371

CONFIDENTIAL CSR 035

UTILITY FLIGHT HANDBOOK

NAVY MODEL

XP6M-1 *Seamaster*

AIRPLANE BU. No. 138822

This publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of an unfriendly nation, unless specifically authorized by the Operational Commander.

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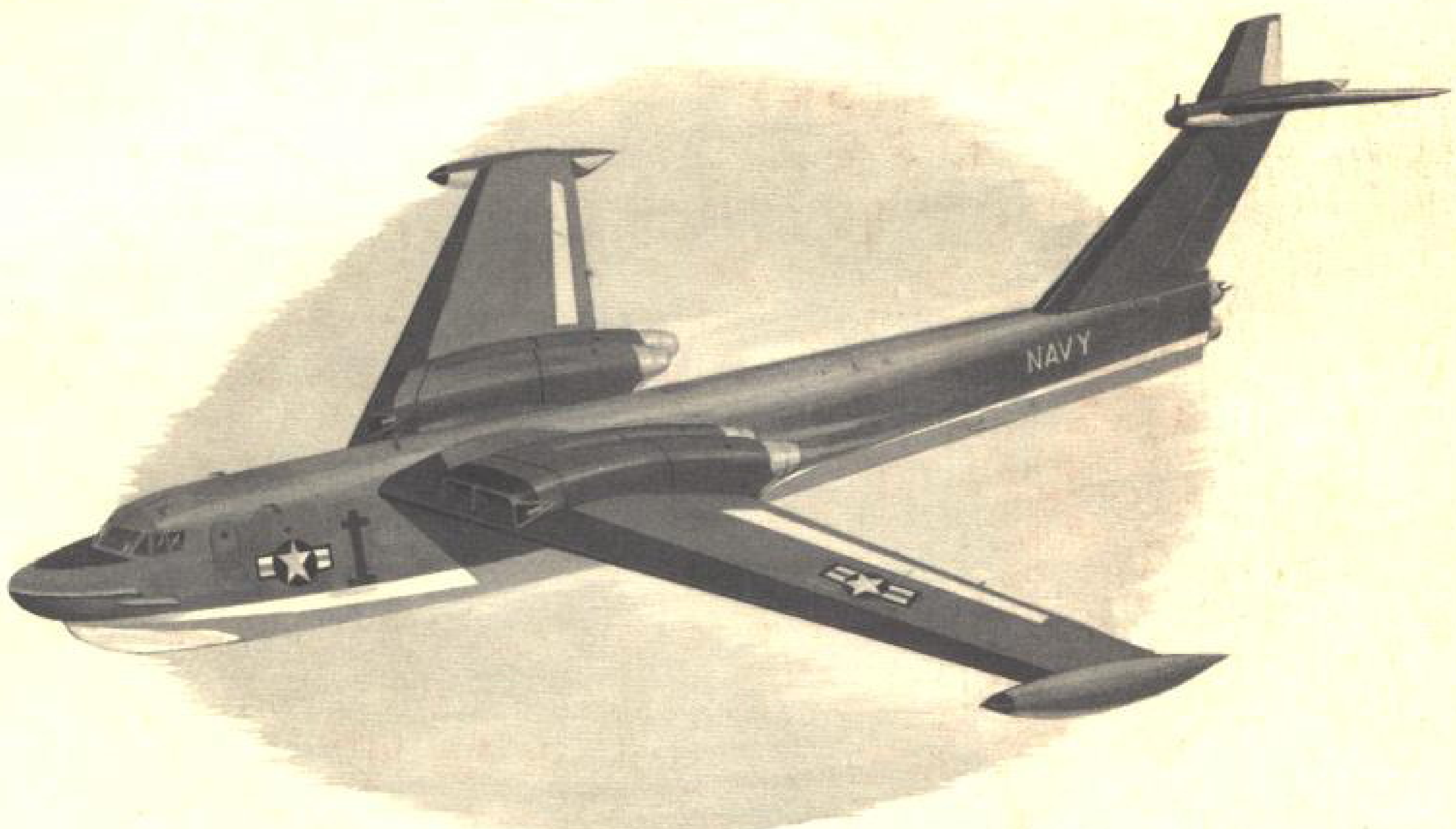

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TABLE OF CONTENTS

FOREWORD

IMPORTANT — To obtain the maximum benefits from this handbook, it is important that you read this page carefully.

This Utility Handbook contains pertinent information which is needed to conduct a safe and successful mission with the XP6M-1 airplane. We have attempted to present these instructions in their proper sequence and in a language familiar to flight crew members. The obvious and elementary have been avoided in favor of a full coverage of items which affect flight safety and ensure the success of the mission. These instructions are based upon the manufacturer's engineering data and reports compiled from flight tests. This handbook will not be replaced with a "regular" handbook since it represents only one specific airplane. Although it was prepared basically to Specification MIL-H-7700, certain detail requirements have been deferred in the interest of better understanding and readability.

This handbook is divided into nine sections, an appendix, and an index as follows:

SECTION I, DESCRIPTION. This section covers the airplane, engines, and all systems and controls which contribute to the actual flying of the airplane. Emergency equipment which is not part of an auxiliary system is also included.

SECTION II, NORMAL OPERATING PROCEDURES. The procedures and operations required for a safe and efficient non-tactical flight are contained in this section, in proper sequence, from the time the pilot approaches the airplane until he leaves it either beached or moored.

SECTION III, EMERGENCY OPERATING PROCEDURES. The red border pages of this section cover the techniques to be employed in coping with any emergency that can reasonably be expected, but do not include those related to auxiliary equipment.

SECTION IV, DESCRIPTION AND OPERATION OF AUXILIARY EQUIPMENT. Auxiliary equipment which aids in the performance of special functions but does not contribute to actual flight is described in this section. In addition, the normal and emergency operating procedures are discussed.

SECTION V, OPERATING LIMITATIONS. This section covers all limitations which must be observed during normal flight.

SECTION VI, FLIGHT CHARACTERISTICS. General and specific flight characteristics are discussed in this section.

SECTION VII, SYSTEM OPERATIONS. Not applicable.

SECTION VIII, CREW DUTIES. Not applicable.

SECTION IX, ALL-WEATHER OPERATION. Not applicable.

APPENDIX I, OPERATING DATA. Charts and curves required for mission planning are found in this section.

Index, Alphabetical. This index lists alphabetically the airplane systems and major components covered in the handbook.

Figure 1-1

Section I

DESCRIPTION

TABLE OF CONTENTS

THE AIRPLANE.

The XP6M-1 SeaMaster, designed and manufactured by The Martin Company, is a jet propelled, long range, high performance seaplane whose primary mission is mine laying at low altitudes and high speeds in all-weather conditions. The airplane is readily adaptable for either aerial photography, reconnaissance, or the delivery of special stores.

A particularly unique feature is the rotary mine door, actually a section of the hull bottom, on which mines, photographic equipment, or other stores are loaded. In flight, 180° door rotation exposes the load into the airstream with little or no effect on trim. A variety of stores can be delivered because of the versatile loading capabilities of this mine door. When the mine door is in the closed position, a pneumatically actuated seal around the periphery of the door makes the mine bay watertight. Release of the stores is controlled electrically through the mine laying system, or by an emergency electrical control system in the cockpit. Stores can be taken aboard through a hatch in the hull crown when the airplane is afloat; or separate mine doors, previously loaded ashore, can be exchanged when the airplane is beached.

The XP6M-1 configuration is substantially different from that of previous seaplanes. The most notable differences are in the hull with its long afterbody, low stern post angle, and streamlined forebody keel — features suitable to high-speed flight. The wing design has a 40-degree sweepback of the quarter-chord. All flight

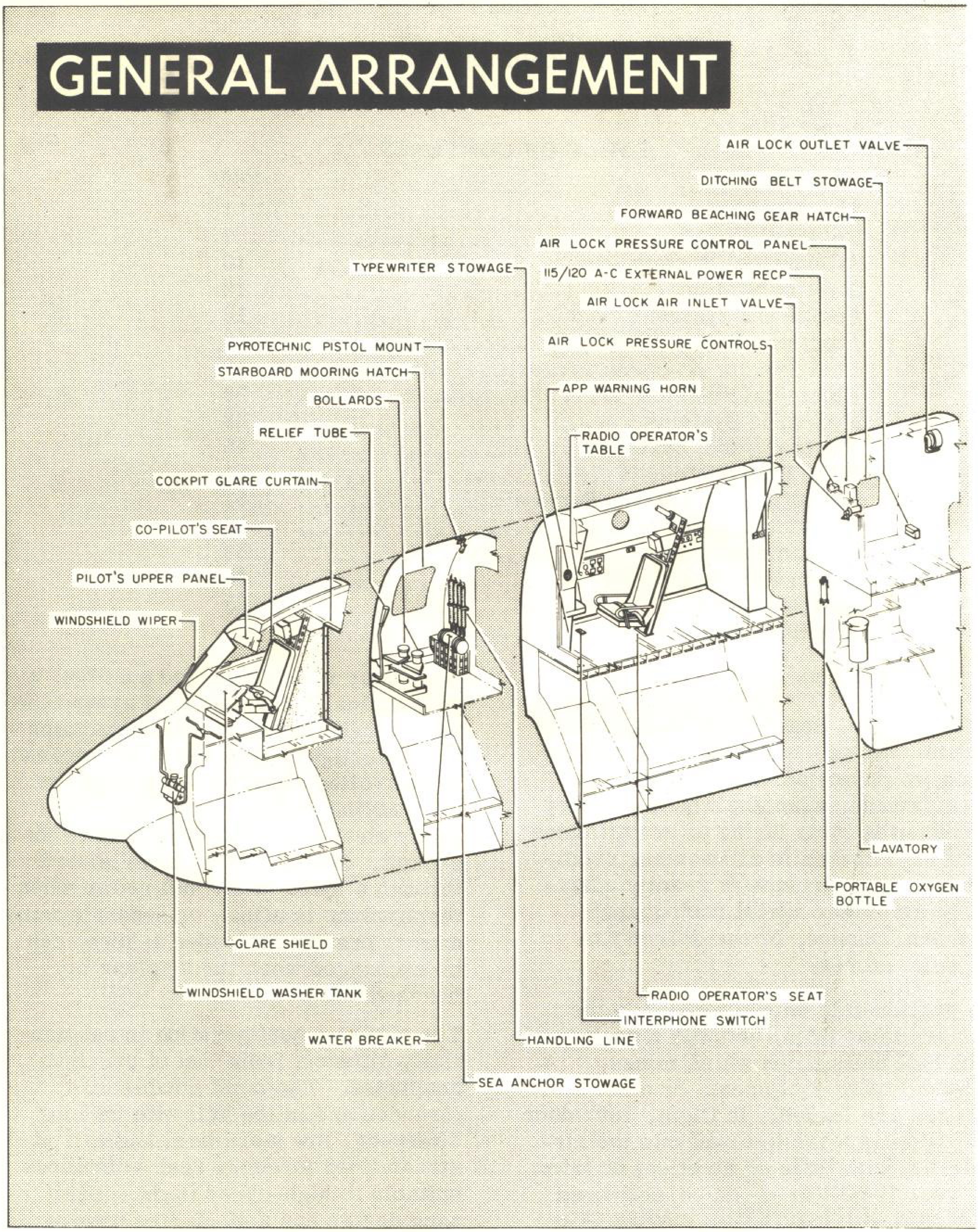


Figure 1-2 (Sheet 1 of 3)

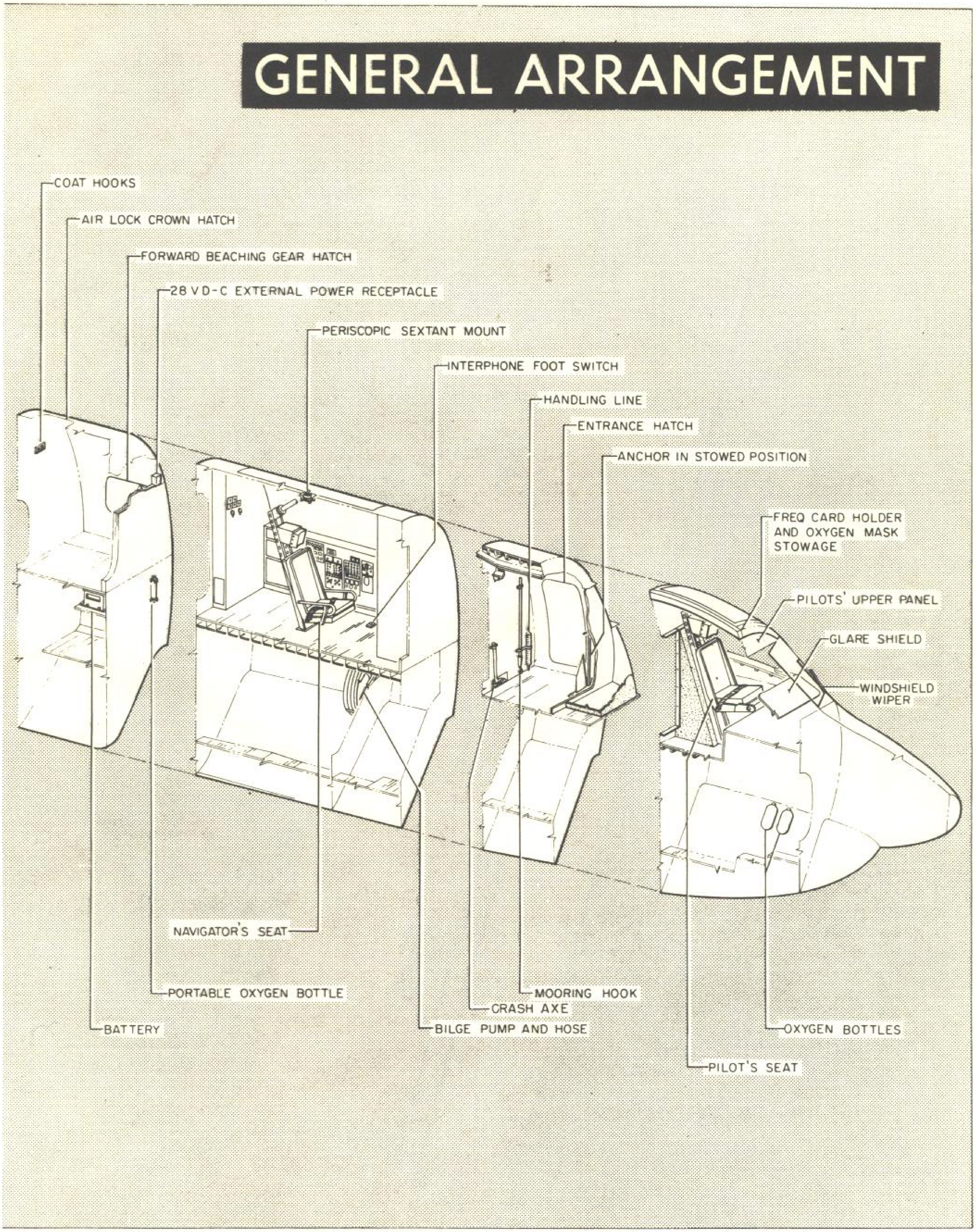


Figure 1-2 (Sheet 2 of 3)

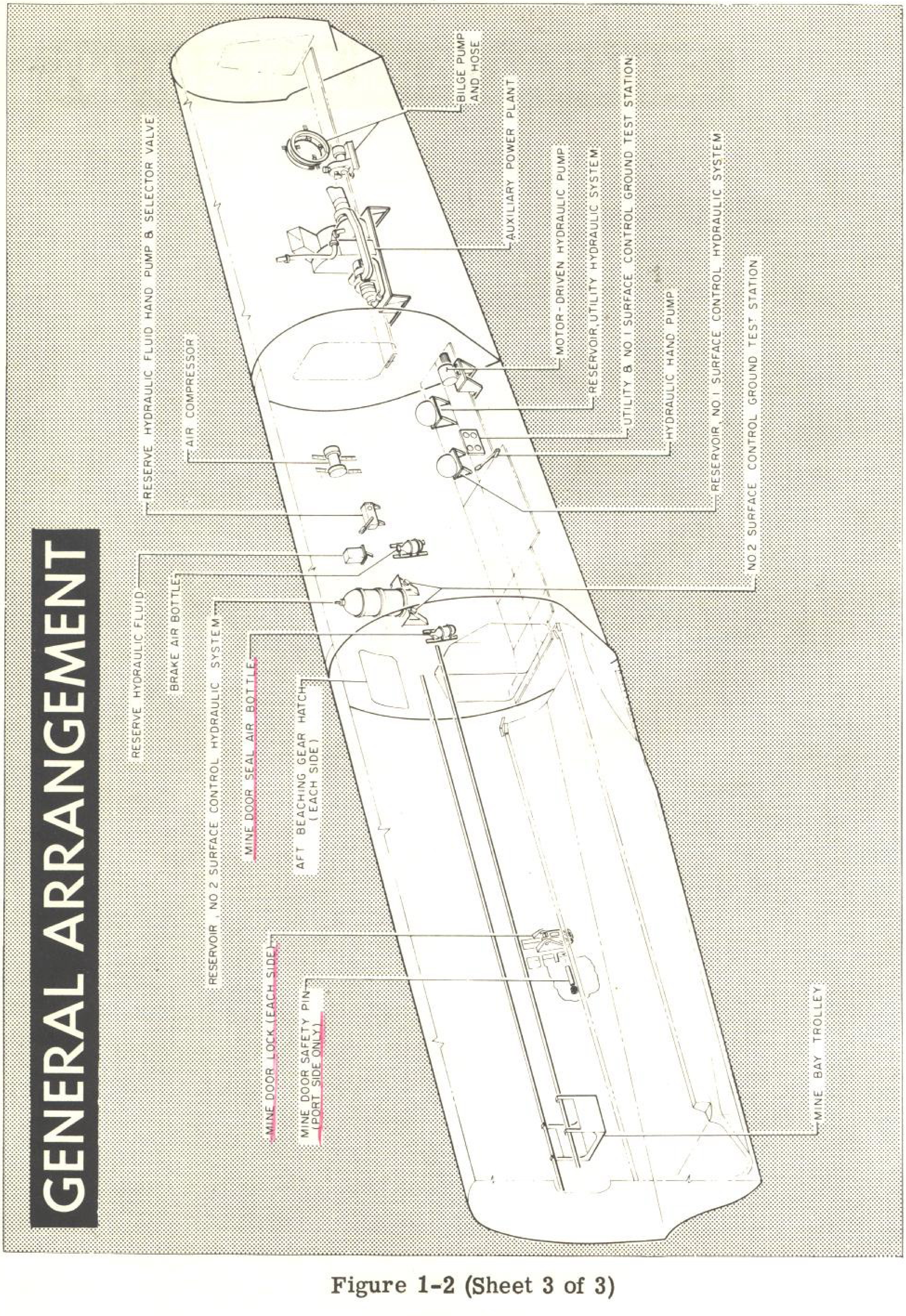


Figure 1-2 (Sheet 3 of 3)

controls are operated normally by hydraulic power incorporating an artifical "feel" system. Spoiler-ailerons are effective in both the high-speed and low-speed flight ranges. Mechanically linked wing slat sections (high lift devices) in the leading edge of each wing extend and retract automatically, assuring optimum control of the airplane at relatively low airspeeds and high angles of attack. The T-tail has two main advantages: 1) high directional stability is obtained with a moderate size fin; 2) the stabilizer is isolated from possible water spray damage during take-off and from the turbulent wing wake during flight. Hydroflaps on the after end of the hull bottom increase maneuverability on the water and serve as dive brakes during flight. The engine nacelles, mounted on the top of the wing, are close to the hull to reduce the effects of water spray at the air intakes.

The hydrodynamic design of the airplane permits it to take off from, and land on, relatively unprotected waters with waves of 6 to 8 feet. During the take-off run, and in rough water operations, spray strips mounted on the airplane's bow deflect water from the engines and the pilots' windshields.

Catapult-type ejection seats are installed at all crew stations. During a bail-out emergency, crew members eject upward from their stations. Armor plate is strategically located throughout the airplane to offer protection for individual crew members and vital flight control units.

Those compartments which are normally occupied in flight are pressurized and air-conditioned.

The crew is made up of a pilot, copilot, navigator, and radio operator. The pilot and co-pilot are seated side by side in the cockpit; the navigator's seat is occupied by the flight test engineer; the radio operator's seat, by the flight engineer (the latter two seats are in the Flight Deck Compartment).

Principle Dimensions (Approximately):

Length	134'
Length (at waterline)	120'3"
Span	102'7"
Height (normal)	35'4"
Draft (160,000 lb gross weight)	6'4"
Height (beaching gear struts extended)	38'1"
Height (squat)	31'8"

NOTE

Squat height is overall height of the airplane with forward beaching gear struts extended and aft beaching gear struts retracted.

Design Gross Weight 160,000 lb

AIRPLANE ARRANGEMENT. (See figure 1-2.)

The Cockpit Compartment contains the pilots' seats and the instruments and controls normally used in flight.

The Entrance (Anchor) Compartment, immediately aft of the cockpit, has the main entrance hatch on the port side and a mooring hatch on the starboard side. When the airplane is ashore and aboard the beaching gear, entrance is made by using a boarding

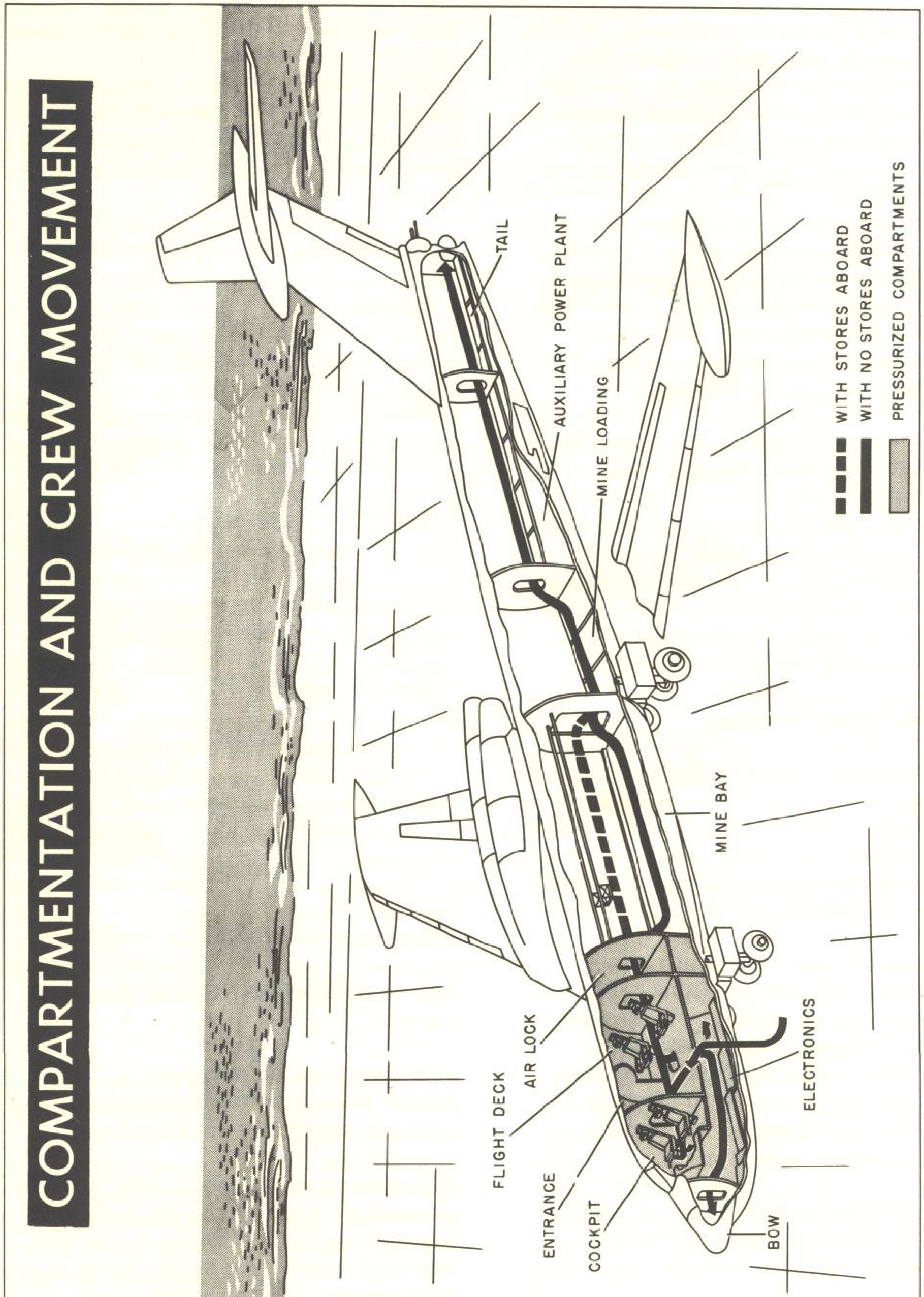

COMPARTMENTATION AND CREW MOVEMENT
TAIL
AUXILIARY POWER PLANT
MINE LOADING
MINE BAY
AIR LOCK
FLIGHT DECK
ENTRANCE
COCKPIT
BOW
ELECTRONICS
WITH STORES ABOARD
WITH NO STORES ABOARD
PRESSURIZED COMPARTMENTS

Figure 1-3

ladder. However, when the airplane is afloat, crew members alighting from a small boat or launch use hand grips beside the entrance hatch to gain entry. The principle water handling equipment as well as a water breaker and relief tube are located in this compartment.

The Flight Deck, immediately aft of the Entrance Compartment, has crew stations for the navigator and radio operator. The controls and equipment relating to navigation and long range radio communication are installed at each crew member's station.

The Air Lock Compartment is isolated from the flight deck and the mine bay by pressure-tight doors. Additional hatches on either side of the compartment facilitate attachment of the forward beaching gear; an overhead hatch provides access to the top of the airplane. This compartment serves as a pressure chamber when passage forward or aft is necessary while the airplane is pressurized.

The Mine Bay Compartment, immediately aft of the air lock, contains the rotary mine door. A personnel carrier which moves on overhead tracks is used for normal in-flight passage through this area when stores are aboard.

The Mine Loading Compartment, separated from the mine bay by a watertight door, permits aft beaching gear attachment through hatches on either side of the hull. When waterborne, the airplane can be loaded with stores through a split, center-opening, overhead hatch (approximately 4.5 feet by 15 feet). In the open position, the two halves of the hatch act as a working platform on either side of the opening. A watertight door at the aft end of this compartment allows access to the APP Compartment.

The APP compartment houses the APP unit, and the bilge pump and its hose.

The Tail Compartment, entered through a watertight door from the APP compartment, contains components of the flight control and feel systems.

The pressurized Electronics Compartment, beneath the cockpit and flight deck, is entered through a hatch at the forward end of the flight deck compartment. In this compartment are remotely controlled electrical and electronic units and a bilge pump. A pressure-tight door at the forward end permits access to the radome.

ENGINES.

This airplane is powered by four Allison Model YJ71-A-4 turbo-jet engines which are rated at approximately 11,300 lbs. maximum thrust with take-off afterburners, 8150 lbs. thrust for military power, and 6890 lbs. thrust for maximum continuous power. The four engines are enclosed in twin nacelles, two engines on each upper center wing surface adjacent to the hull. Each engine consists of 16-stage, axial flow compressor directly connected to a 3-stage turbine. Engine exhaust is regulated by a variable -area exhaust nozzle which automatically provides maximum thrust with proper temperature control for any given power setting.

Air enters the forward frame and passes through the compressor. Compressed air flows into the 10 inner combustion chambers; here fuel is sprayed into the air, and the mixture is burned. Igniter plugs in two combustion chambers provide ignition for starting. Exhaust gases exit through the transition liners to the turbine, causing rotation of this unit. The turbine rotor drives the compressor rotor by means of a splined coupling. From the turbine wheels, the gases travel through the variable jet nozzle.

During afterburner operation, additional fuel is sprayed into the exhaust gases and burned aft of the turbine rotor. The gases then travel through the jet nozzle at a higher velocity, creating additional thrust. Afterburner fuel is ignited by the hot exhaust gases leaving the turbine wheels.

Collectively, the engines provide electrical and hydraulic power to drive the accessories for the various airplane systems.

ENGINE CONTROL.

Several new features are incorporated in the engine power control to simplify operation and reduce to a minimum the possibility of compressor stall or flame-out. One feature is the opening of compressor bleed ports during acceleration or deceleration at the more critical engine speed ranges. Under normal operating conditions, power lever movement need not be so cautious as it is with most turbo-jet engines — changes in engine speed will automatically be made at the best time rate, regardless of the rapidity of the lever movement. Inlet guide vanes operate automatically to differentiate between high and low engine speed, by directing the flow of inlet air in the most efficient manner. For more stable operation, the exhaust nozzle opens during either positive or negative acceleration.

ENGINE FUEL CONTROL.

Engine-driven pumps force fuel through self-cleaning filters to the fuel control unit where it is metered.

NOTE

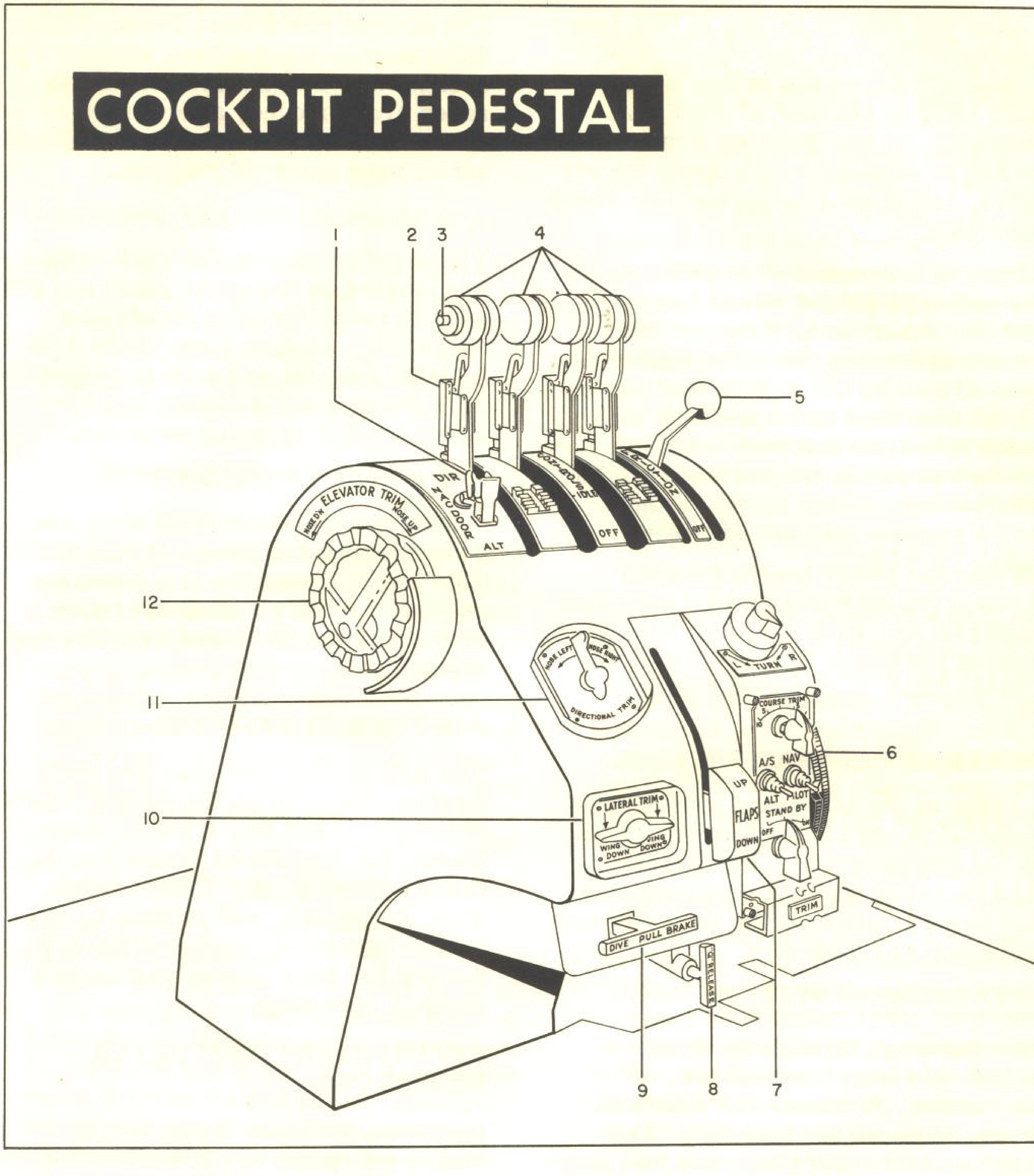
If the tank transfer and boost pumps fail, the engine-driven pumps will supply the engine with sufficient fuel to maintain level flight down to 10% of individual tank capacities.

The position of each power lever acts to meter the fuel to the engine. Compressor inlet air pressure and temperature, and engine speed automatically meter the correct amount. When the power lever establishes a power condition, this condition is maintained regardless of ambient atmosphere change.

Since fuel control is primarily mechanical, a loss of electrical power does not impair fuel flow. However, such a failure will eliminate automatic control of the compressor bleed valves, inlet guide vanes, and exhaust temperature nozzles. If the electrical power fails, the pilot must be careful in power lever movement to avoid flame-out, compressor surge, or excessive temperatures.

POWER LEVERS. (See figure 1-4.)

The four power levers, mounted on the pedestal, are mechanically connected to their respective fuel control units. A latch lever on the forward side of each power lever is used for positive positioning in the OFF and START positions. In the full aft or OFF position, the power lever actuates a microswitch to de-energize the engine-starting circuits and shut off fuel flow at the fuel control unit. Placing the lever at START closes this microswitch which, in conjunction with the START switch on the upper panel, energizes the starting circuits. Further forward movement to IDLE allows fuel to flow to the



1. Nacelle Door/Spray Strip Switch
2. Power Lever Latch
3. A/B Trigger Switch
4. Power Levers
5. Power Lever Friction Lock
6. Autopilot Controller
7. Wing Flap Lever
8. Q-Stop Release Handle
9. Dive Brake Handle
10. Spoiler-Aileron Trim Knob
11. Rudder Trim Knob
12. Stabilizer Trim Wheel

Figure 1-4

engine and results in 56% to 59% rpm. Continued forward movement progressively increases engine speed until 100% is reached at the FULL position. At this position a microswitch is actuated which opens the air valve, initiating afterburner fuel pump operation.

Either of the push-button switches on the outboard side of power levers No. 1 and No. 4 serves to "trigger" afterburner operation, once the system has been armed by the A/B Armed switch on the overhead panel and A/B fuel pump operation has been initiated through power lever positioning. The afterburner system on No. 1 and No. 4 engines only are operative.

Moving the power levers forward through the OFF and START positions requires operating the latch levers; moving the power levers aft will not involve latch engagement except at IDLE.

POWER LEVER FRICTION LOCK.

A lever on the starboard side of the pedestal is used to increase friction on the power levers. Moving the friction lever forward progressively increases friction on the power levers until they are locked.

AFTERBURNER SYSTEM.

Afterburning, through the injection of fuel into the exhaust gases, aft of the turbine, furnishes the additional thrust required for take-off. The airplane fuel supply delivers fuel under pressure to the afterburner fuel pump on each engine. These pumps operate by bleed air from the engine compressor. Separate fuel control units meter the fuel on the basis of compressor pressure. All afterburner controls and indicators operate on 28-volt dc.

The special rakes installed for flight test instrumentation limit afterburner operation to 1-1/2 minutes. If the rakes are removed, afterburner operation is limited to 5 minutes and should not be used above 10,000 feet.

A/B ARMED/AIRSTART SWITCHES.

These switches, one for each engine, are located on the upper panel and are used to ready the afterburners for operation. Placing them in the A/B ARMED position arms their respective A/B power lever switches and the power lever triggering switches.

A/B POWER LEVER SWITCH.

A microswitch is actuated when the power levers are placed in full OPEN. This switch opens the fuel pump air valve and initiates pump operation, provided the A/B armed switches are armed.

A/B TRIGGER SWITCHES.

The A/B trigger switches are push buttons, mounted on the outboard face of the No. 1 and No. 4 power lever knobs, for convenient thumb operation by either pilot. Either switch, when depressed, will initiate afterburner operation, provided the A/B system has been armed and the fuel pump is operating.

AFTERBURNER OR STARTER INDICATORS.

Individual indicator lights on the center sub-panel are illuminated whenever the afterburners are operating. The same lights indicate an energized starter circuit for their respective engines. These lights will illuminate only if engine speed is less then 2380 rpm; when speed has exceeded 2380 rpm, the lights will go off.

VARIABLE EXHAUST AREA.

An iris-type nozzle is installed on each engine tail pipe to provide maximum thrust, with temperature control, under all normal operating conditions. Nozzle position is determined by power lever position with the exception that an overtemperature condition will open the nozzle as necessary for adequate cooling, regardless of power lever position. When the overtemperature condition no longer exists, control of the nozzle reverts to the power lever.

Each engine's hydraulic system, self-contained and independent of the airplane's hydraulic system, powers hydraulic actuators to operate the nozzle.

Because the power lever connection to the servo valve actuator is mechanical and the temperature sensing device is electrically connected, electrical failure in such a system will result in the nozzle going to the open position. In its operation, the nozzle control system requires both 115-volt ac and 28-volt dc.

NOTE

If a malfunction causes the nozzle to go to the open position, a loss of thrust will result. During take-off, with afterburning, this loss will be approximately 10%.

ENGINE AIR INTAKE.

Normally, ram air for both combustion and engine cooling is ducted from the forward portion of the nacelle. Cooling air is taken from the main flow through boundary layer openings within the main duct and is then directed to various sections of the engine and its accessories. An alternate air source on the top of the outboard nacelles is used for slow-speed water operation to prevent bow spray from entering the ram air intake. Other than the selection of the alternate air source, there is no control of air intake.

NACELLE DOOR/SPRAY STRIP SWITCH.

This toggle switch, mounted on the pedestal (figure 1-4), controls simultaneously the operation of the alternate air intake nacelle doors and the spray strips. The switch is placarded ALT and DIR and is guarded in the DIR position. When the switch is in ALT, the nacelle doors are rotated to an almost vertical position above the nacelle, blocking normal airflow into the air intake duct. Air is then drawn into the engine through the opening aft of this extended portion.

NOTE

The nacelle doors take about six seconds to complete the opening or closing cycle.

Simultaneous with this operation, the spray strips mounted on the bow of the airplane extend to the DOWN position. When DOWN, these spray strips direct bow sea spray downward and away from the engine air intakes during take-off or taxiing in rough waters. Power for operation, control, and position indication of the nacelle doors and spray strips is 28-volt dc.

NACELLE DOOR INDICATORS.

A flag-type indicator for each nacelle door is mounted in the center of the pilots' upper panel (figure 1-6) and indicates continuously the position of the doors.

SPRAY STRIP INDICATORS.

Individual indicators in the center of the pilots' upper panel (figure 1-6) give a visual indication of the position of the left and right upper spray strips. Both left and right — upper and lower — sets of spray strips are actuated by electric motors.

ENGINE INDICATORS.

The engine indicators are grouped together in the center of the instrument panel. (See figure 1-5.)

TACHOMETERS. Electrically operated tachometers for each engine indicate engine speed in percentages of normal rated (6100 rpm) speed. They are powered by individual generators independent of the airplane's electrical system.

OIL PRESSURE INDICATORS. Pressure transmitters in each engine use 26-volt ac to record engine oil pressure on individual indicators on the engine instrument panel.

FUEL FLOW INDICATORS. Fuel flow, in pounds per hour, is indicated on the individual instruments for each engine. The system requires 26-volt a-c power.

EXHAUST GAS TEMPERATURE INDICATORS. Exhaust gas temperature (EGT) is detected by thermocouples equally spaced around the exhaust nozzle of each engine. The systems are self-generating, needing no airplane electrical power. The temperatures, in degrees centigrade, are read on individual instruments.

STARTING SYSTEM.

An air turbine is installed on each engine for starting. These starters use compressor bleed air from the APP and/or engines No. 1 and No. 4 for their power. The APP is required for initial engine start because there is no provision for attaching an outside source of air for starting.

Compressed air and fuel for combustion, with 28-volt dc for ignition, are used to start the engine. Starting is almost completely automatic because controls activate in sequence the necessary operations. With the power lever for an engine in the START position, power is made available to all of the starting circuits. Placing the corresponding Start-Motor switch on the upper panel (figure 1-7) momentarily at START accomplishes the following:

1. The igniters are energized.
2. The engine fuel manifold drip valve is closed. (This valve normally is held closed by fuel pressure and opens to eliminate excess fuel when the engine is shut down.)
3. The A/B starter indicator lights.
4. The variable entrance guide vanes are positioned for low-speed engine operation.
5. The starter air shut-off valve is opened.

NOTE

For normal usage, the APP should be on to start each engine. If APP is not used, approximately 70% rpm on No. 1 engine and/or No. 4 engine is required to supply sufficient compressed air to start the remaining engines.

6. The engine fuel manifold fill valve is opened. This manifold fill

ENGINE INSTRUMENT AND SUB-PANEL

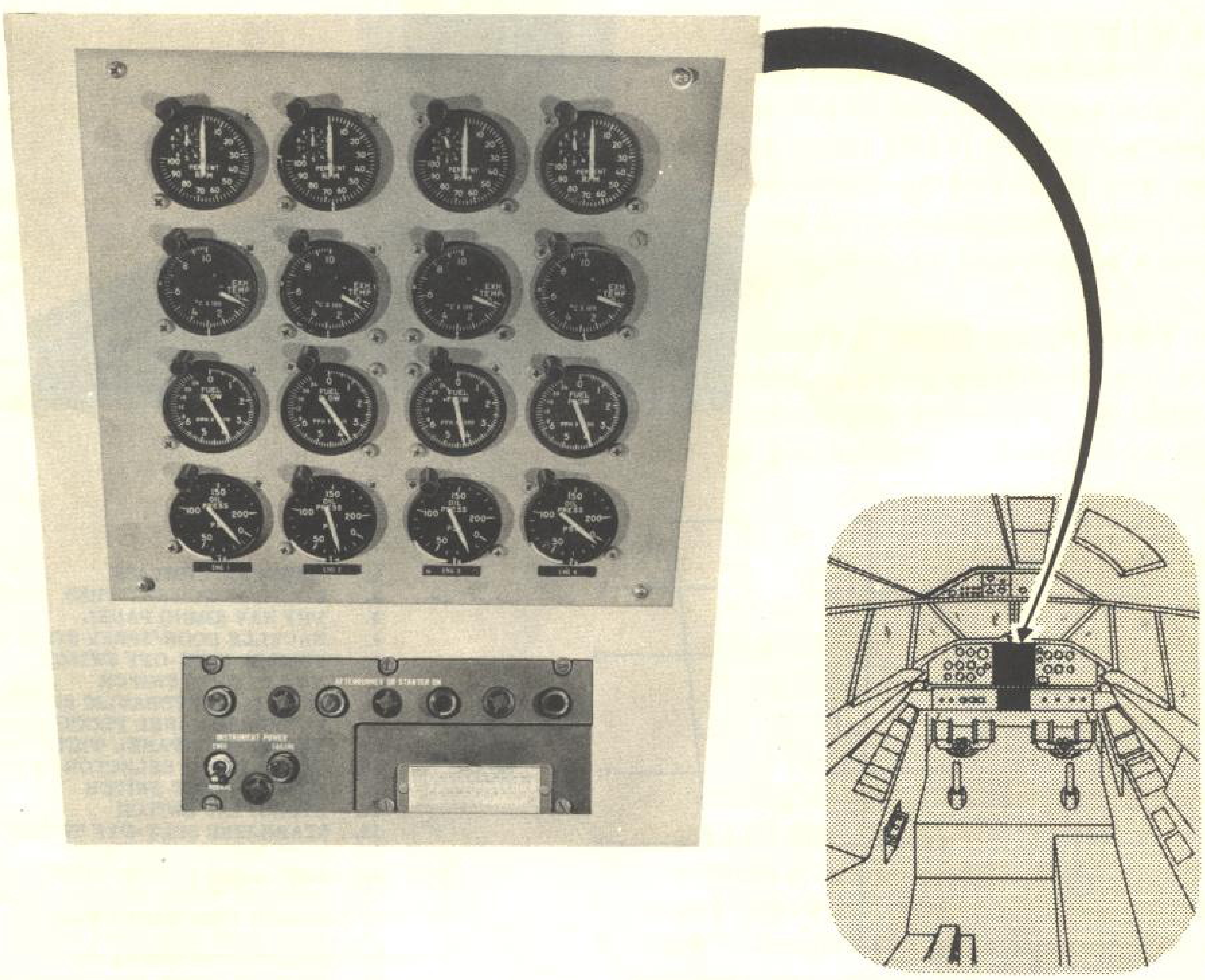
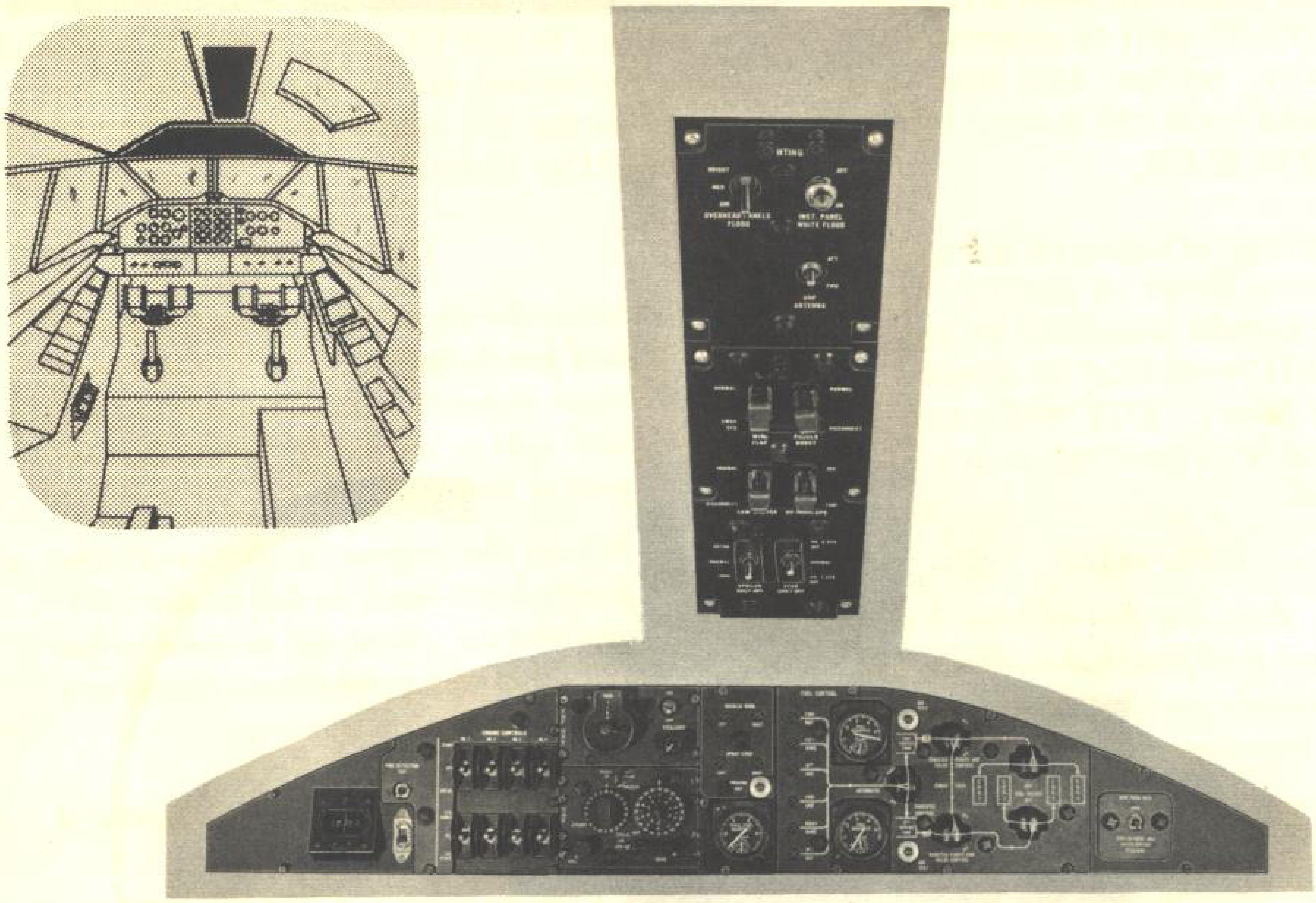
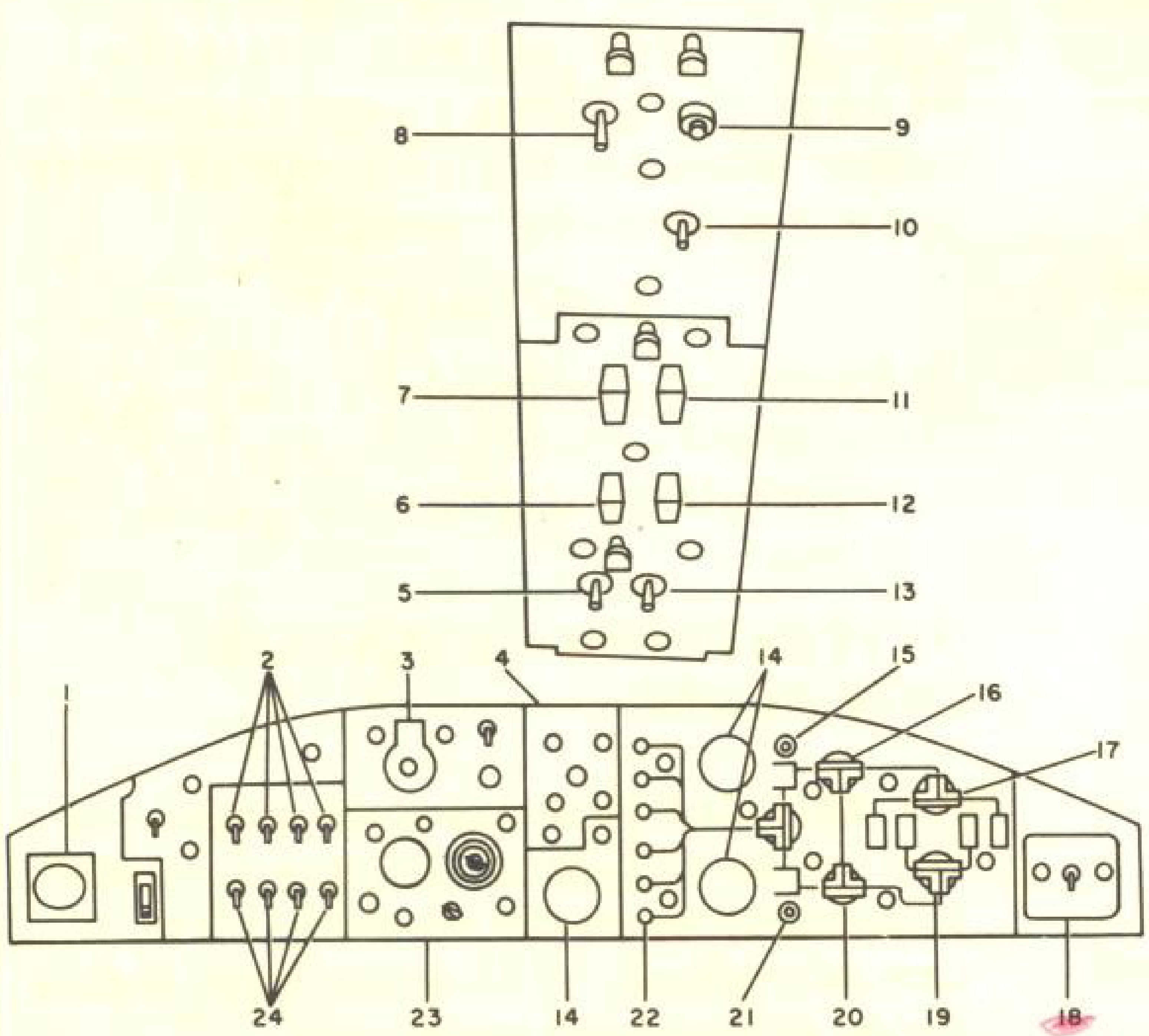


Figure 1-5

COCKPIT UPPER AND OVERHEAD PANELS





1. MAGNETIC COMPASS
2. START/MOTOR SWITCHES
3. VHF NAV (OMNI) PANEL
4. NACELLE DOOR/SPRAY STRIP INDICATORS
5. SPOILER SHUT-OFF SWITCH
6. YAW DAMPER SWITCH
7. WING FLAP HYDRAULIC SELECTOR SWITCH
8. OVERHEAD PANEL FLOOD LIGHT SWITCH
9. INSTRUMENT PANEL WHITE LIGHT SWITCH
10. UHF ANTENNA SELECTOR SWITCH
11. RUDDER BOOST SWITCH
12. HYDROFLAP SWITCH
13. STABILIZER SHUT-OFF SWITCH
14. FUEL TOTALIZER GAGES
15. FUEL GAGE TEST BUTTON
16. BOOSTER PUMPS AND VALVE CONTROL KNOB
17. ENGINE FUEL VALVE KNOB
18. MINE DOOR SEAL HEAT SWITCH
19. ENGINE FUEL VALVE KNOB
20. BOOSTER PUMPS AND VALVE CONTROL KNOB
21. FUEL GAGE TEST BUTTON
22. FUEL TRANSFER PUMP INDICATORS
23. UHF CONTROL PANEL
24. A/B ARMED/AIRSTART SWITCHES

Figure 1-6

valve supplies fuel more rapidly to the engine being started because the fuel control unit is bypassed. The valve closes when the fuel manifold operating pressure (70-75 psi) is reached. However, no fuel will flow to the manifold until the power lever is moved to IDLE.

As the starting procedure progresses and the power lever is moved to IDLE, the engine should stabilize at about 58%. Fuel flow should be about 1,000 pounds per hour. EGT will rise and acceleration will become more rapid at this point.

CAUTION

If EGT does not rise within 5 seconds after fuel flow has built up, the engine should be shut down and the trouble investigated.

Initial fuel flow is approximately 3000 pounds per hour, decreasing to approximately 1100 pounds per hour at light off.

At 38 to 43% rpm, the starter overspeed switch opens to break the holding circuit in the start switch, stopping ignition and de-energizing the starter air valve solenoid, the drip valve, and the manifold fill circuits.

CAUTION

If oil pressure has not stabilized within limits when the engine has stabilized at IDLE, the engine should be shut down and the trouble investigated.

STOP-START.

If it is necessary to abort the engine start, the power lever can be returned to OFF.

ENGINE MOTORING.

The starter is also used for "motoring," or turning the engine without actually starting. Holding the Start/Motor switch in the MOTOR position delivers compressed air to the starter, thus motoring the engine without energizing the other circuits.

CAUTION

Since the engine fuel pump requires fuel for its lubrication, damage may occur if boost pumps are not on and fuel valves not open when the engine is motored.

When the engine is motored, the power lever must be left in the OFF position to avoid an accumulation of fuel in the combustion chambers.

A/B ARMED - AIRSTART SWITCH.

The A/B Armed - Airstart switch on the upper panel (figure 1-7) is used to supply ignition for starting an engine in flight. With this switch in AIRSTART, the ignition cutout is overridden when the engine speed is above the normal cut-out speed.

CAUTION

After airstart is completed, this positive switch must be returned to OFF to prevent burning out the ignition system.

AFTERBURNER OR STARTER INDICATORS.

An indicator light for each engine on the center sub-panel (figure 1-5) will illuminate when the starting circuits are energized. The same light indicates afterburner operation.

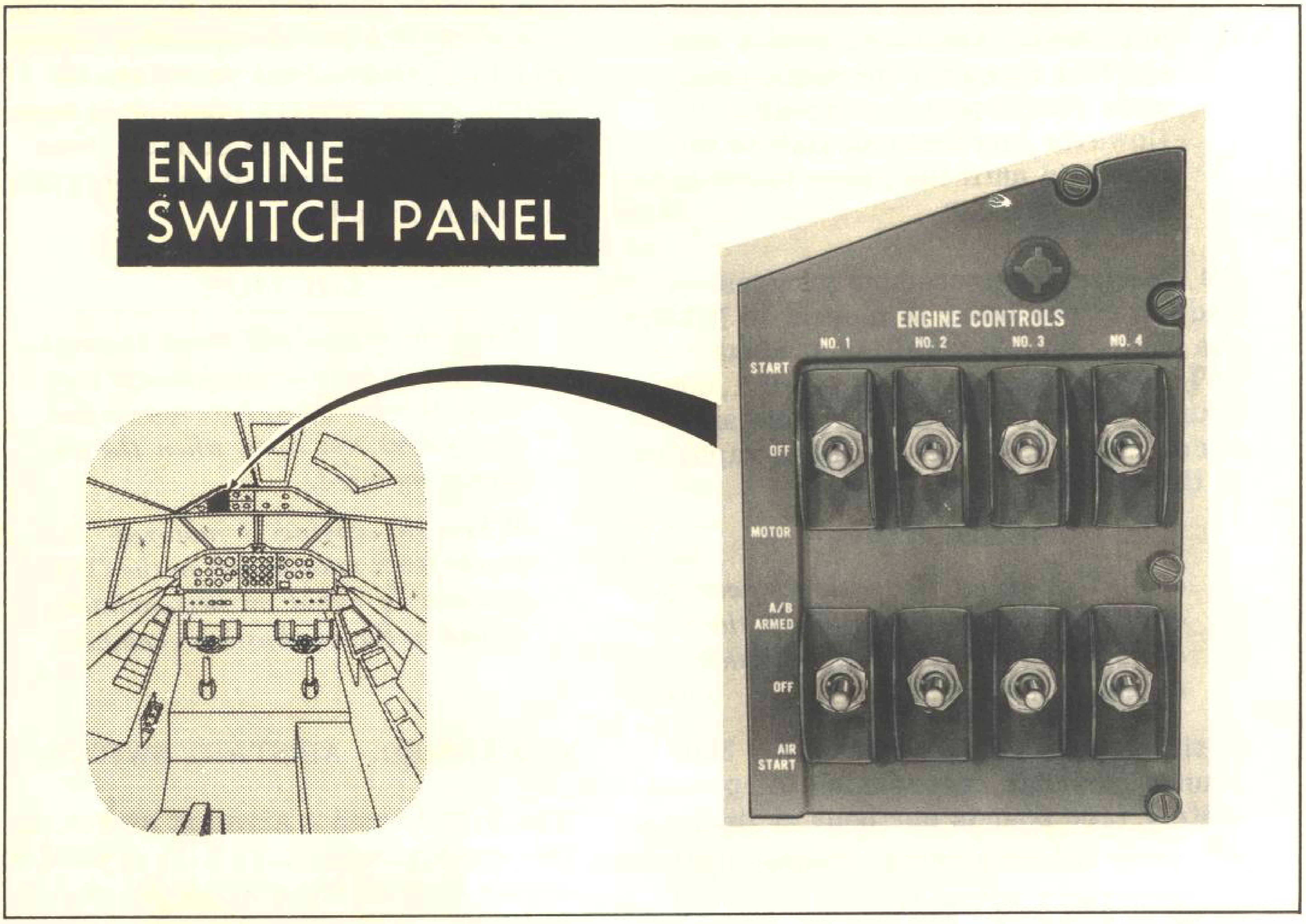


Figure 1-7

ENGINE OIL SYSTEM.

Each engine has a separate dry sump, integral oil system for engine lubrication and constant speed drive operation. The oil tank, which is filled from the outboard side of engines No. 1 and No. 4 and from the inboard side of engines No. 2 and No. 3, is fully serviced with 5.5 U.S. Gal. There is also an additional space for 1.5 gallons expansion space. The system is completely automatic and no controls are provided. Oil quantity is checked with a dip stick on the filler cap. See figure 1-29 for oil specification and grade.

OIL COOLER.

A fuel-oil heat exchanger is used to cool engine oil. No control of the cooler is required of the pilot.

AUXILIARY POWER PLANT (APP).

A gas turbine-type auxiliary power plant drives an a-c generator and supplies bleed air for engine starting, cabin conditioning, and anti-icing. This unit furnishes an airflow of 75 pounds per minute, plus 15-shaft hp to drive the a-c generator. The APP can be started and operated, with reduced power output, up to 30,000 feet. It is governor-controlled to maintain 6000 output rpm. When properly set for starting, the APP is completely automatic in its operation. The unit shuts down if the oil pressure is too low or there is an engine overspeed of 110%. Intake air is ducted from a port in the hull, fuel is supplied by the aft service tank, and exhaust is dumped overboard. The oil system for the unit is self-contained and serviced through a one-gallon capacity tank. See the Servicing Diagram(figure 1- 29) for oil specification and grade.

Normally, the unit will be operated from before airplane engine-start until generator output is obtained from engines No. 1 and No. 3. The APP should be started and its generator output made available to the bus system after the airplane has landed and before engines No. 1 and No. 3 have been shut down. It is recommended the APP not be operated during take-off and landing because of its remote location in the event of APP fire. Should power from the unit be required by an emergency in flight, the APP can be used in the normal manner.

APP CONTROLS. (See figure 1-8.)

The APP is remotely operated from a control panel at the radio operator's station. All control systems and actuators require 28-volt dc.

CAUTION

Because the unit is not equipped with a fire extinguishing system, a fire watch must stand by in the APP compartment when the unit is started.

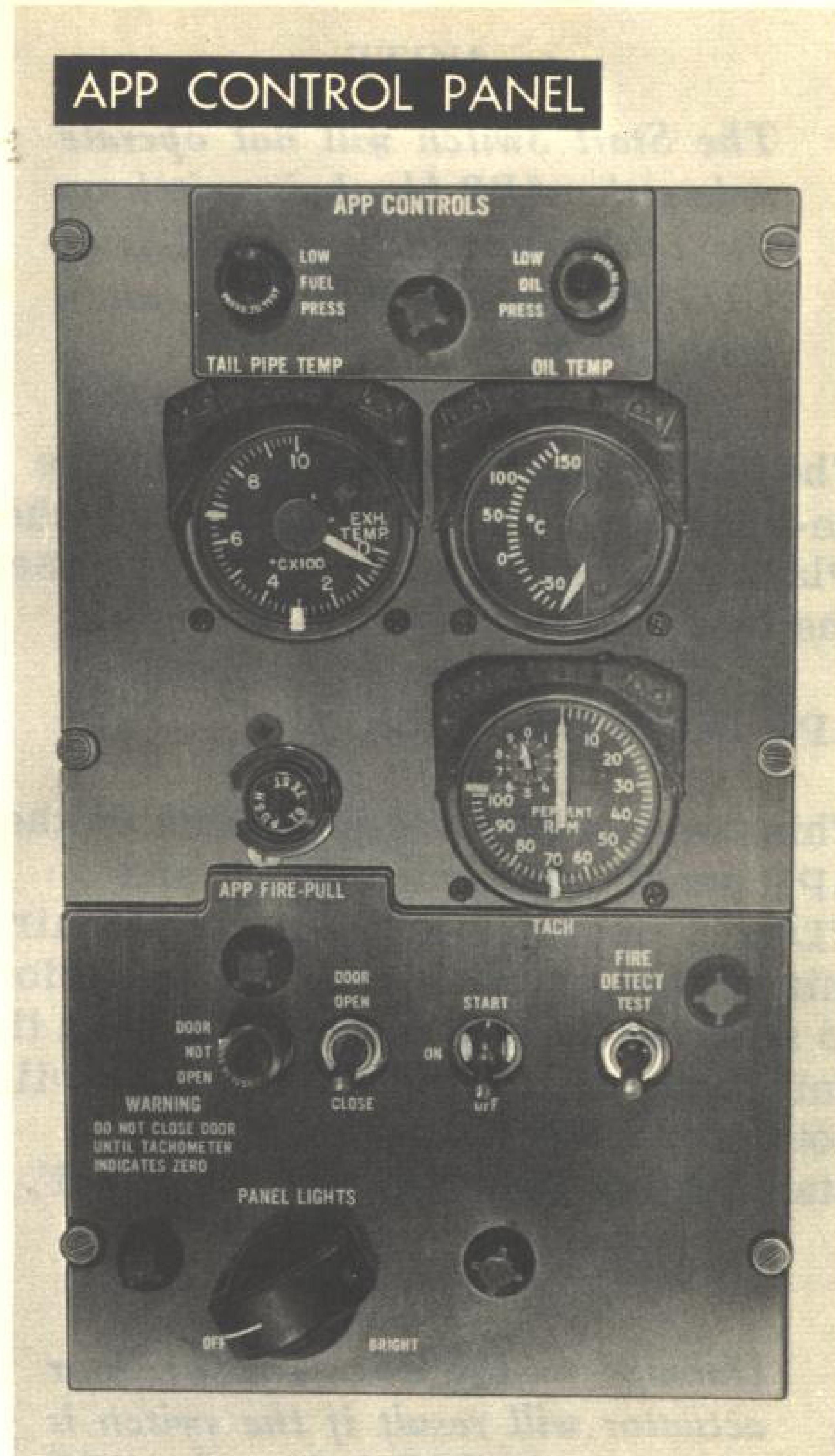


Figure 1-8

START SWITCH. Since operation of the APP is almost entirely automatic, the start switch is the only unit control on the panel. When momentarily placed to START, then allowed to return to ON, the starter is engaged. The fuel valve is opened and the ignition circuit energized by the build-up of oil pressure within the unit. An outside source of 28-volt dc, either airplane or external power, is necessary for starting. Once operating, the unit has its own generator to supply the power for automatic control.

NOTE

The Start Switch will not operate unless the APP bleed-air switch on the cabin conditioning panel is in CLOSED, and the APP door switch is in OPEN.

The starter and ignition circuits are de-energized when 35% rpm is reached. Placing the start switch to OFF closes the fuel valve, stopping the engine.

APP DOOR SWITCH.

This two-position toggle switch on the APP panel, placarded OPEN and CLOSE, operates the door for the air intake port. The door is opened prior to starting the unit and closed when the unit is not operating. The switch will not act to close the door unless the start switch has been placed at OFF.

NOTE

Damage to the door and/or door actuator will result if the switch is placed to CLOSE before the APP tachometer indicates zero.

APP INDICATORS.

All APP indicators which require electrical power use 28-volt dc.

APP LOW FUEL PRESSURE INDICATOR. A push-to-test indicator light on the APP panel illuminates to indicate low fuel pressure. It will normally light when the start switch is placed at START and go off when fuel pressure is within limits.

APP LOW OIL PRESSURE INDICATOR. Another push-to-test indicator light on the APP panel indicates low oil pressure. The light comes on when the START switch is actuated and goes off when pressure is within limits.

TAIL PIPE TEMPERATURE INDICATOR. Exhaust gas temperature, as detected by thermocouples, is indicated in degrees centigrade on a gage on the APP panel.

OIL TEMPERATURE INDICATOR. The "oil-in" temperature, in degrees centigrade, is indicated on a gage on the APP panel. Detection is made by a temperature bulb operating on 28-volt dc.

TACHOMETER. A tachometer on the APP panel indicates APP engine speed in percent of rated rpm. This instrument operates on the electrical output of a tachometer generator.

DOOR-NOT-OPEN INDICATOR. This push-to-test indicator illuminates when the start switch is moved to START and the air intake door is closed. If the indicator lights, the door can be opened with the APP door switch, causing the light to go off. The APP can then be started.

APP FIRE DETECTION. When a fire occurs in the APP, the red APP fire detection light illuminates, simultaneously with the sounding of a warning horn at the radio operator's station. This APP-Fire-Pull knob can be pulled out to shut off the fuel and bleed-air valves when fire is detected. A test switch on the panel can be placed in TEST to check the system. See

EMERGENCY EQUIPMENT in this section for additional information on the APP fire detection system.

In addition to these panel indicators, there are located at the APP unit a direct reading oil pressure gage, a direct reading fuel pressure gage, an engine hour meter (registers the time the unit has been operated), and a start counter (registers the number of unit starts).

FUEL SYSTEM.

The fuel system on this airplane is a continuous flow, pressure system designed for single-point pressure fueling only, at a maximum rate of 400 gallons per minute.

The engine fuel systems are supplied from two service tanks (see figure 1-11) located on the port side of the mine bay. One tank services the inboard engines; the other, the outboard engines. The service tanks, in turn, are replenished by all other tanks aboard. The normal tankage installation, in addition to the service tanks, is an integral tank in each wing, plus two auxiliary hull tanks on the starboard side of the mine bay. The total fixed fuel capacity is 11, 289 gallons. (See figure 1-9 for usable fuel.)

For general reconnaissance, 2786 additional gallons may be carried in two tanks temporarily installed in the mine bay; total fuel capacity with temporary tanks full is 14, 075 gallons.

To minimize the effect of center-of-gravity travel, the hull tanks are located near the wing root; in order to reduce weight of piping, the tanks are located close together. Fuel from the wing tanks is used early in the mission so that no fuel is left in that relatively vulnerable location during flight in the combat zone. All tanks are purged by gases from a combustion gas generator at a pressure of 11 inches of water.

