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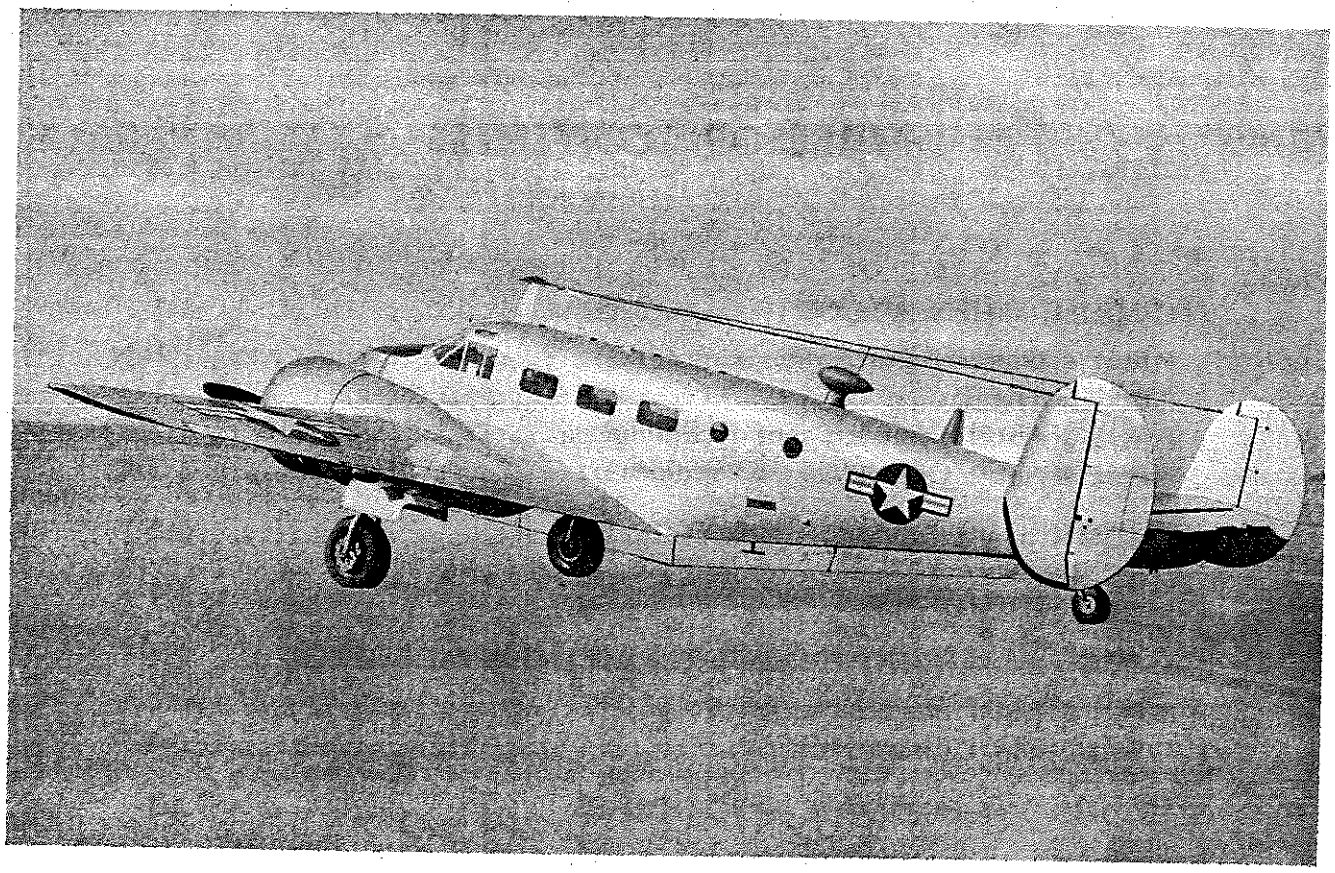

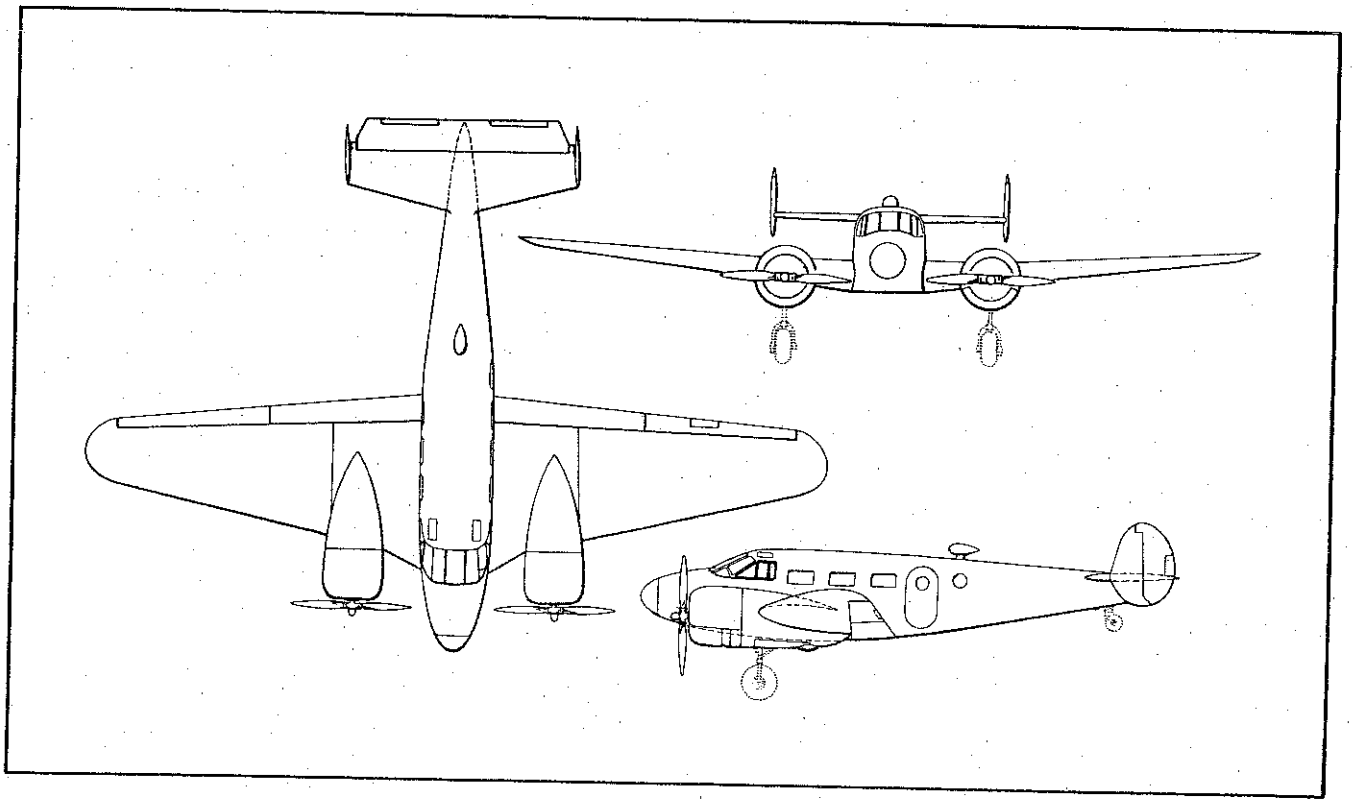

Figure 1-1. The Aircraft

SECTION I – THE AIRCRAFT

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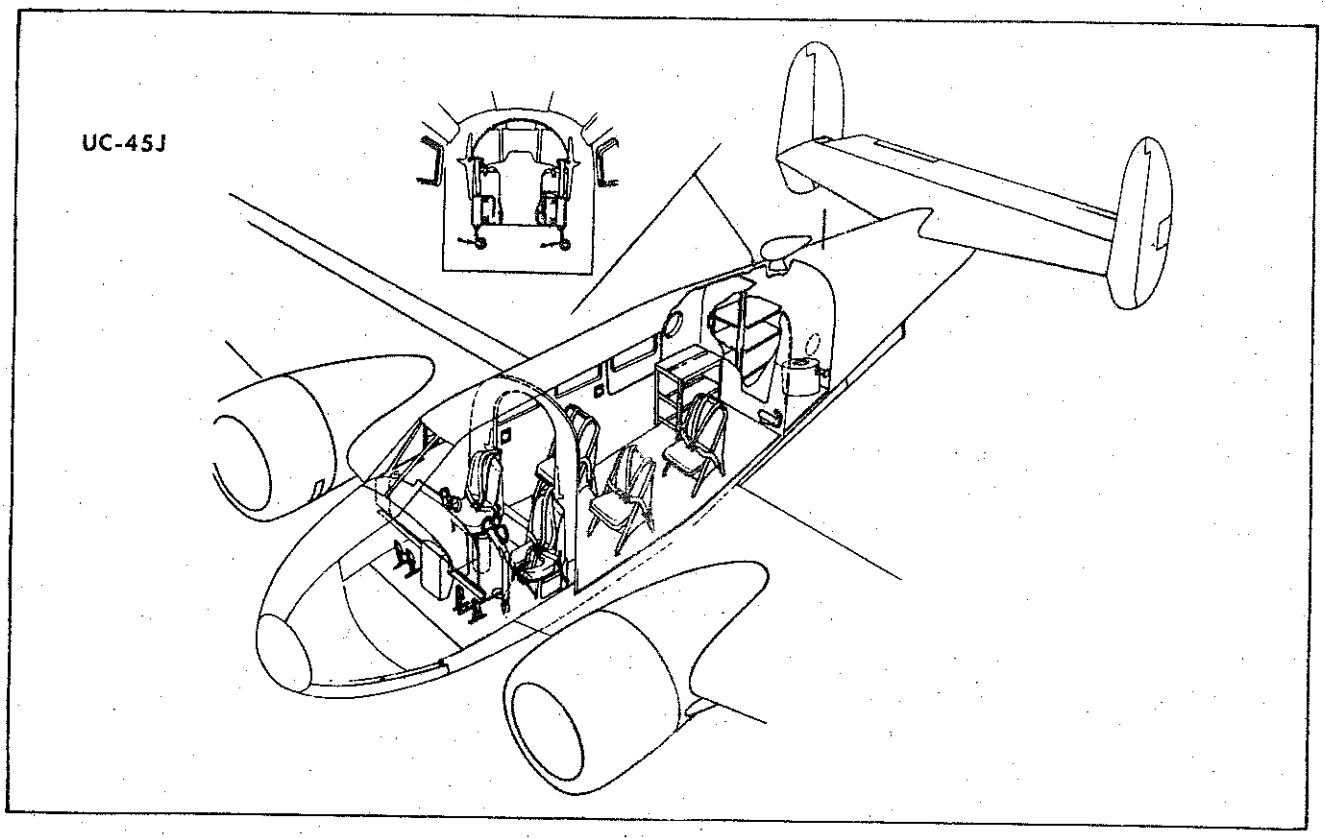
PART 1 GENERAL DESCRIPTION

THE AIRCRAFT

The UC-45J and RC-45J type aircraft (figure 1-1) are twin-engine, low wing, land monoplanes manufactured by the Beech Aircraft Corporation of Wichita, Kansas. The aircraft are designed primarily for personnel transportation. The standard cabin arrangement consists of three transport type seats, however, various other configurations for training and aerial photography missions are in use.



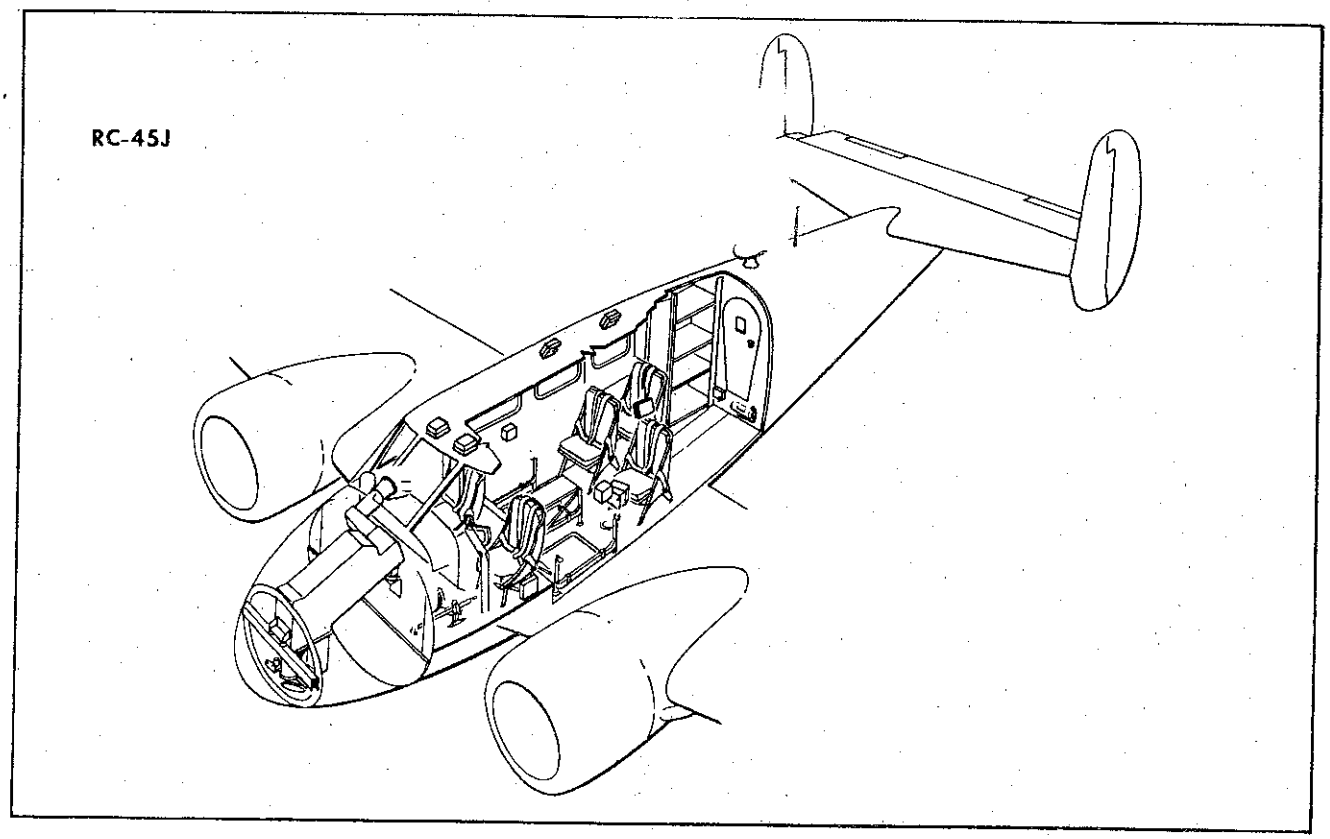


Figure 1-2. Interior Arrangement (Typical)

General interior arrangement of the aircraft includes three compartments for all configurations: the pilot's compartment, cabin or passenger compartment, and rear baggage and lavatory compartment (figure 1-2). All compartments are accessible during flight, however, the rear baggage-lavatory compartment is placarded against occupancy during take-off and landing. A fourth baggage and fuel compartment in the nose section is not accessible during flight and is limited to 300 pounds of baggage when the nose fuel tank is used. All placarded compartment maximum weight capacities are subject to computation to maintain a loading condition within the aircraft's center-of-gravity limitations.

The various systems and equipment in the aircraft are operated both electrically and manually except for the landing gear wheel brake system which is hydraulically operated. The landing gear, wing flaps, windshield wipers, navigation/communication equipment, and propeller anti-icing systems are electric, and the flight control surfaces, trim controls, cowl flaps and engine controls are manual. The pneumatic wing and empennage de-icing boots are cycle-timed electrically for inflation/deflation. Emergency and alternate systems are manually controlled. Heating and ventilation is provided for the pilot and passenger compartments and for hot air defrosting of the pilot's and copilot's windshield.

DIMENSIONS

Overall dimensions of the aircraft are:

Span	47 feet, 5.75 inches
Length	34 feet, 2.75 inches
Height	9 feet, 7.75 inches

DIFFERENCES

The basic difference between the UC and the RC Models is the equipment installations used to perform their mission function; the UC being primarily a transportation and training aircraft, and the RC being an aerial photography mission aircraft. The various equipment installation applicable to each model aircraft are covered in their appropriate location in the following sections.

PART 2 SYSTEMS

ENGINES

All aircraft are powered by two radial type Pratt and Whitney Wasp, Jr. R985-AN-14B air cooled, nine cylinder, reciprocating engines, each developing 450 horsepower for take-off at 2300 rpm (sea level - standard conditions). Engines are equipped with internal, single stage, single-speed blowers having a 10:1 ratio. Each engine is equipped with a direct drive Hamilton-Standard Hydromatic, full-feathering propeller.

ENGINE CONTROLS

Engine throttles, mixture, and manifold heat controls are located on the pilot's control pedestal. Each control knob is identified by both color and an embossed function initial, i.e., throttle-red color and "T" initial, mixture red color and "M" initial and manifold heat-green color and "MH" initial.

THROTTLES

Power for each engine is manually controlled by the respective throttle control lever mounted in the pilot's control pedestal (figures 1-3 and 1-4). The throttles are closed when in the aft position, and are manually moved forward to the open position to increase engine power.

THROTTLE FRICTION LOCK

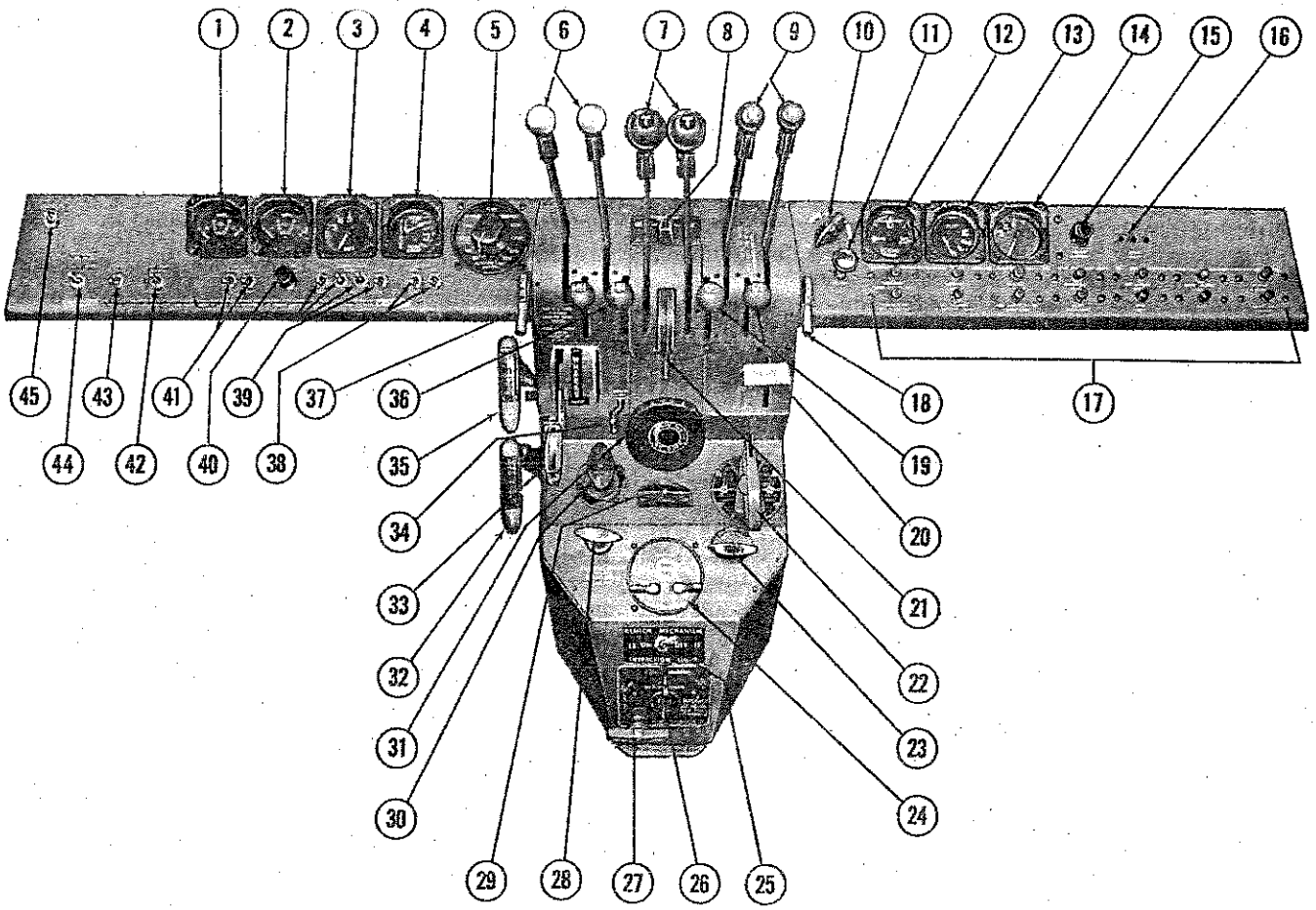
The throttle friction lock is located at the base of the throttle levers (figures 1-3 and 1-4). Throttle levers may be locked in any position by raising the friction lock lever.

MIXTURE LEVERS

The mixture levers consists of a set of manually operated controls located to the right of the throttles on the pilot's control pedestal (figures 1-3 and 1-4). When full aft they are in Idle Cut-off position; when full forward, they are in Full Rich position. For cruising, they may be placed in an optimum position between Full Rich and Idle Cut-off to obtain the desired fuel/air ratio for more efficient operation. The mixture-levers friction lock is mounted on the right side of the pilot's control pedestal.

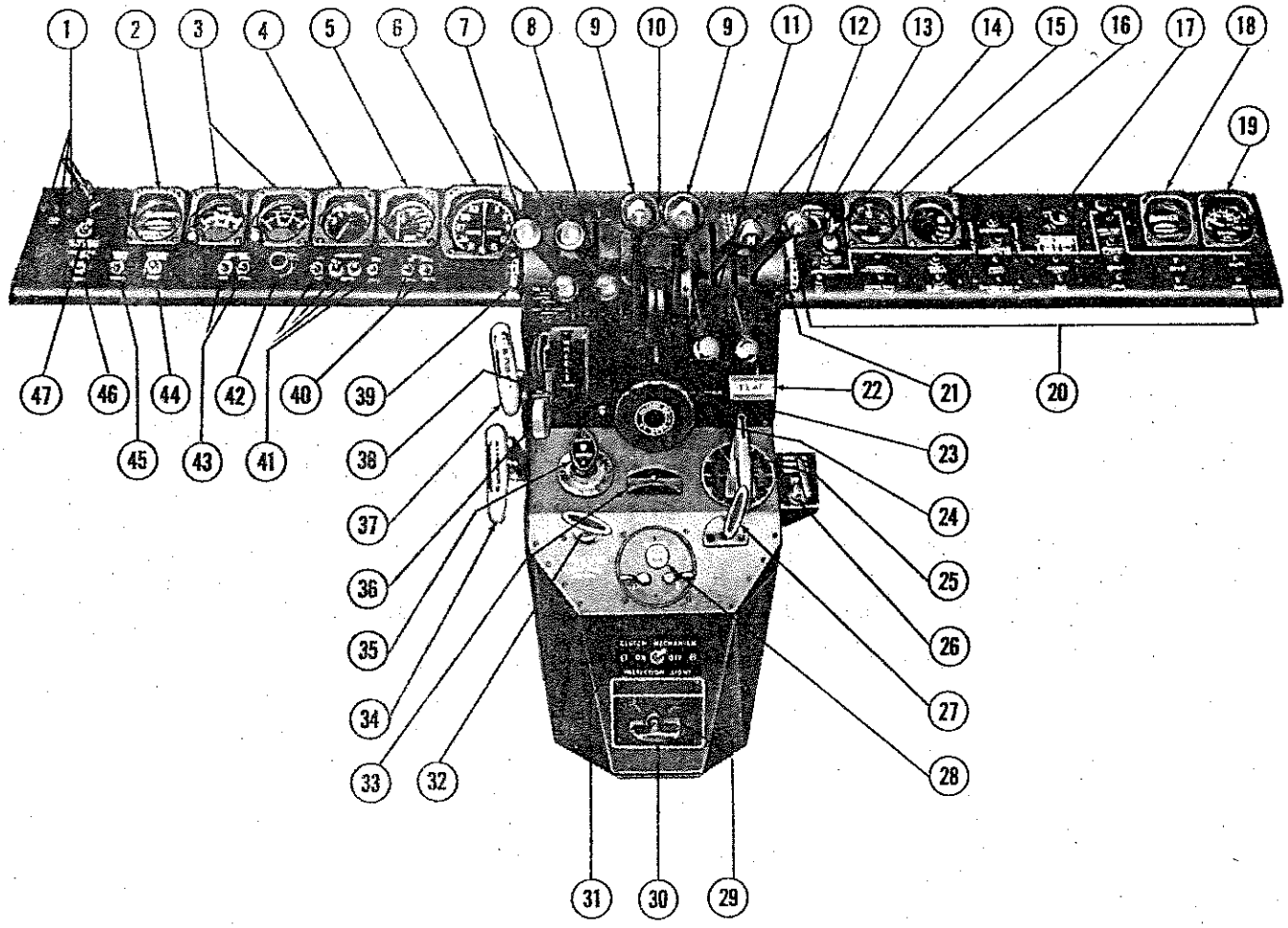
MANIFOLD HEAT LEVERS

The manifold heat levers are located on the left side of the pilot's control pedestal (figures 1-3 and 1-4). Intake air is heated by ducting through a muff around the exhaust collector ring. The manifold heat levers can be set in any position to warm incoming air to desired temperature as indicated on the carburetor air temperature gage (figure 1-3 and 1-4). The manifold heat levers friction lock (also used for propeller levers), is located on the left side of the pilot's control pedestal.



