NAVAIR 01-90CE-1

NATOPS
Flight Manual

NAVY MODELS

UC-45J, RC-45J
AIRCRAFT

THIS PUBLICATION SUPERSEDES NAVWEPS 01-90CE-1 OF 1 JANUARY 1951 REVISED 1 JANUARY 1954, AND C-45 NATOPS MANUAL

ISSUED BY AUTHORITY OF THE CHIEF OF NAVAL OPERATIONS AND UNDER THE DIRECTION OF THE COMMANDER NAVAL AIR SYSTEMS COMMAND

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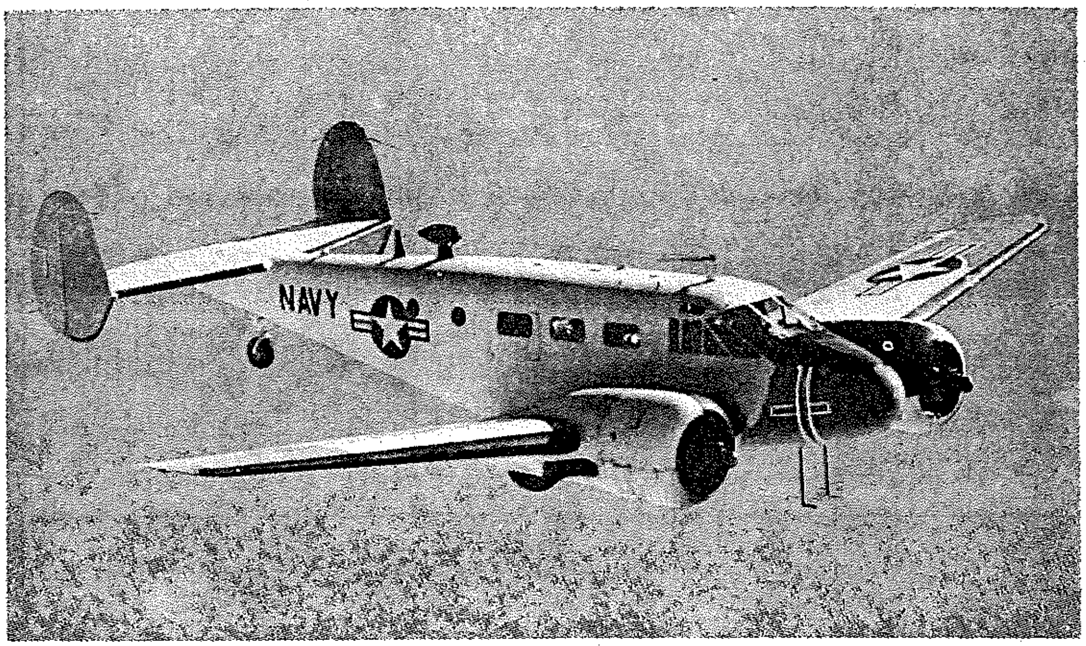

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15 November 1967

LIST OF CHANGED PAGES ISSUED

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the current change is indicated by a vertical line in the outer margins of the page.

* The asterisk indicates pages changed, added or deleted by the current change.

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USAF ACTIVITIES—In accordance with Technical Order No. 00-5-2.

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For information on other available material and details of distribution refer to NAVSUP PUBLICATION 2002, SECTION VIII, PART C and NAVAIR 00-500A.

USAF SERIES — NAVY MODEL

C-45B C-45F — JRB-3 JRB-4

AIRCRAFT

THIS PUBLICATION SUPPLEMENTS T.O. 1C-45B-1/NAVAER 01-90CE-1. Reference to this supplement will be made on title page of the basic handbook by personnel responsible for maintaining the publication in current status.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE AND THE COMMANDER OF THE NAVAL AIR SYSTEMS COMMAND

4 SEPTEMBER 1956

1. PURPOSE.

To prohibit take-off with snow or ice on the aircraft.

2. GENERAL.

Failure to remove snow and ice accumulated on aircraft while on the ground can result in serious aerodynamic and structural effects when flight is attempted. Depending on the weight and distribution of the snow and ice, take-off distances and climb-out performances can be adversely affected. This roughness, pattern and location of the snow and ice can affect stall speeds and handling characteristics to a dangerous degree. In flight structural damage has also resulted due to vibrations induced in flight by unbalanced loads of unremoved accumulations. These hazards can be eliminated by removing the snow and ice from the wings, fuselage, and tail before flight is attempted.

3. INSTRUCTIONS.

Remove all snow and ice accumulations prior to flight.

END

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C. -20350

15 November 1967

LETTER OF PROMULGATION

1. The Naval Air Training and Operating Procedures Standardization Program (NATOPS) is a positive approach towards improving combat readiness and achieving a substantial reduction in the aircraft accident rate. Standardization, based on professional knowledge and experience, provides the basis for development of an efficient and sound operational procedure. The standardization program is not planned to stifle individual initiative but rather, to aid the Commanding Officer in increasing his unit's combat potential without reducing his command prestige or responsibility.

2. This manual standardizes ground and flight procedures but does not include tactical doctrine. Compliance with the stipulated manual procedure is mandatory except as authorized herein. In order to remain effective, NATOPS must be dynamic and stimulate rather than suppress individual thinking. Since aviation is a continuing progressive profession, it is both desirable and necessary that new ideas and new techniques be expeditiously evaluated and incorporated if proven to be sound. To this end Type/Fleet/Air Group/Air Wing/Squadron Commanders and subordinates are obligated, authorized and directed to modify procedures contained herein, in accordance with OPNAV Instruction 3510.9 series and applicable directives, for the purpose of assessing new ideas, in a practical way, prior to initiating recommendations for permanent changes. This manual is prepared and kept current by the users in order to achieve maximum readiness and safety in the most efficient and economical manner. Should conflict exist between the training and operating procedures found in this manual and those found in other publications, this manual will govern.

3. Checklists and other pertinent extracts from this publication necessary to normal operations and training should be made and may be carried in Naval Aircraft for use therein. It is forbidden to make copies of this entire publication or major portions thereof without specific authority of the Chief of Naval Operations.

Thomas F. Connolly

THOMAS F. CONNOLLY
Vice Admiral, USN
Deputy Chief of Naval Operations (Air)

INTERIM CHANGE SUMMARY

CHANGE NUMBER	CHANGE DATE	PAGES AFFECTED	PURPOSE
1 thru 8	15 November 1967	Incorporated where applicable	

FOREWORD

SCOPE

The NATOPS Flight Manual is issued by the authority of the Chief of Naval Operations and under the direction of the Commander, Naval Air Systems Command in conjunction with the Naval Air Training and Operating Procedures Standarization (NATOPS) Program. It provides the best available operating instructions for most circumstances, but no manual is a substitute for sound judgement. Multiple emergencies, adverse weather, or terrain may require modification of the procedures conained herein. Read this manual from cover to cover. It's your responsibility to have a complete knowledge of its contents.

ARRANGEMENT

The manual is divided into eleven sections as follows:

SECTION I - The Aircraft

Part 1, General Description - An introduction to the aircraft.
Part 2, Systems - Description and operation of all major systems, including normal and emergency operation.
Part 3, Aircraft Servicing - Description and operating procedures for complete servicing.
Part 4, Aircraft Operating Limitations - Restrictions for operation of the aircraft, engines, and systems which must be observed for safe flight.

SECTION II - Indoctrination And Training

An introduction to requirements for ground training, flight training, flight crew requirements, personal flying equipment, and pilot currency requirements for compliance with the NATOPS program.

SECTION III - Normal Procedures

Part 1, Briefing and Debriefing - A general outline of requirements.
Part 2, Mission Planning - A guide to effective planning, including definition of responsibilities.
Part 3, Shore-based Procedures - Standard normal procedures used to conduct flight operations from an on-shore station.
Part 4, Carrier-based Procedures - Not Applicable.

SECTION IV - Flight Procedures And Characteristics

A summary of standard in-flight procedures, and the latest available data concerning aircraft characteristics throughout all phases of flight.

SECTION V - Emergency Procedures

Standard procedures to be followed during an emergency which could reasonably be expected.

SECTION VI - All-Weather Operation

Additional information and procedures required for flight under all weather conditions.

SECTION VII - Communications Procedures

Procedures utilized to standardize all forms of communications, including the use of electronic navigation equipment.

SECTION VIII - Special Missions

Description and operating procedures for RC-45J oblique and vertical aerial photography.

SECTION IX - Flight Crew Coordination

Not Applicable

SECTION X - NATOPS Standardization Evaluation

Concept, definitions, implementations, ground and flight evaluation, final grade determination, records and reports, evaluation question blank, and evaluation forms.

SECTION XI - Performance Data

Graphic and tabular data of aircraft performance to be used for effective mission planning.

HOW TO GET COPIES

AUTOMATIC DISTRIBUTION

To receive future changes and revisions to this manual automatically, a unit must be established on the automatic distribution list maintained by the Naval Air Technical Services Facility (NATSF). To become established on the list or change distribution requirements a unit must submit NAVWEPS Form 5605/2 to NATSF, 700 Robbins Ave., Philadelphia, Pennsylvania listing this manual and all other NAVAIR publications required. For additional instructions refer to BUWEPSINST 5605.4 series and NAVSUP publication 2002.

ADDITIONAL COPIES

Additional copies of this manual and changes thereto may be procured by submitting a NAVSTRIP Form DD 1348 to NSD Philadelphia in accordance with NAVSUP Publication 2002.

UPDATING THE MANUAL

To ensure that the manual contains the latest procedures and information, a review conference will be held periodically as necessary.

YOUR RESPONSIBILITY

NATOPS Flight Manuals are kept current through an active manual change program. If you find anything you don't like about the manual, if you have information you'd like to pass along to others, or if you find an error in this manual, submit a change recommendation to the Model Manager.

CHANGE RECOMMENDATIONS

Recommended changes to this manual or other NATOPS publications may be submitted by anyone in accordance with OPNAV INSTRUCTION 3510.0 (series). Change recommendations of an URGENT nature (safety of flight, etc.,) should be submitted directly to the NATOPS Advisory Group Member in the Chain of Command by priority message.

Submit routine change recommendations to the Model Manager on OPNAV Form 3500-22.

Address routine changes to:
Commanding Officer
Naval Air Station
Quonset Pt, R.I.
ATTN: C-45 NATOPS Evaluator

NATOPS FLIGHT MANUAL INTERIM CHANGES (FMIC'S)

FMIC'S are changes or corrections to the NATOPS Flight Manuals promulgated by CNO or NAVAIRSYSCOM. FMIC'S may be received by the individual custodian as a printed page or pages, or by the commands as a naval message. After the completion of the action directed by an interim change, it shall be retained in front of the Interim Changes Summary Page of the Manual unless it contains authorization to discard.

INTERIM CHANGE SUMMARY

The interim change summary in each manual is proviced for the purpose of maintaining a complete record of all interim changes issued to the manual. Each time the manual is changed or revised, the interim change summary will be updated to indicate disposition and/or incorporation of previously issued interim changes. When a regular change is received, the interim change summary should be checked to assertain that all outstanding interim changes have been either incorporated or cancelled; those not incorporated should be re-entered and noted as applicable.

CHANGE SYMBOLS

Revised text is indicated by a black vertical line in either margin of the page, like the one printed next to this paragraph. The change symbol shows where there has been a change. The change might be material added or information restated.

WARNINGS, CAUTIONS, AND NOTES

The following definations apply to "WARNINGS", "CAUTIONS", and "NOTES" found throughout the manual

WARNING

Operating procedures, practices, etc., which may result in injury or death, if not carefully followed.

CAUTION

Operating procedures, practices, etc., which, if not strictly observed, may damage equipment.

NOTE

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

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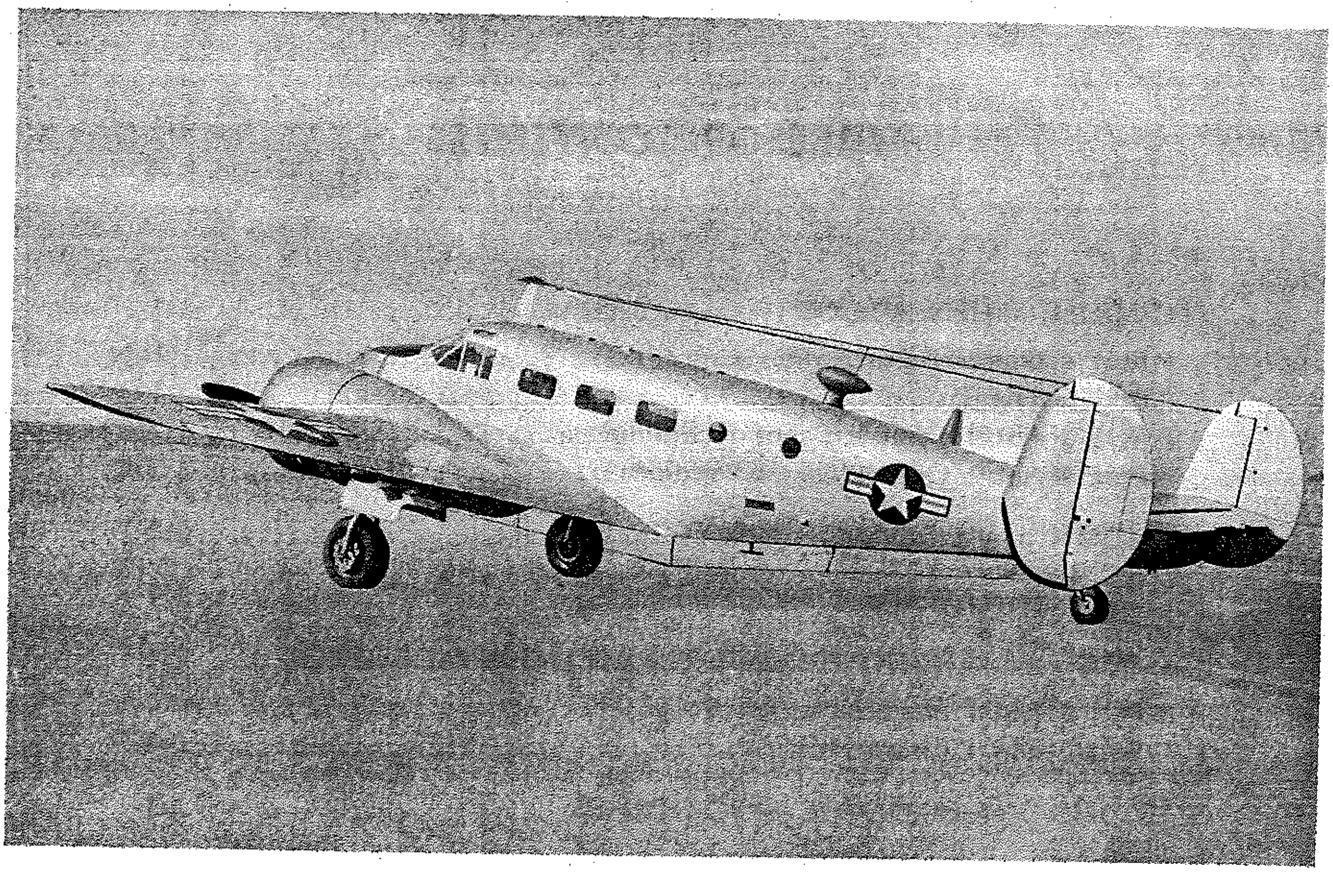

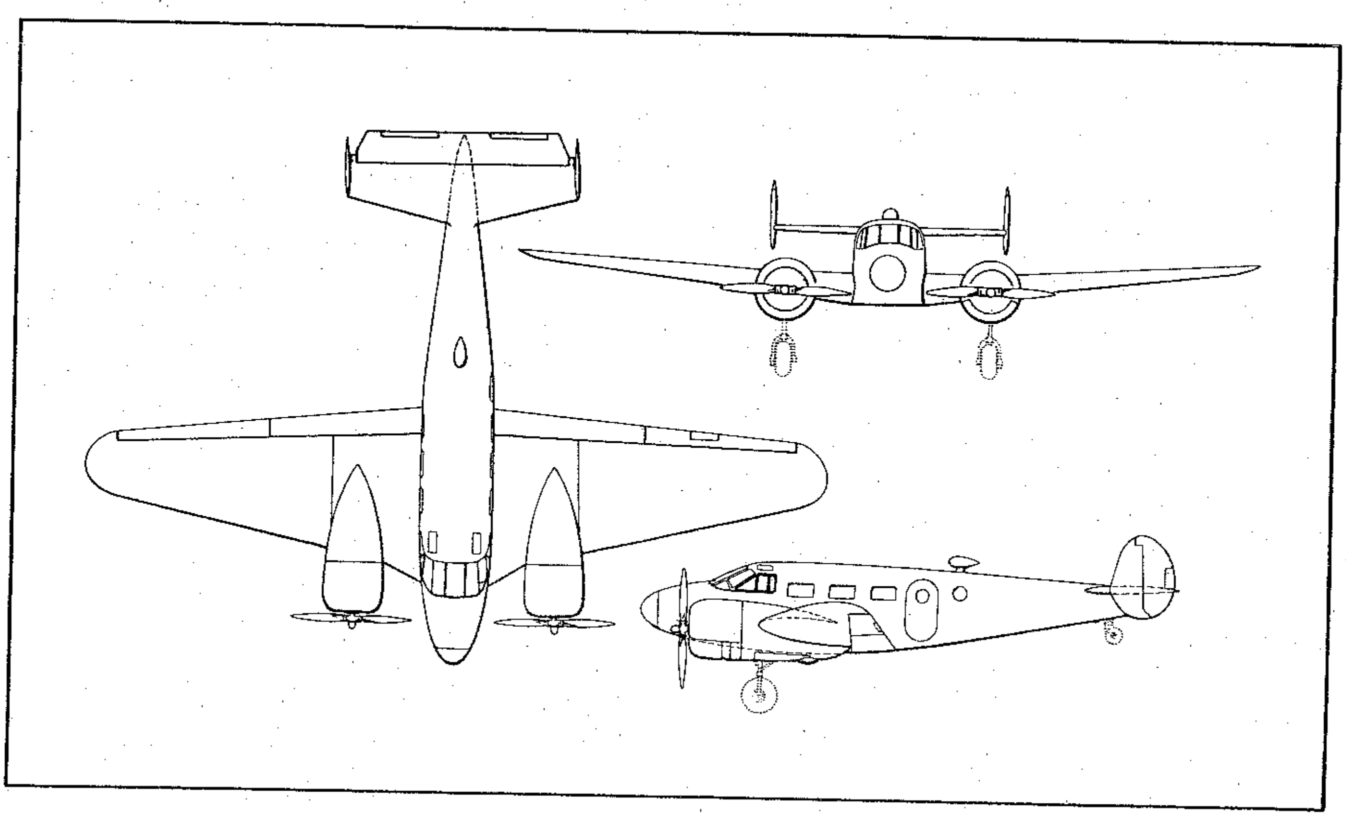

Figure 1-1. The Aircraft

SECTION I – THE AIRCRAFT

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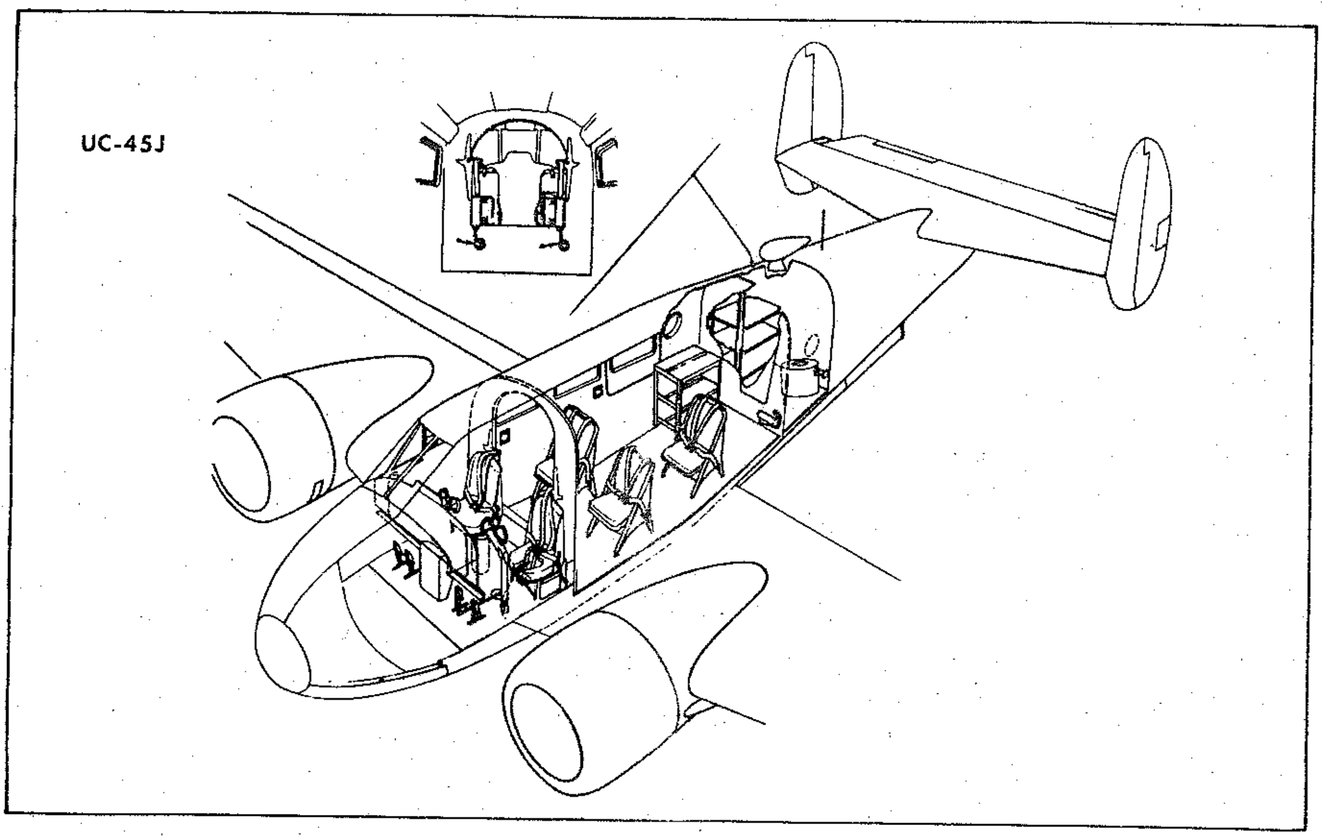
PART 1 GENERAL DESCRIPTION

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.