The fuel system can be operated automatically or manually. During automatic operation, the service tanks are replenished with fuel from the other tanks in the following sequence: the mine bay tanks (when installed) first, the two wing tanks next, and the auxiliary hull tanks last. In manual operation, the same sequence should be followed.

Fuel is supplied from the service tank by two booster pumps operating in parallel. Single transfer pumps in each supply tank deliver fuel under pressure to the service tanks. All pumps operate on 115-volt ac. Each booster pump in either service tank operates from a separate bus. A thermal switch will disconnect any pump that overheats.

The fuel system can be controlled from either the pilots' fuel panel for continuous flow or from the radio operator's auxiliary fuel panel for manual operation. Each panel is in the form of a single-flow diagram. Observing the continuity of lines or the position of switches on a line makes evident the flow resulting from any panel set-up. Although the system can be operated from either panel, the function of both must be thoroughly understood so that inter-relationship can be appreciated.

MAIN FUEL PANEL CONTROLS.
(See figure 1-10.)

The main fuel control on the co-pilot's upper panel affords control of the fuel system for the normal, continuous flow. All fuel valves and fuel pump control

FUEL QUANTITY DATA

U S GALLONS

TANKS	USABLE FUEL	UNUSABLE FUEL LEVEL FLIGHT	EXPANSION SPACE	VOLUME
Service Tank (Forward)	801	6	19	826
Service Tank (Aft)	801	6	29	836
Auxiliary Tank (Forward)	819	10	20	849
Auxiliary Tank (Aft)	840	5	19	864
Wing Tank (Port)	3816	50	111	3977
Wing Tank (Starboard)	3790	52	95	3937
Mine Bay Tank (Forward)	1350*	3*	40*	1393*
Mine Bay Tank (Aft)	1350*	3*	40*	1393*

TOTAL USABLE FUEL: WITH MINE BAY TANKS —— 13567 Gal. (88185 lbs.)
WITHOUT MINE BAY TANKS-10867 Gal. (70635 lbs.)

NOTE: Payload must be sacrificed when Mine Bay Tanks are installed.

DATA AS OF: 12 MAY 1955
DATA BASIS: ACTUAL TEST
(*Estimated)

Weight of fuel required to fill tanks may vary from one filling to another because of the effect of temperature variation on fuel density.

Figure 1-9

circuits operated on 28-volt dc.

NOTE

Fuel flow cannot be directed from the main panel unless the individual transfer pump switches on the auxiliary panel are in the AUTO ON position.

TRANSFER KNOB. This five-position knob energizes all transfer pumps when moved from OFF or transfers the pump control to the auxiliary panel when moved to AUX PANEL. It also operates valves to direct flow to either or both service tanks, as indicated by the flow lines on the knob. Transfer pumps, when operated by this knob, run continuously until their tanks are empty; then they automatically stop.

BOOSTER PUMPS AND CROSSFEED VALVES CONTROL KNOBS. These two knobs direct flow from the service tanks to their respective engines. They also control operation of the booster pumps in the service tank with which they are connected. Both knobs are identical in their operation. In the OFF position, the valves are closed and the pumps off. Flow will be as indicated by the lines on the knob: either from the tank to the engines, or from the tank to the engines and to crossfeed, or from crossfeed line to the engines. In the latter position, the booster pumps will be off.

ENGINE VALVES KNOBS. These knobs direct flow to either or both of the engines as indicated by the flow lines on the knobs. The OFF position closes the valves to both engines.

MAIN PANEL INDICATORS.

FUEL QUANTITY INDICATORS. Three fuel quantity indicators, operating on 115-volt ac, are mounted on the panel. The two service tanks indicators show the total fuel in their individual tanks. The large indicator dial on each gage shows fuel weight in thousands of pounds; the small sub-dial, in hundreds. The total fuel quantity indicator shows the total fuel aboard the airplane. Its large dial shows pounds in multiples of ten thousand; the small sub-dial,thouands.

INDICATOR TEST BUTTON. Individual push buttons, adjacent to each indicator, provide an accurate check for each instrument. Each indicator should read zero when its button is depressed and held in.

TRANSFER PUMP INDICATORS.

Individual flag indicators, operating on 26-volt ac, continuously show the status of each transfer pump during

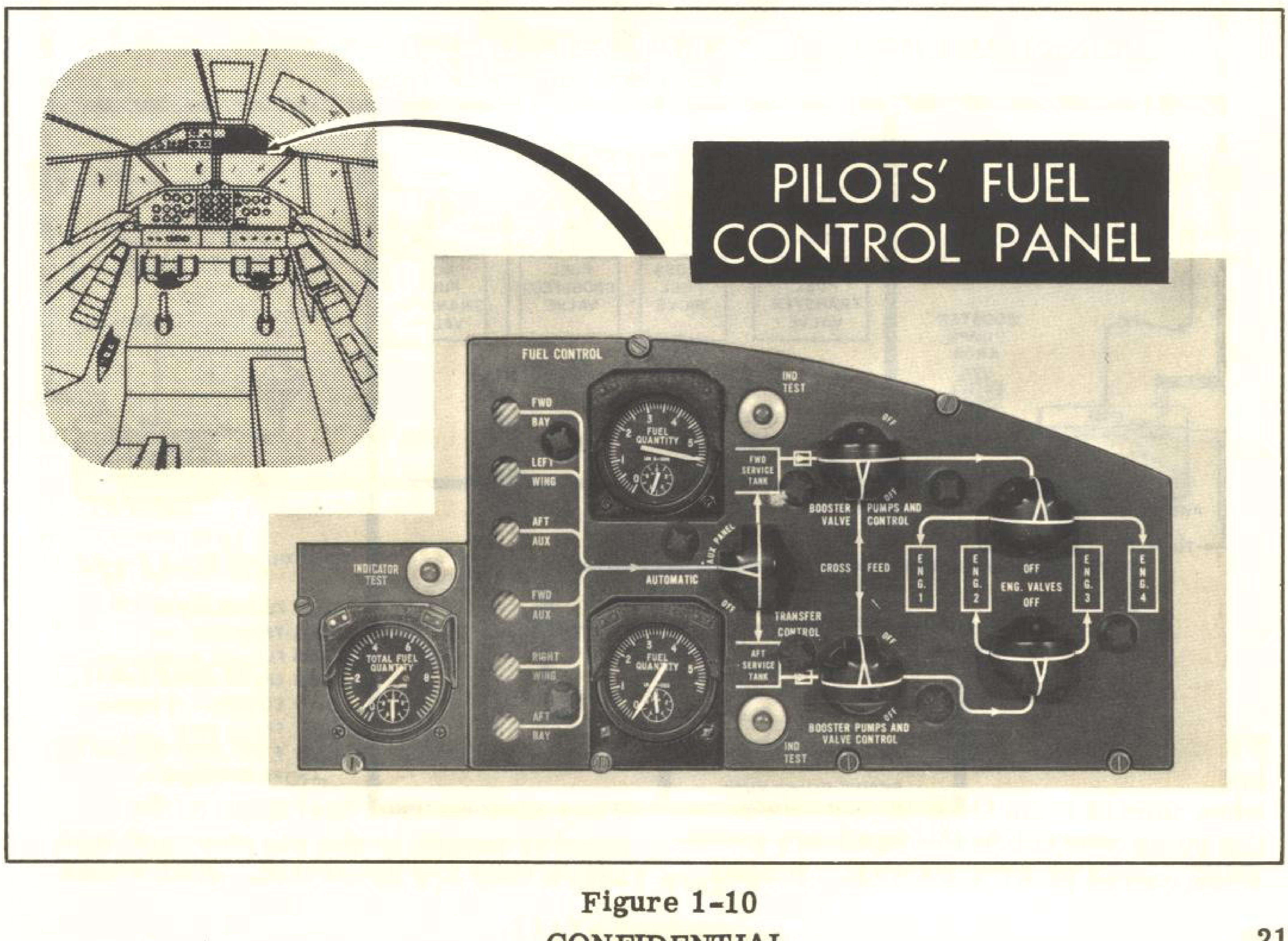


Figure 1-10

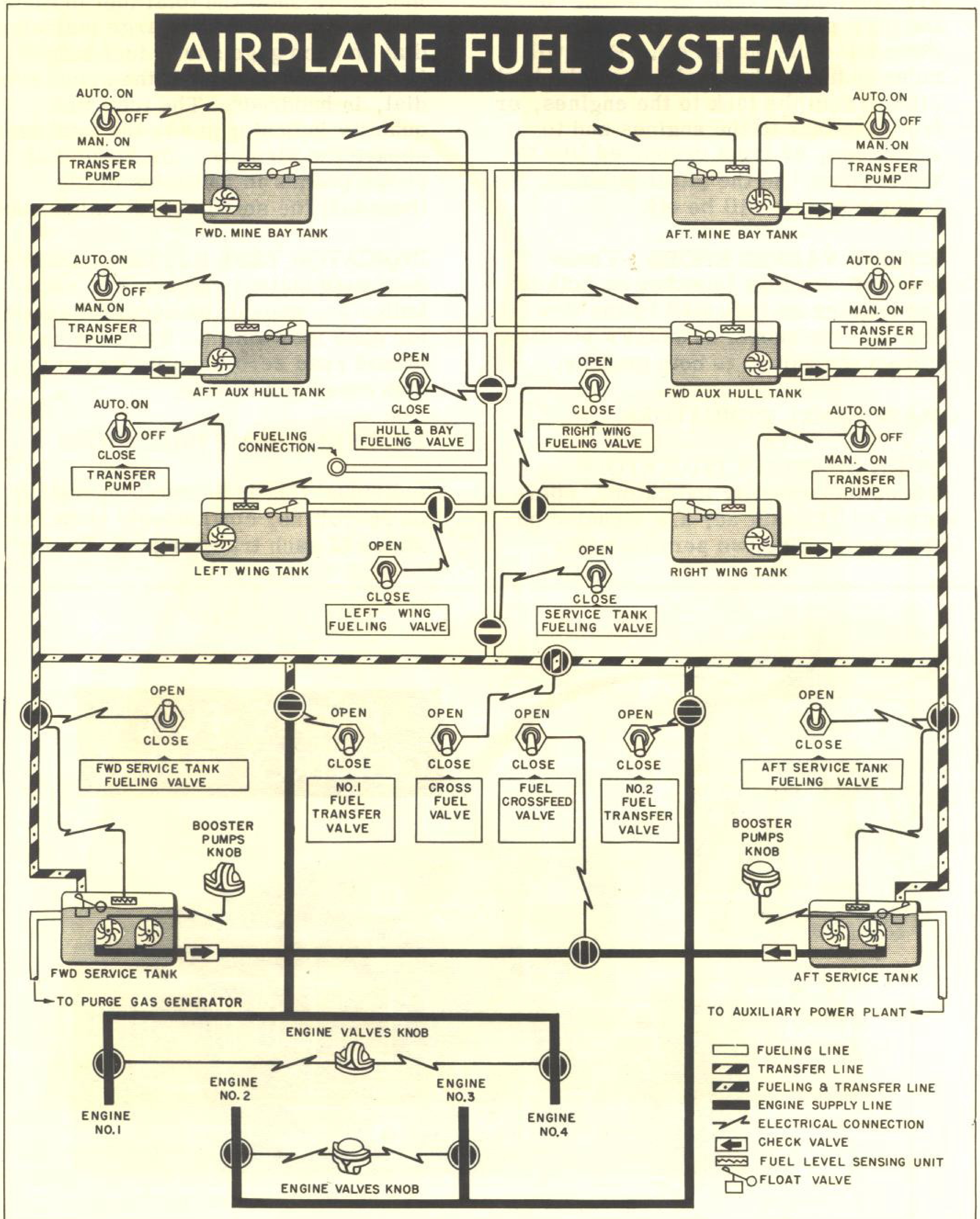

AIRPLANE FUEL SYSTEM
AUTO. ON
OFF
MAN. ON
TRANSFER PUMP
FWD. MINE BAY TANK
AUTO.ON
OFF
MAN. ON
TRANSFER PUMP
AFT. MINE BAY TANK
AUTO.ON
OFF
MAN. ON
TRANSFER PUMP
AFT AUX HULL TANK
OPEN
CLOSE
HULL & BAY FUELING VALVE
OPEN
CLOSE
RIGHT WING FUELING VALVE
AUTO. ON
OFF
MAN. ON
TRANSFER PUMP
FWD AUX HULL TANK
AUTO. ON
OFF
CLOSE
TRANSFER PUMP
FUELING CONNECTION
AUTO. ON
OFF
MAN. ON
TRANSFER PUMP
LEFT WING TANK
OPEN
CLOSE
LEFT WING FUELING VALVE
OPEN
CLOSE
SERVICE TANK FUELING VALVE
RIGHT WING TANK
OPEN
CLOSE
FWD SERVICE TANK FUELING VALVE
OPEN
CLOSE
NO.1 FUEL TRANSFER VALVE
OPEN
CLOSE
CROSS FUEL VALVE
OPEN
CLOSE
FUEL CROSSFEED VALVE
OPEN
CLOSE
NO.2 FUEL TRANSFER VALVE
OPEN
CLOSE
AFT SERVICE TANK FUELING VALVE
BOOSTER PUMPS KNOB
BOOSTER PUMPS KNOB
FWD SERVICE TANK
TO PURGE GAS GENERATOR
AFT SERVICE TANK
TO AUXILIARY POWER PLANT
ENGINE VALVES KNOB
ENGINE NO. 2
ENGINE NO.3
ENGINE NO.1
ENGINE NO.4
ENGINE VALVES KNOB
FUELING LINE
TRANSFER LINE
FUELING & TRANSFER LINE
ENGINE SUPPLY LINE
ELECTRICAL CONNECTION
CHECK VALVE
FUEL LEVEL SENSING UNIT
FLOAT VALVE

Figure 1-11

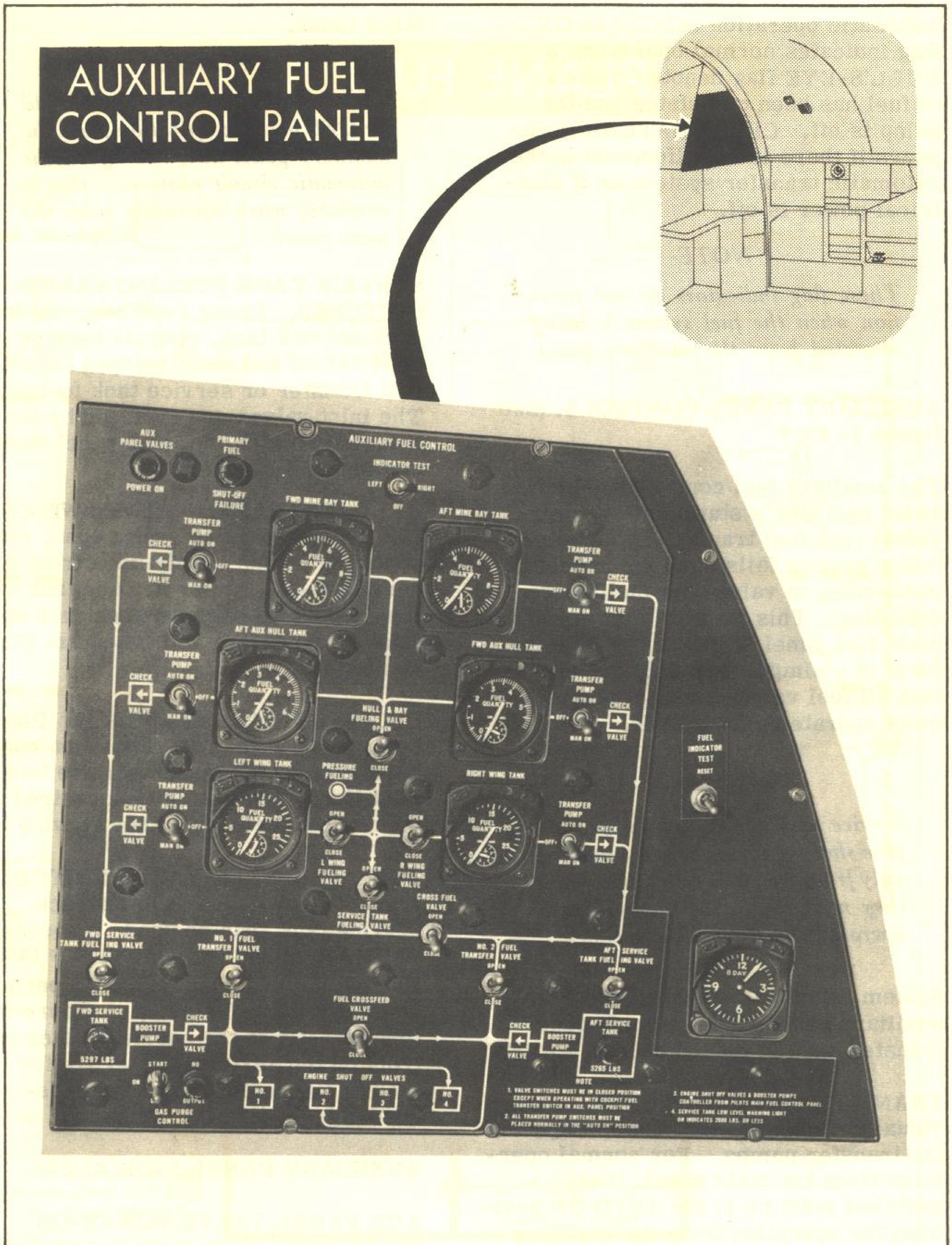

AUXILIARY FUEL CONTROL PANEL
AUXILIARY FUEL CONTROL
AUX PANEL VALVES
POWER ON
PRIMARY FUEL
SHUT-OFF FAILURE
INDICATOR TEST
LEFT
RIGHT
OFF
FWD MINE BAY TANK
AFT MINE BAY TANK
AFT AUX HULL TANK
FWD AUX HULL TANK
LEFT WING TANK
RIGHT WING TANK
TRANSFER PUMP
AUTO ON
OFF
MAN ON
CHECK
VALVE
HULL & BAY FUELING VALVE
PRESSURE FUELING
OPEN
CLOSE
L WING FUELING VALVE
R WING FUELING VALVE
SERVICE TANK FUELING VALVE
CROSS FUEL VALVE
FUEL INDICATOR TEST
RESET
FWD SERVICE TANK FUELING VALVE
NO. 1 FUEL TRANSFER VALVE
NO. 2 FUEL TRANSFER VALVE
AFT SERVICE TANK FUELING VALVE
FWD SERVICE TANK
5297 LBS
BOOSTER PUMP
FUEL CROSSFEED VALVE
AFT SERVICE TANK
5265 LBS
ENGINE SHUT OFF VALVES
NO. 1
NO. 2
NO. 3
NO. 4
START
GAS PURGE CONTROL
NOTE

Figure 1-12

automatic operation only. The ON flag indicates normal operation; a BULL'S-EYE flag denotes transfer of fuel has been completed and the pump is off. CROSS-HATCHING appears if there is a malfunction in the automatic transfer system or if electrical power is off.

NOTE

These flag indicators do not function when the fuel system is being operated from the auxiliary panel.

AUXILIARY PANEL CONTROLS. (See figure 1- 12.)

The auxiliary fuel control panel at the radio operator's station allows individual tank fuel transfer if the automatic system fails, and the proper positioning of valves for fueling or defueling. This panel is similar to the main fuel panel in that it too is in the form of a simple flow diagram and that all fuel valves and fuel pump circuits operate on 28-volt dc.

NOTE

Service tank booster pumps and engine shut-off valves can be operated only from the main panel; therefore, they must be on for the system to operate from the auxiliary panel.

System control is transferred to the auxiliary panel when the main panel transfer knob is placed at AUX PANEL.

TRANSFER PUMP SWITCHES. Individual switches control the operation of the transfer pumps. For normal operation from the main panel, these switches must be in the AUTO ON position; for operation from the auxiliary panel, they should be MAN ON for those tanks in use and OFF for all other tanks.

CAUTION

Transfer pumps not in use should be OFF because operation from the auxiliary panel does not afford the automatic circuit protection that is available when operating from the main panel.

SERVICE TANK FUELING VALVE SWITCHES. These switches, one for each service tank, operate service tank inlet valves and must be open for either fuel transfer or service tank fueling. The inlet valves are operated by the transfer knob on the main panel during continuous flow operation.

FUEL CROSSFEED VALVE SWITCH. The crossfeed valve, when open, connects the engine supply lines from each service tank. Either service tank can then supply all engines when such operation is necessary with attendant flight limitations.

CROSSFUEL VALVE SWITCH. Placing this switch in the OPEN position opens a valve connecting each service tank inlet line. Any supply tank desired can thus be connected to either service tank.

FUEL TRANSFER VALVE SWITCHES. These two switches, one for each service tank, can be used, if necessary, to bypass either or both service tanks. Placing the switches at OPEN permits fuel under transfer pump pressure to flow directly to the engine. Other controls on the auxiliary panel are for fueling and defueling, and are discussed in Section IV.

AUXILIARY PANEL INDICATORS.

AUX PANEL VALVE POWER-ON INDICATOR. This push-to-test light comes on when the transfer knob on the main panel is placed at AUX PANEL, indicating that the fuel system is to be operated from the auxiliary panel.

FUEL QUANTITY INDICATORS.

Fuel quantity indicators for all but the service tanks present a continuous indication. The large indicator dial registers fuel weight in thousands of pounds; the small sub-dial, in hundreds.

INDICATOR TEST SWITCH. This three-position toggle switch, normally OFF, checks the quantity indicators for moisture content or sticking pointers. When the switch is placed at LEFT, the indicators for the forward mine bay tank, the aft aux tank, and the left wing should show a slight movement. The other quantity indicators should show movement when the switch is moved to RIGHT.

CAUTION

With the fuel system operating in AUTO, and the quantity indicator pointers permitted to move near zero, the transfer pumps will stop. If this occurs, the fuel indicator test RESET button, near the clock on the auxiliary fuel panel, must be reset to transfer power to control circuits. The quantity indicators will then resume their normal readings.

SERVICE TANK LOW-LEVEL LIGHT. These push-to-test indicator lights illuminate when the fuel level in their respective tanks drops to or below 2600 pounds (approximately one-half tank capacity). The actual quantity of fuel remaining in either service tank is read on the main fuel panel. For additional information on fuel system management, refer to Section IV.

FUEL VENT SYSTEM.

To prevent excessive pressure inside the fuel tanks from building up during fueling, purging, or flight at high altitudes, pressure relief valves in the vent lines of each wing and hull tank dump excessive vapors overboard. These valves operate mechanically to maintain 1.5 psi differential pressure between the inside of the tank and ambient air. Should these valves fail or if they are unable to exhaust sufficiently, electrically operated secondary valves open at 1.8 psi and close again when pressure drops below this value. The hull tank structural cavities are vented through mechanical two-way pressure regulator valves which maintain 0.5 psi pressure differential between the cavities and the mine bay compartment.

To prevent collapsing of the fuel tanks during dives (because of an excessive pressure differential between the tanks and the ambient air), one-way auxiliary vacuum relief valves in each wing tank allow ambient air back through the vent outlet lines to equalize tank and outside pressure. These valves are entirely automatic and require no control by the pilot.

GAS PURGE SYSTEM.

In combat operation, the fuel tanks and the cavities surrounding them are kept free of inflammable fuel-air mixtures by the use of a purge-gas generator. Low-oxygen-content exhaust from this generator is used in place of vent air. The exhaust is the result of burning fuel from the forward service tank and air from engine compressor bleed. The purge gas first passes through a heat exchanger, water separator, filter, and diverter valve; then it enters the various tanks and cavities. The output of the generator is sufficient to prevent vacuum in the tanks during dives up to 7500 feet per minute. In dives at a faster rate, the auxiliary vent supplies free air to prevent the fuel tanks from collapsing.

NOTE

The purge gas generator is an integral part of the vent system. Although it is not physically used, it must be installed on airplane and in operating condition.

Both 28-volt dc and 115-volt ac are required for system operation and control.

AUTOMATIC CONTROLS. A pressure regulator in the generator exhaust line is actuated by the pressure differential between the exhaust entering and exhaust leaving the system. When the unit is started or it overheats, a diverter valve dumps generator exhaust overboard until the gas reaches the proper consistency. A thermostatically controlled valve maintains the flow of ram air through the heat exchanger at a gas temperature higher than 18°C (65°F), when ambient air is below this temperature. An overheat switch automatically shuts off fuel and bleed air and dumps the exhaust gas overboard if the combustion chamber temperatures become excessive.

ELECTRICAL SYSTEMS.

A-C POWER SUPPLY SYSTEM. (See figure 1-13.)

GENERAL.

The primary electrical power for this airplane is 115/200-volt, 3-phase, 400-cycle, ac. It is this current which is transformed for 26-volt ac, and converted for dc. Primary power is normally supplied by generators, but it may be received from an external source. A three-wire system distributes 200 volts between lines and 115 volts between a single line and ground. The system is fully protected by automatic devices against reverse current, over-voltage, or circuit fault so that a minimum of equipment is isolated with any specific malfunction. All controls and indicators are at the radio operator's station with the exception of circuit breakers throughout the airplane and the voltage regulators in the electronics compartment. All circuit breakers which are "circled" indicate that they are essential for flight (fuel, flight controls, etc.). These circuit breakers afford the only control for their particular circuit.

GENERATORS.

The No. 1 engine, No. 3 engine, and the APP each power an a-c generator. Each generator has a normal rating of 40 kva, with overload ratings of 60 kva for five minutes and 80 kva for five seconds.

CONSTANT SPEED DRIVES.

The generators powered by engines No. 1 and No. 3 are connected to their respective engines through constant speed drives. At sea level, the IDLE position produces about 58% engine rpm. Either generator at this rpm is sufficient to maintain normal electrical load-carrying capacity. A generator will drop out below this rpm.

These drives maintain a generator speed of 6000 rpm which, in turn, produces the 400-cycle current required by certain equipment. The drives use airplane engine oil and are automatically protected against overspeed and underspeed.

MAIN POWER BUSSES.

Each engine-driven generator is connected to a separate bus, identified by the number of the engine which drives the generator connected to that bus. All other busses or equipment are connected to one of these main busses. These two power busses are connected by a cross-tie bus which permits load sharing by the generator or the operation of all equipment if a single generator should fail. It is to this cross-tie bus that the APP generator and external power are connected.

A-C UTILITY RECEPTACLES.

There are six a-c utility receptacles in the airplane. These outlets are in the following areas.

Flight deck, left hand bus (2)

Electronics compartment (2)

APP compartment (1)

Tail compartment (1)

These outlets, energized whenever the main a-c bus system is energized, are used to supply power to operate miscellaneous portable a-c equipment.

A-C CONTROL PANEL.

As seen in figure 1-14, the a-c power panel forms a simple schematic of the system. The ON position of the various knobs is indicated when the flow line on the knob is aligned with flow line on the panel.

GENERATOR KNOBS. A separate knob for each engine-driven generator serves to connect the generators with their respective busses. In addition to the usual ON and OFF positions, an EMER OFF position and a RESET position are provided. When the knob is placed at EMER OFF, the generator field is de-energized. This position would normally be used only if automatic devices fail to de-energize the generator field when a malfunction occurs. The RESET position makes possible re-energizing the generator field, if it is manually or automatically de-energized.

CROSS-TIE KNOB. The cross-tie knobs connect the individual generator busses to the cross-tie bus. The OFF & RESET position, in addition to its normal disconnecting function, will de-energize the lock-out relay if the circuit has been automatically opened because of a malfunction. If the connection has been automatically opened, it is necessary to place the knob at OFF & RESET before the busses can be re-connected.

NOTE

When operating any two or three generators in parallel and the load-sharing differs as much as 15 kw, the frequency and watt knob should be adjusted to regulate the division of load more equally. If this adjustment fails to decrease the load difference, the cross-tie knob should be placed at the OFF & RESET position to isolate generator busses for individual operation.

APP/EXTERNAL POWER KNOB. The APP/External Power knob permits a selection of either APP generator output or external power. When the knob is placed at EMER OFF, either the external power source will be disconnected or the APP generator field will be de-energized. Before external power can be utilized, the generator knobs must be in the OFF position.

A-C DISTRIBUTION

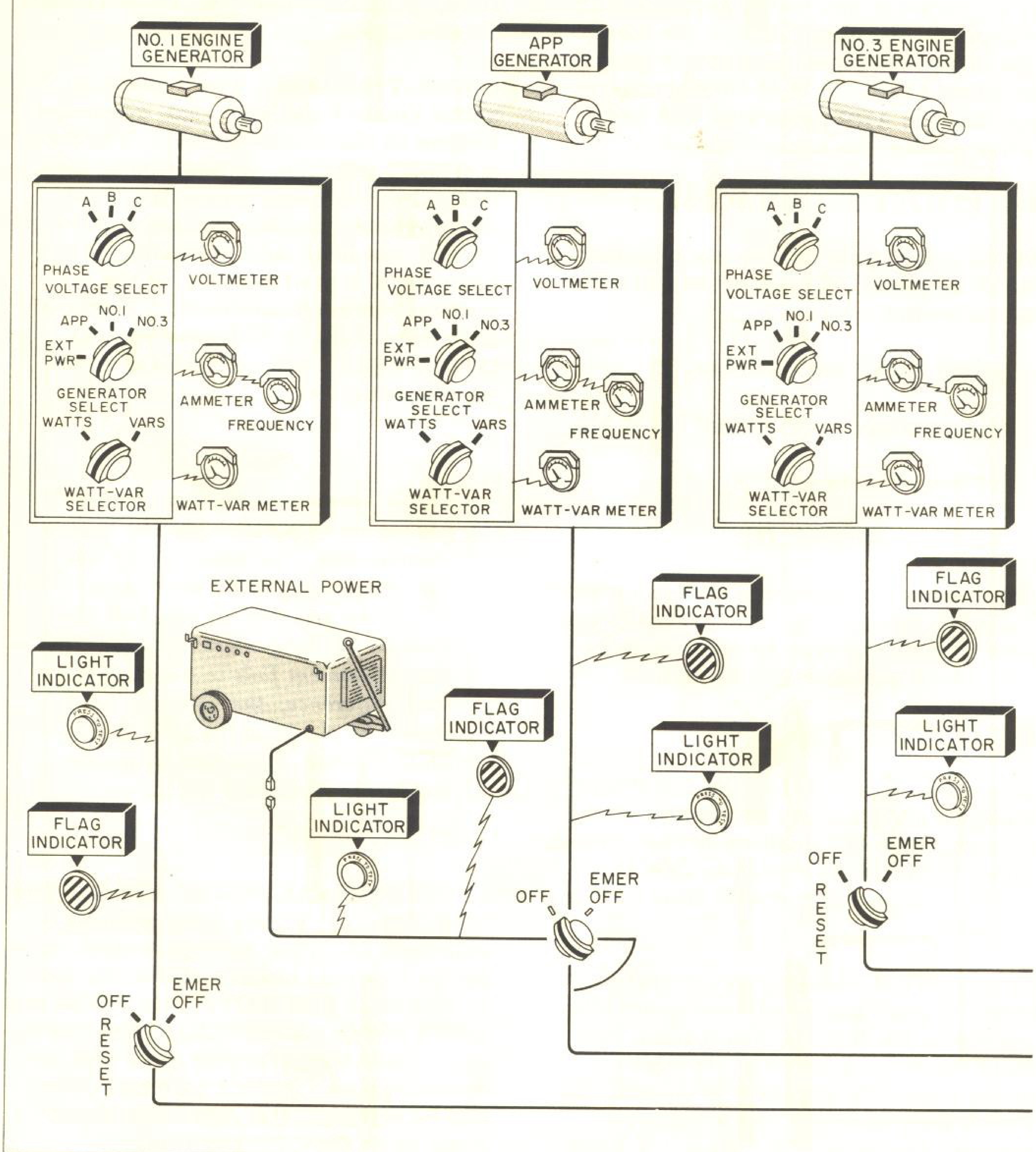


Figure 1-13 (Sheet 1 of 2)

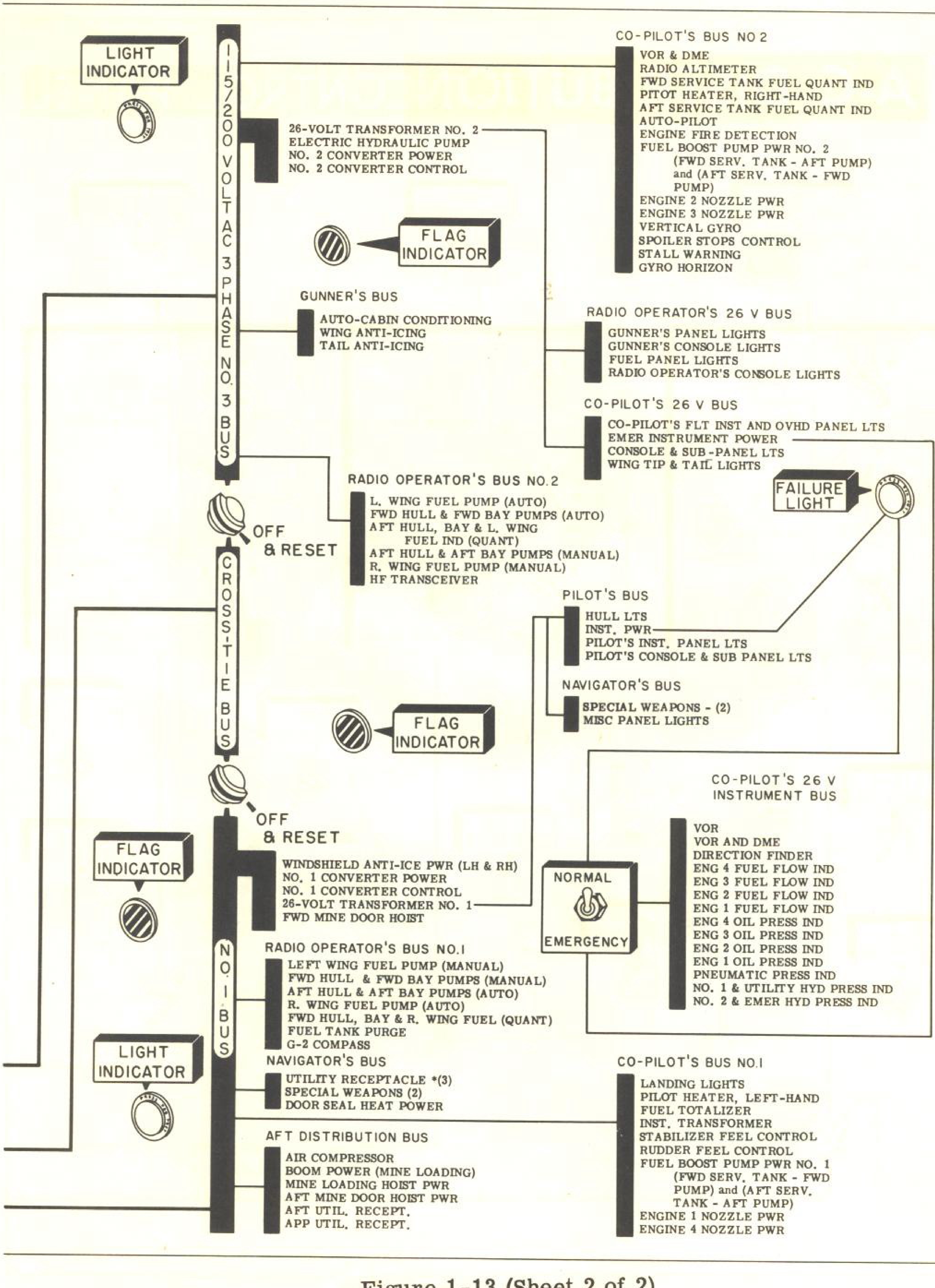
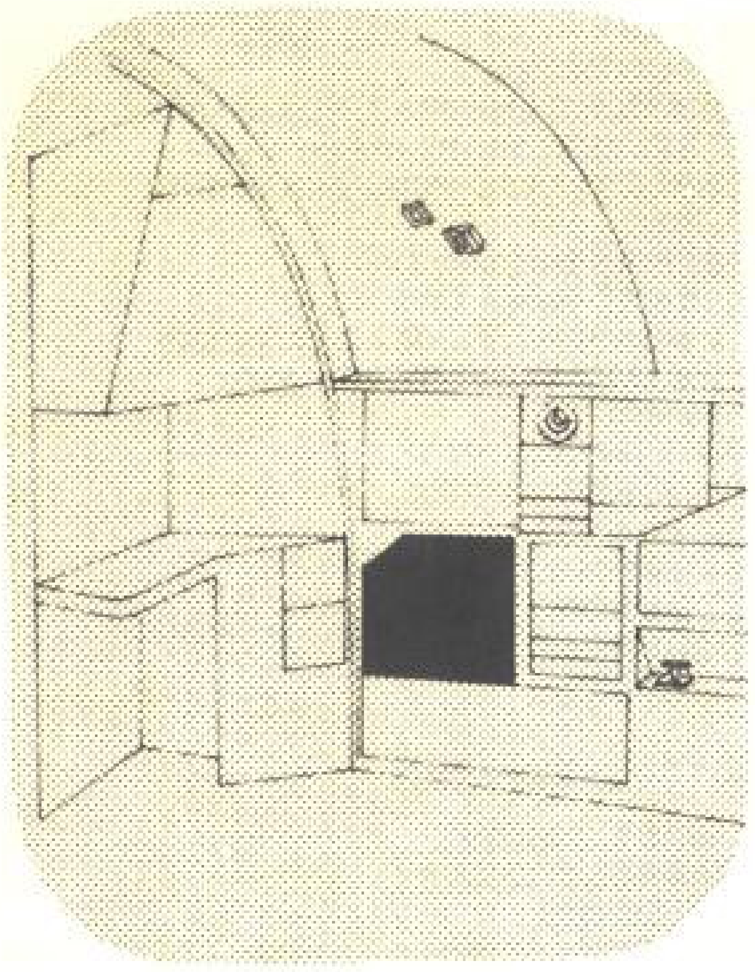


Figure 1-13 (Sheet 2 of 2)



A-C CONTROL PANEL

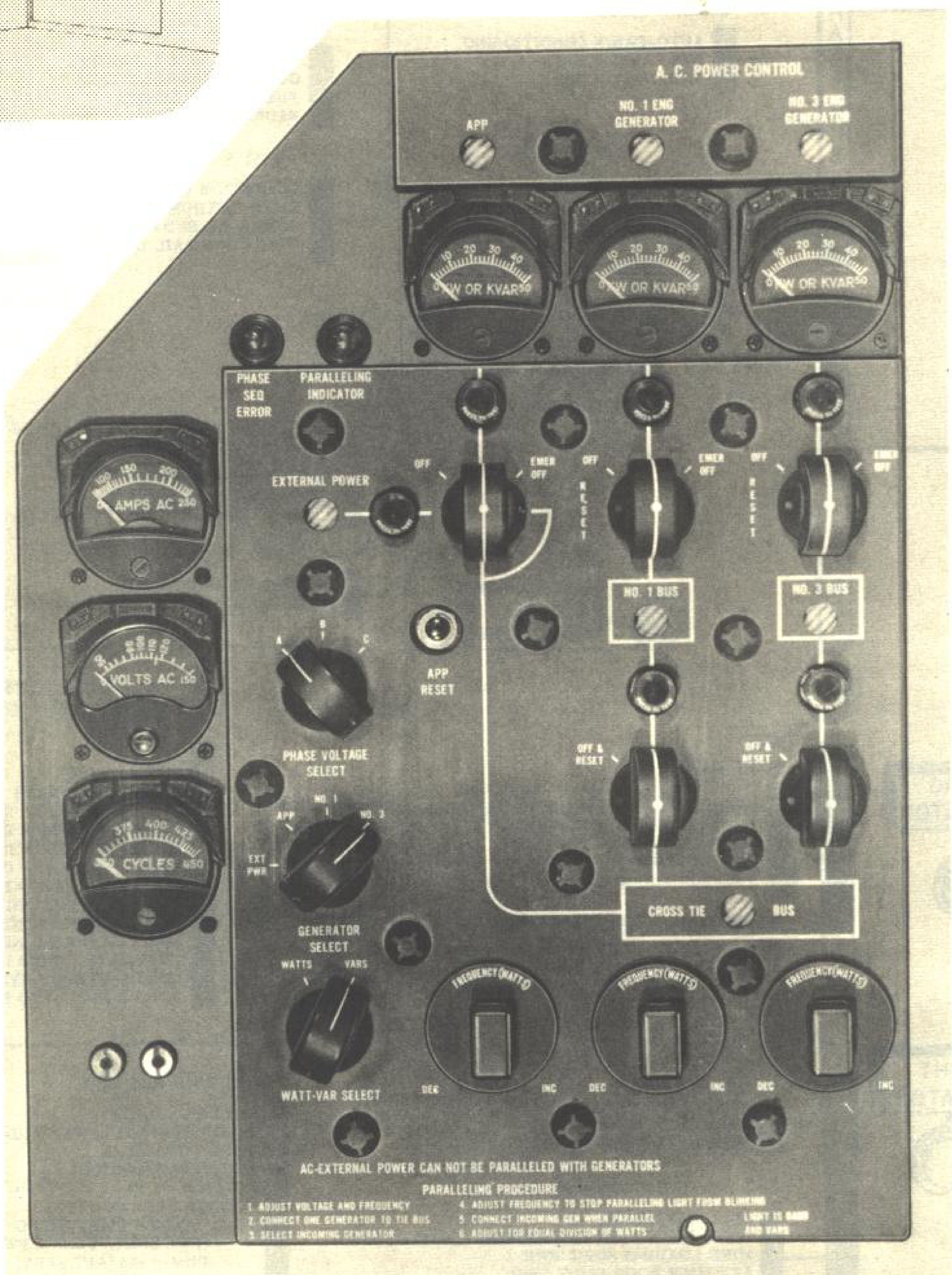


Figure 1-14

APP RESET BUTTON. The APP reset button, when momentarily depressed, will re-energize the APP generator field when it has been automatically or manually de-energized.

CAUTION

The APP/External Power knob must be in the OFF position to prevent d-c flow through the a-c system when the APP reset button is depressed.

FREQUENCY KNOBS. Individual frequency (watts) adjustment knobs control the current frequency for each generator and adjust load balance when generators are operating in parallel.

A-C POWER INDICATORS. The flag indicators, warning lights, and meters on the a-c control panel are covered in detail in the following paragraphs.

Generator Flag Indicators. A flag indicator above each watt-var meter will indicate ON when its respective generator is supplying power. A cross-hatch indication will be given when the generator is de-energized or inoperative.

Generator No. 1 and No. 3 Indicator Lights. An indicator light, immediately above each generator knob, illuminates (regardless of the generator knob position) when its respective generator is disconnected from its bus or when the generator overheat switch is actuated.

APP Generator Indicator Light. The APP indicator light, immediately above the APP generator knob, lights when the APP generator is disconnected from the bus system; when the APP/External Power knob is in the APP or EMER OFF position; or when the generator overheat switch is actuated.

No. 1 and No. 3 Bus Flag Indicators. These flag indicators will show ON when their respective busses are energized and show a cross-hatch flag when their respective busses are de-energized.

Cross-Tie Bus Flag Indicator. This flag indicator shows ON when the cross-tie bus is energized and displays a cross-hatch flag when the bus is de-energized.

External Power Flag Indicator. This flag indicator shows ON when external power is connected and available to the system. A cross-hatch flag indicates no external power available.

External Power Indicator Light. The external power indicator light illuminates if external power is available to the system and is not being used because the APP/External Power knob is in some position other than the external power position.

Phase Sequence Error Indicator Light. The phase sequence error light illuminates after voltage build-up, if one or more phases are open circuited between the source and the bus, or if the phase sequence is incorrect.

Paralleling Indicator Light. This indicator light shows the relationship between the incoming source of power and the power already applied to the cross-tie bus, provided the generator select knob has been positioned to the incoming generator. The light blinks when the two powers are not parallel and grows dim when a parallel condition exits.

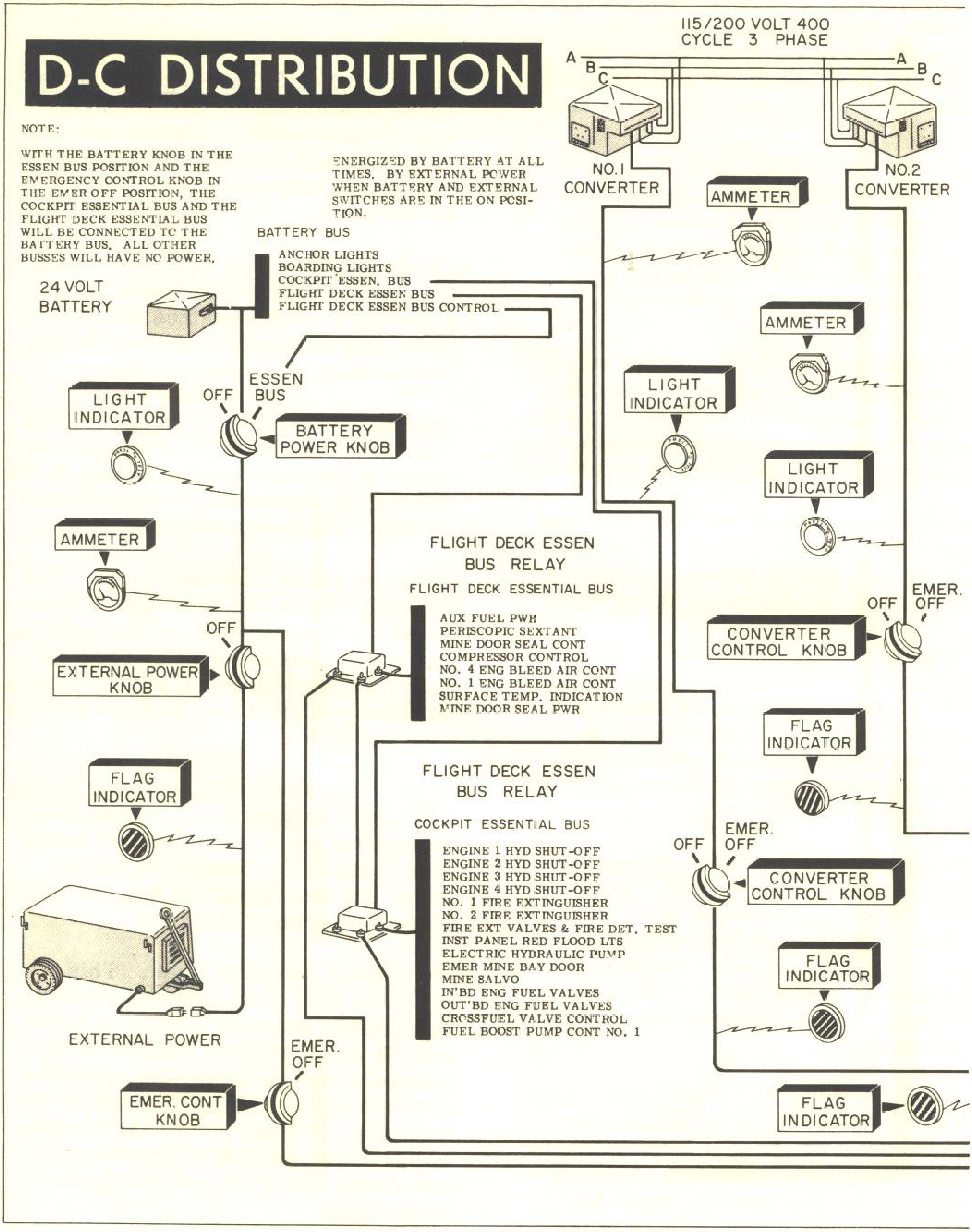
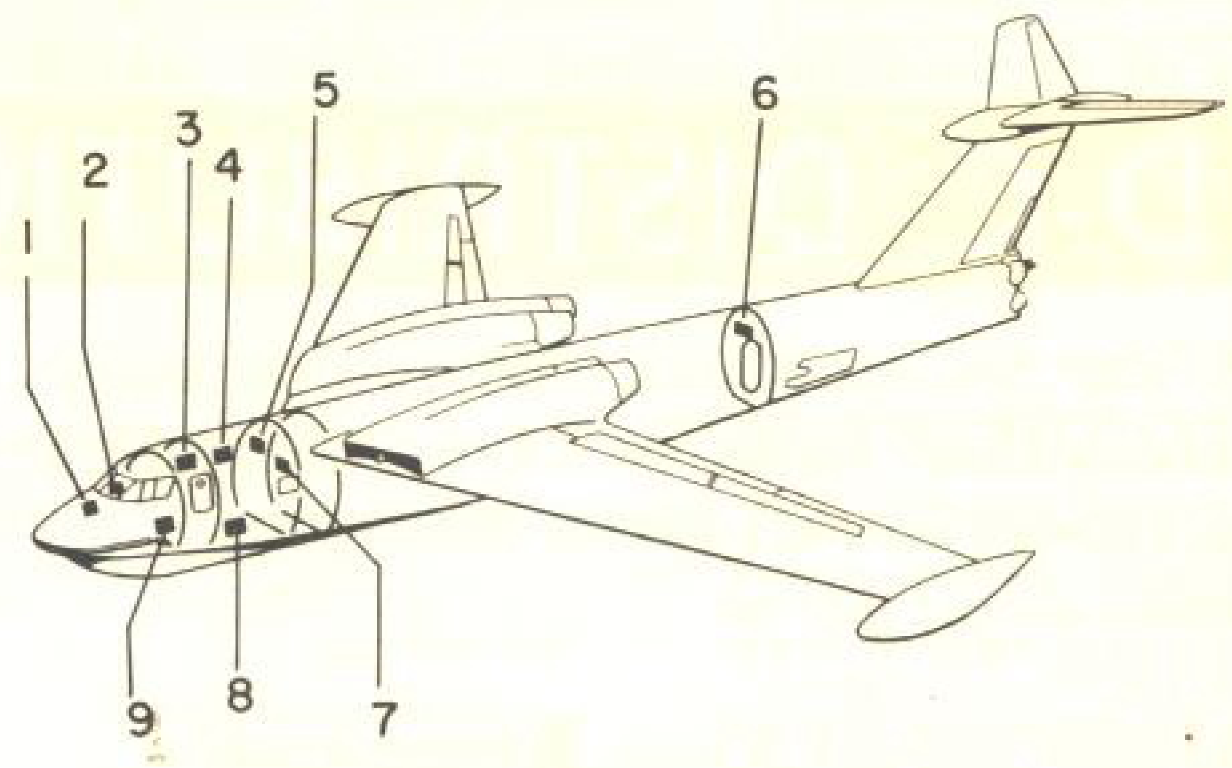


Figure 1-15 (Sheet 1 of 2)



CIRCUIT BREAKER PANELS

1. CO-PILOT
2. CO-PILOT
3. RADIO OPERATOR
4. GUNNER
5. RIGHT DISTRIBUTION CENTER
6. AFT DISTRIBUTION
7. LEFT DISTRIBUTION CENTER
8. NAVIGATOR
9. PILOT

MAIN 28 VOLT DC BUS

NAVIGATOR'S BUS NO. 2

- DOOR SEAL HEAT CONTROL
- FWD. HULL COMPARTMENT LTS

GUNNER'S BUS NO. 1

- ENG ANTI-ICE PWR
- ENG ANTI-ICE CONT
- EXTERNAL PWR & PROT UNIT CONTROL
- WING ANTI-ICING
- TAIL ANTI-ICING
- RADOME ANTI-ICING
- NO. 1 CROSS-TIE MAN. CONT
- NO. 1 CROSS-TIE AUTO CONT
- NO. 3 CROSS-TIE MANUAL CONT
- NO. 3 CROSS-TIE AUTO CONT
- GUNNER'S UTILITY RECEPT

GUNNER'S BUS NO. 2

- AIR LOCK CONT
- PRESS. DUMP CONT
- COOL CONT
- CABIN CONDITION
- AUXILIARY VENT
- MOISTURE SEPARATOR HEATER
- APP BLEED AIR
- APP PANEL LIGHTS
- APP OIL TEMP. INDICATOR
- APP FIRE DETECTION
- APP CONTROL

RADIO OPERATOR'S BUS

- PRIMARY FUEL SHUT-OFF FAILURE
- FLOAT LEVEL TEST
- RIGHT FUEL DRAIN CONTROL
- LEFT FUEL DRAIN CONTROL
- FUEL TANK PURGE
- FUEL VENT
- FWD FUEL TRANSFER CONTROL
- AFT FUEL TRANSFER CONTROL
- INTERPHONE
- G-2 COMPASS

PILOT'S BUS NO. 1

- MASTER ARM. PWR
- HYDROFLAPS & DIVE BRAKE CONT
- TURN AND BANK INDICATION
- SPOILER TRIM CONTROL
- SPOILER STOPS POWER
- RUDDER TRIM CONTROL
- STAB. AND RUDDER TRIM POS. INDIC
- WING FLAP CONTROL AND POS. INDIC
- SEAT POSITION CONTROL
- INDICATOR LIGHTS
- STABILIZER TRIM CONTROL
- INSTRUMENT PANEL VIBRATOR
- IFF (APX-6)

CO-PILOT'S BUS NO. 2

- VOR AND DME
- VOR
- RADIO ALTIMETER
- UHF TRANSCEIVER
- G-2 COMPASS
- LOWER SPRAY STRIP
- UPPER SPRAY STRIP
- NACELLE DOOR
- EMER WING FLAP CONTROL
- EMER HYDRAULIC VALVES
- ENG HYD PUMPS PRESS. IND
- WINDSHIELD ANTI-ICE CONT
- WINDSHIELD WIPER & SPRAY
- AUTOPILOT
- STABILIZER FEEL POWER
- TURN & BANK INDICATION
- FREE AIR TEMP. INDICATION
- EXTERIOR LIGHTS

CO-PILOT'S BUS NO. 1

- CROSSFEED VALVE CONTROL
- ENGINE START
- ENGINE IGNITION
- VERTICAL GYRO
- ENG 1 AFTERBURNER & NOZZLE CONT
- ENG 2 AFTERBURNER & NOZZLE CONT
- ENG 3 AFTERBURNER & NOZZLE CONT
- ENG 4 AFTERBURNER & NOZZLE CONT
- FUEL BOOST PUMP CONT NO. 2
- COCKPIT AUX. LIGHTS
- LANDING LIGHTS POS CONTROL
- STAB. HYD SHUT-OFF
- STALL SYSTEM PWR
- HYDROFLAPS POSITION INDICATOR
- RUDDER FEEL POWER
- RUDDER HYDRAULIC SHUT-OFF
- SPOILER HYD SHUT-OFF

NAVIGATOR'S BUS NO. 1

- MINE DOOR CONTROL
- GROUP SELECTOR
- ARMAMENT INDICATION LTS
- FWD MINE DOOR HOIST CONTROL

- SPECIAL WEAPONS
- SPECIAL WEAPONS
- MINE BAY LIGHTS
- HF TRANSCEIVER
- MAIN BUS INDICATOR
- FWD HULL UTILITY RECEPT
- UPPER COMPARTMENT LIGHTS

AFT DISTRIBUTION BUS

- APP START
- AFT UTIL RECEPT
- AFT MINE DOOR HOIST CONT
- MINE LOADING HOIST CONT
- MINE LOADING COMPT LTS
- AFT HULL LTS
- BOOM CONTROL MINE LOADING
- MINE LOADING HATCH

Figure 1-15 (Sheet 2 of 2)

Watt-Var Meters. Continuous indications of generator output in either watts or vars can be determined from these individual instruments.

Watt-Var Select Knob. When this knob selects either watts or vars, the indications appear on all three watt-var meters.

Generator Select Knob. This knob selects the generator whose measurements and characteristics can then be read from the frequency meter, the voltmeter, the ammeter, the phase sequence error light, and the paralleling indicator light.

A-C Frequency Meter. The frequency meter indicates current frequency of a generator or external power as selected by the generator select knob.

Voltmeter. The voltmeter indicates line-to-ground voltage of various power sources as selected by the generator select knob and the phase voltage select knob.

Phase Voltage Select Knob. This knob makes possible a reading of each phase of the voltage as selected.

A-C Ammeter. The ammeter indicates current phase of a power source as selected by the generator select knob.

D-C POWER SUPPLY SYSTEM.

The 28-volt d-c power is distributed by a single-wire system using the airframe as a ground return. Power is supplied to the main d-c bus by two static converters; or from a 24-volt, 36-ampere hour battery; or from an external power source. (See figure 1-15.)

All indicators and controls used in operating the systems are on the d-c power control panel at the radio operator's station. (See figure 1-17.)

Whenever the main d-c bus is energized, individual panel busses are also energized. Individual bus feeders are connected to the main d-c bus through circuit breakers.

A cockpit essential bus and a flight deck essential bus distribute power to circuits that are essential to safety-to-flight. These busses are normally energized from the main d-c bus. If the main d-c bus fails, the essential busses may be energized from the battery.

CONVERTERS.

Two converters provide the main source of d-c power. Each is rated for 200 amperes at 28 volts with an overload rating of 300 amperes at not less than 27 volts for two minutes; and 400 amperes at not less than 25 volts for 30 seconds. Each converter uses 115/200-volt, 3-phase ac for both power and control. Converter No. 1 is connected to a-c bus No. 1, and converter No. 2 to a-c bus No. 3. Circuit breakers, on the main distribution panel, are provided for each phase of the power and control circuits. Two additional circuit breakers are on each converter in the electronics compartment. One of these breakers is in the converter-cooling fan circuit; the other is in the converter control circuit. Automatic devices in the circuit protect converters against overheat and current reversal. Should the reverse current circuit breaker trip, it must be manually reset at the main distribution panel. An indicator light and a corresponding flag will signal converter operation.

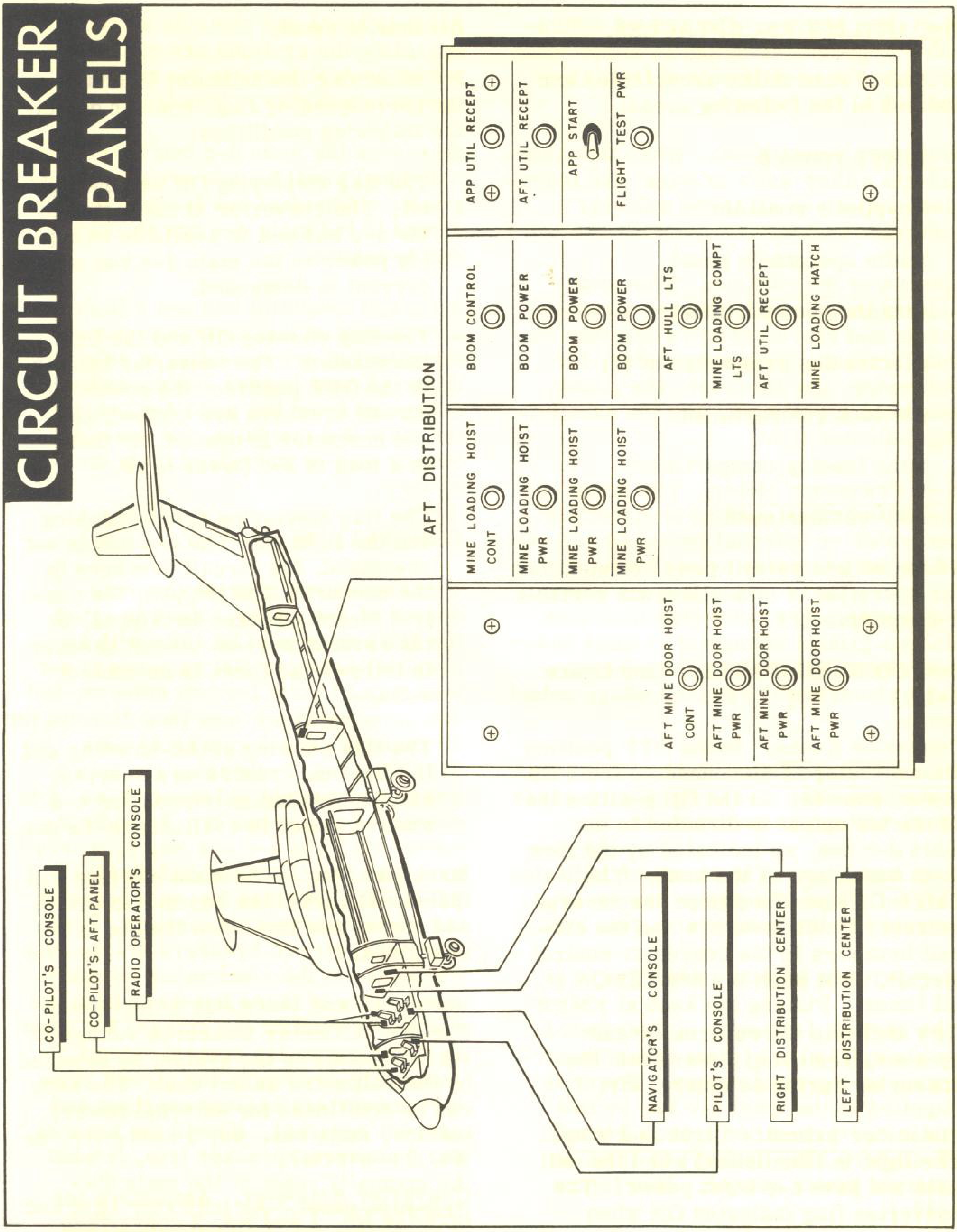

CIRCUIT BREAKER PANELS
AFT DISTRIBUTION
APP UTIL RECEPT
AFT UTIL RECEPT
APP START
FLIGHT TEST PWR
BOOM CONTROL
BOOM POWER
BOOM POWER
BOOM POWER
AFT HULL LTS
MINE LOADING COMPT LTS
AFT UTIL RECEPT
MINE LOADING HATCH
MINE LOADING HOIST CONT
MINE LOADING HOIST PWR
MINE LOADING HOIST PWR
MINE LOADING HOIST PWR
AFT MINE DOOR HOIST CONT
AFT MINE DOOR HOIST PWR
AFT MINE DOOR HOIST PWR
AFT MINE DOOR HOIST PWR
CO-PILOT'S CONSOLE
CO-PILOT'S - AFT PANEL
RADIO OPERATOR'S CONSOLE
NAVIGATOR'S CONSOLE
PILOT'S CONSOLE
RIGHT DISTRIBUTION CENTER
LEFT DISTRIBUTION CENTER

Figure 1-16

D-C UTILITY RECEPTACLES.

A total of nine utility receptacles are located in the following areas.

Pilot's console

Co-pilot's console

Radio operator's panel

Entrance compartment

Electronics compartment (2)

Air lock compartment

Mine loading compartment

APP compartment

These outlets permit power connections for operation of miscellaneous portable d-c equipment.

D-C CONTROL PANEL. (See figure 1-17.)

Converter Knobs. In the OFF position the converter is disconnected from its power sources. In the ON position the converter output is directed to the main d-c bus, as indicated by the flow lines which are on the knob. The EMER OFF position trips the reverse current circuit breakers and the circuit breakers in the converter control circuit. The knob is normally ON at all times. Placing the knob at EMER OFF will trip the reverse circuit breaker, removing power from the converter during an emergency.

Converter Indicator Light And Flag. The light is illuminated when the unit does not have a-c input power. The converter flag indicates ON when there is control voltage from the unit and its reverse current circuit breaker is reset.

By observing the indicator light and its corresponding flag, one can detect the following conditions:

The flag displaying ON and the light off: The converter is connected to the a-c bus and is available to supply power to the main d-c bus when current is demanded.

The flag showing ON and the light illuminated: The converter knob is in the OFF position, the power input circuit breakers are tripped, the a-c contactor is opened, or there is a loss of a-c power input.

The flag displaying cross-hatching and the light off: The a-c bus is not energized, the circuit breakers in the converter are tripped, the control circuit breaker is tripped, or the reverse current circuit breaker is tripped and there is no control voltage.

The flag showing cross-hatching and the light on: The reverse current circuit breaker is tripped and a-c control power is available to the unit.

Main Bus Flag. The main bus flag will indicate ON when the bus is energized, and cross-hatching when the bus is not energized.

Voltmeter and Voltmeter Select Knob. The d-c voltmeter measures voltage at various points in the system as selected by the voltmeter select knob. The knob can be positioned for external power, battery, main bus, No. 1 converter, or No. 2 converter.

Converter Ammeter. Ammeters for both the No. 1 and No. 2 converters indicate current flow through their respective shunts.

D-C CONTROL PANEL

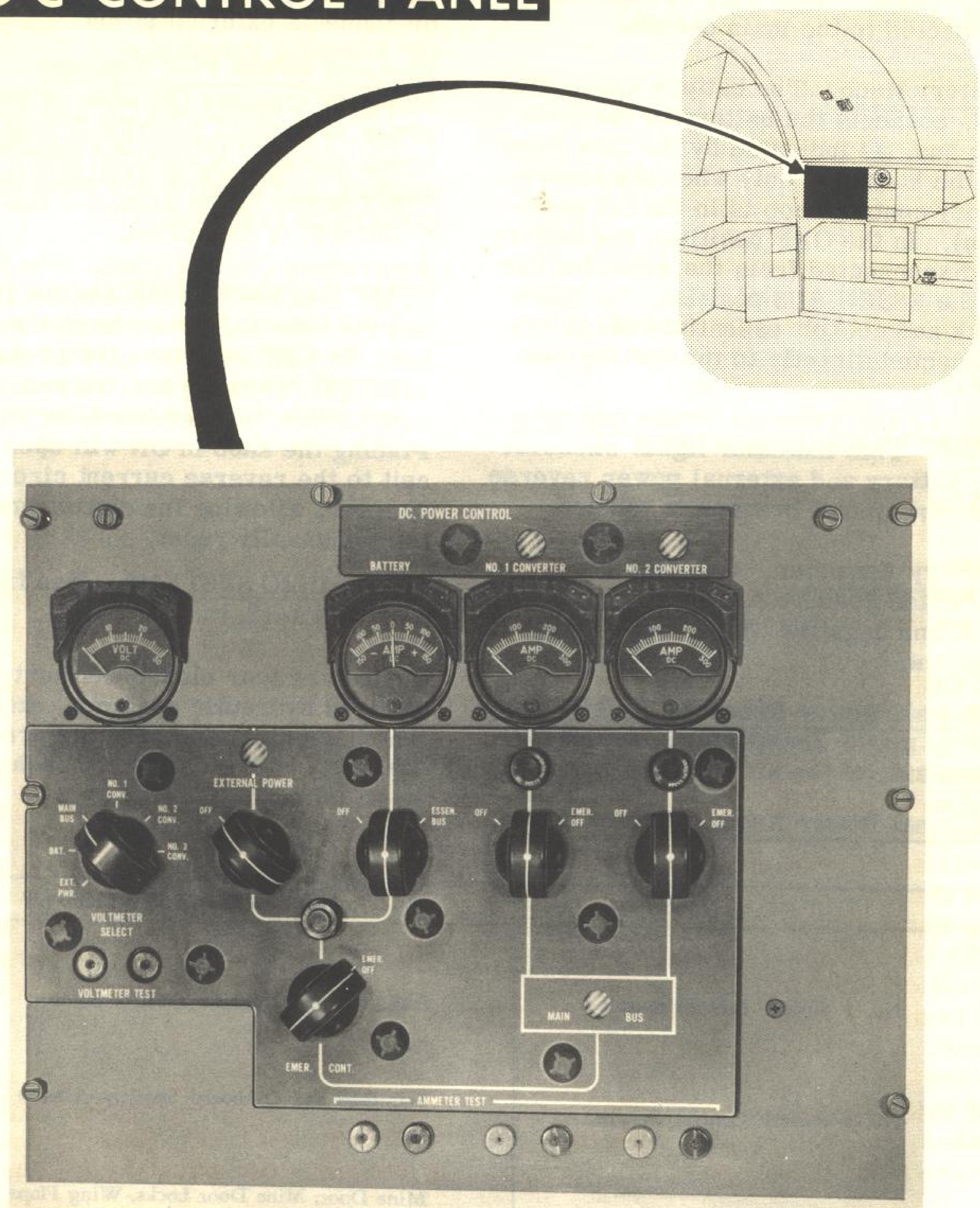


Figure 1-17

Battery. The 24-volt d-c battery in the air lock compartment is connected directly to the battery bus in the battery locker. This bus, in turn, is connected to the main d-c bus.

Battery Knob. The battery knob, when ON, connects the battery to the main d-c bus, as indicated by the flow lines on the knob (but only when the emergency control knob is in the ON position). In the OFF position, the battery is disconnected from the main d-c bus. In the ESSEN BUS position, the flight deck and cockpit essential busses are connected directly to the battery bus.

Battery and External Power Indicator Light. This indicator lights whenever the battery and external power reverse current circuit breaker is tripped.

Battery Ammeter. One ammeter indicates positive for a charging current and negative for a discharging current.

External Power Receptacle. The external power receptacle is on the forward side of the air lock compartment.

