7. MARKER BEACON AUDIO CONTROL PANEL (FIG. 3-2).

a. Description. The marker beacon audio control panel, located on the pedestal extension (fig. 2-7) allows the pilot or copilot to control the volume of the marker beacon (MKR BCN). It also has controls for the selection of ADF voice or range filters and MKR BCN HI-LO sensitivity.

b. Controls and Functions.

(1.) ADF Filter Switches. Controls selected ADF filter.

(a.) FILTER V-OFF switch. Selects filter to block voice transmissions from ADF ground station.

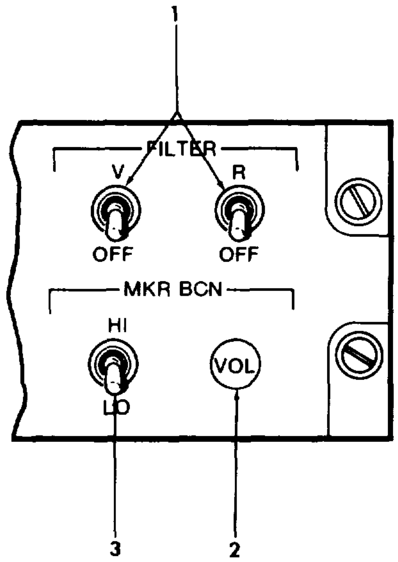
(b.) FILTER R-OFF switch. Selects filter to block range transmissions from ADF ground station.

(2.) MKR BCN volume control. Adjusts volume of marker beacon radio signals received.

(3.) MKR BCN HI-LO switch. Selects sensitivity of marker beacon receiver.

3-8. UHF COMMAND SET (AN/ARC-184).

a. Description. The UHF command set is a line-of-sight radio transceiver which provides transmission and reception of amplitude modulated (AM) signals in the ultra high frequency range of 225.000 to 399.975 MHz for a distance range of approximately 50 miles. Channel selection is spaced at 0.025 MHz. A separate receiver is incorporated to provide monitoring capability for the UHF guard frequency (243.0 MHz). UHF audio output is applied to the audio panel where it is routed to the headsets.



1. ADF filter switch
2. Marker beacon volume control
3. Marker beacon HI-LO switch

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Figure 3-2. Marker Beacon Audio Control Panel

NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the mode selector is set to GUARD position. The receiver-transmitter will be set to the emergency frequency only.

The transmitter and receiver sections of the UHF unit operate independently but share the same power supply and frequency control circuits. Separate cables route transmit and receive signals to their respective receiver/transmitter.

Complete provisions only are installed for a TSEC/KY-28 voice security device to be located on the LH forward avionics rack behind the pilot. The UHF command set is protected by the 71/2 ampere UHF circuit breaker on the overhead circuit breaker panel (fig. 2-26). Figure 3-3 illustrates the UHF command set. The associated blade type antenna is shown in figure 2-1.

b. Controls and Functions. UHF control panel (fig. 3-3):

(1.) Manual frequency selector/indicator (hundreds). Selects and indicates hundreds digit of frequency (2 or 3) in MHz.

(2.) Manual frequency selector/indicator (tens). Selects and indicates tens digit of frequency (0 through 9) in MHz.

(3.) Manual frequency selector/indicator (units). Selects and indicates units digit of frequency (0 through 9) in MHz.

(4.) Preset channel indicator. Displays preset channel.

(5.) Manual frequency selector/indicator (tenths). Selects and indicates tenths digit of frequency (0 through 9) in MHz.

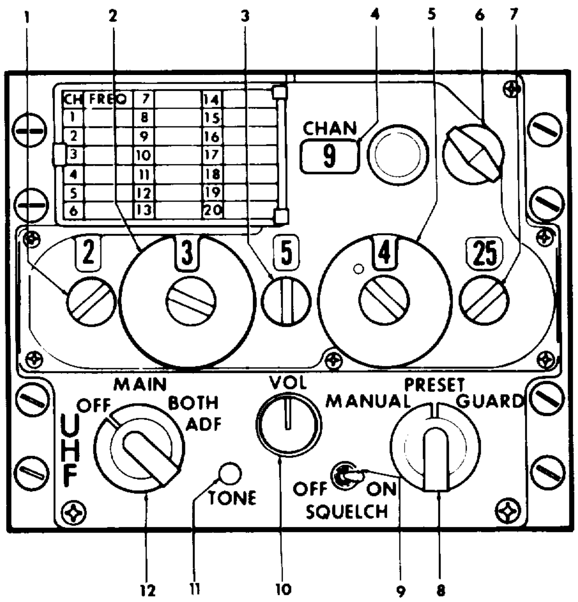
(6.) Preset channel selector. Selects one of 20 preset channel frequencies.

(7.) Manual frequency selector (hundredths and thousandths). Selects hundredths and thousandths digits of frequency (00, 25, 50, or 75) in MHz.

(a.) Mode selector. Selects operating mode and method of frequency selection.

1. MANUAL. Enables the manual selection of any one of 7,000 frequencies.

2. PRESET. Enables selection of any one of 20 preset channels.



1. Manual frequency selector/indicator (hundreds)
2. Manual frequency selector/indicator (tens)
3. Manual frequency selector/indicator (units)
4. Preset channel indicator
5. Manual frequency selector/indicator (tenths)
6. Preset channel selector
7. Manal frequency selector/indicator (hundredths and thousandths)
8. Mode selector
9. SQUELCH switch
10. Volume control
11. TONE pushbutton
12. Function select switch

AP 006265

Figure 3-3. UHF Control panel (AN/ARC- 164)

3. *GUARD.* Selection automatically tunes the main receiver and transmitter to the guard frequency and the guard receiver is enabled.

(b.) SOUELCH switch. Turns main receiver squelch on or off.

(c.) VOL control. adjusts volume.

(8.) TONE pushbutton. When pressed, transmits a 1,020 Hz tone on the selected frequency.

(9.) Function selector. Selects operating function.

(a.) OFF. Turns set off.

(b.) MAIN. Selects normal transmission with reception on main receiver.

(c.) BOTH. Selects normal transmission with reception on both the main receiver and the guard frequency receiver.

(d.) ADF. Not used.

c. Normal Operation.

(1.) Turn on procedure:

NOTE

It is presumed aircraft power is on and normally used avionic circuit breakers remain depressed.

1. Avionics master power switch (overhead panel, fig. 2-12) - ON.
2. Function select switch (UHF control panel, fig. 3-3) -MAIN or BOTH position, as required.

NOTE

If function selector is at MAIN setting, only the normal UHF communications will be received. If selector is at BOTH position, emergency communications on the guard channel and normal UHF communications will both be received.

(2.) Receiver operating procedure:

1. UHF audio monitor switch (No.3, audio control panel) -ON, or transmitter-interphone selector switch (audio control panel) - No.3 position.
2. Volume control (UHF control panel) - Mid position.

(3.) To use preset frequency (UHF control panel):

1. Mode selector switch - PRESET position.
2. Preset channel selector switch - Rotate to desired channel.

(4.) To use non-preset frequency (UHF *control panel):*

1. Mode selector switch - MANUAL position.
2. Manual frequency selectors (5) - Rotate each knob to set desired frequency digits.

NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the mode selector switch is set to the GUARD position.

3. Volume - Adjust.

NOTE

To adjust volume when audio is not being received, turn squelch switch OFF, adjust volume for comfortable noise level, then turn squelch switch ON.

4. Squelch - As desired.

(5.) Transmitter operating procedure:

1. Transmitter-interphone selector (audio panel control panel, fig. 3-1) - No.3 position.
2. UHF control panel (fig. 3-3) - Set required frequency using either PRESET CHAN control or MANUAL frequency select controls.
3. Microphone jack selector switch (instrument panel, fig.2-29) - As desired.
4. Microphone switch - Depress to transmit.

(6.) Shutdown procedure: Function selector switch (UHF control panel, fig. 3-3) -OFF.

d. UHF Command Set Voice Security Operation (KY-28).

NOTE

Disregard operating procedures involving the voice security control-indicator if unit is not installed.

(I.) Turn-on procedure:

1. Power switch (Voice Security panel, fig 3-6) - ON.
2. Function switch (UHF control panel) - BOTH.

(2.) Receiver operating procedure:

1. Mode selector switch (UHF control panel, fig. 3-3) - As required.
2. Transmitter-interphone selector switch (audio control panel, fig. 3-1) - No.3 position, or No.3 radio monitor control - On.
3. Set required frequency using preset channel control or manual frequency selector.
4. Volume control - Adjust.

NOTE

To adjust volume when radio signals are not being received, turn squelch switch OFF, adjust volume for comfortable noise level, then turn squelch disable switch ON.

5. Squelch switch - As required.

(3.) Transmitter operating procedure (PLAIN):

1. Transmitter-interphone selector switch (audio control panel) - No.3 position.

2. Plain/cipher switch (voice security control panel) -PLAIN.

3. Microphone switch - Press.

(4.) Transmitter operating procedure (CIPHER):

1. Transmitter-interphone selector switch (audio control panel) - No.3 position.

2. Plain/cipher switch (voice security control panel, fig. 3-6) - CIPHER. (CIPHER indicator will be illuminated as long as switch is in CIPHER position.)

3. RE-X/REG switch (voice security control panel) - REG.

4. Microphone switch - Press momentarily (interrupted tone from voice security unit should no longer be heard).

NOTE

No traffic will be passed if the interrupted tone is still heard after pressing and releasing the microphone switch.

5. Microphone switch - Press (do not talk). Wait until beep is heard then speak into microphone.

(5.) Shutdown procedure:

1. Function selector switch (UHF control panel)- OFF.

2. Power switch (Voice security control panel) - OFF.

e. UHF Command Set - Emergency Operation:

NOTE

Transmission on emergency frequencies (guard channels) is restricted to emergencies only. An emergency frequency of 121. 500 MHz is also available on the VHF command radio set.

1. Transmitter-interphone selector switch (audio control panel) - No.3 position.
2. Mode selector switch (UHF control panel) - GUARD.
3. Microphone switch - Press.

3-8A. UHF COMMAND SET (AN/ARC-164).

a. Description. The UHF command set is a line-of-sight radio transceiver which provides transmission and reception of amplitude modulated (AM) signals in the ultra high frequency range of 225.000 to 399.975 MHz for a distance range of approximately 50 miles. Channel selection is spaced at 0.025 MHz. A separate receiver is incorporated to provide monitoring capability for the UHF guard frequency (243.0 MHz). UHF audio output is applied to the audio panel where it is routed to the headsets.

NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the mode selector is set to GUARD position. The receiver-transmitter will be set to the emergency frequency only.

Existing capabilities of the HAVE QUICK moditied radio are preserved to the maximum extent possible when it is operated in the normal (non-hopping) mode. No new procedures are required for normal radio operation.

To operate in the AJ mode, the radio must first be initialized. This initialization requires the setting of two control entries into the radio, Word-of-Day (WOD) and Time-of-Day (TOD). The WOD defines the choice of frequency hopping pattern for the day. The WOD choice is a managerial function and the same WOD may be used for one or more days. The TOD must be loaded into the clock contained within the radio.

The transmitter and receiver sections of the UHF unit operate independently, but share the same power supply and frequency control circuits. Separate cables, route transmit and receive signals to their respective receiver/transmitter.

The UHF command set is protected by the 7 1/2-ampere UHF circuit breaker in the overhead circuit breaker panel (fig. 2-6). Figure 3-2 illustrates the UHF command set. The associated blade type antenna is shown in figure 2-1.

b. Controls and Functions. UHF control panel (fig. 3-2):

(1) Manual frequency selector/indicator (hundreds). Selects and indicates hundreds digit of frequency (2 or 3) in MHz.

(2) Manual frequency selector/indicator (tens). Selects and indicates tens digit of frequency (0 through 9) in MHz.

(3) Manual frequency selector/indicator (units). Selects and indicates units digit of frequency (0 through 9) in MHz.

(4) Preset channel indicator. Displays preset channel.

(5) Manual frequency selector/indicator (tenths). Selects and indicates tenths digit of frequency (0 through 9) in MHz.

(6) Preset channel selector. Selects one of 20 preset channel frequencies.

(7) Manual frequency selector (hundredths and thousandths). Selects hundredths and thousandths digits of frequency (00, 25, 50, or 75) in MHz.

(8) Mode selector. Selects operating mode and method of frequency selection.

(a) MANUAL. Enables the manual selection of any one of 7,000 frequencies.

(b) PRESET. Enables selection of any one of 20 preset channels.

(c) GUARD. Selection automatically tunes the main receiver and transmitter to the guard frequency and the guard receiver is enabled.

(9) SQUELCH switch. Turns main receiver squelch on or off.

(10) VOL control. Adjusts volume.

(11) TONE pushbutton. When pressed, transnits a 1,020 Hz tone on the selected frequency.

(12) Function selector. Selects operating 'unction.

(a) OFF. Turns set off.

(b) MAIN. Selects normal transmission with reception on main receiver.

(c) BOTH. Selects normal transmission with reception on both the main receiver and the guard frequency receiver.

(d) ADF. Not used.

c. Normal Operation.

(1) Turn on procedure:

NOTE

It is presumed aircraft power is on and normally used avionic circuit breakers remain depressed.

1. Avionics master power switch - ON.
2. Function select switch - MAIN or BOTH position, as required.

NOTE

If function selector is at MAIN setting, only the normal UHF communications will be received. If selector is at BOTH position, emergency communications on the guard channel and normal UHF communications will both be received.

(2) Receiver operating procedure:

1. Transmitter-interphone selector switch - No. 3 position.
2. UHF audio monitor switch - ON, No. 3 position.
3. Volume control - Mid position.

(3) To use preset frequency:

1. Mode selector switch - PRESET position.
2. Preset channel selector switch - Rotate to desired channel.

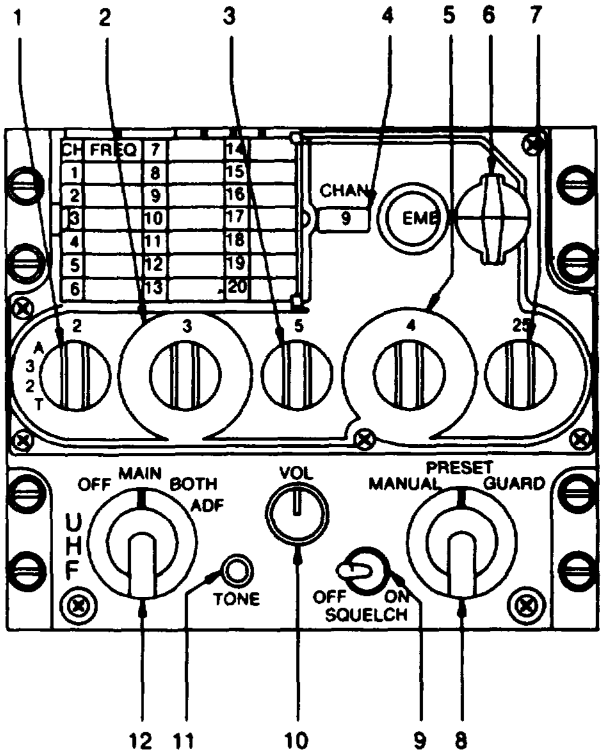
(4) To use non-preset frequency:

1. Mode selector switch - MANUAL position.
2. Manual frequency selectors (5) - Rotate each knob to set desired frequency digits.

NOTE

The PRESET channel selector and manual frequency selectors are inoperative when the mode selector switch is set to the GUARD position.

3. Volume - Adjust.



1. Manual Frequency (100 MHz) Selector-Indicator
2. Manual Frequency (10 MHz) Selector-Indicator
3. Manual Frequency (1 MHz) Selector-Indicator
4. Preset Channel Number Indicator
5. Manual Frequency (100 KHz) Selector-Indicator
6. Preset Channel Selector Knob
7. Manual Frequency (1 and 10 KHz) Selector-Indicator
8. Mode Selector Switch
9. Squelch Switch
10. Volume Control
11. Tone Pushbutton Switch
12. Function Selector Switch

Figure 3-2. UHF Control Panel (AN/ARC-164)

NOTE

To adjust volume when audio is not being received, turn squelch switch OFF, adjust volume for comfortable noise level, then turn squelch switch ON.

4. Squelch - As desired.

(5) Transmitter operating procedure:

1. Transmitter-interphone selector - No. 3 position.
2. UHF control panel - Set required frequency using either PRESET CHAN control or MANUAL frequency select controls.
3. Microphone jack selector switch - As desired.
4. Microphone switch - Depress to transmit.

(6) Shutdown procedure: Function selector switch (fig. 3-2) - OFF.

3-9. VOICE ORDER WIRE (AN/ARC-194).

A radio set identical in type and performance to the UHF command set (fig. 3-3) is located in the pedestal, to serve as voice order wire. This set provides the pilot and copilot with secure 2-way voice communications. Complete provisions only are provided for a KY-58 voice security device. The voice order wire set is protected by a 7 1/2 ampere VOW circuit breaker on the overhead circuit breaker panel (fig. 2-26). The voice order wire shares an antenna mounted on the aircraft belly with the transponder (lower antenna, fig 2-1).

3-10. VHF-AM COMMUNICATIONS (VHF-206).

a. Description. VHF-AM communications provide transmission and reception of amplitude modulated signals in the very high frequency range of 116.000 to 151.975 MHz for a range of approximately 50 miles, varying with altitude. A dual head control panel (fig. 3-4) is mounted on the pedestal extension, accessible to both the pilot and copilot. The panel. provides two sets of control indicators, frequency indicators, frequency select knobs, a single volume control, and a single selector switch for quick frequency changing. Transmission audio is routed by pilot and copilot No.1 transmitter selector switches located on the audio control panel (fig. 3-1). Received audio is routed by pilot and copilot No. 1 receiver audio switches (fig. 3-1), to the respective headsets. The VHF radio is protected by a 10-ampere VHF circuit breaker on the overhead circuit breaker panel (fig. 2-26). The associated antenna is shown in figure 2-1.

b. Controls/Indicators and Functions.

(1.) Frequency indicator. Indicates set operating frequency.

(2.) Control frequency indicators. Indicates frequency selected (left or right active).

(3.) COMM TEST switch. Overrides automatic squelch circuit.

(4.) Frequency selectors. Select desired set operating frequency.

(5.) TRANS switch. Selects right or left frequency control selectors.

(6.) VOL-OFF control. Adjusts volume of received audio, turns set ON or OFF.

c. VHF-AM Set - Normal Operation.

(1.) Turn-on procedure: Volume control - Turn clockwise (ON).

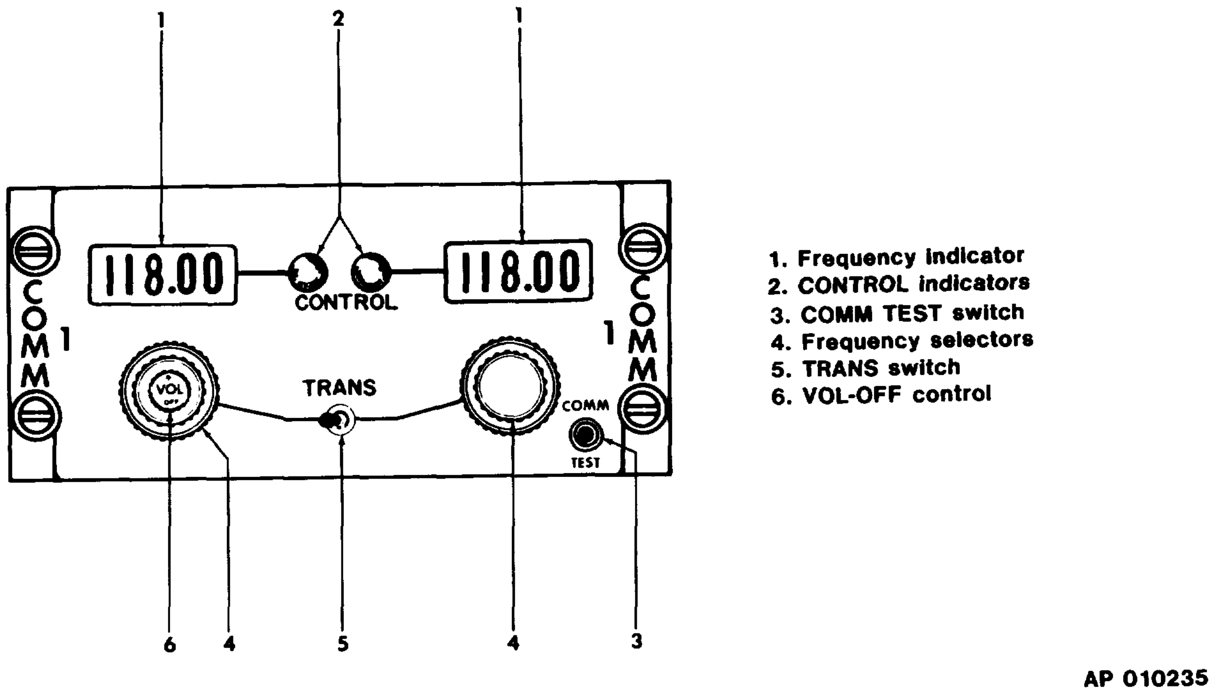


Figure 3-4. VHF-AM Control Panel (VHF-20B)

(2.) Receiver operating procedure:

1. Transmitter-interphone selector switch (audio control panel, fig. 3-1) - No.1 position, or radio monitor control No.1 -ON.
2. Frequency selector - Set desired frequency.
3. Volume control - As required.

(3.) Transmitter operating procedure:

1. Transmitter-inter-phone selector switch (audio control panel, fig. 3-1) - No.1 position.
2. Microphone switch - Press.

(4.) Shutdown procedure: Volume control - Turn counterclockwise (OFF).

d. VHF-AM Set Emergency Operation.

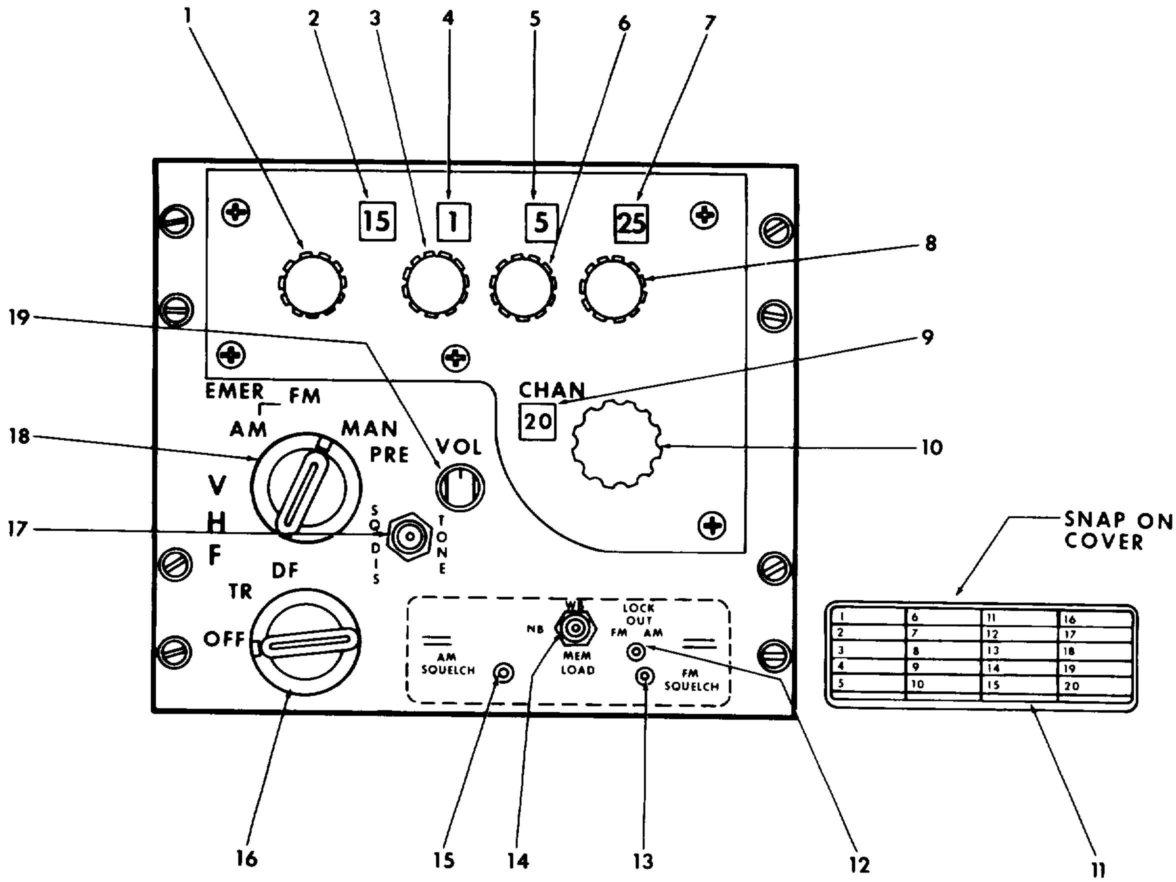
NOTE

Transmission on emergency frequency (121.500 MHz) is restricted to emergencies only. Emergency frequency 243.000 MHz (guard channel) is also available on the UHF command radio.

1. Transmitter-interphone selector switch (audio control panel, fig. 3-1) - No. 1 position.
2. Frequency selector (VHF control panel, fig. 3-4) -121.500 MHz (emergency frequency).
3. Microphone switch - Press.

3-11. VHF AM-FM COMMAND SET (AN/ARC-199).

a. Description. The VHF AM-FM Command Set provides for normal and secure 2-way AM voice communication in the very high frequency range of 116.000 to 151.975 MHz and FM voice communication in the 30.000 to 87.975 MHz band. Twenty channels may be preset. Audio signals are applied through the No.2 position of the transmitter-interphone selector switches and through the No.2 receiver audio switches on the pilot's and copilot's audio control panels (fig. 3-1). Complete provisions only are installed for a TSEC/KY-28 voice security device. Circuits are protected by a lo-ampere VHF AM-FM circuit breaker on the overhead circuit breaker panel (fig. 2-26). Figure 3-5 illustrates the VHF AM-FM control panel. The associated antenna is shown in figure 2-1.



1. 10 MHZ selector
2. 10 MHZ indicator
3. 1.0 MHZ selector
4. 1.0 MHZ indicator
5. 0.1 MHZ indicator
6. 0.1 MHZ selector
7. 0.025 MHZ indicator
8. 0.025 MHZ selector
9. Preset CHAN indicator
10. Preset CHAN selector
11. Preset frequencies list
12. LOCKOUT FM/AM switch
13. FM SQUELCH control
14. WB/NB MEM LOAD switch
15. AM SQUELCH control
16. Mode select switch
17. SQ DIS/TONE select switch
18. Frequency control emergency select switch
19. VOL control

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Figure 3-5. VHF AM-FM Control Panel (AN/ARC-186) *b. Controls/Indicators and Functions.*

(1.) 10 MHz selector. Selects receiver-transmitter frequency in increments of 10 MHz from 30 to 150 MHz. Clockwise rotation increases frequency.

(2.) 10 MHz indicator. Indicates manually selected receiver-transmitter frequency in 10 MHz increments from 30 to 150 MHz.

(3.) 1.0 MHz selector. Selects receiver-transmitter frequency in 1.0 MHz increments. Clockwise rotation increases frequency.

(4.) I.0 MHz indicator. Indicates manually selected receiver-transmitter frequency in 1.0 MHz increments.

(5.) 0.1 MHz indicator. Indicates manually selected receiver-transmitter frequency in 0.1 MHz increments.

(6.) 0.1 MHz selector. Selects receiver-transmitter frequency in 0.1 MHz increments. Clockwise rotation increases frequency.

(7.) 0.025 MHz indicator. Indicates manually selected receiver-transmitter frequency in 0.025 MHz increments,

(8.) 0.025 MHz selector. Selects receiver-transmitter frequency in 0.025 MHz increments. Clockwise rotation increases frequency.

(9.) Preset CHAN indicator. Indicates selected preset channel.

(10.) Preset CHAN selector. Selects preset channel from 1 to 20. Clockwise rotation increases number selected.

(11.) Preset channels freq. list. Writing area to keep track of preset channels,

(12.) LOCKOUT FM-AM switch. Screwdriver adjustable three-position switch. Warning tone announces lockout.

(a.) Center. Selects AM or FM band.

(b.) AM. Shuts off AM band.

(c.) FM. Shuts off FM band.

(13.) FM SQUELCH control. Screwdriver adjustable potentiometer. Squelch fully overdriven at full counterclockwise position. Clockwise rotation increases input signal required to open squelch.

(14.) WB-NB-MEM LOAD switch. Three-position switch.

(a.) NB. Limits selectivity to narrow-band intermediate frequency.

(b.) WB. Limits selectivity to wide-band intermediate frequency of FM band.

(c.) MEM LOAD. Momentary switch. If pressed, loads manually selected frequency in preset channel memory.

(15.) AM SQUELCH control. Screwdriver adjustable potentiometer. Squelch fully overridden at full counterclockwise position. Clockwise rotation increases input signal required to open squelch.

(16.) Mode selector switch. Three-position rotary switch.

(a.) OFF. Shuts off receiver-transmitter.

(b.) TR. Selects transmit/receive modes.

(c.) DF. Not operational.

(I 7.) SQ-DIS-TONE select switch. Three-position switch.

(a.) Center. Selects squelch function.

(b.) SQ-DIS. Shuts off squelch function.

(c.) TONE. Transmits tone of approximately 1000 Hz.

(18.) Frequency control/emergency select switch. Three-position switch.

(a.) PRE. Enables preset channel selection.

(b.) MAN. Enables manual frequency selection.

(c.) EMER-AM-FM. Selects a pre-stored guard channel.

(19.) VOL control. Clockwise rotation increases volume.

c. Normal Operation.

(1.) Turn-on procedure: Mode selector switch (VHF AM-FM control panel, fig. 3-5) -TR.

(2.) Receiver operating procedure:

1. Frequency control emergency selector switch (fig. 3-5) -MAN or PRE, as desired.
2. Transmitter-interphone selector switch (audio control panel, fig.

3-1) - No.2 position, or radio monitor control No.2 -ON.

3. Manual frequency/preset channel selectors - Set desired frequency.

4. Volume control - As required.

(3.) Transmitter operating procedure:

1. Transmitter-interphone selector switch (audio control panel, fig. 3-1) - No.2 position.

2. Microphone switch - Press.

(4.) Shutdown procedure: Mode selector switch (fig. 3-5) - OFF.

d. VHF AM-FM Emergency Operation:

(1.) Emergency AM Mode:

1. Transmitter-interphone selector switch (audio control panel, fig. 3-1) - No.2 position.

2. Mode selector switch - TR.

3. Frequency control/emergency selector switch - EMER AM.

NOTE

Selecting EMER AM or FM automatically disables secure speech function and enables normal voice communication.

4. Microphone switch - Press.

(2.) Emergency FM Mode:

1. Transmitter-interphone selector switch (audio control panel, fig. 3-1) - No.2 position.

2. Mode selector switch - TR.

3. Frequency control/emergency selector switch - EMER FM.

4. Microphone switch - Press.

(3.) Shutdown Procedure: Shutdown mode select switch - OFF.

3-12. VOICE SECURITY SYSTEM TSEC/KY-28 (PROVISIONS ONLY)

NOTE

Voice security system TSEC/KY-58 may be installed in lieu of voice security system TSEC/KY-28. Complete provisions are provided to install either the KY-28 or the KY-58 voice security system on the LH fwd avionics rack behind the pilot (fig. 2-2).

a. Description. The KY-28 voice security system provides secure (ciphered) two-way voice communications for the pilot and copilot in conjunction with the UHF and VHF/AM/FM command sets, and the backup VOW set. System circuits are protected by the VHF, VHF/AM/FM, RADIO RELAY, and BU VOW circuit breakers on the overhead circuit breaker panel (fig. 2-26). Figure 3-6 illustrates the KY-28 voice security (CIPHONY) control indicator.

b. Controls/Indicators and Functions. Voice security control/indicator (LH fwd avionics rack behind the pilot) (fig. 2-2).

(1.) POWER ON switch. Turns set on or Off.

NOTE

The POWER ON switch must be in ON position for FM liaison or secure mission operations in either the plain or cipher mode.

(2.) POWER ON indicator. Illuminates when POWER ON switch is placed in ON (up) position.

(3.) PLAIN indicator. Illuminates when PLAIN/CIPHER switch is in PLAIN position.

(4.) PLAIN/CIPHER switch.

(a.) PLAIN. Enables unciphered communications on FM liaison set.

(b.) CIPHER. Enables ciphered communications on FM liaison set.

(5.) RE-X/REG switch.

(a.) RE-X. Enables re-transmission of ciphered communications at a distant location.

(b.) REG. Enables normal cipher or plain communications.

(6.) ZEROIZE switch. Normally OFF. Place in ON position during emergency situations to neutralize and make inoperative the associated cipher equipment.

(7.) CIPHER indicator. Illuminates when PLAIN/CIPHER switch is in CIPHER position.

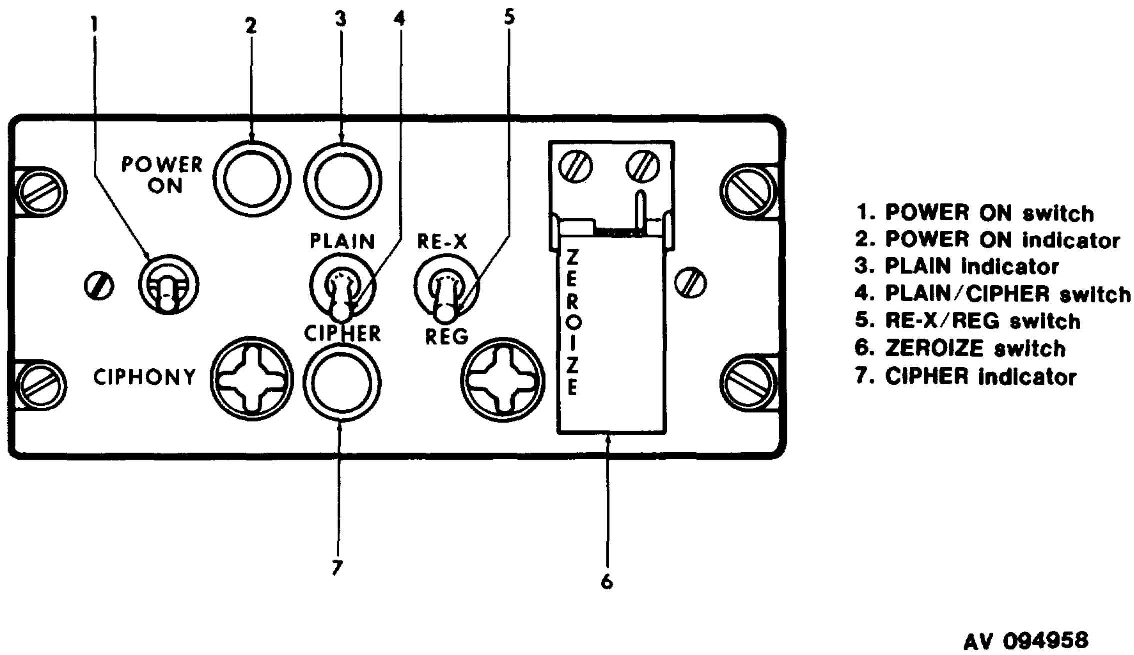


Figure 3-6. Voice Security Control Indicator (C-8157/ARC)

c. VHF/AM/FM Set and Voice Security Operation.

(1.) Turn-on procedure: POWER ON switch (Voice security panel, fig. 3-6) - ON.

NOTE

The POWER ON switch must be in ON position, regardless of the mode of the operation, whenever the voice security (CIPHONY) KY-28 is installed in the aircraft.

(2.) Receive operating procedure:

1. SQUELCH control (VHF/AM/FM panel) - As required.
2. Transmitter-interphone selector (audio panel, fig. 3-1) -#2 position. or Audio monitor control #2 - ON.
3. Mode selector (VHF/AM/FM panel) - TR.
4. Frequency selectors (VHF/AM/FM panel) - As required.
5. PLAIN/CIPHER switch (voice security panel) - As required.

(3.) Transmit operating procedure (PLAIN):

1. Transmit/interphone selector (audio panel) - No. 2 position.
2. PLAIN/CIPHER switch (Voice security panel) - PLAIN.
3. Microphone switch - Press.

(4.) Transmit operating procedure (CIPHER):

1. Transmit/inter-phone selector (audio panel) - No. 2 position.
2. PLAIN/CIPHER switch (Voice security panel) - CIPHER. Indicator will be on while switch is in CIPHER position.)
3. RE-X/REG switch (Voice security panel) - As required. (Set RE-X position only if distant station is using re-transmitting equipment.)
4. Microphone switch - Press momentarily (interrupted tone

from voice security unit should no longer be heard).

NOTE

No traffic will be passed if the interrupted tone is still heard after pressing and releasing the microphone switch.

5. Microphone switch- Press (do not talk). Wait until beep is heard, then speak into microphone.

(5.) Shutdown procedure:

1. Mode selector (VHF/AM/FM panel) - OFF.
2. POWER ON switch (Voice security panel) - OFF.

3-13. VOICE SECURITY SYSTEM TSEC/KY-58 (PROVISIONS ONLY).

a. Description. The TSEC/KY-58 voice security system provides secure (ciphered) two-way voice communications for the pilot and copilot in conjunction with the UHF and VHF AM-FM command sets, and the voice order wire set. The control indicator is located in the forward avionics rack behind the pilot. System circuits are protected by the VHF, VHF AM-FM and BU VOW circuit breakers on the overhead circuit breaker panel (fig. 2-26).

b. Controls/Indicators and Functions.

(1.) POWER ON switch. Turns set on or off.

NOTE

The power switch must be in ON position for FM or secure mission operations in either the plain or cipher mode.

(2.) POWER ON indicator. Illuminates when POWER ON switch is placed in ON (up) position.

(3.) PLAIN indicator. Illuminates when PLAIN-CIPHER switch is in PLAIN position.

(4.) PLAIN-CIPHER. Selects unciphered or ciphered communications on FM set.

(a.) PLAIN. Enables unciphered communications on FM set.

(b.) CIPHER. Enables ciphered communications on FM set.

(5.) RE-X-REG. Two-position switch.

(a.) RE-X. Enables re-transmission of ciphered communications at a distant location.

(b.) REG. Enables normal cipher or plain communications.

(6.) ZEROIZE switch. Normally OFF. Place in ON position during emergency situations to neutralize and make inoperative the associated cipher equipment.

(7.) CIPHER indicator. Illuminates when PLAIN-CIPHER switch is in CIPHER position.

c. VHF AM-FM Set and Voice Security Operation.

(1.) Turn-on procedure: Power switch (voice security panel, fig. 3-6) - ON.

NOTE

The power switch must be in ON position, regardless of the mode of the operation, whenever the voice security (CIPHONY) KY-58 is installed in the aircraft.

(2.) Receive operating procedure:

1. Squelch control (VHF AM-FM panel, fig. 3-5) - As required.
2. Transmitter-interphone selector switch (audio control panel, fig. 3-1) - No.2 position, or radio monitor control No.2 -ON.
3. Mode selector switch (VHF AM-FM control panel, fig. 3-5) - TR.
4. Frequency selectors (VHF AM-FM control panel) - As required.
5. Plain-cipher switch (voice security control panel) - As required.

(3.) Transmitter operating procedure (PLAIN):

1. Transmitter-interphone selector switch (audio control panel, fig. 3-1) - No.2 position.
2. Plain-cipher switch (Voice security control panel) -PLAIN.
3. Microphone switch - Press.

(4.) Transmitter operating procedure (CIPHER):

1. Transmitter-interphone selector (audio control panel, fig. 3-1) - No.2 position.
2. Plain-cipher switch (voice security panel) - CIPHER. (Indicator will be illuminated while switch is in CIPHER position.)
3. RE-X-REG switch (voice security panel) - As required. (Set RE-X position only if distant station is using re-transmitting equipment.)
4. Microphone switch - Press momentarily (interrupted tone from voice security unit should no longer be heard.)

NOTE

No traffic will be passed if the interrupted tone is still heard after pressing and releasing the microphone switch.

5. Microphone switch - Press (do not talk). Wait until beep is heard, then speak into microphone.

(5.) Shutdown procedure:

1. Mode selector switch (VHF AM-FM panel) - OFF.
2. Power switch (voice security panel) - OFF.

3-14. HF COMMUNICATION SET (KHF-950).

a. Description. The HF command set (fig. 3-7) provides long-range voice communications within the frequency range of 2.0 to 29.99 MHz and employs either standard amplitude modulation (AM), lower sideband (LSB), or upper sideband (USB) modulation. The distance range of the set is approximately 2,500 miles and varies with atmospheric conditions. With the capability to preset and store 99 frequencies for selection during flight, the system also allows for selection of other frequencies manually (direct tuning), or reprogramming of any preset frequency. The system will automatically match the antenna by keying the microphone. Power to the system is routed through a 25 ampere circuit breaker placarded HF PWR. The receiving portion of the system is protected by a 5 ampere circuit breaker placarded HF REC. Both circuit breakers are located on the overhead circuit breaker panel.

The HF system has two methods of frequency selection. The first method is called direct tuning (frequency agile). The second is a channelized operation in which desired operating frequencies are preset, stored and referenced to a channel number.

b. Controls/Indicators and Functions (HF Control Panel, jig. 3-7.

(1.) FREQ display. Displays frequency selected.

(2.) MODE display. Displays selected LSB, AM, or USB mode.

(3.) CHANNEL display. Displays channel selected.

(4.) Light sensor. The light sensor is a photocell which adjust brigntness of the display.

(5.) MODE switch. The mode switch is a momentary pushbutton switch that selects LSB, AM or USB.

(6.) FREQ/CHAN switch. Transfers the HF system from a direct frequency operation to a channelized form of operation.

(7.) PGM (Program) recessed switch. Enables channelized data to be modified. The PGM message will be displayed whenever this switch is depressed.

NOTE

The program mode must be used for setting or changing any of the 99 preset frequencies. Each of the 99 channels may be preset to receive and transmit on separate frequencies (semi-duplex), receive only, or transmit and receive on the same frequency (simplex). The operating mode (LSB,USB or AM) must be the same for both receive and transmit and can also be preset.

(8.) Frequency/channel selector. This selector consists of two concentric knobs that control the channel and frequency digits, plus the lateral position of the cursor.

(a.) Frequency control. The outer knob becomes a cursor (flashing digit) control with the FREQ/CHAN switch in the FREQ position. The flashing digit is then increased/decreased with the inner knob.

(b.) Channel control. The outer knob is not functional when the FREQ/CHAN switch is in the CHAN position. The inner knob will provide

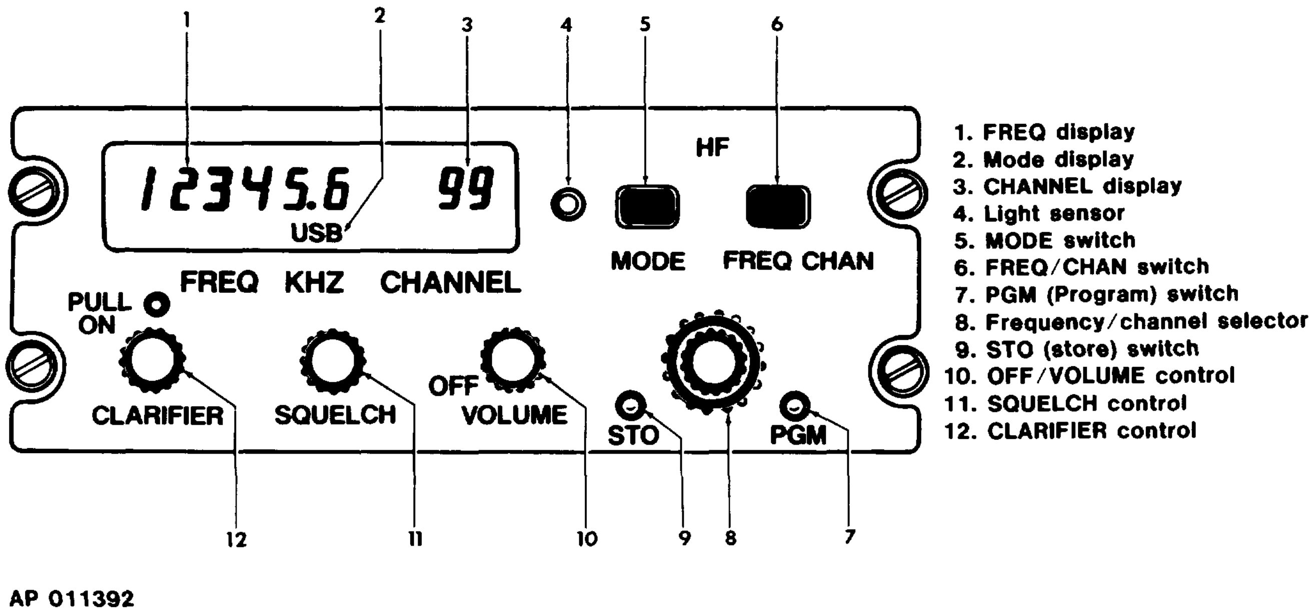


Figure 3-7. HF Control Panel (KCU-951)

channel control from 1 through 99, displayed at the right end of the display window.

(9.) STO (Store) recessed switch. Stores displayed data when programming preset channels.

(10.) OFF- VOLUME control. Applies power to the unit and controls the audio output level.

(11.) SQUELCH control. Provides variable squelch threshold control.

(12.) CLARIFIER control. Provides 250 Hz of local oscillator adjustment.

c. Normal Operation.

(1.) Turn on procedure:

NOTE

It is presumed aircraft power is on and normally used avionic circuit breakers remain depressed.

NOTE

Aircraft can be configured for either HF or VOW on position 4 of Audio control panel (fig. 3-1).

1. AVIONIC MASTER POWER switch - ON.
2. OFF-VOLUME switch - Turn clockwise out of OFF position. Adjust volume as desired.

(2.) Frequency operation (Simplex only): OFF-VOLUME Switch - Turn clockwise out of OFF position. Adjust volume as desired.

NOTE

ch digit of the frequency may be selected instead of dialing up or down to a frequency. The larger concentric knob is used to select the digit to be changed. This digit will flash when selected. Rotation of the knob moves the flashing cursor in the direction of rotation. After the digit to be changed is flashing, the smaller concentric knob is used to select the numeral desired. This process is repeated until the new frequency has been selected. The flashing cursor may then be stowed by moving it to the extreme left or right of the display and then one more click. This stows the cursor behind the display until needed again. The cursor may be recalled by turning the concentric knob one click left or right.

(3.) Direct frequency tuning (Simplex only).

1. FREQ/CHAN button out (FREQ).
2. Select desired mode (USB,LSB,or AM).
3. Select digit to be changed (outer knob), digit (cursor) will flash.
4. Select numerical value of digit (inner knob).
5. Stow cursor (or repeat procedure for additional changes).
6. Tune antenna coupler (press microphone button).

(4.) Channel Programming.

NOTE

There are three ways to set up a channel: Receive only, simplex, and semi-duplex. To gain access to channelized operation, depress FREQ/CHAN button. To utilize the existing programmed channels (i.e. no programming required) use the small control knob to select the desired channel number. Then momentarily key the microphone to tune the antenna coupler. If channel programming is required, it is necessary to activate the program mode as follows. With the FREQ/CHAN button in (CHAN), use a pencil or other pointed object to push the PGM button in. The button is an alternate action switch: push-on, push-off. The letters PGM will appear in the lower part of the display window and the system will remain in the program mode until the PGM button is pressed again.

(5.) Receiver operating procedure:

1. Stow the cursor if a frequency digit is flashing.
2. Select the channel to be preset.
3. Set the desired operating mode (LSB,USB,or AM).
4. Set the desired frequency. (Refer to frequency tuning)
5. Push and release STO button once.

NOTE

"T" will flash in the display window, however a receive only frequency is being set. The flashing "T" should be ignored.

NOTE

If another channel is to be set, the cursor must be stowed before a new channel can be selected. Use the smaller concentric knob to select the channel and repeat the steps for selecting a new frequency.

6. To return to an operating mode, push the PGM button.

(a.) Simplex operation: Setting a channel up for simplex operation (receive and transmit on the same frequency).

1. FREQ/CHAN button in (cursor stowed).
2. PGM button in (PGM displayed).
3. Select channel to be preset.
4. Set mode (LSB,USB or AM).
5. Set desired frequency. (Refer to frequency tuning)
6. Push and release STO button twice.

The first press of the STO button stores the frequency in the receive position and the second press stores the same frequency in the transmit position. The second push also stores the cursor.

If another channel is to be reset, use the smaller concentric knob to select the channel and repeat the steps for selecting a new frequency. The cursor was automatically stowed. To return to one of the operating modes, push the PGM button again.

(b.) Semi-duplex operation: Setting a channel for semi-duplex (transmit on one frequency and receive on another).

1. Select channel to be preset.
2. Set desired frequency. (Refer to frequency selection)
3. Set mode (LSB,USB, or AM).
4. Push STO button once.
5. Set transmit frequency.
6. Push STO button again.

If another channel is to be reset, use the smaller concentric knob to select the channel and repeat the steps.

7. To return to an operating mode, push the PGM button.

NOTE

The mode for each channel (LSB, USB or AM) is stored along with the frequency. If the mode is changed, the system will receive and transmit in the mode selected for transmit.

d. Shutdown. Off/Volume switch - OFF.

e. HF Command Set - Emergency operation. Not applicable.

3-15. EMERGENCY LOCATOR TRANSMITTER (ELT).

a. Description. An emergency locator transmitter is provided to assist in locating an aircraft and crew in the event an emergency landing is necessitated. The output frequency is 121.5 and 243 MHz simultaneously. Range is approximately line-of-sight. The transmitter unit has separate function control switches located on one end of the case. In the event the impact switch has been inadvertently actuated, the beacon can be reset by firmly pressing the pushbutton RESET switch on the front of the case. The RESET switch and a 3-position toggle switch, placarded ARM, OFF and ON, also on the transmitter case, may be actuated by inserting one finger through a small, round, spring-loaded door on the left side of the aft fuselage (fig. 3-8). The transmitter unit is accessible through a service panel located on the bottom of the aft fuselage.

b. Controls and Functions.

(1.) RESET switch. When pressed, resets transmitter.

(2.) Function switch. Selects operating mode of set.

(a.) ARM. Arms set to be actuated by impact switch (normal mode).

(b.) OFF. Turns set off.

(c.) ON. Manually activates transmitter for test or emergency purposes.

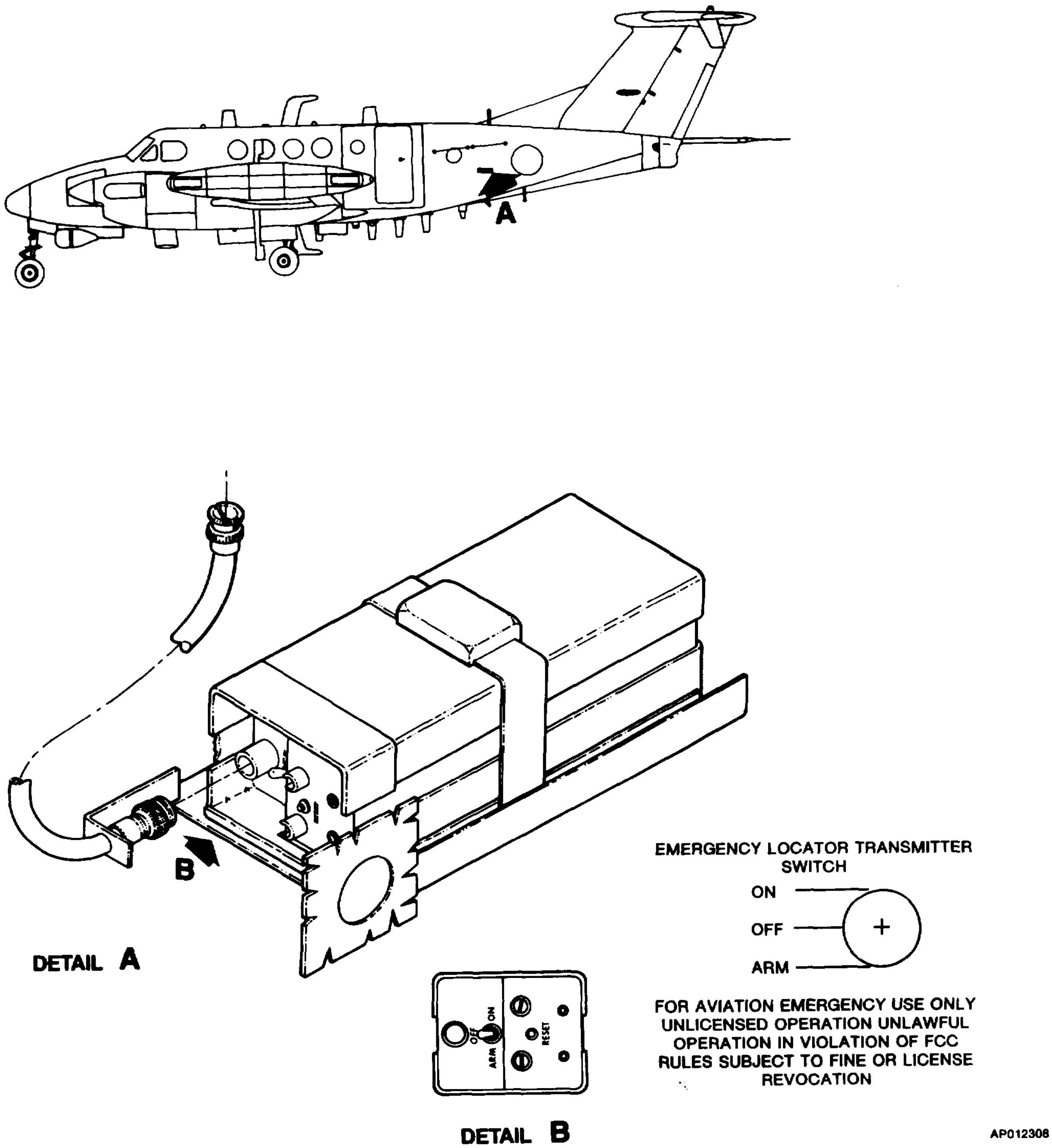


Figure 3-8. Emergency Locator Transmitter (Narco 03716-0300)

Section III. NAVIGATION

3-16. DESCRIPTION.

The navigation equipment group provides the pilot and copilot with instrumentation required to establish and maintain an accurate flight course and position, and to make an approach on instruments under Instrument Meteorological Conditions (IMC). The navigation configuration includes equipment for determining attitude, position, destination range and bearing, heading reference and groundspeed.

3-17. RADIO MAGNETIC INDICATORS (RMI).

a. Description. The pilot and copilot are each provided with identical radio magnetic indicators (RMI) (fig. 3-9) located on the instrument panel (fig. 2-29). Each unit serves as a navigational aid for the respective user and, by means of individual source select switches, will display aircraft magnetic or directional gyro heading and VOR, TACAN, INS or ADF bearing information. The pilot's RMI is protected by the 1-ampere No.1 RMI circuit breaker on the overhead circuit breaker panel (fig. 2-26) and the 3.0-ampere F13 fuse on the No.1 junction box. The copilot's RMI is protected by the 1-ampere No.2 RMI circuit breaker on the overhead circuit breaker panel and the 3.0-ampere F9 fuse on the No.1 junction box.

b. Controls and Functions.

(1.) Pilot's COMPASS No. 1 - No.2 switch. Selects desired source of magnetic heading information for display on pilot's HSI and copilot's RMI.

(a.) No.1. Selects compass system No.1 for display control.

(b.) No.2. Selects compass system No.2 for display control.

(2.) Copilot's COMPASS No. l-No.2 switch. Selects desired source of magnetic heading information for display on copilot's HSI and pilot's RMI.

(a.) No.1. Selects compass system No.1 for display.

(b.) No.2. Selects compass system No.2 for display.

(3.) RMI select switch. Selects which of two signals will be displayed on respective RMI sin-

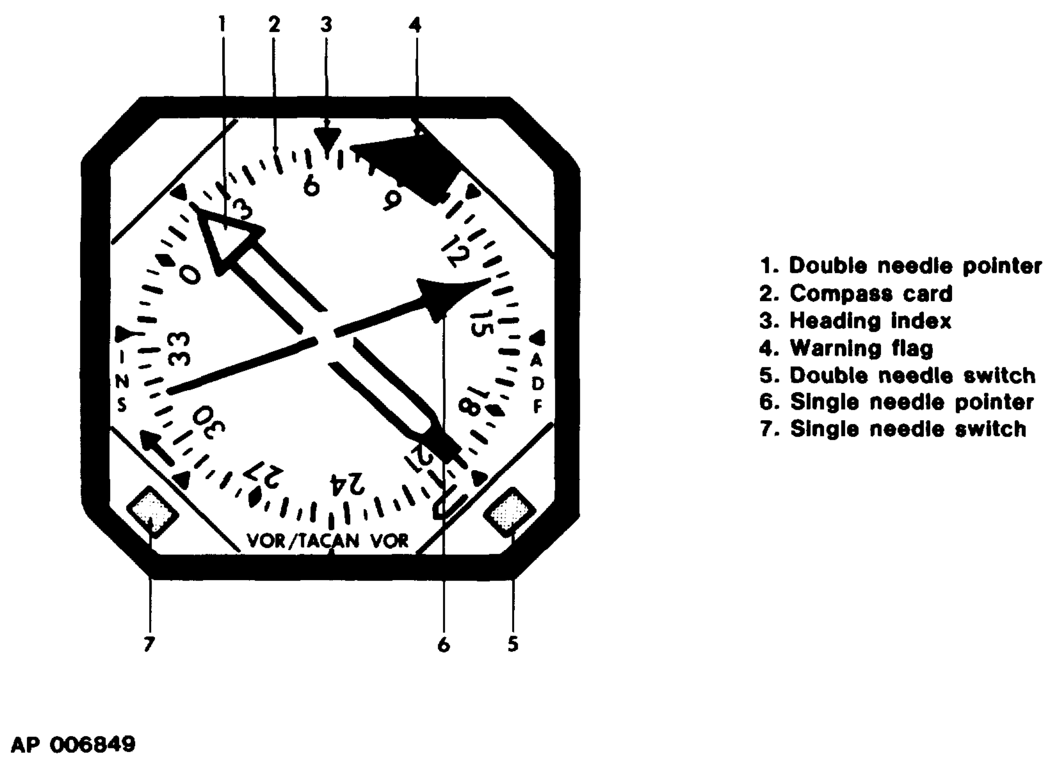


Figure 3-9. Radio Magnetic Indicator (RMI) (332C-10)

gle- needle pointer, if single-needle switch is in the VOR-TACAN position.

(a.) VOR 1. Selects VOR 1 bearing signals for display.

(b.) TACAN. Selects TACAN bearing signal for display.

c. Indicators and Functions (RMI, fig. 3-9).

(1.) Double needle pointer. Indicates bearing selected by double needle switch.

(2.) Compass card. Indicates aircraft heading at top of dial.

(3.) Heading index. Reference point for aircraft heading.

(4.) Warning flag. Indicates loss of compass signal.

(5.) Double needle switch. Selects desired signal to be displayed by double needle pointer.

(a.) ADF. Selects ADF bearing information.

(b.) VOR. Selects VOR 2 bearing information.

(6.) Single needle pointer. Indicates bearing selected by single needle switch.

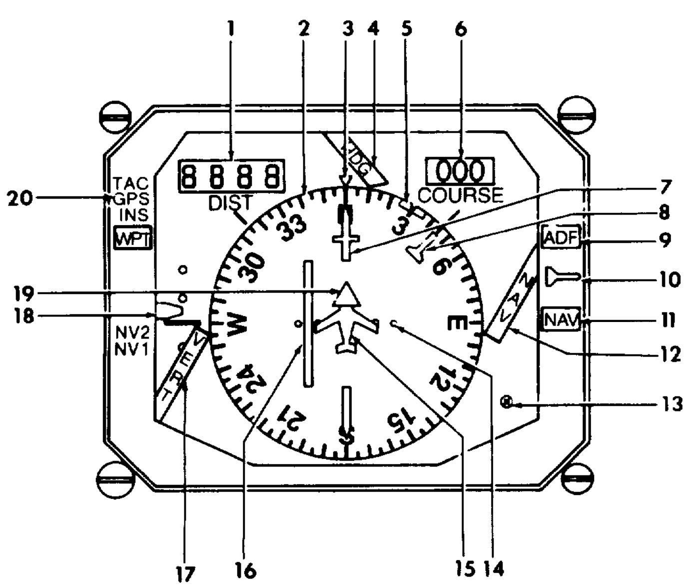
(7.) Single needle switch. Selects desired signal to be displayed on single needle pointer.

(a.) INS. Selects INS bearing information.

(b.) VOR-TACAN. Selects signal as determined by RMI select switch on instrument panel, either VOR 1 or TACAN.

3-18. HORIZONTAL SITUATION INDICATORS.

a. Description. The pilot and copilot have separate HSI instruments on respective instrument panel sections (fig. 3-10 and 3-11). Each HSI combines displays to provide a map-like presentation of the aircraft position with respect to magnetic heading. Each indicator displays aircraft heading, course deviation, and glideslope data. The pilot's HSI allows the desired course and heading to be input to the autopilot. Course deviation data is supplied to the HSI by the VOR 1 or VOR 2 systems, the TACAN, or the INS. Glideslope data is supplied by the VOR 1 or VOR 2 systems. The HSI displays warning flags when the VOR, TACAN, INS or glideslope signals are lost or become unreliable.



1. Distance display
2. Rotating heading dial
3. Lubber line
4. Heading flag
5. Heading bug
6. COURSE display
7. Course pointer
8. Bearing pointer.
9. ADF annunciator
10. Bearing pointer source switch
11. NAV annunciator
12. NAV flag
13. Compass synchronization annunciator
14. Course deviation dots
15. Aircraft symbol
16. Course deviation bar
17. VERT flag
18. Glideslope pointer/scale
19. To/from pointer
20. Navigation source annunciators

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Figure 3-10. Pilot's Horizontal Situation Indicator (RD-650B) *b. Controls/Indicators and Functions (Pilot's HSI, fig. 3-10).*

(1.) Distance display. Provides digital displays of DME/TACAN or INS waypoint distance. TACAN distance is displayed in 1/10 mile increments. INS distance to waypoint is displayed in whole mile increments. The display will show dashes when the distance input data is invalid or absent.

(2.) Rotating heading (azimuth) dial. Displays gyro stabilized magnetic compass information on a dial which rotates with the aircraft throughout 360 degrees. The azimuth ring is graduated in 5 degree increments.

(3.) Lubber line. Fixed heading marks located at the fore (upper) and aft (lower) position.

(4.) HDG flag. Indicates loss of reliable heading information.

(5.) Heading bug. The notched orange heading bug is positioned on the rotating heading dial by the heading knob, to select and display a preselected compass heading. Once set to the desired heading, the heading bug maintains its position on the heading dial. The difference between the bug and the fore (upper) lubber line index is the amount of heading select error applied to the flight director computer. In the heading mode the ADI will display the proper bank commands to turn to and maintain this selected heading.

(6.) Course display. Provides a digital readout of selected magnetic course.

(7.) Course pointer. The yellow course pointer is positioned on the heading dial by the remote course knob, to a magnetic bearing that coincides with the selected course being flown. The course pointer rotates with the heading dial to provide a continuous readout of course error to the computer.

(8.) Bearing pointer. Indicates ADF or NAV relative bearing as selected by the bearing pointer source switch.

(9.) ADF annunciator. When illuminated, indicates ADF bearing information is being displayed.

(10.) Bearing pointer source switch. The bearing pointer source switch, located on the pilot's HSI, provides for selecting between ADF or NAV bearing information as presented by the bearing pointer. Each push of the select switch alternates selection of ADF or NAV. Upon power-up or following long-term power interruption, NAV is displayed.

(1 I.) NAV annunciator. When illuminated, indicates NAV bearing information is being displayed.

(12.) NAV flag. Indicates loss of VOR, TACAN or INS information, or unreliable navigation signal.

(13.) Compass synchronization annunciator. The compass synchronization annunciator consists of a dot and X symbol display. When the compass system is in the slaved mode, the display will oscillate between the dot and X symbol, indicating the heading dial is synchronized with a gyro stabilized magnetic heading.

(14.) Course deviation dots. In VOR or TACAN operation, each dot represents 5 degree deviation from the centerline (± 10 degrees). In ILS operation, each dot represents 1 degree deviation from the centerline. In INS operation, each dot represents 3.75 nautical miles deviation from centerline.

(15.) Aircraft symbol. The fixed miniature aircraft symbol corresponds to the longitudinal axis of the aircraft and lubber line markings. The symbol shows aircraft position and heading with respect to a radial course and the rotating heading (azimuth) dial.

(16.) Course deviation bar. The course deviation bar represents the centerline of the selected VOR, TACAN, INS or localizer course. The miniature aircraft symbol pictorially shows actual aircraft position in relation to this selected course.

(I *7.) VERT flag.* Covers glide slope pointer when not receiving glide slope information.

(18.) Glide slope pointer/scale. The glide slope pointer displays glide slope deviation. The pointer is in view only when tuned to a localizer frequency. If the aircraft is below glide slope path, the pointer is displayed upward on the scale. Each dot on the scale represents approximately 0.4 degree displacement.

(19.) To-from pointer. The to-from pointers aligned on the course pointer, are located 180 degrees apart. One always points in the direction of the station, along the selected VOR radial or towards the INS waypoint.

(20.) Navigation source annunciators. Five different annunciators display navigation data sources. They are: TAC for TACAN, GPS (not used), INS, NV2 for VOR 2, NV1 for VOR 1. WPT indicates arrival at INS waypoint.

(21.) Course knob (located on the pedestal). Positions the course pointer.

(22.) Heading knob (located on the pedestal). Positions the heading bug to a preselected heading.

(23.) Pilot's COURSE INDICATOR selector switch (fig. 2-29). Selects desired source of data for display on pilot's HSI and input to autopilot flight computer.

(a.) VOR 1. Selects data from VOR 1 system.

(b.) VOR 2. Selects data from VOR 2 system.

(c.) TACAN. Selects data from TACAN system.

(d.) INS. Selects data from INS.

c. Controls/Indicators and Functions (Copilot's HSI. fig 3-11).

NOTE

If both the pilot and copilot COURSE INDICATOR select switches are in the same position, except INS, the pilot has sole control of course select functions. The copilot can only monitor deviation displays from the selected system. A PILOT SELECT annunciator will illuminate to notify the copilot that both pilots have selected the same receiver.

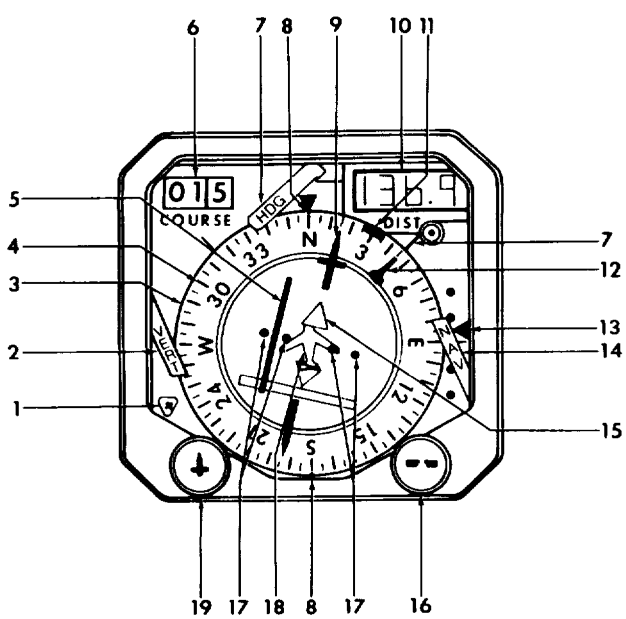
(I.) Compass synchronization annunciator. The compass synchronization annunciator consists of a dot and X symbol display. When the compass system is in the slaved mode, the display will oscillate between the dot and X symbol, indicating the heading dial is synchronized with a gyro stabilized magnetic heading.

(2.) VERT flag. Indicates that the information displayed by the glideslope pointer is invalid and should not be used.

(3.) Rotating heading (azimuth) dial. Displays gyro stabilized magnetic compass information on a dial which rotates with the aircraft throughout 360 degrees. The azimuth ring is graduated in 5 degree increments.

(4.) Azimuth marks. Fixed azimuth marks are at 45° bearings throughout 360 degrees of the compass card for quick reference.

(5.) Course deviation bar. The course deviation bar represents the centerline of the selected VOR, TACAN, INS or localizer course. The miniature aircraft symbol pictorially shows actual aircraft position in relation to this selected course.



1. Compass synchronization annunciator
2. VERT flag
3. Rotating heading dial
4. Azimuth marks
5. Course deviation bar
6. Digital COURSE counter
7. HDG flag
8. Lubber line marks
9. Course pointer
10. Digital DIST display
11. Heading bug
12. Bearing pointer
13. Glideslope pointer/scale
14. NAV flag
15. To-from pointers
16. Heading knob
17. Course deviation dots
18. Aircraft symbol
19. Course knob

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Figure 3-11. Copilot's Horizontal Situation Indicator (RD-550)

(6.) Digital COURSE counter. Provides a digital readout of selected magnetic course.

(7.) HDG flag. Indicates loss of reliable heading information.

(8.) Lubber line marks. Fixed heading marks located at the fore (upper) and aft (lower) position.

(9.) Course pointer. The yellow course pointer is positioned on the heading dial by the course knob to select a magnetic bearing that coincides with the desired VOR or TACAN radial or INS or localizer course. The course pointer rotates with the heading dial to provide a continuous readout of course error to the computer.

(10.) DIST display. Provides digital display of station distance.

(Il.) Heading bug. The notched orange heading bug is positioned on the rotating heading dial by the heading knob, and displays preselected compass heading. The bug rotates with the heading dial.

(12.) Bearing pointer. The bearing pointer provides magnetic bearing to a selected TACAN or VOR station or INS waypoint.

(13.) Glideslope pointer/scale. The glide slope pointer displays glide slope deviation. The pointer is in view only when tuned to a localizer frequency. If the aircraft is below glide slope path, the pointer is displayed upward on the scale. Each dot on the scale represents approximately 0.4 degree displacement.

(14.) NAV flag. Indicates that information derived from the selected navigational source (VOR, TACAN or INS) is invalid and should not be used.

(15.) To-from pointers. The to-from pointers aligned on the course pointer, are located 180 degrees apart. One always points in the direction of the station, along the selected VOR or TACAN radial or toward INS waypoint.

(16.) Heading knob. Positions the heading bug to a preselected compass heading.

(17.) Course deviation dots. In VOR, TACAN or INS operation, each dot represents a 5 degree deviation from the centerline (° 10 degrees). In ILS operation, each dot represents 1 degree deviation from the centerline. In INS operation, each dot represents a 3.75 nautical miles deviation from centerline.

(18.) Aircraft symbol. The fixed miniature aircraft symbol corresponds to the longitudinal axis of the aircraft and lubber line markings. The symbol shows aircraft position and heading with respect to a radio course and the rotating heading (azimuth) dial.

(19.) Course knob. Positions the course indicator.

(20.) Copilot's COURSE INDICATOR switch fig. 2-29). Selects desired source of data for display on copilot's HSI.

(a.) VOR 1. Selects data from VOR 1 system.

(b.) VOR 2. Selects data from VOR 2 system.

(c.) TACAN. Selects data from TACAN system.

(d.) INS. Selects data from INS.

3-19. PILOT'S ATTITUDE DIRECTOR INDICATOR.

a. Description. The pilot's attitude director indicator (ADI) (fig. 3-12) combines the attitude sphere display with computed steering information to provide the commands required to intercept and maintain a desired flight path. It also contains an eyelid display, expanded localizer, glide slope, radio altitude display, rate-of-turn indicator, mode annunciators, go-around and decision height annunciators, and inclinometer. Any warning flag in view indicates that portion of information is unreliable.

b. Controls/Indicators and Functions.

(1.) Attitude sphere. Moves with respect to the symbolic aircraft reference to display actual pitch and roll attitude. Pitch attitude marks are in 5 degree increments on a blue and brown sphere.

(2.) Roll attitude index. Displays actual roll attitude through a movable index and fixed scale reference marks at 0, 10, 20, 30, 45, 60 and 90 degrees.

(3.) GA (go-around) annunciator. Illuminates when go-around mode has been selected.

(4.) SPD annunciator. Illuminates when airspeed is being held by the flight director, in the IAS mode.

(5.) ALT annunciator. Illuminates when altitude is being held by the flight director.

(6.) HDG annunciator. Illuminates when heading is being held by the flight director, in the NAV ARM, BC ARM mode.

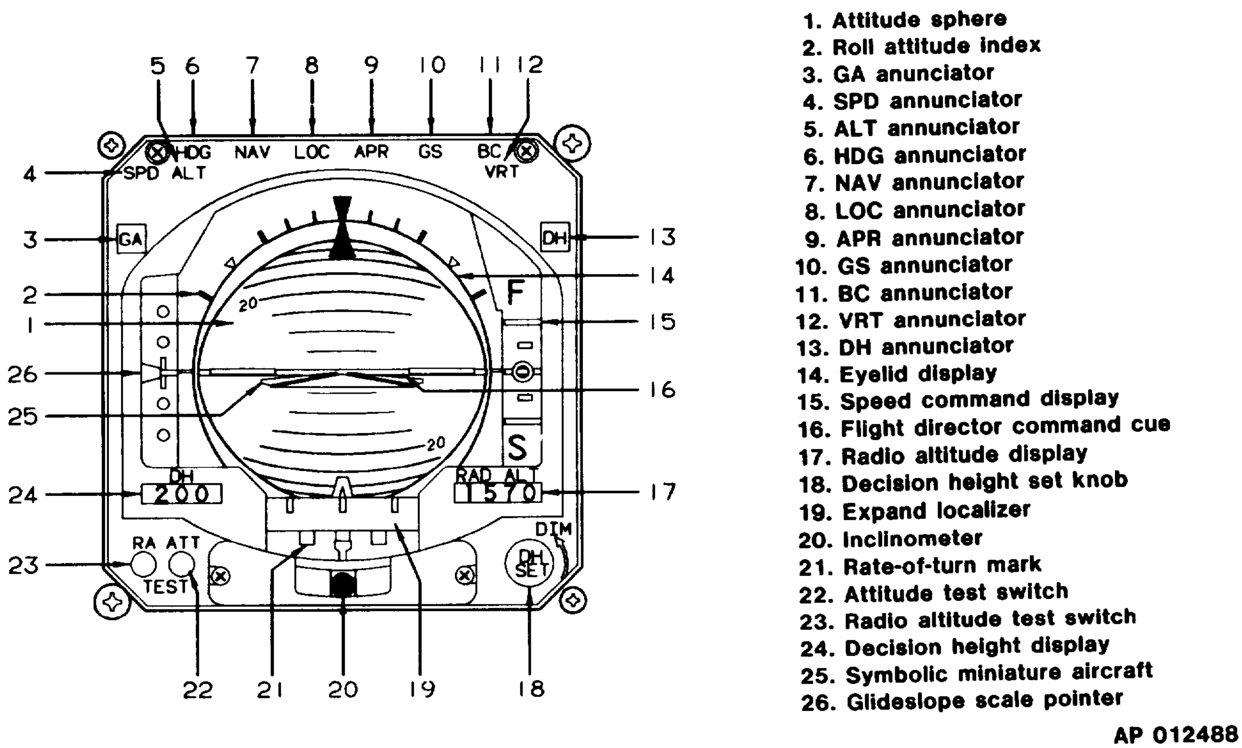


Figure 3-12. Pilot's Attitude Director Indicator

(7.) NAV annunciator. Illuminates when navigation is being controlled by the flight director, in the NAV CAP, VOR APR mode.

(8.) LOC annunciator. Illuminates whenever the flight director is controlling a localizer approach, in the NAV CAP mode.

(9.) APR annunciator. Illuminates whenever the flight director is controlling a approach, in the NAV CAP, VOR APR mode.

(10.) GS annunciator. Illuminates whenever the flight director is in GS CAP mode, and glide slope has been captured.

(11.) BC annunciator. Illuminates whenever the flight director is in BC CAP mode, and has captured the back course approach heading.

(12.) VRT annunciator. Illuminates when vertical speed is being held by the flight director, in the VS mode.

(13.) DH annunciator. Illuminates when aircraft descends below selected decision height as set on the radio altimeter indicator.

(14.) Eyelid display. Surrounds the attitude sphere and provides positive attitude identification by means of a blue eyelid which always shows the relative position of the sky, and a brown eyelid which always shows the relative position of the ground. The eyelids maintain the proper ground-sky relationship, regardless of sphere position.

(15.) Speed command display. The pointer indicates relative airspeed provided by the angle-of-attack/speed command system.

(16.) Flight director command cue. Displays computed commands to capture and maintain a desired flight path. Always fly the symbolic miniature aircraft to the flight director cue. The cue will bias from view should a failure occur in either the pitch or roll channel.

(17.) Radio altitude display. Radio altitude is digital displayed. The range capability of the display is from -20 to 2500 feet AGL. The display resolution between 200 and 2500 feet is in 10 foot increments. The display resolution below 200 feet is 5 feet. The display will be blank at altitudes over 2500 feet AGL. Dashes are displayed whenever invalid radio altitude is being received.

(18.) DH SET control knob. Sets decision height from 0 to 990 feet. Decision height displays in the DH window on lower left corner of ADI. The brightness of the digital radio altitude and decision height display is controlled by the dimming knob

which is concentric with the DH SET knob. The dimming knob also dims the distance and course display on the pilot's HSI, and the altitude alert display.

(19.) Expanded localizer. Raw localizer displacement data from the navigation receiver (HSI display) is amplified approximately 7 1/2 times to permit the expanded localizer pointer to be used as a sensitive reference indicator of the aircraft's position, with respect to the center of the localizer. It is normally used for assessment only, since the pointer is very sensitive and difficult to fly throughout the entire approach. During final approach, the pointer serves as an indicator of the Category II window. Full scale deflection of the expanded localizer pointer is equal to 1/4 degree of beam signal. The expanded localizer is displayed by the localizer pointer only when a valid localizer signal is available.

(20.) Inclinometer. Gives the pilot a conventional display of aircraft slip or skid, and is used as an aid to coordinated maneuvers.

(21.) Rate of turn. Rate of turn is displayed by the pointer at the bottom of the ADI. The marks at the extreme left and right sides of the scale represent a standard rate turn.

(22.) Attitude (ATT) test switch. When depressed, the sphere will show an approximate attitude change of 20 degrees of right bank at 10 degrees pitch-up. The ATT warning flag will appear. In addition, all mode annunciator lights except DH will illuminate.

(23.) Radio altitude (RA) test switch. Pressing the RA test button causes the following displays on the radio altitude readout: all digits display 8's then dashes, and then the preprogrammed test altitude as set in the radio altimeter R/T unit, until the test button is released at which time the actual altitude is displayed. The DH display during the test displays all 8's with the altitude display and then displays the current set altitude for the remainder of the test. RA test is inhibited as a function of APR CAP.

(24.) Decision height (DH) display. The digital DH display, displays decision height range from 0 to 990 feet in 10 foot increments. The decision height is set by the knob in the lower right corner of the ADI.

(25.) Symbolic miniature aircraft. Serves as a stationary symbol of the aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed miniature aircraft and the movable sphere. The symbolic aircraft is flown to align the command cue to the aircraft symbol in order to satisfy the commands of the selected flight director mode.

(26.) Glide slope scale and pointer. Displays aircraft deviation from glide slope beam center only when tuned to a ILS frequency and a valid glide slope is present. The aircraft is below glide path if pointer is displaced upward. The glide slope dot represents approximately 0.4 degree deviation from the beam centerline.

3-20. COPILOT'S GYRO HORIZON INDICATOR.

a. Description. The copilot's gyro horizon indicator (fig. 3-13) is a flight aid which indicates the aircraft's attitude. The attitude given is in relationship to an artificial horizon. There are no front panel fuses or circuit breakers provided for the copilot's gyro horizon indicator.

b. Indicators and Functions.

(1.) Bank angle scale. Indicates aircraft bank angle from zero to 90 degrees with marks at 10, 20, 30, 45, 60, and 90 degrees.

(2.) Bank angle index. Reference indicating zero-degree bank.

(3.) Bank angle pointer. Indicates aircraft bank angle.

(4.) Horizon line. Affixed to sphere, remains parallel to the earth's horizon at all times.

(5.) G *flag.* Presence announces loss of power.

(6.) Sphere. Indicates orientation with earth's axis at all times.

(7.) Inclinometer. Assists the copilot in making coordinated turns.

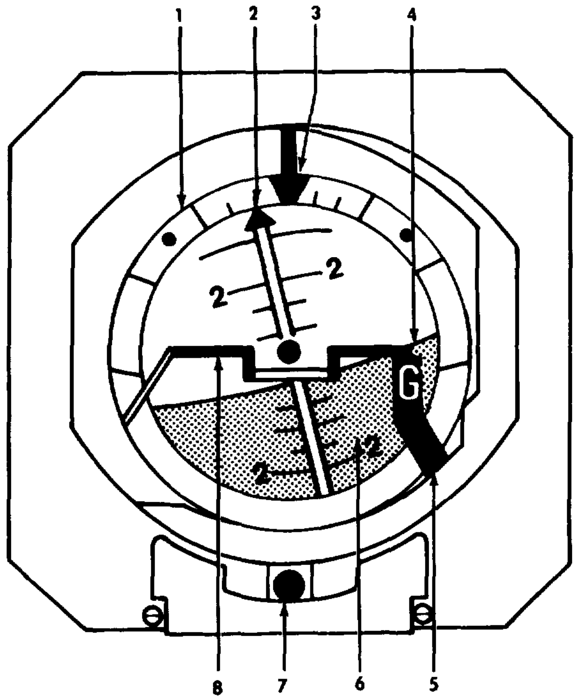
(8.) Miniature aircraft. Indicates attitude of aircraft with respect to the earth's horizon.

3-21. TURN AND SLIP INDICATORS.

a. Description. The pilot and copilot have identical turn and slip indicators (fig. 3-14) protected by the circuit breaker placarded TURN & SLIP on the overhead circuit breaker panel (fig. 2-26).

b. Controls/Indicators and Functions.

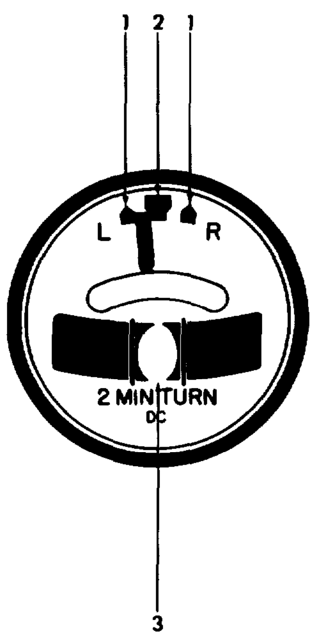
(1.) Two-minute turn marks. Fixed markers indicate two-minute turn rate when covered by turn rate indicator.



1. Bank angle scale
2. Bank angle index
3. Bank angle pointer
4. Horizon line
5. Gyro flag
6. Sphere
7. Inclinometer
8. Miniature aircraft

AP 005017

Figure 3-13. Copilot's Gyro Horizon Indicator (GH-14B)



1. 2-Minute turn marks
2. Turn rate indicaor
3. Inclinometer

AP 012489

Figure 3-14. Turn and Slip Indicator (329T-1)

(2.) Turn rate indicator. Deflects to indicate rate of turn.

(3.) Inclinometer. Indicates lateral acceleration (side slip) of aircraft.

3-22. GYROMAGNETIC COMPASS SYSTEMS.

a. Description. Two identical compass systems provide accurate directional information for the aircraft at all latitudes of the earth. As a heading reference, two modes of operation are used: directional gyro (FREE) mode, or slaved (SLAVE) mode. In polar regions of the earth where magnetic heading references are not reliable, the system is operated in the FREE mode. In this mode, the system furnishes an inertial heading reference, with latitude corrections introduced manually. In areas where magnetic heading references are reliable, the system is operated in the SLAVE mode. In this mode, the directional gyro is slaved to the magnetic flux detector, which supplies long-term magnetic reference to correct the apparent drift of the gyro. Magnetic heading information from both systems is applied to various aircraft systems through pilot and copilot COMPASS No.1 - No.2 switches. There are no circuit breakers for the gyromagnetic compass systems. The circuits are protected by the 2-ampere F2 and F6 fuses on the No. 1 junction box.

b. Vertical Gyro A vertical gyro provides line-of-sight stabilization to the weather radar and roll and pitch information to the autopilot. A FAST ERECT switch at the top of the pilot's instrument panel (figure 2-29) provides a means for fast erection of the gyros. Pressing and holding the FAST ERECT switch will erect the gyro to within 1.0° of pitch and roll within 60 seconds of power application, and erect to within 0.5° within 2 minutes. Normal operation of the vertical gyro system will not require use of the fast erect switch. The circuit is protected by the 3-ampere F22 fuse in the No. 1 junction box.

c. Controls and Functions.

(1.) Pilot's COMPASS No.1-No.2 switch. Selects desired source for magnetic heading information to display on pilot's HSI and copilot's RMI.

(a.) No. 1. Selects compass system No. 1 for display.

(b.) No.2. Selects compass system No.2 for display.

(2.) Copilot's COMPASS No. I-No.2 switch. Selects desired source for magnetic heading information to display on copilot's HSI and pilot's RMI and INS.

(a.) No.1. Selects compass system No. 1 for display.

(b.) No.2. Selects compass system No. 2 for display.

(3.) GYRO SLAVE-FREE switch. Selects system mode of operation.

(a.) SLAVE. Selects slaved mode. Compass flux valve connects to azimuth card.

(b.) FREE. Selects free mode. Flux valve is not connected to azimuth card.

(4.) INCREASE-DECREASE switch. Provides manual fast synchronization of the system.

(a.) INCREASE. Causes gyro heading output to increase (move in clockwise direction).

(b.) DECREASE. Causes gyro heading output to decrease (move in counter-clockwise direction).

d. Normal Operation.

(1.) Alignment procedure:

1. Gyro compass slave-free switch - SLAVE.
2. Gyrocompass increase-decrease switch - Hold switch momentarily in the direction desired, and then release. This will place system in fast erect mode. The gyro will then erect at approximately 30 degrees per minute. While in the fast erect mode, the HEADING flag (HSI) will be in view. When the HEADING flag retracts from view, the heading displayed will be the magnetic heading.

(2.) To determine magnetic heading:

1. Gyrocompass slave-free switch - SLAVE.
2. RMI rotating heading dial (compass card) - Read heading.

(3.) To determine directional gyro heading:

1. Gyrocompass slave-free switch - FREE.
2. Gyrocompass increase-decrease switch - Hold until the RMI compass card aligns with the magnetic heading, then release.
3. Read heading. The heading will agree with the appropriate HSI.

e. Shutdown Procedure. Both compass systems are shut down when the INVERTER No.1 or INVERTER No.2 switch is turned off. (If either inverter is on, both compass sets will be energized.)

3-23. ALTITUDE SELECT CONTROLLER

The Altitude Select Controller (fig. 3-15) provides a means for setting the desired altitude reference for the altitude alerting and altitude preselect system.

(1.) Altitude Alert. As the aircraft reaches a point 1000 feet from the selected altitude, a signal is generated to light the warning light on the altimeter. This light remains on until the aircraft is 250 feet from the selected altitude. If the aircraft now deviates by 250 feet or more from the selected altitude, the light is again energized. The light remains on until the aircraft returns to within 250 feet or deviates more than 1000 feet from the selected altitude.

(2.) Altitude preselect The altitude is selected by turning the selector knob until the altitude display reads the desired value. No further action is taken on the controller. To initiate altitude preselect, the ALTSEL button is selected on the flight director controller. The pilot must initiate a maneuver to fly toward the preselected altitude. Any of the following pitch modes may be engaged: Pitch Hold, Airspeed Hold or Vertical Speed Hold. Upon initiation of altitude preselect capture, the previously selected pitch mode is automatically reset.

3-24. RADIO ALTIMETER INDICATOR.

Description. The radio altimeter indicator (fig. 3-16) displays radio altitude information from 2500 feet to touchdown with an expanded linear scale under 500 feet.

b. Controls/Indicators and Functions.

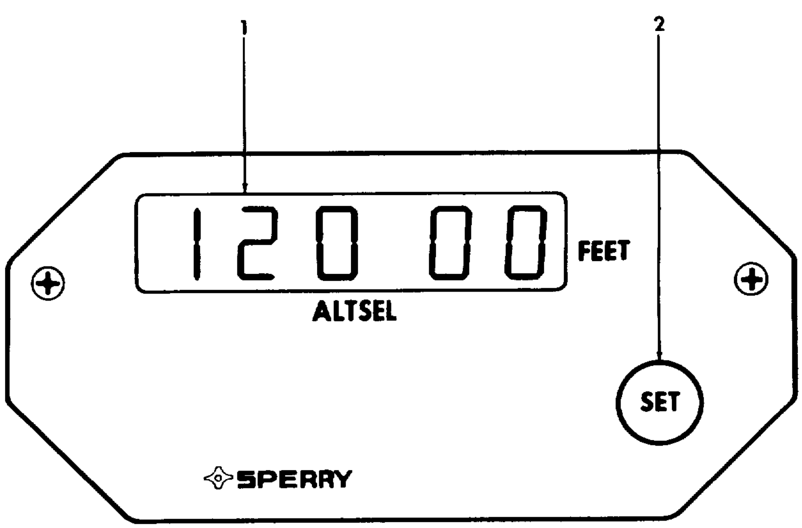
(1.) DH annunciator. Light illuminates to alert that aircraft is at or below selected DH.

(2.) Decision height bug. Manually set by knob to establish DH.

(3.) Failure warning flag (not shown). When visible, indicates that system information may be unreliable.

(4.) Altitude pointer. Points to dial reading for current radio altitude from 0 to 2500 feet.

(5.) Decision height set knob. Used to manually set DH.



1. Selected altitude display
2. Altitude selector knob

AP 011904

Figure 3-15. Altitude Select Controller (AL-800).

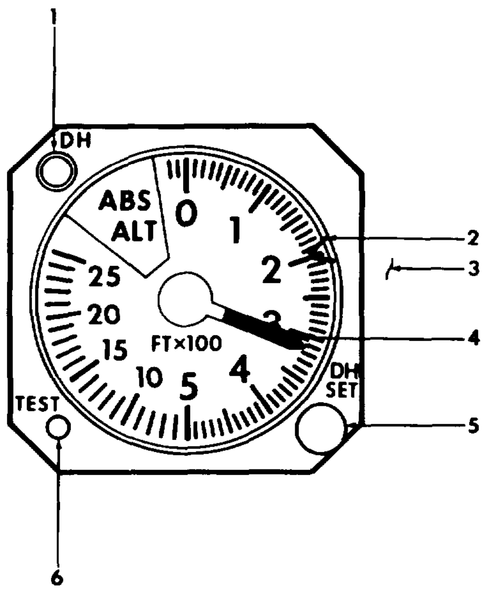


Figure 3-16. Radio Altimeter Indicator (RA-315)

(6.) TEST pushbutton. Pressed to check indicator R/T unit and flag operation.

Operating the test button causes the flag to come into view and altitude pointer to indicate approximately 100 feet. Release of button causes pointer to return to existing altitude and flag to retract.

3-25. VOR/LOC NAVIGATION SYSTEM.

a. Description. The aircraft is equipped with two VOR systems, controlled by a dual NAV 1 - NAV 2 control panel located on the pedestal (fig. 2-7). Either VOR can direct input signals to the attitude director indicator. Controls are shown on figure 3-1. Each VOR system includes independent receiver units for VOR/LOC and glideslope (GS). Each VOR receiver provides a VOR input to a respective RMI, HSI, and the flight director computer. Each glideslope receiver sends GS flag and pointer deviation information to the HSI and flight director computer. VOR/LOC indicators may be used for navigation during manual control of the aircraft, or the autopilot may be coupled to the VOR system, accepting VOR inputs to the autopilot computer. The pilot's unit (VOR 1) is a navigation radio system which receives and interprets VHF omnidirectional radio range (VOR) and localizer (LOC) signals, glideslope signals (GS), and marker beacon signals. It has a maximum range of 120 nautical miles line-of-sight. The system operates in a VOR/LOC frequency range of 108.00 to 117.95 megahertz, in a glideslope frequency range of 329.15 to 335.00 megahertz, and at a marker beacon frequency of 75 megahertz. VOR 2 is similar to VOR 1 except VOR 2 cannot receive or interpret marker beacon signals. Each VOR system provides course deviation and glide path data, which can be switched either to the copilot's HSI or to the autopilot flight computer and pilot's HSI, or both. The audio outputs of VOR 1 and VOR 2 systems are supplied to the NAV control on the audio control panels. VOR 1 bearing data is supplied to the single-needle pointer on both Radio Magnetic Indicators. VOR 2 bearing data is supplied to the double-needle pointer on both Radio Magnetic Indicators. VOR 1 uses a marker beacon antenna located on the underside of the forward fuselage (fig. 2-1). VOR 1 and VOR 2 both use the same glideslope antenna, located inside the radome. Both VOR's are protected by separate 2-ampere circuit breakers, located respectively on the number 1 and number 2 avionics bus. The circuit breakers are placarded VOR No.1 and VOR No.2 are located on the overhead circuit breaker panel (fig. 2-26).

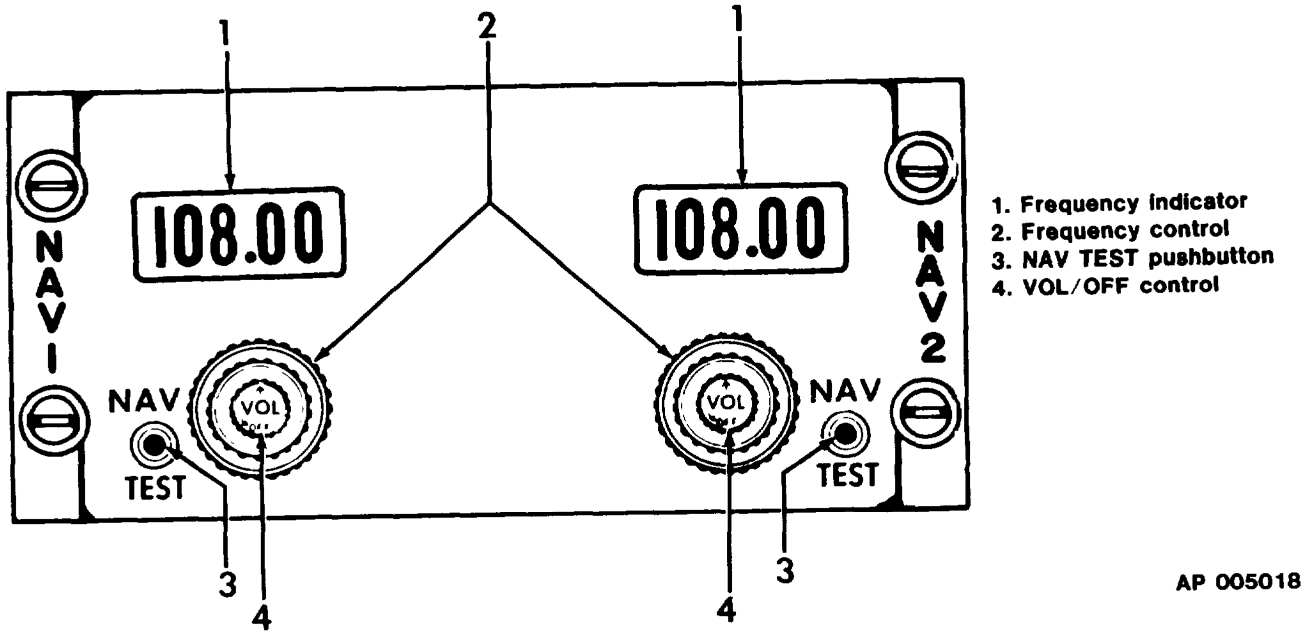


Figure 3-17. NAV 1 - NAV 2 Control Panel (VIR-30AGM, VIR-30AG

b. Controls/Indicators and Functions (NAV 1 Control Panel, fig. 3-17).

