INTERIM REVISION SUMMARY

The following Interim Revisions have been either canceled or incorporated in this Flight Handbook:

Canceled or Previously Incorporated	*Incorporated in This Revision on Pages Indicated*	
No. 1	No. 8	54, 55 (Also see Confidential Supplement NavAer 01-85SAA-1A)
No. 2	No. 10	65, 66
No. 4		
No. 5		
No. 6		
No. 7		

INTERIM REVISIONS OUTSTANDING: (To be maintained by custodian of Flight Handbook)

Number	*Date*	*Purpose*
No. 3	15 February 1955	Operational procedures to prevent burning of wiring in the main distribution box.
No. 9	9 February 1956	Information regarding carrier approach and stall airspeeds for Models S2F-1 and -2 airplanes.

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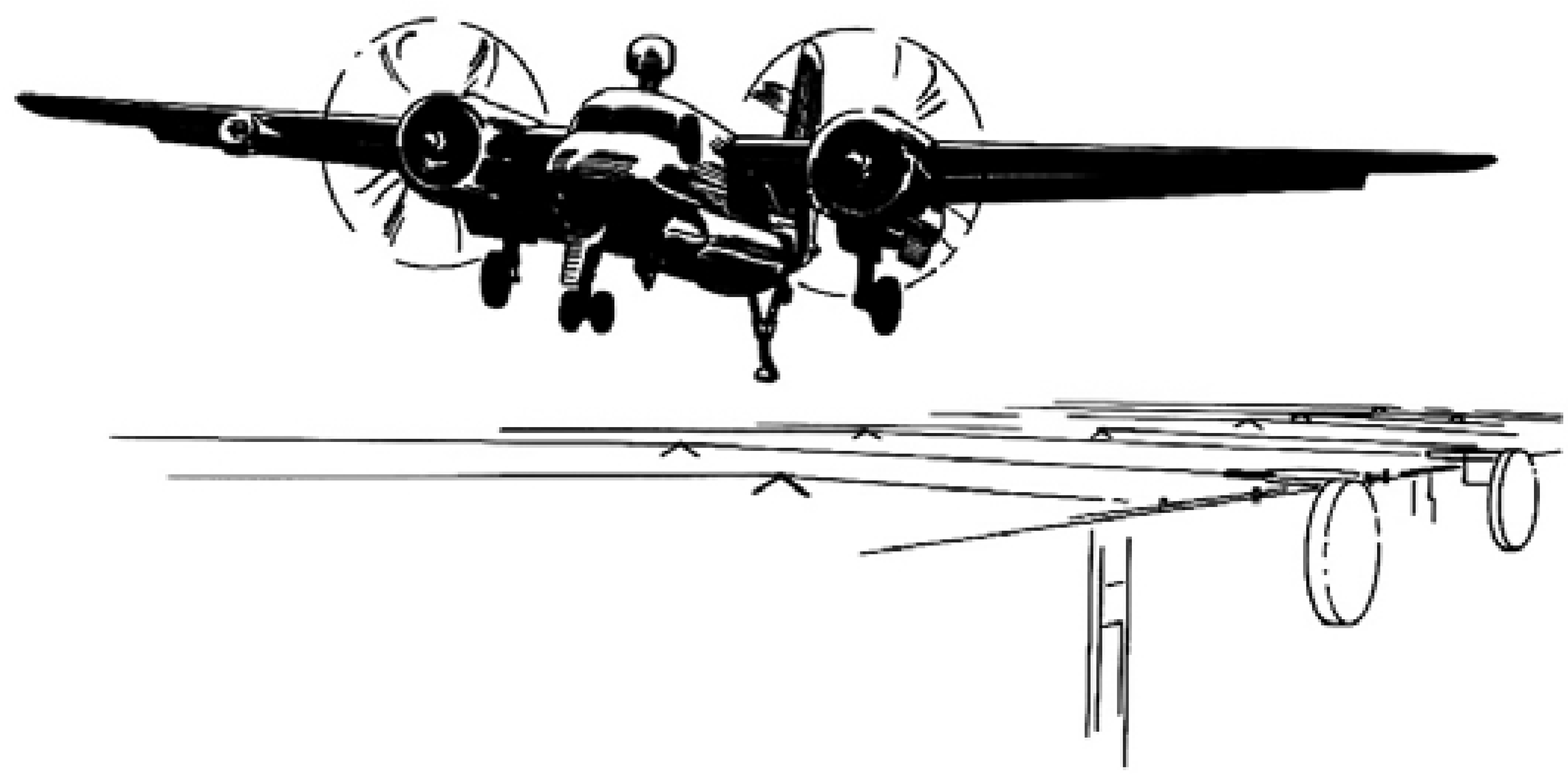


Figure 1-1. S2F-1 Airplane

S2F-2

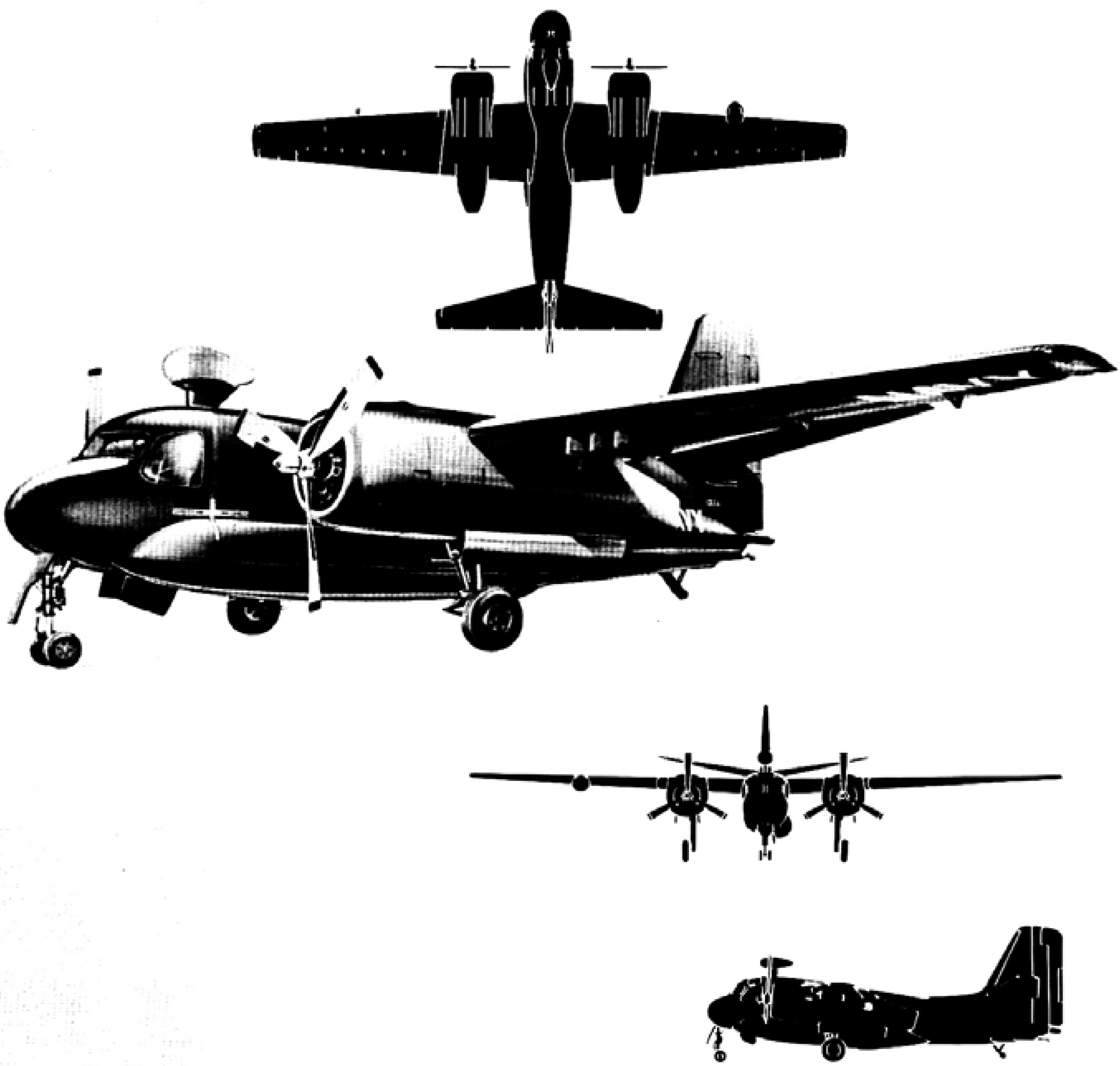


Figure 1-1A. S2F-2 Airplane

WINDSHIELD ANTI-ICING FLUID

Spec: MIL-F-5566

Tank Capacity: 1.5 US Gallons

OIL

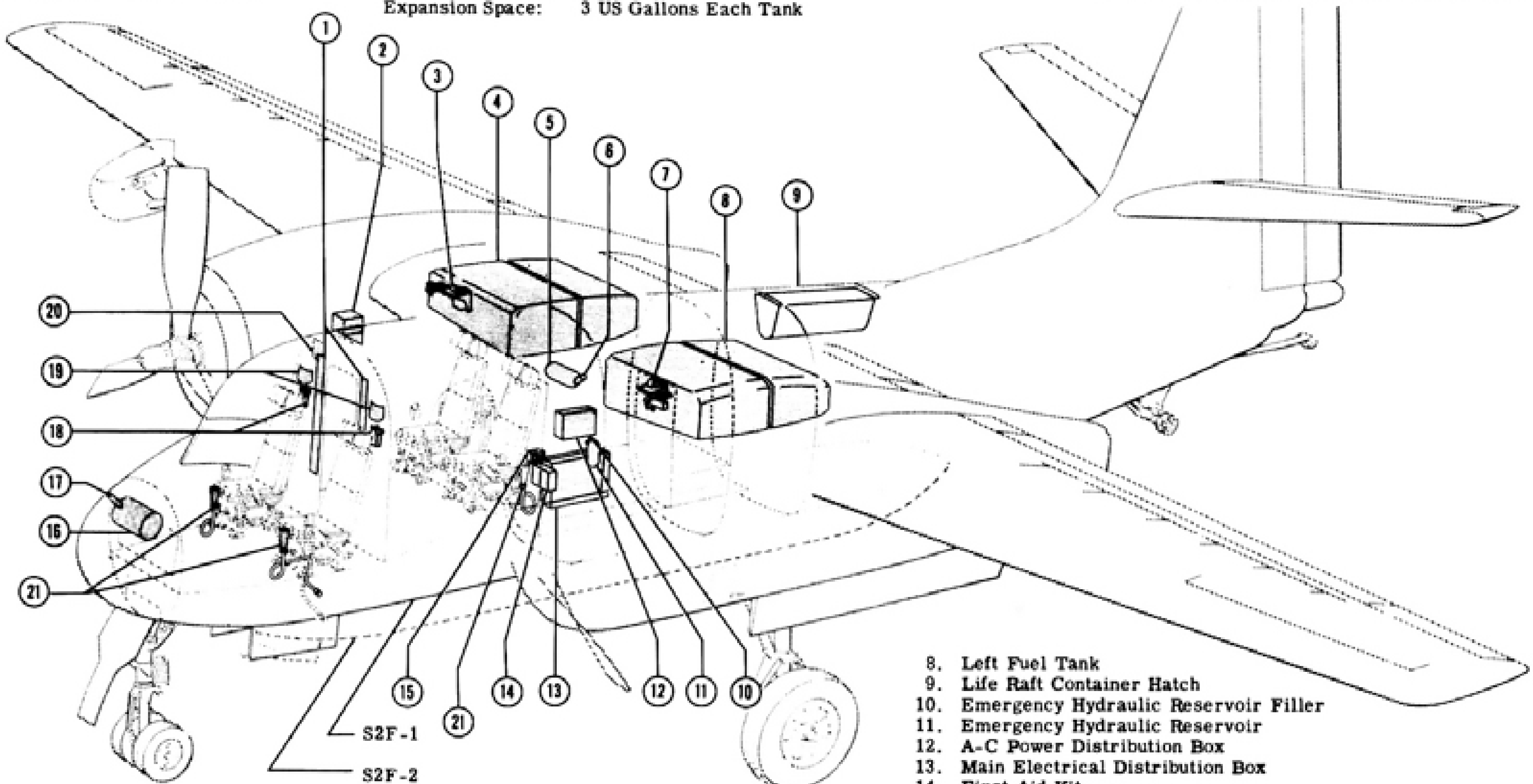
Spec: MIL-L-6082
Grade: 1100 (For normal use)
1065 (For cold weather use)
Tank Capacities: 17 US Gallons Each Tank
Usable Capacities: 14 US Gallons Each Tank
Expansion Space: 3 US Gallons Each Tank

HYDRAULIC FLUID

Spec: MIL-O-5606

Main Reservoir Capacity: 3.7 US Gallons

Emergency Reservoir Capacity: 1.0 US Gallons



FUEL

Spec: MIL-F-5572

Grade: 115/145 or 100/130

Tank Capacities: 200 US Gallons Each Tank

1. Pilots' Compartment Left and Right Circuit Breaker Panels
2. Battery
3. Right Fuel Tank Filler
4. Right Fuel Tank
5. Main Hydraulic Reservoir
6. Main Hydraulic Reservoir Filler
7. Left Fuel Tank Filler
8. Left Fuel Tank
9. Life Raft Container Hatch
10. Emergency Hydraulic Reservoir Filler
11. Emergency Hydraulic Reservoir
12. A-C Power Distribution Box
13. Main Electrical Distribution Box
14. First Aid Kit
15. External Power Receptacles (AC and DC)
16. Windshield Anti-icing Fluid Tank
17. Windshield Anti-icing Fluid Tank Filler
18. Canteen
19. Pilot's and Co-pilot's Microphone and Headset Stowage Bags
20. Operators' Compartment Circuit Breaker Panel
21. Relief Tubes

Figure 1-2. General Arrangement and Servicing Diagram, S2F-1 Airplanes BuNo. 129139 through 129153

WINDSHIELD ANTI-ICING FLUID

Spec: MIL-T-566

Tank Capacity: 1.5 US Gallons

OIL

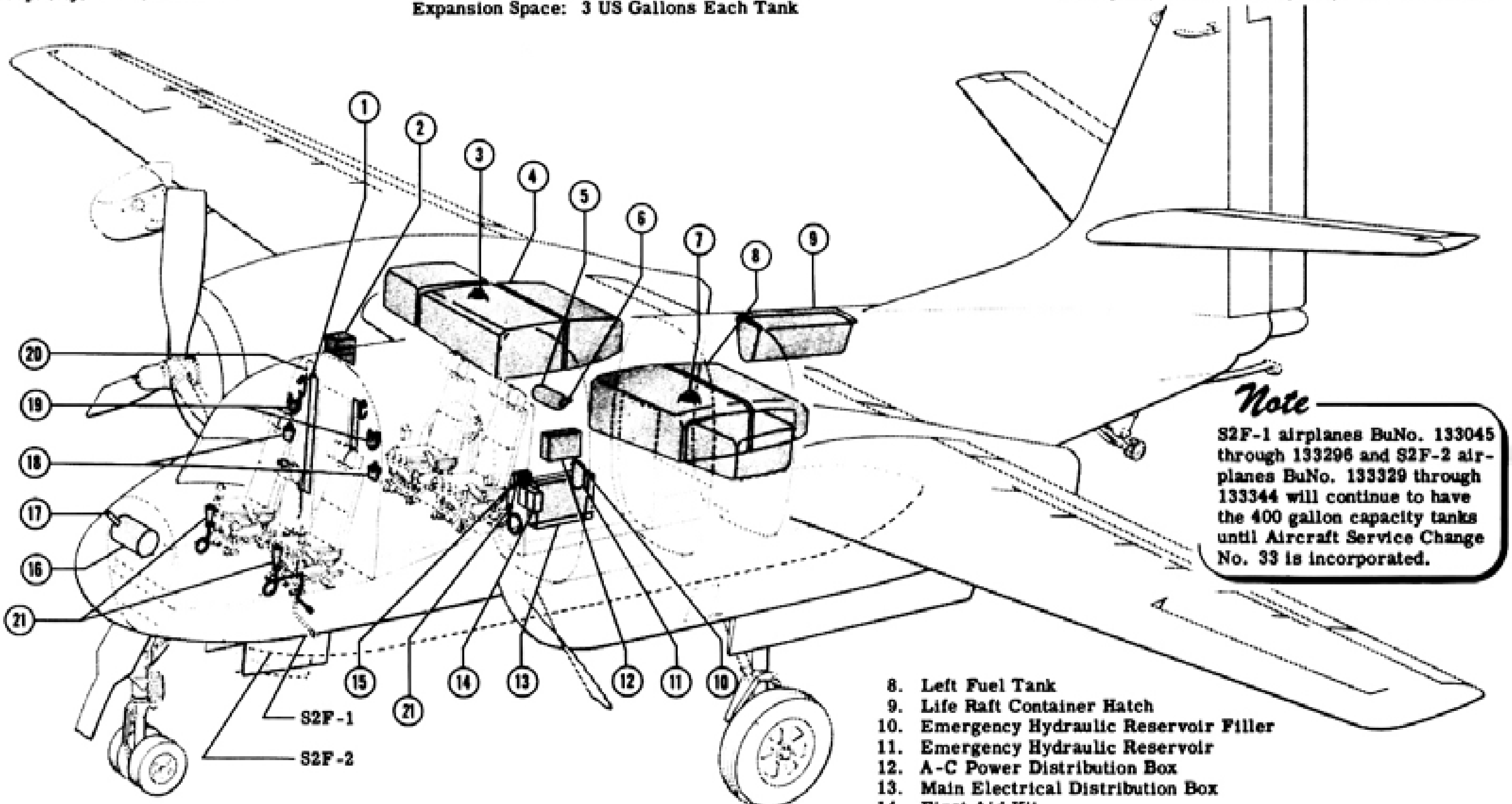
Spec: MIL-L-6082
Grade: 1100 (For normal use)
1065 (For cold weather use)
Tank Capacities: 17 US Gallons Each Tank
Usable Capacities: 14 US Gallons Each Tank
Expansion Space: 3 US Gallons Each Tank

HYDRAULIC FLUID

Spec: MIL-O-5606

Main Reservoir Capacity: 3.7 US Gallons

Emergency Reservoir Capacity: 1.0 US Gallons



FUEL

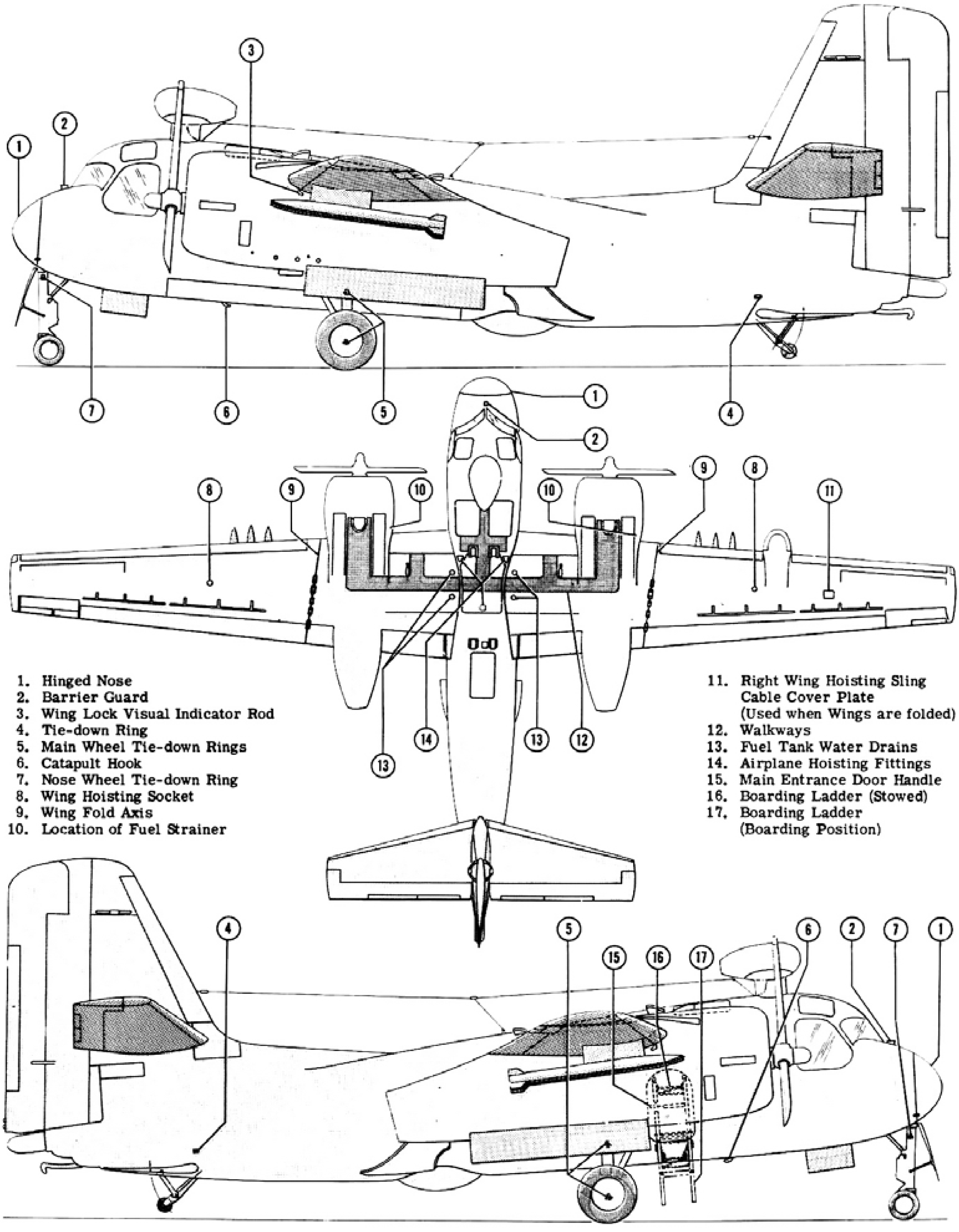
Spec: MIL-F-5572

Grade: 115/145 or 100/130

Tank Capacities: 260 US Gallons Each Tank

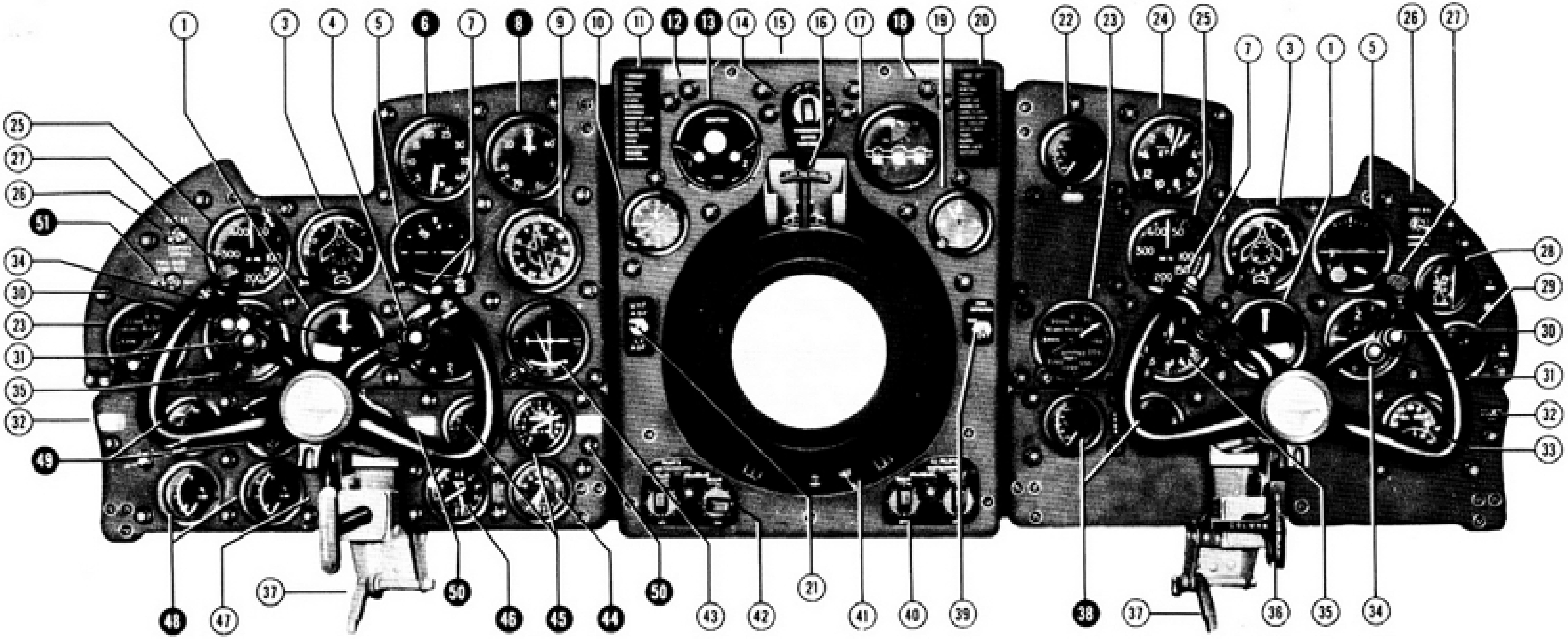
1. Pilots' Compartment Left and Right Circuit Breaker Panels
2. Battery
3. Right Fuel Tank Filler
4. Right Fuel Tank
5. Main Hydraulic Reservoir
6. Main Hydraulic Reservoir Filler
7. Left Fuel Tank Filler
8. Left Fuel Tank
9. Life Raft Container Hatch
10. Emergency Hydraulic Reservoir Filler
11. Emergency Hydraulic Reservoir
12. A-C Power Distribution Box
13. Main Electrical Distribution Box
14. First Aid Kit
15. External Power Receptacles (AC and DC)
16. Windshield Anti-icing Fluid Tank
17. Windshield Anti-icing Fluid Tank Filler
18. Canteen
19. Pilot's and Co-pilot's Microphone and Headset Stowage Bags
20. Operators' Compartment Circuit Breaker Panel
21. Relief Tubes

Figure 1-2A. General Arrangement and Servicing Diagram, S2F-1 Airplanes BuNo. 133045 and Subsequent, and All S2F-2 Airplanes



1. Hinged Nose
2. Barrier Guard
3. Wing Lock Visual Indicator Rod
4. Tie-down Ring
5. Main Wheel Tie-down Rings
6. Catapult Hook
7. Nose Wheel Tie-down Ring
8. Wing Hoisting Socket
9. Wing Fold Axis
10. Location of Fuel Strainer
11. Right Wing Hoisting Sling Cable Cover Plate (Used when Wings are folded)
12. Walkways
13. Fuel Tank Water Drains
14. Airplane Hoisting Fittings
15. Main Entrance Door Handle
16. Boarding Ladder (Stowed)
17. Boarding Ladder (Boarding Position)

Figure 1-3. Ground Handling Diagram



1. Turn and Bank Indicator (2)
2. DELETED
3. Master Direction Indicator (2)
4. Rockets Release Switch
5. Gyro Horizon Indicator (2)
6. Tachometer
7. Torpedo-Bombs Release Switch (2)
8. Manifold Pressure Gage
9. Course Indicator (ID-250/ARN)
10. Elapsed Time Clock
11. Landing Check List
12. Fire Warning Light-Left Engine
13. Ignition Switches
14. Windshield Wiper Control
15. Location of Defroster Control (Above center instrument panel)
16. Radar Indicator Locking Handle
17. Wheels and Flaps Position Indicator
18. Fire Warning Light-Right Engine
19. Eight Day Clock
20. Take-off Check List
21. UHF ADF and LF ADF Indicator Switch
22. Outside Air Temperature Indicator
23. Radio Altimeter Indicator and Low Limit Warning Light (2)
24. Accelerometer
25. Airspeed Indicator (2)
26. G-2 Compass Control Switch (2)
27. Aileron and Elevator Trim Tab Switch (2)
28. D-C Voltammeter-Left Generator
29. D-C Voltammeter-Right Generator
30. ICS Microphone Switch (2)
31. Radio Microphone Switch (2)
32. Flight Instruments A-C Power Off Indicator Light (2)
33. Searchlight Indicator
34. Rate of Climb Indicator (2)
35. Altimeter
36. Co-pilot's Control Column Disconnect Handle
37. Rudder Pedal Adjustment Handle (2)
38. Carburetor Air Temperature Indicator (2)
39. Fire Detector Test Switch
40. Co-pilot's Instrument Lights Controls
41. Radar Indicator (IP-225/APS-38)
42. Pilot's Instrument Lights Controls
43. Cross Pointer Indicator (ID-48/ARN)
44. Oil Pressure Indicator
45. Fuel Quantity Indicator (2)
46. Fuel Pressure Indicator
47. Emergency and Parking Brake Handle
48. Cylinder Head Temperature Indicator (2)
49. Oil Temperature Indicator (2)
50. Fuel Low Level Warning Lights (2)
51. Fuel Quantity Gage Test Switch

Figure 1-4. Pilot's, Co-pilot's and Center Instrument Panels

ENGINE CONTROLS.

THROTTLES.

Engine power is manually controlled by two throttles (22, figure 1-5) which are mounted in the engine control quadrant in the overhead console. The throttles are CLOSED at their aft positions and are advanced forward to OPEN for increased power.

CAUTION

The gust lock (25, figure 1-5), located forward of the throttles on the overhead console, must be pushed full forward to its unlocked position to permit full travel of the throttles. This is to prevent a take-off with the control surfaces inadvertently locked. Regardless of the position of the gust lock control, the ailerons are automatically locked when the wings are placed in the folded position, provided the aileron control is at the neutral position prior to folding.

THROTTLES FRICTION CONTROL.

An adjustable throttle friction control, located adjacent to the throttles on the overhead console (39, figure 1-5), is installed to prevent the throttles from creeping. Turning this control clockwise applies friction to the hubs of both the throttle and propeller control levers.

CATAPULT GRIP.

A catapult grip (23, figure 1-5) is installed forward of the throttles on the overhead console. For use, the grip is pulled down from its normal position, which is flush with the overhead console.

MIXTURE CONTROLS.

The mixture controls consist of a set of paired handles (18, figure 1-5) located to the right of the throttles on the overhead console. The full aft position is IDLE CUT-OFF, the full forward is RICH, and the intermediate setting is NORMAL.

COWL FLAPS SWITCHES.

Electrically actuated cowl flaps are controlled by two cowl flaps three-position toggle switches (35, figure 1-5) located on the overhead console. Each switch can be moved from its central off position to OPEN or CLOSE the cowl flaps.

CARBURETOR.

CARBURETOR AIR INDUCTION SYSTEM.

The air induction system directs ram air from in front of the engine through the two intercylinder ducts, the charge air ducts, and the "Y" duct assembly into the carburetor header. Alternate warm air is taken from directly behind the cylinders and routed through the alternate air duct into the "Y" duct assembly and then to the carburetor header. The "Y" duct is equipped with a pilot controlled, electric, rotary actuator which opens or closes doors within the duct to permit or exclude entry of the charge ram air and, simultaneously, to exclude or permit entry of the hotter, alternate air. An intermediate or mixing position of the actuator can be selected.

KEY TO FIGURE 1-5

1. Fuel Selector Valve Control (Left Engine)
2. Life Raft Release Handle
3. Wing Fold Control Panel
   - Inner (Fold and Spread) Lever
   - Outer (Locking) Lever
   - Wing Fold-Spread Safety Light
4. Fuel Selector Valve Control (Right Engine)
5. Exterior Lights Control Panel
6. Arresting Hook Control Handle
7. Hydraulic System Pressure Gages (2)
8. ICS and Radio Control Panel (AN/AIC-8)
9. Propeller Feathering Button and Indicator Light (2)
10. Engine Oil Switch (2)
11. Fire Extinguisher Switch (2)
12. Propeller De-icing Control Switch and Indicator Light
13. Windshield Anti-icing Switch
14. Emergency Fuel Shut-off Switch (2)
15. Wing and Tail De-icing Control Switch
16. Wing and Tail De-icing Pressure and Suction Gages
17. Torpedo Bay and Sonobuoy Temperature Gages
18. Mixture Controls
19. Air Conditioning Heater Rheostat
20. Air Conditioning Heater Control Switch
21. Ground Ventilation Control Switch
22. Throttles
23. Catapult Grip
24. Stand-by Magnetic Compass
25. Gust Lock Control Handle
26. Propeller Controls
27. Landing Gear Control Handle
28. Console Lights Control
29. Master Electrical Power Panel
    - A-C Generator Field Switch
    - Battery Switch
    - D-C Generator Switches
    - D-C Generator Warning Lights
    - Inverter Selector Switch
    - Pilot's Flight Instrument A-C Power Test Switch
30. Landing Gear Solenoid Override
31. Pitot Heat Switch
32. Auxiliary Fuel Pump Switches (2)
33. Oil Dilution Switches (2)
34. Carburetor Air Switches (2)
35. Cowl Flaps Switches (2)
36. Oil Cooler Doors Switches (2)
37. Primer Switch
38. Starter Switch
39. Throttles Friction Control
40. UHF Transmitter-Receiver Control Panel (AN/ARC-27A)
41. Wing Flaps Control Handle
42. HF Transmitter-Receiver Control Panel (AN/ARC-2, -2A)
43. IFF Control Panel (AN/APX-6, -6B)
44. Radio Compass Control (AN/ARN-6)

CARBURETOR AIR SWITCHES.

Two carburetor air switches, one for each engine (34, figure 1-5), are located on the overhead console. Each can be set at OFF, DIRECT, or ALTERNATE.

CARBURETOR AIR TEMPERATURE INDICATORS.

Two carburetor air temperature indicators, one for each

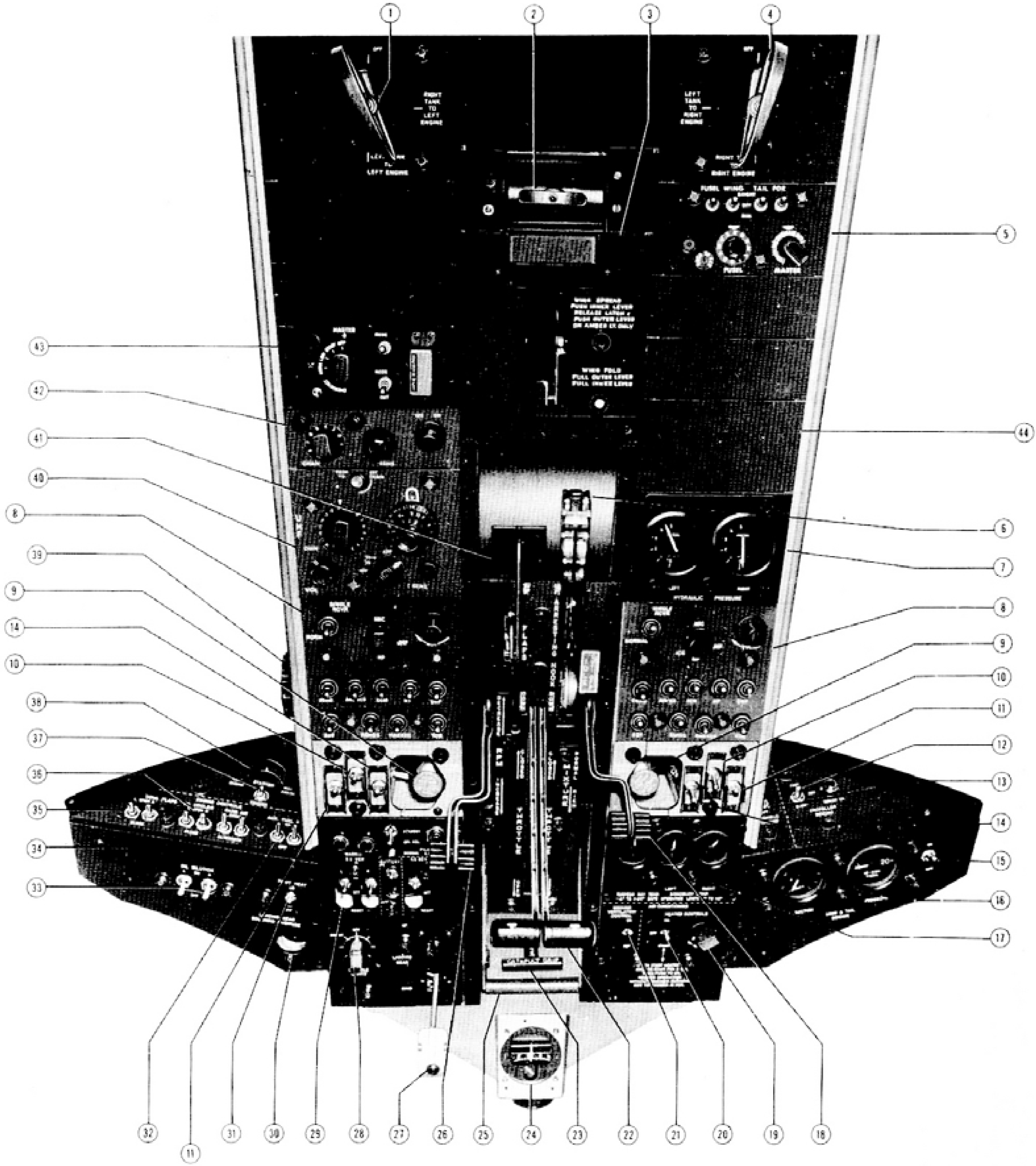
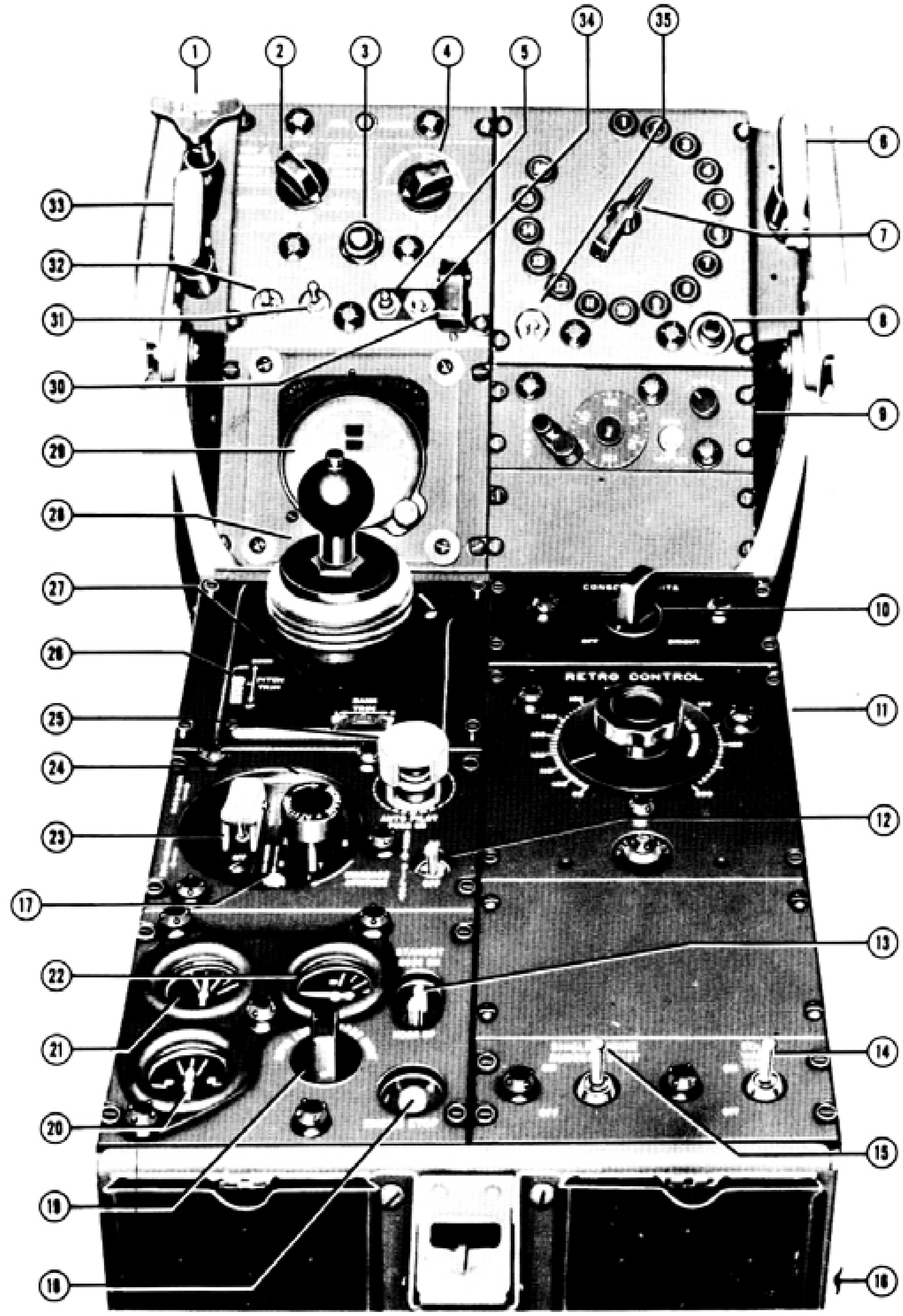
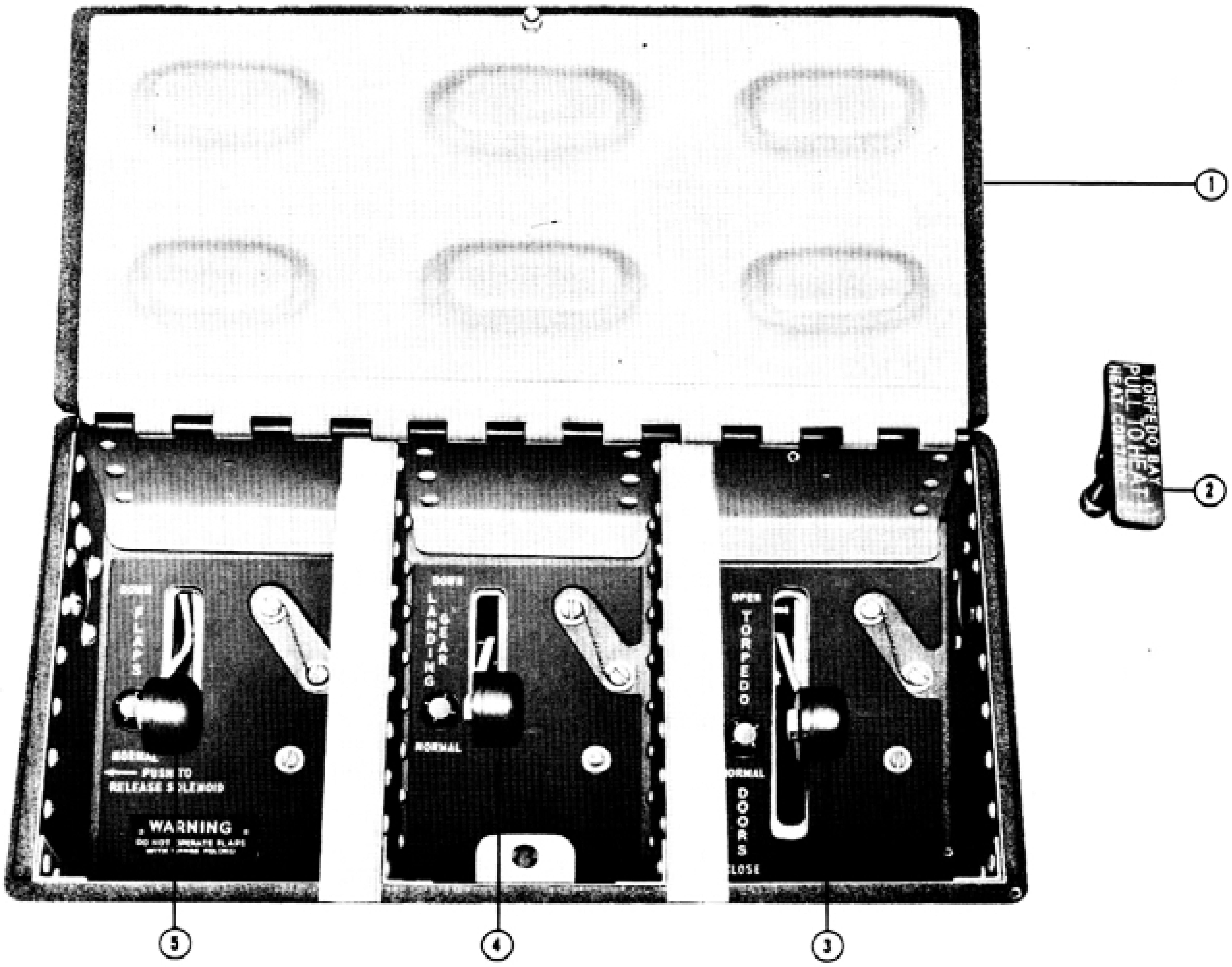


Figure 1-5. Overhead Console, Pilots' Compartment



1. G-limiter Manual Release Handle
2. Armament Selector Switch
3. Torpedo Bay Doors Open Indicator Light
4. Rocket Selector Switch
5. Torpedo Bay Doors Control Switch
6. Torpedo Manual Release Handle
7. Sonobuoy Control Handle
8. Sonobuoy Light Test Switch
9. VOR Control Panel
10. Console Lights Control Rheostat
11. Retro-Marine Marker Ejector Control Box
12. Automatic Pilot Power Switch
13. Elevator Trim Tabs Stand-by Switch
14. Stall Warning Test Switch
15. Single Engine Rudder Assist Switch
16. Location of Emergency Hydraulic Hand Pump (in floor - handle normally stowed on rear of co-pilot's seat)
17. Automatic Pilot Altitude Controller Warning Light
18. Elevator Trim Tabs Emergency Stop Switch
19. Rudder Trim Control
20. Rudder Trim Position Indicator
21. Aileron Trim Tab Position Indicator
22. Elevator Trim Tabs Position Indicator
23. Automatic Pilot Altitude Controller Switch
24. Automatic Pilot Altitude Limit Switch
25. Automatic Pilot Clutch Switch
26. Automatic Pilot Pitch Trim Wheel
27. Automatic Pilot Bank Trim Wheel
28. Automatic Pilot Controller
29. Course Indicator (ID-322/ARN-30)
30. Bomb Emergency Release Switch
31. Intervalometer Switch
32. Rockets and Bombs Arming Switch
33. Automatic Pilot Manual Release Handle
34. Retro Marine Marker Ejector Master Switch
35. Sonobuoy Master Switch

Figure 1-6. Lower and Folding Consoles, Pilots' Compartment



1. Hinged Cover
2. Torpedo Bay Heat Control
3. Emergency Torpedo Doors Control Handle
4. Emergency Landing Gear Down Control Handle
5. Emergency Flaps Down Control Handle

NOTE
These controls are located aft of the folding console in the floor of the pilots' compartment.

Figure 1-7. Flaps, Landing Gear and Torpedo Bay Doors Emergency Controls

FEATHER PROPELLER INDICATOR LIGHT.

A feather propeller indicator light for each propeller is located adjacent to the FEATHER PROP placard on each engine emergency control panel on the overhead console (9, figure 1-5). When lighted, this indicator shows that its engine is developing 400 bhp $\pm$ 200 bhp less than the other engine. It does not indicate a complete power loss nor mean that it is mandatory to feather.

ENGINE OIL SYSTEM.

The oil system for each engine is entirely self-contained within the power package. It consists primarily of a 17 US gallon tank, with three US gallon foam and expansion space; and an oil cooler, with the necessary tubing, fittings and valves to effect engine lubrication, oil dilution, tank and engine venting and draining, and propeller feathering. The tank and standpipes are designed to provide a 0.5 gallon sump, a 1 gallon propeller feathering supply and a 12.5 gallon engine oil supply. For oil grade and specification, see figure 1-2.

ENGINE OIL SYSTEM CONTROLS.

ENGINE OIL SWITCHES.

An engine oil switch (10, figure 1-5) is located on both engine emergency control panels on the overhead console. They permit shutting off the oil system to each engine, through a valve in the oil tank-to-engine line, in the event of fire in flight or other emergency. These two-position toggle switches, normally set at OPEN, can be set to CLOSE to shut off each oil system. Each switch also closes the electric fuel shut-off valve to prevent fuel flow to the engine when the oil is shut off.

OIL COOLER DOORS SWITCHES.

Electrically actuated oil cooler doors, which regulate the flow of air through the oil coolers, are controlled by two oil cooler switches, one for each engine, located on the left side of the overhead console (36, figure 1-5). Each of these three-position toggle switches can be set to OPEN or CLOSE, and can be set to the central (off) position to stop operation of the doors.

TANKS	No.	USABLE FUEL	UNUSABLE FUEL	EXPANSION SPACE	TOTAL VOLUME
LEFT WING S2F-1 airplanes BuNo. 129139 through 129153	1	199	1	13.5	213.5
RIGHT WING S2F-1 airplanes BuNo. 129139 through 129153	1	199	1	13.5	213.5
LEFT WING S2F-1 airplanes BuNo. 133045 and subsequent, and all S2F-2 airplanes	1	259	1	12	272
RIGHT WING S2F-1 airplanes BuNo. 133045 and subsequent, and all S2F-2 airplanes	1	259	1	12	272

All quantities are given in US gallons

Note

S2F-1 airplanes BuNo. 133045 through 133296 and S2F-2 airplanes BuNo. 133329 through 133344 will continue to have the 400 gallon capacity tanks until Aircraft Service Change No. 33 is incorporated.

Figure 1-10. Fuel Quantity Data Table

OIL DILUTION SWITCHES.

The oil dilution controls are two-position, momentary toggle switches, one for each engine, located on the left side of the overhead console (33, figure 1-5). They are normally OFF but can be held momentarily at ON, while the engines are running, to mix raw gasoline with the engine oil. Each oil dilution switch also operates its respective electric fuel pump.

The introduction of gasoline into the engine oil system tends to loosen carbon and sludge deposits within the system. This carbon and sludge may collect in the engine oil strainer in sufficient quantity to clog the strainer, and still not be apparent on visual inspection. Therefore, if gasoline is used to dilute the engine oil during cold weather operation, the strainer must be removed, disassembled, inspected, and all screens and filters cleaned within an hour or two after the first dilution of the season. This inspection and cleaning must be repeated at short intervals until sludge and carbon no longer collect.

Note

A manually operated valve is located in each nacelle to shut off the oil dilution system. These valves are opened ONLY when oil is to be diluted. They must remain closed at all other times.

AIRPLANE FUEL SYSTEM.

Fuel is carried in two tanks in the wing center section, one on each side of the fuselage. Fuel can be fed from

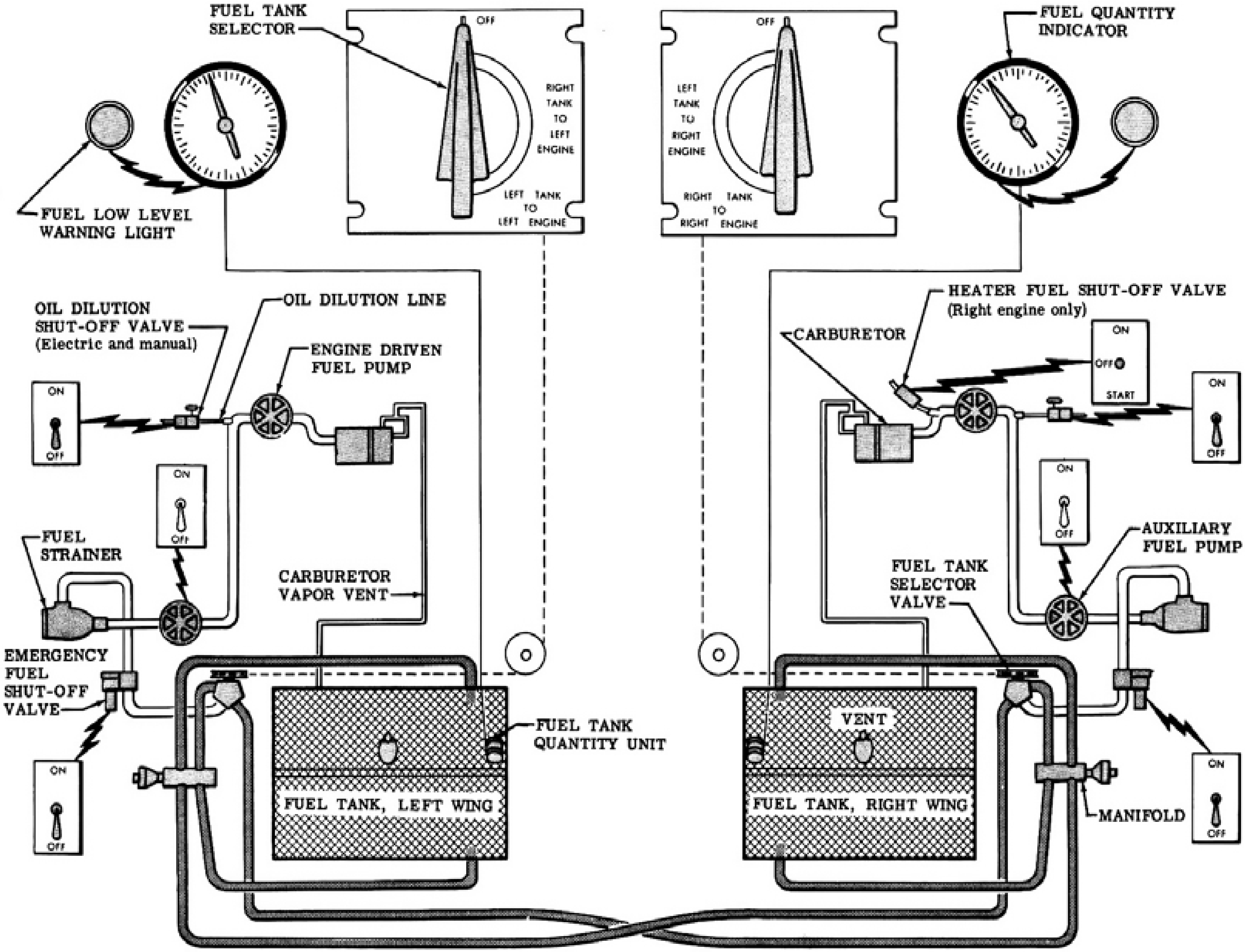
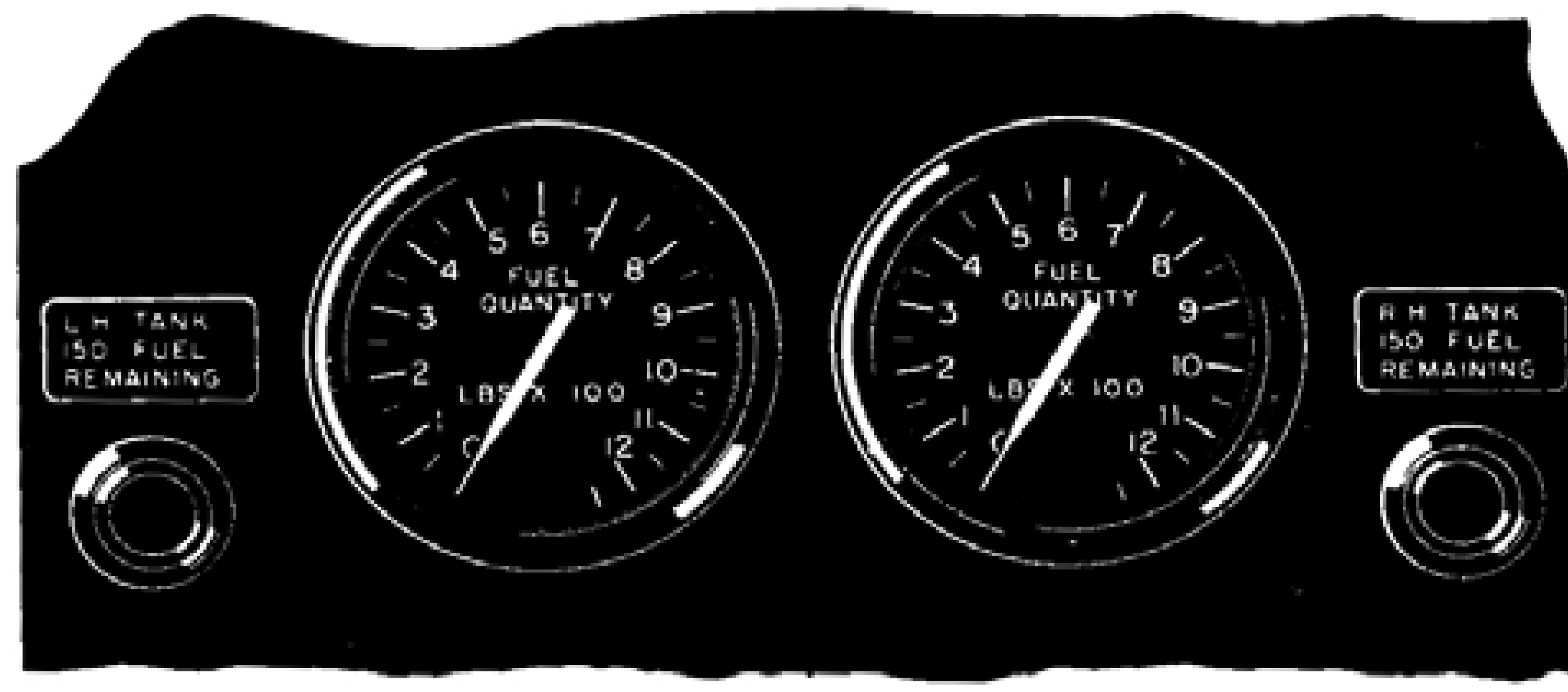


Figure 1-11. Airplane Fuel System—Schematic

FUEL QUANTITY GAGE TEST SWITCH



FUEL QUANTITY GAGES AND FUEL LOW LEVEL WARNING LIGHTS

Figure 1-11A. Fuel Quantity Gages and Test Switch, S2F-1 Airplanes BuNo. 129139 through 129153

either tank through the tank fuel line manifold, then through the tank selector valve, the emergency fuel shut-off valve, the fuel strainer, the electrically-driven auxiliary fuel pump and the engine-driven fuel pump to the carburetor (figure 1-11). Cross-feed is provided by a line running from each manifold across the fuselage at the rear beam to the tank selector valve on the opposite engine installation.

Note

Fuel is not transferable from one tank to the other, or from both tanks to one engine, but may be directed from one tank to either or both engines, as shown in figure 7-1.

Each emergency fuel shut-off valve is normally open and is controlled by a switch in the pilots' compartment. In the event of engine failure, moving the emergency fuel shut-off switch to the closed position closes the valve. Two fuel selector valves control fuel flow to the engines. Each selector valve may be set to use fuel from the tank on the same side, to use fuel from the opposite tank through the cross-feed line, or turned off to close all fuel supply lines to the engine (figure 7-1). A carburetor vapor vent line connects the carburetor of each engine with the tank on the same side. The tanks are pressurized in flight by ram air taken in through a vent fitting on the outboard side of each nacelle. The weight of fuel in each tank is measured by an electronic, capacitance-type system and is shown in pounds by an indicator in the pilots' compartment. The system also operates a low level warning light for each tank, which glows when less than 150 pounds of fuel remains in the tank. On early airplanes,[1] each tank has a capacity of 200 US gallons, making a total of 400 US gallons (figure 1-10). On later airplanes,[2] each tank has a capacity of 260 US gallons, making a total of 520 US gallons. For fuel grade and specification, see figure 1-2.

FUEL SYSTEM CONTROLS.

FUEL SELECTOR VALVE CONTROLS.

Two fuel selector valve controls on the overhead console (1 and 4, figure 1-5) can be used to select desired fuel tanks, as shown in figure 7-1. The selector valve on the right side of the overhead console is used to supply fuel to the right engine from either the right or left tank. It can be set at OFF, at LEFT TANK TO RIGHT ENGINE, or at RIGHT TANK TO RIGHT ENGINE. The selector valve on the left side, used to supply fuel to the left engine from either tank, can be set at OFF, at RIGHT TANK TO LEFT ENGINE, or at LEFT TANK TO LEFT ENGINE.

AUXILIARY FUEL PUMP SWITCHES.

The two auxiliary fuel pump switches (32, figure 1-5), are located on the left side of the overhead console. These two-position toggle switches are labeled for the left and right engines and can be set to ON or OFF.

EMERGENCY FUEL SHUT-OFF SWITCHES.

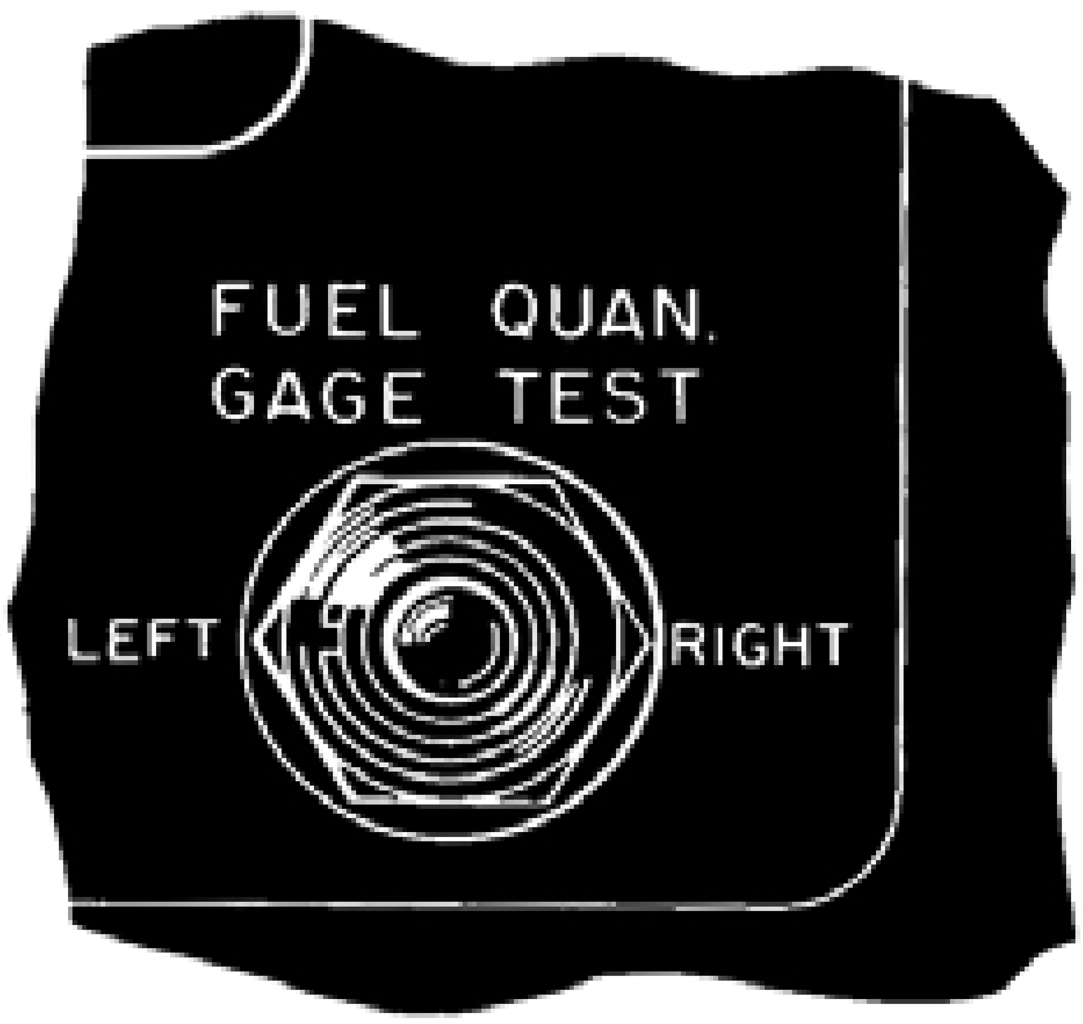
The two emergency fuel shut-off switches (14, figure 1-5) are located on the overhead console, one on each engine control panel. Normally the switch is at OPEN but, in the event of engine failure, the appropriate emergency fuel shut-off switch is moved to CLOSED to close the emergency fuel shut-off valve.