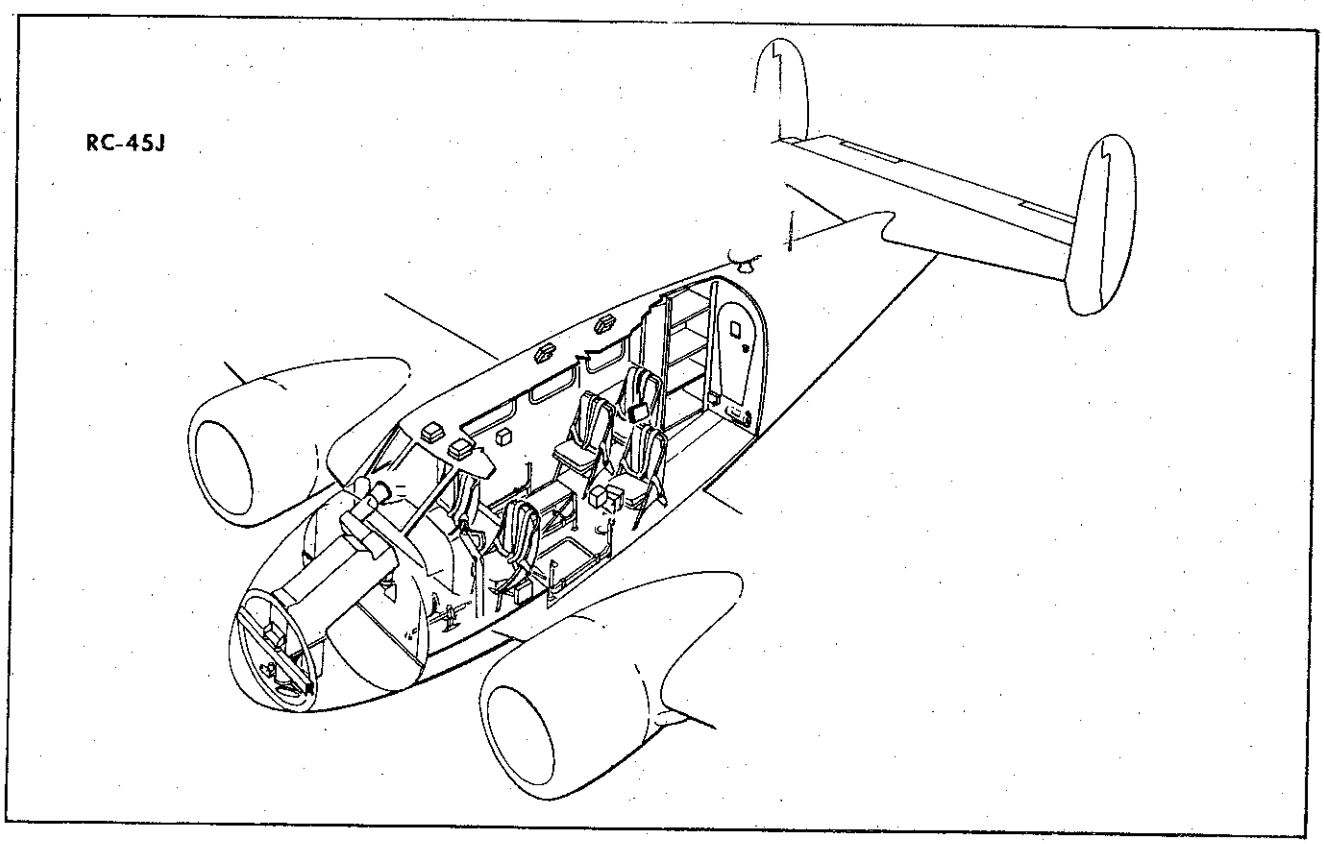


Figure 1-2. Interior Arrangement (Typical)

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

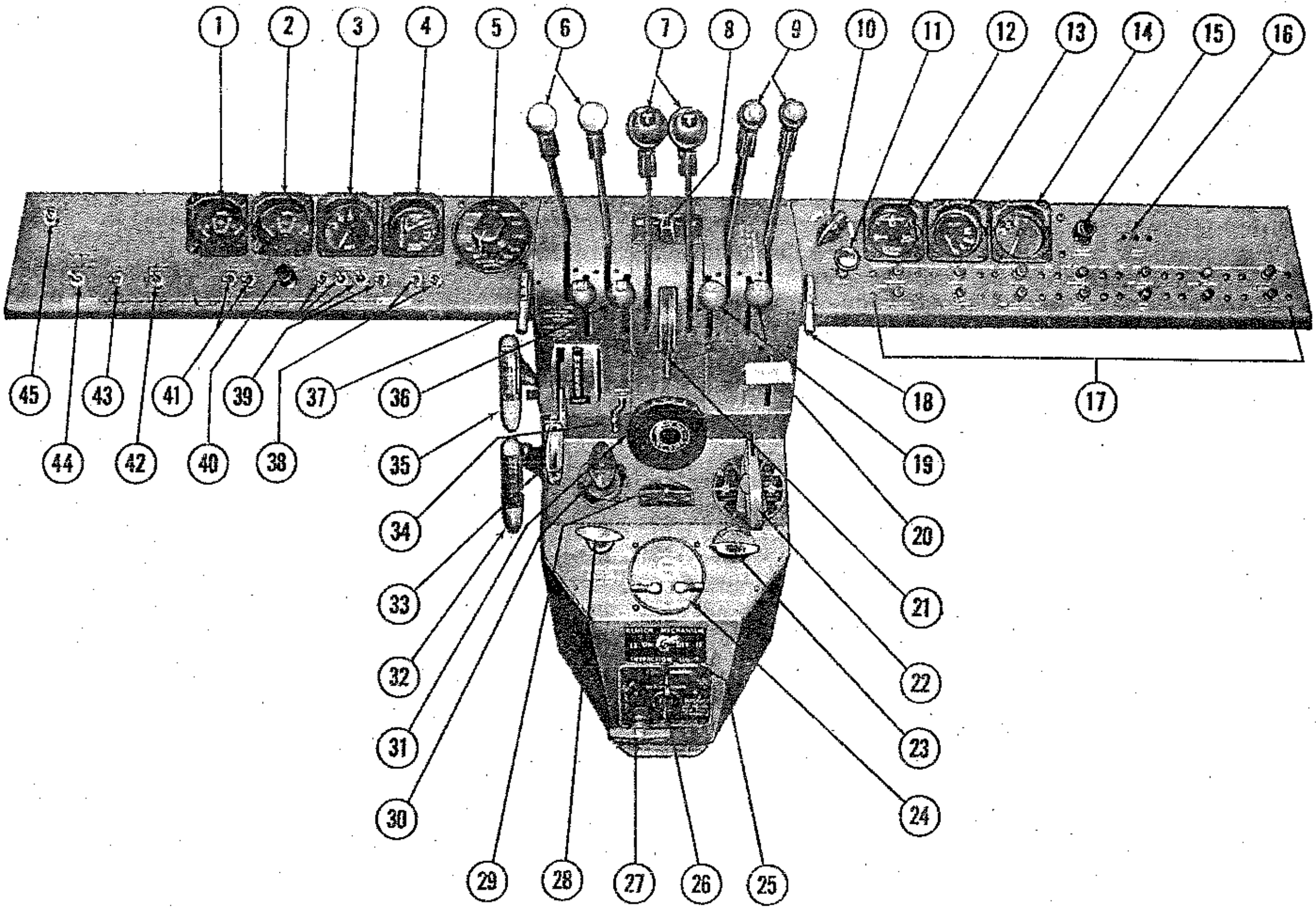
The throttle friction lock is located at the base of the throttle levers (figures 1-3 and 1-4). Throttle levers may be locked in any position by raising the friction lock lever.

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.

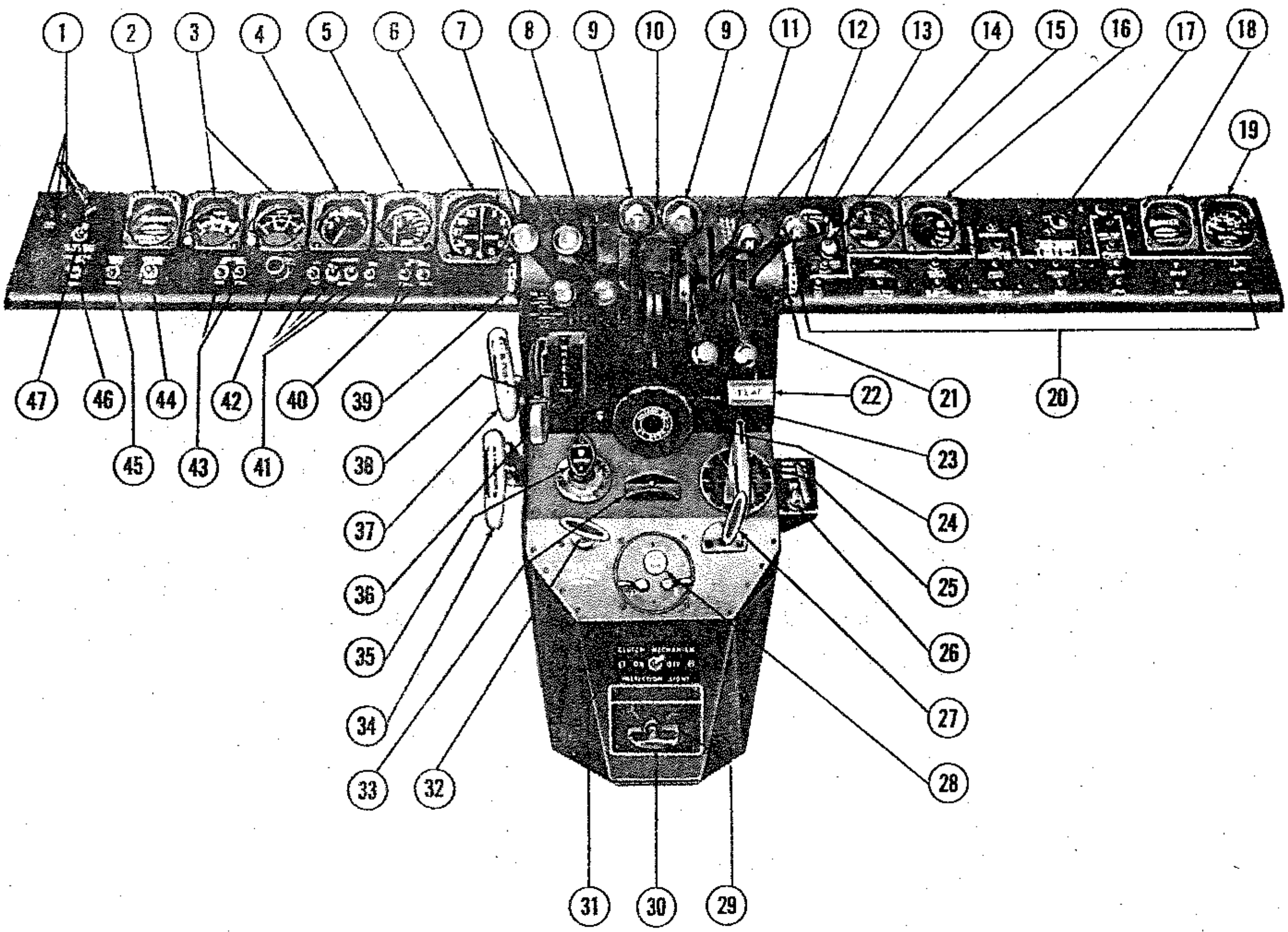
MANIFOLD HEAT LEVERS

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.



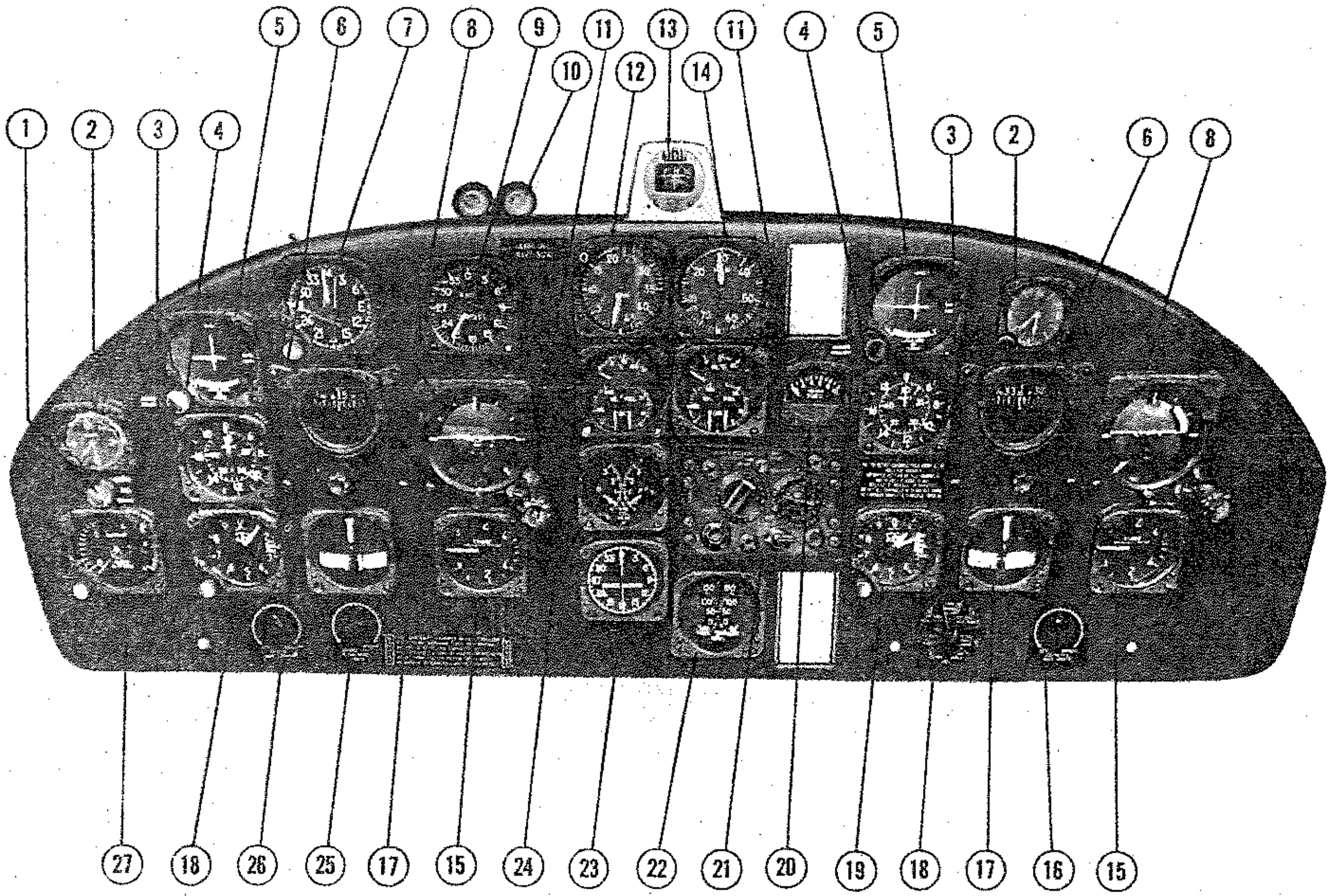
1. LEFT GENERATOR VOLT-AMMETER
2. RIGHT GENERATOR VOLT-AMMETER
3. LEFT SUCTION GAGE
4. ELEVATOR TRIM TAB POSITION INDICATOR
5. RADIO ALTIMETER ALTITUDE LIMIT SWITCH
6. PROPELLER LEVERS
7. THROTTLE LEVERS
8. LANDING-GEAR WARNING HORN SILENCER SWITCH
9. MIXTURE LEVERS
10. PROPELLER ANTI-ICER RHEOSTAT KNOB
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)



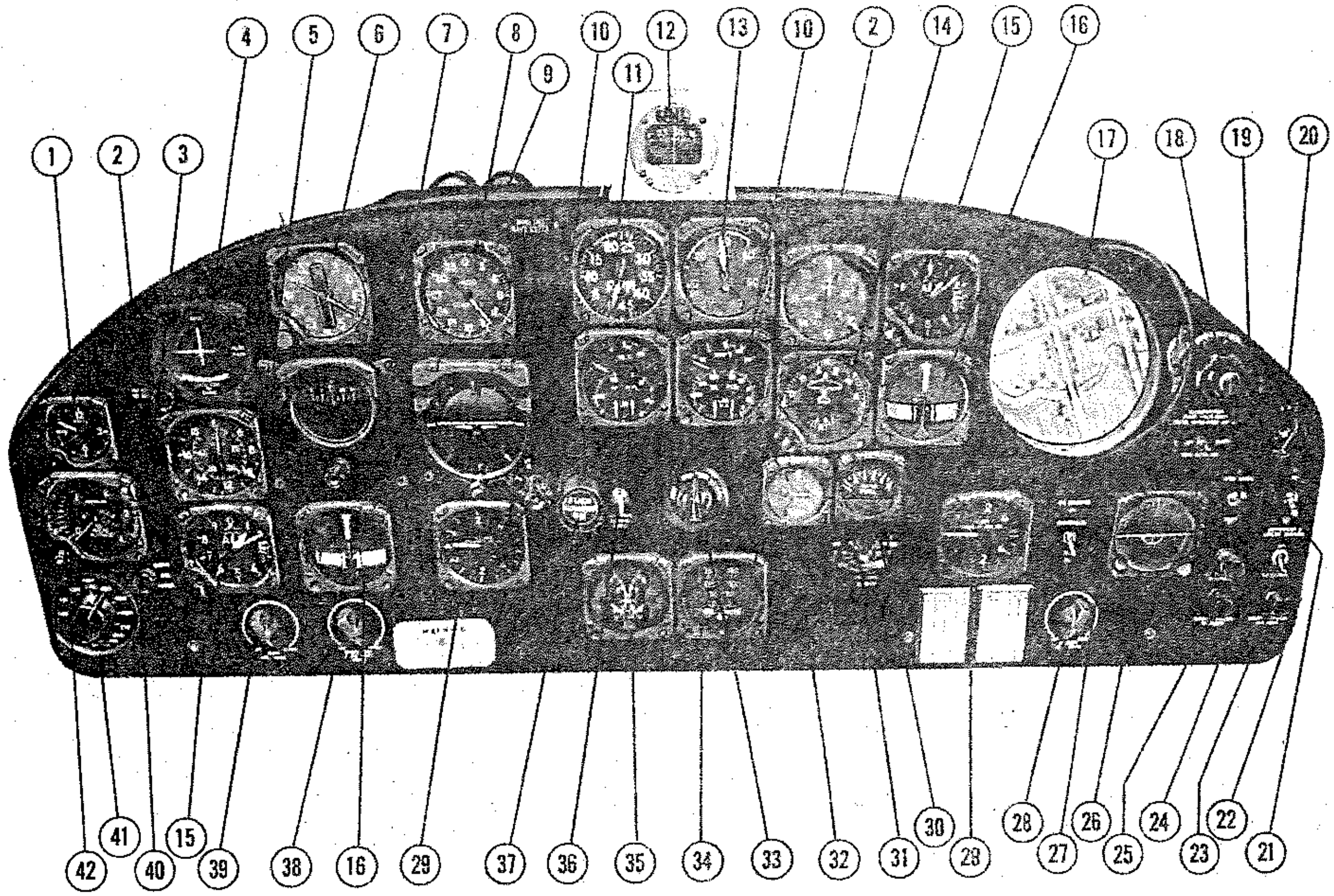
1. SPARE BULBS
2. OXYGEN FLOW INDICATORS
3. VOLT-AMMETERS
4. SUCTION GAGE
5. ELEVATOR TRIM TAB POSITION INDICATOR
6. COURSE SELECTOR
7. PROPELLER LEVERS
8. MANIFOLD HEAT LEVERS
9. THROTTLE LEVERS
10. LANDING-GEAR WARNING HORN SILENCER SWITCH
11. OIL SHUTTER LEVERS
12. MIXTURE LEVERS
13. PROPELLER ANTI-ICER 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.

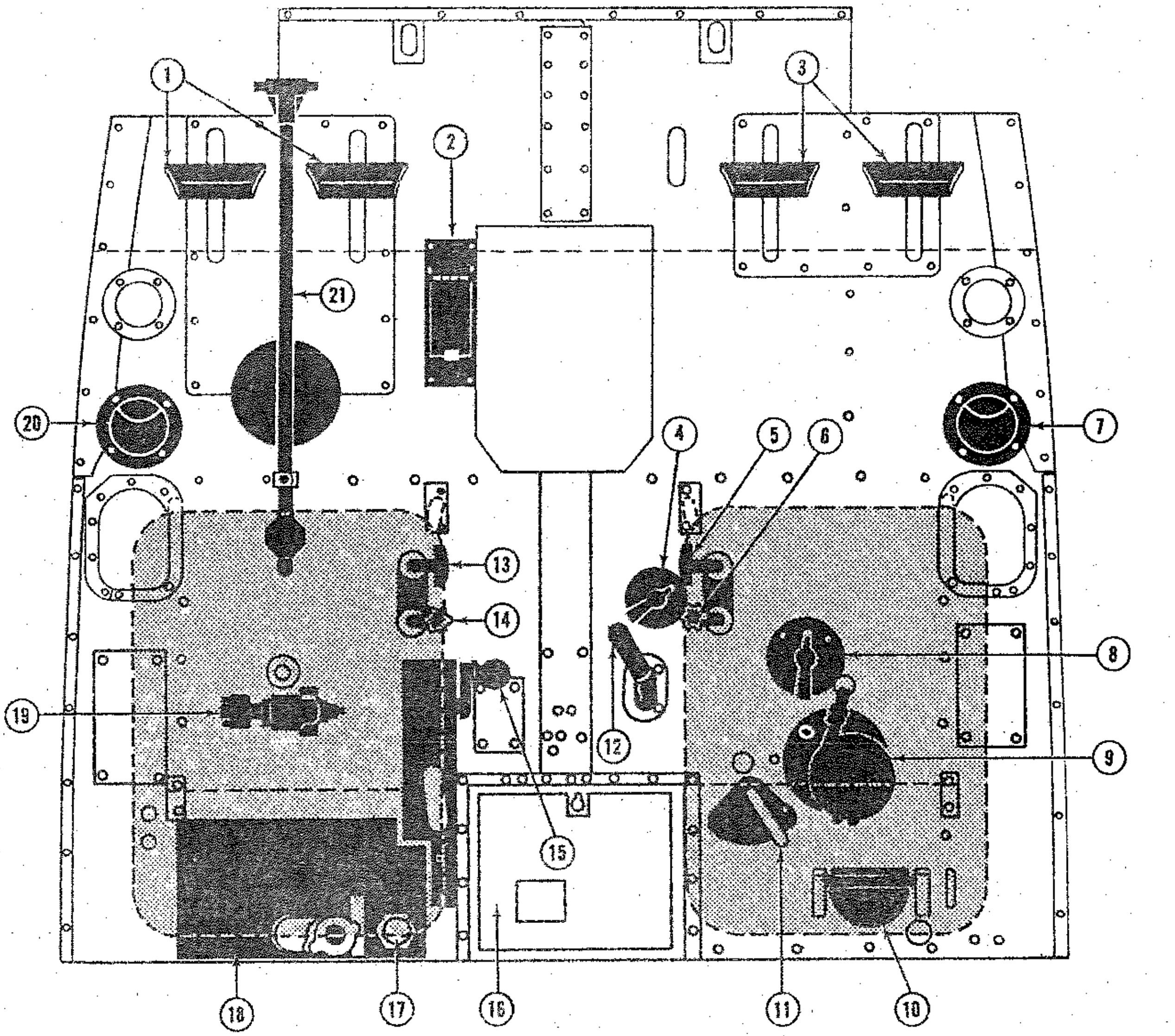
FUEL SUPPLY SYSTEM

The fuel supply system (figure 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)