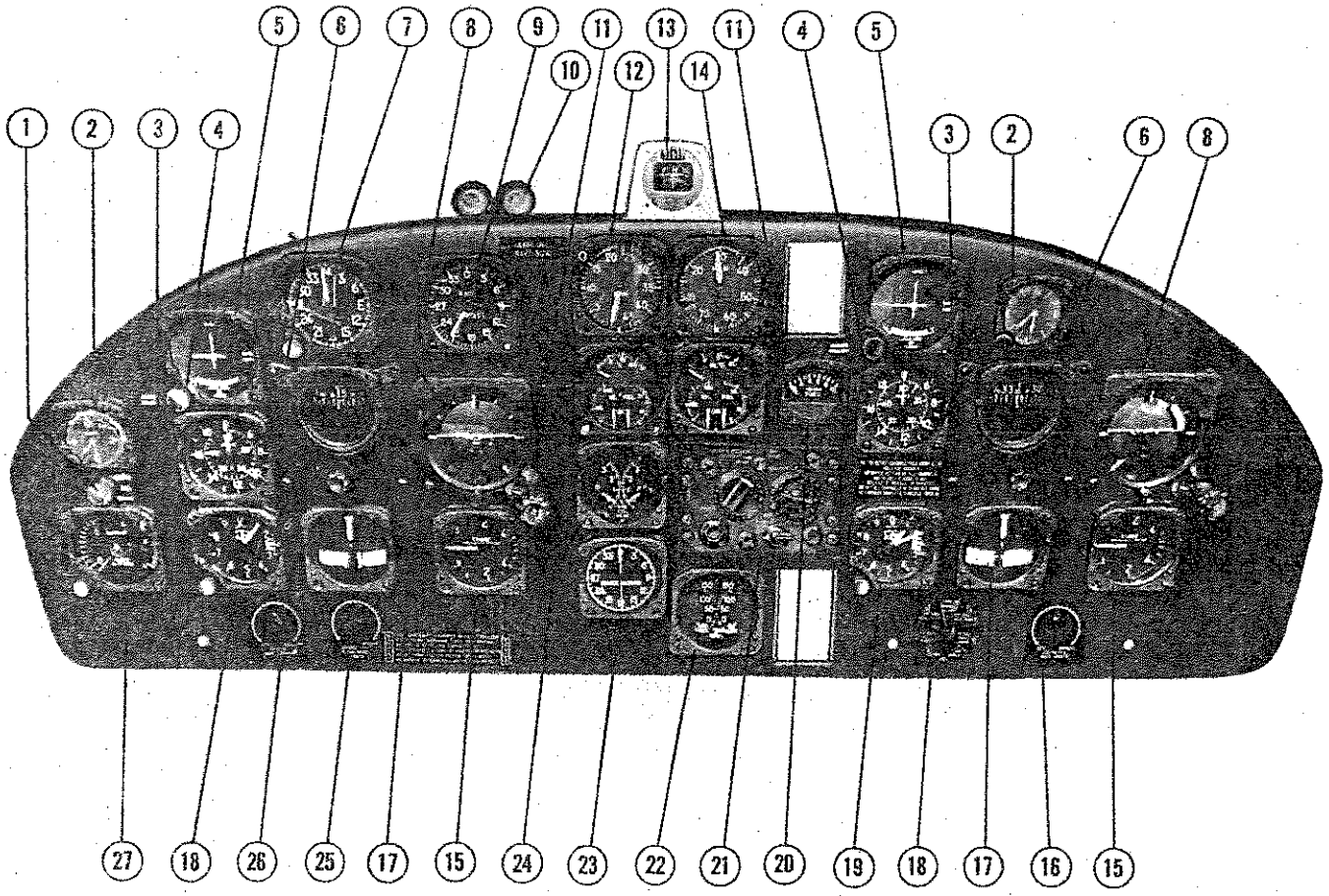
1. LEFT GENERATOR VOLT-AMMETER
2. RIGHT GENERATOR VOLT-AMMETER
3. LEFT SUCTION GAGE
4. ELEVATOR TRIM TAB POSITION INDICATOR
5. RADIO ALTIMETER ALTITUDE LIMIT SWITCH
6. PROPELLER LEVERS
7. THROTTLE LEVERS
8. LANDING-GEAR WARNING HORN SILENCER SWITCH
9. MIXTURE LEVERS
10. PROPELLER ANTI-ICER RHEOSTAT KNOB
11. WING AND TAIL DE-ICER CONTROL
12. DE-ICER PRESSURE GAGE
13. WING FLAP POSITION INDICATOR
14. RIGHT VACUUM PUMP SUCTION GAGE
15. RIGHT VACUUM WARNING LIGHT
16. SPARE BULBS
17. CIRCUIT BREAKERS
18. MIXTURE AND OIL SHUTTER LEVER'S FRICTION LOCK
19. OIL SHUTTER LEVERS
20. WING FLAP SWITCH HANDLE
21. THROTTLE FRICTION LOCK
22. FUEL TANK SELECTOR HANDLE
23. TAIL WHEEL LOCK/UNLOCK HANDLE
24. ENGINE IGNITION SWITCHES
25. LANDING GEAR CLUTCH INSPECTION LIGHT SWITCH
26. ENGINE FIRE EXTINGUISHER SELECTOR VALVE
27. ENGINE FIRE EXTINGUISHER DISCHARGE HANDLE
28. PARKING BRAKE HANDLE
29. STARTER SELECTOR SWITCH
30. ENGINE PRIMER
31. AILERON TRIM TAB WHEEL
32. RIGHT ENGINE COWL FLAP HANDLE
33. LANDING GEAR SWITCH HANDLE
34. LANDING GEAR HANDLE LIGHT TEST SWITCH
35. LEFT ENGINE COWL FLAP HANDLE
36. MANIFOLD HEAT LEVERS
37. PROPELLER-MANIFOLD HEAT LEVER FRICTION LOCK
38. BATTERY SWITCHES
39. LANDING LIGHT SWITCHES
40. LEFT VACUUM PUMP WARNING LIGHT
41. PITOT HEAT SWITCHES
42. NAVIGATION LIGHT SWITCH
43. PASSING LIGHT SWITCH
44. WINDSHIELD WIPER SWITCH
45. ANTI-COLLISION LIGHT SWITCH

Figure 1-3. UC-45J Control Pedestal and Subpanels (Typical)



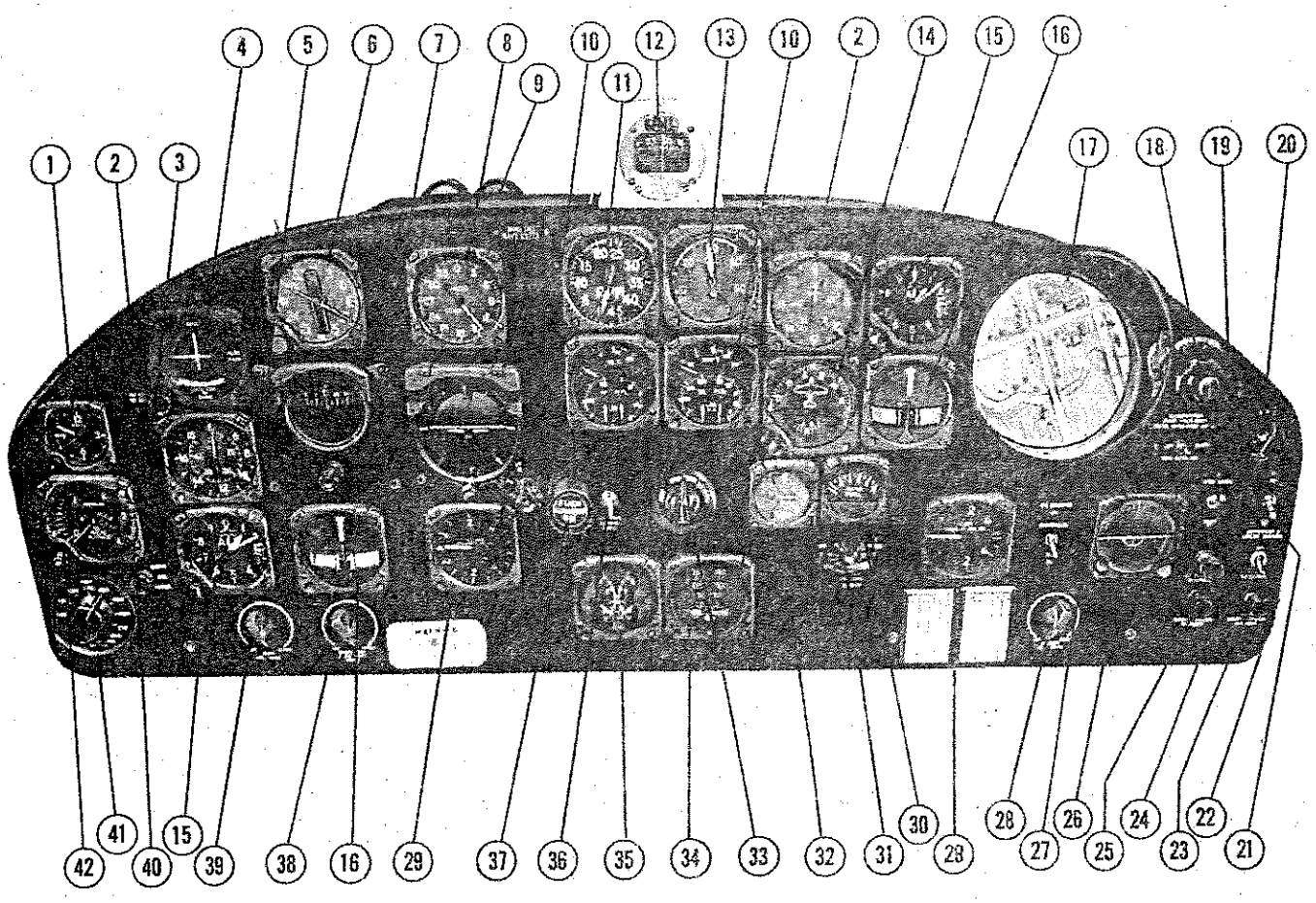
1. SPARE BULBS
2. OXYGEN FLOW INDICATORS
3. VOLT-AMMETERS
4. SUCTION GAGE
5. ELEVATOR TRIM TAB POSITION INDICATOR
6. COURSE SELECTOR
7. PROPELLER LEVERS
8. MANIFOLD HEAT LEVERS
9. THROTTLE LEVERS
10. LANDING-GEAR WARNING HORN SILENCER SWITCH
11. OIL SHUTTER LEVERS
12. MIXTURE LEVERS
13. PROPELLER ANTI-ICER RHEOSTAT KNOB
14. WING AND TAIL DE-ICER CONTROL
15. DE-ICER PRESSURE GAGE
16. WING FLAP POSITION INDICATOR
17. RIGHT VACUUM WARNING LIGHT
18. OXYGEN FLOW INDICATOR
19. OXYGEN SYSTEM PRESSURE
20. CIRCUIT BREAKERS
21. MIXTURE AND OIL SHUTTER LEVERS FRICTION LOCK
22. WING FLAP SWITCH HANDLE
23. THROTTLE FRICTION LOCK
24. AILERON TRIM TAB WHEEL
25. FUEL TANK SELECTOR HANDLE
26. AUTO PILOT EMERGENCY DISCONNECT
27. TAIL WHEEL LOCK/UNLOCK HANDLE
28. ENGINE IGNITION SWITCHES
29. ENGINE FIRE EXTINGUISHER SELECTOR VALVE
30. ENGINE FIRE EXTINGUISHER DISCHARGE HANDLE
31. LANDING GEAR CLUTCH INSPECTION LIGHT SWITCH
32. PARKING BRAKE HANDLE
33. STARTER SELECTOR SWITCH
34. RIGHT ENGINE COWL FLAP HANDLE
35. ENGINE PRIMER
36. LANDING-GEAR SWITCH HANDLE
37. LEFT ENGINE COWL FLAP HANDLE
38. LANDING-GEAR HANDLE LIGHT TEST SWITCH
39. PROPELLER-MANIFOLD HEAT LEVER FRICTION LOCK
40. BATTERY SWITCHES
41. LANDING LIGHT SWITCHES
42. RIGHT VACUUM WARNING LIGHT
43. PITOT HEAT SWITCHES
44. NAVIGATION LIGHT SWITCH
45. PASSING LIGHT SWITCH
46. WINDSHIELD WIPER SWITCH
47. ANTI-COLLISION LIGHT SWITCH

Figure 1-4. RC-45J Control Pedestal and Subpanel (Typical)



1. RADIO ALTITUDE WARNING LIGHT
2. CLOCK
3. AIRSPEED INDICATOR
4. MARKER BEACON LIGHT
5. COURSE INDICATOR
6. DIRECTIONAL GYRO
7. GYROSYN COMPASS INDICATOR
8. ATTITUDE INDICATOR
9. RADIO COMPASS INDICATOR
10. PROPELLER FEATHERING BUTTONS
11. ENGINE GAGE UNIT (OIL TEMPERATURE AND PRESSURE; FUEL PRESSURE)
12. DUAL TACHOMETER
13. MAGNETIC COMPASS
14. DUAL MANIFOLD PRESSURE GAGE
15. VERTICAL SPEED INDICATOR
16. COPILOT'S INSTRUMENT LIGHT CONTROL
17. TURN AND SLIP INDICATOR
18. FUEL LEVEL GAGE SELECTOR SWITCH
19. ALTIMETER
20. FUEL LEVEL GAGE
21. AN/ARC-27A UHF COMMAND RADIO
22. CARBURETOR MIXTURE TEMPERATURE GAGE
23. OMNI COURSE SELECTOR
24. CYLINDER HEAD TEMPERATURE GAGE
25. RHEOSTAT FOR RED LIGHTING — ENGINE INSTRUMENTS
26. RHEOSTAT FOR RED LIGHTING — PILOT'S INSTRUMENTS
27. RADIO ALTITUDE INDICATOR

Figure 1-5. UC-45J Instrument Panel (Typical)



1. CLOCK
2. AIRSPEED INDICATOR
3. MARKER BEACON LIGHT
4. COURSE INDICATOR
5. DIRECTIONAL GYRO
6. GYROSYN COMPASS REPEATER INDICATOR
7. ATTITUDE INDICATOR
8. RADIO COMPASS INDICATOR
9. PROPELLER FEATHERING BUTTONS
10. ENGINE GAGE UNIT (FUEL PRESSURE AND OIL TEMPERATURE AND PRESSURE)
11. DUAL TACHOMETER
12. MAGNETIC COMPASS
13. MANIFOLD PRESSURE GAGE
14. MASTER DIRECTION INDICATOR
15. ALTIMETER
16. TURN AND SLIP INDICATOR
17. VIEW FINDER (FORWARD VISION)
18. VIEW FINDER ILLUMINATION CONTROL
19. WIDE ANGLE AND DRIFT SELECTOR SWITCH
20. FILTER SELECTOR SWITCH
21. VIEW FINDER ON-OFF SWITCH AND CIRCUIT BREAKER
22. S-7 CAMERA ON-OFF SWITCH
23. INTERVALOMETER WARNING (RIGHT)
24. S-7 FILM WARNING
25. INTERVALOMETER WARNING (LEFT)
26. ATTITUDE INDICATOR CONTROL
27. COMPASS DESLAVING SWITCH
28. COPILOT'S INSTRUMENT LIGHT CONTROL
29. VERTICAL SPEED INDICATOR
30. FUEL GAGE
31. FUEL GAGE SELECTOR SWITCH
32. PITCH TRIM INDICATOR
33. AUTO-PILOT CONTROLLER
34. CARBURETOR TEMPERATURE GAGE
35. CYLINDER-HEAD TEMPERATURE GAGE
36. AUTO-PILOT AMPLIFIER SWITCH
37. AUTO-PILOT CLUTCH SWITCH
38. ENGINE INSTRUMENT AND SUBPANEL LIGHT CONTROL
39. PILOT'S INSTRUMENT LIGHT CONTROL
40. RADIO ALTIMETER WARNING
41. ALTITUDE LIMIT SWITCH
42. RADIO ALTIMETER INDICATOR

Figure 1-6. RC-45J Instrument Panel (Typical)

ENGINE COOLING

Engine operating temperatures are regulated by manually actuated cowl flaps located on either side of the bottom half of the main engine cowling on each engine. Any desired engine operating temperature may be obtained by manual in-flight adjustment of the cowl flap handles in conjunction with established cylinder head temperature gage markings.

COWL FLAP HANDLES

Two cowl flap handles are located on the left side of the control pedestal (figures 1-3 and 1-4): the upper for left engine and the lower for the right engine. To open, turn handle one-fourth turn and pull. There are three possible cowl flap settings: Full Open, Trail, and Closed.

IGNITION SYSTEM

Each engine is equipped with a high-tension type ignition system. The system consists of two engine driven magnetos, two distributor assemblies, a manifold assembly, and two spark plugs in each cylinder.

IGNITION CONTROLS

MASTER IGNITION SWITCH

The master ignition switch is a two position push-pull switch which controls the individual left and right magneto switches as a combined unit. It is labeled PULL-OFF and in this position neither individual magneto switch will operate its respective magneto. It is mounted in the center of the lower section of the pilot's control pedestal (figures 1-3 and 1-4).

INDIVIDUAL ENGINE MAGNETO SWITCHES

The individual left and right engine magneto ignition switches are on the same panel as the Master Ignition Switch (figures 1-3 and 1-4). Each individual engine magneto switch has four position placarded BOTH, L, R, and OFF. Their respective magnetos are operationally checked when either switch is positioned to L, or R.

STARTING SYSTEM

The engine starter system includes two direct cranking starters (one on the accessory section of each engine), a toggle type starter switch, and the necessary systems relays and solenoids.

STARTER SWITCH

The single starter switch (figures 1-3 and 1-4) controls the starter circuit and the direct-engage type starters for each engine. The switch is a single-pole double throw type switch which is spring loaded OFF in the center position, and ON when held in either extreme position labelled LEFT engine or RIGHT engine. The switch is located on the lower portion of the pilot's control pedestal.

ENGINE INSTRUMENTS

All engine instruments are on the main instrument panel located forward of the pilot and copilot. Electrically operated instruments which are part of a remote indication system use dc power and are circuit breaker protected. The tachometers and cylinder head temperature gages are self-generated electrical instruments which do not require power from the aircraft's electrical system.

MANIFOLD PRESSURE INDICATOR

The dual manifold pressure indicator (figures 1-5 and 1-6) located on the upper center of the instrument panel is of the double diaphragm aneroid type and has two pointers marked 1 for the left engine and 2 for the right engine. These pointers rotate over a dial marked in increments from 10 to 75 inches Hg. Hose and fittings connect the indicator to the engine intake manifold.

TACHOMETER

A dual tachometer (figures 1-5 and 1-6) located on the upper center of the instrument panel measures engine speed in revolutions per minute. The indicator has two pointers marked 1 for the left engine and 2 for the right engine which rotate over a calibrated dial ranging from 0 to 4,500 rpm. The indicator is electrically connected to a tachometer generator mounted on the engine accessory section. The tachometer is a self-generated electrical instrument and does not require aircraft electrical power.

ENGINE GAGES

Two separate engine gages (figures 1-5 and 1-6) combine oil temperature, oil pressure, and fuel pressure and are mounted in the center of the main instrument panel. The oil temperature portion of the gage is calibrated in degrees Centigrade in increments of 10 through a range of -70° to +150°C. The gage is connected to an oil temperature bulb in the engine. The oil pressure portion of the gage is calibrated in pounds per square inch (psi) in increments of 10 from 0 to 200 psi. The gage is hydrostatically operated. The fuel pressure portion of the gage is also hydrostatically operated and is calibrated in increments of 5 from 0 to 25 psi.

CYLINDER HEAD TEMPERATURE INDICATOR

A dual-indicating cylinder head temperature gage (figures 1-5 and 1-6), on the main instrument panel, indicates the temperature within the cylinders of each engine in degrees Centigrade. The temperature is measured by thermocouple units. These units transform heat within the cylinders to a proportional electric current which is transmitted to the gage as a temperature indication. The indicator dials are graduated in increments of 10 with a range from 0° to 300°C.

CARBURETOR AIR TEMPERATURE INDICATOR

A dual-indicating carburetor air temperatures gage (figures 1-5 and 1-6), on the main instrument panel,

indicates carburetor air temperature in degrees Centigrade. Temperature is measured from a thermometer resistance bulb in each engine induction system. The mixture temperature gage is calibrated in increments from -70° to +150°C and operates on dc electrical power.

PROPELLERS

Each engine drives an 8-foot 3-inch diameter two-blade constant speed Hamilton Standard hydromatic propeller with full feathering capability. Pitch change and control is maintained by both engine oil and governor oil pressure. Normal operation is controlled manually by movement of propeller levers in the pilots compartment. A propeller governor is mechanically connected to the propeller levers on the pilots control pedestal. The propeller governor supplies engine oil under pressure to the propeller pitch change mechanism for pitch control. Feathering and unfeathering control is accomplished through a button-controlled feathering pump. Propeller deicing is accomplished by anti-icer fluid slinger rings attached to the propeller hubs.

PROPELLER CONTROLS

PROPELLER LEVERS

Two manually operated propeller control levers, located on the upper left of the pilot's control pedestal (figures 1-3 and 1-4) are used to change engine rpm by increasing or decreasing propeller pitch. Engine speed is increased by moving the levers forward to low pitch (high rpm), and decreased by moving the levers aft to high pitch (low rpm). During cold weather operation the oil in the propeller hub is exposed to considerable cooling and will thicken if engine oil temperature is too low. Slow propeller control will result.

PROPELLER LEVERS FRICTION LOCK

The propeller levers friction lock (also used for manifold heat levers) is located on the left side of the pilot's control pedestal, sets the amount of friction required to hold the propeller levers in the desired position.

PROPELLER FEATHERING BUTTONS

Two push-to-feather, push-to-unfeather buttons (figures 1-5 and 1-6) one for each propeller, are used in feathering and unfeathering the propellers. These switches (red in color) are located on the left side of the windshield cowl, directly in front of the pilot. A toggle type circuit breaker switch (or propeller feathering switch) located to the left of the feathering buttons, protects the feathering circuits. This switch is normally in the ON position.

PROPELLER FEATHERING

Propeller feathering is accomplished by manually depressing the appropriate propeller feather button. The button will remain depressed until the propeller is feathered, then pops out to the original position.

PROPELLER UNFEATHERING

Propeller unfeathering is accomplished by manually depressing and holding the appropriate propeller feather button, until approximately 800 rpm. Releasing the spring-loaded button stops the unfeathering operation. The propeller blades will now reestablish an rpm relative to the propeller rpm lever setting on the pilot's control pedestal. The appropriate propeller control lever should be in the low rpm (high pitch) position and its respective throttle retarded prior to commencing the propeller unfeathering procedure.

OIL SUPPLY SYSTEM

The oil supply system (figure 1-8) for each engine consists of a supply tank, an oil radiator, and all necessary tubing, valves and fittings required for engine lubrication, tank and engine venting, draining and propeller feathering. The 8 gallon oil supply tank for each engine is located in each engine nacelle. The tank filler neck is accessible through a door in the top of the nacelle. Each ank has a 2.5 gallon expansion space. See Servicing Diagram (firure 1-31) for oil grade and specification.

OIL SYSTEM CONTROLS

OIL RADIATOR SHUTTERS

For quick warm-up and oil temperature control, the air inlet duct to each oil radiator is equipped with a butterfly valve operated by the oil-shutter levers (figures 1-3 and 1-4) on the pilot's control pedestal. Push levers down for hot (shutters closed) and up for cold.

OIL BY-PASS VALVES

During cold weather operations, engine oil may be routed around the radiators by using the oil by-pass valves (figure 1-7). These valves are located on the pilots compartment floorboard on the inboard side of the pilot's and copilot's seats. To unlock, turn by-pass valve handle counterclockwise. To lock in any position turn valve handle clockwise. The valves should be used in either the full hot (out) or full cold (in) position.

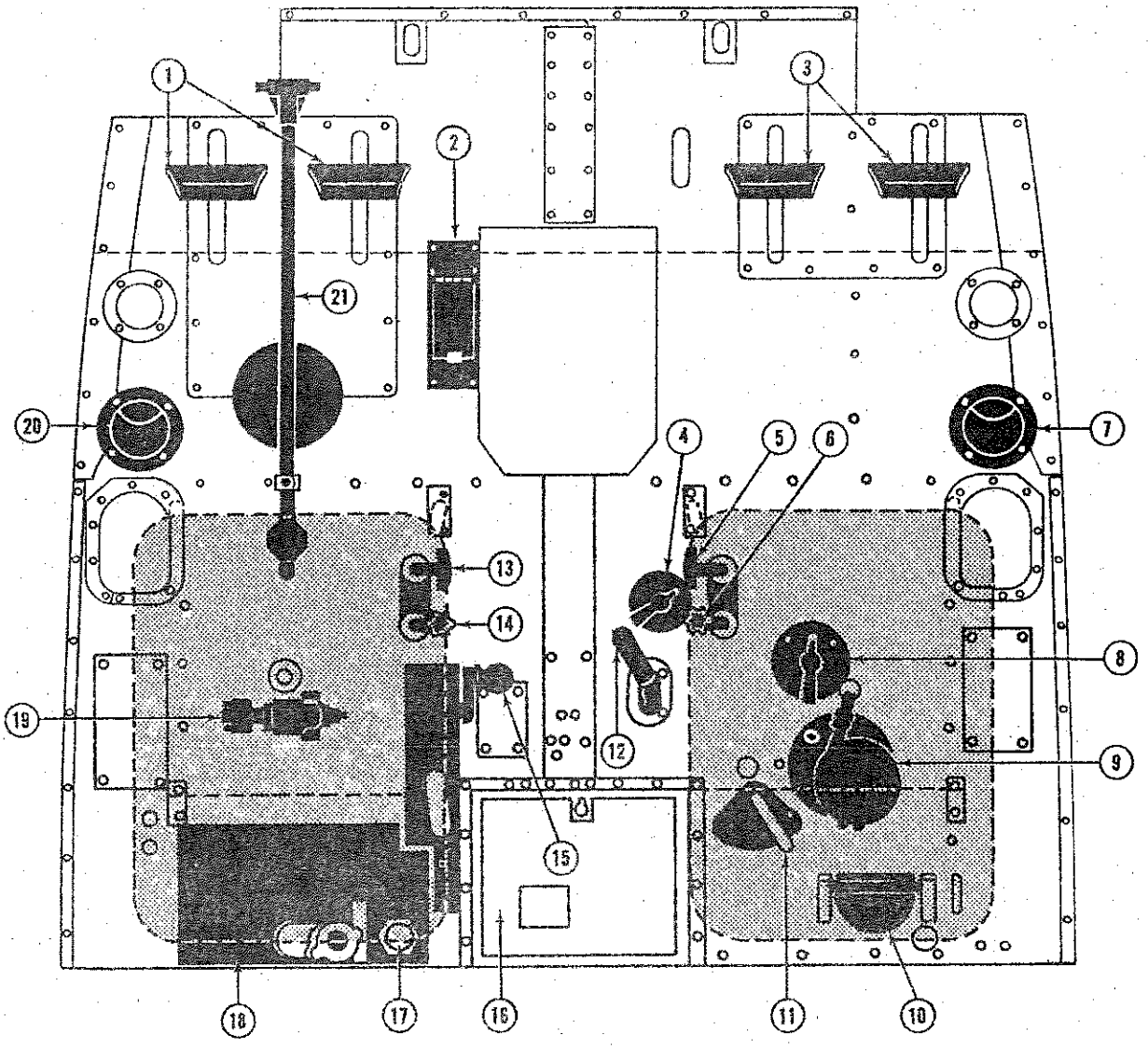
FUEL SUPPLY SYSTEM

The fuel supply system (rigure 1-9) consists of two fuel tank systems, mounted in the wing center sections each side of the fuselage. Each system consists of a main tank and auxiliary tank.