(1.) Frequency indicator. Displays selected frequency of VOR 1 receiver.

(2.) Frequency control. Selects operating frequency of VOR 1 receiver.

(3.) NAV-TEST pushbutton. Activates test of VOR 1 navigation system. If the system is functioning properly, the following indications are presented:

(a.) RMI. Single needle indicates 0°.

(b.) HSI. Indicates lateral deviation to the right and glideslope deviation down, if flag is tuned to ILS frequency. It tuned to NAV frequency, indicates 0° and the G/S flag is in view,

(4.) VOL-OFF control. Activates VOR 1 receiver. Permits monitoring VOR 1 audio and adjusts volume of signals received.

c. Controls/Indicators and Functions (NAV 2 Control Panel, Fig. 3-17).

(1.) Frequency indicator. Displays selected frequency of VOR 2 receiver.

(2.) Frequency control. Selects operating frequency of VOR 2 receiver.

(3.) NAV-TEST switch. Activates test of VOR 2 navigation systems. If the system is functioning properly the following indications will be presented:

(4.) OFF/VOL control. Activates VOR 2 receiver. Permits monitoring VOR 2 audio and adjusts volume of signals received.

(a.) RMI. Single needle indicates 0°.

(b.) HSI. Indicates lateral deviation to the right and glideslope deviation down, if NAV is tuned to ILS frequency. If tuned to NAV frequency, indicates 0° and G/S flag is in view.

d. Controls and Functions, Instrument Panel.

(1.) Pilots COURSE INDICATOR switch. Selects VOR receiver to control pilot's HSI.

(a.) VOR 1. VOR 1 controls pilot's HSI.

(b.) VOR 2. VOR 2 controls pilot's HSI.

(2.) Copilot's COURSE INDICATOR switch. Selects VOR receiver to control copilot's HSI.

(a.) VOR 1. VOR 1 controls copilot's HSI.

(b.) VOR 2. VOR 2 controls copilot's HSI.

(3.) NAV-A switch (audio control panel, fig. 3-1). Applies VOR audio to respective headsets.

(4.) MKR BCN HI-LO (marker beacon audio control panel, fig. 3-2). Controls sensitivity of marker beacon receiver.

e. VOR Operation.

(1.) Turn-on procedure:

1. Insure that aircraft DC and AC power is on.
2. Avionics master power switch (overhead control panel, fig. 2-12) - ON.
3. Frequency controls (VOR control panel) - Set for both receivers.
4. Volume controls (VOR control panel - Turn clockwise to activate sets and adjust volume.
5. NAV A, then NAV B audio switches (audio control panel, fig. 3-1) - ON. Confirm proper signal, then OFF.
6. RMI and HSI - Confirm proper indications.

(2.) Normal Operation.

1. Pilot/copilot course indicator switches (instrument panel) - Select VOR source.
2. To determine course to station on pilot's HSI: TO-FROM pointer reads TO (up) position.
3. To determine bearing from station on pilot's HSI: TO-FROM pointer reads FROM position (down).
4. To determine course to station on RMI: Select VOR, verify single needle points course to station.

(3.) Localizer (LOC) operation:

1. VOR frequency knob (NAV panel) - Select frequency.
2. Pilot's, copilot's COURSE INDICATOR switches (instrument panel) - Select VOR source.
3. Check glideslope flags unmasked.

(4.) VOR receiver operation:

1. VOR frequency control knob (VOR control panel, fig. 3-17) - Select desired frequency.
2. Volume control knob (VOR control panel, fig. 3-17) - Full on.
3. NAV A, audio switch - ON. Adjust audio.

(5.) Shutdown procedure: Volume control (VOR control panel, fig. 3-17) - OFF.

3-26. MARKER BEACON RECEIVER.

a. Description. The marker beacon receiver is located inside the No.1 VOR receiver. The marker beacon receiver obtains power through the VOR receiver. The marker beacon provides visual and aural indication of the aircraft's position over a 75 MHz marker beacon ground transmitter. Upon entering the range of marker beacon signals, blue, amber, or white annunciator lights will illuminate, and corresponding aural signals will indicate aircraft passage over the (0) outer, (M) middle, (A) inner or airway marker beacons. Range is vertical to 50,000 feet. Volume, and sensitivity controls are located on the marker beacon audio control panel (fig. 3-1).

b. Controls/Indicators and Functions.

(1.) Marker beacon sensitivity switch (marker beacon audio control panel, fig. 3-2). Controls sensitivity of marker beacon receiver.

(a.) HI position. Enables high sensitivity operation of marker beacon receiver.

(b.) LO position. Enables low sensitivity operation of marker beacon receiver.

(2.) "0" indicator. Illuminates when aircraft passes over an outer marker beacon.

(3.) "M" indicator. Illuminates when aircraft passes over a middle marker beacon.

(4.) "A" indicator. Illuminates when aircraft passes over an inner or airway marker beacon.

c. Marker Beacon Operation.

1. Marker beacon volume control (marker beacon audio control panel, fig. 3-2) - As required.

2. Marker beacon HI-LO switch (marker beacon audio control panel, fig. 3-2) - As required.

3. Marker beacon indicator lights (instrument panel, fig. 2-29) - Confirm beacon indication.

3-27. AUTOMATIC DIRECTION FINDER (DF-203).

a. Description. The Automatic Direction Finder (ADF) (fig. 3-18), is a radio navigation system which provides a visual indication of aircraft bearing, relative to a selected ground radio station. It may also be used to home to a selected station, find aircraft position, or monitor conventional medium frequency AM radio transmissions. The system is designed to provide reliable reception of a 400-watt radio station at a range of 65 nautical miles throughout a 360-degree turn of the aircraft. It operates in a frequency range of 190 to 1750 kilohertz. Bearing indications are displayed visually on the RMI's and aural signals are applied to the audio control panels. The ADF system consists of a receiver, located on the forward side of the aft cabin bulkhead inside the pressure vessel; a control unit, located on the pedestal extension; a non-directional sense antenna, installed in the aircraft dorsal tin; a directional loop antenna, located on the underside of the fuselage; and a quadrangle error corrector, installed on the loop antenna (to compensate for the deflection of arriving radio signals by the wings and fuselage of the aircraft). The system is protected by a l-ampere ADF, a 5-ampere RADIO RELAY, and a 35-ampere AVIONICS BUS FEEDER No.2 circuit breaker located on the overhead circuit breaker panel (fig. 2-26).

CAUTION

The only warning that the crewmember has for an unreliable ADF signal or loss of the ADF receiver is the loss of the ADF audio signal in the crewmember's headset. This signal should be monitored during all phases of the approach in IMC conditions.

NOTE

Keying the HF radio set while operating the ADF radio set will cause a momentarily unreliable ADF signal.

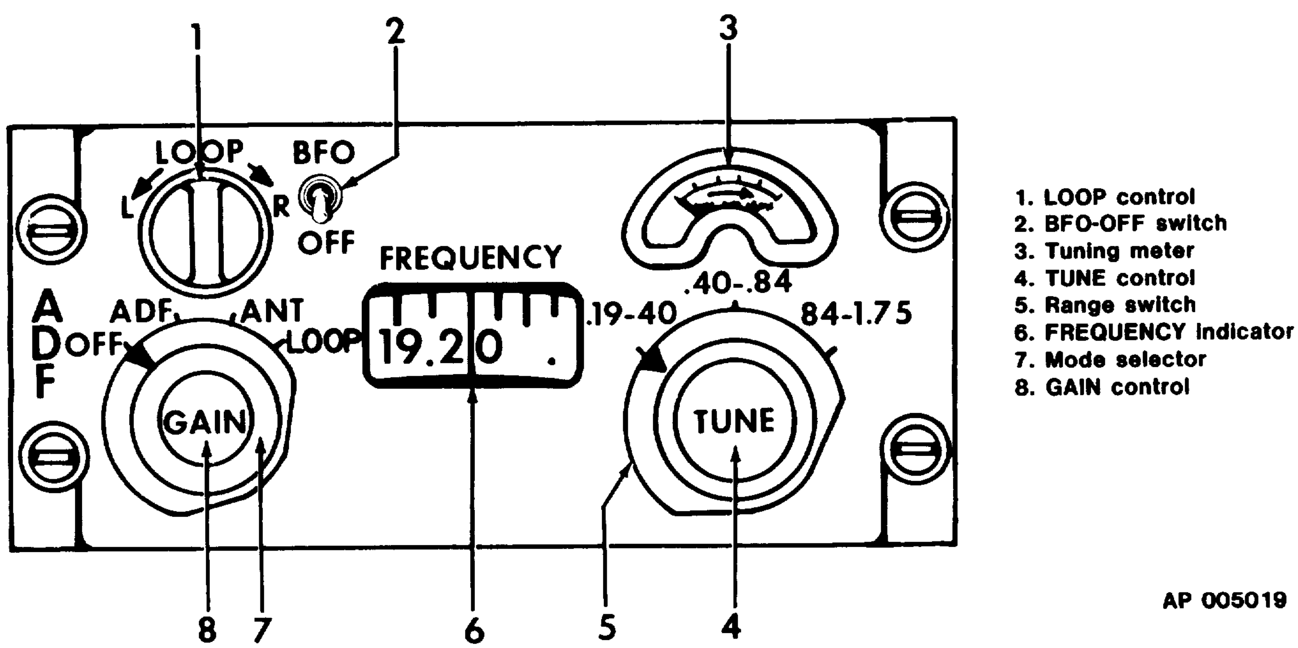


Figure 3-18. ADF Control Panel (DF-203)

b. Controls and Functions (ADF Control Panel, fig. 3-18).

(I.) L-LOOP-R control. Operative only when the function switch is in the LOOP or ADF position. Center position removes rotation signals from the loop antenna and the ADF pointer on the RMl's. L (left) or R (right) of center applies rotation signals to loop antenna and ADF pointer on RMI's for 360-degree rotation left or right. Center position holds antenna position.

(2.) BFO-OFF. At BFO (on) setting, permits line tuning with Beat Frequency Oscillator (BFO). Also provides audio tone when receiving unmodulated CW. OFF position turns BFO off.

(3.) Tuning meter. Indicates relative strength of received signals.

(4.) TUNE control. Selects operating frequency.

(5.) Range switch. Selects operating frequency band.

(6.) FREQUENCY indicator. Indicates selected frequency.

(7.) Mode selector. Selects operating mode.

(a.) OFF. Turns set off.

(b.) ADF. Permits automatic direction finding or homing operation.

(c.) ANT. Permits reception using sense antenna.

(d.) LOOP. Permits audio-null homing and manual direction finding operations.

(8.) GAIN control. Adjusts volume of received signal.

c. Controls and Functions (Audio Control *Panel, jig. 3-1).*

(1.) NAV-B switch. ON position applies ADF audio to respective headset.

d. Controls and Functions (Marker Beacon *Audio Panel, fig. 3-2).*

(1.) FILTER V-OFF switch. Selects whether voice filter will be used with ADF audio.

(2.) FILTER R-OFF switch. Selects whether range filter will be used with ADF audio.

NOTE

Range and voice filtering are cancelled when both FILTER R and FILTER V are ON. Range and voice audio will be heard.

e. ADF Normal Operation.

(1.) To operate the set as ADF.

1. Mode selector - ADF.
2. BFO-OFF switch - BFO.
3. Range switch - Select frequency range.
4. Audio control panel (fig. 3-l) NAV B switch - On and adjusted.
5. Gain control - As required.
6. TUNE control - Rotate for maximum reading on tuning meter and zero BFO beat.
7. BFO-OFF switch - OFF.
8. Double needle switch (RMI, fig. 3-9) - ADF.
9. Double needle pointer (RMI, fig. 3-9) - Read course to station.

(2.) To operate set for sense antenna *receiving only.*

1. Mode selector (ADF control panel, fig. 3-18 - ANT.
2. Range switch - Select operating range.
3. Tune control - Rotate for maximum reading on tuning meter.
4. Gain control - As required.

(3.) To operate set for aural-null direction *finding.*

1. Mode selector (ADF control panel, fig. 3-18) - ANT.
2. BFO-OFF switch - BFO.
3. Range switch - Select operating range.
4. Tune control - Tune desired station.
5. Gain control - Adjust for minimum audio output.
6. Double needle switches (RMI, fig. 3-9) - As required.

7. BFO-OFF switch - OFF.
8. Mode selector switch - LOOP.
9. Loop switch - L or R. Turn left or right until a null is reached (minimum sound in headsets).
10. Double needle on RMI (fig. 3-9) - Read course to station,

NOTE

The true null and direction to the radio station may be indicated by either end of the single needle. This ambiguity must be solved to determine proper direction to the station.

(4.) Shutdown procedure: Mode selector switch (ADF control panel, fig. 3-18) - OFF.

3-28. TACAN SYSTEMS.

a. Description. Two Tactical Air Navigation (TACAN) systems are provided. One is dedicated to the INS and is used only for position updating, and provides only DME information to the INS.The other is used in conjunction with other avionics systems, including the flight director system and the autopilot. For normal navigation TACAN is a radio navigation system which provides aircraft distance and bearing information relative to a TACAN ground station. Both systems operate in the L band frequency range of 962 to 1213 MHz. Their range, though limited to line-of-sight, is designed to provide reliable reception of a TACAN ground station at a distance of 170 nautical miles at an aircraft altitude of 20,000 feet. The normal time required for the systems to lock on to a selected ground station signal is three seconds. Both systems are protected by a 2-ampere circuit breaker, placarded TACAN, located on the overhead circuit breaker panel (fig. 2-26).

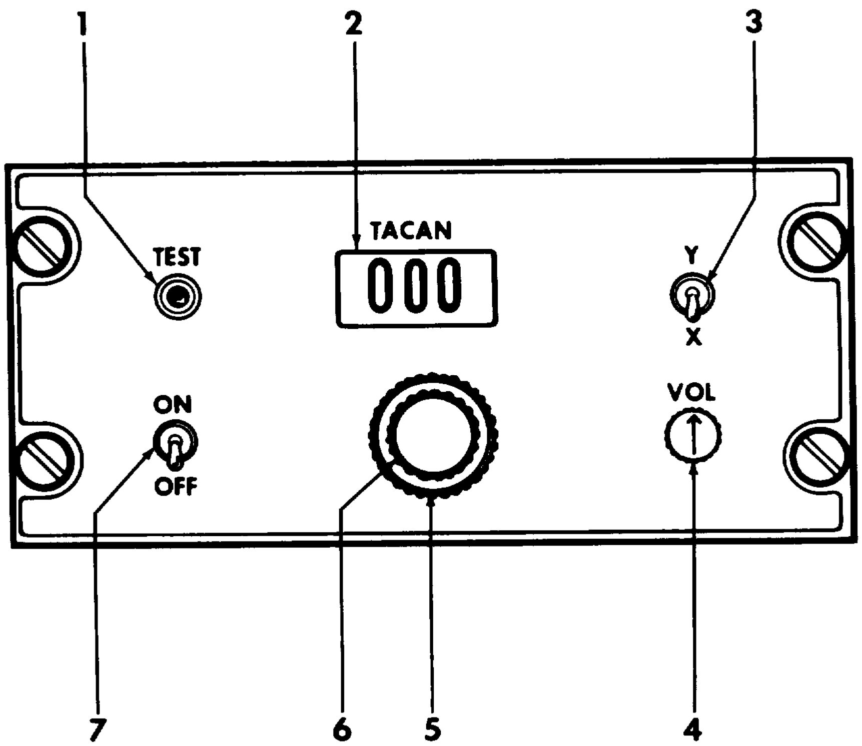
b. TACAN System (Non-INS dedicated). The TACAN system (Non-INS dedicated) consists of a range unit (which includes the system transmitter) and a bearing unit, both located in the right nose avionics compartment; a distance indicator (fig. 3-19) located on the instrument panel; a control unit (fig. 3-20) located in the pedestal extension; and an antenna, located on the top of the fuselage. The TACAN system (non INS dedicated) operates in conjunction with TACAN and VORTAC ground stations to provide distance, ground speed, time-to-station, and bearing-to- station data. It operates in the L band frequency range on one of 252 preselected frequencies, 126 X mode and 126 Y mode channels. Course deviation to TACAN stations are displayed on the HSI's. Distance, time-to-station, and ground speed are displayed on the TACAN digital display (fig. 3-19). The ground speed and time-to-station are accurate only if the aircraft is flying directly toward the ground station at a sufficient distance that the slant range and ground range are nearly equal. The (Non-INS dedicated) TACAN system may be connected to and used with the autopilot system. When employed as the primary means of navigation, aircraft flight may be controlled manually or by the autopilot. Indications of aircraft heading and bearing to ground stations are displayed on the horizontal situation indicators. Magnetic bearing to a station is displayed by the RMI and pilot's HSI bearing pointer. TACAN distance, ground speed, and time-to-station are all displayed on the TACAN indicator located on the copilot's instrument panel (fig. 2-29). TACAN distance is displayed on the HSI's. The TACAN control panel (fig. 3-20) enables selection of the TACAN frequency (channel) to be used, and provides for self-test of TACAN circuits. At the present time, most TACAN and VORTAC stations are operated in the X mode. When Y mode stations are operational, air navigation charts will designate the Y mode stations. The small (outer) control provides system power ON-OFF and station identifier tone, volume and control.

c. INS TACAN System. The INS TACAN system is coupled directly to INS circuits. It is dedicated only to updating the INS, is activated when the INS is operational, and is controlled only by the INS. The INS TACAN consists of a range unit and a distance indicator, both located on the INS equipment rack and both identical to counterparts in the (non-INS dedicated) TACAN and antenna, located on the underside of the fuselage (fig. 2-1). No controls are required or provided for the INS TACAN system.

d. Controls/Indicators and Functions.

(1.) TACAN control panel.

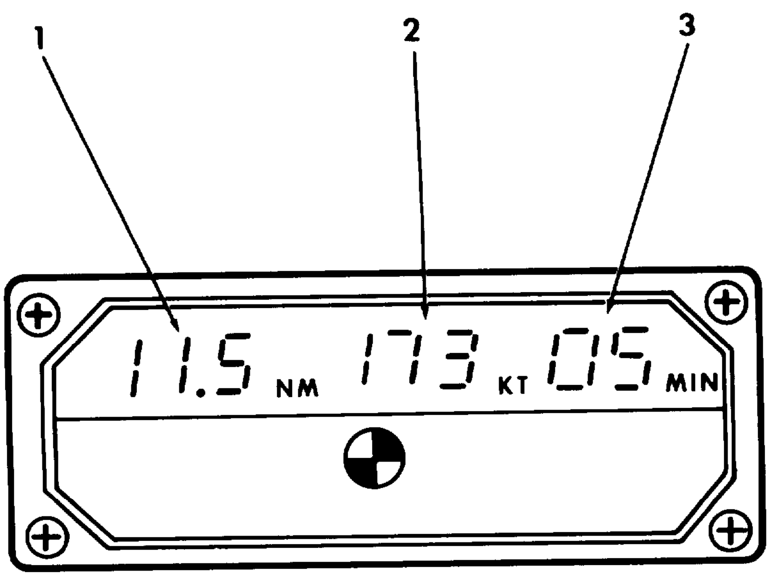
1. TEST SWITCH. Activates system self-test.
2. CHANNEL INDICATOR. Displays selected TACAN channel.
3. X-Y SWITCH. Selects X or Y mode for TACAN channels.
4. VOL CONTROL. Adjusts TACAN volume.
5. OUTER CHANNEL SELECTOR KNOB. For manual selection of tens and hundreds part of channel number.
6. INNER CHANNEL SELECTOR KNOB. For manual selection of units part of channel number.



1. TEST push switch
2. Channel indicator
3. X-Y switch
4. VOL control
5. Tens and hundreds channel select knob
6. Units channel select knob
7. ON-OFF switch

AP 006386

Figure 3-19. TACAN Control Panel (AN/ARN-136)



1. Nautical miles indicator
2. Knots indicator
3. Minutes-to-station indicator

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Figure 3-20. TACAN Distance Indicator (SANS-706)

7. ON-OFF SWITCH. Activates or deactivates system.

(2.) *TACAN distance indicator.*

1. NM INDICATOR. Displays slant range distance in nautical miles from aircraft to selected TACAN ground station.
2. KT INDICATOR. Displays ground speed in knots.
3. MIN INDICATOR. Displays time to TACAN station in minutes.

e. (Non-INS dedicated) TACAN Operation.

(I.) Turn-On procedure:

1. Power switch (TACAN control panel, fig. 3-20) - ON.
2. Volume control - As required.
3. Course indicator switches (instrument panel, fig. 2-29) -TACAN.
4. Self-test procedure: Course knob on pilot's HSI - Set to 180°, press and hold TEST switch.
5. Pilot's HSI course deviation bar - Centered, with course knob set to 180 ±2 degrees, and TO-FROM indicator indicating TO.
6. RMI bearing pointers (fig. 3-9) and pilot's HSI bearing pointer - Point to 180 degrees.
7. HSI course knob - Increase the selected course. The course deviation bar on a 180 ± 2 degrees TO indication and the bearing pointers on each RMI indicator read 180 degrees. Using the course knob, increase the selected course, the course deviation bar will move left. Decrease the selected course, the course bar will center, then move to the right of center. Full scale deflection will be 10 ± 1°.

f. Normal Operating Procedure:

1. RMI single needle switch (fig. 3-9) - VOR-TACAN.
2. RMI selector switch (instrument panel, fig. 2-29) -TACAN.
3. Course indicator selector switch (instrument panel, fig. 2-29) - TACAN.
4. TACAN X-Y switch - As required.
5. TACAN channel selector knobs - Select desired channel.
6. Wait 5 seconds for signal acquisition and lock-on.
7. If bearing lock-on is not obtained, perform an inflight self-test to insure correct operation of the system. Anytime a course indicator NAV or VOR LOC flag is in view, bearing, course deviation, and TO-FROM information may be inaccurate and should be disregarded.
8. Insure that audio station identification signal is correct for the ground station selected.
9. RMI single-needle pointer and pilot HSI bearing pointer -Read bearing to station.
10. HSI course control knob - Set desired course.
11. HSI course deviation bar - Read deviation from selected course. Course arrow will show wind correction angle when the course deviation bar is centered and the aircraft is tracking the selected course.
12. TACAN indicator and pilot's HSI - Read distance to station.
13. To determine course TO or course FROM a TACAN station, rotate course knob (pilot's HSI) until course deviation bar is centered and the TO-FROM pointer reads TO or FROM.
14. To use TACAN during pilot-controlled flight, control aircraft by manual controls, responding to information displayed on the flight director, RMI, HSI, TACAN, and other instruments.
15. To use TACAN with the autopilot, engage autopilot and monitor autopilot performance on flight director, RMI, HSI and TACAN indicators. Verify adherence to preset heading and course, and confirm the execution of displayed steering commands.

NOTE

The TACAN ground speed reading will be accurate only when the aircraft is on a course directly to or from the TACAN station.

g. Shutdown procedure: TACAN power switch (fig. 3-20) - OFF.

3-29. AUTOMATIC FLIGHT CONTROL SYSTEM.

WARNING

The RC-12H aircraft is certified with wingtip pods installed. Should the pods be removed, the autopilot system must be replaced with a standard C-12D autopilot. Effected wiring must also be changed.

a. Description. The Automatic Flight Control System is a completely integrated autopilot/flight director/air data system which has a full complement of horizontal and vertical flight guidance modes. These include all radio guidance modes, and air data oriented vertical modes.

When engaged and coupled to the flight director (FD) commands, the system will control the aircraft using the same commands displayed on the attitude director indicator. When engaged and uncoupled from the flight director commands, manual pitch and roll commands may be inserted using the pitch wheel and turn knob.

When the autopilot is coupled, the flight director instruments act as a means to monitor the performance of the autopilot. When the autopilot is not engaged, the same modes of operation are available for flight director only. The pilot maneuvers the aircraft to satisfy the Flight Director commands, as does the autopilot when it is engaged.

b. Air Data Computer. A digital air data computer located in the forward avionics compartment provides the altitude information for the pilot's altimeter indicator, altitude alerter, and transponder. The computer also provides altitude and airspeed hold function data to the flight control computers. The air data computer receives 28 VDC power through, and is protected by, a 2 amp circuit breaker placarded AIR DATA - ENCDR located in the AVIONICS section of the overhead circuit breaker panel. All air data computer functions are automatic in nature and require no flight crew action.

c. Flight Director Mode Selector. The Flight Director Mode Selector (fig.3-22), located on the pedestal, provides for selection of all modes (except go-around which is initiated by a remote switch located on the left power lever for the flight director. The top row of split light annunciated pushbuttons contains the lateral modes and the bottom row contains the vertical modes. The mode buttons will illuminate when manually selected, or automatically selected through other modes.

The split light pushbutton annunciators, illuminate amber for armed conditions and green for captured. When more than one lateral or vertical mode is selected, the flight director system automatically arms and captures the submode. Mode annunciations are also presented on remote annunciator blocks, located above the pilot's Attitude Director Indicator (ADI), and on the pilot's ADI. Operating modes and annunciation events of the Flight Director system are detailed in figure 3-21.

d. Controls/Indicators and Functions (FD Mode Selector, jig. 3-22):

(1.) Heading Mode Switch (HDG). Engages heading mode. Commands aircraft to acquire the heading indicated by a heading marker on the pilot's HSI.

(2.) Navigation Mode Switch (NAV). Engages the navigation mode selected.

(3.) VOR Approach Mode Switch (APR). Engages approach mode. Commands aircraft to intercept and track ILS inbound course.

(4.) Back Course Mode Switch (BC). Engages backcourse mode. Commands aircraft to intercept back course ILS.

(5.) VNAV Mode Switch. Not used.

(6.) Standby Mode Switch (SBY). Engages standby mode.

(7.) Indicated Airspeed Hold Mode Switch (IAS). Engages indicated airspeed hold mode.

(8.) Vertical Speed Hold Mode Switch (VS). Engages vertical speed hold mode.

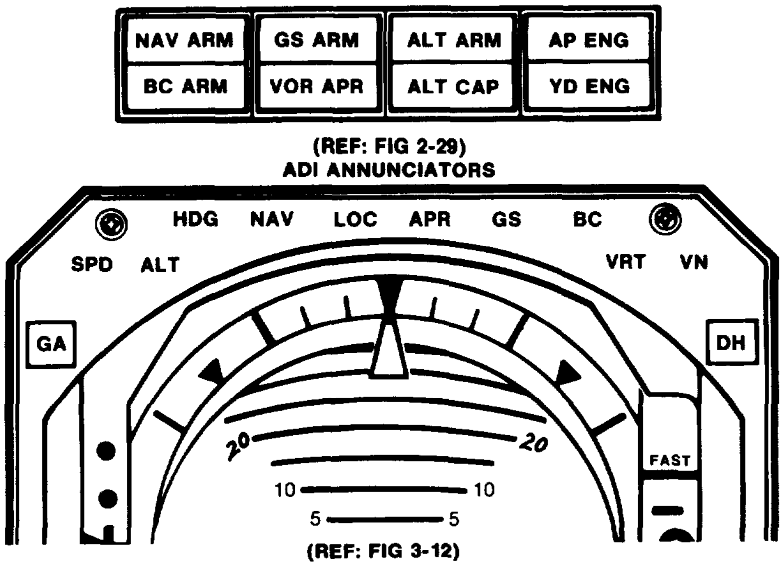
(9.) Altitude Preselect Mode Switch (ALT-SEL). Engages altitude preselect mode.

(10.) Altitude Hold Mode Switch (ALT). Engages altitude hold mode. Commands aircraft to maintain pressure altitude.

e. Autopilot Modes of Operation.

(1.) Heading Select Mode (HDG). In the HDG mode the flight director computer provides

REMOTE ANNUNCIATOR BLOCK

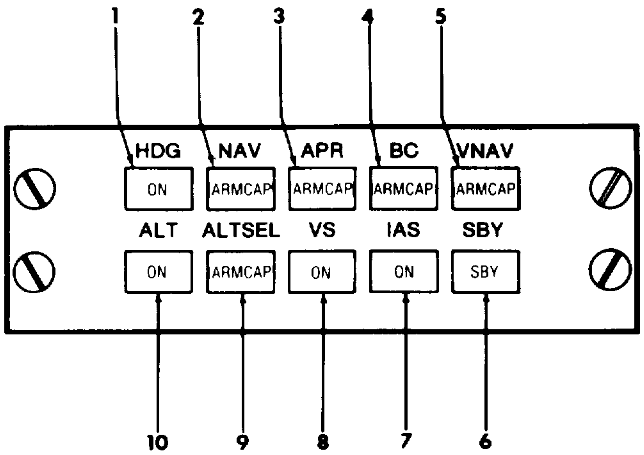


(REF: FIG 3-12)

MODE SELECTED (MANUAL OR AUTO)	MODE SELECTOR ANNUNCIATION	ADI ANNUNCIATION	REMOTE ANNUNCIATION
HDG	HDG	HDG	
NAV ARM } VOR/RNAV NAV CAP }	HDG, NAV ARM NAV CAP	HDG, NAV	NAV ARM
NAV ARM } LOC NAV CAP }	HDG, NAV ARM NAV CAP	HDG, LOC, APR	NAV ARM
APR ARM	HDG, NAV ARM, APR ARM	HDG,	NAV ARM GS ARM
APR ARM (AFTER LOC CAPTURE)	NAV CAP, APR ARM	LOC, APR	GS ARM
APR CAP	NAV CAP, APR CAP	LOC, APR, GS	
BC ARM	HDG, BC ARM	HDG,	BC ARM
BC CAP	BC CAP	BC	
VOR APR ARM } VOR/RNAV	HDG, NAV ARM, APR ARM	HDG,	NAV ARM VOR APR
VOR APR CAP }	NAV CAP, APR CAP	NAV, APR	VOR APR
ALT	ALT	ALT	
ALT SEL ARM ALT SEL CAP	ALT SEL ARM ALT SEL CAP	VRT	ALT ARM ALT CAP
VNAV ARM VNAV CAP	VNAV ARM VNAV CAP	VN	VNAV ARM
VS	VS	VRT	
IAS	IAS	SPD	
GA		GA	

AP 012801

Figure 3-21. Flight Director Modes and Annunciators



1. Heading mode switch
2. Navigation mode switch
3. VOR approach mode switch
4. Back course mode switch
5. VNAV mode switch (not used)
6. Standby mode switch
7. Indicated airspeed hold mode switch
8. Vertical speed hold mode switch
9. Altitude preselect mode switch
10. Altitude hold mode switch

AP 012081

Figure 3-22. Flight Director Mode Selector (MS-500)

inputs to the command cue to command a turn to the heading indicated by the heading bug on the HSI. The heading select signal is gain programmed as a function of airspeed. When HDG is selected, it overrides the NAV, BC APR and VOR APR modes. In the event of a loss of valid signal from the gyro or compass, the command cue on the AD1 is biased out of view. automatically select

(2.) Navigation Mode (NAV). The Navigation Mode represents a family of modes for various navigation systems including VOR, Localizer, TACAN and INS.

(a.) VOR Mode. The VOR Mode is selected by selecting either VOR 1 or VOR 2 on the Course Indicator select switch on the pilot's instrument panel, and then depressing the NAV button on mode selector with the navigation receiver tuned to a VOR frequency. (A VOR indicator, NV1 or NV2 on the pilot's HSI, will illuminate. VOR NAV information will display on the pilot's HSI and RMI). Prior to VOR capture, the command cue receives a heading select command as described above and the HDG mode switch is illuminated along with the NAV ARM annunciators. Upon VOR capture the system automatically: switches to the VOR mode; HDG and NAV ARM annunciators extinguish; NAV capture (NAV CAP) annunciators will illuminate. At capture, a command is generated to capture and track the VOR beam. The course error signal is gain programmed as a function of airspeed. Crosswind washout is included which maintains the aircraft on beam center in the presence of crosswind. The intercept angle is used in determining the capture point to ensure smooth and comfortable performance during bracketing.

When passing over the station, an overstation sensor detects station passage removing the VOR deviation signal from the command until it is no longer erratic. While over the station, course changes may be made by selecting a new course on the HSI.

If the NAV receiver is not valid prior to the capture point, the lateral beam sensor will not trip and the system will remain in the HDG mode. After capture, if the NAV receiver, compass data or vertical gyro go invalid, the ADI command cue will bias out of view. Also, the NAV CAP annunciators will extinguish if the NAV receiver becomes invalid.

(3.) Localizer Mode. The Localizer Mode is selected by depressing the NAV button on the mode selector with the navigation receiver tuned to a LOC frequency. Mode selection and annunciation in the LOC mode is similar to the VOR mode. The localizer deviation signal is gain programmed as a function of radio altitude, time and airspeed. If the radio altimeter is invalid, gain programming is a function of glide slope capture, time and airspeed. Other valid logic is the same as the VOR mode.

(4.) VOR Approach Mode. The VOR Approach Mode is selected by depressing the APR button on the mode selector with the navigation receiver tuned to a VOR frequency and less than 10 DME miles from the station. The mode operates identically to the VOR mode with the gains optimized for a VOR approach.

(5.) Back Course Mode. The back course mode is selected by pressing the BC button on the mode selector. Back course operates the same as the LOC mode with the deviation and course signals reversed to make a back course approach on the localizer. When BC is selected, and outside the lateral beam sensor trip point, BC ARM and HDG annunciators will illuminate. At the capture point, BC CAP will be annunciated with BC ARM and HDG annunciators extinguished. When BC is selected, the glideslope circuits are locked out.

(6.) Localizer Approach Mode (APR). The approach mode is used to make an ILS approach. Pressing the APR button with a ILS frequency tuned, arms both the NAV and APR modes to capture the localizer and glide slope respectively. No alternate NAV source can be selected. Operating

LOC mode is the same as described above except, if the radio altimeter is invalid in APR mode, gain programming is a function of glide slope capture, time, and airspeed.

With the APR mode armed, the pitch axis can be in any one of the other pitch modes except go-around. When reaching the vertical beam sensor trip point, the system automatically switches to the glide slope mode. The pitch mode and APR ARM annunciators extinguish and APR CAP annunciator illuminates on the controller. At capture, a command is generated to make a gradual interception of the glide slope beam. Capture can be made from above or below the beam. The glide slope gain is programmed as a function of radio altitude, time and airspeed. The APR CAP annunciator on the Mode Selector will extinguish if the GS receiver becomes invalid after capture.

Glide slope capture is interlocked so that the localizer must be captured prior to glide slope capture. If the glide slope receiver is not valid prior to capture, the vertical beam sensor will not trip and the system will remain in the pitch mode. After capture, if the NAV receiver, GS receiver, compass data or vertical gyro becomes invalid, ADI command cue will bias out of view. If the radio altimeter is not valid, the glide slope gain programming will be a function of GS capture, time, airspeed, and the middle marker.

(7.) Pitch Hold Mode. Whenever a roll mode is selected without a pitch mode, the ADI command cue will display a pitch attitude hold command. The pitch attitude can be changed by pressing the CWS button on the control wheel and maneuvering the aircraft. The command cue will be synchronized to zero while the button is depressed. Upon release of the button, the pitch command will be such as to maintain the new pitch attitude. In the pitch hold mode, the ADI command cue will be biased out of view if the VG is not valid.

(8.) TACAN Mode. The TACAN mode is selected by selecting “TACAN“ on the course indicator selector switch, located on the pilot’s instrument panel. A TACAN annunciator, placarded TAC, located on the pilot’s HSI, will illuminate. TACAN navigation information will display on the pilot’s HSI and RMI.

NOTE

The TACAN receiver must be tuned to a valid TACAN frequency. TACAN functions are identical to VOR using TACAN information rather then VOR signals. The ARM/CAP annunciation is the same as in VOR mode.

(9.) Altitude Hold Mode (ALT). The Altitude Hold Mode is selected by depressing the ALT button on the mode selector. When ALT mode is selected, it overrides the APR CAP, GA, IAS, VS, and ALTSEL CAP modes. In the ALT mode the pitch command is proportional to the altitude error provided by the air data computer. The altitude error signal is gain programmed as a function of airspeed. Depressing and holding the CWS button allows the pilot to maneuver the aircraft to a new Altitude Hold reference without disengaging the mode. Once engaged in the Altitude Hold Mode, the mode will be reset if the air data computer is not valid and the ADI command cue will bias out of view if the VG is not valid.

NOTE

If the Baro setting on the altimeter is changed, a command is generated to fly the aircraft back to the original altitude reference.

(10.) Indicated Airspeed Hold Mode (IAS). The Indicated Airspeed Hold Mode is selected by depressing the IAS button on the mode selector. When IAS is selected, it overrides the APR CAP, GA, ALT, VS, and ALTSEL CAP modes. In the IAS mode the pitch command is proportional to airspeed error provided by the air data computer. Depressing and holding the CWS button allows the pilot to maneuver the aircraft to a new Airspeed Hold reference without disengaging the mode. Once engaged in the IAS mode, the mode will be reset if the air data computer is not valid. The ADI command cue will bias out of view if the VG is not valid.

(11.) Vertical Speed Hold Mode (VS). The Vertical Speed Hold Mode is selected by depressing the VS button on the mode selector. When VS is selected, it overrides the APR CAP, GA, ALT, ALTSEL CAP, and IAS modes. In the VS mode, the pitch command is proportional to VS error provided by the air data computer. Depressing and holding the CWS button allows the pilot to maneuver the aircraft to a new Vertical Speed Hold reference without disengaging the mode. Once engaged in the VS mode, the mode will be reset if the air data computer is not valid. The ADI command cue will bias out of view if the VG is not valid.

(12.) Altitude Preselect Mode (ALTSEL). The Altitude Preselect Mode is selected by pressing the ALTSEL button on the mode selector. The desired altitude is selected on the altitude preselect controller. Pitch hold, VS or IAS may be selected as a mode to fly to the selected altitude. When outside the altitude bracket trip point, the ALTSEL ARM annunciator along with the selected pitch mode is

illuminated on the mode selector. When reaching the bracket altitude, the system automatically switches to the ALTSEL CAP mode and the previously selected pitch mode is cancelled. When the altitude is reached, the ALTSEL CAP mode is automatically cancelled and the Flight Director switches to the ALT hold mode. If the air data computer is not valid, the altitude preselect mode cannot be selected. The ADI command cue will bias out of view if the VG is not valid.

(13.) Standby Mode (SBY). The Standby Mode is selected by depressing the SBY button on the mode selector. This resets all the other flight director modes and biases the ADI command cue from view. While depressed, SBY acts as a lamp test causing all mode annunciators to illuminate and the flight director warning flag on the ADI to come in view. When the button is released, the mode annunciator lights extinguish and the flight director warning flag retracts from view.

(14.) Go-Around Mode. The Go-Around Mode is selected by depressing the remote go-around switch. When selected all other modes are reset, and the remote go-around (GA) and yaw damp (YD ENG) annunciators will be illuminated. The ADI command cue receives a wings level command (zero command when roll is zero). The command cue also receives the go-around command which is a 7-degree visual pitch up attitude command. Selecting GA disconnects the autopilot. However, the yaw damper remains on.

Once go-around is selected any roll mode can be selected. The wings level roll command will cancel. The go-around mode is cancelled by selecting another pitch mode, or CWS.

f. Autopilot Controller.

(1.) Description. The autopilot controller (fig. 3-23), provides the means of engaging the autopilot and yaw damper as well as manually controlling the autopilot through the turn knob and pitch wheel. The autopilot system limits are shown in Table 3-1.

(2.) Controls/Indicators and Functions (Autopilot Controller, fig. 3-23):

1. PITCH WHEEL. Movement of the pitch wheel will cancel only ALT HOLD, and ALTSEL CAP. With vertical modes of VS or IAS selected on the mode selector, rotation of the pitch wheel will change the respective displayed vertical mode reference. VS or IAS modes may be cancelled by pressing the mode button on the

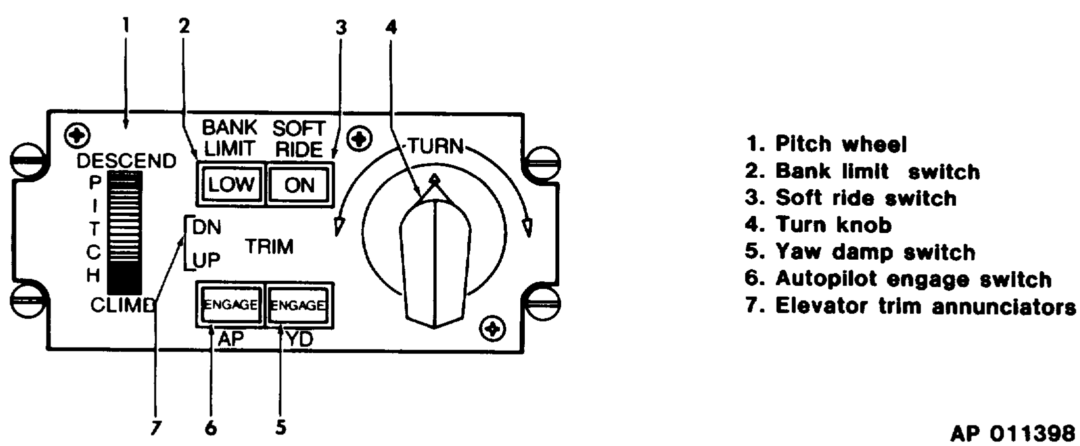


Figure 3-23. Autopilot Con troller

mode selector. If VS or IAS are not selected, the pitch wheel works as described above. The pitch wheel is always disabled during a coupled glide slope.

2. BANK LIMIT PUSHBUTTON/ ANNUNCIATOR SWITCH. Selection of the Bank Limit mode on the autopilot controller provides a lower maximum bank angle while in the Heading Select mode. LOW will illuminate on the Bank Limit switch. The lower bank limit is inhibited and LOW is extinguished during NAV mode captures. If Heading Select is again engaged, Bank Limit will again be illuminated. Pressing Bank Limit when illuminated will return autopilot to normal bank limits.

3. SOFT RIDE PUSHBUTTON/ ANNUNCIATOR SWITCH. Soft ride reduces autopilot gains while still maintaining stability in rough air. This mode may be used with any Flight Director mode selected.

4. TURN KNOB. Rotation of the turn knob out of detent results in a roll command. The roll angle is proportional to and in the direction of the turn knob rotation. the turn knob must be in detent (center position) before the autopilot can be engaged. Rotation of the turn knob cancels any other previously selected lateral mode.

5. YAW DAMP SWITCH. When the autopilot is not engaged, the yaw damper may be utilized by depressing the YD ENGAGE pushbutton.

6. AP ENGAGE PUSHBUTTON/ ANNUNCIATOR SWITCH. The AP ENGAGE switch is used to engage the autopilot. Engaging the autopilot automatically engages the yaw damper. The autopilot may be engaged with the airplane in any reasonable attitude.

7. ELEV TRIM ANNUNCIATORS. The elevator trim annunciator indicates UP or DN when a sustained signal is being applied to the elevator servo. The annunciator should not be illuminated when engaging the autopilot.

(3.) Autopilot Disengagement. The autopilot is normally disengaged by momentarily depressing the control wheel AP DISC switch. The autopilot may however be disengaged by any of the following:

1. Actuation of the control wheel AP DISC button. Disengagement is confirmed by 5 flashes of the AP ENG annunciator.

2. Pressing the respective vertical gyro FAST ERECT button.

3. Actuation of respective compass INCREASE-DECREASE switch.

4. Selection of Go-Around mode. Disengagement is confirmed by the AP ENG annunciator flashing 5 times and illumination of the GA and YD ENG annunciators.

5. Pulling the autopilot CONTROL & AFCS DIRECT circuit breaker.

6. Pressing the autopilot AP ENGAGE pushbutton.

7. Actuation of the manual electric trim.

8. Any of the following malfunctions will cause the autopilot to automatically disengage:

   a. Vertical gyro failure.

   b. Directional gyro failure.

   c. Autopilot power or circuit failure.

   d. Torque limiter failure.

NOTE

Disengaging under any of the previous four conditions will illuminate the AP DISC annunciator and the MASTER WARNING light. Pressing the control wheel AP DISC switch will extinguish the AP DISC annunciator.

(4.) Pitch Sync & Control Wheel Steering (CWS). The CWS push button located on the control wheel (fig. 2-17) allows the pilot to manually change aircraft attitude, altitude, vertical speed and/or airspeed without disengaging the autopilot. After completing the manual maneuver, the CWS pushbutton is released, and the autopilot will automatically

Table 3-1, Autopilot System Limits
(Sheet 1 of 2)

MODE	CONTROL OR SENSOR	PARAMETER	VALUE
Yaw Damper	Yaw Control	Engage Limit	Unlimited
Autopilot Engage		Engage Limit	Roil Up to ±90 deg Pitch Up to ±30 deg
Basic Autopilot	Turn Knob	Roil Angie Limit Roil Rate Limit	±30 deg ±5 deg/sec
	Pitch Wheel	Pitch Angle Limit	±15 deg Pitch
	Heading Hold	Roil Angie Limit	Less than 6 deg and no roll mode selected
Heading Select	Heading SEL Knob on HSI or Remote slew knob on console	Roil Angle Limit Roil Rate Limit	±25 deg ±3.5 deg/sec
VOR	Course Knob, NAV Receiver and TACAN Receiver	Capture Beam Angie intercept (HDG SEL) Roil Angie Limit Course Cut Limit at Capture Capture Point ON Course Roil Angie Limit Crosswind Correction Over Station Course Change Roll Angie Limit	 up to ±90 deg ±25 deg ±45 deg Course Function of beam, beam rate, course error. Max trip point is 175 micro-amps. Min trip point is 30 microamps ±13 deg of Roil Up to ±45 deg Course Error UP to ±90 deg ±17 deg
LOC or APR or BC	Course Knob and NAV Receiver	LOC Capture Beam Intercept Roil Angle Limit Roil Rate Limit Capture Point NAV On-Course Roll Angle Limit Crosswind Correction Limit Gain Programming	 Up to ±90 deg ±25 deg ±5 deg/sec Function of Beam, Beam Rate and Course Error. Max Trip Point is 175 microamps. Min Trip point is 60 micoramps. ±17 deg of roll ±30 deg of course error f (time and TAS) starts at 1200 ft radio altitude, gain reduction = 1 to 5

Table 3-1, Autopilot System Limits
(Sheet 2 of 2)

MODE	CONTROL OR SENSOR	PARAMETER	VALUE
LOC or APR or BC (cont)	GS Receiver and Air Data Computer	Glideslops Capture Beam Capture Pitch Command Limit Glideslope Damping Pitch Rate Limit Gain Programming	 Function of beam and beam rate. Trip point is 30 microamps ±10 deg Vertical velocity f (TAS) f (time and TAS) starts at 1200 ft radio altitude, gain reduction = 1 to .33 f (Radio Alt) starts at 250 ft. gain reduction = .33 at 250 ft to 0 at 0 ft.
GA	Control Switch on Throttles	Fixed Pitch-Up Command, Wings Level	7 deg Pitch Up
Pitch Sync	CWS Switch on Wheel	Pitch Attitude Command	±20 deg max
ALT Hold	Air Data Computer	ALT Hold Engage Range ALT Hold Engage Error Pitch Limit Pitch Rate Limit	0 to 50,000 ft ±20 ft ±20 deg f (TAS)
VS Hold	Air Data Computer	VERT Speed Engage Range VERT Speed Hold Engage Error Pitch Limit Pitch Rate Limit	0 to ±6,000 ft/min. ±30 ft/min ±20 deg f (TAS)
IAS Hold	Air Data Computer	IAS Engage Range IAS Hold Engage Error Pitch Limit Pitch Rate Limit	80 to 450 knots ±5 knots ±20 deg f (TAS)
ALT Preselect	Air Data Computer	Preselect Capture Range Maximum Vertical Speed for Capture Maximum Gravitational Force During Capture Maneuver Pitch Limit Pitch Rate Limit	0 to 50,000 ft ±4,000 ft/min ±20g ±20 deg f (TAS)

resynchronize to the vertical mode. Example: with IAS mode selected, the pilot may depress the CWS pushbutton and manually change airspeed. Once trimmed at the new airspeed the CWS pushbutton is released, and the autopilot will hold this airspeed. If a large pitch attitude change is made, the pilot should trim the aircraft normally before releasing the CWS button.

NOTE

Either pilot's CWS button will permit changing of the autopilot regardless of which pilot has control of the autopilot. However, use of the CWS will cancel the other pilot's flight director GA mode.

3-30. INERTIAL NAVIGATION SYSTEM.

a. Description. The Inertial Navigation System (INS) is a self-contained navigation and attitude reference system. It is aided by (but not dependent upon) data obtained from its own TACAN system, the GPS, the aircraft encoding altimeter and the gyromagnetic compass system. The position and attitude information computed by the INS is supplied to the automatic flight control system, weather radar system, horizontal situation indicator, and radio magnetic indicators. In conjunction with other aircraft equipment, the INS permits operation under Instrument meteorological Conditions (IMC). The INS provides a visual display of present position data in Universal Transverse Mercator (UTM) coordinates or conventional geographic (latitude-longitude) coordinates during all phases of flight. When approaching the point selected for a leg switch, an ALERT light will illuminate informing the pilot of an imminent automatic leg switch or the need to manually insert course change data. The INS may be manually updated for precise aircraft present position accuracy by flying over a reference point of known coordinates. The INS may be updated automatically by the TACAN system or the GPS. Altitude information is automatically inserted into the INS computer by an encoding altimeter whenever the INS is operational.

The Mode Selector Unit (MSU) (fig. 3-24) controls system activation and selects operating modes.

The Control Display Unit (CDU) (fig. 3-25) provides controls and indicators for entering data into the INS and displaying navigation and system status information.

The INS system is protected by the 10-ampere INS AC POWER and the 5-ampere INS HTR AC POWER circuit breakers on the mission AC/DC power cabinet, by the 5-ampere INS CONTROL circuit breaker on the overhead circuit breaker panel and by the 20-ampere circuit breaker on the front of the INS battery unit.

6. Controls/Indicators and Functions (INS Mode Selector Unit, fig. 3-24).

(1.) READY NAV lamp. Illuminates to indicate INS high accuracy alignment has been attained. If attained during ALIGN mode, light remains illuminated until NAV mode is selected. Light illuminates momentarily during alignment, if alignment is accomplished while in NAV mode.

(2.) BAT lamp. Illuminates to indicate INS shutdown due to low battery unit voltage.

(3.) Mode select knob. Controls INS activation and selects operating modes.

(a.) OFF. Deactivates INS.

(b.) STBY. Moving to STBY from OFF mode: Starts fast warmup of system to operating conditions; activates computer so information may be inserted; all INS controlled warning flags will indicate warning. Moving to STBY from any other mode: INS operates as if in attitude reference mode.

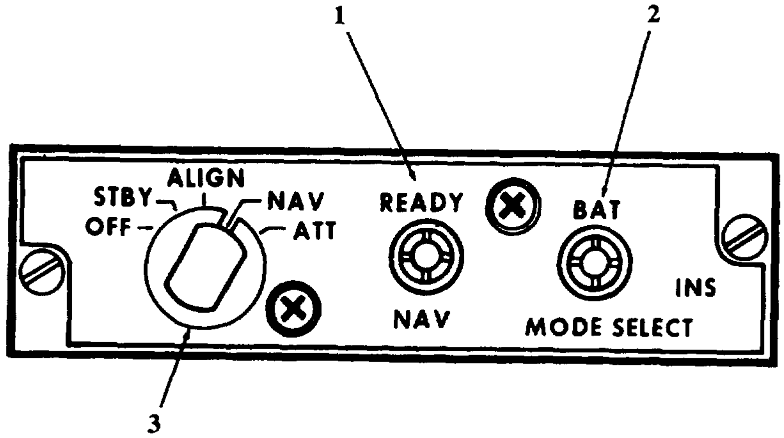
(c.) ALIGN (ground use only, parked). Moving to ALIGN from OFF mode: Leveling starts after fast warmup heaters are off. Moving to ALIGN from STBY: Alignment starts if fast warmup heaters are off. Moving to ALIGN from NAV mode: INS is not downmoded, but will allow automatic shutdown if overtemperature is detected.

(d.) NAV. Activates normal navigation mode after automatic alignment is completed; must be selected before moving aircraft. Moving to NAV from STBY mode causes INS to automatically sequence through STBY and ALIGN to NAV mode, if present position is inserted and aircraft is parked. NAV mode is used to shorten time in STBY and to bypass battery test, if stored heading is valid.

(e.) ATT. Activates attitude reference mode. Used to provide only INS attitude signals. Shuts down computer and CDU leaving only BAT and WARN lights operative. Once selected, INS alignment is lost.

c. Controls/Indicators and Functions, (INS Control Display Unit, fig. 3-25).

(1.) HOLD key. Used with other CDU controls to stop present position display from changing, in order to update position and to display recorded malfunction codes. Lights when pressed first time; goes out when pressed second time or when inserted data is accepted by computer. When



1. READY NAV lamp
2. BAT lamp
3. Mode selector

Figure 3-24. INS Mode Selector Unit

pressed second time, allows displays to resume showing changing current present position.

(2.) ROLL LIM key. Allows selection of Roll Limited steering mode. Press to select mode, key lights. Roll steering output is limited to 10 degrees. Press second time to exit mode, key light extinguishes. Roll steering output returns to normal limit of 25 degrees.

(3.) Data display, left and right. Composed of lights which illuminate to display numbers, decimal points, degree symbols, left and right directions, and latitude or longitude directions.

(4.) INSERT / ADVANCE / HI PREC key. Allows insertion of loaded data into computer. Enters displayed data into INS. When pressed before pressing any numerical key, alternates display of normal and high precision data.

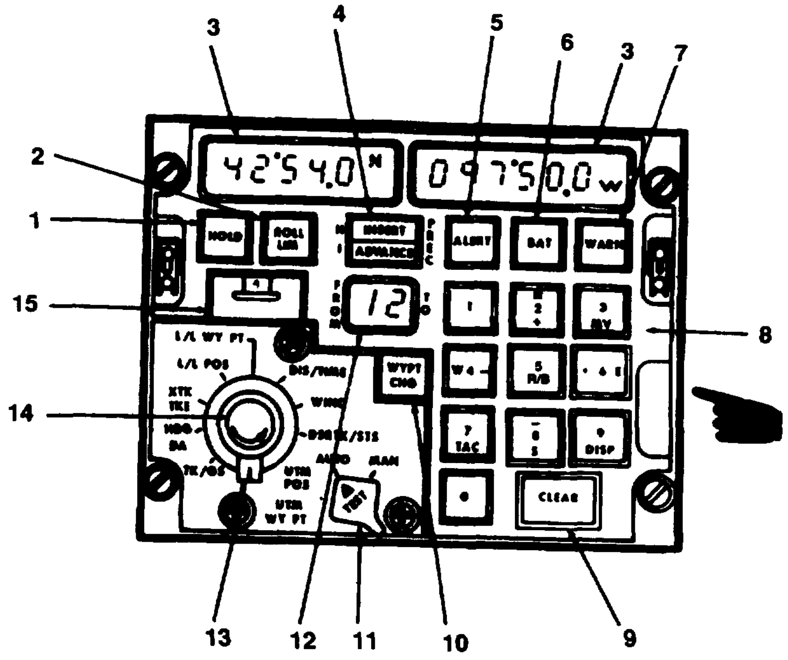
(5.) ALERT lamp. Illuminates amber to alert pilot 1.3 minutes before impending automatic course leg change. Extinguishes when switched to new leg, if AUTO-MAN switch is set to AUTO. Flashes on and off when passing waypoint, if AUTO-MAN switch is set to MAN. Light will extinguish if AUTO is selected or if a course change is inserted.

(6.) BAT lamp. Illuminates amber to indicate loss of 115 VAC power and INS operation on INS battery power.

(7.) WARN /amp. Lights red to alert pilot INS self-test circuits have detected a system fault. Illumination may be caused by continuous or intermittent condition. Intermittent conditions light WARN light until reset by TEST switch. If continuous condition does not degrade attitude operation, light goes out when mode selector is set to ATT.

(8.) Keyboard. Consists of 10 keys for entering load data into data and FROM-TO displays. “N”, “S”, "E". and “W” (on keys 2,8,6 and 4) indicate direction of latitude and longitude. TAC and DISP (on keys “7” and “9”) enable loading and display of TACAN station data. MV/P and DISP (on keys “3” and “9”) are associated with loading and display of magnetic variation and magnetic heading. Pattern steering parameters and DISP (on keys “5” and “9”) are associated with loading and display of UTM coefficients and waypoint move parameters.

(9.) CLEAR key. When pressed, illuminates and erases data loaded into data displays or FROM-TO display. Used to cancel erroneous data. After clearing, data loading can be resumed.



1. HOLD Key
2. ROLL LIM key
3. Data displays
4. INSERT/ADVANCE key
5. ALERT lamp
6. BAT lamp
7. WARN lamp
8. Keyboard
9. CLEAR key
10. WYPT/CHG key
11. AUTO-MAN TEST switch
12. TO/FROM display
13. Data selector
14. Dim knob
15. Waypoint/DME Selector

Figure 3-25. INS Control Display Unit

(10.) WYPT CHG key. When pressed, enables numbers in FROM-TO display to be changed. If INSERT/ADVANCE key is pressed, computer will use navigation leg defined by new number in all navigation computations. If INSERT/ ADVANCE key is not pressed, computer will continue using original numbers in all navigation computations; but distance/time information, based on new leg, may be called up and read in data displays (in case of waypoints). When not in TACAN mix mode, TACAN station number is inserted to display DIS/TIME information.

(11.) AUTO-MAN TEST switch. This is a dual purpose control. When the knob is pressed inward, the TEST switch function is engaged. When the knob is rotated to either the AUTO or MAN setting, the control serves as a selector between those modes.

(a.) AUTO. Selects automatic leg switching mode. Computer switches from one leg to the next whenever waypoint in TO side of the FROM-TO display is reached.

(b.) MAN. Selects manual leg switching mode. Pilot must make waypoint changes manually.

(c.) TEST. When pressed, performs test of INS lights and displays, remote lights and indicators controlled by INS, and computer input/ output operations.

Used with other controls to activate display of numerical codes denoting specific malfunctions and resets malfunction warning circuits.

During alignment, activates the HSI test. Continued pressing of switch provides constant INS outputs to drive cockpit displays in a predetermined fashion.

NOTE

The INS can provide test signals to the Horizontal Situation Indicator (HSI) and connected displays. Pressing TEST switch during STBY, ALIGN, or NAV modes will cause all digits on connected digital displays to indicate “S’s“ and illuminates the HSI “WAYPOINT” and ALERT lights. Additional HSI test signals are provided when INS is in ALIGN and the data selector is at any position other than DSRTK/STS. Under those conditions, pressing TEST switch causes the HSI to indicate heading, drift angle, and track angle error - all at “0°“ or “30°“. At the same time, cross track deviation is indicated at “3.75“ nautical miles (one dot) right or left and INS-controlled HSI flags are retracted from view.

Output test signal are also supplied to the autopilot when INS steering is selected. Rotating AUTO-MAN switch to AUTO and pressing TEST during align furnishes a 15° left bank steering command. A 15° right bank steering command is furnished when the AUTO/MAN switch is set to MAN.

(12.) FROM-TO display. Display numbers defining waypoints of navigation leg being flown or, in the case of a flashing display, displays TACAN station being used. Waypoint numbers automatically change each time a waypoint is reached. Unless flight plan changes during flight, the automatic leg switching sequence will always be 1, 2, 2 3, 3 4....8 9, 9 1, 1 2, etc.

(13.) Data selector. Selects data to be displayed in data displays or entered into INS. The rotary selector has 10 positions. Five positions (L/L POS, L/L WY PT, UTM POS, UTM WY PT and DSRTK/STS) also allow data to be loaded into data display then inserted into computer memory.

(a.) TK/GS. Displays aircraft track angle in left display and ground speed in right display.

(b.) HDG/DA. Displays aircraft true heading in left display and drift angle in right display.

(c.) XTK/TKE. Displays cross track distance in left display and track angle in right display.

(d.) L/L POS. Displays or enters present aircraft position latitude in left data display and longitude in right data display. Both displays indicate degrees and minutes to nearest tenth of a minute. This position also enables the insertion of present position coordinates during alignment and present position updates.

(e.) L/L WY PT. Displays or enters waypoint and TACAN station data, if used in conjunction with the waypoint/TACAN selector. This position will also cause display of inertial present position data when the HOLD key is illuminated.

(f.) DIS/TIME. Displays distance from aircraft to TACAN station or any waypoint, or between any two waypoints in left display. Displays time to TACAN station or any waypoint, or between any two waypoints, in right display.

(g.) WIND. Displays wind direction in left display and wind speed in right display, when true airspeed is greater than the air data system lower limit (115 to 400 KIAS).

(h.) DSRTK/STS. Displays desired track angle to nearest degree in the left data display, and INS system status in right data display.

(i.) UTM POS. Displays or enters aircraft position in Universal Transverse Mercator (UTM) coordinates, with northing data in kilometers in left display and easting data in kilometers in right display. The extra precision display shows meters.

(j.) UTM WY PT. Displays or enters waypoint and TACAN station data in UTM coordinates. Also enables loading and display of spheroid coefficients if GRID and DISP keys are pressed simultaneously.

(14.) Dim knob. Controls intensity of CDU key lights and displays.

(15.) Waypoint/DME selector. Thumbwheel switch, used to select waypoints for which data is to be inserted or displayed. Waypoint station "0" is for display only and cannot be loaded with usable data.

d. INS - Normal Operating Procedures.

NOTE

The following data will be required prior to operating the INS: latitude and longitude (Geographical) or Universal Transverse Mercator (UTM) coordinates of aircraft during INS alignment. This information is necessary to program the INS computer during alignment procedure.

NOTE

When inserting data into INS computer, always start at left and work to right. The first digit inserted will appear in right position of applicable display. It will step to left as each subsequent digit is entered. The degree sign, decimal point, and colon (if applicable) will appear automatically.

(1.) Preflight Procedure.

CAUTION

Insure that cooling air is available to navigation unit before turning the INS on.

NOTE

Aircraft must be connected to a ground power unit if INS alignment is performed prior to engine starting. In this event, the engines must not be started until after the INS is placed in the NAV mode.

1. Applicable circuit breakers - Check depressed.
2. Mode selector switch (MSU, fig. 3-23) - ALIGN. Confirm following:
   a. FROM-TO display (CDU, fig. 3-24) indicates "1 2".
   b. INSERT/ADVANCE pushbutton light (CDU) illuminates.
   c. BAT light (MSU, fig. 3-23) illuminates for approximately 12 seconds at alignment state "8", then extinguishes.
3. Dim knob (CDU) - Adjust for optimum brightness of CDU displays.
4. AUTO-MAN TEST switch (CDU) - AUTO.
5. Data selector (CDU) - L/L POS or UTM POS, as desired. Observe coordinates of last present position prior to INS shutdown appear in data displays.

NOTE

Aircraft must not be towed or taxied during INS alignment. Movement of this type during alignment causes large navigation errors. If aircraft is moved during alignment, restart alignment by setting mode selector switch to STBY, then back to ALIGN and reinserting present position.

NOTE

Passenger or cargo loading in the aircraft could cause the type of motion which affects the accuracy of alignment. Any activity which causes the aircraft to change attitude shall be avoided during the alignment period.

6. AUTO-MAN TEST switch (CDU) - Press and hold for test. Confirm following on CDU:
7. Left and right data displays indicate "88°88.8 N/S" and "88°88.8 E/W" respectively.

8. FROM-TO display indicates "8.8".

9. The following pushbuttons and lights illuminate: ROLL LIM, HOLD, INSERT/ADVANCE, WYPT CHG, ALERT, BAT (on CDU and MSU), WARN, READY NAV and WYPT on pilot's HSI.

10. AUTO-MAN TEST switch (CDU) - Release. Confirm data displays indicate coordinates in computer memory.

11. If UTM coordinates are to be used, verify that appropriate grid coefficients have been loaded.

(2.) Insert present position:

NOTE

Prior to pressing INSERT/ADVANCE pushbutton, any incorrectly loaded data can be corrected by pressing the CLEAR pushbutton and reloading correct data.

NOTE

While parked aircraft is undergoing alignment, encoding altimeter will supply the field elevation (aircraft pressure altitude) into INS.

NOTE

Once present position has been inserted and computer has advanced to alignment state "7", present position cannot be reinserted without downmoding to STBY and restarting alignment.

NOTE

If longitude and latitude coordinates are being used, skip following step (a) -2- and proceed with step (b) -2-.

(a.) Insert UTM coordinates of aircraft present position:

1. Data selector - UTM POS. Observe that prior to initial load, INSERT/ADVANCE pushbutton light illuminates.

2. To load zone and easting values - Press keys in sequence, starting with "E". Example: Zone 16, 425 km East = E16 425. Observe that zone and easting in kilometers appear in right data display as keys are pressed.

3. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light remains illuminated.

4. To load northing data - Press keys in sequence, starting with "N" or "S" to indicate north or south hemisphere. Example: 4749 km North = N 4749. Observe northing kilometers appear in left data display as keys are pressed.

5. INSERT/ADVANCE pushbutton - Press. Observe that the pushbutton light remains illuminated.

6. INSERT/ADVANCE pushbutton -'Press. Observe extra precision display for present position northing and easting, to the nearest meter, appears in left and right data displays, respectively.

7. To load extra precision easting data - Press keys in sequence, starting with "E". Example: 297 m East = E 297. Observe that easting meters appear in right data display as keys are pressed.

8. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light remains illuminated.

9. To load extra precision northing data - Press keys in sequence, starting with "N" "S". Example: 901 m North = N 901. Observe that northing meters appear in left data displays as keys are pressed.

NOTE

Extra precision values are always added to normal values regardless of which key (N/S) is pressed to initiate the entry. The normal entry establishes the hemisphere.

10. INSERT/ADVANCE pushbutton - Press. Observe latitude and longitude data is displayed in UTM and INSERT/ ADVANCE pushbutton light extinguishes.

NOTE

The computer will convert coordinates in the overlap area; however display values will reference appropriate zone.

NOTE

The “W“ key may be used to initiate easting entries; however computer will always interpret such entries as an “E“ input. “E“ will be displayed in normal UTM display.

NOTE

Extra precision values are always added to normal values. As an example, South 4,476.995 m will display “4476S“ in normal display and “995“ in extra precision display. There is no rounding between the two displays.

(b.) To insert geographic coordinates of aircraft present position:

NOTE

Prior to pressing INSERT/ADVANCE pushbutton, any incorrectly loaded data can be corrected by pressing the CLEAR pushbutton and loading correct data.

1. Data selector - L/L POS. Observe that, prior to initial load, the INSERT/ ADVANCE pushbutton light is illuminated.
2. To load latitude data - Press keys in sequence, starting with “N” or “S“ to indicate north or south. Example: 42°54.0' North = N 4 2 5 4 0. Observe that latitude appears in left data display as keys are pressed.
3. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light remains illuminated.
4. To load longitude data - Press keys in sequence, starting with “W” or “E” to indicate west or east. Example: 87°54.9’ West = W 8 7 5 4 9. Observe that longitude appears in right data display as keys are pressed.
5. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.
6. Data selector - DSRTK/STS. Confirm:
   a. Left data display indicates desired track angle in computer memory.
   b. Right data display indicates --84, -74, -64, or --54, depending on which alignment state the computer has reached.

NOTE

After present position has been inserted and computer has advanced to state “7“, present position cannot be reinserted without downmoding to STBY and restarting alignment.

7. Data selector (CDU) - DSRTK/STS. Observe left-hand data display indicates the desired track in computer memory and right data display indicates status "-194“.

NOTE

If fourth digit from right is blank, a valid heading has not been stored. Proceed with normal preflight procedure.

8. Monitor data display for system alignment state “9“ to alignment state “8“. Observe right data display will be “---184“.
9. Monitor data display for malfunction codes. Observe if the 26V 400 Hz power is off, “.03184“ will appear in the right data display and WARN light illuminates. If magnetic compass system is off, “.03184“ will appear in right data display and WARN light is extinguished.
10. If there are malfunction codes, proceed to ABNORMAL PROCEDURES in this chapter.

NOTE

To achieve best accuracy, engine start and heavy loading activity should be delayed until entry into NAV mode.

NOTE

Waypoint data and TACAN station data may be loaded any time after turn-on.

(3.) Verify UTM Grid Coefficients:

1. Data selector (CDU) - UTM WY PT.
2. Keys “5” and “9“ - Press simultaneously. Observe FROM-TO display is blank. Earth flatness coefficient appears in left display. The relative earth radius, in meters, appears in right display.

NOTE

These values are retained from turn-on to turn-on unless changed by operator.

3. Verify that values correspond to those required for spheroid being used.

NOTE

Values for various spheroids are listed in table 3-1.

4. If values are correct, return CDU to normal display mode by momentarily setting data selector to any position except UTM WY PT. If values are to be changed, continue with following steps:

(4.) Abbreviated INS Interface Test - As required.

NOTE

Assuming a level aircraft, attitude indicators will become level during alignment state “8“ and remain level in all modes until INS is shut down. Warning indicators for INS attitude signals from the INS are valid while attitude sphere display is level.

NOTE

The INS can provide test signals to the Horizontal Situation Indicator (HSI) and connected displays. Pressing TEST switch during STBY, ALIGN, or NAV mode causes all digits on connected digital displays to indicate “8’s,” and lights the WYPT on the pilot’s HSI and the ALERT light. Additional HSI test signals are provided when INS is in ALIGN and data selector is at any position other than DSRTK/STS. Under those conditions, pressing TEST switch causes HSI to indicate heading, drift angle, and track angle error - all at “0°" or “30°.“ At the same time, cross track deviation is indicated at “3.75“ nautical miles (one dot) right or left and INS-controlled HSI flags are retracted from view.

NOTE

Output test signals are supplied to the autopilot when INS steering is selected. Rotating AUTO/MAN switch to AUTO and pressing TEST during alignment furnishes a 15° left bank steering command. A 15° right bank steering command is furnished when AUTO/MAN switch is set to MAN.

NOTE

The quick test procedure may be performed any time after alignment State "8" is reached and prior to entry into NAV.

1. Mode selector (MSU) - ALIGN. Observe CDU displays are illuminated.
2. Data selector (CDU) - DSRTK/STS. Monitor right data display until state "8" (or lower) is reached. Observe right data display is ---N4, where "N" is not "9".
3. AUTO-MAN switch (CDU)-MAN.
4. Data selector - Set to any position except DSRTK/STS.
5. INS - Couple to flight director and autopilot, as applicable. After performing the preceeding step, observe:
   a. All lights on MSU - Check illuminated.
   b. All lights on CDU - Check illuminated. All "8's" displayed.
   c. HSI - All angles 30°. Cross-track deviation bar one dot right. All INS flags retracted.
   d. Flight Director/Autopilot - A 15° steering command is issued.
   e. Mission Control Panel - INS UPDATE and NO INS UPDATE annunciator illuminated.
6. CDU TEST switch - Hold depressed, and rotate AUTO-MAN switch to AUTO. Observe all indications are as in step -6- except a 15° left steering command is issued. On HSI, all angles are "0°" and cross-track deviation bar is one dot left.
7. CDU TEST switch - Release. If desired, decouple INS. Observe that operation returns to normal.

(5.) To program destinations or TACAN coordinates:

NOTE

If latitude and longitude (Geographic) coordinates are being used, skip following procedure (5)(a.) and execute next procedure (5)(b.). Enter all of the data for a given destination or TACAN before starting to enter data for another.

(a.) Insertion of UTM waypoint coordinates:

1. Data selector - UTM WY PT. Data displays will indicate last coordinates inserted into related waypoint.
2. Thumbwheel - Set to waypoint number to be loaded.

NOTE

UTM data may be loaded in any order and, until final entry, a value may be reloaded.

3. To load zone and easting - Press keys in sequence, starting with "E". Example: Zone 16, 425 km East = E16 425. Observe that zone and easting in kilometers appear in the right data display as keys are pressed.
4. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light is illuminated.
5. To load northing press keys in sequence, starting with "N" or "S" to indicate north or south hemisphere. Example: 4749 km North = N 4749. Observe that northing kilometers appear in the left data display as keys are pressed.
6. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light remains illuminated.
7. INSERT/ADVANCE pushbutton - Press. Observe that

TABLE 3-2. VARIOUS VALUES FOR UTM GRID COEFFICIENTS

SPHEROID	FLATNESS COEFFICIENT	RELATIVE RADIUS
International	29700	8388 m
Clark 1866	29498	8206 m
Clark 1880	29346	8249 m
Everest	30080	7276 m
Bessel	29915	7397 m
Modified Everest	30080	7304 m
Australian National	29825	8160 m
Airy	29932	7563 m
Modified Airy	29932	7340 m

SOURCE: Universal Transverse Metcator Grid Technical Manual, TM 5-241-8, Headquarters, Department of the Army, 30 April 1973, page 4.

Flatness Coefficient: 100 (I/f)

Relative Radius: a-6,3700.000

an extra precision display related to resident value of northing and easting, to the nearest meter, appears in left and right data displays, respectively.

8. To load extra precision easting value - Press keys in sequence starting with "E". Example: 297 m East = E 297. Observe that easting meters appear in the right data display as keys are pressed.

9. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light remains illuminated.

10. To load extra precision northing value - Press keys in sequence, starting with "N" or "S". Example: 901 m North = N 901. Observe that northing meters appear in left data display as keys are pressed. The value is always added to the normal value regardless of which key (N/S) is pressed to initiate the entry. The normal entry establishes the hemisphere.

11. INSERT/ADVANCE pushbutton - Press. Within 3 seconds computer converts input into latitude and longitude for storage in memory. The stored value is again converted to UTM for display. The INSERT/ADVANCE pushbutton light extinguishes. Conversion routines may cause displays to change by up to 10 m.

NOTE

The computer will convert coordinates in overlap area; however, data display values will reference appropriate zone.

NOTE

The "W" key may be used to initiate easting entries; however, the computer will always interpret such entries as an "E" input. "E" will be displayed in normal UTM data display.

NOTE

The extra precision values are always added to normal values. As an example, South 4,476.995 m will display “4476 (S)“ in the normal display and “995” in extra precision display. In other words, there is no rounding between the two displays.

12. Repeat steps 2 through 11 for each waypoint to be loaded.

NOTE

A load cycle may be terminated prior to insertion of all four values by moving data selector or thumbwheel.

(b.) Insertion of geographic waypoint coordinates:

1. Data selector - L/L WY PT. Data displays indicate last coordinates inserted into the selected waypoint.
2. Thumbwheel - Set to waypoint number to be loaded.
3. To load latitude - Press keys in sequence, starting with “N“ or “S” to indicate north or south. Example: 42° 54.0' North = N 4 2 5 4 0. Observe that INSERT/ ADVANCE pushbutton light illuminates when first key is pressed, and latitude appears in left data display as keys are pressed.
4. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.
5. To load longitude - Press keyboard keys in sequence, starting with “W“ or “E“ indicating west or east. Example: 87°54.9’ West = W 8 7 5 4 9. Observe that INSERT/ADVANCE pushbutton light illuminates when first key is pressed, and longitude appears in display as keys are pressed.
6. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.
7. If desired to insert extra precision coordinate data -Press INSERT/ADVANCE pushbutton. Observe that arc-seconds for loaded latitude and longitude, to nearest tenth of a second, appear in left and right data displays, respectively.
8. To load related arc-second values for latitude - Press keys in sequence, starting with “N“. Example: 35.8“ North = N 358.
9. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.
10. To load related arc-second values for longitude - Press keys in sequence, starting with “E“. Example: 20.1“ East - E 201.
11. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.
12. Repeat steps -2- through -11- for each waypoint to be loaded.

NOTE

In above example, if INSERT/ ADVANCE pushbutton was pressed, the following normal display would appear: “42°54.5 (N)“ and 87°54.3(W). The extra precision values are added to normal values and normal data displays are not rounded off.

NOTE

The normal geographic coordinates must always be loaded prior to extra precision values.

NOTE

The directions “N“ or “S” and “E“ or “W” are established during normal coordinate entry. Either key may be used to initiate entry during extra precision loads and values will be added to the extra precision value without affecting direction.

NOTE

It is characteristic of the computer display routine to add “0.2“ arc-seconds to any display of “59.9” arc-seconds. The value in computer is as loaded by operator.

(6.) To insert TACAN coordinates:

(a.) Insertion of UTM TACAN station data:

NOTE

Prior to pressing the INSERT/ADVANCE pushbutton, any incorrectly loaded data can be corrected by pressing CLEAR pushbutton and loading correct data.

1. Data selector - UTM WY PT.
2. Keys “7“ and “9” - Press simultaneously. Observe that number of TACAN station being used for navigation flashes on and off in “FROM-TO“ display and data displays indicate coordinates of station selected by thumbwheel.
3. Thumbwheel - Set to number of station to be loaded. Confirm thumbwheel is in detent.
4. Station “0” cannot be loaded. Observe that if number of station to be loaded is same as number of the TACAN station currently being used, number in “FROM-TO“ display will be set to “0“ when TACAN data is loaded.
5. To load zone and easting - Press keys in sequence, starting with “E“. Example: Zone 16, 425 km East = E16 425. Observe that zone and easting in kilometers appear in the right display as keys are pressed.
6. INSERT/ADVANCE pushbutton - Press. Observe that pushbutton light is illuminated.
7. To load northing - Press keys in sequence, starting with “N“ or “S” to indicate north or south hemisphere. Example: 4749 km North = N 4749. Observe that northing kilometers appear in left data display as keys are pressed.
8. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light remains illuminated.
9. INSERT/ADVANCE pushbutton - Press. Observe that extra precision display related to the resident value of northing and easting, to nearest meter, appears in left and right data displays, respectively.

NOTE

UTM data may be loaded in any order. Until final fourth entry, actuation of INSERT/ADVANCE pushbutton without a prior data entry will cause normal and extra precision UTM data to be alternately displayed.

10. To load extra precision easting value - Press keys in sequence, starting with “E”. Example: 297 m East = E 297. Observe that easting meters appear in right data display as keys are pressed.
11. INSERT/ADVANCE pushbutton - Press. Observe pushbutton remains illuminated.
12. To load extra precision northing value - Press keys in sequence, starting with “N” or “S”. Example: 901 m North = N 901. Observe that northing meters appear in left data display as keys are pressed. The value is always added to -ormal value regardless of which key (N/S) is pressed to initiate entry. The normal entry establishes hemisphere.

13. INSERT/ADVANCE pushbutton - Press. - 10erve that during the next 1 to 3 seconds, the computer converts input into latitude and longitude for storage in memory. The stored value is again converted back to UTM for display to operator. The INSERT/ADVANCE pushbutton light extinguishes. The conversion routines may cause data displays to change by up to 10 m.

NOTE

The computer will convert coordinates in overlap area; however, data display values will reference appropriate zone.

NOTE

The “W” key may be used to initiate easting entries; however, the computer will always interpret such entries as an “E” input. “E“ will be displayed in normal UTM data display.

NOTE

The extra precision values are always added to normal values. As an example, South 4,476.995 m will display “4476 S“ in normal display and “995” in extra precision display. In other words, there is no rounding between the two displays.

14. INSERT/ADVANCE pushbutton - Press. Observe right data display indicates last previously inserted altitude, and left data display is blank.

15. To indicate the following load is altitude - Press keys “4” or “6“. Observe INSERT/ADVANCE pushbutton light illuminates.

16. To load altitude in feet - Press keys in sequence. Example: 1230 ft = 1230. Observe that numbers appear in right data display as keys are pressed.

NOTE

Altitude inputs are limited to 15,000 feet.

17. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.

18. INSERT/ADVANCE pushbutton - Press. Observe that left data display indicates last previously inserted channel number, and right display is blank.

19. To indicate following load is channel number - Press keys "2" "8" Observe INSERT/ADVANCE pushbutton light illuminates.

20. To load channel number - Press keys in sequence. Example: 109 = 109. Observe number appears in left data display as keys are pressed.

21. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.

NOTE

Any number will be accepted by INS; however, only stations with a channel number within range of “1” through “126“ will be used for TACAN mixing.

NOTE

Channel number has an implied “X“ suffix.

NOTE

Degree symbol (°)should be disregarded when reading altitude and data display.

22. INSERT/ADVANCE pushbutton - Press. Observe station northing, zone, and easting reappear.

23. Repeat steps -1- through -22- for each TACAN station.

24. To return INS to normal mode, momentarily set data selector to UTM POS.

(b.) Insertion of geographic TACAN station data:

NOTE

Prior to pressing INSERT/ADVANCE pushbutton, any incorrectly loaded data can be corrected by pressing CLEAR pushbutton and loading correct data.

1. Data selector - L/L WY PT.

NOTE

If number of station to be loaded is same as number of TACAN station currently being used, number in "FROM-TO" display will be set to "0" when TACAN data is loaded.

2. Keys "7" and "9" - Press simultaneously. Observe that number of TACAN station being used for navigation flashes on and off in "FROM-TO" display. Data displays indicate coordinates of station selected via thumbwheel.

3. Thumbwheel - Set to number of station being loaded. (Insure thumbwheel is in detent.)

NOTE

Station "0" cannot be loaded.

4. To load latitude - Press keys in sequence, starting with "N" or "S" to indicate north or south. Example: 42° 54.0' North = 4 2 5 4 0. Observe that INSERT/ADVANCE pushbutton light illuminates when first key is pressed.

5. INSERT/ADVANCE pushbutton - Press Observe pushbutton light extinguishes.

6. To load longitude - Press keys in sequence, starting with "W" or ,"E" indicating west or east. Example: 87° 54.9'West = W 8 7 5 4 9. Observe that INSERT/ADVANCE pushbutton light illuminates when first key is pressed, and longitude appears in data display as keys are pressed.

7. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.

8. INSERT/ADVANCE pushbutton - Press. Observe that the arc-seconds related to loaded latitude and longitude, to nearest tenth of a second, appear in left and right data display, respectively.

9. If extra precision coordinate data is to be inserted -Press keys in sequence, starting with "N", to load related arc-second values for latitude. Example: 35.8" North = N 358.

10. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.

11. To load related arc-second values for longitude - Press keys in sequence, starting with "E". Example: 20.1" East - E 201.

12. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.

NOTE

In above example, if INSERT/ADVANCE pushbutton were pressed, the following normal display would appear: "42° 54.5 N" and "87° 54.3 W". The extra precision values are added to normal values and normal displays are not rounded off.

NOTE

The normal geographic coordinates must always be loaded prior to extra precision values.

NOTE

The directions “N“ or “S” and “E” or “W“ are established during normal coordinate entry. Either key may be used to initiate entry during extra precision loads and the values will be added to extra precision value without affecting direction.

NOTE

It is characteristic of the computer display routine to add 0.2 arc-seconds to any display of 59.9 arc-seconds. The value in computer is as loaded by operator.

13. INSERT/ADVANCE pushbutton - Press. Observe that right data display indicates last previously inserted altitude, and left data display is blank.
14. To indicate the following load is altitude - Press key “4“ or “6“. Observe INSERT/ADVANCE pushbutton light illuminates.
15. To load altitude first - Press keys in sequence. Example: 1230 ft = 1230. Numbers appear in right data display as keys are pressed.

NOTE

Altitude inputs are limited to 15,000 feet.

16. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.
17. INSERT/ADVANCE pushbutton - Press. Observe that left data display indicates last previously inserted channel number, and right data display is blank.
18. To indicate the following load is channel number - Press key “2” or “8“. Observe INSERT/ADVANCE pushbutton light illuminates.
19. To load channel number - Press keys in sequence. Example: 109 = 109. Numbers appear in left data display as keys are pressed.
20. INSERT/ADVANCE pushbutton - Press. Observe pushbutton light extinguishes.

NOTE

Any number will be accepted by the INS; however only stations with a channel number within range of 1 through 126 will be used for TACAN mixing.

NOTE

The channel number has an implied “X“ suffix.

NOTE

Decimal points and degree symbols should be disregarded when reading altitude and channel number displays.

21. INSERT/ADVANCE pushbutton - Press. Observe station latitude and longitude reappear.
22. Repeat steps -3- through -19- for each TACAN station.
23. To return INS to normal display modes, momentarily set data selector to L/L POS.

(7.) Designating fly-to destinations:

1. Data selector - L/L WY PT or UTM WY PT, as required.
2. Waypoint thumbwheel - Select destination number. Observe number of destination waypoint appears in “TO” part of FROM-TO display.
3. Data selector - HDG/DA. Observe present aircraft heading appears, to nearest tenth of degree, in left data display; also drift angle, to nearest degree, appears in right data display.

NOTE

Navigation information is now available from the INS for display on the pilot and co-pilot RMI's and on the pilot and copilot HSI's, as determined by the COURSE INDICATOR and RMI select switches.

(8.) *To fly selected INS course:*

1. Pilot's COURSE INDICATOR switch - INS.
2. Pilot's RMI select switch - INS.
3. Horizontal Situation Indicators (pilot's and/or copilot's HSI) - Steer toward indicators.
4. CDU ALERT light - Monitor. Observe illumination approx 1.3 minutes before reaching point for automatic leg switch. Indicator flashes on and off after passing a waypoint, if AUTO-MAN switch is in MAN.

(9.) *Aided TACAN operation:*

NOTE

If high accuracy alignment is required, wait for the READY NAV light before selecting NAV mode.

1. Mode selector - NAV.
2. Data selector - DSRTK/STS.
3. Key "4" - Press. Observe right data display is "000004" and INSERT/ADVANCE pushbutton light is illuminated.
4. INSERT/ADVANCE pushbutton - Press. Observe right data display is "1 -XX4" and INSERT/ ADVANCE pushbutton light is extinguished.

NOTE

Every 30 seconds, the INS will select next eligible TACAN station in sequence for updating. To be eligible, TACAN station range must be between 5 and 150 nm and channel between 1 and 126.

5. Data selector - L/L WY PT or UTM WY PT.
6. Keys "7" and "9"- Press simultaneously. Observe channel number of the TACAN station being used for navigation flashes on and off. Data displays indicate coordinates of station selected via thumbwheel.
7. To monitor station selection - Observe FROM-TO data display. Observe only the number of stations eligible for mixing will be displayed. A "0" indicates that none of the 9 stations are eligible for selection.
8. Monitor "INS UPDATE" annunciator.

NOTE

Mixing will not be annunciated if: (a) TACAN control is inappropriately set; (b) TACAN station data loaded in error; (c) aircraft look-down angle is greater than 30"; (d) horizontal ground distance is less than two times the altitude. When 2 minutes elapse without an update, the "NO INS UPDATE" annunciator will illuminate.

9. To return INS display to normal - Set data selector to any position except WYPT or DIS/TIME.
10. To monitor program of mix - Set data selector to DSRTK/STS. (Observe Accuracy Index (AI) will decrement to "0".)

NOTE

To insure favorable geometry during the update process, the following TACAN station criteria should be observed:

11. One station must be at least 15 nm off course.
12. For optimum single TACAN updating, update should continue until aircraft has passed the station.
13. For optimum dual TACAN updating, use one "off-track" TACAN station and one "on-track" station.
14. For optimum multi-TACAN station updating, the stations should

be evenly distributed in azimuth around the aircraft.

15. Waypoint thumbwheel - Set to number of first TACAN station to be used. Observe selected station number is displayed on the "TO" side of FROM-TO data display.

16. Update GPS.

(10.) Switching from aided to unaided inertial operation.

1. Data selector - DSRTK/STS.

2. Key "5" - Press. Observe INSERT/ADVANCE pushbutton light illuminates; 000005 appears in right data display.

3. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ ADVANCE pushbutton light extinguishes. Data display returns to normal with "5" appearing in first digit of right display.

NOTE

Benefits of previous aiding are maintained but no additional automatic updates will be made.

(11.) To obtain readouts from INS:

NOTE

The computer is assumed to be in the NAV mode for all data displays.

(a.) System status: Data selector - DSRTK/STS. Observe numbers indicating system status appear in right data display.

(b.) Geographic present position: Data selector - L/L POS. Observe latitude and longitude of present position appear in left and right data displays, respectively. Both displays are to tenth of a minute.

(c.) UTM position: Data selector - UTM POS. Observe northing and zone with easting of present position appear in left and right displays, respectively. Both displays are in kilometers.

(d.) True heading and MAG heading: Data selector - HDG/DA. Observe aircraft true heading appears in left data display to nearest tenth of a degree. Press and hold keys 3 and 9 simultaneously. MAG heading appears in left data display to nearest tenth of a degree. Release keys 3 and 9. Left display reverts to true heading.

(e.) Ground speed: Data selector - TK/GS. Observe ground speed appears in right data display to nearest knot.

(f.) Ground track angle: Data selector - TK/GS. Observe ground track angle appears in left data display to nearest tenth of a degree.

(g.) Drift angle: Data selector - HDG/DA. Observe drift angle appears in right data display to nearest degree.

(h.) Wind speed and direction: Data selector - WIND. Wind direction appears in left data display to nearest degree and wind speed appears in right display to nearest knot.

(i.) Desired track angle: Data selector - DSRTK/STS. Observe desired track angle in right data display to nearest degree.

(j.) Track angle error: Data selector - XTK/TKE. Observe track angle error appears in right data display to nearest degree.

(k.) Cross track distance: Data selector - XTK/TKE. Observe cross track distance appears in left data display to nearest nautical mile.

(l.) Distance and time to next waypoint: Data selector - DIS/TIME. Observe distance to next waypoint, shown in "TO" side of FROM-TO display, appears in left data display to nearest nautical mile. Observe time to reach next waypoint at present ground speed appears in right data display to nearest tenth of a minute.

(m.) Extra precision geographic present position display:

1. Data selector - L/L POS. Latitude and longitude of present position, to nearest tenth of a minute, appears in left and right data displays, respectively.

2. INSERT/ADVANCE pushbutton - Press. Observe arc-seconds related to present position latitude and longitude, to nearest tenth of a second, appear in left and right data displays, respectively.

(n.) Geographic present inertial position display.

1. Data selector - L/L WY PT.

2. HOLD pushbutton - Press. Observe HOLD pushbutton light illuminates, latitude and longitude of present inertial position to a tenth of degree appear in left and right data displays, respectively.

NOTE

While HOLD pushbutton light is extinguished, TACAN updates are inhibited.

3. INSERT/ADVANCE pushbutton - Press. Observe arc-second related to present inertial position latitude and longitude, to nearest tenth of a second, appears in left and right data displays, respectively.

4. HOLD pushbutton - Press. Observe INS returns to normal operation and HOLD pushbutton light extinguishes.

(o.) UTM present inertial position display:

1. Data selector - UTM WY PT.

2. HOLD pushbutton - Press. Observe HOLD pushbutton light illuminates. Northing and zone with easting of the present inertial position in kilometers appear in left and right data displays, respectively.

NOTE

While HOLD pushbutton light is illuminated, TACAN updates are inhibited,

3. INSERT/ADVANCE pushbutton - Press. Observe extra precision values related to present inertial position northing and easting, to nearest meter, appear in left and right data displays, respectively.

4. HOLD pushbutton - Press. Observe INS returns to norma1 operation and HOLD pushbutton light extinguishes.

(p.) Distance and time to waypoint other than next waypoint:

1. WYPT CHG pushbutton - Press. Observe WYPT CHG and INSERT/ADVANCE pushbutton light illuminates.

2. Key "0" - Press. Observe "FROM" side of FROM-TO data display changes to "0".

3. Key corresponding to desired waypoint - Press. Observe "TO" side of FROM-TO data display changes to desired waypoint number.

NOTE

Do not press INSERT/ADVANCE pushbutton. This would cause an immediate flight plan change.

4. Data selector - DIS/TIME. Observe distance to desired waypoint appears in left data display to nearest nautical mile. Time to reach desired waypoint at present groundspeed appears in right data display to nearest tenth of a minute.

5. CLEAR pushbutton - Press. Observe INS returns to normal operation. Observe INSERT/ADVANCE and WYPT CHG pushbutton lights extinguish. Waypoints defining current navigation leg appear in FROM-TO display.

(q.) Distance and time between any two waypoints:

1. WYPT CHG pushbutton - Press. Observe WYPT CHG and INSERT/ADVANCE pushbutton lights illuminate.

2. Keys corresponding to desired waypoints - Press in sequence. Observe desired waypoint numbers appear in

FROM-TO data display as keys are pressed.

NOTE

Do not press INSERT/ADVANCE pushbutton. This would cause an immediate flight plan change.

3. Data selector - DIS/TIME. Observe distance between desired waypoints appears in left data display to nearest nautical mile. Time to travel between desired waypoints at present ground speed appears in right data display to nearest tenth of a minute.

4. CLEAR pushbutton - Press. Observe INS returns to normal operation. Observe WYPT CHG and INSERT/ADVANCE pushbutton light extinguishes. Waypoints defining current navigation leg appear in FROM-TO data display.

(r.) Distance to any TACAN station:

1. Data selector - DIS/TIME. Observe distance to next waypoint to nearest nautical mile is in left data display. Time to next waypoint to nearest tenth of a minute is in right data display.

2. Keys "7" and "9" - Press simultaneously. Observe number of TACAN station being used for navigation flashes on and off in FROM-TO display. Distance to TACAN station to nearest nautical mile is in left data display. Time to next waypoint is in right data display.

3. If in aided TACAN operation - Monitor display. Observe station number is selected every 30 seconds.

4. If not in aided TACAN operation - Perform steps 5 through 7.

5. WYPT CHG pushbutton - Press. Observe INSERT/ADVANCE and WYPT CHG pushbutton lights illuminate. Station number flashing discontinues.

6. Key indicating desired TACAN station number - Press. Observe number will appear in left digit location of FROM-TO data display.

NOTE

If wrong key is pressed, press CLEAR; displays will revert to that indicated in step 2.

7. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ADVANCE and WYPT CHG pushbutton lights extinguish. The loaded digit will appear in right position of FROM-TO display and will be flashing on and off. Distance to that station to nearest nautical mile appears in left data display. The right display continues to display time to next waypoint.

8. Data selector - WIND, momentarily. Returns INS to normal display mode.

NOTE

If in aided TACAN operation and if the desired station is not being selected, exit aided operation per procedure: "Switching From Aided to Unaided Inertial Operation", perform steps 1 thru 8, and then return to aided operation per procedure: "Aided TACAN Operation".

(s.) Coordinates of any waypoint:

1. Data selector - L/L WY PT or UTM WY PT.

2. Waypoint thumbwheel - Set desired waypoint. Observe following:

   a. L/L WY PT: latitude and longitude of desired waypoint, to a tenth of a minute, appear in left and right data displays respectively.

b. UTM WY PT: Northing and zone with easting of desired waypoint, to a kilometer, appear in left and right data displays respectively.

3. INSERT/ADVANCE pushbutton - Press. Observe the following:

a. L/L WY PT: The arc-seconds related to desired waypoint latitude and longitude, to a tenth of an arc-second appear, in left and right displays respectively.

b. UTM WY PT: The extra precision display related to desired waypoint northing and easting, in meters, appear in left and right data displays respectively.

NOTE

L/L WY PT: A coordinate is the addition of values for degrees, whole minutes and seconds.

Example: W 87° 54’ 58.6“ = 87°54.9W and 58.6.

UTM WY PT: A coordinate is the addition of the values for kilometers and meters.

Example: S 2,474,706m = 2474S and 706.

(t.) TACAN station data:

1. Keys “7” and “9” - Press simultaneously.

2. Waypoint thumbwheel - Set to desires TACAN station. Observe number of TACAN station being used for navigation flashes on and off.

a. L/L WY PT: Latitude and longitude of desired TACAN station, to tenth of minute, appears in left and right data displays, respectively.

b. UTM WY PT: Northing and zone with easting of desired TACAN station, to a kilometer, appear in left and right data displays, respectively.

3. INSERT/ADVANCE PUSHBUTTON - Press. Observe the following:

a. L/L WY PT: The arc-seconds related to desired TACAN station, to tenth of an arc-second, appear in left and right data displays respectively.

b. UTM WY PT: The extra precision display related to desired TACAN station northing and easting, in meters, appear in left and right data displays respectively.

NOTE

Direction is indicated in normal data displays.

4. L/L WY PT: A coordinate is the addition of values for degrees, whole minutes, and seconds.

5. Example: W 87° 54’ 58.6“ will be displayed as “87°54. 9W” and 58.6”.

6. UTM WY PT: A coordinate is the addition of values for kilometers and meters.

7. Example: S 2,474,706 m will be displayed as “2474 S” and “706“.

8. INSERT/ADVANCE pushbutton - Press. Observe TACAN station altitude, in feet, will appear in right data display; degree symbol and decimal points should be

disregarded. Left data display is blank.