External Power Knob. Placing this knob ON will supply power to the main d-c bus as indicated by the flow line on the knob, if external power is available and polarity is correct. When OFF, it disconnects external power.

External Power Flag Indicator. This indicator displays ON when external power of correct polarity is connected, cross-hatching if external power is not applied, and a bull's-eye when the polarity is reversed.

Emergency Control Knob. The EMER CONT position disconnects the battery and the external power from the d-c bus. In addition, the warning indicator will light, showing that the reverse current circuit breaker has been tripped. Placing the knob in ON will open the circuit to the reverse current circuit breaker, allowing the circuit breaker to be manually reset.

HYDRAULIC SYSTEMS. (See figures 1-18 and 1-19.)

There are four closed-center type pressurized hydraulic systems, each of which supplies an operating pressure of 3000 psi. The function of each system is as follows:

SYSTEM	FUNCTION—OPERATION OF
No. 1 Surface Control System	Stabilizer and Inboard Spoiler—Aileron
No. 2 Surface Control System	Stabilizer and Outboard Spoiler—Aileron
Utility System	Mine Door, Mine Door Locks, Wing Flaps, Hydroflaps/Dive Brakes, and Rudder
Emergency System	Mine Door, Mine Door Locks, and Wing Flaps

The total volume is a function of the number of systems operating. These systems are the No. 1 and No. 2 Surface Control Systems, the Utility System, and the Emergency System. No. 1 and No. 2 Surface Control Systems are completely independent of each other and of the other two.

A total of seven variable volume engine-driven pumps and one electric motor-driven pump supply the hydraulic power. The identifying number together with the location and function of each engine-driven pump is shown in the following table:

PUMP	LOCATION	FUNCTION—OPERATION OF
No. 1	Engine No. 1	No. 1 Surface Control System
No. 3	Engine No. 2	No. 1 Surface Control System
No. 5	Engine No. 3	No. 2 Surface Control System
No. 7	Engine No. 4	No. 2 Surface Control System
No. 2	Engine No. 1	Utility System
No. 4	Engine No. 2	Utility System
No. 8	Engine No. 4	Utility System

The electric motor-driven pump supplies power to the emergency system, and supplemental power to the utility system for the operation of the wing flaps, mine door locks, and hydroflaps.

Three pressurized reservoirs supply hydraulic fluid. The location and function of these reservoirs are shown in the following table:

RESERVOIR TYPE	LOCATION	FUNCTION—SUPPLY FOR
Spherical (8 US Gal)	Mine Loading Compartment—Port	No. 1 Surface Control System
Piston (10 US Gal)	Mine Loading Compartment—Starboard	No. 2 Surface Control System
Spherical (14 US Gal)	Mine Loading Compartment—Port	Utility System and Emergency System

All of the above reservoirs may be replenished in flight with a hand pump from a reservoir on the starboard side of the mine loading compartment. Refer to REPLENISHING HYDRAULIC SYSTEM FLUID. Fluid specifications

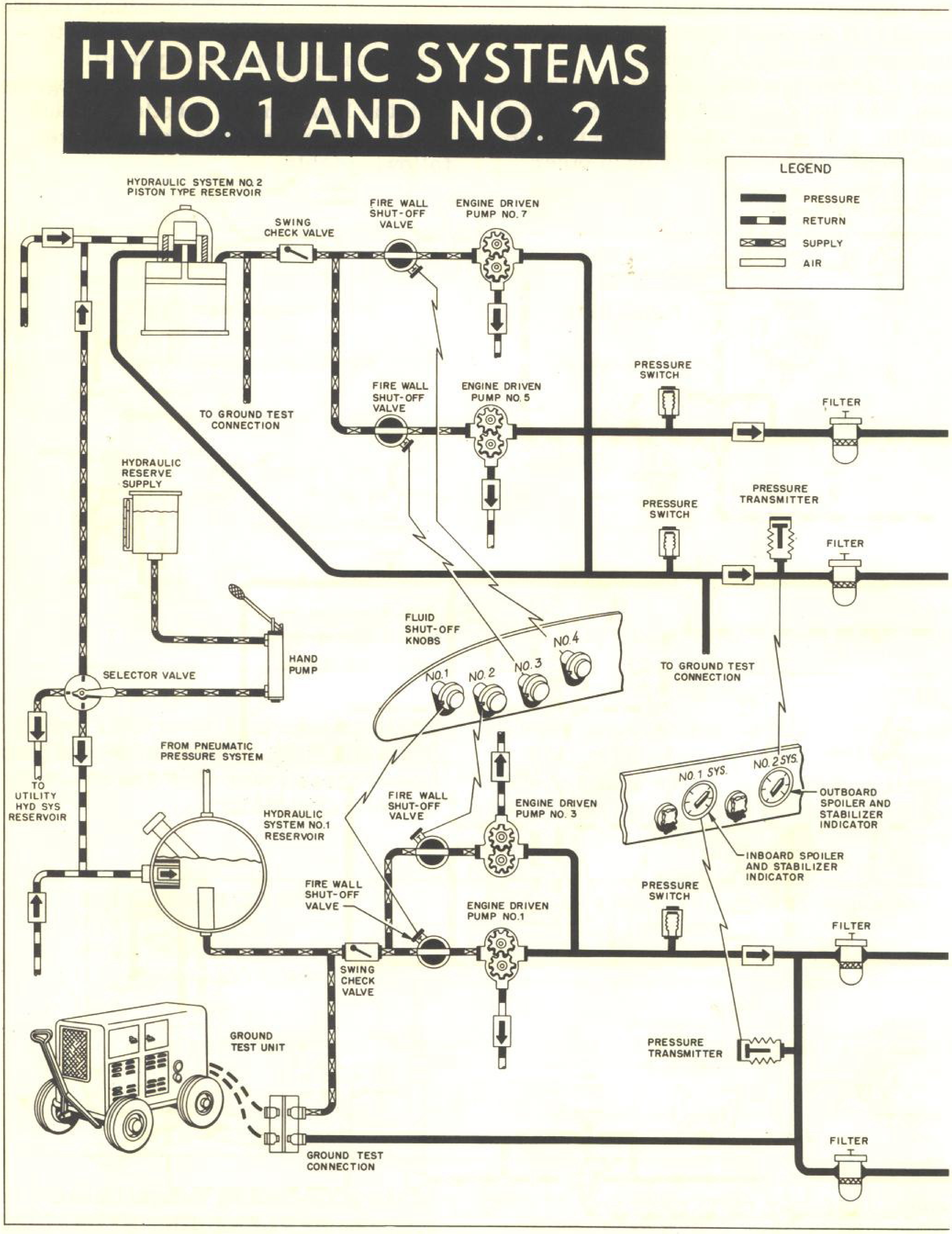


Figure 1-18 (Sheet 1 of 2)

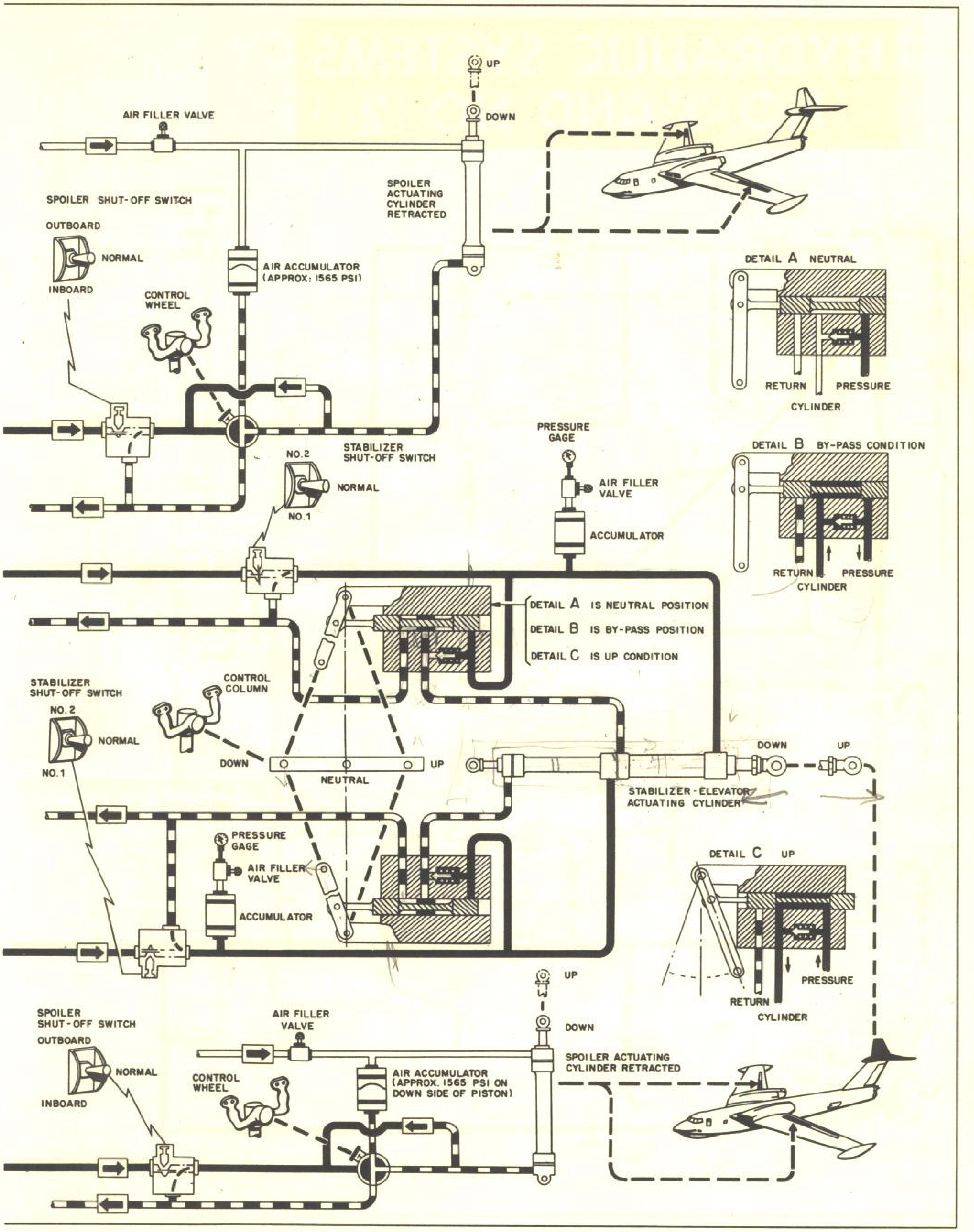


Figure 1-18 (Sheet 2 of 2)

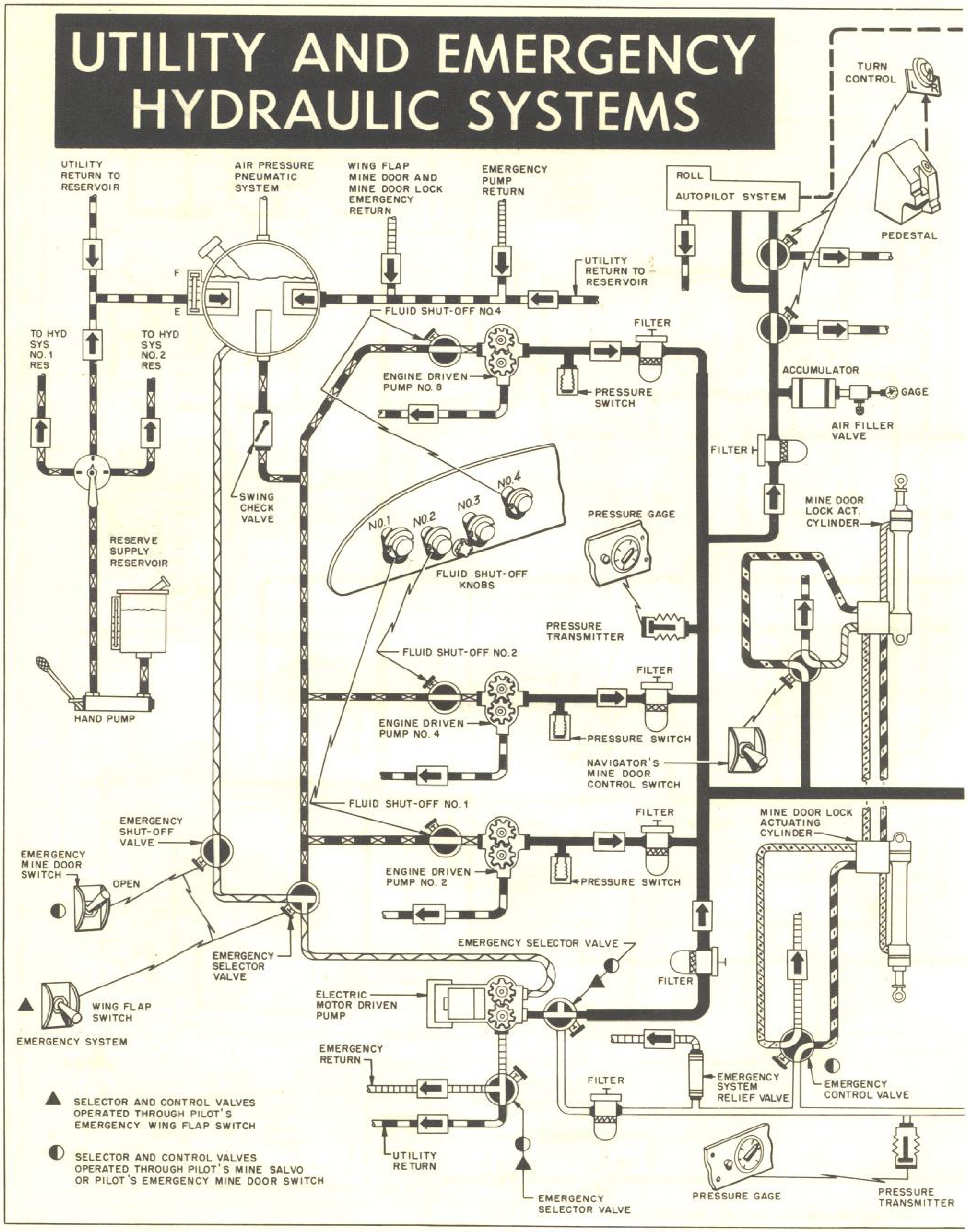


Figure 1-19 (Sheet 1 of 2)

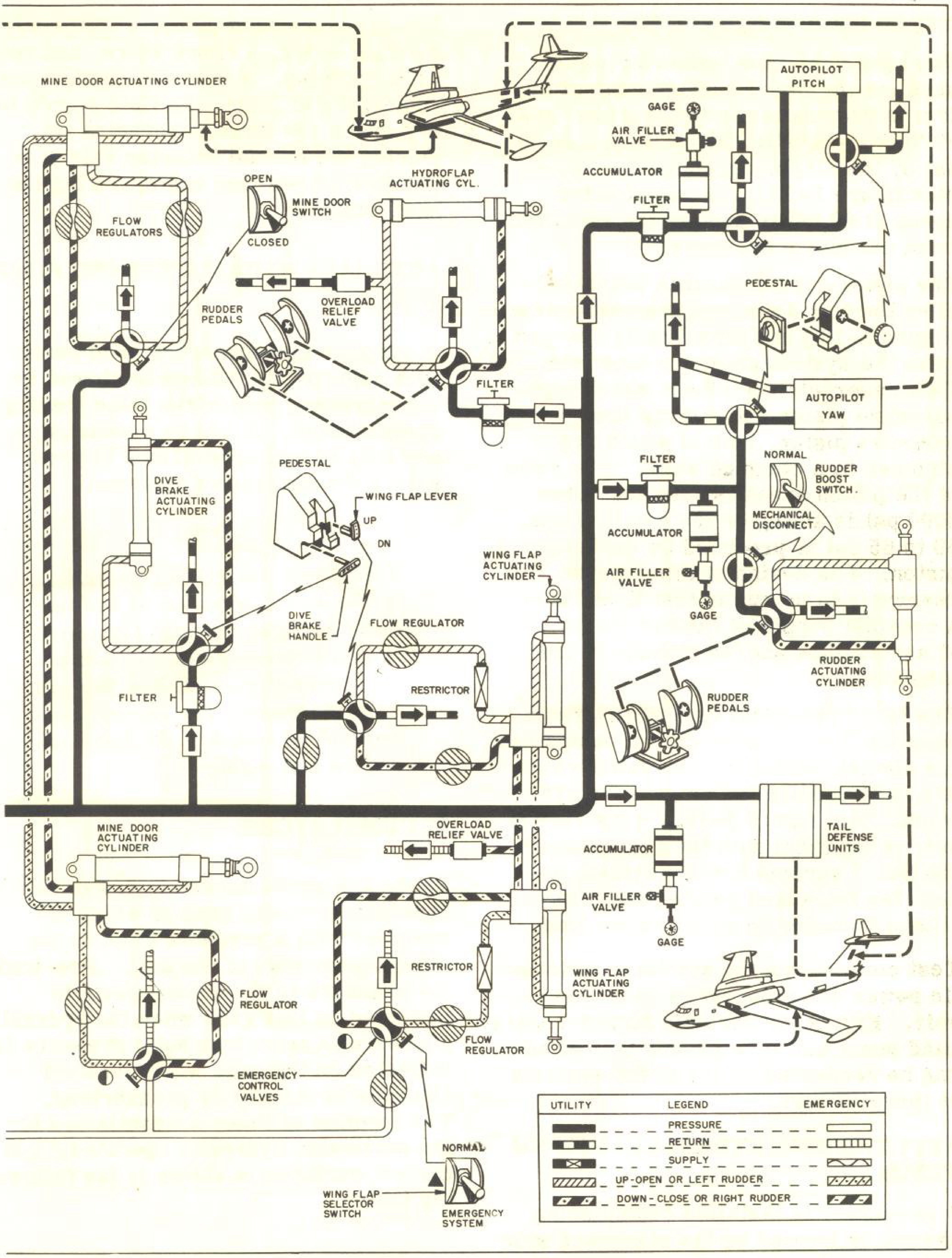


Figure 1-19 (Sheet 2 of 2)

may be found on figure 1-29.

The spherical-type reservoir which supplies the No. 1 surface control system is pneumatically pressurized to a nominal, regulated air pressure of 60 psi by the airplane pneumatic system. (See figure 1- 22 .) A relief valve opens at 80 psi to protect the reservoir from excessive pressure.

The piston-type reservoir which supplies the No. 2 surface control system (figure 1-18) is hydraulically charged from the system pressure manifold. This reservoir contains a small high-pressure piston and a large low-pressure piston, both of which are attached to a common shaft. The ratio of the piston areas is such that when 3000 psi is acting on the small piston, 60 to 65 psi is produced by the large piston. The design of this type of reservoir is unique in that it assures a constant supply of fluid to the pump at any altitude and/or attitude of the airplane.

The other spherical type of reservoir supplies three engine-driven pumps and the electric motor-driven pump which are in the utility and emergency systems. (See figure 1-19.) This reservoir is identical with the reservoir in the No. 1 surface control system except for increased volume and micronic filters installed in each system line.

Test connections for auxiliary hydraulic power are adjacent to each reservoir. Either the portable high-pressure hand pump unit or a ground test stand can be connected to any of the systems at these fittings.

REPLENISHING HYDRAULIC SYSTEM FLUID.

A permanently installed replenishing system is located on the starboard side of the mine loading compartment. It is comprised of a one-gallon reservoir, a low-pressure hand pump, a three-way selector valve, a check valve, and connecting tubing. Any crew member can replenish, in flight, the fluid supply in any one of the three reservoirs by placing the manual selector valves in the desired position and operating the hand pump.

AUXILIARY HYDRAULIC HAND PUMP UNIT.

A portable high-pressure hand pump with appropriate fittings is stowed on the starboard side of the mine loading compartment. It can be connected to any pair of test connections to pressurize the respective systems.

NOTE

This pump has certain limitations in the actual operation of hydraulically operated systems. The extent to which this pump can be used under emergency conditions has not been determined but the information will be added to the handbook when it is available.

ACCUMULATORS.

There are seven accumulators in the hydraulic system, each of which is equipped with a pressure gage on the air chamber side of the unit. Pre-load air pressure in the accumulator is indicated on this gage when the hydraulic pressure is zero; hydraulic pressure is indicated on the gage when the fluid chamber of the unit is pressurized. The function of these accumulators for the particular hydraulic operated flight control surfaces is shown in the following table:

QUANTITY	LOCATION	FUNCTION—OPERATION FOR
2	(1) ea. No. 1 and No. 2 Surface Control Systems	Stabilizer
1	Utility System	Rudder
4	(2) ea. No. 1 and No. 2 Surface Control Systems	Spoiler-Ailerons

FLUID SHUT-OFF.

A shut-off valve is installed in each pump supply line at the firewall. These valves are operated by pull-knobs on the engine fire extinguisher panel. (See figure 1-27.) The valves are actuated by 28-volt dc.

HYDRAULIC SYSTEM INDICATORS.

FLUID QUANTITY INDICATORS. Sight gages on each spherical reservoir are marked with index lines to show the full level and the refill level for both pressurized and unpressurized conditions.

HYDRAULIC PUMP INDICATOR. A single flag-type indicator with a selector knob is mounted on the co-pilot's sub-panel to indicate proper operation of the engine-driven hydraulic pumps. The pressure switches which operate the indicator are so located in the system that they detect pump output pressure, not system pressure.

The selector knob has a position marked ALL, and a position for each of the seven engine-driven hydraulic pumps. When in the ALL position, if the indicator shows ON, all of the pumps are operating at a minimum of 1500 ± 200 psi pressure. If the indicator shows a large red dot, at least one pump is not operating properly. Selecting individual pumps will reveal the one which is not functioning properly. With no electric power, the indicator shows cross-hatching.

HYDRAULIC PRESSURE GAGES.

Four pressure gages, one for each system, are located on the co-pilot's sub-panel. These gages, energized by 26-volt ac, give a continuous indication of the pressure at which the system is operating. Below each gage is a list of major components operated by the respective system.

FLIGHT CONTROL SYSTEMS.

The airplane is controlled in flight by three primary control systems; stabilizer-elevator, spoiler-aileron, and rudder. These systems are hydraulically power-operated with no direct feedback of forces to the pilot. The feel forces supplied are obtained synthetically.

PRIMARY SURFACE CONTROLS.

Dual controls of the wheel-and-column type are installed for the pilot and co-pilot. These control wheels are conventional in operation and have an autopilot temporary disconnect and a radio mike switch on the outboard grips. A camera switch and a mine

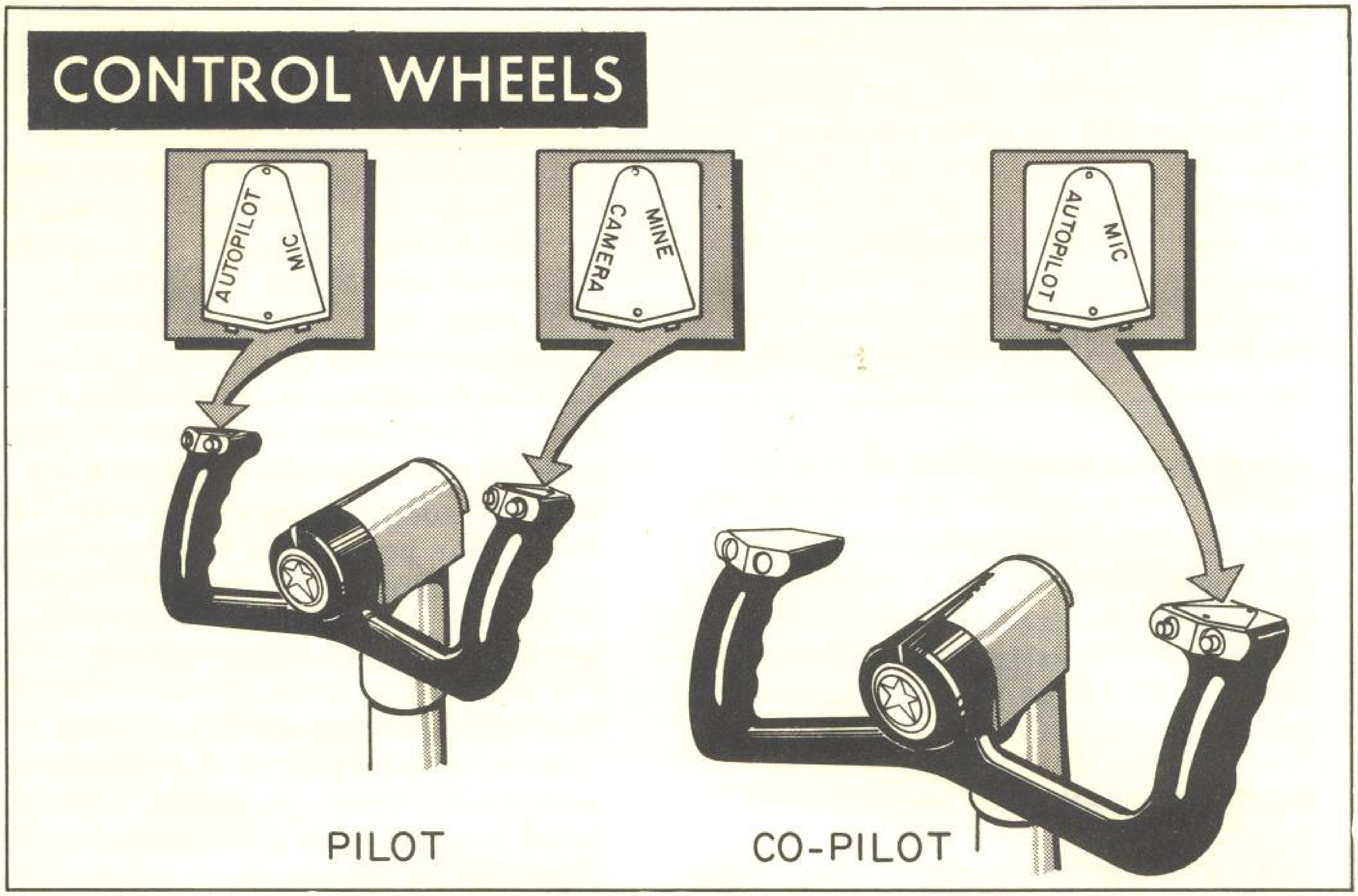


Figure 1-20

switch which releases stores are installed on the inboard grip of the pilot's wheel only. (See figure 1-20.) The stabilizer-elevator is controlled by the fore and aft movement of either control column. Left and right rotation of either control wheel moves the spoiler-ailerons. The rudder is power-operated and controlled through conventional pedals by either pilot.

There are no integral control locks on this airplane. However, when the airplane is parked, the stabilizer is positioned in a nose-up attitude and hydraulic pressure in the accumulators will maintain this attitude. A batten protects the rudder against gusts of wind.

STABILIZER-ELEVATOR CONTROL SYSTEM.

A power-operated, all-movable, stabilizer-elevator combination controls the longitudinal attitude of the airplane. The elevator is moved in a direct relation to the stabilizer by pushrod and bellcranks.

The dual control columns, linked together by a single torque tube, actuate duplicate cable circuits, one on each side of the hull, to an interconnecting cable mast in the fin. Dual valves and tandem cylinders are powered from separate hydraulic systems (No. 1 and No. 2) to actuate the stabilizer-elevator. If one of these hydraulic power systems fails, that system can be eliminated so that the other hydraulic power system can operate the control surface unrestricted.

The synthetic feel device of the stabilizer system transmits a force to the pilot which is proportional to both the control deflection from trim and the air stream impact pressure. This feel is required to prevent the pilot from maneuvering the airplane beyond its designed structural limitations at various airspeeds.

The feel system consists of 1) a stabilizer feel actuator, 2) a control box, and 3) a feel transducer that senses air impact through the airplane pitot-static system and varies automatically the feel on the stabilizer control as airspeed and altitude change.

A snatch unit below the control columns disconnects the columns from the stabilizer-elevator control if the pilots have to make a seat-ejection. Refer to EJECTION SEATS in this section.

STALL WARNING SYSTEM. The stall warning system alerts the pilot to the approaching stall of the airplane. This warning is an unmistakable fore and aft movement of the control column produced by a control shaker motor mounted on each pilot's control column. The shaking closely resembles the natural stall buffet and is felt whenever the airspeed becomes 1.1 times the actual stalling airspeed of the airplane. The speed indicator mounted in front of the pilot presents a visual check of the angle of attack, airspeed, and coefficient of lift. The warning system and speed indicator operation depend on the differential air pressure in the lift transducer probe, located on the left outer wing. The probe dust cover should be used when the airplane is moored or parked to minimize the entry of foreign matter into the transducer.

Operation. During flight, changes in differential air pressure in the lift transducer will move the indicator needle in either the FAST or SLOW direction. When the airplane is in normal flight the differential air pressure in the transducer is zero, and the needle is centered in the dial. Maintaining a constant power setting but increasing the angle of attack will cause a decrease in airspeed and a subsequent change in differential pressure. This change in pressure sends a signal through the amplifier to the indicator. The amplified signal then moves the pointer toward the SLOW position. When a pre-set airspeed percentage above the actual stalling speed is reached, the magnitude of the signal becomes great enough to actuate the control column shaker motors. At a sub-stalling airspeed of approximately 80 knots indicated, a pressure switch opens the circuit to render the system inoperative.

During take-off, needle indication should be disregarded until airplane is airborne. The best climbing angle is attained when the needle is positioned approximately half-way between the center mark and SLOW. The best rate of climb will be indicated when the needle is kept half-way between the center mark and FAST. For landing, the needle should be centered until on final approach, then it begins to move toward SLOW as power is reduced. It is possible that on the landing run-out the control shaker motors will be actuated, depending upon the angle of attack and resultant coefficient of lift.

Stall Warning Test. The stall warning test switch on the pilot's side console allows checking of the stall warning system on the ground or in flight. Moving the switch to TEST starts the operation of the shaker motors, which continues until the switch is released.

System Malfunction. If a malfunction occurs, the stall warning system can be made inoperative by tripping the circuit breaker on the co-pilot's circuit breaker panel. Electrical power to operate this system is 28-volt dc and 115-volts ac.

STABILIZER-ELEVATOR HYDRAULIC POWER SYSTEM. (See figure 1-18.) Duplicate hydraulic power systems are added for flight safety. These systems, the No. 1 surface control system and the No. 2 surface control system, power separate actuating cylinders which are arranged in tandem. Failure of one of the systems in no way affects the operation of the other system. During emergency operation the reduced hydraulic power available to drive the stabilizer-elevator is still sufficient to trim and maneuver the airplane throughout its speed and altitude range, and to take off and land the airplane in the usual manner.

The tandem-type actuating cylinder in the vertical fin is directly connected to the stabilizer surface. A dual, three-way, servo control valve (one side for the No. 1 system and the other for the No. 2 system) is mounted on the actuating cylinder.

The No. 1 and No. 2 surface control systems are so arranged that the small volume end of each half of the tandem cylinder is connected directly to the system pressure so that the stabilizer is held down at all times. Through movement of either control column the dual, three-way, servo control valve admits fluid to, or releases fluid from, the large volume end of each half of the tandem cylinders. This action moves and controls the stabilizer-elevator.

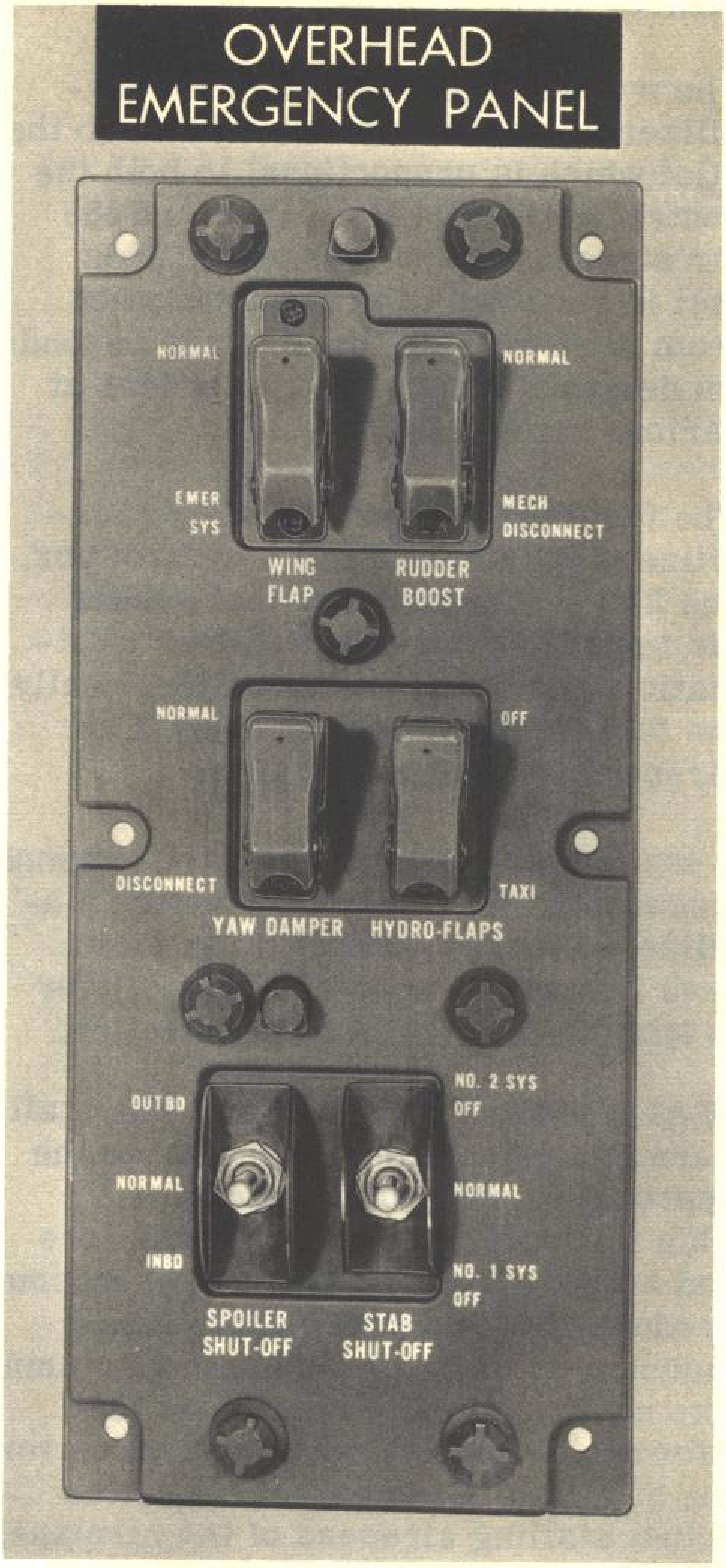


Figure 1-21

STABILIZER SHUT-OFF SWITCH. When the shut-off switch on the emergency overhead panel (figure 1-21) is in the NORMAL position, the shut-off valve in both surface control systems is de-energized; and the hydraulic power of both systems is available for operation of the flight control. With the shut off switch actuated to the NO. 1 SYS OFF or NO. 2 SYS OFF position, the corresponding shut-off valve is closed and hydraulic power from that system is eliminated.

STABILIZER-ELEVATOR TRIM CONTROL. Guarded trim wheels are on each side of the pedestal. Movement of either wheel operates switches which control an electrically operated screw jack in the stabilizer-elevator mechanism. This screw jack applies trim by varying the zero-force position of the control column. Rotating the trim wheel forward causes the zero-force position of the column to move forward, moving the stabilizer-elevator to a more nose-down position. The amount of movement depends on the length of time the trim wheel is actuated. Conversely, rotation of the wheel in the opposite direction will effect nose-up trim. The system requires 28-volt dc for its operation.

CAUTION

Even though the trim control is spring-loaded to the neutral position, the trim wheel should always be manually returned to neutral.

STABILIZER TRIM POSITION INDICATOR. The trim position of the stabilizer is continuously indicated on a dial on the pilot's sub-panel. The indicator operates from a d-c selsyn system, the transmitter for which is located in the tail compartment.

SPOILER-AILERON CONTROL SYSTEM.

Lateral control of the airplane is obtained through four spoiler-ailerons, two on the top surface of each wing. Each spoiler section is hydraulically operated by individual cylinders which are actuated by separate valves. The valves are mechanically connected to the control wheel by duplicate cable circuits.

Feel forces are supplied synthetically by a spring which produces a force as a function of wheel movement only. Wheel centering is aided by a detent at the neutral position.

In addition, wheel movement is restricted by mechanical stops known as Q-stops, which are automatically positioned according to airspeed and altitude. This restriction limits wheel movement for spoiler deflection, thus avoiding possible structural damage at high speeds. At limiting airspeeds, full spoiler deflection is limited 7°. In the event of malfunction, these stops can be released by pulling out the Q-stop release handle at the bottom of the pedestal.

SPOILER-AILERON HYDRAULIC POWER SYSTEM. (See figure 1-18.) Two power systems supply hydraulic operation of the spoilers. The No. 1 surface control system powers the inboard spoilers; the No. 2 surface control system, the outboard spoilers. If one power system should fail, the spoilers operated by the remaining system permits adequate lateral control throughout the flight range of the airplane. Sheer sections are incorporated in each spoiler control system so that the other spoiler control system can be retained if jamming occurs.

When the hydraulic control valve is actuated to direct pressure into the actuating cylinder, the spoiler is raised. The opposite end of the cylinder is connected to the pneumatic system. Air pressure from this system together with the air-stream force lowers the spoiler and keeps it flush with the wing surface. When the hydraulic control valve is positioned to return fluid from the cylinder, air pressure lowers the spoiler.

Without pneumatic pressure, the spoilers will trail up in varying amounts, depending upon airspeed; with the wing flaps down, the trail angle may increase excessively.

SPOILER SHUT-OFF SWITCH. This three-position toggle switch on the emergency overhead panel (figure 1-21), when in the NORMAL position, directs hydraulic power to both the inboard and outboard spoilers. When in the OUTBD (Off) position, this switch actuates a hydraulic shut-off valve, denying power to the outboard spoilers. Similarly, when placed in the INBD (Off) position, this switch actuates another hydraulic shut-off valve, denying power to the inboard spoilers. Any undesirable condition which might arise from a malfunction in one of the power systems can be eliminated through operation of this switch. The shut-off valves operate on 28-volt dc.

NOTE

When operating this switch, it is impossible for both the inboard and outboard spoilers to be denied hydraulic power at the same time.

SPOILER-AILERON TRIM. Spoiler trim is obtained when an electrically operated screw jack, actuated by the spoiler trim knob on the cockpit pedestal, causes linear displacement of the spoiler feel system. This creates a neutral or no-load force at the control wheel, although there is actually a spoiler deflection. Rotating the spoiler trim knob clockwise will produce starboard wing-down trim; rotation counterclockwise will produce port wing-down trim. Spoiler aileron trim operation requires 28-volt dc.

RUDDER CONTROL SYSTEM.

The rudder is normally operated by hydraulic power from the utility hydraulic system. The control valve in the rudder system is operated by a single cable circuit from conventional, adjustable pedals. Synthetic feel is applied to the system in a manner similar to the method of applying feel to the stabilizer-elevator. In addition to operating the hydraulic valve, the control cables are connected to the rudder so that some control is available if a hydraulic failure occurs.

RUDDER BOOST SWITCH. The rudder boost switch is located on the cockpit overhead panel. When this switch is in the NORMAL position, the rudder control cables actuate a valve which controls the hydraulic power used to position the rudder. If the hydraulic boost system fails, placing the switch at MECH DISCONNECT will energize a solenoid that actuates a valve to remove hydraulic pressure from the hydraulic actuating mechanism of the rudder control system. This minimizes the drag of the hydraulic actuator to allow rudder positioning by use of the rudder control cables. Returning the switch to NORMAL restores hydraulic boost to the rudder controls. The power required to operate this system is 28-volts dc.

RUDDER TRIM KNOB. The trim knob on the pedestal (figure 1-4) electrically operates an actuator in the feel system to change the neutral or "no-load" position of the entire control system. This is similar to the stabilizer-elevator trim described in this section.

RUDDER TRIM POSITION INDICATOR. The trim position indicator on the pilot's sub-panel gives a continuous indication of rudder trim. It requires 28-volt dc.

WING FLAP SYSTEM.

The wing flaps are of the split, trailing-edge type and are mechanically interconnected for asymmetric operation. The wing flaps, positioned by hydraulic pressure from the utility system, are maintained in a preselected position by a pressure-lock feature incorporated into the flap-actuating cylinder. Full travel of the wing flaps is from 0° to 45° and intermediate positioning is possible during normal operation.

WING FLAP LEVER.

This lever positions the wing flaps by movement to UP or DOWN, then to OFF. The lever is in the shape of a miniature wing flap section and is mounted on the cockpit pedestal. (See figure 1-4.) The wing flaps are operated by the utility hydraulic system.

WING FLAP POSITION INDICATOR.

The wing flap indicator on the co-pilot's instrument panel (figure 1-24) affords a visual check on wing flap position in percentage of extension (0% to 100%). The indicator's source of electric power is 26-volt ac.

WING FLAP SWITCH.

The wing flap switch on the cockpit overhead panel (figure 1-21) has two positions: NORMAL and EMER SYS. With this switch in the NORMAL position the utility hydraulic system powers the flaps. In the EMER SYS position the emergency hydraulic system furnishes power.

WING SLAT SYSTEM.

Mechanically linked wing slat sections, installed in the leading edge of each wing, extend forward and downward from the wings. Aerodynamic forces acting upon the wing slats cause them to extend and retract automatically, depending upon attitude and airspeed. Optimum control of the airplane is thus assured at relatively low airspeeds and high angles of attack. The stall speed of the airplane is lowered appreciably because the forces exerted on the wing slats during high angles of attack cause the wing slats to extend, permitting air flow to pass behind the slats and dissipate over the airfoil.

When the airplane is moored or parked, negator springs retain the wing slats in the fully closed position.

HYDROFLAP/DIVE BRAKE SYSTEM.

The hydroflaps, recessed in the aft section of the hull bottom, serve a dual purpose: 1) as hydroflaps to aid maneuverability on water and 2) as dive brakes to reduce speed in flight. The hydroflaps/dive brakes are powered hydraulically and supplied electrically by 28-volt dc. For the purpose of clarity, the hydroflaps operation will be treated separately from the dive brakes operation.

HYDROFLAPS.

The hydroflaps are supplied hydraulic pressure from the utility system. Asymmetric control of the hydroflaps is obtained by depressing either toe pedal (corresponding to normal braking operation). Position of the hydroflaps is in direct proportion to the travel of the pedals.

Before operating the hydroflaps, the dive brake handle on the pedestal (figure 1-4) must be fully in (OFF) and the hydroflaps switch on the emergency overhead panel (figure 1-21) must be in TAXI. A relay interchanges the dive brakes positioning control and the hydroflaps control potentiometers for hydroflaps operation. Full travel is limited to 70^o from the hull reference line.

NOTE

If electrical failure occurs, pulling the manual release lever at each hydroflap mechanism closes the hydroflaps.

DIVE BRAKES.

The extension of the dive brakes is controlled by the dive brakes handle on the pedestal (figure 1-4).

NOTE

When dive brakes are used, the hydroflaps switch on the cockpit overhead panel should be in the OFF position.

Pulling out the dive brakes handle actuates an electric motor-driven hydraulic pump. Valves then direct pressure into the actuating cylinders to extend the dive brakes. When the handle is pushed IN, the dive brakes are retracted.

When either the dive brakes handle or the hydroflaps switch is actuated, the electric motor-driven hydraulic pump commences operation because under certain conditions the engine pumps alone are not capable of supplying sufficient hydraulic pressure to operate the dive brakes within the time limits required. Also, during waterborne operation, when engines are running at reduced power, this electric motor-driven hydraulic pump furnishes supplementary pressure essential for hydroflap operation for water braking and maneuvering.

HYDROFLAPS/DIVE BRAKES POSITION INDICATORS. Position of each hydroflap or dive brake can be observed on individual indicators on the pilot's sub-panel. Indications are continuous when 26-volt ac is available.

NOTE

When the dive brakes are used, the wing flaps must be retracted. Conversely, when wing flaps are lowered for landing, the dive brakes, if not closed, will retract automatically.

PNEUMATIC SYSTEMS. (See figure 1-22.)

LOW PRESSURE SYSTEM.

The low-pressure pneumatic system is supplied with compressed air from the engines and is used to pressurize the hydraulic reservoirs and to supercharge the air compressor in the mine loading compartment. The bleed air drawn from the engines is filtered and chemically dried before entering the pressurized hydraulic reservoirs for the No. 1 surface control system and the utility system. The reservoir pressure regulator is adjusted to maintain 60 to 65 psi for reservoir pressurization.

NOTE

The No. 1 surface control system and the utility system reservoirs can also be charged by the high-pressure pneumatic system and by the APP.

HIGH PRESSURE SYSTEM.

The high-pressure pneumatic system is used to operate the mine door seal, beaching gear brakes, and the spoiler air spring cylinders and accumulators.

This 3000 psi high pressure system is charged by an electrically driven air compressor in the mine loading compartment. As the air leaves the compressor, it passes through a moisture separator and a chemical air drier before it enters the operating mechanisms. A thermostatically controlled electric heater in the moisture separator prevents freezing of the condensed moisture.

The compressor, normally supplied by engine bleed air, is regulated to furnish inlet air at 30 inches to 36 inches Hg absolute pressure, regardless of altitude. If this supply source fails, the compressor will draw ambient air through emergency inlets. The inlet pressure, of course, will vary with altitude.

Operation of the compressor is controlled by a pressure switch which is set to stop operation at 3000 ± 50 psi and restart operation when the system pressure drops 150 to 250 psi below the "cut-out" pressure. Pneumatic system leakage is compensated for by the compressor to maintain a constant pressure. A pneumatic pressure indicator for the high pressure system is mounted on the co-pilot's instrument panel. Refer to Section III for flight operation with loss of pneumatic pressure.

Ground charging stations can be used for charging both the low and high pressure systems from outside the airplane. 28-volt dc is used for control power to the air compressor, and 115-volt ac is used for its operation.

PNEUMATIC MINE DOOR SEAL. Water is prevented from entering around the mine door by a metal-backed rubber seal which is opened and closed by two alternately inflating and deflating pneumatic tubes. The compressed air for the seal is controlled by a regulator which reduces the pneumatic pressure from 3000 to 30 psi.

Inflation and deflation of the upper and lower tubes are regulated automatically during the mine door operating sequence. When the mine door switch (figure 4-25) is placed in the OPEN position, after removal of the mine door safety pin, the mine door locks are hydraulically disengaged. As either lock is disengaged, the lower tube is deflated. When both door locks are disengaged and the lower tube is deflated, the upper tube is inflated to open the seal and allow free mine door rotation. When the mine door switch is placed in CLOSE, the mine door rotates to the closed position and is locked. After engagement of both locks, the lower tube is then inflated to close the seal.

A pressure switch actuated by the lower tube illuminates the Seal Deflated warning light on the navigator's armament panel (figure 4-25) whenever the pneumatic pressure falls below 25 psi.

When held momentarily in the OPEN position, a spring-loaded mine door seal switch (figure 1-6) outboard of the pilots' fuel control panel opens the seal and thus allows any accumulated water which could freeze around the seal to be dumped. When the switch

PNEUMATIC SYSTEM

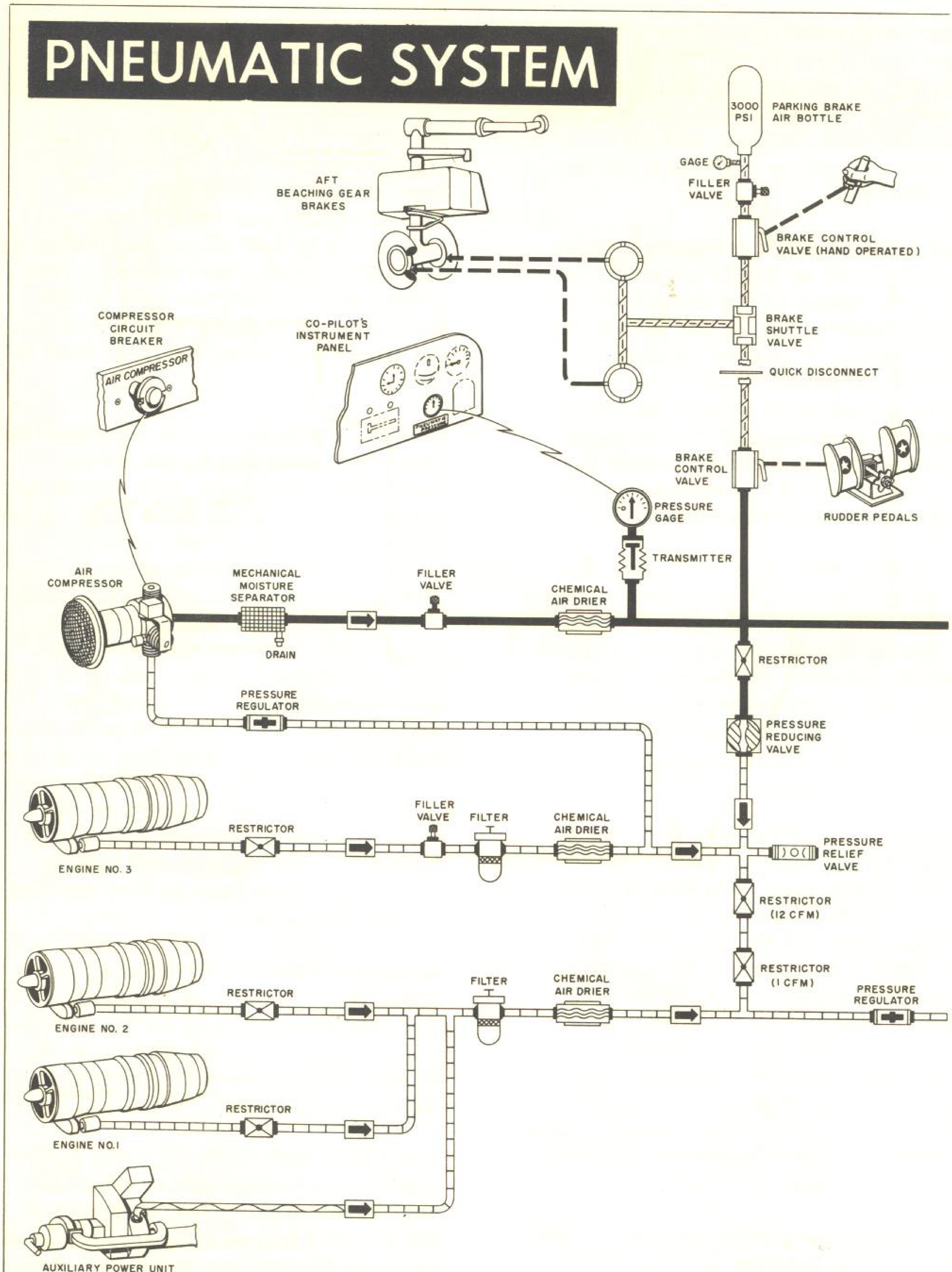


Figure 1-22 (Sheet 1 of 2)

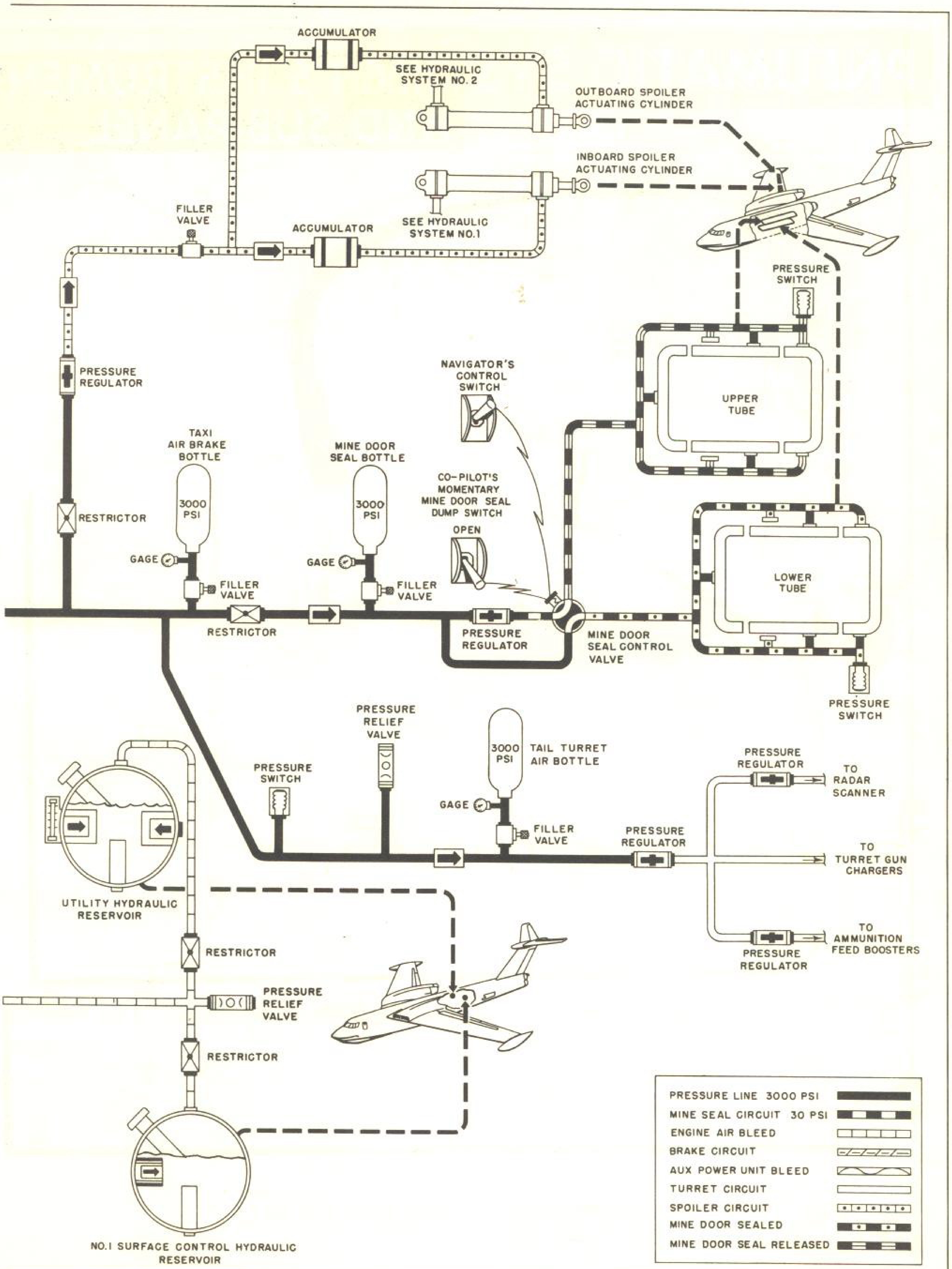
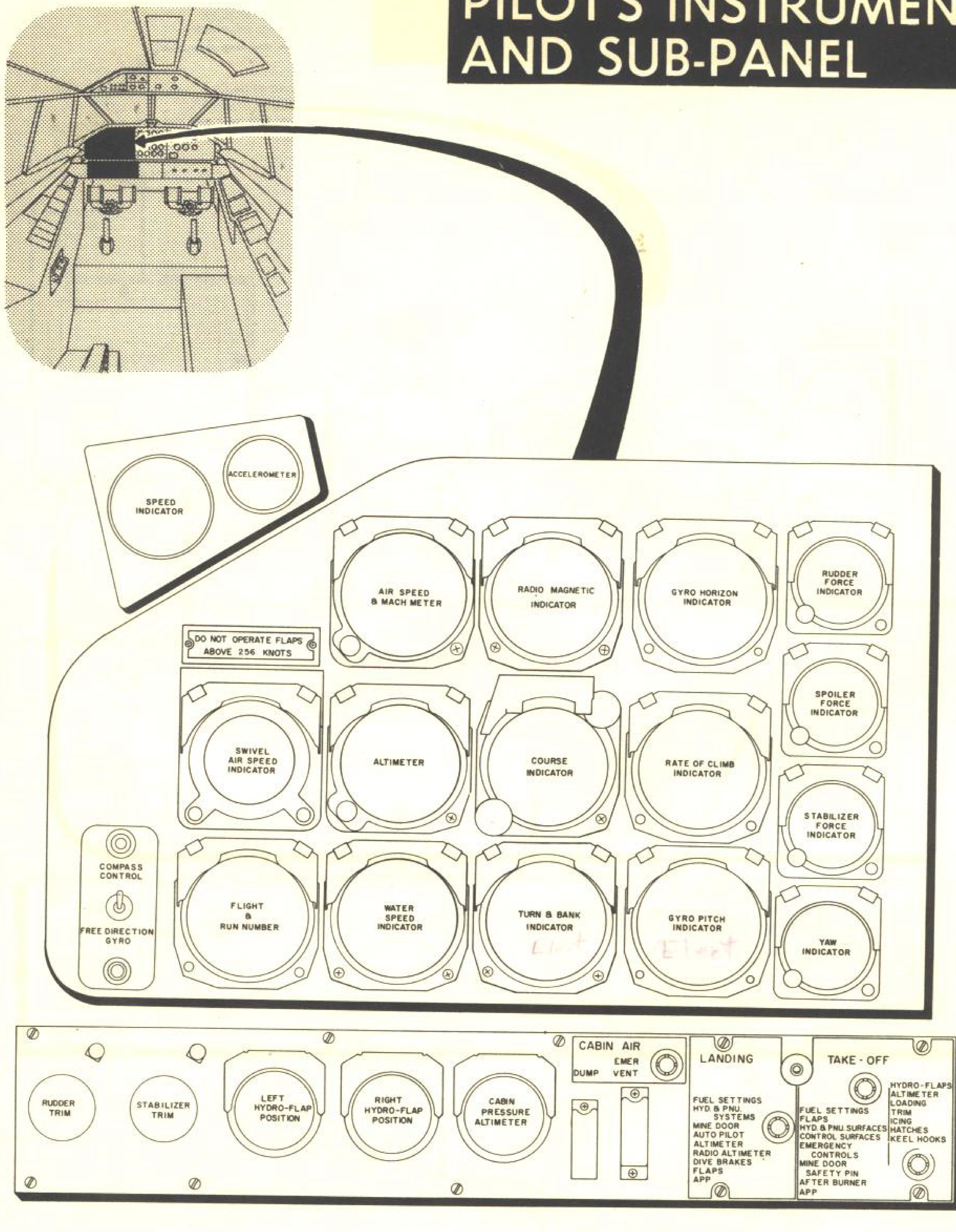


Figure 1-22 (Sheet 2 of 2)

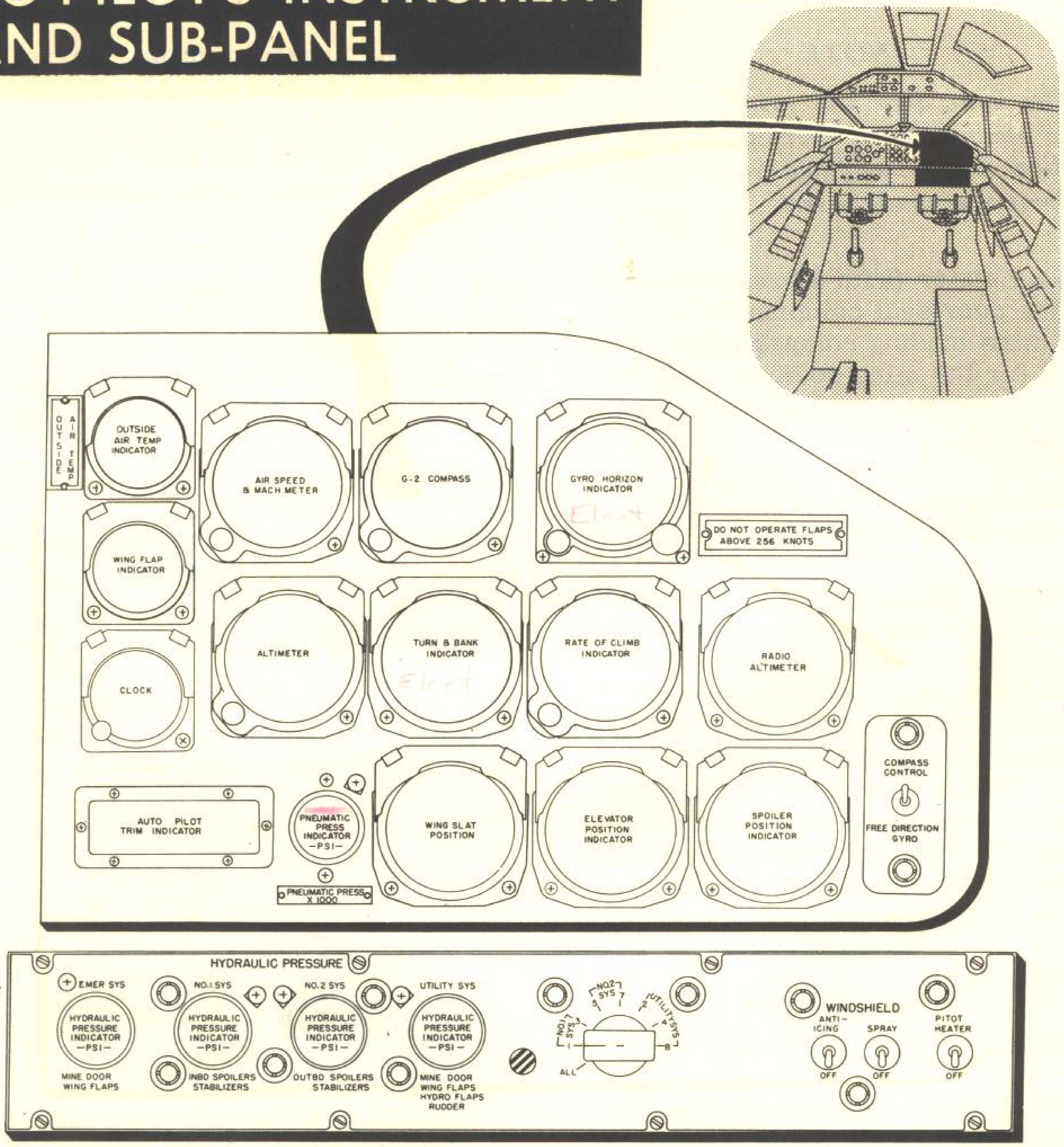
PILOT'S INSTRUMENT AND SUB-PANEL



TO BE REPLACED BY PHOTO WHEN AVAILABLE

Figure 1-23

CO-PILOT'S INSTRUMENT AND SUB-PANEL



TO BE REPLACED BY PHOTO WHEN AVAILABLE

Figure 1-24

returns to its normal or DOWN position, the mine door is sealed.

NOTE

The mine door seal switch should be operated after every take-off to allow any accumulated water to be dumped around the seal.

An accumulator (with a pressure gage) for mine door seal compressed air is in the mine loading compartment. The control for the mine door seal and its Seal Deflated warning light are supplied by 28-volt dc.

The description and operation of the mine door is in Section IV.

BEACHING GEAR BRAKES. The aft beaching gear brakes are supplied reduced compressed air from the high pressure pneumatic system through two brake control valves operated by the pilot's or co-pilot's rudder toe pedals. These valves act as variable pressure regulators, controlling the intensity of brake application from 0 to 665 psi. See Section IV for beaching gear operation.

INSTRUMENTS.

GENERAL.

In addition to the instruments specifically associated with airplane systems, the main instrument panel contains the pilot's and co-pilot's flight instruments. The engine operating instruments are grouped in the center of the panel so they may be readily observed by either pilot.

The entire panel is vibrated (to prevent instruments from lagging or sticking) by a 28-volt d-c unit to provide accurate instrument indications at all times.

A discussion of navigation instruments is found in Section IV.

FREE AIR TEMPERATURE GAGE

The free air temperature gage on the co-pilot's instrument panel (figure 1-24) gives a continuous indication of the outside air temperature. Up to speeds of approximately Mach .3 the gage is accurate within 5°. Above this speed the gage will read high, in direct proportion to increases in airspeed, because of skin friction effect. 28-volt dc is required for operation.

CLOCKS.

Standard eight-day aircraft clocks are located at each crew station.

ALTIMETERS.

A standard sensitive altimeter is mounted on both the pilot's and co-pilot's flight instrument panels.

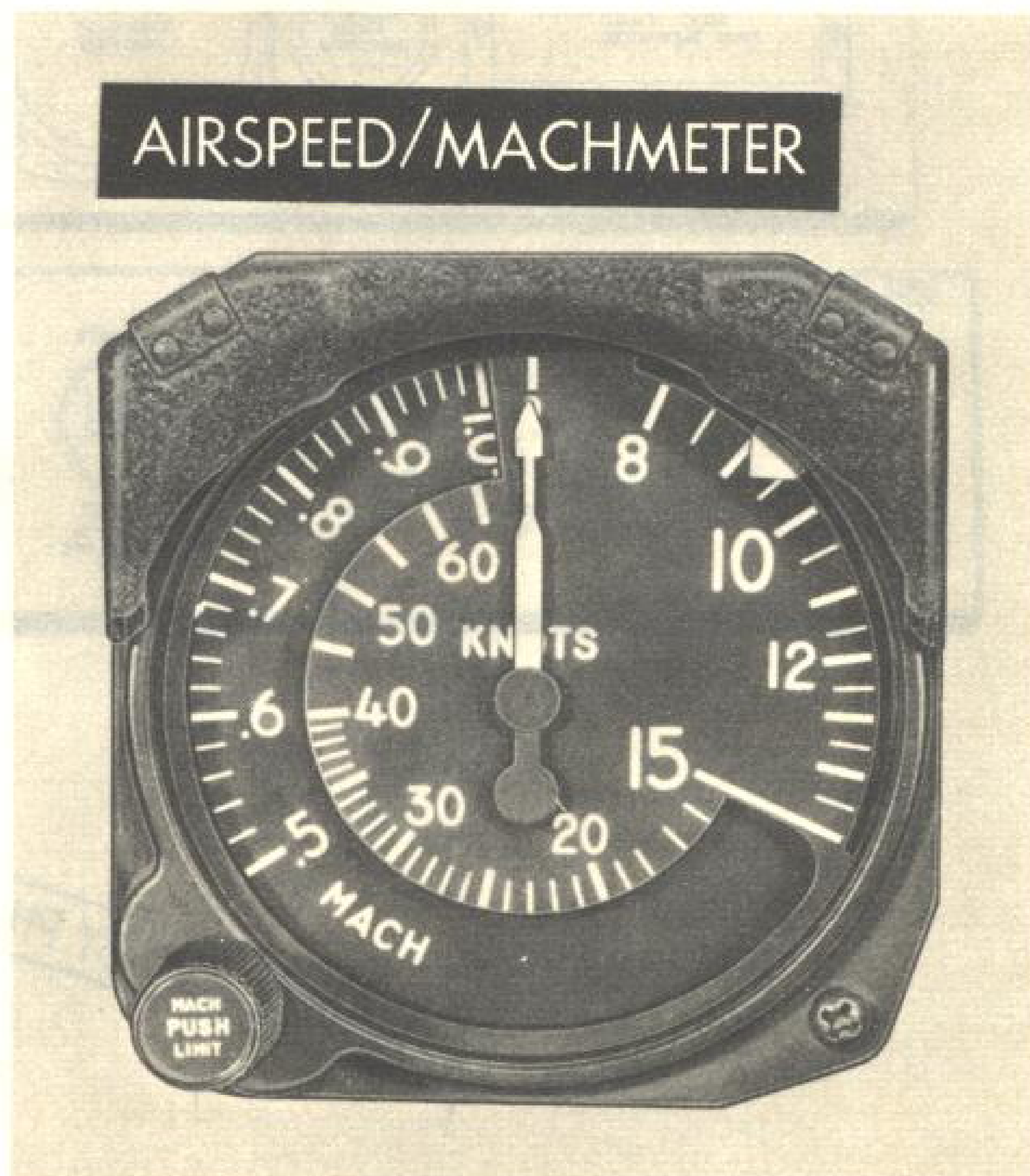


Figure 1-25

AIRSPEED/MACHMETER.
(See figure 1-25.)

An airspeed/machmeter is mounted on both the pilot's and co-pilot's flight instrument panels. The rotating pointer indicates airspeed from 80 to 650 knots; the triangular index point indicates the mach number (ranging from .5 to 2.2) on a rotating dial.

RATE-OF-CLIMB INDICATORS.

A rate-of-climb indicator is located on both the pilot's and co-pilot's flight instrument panel.

ACCELEROMETER.

An accelerometer on the pilot's instrument panel indicates both positive and negative acceleration. The instrument has three pointers: the main pointer gives the existing G-load; two auxiliary pointers indicate the highest positive and negative G-loading which has been applied to the airplane since these pointers were last zeroed. A knob on the face of the instrument can be used to reset the recording pointers to zero.

TURN-AND-BANK INDICATORS.

An electrically operated (4-minute turn) turn and bank indicator which uses 28-volt dc is mounted on each flight instrument panel (pilot's and co-pilot's).

GYRO HORIZONS.