FUEL QUANTITY GAGE TEST SWITCH.

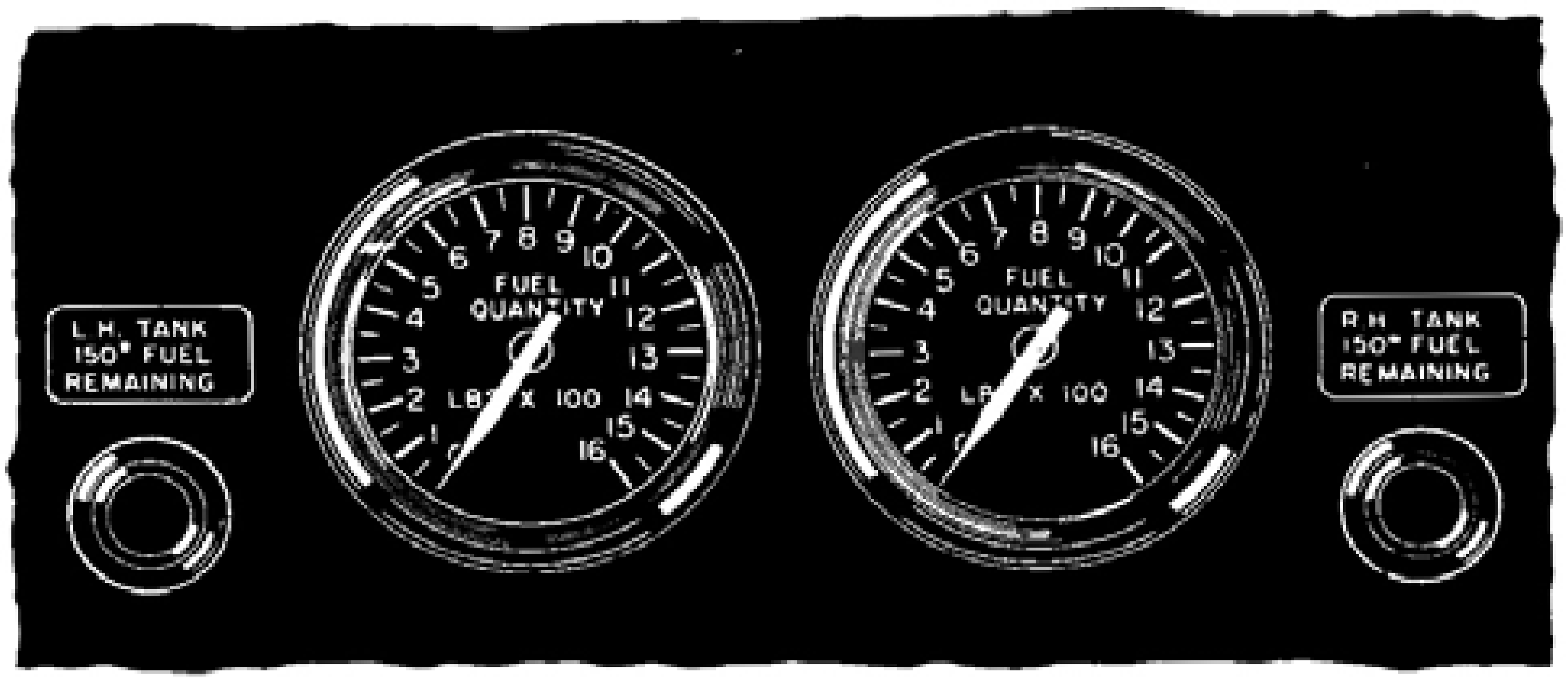
A three-position, momentary, fuel quantity gage test

[1]S2F-1 airplanes BuNo. 129139 through 129153.

[2]S2F-1 airplanes BuNo. 133045 and subsequent, and all S2F-2 airplanes. S2F-1 airplanes BuNo. 133045 through 133296, and S2F-2 airplanes BuNo. 133329 through 133344 will have the 400 gallon capacity until Aircraft Service Change No. 33 is incorporated.



FUEL QUANTITY GAGE TEST SWITCH



FUEL QUANTITY GAGES AND FUEL LOW LEVEL WARNING LIGHTS

Note

S2F-1 airplanes BuNo. 133045 through 133296 and S2F-2 airplanes BuNo. 133329 through 133344 will continue to have the 400 gallon capacity tanks until Aircraft Service Change No. 33 is incorporated.

Figure 1-11B. Fuel Quantity Gages and Test Switch, S2F-1 Airplanes BuNo. 133045 and Subsequent, and All S2F-2 Airplanes

toggle switch, located on the pilot's instrument panel (51, figure 1-4 and figures 1-11A and 1-11B), has a central off position and can be set to LEFT or RIGHT to test the operation of the left and right fuel tank quantity gages. Moving and holding this switch, with the battery switch ON, causes the indicator pointer of the respective gage to move to the low end of the dial. The fuel low level warning light should also light as the pointer reaches the 150 pound position. If the system is operating properly, the pointer should return to its original indication when the switch is returned to the off position.

FUEL SYSTEM INDICATORS.

FUEL PRESSURE INDICATOR.

The dual-unit fuel pressure indicator (46, figure 1-4) is located on the pilot's instrument panel.

FUEL QUANTITY GAGES.

Two fuel quantity gages located on the pilot's instrument panel (45, figure 1-4 and figures 1-11A and 1-11B) indicate pounds of fuel in each fuel tank. On early S2F-1 airplanes,[1] each gage reads to 1200 pounds. On later S2F-1 airplanes,[2] and all S2F-2 airplanes, each gage reads to 1600 pounds.

Note

On some airplanes,[1] fuel surging may cause a differential reading of up to 50 pounds in level flight and up to 100 pounds in a skid when fuel quantities are the same in both tanks.

FUEL LOW LEVEL WARNING LIGHTS.

Two fuel low level warning lights (red) are located adjacent to the fuel quantity gages on the pilot's instrument panel (50, figure 1-4 and figures 1-11A and 1-11B) and are placarded L.H. TANK 150# FUEL REMAINING and R.H. TANK 150# FUEL REMAINING. When lighted, each indicates that less than 150 pounds of fuel remains in its corresponding tank.

ELECTRICAL POWER SUPPLY SYSTEMS.

The electrical power systems consist of a 24-volt direct current, monitored bus system; a 115-volt, fixed frequency, alternating-current system; and a 117-volt, variable frequency, alternating-current system. The systems are of conventional single wire design with the aircraft structure forming the ground return for all circuits. External power receptacles are provided for engine starting and ground operation of all electrically operated equipment.

DIRECT-CURRENT SYSTEM.

The d-c system (figure 1-12) is powered by two 300-ampere, engine-driven generators, one on each engine, and a storage battery located in the right nacelle. The generators are regulated to 27.7 volts and form the principal power source. The battery, rated at 24-volt/36-ampere-hour, serves as an emergency source of power when the engine-driven generators are inoperative. The system may be powered by an external source through a receptacle located on the right side of the fuselage aft

[1] S2F-1 airplanes BuNo. 129139 through 129153.
[2] S2F-1 airplanes BuNo. 133045 and subsequent.

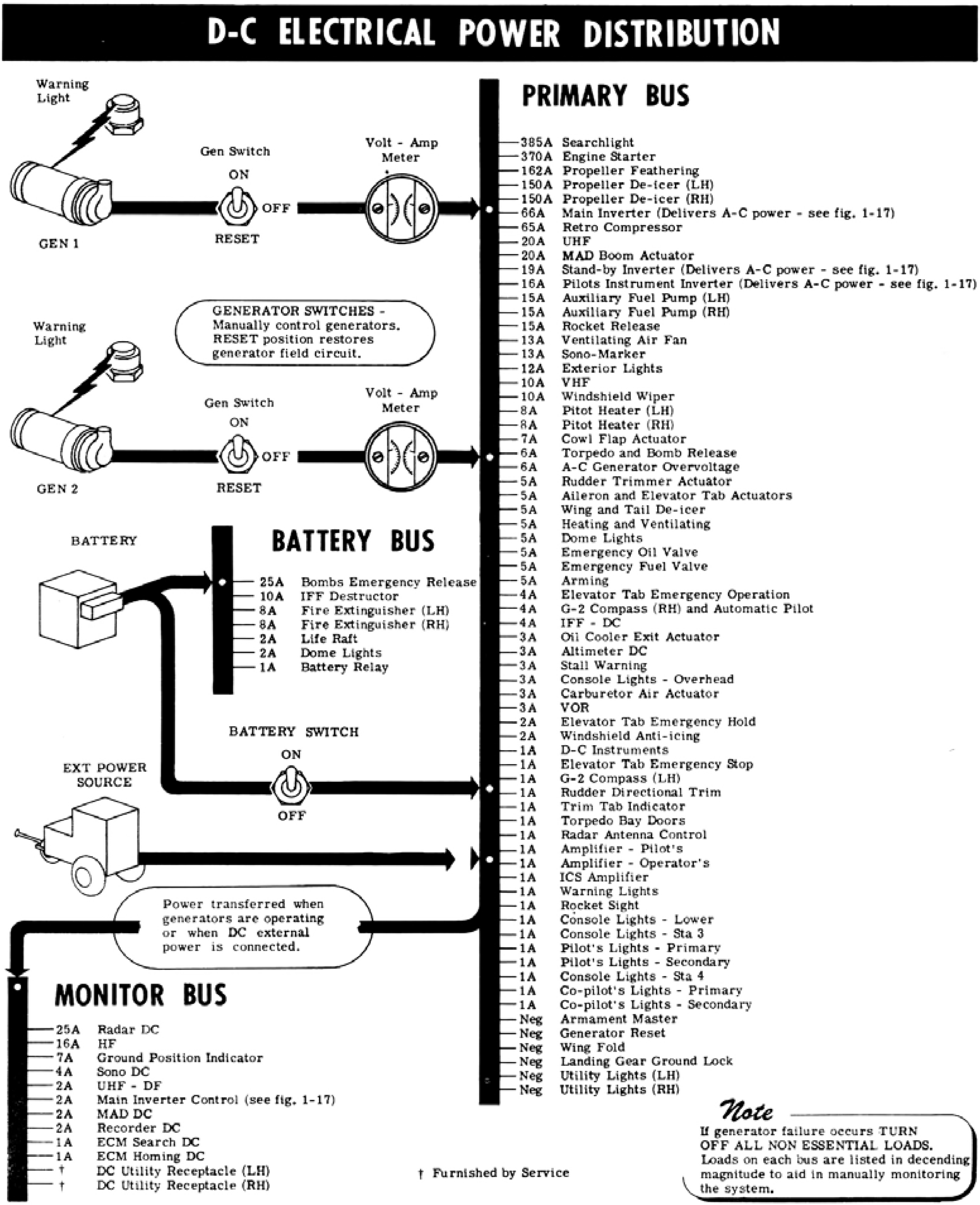


Figure 1-12. D-C Electrical Power Supply System—Schematic

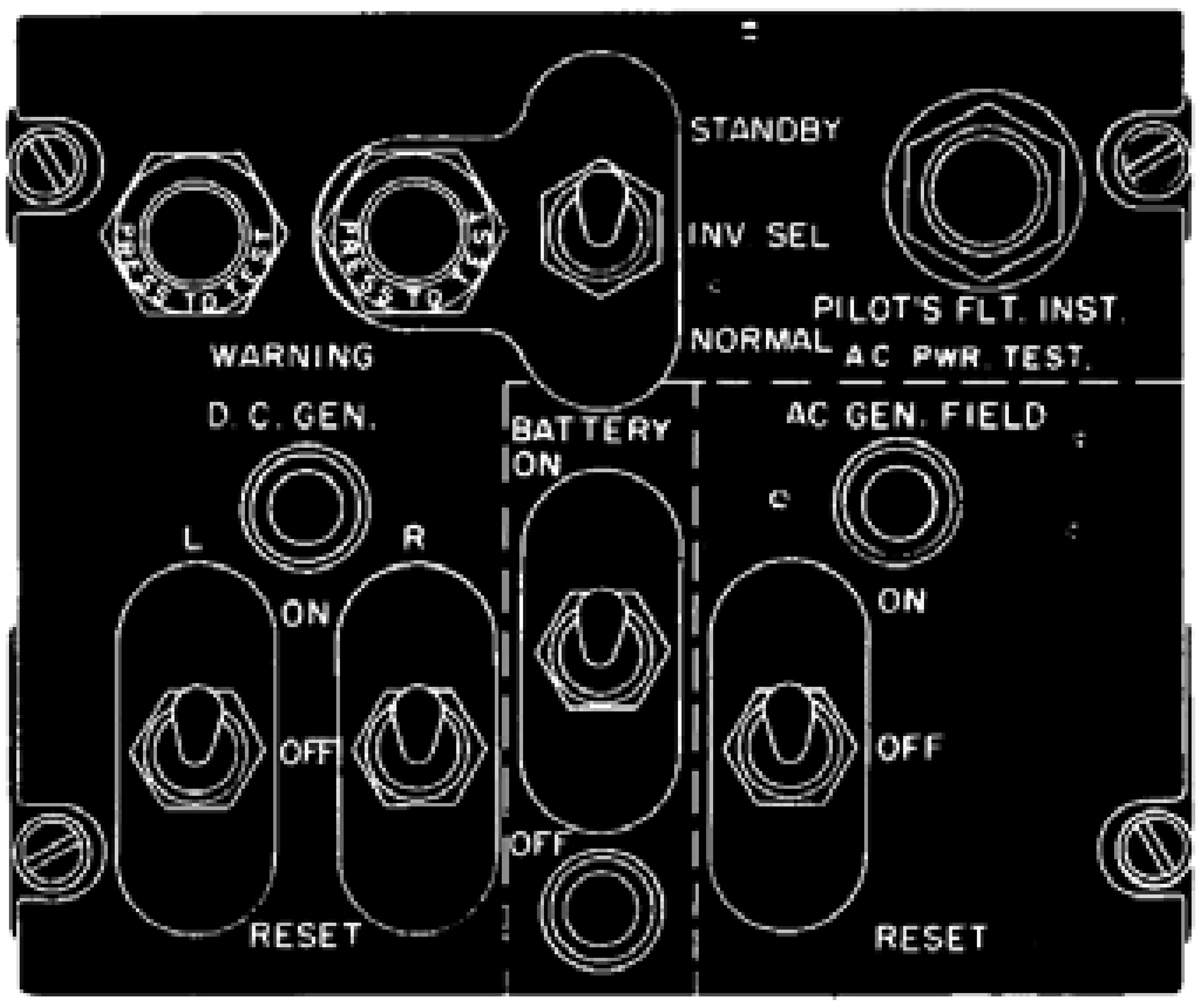


Figure 1-13. Master Power Panel

of the entrance door. The d-c system controls are grouped on the overhead console master power panel (figure 1-13). Generator warning lights and volt-ammeters provide visual indications of system performance. Direct current is distributed to the various units of electrical equipment through the primary, monitor, and battery buses. The system is designed to provide automatic monitoring of power to non-essential equipment during in-flight emergencies when both engine-driven generators are inoperative. This conserves battery power to give added safety of flight. Although the system is automatic in operation, individual circuits must be manually monitored when one generator fails, either by turning off the equipment or pulling out the appropriate circuit breakers. Figure 1-12 lists electrical loads in descending magnitude on each bus to aid in manually monitoring the system.

The primary bus supplies systems and equipment essential to flight control or combat effectiveness of the airplane. It is energized by the battery when the battery switch is ON, by the generators when the generator switches are ON and the generators are operating, or by external power when it is connected to the system. The monitor bus supplies non-essential equipment that are automatically cut-off if the generators fail. The monitor bus is energized when either or both generators are operating or when an external source of power is connected to the system. If both generators fail or rotate below cut-in speed, the monitor bus is automatically disconnected from the system. The battery bus supplies equipment which requires power available at all times and it is energized continuously by either the storage battery or, when the battery switch is ON, by generator or external power.

D-C SYSTEM CONTROLS.

BATTERY SWITCH.

The two-position battery switch (29, figure 1-5; figure 1-13) is located on the overhead console master power panel. When the battery switch is set to ON, the battery is connected to the primary bus. Setting the switch to OFF disconnects the battery from the primary bus.

CAUTION

When external electrical power is supplied to the system, the battery and generator switches must be in the OFF position to prevent possible damage to the battery or system wiring.

GENERATOR SWITCHES.

The three-position left and right d-c generator switches are located on the overhead console master power panel (29, figure 1-5; figure 1-13). The ON and OFF settings are normally used to start or stop operation of the engine-driven d-c generators. The momentary RESET position is used only if a generator has been automatically disconnected from the system because of abnormal voltage output. This occurs when the generator produces excessive voltage beyond the control of its voltage regulator and will be indicated by the glowing of the generator warning light. The disconnected generator may be reconnected to the system by placing the generator switch momentarily in the RESET position and then returning it to ON. This energizes the generator field relay, previously tripped by the abnormal voltage condition, to restore the generator field circuit and start the generator operating. If the generator field relay trips repeatedly, faulty operation of the generator or system components is indicated and the generator switch must be set to OFF.

GENERATOR MANUAL EMERGENCY RESET.

Two access holes, placarded GEN. FIELD RELAYS MANUAL RESET, are located on the face of the d-c distribution box in the electronics compartment. They provide hand access to the left and right generator field relays, so they can be reset manually. This method of resetting a tripped field relay is not used generally since the generator switches normally serve this purpose.

CIRCUIT BREAKERS.

Circuit breakers are grouped on two panels in the pilots' compartment (figure 1-8). The left panel, located aft of the pilot, contains electronic countermeasure, MAD, radar, radio, searchlight, and sonobuoy circuit breakers. The right panel, located aft of the co-pilot, contains armament, electrical, engine, flight, lighting, radio, and weather circuit breakers. The circuit breakers are identified and are arranged alphabetically from top to bottom of the panels. Switch type circuit breakers for the main inverter and retro compressor are installed on the face of the d-c distribution box.

D-C SYSTEM INDICATORS.

VOLTAMMETERS.

Two combined voltmeter and ammeter indicators are located on the co-pilot's instrument panel (28 and 29; figure 1-4; figure 1-15). The voltmeters indicate system voltage and the ammeters indicate d-c output of their respective generators. The voltmeters indicate battery or external power voltage when the generators are not supplying power to the system.

GENERATOR WARNING LIGHTS.

Two red generator warning lights, one for each generator, are located on the overhead console master power panel (29, figure 1-5; figure 1-13). The warning lights glow when the generator switches are set to OFF or when an operating generator is disconnected from the system because of malfunction or abnormal voltage output. If the disconnected generator is successfully returned to the system by the reset procedure, its generator warning light will go out.

CAUTION

When generator failure occurs, the electrical load must be reduced to prevent overloading the operative generator. TURN OFF ALL NON-ESSENTIAL EQUIPMENT IF BOTH GENERATORS FAIL.

VARIABLE FREQUENCY ALTERNATING-CURRENT SYSTEM.

The variable frequency alternating-current system (figure 1-15) is powered by an engine-driven a-c generator installed on the left engine. The generator is a 400/800-cycle, three-phase unit with an output rating of nine kilovolt-amperes. Output voltage is regulated to 117 ± 3 volts. A three-phase receptacle located aft of the entrance door permits connection of external power to the system for ground operation and test of equipment served by the a-c generator. A voltage sensitive relay operates automatically to disconnect the generator from the system when abnormal voltage is produced. An a-c voltmeter, installed on the MAD-CM operator's console, provides a visual indication of system performance.

VARIABLE FREQUENCY A-C SYSTEM CONTROLS.

A-C POWER SELECTOR SWITCH.

The two-position a-c power selector switch is located on the a-c distribution box in the operators' compartment. The AC PWR GENERATOR setting supplies a-c generator power to the system when the a-c generator is operating. The AC PWR EXTERNAL setting supplies three-phase external power to the system for ground operation and test of equipment served by the engine-driven a-c generator.

A-C GENERATOR FIELD SWITCH.

The three-position a-c generator field switch is located on the overhead console master power panel in the pilots' compartment (29, figure 1-5; figure 1-13). The ON and OFF positions are used to place the engine-driven a-c generator in operation or remove it from the system. The momentary RESET position is used only if the a-c generator is shut down due to system malfunction. This occurs when the generator produces excessive voltage beyond the control of the voltage regu-

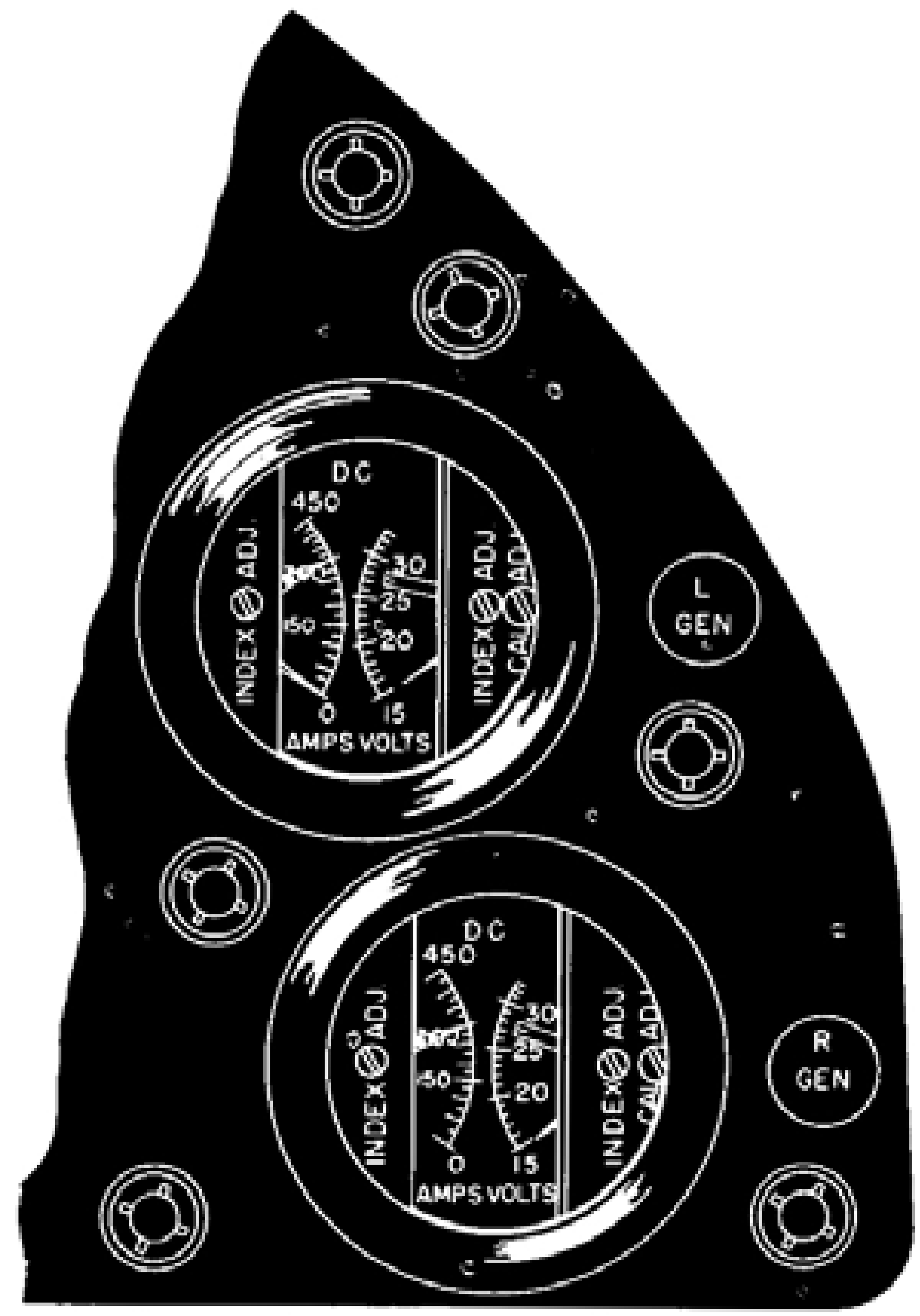


Figure 1-14. Voltammeters

lator due to faulty operation of the generator or system components. When the switch is put in the momentary RESET position and then returned to ON, it returns the generator to operation.

CAUTION

If the a-c generator is shut-down repeatedly after resetting, faulty system operation is indicated and the a-c generator field switch must be set to OFF.

A-C VOLTMETER SELECTOR SWITCH.

The rotary-type a-c voltmeter selector switch is located on the MAD-CM operator's a-c voltmeter panel (figure 1-16). It is used in conjunction with the a-c voltmeter to test voltage on each phase of the a-c generator or the main inverter. To read voltages on the variable frequency system, the selector switch must be set to the desired phase (A, B, or C) on the AC GEN side of the switch.

CIRCUIT BREAKERS.

Variable frequency system loads are protected by circuit breakers located on the left circuit breaker panel in the pilots' compartment. The a-c generator overvoltage circuit breaker is located on the right circuit breaker panel and provides circuit protection for the trip and reset elements of the exciter control relay. The a-c generator field and a-c utility receptacle circuit breakers are located on the a-c distribution box in the operators' compartment.

A-C VARIABLE FREQUENCY POWER SUPPLY SYSTEM

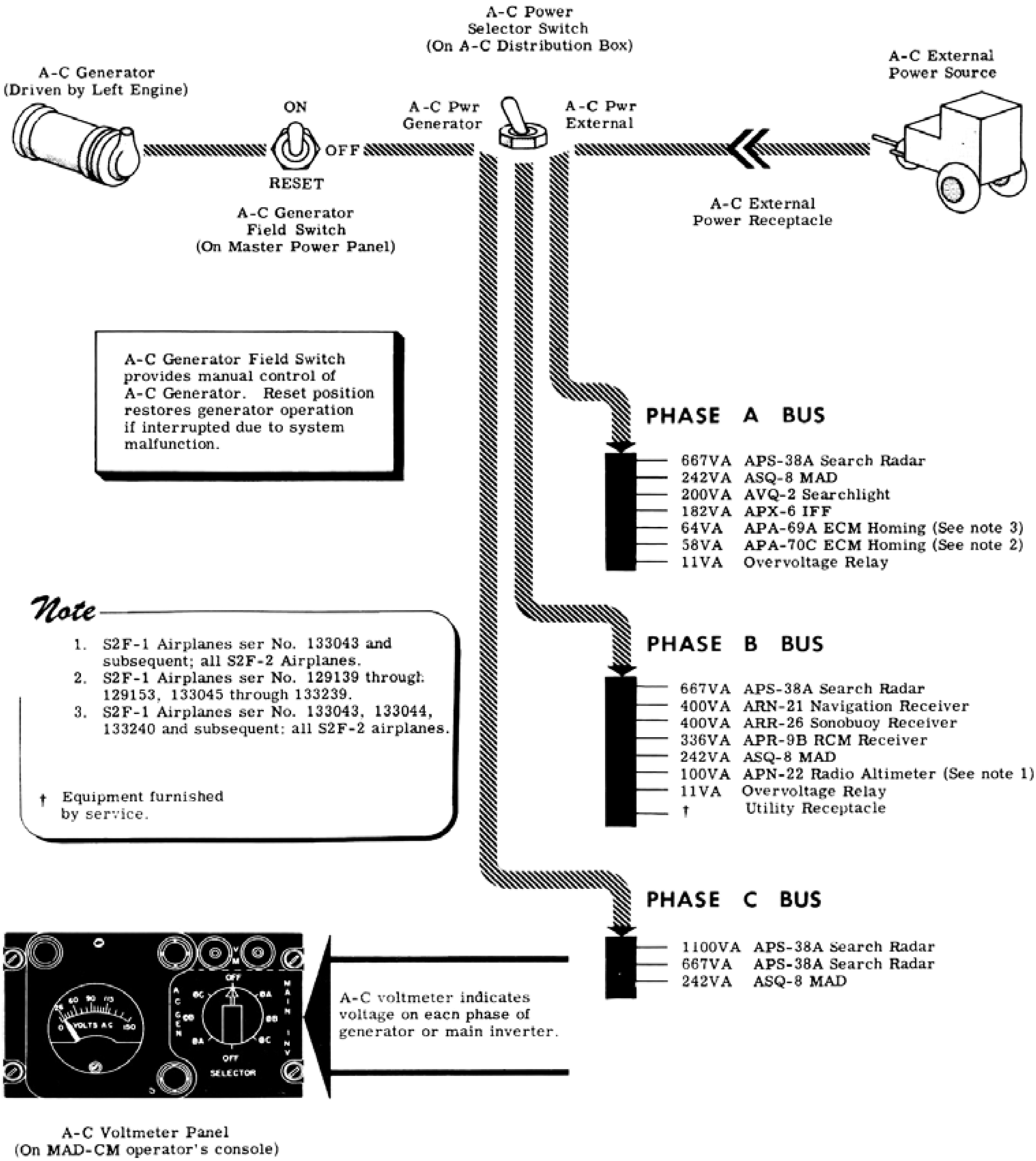


Figure 1-15. A-C Variable Frequency Electrical Power Supply System—Schematic

VARIABLE FREQUENCY A-C SYSTEM INDICATORS.

A-C VOLTMETER.

The a-c voltmeter is located on the MAD-CM operator's a-c voltmeter panel (figure 1-16), adjacent to the a-c voltmeter selector switch. The voltmeter is used in conjunction with the a-c voltmeter selector switch to indicate voltage in each phase of the a-c generator or the main inverter.

FIXED FREQUENCY ALTERNATING-CURRENT SYSTEM.

The fixed frequency source of alternating current (figure 1-17) consists of the main inverter, located in the left wheel well, and the pilot's instrument and stand-by inverters located in the electronics compartment. All are 115-volt, three-phase, 400-cycle motor-generator combinations that operate on direct current from the primary bus. The pilot's instrument inverter operates continuously to power only the pilot's electrically operated flight instruments. The main inverter normally supplies all other 400-cycle loads, while the stand-by inverter serves as an alternate power source when the main inverter is inoperative. When the stand-by inverter is operating, only those circuits essential to flight will operate. The automatic pilot, search radar, and countermeasure equipment will be inoperative. Automatic change-over to the stand-by inverter occurs only when the engine-driven d-c generating system becomes inoperative. Warning lights provide visual indication of inverter system malfunction and loss of a-c power to either the pilot's or co-pilot's flight instruments. An a-c voltmeter, located on the MAD-CM operator's console, is used to check voltage on each phase of the main inverter.

FIXED FREQUENCY A-C SYSTEM CONTROLS.

INVERTER SELECTOR SWITCH.

The two-position inverter selector switch (29, figure 1-5; figure 1-13) is located on the overhead console master power panel in the pilots' compartment. The NORMAL position places the main inverter in operation. When the switch is set to STANDBY, main inverter operation is interrupted and the stand-by inverter is placed in operation.

Note

> Automatic change-over to the stand-by inverter occurs only when both d-c generators become inoperative.

PILOT'S FLIGHT INSTRUMENTS A-C POWER TEST SWITCH.

The pilot's flight instruments a-c power test switch (29, figure 1-5; figure 1-13) is located on the overhead console master power panel in the pilots' compartment. When operated, it illuminates the pilot's flight instruments a-c power off indicator light (32, figure 1-4) and disconnects the pilot's flight instruments from the pilot's instrument inverter. The switch is used to check operation of the pilot's instrument inverter system and indicator light circuits.

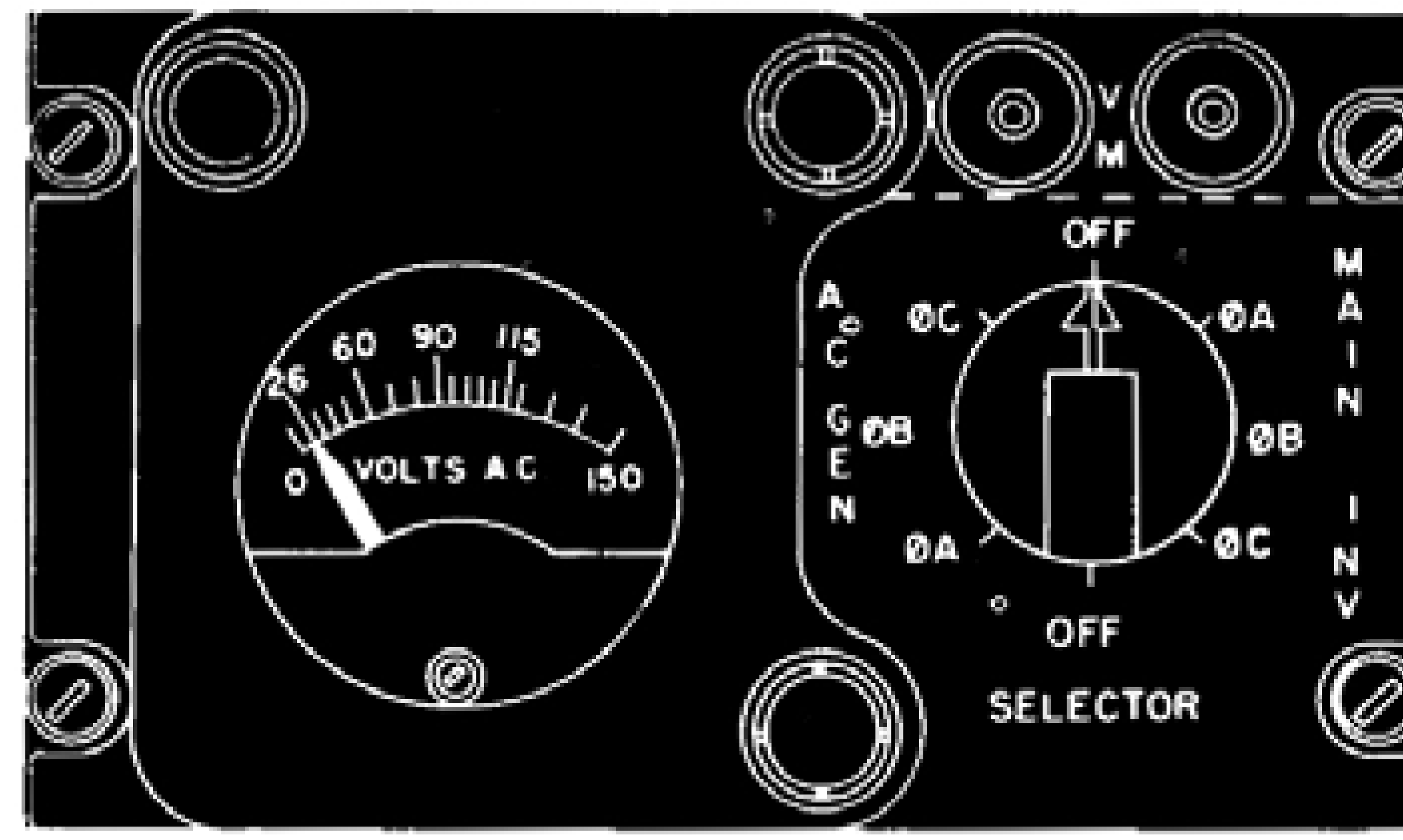


Figure 1-16. A-C Voltmeter Panel

A-C VOLTMETER SELECTOR SWITCH.

The rotary type a-c voltmeter selector switch located on the MAD-CM operator's a-c voltmeter panel (figure 1-16) is used in conjunction with the a-c voltmeter to check voltage on each phase of the main inverter. To read main inverter voltage, set the switch to the desired phase (A, B, or C) on the MAIN INV side of the switch. To read a-c generator phase voltages, see the variable frequency system, preceding.

MAIN INVERTER SWITCH-BREAKER.

The main inverter switch-breaker is located on the face of the d-c distribution box and functions to protect the main inverter in the event of overload or circuit malfunction.

FIXED FREQUENCY A-C SYSTEM INDICATORS.

A-C VOLTMETER.

The a-c voltmeter is located on the MAD-CM operator's a-c voltmeter panel (figure 1-16) adjacent to the a-c voltmeter selector switch, and is used in conjunction with this switch to read voltages of the main inverter and a-c generator.

FLIGHT INSTRUMENTS A-C POWER OFF INDICATOR LIGHTS.

Two red warning lights, placarded FLT. INSTR. A.C. POWER OFF, illuminate to indicate loss of a-c power and failure of the pilot's or co-pilot's flight instruments. The pilot's indicator light, located on the left side of the pilot's instrument panel (32, figure 1-4), glows if the pilot's instrument inverter is disconnected, fails, or if the pilot's gyro horizon fuse has failed.

Note

> Failure of the pilot's gyro horizon fuse may be verified by checking for continued operation of the pilot's G-2 compass.

The co-pilot's indicator light, located on the right side of the co-pilot's instrument panel (32, figure 1-4), glows if the main inverter is disconnected or fails, and will be off when the stand-by inverter is furnishing a-c power. The PILOT'S FLT. INST. A.C. PWR TEST

A-C FIXED FREQUENCY POWER SUPPLY SYSTEM

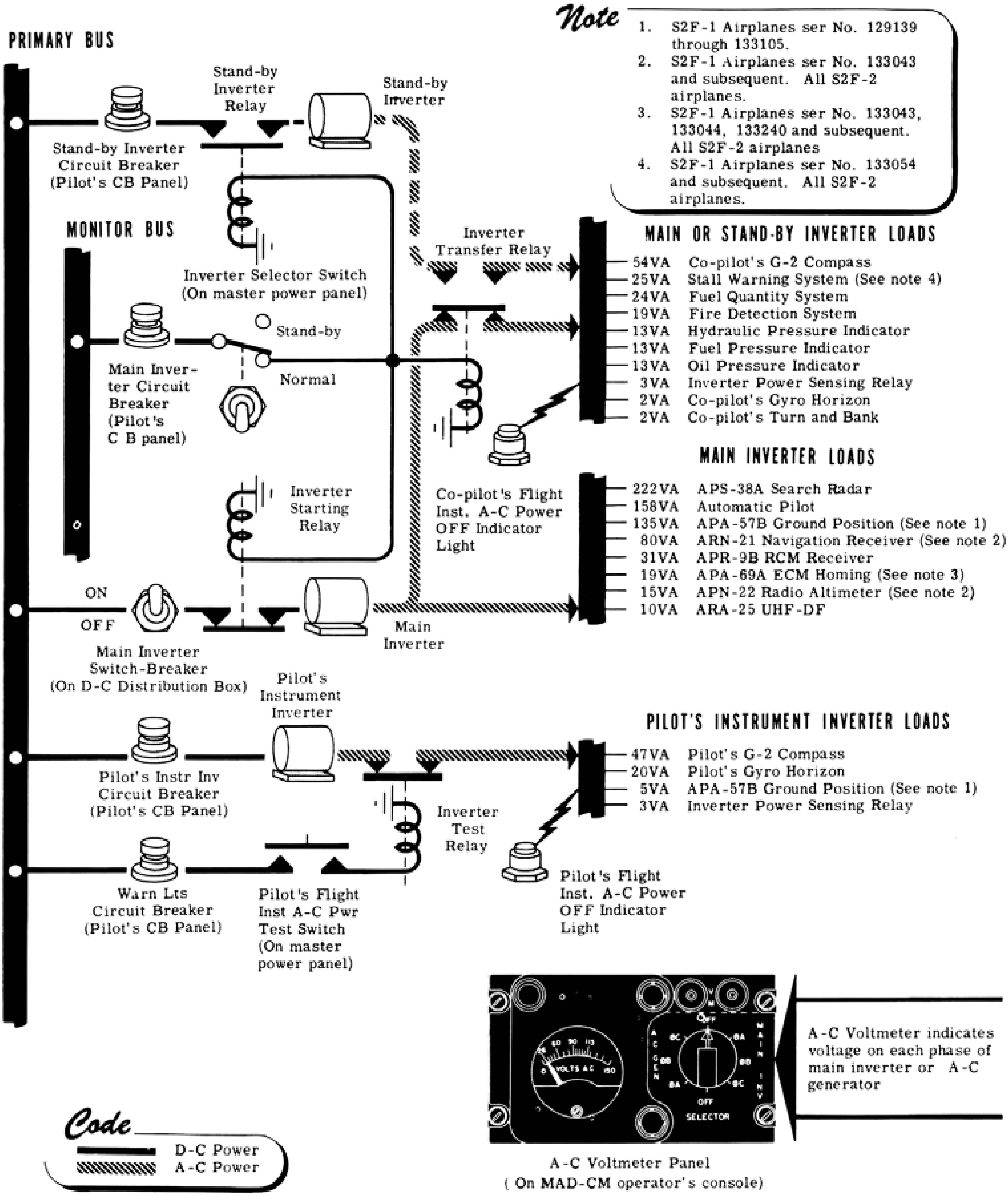


Figure 1-17. A-C Fixed Frequency Electrical Power Supply System—Schematic

switch (29, figure 1-5; figure 1-13) checks the pilot's flight instruments a-c power off indicator light circuit. To check the co-pilot's indicator light circuit, the main and stand-by circuit breakers should be pulled out; when this is done the indicator light should glow.

HYDRAULIC POWER SUPPLY SYSTEMS.

The normal hydraulic system is of the engine-driven, variable-volume pump, closed center type. It provides an operating pressure of 3000 psi for the wing fold system and 1500 psi for torpedo bay doors, landing gear, wing flaps, radome, arresting hook, rudder trimmer, g-limiter, and brakes. Pressure to the 1500 psi systems is supplied directly during normal flight and through a pressure reducer while the wings are being folded or spread. A main reservoir and an emergency reservoir are provided, with the latter being refillable in flight. The emergency system consists of a reservoir, a hand pump, and selector valves to operate the landing gear down, wing flaps down, and torpedo bay doors open and closed. See figure 1-2 for servicing instructions and figure 1-18 for the hydraulic system schematic diagram.

NORMAL HYDRAULIC SYSTEM OPERATION.

With the engines operating, fluid is drawn from the main reservoir to a variable volume pump on each engine. Each pump delivers 1500 psi and also contains a compensator boost chamber which permits delivery of an operating pressure of 3000 psi when the compensator boost is operated during wing folding or spreading. The pressure from each pump is directed through disconnects, filters and check valves into the system selector valve. With the wings spread, the two-position, four-way, system selector valve remains in the deenergized position, allowing 1500 psi to be transmitted to all selector valves in the system. When the wings are being folded, are folded, or are being spread, both wing fold selector valves and the system selector valves are energized. The system selector valve ports pressure to the compensator port of the pump, boosting the compensator spring and allowing the pump to build up 3000 psi pressure. The wing fold selector valve ports the 3000 psi to the wing lock lock cylinder and starts the wing fold operation. During this period, the 1500 psi system is fed through the pressure reducer. The main hydraulic reservoir is non-pressurized and has a capacity of 5-1/4 US gallons, including fluid in the fillerneck (6, figure 1-2). A sight gage is located on the tank for checking fluid level.

MAIN HYDRAULIC SYSTEM INDICATORS.

HYDRAULIC PRESSURE GAGES.

Two electrically-operated hydraulic pressure gages (7, figure 1-5) are located on the overhead console and indicate pounds of pressure output from each of the variable volume pumps. The gages, placarded LEFT and RIGHT, register pressure from 0 to 5000 pounds.

EMERGENCY HYDRAULIC SYSTEM OPERATION.

Fluid is drawn from the emergency reservoir by operation of a hand pump in the pilots' compartment. The hand pump produces 1500 psi pressure and its flow is directed into separate selector valves. These valves are normally in the neutral position, venting the emergency lines to return. The emergency operations are: torpedo bay doors open, torpedo bay doors closed, landing gear down and wing flaps down. Shuttle valves block off the main system lines during hand pump operation. The emergency reservoir (11, figure 1-2) has a capacity of 1-1/2 US gallons and its fillerneck (10, figure 1-2) is located so that it may be filled in flight.

HAND PUMP.

An emergency hydraulic hand pump (16, figure 1-6) is used to develop hydraulic pressure to operate landing gear down, wing flaps down, and torpedo bay doors open and closed in the event of normal system failure or when the engines are inoperative. The hand pump pressure is controlled by three selector valves. To obtain pressure, a fitting on the pump, which extends above the floor in the pilots' compartment, is manually moved fore and aft by a removable handle. This handle is normally stowed in a spring clip attached to the rear of the co-pilot's seat. For operation, the end of the handle is pushed into the pump fitting and then turned clockwise to lock it in position.

EMERGENCY HYDRAULIC SYSTEM CONTROLS.

HAND PUMP EMERGENCY SELECTOR VALVE CONTROLS.

Pressure developed by the hand pump is controlled by three emergency selector valve handles, located under a hinged door in the center of the pilots' compartment floor just forward of the door to the operators' compartment. The door, which folds aft, is opened by use of a finger hole at the forward end. The selector valves are placarded: FLAPS, LANDING GEAR, and TORPEDO DOORS (5, 4, and 3, figure 1-7). The flaps control, normally set at NORMAL, can be set at DOWN to lower the wing flaps by use of the hand pump. The landing gear control is similar, with NORMAL and DOWN positions. The torpedo doors control can be used to either open or close the torpedo bay doors by use of the hand pump. It can be set at NORMAL, OPEN, or CLOSE. If any of the three control handles is moved from its normal position, the related primary control cannot be used again until the emergency dump valve is reset by means of a manual reset button. The hinged door cannot be fully closed over the emergency control handles unless they are all set at NORMAL.

Note

The flaps emergency control handle is held in the NORMAL position by a solenoid which is deenergized when the wing lock handle is unlocked to prevent lowering of the flaps by hand pump pressure when the wings are folded. In the event this solenoid is deenergized due to an electrical failure, and the flaps emergency control handle is consequently held at

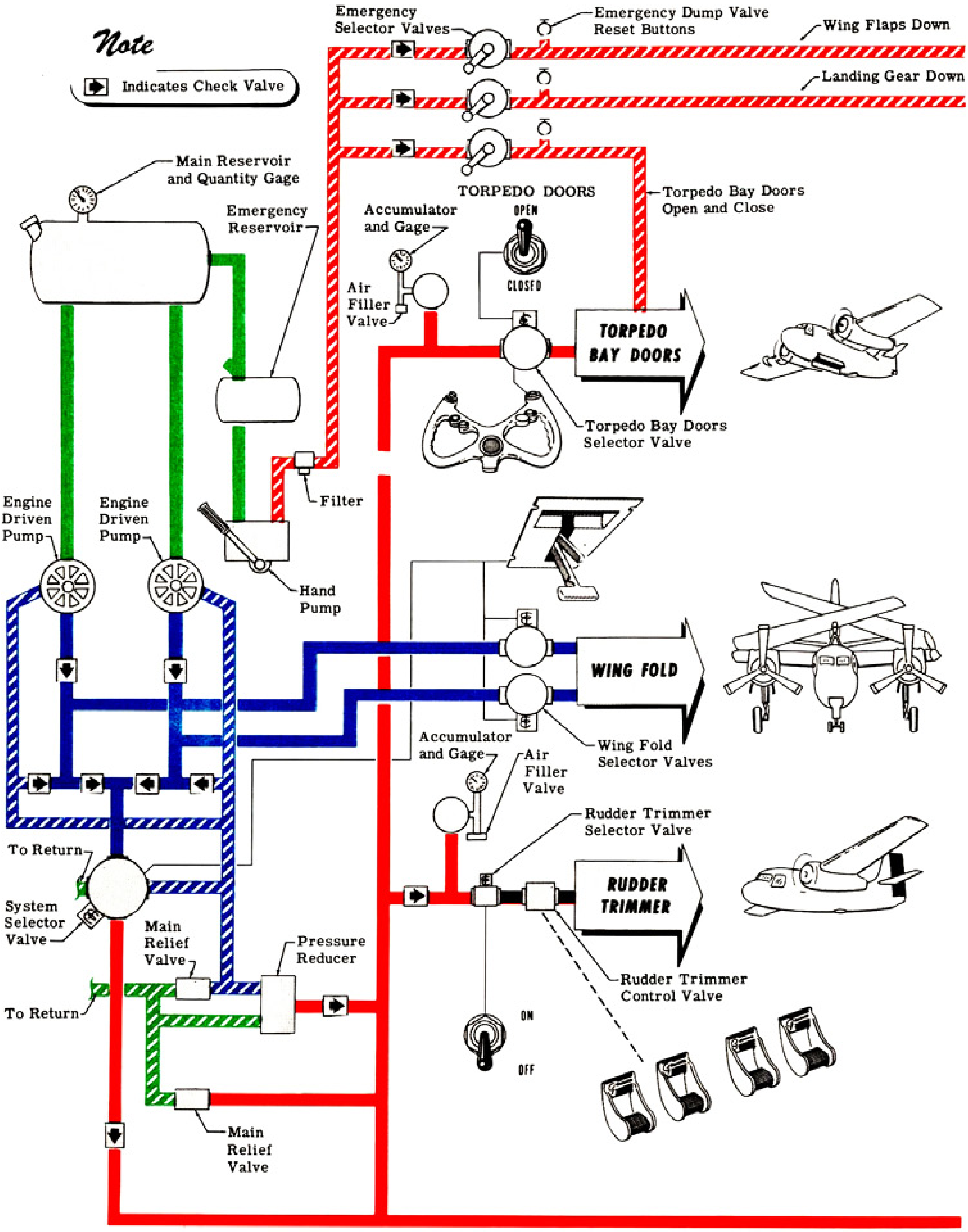


Figure 1-18. Hydraulic Power Supply System—Schematic (Sheet 1)

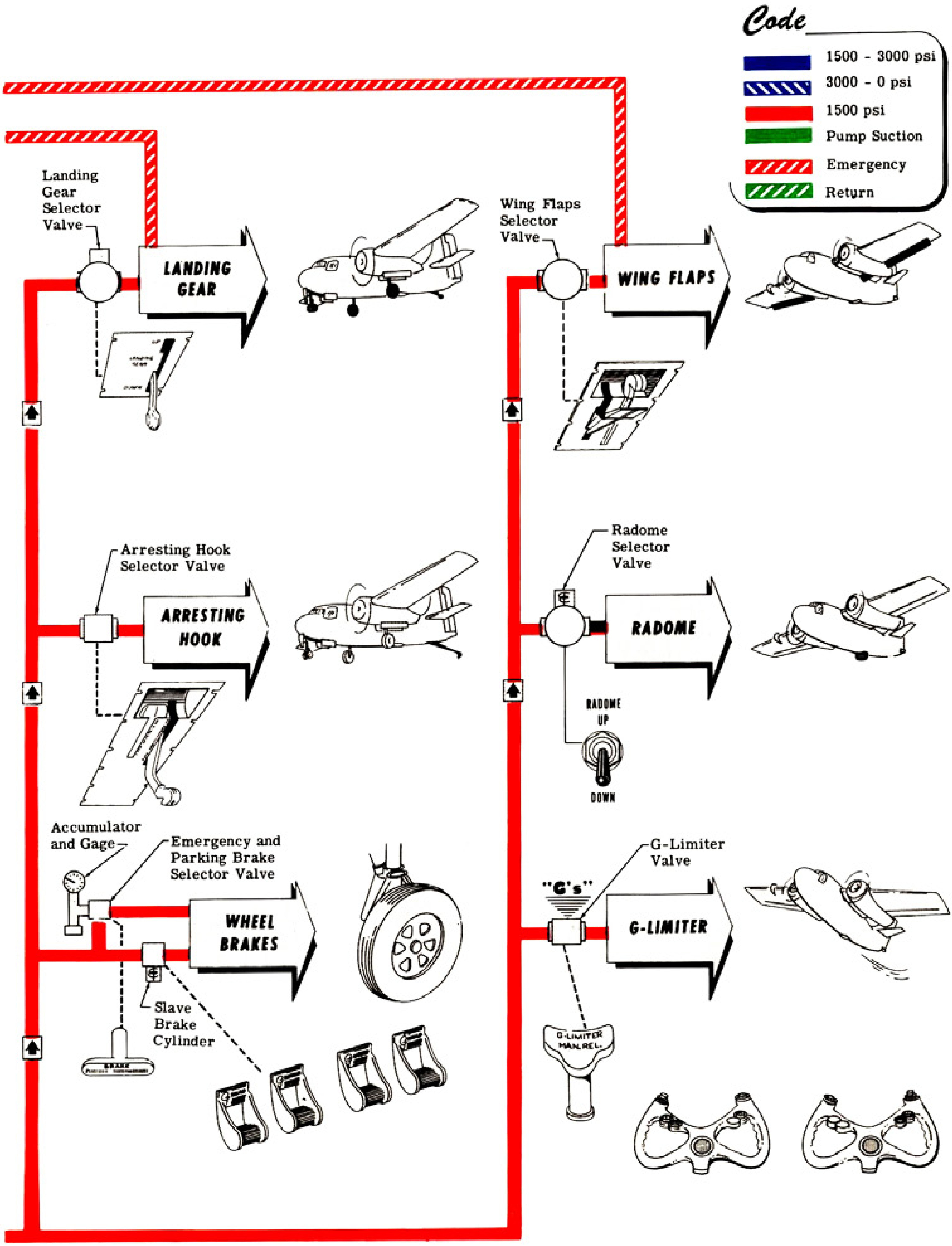


Figure 1-18. Hydraulic Power Supply System—Schematic (Sheet 2)

NORMAL, the handle can be used to lower the flaps by first pushing it to the left to release the solenoid. The control is placarded PUSH TO RELEASE SOLENOID. An adjacent arrow designates the proper direction in which to push.

EMERGENCY DUMP VALVE RESET BUTTONS.

Three emergency dump valve reset buttons are available to crew members: one for the wing flaps, one for the landing gear and one for the torpedo bay doors (figure 1-18). After an emergency use, each must be pushed to reset the dump valve of its system before the system can be used again. After returning the emergency system control handle to its NORMAL position, and then pushing the applicable emergency dump valve reset button, the system can be operated by using the NORMAL controls, provided the necessary portion of the hydraulic system is intact. For locations of these reset buttons, see individual descriptions in this section.

FLIGHT CONTROL SYSTEM.

The primary flight control surfaces are operated from either the pilot's or co-pilot's position by means of a control wheel and two rudder pedals which are mechanically connected to the control surfaces. All control surfaces are conventional except that a rudder trimmer is installed for directional trimming and additional directional control in the event of failure or excessive loss of power of either engine. Spoilers in each wing are linked with the ailerons as part of the lateral control system. An automatic pilot and a g-limiter are provided. Aileron and elevator trim tabs are motor-driven. The rudder tab is not directly controllable, serving as a slave to the rudder trimmer.

CONTROL WHEELS.

The conventional pilot's wheel incorporates the following controls: elevator trim tab switch (27, figure 1-4), inter-communication microphone push button switch (30, figure 1-4), radio microphone push button switch (31, figure 1-4), torpedo-bombs release push button switch (7, figure 1-4), and rockets release switch (4, figure 1-4). The co-pilot's control wheel is also conventional, with the incorporation of a quick-disconnect feature. It includes the following push button control switches: aileron and elevator trim tab switch (27, figure 1-4), inter-communication microphone switch (30, figure 1-4), radio microphone switch (31, figure 1-4), and torpedo-bombs release switch (7, figure 1-4).

CO-PILOT'S CONTROL COLUMN DISCONNECT HANDLE.

A control handle to disconnect the co-pilot's control column from all surface controls and to lock it at its forward position is located directly below the co-pilot's wheel and is placarded COLUMN DISCONNECT. This disconnect control (36, figure 1-4) is a "T" handle which, when pulled, disengages the wheel and, when then turned 90 degrees to the right, with the wheel pushed full forward, locks it at that position.

LATERAL CONTROL SURFACES.

Lateral control surfaces consist of ailerons in the wing outer panels and two spoilers in each wing outer panel, located inboard of the aileron and forward of the outer panel flap. The spoilers are mechanically linked with the ailerons so that as each aileron moves upward, the adjacent pair of spoilers moves upward with it, and extends through the upper surface of the wing. When the aileron travels downward, the spoilers move down into the wing. The spoilers and ailerons are operated mechanically, each aileron being moved by means of a spring tab linked to the control column (figure 1-19, sheet 1).

LONGITUDINAL CONTROL SURFACES.

The longitudinal control system consists of conventional elevators operated mechanically by a system of cables and push rods connected to the pilots' wheels (figure 1-19, sheet 1) and includes a spring installed in the system at the aft end of the fuselage. This spring becomes effective only when the landing gear is retracted, as it is controlled by the motion of the tail bumper. The spring performs the double function of minimizing the change in control wheel force due to trim change associated with landing gear retraction, and also adds to positive stability in all configurations when the landing gear is retracted. The inboard (S2F-1) or outboard (S2F-2) balance tabs are geared to the elevator and move as a function of elevator position.

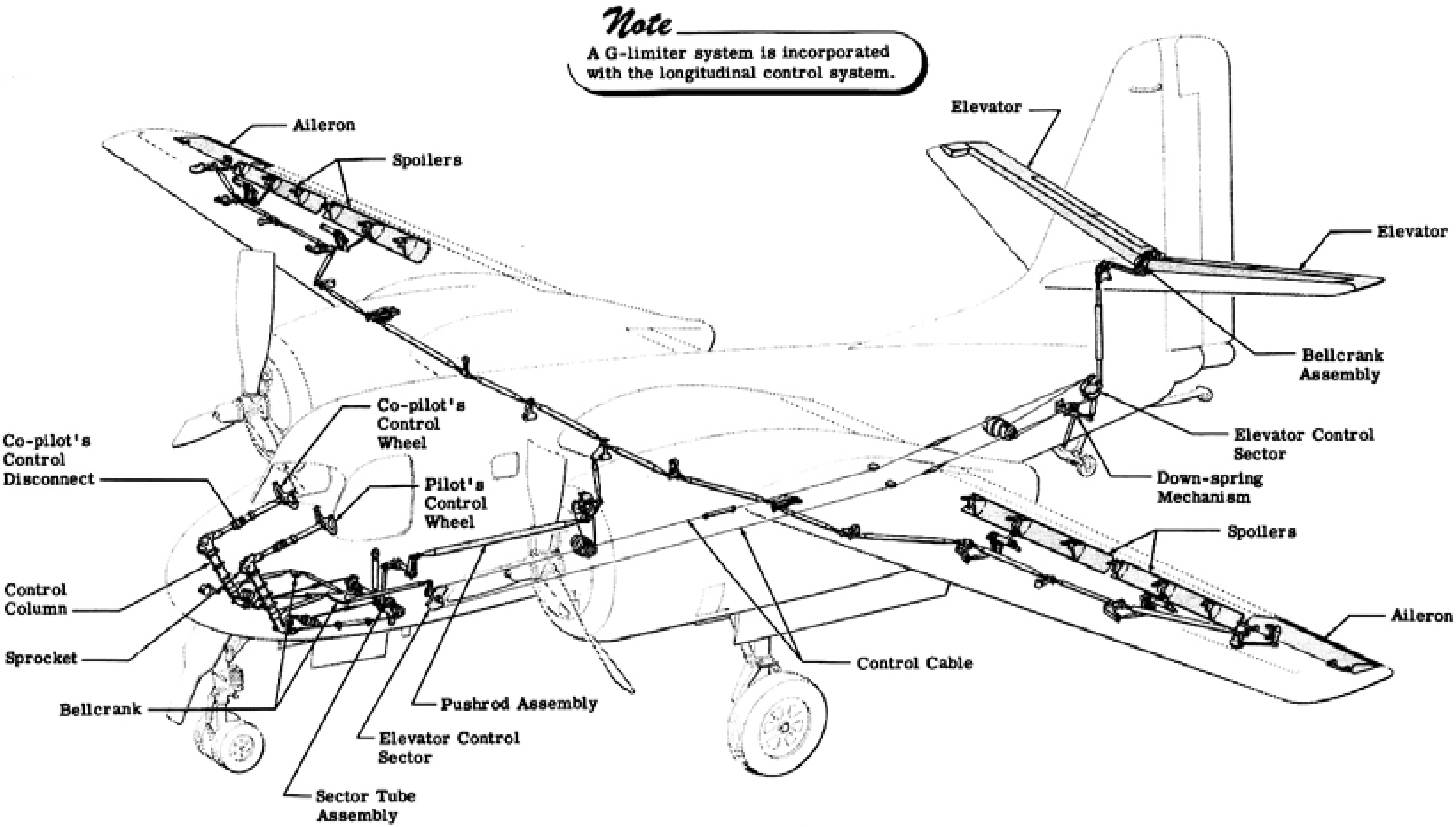
RUDDER CONTROL SURFACES.

RUDDER.

The rudder, conventional except for its operation with the rudder trimmer system, is controlled by either of the two pairs of adjustable rudder pedals to which it is mechanically connected (figure 1-19, sheet 2). The rudder pedals can be adjusted by using the two rudder pedal adjustment handles provided, one for the pilot and one for the co-pilot (37, figure 1-4).