9. INSERT/ADVANCE pushbutton - Press. Observe TACAN station channel number, in whole numbers, will appear in left data display; degree symbol and decimal point should be disregarded. Right data display is blank.

NOTE

If INSERT/ADVANCE pushbutton is pressed, the normal coordinates indicated in step -3- will be displayed.

NOTE

Waypoint thumbwheel may be moved at any time and normal coordinates for new TACAN station will be displayed.

10. Data selector - Momentarily to any position other than L/L WY PT, UTM WY PT or DIS/TIME. (Returns INS to normal operation.)

(u.) Magnetic heading.

1. Data selector - HDG/DA. Observe true heading to nearest tenth degree appears in right data display.
2. Keys "3" and "9" - Press simultaneously and hold. Observe magnetic heading to nearest tenth of a degree appears in left data display. Drift angle continues to be displayed in right data display.
3. Keys "3" and "9" - Release. Observe left data display reverts to true heading.

(12.) INS updating:

(a.) Normal geographic present position check and update:

1. Data selector - L/L POS. Observe latitude and longitude of present position appear in left and right data displays, respectively.
2. Illuminated HOLD pushbutton - Press. Observe latitude and longitude in data displays freeze at values present when HOLD pushbutton is pressed.

NOTE

While HOLD pushbutton light is illuminated, TACAN, GPS and data link updates are inhibited.

3. Keys - Press in sequence to load latitude of position reference, starting with "N" or "S" to indicate north or south. Example: 42°54.0' north = N 4 2 5 4 0. Observe INSERT/ ADVANCE pushbutton light illuminates when first key is pressed, and latitude appears in left data display as keys are pressed.
4. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ADVANCE pushbutton light remains illuminated, and previous value of latitude reappears.
5. Keys - Press in sequence to load longitude of position reference, starting with "W" or "E" to indicate west or east. Example: 87°54.9' west = W 8 7 5 4 9. Observe longitude appears in right data display as keys are pressed.
6. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ADVANCE and HOLD pushbutton lights remain illuminated. North position error and east position error, in tenth of a nautical mile, will appear in left and right data displays, respectively.

NOTE

If WARN light illuminates, proceed to step 7; otherwise proceed to step 8.

7. Data selector - DSRTK/STS. Observe action code "02" and malfunction code "49". This indicates that the radial error between the loaded position and the INS position exceeds 33 nautical miles. Operator must evaluate possibility that either INS is in error or reference point position is incorrect. It is possible to force INS to accept updated position by setting data selector to L/L POS and proceeding to step 8).
8. If displayed values are within tolerance, press HOLD pushbutton to return INS to normal operation. If one or both values are out of tolerance, proceed to step 9.
9. Key "2" - Press. Observe left data display is "00000 N"; INSERT/ADVANCE and HOLD pushbutton lights are illuminated.
10. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ADVANCE and HOLD pushbutton lights extinguish. Present position appears in data displays. Present position check and update is complete.

NOTE

Within 30 seconds, computer will process correction and revised present position will appear in data display. If AI prior to position update is 1 or greater, computer will accept over 95 percent of correction shown in difference display. If AI is "0", amount of correction accepted will be less and is a function of time in NAV mode and number of updates which have been made.

(b.) Extra precision geographic present position check and update:

1. Data selector - DSRTK/STS.
2. Key "2" - Press. Observe INSERT/ADVANCE pushbutton light illuminates, "000002" appears in right data display.
3. INSERT/ADVANCE pushbutton - Press. Observe right data display is "1-XX2", INSERT/ADVANCE pushbutton light is extinguished, and any TACAN, GPS or data link updating is discontinued.
4. Data selector - L/L POS. Observe latitude and longitude of present position appears in left and right data displays, respectively.
5. HOLD pushbutton - Press (when aircraft passes over known position reference.) Observe HOLD pushbutton light illuminates. Latitude and longitude in data displays freeze at values present when HOLD pushbutton was pressed.
6. Load latitude by pressing keys in sequence, starting with "N" or "S" to indicate north or south. Example: 42°54.0' North = N 4 2 5 4 0. Observe latitude appears in left data display as keys are pressed.
7. INSERT/ADVANCE pushbutton - Press Observe INSERT/ADVANCE and HOLD pushbuttons remain illuminated.
8. Load longitude by pressing keys in sequence, starting with "W" on "E" indicating west or east. Example: 87°54.9' West = W 8 7 5 4 9.
9. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ADVANCE and HOLD pushbutton lights remain illuminated.

10. INSERT/ADVANCE pushbutton - Press. Observe arc-seconds related to present position latitude and longitude, to nearest tenth of a second, appear in left and right data displays, respectively.

11. Load related arc-second values for latitude in sequence, starting with “N“. Example: 35.8° North = N 358.

12. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ADVANCE and HOLD pushbuttons remain illuminated.)

13. Load related arc-second values for longitude in sequence, starting with “E“. Example: 20.1° East = E 201.

NOTE

Extra precision values are added to normal values and normal displays are not rounded off.

NOTE

Normal latitude-longitude coordinates must always be loaded prior to extra precision values.

NOTE

Directions “N” or “S“ and “E” or “W” are established during normal coordinate entry. Either key may be used to initiate entry during extra precision loads and values will be added to extra precision values without affecting direction.

NOTE

It is characteristic of the computer display routine to add 0.2 arc-seconds to any display of 59.9 arc-seconds. Value in computer is loaded by operator.

14. Proceed to step 6 in procedure: “Normal Geographic Present Position Check and Update.“

(c.) UTM present position check and update:

NOTE

UTM data may be loaded in any order and, until final entry, a value may be reloaded.

1. Data selector - UTM POS. Observe UTM coordinates of present position appear in data displays.

2. HOLD pushbutton - Press (when aircraft passes over known position reference.) Observe HOLD pushbutton light illuminates. Coordinates in data display freeze at values present when HOLD pushbutton was pressed.

NOTE

While HOLD pushbutton light is illuminated, TACAN, GPS and data link updates are inhibited.

3. Load zone and easting by pressing keys in sequence, starting with “E”. Example: Zone 16, 425 km East = E16 425. Observe zone and easting in kilometers appear in right data display as keys are pressed.

4. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ADVANCE pushbutton light remains illuminated.

5. Load northing by pressing keys in sequence, starting with “N” or “S” to indicate north or south hemisphere. Example: North 4749 km = N 4749. Observe northing kilometers appear in left data display as keys are pressed.

6. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ADVANCE pushbutton light remains illuminated.

7. INSERT/ADVANCE pushbutton - Press. Observe extra precision display related to present position northing and easting, to nearest meter, appears in left and right data displays, respectively.
8. Load extra precision easting value by pressing keys in sequence, starting with "E". Example: 297 m East = E 297. Observe easting meters appear in right data display as keys are pressed.
9. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ADVANCE pushbutton light remains illuminated.
10. Load extra precision northing value by pressing keys in sequence, starting with "N" or "S". Example: 901 m North = N 901. Observe Northing meters appear in left data display as keys are pressed. The value is always added to normal value regardless of which key (N/S) is pressed to initiate entry. Normal entry establishes the hemisphere.

NOTE

The "W" key may be used to initiate easting entries; however, the computer will always interpret such entries as an "E" input.

NOTE

The extra precision values are always added to normal values.

NOTE

Any data inserted when HOLD pushbutton light is not illuminated will be rejected by computer.

11. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ADVANCE and HOLD pushbutton lights remain illuminated. North position error and east position error in kilometers will appear in left and right data displays, respectively.
12. If WARN light illuminates, proceed to step 13; otherwise proceed to step 9 in procedure: "Extra Precision Geographic Present Position Check and Update."
13. Data selector - DSRTK/STS. Observe action code "02" and malfunction code "49". This indicates radial error between loaded position and INS position exceeds 62 kilometers. Operator must evaluate possibility that INS is in error or reference point position is incorrect. It is possible to force INS to accept updated position by setting data selector to UTM POS and proceeding to step 10 of procedure: "Extra Precision Geographic Present Position Check
14. If updating is to be rejected - Press HOLD pushbutton. Observe HOLD and INSERT/ADVANCE pushbutton lights extinguish. INS returns to normal operation.

(d.) Position update eradication:

NOTE

This procedure is not considered common. Its use is limited to those times where an operational error has resulted in an erroneous position fix.

1. Data selector - DSRTK/STS.
2. Key "1" - Press. Observe INSERT/ADVANCE pushbutton light illuminates, 000001 appears in right data display.
3. INSERT/ADVANCE pushbutton - Press. Observe INSERT/ADVANCE pushbutton light extinguishes. Within 30 seconds, data displays return to normal with "0" (normal inertial mode)

in last digit of right display. AI will be set to approximately three times the number of hours in NAV.

(13.) Flight course changes.

(a.) Manual flight plan change insertion:

1. WYPT CHG pushbutton - Press. Observe WYPT CHG and INSERT/ADVANCE pushbuttons illuminate.
2. Select new FROM and TO waypoints by pressing corresponding keys
3. WYPT CHG pushbutton - Press. Observe new waypoint numbers appear in FROM-TO data displays as keys are pressed.

NOTE

Selecting zero as FROM waypoint will cause desired track to be defined by computed present position (inertial present position plus fixes) and TO waypoint.

4. INSERT/ADVANCE pushbutton - Press. Observe WYPT CHG and INSERT/ ADVANCE pushbuttons extinguish.

NOTE

Waypoint zero always contains ramp coordinates if no manual flight plan changes are made. When a manual flight plan change is made, present position at instant of insertion is stored in waypoint zero.

(14.) After landing procedures:

CAUTION

If INS will be unattended for an extended period, it should be shut down.

CAUTION

Do not leave INS operating unless aircraft or ground power and cooling air are available to system.

NOTE

The INS may be shut down, downmoded to STBY or ALIGN mode, or operated in the navigation mode after landing. The determining factor in choosing course of action is expected length of time before the next takeoff.

NOTE

Do not tow or taxi aircraft during INS alignment. Movement during alignment requires restarting alignment.

(a.) Transient stops.

NOTE

Action to be taken during a transient stop depends upon time available and on availability of accurate parking coordinates (latitude and longitude.)

1. Realignment - INS operating.

(Recommended if sufficient time and accurate parking coordinates are available.)

NOTE

INS can be downmoded to perform a realignment and azimuth gyro calibration. Alignment to produce an alignment state number of "5" can be accomplished in approximately 17 minutes. During the 17 minute period, an automatic azimuth gyro recalibration is determined on basis of difference between inertial present position before downmoding and inserted present position. To obtain further refinement of azimuth gyro drift rate, calculated on basis of newly computed error data, INS can be left in alignment mode for a longer period, allowing the alignment state number to attain some value lower than "5".

2. Data selector - STBY, then to ALIGN.
3. Present position coordinates - Insert, according to procedure: "Geographic Present Position Insertion" or "UTM Present Position

4. Realignment - INS shutdown. Perform complete alignment procedures.

5. Position update. Recommended if time is not available for realignment.

NOTE

Perform position update using parking coordinates in accordance with procedure: "Insertion of Geographic Waypoint Coordinates." If parking coordinates are not available, proceed as follows:

Continue operation in NAV, if INS accuracy appears acceptable.

Perform position update using best estimate of parking coordinates.

6. Downmoding to standby: Mode selector - STBY.

NOTE

INS can be downmoded to standby operation which will maintain navigation unit at operating temperature with gyro wheels running. INS is downmoded to standby as follows:

CAUTION

Do not leave INS operating unless aircraft or ground power and cooling air are available to system.

7. Shutdown: Mode selector - OFF.

NOTE

INS will retain inertial present position data computed at time INS is downmoded. This value is compared with present position inserted for next alignment and difference is used to determine azimuth gyro drift rate.

e. Abnormal Procedures:

(1.) General. INS contains self-testing features which provide one or more warning indications when a failure occurs. The WARN light on th CDU provides a master warning for most malfunctions occuring in the navigation unit. Malfunctions in the MSU or CDU will normally be obvious because of abnormal indications of displays and lights. A battery unit malfunction will shut down INS when battery power is used.

(2.) Automatic INS shutdown.

(a.) Overtemperature. An overtemperature in navigation unit will cause INS to shut down (indicated by blank CDU displays) when mode selector is at STBY or ALIGN during ground operation. The WARN light on CDU will illuminate and will not extinguish until mode selector is rotated to OFF. The cooling system should be checked and corrected if faulty. If cooling system is satisfactory, navigation unit should be replaced.

(b.) Low battery charge. A low battery unit charge will cause INS to shut down when INS is operating on battery unit power. Both WARN light on CDU and BAT light on MSU will illuminate and not extinguish until the mode selector is set to OFF. The battery unit should be replaced when this failure occurs.

(c.) Interpretation of failure indications. It is important to be able to correctly interpret failure indications in order to take effective action. Failure indications are listed below under two main categories: WARN light illuminated, and WARN light extinguished. Under each of these categories are listed other indications which will give the operator sufficient information to take action.

1. WARN light illuminated. Take the following action:
   a. If action codes 01, 02, 03, 04, 05 are displayed - See table 3-2.
   b. No action or malfunction codes displayed - Indicated computer failure.
   c. Improper displays - Indicates NU computer failure.
2. WARN light extinguished. If CDU displays are blank, incorrect or frozen - CDU failure is indicated.

NOTE

It is not possible to load displays from the keyboard. A temporary failure of a numerical key may prevent data loading. If a number cannot be loaded into latitude or longitude displays, after pressing/ wiggling the key several times, the cause may be the momentary hang-up of another key. To identify the faulty key, rotate the data selector to DSRTK/STS. The right digit on right display will indicate suspect key. Press and release suspect key several times. To test whether the keyboard problem is corrected, try pressing any other numerical key. Its number should now appear as the right digit. If this test is successful, press the CLEAR key and return data selector to original data loading position. Otherwise, a CDU failure is indicated.

(d.) CDU BAT indicator light is illuminated.

CAUTION

Operation on battery is an indication that there may may be no aircraft power to blower motor with resultant loss of cooling. The INS can operate only a limited time (normally 15 minutes) on battery power before a low voltage shutdown will occur. Then, immediate corrective action must be taken.

NOTE

CDU BAT indicator will illuminate for 12 seconds in alignment State "8" (about 5 minutes after turn-on). This is normal and indicates a battery test is in progress. No corrective action is required.

NOTE

During ground operation, it is recommended that operation on battery power not exceed 5 minutes.

1. To determine corrective action: (Monitor CDU displays while rotating the CDU selector switch.)
   a. If displays are frozen (do not change while data selector is being rotated) problem is normally in the navigation unit.
   b. If displays respond normally to the data selector, the problem is normally absence of 115V AC power to INS.

(e.) For corrective action: Check to assure proper settings of following switches and circuit breakers essential to INS operation:

1. Overhead circuit breaker panel (fig. 2-26) - Circuit breakers in:
   a. AVIONICS MASTER CONTR
   b. INS CONTROL
   c. AVIONICS MASTER PWR No.1
   d. AVIONICS MASTER PWR No.2
2. Overhead control panel (fig. 2-12): INVERTER No. 1 or INVERTER No.2 switch - ON (either).
3. Mission control panel (fig. 4-1):
   a. #1 INV or #2 INV switch - ON.
   b. Bus cross tie switch - ON/AUTO.
4. Mission AC/DC Power Cabinet (fig. 2-2): INS AC PWR circuit breaker - In.

NOTE

CDU BAT indicator should extinguish after above corrective action. If it remains illuminated, INS will eventually shut down when battery voltage drops below approximately 19VDC. Flight crew should prepare for shutdown.

(3.) Malfunction indications and procedures: Table 3-3 details the procedure for a Malfunction Code Check. Table 3-4 lists a number of malfunction indications which occur under given modes of operation. Follow procedure given. Table 3-5 details action codes and recommended action. Table

3-6 lists failed test symptoms by malfunction codes and lists codes for recommended actions.

Table 3-3. Malfunction Code Check

step Indication	Control	Operation	Indicator or Display	Indication
1			WARN light	Lights
2	Data Selector	Rotate to DSRTK/STS	RH data display	Action code second and third digits
3	TEST switch	Press and release	RH data display	Lowest number malfunction code which has occurred since this procedure was performed replaces action code.
4	Repeat step 3 repeatedly, recording all malfunction codes until second and third digits again indicate an action code or go blank. Refer to Table 3-4 for action codes and recommended action and to Table 3-5 for malfunction code definition.			
5	If WARN light extinguishes and two digits go blank, failure was intermittent and has been cleared. If digits do not go blank, perform action according to displayed recommended action code.			

Table 3-4. Malfunction Indications and Procedures

Mode of Operation	Malfunction Indication	Procedure	Probable Cause
STBY or ALIGN	WARN on, CDU blank (DIM control clockwise), MSU BAT off	1. Rotate MSU mode selector OFF. 2. Check aircraft cooling system and correct if faulty. 3. Realign INS.	Automatic shutdown caused by over-temperature.
STBY, ALIGN, NAV	WARN on, MSU BAT on, CDU blank.	1. Rotate MSU mode selector OFF. 2. Insure all switches and circuit breakers applicable to INS operation are set properly. 3. If in flight, rotate MSU mode selector OFF. 4. If on ground, replace battery unit. Battery unit test may be by-passed by rotating mode selector to OFF, then to NAV and reloading position coordinates. When INS advances to alignment State 7 (PI=7) rotate mode selector to ALIGN.	Loss of INS power and low battery Unit (BU).
STBY, ALIGN, or NAV	WARN on, CDU is operating	Perform Malfunction Code Check as described in Table 3-2.	Navigation failure or interfacing system problem.

Table 3-5. Action Codes and Recommended Actions

Code	Recommended Action
01	Shut down INS.
02	Watch for degradation (NAV), During ground operation, downmode to STBY and restart alignment.
03	INS may be used for navigation. One or more analog outputs are not functioning properly. Check 26 VAC circuit breakers, HSI and autopilot.
04	Downmode to STBY and restart alignment (ground operation only).
05	Correct problem in interfacing system (could be INS). Will not seriously affect performance.

Table 3-6. Recommended Codes

Malf Code	Failed Test	Modes of Operation	Recommended Action Code
10	Invalid heading	ALIGN	04
11	GR/CS program pin connected in error	ALIGN	01
12*	Canned altitude profile in use (input altitude invalid)	ALIGN, NAV	05
13	Y velocity change	NAV	02
14	X velocity change	NAV	02
15	Torque limited	ALIGN, NAV	02
16	Invalid pitch and roll	ALIGN, NAV	05
17	Invalid magnetic heading	ALIGN, NAV	05
16	Excessive saturation time	ALIGN	04
20*	Bearing to waypoint	ALIGN, NAV	03
22*	Bearing to waypoint	ALIGN, NAV	03
23*	Drift angle	ALIGN, NAV	03
24*	Steering converter	ALIGN, NAV	03
25*	True heading converter	ALIGN, NAV	03
26*	XTK converter	ALIGN, NAV	03
27*	Tick mark to fast	STBY	01
31	Ground speed	NAV	02
32	Memory parity	STBY, ALIGN, NAV	02
33	Azimuth stabilization loop	ALIGN, NAV	01
34	Inner roll stabilization loop	ALIGN, NAV	01
35	Pitch stabilization loop	ALIGN, NAV	01
36	Accelerometer loop	ALIGN, NAV	01
37	Z platform overtemperature	NAV	01
38	XY platform overtemperature	NAV	01
40	Heading error	ALIGN	04
42	Drift angle !gt!45°	NAV	02
44	Azimuth gyro drift ratye	ALIGN	02
45	Gyro scale factor or loaded altitude	ALIGN	04
47	15-second loop	NAV	02
49	Fix measurement too large	NAV	02
51*	Excessive wind	ALIGN, NAV	05
54*	Incomplete conversion from UTM to L/L	STBY, ALIGN, NAV	05
57	XY platform rotation rate	ALIGN	02
59	600 millisecond loop	STBY, ALIGN, NAV	02
60	X or Y sample and hold change	ALIGN	04
62	XY platform rotation rate	NAV	02
63	CDU self-checks	STBY, ALIGN, NAV	02

*Failed test does not illuminate WARN light on CDU.

3-30A. GLOBAL POSITIONING SYSTEM (AN/ASN-149, (B)3).

a. *Description*. Complete provisions are installed for a global positioning system (GPS). The GPS is used to provide updated position information to the inertial navigation system. The GPS system consists of a control/display unit, receiver, observer headset and GPS key panel, antenna electronics unit, and an antenna.

(1.) *Control/display unit (CDU)*. The control/display unit (fig. 3-25A), located on the electronics rack in the cabin, accomplishes all display and control functions necessary for the operation of the GPS receiver.

(2.) *Observer Headset and GPS Key Panel*. The observer headset and GPS key panel (fig. 3-25B), located on the electronics rack in the cabin, contains a headset connector and GPS key and loading controls.

b. *GPS Controls, Indicators, and Functions.*

(1.) *GPS control/display unit (fig. 3-25A).*

(a.) *Line selection keys*. Four line selection keys, located to the left of the CDU display screen, are used to initiate and terminate data entries, and to select various system options.

(b.) *Display screen*. System information is shown on the cathode ray tube display screen. The display screen can show four lines of text with 13 alphanumeric characters on each.

(c.) *Mode selector switch*. The four-position mode selector switch, placarded PULL OFF, INIT, NAV, and PULL TEST, is used to select the operating mode of the GPS system.

(d.) *Display brightness control*. A control knob placarded BRT is provided to control the brightness of the cathode ray tube display screen. Clockwise rotation of the control increases brightness.

(e.) *Data entry keys (0 through 9)*. The data entry keys are used to enter alphanumeric data.

(f.) *USE LTR key*. The use letter key, placarded USE LTR, is used to select alphabetic prompt in free format data entry. The USE LTR key terminates alphabetic entry when pressed.

(g.) *Clear key*. The clear key, placarded CLR, is used to clear erroneous data entry and message displays.

(h.) *Slew key*. The slew key is used to access additional pages within a data display selected by the data select switch. If more than one page is available a double arrow is displayed in the lower right comer of the display. Pressing the slew key will access the next page. Repeated pressing of the slew key will return the display to the first page after the last page has been accessed.

(i.) *Data selector switch*. For all data selector switch positions there are two modes of displayed data:

1. Destination mode (active waypoint as destination)
2. Waypoint (WP) examine mode (any waypoint)

Pressing the WP key switches the CDU between the two modes.

The 10 position data select switch is used to select the type of information to be displayed on the CDU:

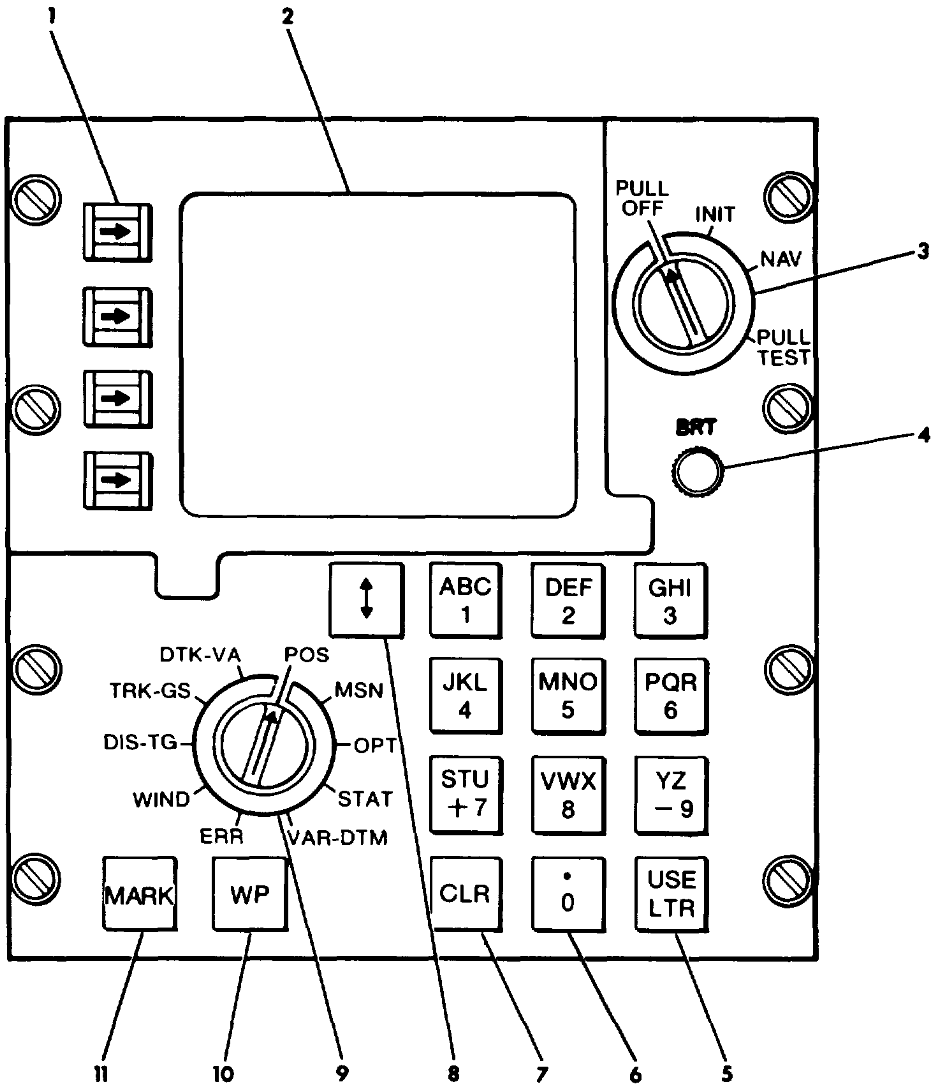
POS.	Position data is displayed.
MSN.	Mission data is displayed.
OPT.	Option data is displayed. Six pages of information pertaining to the GPS receiver are made available when the OPT position is selected.
STAT.	Status data is displayed.
VAR-DTM.	Magnetic variation and map datum data is displayed.
ERR.	Error data is displayed.
WIND.	Wind data is displayed.
DIS-TG.	Distance and time to go data is displayed.
TRK-GS.	Track and ground speed data is displayed.
DTK-VA.	Desired track and vertical angle data is displayed.

(j.) *Waypoint key*. The waypoint key, placarded WP, is used to enter and examine waypoint data.

(k.) *Mark key*. The MARK key is used for MARK and FREEZE functions.

(2.) *Observer Headset and GPS Key Panel Controls, Indicators, and Functions fig. 3-25B).*

(a.) *Interphone hot microphone, normal, key radio switch*. This switch, placarded INT-PH HOT MIC-NORM-KEY RADIO allows selection of hot microphone intercom, normal, and key radio positions.



1. Line selection keys
2. Display
3. Mode selector switch
4. Display brightness control
5. Use letter key
6. Data entry keys (0 through 9)
7. Clear key
8. Slew key
9. Data selector switch
10. Waypoint key
11. Mark key

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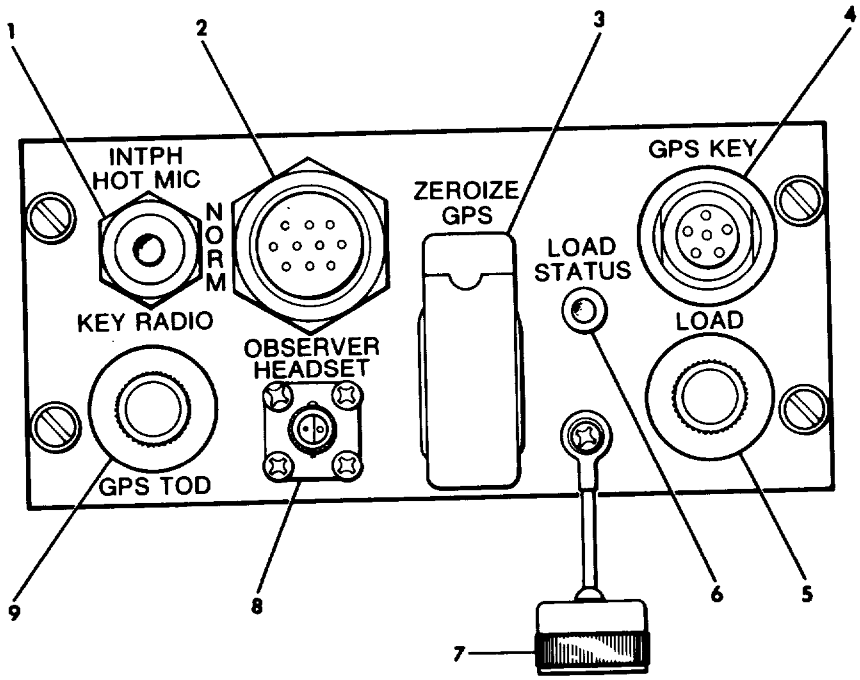
Figure 3-25A. GPS Control/Display Unit (CDU)



1. Interphone, hot microphone - normal - key radio switch
2. Observer headset connector
3. Zeroize GPS switch
4. GPS key connector
5. Load switch
6. Load status indicator light
7. Dust cap
8. Observer microphone connector
9. GPS time of day switch

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Figure 3-25B. Observer Headset and GPS Key Panel *(b.) Observer headset connector.* Alows connection of observer headset.

(c.) GPS Zeroize switch. Actuating he guarded switch, placarded ZEROIZE GPS, will declassify the GPS receiver.

(d.) GPS key connector. Connects GPS key.

(e.) Load switch. This pushbutton switch initiates loading process.

(f.) Load status indicator light. Illuninates to indicate load status.

(g.) Dust cap. Covers GPS key conlector when not in use.

(h.) Observer microphone connector. Connects observer microphone.

(i.) GPS time of day switch. This pushbutton switch is used to transmit GPS time of day to Have Quick II radios.

c. *GPS System Modes of Operation.*

(1.) Off Mode. When the PULL OFF node has been selected, power is removed from the system, except panel lighting.

NOTE

Critical memory and other circuits which cannot be turned off remain powered by batteries in the receiver.

(2.) Initialize Mode. When the INIT (initialize) mode has been selected, position and time, estimates can be entered via the keypad. Waypoint data may be entered and examined, and option selections made. No navigation functions can be performed.

(3.) Navigation Mode. Selection of the NAV (navigation) mode enables normal GPS functions (satellite tracking and navigation), including data transfer to and from other aircraft systems.

(4.) Test Mode. Selection of the PULL TEST mode initiates a full command test of GPS user equipment for line replaceable unit (LRU) fault identification and isolation.

d. GPS Normal Operation.

(1.) GPS Start Procedures. The GPS must be initialized prior to being used for navigation. There are three types of start: normal, quick, and cold. A position estimate, time estimate, and almanac (or ephemeris) data are required for normal start. A quick start uses stored position, time, and recent ephemeris information. A cold start is used only when the GPS is unable to perform a normal startup.

(a.) GPS Normal Start.

1. Mode selector switch - INIT. When built-in-test is complete the display will show data corresponding to the data selector switch position.

NOTE

Data display will not be illuminated for about 30 seconds after GPS has been turned on. Ensure that the display brightness control has been set to the full clockwise position to receive the INIT display, then adjust as desired.

NOTE

If the GPS has been OFF for more than 30 seconds when INIT mode was selected, the set will perform the initial built-in-test which takes approximately 30 seconds.

2. Data selector switch - POS. If ENTER POS message is displayed press line select key 3 next to message. Position must be entered.
3. Displayed position - Check. Verify or enter new updated position and altitude as required.
4. Data selector switch - TRK-GS. Verify correct track and groundspeed are displayed. If not valid, enter correct values.
5. Slew key-Press. Enter current time, year, and day of year on page 2.

NOTE

Prior to next step, ensure all required initialization data has been entered correctly, as they cannot be changed after selection of NAV mode.

6. Mode selector switch - NAV. GPS will begin to search fol satellite signals.

NOTE

If COLD alternates with the figure of merit display, the GPS is performing a cold start.

7. Data selector switch - STAT.

NOTE

The number of satellites (SAT) being acquired and tracked can be observed. Estimated position error (EPE) and figure of merit (FM) can be monitored. The GPS will be ready for use when SAT 3 or SAT 4 is displayed on STAT page 1.

8. Select page 2 of STAT. Check almanac age (ALM). If greater than 5000 hours, force a cold start.

9. While the GPS is acquiring satellites, periodically check STAT page 1 for SAT 3 or SAT 4 message. Figure of merit (FM) is another indication of a converging position fix and can be directly monitored from page 1 of any data selection, where FM alternates with the system map datum and other alerts.

10. SAT 3 or SAT 4 should be displayed within five minutes. If not, check that position, time, track, and groundspeed have been entered correctly. Also check that satellites are available. If all information is correct and satellites are available, force a cold start.

(b.) GPS Quick Start.

1. Mode selector switch - Set to NAV directly from OFF. After power-on test has been completed, the GPS uses velocity estimates from the aircraft's sensors (if available). If velocity is not available from the aircraft, zero velocity is assumed. If position and time are not available from the aircraft, the position estimate from GPS memory is used, and the internal low power time source (LPTS) is used to initialize time.

2. As the GPS is acquiring satellites, position, time, and velocity estimates can be checked to ensure that they are within startup error limits. If so, monitor STAT page 1. If not, a normal start is required.

3. After SAT 4 is achieved with good EPE (Estimated Position Error), and FM (Figure of Merit) of FM3 or below, check position, velocity, and time.

4. GPS is now ready for normal navigation.

(c.) GPS Cold Start.

1. Mode selector switch - INIT.

2. Data selector switch - OPT.

3. Slew key - Select page 4.

4. Enter 04 on line 1.

5. Line select key 2 - Press next to COLD START to initiate.

6. Line select key 3 - Press next to COLD START to clear cold start message and resume normal display.

7. Mode selector switch - NAV.

e. *CHAALS Use of GPS and INS.*

(1.) CHAALS Concept. CHAALS (Coherent High Accuracy Airborne Location System), is an emitter location system that provides timely, high accuracy locations required for targeting and to support emitter associations and battlefield situation assessment. CHAALS provides this capability through coherent processing of differential doppler (DD) and time difference of arrival (TDOA) information received at a ground facility from the aircraft.

CHAALS receivers aboard the aircraft will receive and digitize emitter signals. The data will be transmitted over the data link to the GR/CS integrated processing facility (IPF). There, CHAALS processors will perform the required computations to produce accurate emitter locations. The precise navigation required will be provided by the inertial navigation system (INS) and the global positioning system (GPS). GPS also provides the primary means of time synchronizing the CHAALS receivers (signal conditioners or SC's) aboard the aircraft. A backup for the GPS will be provided by the data link. The resultant emitter reports will be sent to GR/CS by CHAALS.

(2.) GPS (and INS) Involvement. The accurate and timely navigation (position and velocity) is provided by integrating an INS with a GPS, and integrating both (through a series of intermediaries) with a CHAALS ground based navigation processor (NP). The SC, data link, and CHAALS HSSP (High Speed Signal Processor) from the communication link. The critical airborne interfaces for CHAALS navigation and time synchronization include the following:

1. INS to GPS:
   a. Acceleration
   b. Velocity
   c. Position
   d. Altitude
2. INS to CHAALS: Same as INS to GPS
3. GPS to CHAALS:
   a. Time mark pulse (time synchronization)
   b. Navigation data block (position, velocity, and time)
   c. Error state vector data block (9 element ESV, time)
   d. TM/covariance data block (time, TM time, covariance)
   e. Status data block (status including DOP's and FOMN)

Section IV. TRANSPONDER AND RADAR

3-31. WEATHER RADAR SET (AN/APN-215).

a. Description. The weather radar set fig. 3-25) provides a visual The weather radar set (fig. 3-25), provides a visual 120° around the nose of the aircraft, extending to a distance of 240 nautical miles. The presentation on the screen shows the location of potentially dangerous areas, such as thunderstorms and hailstorms, in terms of distance and azimuth with respect to the aircraft. The radar is also capable of ground mapping operations. The weather radar set is protected by a 5-ampere RADAR circuit breaker located on the overhead circuit breaker panel (fig. 2-26).

b. Controls/Indicators and Functions.

(1.) GAIN control. Used to adjust radar receiver gain in the MAP mode only.

(2.) STAB OFF switch. Push type on/off switch. Used to control antenna stabilization signals.

(3.) Range switches. Momentary action type switches. When pressed, clears the screen and increases or decreases the range depending on switch pressed.

(4.) TILT control. Varies the elevation angle of radar antenna a maximum of 15 degrees up or down from horizontal attitude of aircraft.

(5.) 60° switch. Push type on/off switch. When activated, reduces antenna scan from 120° to 60 degrees.

(6.) TRACK switches. Momentary action type switches. When activated, a yellow track line extending from the apex of the display through top range mark appears and moves either left or right, depending on the switch pressed. The track line position will be displayed in degrees in the upper left comer of the screen. The line will disappear approximately 15 seconds after the switch is released. It will then automatically return to "0" degrees.

(7.) HOLD switch. Push type on/off switch. When activated, the last image presented before pressing the switch is displayed and held. The word HOLD will flash on and off in the upper left comer of the screen. Pressing the switch again will update the display and resume normal scan operation.

(8.) Function switch. Controls operation of the radar set.

(a.) OFF. Turns set off.

(b.) STBY. Places set in standby mode. This position also initiates a 90-second warm-up delay when first turned on.

(c.) TEST. Displays test pattern to check for proper operation of the set. The transmitter is disabled during this mode.

(d.) ON. Places set in normal operation.

(9.) MODE switches. Momentary action type switches. Pressing and holding either switch will display an information list of operational data on the screen. The data heading will be in blue, all data except present data will be in yellow, and present selected data will show in blue. The three weather levels will be displayed in red, yellow, and green. If WXA mode has been selected, the red bar will flash on and off. If the switch is released and immediately pressed again, the mode will increase or decrease depending on switch pressed. When either top or bottom mode is reached, the opposite switch must be pressed to further change the mode.

(10.) NAV switch. If pressed with the INS operating and the weather radar operating in a weather depiction mode, the screen will display INS waypoints that are located within the range displayed and within the degree of coverage left or right of the present heading of the aircraft.

(11.) BRT control. Used to adjust screen brightness.

c. Weather Radar - Normal Operation.

WARNING

Do not operate the weather radar set while personnel or combustible materials are within 18 feet of the antenna reflector When the weather radar set is operating, high-power radio frequency energy is emitted from the antenna reflector, which can have harmful effects on the human body and can ignite combustible materials.

CAUTION

Do not operate the weather radar set in a confined space where the nearest metal wall is 50 feet or less from the antenna reflector. Scanning such surfaces may damage receiver crystals.

(1.) Turn-on procedure: Function switch - TEST or ON, as required. (Information will appear after time delay period has elapsed.)

(2.) Initial adjustment operating procedure:

1. BRT control - As required.
2. MODE switches - Press and release as required.
3. RANGE switches - Press and release as required.
4. TILT control - Move up or down to observe targets above or below aircraft level. The echo display will change in shape and location only.

(3.) Test procedure:

1. Function switch - TEST.
2. RANGE switches- Press and release as required to obtain 80-mile display.
3. BRT control - As required.
4. Screen - Verify proper display. (The test display consists of two green bands, two yellow bands, and a red band on a 120-degree scan. The word TEST will be displayed in the upper right comer. The operating mode selected by the MODE switches, either MAP, WX, or WXA, will be displayed in the lower left corner. If WXA has been selected, the red band in the test pattern will flash on and off. The range will be displayed in the upper right corner beneath the word TEST and appropriate range mark distances will appear along the right edge of the screen.)

(4.) Weather observation operating procedure:

1. Function switch - ON.
2. MODE switches - Press and release as required to select WX.
3. BRT control - As required.
4. TILT control - Adjust until weather pattern is displayed. Include the areas above and below the rainfall areas to obtain a complete display.
5. MODE switches - Press and release to select WXA. Areas of intense rainfall will appear as flashing red. These areas must be avoided.
6. TRACK switches - Press to move track line through area of least weather intensity. Read relative position in degrees in upper left corner of screen.

NOTE

Refer to FM 1-30 for weather observation, interpretation and application.

(5.) Ground mapping operating procedure:

1. Function switch - ON.
2. MODE switches - Press and release as required to select MAP.
3. BRT control - As required.
4. GAIN control - As required to present usable display.

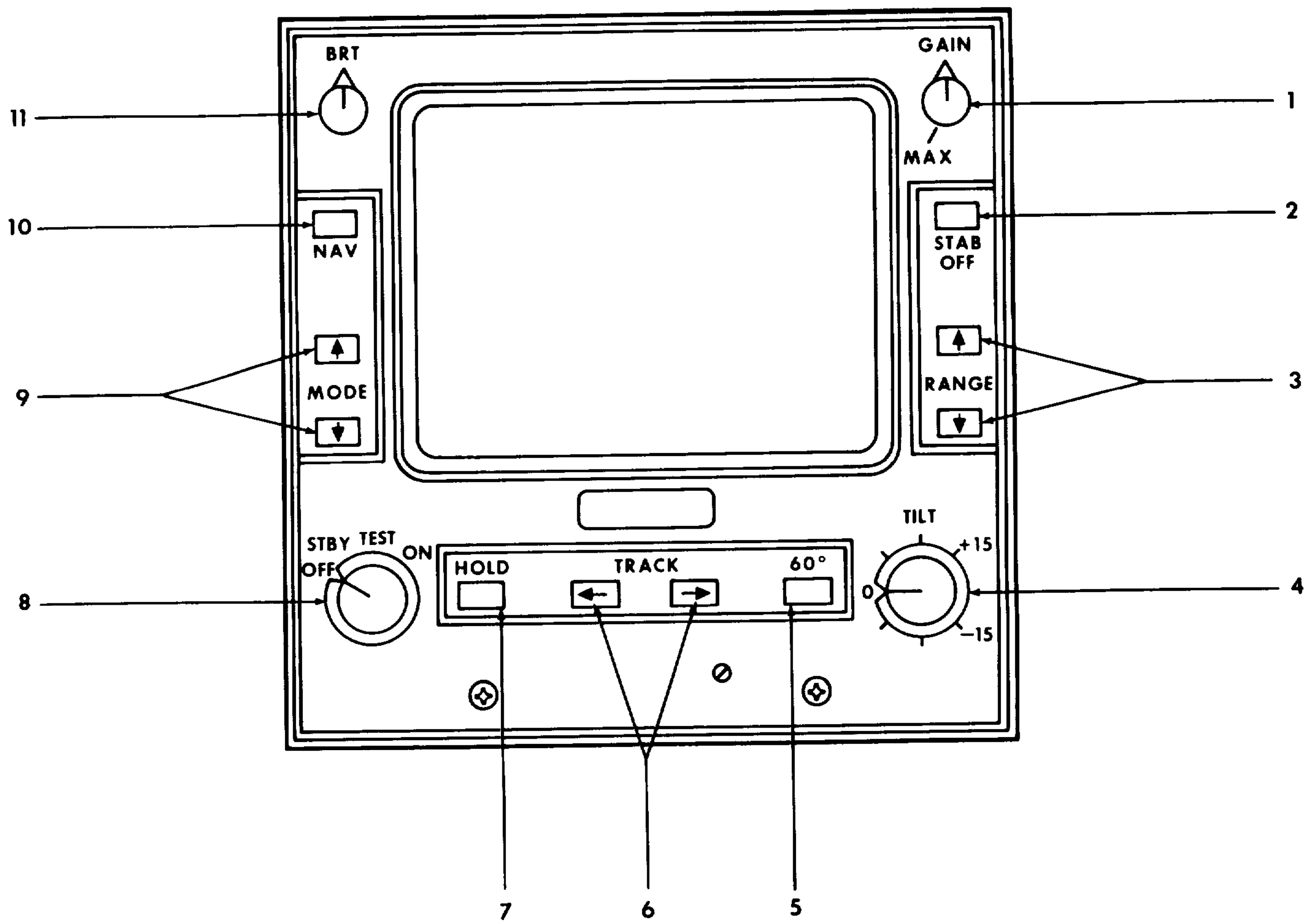
(6.) Standby procedure: Function switch - STBY.

(7.) Shutdown procedure: Function switch - OFF.

(8.) Weather radar emergency operation. Not applicable.

3-32. TRANSPONDER SET (APX-100).

a. Description. The transponder system receives, decodes, and responds to interrogations from Air Traffic Control (ATC) radar to allow aircraft identification, altitude reporting, position tracking, and emergency tracking. The system receives a radar frequency of 1030 MHz and transmits preset coded reply pulses on a radar frequency of 1090 MHz at a minimum peak power of 200 watts. The range of the system is limited to line-of-sight.



1. GAIN control
2. STAB OFF switch
3. RANGE switches
4. TILT control
5. 60 degree scan switch
6. TRACK switches
7. HOLD switch
8. Function switch
9. MODE switches
10. NAV switch
11. BRT control

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Figure 3-26. Weather Radar Control-Indicator (AN/APN-215)

The transponder system consists of a combined receiver/transmitter/ control panel (fig. 3-27) located on the pedestal extension; a pair of remote switches, one on each control wheel; and two antennas, located on the underside and top of the fuselage. The system is protected by the 3-ampere TRANSPONDER and the 35-ampere AVIONICS MASTER PWR No. 1 circuit breakers on the overhead circuit breaker panel (fig. 2-26).

b. Controls/Indicators and Functions.

(1.) TEST-GO indicator. Illuminates to indicate successful completion of built-in-test (BIT).

(2.) TEST-MON indicator. Illuminates to indicate system malfunction or interrogation by a ground station.

(3.) ANT switch. Selects desired antenna for signal input.

(a.) TOP. Selects upper antenna,

(b.) DIV. Selects diverse (both) antennas.

(c.) BOT. Selects lower antenna.

(4.) RAD TEST-OUT switch. Enables reply to TEST mode interrogations from test set.

(5.) MASTER CONTROL. Selects system operating mode.

(a.) OFF. Deactivates system.

(b.) STBY. Activates system warm-up (standby) mode.

(c.) NORM. Activates normal operating mode.

(d.) EMER. Transmits emergency reply code.

(6.) STATUS ANT indicator. Illuminates to indicate the BIT or MON fault is caused by high VSWR in antenna.

(7.) STATUS KIT indicator. Illuminates to indicate the BIT or MON fault is caused by external computer.

(8.) STATUS ALT indicator. Illuminates to indicate the BIT or MON fault is caused by the altitude digitizer.

(9.) IDENT-MIC-OUT switch. Selects source of aircraft indentification signal.

(a.) IDENT. Activates transmission of identification pulse (1P).

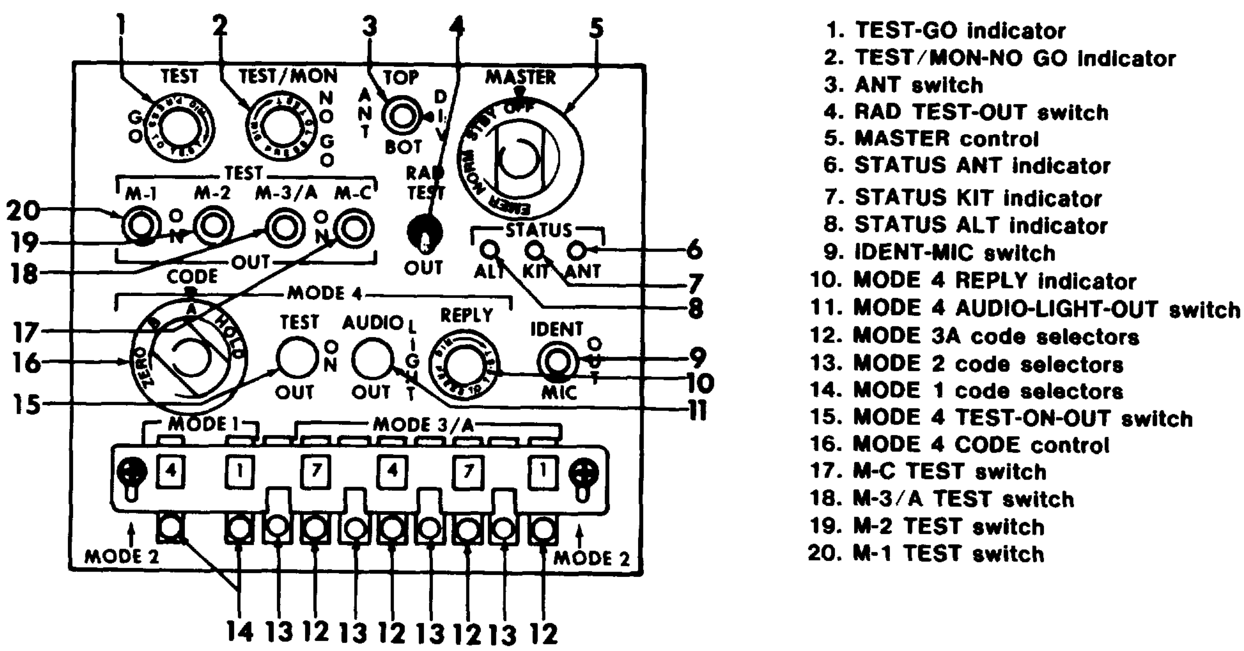


Figure 3-27. Transponder Control Panel (AN/APX - 100)

(b.) MIC. Enables either control wheel POS IDENT switch to activate transmission of ident signal from transponder.

(c.) OUT. Disallows outgoing signal.

(10.) MODE 4 reply indicator light. Illuminates to indicate a reply has been made to a valid Mode 4 interrogation.

(11.) MODE 4 AUDIO OUT switch. Selects monitor mode for mode 4 operation.

(a.) AUDIO. Enables sound and sight monitoring of mode 4 operation.

(b.) LIGHT. Enables monitoring REPLY indicator for mode 4 operation.

(c.) OUT. Deactivates monitor mode.

(12.) MODE 3/A code selectors. Select desired reply codes for mode 3/A operation.

(13.) MODE 1 code selectors. Select desired reply codes for mode 1 operation.

(14.) MODE 4 TEST-ON-OUT switch. Selects test mode of Mode 4 operation.

(a.) TEST. Activates built-in-test of mode 4 operation.

(b.) ON. Activates mode 4 operation.

(c.) OUT. Disables mode 4 operation.

(15.) MODE 4 code control. Selects preset mode 4 code.

(16.) M-C, M-3A, M-2, and M-1 switches. Select test or reply mode of respective codes.

(a.) TEST. Activates self-test of selected code. Transponder can also reply

(b.) ON. Activates normal operation.

(c.) OUT. Deactivates operation of selected code.

(17.) MODE 2 code selectors. Select desired reply codes for Mode 2 operation. The cover over mode select switches must be slid forward to display the selected mode 2 code.

(18.) POS IDENT pushbutton (control wheels, jig. 2-17). When pressed, activates transponder identification reply.

c. Transponder - Normal Operation.

(1.) Turn-on procedure: MASTER switch - STBY. Depending on the type of receiver installed, the TEST/MON NO GO indicator may illuminate. Disregard this signal.

(2.) Test procedure:

NOTE

Make no checks with the master switch in EMER, or with M-3/A codes 7600 or 7700 without first obtaining authorization from the interrogating station(s).

1. Allow set two minutes to warm up.
2. Select codes assigned for use in modes 1 and 3/A by depressing and releasing the pushbutton for each switch until the desired number appears in the proper window.
3. Lamp indicators - Operate press-to-test feature.
4. M-1 switch - Hold in TEST. Observe that no indicator lights illuminate.
5. M-1 switch - Return to ON.
6. Repeat steps 4 and 5 for the M-2, M-3/A and M-C mode switches.
7. MASTER control - NORM.
8. MODE 4 code control - A. Set a code in the external computer.
9. MODE 4 AUDIO OUT switch - OUT.

(3.) Modes 1, 2, 3/A, and/or 4 operating procedure.

NOTE

If the external security computer is not installed, a NO GO light will illuminate any time the Mode 4 switch is moved out of the OFF position.

1. MASTER control - NORM.
2. M-1, M-2, M-3/A, and/or MODE 4 ON-OUT switches - ON. Actuate only those switches corresponding to the required codes. The remaining switches should be left in the OUT position.

3. MODE 1 code selectors - Set (if applicable).
4. MODE 3/A code selectors - Set (if applicable).
5. MODE 4 code control - Set (if required).
6. MODE 4 REPLY indicator - Monitor to determine when transponder set is replying to a SIF interrogation.
7. MODE 4 AUDIO OUT switch - Set (as required to monitor Mode 4 interrogations and replies).
8. MODE 4 audio and/or indicator - Listen and/or observe (for Mode 4 interrogations and replies).
9. IDENT-MIC-OUT switch - Press to IDENT momentarily.
10. MODE 4 TEST-ON-OUT switch - TEST.
11. Observe that the TEST GO indicator light illuminates.
12. MODE 4 TEST-ON-OUT switch - ON.
13. ANT switch - BOT.
14. Repeat steps 4, 5, and 6. Observe that the TEST GO indicator illuminates.
15. TOP-DIV-BOT-ANT switch - TOP.
16. Repeat step 14.
17. TOP-DIV-BOT-ANT switch - DIV.
18. Repeat step 14.
19. When possible, obtain the cooperation of an interrogating station to exercise the TEST mode. Execute the following steps:
    a. RAD TEST-OUT switch - RAD TEST.
    b. Obtain verification from interrogating station that a TEST MODE reply was received.
    c. RAD TEST-OUT switch - OUT.

(4.) Transponder set identification-position operating procedure: The transponder set can make identification-position replies while operating in code Modes 1, 2, and/or 3/A, in response to ground station interrogations. This type of operation is initiated by the operator as follows:

1. Modes 1, 2, and/or 3/A - ON, as required.
2. IDENT-OUT-MIC switch - Press momentarily to IDENT, when directed.

NOTE

Holding circuits within the transponder receiver-transmitter will transmit identification-position signals for 15 to 30 seconds. This is normally sufficient time for ground control to identify the aircraft's position. During the 15 to 30 second period, it is normal procedure to acknowledge via the aircraft communications set that identification- position signals are being generated.

NOTE

Set any of the M1, M2, M3/A, M-C, or MODE 4 switches to OUT to inhibit transmission of replies in undesired modes.

NOTE

With the IDENT-OUT-MIC switch set to the MIC position, the POS IDENT button must be depressed to transmit identification pulses.

(5.) Shutdown procedure:

1. To retain Mode 4 code in external computer during a temporary shutdown:
    a. MODE 4 CODE switch - Rotate to HOLD.
    b. Wait 15 seconds.
    c. MASTER control - OFF.
2. To zeroize the Mode 4 code in the external computer turn MODE 4 CODE switch to ZERO.
3. MASTER control - OFF. This will automatically zeroize the external computer unless codes have been retained (step 1 above).

d. Transponder - Emergency Operation. Not applicable.

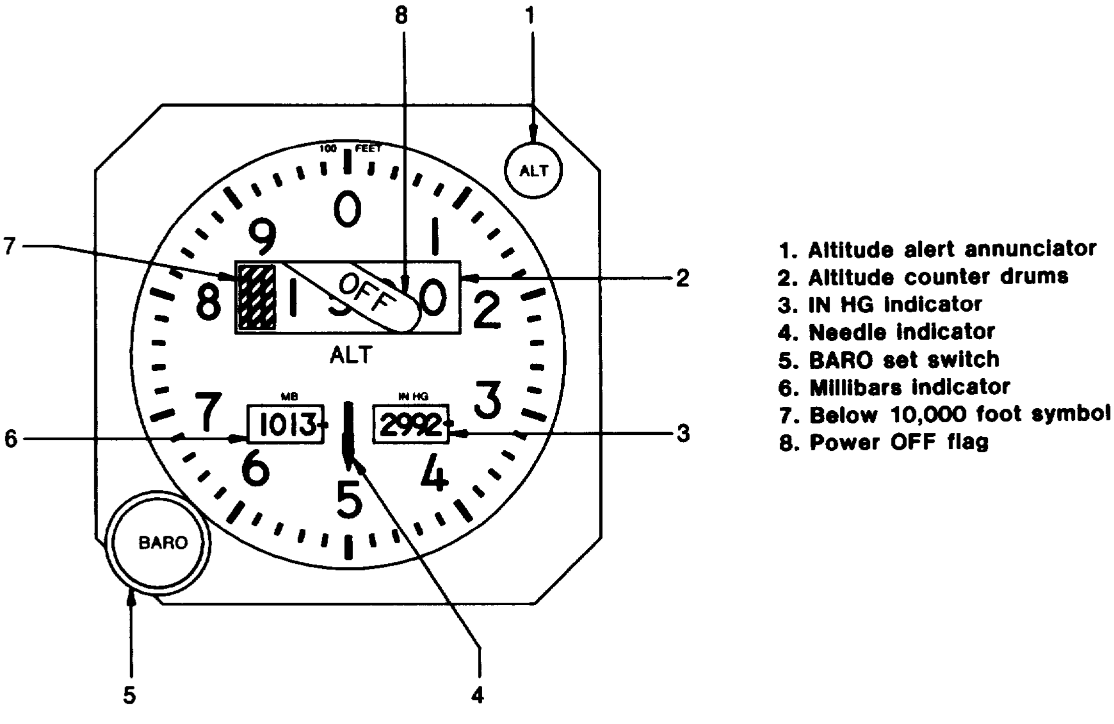


Figure 3-28. Pilot's Altimeter Indicator (BA-141)

3-33. PILOT'S ALTIMETER INDICATOR.

The pilot's altimeter, on the upper left side of the instrument panel (fig, 3-28), is a servoed unit under control of the Air Data Computer and is part of the Flight Director/Autopilot system. Altitude is displayed by a 10,000 foot counter, a 1000 foot counter, a 100 foot counter, and a single needle pointer (coupled with the 100 foot counter) which indicates hundreds of feet on a circular scale in 20 foot increments. Below an altitude of 10,000 feet, a diagonal striped symbol will appear on the 10,000 foot counter. The barometric pressure knob allows ground supplied pressure values to be adjusted and displayed in inches Hg or millibars. If AC power to the altimeter is lost, a warning OFF flag will appear in the upper counter drum display window to indicate power loss, unreliable altimeter readings, and possible loss of encoder transmissions to ground stations. Circuits are protected by a 3-ampere fuse in a junction box.

When the BARO knob is adjusted to ground supplied instructions, the updated altitude pressure is routed to the Air Data Computer. The ADC recomputes all data on hand, sends corrected altitude pressure information to the Flight Director and autopilot, servo commands to correct the display on the pilot's altimeter, and supplies altitude information to the transponder (for transmission to .

a. Controls/Indicators and Functions.

(1.) ALT alert annunciator. Illuminates when aircraft is within 1000 feet of preselected altitude during capture maneuver and extinguishes when aircraft is within 250 feet of preselected altitude. After capture, light will illuminate if aircraft departs more than 250 feet from the selected altitude.

(2.) Altitude counter drums. Indicates aircraft altitude in tens of thousands, thousands, and hundreds of feet above sea level.

(3.) IN HG Indicator. Indicates local barometric pressure in inches of mercury. Adjusted by use of BARO knob.

(4.) Needle indicator. Indicates aircraft altitude in hundreds of feet with subdivisions at 20 foot increments.

(5.) BARO Knob. Used to manually set barometric pressure displayed in the MB and IN HG windows.

(6.) MB Indicator. Indicates local barometric pressure in millibars. Adjusted by use of BARO knob.

(7.) Below 10,000 feet symbol. Presence indicates aircraft altitude is below 10,000 feet.

(8.) OFF Flag. Presence indicates loss of power to instrument and unreliable readings.

NOTE

If the OFF flag is visible, either DC power is off, the fuse has blown, or there is an altimeter encoder failure. Since the OFF flag monitors only the encoder input to the altimeter and not transponder condition, the altitude reporting function may be inoperative without the OFF flag showing, in the case of transponder failure or improper control settings. It is also possible to get a good Mode C test on the transponder control with the OFF flag showing. If the OFF flag remains visible, radio contract should be made with a ground radar site to determine if the altitude reporting function is operative.

b. Pilot's Altimeter - Normal Operation.

(1.) Turn-on procedure: Servoed altimeter will operate when transponder is operating with M-C switch set to center position.

(2.) Operating procedure:

1. Barometric set knob - Set desired altimeter setting in IN. HG. window.
2. OFF flag - Check not visible.
3. Needle indicator - Check operation.

NOTE

If the altimeter does not read within 70 feet of field elevation, when the correct local barometric setting is used, the altimeter needs calibration or internal failure has occurred. An error of greater than 70 feet also nullities use of the altimeter for IFR flight.

c. Pilot's Altimeter - Emergency Operation. Disregard pilot's altimeter and utilize copilot's altimeter.

3-34. COPILOT'S ENCODING ALTIMETER.

Description. The copilot's altimeter (fig. 3-29):' provides an indication of present aircraft pressure altitude above sea level. It also supplies information to the INS and GPS. The air data computer supplies altitude information to the transponder.

b. Controls/Indicators and Functions.

(1.) ALT alert indicator. Not used.

(2.) Needle indicator. Indicates aircraft altitude in hundreds of feet with subdivisions at 20-foot intervals.

(3.) MILLIBARS window. Indicates local barometric pressure in millibars. Adjusted by use of set knob.

(4.) IN HG window. Indicates local barometric pressure in inches of mercury. Adjusted by use of set knob.

(5.) BARO knob. Used to manually set barometric pressure displayed in the MB an IN HG windows.

(6.) Drum indicator. Indicates aircraft altitude in ten-thousands, thousands, and hundreds of feet above sea level.

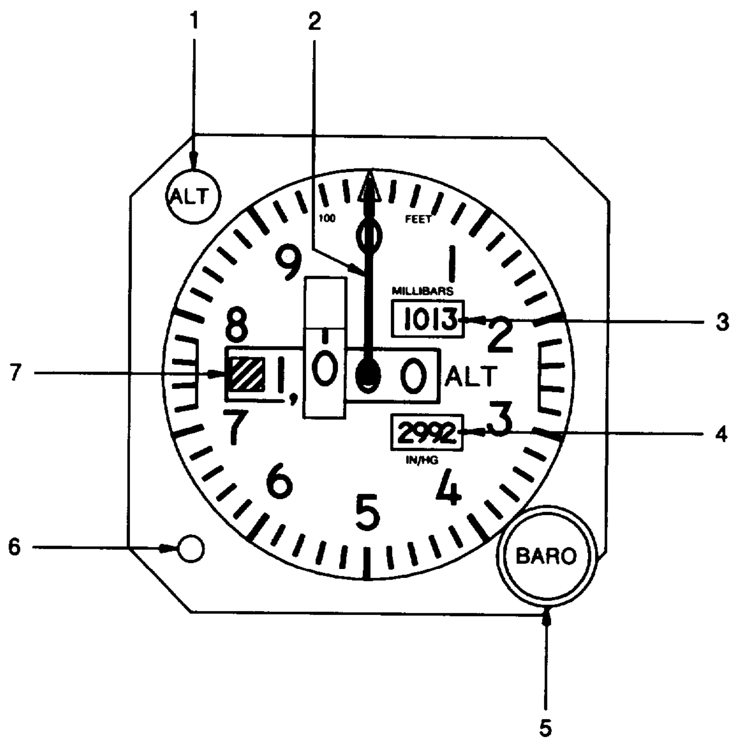
(7.) Test button. Used to test altimeter operation.

c. Encoding Altimeter - Normal Operation.

(1.) Turn-on procedure: Encoding altimeter will operate when transponder is operating with M-C switch set to center position.

(2.) Operating procedure:

1. Barometric set knob - Set desired altimeter setting in IN. HG. window.
2. CODE OFF flag - Check not visible.
3. Needle indicator - Check operation.
4. TEST button -
   a. Push - Reading decreases by 500 feet.
   b. Release - Returns to original reading.



1. Altitude alert annunciator
2. Altitude pointer
3. MILLIBARS barometric pressure counter
4. IN HG barometric pressure counter
5. BARO knob
6. TEST button
7. Counter drum display

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Figure 3-29. Copilot's Encoding Altimeter

NOTE

If the altimeter does not read within 70 feet of field elevation, when the correct local barometric setting is used, the altimeter needs calibration or internal failure has occurred. An error of greater than 70 feet also nullifies use of the altimeter for IFR flight.

d. Encoding Altimeter - Emergency Operation. Altimeter circuit breaker - Pull (if encoder fault occurs).

CHAPTER 4
Mission Equipment

Section I. MISSION AVIONICS

4-1. MISSION AVIONICS COVERAGE.

Complete provisions only are installed for the GPS, CHAALS and AQL mission systems. Equipment descriptions and operating instructions are to be obtained from appropriate vendor and Army Technical manuals.

4-2. MISSION CONTROL PANEL.

The mission control panel (fig 4-l), mounted on the copilot's sidewall, consists of three sections. The top section contains the mission caution/advisory annunciator panel, see Table 2-8. The center section contains one DC volt/ammeter, two digital AC volt/frequency meters, two AC digital load meters, one antenna steering synchro control, and the antenna steering mode selector switch. The bottom section contains the mission equipment control switches and the mission equipment circuit breakers.

Section II. AIRCRAFT SURVIVABILITY EQUIPMENT

4-3. M-130 FLARE AND CHAFF DISPENSING SYSTEM.

a. Description. The M- 130 flare and chaff dispensing system provides effective survival countermeasures against radar guided weapons systems and infrared seeking missile threats. The system consists of two dispenser assemblies with payload module assemblies, a dispenser control panel, a flare dispense switch, two control wheel mounted chaff dispensing switches, an electronic module assembly, and associated wiring. The flare and chaff dispensing system is protected by a 5-ampere circuit breaker, placarded M130 POWER located on the mission control panel (fig. 4-l).

WARNING

Right engine nacelle dispenser is for chaff only.

(1.) Dispenser assemblies. Two interchangeable dispenser assemblies are mounted on the aircraft. One is located in the aft portion of the right nacelle and the other is mounted on the right side of the fuselage. On this aircraft the dispenser in the nacelle will be used for chaff only while the dispenser mounted on the fuselage can be used for either flares or chaff. The selector switch (placarded C-F) on the dispenser can be set for either chaff or flares. The unit also contains the sensor for the flare detector. The dispenser assembly breech plate has the electrical contact pins which fire the impulse cartridges. The unit also contains the sequencing mechanism.

(2.) Payload module assemblies. A removable payload module assembly is provided for each dispenser assembly. Each payload module has 30 chambers which will accept either flares or chaffs. Flares or chaffs are loaded into the rear-end (studded end) of the payload module, and secured in place by a retaining plate.

(3.) Electronic module assembly (EM). The electronic module assembly contains the programmer, the flare detector and a safety switch. The unit is located behind the pilot's seat.

(a.) Flare detector. The flare detector is provided to insure that a flare is burning when it is ejected from the dispenser payload module. If the initial flare fails to ignite, the detector automatically fires another flare within 75 milliseconds. If the second flare fails to ignite, the detector will fire a third flare. If the third flare ignition is not detected, the detector will not fire another flare until the system is activated again by pressing the FLARE DISPENSE switch.

(b.) Programmer. The programmer is used for the chaff mode only. It has four switches for setting count and interval of salvo and burst.

(c.) Safety switch. The safety switch (with safety pin and red flag) prevents firing of chaff

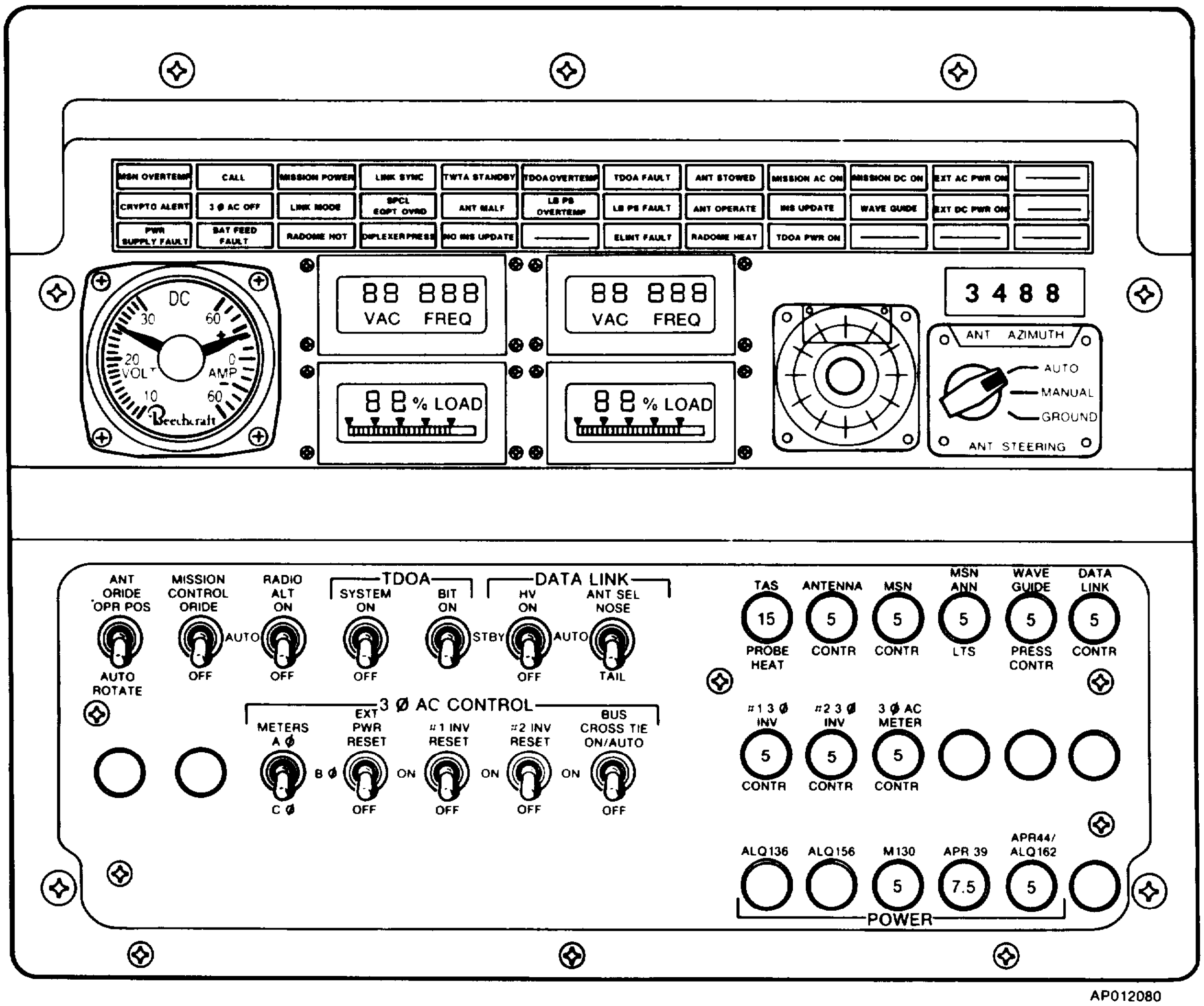

Figure 4- 1. Mission Control Panel

or flares when the safety pin is inserted. The safety pin shall be removed only while the aircraft is in flight or during test of the system.

(4.) Flare dispenser switch. A single pushbutton switch (fig. 4-2) placarded FLARE DISPENSE, located on the control pedestal, will fire a flare from the dispenser payload module each time it is pressed. If the FLARE DISPENSE switch is held down, it will dispense a flare every 2.3 seconds.

(5.) Control wheel mounted chaff dispense switches. Two pushbutton switches placarded CHAFF DISP, one located on top left portion of the pilot's control wheel and the other located on the top right portion of the copilot's control wheel, activates the chaff dispensing system when pressed.

(6.) Wing mounted safety switch. A wing mounted safety switch (with safety pin and red flag) located on top of the right wing, just aft of the nacelle, prevents the firing of chaff or flares when the pin is inserted. This safety pin shall be inserted while the aircraft is on the ground and removed prior to flight or during system test.

(7.) Dispenser control panel (DCP). The flare dispenser control panel (fig. 4-3) is mounted in the control pedestal. Control functions are as follows:

(a.) RIPPLE FIRE switch. A guarded switch placarded RIPPLE FIRE fires all remaining flares when moved to the up position. It is used in the event of an inflight emergency to dispense all flares from the dispenser payload module.

(b.) FLARE counter setting knob. Facilitates setting FLARE counter to the number of flares in the payload module before flight.

(c.) FLARE counter. Indicates the number of flares remaining in the dispenser payload module.

(d.) ARM light. An amber press to test indicator light placarded ARM illuminates when the ARM-SAFE switch is in the ARM position, when the safety pins are removed from the electronic module and the wing safety switch. Clockwise rotation will dim the indicator light.

(e.) CHAFF counter. Indicates the number of chaffs remaining in the payload module.

(f) CHAFF counter setting knob. Facilitates setting CHAFF counter to the number of chaffs in the payload module before flight.

(g.) MAN-PGRM SELECTOR SWITCH. Selects manual or programmed chaff dispense.

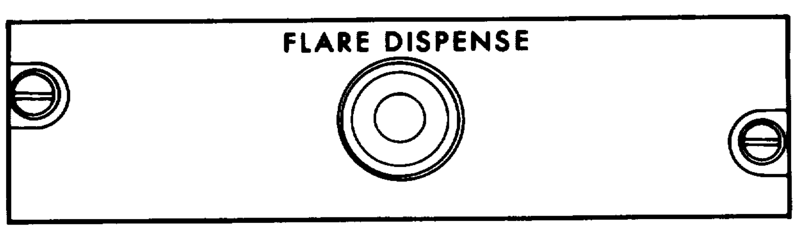

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Figure 4-2. Flare Dispense Switch

(h.) ARM-SAFE switch. When in the SAFE position, power is removed from the M-130 system. When in the ARM position, power is applied to the M-130 system.

1. MAN. Bypasses the programmer and fires one chaff each time one of the chaff dispense switches is pressed.

2. PGRM. Chaff is fired in accordance with the preset chaff program as set into the electronic module (count and interval of bursts and salvo).

(i.) Ripple Fire Switch Cover. Prevents accidental switch activation.

(8.) Ammunition for dispenser. Ammunition for the system consists of countermeasure chaff Ml, countermeasure flares M206, and impulse cartridges M796.

(a.) Countermeasure chaff M1. These units consist of a plastic case 8 inches in length and 0.97 inches square. The base of the chaff case is flanged to provide one-way assembly into the dispenser payload module. The chaff consists of aluminum coated fiberglass strands.

(b) Countermeasure flare M206. These units consist of an aluminum case 8 inches in length and 0.97 inches square. The base of the flare is flanged to provide one-way assembly into the payload module. The flare material consists of a magnesium and teflon composition. A preformed packing is required in the base of the flare unit prior to inserting the impulse cartridge.

(c.) Impulse cartridge M796. This cartridge fits into the base of either the flare or chaff and is electrically initiated to eject flares or chaff from the dispenser payload module.

b. Normal Operation.

NOTE

If aircraft is to be flown with flare dispenser assembly removed, fairing should be removed from fuselage.

(1.) General. At the present time surface-to-air intermediate range guided missiles that are launched against the aircraft must be visually detected by the aircraft crew. Crew members must insure visual coverage over the ground area where a missile attack is possible. The aircraft radar warning system will only alert the pilot and copilot when the aircraft is being tracked by radar-guided anti-aircraft weapons systems. It will not indicate the tiring of weapons against the aircraft.

(2.) Crew responsibilities. The pilot or designated crew member is responsible for removing the safety pin from the right wing before flight, and for replacing it immediately after flight. After the aircraft is airborne the pilot is responsible for removing the safety pin from the electronic module and moving the ARM-SAFE switch on the dispenser control panel to ARM. Before landing, he is responsible for re-inserting the safety pin in the electronic module and moving the ARM-SAFE switch to SAFE. While airborne the pilot and copilot are responsible for scanning the terrain for missile threats. When either pilot recognizes a missile launch he will press the FLARE DISPENSE button to eject flares.

(3.) Conditions for firing. The dispenser system should not be fired unless a missile launch is observed or radar guided weapons systems is detected and locked on. If a system malfunction is suspected, aircraft commander may authorize attempts to dispense flares or chaff as a test in a non-hostile area.

WARNING

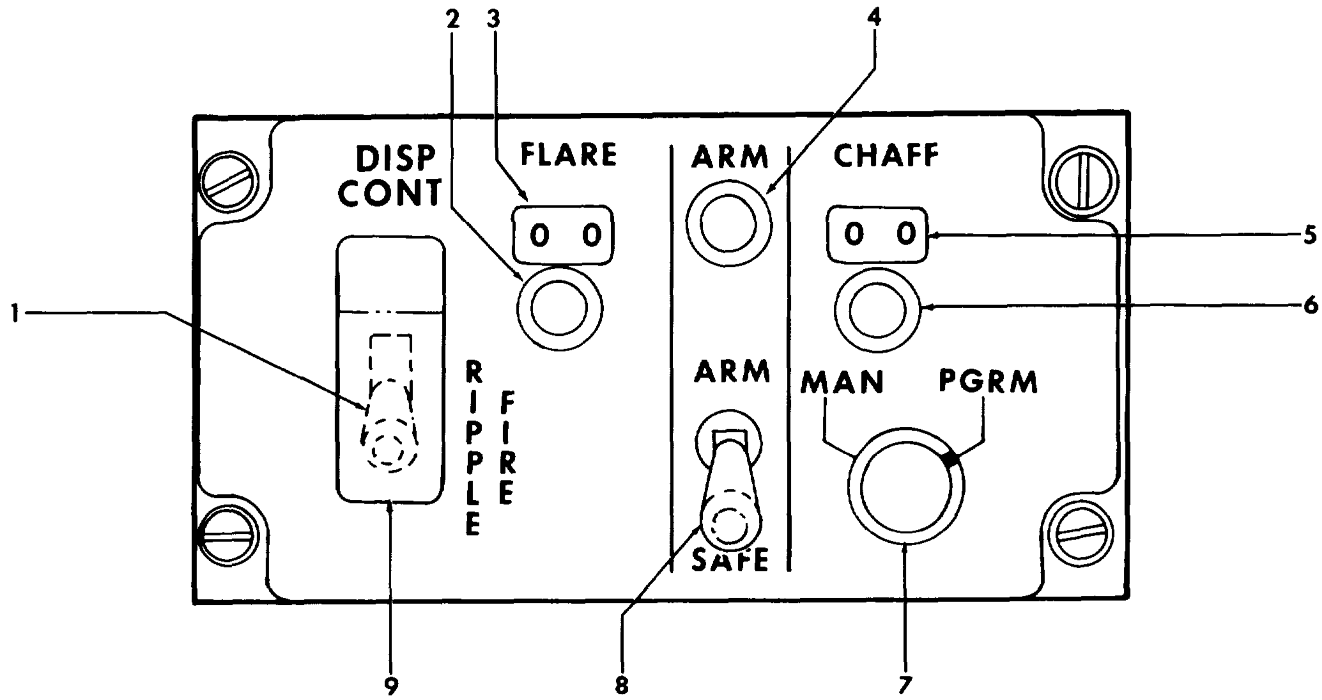
Aircraft must be in flight to dispense flares.

(a.) Firing procedure.

1. Flares. Upon observing a missile launch the pilot or copilot (whoever sights the launch first) will fire a flare. If more than one missile launch is observed, the firing sequence should be continued until the aircraft has cleared the threat area.

2 Chaff Upon receiving an alert from the aircraft radar warning system, the pilot or copilot will fire the chaff and initiate an evasive maneuver. The number of burst/salvo and number of salvo/program and their intervals as established by training doctrine will be set into the programmer prior to take-off (refer to TM 9-1095 206- 13 & P for information on setting programmer). If desired, the operator may override the programmed operational mode and fire chaff countermeasures manually by moving the dispenser function selector switch to MANUAL and pressing a dispenser switch.

(b.) Firing responsibility. When the pilot or copilot observes a missile launch or radar warning indication, he fires flares or chaff and assumes command of the dispenser system, and fires succeeding flares as required. He will advise the other pilot that a missile launch has been observed



1. RIPPLE FIRE switch
2. FLARE counter setting knob
3. FLARE counter indicator
4. ARM light
5. CHAFF counter indicator
6. CHAFF counter setting knob
7. MANUAL-PROGRAM switch
8. ARM-SAFE switch
9 RIPPLE FIRE switch cover

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Figure 4-3. Flare Dispenser Control Panel or a radar warning signal has been received, and announce that flares or chaff have been fired.

4-4. SYSTEM DAILY PREFLIGHT/RE-ARM TEST.

The following test procedures shall be conducted prior to the first flight of each day and prior to each re-arming of the dispensers. The first dispenser tested shall be the one used to dispense flares and the second one shall be the one used to dispense chaff. Notify AVUM if any improper indications occur during the tests.

WARNING

Assure payload module is not connected to dispenser assembly at any time during the following test procedure.

1. On flare dispenser assembly, assure the C-F selector switch is in F (flare) position.
2. Obtain M-91 test set and assure that TEST SEQUENCE switch is in START/HOME position.
3. Connect base plate of test set to breech of dispenser assembly. Secure both mounting studs uniformly hand tight, using 5/32 inch hexagonal wrench provided in test set carrying case.
4. Obtain test set power cable from the M-91 test set carrying case and connect cable between exterior connection J 1 (28V DC) on aircraft and aircraft power + 28V DC (J1) of test set.
5. Remove safety pin from EM and in the top skin of the right wing.

CAUTION

On DCP, assure that RIPPLE FIRE switch guard is in down position.

6. Provide aircraft power to DCP by setting M- 130 POWER circuit breaker to ON position.
7. On DCP, press ARM lamp. Lamp will illuminate. Release ARM lamp. Lamp will extinguish.
8. On DCP, set FLARE counter to 30 CHAFF COUNTER to 30 and MAN-PGRM switch to MAN position.
9. On DCP, set ARM-SAFE switch to ARM. ARM lamp will illuminate.

NOTE

When the test set is installed on the dispenser assembly and 28 volts DC aircraft power has been applied, the sequencer switch inside of dispenser assembly resets, making an audible sound as it rotates. There will be no such sound if the sequencer switch has been previously reset or if switch is in position 12 or 24.

NOTE

On test set, TS PWR ON lamp (clear) illuminates and remains illuminated throughout the test sequence until aircraft power to test set (via test set power cable) is disconnected or shut off.

10. Set mission chaff program on EM.
11. Perform the following operations on the M-91 test set:

    a. Press to test the remaining three lamps on test set. Each lamp will illuminate.

NOTE

Replace any lamp that does not illuminate when pressed. If none of the indicating lamps illuminate, return test set to AVUM.

    b. Rotate TEST SEQUENCE switch clockwise to the next position, TS RESET. No visual indication will occur.

    c. Rotate TEST SEQUENCE switch clockwise to SV SELF TEST position. STRAY VOLTAGE lamp (red) will illuminate.

    d. Rotate TEST SEQUENCE switch clockwise to next position, TS RESET. STRAY VOLTAGE lamp (red) will extinguish.

    e. Rotate TEST SEQUENCE switch clockwise to next position, STRAY VOLT. STRAY VOLTAGE lamp (red) should not illuminate.

    f. Rotate TEST SEQUENCE switch clockwise to next position, SYS NOT RESET. SYS NOT RESET lamp (amber) should not illuminate. If lamp illuminates, press and release MANUAL SYSTEM RESET switch and SYS NOT RESET lamp should then extinguish.

NOTE

When the MANUAL SYSTEM RESET switch is pressed and released, and 28 volts DC power has been applied, the sequencer switch inside the dispenser assembly resets, making an audible sound as it rotates. If the sequencer switch has been previously reset or if the switch is in position 12 or 24, there will be no such sound.

g. Rotate TEST SEQUENCE switch clockwise to next position, DISP COMP.

12. Press FLARE DISP switch once. For each depressing, the FLARE counter on DCP should count down in groups of three.

13. On DCP, raise RIPPLE FIRE switch guard and set toggle switch to up position until FLARE counter counts down to 00. Return switch guard to down position. On DCP, reset FLARE counter back to 30. DISPENSER COMPLETE lamp (green) on test set will illuminate.

14. Perform the following operations on the M-91 test set:

a. Rotate TEST SEQUENCE switch counter-clockwise to SYS NOT RESET position. SYS NOT RESET lamp (amber) will illuminate. DISPENSER COMPLETE lamp (green) will remain illuminated.

b. Press and release MANUAL SYSTEM RESET switch. SYS NOT RESET lamp (amber) will extinguish.

NOTE

When the MANUAL SYSTEM RESET switch is pressed and released, and 28 volts DC power has been applied, the sequencer switch inside the dispenser assembly resets, making an audible sound as it rotates. If the sequencer switch has been previously reset or if the switch is in position 12 or 24, there will be no such sound.

c. Rotate TEST SEQUENCE switch counterclockwise to STRAY VOLT position. STRAY VOLTAGE lamp (red) should not illuminate.

d. Rotate TEST SEQUENCE switch counterclockwise to START/HOME position.

NOTE

When the TEST SEQUENCE switch is turned to the START/HOME position, the DISPENSER COMPLETE lamp will extinguish, the STRAY VOLTAGE lamp will illuminate and then will extinguish when passing through the TS RESET position.

15. On CHAFF dispenser assembly, assure that C-F selector switch is in C (chaff) position.

16. Remove M-91 test set from first dispenser assembly.

17. Connect M-91 test set to breech assembly of second dispenser assembly. Secure both mounting studs uniformly hand tight using ball hexagonal key screwdriver provided in test set carrying case.

NOTE

When the test set is installed on the dispenser assembly and 28 volts DC aircraft power has been applied, the sequence switch inside the dispenser assembly resets, making an audible sound as it rotates. There will be no such sound if the sequencer switch has been previously reset or if switch is in position 12 or 24.

NOTE

On test set, TS PWR ON lamp (clear) illuminates and remains illuminated through the test sequence until aircraft power to test set (via test set power cable) is disconnected or shut off.

18. Perform the following operations on the M-91 test set:

a. Press to test all four lamps on test set. Each lamp will illuminate.

NOTE

Replace any lamp that does not illuminate when pressed. If none of the indicating lamps illuminate, return test set to AVUM.

b. Rotate TEST SEQUENCE switch clockwise to TS RESET position. No visual indication will occur.

c. Rotate TEST SEQUENCE switch clockwise to SV SELF TEST position. STRAY VOLTAGE lamp (red) will illuminate.

d. Rotate TEST SEQUENCE switch clockwise to next position, TS RESET. STRAY VOLTAGE lamp (red) will extinguish.

e. Rotate TEST SEQUENCE switch clockwise to next position, STRAY VOLT. STRAY VOLTAGE lamp (red) should not illuminate.

f. Rotate TEST SEQUENCE switch clockwise to next position, SYS NOT RESET. SYS NOT RESET lamp (amber) should not illuminate. If lamp illuminates, press and release MANUAL SYSTEM RESET switch and SYS NOT RESET lamp should then extinguish.

NOTE

When the MANUAL SYSTEM RESET switch is pressed and released, and 28 volts DC power has been applied, the sequencer switch inside the dispenser assembly resets, making an audible sound as it rotates. If the sequencer switch has been previously reset or if the switch is in position 12 or 24, there will be no such sound.

g. Rotate TEST SEQUENCE switch clockwise to next position, DISP COMPL.

19. Press pilot CHAFF DISP switch once, Press copilot CHAFF DISP switch once. On DCP, for each depressing, the CHAFF counter should count down by an increment of one.

20. On DCP, set MAN-PGRM switch to PGRM position.

21. Press any one of CHAFF DISP switches in aircraft. On DCP, the number shown on CHAFF counter should decrease in accordance with the program set on the EM.

22. Repeatedly press other CHAFF DISPENSE switch until CHAFF counter on DCP reads 00.

23. On test set, observe DISPENSE COMPLETE lamp (green) is illuminated and then perform the following operations:

a. Rotate TEST SEQUENCE switch counter-clockwise to SYS NOT RESET position. SYS NOT RESET lamp (amber) will illuminate.

b. Press and release MANUAL SYSTEM RESET switch. SYS NOT RESET lamp (amber) will extinguish.

NOTE

When the MANUAL SYSTEM RESET switch is pressed and released, and 28 volts DC power has been applied, the sequencer switch inside the dispenser assembly resets, making an audible sound as it rotates. If the sequencer switch has been previously reset or if the switch is in position 12 or 24, there will be no such sound.

c. Rotate TEST SEQUENCE switch counter-clockwise to STRAY VOLT position. STRAY VOLTAGE lamp (red) should not illuminate.

d. Rotate TEST SEQUENCE switch counter-clockwise to START/HOME position.

NOTE

When the TEST SEQUENCE switch is turned to the OFF position, the DISPENSER COMPLETE lamp will extinguish, the STRAY VOLTAGE lamp will illuminate and then will extinguish when the OFF position is reached.

24. Install safety pins.

25. Disconnect test set power cable.

26. Remove M-91 test set from dispenser assembly and restore in carrying case along with the power cable and hexagonal wrench.

27. On DCP, set ARM-SAFE switch to SAFE position.

28. On DCP, reset CHAFF counter to 30.

29. Disconnect aircraft power by pulling the 5 ampere M130 POWER circuit breaker located on the mission control panel (fig. 4-l).

30. Proceed immediately to ammunition loading procedures.

4-5. AMMUNITION.

a. Ammunition Loading Procedure.

WARNING

Only one shipping container is to be opened at a time. If a shipping container has been opened and only partially emptied, the remaining contents will be secured in the container with an appropriate type of packaging material or filler to adequately prevent jostling. All munitions in storage must be in their original shipping containers.

1. Place payload module assembly on work bench in approved safe area so that the retaining plate is facing up.
2. Remove retaining plate by unscrewing two retaining bolts.
3. Insert one flare (or chaff) at a time into each chamber of payload module.
4. Remove plastic dust cap from each chaff or flare.

CAUTION

Prior to insertion of an impulse cartridge, be sure there is preformed packing in the flare cartridge. (There will be no preformed packing in chaff cartridges.) Reinstall any preformed packing that is inadvertently removed with dustcap. The loading of impulse cartridges into a flare or chaff shall be accomplished one at a time.

5. Insert one impulse cartridge into each flare (or chaff).
6. Install retainer plate assembly by screwing to two retainer bolts into payload module.

WARNING

The system must have been tested to assure that there is no stray voltage and all aircraft power must be removed from the system prior to unloading the payload module.

7. On the dispenser control panel, assure ARM-SAFE switch is in SAFE position.
8. On the electronic module and right wing assure safety pins and flag assemblies are installed.
9. Slide payload module assembly into dispenser assembly and secure two stud bolts, hand tight, using 5/32 inch hexagonal wrench.

b. Ammunition Unloading Procedure.

WARNING

All aircraft power to the dispenser system must be turned off prior to removal of payload module from dispenser assembly. Safety pin flag shall be installed in the electronic module prior to landing and the safety pin flag shall be installed in the wing-mounted safety switch immediately after landing.

1. On dispenser control panel, assure ARM-SAFE switch is in SAFE position.
2. Assure safety pin and flag are inserted into electronic module and in the wing mounted safety switch.

WARNING

If there is an indication that a misfire occurred, notify emergency ordnance disposal personnel for disposition and disposal.

3. Remove module from dispenser assembly by unscrewing two stud bolts with a 5/32 inch hexagonal wrench and sliding out of dispenser assembly.
4. Remove retaining plate from payload module by unscrewing two retaining bolts.

5. Remove expended and unexpended impulse cartridges and flares (or chaff) from payload module.
6. Repack unexpended items in original containers and return to stores.

NOTE

It is not unusual for the case of a chaff cartridge to crack when fired. It does not effect performance of the item and should not be reported as a malfunction.

4-6. RADAR SIGNAL DETECTING SET (AN/APR-39(V)1).

The radar signal detecting set (control panel, fig. 4-3) indicates the relative position of search radar stations. Audio warning signals are applied to the pilot's and copilot's headsets. The radar signal detecting set is protected by the 7.5-ampere circuit breaker placarded APR39, located on the mission control panel (fig. 4-l). The associated antennas are shown in figure 2-1. For operating instructions, refer to TM I l-5841-283-20. Pattern # 1 self test, shall be as shown in figure 4-4.

a. Radar Signal Detecting Set Control Panel *Functions (AN/APR-39(V)1) (fig. 4-4).*

(1.) PWR switch. Turns set on or off.

(2.) SELF TEST switch. Initiates self test.

(3.) DSCRM switch. Turns discriminate function on or off.

(4.) AUDIO control. Adjusts audio level.

b. Radar Signal Detecting Set Indicator Functions (fig. 4-5).

(1.) MA indicator. Illuminates to indicate the presence of an MA threat.

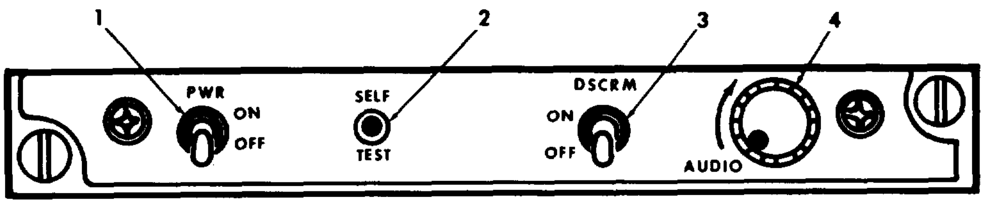
(2.) Display. Indicates relative position of search radar stations.

(3.) BRIL control. Adjusts brilliance,

(4.) DA Y-NIGHT control. Rotate to adjust intensity of display.

4-7. RADAR WARNING RECEIVER (AN/APR-44() (V3).

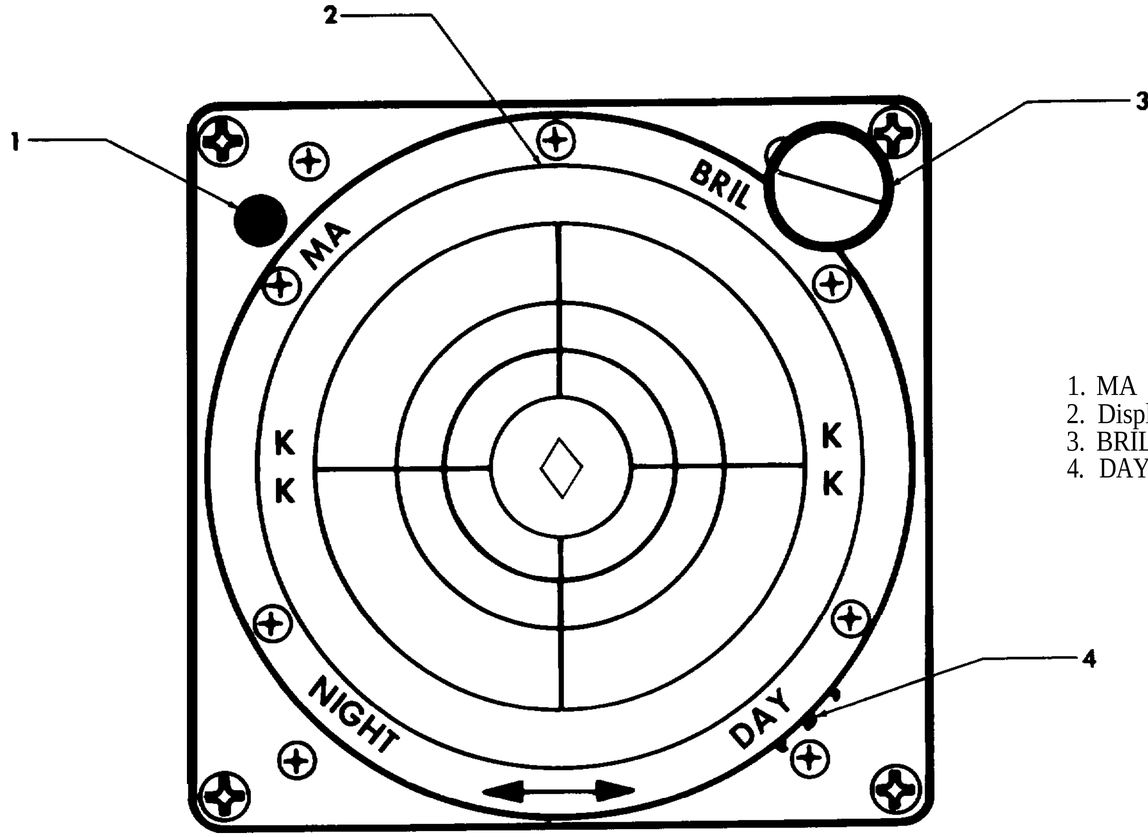
The radar warning receiver (fig. 4-6) indicates the presence of certain types of search radar signals.