A gyro horizon (figure 1-26) is mounted on each pilot's instrument panel. These gyroscopic indicators furnish airplane attitude information, with reference to the surface of the earth. Each indicator shows whether the airplane is climbing or descending, the angle (in degrees) being shown at a small window in the center of the instrument. The degree of bank is shown by the angular difference, as seen on the upper half of the instrument. An OFF flag will appear on the face of the instrument to warn the operator that the reading is erroneous. Before caging the gyro, the pilot should fly the airplane in straight and level flight. To cage the instrument, the Pull-to-Cage knob must be pulled out, then released. The gyro horizons are supplied with 115-volt ac for operation.

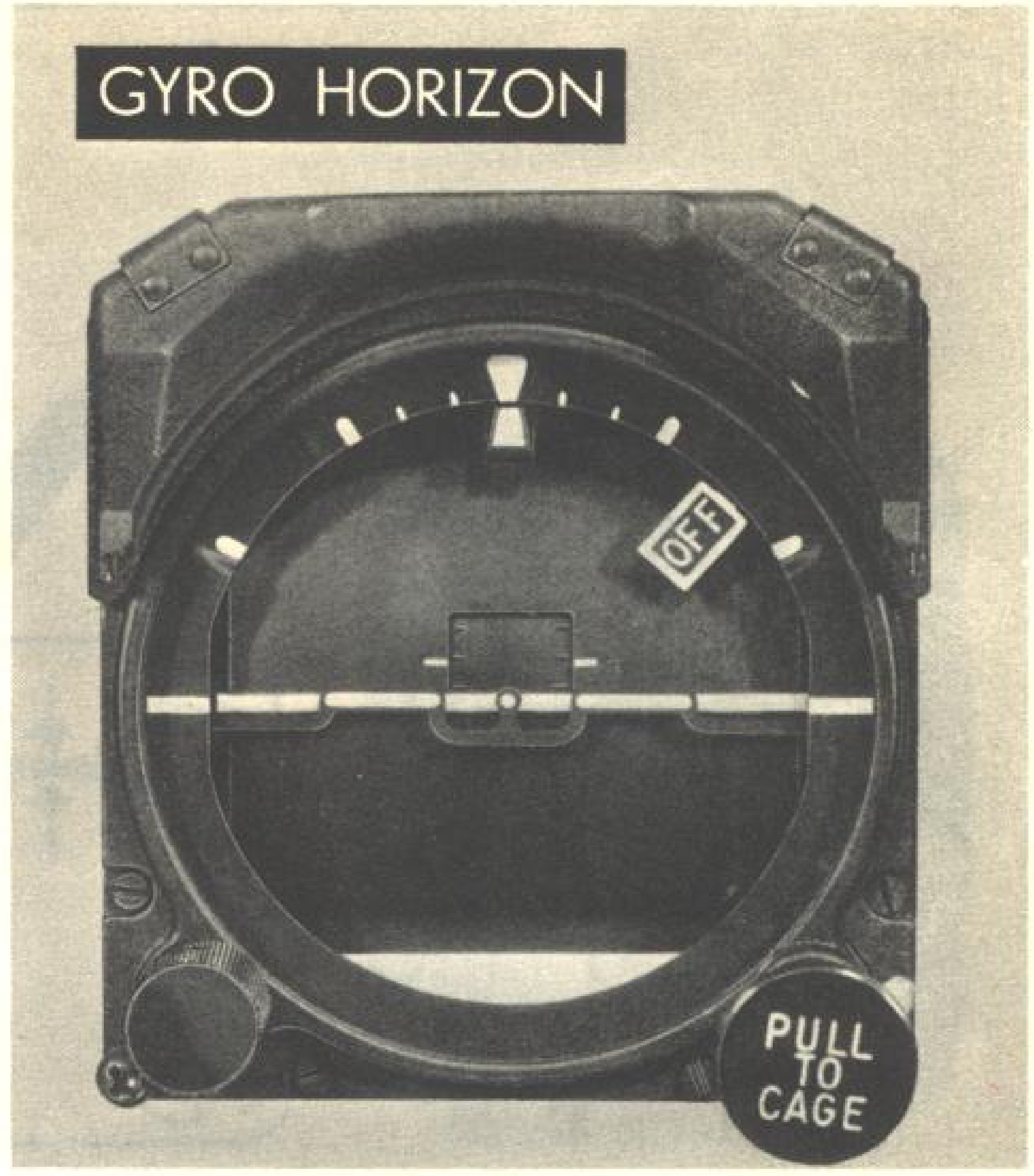


Figure 1-26

STAND-BY COMPASS.

A conventional magnetic compass (figure 1-6) is mounted on the pilot's upper panel. Illumination of the stand-by compass is controlled by a switch next to the compass.

Even if there is a complete electrical failure on the airplane, this compass can still be relied upon for course indications.

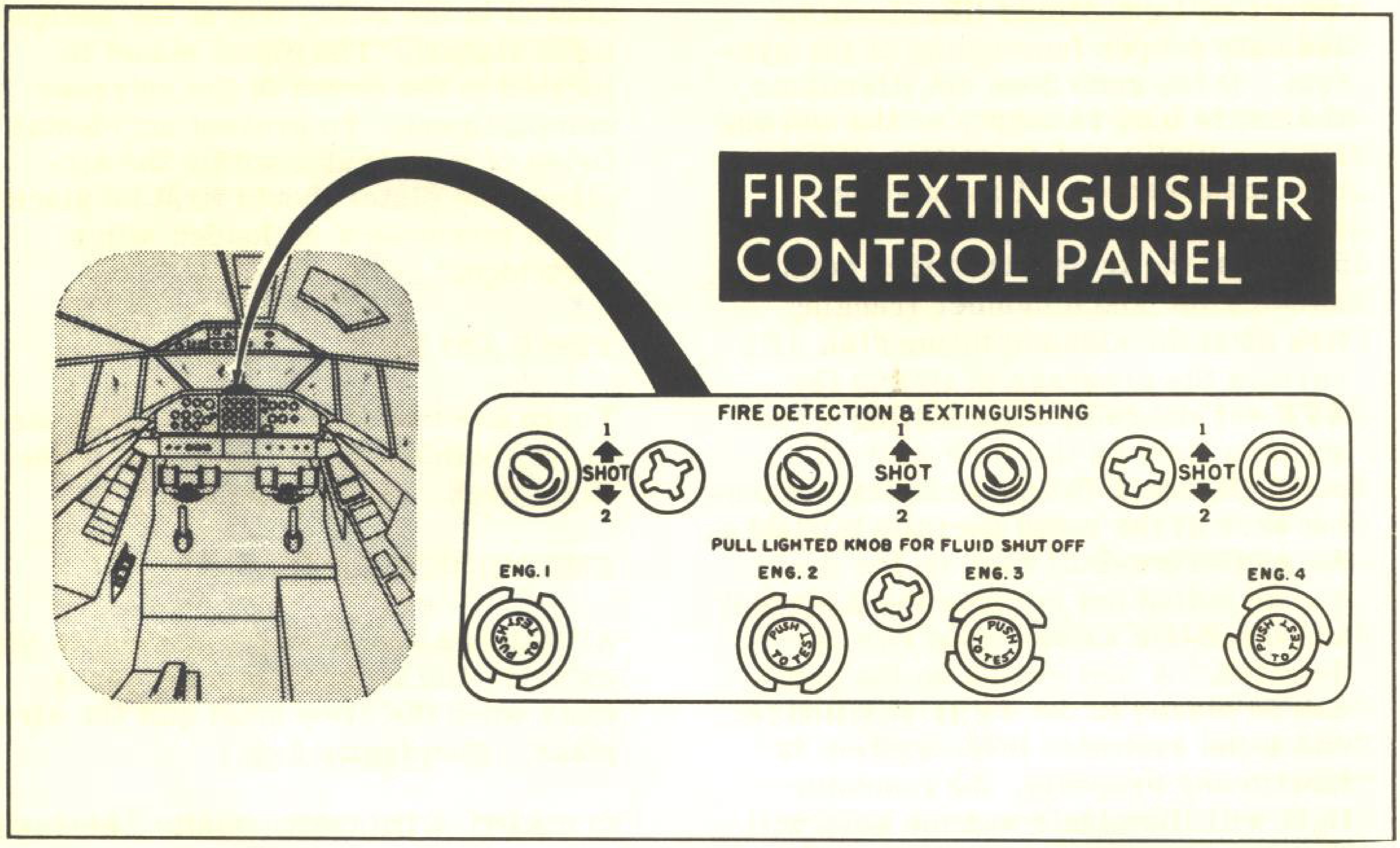


Figure 1-27

EMERGENCY EQUIPMENT.

FIRE EXTINGUISHING SYSTEMS.

ENGINE FIRE DETECTOR AND EXTINGUISHER SYSTEM. Detector elements in each engine indicate fire by illuminating a fire-warning light on the fire detection panel. (See figure 1-27.) This panel on the pilots' glare shield consists of four fire-warning lights set in four fluid shut-off knobs. A fire extinguisher bottle selector switch for each engine is above its respective engine fire warning light. Each switch can be placed to either side of center to release the extinguishing agent from the No. 1 or No. 2 bottle. Only one bottle can be fired at a time into an engine. However, both bottles can be released simultaneously into separate engines; or No. 2 bottle can be released after No. 1 bottle has been discharged. Discharging both bottles exhausts the fire extinguishing agent.

An engine fire is extinguished by directing bromotrifluoromethane from either of the bottles into the engine compartment. Pulling the fluid shut-off knob on which the fire-warning light appears will close the hydraulic and fuel valves to that engine. (In engines No. 1 and No. 4, the bleed-air valves are also closed.) Moving the fire extinguisher bottle selector switch to No. 1 or No. 2 position for the engine on fire will discharge the CF_3BR to that engine.

This fire-warning light and the detector system can be checked if the fire detector selector switch on the pilot's upper panel is moved to TEST: each fire detection light should illuminate to indicate proper functioning of the system. If the knob does not illuminate, the bottle may be empty or the warning bulb or its circuit defective. The system is operated by 115-volt ac and 28-volt dc.

APP FIRE DETECTION SYSTEM. A fire detector element around the APP reveals the presence of fire in the APP enclosure by illuminating a red warning light on the APP control panel (figure 1-8) and sounding a warning horn at the radio operator's station. An APP-Fire-Pull knob on the panel can be pulled out to close the APP fuel and bleed-air valves when fire is detected. A test switch on the panel can be placed to the TEST position to check the system: if the system is functioning properly, the indicator light will illuminate and the horn will blow.

NOTE

There is no internal fire extinguisher system for the APP.

PORTABLE FIRE EXTINGUISHERS. There are three portable, hand-operated, CO_2 fire extinguishers on the airplane. They are located on the forward deck on the entrance compartment, at the navigator's station, and on the aft bulkhead of the mine loading compartment. (See figure 3-1.)

EMERGENCY AXES.

Two emergency crash axes are aboard the airplane, one secured against the aft bulkhead of the entrance compartment and one against the port side of the APP compartment. (See figure 3-1.)

PYROTECHNIC PISTOL.

A pyrotechnic pistol and cartridges are stowed in the utility box at the navigator's station. The pistol mount is located in the crown of the entrance compartment. To prevent accidental firing of a cartridge within the airplane, the pistol should first be placed in the mount — then loaded with a cartridge.

FIRST AID KITS.

There are two first aid kits in the airplane, both on the aft port side of the flight deck. (See figure 3-1.)

EMERGENCY EXITS.

All hatches and windows opening to the exterior can be used as emergency exits when the crew must quit the airplane. (See figure 3-4.)

COCKPIT WINDOWS. Sliding windows are on each side of the cockpit, adjacent to the windshield.

HATCHES. The main entrance hatch is on the port side of the entrance compartment; a mooring hatch is on the starboard side of the same compartment. The ejection hatches above each crew member's seat can be used for emergency escape. Three hatches are in the air lock compartment: one on each side and one in the crown. Two hatches for installing the aft beaching gear are in the mine loading compartment, one on each side. (See figure 3-4.)

In addition to permitting emergency escape in flight, the seat ejection hatches can be used during ditching or a forced landing. The hatches, in the hull crown above each crew member's seat, are stenciled "EMERGENCY EXIT." To release the hatch, the emergency hatch release handle at each station console must be pulled.

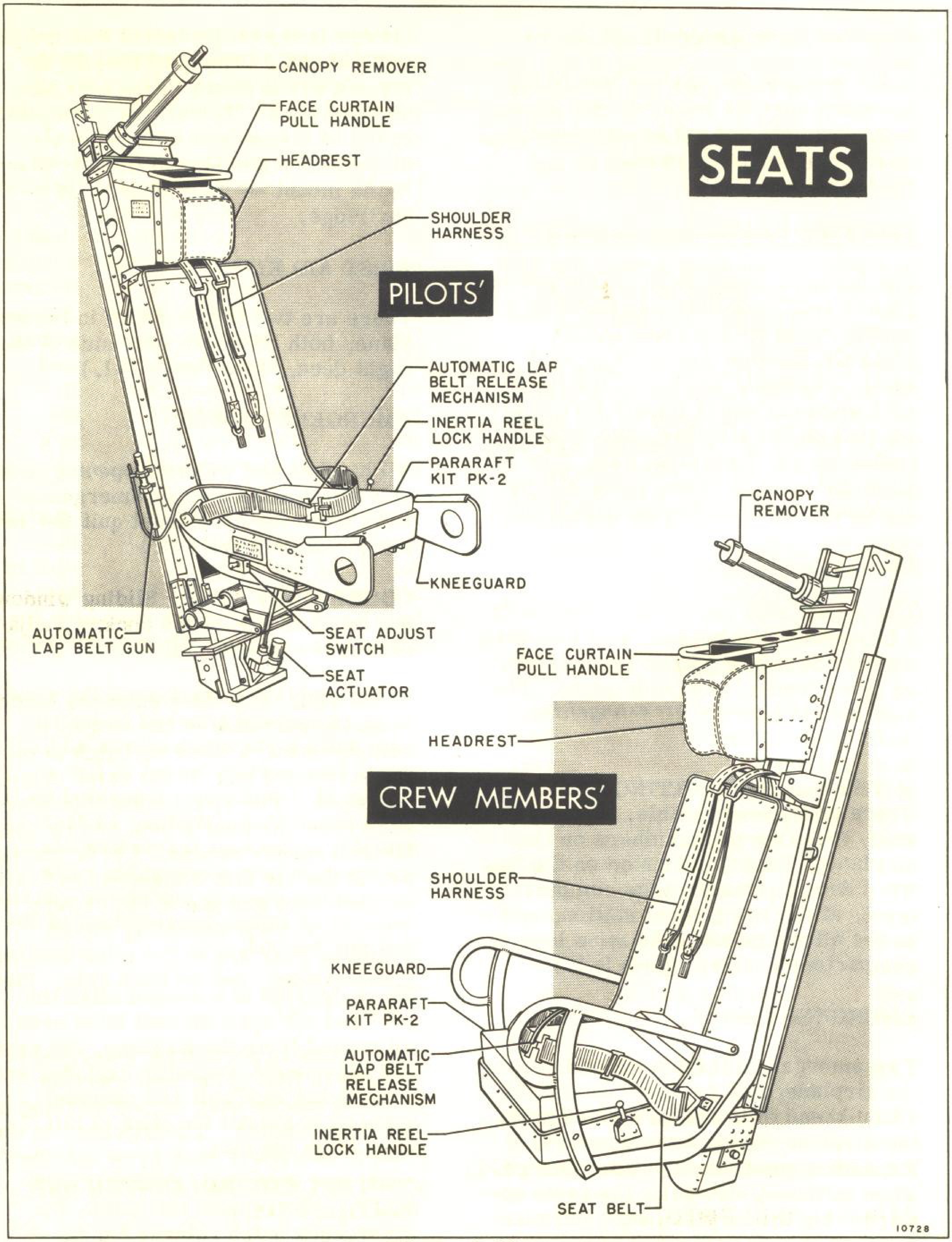

SEATS
PILOTS'
CANOPY REMOVER
FACE CURTAIN PULL HANDLE
HEADREST
SHOULDER HARNESS
AUTOMATIC LAP BELT RELEASE MECHANISM
INERTIA REEL LOCK HANDLE
PARARAFT KIT PK-2
KNEEGUARD
AUTOMATIC LAP BELT GUN
SEAT ADJUST SWITCH
SEAT ACTUATOR
CREW MEMBERS'
CANOPY REMOVER
FACE CURTAIN PULL HANDLE
HEADREST
SHOULDER HARNESS
KNEEGUARD
PARARAFT KIT PK-2
AUTOMATIC LAP BELT RELEASE MECHANISM
INERTIA REEL LOCK HANDLE
SEAT BELT
10728

Figure 1-28

WARNING

Do not pull the ejection seat face curtain after the hatch has been jettisoned—the seat will be armed and serious injury might result.

EJECTION SEATS.

The features common to all the seats (figure 1-28) are shoulder harness inertia reels with manual LOCK-UNLOCK handles (left side of each seat), automatic locking of the inertia reel when certain G impact forces are exerted on the airplane, and self-contained PK-2 pararaft kits. The main differences in the seats will be discussed in the following paragraphs.

PILOTS' SEATS.

The pilots' seat assemblies consist of a headrest, seat bucket, seat belt disconnect detonator, fixed kneeguards, an outer frame, and guide rails. The seat has no specific fore-aft movement control. However, as the seat is moved vertically through a travel of 5 inches, the upper part of the seat tilts slightly along adjustment tracks. Holding the spring-loaded toggle switch on the starboard side of the seat in the UP position elevates the seat electrically and tilts it forward; holding the switch in the DOWN position lowers the seat and tilts it aft. Returning the switch to its center position stops vertical movement.

EJECTION OF PILOTS' SEATS.

The pilots' seats can be ejected from the airplane during an emergency. Expanding gas from a powder charge, when initiated, catapults the seats upward from the airplane with sufficient force to ensure clearance of the tail structure.

The ejection seat mechanism is set in operation by a prolonged pull on the face curtain (curtain will travel approximately 18 inches). A cable connected to the curtain fires an M-3 initiator, the gas from which fires two M-5 initiators. One M-1 thruster, operated by the first of these M-5 initiators, unlocks the ejection hatch; and a second thruster blows the hatch clear of the opening. An M-3 thruster, fired by the second of the M-5 initiators, disconnects the control column from the flight control system and slams it forward (see CONTROL COLUMN SNATCH UNIT) into the main instrument panel, clearing a path for the ejection seats.

Before ejection, when the face curtain is pulled, the inertia reel is automatically locked to retain the pilot in his seat during ejection. The seat belt has a detonator incorporated for automatic unlocking after seat ejection.

As the ejection hatch leaves the airplane, a lanyard attached to its aft edge pulls a pin which allows additional face curtain travel to fire a second M-3 initiator. Operated by this second M-3 initiator, an M-3 catapult in the seat frame propels the ejection seat along guide rails through the opening left by the ejection hatch at an initial acceleration of 80 feet per second.

Three-fourths of a second after the pilot and his ejection seat have been catapulted from the airplane, the seat belt disconnect detonator explodes and unlocks the seat belt and shoulder harness to permit the pilot to fall away from the seat.

CONTROL COLUMN SNATCH UNIT.
(See figure 3-5.)

This unit acts in conjunction with the

SERVICING DIAGRAM

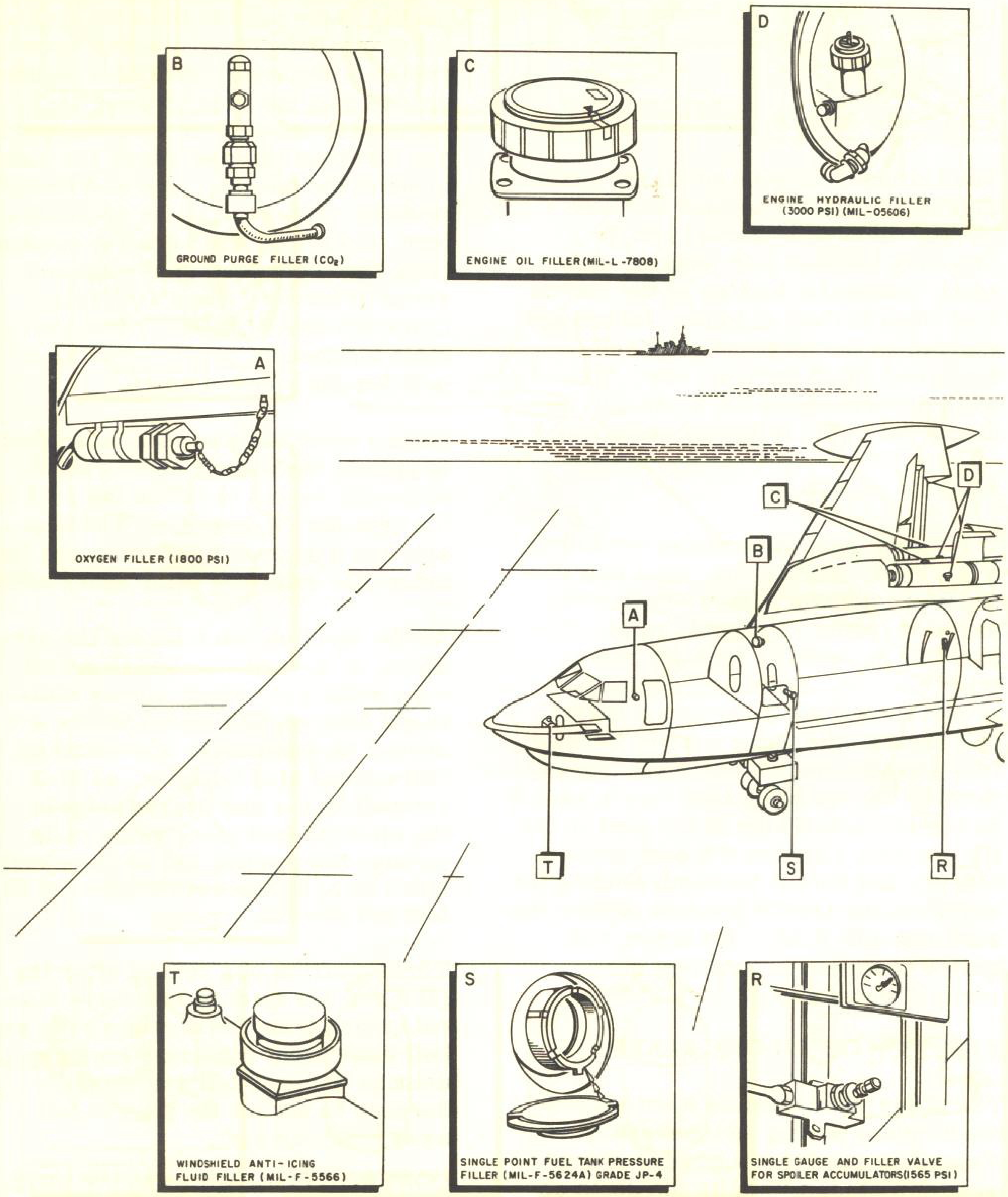


Figure 1-29 (Sheet 1 of 2)

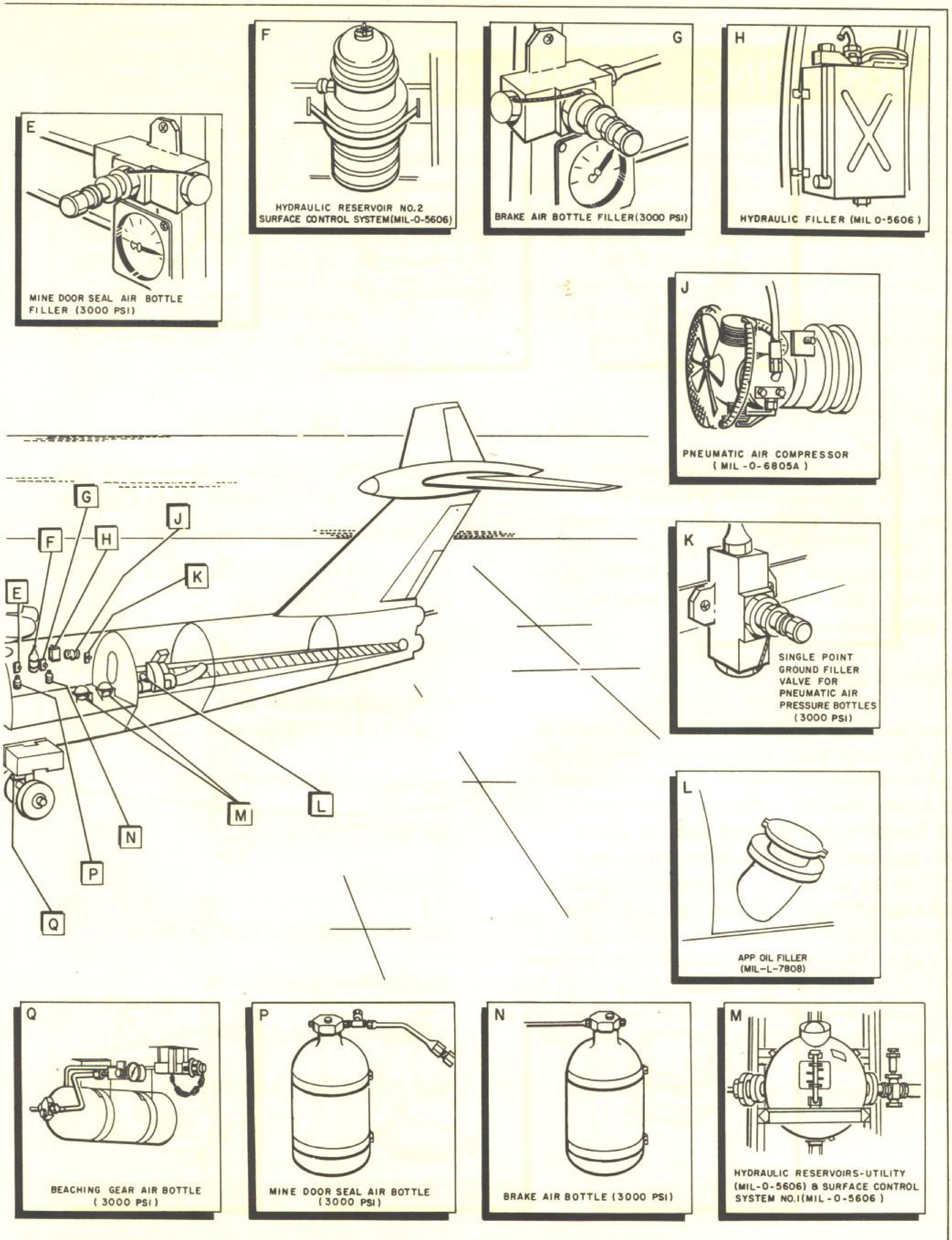


Figure 1-29 (Sheet 2 of 2)

ejection hatch mechanism to remove the control column from the path of the seat bucket during ejection. Gas from the initiator, fired by pulling the face curtain down, actuates a second initiator at the base of the control column. This initiator sets off a thruster which slams the control column into the main instrument panel to clear the path for seat ejection. The action of this initiator also severs the control column from the flight control system to ensure no change in flight attitude from that which was last held.

CREW MEMBER SEATS.

The navigator's and radio operator's seats are ejection seats similar to those for the pilots. The crew seats are fixed in the forward position and are non-adjustable. The ejection procedure is the same as that used for the pilots.

INERTIA REEL.

A mechanical shoulder harness inertia reel on each seat prevents injury to the wearer whenever rapid decelerations are encountered. The inertia reel lock handle on the port side of each seat may be moved freely from one position to another. When the handle is in the UNLOCK position, the reel harness cable will extend to permit the individual crew member free movement forward of his seat. However, the reel cable will automatically lock when an impact force of 2 to 3g's is exerted on the airplane. When the reel is locked in this manner, it will remain locked until the handle is manually moved forward to the LOCK position and then returned aft to UNLOCK.

The seat occupant can manually lock the reel harness in the LOCK position to prevent himself from bending or falling forward. This LOCK position is used whenever a crash landing is anticipated, and may be used during take-offs and landings, if desired. The LOCK position provides an added safety precaution over and above that of the automatic safety lock.

AUXILIARY EQUIPMENT.

The following auxiliary equipment and its operation are discussed in Section IV:

Cabin Air-Conditioning and Pressurization Systems

Anti-Icing and De-Icing Systems

Communications and Associated Electronic Equipment

Lighting Equipment

Oxygen System

Autopilot

Single-Point Fueling System

Navigation Equipment

Armament Equipment

Miscellaneous Equipment

Section II

NORMAL OPERATING PROCEDURES

TABLE OF CONTENTS

FLIGHT RESTRICTIONS.

Refer to Section V for a listing of airplane and engine operating limitations and restrictions.

CRUISE CONTROL.

The operating data in Appendix I supply the information on airspeed, fuel consumption, and power settings required for flight and mission planning.

Figure 2-1

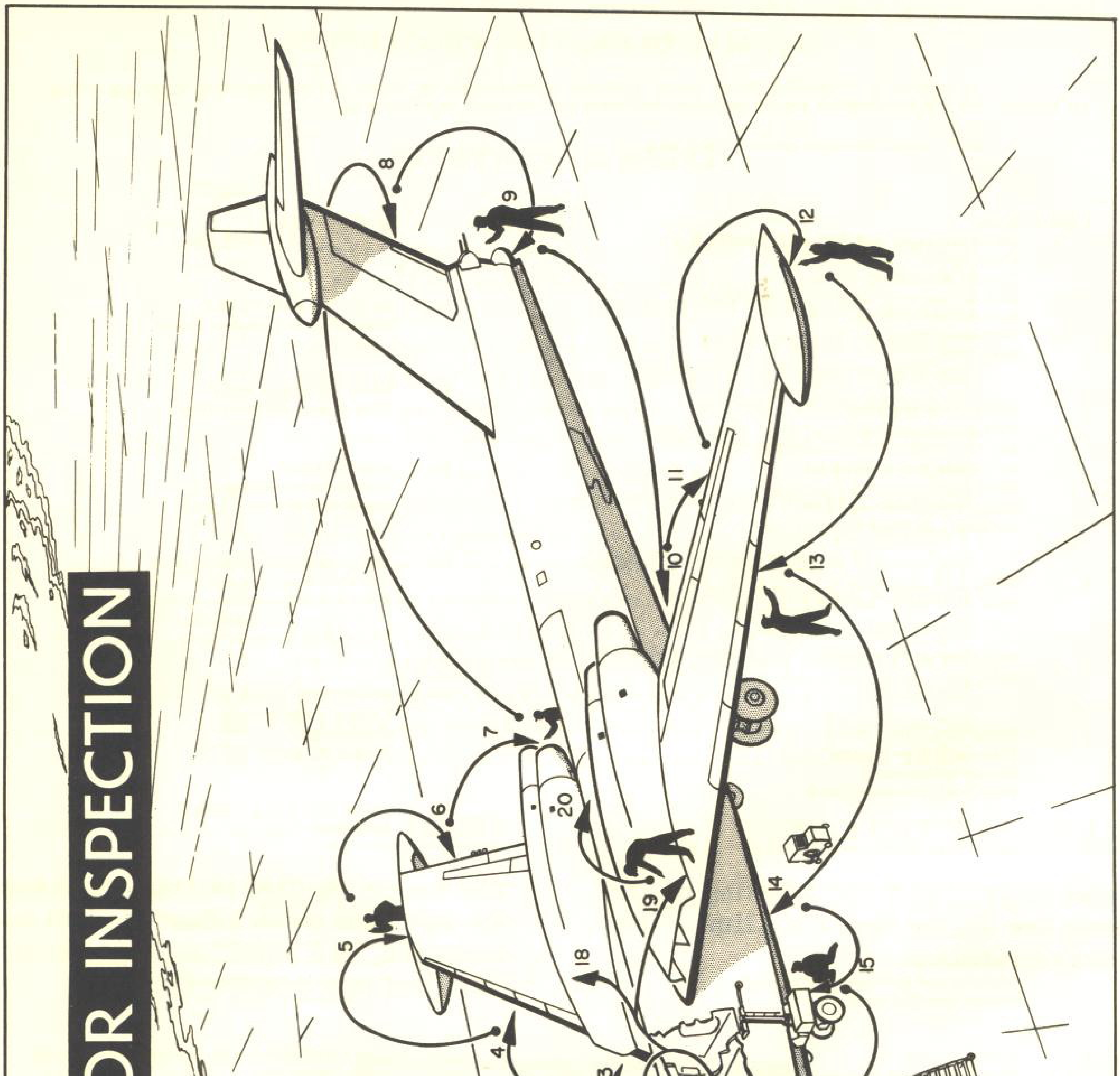


Figure 2-2 (Sheet 1 of 2)

In addition to the specific checks below, it should be determined that all service and inspection doors and covers are secure, and that the airplane and its equipment are generally seaworthy and airworthy.

In the areas indicated check the following:

1 and 2 BOW
Spray Strips—POSITION AND DAMAGE
Spray Shield
Cockpit Enclosure
Hull Bottom—STRUCTURAL DAMAGE
Bow Anchor Fitting
Radome
Keel Hook

3 HULL AND ENGINE
Fwd Beaching Gear
Air Intake Duct Covers—REMOVED
Air Intake Ducts—CLEAR
Pitot Tube Cover—REMOVED
Static Vent Holes—CLEAR
Landing Lights—RETRACTED

4 WING LEADING EDGE
Wing Slats—RETRACTED

5 WING TIP AND FLOAT
Navigation and Anchor Lights

6 WING TRAILING EDGE
Flaps and Hinge Points
Spoiler-Ailerons
Fuel Tank Vents—CLEAR

7 HULL AND CENTER WING TRAILING EDGE
After Beaching Gear
Engine Tail Pipe Covers—REMOVED
Beaching Gear Air Bottle—FULLY CHARGED

8 EMPENNAGE
Vertical and Horizontal Stabilizer
Rudder and Elevator

9 AFTER HULL
Tail Turret and Radome Fairing
Navigation Lights
Warm-up Fittings
Hydroflaps

10 HULL AND ENGINE
After Beaching Gear
Mine Door—SECURED AND SEAL INFLATED
Engine Tail Pipe Covers—REMOVED
After Beaching Gear Air Bottle—FULLY CHARGED

11 WING TRAILING EDGE
Flaps and Hinge Points
Spoiler-Ailerons
Fuel Tank Vents—CLEAR

12 WING TIP AND FLOAT
Navigation and Anchor Lights

13 WING LEADING EDGE
Wing Slats—RETRACTED

14 AIR INTAKES
Duct Covers—REMOVED
Air Intake Ducts—CLEAR

15 HULL AND BEACHING GEAR
Forward Beaching Gear
Fuel Filler Connector—SECURED
Pitot Tube Cover—REMOVED
Static Vent Holes—CLEAR

16 ENTRANCE AREA
Entrance Hatch
Hand Grips
Pilot's Windows

17 FORWARD HULL CROWN
Astrodome

18 TOP RIGHT WING AND ENGINE NACELLES
Spoiler-Ailerons
Nacelle Alternate Air Door
Nacelle Access Doors
Nacelle Air Outlets—OPEN
Nacelle Exhaust Exits—CLEAR
Tail Pipes—CLEAR OF FUEL AND OIL

19 TOP LEFT WING AND ENGINE NACELLES
Spoiler-Ailerons
Nacelle Alternate Air Door
Nacelle Access Doors
Nacelle Air Outlets—OPEN
Purge Gas Generator Air Scoops—CLEAR
Stall Warning Dust Cover—REMOVED
Tail Pipes—CLEAR OF FUEL AND OIL

20 AFT HULL CROWN
APP Air Duct Inlet Door
APP Exhaust Outlet
Cabin Air Conditioning Duct Outlet
Antenna

Figure 2-2 (Sheet 2 of 2)

WEIGHT AND BALANCE.

Check the weight and balance for take-off and the anticipated weight and balance for landing.

CHECK LISTS.

Abbreviated check lists for both take-off and landing are mounted on the pilot's sub-panel. (See figure 2-1.)

BEFORE EXTERIOR INSPECTION.

Before exterior inspection, check the yellow sheet to determine the status of the airplane. Recheck the servicing of the airplane. Recheck the servicing of the various systems; such as fuel, oil, APP, hydraulic, oxygen, etc.

EXTERIOR INSPECTION.

Complete the exterior inspection as shown in figure 2-2. The inspection when the airplane is waterborne is similar to a beached inspection except that it precludes a thorough hull examination. Use a boat to circle the airplane.

CAUTION

To prevent metal fatigue and possible failure in flight, avoid scratching or damaging the hull surface skin, particularly in the pressurized area.

ON ENTERING THE AIRPLANE.

ENTRANCE.

The airplane is normally entered through the forward entrance hatch, where handholds are provided for steadying a boarding craft and assisting entry.

A ladder or loading platform is necessary for entering the airplane when beached.

INTERIOR CHECKS.

All compartments of the airplane must be checked for proper provisioning and stowage of required items. (See figure 1-2 and 3-1.) Portable gear such as oxygen bottles, fire extinguishers, first aid kits, axes, mooring equipment, etc., must be carefully checked for secure lashings. A recommended procedure is as follows:

Pilot and co-pilot inspect flight deck, entrance compartment, and cockpit.

Radio operator inspects the electronics compartment.

Navigator inspects the pressure lock, mine bay, mine loading compartment, and the APP compartment after he has completed his station check as outlined in this section. Specifically, he should check the following:

Oil level in all hydraulic reservoirs.

Pre-load air pressure on all accumulators.

Oil level in the air compressor.

Pressure on all air bottles.

Fire extinguisher pressure and blow-out plugs.

CREW STATION CHECKS.

All check lists will be tabulated in the left column; precautionary notes and descriptive text will be listed in the right column opposite their pertinent check list items.

COCKPIT.

Ejection Seat Safety Pins - REMOVED.

Pilots' Emergency Canopy Release Handles - IN PLACE AND PINNED.

All Interior Lighting Controls - OFF.

Hydroflaps - OFF (Guard Closed).

Yaw Damper - NORMAL (Guard Closed).

Spray Strip Switch - UP.

Rudder Boost - NORMAL (Guard Closed).

Spoiler Shut-off - NORMAL.

Stab. Shut-off - NORMAL.

Wing Flap Switch - NORMAL (Guard Closed).

Fire Extinguisher Bottle Selector Switches - OFF.

All Engine Control Switches - OFF.

VHF Nav. - OFF.

UHF - OFF.

Fuel Transfer Control Knob - OFF.

Booster Pumps and Crossfeed Valves Control Knobs (two) - OFF.

Mine Door Seal Switch - DOWN.

Pilot's Interior Light Switches - OFF.

Pilot's Oxygen Regulator Supply Knob - ON.

Oxygen Quantity - Check.

Master Armament Switch - OFF (Guard Closed).

Pilot's Emer. Mine Door Switches - CLOSE (Guard Closed).

Pilot's Radio Controls - OFF.

Pilot's Console Lighting Switches- OFF.

Pilot's Windshield Wiper Knob - OFF.

Landing Lights - OFF.

If exterior inspection reveals that the landing lights are not fully retracted, they should be retracted when power is available and the switches then returned to OFF.

Stall Warning Switch - OFF.

Cabin Air Dump Switch - OFF (Guard Closed).

Cabin Air Emer. Vent. Switch - OFF (Guard Closed).

Instrument Power Switch - NORMAL.

Hydraulic Pump Indicator Selector Knob - ALL.

Windshield Anti-Icing Switch - OFF.

Pitot Heater Switch - OFF.

Windshield Spray Switch - OFF.

Co-pilot's Windshield Wiper Knob - OFF.

Co-pilot's Compass Control Switch - COMPASS CONTROL.

Co-pilot's Interior Light Switches - OFF.

Co-pilot's Oxygen Regulator Supply Knob - ON.

Co-pilot's Radio Controls - OFF.

Master White Lights Switch - NORMAL.

All Exterior Lights Switches - OFF.

IFF - OFF.

Nacelle Door Switch - DIR (Guard Closed).

Power Control Levers - OFF.

Power Control Friction Lever - As desired.

Autopilot - OFF.

Wing Flap Lever - UP.

Trim-Set for take-off. Estimated as:

Spoiler	0
Rudder	0
Stabilizer	1 degree - Nose down.

Dive Brake Handle - IN.

Q-Stop Release Handle - IN.

Rudder Pedals - Adjust.

NAVIGATOR'S STATION.

Ejection Seat Safety Pin - REMOVED.

Emergency Canopy Release Handle - IN PLACE AND PINNED.

Armament Group Select Switches (four) - OFF.

Arming Switch - SAFE.

Mine Door Switch - CLOSE.

Emergency Mine Door Switch - OFF.

Mine Door Seal Heat Switch - OFF.

Oxygen Regulator Supply Lever - ON. Check quantity.

All Lighting Controls - OFF.

APP Fire Watch - Stand by.

RADIO OPERATOR'S STATION.

Ejection Seat Safety Pin - REMOVED.

Emergency Canopy Release Handle - IN PLACE AND PINNED.

Fuel Transfer Pump (six) - AUTO ON.

Fuel Valves (ten) - CLOSE.

Indicator Test Switch - OFF.

Clock - Set.

All Lighting Controls - OFF.

Oxygen Supply Lever - ON. Check quantity.

Radio - OFF.

DC Power Control - Check.

External Power Knob - ON if external power connected; otherwise OFF.

Battery Knob - ON.

Converter Control Knobs (two) - ON.

Emer. Cont. Knob - ON.

Bleed-Air Control Valve Switches (three) - CLOSED.

Pressure Control Dump Switch - OFF (Guard Closed).

Surface Anti-Icing Switches (three) - OFF.

NOTE

Because of high heat generated by engine compressors operating at speeds greater than 59% (3500 rpm), the surface anti-icing switches should be OFF except in flight.

Cabin Conditioning Select Knob - OFF.

Engine Anti-Icing Control Switches (two) - OFF.

Aux. Vent Control Knob - CLOSED.

Panel Lights Switch and Knobs - OFF.

Gas Purge Switch - OFF.

AC Power Control - Check.

External Power - APP Knob - EXTERNAL POWER if available; otherwise OFF.

No. 1 Generator Control - OFF.

No. 3 Generator Control - OFF.

No. 1 Cross-Tie - ON.

No. 3 Cross-Tie - ON.

APP Door Switch - OPEN.

APP Exhaust and Intake Area - CLEAR.

APP Fire Watch - Standing by.

APP Start Switch - START momentarily, then ON.

Check APP - Speed and temperatures within limits.

Generator Select Knob - APP.

Voltage - Check and adjust 115 volts.

Frequency - Check and adjust 400 cycles.

Phase Seq. Error Light - Check unlighted.

External Power/APP Knob - APP.

D-C External Power Knob (if ON) - OFF.

APP Bleed-Air Control Valve Switch - OPEN.

ADDITIONAL INTERIOR CHECK (NIGHT FLIGHT).

If it is anticipated that any portion of the flight will be during the hours of darkness, all interior and exterior lighting should be checked, in addition to the normal interior checks. An adequate supply of spare lamps should be

CAUTION

Because of its remote location, do not start the APP without a fire watch standing by. Crewman assuming this duty—stand clear of compressor rotor.

NOTE

The APP firewatch (on returning to flight deck) should close all water and pressure tight doors, and make certain (while coming forward) that the curtain at the air-conditioning unit is drawn. The curtain and door between the air lock and mine bay compartments must be closed to ventilate the wing box and prevent possible accumulation of fuel fumes.

aboard, and each crewman should have a flashlight in operating condition.

NOTE

Each crew member must check all circuit breakers at his station.

BEFORE STARTING ENGINES.

COCKPIT.

Electrical Hydraulic Pump Switch - ON. (Check wing flaps, rudder, and hydroflaps operation.)

Electrical Hydraulic Pump Switch - OFF.

Spray Strip Switch - DOWN (check indicators).

Spray Strip Switch - UP.

Fuel Transfer Control Knob - AUTO.

Booster pumps and cross-feed valves control knob - BOTH ON (then cross-feed valve knob - OFF).

Engine Valves Knob - ENGINE NO. 1 or 4.

Indicator Test Buttons (three) - PUSH. (Check indicators for movement towards zero.)

Master Armament Switch - ON (Navigator check Armament Power Indicator Light - ON).

Master Armament Switch - OFF.

To conserve fuel, complete as much of the pre-take-off routine as possible before starting engines.

ENGINE START.

Start No. 1 engine as follows:

Motor engine 30 seconds (tachometer should register about 15%).

WARNING

Be certain the danger areas fore and aft of the engine (figure 2-3) are clear. The suction ahead of the engine is sufficient to injure seriously personnel drawn into or against the duct. The dangers aft of the engine are the high exhaust velocities and the extreme temperatures.

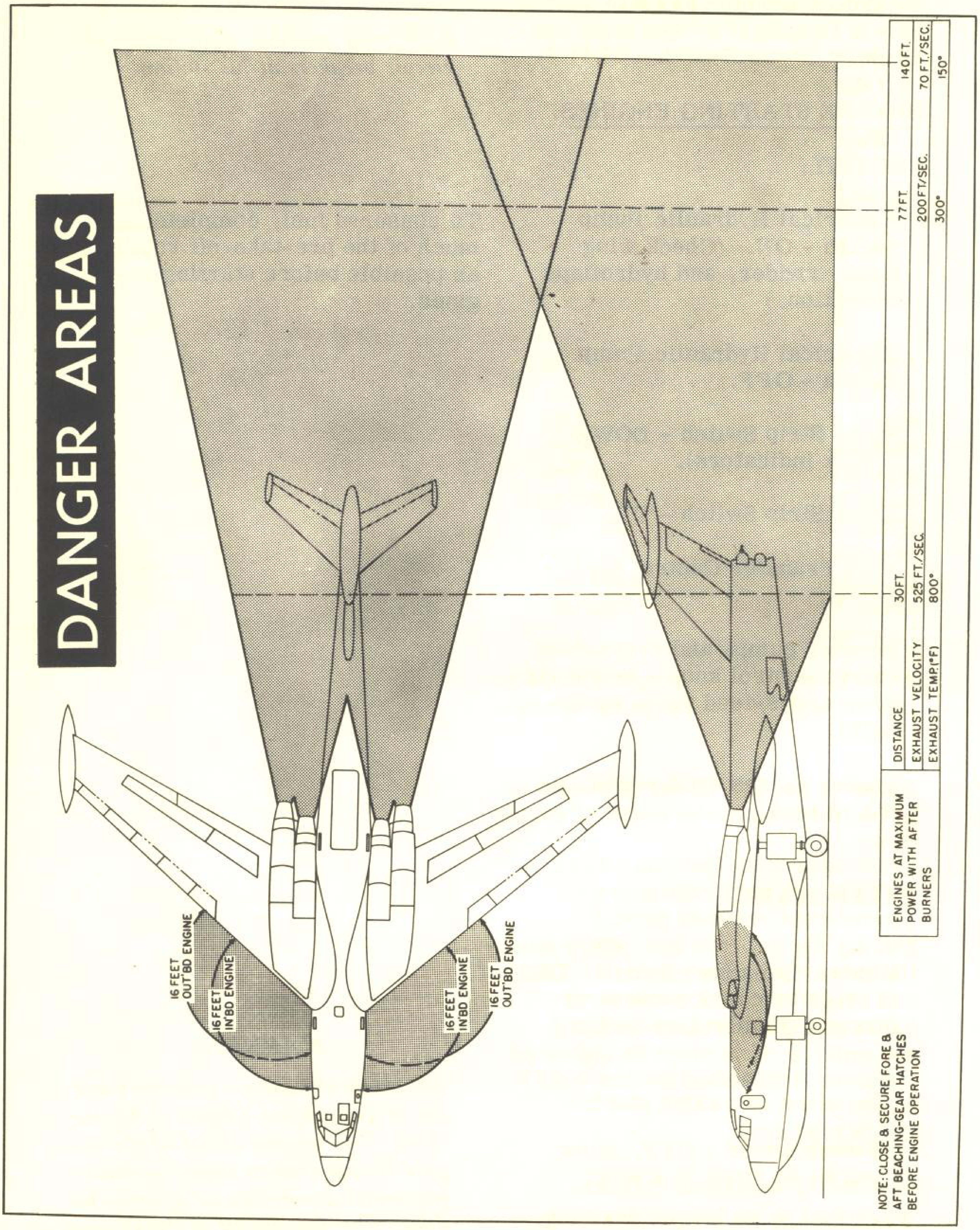

DANGER AREAS
16 FEET OUT'BD ENGINE
16 FEET IN'BD ENGINE
16 FEET IN'BD ENGINE
16 FEET OUT'BD ENGINE
ENGINES AT MAXIMUM POWER WITH AFTER BURNERS
DISTANCE 30 FT. 77 FT. 140 FT.
EXHAUST VELOCITY 525 FT./SEC. 200 FT./SEC. 70 FT./SEC.
EXHAUST TEMP.(°F) 800° 300° 150°
NOTE: CLOSE & SECURE FORE & AFT BEACHING-GEAR HATCHES BEFORE ENGINE OPERATION

Figure 2-3

Power Lever - START.

Start/Motor Switch - START (Momentarily).

Start A/B light - ON.

At 12% rpm:

Power Lever - IDLE.

Fuel flow should read about 3,000 pounds per hour.

CAUTION

Unless there is some indication of oil pressure at 12%, adequate lubrication is not assured and the "start" should be aborted.

After power lever has been placed at IDLE, check for increase in speed and temperature. During normal engine starts, the tailpipe temperature should not exceed 700° centigrade. At normal IDLE, check rpm, oil flow, oil pressure, and exhaust gas temperature. Fuel flow should be about 1,000 pounds per hour at light-off.

At 38%, starter A/B light should go off. Check hydraulic pump operation.

Refer to Section III for procedures to be followed in the event of engine fire.

FALSE START.

During the starting procedure when the power lever is placed at IDLE and there is no increase in exhaust gas temperature within 5 seconds, a false start is indicated.

In the event of a false start:

Power Lever - OFF, allow engine to coast to a stop.

When fuel is no longer draining:

Start/Motor Switch - MOTOR to 12%.

Start/Motor Switch - OFF, allow engine to coast to a stop.

Three minutes after the previously attempted start, restart in the normal manner.

CAUTION

The endurance of the ignition system limits the start system operation to two minutes on, three minutes off, two minutes on, twenty-three minutes off. These limits must not be exceeded.

HOT START.

During starts and acceleration, temperatures between 665°C and 900°C are permitted for 30 seconds. This limit will not usually be exceeded if normal starting procedures are followed.

A close watch of temperatures should be made and each start or acceleration which causes exhaust temperatures in excess of 900°C should be recorded in the engine log.

NOTE

Five instances of temperatures in excess of 899°C or a single instance of temperature in excess of 1000°C requires engine removal for inspection.

AFTER ENGINE START.

APP Bleed Air Switch - CLOSED.

Engine No. 1 Bleed-Air Switch - OPEN.

Parallel the output of No. 1 Generator with APP.

NOTE

When engine No. 1 is stabilized, its generator should be adjusted to parallel the APP generator and the output connected to the a-c distribution system.

Start engine No. 4.

Check stabilizer, rudder, and spoiler operation through an external observer.

Because of high fuel consumption, taxiing will normally be with No. 1 and No. 4 engines.

NOTE

Before proceeding to taxi, make sure the airplane is clear of all mooring lines and buoys.

ENGINE GROUND OPERATIONS.

The minimum power consistent with requirements should be used before take-off. Engine speed limits should be respected and any overspeed, regardless of the temperature, is to be noted in the engine log. See Section V for complete discussion of engine limitations.

TAXIING.

Hydroflap Switch - TAXI.

Spray Strip Switch - As required.

Nacelle Door Switch - As required.

Check flight controls for free and correct movement.

Check gyro indicators during turns for proper operation.

Use hydroflaps to maintain heading or to facilitate turning.

Fuel - AUTOMATIC.

Altimeter - Set.

Gyro Instruments - Set and Uncaged.

Hydraulic and Pneumatic Systems - 3000 psi.

Trim Tabs - STABILIZER 1^{o}, Nose down.

Wing Flaps - UP.

Cabin Air Conditioning - As required.

De-icing - As required.

Pitot Tube Heat - As required.

Mine Door Safety Pin - LOCKED.

NOTE

Minimize taxi time as flight range is considerably decreased by high fuel consumption during taxiing.

TAXIING

The airplane will, under normal conditions, be taxied using only the idle thrust of engines No. 1 and No. 4. Taxi speed builds up slowly to approximately 10 or 12 knots with hydroflaps retracted. Since asymmetric power is ineffective, the use of hydroflaps is the only means of maintaining directional control. The best maneuvering speed is 8 knots; speeds that are higher or lower will result in a larger turning radius. A minimum of 4 or 5 knots is necessary for maneuvering. Taxi speed of 2 to 3 knots with hydroflaps fully extended can be attained, although directional control is lost. High speed taxi characteristics are very good. With all four engines and No. 1 and No. 4 afterburners operating, taxi speeds up to 135 knots have been attained with no adverse handling characteristics; however, 85 knots is recommended as a good on-the-step taxi speed. When taxiing at high speeds, care should be taken not to allow a wing-tip float to get too low in the water because this may produce a hooking tendency. Alternate air doors and spray strips should be used up to about 80 knots in rough or choppy seas. The alternate air doors must be closed above 100 knots to prevent damage to doors.

Nacelle Air Door - As required.

Hatches - CLOSED AND SECURE.

TAKE-OFF AND ENGINE CHECKS.

This check is accomplished on take-off run.

Start remaining engines. Engines No. 2 and 3 may be started by engines No. 1 and 4 at IDLE rpm, if the APP is operating. If the APP is off, either engine No. 1 or No. 4 must be operated with at least 70% rpm to supply sufficient bleed air to start the remaining engines.

APP - OFF.

Head airplane into the wind.

Hydroflaps - OFF.

Cockpit Sliding Windows - CLOSED.

A/B Armed Switch - ARMED.

Power Levers - FORWARD (100% RPM). Observe exhaust gas temperatures, engine speed, and oil pressure for proper ranges.

With all engines at 100% - A/B Trigger Switch ON momentarily.

Afterburner light - Check ON.

NOTE

On all take-offs and landings, make certain that all water-tight doors are closed.

WARNING

Because of the great flow of air, the sliding cockpit windows must be closed during 100% rpm operation.

As the afterburner ignites, exhaust gas temperature will rise and speed will drop to 96% rpm and then return to 100% rpm. The indicator light denotes afterburner operation. If the speed drops to 89% rpm, retard the power lever to IDLE and re-accelerate.

If the A/B drops out, as indicated by the A/B light "off", retard engine to about 90% and re-accelerate. In each case, after the engine reaches 100%, it will be necessary to depress the A/B Trigger Button momentarily.

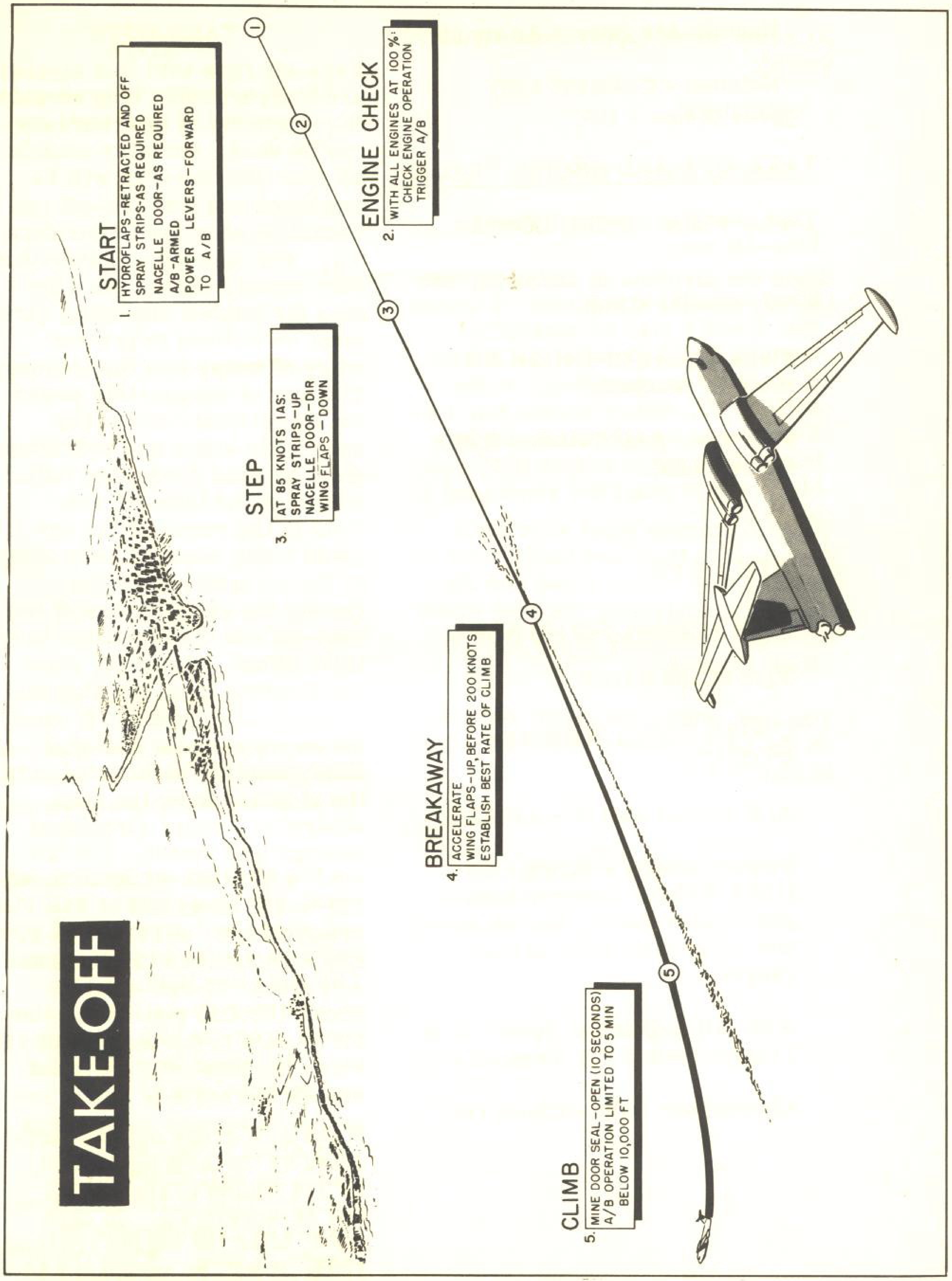

TAKE-OFF
START
1. HYDROFLAPS-RETRACTED AND OFF
SPRAY STRIPS-AS REQUIRED
NACELLE DOOR-AS REQUIRED
A/B-ARMED
POWER LEVERS-FORWARD
TO A/B
ENGINE CHECK
2. WITH ALL ENGINES AT 100%:
CHECK ENGINE OPERATION
TRIGGER A/B
STEP
3. AT 85 KNOTS IAS:
SPRAY STRIPS-UP
NACELLE DOOR-DIR
WING FLAPS-DOWN
BREAKAWAY
4. ACCELERATE
WING FLAPS-UP, BEFORE 200 KNOTS
ESTABLISH BEST RATE OF CLIMB
CLIMB
5. MINE DOOR SEAL-OPEN (10 SECONDS)
A/B OPERATION LIMITED TO 5 MIN
BELOW 10,000 FT
1
2
3
4
5

Figure 2-4

At hump speed (approximately 85 knots):

Spray Strips - UP.

Nacelle Door - DIR.

Wing Flaps - FULL DOWN.

When the airplane is airborne, establish normal climb.

Flaps - Start UP before 200 knots is reached.

Mine Door Seal Switch - OPEN (10 seconds).

To gain altitude most efficiently (conserving time and fuel), first attain the best climb speed and then ascend, maintaining the best climb airspeed according to the type of climb desired.

The best power for climb depends on the performance required. (Refer to figure A-6.)

TAKE-OFFS

Take-off runs with this airplane are comparatively long as only No. 1 and No. 4 afterburners can be used. On later models all four afterburners will be employed and the take-off run should be shortened considerably. For take-off on other than very smooth water, the alternate air intakes and spray strips must be utilized to prevent entry of water into the engines. The use of asymmetric power for directional control has very little effect and hydroflaps must be used during the initial stages of the take-off run. This is the result of the engines being mounted very close to the aircraft centerline. During the early phases of the take-off run the elevators have little effect. However, once the airplane is on the step all controls are normal. It cannot be overemphasized that flaps must not be lowered until the airplane is on the step; otherwise, major structural damage will result. The aircraft will break water at about 125 to 130 knots IAS at low gross weight, and there is a slight buffet until the flaps are retracted. Gross weights above 150,000 pounds require air speeds in the vicinity of 145 knots for take-off. At these speeds the angle of attack required to become airborne is very close to that angle at which the hull afterbody is wetted. This latter condition results in considerable increase in drag. When the pilot feels this increase in water drag, he will know the hull

FLIGHT CHARACTERISTICS.

See Section VI for additional information on flight characteristics.

DESCENT.

Any combination of power and speed brake positions may be used during descent as long as airspeed limitations in Section V are observed.

PRE-TRAFFIC PATTERN CHECK.

Enter traffic pattern below 250 knots IAS.

Altimeter - Set.

Alert crew on intercom.

Safety Belt and Shoulder Harness - SECURE.

Surface Control De-icing - As required.

Fuel - AUTOMATIC.

Mine Door - CLOSED AND LOCKED.

All Compartment Doors - CLOSED.

Mine Door Seal Heat Switch - OFF.

Hydraulic and Pneumatic Indicators - 3000 psi.

Nacelle Door Switch - DIR.

Autopilot - OFF.

Dive Brake Handle - IN.

Cabin Conditioning Selector Knob - As required.

afterbody is being wetted. This condition should be corrected immediately by lowering the nose.

LANDING.

On base leg or final approach (with about 200 knots IAS) start flaps down.

Slow airplane to about 135 knots on final approach (airspeed varies directly with gross weight).

Maintain power until flare, then retard throttles to IDLE.

At touchdown:

Normal touchdown airspeed is about 120 knots, depending upon gross weights. The quoted airspeed is for 120,000 pounds gross weight or lighter.

Wing Flaps - UP. (When airspeed of 90 knots is attained, the flaps must be retracted immediately to prevent structural damage to the flaps from water spray.)

Nacelle Air Doors - ALT.

Spray Strips - DOWN.

Hydroflaps Switch - TAXI.

GO-AROUND.

Because of slow engine and airplane acceleration, make any decision to go around as soon as possible. For this procedure, if a landing cannot be completed, consult Go-around Procedure in Section III.

AFTER LANDING.

ENGINE SHUT-DOWN.

When the airplane is waterborne,

LANDINGS

Flaps should be started down at 200 knots IAS and will be extended fully when airspeed is about 165 knots. (A mild buffet occurs when the flaps are completely down.) For low gross weights, an approach speed of 150 knots is recommended, with engines at 80 to 85 percent. This power setting should be maintained until flare-out at 130 knots, then the throttle is retarded to IDLE position and the touchdown made at 120 knots. Landings at high gross weight (153,000 pounds) will produce no adverse aerodynamic or hydrodynamic effects. After touchdown, air intake doors and spray strips should be opened if the sea is rough or choppy. Flaps should be retracted immediately after touchdown. It is mandatory that they be fully raised before the airplane comes off the step.

On landing, high-angle porpoising may occur at angles less than the aircraft stall angle. This is damped immediately when the hull angle is decreased slightly by lowering the nose. After landing, caution should be exercised not to allow one wing-tip float to get too low in the water or a hooking tendency may result.

Landings runs are rather long and,at low gross rates, the airplane decelerates slowly.

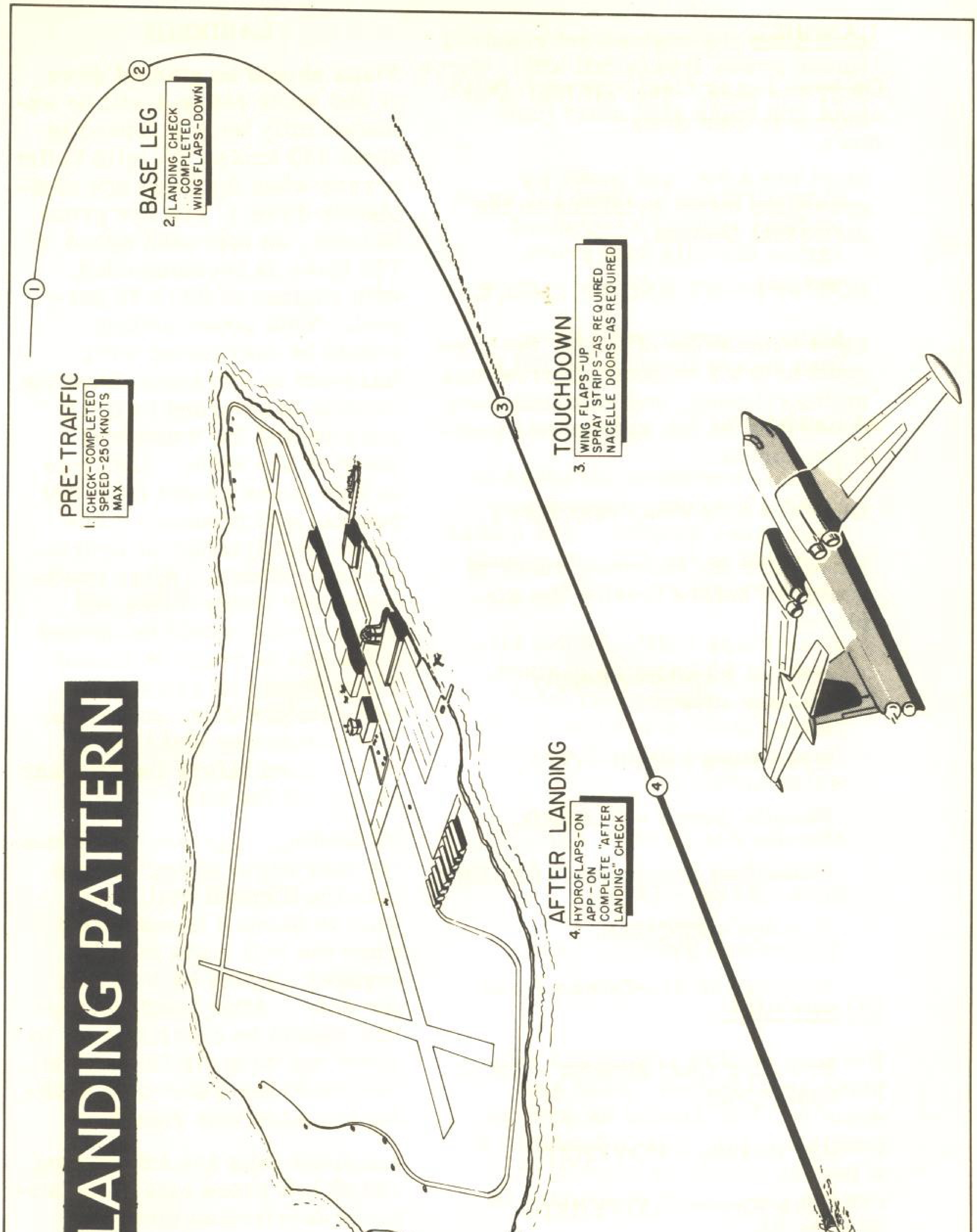

LANDING PATTERN
PRE-TRAFFIC
1. CHECK-COMPLETED
SPEED-250 KNOTS
MAX
BASE LEG
2. LANDING CHECK
COMPLETED
WING FLAPS-DOWN
TOUCHDOWN
3. WING FLAPS-UP
SPRAY STRIPS-AS REQUIRED
NACELLE DOORS-AS REQUIRED
AFTER LANDING
4. HYDROFLAPS-ON
APP-ON
COMPLETE "AFTER
LANDING" CHECK

Figure 2-5

shut down the engines not required (move power levers full aft). Watch EGT for rise. Shut off fuel after engine is shut down.

Start the APP, and make its generator output available to the electrical system.

POST-FLIGHT ENGINE CHECK.

Upon completion of flight, the crew shall note all unusual observations, malfunctioning, and unsatisfactory conditions on the appropriate post-flight forms.

BEFORE LEAVING AIRCRAFT.

Make sure the following check is complete before leaving the airplane:

Oxygen Regulator Supply Levers - OFF.

Hydroflaps Switch - OFF.

Nacelle Doors - CLOSED.

Classified Equipment - SECURE.

Hatches - SECURE.

Mooring or Tie-Downs Lines - SECURE.

Beaching Gear Brakes - ON (if applicable).

Air Intakes - COVERED.

Pitot Heads - COVERED.

Stabilizer Trim - FULL NOSE DOWN.

Landing Lights - RETRACTED and OFF.

Mine Door Safety Pin -
LOCKED.

Anchor Lights - ON (if airplane is moored after sunset).

Stall Warning Probe Cover -
Installed.

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Section III

EMERGENCY OPERATING PROCEDURES

TABLE OF CONTENTS

ENGINE FAILURES.

FLIGHT CHARACTERISTICS WITH ONE ENGINE INOPERATIVE.

The general flight characteristics with one engine inoperative are essentially the same as with all engines operating because the thrust line is near the centerline of the airplane.