NOTE

On most UC-45J aircraft, a nose tank is installed in addition to the main and auxiliary tanks. Nose tanks are not installed on RC-45J aircraft.

Fuel to both engines is fed from the selected tank, through the engine selector valve, the fuel strainer, and through the engine driven fuel pump to the car-



1. PILOT'S RUDDER PEDALS AND BRAKES
2. LANDING GEAR CLUTCH
3. COPILOT'S RUDDER PEDALS AND BRAKES
4. FUEL CROSSFEED VALVE
5. RIGHT HEAT CONTROL VALVE
6. RIGHT ENGINE OIL BY-PASS VALVE HANDLE
7. COPILOT'S HOT AIR OUTLET
8. ENGINE FUEL SELECTOR VALVE
9. ENGINE FIRE EXTINGUISHER CO_2 BOTTLE
10. LANDING GEAR WARNING HORN
11. VACUUM SELECTOR VALVE (ON SOME AIRCRAFT)
12. WOBBLE PUMP
13. LEFT HEAT CONTROL VALVE T-HANDLE
14. LEFT ENGINE OIL BY-PASS VALVE HANDLE
15. LANDING GEAR AND WING FLAP EMERGENCY HAND CRANK
16. LANDING GEAR AND WING FLAP MOTORS ACCESS DOOR
17. PROPELLER ANTI-ICER FLUID LEVEL GAGE
18. PROPELLER ANTI-ICER FLUID TANK
19. PROPELLER ANTI-ICER PUMP
20. PILOT'S HOT AIR OUTLET
21. CONTROL SURFACES LOCK

Figure 1-7. Pilot's Compartment and Floorboard (Typical)

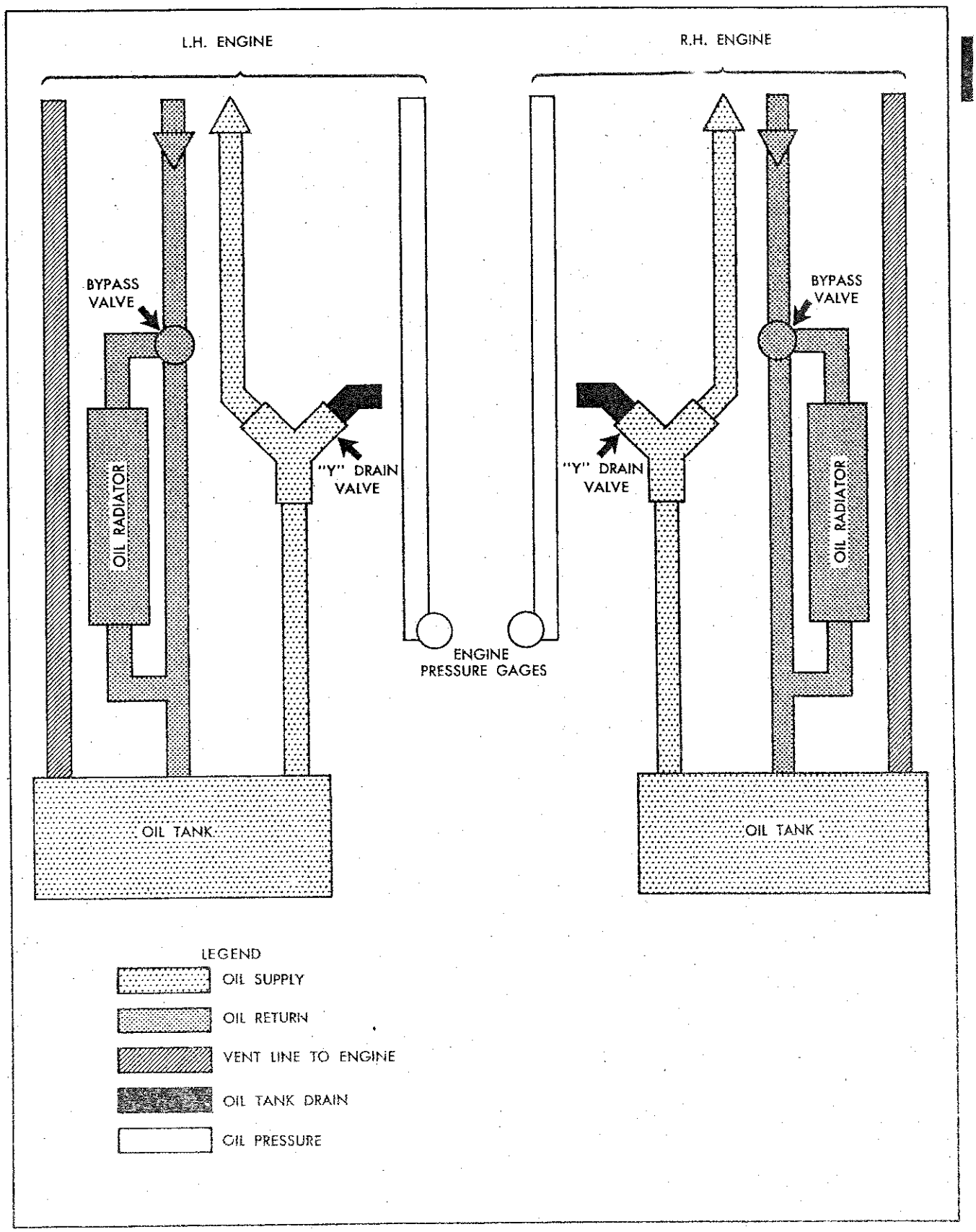


Figure 1-8. Engine Oil Supply System

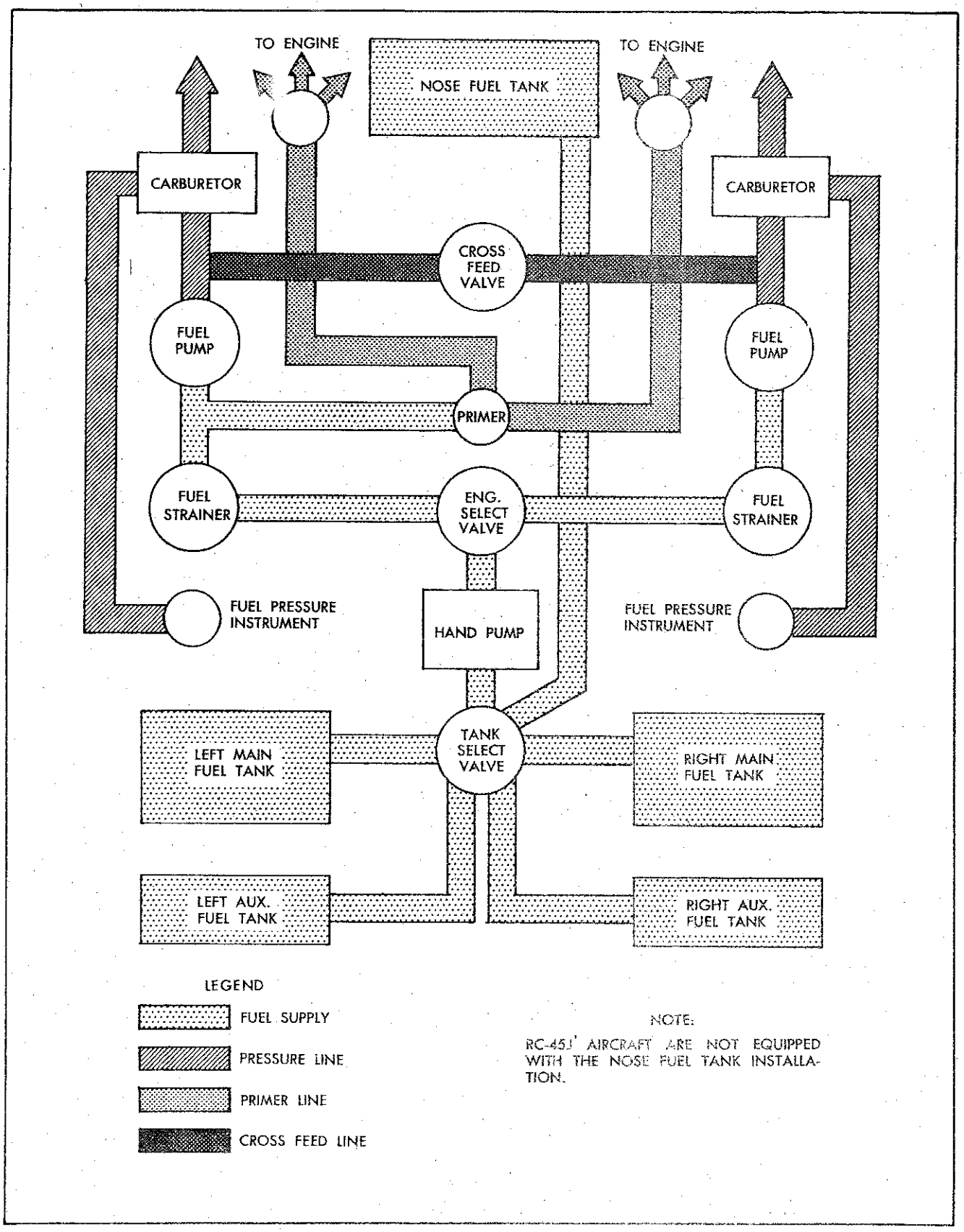


Figure 1-9. Fuel Supply System

buretor. A manually operated wobble pump is used to increase fuel pressure during starting, take-off and in maintaining an even fuel pressure while changing tanks, or to supply pressure in event an engine driven fuel pump becomes inoperative. The crossfeed system consists of a crossfeed selector ON/OFF valve which when placed in the ON position enables either engine driven fuel pump to provide fuel to both engines. The amount of fuel in each tank is measured by electrically operated liquidometers which read in tenths of total tank capacity on the fuel quantity indicator.

FUEL SYSTEM CONTROLS

FUEL TANK SELECTOR VALVE

The fuel tank selector valve, located on the base of the pilot's control pedestal, has six positions: (1) LEFT MAIN, (2) RIGHT MAIN, (3) LEFT AUX., (4) RIGHT AUX., (5 and 6) NOSE (both sections of nose tank are connected as one), and OFF. When turned to any one of the tank positions, fuel will flow from the tank selected to both engines. On RC-45J aircraft, the tank selector valve has another OFF position instead of the NOSE position.

ENGINE FUEL SELECTOR VALVE

The engine fuel selector valve (figure 1-7), located on the floorboard under the copilots seat, has four positions: BOTH ON (valve pointing forward), RIGHT ON (valve pointing to right engine), OFF, (valve pointing aft), and LEFT ON (valve pointing to left engine). For normal operation, the valve will be positioned in the BOTH ON position and to the respective operative engine during single-engine operations.

FUEL CROSSFEED VALVE

The fuel crossfeed valve (figure 1-7), located on the floorboard just to the left of the copilots seat, is a two position ON, OFF valve. When the valve is in the ON position, either engine driven fuel pump can supply fuel to both engines. When turned to the OFF position each engine depends entirely upon its own fuel pump.

WOBBLE PUMP

A hand operated wobble pump, mounted on the floorboard near the inboard side of the copilots seat, provides fuel pressure for starting and fuel system emergency operation. Movement of the handle fore and aft increases fuel pressure.

PRIMER

The manually operated push-pull type engine primer (figures 1-3 and 1-4), located on the base of the pilots control pedestal, has three placarded positions: RIGHT ON, OFF, and LEFT ON. Positioning the primer handle to either of the placarded engine positions and operating the push-pull type handle will inject fuel directly into the combustion chamber on the top five cylinders of the selected engine.

CAUTION

The primer should be checked to be in the OFF position when not in use to avoid possible fire or loss of power due to excessively rich mixture.

FUEL PRESSURE GAGE

The fuel pressure gages (figures 1-5 and 1-6) are located in the center of the instrument panel and are combined with the engine oil pressure and temperature indicating units in the respective engine gage for each engine. The fuel pressure portion of the gage is calibrated in psi in increments of 5 from 0 to 25 psi, and is hydrostatically operated.

FUEL LEVEL GAGE AND SELECTOR SWITCH

The fuel level in all tanks is indicated on a single electrically operated liquidometer gage (figures 1-5 and 1-6) located on the center of the instrument panel. The float mechanism in each tanks is connected to the gage through a fuel-level gage selector switch also located on the instrument panel near the fuel level gage.

On UC-45J aircraft, with nose fuel tanks installed, the gage selector switch has seven positions: OFF, "1" (left main), "2" (right main), "3" (left auxiliary), "4" (right auxiliary), "5" (20-gallon nose tank), "6" (27-gallon nose tank). On RC-45J aircraft, the gage selector switch has five positions: one for each tank and an OFF position.

CARBURETOR AIR INDUCTION

Each engine is equipped with a carburetor air induction system to furnish the carburetor with either cold air, warm air or a mixture of both. External air intakes supply ambient temperature ram air to the carburetor air mixture box where it is selected for use as cold air or heated as required. Temperature controlled air is regulated by the manifold heat levers on the pilot's control pedestal.

FUEL SYSTEM MANAGEMENT

Fuel to either or both engines can only be fed from any single tank. Refer to the Fuel Quantity Data Table, figure 1-10, for fuel tank location and capacity.

FUEL TANK SEQUENCE

The main tanks should always be used for take-off and landings. When accelerating in a nose-high attitude (such as during a wave-off) and the fuel level in the auxiliary tanks is low, it is possible that the fuel will not feed to the engines. For this reason it is not advisable to use auxiliary or nose tanks under such conditions.

For cruising, the nose and auxiliary tanks should be used to maintain a satisfactory CG position.

TANK	NO.	USABLE FUEL	UNUSABLE FUEL LEVEL FLIGHT	EXPANSION SPACE	TOTAL VOLUME
LH MAIN	1	77.7	0.3	2.3	80.3
RH MAIN	2	77.7	0.3	2.3	80.3
AUX. LH	3	24.8	0.2	.8	25.8
AUX. RH	4	24.8	0.2	.8	25.8
NOSE	5	20	0.0	0.0	20
NOSE	6	27	0.0	0.0	27

TOTAL USABLE FUEL WITHOUT NOSE TANK 205.0
TOTAL USABLE FUEL WITH NOSE TANK (47-GAL.) 252.0

NOTE

- USABLE/UNUSABLE FUEL QUANTITY BASED ON AIRCRAFT LEVEL FLIGHT ATTITUDE
- ALL QUANTITIES ARE U. S. GALLONS
- TO CONVERT GALLONS TO POUNDS AT 0° C, MULTIPLY BY 6.0

Figure 1-10. Fuel Quantity Data Table

CAUTION

Use of the nose and rear wing tanks affect the CG to a considerable extent and consumption of fuel from these tanks without regard to proper sequencing may cause the CG limits to be exceeded.

When changing from one tank to another, normal procedure is to make the change before a tank runs dry. However, at such times as maximum utilization of fuel is necessary, the tanks may be used until exhausted. If the engine fuel selector valve handle is turned to another tank and fuel pressure is maintained with wobble pump operation at the first indication of fuel pressure drop, fuel pressure can be re-established before any interruption in engine operation occurs. Use the "click and feel" method when repositioning the fuel tank selector valve to assure proper valve and seat alignment.

CAUTION

If a tank is inadvertently run dry, RETARD THE THROTTLES prior to restart to avoid engine overspeed or detonation.

ELECTRICAL SYSTEM

The electrical power supply system is a 24-volt dc single-wire ground-return system. The system consists of two engine-driven 50 amps generators and two 24-volt batteries in connection with the necessary system control switches, circuit breakers, indicators and regulators. An external dc power receptacle is provided for engine starting and ground operation of all electrical operated equipment.

ELECTRICAL SYSTEM CONTROLS

BATTERY SWITCHES

Two ON-OFF battery switches (figures 1-3 and 1-4) are mounted on the left subpanel. These switches must be on before electrical equipment will operate when generators are not charging.

GENERATOR SWITCHES

The generator switches (figure 1-11) are located on the inboard side of the voltage regulator boxes mounted on

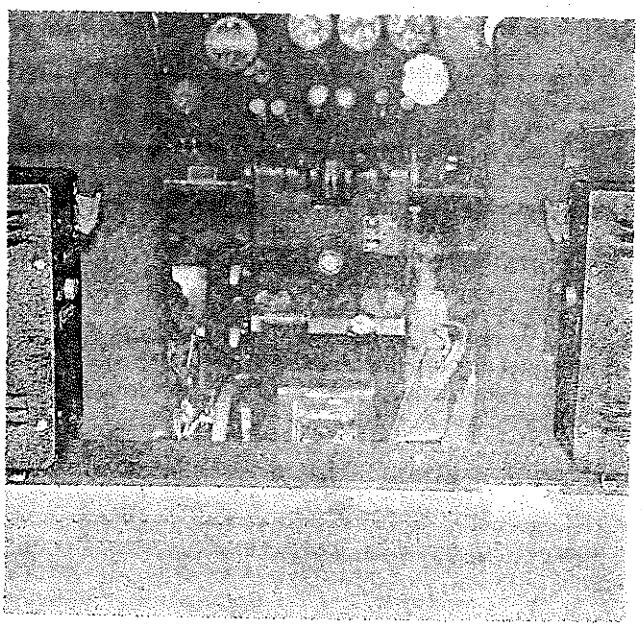


Figure 1-11. Voltage Regulator and Generator Circuit Breaker Boxes

the threshold at the entrance to the pilot's compartment. The switches have two positions, ON and OFF, and are guarded in the ON position by a red colored switch guard. The switches will normally be ON except during test operations, when external power is in use, or when a generator becomes inoperative.

DC VOLT-AMMETER INDICATORS

Two volt-ammeters (figures 1-3 and 1-4) are located on the left subpanel. These indicators normally read in amperes until the small button on the indicator's rim is depressed which changes the reading to a voltage indication.

CIRCUIT BREAKER PANELS

The main circuit breaker panels for the various systems and equipment installations are in two locations, on the right subpanel (figures 1-3 and 1-4) and on the forward side of the bulkhead above and behind the copilot. Both panels are visible and accessible from the pilot's compartment. All circuit breakers are the trip free, push-to-reset type and may be pulled out manually.

BATTERIES

The aircraft is equipped with two 24-volt batteries (figure 1-31) located just aft of the leading edge of the wing center section on each side of the fuselage. During engine starting, both batteries supply power through the battery master switches on the left subpanel.

EXTERNAL POWER RECEPTACLE

An external power receptacle, located on the outboard side of the left engine nacelle, may be used during engine starting and ground operation of all electrical equipment.

NOTE

When using external power, the battery switches should be in the OFF position.

HYDRAULIC SYSTEM

Hydraulic pressure is used for the main landing wheel brakes only. See Servicing Data, figure 1-31 for hydraulic fluid specification and reservoir location. Refer to Wheel Brake System for brake coverage.

FLIGHT CONTROL SYSTEM

The flight control surfaces may be operated from either the pilot's or copilot's position by dual control columns, dual control wheels and left and right rudder pedal installations. All controls are manually operated and are mechanically linked directly to the surfaces by cable-operated bellcranks and push rods. The rudder pedals are not adjustable. Fore and aft adjustment of the pilot's or copilot's seats provides a comfortable pedal position. Trim tabs on the trailing edge of the port aileron, elevator, and port rudder are provided for trimming the aircraft. All primary flight control surfaces can be automatically controlled by the type P-1 electrically-operated auto-pilot system (RC-45 only).

TRIM TABS AND CONTROLS

All trim tab surfaces are manually operated by cable systems attached to wheel and bell crank controls in the pilots compartment. These trim controls mechanically actuate moveable tabs on the elevator, aileron and rudder surfaces for final adjustment of the aircraft inflight pitch, roll, and yaw attitude.

ELEVATOR TRIM

Elevator (pitch) trim-tab operation is controlled by the elevator trim tab wheel (figure 1-12) located to the right of the pilot's seat. Rotation of the wheel up or aft (when gripping the wheel at the front or top) will raise the nose of the aircraft; rotation of the wheel down or forward will lower the nose of the aircraft.

AILERON TRIM

Aileron (roll) trim tab operation is controlled by a manually actuated wheel control (figures 1-3 and 1-4) located in the center of the pilot's control pedestal. Clockwise rotation of the wheel, as placarded by a directional arrow, will deflect the aileron trim tab and produce a corresponding "right wing down" trim condition. Rotating the wheel in the opposite direction (counterclockwise) will reverse the direction of the trim tab and produce a "right wing up" trim condition. The trim tab is located only on the left aileron and is visible from the pilot's position.

Figure 1-12. Elevator Trim Wheel

RUDDER TRIM

Rudder (yaw) trim tab operation is controlled by turning a hand crank located in the overhead center of the pilot's compartment. Rotating the handcrank either right or left, as indicated by directional arrows on each side of the handcrank, will produce a corresponding movement of the rudder trim tab. The trim tab is located on the left rudder only, and is visible from the pilot's position.

TRIM TAB POSITION INDICATORS

Elevator trim tab position is shown by an indicator on the left subpanel (figure 1-3 and 1-4) calibrated in "nose up" and "nose down" increments. These increments provide a reference to relative position of the tab. Normal flight position is in the green area between "0" and "1" on the "nose down" scale. Determination of the rudder trim tab neutral position, is indicated by two red paint markers on the tab control cable. Alignment of these red markers indicates a neutral tab position. No trim tab position indicator is provided for the aileron tab since the tab is easily visible from the pilot's position.

CONTROL SURFACES LOCK

A gust lock is used to secure the control surfaces in the neutral position when the aircraft is parked. When not in use, the lock is stowed on the floor between the pilot's rudder pedals (figures 1-7 and 1-13).

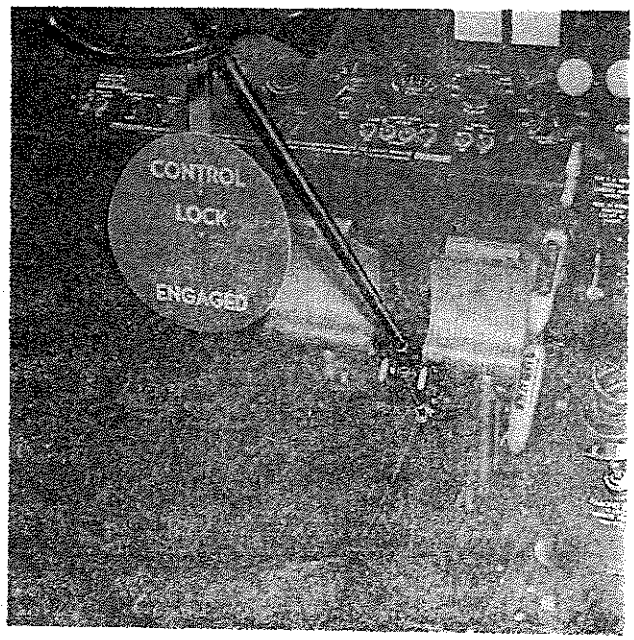


Figure 1-13. Control Surface Lock

P-1 AUTOMATIC PILOT SYSTEM

The P-1 type electric automatic pilot system (RC-45J only) will automatically maintain the aircraft at a selected attitude about its pitch, roll, and yaw axis at an established heading and altitude. All autopilot control gyros are coordinated to permit maneuvering changes in attitude around any of the aircraft's axes with the automatic pilot system in operation.

AUTOMATIC PILOT CONTROLS

The P-1 autopilot system control gyros are located on the right side of the instrument panel and serve as normal flight instruments regardless of whether the automatic pilot system is operating or not. Gyro precession is prevented by a flux gate transmitter. The basic system controls (figure 1-6) are instrument panel mounted and consist of an autopilot controller, an autopilot amplifier switch, an autopilot clutch push button; and a gyro caging knob. Additional autopilot system controls consists of an autopilot disengage button, located on the pilot's control wheel, and a system emergency disconnect handle which is located on the right side of the pilot's control pedestal. The system uses 24 volt dc power for operation.

CONTROLLER

The autopilot controller (figure 1-14), located in the center of the instrument panel, is manipulated to maneuver and trim the aircraft throughout the pitch, roll, and yaw autopilot control range.

AMPLIFIER SWITCH

The autopilot amplifier switch (figure 1-6), located adjacent to the autopilot controller in the center of the instrument panel, energizes the autopilot amplifier and must be switched on at least two minutes before the autopilot is engaged.

CLUTCH PUSH-BUTTON

The autopilot clutch push-button switch (figure 1-6) is located adjacent to the autopilot amplifier switch in the center of the instrument panel. Depressing this push button switch engages the servo clutches which places the aircraft under autopilot control.

DISENGAGE BUTTON

The autopilot disengage push-button switch (figure 1-14) is located on the rim of the pilot's control wheel. Depressing the switch disengages the autopilot. To re-engage the autopilot, the autopilot clutch push-button must be depressed.

GYRO CAGING KNOB

The gyro horizon caging and erecting knob on the gyro horizontal (attitude indicator) control (figure 1-6), cages and erects the gyros of both the gyro flux gate transmitter and the gyro horizon control. Gyros are erected for operation by first caging and then uncaging.