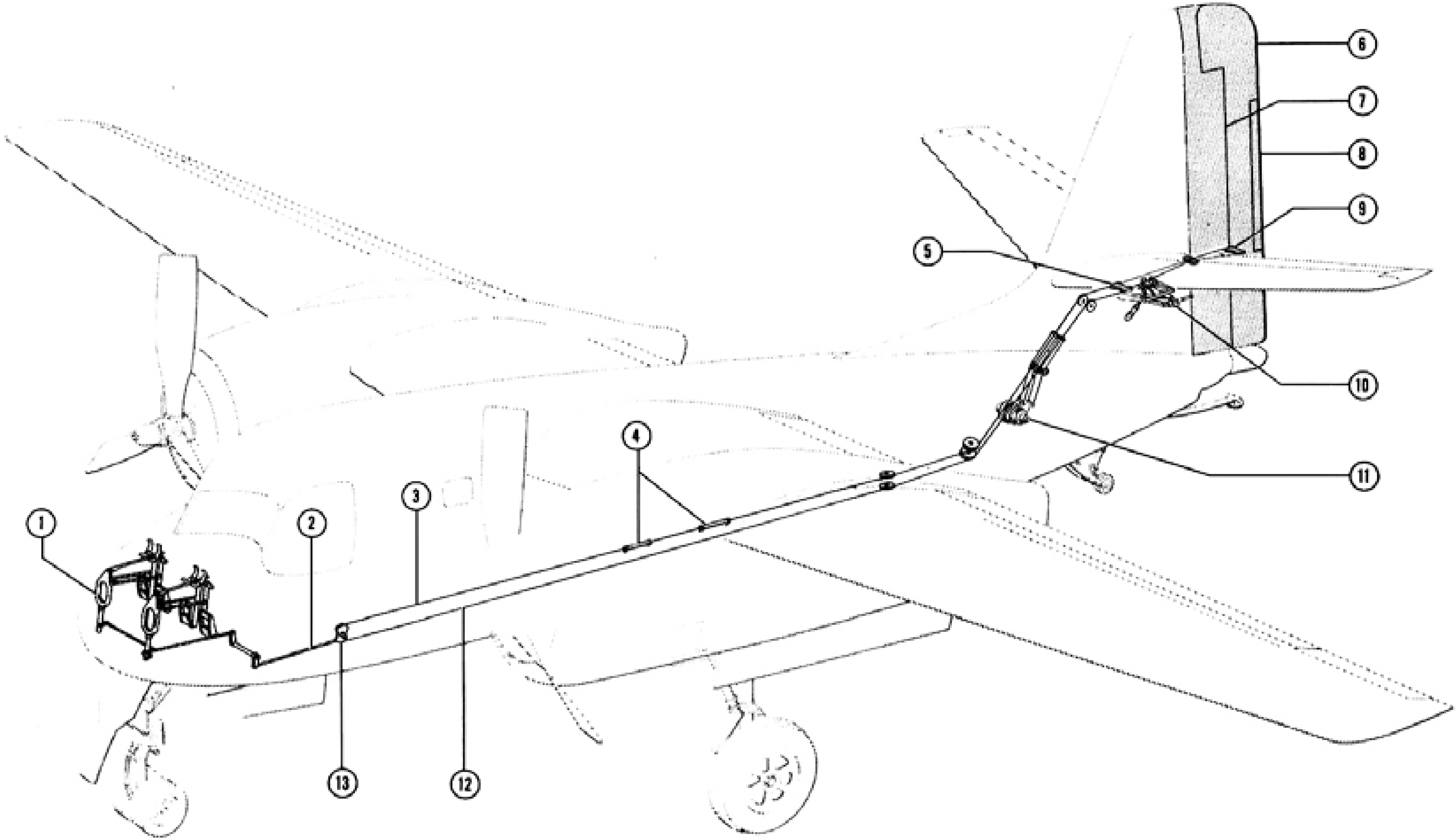
RUDDER TRIMMER.

The rudder trimmer is an auxiliary directional control surface which, in effect, increases the airplane's rudder control surface. The forward end of the trimmer is hinged to the vertical fin and the rudder is hinged to the aft end of the trimmer. This auxiliary surface permits directional trimming during normal flight to provide greater trimming effectiveness than a conventional trim tab, and allows additional emergency directional control, as during single engine operation. The trimmer is deflected for normal trimming by an electric screw jack actuator; for emergency use (single engine rudder assist switch ON) it is deflected by a hydraulic-powered servo mechanism. The trimmer system greatly increases directional control, with conventional use of the rudder pedals, through a follow-up system which positions the trimmer proportionally to rudder deflection.



LATERAL AND LONGITUDINAL CONTROL SYSTEM

Figure 1-19. Surface Controls Diagram (Sheet 1)

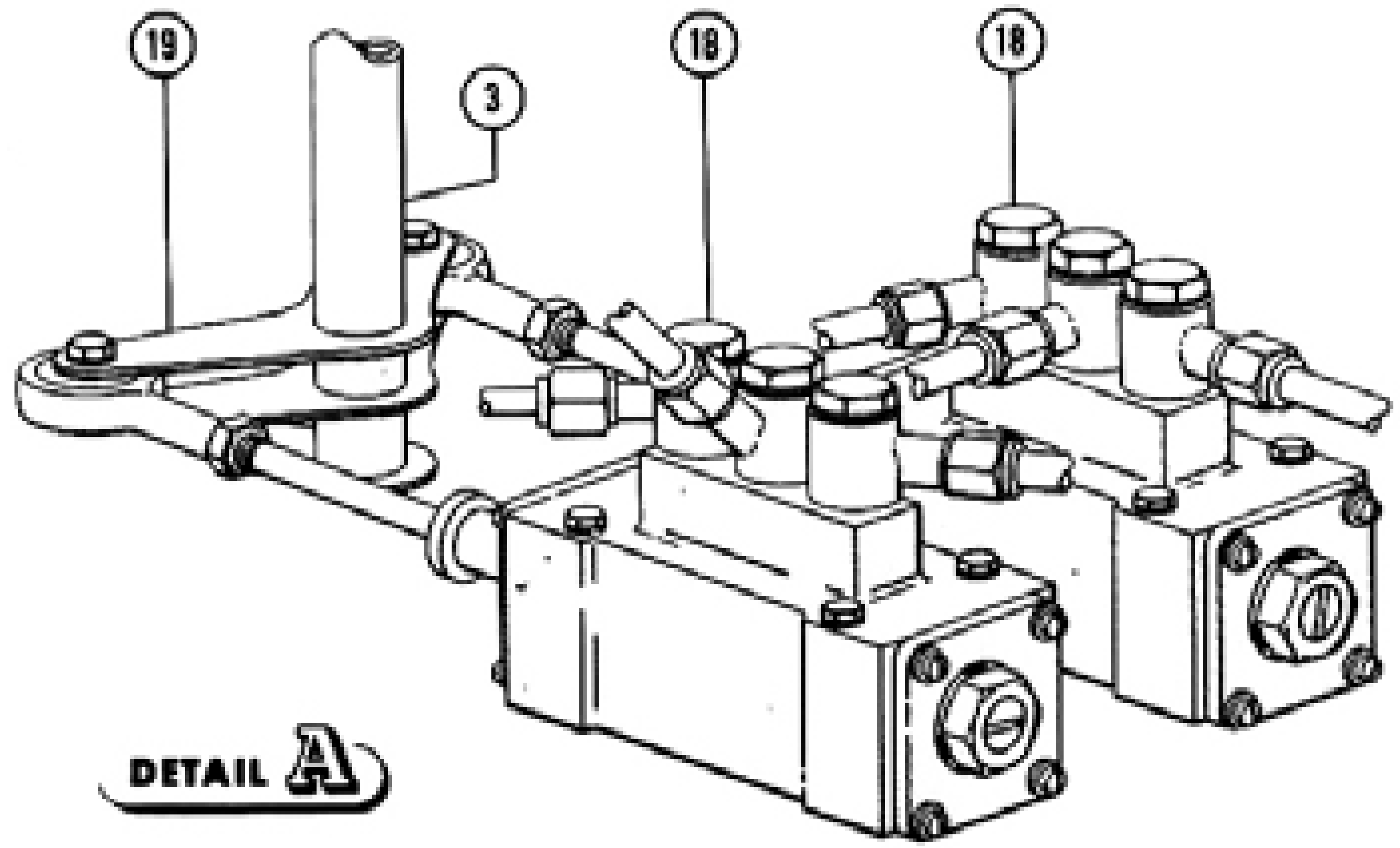


1. Rudder Pedal Installation
2. Push Rod
3. Right Rudder Cable
4. Fairlead
5. Aft Rudder Control Sector
6. Rudder
7. Rudder Trimmer
8. Rudder Balance Tab
9. Rudder Horn
10. Rudder Trimmer System
11. Rudder Auto Pilot Servo
12. Left Rudder Cable
13. Forward Rudder Control Sector

RUDDER CONTROL SYSTEM

Figure 1-19. Surface Controls Diagram (Sheet 2)

1. Aft Rudder Control Sector
2. Follow-up Link
3. Torque Tube
4. Follow-up Arm
5. Rudder Trimmer
6. Right Rudder Cable
7. Left Rudder Cable
8. Rudder Horn
9. Rudder
10. Trimmer Horn
11. Trimmer Actuator (Electric)
12. Trimmer Crank (In "Trimmer Locked" Position)
13. Spring Locked Push Rod
14. Lock Cylinder (Extends to Unlock Trimmer)
15. Lock Arm
16. Lock Arm Return Spring Rod
17. Trimmer Actuating Cylinder (Hydraulic)
18. Slide Valves
19. Lower Bellcrank



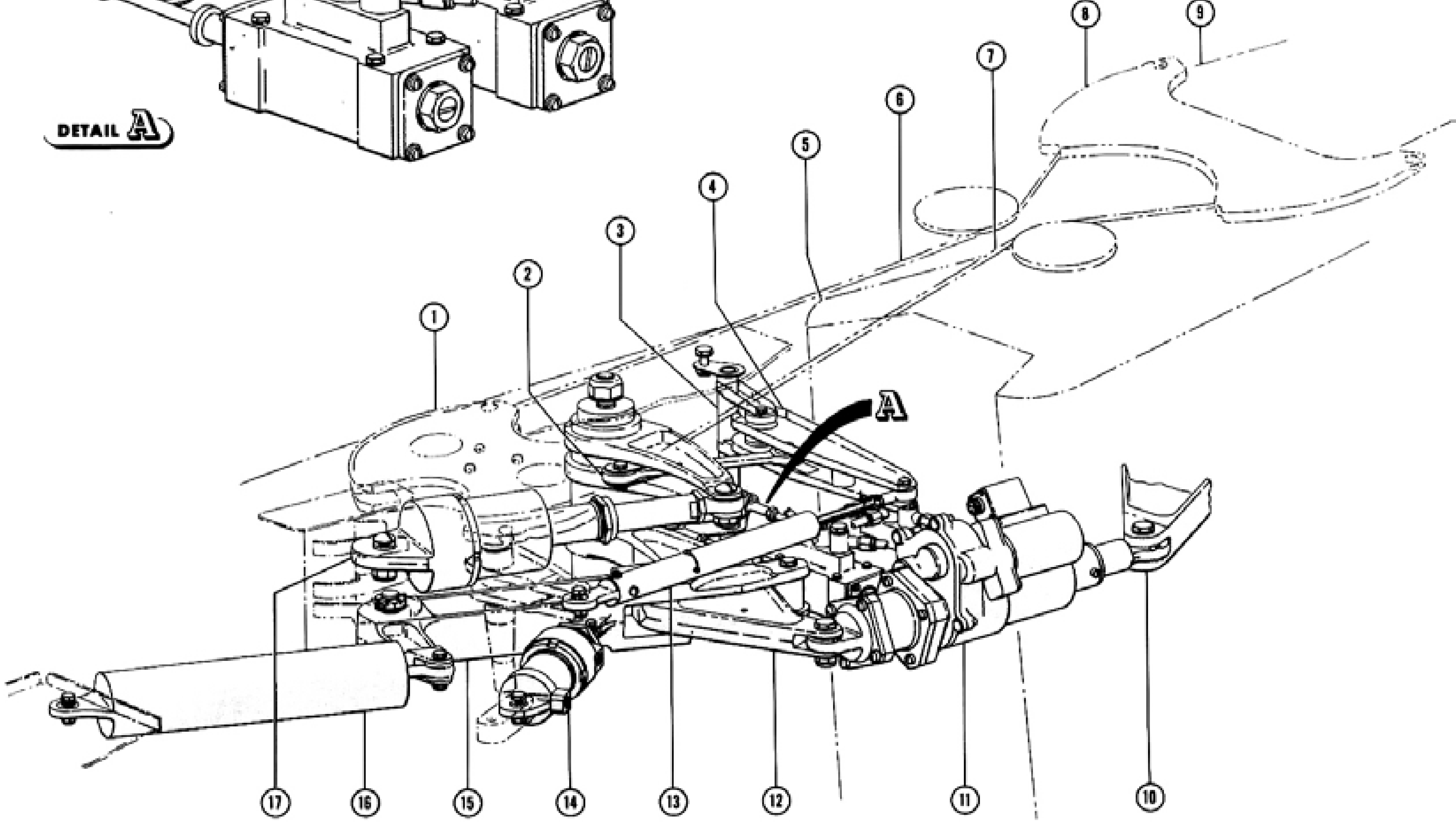
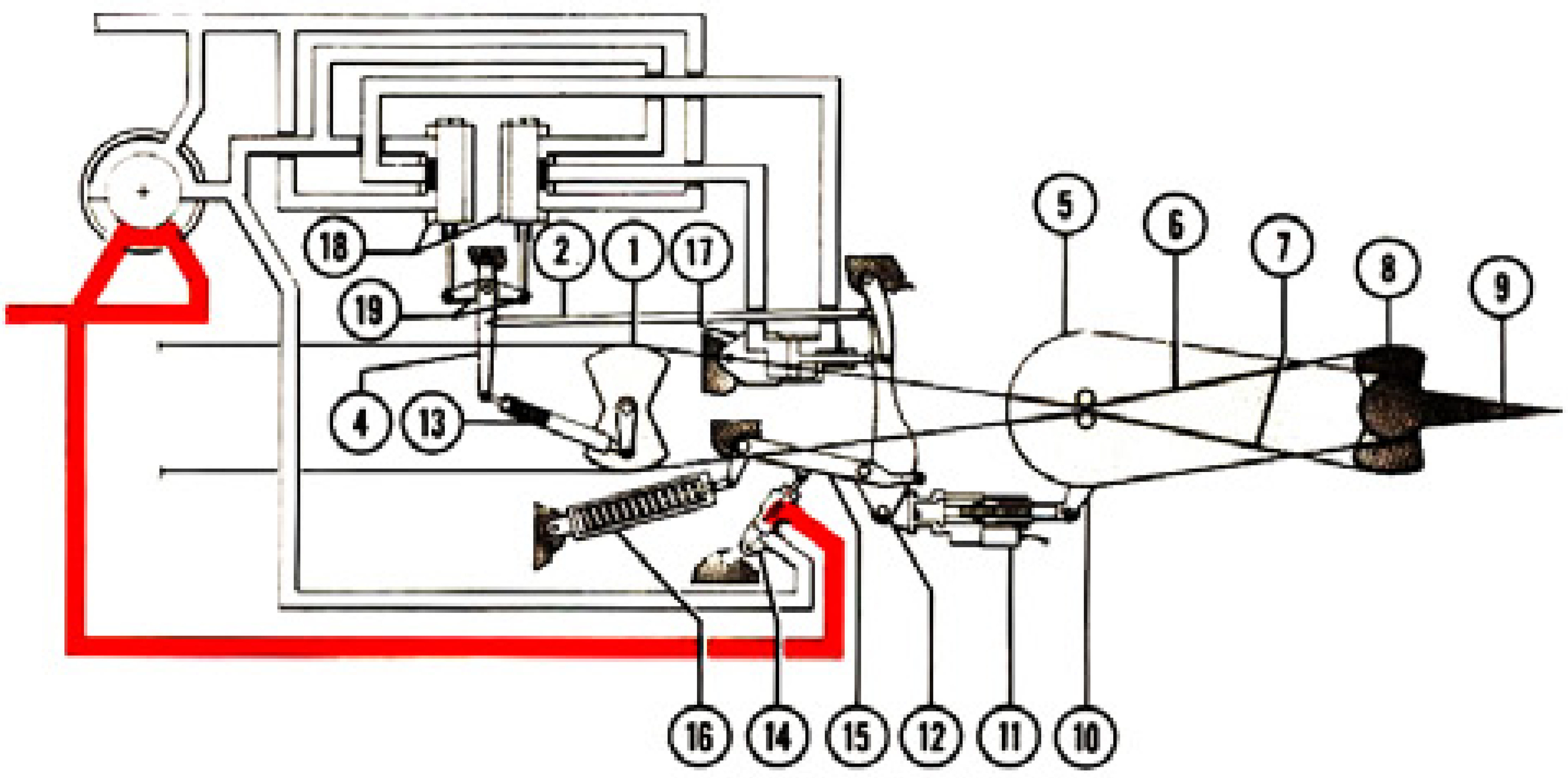


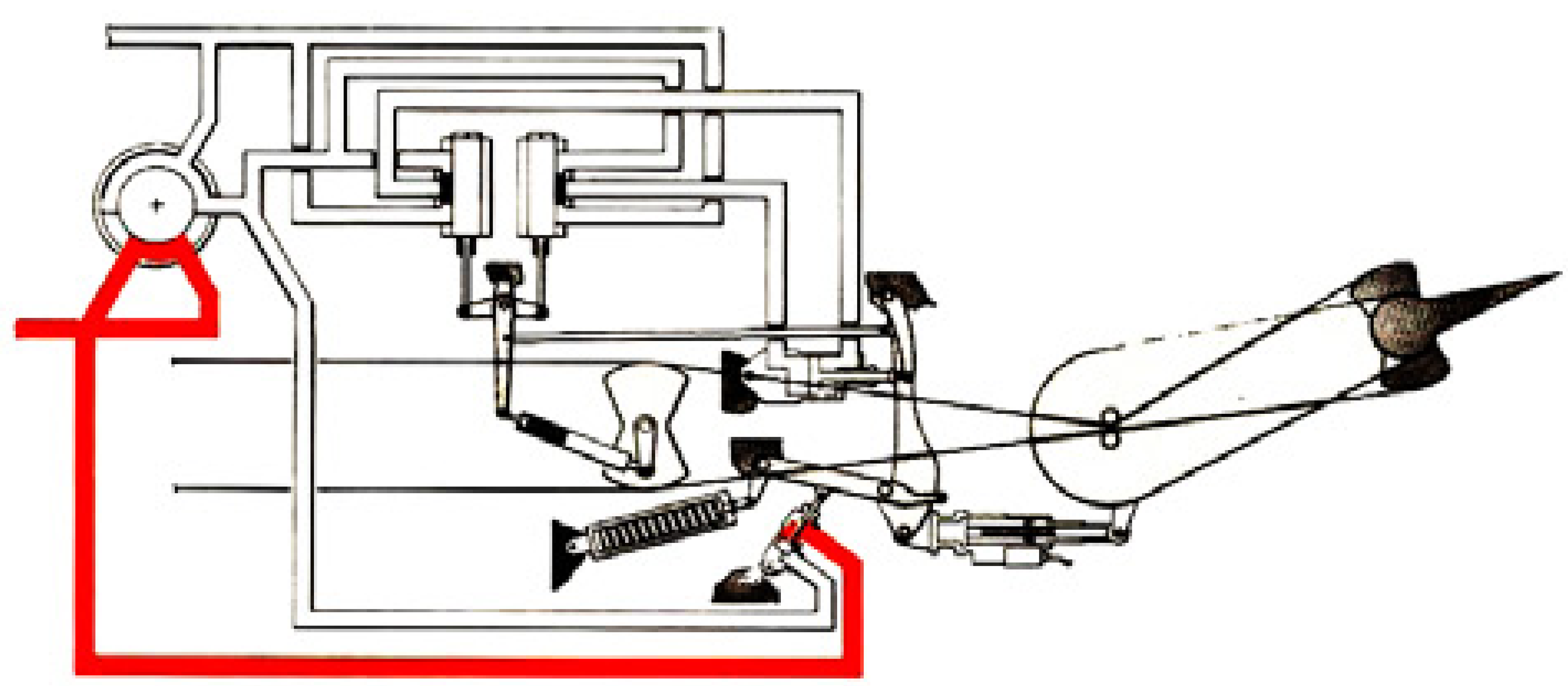
Figure 1-19A. Rudder Trimmer Operating Mechanism (Sheet 1)

OPERATION WITH SINGLE ENGINE RUDDER ASSIST SWITCH "OFF"
(Electric actuator operating, no hydraulic pressure.)

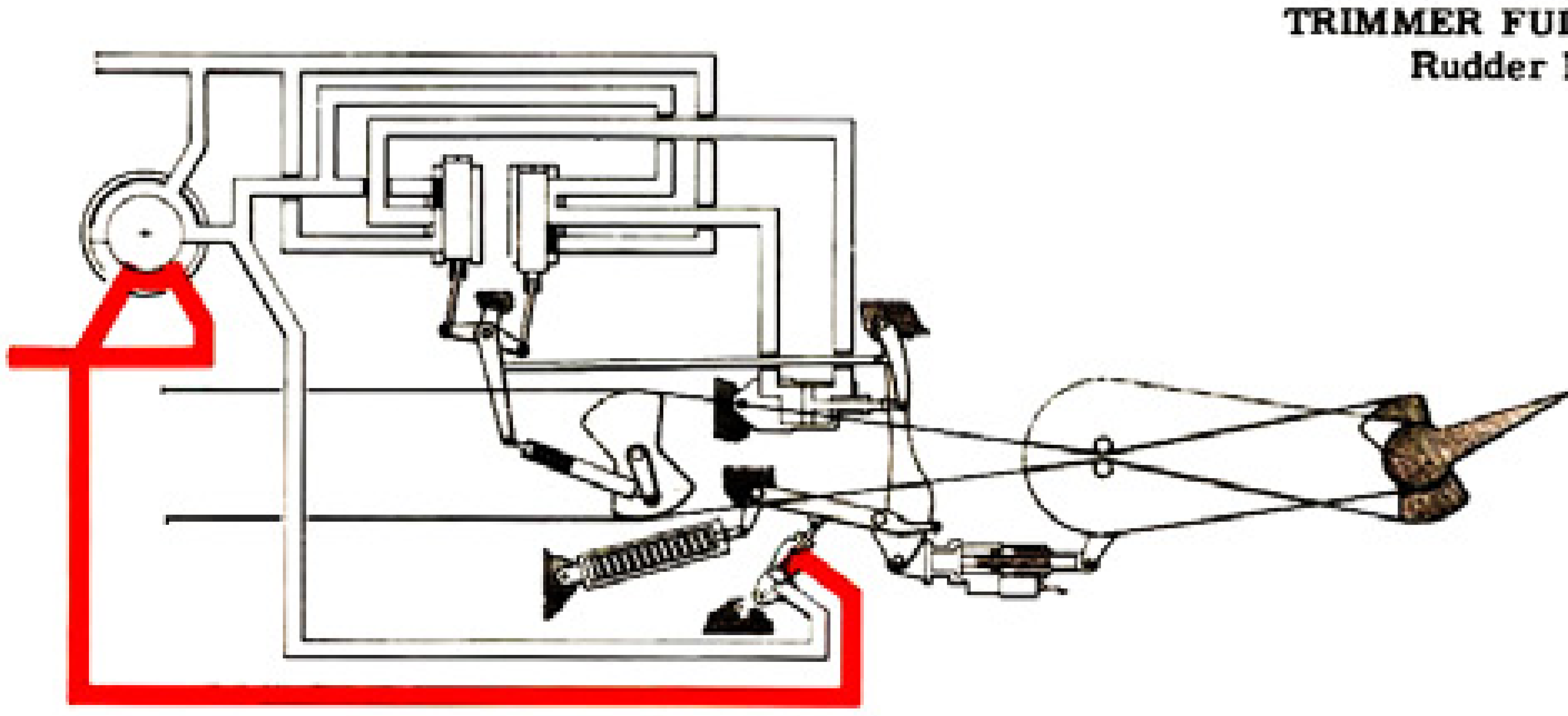
Code
Pressure



TRIMMER NEUTRAL
Rudder Neutral



TRIMMER FULL RIGHT (5°)
Rudder Neutral



TRIMMER NEUTRAL
Rudder Full Right

Note

TRIMMER LOCKED POSITION
(Single Engine Rudder Assist Switch "OFF".)

Trimmer Motion (With Electric Actuator) . . . . 5°R, 5°L

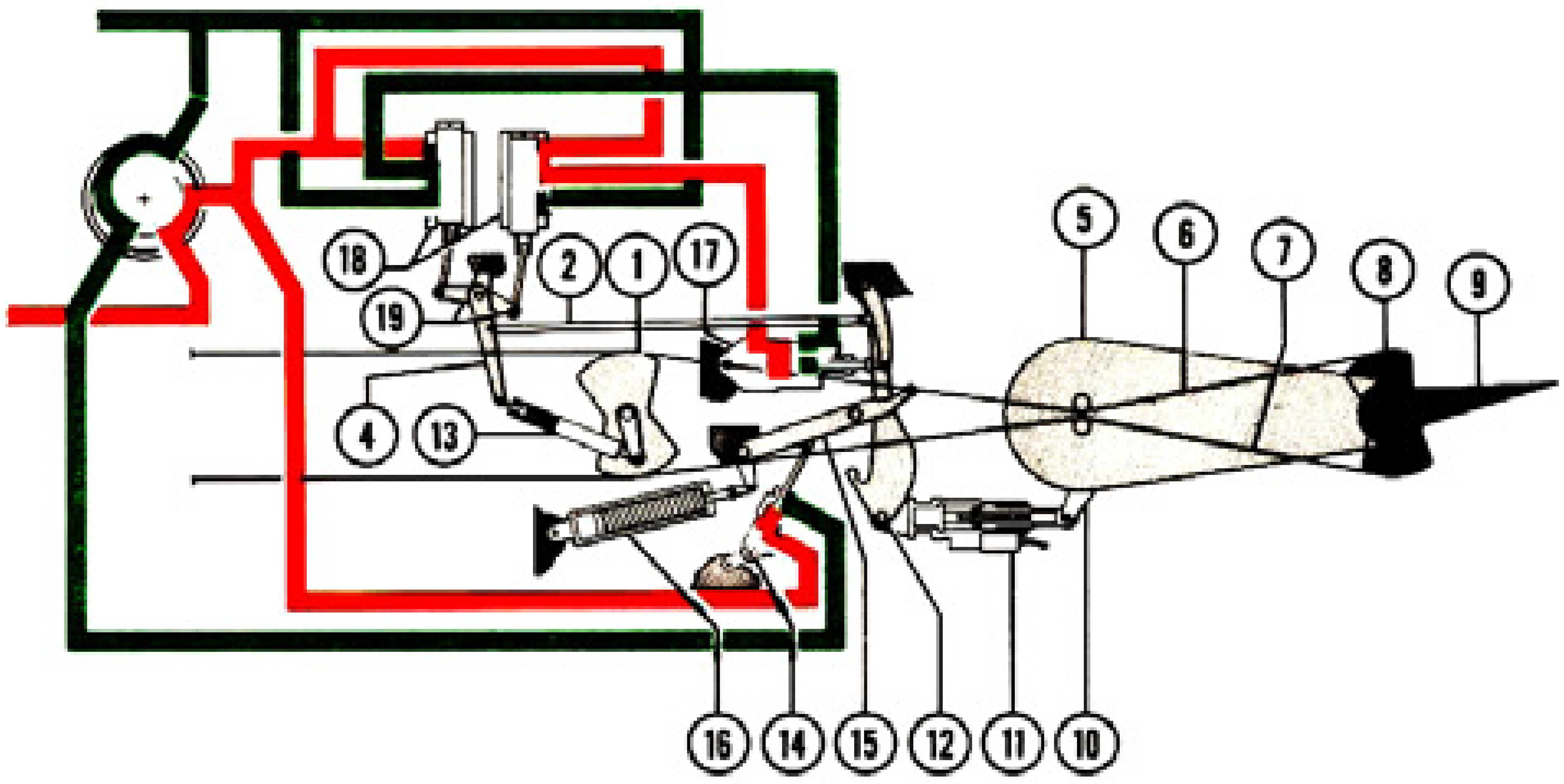
Figure 1-19A. Rudder Trimmer Operating Mechanism (Sheet 2)

OPERATION WITH SINGLE ENGINE RUDDER ASSIST SWITCH "ON"
(Hydraulic pressure to trimmer, electric actuator utilization optional.)

INITIATION OF EMERGENCY OPERATION

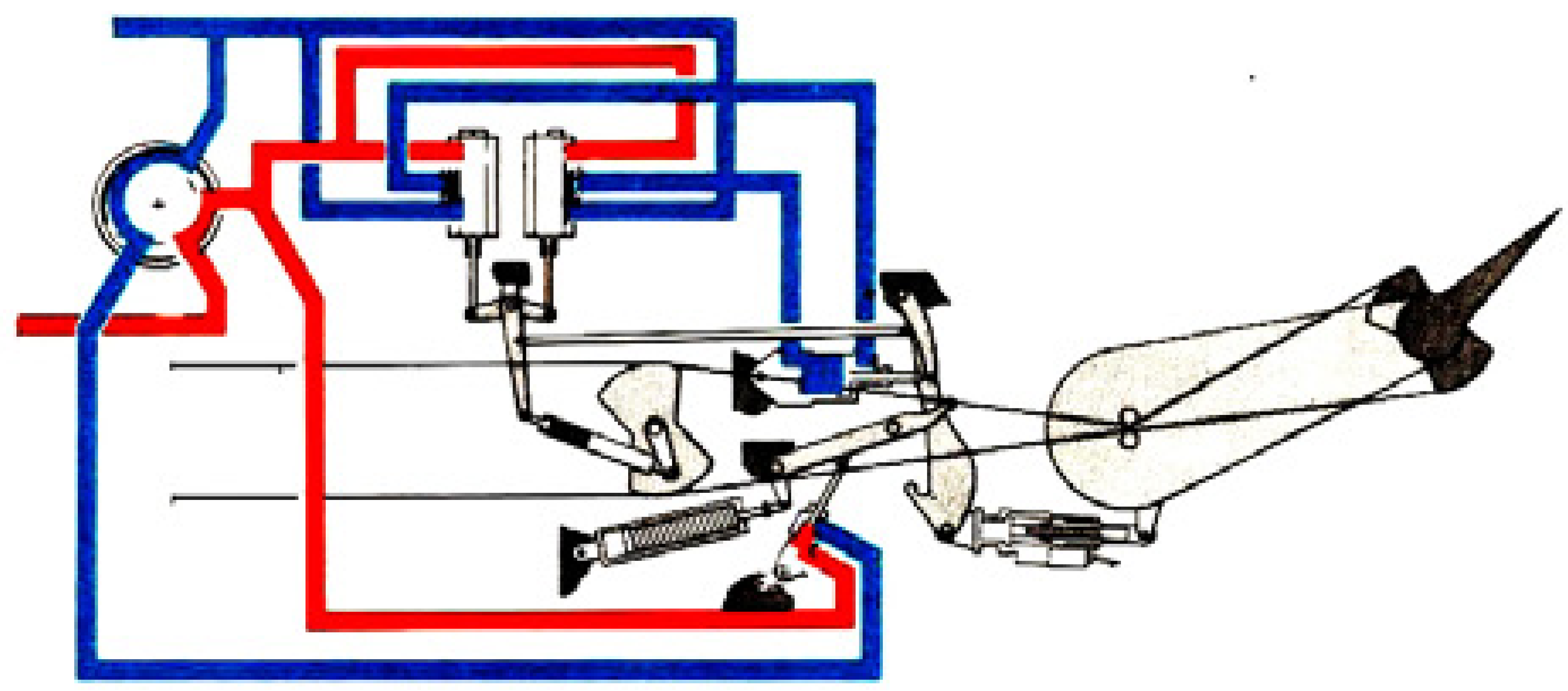
Code

- Pressure
- Return
- Static

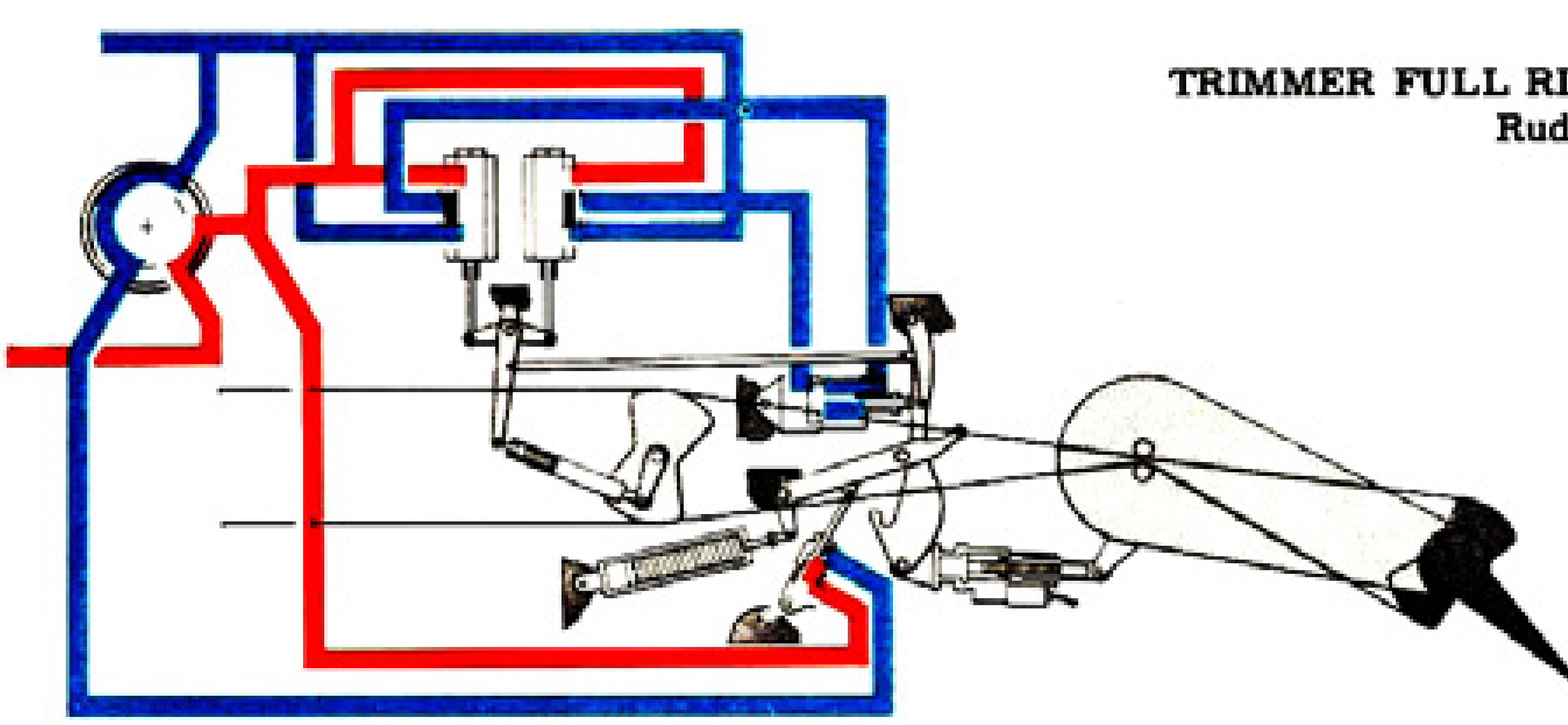


TRIMMER NEUTRAL

Rudder deflecting right, follow-up linkage in operation and hydraulic fluid entering the trimmer operating cylinder.



TRIMMER FULL RIGHT - ACTUATOR NEUTRAL
Rudder Full Right



TRIMMER FULL LEFT - ACTUATOR NEUTRAL
Full Left Rudder

Note

TRIMMER UNLOCKED POSITION
(Single Engine Rudder Assist Switch "ON".)

Trimmer Motion (Electric Actuator in Neutral) . . . . 20°R, 20°L
Trimmer Motion (Electric Actuator Extended 5°R) . . 25°R, 15°L
Trimmer Motion (Electric Actuator Retracted 5°L) . . 15°R, 25°L

Figure 1-19A. Rudder Trimmer Operating Mechanism (Sheet 3)

the wing flaps are raised. To lower flaps, the control is moved down and forward toward the DOWN position.

CAUTION

The wing flaps control should be pushed full up past the console level. If this is not done, flaps will travel a few degrees and wings will not fold.

FLAPS POSITION INDICATOR.

The flaps portion of the wheels and flaps position indicator, which is located on the center instrument panel (17, figure 1-4), shows the position of the wing flaps in increments from full up to full down.

WING FLAP EMERGENCY SYSTEM.

An emergency system is provided for flaps-down operation. Normally, the flaps emergency selector valve is at the neutral position, venting the emergency side of the shuttle valve to return. However, when an emergency down is selected and the emergency hand pump is used to lower the flaps, pressure is supplied to the shuttle valve at the cylinder and the emergency dump valve, which blocks off the pressure port and vents the cylinder up lines to the reservoir. The dump valve has a manual reset button available to the crew members. This enables the flaps to be raised, providing the normal up system is operative, by setting the emergency selector valve to the neutral position, pushing the reset button of the emergency dump valve, and selecting the flaps up position on the normal control.

Note

The flaps emergency control handle is held in the neutral position by a solenoid which is deenergized when the wing lock handle is unlocked, to prevent lowering the flaps by hand pump when the wings are folded.

WING FLAP EMERGENCY SYSTEM CONTROLS.

WING FLAP EMERGENCY CONTROL HANDLE.

The wing flap emergency control handle (5, figure 1-7) is located beneath a hinged door in the floor of the pilots' compartment. It is normally set at NORMAL. When it is moved to the DOWN position, the flaps can be lowered by use of the hand pump.

HAND PUMP.

The emergency hydraulic hand pump (16, figure 1-6), located to the right of the folding console, is used with the wing flaps emergency control handle. After the control is moved to DOWN, pressure for lowering the flaps is supplied by the hand pump. The emergency hydraulic hand pump handle, used for hand pump operation, is normally stowed in a spring clip attached to the rear of the co-pilot's seat.

WING FLAP EMERGENCY CONTROL HANDLE SOLENOID.

The handle is held at NORMAL by a deenergized solenoid, located adjacent to the handle, when the wings are unlocked. If this solenoid becomes deenergized during flight, due to electrical failure, thus locking the wing flap emergency control handle at NORMAL, it can be manually released by pushing the flap emergency handle to the left. The handle is placarded PUSH TO RELEASE SOLENOID, and an arrow indicates the direction of movement.

WARNING

The wing flap emergency control handle should not be operated when the wings are in a folded position.

WING FLAP EMERGENCY DUMP VALVE RESET BUTTON.

The wing flap emergency dump valve reset button (figure 1-18), located in the electronic compartment on the rear beam of the wing center section, is placarded FLAP VA. EMERG. RESET BUTTON. This button must be pushed in to return the system to normal operation after the emergency system has been used. When the flap emergency control handle is returned from DOWN to NORMAL and the reset button, placarded PUSH TO RESET, is pushed, the flaps can be raised by use of the normal flaps control, provided the up side of the hydraulic system is operative.

WING FOLD SYSTEM.

The wing fold system is operated by 3000 psi hydraulic pressure. Each wing is individually operated by a spring centered, three-position, manual- and solenoid-operated, four-way selector valve (figure 1-18). Two wing fold cylinders, 16 lock cylinders, a lock lock cylinder, and a lock latch cylinder are provided for each wing; timing sequence is achieved by mechanically operated two four-way, two-position slide valves in each wing. The wings can be unlocked and folded by controls in the pilots' compartment. Limit switches prevent unlocking and folding the wings when the weight of the airplane is not on the main landing gear, or when the wing flaps are not fully up. The wing fold selector valves have manual overrides so that any selection can be made in the event of electrical failure. Quick disconnects are provided in each nacelle to permit wing folding or spreading on the ground by means of an external rig. A mechanical interference of the normal flap control handle and the lock handle is installed to prevent lowering the wing flaps when the wings are unlocked. A wing flap emergency solenoid valve prevents emergency operation of the flaps when the wings are folded.

Note

If wings are folded or spread while one engine is inoperative, the wing on the dead engine side will fold and spread much more slowly than the opposite wing.

WARNING

Before starting the engines, the pilot should make certain that the wing lock and wing fold control levers are set to correspond with the position of the wings (if wings are spread, both levers pushed up and outer lever flush with panel; if wings are folded, both levers down).

WING FOLD SYSTEM CONTROLS AND INDICATORS.

WING LOCK—WING FOLD CONTROL LEVERS.

Two levers installed on the overhead console in the pilots' compartment (3, figure 1-5) control the wings in folding or spreading. The levers are arranged as an outer (locking) lever and an inner (fold and spread) control lever. They are operated as placarded to fold the wings; PULL OUTER LEVER, PULL INNER LEVER. This arrangement requires that the outer lever, which unlocks the lock lock strap safety pin, be pulled out to expose the fold and spread lever, and also requires that the latter be pushed in before the outer lever can be returned to the flush position.

Note

The outer lever also latches mechanically in the extended position when the wings are unlocked. To lock the wings, a manual release on the left side of the outer (locking) lever must be pushed forward to first release the outer lever. If this lever resists attempts to push it flush with the console, the wings are not locked.

If wings do not fold, check that wing flaps control is pushed full up past the console level.

WARNING

During wing folding or spreading, external stores load must not exceed 700 pounds on each wing.

Note

See Wing Fold System Operation paragraph under Before Starting Engines, Section II, to prevent possible damage to or malfunction of wing fold system caused by improper operating procedure.

WING LOCK WARNING FLAGS.[1]

A round, red tube extends from the inboard side of each engine nacelle, just forward of the wing leading edge, when the wings are unlocked. These flags are the primary and most important means of checking that the wings are locked.

WING LOCK WARNING FLAGS.[2]

A red wing lock warning flag is located within a painted white circle just below the exhaust trough on the inboard side of each engine nacelle. When the wings are in any position other than spread and locked, the sequence mechanism locking pin for each wing is held in the unlocked position and the warning flags are extended so that they are in full view of the pilot and co-pilot. The warning flags are so located that when extended (unlocked position) they can be seen at night silhouetted against the engine exhaust flame.

WING FOLD—SPREAD SAFETY LIGHT.

This amber light is located on the overhead console adjacent to the wing lock-wing fold control levers. The light is illuminated only when the outer lever is in the extended position and the automatic spread and lock cycle has been completed. The light will go out when the outer lever is returned to the flush position.

LANDING GEAR SYSTEM.

The landing gear is of the tricycle type, consisting of two main wheels and dual nose wheels. In addition, a tail bumper extends and retracts with the landing gear and acts as a tail skid or bumper. The landing gear is operated by 1500 psi hydraulic pressure (figure 1-18). Through linkage, the pilot's control operates a manual slide valve. A solenoid, energized only when the landing gear is locked down and the weight of the airplane is on the wheels, prevents movement of the control unless the airplane is airborne.

Note

To facilitate loading of a torpedo, the nose wheel doors can be closed. To accomplish this, a selector valve control handle in the nose wheel well is available to ground personnel. To close the doors manually, the valve handle, which is spring loaded to the normal position, must be actuated and held. When the handle is released, the doors automatically open when the hydraulic system is pressurized.

LANDING GEAR UP OPERATION.

When the landing gear control is set to UP, hydraulic pressure is directed through the selector valve into the up cylinder lines. The doors are locked in the closed position by an internal lock in the door cylinder. The tail bumper cylinder is retracted, raising the tail bumper; the nose wheel cylinder is retracted, raising the nose wheel, which engages the uplocks, and pressure extends the nose wheel door cylinder to close the doors, locking them closed by overcenter linkage. These operations are interlocked and sequenced mechanically. Pressure is also directed to the main gear cylinders and the main gear door cylinder (one cylinder mechanically

[1] S2F-1 airplanes BuNo. 129139 through 133290 and 133292 through 133296, and S2F-2 airplanes BuNo. 133329 through 133356.

[2] S2F-1 airplanes BuNo. 133291, 133297 and subsequent, and S2F-2 airplanes BuNo. 133357 and subsequent.

electrically heated pitot pressure tube is mounted on each side of the fuselage and a static system line is connected to a static plate on each side of the fuselage. On S2F-2 airplanes, the two pitot pressure tubes are located on top of the fuselage nose section, forward of the windshield.

PITOT HEAT SWITCH.

The PITOT HEAT, two-position toggle switch (31, figure 1-5) is located on the overhead console. It can be set to OFF or ON.

MASTER DIRECTION INDICATORS.

The pilot's and co-pilot's master direction indicators (3, figure 1-4) are electrically operated, remote indicating devices, each of which indicates both the magnetic heading (center dial) and the gyroscopic heading, corrected for precession (outer dial), of the airplane. The resetting knob is located on the lower left front of the instrument, and is used when starting or resetting the gyro. The compass is caged only when the reset knob is pressed and held and, upon release, it is automatically uncaged.

Note

The compass need not be caged during any flight maneuvers and the co-pilot's master direction indicator should not be caged or rotated when the automatic pilot is engaged.

Compass readings are not reliable when the wings are folded.

The pilot's and co-pilot's compass systems are independent of each other. The pilot's system indicates heading and furnishes azimuth signals for AN/APA-57B radar stabilzation,[1] while the co-pilot's system also indicates heading and furnishes azimuth signals to the auto pilot. On later airplanes,[2] which are not equipped with AN/APA-57B radar, the co-pilot's G-2 compass system furnishes radar stabilization.

GYRO HORIZON INDICATORS.

Each gyro horizon indicator (5, figure 1-4) consists essentially of an electrically-driven, vertical seeking gyro which provides the pilot and co-pilot with visual indications of the airplane's attitude with reference to a stable vertical plane. Departures in bank and pitch can be measured from this reference. The pilot's gyro horizon is a 115-volt, 3-phase, 400-cycle unit while the co-pilot's gyro horizon is a 26-volt, 3-phase, 400-cycle unit that provides pitch and bank signals for auto pilot operation.

PILOT'S GYRO HORIZON.

The pilot's H-6 gyro horizon indicator is powered by the pilot's instrument inverter. Quick erection of the gyro is accomplished in this indicator by means of a mechanical caging device. The gyro must be caged immediately after power is supplied to the indicator by pulling out the caging knob on the front bezel. The knob should be held in the extended position until the horizon bar and bank index cease to oscillate, at which time they should indicate zero roll and pitch within approximately three degrees. The caging time will depend upon the position of the gyro; however, the longest time will be approximately 10 seconds. Instantaneous erection may be obtained by holding the caging knob in the extended position when the power supply is turned on.

WARNING

Since the caging device cages the gyro to the true attitude of the aircraft and not to the true vertical, THE INDICATOR SHOULD NOT BE CAGED IN FLIGHT unless the aircraft is known to be in straight and level flight during the caging procedure.

The indicator contains a power warning flag that is visible whenever the power supply is shut off, there is an improper phase rotation, or an open or short circuit in the instrument. The flag will disappear under normal circumstances, indicating that the power supply is on and is satisfactory.

WARNING

The pilot should not rely upon the indicator for flight indications if the power warning flag is visible in the face of the instrument.

CO-PILOT'S GYRO HORIZON.

The co-pilot's gyro horizon indicator is powered by either the main or stand-by inverter. Two autosyns to control the automatic pilot in pitch and bank maneuvers are incorporated in the co-pilot's gyro horizon only. The instrument also has a manually operated caging mechanism which provides for rapid erection from positions away from vertical when caged and uncaged; it also holds the gyro fixed during maneuvers which exceed its limitations or when the instrument is shipped.

STAND-BY (MAGNETIC) COMPASS.

A standard magnetic compass (24, figure 1-5) is provided for use in the event of failure of the master direction indicator or as a checking instrument.

Note

Magnetic compass indications are unreliable when the heating and ventilating blower is operating, when the pilot's radar scope is extended or when the landing gear is down.

[1] S2F-1 airplanes BuNo. 133045 through 133105.

[2] S2F-1 airplanes BuNo. 133106 and subsequent, and all S2F-2 airplanes.

COMPASS CORRECTION CARDS.

Compass correction cards and holders are installed on the pilot's and co-pilot's overhead console side frames.

RATE OF CLIMB INDICATOR.

Two rate of climb indicators are installed (34, figure 1-4), one on the pilot's and one on the co-pilot's instrument panel.

ACCELEROMETER.

An accelerometer (24, figure 1-4) is located on the co-pilot's instrument panel. This instrument indicates the acceleration of the airplane along its vertical axis. The dial is graduated in terms of gravity units, with a range from −5g to +12g. The instrument has three pointers; one is a continuous reading hand which varies the reading with changing acceleration and the other two pointers show maximum readings, remaining at the highest and lowest readings reached during any maneuvers. These latter pointers record, for reference purposes, the highest positive and negative g-loads to which the airplane is subjected. Turning a knob on front of the instrument resets these maximum reading pointers to 1g.

Note

Accelerometer readings indicated during taxiing and landing are usually erroneous and read high. The instrument should be reset immediately after take-off, as only readings indicated in flight are reliable.

RECORDING ACCELEROMETER.

The recording accelerometer, which records the number of times a specific load factor is exceeded in the airplane, is located on the aft bulkhead of the operators' compartment. The counter, which will record up to 999 times, is actuated once each time a positive acceleration of 3.0g is attained or exceeded for any period of time greater than one tenth of one second. Each additional count is possible after the acceleration has dropped to 2.5g following the previous count. The unit is electrically operated and is energized from the direct current system, in a circuit originating at the primary bus. The unit is grounded through the contacts of the right landing gear up-lock switch and is consequently energized to record in-flight accelerations only.

RADAR ALTIMETER INDICATORS.

The two radar altimeter indicators (23, figure 1-4) are located on the pilot's and co-pilot's instrument panels. For further information on this system (AN/APN-22), see Section IV.

TURN AND BANK INDICATORS.

The turn and bank indicators consist essentially of a driven gyro connected through a mechanical linkage to a pointer which indicates rate of turn of the airplane. The instrument on the pilot's instrument panel (1, figure 1-4) is air-driven while the one on the co-pilot's instrument panel (1, figure 1-4) is a 26-volt a-c type that also supplies rate signals to the auto pilot.

AIRSPEED CORRECTION CARDS.

An airspeed correction card and holder are installed on the pilot's and co-pilot's overhead console side frames.

EMERGENCY EQUIPMENT.

FIRE DETECTION SYSTEM.

The fire detection system provides a warning to the pilot if a fire occurs in either engine or the engine accessory compartment. Each engine's system is a continuous-type, automatic resetting detector system consisting of a warning light, relay, control unit, sensing elements, and connectors. A single test switch is provided to check the operation of both systems simultaneously. Each system is powered from the a-c power bus and is fused for protection. The test relay operates on dc from the battery bus and is protected by a circuit breaker. The sensing elements are wired in series with the warning lights and in the normal condition present an open circuit. A wire assembly connects the elements with the test relay, the control unit, and the power source. The elements are installed in a loop around the forward face of the engine baffle for engine fire detection, and along the bottom "V" of the engine mount tubes, across the aft face of the oil cooler, and around the periphery of the firewall for accessory compartment fire detection. When excessive temperatures exist in the areas in which the sensing elements are located, the electrical resistance of the ceramic material in which the element wires are encased decreases rapidly and current passes between the two wires, completing the circuit and causing the warning light to glow.

Note

A-C operation of the system enables the two sensing element wires to remain ungrounded so that if either is shorted to ground, no false indication of fire is given.

FIRE DETECTOR TEST SWITCH.

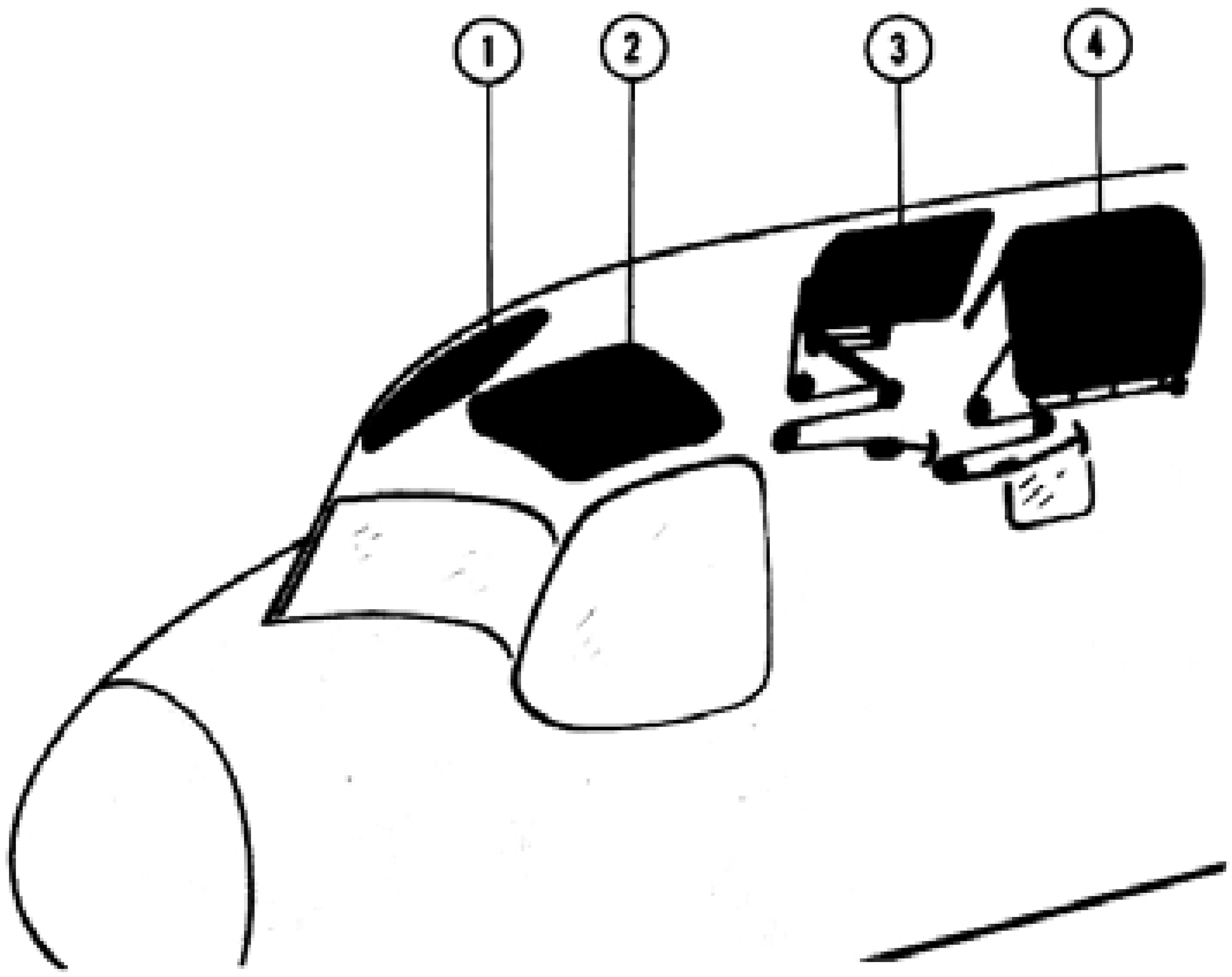
The fire detector test switch on the center instrument panel (39, figure 1-4) is a momentary-type toggle switch which is normally OFF. When held at TEST, the fire detection sensing element circuit is shorted, lighting the fire warning lights.

FIRE WARNING LIGHTS.

Two red fire warning lights (12 and 18, figure 1-4), located on the center instrument panel, are placarded FIRE WARNING LEFT ENGINE and FIRE WARNING RIGHT ENGINE. When lighted, they indicate excessive heat and possible fire in their respective engine or engine accessory compartments.

FIRE EXTINGUISHER SYSTEM.

Each engine accessory compartment is equipped with a complete fire extinguisher system. The extinguishing agent is stored in a pressurized, spherical container mounted in the main landing gear well.



1. Co-pilot's (No. 2) Escape Hatch
2. Pilot's (No. 1) Escape Hatch
3. Radar-Sonobuoy Operator's (No. 4) Escape Hatch
4. MAD-CM Operator's (No. 3) Escape Hatch

Figure 1-21. Escape Hatches

Note

Although fire in either an engine or an accessory compartment will illuminate a fire warning light, the fire extinguishing agent discharges only into the accessory compartment.

Each fire extinguisher switch provides power from the battery bus through the left or right fire extinguisher circuit breaker to the fusing contact in the container head. Each container has a capacity of 12.5 pounds. The gage dial in the lower side of the container should read 400 psi at 21.3°C (70°F).

FIRE EXTINGUISHING AGENT.

The bromotrifluoromethane (CF_3Br) used in this system is more efficient than and considerably less toxic than carbon tetrachloride, with 800000 ppm concentration required to establish lethal effect. It does not present any corrosion problems in metals used in the extinguisher system and is suitable for use at temperatures ranging from —65°F to 210°F. Decomposed vapors (resulting from the chemical in contact with fire) are considerably more toxic than undecomposed vapors (resulting from natural evaporation).

WARNING

Container should not be discharged in a confined area. If the liquid has been used openly or spilled in an aircraft, the aircraft should be ventilated.

If a person has been exposed to high concentrations of gas for a long while, a doctor should be called. PATIENT SHOULD NOT BE LEFT ALONE.

Charged containers should be handled with care to avoid rupturing the frangible seal disc or damaging the container or gage.

FIRE EXTINGUISHER SWITCHES.

Release of the fire extinguishing agent is controlled by an ON-OFF toggle switch for each engine (11, figure 1-5), located on the engine control panels on the overhead console. When the switch is moved to ON, the agent is released into the accessory compartment of the engine selected.

Note

Fuel and oil shut-off switches are located adjacent to the fire extinguisher switches.

HAND FIRE EXTINGUISHER.

A hand fire extinguisher (3, figure 3-3) is located at the aft side of the main entrance door.

MAIN ENTRANCE DOOR.

The main entrance door on the right side is jettisonable for emergency bail-out. A boarding ladder, normally stowed on the inside of the door, hooks into two fittings at the base of the main entrance door (figure 2-2).

MAIN ENTRANCE DOOR JETTISON HANDLE.

A red jettison handle is located immediately aft of this door. It must be pulled up to jettison the door.

PILOTS' COMPARTMENT ESCAPE HATCHES.

There are two emergency sliding hatches (6 and 7, figure 1-9 and figure 1-21) located directly above the pilot's and co-pilot's seats. These hatches are designed for ventilation while on the ground and for escape after ditching. Each hatch has a locking T-handle which must be turned to unlatch the lock, after which the hatch can be pulled aft to slide it open. To close the hatch, the handle must be turned to unlatch the lock.

OPERATORS' COMPARTMENT ESCAPE HATCHES.

The two emergency hatches in the operators' compartment (3 and 4, figure 1-9 and figure 1-21) are located directly above the MAD-CM and radar-sonobuoy operators' seats. Both hatches can be jettisoned for emergency escape after ditching or crash landing. The jettison release for the MAD-CM operator's escape hatch is a red T-handle located just forward of and above the left side window, and the radar-sonobuoy operator's hatch release is located just forward of and above the right side window. The MAD-CM operator's hatch can also be pushed open for ground ventilation, after unlocking it with a handle on the inside of the hatch. This handle is turned forward to LOCK, aft to OPEN.

Note

The radar-sonobuoy operator's hatch is not equipped with a handle. It can be opened by using a special tool, but this tool is not carried on the airplane. This hatch is also safety-wired shut to prevent inadvertent loss in flight. The safety wire will break if the hatch is jettisoned.

LIFE RAFT.

The life raft compartment is located on top of the fuselage (9, figure 1-2; 1, figure 1-9; 4, figure 3-3). A trough riveted to the structure serves as a container for the MK 4 Type D life raft.

LIFE RAFT RELEASE HANDLES.

Four life raft release handles (2, figure 3-3), placarded LIFE RAFT—PULL TO RELEASE, are located as follows: on the pilots' overhead console (2, figure 1-5); on the aft bulkhead of the operators' compartment near the overhead; on the aft bulkhead of the electronic compartment near the overhead; and, externally, on the upper surface of the fuselage near the wing trailing edge. The life raft release handle on the aft bulkhead of the electronic compartment may be used to inspect the life raft compartment. The handle should be pulled just far enough to open the compartment door without releasing the life raft.

CANTEENS.

Four canteens (1, figure 3-3) are provided. Two are in the pilots' compartment on the bulkhead between the pilots' and operators' compartments, one behind the pilot's seat and the other behind the co-pilot's seat (17, figure 1-8). Two others are located in the operators' compartment, one beside each seat in a pocket in the upholstery.

FIRST AID KIT.

A first aid kit (5, figure 3-3) is located on a bracket immediately aft of the MAD-CM operator's seat.

SEATS.[1]

All seats are equipped with headrests and lap-type safety belts, with adjustable shoulder harnesses and inertia reels. The harnesses can be locked or unlocked by controls located on the sides of the seats (4, figure 1-22). Each seat is suitable for use with a back-type parachute and a type PK-2 pararaft kit. Each seat can be adjusted in height and tilt by controls located on the front of the seat (5 and 6, figure 1-22). The backs of the seats can be adjusted through a range of approximately 15 degrees. The pilots' seats can be adjusted vertically through a range of four inches, and the operators' seats, three inches. All seat headrests can be adjusted vertically by moving the adjusting lever (1, figure 1-22) on the top of the headrest to the right, thus releasing the spring-loaded locking plungers. The headrest can then be shifted to the desired position. Fore and aft adjustments of the pilots' headrests are made by releasing the locking plungers, lifting the headrest off the support, and replacing it so that the locking plungers engage either of two parallel rows of holes.

SEATS.[2]

All seats (figure 1-22A) are essentially the same as those in earlier airplanes, except that each seat back is provided with a parachute support and is covered with a nonskid surface to hold a back-type parachute in a comfortable position during flight.