1. POWER switch
2. SELF TEST switch
3. DESCRIMINATE function switch
4. AUDIO level control

AP 003891

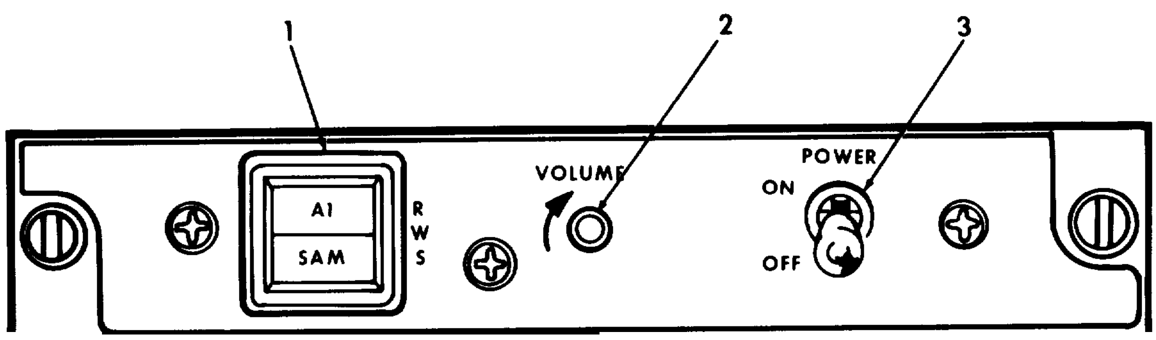
Figure 4-4. Radar Signal Detecting Set Control Panel (AN/APR-39(V)1)



1. MA indicator
2. Display
3. BRIL control
4. DAY-NIGHT control

AP 005715

Figure 4-5. Radar Signal Detecting Set Indicator



1. Radar warning indicator
2. VOLUME control
3. POWER switch

AP 003892

Figure 4-6. Radar Warning Receiver Control Panel (AN/APR-44() (V3)

The radar warning receiver is protected by the 5-ampere circuit breaker placarded APR44, located on the mission control panel (fig. 4-1). For operating instructions, refer to TM 11-5841-291-12.

a. Radar warning indicator. Illuminates to indicate the presence of an AI or SAM threat.

b. VOLUME control. Adjusts volume.

c. POWER switch. Turns set on and off.

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 result of design analysis, tests, and operating experiences. Compliance with these limits will allow the pilot to safely perform the assigned missions and to derive maximum utility from the aircraft. Limits concerning maneuvers, weight, and center of gravity are also covered in this chapter.

5-3. EXCEEDING OPERATIONAL LIMITS.

Anytime an operational limit is exceeded an appropriate entry shall be made on DA Form 2408-13. Entry shall state what limit or limits were exceeded, range, time beyond limits, and any additional data that would aid maintenance personnel in the maintenance action that may be required.

5-4. MINIMUM CREW REQUIREMENTS.

The minimum crew required for aircraft operation is two pilots. Additional crewmembers as required will be added at the discretion of the commander, in accordance with pertinent Department of the Army regulations.

Section II. SYSTEM LIMITS

5-5. INSTRUMENT MARKINGS.

Instruments which display operating limitations are illustrated in figure 5-1. The operating limitations are color coded on the instrument faces. Color coding of each instrument is explained in the illustration.

5-6. INSTRUMENT MARKING COLOR CODES.

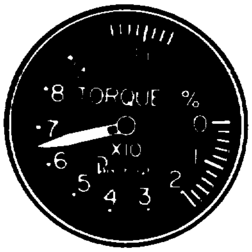
Operating limitations and ranges are illustrated by the colored markings which appear on the dial faces of engine, flight, and utility system instruments. Red markings indicate the limit above or below which continued operation is likely to cause damage or shorten life. The green markings indicate the safe or normal range of operation. The yellow markings indicate the range when special attention should be given to the operation covered by the instrument. Operation is permissible in the yellow range, but should be avoided. White markings on the airspeed indicator denotes flap operating range. The blue marking on the airspeed indicator denotes best rate of climb with one engine inoperative, at maximum gross weight, maximum forward c.g., sea level standard day conditions.

5-7. PROPELLER LIMITATIONS.

The maximum propeller overspeed limit is 2200 RPM. Propeller speeds above 2000 RPM indicate failure of the primary governor. Propeller speeds above 2080 RPM indicate failure of both primary and secondary governors. Torque is limited to 81% for sustained operation above 2000 RPM.

5-8. STARTER LIMITATIONS.

The starters in this aircraft are limited to an operating period of 30 seconds ON, then 5 minutes OFF, for two starter operations. After two starter operations the starter shall be operated for 30 seconds ON, then 30 minutes OFF.



TORQUE

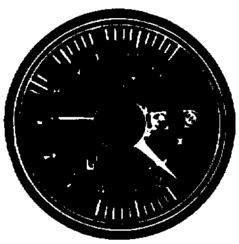
49% MAXIMUM BELOW 1600 RPM

20-100% NORMAL OPERATING RANGE

100% MAXIMUM
123% TRANSIENT (5 SECONDS)

TURBINE TACHOMETER (N1 SPEED)

52% MINIMUM LOW IDLE
88% MAXIMUM REVERSE (ONE MINUTE)
101.5% MAXIMUM
100.1% MAXIMUM BELOW -48 C
102.6% TRANSIENT (10 SECONDS)



TURBINE GAS TEMPERATURE

400-750°C NORMAL OPERATING RANGE
660°C MAXIMUM LOW IDLE

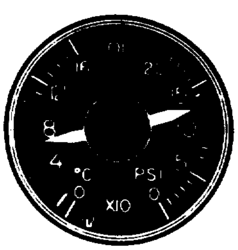
750°C MAXIMUM CONTINUOUS
750°C MAXIMUM REVERSE (1 MINUTE)

850°C MAXIMUM TRANSIENT
1000°C MAXIMUM STARTING (5 SECONDS)

PROPELLER TACHOMETER

1600-2000 RPM NORMAL OPERATING RANGE
1900 RPM MAXIMUM REVERSE (1 MINUTE)

2000 RPM MAXIMUM
2200 RPM TRANSIENT (5 SECONDS)



OIL TEMPERATURE AND PRESSURE

OIL TEMPERATURE SCALE

10-99°C NORMAL OPERATING RANGE
0-99°C CRUISE CLIMB AND RECOMMENDED SPEED
-40-99°C STARTING. LOW IDLE. HIGH IDLE

99°C MAXIMUM
104 C TRANSIENT (5 MINUTES)

OIL PRESSURE SCALE

60 PSI MINIMUM
60 TO 85 PSI. 49% TORQUE MAXIMUM

85-135 PSI NORMAL OPERATING ABOVE 21.000 FEET
85-105 PSI CAUTION RANGE BELOW 21.000 FEET

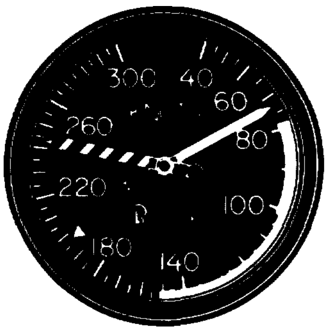
105-135 PSI NORMAL OPERATING BELOW 21.000 FEET

200 PSI MAXIMUM STARTING WITH COLD OIL

NOTE: + 10 PSI FLUCTUATIONS ARE ACCEPTABLE

G
R
Y

Figure 5-1 Instrument Markings (Sheet 1 of 3)



243 KIAS MAXIMUM (Vmo) (.47 MACH)

NOTE

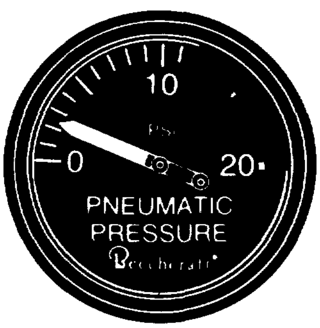
MAXIMUM ALLOWABLE AIRSPEED (RED) STRIPED) POINTER IS SELF ADJUSTING WITH ALTITUDE

91 KIAS MINIMUM SINGLE-ENGINE CONTROL SPEED (Vmca)

127 KIAS ONE-ENGINE INOPERATIVE BEST RATE-OF-CLIMB (Vyse)

78-153 KIAS FULL FLAP OPERATING RANGE

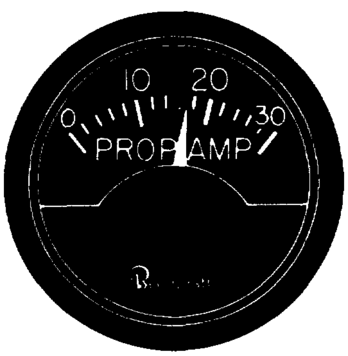
198 KIAS MAXIMUM APPROACH FLAP EXTENSION SPEED



PNEUMATIC PRESSURE

12-20 PSI NORMAL OPERATING RANGE

20 PSI MAXIMUM



PROPELLER DEICER AMMETER

14-18 AMPERES NORMAL OPERATION

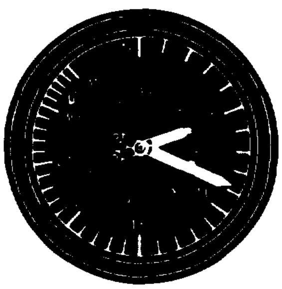
R
B
G

APO12879

Figure 5-1. Instrument Markings (Sheet 2 of 3)

FUEL QUANTITY

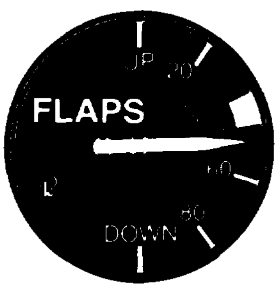
O-265 LBS NO TAKEOFF RANGE



CABIN ALTIMETER AND DIFFERENTIAL PRESSURE

O-6.1 PSI NORMAL RANGE

6.1 PSI MAXIMUM



FLAP POSITION INDICATOR

40% TAKEOFF AND APPROACH

R
Y
G

APOO4768.3

Figure 5-1. Instrument Markings (Sheet 3 of 3)

5-9. AUTOPILOT LIMITATIONS.

WARNING

The RC-12H aircraft is certified with wingtip pods installed. Should the pods be removed, the autopilot system must be replaced with a standard C-12D autopilot. Affected wiring must also be changed.

a. An autopilot preflight check must be. conducted and found satisfactory prior to each flight on which the autopilot is to be used.

b. A pilot must be seated at the controls with the seat belt fastened when the autopilot is in operation.

c. Operation of the autopilot and yaw damper is prohibited during takeoff and landing, and below 200 feet above terrain. Maximum speed for autopilot operation is 243 KIAS/O.47 Mach.

d. During a coupled ILS approach do not operate the propellers in the 1750 to 1850 RPM range.

5-10. FUEL SYSTEM LIMITS.

NOTE

Aviation gasoline (AVGAS) contains a form of lead which has an accumulative adverse effect on gas turbine engines. The lowest octane AVGAS available (less lead content) should be used. If any AVGAS is used the total operating time must be entered on DA Form 2408-13.

a. Operating Limits. Operation with FUEL PRESS light on is limited to IO hours. Log FUEL PRESS light on time on DA Form 2408-13. One standby boost pump may be inoperative for takeoff. (Crossfeed fuel will not be available from the side with the inoperative standby boost pump.) Operation on aviation gasoline is time limited to 150 hours between engine overhaul and altitude limited to 20,000 feet with one standby boost pump inoperative. Crossfeed capability is required for climb, when using aviation gasoline above 20,000 feet.

b. Fuel Management. Auxiliary tanks will not be filled for flight unless the main tanks are full. Maximum allowable fuel imbalance is 400 lbs. Do not take off if fuel quantity gages indicate in yellow arc (less than 265 lbs. of fuel in each main tank). Crossfeed only during single engine operation.

c. Fuel System Anti-Icing. Icing inhibitor conforming to MIL-I-27686 will be added to commercial fuel, not containing an icing inhibitor, during fueling operations, regardless of ambient temperatures. The additive provides anti-icing protection and also functions as a biocide to kill microbial growth in aircraft fuel systems.

5-11. BRAKE DEICE LIMITATIONS.

The following limitations apply to the brake deice system:

a. The brake deice system shall not be operated at ambient temperatures above 15°C.

b. The brake deice system shall not be operated longer than 10 minutes (one timer cycle) with the landing gear retracted. If operation does not automatically terminate approximately 10 minutes after gear retraction, turn the brake deice switch OFF.

c. Maintain 85% N_1 or higher during simultaneous operation of the brake deice and surface deice systems. If adequate pneumatic pressure cannot be provided for simultaneous operation of the brake deice and surface deice systems, turn OFF the brake deice system.

d. In order to maintain an adequate supply of systems pneumatic bleed air, the brake deice system shall be turned OFF during single engine operation.

5-12. PITOT HEAT LIMITATIONS.

Pitot heat should not be used for more than 15 minutes while the aircraft is on the ground.

Section ill. POWER LIMITS

5-13. ENGINE LIMITATIONS.

Observe the following limitations (table 5-1) during operation of this aircraft equipped with two Pratt and Whitney of Canada, Ltd. PT6A-41 engines. Each column is a separate limitation. The limits presented do not necessarily occur simultaneously. Whenever operating limits are exceeded, pilot should record the value and duration of the condition encountered in the aircraft log. Operation of the engines is monitored by instruments, with the operating limits marked on the face of each instrument.

CAUTION

Engine operation using only the engine driven fuel pump without boost pump fuel pressure is limited to 10 cumulative hours. All time in this category shall be entered on DA Form 2408-13 for the attention of maintenance personnel.

CAUTION

Use of aviation gasoline is time-limited to 150 hours of operation during any Time-Between-Overhaul (TBO) period. It may be used in any quantity with primary or alternate fuel.

5-14. OVERTEMPERATURE AND OVERSPEED LIMITATIONS.

a. Whenever the limiting temperatures are exceeded and cannot be controlled by retarding the power levers, the engine will be shut down and a landing made as soon as possible.

b. During engine operation, the temperatures, speeds and time limits listed in the Engine Operating Speeds Limitations chart (table 5-1) must be observed. When these limits are exceeded, the incident will be entered as an engine discrepancy in the appropriate maintenance forms. It is particularly important to record the amount and duration of over temperature and/or overspeed.

c. Continuous engine operation above 725ºC will reduce engine life.

5-15. POWER DEFINITIONS FOR ENGINE OPERATIONS.

The following definitions describe the engine power ratings.

a. Takeoff Power. The maximum power available, limited to periods of five minutes duration.

b. Maximum Continuous Power. The highest power rating not limited by time. Use of this rating is intended for emergency situations at the discretion of the pilot.

5-16. GENERATOR LIMITS.

Maximum generator load is limited to 100% for flight and variable during ground operations. Observe the limits shown in Table 5-2 during ground operation.

Table 5-1. Operating Limits

OPERATING CONDITION	SHP	TORQUE PERCENT (1)	MAXIMUM OBSERVED TGT °C	GAS GENERATOR RPM N_1 (10)	GAS GENERATOR RPM %	PROP RPM N_2	OIL PRESS PSI (2)	OIL TEMP °C
TAKEOFF (3)	850	100%	750	38,100	101.5	2000	105 to 135	10 to 99
MAX CONT	850	100% (4)	750	38,100	101.5	2000	105 to 135	10 to 99
MAX CLIMB	850	100% (4)	725	38,100	101.5	2000	105 to 135	0 to 99
MAX CRUISE								
HIGH IDLE	-	-	-	-	(5)	-	-	-40 to 99
LOW IDLE	-	-	660 (6)	19,500	52(min)	-	60(min)	-40 to 99
STARTING	-	-	1000(7)	-	-	-	-	-40(min)
TRANSIENT	-	123% (7)	850	38,500(8)	102.6(8)	2200(7)	-	0 to 104 (3)
MAX REVERSE(9)		-	750	-	88	1900	105 to 135	0 to 99

NOTES:

(1) Torque limit applies within range of 1600-2000 propeller RPM (N_2). Below 1600 RPM, torque is limited to 49%.

(2) Normal takeoff and maximum continuous operation oil pressure at gas generator speeds above 72% with oil temperature between 60 and 71°C is 105 to 135 PSIG up to 21,000 feet. Above 21,000 feet, the minimum oil pressure is 85 PSIG. Plus or minus 10 PSIG fluctuations are acceptable. Oil pressure between 60 and 85 PSIG should be tolerated only for the completion of the flight at power setting not to exceed 49% torque. Oil pressure below 60 PSIG are unsafe and require that either the engine be shut down or a landing be made as soon as possible, using the minimum power required to sustain flight. During extremely cold starts, oil pressure may reach 200 PSI.

(3) These values are time limited to 5 minutes.

(4) Cruise torque values vary with altitude and temperature.

(5) At approximately 70% N_1.

(6) High TGT at ground idle may be corrected by reducing accessory load and/or increasing N_1 RPM.

(7) These values are time limited to 5 seconds.

(8) These values are time limited to 10 seconds.

(9) This operation is time limited to 1 minute.

(10) For every 5.6ºC below -48ºC ambient temperature, reduce maximum allowable N_1 by 1.6%.

TABLE 5-2. GENERATOR LIMITS

GENERATOR LOAD	MINIMUM GAS GENERATOR RPM - N_1 WITHOUT AIR CONDITIONING	MINIMUM GAS GENERATOR RPM - N_1 *WITH AIR CONDITIONING
0 to 50%	53%	60%
50 to 80%	60%	65%
80 to 100%	63%	70%

*Right engine only

Section IV. LOADING LIMITS

5-17. CENTER OF GRAVITY LIMITATIONS.

Center of gravity limits and instructions for computation of the center of gravity are contained in Chapter 6. The center of gravity range will remain within limits, providing the aircraft loading is accomplished according to instructions in Chapter 6.

5-18. WEIGHT LIMITATIONS.

Maximum takeoff gross weight is 15,000 pounds. Maximum landing weight is 15,000 pounds. Maximum ramp weight is 15,090 pounds. Maximum zero fuel weight is 11,500 pounds.

WARNING

The ability to sustain loss of engine power and successfully stop, continue the takeoff, or climb before or after gear retraction is not assured for all conditions. Thorough mission planning must be accomplished prior to takeoff by analysis of maximum takeoff weight permitted by takeoff distance, accelerate-stop, positive one-engine-inoperative climb at lift off, accelerate-go, takeoff climb gradient, and climb performance. These data will describe performance capabilities for critical mission decisions.

Section V. AIRSPEED LIMITS, MAXIMUM AND MINIMUM

5-19. AIRSPEED LIMITATIONS.

Airspeed indicator readings contained in procedures, text, and illustrations throughout this Operator's Manual are given as indicated airspeed (IAS). Airspeed indicator markings (fig. 5-1) and placarded airspeeds, located on the cockpit overhead control panel (fig. 2- 12), are also indicated airspeeds.

5-20. MAXIMUM ALLOWABLE AIRSPEED.

The maximum allowable airspeed is 243 KIAS/ 0.42 Mach.

5-21. LANDING GEAR EXTENSION SPEED.

The airspeed limit for extending the landing gear and for flight with the landing gear extended is 180 KIAS.

5-22. LANDING GEAR RETRACTION SPEED.

The airspeed limit for retracting the landing gear is 162 KIAS.

5-23. WING FLAP EXTENSION SPEEDS.

The airspeed limit for APPROACH extension (40%) of the wing flaps is 198 KIAS. The airspeed limit for full DOWN extension (100%) of the wing flaps is 153 KIAS. If wing flaps are extended above these speeds, the flaps or their operating mechanisms may be damaged.

5-24. MINIMUM SINGLE-ENGINE CONTROL AIRSPEED (V_{mc}).

Chapter 7, Section X describes minimum single-engine control airspeeds. The minimum single-engine control airspeed (V_{mc}) at sea level standard conditions is 91 KIAS.

5-25. MAXIMUM DESIGN MANEUVERING SPEED.

The maximum design maneuvering speed is 168 KIAS.

FLIGHT ENVELOPE CHART

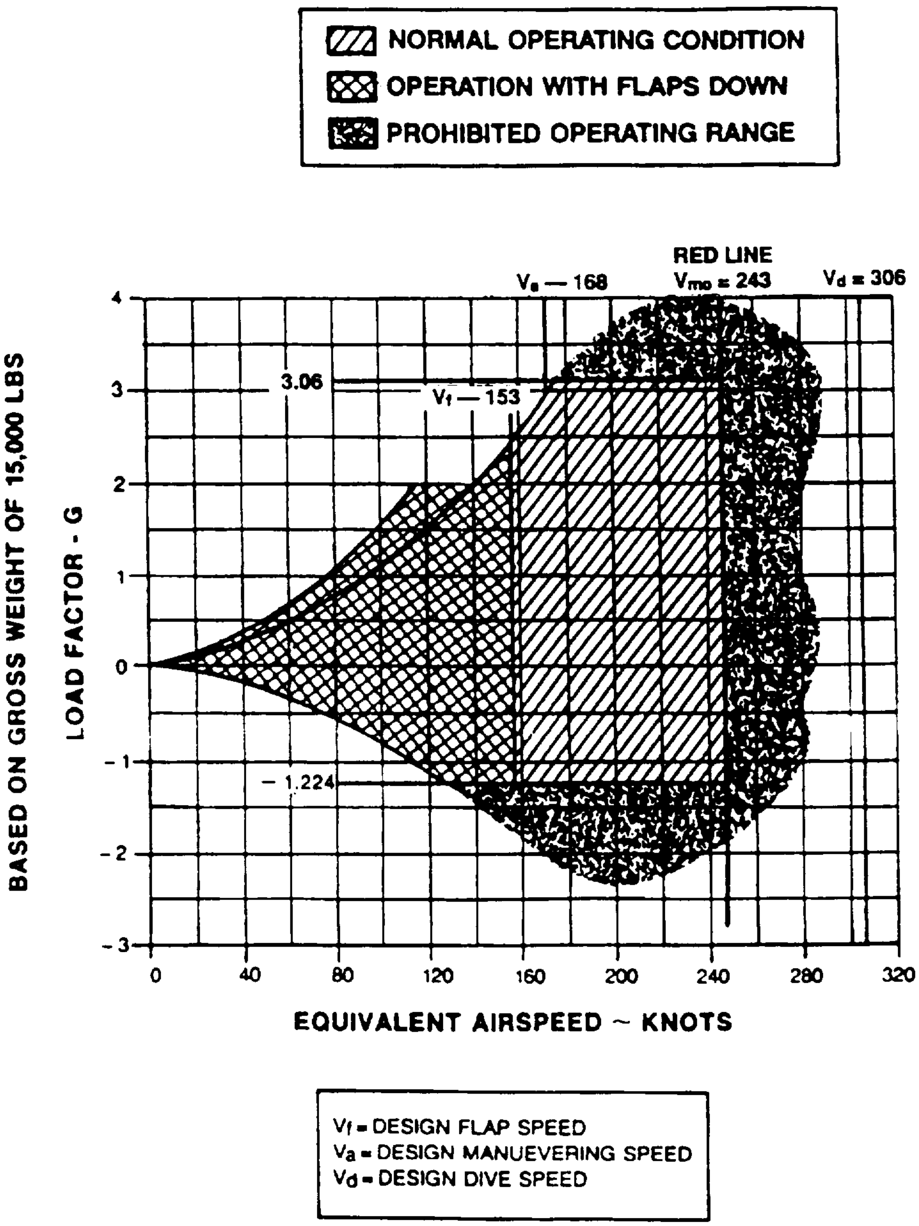


Figure 5-2. Flight Envelope

Section VI. MANUEVERING LIMITS

5-26. MANEUVERS.

For abrupt maneuvers above 168 KIAS. refer to Flight Envelope (tip. 5-2).

a. The following maneuvers are prohibited.

1. Spins.

3. Aerobatics of any kind.

3. Abrupt maneuvers above 168 KIAS.

4. Any maneuver which results in a positive load factor of 3.06G's or a negative load factor of 1.224G's with wing flaps up, or a positive load factor of 2.0G's or a negative 1224G's with wing flaps down.

b. Recommended turbulent air penetration airspeed is 158 KIAS.

5-27. BANK AND PITCH LIMITS.

a. Bank limits are 60° left or right.

b. Pitch limits are 30° above or below the horizon.

Section VII. ENVIRONMENTAL RESTRICTIONS

5-28. ALTITUDE LIMITATIONS.

The maximum altitude that the aircraft may be operated at is 31,000. When operating with inoperative yaw damp, the altitude limit is 17,000 feet.

5-29. TEMPERATURE LIMITS.

a. The aircraft shall not be operated when the ambient temperatures are warmer than ISA 37°C at SL to 25,000 feet. ISA 31°C above 25,000 feet.

b. Engine ice vanes shall be retracted at 1°C and above.

5-30. FLIGHT UNDER IMC (INSTRUMENT METEOROLOGICAL CONDITIONS).

This aircraft is qualified for operation in instrument meteorological conditions.

5-30A. ICING LIMITATIONS (TYPICAL).

WARNING

While in icing conditions, if there is an unexplained 30% increase of torque needed to maintain airspeed in level flight, a cumulative total of two or more inches of ice accumulation on the wing, an unexplained decrease of 15 knots IAS, or an unexplained deviation between pilot's and copilot's airspeed indicators, the icing environment should be exited as soon as practicable. Ice accumulation on the pitot tube assemblies could cause a complete loss of airspeed indication.

The following conditions indicate a possible accumulation of ice on the pitot tube assemblies and unprotected airplane surfaces. If any of these conditions are observed, the icing environment should be exited as soon as practicable.

1. Total ice accumulation of two inches or more on the wing surfaces. Determination of ice thickness can be accomplished by summing the estimated ice thickness on the wing prior to each pneumatic boot deice cycle (e.g. four cycles of minimum recommended 1/2-inch accumulation.

2. A 30 percent increase in torque per engine required to maintain a desired airspeed in level flight (not to exceed 85 percent torque) when operating at recommended holding speed.

3. A decrease in indicated airspeed of 15 knots after entering the icing condition (not slower than 1.4 power off stall speed) if maintaining original power setting in level flight. This can be determined by comparing pre-icing condition entry speed to the indicated speed after a surface and antenna deice cycle is completed.

4. Any variations from normal indicated airspeed between the pilot's and copilot's airspeed indicators.

5-30B. ICING LIMITATIONS (SEVERE).

WARNING

Severe icing may result from environmental conditions outside of those for which the airplane is certificated. Flight in freezing rain, freezing drizzle, or mixed icing conditions (supercooled liquid water and ice crystals) may result in a build-up on protective surfaces exceeding the capability of the ice protection system, or may result in ice forming aft of these protected surfaces. This ice may not shed using ice protection systems, and may seriously degrade the performance and controllability of the airplane.

a. During flight, severe icing conditions that exceed those for which the airplane is certficated shall be determined by the following visual cues. If one or more of these visual cues exists. immediately request priority handling from air traffic control to facilitate a route or an altitude change to exit the icing conditions:

(1) Unusually extensive ice accreted on the airframe in areas not normally observed to collect ice.

(2) Accumulation of ice on the upper (or lower. as appropriate) surface of the wing aft of the protected area.

(3) Accumulation of ice on the propeller spinner farther aft than normally observed.

b. Since the autopilot may mask tactile cues that indicate adverse changes in handling characteristics. use of the autopilot is prohibited when any of the visual cues specified above exist. or when unusual lateral trim requirements or autopilot trim warnings are encountered while the airplane is in icing conditions.

NOTE

All icing detection lights must be operative prior to flight into icing conditions at night. This supersedes any relief provided by the master minimum equipment list (MMEL) or equivalent.

5-31. CROSSWIND LIMITATION.

The maximum crosswind component is 25 knots at 90°. The maximum angle of bank in a slip during landing is 8°. Landing the aircraft in a crab will impose side loads on the landing gear and should he recorded on the DA Form 2408 13-1. Refer to Chapter 8 for crosswind landing technique.

5-32. OXYGEN REQUIREMENTS.

A minimum ten minute supply of supplemental oxygen shall be available during flight at or above an altitude of 25,000 feet based on the highest total aircraft oxygen flow rates.

In addition to the supply required by the information in the above paragraph. sufficient oxygen will be carried for each flight. assuming a decompression will occur at the altitude or point of flight that is most critical from the standpoint of oxygen need. and that after decompression the aircraft will descend. in accordance with the emergency procedures. to a flight altitude that Will allow successful termination of the flight. Following the decompression, the cabin pressure altitude is considered to be the same as the flight altitude.

An oxygen system data/duration table may be found in Chapter 2.

5-33. CABIN PRESSURE LIMITS.

Maximum cabin differential is 6.2 PSI.

5-34. CRACKED CABIN WINDOW / WINDSHIELD.

If a crack occurs in an outer cabin window. the aircraft is limited to an altitude of 25,000 feet, and maximum cabin pressure differential is limited to 4.6 PSI. Maximum operating time with a crack in an outer cabin window is 20 hours. If an external windshield crack is noted. no action is required in flight. If an external crack occurs in either cabin window or the windshield, refer to Chapter 9. Emergency Procedures.

Section VIII. OTHER LIMITATIONS

5-35. MAXIMUM DESIGN SINK RATE.

The maximum design sink rate is 500 feet per minute.

5-36. INSTRUMENT LANDING SYSTEM LIMITS.

During ILS approach do not operate the propellers in the 1750 to 1850 RPM range.

5-37. INTENTIONAL ENGINE OUT SPEED.

Inflight engine cuts below the safe one-engine inoperative speed (V_{sse} - 109 KIAS) are prohibited.

5-38. LANDING ON UNPREPARED RUNWAY.

CAUTION

Except in an emergency, propellers should be moved out of reverse above 40 knots to minimize propeller blade erosion, and during crosswind to minimize stress imposed on propeller, engine and airframe. Care must be exercised when reversing on runways with loose sand or dust on the surface. Plying gravel will damage propeller blades and dust may impair the pilot's forward visibility at low aircraft speeds.

5-39. MINIMUM OIL TEMPERATURE REQUIRED FOR FLIGHT.

Engine oil is used to heat the fuel upon entering the fuel control. Since no temperature measurement is available for the fuel at this point, it must be assumed to be the same as the OAT. The minimum oil temperature graph (fig. 5-3) is provided for use as a guide in preflight planning, based on known or forecast operating conditions, to allow the operator to become aware of operating temperatures where icing at the fuel control could occur. If the plot should indicate that oil temperatures versus OAT are such that ice formation could occur during takeoff or in flight, anti-icing additive per MIL-I-27686 should be mixed with the fuel at refueling to insure safe operation. In the event that authorized fuels (Prist) are not available the limitation of this chart apply.

CAUTION

Anti-icing additive must be properly blended with the fuel to avoid deterioration of the fuel cell. The additive concentration by volume shall be a minimum of 0.060% and a maximum of 0.15%. Approved procedure for adding anti-icing concentrate is contained in Chapter 2, Section XII.

CAUTION

JP-4 fuel per MIL-T-5624 has anti-icing additive per MIL-I-27686 blended in the fuel at the refinery and no further treatment is necessary. Some fuel suppliers blend anti-icing additive in their storage tanks. Prior to refueling, check with the fuel supplier to determine if fuel has been blended. To assure proper concentration by volume of fuel on board, blend only enough additive for the unblended fuel.

MINIMUM OIL TEMPERATURE REQUIRED FOR OPERATION WITHOUT ANTI-ICING ADDITIVE

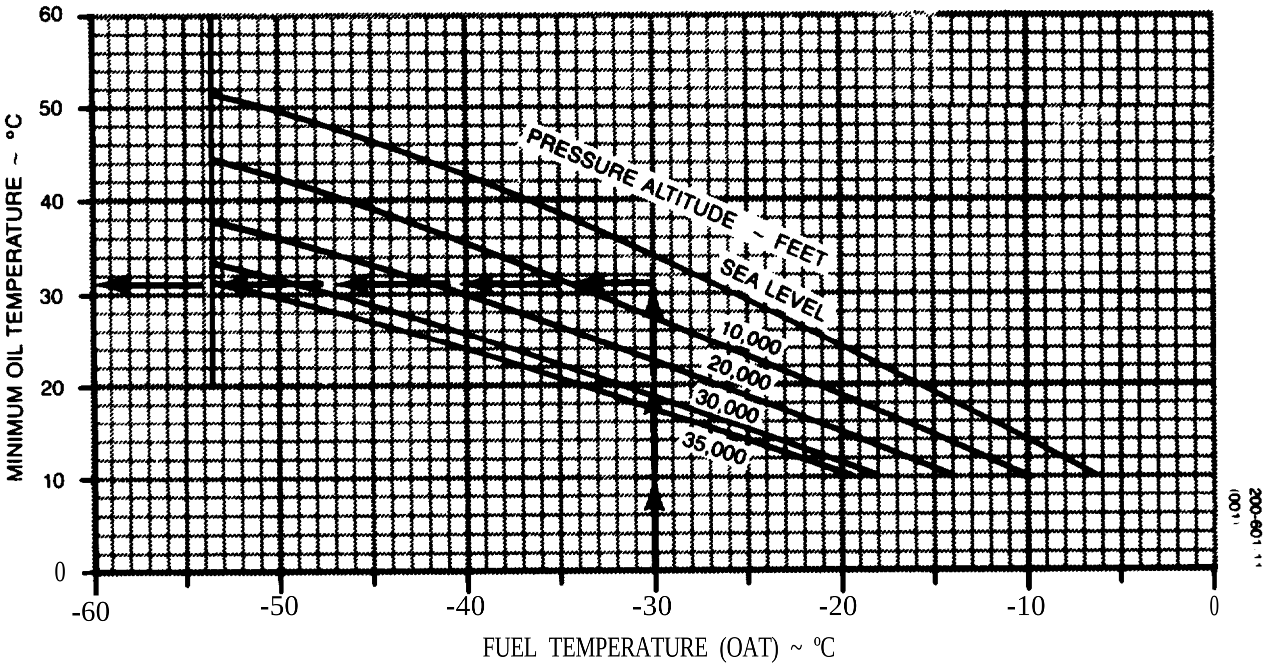


Figure 5-3. Minimum Oil Temperature

Section IX. REQUIRED EQUIPMENT FOR VARIOUS CONDITIONS OF FLIGHT

5-40. REQUIRED EQUIPMENT LISTING.

a. A Required Equipment for Various Conditions of Flight listing (fig. 5-4) is provided to enable the pilot to indentify those systems/components required for flight. For the sake of brevity, the listing does not include obviously required items such as wings, rudders, flaps, engines, landing gear, etc. Also the list does not include items which do not affect the airworthiness of the aircraft such as galley equipment, entertainment systems, passenger convenience items, etc. However, it is important to note that ALL ITEMS WHICH ARE RELATED TO THE AIRWORTHINESS OF THE AIRCRAFT AND NOT INCLUDED ON THE LIST ARE AUTOMATICALLY REQUIRED TO BE OPERATIVE.

b. It is the final responsibility of the pilot to determine whether the lack or inoperative status of a piece of equipment on his aircraft will limit the conditions under which he may operate the aircraft.

(-) Indicates item may be inoperative for the specified flight condition,

(*) Refers to remarks and/or exceptions column for explicit information or reference.

Numbered items contained in ( ) are required for flights by AR 95-l.

c. The pilot is responsible for exercising the necessary operational control to assure that no aircraft is flown with multiple items inoperative, without first determining that any interface or interrelationship between inoperative systems or components will not result in a degradation in the level of safety and/or cause an undue increase in crew workload.

d. The exposure to additional failures during continued operation with inoperative systems or components must also be considered in determining that an acceptable level of safety is being maintained. The REL may not deviate from requirements of the Operators Manual limitations section, emergency procedures or safety of flight messages.

SYSTEM and/or COMPONENT	VFR DAY	VFR NIGHT	IFR DAY	IFR NIGHT	ICING CONDITIONS	REMARKS and/or Exceptions
ELECTRICAL POWER						
1. AC Volts/Frequency Meter	1	1	1	1	1	
2. Battery	1	1	1	1	1	
3. Battery Charge Monitor System and Annunciator	1	1	1	1	1	
4. DC Generator	2	2	2	2	2	
5. DC Generator Annunciator	2	2	2	2	2	
6. DC Load Meter	2	2	2	2	2	One may be inoperative provided corresponding loadmeter is monitored.
7. lnverter	2	2	2	2	2	
8. lnverter Annunciator	1	1	1	1	1	May be inoperative provided both inverters are operative.
ENVIRONMENTAL						
1. Bleed Air Fail Annunciators	2	2	2	2	2	Provided bleed air is not used from side of failed light.
2. Altitude Warning Annunciator (cabin)	1	1	1	1	1	May be inoperative provided airplane remains unpressurized.
3. Cabin Rate of Climb Indicator	1	1	1	1	1	
4. Differential Pressure/Cabin Altitude Indicator	1	1	1	1	1	
5. Duct Overtemp Annunciator	1	1	1	1	1	
6. Outflow Valve	1	1	1	1	1	
7. Pressurization Controller	1	1	1	1	1	
8. Safety Valve	1	1	1	1	1	
9. Bleed Air Shutoff Valve	2	2	2	2	2	
FIRE PROTECTION						
1. Engine Fire Detector System and Annunciator	2	2	2	2	2	
FLIGHT CONTROLS						
1. Flap Position Indicator	1	1	1	1	1	May be inoperative provided that the flap travel is visually inspected prior to takeoff.
2. Flap System	1	1	1	1	1	
3. Stall Warning Horn	1	1	1	1	1	
4. Trim Tab Position Indicator (Rudder, Aileron, Elevator)	3	3	3	3	3	May be inoperative provided that the trim tabs are checked in the neutral position prior to each take off and checked for full range of operation.
5. Yaw Damp System	1	1	1	1	1	May be inoperative for flight at and below 17,000 feet.

Figure 5-4. Required Equipment Listing (1 of 3)

SYSTEM and/or COMPONENT	VFR DAY	VFR NIGHT	IFR DAY	IFR NIGHT	ICING CONDITIONS	REMARKS and/or Exceptions
FUEL						
1. Engine Driven Boost Pump	2	2	2	2	2	
2. Fuel Crossfeed System Including Annunciator	1	1	1	1	1	
3. Standby Fuel Boost Pump	2	2	2	2	2	
4. Fuel Pressure Annunciator	2	2	2	2	2	
5. Fuel Quantity Indicating System Including Annunciators	2	2	2	2	2	One may be inoperative provided other side is operative and amount of fuel on board can be established to be adequate for intended flight. Fuel flow on affected side must be operational and monitored.
6. Firewall Fuel Shutoff System Including Annunciators	2	2	2	2	2	
7. Jet Transfer Pump	2	2	2	2	2	
8. Motive Flow Valve	2	2	2	2	2	
9. Fuel Flow Indicator	2	2	2	2	2	
ICE AND RAIN PROTECTION						
1. Alternate Static Air Source	0	0	1	1	1	
2. Engine Auto Ignition and Annunciators	2	2	2	2	2	
3. Engine Anti-Ice System and Annunciators	2	2	2	2	2	
4. Heated Fuel Vent	0	0	0	0	1	
5. Heated Windshield (Left)	0	0	0	0	1	
6. Pitot Heat	0	0	2	2	2	
7. Pneumatic Pressure Indicator	0	0	1	1	1	
8. Propeller Deicer System	0	0	0	0	1	
9. Stall Warning Heat (Lift Transducer & Mounting Plate)	0	0	0	0	1	
10. Surface Deicer System	0	0	0	0	1	
11. Wing Ice Light (Left)	0	0	0	0	1	
12. Antenna Deice System	0	0	0	0	1	
LANDING GEAR						
1. Landing Gear Positon Indicator Lights	3	3	3	3	3	One of three may be inoperative provided gear handle light is monitored.
2. Landing Gear Handle Light	1	1	1	1	1	
3. Landing Gear Aural Warning	1	1	1	1	1	
4. Alternate Landing Gear Extension System	1	1	1	1	1	
5. Brake Deice Overheat Annunciators	2	2	2	2	2	
6. Landing Gear Motor and Gearbox	1	1	1	1	1	
LIGHTS						
1. Cockpit and Instrument Lighting System	0	1	0	1	0	Lights must illuminate all instruments and controls.
2. Cabin Door Annunciator	1	1	1	1	1	
3. Landing Lights	0	1	0	1	0	
4. Position Lights	0	3	0	3	0	
5. Anti-collision Lights System	0	1	0	1	0	

Figure 54. Required Equipment Listing (2 of 3)

SYSTEM and/or COMPONENT	VFR DAY	VFR NIGHT	IFR DAY	IFR NIGHT	ICING CONDITIONS	REMARKS and/or Exceptions
NAVIGATION INSTRUMENTS						
1. Airspeed Indicator (Left)	1	1	1	1	1	Right side may be inoperative.
2. Altimeter (Left)	1	1	1	1	1	Right side may be inoperative.
3. Magnetic Compass	1	1	1	1	1	
4. Outside Air Temperature Gauge	1	1	1	1	1	
OXYGEN						
1. Oxygen System	1	1	1	1	1	
PROPELLERS						
1. Autofeather System Including Annunciators	1	1	1	1	1	
2. Propeller Reversing System Including Annunciators	2	2	2	2	2	
3. Propeller Governor Test Switch	1	1	1	1	1	
4. Propeller Overspeed Governor	2	2	2	2	2	
5. Propeller Primary Low-Pitch Stop	2	2	2	2	2	
VACUUM SYSTEM						
1. Instrument Air System	0	1	1	1	1	
ENGINE INDICATIONS						
1. TGT Indicator	2	2	2	2	2	
2. Tachometer (Gas Generator)	2	2	2	2	2	
3. Tachometer (Propeller)	2	2	2	2	2	
4. Torque Indicator	2	2	2	2	2	
ENGINE OIL						
1. Chip Detector System Including Annunciators	2	2	2	2	2	
2. Oil Pressure Indicator	2	2	2	2	2	
3. Oil Temperature Indicator	2	2	2	2	2	
4. Oil Pressure Annunciator	2	2	2	2	2	

NOTE

The above equipment list does not include all specific flight instruments and communications/navigation equipment required by FAR Parts 91 and 135 Operating Requirements.

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Figure 5-4. Required Equipment Listing (3 of 3)

CHAPTER 6
WEIGHT/BALANCE AND LOADING

Section I. GENERAL.

6-1. EXTENT OF COVERAGE.

Sufficient data has been provided so that, knowing the basic weight and moment of the aircraft, any combination of weight and balance can be computed.

6-2. CLASS.

Army Model RC-12H aircraft are in Class 1. Additional directives governing weight and balance of Class 1 aircraft forms and records are contained in DA PAM 738-751 and TM 55-1510-342-23.

6-3. AIRCRAFT COMPARTMENT AND STATIONS.

The aircraft is separated into two compartments associated with loading. These compartments are the cockpit and the cabin. Figure 6-l shows the general description of aircraft compartments.

Section II. WEIGHT AND BALANCE

6-4. PURPOSE.

The data to be inserted on weight and balance charts and forms are applicable only to the individual aircraft, the serial number of which appears on the title page of the booklet entitled WEIGHT AND BALANCE DATA supplied by the aircraft manufacturer and on the various forms and charts which remain with the aircraft. The charts and forms referred to in this chapter may differ in nomenclature and arrangement from time to time, but the principle on which they are based will not change.

6-5. CHARTS AND FORMS.

The standard system of weight and balance control requires the use of several different charts and forms. Within this Chapter, the following are used:

a. Chart C - Basic Weight and Balance Record, DD Form 365-3 (fig. 6-2).

b. Form F - Weight and Balance Clearance Form F, DD Form 365-4 (Tactical), fig. 6-3).

6-6. RESPONSIBILITY.

The aircraft manufacturer inserts all aircraft identifying data on the title page of the booklet entitled WEIGHT AND BALANCE DATA and on the various charts and forms. All charts, including one sample Weight and Balance Clearance Form F, if applicable, are completed at time of delivery. This record is the basic weight and balance data of the aircraft at delivery. All subsequent changes in weight and balance are compiled by the weight and balance technician.

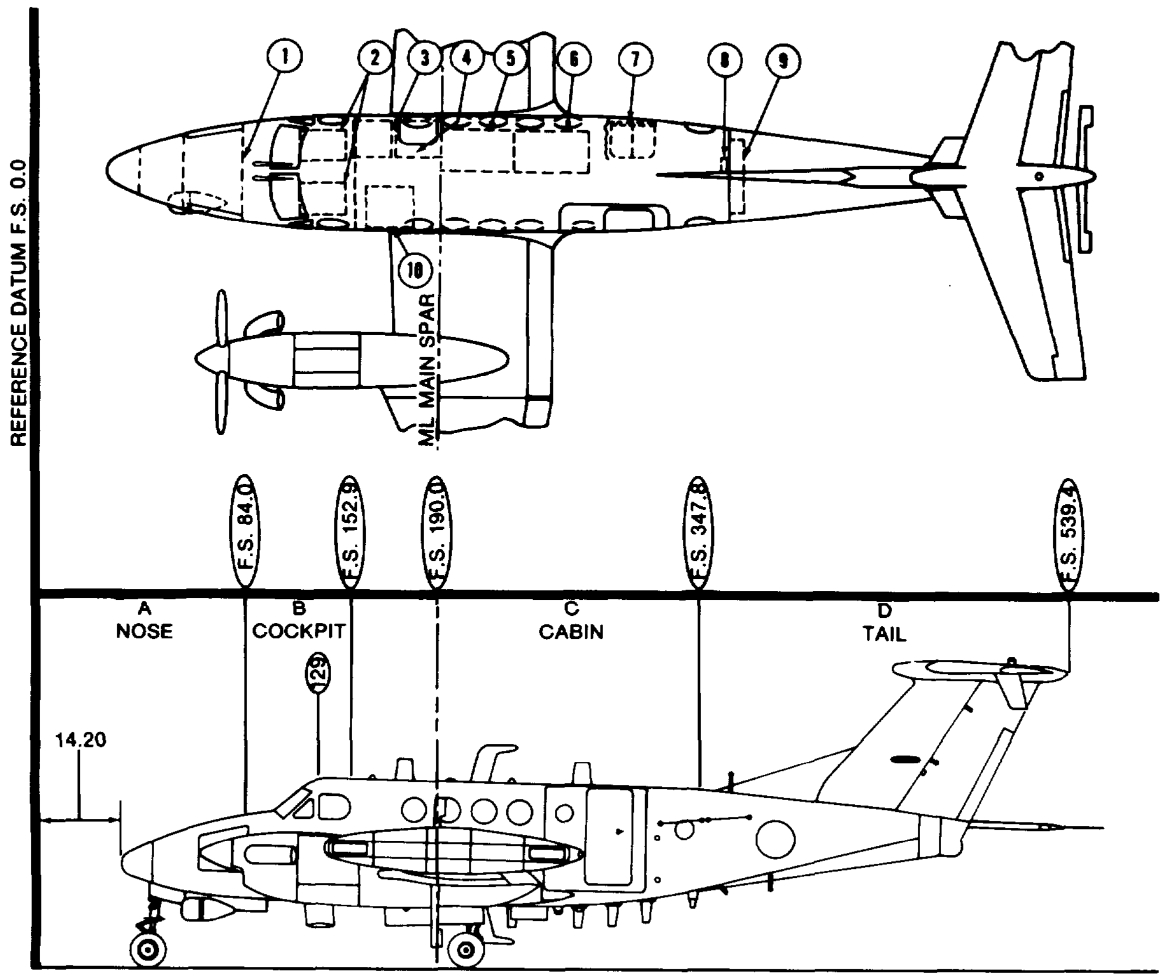
6-7. WEIGHT DEFINITIONS.

Weight definitions are as follows:

a. Basic Weight, The basic weight of an aircraft is that weight which includes all fixed operating equipment and unusable fuel and engine oil. It is only necessary to add variable or expendable load items for various missions. The basic weight of an aircraft varies with structural modifications and changes in fixed operating equipment. The term basic weight, when qualified with a word indicating the type of missions such as Basic Weight for Combat, Basic Weight for Ferry, etc., may be used in conjunction with directives stating what the equipment will be for these missions. For example, extra fuel tanks and various items of equipment installed for long range ferry flight, which are not normally carried on combat missions, will be included in Basic Weight for Ferry but not in Basic Weight for Combat.

b. Operating Weight. The operating weight is the basic weight of the aircraft, including the crew and all equipment required for the mission, but not including fuel or payload.

c. Gross Weight. The gross weight is the total weight of an aircraft contents, and fuel.



(1) AVIONICS COMPARTMENT: VHF-20B COMM, VIR-30 NAV NO. 1 & NO. 2, AN/ARM-136 TACAN, AN/APN-215 RADAR, INS BATTERY, AND PC-17A INVERTER (2)

(2) PILOT AND COPILOT SEATS

(3) MISSION AC DC POWER CABINET

(4) INS EQUIPMENT RACK

(5) MISSION CONSOLE

(6) MISSION CONSOLE

(7) LAVATORY

(8) DF-203 ADF RECEIVER AND MOUNT

(9) KHF-950 HF EQUIPMENT AND OXYGEN BOTTLES

(10) EQUIPMENT RACK - COMM SECURITY, RF PROCESSOR, TUNEABLE DIPLEXER, RADIO ALTIMETER, AND AN/APR-39.

AP011775

Figure 6-1. Aircraft Compartments and Stations

1.) The takeoff gross weight is the operating weight plus the variable and expendable load items which vary with the mission.

(2.) The landing gross weight is the takeoff gross weight minus the expended load items.

6-8. BALANCE DEFINITIONS.

Balance definitions are as follows:

a. Reference Datum. The reference datum is an imaginary vertical plane at, or forward of, the nose of the aircraft from which all horizontal distances are measured for balance purposes. Diagrams of each aircraft show this reference datum as fuselage station zero.

b. Arm. Arm, for balance purposes, is the horizontal distance in inches from the reference datum to the center of gravity of the item. Arm may be determined from the Aircraft Compartment and Station Diagram (fig. 6-l).

c. Moment. Moment is the product of a weight multiplied by its arm. Moment divided by a constant is generally used to simplify balance calculations by reducing the number of digits. For this aircraft, inches and moment/100 have been used.

d. Average Arm. Average arm is the arm obtained by adding the weights and the moments of a number of items and dividing the total moment by the total weight.

e. Basic Moment. Basic moment is the sum of the moments of all items making up the basic weight. When using data from an actual weighing of an aircraft, the basic moment is the total moment of the basic aircraft with respect to the reference datum.

f Center of Gravity (CG). Center of gravity is the point about which an aircraft would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the aircraft.

g. CG Limits. CG limits are the extremes of movement which the CG can have without making the aircraft unsafe to fly. The CG of the loaded aircraft must be within these limits at takeoff, in the air, and on landing.

6-9. CHART C - BASIC WEIGHT AND BALANCE RECORD.

Chart C is a continuous history of the basic weight and moment resulting from structural and equipment changes made in service. At all times, the last weight and moment/100 entry is considered the current weight and balance status of the basic aircraft (fig. 6-2).

6-10. WEIGHT AND BALANCE CLEARANCE FORM F, DD FORM 365-4 (TACTICAL).

Form F (fig. 6-3) is a summary of the actual disposition of load in the aircraft. It records the balance status of the aircraft step by step. It serves as a work sheet to record weight and balance calculations and any corrections that must be made to insure that the aircraft will be within weight and CG limits. It is necessary to complete a Form F prior to flight when an aircraft is loaded in a manner for which no previous valid Form F is available. A copy must remain in the aircraft for the duration of the flight. Form F (Tactical) is completed as follows:

1. Insert necessary identifying information at top of form. In blank spaces of LIMITATIONS table, enter gross weights for takeoff and landing obtained from the WEIGHT LIMITATIONS paragraph in Chapter 5.
2. Ref 1. Enter aircraft basic weight and index or mom/100 figure. Obtain this information from last entry on Chart C (fig. 6-2).
3. Ref 2. Leave blank (oil is included in basic weight).
4. Ref 3. Using compartment letter designations as shown in Aircraft Compartment and Station Diagram (fig. 6-1) enter number, weight, and mom/100 figures of crew at their takeoff positions. Use actual crew weights if available. Enter total of each compartment in WEIGHT and MOM/100 columns. To determine MOM/ 100 of crew use Table 6-1, Occupants Useful Load, Weights and Moments.

NOTE

The maximum baggage compartment weight is 410 pounds. Also the floor loading limit of 100 Lbs/Sq Ft shall not be exceeded.

5. Ref 4. Enter sum of weights and sum of mom/100 figures for Ref 1 through Ref 3 to obtain OPERATING WEIGHT and corresponding mom/ 100 figure.
6. Ref 5. Enter the item description (flare/ chaff), total amount, weight, and MOM/100 of all expendable stores.

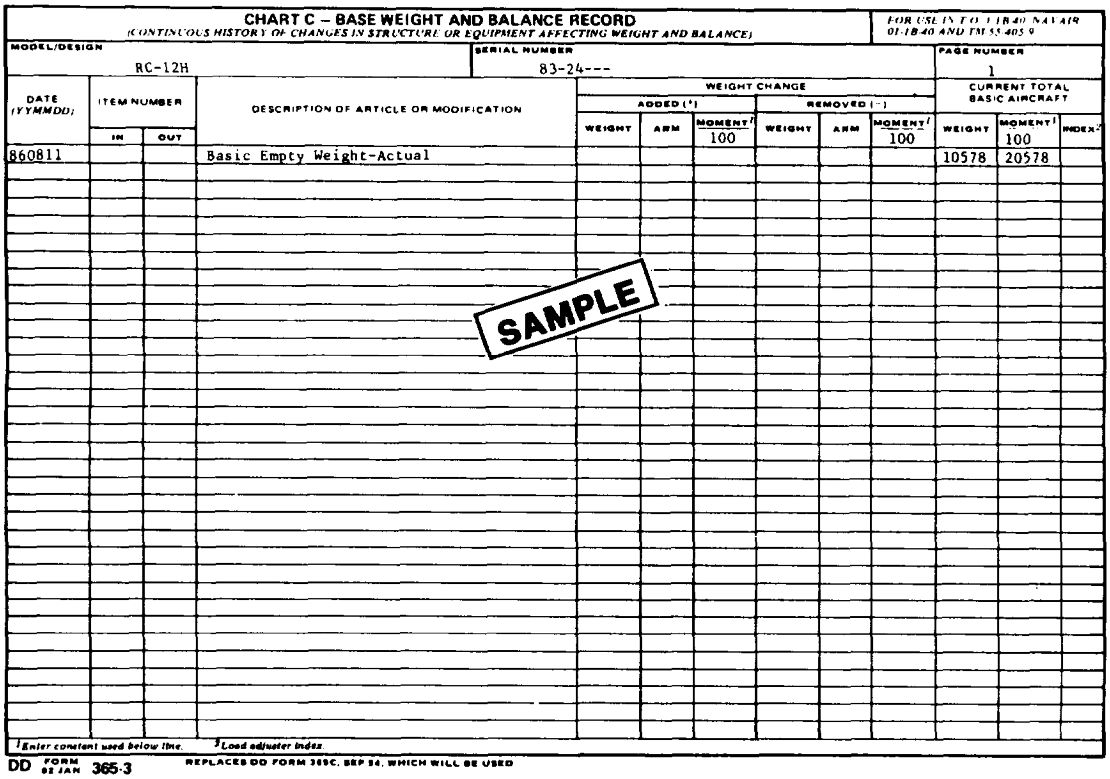


CHART C – BASE WEIGHT AND BALANCE RECORD
(CONTINUOUS HISTORY OF CHANGES IN STRUCTURE OR EQUIPMENT AFFECTING WEIGHT AND BALANCE)

FOR USE IN T.O. 1-1B-40, NAVAIR 01-1B-40 AND TM 55-405-9

MODEL/DESIGN: RC-12H — SERIAL NUMBER: 83-24--- — PAGE NUMBER: 1

DATE (YYMMDD)	ITEM NUMBER		DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE						CURRENT TOTAL BASIC AIRCRAFT		
				ADDED (+)			REMOVED (-)					
	IN	OUT		WEIGHT	ARM	MOMENT[1]/100	WEIGHT	ARM	MOMENT[1]/100	WEIGHT	MOMENT[1]/100	INDEX[2]
860811			Basic Empty Weight-Actual							10578	20578	

[1] Enter constant used below line. [2] Load adjuster index.

DD FORM 1 JAN 62 365-3 REPLACES DD FORM 365C, SEP 54, WHICH WILL BE USED

Figure 6-2. Chart C - Basic Weight and Balance Record, DD Form 365-3

7. Ref 6. Not applicable to RC-12H aircraft.

8. Ref 7. Enter the number of gallons, weight and sum of mom/100 figures for takeoff fuel. The weight of fuel used in warm up and taxiing should not be included. If JP-4 fuel at a density of 6.5 Lb/Gal is being used, use Fuel Moments Table (Table 6-2) to determine fuel weight and mom/ 100 figures. If other than JP-4 is being used, use the following procedures to obtain accurate fuel weight and mom/100 figures from the Fuel Moment Chart and to record information on Form F.

   a. Assume 6.7 Lb/Gal for JP-5 fuel or 6.0 Lb/Gal for AVGAS.

   b. Multiply the total number of gallons of fuel in the aircraft times the computed fuel density figure and thereby determine actual fuel weight.

   c. Use Fuel Moment Table (Table 6-2) to determine mom/ 100 figure.

   d. Enter the weight and corresponding mom/100 figure in the corresponding columns of Ref 7. Also, enter a figure for the total fuel gallons known to be in the aircraft.

9. Ref 8. Not applicable to RC-12H aircraft.

10. Ref 9. Enter sum of weights and moments for reference 4 through reference 8 opposite TAKEOFF CONDITION (uncorrected).

11. Ref 10. Enter TAKEOFF C.G. (uncorrected) as determined from weight and moment values of reference 9.

Check WEIGHT figure opposite Ref 10 against GROSS WT. TAKEOFF. Check mom/100 figure opposite Ref 10 with Center-of-Gravity Limits Table (Table 6-4) to ascertain that CG is within allowable limits.

12. Ref 11. If changes in amount or distribution of loads are required, indicate necessary adjustments by proper entries in CORRECTIONS table. Enter a brief description of adjustment made in column marked ITEM. Add all weight and moment decreases and insert totals in space opposite TOTAL WEIGHT REMOVED. Add all weight and moment increase and insert totals in space opposite TOTAL WEIGHT ADDED. Subtract smaller from larger of two totals and enter differences (with applicable + or - sign) opposite NET DIFFERENCE. Transfer these NET DIFFERENCE figures to spaces opposite Ref 11.

WEIGHT AND BALANCE CLEARANCE FORM F — TACTICAL
(USE REVERSE FOR TRANSPORT MISSIONS)

FOR USE IN T.O. 1-1B-40, NAVAIR 01-1B-40, AND TM-55-405-9

DATE (YYMMDD) 860811	AIRCRAFT TYPE RC-12H	FROM	HOME STATION
MISSION Ferry	SERIAL NO. 83-24---	TO	PILOT

MOST FWD, MOST AFT, CORRECTIONS (Ref. 11)

COMPT	ITEM	CHANGES (+ or −) WEIGHT	INDEX OR MOM/
TOTAL WEIGHT ADDED		+	+
TOTAL WEIGHT REMOVED		−	−
NET DIFFERENCE (Ref. 11)			

REMARKS

LIMITATIONS

GROSS WT. TAKEOFF (lb.) 15000	GROSS WT. LANDING (lb.) 15000	
PERMISSABLE C.G. TAKEOFF (% M.A.C. or in.)	FORWARD 188.3	AFT 195.1
PERMISSABLE C.G. LANDING (% M.A.C. or in.)	FORWARD 181.0	AFT 195.1

COMPUTED BY SIGNATURE

WEIGHT AND BALANCE AUTHORITY SIGNATURE

PILOT SIGNATURE

REF	ITEM	WEIGHT	INDEX OR MOM/ 100
1	BASIC AIRCRAFT (From Chart C)	10578	20578
2	OIL (Gal.)		
3 (DISTRIBUTION OF LOAD)	COMPT / CREW NO. / WEIGHT / CARGO/MISC		
	B 2 210	420	542
	C 2 52 Parachute	52	81
4	OPERATING WEIGHT	11050	21201
5 (AMMO)			
6 (BOMBS, MISSILES, ETC.)			
7 (FUEL)	(542 Gallons)	3631	6907
8	MISC. VARIABLES		
9	TAKEOFF CONDITION (uncorrected)	14681	28108
10	TAKEOFF C.G. IN % M.A.C. OR IN		
11	CORRECTIONS (If required)		
12	TAKEOFF CONDITION (corrected)	14681	28108
13	TAKEOFF C.G. IN % M.A.C. OR IN		191.5 IN.
14	TAKEOFF FUEL	3631	6907
(LESS EXPENDABLES)		3408	6547
15	ESTIMATED LANDING FUEL	223	360
16	ESTIMATED LANDING CONDITION	11273	21561
17	ESTIMATED LANDING C.G. IN % M.A.C. OR IN		191.3 IN.

SAMPLE

DD FORM 82 JAN 365-4 REPLACES DD FORM 365F, SEP 54, WHICH WILL BE USED. S/N 0102-LF-000-3668

Figure 6-3. Weight and Balance Clearance, DD Form 365-4 (Tactical)

Table 6-1. Occupants Useful Load, Weights and Moments

USEFUL LOAD WEIGHTS AND MOMENTS OCCUPANTS

WEIGHT	CREW F.S.129 MOM/100
80	103
90	116
100	129
110	142
120	155
130	168
140	181
150	194
160	206
170	219
180	232
190	245
200	258
210	271
220	284
230	297
240	310
250	323

13. Ref 12. Enter sum of the difference between Ref 10 and Ref 11. Recheck against GROSS WT. TAKEOFF in LIMITATIONS table to assure that this figure does not exceed allowable limit.

Record figures in LIMITATIONS table as follows: In FORWARD and AFT space for PERMISSIBLE C.G. TAKEOFF enter an inches figure obtained as follows: Match weight figure recorded in Ref 12 with a corresponding figure in the GROSS WEIGHT-POUNDS on Center-of-Gravity Limits Table (Table 6-4). Determine the FORWARD limit in inches figure for the weight matched and record in the FORWARD space stated. Enter AFT C.G. LIMIT in inches in AFT space.

14. Ref 13. By referring to Center-of-Gravity Limits Table (Table 6-4), determine takeoff C.G. position. Enter this figure in space provided opposite TAKEOFF C.G. in inches. Insure that this position is within the FWD and AFT C.G. limit in LIMITATIONS table.

15. Ref 14. Less expendables.

Fuel.

a. Enter estimated weight of fuel to be expended. Subtract this figure from weight of fuel on board (reference 7). This figure represents the landing fuel weight. Use the Fuel Moments Table (Table 6-2) to determine landing fuel moment. Subtract the landing fuel moment from the total fuel moment on board (reference 7). This figure represents the moment of fuel expended. Enter in reference 14.

NOTE

Do not consider reserve fuel as expended when determining ESTIMATED LANDING CONDITIONS.

Flare/Chaff cartridges.

b. Determine total weight of flares and/or chaff cartridges that have been expended. Use the Aircraft Survivability Equipment table (Table 6-3) to determine landing expendables moment. Enter figures in WEIGHT and MOM/ 100 columns.

c. Ref 15. Enter differences in weights and MOM/100 figures between reference 12 and totals of reference 14.

Record figures in LIMITATIONS table as follows: In FORWARD and AFT space for PERMISSIBLE C.G. LANDING, enter a figure obtained as follows: Match weight figure recorded in reference 15 with a corresponding figure in the GROSS WEIGHT-POUNDS on Center-of-Gravity Limits Table (Table 6-4). Determine the FORWARD limit in inches figure for the weight matched and record in the FORWARD space stated. Within the AFT space for PERMISSIBLE C.G. LANDING, record the AFT C.G. limit in inches. Check data against PERMISSIBLE C.G. LANDING in LIMITATIONS table.

d. Ref 16. Refer to Center-of-Gravity Limits Table (Table 6-4) to determine landing C.G. position. Enter this figure in space provided opposite ESTIMATED LANDING C.G. in inches.

Check Ref 16 against PERMISSIBLE C.G. LANDING in LIMITATIONS Table.

Necessary signatures must appear at bottom of form.

FUEL DENSITY/WEIGHT
vs
TEMPERATURE

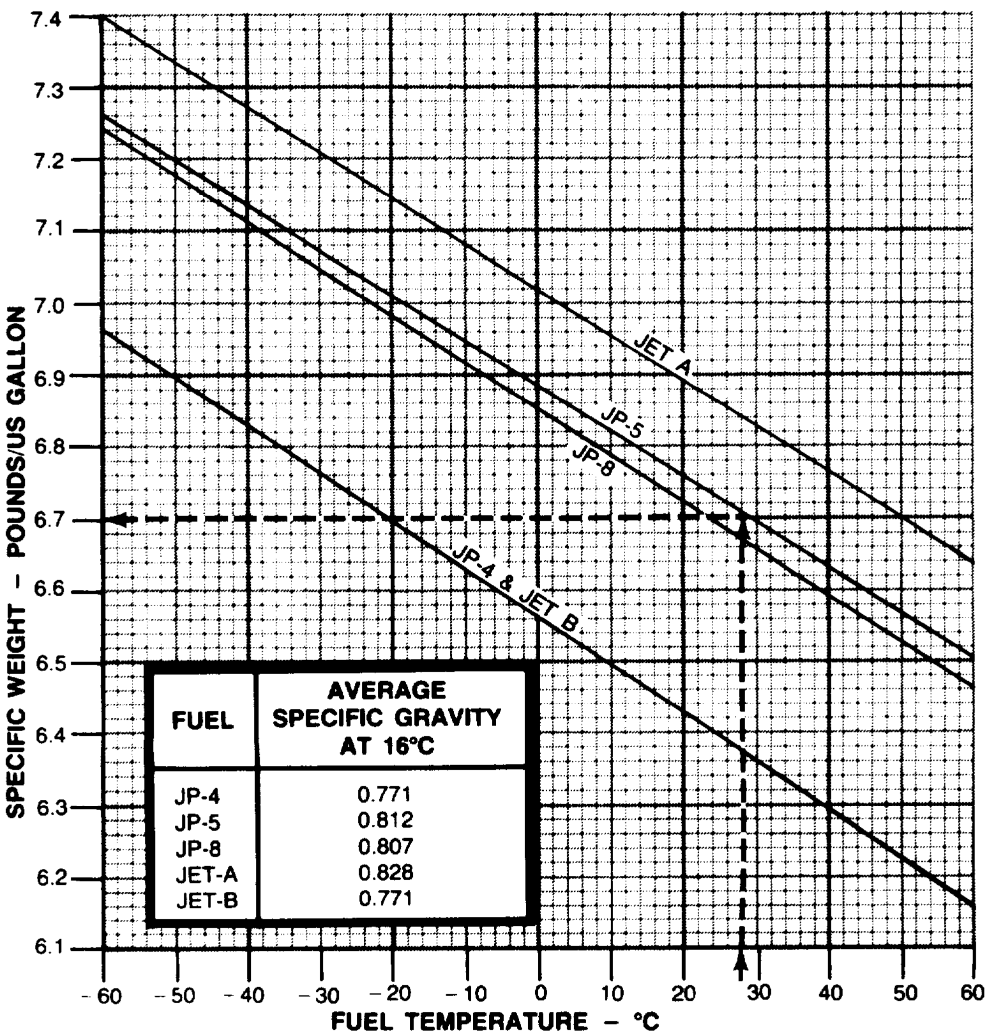
MODEL: UC-12B
DATE: 14 MAY 1979
DATA BASIS: FLIGHT TEST

CONFIGURATION:

ENGINE: PT6A-41
PROPELLER: T10178
FUEL GRADE: JP-5
FUEL DENSITY: 6.8 LB/GAL

EXAMPLE:

FUEL TEMPERATURE:	28°C
FUEL GRADE:	JP-5
SPECIFIC WEIGHT	= 6.7 LB/US GAL
FUEL QUANTITY:	130 US GAL
FUELWEIGHT:	(6.7 X 130) = 871 LBS



FUEL	AVERAGE SPECIFIC GRAVITY AT 16°C
JP-4	0.771
JP-5	0.812
JP-8	0.807
JET-A	0.828
JET-B	0.771

AP 004484

Figure 6-4. Density Variation of Aviation Fuel.

Table 6-2. Fuel Center-of-Gravity Moments

USEFUL LOAD WEIGHTS AND MOMENTS
USABLE FUEL

GALLONS	6.4 LB GAL		6.5 LB GAL		6.6 LB GAL		6.7 LB GAL		6.8 LB GAL	
	WEIGHT	MOMENT 100	WEIGHT	MOMENT 100	WEIGHT	MOMENT 100	WEIGHT	MOMENT 100	WEIGHT	MOMENT 100
10	64	99	65	100	66	102	67	103	68	105
20	128	197	130	200	132	203	134	206	136	209
30	192	305	195	310	198	314	201	319	204	324
40	256	423	260	430	264	436	268	443	272	450
50	320	542	325	550	330	559	335	567	340	575
60	384	662	390	672	396	683	402	693	408	703
70	448	782	455	794	462	807	469	819	476	831
80	512	904	520	918	528	932	536	926	544	960
90	576	1023	585	1039	594	1055	603	1071	612	1087
100	640	1142	650	1160	660	1178	670	1196	680	1214
110	704	1260	715	1280	726	1300	737	1319	748	1339
120	768	1379	780	1400	792	1422	804	1443	816	1465
130	832	1496	845	1519	858	1543	871	1566	884	1589
140	896	1615	910	1640	924	1665	938	1690	952	1715
150	960	1734	975	1761	990	1788	1005	1815	1020	1842
160	1024	1852	1040	1881	1056	1910	1072	1939	1088	1968
170	1088	1971	1105	2002	1122	2033	1139	2064	1156	2095
180	1152	2090	1170	2122	1188	2155	1206	2188	1224	2221
190	1216	2209	1235	2244	1254	2279	1273	2313	1292	2348
200	1280	2328	1300	2365	1320	2401	1340	2437	1360	2473
210	1344	2447	1365	2486	1386	2524	1407	2562	1428	2600
220	1408	2567	1430	2607	1452	2647	1474	2687	1496	2727
230	1472	2686	1495	2728	1518	2770	1541	2812	1564	2854
240	1536	2806	1560	2850	1584	2894	1608	2938	1632	2982
250	1600	2926	1625	2971	1650	3107	1675	3063	1700	3109
260	1664	3045	1690	3093	1716	3140	1742	3188	1768	3236
270	1728	3164	1755	3213	1782	3263	1809	3312	1836	3361
280	1792	3283	1820	3334	1848	3386	1876	3437	1904	3488
290	1856	3402	1885	3455	1914	3508	1943	3562	1972	3615
300	1920	3521	1950	3576	1980	3631	2010	3686	2040	3741
310	1984	3641	2015	3698	2046	3754	2077	3811	2108	3868
320	2048	3760	2080	3819	2112	3878	2144	2936	2176	3995
330	2112	3880	2145	3940	2178	4001	2211	4062	2244	4123
340	2176	3999	2210	4062	2244	4124	2278	4187	2312	4249
350	2240	4119	2275	4184	2310	4248	2345	4312	2380	4376
360	2304	4244	2340	4310	2376	4377	2412	4443	2448	4509
370	2368	4365	2405	4434	2442	4502	2479	4570	2516	4638
380	2432	4489	2470	4560	2508	4630	2546	4700	2584	4770
384	2458	4540	2496	4610	2534	4680	2573	4752	2611	4821
400	2560	4748	2600	4822	2640	4896	2680	4970	2720	5043
410	2624	4879	2665	4955	2706	5031	2747	5107	2788	5182
420	2688	5009	2730	5087	2772	5166	2814	5244	2856	5321
430	2752	5140	2795	5220	2838	5300	2881	5380	2924	5460
440	2816	5270	2860	5353	2904	5435	2948	5517	2992	5598
450	2880	5401	2925	5485	2970	5569	3015	5654	3060	5737
460	2944	5531	2990	5618	3036	5704	3082	5790	3128	5876
470	3008	5662	3055	5750	3102	5839	3149	5927	3196	6014
480	3072	5793	3120	5883	3168	5973	3216	6064	3264	6153
490	3136	5923	3185	6016	3234	6108	3283	6200	3332	6292
500	3200	6054	3250	6148	3300	6243	3350	6337	3400	6431
510	3264	6184	3315	6281	3366	6377	3417	6474	3468	6569
520	3328	6315	3380	6413	3432	6512	3484	6610	3536	6708
530	3392	6445	3445	6546	3498	6647	3551	6747	3604	6847
540	3456	6576	3510	6679	3564	6781	3618	6884	3672	6985
542	3468	6602	3523	6705	3577	6808	3631	6910	3686	7014

Table 6-3. Survivability Equipment Weights and Moments

Item	NACELLE DISPENSER Weight (lb)	Moment/100
Dispenser (Empty) Chaff Cartridges (30)	10 9	21 19
TOTAL : (Dispenser/30 chaff cartridges)	19	40
FUSELAGE DISPENSER		
Dispenser (Empty) Chaff and/or Flare Cartridges	10 9	49 26
TOTAL : (Dispenser/30 chaff and/or flare cartridges)	19	55

Table 6-4. Center-of-Gravity Moments (sheet 1 of 3)

CENTER OF GRAVITY MOMENT TABLE - MOMENT/100

GROSS WEIGHT POUNDS	FWD LIMIT %MAC MOM/100	% MAC								
		13.9	17.3	19.6	24.0	27.0	30.0	33.0	33.9	35.7
		ARM								
		181.0	183.4	185.0	188.1	190.3	192.4	194.5	195.1'	196.4'
7200		13032	13205	13320	13543	13702	13853	14004	14047	14141
7250		13123	13297	13413	13637	13797	13949	14101	14145	14239
7300		13213	13388	13505	13731	13892	14045	14199	14242	14337
7350		13304	13480	13598	13825	13987	14141	14296	14430	14435
7400		13394	13572	13690	13919	14082	14238	14393	14437	14534
7450		13485	13663	13783	14013	14177	14334	14490	14535	14632
7500		13575	13755	13875	14108	14272	14430	14588	14633	14730
7550		13666	13847	13968	14202	14368	14526	14685	14730	14828
7600		13756	13938	14060	14296	14463	14622	14782	14828	14926
7650		13847	14030	14153	14390	14558	14719	14879	14925	15025
7700		13937	14122	14245	14484	14653	14815	14977	15023	15123
7750		14028	14214	14338	14578	14748	14911	15074	15120	15221
7800		14118	14305	14430	14672	14843	15007	15171	15218	15319
7850		14209	14397	14523	14766	14939	15103	15268	15315	15417
7900		14299	14489	14615	14860	15034	15200	15366	15413	15516
7950		14390	14580	14708	14954	15129	15296	15463	15510	15614
8000		14480	14672	14800	15048	15224	15392	15560	15608	15712
8050		14571	14764	14893	15142	15319	15488	15657	15706	15810
8100		14661	14855	14985	15236	15414	15584	15755	15803	15908
8150		14752	14947	15078	15330	15509	15681	15852	15901	16007
8200		14842	15039	15170	15424	15605	15777	15949	15998	16105
8250		14933	15131	15263	15518	15700	15873	16046	16096	16203
8300		15023	15222	15355	15612	15795	15969	16144	16193	16301
8350		15114	15314	15448	15706	15890	16065	16241	16291	16399
8400		15204	15406	15540	15800	15985	16162	16338	16388	16498
8450		15295	15497	15633	15894	16080	16258	16435	16486	16596
8500		15385	15589	15725	15989	16175	16354	16533	16584	16694
8550		15476	15681	15818	16083	16271	16450	16630	16681	16792
8600		15566	15772	15910	16177	16366	16546	16727	16779	16890
8650		15657	15864	16003	16271	16461	16643	16824	16876	16989
8700		15747	15956	16095	16365	16556	16739	16922	16974	17087
8750		15838	16048	16188	16459	16651	16835	17019	17071	17185
8800		15928	16139	16280	16553	16746	16931	17116	17169	17283
8850		16019	16231	16373	16647	16842	17027	17213	17266	17381
8900		16109	16323	16465	16741	16937	17124	17311	17364	17480
8950		16200	16414	16558	16835	17032	17220	17408	17461	17578
9000		16290	16506	16650	16929	17127	17316	17505	17559	17676
9050		16381	16598	16743	17023	17222	17412	17602	17657	17774
9100		16471	16689	16835	17117	17317	17508	17700	17754	17872
9150		16562	16781	16928	17211	17412	17605	17797	17852	17971
9200		16652	16873	17020	17305	17508	17701	17894	17949	18069
9250		16743	16965	17113	17399	17603	17797	17991	18047	18167
9300		16833	17056	17205	17493	17698	17893	18089	18144	18265
9350		16924	17148	17298	17587	17793	17989	18186	18242	18363
9400		17014	17240	17390	17681	17888	18086	18283	18339	18462
9450		17105	17331	17483	17775	17983	18182	18380	18437	18560
9500		17195	17423	17575	17870	18078	18278	18478	18535	18658
9550		17286	17515	17668	17964	18174	18374	18575	18632	18756
9600		17376	17606	17760	18058	18269	18470	18672	18730	18854
9650		17467	17698	17853	18152	18364	18567	18769	18827	18953

Table 6-4. Center-of-Gravity Moments (sheet 2 of 3)

CENTER OF GRAVITY MOMENT TABLE - MOMENT 100

GROSS WEIGHT POUNDS	FWD LIMIT %MAC MOM 100	% MAC 13.9	17.3	19.6	24.0	27.0	30.0	33.0	33.9	35.7
		ARM 181.0	183.4	185.0	188.1	190.3	192.4	194.5	195.1	196.4
9700		17557	17790	17945	18246	18459	18663	18867	18925	19051
9750		17648	17882	18038	18340	18554	18759	18964	19022	19149
9800		17738	17973	18130	18434	18649	18855	19061	19120	19247
9850		17829	18065	18223	18528	18745	18951	19158	19217	19345
9900		17919	18157	18315	18622	18840	19048	19256	19315	19444
9950		18010	18248	18408	18716	18935	19144	19353	19412	19542
10000		18100	18340	18500	18810	19030	19240	19450	19510	19640
10050		18191	18432	18593	18904	19125	19336	19547	19608	19738
10100		18281	18523	18685	18998	19220	19432	19645	19705	19836
10150		18372	18615	18778	19092	19315	19529	19742	19803	19935
10200		18462	18707	18870	19186	19411	19625	19839	19900	20033
10250		18552	18799	18963	19280	19506	19721	19936	19998	20131
10300		18643	18890	19055	19374	19601	19817	20034	20095	20229
10350		18734	18982	19148	19468	19696	19913	20131	20193	20327
10400		18824	19074	19240	19562	19791	20010	20228	20290	20426
10450		18915	19165	19333	19656	19886	20106	20325	20388	20524
10500		19005	19257	19425	19751	19981	20202	20423	20486	20622
10550		19096	19349	19518	19845	20077	20298	20520	20583	20720
10600		19186	19440	19610	19939	20172	20394	20617	20681	20818
10650		19277	19532	19703	20033	20267	20491	20714	20778	20917
10700		19367	19624	19795	20127	20362	20587	20812	20876	21015
10750		19458	19716	19888	20221	20457	20683	20909	20973	21113
10800		19548	19807	19980	20315	20552	20779	21006	21071	21211
10850		19639	19899	20073	20409	20648	20875	21103	21168	21309
10900		19729	19991	20165	20503	20743	20972	21201	21266	21408
10950		19820	20082	20258	20597	20838	21068	21298	21363	21506
11000		19910	20174	20350	20691	20933	21164	21395	21461	21604
11050		20001	20266	20443	20785	21028	21260	21492	21559	21702
11100	MAX	20091	20357	20535	20879	21123	21356	21590	21656	21800
11150	ZERO FUEL	20182	20449	20628	20973	21218	21453	21687	21754	21899
11200	WEIGHT	20272	20541	20720	21067	21314	21549	21784	21851	21997
11250		20363	20633	20813	21161	21409	21645	21881	21949	22095
11300	14.0	20461	20724	20905	21255	21504	21741	21979	22046	22193
11350	14.2	20570	20816	20998	21349	21599	21837	22076	22144	22291
11400	14.4	20679	20908	21090	21443	21694	21934	22173	22241	22390
11450	14.7	20789	20999	21183	21537	21789	22030	22270	22339	22488
11500	14.9	20899	21091	21275	21632	21884	22126	22368	22437	22586
11550	15.1	21008	21183	21368	21726	21980	22222	22465	22534	22684
11600	15.4	21118	21274	21460	21820	22075	22318	22562	22632	22782
11650	15.6	21229	21366	21553	21914	22170	22415	22659	22729	22881
11700	15.8	21339	21458	21645	22031	22265	22511	22757	22827	22979
11750	16.1	21449	21550	21738	22125	22360	22607	22854	22924	23077
11800	16.3	21560	21641	21830	22219	22455	22703	22951	23022	23175
11850	16.5	21671	21733	21923	22314	22551	22799	23048	23119	23273
11900	16.8	21782	21825	22015	22408	22646	22896	23146	23217	23372
11950	17.0	21892	21916	22108	22502	22741	22992	23243	23314	23470
12000	17.2	22003	22008	22200	22596	22836	23088	23340	23412	23568
12052		17.5	22119	22293	22690	22931	23184	23437	23510	23666
12100		17.7	22231	22385	22784	23026	23280	23535	23607	23764
12150		18.0	22343	22478	22878	23121	23377	23632	23705	23863
12200		18.2	22455	22570	22973	23217	23473	23729	23802	23961
12250		18.4	22567	22663	23067	23312	23569	23826	23900	24059
12300		18.7	22679	22755	23161	23407	23665	23924	23997	24157
12350		18.9	22792	22848	23255	23502	23761	24021	24095	24255
12400		19.1	22904	22940	23349	23597	23858	24118	24192	24354

Table 6-4. Center-of-Gravity Moments (sheet 3 of 3)

CENTER OF GRAVITY MOMENT TABLE - MOMENT/ 100 (CONT'D)

GROSS WEIGHT POUNDS	FWD LIMIT %MAC MOM/100	% MAC 13.9	17.3	19.6	24.0	27.0	30.0	33.0	33.9	35.7
		ARM 181.0	183.4	185.0	188.1	190.3	192.4	194.5	195.1*	196.4*
12450		19.4	23017	23033	23443	23692	23954	24215	24290	24452
12500			19.6	23125	23538	23787	24050	24313	24388	24550
12550			19.8	23238	23632	23883	24146	24410	24485	
12600			20.0	23352	23726	23978	24242	24507	24583	
12650			20.3	23465	23820	24073	24339	24604	24680	
12700			20.5	23579	23914	24168	24435	24702	24778	
12750			20.7	23693	24008	24263	24531	24799	24875	
12800			21.0	23807	24102	24358	24627	24896	24973	
12850			21.2	23921	24197	24454	24723	24993	25070	
12900			21.4	24035	24291	24549	24820	25091	25168	
12950			21.7	24150	24385	24644	24916	25188	25265	
13000			21.9	24265	24479	24739	25012	25285	25363	
13050			22.1	24379	24573	24834	25108	25382	25461	
13100			22.4	24494	24667	24929	25204	25480	25558	
13150			22.6	24610	24761	25024	25301	25577	25656	
13200			22.8	24725	24856	25120	25397	25674	25753	
13250			23.1	24840	24950	25215	25493	25771	25851	
13300			23.3	24956	25044	25310	25589	25869	25948	
13350			23.5	25072	25138	25405	25685	25966	26046	
13400			23.8	25188	25232	25500	25782	26063	26143	
13450			24.0	25304	25326	25595	25878	26160	26241	
13500					25421	25691	25974	26258	26339	
13550					25515	25786	26070	26355	26436	
13600					25609	25881	26166	26452	26534	
13650					25703	25976	26263	26549	26631	
13700					25797	26071	26359	26647	26729	
13750					25891	26166	26455	26744	26826	
13800					25985	26261	26551	26841	26924	
13850					26080	26357	26647	26938	27021	
13900					26174	26452	26744	27036	27119	
13950					26268	26547	26840	27133	27216	
14000					26362	26642	26936	27230	27314	
14050					26456	26737	27032	27327	27412	
14100					26550	26832	27128	27425	27509	
14150					26644	26927	27225	27522	27607	
14200					26739	27023	27321	27619	27704	
14250					26833	27118	27417	27716	27802	
14300					26927	27213	27513	27814	27899	
14350					27021	27308	27609	27911	27997	
14400					27115	27403	27706	28008	28094	
14450					27209	27498	27802	28105	28192	
14500					27304	27594	27898	28203	28290	
14550					27398	27689	27994	28300	28387	
14600					27492	27784	28090	28397	28485	
14650					27586	27879	28187	28494	28582	
14700					27680	27974	28283	28592	28680	
14750					27774	28069	28379	28689	28777	
14800					27868	28164	28475	28786	28875	
14850					27963	28260	28571	28883	28972	
14900					28057	28355	28668	28981	29070	
14950					28151	28450	28764	29078	29167	
15000					28245	28545	28860	29175	29265	

Table 6-5. C.G. Limits (Landing Gear Down) - Restricted Category

***CENTER OF GRAVITY LIMITS (LANDING GEAR DOWN) RESTRICTED CATEGORY**

WEIGHT CONDITION	FORWARD CG LIMIT	AFT CG LIMIT
15,000 LBS (MAX TAKE-OFF & LANDING)	188.3	195.1
13,500 LBS	188.3	195.1
11,279 LBS OR LESS	181.0	196.1

NOTES:
-The moment/100 for retraction of the alighting gear is - 60.4. Loadings based on wheels-down condition which fall within the limiting moments in the table, will be satisfactory for flight with alighting gear retracted.

Section III. FUEL/OIL

6-11. FUEL LOAD.

Fuel loading imposes a restriction on the amount of load which can be carried. The required fuel must first be determined, then that weight subtracted from the total weight of crew and fuel. Weight up to and including the remaining allowable capacity can be subtracted directly from the weight of crew and fuel. As the fuel load is increased, the loading capacity is reduced.

6-12. FUEL AND OIL DATA.

a. Fuel Moment Table. This table (Table 6-2) shows fuel moment/ 100 given US gallons or pounds for JP-4 and JP-5.

b. Oil Data. Total oil weight is 62 pounds and is included in the basic weight of the aircraft. Servicing information is provided in Section XII of Chapter 2.

Section IV. CENTER OF GRAVITY

6-13. CENTER OF GRAVITY LIMITATIONS.

WARNING

Removal of mission gear may result in exceeding the forward center-of-gravity limit.

Center of gravity limitations are expressed in ARM inches which refers to a positive measurement from the aircraft's reference datum. The forward CG limit at 11,279 Lbs. or less is 181.0 ARM inches. The forward-sloping CB limit line from 11,279 Lbs. to 13,500 Lbs., and straight up to 15,000 Lbs., is fuselage station 188.3. At 15,000 Lbs. or less, the aft CG limit is 195.1 ARM inches. The Center of Gravity Limitations Table (Table 6-4) is designed to establish forward and aft CG limitations.

Section IV. Cargo Loading

6-14. LOAD PLANNING. The basic factors to be considered in any loading situation are as follows:

a. Cargo shall be arranged to permit access to all emergency equipment and exits during flight.

b. Floorboard structural capacity shall be considered in the loading of heavy or sharp-edged containers and equipment. Shorings shall be used to distribute highly condensed weights evenly over the cargo areas.

c. All cargo shall be adequately secured to prevent damage to the aircraft, other cargo, or the item itself.

6-15. LOADING PROCEDURE.

NOTE

The cabin door is weight limited to a maximum of 300 pounds to prevent possible structural damage.

Loading of cargo is accomplished through the cabin door (21.5 in. X 50.0 in.) or the cargo door (52.0 in. X 52.0 in).

6-16. SECURING LOADS.

All cargo shall be secured with restraints strong enough to withstand the maximum force exerted in any direction. The maximum force can be determined by multiplying the weight of the cargo item by the applicable load factor. These established load factors (the ratio between the total force and the weight of the cargo item) are 1.5 to the side and rear, 3.0 up, 6.6 down, and 9.0 forward.

CHAPTER 7

PERFORMANCE

TABLE OF CONTENTS

CHAPTER 7

PERFORMANCE

7-l. INTRODUCTION TO PERFORMANCE.

The graphs in this Section present performance information for takeoff, climb, cruise, and landing at various parameters of weight, altitude, and temperature.

The following example presents calculations for a proposed flight from Denver to Reno using the conditions listed below:

7-2. CONDITIONS.

At Stapleton International (DEN):
Free Air Temperature .... 28°C (82°F)
Field Elevation .... 5333 feet[1]
Altimeter Setting .... 30.02 in. Hg
Wind .... 030° at 13 knots
Runway 35R Length .... 12,000 feet[1]
Route of trip:
DEN - J116 - EKR - J173 - SLC - J154 -
BAM - J32 - RN0
Cruise Altitude:
26,000 feet
At Cannon International (RNO):
Free Air Temperature .... 32°C (90°F)
Field Elevation .... 4412 feet[1]
Altimeter Setting .... 29.60 in. Hg
Wind .... 200° at 15 knots
Runway 25 Length .... 6101 feet[1]

1 Source: NOAA Standard Instrument Departures for Western United States, 9 APR 1987.

2 Source: NOAA Enroute High Altitude -U.S. Chart H-l, 9 APR 1987.

3 MEA on NOAA Enroute Low Altitude -U.S. Chart L-8, 9 JUN 1983.

4 Includes distance between airport and VORTAC, per NOAA Airport/Facility Directory (Southwest US.), 9 APR 1987.

7-3. PRESSURE ALTITUDE.

To determine the approximate pressure altitude at origin and destination airports, add 1000 feet to field elevation for each 1.00 in. Hg that the reported altimeter setting value is below 29.92 in. Hg, and subtract 1000 feet for each 1.00 in. Hg above 29.92 in. Hg. Always subtract the reported altimeter setting FROM 29.92 in. Hg, then multiply the answer by 1000 to find the difference in feet between field elevation and pressure altitude.

Pressure Altitude at DEN:

29.92 in. Hg - 30.02 in. Hg = -0.10
-0.10 x 1000 feet = -100 feet
The pressure altitude at DEN is 100 feet below field elevation.
Pressure altitude at DEN = 5333 - 100 = 5233 feet.
Pressure altitude at RNO:
29.92 in. Hg - 29.60 in. Hg = 0.32
0.32 x 1000 feet = 320 feet
The pressure altitude at RN0 is 320 feet above field elevation.
Pressure altitude at RN0 = 4412 + 320 = 4732 feet.

7-4. PERFORMANCE EXAMPLE.

Maximum takeoff weight (from LIMITATIONS Section) = 15,000 pounds

7-5. MAXIMUM TAKEOFF WEIGHT PERMITTED BY ENROUTE CLIMB REQUIREMENT.

Enter the graph at 5233 feet take-off field pressure altitude to 28°C takeoff FAT:

Maximum Allowable Takeoff Weight 14,200 pounds

The maximum takeoff weight permitted by the Enroute Climb Requirement graph is the only operating limitation required to meet applicable FAR requirements. Information has been presented, however, to determine the takeoff weight, field requirements, and takeoff flight path assuming an engine failure occurs during the take-off procedure. The following illustrates the use of these charts.

7-6. TAKEOFF WEIGHT TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFTOFF (Flaps 0%).

Enter the graph at 5233 feet to 28ºC, to determine the maximum weight at which the accelerate-go procedure should be attempted.

Maximum Accelerate-Go Weight . . . . 13,480 pounds

7-7. ACCELERATE-STOP (FLAPS 0%).

Enter the Accelerate-Stop graph at 28ºC, 5233 feet pressure altitude, 13,480 pounds, and 10 knots head wind component:

Accelerate-Stop Distance .... 5050 feet
Takeoff Decision Speed (V_R) .... 98 knots

7-8. TAKEOFF DISTANCE (FLAPS 0%).

Enter the graph at 28ºC, 5233 feet pressure altitude, 13,480 pounds, and IO knots head wind component:

Ground Roll .... 3420 feet
Total Distance Over 50-foot Obstacle . . . . 5100 feet
Takeoff Speed:
At Rotation .... 100 knots
At 50 Feet .... 1 16 knots

7-9. TAKEOFF FLIGHT PATH EXAMPLE.

The following example assumes the aircraft is loaded so that takeoff weight is 10,000 pounds.

7-10. ACCELERATE-GO DISTANCE OVER 50-FOOT OBSTACLE (FLAPS 0%).

Enter the graph at 28°C, 5233 feet pressure altitude, 10,000 pounds, and 10 knots head wind component:

Total Distance Over 50-foot Obstacle . . . . 5550 feet
Speed at Rotation (V_R) .... 93 knots
Speed at 35 Feet Above Runway (Climb Speed) Knots

7-11. TAKEOFF CLIMB GRADIENT - ONE ENGINE INOPERATIVE (FLAPS 0%).

Enter the graph at 28°C, 5233 feet pressure altitude, and 10,000 pounds:

Climb Gradient 5.1%
Climb Speed .... 101 knots

A 5.1% climb gradient is 51 feet of vertical height per 1000 feet of horizontal distance.

NOTE

The graphs for take-off climb gradient assume a zero-wind condition. Climbing into a head wind will result in higher angles of climb, and hence better obstacle clearance capabilities.

Calculations of the horizontal distance to clear an obstacle 100 feet above the runway surface:

Horizontal distance used to climb from 50 feet to 100 feet - (100 - 50) (1000 ÷ 51) = 981 feet
Total Distance = 5500 + 981- 6531 feet
Results are illustrated below:

7-12. FLIGHT PLANNING.

Calculations for flight time, block speed, and fuel requirements for a proposed flight are detailed below using the same conditions presented on page 4-3, and a takeoff weight of 12,000 pounds.

Enter ISA CONVERSION graph at the conditions indicated:

DEN-BVL

Pressure Altitude .... 26,000 feet
FAT .... -20°C
ISA Condition .... ISA + 17°C

BLV-RN0

Pressure Altitude .... 26,000 feet
FAT .... -10°C
IAS Condition .... ISA + 27°C

Enter the TIME, FUEL, AND DISTANCE TO CLIMB Graph at 28°C to 5233 feet, and to 12,000 pounds, and enter at -10°C to 26,000 feet, and to 12, 000 pounds, and read:

Time to Climb .... 30.0-3.1 = 26.9=27 minutes
Fuel Used to Climb .... 379.3-60.0=319.3= 320 pounds
Distance Traveled ...... 85.7-8.7=77 nautical miles

Enter the TIME, FUEL, AND DISTANCE TO DESCEND Graph at 26,000 feet, and enter again at 4732 feet, and read:

Time to Descend ...... 17.7-3.1= 14.6 = 15 minutes
Fuel Used to Descend . . . . 198.5-50.0=149 pounds
Distance Traveled .... 86.5- 15.3 =71.2= 71 nautical miles

An estimated average cruise weight of 11,200 pounds was used for this example.

Enter the tables for MAXIMUM ENDURANCE POWER 1700 RPM for ISA + 10°C ISA + 20°C, and ISA + 30°C and read the cruise speeds for 26, 000 feet at 12,000 pounds and 11,000 pounds:

Cruise True Airspeed (ISA + 17°C) . . . . . . 169 knots
Cruise True Airspeed (ISA + 27°C) . . . . . . 172 knots

Enter the *MAXIMUM ENDURANCE POWER 1700 RPM Tables for ISA + 10°C ISA + 2OºC, and ISA + 30°C at 12,000 pounds and 11,000 pounds and interpolate the recommended torque settings for ISA + 17°C and ISA + 27°C at 11,200 pounds.