ENGINE FAILURE DURING TAKE-OFF.

If an engine fails before the airplane is airborne and the pilot elects to abort, proceed as follows:

Power Levers - IDLE (to drive hydraulic pumps).

Affected Engine Power Lever - OFF.

Wing Flap Lever - UP.

Hydroflaps - As required.

NOTE

Little braking action is available from the hydroflaps at high speeds because of blow-back; however, hydroflaps may be used as desired after the entire hull length is wetted.

CAUTION

Do not open hydroflaps while the airplane is planing. Lack of water loads permits full hydroflaps extension and subsequent hull wetting will result in sudden loads and possible structural damage.

Spray Strips - As required.

Nacelle Doors - As required.

Moor the airplane and investigate.

If an engine should fail on take-off, and the take-off is continued, maintain altitude and allow airspeed to build up before establishing a climb. Take the following steps:

Power Lever for the affected engine - OFF.

Engine Fire Selector Knob - TO AFFECTED ENGINE (stand by to fight possible engine fire).

Wing Flap Lever - UP, when normal climb is established.

Generator Switch (if No. 1 or No. 3 engine) - OFF.

Make a landing as soon as practicable.

NOTE

Take-off with one engine inoperative presents no particular hazard with afterburners functioning. The minimum airspeed requirement for directional control of the airplane under such circumstances is 95 knots IAS.

TWO-ENGINE FAILURE DURING TAKE-OFF.

If two engines fail during take-off, while the airplane is still waterborne, abort immediately. If two engines fail following break-away from water, a safe go-around is possible after wing flap retraction. At high gross weight conditions on a hot day, while flaps are still extended, the inability to climb or accelerate will necessitate an immediate straight-ahead landing.

WARNING

If three engines fail during take-off, under no condition attempt to complete take-off.

VARIABLE AREA EXHAUST NOZZLE FAILURE.

An electrical failure in the exhaust nozzle actuating system will bring the nozzle to the full OPEN position. On take-off, with afterburners operating, nozzle failure will result in approximately a 10% loss of thrust.

AFTERBURNER FLAME-OUT.

If an afterburner flame-out occurs, recycle the power levers to 90%, then return to full rpm. Then recycle A/B demand switch.

ENGINE FAILURE DURING FLIGHT.

As with engine failure under any condition, engine failure during flight necessitates positioning the power lever of the affected engine to OFF. This precludes the possibility of quantities of fuel being emptied into the engine. The cause of the failure should then be determined, if possible. If the cause is remedied, an engine re-start can be accomplished. If, however, a mechanical failure has occurred, shut down the engine completely and plan the remaining portion of the flight on partial power. If prolonged flight is necessary, adjust the remaining engines for economy cruise.

TWO-ENGINE FAILURE DURING FLIGHT.

With two engines out on one side while the airplane is in flight,

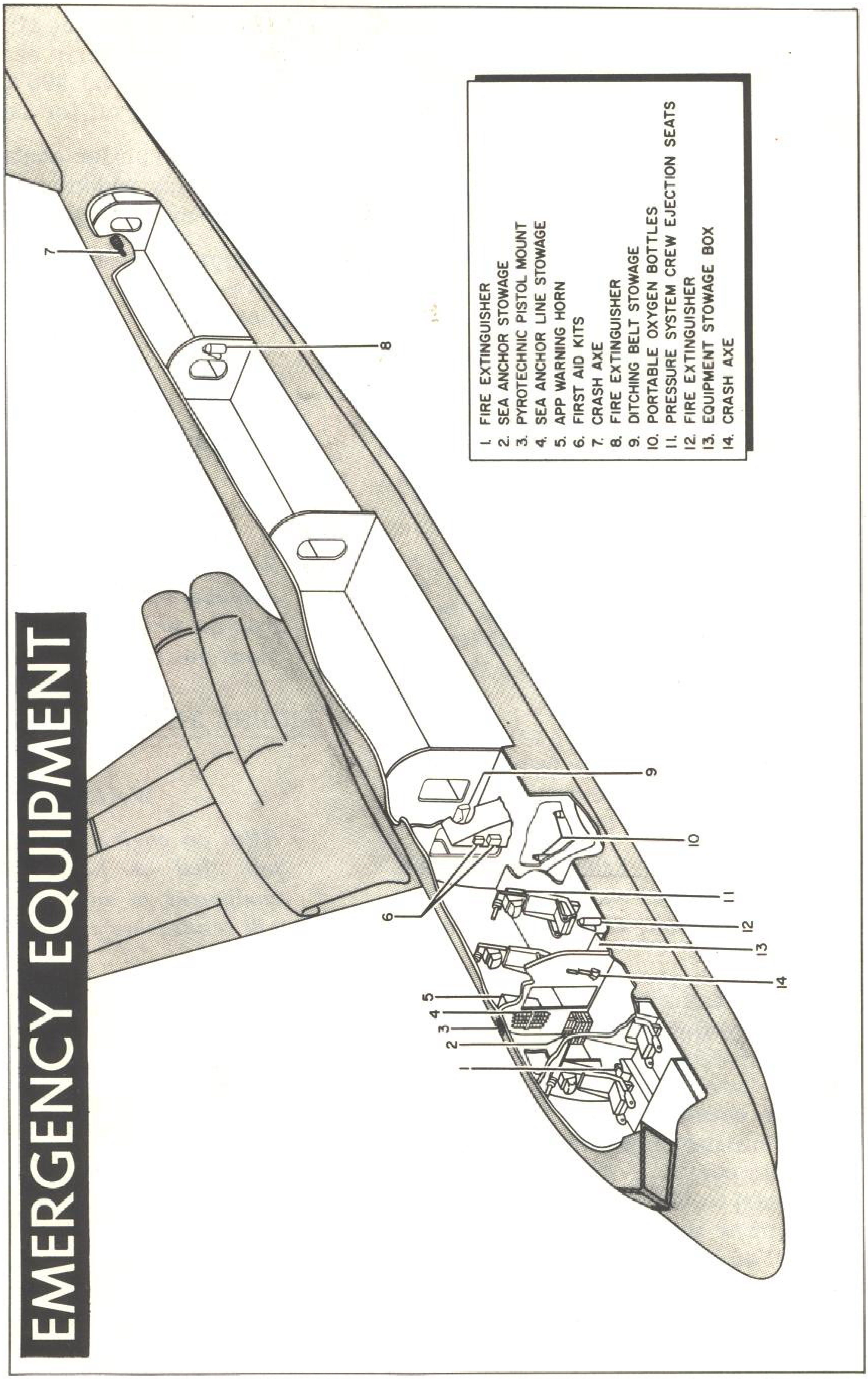

EMERGENCY EQUIPMENT
1. FIRE EXTINGUISHER
2. SEA ANCHOR STOWAGE
3. PYROTECHNIC PISTOL MOUNT
4. SEA ANCHOR LINE STOWAGE
5. APP WARNING HORN
6. FIRST AID KITS
7. CRASH AXE
8. FIRE EXTINGUISHER
9. DITCHING BELT STOWAGE
10. PORTABLE OXYGEN BOTTLES
11. PRESSURE SYSTEM CREW EJECTION SEATS
12. FIRE EXTINGUISHER
13. EQUIPMENT STOWAGE BOX
14. CRASH AXE

Figure 3-1

minimum control speed of the airplane, down to a speed 10% above stall speed, is possible when maximum power is applied to the two operating engines. With the two operating engines at 100% rpm, 135 knots is achieved in level flight with 140 pounds of pedal force.

THREE-ENGINE FAILURE DURING FLIGHT.

If three engines fail during flight at high gross weights, altitude can be maintained only through use of the afterburner on the operating engine. On a hot day, altitude can be maintained only at light weights.

FOUR-ENGINE FAILURE DURING FLIGHT.

If all engines fail during flight, a safe, power-off landing on water can be executed. To maintain adequate flight control, the pilot should take the following steps:

If possible, start the APP to provide electrical power for the utility hydraulic system and other electrically operated components.

On the pilot's overhead panel, shut off the outboard spoilers (spoiler shut-off switch, OUTBOARD position).

Glide at a minimum of 200 knots IAS to charge the spoiler accumulators and maintain adequate flight control. However, more effective control is obtained at 350 knots IAS. (Windmilling engines will drive hydraulic pumps.) If flame-out is believed to have occurred, advance the power lever and check engine speed and the EGT for an increase; if they do not increase, immediately retard the power lever to OFF.

Set up final approach as soon as possible and avoid all unnecessary control movements.

Extend flaps (about 10 seconds extension time) early enough to assure full extension (at 200 knots IAS) before leveling off for landing.

Minimize spoiler control movements by utilizing rudder for lateral control as much as possible.

At approximately 130 knots IAS, flare-out as close to the water as possible.

NOTE

If gusty conditions prevail, touch down at no lower than 160 knots IAS.

NOTE

When stabilizer control ceases, the airplane will assume a nose-down moment which helps to keep the airplane on the water.

ENGINE AIR START.

WARNING

After an engine failure, make certain that no further damage to equipment or injury to personnel will result from a re-start.

The best conditions for re-starting an engine in flight are at altitude of 20,000 feet or lower, with an engine speed of 20 to 25%. At 20,000 feet, this engine speed is attained at approximately 280 knots IAS. Light-off above 35% rpm is improbable.

WARNING

Before attempting an air start, fly the airplane in a nose-high attitude to drain any accumulated fuel from the engine.

EMERGENCY LANDING DUTIES

	DUTY	PROVIDE	POSITION	EXIT
PILOT	Warn crew to standby for ditching. Fasten shoulder harness and seat belt. Accomplish a ditching landing. Put EMERGENCY switches ON as required.	Sea anchor Pararaft kit	Pilot Seat	Ejection, main entrance, or mooring hatch. (See Figure 3-4.)
CO-PILOT	Turn IFF to EMERGENCY. Fasten shoulder harness and seat belt. Assist pilot as directed. Stand by on ICS.	Water breaker Handling line for lashing rafts Pararaft kit	Co-Pilot Seat	Ejection, main entrance, or mooring hatch. (See Figure 3-4.)
NAVIGATOR (Flight Test Engineer)	Jettison internal stores. Establish position and notify radio operator. Fasten shoulder harness and seat belt.	Sextant and charts for area Pararaft kit	Navigator Seat	Ejection, main entrance, forward beaching gear, or hull crown hatch. (See Figure 3-4.)
RADIO OPERATOR (Flight Engineer)	Radio distress signal and position. Stand by on ICS. Fasten shoulder harness and seat belt.	First aid kits Pyrotechnic pistol and cartridges Pararaft kit	Radio Operator Seat	Ejection, main entrance, forward beaching gear, or hull crown hatch. (See Figure 3-4.)

Figure 3-2

The air start procedure follows:

Engine Fuel Valve - ON.

Establish proper engine speed.

A/B Armed/Air Start Switch - AIR START. This is a positive position switch - return to OFF after light goes off to prevent burning up the ignition system.

Power Lever - IDLE.

NOTE

If engine does not start within 20 seconds, retard both the power lever and air start switch to OFF. Again assume a nose-high attitude to drain excess fuel from the engine and repeat the air start procedure.

FIRE.

ENGINE FIRE AT START.

With any indication of engine fire during the starting procedure, proceed as follows:

Power lever for the affected engine - OFF.

Illuminated Fluid Shut-off Knob - PULL (the hydraulic and fuel valves to that engine are closed to reduce fire hazard).

Fire Extinguisher Bottle Selector Switch for affected engine - Bottle No. 1.

If fire is not extinguished with contents of first bottle, place bottle selector switch to No. 2.

If the fire remains uncontrollable, shut down other engines which may have been started, and turn the APP switches off. Then abandon the airplane.

ENGINE FIRE DURING FLIGHT.

Combat an engine fire in flight in the same manner outlined for engine fires during starting.

NOTE

In flight there is the additional possibility that, if the source of fuel for the fire is eliminated, airflow may blow out the fire.

APP FIRE.

With an indication of an APP fire:

APP Fire Switch - PULL.

Fire Watch - Combat fire.

After tachometer indicates zero - Close APP intake door.

HULL FIRE.

If a hull fire occurs de-energize all non-essential circuits in the area. If smoke or fumes are concentrated, the entire crew should go on 100% oxygen; fire fighting personnel should use portable, walk-around oxygen bottles to avoid inhaling smoke or fumes. Use portable fire extinguishers shown on figure 3-1. Because any fire may become uncontrollable, make preparations for an emergency descent and landing.

WING FIRE.

If a wing fire should occur, the source of fuel should be determined and eliminated. As with all other interior fires, the probability of electrical origin must be considered and all non-essential circuits in the area should be de-energized until the faulty circuit is identified and isolated. If these things cannot be accomplished and the fire cannot be controlled, the pilot should alert the crew for bail-out or emergency landing since no means of extinguishing a wing fire is available.

ELECTRICAL FIRE.

When an interior fire has been extinguished, the faulty circuit should not be used again except in the most extreme emergencies or only after the circuit has been repaired.

SMOKE AND FUME ELIMINATION.

Assuming that in the presence of concentrated smoke or fumes all crew members are using 100% oxygen, clear the airplane of fouled air as follows:

Cabin Pressure Dump Switch - DUMP.

Cabin Conditioning Knob - EMER VENT.

Bleed-air Switches - CLOSE.

NOTE

The time required to clear the airplane completely of fouled air is approximately 11 seconds.

BLEED-AIR CONTAMINATION.

Fumes within the airplane probably originate in the engine and are being distributed by the cabin conditioning system. In such a case, identify the faulty engine compressor and eliminate it from the system. The other compressor maintains pressurization which allows normal airplane operation.

EMERGENCY LANDINGS.

If a decision is made to proceed with an emergency landing on the open sea, it is proposed that the following procedure be immediately initiated. Figure 3-2 outlines suggested crew duties for emergency landing at sea.

1. The pilot will give the order to stand by for emergency landing and advise the crew if the landing will be immediate or deferred.
2. If possible, jettison the stores.
3. All crew members will remain in their seats. Attach and tighten safety belts and shoulder harnesses. (See figure 3-3.)
4. Turn IFF to EMERGENCY to alert rescue facilities and surface units.
5. Lower the wing flaps for a normal approach. If landing is made after dark, drop parachute flares and use landing lights.
6. Before touchdown, cut the battery. The generators, even at IDLE power lever setting, are sufficient to supply electrical power for the landing approach.
7. If power is available, make a slightly nose-high landing, keeping the airspeed as low as possible. Warn the crew just before water contact is made.

NOTE

If a landing is to be made on exceedingly rough seas or when a safe and normal landing is not assured, blow the ejection hatches prior to contact with the water.

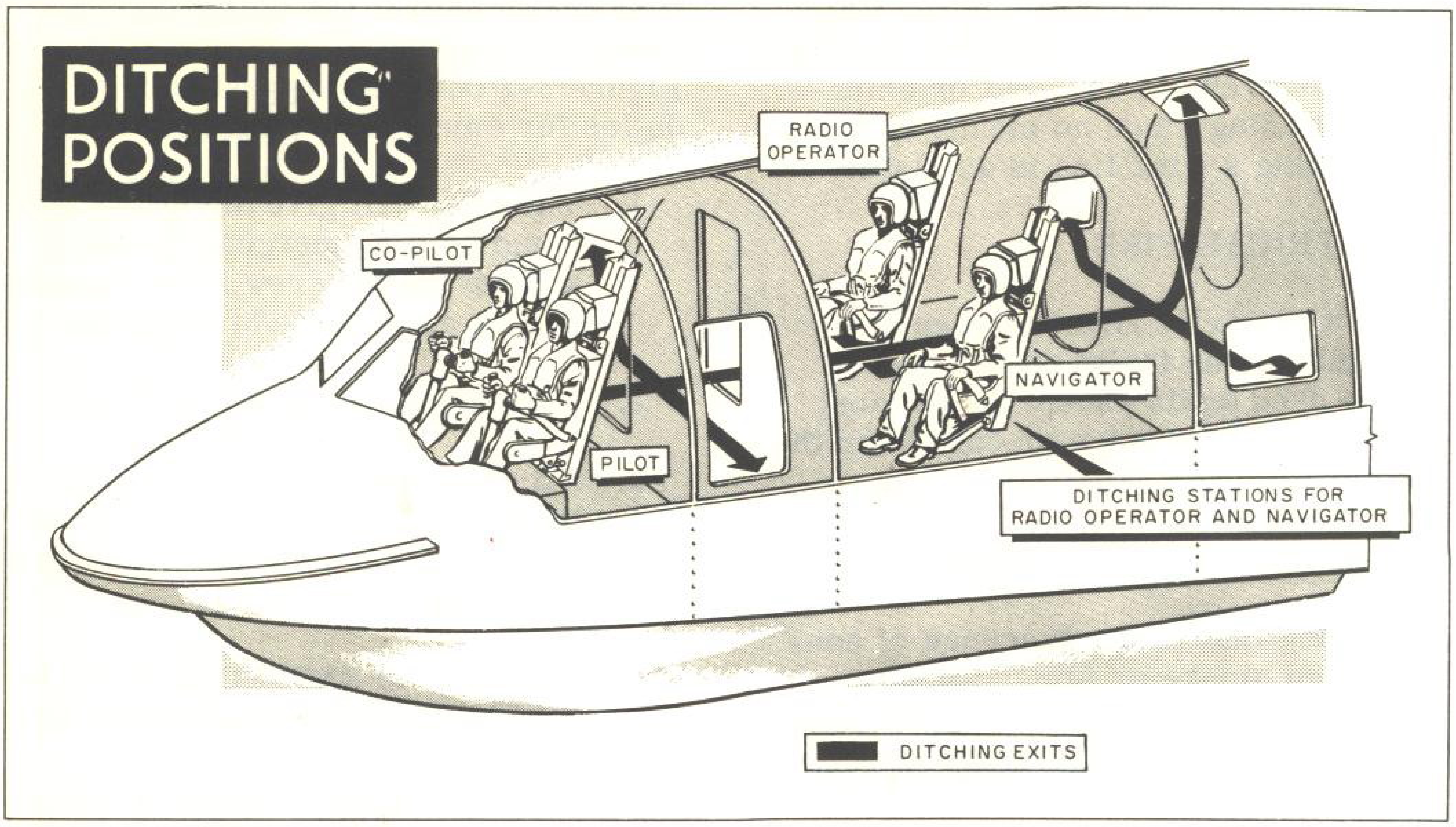


Figure 3-3

WARNING

When the emergency canopy is released, the ejection seat is partially armed. Do not touch face curtain as further movement will initiate seat ejection.

8. After airplane is waterborne, cut engines to stop generators. If there is any danger of a fire or sinking, abandon the airplane and disperse at a safe distance. (Refer to Emergency Landing Duties, figure 3-2.)

9. If abandonment of the airplane after landing is unnecessary, and there is no danger of an electrical fire, use the APP electrical output to supply power for emergency radio transmission. Remove water from the lower compartments with the bilge pumps. Close the watertight compartment doors to prevent seepage.

EMERGENCY LANDINGS ON LAND.

Although no data are available on emergency landings on land, a safe landing on beaches or level terrain is probable with normal slow-landing technique, without injury to the crew or extensive damage to the airplane.

EMERGENCY EXITS.

If a quick emergency exit is necessary after landing, crew members can use any of the following escape hatches nearest their stations:

Main entrance hatch.

Forward mooring hatch.

Hull crown hatch in the air lock.

Forward beaching gear hatches.

Crew member ejection hatches.

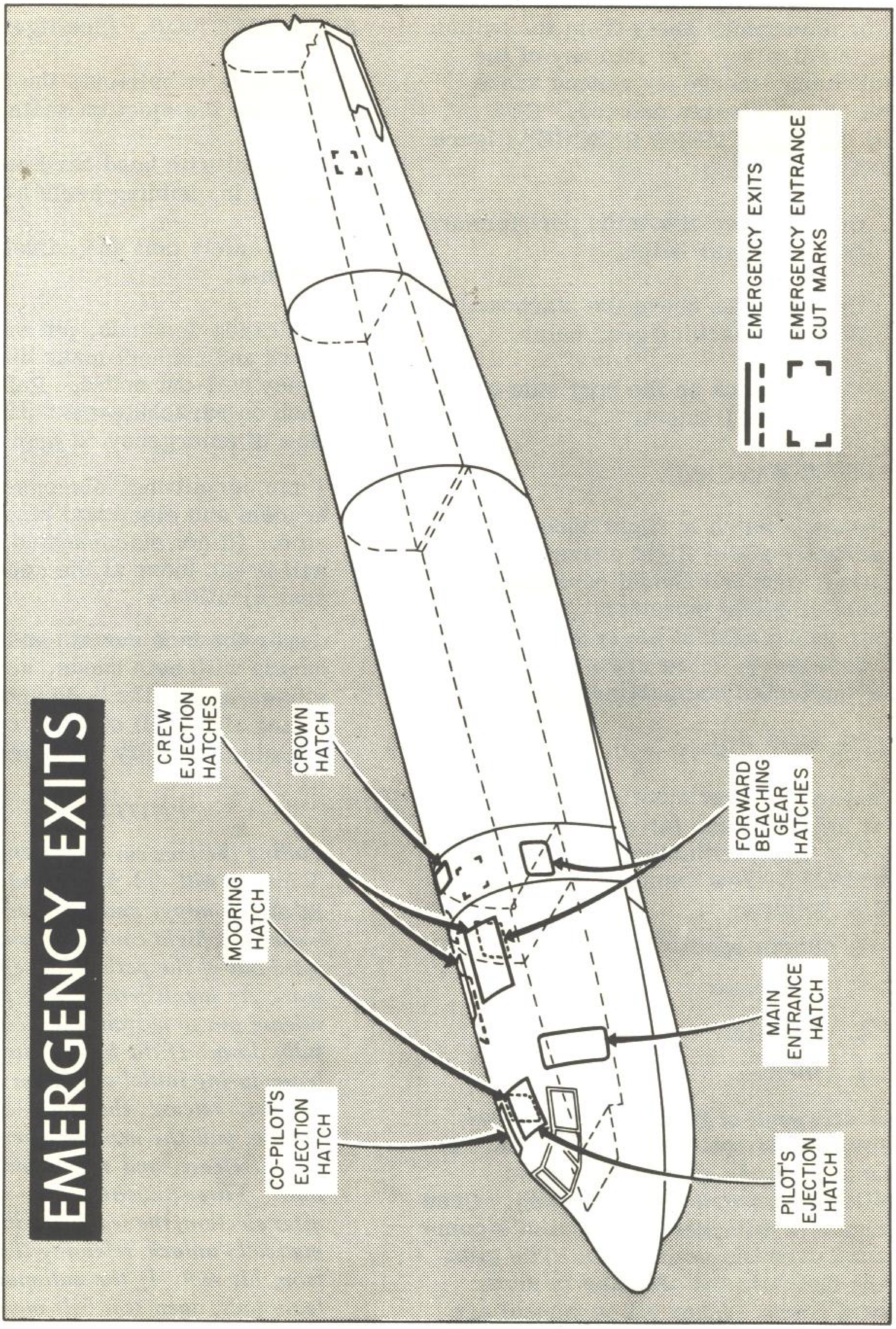

EMERGENCY EXITS
CREW EJECTION HATCHES
CROWN HATCH
MOORING HATCH
CO-PILOT'S EJECTION HATCH
FORWARD BEACHING GEAR HATCHES
MAIN ENTRANCE HATCH
PILOT'S EJECTION HATCH
EMERGENCY EXITS
EMERGENCY ENTRANCE CUT MARKS

Figure 3-4

For emergency entry from the outside of the airplane, cut into any of the following emergency rescue areas which are clearly marked, "CUT HERE FOR EMERG RESCUE" (figure 3-4).

Cut-out area above the port forward beaching gear hatch.

Cut-out area above the starboard forward beaching gear hatch.

Cut-out area on the port side of the APP compartment.

BLOWN HATCHES.

Loss of a hatch in flight should not seriously affect flight characteristics. Lower airspeed should counteract the possible slight buffeting. When landing, guard against heavy spray and, if necessary, move crew members to an unaffected compartment.

BAIL-OUT (figure 3-5).

Bail-out by seat ejection is considered the safest means for escape (figure 3-5). The recommended order of individual crew member seat ejection is as follows:

1. Radio operator.
2. Navigator.
3. Co-pilot.
4. Pilot.

An airspeed of 200 knots IAS is believed to be optimum for bail-out. If necessary, de-pressurize cabin (pilot's emergency vent switch). Crew members will eject at the pilot's command over the interphone. The pilot will maintain the airplane in slow, level flight. After all personnel are clear, the pilot can make his emergency ejection.

SEAT EJECTION. (See figure 3-5.)

In all cases of bail-out, the crew should use the ejection seats.

Sit erect with head hard back and chin tucked in, holding heels hard aft.

Lock safety belt and adjust shoulder harness.

If altitude demands, put on oxygen mask and connect mask hose to emergency bail-out bottle. Pull green knob on parachute-seat-pack to start flow of emergency oxygen supply.

Time permitting, disconnect radio headset and electrical plugs at console. (If not disconnected, the plugs will break loose at the console during seat ejection.)

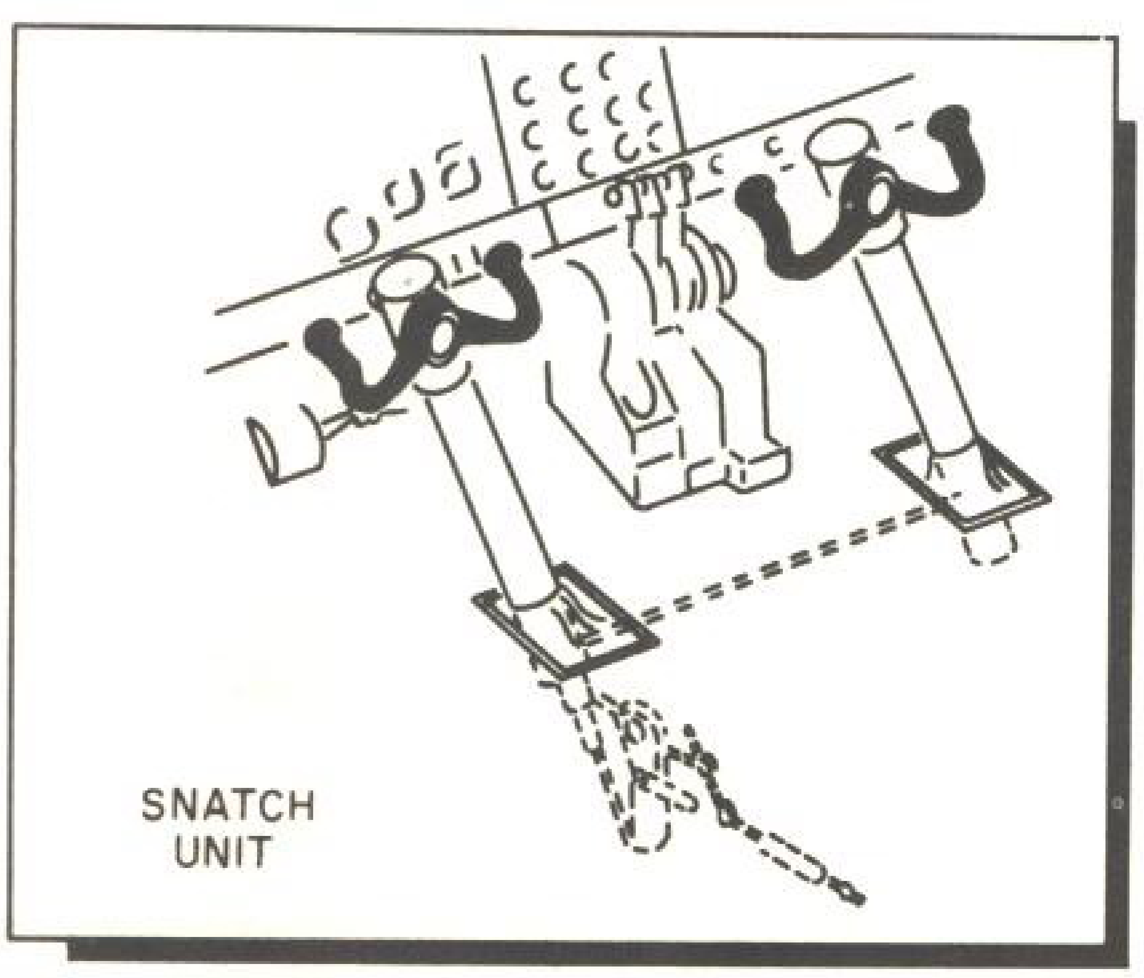
Grasp the face curtain and pull handle with both hands, keeping elbows agains the body and palms facing aft. Pull steadily on the curtain until fully down over face.

NOTE

Pulling the face curtain down about 5 inches will 1) fire initiators to release canopy, and 2) break and snatch the flight control column forward out of the path of the ejection seat. As hatch jettisons, it pulls a release pin so curtain can be pulled fully down. If the hatch fails to release during initial operation of the curtain, release the face curtain handle, pull the manual emergency hatch release, and repull face curtain. Three-fourths of a second after ejection, the seat belt will automatically unlock, releasing the pilot from his seat. If the automatic release fails, open seat belt manually.

EMERGENCY BAILOUT

1. REDUCE AIRSPEED AS MUCH AS POSSIBLE (200 KNOTS OPTIMUM).
2. AT ALTITUDE, PREPARE FOR BAIL-OUT. PULL HANDLE ON OXYGEN BAIL-OUT BOTTLE.
3. SIT ERECT, WITH HEAD HARD BACK AND CHIN TUCKED IN.
4. PULL FACE CURTAIN DOWN UNTIL HATCH IS JETTISONED, AND CONTROL COLUMNS ARE SNATCHED FORWARD.
5. COMPLETE PULL DOWN OF FACE CURTAIN. SEAT WILL THEN BE CATAPULTED, AND OXYGEN AND WIRING WILL BREAK LOOSE AT CONSOLE.
6. AFTER EJECTION, THE SAFETY BELT WILL AUTOMATICALLY OPEN, PERMITTING CREW MEMBER TO FALL AWAY FROM THE SEAT.
7. DELAY OPENING CHUTE AS LONG AS ALTITUDE WILL PERMIT.



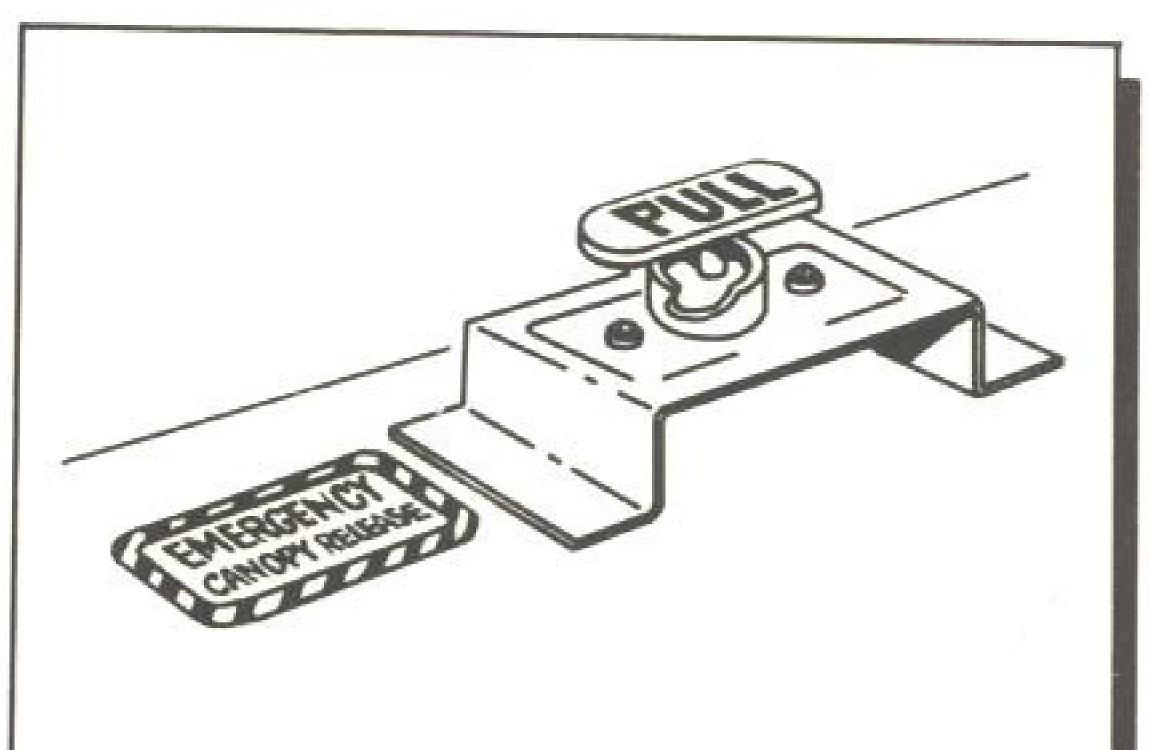


Figure 3-5

FUEL SYSTEM EMERGENCY OPERATION.

Fuel system emergency operation is managed from the auxiliary panel at the radio operator's station. (See figure 1-12.)

The fuel system is so arranged that fuel can be transferred from any auxiliary tank to either service tank. Fuel can also be supplied directly to any engine from any auxiliary or service tank.

The following are emergency operations of the fuel system:

From the pilots' panel:

The crossfeed valve on the pilots' panel may be opened to allow operation of all engines from either service tank.

The transfer control switch may be positioned so that all fuel is transferred to one service tank.

From the auxiliary fuel panel (when the pilots' fuel panel transfer control switch is positioned to AUX PANEL):

Transfer of fuel to the service tanks is controlled manually.

All of the fuel may be transferred to one service tank.

The engines may be supplied fuel directly from the auxiliary tanks.

Fuel may be transferred from one auxiliary tank to another.

To control flow from the various tanks in event of electrical system failure, a crew member may manually position the ON-OFF valves in the wing box or in the compartment between the forward and aft tanks. For asymmetric fuel loading, refer to Section VI.

FAILURE OF AUTOMATIC FUEL CONTROL.

If the automatic fuel control system fails, manual control should be established as follows:

Pilot's fuel control panel:

Transfer Control - AUX PANEL.

Auxiliary fuel control panel:

Forward Service Tank Fueling Valve - OPEN.

Aft Service Tank Fueling Valve - OPEN.

Two Transfer Pumps - MAN ON.

NOTE

A transfer pump to supply fuel to each service tank should be on. Which transfer pump to operate is determined by the normal tank sequence. In manual control, pump operation does not stop when the tank is empty. As soon as a tank is emptied, that transfer pump should be placed OFF and the succeeding pump MAN ON.

CAUTION

If manual control is assumed because of an indication of pump failure, the suspected pump should be operated and flow from it noted. If no flow is apparent, the switch should be placed OFF since it may be damaged and/or overheating.

LOSS OF SERVICE TANKS.

If, for any reason, flow from either service tank is stopped or restricted, proceed as follows:

Power Levers - CLOSED (Affected engines).

Fuel Crossfeed Valve - OPEN.

Service Tank Fueling Valve - CLOSE (Affected engine).

Cross Fuel Valve - OPEN.

Proceed with Air Start Procedure outlined in this section.

If both service tank facilities are lost simultaneously, transfer fuel control to the AUX PANEL immediately:

Power Levers - CLOSED.

Pilot's fuel control panel:

Transfer Control - AUX PANEL.

Auxiliary fuel control panel:

No. 1 Transfer Valve - OPEN.

No. 2 Transfer Valve - OPEN.

Transfer Pumps - MAN ON.

NOTE

The transfer pump from each service tank, as determined by the sequence of operation, should be positioned to MAN ON. All other transfer pumps should be OFF.

Forward Service Fueling Valve - CLOSE.

Aft Service Fueling Valve - CLOSE.

Proceed with Air Start Procedure outlined in this section.

BOOSTER AND TRANSFER PUMP FAILURE.

Even though a complete failure were to render all booster and transfer pumps inoperative, the fuel system is designed so that engine pumps can draw sufficient fuel from any tank, down to 10% of individual tank capacity, to maintain level flight below 20,000 feet.

LOSS OF FUEL SUPPLY.

Should the fuel in any supply tank for any reason become inaccessible, both service tanks can be supplied from any one or a combination of supply tanks by placing the cross fuel valve to OPEN.

If one of the wing fuel tanks is not available, see Asymmetric Fuel Loading in Section VI. If one of the hull tanks cannot be used, the effect on CG must be considered when emptying the existing tanks.

ELECTRICAL SYSTEM EMERGENCIES.

Usually, loss of a generator or converter, either ac or dc, presents no particular problem with regard to flight safety or normal operation. Because the combined output of three a-c generators provides a 100% reserve above the a-c requirements, the APP can be used to compensate for the loss of an engine-driven generator. The same reserve is afforded in the d-c system since either converter can supply the required d-c power.

A-C SYSTEM EMERGENCIES.

CROSS-TIE BUS MALFUNCTION.

Cross-tie Control Knobs - Both knobs OFF.

NOTE

The cross-tie contactors will automatically open with the grounding of the cross-tie bus or any of its contactors. This will be indicated by the lighting of the No. 1 and No. 3 cross-tie failure indicator lights. In this case, operation continues without load division.

If a temporary condition is the cause of failure, close one cross-tie contactor by returning the knob to ON. If the contactor again opens, as evidenced by the indicator, return the knob to OFF and make no further attempt to use the cross-tie. However, if the contactor remains closed and operation appears normal, reconnect the other generator as follows:

Generator Control Knob - OFF (Generator to be paralleled).

Cross-tie Control Knob - ON (Generator to be paralleled).

Continue normal paralleling.

GENERATOR BUS MALFUNCTION. Should either generator bus or any of its leads ground out, the generator contactors for that bus and its cross-tie contactors open automatically and light the indicators for both contactors. To reconnect the bus, perform the following:

Cross-tie Control Knob - OFF (Affected bus).

Generator Control Knob - OFF (Affected bus).

Generator Control Knob - ON.

If normal operation is indicated:

Generator Control Knob - OFF.

Cross-tie Control Knob - ON.

Proceed with normal paralleling.

If, when the bus is reconnected, the contactor again opens indicating permanent malfunction, return the generator knob to OFF and consider circuits dependent on that bus unusable.

GENERATOR FAILURE. A generator or generator-feeder fault, a condition of over or under voltage, or a condition of low frequency will cause the generator contactor to open and de-energize the generator field. This is indicated by both the light and the flag indicators for the affected generator. Attempt to re-energize the generator as follows:

Generator Control Knob - Momentarily RESET, then OFF.

If the condition was temporary, the flag will indicate normal operation and the generator can be re-paralleled into service. If the flag fails to indicate normal operation or again indicates failure, leave the generator OFF and use APP output if necessary.

A-C TRANSFORMER FAILURE. Loss of power from an a-c transformer, either through transformer failure or the loss of the transformer's source of power, renders useless those circuits which it supplies with the exception of certain instruments which can operate from either transformer through the emergency instrument power switch. A warning light indicates power failure. See figure 1-5.

GENERATOR EMERGENCY. If a generator malfunction is indicated and the generator fails to cut out automatically, place the generator control knob in the EMER OFF position. This will open the contactor and de-energize the generator field.

D-C SYSTEM EMERGENCIES.

CONVERTER FAILURE. Any fault in a converter or its leads will result in automatic tripping of its reverse current circuit breaker at the left-hand main distribution center. Should this circuit breaker trip, as evidenced by the indicator light, attempt to reconnect it as follows:

Converter Control Knob - OFF (Affected converter).

Reverse Current Circuit Breaker - Manually RESET.

If normal operation is indicated:

Converter Control Knob - ON.

If the circuit breaker again trips, leave the control knob OFF and use only the other converter.

If a converter malfunction occurs and the reverse current circuit breaker fails to trip automatically, open circuit breaker by placing the control knob to EMER OFF.

FAILURE OF BOTH CONVERTERS. With the failure of both converters, conserve battery power for essential equipment. Place the battery knob at ESSEN BUS, and the EMER CONT knob at EMER OFF. This selects the essential busses (see figure 1-15) and disconnects all other d-c circuits.

EMERGENCY MINE DOOR OPERATION.

If the mine door fails to operate in the normal manner, the pilot's emergency mine door switch is the only available means of operating the mine door with the emergency hydraulic system.

NOTE

Mine door hydraulic control valves (detent type) remain in the open position if in that position when an electrical power failure occurs during mine door operation. After emergency hydraulic system operation, reclose valves by placing the pilot's guarded emergency mine door control switch in CLOSE.

Before the pilot can use the emergency mine door switch or the salvo switch, the master armament control switch must be placed in ON. This is a guarded switch on the armament panel at the pilot's console. (See figure 4-26.)

Use of this emergency switch for emergency mine door operation will bypass the electrical and pneumatic circuits which establish the normal operating sequence of the door and the seal. This emergency operation may result in serious seal damage which will cause compartment flooding after landing. Before landing, the pilot should alert ground personnel so that emergency equipment can be readied for the immediate beaching of the airplane.

Should all the above emergency steps fail to operate the door, and the mine door be unloaded, shut off emergency hydraulic system to conserve hydraulic fluid, and cut the hydraulic lines leading to the actuating cylinder to relieve cylinder pressure. Roll the airplane enough to allow the CG of the door to tend to close it. When closed in this manner, the door will not be locked or sealed, but the extreme hazard of landing with an open door will be eliminated.

NOTE

To close the mine door seal when the mine door is not fully locked, pull out the Door Seal Power circuit breaker on the flight deck essential bus.

Should closing the door by any means be impossible, landing on a concrete runway at slightly higher than normal speed is advisable.

HYDRAULIC SYSTEM EMERGENCIES.

There are no emergency operating procedures for the No. 1 or No. 2 surface control systems.

In the event of failure of the utility hydraulic system, the emergency system can be used for the operation of wing flaps and the mine door. Also, if the utility hydraulic system were to fail, the wing flaps would positive lock in the flaps up position.

To use the emergency system for wing flap operation, place the wing flap switch in the EMER position; then operate with the wing flap lever UP or DOWN. No intermediate setting can be made when using this system.

NOTE

Do not return the wing flap lever to OFF during emergency wing flap operation because the actuating cylinders will lose pressure and cause the wing flaps to trail.

To use the emergency hydraulic system for mine door operation, place the pilot's or navigator's emergency mine door switch to OPEN or CLOSE.

PNEUMATIC PRESSURE LOSS.

If the pneumatic system pressure indicator on the co-pilot's sub-panel shows zero pressure or a steady decrease at 35,000 feet or above, descend at cruising airspeed to approximately 25,000 feet to sustain the hydraulic system reservoir pressure by engine bleed air.

Tests to date indicate that an unpressurized mine door seal will remain nominally watertight as long as the airplane retains headway. If forward motion of the airplane stops, the seal will probably open and flood the mine bay area. Flooding of the mine bay under these circumstances, however, should not present any serious problem.

FLIGHT CONTROL EMERGENCIES.

Since hydraulic power moves the flight control surfaces, the loss of this hydraulic power is the basic cause of most flight control emergencies.

The rudder, although powered by the utility system alone, can be operated to a limited extent by direct mechanical connection. However, the total air load plus the feel system, both opposing this pedal movement, makes the amount of rudder displacement negligible.

In the case of both the spoiler-aileron and the stabilizer, failure of the No. 1 or No. 2 system will result in only slower airplane response. When either system fails, select it out of operation so it can in no way interfere with the remaining operating system. For all practical purposes, either system should be considered ineffectual and inoperative at pressures below 2000 psi.

WARNING

Loss of both surface control hydraulic systems will result in a complete loss of flight control within 30 seconds.

EMERGENCY TRIM OR SCREW JACK FAILURE.

Failure of any of the control trim or Q-screw jacks is sufficient cause for immediate return to base, particularly in the event of longitudinal (stabilizer) failure.

If Q-stops in the lateral (spoiler) control system fail or jam, or run away to the closed-down position, an emergency Q-stop release handle (below dive brake handle on the pilot's pedestal) opens the Q-stops fully, permitting full control wheel travel. When controlling the airplane under the emergency Q-release condition, avoid high rolling rates at speeds in excess of 400 knots IAS. Maintain flight speed below 250 knots IAS where full spoiler maneuvers may be made with adequate safety.

Emergency manual operation of the stabilizer trim is provided for in the aft section below the fin on the starboard side.

A rudder trim actuator for manual operation is located in the same general area but on the port side near the hull crown.

NOTE

The pilot receives no visual or audible warning in the event of failure of one or more screw jacks. Malfunctioning is apparent only if the pilot is alert to unnatural control motions or forces.

WING FLAP FAILURE.

If both the utility and the emergency hydraulic systems fail and the flaps cannot be extended, maintain slightly higher than normal approach and touchdown airspeeds for a safe landing with wing flaps retracted.

HYDROFLAPS/DIVE BRAKES FAILURE.

Without the full use of hydroflaps, maneuvering on water would be seriously impaired. Use of differential engine power, however, will aid in turning.

If one or both dive brakes fail to retract, pulling the emergency dive brakes handles (aft hull near dive brake mechanism) will retract these dive brakes. If one or both dive brakes cannot be retracted by this method, make a normal landing but do not immerse the flaps until the airplane is sufficiently decelerated. Intermittent wetting may blow the flaps back to the closed position.

INOPERATIVE WING SLATS.

If wing slats rack or become inoperative, observe the following limitations for a safe flight or a normal landing:

If both slats fail to retract following a take-off, execute a go-around, increase touchdown speed 10 knots IAS above normal for the existing gross weight, and land.

When the slats will not extend, avoid low speed or high speed flight or high altitude maneuvers (where wing slats normally extend).

AUTOPILOT EMERGENCY.

If the autopilot malfunctions, depress the temporary disconnect button in either the pilot's or co-pilot's control wheel outboard grip to disconnect the autopilot temporarily. The button does not disconnect the yaw damper (switch on emergency overhead panel). If the disconnect button does not function, turn the switch on the face of the autopilot controller to OFF position.

NOTE

Placing the yaw damper switch in the DISCONNECT position, in event of yaw damper malfunction or autopilot electrical failure, isolates all electrical and hydraulic power from the autopilot.

ACCIDENTIAL DEPRESSURIZATION.

In case of depressurization through accidental tripping of the dump switch, immediately return the switch to its original position; use oxygen if conditions warrant; and, if at high altitudes, descend to 40,000 feet or lower. A check of actual altitude and cabin pressure altitude differential indicates instantly the requirements for oxygen.

WARNING

Remember: oxygen starvation can ruin your judgment. Take immediate action to prevent anoxia.

INSTRUMENT POWER FAILURE.

Failure of the normal source of instrument electrical power is indicated by a light on the center sub-panel. To obtain alternate electrical power, place the instrument power switch, adjacent to the indicator light, in the EMER position. The affected instruments are

Engine fuel flow indicators.

Engine oil pressure indicators.

All pneumatic and hydraulic pressure gages.

Hydroflap position indicators.

Section IV

DESCRIPTION AND OPERATION OF AUXILIARY EQUIPMENT

TABLE OF CONTENTS

CABIN AIR-CONDITIONING SYSTEM.

The cabin air-conditioning system (figure 4-1) ventilates and controls temperature for the cockpit, electronics, entrance, flight, and air lock compartments.

The system consists of a refrigeration unit containing heat exchangers and a reheat condenser; ducting from the bleed-air ports of No. 1 and No. 4 engine compressors; ducting from the airscoops in the wings; the tubing and outlets necessary for distributing the air to the cabin; and controls to regulate the system.

Air taken from the two engine compressors passes to a manifold where air from both engines is mixed. From the manifold, the air is branched to the refrigeration unit and to a duct which bypasses the refrigeration unit. The air branched to the refrigeration unit is partially cooled in a heat exchanger by ram air supplied from the airscoops and then passes through the reheater condenser into a turbine where it is further cooled by expansion. The air finally passes into the cabin distribution system. Controls regulate the amounts of air which flow into the distribution system from the refrigeration unit and from the engine compressors and airscoops.

The cockpit contains three air outlets: one on each pilot's side console and the third in the cockpit crown. There are four outlets in the flight deck compartment: two discharge air laterally fore and aft at deck level, and two in the aft crown discharge downward. Face vents at the flight stations of each crew member may be adjusted manually to discharge air in any direction. The electronics compartment receives conditioned air through an air opening in the cockpit deck,

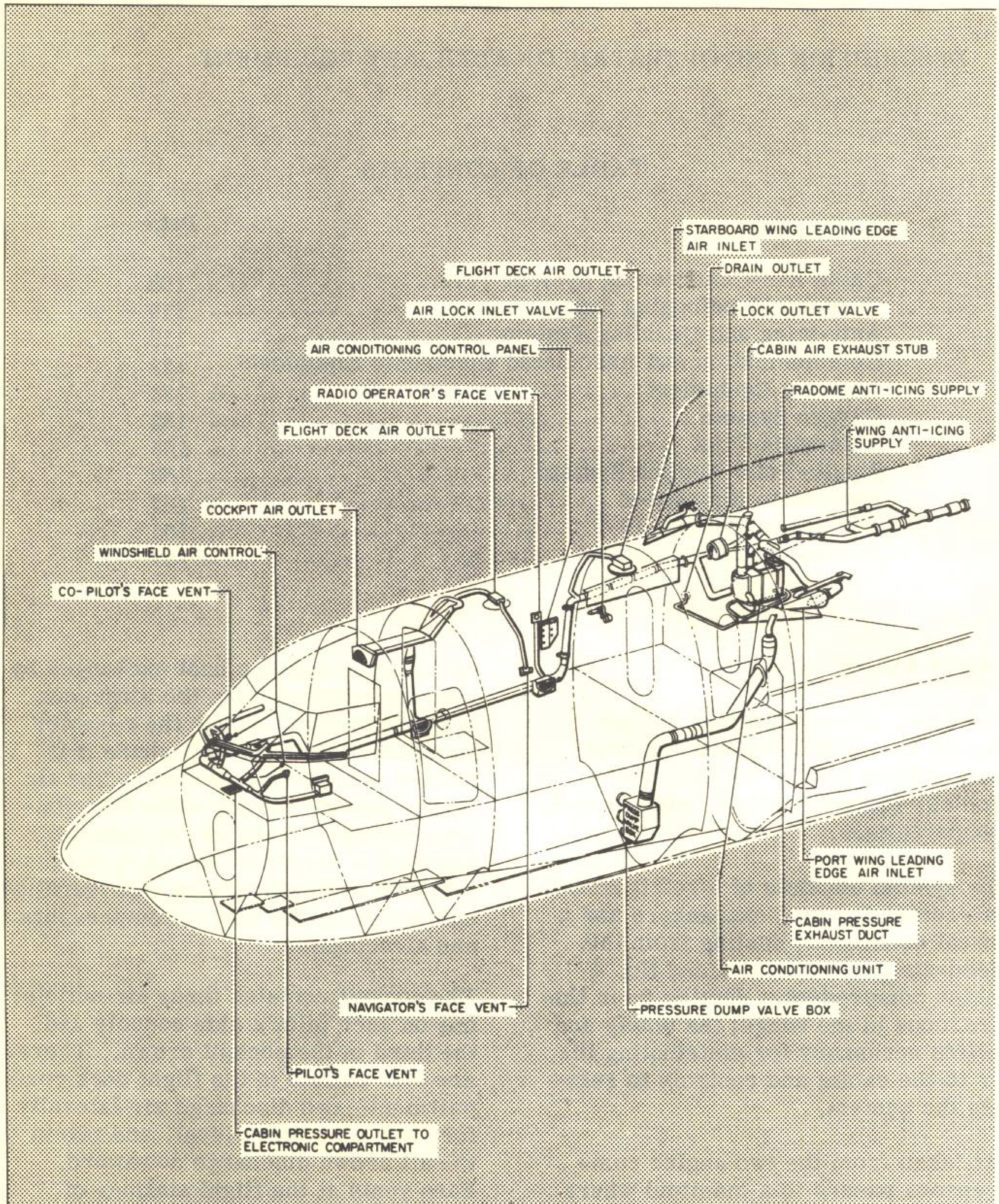


Figure 4-1 (Sheet 1 of 2)

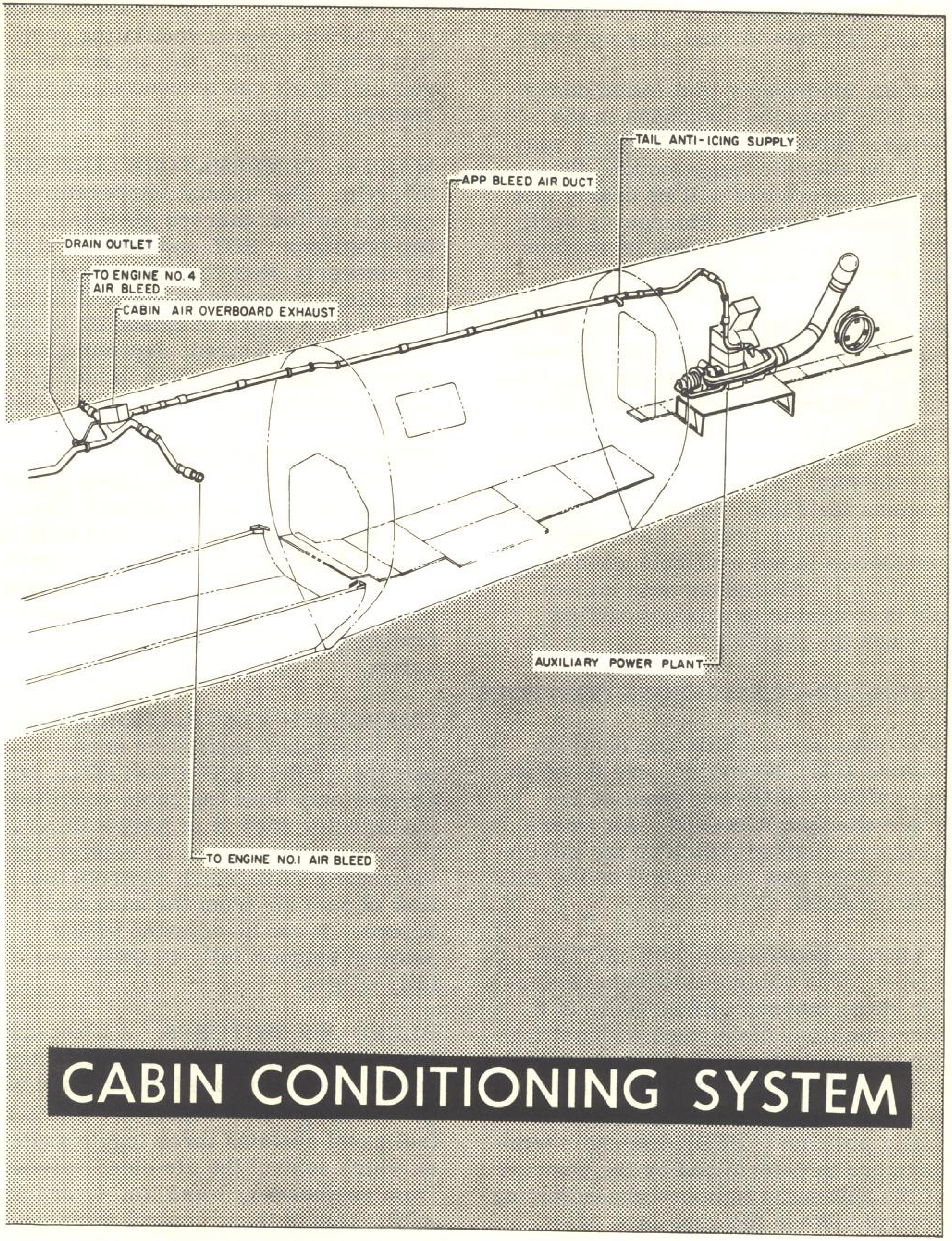


Figure 4-1 (Sheet 2 of 2)

forward of the pilot's pedestal. The air from the cockpit and flight deck areas exhausts through this opening.

Air for emergency ventilation comes directly from the airscoops in the wings. Since there is no way to control the ram air temperature, the cabin temperature will be nearly that of the outside air. Emergency ventilation is necessary when the engines or the APP fails.

During mooring, the cabin may be heated or cooled by air from the operation of the APP or from the No. 1 and No. 4 engines. When operating from the APP, the air-conditioning system cannot satisfy summer day cooling requirements. However, use of the engines for cabin conditioning is the same as during flight. Emergency ventilation is not available when the airplane is moored because no ram air is available to produce airflow through the system.

CABIN AIR-CONDITIONING CONTROLS.

The cabin air-conditioning controls (figure 4-2), 28-volt dc, are found on the cabin conditioning panel at the radio operator's station. An emergency ventilating switch on the pilot's panel overrides the control on the main control panel.

CABIN CONDITIONING SELECTOR KNOB. The cabin conditioning selector knob, marked SELECTOR, is a four-position rotary knob with settings for automatic control, manual control, emergency ventilation, and shut-off. When the selector knob is in the automatic position (AUTO), the cabin temperature is determined by the position of the automatic temperature-adjusting control. When the knob is at MAN, the cabin temperature can be raised or lowered by the manual temperature control switch. When the selector knob is in the emergency ventilating position (EMER VENT), the amount of ventilating air can be controlled by the emergency knob.

MANUAL TEMPERATURE CONTROL SWITCH. The manual temperature control switch, marked MANUAL, has two positions: HOT and COLD. It can be used only when the cabin conditioning selector knob is in MAN. The cabin temperature is raised or lowered to the degree desired, depending on the length of time the switch is held in either position.

AUTOMATIC TEMPERATURE ADJUSTMENT KNOB. The AUTO TEMP ADJUST knob can be used only when the cabin conditioning selector knob is in AUTO. This adjustment knob selects the cabin temperature, anywhere from fully COOL to fully WARM, by positioning the cabin temperature control valve.

EMERGENCY VENTILATION KNOB. The emergency ventilation knob, marked EMER VENT CONTROL, can be used only when the cabin conditioning selector knob is in EMER VENT. This control positions an emergency ventilating valve which controls the flow of ram air from the wing airscoops. It can be adjusted to any position between fully CLOSED and fully OPEN.

BLEED-AIR SWITCHES. A bleed-air control valve switch panel is mounted next to the cabin conditioning panel at the radio operator's station. The control panel contains three toggle switches which control the air bleed valves from engines No. 1 and No. 4, and the APP. One of these control switches must be at OPEN before the cabin conditioning system can be operated. Bleed air from both engines is used for normal operation; the APP is used for ground operation before the airplane engines are started. For ground operation of the cabin conditioning system, the APP bleed-air control switch must be at CLOSED before the APP is started. After the APP is started and operating normally, the APP bleed-air switch can then be moved to OPEN and air will be directed to the cabin air-conditioning system. If the engines have been started, turn off the APP and use engine bleed air. If both engine and APP bleed air are used, the two pressures will oppose each other.

WARNING

During an emergency involving engines No. 1 or No. 4, or the APP, the bleed-air switch for the affected unit must be immediately closed to shut off the valves so that no smoke and fumes will reach the crew through the cabin conditioning system.

OPERATION OF THE AIR-CONDITIONING SYSTEM.

The cabin air-conditioning system can be operated only when the No. 1 and No. 4 engines or the APP is operating. To heat or cool the cabin during flight, proceed as follows:

Engine Bleed-air Control Valves Switches - OPEN.

Cabin Conditioning Selector Knob - AUTO.

Auto Temp Adjust - As desired.

If manual control is preferred, move the cabin conditioning selector knob to MAN and place the manual temperature control switch to either HOT or COLD until the desired temperature is obtained.

To heat or cool the cabin while moored, proceed as follows:

Start the APP.

APP Bleed-air Switch - OPEN.

Follow the same procedure used for cabin conditioning during flight (see preceding paragraph).

NOTE

Starting engines No. 1 and No. 4 operates the cabin air-conditioning system when the airplane is moored. Operation is identical to that during flight. However, the flow and shut-off valves on the engines and APP prevent bleed air from entering the cabin air-conditioning system during starting.

EMERGENCY OPERATION OF THE AIR-CONDITIONING SYSTEM.

During a cabin air-conditioning system failure, the cabin can be ventilated by the emergency ventilation system in this manner:

If depressurization is required, move the dump switch on either the pilot's panel or the main cabin conditioning control panel to DUMP. This opens the safety valve and depressurizes the cabin. See CABIN PRESSURIZATION CONTROLS in this section.

Place the cabin conditioning selector switch at EMER VENT.

Several types of emergencies require operation different from the normal procedure, as shown in the following examples:

ANTI-ICING AND CABIN CONDITIONING CONTROL PANEL

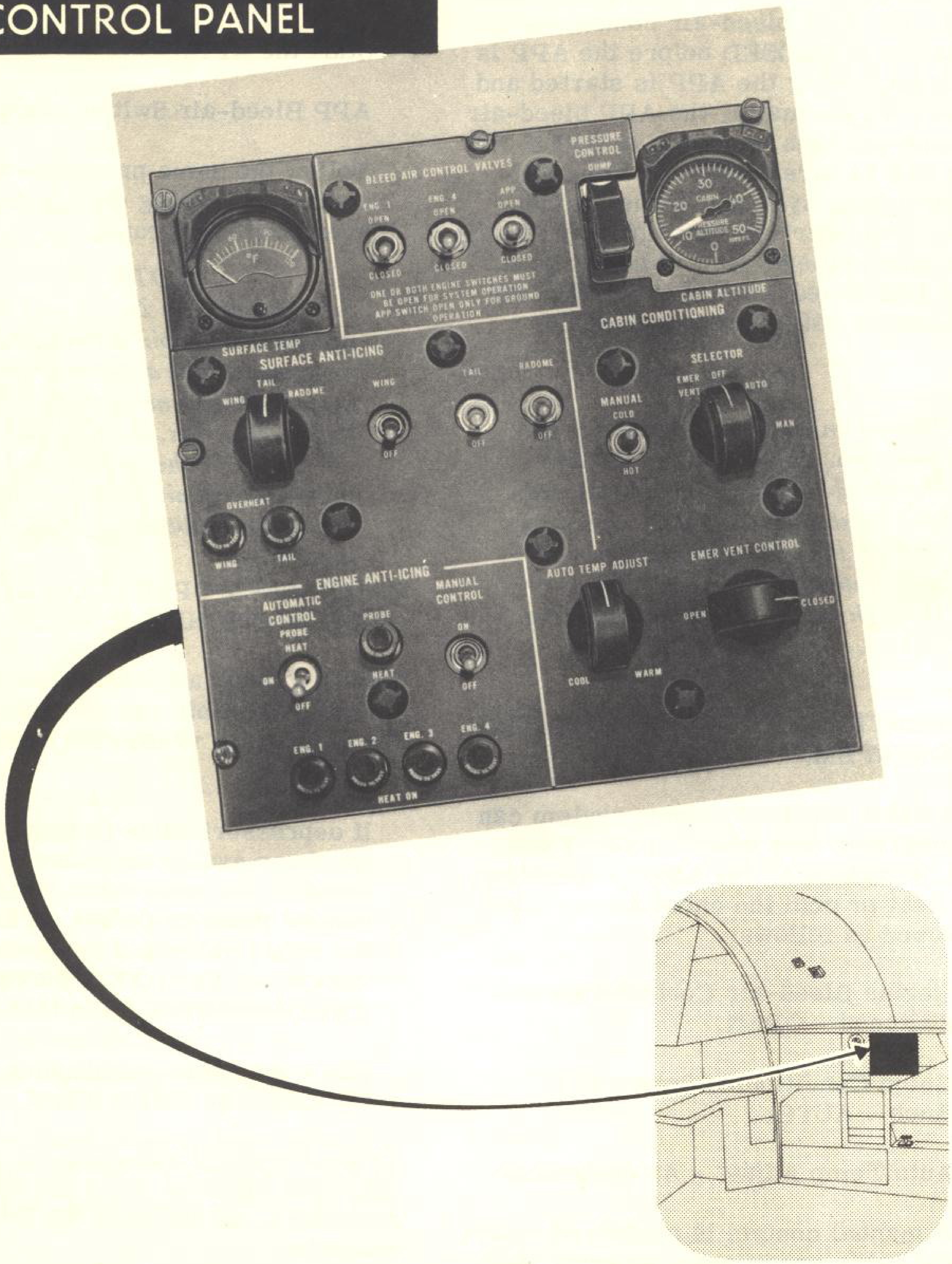


Figure 4-2.

Some engine conditions may cause the bleed air to become contaminated. If this occurs, the crew should use 100% oxygen and operate the cabin conditioning system to provide pressurization. If the oxygen supply exhausts, the airplane should be brought to a safe altitude, the cabin pressure dumped, and the emergency ventilation system switched on.

When either engine No. 1 or No. 4 fails, a check valve in the bleed-air duct closes, preventing loss of bleed air from the operating engine through the inoperative engine. As a safety precaution, the radio operator should place the bleed-air switch for the inoperative engine in CLOSED. The cabin altimeter will indicate whether adequate pressure is being maintained in the cabin. One engine should be able to maintain the cabin pressure schedule. If one engine cannot, the crew should go on oxygen. Emergency ventilation should be used only under such critical conditions as fire or dense smoke. If an engine fire occurs, the bleed-air shut-off valve is automatically closed when the fire extinguishing system for that engine is actuated. (See ENGINE FIRE DETECTOR AND EXTINGUISHER SYSTEM in Section I.)

If the high-pressure ducting ruptures, hot bleed air discharging at the rupture could cause damage to surrounding components because of its excessively high temperature. The indication of such a rupture is loss of cabin pressure. To prevent damage to components, turn OFF both engine bleed-air switches and put the crew on oxygen.

CABIN PRESSURIZATION SYSTEM.

Pressurization of the cockpit, entrance, flight, air lock, and electronics compartments is the result of automatic regulation of the high-pressure air forced into the sealed cabin through the air-conditioning system by the engine compressors. An automatic regulating valve restricts the escape of air through the hull crown in the aft end of the mine bay compartment. This valve is controlled by pressure-sensing elements maintaining a fixed pressurization schedule.

Pressurization begins at 8000 feet and remains at the 8000-foot value to 23,000 feet. Above 23,000 feet, the valve maintains a 5 psi differential between outside and inside pressures. A cabin pressure safety valve supplies pressure relief at a nominal differential of 5.25 psi. This valve works with a solenoid-operated pilot valve in an emergency to depressurize the cabin in 12 seconds.

NOTE

Once the pilot is acquainted with the cabin pressurization schedule, a comparison of the cabin pressure with the altimeter will show how the system is performing.

The automatic regulating valve, its control mechanism, and the cabin pressure safety valve are in the cabin pressure and dump box on the left side of the electronics compartment.

CABIN PRESSURIZATION CONTROLS.

Although cabin pressurization is automatic, a pressure control dump switch just above the cabin conditioning panel regulates the cabin pressure safety valve. It is a toggle switch with a red plastic guard to prevent inadvertent dumping of cabin pressure. To dump cabin pressure, raise the guard and throw the switch in a single motion.

A secondary dump switch, marked CABIN AIR on the pilot's sub-panel, is designed to override the controls on the main cabin conditioning panel. It is a guarded toggle switch identical to that on the main panel.

WARNING

Do not dump cabin pressure at high altitudes except in extreme emergencies. Do not open hatches when the cabin is pressurized even with slight differential in pressure. Serious injury may result from the rapid escape of air.

AIR LOCK SYSTEM.

The air lock between the flight deck and the mine bay bulkheads allows the crew to pass from a pressurized area to an unpressurized area without disturbing cabin pressure. This air lock is normally unpressurized; however, when it is pressurized, air from No. 1 and No. 4 engine compressors is used. When pressurized, it maintains the same pressurization schedule as the cabin pressurization system.

The air lock system contains an inflow valve in the forward bulkhead of the air lock and an outflow valve in the aft bulkhead. These valves are operated from three different control panels: air lock, flight deck, and mine bay.

When the output valve is fully open, it depressurizes the air lock from 5.0 psi to 0.25 psi in 5 seconds. When the inflow valve is open, it pressurizes the air lock to 0.25 psi differential with respect to the cabin pressure in approximately 5 minutes.

A pressure lock door-open light on the radio operator's console will illuminate whenever the door to the air lock is not closed. It cannot be overemphasized that all water and pressure tight doors be closed for take-off and landing.

AIR LOCK SYSTEM CONTROLS.

Three separate controls regulate the pressurization of the air lock. A control panel within the air lock is mounted on the starboard side of the forward bulkhead. There are two control panels on the outside of the air lock: one for entry from the flight compartment and one for entry from the mine bay compartment.

FLIGHT DECK CONTROL PANEL. The control panel adjacent to the forward entrance hatch to the air lock contains a control switch to regulate pressurization of the air lock, a differential pressure gage that works like its counterpart in the air lock, and an indicator light which glows Red when the air lock is depressurized.

AIR LOCK CONTROL PANEL (figure 4-3). The air lock control panel contains a control switch for pressurizing or depressurizing the chamber, an indicator light which glows Amber when the chamber is depressurized, and a gage that indicates in psi the differential pressure between the air lock and the cabin. When this gage reads 0, the air pressure of the cabin and the air pressure of the air lock are equal and the door between the two can be opened.