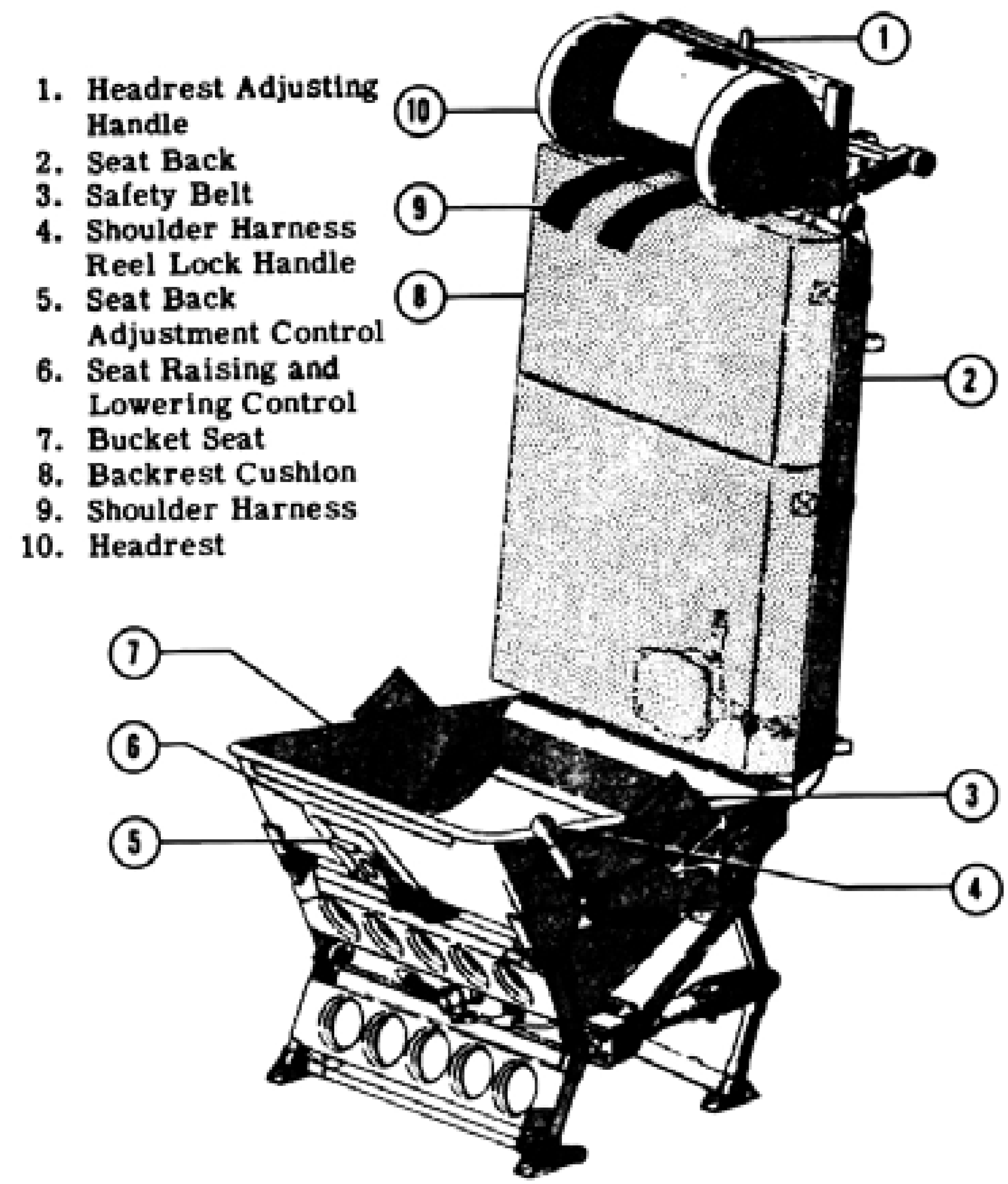


Figure 1-22. Seat, S2F-1 Airplanes BuNo. 129139 through 133229, and S2F-2 Airplanes BuNo. 133329 through 133332

On some airplanes,[3] a seat back emergency release pin with a red pull ring is installed behind the headrest of the radar-sonobuoy operator's seat. When this pin is pulled, the seat back springs forward, while the seat back brace moves up and outboard, permitting unrestricted exit from the airplane in an emergency or easy access to and from the airplane when desired. The seat back can be returned to its normal location by repositioning the seat back brace, swinging the seat back to its vertical position, replacing the channel bracket and inserting the emergency release pin.

SHOULDER HARNESS-INERTIA REEL LOCK CONTROL.[1]

A two-position (locked-unlocked) shoulder harness-inertia reel lock control is installed on the left side of each seat located on the left side of the airplane, and on the right side of each seat located on the right side of the airplane. Detent latches are provided for positively retaining the control handle at either position of the quadrant. By pressing on the top of the control handle,

[1] S2F-1 airplanes BuNo. 129139 through 133229 and S2F-2 airplanes BuNo. 133329 through 133332.
[2] S2F-1 airplanes BuNo. 133230 and subsequent, and S2F-2 airplanes BuNo. 133333 and subsequent.
[3] S2F-1 airplanes BuNo. 133261 and subsequent, and S2F-2 airplanes BuNo. 133337 and subsequent.

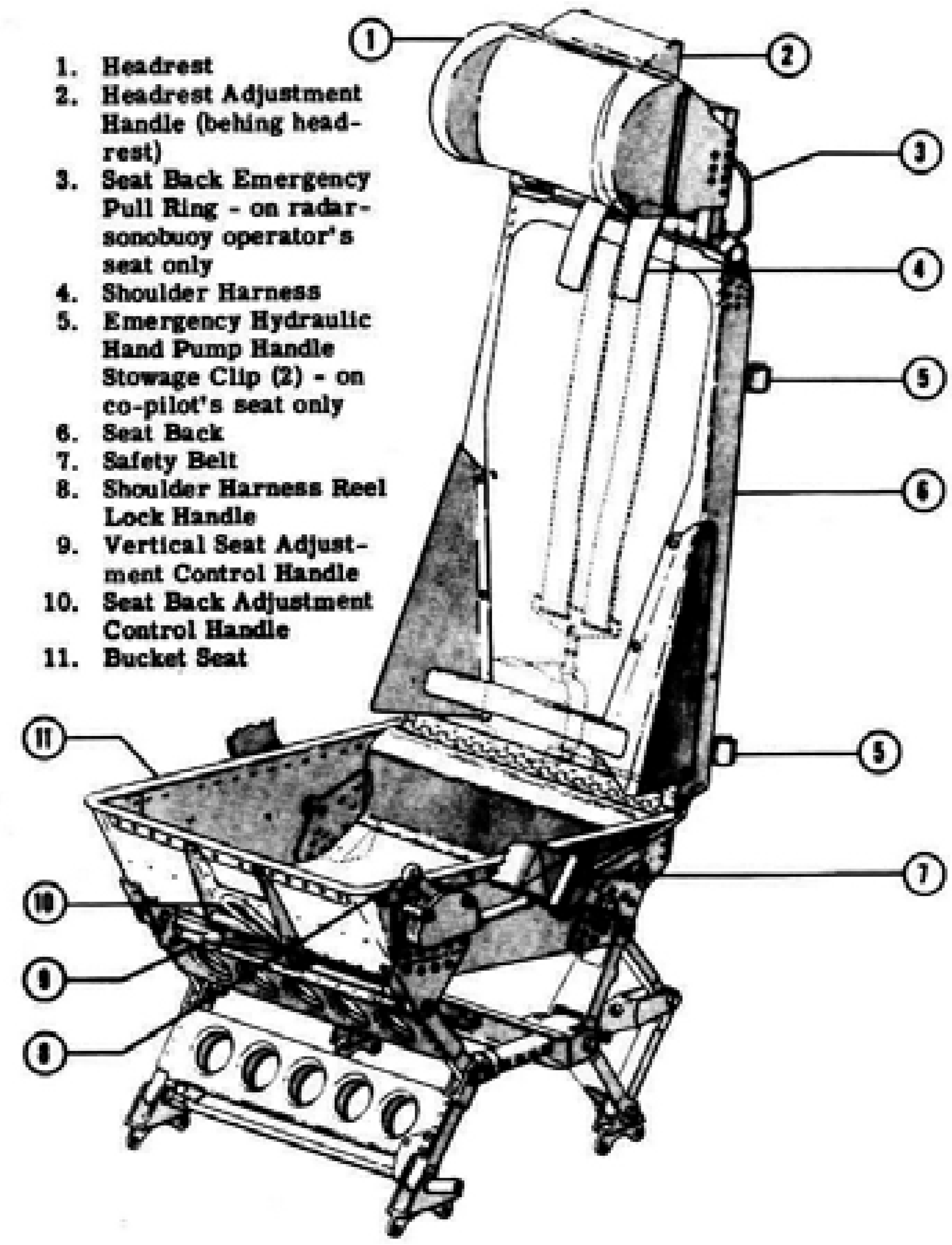


Figure 1-22A. Seat, S2F-1 Airplanes BuNo. 133230 and Subsequent, and S2F-2 Airplanes BuNo. 133333 and Subsequent

the latch is released and the control handle can then be moved from one position to the other. The handle is also spring-loaded toward the locked position. When the control is in the unlocked (aft) position, the reel harness cable will be released to permit leaning forward; however, the reel harness cable will automatically lock when an impact force of 2g to 3g is encountered. When the reel is locked in this manner, it will remain locked until the control handle is moved to the locked position and then returned to the unlocked position. When the control is in the locked position, the reel harness cable is manually locked to prevent leaning forward. The control handle should be left in the locked position except during straight and level flight. This provides an added safety precaution over and above that of the automatic safety-lock.

SHOULDER HARNESS-INERTIA REEL LOCK CONTROL.[1]

Operation of the reel lock control is essentially the same as on earlier airplanes, except that the manual control has no detent latches or top control knob release. The control is unlocked by movement to the aft position and locked by movement to the forward position. The shoulder harness take-up reel automatically ratchets itself to take up any slack in the harness cable.

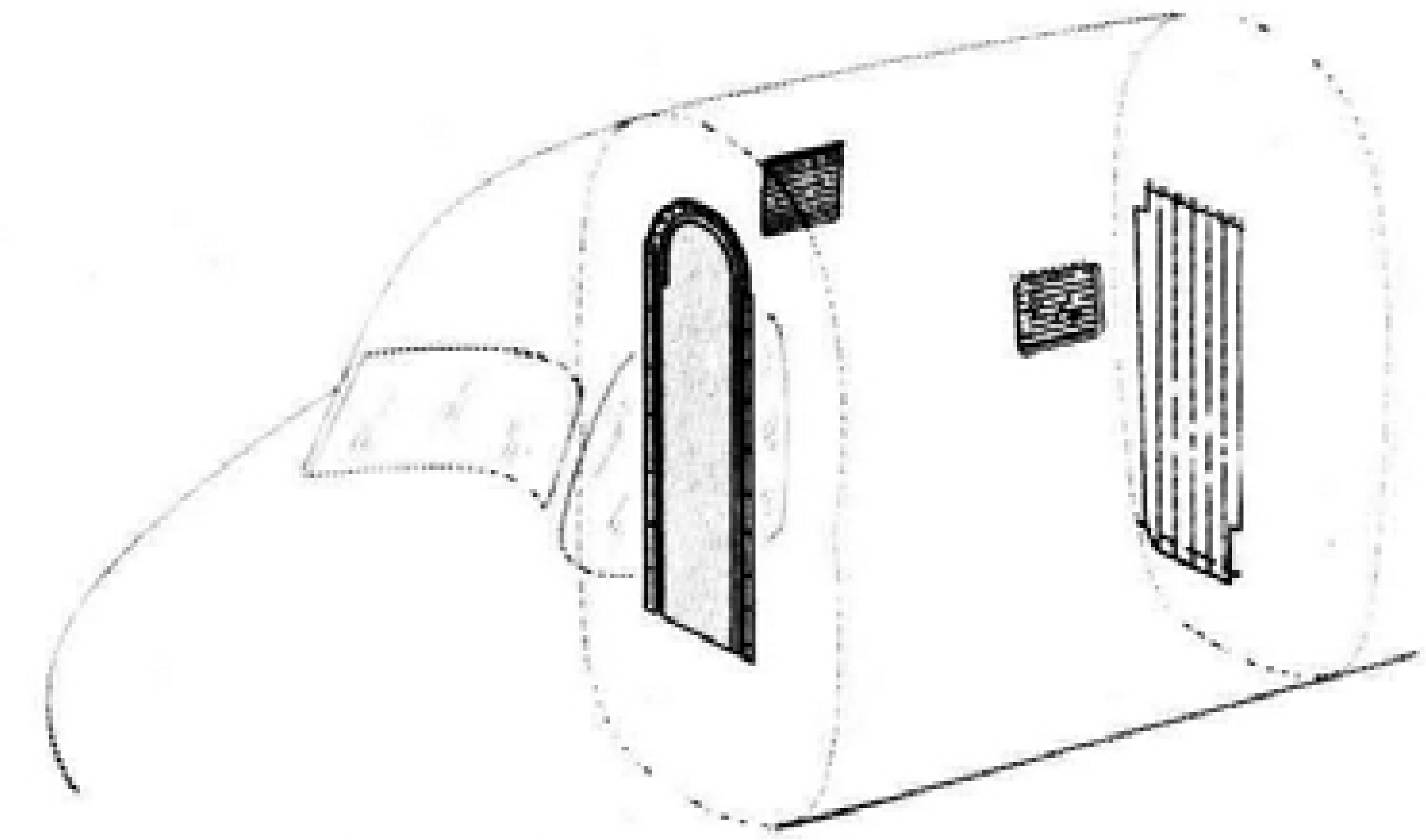


Figure 1-23. Black-out Curtains

BLACK-OUT CURTAINS.

Black-out curtains are provided for both windows in the operators' compartment (figure 1-23). A drop curtain is located between the operators' and the electronic compartments and a door curtain with slide fastener is located between the pilots' and operators' compartments. This curtain is also equipped with snap fasteners so that it can be pushed open for quick release. The door curtains (figure 1-23) serve to keep light from the pilots' compartment and also to keep heat from the electronic compartment out of the operators' compartment.

PERSONNEL FURNISHINGS.

Relief tubes, ash receivers, and utility receptacles are provided in convenient positions for all members of the crew. Canvas pouches are attached to the airframe adjacent to each crew member's seat for the stowage of earphones, microphones, and canteens. A chart case is located by the co-pilot's seat. Map reading lamps are convenient to both the pilot and co-pilot (figure 1-8).

SIGNAL LAMP.

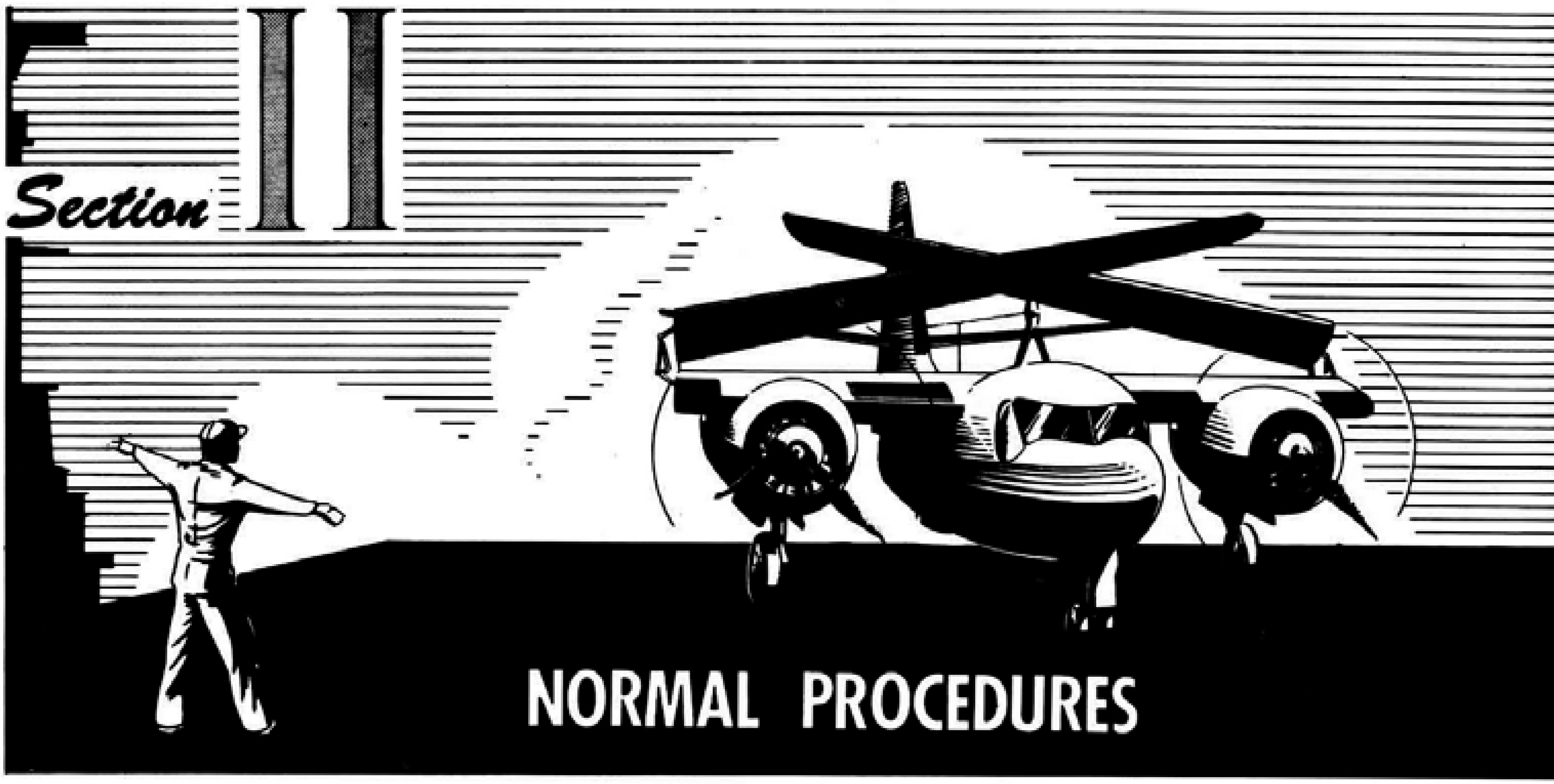
A trigger-action signal lamp (21, figure 1-8 and 6, figure 3-3) is held by snap fasteners to a bracket on the bulkhead aft of the co-pilot's seat. A case for lamp filters is located adjacent to the lamp (22, figure 1-8). The signal lamp can be plugged into the utility receptacle at the aft end of the folding console.

AUXILIARY EQUIPMENT.

The following auxiliary equipment is described in Section IV:

Air Conditioning System
De-icing System
Windshield Anti-icing System
Communications and Associated Electronic Equipment
Lighting Equipment
Searchlight
Automatic Pilot
Navigation Equipment
Armament Equipment
Non-Emergency Equipment (not part of a system)

[1] S2F-1 airplanes BuNo. 133230 and subsequent, and S2F-2 airplanes BuNo. 133333 and subsequent.



BEFORE ENTERING AIRPLANE.

FLIGHT RESTRICTIONS.

Refer to Section V of this handbook for flight restrictions and limitations imposed upon this airplane.

CRUISE CONTROL.

The required fuel, airspeed, power setting, etc to complete a mission shall be determined from the operating data supplied in Appendix I.

WEIGHT AND BALANCE.

Obtain the take-off and anticipated landing gross weights. Ascertain that the armament necessary for the mission and the useful load has been loaded in accordance with the Handbook of Weight and Balance, AN 01-1B-40. Check that the weight limitations covered in Section V have not been exceeded. Make certain that weight and balance clearance (Form F) is satisfactory.

CHECK LISTS.

For take-off and landing check lists, see figure 2-3.

EXTERIOR INSPECTION.

a. Check Navy yellow sheet for condition of airplane.

b. Make complete preflight inspection of airplane exterior. (See figure 2-1.)

Note

Check that external electrical power is connected, if available.

ENTRANCE TO AIRPLANE.

For instructions on entering the airplane, see figure 2-2.

ON ENTERING AIRPLANE.

INTERIOR CHECK (ALL FLIGHTS).

a. Torpedo bay, wing flaps and landing gear emergency dump valve reset buttons—push to reset.

b. Torpedo bay door and brake accumulator pressure gages—check.

c. Boarding ladder—removed and stowed on inside of main entrance door.

d. Main entrance door and operators' compartment hatches—closed and locked. Pilots' compartment hatches—optional.

Note

Check that the radar-sonobuoy operator's hatch is safety-wired shut to prevent inadvertent loss in flight.

e. MAD boom and radome switches—in retracted position.

f. All necessary equipment—stowed.

g. Landing gear selector handle—DOWN.

h. Gust lock—disengaged.

i. Control wheels, columns and rudder pedals—check for free movement and full throw of control surfaces. Adjust pedals to desired position.

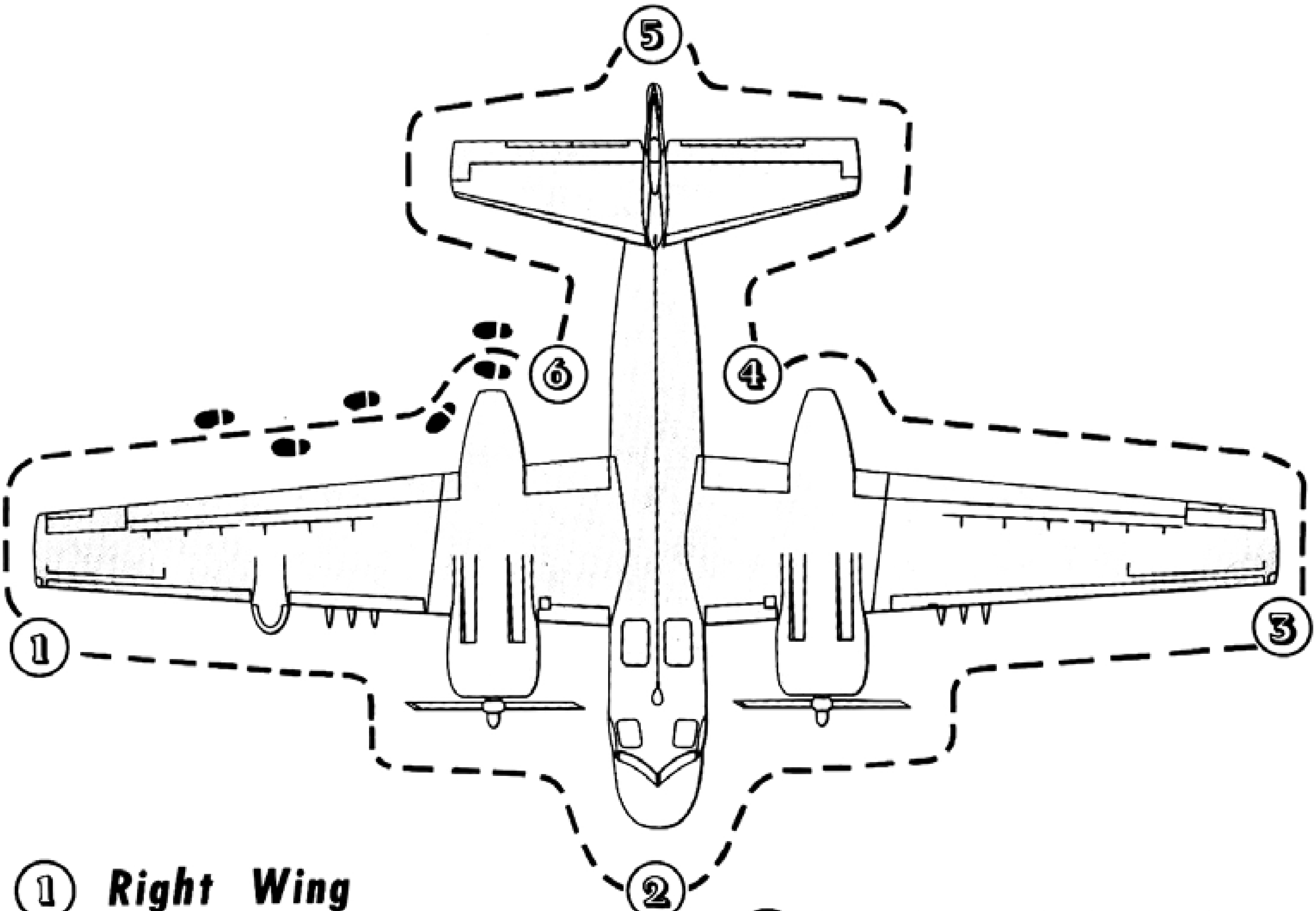
j. Seats—adjust as desired.

k. Safety belts and shoulder harnesses—secure and adjust.

l. Emergency and parking brake handle—on and locked.

m. Altimeters—set.

n. Clocks—set.



① Right Wing

a. Wing tip and navigation light - Condition.
b. Wing skin - Condition and evidence of fuel leakage.
c. Aileron, spoilers and flap - Condition.
d. Access doors - Secured.
e Tie-down cables - Removed.
f. Propeller - Condition.
g. Searchlight - Condition.
h. Armament - Properly secured.
i. Nacelle cowling and access doors - Secured.
j. WING LOCK WARNING FLAG-RETRACTED.
k. Lower wing lock pins - Engaged (flush with lower surface).

② Nose

a. Nose gear tire and shock strut - Condition and inflation.
b. Nose wheel doors - Condition.
c. Tie-down cables - Removed.
d. Pitot head covers - Removed.

③ Left Wing

a. Repeat procedures for right wing, except for searchlight.
b. Aileron trim tab - Condition.
c. Approach light - Condition.
d. WING LOCK WARNING FLAG-RETRACTED.
e. Lower wing lock pins - Engaged (flush with lower surface).

④ Fuselage - Left Side

a. Main landing gear tire and shock strut - Condition and inflation.
b. Landing gear doors - Condition.
c. Fuselage skin - Condition.
d. Torpedo bay doors - Secured.
e. Access doors - Secured.
f. Radome - Condition.
g. Arresting hook dashpot pressure gages (2) - 552±10 psi.
h. Rudder trimmer accumulator pressure gage - 900 psi (preload).

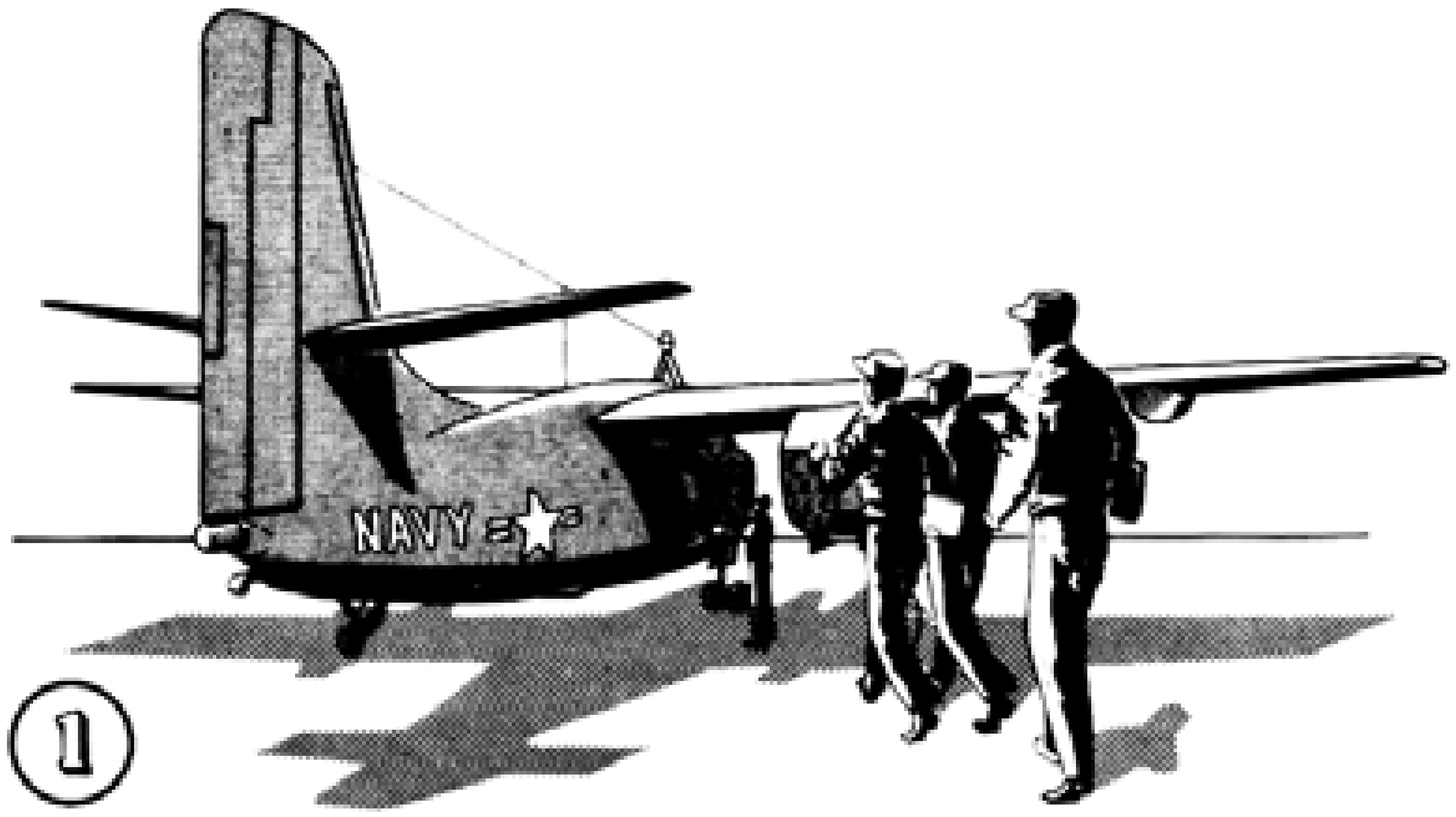
⑤ Empennage

a. Vertical fin, rudder trimmer, rudder and rudder tab - Condition.
b. Horizontal stabilizer, elevators and elevator tabs - Condition.
c. Tail position lights - Condition.
d. Arresting hook - Retracted and secured.
e. MAD boom - Retracted and secured.

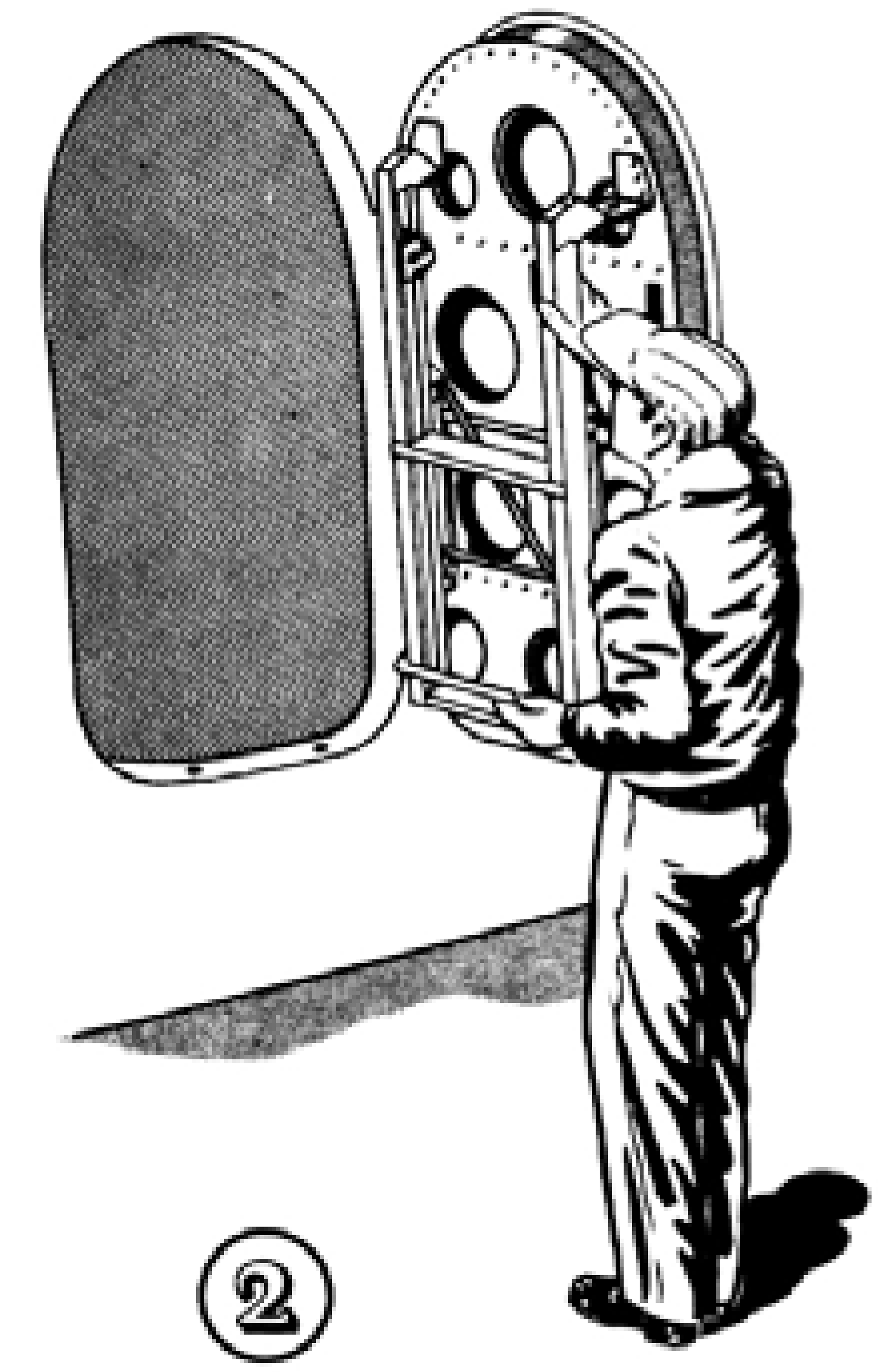
⑥ Fuselage - Right Side

a. Repeat procedure for fuselage - left side, except for torpedo bay doors.
b. Main entrance door - Condition.
c. Radar access hatch warning flag - flush.

Figure 2-1. Exterior Inspection Diagram



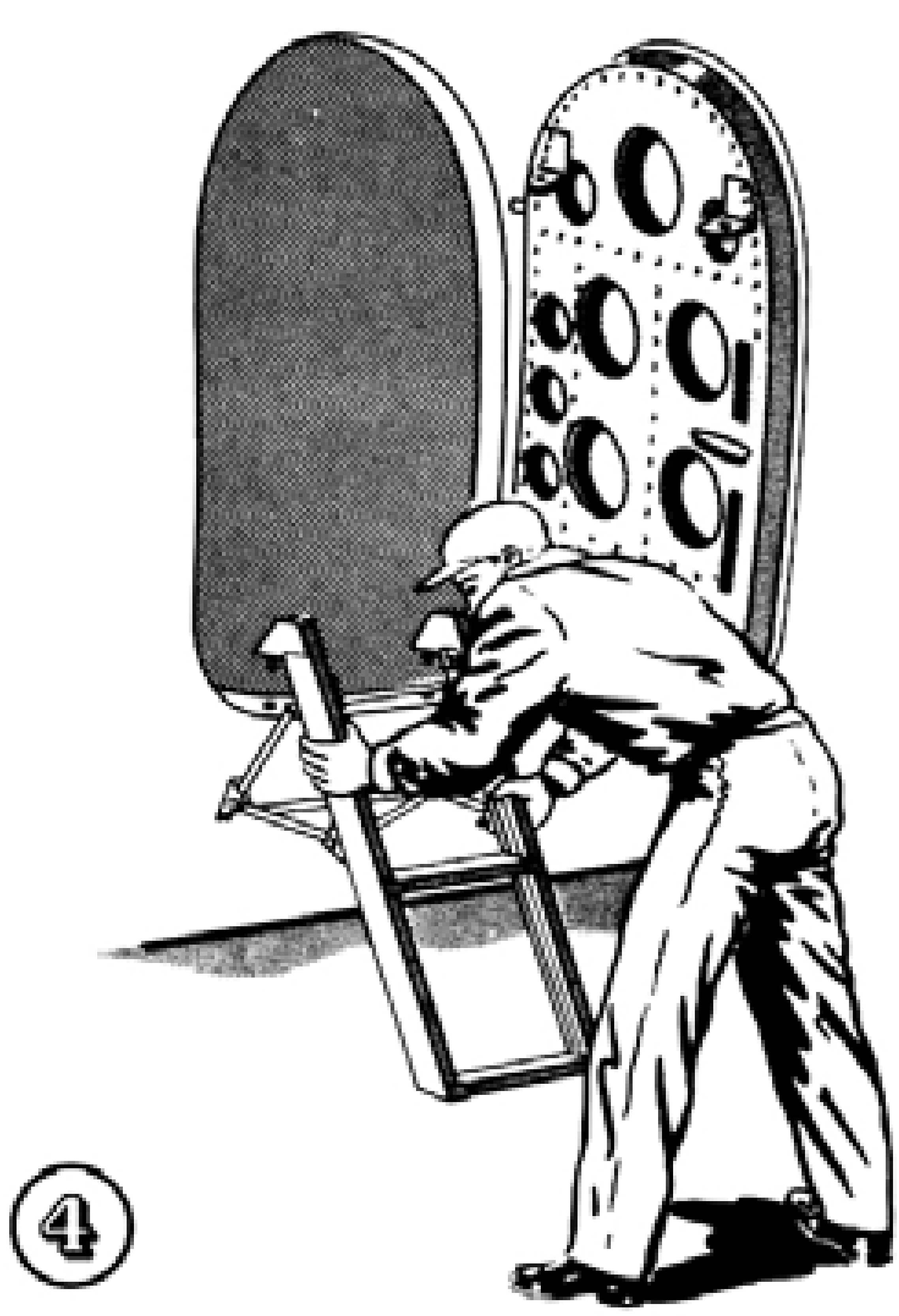
Approach airplane from rear to avoid propellers.



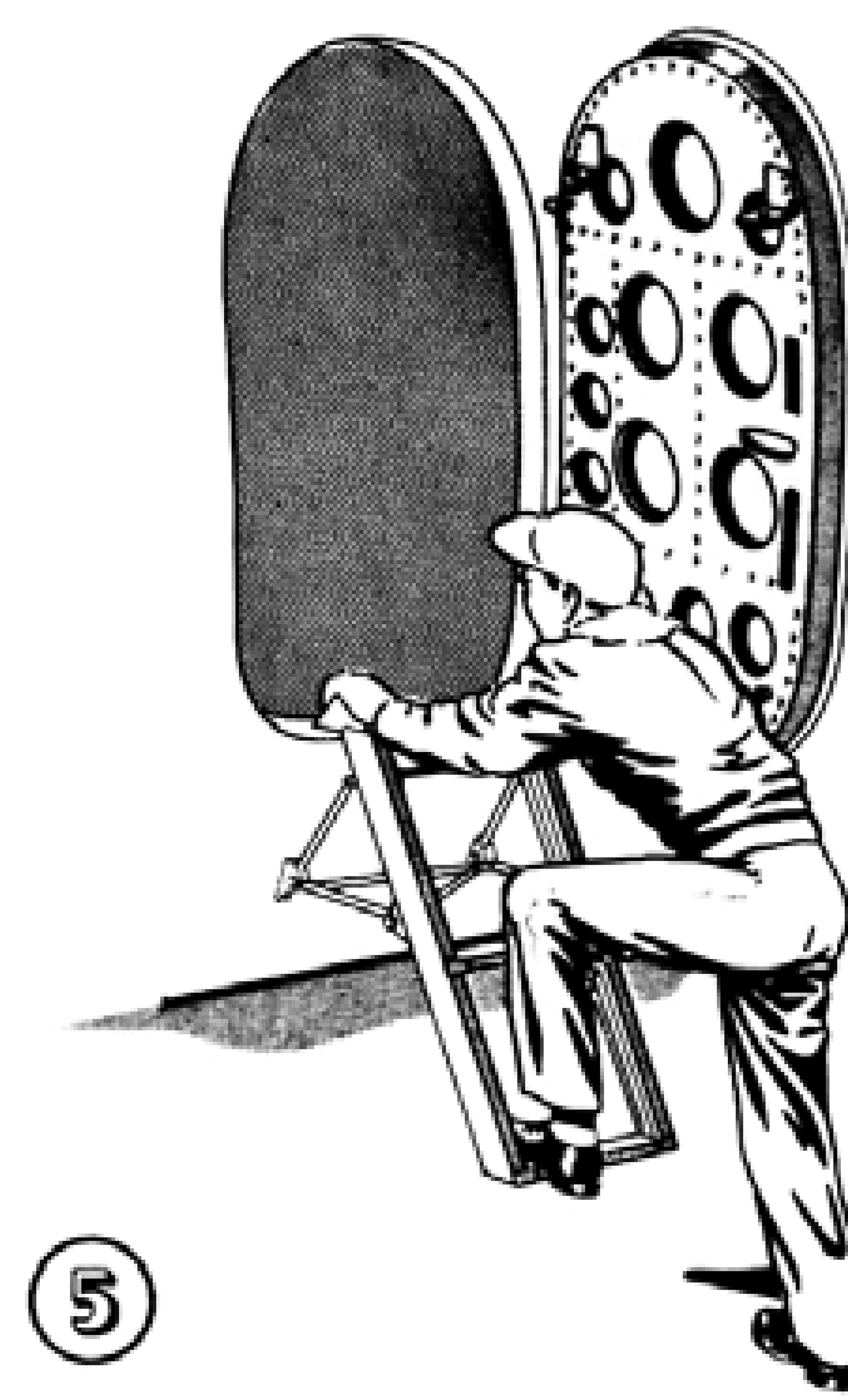
Turn handle to open main entrance door, then stretch elastic cord which holds ladder to bottom of door, raise ladder to release ladder mounting pins from holes in door fittings and remove ladder.

Unfold ladder so that ends of ladder brace are engaged by self-locking hooks, securing ladder for use (S2F-1 airplanes ser No. 133150 and subsequent, S2F-2 airplanes ser No. 133329 and subsequent).

(On S2F-1 airplanes ser No. 129139 through 133149, unfold ladder and squeeze levers to retract spring loaded pins in ladder brace, line up pins with holes in ladder fittings and release levers so that pins enter holes, securing ladder for use.)



Place ladder mounting pins in holes at bottom of door frame.



Check that ladder is securely mounted and enter airplane.

Figure 2-2. Entrance to Airplane

o. All communication equipment switches—off.

p. Master and ignition switches—OFF.

q. Fuel selector valve controls—as desired.

r. Mixture controls—IDLE CUT-OFF.

s. Propeller rpm controls—INCREASE (full low pitch).

t. Emergency fuel shut-off switches—OPEN.

u. Left and right engine oil switches—OPEN.

v. Left and right engine fire extinguisher switches—OFF.

w. Left and right auxiliary fuel pump switches—OFF.

x. Throttles—CLOSED.

y. Pitot heat switch—OFF.

z. Left and right oil cooler doors switches—CLOSED.

aa. Cowl flaps switches—OPEN.

ab. Left and right carburetor air switches—DIRECT.

ac. Circuit breakers—check that all are in.

ad. Battery switch—ON (OFF if external electrical power is connected).

ae. Inverter selector switch—NORMAL.

af. D-C generator switches—ON (OFF if external power is connected).

ag. A-C generator field switch—ON.

ah. Automatic pilot on-off switch—OFF.

ai. Wing lock and wing fold control levers—if wings are spread, both levers pushed up and outer lever flush with panel; if wings are folded, both levers down.

aj. Co-pilot's gyro horizon indicator—uncage.

ak. Arresting hook control—UP.

al. G-2 compass switch—COMPASS CONTROL.

am. Emergency flaps, landing gear and torpedo doors control—all at NORMAL.

an. Hand pump handle—stowed.

INTERIOR CHECK (NIGHT FLIGHTS).

Turn on, as required, and check operation of lighting equipment as follows: pilot's primary and secondary light control switches, co-pilot's primary and secondary light control switches, pilot's overhead console lights rheostat, pilot's lower console lights rheostat, pilots' compartment utility lights switches, exterior lights control switches.

BEFORE STARTING ENGINES.

Check that all personnel are safely clear of propellers and that wheels are chocked. Make certain that stand-by fire fighting equipment is manned.

WING FOLD SYSTEM OPERATION

To prevent wing fold malfunctioning caused by incorrect operating procedure on airplanes which have been stored with wings folded, and on which no revisions or adjustments have been made to the wing fold system:

a. Set wing fold control to fold selection.

b. Start engines (see Starting Engines, below) and check hydraulic gages for 3000 psi indication.

c. If above conditions are met, spread wings.

Note

If wings are being spread through ground test connections, the fold selection should always be made first and the fold mechanism checked for proper position before selectng spread.

CAUTION

To prevent structural damage to wings after adjustment, rework or replacement of any portion of the wing fold system, the following steps should be followed:

Pressurize fold selection and observe wing fold mechanism to insure proper operation.

Select spread, raise wing tip from three to five feet above folded position. Observe mechanism, MAKING SURE LOCK PINS DO NOT EXTEND. Return to folded position and repeat procedure several times.

Spread wings while an observer is stationed at each fold joint to check and ensure proper operation.

STARTING ENGINES.

a. Turn each propeller through four revolutions with starter.

CAUTION

If there is unusually high compression, have spark plugs removed from lower cylinders and all liquid drained, as the presence of any quantity of liquid in a combustion chamber is likely to cause serious damage. Never turn the propeller opposite to engine rotation as this may force liquid into the intake pipe, from where it is apt to be drawn back into the cylinder when the engine is started.

b. Left and right auxiliary fuel pump switches—ON.

c. Master ignition switch—on (push in).

d. Throttle—crack open for approximately 1200 rpm.

e. Starter switch—on (to left for left engine or right for right engine, and hold).

f. Ignition switch—BOTH (after propeller has turned two revolutions).

CAUTION

Continuous cranking should not exceed 30 seconds. If engine does not start, release starter switch and allow starter to cool.

g. Primer switch—ON intermittently until engine fires, then continuously while gradually opening throttle to clear up exhaust and obtain smooth operation.

Note

Excessive throttle opening and intermittent priming after the engine has fired are the principal causes of backfiring during starting. Gradual opening of the throttle while priming continuously will reduce the initial over-rich mixture to a smooth running, best-power mixture as the engine picks up speed. An over-rich mixture is sluggish but will not backfire.

h. Mixture control—after engine is operating smoothly on primer, move mixture control to RICH while watching tachometer. Release primer as soon as drop in rpm indicates engine is receiving additional fuel from carburetor.

CAUTION

If oil pressure indicator does not show pressure within 30 seconds, stop engine and investigate.

i. Throttle—after transfer from primer to carburetor has been accomplished, adjust throttle to idle between 700-1000 rpm.

j. Repeat steps d. through i. for starting other engine.

k. Disconnect external power supplies, if connected, and set battery and generator switches to ON.

Note

For instructions on procedure to be followed in case of fire, see Section III.

ENGINE GROUND OPERATION.

WARM-UP.

a. Idle engines at 1100-1300 rpm.

Note

Spark plugs will foul up rapidly at low idle rpm if idle mixture is not adjusted properly.

b. After one minute, check that 40 psi oil pressure is indicated (15 psi minimum at idle).

c. Warm up at 1100-1300 rpm until oil temperature reaches 40-85°C.

Note

An excessive rise in oil pressure when throttles are advanced indicates that further warm-up is necessary.

d. When oil reaches satisfactory operating temperature, move left and right oil cooler doors switches to OPEN, as required, then return to OFF to stop operation of doors at desired setting.

e. Hold fire detector test switch momentarily at TEST (fire warning lights should light).

GROUND TESTS.

HYDRAULIC SYSTEM.

a. Check that left and right hydraulic system pressure gages indicate 1400-1500 psi with wings spread. If wings are folded, check that left and right hydraulic gages indicate 2700-3000 psi.

b. Check wing flaps operation if wings are spread.

c. Check rudder trimmer operation.

d. Check arresting hook operation.

e. Check torpedo bay doors operation.

CAUTION

Make certain that all ground personnel are clear, as torpedo bay doors open very rapidly.

f. Have crew member check that RADOME UP indicator lights are lighted.

g. Have crew member check that MAD BOOM IN indicator lights are lighted.

h. Check that landing gear position indicator shows that gear is down and locked.

AUTOMATIC PILOT.

a. With engines running and battery switch ON, check that auto pilot power switch is OFF and check rudder, aileron and elevator controls for freedom of movement and full travel.

b. After battery switch has been ON for two minutes, (to give gyros time to reach operating speed), erect vertical gyro by first caging and then uncaging it by means of knob on co-pilot's gyro horizon indicator.

c. Set co-pilot's master direction indicator to heading shown on correspondence indicator.

d. Set auto pilot power switch to ON.

e. Wait two minutes to allow amplifiers to warm up, then center stick controller in its detent position, and align centering marks on both pitch and bank trim wheels with index marks.

f. Engage auto pilot by pressing clutch switch.

g. Check that manual controls (control wheel and rudder pedals) are held firmly by auto pilot.

h. Move stick controller left and right—check for related travel of ailerons and rudders.

i. Move stick controller fore and aft—check for related travel of elevator controls.

j. Turn pitch trim control wheel fore and aft to check response of elevator.

k. Turn bank trim control wheel to left and right—check for related aileron control travel.

l. Change airplane heading to change master direction indicator reading and observe aileron and rudder controls travel.

m. Pull out clutch switch and check that auto pilot is disengaged and that all manual controls are free and unrestricted.

n. Engage auto pilot again by pressing clutch switch.

o. Cage co-pilot's gyro horizon and check that clutch switch pops out to off position, and that auto pilot has disengaged controls. Press clutch switch to engage auto pilot and repeat check by caging co-pilot's master direction indicator. Clutch switch should again pop out.

ELECTRICAL SYSTEM.

a. With engine idling, check voltammeters and note 24-volt battery voltage. The d-c generator warning lights should be lighted.

b. Advance throttles and note extinguishing of d-c generator warning lights at approximately 1100 rpm, indicating that d-c generators have cut in.

c. Check right generator voltage at 1800 rpm by moving left generator switch to OFF. Right generator voltammeter should indicate approximately 28 ±.5 volts.

d. Return left generator switch to ON and repeat step c. for left generator.

e. Check paralleling of d-c generators by turning on radio equipment, lighting, etc. Ammeter readings should indicate that each generator is carrying an equal portion of the load, within 10 per cent.

f. With electrical load still applied, move left d-c generator switch to OFF. Left generator ammeter should show no load and right generator ammeter should indicate that load has been picked up by right generator.

g. Return d-c generator switch to ON and repeat step f. for left generator. Then return right generator switch to ON.

h. Check operation of communication equipment.

FUEL SYSTEM.

a. Check fuel flow from left tank to right engine and from right tank to left engine (figure 7-1) for two minutes with rpm over 1200. Return to left tank to left engine and right tank to right engine.

b. Fuel quantity and fuel quantity gage test switch—set momentarily at LEFT and then at RIGHT. Applicable gage pointer should move to low end of dial and fuel low level warning light should light when pointer reaches 150 pounds of fuel position.

c. Fuel low level warning lights—check operation.

DE-ICING AND ANTI-ICING EQUIPMENT.

WING AND TAIL DE-ICING SYSTEM.

a. Instruct ground crewman to observe operation of wing and tail de-icer boots.

b. Set rpm to 1200-1400.

c. Turn ON wing and tail de-icer switch.

d. Observe pressure gage—six fluctuations of the pressure gage between 0 and 15 psi should occur in 30 seconds, which completes an inflation period. This is followed by an approximate 30-second dwell period after which the cycle will restart.

e. To check both vacuum pumps, close both throttles, then open left throttle to approximately 1500 rpm and note .2 to .3 in. Hg rise on suction gage.

f. Close left throttle and repeat check with right throttle.

PITOT HEAT.

a. Set rpm to 1200-1400.

b. Turn pitot heat switch ON momentarily and note slight rise in ammeter reading.

PROPELLER DE-ICING.

a. Set rpm to 1200-1400.

b. Turn propeller de-icing switch on momentarily and note slight rise in ammeter reading.

CARBURETOR ALTERNATE AIR.

a. Set rpm to 1200-1400.

b. Set carburetor air switch to ALTERNATE and note carburetor air temperature rise within approximately 30 seconds. Return to DIRECT.

STALL WARNING SYSTEM.

Press stall warning test switch to ON and note pilot's wheel shake.

TAXIING INSTRUCTIONS.

The nose wheel is free swiveling and does not incorporate a locking device. To taxi, hold brakes and have chocks removed. Release parking brake and check operation of each brake. Apply even power to start moving, steer and control speed by use of throttles and brakes. When taxiing cross-wind, use less power on down-wind engine for better control. Before take-off, roll a few feet in take-off direction to straighten nose wheel.

Note

Do not apply parking brake while airplane is moving.

BEFORE TAKE-OFF.

a. If wings are folded, check for removal of struts and spread wings by pushing fold-spread (inner) lever up. Wait for completion of automatic portion of spread cycle, as indicated by lighting of amber wing fold-spread safety light.

Note

The hydraulic pressure should drop from 2700-3000 psi to 1400-1500 psi when the light comes on.

b. Release manual latch on outer (locking) lever and stow (watch the wing lock warning flags retract into the nacelles during this operation). Amber safety light should go out when handle is stowed.

CAUTION

The outer (locking) lever is spring-loaded to the flush position. Do not force the outer lever up, as resistance to motion indicates a malfunction in the system.

c. If wings are spread, pull down outer (locking) lever and watch extension of wing lock warning flags.

d. Stow outer lever as outlined under step b. above.

e. Have ground observer check operation of wing flaps and flight control surfaces.

PREFLIGHT ENGINE CHECK.

INSTRUMENTS CHECK.

With engines operating at 1500 rpm and propellers set for high rpm, check the following:

a. Oil temperature—70-85°C.

b. Oil pressure—65-75 psi.

c. Fuel pressure—23±2 psi (check with auxiliary fuel pumps off and with auxiliary fuel pumps on).

d. Cylinder head temperature—100-245°C.

e. Carburetor air temperature—5-38°C.

PROPELLER CHECK.

a. Lock parking brake and set throttles for approximately 25 in. Hg MAP and operate propeller rpm control levers through the complete range from full INCREASE to full DECREASE three to four times, then return to INCREASE. Engine rpm should change due to propeller pitch change. This procedure will also expel any air in the propeller control oil lines.

b. PUSH right propeller feathering button until 200 rpm drop is obtained, then pull button out to the off position. Repeat procedure for left propeller.

IGNITION CHECK.

Set throttles so that manifold pressure equals field barometric pressure. Operate approximately 15 seconds in NORMAL mixture to clear engines, then return to

RICH. Move right engine ignition switch from BOTH to R and back to BOTH, then from BOTH to L and back to BOTH. Allow rpm to stabilize on BOTH before switching. Normal drop-off in either L or R position is 50-75 rpm, maximum is 100 rpm. Follow same procedure with left engine. (See Idle Mixture Check paragraph below for information on clearing fouled spark plugs.)

FULL POWER CHECK.

Advance throttle to obtain 2750-2800 rpm. Manifold pressure should rise to 54-56 in. Hg. Decrease rpm immediately to idle (550-650 rpm).

IDLE MIXTURE CHECK.

Check closed-throttle idle mixture by manually leaning mixture until a noticeable decrease in rpm is obtained. There should be no increase in rpm or decrease in manifold pressure during this process if mixture adjusting screw has been properly set for a "best-power" mixture. Idling for a few minutes with manually leaned mixture is better than operating at high power for "burning-out" carbon deposits.

PREFLIGHT AIRCRAFT CHECK.

a. Pilots' compartment hatches—locked open or locked closed.

b. Wing lock indicators—retracted.

c. Check for free movement of flight controls.

d. Gyros—PULL TO CAGE, then uncage. Set G-2 compass.

e. Single engine rudder assist switch—ON.

f. Aileron, elevator and rudder trim—check for full throw on trim position indicators.

Note

If normal elevator tab switches are inoperative, see Elevator Trim Tabs Stand-by Switch paragraph, Section I.

g. Trim tab control—set as follows:

Aileron trim—0°.

Elevator trim, flaps up—S2F-1, 7° nose-down; S2F-2, 0°.

Elevator trim, flaps full down—S2F-1, 5° nose-up; S2F-2, 7° nose-up.

Rudder trim—0°.

h. Automatic pilot power switch—OFF.

i. Automatic pilot clutch switch—pull off.

j. Wing and tail de-icing control switch—OFF.

k. Heater control switch—OFF.

l. Fuel selector valve controls—LEFT TANK TO LEFT ENGINE and RIGHT TANK TO RIGHT ENGINE.

m. Wing flaps control—normally UP.

n. Propeller rpm controls—full INCREASE.

o. Mixture controls—RICH.

p. Gust lock control handle—up and locked.

q. Pitot heat switch—as required.

r. Cowl flaps switches—OPEN as required.

s. Oil cooler doors switches—OPEN as required.

t. Carburetor air switches—DIRECT.

u. Auxiliary fuel pump switches—ON.

v. Crewmembers—ready for take-off.

w. Parking brake—unlock and release.

x. Nose wheel—straight (taxi forward a few feet to align wheel).

TAKE-OFF.

NORMAL TAKE-OFF.

a. Release brakes and advance throttles full forward to obtain maximum of 2800 rpm at 56.0 in. Hg manifold pressure.

b. Maintain direction with brakes and/or throttles until rudder control becomes effective at approximately 30 knots.

c. Lift nose wheel from deck at approximately 60 knots.

d. The airplane should be eased off the deck with elevator control at approximately 85 knots.

e. Comfortable single engine control speed (100 knots IAS) should be obtained as soon as practicable.

MINIMUM TAKE-OFF RUN.

The calculated minimum take-off distance is obtained with wing flaps set at two-thirds down, with brakes held until 56.0 in. Hg and 2800 rpm are attained. For required lift-off speeds and corresponding distances, refer to figure A-7.

OBSTACLE-CLEARANCE TAKE-OFF.

For data on clearing a 50-foot obstacle, refer to figure A-7.

CROSS-WIND TAKE-OFF.

Cross-wind take-off is not critical due to the inherent stability of the tricycle landing gear. Differential use of throttles and brakes facilitates directional control. In strong cross winds it is recommended that lift-off speed be increased as a margin of safety. Although undetermined, it is estimated that take-offs can be made in 90-degree cross winds with wind velocities of 30-40 knots.

NIGHT TAKE-OFF.

Check interior and exterior lighting for proper operation. Use normal take-off procedure.

AFTER TAKE-OFF.

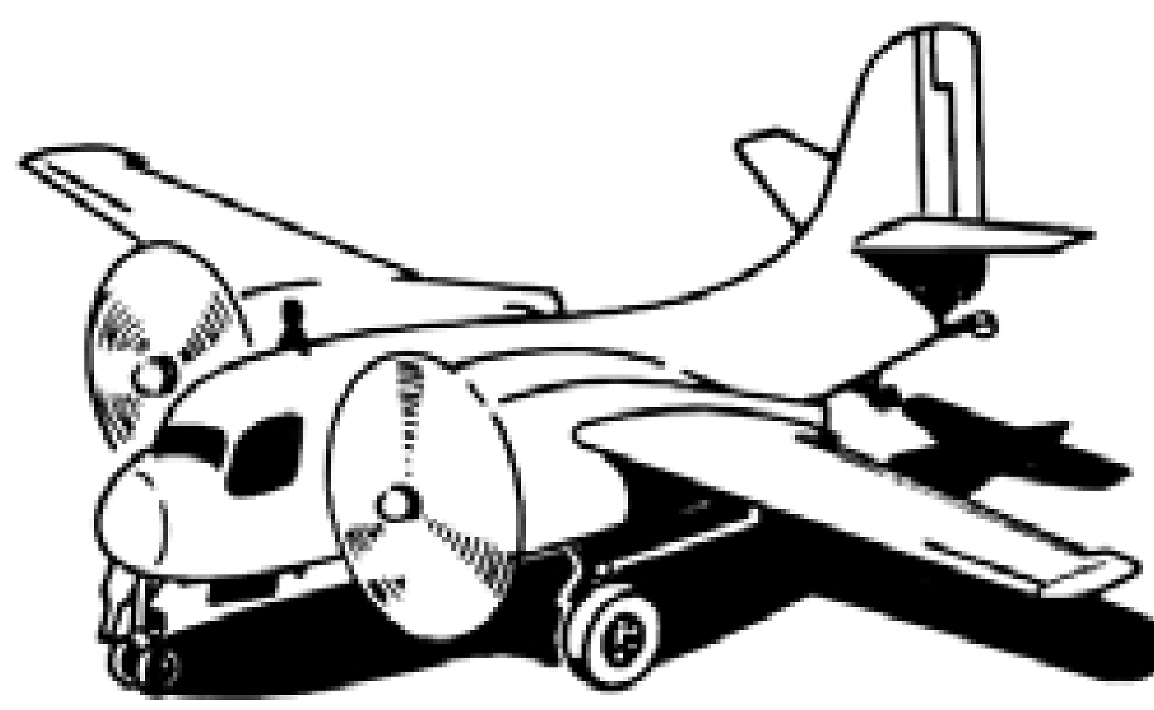
a. When airplane is safely airborne, set landing gear control handle to UP position.

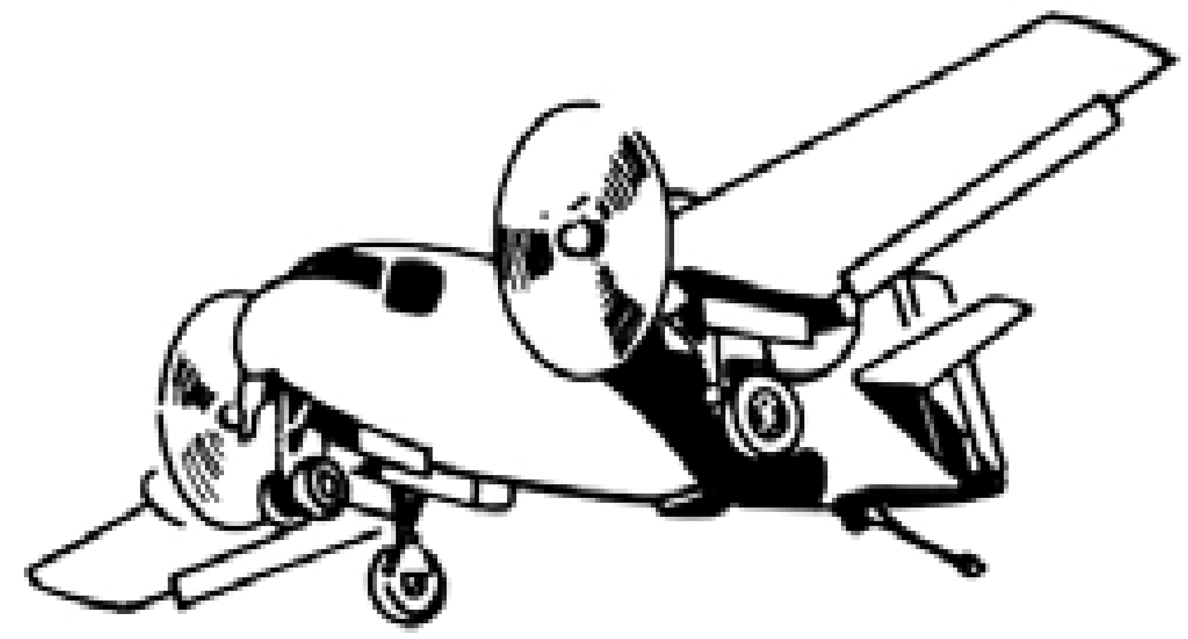
WARNING

Landing gear retracts in approximately six seconds and causes a slight nose-up trim change. On S2F-2 airplanes, the nose-up trim change is followed by a slight nose-down trim change when the landing gear becomes fully retracted.