ISA + 17°C .... 40% torque per engine

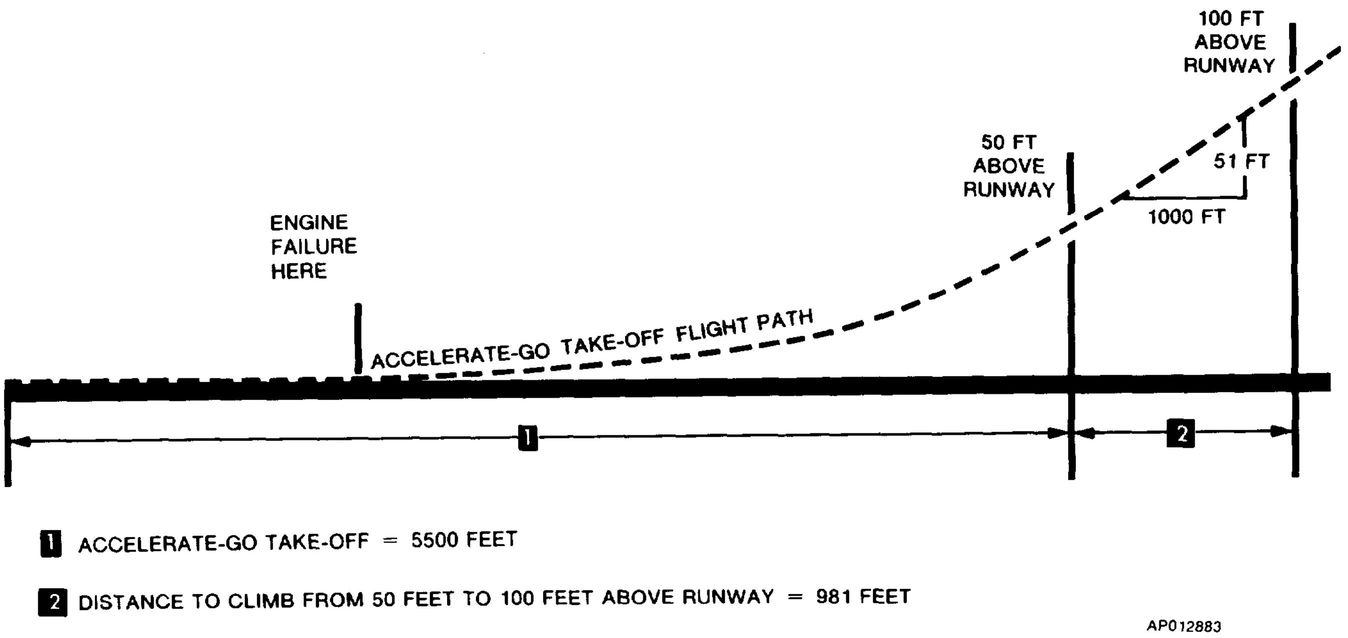


Figure 7-1. Takeoff Flight Path

ISA + 27°C .... 41% torque per engine

Enter the *MAXIMUM ENDURANCE POWER 1700 RPM Tables for ISA + 10°C ISA + 20°C and ISA + 30°C at 12,000 pounds and 11,000 pounds at 26,000 feet, and interpolate the fuel flows for ISA + 17°C and ISA + 27°C at 11,200 pounds.

ISA + 17°C
Fuel Flow Per Engine .... 198.75 Lbs/hr
Total Fuel Flow .... 397.50 Lbs/hr
ISA + 27°C
Fuel Flow Per Engine .... 203.5 Lbs/hr
Total Fuel Flow .... 407 Lbs/hr

NOTE

For flight planning, enter these charts at the forcasted ISA condition; for enroute power settings and fuel flows, enter at the actual indicated FAT.

Time and fuel used were calculated at MAXIMUM ENDURANCE POWER 1700 RPM as follows:

Time = Distance Ground Speed
Fuel Used = Distance x Total Fuel Flow / Ground Speed

Results are as follows:

7-13. RESERVE FUEL.

Reserve Fuel is calculated as 45 minutes at Maximum Range Power 1700 RPM. Use planned cruise altitude (26,000 feet), forecasted ISA condition (ISA + 27°C) and estimated weight at end of planned trip (10,309 pounds). (Since the lowest weight column in the tables is 11,000 pounds, assume weight at the end of the planned trip to be 11,000 pounds, and use that fuel flow value for this example.)

Enter the tables for MAXIMUM RANGE POWER 1700 RPM for ISA + 20°C and ISA + 30°C at 11,000 Lbs and 26,000 feet, and read the total fuel flows:

ISA + 20°C .... 478 Lbs/hr
ISA + 30°C .... 448 Lbs/hr

Then interpolate for the fuel flow at ISA + 27°C as follows:

Change in Fuel Flow = 478 - 448 = 30 Lbs/hr

Change in Temperature = (ISA + 20°C) - (ISA + 30°C) = 10°C

Rate of Change in Fuel Flow = Change in Fuel Flow ÷ Change in Temperature

Rate of Change in Fuel Flow = (30 Lbs/hr) ÷ (10°C)

Rate of Change in Fuel Flow = 3.0 Lbs/hr decrease per 1°C increase

Temperature increase from ISA + 20°C to ISA + 27°C = 7°C

Total Change in Fuel Flow = 7 x 3.0 Lbs/hr = 21.0 Lbs/hr

Total Fuel Flow = (ISA + 20°C Fuel Flow) + (Total Change in Fuel Flow)

Total Fuel Flow = (478) - (21) = 457 Lbs/hr

Reserve Fuel = 45 minutes x Total Fuel Flow

Reserve Fuel = (0.75) x (457 Lbs/hr) = 342.75 = 343 lbs.

Total Fuel Requirement = 1781 + 343 = 2124 pounds

7-14. ZERO FUEL WEIGHT LIMITATION.

For this example, the following conditions were assumed:

Ramp Weight .... 12,090 pounds
Weight of Usable Fuel Onboard ...... 2124 pounds

Zero Fuel Weight = Ramp Weight - Weight of Usable Fuel Onboard

Zero Fuel Weight = (12,090) - (2124) = 9966 pounds

Maximum zero fuel weight limitation (from LIMITATIONS section) = 11,500 pounds.

Maximum Zero Fuel Weight Limitation has not been exceeded.

Anytime the Zero Fuel Weight exceeds the Maximum Zero Fuel Weight Limit, the excess must be off-loaded from PAYLOAD. If desired, additional FUEL ONLY may then be added until the ramp weight equals the Maximum Ramp Weight Limit of 15.090 Lbs.

7-15. LANDING INFORMATION.

The estimated Landing Weight is determined by subtracting the fuel required for the trip from the Ramp Weight:

Ramp Weight .... 12,090 Lbs
Fuel Required for Total Trip .... 1781 pounds
Landing Weight (12,090 - 1781) . . . . 10,309 pounds

Enter the NORMAL LANDING DISTANCE WITHOUT PROPELLER REVERSING - FLAPS 100% Graph at 32°C, 4732 feet, 10,309 pounds, and 10 knots head wind component:

Ground Roll .... 1800 feet
Total Distance Over 50-foot Obstacle . . . . 2510 feet
Approach Speed .... 99 knots

Enter the CLIMB - BALKED LANDING Graph at 32°C, 4732 feet, and 10,309 pounds:

Rate of Climb .... 1270 ft/min
Climb Gradient 10.2%

7-16. COMMENTS PERTINENT TO THE USE OF PERFORMANCE GRAPHS.

a. In addition to presenting the answer for a particular set of conditions the example on a graph also presents the order in ‘which the various scales on the graph should be used. For instance, if the first item in the example is FAT, then enter the graph at the existing FAT.

b. The reference lines indicate where to begin following the guidelines. Always project to the reference line first, then follow the guidelines to the next known item by maintaining the same PROPORTIONAL DISTANCE between the guide line above and the guide line below the projected line. For instance, if the projected line intersects the reference line in the ratio of 30% down/70% up between the guidelines, then maintain this same 30%/70% relationship between the guide lines and follow them to the answer or next known item.

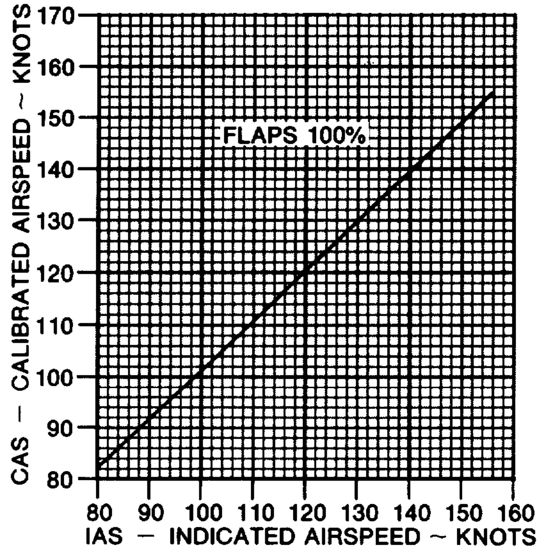
c. The associated conditions define the specific conditions from which performance parameters have been determined. They are not intended to be used as instructions; however, performance values determined from charts can only be achieved if the specified conditions exist.

d. The full amount of usable fuel is available for all approved flight conditions.

e. Indicated airspeeds (IAS) were obtained using the Airspeed Calibration - Normal System graph.

f: Notes have been provided on various graphs and tables to approximate performance with ice vanes extended. The effect will vary, depending upon airspeed, temperature, altitude, and ambient conditions. At lower altitudes, where operation on the torque limit is possible, the effect of ice vane extension will be less, depending upon how much power can be recovered after the ice vanes have been extended.

AIRSPEED CALIBRATION - NORMAL SYSTEM



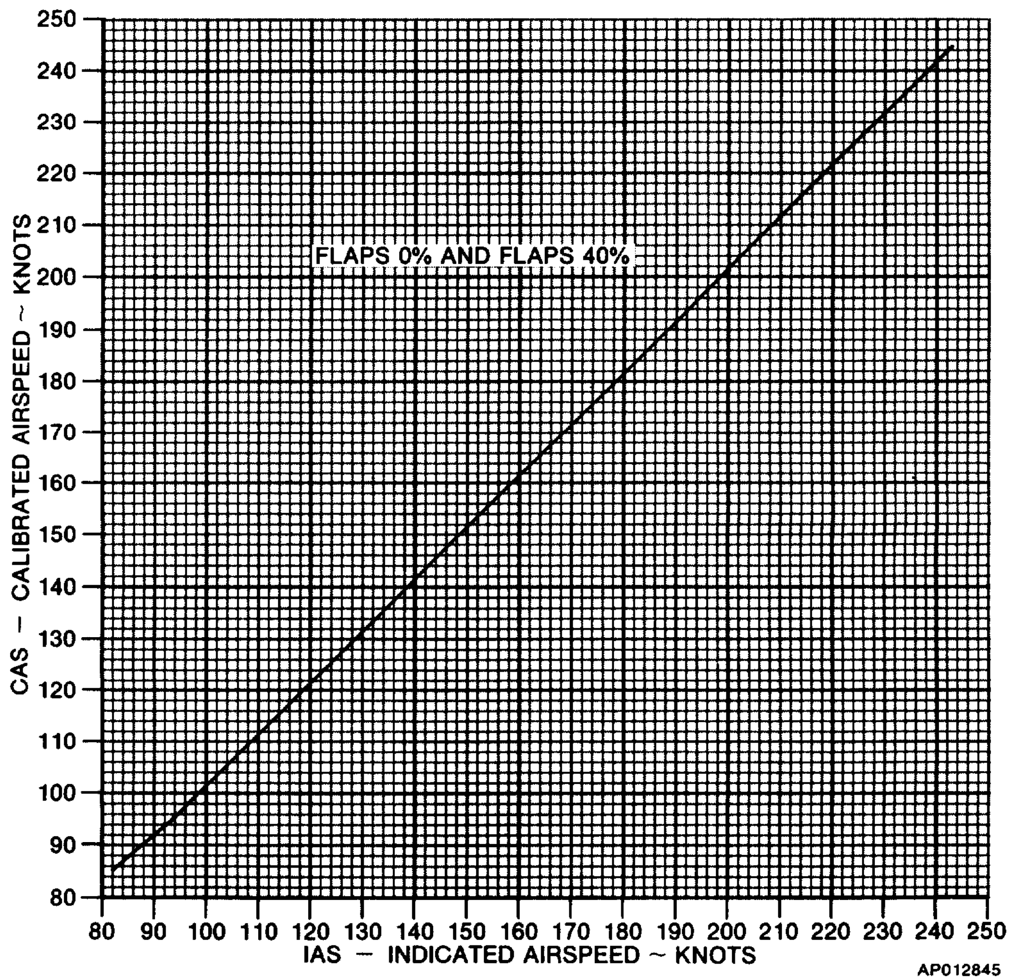


Figure 7-2. Airspeed Correction - Normal System

ALTIMETER CORRECTION - NORMAL SYSTEM

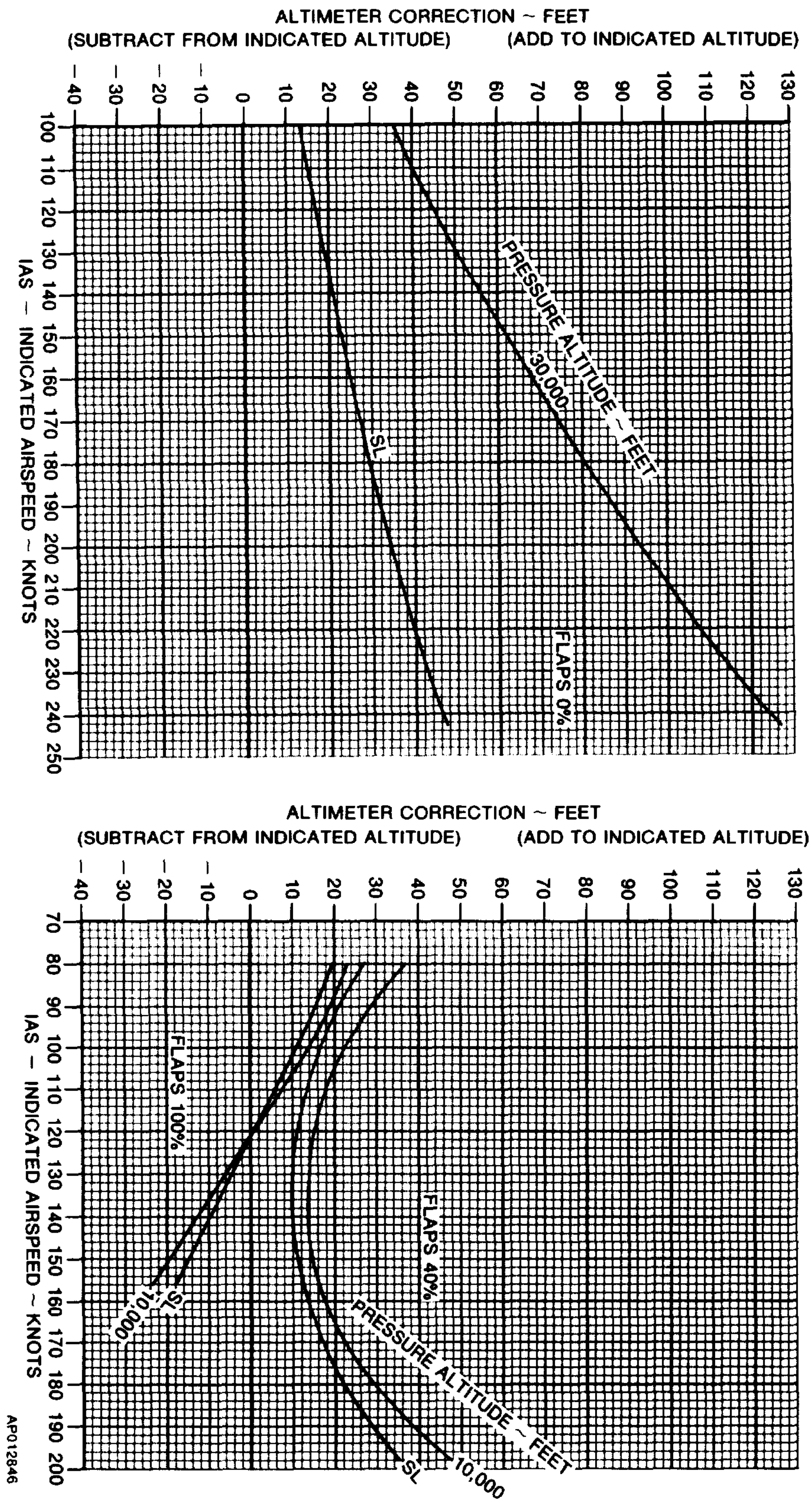


Figure 7-3. Altimeter Correction - Normal System

AIRSPEED CALIBRATION – ALTERNATE SYSTEM

APPLICABLE FOR ALL FLAP POSITIONS

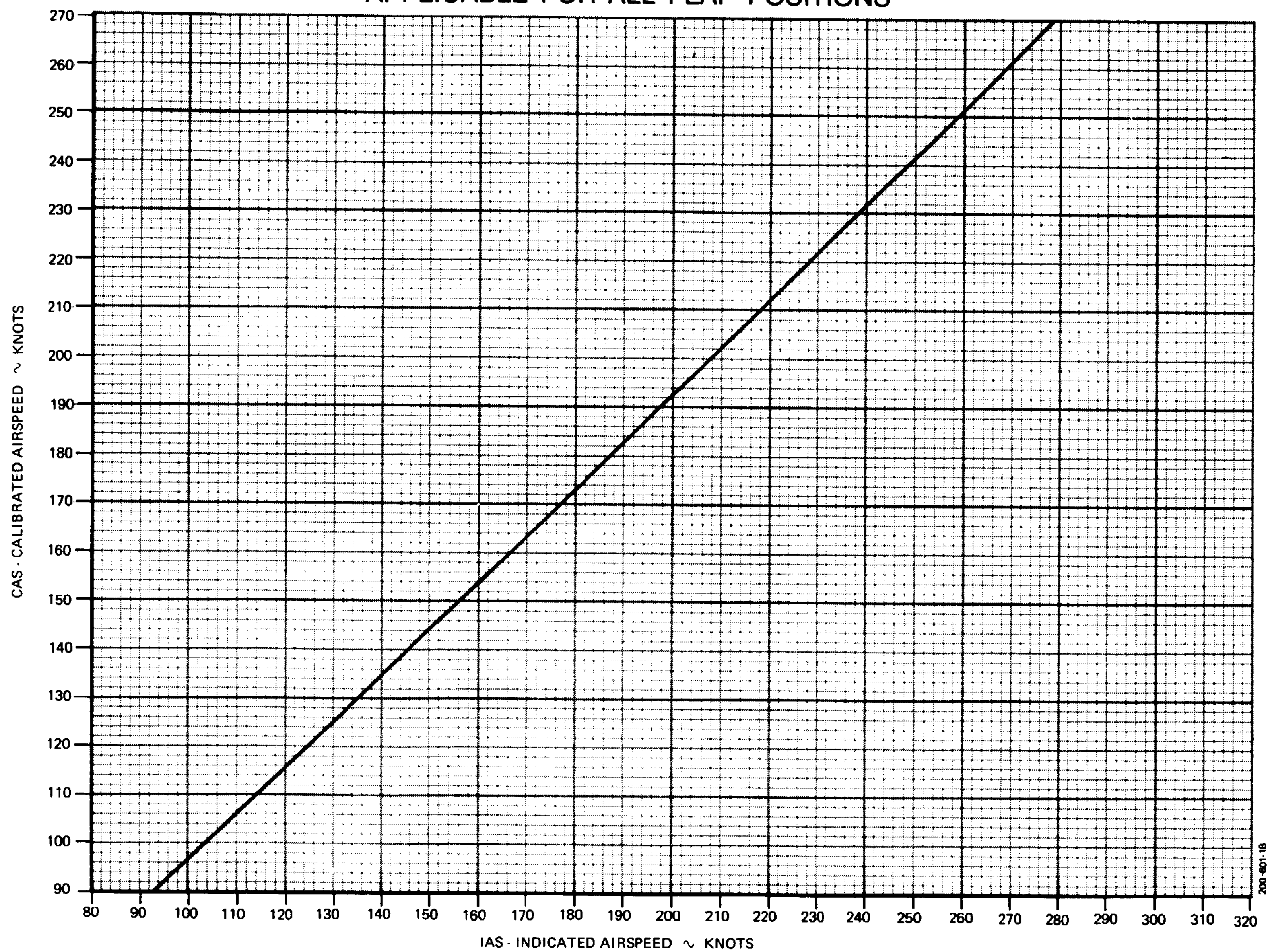


Figure 7-4. Airspeed Calibration - Alternate System

ALTIMETER CORRECTION – ALTERNATE SYSTEM

APPLICABLE FOR ALL FLAP POSITIONS

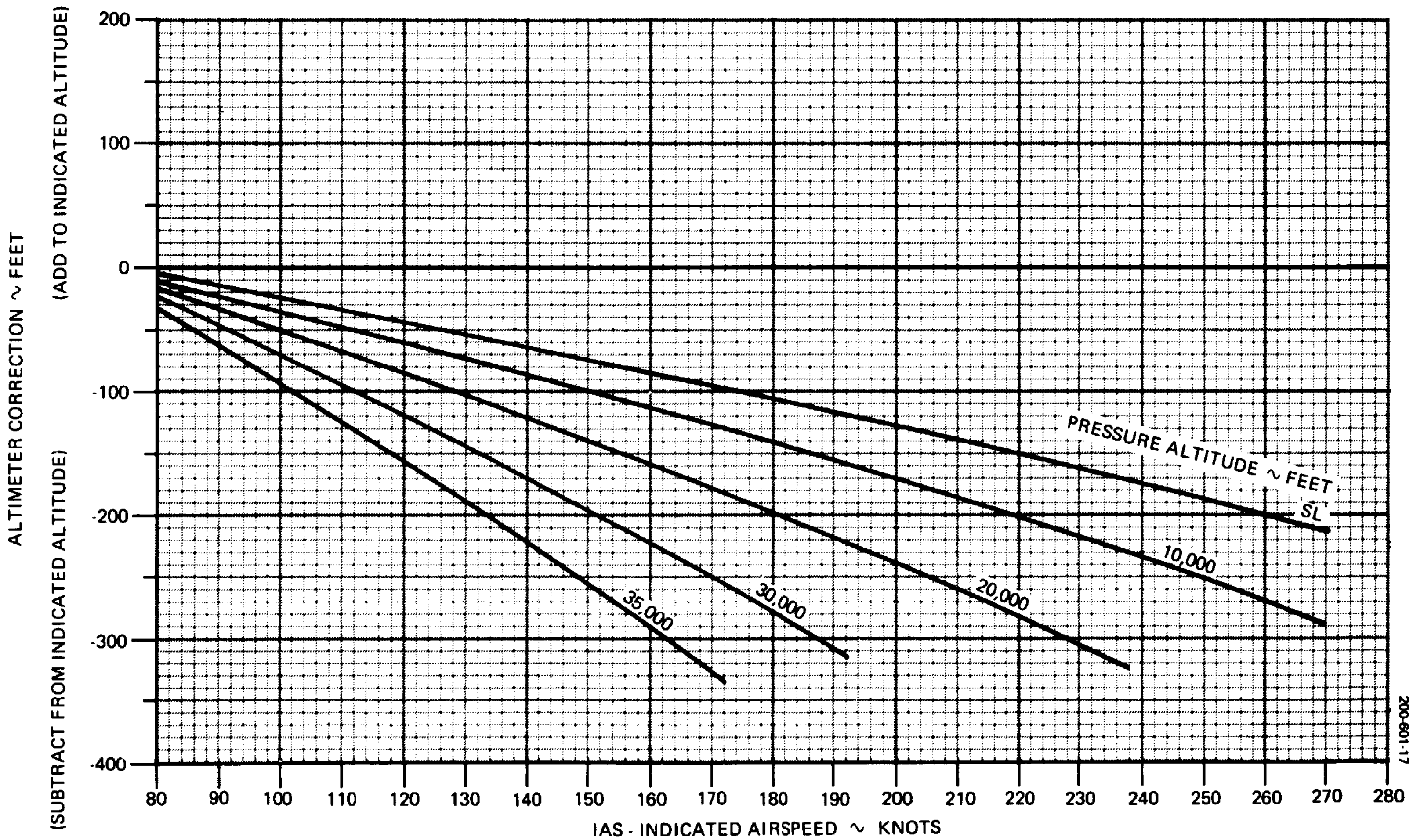


Figure 7-5. Altimeter Correction - Alternate System

INDICATED OUTSIDE AIR TEMPERATURE CORRECTION

STANDARD DAY (ISA)

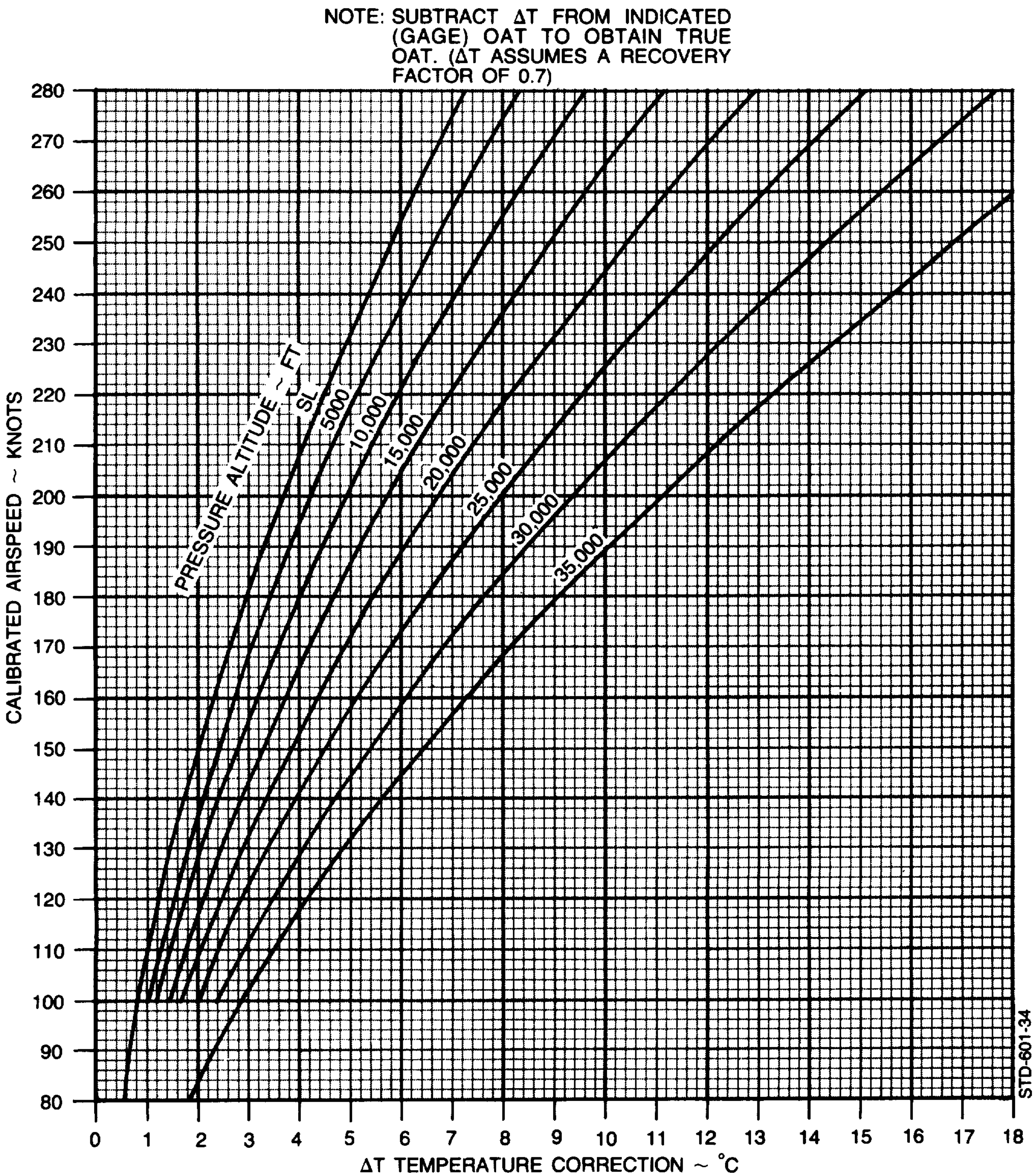


Figure 7-6. Free Air Temperature Correction

ISA CONVERSION

PRESSURE ALTITUDE vs FREE AIR TEMPERATURE

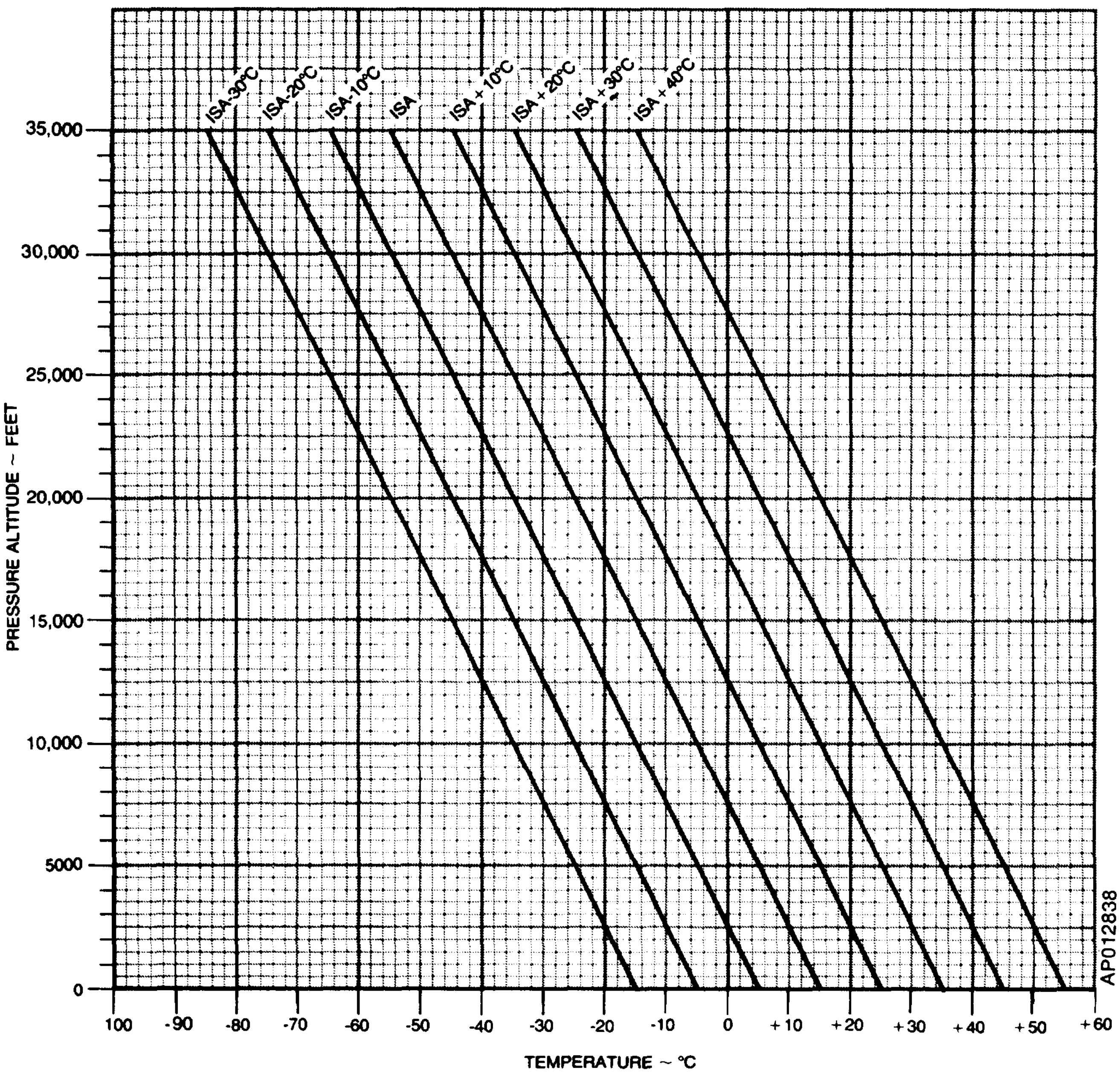


Figure 7-7. ISA Conversion

FAHRENHEIT TO CELSIUS TEMPERATURE CONVERSION

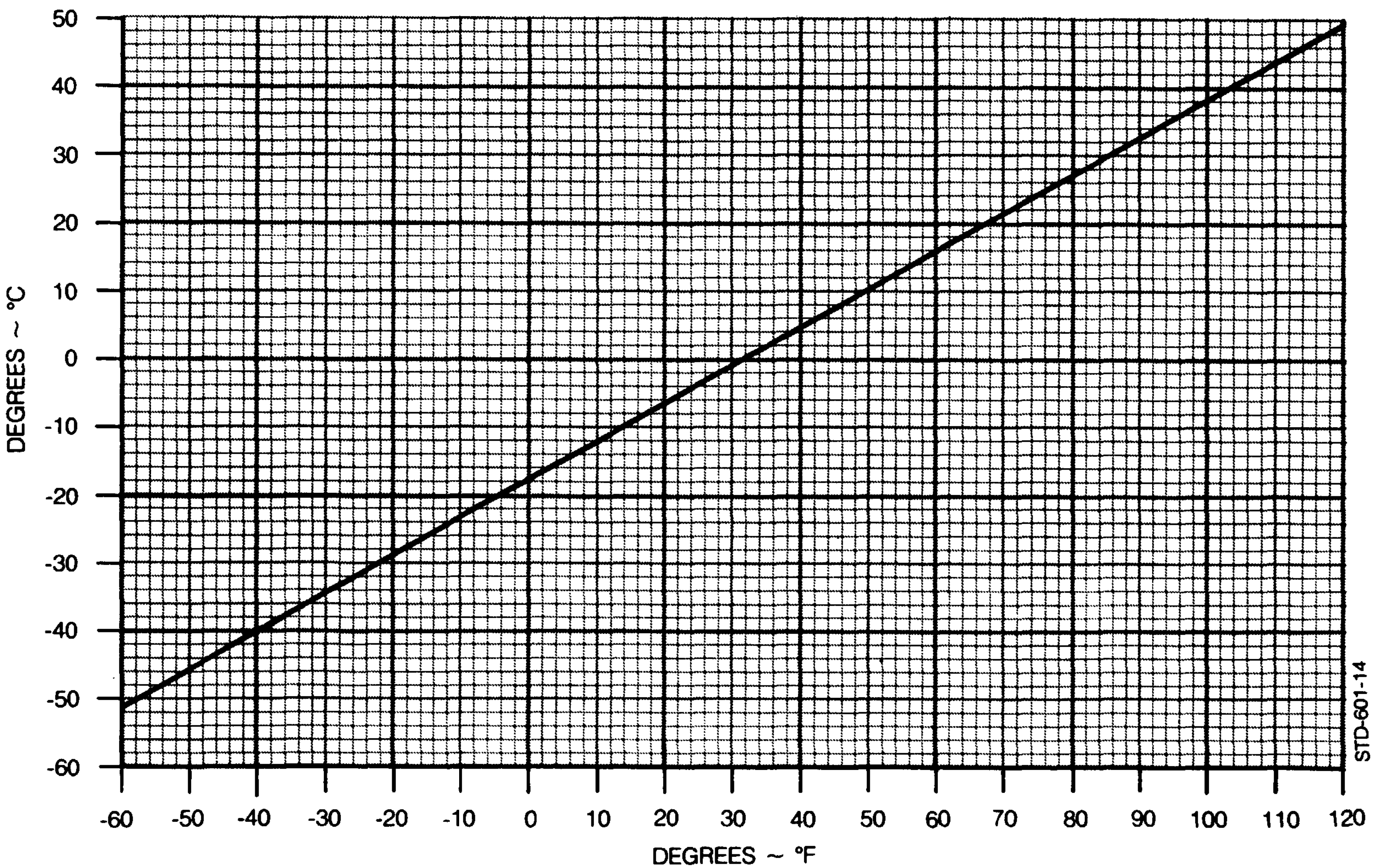


Figure 7-8, Fahrenheit to Celsius Temperature Conversion

MINIMUM TAKEOFF POWER AT 2000 RPM

(65 KNOTS)

NOTES:

1. TORQUE INCREASES APPROXIMATELY 1% FROM 0 TO 65 KNOTS.
2. THE PERCENT TORQUE INDICATED IN THIS FIGURE IS THE MINIMUM VALUE AT 65 KNOTS AT WHICH TAKEOFF PRESENTED IN THIS SECTION CAN BE REALIZED. ANY EXCESS POWER WHICH CAN BE DEVELOPED WITHOUT EXCEEDING ENGINE LIMITATIONS SHOULD BE UTILIZED.
3. FOR OPERATION WITH ICE VANES EXTENDED, INCREASE FIELD PRESSURE ALTITUDE 1000 FEET BEFORE ENTERING GRAPH.

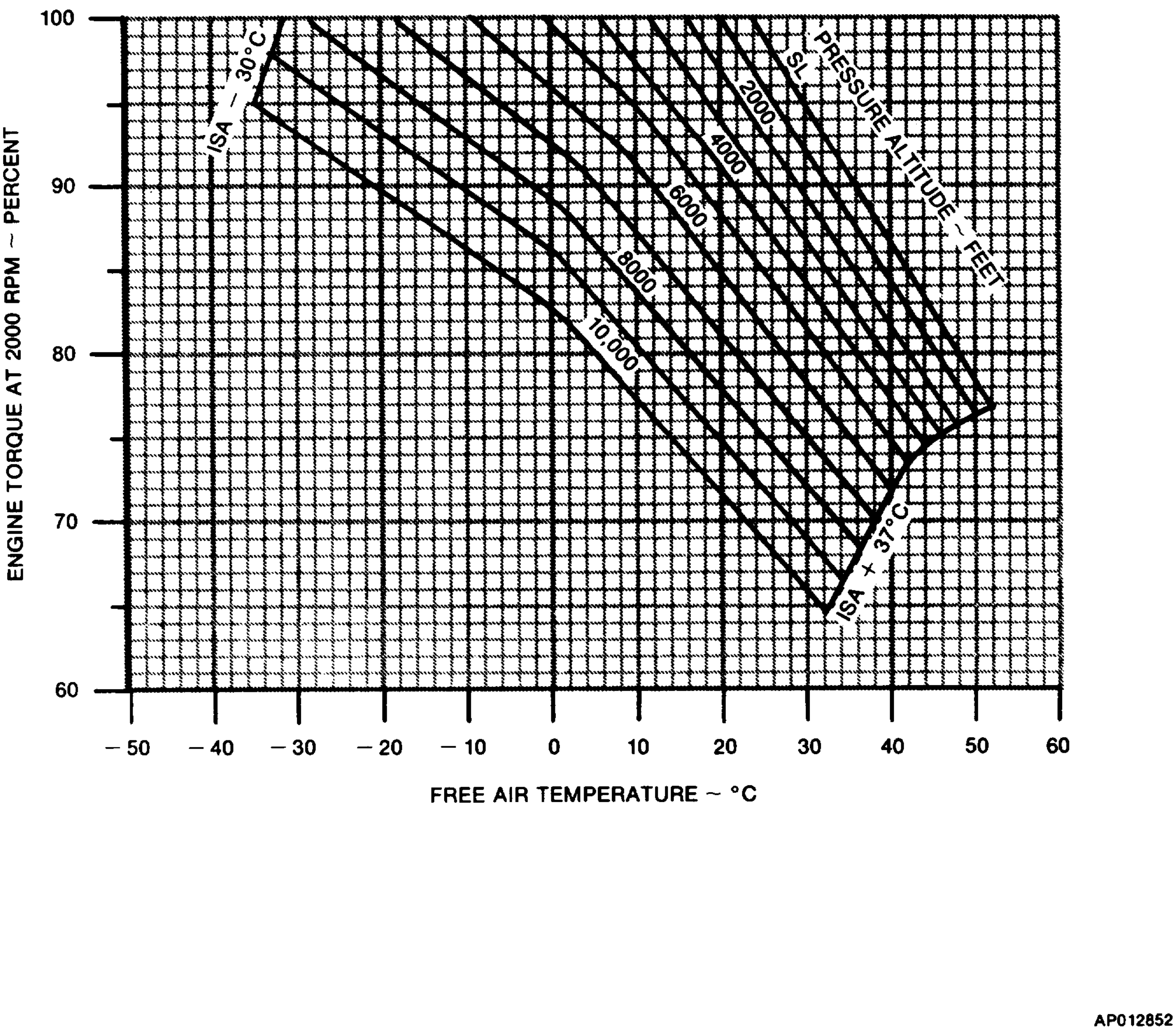


Figure 7-9. Minimum Takeoff Power at 2000 RPM

MAXIMUM TAKEOFF WEIGHT PERMITTED BY ENROUTE CLIMB REQUIREMENT

ASSOCIATED CONDITIONS:

POWER .... MAXIMUM CONTINUOUS
INOPERATIVE PROPELLERS .... FEATHERED
LANDING GEAR .... UP
FLAPS 0%

EXAMPLE:

PRESSURE ALTITUDE . . . . . . 5233 FT
FAT . . . . 28°C

MAXIMUM TAKEOFF WEIGHT 14.200 LBS

NOTE: ONE-ENGINE-INOPERATIVE PERFORMANCE WEIGHT LIMIT IS FOR RATE-OF-CLIMB CAPABILITIES AT 5000 FT PRESSURE ALTITUDE. REFER TO THE l CLIMB - ONE ENGINE INOPERATIVE' GRAPH FOR ACTUAL CLIMB CAPABILITIES APPLICABLE TO THE PARTICULAR TEMPERATURE AND ALTITUDE BEING CONSIDERED.

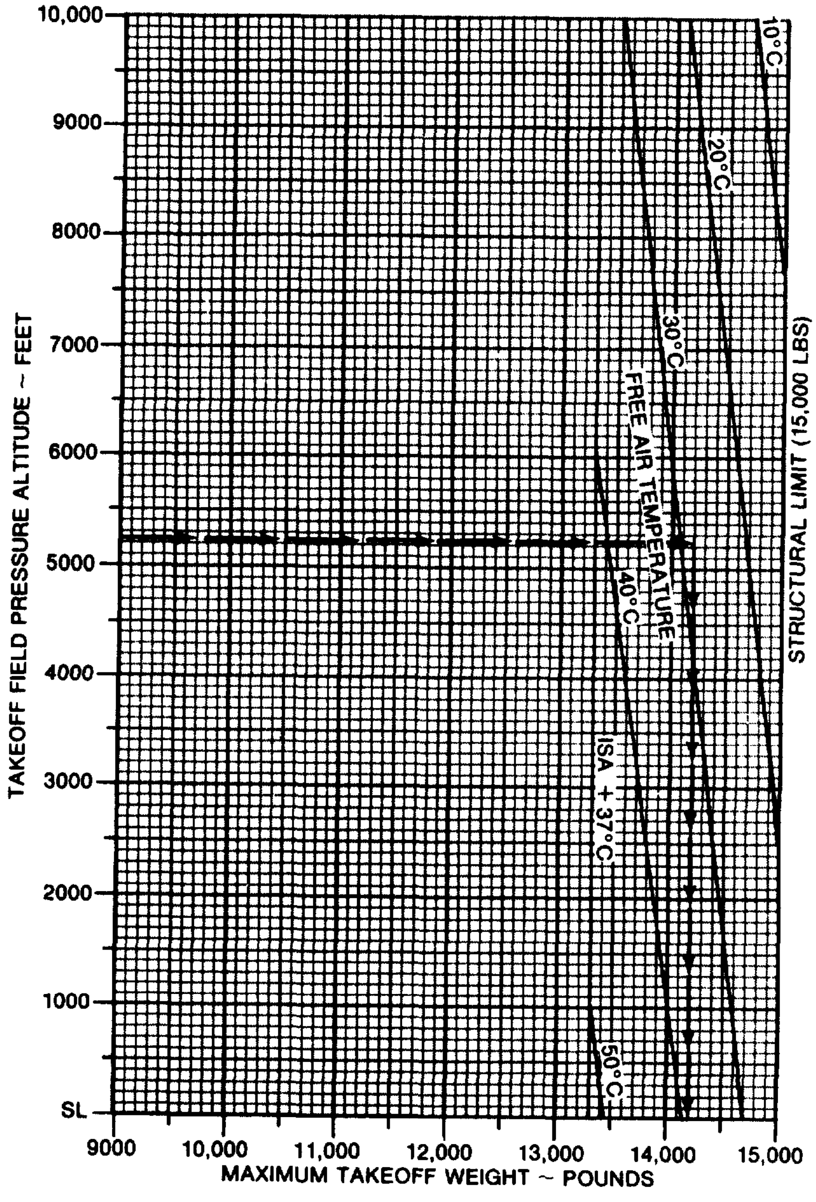


Figure 7-10. Maximum Takeoff Weight Permitted by Enroute Climb Requirement

TAKEOFF WEIGHT - FLAPS 0%
TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF

ASSOCIATED CONDITIONS:

POWER . . . TAKEOFF
FLAPS 0%
LANDING GEAR .... DOWN
INOPERATIVE PROPELLER .... FEATHERED

EXAMPLE:

PRESSURE ALTITUDE .... 5233 FT
FAT ...... 28°C
TAKEOFF WEIGHT .... 13,480 LBS

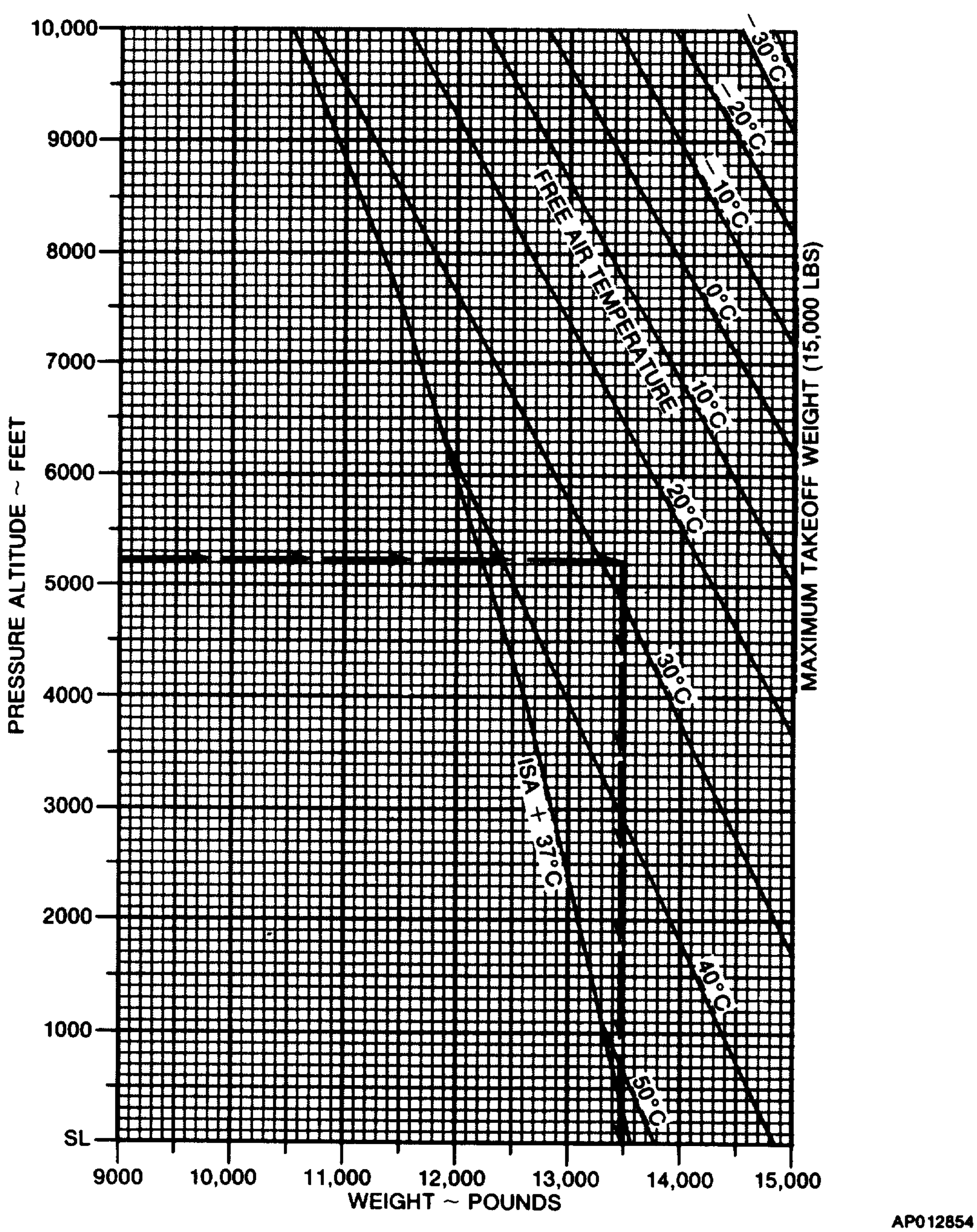


Figure 7-11. Takeoff Weight - Flaps 0%, To Achieve Positive One-Engine Climb at Lift-Off

TAKEOFF WEIGHT - FLAPS 40%
TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF

ASSOCIATED CONDITIONS:

POWER .... TAKEOFF
FLAPS 40%
LANDING GEAR .... DOWN
INOPERATIVE PROPELLER.... FEATHERED

EXAMPLE:

PRESSURE ALTITUDE .... 5233 FT
FAT .... 28°C
TAKEOFF WEIGHT .... 11,925 LBS

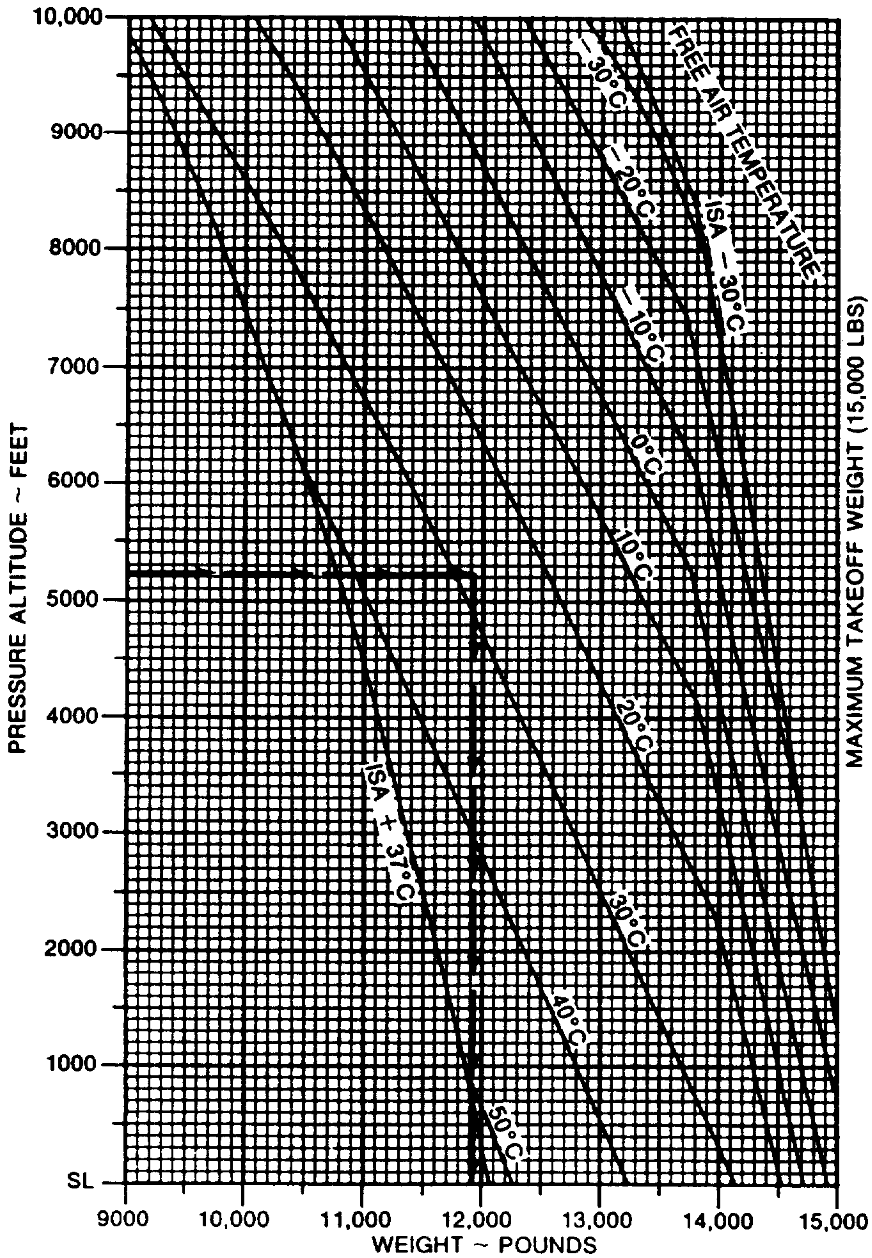


Figure 7-12. Takeoff Weight - Flaps 40%, To Achieve Positive One-Engine Climb at Lift-Off Flaps 40%

WIND COMPONENTS

Demonstrated Crosswind is 17 kts

EXAMPLE:

WIND SPEED	20 KTS
ANGLE BETWEEN WIND DIRECTION AND FLIGHT PATH	50%
HEADWIND COMPONENT	13 KTS
CROSSWIND COMPONENT	15 KTS

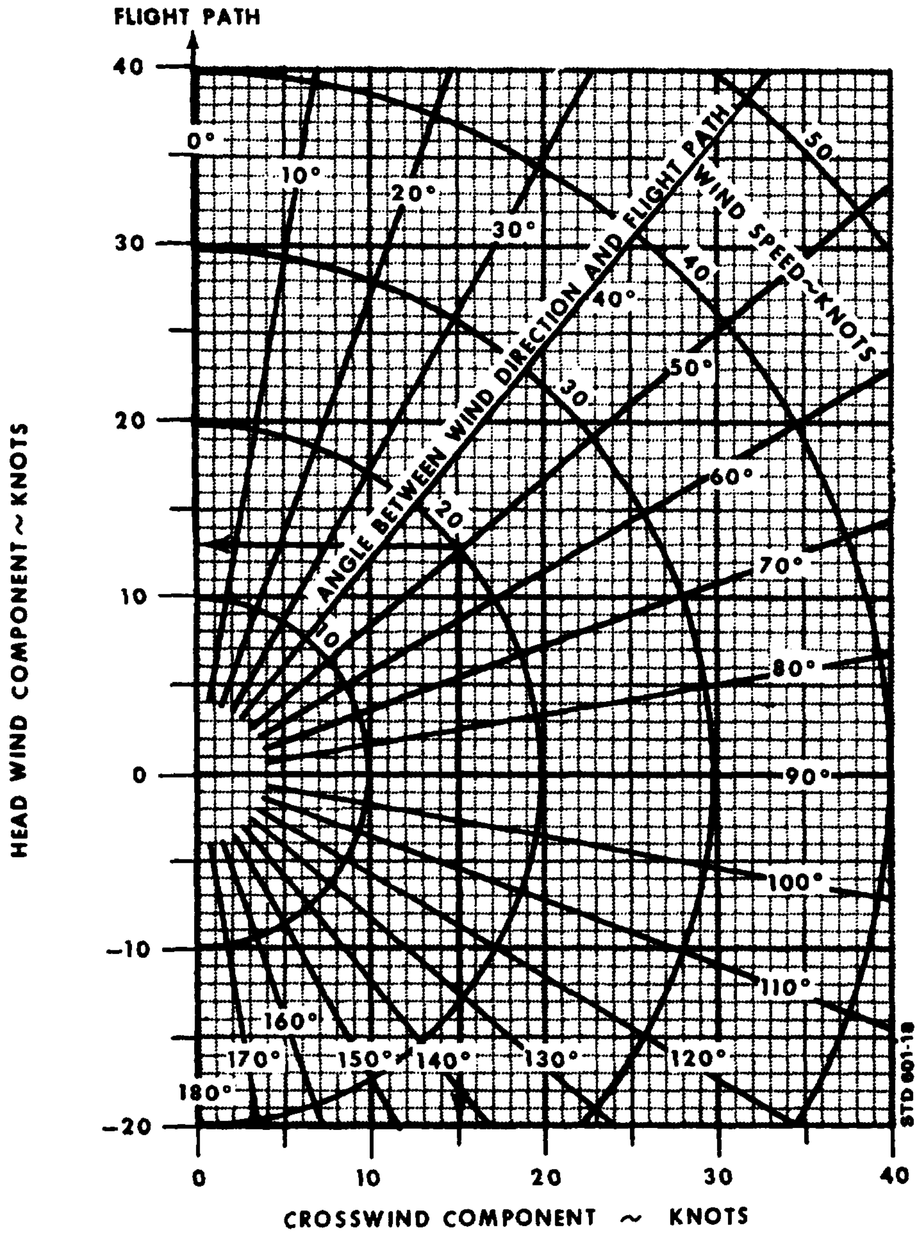


Figure 7-13. Wind Components

TAKEOFF DISTANCE - FLAPS 0%

ASSOCIATED CONDITIONS:

POWER........................ TAKEOFF POWER SET BEFORE BRAKE RELEASE
FLAPS........................... 0%
LANDING GEAR.......... RETRACT AFTER LIFT-OFF
RUNWAY...................... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	TAKEOFF SPEED ~ KNOTS	
	ROTATION	50 FT
15,000	102	118
13,000	97	115
11,000	93	106
9,000	93	99

EXAMPLE:

FAT.. 28°C
PRESSURE ALTITUDE.......................... 5233 FT
TAKEOFF WEIGHT................................ 13,480 LBS
HEADWIND COMPONENT.................... 10 KTS

GROUND ROLL.. 3420 FT
TOTAL DISTANCE OVER 50-FT OBSTACLE................................ 5100
TAKEOFF SPEED AT ROTATION.......... 100 KTS
AT 50 FT............. 116 KTS

NOTES:

1. FOR OPERATION WITH ICE VANES EXTENDED, INCREASE TOTAL DISTANCE OVER 50-FT OBSTACLE BY 8%.
2. ADD 12% TO OR SUBTRACT 5% FROM TOTAL TAKEOFF DISTANCE FOR EACH 1% OF RUNWAY SLOPE (UP - ADD; DOWN - SUBTRACT).

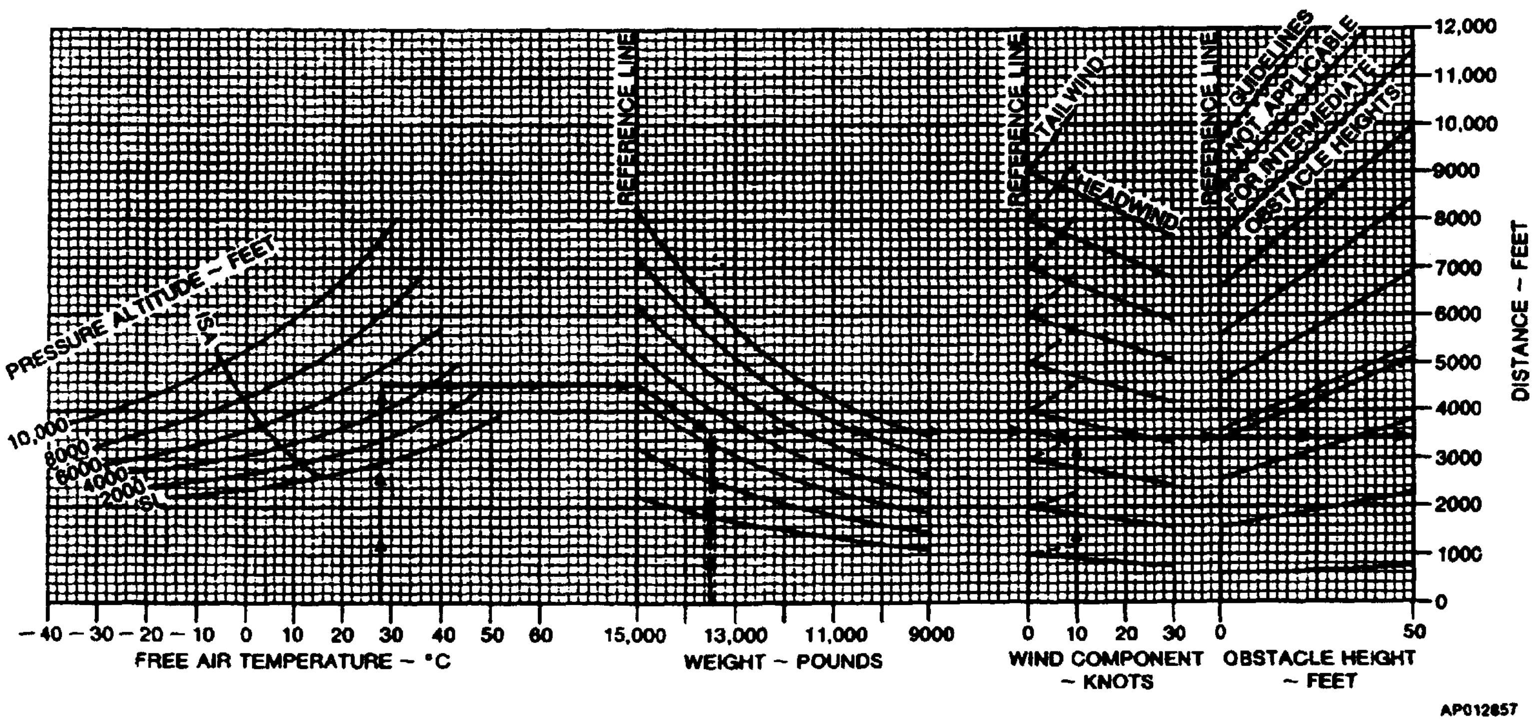


Figure 7-14. Takeoff Distance - Flaps 0%

ACCELERATE-STOP - FLAPS 0%

ASSOCIATED CONDITIONS:

POWER........................ 1. TAKEOFF POWER SET BEFORE BRAKE RELEASE
2. BOTH ENGINES IDLE AT V_R AND REVERSE OPERATING ENGINE

FLAPS........................ 0%
AUTOFEATHER........ ARMED
BRAKING.................... MAXIMUM
RUNWAY.................... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	V_R ~ KNOTS
15,000	102
13,000	97
11,000	93
9,000	93

EXAMPLE:

FAT.. 28°C
PRESSURE ALTITUDE............ 5233 FT
WEIGHT.................................... 13,480 LBS
HEADWIND COMPONENT....... 10 KTS
FIELD LENGTH......................... 5050 FT
V_R.. 98 KTS

NOTES:
1. FOR OPERATION WITH ICE VANES EXTENDED, INCREASE ACCELERATE - STOP FIELD LENGTH BY 3%.
2. ADD 6% TO ACCELERATE-STOP FIELD LENGTH FOR EACH 1% OF UPHILL RUNWAY SLOPE. DO NOT SUBTRACT ANYTHING FOR DOWNHILL SLOPE.

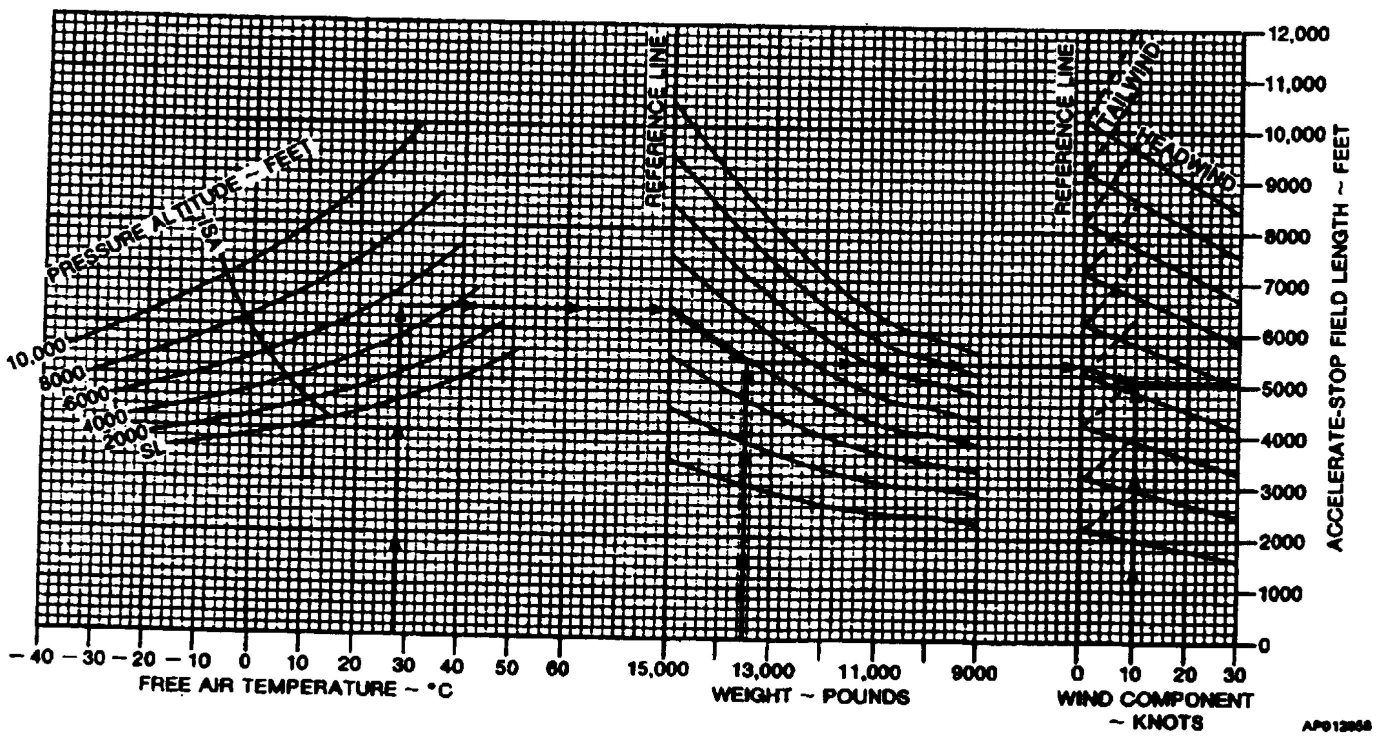


Figure 7-15. Accelerate-Stop - Flaps 0%

ACCELERATE-GO DISTANCE OVER 50-FT OBSTACLE – FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .... TAKEOFF POWER SET BEFORE BRAKE RELEASE
FLAPS................ 0%
AUTOFEATHER .... ARMED
LANDING GEAR....... RETRACTED AFTER LIFT-OFF
RUNWAY .... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	SPEED ~ KNOTS	
	ROTATION	CLIMB
15,000	102	118
13,000	97	112
11,000	93	106
9000	93	99

EXAMPLE:

FAT .... 28°C
PRESSURE ALTITUDE .... 5233 FT
TAKEOFF WEIGHT .... 10,000 LBS
HEADWIND COMPONENT .... 10 KTS

TAKEOFF DISTANCE OVER 50-FT OBSTACLE .... 5550 FT
ROTATION SPEED .... 93 KTS
CLIMB SPEED .... 103 KTS

NOTES:
1. DISTANCES ASSUME AN ENGINE FAILURE AT ROTATION AND PROPELLER IMMEDIATELY FEATHERED.
2. FOR OPERATION WITH ICE VANES EXTENDED, INCREASE TAKEOFF DISTANCE OVER 50-FT OBSTACLE BY 15%.
3. ADD 13% TO OR SUBTRACT 3% FROM TOTAL TAKEOFF DISTANCE FOR EACH 1% OF RUNWAY SLOPE (UP-ADD; DOWN-SUBTRACT).

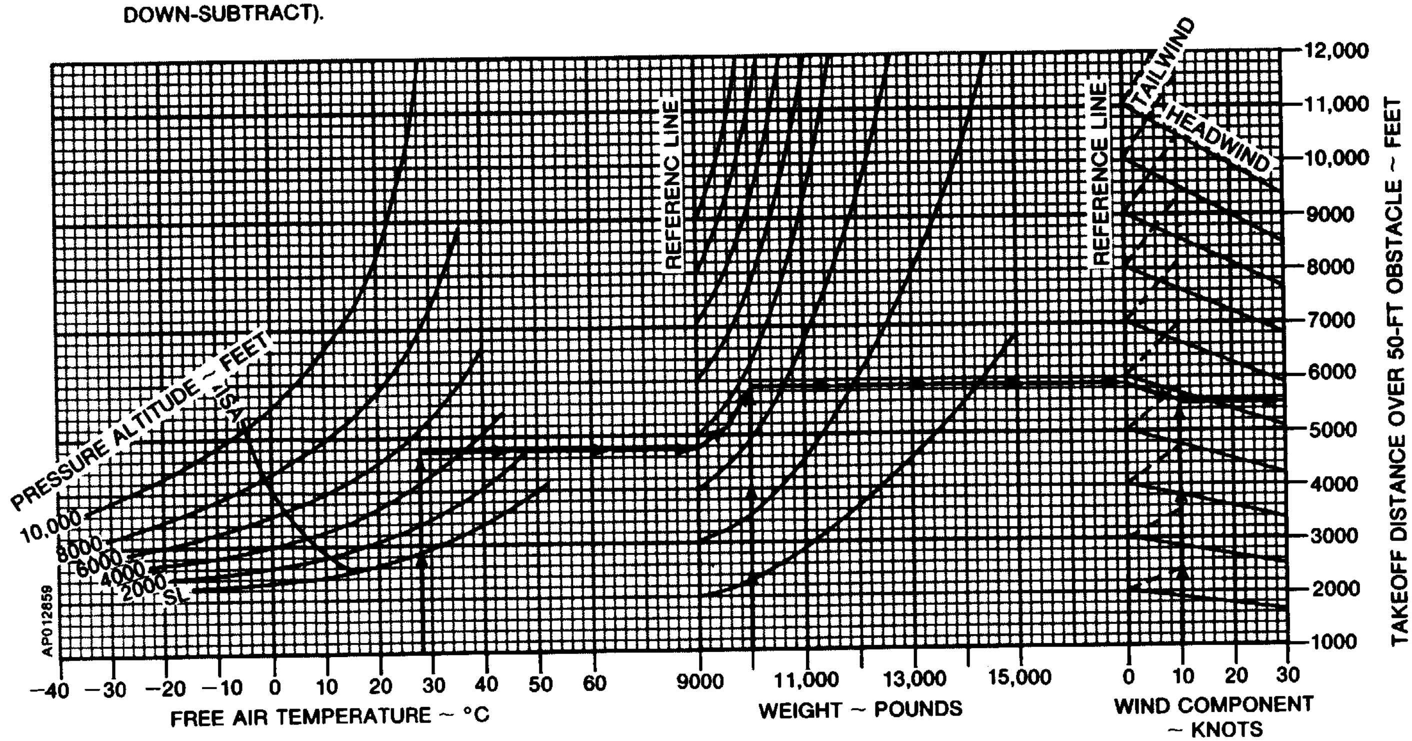


Figure 7-16. Accelerate-Go Distance Over 50-FT Obstacle - Flaps 0%

TAKEOFF CLIMB GRADIENT — ONE ENGINE INOPERATIVE — FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .... TAKEOFF
FLAPS 0%
LANDING GEAR .... UP
INOPERATIVE PROPELLER ...... FEATHERED

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
15,000	118
13,000	112
11,000	106
9500	99
9000	99

EXAMPLE:

FAT .... 28°C
PRESSURE ALTITUDE ..... 5233 FT
WEIGHT .... 10,000 LBS

CLIMB GRADIENT 5.1%
CLIMB SPEED .... 101 KTS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, SUBTRACT 0.5 PERCENTAGE UNITS FROM CLIMB GRADIENT (EXAMPLE: 5.1 - 0.5% = 4.6%).

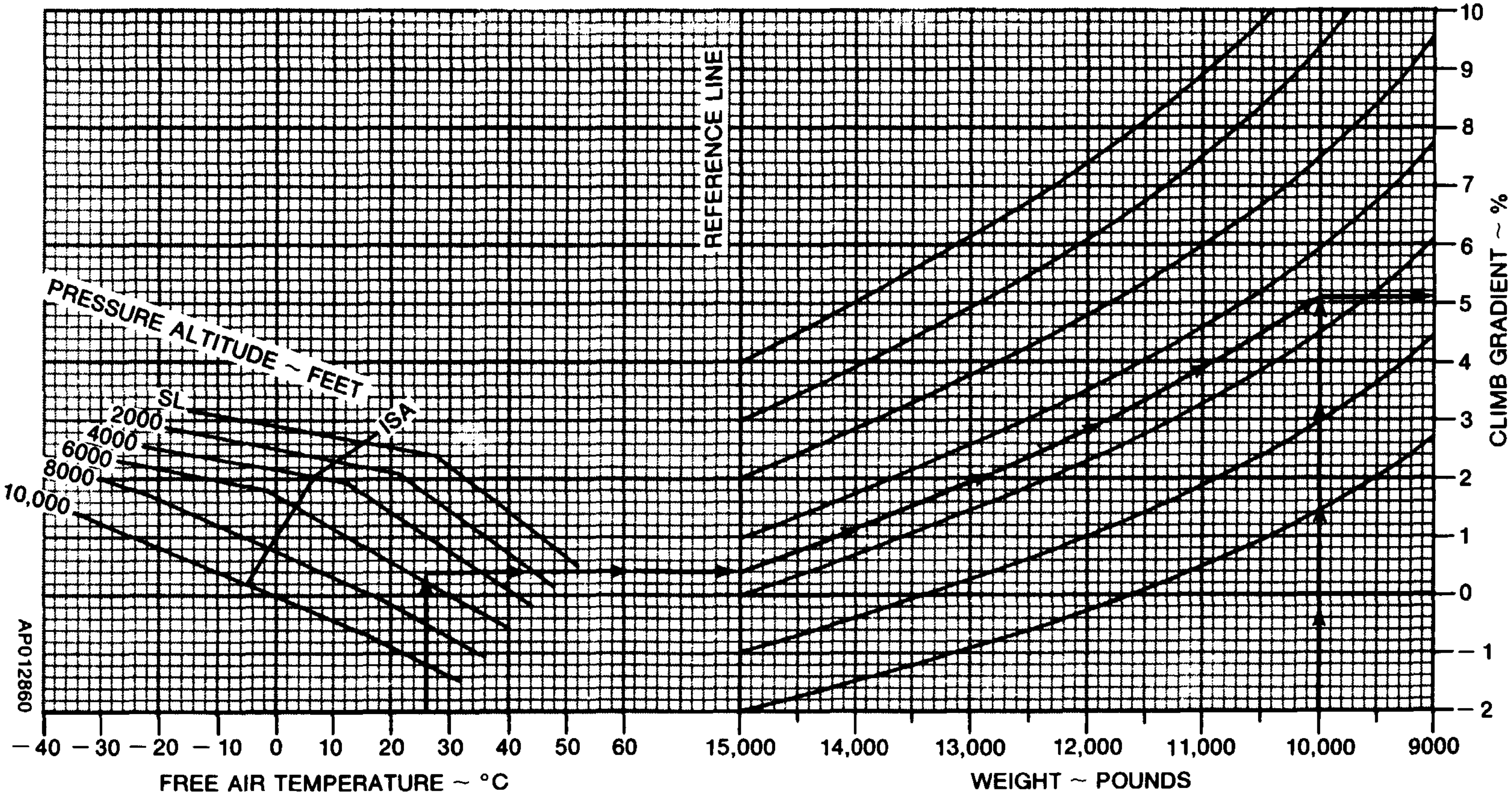


Figure 7-17. Takeoff Climb Gradient - One-Engine-Inoperative - Flaps 0%

TAKEOFF DISTANCE — FLAPS 40%

ASSOCIATED CONDITIONS:

POWER .... TAKEOFF POWER SET BEFORE BRAKE RELEASE
FLAPS 40%
LANDING GEAR ... RETRACT AFTER LIFT-OFF
RUNWAY .... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	TAKEOFF SPEED ~ KNOTS	
	ROTATION	50 FT
15,000	93	103
13,000	93	99
11,000	93	99
9000	93	99

EXAMPLE:

FAT .... 28°C
PRESSURE ALTITUDE .... 5233 FT
TAKEOFF WEIGHT .... 11,925 LBS
HEADWIND COMPONENT .... 10 KTS

GROUND ROLL .... 2775 FT
TOTAL DISTANCE OVER 50-FT OBSTACLE .... 3600 FT
TAKEOFF SPEED AT ROTATION ... 93 KTS
AT 50 FT .... 99 KTS

NOTES:

1. FOR OPERATION WITH ICE VANES EXTENDED, INCREASE TOTAL DISTANCE OVER 50-FOOT OBSTACLE BY 10%.
2. ADD 15% TO OR SUBTRACT 4% FROM TOTAL TAKEOFF DISTANCE FOR EACH 1% OF RUNWAY SLOPE (UP - ADD; DOWN - SUBTRACT).

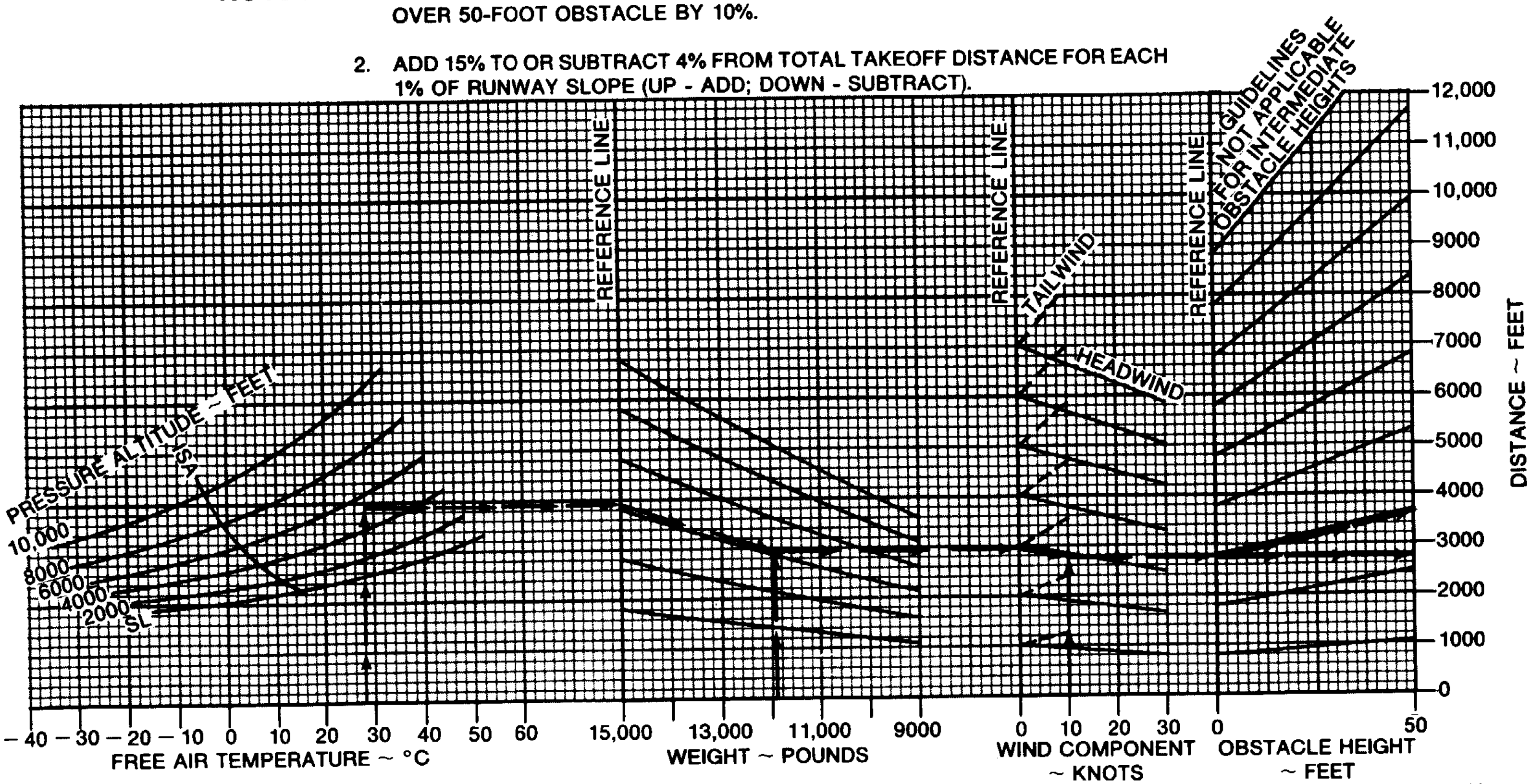


Figure 7-18. Takeoff Distance - Flaps 40%

ACCELERATE-STOP — FLAPS 40%

ASSOCIATED CONDITIONS:

POWER .... 1. TAKEOFF POWER SET BEFORE BRAKE RELEASE
2. BOTH ENGINES IDLE AT V_R AND REVERSE OPERATING ENGINE

FLAPS................ 40%

AUTOFEATHER .... ARMED

BRAKING............. MAXIMUM

RUNWAY .... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	V_R ~ KNOTS
15,000	93
13,000	93
11,000	93
9000	93

EXAMPLE:

FAT .... 28°C

PRESSURE ALTITUDE .... 5233 FT

WEIGHT .... 11,925 LBS

HEADWIND COMPONENT .... 10 KTS

FIELD LENGTH.................... 4400 FT

V_R .... 93 KTS

NOTES: 1. FOR OPERATION WITH ICE VANES EXTENDED, INCREASE ACCELERATE-STOP FIELD LENGTH BY 2%.
2. ADD 7% TO ACCELERATE-STOP FIELD LENGTH FOR EACH 1% OF UPHILL RUNWAY SLOPE. DO NOT SUBTRACT ANYTHING FOR DOWNHILL SLOPE.

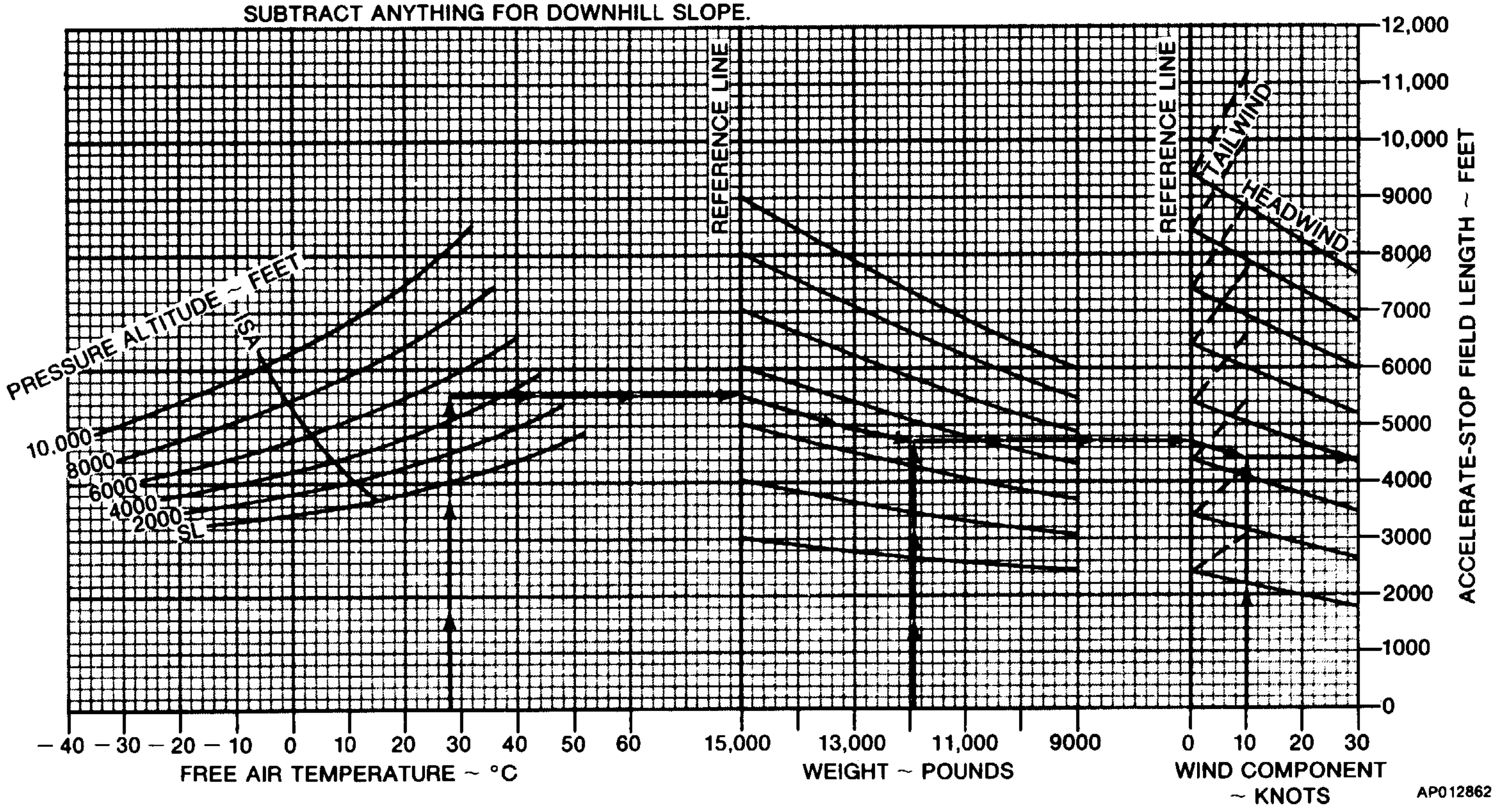


Figure 7-19. Accelerate-Stop - Flaps 40%

ACCELERATE-GO DISTANCE OVER 50-FT OBSTACLE – FLAPS 40%

ASSOCIATED CONDITIONS:

POWER .... TAKEOFF POWER SET BEFORE BRAKE RELEASE
FLAPS 40%
AUTOFEATHER .... ARMED
LANDING GEAR .... RETRACTED AFTER LIFT-OFF
RUNWAY .... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	SPEED ~ KNOTS	
	ROTATION	CLIMB
15,000	93	103
13,000	93	99
11,000	93	99
9000	93	99

EXAMPLE:

FAT .... 28°C
PRESSURE ALTITUDE .... 5233 FT
TAKEOFF WEIGHT .... 10,000 LBS
HEADWIND COMPONENT ..... 10 KTS

TAKEOFF DISTANCE OVER 50-FT OBSTACLE .... 6660 FT
ROTATION SPEED .... 93 KTS
CLIMB SPEED .... 99 KTS

NOTES:
1. DISTANCES ASSUME AN ENGINE FAILURE AT ROTATION AND PROPELLER IMMEDIATELY FEATHERED.
2. WEIGHTS IN SHADED AREA MAY NOT PROVIDE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB. REFER TO "MAXIMUM TAKEOFF WEIGHT TO ACHIEVE POSITIVE ONE-ENGINE-INOPERATIVE CLIMB AT LIFT-OFF" GRAPH FOR MAXIMUM WEIGHT AT WHICH THE ACCELERATE-GO PROCEDURE SHOULD BE ATTEMPTED.
3. FOR OPERATION WITH ICE VANES EXTENDED, INCREASE TAKEOFF DISTANCE OVER 50-FT OBSTACLE BY 16%.
4. ADD 33% TO OR SUBTRACT 4% FROM TOTAL TAKEOFF DISTANCE FOR EACH 1% OF RUNWAY SLOPE (UP-ADD; DOWN-SUBTRACT).

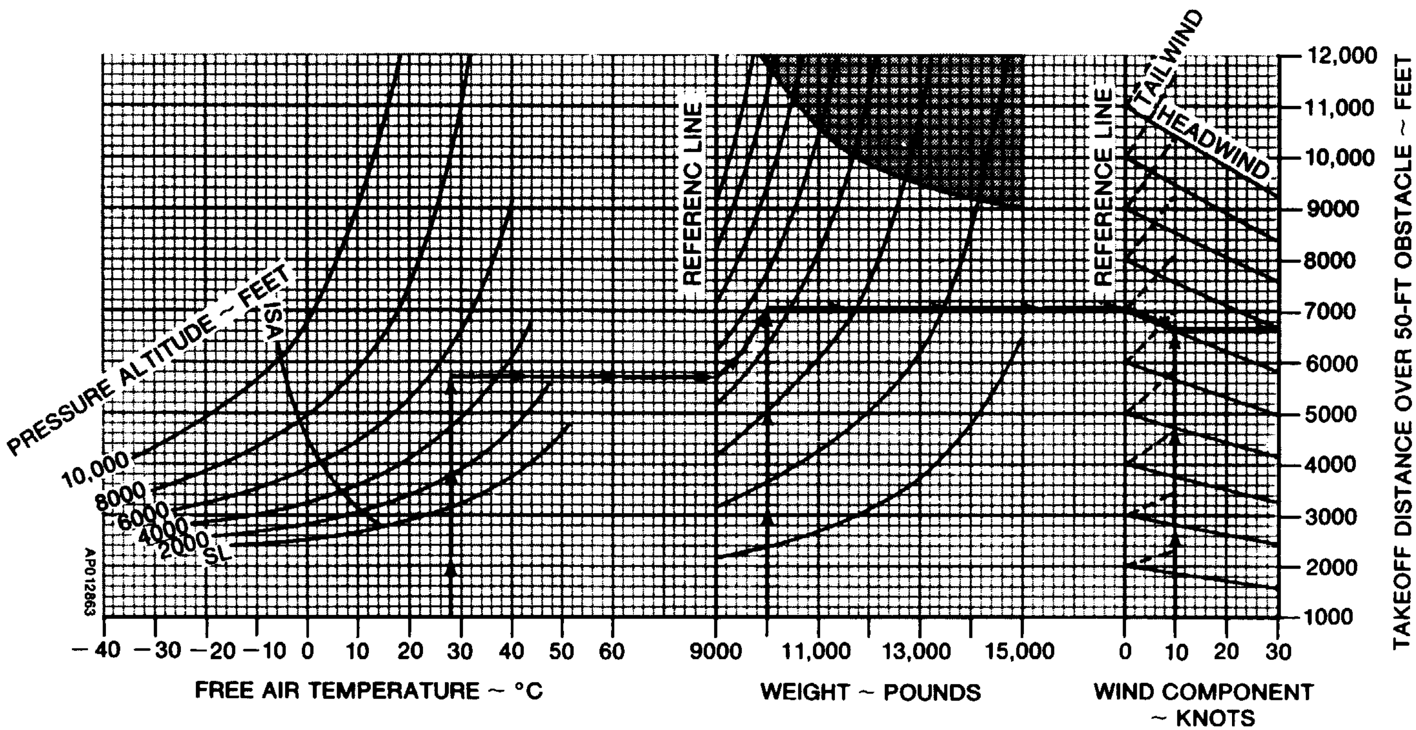


Figure 7-20. Accelerate-Go Distance Over 50-FT Obstacle - Flaps 40%

TAKEOFF CLIMB GRADIENT — ONE ENGINE INOPERATIVE — FLAPS 40%

ASSOCIATED CONDITIONS:

POWER .... TAKEOFF
FLAPS 40%
LANDING GEAR .... UP
INOPERATIVE PROPELLER...... FEATHERED

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
15,000	103
13,000	99
11,000	99
9000	99

EXAMPLE:

FAT .... 28°C
PRESSURE ALTITUDE ..... 5233 FT
WEIGHT .... 10,000 LBS

CLIMB GRADIENT.......... 4.2%
CLIMB SPEED.............. 99 KTS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, SUBTRACT 0.6 PERCENTAGE UNITS FROM CLIMB GRADIENT (EXAMPLE: 4.2 - 0.6% = 3.6%).