MINE BAY CONTROL PANEL. The control panel in the mine bay compartment adjacent to the air lock hatch is

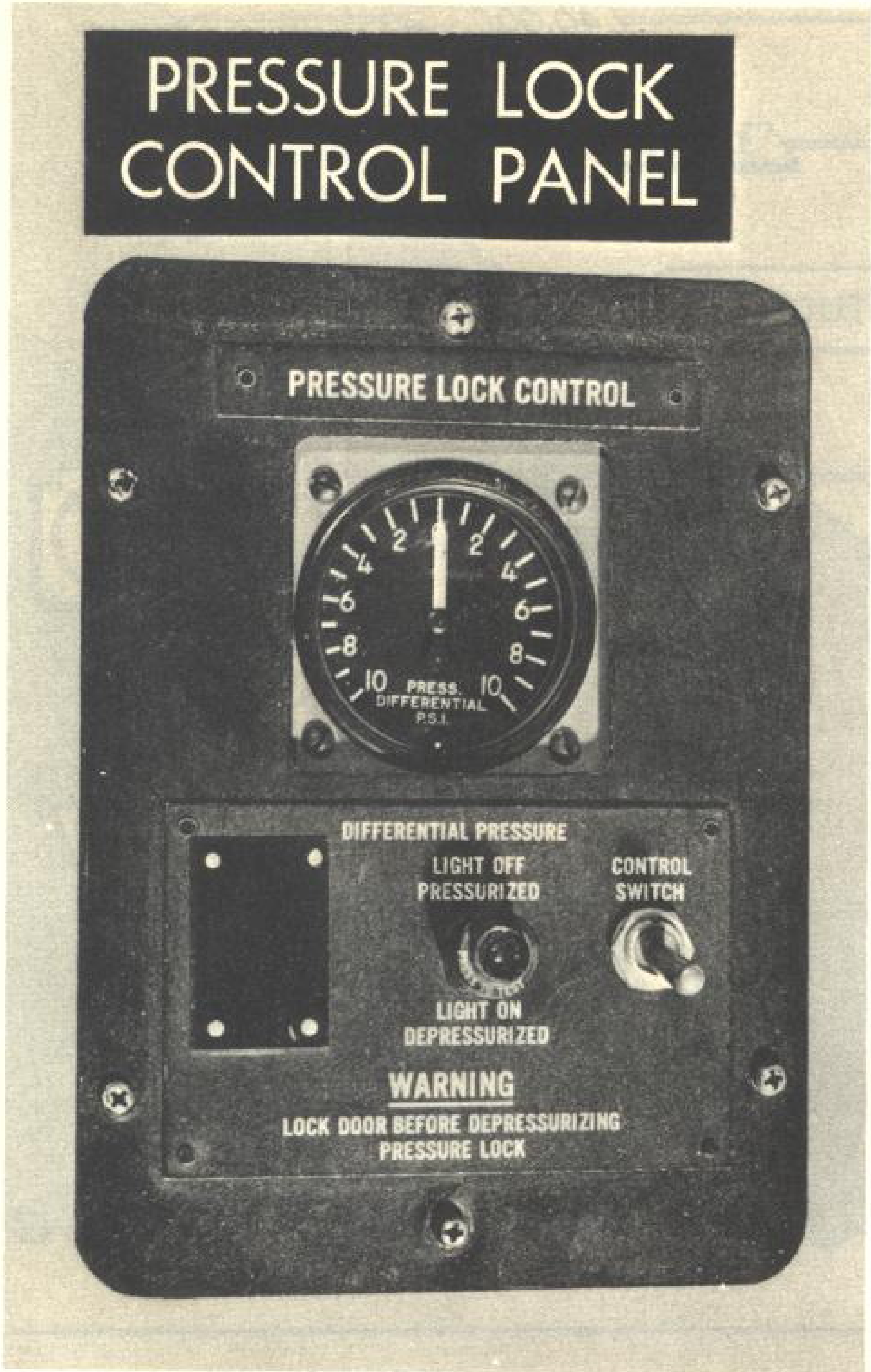


Figure 4-3

essentially the same as the flight deck control panel except that the indicator light will be Green to denote that the air lock is depressurized.

NOTE

Each of the three pressure control switches actuates the inflow and outflow valves, opening one and closing the other simultaneously when pressurization or depressurization is required. When the indicator light is off on any of the control panels, the air lock is pressurized.

OPERATION OF THE AIR LOCK SYSTEM.

NOTE

When both the cabin and the air lock are pressurized equally, the entrance hatch between them must be closed.

PASSAGE AFT. For passage aft from the pressurized cabin into an unpressurized area, make sure that the air lock is pressurized, and proceed in the following manner.

If the entrance hatch is closed, check the light on the panel next to the forward air lock hatch.

If the light is off, the air lock is pressurized.

Enter the lock and close air lock hatch.

Connect oxygen mask to a portable, walk-around oxygen bottle at this time.

Depressurize the air lock.

Wait 12 seconds.

Enter the aft section and close the hatch.

For passage aft when the air lock is depressurized (the light is Red), follow this procedure:

Actuate the switch next to forward air lock hatch to pressurize the air lock.

Wait five minutes and check the differential gage. When it reads 0, open the hatch and enter the air lock.

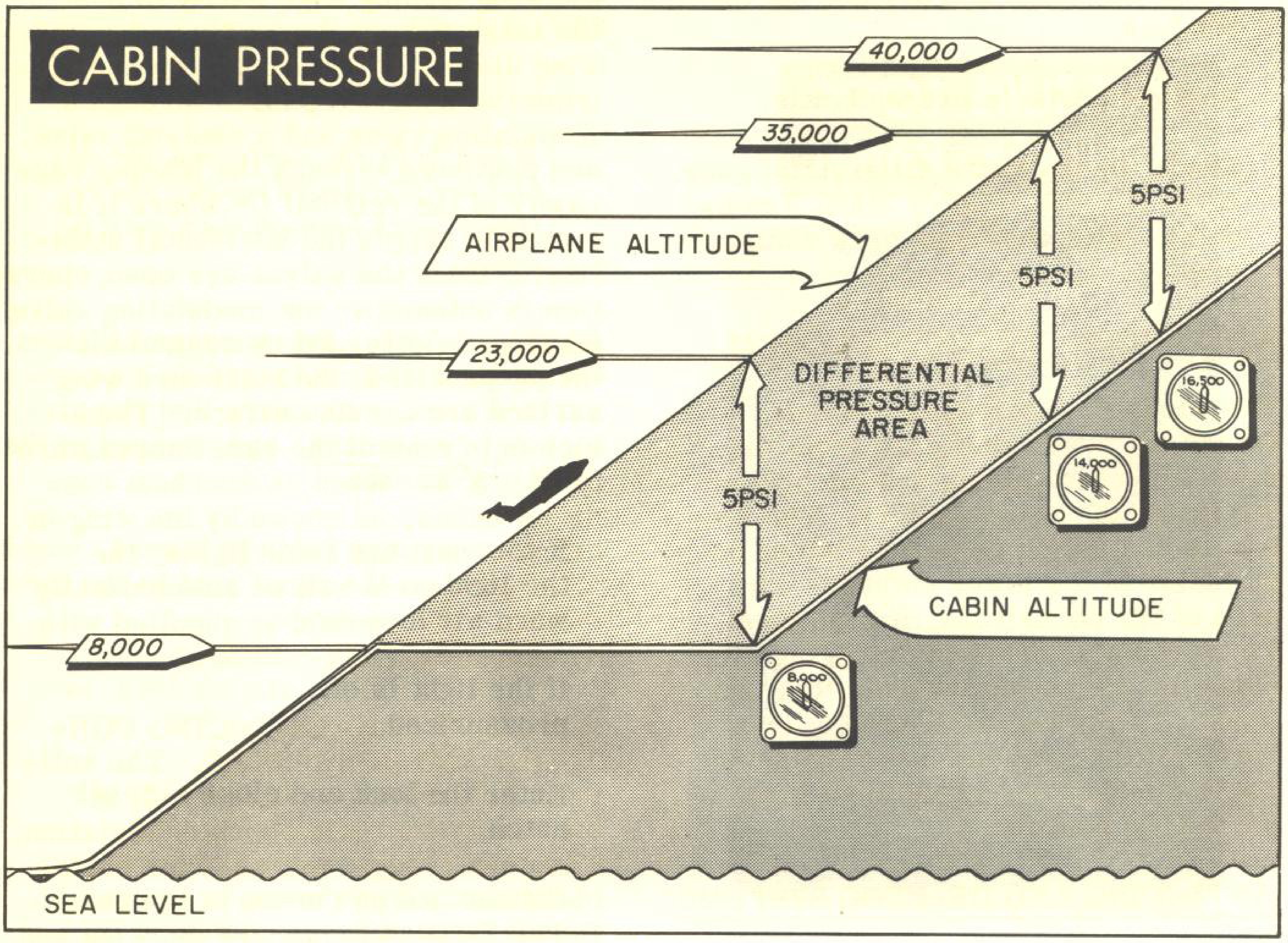


Figure 4-4

Connect oxygen mask to a portable, walk-around oxygen bottle at this time.

Close the air lock hatch and actuate the switch on the air lock control to depressurize the chamber.

Wait 12 seconds, then enter the mine bay area.

Close the air lock hatch, leaving the air lock depressurized for return passage.

PASSAGE FORWARD. For passage forward into the pressurized cabin from an unpressurized area, make sure that the air lock is not pressurized and proceed in the following manner.

Check the light next to the air lock hatch. If the light shows Green, the air lock is depressurized.

If the light is off, the air lock is pressurized. Actuate the control switch, depressurizing the air lock.

Wait 12 seconds.

Open the hatch, then enter the air lock.

Close the hatch and pressurize the air lock.

Remove portable oxygen bottle.

Check the pressure differential gage. When it reads 0 (after about 5 minutes), enter the flight deck compartment.

WINDSHIELD DEFOGGING SYSTEM.

The windshield defogging system forces hot conditioning air from the cabin air-conditioning system against the inside of the windshield. The system is controlled by pulling the push-pull knob in the lower outboard corners of the cockpit instrument panel. To increase the flow of defogging air, close the air outlets at the pilots' stations. To further increase the efficiency of the system, move the automatic temperature adjustment knob to the WARM position.

ANTI-ICING AND DE-ICING SYSTEMS.

WING AND TAIL ANTI-ICING SYSTEM.

The anti-icing system includes thermal anti-icing which prevents or eliminates ice formation on the wing and empennage leading edges, and on the engine nacelles. Hot air extracted from the bleed ports on engines No. 1 and No. 4 passes through combination shut-off, check, and pressure-regulating valves to a manifold where air from both engines is combined. At the manifold, the ducting extends fore and aft: the forward section supplies the wing and engine nacelle ducts; the aft section supplies the vertical fin and horizontal stabilizer. Heated air is first ducted forward and passes through a modulating valve and shut-off valve; then it is forced through air ejectors at numerous locations along the wing leading edge cavity to heat the outer skin of the leading edge and wing slats. The bleed air ducted aft from the manifold passes through a modulating valve and a shut-off valve, and continues through the leading edge cavity of the vertical fin where it is tapped to supply the horizontal stabilizer. Once the valves are open, operation is automatic; the modulating valve position is governed by control elements located in the starboard wing surface and the fin surface. These elements control the skin temperature to $97 \pm 5^{\circ}F$. When an overheat condition exists, as shown by the wing or tail overheat indicator lights, the affected system will be automatically closed. The system is supplied with 28-volt dc and 115-volt ac.

WING AND TAIL ANTI-ICING CONTROLS AND INDICATORS. The anti-icing control panel (figure 4-2) is located at the radio operator's station. The on-off toggle switches for engine bleed-air are on the top of the panel. Below these switches are the wing and tail surface anti-icing controls. The surface temperature indicator knob, when placed in WING or TAIL position, allows the selected surface temperature (in $^{\circ}F$) to be read on the temperature indicator in the upper left corner of the panel. The appropriate overheat light will come on when an overheat or over-pressurization condition exists. The affected system will then be automatically closed.

CAUTION

Radome anti-icing and surface temperature indication controls have been disconnected from the system until status can be determined at a later date.

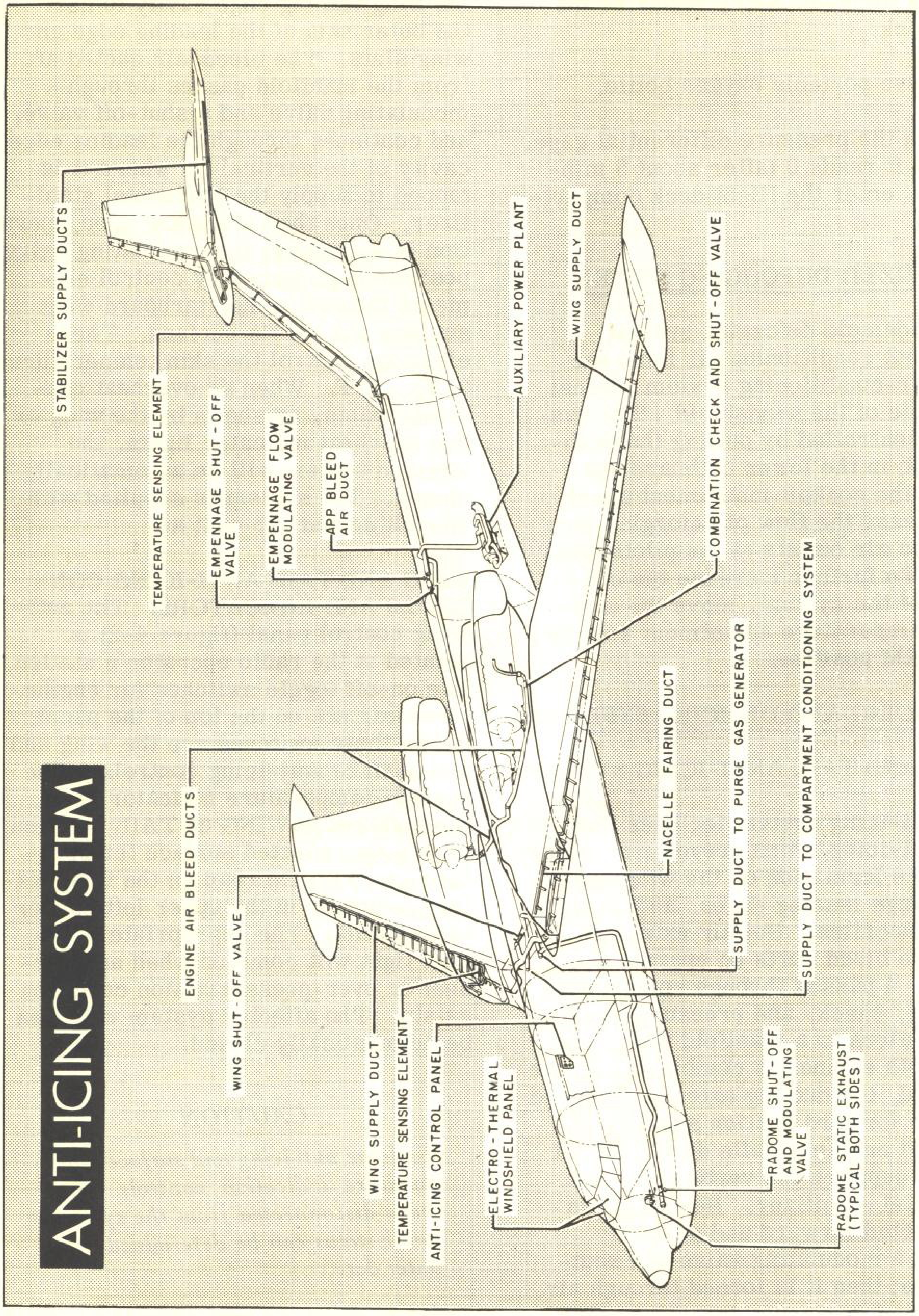

ANTI-ICING SYSTEM
STABILIZER SUPPLY DUCTS
TEMPERATURE SENSING ELEMENT
EMPENNAGE SHUT-OFF VALVE
EMPENNAGE FLOW MODULATING VALVE
APP BLEED AIR DUCT
AUXILIARY POWER PLANT
WING SUPPLY DUCT
COMBINATION CHECK AND SHUT-OFF VALVE
SUPPLY DUCT TO COMPARTMENT CONDITIONING SYSTEM
SUPPLY DUCT TO PURGE GAS GENERATOR
NACELLE FAIRING DUCT
ENGINE AIR BLEED DUCTS
WING SHUT-OFF VALVE
WING SUPPLY DUCT
TEMPERATURE SENSING ELEMENT
ANTI-ICING CONTROL PANEL
ELECTRO-THERMAL WINDSHIELD PANEL
RADOME SHUT-OFF AND MODULATING VALVE
RADOME STATIC EXHAUST (TYPICAL BOTH SIDES)

Figure 4-5

WING AND TAIL ANTI-ICING NORMAL OPERATION. During flight, if icing conditions are encountered or anticipated, proceed as follows:

No. 1 and No. 4 Engine Bleed-air Control Valve Switches - OPEN.

Wing and Tail Surface Anti-icing Switches - ON.

Check the surface temperature indicator for the wing and tail to determine whether the surfaces are being heated.

When icing conditions cease or are no longer anticipated, place the wing and tail surface switches OFF.

NOTE

When making a descent while icing conditions exist, maintain sufficient rpm for engines to supply bleed-air for the anti-icing system. If low pressure and low temperature of the bleed-air persist at IDLE position, boost engine power to CRUISE, without increasing airspeed, to de-ice control surfaces.

WING AND TAIL ANTI-ICING EMERGENCY OPERATION. If either the wing spar or vertical fin temperature exceeds 200°F or the differential pressure within the wing or tail exceeds 5.0 psi, the respective shut-off valve will automatically close and the overheat light will come on. Should the condition persist, the switch for the malfunctioning system should be put in the OFF position.

WINDSHIELD ANTI-ICING SYSTEM.

The windshield anti-icing system (figure 4-5), operating on 115-volt ac and 28-volt dc, automatically prevents ice from forming on the windshield and gives the pilots a clear vision area. The system consists of a current-conducting plastic film embedded in the windshield, a temperature-sensing element within each windshield, and a control switch.

Placing the control switch on the co-pilot's sub-panel in the ANTI-ICING position operates the system. Two temperature control boxes in the electronics compartment automatically keep the temperatures of the windshield between 125° to 135°F. When the windshield temperature is high enough, the temperature-sensing elements automatically unbalance an electrical bridge circuit which shuts off the power supply. As the outside temperature of the windshield approaches freezing, the sensing elements close and current again flows through the plastic layer.

STALL WARNING DETECTOR PROBE DE-ICING SYSTEM.

The probe and internal de-icer heater circuits for the stall warning detector probe are energized when the airplane's 28-volt supply is turned on. The probe heater thermostat closes whenever the probe temperature drops below 27°C (80°F) and opens when it rises above 95°C (200°F). The internal heater circuit is opened by its thermostat when the temperature reaches 35°C (105°F).

PITOT TUBE HEATERS.

The pitot tubes on each side of the flight deck crown are electrically heated by hermetically sealed heating elements within the pitot tube units. These 115-volt a-c elements are regulated by a double-pole, two-position switch on the co-pilot's sub-panel. Both heaters operate when the control switch is turned to the PITOT HEATER position.

ENGINE ANTI-ICING SYSTEM.

Each engine is protected from formation of ice on its entrance guide vanes, alternator fairing, and struts by hot discharge air piped from its own compressor. An ice-sensing probe in the engine air intake detects the difference between the static air pressure and the true pressure. At freezing temperatures, ice will form on the true pressure tube, but not on the static tube. The ice-sensing probe reacts to this change in pressure differential and closes the contacts of a pressure-operated electrical switch. This switch opens the engine air valves and releases the hot discharge air (figure 4-5).

ENGINE ANTI-ICING CONTROL. The operating switches and heat indicator lights for the engine anti-icing system, 28-volt dc, are found at the radio operator's station (figure 4-2).

When the automatic control switch is turned to ON, the anti-icing indicator light for each engine will illuminate, showing that its engine hot air valve is open. The lights remain on as long as there is ice on the ice-sensing probe. Holding the control switch momentarily in PROBE HEAT de-ices all engine probes, and the indicator lights will go out. With the control switch in the ON position, the system is prepared to react automatically to icing conditions.

The manual control switch is used when one or several of the indicator lights go out. When this switch is placed at ON, all engines are continuously anti-iced without the automatic sensing feature.

CAUTION

If the engines are not running, make sure that both control switches are turned OFF.

OPERATION OF ENGINE ANTI-ICING SYSTEM. To operate the engine anti-icing system:

Engine anti-icing control - ON.

Place the automatic control switch to ON. The indicator lights will come on and stay on as long as icing continues.

If the indicators remain lighted, although icing conditions have disappeared, de-ice the probe by moving the automatic control switch momentarily to PROBE HEAT.

If automatic control is not needed, hold the manual control switch momentarily in ON position.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

INTERCOMMUNICATION SYSTEM AN/AIC-5B.

This system, operating on 28-volt dc, provides for intercommunication between crew members, monitoring of the various receiving equipment, and control of the transmitting units. In addition to the monitoring of individual units, mixing provisions at the pilot's and co-pilot's stations permit various signals to be heard simultaneously. Full utilization of the system is extended to the pilot, co-pilot, and radio operator, with limited control available to the navigator.

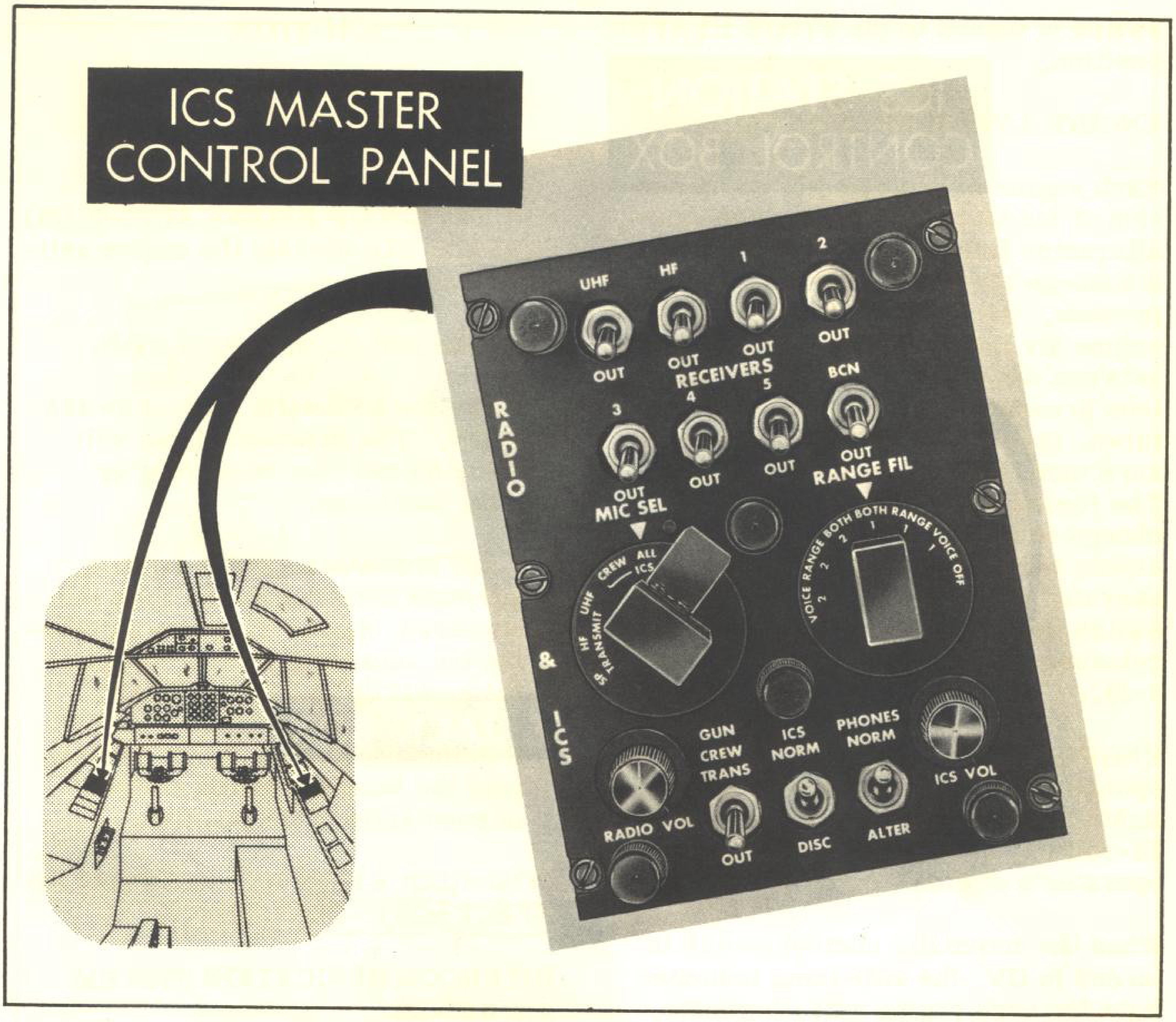


Figure 4-6

MASTER CONTROL PANEL (figure 4-6). Three master control panels on the pilot's, co-pilot's, and radio operator's side consoles afford each operator maximum use of the system for radio and interphone communication.

There are eight receiver toggle switches on each panel for receiving or eliminating incoming signals.

The rotary RANGE FIL knob would normally be used to select one of two low-frequency radio range receivers. These receivers, however, are not on this airplane.

The MIC SEL knob is used for transmission selection and has the following positions: SP (spare position—not used), HF, UHF, and CREW/ALL. The last two positions, CREW/ALL, combine into a common interphone channel and interrupt all other interphone signals in each headset.

A two-position PHONES switch has a NORM position and an ALT (alternate) position. Placing the switch in ALT allows a crew member with an

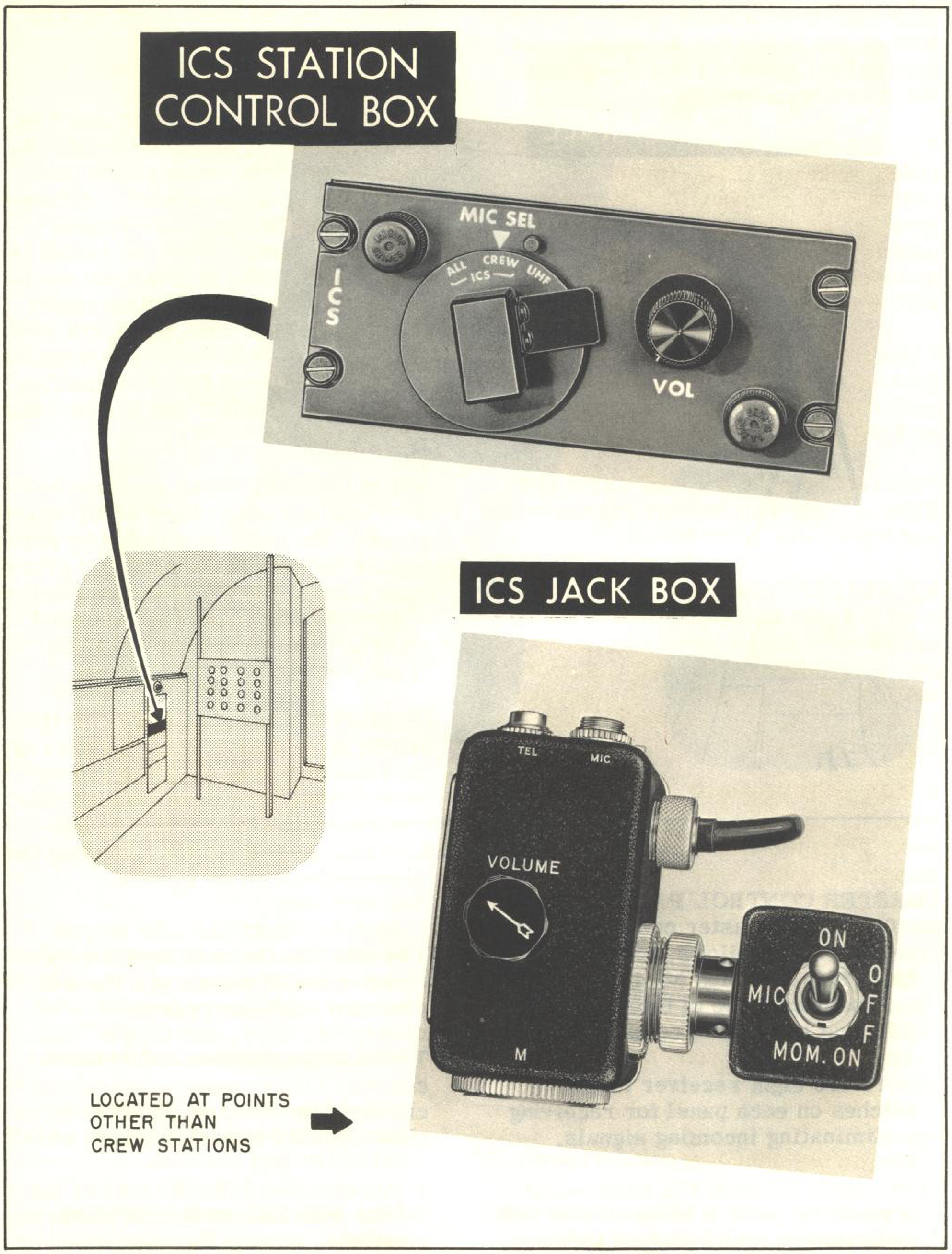

ICS STATION CONTROL BOX
MIC SEL
ALL
CREW
ICS
UHF
ICS
VOL
ICS JACK BOX
TEL
MIC
VOLUME
M
ON
MIC
OFF
MOM. ON
LOCATED AT POINTS OTHER THAN CREW STATIONS

Figure 4-7

inoperative isolation amplifier (through loss of one of the two dynamotors) to parallel his master control panel with the operative amplifier.

The ICS switch is marked NORM and DISC. When in DISC, the switch permits a crew member to disconnect from the interphone circuit when the urgency of an incoming message so dictates. In NORM, the interphone will again be connected to the circuit.

The gun crew switch is marked OUT and TRANS. When placed in TRANS, the switch allows the navigator to transmit on UHF directly from his station box.

Two volume controls, marked RADIO VOL and ICS VOL, permit varying radio and interphone audio levels.

ICS STATION CONTROL BOX (figure 4-7). A station control box at the navigator's station provides interphone on CREW/ALL, and transmission on UHF (when permitted by a master control). The VOL knob affords audio level adjustment.

ICS JACK BOX (figure 4-7). Ten jack boxes situated throughout the airplane make possible the use of the interphone during mooring, beaching, or mine loading operations. They are located as follows:

One in the entrance compartment.

Three in the electronics compartment (one at each end and one in the center).

One in the air lock compartment.

One in the mine bay compartment.

Two in the mine loading compartment (adjacent to each beaching gear hatch).

One in the aft section (aft of APP).

One in the tail gun section.

These jack boxes have MIC and TEL jacks into which extension cords can be plugged. The volume knob permits control of audio level. Attached to each jack box is a microphone selector switch. When the switch is placed at ON, the microphone can be operated continuously. The center position is OFF. The MOM. ON switch is used for intermittent operation and must be held down for transmission. When it is released, the spring-loaded switch returns to OFF.

MICROPHONES. The pilot and copilot can use either hand or lip microphones, the latter controlled by press-to-talk buttons on the outboard grip of each control wheel. The navigator and radio operator have foot-actuated switches for interphone and radio transmission.

OPERATION OF THE INTERCOMMUNICATION SYSTEM. Because of the limited operation of the station control boxes, only the master control boxes will be included in the following procedure for operating the intercommunication system.

Push in the AN/AIC-5B circuit breaker on the radio operator's side console and allow a three-minute warm-up period.

Plug in microphone and headset.

Choose the desired receiver by placing its respective toggle switch in the ON (up) position.

Turn MIC SEL knob to desired system.

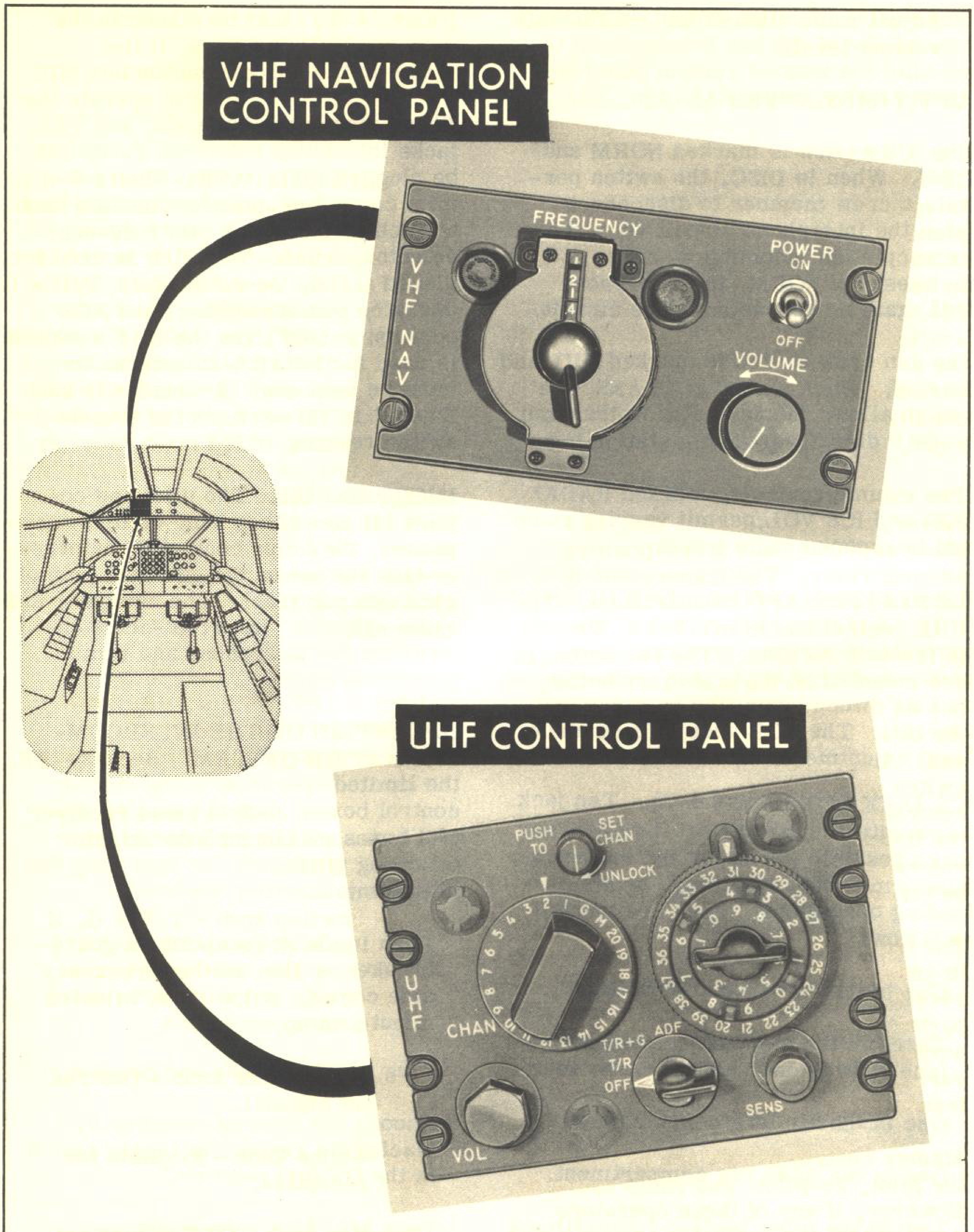

VHF NAVIGATION
CONTROL PANEL
FREQUENCY
POWER
ON
OFF
VOLUME
VHF NAV
UHF CONTROL PANEL
PUSH
TO
SET
CHAN
UNLOCK
CHAN
T/R+G
ADF
T/R
OFF
SENS
VOL
UHF

Figure 4-8

Adjust radio control for comfortable volume level.

UHF TRANSCEIVER AN/ARC-27A.

The UHF transceiver, operating on 28-volt dc, provides two-way radio-telephone communication from airplane to airplane, or from airplane to ship or ground. The unit, designed to operate over a frequency range of 225.0 to 399.9 megacycles, has available 20 pre-set frequencies, and the established guard frequency. Range varies with altitude and atmospheric conditions and is limited to line-of-sight.

The system is composed of the transceiver, a remote control box, two blade antennas, and a two-position antenna relay. The transceiver is located in the APP compartment. The UHF control box is overhead, directly in front of the pilot. The two antennas are mounted on the stabilizer bullet, one on the top of the forward end and the other on the underside of the after end. A FWD/AFT antenna selector switch on the cockpit overhead panel controls the coaxial relay connecting the transceiver to that antenna considered by the pilot to produce the better operation.

The transmitter employs 22 crystals to generate 1733 usable channels. The receiver section is divided into two parts: a fixed tuned guard receiver, normally pre-set on 243.0 mc; and a variable tuned receiver, set to the transmitting frequency.

Master control panels are provided for the pilot, co-pilot, and radio operator. However, if any of these operators desires that the navigator transmit and receive directly on UHF, any one of the C-762 CREW TRANS switches (figure 4-6) may be placed in the TRANS position. Then, if the navigator places his station box MIC SEL knob to UHF, he can operate the transceiver directly.

UHF CONTROL PANEL (figure 4-8). There is a four-position function knob on the control panel. OFF de-energizes the transceiver; T/R is used for main receiver operation only; T/R + G adds the guard receiver; and ADF transfers input from the UHF antennas to the AS-578/ARA-25 antenna for homing purposes. A sensitivity knob marked SENS provides for remote squelch setting of the main receiver only. Turn the knob clockwise until background noise is perceptible, then back off slowly until the noise disappears. This control, too, can increase the sensitivity for quieter channels and improves reception on all channels.

NOTE

Controls for interphone radio volume govern headset level.

OPERATION OF UHF TRANSCEIVER.

ICS master control panel receiver switch and microphone selector knob - UHF.

UHF function knob - T/R + G, if simultaneous reception on guard-frequency plus another frequency is desired. Allow three minutes for warm-up.

Channel selector knob - Desired pre-set channel.

ICS volume knob - Regulate for best reception.

Function knob - OFF to turn set off.

FREQUENCY SELECTION. To preset any one of 20 possible channels, proceed as follows:

Desired channel - Set on channel selector dial.

Desired frequency - Set on three concentric frequency selector dials.

Push-to-set CHAN knob - Rotate clockwise, depress, and release.

For selecting mechanically any desired frequency, place the channel selector dial to M (manual), and proceed according to normal frequency selection. No power is required for this operation.

HF TRANSCEIVER 618S-1.

The 618S-1 transceiver provides reliable, long range, high frequency voice and CW communication with other aircraft or with a ship or ground station. The system consists of a transceiver, power supply, antenna tuner, and a remote control unit. A fixed wire antenna is located between the hull crown antenna mast and the vertical stabilizer. A frequency control system allows common usage of each of the 144 crystals for both transmitting and receiving in the frequency range of 2.0 to 25.0 megacycles. Mixer and multiplier circuits are used to provide complete coverage within the frequency limits of the equipment. 28-volt dc is used to heat the tube filaments and operate the high voltage dynamotor; 115-volt ac is used in two selenium rectifier power supplies and for CW sidetone.

OPERATION OF THE 618S-1 TRANSCEIVER. The transceiver system is controlled remotely from the radio operator's console by the control unit which is mounted in the accessory panel. (See figure 4-9.) The radio operator is the only crew member who can select the mode of operation (VOICE or CW), change channels, adjust MCW or CW sensitivity, control BFO (CW) pitch, or key the transmitter on CW. The ICS must be energized since all audio output from the transceiver is fed through the ICS.

The remote control unit contains the channel selecting dials, and the volume knob used in radio telephone operation. The desired channel is set into a vertical window by the rotation of the two outer concentric knobs. The inner concentric knob is for the phone volume control only and is shunted for full volume when operating on CW. The accessory panel has a function knob, marked OFF-VOICE-CW, which energizes the system and selects either VOICE or CW operation. During CW operation, a CW sensitivity knob, in addition to the volume knob, regulates volume and sensitivity. A sensitivity knob marked MCW SENSITIVITY is provided for phone operation. The BFO knob varies the signal pitch on CW.

If the pilot or co-pilot wishes to use the HF transceiver for voice transmission, the radio operator's HF function switch must be in VOICE position and the respective pilot's receiver switch and MIC SEL knob on the master control panel must be in HF.

VHF NAVIGATION SET AN/ARN-14E.

The VHF Navigation set provides navigational and communication information in the 108 to 135.9 megacycle range as employed in the following categories:

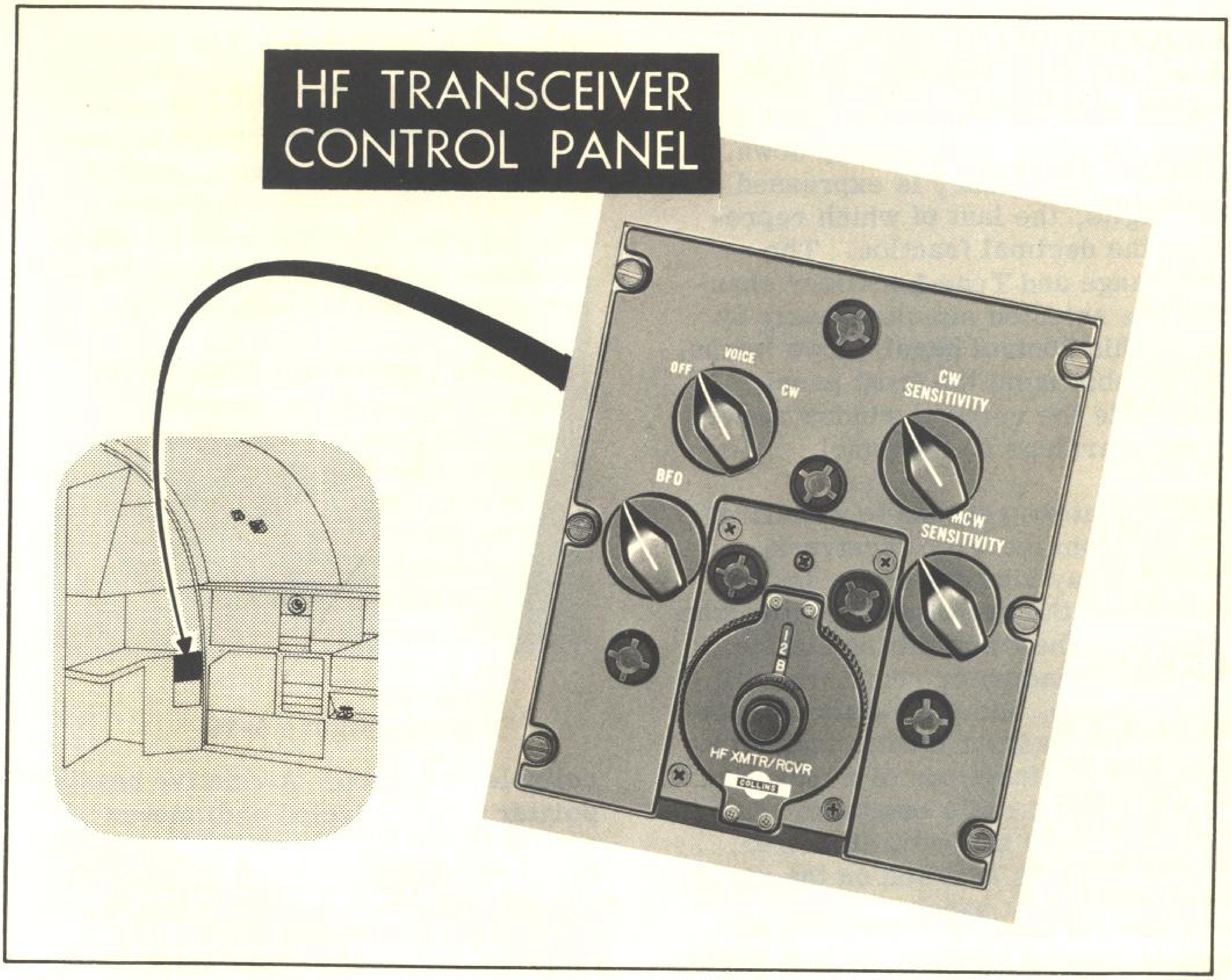


Figure 4-9

Service	Frequency (mc)
Runway Localizer	108.0 to 111.9
Visual-aural Range	108.3 to 110.3
Weather	111.0 to 111.9
Omnirange	112.0 to 117.9
Tower	118.0 to 121.9
Voice Communication	122.0 to 135.9

Because range is limited to line-of-sight, reception varies from 3 miles (unobstructed distance) at sea level to approximately 100 miles at 10,000 feet, and to progressively greater distances at higher altitudes, depending upon atmospheric conditions.

The system requires 28-volt dc for dynamotor operation and 26-volt ac for indicator circuits. The equipment is installed in the APP compartment. Two antennas for VHF reception are mounted in the same compartment, one on either side.

VHF CONTROL PANEL (figure 4-8). This control unit on the pilot's overhead panel immediately above the UHF control panel contains a power ON-OFF switch, a frequency selector knob, and a volume knob. The ON position of the power switch is used for VHF Omnirange and Runway Localizer reception.

For frequency selection, the desired frequency is set into the vertical window with the concentric dials provided. Reading from the top down, the megacycle frequency is expressed in four digits, the last of which represents the decimal fraction. The Omnirange and Tone Localizer channels are selected simultaneously by use of this control panel. Two lamps, replaceable from the front panel, illuminate the vertical window as well as the markings on the panel.

Two indicators respond to electrical signals from the VHF receivers. They portray visually on the instrument panel the position of the airplane relative to the transmitting station. The course indicator registers VOR, VAR, course, and glide-path orientations. The radio magnetic indicator combines the functions of a magnetic compass and a radio compass. A duplicate radio magnetic indicator, ID 250/ARN, is mounted on the navigator's instrument panel.

COURSE INDICATOR ID 249A/ARN (figure 4-10). The course indicator is mounted on the pilot's instrument panel for easy reference. In the upper right corner of the instrument there is a press-to-test marker beacon light and a dim control knob. In the diagonally opposite corner there is a set knob used to set the desired course into the course window. The ambiguity window will show whether the selected course is TO or FROM the transmitting station. When the receiver is tuned to an omnirange station, the warning OFF flags (extreme left side of the horizontal bar and the lower end of the vertical bar) will retract after the set is sufficiently warmed up. If the flags are still visible after warm-up, they probably indicate that insufficient signal strength is available for reliable operation. A relative heading pointer (white-circled end) moves around the periphery of the instrument face to indicate the angle between the airplane and the course set into the course window. Its travel, calibrated to 45 degrees, each side of center—top and bottom, aids the pilot to approach and intercept the desired track at definite angles and to detect wind drift. The vertical bar, operated by the ARN-14E receiver, indicates the on-course or off-course condition of the airplane; the horizontal bar, actuated by a runway localizer, gives glide-path orientation.

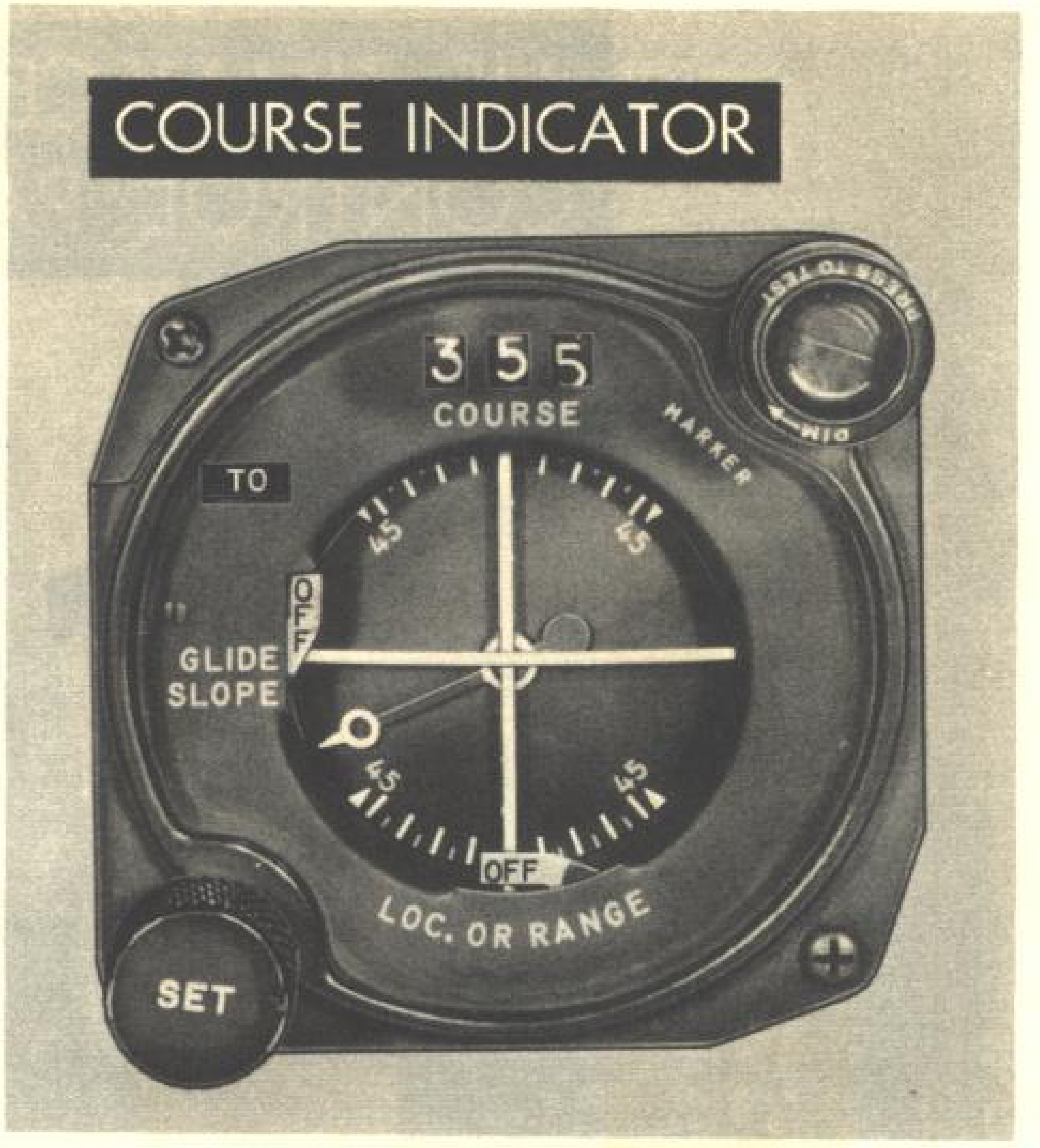


Figure 4-10

NOTE

The horizontal bar, or glide-path indicator, is inoperative because its receiver is not installed in the airplane at this time.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

TYPE	DESIGNATION	FUNCTION	PRIMARY OPERATOR	RANGE	LOCATION OF CONTROLS
INTERPHONE	AN/AIC-5B	Intercrew communication	Crew members	Within airplane	Each crew station
UHF COMMAND	AN/ARC-27A	Two-way voice communication	Pilot, co-pilot and radio operator	Line-of-sight	Pilot, co-pilot and radio operator's stations
HF LIAISON	COLLINS 618S-1	Long range, two-way voice and code communication	Radio operator		Radio operator's station
AUTOMATIC NAVIGATOR	APN-66	Automatic navigation, adjunct to autopilot	Navigator	(Provisional)	Navigator's station
AUTOPILOT	XW-4	Automatic pilot	Pilot or co-pilot		Cockpit pedestal
VHF NAVIGATOR	AN/ARN-14E	VOR, VAR, Localizer and voice reception	Pilot	Line-of-sight	Pilot's upper panel
RADIO TRANSCEIVER	AN/ARN-21	Distance and bearing information	Pilot	(Provisional)	
RADIO ALTIMETER	AN/APN-22	Absolute distance in feet above terrain	Pilot	0-20,000 feet	Pilot's instrument panel
IFF	AN/APX-6	Automatic aircraft identification	Pilot	200 nautical miles or line-of-sight	Co-Pilot's side console panel
IFF CODER GROUP	AN/APA-89	Pulse coder, adjunct to AN/APX-6	Pilot	(Provisional)	Co-Pilot's side console panel
TAIL WARNING RADIO RECEIVER	AN/ALQ-2	Tail warning of approaching aircraft	Gunner	(Provisional)	
SEARCH RADAR	AN/ASB-1	Radar Search	Navigator	(Provisional)	

Figure 4-11

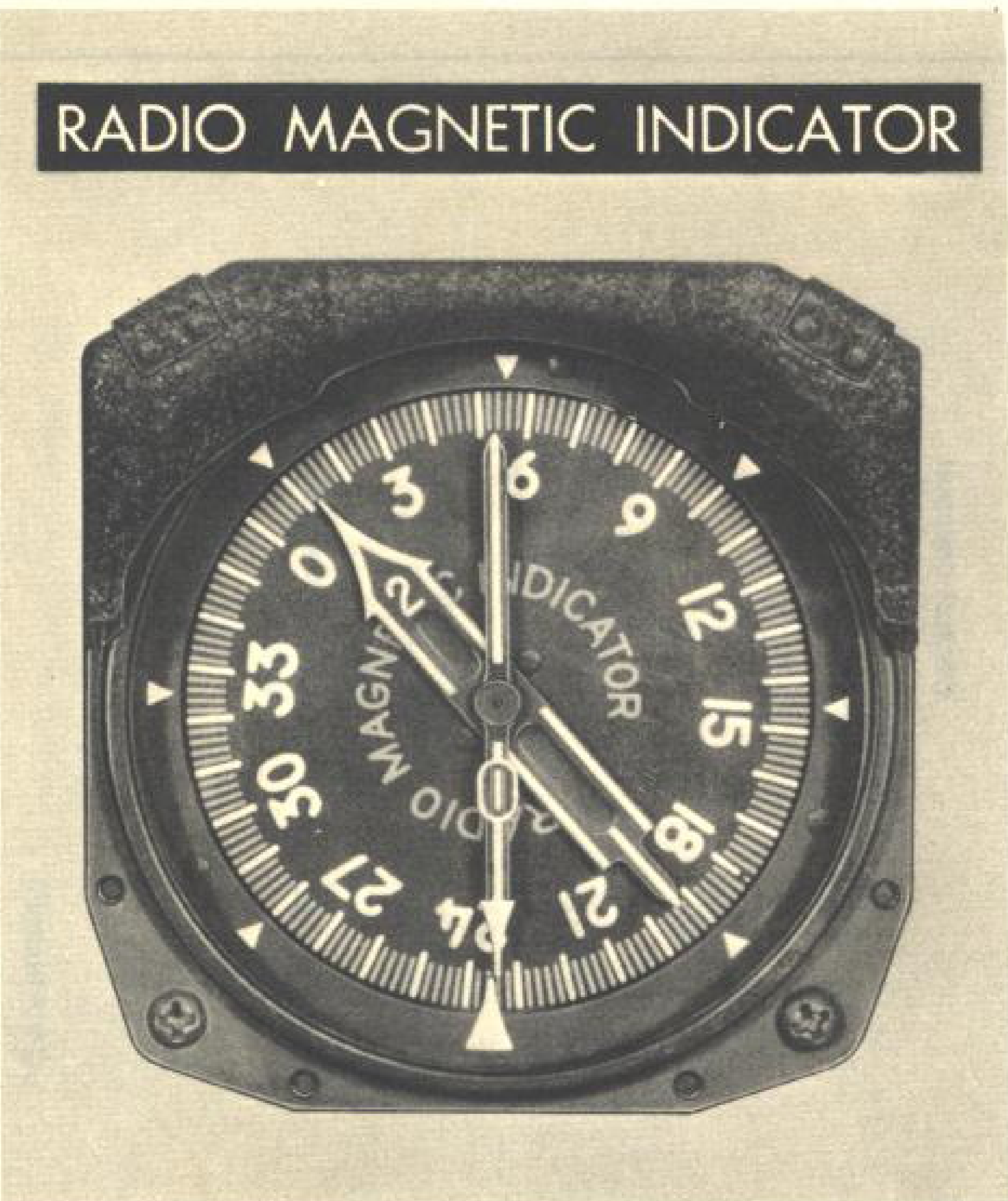


Figure 4-12

RADIO MAGNETIC INDICATOR ID 250/ARN (figure 4-12). The radio magnetic indicator adjacent to the course indicator on the pilot's instrument panel includes a circular compass card which rotates as the airplane turns so that the magnetic heading of the airplane will always be under the reference point at the top of the instrument. The card is operated by the G-2 Compass System. A double-barred pointer, numbered 2, provides a relative bearing by pointing always toward the omnirange station to which the AN/ARN-14E receiver is tuned; a single-barred pointer, numbered 1, indicates (when operated by the AN/ARA-25 receiver—not installed in this airplane) the actual bearing to the station regardless of airplane heading.

VHF NAVIGATION SET OPERATION WITH VAR.

VHF Nav power switch - ON.

VAR frequency - Set into vertical window.

Observe deflection of the vertical bar. If bar deflects to the left, the airplane is in the blue sector of the VAR range; if bar deflects to the right, the airplane is in the yellow sector.

Consult airways chart for identification of sector.

NOTE

On VAR the deflection of the vertical bar does not necessarily indicate the direction the airplane must take to get on course. It indicates one of two color sectors in which the airplane may be located.

Identify signal in headset as aural N or A. Refer to airways chart to determine whether the station is fore or aft of the airplane. When aural signals N and A are superimposed to give a continuous dash, the airplane is on aural leg at right angles to the visual range.

Relative heading pointer indicates the heading relative to the course selected.

VHF NAVIGATION SET OPERATION WITH LOCALIZER.

VHF Nav power switch - ON.

Localizer frequency - Set into the vertical window.

Turn the set knob on the course indicator until the magnetic course of the final approach to the runway appears in the course window.

Turn airplane until the white circle of the relative heading indicator is beneath the upper half of the vertical bar.

As the course is approached and the vertical bar moves toward center, turn the airplane in the direction of vertical bar movement so as to keep the white circle beneath the vertical bar. Thus, the airplane turns onto the course without overshooting or bracketing.

Steer airplane to keep vertical bar centered, using normal sensing.

VHF NAVIGATION EMERGENCY OPERATION. The voice facilities of the VHF receiver are to some extent independent of the navigation facilities: failure of one does not indicate failure of the other. Also, navigational information presented to the course indicator is independent of that presented on the radio magnetic indicator. Consequently, limited operation can be obtained on either of the above indicators in the event of failure of the other.

WARNING

When using limited operation on Tone Localizer, the pilot must exercise extreme caution in cross-checking with marker beacons, altimeter, and heading.

RADIO ALTIMETER AN/APN-22.

The AN/APN-22 radio altimeter provides radar-measured, absolute height information for the pilot and navigator on their respective instruments. Power to operate the equipment consists of 115-volt ac and 28-volt dc. The equipment operates in the 4200-4400 megacycles band and presents reliable indications over land with ranges of 0-10,000 feet, and over water with ranges of 0-20,000 feet.

Figure 4-13

The radar pulse transmitter in the port outer wing directs pulses to the terrain; these pulses are then reflected back to the airplane. Electronic measurement of the time element involved determines the distance of the airplane above the terrain.

RADIO ALTIMETER OPERATION. To start operation, turn the ON-LIMIT knob on the radio altimeter indicator to ON position. The equipment will start operating approximately three minutes after the control is turned ON.

CAUTION

Allow at least 12 minutes warm-up time after starting to ensure final accuracy. If the temperature is below —40° C, allow 25 minutes for warm-up time.

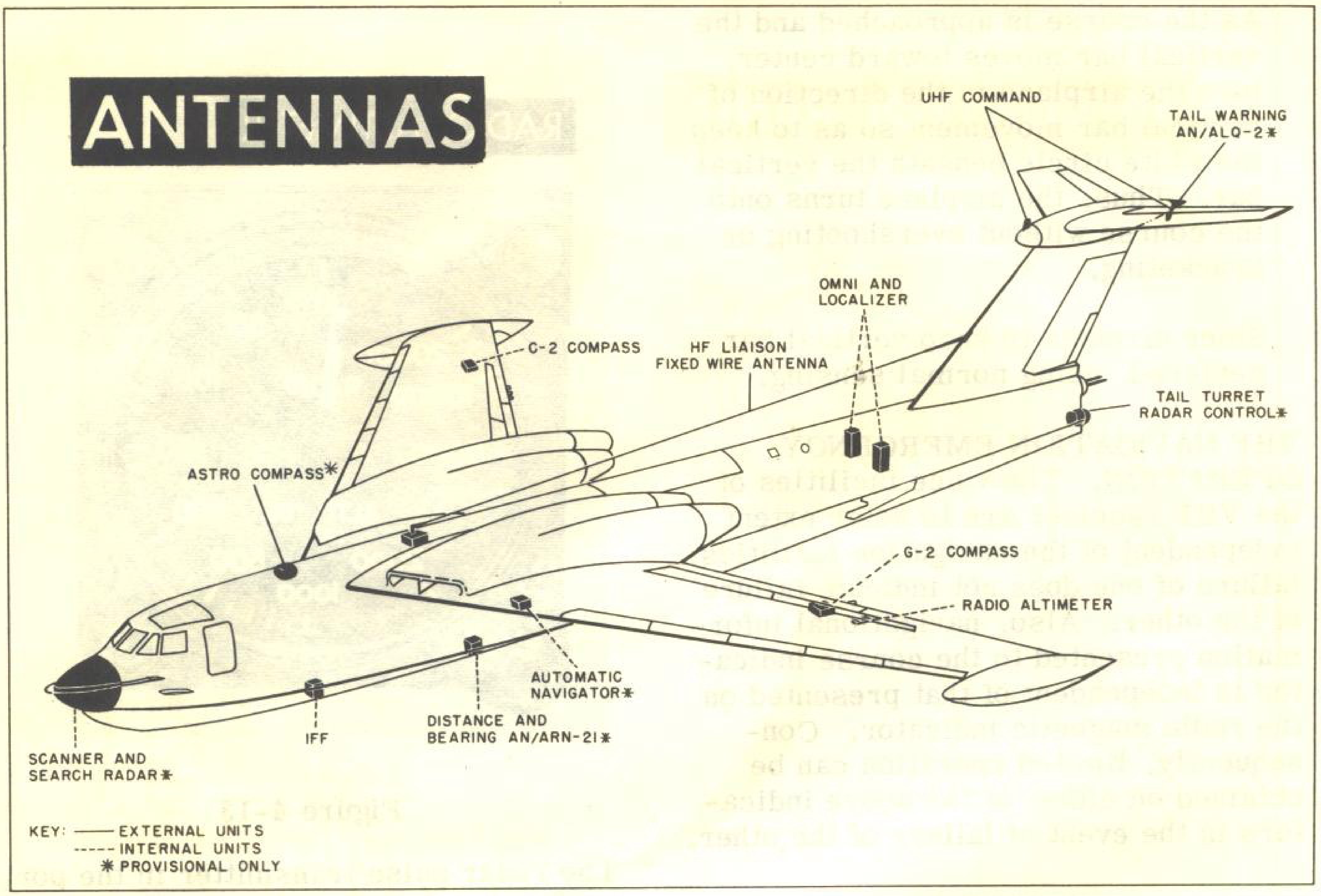


Figure 4-14

In flight, the same ON-LIMIT knob is used to set the limit bug (arrow head on periphery of dial face) to the desired pre-set altitude.

NOTE

When flying at or below the pre-set altitude, a red light on the lower right corner of the instrument will illuminate; when flying above the pre-set altitude, the light will go out.

DROP-OUT. The drop-out altitude (altitude at which the reflected r-f signal becomes too weak to operate the system; or when banks, climbs, or dives exceed approximately 60°) generally occurs above 10,000 feet over land, and higher over water. When drop-out occurs, the altitude pointer will position behind a mask on the dial which is midway between the 20,000 feet and 0 points. This position visually warns the pilot that the indicator reading is meaningless. To restore normal operation, reduce altitude slightly below the point where drop-out occurred or level out from the maneuver that causes drop-out. Resumption of normal indicator operation follows approximately a 10-second lapse from recovery time to normal operation.

To stop operation, turn off the ON-LIMIT control.

RADAR IDENTIFICATION SET AN/APX-6.

This IFF equipment is an airborne transponder and one of several units which may be operated together to

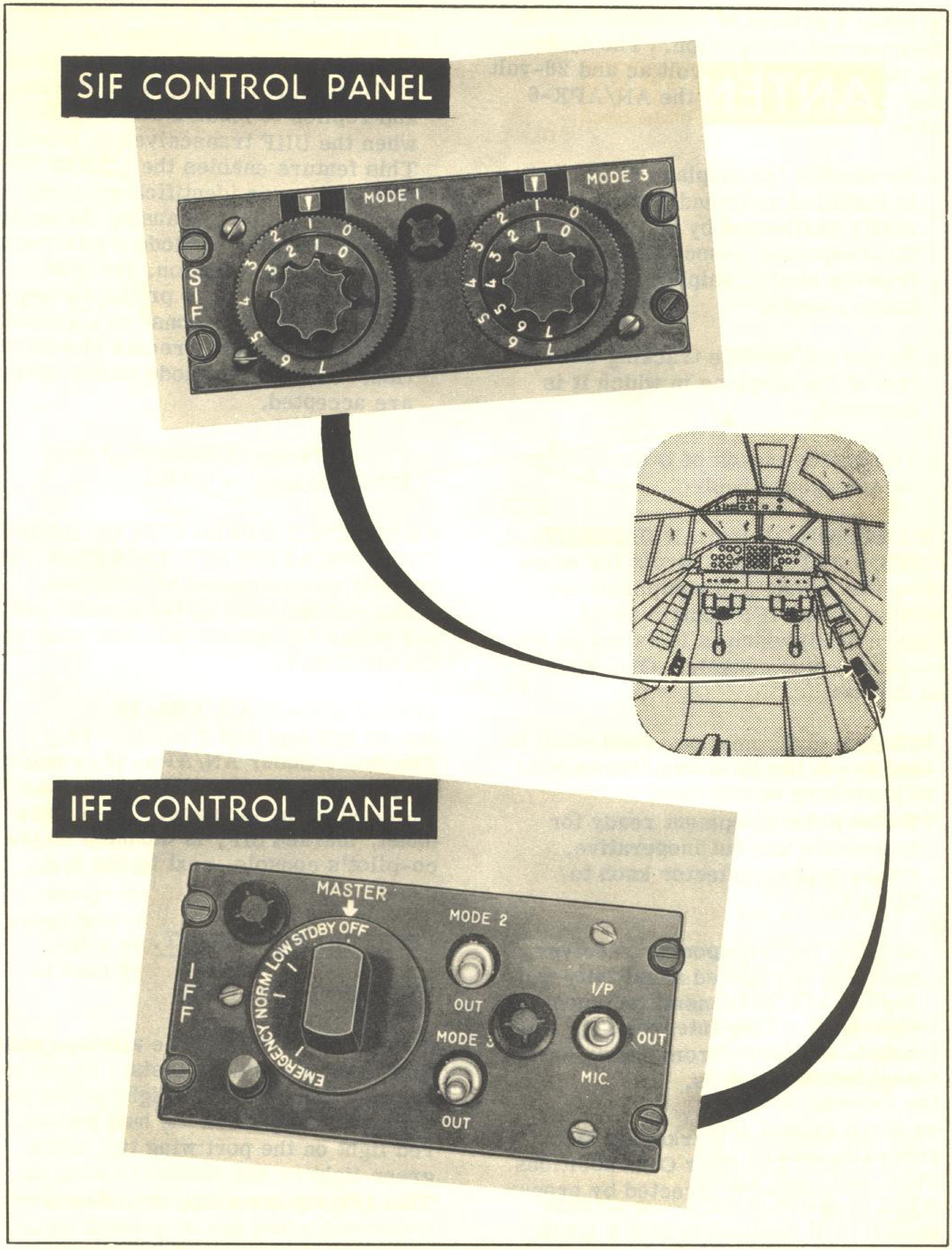

SIF CONTROL PANEL
MODE 1
MODE 3
SIF
IFF CONTROL PANEL
MASTER
EMERGENCY NORM LOW STDBY OFF
MODE 2
OUT
MODE 3
OUT
I/P
OUT
MIC.
IFF

Figure 4-15

provide a system of electronic identification and recognition. The system is supplied with 115-volt ac and 28-volt dc. The purposes of the AN/APX-6 are

To identify the airplane in which it is installed as friendly when correctly challenged by an interrogator-responsor associated with friendly shore, shipboard, and airborne radars.

To permit surface tracking and control of the airplane in which it is installed.

To provide means of transmitting an emergency reply.

OPERATION OF RADAR IDENTIFICATION SET. All controls for operating the AN/APX-6 equipment are located on the IFF control panel (figure 4-15) which is installed on the co-pilot's side console. Operation is as follows:

To turn equipment on, rotate master selector knob to NORM.

To keep the equipment ready for immediate use but inoperative, rotate master selector knob to STDBY.