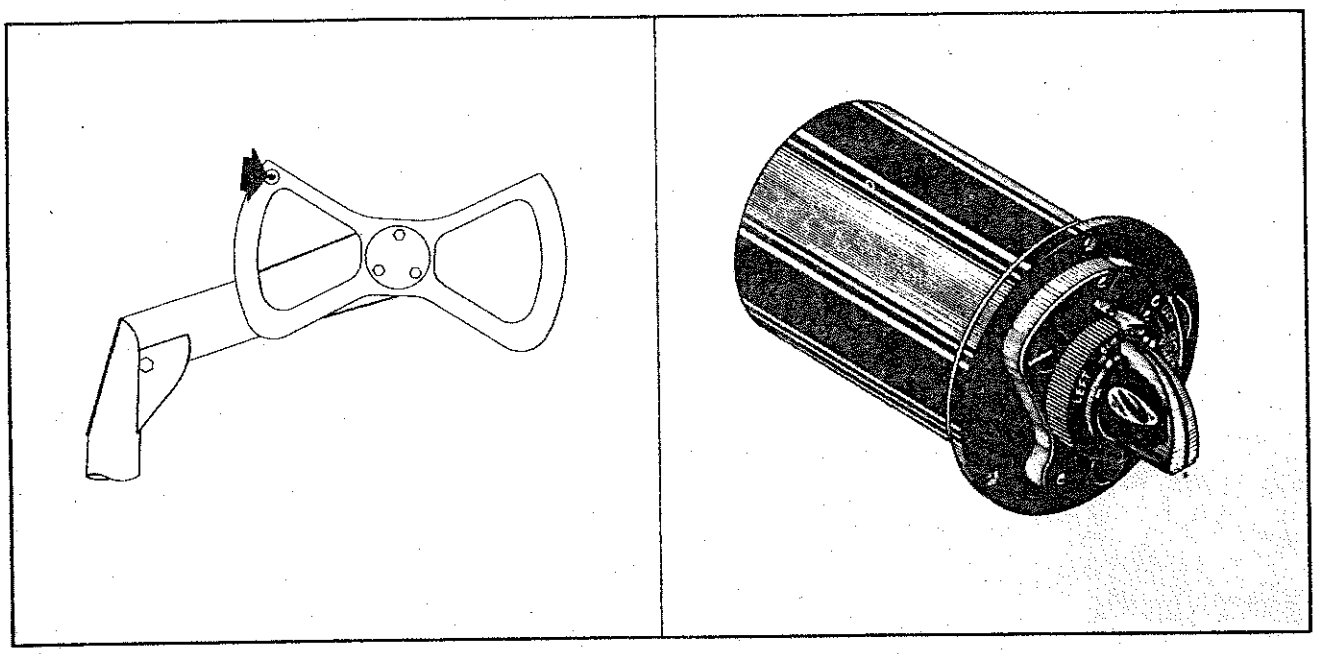


Figure 1-14. P-1 Automatic Pilot Controls

EMERGENCY DISCONNECT HANDLE

The autopilot system emergency disconnect T-handle (figure 1-14) is located on a bracket mounted on the right side of the pilot's control pedestal. Pulling the handle mechanically disconnects the autopilot system. The system cannot be re-engaged in flight once the emergency disconnect is actuated.

AUTOMATIC PILOT SYSTEM OPERATION

To engage the automatic pilot system, proceed as follows:

1. Manually trim the aircraft to the desired flight attitude using the conventional trim tab controls, and center the up-down, LEFT-RIGHT, and "Bank Trim" controls on the autopilot system controller.
2. Position the autopilot amplifier switch to ON. This switch must be actuated at least two minutes prior to engaging the autopilot system.
3. Using the gyro caging knob, cage, set, and erect the gyro horizon control, then uncage for operation.

NOTE

The gyros should be caged when attitudes of pitch or bank in excess of 45 degrees are anticipated. The autopilot system will disengage when the gyros are caged.

4. Depress the autopilot clutch push-button to engage the autopilot system.
5. Adjust yaw trim by using the turn and slip indicator to determine a slip or skid condition. Then adjust the autopilot system controller to center the turn and slip indicator ball. Use flat turns to attain the desired heading and re-center the ball upon completion of a turn.
6. Adjust pitch attitude trim by manipulation of the autopilot system controller with reference to the pitch attitude gyro.
7. Adjust roll or wing heaviness trim by centering or neutralizing the bank trim on the autopilot system controller. Then adjusting the aileron trim to the desired degree of lateral roll. Re-check yaw and pitch trim settings.
8. To disengage the autopilot system, depress the disengage push button on the pilot's control wheel. To re-engage the system, depress the clutch push button switch.

NOTE

The automatic pilot system can be manually overpowered with the normal flight controls for emergency operation.

9. Pull the emergency disconnect "T" handle to mechanically disconnect the autopilot system. Refer to Section III, Part 3 for P-1 Automatic Pilot System ground and flight checks, and to Section V for emergency autopilot system disengage procedure.

WING FLAP SYSTEM

The aircraft is equipped with trailing edge flaps for use primarily as a landing aid, however, they may also be used for short field and emergency take-offs. The flaps are actuated normally by an electric motor, but they may be operated manually by using the emergency hand crank. They are held in any preset position by the mechanical advantage of the system. Maximum flap deflection is 45 degrees.

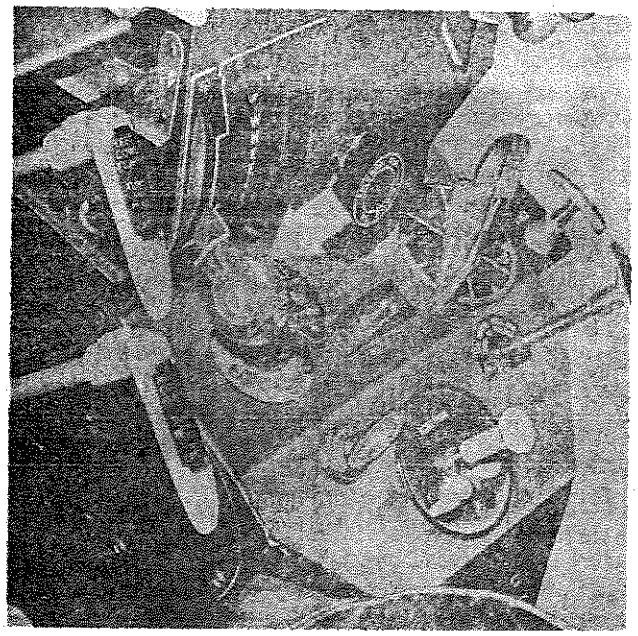


Figure 1-15. Landing Gear Handle

WING FLAP CONTROLS

WING FLAP LEVER

Position of the wing flaps is selected by a manually operated wing flap lever (figures 1-3 and 1-4) located on the right hand side of the pilots control pedestal. The yellow colored flap lever is formed in the shape of a miniature flap for easy recognition. To position or reposition the flap lever to either the UP, DOWN or OFF position it must first be pulled out. Placing the lever in UP or DOWN position actuates an up or down limit switch which completes the dc electrical circuit to a reversible type motor, resulting in a corresponding (UP or DOWN) position of the wing flaps. Placing the lever in the center position between UP and DOWN, placarded OFF opens the circuit to the actuating motor, thus stopping up or down travel of the flaps. This provides a means of selecting an intermediate flap position between full down and full up.

NOTE

The wing flap lever may be left in either UP or DOWN position without causing damage; however, it is recommended that it be placed in the OFF position after the desired flap position has been obtained.

WING FLAP POSITION INDICATOR

The electrically operated wing flap position indicator (figures 1-3 and 1-4), located on the right subpanel, shows flap position of the flaps in 15 degree increments, ranging from "0" (full up) to 45 degrees (full down).

WING FLAP EMERGENCY HANDCRANK

Emergency operation of the flaps is provided by use of the emergency handcrank (figure 1-16), located to the right of the pilots seat. Extension of the flaps with the handcrank is accomplished by pushing the crank in (toward the pilot) and turning (clockwise); to retract the flaps, turn the handcrank (counterclockwise). When the handcrank is pulled out (away from the pilot) it can be used for emergency operation of the landing gear.

LANDING GEAR SYSTEM

The landing gear system is the conventional type consisting of two retractable main landing gear and a single full-swivel type tail wheel. The tail wheel, although retractable in installation, is usually fixed permanently down on in-service aircraft. Both main gear retract aft and up into the nacelle housings on tubes, running diagonally through the nacelles. The slide tubes are set at such an angle that when in the full down position, the shock absorber type drag legs are in a past-center position and form positive down locks, therefore no electrical or mechanical down lock devices are required. Positive uplock for the gears is achieved by the irreversible characteristics of the worm drive reduction gearing which locks whenever a driving load is placed on the drive gear. When the landing gear is fully retracted, there is approximately one-third of the wheels exposed below the nacelle contour for wheels up landing protection. Retraction and extension of the landing gear is normally accomplished electrically by the landing gear motor located beneath the pilot's floorboard however it may also be extended or retracted manaually by the emergency handcrank. Protection of accidental retraction of the landing gear

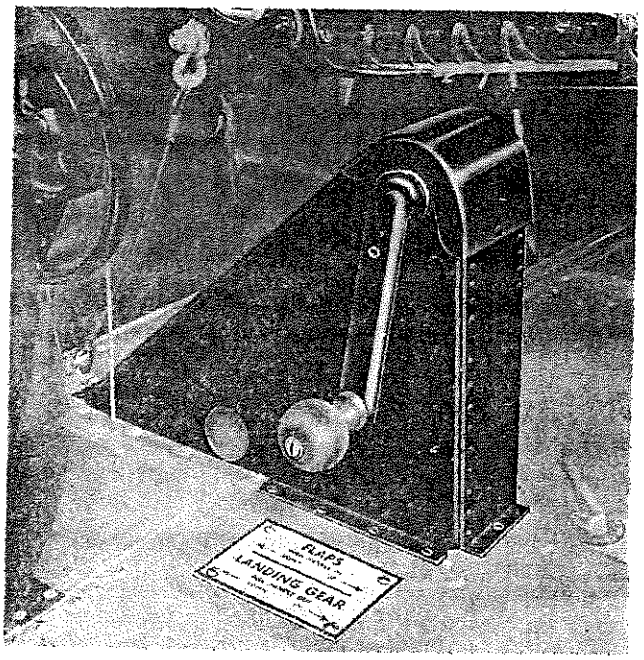


Figure 1-16. Landing Gear/Wing Flap Emergency Handcrank

while the aircraft is on the ground (due to inadvertent operation of the landing gear handle) is provided by a safety switch located on the left main shock strut. This switch cuts off all power to the landing gear motor whenever the strut is not fully extended. Protection of the landing gear motor and gear mechanism against overloads and the shock of starting and stopping is furnished by a spring-loaded disc type friction clutch.

LANDING GEAR CONTROLS

LANDING GEAR HANDLE

Extension and retraction of the landing gear is accomplished by placing the landing gear handle figure 1-15, located on the pilot's control pedestal, in the UP or DOWN position. The plastic landing gear handle, formed in the shape of a wheel, must be moved outboard against spring tension to move it from either detent.

LANDING GEAR WARNING LIGHT

The landing gear warning light, enclosed in the transparent landing gear handle (figure 1-15), illuminates causing the handle to glow red any time the position of the landing gear dies not correspond with that of the landing gear handle thereby providing an effective landing gear position indication. Operation of the landing gear malfunction light may be tested by pressing the LIGHT TEST button (figure 1-15), which is located just below the landing gear handle.

LANDING GEAR HANDLE (SOLENOID) EMERGENCY RELEASE

Inadvertent ground retraction of the landing gear is prevented by a latching solenoid, located in the pilots control pedestal, that prohibits movement of the landing gear handle to the UP position unless the aircraft is airborne or the main landing gear struts are fully extended. In the event of solenoid malfunction or an emergency where it is necessary to retract the gear while the aircraft is on the ground, the solenoid latching bar may be moved manually to release the landing gear handle by inserting a finger in the hole in the left side of the pedestal immediately above the cowl flap handles (figure 1-15) and pushing firmly against the bar while simultaneously moving the landing gear handle to the UP position.

CAUTION

The landing gear handle emergency release should not be operated on the ground except in the event of an emergency.

LANDING GEAR WARNING HORN

Retarding either throttle to a position equivalent to approximately 12 inches Hg., closes the ground circuit to the landing gear warning horn, located on the floorboard under the copilot's seat. The positive circuit of the horn is broken by the landing gear lower (down) limit switch so the horn will not operate when the gear is in the full down position.

WARNING HORN SILENCER SWITCH

A spring loaded, self-centering landing gear warning horn silencer knob (figures 1-3 and 1-4) is located between the throttles on the top of the pilots control pedestal. Rotating the knob toward the throttle which is actuating the horn will silence the horn until the throttle is advanced and then again retarded.

LANDING GEAR CLUTCH PEDAL

Disengagement of the friction clutch for manual operation of the landing gear system is accomplished by use of the clutch pedal (figure 1-7) which is located on the floor to the left of the control pedestal. Operation of the clutch pedal is accomplished by lifting the cover and pushing forward on the pedal. This releases the clutch, from other components of the system. The main landing gear will then free fall to the trail position. The amount of free-fall will depend largely on the amount of wind resistance against the wheels due to airspeed. The clutch pedal must be released and the electric drive re-engaged to lock the gear after it has been repositioned either up or down.

LANDING GEAR EMERGENCY HANDCRANK

The landing gear the flaps may be operated manually by using the emergency handcrank (figure 1-16) which is located to the right of the pilot's seat. Pulling the handcrank out (away from the pilot) engages it to the landing gear mechanism. Extension is accomplished by turning the handcrank clockwise, retraction is accomplished by turning the handcrank counterclockwise. Position of the landing gear switch lever has no effect on emergency operation of the landing gear. However, as a safety precaution, since failure of the normal control system might will be severance of an electrical circuit which could reconnect, the landing gear switch lever should be positioned at DOWN and landing gear circuit breaker pulled out before use of the emergency system.

WARNING

To lower the gear manually, always depress the clutch and allow the gear to drop free before attempting to engage the hand crank. If the handcrank is engaged prior to depressing the clutch, the entire weight of the gear must be supported by the handcrank after the clutch is depressed. With the weight of the gear on the handcrank, it is extremely difficult for the operator to control safely. Should the crank slip from the operator's grasp, serious injury may result.

CAUTION

Although it is possible to retract the gear manually without causing failure of component parts of the retract system; manual retraction is very difficult due to weight of the landing gear and should not be practiced unless absolutely necessary.

LANDING GEAR ELECTRICAL OVERLOAD CONTROLS

The landing gear handle switch circuit breaker, placarded LANDING GEAR CONTROL, is mounted on the right subpanel and protects the switch circuit from overloads in the event the switch is repositioned while the gear is retracting or extending.

LANDING GEAR CLUTCH INSPECTION LIGHT

The landing gear clutch mechanism inspection light is located beneath the landing gear and wing flap motor access door in the floorboard area between the pilot and copilot seats. The light is controlled by an ON, OFF switch on the base of the pilots control pedestal, and is used to visually inspect landing gear motor clutch mechanism for condition and/or indication of slippage.

TAIL WHEEL LOCK/UNLOCK HANDLE

The tail wheel locking system is a mechanical linkage from the T-shaped tail wheel locking handle (figures 1-3 and 1-4), located on the pilot's control pedestal, to a locking pin in the tail wheel strut. When the lock is engaged (T-handle full-in), the lock will hold the tail wheel in a straight fore and aft position which will aid in preventing the aircraft from turning in either direction during ground operations. To unlock, pull the handle full out (about four inches) and twist one-quarter turn to right. The lock handle is cable-connected to a locking pin in the tailwheel strut. Using a combination of differential engine power and wheel brake application to remove all side loads from the tailwheel when unlocking it reduces binding of the pin and facilitiates the procedure.

WHEEL BRAKE SYSTEM

The single-disc main wheel brakes are the manual hydraulic, master cylinder type operated by toe pressure on both the pilot's and copilot's rudder pedals. As an added safety feature, a shuttle valve in the line allows only one set of brake pedals at a time to be effective, which essentially divides the system into two individual brake systems, the pilots and copilots. The system having the greater pressure applied is the one which will be effective in braking the aircraft, the other will be completely ineffective. The additional safety provided by separate systems eliminates the necessity for a separate emergency brake system.

BRAKE CONTROLS

BRAKE CONTROL PEDALS

A pair of toe actuated manual brake pedals for both the pilot and copilot are a part of the normal rudder control assembly. Effectiveness of wheel braking action is directly proportional to the toe pressure applied to the rudder pedals. When toe pressure is released, the brake lining actuating pistons return to their original position thereby decreasing or removing all wheel braking action.

PARKING BRAKE HANDLE

The parking brake handle (figures 1-3 and 1-4) located on the control pedestal, is mechanically linked to parking brake valves which are incorporated only in the pilot's brake system. When the handle is pulled out, the valves are closed thus maintaining, on the brake, whatever pressure that has been applied by the pilot's pedals. Pushing the handle in opens the valves, releasing the trapped fluid. To set the brakes, it is necessary to apply pressure to the brakes with the pilot's pedals; then pull the parking brake handle out. To release the parking brakes depress the pilots brake pedals or push the parking brake handle in.

The brakes on both main landing gear wheels are set and released simultaneously. While parking brakes are on, copilot's toe pedals are ineffective.

CAUTION

When on landing roll, do not confuse the parking brake handle with the tailwheel lock control, which is a similar handle located to the right of the parking brake.

PITOT STATIC PRESSURE SYSTEM

The airspeed altimeter and vertical speed indicators located on the instrument panel are operated by the aircraft's pitot static system. The altimeters and vertical speed indicators are operated by the static pressure alone while the airspeed indicators are operated by pitot and static pressure combined. Pitot and static pressure are obtained at the two pitot masts located on the underside of the forward fuselage just aft of the nose. The mast heads are constructed in two sections internally. One section furnishes pitot pressure while the other serves to provide static pressure. No alternate static air source is provided.

VACUUM SYSTEM

An engine driven vacuum pump on each engine supplies vacuum for the flight instruments requiring vacuum for operation, i.e., altitude, turn and slip, and directional indicators. The exhaust from these pumps is utilized to supply pressure for operation of the surface deicer system. Both pumps are integrated into a single system which uses automatic check valves in such a manner that failure of a single pump results only in decreased capacity rather than complete failure of the entire vacuum system. Each pump is capable of driving all vacuum-operated instruments. The pilot has no operating controls for the system since pumps operate whenever the engine is operating. Relief valves are preset to maintain proper operating pressures at all times.

VACUUM SYSTEM INDICATORS

VACUUM GAGES

On UC-45J aircraft, two direct reading vacuum gages

(figures 1-3 and 1-4) are located on the right and left subpanel. These gages are calibrated in inches Hg. and are used to indicate the pressure differential available within the vacuum system for the vacuum operated flight instruments. On RC-45J aircraft only a single vacuum gage, located on the left subpanel is used.

VACUUM WARNING LIGHTS

On UC-45J and RC-45J aircraft, a vacuum pump inoperative warning light (figures 1-3 and 1-4) is located on both the right and left subpanel. These lights are operated by pressure switches located in each battery well and illuminate to indicate vacuum pump failure of their respective pump, i.e., right or left.

CAMERA VACUUM SUPPLY

On RC-45J aircraft, vacuum for camera operation is supplied by the left engine vacuum pump camera vacuum being taken between the engine pump and the automatic system isolation check valve. Due to the limited vacuum capacity of the vacuum system with one pump inoperative, adequate vacuum for both flight instruments and camera operation is not available. Therefore, should the left vacuum warning light illuminate (left engine inoperative) all cameras should be turned off. If the light goes out when the cameras are turned off, check each station by turning on its vacuum and noting the reaction of the left warning light. Once a station leak has been located, the other stations may be used again.

FLIGHT INSTRUMENTS

Flight instruments include all instruments required by the pilot or copilot for visual and instrument flight. These instruments are conveniently located on the pilot's instrument panel and duplicated on the copilot's instrument panel.

AIRSPEED INDICATORS

Two airspeed indicators are provided, one each on the pilot's and copilot's instrument panels (figures 1-5 and 1-6). A pointer moves over a dial calibrated from 0 to 400 knots in increments of 10.

PRESSURE ALTIMETERS

Two pressure altimeters are provided, one on the pilot's and one on the copilot's instrument panels (figures 1-5 and 1-6). Three concentric pointers sweep a calibrated dial to indicate the altitude of the aircraft. The shortest pointer indicates altitude in thousands of feet, the intermediate pointer in hundreds of feet, and the longest pointer at the outer periphery of the instrument face, in tens of thousands of feet. A barometric scale is located at the right side of the face, and a low altitude warning symbol at the bottom.

VERTICAL SPEED INDICATORS

Two vertical speed (rate of climb) indicators (figures 1-5 and 1-6) are provided, one each on the pilot's and copilot's section of the instrument panel. The dials are placarded CLIMB on the top half of the instrument face or climb indication range and are graduated in 100 fpm increments from 0 to 6000 fpm.

TURN AND SLIP INDICATORS

Two turn-and-slip indicators (figures 1-5 and 1-6) are located on each side of the instrument panel, one for the pilot and one for the copilot. These indicators are vacuum driven and are utilized to provide visual indications of the rate and coordination of a turn. Each indicator is equipped with a pointer which indicates the degree of turn and an inclinometer tube and ball which gives an indication of the lateral stability of the aircraft. No adjustment or caging knobs are required to operate the instrument.

PANEL CLOCK

On UC-45J aircraft a standard 8-day manually wound clock (figures 1-5 and 1-6) is located in both the upper left and upper right corners of the instrument panel. On RC-45J aircraft, a single clock installation is located in the upper left corner of the instrument panel.

OUTSIDE AIR TEMPERATURE INDICATORS

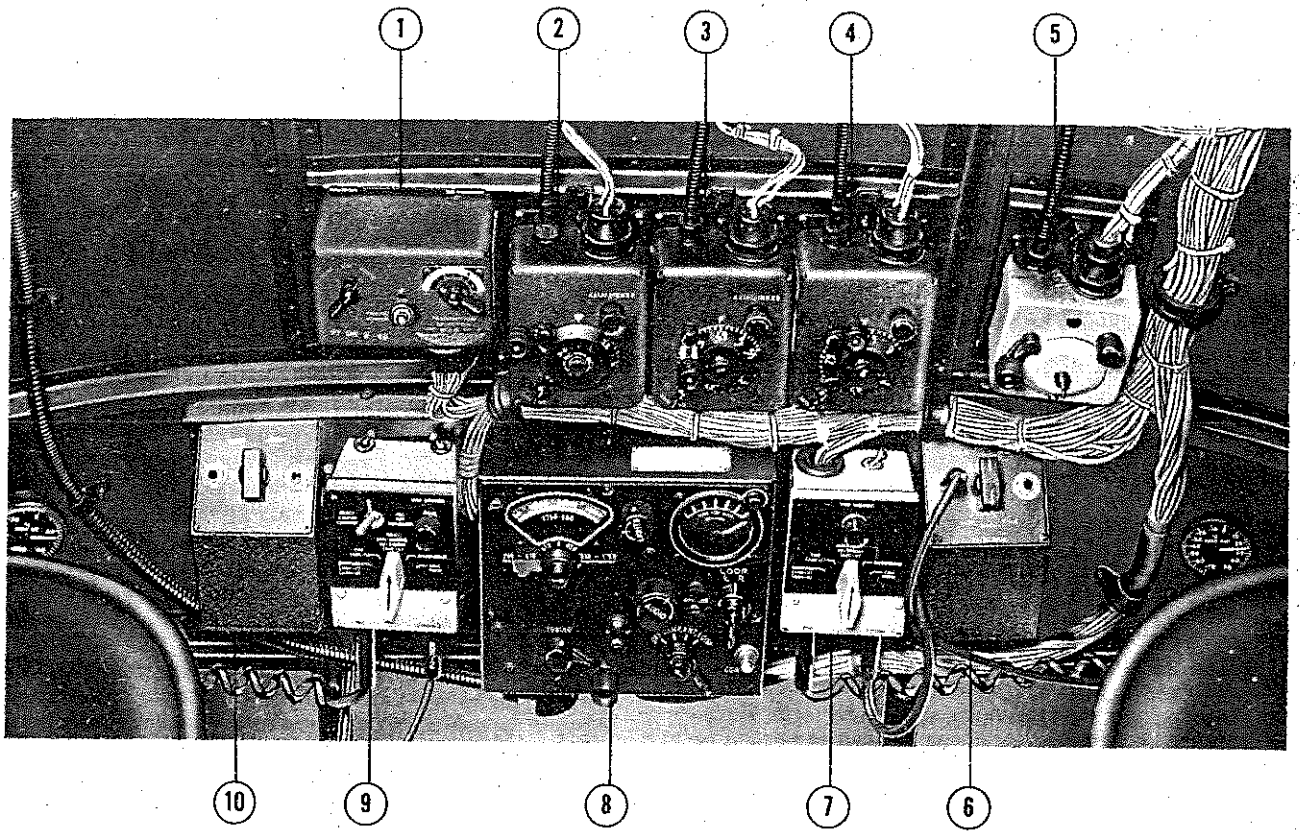
An outside air temperature (OAT) indicator is mounted through the overhead fuselage structure; one above the pilot's seat, and one above the copilot's seat. Both indicators are direct reading instruments and are calibrated in degrees centigrade (C°).

MAGNETIC (STANDBY) COMPASS

A standard magnetic compass (figures 1-3 and 1-4) is mounted at the top center of the instrument panel.

ATTITUDE INDICATORS

On UC-45J aircraft, two attitude indicators are installed on the instrument panel (figure 1-3). One instrument, located on the left side and an identical instrument, located on the right hand side. Both instruments are vacuum operated and are identical in operation. An indicating plane in front of the face of the instrument represents the aircraft and a movable horizontal bar behind the indicating plane represents the horizon. The indicating plane may be adjusted vertically by means of a small knob located at the lower edge of each indicator to correct for variations in level flight attitude at different airspeeds and gross weights. The indicators may be caged manually by turning the caging knob located on the lower right hand corner of the instrument.