TAKE-OFF

TAKE-OFF
- FUEL
- MIXTURE
- PROPS
- CARB AIR
- HARNESS
- COWL FLAPS
- RUDDER TRIM
- OIL COOLER
- GUST LOCK
- TABS
- FLAPS
- WING LOCK
- HATCHES





LANDING

LANDING
- WHEELS
- FUEL
- MIXTURE
- PROPS
- HARNESS
- HATCHES
- RUDDER TRIM
- CARB AIR
- COWL FLAPS
- FLAPS
- HOOK
- ARMAMENT
- RADOME
- MAD BOOM

Figure 2-3. Take-off and Landing Check Lists

b. Comfortable single engine control speed (100 knots IAS) should be obtained as soon as practicable.

c. Check wheels position indicator and check visually to see that landing gear is up and locked. The nose wheel can be checked by means of the polished leading edge of the left engine cowling.

d. If wing flaps are used, move flaps control to UP. Do not retract flaps until safe altitude and airspeed are reached. (Retract in increments.)

CAUTION

Be sure to push wing flaps control full up past console level.

e. Accelerate to 130 knots IAS. (For climb data, see figures A-8 and A-9.)

CLIMB.

a. Figures A-8 and A-9 show climb performance at military and normal rated power. A normal climb power is approximately 70 per cent of normal rated power. At sea level, this is approximately 2250 rpm and 34 in. Hg manifold pressure. See figures A-5 and A-6, for manifold pressures at various altitudes.

b. Set single engine rudder assist switch to OFF at approximately 130 knots IAS. See Section III for use of rudder trimmer under single engine condition.

c. Mixture controls—NORMAL.

d. Set cowl flaps so that cylinder head temperature does not exceed 260°C (500°F).

e. Set oil cooler doors. Oil temperature should not go above 104°C maximum or below 40°C minimum.

f. Climb characteristics of the airplane are normal.

g. After reaching desired altitude, level off and reduce power for cruising.

h. Adjust cowl flaps.

i. Adjust oil cooler doors.

j. Set auxiliary fuel pump switches to OFF.

FLIGHT CHARACTERISTICS.

See Section VI.

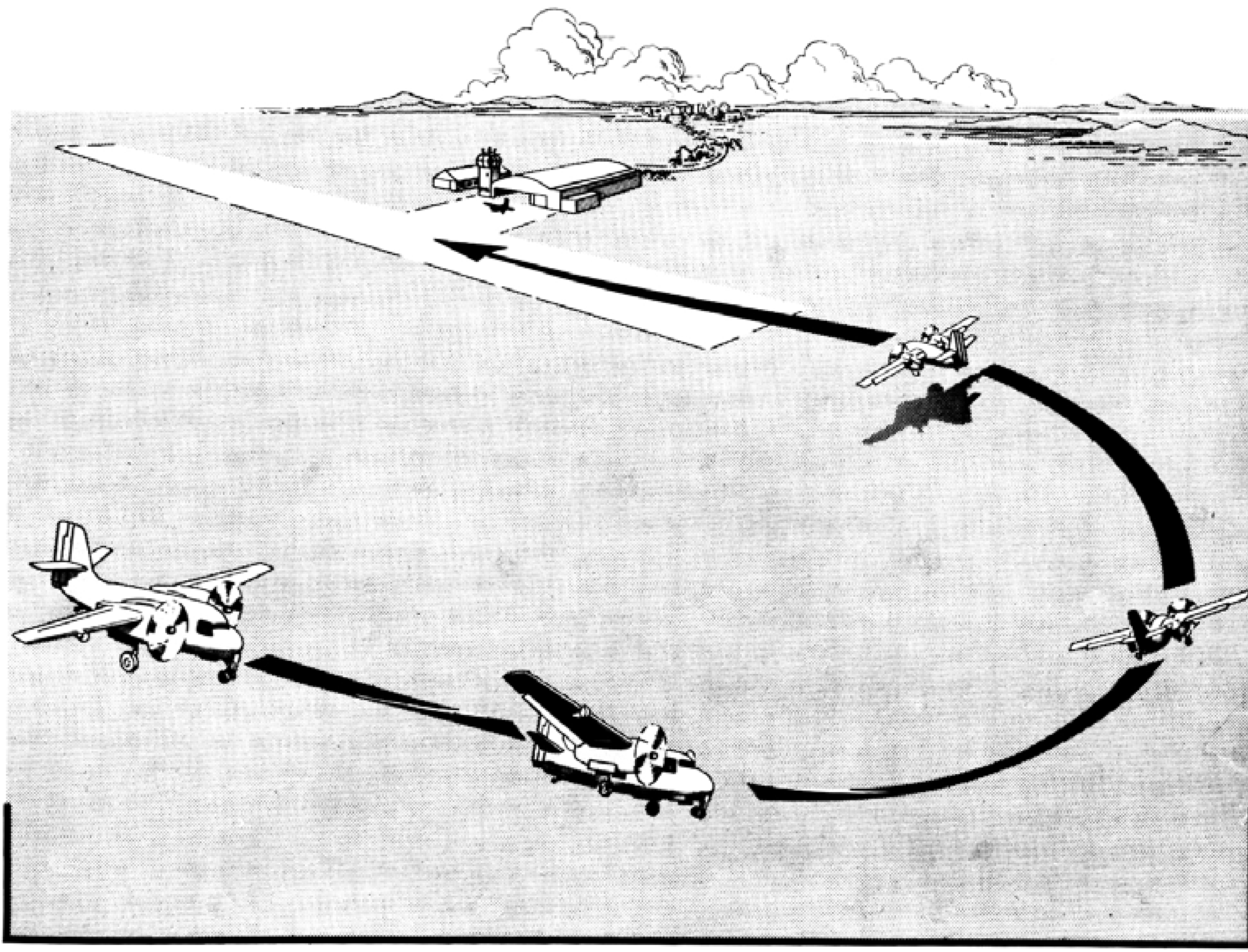
SYSTEMS OPERATION.

See Section VII.

ENGINE COOLING.

If carburetor air temperatures in excess of 38°C occur during field carrier landing practice when high power settings are used, limit aircraft operation to five consecutive passes followed by 10 minutes of cruising at moderate power. This procedure should serve to reduce the over-all temperature level of the power plant and preclude the possibility of failure of marginal parts of the system.

For all other operation, carburetor air temperatures 3—5°C above OAT are permissible during take-off. However, for cruise condition, decrease allowable MAP for given rpm by 1 in. Hg for each 6°C that CAT exceeds 38°C.



1. DOWNWIND LEG. Maintain prescribed field altitude. Check that MAD boom is retracted and radome is up. Extend landing gear.

   Check gear position indicator and check gear position visually. For carrier landing, extend arresting hook.

2. TURN ONTO BASE LEG. Complete landing check list. Extend flaps to 1/3 or as required.

3. BASE LEG. Extend flaps to 2/3 or as required. Maintain 100 knots IAS minimum.

4. FINAL APPROACH. Make power approach at 85 to 90 knots IAS or power-off approach at 95 to 100 knots IAS with full flaps. After landing, hold nose wheel off until speed lessens. After nose wheel makes contact, apply brakes slowly and evenly.

Figure 2-4. Landing Pattern Diagram

PRE-TRAFFIC PATTERN CHECK LIST.

a. Check communications equipment.

b. Crew members ready for landing. Check that radome switch is set at RADOME UP and MAD boom switch at BOOM IN.

Note

If radome will not retract either automatically or manually, lower arresting hook for landing. Hook will hold tail up, preventing damage to radome.

c. Safety belts and shoulder harnesses tightened.

d. Check fuel quantity gages.

e. Fuel selector valve controls—LEFT TANK TO LEFT ENGINE and RIGHT TANK TO RIGHT ENGINE.

f. Automatic pilot clutch switch—pull off.

g. Auto pilot power switch—OFF.

h. Cowl flaps switches—position depending upon temperature.

i. Carburetor air switches—as required.

CAUTION

Detonation may occur at high power settings when full alternate air is used. Regulate alternate air to maintain temperature below 38°C.

TRAFFIC PATTERN CHECK LIST.

a. Lower landing gear and check position on indicator. Also check gear position visually; the nose wheel can be checked by noting its reflection in the

at an approach airspeed slower than the recommended range, under this condition, when the throttle is retarded at the cut the airspeed may be such that it is below the power-off stall airspeed or it may quickly reach that point as a result of the airplane decelerating from the loss of thrust. On the other hand, the higher the cut airspeed is increased above the recommended range the more difficult it will become to prevent nose wheel first landings, bounce landings or floating, with the possibility of a barrier crash. If the higher cut airspeed causes the pilot to force the airplane to the deck without flare, so as to land nose wheel first, and if the nose gear structure does not fail, the resulting nose-up moment will cause the angle of attack to increase beyond that required to sustain level flight at that airspeed. The lift will then be sufficient to overcome the weight of the airplane and the airplane will become airborne again. Should a flare be used in landings at the higher cut airspeeds, the nose-down moment from the impact of the main wheels may not be sufficient to overcome the aerodynamic moments from the nose-up elevator position and the nose-up rotational inertia from the flare, thus the airplane can become airborne as a result of the excess lift. Under the circumstances in which the airplane is climbing from the deck and the arresting hook engages a wire before the airplane contacts the barrier, the resulting arrestment will be somewhat erratic and may cause high loads to be applied to the structure. In the case of an exaggerated and or a premature flare, the airplane may not contact the deck before a barrier crash becomes imminent.
The recommended cut airspeed range is from 20 to 25 per cent above the POWER-OFF INDICATED STALL SPEED of the airplane for its configuration and weight (see Section VI for the proper method of obtaining this airspeed for each individual airplane and Section III for recommended minimum carrier approach airspeed in the event of an engine failure). The airspeed on the down-wind and cross-wind legs can be slightly higher to permit maneuvering; however, in no normal approach should the airspeed be so great that the throttle has to be retarded erratically in order to reduce the airspeed. As can be seen by the stall airspeed information contained in Section VI, large reductions in thrust will cause a substantial increase in stall speed, thus reducing the margin of airspeed available for maneuvering. An increase in power should be used in maneuvers to increase altitude, to check rates of descent or to increase angle of bank in the approach from a stabilized flight condition.

WARNING

After the airplane has landed, the nose wheel should be lowered to the deck to ensure proper engagement of the barriers in the event of no engagement.

WAVE-OFF.

Apply take-off power smoothly and rapidly, then follow normal take-off procedure.

Note

A slight nose-down trim change occurs with application of wave-off power.

AFTER LANDING.

a. Wing flaps control—UP upon completion of landing roll.

b. Arresting hook control—UP.

c. Cowl flaps switches—OPEN.

d. Oil cooler doors switches—OPEN.

STOPPING ENGINES.

a. Have main wheels chocked.

b. If difficult starting is anticipated due to low temperature, use oil dilution procedure described in Section IX.

c. Auxiliary fuel pump switches—OFF.

d. Single engine rudder assist switch—OFF.

e. Mixture controls—IDLE CUT-OFF.

f. Master ignition switch and individual engine switches—OFF (after engines stop).

g. Battery switch—OFF.

BEFORE LEAVING AIRPLANE.

a. Main wheels chocked or parking brake set (land).

b. Engage gust lock control handle.

Note

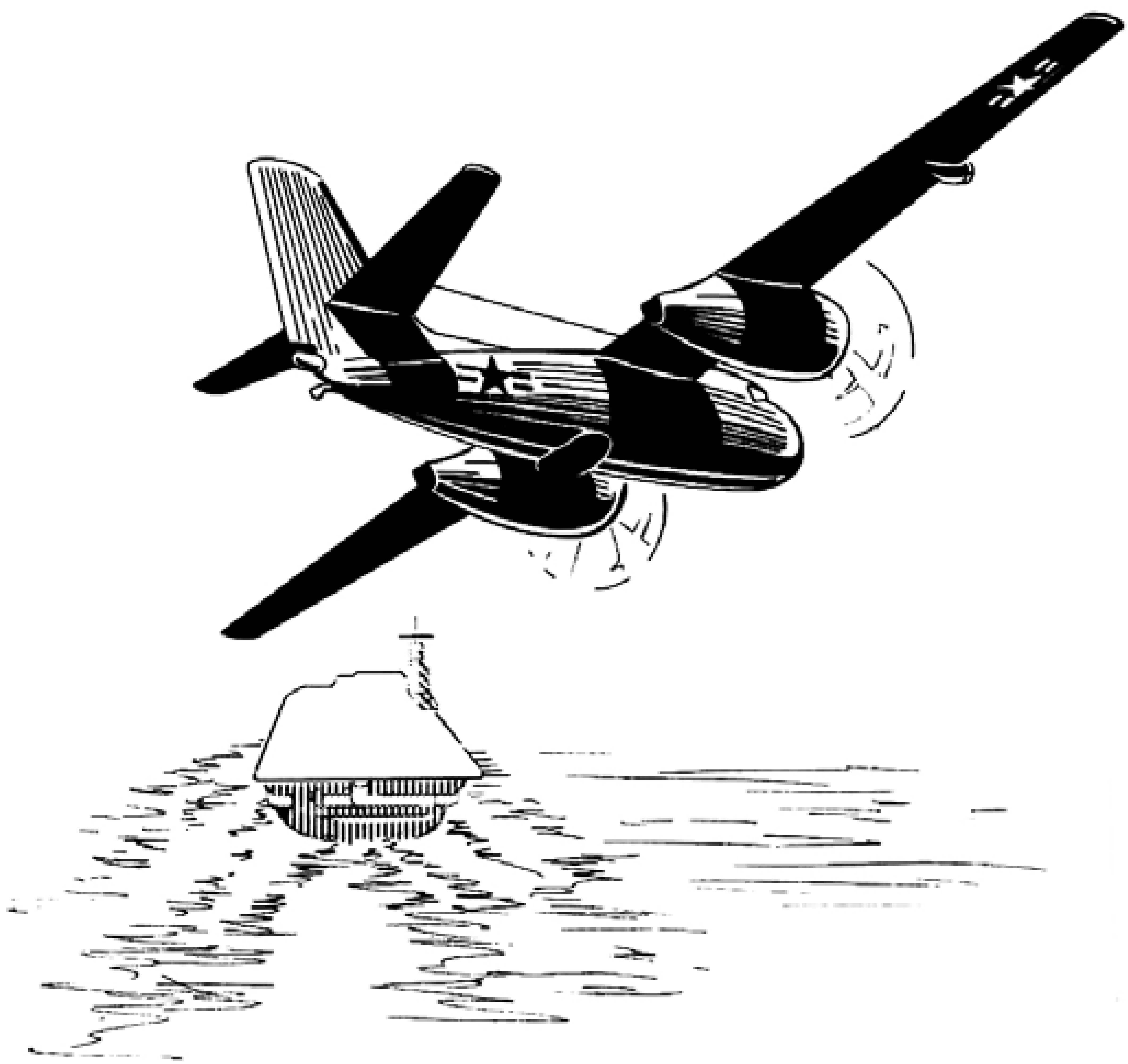
Throttles must be closed to engage gust lock.

c. Fuel selector valve controls—OFF.

d. All electrical switches—off.

e. All hatches and doors—closed.

f. Complete Yellow Sheet.



Section III

EMERGENCY PROCEDURES

ENGINE FAILURE.

FLIGHT CHARACTERISTICS UNDER SINGLE ENGINE OPERATION.

The hydraulically operated rudder trimmer, controlled by the single engine rudder assist switch, is incorporated in the airplane to provide single engine directional control under critical conditions; i.e., low airspeeds and high asymmetric power. The airplane can be controlled using rudder and trimmer at the design catapult end speed of 85 knots IAS under the following conditions: take-off flaps, landing gear down, take-off power (1525 bhp) on the live engine, and the dead engine propeller windmilling against the low pitch stop (propeller control in the full increase rpm position). Under the above conditions it is possible to maintain straight flight using full rudder (single engine rudder assist switch on) and using partial lateral control to lower the live engine wing approximately five degrees to counteract the yaw and roll. With the rudder and lateral trim set for take-off, the forces required are approximately 180 pounds on the rudder and 10 pounds on the control wheel. If the engine failure is instantaneous, the airplane can still be satisfactorily controlled, although the airplane will yaw and roll momentarily toward the dead engine.

Directional control of the airplane improves markedly when the propeller is feathered, when the power on the live engine is reduced, when the airspeed is increased and when the airplane is trimmed directionally and laterally. For example, when cruising at 130 knots IAS (speed for maximum range) and an engine fails instantaneously, directional control can easily be maintained with the single engine rudder assist switch OFF. After feathering the propeller of the dead engine (single engine rudder assist switch still OFF), the airplane can be trimmed with hands and feet off the controls down to 130 knots IAS with normal rated power on the live engine.

The single engine rudder assist switch will be set ON (rudder trimmer operative) for all single engine landings. However, it is possible to make single engine landings with the single engine rudder assist switch OFF (rudder trimmer inoperative). Utilization of the rudder trimmer reduces pedal forces and increases directional control. For example, in the case shown in the table below with landing gear down and flaps full down at 85 knots IAS, the pedal force would only be approximately 60 pounds with the rudder trimmer operative.

Landing Gear Position	*Wing Flaps*	*IAS Knots*	*BHP (approx)*	*Pedal Force (lb) (Trimmer Inoperative)*
Down	1/3	100	925	80
Down	2/3	90	975	100
Down	Full	85	1050	150

PROCEDURE ON ENCOUNTERING ENGINE FAILURE.

a. Set single engine rudder assist switch to ON.

b. Advance propeller controls and throttles full forward for both engines, so that full power will be obtained by operative engine.

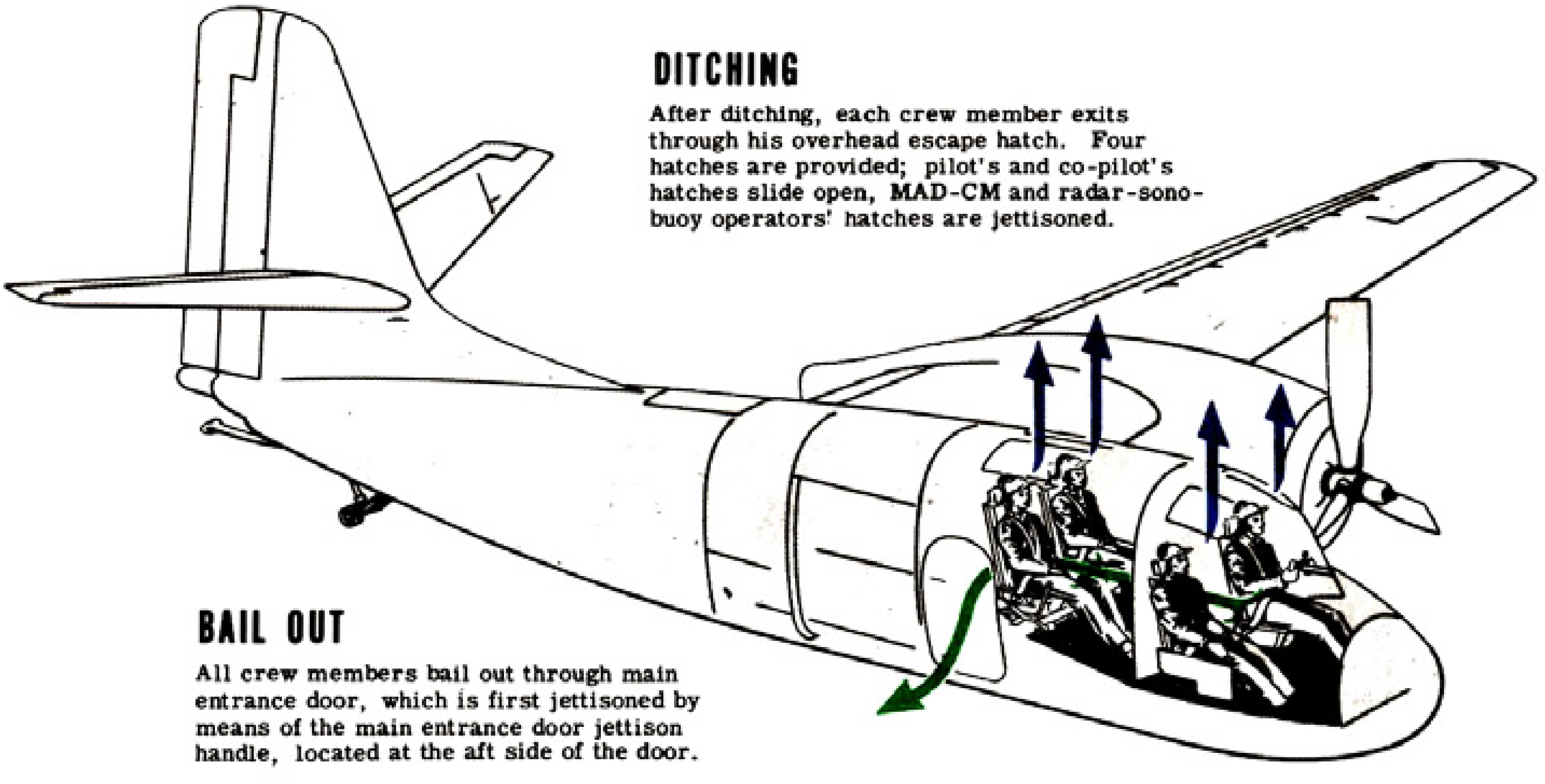


Figure 3-1. Emergency Exits and Crash Landing Stations

c. Lower live engine wing and maintain straight ight path.

d. Determine definitely which engine has failed be- ɪre proceeding with the following steps affecting the :ad engine.

Note

A lighted feather propeller indicator light indicates that its respective engine is developing 400 bhp ± 200 bhp less than the other engine. It does not necessarily mean that there is a complete loss of power on that engine nor that it is mandatory to feather that propeller. It does, however, indicate that the propeller of the other engine SHOULD NOT be feathered. In the event of complete loss of power, the following procedures should be followed.

e. Throttle (dead engine)—CLOSED.

f. Push feathering button to feather propeller of dead engine.

g. Mixture control (dead engine)—IDLE CUT-OFF.

h. Adjust power on live engine as required.

i. Retrim airplane as necessary. Set single engine rudder assist switch to OFF, unless required.

j. Emergency fuel switch (dead engine)—CLOSE.

k. Engine oil switch (dead engine)—CLOSE.

l. Cowl flaps switch (dead engine)—CLOSE.

m. Cowl flaps switch (live engine)—set as required to keep cylinder head temperature within limits.

n. Check for fire and fire warning.

o. Individual ignition switch (dead engine)—OFF.

p. Fuel system selector (dead engine)—OFF.

CAUTION

The fuel system selector on the live engine must be alternated between the left and right fuel tanks. It is not possible to feed one engine from both tanks simultaneously (see figure 7-1).

q. Auxiliary fuel pump switch (dead engine)—OFF.

r. Generator switch—OFF.

s. Turn off all unnecessary electrical equipment to reduce load on remaining generator.

WARNING

Making a single engine landing is a safer procedure than taking a chance on restarting the failed engine.

t. Land as soon as possible and investigate cause of engine failure.

FUEL SYSTEM MANAGEMENT DURING SINGLE ENGINE OPERATION.

During prolonged single engine operation, it is necessary to use fuel from alternate tanks as it is impossible to feed one engine from both tanks simultaneously (see figure 7-1). In coordinated turns, all the fuel is usable regardless of the angle of bank. On airplanes with the 520 gallon fuel capacity (see Airplane Fuel System paragraph, Section I) all the fuel is usable in uncoordinated flight or maneuvers because each tank has fuel outlets located at the inboard fore and aft ends and the outboard bottom side. However, on airplanes with the 400 gallon fuel capacity, the fuel outlets are located only at the inboard fore and aft ends of the tanks and therefore, less fuel is usable during uncoordinated flight or during any maneuvers which cause the fuel to move laterally in the tanks. For example: a skidding right turn will cause the fuel in the tanks to move to the left, resulting in an increased amount of unusable fuel in the left tank. Similarly, a slipping turn to the right will cause the fuel to move to the right, resulting in an increased amount of unusable fuel in the right tank. As the fuel quantity probes are also located at the inboard ends of the fuel tanks on these airplanes, the above mentioned fuel movement will be indicated by the fuel gages. One gage will read high and the other gage will read low by equal amounts. The differential between the fuel gage readings will increase as the amount of slip or skid is increased. The low reading fuel gage will indicate usable fuel available from that tank.

For single engine operation, it is recommended that the live engine wing be kept approximately two degrees low and the ball of the turn and bank indicator approximately one-eighth of a ball-width toward the low wing. This will give the minimum drag condition. With the wing two degrees low, there is no increase in the amount of unusable fuel on airplanes with the 400 gallon fuel capacity. However, because of the reasons outlined in the preceding paragraph, it is important to avoid slipping or skidding with these airplanes during single engine operation with low fuel quantities.

While operating on one engine, it is recommended that the fuel to the live engine be alternated from the left and right tanks at a fuel differential of approximately 200 pounds. When the fuel quantity gages indicate approximately 200 pounds remaining in each tank, the fuel from the low (live) engine wing tank should be used until the fuel gage reads zero, or until a drop in fuel pressure is noted. The fuel selector valve control should then be immediately turned to the other tank. Do not run the tank dry.

Manage fuel to keep fuel load in balance. Do not go below 200 pounds in the tank behind the live engine while the other tank contains fuel.

RESTARTING ENGINE IN FLIGHT.

a. Mixture control—IDLE CUT-OFF.

b. Throttle—CLOSED.

c. Propeller control—warm engine—set to match operative engine; cold engine—set to minimum governing.

d. Fuel selector—turn on for desired tank.

e. Emergency fuel switch—OPEN.

f. Engine oil switch—OPEN.

g. Individual ignition switch—BOTH.

h. Feathering button—pull to unfeather propeller and hold until rpm reaches 800-1000, then release.

i. Mixture control—NORMAL.

j. Warm up engine slowly to minimum operating temperature.

k. Cowl flaps switch—as required.

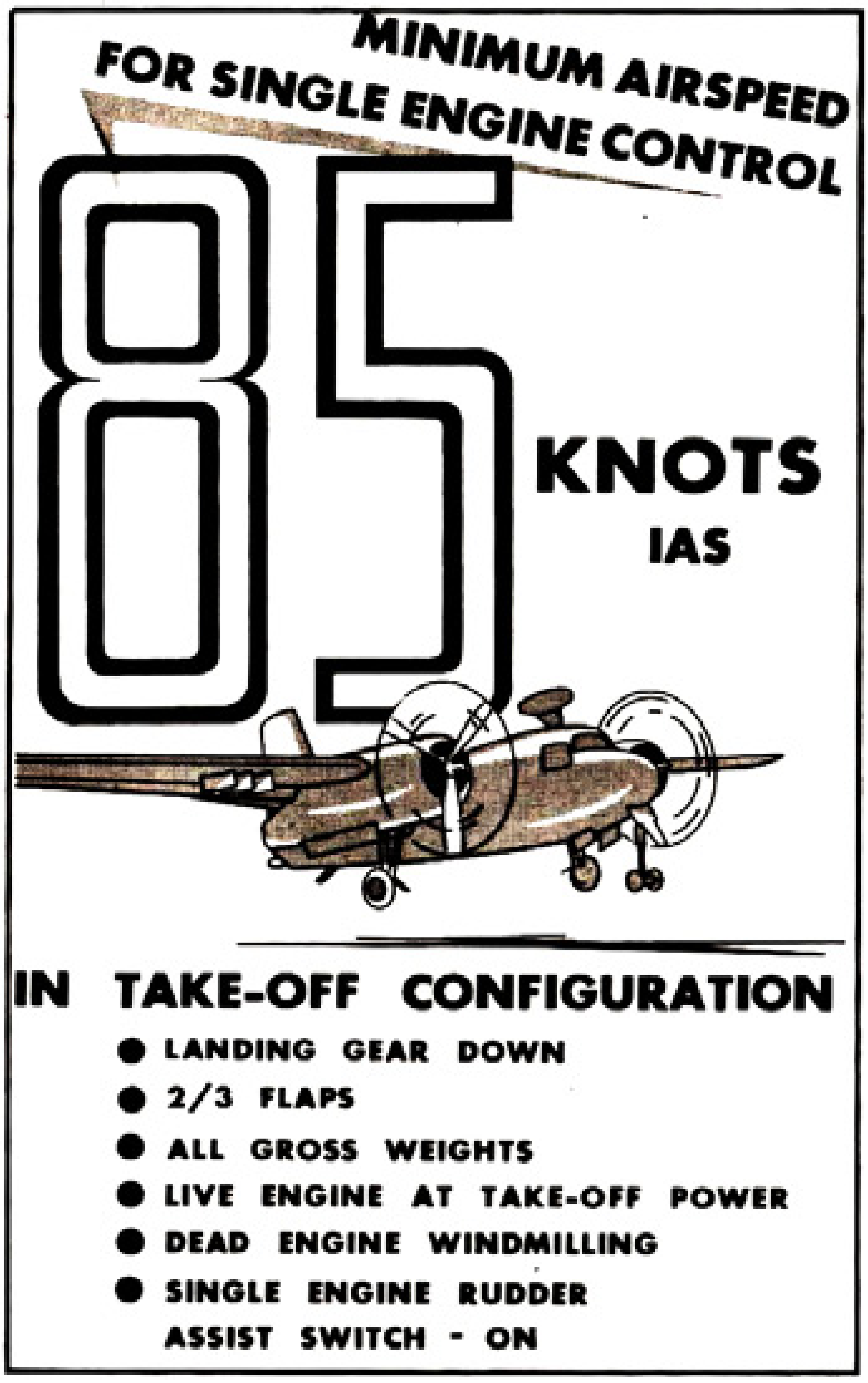
l. Generator switch—ON.

ENGINE FAILURE DURING TAKE-OFF.

WARNING

Always set single engine rudder assist switch to ON before take-off and landing.

If engine fails before airplane reaches single engine control speed (85 knots IAS), abort take-off.



If engine fails during take-off, and take-off is not abandoned, proceed as follows:

a. Make certain which engine has failed, then lower live engine wing and maintain control of the airplane.

b. Push feathering button to feather dead engine propeller. See Note under PROCEDURE ON ENCOUNTERING ENGINE FAILURE, this section.

c. Landing gear control—UP.

d. Wing flaps—leave at take-off setting.

e. Increase speed until 110 to 115 knots IAS is reached. If necessary to clear obstacles, the speed should not be allowed to drop below 100 knots IAS, in order to maintain a comfortable single engine control speed. After obstacles are cleared, raise flaps in increments while maintaining altitude. Accelerate to best climbing airspeed, approximately 125 knots IAS.

f. Throttle, propeller control and mixture control (live engine)—as required.

g. Cowl flaps switch (live engine)—as required to maintain cylinder head temperature within limits.

h. Cowl flaps switch (dead engine)—CLOSE.

i. When flight conditions are no longer critical, secure dead engine as described under PROCEDURE ON ENCOUNTERING ENGINE FAILURE, this section.

WARNING

Do not attempt to restart dead engine.

j. Land as soon as possible and investigate cause of engine failure.

ENGINE FAILURE AFTER TAKE-OFF, AIRPLANE IN CLEAN CONFIGURATION.

Refer to PROCEDURE ON ENCOUNTERING ENGINE FAILURE, this section, and figure A-23.

LANDING WITH ONE OR BOTH ENGINES INOPERATIVE.

LANDING WITH ONE ENGINE INOPERATIVE. Make initial approach with flaps and landing gear up and at approximately 100 knots IAS. See FLIGHT CHARACTERISTICS UNDER SINGLE ENGINE OPERATION, this section. It is recommended that the approach be made at a higher than normal altitude. Line up with the landing area and extend the landing gear, slowly adding power on the live engine as required. As wave-off is jeopardized by use of flaps, do not use flaps until committed to land.

CARRIER LANDINGS WITH ONE ENGINE INOPERATIVE.

A normal carrier landing pattern may be flown with either engine inoperative. Landing flaps should be extended to the two-thirds position during the approach. The power on the remaining engine should be adjusted to maintain an airspeed of not less than 85 knots.

LANDING WITH BOTH ENGINES INOPERATIVE.

Glide at 120-135 knots IAS with flaps and landing gear up, propellers feathered, or at 115-130 knots IAS with flaps and landing gear up, propellers windmilling. See figure 3-2 for rates of descent at various weights and altitudes. Glide at 100 knots IAS with flaps and landing gear down. Landing gear and flaps will extend normally with engines windmilling. However, with both propellers feathered, it will be necessary to hand pump the gear and flaps down. Because of the time required to hand pump the gear down, it may be advisable to make a wheels-up landing when both propellers are feathered. In the event a wheels-up landing is selected, it is recommended that both propellers be feathered prior to touch-down, since propellers and engines of similar type airplanes have been driven into fuselages when making dead-stick landings.

RATE OF DESCENT CURVES.

Figure 3-2 presents the rate of descent, both engines inoperative, for maximum and minimum probable flying weights vs altitude, propellers feathered, and propellers windmilling. Maximum glide range is also shown for both engines inoperative vs altitude, propellers windmilling, and propellers feathered. The maximum glide range CAS is also noted. These curves vividly point out the advantage of feathering inoperative propellers. Note that the glide range is approximately doubled by feathering both propellers. It is recommended that these curves be studied carefully. Note that at the recommended glide CAS shown, the airplane will glide 2.1 nautical miles per 1000 feet altitude with propellers feathered and 1.1 nautical miles per 1000 feet altitude with propellers windmilling.

WAVE-OFF WITH ONE ENGINE INOPERATIVE.

The single engine landing should be planned carefully to minimize the possibility of a wave-off. It is much better to take a single engine wave-off early and execute it smoothly than to wait until the last minute. In any event, the power should be applied smoothly and adequate airspeed and control should be maintained at all times. Refer to FLIGHT CHARACTERISTICS UNDER SINGLE ENGINE OPERATION, ENGINE FAILURE DURING TAKE-OFF and LANDING WITH ONE ENGINE INOPERATIVE, this section.

WARNING

The single engine rudder assist switch must be set to ON, engaging the rudder trimmer, for a single engine wave-off. Because of probable loss of directional control if the airspeed drops below 85 knots on wave-off, raise landing gear, add power as required and raise flaps in increments.

SINGLE ENGINE PRACTICE MANEUVERS.

Single engine practice maneuvers should be performed in the following order:

a. Cruise—Start at approximately 130-150 knots IAS with flaps and landing gear up and trimmer off for normal flight. Set single engine rudder assist switch to ON, cut one engine slowly and feather. Add power on good engine for level flight. Practice turns in both

RATE OF DESCENT AND GLIDE RANGE

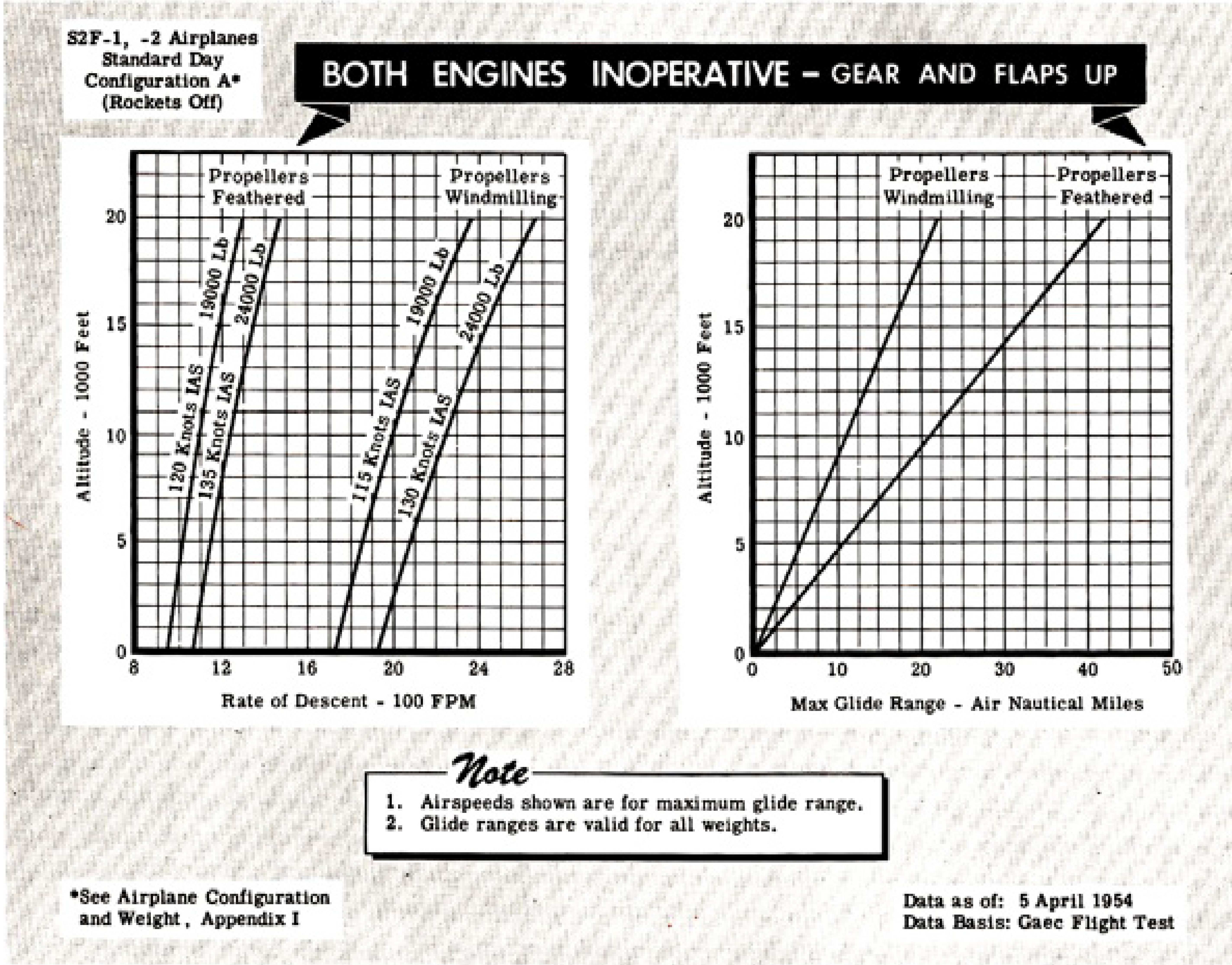


Figure 3-2. Rate of Descent and Glide Range Curves

directions. This procedure should also be practiced with the trimmer off, to simulate an engine failure under normal operating conditions.

b. Take-off configuration—Begin at a safe altitude at approximately 100 knots IAS with landing gear down and flaps set for take-off. Add take-off power to both engines, trimmer on. Slowly close throttle on one engine, maintaining directional control and airspeed. When throttle is closed, reduce airspeed to 85 knots IAS. DO NOT PRACTICE ACTUAL SINGLE ENGINE TAKE-OFFS AT SPEEDS BELOW 85 KNOTS IAS.

PROPELLER FAILURE.

For a runaway propeller, close throttle and immediately push feathering button. To obtain partial power from the engine with the inoperative propeller governor, proceed as follows:

a. Reduce airspeed to 80-90 knots IAS.

b. Close throttle.

c. Unfeather feathered propeller.

d. Restart engine (see RESTARTING ENGINE IN FLIGHT, this section).

e. Advance throttle slowly, so as not to exceed 2800 rpm.

FIRE.

ENGINE FIRE ON DECK.

If an engine fire develops during the starting procedure, continue cranking to start the engine and blow out the fire. If the engine does not start and the ground crew signals to cut engine, proceed as follows:

a. Mixture control—IDLE CUT-OFF.

b. Emergency fuel switch—CLOSE.

c. Engine oil switch—CLOSE.

d. Cowl flaps switch—CLOSE.

e. Auxiliary fuel pump switch—OFF.

f. Fuel system selector—OFF.

g. If fire fighting apparatus is not available to ground crew, set fire extinguisher switch to ON.

WARNING

The agent used in the fire extinguishing system can produce toxic effects if inhaled. Warn ground crew that system is to be used.

h. Ignition switch—OFF.

CAUTION

Do not start engine until reason for fire is determined and cause is corrected.

If fire extinguisher switch is operated, fire extinguishing agent containers must be serviced and affected areas cleaned before engine is started.

ENGINE FIRE IN FLIGHT.

a. Mixture control—IDLE CUT-OFF.

b. Propeller feathering button—push to feather.

c. Emergency fuel switch—CLOSE.

d. Engine oil switch—CLOSE.

e. Cowl flaps and oil cooler door switches—OPEN.

f. Auxiliary fuel pump switch—OFF.

g. Fuel system selector—OFF.

h. Fire extinguisher switch—ON.

i. Ignition switch—OFF.

j. Throttle—CLOSE.

k. Generator switch—OFF.

l. Turn off all unnecessary electrical equipment to reduce generator load.

m. Notify all crewmembers.

WARNING

Do not restart engine. Land as soon as possible and investigate cause of fire.

FUSELAGE FIRE.

Use hand fire extinguisher mounted at aft side of main entrance door.

WING FIRE.

a. If fire is outboard of nacelle, turn off all electrical equipment of that wing.

b. If fire is in nacelle area, proceed as directed under ENGINE FIRE IN FLIGHT, this section.

c. Slip the airplane away from the fire.

d. Land as soon as possible.

ELECTRICAL FIRE.

The possibility of electrical fire is minimized by circuit breakers and fuses which function to deenergize malfunctioning circuits. However, if an electrical fire occurs and cannot be isolated, proceed as follows:

a. Set d-c generator switches, a-c generator field switch and battery switch to OFF.

b. Manually monitor electrical system by pulling all circuit breakers, removing all fuses and turning off all nonessential equipment.

c. If fire continues, fight fire, if accessible, with hand fire extinguisher.

d. If fire is uncontrollable, close necessary communications circuit breakers.

e. Set battery switch to ON.

f. Broadcast distress signal and notify crew for bail-out or ditching.

g. Set battery switch to OFF.

Note

When the battery and generator switches are set to OFF, the airplane electrical system and all electrically operated instruments and equipment will be deenergized. Flight operation under these conditions is limited to use of the following basic flight and engine instruments which are not dependent on electric power:

Flight	*Engine*
Stand-by Compass	Manifold Pressure
Airspeed	Tachometer
Turn and Bank (Pilot's)	
Rate of Climb	
Altimeter	

The G-2 compass system gyro horizon indicators and the co-pilot's turn and bank indicator will not operate when the electrical system is deenergized.

LANDING EMERGENCIES (EXCEPT DITCHING).

a. Warn crewmembers.

b. Remove parachutes for more rapid exit.

c. Check safety belts and lock shoulder harness.

d. Complete landing check off.

e. Open pilots' overhead hatches.

f. Make final approach as slowly as possible, using full flaps.

g. If in doubt of terrain, land with gear up. If gear up landing is selected, it is recommended that both propellers be feathered prior to touch-down.

h. Overhead escape hatches, one for each crewman, are designed for fastest means of exit. If time permits, the main entrance door may be used for escape.

ONE WHEEL RETRACTED LANDINGS.

If emergency landing gear extension procedure fails, proceed as follows: One main landing gear retracted—land with wing low on side landing gear is extended. As speed decreases, turn into retracted gear with hard rudder, utilizing centrifugal force to keep the other wing down as long as possible. Feather both propellers before landing. Nose wheel retracted—land flaps up, do not use brakes, hold control wheel full back to keep nose up as long as possible.

DITCHING.

No tests or actual ditchings have been made at this time. However, it is recommended that the ditching be made with landing gear up, flaps full down and at as low a speed as possible. If conditions permit, it is recommended that the propellers be feathered just prior to touch-down because of the possibility of the propellers going into the fuselage.

DITCHING CHART.

	Duty	*Provide*	*Position*	*Exit*
PILOT	Give warning to crew. Turn on IFF, jettison all armament, open overhead hatch, stow rocket sight, remove parachute.	Parachute	Pilot's seat	Overhead hatch
CO-PILOT	Open overhead hatch, stow radar scope and control wheel, remove parachute, release life raft.	Confidential folder and brief case, flashlight, first aid kits.	Co-pilot's seat	Overhead hatch
MAD-CM OPERATOR	Send position and distress report (lock key down on pilot's order), jettison hatch on pilot's order, retract MAD boom, remove parachute.		MAD-CM operator's seat	Overhead hatch
RADAR-SONOBUOY OPERATOR	Jettison hatch on pilot's order, retract radome, remove parachute.		Radar-Sonobuoy operator's seat	Overhead hatch

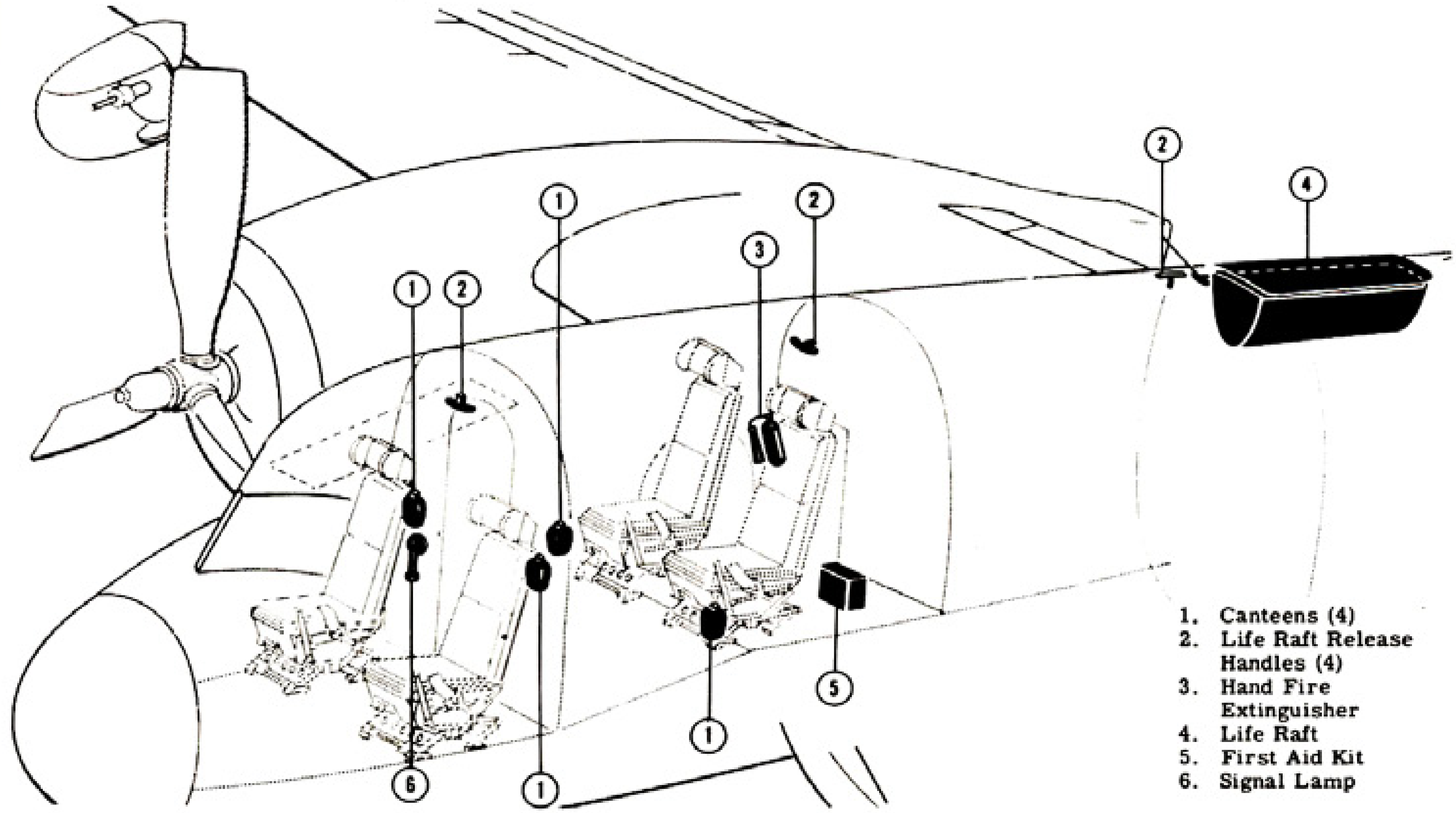


Figure 3-3. Miscellaneous Emergency Equipment

BAIL-OUT.

All crewmembers bail out through the main entrance door, which should be jettisoned by means of the main entrance door jettison handle, located at the aft side of the door. On some airplanes,[1] a seat emergency release pin with a pull ring is installed behind the headrest of the radar-sonobuoy operator's seat. When pulled, this permits the seat back to spring forward, while the seat back brace moves outboard, permitting unrestricted exit from the airplane. The seat emergency release pin will normally be pulled by the MAD-CM operator as soon as the radar-sonobuoy operator leaves his seat. The MAD-CM operator will then pull the main entrance door jettison handle and normally will be the first crewmember to exit.

After the main entrance door has been jettisoned, the most satisfactory method of abandoning the airplane is as follows:

a. Assume a squatting position with both feet on the deck in front of the door.

b. Cross arms on chest (hand not on ripcord handle) or extend arms forward out the door.

c. Duck head.

d. Lean or roll forward out the door.

Delaying two seconds before pulling the ripcord handle will preclude parachute damage because of turbulence created by the airplane.

FUEL SYSTEM EMERGENCY OPERATION.

For fuel system management, see figure 7-1. To shut off fuel supply to either engine, set emergency fuel switch to CLOSE. If loss of fuel pressure is indicated, turn on auxiliary fuel pump switches.

ELECTRICAL POWER SUPPLY SYSTEM EMERGENCY OPERATION.

D-C GENERATOR FAILURE.

Failure of either generator will be evidenced by illumination of its associated generator warning light. If failure was caused by abnormal voltage output, an attempt may be made to return the generator to the system by setting the generator switch to RESET and then to ON. If the inoperative generator is successfully returned to the system, the generator warning light will remain off. Continued illumination of the generator warning light is indication of faulty generator operation, in which case the generator switch must be set to OFF and the electrical load on the operating generator reduced as necessary to prevent overloading the operative generator.

WARNING

If both generators fail, conserve battery power by turning off all non-essential equipment and land as soon as possible.

[1] S2F-1 airplanes BuNo. 133261 and subsequent, and S2F-2 airplanes BuNo. 133337 and subsequent.

A-C GENERATOR FAILURE.

Failure of the a-c generator will be evidenced by zero voltage indications on the a-c voltmeter, located on the MAD-CM operator's console. If abnormal voltage was produced by the generator prior to failure, it is likely that the exciter control relay has tripped, in which case an attempt may be made to restore generator operation by setting the a-c generator field switch to RESET and then to ON. If the a-c generator is shut-down repeatedly after resetting, malfunction of the generator or system components is indicated and the a-c generator field switch must be set to OFF.

INVERTER FAILURE.

If the main inverter fails, the co-pilot's flight instruments a-c power off warning light will illuminate, indicating loss of a-c power. The stand-by inverter must be manually selected by setting the inverter selector switch to STANDBY. When the stand-by inverter is engaged and operating, the co-pilot's flight instruments a-c power off warning light will extinguish, indicating that the stand-by inverter is furnishing a-c power. When the stand-by inverter is operating, a-c power will be restored only to those main inverter loads essential to flight, i.e., co-pilot's flight instruments, fuel quantity indicator, fire detector circuits and engine instruments. The automatic pilot, search radar and counter-measure equipment will consequently be inoperative.

Note

If both d-c generators fail or rotate below cut-in rpm, the main inverter will be deenergized and the stand-by inverter will automatically be placed in operation.

Illumination of the pilot's flight instrument a-c power off warning light will indicate failure of either the pilot's instrument inverter or the pilot's gyro horizon indicator fuse. Failure of the pilot's gyro horizon indicator fuse may be verified by checking for continued operation of the pilot's G-2 compass. If both the pilot's G-2 compass and gyro horizon indicator are inoperative, failure of the pilot's instrument inverter is indicated.

Note

The pilot's bank and turn indicator is a vacuum-driven instrument and is not dependent on electric power for operation.

INSTRUMENT POWER FAILURE.

When a power failure occurs in the circuits of certain instruments, the indicators will freeze in the position they were in when power was interrupted and thus give a false reading. These instruments are as follows:

Fuel Quantity Indicators
Hydraulic Pressure Indicators
Oil Pressure Indicator
Fuel Pressure Indicator

WARNING

In the event of complete electric power failure, all d-c and inverter powered a-c flight and engine instruments will be inoperative. Flight operation under these conditions will be limited to use of the following instruments, which are not dependent on electric power.

Stand-by Compass
Airspeed Indicator
Turn and Bank Indicator (Pilot's)
Rate of Climb Indicator
Altimeter
Manifold Pressure Gage
Tachometer

HYDRAULIC POWER SUPPLY SYSTEM EMERGENCY OPERATION.

When normal hydraulic system pressure is not available, operate hand pump to open or close torpedo bay doors, extend landing gear, or lower wing flaps. In the event the emergency operation listed below does not function, refill emergency hydraulic reservoir with fluid (10, figure 1-2).

WING FLAPS EMERGENCY OPERATION.

a. Set wing flaps emergency control handle to DOWN.

b. Supply hydraulic pressure by pumping hand pump.

LANDING GEAR SYSTEM EMERGENCY OPERATION.

a. Set landing gear emergency control handle to DOWN.

b. Supply hydraulic pressure by pumping hand pump.

TORPEDO BAY DOORS EMERGENCY OPERATION.

a. Set torpedo bay doors emergency control handle to OPEN or CLOSE, as required.

b. Supply hydraulic pressure by pumping hand pump.

HYDRAULIC SYSTEM FAILURE—RUDDER TRIMMER OPERATION.

If hydraulic failure occurs while rudder trimmer is engaged, set single engine rudder assist switch to OFF. If hydraulic failure occurs while rudder trimmer is disengaged, the trimmer cannot be operated, so leave single engine rudder assist switch set to OFF.

FLIGHT CONTROL SYSTEM EMERGENCY OPERATION.

RUDDER TRIMMER FAILURE.

The following steps are recommended to insure adequate safety in the event of directional control difficulties.

a. Use all possible lateral and directional control.

WARNING

Adverse turning of the airplane will usually indicate failure of an engine, but may also be caused by rudder trimmer malfunction. MAKE CERTAIN THAT TURNING IS NOT DUE TO ENGINE FAILURE before continuing with this emergency procedure.

b. Throttle an engine as necessary to reduce the turn.

c. Check rudder trimmer position indicator to determine whether rudder position agrees with indicator.

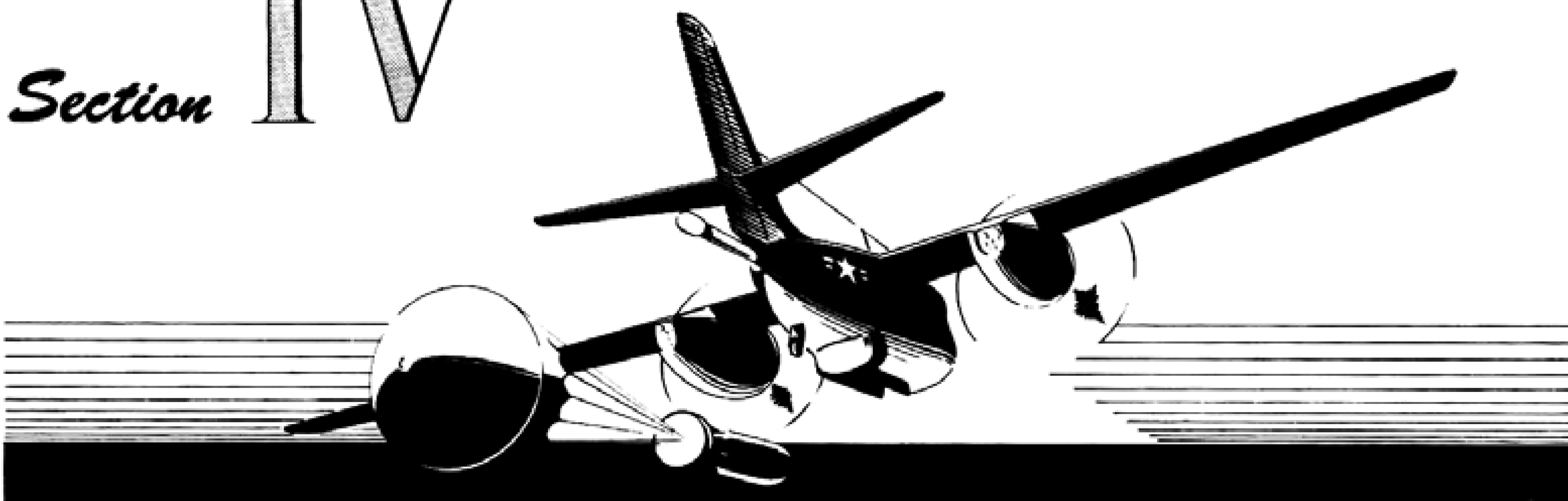
d. If rudder position and indicator do not agree, TURN OFF SINGLE ENGINE RUDDER ASSIST SWITCH.

e. Retrim rudder and ailerons as required.

WARNING

Make certain that emergency is caused by rudder trimmer malfunction and not by engine failure before following the above procedure. If it is assumed that turning is caused by the trimmer, when it is actually due to engine failure, setting the single engine rudder assist switch to OFF will make it more difficult to control the turn as directional control is reduced. On the other hand, assuming engine failure, when adverse turning is actually caused by trimmer malfunction, will result in securing the engine which is most needed, again making it more difficult to control the turn.

Section IV



DESCRIPTION AND OPERATION OF AUXILIARY EQUIPMENT

AIR CONDITIONING SYSTEM.

The air conditioning system (figure 4-1) is designed to provide heating and ventilating air either on the ground or in flight. The system consists of a spark-ignited combustion heater of 50000 BTU per hour capacity, with necessary components, ventilation and combustion air blowers, distribution ducts, and temperature controls. The complete system provides temperature control for the pilots' and crew compartments and the torpedo bay, and also provides for windshield and side window defrosting. Air for both heating and ventilating enters the system from the nose inlet duct, which incorporates an actuator door. This door diverts the air flow when required. A 350°F overheat switch is located in the main air inlet duct. When overheating occurs, this switch is actuated and it deenergizes the two fuel solenoid valves, the temperature control box and the ignition unit. A thermoswitch, also located in the main inlet air duct, cycles the heater solenoid valve and prevents the temperature from exceeding 121°C (250°F) until the temperature control system takes over. A 100°F overheat switch in the main inlet air duct shuts off the heater and prevents overheating of the unit in the event of failure of the ventilating fan during ground operation.

When the system is operated, heating or ventilating air is passed throughout the airplane by means of ducts. Adjustable foot registers and face outlets are provided for the pilot, co-pilot and two crew members. Torpedo bay temperatures are regulated manually by a control in the pilots' compartment. The heating or ventilating air is dumped overboard through two exhaust outlets on top of the fuselage. These exhaust outlets also serve as hand grips.

CONTROLS.

HEATER CONTROL SWITCH.

The heater control switch is one of two heater controls on the air conditioning control panel (20, figure 1-5 and figure 4-1A) on the overhead console. This three-position toggle switch can be set at OFF, ON, or momentary START and is placarded TO START HEATER HOLD ON "START" FOR 3 SEC. THEN PUSH TO "ON".

HEATER TEMPERATURE RHEOSTAT.

The heater temperature rheostat, one of two heater controls on the air conditioning control panel (19, figure 1-5 and figure 4-1A) on the overhead console, can be turned clockwise for WARMER temperatures.

GROUND VENTILATION CONTROL SWITCH.

The ground ventilation control switch is a two-position toggle switch, located on the air conditioning control panel (21, figure 1-5 and figure 4-1A) on the overhead console, which can be set at OFF or ON.

Note

In flight, an air pressure switch (which is actuated when the airspeed reaches 120 knots) causes the nose inlet heater duct by-pass door to open and automatically turns off the ventilating fan at approximately 120 knots. When airspeed decreases, the air pressure switch closes the by-pass door and starts the fan operating when airspeed is at approximately 115 knots.