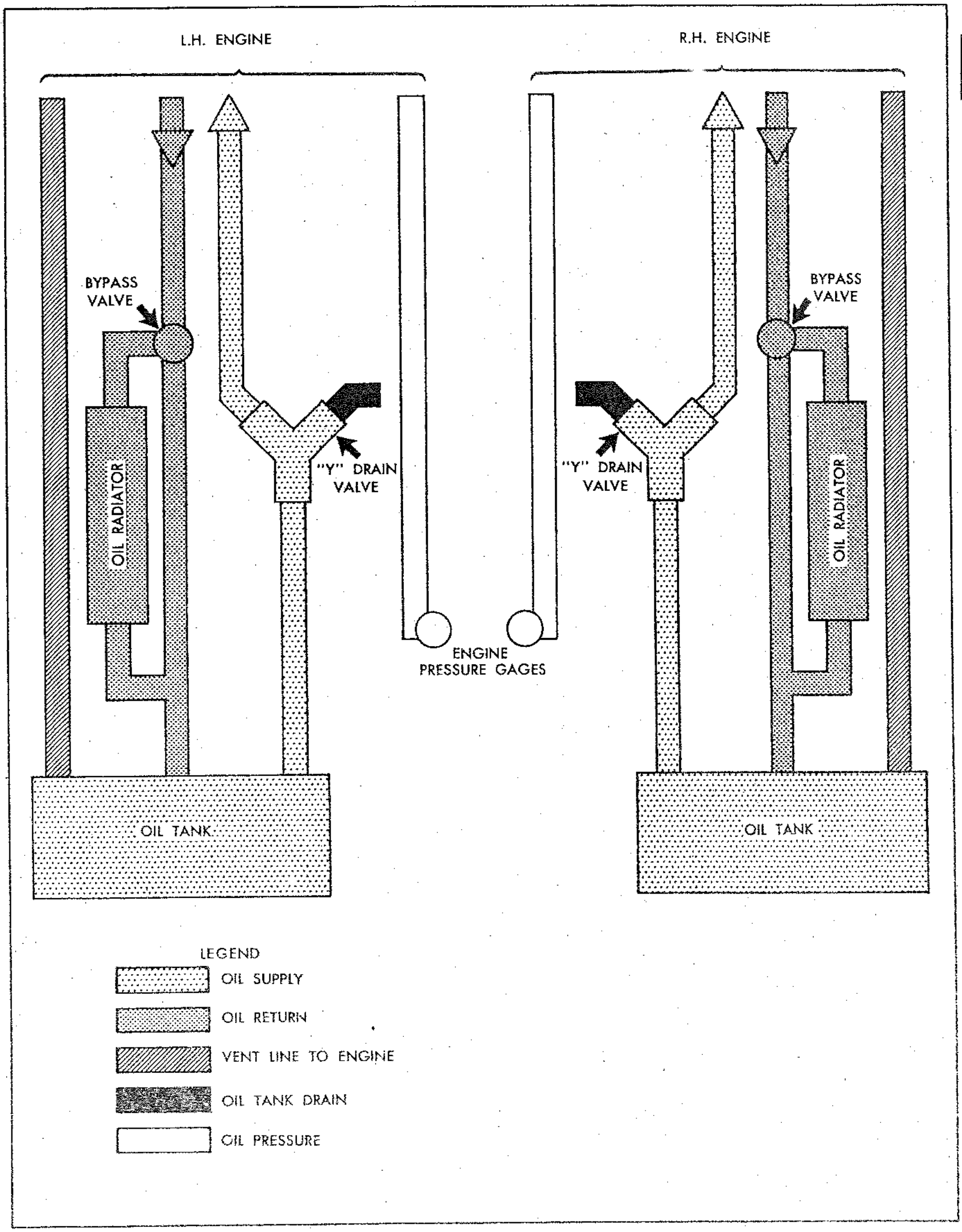


Figure 1-8. Engine Oil Supply System

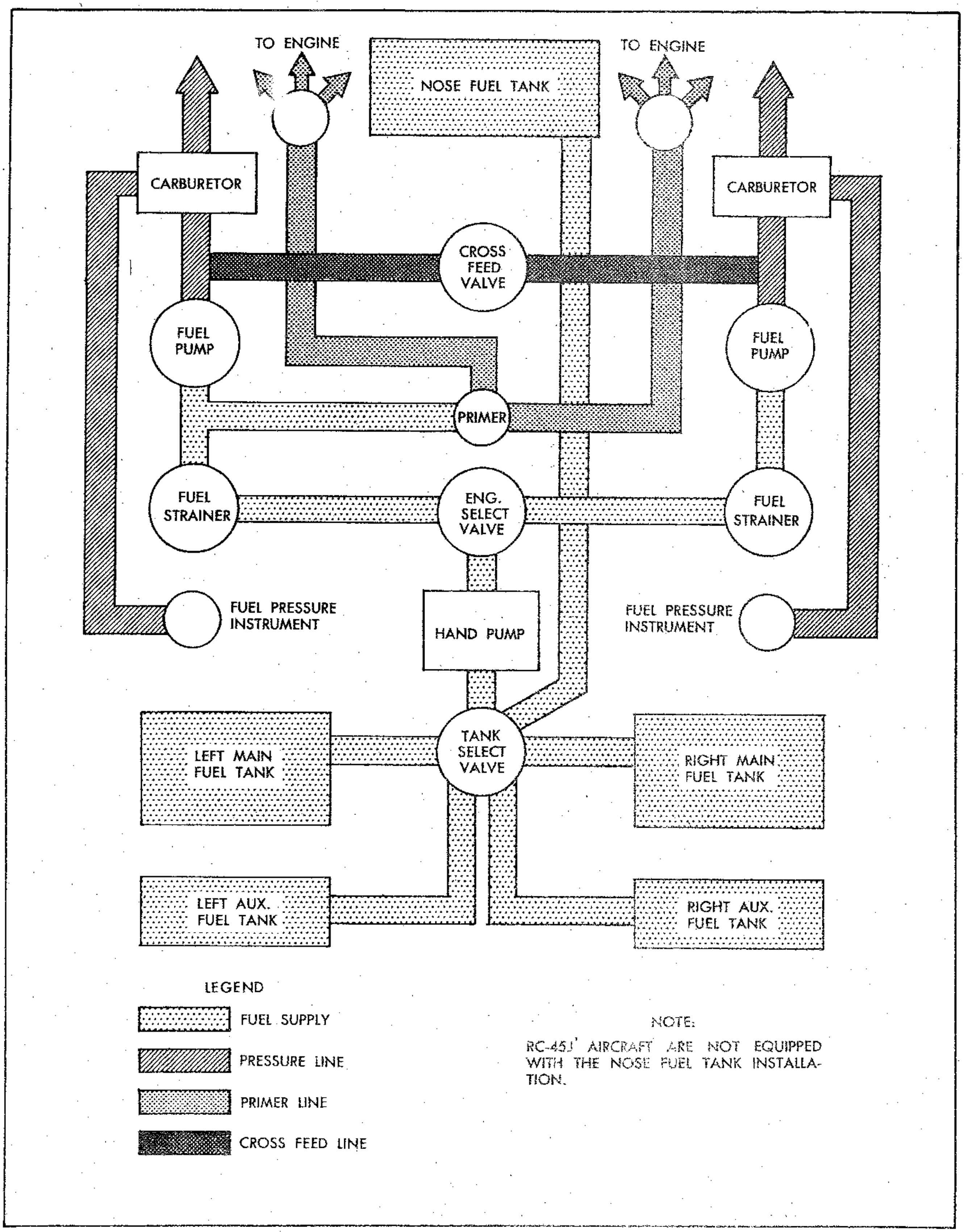


Figure 1-9. Fuel Supply System

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

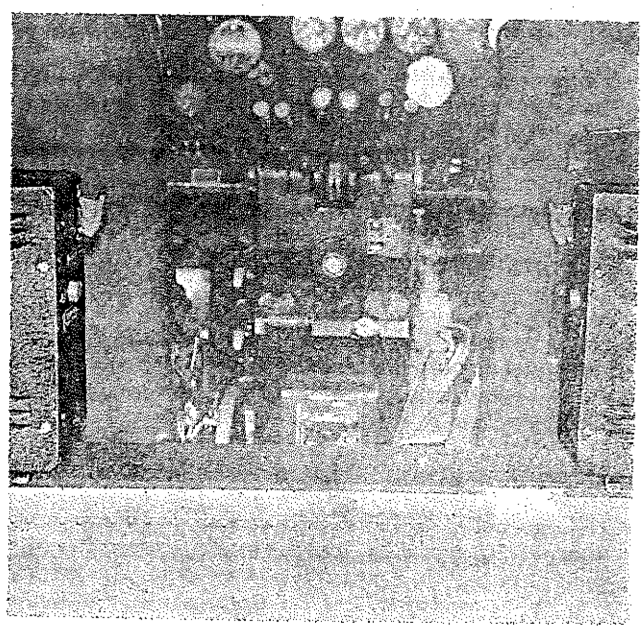


Figure 1-11. Voltage Regulator and Generator Circuit Breaker Boxes

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).

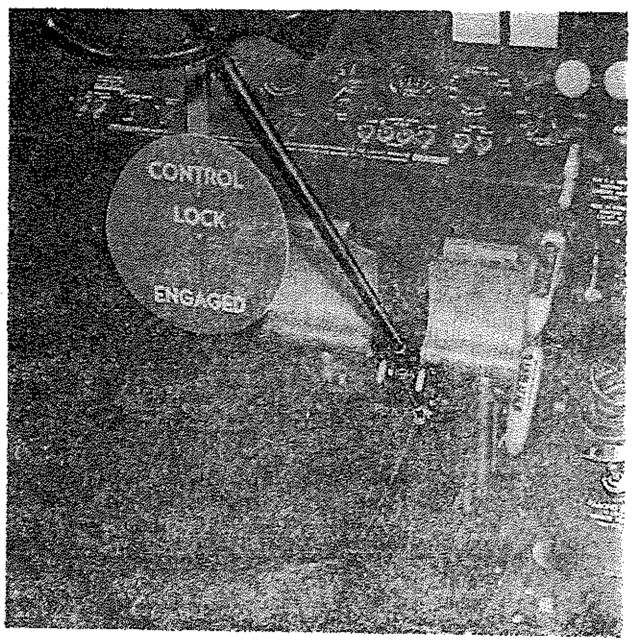


Figure 1-13. Control Surface Lock

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.

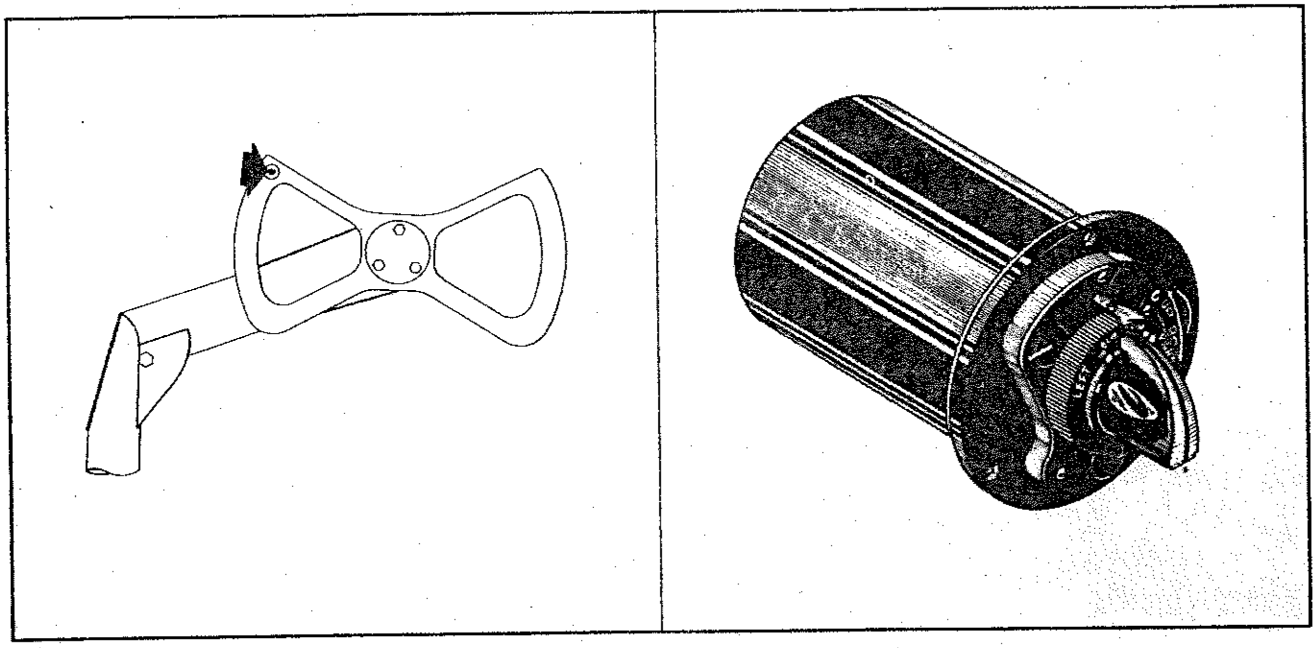


Figure 1-14. P-1 Automatic Pilot Controls

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.

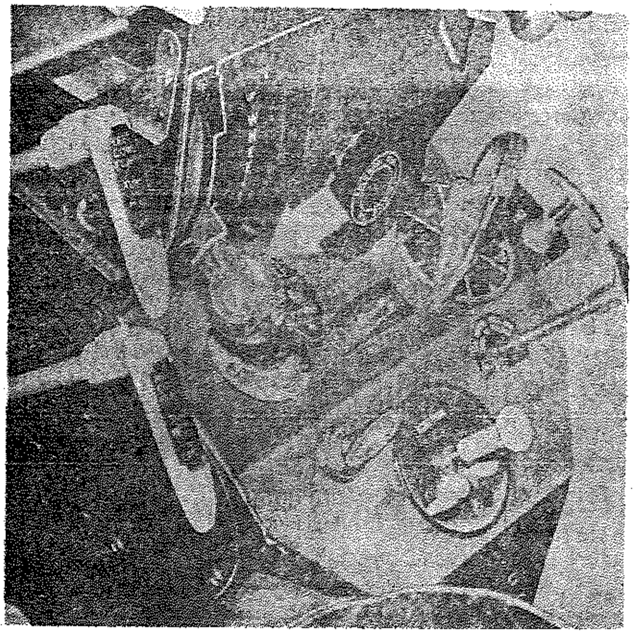


Figure 1-15. Landing Gear Handle

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

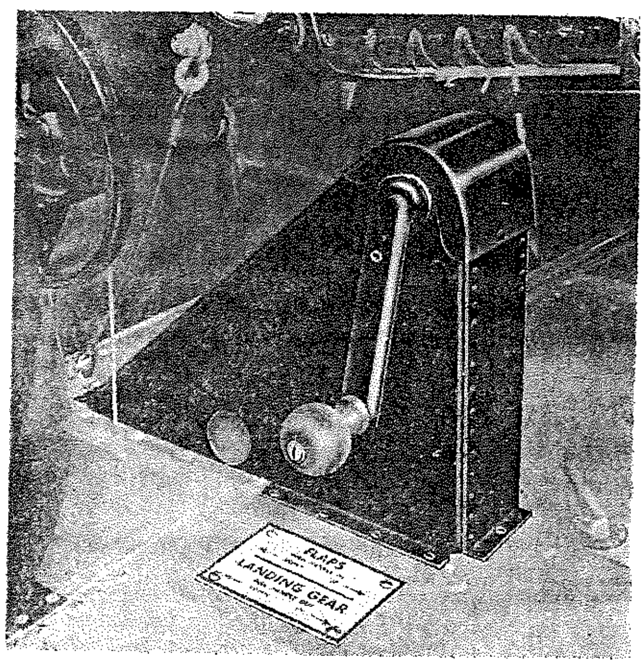


Figure 1-16. Landing Gear/Wing Flap Emergency Handcrank

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

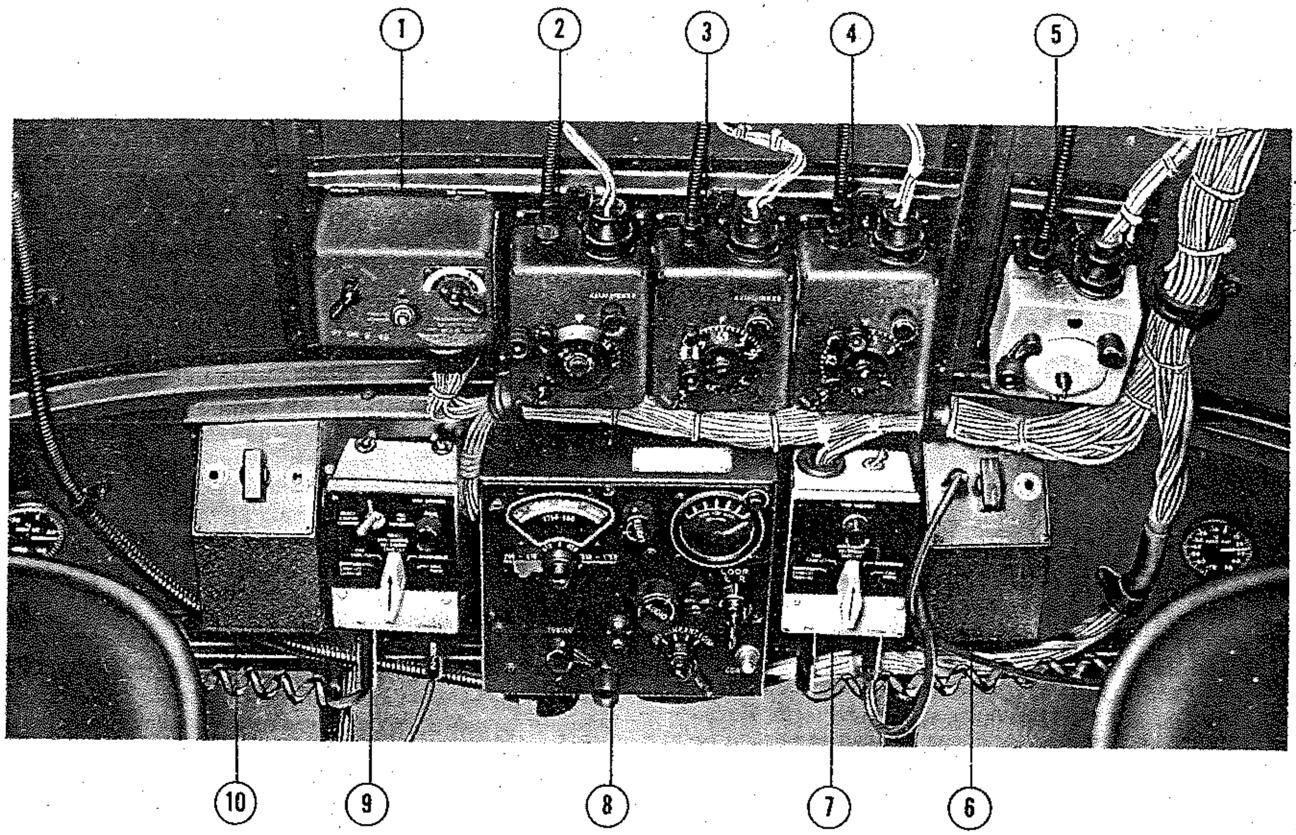
An outside air temperature (OAT) indicator is mounted through the overhead fuselage structure; one above the pilot's seat, and one above the copilot's seat. Both indicators are direct reading instruments and are calibrated in degrees centigrade (C°).

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

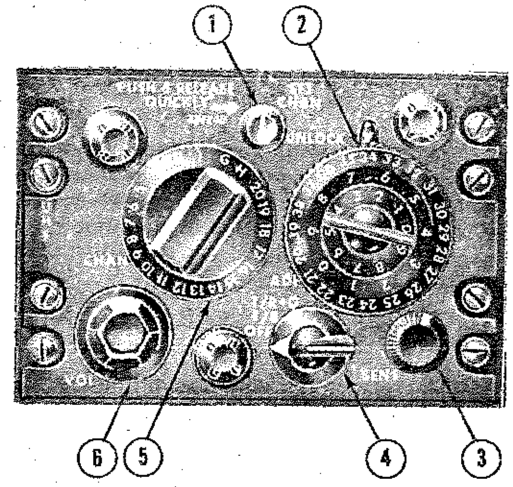


Figure 1-19. Command Radio Set AN/ARC-27 or 27A

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 counter-clockwise. 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

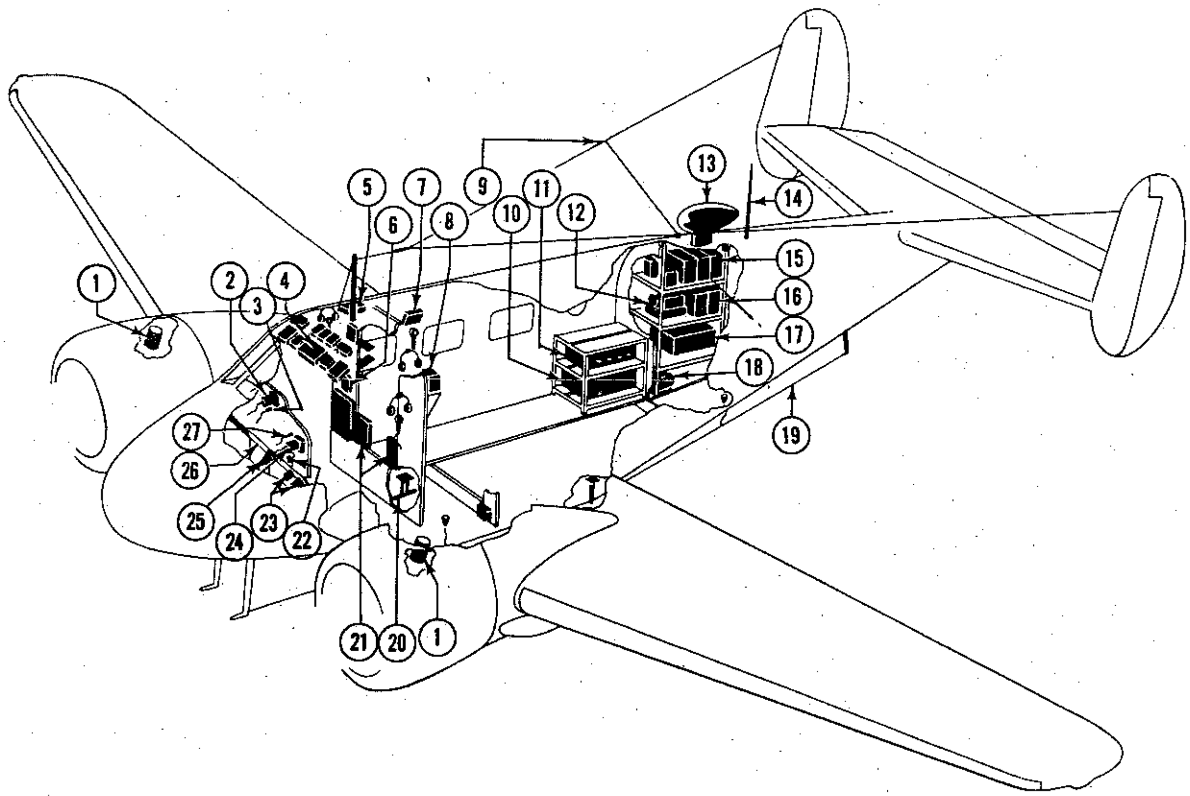
The following HF transmitter controls are located on the transmitter control box (figure 1-17) located on the pilot's compartment overhead panel.

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 follo ng 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 (copilot'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).

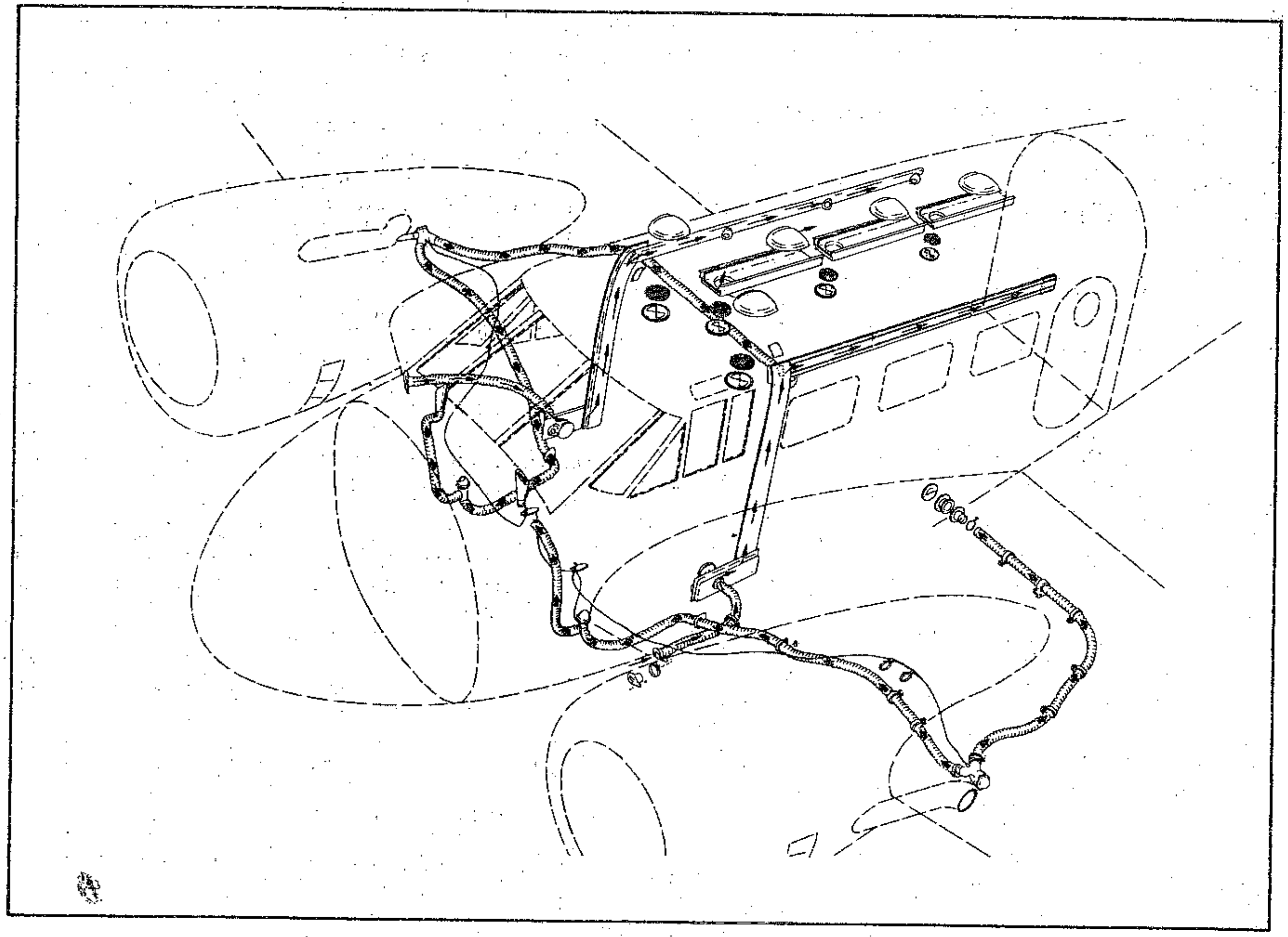


Figure 1-22. Heating and Ventilating System

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.