1. ARC-5 TRANSMITTER CONTROL BOX
2. ARC-5 RECEIVER CONTROL BOX 6 TO 9.1 MC
3. ARC-5 RECEIVER CONTROL BOX 3 TO 6 MC
4. ARC-5 RECEIVER CONTROL BOX .2 TO .55 MC
5. ARN-30 OMNI CONTROL BOX
6. COPILOT'S RANGE FILTER
7. COPILOT'S JACK BOX
8. ARN-7 RADIO COMPASS CONTROL BOX
9. PILOT'S JACK BOX
10. PILOT'S RANGE FILTER

Figure 1-17. Radio Controls (Typical UC 45J/RC-45J)

CAUTION

A temporary displacement of the gyro from its normal position during turns, commonly referred to as "turn error," may be introduced into the indicators when normal turns are performed.

On RC-45J aircraft, a single vacuum operated attitude indicator (figure 1-4) is located in the left center of the instrument panel. The electrically operated attitude indicator on the right side of the instrument panel is used in conjunction with the P-1 Autopilot System as a gyro horizon control.

DIRECTIONAL INDICATORS

On UC-45J aircraft, two directional indicators are installed on the instrument panel (figure 1-3) and indicate the heading of aircraft turn in five degree increments. These indicators are aircraft vacuum system operated. Since these directional indicators are not magnetically slaved, they will show apparent drift due to the earth's rotation. The quantity of this apparent drift will depend upon the latitude at which the aircraft is flying. Therefore, the indicators should be adjusted to the desired heading just before beginning the take-off run and, when flying straight and level for extended periods of time, should be checked and adjusted as necessary in order to maintain the desired heading. Each indicator is equipped with a caging knob, located just below the indicator, which can be rotated in either direction while the indicator is caged to set the dial at a desired heading. Pushing the knob in cages the indicator and pulling it out uncages it.

On RC-45J aircraft, a single vacuum operated directional indicator (figure 1-4) is located near the left center of the instrument panel.

SLAVED GYRO MAGNETIC COMPASS

A slaved gyro magnetic compass indicator (figures 1-5 and 1-6) located on the upper left corner of the instrument panel, provides a stable directional indication under all adverse conditions. The compass system consists basically of a transmitter, located in the right wing tip, which serves as a reference for slaving the gyros to the earth's magnetic field, the panel mounted indicator, and the ac inverter required to convert aircraft dc power into alternating current required for operation of the compass. The indicator provides compensated compass readings by means of a direct-reading, 360-degree dial. The dial shows the four cardinal headings as well as intermediary headings which are marked every 5 degrees and numbered every 30 degrees. Directional indications are shown by a pointer that moves across the face of the instrument showing the direction of flight, and an indicating pointer, controlled by a knob in the lower left corner of the indicator, for setting to the desired course. The circuit breaker for this ac inverter is located behind the copilot's right elbow and is used as the ON/OFF switch in the UC-45J aircraft.

COMMUNICATIONS EQUIPMENT

All UC-45J and RC-45J aircraft are equipped with various radio communications equipment combinations listed in figure 1-18. Location of controls and equipment installed will vary between aircraft. However, the complete system as described may be considered typical for aircraft now in service.

COMMAND RADIO AN/ARC-27 AND 27A

All UC-45J and RC-45J aircraft are equipped with either the AN/ARC-27 or the AN/ARC-27A command radio system; the only variation being in the location

TABLE OF COMMUNICATIONS EQUIPMENT

ARC-27 OR 27A	UHF TRANSCEIVER FOR VOICE COMMUNICATIONS	18 PRESET CHANNELS PLUS 243.0 (GUARD) AND ONE MANUALLY CONTROLLED CHANNEL FROM 225.0 TO 399.9 MC
ARC-5	HF VOICE TRANSMITTER	CRYSTAL CONTROLLED (3105 KC TYPICAL)
ARC-5	LF RANGE RECEIVER	.2 TO .55 MC
ARC-5	HF RECEIVER	3 TO 6 MC
ARC-5	HF RECEIVER	6 TO 9.1 MC

Figure 1-18. Communications Equipment

NOTE

ON UC-45J AIRCRAFT, THE AN/ARC-27A UHF COMMAND RADIO CONTROL HEAD IS MOUNTED ON THE INSTRUMENT PANEL. ON RC-45J AIRCRAFT, THE CONTROL HEAD IS MOUNTED ON THE FORWARD SIDE OF BULKHEAD BETWEEN THE PILOT'S AND COPILOT'S SEATS.

1. CHANNEL SETTING BUTTON
2. FREQUENCY SELECTOR DIALS
3. SENSITIVITY TRIM SWITCH
4. FUNCTION SWITCH
5. CHANNEL SELECTOR SWITCH
6. VOLUME CONTROL KNOB

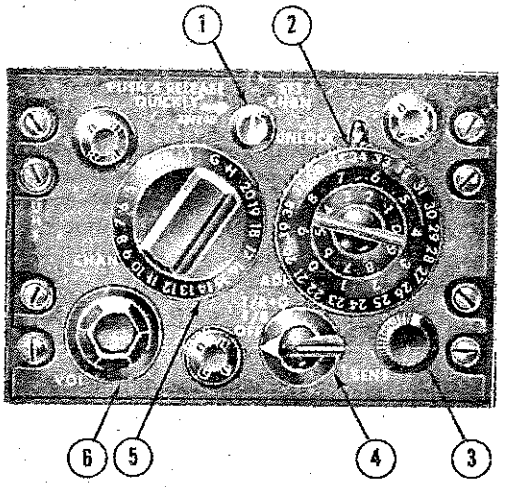


Figure 1-19. Command Radio Set AN/ARC-27 or 27A

of the set control head. On UC-45J aircraft, the control head is located in the center of the instrument panel (figure 1-5) while on RC-45J aircraft the control head is located near the floor between the pilot and copilot seats and is mounted on the forward side of the pilot's compartment bulkhead (figure 1-19). This radio set provides the pilot with two-way radio-telephone voice communications between aircraft, or between aircraft and ground stations in the ultra-high-frequency range (225.0 to 399.9 mc) on any of twenty preset channels plus a guard (243.0) and a manual channel which can be preset for automatic selection. The receiver is designed to permit monitoring on guard-channel while operating on any of the other channels. Reception is continuous except during periods of transmission. The change from receiving to transmitting is accomplished by depressing the microphone button. Under normal conditions, reliable communication can be expected over line-of-sight distances.

CONTROLS AND INDICATORS

The following controls are located on the command radio control box:

1. Channel selector switch - M position permits selection of frequency channels. G position permits reception and transmission on guard channel. All other positions permit selection of the 18 preset channels.
2. Preset channel indicator - Indicates which of 18 preset channels is selected for operation.
3. Frequency selector dials - Used for selecting frequency when channel selector switch is at M or for presetting frequencies in channels selected by channel selector switch.
4. Function switch - T/R position puts main receiver in operation and transmitter in standby. T/R & G position puts main and guard receivers in operation and transmitter in standby. ADF position is inoperative. OFF position turns off the set.
5. Channel setting button - Locks preset frequencies in related channels for automatic channel selection.
6. Sensitivity trim switch - Adjusts receiver sensitivity.
7. UHF Volume Control Knob - Inoperative.

OPERATION

To place the UHF Command radio system in operation, proceed as follows:

1. Function switch - T/R or T/R + G and allow a 1-minute warmup time before attempting to transmit (aircraft battery switches ON). Premature keying of equipment can result in rendering the equipment inoperative.
2. Channel selector switch - Desired Channel.
3. Jack-box volume control knob - Adjust as desired.
4. Sensitivity trim knob - Adjust. The sensitivity must be adjusted for each frequency (except guard, which is preset) to assure maximum reception. Then rotate the sensitivity trim knob clockwise until a background noise is heard, then slowly rotate the knob counterclockwise. Stop rotation the instant the background noise disappears. To increase reception range, it may occasionally be necessary to adjust sensitivity to a point where background noise is audible.

Channel presetting is a mechanical procedure which does not require electrical power and is accomplished by setting the channel selector switch to the desired channel and setting the frequency selector dials to the frequency to be preset. Rotate the channel setting button to the SET position, then turn the button one-quarter turn clockwise, depress and release. The channel is correctly preset if index line assumes a vertical position.

RANGE AND HF RECEIVER (ARC-5)

The range and HF (high frequency) receiver systems consist of three receiver units mounted in the rear lavatory compartment (figure 1-21) and their respective control boxes mounted on the overhead pand in the pilot's compartment (figure 1-17). This equipment is designed for long-range operation between aircraft or between ground stations and aircraft. The 190 to 550 kc receiver is used primarily for radio navigation. This frequency band covers all low frequency airway radio navigation stations. The 3 to 6 mc and 6 to 9.1 mc receivers will pick up HF aircraft and ground transmissions on frequencies such as 3105 kc, 4495 kc, and 6210 kc.

CONTROLS AND INDICATORS

The three separate receiver systems controls and indicators are located on the respective units control box located on the pilot's compartment overhead panel. The following controls are located on each control box:

1. Voice/CW switch - During normal operation, the voice-cw switch should be in the voice position. The CW position introduces a background tone into reception, making coded signals more readable while still allowing voice transmissions to be understood.
2. Volume control - Controls headset audio volume.
3. Tuning crank and calibrated dial - dial indicates frequency selected by manual crank rotation.

OPERATION

The desired range receiver may be operated as follows:

NOTE

Since no system ON-OFF switch is provided, the equipment may be shut-down by pulling the circuit breaker located on the bulkhead behind the copilot's seat.

1. Voice/CW switch - Voice (aircraft battery switches ON).
2. Volume control - Full ON (allow approximately thirty seconds for tube warm-up).
3. Jack box selector switch - HF RANGE (ARC-5).
4. Beam filter box selector switch - PHONE or BOTH for voice transmission.
5. Tuning crank and calibrated dial - Select desired frequency when static type noise becomes audible.
6. Volume control - Adjust to desired level.

HF TRANSMITTERS

Two preset HF (high frequency) transmitter units are located in the lavatory compartment and are remotely controlled by three switches on the transmitter control box.

CONTROLS AND INDICATORS

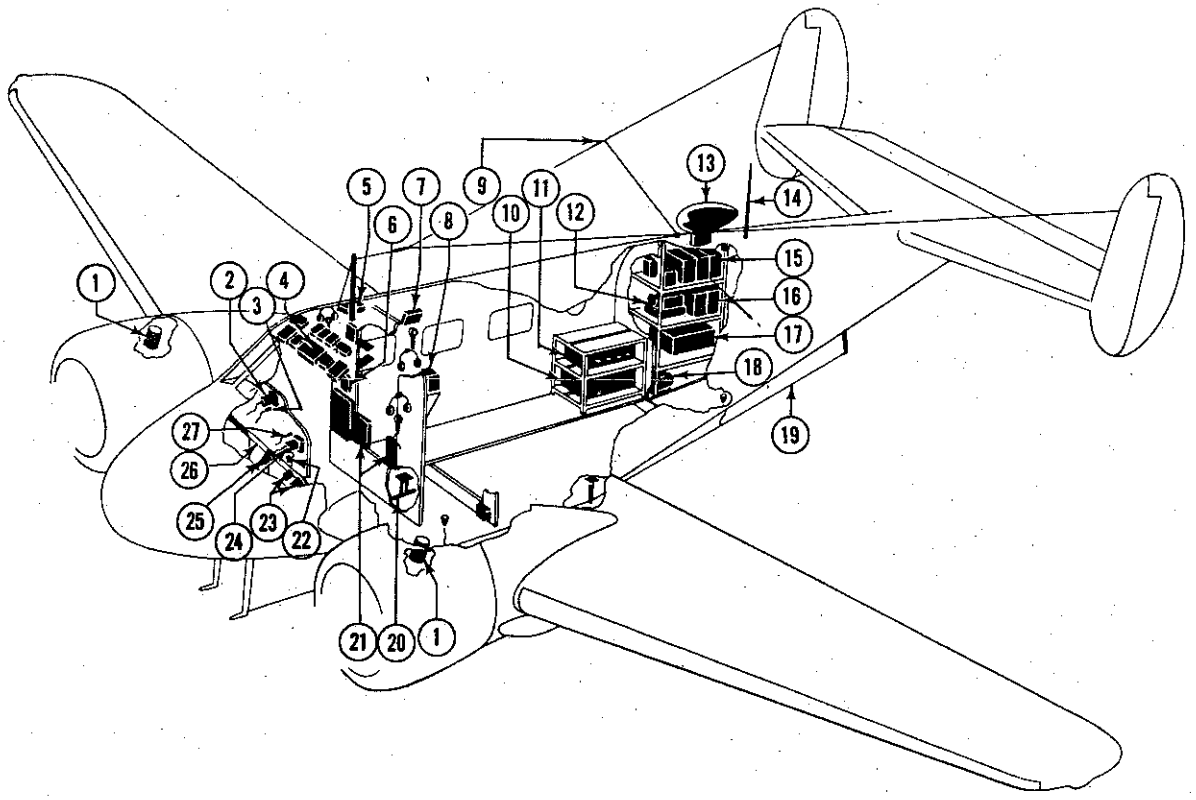
The following HF transmitter controls are located on the transmitter control box (figure 1-17) located on the pilot's compartment overhead panel.

1. Voice/CW/Tone switch - During normal transmissions the VOICE position is used. Use CW or TONE positions when sending code while using the microphone switch as the key.
2. Transmitter power switch - OFF position de-energizes; ON position energizes.
3. Transmitter selector switch has four positions, two of which are operative.

TABLE OF NAVIGATION EQUIPMENT

ARN-30	OMNIDIRECTIONAL RECEIVER (OMNI)	108-118 MC VOR 108-110 MC VAR 108-112 MC LOCALIZER 108-135 MC VOICE RECEPTION
ARN-7	LOW FREQUENCY DIRECTION FINDER (ADF)	100 TO 1750 KC IN FOUR BANDS: 100-200 200-410 410-850 850-1750
ARN-8	MARKER BEACON RECEIVER	72 TO 78 MC (OPERATES AT 75 MC)
APN-1	RADIO ALTIMETER	420-460 MC, FM MODULATED

Figure 1-20. Navigation Equipment



1. ENGINE GENERATORS
2. RADIO COMPASS BEARING INDICATOR
3. MARKER-BEACON LIGHT
4. RADIO CONTROLS
5. RADIO FUSE BOX
6. ARC-5 CIRCUIT BREAKERS
7. PASSENGER/CREW COMPARTMENT JACKBOX
8. ARN-8 MARKER-BEACON RECEIVER
9. ARC-5 COMMAND ANTENNA
10. RADIO ALTIMETER TRANSMITTER-RECEIVER
11. ARC-27 UHF RECEIVER–TRANSMITTER
12. MODULATOR UNIT
13. RADIO COMPASS LOOP ANTENNA
14. ARC-27 UHF ANTENNA
15. ARC-5 RECEIVERS
16. ARC-5 HF TRANSMITTERS
17. ARN-7 RADIO COMPASS RECEIVER
18. INVERTER
19. RADIO COMPASS SENSE ANTENNA
20. RADIO ALTIMETER TRANSMITTING ANTENNA
21. VOLTAGE REGULATORS
22. LANDING GEAR CIRCUIT BREAKER
23. VOLT-AMMETERS
24. RADIO ALTIMETER INDICATOR
25. RADIO ALTIMETER ALTITUDE SELECTOR SWITCH
26. CIRCUIT BREAKER PANEL
27. RADIO ALTIMETER LOW WARNING LIGHT

Figure 1-21. Radio Equipment Location (Typical)

OPERATION

To place the HF transmitters in operation, use the following procedure:

1. Transmitter power switch - ON (aircraft battery switches ON). Approximately twenty seconds are required for the transmitter tubes to reach operating temperature.
2. Transmitter selector switch - Select the desired transmitter frequency.
3. Voice/CW/Tone switch - VOICE position (for normal transmission).
4. Microphone button - Depress and talk into mouthpiece. When transmission is ended, release microphone button.

CAUTION

Avoid switching from one transmitter to another while transmitting.

5. Voice/CW/Tone switch - CW (continuous wave) if CW type transmission is desired. Use microphone button as key to form coded signals.

NOTE

When Voice/CW/Tone switch is on VOICE, transmitter dynamotor runs only when microphone button is depressed. When switch is on either CW or TONE, dynamotor runs continuously. To avoid excessive wear on dynamotor, keep switch on VOICE when not transmitting CW.

On CW, the transmitter puts out an unmodulated carrier wave. The station receiving the signal must use a CW (beat oscillator) feature to make the signal readable as a coded tone. If the CW feature is not used the receiving station will hear a "rush" or open microphone sound. When sending on TONE, the transmitter puts out a modulated wave. Any station receiving this signal will hear it as a coded tone. This type of transmission should be used when it is known that the receiving station does not use a CW feature while guarding the frequency being transmitted. Transmit on CW when the receiving station is distant or when electrical disturbances are present. CW (unmodulated) transmissions are less affected by static than are tone (modulated) transmissions.

NAVIGATION EQUIPMENT

Refer to navigation equipment listing, figure 1-20.

OMNI-RANGE RECEIVER AN/ARN-30

The omni-directional navigation system consists of a type 15C receiver mounted on the radio equipment rack in the aft passenger compartment and the receiver's remote control box mounted on the overhead panel in the pilots compartment (figure 1-17). The type 15C omni navigational receiver is designed to operate in the frequency range from 108 to 135 megacycles, utilizing the following facilities.

VHF-omni directional airways radio ranges (108 to 118 megacycles VOR)

VHF-visual-aural airways radio ranges (108 to 110 megacycles VAR)

VHF-90/150 cps runway localizers (108 to 112 megacycles LOC)

VHF-voice reception (108 to 135 megacycles)

The system may be used for flying the desired track on the VHF omni-range for obtaining a precise fix on two or more VHF navigation stations, for making runway localizer approaches, and for flying a fixed track on the VHF visual-aural system. On UC-45J aircraft, visual signals are presented on two course indicators located respectively on the left (pilot's) and right (co-pilot's) side of the instrument panel. On RC-45J aircraft, only the left (pilot's) indicator is installed. Localizer readings are presented on both indicators.

CONTROLS AND INDICATORS

1. The remote control box contains;
   a. The ON/OFF volume control knob - Controls volume. Turning the knob clockwise turns the set on and increases volume. The volume control knob also controls the power (but not volume) to the marker beacon receiving system.
   b. OMNI/VAR/LOC switch - Selects type of navigation signals desired. When the switch is in the OMNI position and an OMNI range station is tuned in, the magnetic bearing "to" or "from" the station will be presented on the course selector needle when the course deviation needle is centered. When placed on the VAR/LOC position and a visual aural range or runway localizer station is tuned in, a left or right indication will appear on the course indicators.
2. The course selector contains:
   a. A course selector knob - Sets the course selector needle for a desired radial.
   b. A course selector needle - When used in conjunction with the course deviation needle, shows bearing "to" or "from" a station. When on VAR/LOC position, it does not function.
   c. A TO/FROM indicator - Used in conjunction with the course selector needle.
3. A course indicator which contains no controls displays the relative position of the aircraft to the course selected in the course selector.

OPERATION

Typical navigational procedures using VOR and BAR facilities are as follows:

1. ON-OFF volume control knob - ON.
2. OMNI/VAR/LOC switch - As desired.
3. Tuning Crank - Select desired frequency.
4. Adjust volume level.

5. Determine aircraft bearing relative to one or more VOR stations.
6. Fly desired track to or from VOR station, or for holding fix, or instrument let down as required.

NOTE

Partial failure of the type 15C navigational receiver equipment does not necessarily render all of the equipment inoperative. If either the VAR or VOR fails to function, the other still may be operative. However, there are no emergency methods of operation for the equipment.

RADIO COMPASS AN/ARN-7

The ARN-7 radio compass is a navigational system which provides an automatic visual indication of the direction to a low frequency transmitting facility or AM radio broadcasting station with respect to the heading of the aircraft, and simultaneous aural reception of modulated or unmodulated signals. The system consists of a receiver mounted in the radio equipment rack aft of the rear cabin bulkhead and the radio compass control panel mounted on the pilots compartment overhead radio panel. The receiver covers a continuous frequency range from 100 kc to 1750 kc in four bands; 100 to 200 kc; 200 to 410 kc; 410 to 850 kc; and 850 to 1750 kc.

CONTROLS AND INDICATORS

All controls for the ARN-7 system are located on the radio compass control panel (figure 1-17) on the pilot's compartment overhead radio panel. Seven separate controls are provided and one indicator.

1. Tuning crank - Controls signal strength and frequency adjustment within the selected band.
2. Tuning meter - Aids in tuning accuracy. Maximum pointer deflection to the right indicates the strongest signal.
3. Antenna selector switch - Controls system antenna function in OFF, COMP, ANT, and LOOP positions as follows:

OFF - System secured.

COMP - Automatic direction finding with instrument panel mounted radio compass.

ANT - Primary listen, tune, and voice monitor position. The instrument panel mounted radio compass indicator and the loop switch on the control box are inoperative when the selector switch is on ANT.

LOOP - Allows manual control of loop antenna for aural null operation and best listen during adverse conditions.

4. Volume control knob - Provides adjustment of audio signals received through the radio compass. A definite decrease in volume setting required when COMP mode operation is selected, and an increase is required on LOOP selection.
5. LOOP L-R switch - Operable only when antenna selector switch is in loop position and controls rotation of the compass loop antenna.
6. Band select knob - Controls selection of any one of four frequency bands.
7. Compass control changes button - Not applicable.
8. Radio compass indicator - indicates azimuth of a received station. Indicator is the fixed card type, zero degrees indicates the nose of the aircraft, and the ADF bearing pointer reading indicates relative bearing to a station.

OPERATION

The ARN-7 low frequency radio navigation system is operated as follows:

NOTE

On units which have a VOICE-CW switch on the radio compass control panel, position the switch to VOICE for normal operations. The CW position of the switch provides a beat frequency oscillation which creates a tone to be heard when a weak station is tuned in. The tone may be used to tune a station in even though the station is too weak to hear intelligibly or to operate the tuning meter. For precise tuning the tone should come back in on each side of the station frequency. By rocking the tuning crank, a station may be tuned accurately.

If a VOICE/CW switch is not mounted on the radio compass control panel, it is mounted on the front of the system receiver unit on the radio equipment rack.

As a low frequency radio receiving system using ANT position:
1. VOICE/CW switch - Set for desired operation.
2. Volume control knob - Rotate full clockwise.
3. Antenna selector switch - ANT position.
4. Jack box selector switch - COMP.
5. Beam filter switch - PHONE or BOTH.
6. Band select knob - Desired frequency range.
7. Tuning crank - Desired station frequency and check tuning meter (TUNE FOR MAX.).
8. Volume control knob - Adjust for usable level.

NOTE

Operate receiver with volume advanced only far enough to hear the signal clearly. If volume is advanced too far the course may appear broad and the accuracy will be affected. If extra sensitive tuning is required, turn compass selector switch to COMP, wait until compass needle is steady, and check "TUNE FOR MAX." needle again.

As an Automatic Direction Finder (using COMP position).

1. Volume control knob - Rotate full clockwise.
2. Antenna selector switch - ANT position.
3. Band select knob - Desired frequency.
4. Tuning crank - Desired station frequency.

5. Antenna selector switch - COMP position. Adjust for maximum deflection on tuning meter.
6. Volume control knob - Readjust for comfortable level.
7. Radio compass indicator - Read bearing.
8. Loop L-R switch - Check operation of ADF on station by operating loop switch to left or right. Indicator hand should return to same bearing when the switch is released. If the indicator hand does not return to the same bearing, the signal should not be used for ADF navigation.

NOTE

For aural reception of aural-null signals, operate the system with the antenna selector switch in ANT or LOOP position instead of COMP, since the action of the AVC (automatic volume control) in COMP position will cause broad course indications. When practical, avoid continuous operation in COMP position to prevent unnecessary wear on the loop drive motor.

As a manually controlled direction finder using ANT and LOOP positions.

1. Volume control knob - Rotate full clockwise.
2. Antenna selector switch - ANT position.
3. Band selector knob - Desired frequency range.
4. Tuning crank - Desired station frequency.
5. Antenna selector switch - LOOP position.

NOTE

For best definition of A and N quadrant signals on ANT or LOOP positions, the volume control knob must be reduced to the lowest usable volume level as A - N signal intensity increases.

6. VOICE/CW switch - CW position.
7. Loop L-R switch - Adjust, left or right, full null location.
8. Volume control knob - Readjust for desired null width.

NOTE

When using receiver in LOOP position to obtain a bearing, adjust volume level to give best null width. As volume is increased, null width decreases. Best null width is 5 to 10 degrees. When taking a loop-null bearing on any station transmitting a continuous carrier wave (airway radio range or AM radio broadcast), place the VOICE/CW switch in CW. In this position, a null is more noticeable since a constant tone will be heard during the pause between signals, spoken words, etc. Otherwise, this pause may be confused with a null.

When operating on loop with the loop stationary, the volume of the signal will change with a change in bearing between aircraft and station. Be aware of this condition when working for a fade or build during orientation.

MARKER BEACON AN/ARN-8

The marker beacon receiver system consists of the receiver unit mounted in the aft radio equipment rack and the necessary system controls and indicators located in the pilots compartment. The system provides either or both visual and aural indication when the aircraft passes over a marker beacon transmitter station. The marker receiver has a frequency range of 62 to 78 mc and is preset to receive 75 mc modulated signals. Airway fan markers, Z markers, and inner and outer ILS localizers operate on 75 mc. The marker receiver requires no tuning.

CONTROLS AND INDICATORS

All marker beacon controls are located on the pilot's compartment overhead radio panel and all marker indicator lights are on the instrument panel. On UC-45J aircraft, two switches and two indicator lights are provided, while on RC-45J aircraft, only one switch and one indicator light is installed (due to the instrument panel mounted forward vision view finder). The switch controls are located on the pilot's and copilot's jack boxes and the marker indicator lights are located adjacent to the omni and localizer course indicator. Function of the system controls is as follows:

1. Pilot's audio switch - Controls pilots audio (75 mc modulated tone) portion of system (in head phones).
2. Copilot's audio switch - Controls copilot's audio (75 mc modulated tone) portion of system (in headphones).