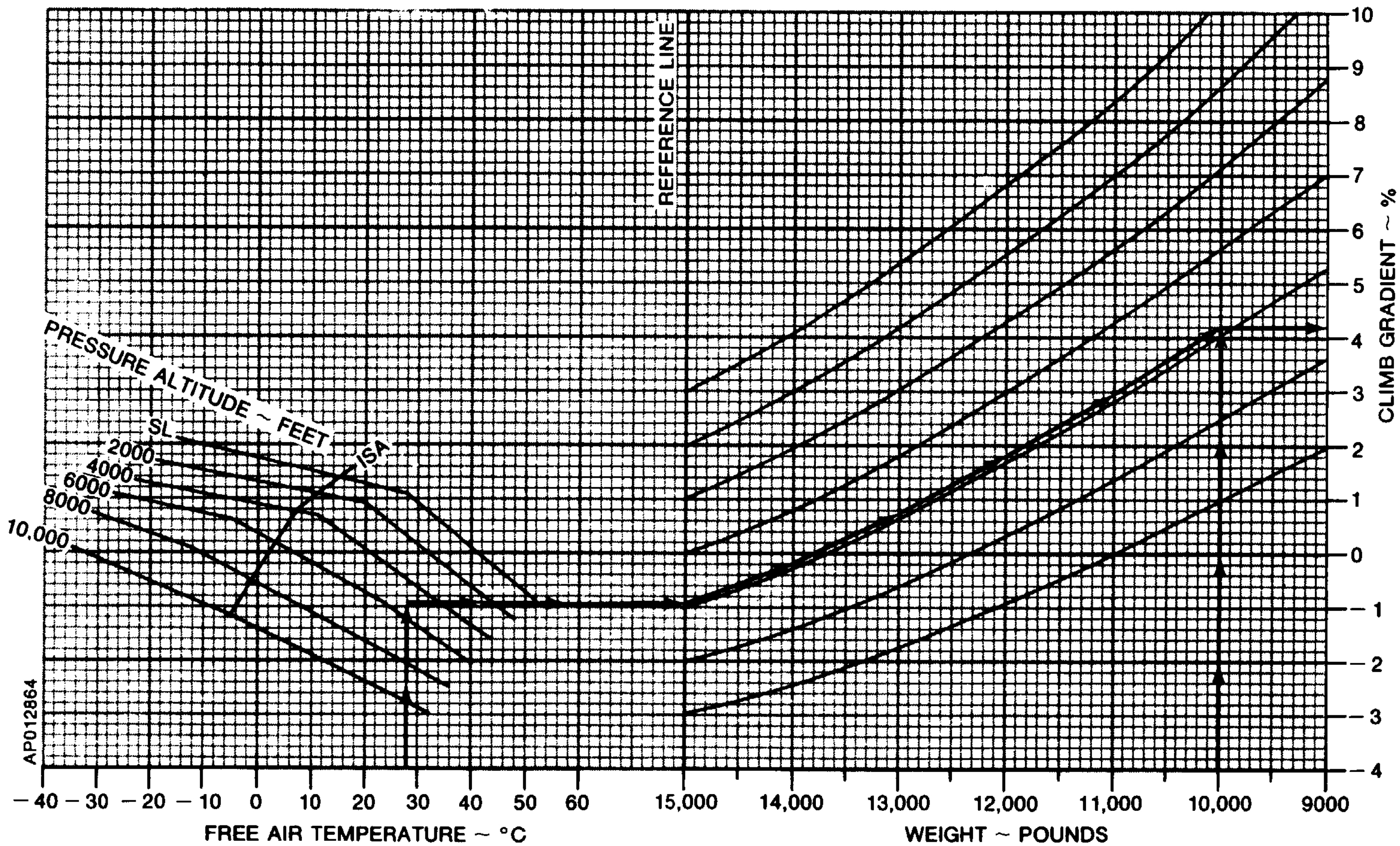


Figure 7-21. Takeoff Climb gradient - One-Engine-Inoperative - Flaps 40%

CLIMB — TWO ENGINES — FLAPS 0%

ASSOCIATED CONDITIONS:

POWER .... MAXIMUM CONTINUOUS
FLAPS 0%
LANDING GEAR .... UP

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
15,000	132
13,000	127
11,000	123
9000	118

EXAMPLE:

FAT .... 28°C
PRESSURE ALTITUDE .... 5233 FT
WEIGHT .... 9500 LBS

RATE OF CLIMB .... 2490 FT/MIN
CLIMB GRADIENT 20.4%
CLIMB SPEED .... 119 KTS

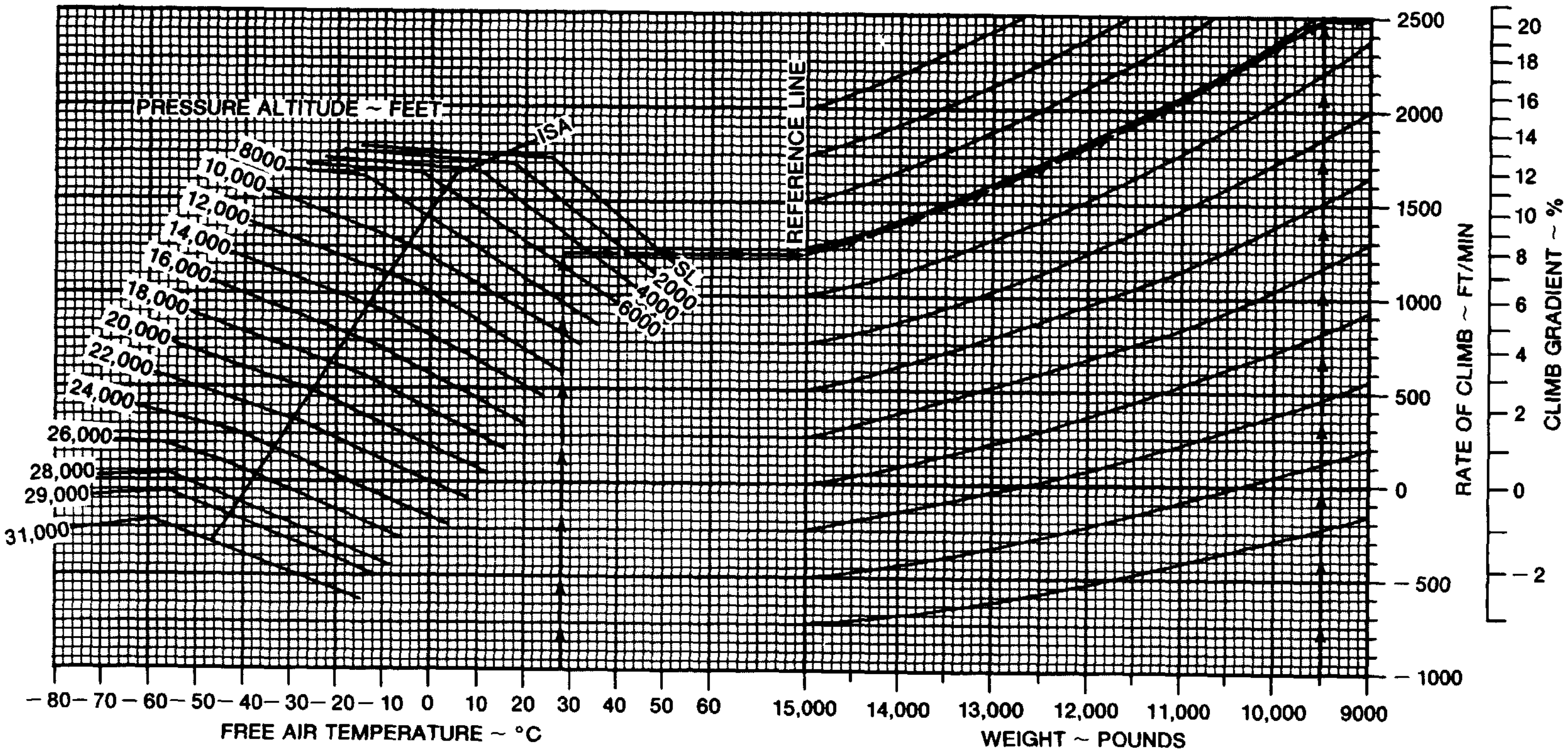


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Figure 7-22. Climb Two-Engine - Flaps 0%

CLIMB — TWO ENGINES — FLAPS 40%

ASSOCIATED CONDITIONS:

POWER	MAXIMUM CONTINUOUS
FLAPS	40%
LANDING GEAR	UP

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
15,000	126
13,000	122
11,000	119
9000	119

EXAMPLE:

FAT	0°C
PRESSURE ALTITUDE	16,000 FT
WEIGHT	9500 LBS
RATE OF CLIMB	1230 FT/MIN
CLIMB GRADIENT	8.5%
CLIMB SPEED	119 KTS

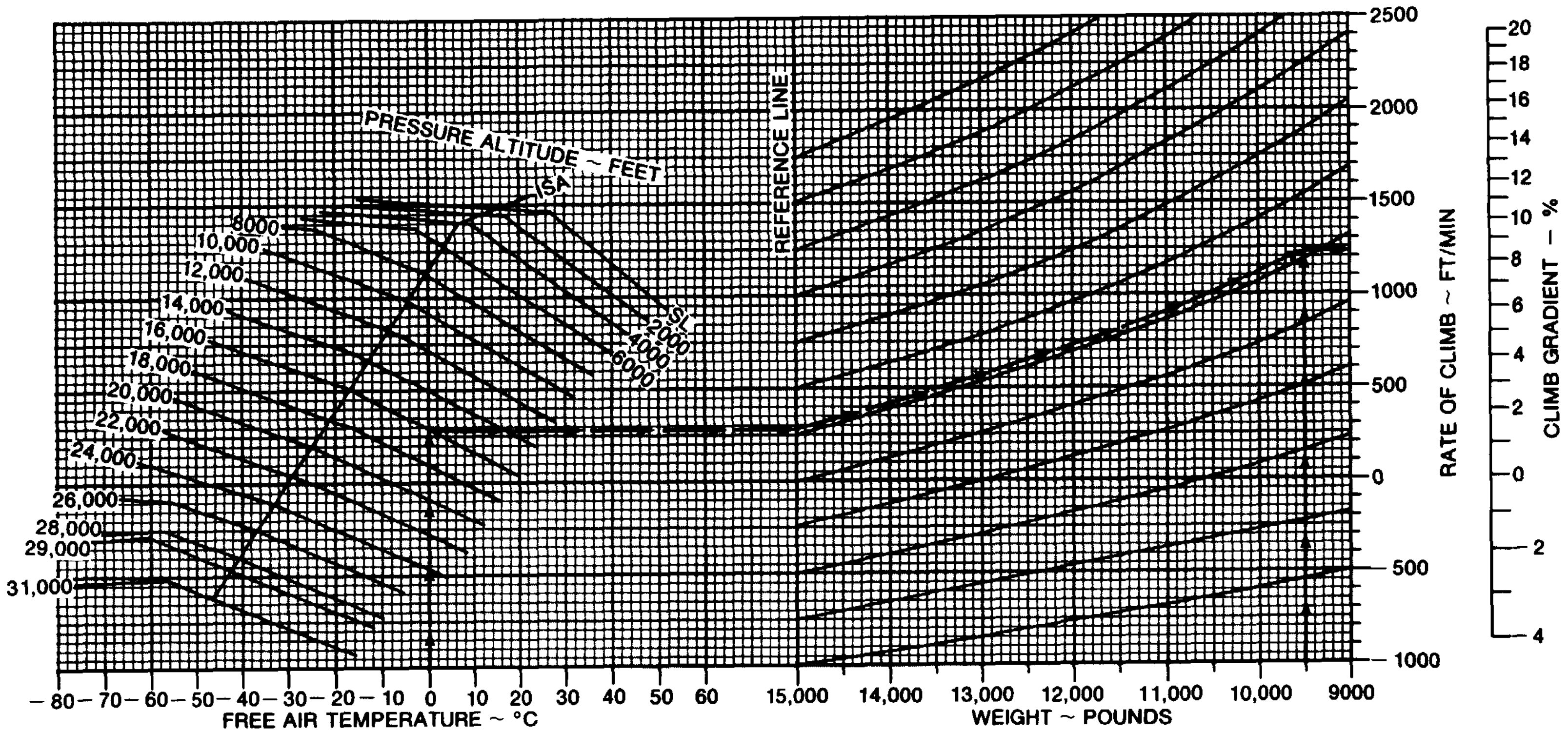

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Figure 7-23. Climb Two-Engine - Flaps 40%

CLIMB — ONE ENGINE INOPERATIVE

ASSOCIATED CONDITIONS:

POWER .... MAXIMUM CONTINUOUS
FLAPS 0%
LANDING GEAR .... UP
INOPERATIVE PROPELLER .... FEATHERED

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
15,000	127
13,000	123
11,000	118
9000	118

EXAMPLE:

FAT .... 0°C
PRESSURE ALTITUDE ... 16,000 FT
WEIGHT .... 9500 LBS

RATE OF CLIMB .... 25 FT/MIN
CLIMB GRADIENT 0.2%
CLIMB SPEED .... 118 KTS

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, RATE OF CLIMB WILL BE REDUCED APPROXIMATELY 100 FT/MIN.

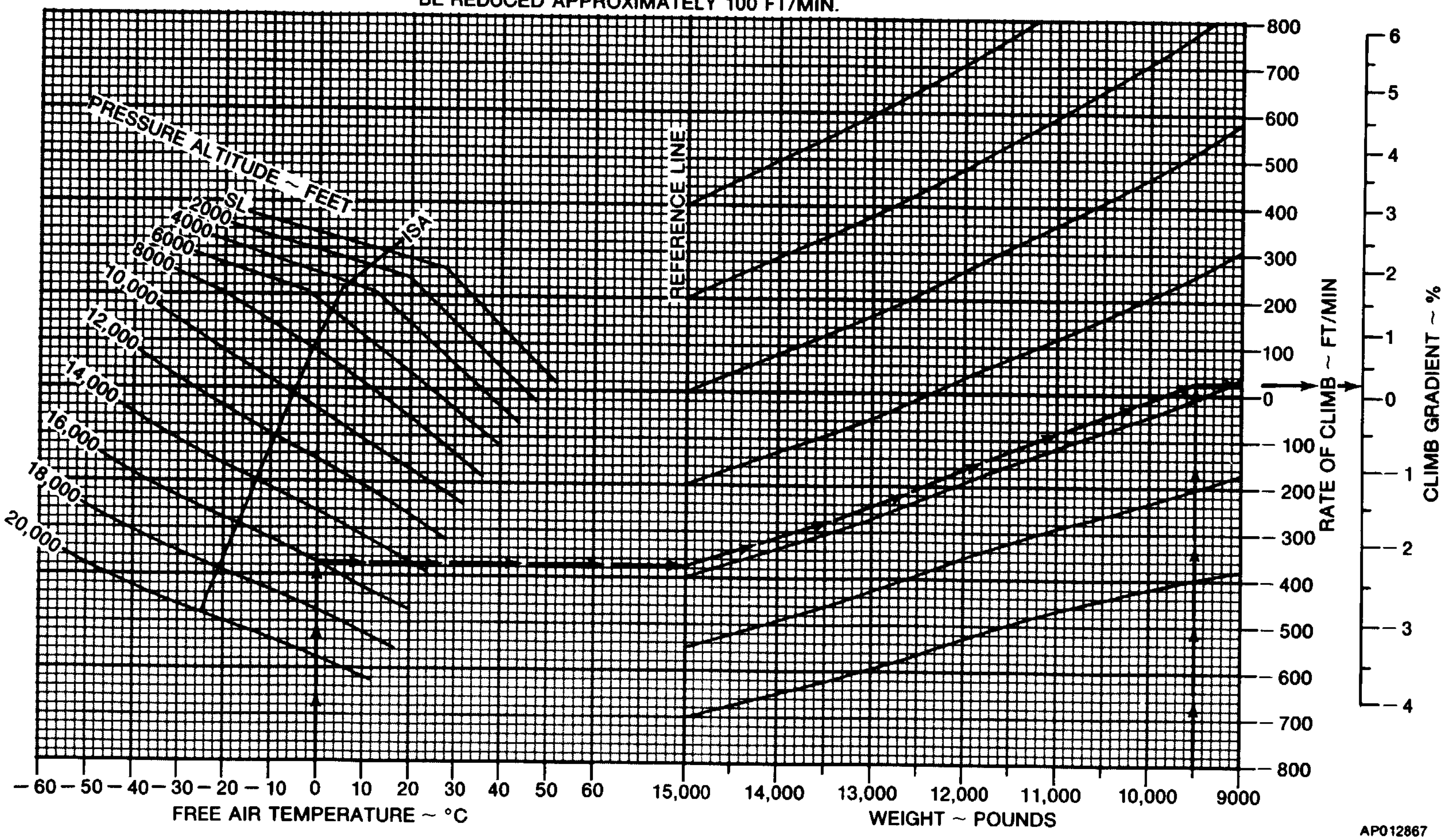


Figure 7-24. Climb One-Engine Inoperative

SERVICE CEILING — ONE ENGINE INOPERATIVE

ASSOCIATED CONDITIONS:

POWER .... MAXIMUM CONTINUOUS
LANDING GEAR .... UP
INOPERATIVE PROPELLER ..... FEATHERED
FLAPS .... UP (0%)

EXAMPLE:

FAT .... 0°C
WEIGHT .... 10,500 LBS

SERVICE CEILING .... 15,090 FT

NOTE: SERVICE CEILING IS THE MAXIMUM ALTITUDE AT WHICH THE AIRPLANE IS CAPABLE OF CLIMBING 50 FT PER MINUTE WITH ONE PROPELLER FEATHERED.

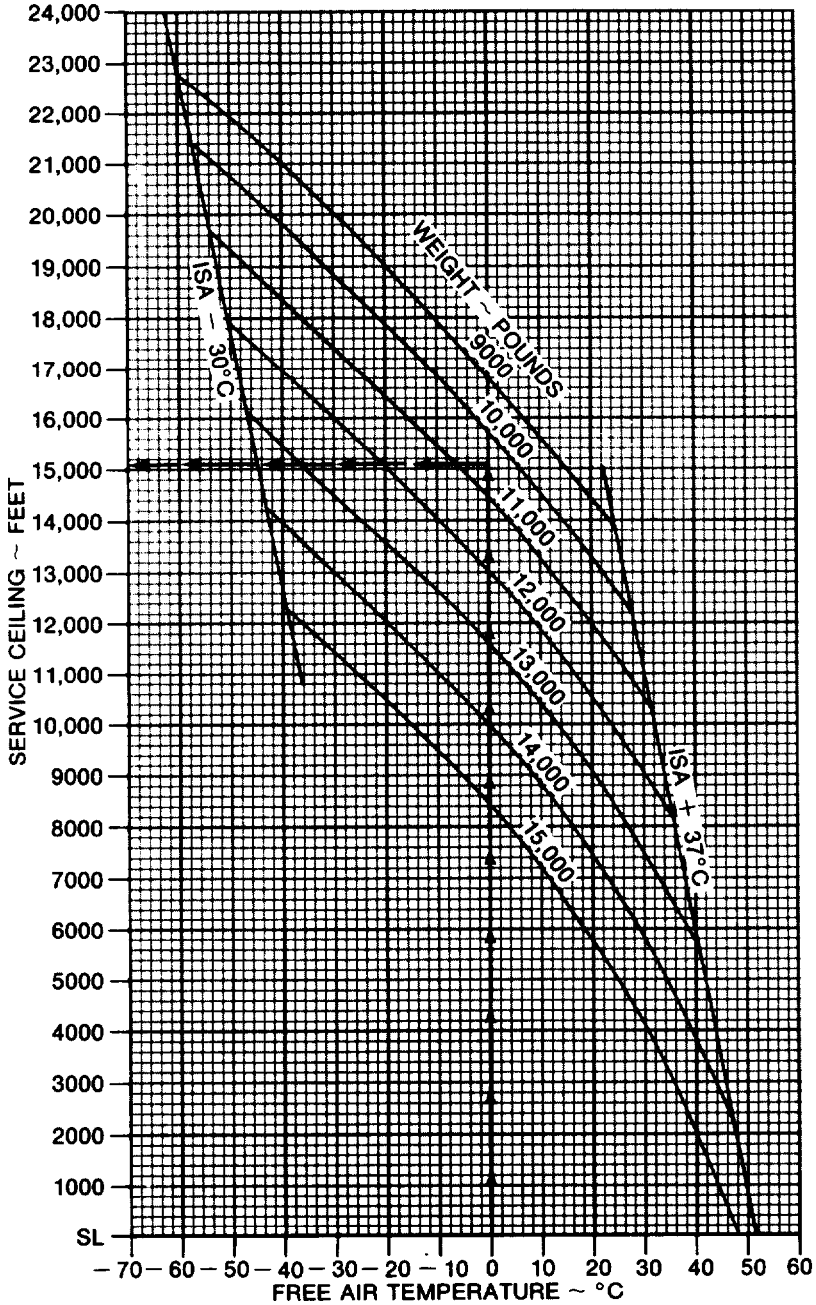


Figure 7-25. Service Ceiling One-engine-Inoperative

TIME, FUEL, AND DISTANCE TO CRUISE CLIMB

ASSOCIATED CONDITIONS:

PROPELLER SPEED ..... 1900 RPM
POWER:
TGT .... 750°C
OR TORQUE 100%

ALTITUDE ~ FT	CLIMB SPEED ~ KNOTS
SL TO 10,000	140
10,000 TO 20,000	131
20,000 TO 31,000	121

EXAMPLE:

FAT AT TAKEOFF .... 28°C
FAT AT CRUISE .... −20°C
AIRPORT PRESSURE ALTITUDE.... 5233 FT
CRUISE ALTITUDE .... 26,000 FT
INITIAL CLIMB WEIGHT............ 12,000 LBS

TIME TO CLIMB .... (30.0-3.1 = 26.9) 27 MIN
FUEL TO CLIMB .... (379.3-60.0 = 319.3) 320 LBS
DISTANCE TO CLIMB .... (85.7-8.7 = 77.0) 77 NM

NOTE: ADD 90 POUNDS FUEL FOR START, TAXI, AND TAKEOFF.

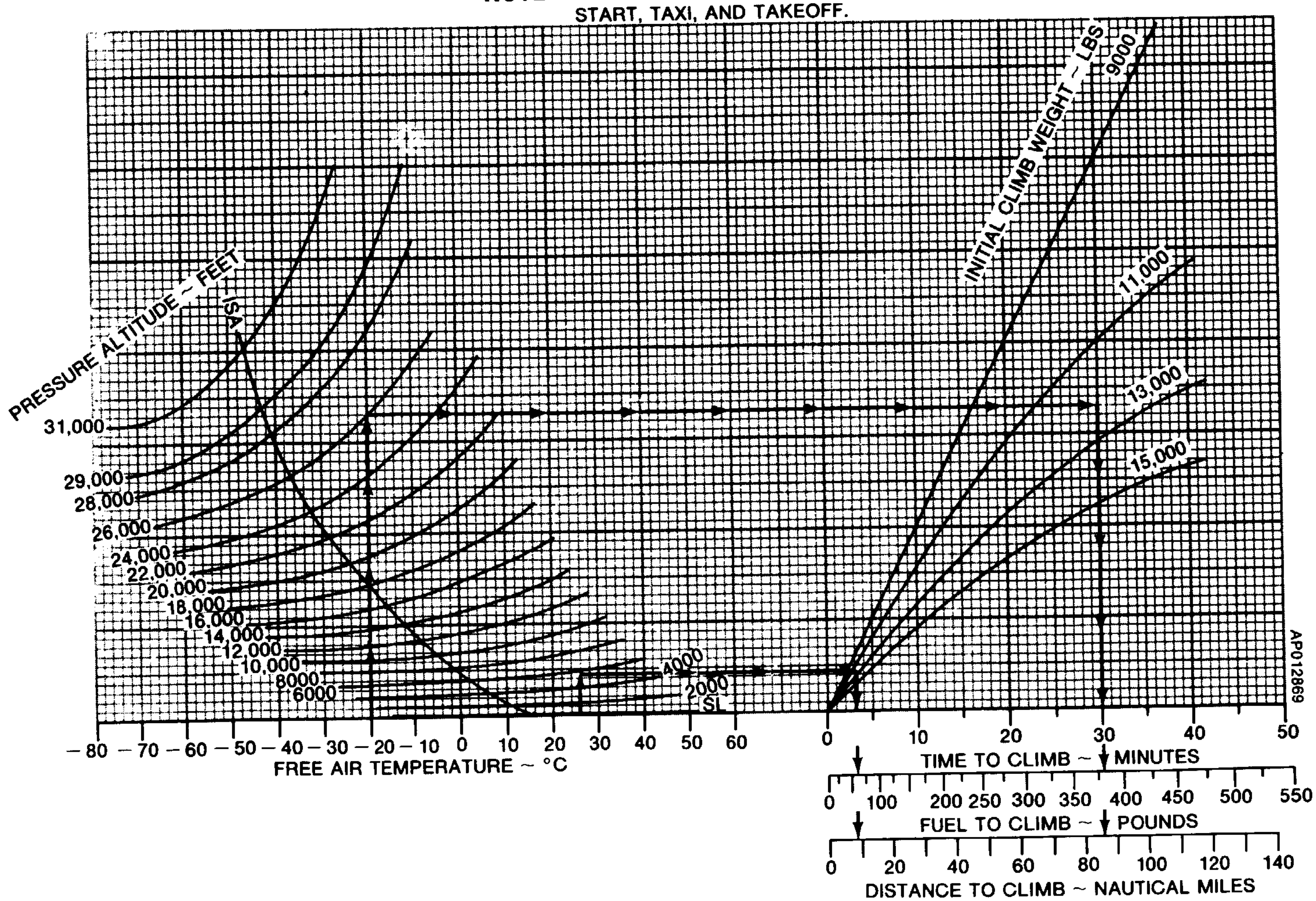


Figure 7-26. Time, Fuel, and Distance to Cruise Climb

MAXIMUM CRUISE POWER
1900 RPM
ISA -30 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-11	-15	100	521	1042	222	212	100	521	1042	223	213
2000	-15	-19	100	509	1018	220	216	100	509	1018	221	217
4000	-18	-23	100	497	994	218	220	100	497	994	219	221
6000	-22	-27	100	486	972	215	224	100	486	972	216	225
8000	-26	-31	100	476	952	213	228	100	476	952	214	229
10,000	-30	-35	100	466	932	211	232	100	466	932	212	233
12,000	-34	-39	100	460	920	208	236	100	460	920	210	238
14,000	-37	-43	100	455	910	206	241	100	454	908	207	242
16,000	-41	-47	96	434	868	200	241	96	435	870	202	243
18,000	-45	-51	89	404	808	192	238	89	405	810	194	241
20,000	-50	-55	83	376	752	183	235	83	377	754	186	238
22,000	-54	-59	77	351	702	175	232	77	352	704	178	235
24,000	-58	-63	71	326	652	166	227	71	327	654	169	231
26,000	-62	-67	64	297	594	155	220	64	299	598	159	225
28,000	-67	-71	56	265	530	140	205	57	268	536	146	214
29,000	-69	-72	51	248	496	129	194	52	251	502	138	206
31,000	-73	-76	—	—	—	—	—	45	221	442	117	182

Figure 7-27. Maximum Cruise Power 1900 RPM ISA-30°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA -30 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-11	-15	100	521	1042	224	214	100	521	1042	225	215
2000	-15	-19	100	509	1018	222	218	100	508	1016	223	219
4000	-18	-23	100	496	992	220	222	100	496	992	220	223
6000	-22	-27	100	486	972	217	226	100	485	970	218	227
8000	-26	-31	100	476	952	215	230	100	475	950	216	231
10,000	-30	-35	100	466	932	213	234	100	466	932	214	235
12,000	-34	-39	100	460	920	211	239	100	459	918	212	240
14,000	-37	-43	100	454	908	208	243	100	454	908	209	244
16,000	-41	-47	96	435	870	203	245	97	436	872	204	246
18,000	-45	-51	90	405	810	195	243	90	406	812	197	244
20,000	-49	-55	83	378	756	187	240	83	378	756	189	243
22,000	-53	-59	77	353	706	180	238	78	354	708	182	241
24,000	-57	-63	71	328	656	171	235	72	329	658	174	238
26,000	-62	-67	65	300	600	162	230	65	302	604	165	233
28,000	-66	-71	57	270	540	150	221	58	272	544	154	226
29,000	-68	-72	53	254	508	144	215	54	256	512	148	221
31,000	-73	-76	46	224	448	128	199	47	227	454	135	209

Figure 7-27. Maximum Cruise Power 1900 RPM ISA-30°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA -20 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-1	-5	100	523	1046	221	215	100	523	1046	222	216
2000	-5	-9	100	511	1022	218	218	100	511	1022	219	219
4000	-8	-13	100	499	998	216	222	100	498	996	217	223
6000	-12	-17	100	487	974	214	226	100	487	974	215	228
8000	-16	-21	100	477	954	211	231	100	477	954	213	232
10,000	-20	-25	100	468	936	209	235	100	468	936	210	236
12,000	-24	-29	100	461	922	206	239	100	461	922	208	240
14,000	-27	-33	98	449	898	202	242	98	450	900	204	243
16,000	-31	-37	92	419	838	194	240	92	420	840	196	242
18,000	-35	-41	85	390	780	186	237	85	391	782	188	239
20,000	-40	-45	79	364	728	178	234	79	365	730	180	237
22,000	-44	-49	73	340	680	169	230	74	341	682	172	234
24,000	-48	-53	68	315	630	160	225	68	316	632	163	230
26,000	-52	-57	62	291	582	150	218	62	292	584	154	224
28,000	-56	-61	56	267	534	138	208	57	270	540	144	217
29,000	-59	-62	53	255	510	130	200	54	258	516	138	212
31,000	-62	-66	—	—	—	—	—	47	231	462	121	192

Figure 7-28. Maximum Cruise Power 1900 RPM ISA-20°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA -20 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-1	-5	100	523	1046	222	216	100	523	1046	223	217
2000	-4	-9	100	510	1020	220	220	100	510	1020	221	221
4000	-8	-13	100	498	996	218	224	100	498	996	219	225
6000	-12	-17	100	487	974	216	229	100	487	974	216	229
8000	-16	-21	100	477	954	214	233	100	477	954	214	234
10,000	-20	-25	100	468	936	211	237	100	467	934	212	238
12,000	-23	-29	100	461	922	209	242	100	461	922	210	243
14,000	-27	-33	99	450	900	205	245	99	451	902	206	246
16,000	-31	-37	92	421	842	198	244	92	421	842	199	245
18,000	-35	-41	86	392	784	190	242	86	392	784	192	244
20,000	-39	-45	80	366	732	182	240	80	366	732	184	242
22,000	-43	-49	74	341	682	175	237	74	342	684	177	240
24,000	-48	-53	68	317	634	166	233	69	318	636	169	237
26,000	-52	-57	63	294	588	158	229	63	295	590	161	233
28,000	-56	-61	57	271	542	148	223	58	273	546	152	229
29,000	-58	-62	55	260	520	143	220	55	262	524	148	226
31,000	-62	-66	48	234	468	130	207	49	237	474	136	217

Figure 7-28. Maximum Cruise Power 1900 RPM ISA-20°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA -10 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	9	5	100	524	1048	219	217	100	524	1048	220	218
2000	6	1	100	511	1022	217	221	100	511	1022	218	222
4000	2	-3	100	499	998	214	225	100	499	998	215	226
6000	-2	-7	100	488	976	212	229	100	488	976	213	230
8000	-6	-11	100	479	958	210	233	100	478	956	211	235
10,000	-10	-15	100	469	938	207	238	100	469	938	208	239
12,000	-13	-19	99	457	914	203	240	99	457	914	205	242
14,000	-17	-23	92	428	856	196	239	93	428	856	197	241
16,000	-22	-27	86	400	800	188	236	86	400	800	190	239
18,000	-26	-31	80	373	746	180	234	81	374	748	182	236
20,000	-30	-35	75	348	696	171	230	75	349	698	174	234
22,000	-34	-39	69	325	650	163	226	70	326	652	166	230
24,000	-38	-43	64	301	602	153	220	64	302	604	157	226
26,000	-42	-47	58	279	558	142	212	59	280	560	148	220
28,000	-47	-51	53	257	514	129	200	54	259	518	137	211
29,000	-49	-52	50	247	494	120	190	51	249	498	131	206
31,000	-53	-56	—	—	—	—	—	46	228	456	114	187

Figure 7-29. Maximum Cruise Power 1900 RPM ISA- 10°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA -10 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	9	5	100	524	1048	221	219	100	524	1048	221	220
2000	6	1	100	510	1020	219	223	100	510	1020	220	224
4000	2	-3	100	499	998	216	227	100	498	996	217	228
6000	-2	-7	100	488	976	214	231	100	488	976	215	232
8000	-6	-11	100	478	956	212	236	100	478	956	213	237
10,000	-9	-15	100	468	936	209	240	100	468	936	210	241
12,000	-13	-19	99	458	916	206	244	99	458	916	207	245
14,000	-17	-23	93	429	858	199	242	93	429	858	200	244
16,000	-21	-27	87	401	802	192	241	87	402	804	193	243
18,000	-25	-31	81	374	748	184	239	81	375	750	186	241
20,000	-29	-35	75	349	698	176	237	75	350	700	178	239
22,000	-34	-39	70	327	654	169	234	70	327	654	171	237
24,000	-38	-43	64	304	608	160	230	65	304	608	163	234
26,000	-42	-47	59	281	562	152	225	60	282	564	155	230
28,000	-46	-51	54	261	522	142	219	55	262	524	146	226
29,000	-48	-52	54	251	502	137	216	52	252	504	142	223
31,000	-53	-56	47	231	462	126	205	48	233	466	132	216

Figure 7-29. Maximum Cruise Power 1900 RPM ISA- 10°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	19	15	100	525	1050	217	219	100	525	1050	218	220
2000	16	11	100	513	1026	215	223	100	513	1026	216	224
4000	12	7	100	500	1000	213	227	100	500	1000	214	229
6000	8	3	100	489	978	210	232	100	489	978	211	233
8000	4	-1	100	479	958	208	236	100	479	958	209	237
10,000	0	-5	97	460	920	203	237	97	461	922	205	239
12,000	-4	-9	92	434	868	196	237	92	434	868	198	239
14,000	-8	-13	86	406	812	189	235	87	407	814	191	237
16,000	-12	-17	81	380	760	181	233	81	380	760	183	235
18,000	-16	-21	75	354	708	173	229	75	355	710	175	233
20,000	-20	-25	70	329	658	164	225	70	330	660	167	229
22,000	-24	-29	64	307	614	155	220	65	309	618	159	226
24,000	-28	-33	59	285	570	145	213	60	286	572	150	220
26,000	-33	-37	54	263	526	132	201	54	265	530	139	212
28,000	-37	-41	—	—	—	—	—	49	245	490	127	201
29,000	-39	-42	—	—	—	—	—	47	235	470	119	192
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-30. Maximum Cruise Power 1900 RPM ISA (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	20	15	100	525	1050	219	221	100	525	1050	220	222
2000	16	11	100	513	1026	217	225	100	512	1024	218	226
4000	12	7	100	500	1000	215	230	100	500	1000	216	231
6000	8	3	100	489	978	213	234	100	488	976	213	235
8000	4	-1	100	479	958	210	238	100	479	958	211	239
10,000	1	-5	98	461	922	206	241	98	462	924	207	242
12,000	-3	-9	93	435	870	199	240	93	435	870	201	242
14,000	-7	-13	87	408	816	192	239	87	408	816	194	241
16,000	-11	-17	81	381	762	185	238	81	382	764	187	240
18,000	-16	-21	76	355	710	178	236	76	356	712	179	238
20,000	-20	-25	70	331	662	170	233	70	332	664	172	236
22,000	-24	-29	65	310	620	162	230	65	311	622	165	233
24,000	-28	-33	60	288	576	153	225	60	289	578	156	230
26,000	-32	-37	55	267	534	144	220	56	268	536	148	225
28,000	-36	-41	50	247	494	134	212	51	248	496	139	220
29,000	-38	-42	48	237	474	128	207	49	239	478	135	217
31,000	-43	-46	43	218	436	115	192	44	220	440	124	207

Figure 7-30. Maximum Cruise Power 1900 RPM ISA (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA + 10°C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	30	25	100	528	1056	216	222	100	527	1054	217	223
2000	26	21	100	514	1028	214	226	100	513	1026	215	227
4000	22	17	100	500	1000	211	230	100	500	1000	212	231
6000	18	13	99	485	970	208	233	99	486	972	209	234
8000	14	9	95	461	922	202	233	95	461	922	203	235
10,000	10	5	90	436	872	196	233	91	436	872	198	235
12,000	6	1	86	410	820	189	232	86	411	822	191	235
14,000	2	-3	80	384	768	181	230	80	385	770	183	233
16,000	-2	-7	75	359	718	173	227	75	360	720	176	230
18,000	-6	-11	70	336	672	165	224	70	336	672	168	228
20,000	-10	-15	65	313	626	157	220	65	314	628	160	225
22,000	-14	-19	60	291	582	147	213	60	293	586	152	220
24,000	-19	-23	55	269	538	135	204	55	271	542	142	213
26,000	-23	-27	49	248	496	119	186	50	249	498	130	202
28,000	-27	-31	—	—	—	—	—	46	231	462	114	184
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-37. Maximum Cruise Power 1900 RPM ISA+ 10°C (Sheer 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA + 10°C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	30	25	100	527	1054	218	224	100	527	1054	219	224
2000	26	21	100	513	1026	215	228	100	513	1026	216	229
4000	22	17	100	500	1000	213	232	100	500	1000	214	233
6000	18	13	99	486	972	210	236	99	486	972	211	237
8000	14	9	95	461	922	205	236	95	462	924	206	238
10,000	10	5	91	437	874	199	237	91	437	874	200	238
12,000	6	1	86	412	824	193	237	86	412	824	194	238
14,000	2	-3	80	385	770	185	235	81	386	772	187	237
16,000	-2	-7	75	360	720	178	233	75	361	722	180	236
18,000	-6	-11	70	337	674	171	231	71	338	676	173	234
20,000	-10	-15	66	315	630	163	229	66	315	630	166	232
22,000	-14	-19	61	294	588	155	225	61	294	588	158	229
24,000	-18	-23	56	272	544	146	220	56	273	546	150	225
26,000	-22	-27	51	251	502	136	212	51	253	506	141	220
28,000	-27	-31	46	232	464	125	202	47	234	468	132	213
29,000	-29	-32	44	223	446	118	195	45	225	450	127	208
31,000	-33	-36	—	—	—	—	—	41	207	414	114	195

Figure 7-31. Maximum Cruise Power 1900 RPM ISA+ 10°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA + 20°C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	40	35	99	525	1050	213	222	99	525	1050	214	224
2000	36	31	96	503	1006	209	224	96	504	1008	210	226
4000	32	27	94	482	964	205	227	94	482	964	206	228
6000	28	23	91	459	918	200	228	91	459	918	201	229
8000	24	19	87	436	872	194	228	88	436	872	196	230
10,000	20	15	84	413	826	188	229	84	413	826	190	231
12,000	16	11	79	389	778	182	228	80	389	778	184	230
14,000	12	7	74	363	726	174	225	74	364	728	176	228
16,000	8	3	69	339	678	166	222	69	340	680	169	225
18,000	4	-1	64	317	634	158	218	65	317	634	161	222
20,000	0	-5	59	294	588	147	211	60	295	590	152	217
22,000	-5	-9	55	274	548	137	203	55	276	552	143	211
24,000	-9	-13	50	254	508	123	189	51	256	512	132	203
26,000	-13	-17	—	—	—	—	—	46	236	472	118	188
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-32. Maximum Cruise Power 1900 RPM ISA+20°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA + 20°C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	40	35	99	526	1052	215	225	99	526	1052	216	226
2000	36	31	97	504	1008	211	227	97	504	1008	212	228
4000	32	27	94	482	964	207	229	94	482	964	208	231
6000	28	23	91	460	920	203	231	91	460	920	204	232
8000	24	19	88	437	874	197	232	88	437	874	199	233
10,000	20	15	84	414	828	192	233	84	414	828	193	234
12,000	16	11	80	390	780	186	232	80	390	780	187	234
14,000	12	7	75	364	728	178	231	75	365	730	180	233
16,000	8	3	70	341	682	171	229	70	341	682	173	231
18,000	4	-1	65	318	636	164	226	65	319	638	166	230
20,000	0	-5	60	296	592	155	222	60	297	594	158	226
22,000	-4	-9	56	277	554	147	218	56	278	556	151	223
24,000	-8	-13	51	257	514	138	212	52	259	518	143	219
26,000	-13	-17	47	238	476	128	203	48	239	478	134	213
28,000	-17	-21	43	219	438	114	188	43	221	442	123	203
29,000	-19	-22	—	—	—	—	—	41	212	424	117	197
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-32. Maximum Cruise Power 1900 RPM ISA+20°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA + 30°C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	49	45	89	495	990	203	216	89	495	990	205	217
2000	45	41	87	475	950	199	218	87	475	950	201	219
4000	42	37	85	455	910	196	220	85	455	910	197	222
6000	38	33	83	435	870	191	222	83	435	870	193	224
8000	34	29	80	412	824	186	222	80	412	824	188	224
10,000	30	25	77	389	778	180	222	77	390	780	182	225
12,000	26	21	72	366	732	173	221	73	366	732	176	224
14,000	22	17	68	343	686	166	218	68	343	686	169	222
16,000	18	13	63	320	640	157	214	64	321	642	161	219
18,000	13	9	58	297	594	148	208	59	298	596	152	214
20,000	9	5	54	276	552	138	201	55	278	556	143	209
22,000	5	1	50	257	514	124	188	50	259	518	133	201
24,000	1	-3	—	—	—	—	—	46	239	478	119	187
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-33. Maximum Cruise Power 7900 RPM ISA+30°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA + 30°C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	49	45	89	496	992	206	218	89	496	992	207	220
2000	46	41	87	475	950	202	221	87	475	950	203	222
4000	42	37	85	456	912	198	223	86	456	912	200	225
6000	38	33	83	435	870	194	225	83	435	870	196	227
8000	34	29	80	413	826	189	226	80	413	826	191	228
10,000	30	25	77	390	780	184	227	77	391	782	186	229
12,000	26	21	73	367	734	178	227	73	367	734	180	229
14,000	22	17	69	344	688	171	225	69	344	688	173	228
16,000	18	13	64	321	642	164	223	64	322	644	166	226
18,000	14	9	59	299	598	156	219	60	300	600	158	223
20,000	10	5	55	279	558	148	215	56	280	560	151	220
22,000	6	1	51	260	520	139	209	51	261	522	143	216
24,000	1	-3	46	241	482	128	200	47	242	484	134	210
26,000	-3	-7	42	223	446	115	187	43	224	448	124	201
28,000	-7	-11	—	—	—	—	—	39	208	416	112	189
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-33. Maximum Cruise Power 1900 RPM ISA+30°C (Sheet 2 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA + 37°C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	56	52	82	475	950	196	210	82	475	950	198	212
2000	52	48	80	456	912	193	213	81	456	912	194	214
4000	48	44	79	437	874	189	215	79	437	874	191	217
6000	44	40	77	417	834	185	217	77	418	836	186	219
8000	41	36	74	396	792	179	217	75	396	792	182	220
10,000	37	32	72	374	748	174	218	72	375	750	176	220
12,000	33	28	68	351	702	167	216	68	352	704	170	219
14,000	28	24	63	328	656	159	213	64	329	658	163	217
16,000	24	20	59	306	612	151	208	60	307	614	155	213
18,000	20	16	55	284	568	141	201	55	286	572	146	208
20,000	16	12	51	265	530	130	192	51	266	532	137	202
22,000	12	8	—	—	—	—	—	47	248	496	125	192
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-34. Maximum Cruise Power 1900 RPM ISA+37°C (Sheet 1 of 2)

MAXIMUM CRUISE POWER
1900 RPM
ISA + 37°C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	56	52	82	476	952	199	214	82	476	952	200	215
2000	52	48	81	456	912	196	216	81	457	914	197	217
4000	49	44	79	438	876	192	219	80	438	876	194	220
6000	45	40	78	418	836	188	221	78	418	836	190	223
8000	41	36	75	397	794	183	222	75	397	794	185	224
10,000	37	32	72	376	752	178	223	72	376	752	180	225
12,000	33	28	68	353	706	172	222	69	353	706	174	225
14,000	29	24	64	330	660	165	220	64	331	662	168	223
16,000	25	20	60	308	616	158	218	60	309	618	161	221
18,000	21	16	56	287	574	150	214	56	288	576	153	219
20,000	16	12	52	268	536	142	210	52	269	538	146	216
22,000	12	8	48	249	498	132	203	48	250	500	138	211
24,000	8	5	43	231	462	121	192	44	232	464	128	203
26,000	4	1	—	—	—	—	—	40	214	428	117	193
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-34. Maximum Cruise Power 1900 RPM ISA+37°C (Sheet 2 of 2)

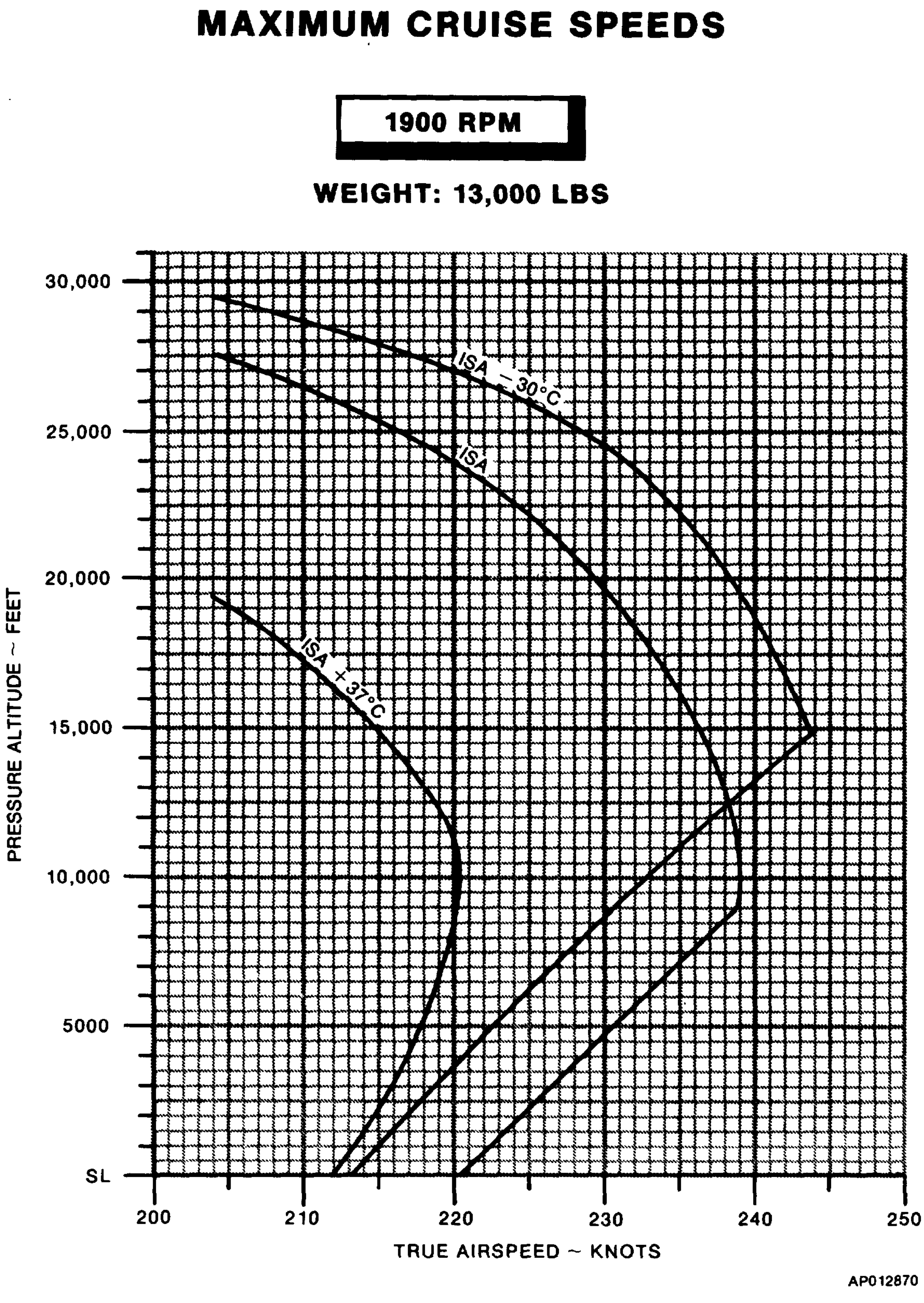


Figure 7-35. Maximum Cruise Speeds 1900 RPM

MAXIMUM CRUISE POWER

1900 RPM

NOTE: FOR FLIGHT PLANNING, ENTER THE GRAPH AT THE FORECASTED ISA CONDITION. FOR ENROUTE USE, ENTER THE GRAPH AT THE IFAT ACTUALLY OBSERVED.

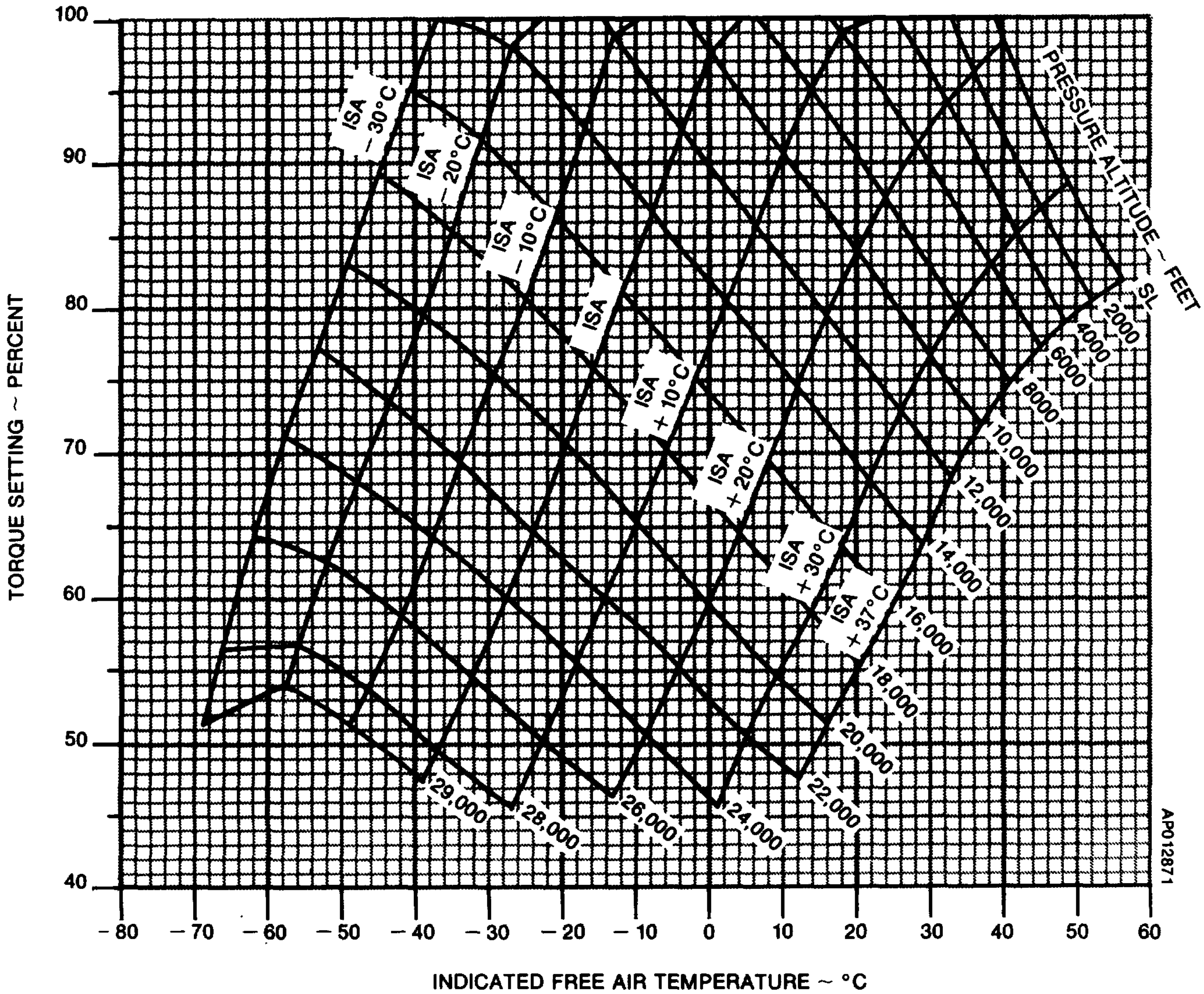


Figure 7-36. Maximum Cruise Power 1900 RPM

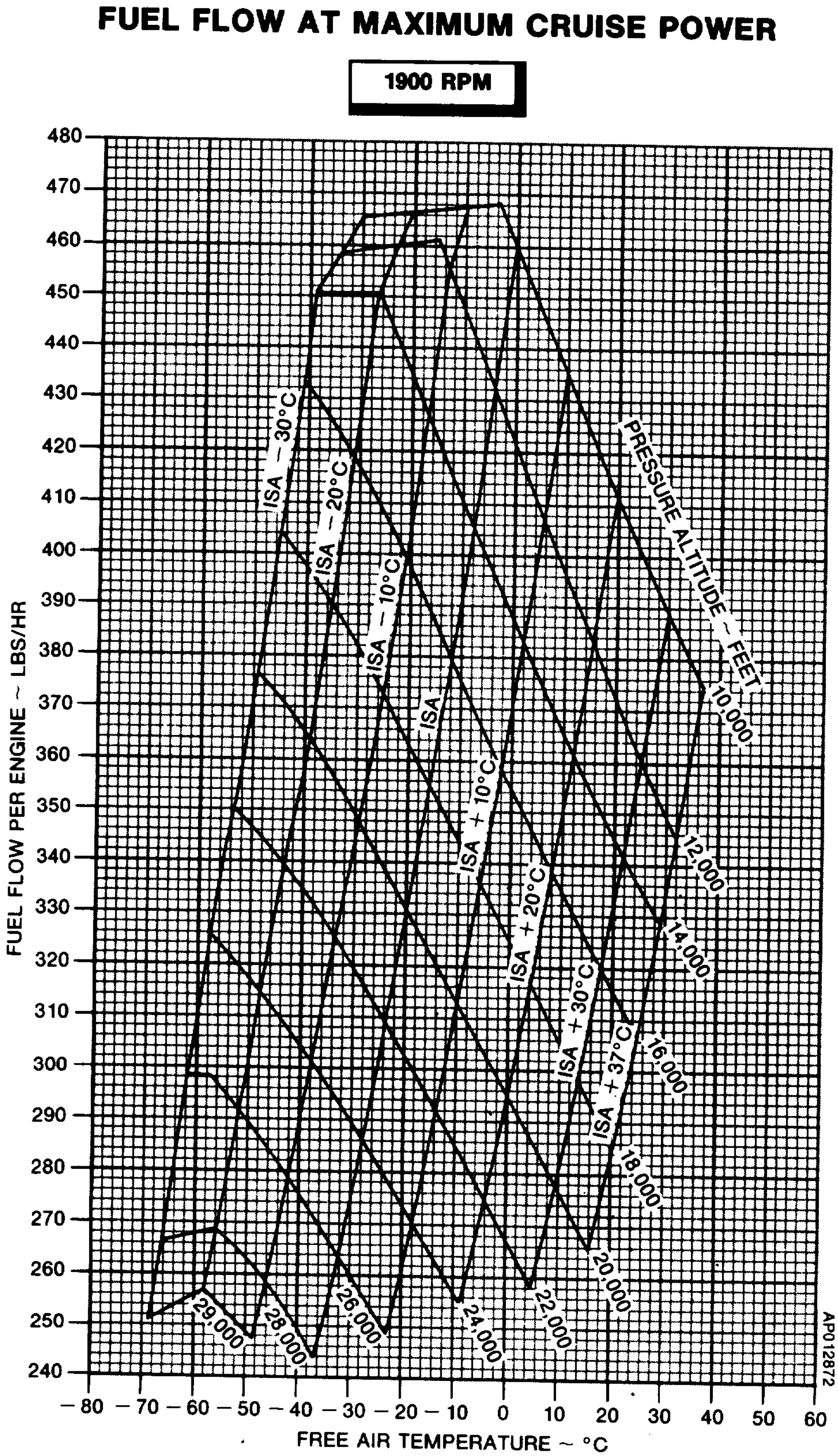


Figure 7-37. Fuel Flow At Maximum Cruise Power 1900 RPM

RANGE PROFILE — MAXIMUM CRUISE POWER

1900 RPM

STANDARD DAY (ISA)

ASSOCIATED CONDITIONS:

WEIGHT .... *15,090 LBS BEFORE ENGINE START
FUEL .... AVIATION KEROSENE
FUEL DENSITY ..... 6.7 LBS/GAL
WIND .... ZERO

EXAMPLE:

PRESSURE ALTITUDE ..... 26,000 FT
FUEL .... 2124 LBS
RANGE .... 571 NM

NOTES:
1. RANGE ALLOWS FOR TAXI AND RUNUP; INCLUDES CRUISE CLIMB AND DESCENT; AND ALLOWS FOR 45 MINUTES RESERVE FUEL AT LONG RANGE POWER.
*2. AT 15,090 LBS RAMP WEIGHT, THE MAXIMUM ZERO-FUEL WEIGHT LIMITATION OF 11,500 LBS WOULD BE EXCEEDED AT FUEL LOADINGS LESS THAN 3590 LBS.

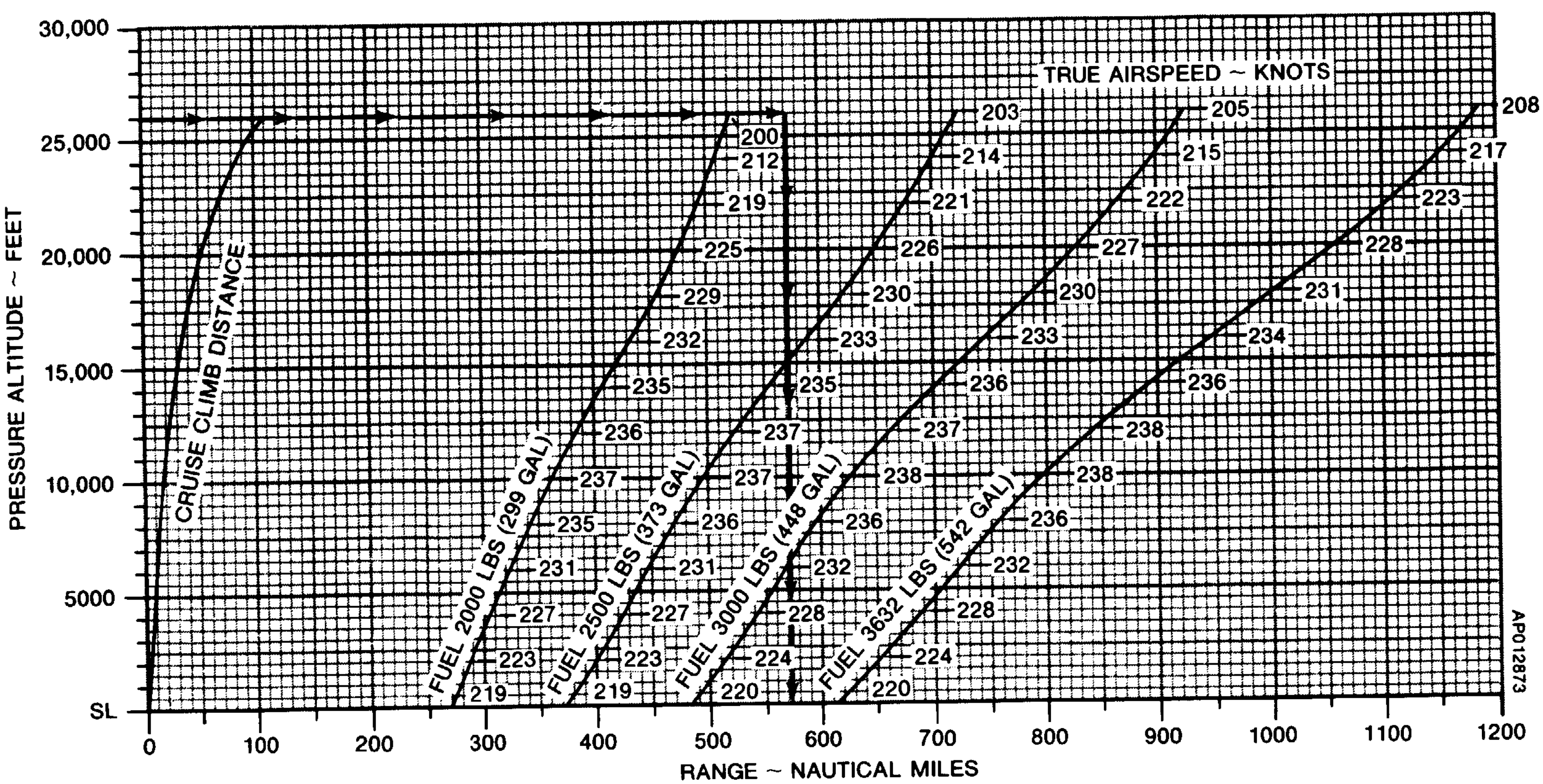


Figure 7-38. Range Profile - Maximum Cruise Power 1900 RPM

MAXIMUM RANGE POWER
1700 RPM
ISA -30 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-12	-15	75	407	814	190	182	73	400	800	189	181
2000	-16	-19	72	384	768	184	181	68	373	746	181	178
4000	-20	-23	68	360	720	178	180	64	347	694	174	177
6000	-24	-27	66	341	682	173	180	61	328	656	169	176
8000	-28	-31	64	326	652	169	181	60	312	624	165	177
10,000	-32	-35	63	311	622	165	182	58	297	594	161	178
12,000	-36	-39	63	302	604	162	185	58	287	574	159	181
14,000	-39	-43	63	293	586	160	188	58	278	556	156	183
16,000	-43	-47	62	284	568	156	189	58	271	542	153	186
18,000	-47	-51	61	274	548	152	189	57	264	528	151	188
20,000	-51	-55	60	266	532	147	190	57	256	512	147	190
22,000	-55	-59	60	265	530	145	194	55	248	496	142	190
24,000	-59	-63	61	264	528	143	197	55	245	490	139	192
26,000	-63	-67	62	266	532	141	200	56	245	490	137	195
28,000	-67	-71	56	265	530	140	205	58	250	500	136	201
29,000	-69	-72	51	248	496	129	194	52	251	502	138	206
31,000	-73	-76	—	—	—	—	—	45	221	442	117	182

Figure 7-39. Maximum Range Power 1700 RPM ISA-30°C (Sheet 1 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA -30 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-12	-15	70	391	782	187	179	67	382	764	185	177
2000	-16	-19	64	362	724	179	176	61	352	704	176	174
4000	-20	-23	60	335	670	171	173	56	323	646	168	170
6000	-24	-27	57	314	628	165	172	52	301	602	162	168
8000	-28	-31	55	298	596	161	173	50	284	568	157	169
10,000	-32	-35	54	283	566	157	174	49	268	536	153	169
12,000	-36	-39	53	273	546	155	176	48	258	516	151	172
14,000	-40	-43	53	263	526	152	179	48	248	496	148	174
16,000	-44	-47	52	255	510	149	181	48	240	480	145	176
18,000	-48	-51	52	248	496	147	184	47	233	466	143	179
20,000	-51	-55	53	243	486	145	187	47	227	454	141	182
22,000	-55	-59	53	239	478	142	190	48	223	446	139	185
24,000	-59	-63	51	231	462	138	190	48	220	440	137	189
26,000	-63	-67	50	225	450	133	190	47	214	428	133	190
28,000	-67	-71	51	227	454	132	194	46	208	416	128	189
29,000	-69	-73	52	229	458	131	197	46	208	416	127	190
31,000	-73	-77	46	224	448	128	199	48	211	422	126	196

Figure 7-39. Maximum Range Power 7700 RPM ISA-30°C (Sheet 2 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA -20 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-2	-5	71	397	794	184	179	70	393	786	184	179
2000	-6	-9	70	381	762	180	181	68	375	750	180	181
4000	-10	-13	69	364	728	177	183	66	357	714	176	182
6000	-14	-17	67	348	696	173	184	65	340	680	172	183
8000	-18	-21	66	333	666	169	185	63	323	646	168	184
10,000	-22	-25	64	317	634	165	186	61	307	614	163	184
12,000	-26	-29	63	304	608	161	187	60	294	588	160	186
14,000	-30	-33	61	290	580	155	187	59	283	566	156	187
16,000	-33	-37	60	281	562	152	188	57	271	542	151	187
18,000	-37	-41	61	276	552	149	191	56	260	520	147	187
20,000	-41	-45	62	275	550	148	196	56	255	510	144	190
22,000	-45	-49	61	270	540	144	197	57	256	512	143	195
24,000	-49	-53	61	268	536	141	199	57	251	502	139	197
26,000	-53	-57	64	274	548	141	205	57	249	498	135	198
28,000	-57	-61	56	267	534	138	208	59	256	512	136	205
29,000	-59	-62	53	255	510	130	200	54	258	516	138	212
31,000	-62	-66	—	—	—	—	—	47	231	462	121	192

Figure 7-40. Maximum Range Power 1700 RPM ISA-20°C (Sheet 1 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA -20 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-2	-5	68	388	776	184	179	67	384	768	184	179
2000	-6	-9	66	370	740	180	181	64	363	726	179	180
4000	-10	-13	64	349	698	175	181	61	339	678	173	178
6000	-14	-17	61	328	656	169	180	57	316	632	166	177
8000	-18	-21	58	310	620	164	180	54	298	596	161	177
10,000	-22	-25	56	293	586	160	180	52	280	560	156	176
12,000	-26	-29	55	281	562	156	182	51	268	536	153	178
14,000	-30	-33	55	271	542	154	184	50	257	514	150	180
16,000	-33	-37	54	261	522	150	186	50	248	496	147	182
18,000	-37	-41	53	251	502	146	187	50	240	480	145	185
20,000	-41	-45	52	242	484	142	187	49	233	466	141	187
22,000	-45	-49	51	236	472	138	189	48	226	452	138	188
24,000	-49	-53	53	236	472	137	194	47	219	438	133	188
26,000	-53	-57	52	233	466	134	196	48	217	434	131	192
28,000	-57	-61	52	230	460	130	197	48	215	430	129	195
29,000	-59	-63	54	235	470	131	201	48	214	428	127	195
31,000	-63	-67	48	234	468	130	207	49	217	434	126	201

Figure 7-40. Maximum Range Power 1700 RPM ISA-20°C (Sheet 2 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA -10 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	8	5	71	398	796	182	181	67	388	776	180	178
2000	4	1	67	374	748	176	180	65	366	732	175	179
4000	0	-3	66	357	714	172	181	63	349	698	171	180
6000	-4	-7	65	343	686	168	183	62	333	666	167	181
8000	-8	-11	64	330	660	165	184	61	319	638	164	183
10,000	-12	-15	63	317	634	162	186	60	305	610	160	184
12,000	-15	-19	63	307	614	159	189	59	292	584	156	185
14,000	-19	-23	63	300	600	157	192	58	283	566	153	188
16,000	-23	-27	63	292	584	154	195	58	276	552	151	190
18,000	-27	-31	62	283	566	150	195	58	269	538	148	193
20,000	-31	-35	62	276	552	146	196	58	263	526	145	195
22,000	-35	-39	63	278	556	145	202	57	257	514	141	196
24,000	-39	-43	63	275	550	141	203	58	258	516	139	201
26,000	-43	-47	58	279	558	142	212	59	256	512	136	203
28,000	-47	-51	53	257	514	129	200	54	259	518	137	211
29,000	-49	-52	50	247	494	120	190	51	249	498	131	206
31,000	-53	-56	—	—	—	—	—	46	228	456	114	187

Figure 7-41. Maximum Range Power 1700 RPM ISA- 10°C (Sheet 1 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA-10°C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	8	5	65	380	760	179	177	63	375	750	178	177
2000	4	1	63	361	722	174	178	62	357	714	175	179
4000	0	-3	61	344	688	171	180	60	339	678	171	180
6000	-4	-7	60	328	656	167	181	58	322	644	167	181
8000	-8	-11	59	313	626	163	182	56	305	610	163	182
10,000	-12	-15	57	297	594	159	183	54	289	578	158	182
12,000	-16	-19	56	283	566	155	184	53	275	550	154	183
14,000	-20	-23	54	271	542	151	185	51	262	524	150	184
16,000	-24	-27	53	260	520	147	186	50	251	502	146	185
18,000	-27	-31	53	252	504	144	188	49	240	480	142	185
20,000	-31	-35	53	247	494	142	191	48	231	462	138	186
22,000	-35	-39	53	244	488	140	195	48	228	456	136	190
24,000	-39	-43	53	238	476	136	196	49	225	450	134	194
26,000	-43	-47	53	237	474	133	198	48	220	440	131	195
28,000	-47	-51	54	238	476	131	202	48	217	434	127	196
29,000	-49	-53	55	241	482	131	206	48	218	436	126	198
31,000	-53	-57	47	231	462	126	205	50	223	446	126	205

Figure 7-41. Maximum Range Power 1700 RPM ISA- 10°C (Sheet 2 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	18	15	75	412	824	185	187	72	403	806	184	186
2000	14	11	71	389	778	179	186	67	376	752	176	184
4000	10	7	68	367	734	174	186	64	353	706	170	183
6000	6	3	67	350	700	170	187	62	335	670	166	183
8000	2	-1	66	338	676	166	189	61	322	644	163	185
10,000	-1	-5	66	325	650	163	191	61	310	620	160	187
12,000	-5	-9	65	314	628	160	193	61	301	602	157	190
14,000	-9	-13	63	301	602	155	194	60	292	584	155	193
16,000	-13	-17	62	290	580	150	194	59	280	560	150	194
18,000	-17	-21	62	285	570	148	197	57	269	538	145	193
20,000	-21	-25	64	285	570	147	202	58	264	528	142	196
22,000	-25	-29	64	281	562	143	203	60	266	532	142	202
24,000	-29	-33	59	285	570	145	213	59	261	522	137	202
26,000	-33	-37	54	263	526	132	201	54	265	530	139	212
28,000	-37	-41	—	—	—	—	—	49	254	490	127	201
29,000	-39	-42	—	—	—	—	—	47	235	470	119	192
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-42. Maximum Range Power 1700 RPM ISA (Sheet 1 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	18	15	68	392	784	181	183	64	381	762	178	180
2000	14	11	63	364	728	174	181	60	353	706	171	178
4000	10	7	60	341	682	168	180	57	332	664	166	178
6000	6	3	58	323	646	163	180	55	314	628	162	178
8000	2	-1	56	308	616	159	181	54	299	598	158	180
10,000	-2	-5	55	294	588	155	182	52	284	568	154	181
12,000	-6	-9	55	284	568	153	185	51	271	542	150	182
14,000	-9	-13	56	277	554	151	189	50	261	522	147	184
16,000	-13	-17	55	269	538	149	192	50	253	506	145	187
18,000	-17	-21	55	259	518	145	193	50	246	492	143	190
20,000	-21	-25	53	250	500	141	194	50	239	478	140	193
22,000	-25	-29	53	245	490	137	195	49	232	464	136	194
24,000	-29	-33	55	246	492	137	201	48	225	450	132	194
26,000	-33	-37	54	242	484	132	202	50	226	452	131	200
28,000	-37	-41	50	247	494	134	212	50	224	448	128	202
29,000	-39	-43	48	237	474	128	207	49	221	442	125	201
31,000	-43	-46	43	218	436	115	192	44	220	440	124	207

Figure 7-42. Maximum Range Power 1700 RPM ISA (Sheet 2 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA +10 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	28	25	72	406	812	180	185	70	400	800	180	185
2000	24	21	70	388	776	177	187	68	381	762	176	186
4000	20	17	69	369	738	172	188	66	362	724	172	187
6000	16	13	67	352	704	168	189	64	344	688	167	188
8000	12	9	66	337	674	164	190	63	328	656	163	189
10,000	9	5	64	322	644	160	191	61	313	626	159	190
12,000	5	1	64	310	620	156	193	60	300	600	155	191
14,000	1	-3	64	304	608	154	196	59	288	576	151	192
16,000	-3	-7	65	300	600	152	200	59	281	562	148	194
18,000	-7	-11	64	292	584	148	201	59	276	552	146	198
20,000	-11	-15	64	288	576	145	203	60	272	544	143	201
22,000	-15	-19	60	291	582	147	213	60	268	536	140	203
24,000	-19	-23	55	269	538	135	204	55	271	542	142	213
26,000	-23	-27	49	248	496	119	186	50	249	498	130	202
28,000	-27	-31	—	—	—	—	—	46	231	462	114	184
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-43. Maximum Range Power 1700 RPM ISA+10°C (Sheet 1 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA+10 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	28	25	68	393	786	179	184	66	387	774	179	184
2000	24	21	66	374	748	176	186	63	365	730	174	184
4000	20	17	63	353	706	171	186	60	342	684	168	183
6000	16	13	61	333	666	165	186	56	320	640	162	182
8000	12	9	59	317	634	161	187	55	303	606	158	183
10,000	8	5	57	301	602	157	187	53	286	572	153	183
12,000	5	1	57	289	578	154	190	52	275	550	150	186
14,000	1	-3	56	279	558	150	191	52	267	534	148	189
16,000	-3	-7	54	267	534	146	191	51	258	516	145	191
18,000	-7	-11	54	258	516	142	193	50	247	494	141	191
20,000	-11	-15	54	254	508	140	196	49	237	474	136	191
22,000	-15	-19	55	253	506	138	201	49	234	468	134	195
24,000	-19	-23	55	248	496	134	202	50	233	466	133	200
26,000	-23	-27	51	251	502	136	212	50	228	456	129	201
28,000	-27	-31	46	232	464	125	202	51	229	458	127	205
29,000	-29	-32	44	223	446	118	195	45	225	450	127	208
31,000	-33	-36	—	—	—	—	—	41	207	414	114	195

Figure 7-43. Maximum Range Power 1700 RPM ISA+ 10°C (Sheet 2 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA +20 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	38	35	73	412	824	180	188	69	399	798	178	186
2000	34	31	70	390	780	175	188	66	377	754	172	185
4000	30	27	68	371	742	171	189	64	359	718	168	187
6000	26	23	67	354	708	167	190	63	341	682	164	187
8000	23	19	66	340	680	163	192	61	325	650	160	189
10,000	19	15	65	327	654	160	194	60	310	620	156	190
12,000	15	11	66	318	636	157	197	60	300	600	153	192
14,000	11	7	66	311	622	155	200	61	295	590	152	197
16,000	7	3	64	299	598	149	200	61	288	576	149	200
18,000	3	-1	64	293	586	146	202	60	278	556	145	200
20,000	-1	-5	59	294	588	147	211	60	274	548	141	202
22,000	-5	-9	55	274	548	137	203	55	276	552	143	211
24,000	-9	-13	50	254	508	123	189	51	256	512	132	203
26,000	-13	-17	—	—	—	—	—	46	236	472	118	188
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-44. Maximum Range Power 1700 RPM ISA+20°C (Sheet 1 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA +20 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	38	35	65	389	778	176	184	63	382	764	175	182
2000	34	31	63	368	736	171	184	61	362	724	171	184
4000	30	27	62	351	702	167	186	60	344	688	167	185
6000	26	23	60	333	666	163	187	58	327	654	163	186
8000	22	19	59	317	634	159	188	56	309	618	159	187
10,000	18	15	57	301	602	155	188	54	292	584	154	188
12,000	15	11	56	287	574	151	189	53	278	556	150	189
14,000	11	7	55	277	554	148	191	51	266	532	146	189
16,000	7	3	56	271	542	146	195	50	255	510	142	190
18,000	3	-1	56	266	532	144	199	50	248	496	139	193
20,000	-1	-5	55	258	516	139	199	51	246	492	138	198
22,000	-5	-9	55	254	508	136	201	50	240	480	134	199
24,000	-9	-13	51	257	514	138	212	50	234	468	130	200
26,000	-13	-17	47	238	476	128	203	48	239	478	134	213
28,000	-17	-21	43	219	438	114	188	43	221	442	123	203
29,000	-19	-22	—	—	—	—	—	41	212	424	117	197
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-44. Maximum Range Power 1700 RPM ISA+20°C (Sheet 2 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA+30 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	48	45	75	419	838	181	192	72	411	822	179	191
2000	44	41	73	399	798	176	193	69	388	776	175	191
4000	41	37	71	380	760	172	194	67	367	734	169	191
6000	37	33	70	364	728	168	195	65	350	700	166	193
8000	33	29	68	349	698	164	197	64	335	670	162	194
10,000	29	25	67	334	668	160	198	63	321	642	158	196
12,000	25	21	66	320	640	156	199	62	309	618	155	198
14,000	21	17	65	310	620	152	200	61	298	596	151	199
16,000	17	13	66	306	612	150	205	60	287	574	146	199
18,000	13	9	58	297	594	148	208	61	283	566	144	203
20,000	9	5	54	276	552	138	201	55	278	556	143	209
22,000	5	1	50	257	514	124	188	50	259	518	133	201
24,000	1	-3	—	—	—	—	—	46	239	478	119	187
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-45. Maximum Range Power 1700 RPM ISA+3O°C (Sheet 1 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA +30 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	48	45	68	400	800	177	188	64	388	776	174	185
2000	44	41	65	375	750	172	188	60	362	724	168	184
4000	40	37	62	353	706	166	187	58	341	682	164	184
6000	36	33	60	334	668	162	188	56	323	646	159	185
8000	32	29	59	319	638	158	189	55	307	614	155	186
10,000	29	25	58	305	610	154	191	53	291	582	152	188
12,000	25	21	57	294	588	152	194	52	279	558	148	189
14,000	21	17	57	285	570	149	197	52	269	538	145	192
16,000	17	13	56	275	550	145	198	52	261	522	143	195
18,000	13	9	55	265	530	141	198	52	255	510	140	198
20,000	9	5	55	260	520	138	201	51	245	490	136	198
22,000	5	1	51	260	520	139	209	50	240	480	132	200
24,000	1	-3	46	241	482	128	200	47	242	484	134	210
26,000	-3	-7	42	223	446	115	187	43	224	448	124	201
28,000	-7	-11	—	—	—	—	—	39	208	416	112	189
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-45. Maximum Range Power 1700 RPM ISA+3O°C (Sheet 2 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA+37 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	55	52	73	416	832	178	191	70	408	816	177	190
2000	51	48	71	396	792	173	192	68	388	776	173	191
4000	48	44	70	378	756	170	193	67	370	740	169	193
6000	44	40	68	362	724	166	195	66	353	706	165	194
8000	40	36	67	346	692	161	196	64	337	674	161	195
10,000	36	32	66	331	662	157	197	63	322	644	157	197
12,000	32	28	66	321	642	154	199	61	308	616	153	197
14,000	28	24	67	317	634	153	205	61	297	594	149	199
16,000	24	20	59	306	612	151	208	62	293	586	147	203
18,000	20	16	55	284	568	141	201	55	286	572	146	208
20,000	16	12	51	265	530	130	192	51	266	532	137	202
22,000	12	8	—	—	—	—	—	47	248	496	125	192
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-46. Maximum Range Power 1700 RPM ISA+37°C (Sheet 1 of 2)

MAXIMUM RANGE POWER
1700 RPM
ISA +37 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	55	52	68	401	802	176	189	65	391	782	175	188
2000	51	48	66	380	760	172	190	62	369	738	170	188
4000	47	44	64	360	720	167	191	59	347	694	165	188
6000	44	40	62	342	684	163	192	57	327	654	160	188
8000	40	36	61	326	652	159	193	56	311	622	156	189
10,000	36	32	59	311	622	156	195	54	296	592	152	191
12,000	32	28	58	298	596	152	196	54	284	568	149	193
14,000	28	24	57	286	572	148	197	53	274	548	146	195
16,000	24	20	56	275	550	144	198	52	263	526	143	197
18,000	20	16	56	268	536	141	201	51	253	506	138	197
20,000	16	12	52	268	536	142	210	51	244	488	134	199
22,000	12	8	48	249	498	132	302	48	250	500	138	211
24,000	8	5	43	231	462	121	192	44	232	464	128	203
26,000	4	1	—	—	—	—	—	40	214	428	117	193
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-46. Maximum Range Power 1700 RPM ISA+37°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA -30 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-14	-15	34	292	584	119	114	31	281	562	114	110
2000	-18	-19	35	278	556	119	117	31	266	532	114	113
4000	-22	-23	35	265	530	119	121	31	252	504	114	116
6000	-25	-27	36	255	510	119	124	32	241	482	114	120
8000	-29	-31	37	247	494	119	128	33	234	468	114	123
10,000	-33	-35	38	239	478	119	132	34	226	452	114	127
12,000	-37	-39	40	234	468	119	136	35	221	442	114	131
14,000	-41	-43	41	230	460	119	140	37	216	432	114	135
16,000	-45	-47	43	227	454	119	144	38	213	426	114	139
18,000	-49	-51	44	225	450	119	149	39	210	420	114	144
20,000	-52	-55	45	223	446	119	154	41	208	416	114	148
22,000	-56	-59	47	223	446	119	159	42	208	416	114	153
24,000	-60	-63	49	224	448	119	164	44	208	416	114	158
26,000	-64	-67	51	228	456	119	170	45	209	418	114	164
28,000	-68	-71	53	234	468	119	175	47	213	426	114	169
29,000	-70	-72	54	237	474	119	178	48	215	430	114	172
31,000	-73	-76	—	—	—	—	—	50	223	446	114	178

Figure 7-47. Maximum Endurance Power 1700 RPM ISA-30°C (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA -30 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-14	-15	27	271	542	110	105	23	260	520	105	101
2000	-18	-19	27	254	508	110	108	23	243	486	105	104
4000	-22	-23	27	239	478	110	112	23	227	454	105	107
6000	-26	-27	27	228	456	110	115	23	215	430	105	110
8000	-30	-31	28	220	440	110	118	24	206	412	105	113
10,000	-33	-35	30	212	424	110	122	25	198	396	105	117
12,000	-37	-39	31	207	414	110	126	26	193	386	105	120
14,000	-41	-43	32	202	404	110	130	27	189	378	105	124
16,000	-45	-47	33	199	398	110	134	29	185	370	105	128
18,000	-49	-51	35	196	392	110	138	30	182	364	105	132
20,000	-53	-55	36	194	388	110	142	31	179	358	105	136
22,000	-57	-59	37	193	386	110	147	32	178	356	105	141
24,000	-60	-63	39	192	384	110	152	34	177	354	105	146
26,000	-64	-67	40	192	384	110	157	35	176	352	105	151
28,000	-68	-71	41	193	386	110	163	36	177	354	105	156
29,000	-70	-72	42	195	390	110	165	37	177	354	105	158
31,000	-74	-76	44	199	398	110	171	38	179	358	105	164

Figure 7-47. Maximum Endurance Power 1700 RPM ISA-30°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA -20 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-4	-5	36	299	598	119	116	33	289	578	114	112
2000	-8	-9	36	285	570	119	119	33	274	548	114	115
4000	-12	-13	37	273	546	119	123	33	261	522	114	118
6000	-15	-17	38	262	524	119	127	34	250	500	114	122
8000	-19	-21	39	254	508	119	130	35	241	482	114	126
10,000	-23	-25	40	245	490	119	134	36	232	464	114	129
12,000	-27	-29	41	240	480	119	139	37	226	452	114	134
14,000	-31	-33	42	235	470	119	143	38	221	442	114	138
16,000	-35	-37	44	231	462	119	147	39	217	434	114	142
18,000	-39	-41	45	228	456	119	152	40	214	428	114	147
20,000	-42	-45	46	227	454	119	157	42	212	424	114	152
22,000	-46	-49	48	228	456	119	162	43	211	422	114	157
24,000	-50	-53	50	230	460	119	168	45	212	424	114	162
26,000	-54	-57	52	234	468	119	174	46	214	428	114	167
28,000	-57	-61	55	241	482	119	180	48	219	438	114	173
29,000	-59	-62	56	245	490	119	183	49	222	444	114	176
31,000	-63	-66	—	—	—	—	—	52	228	456	114	183

Figure 7-48. Maximum Endurance Power 1700 RPM ISA-20°C (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA -20 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	-4	-5	30	279	558	110	107	26	270	540	105	103
2000	-8	-9	29	263	526	110	111	26	253	506	105	106
4000	-12	-13	29	250	500	110	114	25	238	476	105	109
6000	-16	-17	30	238	476	110	117	26	226	452	105	112
8000	-20	-21	30	228	456	110	121	26	216	432	105	116
10,000	-23	-25	31	219	438	110	124	27	206	412	105	119
12,000	-27	-29	32	213	426	110	128	28	200	400	105	123
14,000	-31	-33	33	208	416	110	132	29	195	390	105	127
16,000	-35	-37	35	204	408	110	137	30	190	380	105	131
18,000	-39	-41	36	200	400	110	141	31	186	372	105	135
20,000	-43	-45	37	198	396	110	146	32	184	368	105	139
22,000	-46	-49	38	196	392	110	151	33	182	364	105	144
24,000	-50	-53	39	195	390	110	156	35	181	362	105	149
26,000	-54	-57	41	196	392	110	161	36	180	360	105	154
28,000	-58	-61	43	198	396	110	167	37	180	360	105	160
29,000	-60	-62	43	200	400	110	169	38	181	362	105	162
31,000	-64	-66	45	205	410	110	175	39	184	368	105	168

Figure 7-48. Maximum Endurance Power 1700 RPM ISA-20°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA -10 °C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	6	5	37	302	604	119	118	33	292	584	114	114
2000	2	1	38	289	578	119	122	34	279	558	114	117
4000	-1	-3	38	277	554	119	125	34	266	532	114	121
6000	-5	-7	39	267	534	119	129	35	255	510	114	124
8000	-9	-11	40	258	516	119	133	36	246	492	114	128
10,000	-13	-15	41	250	500	119	137	37	238	476	114	132
12,000	-17	-19	42	244	488	119	141	38	231	462	114	136
14,000	-21	-23	43	239	478	119	146	39	226	452	114	141
16,000	-25	-27	44	235	470	119	151	40	221	442	114	145
18,000	-28	-31	46	233	466	119	155	41	218	436	114	150
20,000	-32	-35	48	233	466	119	161	42	216	432	114	155
22,000	-36	-39	49	233	466	119	166	44	216	432	114	160
24,000	-40	-43	52	236	472	119	172	46	217	434	114	166
26,000	-44	-47	54	241	482	119	178	48	220	440	114	171
28,000	-47	-51	56	248	496	119	184	50	225	450	114	177
29,000	-49	-52	58	253	506	119	187	51	228	456	114	180
31,000	-53	-56	—	—	—	—	—	54	236	472	114	187

Figure 7-49. Maximum Endurance Power 1700 RPM ISA-10° (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA -10 °C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	6	5	30	283	566	110	109	27	274	548	105	105
2000	2	1	31	269	538	110	113	27	260	520	105	108
4000	-2	-3	31	255	510	110	116	27	245	490	105	111
6000	-6	-7	31	244	488	110	119	27	233	466	105	114
8000	-9	-11	32	235	470	110	123	28	223	446	105	118
10,000	-13	-15	33	225	450	110	127	29	213	426	105	122
12,000	-17	-19	33	218	436	110	131	29	206	412	105	125
14,000	-21	-23	34	212	424	110	135	30	200	400	105	129
16,000	-25	-27	35	208	416	110	139	31	195	390	105	134
18,000	-29	-31	37	204	408	110	144	32	190	380	105	138
20,000	-33	-35	38	201	402	110	149	33	187	374	105	143
22,000	-36	-39	39	200	400	110	154	34	185	370	105	147
24,000	-40	-43	40	200	400	110	159	35	184	368	105	152
26,000	-44	-47	42	201	402	110	165	37	184	368	105	158
28,000	-48	-51	44	204	408	110	170	38	185	370	105	163
29,000	-50	-52	45	206	412	110	173	39	186	372	105	166
31,000	-53	-56	47	212	424	110	180	41	190	380	105	172

Figure 7-49. Maximum Endurance Power 1700 RPM ISA-10°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	16	15	36	303	606	119	120	33	293	586	114	116
2000	12	11	38	291	582	119	124	34	281	562	114	119
4000	9	7	39	279	558	119	128	35	269	538	114	123
6000	5	3	39	269	538	119	131	36	258	516	114	127
8000	1	-1	40	261	522	119	135	36	249	498	114	131
10,000	-3	-5	41	253	506	119	140	37	241	482	114	135
12,000	-7	-9	42	247	494	119	144	38	234	468	114	139
14,000	-11	-13	44	243	486	119	149	39	229	458	114	143
16,000	-15	-17	45	240	480	119	154	40	225	450	114	148
18,000	-18	-21	47	238	476	119	159	42	222	444	114	153
20,000	-22	-25	49	237	474	119	164	44	221	442	114	158
22,000	-26	-29	51	239	478	119	170	45	221	442	114	163
24,000	-30	-33	53	242	484	119	175	47	223	446	114	169
26,000	-33	-37	55	248	496	119	181	49	225	450	114	175
28,000	-37	-41	—	—	—	—	—	51	232	464	114	181
29,000	-39	-42	—	—	—	—	—	53	236	472	114	184
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-50. Maximum Endurance Power 1700 RPM ISA (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	16	15	30	284	568	110	111	27	276	552	105	107
2000	12	11	31	271	542	110	115	28	262	524	105	110
4000	8	7	32	259	518	110	118	28	249	498	105	113
6000	4	3	32	248	496	110	122	29	237	474	105	116
8000	1	-1	33	238	476	110	125	29	227	454	105	120
10,000	-3	-5	33	229	458	110	129	29	217	434	105	124
12,000	-7	-9	34	222	444	110	133	30	210	420	105	128
14,000	-11	-13	35	216	432	110	138	31	204	408	105	132
16,000	-15	-17	36	211	422	110	142	32	198	396	105	136
18,000	-19	-21	37	207	414	110	147	33	194	388	105	141
20,000	-22	-25	38	205	410	110	152	34	190	380	105	145
22,000	-26	-29	40	205	410	110	157	35	189	378	105	150
24,000	-30	-33	41	204	408	110	163	36	188	376	105	156
26,000	-34	-37	43	206	412	110	168	38	188	376	105	161
28,000	-38	-41	45	209	418	110	174	39	189	378	105	167
29,000	-40	-42	46	211	422	110	177	49	191	382	105	170
31,000	-43	-46	48	219	438	110	184	42	195	390	105	176

Figure 7-50. Maximum Endurance Power 1700 RPM ISA (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA + 10°C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	26	25	37	303	606	119	122	32	293	586	114	118
2000	23	21	37	291	582	119	126	34	281	562	114	121
4000	19	17	38	280	560	119	130	35	270	540	114	125
6000	15	13	40	271	542	119	134	36	260	520	114	129
8000	11	9	41	263	526	119	138	37	251	502	114	133
10,000	7	5	42	255	510	119	142	38	242	484	114	137
12,000	3	1	43	250	500	119	147	39	236	472	114	141
14,000	-1	-3	45	247	494	119	152	40	232	464	114	146
16,000	-4	-7	46	244	488	119	157	41	229	458	114	151
18,000	-8	-11	48	242	484	119	162	43	226	452	114	156
20,000	-12	-15	50	243	486	119	167	44	225	450	114	161
22,000	-16	-19	52	245	490	119	173	46	226	452	114	167
24,000	-20	-23	54	248	496	119	179	48	228	456	114	173
26,000	-23	-27	58	257	514	119	185	50	231	462	114	179
28,000	-27	-31	—	—	—	—	—	53	240	480	114	185
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-51. Maximum Endurance Power 1700 RPM ISA+ 10°C (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA + 10°C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	26	25	29	283	566	110	113	26	274	548	105	108
2000	22	21	30	271	542	110	117	27	262	524	105	112
4000	18	17	32	260	520	110	120	28	250	500	105	115
6000	15	13	32	250	500	110	124	29	239	478	105	119
8000	11	9	33	240	480	110	128	30	229	458	105	122
10,000	7	5	34	231	462	110	132	30	219	438	105	126
12,000	3	1	35	223	446	110	136	31	212	424	105	130
14,000	-1	-3	35	218	436	110	140	31	206	412	105	134
16,000	-5	-7	37	214	428	110	145	32	200	400	105	139
18,000	-9	-11	38	211	422	110	150	33	196	392	105	143
20,000	-12	-15	39	209	418	110	155	34	194	388	105	148
22,000	-16	-19	41	208	416	110	160	36	192	384	105	153
24,000	-20	-23	42	209	418	110	166	37	191	382	105	159
26,000	-24	-27	44	211	422	110	172	38	192	384	105	165
28,000	-28	-31	46	215	430	110	178	40	194	388	105	170
29,000	-29	-32	47	217	434	110	181	41	195	390	105	174
31,000	-33	-36	—	—	—	—	—	43	200	400	105	180

Figure 7-51. Maximum Endurance Power 1700 RPM ISA+ 10°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA + 20°C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	36	35	38	308	616	119	124	34	296	592	114	120
2000	33	31	38	295	590	119	128	34	284	568	114	123
4000	29	27	39	284	568	119	132	35	272	544	114	127
6000	25	23	40	275	550	119	136	36	262	524	114	131
8000	21	19	42	267	534	119	140	37	254	508	114	135
10,000	17	15	43	259	518	119	145	38	245	490	114	140
12,000	13	11	44	253	506	119	149	40	239	478	114	144
14,000	9	7	46	250	500	119	154	41	235	470	114	149
16,000	6	3	47	248	496	119	159	42	231	462	114	154
18,000	2	-1	49	246	492	119	165	44	229	458	114	159
20,000	-2	-5	51	247	494	119	170	45	230	460	114	164
22,000	-6	-9	53	251	502	119	176	47	230	460	114	170
24,000	-9	-13	57	260	520	119	183	49	233	466	114	176
26,000	-13	-17	—	—	—	—	—	53	242	484	114	182
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-52, Maximum Endurance Power 1700 RPM ISA+20°C (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA + 20°C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	36	35	30	286	572	110	115	27	275	550	105	110
2000	32	31	31	272	544	110	119	27	262	524	105	114
4000	28	27	31	260	520	110	122	28	250	500	105	117
6000	25	23	32	250	500	110	126	29	240	480	105	121
8000	21	19	33	241	482	110	130	29	230	460	105	124
10,000	17	15	34	232	464	110	134	30	221	442	105	128
12,000	13	11	35	225	450	110	138	31	213	426	105	133
14,000	9	7	36	221	442	110	143	32	207	414	105	137
16,000	5	3	37	217	434	110	148	33	202	404	105	141
18,000	2	-1	39	213	426	110	153	34	199	398	105	146
20,000	-2	-5	40	213	426	110	158	35	197	394	105	151
22,000	-6	-9	42	213	426	110	163	36	196	392	105	156
24,000	-10	-13	43	213	426	110	169	38	195	390	105	162
26,000	-14	-17	45	216	432	110	175	39	196	392	105	168
28,000	-17	-21	49	224	448	110	182	41	199	398	105	174
29,000	-19	-22	—	—	—	—	—	42	200	400	105	177
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-52. Maximum Endurance Power 1700 RPM ISA+20°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA +30°C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	46	45	38	311	622	119	126	35	301	602	114	122
2000	43	41	39	299	598	119	130	35	288	576	114	125
4000	39	37	40	288	576	119	134	36	275	550	114	129
6000	35	33	41	278	556	119	138	37	266	532	114	133
8000	31	29	42	270	540	119	143	38	257	514	114	138
10,000	27	25	43	263	526	119	147	39	249	498	114	142
12,000	23	21	45	258	516	119	152	40	243	486	114	147
14,000	20	17	47	254	508	119	157	41	238	476	114	151
16,000	16	13	48	252	504	119	162	45	235	470	114	156
18,000	12	9	50	251	502	119	168	46	234	468	114	162
20,000	8	5	52	252	504	119	174	46	232	464	114	167
22,000	4	1	54	255	510	119	180	48	235	470	114	173
24,000	1	-3	—	—	—	—	—	50	238	476	114	179
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-53. Maximum Endurance Power 1700 RPM ISA+3O°C (Sheet I of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA + 30°C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	46	45	31	291	582	110	117	28	281	562	105	112
2000	42	41	32	277	554	110	121	28	266	532	105	115
4000	39	37	32	263	526	110	124	28	252	504	105	119
6000	35	33	33	253	506	110	128	29	241	482	105	123
8000	31	29	34	244	488	110	132	30	232	464	105	127
10,000	27	25	35	236	472	110	136	31	223	446	105	131
12,000	23	21	36	229	458	110	141	31	216	432	105	135
14,000	19	17	37	224	448	110	145	32	210	420	105	139
16,000	15	13	38	219	438	110	150	33	205	410	105	144
18,000	12	9	39	218	436	110	155	34	202	404	105	149
20,000	8	5	41	216	432	110	161	36	200	400	105	154
22,000	4	1	42	216	432	110	166	37	199	398	105	159
24,000	0	-3	44	218	436	110	172	39	199	398	105	165
26,000	-4	-7	46	221	442	110	179	40	201	402	105	171
28,000	-7	-11	—	—	—	—	—	42	203	406	105	177
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-53. Maximum Endurance Power 1700 RPM ISA+30°C (Sheet 2 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA + 37°C

WEIGHT			14,000 POUNDS					13,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	54	52	38	311	622	119	128	35	301	602	114	123
2000	50	48	39	300	600	119	132	35	289	578	114	127
4000	46	44	40	290	580	119	136	36	278	556	114	131
6000	42	40	41	280	560	119	140	37	268	536	114	135
8000	38	36	43	273	546	119	144	38	259	518	114	139
10,000	34	32	44	266	532	119	149	39	251	502	114	144
12,000	30	28	46	261	522	119	154	41	245	490	114	148
14,000	27	24	47	257	514	119	159	42	241	482	114	153
16,000	23	20	49	254	508	119	164	44	238	476	114	158
18,000	19	16	51	254	508	119	170	45	236	472	114	164
20,000	15	12	53	255	510	119	176	47	236	472	114	169
22,000	12	8	—	—	—	—	—	49	238	476	114	175
24,000	—	—	—	—	—	—	—	—	—	—	—	—
26,000	—	—	—	—	—	—	—	—	—	—	—	—
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-54. Maximum Endurance Power 1700 RPM ISA+37°C (Sheet 1 of 2)

MAXIMUM ENDURANCE POWER
1700 RPM
ISA + 37°C

WEIGHT			12,000 POUNDS					11,000 POUNDS				
PRESSURE ALTITUDE	IFAT	FAT	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS	TORQUE PER ENGINE	FUEL FLOW PER ENG	FUEL FLOW TOTAL	IAS	TAS
FEET	°C	°C	%	LBS/HR	LBS/HR	KTS	KTS	%	LBS/HR	LBS/HR	KTS	KTS
SL	53	52	31	291	582	110	118	28	282	564	105	113
2000	49	48	32	279	558	110	122	29	269	538	105	117
4000	46	44	33	266	532	110	126	29	255	510	105	120
6000	42	40	33	256	512	110	130	29	244	488	105	124
8000	38	36	34	247	494	110	134	30	234	468	105	128
10,000	34	32	35	238	476	110	138	31	225	450	105	132
12,000	30	28	36	231	462	110	142	32	218	436	105	136
14,000	26	24	37	226	452	110	147	33	212	424	105	141
16,000	22	20	39	222	444	110	152	34	207	414	105	146
18,000	19	16	40	220	440	110	157	35	204	408	105	151
20,000	15	12	41	218	436	110	163	36	201	402	105	156
22,000	11	8	43	218	436	110	169	38	201	402	105	161
24,000	7	5	45	220	440	110	175	39	201	402	105	167
26,000	4	1	—	—	—	—	—	41	203	406	105	173
28,000	—	—	—	—	—	—	—	—	—	—	—	—
29,000	—	—	—	—	—	—	—	—	—	—	—	—
31,000	—	—	—	—	—	—	—	—	—	—	—	—

Figure 7-54. Maximum Endurance Power 1700 RPM ISA+37°C (Sheet 2 of 2)

RANGE PROFILE — LONG RANGE POWER

1700 RPM

STANDARD DAY (ISA)

ASSOCIATED CONDITIONS:

WEIGHT .... *15,090 LBS BEFORE ENGINE START
FUEL .... AVIATION KEROSENE
FUEL DENSITY ..... 6.7 LBS/GAL
WIND .... ZERO

EXAMPLE:

PRESSURE ALTITUDE ..... 26,000 FT
FUEL .... 2124 LBS
RANGE .... 574 NM

NOTES: 1. RANGE ALLOWS FOR TAXI AND RUNUP; INCLUDES CRUISE CLIMB AND DESCENT; AND ALLOWS FOR 45 MINUTES RESERVE FUEL AT LONG RANGE POWER.

*2. AT 15,090 LBS RAMP WEIGHT, THE MAXIMUM ZERO-FUEL WEIGHT LIMITATION OF 11,500 LBS WOULD BE EXCEEDED AT FUEL LOADINGS LESS THAN 3590 LBS.