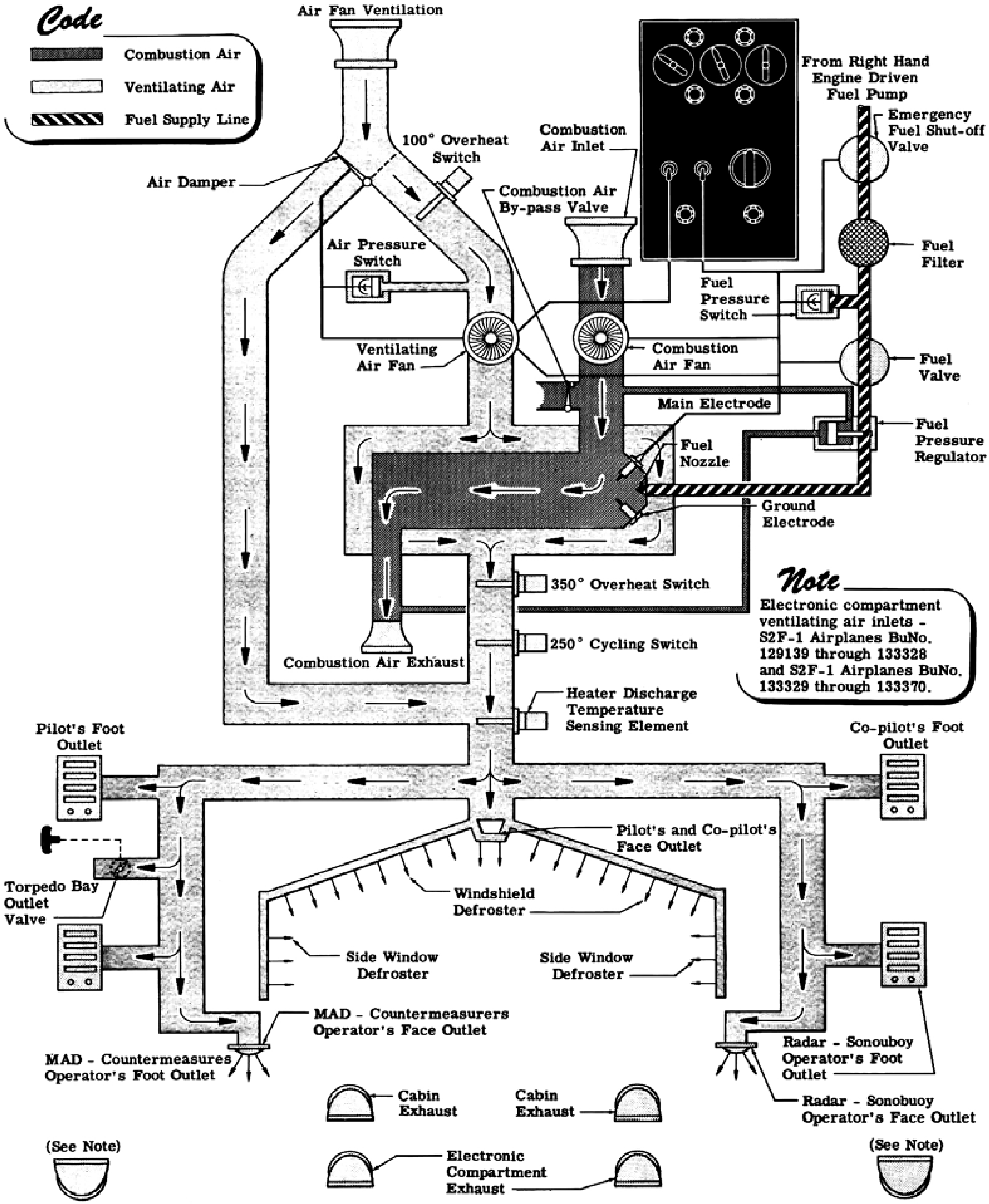


Figure 4-1. Air Conditioning System—Schematic

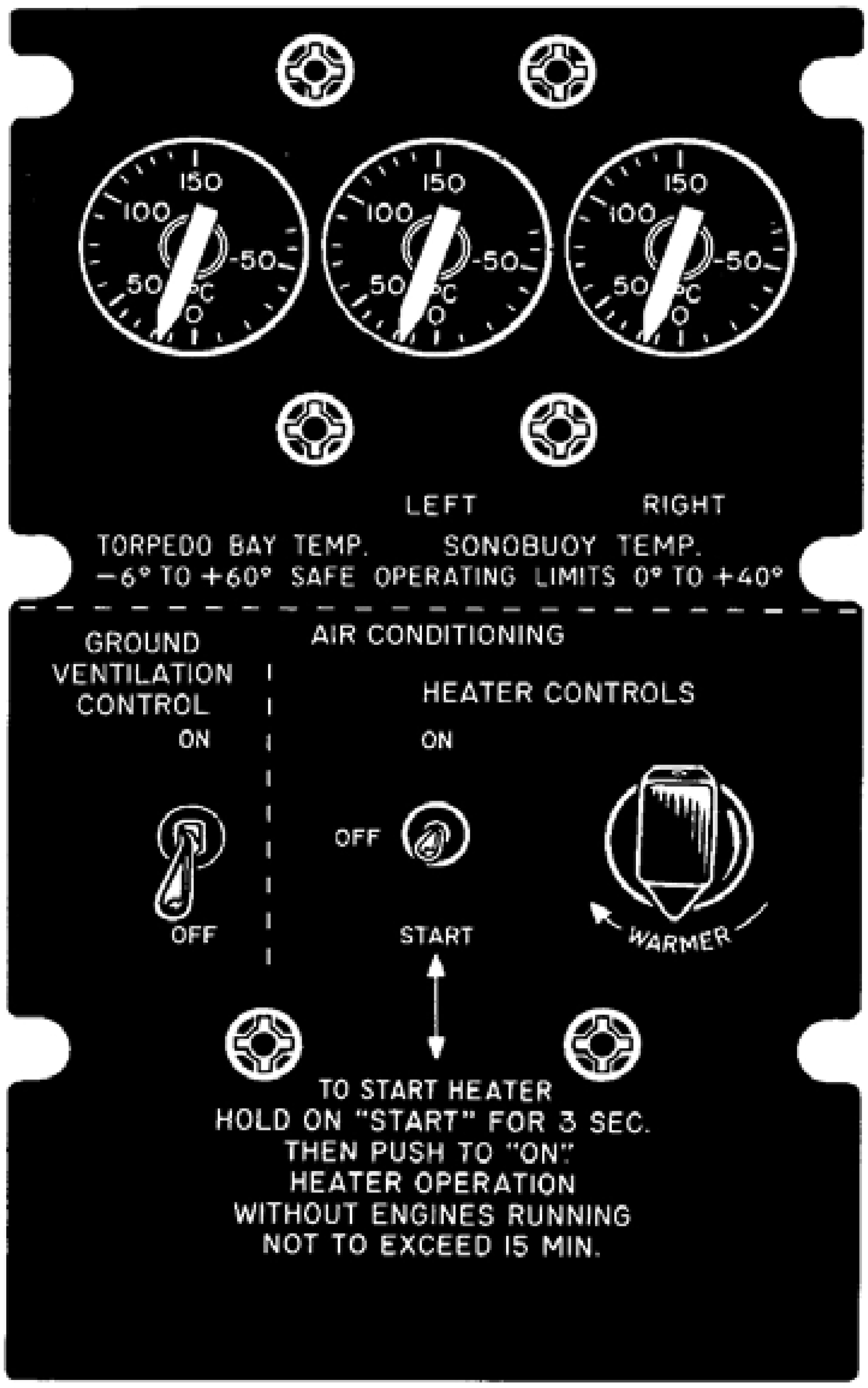


Figure 4-1A. Air Conditioning and Temperature Gage Panel

NORMAL SYSTEM OPERATION—HEATING ON GROUND.

a. Battery switch—ON.

b. Right auxiliary fuel pump switch—ON.

c. Heater control switch—Hold to START for three seconds, then push to ON.

d. Heater temperature rheostat—Turn clockwise for WARMER or counterclockwise for cooler. For ground heating, the combustion and ventilating air fans are on.

Note

Maximum heater ground operation is 15 minutes because of overheating of the auxiliary fuel pump.

NORMAL OPERATION—HEATING IN FLIGHT.

Operation is the same as for heating on the ground. In flight, at approximately 120 knots, the air pressure switch automatically operates the ventilating air fan and the nose inlet by-pass door.

NORMAL SYSTEM OPERATION—VENTILATING (ON GROUND OR IN FLIGHT).

a. Battery switch—ON.

b. Ventilating control switch—ON.

SONOBUOY HEATING SYSTEM.

Engine cooling air is ducted from a port in the baffle assembly, through a manually controlled valve, to the AN/SSQ-1 sonobuoy chutes and a plenum chamber ahead of the chutes. The system is designed to maintain sonobuoy temperatures within specified limits by positioning the manual control valve. A temperature bulb is located in each duct. The entire system is automatic and is not under the pilot's control.

INDICATORS.

SONOBUOY HEATING TEMPERATURE GAGES.

Two temperature gages, one for each nacelle sonobuoy heating system (17, figure 1-5 and figure 4-1A), are located on the overhead console. They are marked LEFT and RIGHT and are placarded SONOBUOY TEMP. SAFE OPERATING LIMITS 0° TO 40°C.

TORPEDO BAY HEATING SYSTEM.

Hot air from the cabin heating system is ducted into the torpedo bay. The temperature is maintained within the operating limits of −6° and +60°C (20°F and 140°F) by means of a torpedo bay temperature control handle.

CONTROL AND INDICATORS.

TORPEDO BAY TEMPERATURE CONTROL HANDLE.

The torpedo bay temperature control handle (2, figure 1-7) is located in the floor of the pilots' compartment and is placarded PULL TO HEAT. When heat is not desired, the handle can be pushed down and friction locked by turning it to the right.

TORPEDO BAY HEATING TEMPERATURE GAGE.

The torpedo bay temperature gage (17, figure 1-5 and figure 4-1A) is placarded TORPEDO BAY TEMP. −6° TO +60° SAFE OPERATING LIMITS.

ELECTRONICS COMPARTMENT VENTILATION.

Ventilation of the electronics compartment is designed to maintain satisfactory cooling in the compartment, both on the ground and in flight. This system consists of a ram air scoop on the left hand side of the airplane. This ram air is exhausted from within the compartment by two air outlets located on the top side of the airplane.

COOLING IN FLIGHT.

Ram air enters at the intake scoop, circulates through the compartment and exits at the air outlets.

COOLING ON GROUND.

For ground cooling of the electronics compartment, an adaptor is incorporated on the air inlet scoop to facilitate incorporation of an external refrigeration unit.

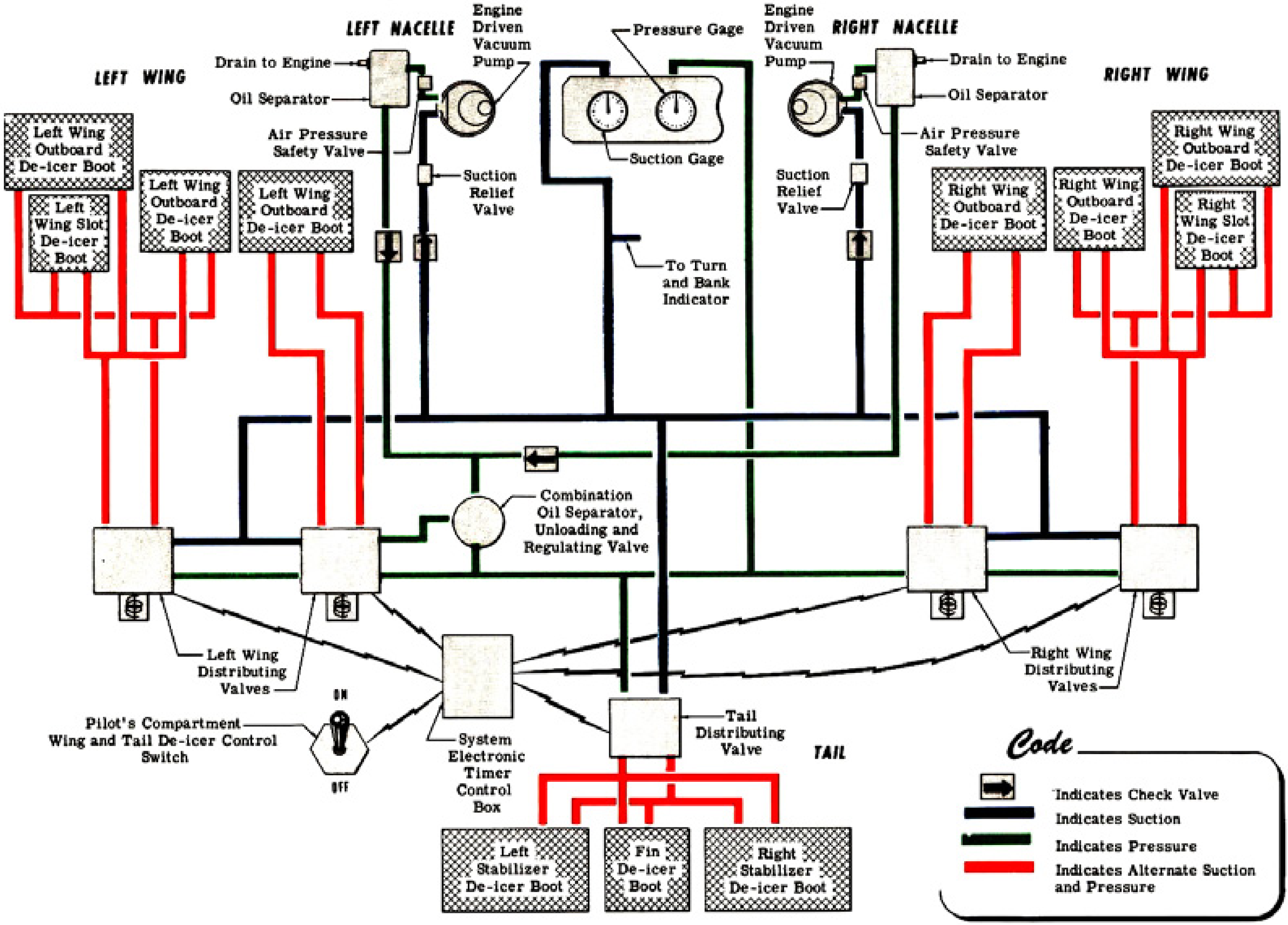


Figure 4-2. Wing and Tail De-icing System—Schematic

HEATER FUEL SYSTEM.

The heater fuel system consists of two solenoid valves, a fuel filter, fuel pressure regulator, fuel pressure switch, and piping. Fuel for the heater is supplied from the downstream side of the right hand engine-driven fuel pump. One solenoid valve near the fuel supply source is used as an automatic emergency fuel shut-off valve. The fuel pressure switch detects a drop in fuel pressure in the event of line failure and actuates this solenoid valve, thus closing the fuel supply. The other solenoid valve is located at the heater and is used as a heater cycling valve. The fuel pressure regulator controls the fuel flow to the heater in relation to combustion air flow, thus maintaining at any given altitude an approximately constant fuel-air ratio. A filter safeguards the heater from foreign matter.

WING AND TAIL DE-ICING SYSTEM.

The wing and tail de-icing system is conventional in design, using pulsating rubber boots to eliminate ice formations. These are attached to the leading edges of the wings, the wing slots, the fin and the stabilizer. Air pressure from the outlet or pressure side of each of the two engine-driven air pumps inflates the de-icer boots through an electronically-regulated, 60-second cycle. Air under suction from the inlet side of the air pumps holds the boots down when not being inflated. Primary oil separators collect vaporized oil from the air pressure lines and return it to the engine oil sump. An electronic timer, in conjunction with the solenoid distributor valves, regulates the proper sequence of the de-icer boots pulsation cycle. The combination regulating and unloading valve separator removes the residual oil left in the air by the primary oil separator and maintains a constant system pressure of 15 psi, automatically venting excess air to the atmosphere. Suction relief valves are installed in the system to automatically regulate suction. Pressure safety valves are incorporated to relieve excessive air pressure and check valves are provided to prevent loss of air in the event of the failure of one pump.

CONTROL AND INDICATORS.

WING AND TAIL DE-ICER SWITCH.

A two-position, ON-OFF toggle switch (15, figure 1-5) is located on the overhead console and is used to operate the de-icer system.

AIR PRESSURE GAGE.

The air pressure gage (16, figure 1-5) is located on the right hand overhead console.

SUCTION GAGE.

A suction gage (16, figure 1-5) is used to check system operation.

DE-ICER SYSTEM OPERATION.

a. When switch is turned to ON, after a 20 second delay for tube warm-up, the cycle starts. The cycle is of 60 seconds duration and will continue automatically until switch is turned to OFF. In each cycle, each boot or boot group is fully inflated once. Indication of proper operation of the de-icer system is obtained from the air pressure gage as outlined in Section II, Ground Tests, De-icing and Anti-icing Equipment, Wing and Tail De-icing System paragraph, step d.

b. When switch is turned to OFF, the timer trips through remaining contacts rapidly to its homing position.

WINDSHIELD ANTI-ICING SYSTEM.

The windshield anti-icing system consists of a tank, mounted in the nose section, that supplies anti-icing fluid to a pump, which in turn delivers the fluid to the windshield spray nozzle. The pump is controlled by an anti-icer toggle switch which is used to start and stop the flow from the pump. A restrictor in the line to the windshield restricts the flow to two gallons per hour.

CONTROLS.

WINDSHIELD ANTI-ICING SWITCH.

The windshield anti-icing control (13, figure 1-5) is a two-position, ON-OFF toggle switch.

WINDSHIELD DEFROSTER CONTROL.

The windshield defroster control (15, figure 1-4) is located above the center instrument panel on the windshield deck and can be set fully OFF, fully ON or at any desired intermediate position. For maximum defrosting, two air outlets, one on either side of the control, can be closed.

WINDSHIELD WIPER CONTROL.

The windshield wiper control (14, figure 1-4) is located on the center instrument panel in the pilots' compartment. Any of six positions can be selected: PARK, OFF, FULL, 3/4, 1/2, or LOW.

COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT.

Note

For additional information, see Confidential Supplement, NavAer 01-85SAA-1A.

GENERAL.

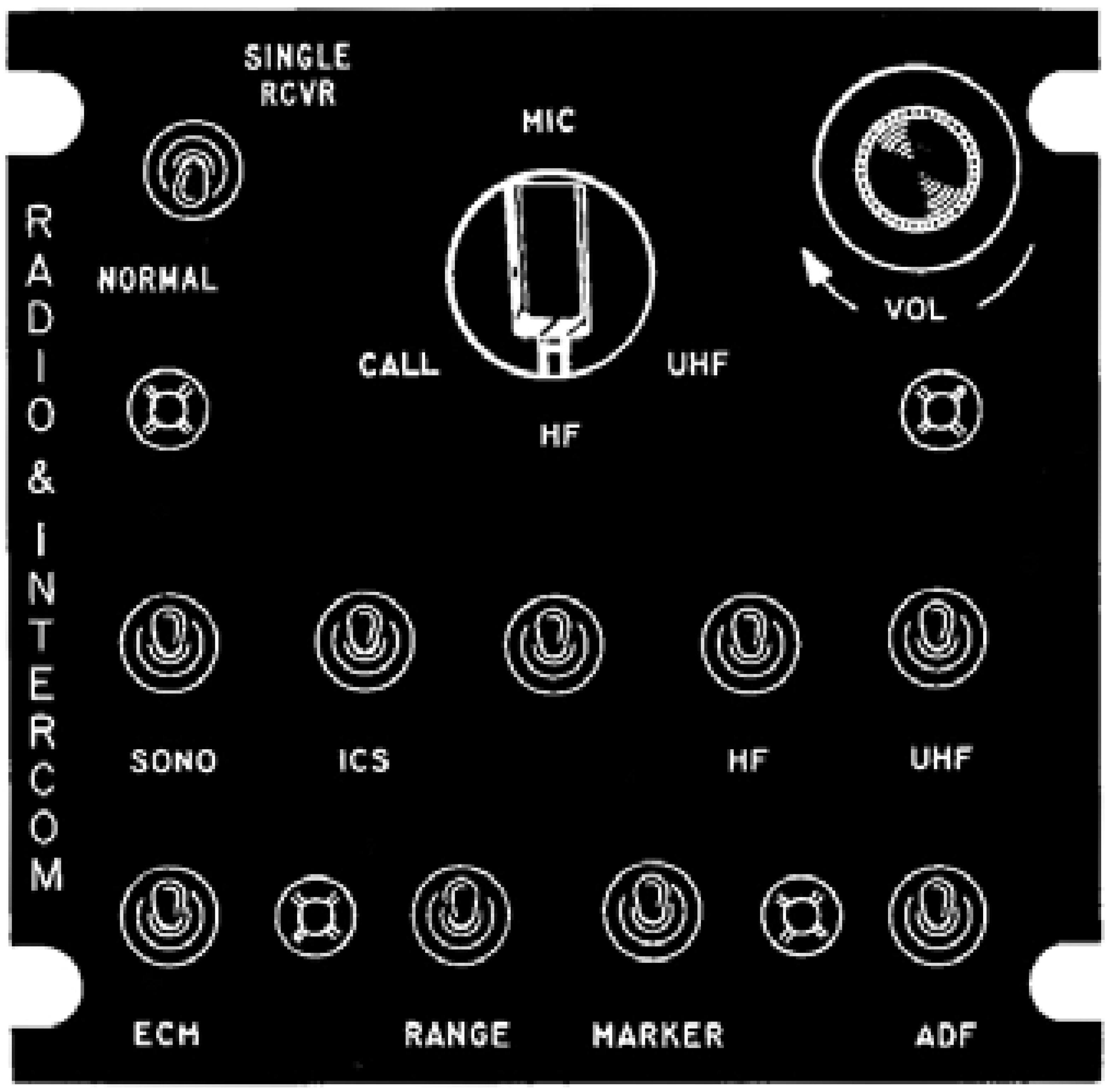
In addition to the electronic equipment requiring only dc, some equipments require both ac and dc. Two types of ac are provided: fixed frequency ac from an inverter and variable frequency ac from the a-c generator. For ground operation and testing of electronic equipment, sources of d-c and a-c power must be connected at the external power receptacle when the engine-driven d-c and a-c generators are not operating. With external sources of dc and ac plugged in, or with the d-c and a-c generators charging (engine running), dc and both types of a-c power will be available to operate the equipment. Refer to figures 1-12, 1-15 and 1-17 for power distribution.

TABLE IV-I. TABLE OF COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT.

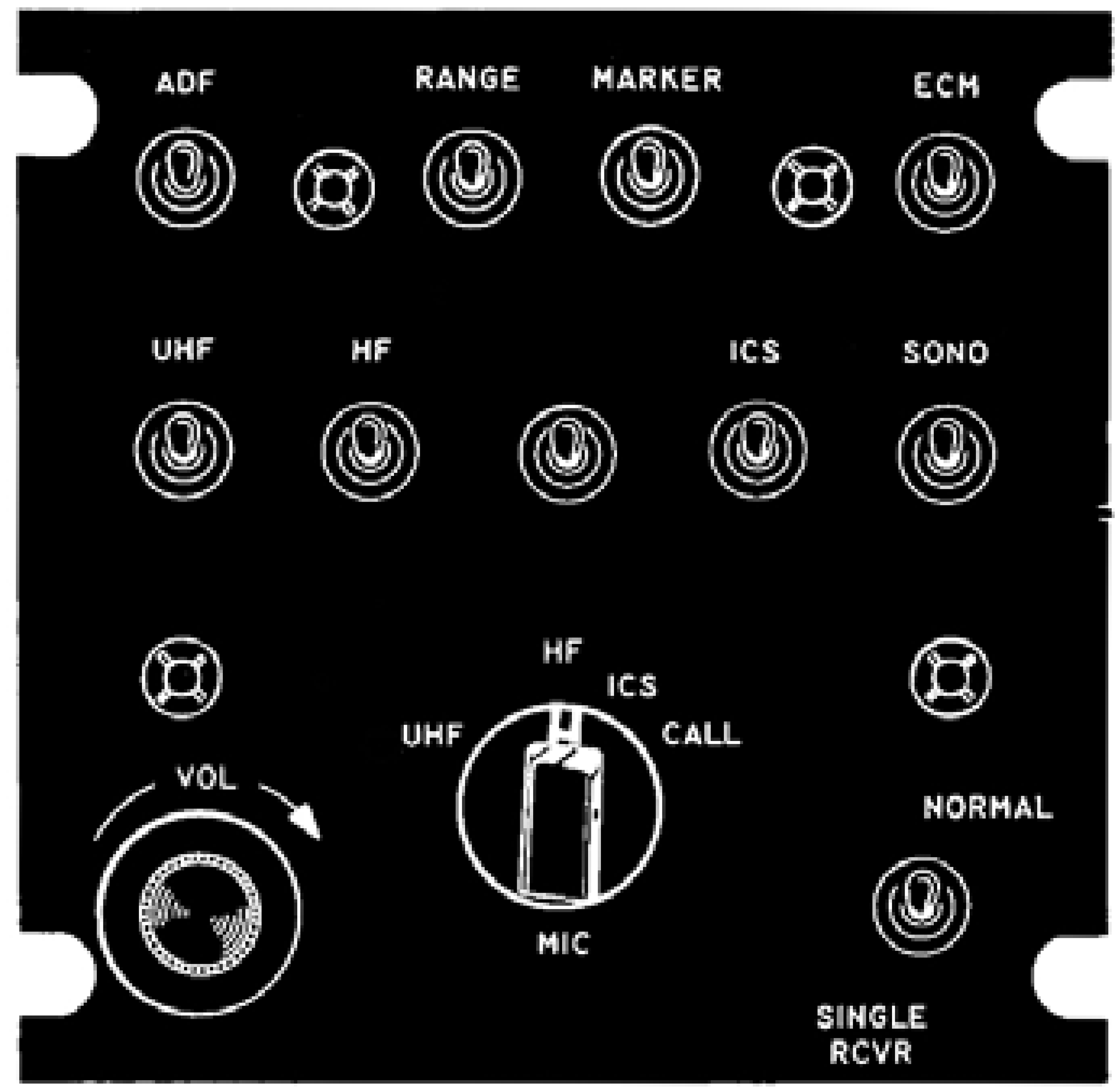
Type	*Designation*	*Use*	*Range*	*Primary Operator*
Radio Interphone	AN/AIC-8	Interphone and radio selection		All
VHF Trans-Rec (Provisions only)	AN/ARC-1	Ten channel, two-way voice communication	Line of sight	Pilot and co-pilot
HF Trans-Rec	AN/ARC-2, -2A	Eight channel, two-way voice, cw and mcw communication	Long range	Pilot and co-pilot
Radio Range Receiver[2]	AN/ARC-5	Low frequency range signals	Long range	Pilot and co-pilot
UHF Trans-Rec	AN/ARC-27A	Twenty channel, two-way voice communication	Line of sight	Pilot and co-pilot
Radar Altimeter	AN/APN-22	Measure terrain clearance	0 to 5000 ft over water and less over land	Pilot and co-pilot
Direction Finder Equipment	AN/ARA-25	Relative direction of radio signals	Line of sight	Pilot and co-pilot
Radio Compass	AN/ARN-6	Direction of bearing of low frequency radio signals	Medium range	Pilot and co-pilot
Marker Beacon Receiver[2]	AN/ARN-8	Marker beacon signals	Approximately over ground station	Pilot and co-pilot
Navigation Equipment (Provisions only)	AN/ARN-21	Classified[1]	Classified[1]	Pilot and co-pilot
Omnirange Receiver	AN/ARN-30A	Reception of VOR, VAR and localizer signals	Line of sight	Pilot and co-pilot
IFF Equipment	AN/APX-6, -6B	Identification	Classified[1]	Pilot
Coder Group	AN/APA-89	Identification	Classified[1]	Pilot and co-pilot
Countermeasures Equipment	AN/APA-69A and AN/APR-9B	Classified[1]	Classified[1]	Countermeasures operator
Magnetic Airborne Detector	AN/ASQ-8	Magnetic anomaly detection of submarines	Classified[1]	Countermeasures operator
Search Radar	AN/APS-38A	Radar detection of surface and airborne objects	Classified[1]	Radar operator
Sonobuoy Receiver	AN/ARR-26A	Detect underwater targets within range of sonobuoys	Classified[1]	Radar operator
Wire Recorder (Provisions only)	13-A-3-J or IC/VRW-7	Records all communications received by radar operator		Radar operator

[1] See Confidential Supplement, NavAer 01-85SAA-1A.

[2] S2F-1 airplanes BuNo. 133043, 133044, 133149 and subsequent and S2F-2 airplanes BuNo. 133331 and subsequent.



PILOTS' CONTROL



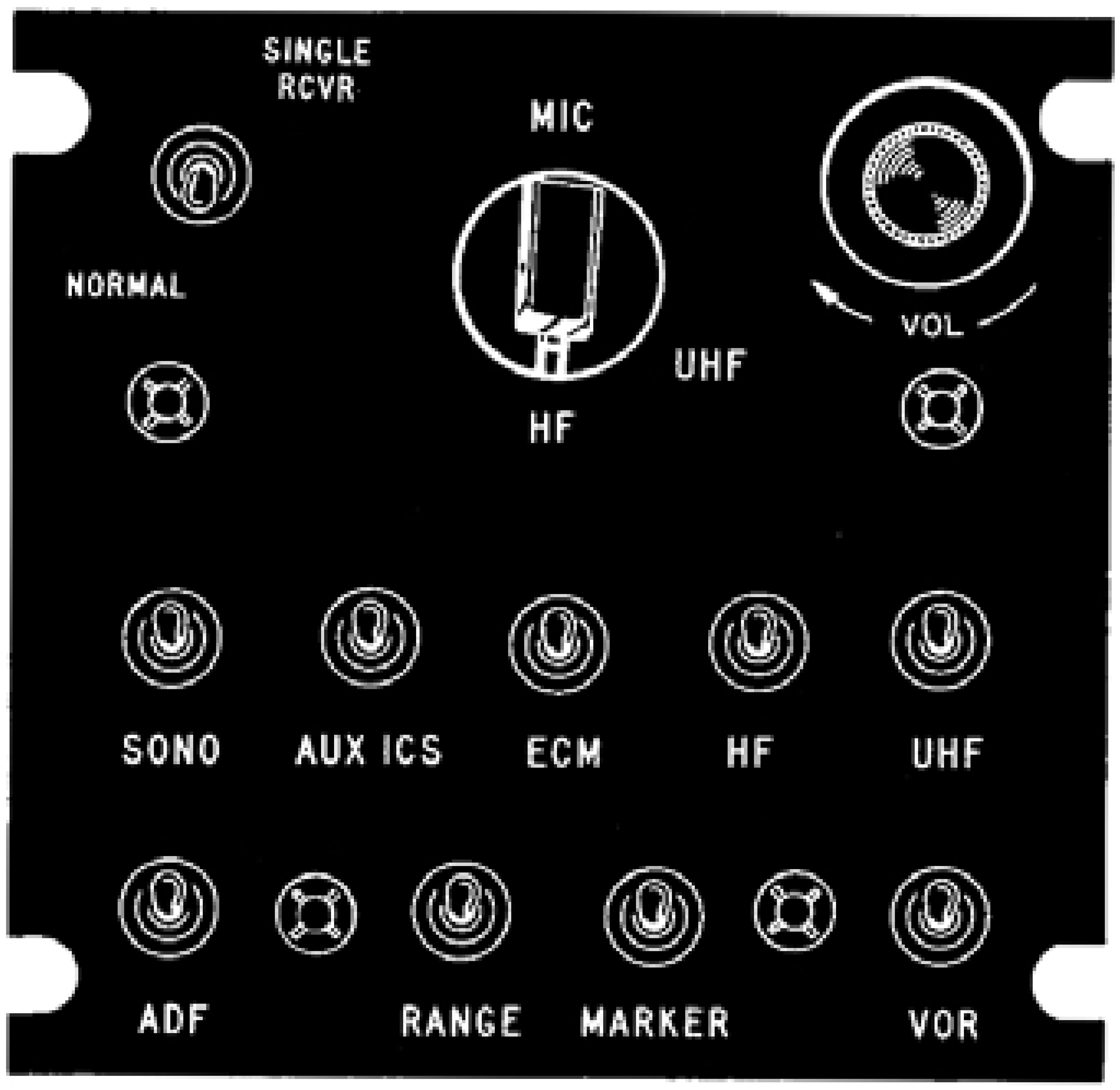
OPERATORS' CONTROL

AUDIO SWITCH	SYSTEM	DESIGNATION	FREQUENCY RANGE
ECM	Countermeasures Receiver	AN/APR-9B	
ADF	Omnirange	AN/ARN-30A	108 to 135 Megacycles
RANGE (see note)	Range Receiver	AN/ARC-5	190 to 550 Kilocycles
MARKER (see note)	Marker Beacon Receiver	AN/ARN-8	75 Megacycles (Fixed)
SONO	Sonobuoy Receiver	AN/ARR-26	
ICS	Intercommunication	AN/AIC-8	
HF	High Frequency Receiver	AN/ARC-2, -2A	2000 to 9050 Kilocycles
UHF	Ultra High Frequency Receiver UHF Direction Finder	AN/ARC-27, -27A AN/ARA-25	225.0 to 399.9 Megacycles

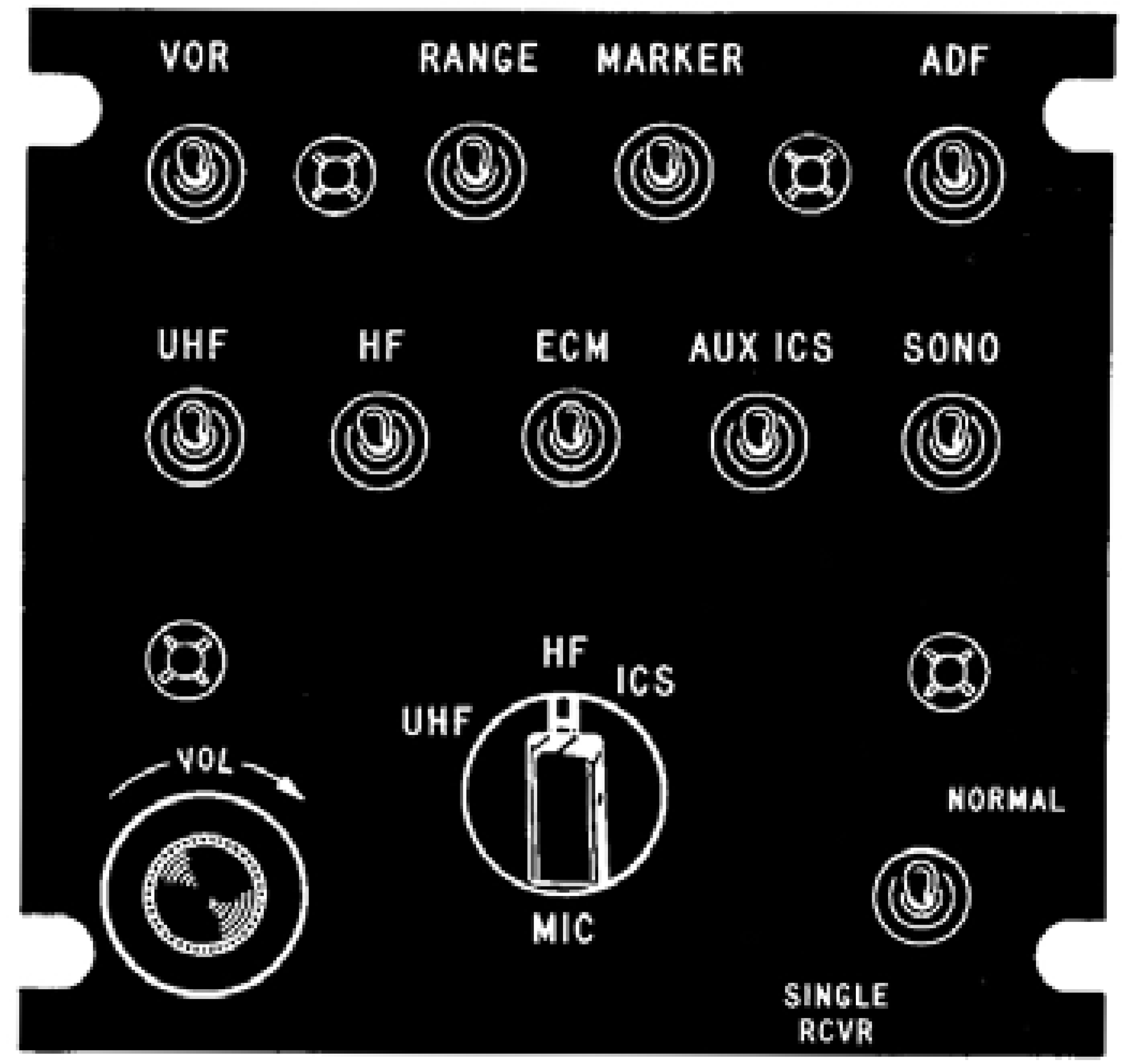
Note

Range Receiver and Marker Beacon Receiver in Airplanes ser No. 133149 and subsequent.

Figure 4-2A. Control Box C-633/AIC-8—Audio Switch Functions, S2F-1 Airplanes BuNo. 133045 through 133264



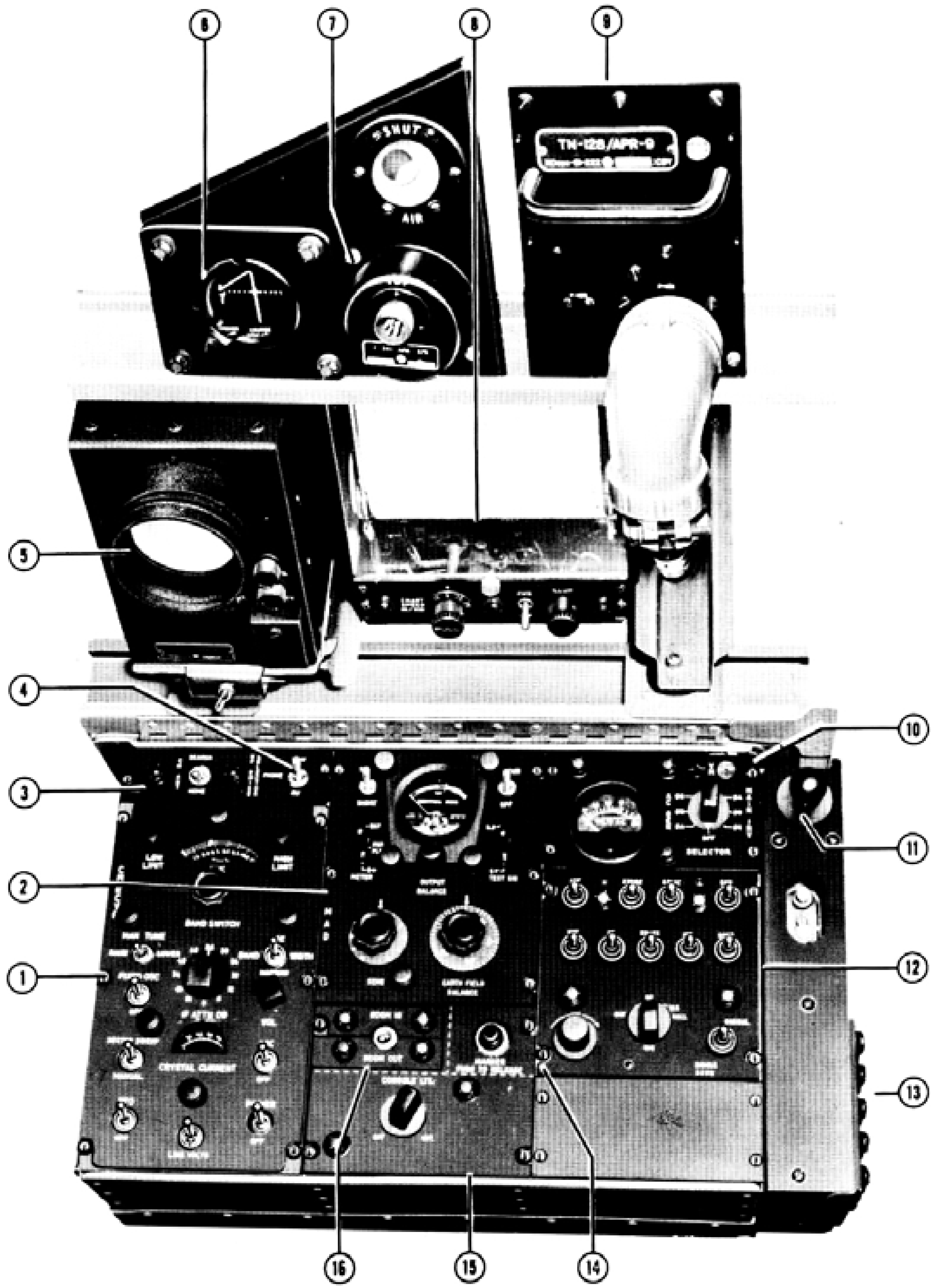
PILOTS' CONTROL



OPERATORS' CONTROL

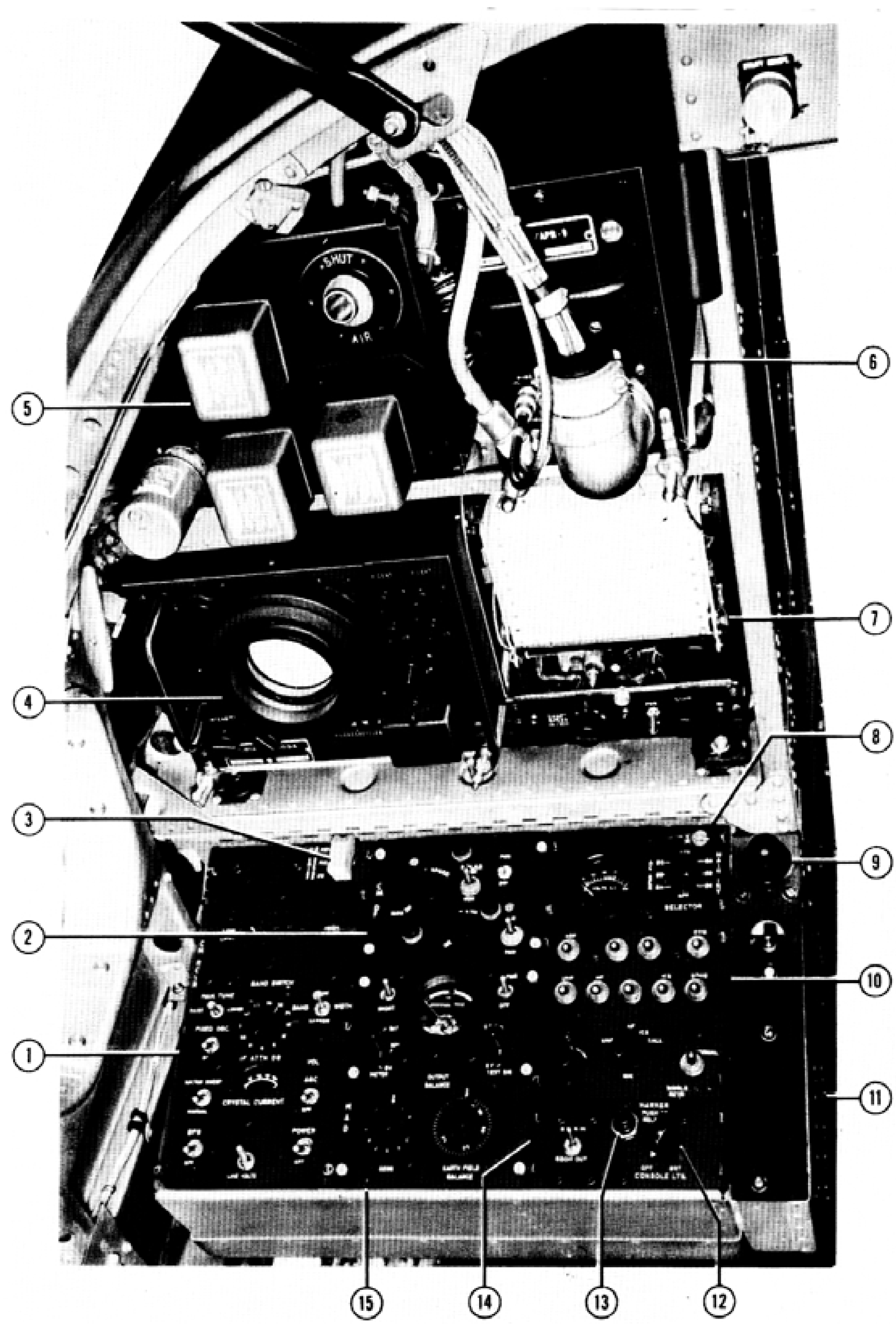
AUDIO SWITCH	SYSTEM	DESIGNATION	FREQUENCY RANGE
VOR	Omnirange	AN/ARN-30A	108 to 135 Megacycles
RANGE	Range Receiver	AN/ARC-5	190 to 550 Kilocycles
MARKER	Marker Beacon Receiver	AN/ARN-8	75 Megacycles (Fixed)
ADF	LF Direction Finder	AN/ARN-6	100 to 1750 Kilocycles
UHF	UHF Receiver UHF Direction Finder	AN/ARC-27A AN/ARA-25	225.0 to 399.9 Megacycles
HF	HF Receiver	AN/ARC-2, -2A	2000 to 9050 Kilocycles
ECM	Countermeasures Receiver	AN/APR-9B	
AUX ICS	Intercommunication	AN/AIC-8	
SONO	Sonobuoy Receiver	AN/ARR-26	

Figure 4-2B. Control Box C-633/AIC-8—Audio Switch Functions, S2F-1 Airplanes BuNo. 133265 and Subsequent



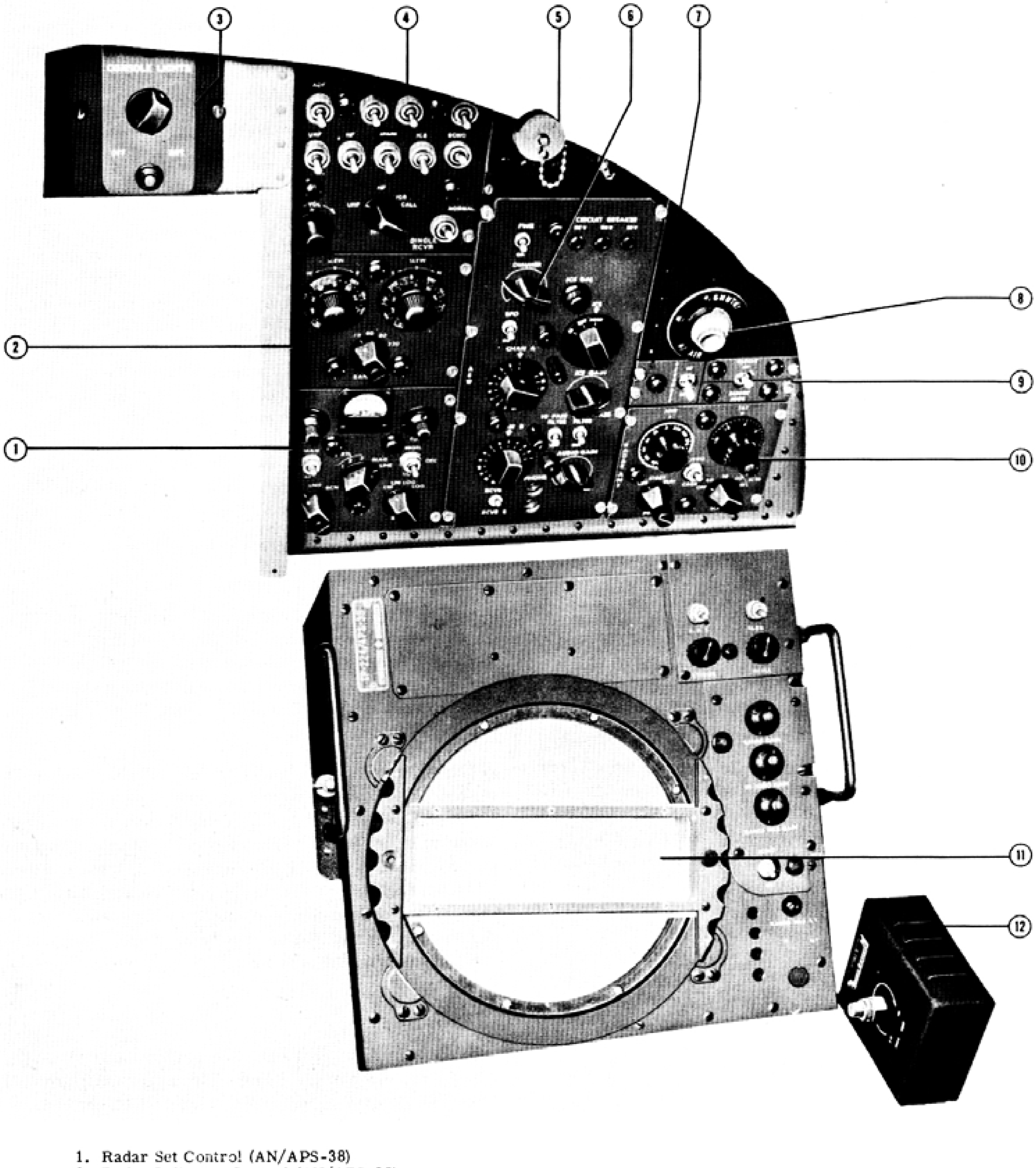
1. Countermeasures Receiver Control (AN/APR-9B)
2. MAD Control (AN/ASQ-8)
3. Countermeasures Antenna Switch (AN/APR-9B)
4. HF Emission Selector Switch (AN/ARC-2)
5. Countermeasures Indicator (AN/APR-9B)
6. Ground Stabilization Course Indicator (AN/APA-70C)
7. Airspeed Transmitter (AN/APA-57B) Airplanes ser. No. 129139 through 129153 and 133045 through 133105
8. MAD Recorder (AN/ASQ-8)
9. Countermeasures Tuning Unit (AN/APR-9B)
10. AC Voltmeter Panel
11. Telegraph Key
12. Intercommunication Control (AN/AIC-8)
13. Sonobuoy Release and Key Box (AN/ARR-26)
14. Marker Release Button
15. Console Lights Control
16. MAD Boom Control Switch and Indicator Lights (AN/ASQ-8)

Figure 4-3. MAD-CM Operator's Station, S2F-1 Airplanes BuNo. 129139 through 133264



1. Countermeasures Receiver Control (AN/APR-9B)
2. Countermeasures Antenna Control (AN/APA-69A)
3. HF Emission Selector Switch (AN/ARC-2)
4. Countermeasures Indicator (IP-81/APA-69A)
5. Relay Installation
6. Countermeasures Tuner (AN/APR-9B)
7. MAD Recorder (AN/ASQ-8)
8. A-C Voltmeter Panel
9. Telegraph Key
10. Intercommunication Control (AN/AIC-8)
11. Sonobuoy Release and Key Box (AN/ARR-26)
12. Console Lights Control
13. Marker Release Button
14. MAD Boom Control Switch and Indicator Lights (AN/ASQ-8)
15. MAD Control (AN/ASQ-8)

Figure 4-3A. MAD-CM Operator's Station



1. Radar Set Control (AN/APS-38)
2. Radar Indicator Control (AN/APS-38)
3. Console Lights Control
4. Intercommunication Control (AN/AIC-8)
5. A-C - D-C Utility Outlets
6. Sonobuoy Receiver Control (AN/ARR-26)
7. Recorder Switch
8. Cabin Warm Air Outlet
9. Radome Control Switch and Indicator Lights
10. Radar Antenna Control (AN/APS-38)
11. Radar Indicator (AN/APS-38)
12. Autotransformer (AN/APS-38)

NOTE

Recorder and Microphone Foot Switches are located on floor under AN/APS-38 indicator.

Figure 4-4. Radar-Sonobuoy Operator's Station, Airplanes BuNo. 129139 through 133369

UPON ENTERING THE AIRPLANE.

PILOT.

a. Plug microphone and headphone cord into jack and cord assembly hanging alongside seat.

b. Set battery switch to BAT and then throw RADIO MASTER switch to ON to energize all equipment except the AN/ARC-2, -2A. This equipment will be energized by setting the power switch on the HF control to ON.

MAD-CM OPERATOR AND RADAR-SONOBUOY OPERATOR.

Plug microphone and headphone cords into jack and cord assemblies stowed above and to right of each seat.

RADIO INTERPHONE AN/AIC-8.

This equipment serves as a communication system between crew members, as a mixer for the audio output of various receiving equipment and as a means for partially controlling the transmitting equipment. There are four interphone control stations, one for each member of the crew. In addition, a jack box is located near the nose wheel well, in the electronics compartment, and in the aft compartment.

CONTROLS.

A MIC selector switch on each of the four control panels, is used to select the desired equipment for voice communication. Also included is a CALL position to enable any of the four stations to call all other positions by voice communication regardless of the setting of microphone or audio switches at any of the other stations.[1]

Two rows of toggle switches on the control panel are provided for the selection of receivers to be monitored (see figures 4-2A and 4-2B). Volume is adjusted by the VOL control. A NORMAL-SINGLE RCVR toggle switch is installed for emergency operation of the system in the event the isolation amplifier fails. Radio volume also may be controlled during ICS transmissions by means of four controls located near the MAD-CM operator.[2] Each control is placarded for its respective crew member and the entire panel is placarded RADIO ICS VOL. CONT. ADJUST. These controls should be adjusted for a comfortable level of radio volume during ICS transmissions.

NORMAL OPERATION.

a. Pilot and co-pilot—throw ICS switch to ON. Depress wheel button marked I and talk into microphone.

b. Number 3 and 4 operators—set MIC switch to ICS. Depress foot switch and talk into microphone.

EMERGENCY OPERATION.

If failure of a crew member's isolation amplifier occurs, place NORMAL—SINGLE RCVR switch in SINGLE RCVR position. This will result in unamplified reception direct from the receiver, by-passing the defective amplifier. With the emergency switch in this position, all audio switches except that of the desired system must be in the OFF position. Failure of the isolation amplifier does not affect CALL operation.

Note

ICS amplifiers will not reproduce high audio frequency signals. Therefore, in order to hear the high frequency component of the sonobuoy signals, the operator's phones must be connected directly to the sonobuoy receiver rather than through the ICS amplifier. In order to accomplish this, the sonobuoy operator must set the NORMAL—SINGLE RCVR toggle switch on his ICS control to SINGLE RCVR. This action permits the sonobuoy signals to by-pass the amplifiers. All audio switches, except the sonobuoy switch, must be in their off position. In some airplanes, other crew members will be required to use CALL operation for communication with the sonobuoy operator.[1]

VHF RECEIVER-TRANSMITTER AN/ARC-1.[3]

Note

The AN/ARC-1 system is installed only as an alternate for AN/ARC-27A. When the AN/ARC-1 system is used instead of the AN/ARC-27A, the stop on the VHF circuit breaker should be removed and installed on the UHF circuit breaker.

When AN/ARC-1 is installed, the C-1015/ARC-27A control in the pilots' overhead console is replaced by a C-865/ARC-1 control. This control provides for communication on any of nine preset main channels and one guard channel. The receiver-transmitter incorporates a relay which cuts out the receiver section and cuts in the transmitter section when the microphone switches are depressed. When the microphone switch is released, the transmitter section is cut out and the receiver section is engaged.

OPERATION.

a. Pilot and co-pilot—Set ICS console control C-633/AIC-8 MIC knob to UHF and UHF toggle switch to ON. On VHF control C-865/ARC-1, set CHAN SEL to desired channel. For simultaneous reception on guard and any main channel, turn VHF control marked GUARD T/R—MAIN T/R+G REC—MAIN T/R to MAIN T/R+G REC. For reception on guard channel alone, set control to GUARD T/R; and for any main channel alone, set control to MAIN T/R. To increase or decrease volume of received signals, adjust VOL control knob on ICS control panel. To transmit—press RADIO switch on wheel and talk into microphone.

[1] S2F-1 airplanes BuNo. 133045 through 133264, and S2F-2 airplanes BuNo. 133331 through 133335.

[2] S2F-1 airplanes BuNo. 133265 and subsequent, and S2F-2 airplanes BuNo. 133336 and subsequent.

[3] Provisions only in S2F-1 airplanes BuNo. 133043 through 133328.

b. MAD-countermeasures and radar-sonobuoy operators—Set ICS console control C-633/AIC-8 MIC knob to UHF and UHF toggle switch to on. Regulate volume of signals by adjusting VOL control on same panel. To transmit—call pilot on ICS and have desired channel set up on C-865/ARC-1 control in overhead console. Press microphone foot switch and talk.

c. To turn equipment off, set UHF toggle switch to off.

HF RECEIVER-TRANSMITTER AN/ARC-2.

The AN/ARC-2 equipment provides preset multi-channel voice, CW, or MCW amplitude-modulated, pilot-controlled, two-way radio communication on any one of eight channels within the frequency range of 2000-9050 kilocycles. Selection of voice, CW, or MCW may be made with the EMISSION switch on the face of the receiver-transmitter, located in the electronic compartment, if the receiver-transmitter POWER switch is in the ON position. Transmission can also be made with the MAD-CM operator's HF EMISS SELECTOR switch if the ON-OFF switch on the overhead control panel is in the ON position. A telegraph key is mounted at the right side of the MAD-CM operator's folding console for use during CW or MCW transmission.

OPERATION.

All controls required for operation of the AN/ARC-2 system are located on the pilots' overhead console. The control panel consists of a power ON-OFF switch, an eight-channel selector knob, and a sensitivity control.

a. Pilot and Co-pilot—Turn power switch ON. Operate CHANNEL selector to desired channel. Place ICS console control C-633/AIC-8 MIC knob to HF and HF toggle switch to on. Adjust SENS control on AN/ARC-2 panel for a comfortable volume. To transmit—press RADIO switch on control wheel and talk into microphone.

b. MAD-Countermeasures operator—Place ICS console control C-633/AIC-8 MIC knob to HF and HF toggle switch to on. To transmit—call pilot on ICS and have desired channel set up on HF control panel in overhead console. If voice is to be used, set HF EMISS SELECTOR switch to PHONE. This switch is located at the upper left corner of the folding console. Depress MIKE foot switch and talk. If code is to be used, set HF EMISS SELECTOR switch to CW or MCW and operate telegraph key, located at right side of folding console.

c. Radar-sonobuoy operator—Set ICS console control C-633/AIC-8 MIC knob to HF and HF toggle switch to on. To transmit—call pilot on ICS and have desired channel set up on HF control panel in overhead console. Depress MIKE foot switch and talk.

d. To turn equipment off, set power ON-OFF switch to OFF.

RADIO RANGE RECEIVER AN/ARC-5.[1]

The AN/ARC-5 equipment receives voice or mcw low frequency communications and radio ranges between 190 and 550 kc. Controls are available to the pilots, but the receiver may be monitored by any crew member. The AN/ARC-5 equipment uses the AN/ARC-2 wire antenna.

CONTROLS.

All controls required for operation of the AN/ARC-5 equipment are located on the aft left side of the pilots' overhead console, between the IFF and HF control panels. The panel is edge-lighted and contains a sensitivity control and a frequency dial. Frequency is selected by rotating the crank handle until the desired frequency appears in the dial window of the control unit. Panel lighting is obtained through the console lights control on the overhead console.

OPERATION.

a. Pilot and co-pilot—Set ICS console control RANGE toggle switch to on. Select proper frequency by rotating crank on AN/ARC-5 control. Adjust volume at ICS control.

b. MAD-countermeasures and radar-sonobuoy operators—Set ICS control RANGE toggle switch to on. Adjust volume control for comfortable reception level.

c. To turn equipment off, set RANGE toggle switch to off.

UHF RECEIVER-TRANSMITTER AN/ARC-27A.

This equipment is used for uhf voice communication between airplanes or between airplanes and ground or shipboard stations similarly equipped for uhf transmission. Under normal conditions, reliable reception can be expected over line-of-sight distances provided there are no intervening obstructions. The equipment provides 20 preset frequencies, a guard channel, and a manual control. Any one of 1750 channels may be selected manually by placing the CHAN selector switch on the C-1015/ARC-27A control in the M position and rotating the three rotary decade frequency selectors to the desired frequency. No danger of disturbing the preset channels exists when the CHAN selector switch is in the M position. Of the 1750 channels available, 20 may be preset on the C-1015/ARC-27A control located on the left side of the pilot's overhead control console. These channels may then be selected by operation of the CHAN selector switch. Sensitivity may be adjusted by a suitably marked control mounted on the same panel. The OFF—T/R—T/R+G—ADF switch turns the receiver on when advanced from the OFF position and also selects the units that will be powered. In the T/R position, only the main receiver-transmitter is turned on and in the T/R+G position, both the main receiver and the guard receiver are turned on. When this switch is in the ADF position, the system is switched by a solenoid relay from the use of the AN/ARC-27A an-

[1] S2F-1 airplanes BuNo. 133149 and subsequent, and S2F-2 airplanes BuNo. 133331 and subsequent.

tenna to the use of the AN/ARA-25 antenna for the purpose of homing on another station.

OPERATION.

a. Pilot and co-pilot—Set ICS console control C-633/AIC-8 MIC switch to UHF and set UHF toggle switch to on. On UHF control C-1015/ARC-27A, set CHAN selector to desired channel. For reception on any main channel, set OFF—T/R—T/R+G—ADF switch to T/R; and for simultaneous reception on a main channel and the guard channel, set switch to T/R + G. To select a frequency manually, set CHAN selector to M and rotate three rotary decade frequency selectors to desired frequency. To use the AN/ARA-25 direction finder, set OFF—T/R—T/R + G—ADF switch to ADF.

b. MAD-Countermeasures and radar-sonobuoy operators—Set ICS panel MIC switch to UHF and receiver toggle switch on control C-633/AIC-8 to on. Adjust VOL control for a comfortable reception level. To transmit—call pilot on ICS and have desired transmission channel set up. Press microphone foot switch and talk into microphone. Sidetone will be heard in headphones.

c. To turn equipment off, set UHF toggle switch to off.

RADAR ALTIMETER AN/APN-22.

The AN/APN-22 radar altimeter indicates the airplane's altitude above the terrain and operates in the 4200-4400 mc band. This altitude is shown on two duplicate indicators, one for the pilot and one for the co-pilot. The equipment is also used to feed signals into the P-1 automatic pilot (see Automatic Pilot paragraph, this section), through an automatic altitude control, to insure that the airplane maintains a preset altitude when the auto pilot is engaged.

Flight tests indicate that this equipment will operate, in this airplane, up to an altitude of at least 5000 feet over water but less over land. It will give indications at this altitude (5000 feet over water) when the airplane is banked up to 30 degrees in either direction.

If the signal becomes so weak that the equipment is unable to provide a reliable altitude indication, a reliability circuit disables the indicator, placing the altitude indicator needle behind a mask so that it cannot be used.

ON-LIMIT SWITCH.

An ON-LIMIT switch, located at the lower left corner of the bezel, is the only operating control for the equipment. This knob operates the system on-off switch; the equipment will operate when the knob is turned clockwise from the off position. When rotated after being turned on, the knob is used to set the bug pointer (see Altitude Bug Pointer paragraph, below) to any desired altitude.

INDICATORS.

ALTITUDE INDICATOR.