NOTE

The omni system ON-OFF volume control knob located on the pilot's compartment overhead omni control box (figure 1-17) must be turned on to supply marker beacon power. Clockwise rotation of the knob turns the system ON.

3. Marker beacon indicator light - Provides amber color visual signal when the aircraft passes over a marker beacon transmitter.

OPERATION

The marker beacon system is energized as follows:

1. Omni ON-OFF volume control knob - Rotate clockwise until ON. This knob has no effect upon the volume of the marker beacon signal. No volume control is provided.
2. Pilot's and/or copilot's audio switch - ON, if audio signal is desired.
3. Jack box selector switch - CMPS, is the only position in which marker beacon audio can be heard.
4. Marker beacon indicator light - Observe for illumination. The light will blink the received code when a signal is picked up.

NOTE

Indicator light on instrument panel and audio signal will not be actuated until the aircraft is

over a 75 mc transmitter. Length of time signal is heard and indicator light blinks depends on ground speed, altitude, and type of marker.

RADIO ALTIMETER AN/APN-1

The radio altimeter system consists of an instrument panel mounted indicator (figures 1-5 and 1-6) and the necessary instrument and subpanel mounted system controls and indicators. The primary function of the system is to provide a direct indicator reading of "absolute altitude" (terrain clearance) during flight. This is accomplished by electrically measuring the time interval required for a transmitted radio signal to travel to the earths surface and return to the aircraft. The measurement is indicated directly by a dc-meter (altitude indicator) operated from the altimeter. Two altitude ranges are provided: a low range from 0 to 400 feet and a high range from 400 to 4000 feet.

CONTROLS AND INDICATORS

All radio altimeter system controls and indicators are located on the instrument panel and subpanel. On UC-45J aircraft the altitude limit switch is located on the left subpanel and the system altitude indicator and remaining system controls are located on the left side of the instrument panel. On the RC-45J aircraft, the altitude indicator, altitude limit switch, and all associated system controls and indicators are located on the left instrument panel. The system controls and indicators function as follows:

1. Altitude indicator - Indicates altitude above terrain in hundreds of feet in two separate, manually selected scales of 0 to 400 feet or 400 to 4000 feet.
2. Power switch knob - Rotate clockwise to ON position. Knob is located on lower left side of altitude indicator.
3. RANGE switch knob - Selects desired altitude range. Knob is placarded RANGE and is located on upper right corner of altitude indicator.
4. Radio altimeter warning light - Illuminates to visually indicate when preset altitude minimum (as set by the altitude limit switch) is reached.
5. Altitude limit switch - Controls altitude at which radio altimeter warning light will illuminate. Switch scale is calibrated directly in feet for a low range; multiply reading by ten for the high range. In the low range, the altitude warning light may be set for positions between 50 and 300 feet in increments of 25 feet. The high range settings are between 500 and 3000 feet in increments of 250 feet.

OPERATION

The radio altimeter system is operated as follows:

1. RANGE switch knob - Set for required range. When on the ground or in flight at an altitude below 400 feet, always use the low ranges (0 to 400 feet). When in flight at an altitude above 400 feet, use the high range (400 to 4000 feet).

WARNING

The high range is not calibrated for (and must not be used at) altitudes below 400 feet. Under conditions of poor visibility, always use the low range when flying at altitudes below 600 feet.

2. Altitude limit switch - Set for desired altitude with respect to desired warning light illumination reference.
3. Power switch knob - Rotate clockwise to ON position. After approximately one minute, the altitude indicator pointer will move from the sub-zero stop position to some positive indication.

NOTE

When the aircraft is on the ground, the altitude indicator pointer may not indicate zero altitude exactly. Do not attempt to adjust the equipment to obtain a zero reading.

4. Altitude indicator - Observe altitude indications. Absolute altitude relative to actual terrain clearance is indicated after take-off over both the low range (0 to 400 feet) and the high range (400 to 4000 feet).
5. Radio altimeter warning light - Illuminates when terrain clearance is less than the altitude set on the altitude limit switch.

NOTE

To check calibration of altitude indicator, switch to low range (0 to 400 feet) and observe reading upon landing. Pointer should read zero.

RADIO JACK BOXES

Radio equipment jack boxes for both the pilot and copilot positions are located on the pilots compartment overhead radio panel (figure 1-17). The pilots jack box provides controls for listening to any receiver separately, listening to all receivers simultaneously, listening to interphone, calling on interphone, an audio ON-OFF switch for marker beacon receiver, and UHF VOLUME control knob. The copilot's jack box is identical to the pilot's except that the toggle type selector switch control, "all receivers combined" switch, is not provided. A minimum of one jack box (copilot type) is mounted in the passenger compartment.

CONTROLS AND INDICATORS

Four controls are located on the pilot's jack box and perform the following functions:

1. Receiver selector switch (five positions)
   a. CMPS position for receiving radio compass and marker beacon signals.
   b. UHF position for receiving ARC-27 UHF signals.
   c. HF/RANGE position for listening to ARC-5 .2 to .55 mc, 3 to 6 mc, and 6 to 9.1 mc receivers.

NOTE

Selector switch must be on UHF or HF/RANGE for transmissions.

d. INTERPHONE position for communication with crew and passengers.

e. CALL CREW position for breaking into reception of crew and passengers regardless of the position of their jack box selector switches. In the CALL CREW position, selector switch is spring loaded and unless held to CALL CREW, it will switch to the INTERPHONE position.

2. Receiver SELECT SWITCH CONTROL - Used to by-pass jack box selector switch to combine all receivers.

3. UHF VOLUME control knob - Adjusts volume for the UHF volume control box.

4. Marker beacon audio switch - Controls pilot's/copilot's audio (75 mc modulated tone) portion of the marker beacon system.

NOTE

For interphone operation, position the receiver selector switches to INTERPHONE on both jack boxes concerned and operate microphone in normal manner. No volume control is provided for interphone.

BEAM FILTER

Beam filter boxes (figure 1-17) for both the pilot and copilot are located just outboard of the jack boxes for the respective positions. The filter is used for radio navigation and is especially useful when static is present.

CONTROLS AND INDICATORS

The beam filter box is controlled by a single three-position beam filter switch. Each switch position performs the following functions:

1. RANGE position - Allows coded signals to be heard, voice reception will be garbled and unitelligible (even interphone). This position also softens static and makes coded reception more readable.

2. PHONE position - Allows coded range signals of ranges with simultaneous voice and code transmission to be cut out and only voice transmissions will be heard (provided station is properly tuned).

3. BOTH position - Allows voice and coded signals to be heard simultaneously.

NOTE

For voice reception or when transmitting, position beam filter switch in either PHONE or BOTH. A listen watch cannot be maintained on RANGE position during operations requiring exact understanding of voice reception.

HEATING AND VENTILATING SYSTEM

The heating and ventilating system (figure 1-22) provides either heated, or unheated (outside ambient temperature) air to the pilots, and passenger compartments of the aircraft. Complete distribution of either heated or ventilation air is accomplished by ram air effect since no heating and ventilating air blower system is installed. The heating portion of the system consists of an engine exhaust intensifier tube type heater, distribution ducts, and hot air flow regulating controls. The ventilating air system components consists of ram air inlet ducts, distribution plenums, and air flow regulating controls. Air for the heating system enters through air intake port on each engine, and air for the ventilating system enters through an intake port in each wing stub.

HEATING AND DEFROSTING SYSTEM

Windshield defrosting and interior heating air enters the system through an intake port located between the cylinder baffles on each engine. The air then flows through an exhaust stack intensifier tube where it is heated by the engine exhaust, then routed through the hot air control valve to the pilot's compartment floorboard outlets and passenger compartment outlets. Heat for windshield defrosting is furnished by a duct extension from the pilot's compartment floorboard outlets. The hot air outlets in the pilots compartment consist of the combination deflector and shut-off valve type floorboard outlets on each side of the compartment, and the defroster air outlet on either side at the base of the windshield. Seven individual outlets are located in the passenger compartment; one near the floorboards in the left center of the compartment, and six along the sidewalls near the ceiling, three on each side.

HEATING CONTROL VALVE (T-HANDLE)

Heated air flow to the pilot and passenger compartments is regulated by two push-pull, turn-to-lock type controls located on the floorboard (figure 1-7), one under the pilots seat and one under the copilots seat. These controls are mechanically connected to the hot air control valve attached to the intensifier tube. With the heat control valve handle full OUT all of the heated air is dumped overboard - full IN, all the heated air is directed into both the pilot's and passenger compartments. Any intermediate position will direct a proportional amount of heated air to the aircraft interior. No further control is provided for heated air which flows into either compartment other than normal overboard exhaust through the exhaust air vents in both the pilot's and passenger compartments overhead.

HEATED AIR OUTLET VALVES

The individual (spherical) hot air outlets for the pilot's compartment are located on the floorboards just forward and outboard of each seat (figure 1-7). These valves are a combination deflector and shutoff type. All air which does not pass these valves is directed to the windshield defroster outlets. No separate controls are provided for windshield defrosting; therefore, air for this purpose is provided at all times when the heat control valve handles are full in. Maximum defrosting heat is obtained when the valves are closed (deflector opening pointed aft).

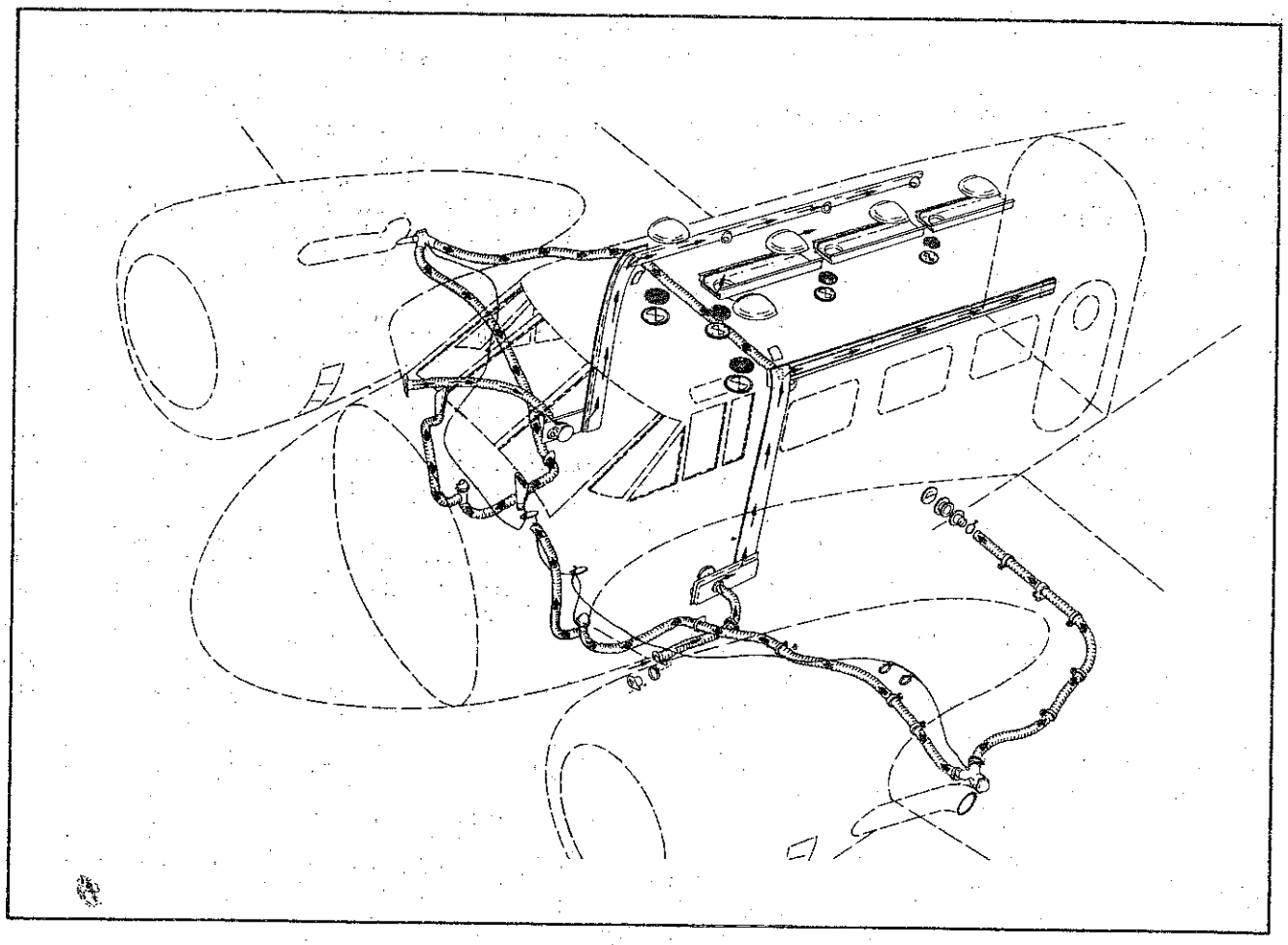


Figure 1-22. Heating and Ventilating System

Two hot air outlets for the passenger compartment are located just above the floorboards on each side of the compartment. The outlets are the on-off flow adjustable type.

HEATING AND DEFROSTING SYSTEM OPERATION

Operate the heating system as follows:

Pilot's Compartment

1. Heat control valve (T-handles) pilot's and/or co-pilot's - Rotate handles counterclockwise and push full IN (or any intermediate position as desired). Rotate handles clockwise to lock in set position.

NOTE

Due to lack of ram air effect, the heating and defrosting system will not be as efficient during ground operation as when in flight.

2. Heated air outlet (floorboard) valves - Rotate deflector until desired heat output is obtained (valve is closed with deflector opening pointed aft).

NOTE

Maximum windshield defrosting heat is obtained when the floorboard hot air outlet valves are closed.

Passenger Compartment

3. Heated air floor outlets - Adjust to desired heat output.

NOTE

With the propeller anti-icer system operating, anti-icer fluid fumes will be ingested by the heating and defrosting system and will become quite noticeable in the aircraft interior.

VENTILATING SYSTEM

Cold (ambient temperature) air for the pilot and passenger compartments ventilation enters through an air intake port in each wing stub leading edge (figure 1-22). The air is then routed through flow control valves and into distribution plenums and from here to

the individual outlets in both compartments. Identical systems for air flow routing and flow control are provided on each side of the fuselage. Ventilation system air flow control valves and the pilot's compartment air outlets are located behind the pilot's and copilot's seat in the lower rear corner of the pilot's compartment. The cold air outlets for the passenger compartment are mounted on the air distribution plenum located just above the windows on each side of the compartment. Overhead interior exhaust vents are provided in both the pilot and passenger compartments to permit escape of stale air from the aircraft.

VENTILATING AIR CONTROL VALVE

Ventilating air to the pilot and passenger compartments is controlled by screw type control valves located near the floor on the sidewall behind the pilot's and copilot's seat. Turning the handle clockwise stops all air flow to both compartments for that respective side of the aircraft. Turning the handle counterclockwise progressively increases airflow.

VENTILATING AIR OUTLETS

The individual directional type outlets (figure 1-22) located adjacent to the ventilating air control valve in the pilots compartment and above each passenger seat, are a combination deflector and shut-off valve. The deflector may be rotated for directional air flow, or may be rotated to OFF.

VENTILATING SYSTEM OPERATION

Operate the ventilating system as follows:

Pilot's Compartment

1. Ventilating air control valve, pilot's and/or copilot's - Turn valve handle counterclockwise until desired ventilating airflow is obtained.

NOTE

Due to lack of ram air effect, the ventilating system will not be as efficient during ground operation as when in flight.

2. Ventilating air outlets - Rotate air outlet until desired direction and output are obtained.

Passenger Compartment

3. Individual ventilating air outlets - Rotate outlet until desired direction and air output are obtained.

OXYGEN SYSTEM (RC-45J ONLY)

A low pressure gaseous type oxygen system is installed on RC-45J aircraft for pilot and crew member use on flights above 10,000 feet. See figure 1-24 for oxygen system duration. Oxygen pressure is supplied by two cylinders in a rack on the left side of the passenger compartment just forward of the entrance door. A diluter-demand oxygen regulator and blinker type flow indicator are installed at each oxygen outlet location; only demand type oxygen masks may be used. Location of the system filler valve and the system pressure gage are shown in figure 1-23.

NOTE

Since all oxygen outlets are supplied by a common line, the entire system may be exhausted through a single outlet.

OXYGEN CONTROLS

OXYGEN REGULATORS

A diluter-demand oxygen regulator (figure 1-23) is located at each oxygen outlet station. Each regulator is equipped with a two position diluter lever, and a regulator emergency by-pass knob. The two position diluter lever is placarded NORMAL OXYGEN and 100% oxygen and controls the delivered oxygen mixture. In the NORMAL OXYGEN position, the regulator delivers the correct mixture of air and oxygen for any altitude; when in the 100% OXYGEN position, only pure oxygen is delivered. The red emergency by-pass knob permits by-passing an inoperative regulator and is turned counterclockwise to open.

NOTE

Use of either 100% pure oxygen, or any of the red emergency by-pass valves should be limited to operations specifically requiring their use due to the greatly increased rate of oxygen depletion. The pilot should always be advised when either condition exists.

OXYGEN INDICATORS

Oxygen system pressure is indicated by a pressure gage mounted on the copilot's subpanel (figure 1-4), and oxygen system (blinker type) flow indicators located above each oxygen regulator in the passenger compartment and on the outboard end of the respective subpanel for the pilot and copilot.

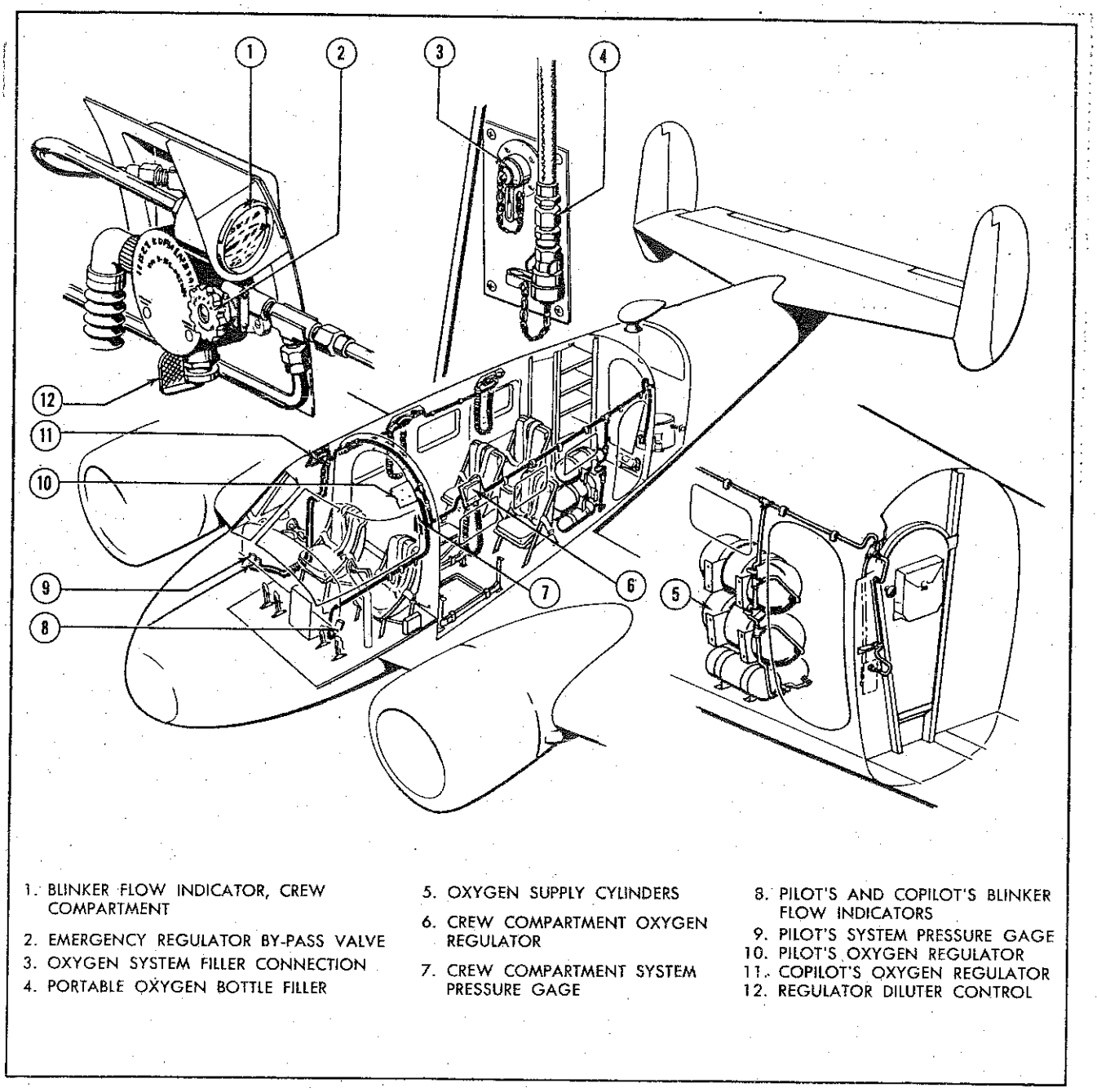
OXYGEN SYSTEM OPERATION

Normal operation is as follows:

1. Oxygen system pressure gage - Check capacity before each flight requiring use of oxygen.

NOTE

At higher altitudes, where ambient temperature is quite low, the oxygen system becomes chilled. As the system becomes colder, pressure is reduced, sometimes rather rapidly. With a 38°C decrease in temperature, indicated oxygen system pressure may drop 20 percent. This rapid decrease in pressure is occasionally a cause for unnecessary alarm. Since all system capacity is still there, a descent to



1. BLINKER FLOW INDICATOR, CREW COMPARTMENT
2. EMERGENCY REGULATOR BY-PASS VALVE
3. OXYGEN SYSTEM FILLER CONNECTION
4. PORTABLE OXYGEN BOTTLE FILLER
5. OXYGEN SUPPLY CYLINDERS
6. CREW COMPARTMENT OXYGEN REGULATOR
7. CREW COMPARTMENT SYSTEM PRESSURE GAGE
8. PILOT'S AND COPILOT'S BLINKER FLOW INDICATORS
9. PILOT'S SYSTEM PRESSURE GAGE
10. PILOT'S OXYGEN REGULATOR
11. COPILOT'S OXYGEN REGULATOR
12. REGULATOR DILUTER CONTROL

Figure 1-23. Oxygen System (RC-45J)

warmer altitude will tend to increase pressure so that the rate of oxygen consumption may appear to be slower than normal. A RAPID decrease in oxygen pressure, while in level flight or while descending, is not necessarily due to falling temperature. Should this occur, system leakage may be suspected.

2. Individual oxygen masks - Check for fit and leakage. The regulators should be checked with the diluter lever first at the NORMAL OXYGEN position and then at the 100% oxygen position by blowing gently into the end of the oxygen regulator hose.

CAUTION

Make sure the mask in use is the type recommended for the regulators installed.

3. Diluter lever - Breathe normally several times with the diluter lever at NORMAL OXYGEN and 100% OXYGEN to check flow from oxygen regulator and to

OXYGEN DURATION
IN HOURS FOR ONE MAN

DILUTER ON

ALTITUDE	PRESSURE (P.S.I.) 400	350	300	250	200	150	100
10,000 FT.	14.0	12.0	10.0	8.0	6.0	4.0	2.0
15,000 FT.	14.8	12.8	10.6	8.5	6.4	4.2	2.1
20,000 FT.	14.4	12.3	10.4	8.2	6.2	4.1	2.1
25,000 FT.	8.6	7.4	6.1	5.0	3.7	2.5	1.3

DILUTER OFF

ALTITUDE	PRESSURE (P.S.I.) 400	350	300	250	200	150	100
10,000 FT.	3.2	2.7	2.2	1.8	1.4	0.9	0.5
15,000 FT.	3.8	3.3	2.7	2.2	1.6	1.1	0.6
20,000 FT.	5.1	4.3	3.6	2.9	2.2	1.5	0.7
25,000 FT.	6.4	5.4	4.5	3.6	2.7	1.8	0.9

DURATION IS SHOWN IN HOURS FOR ONE MAN AT INDICATED ALTITUDES WITH PRESSURE GAUGE READINGS FROM 400 TO 100 P.S.I.

DIVIDE HOURS BY NUMBER OF MEN ABOARD TO DETERMINE DURATION OF OXYGEN SUPPLY.

Figure 1-24. Oxygen Duration Table (RC-45J)

check operation of the blinker type flow indicator. Return diluter lever to NORMAL OXYGEN for normal oxygen system operation.

During flight:

4. Blinker type flow indicator - Check frequently for flow of oxygen.
5. System pressure gage - Check frequently for oxygen pressure and determine duration.
6. Mask hose to regulator hose - Check connection.

With the presence of smoke or fumes or when the symptoms of anoxia occur, immediately set diluter lever to 100% OXYGEN. Should the oxygen regulator become inoperative, open emergency by-pass valve by turning red emergency by-pass knob counterclockwise.

PORTABLE OXYGEN EQUIPMENT

A bracket for portable oxygen cylinder is located on the right side of the aft bulkhead. The cylinder may be recharged in flight from a hose located on the aft cabin bulkhead above the filler valve.

DEICING AND ANTI-ICING SYSTEM

WING AND TAIL DEICING SYSTEM

The wing and tail deicing system is conventional in design using penumatic deicer boots to remove ice formations. The deicer boots are attached to the leading edge of the outboard wing panels, and the leading edge of the horizontal stabilizer. Air pressure from the exhaust side of the engine driven vacuum pumps supplies air pressure to inflate the boots in an electrical controlled inflation-deflation cycle. Suction from the inlet side of engine driven vacuum pump holds the boots down between inflation and deflation cycles. Oil separators collect vaporized oil from the air pressure lines.

DEICER PUSH-PULL BUTTON

A two position push-pull button (figures 1-3 and 1-4) on the inboard end of the copilots subpanel, is used to operate the deicing system. The center button on the control is self locking and must be manually depressed to reposition the control. There are two operating positions; full OUT (approximately six inches) and full IN. When positioned full OUT, pressure from the engine driven vacuum pumps is directed into the deicing system, actuating an electrically driven cycling valve which further directs pressure to the various cells within the deicer boots. With the button full IN, cycling operation is stopped and the air is dumped overboard.