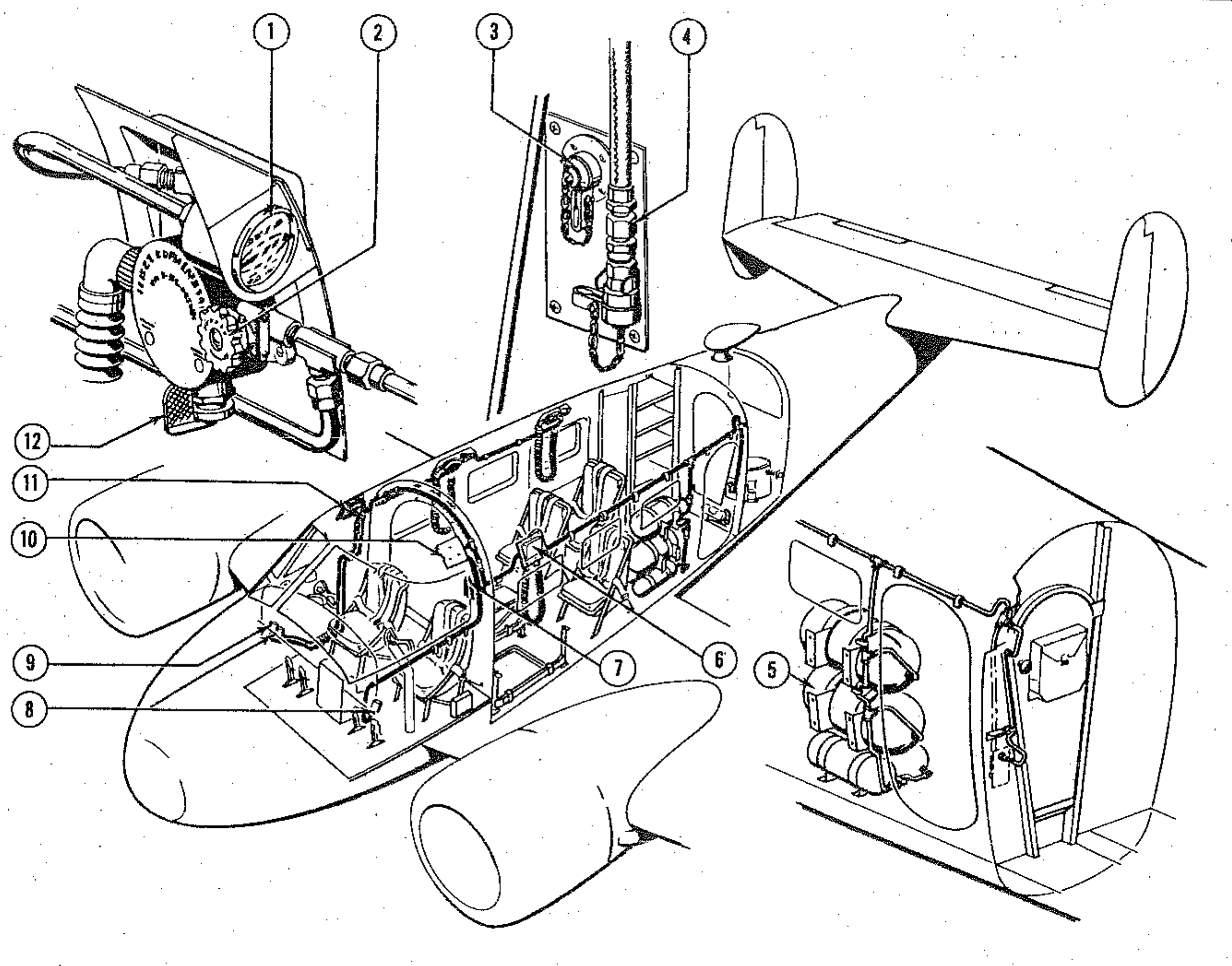
OXYGEN SYSTEM OPERATION

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.

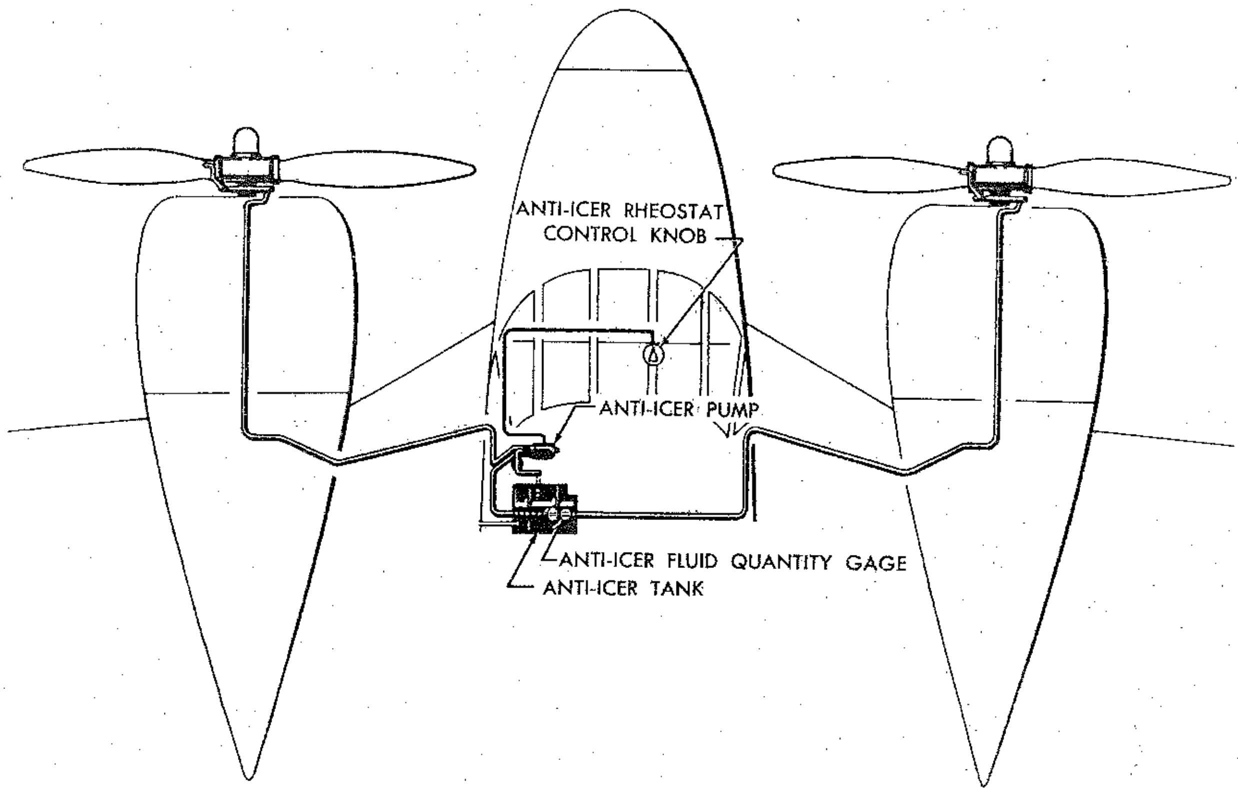


Figure 1-25. Propeller Anti-Icer System

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

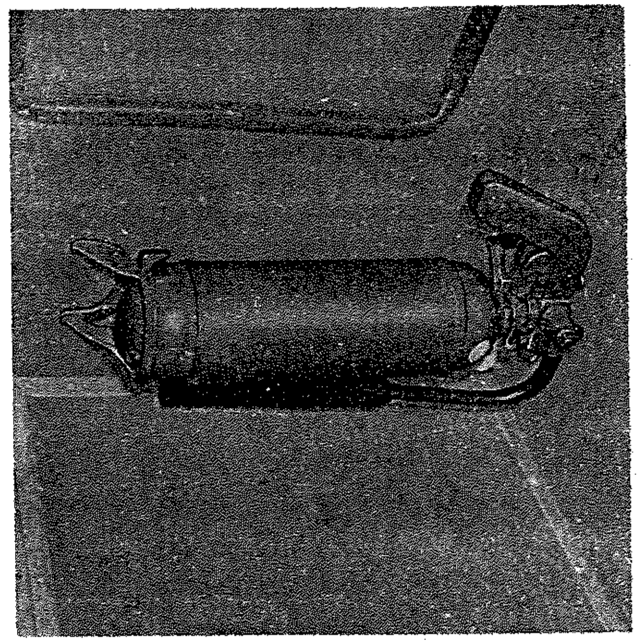


Figure 1-27. Hand Operated Fire Extinguisher

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-

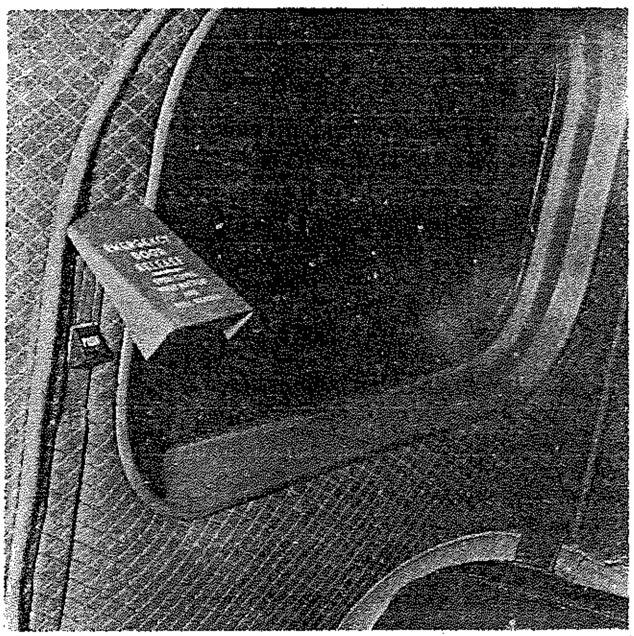


Figure 1-28. Emergency Escape Hatch

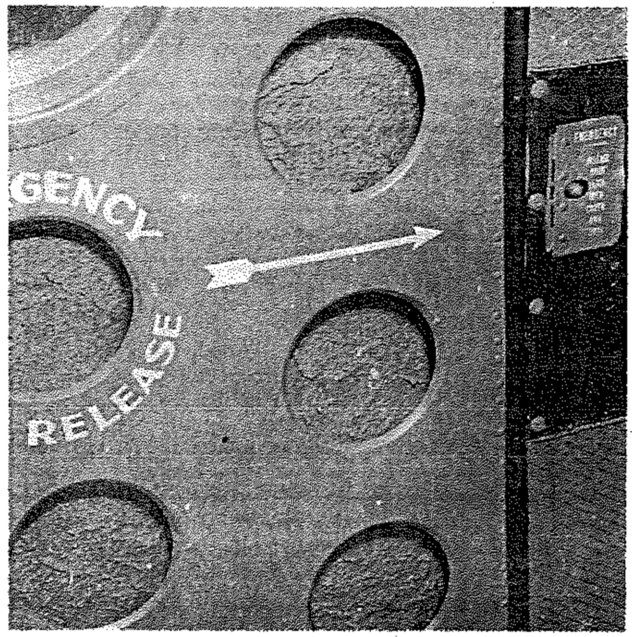


Figure 1-29. Main Entrance Door Emergency Release

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. Construction 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

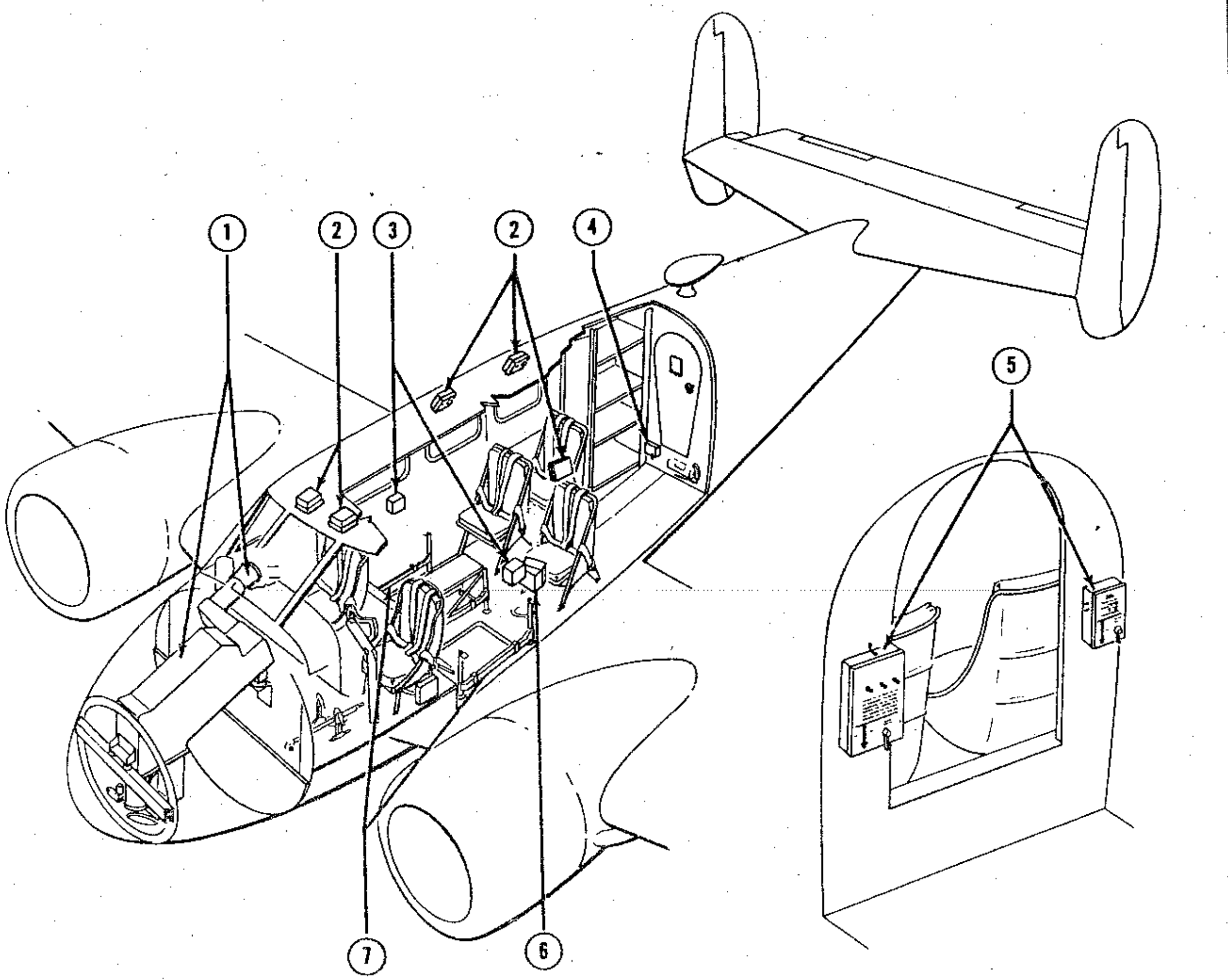
A relief tube (figure 1-2) is provided at the pilots station, and a chemical type head and relief tube are provided in the lavatory aft of the passenger compartment.

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

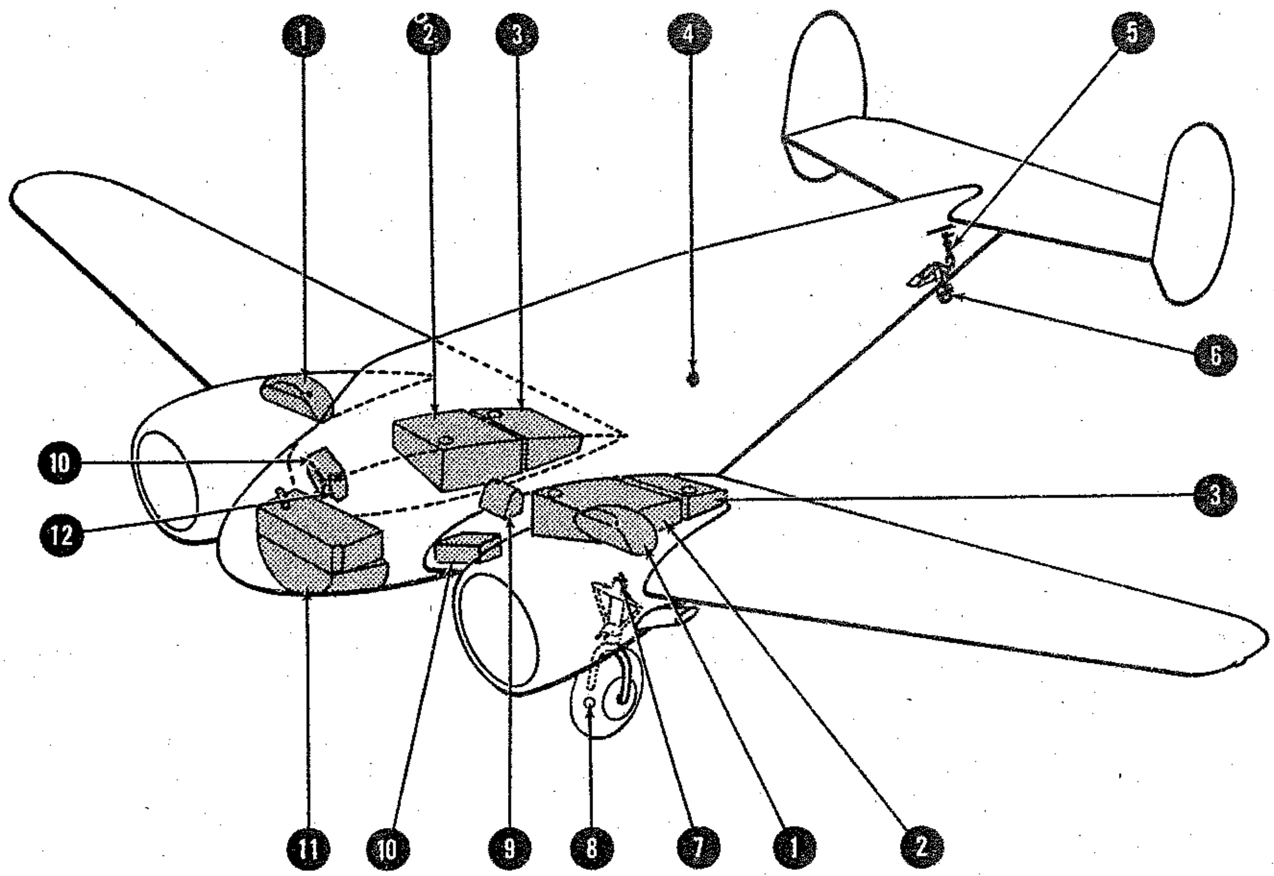
Keep oxygen away from oil, grease, or other combustible materials. Ensure adequate ventilation.

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:

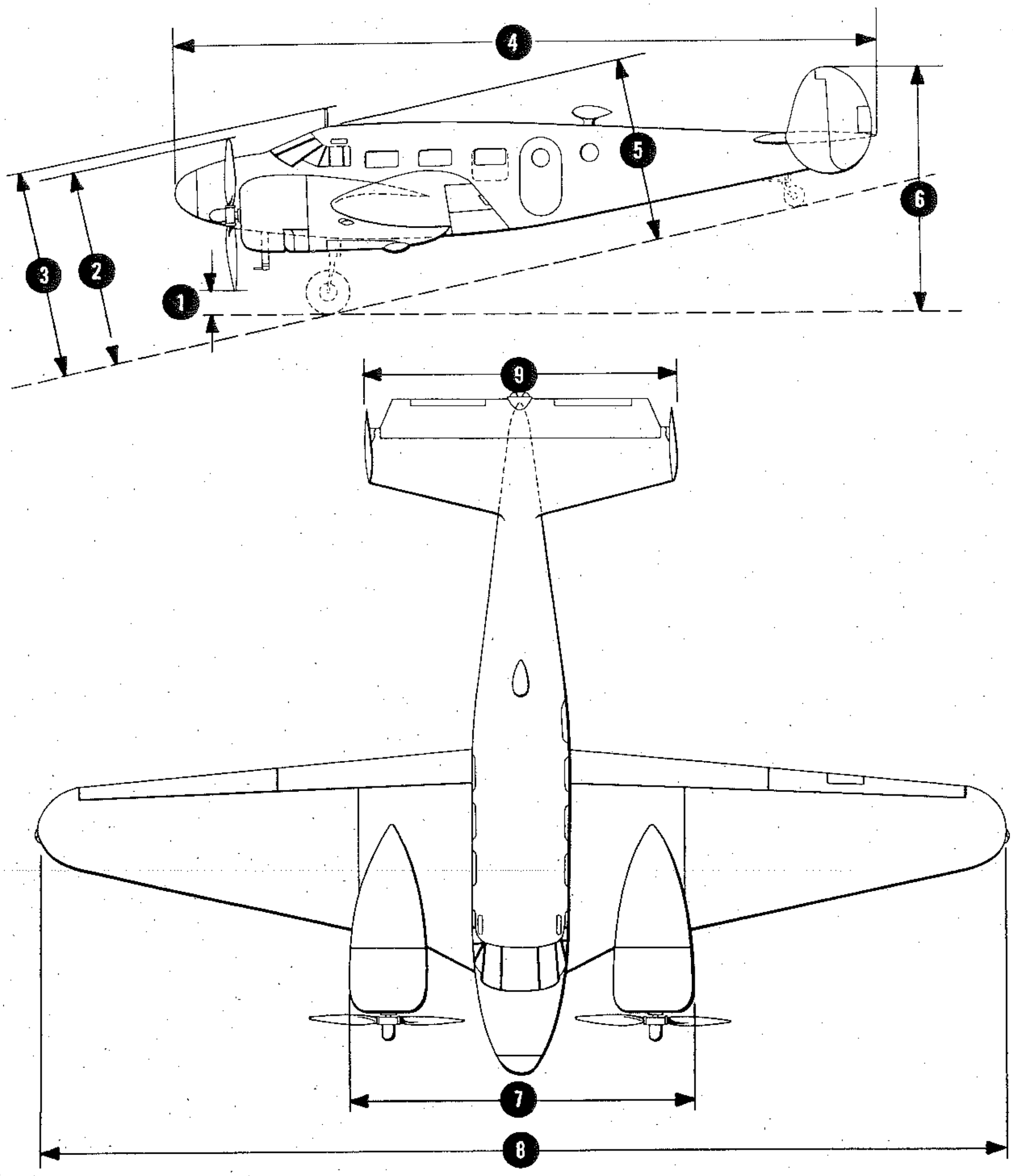
NAVY UNITS	USAF UNIT	
NC-2A	A-1	C-26
NC-5	A-3	MD-3 & -3A
NC-6	A-4	MD-3M
NC-7		
NC-8	A-7	MC-1
NC-10	AF-M32A-10	MA-1 MP
NC-12	B-10A	MA-2 MP
	1-101	

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

GENERAL

This 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

When 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

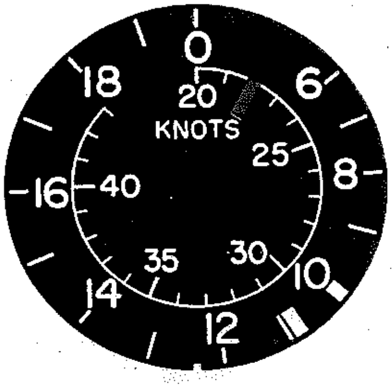
Refer to Manual of Weight and Balance Data, AN 01-1B-40, for current aircraft configuration weight and balance data.