The pilot's and co-pilot's indicators (23, figure 1-4) are identical, each showing the airplane's altitude on a single dial. The indicator needle is moved linearly over the 0 to 200 feet range scale to provide an accurate and easily read indication at low altitudes. The dial scale is compressed above 200 feet and the needle moves non-linearly between 200 and 20000 feet, where accuracy of meter interpretation is less important.

ALTITUDE BUG POINTER.

An adjustable bug pointer at the outside of the calibrated scale of the indicator can be preset to any desired altitude by means of the ON-LIMIT control. This can be used as a reference for flying at a fixed altitude by observing the position of the altitude needle with respect to the bug pointer, or by observing a red low limit warning light which lights when the airplane's altitude goes below the preset altitude (see Altitude Low Limit Warning Light paragraph, below).

ALTITUDE LOW LIMIT WARNING LIGHT.

This red light, located adjacent to the altimeter dial (23, figure 1-4), lights when the airplane's altitude drops below that selected by the altimeter bug pointer.

Note

The warning light will glow when the reliability circuit disables the indicator and places the altitude indicator needle behind a mask.

OPERATION.

a. Pilot and co-pilot—rotate ON-LIMIT switch clockwise. After approximately one minute, the altitude indicator needle will move from the sub-zero position, indicating that the equipment is operating.

b. Continue to rotate ON-LIMIT switch to set bug pointer to desired flight altitude.

CAUTION

Due to sudden changes in land terrain, and consequently, the possibility of an auto pilot drop-out. The auto pilot tie-in to the altimeter should be avoided during low altitude operations over land.

DIRECTION FINDER EQUIPMENT AN/ARA-25.

The direction finder is used in conjunction with the uhf (AN/ARC-27A) radio communication system. The direction finder and the uhf radio communication receiver provide the pilot with a continuous indication, in degrees, of the relative direction of arrival of amplitude modulated or unmodulated received radio signals in the 225-399.9 mc frequency band. Operation of the direction finder, in both stand-by and full operation, is controlled by the UHF radio communication control panel. When the OFF—T/R—T/R+G—ADF switch is placed in the ADF position, the direction finder antenna will then supply the r-f input to the uhf radio communication receiver. The uhf radio communication receiver output will then be applied to the control amplifier, which in turn will operate the No. 1 pointer of the ID-250/

ARN course indicator when the UHF ADF—LF ADF switch, located under the elapsed time clock on the center instrument panel, is set to UHF ADF.

Note

The ADF switch is inoperative and will remain so until Aircraft Service Change No. 40 (AN/ARN-21) is incorporated. In the meantime, the No. 1 pointer of the ID-250/ARN indicator will indicate AN/ARA-25 signals exclusively while the No. 2 pointer will be utilized by the AN/ARN-6 system.

OPERATION.

When the uhf (AN/ARC-27A) system is energized, the direction finder equipment is automatically put in standby operation.

a. Pilot and Co-pilot—Set channel selector switch on C-1015/ARC-27A control to channel required for direction finding. Set OFF—T/R—T/R+G—ADF selector switch to ADF and turn up volume control to proper level. Set UHF ADF—LF ADF switch to UHF ADF. The relative direction of arrival of received radio signals will then be displayed by the slaved pointers of the ID-250/ARN course indicator. To receive the audio signal received by the AN/ARA-25 systems, set UHF toggle switch on C-633/AIC-8 mixer panel to on position. The signals will be heard in the headphones.

b. MAD-countermeasures and Radar-sonobuoy operators—Place UHF toggle switch on C-633/AIC-8 mixer panel in on position and the audio signal will be heard in headphones. Neither of these two operators are supplied with course indicators.

RADIO COMPASS AN/ARN-6.

The AN/ARN-6 radio compass is a navigational aid used to receive, locate, and home on transmitting stations operating in the frequency range of 100 to 1750 kc. A control unit, located in the right side of the overhead console, permits selection of the following modes of operation:

a. Automatic visual bearing indication by the slaved pointers of the ID-250/ARN course indicator of the direction of arrival of a transmitted signal and simultaneous audio reception of that signal (COMP).

b. Aural reception of transmitted signals, using the non-directional sense antenna (ANT).

c. Aural direction indication by controlled rotation of the loop antenna in the direction of a transmitted signal (LOOP).

Since no auxiliary control is used in this installation, the CONT function is inoperative. The frequency range of the equipment is divided into the following four bands:

Band 1—100 to 200 kilocycles.
Band 2—200 to 410 kilocycles.
Band 3—410 to 850 kilocycles.
Band 4—850 to 1750 kilocycles.

TO START EQUIPMENT.

a. Set ADF toggle switch on ICS control panel to on.

b. Set UHF ADF—LF ADF toggle switch, located on instrument panel directly under elapsed time clock, to LF ADF.

Note

The ADF switch is inoperative and will remain so until Aircraft Service Change No. 40 (AN/ARN-21) is incorporated. In the meantime, the No. 1 pointer of the ID-250/ARN indicator will indicate AN/ARA-25 signals exclusively while the No. 2 pointer will be utilized by the AN/ARN-6 system.

c. Set function switch on AN/ARN-6 control panel to desired mode of operation.

TO STOP EQUIPMENT.

Set function switch on AN/ARN-6 control panel to OFF.

MARKER BEACON RECEIVER AN/ARN-8.[1]

The AN/ARN-8 equipment is installed for the reception of marker beacon signals at a frequency of 75 mc. While flying over a marker beacon station, a modulated tone is heard and the marker indicator light glows. The indicator light is located in the ID-48/ARN cross-pointer meter on the pilot's instrument panel. The frequency of the tone depends upon the type of marker station. A sense control is the only control incorporated on the marker beacon receiver. This equipment may be monitored by any crew member. The system antenna is mounted on the aft compartment access door.

OPERATION.

All crew members—Set ICS control MARKER toggle switch to on. Adjust volume of ICS control for comfortable reception level.

AN/ARN-30A VISUAL OMNIRANGE RECEIVER.

The AN/ARN-30 vhf visual omnirange receiver is dedesigned for airborne use in the frequency range of 108-135 megacycles on the following facilities:

a. VHF omnidirectional radio ranges (VOR).

b. VHF visual-aural airways radio ranges (VAR).

c. VHF 90-150 cps runway localizers (LOC).

d. VHF voice reception simultaneous with navigation facilities.

The VHF omnidirectional ranges (VOR ranges) have been designed to increase the number of available airways courses over the existing standard low-frequency ranges or over the existing VHF visual-aural ranges. In the omni system, the pilot sets up any track he desires by means of the course selector, and flies that track by reference to the cross-pointer meter.

The VHF simultaneous visual-aural ranges (VAR ranges) provide a course that may be followed by observing the center reading cross-pointer meter and another course

[1] S2F-1 airplanes BuNo. 133043, 133044, 133149 and subsequent and S2F-2 airplanes BuNo. 133331 and subsequent.

that may be followed by listening to the A-N signals with a continuous tone for on-course. The visual course is usually along the airway, and the aural at right angles to the airway. By listening for the A or N signal and noting whether the vertical needle is in the blue or yellow sector of the cross-pointer meter, the quadrant may be identified immediately by reference to airways charts.

Note

For location and set-up for VAR stations, see applicable publications.

VHF runway localizers (LOC) produce a sharp course by the transmission of two modulations indicated by center reading of the vertical cross-pointer meter. A runway approach in the proper direction will result in center reading, while a movement of the needle to the right requires steering right to get back on course, and a movement to the left requires steering left to get back on course. If the approach is made 180° off course, the reverse motions will occur.

VHF voice reception may be tuned in with the selector switch in either position. A built-in filter separates voice signals from the navigation signals. The VOLUME control affects only the audio headphone level; the navigation circuits of the receiver are not affected by the control.

OPERATION—VOR RANGES.

a. Turn OFF-VOLUME power switch on.

b. Set selector toggle switch to OMNI.

c. Tune in desired signal, using crank on VHF NAV control panel. Note identifying signal. Make certain that OFF flag alarm for vertical needle of cross-pointer meter is out of sight.

d. Turn course selector knob until vertical needle of cross-pointer meter is centered, and check that TO-FROM meter is operating and reading either TO or FROM. Course selector reading will then give magnetic bearing *to* or *from* the station, depending on reading of TO-FROM meter.

e. The indicated bearing will not be the heading of the aircraft at that moment; therefore, use directional gyro or magnetic compass to maintain desired heading and use cross-pointer meter only as an indication of bearing.

f. If, with vertical needle centered, TO-FROM meter reads FROM and it is desired to fly *to* the station, reset course selector to 180° from its present position, at which time vertical needle of cross-pointer meter will again be in the center, but TO-FROM meter will now read TO.

g. Turn aircraft to a magnetic compass heading equal to that shown on course selector and continue on that heading unless cross-pointer meter drifts off to either side.

h. If it creeps off to the left, change magnetic heading enough to left to change trend of needle back to center. Do not reset course selector.

i. Small changes of heading may be required from time to time to establish proper drift or crab angle to make good the required track set up on course selector. The actual magnetic compass heading may be several degrees off course selector setting, depending upon cross wind.

j. To obtain a position fix on two VOR stations, tune in two stations in quick succession, noting magnetic bearing *to* or *from* then plot these on map, making certain to use magnetic north for 0°.

k. If aircraft is flying a VOR course of 270° *to* a station and it is desired to change to for example, 300°, set course selector to 300°, at which time cross-pointer needle will go off scale to left. Change course to left by an amount calculated to intersect the 300° track in a short time. Continue on this calculated track until cross-pointer meter starts to center; change course gradually to 300° to return cross-pointer meter to center without overrun.

l. If course selector for on-course is set so that TO-FROM meter is TO in going toward a station and FROM in going away from a station, the rule for steering is: if cross-pointer meter needle moves to left, steer to left; if needle moves to right, steer to right.

OPERATION—VAR RANGES.

a. Turn OFF-VOLUME power switch on.

b. Set selector toggle switch to VAR-LOC.

c. Tune in desired signal. Note identifying signal. Make certain that OFF flag alarm on cross-pointer meter is out of sight.

d. Observe whether vertical needle of cross-pointer meter is in blue or yellow sector and note whether audio signal is an A or an N.

e. Refer to proper publication for this vhf range station to determine quadrant from which signal is emanating.

OPERATION—LOC RUNWAY LOCALIZER.

a. Turn OFF-VOLUME power switch on.

b. Set selector toggle switch to VAR-LOC.

c. Tune in desired station. Note code identifying signal. Make certain that OFF flag alarm for vertical needle of cross-pointer meter is out of sight.

d. On approaching runway in the normal sense, a meter reading to left or right of center indicates that pilot must steer left or right, respectively, to bring needle back to on-course center.

e. If runway localizer is flown 180° to normal approach direction, a meter reading to left or right of center indicates that pilot must steer right or left, respectively, to bring needle back to on-course center.

OPERATION—VOICE.

Voice signals may be tuned in with selector toggle switch in either position. There is a built-in filter which separates voice signals from navigation signals. The VOLUME control affects only audio headphone level; the navigation circuits of receiver are not affected by this control.

IFF EQUIPMENT AN/APX-6, -6B.

See Confidential Supplement, NavAer 01-85SAA-1A.

CODER GROUP AN/APA-89.

See Confidential Supplement, NavAer 01-85SAA-1A.

COUNTERMEASURES EQUIPMENT AN/APA-69A AND AN/APR-9B.

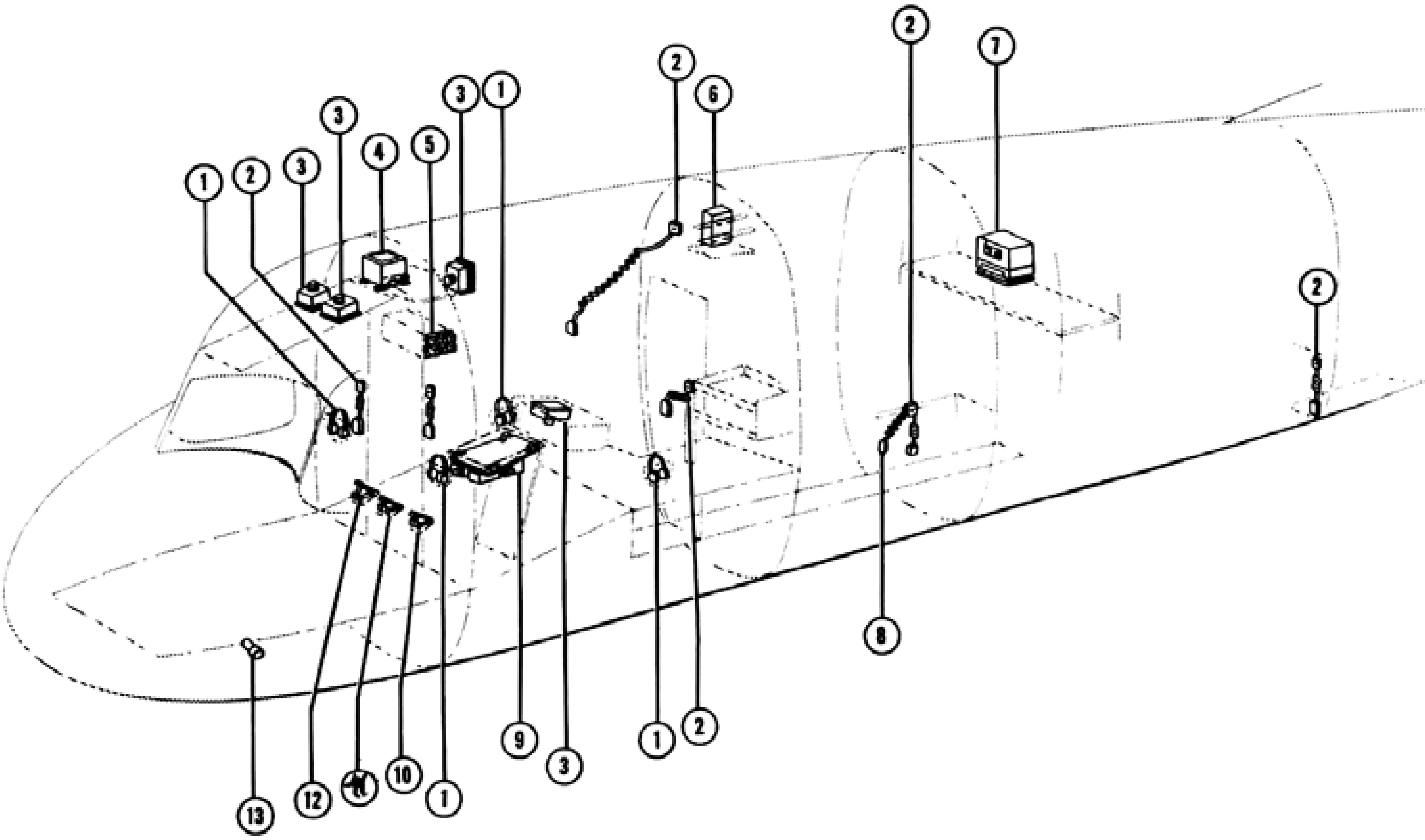
See Confidential Supplement, NavAer 01-85SAA-1A.

MAGNETIC AIRBORNE DETECTOR (MAD) SYSTEM AN/ASQ-8.

See Confidential Supplement, NavAer 01-85SAA-1A.

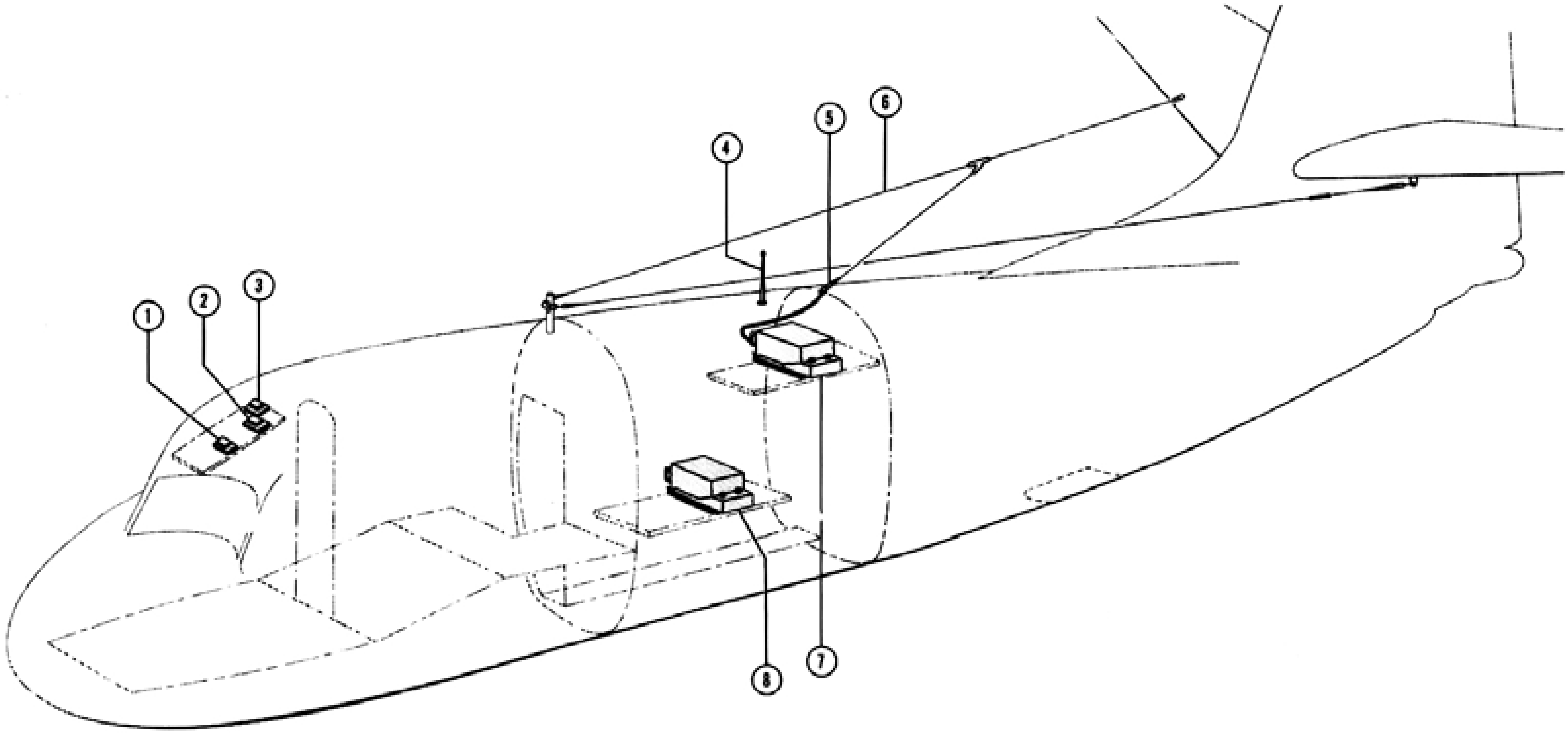
FIGURE 4-4A DELETED

See Confidential Supplement, NavAer 01-85SAA-1A.



1. Microphone and Headset Assembly 89R1142-1 (G.A.E.C.) (4)
2. Microphone and Headset Extension Cord CX-1301/AR (5)
3. ICS Control Box C-633/AIC-8 (4)
4. ICS Amplifier AM-300/AIC
5. Radio ICS Relay Panel
6. Radio ICS Volume Control Assembly 89R1378-3 (G.A.E.C.) (Airplanes BuNo. 133043, 133044, 133265 through 133328 and 133336 and subsequent)
7. Wire Recorder 13-A-3-J or IC/VRW-7
8. Microphone Switch NAF1124-17
9. ICS Mixer Amplifier AM-142/AIC (4)
10. MAD-CM Operator's Microphone Foot Switch
11. Radar-Sonobuoy Operator's Recorder Foot Switch
12. Radar-Sonobuoy Operator's Microphone Foot Switch
13. External ICS Jack

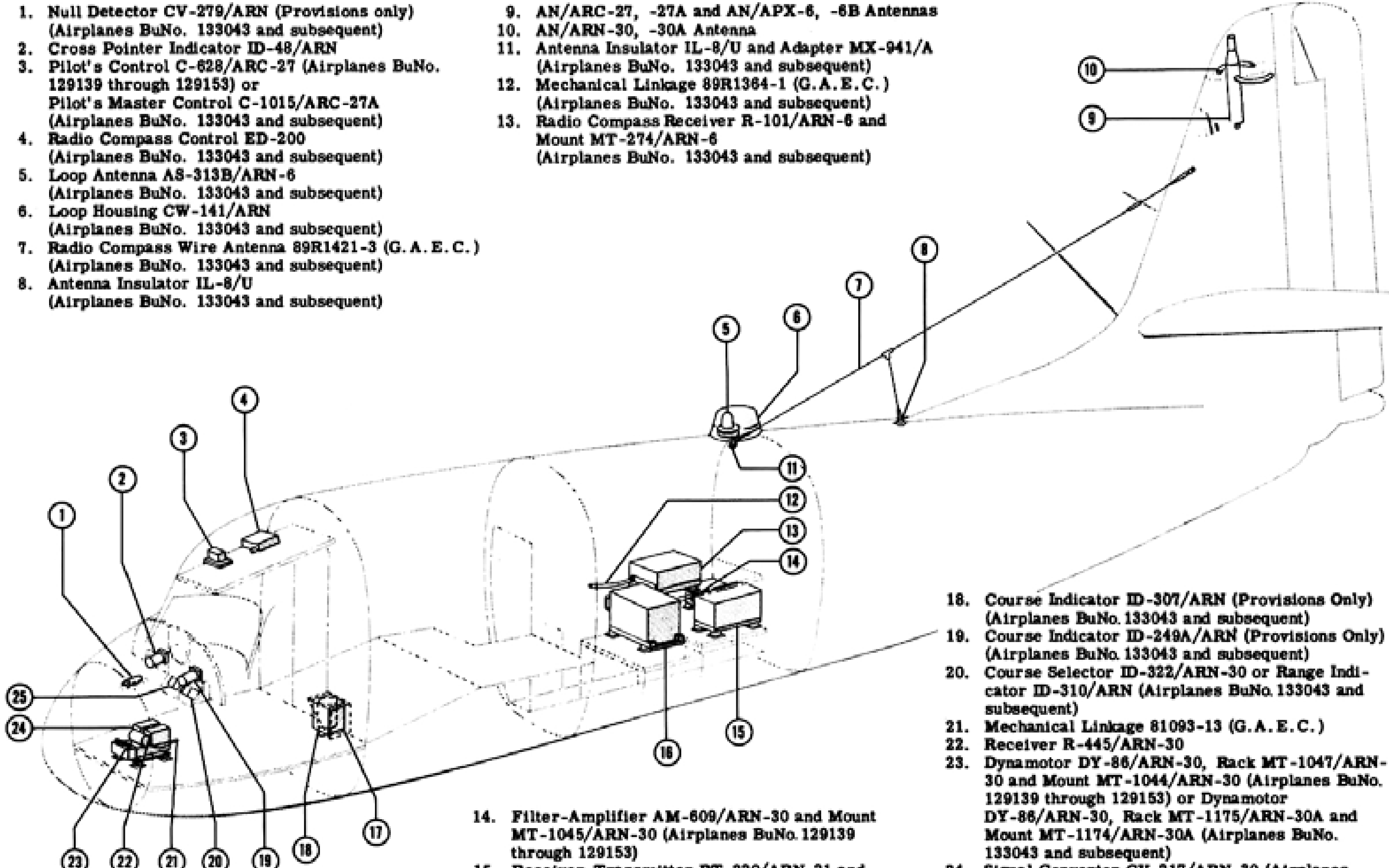
Figure 4-5. Electronics Units Location—AN/AIC-8 Intercommunication System



1. Control C-865/ARC-1 (provisions only) (Airplanes BuNo. 129139 through 133388)
2. Control C-732/ARC-2 (Airplanes BuNo. 129139 through 129143 and 133043, 133044, 133206 and subsequent) or Control C-732A/ARC-2 (Airplanes BuNo. 129144 through 129153 and 133045 through 133205)
3. Sensitivity Control Panel 89R1372-1 (G.A.E.C.) (Airplanes BuNo. 129139 through 129143 and 133043, 133044, 133206 and subsequent)
4. VHF Communications Antenna AT-8/AR (provisions only) (Airplanes BuNo. 129139 through 133338)
5. Antenna Insulator IL-8/U and Adapter MX-941/A
6. HF Wire Antenna 89R1421-5 (G.A.E.C.)
7. Receiver-Transmitter RT-91/ARC-2 and Mount MT-421/AR (Airplanes BuNo. 129139 through 129153, 133045 through 133270 and 133329 through 133335) or Receiver-Transmitter RT-91/ARC-2 or RT-298/ARC-2A and Mount MT-421/AR (Airplanes BuNo. 133043, 133044, 133271 through 133328 and 133336 and subsequent)
8. Receiver-Transmitter RT-18/ARC-1 and Mount MT-230A/ARC-1 (provisions only) (Airplanes BuNo. 129139 through 133388)

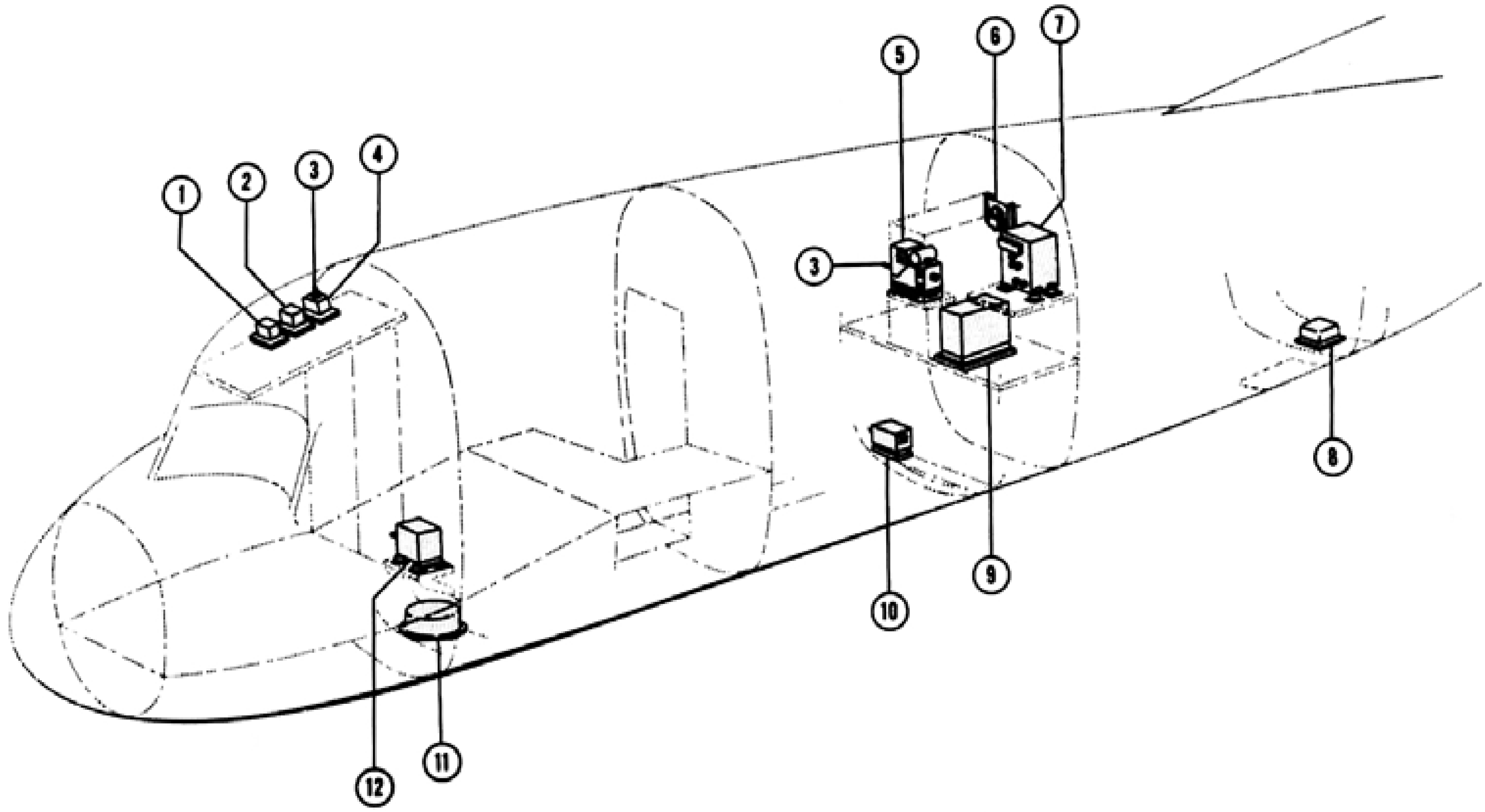
Figure 4-5A. Electronic Units Locations—AN/ARC-1 VHF Communications System and AN/ARC-2, -2A HF Communications System

1. Null Detector CV-279/ARN (Provisions only) (Airplanes BuNo. 133043 and subsequent)
2. Cross Pointer Indicator ID-48/ARN
3. Pilot's Control C-628/ARC-27 (Airplanes BuNo. 129139 through 129153) or Pilot's Master Control C-1015/ARC-27A (Airplanes BuNo. 133043 and subsequent)
4. Radio Compass Control ED-200 (Airplanes BuNo. 133043 and subsequent)
5. Loop Antenna AS-313B/ARN-6 (Airplanes BuNo. 133043 and subsequent)
6. Loop Housing CW-141/ARN (Airplanes BuNo. 133043 and subsequent)
7. Radio Compass Wire Antenna 89R1421-3 (G. A. E. C.) (Airplanes BuNo. 133043 and subsequent)
8. Antenna Insulator IL-8/U (Airplanes BuNo. 133043 and subsequent)
9. AN/ARC-27, -27A and AN/APX-6, -6B Antennas
10. AN/ARN-30, -30A Antenna
11. Antenna Insulator IL-8/U and Adapter MX-941/A (Airplanes BuNo. 133043 and subsequent)
12. Mechanical Linkage 89R1364-1 (G. A. E. C.) (Airplanes BuNo. 133043 and subsequent)
13. Radio Compass Receiver R-101/ARN-6 and Mount MT-274/ARN-6 (Airplanes BuNo. 133043 and subsequent)



14. Filter-Amplifier AM-609/ARN-30 and Mount MT-1045/ARN-30 (Airplanes BuNo. 129139 through 129153)
15. Receiver-Transmitter RT-220/ARN-21 and Mount MT-928/ARN-21 (Provisions Only) (Airplanes BuNo. 133043 and subsequent)
16. Receiver-Transmitter RT-178/ARC-27 and Mount MT-822/ARC-27
17. Master Control C-626/ARC-27 and Mount MT-821/ARC-27 (Airplanes BuNo. 129139 through 129153)
18. Course Indicator ID-307/ARN (Provisions Only) (Airplanes BuNo. 133043 and subsequent)
19. Course Indicator ID-249A/ARN (Provisions Only) (Airplanes BuNo. 133043 and subsequent)
20. Course Selector ID-322/ARN-30 or Range Indicator ID-310/ARN (Airplanes BuNo. 133043 and subsequent)
21. Mechanical Linkage 81093-13 (G. A. E. C.)
22. Receiver R-445/ARN-30
23. Dynamotor DY-86/ARN-30, Rack MT-1047/ARN-30 and Mount MT-1044/ARN-30 (Airplanes BuNo. 129139 through 129153) or Dynamotor DY-86/ARN-30, Rack MT-1175/ARN-30A and Mount MT-1174/ARN-30A (Airplanes BuNo. 133043 and subsequent)
24. Signal Converter CV-217/ARN-30 (Airplanes BuNo. 129139 through 129153) or Signal Converter CV-265/ARN-30A (Airplanes BuNo. 133043 and subsequent)
25. Control R-3001 (Airplanes BuNo. 129139 through 129153) or Control C-1254/ARN-30 or Control C-866/ARN-21 (Airplanes BuNo. 133043 and subsequent)

Figure 4-5A-1. Electronic Units Locations—AN/ARC-27, -27A UHF Communications System, AN/ARN-6 Radio Compass, AN/ARN-21 UHF Navigation System and AN/ARN-30, -30A Visual Omnirange Receiver



1. Control C-629/APX-6 (Used with receiver-transmitter RT-82/APX-6) or Control C-1159/APX-6B (Used with receiver-transmitter RT-82A/APX-6)
2. Control C-1272/APA-89 (Airplanes BuNo. 133043 and subsequent)
3. Mechanical Linkage 89R1346-1 (G.A.E.C.) (Airplanes BuNo. 133149 through 133207, 133331 and 133332) or Mechanical Linkage 89R1346-3 (G.A.E.C.) (Airplanes BuNo. 133043, 133044, 133208 through 133328 and 133333 and subsequent)
4. Control C-744/ARC-5 and Adapter MC-211/A (Airplanes BuNo. 133043, 133044, 133149 through 133328 and 133331 and subsequent)
5. Range Receiver R-23( )/ARC-5 Adapter MC-211/A, Adapter MX-21/ARC-5 Rack MT-7A/ARR-2 and Mount MT-5/ARR-2 (Airplanes BuNo. 133043, 133044, 133149 through 133328 and 133331 and subsequent)
6. Relay RE-120/ARA-25 and Mount MT-1042/ARA-25
7. Receiver-Transmitter RT-82/APX-6 and Mount MT-362A/A (Airplanes BuNo. 129139 through 129153, 133045 through 133208 and 133329 through 133332) or Receiver-Transmitter RT-82/APX-6 (modified) or RT-82A/APX-6 and Mount MT-362A/A (Airplanes BuNo. 133043, 133044, 133209 through 133328 and 133333 and subsequent)
8. Marker Beacon Antenna AT-134A/ARN (Airplanes BuNo. 133043, 133044, 133149 through 133328 and 133331 and subsequent)
9. Coder KY-81/APA-89 (Airplanes BuNo. 133043 and subsequent)
10. Marker Beacon Receiver R-8/ARN-8 (Airplanes BuNo. 133043, 133044, 133149 through 133328 and 133331 and subsequent)
11. Antenna AS-578/ARA-25
12. Control Amplifier AM-608/ARA-25 and Mount MT-1043/ARA-25

Figure 4-5A-2. Electronics Units Locations—AN/APA-89 Coder Group, AN/APX-6, -6B IFF System, AN/ARA-25 UHF Direction Finder, AN/ARC-5 Range Receiver and AN/ARN-8 Marker Beacon Receiver

SEARCH RADAR SYSTEM AN/APS-38A.

See Confidential Supplement, NavAer 01-85SAA-1A.

SONOBUOY RECEIVER AN/ARR-26A.

See Confidential Supplement, NavAer 01-85SAA-1A.

WIRE RECORDER 13-A-3-J OR IC/VRW-7.

This is a recording device designed for operation on a nominal 28-volt, direct-current power source. The equipment functions primarily to record signals from the sonobuoys and is composed of a recording mechanism consists of a recording head and a wire transport-motor and associated mechanism, and a base plate with shock mounts and accessories. The recording mechanism, an audio amplifier, a 30-kc oscillator, a driveing mechanism. The output of the audio amplifier is connected in series with the oscillator transformer to the coil in the recording head. The audio signal is recorded magnetically on a moving wire as it runs through a groove in the recording head. The drive mechanism moves the wire from a take-off spool through the guide pulleys and recording head onto the take-up spool.

PREPARATION FOR USE.

a. Open cover and place a loaded spool on left shaft, with wire feeding off the top. Place an empty spool on right shaft.

position lights switch set to BRT or DIM, then the wing and tail position lights burn continuously. The wing position lights and the white tail position light will flash alternately with the fuselage lights and yellow tail position light when the flash-steady switch is set to FLSH.

TAIL POSITION LIGHTS.

The tail position lights are installed on the trailing edge of the rudder. The upper light is fitted with a yellow cover, the lower with a white cover. Both lights incorporate 28-volt bayonet type lamps and are controlled by a selector switch located on the exterior lights control panel.

TAIL POSITION LIGHTS SELECTOR SWITCH.[1]

This toggle switch can be set at any of three positions, BRIGHT, DIM or OFF, and is on the exterior lights control panel (figure 4-7). The tail position lights will burn continuously if the master switch is set to MAN, CODE or STDY. If the master switch is set to FLASH the tail position lights will flash alternately with the wing position lights.

WING AND TAIL POSITION LIGHTS SELECTOR SWITCH.[2]

See Tail Position Lights Selector Switch paragraph above.

FORMATION LIGHTS.

A white formation light is located on the underside of each outboard wing panel. The lights are controlled by the master switch and by the formation lights switch.

FORMATION LIGHTS SELECTOR SWITCH.[1]

The formation lights control is a three-position toggle switch on the exterior lights control panel (figure 4-7). It can be set at BRIGHT, DIM or OFF. The formation lights will be lighted continuously when the master switch is set to MAN, CODE, STDY or FLASH and the formation lights switch is set to BRIGHT or DIM.

FORMATION LIGHTS SELECTOR SWITCH.[2]

The three-position formation lights switch is located on the exterior lights control panel (figure 4-7A) and can be set to OFF, BRT or DIM. The formation lights will burn continuously when the master switch is set to ON, the formation lights switch is set to BRT or DIM and the flash-steady switch is set to either STDY or FLSH.

FLASH-STEADY SELECTOR SWITCH.[2]

The two-position flash-steady switch is located on the exterior lights control panel on the overhead console (figure 4-7A). When the master switch is set to ON and the flash-steady switch to STDY, all exterior lights are illuminated continuously provided the individual light switches are turned on. The FLSH position energizes the type F-1 flasher unit, which supplies interrupted dc for alternate flashing of the wing position lights and white tail light with the fuselage lights and yellow tail light.

INTERIOR LIGHTING SYSTEM.

The interior lighting system consists of the instrument panel lights, console lights, utility lights, compartment dome lights and the torpedo bay light. All lighting circuits are energized from the primary bus except for the forward and center red dome lights, which receive power from the battery bus. Circuit breakers and fuses are grouped on the right circuit breaker panel in the pilots' compartment.

INSTRUMENT LIGHTS.

The instrument lights provide illumination for the pilot's and co-pilot's primary and secondary instruments, the emergency hydraulic panel and the stand-by compass. These lights are controlled by rotary switches which are located on the center instrument panel. Resistors, located in the nose wheel well resistor box, are cut into or out of the circuit and, depending on the setting of the light switches, control light intensity. Circuit protection for the pilot's and co-pilot's primary and secondary instrument lights is furnished by fuses which are installed in holders on the right circuit breaker panel.

INSTRUMENT LIGHT CONTROL SWITCHES.

The pilot's and co-pilot's primary and secondary instrument light control switches are of the rotary type and are located on the center instrument panel (40 and 42, figure 1-4). Each switch serves as an on-off and light intensity control. In addition, the pilot's primary instrument lights switch controls brilliance of the various warning lights through the action of four dimming relays located on the main distribution box.

CONSOLE LIGHTS.

The console lights provide illumination for the pilot's overhead and lower consoles, the MAD-CM operator's console, and the radar-sono operator's console. The pilot's overhead console lights are controlled by a rotary switch. Resistors, located in the nose wheel well resistor box, are cut into or out of the circuit, depending on switch setting, to control light intensity. The pilot's lower console lights, MAD-CM operator's console lights, and radar-sono operator's console lights are controlled by rheostats. Fuses for the console lights circuits are installed in holders on the right circuit breaker panel.

CONSOLE LIGHTS RHEOSTATS.

Rheostats provide ON-OFF control and regulate intensity of the pilot's lower console lights, the MAD-CM operator's and the radar-sono operator's console lights. Rotation clockwise from the OFF position decreases resistance. Maximum resistance is obtained when the rheostat is turned on from the OFF position.

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[1] S2F-1 airplanes BuNo. 129139 through 129153 and 133045 through 133148.

[2] S2F-1 airplanes BuNo. 133043, 133044, 133149 and subsequent; S2F-2 airplanes BuNo. 133329 and subsequent.

UTILITY LIGHTS.

A utility light is installed at each crew member's station for auxiliary lighting purposes. The lights are demountable and, by means of a ball and socket arrangement, may be rotated to any desired position. A switch installed on the lamp housing provides ON-OFF and intensity control. The utility lights receive power from the primary bus through the 5-ampere UTILITY LTS. circuit breakers.

DOME LIGHTS.

Compartment illumination is provided by the forward, center, and aft dome lights. Each light assembly is fitted with a red and a white single contact bayonet-based lamp and a cover. All lights are toggle switch controlled. The forward dome light is controlled by a guarded switch installed overhead and forward of the light. The center dome light is controlled by both a guarded switch installed overhead at the radar-sono operator's station and by two parallel-wired switches, one bracketed to the structure forward of the entrance door and the other installed adjacent to the guarded switch. The aft dome light is controlled by a guarded switch bracketed to the forward face of the bulkhead in the operators' compartment. The guards are installed on the switches to prevent inadvertent use of the white lights during flight. The forward and center red dome lights are energized from the battery bus. The forward and center white dome lights and the aft white and red dome lights receive power from the primary bus. Circuit protection is afforded by two 5-ampere DOME LTS. circuit breakers installed on the right circuit breaker panel in the pilots' compartment.

CONTROLS.

FORWARD DOME LIGHT SWITCH.

The three-position forward dome light switch is bracketed to the structure overhead and forward of the dome light. Switch positions are WHITE, OFF, and RED. The WHITE setting illuminates the white lamp. The RED position illuminates the red lamp. A plastic guard prevents inadvertent illumination of the white lamp during flight.

CENTER DOME WHITE LIGHT SWITCH.

The center dome white light switch is installed overhead at the radar-sono operator's station. Switch positions are ON and OFF. The ON position completes a circuit from the primary bus to illuminate the white lamp. The OFF setting not only extinguishes the white lamp but also completes a circuit from the battery bus to the parallel wired center dome red light switch and the entrance door center dome red light switch. The center dome white light switch is guarded to prevent inadvertent illumination of the white lamp during flight.

CENTER DOME RED LIGHT SWITCHES.

The two center dome red light switches are of the single pole, double-throw type and are parallel wired to permit alternate control of the center dome red light. One switch is installed overhead at the radar-sono operator's station adjacent to the guarded center dome white light switch, the other is bracketed to the structure forward of the entrance door.

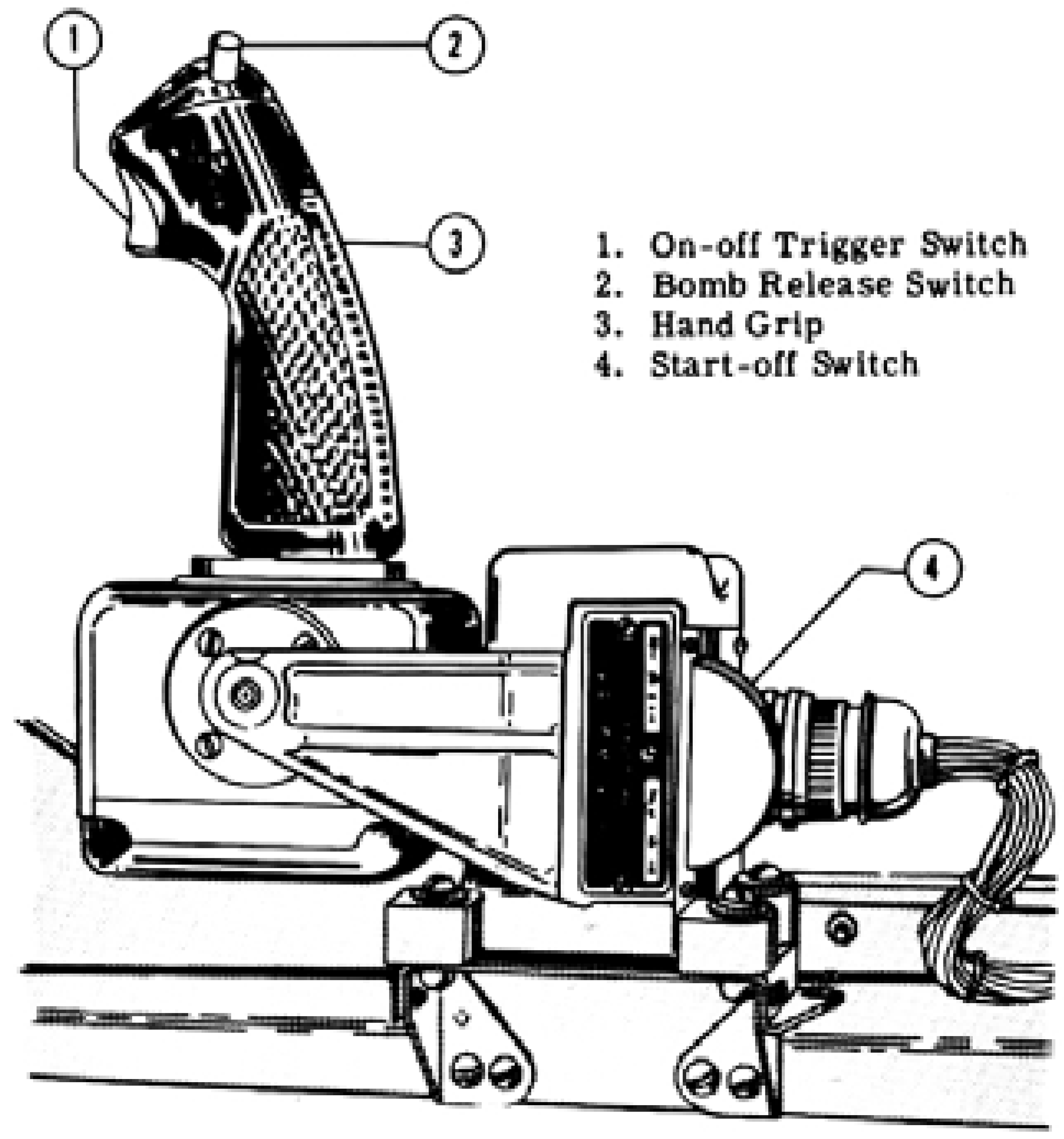

Figure 4-8A. Searchlight Control

AFT DOME LIGHT SWITCH.

The aft dome light switch is installed on the forward face of the bulkhead in the operators' compartment. The switch is a single pole, double-throw unit with positions of WHITE, OFF, and RED. The switch illuminates either the red or the white lamp, depending on switch setting. A plastic guard prevents inadvertent illumination of the white lamp during flight.

APPROACH LIGHT.

The approach light is installed in the leading edge of the left wing outer panel and provides the landing signal officer with a visual reference to the airplane's approach attitude and gives him an indication of the landing gear and arresting hook condition. The approach light is normally controlled by the combined operation of the landing gear down-lock switches and the arresting hook switch. When the airplane is used for field carrier landing practice (bounce drill), a hook by-pass switch, located on the nose wheel well junction box, can be actuated by a ground crewman to make the illumination of the approach light a function of the landing gear only. The approach light is fitted with a conventional red, green and amber filter. When the exterior lights master switch is set to ON, the approach light will operate as follows, according to the position of the landing gear and arresting hook:

Landing Gear	*Hook*	*Light*
Locked Down	Down	On
Not Locked Down	Any Position	Off

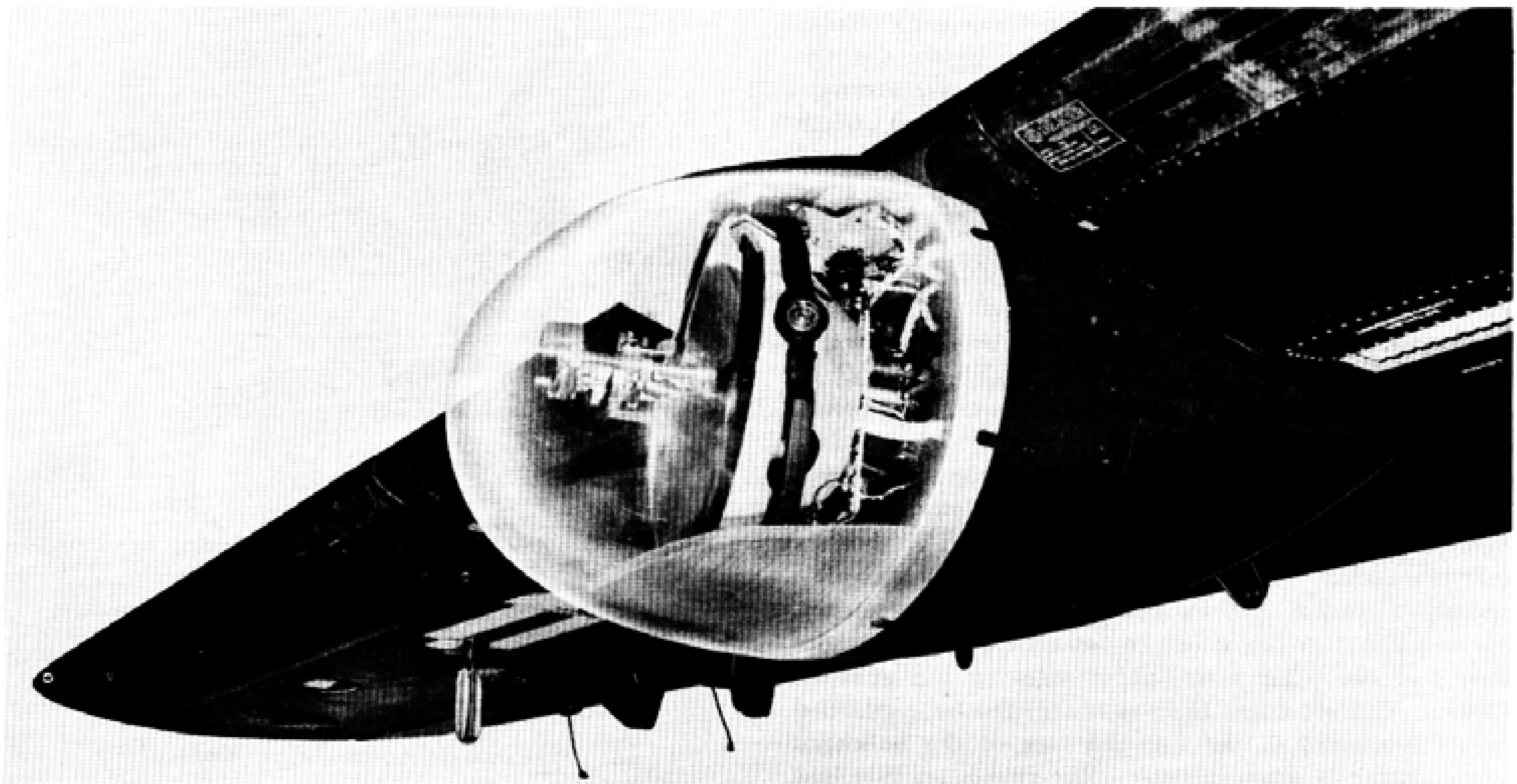

Figure 4-8B. Searchlight Installation

Note

If the arresting hook by-pass switch is actuated, the approach light will be controlled by the landing gear down-lock switches only. Normal system operation can be restored by extending the arresting hook or by turning off all electric power.

SEARCHLIGHT.

A type AN/AVQ-2A[1] or AN/AVQ-2C[2] searchlight set is installed, with the searchlight mounted in the leading edge of the right wing (figure 4-8B). The searchlight is a remotely controlled, high intensity carbon arc lamp having a minimum rating of 70 million candlepower and is used as a target identifying device. The carbon arc lamp located within the searchlight housing can be positioned through 53 degrees in azimuth (26.5 degrees either side of center) and 48 degrees in elevation (43 degrees depression from center and 5 degrees elevation from center).

SEARCHLIGHT CONTROL.

This control (figure 4-8A) is mounted in a fixed position just to the right of the co-pilot's seat on some airplanes.[3] On later airplanes,[4] the searchlight control unit can be stowed on a bracket located on the floor behind the co-pilot's seat. When used, this control is mounted on a bracket, which is secured to the stringer alongside the co-pilot's window, by a quick releasing, wing type fastener. The searchlight control can be removed by disconnecting a connector plug at the aft end of the unit, rotating the wing type fastener located under the control, and sliding the unit inboard. The cable end is stowed under a strap aft of the control position.

The control contains a START-OFF switch (4, figure 4-8A) which controls the supply of electrical power to the searchlight set, a trigger switch (1, figure 4-8A) which is used to turn the lamp on or off, a bomb release switch (2, figure 4-8A) and a handgrip. Moving the handgrip on the control (3, figure 4-8A) forward or aft positions the lamp in elevation; turning it to the left or to the right positions the lamp in azimuth; a movement of the hand control through one degree of arc will dispose the cabon arc lamp a like amount. The handgrip and lamp return to the neutral position when the handgrip is released.

SEARCHLIGHT AZIMUTH-ELEVATION INDICATOR.

This indicator, located on the co-pilot's instrument panel (33, figure 1-4), shows the direction and degree of movement of the carbon arc lamp in azimuth and elevation.

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[1]S2F-1 airplanes BuNo. 129139 through 133328, and S2F-2 airplanes BuNo. 133329 and subsequent.

[2]S2F-1 airplanes BuNo. 136393 and subsequent.

[3]S2F-1 airplanes BuNo. 129139 through 133292, and S2F-2 airplanes BuNo. 133329 through 133342.

[4]S2F-1 airplanes BuNo. 133293 and subsequent, and S2F-2 airplanes BuNo. 133343 and subsequent.

OPERATION IN FLIGHT.

a. Check that left and right d-c generator switches are ON.

b. Set armament selector to ROCKETS position to energize armament bus.

c. Check that a-c generator field switch is ON[3] or set inverter selector switch to NORMAL.[4]

d. Check that the following circuit breakers are closed: searchlight dynamotor, searchlight control, searchlight a-c power and searchlight trigger.

e. Set START-OFF switch on searchlight control to START and allow one full minute for amplifier to warm up.

f. Move searchlight control handgrip slowly through its full range in azimuth and elevation and check that the pointers of the azimuth-elevation indicator move in synchronization with the motion of the handgrip.

WARNING

Do not depress trigger switch on handgrip as this will cause the searchlight to illuminate and temporarily blind the pilot if he is looking at the light.

g. The searchlight is now ready for operation. No check should be made on the illumination of the carbon arc lamp. Do not attempt a quick triggering to test-flash the lamp, since this will result in damage to the lamp. When turned on, the arc reaches full intensity in approximately two seconds.

CAUTION

To avoid overheating, do not operate carbon arc lamp for more than 30 seconds. After operating for 30 seconds, the lamp should be left off for 4.5 minutes for cooling.

Note

It is recommended that the handgrip be grasped with both hands to prevent the searchlight from deviating from the target as the trigger is squeezed.

h. If the light flickers badly or goes off on the first strike of the arc, release the trigger switch. Wait several seconds and squeeze the trigger switch to strike the arc again. If a bad flicker persists, secure the arc as defective.

CAUTION

Extensive damage to the equipment will result from continued operation when the searchlight is not functioning properly. Secure the equipment when any of the following indications occur: doughnut shaped beam, oscillation of the light on and off at approximately two-second intervals, yellow or orange colored beam.

AUTOMATIC PILOT.

DESCRIPTION.

The P-1 automatic pilot is an electrical and electronic device which automatically maintains the airplane in level flight or any desired attitude through a range of 40 degrees in climb or dive, 40 degrees in bank, and 360 degrees in azimuth, or permits maneuvering within these limits. When the airplane is displaced from its course, while the auto pilot is engaged, it is returned smoothly to its original attitude and course. While under automatic control the airplane can be made to climb, dive, and execute perfectly coordinated turns by operating the stick type controller on the pedestal. Bank and pitch signals are supplied by the gyro autosyns in the co-pilot's gyro horizon indicator. Azimuth signals, as detected by the right wing G-2 compass transmitter, are supplied by the co-pilot's G-2 compass master direction indicator. Signals for turn control are furnished by the co-pilot's turn and bank indicator so as to effect a coordinated motion of rudder, ailerons, and elevators when making an automatic turn.

An automatic altitude control feature is included to control the auto pilot operation at a preset altitude, as determined by the setting of the pilot's radio altimeter bug pointer. The altitude is measured relative to the terrain over which the airplane is flying. Any deviation from the preset altitude will cause the airplane to return smoothly to that altitude. Selection of a new preset altitude while in flight will also cause the airplane to approach that altitude in a curved flight path. The automatic altitude control receives d-c signals from the radio altimeter receiver-transmitter; a positive signal to cause climb and a negative signal to initiate dive. The altitude control, in turn, transmits a voltage to the auto pilot to start action of the airplane controls.

This enables the pilot to control the altitude of the airplane by setting the pilot's altitude limit switch.

The incorporation of the automatic altitude control into the auto pilot system is governed by a controller mounted in the auto pilot panel of the pedestal console, between the pilot and co-pilot. The auto pilot is engaged and disengaged electrically by means of a clutch switch. It can also be disengaged by mechanical means in an emergency.

The system uses both a-c and d-c power. The 115-volt, three-phase, 400-cycle, ac is supplied by the main inverter only. In the event of failure of the main inverter, the auto pilot becomes inoperative. The a-c portion of the power supply is protected by the power junction box No. 1 and No. 2 fuses. A-C power for the G-2 compass portion is protected by the LEFT G-2 COMPASS fuse. The d-c portion is supplied from the primary bus and is protected by the R.H. G-2 COMPASS and AUTO PILOT circuit breakers.

AUTOMATIC ALTITUDE CONTROL.

The automatic altitude control functions to tie-in the AN/APN-22 radio altimeter with the P-1 auto pilot system to ensure proper terrain-clearance altitude during normal straight and level flight on auto pilot. The desired altitude is preset in the AN/APN-22 radio altimeter indicator by setting the bug pointer by means of the indicator knob (see Radio Altimeter AN/APN-22, this section). At low altitudes, the terrain clearance will be within ± 10 feet of the set altitude; at high altitudes, within five percent of the set altitude. A safety circuit will cause the automatic altitude control to drop out, and the red low limit warning light to come on, if the indicated altitude is less than the setting of the bug pointer by approximately 400 feet at high altitudes and by a maximum of approximately 50 feet (but decreasing with rate of error build-up) at low altitudes. In addition to malfunctioning as a cause, this drop-out of the automatic altitude control at low altitudes also could be caused by a sudden change in terrain. Operation is good from 0 to 5000 feet over water, but less over land. Altitude settings may be changed while flying on automatic altitude control by resetting the bug pointer. Selection of a new altitude will cause the airplane to approach the selected altitude in a curved flight path. The automatic altitude control receives d-c signals from the AN/APN-22 radio altimeter (a positive signal to cause climb and a negative signal to initiate dive), and then transmits a voltage to the auto pilot to start action of the airplane controls. Power is derived from the a-c main and stand-by inverters, through the altimeter circuit breaker panel.

NORMAL CONTROLS.

AUTO PILOT POWER SWITCH.

This two position ON-OFF toggle switch (12, figure 1-6), located immediately aft of the clutch switch in the pedestal, controls the d-c power supply to the auto pilot.

AUTO PILOT CLUTCH SWITCH.

This push-pull, button type switch (25, figure 1-6), located immediately aft of the stick type controller in the pedestal, is placarded AUTO PILOT PUSH ON. It is used to engage or disengage all the servo clutches in the auto pilot system. When pushed to the on position, it is held on by a solenoid. When solenoid is deenergized, a spring in the switch returns it to off position.

STICK TYPE CONTROLLER.

This unit (28, figure 1-6) is a square box installed in the pedestal just forward of the clutch switch. It consists of a miniature control stick with a detent button in the top of the knob handle, and two trim wheels for bank and pitch control (26 and 27, figure 1-6). The control stick is used for maneuvering when the auto pilot is engaged, and the trim wheels for trimming for straight and level flight while on auto pilot.

AUTOMATIC ALTITUDE CONTROLLER.

The incorporation of the automatic altitude control into the auto pilot system is governed by an altitude controller located on the folding console. This control contains a CENTER-ENGAGE switch (23, figure 1-6), a red warning light (17, figure 1-6) and a PITCH ANGLE potentiometer (24, figure 1-6). The setting of the potentiometer determines the maximum elevator angle for the airplane in which the controller is installed. The equipment is designed to hold the airplane within approximately ± 10 feet of indicated altitude below 200 feet and within ± 5 per cent of indicated altitude above 200 feet. The indicated error is the difference between the altimeter bug pointer setting on the radio altimeter indicator (see Radio Altimeter AN/APN-22 paragraph, this section) and the height at which the airplane flies, as indicated by the radio altimeter pointer. The actual error signal fed to the auto pilot may be different, due to dynamic response limitations of the altimeter servo system and to indicator selsyn tolerance.

EMERGENCY CONTROLS.

MANUAL RELEASE.

This control (33, figure 1-6) is a red "T" handle mounted on the left side of the lower console. When pulled, this control mechanically disengages all the servos in the auto pilot system. Once disengaged, the auto pilot cannot be used again until each servo disconnect has been manually reengaged—a ground operation.

OPERATION OF AUTO PILOT.

BEFORE ENGAGING AUTO PILOT.

a. Manually trim airplane for level flight.

b. Check that main inverter is on.

c. Set automatic altitude control switch to CENTER.

d. Center stick type controller. Detent button will pop up.

e. Center pitch and bank trim wheels on indexing marks.

f. Check that AUTO PILOT circuit breaker is in.

g. Set G-2 compass switch to COMPASS CONTROL.

h. Set outside dial of co-pilot's master direction indicator to approximate heading shown on correspondence dial.

ENGAGING AUTO PILOT.

CAUTION

Do not engage the auto pilot while in a turn, or in climbs, dives, or banks of more than 10 degrees. To do so may result in insufficient trim adjustment being available at the controller to return the ship to level flight.

a. Turn auto pilot power switch ON.

b. Wait two minutes to allow amplifiers to warm up.

Note

Approximately two minutes are required for the gyros to come up to speed after the inverter is turned on. If main inverter had not been operating, wait two minutes before proceding.

c. Engage auto pilot by pushing clutch switch down.

d. The airplane will follow the course as directed by the master direction indicator. Check flight instruments and carefully trim for straight and level flight with bank and pitch trim wheels.

CAUTION

Do not adjust airplane trim tabs while auto pilot is engaged. Do not cage the co-pilot's master direction indicator or co-pilot's gyro horizon indicator while the auto pilot is engaged, since caging either of these will automatically cause the clutch switch to pop out, disengaging the auto pilot.

After any change in load or speed, disengage auto pilot (using clutch switch), retrim airplane manually, then re-engage auto pilot. In normal flight on auto pilot, it is recommended that the airplane be re-trimmed every hour. Always disengage the auto pilot, trim manually, and re-engage auto pilot.