DEICER PRESSURE GAGE

Operating pressure for the deicer system is shown on the deicer pressure gage (figures 1-3 and 1-4), located on the left side of the copilot's subpanel. The gage registers pressure within the system in pounds per square inch, psi.

DEICER SYSTEM OPERATION

Operate the wing and tail deicer system as follows:

1. Depress the center button on the control and pull the control full OUT (there is no intermediate position). The boots are inflated in four stages, once every 40 seconds. All boots are inflated and deflated once during each cycle.
2. Deicer pressure gage - Observe for proper operation. Normal operating pressure is approximately 7 1/2 psi. Do not exceed 10 psi at any time.

CAUTION

If at any time during flight, a rippling movement of a deicer boot is observed when the system is shut down, the boot should be inspected for looseness upon landing and replaced if necessary. A rippling or loose boot is a flight hazard and may cause failure of the skin.

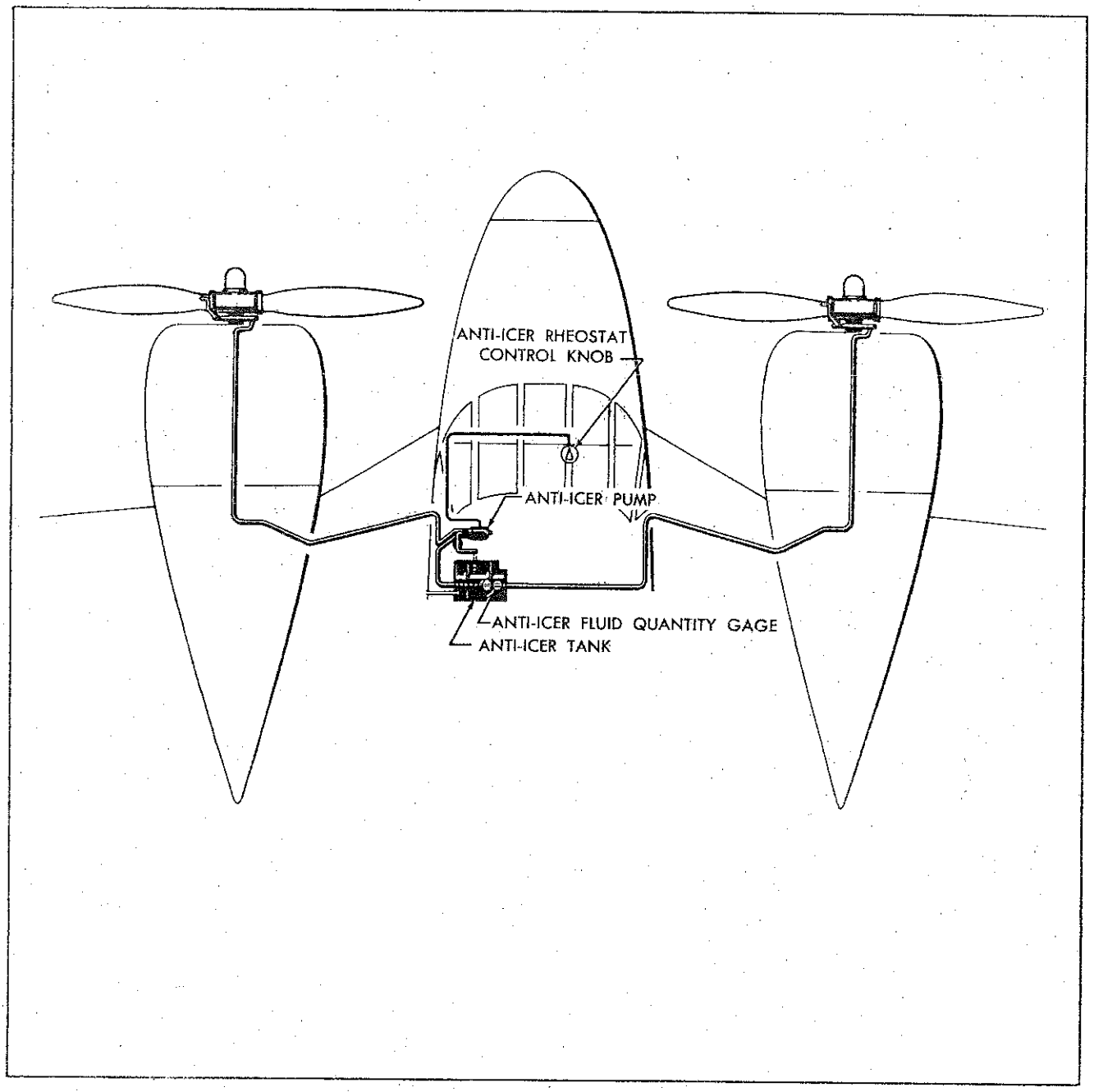


Figure 1-25. Propeller Anti-Icer System

WARNING

Do not attempt to take-off or land with the de-icer system in operation. The boot changes the shape of the airfoil as it inflates and deflates. If the aircraft is flown near stalling speed with the boots in operation, a stall may result.

3. Depress the center button on the control and push the control IN. The distributor valve completes the cycle and vacuum is applied to the boots for hold-down while vacuum pump pressure is vented overboard.

NOTE

In the event of vacuum pump failure or single engine failure, resulting in an inoperative pump, exhaust pressure from the remaining pump is adequate for continued operation of the de-icer system. No additional controls are required.

PROPELLER ANTI-ICER SYSTEM

Propeller ice formation is prevented by the use of a liquid type anti-icer system (figure 1-25). Fluid for

the system is supplied from a 3 gallon tank, located behind the pilot's seat. The fluid is pumped, under pressure, through check valves to slinger rings installed on each propeller hub where centrifugal force distributes the fluid over the blades. See figure 1-31 for anti-icer fluid specification.

WARNING

The propeller anti-icer is designed to prevent the formation of ice, not remove ice after it has formed. Turn the anti-icer on before entering any area with known icing conditions. Turn full ON for approximately one minute to lubricate the propeller blades; then adjust for the existing icing conditions.

PROPELLER ANTI-ICER RHEOSTAT KNOB

Control of the anti-icer fluid pump and the rate of anti-icer fluid flow is provided by a rheostat knob (figure 1-25) located on the left side of the copilot's subpanel. As the rheostat knob is turned in a clockwise direction, from OFF position, the maximum rate of flow (approximately 35 minutes' supply) is provided as the pump starts to operate. Continued rotation of the rheostat knob clockwise decreases the rate of flow to a minimum (approximately 3 1/2 hours' supply). Maximum travel of the rheostat is approximately 270 degrees.

ANTI-ICER FLUID QUANTITY GAGE

Fluid quantity of the anti-icer tank is indicated by the anti-icer tank gage (figure 1-25). The gage is mounted integral with the top of the tank and is the direct reading, float actuated type.

ANTI-ICER SYSTEM OPERATION

Proceed as follows in preparing for propeller ice:

1. Propeller anti-ice knob - MAX (for period of 1 minute).
2. Propeller anti-ice knob - As required, to prevent accumulations of ice.

NOTE

The rate of flow of anti-icing fluid necessary to prevent the formation of ice on propeller blades will vary greatly with existing conditions; however, if the severity of conditions is unknown, attempt to maintain prevention with a minimum amount of fluid flow, increasing as necessary. The knob is positioned for MAX flow for the period of one minute to thoroughly lubricate the propeller blades.

WINDSHIELD WIPER SYSTEM

The electrically operated windshield wipers are designed and installed for use during taxi, take-off, and landing. They should not be turned on in flight except in an emergency, since they are relatively ineffective at cruising speed and the air loads imposed on them may cause damage to the operating mechanism.

WINDSHIELD WIPER SWITCH

The windshield wipers are controlled by a three-position switch (figures 1-3 and 1-4) located on the pilot's subpanel and placarded FAST-OFF-SLOW, the center position being OFF.

CAUTION

Do not operate windshield wipers on dry glass since this can severely damage the linkage and operating mechanism as well as scratching the windshield.

PITOT HEAT SYSTEM

The electrically operated pitot heat elements inside each pitot tube head prevent the formation of ice.

PITOT HEAT SWITCHES

Two pitot heat toggle switches (figures 1-3 and 1-4) placarded LEFT and RIGHT for their respective pitot heat installation, are located on the pilot's subpanel. These switches complete the circuit to the heating elements in the pitot pressure heads when placed in the ON position.

PITOT HEAT OPERATION

When visible signs of moisture are encountered or when conditions which may cause ice formations are anticipated, pitot heat should be turned on in advance. This will preclude the possibility of even temporary instrument failure whenever actual icing conditions are encountered. The heaters are designed to prevent ice formation, not remove ice after it has formed.

CAUTION

The electric heating element should never be placed in operation while the aircraft is on the ground, except for a quick operational check. Prolonged ground operation during the absence of the cooling slip stream will seriously damage the heating element.

EXTERIOR LIGHTING SYSTEM

The exterior lighting system consists of position (navigation) lights, fuselage clearance lights, anti-collision lights, landing lights, and a passing light. Control switches for the exterior lights are on the pilot's subpanel. Power for operation of all exterior lighting is provided by the aircraft's dc electrical system.

EXTERIOR LIGHTING AND CONTROLS

POSITION (NAVIGATION) LIGHTS

The position (navigation) lights consist of a red light on the left wing tip, a green light on the right wing tip, and one white and one amber light mounted on the center of the elevator trailing edge. The lights are controlled by a three-position toggle switch (figures 1-3 and 1-4) placarded STEADY, OFF, and FLASHER and located on the pilots subpanel.

FUSELAGE CLEARANCE LIGHTS

The fuselage mounted clearance lights consist of two white lights, one on the top and one on the underside of the fuselage. These lights are electrically wired in with the position (navigation) lights and are controlled by the position light switch. They are not, however, wired in with the flasher portion of the system and burn continuously regardless of the switch position STEADY or FLASHER.

ANTI-COLLISON LIGHTS

Two anti-collision lights are installed for inflight safety. Each light has a near center location on the top and bottom of the fuselage respectively. The lights rotate at approximately 45 rpm and provide approximately 90 flashes per minute.

NOTE

The anti-collision lights should be turned OFF during flight through conditions of reduced visibility where the pilot could experience vertigo as a result of the rotating reflections of the light against the clouds. Under these conditions the light would be ineffective as an anti-collision light since it can not be observed by pilots of other aircraft.

Operation of the anti-collision lights is controlled by a two-position ON-OFF switch (figures 1-3 and 1-4) located on the pilot's subpanel. Both the light and the rotating motor is placed in operation when the switch is in the ON position.

LANDING LIGHTS

A retractable type flush-mounted landing light is installed in the near center location on the lower surface of each outboard wing panel. Each light is individually controlled by two switches on the pilot's subpanel (figures 1-3 and 1-4). One switch extends and retracts each light and the other turns the light ON and OFF.

CAUTION

Do not use the landing lights during ground operation (except during an emergency) since cooling airflow is insufficient. During flight operations, use the lights only as absolutely necessary. Retract the lights immediately after take-off and do not extend them at speeds above 95 knots.

PASSING LIGHT

A red passing light is installed in the left outer wing leading edge. The light is controlled by a two position ON, OFF toggle switch located on the pilot's subpanel (figures 1-3 and 1-4).

INTEROR LIGHTING SYSTEM

The interior lighting system consists of instrument panel lights, passenger compartment lights, pilot's compartment lights, and various utility lights. All lighting circuits are individually controlled. Electrical power for interior lighting is provided by the aircraft dc power. Circuit protection is by push-pull type circuit breakers on the copilot's subpanel.

NOTE

Radio control panel lighting is provided by two self contained rheostat controlled fluorescent lights located on the overhead above the pilot and copilot, and by equipment control head dial edge lighting from a light within each control unit. The radio compass (AN/ARN-7) control panel incorporates its own rheostat controlled light.

INTERIOR LIGHTING AND CONTROLS

INSTRUMENT RED LIGHTS

All instruments are individually illuminated with shaded red lights and arranged on three separate circuits so the desired intensity of each group may be obtained. The pilots instruments are on one circuit, the engine instruments are on a separate circuit, and the copilot's instruments are on a third circuit. Each group of instrument lights is controlled by an ON-OFF type rheostat switch which also controls light intensity. The rheostat switch for the pilot's instruments and the engine instruments is located on the lower left side of the instrument panel and the switch for the copilots instruments is located on the lower right side of the instrument panel (figures 1-5 and 1-6). The overhead radio panel is illuminated by a red light located on the forward side of the pilot's compartment threshold. The ON/OFF type rheostat switch for this light is located adjacent to the fixture and also controls the shaded red lighting in the AN/ARC-27. Circuit breaker protection for these lights is provided by a push-pull type circuit breaker located on the copilot's subpanel (figures 1-3 and 1-4).

PASSENGER COMPARTMENT LIGHTS

The passenger compartment is illuminated by three dome lights located on the overhead. Each light is controlled by a switch installed next to it. The battery master switches must be ON before the individual light switches become operative. The circuit is protected by a push-pull type circuit breaker on the copilot's subpanel.

Figure 1-26. Extension Light and Shoulder Harness Lock

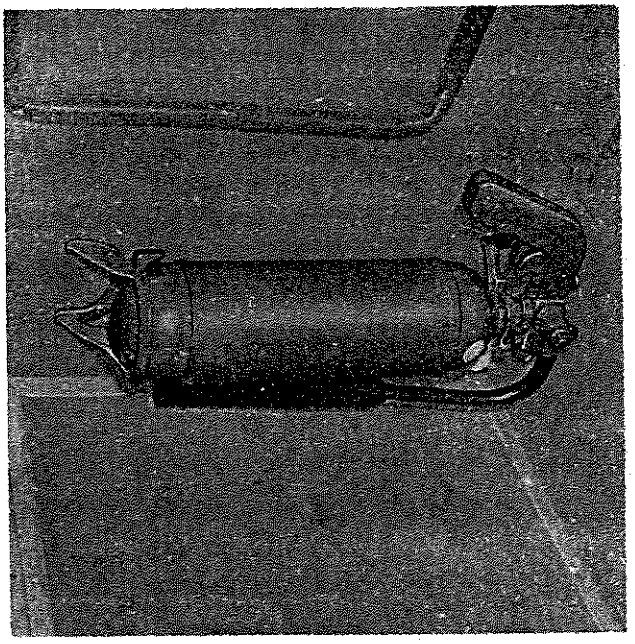


Figure 1-27. Hand Operated Fire Extinguisher

AUXILIARY LIGHTS

Auxiliary light installations in the aircraft consist of two overhead red/white map lights above the pilot and one above the copilot, a reel type utility extension light on the bulkhead behind the copilot's seat (figure 1-26), two white dome lights in the pilot's compartment, individual reading spot lights mounted above each passenger seat and a dome light in the lavatory. An individual control switch for each installation is located on each light. UC-45J aircraft are equipped with a dome light and dome light control switch in the nose baggage compartment.

EMERGENCY EQUIPMENT

HAND FIRE EXTINGUISHER

A carbon dioxide (CO_2) type hand fire extinguisher (figure 1-27) is located on the aft bulkhead of the passenger compartment.

ENGINE FIRE EXTINGUISHER

A single-shot CO_2 engine fire extinguisher system is provided to combat fire in each engine. The system includes an engine fire extinguishing agent (CO_2) supply cylinder (figure 1-7) mounted in the floorboards beneath the copilot's seat and the necessary system controls, plumbing and engine compartment CO_2 distribution fixtures, and a red blow-out disc indicator. The CO_2 supply cylinder will discharge completely in approximately three seconds after being actuated.

SELECTOR VALVE

Selection of the desired engine for the CO_2 system is accomplished by operation of the engine selector valve handle (figures 1-3 and 1-4) located on the bottom of the control pedestal. The handle has three placarded positions, LEFT MOTOR - OFF - RIGHT MOTOR.

DISCHARGE HANDLE

Actuation of the CO_2 system is accomplished with the use of a manually operated discharge handle (figures 1-3 and 1-4) which is located at the bottom of the pilot's control pedestal. The discharge handle is connected at a valve on top of the CO_2 cylinder by a flexible cable. Pulling the discharge handle straight back opens the valve and allows the CO_2 extinguishing agent to flood the engine compartment and induction system of the selected engine.

BLOW-OUT DISC

A red blow-out disc type indicator is located under the forward starboard side of the fuselage and must be present to indicate a charged system.

FIRST AID KITS

Two first aid kits are provided, one on the front side of the lavatory door, and one on the rear side of the front passenger compartment bulkhead (figure 5-2).

EMERGENCY ESCAPE HATCH

An emergency escape hatch, located in the right passenger compartment wall (figure 5-2), is designed pri-

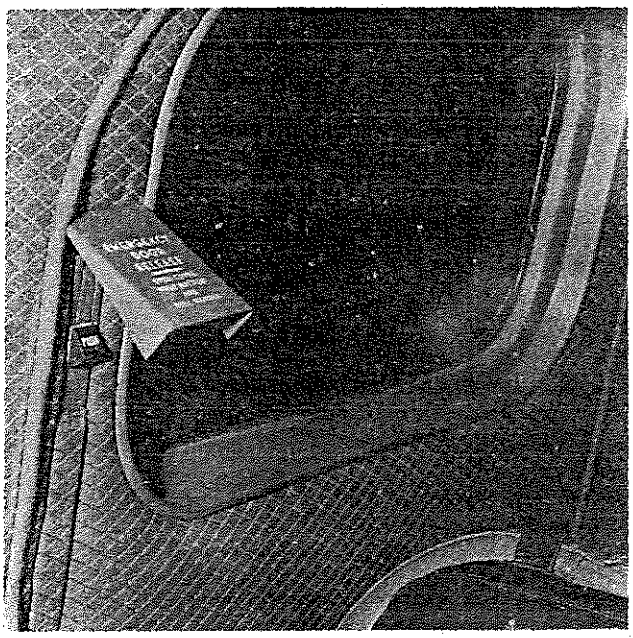


Figure 1-28. Emergency Escape Hatch

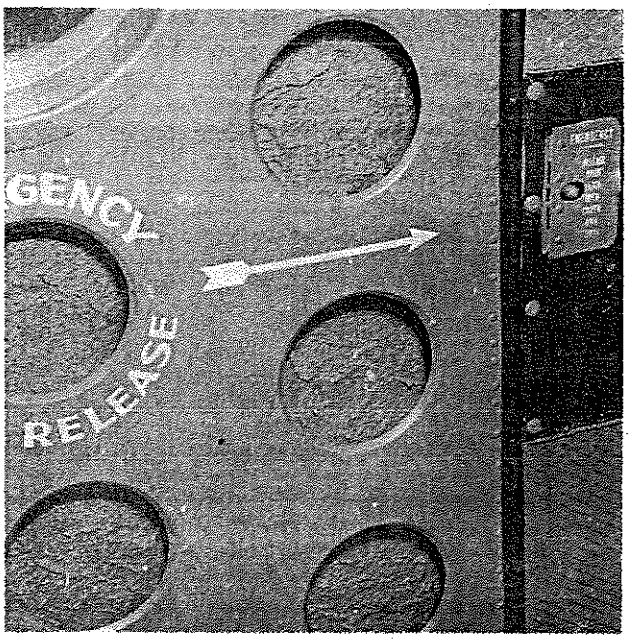


Figure 1-29. Main Entrance Door Emergency Release

marily for escape should the main entrance door become jammed or blocked. The hatch should not be opened except during an emergency.

EMERGENCY ESCAPE HATCH RELEASE HANDLE

The emergency escape hatch release handle (figure 1-28) is located just forward of the hatch and is safety wired in the closed and latched position to prevent inadvertent operation.

MAIN ENTRANCE DOOR EMERGENCY RELEASE

The aircraft's main entrance door is provided with a safety wired mechanism for releasing the hinge pins so that the door maybe jettisoned for emergency exit (figure 5-2).

MAIN ENTRANCE DOOR EMERGENCY RELEASE HANDLE

The passenger compartment main entrance door jettison handle is located on the compartment wall at the forward edge of the door (figure 1-29).

SHOLDER HARNESS INERTIA REEL

All seats are equipped with a safety belt and shoulder harness for additional safety in the event of a crash landing. Each passenger's shoulder harness is attached to the airframe and when properly adjusted, allows limited movement. The pilot and copilot's shoulder harness incorporate an automatic inertia reel to allow for additional movement required to operate the aircraft's controls.

INERTIA REEL LOCK HANDLE

The inertia reel is attached to the main spar web behind each seat and is controlled by a two position shoulder-harness lock handle (figure 1-26) which is located to the left of each pilot's seat. A flexible cable and housing assembly links each handle to its respective inertia reel. A spring-loaded latch in the end of the handle locks the handle in either position selected. When the handle is UNLOCKED (aft), the inertia reel maintains a slight tension on the harness but permits the pilot or copilot to lean forward to reach the controls. When the handle is moved to the LOCKED (forward) position, the inertia reel locks the harness in successive positions as the pilot leans back. Before the inertia reel can be unlocked, all tension must be removed from the harness by leaning full back in the seat. If the handle is in the UNLOCKED position, an impact force of 2g's will automatically lock the inertia reel, thus preventing the occupant from being thrown forward. To unlock the inertia reel after the 2g force has locked it, the handle must be moved to the LOCKED position and then to the UNLOCKED position.

MISCELLANEOUS EQUIPMENT

On UC-45J aircraft, seating includes two seats in the pilot's compartment and a three seat arrangement (figure 1-2) in the passenger compartment. On RC-45J aircraft, the seating consists of two seats in the pilot's compartment and three seats in the passenger/camera operator's compartment (figure 1-2). The pilot's and copilot's seats are adjustable fore and aft by a handcrank located below the front of each seat. Con-

struction of these seats is such that the seat rises as it moves forward and lowers as it moves back.

MAP AND DATA CASES

Map or aircraft data cases are provided on the left side of the pilot's seat and on the aft side of the lavatory door at the rear of the passenger compartment.

RELIEF TUBES

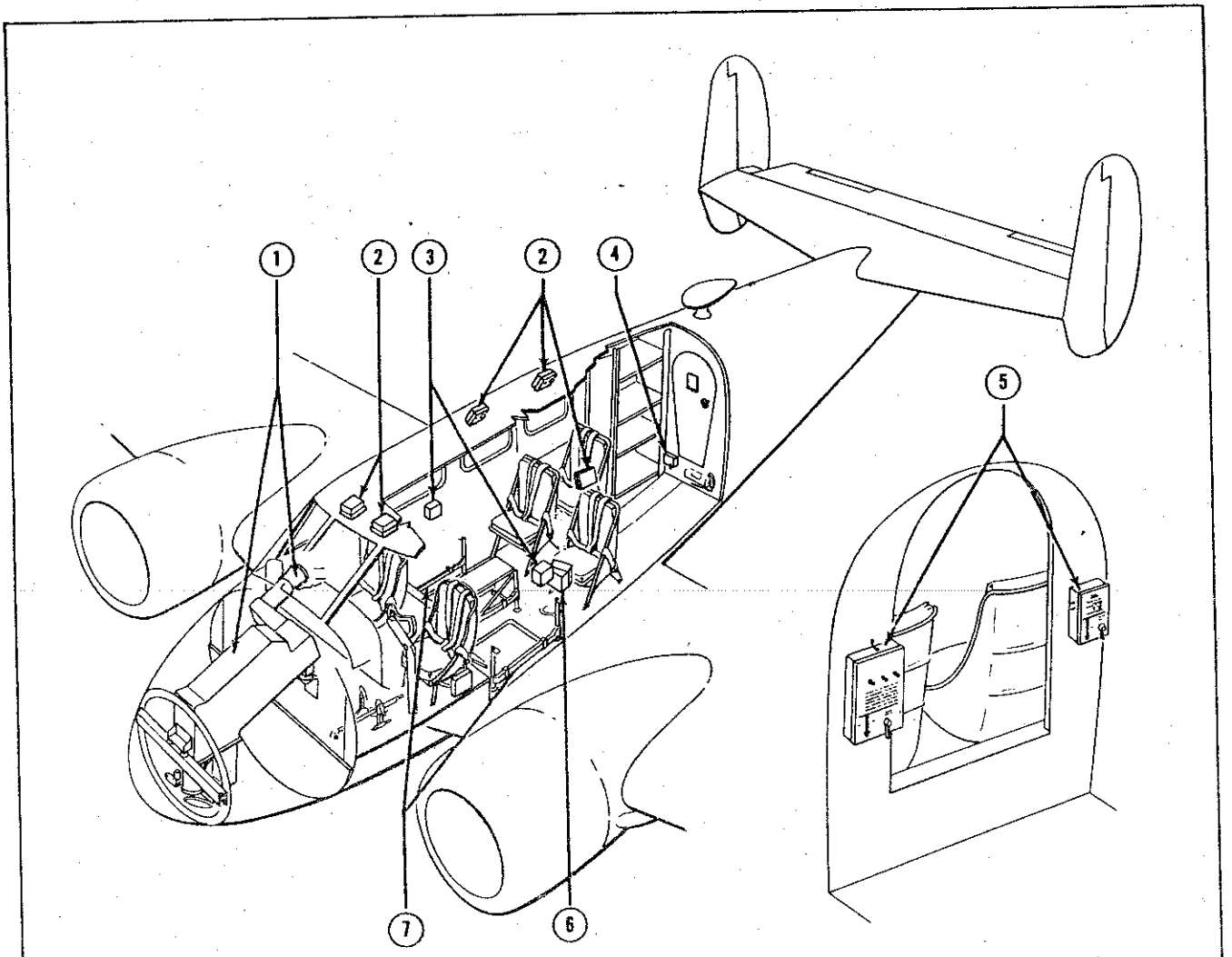
A relief tube (figure 1-2) is provided at the pilots station, and a chemical type head and relief tube are provided in the lavatory aft of the passenger compartment.

WINDOWS

Side windows for both pilot and copilot may be opened in flight or on the ground for ventilation. The windshield storm window on the pilot's side may also be opened. The storm window is provided for visibility during operations when the windshield is obscured.