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.

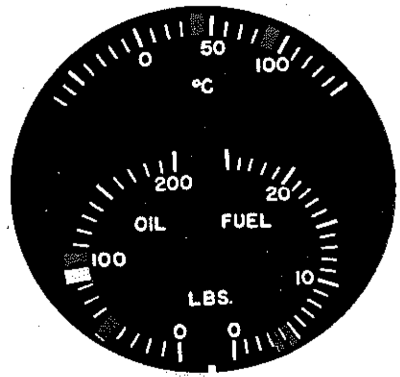
AIRSPEED LIMITATIONS

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



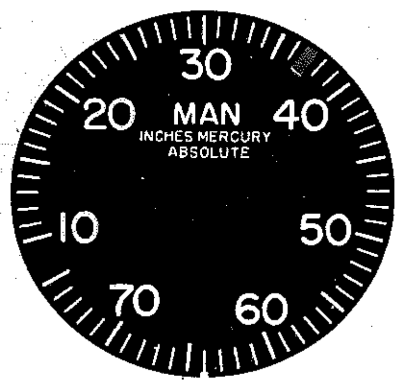
AIRSPEED INDICATOR
KNOTS

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



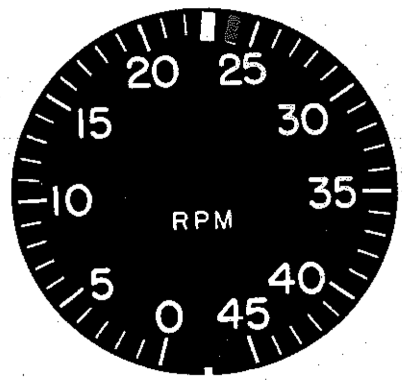
ENGINE GAGE UNIT

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

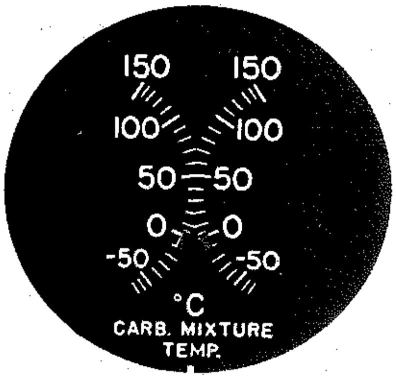
37	TAKE-OFF
18 TO 30	MANUAL LEAN PERMITTED



TACHOMETER
(DUAL TYPE)
RPM

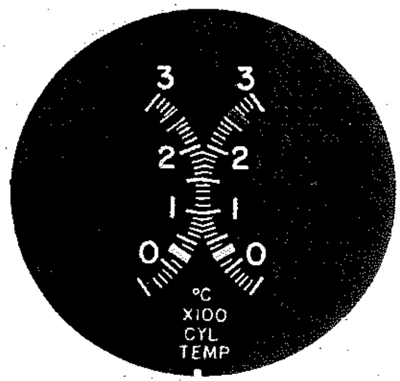
2300	TAKE-OFF
2400	MAXIMUM
1700 TO 2000	MANUAL LEAN PERMITTED

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



CARB. AIR TEMP. GAGE
°CENTIGRADE

−10 TO +3	NORMAL ICING ZONE

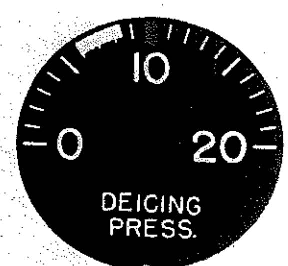


CYL. HEAD TEMP. GAGE
°CENTIGRADE

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.

SECTION II – INDOCTRINATION

TABLE OF CONTENTS

INTRODUCTION

This chapter establishes the training syllabus for the minimum instruction requirements for pilot training, qualification and currency in the UC-45J and RC-45J aircraft.

GROUND TRAINING SYLLABUS

The overall ground training syllabus for each activity varies according to local conditions, facilities, authority, and the currency of C-45 pilot personnel involved. However, to establish a standardized subject course, the following outline is presented.

ENGINEERING

GENERAL

General description of aircraft.

ENGINE OPERATING PROCEDURE AND LIMITATIONS

Discuss the powerplant operation and limitations during ground and flight operations.

AIRCRAFT SYSTEMS

1. Landing gear
2. Flaps
3. Brakes
4. Propeller
5. Deicing and anti-icing
6. Oil
7. Fuel
8. Electrical

TRANSITION AND FAMILIARIZATION

GROUND OPERATIONS

1. Preflight
2. Starting procedures
3. Taxiing procedures
4. Engine ground check

FLIGHT OPERATIONS

1. Takeoff
2. Level-off
3. Basic transitions
4. Climbs and glides
5. Steep turns
6. Stall characteristics

7. Slow-flight
8. Landings

EMERGENCY PROCEDURES

Discuss aircraft emergencies and the correct procedures to follow for each.

INSTRUMENTS

AIRCRAFT RADIO AND INSTRUMENT OPERATIONS

Discuss the location, function, and operation of the aircraft radio equipment and flight instruments.

INSTRUMENT PROCEDURES

1. Discuss instrument departures, en route, and terminal procedures.
2. Discuss the characteristics of the aircraft during instrument flight.

FLIGHT TRAINING SYLLABUS

Specific aircraft utilization, local command restrictions, geographic location and other factors influence the actual flight syllabus and its sequence of completion.

AIRCRAFT FAMILIARIZATION

FLIGHT ONE

The instructor pilot will introduce:
1. Preflight
2. Starting procedures
3. Taxiing
4. Engine ground check
5. Takeoff
6. Climbout
7. Climbs and descents
8. Level speed changes
9. Steep turns
10. Slow-flight
11. Stall characteristics
12. Anti-icing and deicing equipment
13. Normal landings

FLIGHT TWO

Practice all maneuvers previously introduced. The Instructor Pilot will introduce:
1. Engine fire during start
2. Cabin fire
3. Electrical fire
4. Fuel starvation
5. Emergency operation of gear and flaps
6. Single-engine emergency procedures
7. No-flap and no-brake landings
8. Basic instruments
   a. Steep turn pattern
   b. Partial panel
   c. Unusual attitudes
   d. Climbs and descents

FLIGHT THREE

Practice all maneuvers previously introduced. The Instructor Pilot will introduce:
1. Engine fire in flight
2. Obstacle takeoff
3. Obstacle landing
4. Single-engine landing
5. Crosswind landing
6. Single-engine failure after takeoff
7. Failure of both engines after takeoff
8. Radio and instrument departure, enroute, and terminal procedure

FLIGHT FOUR

Practice all maneuvers previously introduced.

FLIGHT FIVE

Standardization evaluation flight check.

NOTE

Flight four or five may be standardization, evaluation flight check depending on pilot proficiency.

AIRCRAFT FAMILIARIZATION MANEUVERS

The following maneuvers may be used to demonstrate various flight characteristics.

1. Steep Turns - The steep turn maneuver will be flown with the aircraft trimmed for normal cruise. The maneuver consists of two level 360-degree turns (one in each direction), utilizing 45 degrees of bank. If the airspeed drops below 105 KIAS, power should be added.
2. Stalls - The stall series consists of the following maneuvers:
   a. Prior to starting a maneuver, conduct these checks:
      Mixture levers - RICH
      Propeller levers - 2000 rpm
      Fuel supply (minimum - 0.5 auxiliary or 0.3 main) - CHECKED
      Shoulder harness - LOCKED
   b. Execute one 180-degree or two 90-degree clearing turns.
   c. Throttle back to 13 inches MAP, maintaining a constant altitude when commencing clearing turns. After rollout, maintain directional control with the rudders, allowing the airspeed to diminish until the aircraft shudders (approximately 61 KIAS when clean).
   d. Recover by opening the throttle to 30 inches MAP, simultaneously reducing the angle of attack.
   e. Maintain a constant altitude while accelerating to 105 KIAS.
   f. When an airspeed of 105 KIAS is attained, throttle back until the horn blows and lower the landing gear.
   g. At 100 KIAS, lower full flaps.
   h. Close the throttles, maintaining a constant heading and altitude. When the aircraft shudders (approximately 52 knots), recover as in item d above. Raise

the landing gear immediately following application of power.

i. Begin retracting the flaps in increments of 15 degrees at an airspeed of at least 75 KIAS. Raise the last 15 degrees after a speed of 95 KIAS.

j. Return to normal cruise.

WARNING

The aircraft should not be trimmed below 90 KIAS during an approach to the stall.

3. Slow-flight

a. Prior to establishing a slow-flight condition:
Mixture levers - RICH
Propeller levers - 2000 rpm
Fuel supply (minimum - 0.5 auxiliary or 0.3 main) - CHECKED
Shoulder harness - LOCKED

b. Maintain a constant altitude and heading during the entry and recovery.

c. Reduce power (until horn sounds), slow to 105 KIAS and lower the landing gear.

d. At 100 KIAS, lower full flaps

e. Assume a nose high attitude and apply right rudder as required to maintain heading. Apply power (24 to 26 inches MAP) as required to maintain 65 KIAS.

f. Cowl flaps - OPEN

g. Fly through several coordinated turns, using power to counteract lift loss due to banking attitude.

h. Upon completion of slow-flight, advance throttles to 30 inches MAP and retract the landing gear. Raise the wing flaps at 75 KIAS and transtion to normal cruise flight.

FLIGHT CREW REQUIREMENTS

The minimum flight crew is a pilot qualified in model plus a crewmember assigned lookout duties for the off-pilot side. Under actual or simulated instruments, a copilot is required in addition to a pilot qualified in model. During all simulated instrument flights, since the safety pilot is restricted from maintaining a proper lookout on both sides of the aircraft, a rear seat observer, equipped with a functioning microphone and earphones for communications with the pilots, will be stationed as lookout in a seat on the side opposite the safety pilot. This lookout shall be thoroughly briefed on his responsibility for properly reporting any aircraft.

PILOT IN COMMAND INITIAL QUALIFICATION AND CURRENCY REQUIREMENTS

Unit commanders may waive minimum ground and flight training requirements when pilot proficiency and recent experience in similar models warrants.

INITIAL QUALIFICATIONS

For initial qualifications in either the UC-45J or RC-45J aircraft, a pilot shall meet the following minimum requirements:

1. Complete the ground and flight training syllabus.
2. Satisfactorily complete a NATOPS evaluation.
3. Log 10 hours of first pilot time in either the UC-45J or RC-45J aircraft within the preceeding 90 days.
4. Possess a current instrument rating.

CURRENCY

To maintain currency in either the UC-45J or RC-45J aircraft, a pilot must meet the following minimum currency requirements:

1. Log 5 hours of first pilot time and two take-offs and landings within the preceeding 90 days.
2. Maintain NATOPS qualifications in accordance with OPNAVINST 3510.9 series.
3. Maintain instrument rating in accordance with OPNAVINST 3710.7 series and the NATOPS Instrument Flight Manual.

FERRY PILOTS

Training requirements, checkout procedures, evaluation procedures, and weather minima for ferry squadron pilots are governed by the previous contained in OPNAV Instruction 3710.6 series.

PERSONAL FLYING EQUIPMENT

Refer to OPNAV 3710.7 series for personal flying equipment requirements.

FLIGHT TEST

TEST PILOT QUALIFICATION

Aviators appointed as test pilots should meet the following requirements.

1. Logged at least 50 hours in the C-45 series type aircraft within the preceeding six months. Commanding Officers are authorized to waive this requirement when individual pilot proficiency warrants.
2. Designated as qualified test pilot in writing by Commanding Officer.

FLIGHT TEST SAFETY RULES

Safety shall be the governing factor on all test flights, and the following general rules shall apply:

1. No aircraft shall be test-flown until all safety-of-flight discrepancies have been corrected and signed off by a designated inspector.
2. All test flights shall be conducted in accordance with OPNAV, FAR, and local directives.
3. Radio communication with the control tower shall be maintained at all times.
4. Test flights will be flown in a designated area where an emergency landing can be made on a hard-surfaced runway.

SECTION III – NORMAL PROCEDURES

TABLE OF CONTENTS

BRIEFING/DEBRIEFING OPERATIONS

Mission briefing and debriefing is the responsibility of the pilot in Command and should cover all items pertinent to the specific mission. Particular attention should be paid to any area where difficulty was encountered or where any tactics employed were ineffective or limited. The pilot in command shall be responsible for briefing passengers on all phases of the flight, including all directives related thereto.

MISSION PLANNING

The basic aircraft mission is personnel transportation for the UC-45J and aerial photography for the RC-45J. These missions, although quite dissimilar in purpose, have a common element in that training is their objective. Although these missions may be pre-planned, their actual execution requires the entire aircrew to employ their knowledge, experience, originality and even imagination. Any mission which allows planning, should be planned as thoroughly and completely as possible in order to realize maximum safety and mission accomplishment. Planning for a mission is the responsibility of the pilot in command.

NAVIGATION

The importance of maintaining a current plot or exact knowledge of aircraft position cannot be over emphasized. This enables a pilot to return to an installation and to make prompt and accurate position reports.

The following radio equipment installations will be available in various combinations (due to the difference in aircraft configuration) to assist in navigation.

1. Omni range receiver AN/ARN-30
2. Radio compass AN/ARN-7
3. Marker beacon AN/ARN-8
4. Radio altimeter AN/APN-1

CRUISE CONTROL

Normally, adequate fuel for a planned mission will be aboard. However, a pilot should practice fuel conservation on each flight since an unknown element such as a diversion, extended hold, etc., may present itself. Power settings in accordance with Section XI, Performance Data should be used to obtain the maximum effective control of fuel consumption. If necessary, a fuel management log should be maintained to assist in determining performance and for estimating endurance. Although it is permissible to use up to maximum continuous power when necessary to meet aircraft performance requirements cruise power settings above the maximum cruise limits should be restricted to emergency cruise operations only.

SPECIAL MISSIONS

The capabilities of the C-45J series aircraft are such that a variety of special missions may be assigned. Specifically, the RC-45J aircraft is designed for aerial photography and is used extensively for training photographer's mates and selected officers in aerial photography, obtaining photographic coverage of military establishments, plus many varied photographic missions. Refer to Section VIII, Special Missions for a discussion of RC-45J aircraft and photographic equipment operating techniques.

PREFLIGHT PREPARATION

SCHEDULING

Flight scheduling and the determination of pilot qualification for scheduling purposes is the responsibility of the Commanding Officer. The purpose of the preplanned schedule is the orderly and efficient utilization of aircraft and pilots.

LINE OPERATION

AIRCRAFT ACCEPTANCE

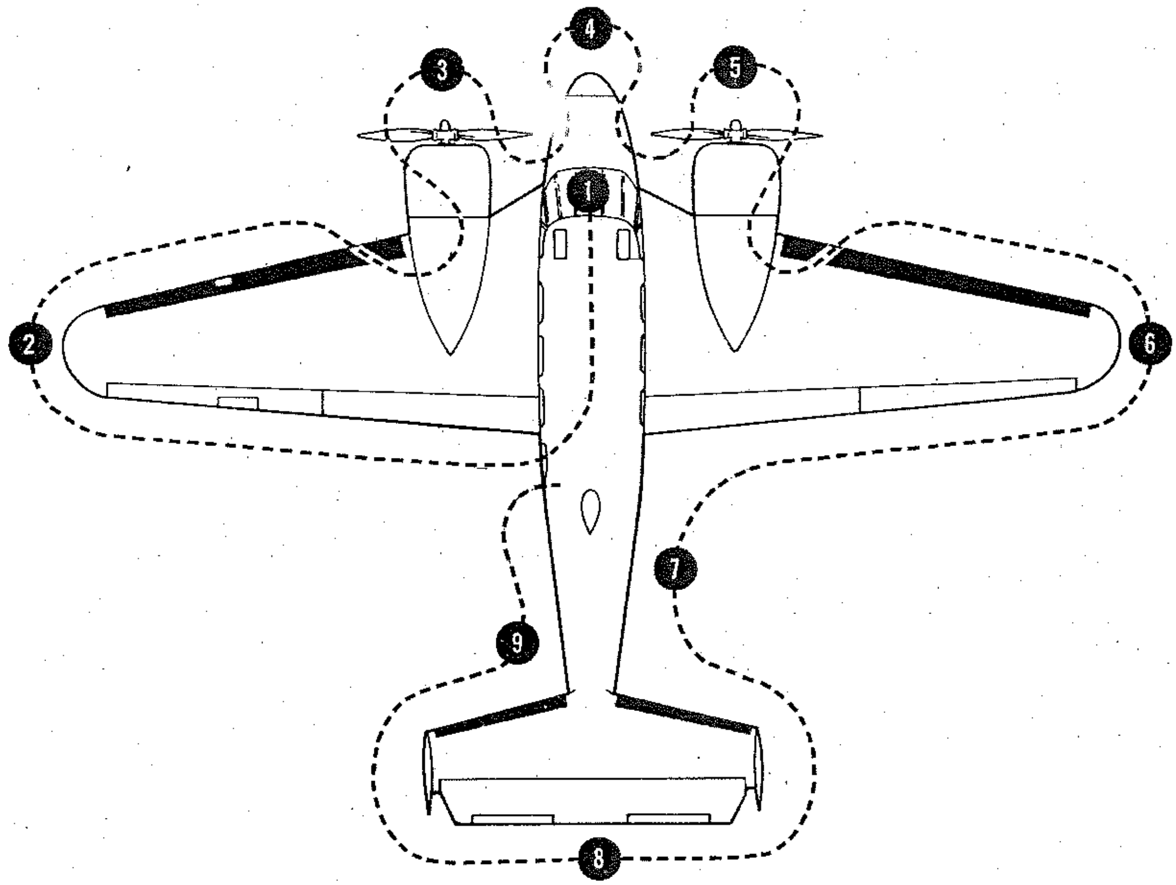
The pilot in command should not accept an aircraft until he is satisfied that it is safe for flight and is capable of completing the intended mission. The two main factors involved in this determination are careful examination of the aircraft's recent discrepancies and a thorough preflight inspection.

YELLOW SHEETS

Review at least the last ten yellow sheets for the discrepancies noted and the corrective action taken. When satisfied with the yellow sheet information on aircraft flight status, fuel loading, gross weight, center-of-gravity, configuration, etc., the pilot in command will sign the sheet and proceed with the preflight inspection.

PREFLIGHT INSPECTION (EXTERIOR)

The exterior inspection is presented in figure 3-1 and is reproduced in the Pilot's Pocket Checklist NAVAIR 01-90CE-1B. Completion of these checks is the responsibility of the pilot in command.



1

PILOT'S COMPARTMENT (INITIAL)

1. BATTERIES OFF.
2. MIXTURES IDLE CUT-OFF.
3. FUEL TANK SELECTOR OFF.
4. MAGS OFF.
5. LANDING GEAR HANDLE DOWN.
6. COWL FLAPS OPEN.
7. TRIM TABS SET.
8. CONTROLS LOCK OFF.

2

LEFT WING

1. SKIN CONDITION.
2. ACCESS COVERS SECURE.
3. FLAP.
4. AILERON.
5. AILERON TAB.
6. NAVIGATION AND PASSING LIGHT.
7. DEICER BOOTS.
8. LANDING LIGHT.

3

LEFT ENGINE, LANDING GEAR, AND WHEEL WELL

1. EXHAUST STACK AND INTENSIFIER TUBE.
2. EXTERNAL POWER RECEPTACLE.
3. COWL FLAPS AND FASTENERS.
4. VISUAL CHECK THROUGH COWL FLAP OPENING —
   (1) ACCESSORY SECTION.
   (2) CARBURETOR ELBOW INTAKE PIPE.
5. WHEEL BRAKE COMPONENTS.
6. LANDING GEAR SHOCK STRUT (2½ INCHES MAX., 1½ INCHES MIN.).
7. WHEEL WELL AREA —
   (1) DEICER DISTRIBUTOR VALVE AND FILTER.
   (2) HEATER HOSES.
   (3) OIL "Y" DRAIN OFF.
   (4) OIL BYPASS VALVE AND CONTROL CABLE.
   (5) LANDING GEAR CHAIN.
   (6) SLIDE TUBE (BELOW LANDING GEAR CHAIN).
   (7) LANDING GEAR UP AND DOWN LOCK SWITCHES.
   (8) PROP FEATHERING PUMP.
   (9) WHEEL DOORS (IF INSTALLED).
   (10) LANDING GEAR STRUT WELD JOINTS.
8. PROP CONDITION.
9. PROP ANTI-ICER LINE.
10. ENGINE NOSE SECTION.
11. IGNITION HARNESS.

4

LEFT INBOARD WING, UNDERSIDE OF AIRCRAFT, NOSE, AND RIGHT INBOARD WING

1. ENGINE OIL SHUTTER FLAPPER.
2. VENTILATION AIR INTAKE.
3. BATTERY VENT.
4. BELLY ANTENNA.
5. ANTI-COLLISON AND FUSELAGE LIGHTS.
6. FUEL SUMP DRAINS.
7. FUSELAGE ACCESS DOOR.
8. PITOT TUBES.
9. NOSE DOOR.
10. NOSE FUEL TANK FILLER COVER.
11. ENGINE FIRE EXTINGUISHER BLOW-OUT DISK.
12. BATTERY VENT.
13. VENTILATING AIR INTAKE.
14. OIL SHUTTER FLAPPER.

Figure 3-1. Preflight Inspection (Sheet 1 of 2)

5

RIGHT ENGINE, LANDING GEAR, AND WHEEL WELL

1. COWL FLAPS AND FASTENERS
2. VISUAL CHECK THROUGH COWL FLAP OPENING —
   (1) ACCESSORY SECTION.
   (2) CARBURETOR ELBOW INTAKE PIPE.
3. WHEEL BRAKE COMPONENTS.
4. LANDING GEAR SHOCK STRUT (2½ INCHES MAX., 1½ INCHES MIN.).
5. IN WHEEL WELL AREA —
   (1) HEATER HOSES.
   (2) OIL "Y" DRAIN OFF.
   (3) OIL BYPASS VALVE AND CONTROL CABLE.
   (4) LANDING GEAR CHAIN.
   (5) SLIDE TUBE (BELOW LANDING GEAR CHAIN).
   (6) LANDING GEAR UP AND DOWN LOCK SWITCHES.
   (7) PROP FEATHERING PUMP.
   (8) WHEEL DOORS (IF INSTALLED).
   (9) LANDING GEAR STRUT WELD JOINTS.
6. PROP CONDITION.
7. PROP ANTI-ICER LINE.
8. ENGINE NOSE SECTION.
9. IGNITION HARNESS.
10. EXHAUST STACK AND INTENSIFIER TUBE.

6

RIGHT WING

1. LANDING LIGHT.
2. DEICER BOOTS.
3. NAVIGATION LIGHT.
4. AILERON.
5. FLAP.
6. ACCESS COVERS SECURE.
7. SKIN CONDITION.

7

AFT FUSELAGE, RIGHT SIDE

1. SKIN AND WINDOWS.
2. EMERGENCY EXIT HATCH.

8

TAIL OF AIRCRAFT

1. TAIL WHEEL ASSEMBLY —
   (1) SHOCK STRUT EXTENSION (3 TO 6 INCHES).
   (2) SHOCK STRUT WELD JOINTS.
   (3) LOCK AND PIN.
   (4) TIRE.
   (5) TAIL GROUND WIRE.
2. EMPENNAGE —
   (1) RUDDERS.
   (2) DEICER BOOTS.
   (3) ELEVATOR AND RUDDER FABRIC.
   (4) HINGES.
   (5) SURFACE TRAVEL UNOBSTRUCTED.
   (6) DRAIN HOLES.
   (7) TAIL POSITION LIGHT.
   (8) ELEVATOR TABS.
   (9) TAIL CONE.

9

AFT FUSELAGE, LEFT SIDE, AND INSIDE MAIN ENTRANCE DOOR

1. SKIN AND WINDOWS.
2. ANTENNAS.
3. LIGHTS.
4. ENTRANCE DOOR EMERGENCY RELEASE.
5. OXYGEN FILLER VALVE PLUG.
6. FIRE EXTINGUISHER.
7. FIRST AID KITS.
8. RADIO RACKS.