At LOW the transponder receiver operates at reduced sensitivity and replies will be transmitted upon receipt of strong interrogation signals—ordinarily from nearby interrogator-responders.

Set the switches marked MODE 2 and MODE 3 to their OUT positions unless otherwise directed by proper authority.

The third toggle switch on the right of the panel has three positions. With the switch in I/P (Identification of Position), the equipment accepts and replies to Mode 2 interrogation when the UHF transceiver is keyed. This feature enables the pilot to transmit radar identification position information by causing the equipment to respond to Mode 2 interrogations. In MIC position, the pilot transmits on UHF to produce a temporary Mode 2 response to a ground station for a more precise identification. In OUT, no mode interrogations are accepted.

To secure the equipment, rotate MASTER knob to OFF.

EMERGENCY OPERATION OF RADAR IDENTIFICATION SET AN/APX-6. To indicate an emergency or distress, press red dial stop on the control unit and rotate the master selector knob to EMERGENCY.

CODER GROUP AN/APA-89.

The Pulse Coder AN/APA-89, used in conjunction with the AN/APX-6, is not installed in the airplane. The control panel, marked SIF, is mounted on the co-pilot's console, next to the IFF panel.

LIGHTING EQUIPMENT.

EXTERIOR LIGHTING.

POSITION LIGHTS. The airplane position lighting system consists of one yellow light and one white light on the tail, three white lights on the hull bottom, a red light on the port wing tip, and a green light on the starboard wing tip. These lights are singly or collectively

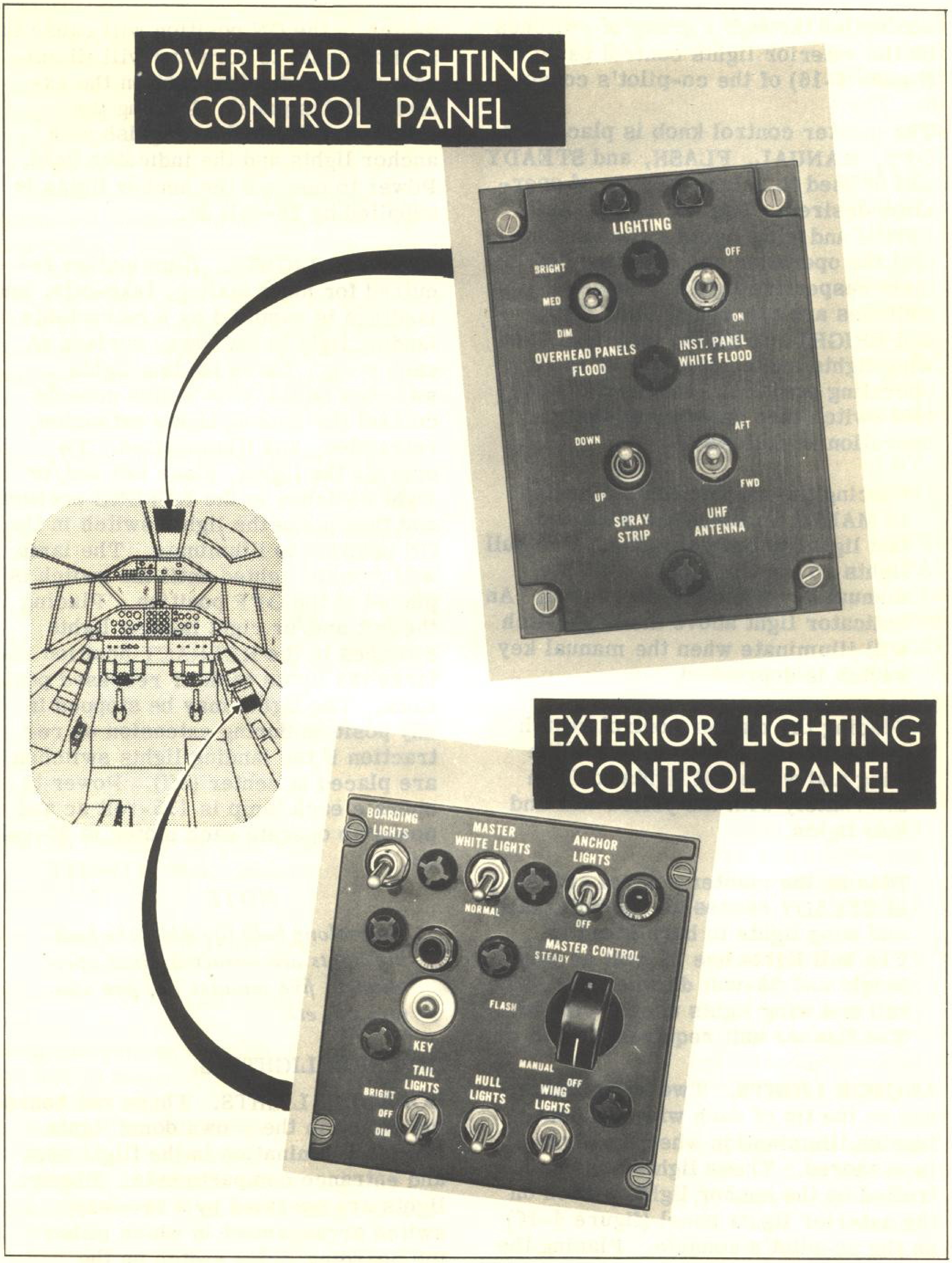

OVERHEAD LIGHTING CONTROL PANEL
LIGHTING
BRIGHT
MED
DIM
OFF
ON
OVERHEAD PANELS FLOOD
INST. PANEL WHITE FLOOD
DOWN
UP
SPRAY STRIP
AFT
FWD
UHF ANTENNA
EXTERIOR LIGHTING CONTROL PANEL
BOARDING LIGHTS
MASTER WHITE LIGHTS
NORMAL
ANCHOR LIGHTS
OFF
MASTER CONTROL
STEADY
FLASH
MANUAL
OFF
KEY
TAIL LIGHTS
BRIGHT
OFF
DIM
HULL LIGHTS
WING LIGHTS

Figure 4-16

controlled through a group of switches on the exterior lights control panel (figure 4-16) of the co-pilot's console.

The master control knob is placarded OFF, MANUAL, FLASH, and STEADY and is used to select the type of operation desired. The tail lights, hull lights, and wing lights switches control the operation and brilliancy of their respective lights. These switches are placarded DIM, OFF and BRIGHT. With the tail, hull, and wing lights switches in one of their operating positions, the master control switch then determines their operation as follows:

Placing the master control switch in MANUAL causes the wing and tail lights to burn steadily. The hull lights do not illuminate until the manual key switch is depressed. An indicator light above the key switch will illuminate when the manual key switch is depressed.

Placing the master control switch in the FLASH position causes the wing and white tail lights to flash alternately with the yellow tail and hull lights.

Placing the master control switch at STEADY causes all the hull, tail, and wing lights to burn steadily. The hull lights use 26-volt ac when bright and 28-volt dc when dim. The tail and wing lights use 26-volt ac. The flasher unit requires 28-volt dc.

ANCHOR LIGHTS. Two white lights, one on the tip of each wing tip float, furnish illumination when the aircraft is anchored. These lights are controlled by the anchor lights switch on the exterior lights panel (figure 4-16) on the co-pilot's console. Placing the switch in the ON position will cause the anchor lights to burn and will illuminate a red indicator light on the exterior lights panel. Placing the switch in OFF will extinguish both anchor lights and the indicator light. Power to operate the anchor lights is supplied by 28-volt dc.

LANDING LIGHTS. Illumination required for night taxiing, take-offs, and landings is supplied by a retractable landing light in the lower surface of each wing. Three landing lights switches on the pilot's side console control the landing lights extension, retraction, and illumination. To operate the lights, place left and/or right switches in the EXTEND position, and then place the lights switch in the ON position to illuminate. The lamp will remain lighted until the switch is placed in the OFF position. Placing the left and/or right landing lights switches in the RETRACT position returns the lights to their recessed positions. The lights may be stopped in any position during extension or retraction if the landing lights switches are placed at center (off). Power to operate each lamp is 115-volt ac and power to operate each motor is 28-volt dc.

NOTE

To prolong bulb life while the landing lights are retracted, limit operation to five minutes on, five minutes off, etc.

INTERIOR LIGHTING.

BOARDING LIGHTS. Three red boarding lamps in the crown dome lights furnish illumination in the flight deck and entrance compartments. These lights are operated by a two-way switch arrangement in which either the boarding lights switch on the co-pilot's console or the boarding lights switch on the port side of the entrance compartment may be used. Power to operate these lights is supplied by 28-volt dc.

FORWARD HULL LIGHTS. Three white forward hull lights furnish general illumination for the entrance compartment and the flight deck. These lights are operated by a two-way switch arrangement in which either the boarding lights switch on the co-pilot's console or the boarding lights switch on the port side of the entrance compartment may be used. The master white lights switch, on the co-pilot's console, must be in NORMAL before actuation of either of the above switches is effective. If the master white lights switch is in the UP (or forward) position, all the above white lights will remain unlighted. This is also true for the white lights in the air lock compartment. Power to operate these lights is supplied by 28-volt dc.

INSTRUMENT PANEL ANTI-GLARE LIGHTS. Four instrument panel white floodlights are mounted under the glare shield in the cockpit for use under certain lighting conditions, such as thunderstorms, which cause glare on the instrument dials. These lights are controlled by the instrument panel flood knob on the cockpit overhead panel. This rheostat-type control varies the brilliance from OFF to BRIGHT as desired. Power for operating the anti-glare lights is supplied by 28-volt dc.

COCKPIT LOW-INTENSITY LIGHTS. The cockpit low-intensity lighting system, operating on 28-volt dc, furnishes red illumination for movement into and around the cockpit. This lighting supplements the panel lighting so that the controls may be located, and floods the instrument and control panel if the panel lights fail. The low-intensity system consists of four circuits: overhead panel, pilot's section, co-pilot's section, and instrument panel red floodlights. The overhead panel lights, the pilot's lights, and co-pilot's lights are controlled by a master red flood switch on the port side of the cockpit entrance hatch and three switches (on the overhead panel, the pilot's console, and the co-pilot's console) control the brilliance of each set of lights. The individual switches control the brilliance only. These switch positions are marked DIM, MEDIUM, and BRIGHT. The instrument panel red floodlights are controlled by knobs which turn the lights on and vary the brilliance as desired by the rotation of the control knob from OFF to BRIGHT.

COCKPIT PANEL LIGHTS. The red illumination lighting system for the cockpit panels is provided to identify readily the switches and controls on the cockpit panels. The brillance of the lights is controlled by nine knobs on the pilot's, co-pilot's, and the overhead lighting control panels. These rheostat-type switches control the lights on the pilot's console, pilot's sub-panel, co-pilot's sub-panel, co-pilot's console, overhead panel, instrument masks, pilot's flight panel, co-pilot's flight panel, engine instrument panel, pedestal lights, and the take-off and landing check lists. The check list lights operate at full brilliance only. A two-way toggle switch on this panel enables the pilot to select lighting for whichever check list he is using. Power to operate the cockpit panel lights is supplied by 26-volt ac.

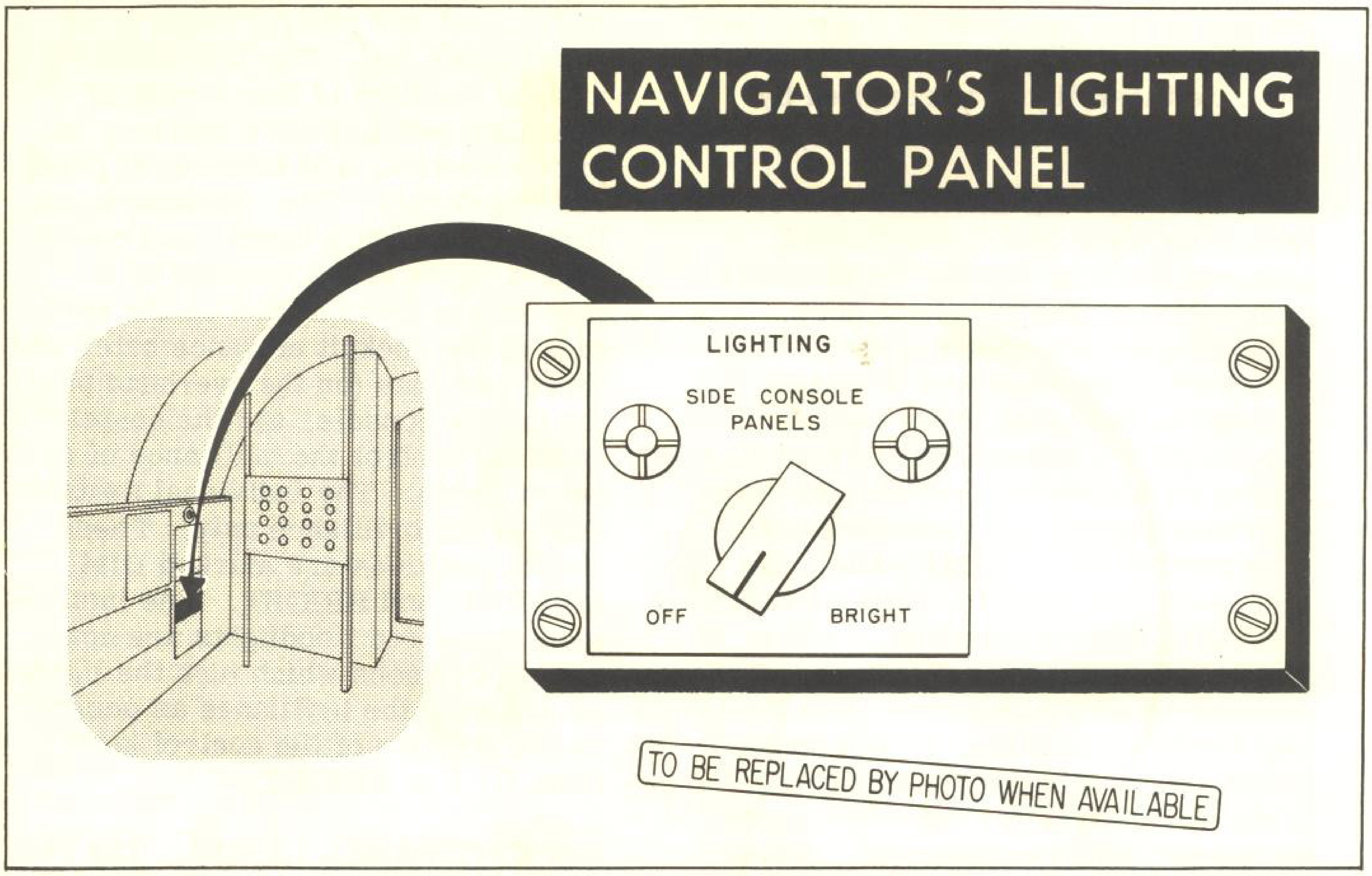


Figure 4-17

NOTE

All control panels at crew stations use edge lighting to facilitate easy reading of placard lettering. Individual knobs control intensity of lighting.

NAVIGATORS PANEL LIGHTS.

The navigator's lighting control (figure 4-17) is a rheostat mounted directly below the mine door seal heating panel. Side console panel lighting can be varied from OFF through BRIGHT.

RADIO OPERATOR'S PANEL LIGHTS. The radio operator's lighting panel (figure 4-18) has the following rheostat-type controls: red flood, side panel, console, AC power control panel, and DC power control panel. Individual knobs control intensity of lighting from OFF to BRIGHT. The master toggle switch, when in OFF position, disconnects the radio operator's panel lights. Power to operate these lights is supplied by 26-volt ac.

AIR LOCK COMPARTMENT LIGHTS. Two white and two red lights in the crown of the air lock compartment furnish general and restricted illumination respectively. These lights are operated by the COMPT LTS switch on the starboard side of the compartment forward bulkhead. Placing the switch in WHITE will turn on the white lights; placing the switch in RED will turn on the red lights. The center position is OFF. The white lights may be turned off by the master white lights switch on the co-pilot's console. See FORWARD HULL LIGHTS (this section)

Figure 4-18

for extinguishing the white lights by the master white lights switch.

MINE BAY COMPARTMENT LIGHTS. White lights for the mine compartment are operated by any of three switches, one on the forward bulkhead, one on the after bulkhead of the compartment, and one on right-hand distribution center. Lights operate on 28-volt dc.

MINE LOADING COMPARTMENT LIGHTS. Four white dome lights illuminate the mine loading compartment. These lights are operated by an ON-OFF switch on the forward bulkhead of the mine loading compartment. Lights operate on 28-volt dc.

APP COMPARTMENT LIGHTS. Three white lights in the crown supply general illumination throughout the APP compartment. These lights are operated by an ON-OFF switch in the mine loading compartment. Power is supplied by 28-volt dc.

OXYGEN SYSTEM.

High-pressure oxygen (1800 psi) is stored in two oxygen cylinders permanently installed in the forward port side of the electronics compartment. Three spare cylinders for long-range missions can be temporarily installed in the same location. This high-pressure oxygen is reduced before it enters the oxygen regulators. A single-point filler valve forward of the entrance hatch serves as a ground-refilling receptacle for the oxygen system. Automatic, positive pressure, diluter demand oxygen regulators are mounted on the pilot's and co-pilot's side consoles and at the navigator's and radio operator's stations. Figure 4-20 outlines approximate duration of the oxygen system at various altitudes.

NOTE

Only a pressure-breathing type oxygen mask should be used with this regulator.

OXYGEN REGULATOR CONTROLS.

OXYGEN SUPPLY LEVER. The oxygen supply lever on the bottom of the regulator panel (figure 4-19) controls the oxygen flow to the regulator.

CAUTION

Leave the supply lever ON during all flights so that the regulator will be available for instant use.

OXYGEN DILUTER LEVER. The oxygen diluter lever in the upper right corner of the regulator panel controls the oxygen-air mixture. When the lever is at NORMAL OXYGEN, the regulator will deliver oxygen and cabin air in the proper ratio, from sea level to 30,000 feet cabin altitude. Above 30,000 feet cabin altitude, the regulator supplies 100% oxygen automatically because an aneroid-operated air inlet valve closes at this altitude to shut off the cabin air. To obtain pure oxygen at any altitude, place the diluter in 100% OXYGEN position.

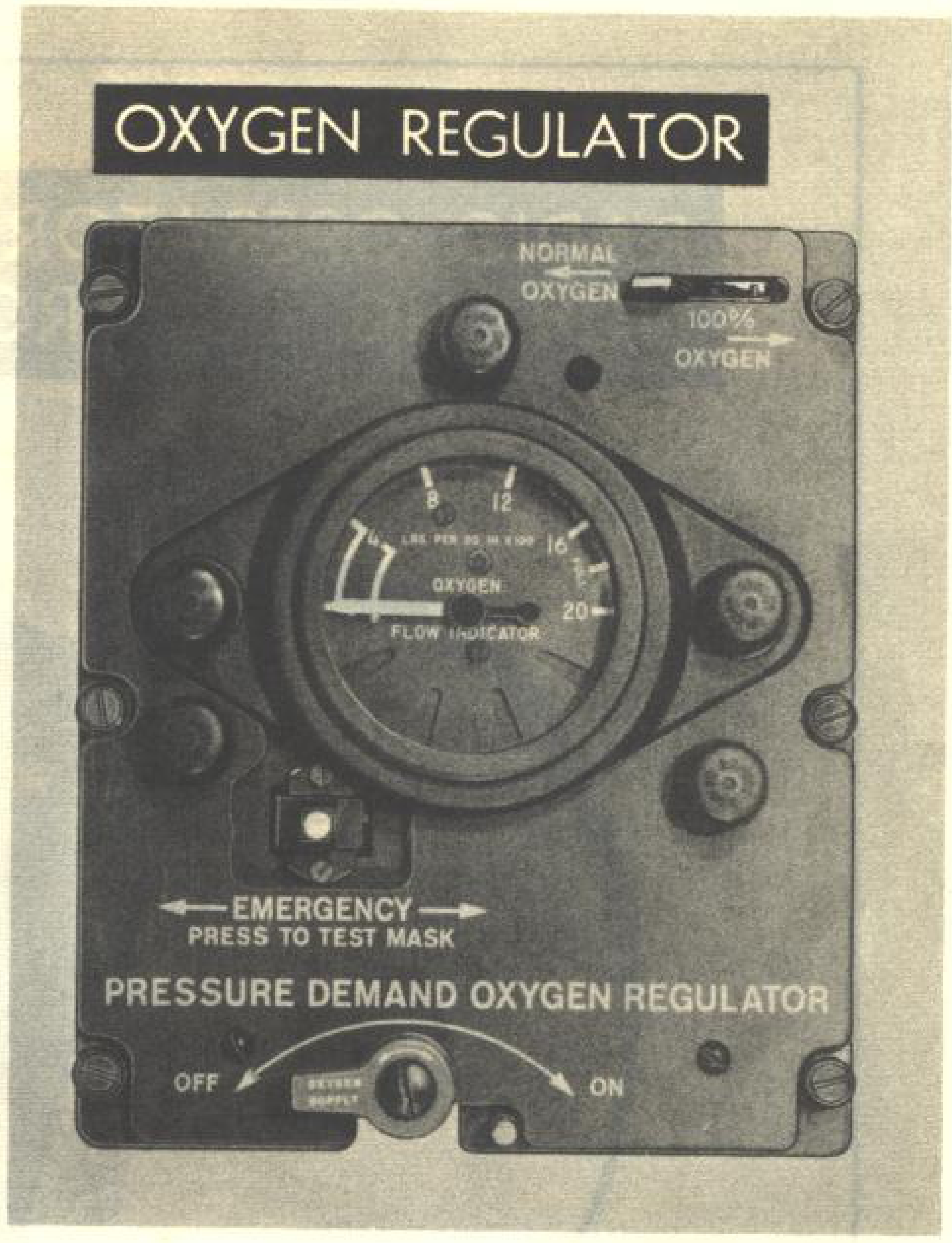
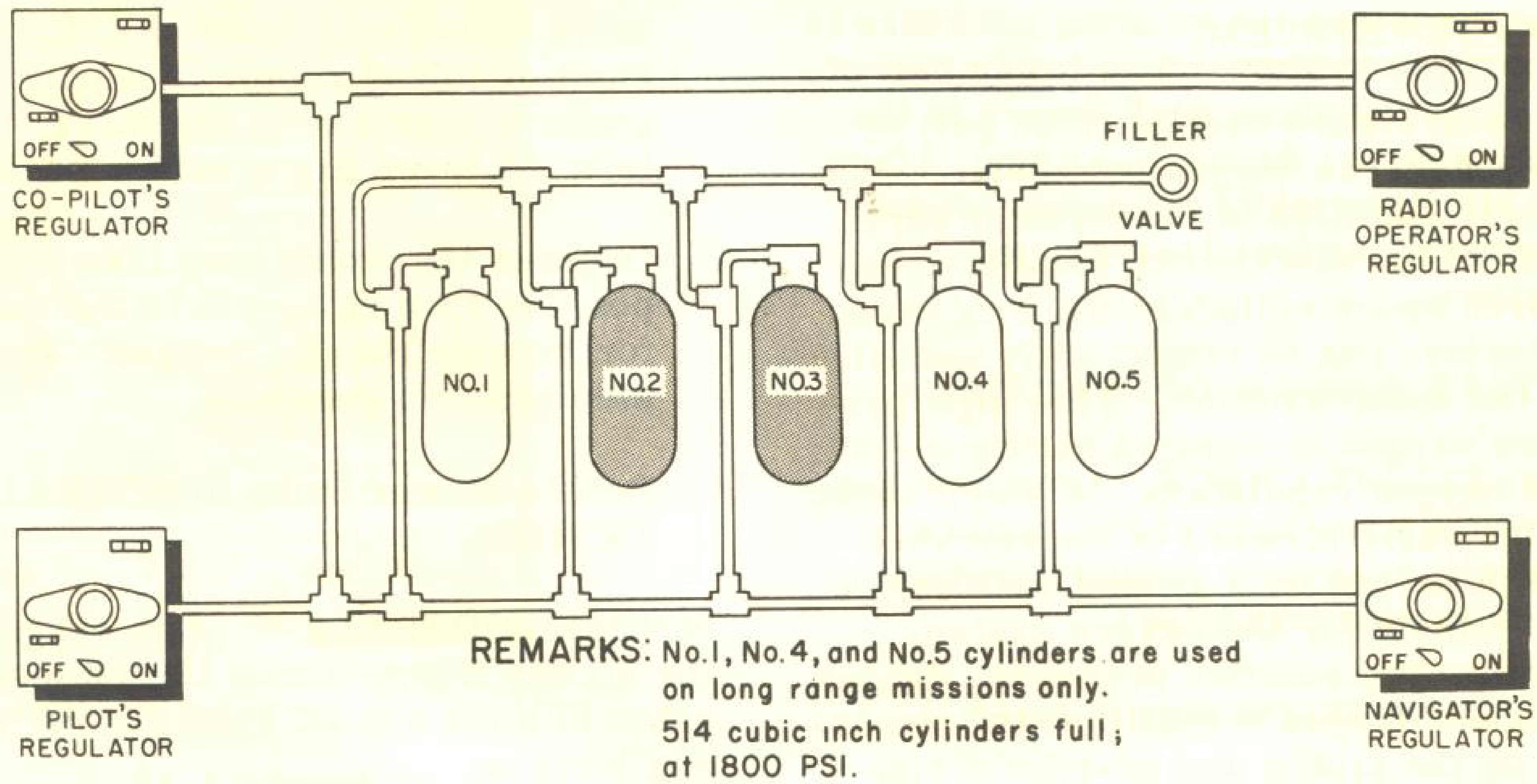


Figure 4-19

EMERGENCY OXYGEN LEVER. The emergency oxygen lever below the oxygen flow indicator supplies continuous positive pressure to the mask for emergency purposes whenever the control is deflected to either side of the center (normal position). Depress spring-loaded lever to supply positive pressure to the oxygen mask for leakage check; release this lever to resume automatic oxygen flow.

OXYGEN SYSTEM



OXYGEN DURATION CHART

UPPER FIGURE = 100% OXYGEN-HOURS
LOWER FIGURE = NORMAL OXYGEN-HOURS

CABIN ALTITUDE IN FEET	GAGE PRESSURE PSI (2 CYLINDERS)					
	1800	1500	1200	900	600	300
40,000	2.80	2.24	1.68	1.12	.56	DESCEND BELOW 10,000 FEET
	2.80	2.24	1.68	1.12	.56	
35,000	1.60	1.28	.96	.64	.32	
	1.60	1.28	.96	.64	.32	
30,000	1.28	1.02	.77	.51	.26	
	1.28	1.02	.77	.51	.26	
25,000	.96	.77	.58	.39	.19	
	1.60	1.28	.96	.64	.32	
20,000	.72	.58	.43	.29	.14	
	2.80	2.24	1.68	1.12	.56	
15,000	.64	.51	.38	.26	.13	
	3.92	3.14	2.35	1.57	.78	
10,000	.48	.38	.29	.19	.10	
	4.00	3.20	2.40	1.60	.80	

REMARKS: When all five cylinders are connected to the system, multiply hours by 2.5

Figure 4-20

OXYGEN PRESSURE GAGE AND FLOW INDICATOR.

A combination pressure gage and flow indicator is in the center of the regulator panel. The upper half of the gage registers the existing pressure in the oxygen system. The lower half of the gage registers each breath of the mask wearer; during breathing, black and luminous white segments appear alternately at four tear-shaped windows.

OXYGEN SYSTEM OPERATION.

PRE-FLIGHT CHECK. Complete the following pre-flight check, before take-off, to ensure proper functioning of the oxygen regulator:

Turn on oxygen supply lever.

Check oxygen pressure (1800 ± 50 psi when cylinders are fully charged).

Remove the oxygen mask, place the diluter lever in the NORMAL OXYGEN position, and blow gently into the end of the oxygen regulator hose. Resistance to the breath indicates satisfactory operation of the diaphragm and diluter air valve; little or no resistance to the breath indicates a faulty demand diaphragm or diluter air valve, a leaking mask-to-regulator tubing, or a faulty quick-disconnect.

CAUTION

Do not blow too hard during the test, as a leaky diaphragm may be seated and seem normal.

If the previous check proved satisfactory, connect the oxygen mask to the regulator hose, put the oxygen supply lever ON, and place the diluter lever in the 100% OXYGEN position. Breath normally through the mask when conducting the following check:

Observe the blinker operation for positive flow of oxygen.

Move emergency lever to either right or left of center to supply positive pressure to the mask. Return the lever to the center position.

Depress the emergency lever for a positive flow of oxygen to the mask for leakage check. Release lever to stop positive pressure.

Return diluter lever to NORMAL OXYGEN.

NORMAL OPERATION. Use oxygen for all day flights above 10,000 feet cabin altitude and all night flights from sea level up.

Fit mask to face and check for proper engagement of mask to the oxygen tubing and proper engagement of the tubing to the quick-disconnect on side console.

Oxygen diluter lever - NORMAL OXYGEN.

WARNING

Frequently check pressure gage for oxygen supply. Do not exhaust supply below 300 psi except in emergency. Below 300 psi, descend to 10,000 feet cabin altitude or lower where oxygen is not required. (Refer to Oxygen Duration Chart, Figure 4-20.)

If symptoms of anoxia are detected, or the oxygen regulator fails, immediately use emergency oxygen and descend below 10,000 feet cabin altitude.

Remember: lack of oxygen causes hypoxia which impairs vision and judgment.

PORTABLE OXYGEN SYSTEM.

The airplane is equipped with two 1800 psi portable oxygen bottles (walk-around type) which crew members use when entering the unpressurized aft area. Figure 4-21 shows the duration for the Portable Oxygen System.

WARNING

Crew members must use ear protection when they go aft during flight.

When flights are made above 10,000 feet altitude, crew members going aft will use the portable bottles, stowed on the port and starboard sides of the air lock compartment forward bulkhead.

The principal components of each portable oxygen system bottle consist of a diluter demand regulator which incorporates a flow indicator, a cylinder pressure gage, and an emergency valve. A strap which fits over the user's shoulder is attached to the bottle carrier assembly so that it may be conveniently carried while in use. The breathing hose assembly has a spring-type clip for attachment to the user's clothing.

NOTE

The crew member's personal oxygen mask can be used with the portable oxygen system.

PORTABLE OXYGEN DURATION CHART

UPPER FIGURES = 100% OXYGEN
LOWER FIGURES = NORMAL OXYGEN

OXYGEN GAGE

ALTITUDE FEET	GAGE PRESSURE					
	1800	1500	1200	900	600	300
35,000	0.8	0.6	0.5	0.3	0.2	DESCEND BELOW 10,000 FEET
	0.8	0.6	0.5	0.3	0.2	
30,000	0.6	0.5	0.3	0.2	0.1	
	0.6	0.5	0.3	0.2	0.1	
25,000	0.43	0.35	0.26	0.18	0.09	
	0.80	0.60	0.50	0.30	0.20	
20,000	0.33	0.27	0.21	0.14	0.07	
	1.30	1.00	0.80	0.50	0.30	
15,000	0.27	0.22	0.15	0.10	0.05	
	1.60	1.30	1.00	0.60	0.30	
10,000	0.2	0.16	0.12	0.08	0.04	
	1.7	1.40	1.00	0.70	0.30	

REMARKS: *Above figures represent man hours for 96 cubic inch bottle.*

Figure 4-21

PORTABLE OXYGEN CONTROLS.

OXYGEN DILUTER LEVER. A two-position diluter lever is provided on each oxygen regulator. With the diluter lever in the NORMAL OXYGEN position, the regulator automatically mixes air with oxygen in correct proportions and supplies this mixture to the mask until a cabin altitude of 30,000 feet is reached. With the lever in 100% OXYGEN position, the regulator supplies pure oxygen to the mask for emergency use.

PORTABLE OXYGEN EMERGENCY KNOB. If the oxygen regulator fails, a red emergency knob above the diluter demand on the regulator can be turned counterclockwise to open the regulator emergency valve, thus supplying continuous 100% oxygen to the mask.

WARNING

If the emergency knob with the existing pressure-breathing mask is opened fully, the high pressure (1800 psi) is unregulated. Oxygen released suddenly under this pressure into the mask could cause internal injury.

NORMAL OPERATION OF PORTABLE OXYGEN BOTTLE SYSTEM.

Connect mask to regulator.

Turn knob (on top of bottle) counterclockwise to supply oxygen to the regulator.

Set the oxygen diluter lever in NORMAL OXYGEN to supply oxygen to the mask.

CAUTION

Do not exhaust portable oxygen bottle supply below 300 psi. Do not use portable oxygen bottles when above an altitude of 30,000 feet.

NOTE

As the airplane ascends to higher altitudes where temperatures normally are quite low, the oxygen cylinders cool and the oxygen gage pressure is reduced, sometimes quite rapidly. With a 100°F decrease in cylinder temperature, the gage pressure can be expected to drop approximately 20%. This rapid drop in temperature should not be a cause for alarm because all the oxygen is still in the cylinder. Descending to warmer altitudes will cause the pressure gage to rise to its correct reading. A rapid decline in oxygen pressure during level flight or descent is not ordinarily due to falling temperatures, of course. When this occurs, leakage or loss of oxygen must be suspected.

AUTOMATIC PILOT XW-4.

The XW-4 autopilot is capable of performing straight and level flight, coordinated turns, climbs, and descents with or without maneuvering turns; generating yaw damping signals; and maintaining constant pressure altitude or constant true airspeed. The autopilot, powered by 115-volt ac and 28-volt dc, uses hydraulic pressure from the utility system to actuate the flight control mechanisms.

The autopilot can be engaged during normal maneuvers without producing abrupt changes in control or airplane attitude. The autopilot can be overpowered manually with a maximum force of 50 pounds. A G-limiter, that makes the autopilot "fail safe", returns the system to STANDBY if the acceleration exceeds +2.5g or -1.2g.

Three rate gyro (pitch, yaw, and roll), a vertical gyro, a true airspeed unit, a compass coupler, and a lateral accelerometer supply signals to associated magnetic amplifiers to provide smooth coordination of the flight controls in both entry into maneuvers and recovery to straight and level flight. The gyro horizon provides a reference for measuring airplane displacement in the pitch and roll axes.

As the autopilot functions, it is capable of the following:

Commanding coordinated turns in a speed range from 150 to 600 knots IAS at sea level, or 525 knots TAS at 45,000 feet.

Commanding rates of climb and dive through a maximum of 12,000 feet per minute.

Maintaining the airplane at a constant pressure altitude within ±10 feet from sea level up to 10,000 feet, and to within ±30 feet from 10,000 feet up to 30,000 feet.

Maintaining the airplane at a constant true airspeed within six (6) knots.

Providing yaw damping throughout the speed and altitude range of the airplane by controlling the rudder.

YAW DAMPER.

The yaw damper switch on the emergency overhead panel is connected so that the autopilot can be turned on only when the switch is in NORMAL. The rudder is controlled by signals proportional to yaw rate for directional stability and proper damping of yawing oscillations.

TRIM INDICATOR. (See figure 4-22.)

The automatic trim indicator on the co-pilot's instrument panel displays

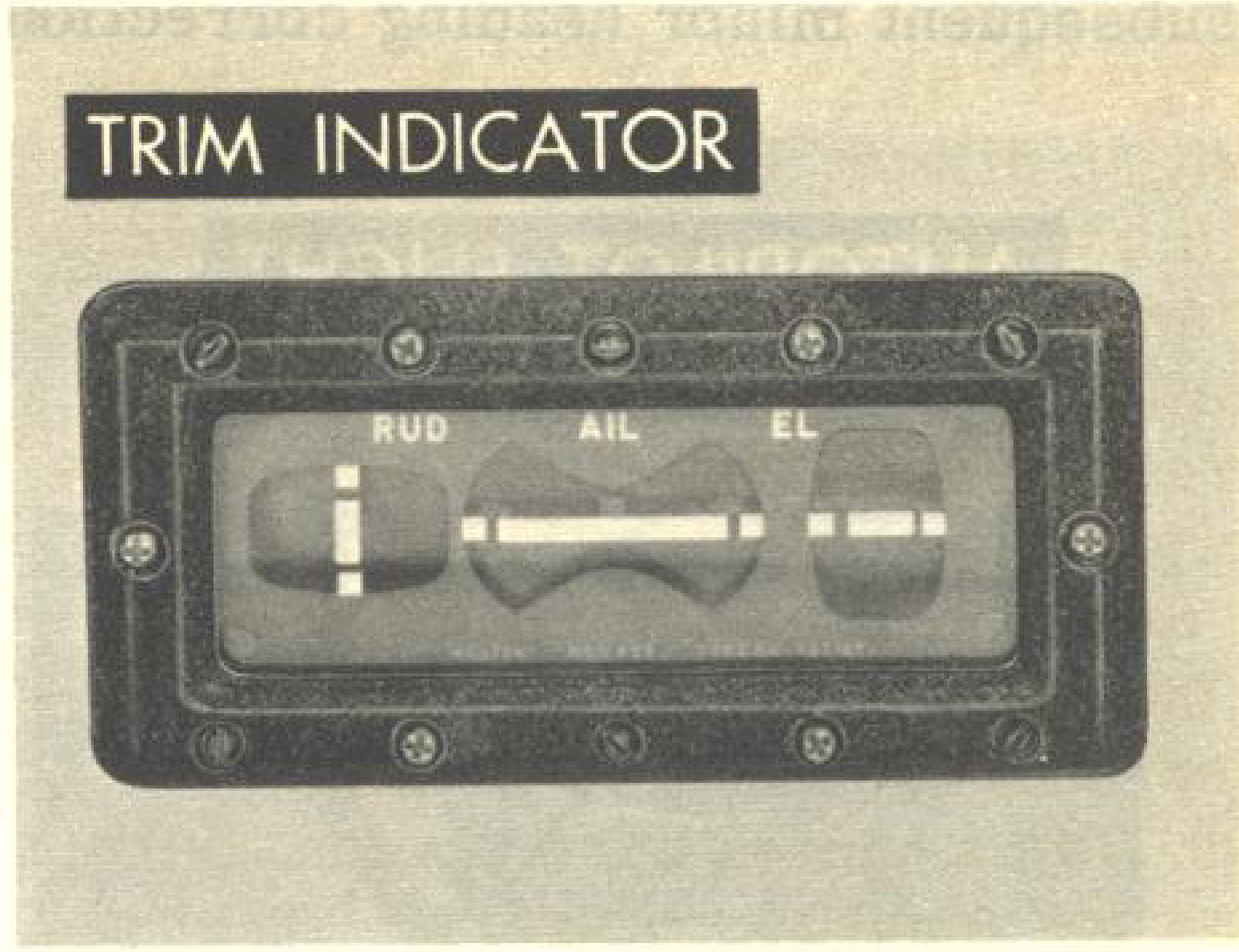


Figure 4-22

visually the displacement of the trim due to the autopilot in the yaw, roll, and pitch axes. Individual trim indicators are labeled RUD-AIL-EL. The indicator serves a dual purpose in pitch and roll: it indicates the operation of the autopilot; and, before autopilot engagement, it indicates that when the airplane is out of trim the autopilot should not be engaged because of improper synchronization. Disengaging the autopilot while there is any deflection of the pitch or roll indicators (out-of-trim condition) will cause an unintentional maneuver of the airplane.

The yaw trim indicator shows the amount of rudder deflection that the autopilot actuator is holding.

FLIGHT CONTROLLER (figure 4-23).

The flight controller, fitted into the cockpit pedestal for convenient operation by either pilot, contains all the controls necessary for normal operation of the autopilot.

The turn knob on top of the controller, permits coordinated turns by rotation to left or right, the angle of bank proportional to the deflection from neutral. The course trim knob can be depressed and turned in the desired direction for subsequent minor heading corrections.

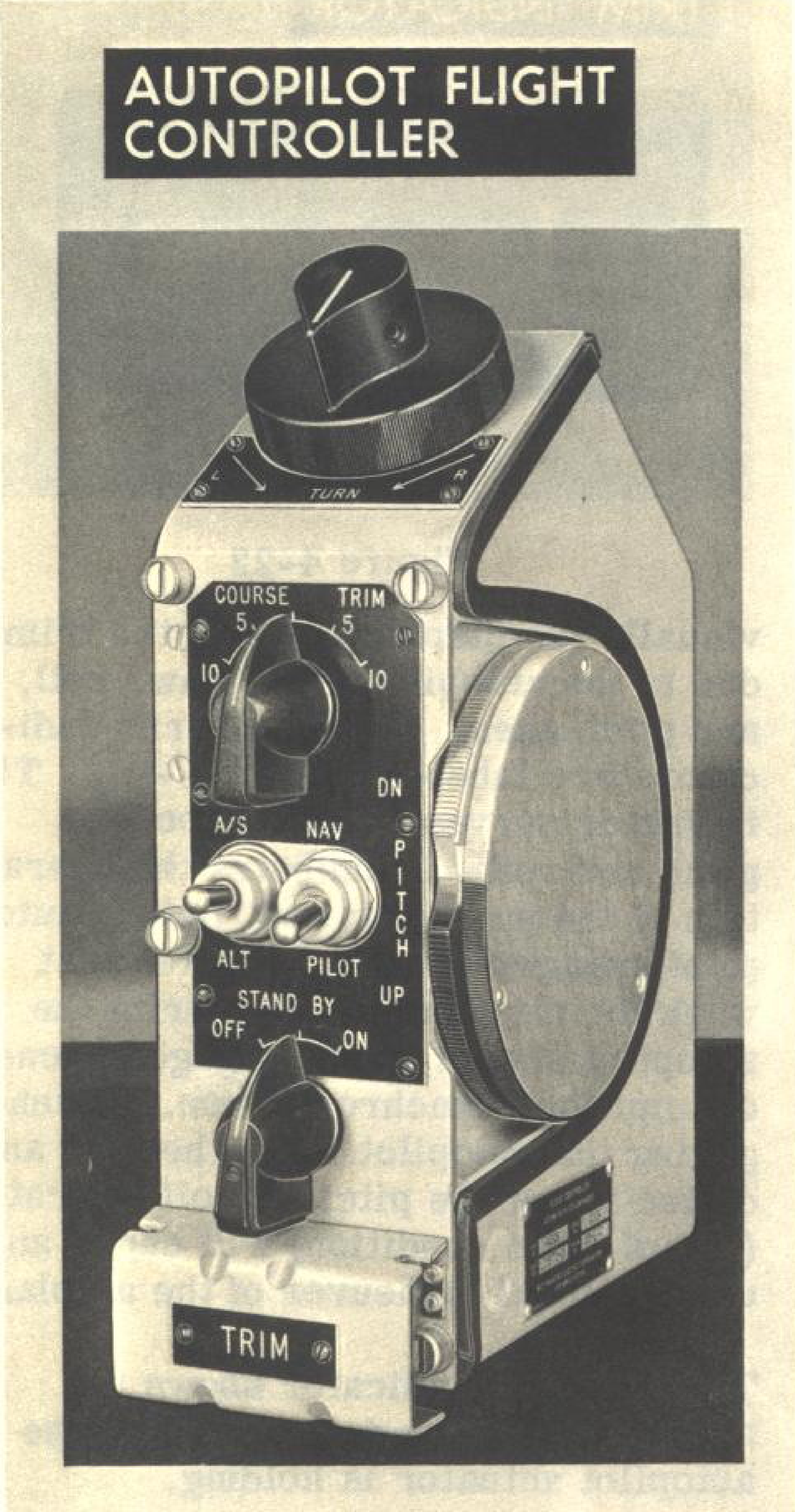


Figure 4-23

The Altitude/Airspeed switch is the three-position type; the center position engages attitude control. If the autopilot is engaged with the switch in attitude position, the airplane will maintain the attitude at time of engagement. ALTITUDE or AIRSPEED is selected after the airplane is properly trimmed, and the desired altitude or true airspeed is reached. Prior to autopilot engagement, the switch must be in the center position. A two-position selector switch is provided for PILOT control or NAV control (Automatic Navigator).

The pitch control wheel, on the right side of the flight controller, is automatically returned to the neutral position after the control is released. To change pitch attitude, rotate the control wheel to UP or DN as desired and hold throughout the maneuver. The controller knob (OFF, STANDBY, ON) energizes the autopilot system. When the switch is placed in STANDBY, electrical and hydraulic power will be supplied to the autopilot, through the servos will be disconnected. The ON position engages the autopilot for airplane control.

NOTE

A 15-second delay period is automatically timed in STANDBY before engagement for warm-up and synchronization of the auto-pilot system. The auto-pilot cannot be engaged if the locking devices associated with the pitch and roll channels do not lock their respective actuator shafts or if electrical power is not being supplied to the system. If such a condition exists, the controller switch will snap back to STANDBY.

Roll trim and yaw trim control knobs, on the bottom of the flight controller, are used to reduce minor trim errors. Clockwise rotation of these knobs corrects to the right; counterclockwise rotation corrects to the left. Both controls are protected by a guard marked TRIM which is retained in the closed position by spring locks. The guard disengages heading control when opened.

CONSTANT ALTITUDE CONTROL.

Flight at constant altitude is maintained by an aneroid altitude sensor which reacts to changes in barometric pressure. When altitude control is desired, proceed according to normal operating procedure, selecting the desired altitude by referring to the cockpit altimeter. When altitude is reached, place the altitude/airspeed selector switch in the ALTITUDE position.

CONSTANT AIRSPEED CONTROL.

Constant airspeed control is used primarily for cruise control. A true airspeed coupler links the airspeed sensor to the automatic pilot, converting airplane speed information into command signals for the stabilizer channel of the automatic pilot. These command signals control the true airspeed of the airplane. To engage airspeed control, proceed according to normal operating procedure. When the autopilot is set up and the desired airspeed has stabilized, as shown by the airspeed indicator, place the altitude/airspeed selector switch in the AIRSPEED position.

TURN CONTROL. The turn control executes coordinated turns with the autopilot. The normal position for the knob is in the neutral detent (knob pointing aft). When the knob is neutralized, the airplane gyro-magnetic compass relays directional signals to the autopilot and, at the same time, provides the pilot with a visual heading reference.

Moving the knob from the detent position to the right or left results in an autopilot-controlled coordinated turn in the respective direction, at a bank angle proportional to the amount of knob turn — up to a maximum of 45 degrees of bank. When the knob is returned to the neutral detent, the airplane will roll smoothly out of the turn and automatically lock on the heading assumed when completing the turn.

AUTOPILOT OPERATION.

To operate the XW-4 Autopilot, proceed as follows:

Compass control switch - COMPASS CONTROL.

Yaw damper switch - NORMAL.

Airplane - Manually trimmed for desired flight attitude.

Flight Controller:

Pilot/Nav switch - PILOT.

Trim Indicator - Check all indicators centered.

Altitude/Airspeed Selector switch - As desired.

Controller knob - STANDBY.

(Allow 15-second delay period before engaging).

NOTE

The turn, course trim, roll and yaw knobs, and the pitch control are automatically neutralized in straight and level flight when the autopilot selector switch is placed in STANDBY.

Controller knob - ON for engaging.

To Disengage Autopilot - Controller switch OFF.

EMERGENCY PROCEDURE.

In the event of autopilot malfunctioning, such as a hardover in pitch or roll, depress the temporary disconnect button. A temporary disconnect button, on the outboard grip of either pilot's control wheel, disengages the autopilot only while the button is depressed; it does not disconnect the yaw damper (switch on emergency overhead panel). If the temporary disconnect button fails to operate, turn the controller knob on the face of the flight controller to OFF.

NOTE

The performance data included in the Autopilot System are estimated. Further information will be available after flight test of equipment.

SINGLE-POINT FUELING SYSTEM.

All tanks are normally fueled from ground equipment or water surface vessels through the single-point fueling connector aft of the forward beaching gear hatch on the port side of the airplane. The fuel passing through this connector must not exceed 55 psi. (approximately 400 gpm when all tank valves are open). The fuel is then forced through a fuel manifold, then it passes through electrically operated valves to the wing, auxiliary, mine bay, and service tanks until each is full. Each fuel tank has a float-operated shut-off valve which automatically closes at a pre-determined point in fueling to prevent the tank from overflowing. If this shut-off valve fails, a thermistor, when cooled sufficiently by the rising fuel, electrically closes the fueling valve. The system requires 28-volt dc and 115-volt ac for operation.

FUELING CONTROLS.

The auxiliary fuel control panel (figure 1-12) contains all the necessary transfer pump, fueling valve, crossfeed, and cross-fuel valve controls for fueling operation.

NOTE

Following the fuel flow diagram on the panel simplifies fueling and fuel transfer operations.

FUELING INDICATORS.

The auxiliary fuel control panel contains a fuel quantity indicator for each tank (except the service tank indicators which are on the main fuel panel), an indicator light for low-level warning of each service tank, a primary fuel shut-off failure warning light, a fuel quantity indicator test switch, and a light to denote AUX POWER ON for manual operation of pumps and valves.

PRIMARY FUEL SHUT-OFF FAILURE LIGHT.

This warning light, when on, indicates that the primary float valve has failed to shut off the fuel inlet, and the level for the indicated tank is above the normal full level. The thermistor in the tank, when cooled by the fuel, will then close the valve. One light is provided for all tanks. An increase in fuel quantity on a particular quantity indicator denotes a defective valve in that tank.

FUEL TANK FILLER FLOAT VALVE TEST.

The fuel tank filler float valve toggle switch on the port side of the air lock compartment tests the float-operated shut-off valves by electrically actuating all of them to the closed position when the switch is placed UP. If the switch is placed UP while the airplane is being fueled, all flow from the fueling unit should stop. Continued flow would indicate a faulty valve and individual quantity gages should be checked to locate it.

FUEL TRANSFER OPERATION.

During normal operation, fuel is automatically supplied from the two service tanks. As the fuel in these tanks is consumed, it is replaced with fuel from the two wing tanks and two auxiliary tanks.

In the manual transfer of fuel, a constant pressure must be maintained in the transfer manifold from all auxiliary tanks. By selection of the transfer control switch to the forward service tank only, all auxiliary tanks will pump to the forward service tank only. If selection is to the aft service tank, all auxiliary tanks will pump to the aft service tank only. Fuel is then pumped from the selected tanks to the transfer manifold. From the manifold it flows, according to demand, to either or both service tanks through their corresponding valves. During transfer operations, the service tank fueling valve must be closed to prevent pressurization of the filler lines.

FUELING OPERATION.

If ashore, the airplane and fuel pumping equipment must be grounded during the fueling operation.

Before fueling, turn off the knobs on the pilots' fuel panel for the engine shut-off valves, the booster pumps, and valves control. Then set the transfer control knob to AUX PANEL so the radio operator may assume control as follows:

Supply 28-volt d-c and 115-volt a-c power.

Attach fueling nozzle to single-point fueling connector, with fueling nozzle turned OFF.

All warning lights - Press to test.

All Transfer Pump Switches - AUTO ON or OFF.

NOTE

Turn off all booster and fuel transfer pumps during fueling as all tanks are pressure-filled.

Cross-fuel valve switch - OPEN.

All fueling valve switches - OPEN.

Fueling nozzle - OPEN.

Fuel level float control valve switch - UP, to test float valve operation (after fuel flow has been established).

Check fuel indicators for quantities. Close fueling valves when tanks are filled. (After fueling valves are closed, a suction should be placed on the refueling hose to siphon all fuel out of the airplane filler lines.)

Fueling nozzle - OFF, when all tanks are full.

Cross-fuel valve switch - CLOSE.

DEFUELING OPERATION.

Individual tanks can be defueled by normal transfer when space in other tanks is available and the transfer pump in the affected tank is operative.

When defueling is necessary for maintenance and repair of the tanks, manual control of each tank's fuel pump and associated valves forces fuel from the tanks, through the manifold, and out the pressure-fueling inlet connector. All tanks can be defueled as follows:

If ashore, ground the airplane and fuel pumping equipment.

Supply 28-volt d-c and 115-volt a-c power.

Pilots' fuel control panel:

Engine Shut-off Valves Knobs - OFF.

Booster Pumps and Crossfeed Valves Control Knobs - ON.

Transfer Knob - AUX PANEL.

Radio operator's fuel control panel:

Tank Transfer Pump Switches - MAN ON.

All tank fueling valves - OPEN.

No. 1 and No. 2 Fuel Transfer Valves - OPEN.

Defueling nozzle - OPEN.

When any fuel quantity indicator shows empty, its transfer pump switch should be returned to OFF.

NOTE

If defueling of only the auxiliary tanks is desired, the service tanks fueling and the cross-fuel valve switches are the only ones to be OPEN. Operating each auxiliary tank auto-manual pump control switch on the panel empties the corresponding tank.

SUCTION DEFUELING.

When no electrical power is available for fuel pump operation or if, at any time, it is desirable, the airplane can be defueled by suction. The only equipment required is an outside storage tank, a suction pump, and a fuel line attached to the single-point fueling connector. Proceed as follows to defuel tanks:

Attach fuel line to single-point fueling connector.

Service Tank Fueling Valve - OPEN.

Cross-fuel Valve - OPEN.

Transfer Valves - OPEN.

Start suction pump for defueling.

NOTE

If only certain tanks are to be defueled, close the transfer valves to stop flow from the service tanks and use manually operated valves in the outlet lines of other tanks to stop flow from their respective tanks.

NAVIGATION EQUIPMENT.

G-2 COMPASS SYSTEM.

The G-2 compass system provides an accurate and continuous indication of the airplane heading by combining the principles of the magnetic compass and the gyroscope. The system, supplied by 115-volt ac and 28-volt dc, consists of a master direction

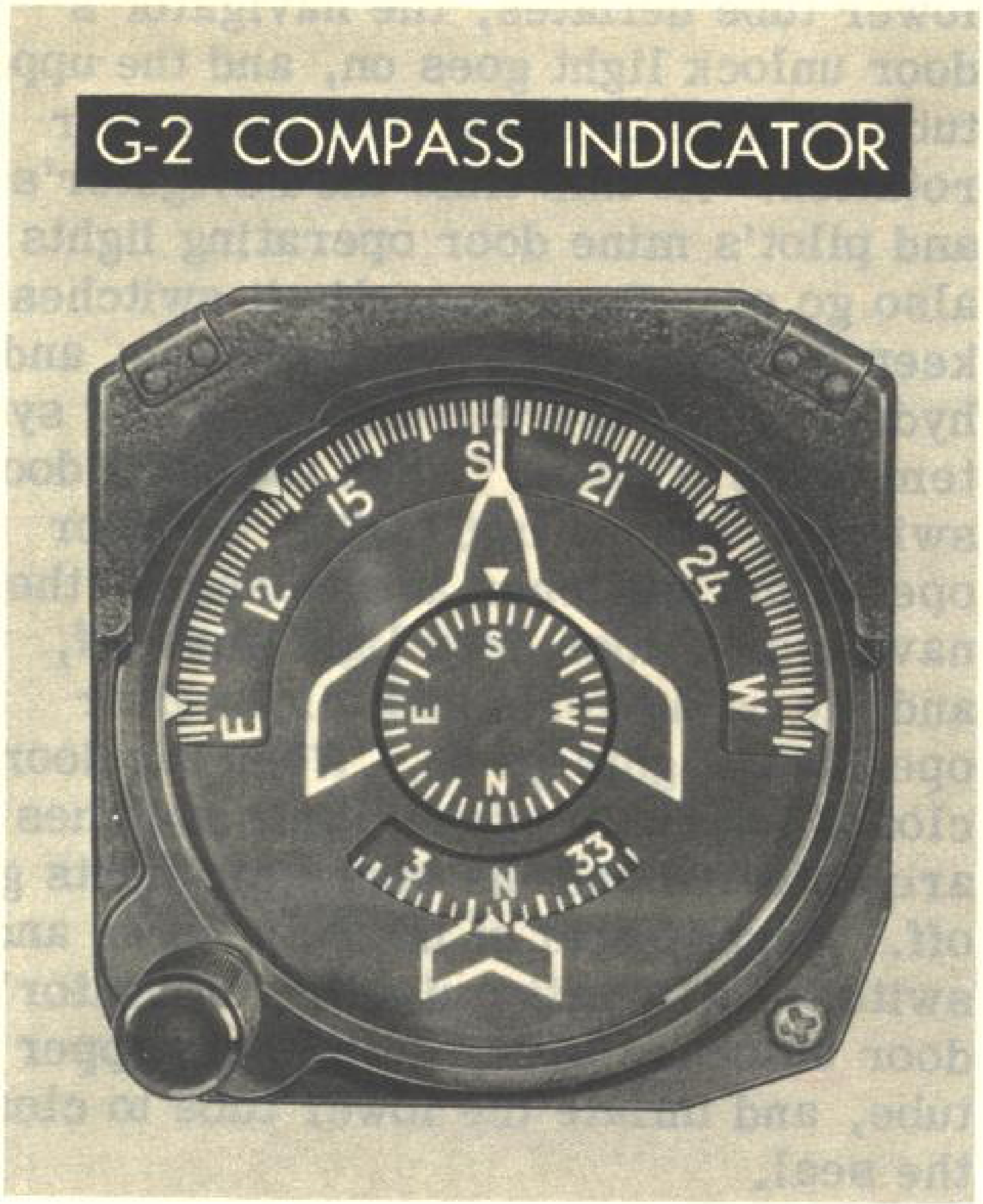


Figure 4-24

indicator on the co-pilot's instrument panel, and one below the auxiliary fuel panel, a remote transmitter in the port wing, and an amplifier in the electronics compartment. The remote compass transmitter (a magnetic compass) sends the airplane's magnetic heading to the master direction indicator, where it is compared to the heading of the gyro element. Any differential error is relayed through the amplifier back to the gyro element of the indicator to slave the gyro until the gyro and compass headings agree. During compass-controlled operation, the gyro is slaved to align with the magnetic heading of the airplane at the rate of approximately four degrees per minute. For example, if the initial gyro setting is twelve degrees from the magnetic compass heading of the airplane, the master direction indicator will take about three minutes to align itself. The compass control switches on the pilots' instrument panels connect either the master direction indicator for normal flight or the free gyro system during sustained turns, maneuvers, or flights over magnetically unreliable regions.

COMPASS-CONTROLLED OPERATION. Make sure the G-2 compass control switch is in COMPASS CONTROL. Do not consider the indicator reading reliable until the gyro has attained operating speed (normally takes three minutes). For initial setting of heading:

Depress the reset knob to cage the gyro and turn the knob until the outer and inner dials on the master direction indicator read approximately the same.

Hold knob in for about three seconds before releasing straight out. From this approximate heading, the master direction indicator will align itself to indicate the correct airplane magnetic heading.

FREE GYRO OPERATION. Because of excessive dip of the earth-magnetic field near the magnetic poles, a magnetic compass becomes very erratic in these areas. In counteracting this error, a free gyro type of indicator has a definite advantage over a compass-controlled type. To change the G-2 compass system to free gyro, proceed as follows:

Compass Control Switch - FREE DIRECTION GYRO.

Depress reset knob and turn to select desired heading.

NOTE

When used without compass control, the correspondence, or inner dial, will show the unstabilized magnetic compass heading. With precession of the gyro up to 15 degrees per hour in most latitudes, reset the gyro manually at intervals to compensate for drift error.

To return G-2 compass back to compass-controlled operation, follow normal starting procedure.

ARMAMENT EQUIPMENT.

MINE DOOR.

The mine door is a removable section of the hull bottom on which mines, photographic equipment, and a variety of other stores can be loaded. 180° rotation of the door in flight, by use of hydraulic pressure, exposes the load into the airstream. When closed, the mine door is made watertight by a pneumatic seal around the periphery of the door. Stores are electrically released by controls at the navigator's mine laying panel or an emergency control system in the cockpit. When the airplane is in the water, stores are loaded through a hatch in the hull crown. Previously loaded mine doors can be installed when the airplane is on the ramp.

NORMAL OPERATION. The mine door switch on the navigator's armament panel (figure 4-25) is labeled OPEN and CLOSE. Hydraulic pressure from the utility hydraulic system unlocks the mine door when the switch is placed at OPEN. Inflation and deflation of the mine door seals begins automatically as soon as either lock is disengaged. When both locks are disengaged, the lower tube deflates, the navigator's door unlock light goes on, and the upper tube inflates to allow free mine door rotation. At this time the navigator's and pilot's mine door operating lights also go on. Door open-limit switches keep the door from overtraveling, and hydraulic pressure from the utility system holds it open. When the mine door switch is placed in CLOSE, the door open-limit switches are released, the navigator's door open light goes off, and the navigator's and pilot's door operating lights go on. When the door closes, the door close-limit switches are actuated and the operating lights go off. Engagement of the door locks and switches will extinguish the navigator's door unlocked light, deflate the upper tube, and inflate the lower tube to close the seal.

Mine Door Safety Pin. This safety pin in the mine door lock mechanism precludes accidental unlocking of the door when a loss in hydraulic pressure occurs in the utility system. A handle on the port side of the pilot's sub panel controls movement of the safety pin in the port mine door lock. Pulling the handle out and turning it to LOCK disengages the safety pin from the mine door lock. To resafety the mine door lock, push handle in. The handle is locked in both the "in" and "out" positions.

Mine Door Seal Heating. Placing the switch on the mine door seal heating control panel (at the navigator's station) in AUTO ON eleminates the possibility of the mine door seal freezing. Whenever the ambient temperature falls below 10°C (50°F), heat is automatically applied to the seal. A flag indicator, with the switch in AUTO ON, shows crosshatching when heat is being applied to the seal. The navigator can also control seal heating manually by placing the switch in MAN ON.

NAVIGATOR'S ARMAMENT CONTROL PANEL

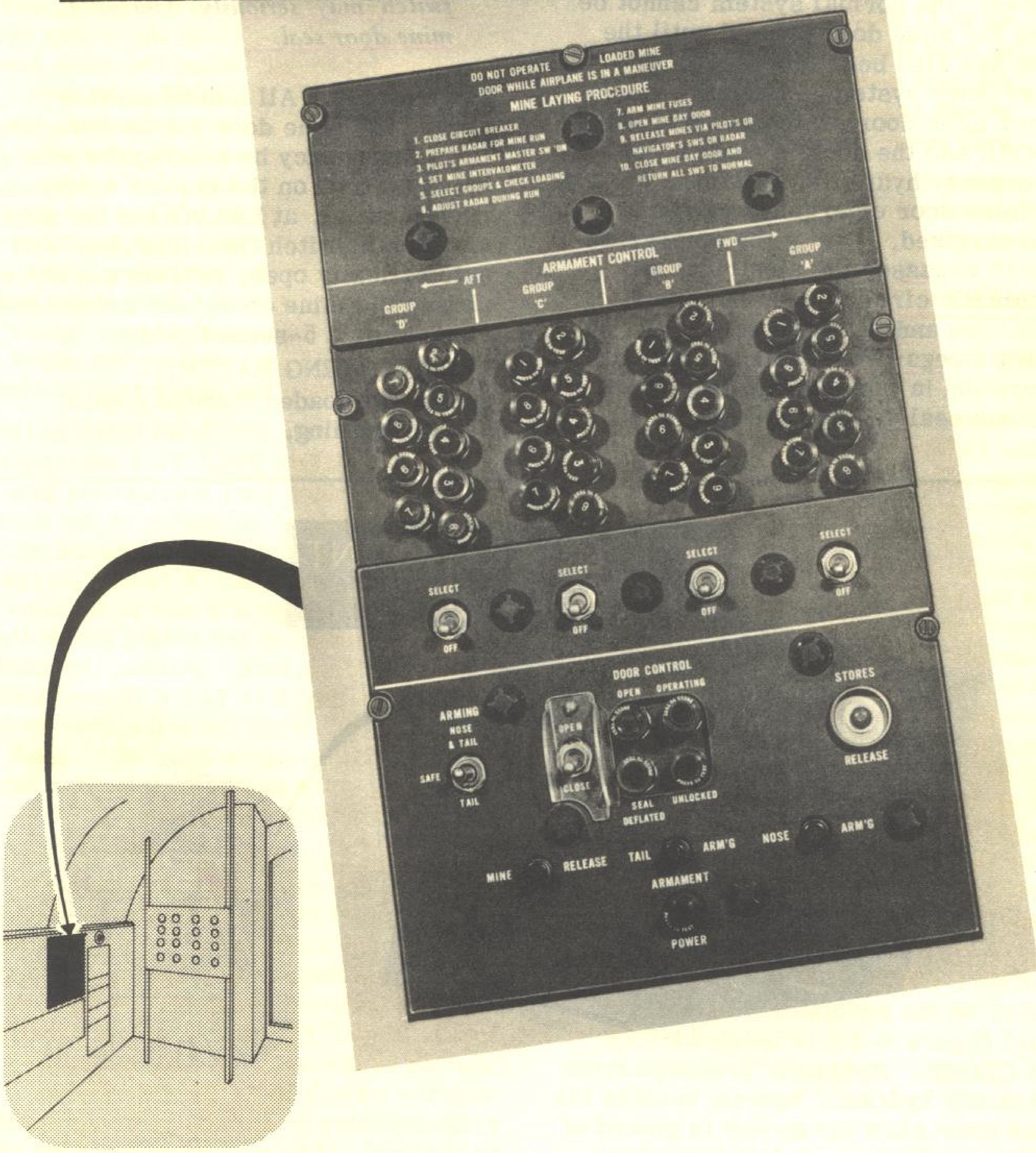


Figure 4-25

EMERGENCY OPERATION. Placing the master armament switch on the pilot's console (figure 4-26) to ON and the emergency switch to OPEN actuates the door through use of the emergency hydraulic system. Once the door has been opened by use of the emergency system, the normal system cannot be used for mine door control until the door has also been closed with the emergency system. When the emergency mine door switch is returned to CLOSE and the door is closed, the emergency hydraulic system is off and all mine door emergency valves are de-energized. Use of the emergency switch bypasses the electrical and pneumatic circuits used in normal operation and the mine door will operate regardless of seal position. Operation in this manner may cause serious seal damage and result in mine bay flooding on landing. Additional emergency procedures are covered in Section III.

CAUTION

Operation of either the pilot's emergency mine door switch or the salvo switch may seriously damage the mine door seal.

Salvo Switch. All stores carried aboard the mine door can be jettisoned in an emergency by placing the pilot's salvo switch, on the master armament control panel, at SALVO and the master armament switch ON. The door will automatically open, jettison any stores aboard the mine door, and automatically close after a 5-second delay.

MINE LOADING HATCH.

Stores are loaded through a split, center-opening, overhead hatch in the

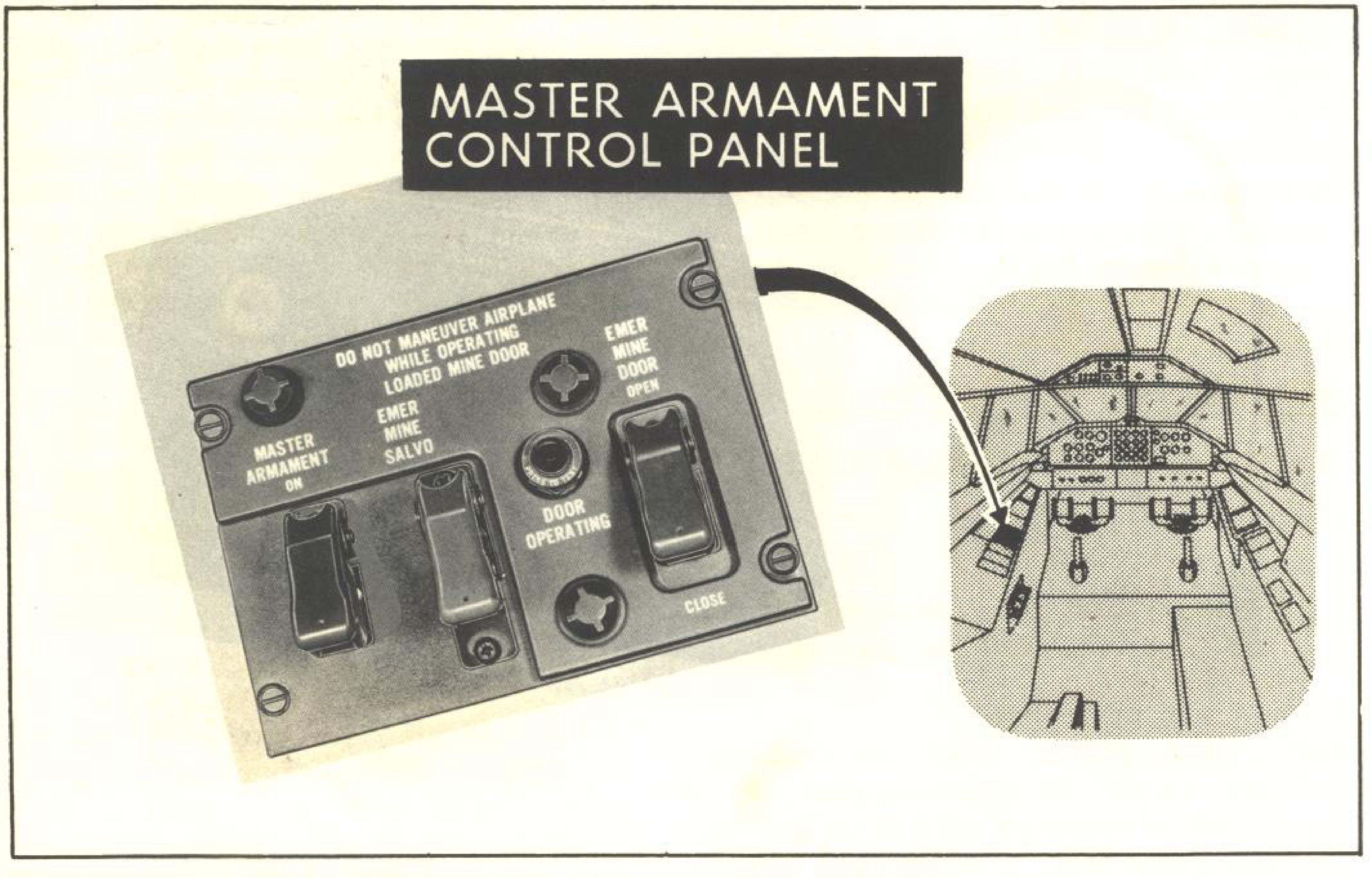


Figure 4-26

mine loading compartment. When the halves of the hatch are open, they also act as a working platform. The hatch is extended or retracted by electrically driven 28-volt d-c screw jacks. When in the fully open or closed position, a limit switch automatically stops the d-c motor.