MANEUVERING.

Note

Do not maneuver in pitch with altitude control engaged.

a. To climb, move stick type controller aft, or turn pitch trim wheel aft.

b. To dive, move stick type controller forward, or turn pitch trim wheel forward.

c. To turn, move stick type controller to left or right. The ailerons and rudder will be coordinated. To make a level flight turn it is necessary to move the stick controller aft as no elevator signal is fed to the elevators when the stick type controller is moved only in the lateral direction.

d. To return to straight and level flight, return stick type controller to center position. Ensure that detent button springs up, indicating neutral.

FLYING ON PRESET ALTITUDE.

a. Proceed as in ENGAGING AUTO PILOT, through step b., then turn on radio altimeter by rotating ON-LIMIT switch clockwise.

b. Continue to rotate ON-LIMIT switch until bug pointer lines up with the altitude needle on the AN/APN-22 indicator.

Note

Only the pilot's indicator has control over the auto pilot altitude control.

c. Set PITCH ANGLE potentiometer on altitude controller to 3. This is an adjustment to limit the amount of up elevator available to the altitude control (1 is minimum; 5 is maximum).

Note

An adjustment in the electronic control amplifier limits the amount of down elevator; it is set at 0.4 of the up elevator displacement.

d. Allow three minutes for warm-up.

e. Trim airplane manually.

f. Press auto pilot clutch switch.

g. Trim airplane on auto pilot.

h. Check that bug pointer and altitude indicator pointer positions on AN/APN-22 indicator agree.

i. Set altitude controller CENTER-ENGAGE switch to ENGAGE. If engagement is smooth and red low limit warning light stays off, rotate pitch angle selector to position 5. Airplane is now under automatic altitude control.

Note

Lower settings of the pitch angle selector will not control altitude accurately, although they may be desirable for flight in rough air.

j. To change to another altitude, reset bug pointer to desired altitude.

k. In going to a higher altitude, move bug pointer slowly to prevent negative error signal from building up and causing cut-out of automatic altitude control. Power settings must also be increased.

l. In going to a lower altitude, bug pointer may be moved faster but power settings should be reduced and altitude should be carefully monitored to prevent possible overshooting. Automatic altitude control should provide smooth leveling out but, if trim has changed due to wide speed variation, desired altitude may not be held accurately. Re-trimming and reengagement will correct.

m. At low altitudes, turns (especially with fast entry into high bank angles) will cause loss of altitude. To prevent this, provide sufficient up elevator by means of auto pilot stick controller. Bank angles of over 30 degrees may cause a loss of AN/APN-22 signal and consequent drop-out of automatic altitude control.

n. To release airplane from automatic altitude control, throw altitude controller switch to CENTER.

o. Adjustment of climb and dive angle limits can be made by manipulation of the PITCH ANGLE knob on the altitude controller to suit personnel or stall limits. When changing altitude under automatic altitude control the airplane should dive at a constant rate initially and taper off as the new altitude is approached.

Note

When signal is too weak to provide a reliable altitude indication, the altitude indicator needle will move behind a mask so that it cannot be used.

WARNING

If the red low limit warning light goes on (indicating malfunctioning or insufficient signal), set CENTER-ENGAGE switch to CENTER. Light will go out. Reengagement may be attempted after 60 seconds, but if the warning light continues to come on, leave the switch in CENTER position and do not attempt to operate on preset altitude until the system is checked. The AN/APN-22 indicator may still operate correctly for visual indication, but should be checked by reference to the barometric altimeter. The auto pilot may still be used for other operations.

Note

Failure of the system to engage, indicated by the red warning light, can be due to any of several faults: improper engagement of the auto pilot, unreliable signals from the AN/APN-22, poor calibration of the altimeter and adapter, and/or insufficient synchronization time after large bug pointer movements.

p. To overpower automatic altitude control, operate stick controller or manual elevator control. When automatic altitude control is again desired, release manual controls and auto pilot will bring airplane back on controlled altitude course.

Note

If overpowering in a dive, the altitude control may disengage and the red light may come on, depending upon the rate and amount of overpowering.

q. Coordinated, constant altitude turns will be made on altitude control if the auto pilot stick controller is moved in bank only.

CAUTION

Do not move controller in pitch while on altitude control. If the stick controller is moved in pitch it will overpower the altitude control signal and cause the airplane to climb or glide. With the altitude control operating it is recommended that no more than a standard rate turn be used at any time. At altitudes below 1000 feet it is recommended that both the pilot and co-pilot constantly monitor the altitude control in both straight and turning flight.

WARNING

When making turns on altitude control, if the AN/APN-22 radio altimeter drops out or the altitude hold cuts out, an abrupt diving turn will occur. This is because the elevator will return to the position required for straight and level flight trim, which is less than that required in the turn.

DISENGAGING AUTO PILOT.

a. Pull clutch switch up (off) to disengage auto pilot.

b. Turn auto pilot power switch off if the system is not to be used again soon.

Note

Caging the co-pilot's gyro horizon indicator or co-pilot's master direction indicator will disengage the auto pilot. If this is done first, follow step b., above.

EMERGENCY DISENGAGEMENT OF AUTO PILOT.

a. Pull MANUAL RELEASE "T" handle on left side of sloping console.

Note

Use this system only when the normal electrical disengagement fails. This handle disengages the auto pilot servo clutches, and the system cannot be reengaged while in flight. Clutches must be reset manually on the ground.

NAVIGATION EQUIPMENT.

G-2 COMPASS SYSTEM.

The pilot's G-2 compass system is powered exclusively by the pilot's instrument inverter while the co-pilot's G-2 compass system is powered by either the main inverter or the stand-by inverter through a power adapter. A remote compass transmitter transmits heading signals to each master direction indicator through an amplifier. These signals reflect the magnetic heading of the airplane (indicated on the center dial of the master direction indicator), while the master direction indicator itself detects the gyroscopic heading. Any variation between the two headings sets up a signal within the indicator, which is sent to the amplifier, strengthened, and sent back to the indicator, where the internal gyro is precessed until an average of the oscillating magnetic heading and the gyroscopic heading is shown on the indicator outer dial. The heading thus obtained contains neither the inaccuracy of free gyro drift nor the northerly turning error or short period oscillations of pure magnetic indications.

G-2 COMPASS CONTROL SWITCHES.

The compass control switches on the pilot's and co-pilot's instrument panels (26, figure 1-4) provide a method of disconnecting the effect of the remote compass transmitter upon each master direction indicator when flying over areas where magnetic indications are unreliable. When the compass transmitter is disconnected, the switch is set at FREE DG and the master directional gyro may be used as a standard directional gyro. If used as a directional gyro, the indicator must be reset periodically from a magnetic compass or other source of heading information. A correction card is supplied for the master indicator.

Note

Gyro drift is 15 degrees per hour maximum.

MK 6A CHART PLOTTING BOARD.

A MK 6A chart plotting board is stowed in the forward end of a combination map case and chart board holder, located on the right side of the pilots' compartment, adjacent to the co-pilot's seat.

ARMAMENT EQUIPMENT.

See Confidential Supplement, NavAer 01-85SAA-1A.

FIGURES 4-9 THROUGH 4-22 DELETED

TORPEDO BAY DOORS SYSTEM.

The torpedo bay doors system is operated by 1500 psi hydraulic pressure (figure 1-18). A solenoid-operated, two-position, four-way selector valve is located in the torpedo bay; and a cylinder, containing internal locks to hold the doors in the closed position, is mounted at each end of the torpedo bay. The doors can normally be opened by a switch on the armament panel or by a push button switch on the control wheel. If the doors are operated by the control wheel switch, as soon as they are completely open a limit switch is actuated, which energizes the bomb racks and results in release of the torpedo. The doors are normally closed by the switch on the armament panel. A piston type accumulator is installed in the pressure line to provide rapid opening of the doors; they move from closed to fully open, or from open to closed, in one-half second. The accumulator gage and filler are installed alongside the torpedo inspection door.

CONTROLS AND INDICATOR.

TORPEDO BAY DOORS CONTROL SWITCH.

The torpedo bay doors control switch, located on the armament control panel on the lower console (5, figure 1-6), is a momentary-type toggle switch which is normally at the central, off, position. It is held at OPEN to open the doors or at CLOSE to close them.

WARNING

When opening the torpedo bay doors while on the deck, make certain all ground personnel are clear—doors open or close in one-half second.

CONTROL WHEEL TORPEDO-BOMBS RELEASE SWITCHES.

The torpedo bay doors can also be opened by either of the momentary, push button type torpedo-bombs release switches (7, figure 1-4) located on the pilot's and co-pilot's control wheels. These switches automatically release the torpedo when the doors are fully open.

Note

The torpedo bay doors are normally closed by using the switch on the armament control panel on the lower console (5, figure 1-6).

TORPEDO BAY DOORS OPEN INDICATOR LIGHT.

This red, press-to-test indicator light, engraved OPEN and placarded TORP DOORS, is located on the armament control panel on the lower console (3, figure 1-6). It lights when the torpedo bay doors are opened completely and remains lighted until the doors are fully closed.

TORPEDO BAY DOORS EMERGENCY SYSTEM.

A torpedo bay doors emergency selector valve is located under the emergency access door in the center of the floor between the pilot's and co-pilot's seats. The emergency valves are normally left in their neutral position. After a selection is made with the emergency selector valve, the emergency hand pump is used to move the doors to the desired position. A shuttle valve, between the open and close emergency line, blocks off the line that is not pressurized; the pressure then operates the doors and the emergency dump valve. The emergency dump valve which when operated blocks the pressure port and vents the cylinder lines not pressurized back to the reservoir, has a manual reset button, located near the torpedo inspection door, which is used to return the system to the normal hydraulic system after an emergency system use.

TORPEDO BAY DOORS EMERGENCY CONTROL HANDLE.

The torpedo bay doors emergency control handle (3, figure 1-7), located beneath a hinged door in the floor of the pilots' compartment, is set at NORMAL. When it is moved to OPEN or to CLOSE, the doors can be opened or closed by use of the hand pump.

HAND PUMP.

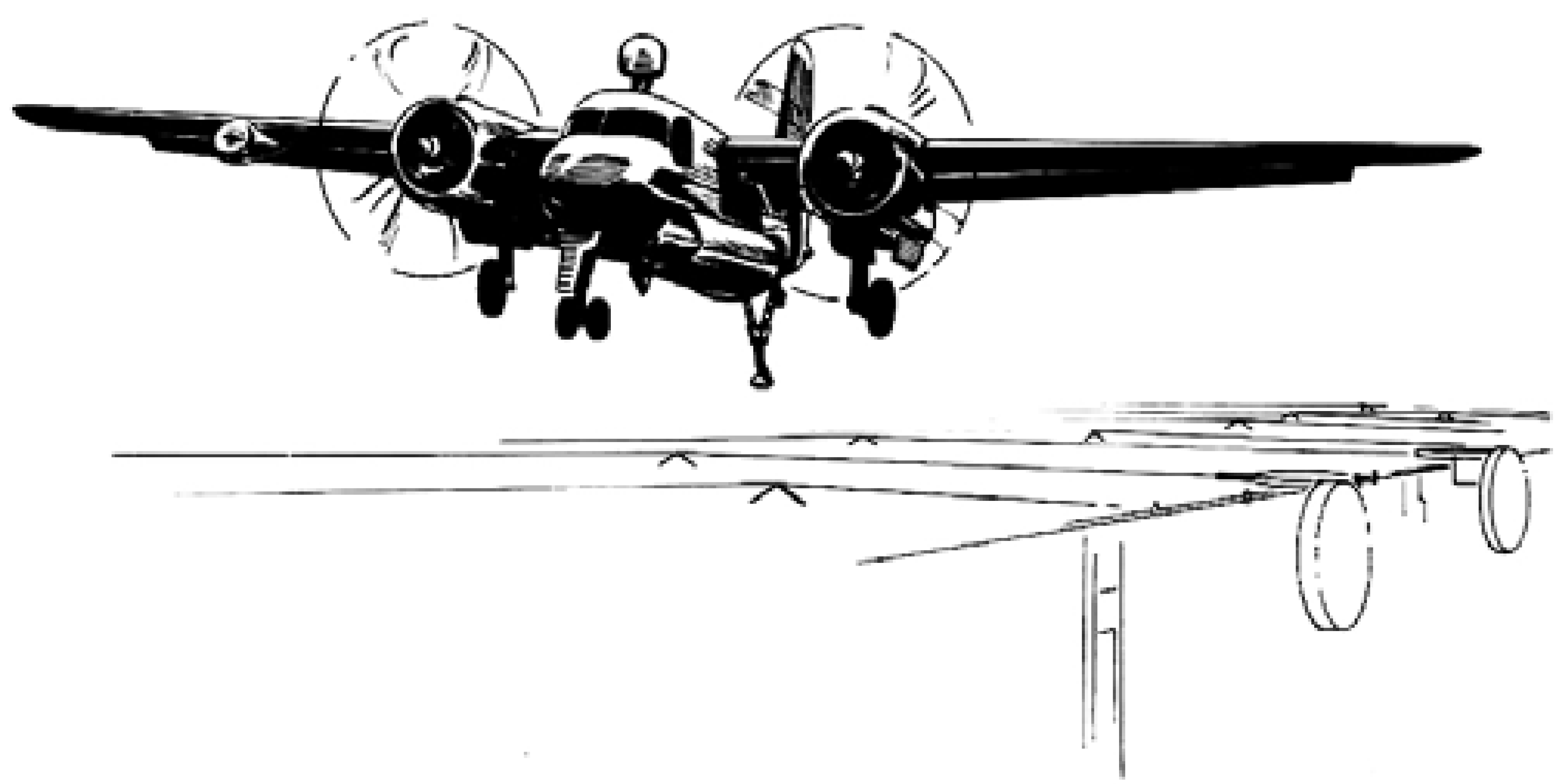
The emergency hydraulic hand pump (16, figure 1-6), located at the right of the folding console, is used with the torpedo doors emergency control handle when the control is at OPEN or CLOSE. The emergency hydraulic hand pump handle used for hand pump operation is normally stowed in a spring clip attached to the rear of the co-pilot's seat.

TORPEDO BAY DOORS EMERGENCY DUMP VALVE RESET BUTTON.

The torpedo bay doors emergency dump valve reset button (figure 1-18), located aft of the MAD-CM operator's seat on the floor of the operators' compartment, is placarded TORPEDO BAY DOOR EMERG. RESET

BUTTON. This button must be pushed in to return the system to normal operation after the emergency system has been used. When the torpedo bay doors emergency control handle is returned from either OPEN or CLOSE to NORMAL and the reset button, placarded PUSH TO RESET, is pushed, the doors can be opened or closed by use of the normal doors control switch, provided the hydraulic system is operative.

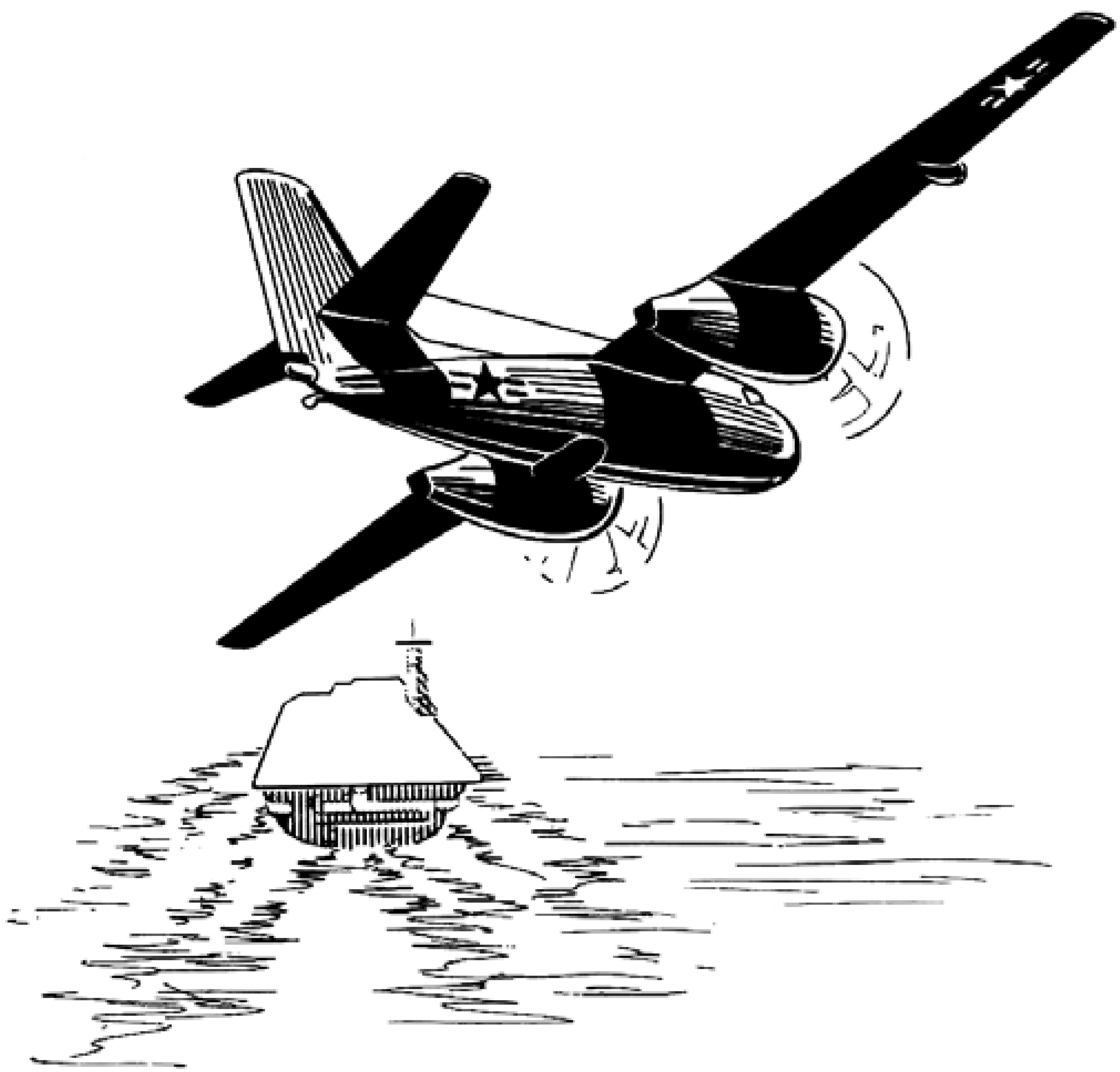
SEE CONFIDENTIAL SUPPLEMENT
NAVER 01-85SAA-1A



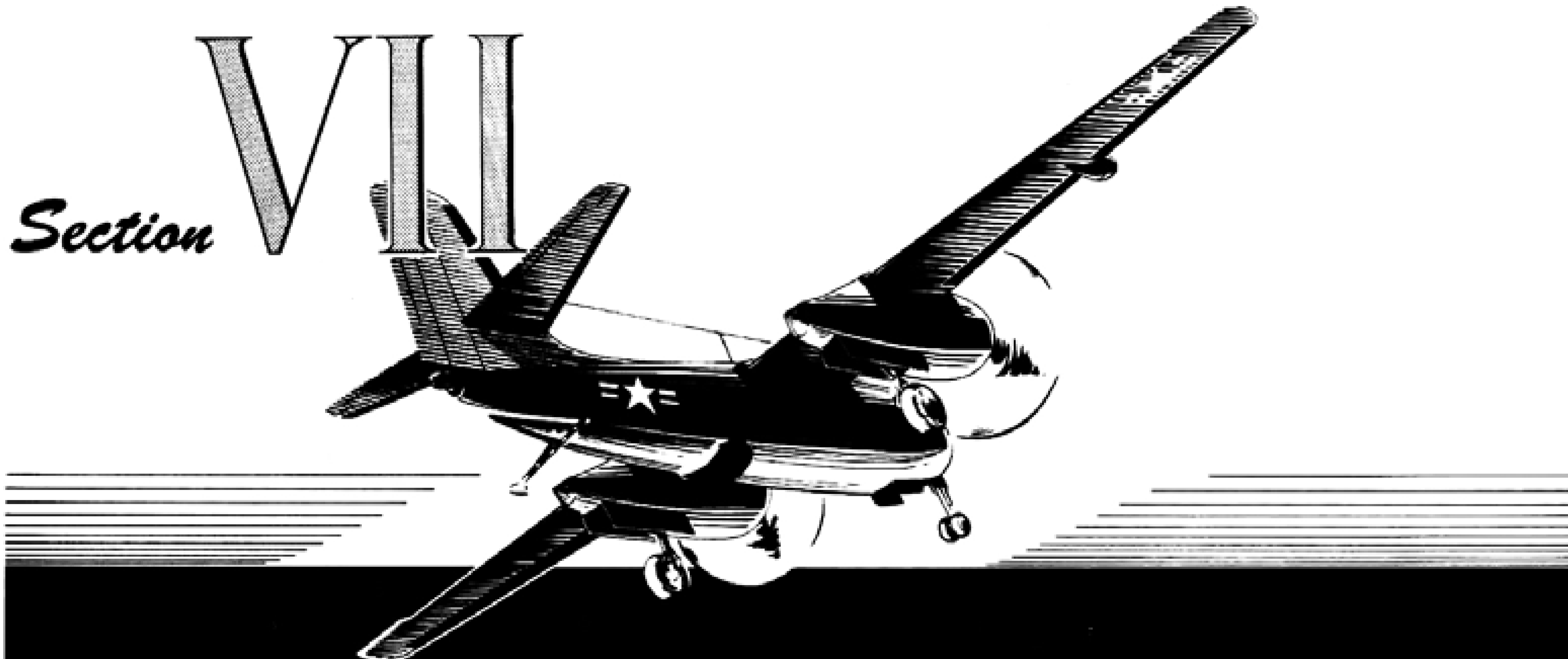
Section VI

FLIGHT CHARACTERISTICS

SEE CONFIDENTIAL SUPPLEMENT
NAVER 01-85SAA-1A



Section VII



SYSTEMS OPERATION

ENGINE OPERATION.

ENGINE OPERATION IN FLIGHT.

a. Set propeller controls and throttles for desired power settings. Refer to Appendix I for cruise control data.

b. Check instrument readings periodically.

POWER CHANGES IN FLIGHT.

a. When increasing power, first increase engine rpm, then manifold pressure.

b. When decreasing power, first reduce manifold pressure, then engine rpm.

Note

> When corrosion preventive compound, Specification AN-VV-C-756, has been added to the engine oil, reduce rpm gradually after operating for extended periods at high power settings in order to avoid a momentary drop in oil pressure below limits.

USE OF CARBURETOR ALTERNATE AIR.

Alternate air should be used whenever conditions are such that carburetor ice may form. The alternate air should be applied prior to the formation of ice, to prevent its developing, rather than after ice has already formed. It is advisable that alternate air be used to improve fuel vaporization and fuel consumption when cruising during cold weather. As detonation may occur at high power settings when full alternate air is used, the alternate air temperature should be regulated to maintain temperature below 38°C (100.4°F). During flight conditions where carburetor air temperature exceeds 38°C in DIRECT position, the allowable manifold pressure for a given rpm shall be reduced by 1 in. Hg for each 6°C that the carburetor air temperature exceeds 38°C.

CAUTION

> To close cowl flaps when alternate air is in use, move carburetor air switch to DIRECT, close cowl flaps, then reset carburetor air switch to ALTERNATE to obtain desired temperature. Unless this is done, alternate air temperature rise may exceed required temperature.

FUEL SYSTEM MANAGEMENT.

Fuel to either or both engines can be fed from either tank. Fuel cannot be fed from both tanks to one engine simultaneously. The various combinations of fuel selector valve settings are shown in figure 7-1. For a discussion of fuel system management during single engine operation, see Section III.

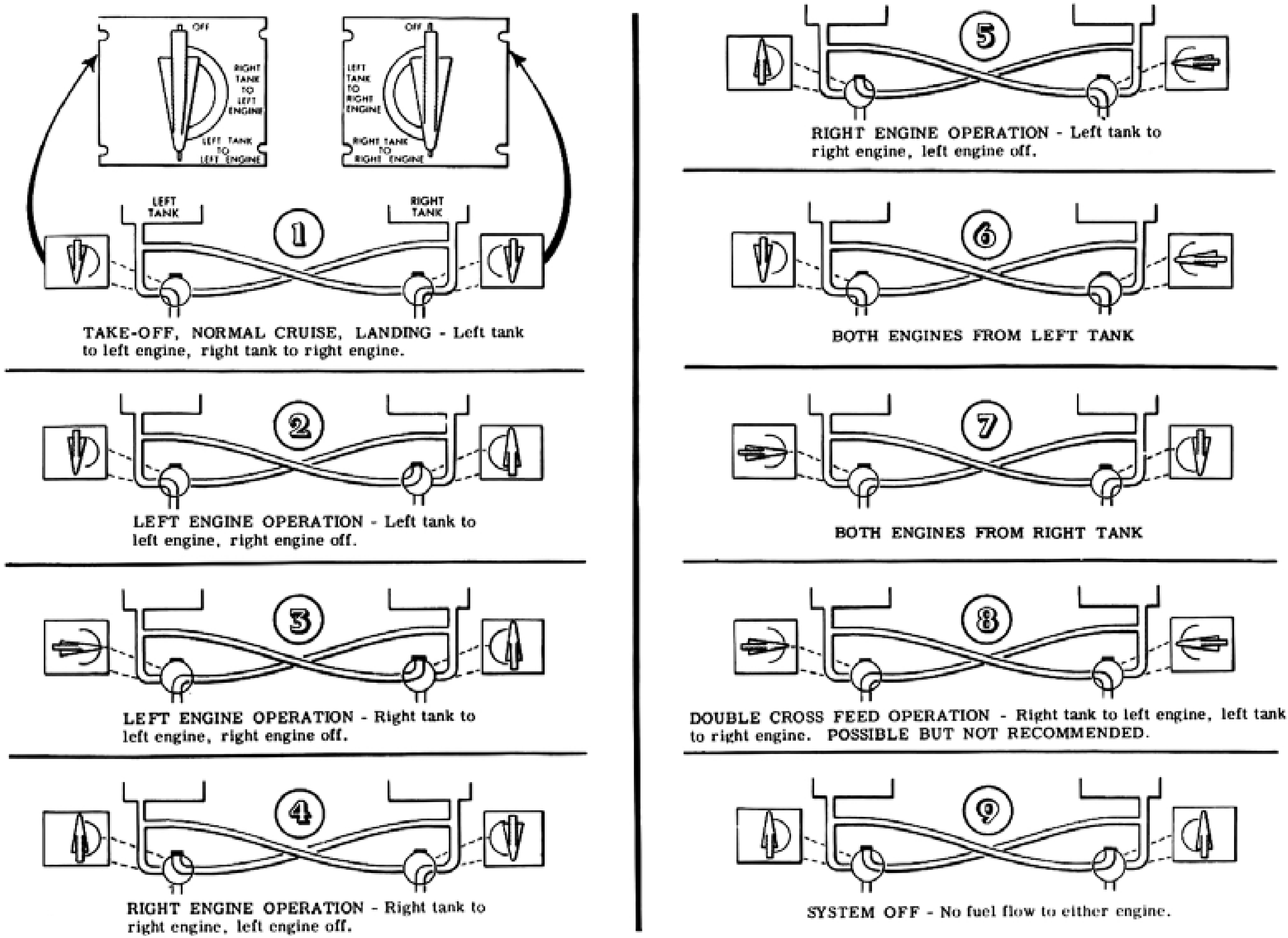


Figure 7-1. Fuel Flow Diagrams

Section VIII

CREW DUTIES

PILOT.

The pilot's primary duties include flying the airplane under all weather conditions and taking command of all operations.

CO-PILOT.

The duties of the co-pilot include operation of the search radar scope, located on the center instrument panel, and the selection and dropping of sonobuoys and marker buoys. In addition, he assists or relieves the pilot in flight control, monitoring fuel and engine controls, navigating and handling communications as directed. The co-pilot also operates the searchlight control.

MAD-CM OPERATOR.

The MAD-CM operator occupies the station at the left side of the operator's compartment (figures 4-3 and 4-3A). His primary duties consist of operating the countermeasures equipment and the MAD gear. Secondary duties are cw transmission on the HF communications equipment and operation of the a-c, retro compressor and main inverter circuit breakers.

BEFORE ENTERING AIRPLANE.

Make sure the MAD boom is properly retracted. Check the wire antenna and countermeasures antenna for security.

ON ENTERING AIRPLANE.

a. Check to make certain that all MAD gear, countermeasures equipment and other associated equipment is aboard, in its proper place, and ready to function.

b. Check that overhead escape hatch is closed and locked.

c. Check that MAD boom switch is in BOOM IN position.

d. Adjust seat as desired.

e. Inspect and adjust safety belt and shoulder harness.

f. See that all power switches on console are off.

g. Check that circuit breakers are all engaged.

GROUND TEST.

a. Check operation of interphone.

b. Check that MAD BOOM IN indicator lights are lighted.

DURING FLIGHT.

Operate the MAD gear and countermeasures receiver as directed.

BEFORE LANDING.

a. Check that MAD gear and countermeasures equipment are turned off.

b. MAD boom switch must be set to BOOM IN and BOOM IN indicator lights must be lighted.

c. Tighten safety belt and shoulder harness.

BEFORE LEAVING AIRPLANE.

See that all power switches are off.

RADAR-SONOBUOY OPERATOR.

The radar-sonobuoy operator occupies the station at the right side of the operators' compartment (figure 4-4). His primary duties consist of operating the search radar and the sonobuoy receiving equipment. The radar-sonobuoy operator is also responsible for operation of the wire recorder.

BEFORE ENTERING AIRPLANE.

a. Check condition of radome.

b. Check to see that sonobuoys are properly loaded.

c. Check condition of sonobuoy antennas.

d. Obtain sonobuoy loading pattern.

ON ENTERING AIRPLANE.

a. Check that all search radar equipment and sonobuoy equipment is aboard, in its proper place, and ready to function.

b. Check that hand crank is not engaged and is stowed in its proper place in electronics compartment.

c. Check that overhead escape hatch is closed, locked and safety-wired.

d. Check that radome switch is in RADOME UP position.

e. Check that all power switches on control panel are off.

f. Adjust seat as desired.

g. Inspect and adjust safety belt and shoulder harness.

GROUND TEST.

a. Check operation of interphone.

b. Check that RADOME UP indicator lights are lighted.

c. Check that all sonobuoy indicator lights are lighted except for those slots which are not loaded.

DURING FLIGHT.

Operate search radar and sonobuoy equipment as directed. Radome extension and retraction should be made at airspeeds below 150 knots IAS.

BEFORE LANDING.

a. Check that radome switch is in the RADOME UP position and that RADOME UP lights are lighted.

b. Tighten safety belt and shoulder harness.

BEFORE LEAVING AIRPLANE.

See that all power switches are off.

Section IX

ALL WEATHER OPERATION

INTRODUCTION.

Except for some repetition necessary for emphasis, clarity, or continuity of thought, this section contains only those procedures that differ from, or are in addition to, the normal operating instructions covered in Section II. Also, any discussions relative to operation are covered in Section VII.

INSTRUMENT FLIGHT.

Flight characteristics for instrument flight are normal. Flight instruments are provided on the pilot's and co-pilot's instrument panels and an automatic pilot is installed. When the automatic pilot is in operation, re-trim the airplane for manual flight at least once every hour. Steep turns and abrupt maneuvers should be avoided. The radio altimeter will provide terrain clearance indications (see Radio Altimeter AN/APN-22 paragraph, Section IV).

INSTRUMENT TAKE-OFF.

BEFORE TAKE-OFF.

Follow normal procedures in Section II.

TAKE-OFF.

a. Follow normal procedures in Section II.

b. Use G-2 compass to maintain direction.

c. Hold nose wheel on runway until take-off speed is reached, then ease control wheel back slowly until airplane leaves ground.

DURING FLIGHT.

a. Check power settings.

b. Maintain carburetor air temperature above icing range by using alternate air as required.

CAUTION

When full alternate air is used at high power settings, detonation may occur. Regulate alternate air to maintain temperature below 38°C (100.4°F). Use RICH mixture if it is not possible to remain below this temperature.

c. If icing conditions are anticipated, turn on anti-icing and de-icing equipment.

d. Keep airplane trimmed. Instruct crew members to remain at their stations unless movement is absolutely necessary for carrying out assigned duties.

FLIGHT IN SNOWSTORMS.

Snow is moisture which has already solidified at temperature below freezing and, consequently, does not normally stick to leading edges to form ice.

FLIGHT IN TURBULENT AIR.

CAUTION

Flying in thunderstorms should be attempted only by well qualified instrument pilots. However, many routine flight operations require a certain amount of thunderstorm flying, since it is often impossible to detect individual storms or to find clear areas between them.

Power setting and pitch attitude should be established before entering a storm. Set cockpit lights to maximum intensity. Power setting and pitch attitude, if maintained throughout the storm, will result in a nearly constant airspeed, regardless of any false readings of the airspeed indicator.

BEFORE TAKE-OFF.

a. Study weather situation to determine thunderstorm areas and prepare a flight plan which will require least exposure to possible storms.

b. Check proper operation of flight instruments, navigation equipment, pitot heaters, instrument panel lights, and anti-icing equipment before attempting instrument or thunderstorm flight.

APPROACHING A STORM.

Prepare the airplane as follows before entering turbulent air. If the storm cannot be seen, its proximity can be detected by radio crash static or by radar.

a. Adjust power settings, as necessary, for safe penetration speed, which should be sufficiently above stalling speed to prevent inadvertent stalling due to turbulence.

b. Trim airplane.

c. Pitot heat switch ON, windshield anti-icing switch ON, windshield defroster and windshield wipers on, if required.

d. Check instruments for desired settings.

e. Turn flight compartment lights full bright, or use dark glasses to minimize blinding effects of lightning.

CAUTION

Do not lower landing gear or flaps, for they decrease the aerodynamic efficiency of the airplane.

FLIGHT IN A STORM.

a. Maintain power setting and pitch attitude established before entering storm. Airspeed will then remain constant regardless of airspeed indicator reading.

b. Maintain heading. Do not make turns unless absolutely necessary.

c. Use elevator control only as necessary to maintain attitude to minimize stresses on airplane.

d. The altimeter may be unreliable because of differential barometric pressures within the storm and may show a gain or loss of several thousand feet.

COLD WEATHER OPERATION.

Normal operating procedures outlined in Section II should be used during cold weather operation, with the following additions and exceptions.

OIL GRADES AND TEMPERATURES.

Grade 1100 lubricating oil shall be used at ground starting temperatures down to 2°C (35°F). When temperatures below 2°C (35°F) are expected, or if it will be necessary to use oil dilution, use grade 1065 lubricating oil. When using grade 1065 lubricating oil, inlet temperatures shall be maintained between 65°C (149°F) and 75°C (167°F) during operation to obtain proper engine lubrication and to prevent accumulation of moisture and volatile products of oxidation in the oil. If it is not possible to maintain these temperature limits, oil pressure should be maintained within the operating range and oil temperature should be kept above 60°C (140°F). Grade 1065 oil will generally require preheat for starting below −18°C (0°F).

If the conditions described above cannot be met or if equipment is not available for preheating, oil dilution may be accomplished as an alternate procedure.

BEFORE ENTERING AIRPLANE.

a. Preheat engines if temperatures are below −18°C (0°F), even though oil dilution was accomplished at last shutdown.

b. Preheat engines if temperatures are below 2°C (35°F) if oil dilution was not accomplished at last shutdown.

c. Apply heat to power section and accessory section until oil will flow from "Y" drain and propeller can be pulled through with comparative ease. Apply heat particularly to oil "Y" drain valve, oil lines, and oil tank sump. Do not apply heat directly to oil tanks.

CAUTION

Never consider pre-heating adequate until fluid oil will flow from the "Y" drain and the propellers can be pulled through with comparative ease. Do not attempt to start the engine if oil flow cannot be obtained from the "Y" drain.

d. Remove ice, snow, and frost from wing and tail surfaces with a stiff broom, with particular attention to aileron and empennage control surface leading edges. To remove ice, apply sufficient heat to loosen ice particles and remove them with a stiff brush. Alcohol and other sprays tried for this purpose have proved unsatisfactory. When removing ice with heat, do not melt ice completely, as water may get into control surface bearings and freeze. The best way to remove ice on propeller devices and blades is by direct application of heat. The same applies for shock struts.

e. Remove any ice present at fuel tank vent, crankcase breathers, and pitot tube. Carefully inspect all openings.

CAUTION

Ice or snow in the vent line can stop the flow of fuel, causing engine failure and possible collapsing of the fuel tanks. Frozen crankcase breathers may cause engine failure in flight.

f. Drain engine fuel strainers and fuel tank drain cocks. Check for flow from the fuel tank sumps. If there is no flow, apply more heat and drain frozen condensate.

g. Check oil tank drains for freedom of flow. If there is no flow, apply more heat and drain frozen condensate.

h. Clean shock struts of dirt and ice with a rag soaked in hydraulic fluid and check for hydraulic leaks and proper inflation.

i. Clean snow and ice off antennas before take-off.

j. Check that windshield is clear before take-off.

k. Use an external power source for starting engines and testing all electrical equipment.

STARTING ENGINES.

a. Remove engine covers and ground heaters just before starting engines.

b. Use normal engine starting procedure with an external power source.

c. Prime engine. In extremely cold weather, considerable priming is necessary to assure successful engine starts. Avoid priming except while engine is turning. If engine is primed prematurely, the gasoline will not vaporize but will run down into the lower cylinders and will result in bent connecting rods and cracked cylinder heads when the piston contacts the cylinder full of fluid gasoline. Priming may be continued for some time after starting to maintain smooth engine operation.

CAUTION

Overpriming is dangerous. It may result in fires, scuffed cylinders, and engine failures.

d. Move mixture control to RICH only after engine is running smoothly on primer.

CAUTION

If there is no oil pressure after 30 seconds of operation, immediately stop the engine and investigate.

e. Keep carburetor air control switches on DIRECT.

ENGINE WARM-UP

a. Use firmly anchored wheel chocks for engine run-up. Make certain that no personnel, ground installations or other planes are in the prop wash.

b. Set throttles to maintain 1200 rpm until oil temperatures and pressures and cylinder head temperatures are within desired limits.

c. In extremely low temperatures, use carburetor heat immediately after engine has started to improve fuel vaporization, to prevent spark plug fouling, and to prevent ice formation in induction system.

d. Adjust cowl flaps to degree of opening necessary for normal cylinder head temperatures. Check cylinder head temperatures, for excessive temperatures may be reached at take-off power if cowl flaps are fully closed.

e. Do not turn on electrical equipment not absolutely needed until generators show output. Storage batteries are of little or no value at sub-zero temperatures and an attempted use may damage the battery or electrical equipment.

TAXIING.

a. When taxiing, use the same precautions in regard to prop wash as during engine warm-up.

b. Use sufficient engine power while taxiing to keep engine warm and prevent it from dying out. In loose snow, hold control wheel well back and keep momentum. Avoid abrupt turns and use a minimum of differential braking to prevent a wheel from digging in. In deep snow, the nose wheel takes the full thrust of the engines.
Raising the elevators will relieve the pressure, but excessive gunning of engines will result in damage to the nose strut.

c. Watch for frost formation. Although not particularly dangerous during flight, frost can cause trouble during take-off.

d. If deep, heavy snow interferes with the take-off run but permits taxiing, roll slowly up and down the runway before attempting the actual take-off. In slush or deep snow, moisture may get into the brake drums and freeze when the airplane is stopped for engine run-up. Do not stop in deep snow. Watch out for obstacles hidden by freshly fallen snow.

BEFORE TAKE-OFF.

a. Carefully check surface controls and trim tabs for proper operation.

b. Cycle wing flaps to insure proper operation.

c. After engine oil temperatures and pressures are up to normal, operate propeller control as described under Propeller Check, Section II.

d. Turn pitot heat switch ON just prior to rolling into position for take-off.

e. Cycle the de-icing boost to ensure proper operation. (See ground test procedure under De-icing and Anti-icing Equipment, Section II.)

TAKE-OFF.

a. At start of take-off run, advance throttles rapidly to take-off power settings and make certain that full power is available. If full power is not obtained, discontinue take-off immediately.

b. Do not take off with over-diluted oil. It is safe to take off immediately without the normal warm-up, provided there has been a rise in oil temperature, oil pressure is steady, and engine is running smoothly.

Note

Cold oil properly diluted has the same viscosity as hot undiluted oil, and therefore the same ability to circulate and properly lubricate the engine.

c. Use the best attitude suitable for the conditions. This will usually be with the tail somewhat lower than for normal hard surface take-off. When snow is rough or sticky, pull the plane off with the tail well down, then pick up flying speed by holding constant altitude. In heavily drifted snow, a pulled take-off is usually essential to avoid damage. Just before the airplane settles back, bring the tail down as far as possible without stalling, and hold the plane in the air if speed is sufficient.

d. These procedures do not apply if an emergency makes it necessary to take off with frost or snow on the wings. Under these conditions, do not make a pulled take-off but take off in flying position. Watch the airspeed and do not try to climb too rapidly. Do not make steep turns with iced wings and tail surfaces.

WARNING

Do not attempt to take off with snow or ice on the wings unless there is no other alternative, as loss of lift and stalling may result. Loose snow may not blow off.

e. After take-off from a snow or slush covered field, operate landing gear, wing flaps, and torpedo bay doors through a complete cycle two or three times to prevent freezing.

DURING FLIGHT.

a. Use carburetor alternate air under icing conditions to maintain carburetor air temperature above 15°C (59°F).

Note

For each 6°C rise in carburetor air temperature above 38°C (100.4°F), reduce limiting manifold pressure for the operating rpm 1 in. Hg to prevent detonation.

CAUTION

To close cowl flaps when alternate air is in use, move carburetor air switch to DIRECT. close cowl flaps, then reset carburetor air switch to ALTERNATE to obtain desired temperature. Unless this is done, alternate air temperature rise may exceed required temperature.

b. Check all instruments. Many instruments are not reliable at low temperatures.

c. Turn on anti-icing systems as necessary to prevent formation of ice on wings windshields and propellers.

d. Avoid long glides at low power settings when temperature is low, to prevent excessive engine cooling.

e. Stiffening of controls may indicate congealing of lubricant or freezing of moisture in control hinges. Get into a warmer layer of air or move the control frequently to prevent freezing.

f. Failure of either airspeed indicator may result from freezing of its pitot head or static line. Use pitot heater as required.

APPROACH AND LANDING.

WARNING

Make certain that de-icer boots are turned OFF before landing.

a. Close cowl flaps in prolonged glides or approaches. Open them immediately after landing.

b. Lower landing gear and flaps and use enough power to maintain cylinder head temperatures above 100°C (212°F).

Note

If desired, extend landing gear and partial flaps before making approach, to check operation while enough altitude remains for emergency procedure. This will also permit use of more engine power, reducing possibility of carburetor icing.

c. Use carburetor heat while landing so that if rapid acceleration is necessary, heat will be available for fuel vaporization regardless of low cylinder head temperature. However, if full power is needed to go around, keep carburetor air temperatures below 40°C(104°F) and be prepared to reduce or shut off carburetor heat. Before making final approach, make certain that the engines will deliver while altitude is still adequate.

d. Pump brake pedals several times during approach to insure circulation of sluggish fluid.

e. Land a heavily iced airplane as an overloaded airplane. Come in at an approach speed which is higher than normal, depending upon amount of icing.

f. Use brakes sparingly and not until absolutely necessary after landing on an icy runway.

g. Turn off anti-icing systems after landing. If flying in a snowstorm, turn off anti-icing systems 10 minutes before landing unless ice continues to form.

PARKING.

a. When parking on ice, after having gone through slush, or when temperature varies between freezing and thawing, place a double layer of paper, fabric, grass, straw, green boughs, or other insulation material under wheels to prevent their freezing to the surface. Otherwise, rubber may be torn from the tires when the airplane is moved.

STOPPING ENGINES.

a. If outside air temperature is expected to fall below −5°C (23°F) before engines are started, dilute engine oil.

b. Cool engines by idling at 1000 rpm with cowl flaps and oil cooler doors open until oil temperatures drop to 40°C(104°F).

c. Unsafety and open manual shut-off valve in dilution fuel line of each engine. If it is desired that one engine oil system be diluted at a time, only open shut-off valve for system to be diluted.

d. Run engines between 1000 and 1200 rpm for oil dilution.

e. Maintain oil temperature below 50°C(122°F) and oil pressure above 15 psi during this procedure.

f. Hold dilution switch on for period of time determined by anticipated temperature as follows:

Anticipated Temperature	*Dilution Time (Minutes)*
−7°C (+20°F)	2
−13°C (+9°F)	3
−18°C (0°F)	4
−24°C (−11°F)	5
−31°C (−23°F)	6
−37°C (−34°F)	7

g. Before the last minute of dilution, increase rpm to 1500, press propeller feathering buttons and wait for a drop of approximately 300-400 rpm, then pull buttons out. Repeat this procedure twice, allowing engines to regain full speed each time after feathering buttons are pulled out. This supplies diluted oil to the propeller dome and feathering lines.

h. Operate propeller pitch control levers from full high pitch to full low pitch through two cycles.

i. Place mixture controls to IDLE CUT-OFF.

j. Turn ignition switches OFF after engines stop turning.

k. Open oil tank sump and "Y" drain and remove any water condensate from the system before it freezes.

l. Close and safety wire manual shut-off valves in oil dilution lines.

CAUTION

The oil supply of an engine in which the oil has been diluted should be checked after a thorough warm-up.

AFTER FLIGHT.

a. Clean dirt and ice from shock struts.

b. Leave an opening, such as a side window, partly open to prevent formation of frost on windows.

c. Release brakes. If left on, formation of ice may lock wheels.

d. Install protective covers.

e. Drain oil tank sumps, "Y" drains, and fuel drains of condensate approximately 30 minutes after stopping engine.

f. Check battery frequently for proper charge. If lay-over of several days is anticipated, or if temperature is below −4°C(+24°F) and airplane is to be idle for more than four hours, remove battery and store in a heated room.

HOT WEATHER OPERATION.

TROPIC OPERATION.

BEFORE ENTERING AIRPLANE.

a. Check seals at rudder, aileron and elevator leading edges for freedom from fungi.

b. Inspect struts and tires for cleanliness and proper inflation.

c. Remove weather covers and pitot covers.

ON ENTERING AIRPLANE.

a. Operate all movable surfaces.

b. If necessary, warm electrical instruments with an external source of heat until all moisture is eliminated.

BEFORE LEAVING AIRPLANE.

a. As soon as engines have cooled, install weather covers to keep out moisture and inhibit corrosion and growth of fungi.

DESERT OPERATION.

BEFORE ENTERING AIRPLANE.

a. Operate all movable surfaces and inspect for freedom from sand and dust.

b. Wipe struts free of dust and sand, using cloth moistened with hydraulic fluid.

c. Check that tires are not blistered or show other signs of deterioration.

d. If operating in sandy country, check that fuel and oil system filters are clean.

e. Remove weather covers and pitot covers.

ENGINE WARM-UP.

a. Conduct warm-up and ground tests in minimum time. Head into wind for better cooling.

TAKE-OFF.

a. Keep in mind that excessive heat requires a longer take-off run than ordinary temperatures.

b. Avoid taking off in the wake of another airplane if ground is sandy and dusty.

LANDING.

Remember that the airplane will sink faster in excessive heat than in moderate temperature.

BEFORE LEAVING AIRPLANE.

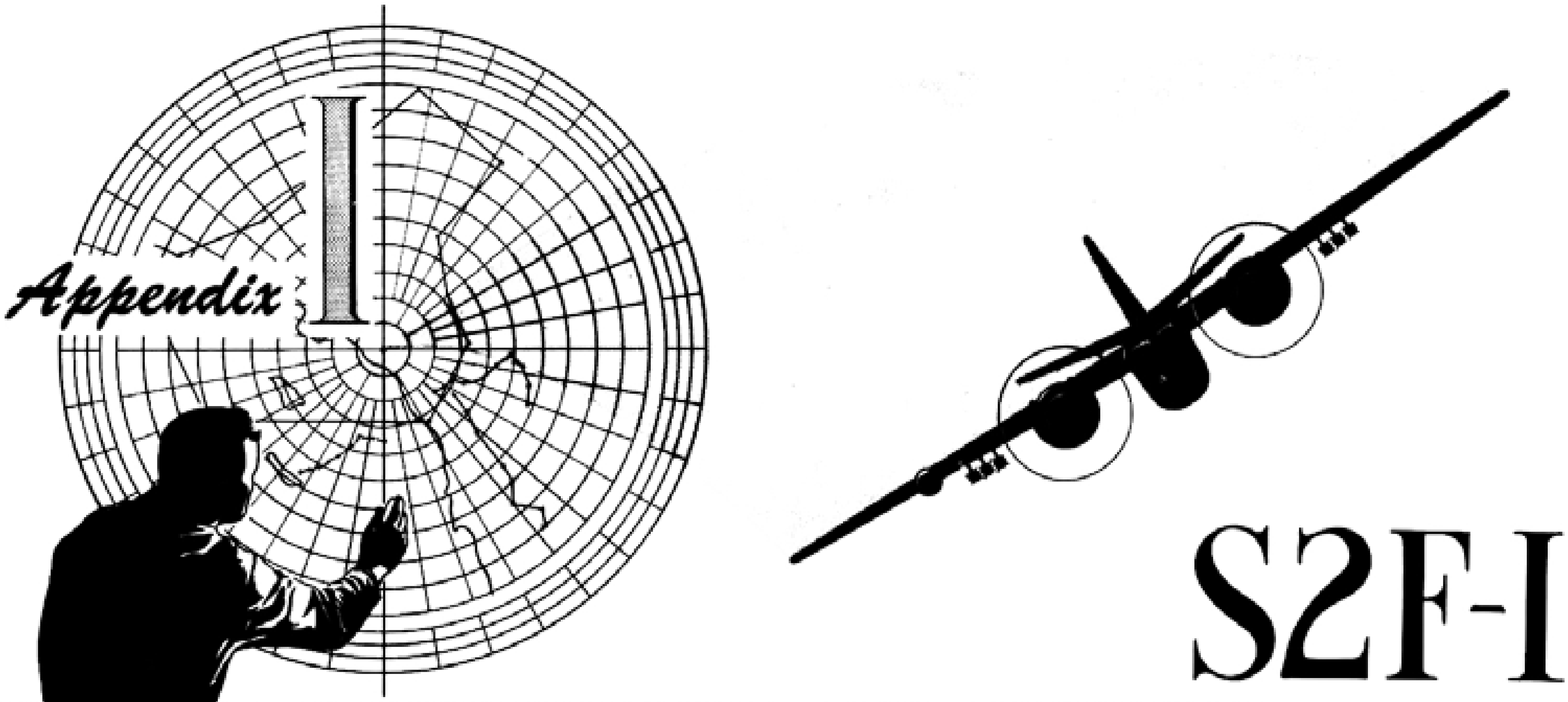
a. As soon as engines have cooled, install weather covers and pitot covers.

b. Exercise care to prevent sand or dust from entering fuel and oil tanks during servicing.

c. Clean sand and dust from all hinge points or movable surfaces.

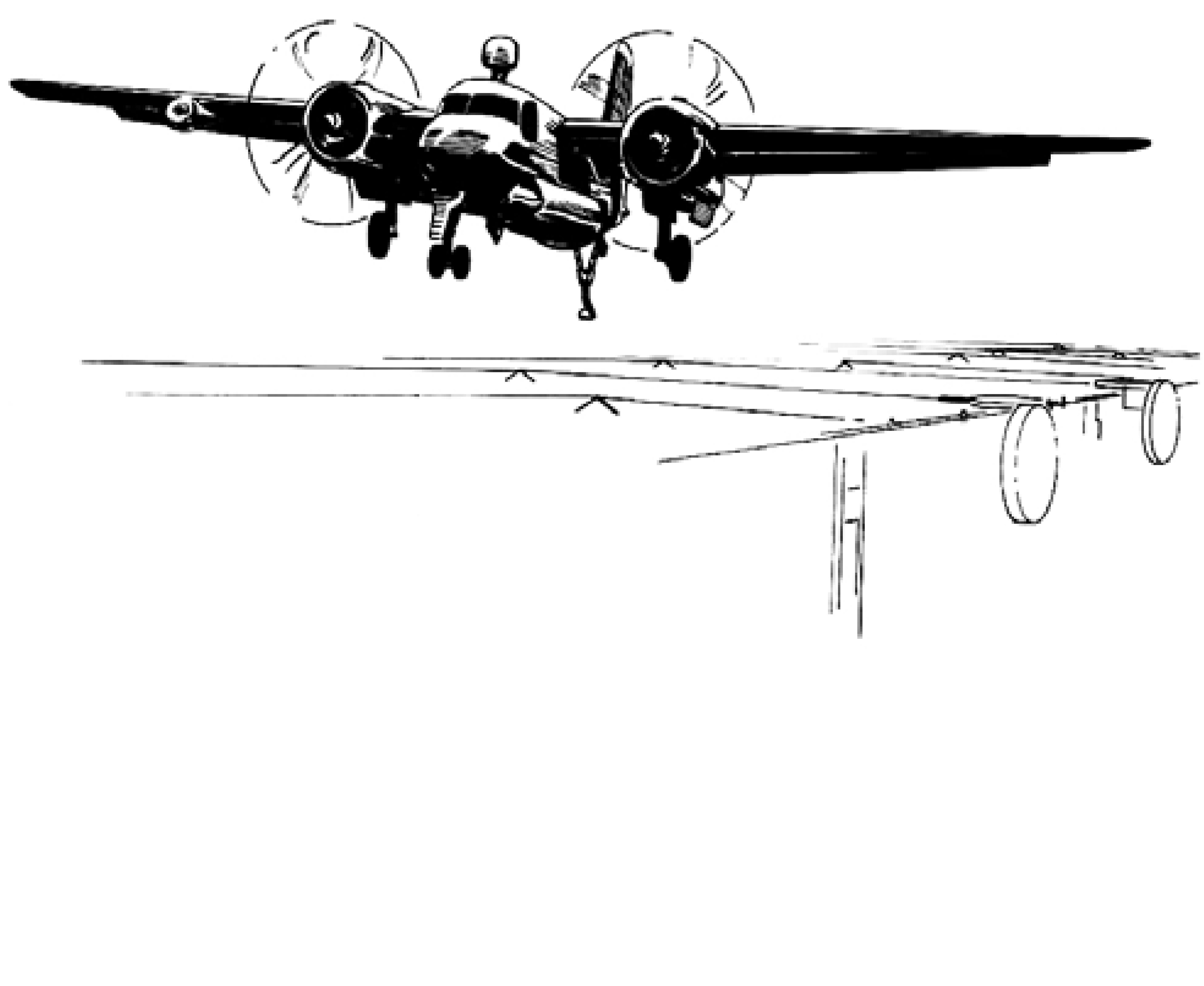
d. Cover windshield and all windows to prevent scratching.

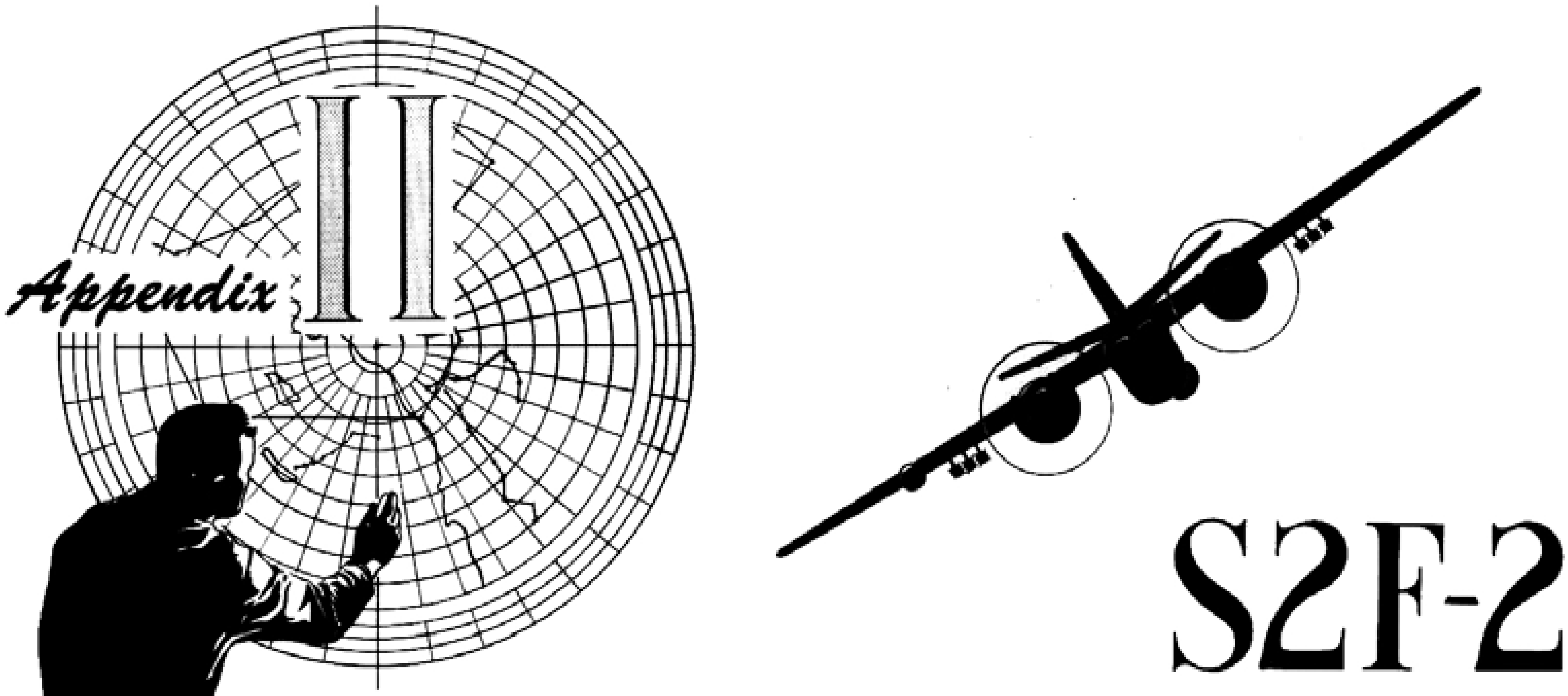
e. If blowing sand is not a hazard, keep doors and hatches open to permit air circulation.



OPERATING DATA

SEE CONFIDENTIAL SUPPLEMENT
NAVER 01-85SAA-1A





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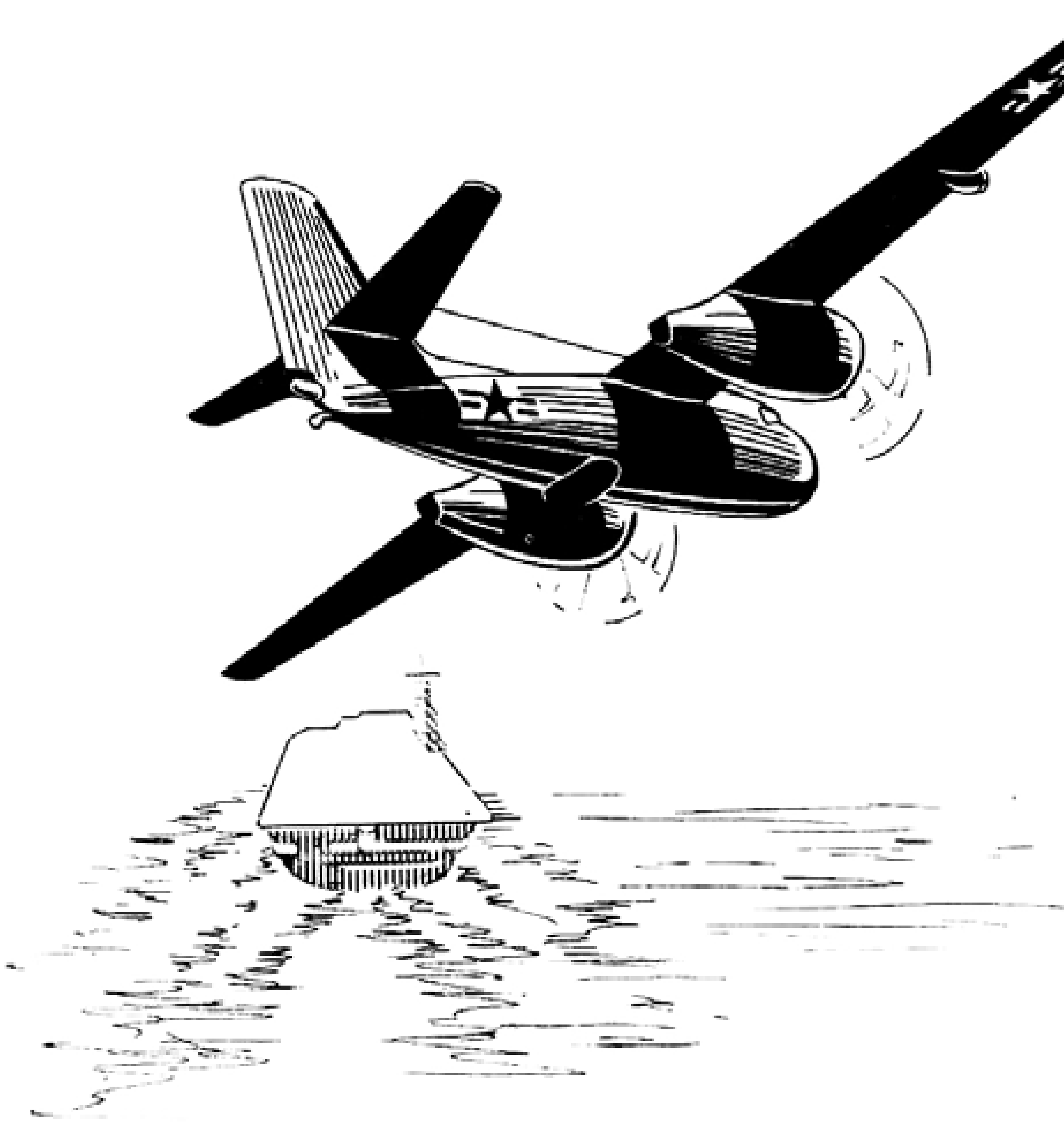

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