Figure 3-1. Preflight Inspection (Sheet 2 of 2)

PRESTART CHECKLIST

1. Circuit breakers - IN
2. Landing gear clutch teeth - MESHED
3. Landing gear emergency clutch pedal - COVERED
4. Landing gear handle - DOWN
5. Radio equipment - OFF
6. Battery switches (or external power) - ON

CAUTION

If external power is used, battery switches should be OFF until external power is disconnected. Battery switches should then be turned ON below generator cut-in speed.

7. Exterior/Interior Lights - AS REQUIRED

NOTE

If night operations are to be conducted, ensure that all external, and internal lights are operable in all positions.

8. Parking brake - RELEASE AND RESET

CAUTION

To set the parking brakes, depress the brake pedals, and pull the "T" handle straight out to its limit of travel (do not use a twisting movement) and release pressure as the full limit of travel is reached. Damage to the "T" handle linkage, will result if excessive pressure is exerted after full limit of travel is reached.

9. Control quadrant friction locks - UNLOCKED
10. Manifold heat levers - COLD (up)
11. Propeller levers - FULL INCREASE RPM
12. Throttles - CRACKED
13. Mixture levers - RICH
14. Oil shutter levers - AS REQUIRED
15. Heaters/deicers - OFF (check heater, deicer, and anti-icer switches OFF)
16. Fuel crossfeed valve - OFF
17. Oil bypass valve handles - AS REQUIRED (OUT, for full hot if oil temperature is below 10°C. Slowly push IN after temperature reaches 20°C)
18. Anti-icer tank gage - FULL
19. Engine fuel selector valve - BOTH
20. Engine fire extinguisher - AS REQUIRED
21. Pitot heat switches - OFF
22. Fuel quantity gage - CHECK ALL TANKS
23. Wing flaps - UP (then wing flap lever OFF)

24. Fuel tank selector handle - DESIRED TANK
25. Landing gear handle light - CHECK
26. Propeller Anti-icer - OFF
27. Fire Guard - POSTED

NOTE

Determine that the area aft of the aircraft is clear of any object that may be blown around by propeller blast. The fire guard should be in a position to indicate to the pilot that the area is clear. The left engine should not be started with the main entrance door open or unlatched.

28. Propeller - CLEAR TO START

STARTING ENGINES

1. Prime each engine seven (7) full strokes for cold engines and three (3) or four (4) for warm engines.

CAUTION

Do not pump throttles in an effort to prime engines. Doing so can cause a carburetor fire.

2. MAG master switch - ON
3. Starter switch - ENGAGE (either engine)
4. Individual engine MAG switch - BOTH (after propeller has turned six blades)
5. Check oil pressure indicator for proper indication and that limitations are not exceeded (20 psi in 30 seconds or shut-down).

CAUTION

In case of fire keep engine turning with starter and attempt to start engine. If this does not put out fire, pull fire extinguisher handle at the base of the pilot's control pedestal (fire extinguisher selector valve set to engine being started in preceeding procedure). Refer to Engine Fire During Start, Section V, Emergency Procedures.

CAUTION

Overheating of the starter motor will occur with prolonged operation. Thirty seconds should be considered the maximum for continuous operation without a cooling period.

NOTE

Engine back firing may cause the manifold heat lever to move to the HOT (down) position. Return the lever to the COLD (up) position when this occurs. Keep the propeller-manifold heat friction lock knob in the unlocked position to avoid damage to the manifold heat valve and linkage.

6. Warm up engine using 1100 RPM until oil temperature reaches 40°C . Avoid exceeding 100 psi engine oil pressure by reducing RPM as necessary.
7. Repeat engine start procedure for other engine.

PRETAXI CHECKLIST

1. Oil bypass valve handles - IN (minimum oil temperature is 40°C for engine speeds greater than 1000 RPM)
2. Radio equipment - AS DESIRED
3. Flight instruments - UNCAGED/OPERATING
4. Fuel system - Consume fuel from each tank for a minimum of two minutes.

TAXI

Taxi operations should be conducted with the engine cowl flaps open and the propeller in FULL INCREASE RPM (low pitch). Avoid extended periods at idle RPM, since these settings will foul the spark plugs. After initial forward movement apply the brakes to check the system. Continue to taxi slowly, checking ahead and to either side for obstructions and personnel. Use engine power differential to assist in turning and avoid excessive use of brakes. At some point during the taxi operation the copilot should check his brakes, however, they should not be applied simultaneously with the pilot's. The tailwheel lock "T" handle may be placed in either the locked or unlocked position at any time, however, the tailwheel will only lock in the forward or zero-degree position, i.e., with the wheel in the normal trail position. When the tailwheel is locked it is difficult to unlock if side pressure is exerted on the aircraft (due to a strong wing or unequal brake application). In general night taxi procedures are the same as day commensurate with ground safety. The landing lights may be used on a limited basis when there is any doubt about the area ahead. Observe gyro operation while turning.

PRETAKE-OFF CHECKLIST

1. Fuel tank selector handle and quantity indicator - FULLEST MAIN
2. Engine instruments - NORMAL
   a. Cylinder head temperature - 140°C MINIMUM
   b. Oil pressure - 50 psi MINIMUM (70 to 90 psi normal range)
   c. Oil temperature - 40°C MINIMUM (60 to 75°C normal range, 90°C maximum)
   d. Fuel pressure - 2.0 PSI MINIMUM IDLING, 3.5 PSI NORMAL OPERATING, 4.0 PSI MAXIMUM
   e. SUCTION - 3.50 MINIMUM, 3.50 TO 4.50 NORMAL, 4.50 MAXIMUM (a vacuum warning light for the appropriate engine will illuminate in the event a pump becomes inoperative)

CAUTION

Avoid prolonged ground runup. Do not exceed a cylinder head temperature indication of 232°C.

3. Engine - RUNUP (adjust the throttle on both engines to obtain 1500 rpm and complete the following procedures):

NOTE

During runup, the landing gear drag leg shock absorber will compress a small but noticeable distance as power is added. Hold the control column back during runup. Do not rely on the parking brake to hold during the power check.

a. Volt/ammeters - CHECK PARALLEL (same indication on both, ± 5 amps.)
b. Voltage - CHECK approximately 27.5 volts (± 1 volt)
c. Generator - CHECK:
   (1) Generator switches - OFF (one at a time) and check for a definite increase in load meter reading for the opposite or operating generator. Return both generators to ON.
d. Pitot heat switches - ON (one at a time) and check for a slight increase in loadmeter reading; then return switches to OFF
e. Propeller - CHECK:
   (1) Propeller levers - FULL DECREASE RPM (engine speed should stabilize at approximately 1200 ± 50 RPM)
   (2) Manifold heat levers - HOT (down)
   (3) Carburetor air temperature gage - CHECK (should increase approximately 30 degrees from original indication)
   (4) Propeller levers - FULL INCREASE (retard and advance the propeller levers several times to circulate warm oil through the propeller dome).
   (5) Manifold heat levers - COLD (up)
f. Individual propeller feathering - CHECK:
   (1) Propeller feathering switch - ON
   (2) Propeller feathering button - DEPRESS until approximately 200 RPM drop is noted.
   (3) Propeller feathering switch - OFF
   (4) Propeller feathering switch - ON (repeat procedure for opposite engine)

NOTE

When the engine is operating at approximately 1500RPM before feathering, it will continue to run fully feathered at about 450RPM. Under these conditions, once the propeller is feathered, it will tend to slowly and steadily come out of the feathered position. This should not be considered abnormal since it is caused by the engine oil remaining under pressure.

g. Engine power - CHECK. Retard the throttle to approximately 1100 RPM on engine not to be checked, and advance the remaining throttle until the manifold pressure reading is equal to existing field barometric pressure as read on manifold pressure gage before starting engines (approximately 30 inches MAP at sea level) and check for 1950 ± 50 RPM.

NOTE

If engine RPM is too low for the given manifold pressure, engine is not developing sufficient power and should be checked before flight.

h. Ignition system MAGS - CHECK (each engine simultaneously with engine power check)
   (1) Individual engine MAG switch - BOTH to R to BOTH to L to BOTH (momentarily stop on the R and L position to note the RPM drop)

CAUTION

Normal drop-off in either R or L position, is 50 to 75 RPM, and should not exceed 100 RPM. Difference in drop between R and L should not exceed 40 RPM. Avoid running on one magneto for more than 5 seconds.

NOTE

Throughout the engine check, with the mixture RICH, acceleration or deceleration should be both smooth and rapid with no tendency to miss or backfire.

   (2) Throttle - CLOSED (idle RPM)
   (3) Individual engine MAG switch - BOTH to OFF to BOTH (momentarily pause on OFF to insure no "hot" MAGS)
i. Repeat preceeding steps "g" and "h" for other engine.
j. Engine idle speed - CHECK. Retard throttles (individually) to full CLOSED position; engine should idle at approximately 500 RPM
k. Idle mixture - CHECK (each engine individually)
   (1) Throttle (on engine being checked) - 600 RPM
   (2) Mixture lever (on engine being checked) - RETARD slowly and smoothly into IDLE CUT-OFF position and observe tachometer for any change in RPM. Return the mixture lever to full RICH before engine cuts out. Do not add power to revive the engine unless the engine fails to respond to the full RICH mixture.

NOTE

A rise of more than 10 RPM indicates too rich an idle mixture, and no change or a drop of RPM indicates that the mixture is too lean. A rise from 5 to 10 RPM is recommended to permit lower idling speeds without the danger of fouling plugs and at the same time to afford good acceleration characteristics.

1. Throttle - 1100 RPM (generator cut-in speed)

ENGINE RUNUP COMPLETE

4. Propeller feathering switch - ON
5. Propeller levers - FULL INCREASE RPM
6. Manifold heat levers - AS REQUIRED

WARNING

Manifold heat should be used for take-off under carburetor icing conditions. Manifold heat may be used for take-off in ambient air temperatures of 0°C or lower and is strongly recommended at temperatures of -20°C or lower. Adjust manifold heat levers as necessary throughout flight.

7. Mixture levers - RICH
8. Oil shutter levers - AS REQUIRED
9. Control quadrant friction locks - SET
10. Trim tabs - SET
11. Magneto switches - BOTH
12. Wing flaps - AS REQUIRED
13. Radio equipment - CHECKED/SET
14. Gyro instruments - SET
15. Cowl flaps - TRAIL
16. Pitot heat - AS REQUIRED
17. Propeller Anti-icer - AS REQUIRED
18. Flight Controls - NORMAL/FULL TRAVEL
19. Interior/exterior lighting - AS REQUIRED
20. Shoulder harness and safety belts - SECURE
21. Crew and passengers - READY
22. Tailwheel - LOCKED

TAKE-OFF

After completion of the Pretake-off Checklist (except for locking the tailwheel) taxi into take-off position, align the aircraft with the runway and allow it to roll straight ahead for a few feet then lock the tailwheel. Check for locking by alternating pressure on the brakes. After all checks are complete and final clearance is received, the take-off shall be made as follows:

WARNING

Do not take-off or land with the lavatory compartment occupied, since, this will exceed aircraft weight and balance limitations.

1. Release the brakes and advance the throttles smoothly to take-off power. Maximum allowable manifold pressure is 37 inches MAP.

NOTE

Take-off power is provided to be used and there should be no hesitation in taking advantage of the full rating. Engine life depends mainly on the number of revolutions the engine makes. Get the airplane off the ground and gain safe single-engine airspeed in a minimum of time, then reduce manifold pressure and engine speed for climb.

2. Maintain directional control during the first part of the take-off run by the use of differential power, rudder control, and if necessary braking action. The rudder is effective for directional control above approximately 35 knots. As the controls become effective, raise the tail to take-off atitude and maintain directional control with the rudders.

NOTE

Do not attempt to raise tail too early. Directional stability from control surfaces is not effective below approximately 30 knots. If weight is removed from tailwheel below this speed, aircraft may tend to swerve.

3. Maintain a take-off attitude and allow the aircraft to fly off at 70 to 80 KIAS. Continue to accelerate to Best Rate of Climb speed.

4. Retract the landing gear only when there is insufficient runway remaining to abort the take-off and reland. In no event will the landing gear be retracted until the aircraft is completely airborne and safely climbing.

WARNING

Do not retract the landing gear prematurely, since, the retraction mechanism will probably be damaged if the wheels re-contact the runway after retraction has started. However, keep in mind that aircraft single-engine performance is greatly improved with the landing gear (and wing flaps) UP.

NOTE

As landing gear retracts the center of gravity moves aft. Weight should be distributed so that CG limits will not be exceeded under these conditions.

5. After the landing gear is retracted and sing engine climb speed is attained, (wing flaps r tracted above 95 knots if used) reduce power climb power setting, which is 30 inches MAP a 2,000 RPM. Maintain a climb airspeed of 1 KIAS.

6. Adjust manifold heat and oil radiator shutters conditions warrant.

NOTE

Cylinder-head temperature will increase 25° to 30°C during take-off run. Before take-off is started cylinder temperatures must be sufficiently below the maximum to prevent this rise from exceeding the maximum allowable temperature of 260°C. This higher temperature is allowable for 5 minutes only.

CROSSWIND TAKE-OFF

When take-off is made in a severe crosswind, directional control can be maintained with differential power, rudder, and aileron. The tailwheel should be held on the runway slightly longer in a crosswind than is customary for a normal into-the-wind takeoff. This procedure will minimize the effect of the crosswind on the vertical tail surfaces and reduce the aircraft's tendency to weather vane. As the aircraft accelerates, gradually reduce aileron displacement, holding enough aileron to keep the wing slightly down. Lift the aircraft off as soon as flying airspeed is attained. When safely airborne, counteract drift by a coordinated turn into the wind. Avoid the use of brakes on take-off, except at the very beginning of the roll or as a last resort. See figure 11-3 for recommended liftoff airspeed under various crosswind conditions.

MINIMUM RUN TAKE-OFF

A minimum run take-off is a maximum performance maneuver requiring excellent feel of the aircraft at airspeeds just above stalling airspeeds. When conditions necessitate a minimum run take-off, align the aircraft on the extreme end of the runway lock the tail wheel and lower approximately 15 degrees flaps. Hold the brakes on with toe pressure and advance throttles to maximum power. Hold back pressure on the control column and release brakes. As the aircraft accelerates, gradually release back pressure on the control column. When the aircraft has reached an airspeed of approximately 60 to 65 KIAS, apply elevator pressure to pull the aircraft off the ground. After definitely airborne, level off to accelerate and retract the landing gear and wing flaps.

WARNING

Do not retract the wing flaps below 95 KIAS.

OBSTACLE CLEARANCE TAKE-OFF

When a maximum performance take-off and climbout over obstructions is required, use the procedure for Minimum Run Take-Off up to the point where the aircraft is airborne. From that point it varies as follows: As soon as aircraft is airborne, retract the landing gear and maintain a climbing attitude; accelerating to 85 to 90 KIAS as rapidly as possible. Maintain this airspeed in climb attitude until all obstructions are cleared. Level off to accelerate, retracting wing flaps when maximum flap airspeed is reached. Re-establish a climbing attitude after attaining Best Rate-of-Climb speed.

NIGHT TAKE-OFF

Normal take-off technique can be employed for night take-off with the exception that all instrument and pilot's compartment lights should be dimmed to minimize glare. This will provide maximum outside visibility. Turn the landing lights on, if desired, and maintain heading by visual cross-reference to the directional indicator. Acceleration after take-off should be accomplished in a climbing attitude. Maintain attitude by reference to the attitude indicator.

AFTER TAKE-OFF -- CLIMB

When comfortably airborne, and the aircraft is "cleaned-up", check power setting and climb speed. Normal power settings for climb are 30 inches MAP and 2000 RPM. Do not exceed 35 inches MAP and 2000 rpm at any time for continuous operation. Best climbing speed at sea level is from 95 to 105 KIAS. During climb proceed as follows:

1. Adjust cowl flaps as necessary. Never close cowl flaps beyond TRAIL position during climb.
2. Check cylinder head temperatures frequently. If over allowable limit of 232°C for continuous operation, increase airspeed by decreasing rate of climb.
3. At approximately 50 feet below the desired cruising altitude, smoothly lower the nose to the level-flight attitude.
4. On the desired cruising altitude, accelerate to the desired airspeed at climb power, then reduce to cruise power, retrim, and adjust the engine controls as necessary.
5. Check all indicated operating temperatures; oil, carburetor mixture, cylinder head, and outside air temperature.
6. Select desired fuel tank and corresponding liquidometer selector switch setting.

DURING FLIGHT

Trim tabs should be used at all times during flight to reduce control pressures. Stability and control of the aircraft is good under all normal loading conditions. Refer to Section IV for flight and handling characteristics.

For all flight conditions, when practical, it is desirable to maintain carburetor mixture temperature at 3°C for most satisfactory engine operation. When operating under conditions of rapidly changing power and altitude, care should be exercised that carburetor mixture temperature does not exceed 15°C.

NOTE

The maximum allowable cylinder-head temperature for continuous operation is 232°C. Minimum cylinder head temperature for smooth engine operation is 120°C. Oil temperature is the best indication of over-all engine conditions.

Refer to Section XI, Performance Data for cruise control computation. Do not draw more than 400 horsepower for maximum continuous operation.

MANUAL MIXTURE LEANING

For fuel consumption economy, lean the engine fuel mixture as follows:

1. Adjust both throttles to desired cruise settings, synchronize the propellers, and note the cylinder head temperature.
2. Lean one engine at a time by retarding the mixture lever in small increments until a slight engine roughness is noted; immediately move the mixture control forward (RICH) until the engine is again operating smoothly and synchronization is regained.
3. Monitor cylinder head temperatures and do not exceed the maximum continuous temperature of 232°C.
4. Repeat procedure for other engine.
5. The mixtures must be placed in full RICH and the engines re-leaned whenever any of the following changes occur:

    a. Upon commencing a climb or descent (mixture RICH until desired altitude is reached).
    b. A change in throttle or RPM setting.
    c. A change in manifold heat setting.

FUEL MANAGEMENT

Recommended fuel tank usage sequence and restrictions are as follows:

1. Start engines on the nose tanks, if fully serviced (UC-45J Only), otherwise use the right main.
2. Rotate the fuel tank selector handle counterclockwise, and consume fuel from each tank for at least two minutes.
3. All takeoffs and landings should be made on a main tank. Fuel should be drawn from the tanks in inverse numerical order.
4. Do not use the tanks below one-tenth indicated. The fuel tanks should not be run dry, due to the possibility of airlock or damage to the liquidometer.

DESCENT

Aircraft range can be increased by a good descent technique i.e., by executing the descent to locate the aircraft at the desired altitude at the desired point. The rate of descent is determined by altitude, distance from landing point, terrain, and aircraft gross weight (below maximum landing weight of 8600 pounds). For normal descent from cruise altitude, reduce power as required to maintain desired rate of descent and airspeed. Maintain cylinder head and carburetor air temperatures within normal limits. Obtain landing instructions and accomplish the Prelanding Checklist prior to entering the traffic pattern.

PRELANDING CHECKLIST

1. Crew and/or passengers - BRIEFED ADVISED
2. Fuel quantity gage - CHECK FUEL QUANTITY
3. Fuel tank selector handle - FULLEST MAIN
4. Mixture levers - RICH (full forward)
5. Manifold heat levers - AS REQUIRED

CAUTION

Monitor carburetor air temperatures, since fuel/air ratios during descent are those most conductive to the formation of ice in the induction system.

6. Autopilot - OFF (RC-45J Only)
7. Surface deicer button - OFF (full down)
8. Altimeter - SET

CAUTION

Do not allow cylinder head temperature to go below 125°C or use less than 14 inches MAP during prolonged descents.

All transitions from descent to level flight at the same airspeed are commenced 50 feet prior to reaching altitude, and transitions from descent to level flight at a greater airspeed are commenced 175 feet prior to reaching altitude. Six inches less manifold pressure than that required for level flight will result in approximately 500 feet-per-minute rate of descent for any given airspeed.

9. Gyros - SET
10. Landing gear emergency extension clutch - COVERED
11. Tail wheel - LOCKED
12. Pilot's compartment heater controls - OFF (full out)
13. Shoulder harness and safety belts - LOCKED (advise crew and passengers)

CAUTION

The lavatory compartment must not be occupied during landing operations.

NOTE

Prior to extending the landing gear, one throttle should be retarded momentarily to check operation of the landing gear warning horn.

ENTERING DOWNWIND

14. Slow aircraft - 105 KIAS (approximately)
15. Throttles - RETARD (until landing gear warning horn sounds at approximately 12 inches MAP)

LANDING CHECKLIST

1. Landing gear handle - DOWN (landing gear handle light OUT. Visually check in mirror for gear in DOWN and LOCKED position)

2. Throttles - ADVANCE (to maintain level flight when horn stops)
3. Elevator trim - ADJUST (to compensate for nose-heavy condition which exists when landing gear, or wing flaps, are DOWN)
4. Wheel brakes - DEPRESS PEDALS (check for solid feel)
5. Wing flaps - DOWN 15 DEGREES (then wing flap lever OFF)

BASE LEG

6. Slow aircraft - 90 KIAS (approximately)
7. Wing flaps - DOWN (additional flaps as required, then wing flap lever OFF)
8. Elevator trim - ADJUST

FINAL

9. Propeller levers - FULL INCREASE RPM
10. Slow aircraft - 85 KIAS (approximately)
11. Elevator trim - ADJUST
12. Landing light switches - ON (if required)
13. Airspeed - 80 KIAS (approximately) across field boundary. Intercept the runway centerline with a straightaway of 800 to 1000 feet at an altitude of 50 to 150 feet

NOTE

In the event a no flap landing is to be conducted, use an approach speed of 90 KIAS slowing to 85 KIAS on final.

LANDING

NORMAL LANDING TECHNIQUE

Throughout the approach, trim the aircraft to relieve elevator pressure as more control is applied to reduce airspeed. Maintain the desired rate-of-descent with power variation rather than causing airspeed fluctuation by using elevators. Contact with the runway should be on the main wheels first in a slight tail-low attitude. Check throttles closed, retract the wing flaps, and reduce back pressure on the control column. As the aircraft decelerates, lower the tail wheel to the runway, in one smooth continuous motion. Maintain directional control by use of rudder, differential power, and brakes, as necessary. Maintain back pressure on the control column until the landing roll is completed. Utilize the full landing area, permitting the aircraft to roll to a stop, rather than using the brakes unnecessarily. When speed has decreased sufficiently (normal taxi speed), open the cowl flaps and unlock the tail wheel. When clear of the runway, turn off all unnecessary electrical and radio equipment.

CROSSWIND LANDING TECHNIQUE

When making a cross wind landing in a crosswind of moderate component, fly the approach with not more than 15 degrees of flap. Use a combination of crab into the wind and lowering the upwind wing to compensate for wind drift. If wind velocity is constant, maintain normal approach airspeed. In gusty conditions, increase approach airspeed approximately 10 knots above normal. Remove any crab effect just prior to touchdown. During the ground roll, when airspeed has decreased, the tail should be lowered and full back pressure applied in one smooth continuous motion. Use rudders and throttles to maintain directional control on the runway. See figure 11-3 for recommended touchdown airspeed under various crosswind conditions.

MINIMUM ROLL LANDING TECHNIQUE

If conditions require a minimum roll landing, use a power-on, full flap approach. Cross the approach end of the runway in a slightly nose high attitude at approximately 70 KIAS. In this attitude, the rate of descent is very rapid unless considerable power is used to retard it. Variations in airspeed/power/altitude combinations will be required for the individual circumstances and must be determined by the pilot in command. As contact is made with the runway, retard the throttles and retract the wing flaps. The control column should be held full back. Apply brake pressure as required to stop the landing ground roll.

NIGHT LANDING TECHNIQUE

Power-on approaches are used for night landings. Procedures are the same as used during a normal landing except for the use of power which decreases the rate-of-descent on the approach. This decreased rate-of-descent gives more time for accurate appraisal of distance from the ground during the flare-out and touch-down portions of the landing. Landing lights may be used at the pilots discretion.

TOUCH-AND-GO LANDING TECHNIQUE

The approach and touchdown for touch-and-go landings is the same as used for a normal landing. Following touchdown, however, since a take-off is to be initiated immediately, the normal post landing procedures require the attention of both pilot and copilot, i.e., the pilot requests the copilot to retract the wing flaps while he adjusts the elevator trim and applies take-off power. After take-off, initiate a climb straight ahead to an altitude of 300 feet (actual). Before starting a turn to the downwind leg of the pattern, level off on the downwind leg at pattern altitude and 105 KIAS and accomplish the usual pre-landing procedures.