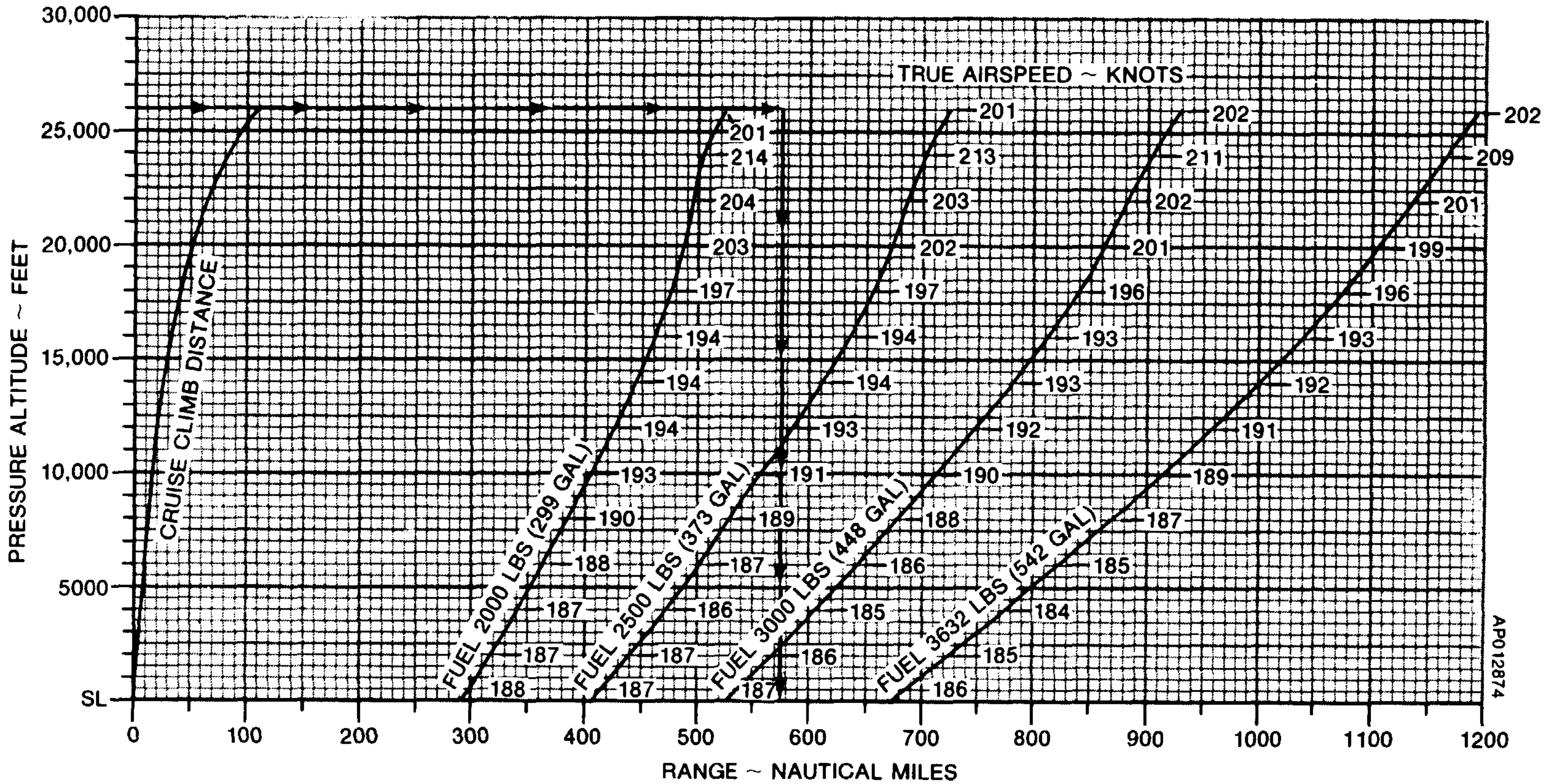


Figure 7-55. Range Profile - Long Range Power 1700 RPM

RANGE PROFILE - 542 GALLONS USABLE FUEL

STANDARD DAY (ISA)

ASSOCIATED CONDITIONS:

WEIGHT .... 15,090 LBS BEFORE ENGINE START
FUEL .... AVIATION KEROSENE
FUEL DENSITY .... 6.7 LBS/GAL
WIND .... ZERO

EXAMPLE:

PRESSURE ALTITUDE .... 20.000 FT

RANGE AT:
MAXIMUM CRUISE POWER .... 1059 NM
MAXIMUM ENDURANCE POWER .... 1079 NM
LONG RANGE POWER .... 1107 NM

NOTE: RANGE ALLOWS FOR TAXI AND RUNUP; INCLUDES CRUISE CLIMB AND DESCENT; AND ALLOWS FOR 45 MINUTES RESERVE FUEL AT LONG RANGE POWER.

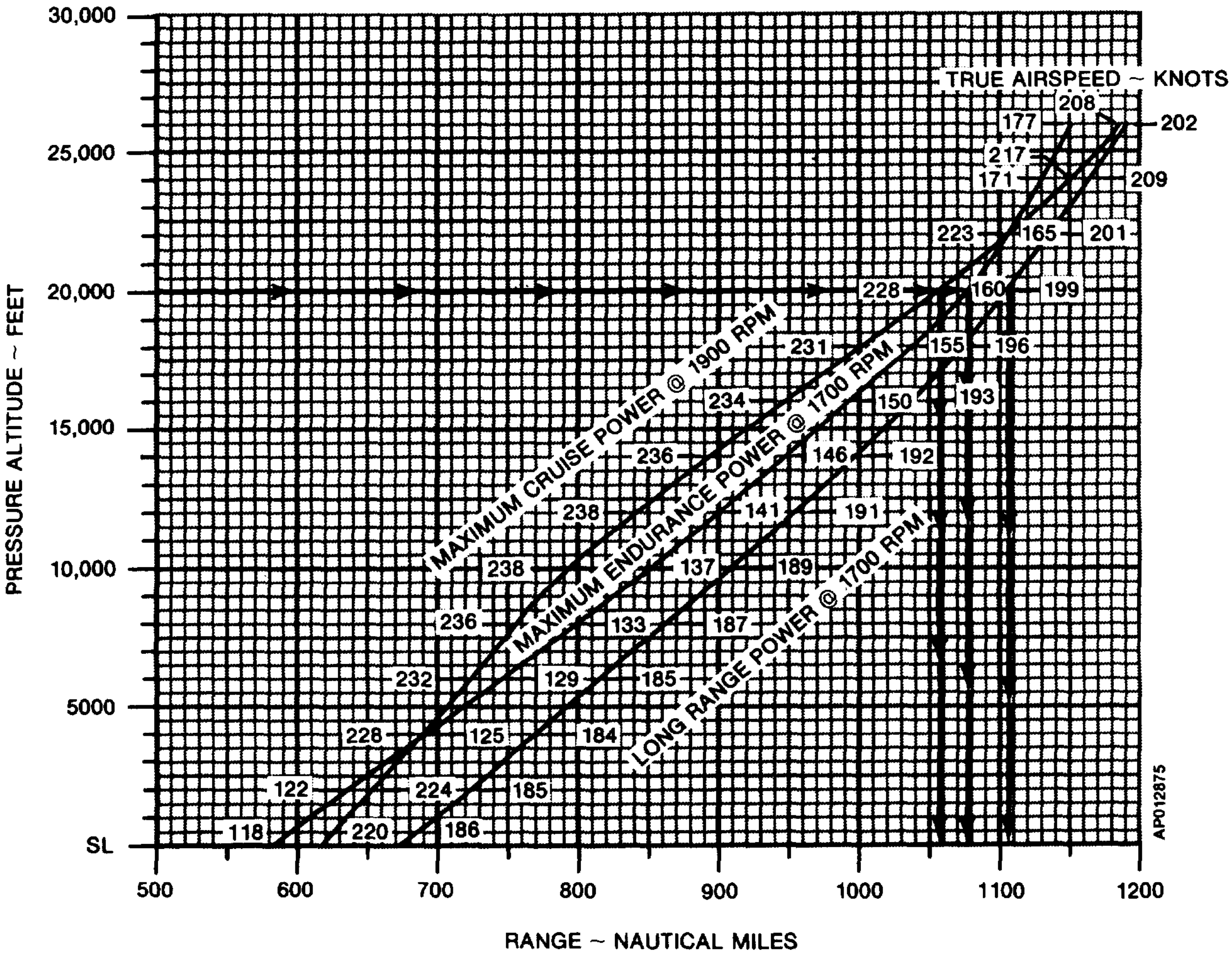


Figure 7-56. Range Profile - 542 Gallons Useable Fuel

ENDURANCE PROFILE — 542 GALLONS USABLE FUEL

STANDARD DAY (ISA)

ASSOCIATED CONDITIONS:

WEIGHT .... 15,090 LBS BEFORE ENGINE START
FUEL .... AVIATION KEROSENE
FUEL DENSITY .... 6.7 LBS/GAL

NOTE: ENDURANCE ALLOWS FOR TAXI AND RUNUP; INCLUDES CRUISE CLIMB AND DESCENT; AND ALLOWS FOR 45 MINUTES RESERVE FUEL AT LONG RANGE POWER.

EXAMPLE:

PRESSURE ALTITUDE .... 20,000 FT

ENDURANCE AT:
- MAXIMUM CRUISE POWER .... 4.69 HR
- LONG RANGE POWER .... 5.53 HR
- MAXIMUM ENDURANCE POWER .... 6.56 HR

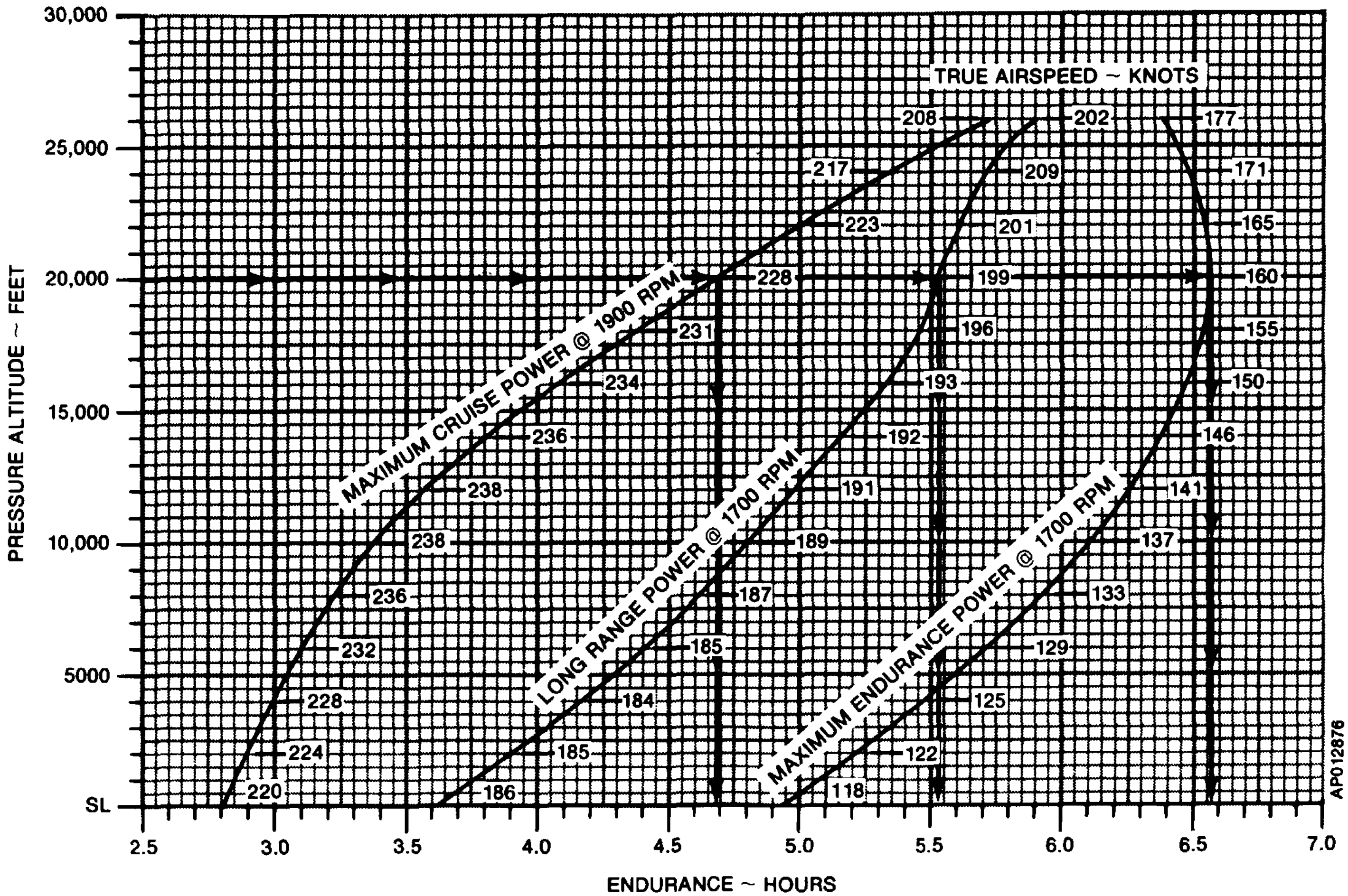


Figure 7-57. Endurance Profile - 542 Gallons Useable Fuel

TIME, FUEL, AND DISTANCE TO DESCEND

ASSOCIATED CONDITIONS:

POWER . . . AS REQUIRED TO DESCEND AT 1500 FT/MIN
LANDING GEAR.. UP
FLAPS . . 0%

EXAMPLE:

INITIAL ALTITUDE. . . 26,000 FT
FINAL ALTITUDE . . . . 4732 FT

TIME TO DESCEND . . (17.7-3.1) 15 MIN
FUEL TO DESCEND . . (198.5-50.0) 149 LBS
DISTANCE TO DESCEND . . (86.5-15.3) 71 NM

DESCENT SPEED: V_{MO}/M_{MO}

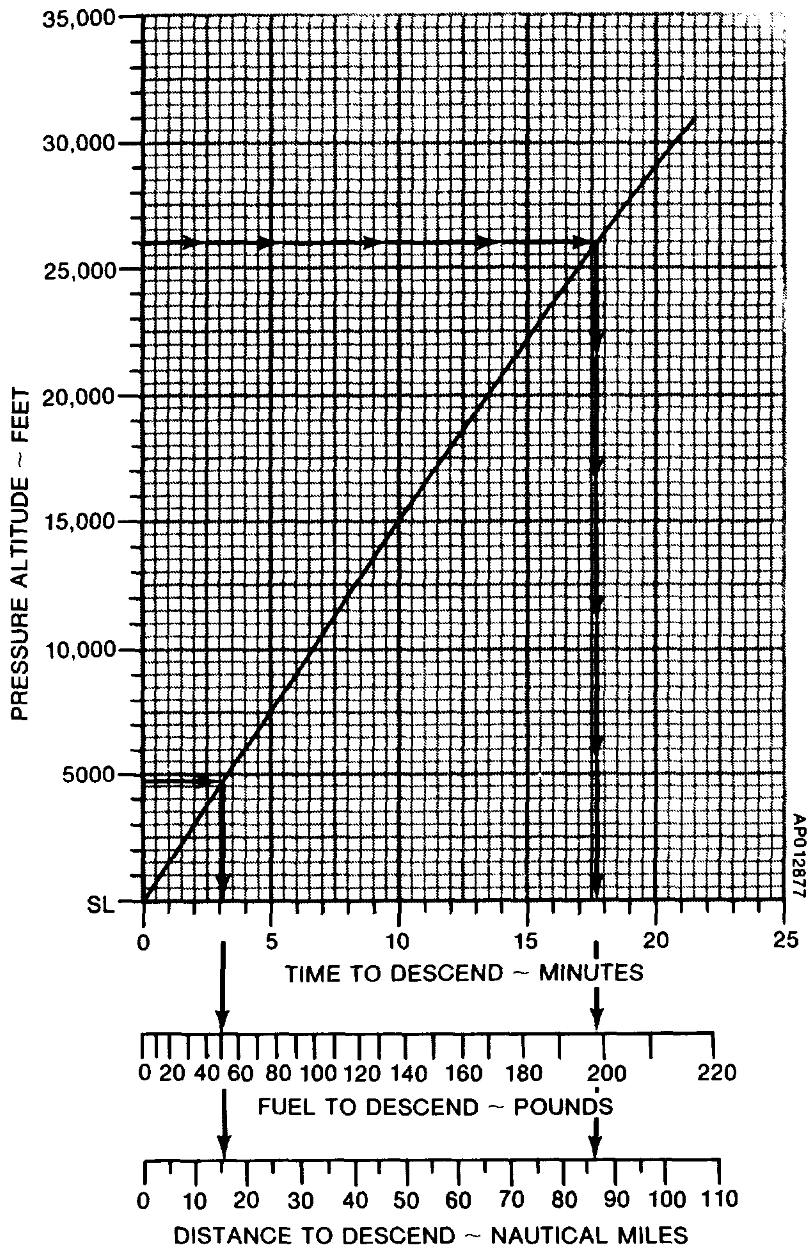


Figure 7-58. Time, Fuel, And Distance to Descend

ASSOCIATED CONDITIONS:

POWER .... TAKEOFF
FLAPS 100%
LANDING GEAR .... DOWN

EXAMPLE:

FAT .... 32°C
PRESSURE ALTITUDE .... 4732 FT
WEIGHT .... 10,309 LBS

RATE OF CLIMB .... 1270 FT/MIN
CLIMB GRADIENT 10.2%

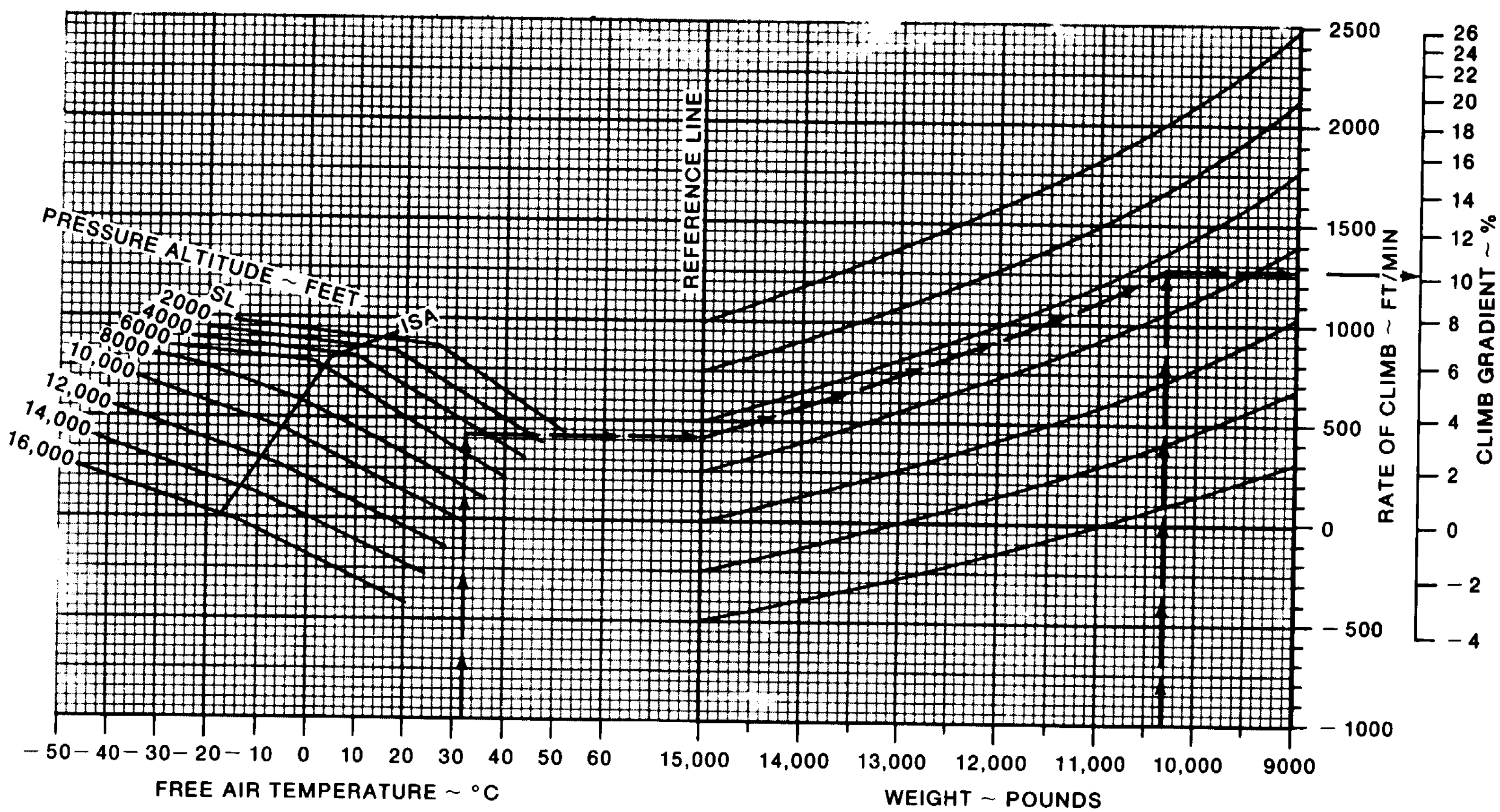


Figure 7-59. Climb - Balked Landing

NORMAL LANDING DISTANCE WITHOUT PROPELLER REVERSING — FLAPS 100%

ASSOCIATED CONDITIONS:

POWER .... RETARDED TO MAINTAIN APPROPRIATE DESCENT RATE ON FINAL APPROACH. ABOVE 13,500 LBS, USE 500 FT/MIN; AT OR BELOW 13,500 LBS USE 600 FT/MIN.
FLAPS 100%
RUNWAY .... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED ..... IAS AS TABULATED
BRAKING .... MAXIMUM

WEIGHT ~ POUNDS	APPROACH SPEED ~ KNOTS
15,000	104
13,500	99
13,000	99
11,000	99
9000	99

EXAMPLE:

FAT .... 32°C
PRESSURE ALTITUDE .... 4732 FT
LANDING WEIGHT .... 10,309 LBS
HEADWIND COMPONENT ..... 10 KTS

GROUND ROLL .... 1800 FT
TOTAL DISTANCE OVER 50-FT OBSTACLE .... 2510 FT
APPROACH SPEED .... 99 KTS

NOTE: USE DASH LINES ON OBSTACLE HEIGHT FOR 500 FT/MIN DESCENT.

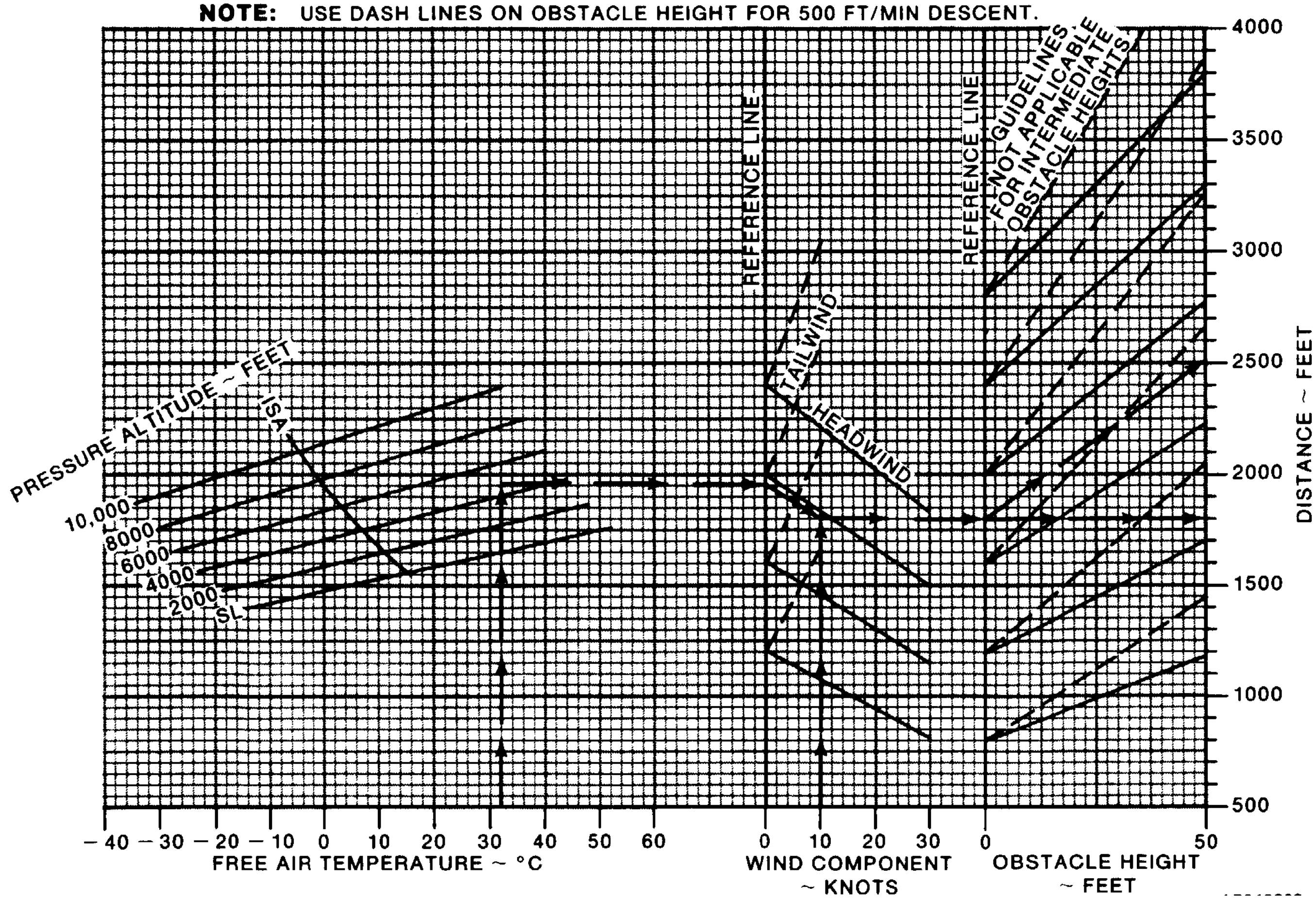


Figure 7-60. Normal Landing Without propeller Reversing - Flaps 100%

LANDING DISTANCE WITHOUT PROPELLER REVERSING - FLAPS 0%

ASSOCIATED CONDITIONS:

POWER RETARDED TO MAINTAIN APPROPRIATE DESCENT RATE ON FINAL APPROACH. ABOVE 13.500 LBS USE 500 FT/MIN: AT OR BELOW 13,500 LBS USE 600 FT/MIN:
FLAPS 0%
RUNWAY PAVED, LEVEL, DRY SURFACE
APPROACH SPEED.. IAS AS TABULATED
BRAKING MAXIMUM

EXAMPLE:

FLAPS - 100% LANDING DISTANCE OVER 50-FT OBSTACLE.. 2510 FT
LANDING WEIGHT 10,309 LBS

FLAPS-UP LANDING DISTANCE OVER 50-FT OBSTACLE. _. 3410 FT
APPROACH SPEED 111 KTS

WEIGHT ~ POUNDS	APPROACH SPEED ~ KNOTS
15,000	128
13,500	123
13,000	122
11,000	115
9000	104

NOTES: 1. LANDING WITH FLAPS FULL DOWN (100%) IS NORMAL PROCEDURE. USE THE GRAPH BELOW WHEN IT IS NECESSARY TO LAND WITH FLAPS UP (0%).
2. TO DETERMINE FLAPS-UP LANDING DISTANCE, READ FROM THE "NORMAL LANDING DISTANCE WITHOUT PROPELLER REVERSING - FLAPS 100%" GRAPH THE LANDING DISTANCE APPROPRIATE TO FAT, ALTITUDE, WIND, AND 50-FT OBSTACLE, THEN ENTER THE GRAPH BELOW WITH DERIVED VALUE AND READ THE FLAPS-UP LANDING DISTANCE.

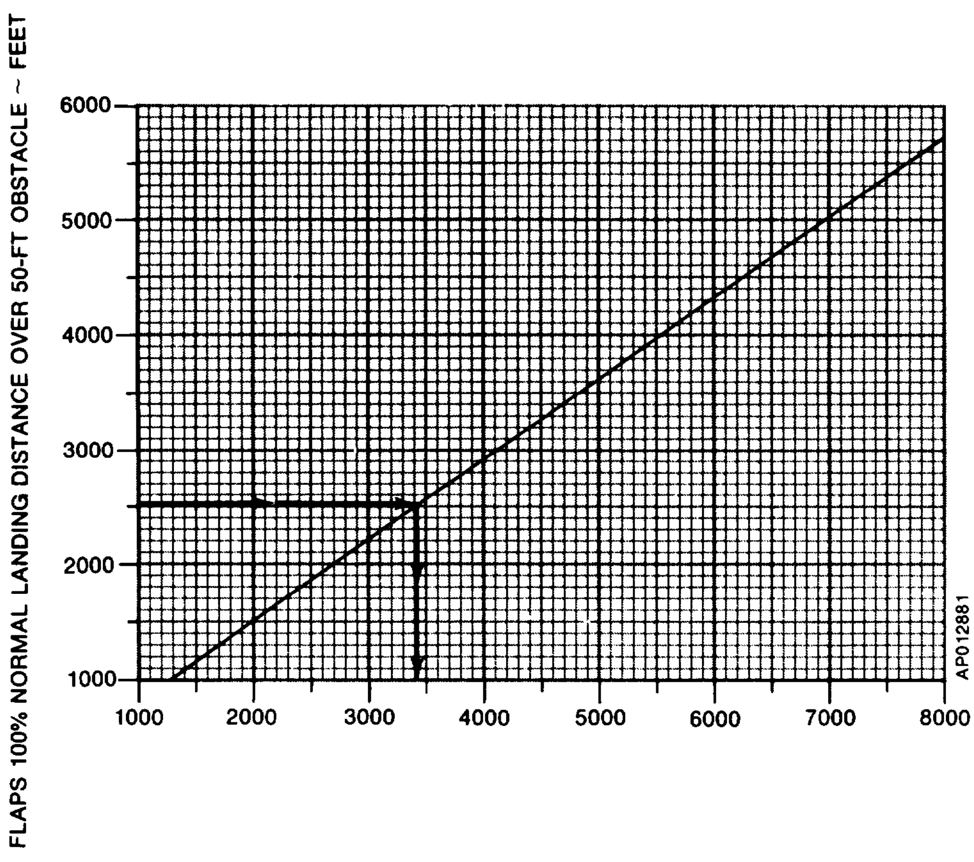


Figure 7-61. Landing Distance Without Propeller Reversing - Flaps 0%

CHAPTER 8

Normal Procedures

Section I. MISSION PLANNING

8-l. MISSION PLANNING.

Mission planning begins when the mission is assigned and extends to the preflight check of the aircraft. 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 in command shall insure compliance with the contents of this manual that are applicable to the mission.

8-2. OPERATING LIMITS AND RESTRICTIONS.

Minimum, maximum, normal, and cautionary operational ranges represent careful aerodynamic and structural calculations, substantiated by flight test data. These limitations must be adhered to during all phases of the mission. Refer to Chapter 5, OPERATING LIMITS AND RESTRICTIONS, for detailed information.

8-3. WEIGHT, BALANCE, AND LOADING.

The aircraft must be loaded and weight and balance verified per Chapter 6. WEIGHT, BALANCE, AND LOADING.

8-4. PERFORMANCE.

Refer to Chapter 7, PERFORMANCE DATA, to determine the capability of the aircraft for the entire mission. Consideration must be given to changes in performance resulting from variation in loads, temperatures, and pressure altitudes. Record the data on the Performance Planning Card for use in completing the flight plan and for reference throughout the mission.

8-5. FLIGHT PLAN.

A flight plan must be completed and filed per AR 95-1, DOD FLIP, and local regulations.

8-6. CREW BRIEFINGS.

A crew briefing must be conducted for a thorough understanding of individual and team responsibilities. The briefing should include, but not be limited to, copilot, crew chief, and ground crew responsibilities and the coordination necessary to complete the mission most efficiently. A review of visual signals is desirable when ground guides do not have a direct voice communications link with the crew. Refer to Section VI for crew briefings.

Section II. OPERATlNG PROCEDURES AND MANEUVERS

8-7. OPERATING PROCEDURES AND MANEUVERS.

This section deals with normal procedures and includes all steps necessary for safe and efficient operation of the aircraft from the time a preflight begins until the flight is completed and the aircraft is parked and secured. Unique feel, characteristics, and reaction of the aircraft during various phases of operation and the techniques and procedures used for taxiing, takeoff. climb. etc., are described, including precautions to be observed. Only the duties of the minimum crew necessary for the actual operation of the aircraft are included. For operation of avionics equipment. refer to the operating handbooks that accompany the aircraft loose tools.

8-8. ADDITIONAL DATA.

Additional crew duties are covered as necessary in Section VI, 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 III, FLIGHT CHARACTERISTICS, and are repeated in this section only when required for emphasis. Checks that must be made 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.

8-9. CHECKLIST.

Normal procedures are given primarily in checklist form and are 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 Operator's and Crewmember's Checklist, TM 55-1510-221-CL. To provide for easier cross referencing, the procedural steps are numbered to coincide with the corresponding numbered steps in TM 55-1510-221-CL.

8-10. USE OF CHECKLIST.

Although a good working knowledge of all aircraft procedures is desirable, it is not mandatory that they be committed to memory. The pilot is responsible for the initiation and accomplishment of all required checks. Checklist items will be called out orally and the action verified using the pilot's checklist (-CL). The copilot will normally read the checklist and perform such duties as indicated, as well as those directed by the pilot. 'As required" will not be used as a response; instead the actual position or setting of the unit or item, such as "ON" or "UP" or "APPROACH' will be stated. Upon completion of each checklist, the copilot will advise the pilot that the checklist called for has been completed.

8-11. CHECKS.

Items which apply only to night or only to instrument flying shall have an "N" or "I" respectively, immediately preceding the check to which it is pertinent. The symbol "O' shall be used to indicate "if installed.' Those duties which are the responsibility of the copilot, at the command of the pilot, will be indicated by a circle "O" around the step number, i.e., ④ Circuit breakers - In. The star symbol " ★ " indicates an operational check contained in the performance section of the condensed checklist. The asterisk symbol "*" 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 upper case.

8-12. BEFORE EXTERIOR CHECK.

* 1. Publications - Check DA Forms 2408-12, -13, -14, and -18, DD Form 365-4, locally required forms and publications, and availability of operator's manual (-10) and checklist (-CL).

* 2. Oxygen system - Check that oxygen quantity is sufficient for the entire mission.

CAUTION

If high or gusty winds are present, and the flight controls are unlocked, control surfaces may be damaged by buffeting.

* 3. Flight controls - Unlock and check.

* 4. Parking brake - Set.

CAUTION

The elevator trim system must not be forced past the limits which are indicated on the elevator trim tab position indicator.

5. Elevator trim - Set to "0" (neutral).

CAUTION

Do not cycle landing gear handle on the ground.

* 6. Gear - DN.

* 7. ICC vane pull handles - In.

* 8. Keylock switch - ON.

* 9. Battery switch - ON.

10. Ice vane switches - RETRACT.

11. Lighting systems - Check as required, to include navigation lights, recognition lights, landing/taxi light, wing ice lights, beacons, emergency lights, and interior lights, then OFF.

NOTE

The emergency lights override switch should be placed in the TEST position and the emergency lights (5) checked for illumination and intensity. A dim light indicates a weak battery pack. At the completion of the check, the switch must be cycled from the TEST position to the OFF/RESET position and then placed in AUTO.

12. Fuel gages - Check fuel quantity and gage operation.

★ 13. Pitot tubes (2), stall warning vane, heated fuel fuel vents (2) - Check.

1. Stall warning heat switch - ON.

2. Pitot heat switches (2) - ON. Check cover removed.

3. Fuel vent heat switches (2) - ON.

4. Left wing heated fuel vent - Check by feel for heat and condition.

5. Stall warning vane - Check by feel for heat and condition.

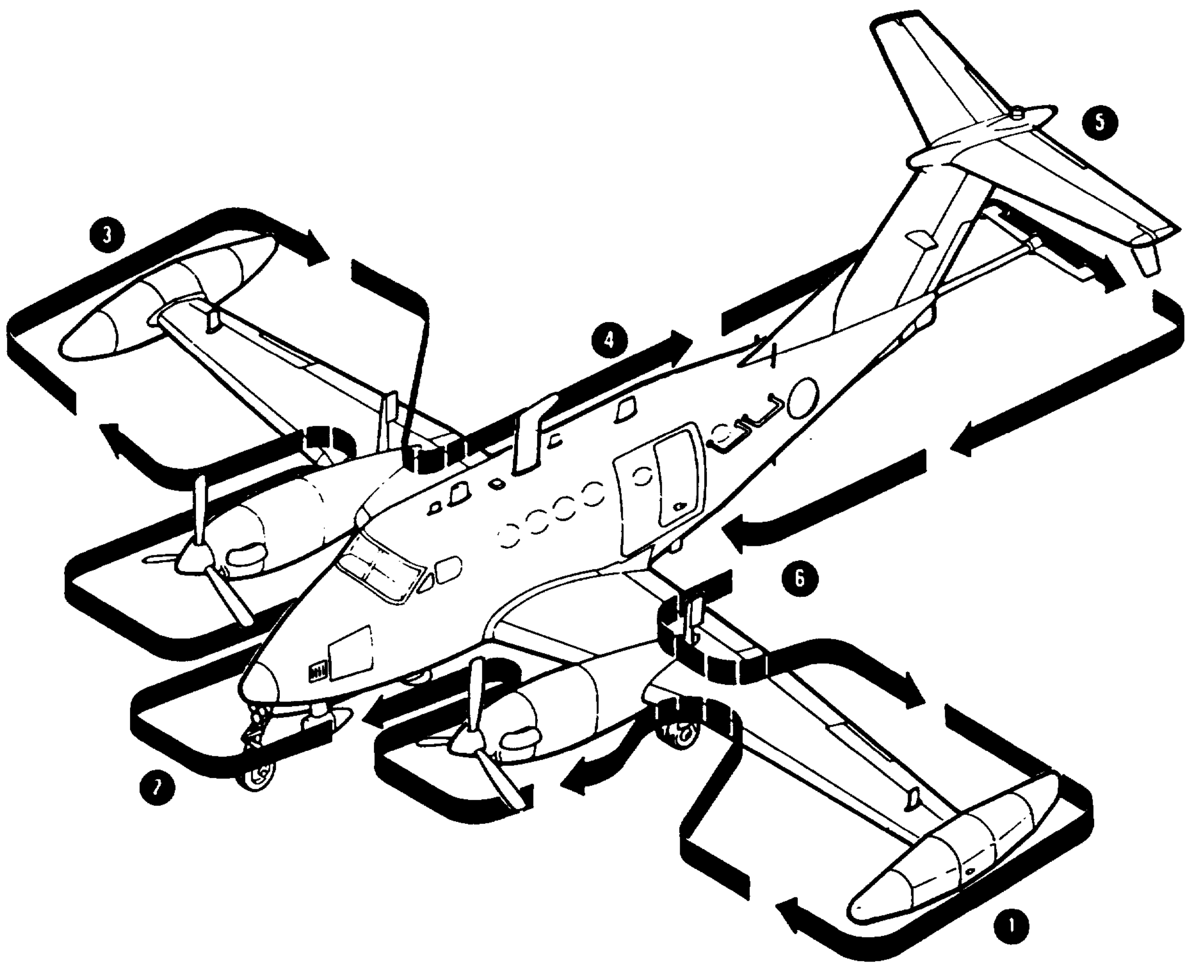
6. Right wing heated fuel vent - Check by feel for heat and condition.

7. Stall warning heat switch - OFF.

8. Pitot heat switches (2) - OFF.

9. Heated fuel vent switches (2) - OFF.

14. Battery switch - As required.



1. Area 1 - Left wing, landing gear, engine, nacelle and propeller
2. Area 2 - Nose section
3. Area 3 - Right wing, landing gear, engine, nacelle and propeller
4. Area 4 - Fuselage, right side
5. Area 5 - Empennage
6. Area 6 - Fuselage, left side

AP 012082

Figure 8-1. Exterior Inspection

15. Mission equipment and circuit breakers - Check and set.

16. Toilet - Check condition.

17. Emergency equipment - Check that all required emergency equipment is available and that fire extinguishers and first aid kits have current inspection dates.

18. Parachutes - Check secure and for current inspection and repack dates.

8-13. EXTERIOR CHECK.

8-14. FUEL SAMPLE.

NOTE

Fuel and oil quantity check may be performed prior to EXTERIOR CHECK. During warm weather open fuel cap slowly to prevent being sprayed by fuel under pressure due to thermal expansion.

* 1. Fuel sample - Check collective fuel sample from all drains for possible contamination. Thru-flight check is only required if aircraft has been refueled.

8-15. LEFT WING, AREA I.

1. Left wing area - Check as follows (fig. 8-l):

* a. General condition - Check for skin damage such as buckling, splitting, distortion, dents, or fuel leaks.

b. Flaps - Check for full retraction (approximately 0.25 inch play) and skin damage such as buckling, splitting, distortion, or dents.

c. Fuel sump drains (3) - Check for leaks.

d. Controls and moveable trim tab - Check security and moveable trim tab position.

NOTE

All static wicks (27) must be installed for optimum radio performance.

e. Static wicks (4) - Check security and condition.

f. Wing pod, navigation lights, deice boots and antennas - Check condition.

g. Recognition light - Check condition.

h. Outboard antenna set - Check condition.

i. Main tank fuel and cap - Check fuel level visually, condition of seal, and cap tight and properly installed.

j. Outboard wing fuel vent - Check free of obstructions.

k. Outboard deice boot - Check for secure bonding, cracks, loose patches, stall strips, and general condition.

l. Stall warning vane - Check free.

m. Monopole antenna - Check general condition.

* n. Tiedown - Release.

o. Inboard dipole antenna set - Check for security and cracks at mounting points. Check bonding secure, boots free of cuts and cracks.

p. Wing ice light - Check condition.

q. AC GPU access door - Secure.

r. Recessed and heated fuel vents - Check free of obstructions.

s. Inverter inlet and exhaust louvers - Check free of obstructions.

8-16. LEFT MAIN LANDING GEAR.

1. Left main landing gear - Check as follows:

* a. Tires - Check for cuts, bruises, wear, proper inflation and wheel condition.

b. Brake assembly - Check brake lines for damage or signs of leakage, brake linings for wear (0.25 inch maximum, between housing and lining carrier), brake deice assembly and bleed air hose for condition and security.

* c. Shock strut - Check for signs of leakage, minimum strut extension (5.56 inches), and that left and right strut extension is approximately equal.

d. Torque knee - Check condition.

e. Safety switch - Check condition, wire, and security.

★ f. Fire extinguisher pressure - Check pressure within limits.

g. Wheel well, doors, and linkage - Check for signs of leaks, broken wires, security, and general condition.

h. Fuel sump drains (forward) - Check for leaks.

8-17. LEFT ENGINE AND PROPELLER.

1. Left engine - Check as follows:

CAUTION

A cold oil check is unreliable. Oil should be checked within 10 minutes after stopping engine. If more than 10 minutes have elapsed, motor engine for 30 seconds, then recheck. If more than 10 hours have elapsed, run engine for 2 minutes, then recheck. Add oil as required. Do not overfill.

* a. Engine oil - Check oil level no more than 2 quarts low, cap secure, locking tab aft, and access door locked.

b. Engine compartment, left side - Check for fuel and oil leaks, security of oil cap, door locking pin, and general condition.

NOTE

Secure front cowling latches first.

c. Left cowl locks - Locked.

d. Left exhaust stack - Check for cracks and free of obstructions.

* e. Propeller blades and spinner - Check blade condition, boots, security of spinner and free propeller rotation.

* f. Engine air inlets and ice vane - Check free of obstruction and ice vane retracted.

g. Bypass door - Check condition.

h. Right cowl locks - Locked.

i. Right exhaust stack - Check for cracks and free of obstructions.

j. Engine compartment, right side - Check for fuel and oil leaks, ice vane linkage, door locking pin, and general condition. Lock compartment access door.

8-18. CENTER SECTION LEFT SIDE.

1. Center section - Check as follows:

a. Heat exchanger inlet and outlet - Check for cracks and free of obstruction.

b. Auxiliary tank fuel sump drain - Check for leaks.

C. Inboard deice boot - Check for secure bonding, cracks, loose patches, and general condition.

* d. Auxiliary tank fuel gage and cap - Check fuel level visually, condition of seal, and cap tight and properly installed.

e. Monopole antenna - Check condition.

8-19. FUSELAGE UNDERSIDE.

1. Fuselage underside - Check as follows:

* a. General condition - Check for skin damage such as buckling, splitting, distortion, dents, or fuel leaks.

b. Antennas - Check security, and general condition.

8-20. NOSE SECTION, AREA 2.

1. Nose section - Check as follows:

a. Outside air temperature probe - Check condition.

b. Avionics door, left side - Check secure.

c. Air conditioner exhaust - Check free of obstructions.

d. Wheel well - Check for signs of leaks, broken wires and general condition.

e. Doors and linkage - Check condition, security, and alignment.

f. Nose gear turning stop - Check condition.

* g. Tire - Check for cuts, bruises, wear, appearance of proper inflation, and wheel condition.

* h. Shock strut - Check for signs of leakage and 3.0 inches minimum extension.

i. Torque knee - Check condition.

j. Shimmy damper and linkage - Check for security and condition.

k. Landing and taxi lights - Check for security and condition.

l. Pitot tubes - Check covers removed, alignment, security, and free of obstructions.

m. Radome - Check condition.

n. Antenna pod - Check general condition.

o. Monopole antennas (2) - Check general condition.

p. Windshields and wipers - Check windshield for cracks and cleanliness and wipers for contact with glass surface.

q. Air conditioner inlet - Check free of obstructions.

r. Avionics door, right side - Check secure.

8-21. CENTER SECTION, RIGHT SIDE.

1. Center section - Check as follows:

a. Inboard deice boot - Check for secure bonding, cracks, loose patches, and general condition.

b. Battery access panel - Secure.

c. Battery vents - Check free of obstruction.

* d. Auxiliary tank fuel gage and cap - Check fuel level visually, condition of seal, and cap tight and properly installed (locking tab aft).

e. Battery compartment drain - Check free of obstruction.

f. Battery ram air intake - Check free of obstruction.

g. INS TAS temperature probe - Check condition and free of obstructions.

h. Auxiliary tank fuel sump drain - Check for leaks.

i. Heat exchanger inlet and outlet - Check for cracks and free of obstructions.

j. Monopole antenna - Check condition.

8-22. RIGHT ENGINE AND PROPELLER.

1. Right engine and propeller - Check as follows:

CAUTION

A cold oil check is unreliable. Oil should be checked within 10 minutes after stopping engine. If more than 10 minutes have elapsed, motor engine for 30 seconds, then recheck. If more than 10 hours have elapsed, run engine for 2 minutes, then recheck. Add oil as required. Do not overfill.

* a. Engine oil - Check oil level, oil cap secure (locking tab aft), and access door locked.

b. Engine compartment, left side - Check for fuel and oil leaks, security of oil cap, door locking pins, and general condition.

c. Left cowl locks - Locked.

d. Left exhaust stack - Check for cracks and free of obstructions.

* e. Propeller blades and spinner - Check blade condition, boots, security of spinner, and free propeller rotation.

* f. Engine air inlets and ice vane - Check free of obstruction and ice vane retracted.

g. Bypass door - Check condition.

h. Right cowl locks - Locked.

i. Right exhaust stack - Check for cracks and free of obstructions.

j. Engine compartment, right side - Check for fuel and oil leaks, ice vane linkage, door locking pins, and general condition. Lock compartment access door.

8-23. RIGHT MAIN LANDING GEAR.

1. Right main landing gear - Check as follows:

a. Fuel sump drains (forward) - Check for leaks.

* b. Tires - Check for cuts, bruises, wear, proper inflation and wheel condition.

c. Brake assembly - Check brake lines for damage or signs of leakage, brake linings for wear (0.25 inch maximum, between piston housing and lining carrier), brake deice assembly and bleed air hose for condition and security.

* d. Shock strut - Check for signs of leakage, minimum strut extension (5.50 inches), and that left and right strut extension is approximately equal.

e. Torque knee - Check condition.

f. Safety switch - Check condition, wire, and security.

★ g. Fire extinguisher pressure - Check pressure within limits.

h. Wheel well, doors, and linkage - Check for signs of leaks, broken wires, security, and general condition.

8-24. RIGHT WING, AREA 3.

1. Right wing - Check as follows:

a. Recessed and heated fuel vents - Check free of obstructions.

b. Inverter inlet and exhaust louvers - Check free of obstructions.

c. DC GPU access door - Secure.

d. Inboard dipole antenna set - Check for security and cracks at mounting points, bonding secure, free of cuts and cracks.

e. Wing ice light - Check condition.

f. Outboard deice boot - Check for secure bonding, cracks, loose patches, stall strips, and general condition.

* g. Tiedown - Release.

* h. Main tank fuel and cap - Check fuel level visually, condition of seal, and cap tight and properly installed.

i. Outboard wing fuel vent - Check free of obstructions.

j. Outboard antenna set - Check condition.

k. Recognition light - Check condition.

1. Wing pod navigation lights, deice boots and antennas - Check condition.

m. Static wicks (4) - Check security and condition.

n. Controls - Check security and condition of ground adjustable tab.

o. Fuel sump drains (3) - Check for leaks.

p. Flaps - Check for full retraction (approximately 0.25 inch play) and skin damage, such as buckling, splitting, distortion, or dents.

q . Chaff dispenser - Check number of chaffs in payload module and for security.

* r. General condition - Check for skin damage such as buckling, splitting, distortion, dents, or fuel leaks.

8-25. FUSELAGE RIGHT SIDE, AREA 4.

1. Fuselage right side - Check as follows:

* a. General condition - Check for skin damage such as buckling, splitting, distortion or dents.

b. Emergency light - Check condition.

C. Flare/chaff dispenser - Check number of flares in payload module and for security.

d. Beacon - Check condition.

e. Underside fuselage antennas - Cheek general condition.

f. Towel bar antennas (2) - Check general

g. P-band antenna - Check general condition.

h. Tailcone access door - Check secure.

i. Oxygen filler door - Check secure.

j. Static ports - Check clear of obstructions.

k. APR 44 antennas (2) - Check.

l. Emergency locator transmitter antenna - Check condition.

8-26. EMPENNAGE, AREA 5.

1. Empennage - Check as follows:

a. Vertical stabilizer, rudder, and trim tab - Check for skin damage, such as buckling, distortion, or dents, and trim tab rig.

b. Static wicks (19) - Check installed.

c. Antennas - Check security, and general condition.

d. Deice boots - Check for secure bonding, cracks, loose patches, and general condition.

e. Horizontal stabilizer, and elevator - Check for skin damage, such as buckling, distortion and dents.

NOTE

Any difference between the indicated position on the trim tab position indicator and the actual position of the elevator trim tab signifies an unairworthy condition and must be corrected prior to the next flight of the aircraft.

f. Elevator trim tab - Verify “0” (neutral) position.

WARNING

If the possibility of ice accumulation on the horizontal stabilizer or elevator exists, takeoff will not be attempted.

g. Position and beacon lights - Check condition.

h. Rotating boom dipole antenna - Check condition and positron.

i. Wide band data link antenna pod - Check for cracks and chips.

8-27. FUSELAGE, LEFT SIDE, AREA 6.

1. Fuselage left side - Check as follows:

* a. General condition - Check for skin damage such as buckling, distortion, or dents.

b. Static ports - Check clear of obstructions.

c. ELT-ARMED.

d. APR-44 antennas (2) - Check.

e. P band antenna - Check general condition.

f. Towel bar antennas (2) - Check general condition.

g. Emergency light - Check condition.

h. Cabin door - Check door seal and general condition.

i. Fuselage to side - Check general condition and antennas.

* j. Chocks and tiedowns - Check removed.

8-28. INTERIOR CHECK.

1. Cargo/loose equipment - Check secure.

2. Cabin/cargo doors - Test and lock:

a. Cabin door - Check closed and latched by the following.

(1) Safe arm and diaphram plunger - Check position (lift door step).

(2) Index marks on rotary cam locks (6) - Check aligned with indicator windows.

b. Cargo door - Check closed and latched by the following:

(1) Upper handle - Check closed and latched. (Observe through cargo door latch handle access cover window.)

(2) Index marks on rotary cam locks (4) - Check aligned with indicator windows.

(3) Lower pin latch handle - Check closed and latched. (Observe through cargo door lower latch handle access , cover window.)

(4) Carrier rod - Check indicator aligned with orange stripe on carrier rod. (Observe through window aft lower comer.)

(5) Battery switch - OFF.

(6) Cargo door - Check closed and latched.

(7) Cabin door - Close but leave unlatched. Check CABIN DOOR annunciator light illuminated.

(8) Cabin door - Open. Check CABIN annunciator light extinguished

(9) Battery switch - ON. Check CABIN DOOR annunciator light illuminated.

(10) Cabin door - Close and latch. Check CABIN DOOR annunciator light extinguished.

(11) Battery switch - OFF.

3. Emergency exit - Check secure and key removed.

4. Mission cooling ducts - Check open and free of obstructions.

5. Flare/chaff dispenser preflight test - Completed.

6. KKY-28/58 key loaded - As required.

★ 7. Crew briefing - As required. Refer to Section VI.

8-29. BEFORE STARTING ENGINES.

★ 1. Oxygen system - Check as required.

a. Oxygen supply pressure gages - Check.

b. Supply control lever (green) - ON.

c. Diluter control lever - 100% OXYGEN.

d. Emergency control lever (red) - Set to TEST MASK position while holding mask directly away from face, then return to NORMAL.

e. Oxygen masks - Put on and adjust.

f. Emergency pressure control lever - Set to TEST MASK position and check mask for leaks, then return lever to NORMAL.

g. Flow indicator - Check, during inhalation blinker appears, during exhalation blinker disappears). Repeat a minimum of 3 times.

2. Circuit breakers - Check in.

* 3. Overhead control panel switches - Set as

a. Light dimming controls - As required.

b. Cabin temperature mode selector switch - OFF.

c. Ice & rain switches - As required.

d. Exterior light switches - As required.

e. Master panel lights switch - As required.

f. Inverter switches - As required.

g. Avionics master power switch - As required.

h. Environmental switches - As required.

i. Autofeather switches - OFF.

j. # 1 engine start switches - OFF.

k. Master switch - As required.

l. #2 engine start switches - OFF.

* 4. Fuel panel switches - Check as follows:

a. Standby fuel pump switches - OFF.

b. Auxiliary transfer override switches - AUTO.

c. Crossfeed switch - OFF.

5. Magnetic compass - Check for fluid, heading and current deviation card.

* 6. Pedestal controls - Set as follows:

CAUTION

Movement of power levers into reverse range while engines are shut down may result in bending and damage to control linkages.

a. POWER levers - IDLE.

b. Propeller levers - HIGH RPM.

c. CONDITION levers - FUEL CUTOFF.

d. Flaps- UP.

e. Friction locks - Check and set.

* 7. Pedestal extension switches - Set as follows:

a. Flare/chaff dispenser control - SAFE.

b. Avionics - As required.

c. Rudder boost switch - ON.

8. Gear alternate engage and ratchet handles - stowed.

9. Outside air temperature gage - Check, note current reading.

10. Instrument panel - Check and set as follows:

a. Pilot’s and copilot’s course indicator switches -As required.

b. Pilot’s and copilot’s RMI switches - As required.

c. Pilot’s and copilot’s microphone switch - As required.

d. Pilot’s and copilot’s compass switches - As required.

e. Gyro switches - SLAVE.

f. Flight instruments - Check instruments for protective glass, warning flags (12 pilot, 6 copilot), static readings, and heading correction card.

g. Radar - OFF.

h. APR-39 and APR-44 - OFF.

i. Engine instruments - Check for protective glass and static readings.

11. Deleted.

12. Mission panel switches and circuit breakers - set and OFF.

13. Pressurization controls - Set.

14. Subpanels - Check and set as follows:

   a Fire protection test switch - OFF.

   b. Landing, taxi, and recognition lights - OFF.

   c. Landing gear control switch - Recheck DN.

   d. Cabin lights - As Required.

15. Pilot's static air source - NORMAL.

NOTE

Do not use alternate static source during takeoff and landing except in an emergency. Pilot's instruments will show a variation in airspeed and altitude.

16. Pilot's and copilot's audio control panels - As required.

17. Deleted.

★ 18. Fuel pumps/crossfeed operation - Check as

   a . Fire pull handles - Pull.

   b . Standby fuel pump switches - On.

   c . Battery switch - ON.

   d . #1 fuel pressure and #2 fuel pressure warning lights - Illuminated

   e. Fire pull handles - In.

   f. #l fuel press and #2 fuel press warning annunciator lights - Extinguished.

   g. Standby fuel pump switches - Off.

   h. #1 fuel pressure and #2 fuel pressure warning lights - Illuminated.

   i. Crossfeed - check. Check system operation by activating switch momentarily left then right, noting that #1 FUEL PRESS and #2 FUEL PRESS warning annunciator lights extinguish and that the FUEL CROSSPEED advisory annunciator light illuminates as switch is energized.

19. AC and DC GPU - As required.

20. External power advisory annunicator lights - As required. (Aircraft EXTERNAL POWER and mission EXT DC PWR ON annunciator lights illuminated.)

21. DC power - Check. (22 VDC minimum for battery, 28 maximum for GPU starts).

★ 22. Annunciator panels - Test as required.

   a MASTER CAUTION, MASTER WARNING, #1 FUEL PRESS, #2 FUEL PRESS, GEAR DN, L BL AIR FAIL, R BL AIR FAIL, INST AC, #1 DC GEN. #1 INVERTER, #1 NO FUEL XFR, #2 NO FUEL XFR, #2 INVERTER, #2 DC GEN, - Check illuminated.

   b. ANNUNCIATOR TEST switch - Press and hold. Check that the annunciator panels, FIRE PULL handle lights, marker, beacon lights, ANT Azimuth indicator, MASTER CAUTION and MASTER WARNING lights are illuminated. Release switch and check that all lights except those in step (1) are extinguished.

   c. MASTER CAUTION and MASTER WARNING lights - Press. Check that both lights extinguish.

★ 23. Stall and gear warning system - Check as follows:

   a. STALL WARN TEST switch - TEST. Check that warning horn sounds.

   b. LDG GEAR WARN TEST switch - TEST. Check that waming horn sounds and that the LDG GEAR CONTR handle warning lights (2) illuminate.

★ 24. Fire Protection system - Check as follows:

   a. Fire Detector Test switch - Rotate counterclockwise to check three DETR positions. FIRE PULL handles should Illuminate in each position. Reset MASTER WARNING in each position.

   b. Fire Detector Test switch - Rotate counterclockwise to check two EXTGH positions. SQUIB OK light, associated #1 EXTGH DISCH and #2 EXTGH DISCH annunciator caution light and MASTER CAUTION LIGHT should illuminate in each position.

25. INS - Align as required.

8-30. * FIRST ENGINE START (BATTERY START).

NOTE

The engines must not be started until after the INS is placed into the NAV mode or OFF as required.

Starting procedures are identical for both engines. When making a battery start, the right engine should be started first. When making a ground power unit (GPU) start, the left engine should be started first due to the GPU receptacle being located adjacent to the right engine. A crewmember should monitor the outside observer throughout the engines start.

1. Avionics master switch - As required.
2. Exterior light switches - As required.
3. Propeller - Clear.
4. Ignition and engine start switch - ON. Propeller should begin to rotate and associated #1 IGN ON or #2 IGN ON annunciator light should illuminate. Associated #1 FUEL PRESS or #2 FUEL PRESS light should extinguish.

CAUTION

If ignition does not occur within 10 seconds after moving condition lever to LOW IDLE, initiate engine clearing procedure. If for any reason a starting attempt is discontinued, the entire starting sequence must be repeated after allowing the engine to come to a complete stop (5 minute minimum).

5. CONDITION lever (after N_1 RPM stabilizes, 12% minimum) - LOW IDLE.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During starting, the maximum allowable TGT is 1000°C for five seconds. If this limit is exceeded, use ABORT START procedure and discontinue start. Enter the peak temperature and duration on DA Form 2408-13.

6. TGT and N_1 - Monitor (TGT 1000°C maximum, N_1 52% minimum).
7. Oil pressure - Check (60 PSI minimum).
8. Ignition and engine start switch - OFF, after 50% N_1.
9. CONDITION lever - HI IDLE. Monitor TGT as the condition lever is advanced.
10. Generator switch - RESET, then ON.

8-31. SECOND ENGINE START (BATTERY START).

1. First engine generator load 50% or less.
2. Propeller - Clear.
3. Ignition and engine start switch - ON. Propeller should begin to rotate and associated #l IGN ON or #2 IGN ON annunciator light should illuminate. Associated #l FUEL PRESS or # 2 FUEL PRESS annunciator light should extinguish.

CAUTION

If ignition does not occur within 10 seconds after moving condition lever to LOW IDLE, initiate engine clearing procedure. If for any reason a starting attempt is discontinued, the entire starting sequence must be repeated after allowing the engine to come to a complete stop (5 minute minimum).

4. CONDITION lever (after N_1 RPM passes 12% minimum) - LOW IDLE.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During starting, the maximum allowable TGT is 1000°C for five seconds. If this limit is exceeded, use ABORT START procedure and discontinue start. Enter the peak temperature and duration on DA Form 2408-13.

5. TGT and N_1 - Monitor (TGT 1000°C maximum, N_1 52% minimum).
6. Oil pressure - Check (60 PSI minimum).
7. Ignition and engine start switch - OFF after 50% N_1.

8. Battery charge light - Check (light should illuminate approximately 6 seconds after generator is brought on line. Light should extinguish within 5 minutes following a normal engine start on battery).

9. Inverter switches - ON, check INVERTER annunciator lights extinguished.

10. Second engine generator - RESET, then ON.

11. CONDITION levers - As required.

8-32. ABORT START.

1. CONDITION lever - FUEL CUTOFF.
2. Ignition and engine start switch - STARTER ONLY.
3. TGT - Monitor for drop in temperature.
4. Ignition and engine start switch - OFF.

8-33. ENGINE CLEARING.

1. CONDITION lever - FUEL CUTOFF.
2. Ignition and engine start switch - OFF (5 minute minimum).

CAUTION

Do not exceed starter limitation of 30 seconds ON and 5 minutes OFF for two starting attempts and engine clearing procedure. Allow 30 minutes off before additional starter operation.

3. Ignition and engine start switch - STARTER ONLY (15 seconds minimum, 30 seconds maximum).
4. Ignition and engine start switch - OFF.

8-34. * FIRST ENGINE START (GPU START).

1. INS - As required.

NOTE

The engines must not be started until after the INS is placed into the NAV mode or OFF as required.

2. Avionics master switch - As required.
3. Exterior light switches - As required.
4. Propeller - Clear.
5. Ignition and engine start switch - ON. Propeller should begin to rotate and associated #1 IGN ON or #2 IGN ON should illuminate. Associated #1 FUEL PRESS or #2 FUEL PRESS warning annunciator light should extinguish.
6. CONDITION lever (after N_1, RPM stabilizes, 12% minimum) - LOW IDLE.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During engine start, the maximum allowable TGT is 1000°C for five seconds. If this limit is exceeded, use ABORT START procedure and discontinue start. Enter the peak temperature and duration on DA Form 2408- 13.

7. TGT and N_1 - Monitor (TGT 1000°C maximum, N_1 52% minimum).
8. Oil pressure - Check (60 PSI minimum).
9. Ignition and engine start switch - OFF after 50% N_1.
10. CONDITION lever - HI IDLE. Monitor TGT as the condition lever is advanced.
11. DC GPU - Disconnect as required,
12. Generator switch (GPU disconnected) - RESET, then ON.

8-35. SECOND ENGINE START (GPU START).

1. Propeller - Clear.
2. Ignition and engine start switch - ON. Propeller should begin to rotate and associated #1 IGN ON or #2 IGN ON annunciator light should illuminate. Associated #1 FUEL PRESS or #2 FUEL PRESS annunciator light should extinguish.

CAUTION

If ignition does not occur within 10 seconds after moving condition lever to LOW IDLE, initiate engine clearing procedure. If for any reason a starting attempt is discontinued, the entire starting sequence must be repeated after allowing the engine to come to a complete stop (5 minute minimum).

3. CONDITION lever (after N_1 RPM passes 12% minimum) - LOW IDLE.

CAUTION

Monitor TGT to avoid a hot start. If there is a rapid rise in TGT, be prepared to abort the start before limits are exceeded. During engine start, the maximum allowable TGT is 1000°C for five seconds. If this limit is exceeded, use ABORT START procedure and discontinue start. Enter the peak temperature and duration on DA Form 2408-13.

4. TGT and N_1 - Monitor (TGT 1000°C maximum, N_1 52% minimum).
5. Oil pressure - Check (60 PSI minimum).
6. Ignition and engine start switch - OFF, after 50% N_1
7. Propeller levers - FEATHER.
8. GPU - Disconnect. (Check aircraft external power and mission external power light extinguished.)
9. Propeller levers - HIGH RPM.
10. Aircraft inverter switches - ON, check #1 INVERTER and #2 INVERTER annunciator lights extinguished.
11. Generator switches - RESET, then ON.
12. CONDITION levers - As required.

8-36. BEFORE TAXING.

* 1. Brake deice - As required. To activate the brake deice system proceed as follows:

a. Bleed air valves - OPEN.

b. CONDITION levers - HI IDLE.

c. Brake deice switch - DEICE. Check BRAKE DEICE ON advisory annunciator light illuminated.

* 2. Cabin temperature and mode - Set.

CAUTION

Verify airflow is present from aft cockpit eyeball outlets to insure sufficient cooling for mission equipment.

NOTE

For maximum cooling on the ground, turn the bleed air valve switches to ENVIRO OFF position.

★ * 3. AC/DC power - Check for:

a. AC frequency - 394 to 406 Hz.

b. AC voltage - 104 to 124 VAC.

c. DC load - Check.

d. DC voltage - 27.0 to 28.5 VDC.

WARNING

Do not operate radar in congested areas. Injury could result to personnel in close proximity to operating radar.

CAUTION

Do not operate the weather radar in an area where the nearest effective surface is 50 feet or less from the antenna reflector. Scanning such surfaces within 50 feet of the antenna reflector may damage receiver crystals.

* 4. Avionics master switch - ON.

5. Mission panel - Set and checked as required.

★ 6. Automatic flight control system - Check as follows:

a. Altitude alert.

NOTE

Pause a few seconds between each step to allow time for the proper indications.

(1) Set alert controller more than 1000 feet above altitude indicated on pilot's altimeter. The pilot's altimeter alert light should be extinguished.

(2) Decrease the alert controller to within 1000 feet of the pilot's altimeter setting. The alert light should illuminate.

(3) Decrease the controller to less than 250 feet above the pilot's altimeter setting. The alert light should extinguish.

(4) Increase the controller to 300 ±50 feet above the pilot's altimeter indication and check that the alert light illuminates.

(5) Set the desired altitude.

b. Autopilot.

(1) Autopilot controller UP TRIM, DN TRIM annunciators - CHECK not illuminated.

CAUTION

A steady illumination of UP TRIM or DN TRIM annunciator indicates that the automatic synchronization is not functioning and the autopilot should not be engaged.

(2) Turn knob - Center.

(3) Elevator trim control switch - ON.

(4) Control wheel - Hold to mid travel.

(5) AP button - Press. AP ENGAGE and YD ENGAGE annunciators on.

(6) Deleted.

(a) Deleted.

(b) Deleted.

(7) Elevator trim follow-up - Check.

(a) Control wheel - Hold aft of mid travel. Trim wheel should run nose down after approximately 3 seconds. Trim down annunciator should illuminate after approximately 8 seconds.

(b) Control wheel - Hold forward of mid travel. Trim wheel should run nose up after approximately 3 seconds, trim up annunciator should illuminate after approximately 8 seconds, and AP TRIM FAIL annunciator and MASTER WARNING lights should illuminate after approximately 15 seconds.

WARNING

The elevator trim system must not be forced beyond the limits which are indicated on the elevator trim tab indicator.

(8) AP/YD & TRIM DISC Button - Depress through second level. Autopilot and yaw damper should disengage and ELECT TRIM OFF annunciator should illuminate. AP ENG and YD ENG annunciators on instrument panel should flash 5 times.

(9) Elevator trim control switch - OFF, then ON. (ELEC TRIM OFF annunciator should extinguish).

(10) AP - Re-engage.

(11) Turn controller - Check that control wheel follows in each applied direction, then center.

(12) Pitch wheel - Check that trim responds to pitch wheel movement. (UP TRIM and DN TRIM annunciators may illuminate).

(13) Heading bug - Center and engage HDG. Check that control follows a turn in each direction.

(14) Disengage AP by selecting GA. Check that AP disengages and FD commands 7° nose up, wings level attitude. YD disengage - Autopilot mode selector - STBY.

7. Electric elevator trim - Check.

a. Elevator trim switch - ON.

b. Pilot and copilot trim switches - Check operation.

WARNING

Operation of the electric trim system should occur only by movement of pairs of switches. Any movement of the elevator trim wheel while depressing only one switch element denotes a system malfunction. The electric elevator trim control switch must then be turned OFF and flight conducted by operating the elevator trim wheel manually. Do not use autopilot.

(1) Pilot and copilot. Check individual element for no movement of trim, then check proper operation of both elements.

(2) Check pilot switches override copilot switches while trimming in opposite directions, and trim moves in direction commanded by pilot.

C. Check pilot and copilot trim disconnects while activating trim.

d. Elevator trim switch - OFF then ON (ELECT TRIM OFF annunciator extinguishes).

8. Avionics - Check and set as required.

9. INS - NAV mode, if on.

10. Flaps - Check.

11. Altimeters - Set and check.

8-37. TAXIING.

CAUTION

Excessive use of brakes with the increased weight of this aircraft will increase the possibility of brake failure and/or brake fire. Judicious use of the brakes is recommended with coordinated use of beta range.

Taxi speed can be effectively controlled by the use of power application and the use of the variable pitch propellers in beta range. Normal turns may be made with the steerable nose wheel; however, a turn may be tightened by using full rudder and inside brake as necessary. Turns should not be started with brakes alone, nor should the aircraft be pivoted sharply on one main gear.

1. Brakes - Check.

2. Flight instruments - Check for normal operation.

8-38. ENGINE RUNUP.

1. Mission control panel - Set.

*2. Propeller manual feathering - Check as follows:

a. CONDITION lever - LOW IDLE.

b. Left propeller lever - FEATHER Check that propeller feathers.

c. Left propeller lever - HIGH RPM.

d. Repeat procedure for right propeller.

*3. Autofeather- Check as follows:

a. CONDITION levers - LOW IDLE.

b. AUTOFEATHER switch - Hold to TEST. (#1 AUTOFEATHER and #2 AUTOFEATHER advisory annunciator lights should remain extinguished.)

c. POWER levers - Advance until AUTOFEATHER lights are illuminated (approximately 22% torque).

d. Left POWER lever - Retard and check:

(1) At 16 - 21% torque - #2 AUTOFEATHER light out.

(2) At 9 - 14% torque - Both AUTOFEATHER lights out and left propeller starts to feather.

e. Left POWER lever - Approximately 22% torque.

f. Repeat steps b and d for right engine.

g. POWER levers - IDLE (both lights out, neither propeller feathers).

*4. Overspeed governors - Check as follows:

a. POWER levers - Set approximately 1950 RPM (both engines).

b. #1 propeller governor test switch - Hold to TEST position.

c. #1 propeller RPM 1830 to 1910 - Check.

d. Repeat steps b and c for # 2 engine.

e. POWER levers - Set 1800 RPM.

*5. Primary governors - Check as follows:

a. POWER levers - Set 1800 RPM.

b. Propeller levers - Move aft to detent. Check that propeller RPM drops to 1600 to 1640 RPM.

c. Propeller levers - HIGH RPM.

*6. Ice vanes - Check as follows:

a. Ice vane switches - EXTEND. Verify torque drop, TGT increase, and illumination of #1 ICE VANE EXTEND and #2 ICE VANE EXT annunciators.

b. Ice vane switches - RETRACT. Verify return to original torque and TGT, and that #1 ICE VANE EXTEND and #2 ICE VANE EXT annunciators extinguish.

7. CONDITION levers - HI IDLE.

8. POWER levers - IDLE.

*9. Anti-ice and deice systems - Check as follows:

a. Windshield anti-ice switches - NORMAL and HI. Check PILOT and COPILOT (individually) for loadmeter rise, then OFF.

b. Propeller switches - INNER and OUTER (momentarily). Check for loadmeter rise.

c. Surface deice switch - SINGLE CYCLE AUTO. Check for a drop in pneumatic pressure and wing deice boot inflation and after 6 seconds for a second drop in pneumatic pressure.

d. Surface deice switch - MANUAL. Check that surface boots inflate, and remain inflated, then OFF.

e. Antenna deice switch - SINGLE. Check for a drop in pneumatic pressure and antenna deice boot inflation.

f. Antenna deice switch - MANUAL. Check that boots inflate, and remain inflated, then OFF.

g. Engine inlet lip heat switches - ON. Check that #1 LIP HEAT ON and #2 LIP HEAT ON advisory annunciator lights are illuminated, and the #1 LIP HEAT and #2 LIP HEAT caution annunciator lights are extinguished, then OFF.

h. RADOME ANTI-ICE switch - ON. Check that RADOME HEAT annunciator is illuminated, then OFF.

*10. Pneumatic pressure - Check as follows:

a. Left bleed air valve switch - PNEU & ENVIRO OFF.

b. Pneumatic pressure - Check 12 to 20 PSI.

c. Right pneumatic and environmental switch - PNEU & ENVIRO OFF. Check that L BL AIR FAIL and R BLAIR FAIL, and L BL AIR OFF and R BL AIR OFF annunciator lights are illuminated.

d. Pneumatic pressure - Verify zero.

e. Left pneumatic and environmental switches - OPEN. Check that L BL AIR FAIL and R BL AIR FAIL, and L BL AIR OFF and R BL AIR OFF annunciator lights are extinguished.

f. Pneumatic pressure - Verify 12 to 20 PSI.

g. Right pneumatic and environmental switches - OPEN.

* 11. Pressurization system - Check as follows:

a. Cabin door caution light - Check extinguished.

b. Storm windows - Check closed.

c. Bleed air valve switches - Check OPEN.

d. Cabin altitude - Set 500 feet lower than airfield elevation.

e. Cabin pressure/dump switch - TEST (hold).

f. Cabin rate-of-climb gage - Check for descending indication and, when confirmed, release cabin pressure/dump switch from TEST.

g. Aircraft altitude - Set to planned cruise altitude plus 500 feet. (If this setting does not result in a CABIN ALT indication of at least 500 feet over takeoff field pressure altitude, adjust as required).

12. CONDITION levers - As required

13. ANTI-ICE - As required.

NOTE

If windshield anti-ice is needed prior to takeoff, use normal setting for a minimum of 15 minutes prior to selecting high temperature to provide adequate preheating and minimize effects of thermal shock.

8-39. BEFORE TAKEOFF.

1. Autofeather switch - ARM.

2. Bleed air valves - As required.

3. Ice & rain switches - As required.

4. Fuel panel - Check fuel quantity and switch positions.

5. Flight and engine instruments - Check for normal indications.

6. Cabin altitude and rate-of-climb controller - Set.

7. Annunciator panels - Check (note indications).

8. Propeller levers - HIGH RPM.

9. Flaps - As required.

10. Trim - Set.

11. Avionics - Set.

12. Flight controls - Check

13. Departure briefing - Complete.

8-40. LINE UP.

1. Transponder - As required.

2. Engine autoignition switch - ARM.

3. Power stabilized - Check approximately 25% minimum.

4. CONDITION levers - LOW IDLE.

5. Lights - As required.

6. Mission control panel - Set.

8-41. TAKEOFF.

To aid in planning the takeoff and to obtain maximum aircraft performance, make full use of the information affecting takeoff shown in Chapter 7. The data shown is achieved by setting brakes, setting takeoff power, and then releasing brakes. When runway lengths permit, the normal takeoff may be modified by starting the takeoff after power has been stabilized at approximately 25% torque, then applying power smoothly so as to attain full power no later than 65 KIAS. This will result in a smoother takeoff but will significantly increase takeoff distance.

a. Normal Takeoff. After LINE Up procedures have been completed, release brakes and smoothly apply power to within 5% of target. Power should be applied at a rate that will produce takeoff power by 40 KIAS. Maintain directional control with nosewheel steering rudder, and differential power, while maintaining wings level with ailerons. The pilot should retain a light hold on the power levers throughout the takeoff and be ready to initiate ABORT procedures if required. The copilot should insure that the AUTOFEATHER advisory lights are illuminated (if applicable), adjust and maintain power at the exact takeoff power settings, and monitor all engine instruments. The pilot will rotate at the recommended rotation speed (Vr) and establish the climb attitude (9° to 16°) that will attain best rate-of-climb airspeed (Vy) during the initial climb. Rotation should be at a rate that will allow liftoff at liftoff airspeed (V1of).

b. Crosswind Takeoff. Position the aileron control into the wind at the start of the takeoff roll to maintain a wings level attitude. Under strong crosswind conditions, leading with upwind power at the beginning of the takeoff roll will assist in maintaining directional control. As the nosewheel comes off the ground, the rudder is used as necessary to prevent turning (crabbing) into the wind. Rotate in a positive manner to keep from side-skipping as weight is lifted from the shock struts. To prevent damage to the landing gear, in the event that the aircraft were to settle back onto the runway, remain in "slipping" flight until well clear of the ground, then crab into the wind to continue a straight flight path.

c. *Minimum Run Takeoff.*

WARNING

Spectacular takeoff performance can be obtained by lifting off at speeds below those recommended in Chapter 7. However, control of the aircraft will be lost if an engine failure occurs immediately following liftoff until a safe speed can be attained. Except during soft field takeoff, liftoff below recommended speeds will not be performed.

Minimum run takeoffs are performed with flaps extended to 40% although at some conditions, use of flaps during takeoff may result in the inability to attain positive single-engine climb if an engine fails immediately after liftoff.

To compensate for torque effect during the beginning of the takeoff roll, align the aircraft with the nose approximately 10° right of centerline. After LINE UP procedures have been completed, hold brakes firmly and apply TAKEOFF POWER, allowing for some increase in power as airspeed increases during the takeoff roll. Copilot action is the same as for normal takeoff. Release brakes and maintain directional control and nosewheel steering and rudder. Do not use brakes unless absolutely necessary. Hold the elevators in a neutral position, maintaining wings level with ailerons. Allow the aircraft to roll with its full weight on the wheels until the recommended rotation speed (V,) is reached. At this speed rotate smoothly and firmly at a rate that will allow liftoff at liftoff air speed (V1of). When flight is assured, retract the landing gear.

d. Obstacle Clearance Climb. Follow procedures as outlined for a minimum run takeoff, to the point of actual liftoff. When flight is assured, retract the landing gear and establish a wings level climb attitude, maintaining the computed obstacle clearance airspeed (V,). Climb at this speed until clear of the obstacle. After the obstacle is cleared, lower the nose slowly and accelerate to best rate-of-climb airspeed (V). Retract flaps after attaining single engine best rate-of-climb airspeed (V_{yse}).

NOTE

The best angle-of-climb speed (V,) is very close to single engine power-off stall speed. To provide for a margin of safety in the event of engine failure immediately after takeoff, the obstacle clearance airspeed value is used in lieu of true Vx, for maximum angle takeoff climbs. Takeoff performance data shown in Chapter 7 is based on the use of obstacle clearance climb speed.

e. *Soft Field Takeoff.* If a takeoff must be made in conditions of mud, snow, tall grass, rough surface or other conditions of high surface friction, the following procedure should be used. Set flaps at TAKEOFF (40%), align the aircraft with the runway, and with the yoke held firmly aft, begin a slow steady acceleration, avoiding rapid or transient accelerations. Continue to hold full aft yoke so as to transfer the weight of the aircraft from the wheels to the wings as soon as possible. When the aircraft rotates, control pitch attitude (nose) so as to lift off from the soft surface at the slowest possible speed. When airborne, level off immediately in ground effect just above the surface, and accelerate to normal lift-off airspeed (V1of) before rotating to climb attitude and retracting the landing gear. Consider the effects of snow or mud on gear retraction as applicable.

8-42. AFTER TAKEOFF.

WARNING

Immediately after takeoff, the pilot flying the aircraft should avoid adjusting controls located on the aft portion of the extended pedestal to preclude inducing spatial disorientation due to Coriolis illusion.

After the aircraft is positively airborne and flight is assured, retract the landing gear. Adjust pitch attitude as required to maintain best rate-of-climb airspeed (V,). Retract flaps after attaining best single-engine rate-of-climb airspeed (V,,). The copilot should continue to maintain power at the computed setting and to monitor instruments. At single-engine maneuvering altitude, adjust pitch attitude to obtain cruise climb airspeed. As cruise climb airspeed, is attained, adjust power to the climb power setting. The copilot then activates the yaw damp and checks that the cabin is pressurizing. Both pilots check the wings and nacelles for fuel or oil leaks. The procedural steps after takeoff are as follows:

1. Gear-up.
2. Flaps-UP.
3. Landing lights - OFF.
4. Climb power - Set.
5. PROP SYNC Switch - As required
6. YAW DAMP switch - As required.
7. Autofeather switch - As required.
8. Brake deice - As required.
9. Windshield Anti-ice - As required.

NOTE

Turn windshield anti-ice on to normal when passing 10,000 feet AGL or prior to entering the freezing level (whichever comes first). Leave on until no longer required during descent for landing. High temperature may be selected as required, after a minimum warm-up period of 15 minutes.

10. Cabin pressurization - Check, adjust RATE control knob so that cabin rate-of-climb equals one-third aircraft rate-of-climb.
11. Wings and nacelles - Check.
12. Flare/chaff dispenser safety pin (electronic module) - Remove.
13. Chaff function selector switch - As required.
14. APR-39 and APR-44 - As required.

8-43. CLIMB.

a. Cruise Climb. Cruise climb is performed at a speed which is the best combination of climb, fuel bum-off, and distance covered Set propellers at 1900 RPM and torque as required. Adhere to the following airspeed schedule as closely as possible.

SL to 10,000 feet	140 KIAS
10,000 to 20,000 feet	131 KIAS
20,000 to 31,000 feet	121 KIAS

b. Climb - Maximum Rate. Maximum rate of climb performance is obtained by setting propellers at 2,000 RPM. torque at 100% (or maximum climb TGT), and maintaining best rate-of-climb airspeed. Refer to Chapter 7 for best rate-of-climb airspeed for specific weights.

8-44. CRUISE.

Cruise power settings are entirely dependent upon the prevailing circumstances and the type of mission being flown. Refer to Chapter 7 for airspeed, power settings, and fuel flow information. The following procedures are applicable to all cruise requirements.

1. Power - Set. Refer to the cruise power graphs contained in Chapter 7. To account for ram air temperature increase, it is essential that temperature be obtained at stabilized cruise airspeed.

NOTE

A new engine operated at the torque value presented in the cruise power charts will show a TGT margin below the maximum cruise limit. Maximum cruise power settings for temperature and altitude (derived from Chapter 7) if exceeded will adversely affect engine life. With ice vanes retracted, if cruise torque settings shown on cruise power charts cannot be obtained without exceeding TGT limits, the engine should be inspected.

2. Ice & rain switches - As required. Insure that anti-ice equipment is activated before entering icing conditions.

NOTE

Ice vanes must be extended when operating in visible moisture at +5°C or less. Visible moisture is moisture in any form (clouds, ice crystals, snow, rain, sleet, hail, or any combination of these).

3. Auxiliary fuel gages - Monitor. Insure that fuel is being transferred from auxiliary tanks. (Chapter 2, Section IV.)
4. Altimeters - Check. Verify that altimeter setting complies with transition altitude requirement.
5. Engine instrument indications - Check all engine instruments for normal indications.
6. Recognition lights - As required.

8-45. DESCENT.

Descent from cruising altitude should normally be made by letting down at cruise airspeed with reduced power. Refer to Chapter 7 for power settings and rates of descent.

NOTE

Cabin altitude and rat-f-climb controller should be adjusted prior to starting descent.

a. Descent - Max Rate (Clean). To obtain the maximum rate of descent in clean configuration, perform the following:

1. Cabin pressurization - Set. Adjust CABIN CONTROLLER dial as required and adjust RATE control knob so that cabin rate of descent equals one-third aircraft rate of descent.

2. POWER levers - IDLE.

3. Propeller levers - HIGH RPM.

4. Flaps - UP.

5. Gear - UP.

6. Airspeed - V_{mo}.

7. Ice & rain switches - As requited.

8. Recognition lights - As required.

b. Descent - Max Rate (Landing Configuration). If required to descend at a low airspeed (e.g., to conserve airspace or in turbulence), approach flaps and landing gear may be extended to increase the rate and angle of descent while maintaining the slower airspeed. To perform the maximum rate of descent in landing configuration, perform the following:

1. Cabin pressurization - Set. Adjust CABIN CONTROLLER dial as requited and adjust RATE control knob so that cabin descent rate equals one-third aircraft descent rate.

2. POWER levers - IDLE.

3. Propeller levers - HIGH RPM.

4. Flaps - APPROACH.

5. Gear - DN.

6. Airspeed - 180 KIAS maximum.

7. Ice & rain switches - As required.

8. Recognition lights - As required.

8-46. DESCENT-ARRIVAL.

Perform the following checks prior to the final descent for landing.

1. Cabin pressurization - Set. Adjust CABIN CONTROLLER dial as required.

2. Ice & rain switches - As required.

3. Windshield anti-ice - As required.

NOTE

Set windshield ANTI-ICE to normal or high as required well before descent into icing conditions or into warm moist air to aid in defogging. Turn off windshield anti-ice when descent is completed to lower altitudes and when heating is no longer required. This will preclude possible wind screen distortions.

4. Recognition lights - ON.

5. Altimeters - Set to current altimeter setting.

6. Flare/chaff dispenser arm-safe switch - SAFE.

7. Flare/chaff dispenser safety pin (electronic module) - Insert.

* 8. Crew briefing - Complete.

8-47. BEFORE LANDING.

1. Propeller synchronization switch - OFF.

2. Autofeather switch - ARM.

3. Propeller levers - As required.

NOTE

During approach, propellers should be set to 1900 RPM to prevent glideslope interference (ILS approach), provide better power response during approach, and minimize attitude change when advancing propeller levers for landing.

4. Flaps (below 198 KIAS) - APPROACH.

5. Gear - DN.

6. Landing lights - As required.

7. Brake deice - As required.

8-48. OBSTACLE CLEARANCE APPROACH AND MINIMUM RUN LANDING.

When landing over obstacles that require a steeper than normal approach path, or when greater precision is required due to restricted runway lengths, the "Power Approach/Precision Landing" technique should be employed as follows: Prior to intercepting the descent path, complete the LANDING check and stabilize airspeed (V_{ref} at 1.2 times power-off stall speed in landing configuration (V_{so}). After intercepting the desired approach angle maintain a constant descent by controlling the descent with power and airspeed with elevator. Transition smoothly from approach to landing attitude. Touchdown should be made on the main gear with the nose slightly high, with power as required to control rate of descent for a smooth touchdown. Immediately after touchdown. allow the nosewheel to make ground contact and apply full reverse power and braking, as required. If possible, remove reverse thrust as the aircraft slows to 40 KIAS to minimize propeller blade erosion.

NOTE

Using 1.2 x V_{so} for approach airspeed will provide increased performance and more responsive controls however, performance data are not available for approach at this slower airspeed.

8-49. LANDING.

CAUTION

> Except in an emergency, propellers should be moved out of reverse above 40 knots to minimize propeller blade erosion, and during crosswind to minimize stress imposed on propeller, engine and airframe. Care must be exercised when reversing on runways with loose sand and/or dust on the surface. Flying gravel will damage propeller blades and dust may impair the pilot's forward visibility at low airplane speeds. Performance data charts for landing computations assume that the runway is paved, level and dry. Additional runway must be allowed when these conditions are not met. Refer to Chapter 7 for landing data. Do not consider headwind during landing computations; however, if landing must be downwind, include the tailwind in landing distance computations. Plan the final approach to arrive at 50 feet over the landing area at approach speed (V_{ref}) plus 1/2 wind gust speed. Perform the following procedures as the an-craft nears the runway:

1. Autopilot and yaw damp - Disengaged.
2. Gear down lights - Check three green.
3. Propeller levers - HIGH RPM.

a. Normal. Landing. As the aircraft nears the runway, flare slightly to break the rate or descent and reduce power smoothly to idle as the nose. of the aircraft is rotated to landing attitude. Avoid the tendency to ride the ground effect cushion while waiting for the aircraft to slow down to a soft landing. As the aircraft touches down, gently lower the nosewheel to the runway and use reversing, brakes, or beta range, as required. If reversing is used, remove reverse power as the aircraft slows to 40 KIAS to minimize propeller blade erosion.

b. Crosswind Landing. Refer to Chapter 7 for recommended V_{ref} speeds. Use the "crab-into-the wind" method to correct for drift during final approach. The "crab" is changed to a slip (aileron into wind and top rudder) to correct for drift during flare and touchdown. After landing, position ailerons as required to correct for crosswind effect. For crosswind exceeding the published limits, a combination "slip and crab" method at touchdown should be used.

c. Soft Field Landing. When landing on a soft unprepared surface such as mud, tall grass, or snow, plan a normal power approach with flaps fully extended. Decelerate to the slowest possible airspeed just prior to touchdown, using power to control the final rate of descent to as slow as possible. Do not stall prior to touchdown as the nose attitude and rate of descent will become unacceptable. On touchdown apply full back (aft) elevator and then reduce power slowly. Do not use brakes unless absolutely necessary. Every precaution must be taken to prevent the nose wheel from digging into the surface.

d. Touch-and-Go Landings. The instructor should select a point on the runway where all pretakeoff procedures will have been completed prior to the pilot's initial application of power. In selecting this point, prime consideration shall be given to the required accelerate-stop distance pre-computed for the runway in use. The nosewheel should be on the runway and rolling straight before the touch-and-go procedures are initiated. After the pilot applies power to within 5 percent of target, the copilot's (instructor's) actions are the same as during a normal takeoff. If touch-and-go landings are approved for training purposes use the following procedure:

1. Propeller levers - HIGH RPM.
2. Flaps - As required.
3. Trim - Set.
4. Power stabilized - Check approximately 25% minimum.
5. Takeoff power - Set.

8-50. GO-AROUND.

When a go-around is commenced prior to the LANDING check, use power as required to climb to, or maintain, the desired altitude and airspeed. If the go-around is started after the LANDING check has been performed, apply maximum allowable power and simultaneously increase pitch attitude to stop the descent. Retract the landing gear after insuring that the aircraft will not touch the ground. Retract the flaps to APPROACH, adjusting pitch attitude simultaneously to avoid an altitude loss. Accelerate to best rate-of-climb airspeed (Vy) retracting flaps fully after attaining the V_{ref} speed used for the approach. Perform the following:

1. Power - As required.
2. Gear - UP.
3. Flaps - UP.
4. Landing lights - OFF.
5. Climb power - Set.

6. Yaw damp - As required.

7. Brake deice-OFF.

8-51. AFTER LANDING.

Complete the following procedures after the aircraft has cleared the runway:

1. CONDITION levers - As required.
2. Engine autoignition switch - OFF.
3. Ice & rain switches - OFF.
4. Flaps - UP.
5. Transponder - As required.
6. Radar - As required.
7. Lights - As required.
8. Mission control panel - Set.

8-52. ENGINE SHUTDOWN.

CAUTION

To prevent sustained loads on rudder shock links, the aircraft should be parked with the nose gear centered.

1. Brake deice - OFF.
2. Parking brake - Set.
3. Landing/taxi lights - OFF.
4. Cabin temperature mode selector switch - OFF.
5. Autofeather switch - OFF.
6. Vent and aft vent blower switches - AUTO.
7. INS - OFF.
8. Mission equipment - OFF, as required.
9. Inverter switches - OFF.
10. Battery condition - Check as required.
11. TGT - Check. TGT must be 660°C or below for one minute prior to shutdown.

CAUTION

Monitor TGT during shutdown. If sustained combustion is observed, proceed immediately to ABORT START procedure.

12. Propeller levers - FEATHER.
13. CONDITION levers - FUEL CUTOFF.

WARNING

Do not turn exterior lights off until propeller's rotation has stopped.

14. Exterior lights - OFF.
15. Master panel lights switch - OFF.
16. Avionics master switch - Off.
17. Master switch - OFF. -
18. Keylock switch - OFF.
19. Oxygen system - OFF.

8-53. BEFORE LEAVING AIRCRAFT.

1. Wheels - Chocked.
2. Parking brake - As required.

NOTE

Brakes should be released after chocks are in place (ramp conditions permitting).

3. Flight controls - Locked.
4. Overhead flood lights - Off.
5. Standby fuel pump switches - OFF.
6. Transponder - OFF.
7. Mode 4 - As required.
8. KY-28/58 - Zeroize as required.
9. Emergency exit lock - As required.
10. Aft cabin light - OFF.
11. Door light - OFF.

CAUTION

If strong winds are anticipated while the aircraft is unattended, the propellers shall be secured to prevent their windmilling with zero engine oil pressure.

12. Walk-around inspection - Complete. Conduct a thorough walk-around inspection. Checking for damage, fluid leaks. and levels. Check that covers, tiedowns. restraints.

safety pins and chocks are installed as required.

NOTE

A cold oil check is unreliable. Oil should be checked within 10 minutes after stop ping engine.

13. Aircraft forms - Complete. In addition to established requirements for reporting any system defects, unusual and excessive operation such as hard landings, etc., the flight crew will also make entries on DA Form 2408-13 to indicate when limits in the Operator's Manual have been exceeded.

14. Aircraft - Secured. Lock cabin door as required.

Section III. INSTRUMENT FLIGHT

8-54. GENERAL.

This aircraft is qualified for operation in instrument meteorological conditions. Flight handling, stability characteristics and range are approximately the same during instrument flight conditions as when under visual flight conditions.

8-55. INSTRUMENT FLIGHT PROCEDURES.

Refer to FM 1-5, FM 1-230; FLIP; AR 95-1; FC 1-2 18; or applicable foreign government regulations, and procedures described in this manual.

8-56. INSTRUMENT TAKEOFF.

Complete the BEFORE TAKEOFF check. Engage the heading (HDG) mode on the autopilot computer/control (do not engage autopilot). Set heading marker (HDG) to runway heading and align the aircraft with the runway centerline, insuring that nosewheel is straight before stopping aircraft. Hold brakes and complete the LINEUP check. Insure that the roll steering bar is centered. Power application and copilot duties are identical to those prescribed for a "visual" takeoff. After the brakes are released, initial directional control should be accomplished predominantly with the aid of outside visual references. As the takeoff progresses, the crosscheck should transition from outside references to the flight director and airspeed indicator. The rate of transition is directly proportional to the rate at which the outside references deteriorate. Approaching rotation speed (V,), the crosscheck should be totally committed to the instruments so that erroneous sensory inputs can be ignored. At rotation speed, establish takeoff attitude on the flight director. Maintain this pitch attitude and wings-level attitude until the aircraft becomes airborne. When both the vertical-velocity indicator and altimeter show positive climb indications, retract the landing gear. After the landing gear is retracted, adjust the pitch attitude as required to attain best rate-of-climb airspeed (V,). Use PITCH-SYNC as required to reposition the flight director pitch steering bar. Retract flaps after attaining best single-engine rate-of-climb speed (V yse), and re-adjust pitch as required. Control bank attitude to maintain the desired heading. Support flight director indications throughout the maneuver by crosschecking "raw data" information displayed on supporting instruments.

NOTE

Due to possible precession error, the pitch steering bar may lower slightly during acceleration, causing the pitch attitude to appear higher than actual pitch attitude. To avoid lowering the nose prematurely, crosscheck the vertical-velocity indicator and altimeter to insure proper climb performance. The erection system will automatically remove the error after the acceleration ceases.

8-57. INSTRUMENT CLIMB.

Instrument climb procedures are the same as those for visual climb. Enroute instrument climbs are normally performed at cruise climb airspeeds.

8-58. INSTRUMENT CRUISE.

There are no unusual flight characteristics during cruise in instrument meteorological conditions.

8-59. INSTRUMENT DESCENT.