PHOTOGRAPHIC PROVISIONS (RC-45J ONLY)

Photograph provisions on RC-45J aircraft (figure 1-30) consists of the following equipment. Two camera hatches in the passenger/camera operator's compartment floorboard, just behind the forward compartment bulk-



1. FORWARD VIEW FINDER
2. RADIO JACK BOXES
3. CAMERA INTERVALOMETERS
4. CAMERA ELECTRICAL JUNCTION BOX
5. CAMERA ELECTRICAL JUNCTION BOXES
6. CK-1 CONTROL BOX FOR S-7 CAMERA
7. CAMERA MOUNTS

Figure 1-30. Photographic Provisions (RC-45J)

head, are fitted with supports for camer amounts. The external doors beneath plate glass windows may be opened and closed in flight by turning cranks mounted on the aft side of the forward compartment bulkhead. (Refer to Airspeed Limitations, Part 4 of this Section). Just behind each camera hatch is an open hatch for a vertical viewfinder and sliding curtains over the cabin windows to exclude light. Covers of wood and metal are fitted in all four hatches when not in use. Two camera junction boxes are mounted on the aft side of the passenger/camera operator's compartment bulkhead and a third is mounted on the aft compartment bulkhead for oblique photographic work with the main entrance door removed (or door panel removed). The junction boxes furnish current from the aircraft's 28-volt dc system and vacuum from the left engine-driven vacuum pump. Two intervalometers are mounted beside the camera hatches and a CK-1 control box, for the S-7 camera, is mounted on the cabin wall behind the left hatch. An optical viewfinder is mounted in the nose compartment, with its objective lens in the right side of the instrument panel (figure 1-6) providing both forward and vertical vision. A switch and rheostat, to the right of the lens, control objective illumination. A dehydrator in the viewfinder is connected to the battery master switches and operates whenever the switches are in the on position. Camera vacuum is supplied by the port engine vacuum pump. Failure of the left vacuum pump or a severe leak in the camera vacuum system will close a check valve in the system and illuminate the left vacuum warning light. In this event, shut off all camera vacuum outlets and check the warning light. If the light goes off with the valves closed, open them one at a time to isolate the leaking outlet. The remaining operative outlets may be used to continue camera operation.

NOTE

In event the port engine vacuum pump fails, camera vacuum will not be supplied by the starboard engine vacuum pump since the system check valve will remain closed.

Heated air from the passenger/camera operator compartment heating ducts is blown over the inner surfaces of the camera hatch windows for defrosting and defogging. Controls valves for each defroster are located at the compartment heat outlets. When the valves are turned counterclockwise to the DEFROSTER position. The entire heat output is diverted to the DEFROSTER ducts for compartment. The valves are rotated clockwise from the DEFROSTER position.

PART 3 AIRCRAFT SERVICING AND HANDLING

SERVICE REQUIREMENTS

The following part contains servicing information to be used by pilot or crewmember personnel in determining the applicable aircraft servicing points and consumable materials. Figure 1-31 illustrates aircraft servicing points.

FUELING

Authorized engine fuels are 115/145 octane primary grade, and 91/96 or 100/130 octane as an acceptable alternate. Instrument markings and engine limitations are based on the use of 115/145 octane fuel. Grade 80/87 fuel may be used but only if no other fuel is available. Fuel specifications are MIL-G-5572 and ASTM D-910-65T.

NOTE

Full extension of the wing flaps facilitates personnel access to the upper wing root area during fueling operations.

ENGINE OIL SYSTEM

Service the engine oil system with lubricating oil grade W-120. If oil grade W-120 is not available, grade 1100 MIL-L-22851 (WEP) may be used. Oil system capacity is 8 U.S. gallons.

OXYGEN SYSTEM

On RC-45J aircraft, the oxygen system cylinders are serviced with breathing oxygen (gas) specification MIL-O-27210. UC-45J aircraft are not equipped with oxygen.

CAUTION

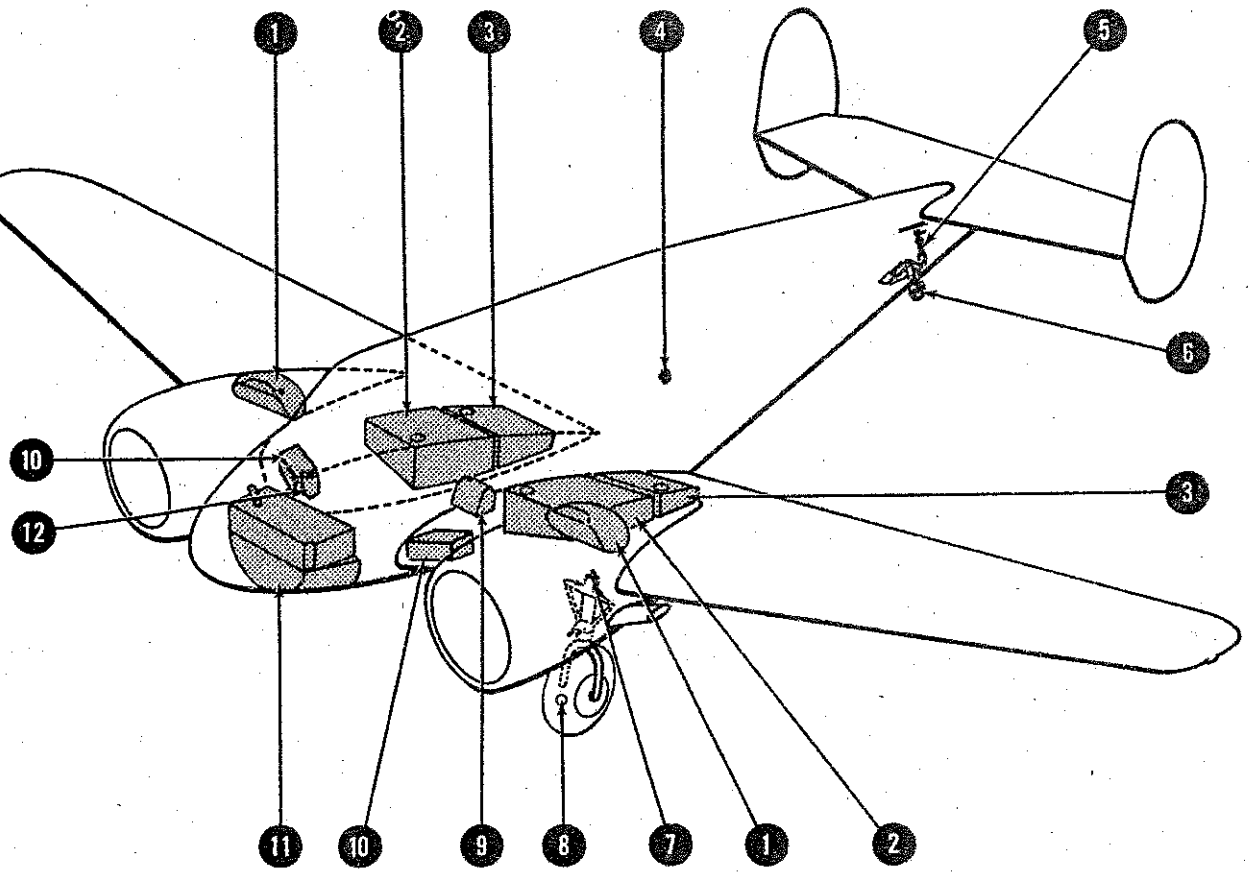
Keep oxygen away from oil, grease, or other combustible materials. Ensure adequate ventilation.

HYDRAULIC (WHEEL BRAKE) SYSTEM

Hydraulic fluid is used only in the landing gear wheel brake system. Service the brake fluid reservoir to within 2 inches of the top using red hydraulic fluid specification MIL-H-5606.

ANTI-ICER SYSTEM

Service the anti-icer system tank with specification MIL-G-5566 fluid. The tank capacity is 3 U.S. gallons.



1. OIL TANKS
2. MAIN FUEL TANKS
3. AUX. FUEL TANKS
4. OXYGEN FILLER
5. TAIL WHEEL OLEO STRUT FILLER
6. TAIL WHEEL
7. MAIN LANDING GEAR OLEO STRUT FILLER
8. MAIN LANDING WHEEL
9. ANTI-ICER FLUID TANK
10. BATTERIES
11. NOSE FUEL TANK
12. BRAKE FLUID RESERVOIR

NOTE

REFER TO SERVICE REQUIREMENTS FOR APPLICABLE AIRCRAFT CONSUMABLE MATERIALS

Figure 1-31. Servicing Data

PNEUMATIC SYSTEM

TIRES

Service the main landing gear tires (tube type) and tail wheel tire (tube type) with dry compressed air to the following pressure:

Main wheel tires (11.00 x 12, 8 ply rating) - 30 psi
Tail wheel tire (14.50 x 5, 8 ply rating) - 45 psi

NOTE

If a pressure gage is not available, inflate the main wheel and tail wheel tires until a measured distance of 13 inches exists between the surface and the center line of the main landing gear axle. Six inches should exist between the surface and the center line of the tail wheel axle.

LANDING GEAR SHOCK STRUT EXTENSION

Landing gear shock struts are serviced with specification MIL-H-5606 red hydraulic fluid and dry high pressure air (PRES AIR). The struts should be serviced to the following minimum extension:

Main gear - 2 1/2 inches
Tail gear - 4 to 6 inches

Servicing a shock strut is required when a visual inspection and subsequent measurement, determines that a lower-than-normal condition exists. A tendency for one wing to ride high or low during ground operations may be an indication of improper hydraulic fluid level in one of the main struts. Actual servicing, by the addition of MIL-H-5606 red hydraulic fluid in either the tail or main gear shock struts is accomplished by completely deflating the strut adding hydraulic fluid to the prescribed level, and reinflating the strut to the specified height. Servicing is normally required only when a strut has been damaged or when fluid loss is apparent. Normally a strut that is only slightly low, with no past history or evidence of leakage, may be inflated to minimum limits with dry high pressure, compressed air. A slight variation in strut extension normally occurs with the more extreme ambient temperature changes i.e., higher struts with higher temperatures, and vice-versa.

IGNITION SYSTEM

SPARK PLUGS

Replacement of fouled or inoperative spark plugs should be limited to types SH200 ro RHM-40E. The SH200 is preferred.

CAUTION

Replacement of inoperative plugs MUST be with the same type as removed. Do not mix plug types.

ELECTRICAL SYSTEM

BATTERIES

Two 24-volt, 24 ampere-hour batteries are used. For normal operation, a full charge hydrometer reading should be between 1.275 and 1.300. If less than 1.240, replace or recharge the battery. The following electrolyte temperature correction must be used to arrive at the correct hydrometer reading:

ELECTROLYTE TEMP (°F)	CORRECTIVE FACTOR
140	+0.024
120	+0.016
100	+0.008
80	Zero
60	-0.008
40	-0.016
20	-0.024
0	-0.032
-20	-0.040

EXTERNAL POWER REQUIREMENTS

External power units must be capable of producing 24-volts dc power at a minimum of approximately 200 to 250 amperes for starting. The following standard units may be used:

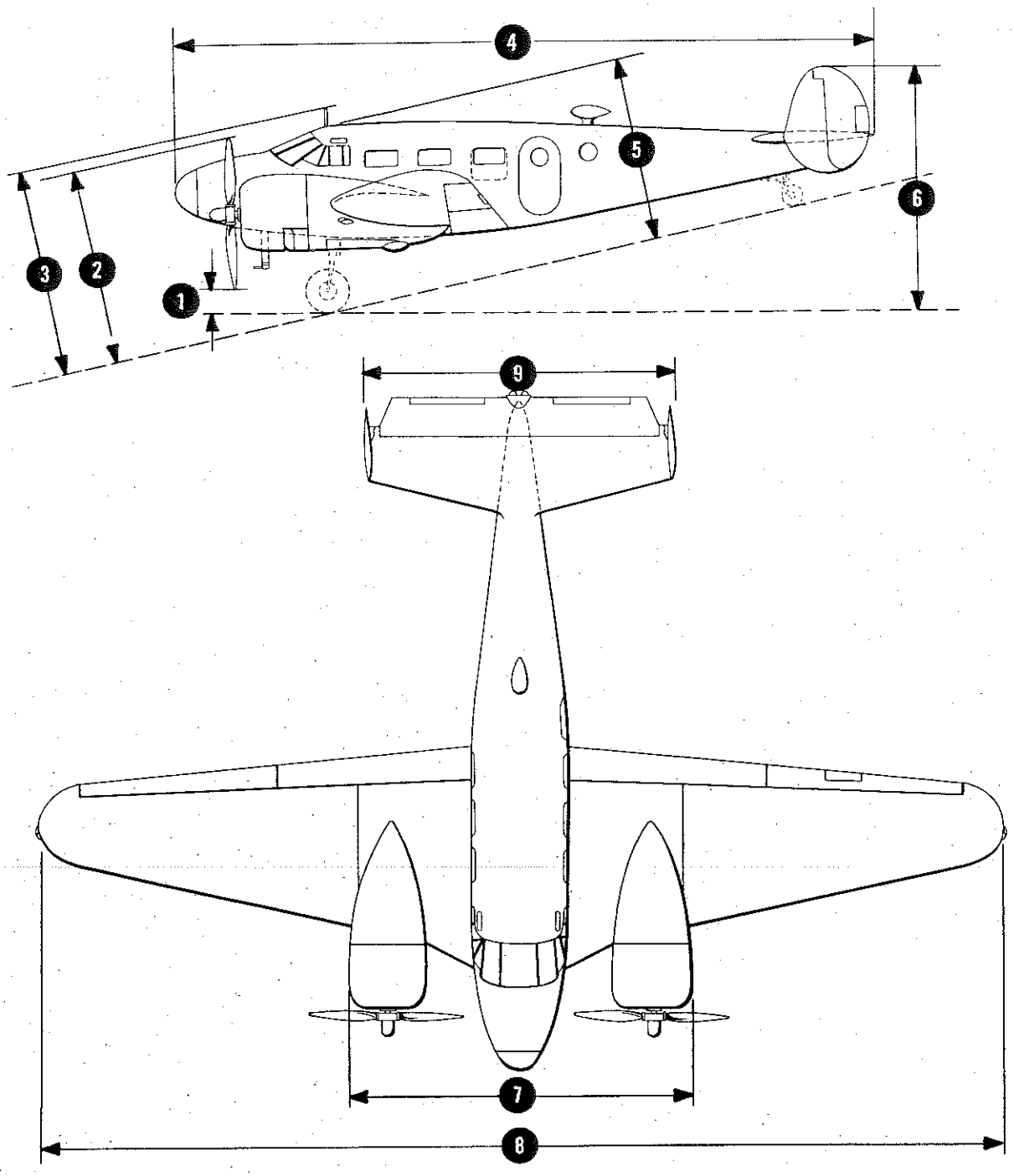
NAVY UNITS	USAF UNIT	
NC-2A	A-1	C-26
NC-5	A-3	MD-3 & -3A
NC-6	A-4	MD-3M
NC-7		
NC-8	A-7	MC-1
NC-10	AF-M32A-10	MA-1 MP
NC-12	B-10A	MA-2 MP
	1-101	

HANDLING

Maneuvering the aircraft through ground operations will normally be accomplished by ground personnel using a tow vehicle with a tow bar attached to the main landing gear. However, due to the aircraft's relatively light weight limited ground maneuvering may be done manually when the aircraft is on a smooth surface. During all ground maneuvering operations, the pilot's (or copilot's) station should be manned to provide wheel brake and tail wheel lock operation. Personnel should also be stationed at each wing tip to observe clearance.

CAUTION

The tail wheel LOCK/UNLOCK handle on the pilot's control pedestal should be in the UNLOCK position during any ground maneuver except straight line forward movement of the aircraft. This will prevent excessive and unnecessary side loads on the tail wheel and fuselage structure during turns.



1	11″	4	34′ 2″	7	12′ 11″
2	9′ 10″	5	9′ 2″	8	47′ 7″
3	10′ 8″	6	12′ 5″	9	14′ 11″

Figure 1-32. Ground Clearances and Dimensions

MINIMUM TURNING RADIUS AND GROUND CLEARANCE

Approximate ground clearances and aircraft dimensions are illustrated in figure 1-32.

ARKING AND MOORING

Accomplish the following steps for parking:

1. Head the aircraft into the wind if possible.
2. Engage the controls lock.
3. Close pilot's compartment storm and side windows (unless existing or anticipated weather conditions permit leaving the windows open for ventilation).
4. Engage tail wheel lock.
5. Install pitot covers.
6. Chock wheels fore and aft.

For mooring, complete the preceeding procedure and attach tiedown cables, chains, rope etc., to the aircraft tiedown fittings on the wings and tail wheel strut assembly. In addition to the normal three-point tiedowns when high winds are anticipated, the main landing gear towing lugs may be used, thus providing a five-point tiedown. Also, battens maybe installed on the flight control surfaces to ensure security.

PART 4 AIRCRAFT OPERATING LIMITATIONS

ENERAL

his part establishes the operating limitations that must be observed during operation of the aircraft. These limits must be observed not only for the safety of the pilot and his passengers, but also to obtain the most satisfactory aircraft performance. See figure 1-33 for instrument markings and limitations.

ENGINE LIMITATIONS

OVERSPEED

The allowable engine overspeed limit is 2400 rpm. Any speed in excess of this requires that the engine be inspected. A speed of 2700 rpm necessitates engine removal. In all instances, the amount of overspeed, duration, and if possible the cause, should be recorded on the yellow sheet. Refer to general reciprocating engine Bulletin No. 167 for additional information.

OVERBOOST

fer to general reciprocating engine Bulletin No. 197 r overboost limitations.

IN-FLIGHT FEATHERING

/hen feathering an engine inflight with cold outside air temperature, restart the engine before the oil temperature drops below +40°C. Temperatures below this limit will prevent the use of the engine for power until an oil temperature of 40°C is reached.

CENTER-OF-GRAVITY LIMITATIONS

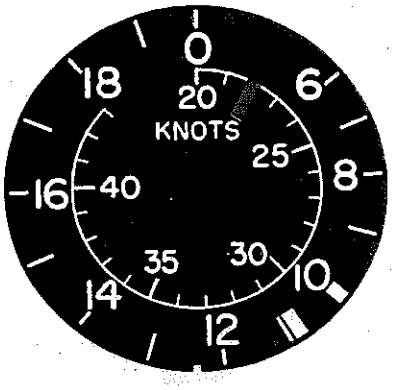
Refer to Manual of Weight and Balance Data, AN 01-1B-40, for current aircraft configuration weight and balance data.

CAUTION

Since it is possible to load the aircraft with a center-of-gravity location aft of the aft limit, it is strongly recommended that personnel loading be limited to a maximum of six persons including pilot and copilot. In aircraft which have three seats on the starboard side, the aft seat should be unoccupied. Relocation of loose gear (tools, covers, etc.) from the aft baggage compartment, stowage of baggage in the nose compartment, and limitations of fuel in the aft tanks, are recommended to facilitate observance of these limits. The lavatory compartment is also restricted against occupancy during take-off and landing.

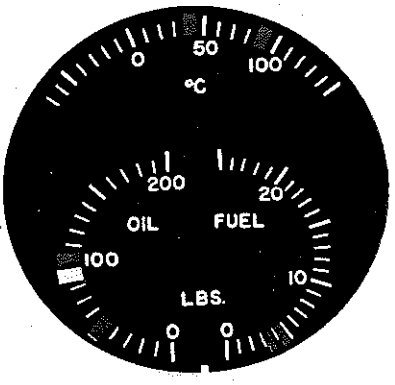
AIRSPEED LIMITATIONS

The maximum permissible airspeeds (IAS) are as follows in smooth to moderately turbulent air:



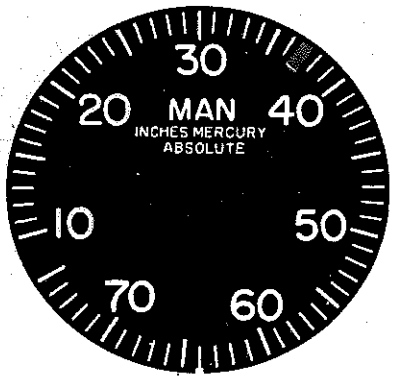
AIRSPEED INDICATOR
KNOTS

▬	220	MAXIMUM PERMISSIBLE INDICATED AIRSPEED
▭	108	MAXIMUM PERMISSIBLE INDICATED AIRSPEED WITH LANDING GEAR EXTENDED (135 KNOTS WITH WHEEL DOORS REMOVED)
▭	100	MAXIMUM PERMISSIBLE INDICATED AIRSPEED WITH WING FLAPS EXTENDED



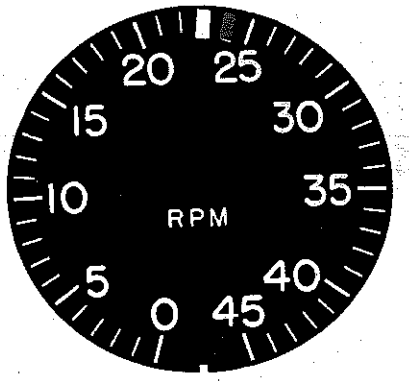
ENGINE GAGE UNIT

	OIL TEMP	OIL PRESS. PSI	FUEL PRESS. PSI
▬	40°C	50	3.5 MINIMUM
▭	60° TO 75°C	70 to 90	3.5 TO 4.0 NORM.
▬	90°C	100	4.0 MAXIMUM



MANIFOLD PRESSURE GAGE
(DUAL TYPE)
INCHES HG

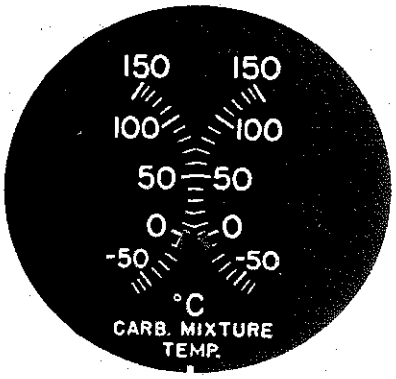
▬	37	TAKE-OFF
	18 TO 30	MANUAL LEAN PERMITTED



TACHOMETER
(DUAL TYPE)
RPM

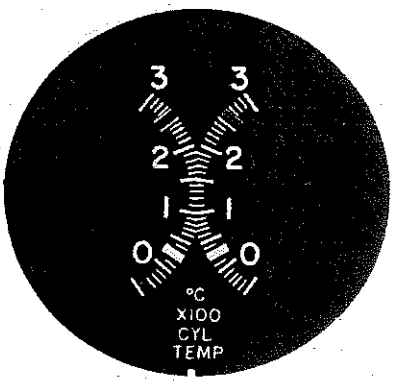
▭	2300	TAKE-OFF
▬	2400	MAXIMUM
	1700 TO 2000	MANUAL LEAN PERMITTED

Figure 1-33. Instrument Markings and Limitations (Sheet 1 of 2)



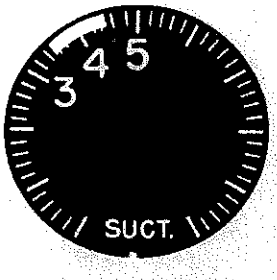
CARB. AIR TEMP. GAGE
°CENTIGRADE

▭	−10 TO +3	NORMAL ICING ZONE



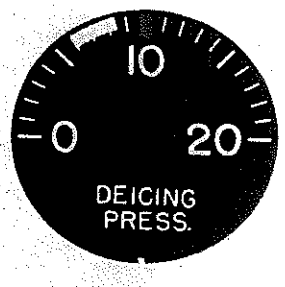
CYL. HEAD TEMP. GAGE
°CENTIGRADE

▭	260	MAXIMUM DURING TAKE-OFF
	150 to 232	NORMAL
▭	120	MINIMUM FOR NORMAL OPERATION



SUCTION GAGE
INCHES HG

▭	3.50 TO 4.50	NORMAL



DE-ICING PRESSURE GAGE
PSI

▬	10	MAXIMUM
▭	6.0 TO 8.5	NORMAL

Figure 1-33. Instrument Markings and Limitations (Sheet 2 of 2)

Wing flaps, landing gear, and landing lights retracted	220 Knots
Wing flaps, landing gear, and landing lights retracted (rough air)	193 Knots
Wing flaps, landing gear, and landing lights retracted (in severe turbulence)	120 to 145 Knots
Wing flaps extended	100 Knots
Landing gear extended	
With wheel well doors installed	108 Knots
Without wheel well doors installed	135 Knots
Landing lights extended	95 Knots
Camera doors open (RC-45J aircraft)	160 Knots

TURBULENT AIR PENETRATION

A recommended airspeed for penetrating severe turbulence may be determined by adding approximately 60 knots to the power-on-stall speed for the weight and configuration being flown.

ACCELERATION LIMITATIONS

The maximum permissible acceleration for flight in smooth air at gross weights of 8,200 pounds or less is 3.6 g. As gross weights are increased above 8,200 pounds the permissible accelerations decrease. At a gross weight of 9,200 pounds, the acceleration limit is 1.8 g's.

GROSS WEIGHT LIMITATIONS

Maximum gross weights for the UC-45J are 8,730 pounds for the take-off, and 8,600 pounds for landing; for the RC-45J, 9,200 pounds for take-off and 8,700 pounds for landing.

LANDING GEAR LIMITATIONS

Landing gear structure is designed for normal landing operations at 9000 pounds aircraft gross weight with a maximum contact sinking speed of 10 feet per second limit. (Although normal maximum landing weight is 8600 pounds). This weight is an absolute maximum except under emergency conditions requiring a landing at maximum aircraft gross weight (9200 pounds for RC-45J aircraft). UC-45J aircraft maximum gross is less than the 9000 pound limit. These weight limitations are based on the strength of the tail wheel and tire since there is a possibility of the tire and tube blowing out during an extremely rough landing. Therefore, when landing at gross weights in excess of the maximum recommended landing weight of 8600 pounds, the tail down attitude type landing should be avoided.

CAUTION

In order to prevent unnecessary stress on the landing gear structure and operating mechanism, the "transport-type" semi-stall landing technique should be used. No full-stall or fast tail-high landings should be made.

MANEUVER LIMITATIONS

All aerobatic maneuvers including spins are prohibited. In-flight maneuvers are restricted as follows:

1. The angle of bank shall not exceed 60 degrees.
2. Slipping or skidding shall be avoided at indicated airspeeds above 160 knots. At indicated airspeeds below 160 knots, slipping or skidding is permitted as required for asymmetric power conditions or for landing approaches.

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