NO BRAKE LANDING TECHNIQUE

In event of landing wheel brake failure during flight, touchdown airspeed should be as slow as possible commensurate with safety and positive control. Maintain directional control with rudders and differential throttle control.

WAVE-OFF

A wave-off signal, regardless of how received, requires immediate and positive action in aborting

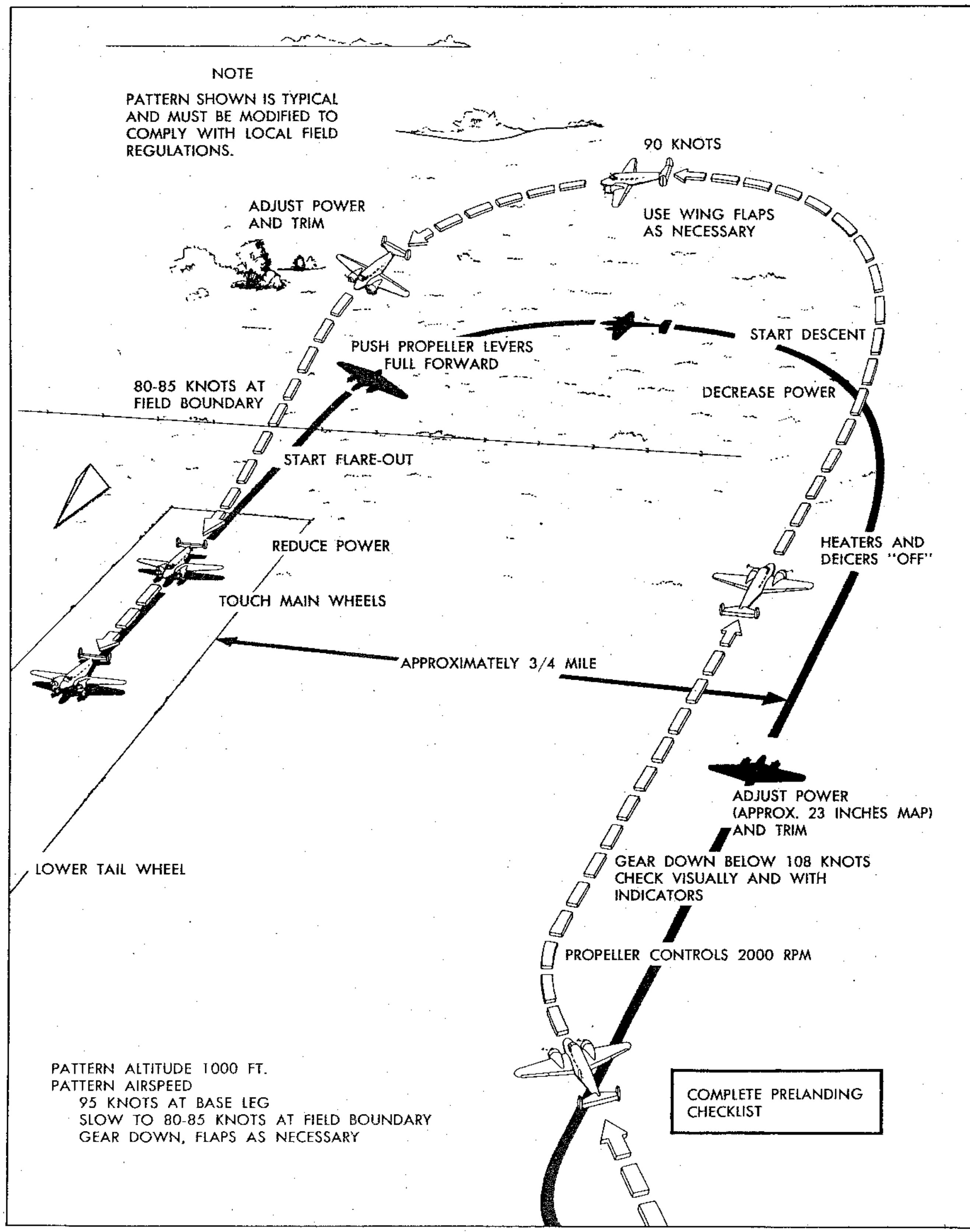


Figure 3-2. Normal Landing Pattern (Typical)

either the approach or landing. A wave-off is executed by simultaneously leveling the wings, adding full power (not to exceed 37 inches MAP and 2300 RPM), and establishing a slight climb attitude. Retract the landing gear, clear the runway and accelerate to Best Rate of Climb speed unless a steeper climb is required to clear an obstruction. Retract the wing flaps in increments as airspeed permits, open the cowl flaps, and retrim the aircraft.

POSTLANDING CHECKLIST

(After Clearing Runway)

1. Wing Flaps - UP
2. Landing Lights - UP (retracted and OFF)
3. Cowl Flaps - FULL OPEN
4. Unnecessary electrical equipment - OFF

GROUND SECURE CHECKLIST

After the aircraft is in the parking spot, set the throttles for 600 to 800 RPM and complete the following checks:

1. Tailwheel - LOCKED
2. Parking brakes - SET
3. Individual engine MAG switches - BOTH to OFF to BOTH (momentarily pause on OFF to insure no "hot" MAGS)
4. Wing Flaps - UP (Down, when auxiliary tanks are to be fueled, unless gusty wind conditions exist)
5. Mixture levers - IDLE CUT-OFF
   a. Throttles - OPEN slowly as engine shut down occurs
6. Master ignition and individual MAG switches - OFF
7. All electrical equipment - OFF
8. Battery switches - OFF
9. Fuel tank selector handle - OFF
10. Parking brakes - RELEASED (after wheel chocks are placed)
11. Cowl flaps - OPEN (until engines have cooled to ambient temperatures)
12. Flight Controls lock - INSTALLED

POST-FLIGHT INSPECTION

Visually inspect the aircraft for signs of fuel, oil, or hydraulic fluid leaks after each flight before signing off the aircraft yellow sheet.

AUXILIARY CHECKS (RC-45J Only)

The following P-1 automatic pilot and photographic equipment systems checks are not usually performed for each flight, however, they do apply if desired.

P-1 AUTOMATIC PILOT SYSTEM GROUND CHECK

1. Aircraft power - ON
2. Autopilot clutch push button switch-DISENGAGED
3. Autopilot amplifier switch - ON

NOTE

Gyros and amplifier must be on for two minutes, for proper operation.

4. Flight controls - CHECK (manually manipulate through full range of travel to ensure freedom from aircraft control system drag)
5. P-1 autopilot controller adjustments - CENTERED
6. Autopilot clutch push button switch - ENGAGED (depressed)
7. P-1 autopilot controller adjustments - OPERATE (check carefully for proper control surface deflection)
8. Autopilot disengage button (on pilot's control wheel) - DEPRESSED
9. Autopilot clutch push button switch-DISENGAGED (out)
10. Autopilot amplifier switch - OFF

P-1 AUTOMATIC PILOT SYSTEM FLIGHT CHECK

1. Altitude - CHECK SAFE
2. P-1 Autopilot controller adjustments - CENTERED
3. Aircraft trim - HANDSOFF AND SLIGHT CLIMB
4. Autopilot amplifier switch - ON (allow two minutes for system warmup)
5. Autopilot clutch push button - DEPRESSED
6. Turn and slip indicator - CHECK BALL IN CENTER
7. Control wheel steering - CHECK ROLL/PITCH
8. Aircraft - Bank left or right 20 degrees with controller adjustments and check trim indicator.
9. Autopilot disengage button (on pilot's control wheel) - DEPRESSED
10. Autopilot amplifier switch - OFF

PHOTOGRAPHIC EQUIPMENT

PREFLIGHT AND PRESTART INSPECTION (INTERIOR)

1. General camera installation - SECURITY
2. All camera installation switches and controls OFF or as required.
3. Set B-9 intervalometer as required for particular type camera operation.
4. CK-1 control box for S-7 type continuous strip camera switches and controls - AS REQUIRED

PREFLIGHT INSPECTION (EXTERIOR)

1. Camera hatch exterior doors - SECURED
2. Forward vision view finder lens - CLEAN

AFTER START

1. Instrument vacuum supply - IN LIMITS

DEBRIEFING

Debriefing will be the responsibility of the pilot in command and will cover matters pertinent to the flight.

The operational capabilities of the UC-45J and RC-45J aircraft are limited to normal shore-based operations. No carrier based procedures are applicable.

SECTION IV

FLIGHT PROCEDURES AND CHARACTERISTICS

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PART 1 FLIGHT PROCEDURES

GENERAL

Transistion to the C-45J series aircraft poses no problem to the conventional landing gear oriented pilot. However, to pilots making the transition to either or both multi-engine and/or conventional type landing gear, ground handling and take-off and landing acceleration and deceleration, crosswind technique, throttle handling, etc., will require greater attention than nose wheel type aircraft. Otherwise, transition and familiarization of different pilot categories should be normal, depending on the experience level in each category.

ENGINE POWER CHANGE

Cylinder pressures in any engine are the prime limiting factors on engine operation. For this reason proper coordination of propeller and throttle controls is an absolute must. Use the following technique when changing engine power settings.

To increase power:

1. MIXTURES - RICH
2. PROPS - ADJUST to desired RPM
3. THROTTLES - ADJUST to desired MAP
4. MIXTURES - ADJUST for new power setting

To reduce power:

1. MIXTURES - RICH
2. THROTTLES - ADJUST to desired MAP
3. PROPS - ADJUST to desired RPM
4. THROTTLES - READJUST as necessary
5. MIXTURES - ADJUST for new power setting

INFLIGHT PROPELLER FEATHERING CHECK

Proper propeller feathering action may be checked in flight by depressing the feathering button for the propeller to be checked (at or below cruise power settings). Observe the tachometer for rpm drop as the propeller begins to feather. After a drop of approximately 200 rpm, trip the propeller feathering circuit breaker. The propeller feathering button will "pop out" and the propeller will return to its original pitch setting. Re-set the feathering circuit breaker after the feathering check is completed.

ENGINE COWL FLAPS

Normal operation cylinder head temperatures are regulated by engine cowl flaps. These flaps adequately control temperature for ground and air operations, other than during icing conditions. During flight operations, full open cowl flaps create an unnecessarily high drag and will usually result in less than normal (cold) cylinder temperatures. Under most flight conditions optimum performance will be obtained with the cowl flaps in the "trail" or "full closed" position. In any event the cowl flaps must be set to maintain in-flight cylinder head temperatures within limits.

OIL TEMPERATURE

Engine oil temperature (and pressure which is relative to temperature) is probably the most important single factor in engine life and performance. Reaching the normal operational temperatures as quickly after engine start as possible, and maintaining this temperature is accomplished by oil radiator shutters and oil radiator by-pass valves. For quick oil system warm-up, close the oil by pass valves which allows oil to by-pass the respective oil radiator and flow from the engine directly to the supply tank for a quicker warm up. Once operational temperatures are reached in this manner, the oil by-pass may be opened and the oil radiator shutters closed until the oil radiator is warmed. The shutters may then be opened as required to maintain operational oil system temperature.

BRAKE OPERATION

In general, operating personnel use the wheel brakes excessively to decelerate or stop the aircraft as quickly as possible regardless of runway length, and are often times guilty of dragging the brakes while taxiing. To minimize tire and wheel brake wear, be extremely judicious in the use of brakes immediately after touchdown, during landing deceleration, and taxiing.

PART 2 FLIGHT CHARACTERISTICS

FLIGHT HANDLING CHARACTERISTICS

The aircraft has satisfactory stability and control characteristics under all conditions of speed, power, load factor (G) and altitude when operated within the respective limitations of airspeed, power, weight, and center-of-gravity loading.

STABILITY AND CONTROL

Stability and control characteristics relative to the indicated center-of-gravity location is as follows: All conditions are with the landing gear retracted; center-of-gravity references are relative to mean aerodynamic chord or MAC. Refer to the manual of weight and balance data, T.O. 01-1B-40 and AN 01-1B-40.

1. Approximately 28.5% MAC - Longitudinal stability, as evidenced by the variation in amount and direction of control force relative to airspeed, is slightly positive except in high power climbs, during which no change in control force is noted by a change in trim speed.
2. Aft of approximately 28.5% MAC and forward of 30.5% MAC - Control column force and movement required to stall the aircraft without power are in the desired direction but barely perceptible.
3. Approximately 30.5% MAC - Longitudinal stability is negative in all power-on conditions and a push force and forward control position is required to maintain a speed less than trim speed, while a pull force and rearward control position is required to maintain a speed above trim speed. Under these conditions, control "feel" in approaching the stall is opposite to that experienced in a stable aircraft. Adequate control, however, is available to recover from power-on stalls. The dynamic stability, evidenced by the degree with which pitching oscillations are damped out, is negative in all power-on conditions. Full nose down elevator trim is inadequate in high power climb at low speeds.
4. Aircraft stability will progressively decrease with center-of-gravity movement aft of 30.5% MAC.

CONTROL PRESSURES

Control pressure "feel" throughout the range of control surface travel may be considered as very light and effective. Extreme trim settings may be applied individually with one hand.

STALL CHARACTERISTICS

Adequate stall warning is given in the form of tail buffeting and a decrease in control effectiveness in either power-on or power-off stalls. During the approach to a stall, recovery is possible with no loss of altitude. With the aircraft completely stalled, no extreme changes of attitude are required for recovery. If the aircraft is stalled in a near level attitude, the tendency will be for it to "mush" without the nose dropping any great amount. If stalled in a nose high attitude, the aircraft will "mush" for a period, then the nose will drop. In either case, although the left wing may drop first, there is no great tendency for the stall to develop into a spin. Recovery can be effected by a relaxing of back pressure and an addition of power. Diving the aircraft is not necessary. See figure 4-1 for indicated stall speeds at various gross weights, and configurations.

CONFIGURATION	ANGLE OF BANK DEGREES	9200	9000	8800	8600	8400	8200	8000	7800	7600	7400
		APPROXIMATE IAS — KNOTS / GROSS WEIGHT — POUNDS									
		MAXIMUM POWER									
FLAPS UP, GEAR UP	0	66	66	65	64	64	63	62	61	61	60
	15	67	67	66	65	65	64	63	62	61	61
	30	70	70	69	68	67	66	66	65	64	63
	45	79	78	77	76	75	74	74	73	72	71
		POWER OFF									
FLAPS UP, GEAR UP	0	74	73	72	72	71	70	69	68	67	67
	15	75	74	74	73	72	71	70	69	68	67
	30	79	78	77	76	75	74	74	73	72	71
	45	87	86	85	84	83	82	81	80	79	78
		APPROACH POWER (2000 RPM, 20 INCHES MAP)									
FLAPS FULL DOWN, GEAR DOWN	0	58	57	56	56	55	54	54	53	53	52
	15	59	58	57	57	56	55	55	54	53	53
	30	62	61	60	60	59	58	57	57	56	55
	45	67	67	66	65	65	64	63	62	61	61
		POWER OFF									
FLAPS FULL DOWN, GEAR DOWN (GEAR DOORS INSTALLED)	0	68	67	67	66	65	64	64	63	62	61
	15	69	68	68	67	66	65	65	64	63	62
	30	75	74	74	73	72	71	70	69	68	67
	45	82	81	80	79	78	77	76	75	74	73
		SINGLE ENGINE, MAXIMUM POWER									
FLAPS UP, GEAR UP, PROPELLER FEATHERED	0	74	73	72	72	71	70	69	68	67	67
	15	75	74	74	73	72	71	70	69	68	67
	30	79	78	77	76	75	74	74	73	72	71
	45	87	86	85	84	83	82	81	80	79	78

Figure 4-1. Stall Speeds

SPINS

Intentional spins are prohibited. However, if a spin is inadvertently entered, use the following recovery procedure:

1. Throttles - CLOSED
2. Apply opposite rudder to stop rotation
3. Apply enough forward pressure to relieve the stall.
4. Recover from the resulting dive as rapidly as possible without imposing excessive wing loads.

NOTE

Power should not be used for spin recovery. Power will be of no advantage in your recovery and it will increase diving speeds.

ACROBATICS

Any deliberate maneuver or flight attitude normally considered to be acrobatic is prohibited. Acrobatic flight is considered to exist when:

1. A bank angle in excess of 60 degrees relative to the horizon exists; and/or
2. A nose up or nose down angle in excess of 30 degrees relative to the horizon exists.

DIVING

The airplane becomes slightly tail-heavy as speed increases during a dive, but has no tendency to yaw.

INSTRUMENT FLIGHT

STANDARD RATE TURNS

The approximate angles of bank for standard rate turns (3 degrees per second) are:

105 knots - - 16 DEGREES
125 knots - - 19 DEGREES
140 knots - - 22 DEGREES

HOLDING

Holding airspeed is 105 knots.

APPROACH

When begining an approach, the following procedures are performed:

1. Check time over the station
2. Turn, if necessary, to intercept the desired course
3. MIXTURES - RICH
4. Descend, if necessary
5. Make the appropriate voice report
6. Perform the Landing Checklist
7. The landing gear is extended and the wing flaps lowered at the discretion of the pilot.

MISSED APPROACH

If a visual landing cannot be effected upon reaching facility instrument minimums:

1. THROTTLES - ADVANCE to 30 inches MAP
2. GEAR - UP
3. Establish climb
4. FLAPS - UP
5. Comply with published procedures.

GROUND CONTROLLED APPROACH (GCA)

The downwind leg of the GCA pattern is flown at an airspeed of 105 knots. The recommended final approach airspeed is 90 KIAS, with 30 degrees of flap, 20 - 22 inches MAP gives approximately 500 feet-per-minute rate of descent.

NIGHT FLIGHT

Night flying may be considered very closely related to instrument operations. It is therefore of utmost importance to insure that all aircraft instrumentation, radio navigation, and lighting equipment is functioning properly prior to take-off. Otherwise, night flying is the same as day, with the exception that departure and approach patterns are usually somewhat larger except that power is carried to decrease the rate of descent on the approaches.

SECTION V – EMERGENCY PROCEDURES

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GENERAL

Emergency situation possibilities are myriad in type and surrounding circumstances. For this reason the actual procedures used in a particular situation must be based on the emergency involved. The following procedures cover the common types of emergencies usually encountered. A thorough familiarization with these procedures should provide a basis for a corrective procedure for almost any specific emergency.

NOTE

Refer to figure 5-2 for location of miscellaneous emergency equipment.

GROUND EMERGENCIES

The following ground emergency situations and remedial procedures pertain only to ground operation since engine shutdown is the end result of the corrective action.

ENGINE FIRE DURING START

Engine fire on the ground is usually an induction system fire which develops during the starting operation. Indication of this type fire is usually an audible backfire followed by a rapid increase in carburetor air temperature. This type fire is usually due to overpriming or pumping the throttle. To combat this type fire, proceed as follows:

IF ENGINE STARTS—

1. Keep the engine operating if possible, then fire will be pulled into the engine induction system and extinguished.

IF ENGINE DOES NOT START OR IF ENGINE STARTS AND FIRE CONTINUES—

2. MIXTURES - IDLE CUT-OFF
3. ENGINE STARTER - ENGAGE (unless engine starts)
4. FUEL SELECTORS - OFF
5. THROTTLE - OPEN (unless engine is started)
6. MAGS - OFF
7. BATTERIES - OFF
8. FIRE EXTINGUISHER - SELECT AFFECTED ENGINE

NOTE

If fire does not extinguish, stop cranking the engine and order the fire guard to extinguish the fire. If the fire does not extinguish immediately, discharge the selected engine fire extinguishing system.

9. EVACUATE AIRCRAFT - STANDBY

TAKE-OFF EMERGENCIES

Should an emergency situation develop on take-off, the take-off should be aborted, if possible.

ENGINE FAILURE

The decision to abort or continue a take-off, in the event of engine failure, is dependent on factors such as gross weight, remaining runway, density altitude, speed, etc. Speed is the most important factor since it establishes aircraft MINIMUM SINGLE ENGINE CONTROL SPEED and aircraft SAFE SINGLE ENGINE SPEED. Minimum single engine control speed is approximately 80 knots and is the minimum speed at which aircraft directional control can be maintained with the gear and flaps down, one propeller windmilling, and the take-off (maximum) power on the operative engine. Safe single engine speed is approximately, 90 knots. At this speed in clean configuration the aircraft will have adequate directional control and will maintain a positive rate-of-climb of 100 feet per minute, with take-off power, under maximum gross weight, sea level standard conditions. See figure 5-1 for maximum gross weight and aircraft configuration required to maintain safe single engine operation.

SINGLE-ENGINE ON TAKE OFF

1. Determine if take-off is to be continued or aborted.

Take-Off Continued:

2. LANDING GEAR - UP (immediately when airborne)
3. THROTTLE - CLOSED (FAILED ENG)

NOTE

The landing gear warning horn may be silenced by turning the horn silencer switch toward the throttle for the inoperative engine, or by advancing the throttle after engine shut-down.

4. PROP - FEATHERED (FAILED ENG) propeller lever full aft and feathering button depressed
5. MIXTURE - IDLE CUT-OFF (FAILED ENG)
6. ENGINE FUEL SELECTOR - GOOD ENGINE
7. FIRE EXTINGUISHER - AS REQUIRED
8. MAGS - OFF (FAILED ENG)
9. OIL SHUTTERS - CLOSED (FAILED ENG) lever full down (HOT)
10. COWL FLAPS - CLOSED (FAILED ENG)
11. ELECTRICAL LOAD - REDUCE
12. AIRSPEED - MAINTAIN SAFE SINGLE-ENGINE SPEED approximately 90 KIAS

FAILURE OF BOTH ENGINES ON TAKE OFF

1. Normally, a straight-ahead landing will be accomplished.
2. LANDING GEAR - UP (DOWN if sufficient field length is available)
3. AIRSPEED - ESTABLISH GLIDE approximately 95 KIAS

IN-FLIGHT EMERGENCIES

Impending inflight emergency situations will usually be characterized by one or more symptoms which indicate imminent system or component malfunctions. In such instance the appropriate preventive action may be applied in time to circumvent an actual emergency condition. The following corrective procedures are applicable to the common types of emergencies encountered, however, some situations may require a variation from the normal corrective procedure in order to follow the least hazardous plan.

GLIDE DISTANCE

Maximum glide distance is obtained with the aircraft in clean configuration; gear and flaps up, both propellers feathered and cowl flaps closed. In this configuration a glide ratio of approximately 10 to 1 or 2 miles per thousand feet of altitude can be obtained with a no-wind condition. This distance can be obtained by maintaining an airspeed relative to aircraft gross weight, i.e., at a gross weight of 9200 pounds -- maintain 112 knots, at 8730 pounds -- maintain 108 knots, at 7500 pounds -- maintain 100 knots. This information is of value when a desired landing location is available and distance is a prime consideration.

ENGINE FIRE

IMMEDIATELY—

1. ENGINE FUEL SELECTOR - GOOD ENGINE
2. MIXTURES - RICH
3. PROPS - FULL INCREASE RPM
4. THROTTLES - OPEN
5. LANDING GEAR - UP
6. FLAPS - UP
7. COWL FLAPS - OPEN SLIGHTLY (for engine on fire)
8. FIRE EXTINGUISHER - SELECT AFFECTED ENGINE (and discharge the fire extinguishing system if needed)

ON AFFECTED ENGINE—

1. MIXTURE - IDLE CUT-OFF
2. THROTTLE - CLOSED
3. PROP - FEATHERED
4. MAG - OFF
5. GENERATOR - OFF
6. OIL SHUTTERS - CLOSED lever full down (HOT)
7. COWL FLAPS - CLOSED
8. NONESSENTIAL ELECTRICAL EQUIPMENT - OFF

CAUTION

Do not attempt restart of inoperative engine.