OPERATION. Before opening the hatch, make certain that the manual safety locks at either end of the hatch are disengaged. If the door is opened, and the locks are not disengaged, severe damage to the screw jacks and mounting structure will result. To disengage the safety locks, first remove the pip pins,then lift up on the vertically mounted handles at both ends of the hatch. To open the hatch, place the mine loading hatch switch on the aft distribution panel in OPEN.

To close the hatch, make sure the area is clear, then place the switch in CLOSE. When the hatch is fully closed, engage both safety locks. To engage the locks, pull down on the safety lock handles, then install the pip pins.

It is imperative that the mine loading hatch be closed and the safety locks engaged during flight. Double check for proper engagement of the hatch and locks before take-off.

MISCELLANEOUS EQUIPMENT.

LAUNCHING, MOORING, AND BEACHING.

NOTE

Standard seaplane launching and beaching techniques are applicable to this airplane.

BEACHING GEAR. When the airplane is waterborne, the beaching gear can be installed or removed with little difficulty in two operations. The forward beaching gear will caster through 360°. A lock pin mechanism is used to lock this gear in the fore and aft positions. The after beaching gear is fixed along the longitudinal axis of the airplane.

Brakes, installed on the after beaching gear, allow use of engine power for taxiing on the ramp. The rudder toe pedals are used to control the brakes differentially or simultaneously for steering or braking. The brake hose on the after beaching gear must be connected to the quick disconnect fittings inside the airplane. The brakes can also be operated manually by personnel on the ground. (Approximately 11 full brake applications can be obtained from a fully charged brake air bottle.)

LAUNCHING FROM RAMP. The airplane is towed or taxied to the head of the ramp. Buoy lines are made fast to the bollards in the entrance compartment and the forward beaching gear is locked in anti-swivel. The airplane is eased down the ramp until waterborne, maintaining the bow lines taut enough to keep the airplane straight with the ramp. The beaching gear is then removed by disconnecting first the chine pin release on the top outboard side of the gear, then the upper trunnion pins release from a lever below the hatch sill.

Figure 4-27

The gear is pushed free of the airplane

and pulled ashore. The after gear is pulled with handling lines; the forward gear is towed around the end of the wings by a small boat, then to shore.

CAUTION

Do not attempt to float the forward gear under the wing. Insufficient clearance exists and damage to the wing could result.

The No. 1 and No. 4 engines are then started and, upon command of the pilot, all lines are cast off.

MOORING WITH BRIDLE LINE. When this airplane is moored at a permanent XP6M-1 installation, use of a bridle line floated between two buoys is recommended. With this type of mooring, the keel hook must be extended after landing. Engines No. 2 and No. 3 must be cut, then the airplane taxied with No. 1 and No. 4 operating at IDLE. Full hydroflaps are used to reduce speed to 2 knots. Taxi the airplane between the buoys. When the keel hook closes on the bridle line, cut engines to complete mooring procedure.

MOORING TO BUOY. A single-buoy pickup can be made by using a boat hook from the entrance hatch on the port side of the airplane. The mooring line is made fast to a removable bollard, at the entrance hatch, to the buoy. The bollards are normally stowed in racks on the forward bulkhead in the entrance compartment.

ANCHORING. In rough water or when the airplane is to be moored for several days, the mooring line must be attached to the bow fitting. The bow fitting is extended from inside the bow compartment and the outside attachment made from a small boat. In an emergency, a release lever can be used to drop the bow fitting from its mounting. A 45-pound anchor is stowed in the entrance compartment.

BEACHING. The beaching gear with green flotation tanks must be installed on the starboard side; those with red tanks, on the port side. All beaching gear assemblies are mounted in the same manner. One point of attachment is at the hatch sill and the other at the chine below the water line. In the attachment of the upper fittings, the gear is first positioned in the recessed trunnion fitting, keeping the gear parallel to the side of the airplane. Then, the crew member at the hatch immediately locks in the upper pins, using the manually operated lever just inside the hatch sill. Two retractable push rods under the control handles are used to submerge the gear and hold it in place under the chine. With the gear submerged and in position, the chine pin control handle is pulled up to the stop and the safety pin inserted. On the after gears only, a brake hose connected to the quick disconnect fitting inside the airplane permits use of the airplane's pneumatic system for braking.

If the slope of the ramp is not over 10 to 1, the airplane can proceed up the ramp using the power of two engines.

When beached by the towing method, the airplane is pulled up the ramp stern first. After the airplane is tied up to the buoy, a crew in a small boat will bring the second bow line to the airplane and attach the stern line. The beaching gear can be attached when the airplane is in line with the ramp. After the airplane is solidly on the ramp, bow lines are cast off and the airplane towed to the parking area.

TOWING ON GROUND.

Remove all tie-down lines.

Lower keel hook and lock it in full-swivel.

Lock tow bar in keel hook.

Remove lock pins on forward beaching gear to allow full swivel of gear.

Hook up to tractor and remove chocks.

Tow airplane in a forward direction for a short distance before commencing any turn.

Lock forward beaching gear in the trailing aft position before pushing the airplane backwards.

TIEING DOWN. Tie-down lines are attached to the stern towing fitting, the forward keel hook, and the wing tip floats. All wheels are chocked.

WINDSHIELD WIPERS.

The windshield wipers are controlled by individual knobs on the pilot's and co-pilot's side consoles. The knobs select FAST, MEDIUM, or SLOW wiper speeds. The OFF position stops the wiper at the place it has reached when the wiper motor stopped. For better visibility the wiper can be returned to the extreme outboard position of the windshield with the spring-loaded knob held momentarily in PARK and then allowed to return to OFF. To prevent damage to the wiper motor, do not hold wiper knob in PARK for more than one second. 28-volt d-c electrical power operates the windshield wiper motor.

NOTE

The windshield wipers are ineffective at high airplane speeds but can be used during take-off or landing approach when air speeds are reduced.

CAUTION

To prevent scratching the windshield, do not operate the windshield wipers on dry glass.

WINDSHIELD SPRAY SYSTEM.

The windshield spray unit, when the wipers are operating, is used to clean the windshield. When the spray control switch on the co-pilot's sub-panel is moved to the SPRAY position, a pump will spray isopropyl alcohol or isopropyl alcohol and water from a reservoir to both windshields. The system uses 28-volt dc for control and power.

BOLLARDS.

Two bollards are stowed on the forward side of the entrance compartment (figure 1-2). For anchoring or mooring, one bollard is positioned at the mooring hatch on the starboard side of the compartment; the other is positioned at the entrance hatch at deck level.

RELIEF AND TOILET EQUIPMENT.

A relief tube is installed on the starboard side of the entrance compartment (figure 1-2). A chemical toilet and accessories are installed in the air lock compartment.

SEA ANCHOR.

A collapsible sea anchor is stowed on

the after bulkhead on the starboard side of the entrance compartment (figure 1-2).

ANCHOR.

An anchor is stowed on the forward bulkhead near the entrance hatch (figure 1-2).

HANDLING LINES.

Two 30-foot trip lines and two 25-foot tow lines are stowed on the aft bulkhead of the entrance compartment (figure 1-2).

BILGE PUMP AND HOSE.

Electric bilge pumps with suction and discharge hoses are stowed in the electronics compartment and APP compartment (figure 1-2). These pumps can be used to pump from any section of the airplane.

LADDER.

A removable ladder below the flight deck access hatch can be used for entering the electronics compartment and bow compartment.

MOORING HOOK.

A mooring hook is stowed on the aft port side of the entrance compartment (figure 1-2).

WATER BREAKER.

A 4-1/2-gallon-capacity water breaker on the starboard side of the entrance compartment is equipped with a filler cap and a spigot (figure 1-2).

MAP CASE AND FLIGHT-REPORT HOLDER.

A map case and flight report holder is installed on the pilot's side console. The metal cover is spring-loaded to remain in the closed position.

COTTON TRAYS.

Cotton trays are conveniently located at each crew station.

EMERGENCY EQUIPMENT.

For location of emergency equipment see figure 3-1.

Section V

OPERATING LIMITATIONS

TABLE OF CONTENTS

GENERAL.

The limitations and restrictions covered in this section are subject to change after flight test evaluation.

This information does not necessarily appear elsewhere in the handbook.

MINIMUM CREW REQUIREMENTS.

The minimum crew requirements to fly the airplane consist of a pilot, co-pilot, radio operator, and navigator.

INSTRUMENT MARKINGS.

The instrument markings shown in figure 5-1 illustrate limitations that are not necessarily repeated elsewhere in the handbook. Information relative to the airspeed-mach indicator and accelerometer will be added when available.

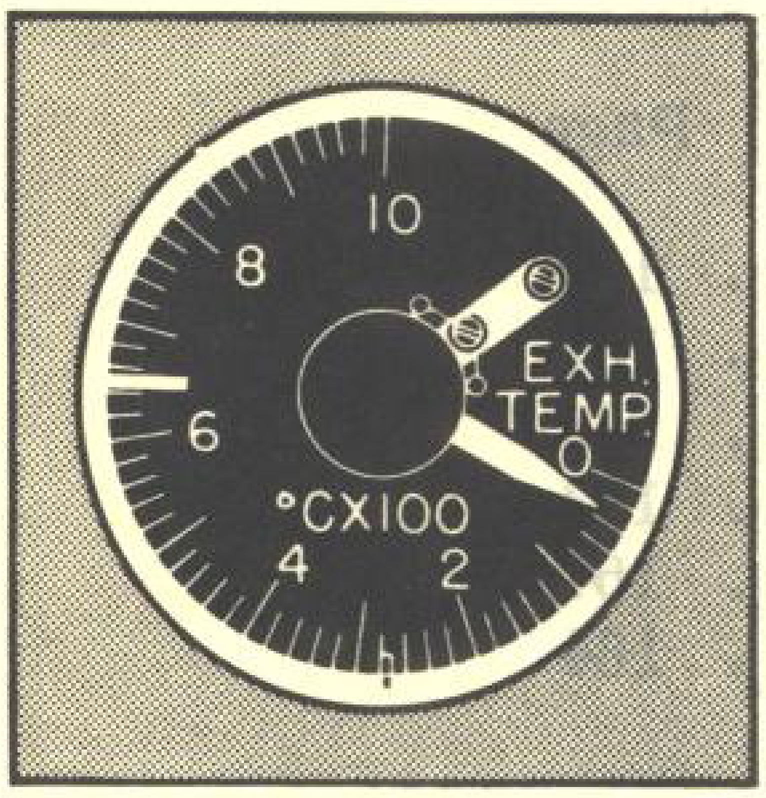
ENGINE AND APP LIMITATIONS.

All normal limitations for the engine and APP are shown in figure 5-1. In addition, the engine limitations for ground idle through maximum engine speed are noted in the following table:

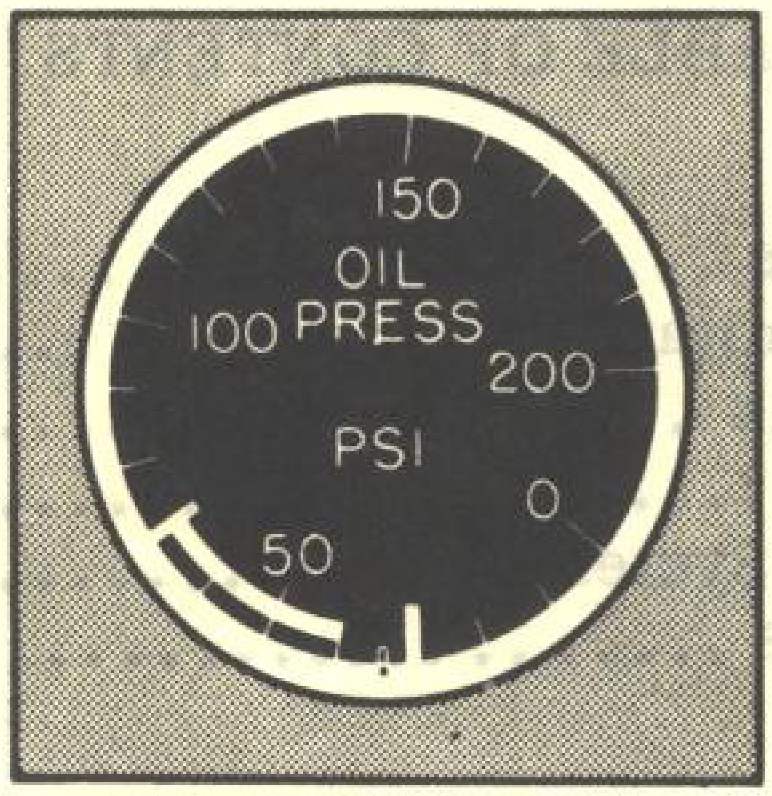
OPERATING CONDITIONS	(% RPM)	RPM
Ground Idle	53.4 - 56.6	3500
Normal (continuous)	97.5	5947
	90	5490
	75	4575
Military (30 minutes)	100	6100
Maximum A/B (5 minutes)	102	6100

INSTRUMENT MARKINGS

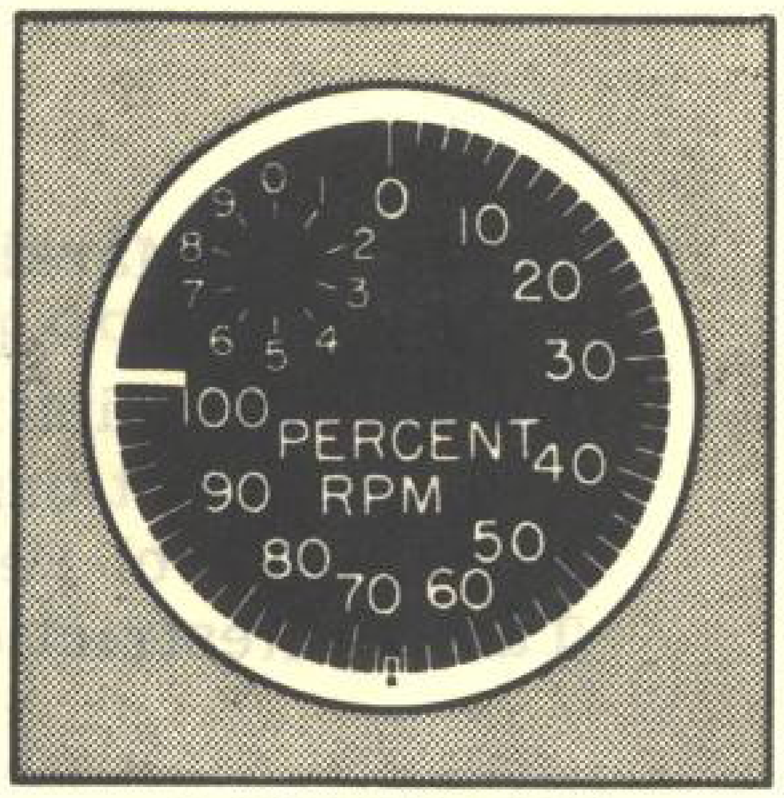
WHITE ARC
RED STRIP



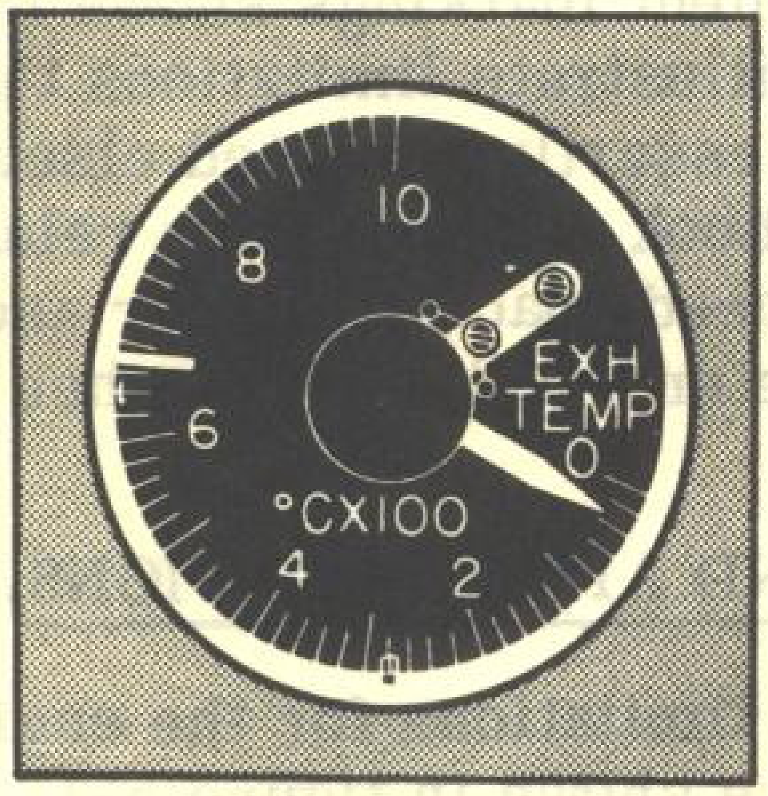
EXHAUST TEMPERATURE INDICATOR
650°C AT MAXIMUM POWER



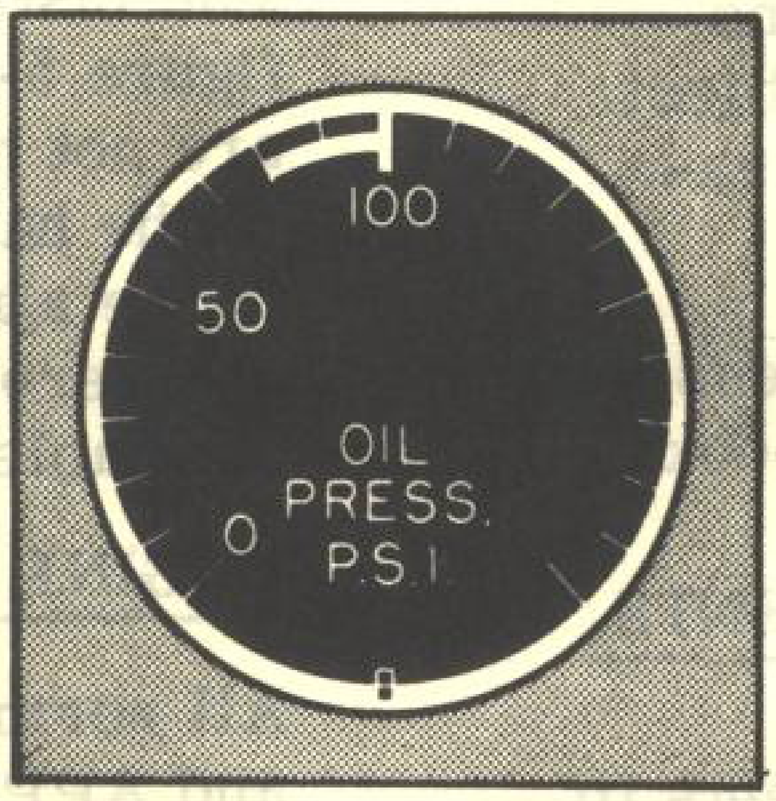
OIL PRESSURE INDICATOR
30 PSI MINIMUM
70 PSI MAXIMUM



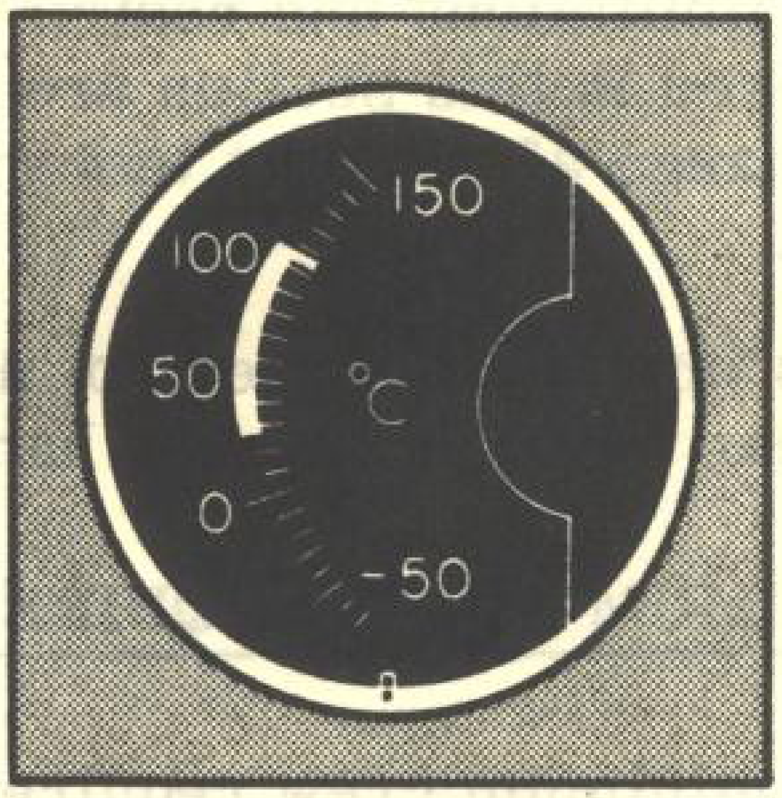
TACHOMETER INDICATOR
102% MAXIMUM



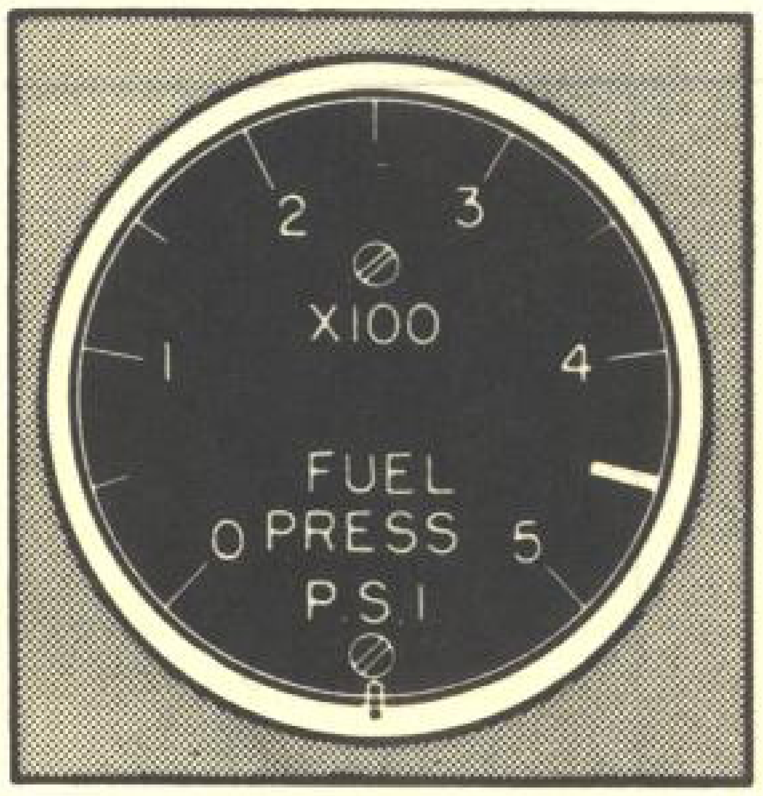
A.P.P. EXHAUST TEMPERATURE INDICATOR
677°C MAXIMUM



A.P.P. OIL PRESSURE GAGE
80 PSI MINIMUM
100 PSI MAXIMUM



A.P.P. OIL TEMPERATURE INDICATOR
27°-107°C CONTINUOUS
107°C MAXIMUM



A.P.P. FUEL PRESSURE INDICATOR
450 PSI MAXIMUM

AIRSPEED & MACH. NO. INDICATOR

ACCELEROMETER

Figure 5-1

EXHAUST TEMPERATURE.

The maximum allowable stabilized EGT is 649°C. During start or engine acceleration momentary temperatures are allowable up to 899°C.

NOTE

Each instance of exhaust temperature in excess of 899°C in starting or accelerating must be entered in the engine log. After five such instances, or after a single instance of temperature in excess of 1000°C, the engine must be removed for inspection.

ENGINE OVERSPEED.

Regardless of EGT's, the engine must be removed for inspection each time a stabilized speed of 103% is exceeded. Momentary speeds are allowable to speeds not in excess of 105% or, if the afterburner is being shut off, not in excess of 106.5%

ENGINE OIL PRESSURE.

The maximum allowable oil pressure is 70 psi; the minimum at IDLE is 40 psi.

IGNITION LIMITATIONS.

Because of overheating, the operation of the ignition system is limited to two minutes on, three minutes off, two minutes on, and twenty-three minutes off.

AIRSPEED LIMITATIONS.

The maximum allowable airspeeds, based on level flight and 120,000 pounds gross weight, are as follows:

40,000 ft. - 260 kts. IAS - Mach .84

20,000 ft. - 415 kts. IAS - Mach .88

10,000 ft. - 475 kts. IAS - Mach .87

sea level - 555 kts. IAS - Mach .84

WING FLAP RESTRICTION.

Wing flaps are not to be in the extended position at water speeds of less than 90 knots or at airspeeds in excess of 256 knots IAS.

LANDING LIGHTS.

Landing lights should not be extended at speeds greater than 175 knots IAS.

NACELLE AIR DOOR.

The nacelle air doors are not to be in the open position (ALT) at speeds in excess of 80 knots IAS.

MINE DOOR.

Operation of the mine door should be limited to level flight and the pilot should be advised prior to its operation.

FLIGHT LIMITATIONS.

Intentional spins, inverted flight, or any maneuver which may result in extended negative acceleration are prohibited. Under conditions of negative acceleration, oil will not be available for engine lubrication nor fuel for operation.

FLIGHT CONTROL FEEL SYSTEM.

With the flight control feel system inoperative, extreme caution should be exercised in any movement of flight controls which might impose severe air loads on the airplane. In any event, a maximum speed of 250 knots IAS is tentatively considered advisable.

TAXIING RESTRICTIONS.

An automatic keel hook pickup should not be attempted at water speeds in excess of 10 knots.

Section VI

FLIGHT CHARACTERISTICS

TABLE OF CONTENTS

INTRODUCTION

The information contained in this section is gathered from flight tests, wind tunnel tests, and estimated data. Flight characteristics which are predicted to be critical in various flight regions are summarized to focus your attention on possible trouble spots. The pilot who understands the capabilities of this airplane and the forces applied to it at various speeds and attitudes should have no difficulty. When flight tests are completed, this section will be expanded to include any additional or revised information.

GENERAL.

The airplane is statically stable throughout its speed and altitude range. It is worthy of note that shifting the CG through its range of 29% to 44% MAC has negligible effect on normal flight characteristics.

NOTE

Hereafter in this section reference to CG location will be noted simply as forward or aft CG.

At high altitudes, this airplane is readily controllable at high Mach numbers and has normal flight characteristics; at low altitudes, this airplane, like all high-performance airplanes, can be overstressed to the point of structural failure. The limit load factors of +3.8g and -1.8g must not be exceeded.

WARNING

Avoid negative G-maneuvers to prevent possible flame-out or damage to the engines.

The inboard and outboard spoilers are driven by individual hydraulic systems. If one surface hydraulic system fails, the spoilers powered by the remaining system provide adequate control. The stabilizer, operated by the same two hydraulic systems, incorporates the same safety feature as the spoiler — failure of one system does not result in the loss of stabilizer action.

STALL CHART

MODEL XP6M-1 ENGINES: (4) YJ71-A-4

GROSS WEIGHT (POUNDS)		90,000	120,000	150,000	180,000
	ANGLE OF BANK DEGREES	STALL SPEED KNOTS	STALL SPEED KNOTS	STALL SPEED KNOTS	STALL SPEED KNOTS
CLEAN CONDITION	0	101	116	130	143
	10	102	117	131	144
	20	104	120	134	147.5
LANDING AND TAKE-OFF CONDITION (FLAPS 45°)	0	92	106	119	131
	10	93	107	120	132
	20	95	109	123	135

DATA AS OF: 5/12/53

DATA BASIS: ESTIMATED

Figure 6-1

The control force resulting from any normal change in trim at any speed does not exceed 10 pounds at the control wheel.

STALLS.

No bad characteristics are demonstrated either at the stall or during recovery.

With power at 80% rpm and the airplane in a clean configuration, control forces are positive throughout the approach to the stall. The control column shaker motors are actuated at approximately 1.1 times the actual stalling speed. There is no tendency to roll at the stall; however, even though spoiler effectiveness near the stall is decreased, the control surfaces retain positive control. The stall characteristics with flaps down is the same as with flaps up. A mild pitch-up will occur just prior to the stall. This pitch-up could become quite severe if the wing slats should fail to function properly. Figure 6-1 lists the estimated stall speeds at various gross weights and configurations. The pilot should be alert to the stall warning, as evidenced by shaking of the control columns.

ACCELERATED STALLS.

Pitch-up in an accelerated stall with flaps extended should be mild and easily controlled by the pilot, who can employ light stick forces for a positive recovery. Spoiler control at the stall remains high, especially with the wing flaps extended. During recovery, be careful not to exceed the maximum wing flaps-down airspeed restriction. Do not rely upon the normal "feel" at the wheel to stay out of trouble. Exercise caution during low-speed, quick pull-ups, and accelerated maneuvers to ensure proper operation of the wing slats under high-load factor conditions.

SPINS.

Spins in this airplane are prohibited. Avoid any flight attitude that will cause a spin.

The configuration of the airplane makes it difficult to enter a spin unintentionally. If, however, a spin is entered inadvertently, the stall should be smooth with very little roll-off tendency and spoiler control will be exceptionally good. The long tail length, the large vertical fin, and the large hull surface area provide a high damping power factor which aids satisfactory spin recovery with rudder and stabilizer.

FLIGHT CONTROLS.

STABILIZER-ELEVATOR.

The stabilizer hydraulic actuating system and the synthetic feel device are both located in the aft section of the airplane to ensure a closer control link between stabilizer movement and feel force. The feel device supplies a force to the pilot which is proportional to both the control deflection from trim and the airstream impact pressure.

The "stick force to trim against speed" curves show that requirements for stick-free stability up to Mach .8 are met. Stick-free characteristics beyond Mach .8 are discussed under HIGH SPEED in this section. At very low speeds in approaching the stall, the stick forces, since they do not reduce to zero, lighten but do not deprive the stabilizer of effective control.

The critical condition for longitudinal control exists during take-off at forward CG with maximum engine power and the airplane not yet airborne. The inboard location of the engine above the CG requires additional control power to trim out the nose-down moment due to thrust.

SPOILER-AILERONS.

During rolling maneuvers, airplane load factors must be held between +3.04g and 0g. High rolling velocities at high speeds and low altitudes impose severe side loads and torques on the hull afterbody. Spoiler deflection produces the high yawing moments which create these loads. The Q-stops restrict spoiler movement in proportion to calibrated airspeed. At altitudes of 10,000 feet and above, for example, the Q-stops limit spoiler deflection so that less than two-thirds of the design loads are imposed on the hull afterbody. However, at sea level, in a rolling maneuvers at Mach .8, maximum design limit loads are reached.

WARNING

To prevent bending of and possible structural damage to the airplane, avoid violent rolling maneuvers below 10,000 feet.

RUDDER.

The hydraulically operated rudder uses a synthetic feel device to relay forces to the pilot through the rudder pedals. If the hydraulic power fails, the pilot can operate the rudder through direct mechanical linkage. Since the feel system cannot be conveniently disconnected, the pilot must oppose the feel forces fed back from the feel device. In addition, the lack of power control results in a dead band on either side of the neutral rudder pedal position in which no rudder deflection is obtained. This dead band is caused by the gap between the limit stops in the hydraulic valve, and is equivalent to a loss of 6^{o} rudder deflection. Because of extremely high control forces, effective use of the rudder is not possible.

TRIM.

Forces produced by trim change are kept below 10 pounds at the control wheel. The maximum force required to keep the airplane in trim is a push force of 15.6 pounds resulting from the release of 30,000 pounds of stores. No stick force is necessary to maintain trim speed up to a sideslip angle of 6^{o}; higher sideslip angles require very light forces.

WING SLATS.

As has been discussed previously, a mild pitch-up occurs at the stall and is easily controlled with the stabilizer. Any dangerous pitch-up conditions at high speeds would probably be preceded by buffet warning. At low speeds, where maximum lift can be developed with the wing flaps extended, failure of the wing slats to extend would result in a serious pitch-up near the stall. However, sufficient stabilizer control is available to prevent any pitch-up divergence, provided recovery action is initiated before the full stall is approached.

WING FLAPS.

The wing flaps extend or retract symmetrically even though the mechanical interconnect which links them should break. However, if one wing flap remains fully retracted and the other is fully extended, the lateral asymmetry can be corrected by the pilot's holding about 30^{o} of spoiler while he attempts to close or open the wing flaps fully. Should operation be impossible, a safe landing can be made if the approach and touchdown speeds are increased enough for a flaps-up landing. The spoiler deflection needed to balance the asymmetry kills the lift on the extended wing flap.

To prevent water damage, the extension and retraction of the wing flaps is much faster than on the majority of airplanes. In flight, the flaps will remain fully extended up to an airspeed of 180 knots. At higher airspeeds automatic load relief allows the flaps to retract to 18.5 degrees at 256 knots. At higher airspeeds structural damage could result.

DIVE BRAKES.

Trim change during high-speed brake extension should be minor. Small dive brake extension should be accompanied by a nose-down pitch; large deflections should cause the airplane to pitch nose-up. The dive brake structure is protected by a blow-back to prevent maximum extension at high speeds.

If an open dive brake cannot be manually released to the closed position during a utility hydraulic system failure, the resulting slight yawing moment can be easily held with the rudder. Should this faulty condition be impossible to correct, a safe landing can still be made with either one or both dive brakes in the extended position.

MINE DOOR EMPTY.

Operation of the empty mine door throughout the speed range produces a buffet which is well within limits at all times. At low airspeeds the buffet is slight and shows a moderate increase as the higher speeds are reached. At all speeds the intensity of the buffeting varies throughout the operating cycle, being greatest near the start and the completion. A slight lateral oscillation, caused by inertial effects of the door, may accompany the buffet. At speeds greater than 310 knots, a mild pitch up, never exceeding 6 to 8 pounds, will occur during the cycle.

MINE DOOR LOADED.

The conditions accompanying the rotation of a loaded door are the same, but of lesser intensity, as those of an empty door. In cycling a loaded door, the inertial effects are increased and the aerodynamic effects decreased, in comparison to cycling an empty door.

WARNING

The mine door should be operated only in level flight and in relatively smooth air because the design load factor for mine door operation is 2.5, as compared to 3.8 for the airplane. The door and its mechanism are designed for the full 3.8 load factor in the fully closed or the fully open position.
During the flight test program, no more than two-thirds of these values will be demonstrated.

LEVEL FLIGHT CHARACTERISTICS.

The airplane has very good stability and control characteristics down to stall. Asymmetric power presents no problem even at minimum control speed. With No. 1 engine at IDLE and the other engines at 100% rpm, level flight attitude is maintained at 135 knots by 125 pounds of pedal force. (With only No. 3 and No. 4 at 100% rpm, 135 knots is achieved in level flight with 140 pounds of pedal force.)

HIGH SPEED.

The aircraft accelerates rather slowly and may have to be dived slightly to obtain optimum speed for a given power setting. Maximum speed in level flight is in the vicinity of 0.85 Mach number, above an altitude of 10,000 feet and 520 knots below this attitude. These speeds can be attained without using afterburners, which are intended for take-off only.

MINE DOOR OPERATION.

Operation of the rotary mine door between speeds of 200 and 500 knots empty and 270 to 520 knots fully loaded will have very little aerodynamic effect.

DIVES.

High speeds in dives can be attained only by using steep dive angles.

Below 0.92 Mach number, the airplane is smooth and stable, and control is normal. At 0.95 Mach number, buffet is quite pronounced, but still within tolerable limits. Above this speed, the airplane is rapidly approaching buffet limits and a slight tucking tendency may be present.

ASYMMETRIC FUEL LOADING.

An asymmetric weight condition will result when fuel can not be transferred out of one wing tank. An extreme condition would exist if one wing tank were empty and the other contained 25,000 pounds of fuel. Lateral control of the airplane to correct this wing-low condition will be more critical at low speeds with the wing flaps retracted. In this instance, full spoiler deflection can stabilize the airplane down to a speed 10% above the stall. The asymmetry can be corrected down to the stall if approximately 30^{o} of spoiler is held and the wing flaps are extended (as in a normal landing).

SECTION VII

SYSTEMS OPERATION

This section is not required in a Preliminary Flight Handbook.

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SECTION VIII

CREW DUTIES

This section is not required in a Preliminary Flight Handbook.

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SECTION IX

ALL-WEATHER OPERATION

This section is not required in a Preliminary Flight Handbook.

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APPENDIX I

The full complement of Charts on Operating Data will not be available until flight tests are completed.

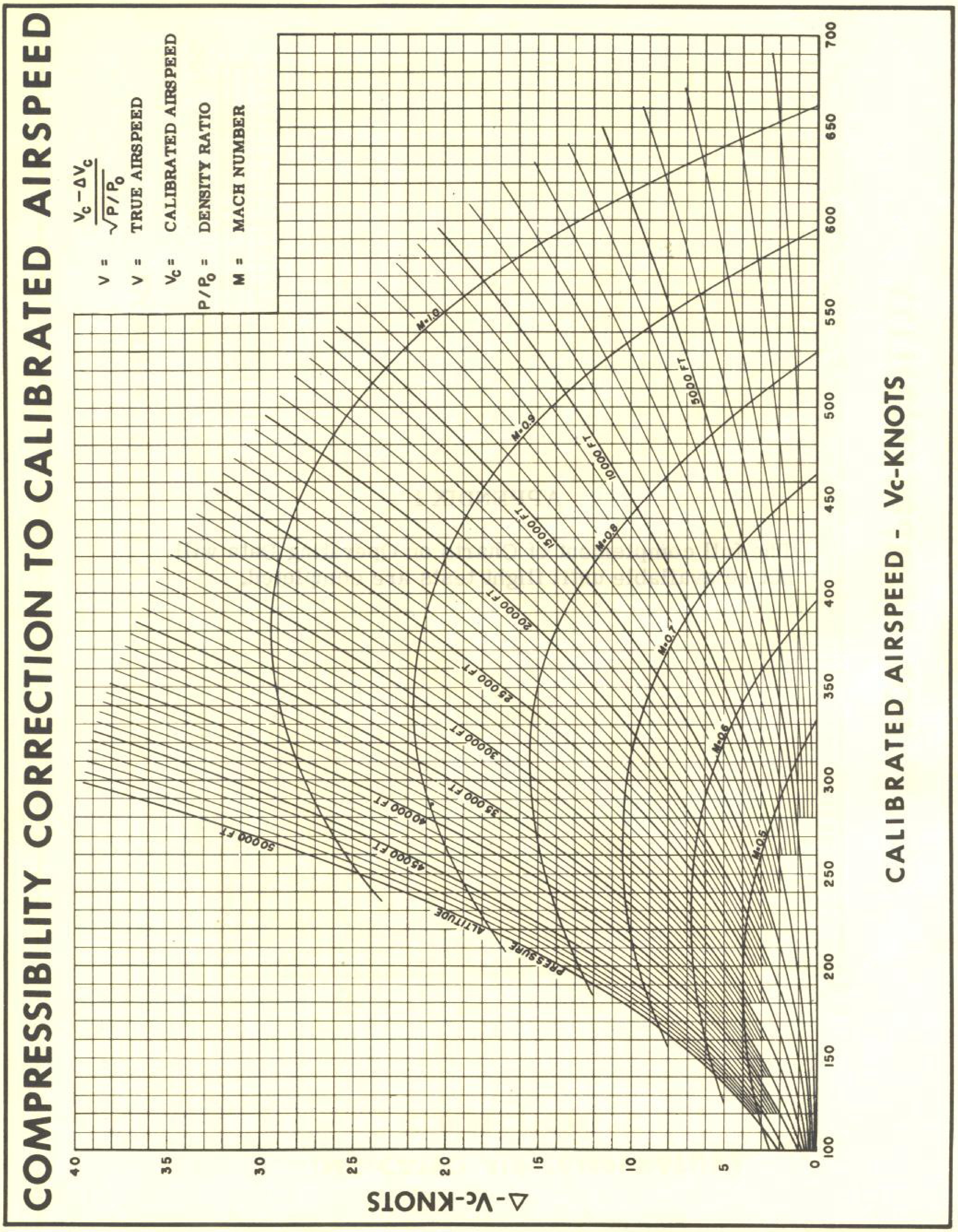
COMPRESSIBILITY CORRECTION TO CALIBRATED AIRSPEED
V = $\frac{V_c - \Delta V_c}{\sqrt{P/P_0}}$
V = TRUE AIRSPEED
V_c = CALIBRATED AIRSPEED
P/P_0 = DENSITY RATIO
M = MACH NUMBER
M=1.0
M=0.9
M=0.8
M=0.7
M=0.6
M=0.5
5000 FT
10000 FT
15000 FT
20000 FT
25000 FT
30000 FT
35000 FT
40000 FT
45000 FT
50000 FT
PRESSURE ALTITUDE
CALIBRATED AIRSPEED - Vc-KNOTS
Δ-Vc-KNOTS
100
150
200
250
300
350
400
450
500
550
600
650
700
0
5
10
15
20
25
30
35
40

Figure A-1

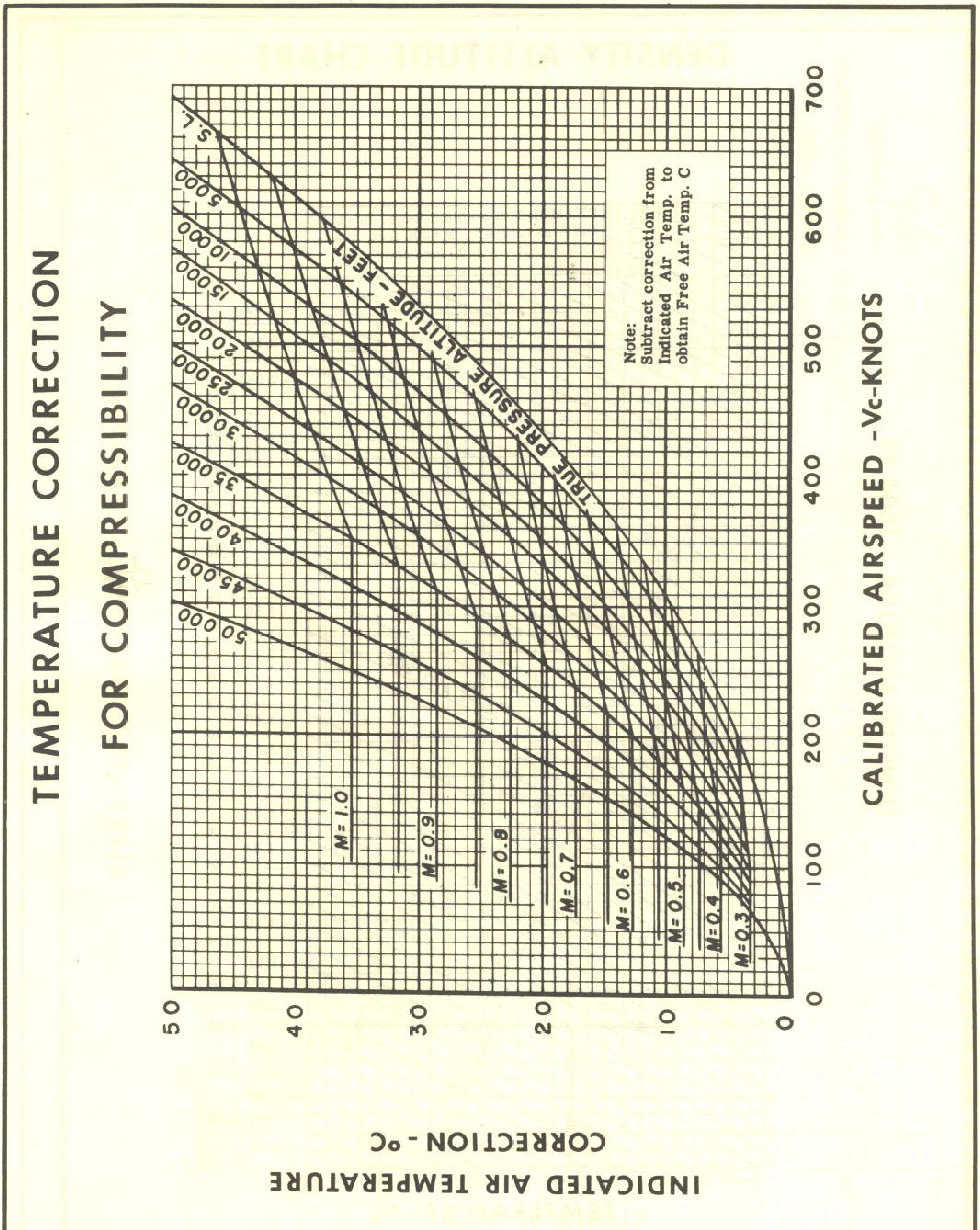
TEMPERATURE CORRECTION
FOR COMPRESSIBILITY
TRUE PRESSURE ALTITUDE - FEET
S. L.
5000
10 000
15 000
20 000
25 000
30 000
35 000
40 000
45 000
50 000
M=1.0
M=0.9
M=0.8
M=0.7
M=0.6
M=0.5
M=0.4
M=0.3
Note:
Subtract correction from
Indicated Air Temp. to
obtain Free Air Temp. C
0
100
200
300
400
500
600
700
CALIBRATED AIRSPEED -Vc-KNOTS
0
10
20
30
40
50
INDICATED AIR TEMPERATURE
CORRECTION -°C

Figure A-2

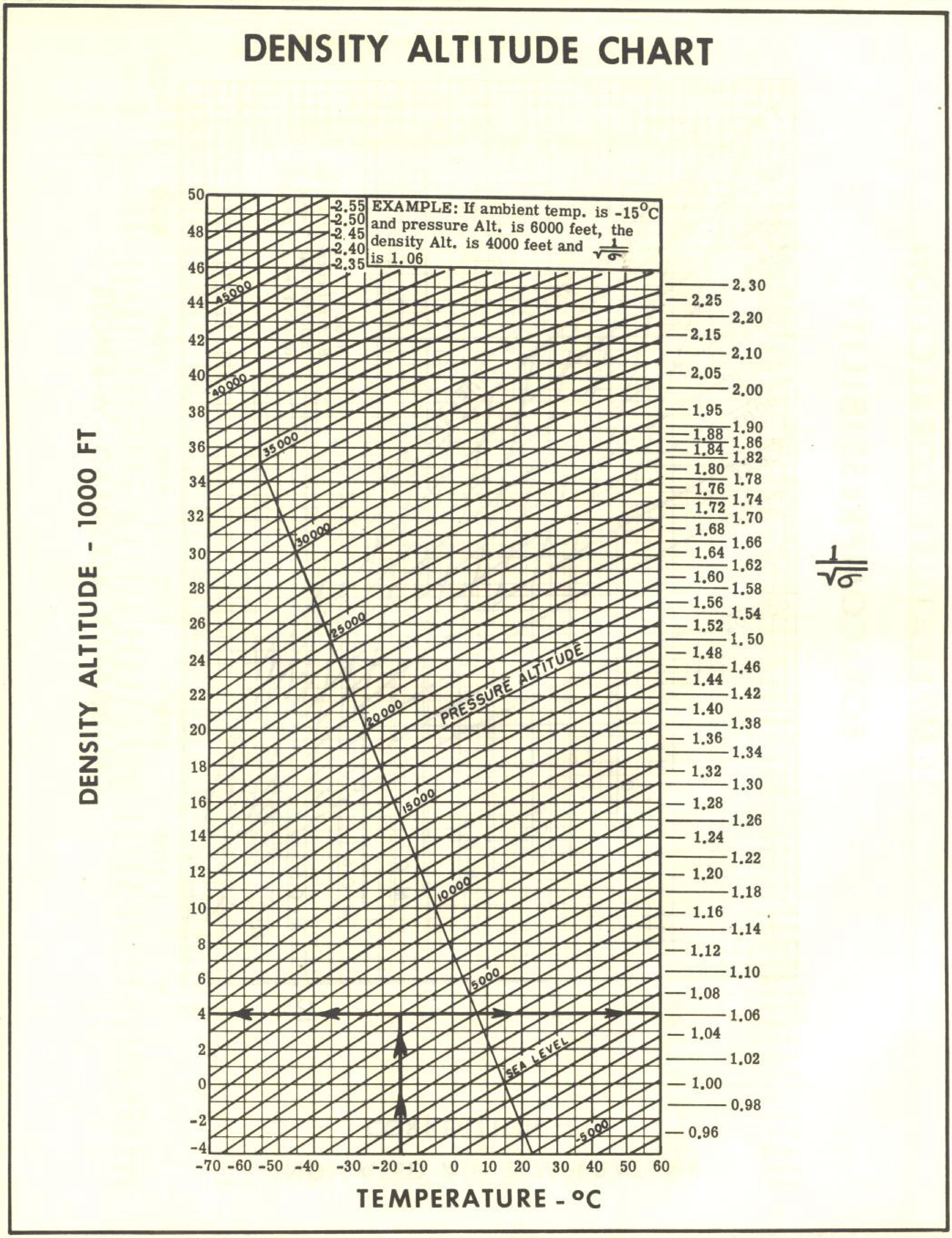
DENSITY ALTITUDE CHART
EXAMPLE: If ambient temp. is -15°C and pressure Alt. is 6000 feet, the density Alt. is 4000 feet and $\frac{1}{\sqrt{\sigma}}$ is 1.06
DENSITY ALTITUDE - 1000 FT
TEMPERATURE - °C
PRESSURE ALTITUDE
45000
40000
35000
30000
25000
20000
15000
10000
5000
SEA LEVEL
-5000
$\frac{1}{\sqrt{\sigma}}$
-70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60
-4 -2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50
2.55 2.50 2.45 2.40 2.35
2.30 2.25 2.20 2.15 2.10 2.05 2.00 1.95 1.90 1.88 1.86 1.84 1.82 1.80 1.78 1.76 1.74 1.72 1.70 1.68 1.66 1.64 1.62 1.60 1.58 1.56 1.54 1.52 1.50 1.48 1.46 1.44 1.42 1.40 1.38 1.36 1.34 1.32 1.30 1.28 1.26 1.24 1.22 1.20 1.18 1.16 1.14 1.12 1.10 1.08 1.06 1.04 1.02 1.00 0.98 0.96

Figure A-3

Standard Altitude Table

Standard Sea Level Air:
T = 15° C. W = .07651 lb/cu. ft. ρ_0 = .002378 slugs/cu. ft.
P = 29.921 in. of Hg. 1" of Hg. = 70.732 lb/sq. ft. = 0.4912 lb/sq. in.
This table is based on NACA Technical Report No. 218 a_o - 1116 ft./sec.

Altitude feet	Density Ratio ρ/ρ_0	$\frac{1}{\sqrt{\sigma}}$	Temperature Deg. C	Temperature Deg. F	Speed of Sound Ratio a/a_o	Pressure In. of Hg.	Pressure Ratio P/Po
0	1.0000	1.0000	15.000	59.000	1.0000	29.92	1.0000
1000	.9710	1.0148	13.019	55.434	.997	28.86	.9644
2000	.9428	1.0299	11.038	51.868	.993	27.82	.9298
3000	.9151	1.0454	9.056	48.301	.990	26.81	.8962
4000	.8881	1.0611	7.075	44.735	.986	25.84	.8636
5000	.8616	1.0773	5.094	41.169	.983	24.89	.8320
6000	.8358	1.0938	3.113	37.603	.979	23.98	.8013
7000	.8106	1.1107	1.132	34.037	.976	23.09	.7716
8000	.7859	1.1280	-0.850	30.471	.972	22.22	.7427
9000	.7619	1.1456	-2.831	26.904	.968	21.38	.7147
10000	.7384	1.1637	-4.812	23.338	.965	20.58	.6876
11000	.7154	1.1822	-6.793	19.772	.962	19.79	.6614
12000	.6931	1.2012	-8.774	16.206	.958	19.03	.6359
13000	.6712	1.2206	-10.756	12.640	.954	18.29	.6112
14000	.6499	1.2404	-12.737	9.074	.950	17.57	.5873
15000	.6291	1.2608	-14.718	5.507	.947	16.88	.5642
16000	.6088	1.2816	-16.699	1.941	.943	16.21	.5418
17000	.5891	1.3029	-18.680	-1.625	.940	15.56	.5202
18000	.5698	1.3247	-20.662	-5.191	.936	14.94	.4992
19000	.5509	1.3473	-22.643	-8.757	.932	14.33	.4790
20000	.5327	1.3701	-24.624	-12.323	.929	13.75	.4594
21000	.5148	1.3937	-26.605	-15.890	.925	13.18	.4405
22000	.4974	1.4179	-28.586	-19.456	.922	12.63	.4222
23000	.4805	1.4426	-30.568	-23.022	.917	12.10	.4045
24000	.4640	1.4681	-32.549	-26.588	.914	11.59	.3874
25000	.4480	1.4940	-34.530	-30.154	.910	11.10	.3709
26000	.4323	1.5209	-36.511	-33.720	.906	10.62	.3550
27000	.4171	1.5484	-38.493	-37.287	.903	10.16	.3397
28000	.4023	1.5768	-40.474	-40.853	.899	9.720	.3248
29000	.3879	1.6056	-42.455	-44.419	.895	9.293	.3106
30000	.3740	1.6352	-44.436	-47.985	.891	8.880	.2968
31000	.3603	1.6659	-46.417	-51.551	.887	8.483	.2834
32000	.3472	1.6971	-48.399	-55.117	.883	8.101	.2707
33000	.3343	1.7295	-50.379	-58.684	.879	7.732	.2583
34000	.3218	1.7628	-52.361	-62.250	.875	7.377	.2465
35000	.3098	1.7966	-54.342	-65.816	.871	7.036	.2352
36000	.2962	1.8374	-55.000	-67.000	.870	6.708	.2242
37000	.2824	1.8818	-55.000	-67.000	.870	6.395	.2137
38000	.2692	1.9273	-55.000	-67.000	.870	6.096	.2037
39000	.2566	1.9738	-55.000	-67.000	.870	5.812	.1943
40000	.2447	2.0215	-55.000	-67.000	.870	5.541	.1852
41000	.2332	2.0707	-55.000	-67.000	.870	5.283	.1765
42000	.2224	2.1207	-55.000	-67.000	.870	5.036	.1683
43000	.2120	2.1719	-55.000	-67.000	.870	4.802	.1605
44000	.2021	2.2244	-55.000	-67.000	.870	4.578	.1530
45000	.1926	2.2785	-55.000	-67.000	.870	4.364	.1458
46000	.1837	2.3332	-55.000	-67.000	.870	4.160	.1391
47000	.1751	2.3893	-55.000	-67.000	.870	3.966	.1325
48000	.1669	2.4478	-55.000	-67.000	.870	3.781	.1264
49000	.1591	2.5071	-55.000	-67.000	.870	3.604	.1205
50000	.1517	2.5675	-55.000	-67.000	.870	3.436	.1149

Figure A-4

SEAPLANE TAKE-OFF CHART

MODEL(S): XP6M-1

FLAPS, 45°

SEA LEVEL

WATER

ENGINE (S): (4) YJ71-A-4

CONFIGURATION AND GROSS WEIGHT	-5 DEG. CENT.				+15 DEG. CENT.				+35 DEG. CENT.				+55 DEG. CENT.			
	ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND		ZERO WIND		30 KNOT WIND	
	TIME (SEC.)	DIST. (FEET)	TIME (SEC.)	DIST. (FEET)	TIME (SEC.)	DIST. (FEET)	TIME (SEC.)	DIST. (FEET)	TIME (SEC.)	DIST. (FEET)	TIME (SEC.)	DIST. (FEET)	TIME (SEC.)	DIST. (FEET)	TIME (SEC.)	DIST. (FEET)
188,000	52	6250	36	3440	79	9820	50	5000	100	13000	78	8150	----	----	100	11000
171,000	40	4600	29	2620	56	6650	38	3580	87	10700	55	5410	----	----	100	10500
154,000	31	3370	24	2020	41	4620	30	2640	61	7110	41	3780	100	12000	79	7640
137,000	25	2560	18	1400	31	3290	23	1880	43	4720	31	2640	76	8670	49	4390
120,000	19	1820	14	1000	23	2290	17	1270	32	3300	24	1880	47	5030	33	2820
103,000	14	1212	10	620	16	1440	12	780	23	2140	17	1160	30	2900	23	1655

REMARKS: FLAPS ARE LOWERED TO 45° AT PLANNING SPEED

DATA AS OF: 12 MAY 1953
DATA BASIS: ESTIMATED

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL.

Figure A-5

CLIMB CHART FOR NORMAL POWER

STANDARD DAY

MODEL(S): XP6M-1

ENGINE(S): (4) YJ71-A-4

CONFIGURATION: CLEAN
WEIGHT: 120,000 LBS.

CONFIGURATION: CLEAN
WEIGHT: 103,000 LBS.

APPROXIMATE				CAS	PRESSURE ALTITUDE FEET	CAS	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL			KNOTS (2)		KNOTS (2)	FROM SEA LEVEL			RATE OF CLIMB
	DIST.	TIME	FUEL				FUEL	TIME	DIST.	
3600	0	0	4165(1)	293	SEA LEVEL	291	4165(1)	0	0	4280
3380	7.1	1.4	4840	284	5,000	282	4720	1.2	6	4050
3050	15.1	3.0	5500	277	10,000	273	5260	2.4	12.5	3700
2650	24.9	4.8	6175	269	15,000	265	5820	3.9	20	3250
2230	36.6	6.8	6860	260	20,000	255	6345	5.6	29	2780
1750	51.6	9.4	7620	251	25,000	245	6950	7.5	41	2250
1300	71.7	12.6	8455	243	30,000	237	7600	9.9	56	1780
850	103.1	17.3	9530	236	35,000	230	8280	13.1	76	1350
150	189.6	29.4	11,820	229	40,000	221	9280	17.8	112	560
					45,000					
					50,000					

CONFIGURATION:
WEIGHT:

CONFIGURATION:
WEIGHT:

APPROXIMATE				CAS	PRESSURE ALTITUDE FEET	CAS	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL						FROM SEA LEVEL			RATE OF CLIMB
	DIST.	TIME	FUEL				FUEL	TIME	DIST.	
					SEA LEVEL					
					5,000					
					10,000					
					15,000					
					20,000					
					25,000					
					30,000					
					35,000					
					40,000					
					45,000					
					50,000					

REMARKS:
(1) ALLOWANCE FOR START ENGINES, TAXI, TAKE-OFF AND ACCELERATE TO CLIMB SPEED
(2) CLIMB AT RECOMMENDED CAS

RATE OF CLIMB: FEET PER MINUTE
DISTANCE: NAUTICAL MILES
TIME: MINUTES
FUEL: POUNDS
CAS: CALIBRATED AIRSPEED IN KNOTS

DATA AS OF: 5/12/53
DATA BASIS: ESTIMATED

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS./GAL.

Figure A-6 (Sheet 1 of 4)

CLIMB CHART FOR NORMAL POWER

STANDARD DAY

MODEL(S): XP6M-1

ENGINE(S):(4) YJ71-A-4

CONFIGURATION: CLEAN
WEIGHT: 188,000 LBS.

CONFIGURATION: CLEAN
WEIGHT: 171,000 LBS.

APPROXIMATE				CAS KNOTS (2)	PRESSURE ALTITUDE FEET	CAS KNOTS (2)	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL						FROM SEA LEVEL			RATE OF CLIMB
	DIST.	TIME	FUEL				FUEL	TIME	DIST.	
1930	0	0	4165(1)	298	SEA LEVEL	306	4165(1)	0	0	2410
1650	14	2.9	5680	291	5,000	290	5295	2.4	12	1930
1370	33	6.3	7330	290	10,000	287	6475	5.2	27	1640
1130	56	10.3	8810	284	15,000	280	7715	8.4	45	1420
780	90	15.8	10,820	279	20,000	274	9020	12.6	70	1020
450	145	23.7	13,870	274	25,000	268	10,880	18.5	107	680
					30,000	261	13,780	29.2	179	310
					35,000					
					40,000					
					45,000					
					50,000					

CONFIGURATION: CLEAN
WEIGHT: 154,000 LBS.

CONFIGURATION: CLEAN
WEIGHT: 137,000 LBS.

APPROXIMATE				CAS KNOTS (2)	PRESSURE ALTITUDE FEET	CAS KNOTS (2)	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL						FROM SEA LEVEL			RATE OF CLIMB
	DIST.	TIME	FUEL				FUEL	TIME	DIST.	
2600	0	0	4165(1)	295	SEA LEVEL	294	4165(1)	0	0	3070
2330	10	2.0	5125	288	5,000	286	4970	1.7	8.5	2820
2020	22	4.3	6080	283	10,000	280	5765	3.6	18	2500
1770	37	7.0	7115	276	15,000	273	6580	5.8	30	2170
1350	56	10.3	8180	269	20,000	264	7440	8.4	45	1760
980	83	14.5	9455	262	25,000	257	8410	11.6	65	1330
580	124	21.0	11,180	255	30,000	249	9525	15.9	93	900
150	265	41.0	15,900	249	35,000	243	11,630	24.5	158	470
					40,000					
					45,000					
					50,000					

REMARKS:
(1) ALLOWANCE FOR START ENGINES, TAXI, TAKE-OFF, AND ACCELERATE TO CLIMB SPEED
(2) CLIMB AT RECOMMENDED CAS

RATE OF CLIMB: FEET PER MINUTE
DISTANCE: NAUTICAL MILES
TIME: MINUTES
FUEL: POUNDS
CAS: CALIBRATED AIRSPEED IN KNOTS

DATA AS OF: 5/12/53
DATA BASIS: ESTIMATED

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS./GAL.

Figure A-6 (Sheet 2 of 4)

CLIMB CHART FOR MILITARY POWER

STANDARD DAY

MODEL(S): XP6M-1

ENGINE(S): (4)YJ71-A-4

CONFIGURATION: CLEAN
WEIGHT: 120,000 LBS.

CONFIGURATION: CLEAN
WEIGHT: 103,000 LBS.

APPROXIMATE				CAS	PRESSURE ALTITUDE FEET	CAS	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL			KNOTS (2)		KNOTS (2)	FROM SEA LEVEL			RATE OF CLIMB
	DIST.	TIME	FUEL				FUEL	TIME	DIST.	
5280	0	0	4165(1)	330	SEA LEVEL	326	4165(1)	0	0	6150
4640	6	1.0	4800	332	5,000	318	4700	.9	5	5410
3970	12.5	2.2	5430	314	10,000	310	5230	1.9	11	4680
3330	21	3.6	6050	303	15,000	300	5750	3.1	17.5	3970
2700	32	5.2	6730	291	20,000	288	6310	4.3	26	3270
2040	45	7.4	7440	279	25,000	276	6860	6.1	37	2570
1460	65	10.3	8270	265	30,000	262	7460	8.2	51	1950
970	94	14.4	9250	250	35,000	247	8060	11.1	73	1350
250	160	23.5	11,100	228	40,000	226	8870	16.6	110	670
					45,000					
					50,000					

CONFIGURATION:
WEIGHT:

CONFIGURATION:
WEIGHT:

APPROXIMATE				CAS	PRESSURE ALTITUDE FEET	CAS	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL						FROM SEA LEVEL			RATE OF CLIMB
	DIST.	TIME	FUEL				FUEL	TIME	DIST.	
					SEA LEVEL					
					5,000					
					10,000					
					15,000					
					20,000					
					25,000					
					30,000					
					35,000					
					40,000					
					45,000					
					50,000					

REMARKS:

(1) ALLOWANCE FOR START ENGINES, TAXI, TAKE-OFF, AND ACCELERATE TO CLIMB SPEED
(2) CLIMB AT RECOMMENDED CAS

RATE OF CLIMB: FEET PER MINUTE
DISTANCE: NAUT. MILES
TIME: MINUTES
FUEL: POUNDS
CAS: CALIBRATED AIRSPEED (KNOTS)

DATA AS OF: 5/12/53
DATA BASIS: ESTIMATED

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL.

Figure A-6 (Sheet 3 of 4)

CLIMB CHART FOR MILITARY POWER

STANDARD DAY

MODEL(S): XP6M-1 **ENGINE(S):** (4) YJ71-A-4

CONFIGURATION: CLEAN
WEIGHT: 188,000 LBS. (left)

CONFIGURATION: CLEAN
WEIGHT: 171,000 LBS. (right)

APPROXIMATE				CAS KNOTS (2)	PRESSURE ALTITUDE FEET	CAS KNOTS (2)	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL						FROM SEA LEVEL			RATE OF CLIMB
	DIST.	TIME	FUEL				FUEL	TIME	DIST.	
3080	0	0	4165(1)	353	SEA LEVEL	344	4165(1)	0	0	3470
2570	11	1.9	5320	343	5,000	335	5150	1.6	9	2960
2130	24	4.0	6500	333	10,000	325	6160	3.5	20	2450
1680	42	6.6	7790	320	15,000	313	7230	5.6	35	1970
1190	65	10.2	9240	308	20,000	301	8400	8.6	54	1450
680	104	15.6	11,200	294	25,000	288	9850	12.8	83	930
240	193	32.0	14,430	279	30,000	273	11,920	20.0	135	450
					35,000					
					40,000					
					45,000					
					50,000					

CONFIGURATION: CLEAN
WEIGHT: 154,000 LBS. (left)

CONFIGURATION: CLEAN
WEIGHT: 137,000 LBS. (right)

APPROXIMATE				CAS KNOTS (2)	PRESSURE ALTITUDE FEET	CAS KNOTS (2)	APPROXIMATE			
RATE OF CLIMB	FROM SEA LEVEL						FROM SEA LEVEL			RATE OF CLIMB
	DIST.	TIME	FUEL				FUEL	TIME	DIST.	
3970	0	0	4165(1)	338	SEA LEVEL	334	4165(1)	0	0	4570
3440	8	1.4	5020	330	5,000	326	4910	1.2	7	4000
2880	17	3.0	5860	321	10,000	317	5640	2.6	14.5	3400
2350	30	4.8	6760	309	15,000	306	6370	4.2	25	2800
1800	45	7.3	7770	297	20,000	295	7220	6.2	38	2210
1250	68	10.7	8930	284	25,000	281	8130	9.0	55	1600
740	103	15.9	10,400	270	30,000	267	9200	12.8	82	1006
180	185	26.6	13,980	255	35,000	252	10,850	18.7	127	500
					40,000					
					45,000					
					50,000					

REMARKS:
(1) ALLOWANCE FOR START ENGINES, TAXI, TAKE-OFF, AND ACCELERATE TO CLIMB SPEED
(2) CLIMB AT RECOMMENDED CAS

RATE OF CLIMB: FEET PER MINUTE
DISTANCE: NAUT MILES
TIME: MINUTES
FUEL: POUNDS
CAS: CALIBRATED AIRSPEED (KNOTS)

DATA AS OF: 5/12/53
DATA BASIS: ESTIMATED

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL.

Figure A-6 (Sheet 4 of 4)

COMBAT ALLOWANCE CHART
CLEAN CONFIGURATION
STANDARD DAY

MODEL: XP6M-1

ENGINES: (4) YJ-71-A-4

AT ALTITUDE FEET	FUEL REQUIRED - POUNDS PER MINUTE	
	97.5% RPM NORMAL POWER MAXIMUM CONTINUOUS	100% RPM MILITARY POWER 30 MINUTE LIMIT
SEA LEVEL	563	784
5,000	513	700
10,000	460	615
15,000	408	530
20,000	354	447
25,000	306	370
30,000	266	303
35,000	230	247
40,000	185	194

REMARKS:

CLEAN GROSS WEIGHT = 112,000 LBS.

DATA AS OF: 5-12-53
DATA BASIS: ESTIMATED

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LBS/GAL.

Figure A-7

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ALPHABETICAL INDEX

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