When a descent at slower than recommended speed is desired, slow the aircraft to the desired speed before initiating the descent. Normal descent to approach altitude can be made using cruise airspeed. Normally, descent will be made with the aircraft in a cruise configuration, maintaining desired speed as required.

8-60. INSTRUMENT APPROACHES.

There are no unusual preparations or control techniques required for instrument approaches. The approaches are normally flown at an airspeed of V ref +20 until transitioning to visual flight.

8-61. AUTOPILOT APPROACHES.

There are no special preparations required for placing the aircraft under autopilot control. Refer to Chapter 3 for procedures to be followed for automatic approaches.

NOTE

The ILS localizer and glideslope warning flags indicate insufficient signal strength to the receiver. Certain electrical mechanical malfunctions between the receiver and indicators may result in erroneous localizer/glideslope information without a warning flag. It is recommended that ILS information be crosschecked with other flight instruments prior to and during final approach. Utilization of NAV TEST on VOR control prior to the final approach fix may detect certain malfunctions not indicated by the warning flags.

Section III. FLIGHT CHARACTERISTICS

8-62. STALLS.

A prestall warning in the form of very light buffeting can be felt when a stall is approached. An aural warning is provided by a warning horn. The warning horn starts sounding approximately five to ten knots above stall speed with the aircraft in any configuration. If correct stall recovery technique is used, very little altitude will be lost during the stall recovery. For the purpose of this section, the term "power-on" shall mean that both engines and propellers of the aircraft are operating normally and power is set at approximately 50%. The term "power-off" shall mean that both engines are operating at idle power. Landing gear position has no effect on stall speed. During practice, enter power-off stalls from normal glides. Enter power-on stalls by smoothly increasing pitch attitude to decrease airspeed by approximately one knot per second until stall occurs.

a. Power-On Stalls. The power-on stall attitude is very steep and unless this high-pitch attitude is maintained, the aircraft will generally “settle“ or “mush“ instead of stall. It is difficult to stall the aircraft inadvertently in any normal maneuver. A light buffet precedes most stalls, and the first indication of approaching stall is generally a decrease in control effectiveness, accompanied by a “chirping“ tone from the stall warning horn. The stall itself is characterized by a rolling tendency to the right, if the aircraft is allowed to yaw. The proper use of rudder will prevent the tendency to roll. A slight pitching tendency will develop if the aircraft is held in the stall, resulting in the nose dropping sharply, then pitching up toward the horizon; this cycle is repeated until recovery is made. Control is regained very quickly with little altitude loss, providing the nose is not lowered excessively. Begin recovery with forward movement of the control wheel and a gradual return to level flight. The roll tendency caused by yaw is more pronounced in power-on stalls, as is the pitching tendency; however, both are easily controlled after the initial entry. Power-on stall characteristics are not greatly affected by wing flap position, except that stalling speed is reduced in proportion to the degree of wing flap extension.

b. Power-Off Stalls. Power-off stalls are characterized by a right rolling tendency, as the stall is approached. Elevator control is effective to the stop and the pitch attitude can be maintained with a deceleration rate of 1 knot/sec. Light to moderate buffet commences approximately 5 - 8 knots above the stall and the warning horn will sound and continue to the stall. With wing flaps down, the right rolling tendency is more pronounced and stalling speed is much slower than with the wing flaps up. The Stall Speed Chart (fig. 8-2) shows the indicated power-off stall speeds with the aircraft in various configurations. Altitude loss during a full stall will be approximately 800 feet.

c. Accelerated Stalls. The aircraft gives noticeable stall warning in the form of buffeting when the stall occurs. The stall warning and buffet can be demonstrated in turns by applying excessive back pressure on the control wheel.

8-63. SPINS.

Intentional spins are prohibited. If a spin is inadvertently entered use the following recovery procedure:

STALL SPEEDS – POWER IDLE

NOTES:

1. MAXIMUM ALTITUDE LOSS EXPERIENCED WHILE CONDUCTING STALLS IN ACCORDANCE WITH FAR 23.201 WAS 1000 FEET.
2. MAXIMUM NOSE-DOWN PITCH ATTITUDE AND ALTITUDE LOSS DURING RECOVERY FROM ONE-ENGINE-INOPERATIVE STALLS PER FAR 23.205 ARE APPROXIMATELY 18° AND 800 FEET RESPECTIVELY.
3. A NORMAL STALL RECOVERY TECHNIQUE MAY BE USED. THE BEST PROCEDURE IS A BRISK FORWARD WHEEL MOVEMENT TO A NOSE-DOWN ATTITUDE. LEVEL THE AIRCRAFT AFTER AIRSPEED HAS INCREASED APPROXIMATELY 25 KNOTS ABOVE STALL.
4. LANDING GEAR POSITION HAS NO EFFECT ON STALL SPEED.

EXAMPLE:

WEIGHT .... 10,000 LBS
FLAPS 100%
ANGLE OF BANK .... 20°

STALL SPEEDS .... 71 KIAS
69 KCAS

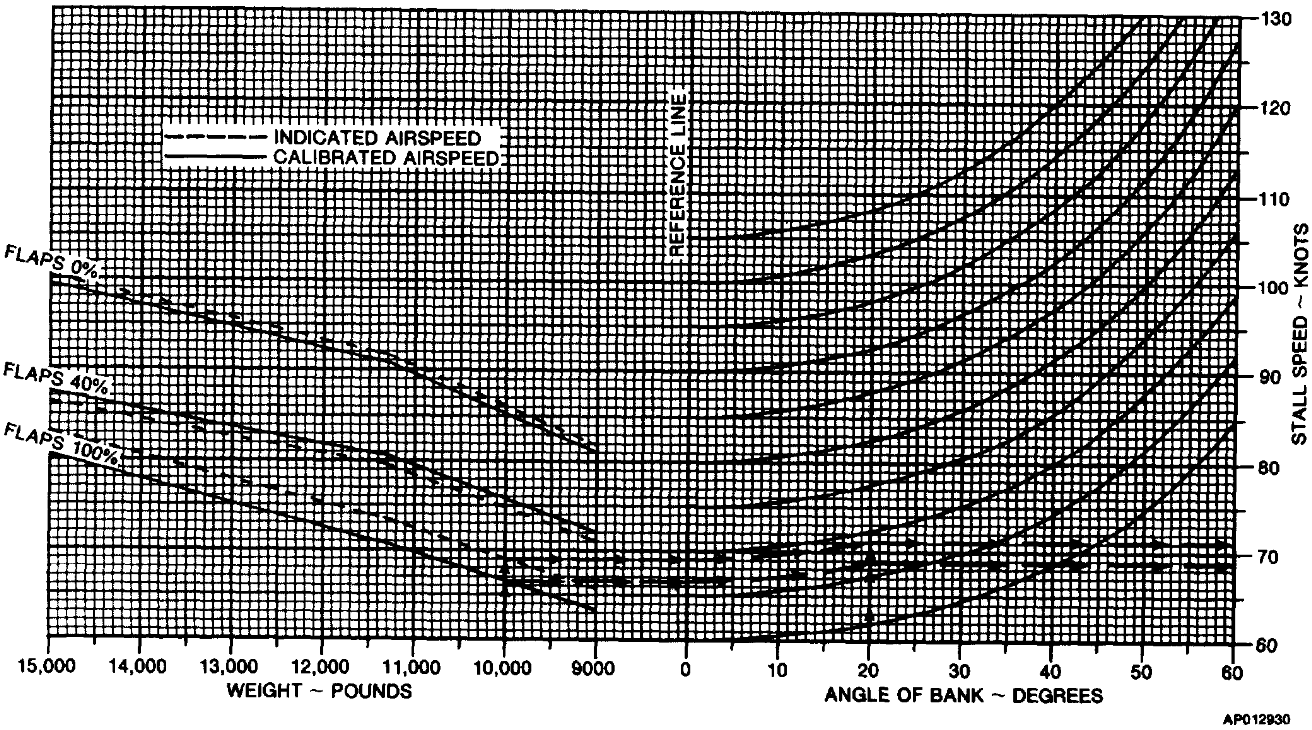


Figure 8-2. Stall Speed

NOTE

Spin demonstrations have not been conducted. The recovery technique is based on the best available information. The first three actions should be accomplished as nearly simultaneous as possible.

1. POWER levers - IDLE.
2. Apply full rudder opposite the direction of spin rotation.
3. Simultaneously with rudder application, push the control wheel forward and neutralize ailerons.
4. When rotation stops, neutralize rudder.

CAUTION

Do not pull out of the resulting dive too abruptly as this could cause excessive wing loads and a possible secondary stall.

5. Pull out of dive by exerting a smooth, steady back pressure on the control wheel, avoiding an accelerated stall and excessive aircraft stresses.

8-64. DIVING.

Maximum diving airspeed (red line) is 243 KIAS or 0.47 Mach. Flight characteristics are conventional throughout a dive maneuver; however, caution should be used if rough air is encountered after maximum allowable dive speed has been reached, since it is difficult to reduce speed in dive configuration. Dive recovery should be very gentle to avoid excessive aircraft stresses.

8-65. MANEUVERING FLIGHT.

Maneuvering speed (V,), 168 KIAS), is the maximum speed that abrupt control movements can be applied without exceeding the design load factor of the aircraft. The data is based on 15,000 pounds.

8-66. FLIGHT CONTROLS.

The aircraft is stable under all normal flight conditions. Aileron, elevator, rudder and trim tab controls function effectively throughout all normal flight conditions. Elevator control forces are relatively light in the extreme aft CG (center of gravity) condition, progressing to moderately high with CG at the forward limit. Extending and retracting the landing gear causes only slight changes in control pressure. Control pressures, resulting from changes in power settings or the repositioning of the wing flaps are not excessive in the landing configuration at the most forward CG position. The minimum speed at which the aircraft can be fully trimmed is 89 KIAS (gear and flaps down, propellers at high RPM, and 15,000 pounds power for a 3° angle of descent. Control forces produced by changes in speed, power setting, wing flap position and landing gear position are light and can be overcome with one hand on the control wheel. Trim tabs permit the pilot to reduce these forces to zero. During single engine operation, the rudder boost system aids in relieving the relatively high rudder pressures resulting from the large variation in power.

8-67. LEVEL FLIGHT CHARACTERISTICS.

All flight characteristics are conventional throughout the level flight speed range.

Section V. ADVERSE ENVIRONMENTAL CONDITIONS

8-68. INTRODUCTION.

The purpose of this part is to inform the pilot of the special precautions and procedures to be followed during the various weather conditions that may be encountered in flight. This part is primarily narrative, only those checklists that cover specific procedures characteristic of weather operations are included. The checklist in Section II provides for adverse environmental operations.

8-69. COLD WEATHER OPERATIONS.

CAUTION

Operation of the surface deice system in ambient temperatures below -40°C can cause permanent damage to the deice boots. Operational diffIculties may be encountered during extremely cold weather, unless proper steps are taken prior to or immediately after flight. All personnel should understand and be fully aware of the necessary procedures and precautions involved.

a. Preparation For Flight. Accumulations of snow, ice, or frost on aircraft surfaces will adversely affect takeoff distance, climb performance and stall speeds to a dangerous degree. Such accumulations must be removed before flight. In addition to the normal exterior checks, following the removal of ice, snow, or frost, inspect wing and empennage surfaces to verify that these remain sufficiently cleared. Also, move all control surfaces to confirm full freedom of movement. Assure that tires are not frozen to wheel chocks or to the ground. Use ground heaters, anti-ice solution, or brake deice, to free frozen tires. When heat is applied to release tires, the temperature should not exceed 71 °C (160°F). Refer to Chapter 2 for anti-icing, deicing, and defrosting treatment.

b. Engine Starting. When starting engines on ramps covered with ice, propeller levers should be in the FEATHER position to prevent the tires from sliding. To prevent exceeding torque limits when advancing CONDITION levers to HIGH IDLE during the starting procedure, place the power lever in BETA and the propeller lever in HIGH RPM before advancing the condition lever to HI IDLE.

c. Warm-Up and Ground Test. Warm-up procedures and ground test are the same as those outlined in Section II.

d. Taxiing. Whenever possible, taxiing in deep snow, light weight dry snow or slush should be avoided, particularly in colder OAT conditions. If it is necessary to taxi through snow or slush, do not set the parking brake when stopped. If possible, do not park the aircraft in snow or slush deep enough to reach the brake assemblies. Chocks or sandbags should be used to prevent the aircraft from rolling while parked. Before attempting to taxi, activate the brake deice system, insuring that the bleed air valves are OPEN and that the condition levers are in HI IDLE. An outside observer should visually check wheel rotation to insure brake assemblies have been deiced. The condition levers may be returned to LOW IDLE as soon as the brakes are free of ice.

e. Before Takeoff.

(1.) If icing conditions are expected, activate all anti-ice systems before takeoff, allowing sufficient time for the equipment to become effective.

(2.) If the possibility of ice accumulation on the horizontal stabilizer or elevator exists, takeoff will not be attempted. If icing conditions are expected, activate all anti-ice systems before takeoff, allowing sufficient time for the equipment to become effective.

f. Takeoff. Takeoff procedures for cold weather operations are the same as for normal takeoff. Taking off with temperatures at or below freezing, with water, slush or snow on the runway, can cause ice to accumulate on the landing gear and can throw ice into the wheel well areas. Such takeoffs shall be made with brake deice on and with the ice vanes extended to preclude the possibility of ice build-up on engine air inlets. Monitor oil temperatures to insure operation within limits. Before flight into icing conditions, the pilot and copilot WSHLD ANTI-ICE switches should be set at NORMAL position.

g. During Flight.

(1.) Brake deice. After takeoff from a runway covered with snow or slush, it may be advisable to leave brake deice ON to dislodge ice accumulated from the spray of slush or water. Monitor BRAKE DE-ICE annunciator for automatic termination of system operation and then turn the switch OFF.

(2.) Flight controls. During flight, trim tabs and controls should also be exercised periodically to prevent freezing.

(3.) Anti-icing equipment. Insure that anti-icing systems are activated before entering icing conditions. Do not activate the surface deice system until ice has accumulated one-half to one inch. The propeller deice system operates effectively as an anti-ice system and it may be operated continuously in flight. If propeller imbalance due to ice does occur, it may be relieved by increasing RPM briefly, then returning to desired setting.

NOTE

Do not operate deicer boots continuously. Continuous operation tends to balloon the ice over the boots. Allow at least 1/2 inch of ice to accumulate on the surface boots and 1/8 to 1/4 inch of ice to accumulate on the antenna boots, then activate the deicer boots to remove the ice. Repeat this procedure as required.

(4.) Ice vanes. Ice vanes must be extended when operating in visible moisture or when freedom from visible moisture cannot be assured, at 5°C OAT or less. Ice vanes are designed as an anti-ice system, not a deice system. After the engine air inlet screens are blocked, lowering the ice vanes will not rectify the condition. Ice vanes should be retracted at 15°C OAT and above to assure adequate engine oil cooling.

(5.) *Stall speeds.* Stalling airspeeds should be expected to increase when ice has accumulated on the aircraft causing distortion of the wing airfoil. For the same reason, stall warning devices are not accurate and should not be relied upon. Keep a comfortable margin of airspeed above the normal stall airspeed. Maintain a minimum of 140 KIAS during sustained icing conditions to prevent ice accumulation on unprotected surfaces of the wing. In the event of windshield icing, reduce airspeed to 226 KIAS or below.

h. Descent. Use normal procedures in Section II. Brake icing should be considered if moisture was encountered during previous ground operations or inflight in icing conditions with gear extended.

i. Landing. Landing on an icy runway should be attempted only when absolutely necessary and should not be attempted unless the wind is within 10 degrees of runway heading. Application of brakes without skidding the tires on ice is very difficult, due to the sensitive brakes. In order not to impair pilot visibility, reverse thrust should be used with caution when landing on a runway covered with snow or standing water. Use the procedures in Section II for normal landing.

j. *Engine Shutdown.* Use normal procedures in Section II.

k. Before Leaving the Aircraft. When the aircraft is parked outside on ice or in a fluctuating freeze-thaw temperature condition the following procedures should be followed in addition to the normal procedures in Section II. After wheel chocks are in place, release the brakes to prevent freezing. Fill fuel tanks to minimize condensation, remove any accumulation of dirt and ice from the landing gear shock struts, and install protective covers to guard against possible collection of snow and ice.

8-70. DESERT OPERATION AND HOT WEATHER OPERATION.

Dust, sand, and high temperatures encountered during desert operation can sharply reduce the operational life of the aircraft and its equipment. The abrasive qualities of dust and sand upon turbine blades and moving parts of the aircraft and the destructive effect of heat upon the aircraft instruments will necessitate hours of maintenance if basic preventive measures are not followed. In flight, the hazards of dust and sand will be difficult to escape, since dust clouds over a desert may be found at altitudes up to 10,000 feet. During hot weather operations, the principle difficulties encountered are high turbine gas temperatures (TGT) during engine starting, over-heating of brakes, and longer takeoff and landing rolls due to the higher density altitudes. In areas where high humidity is encountered, electrical equipment (such as communication equipment and instruments) will be subject to malfunction by corrosion, fungi and moisture absorption by nonmetallic materials.

a. Preparation For Flight. Check the position of the aircraft in relation to other aircraft. Propeller sand blast can damage closely parked aircraft. Check that the landing gear shock struts are free of dust and sand. Check instrument panel and general interior for dust and sand accumulation. Open main entrance door and cockpit vent storm windows to ventilate the aircraft.

CAUTION

N1 speeds of 70% or higher may be required to keep oil temperature within limits.

b. Engine Starting. Use normal procedures in Section II. Engine starting under conditions of high ambient temperatures may produce a higher than normal TGT during the start. The TGT should be closely monitored when the condition lever is moved to the LO IDLE position. If overtemperature tendencies are encountered, the condition lever should be moved to the IDLE CUTOFF position periodically during acceleration of gas generator RPM (N1). Be prepared to abort the start before temperature limitations are exceeded.

c. Warm-Up Ground Tests. Use normal procedures in Section II. To minimize the possibility of damage to the engines during dusty/sandy conditlons. activate ICE VANES if the temperature is below 15°C.

d. Taxing. Use normal procedures in Section II. When practical. avoid taxiing over sandy terrain to minimize propeller damage and engine deterioration that results from Impingement of sand and gravel. During hot weather operation. use minimum braking action to prevent overheating.

e. Takeoff Use normal procedures in Section II. Avoid taking off in the wake of another alrcraft of the runway surface is sandy or dusty.

f. During Flight. Use normal procedures in Section II.

g. Descent. Use normal procedures in Section II.

h. Landing. Use normal procedures in Section II.

i. Engine Shutdown. Use normal procedures in Section II.

CAUTION

During hot weather. if fuel tanks are completely filled. fuel expansion may cause overflow, thereby creating a fire hazard.

j. *Before Leaving Aircraft.* Use normal procedures in Section II. Take extreme care to prevent sand or dust from entering the fuel and oil system during servicing. During hot weather. release the brake immediately after installing wheel chocks to prevent brake disc warpage.

8-71. TURBULENCE AND THUNDERSTORM OPERATION.

CAUTION

Due to the comparatively light wing loading, control in severe turbulence and thunderstorms is critical. Since turbulence imposes heavy loads on the aircraft structure. make all necessary changes in aircraft attitude with the least amount of control pressures to avoid excessive loads on the aircraft's structure.

Thunderstorms and areas of severe turbulence should be avoided. If such areas are to be penetrated. it will be necessary to counter rapid changes in attitude and accept major Indicated altitude variations. Penetration should be of an altitude which provides adequate maneuvering margins as a loss or gain of several thousand feet of altitude may be expected. The recommended penetration speed in severe turbulence is 158 KIAS. Pitch attitude and constant power settings are vital to proper flight technique. Establish recommended penetration speed and proper attitude prior to entering turbulent air to minimize most difficulties. False Indications by the pressure Instruments due to barometric pressure variations within the storm make them unreliable. Maintaining a pre-established attitude will result in a fairly constant airspeed. Turn cockpit and cabin lights on to minimize the blinding effects of lighting. Do not use autopilot altitude hold. Maintaln constant power settings and pitch attitude regardless of airspeed or altitude indications. Concentrate on maintaining a level attitude by reference to the Flight Director/Attitude Indicator. Maintain original heading. Maker no turns unless absolutely necessary.

8-72. ICE AND RAIN (TYPICAL).

WARNING

While in icing conditions. if there is an unexplained 30% increase of torque needed to maintain airspeed in level flight, a cumulative total of two or more inches of ice accumulation on the wing, an unexplained decrease of 15 knots IAS. or an unexplained deviation between pilot's and copilot's airspeed indicators, the icing environment should be exited as soon as practicable. Ice accumulation on the pitot tube assemblies could cause a complete loss of airspeed indication.

The following conditions indicate a possible accumulation of ice on the pitot tube assemblies and unprotected alrplane surfaces. if any of these conditions are observed. the icing environment should be exited as soon as practicable.

(1) Total ice accumulation of two inches or more on the wing surfaces. Determination of ice thickness can be accomplished by summing the estimated ice thickness on the wing prior to each pneumatic boot deice cycle (e.g. four cycles of minimum recommended 1/2-inch accumulation.

(2) A 30 percent Increase in torque per engine required to maintain a desired airspeed in level flight (not to exceed 85 percent torque) when operating at recommended holding/loiter speed.

(3) A decrease in Indicated airspeed of 15 knots after entering the icing condition (not slower than 1.4 power off stall speed) if maintaining original power setting in level flight. This can be determined by comparing pre-

icing condition entry speed to the indicated speed after a surface and antenna deice cycle is completed.

(4) Any variations from normal indicated airspeed between the pilot's and copilot's airspeed indicators.

a. Typical Ice. Icing occurs because of supercooled water vapor such as fog, clouds or rain. The most severe icing occurs on aircraft surfaces in visible moisture or precipitation with a true outside air temperature between -5°C and +1°C; however, under some circumstances. dangerous icing conditions may be encountered with temperatures below -10°C. The surface of the aircraft must be at a temperature of freezing or below for it to stick. If severe icing conditions are encountered, ascend or descend to altitudes where these conditions do not prevail. If flight into icing conditions is unavoidable, proper use of aircraft anti-icing and deicing systems may minimize the problems encountered. Approximately 15 minutes prior to flight into temperature conditions which could produce frost or icing conditions, the pilot and co-pilot windshield anti-ice switches should be set at normal or high temperature position (after preheating) as necessary to eliminate windshield ice. Stalling airspeeds should be expected to increase when ice has accumulated on the aircraft causing distortion of the wing airfoil. For the same reason. stall warning devices are not accurate and should not be relied upon. Keep a comfortable margin of airspeed above the normal stall airspeed with ice on the aircraft. Maintain a minimum of 140 knots during sustained icing conditions to prevent ice accumulation on unprotected surfaces of the wing. In the event of windshield icing, reduce airspeed to 226 knots or below.

b. Rain. Rain presents no particular problems other than restricted visibility and occasional incorrect airspeed indications.

c. Taxiing. Extreme care must be exercised when taxiing on ice or slippery runways. Excessive use of either brakes or power may result in an uncontrollable skid.

d. Takeoff. Extreme care must be exercised during takeoff from ice or slippery runways. Excessive use of either brakes or power may result in an uncontrollable skid.

e. *Climb.* Keep aircraft attitude as flat as possible and climb with higher airspeed than usual, so that the lower surfaces of the aircraft will not be iced by flight at a high angle of attack.

f. Cruise Flight.

(1) Prevention of ice formation. Prevention of ice formation is far more effective and satisfactory than attempts to dislodge the ice after it has formed. If icing conditions are inadvertently encountered, turn on the anti-icing systems prior to the first sign of ice formation.

(2) *Deicer boots.* Do not operate deicer boots continuously. Allow at least one-half inch of ice on the boots before activating the deicer boots to remove the ice. Continued flight in severe icing conditions should not be attempted. If ice forms on the wing area aft of the deicer boots, climb or descend to an altitude where conditions are less severe.

g. Landing. Extreme care must be exercised when landing on ice or slippery runways. Excessive use of either brakes or power may result in an uncontrollable skid. Ice accumulation on the aircraft will result in higher stalling airspeeds due to the change in aerodynamic characteristics and increased weight of the aircraft due to ice buildup. Approach and landing airspeeds must be increased accordingly.

NOTE

When operating on wet or icy runways, refer to stopping distance factors shown in Chapter 7.

8-72A. ICING (SEVERE).

a. The following weather conditions may be conducive to severe in-flight icing:

(1) Visible rain at temperatures below zero degrees Celsius ambient air temperature.

(2) Droplets that splash or splatter on impact at temperatures below zero degrees Celsius ambient air temperature.

b. The following procedures for exiting a severe icing environment are applicable to all flight phases from takeoff to landing.

(1) Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18 degrees Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present.

(2) Upon observing the visual cues specified in the limitations section of the airplane flight manual (Military Operations Manual) for the identification of severe icing conditions (reference paragraph 5-30B.), accomplish the following:

(a) Immediately request priority handling from air traffic control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid

extended exposure to flight conditions more severe than those for which the airplane has been certificated.

(b) Avoid abrupt and excessive maneuvering that may exacerbate control difficulties

(c) Do not engage the autopilot.

(d) If the autopilot is engaged. hold the control wheel firmly and disengage the autopilot.

(e) If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.

(f) Do not cxtend flaps during extended operation in icing conditions. Operations with flaps extended can result in a reduced angle-of-attack. with the possibility of ice forming on the upper surface further aft on the wing than normal. possibly aft of the protected area.

(g) If the flaps are extended. do not retract them until the airframe is clear of ice.

(h) Report these weather conditions to air traffic control.

Section VI. CREW DUTIES

* 8-73. CREW BRIEFING.

The following guide should be used in accomplishinp required passenger briefings. Items that do not pertain to a specific mission may be omitted.

a. Crew introduction.

b. Equipment.

1. Personal, to include ID tags.
2. Professional (medical equipment. etc.).
3. Survival.

c. Flight data.

1. Route.
2. Altitude.
3. Time enroute.
4. Weather.

d. Normal procedures.

1. Entry and exit of aircraft.
2. Seating and seat position.
3. Seat belts.
4. Movement in aircraft.
5. Internal communications.
6. Security of equipment.
7. Smoking
8. Oxygen.
9. Refueling.
10. Weapons and prohibited items.
11. Protective masks.
12. Toilet

e. Emergency procedures.

1. Emergency exits.
2. Emergency equipment
3. Emergency landing/ditching procedures.

* 8-74. DEPARTURE BRIEFING.

The following is a guide that should be used as applicable in accomplishing the required crew briefing prior to takeoff. However. if the crew has operated together previously and the pilot is certain that the copilot understands all items of the briefing. he may omit the briefing by stating “standard briefing.” when the briefing is called for during the BEFORE TAKEOFF CHECK.

a. ATC clearance - Review.

1. Routing

2. Initial altitude.

b. Departure procedure - Review.

1. SID.
2. Noise abatement procedure.
3. VFR departure route.

c. Copilot duties - Review.

1. Adjust takeoff power.
2. Monitor engine instruments.
3. Power check at 65 KIAS.
4. Call out engine malfunctions.
5. Tune/ident all nav/com radios.
6. Make all radio calls.
7. Adjust transponder and radar as required.
8. Complete flight log during flight (note altitudes and headings).
9. Note departure time.

d. PPC - Review.

1. Takeoff power.
2. V_r
3. V_y (climb to 500' AGL).
4. V_{yse}

8-75. ARRIVAL BRIEFING.

The following is a guide that should be used as applicable in accomplishing the required crew briefing prior to landing; however, if the crew has operated together previously and the pilot is certain that the copilot understands all items of the briefing, he may omit the briefing by stating "standard briefing," when the briefing is called for during the DESCENT-ARRIVAL check.

a. Weather/altimeter setting.

b. Airfield/facilities - Review.

2. 1. Field elevation.
2. Runway length.
3. Runway condition.

c. Approach procedure - Review.

1. Approach plan/profile.
2. Altitude restrictions.
3. Missed approach.
   a. Point.
   b. Time.
   c. Intentions.
4. Decision height or MDA.
5. Lost communications.

d. Back up approach/frequencies.

e. Copilot duties - Review.

1. Nav/Com set-up.
2. Monitor altitude and airspeeds.
3. Monitor approach.
4. Call out visual/field in sight.

f. Landing performance data - Review.

1. Approach speed.
2. Runway required.

CHAPTER 9

EMERGENCY PROCEDURES

Section I. AIRCRAFT SYSTEMS

9-1. AIRCRAFT SYSTEMS.

This section describes the aircraft systems emergencies that may reasonably be expected to occur and presents the procedures to be followed. Emergency procedures are given in checklist form when applicable. A condensed version of these procedures is in the Operator's and Crewmember's Checklist, TM 55-1510-221-CL. Emergency operations of avionics equipment are covered when appropriate in Chapter 3, Avionics, and are repeated in this section only as safety of flight is affected.

9-2. IMMEDIATE ACTION EMERGENCY CHECKS.

Immediate action emergency items are underlined for your reference and shall be committed to memory. During an emergency, the checklist will be called for to verify the memory steps performed and to assist in completing any additional emergency procedures.

NOTE

The urgency of certain emergencies requires immediate action by the pilot. The most important single consideration is aircraft control. All procedures are subordinate to this requirement. Reset MASTER CAUTION after each malfunction to allow systems to respond to subsequent malfunctions.

9-3. DEFINITION OF LANDING TERMS.

The term LANDING IMMEDIATELY is defined as executing a landing without delay. (The primary consideration is to assure the survival of occupants.) The term LAND AS SOON AS POSSIBLE is defined as executing a landing at the nearest suitable landing area without delay. The term LAND AS SOON AS PRACTICABLE is defined as executing a landing to the nearest suitable airfield.

9-4. AFTER EMERGENCY ACTION.

After a malfunction has occurred, appropriate emergency actions have been taken, and the aircraft is on the ground, an entry shall be made in the remarks section of DA Form 2408-13 describing the malfunction.

9-5. EMERGENCY EXITS AND EQUIPMENT.

Emergency exits and equipment are shown in figure 9-1.

9-6. EMERGENCY ENTRANCE.

Entry may be made through the cabin emergency hatch. The hatch may be released by pulling on its flush-mounted pull-out handle, placarded EMERGENCY EXIT - PULL HANDLE TO RELEASE. The hatch is of the nonhinged plug type which removes completely from the frame when the latches are released. After the latches are released, the hatch may be pushed in.

9-7. ENGINE MALFUNCTION.

a. Flight Characteristics Under Partial Power Conditions. There are no unusual flight characteristics during single-engine operation as long as airspeed is maintained at or above minimum control speed (V,,) and above power-off stall speed. The capability of the aircraft to climb or maintain level flight depends on configuration, gross weight, altitude, and outside air temperature. Performance and control will improve by feathering the propeller of the inoperative engine, retracting the landing gear and flaps, and establishing the appropriate single-engine best rate-of-climb speed (V_{yse}). Minimum control speed (V,,) with flaps retracted is approximately 1 knot higher than with flaps at takeoff (40%) position.

b. Engine Malfunction During And After Takeoff. The action to be taken in the event of an engine malfunction during takeoff depends on whether or not liftoff speed ($V_{1of)}$ has been attained. If an engine fails immediately after liftoff, many variables such as airspeed, runway remaining, air-

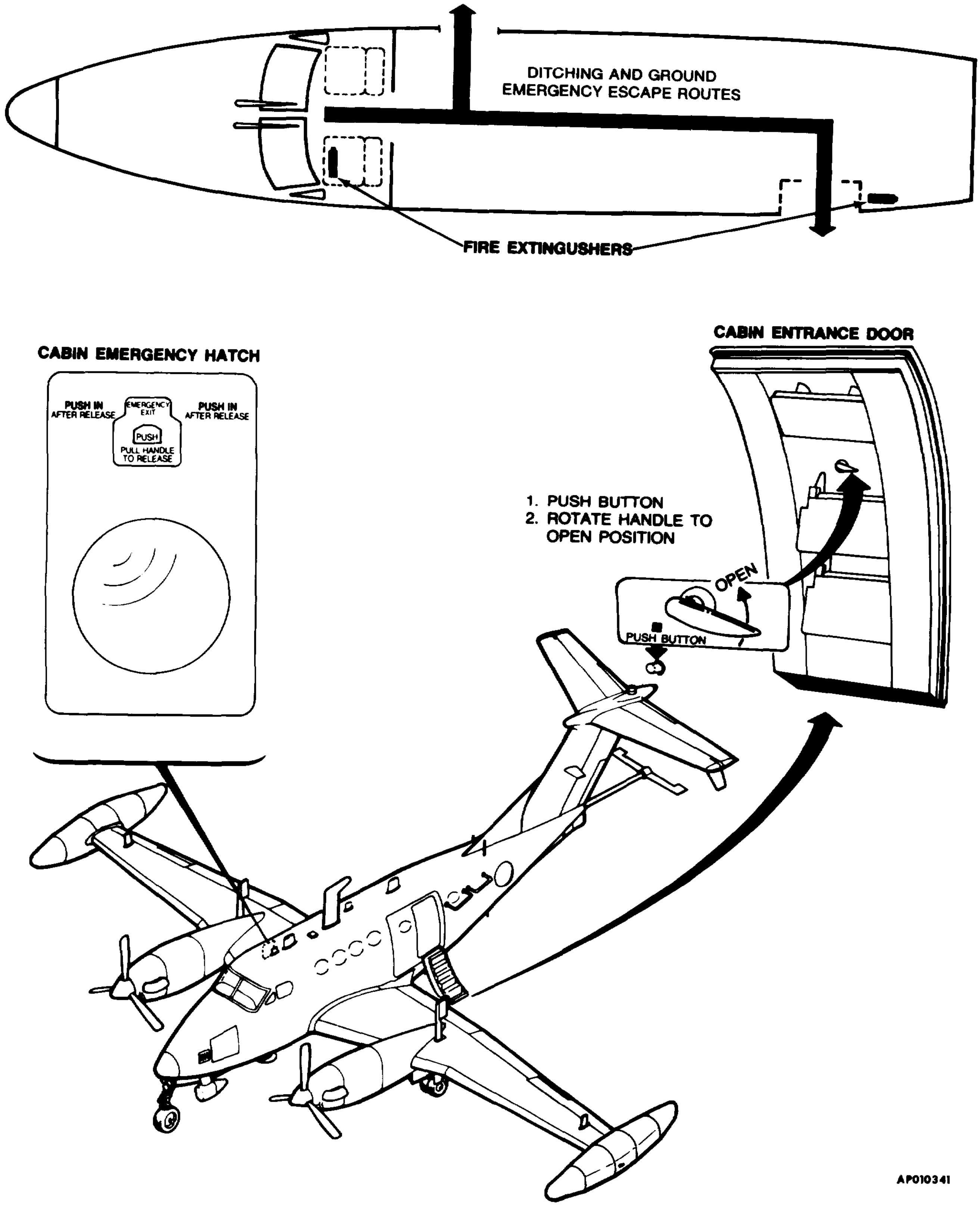


Figure 9-1. Emergency Exits and Equipment

craft weight, altitude at time of engine failure, and single-engine performance must be considered in deciding whether it is safer to land or continue flight.

c. Engine Malfunction Before Liftoff (Abort). If an engine fails and the aircraft has not accelerated to recommended liftoff speed (V_{1of}), retard power levers immediately to IDLE and stop the aircraft with brakes and reverse thrust. Perform the following:

1. Power levers - IDLE.

2. Braking - As required.

NOTE

If able to land on remaining runway, check gear down and use brakes and reverse thrust as required. If insufficient runway remains for stopping, perform the following:

3. Condition levers - FUEL CUTOFF.

4. Fire pull handles - Pull.

5. Master switch - OFF.

d. Engine Malfunction After Liftoff. If an engine fails after becoming airborne, maintain single-engine best rate-of-climb speed (V_{yse}) or, if air speed is below V_{yse} maintain whatever airspeed is attained between liftoff (V_{1of}) and V_{yse} until sufficient altitude is attained to trade altitude for-airspeed and accelerate to V_{yse}.

(1.) Engine Malfunction after liftoff (abort), perform the following and land in a wingslevel attitude:

1. Power levers - Reduce.

2. Gear - DN.

3. Complete normal landing.

NOTE

If able to land on remaining runway, check gear down and use brakes and reverse thrust as required. If insufficient runway remains for stopping, perform the following:

4. Condition levers - FUEL CUTOFF

5. Fire pull handles - Pull.

6. Master switch - OFF.

(2.) Engine malfunction after liftoff (flight continued) perform the following:

1. Power - Maximum controllable.

NOTE

If airspeed is below V_{yse} maintain whatever airspeed has been attained (between V_{1of} and V_{yse}) until sufficient altitude can be obtained to trade off altitude for airspeed to assist in acceleration to V_{yse}.

2. Gear - UP

3. Flaps - UP.

4. Landing lights - OFF.

5. Brake deice - OFF.

6. Engine cleanup - Perform.

7. Generator load - 100% max.

NOTE

Holding three to five degrees bank (one-half ball width) towards the operating engine will assist in maintaining directional control and improve aircraft performance.

e. Engine Malfunction During Flight. If an engine malfunctions during cruise flight, maintain control of the aircraft while maintaining heading or turn as required. Add power as required to keep airspeed from decaying excessively and to maintain altitude. Identify the failed engine by feel (if holding rudder pressure to keep the aircraft from yawing; the rudder being pressed indicates the good engine) and engine instruments, then confirm identification by retarding the power lever of the suspected failed engine. Refer to Chapter 7 for single-engine cruise information. If one engine malfunctions during flight, perform the following:

1. Autopilot/yaw damp - DISENGAGE.

2. Power - As required.

3. Dead engine - Identified.

4. Power lever (dead engine) - IDLE.

5. Propeller lever (dead engine) - FEATHER.

6. Propeller synchronization switch - Off.

7. Gear - As required.

8. Flaps - As required.

9. Generator load - 100% max.

10. Power - Set for single engine cruise.

11. Engine cleanup - Perform.

NOTE

At V_{yse}, speeds, holding three to five degrees bank (one-half ball width) towards the operating engine will assist' in maintainin directional control and improve aircraft performance.

f. Engine Malfunction During Final Approach. If an engine malfunctions during final approach (after LANDING CHECK) the propeller should not be manually feathered unless time and altitude permit or conditions require it. Continue approach using the following procedure:

1. Power-As required
2. Gear - DN.

g. Engine Malfunction (Second Engine). If the second engine fails, do not feather the propeller if an engine restart is to be attempted. Engine restart without starter assist can not be accomp lished with a feathered propeller, and the propeller Will not unfeather without the engine operating 140 KIAS is recommended as the best all around glid e speed (considering engine restart, distance covered, transition to landing configuration, etc.), although it does not necessarily result in the minimum rate of descent. Perform the following procedure if the second engine fails during cruise flight.

1. Airspeed - 140 KIAS.
2. Powerlever - IDLE
3. Propeller lever - Do not FEATHER.
4. Conduct engine restart procedure.

h. Engine Shutdown In Flight. If it becomes necessary to shut an engine down during flight, perform the following:

1. Power lever - IDLE.
2. Propeller lever - FEATHER.
3. Condition lever - FUEL CUTOFF.
4. Engine clean up - Perform.

i. Engine Cleanup. The clean up procedure to be used after engine malfunction, shutdown, or an unsuccessful restart is as follows:

1. Autoignition switch - OFF.
2. Autofeather switch - OFF.
3. Generator switch - OFF.
4. Propeller synchronization switch - OFF.

j. Engine Restart During Flight Using Starter. Engine restarts may be attempted at all altitudes. If restart is attempted, perform the following:

1. Cabin temperature mode selector switch - OFF.
2. Electrical load - Reduce to minimum.
3. Fire pull handle - In.
4. Power lever - IDLE.
5. Propeller lever - FEATHER.
6. Condition lever - FUEL CUTOFF.
7. TGT (operative engine) - 700°C or less.
8. Ignition and engine start switch - ON.
9. Condition lever - LOW IDLE.

NOTE

If a rise in TGT does not occur within 10 seconds after moving the condition lever to LOW IDLE, abort the start.

10. TGT - Monitor (1,000°C for 5 seconds maximum).
11. Oil pressure - Check.
12. Ignition and engine start switch - OFF at 50% N1.
13. Generator switch - RESET, then ON.
14. Engine cleanup - Perform if engine restart unsuccessful.
15. Cabin temperature mode selector switch - As required.
16. Electrical equipment - As required.
17. Autoignition switch - ARM.
18. Propellers - Synchronize.
19. Power - As required.

k. Engine Restart During Flight (Not Using Starter). A restart without starter assist may be accomplished provided airspeed is at or above 140 KIAS altitude is below 20,000 feet, and the propeller is not feathered. If altitude permits, diving the aircraft will increase N1 and assist in restart. N1 required for airstart should be at or above 9%. If a start is attempted, perform following:

1. Cabin temperature mode selector switch - OFF.

2. Electrical load - Reduce to minimum.
3. Generator switch (affected engine) - OFF.
4. Fire pull handle - Check in.
5. Power lever - IDLE.
6. Propeller lever - HIGH RPM.
7. Condition lever - FUEL CUTOFF.
8. Airspeed - 140 KIAS minimum.
9. Altitude below 20,000 feet - Check.
10. Engine autoignition switch - ARM.
11. Condition lever - LOW IDLE.

NOTE

If N, is below 12%, starting temperatures tend to be higher than normal. To preclude overtemperature (1000°C or above) during engine acceleration to idle speed, periodically move the condition lever into FUEL CUTOFF position as necessary.

NOTE

If a rise in TGT does not occur within 10 seconds after moving the condition lever to LOW IDLE, abort the start.

12. TGT - Monitor (1 ,OOO"C for 5 seconds maximum).
13. Oil pressure - Check.
14. Generator switch - RESET, then ON.
15. Engine Cleanup - Perform if engine restart unsuccessful.
16. Cabin temperature mode selector switch - As required.
17. Electrical equipment - As required.
18. Autoignition switch - ARM.
19. Propellers - Synchronized.
20. Power - As required.

l. *Maximum Glide.* In the event of failure of both engines, maximum gliding distance can be obtained by feathering both propellers to reduce propeller drag and by maintaining the appropriate airspeed with the gear and flaps up. Figure 9-2 gives the approximate gliding distances in relation to altitude.

m. *Landing With Two Engines Inoperative.* Maizain best glide speed (figure 9-2). If sufficient altitude remains after reaching a suitable landing area, a circular pattern will provide best observation of surface conditions, wind velocity, and direction. When the condition of the terrain has been noted and the landing area selected, set up a rectangular pattern. Extending APPROACH flaps and landing gear early in the pattern will give an indication of glide performance sooner and will allow more time to make adjustments for the added drag. Fly the base leg as necessary to control point of touchdown. Plan to overshoot rather than undershoot, then use flaps as necessary to arrive at the selected landing point. Keep in mind that, with both propellers feathered the normal tendency is to overshoot due to less drag. In event a positive gear-down indication cannot be determined, prepare for a gear-up landing; also, unless the surface of the landing area is hard and smooth, the landing should be made with the landing gear up. If landing on rough terrain, land in a slightly tail-low attitude to keep nacelles from possibly digging in. If possible, land with flaps fully extended.

9-8. LOW OIL PRESSURE.

In the event of a low oil pressure indication, perform the procedures below as applicable:

1. Oil pressure below 105 PSI below 21,000 feet or 85 PSI 21,000 feet and above, torque - 49% maximum.
2. Oil pressure below 60 PSI - Perform engine shutdown, or land as soon as practicable using minimum power to insure safe arrival.

9-9. CHIP DETECTOR WARNING LIGHT ILLUMINATED.

If a L CHIP DETR or a R CHIP DETR warning light illuminates, and safe single-engine flight can be maintained; perform engine shutdown.

9-10. DUCT OVERTEMP CAUTION ANNUNCIATOR LIGHT ILLUMINATED.

If a DUCT OVERTEMP caution annunciator light is illuminated, insure that the cabin floor outlets are open and unobstructed, then perform the following steps in sequence until the light is extinguished. After completion of steps 1 thru 4, if light does not extinguish, Allow approximately 30 seconds after each adjustment for the system temperature to stabilize. The overtemperature condition is considered corrected at any point during the procedure that the light extinguishes.

1. Cabin air control - In.

MAXIMUM GLIDE DISTANCE

STANDARD DAY (ISA)

ASSOCIATED CONDITIONS:

POWER .... BOTH ENGINES INOPERATIVE
PROPELLERS.......... FEATHERED
LANDING GEAR....... UP
FLAPS................... 0%
AIRSPEED.............. IAS AS TABULATED
WIND.................... ZERO

EXAMPLE:

HEIGHT ABOVE TERRAIN .... 12,000 FT
WEIGHT .... 11,500 LBS

MAXIMUM GLIDE DISTANCE ..... 23 NM
GLIDE SPEED .... 102 KTS

WEIGHT ~ LBS	BEST GLIDE SPEED ~ KNOTS
15,000	116
14,000	112
13,000	108
12,000	104
11,000	100

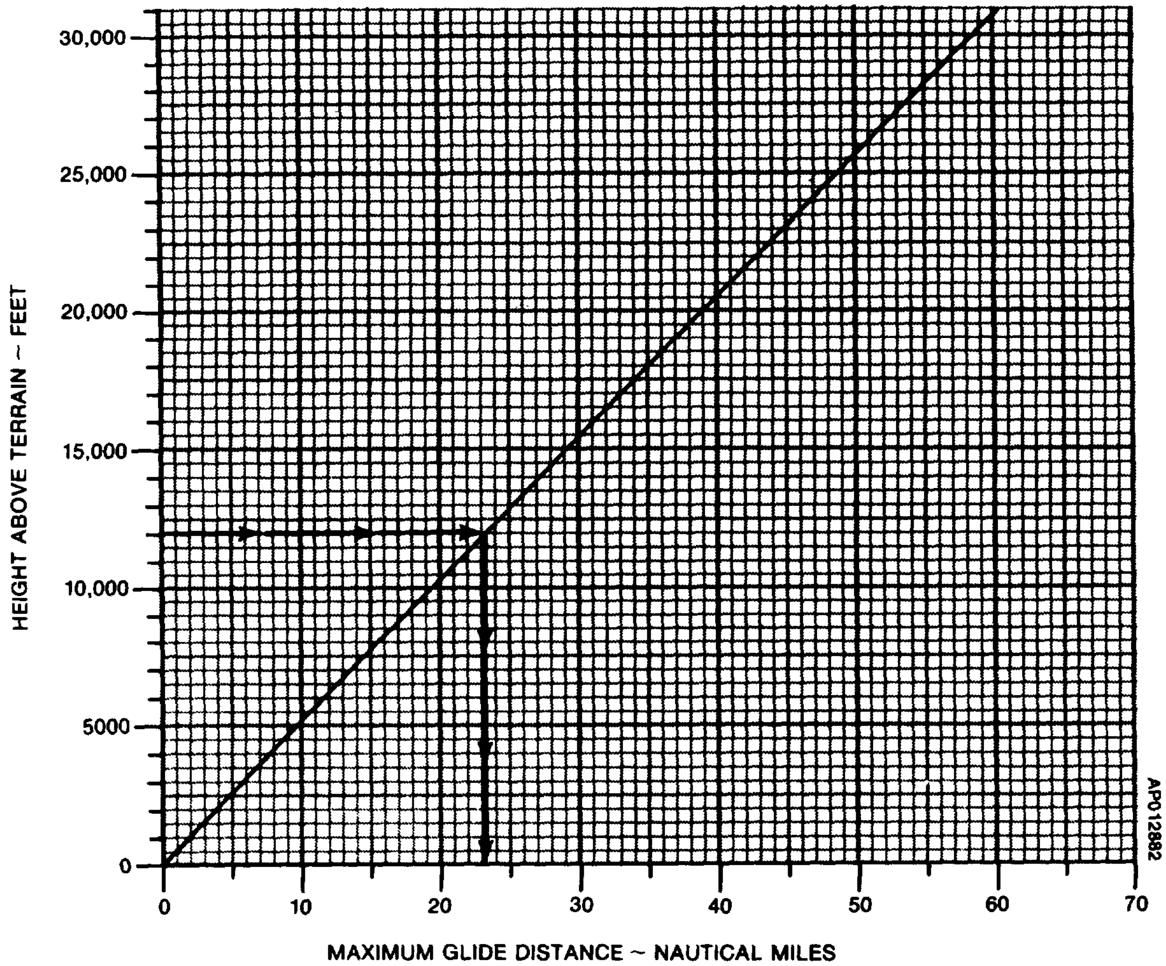


Figure 9-2. Maximum Glide Distance

2. Cabin temperature mode selector switch - AUTO.
3. Cabin temperature control rheostat - Full decrease.
4. Vent blower switch - HI.
5. Cabin temperature mode selector switch - MAN COOL.
6. Manual temperature switch - DECREASE (hold).
7. Left bleed air valve switch - ENVIRO OFF.
8. If the light is still illuminated after 30 seconds: Left bleed air valve switch - OPEN.
9. Right bleed air valve switch - ENVIRO OFF.
10. If the light is still illuminated after 30 seconds: Right bleed air valve switch - OPEN.

NOTE

If the overtemperature light has not extinguished after completing the above procedure, the warning system has malfunctioned.

9-11. ICE VANE FAILURE.

Ice vane failure is indicated by #1 VANE FAIL or #2 VANE FAIL caution annunciator light illumination. If an ice vane fails to operate electrically, perform the following:

CAUTION

After the ice vanes have been manually extended, they must be mechanically retracted. No electrical extension or retraction shall be attempted as damage to the electric actuator may result. Linkage in the nacelle area must be reset prior to operation of the electric system. Do not reset ice vane control circuit breaker.

CAUTION

Do not retract ice vanes electrically after manual extension.

1. Airspeed - 160 KIAS or below.
2. Ice vane control circuit breaker - Pull.
3. Ice vane - Operate manually.
4. Airspeed - Resume normal airspeed.

9-12. ENGINE BLEED AIR SYSTEM FAILURE.

a. Bleed Air Failure Light Illuminated. Steady illumination of the warning light in flight indicates a possible ruptured bleed air line aft of the engine firewall. The light will remain illuminated for the remainder of flight. Perform the following:

NOTE

L BL AIR FAIL or R BL AIR FAIL lights may momentarily illuminate during simultaneous surface deice and brake deice operation at low N1 speeds.

1. Brake deice - OFF.
2. TGT and torque - Monitor (note readings).
3. Bleed air valve switch - PNEU & ENVIRO OFF.

NOTE

Brake deice on the affected side, and rudder boost, will not be available with bleed air valve switch in PNEU & ENVIRO OFF.

4. Cabin pressurization - Check.

b. Excessive Differential Pressure. If cabin differential pressure exceeds 6.1 PSI, perform the following:

1. Cabin altitude and rate-of-climb controller -Select higher setting.
2. If condition persists: LEFT BLEED AIR VALVE switch - ENVIRO OFF (light illuminated).
3. If condition still persists: RIGHT BLEED AIR VALVE switch - ENVIRO OFF (light illuminated).
4. If condition still persists - Descend immediately.
5. If unable to descend: CABIN PRESS DUMP switch -CABIN PRESS DUMP.
6. Bleed air valve switches - OPEN, if cabin heating is required.

9-13. LOSS OF PRESSURIZATION (ABOVE 10, 000 FEET).

If cabin pressurization is lost when operating above 10,000 feet or the ALT WARN warning annunciator light illuminates, perform the following:

1. Crew oxygen masks - 100% and on.

9-14. CABIN DOOR CAUTION LIGHT ILLUMINATED.

Remain clear of cabin door and perform the following:

1. Bleed air valve switches - ENVIRO OFF.
2. Descend below 14,000 feet as soon as practicable.
3. Oxygen - As required.

9-15. SINGLE-ENGINE DESCENT/ARRIVAL.

NOTE

Approximately 85% N1 is required to maintain pressurization schedule.

Perform the following procedure prior to the final descent for landing.

1. Cabin controller - Set.
2. Ice and rain switches - As required.
3. Altimeters - Set.
4. Recognition lights - ON.
* 5. Arrival briefing - Complete.

9-16. SINGLE-ENGINE BEFORE LANDING.

1. Propeller lever - As required.

NOTE

During approach, propeller should be set at 1900 RPM to prevent glideslope interference (ILS approach), provide better power response during approach, and to minimize attitude change when advancing propeller levers for landing.

2. Flaps - APPROACH.
3. Gear - DN.
4. Landing lights - As required.
5. Yaw damp - OFF.
6. Brake deice - OFF.

9-17. SINGLE-ENGINE LANDING CHECK.

Perform the following procedure during final approach to runway.

1. Autopilot/yaw damp - Disengaged.
2. Gear lights - Check (three green).
3. Propeller lever (operative engine) - HIGH RPM.

NOTE

To insure constant reversing characteristics, the propeller control must be in the HIGH RPM position.

9-18. SINGLE-ENGINE GO-AROUND.

The decision to go around must be made as early as possible. Elevator forces at the start of a go-around are very high and a considerable amount of rudder control will also be required at low airspeeds. Retrim as required. If rudder application is insufficient, or applied too slowly, directional control cannot be maintained. If control difficulties are experienced, reduce power on the operating engine immediately. Insure that the aircraft does not touch the ground before retracting the landing gear. Retract the flaps only as safe airspeed permits (TAKEOFF until V ref, then UP). Perform single-engine go-around as follows:

WARNING

Once flaps are fully extended, a single-engine go-around may not be possible when close to the ground under conditions of high gross weights and/or high density altitude.

1. Power - Maximum allowable.
2. Gear - UP.
3. Flaps - As required.
4. Landing lights - OFF.
5. Power - As required.
6. Yaw damp - As required.

9-19. PROPELLER FAILURE (OVER 2080 RPM).

If an overspeed condition occurs that cannot be controlled with the propeller lever, or by reducing power, perform the following:

1. Power lever (affected engine) - IDLE.
2. Propeller lever - FEATHER.
3. Condition lever - As required.
4. Propeller synchronization - OFF.
5. Engine cleanup - As required.

9-20. FIRE.

The safety of aircraft occupants is the primary consideration when a tire occurs; therefore, it is imperative that every effort be made by the flight crew to put the fire out. On the ground it is essential that the engines be shut down, crew evacuated, and fire fighting begun immediately. If the aircraft is airborne when a fire occurs, the most important single action that can be taken by the pilot is to land safely as soon as possible.

a. Engine Fire. The following procedures shall be performed in case of engine fire:

(1.) Engine/nacelle fire during start or ground operations. If engine/nacelle fire is identified during start or ground operation, perform the following:

1. Propeller levers - FEATHER.
2. Condition levers - FUEL CUT-OFF.
3. Fire pull handle - Pull.

CAUTION

If fire extinguisher has been used to extinguish an engine fire, do not attempt to restart, until maintenance personnel have inspected the aircraft and released it for flight.

4. Push to extinguish switch - Push.
5. Master switch - OFF.

(2.) Engine fire in flight fire pull handle light illuminated). If an engine fire is suspected in flight, perform the following:

1. Power lever - IDLE.
2. If fire pull handle light out is extinguished: Advance power.
3. If fire pull handle light is still illuminated: Engine fire in flight procedures (identified) - Perform.

NOTE

Flight into the sun at high aircraft pitch attitude may actuate the tire warning system. Lowering the nose and/or changing headings will confirm a warning system failure-caused by sun rays.

(3.) Engine fire in fright (identified). If an engine fire is confirmed in flight, perform the following:

CAUTION

Due to the possibilities of fire warning system malfunctions, the fire should be visually identified before the engine is secured and the extinguisher actuated.

1. Power lever - IDLE.
2. Propeller lever - FEATHER.
3. Condition lever - FUEL CUT-OFF.
4. Fire pull handle - Pull.
5. Fire extinguisher - Actuate as required.
6. Engine cleanup - Perform.

b. Fuselage Fire. If a fuselage fire occurs, perform the following:

WARNING

The extinguisher agent (Bromochlorodifluoromethane) in the fire extinguisher can produce toxic effects if inhaled.

1. Fight the fire.
2. Land as soon as possible.

c. Wing Fire. There is little that can be done to control a wing fire except to shut off fuel and electrical systems that may be contributing to the fire, or which could aggravate it. Diving and slipping the aircraft away from the burning wing may help. If a wing fire occurs, perform the following:

1. Perform engine shutdown on affected side.

2. Land as soon as possible.

d. Electrical Fire. Upon noting the existence or indications of an electrical fire, turn off all affected electrical circuits, if known. If electrical fire source is unknown, perform the following:

1. Crew oxygen - 100%.
2. Master switch - OFF (visual conditions only).
3. All nonessential electrical equipment - OFF.

NOTE

With loss of DC electrical power, the aircraft will depressurize. All electrical instruments, with the exception of the propeller RPM, Nt RPM, and TGT gages will be inoperative.

4. Battery switch - ON.
5. Generator switches (individually) - RESET, then ON.
6. Circuit breakers - Check for indication of defective circuit.

CAUTION

As each electrical switch is returned to ON (note loadmeter reading) and check for evidence of fire.

7. Essential electrical equipment - On (individually until fire source is isolated).
8. Land as soon as practicable.

e. Smoke and Fume Elimination. To eliminate smoke and fumes from the aircraft, perform the following:

1. Crew oxygen - 100% and ON.
2. Bleed air valve switches - ENVIRO OFF.
3. Vent blower switch - AUTO.
4. Aft vent blower switch - OFF.
5. Cabin temperature mode selector switch - OFF.
6. If smoke and fumes are not eliminated: Cabin pressure dump switch - CABIN PRESS DUMP.

NOTE

Opening storm window (after depressurizing) will facilitate smoke and fume removal.

7. Engine oil pressure - Monitor.

9-21. FUEL SYSTEM.

a. Fuel Pressure Warning Annunciator Light Illuminated. Illumination of the #1 FUEL PRESS or #2 FUEL PRESS warning light usually indicates failure of the respective engine-driven boost pump. Perform the following:

1. Standby pump switch - ON.
2. Fuel pressure warning annunciator light - Check extinguished.
3. If fuel pressure warning light is still illuminated: Record unboosted time.

b. No Fuel Transfer Caution Light Illuminated. Illumination of a #1 NO FUEL XFR or #2 NO FUEL XFR annunciator light with fuel remaining in the respective auxiliary fuel tank indicates a failure of that automatic fuel transfer system. Proceed as follows:

1. AUX TRANSFER switch (affected side) - OVERRIDE.
2. Auxiliary fuel quantity - Monitor.
3. AUX TRANSFER switch (after respective auxiliary fuel has completely transferred) - AUTO.

c. Nacelle Fuel Leak. If nacelle fuel leaks are evident, perform the following:

1. Perform engine shutdown.
2. Fire pull handle - Pull.
3. Land as soon as practicable.

d. Fuel Crossfeed. Fuel crossfeed is normally used only during single-engine operation. The fuel from the dead engine side may be used to supply the live engine by routing the fuel through the crossfeed system. During extended flights, this method of fuel usage will provide a more balanced lateral load condition in the aircraft. For fuel crossfeed, use the following procedure:

1. AUX TRANSFER switches - AUTO.

NOTE

With the FIRE PULL handle pulled. the fuel in the auxiliary tank for that side will not be available (usable) for crossfeed.

2. Standby pumps - OFF.
3. Crossfeed switch - As required.
4. Fuel crossfeed advisory annunciator light - Check illuminated.

NOTE

With the FIRE PULL handle pulled, the respective WI FUEL PRESS or #2 FUEL PRESS light will remain illuminated on the side supplying fuel.

5. Fuel pressure light extinguished - Check.
6. Fuel quantity - Monitor.

e. Illumination of the #1 NAC LOW or #2 NAC LOW caution annunciator fight. Illumination of the #1 NAC LOW or #2 NAC LOW caution annunciator light indicates that the affected tank has 20 minutes remaining at sea level, normal cruise power consumption rate. Proceed as follows:

WARNING

Failure of the fuel tank venting system will prevent the fuel in the wing tanks from gravity feeding into the nacell tank. Fuel vent system failure may be indicated by illumination of the #1 or #2 NAC LOW caution light with greater than 20 minutes of usable fuel indicated in the main tank fuel system. The total usable fuel remaining in the main fuel supply system with the LOW FUEL caution light illuminated may be as Iittle as 114 pounds, regardless of the totaI fuel quantity indicated. Continued fIight may result in engine flameout due to fuel starvation.

1. Twenty minutes fuel remaining - Confirm:
2. Land as soon as possible.

NOTE

If a "NAC LOW" light occurs about the time the "AUX" tanks go empty and the fuel gages show the main tanks "FULL". this may indicate the fuel vent float valve in the wet section has stuck. Rocking the aircraft or changing pitch will probably unstick it. If not. fuel may be crossfed.

9-22 ELECTRICAL SYSTEM EMERGENCIES.

a. DC Generator Caution Annunciator Light Illuminated. Illumination of a #1 DC GEN or #2 DC GEN caution annunciator light indicates failure of a generator or one of its associated circuits (generator control unit). If one generator system becomes inoperative. all nonessential electrical equipment should be used judiciously to avoid overloading the remaining generator. The use of accessories which create a very high drain should be avoided. If both generators are shut off due to either generator system failure or engine failure. all nonessential equip ment should be turned off to preserve battery power for extending the landing gear and wing flaps. When a DC GEN light illuminates, perform the following:

1. Generator switch - OFF, RESET, then ON.
2. Generator switch (no reset) - OFF.
3. Mission control switch - OVERRIDE.
4. Operating loadmeter - 100% maximum.

b. Both DC Generator Warning Annunciator Lights Illuminated.

1. All nonessential equipment - OFF.
2. Land as soon as practicable.

c. Excessive Loadmeter Indication (Over 100%). If either loadmeter indicates over 100%, perform the following:

1. Battery switch - OFF (monitor loadmeter).
2. Loadmeter over 100% - Nonessential electrical equipment OFF.
3. Loadmeter under 100% - BATT switch ON.

d. Inventer Caution Annunciator Light Illuminated. Illumination of the #1 INVERTER or #2 lNVERTER caution annunciator light indicates failure of the affected inverter. When either inverter fails, the total aircraft load is automatically switched to the remaining inverter. When a #1 INVERTER or #2 INVERTER caution annunciator light illuminates, perform the following:

1. Affected #1 INVERTER or #2 INVERTER switch - OFF.

e. INST AC Warning Annunciator Light Illuminated. Illumination of the INST AC warning light indicates that 26 VAC power is not available. All items connected to the 26 VAC bus will be inoperative (refer to AC wiring schematic diagram in chap ter 2 for equipment effected). Under these conditions. power must be controlled by indications of the Nt and TGT gages. Perform the following

1. Nt and TGT indications - Check.
2. Other engine instruments - Monitor.

f. Circuit Breaker Tripped. If the circuit breaker is for a nonessential item. do not reset in flight. If the circuit breaker is for an essential item, the circuit breaker may be reset once. If a bus feeder circuit breaker (on the overhead circuit breaker panel) trips. a short is indicated. Do not reset in flight. If a circuit breaker trips. perform as follows:

1. BUS FEEDER breaker tripped - Do not reset.
2. Nonessential circuit - Do not reset.
3. Essential circuit - Reset once.

NOTE

Circuit breakers should not be reset more than once until the cause of the circuit malfunction has been determined and corrected. Do not reset dual fed bus feeder circuit breakers.

g. BATTERY CHARGE Light Illuminated. If the BATTERY CHARGE caution light illuminates during normal cruise flight. perform the following:

1. Battery Volt-Ampmeter - Monitor. If battery current continues to increase, turn battery switch off.
2. Battery switch (landing gear/flap extension only) - ON.

9-23. EMERGENCY DESCENT.

Emergency descent is a maximum effort in which damage to the aircraft must be considered secondary to getting the aircraft down. The following procedure assumes the structural integrity of the aircraft and smooth flight conditions. If structural integrity is in doubt. limit speed as much as possible. reduce rate of descent if necessary, and avoid high maneuvering loads. For emergency descent, perform the following:

NOTE

Windshield defogging may be required.

1. <u>Power lever - IDLE.</u>
2. <u>Propeller lever - HIGH RPM.</u>
3. <u>Flaps - APPROACH.</u>
4. <u>Gear - DN.</u>
5. <u>Airspeed - 180 KIAS maximum.</u>

9-24. LANDING EMERGENCIES.

WARNING

Structural damage may exist after landing with brake, tire, or landing gear malfunctions. Under no circumstances shall an attempt be made to inspect the aircraft until jacks have been installed.

a. Landing Gear Unsafe Indication. Should one or more of the three green landing gear indicator lights fail to indicate a safe condition. the following steps should be taken before proceeding to extend the gear manually.

1. Gear - DN.
2. Gear lights - Check (three green).
3. Landing gear relay and indicator circuit breaker - Check In.

NOTE

If gear continues to indicate unsafe. attempt to verify position of the landing gear visually.

h. Landing Gear Emergency Extension.

CAUTION

Continued pumping of the handle after GEAR DOWN position indicator lights (3) are illuminated could damage the drive mechanism. and prevent subsequent gear retraction.

CAUTION

After an emergency landing gear extension has been made. do not stow the gear ratchet handle or move any landing gear controls or reset any switches or circuit breakers until the cause of the malfunction has been corrected.

1. Airspeed - 130 KIAS.
2. LANDING GEAR RELAY circuit breaker - Out.
3. Gear - DN.
4. Landing gear alternate engage handle - Lift and turn clockwise to the stop.
5. Alternate landing gear extension handle - Pump.
6. Gear lights - Check (three green).

c. Gear-up Landing (All Gear Up or Unlocked). Due to decreased drag with the gear up. the tendency will be to overshoot the approach. The

center-of-gravity with the gear retracted is aft of the main wheels. This condition will allow the aircraft to be landed with the gear retracted and should result in a minimum amount of structural damage to the aircraft, providing the wings are kept level. It is recommended that the fuel load be reduced and the landing made with flaps fully extended on a hard surface runway. Landing on soft ground or dirt is not recommended as sod has a tendency to roll up into chunks, damaging the underside of the aircraft's structure. When fuel load has been reduced, prepare for a gear-up landing as follows:

1. Crew emergency briefing - Complete.
2. Loose equipment - Stowed.
3. Bleed air valve switches - ENVIRO OFF.
4. Cabin pressure dump switch - CABIN PRESS DUMP.
5. Cabin emergency hatch - Remove and stow.
6. Seat belts and harnesses - Secured.
7. Landing gear alternate engage handle - Disengaged.
8. Alternate landing gear extension handle - Stowed.
9. Gear relay circuit breaker - In.
10. Gear - UP.
11. Nonessential electrical equipment - OFF.
12. Flaps - As required (DOWN for landing).

NOTE

Fly a normal approach to touchdown. After landing, accomplish the following:

13. Power levers (runway assured) - IDLE.
14. Condition levers - FUEL CUTOFF.
15. Fire pull handles - Pull.
16. Master switch - OFF.

d. Landing With Nose Gear Unsafe. If the landing gear control switch handle warning light is illuminated and the nose GEAR DOWN indicator light shows an unsafe condition, the nose gear is probably not locked down, and the gear position should be checked visually by another aircraft, if possible. If all attempts to lock the nose gear fail, a landing should be made with the main gear down and locked. Hold the nose off the runway as long as possible and do not use brakes. Use the following procedures:

1. Crew emergency briefing - Complete.
2. Loose equipment - Stowed.
3. Bleed air valve switches - ENVIRO OFF.
4. Cabin pressure dump switch - CABIN PRESS DUMP.
5. Cabin emergency hatch - Remove and stow.
6. Seat belts and harnesses - Secured.
7. Nonessential electrical equipment - OFF.

NOTE

Fly a normal approach to touchdown. After landing, accomplish the following:

8. Power levers (runway assured) - IDLE.
9. Condition levers - FUEL CUTOFF.
10. Fire pull handle - Pull.
11. Master switch - OFF.

e. Landing With One Main Gear Unsafe. If one main landing gear fails to extend, retract the other gear and make a gear-up landing. If all efforts to retract the extended gear fail, land the aircraft on a hard runway surface, touching down on the same edge of the runway as the extended gear. Roll on the down and locked gear, holding the opposite wing up and the nose gear straight as long as possible. If the gear has extended, but is unsafe, apply brakes lightly on the unsafe side to assist in locking the gear. If the gear has not extended or does not lock, allow the wing to lower slowly to the runway. Use the following procedures:

1. Crew emergency briefing - Complete.
2. Loose equipment - Stowed.
3. Bleed air valve switches - ENVIRO OFF.
4. Cabin pressure dump switch - CABIN PRESS DUMP.
5. Cabin emergency hatch - Remove and stow.
6. Seat belts and harnesses - Secured.
7. Nonessential electrical equipment - OFF.

8. Touchdown - On safe main gear first.

NOTE

Fly a normal approach to touchdown. After landing, accomplish the following:

9. Power levers (runway assured) - IDLE.
10. Condition levers - FUEL CUTOFF.
11. Fire pull handle - Pull.
12. Master switch - OFF.

f. Landing With Flat Tire(s). If aware that a main gear tire(s) is flat, a landing close to the edge of the runway opposite the flat tire will help avoid veering off the runway. If the nose wheel tire is flat, use minimum braking.

9-25. LANDING WITH INOPERATIVE WING FLAPS (UP).

The aircraft does not exhibit any unusual characteristics when landing with the wing flaps up. The approach angle will be shallow and the touchdown speed will be higher resulting in a longer landing roll.

9-26. CRACKED WINDSHIELD.

a. External Crack. If an external windshield crack is noted, no action is required in flight.

NOTE

Heating elements may be inoperative in areas of crack.

b. Internal Crack. If an internal crack occurs, perform the following:

1. Descend to below 25,000 feet.
2. Cabin Pressure - Reset pressure differential to 4 PSI or less within 10 minutes.

9-27. CRACKED CABIN WINDOW (OUTER PANEL).

If a cabin window outer panel crack occurs, perform the following:

1. Descend to below 25,000 feet.
2. Cabin pressure - 4.6 PSI maximum.
3. Do not operate more than 20 flight hours.

NOTE

Treat outer panel cracks which are linear (not circular) or cracks that touch the frame, as an inner panel crack.

9-28. CRACKED CABIN WINDOW (INNER PANEL).

If a cabin window inner panel crack occurs, perform the following:

1. Oxygen - As required.
2. Cabin pressure - Depressurize.
3. Descend - As required.

9-29. DITCHING.

If a decision to ditch is made, immediately alert all crewmembers to prepare for ditching. Plan the approach into the wind if the wind is high and the seas are heavy. If the swells are heavy but the wind is light, land parallel to the swells. Set up a minimum rate descent (power on or off, as the situation dictates, airspeed - (110-120 KIAS). Do not try to flare as in a normal landing, as it is very difficult to judge altitude over water, particularly in a slick sea. Leveling off too high may cause a nose low “drop in,“ while having the tail too low on impact may result in the aircraft pitching forward and “digging in.“ Expect more than one impact shock and several skips before the final hard shock. There may be nothing but spray visible for several seconds while the aircraft is decelerating. To prevent cartwheeling, it is important that the wings be level when the aircraft hits the water. After the aircraft is at rest, supervise evacuation of passengers and exit the aircraft as quickly as possible. In a planned ditching, the life raft and first-aid kits should be secured close to the cabin emergency hatch for easy access when evacuating; however, do not remove the raft from its carrying case inside the aircraft. After exiting the aircraft, keep the raft away from any damaged surfaces which might tear or puncture the fabric. The length of time that the aircraft will float depends on the fuel level and the extent of aircraft damage caused by the ditching. Refer to figure 9-3 for body positions during ditching. Figure 9-4 shows wind swell information. Perform the following procedures:

WARNING

Do not unstrap from the seat until all motion stops. The possibility of injury and disorientation requires that evacuation not be attempted until the aircraft comes to a complete stop.

1. Radio calls/transponder - As required.
2. Crew emergency briefing - As required.
3. Bleed air valve switches - ENVIRO OFF.
4. Cabin pressure dump switch - CABIN PRESS DUMP.
5. Cabin emergency hatch - Remove and stow.
6. Seat belts and harnesses - Secured.
7. Gear - UP.
8. Flaps - DOWN.
9. Nonessential electrical equipment - OFF.
10. Approach - Normal, power on.
11. Emergency lights - As required.

9-30 FLIGHT CONTROLS MALFUNCTION.

Use the following procedures, as applicable, for flight control malfunctions.

a. *Autopilot/Yaw Damp Emergency Disconnection.* The autopilot can be disengaged by any of the following methods:

1. Pressing the DISC - TRIM - AP - YD disconnect switch (control wheels).
2. Pressing the autopilot "AP ENGAGE" pushbutton on the autopilot mode selector control panel.
3. Pressing the go-around switch (left power lever), (yaw damper will remain on).
4. Pulling the AP CONTR and AFCS DIRECT circuit breakers (overhead control panel).
5. Setting AVIONICS MASTER PWR switch (overhead control panel) to the OFF position.
6. Setting aircraft MASTER switch (overhead control panel) to the OFF position.

b. *Unscheduled Rudder Boost Activation.* Rudder boost operation without a large variation of power between engines indicates a failure of the system. Perform the following:

1. Rudder boost - OFF.

NOTE

The rudder boost system may not operate when the brake deice system is in use. Availability of the rudder boost system will be restored to normal when the BRAKE DEICE switch is turned off.

IF CONDITION PERSISTS:

2. Bleed air valve switches - PNEU & ENVIRO OFF.
3. Rudder trim - Adjust.

c. *Unscheduled Electric Elevator Trim.* In the event of unscheduled electric elevator trim, perform the following:

1. Elevator trim switch - OFF.
2. Elevator trim circuit breaker - Out.

9-31. BAILOUT.

When the decision has been made to abandon the aircraft in flight, the pilot will give the warning signal. Exit from the aircraft will be through the main entrance door, and in the departure sequence using the exit routes as indicated in figure 9-1. Proceed as follows if bailout becomes necessary:

1. Notify crew to prepare to bail out.
2. Distress message - Transmit.
3. Voice security - ZEROIZE.
4. Transponder - 7700.
5. Mode 4 - Zeroize.
6. Flaps - DOWN.
7. Airspeed - 100 KIAS.
8. Trim - As required.
9. Autopilot - Engage.
10. Cabin pressure switch - DUMP.
11. Parachute - Attach to harness.
12. Cabin door - Open.
13. Abandon the aircraft.

Table 9-1. Ditching

PLANNED DITCHING	IMMEDIATE DITCHING
PILOT	**PILOT**
A. ALERT OCCUPANTS B. ORDER TO PREPARE SURVIVAL GEAR FOR AERIAL DROP C. TRANSMIT DISTRESS MESSAGE D. LIFE VEST - CHECK (DO NOT INFLATE) E. DISCHARGE MARKER F. LAND AND DITCH AIRCRAFT G. ABANDON AIRCRAFT	A. WARN OCCUPANTS B. TRANSMIT DISTRESS MESSAGE C. LIFE VEST - CHECK (DO NOT INFLATE) D. APPROACH - NORMAL E. NOTIFY OCCUPANTS TO BRACE FOR DITCHING F. LAND AND DITCH AIRCRAFT G. ABANDON AIRCRAFT AFTER COPILOT THROUGH CABIN EMERGENCY HATCH
COPILOT	**COPILOT**
A. REMOVE CABIN EMERGENCY HATCH B. LIFE VEST - CHECK (DO NOT INFLATE) C. ABANDON AIRCRAFT (TAKE LIFE RAFT AND FIRST AID KIT)	A. REMOVE CABIN EMERGENCY HATCH B. LIFE VEST - CHECK (DO NOT INFLATE) C. ABANDON AIRCRAFT (TAKE LIFE RAFT AND FIRST AID KIT)
PASSENGERS	**PASSENGERS**
A. SEAT BELTS - FASTEN B. LIFE VEST - CHECK (DO NOT INFLATE C. ON PILOTS SIGNAL - BRACE FOR DITCHING D. ABANDON AIRCRAFT THROUGH CABIN DOOR (TAKE LIFE RAFT AND FIRST AID KIT	A. SEAT BELTS - FASTEN B. LIFE VEST - CHECK (DO NOT INFLATE) C. ON PILOTS SIGNAL -BRACE FOR DITCHING D. ABANDON AIRCRAFT THROUGH CABIN DOOR (TAKE LIFE RAFT AND FIRST AID KIT)

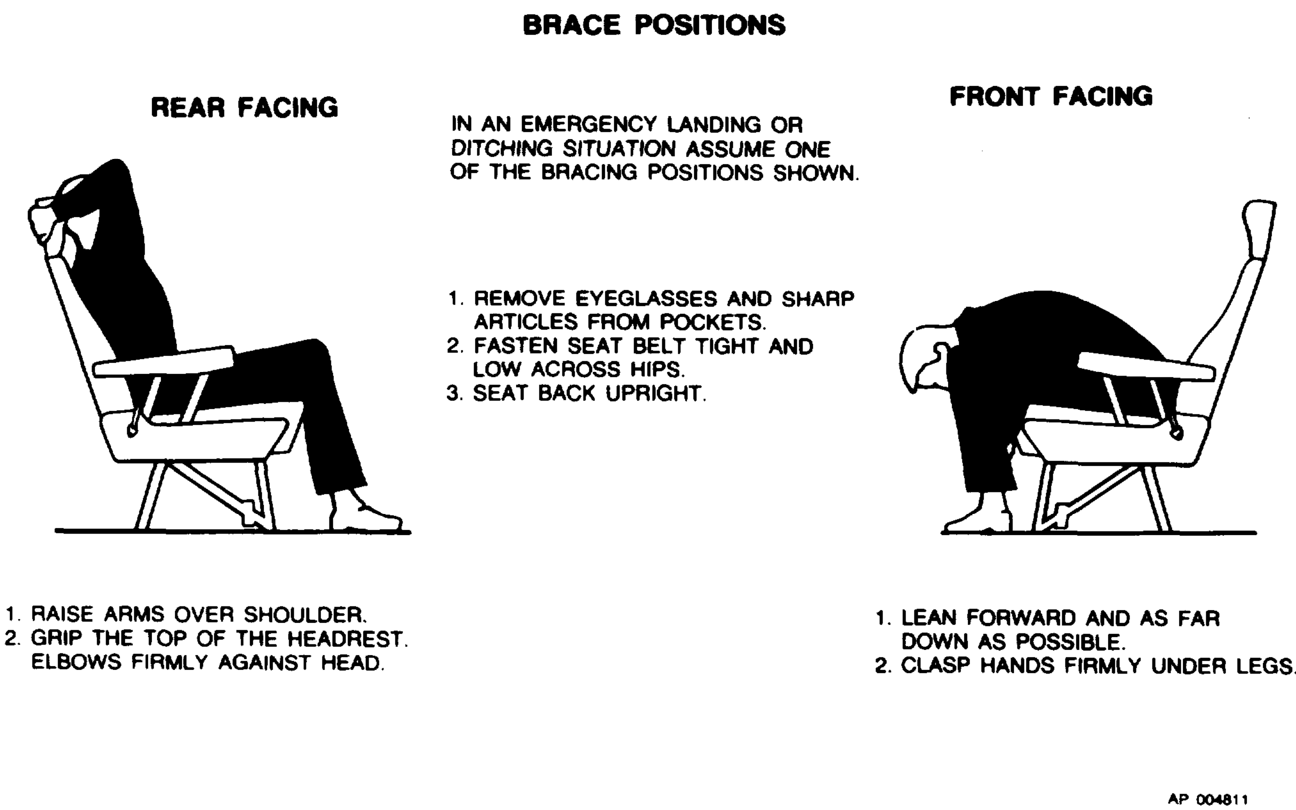


Figure 9-3. Emergency Body Positions

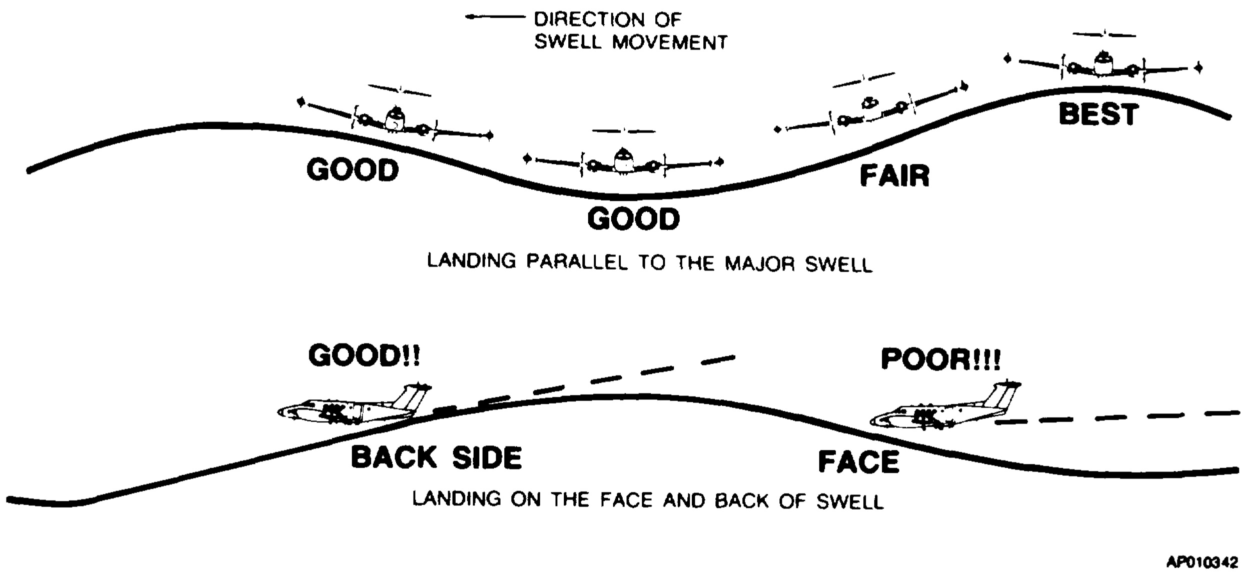


Figure 9-4. Wind Swell Ditch Heading Evaluation

APPENDIX A

REFERENCES

Reference information for the subject material contained in this manual can be found in the following publications:

AR 70-50	Designating and Naming Defense Equipment, Rockets, and Guided Missles
AR 95-1	Army Aviation - General Provisions and Flight Regulations
AR 95-16	Weight and Balance - Army Aircraft
AR 380-40	Safeguarding COMSEC Information
AR 385-40	Accident Reporting and Records
AR 700-26	Aircraft Designation System
DA PAM 738-751	Functional User's Manual for the Army Maintenance Management System Aviation (TAMS-A)
FAR Part 91	General Operating and Flight Rules
FM 1-5	Instrument Flying and Navigation for Army Aviators
FM 1-30	Meterology for Army Aviators
TB AVN 23-13	Anti-icing, Deicing and Defrosting Procedures for Parked Aircraft
TB MED 501	Noise and Conservation of Hearing
TB 55-9150-200-24	Engine and Transmission Oils, Fuels, and additives for Army Aircraft
TM 9-1095-206-13&P	Operator's Aviation Unit Maintenance and Aviation Intermediate Maintenance Manual (Including Repair Parts and Special Tools List) to Dispenser, General Purpose Aircraft: M-130
(C) TM 11-5825-252-15	Operator, Organizational, DS, GS, and Deport Maintenance Manual: RC-12H Aircraft Mission Equipment, (V)
TM 11-5841-291-12	Operator and Organizational Maintenance Manual, Radar Warning System, AN/APR-44(V)1
TM 11-5841-283-20	Organizational Maintenance Manual for Detection Set, Radar Signal AN/APR-39(V)1.
TM 11-6140-203-14-2	Operator's Organizational, Direct Support, General Support and Depot Maintenance Manual Including Repair Parts and Special Tools List: Aircraft Nickel-Cadmium Batteries
TM 11-6940-214-12	Operator and Organization Maintenance Manual, Simulator, Radar Signal, SM-756/APR-44(V)
TM 55-410	Aircraft Maintenance, Servicing and Ground Handling Under Extreme Environmental Conditions
TM 55-1500-204-25/1	General Aircraft Maintenance Manual Maintenance Manual: Army Model RC-12H Aircraft
TM 55-1500-314-25	Handling, Storage, and Disposal of Army Aircraft Components Containing Radioactive Materials
TM 55-1500-342-23	Army Aviation Maintenance Manual: Weight and Balance
TM 55-1510-200-PM	Phased Maintenance Checklist
TM 55-1510-219-23	Aviation Unit and Aviation Intermediate

TM 750-244-1-5	Procedures for the Destruction of Aircraft and Associated Equipment to Prevent Enemy Use

APPENDIX B

ABBREVIATIONS AND TERMS

For the purpose of this manual, the following abbreviations and terms apply. See appropriate technical manuals for additional terms and abbreviations.

Airspeed Terminology.

CAS	Calibrated airspeed is indicated airspeed corrected for position and instrument error.
FT/MIN	Feet per minute.
GS	Ground speed, though not an airspeed, is directly calculable from true airspeed if the true wind speed and direction are known.
IAS	Indicated airspeed is the speed as shown on the airspeed indicator and assumes no error.
KT	Knots.
TAS	True airspeed is calibrated airspeed corrected for temperature, pressure, and compressability effects.
V_a	Maneuvering speed is the maximum speed at which application of full available aerodynamic control will not overstress the aircraft.
V_f	Design flap speed is the highest speed permissible at which wing flaps may be actuated.
V_{fe}	Maximum flap extended speed is the highest speed permissible with wing flaps in a prescribed extended position.
V_{le}	Maximum landing gear extended speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.
V_{lo}	Maximum landing gear operating speed is the maximum speed at which the landing gear can be safely extended or retracted.
V_{lof}	Lift off speed (takeoff airspeed).
V_{mea}	The minimum flight speed at which the aircraft is directionally controllable as determined in accordance with Federal Aviation Regulations. Aircraft Certification conditions include one engine becoming inoperative and windmilling; a 5° bank towards the operative engine; takeoff power on operative engine; landing gear up; flaps up; and most rearward CG. This speed has been demonstrated to provide satisfactory control above power off stall speed (which varies with weight, configuration, and flight attitude).
V_{mo}	Maximum operating limit speed.
V_{ne}	Never exceed speed.
vr	Rotation speed.
vs	Power off stalling speed or the minimum steady flight speed at which the aircraft is controllable.
V_{so}	Stalling speed or the minimum steady flight speed in the landing configuration.
V_{sse}	The safe one-engine inoperative speed selected to provide a reasonable margin against the occurence of an unintentional stall when making intentional engine cuts.

V_x	Best angle of climb speed.
V_{xse}	Best single-engine angle of climb speed.
V_y	Best rate of climb speed.
V_{yse}	The best single engine rate of climb speed.

Meteorological Terminology.

Altimeter Setting	Barometric pressure corrected to sea level.
°C	Degrees Celsius.
°F	Degrees Fahrenheit.
FAT	Free Air Temperature is the free air static temperature obtained either from the temperature indicator (IFAT), adjusted for compressibility effects, or from ground meteorlogical sources.
Indicated Pressure Altitude	The number actually read from an altimeter when, the barometric scale (Kollsman window) has been set to 29.92 inches of mercury (1013 millibars).
ISA	International Standard Atmosphere in which: a. The air is a dry perfect gas. b. The temperature at sea level is 59 degrees Fahrenheit, 15 degrees Celsius. c. The pressure at sea level is 29.92 inches Hg. d. The temperature gradient from sea level to the altitude at which the temperature is -69.7 degrees Fahrenheit is -0.003566 Fahrenheit per foot and zero above that altitude.
Pressure Altitude	Indicated pressure altitude corrected for altimeter error.
SL	Sea level.
Wind	The wind velocities recorded as variables on the charts of this manual are to be understood as the headwind or tailwind components of the actual winds at 50 feet above runway surface (tower winds).
Beta Range	The region of the power lever control which is aft of the idle stop and forward of reversing range where blade pitch angle can be changed without a change of gas generator RPM.
Cruise Climb	Is the maximum power approved for normal climb. This power is torque or temperature (ITT) limited.
High Idle	Obtained by placing the condition lever in the HIGH IDLE position.
HP	Horsepower.
Low Idle	Obtained by placing the condition lever in the LO IDLE position.
Maximum Cruise Power	Is the highest power rating for cruise and is not time limited.
Maximum Power	The maximum power available from an engine for use during an emergency operation.
Normal Rated Climb Power	The maximum power available from an engine for continuous normal climb operations.
Normal Rated Power	The maximum power available from an engine for continuous operation in cruise (with lower ITT limit than normal rated climb power).
Reverse Thrust	Obtained by lifting the power levers and moving them aft of the beta range.

RPM	Revolutions Per Minute.
Takeoff Power	The maximum power available from an engine for takeoff, limited to periods of five minutes duration.

Control and Instrument Terminology.

Condition Lever (Fuel Shut-off Lever)	The fuel shut-off lever actuates a valve in the fuel control unit which controls the flow of fuel at the fuel control outlet and regulates the idle range from LO to HIGH.
Interstage Turbine Temperature (ITT)	Eight probes wired in parallel indicate the temperature between the compressor and power turbines.
Nt Tachometer (Gas Generator RPM)	The tachometer registers the RPM of the gas generator with 100% representing a gas generator speed of 37,500 RPM.
Power Lever (Gas Generator N1 RPM)	This lever serves to modulate engine power from full reverse thrust to takeoff. The position for idle represents the lowest recommended level of power for flight operation.
Propeller Control Lever (N2 RPM)	This lever requests the control to maintain RPM at a selected value and, in the maximum decrease RPM position, feathers the propeller.
Propeller Governor	This Governor will maintain the selected propeller speed requested by the propeller control lever.
Torquemeter	The torquemeter system determines the shaft output torque. Torque values are obtained by tapping into two outlets on the reduction gear case and recording the differential pressure from the outlets.

Graph and Tabular Terminology.

AGL	Above ground level.
Best Angle of Climb	The best angle-of-climb speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance with gear and flaps up.
Best Rate of Climb	The best rate-of-climb speed is the airspeed which delivers the greatest gain of altitude in the shortest possible time with gear and flaps up.
Clean Configuration	Gear and flaps up regardless of mission antenna installation.
Demonstrated Crosswind	The maximum 90° crosswind component for which adequte control of the aircraft during takeoff and landing was actually demonstrated during certification tests.
Gradient	The ratio of the change in height to the horizontal distance, usually expressed in percent.
Landing Weight	The weight of the aircraft at landing touchdown.
Maximum Zero Fuel Weight	Any weight above the value given must be loaded as fuel.
MEA	Minimum Enroute Altitude.
Obstacle Clearance Climb Speed	Obstacle clearance climb speed is a speed near Vx and Vy 1.1 times power off stall speed, or 1.2 times minimum single-engine stall-speed, whichever is higher.
Ramp Weight	The gross weight of the aircraft before engine start. Included is the takeoff weight plus a fuel allowance for start, taxi, run up and takeoff grond roll to liftoff.
Route Segment	A part of a route. Each end of that part is identified by: a. A geographic location; or

	b. A point at which a definite radio fix can be established.
Service Ceiling	The altitude at which the minimum rate of climb of 100 feet per minute can be attained for existing aircraft weight.
Takeoff Weight	The weight of the aircraft at liftoff from the runway.

Weight and Balance Terminology.

Arm	The distance from the center of gravity of an object to a line about which moments are to be computed.
Approved Loading Envelope	Those combinations of aircraft weight and center of gravity which define the limits beyond which loading is not approved.
Basic Empty Weight	The aircraft weight with unusable fuel, full oil, and full operating fluids.
Center-of-Gravity	A point at which the weight of an object may be considered concentrated for weight and balance purposes.
CG Limits	CG limits are the extremes of movement which the CG can have without making the aircraft unsafe to fly. The CG of the loaded aircraft must be within these limits at takeoff, in the air, and on landing.
Datum	A vertical plane perpendicular to the aircraft longitudinal axis from which fore and aft (usually aft) measurements are made for weight and balance purposes.
Engine Oil	That portion of the engine oil which can be drained from the engine.
Empty Weight	The aircraft weight with fixed ballast, unusable fuel, engine oil, engine coolant, hydraulic fluid, and in other respects as required by applicable regulatory standards.
Landing Weight	The weight of the aircraft at landing touchdown.
Maximum Weight	The largest weight allowed by design, structural, performance or other limitations.
Moment	A measure of the rotational tendency of a weight, about a specified line, mathematically equal to the product of the weight and the arm.
Standard	Weights corresponding to the aircraft as offered with seating and interior, avionics, accessories, fixed ballast and other equipment specified by the manufacturer as composing a standard aircraft.
Station	The longitudinal distance from some point to the zero datum or zero fuselage station.
Takeoff Weight	The weight of the aircraft at liftoff.
Unusable Fuel	The fuel remaining after consumption of usable fuel.
Usable Fuel	That portion of the total fuel which is available for consumption as determined in accordance with applicable regulatory standards.
Useful Load	The difference between the aircraft ramp weight and basic empty weight.

Miscellaneous Abbreviations.

Deg	Degrees
DN	Down
FT	Foot or feet
FT LB	Foot-pounds

GAL	Gallons
HR	Hours
kHz	Kilohertz
LB	Pounds
MAX	Maximum
MHz	Megahertz
MIN	Minimum
NAUT	Nautical
NM	Natucial miles
PSI	Pounds per square inch
R/C	Rate of climb

INDEX

Subject	Paragraph, Figure, Table Number

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Subject	Paragraph, Figure, Table Number

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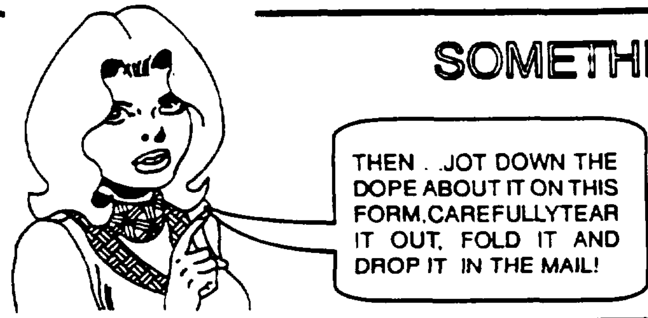

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81		4-3		Callout 16 on figure 4-3 is pointed at a bolt. In key to figure 4-3, item 16 is calle a shim. Please correct one or the other

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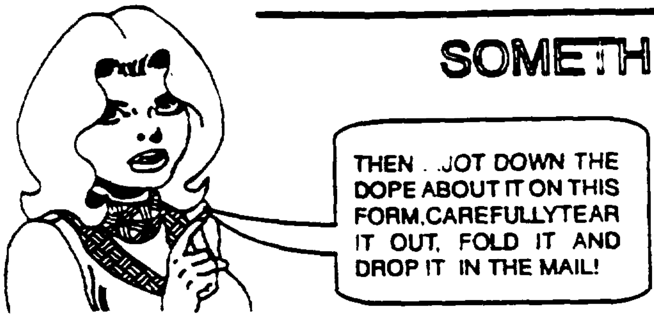

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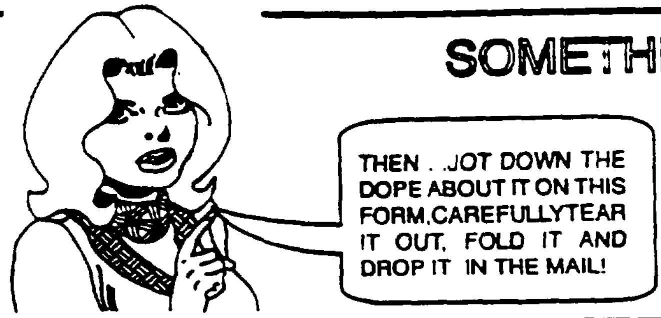

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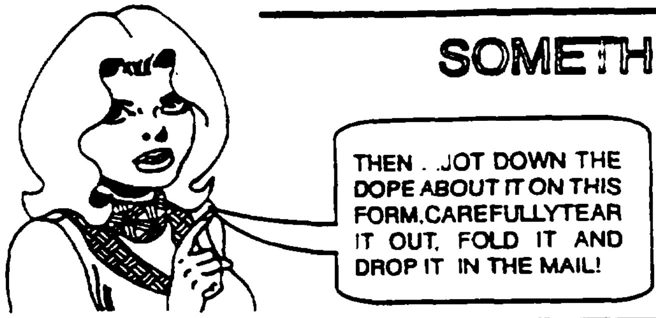

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TEAR ALONG PERFORATED LINE

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 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 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	1.365	metric tons	short tons	1.102
pound-inches	mewton-meters	.11375			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 065798-000