POWER		GEAR		FLAPS		INOP. ENGINE PROPELLER		GROSS WEIGHT
TAKE-OFF	NORMAL RATED	UP	DOWN	UP	11° DOWN	FEATHERED	WINDMILLING	(POUNDS)
✓			✓		✓		✓	7500
✓			✓	✓			✓	7900
✓			✓		✓	✓		7900
✓			✓	✓		✓		8340
	✓	✓		✓			✓	8330
	✓	✓		✓		✓		8840
✓		✓		✓			✓	9000
✓		✓		✓		✓		9450

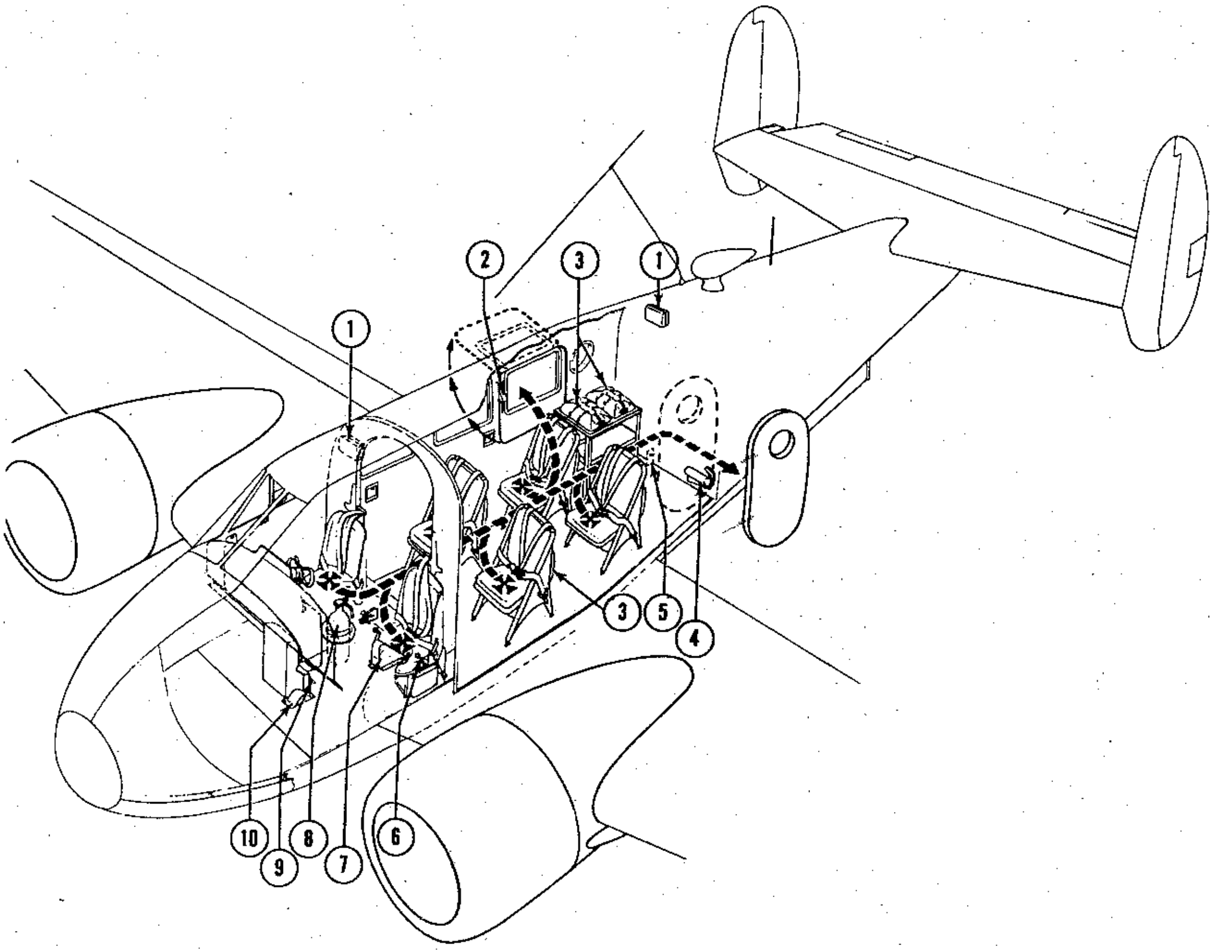
MAXIMUM GROSS WEIGHT AND CONFIGURATION REQUIRED TO MAINTAIN SAFE SINGLE-ENGINE SPEED AND 100 FPM RATE-OF-CLIMB AT SEA LEVEL STANDARD CONDITIONS (15° C AND DRY AIR). FOR OTHER THAN STANDARD CONDITIONS, OF TEMPERATURE AND HUMIDITY, REDUCE THE ABOVE GROSS WEIGHTS AS FOLLOWS:

		REQUIRED WEIGHT REDUCTION (POUNDS)
RELATIVE HUMIDITY (PERCENT) @ 27° C	0	100
	50	300
	100	540
RELATIVE HUMIDITY (PERCENT) @ 38° C	0	200
	50	580
	100	1030

NOTE

CRITICAL ENGINE ALTITUDE IS 16000 FEET FOR TAKE-OFF POWER AND 5000 FEET FOR NORMAL RATED POWER. FOR OTHER THAN STANDARD ATMOSPHERIC CONDITIONS, REDUCE MAXIMUM GROSS WEIGHT BY 100 POUNDS FOR EACH 1000 FEET OF ALTITUDE UP TO THE CRITICAL ALTITUDE OF THE ENGINE AND 250 POUNDS FOR EACH ADDITIONAL 1000 FEET ABOVE THE CRITICAL ALTITUDE.

Figure 5-1. Safe Single-Engine Configuration and Weight



1. FIRST AID KITS
2. EMERGENCY ESCAPE HATCH RELEASE
3. PARACHUTES
4. CO_2 HAND FIRE EXTINGUISHER
5. EMERGENCY DOOR RELEASE LEVER
6. SHOULDER-HARNESS LOCKS
7. LANDING GEAR AND WING FLAP HAND CRANK
8. ENGINE FIRE EXTINGUISHER CO_2 BOTTLE
9. ENGINE FIRE EXTINGUISHER CONTROLS
10. LANDING GEAR CLUTCH

Figure 5-2. Emergency Equipment and Escape Routes

NOTE

Monitor operative engine temperatures to assure that they are maintained within the operating limits.

FUSELAGE FIRE

Due to in-flight inaccessibility of potential fire areas and limited maneuvering room in which to combat a fuselage fire, this type of emergency is one of the most serious. If a fuselage fire should develop, transmit an emergency report and if over water, reduce altitude to allow a quick ditching if it becomes necessary. If over land, maintain sufficient altitude for bail out. Combat fuselage fire as follows:

NOTE

On RC-45J aircraft, personnel may use the oxygen system (select 100%) to avoid smoke and fume inhalation.

1. Turn OFF electrical equipment in fire area and any equipment suspected of causing fire.
2. Close windows and ventilating ducts.
3. Use hand CO_2 fire extinguisher.

WARNING

Avoid dangerous concentrations of CO_2 when using hand fire extinguisher. Open windows and vents fully after fire is extinguished to dissipate smoke and CO_2 fumes. (See smoke and fume elimination procedure.)

ELECTRICAL FIRE

Electrical fire probability is minimized by circuit breakers which de-energize a malfunctioning circuit. Proceed as follows in event of electrical fire.

NOTE

On RC-45J aircraft, personnel may use the oxygen system (on 100%) to avoid smoke and fume inhalation.

1. BATTERIES/GENERATORS - OFF
2. WINDOWS/VENTILATING DUCTS - CLOSED
3. HAND CO_2 FIRE EXTINGUISHER - AS REQUIRED
4. WINDOWS/VENTILATING DUCTS - OPEN to dissipate smoke and CO_2 fumes (see smoke and fume elimination procedure)
5. RADIOS/ELECTRICAL EQUIPMENT - OFF
6. CIRCUIT BREAKERS - PULLED
7. Isolate faulty compartment or circuit as follows:
   a. Turn ON each generator individually and check operation.
   b. Turn ON each battery individually and check operation.
   c. Re-energize components and systems individually using only systems necessary for safe flight operation. Check for recurrence of fire, smoke or smell indication.

CAUTION

If only the batteries can be used for electrical power, do not use the necessary systems until actually needed.

SMOKE AND FUME ELIMINATION

The most rapid method of eliminating smoke and fumes from the aircraft interior after a fire has been extinguished is to close all windows and vents and open the passenger compartment main entrance door. If smoke and/or fumes remain in the area, open the pilot's compartment side windows or the storm window for final elimination. On RC-45J aircraft, the oxygen system may be used (on 100%) to avoid smoke and/or fume inhalation.

NOTE

When the passenger compartment main entrance door is unlatched, it will trail open approximately 2 inches. For more rapid elimination the door may be held open up to 6 inches.

ENGINE FAILURE

Should an engine failure in flight occur determine definitely which engine has failed and proceed as follows:

IMMEDIATELY—

1. LANDING GEAR - UP
2. FLAPS - UP
3. MIXTURES - RICH
4. PROPS - FULL INCREASE RPM
5. THROTTLE - OPEN (GOOD ENG)
6. Analyze engine instruments to determine cause of engine failure. If fuel pump failure is indicated proceed as follows:
   a. Crack failed engine throttle.
   b. Actuate hand wobble pump to determine if fuel pressure can be maintained; if NOT, secure engine.
   c. If fuel pressure can be maintained:
      (1) Turn fuel crossfeed valve ON.
      (2) Check fuel consumption to determine if fuel valve leaks, and if fuel pressure is maintained.
      (3) If valve leaks, turn fuel crossfeed OFF and maintain fuel pressure with the hand wobble pump.

TO SECURE FAILED ENGINE—

1. MIXTURE - IDLE CUT-OFF
2. THROTTLE - CLOSED
3. PROP - FEATHERED
4. COWL FLAPS - CLOSED
5. OIL SHUTTERS - CLOSED lever full down (HOT)
6. MAG - OFF
7. GENERATOR - OFF
8. ENGINE FUEL SELECTOR - GOOD ENGINE

ENGINE RESTART AND PROPELLER UNFEATHERING

1. GENERATOR - ON
2. ENGINE FUEL SELECTOR - BOTH
3. MAG - ON

4. THROTTLE - CRACKED
5. PROP - FULL DECREASE RPM
6. PROP FEATHER BUTTON - PUSH (hold until 800 rpm is indicated on tachometer)
7. PROP - CRUISE RANGE (approximately one-half forward, then full forward for warm-up)
8. MIXTURE - RICH
9. THROTTLE - 20 INCHES MAP (after engine starts)

PROPELLER FAILURE

Propeller governing malfunctions will be in two categories, the condition where the propeller goes completely to the low pitch (high rpm) position, and those in which the propeller overspeed exceeds 2400 rpm. Due to blade angle stop settings, in either situation, the proper use of airspeed will still provide a positive and beneficial thrust condition. For this reason, if engine power is available, do not feather a propeller if engine power is required, i.e., if you are committed during a take-off, go-around, or other maximum performance maneuver. To regain control after a propeller governor failure has occurred resulting in an overspeed condition proceed as follows on the affected engine:

1. THROTTLE - RETARD
2. Establish a climb attitude to load overspeeding propeller.
3. MIXTURE - RICH
4. PROP LEVER - MANIPULATE (to restore possible governing control)
5. PROP FEATHER BUTTON - PUSH (momentarily to begin feathering cycle, then release. Repeat as required)
6. AIRSPEED - REDUCE (within limits, by reducing power)
7. If control cannot be maintained or 2400 rpm has been exceeded, secure engine using ENGINE FAILURE PROCEDURE.

FUEL TANK EXHAUSTION

Characteristics of individual aircraft liquidometer readings may on occasion be responsible for inadvertently allowing a fuel tank to run dry. In this event, proceed as follows:

1. THROTTLES - CRACKED
2. MIXTURES - RICH
3. AIRSPEED - MAINTAIN MINIMUM OF 95 KIAS (nose up slightly to prevent propeller and engine overspeed)
4. WOBBLE PUMP - OPERATE (if engines will not start after fuel pressure is regained, use primer as necessary)
5. After engines are operating smoothly, establish cruise power settings.

FUEL PUMP FAILURE

If engine failure occurs due to loss of fuel pressure, accomplish the fuel pump operational check-out procedures as follows:

1. THROTTLE - CRACKED
2. WOBBLE PUMP - OPERATE (to determine if fuel pressure can be maintained; if NOT, secure engine using Engine Failure shutdown procedures)
3. If engine fuel pressure can be maintained:
   a. Turn fuel crossfeed valve ON.
   b. Check fuel consumption to determine if fuel valve leaks, and if fuel pressure is maintained.
   c. If valve leaks, turn fuel crossfeed OFF and maintain fuel pressure with the hand wobble pump.

ELECTRICAL POWER FAILURE

In the event a generator becomes inoperative:

1. GENERATOR - ON (check)
2. CIRCUIT BREAKERS - RESET
3. VOLTAGE AND AMPERAGE - CHECK
4. If either or both generators remains inoperative or operate for a short time then fail again, turn the affected generators and as much electrical equipment as practicable OFF to conserve battery power.

AUTOPILOT SYSTEM DISENGAGE (RC-45J ONLY)

The P-1 type electrically operated automatic pilot system may be disengaged by any one of the following:

1. EMERGENCY HANDLE - PULL

NOTE

The autopilot system cannot be re-engaged in flight once the emergency disconnect handle is actuated.

2. PUSH-BUTTON (on pilot's control wheel) - DEPRESS
3. AC POWER CIRCUIT BREAKERS - PULLED

WING FLAP EMERGENCY OPERATION

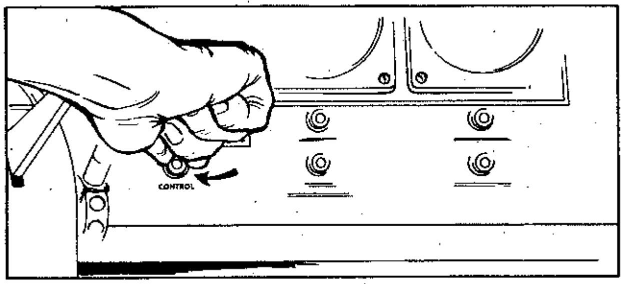
If a loss of electrical power occurs, and it is necessary to operate the wing flaps, proceed as follows:

1. FLAP SWITCH HANDLE - OFF
2. CIRCUIT BREAKER - PULLED
3. FLAP EMERGENCY HANDCRANK - ENGAGE AND CRANK (move crank toward pilot and turn forward at the top of the stroke to lower the flaps, and aft to raise the flaps), see figure 5-3.

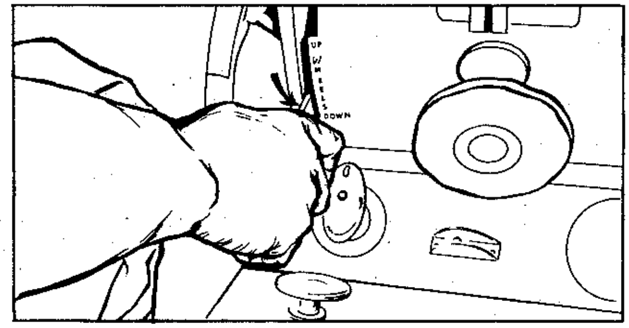
NOTE

Each complete handcrank revolution is equivalent to approximately 1-1/2 degrees of flap deflection. Approximately 30 turns of the hand crank are required for full flap travel. The jackscrew type flap actuators will hold the flaps in whatever position they are extended to.

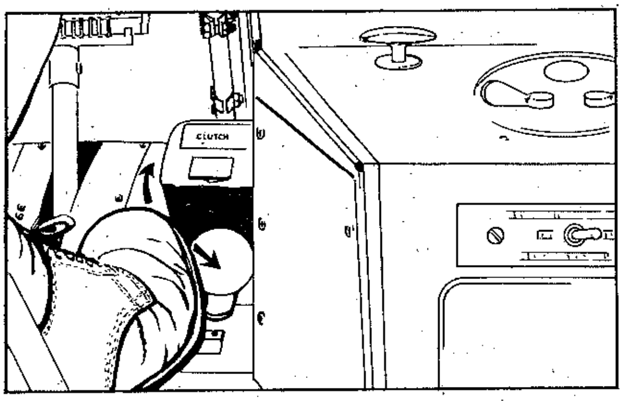
EMERGENCY LANDING GEAR OPERATION



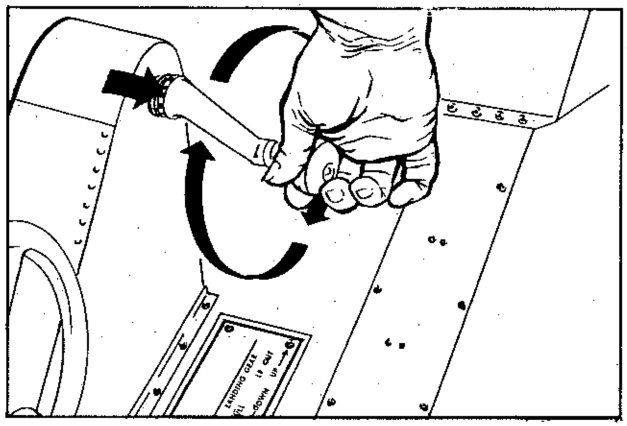
1. PULL OUT LANDING GEAR CONTROL CIRCUIT BREAKER.



2. PLACE LANDING GEAR HANDLE IN DOWN POSITION.

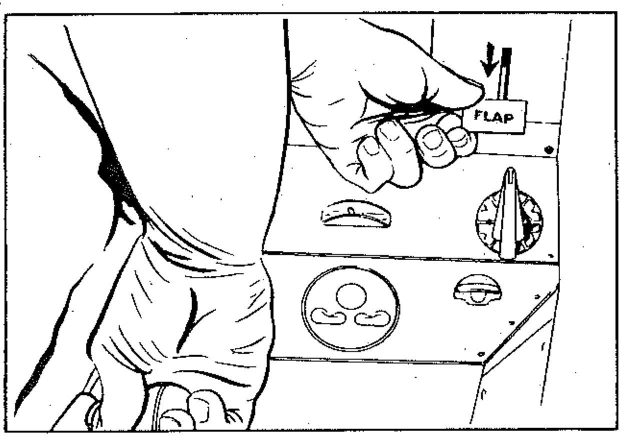


3. RAISE LANDING GEAR CLUTCH COVER.
4. DEPRESS CLUTCH PEDAL WITH TOE AND HOLD.
5. ALLOW GEAR TO FALL TO TRAIL POSITION.

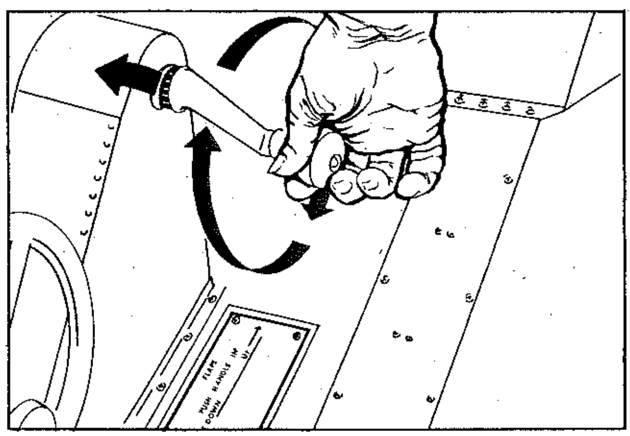


6. ENGAGE EMERGENCY HAND CRANK (MOVE CRANK AWAY FROM PILOT) AND TURN FORWARD AT TOP OF STROKE UNTIL CONSIDERABLE RESISTANCE IS FELT.
7. RELEASE CLUTCH.
8. ROCK HAND CRANK BACK AND FORTH SLIGHTLY UNTIL CLUTCH PEDAL IS ALL THE WAY BACK AGAINST THE FLOOR BOARDS.

EMERGENCY WING FLAP OPERATION



1. PLACE FLAP SWITCH IN OFF POSITION.
2. PULL CIRCUIT BREAKER



3. ENGAGE EMERGENCY HAND CRANK (PUSH IN TOWARD PILOT AND TURN FORWARD AT TOP OF STROKE TO LOWER AND OPPOSITE DIRECTION TO RAISE FLAPS.

Figure 5-3. Landing Gear and Wing Flap System Emergency Operation

BAIL OUT

The decision to bail out must be made by the pilot in command. It is also his responsibility to be certain that all crew-members and passengers are thoroughly indoctrinated on bail out procedure and use of equipment. Use the following procedure for normal bail out:

1. Receive verbal acknowledgement from all personnel on board "Ready".
2. Reduce airspeed as much as practicable (87 KIAS or less) and trim slightly nose down.
3. Head aircraft toward uninhabited area if possible
4. Transmit emergency report.
5. Instruct passengers to go aft to the main entrance door, ONE MAN AT A TIME for departure.
6. Unlock and jettison cabin door.
7. Disconnect radio cords.
8. Tighten parachute harness before leaving seat.
9. Attach parachute to harness.
10. Go aft and kneel before the cabin door. Actual departure is made by rolling or falling forward out the door head first.

WARNING

Do not jump from the main entrance door since bodily contact may be made with the empennage structure when leaving the aircraft in this manner.

AIRBORNE DAMAGED AIRCRAFT

If the aircraft is uncontrollable, bail out. However, if control can be maintained, proceed as follows:

1. Start a climb to at least 5000 feet and head toward a landing field.
2. Transmit emergency report and request a visual in-flight inspection.
3. Conduct test with landing gear extended and then with wing flaps down to determine aircraft flight characteristics and stability in landing configuration. Reduce airspeed in increments of 10 knots being careful not to reach a stall condition. This test should determine a safe minimum landing speed.
4. If all appears satisfactory, fly a wide easy approach; if a control problem exists fly a straight-in approach using an airspeed at least 10 knots above the minimum obtained during the flight characteristics check.

LANDING EMERGENCIES

Two types of landing emergencies will be encountered: Those which develop during the approach and actual landing where reaction and countermeasure time are minimized, and those which develop during the flight thereby allowing a specific landing procedure and technique to be applied. For those situations which develop during the landing approach, complete the landing if possible.

LANDING GEAR EMERGENCY OPERATION

If electrical powe does not operate the landing gear, it may be extended manually. However, due to the weight of the gear and location of the emergency handcrank it is not recommended that the gear be retracted manually. Proceed as follows for manual landing gear extension.

1. LANDING GEAR CIRCUIT BREAKER - CHECK (reset if necessary)
2. GENERATORS - CHECK (ON and operating)
3. LANDING GEAR - DOWN

IF LANDING GEAR WILL NOT EXTEND —

1. LANDING GEAR CIRCUIT BREAKER - PULLED
2. AIRSPEED - REDUCE (108 KIAS or less)
3. LANDING GEAR HANDLE - DOWN
4. LANDING GEAR EMERGENCY HANDCRANK - FREE
5. LANDING GEAR CLUTCH PEDAL - DEPRESSED Hold clutch pedal in the depressed position until the landing gear free-falls into the trail position. (see figure 5-3)

WARNING

When manually extending the landing gear, always depress the clutch pedal and allow the gear to free-fall in to the trail position before attempting to engage the landing gear emergency handcrank. If the handcrank is engaged prior to depressing the clutch pedal, the entire weight of the gear must be supported by the handcrank after the clutch pedal is depressed. In this configuration, the weight of the landing gear makes it difficult to hold and the handcrank will spin quite rapidly thereby resulting in possible injury to the operator.

6. LANDING GEAR EMERGENCY HANDCRANK - ENGAGE (with landing gear clutch pedal depressed, move crank away from pilot and crank).
7. LANDING GEAR CLUTCH PEDAL - RELEASE
8. LANDING GEAR EMERGENCY HANDCRANK - CRANK FORE AND AFT (until clutch pedal returns to the normal completely engaged position)
9. Check landing gear completely extended and locked as follows:
   a. Cross-shaft teeth meshed.
   b. Landing gear handle light OUT.
   c. Landing gear warning horn OFF.
   d. Check visually that the landing gear is extended and locked.

IF LANDING GEAR WILL NOT RETRACT —

1. If landing gear handle will not move to the UP position.
   a. Check landing gear circuit breakers.
   b. Landing gear handle - UP. Depress override plunger if necessary.

2. Landing gear handle moves to UP, but gear will not retract:
 a. Check landing gear circuit breakers.
 b. Do not manually retract the landing gear unless necessary to maintain flight.

NOTE

In event manual landing gear retraction is attempted, manually releasing the clutch pedal (removing toe pressure) will restrain the gear at any point in the retraction cycle.

FORCED LANDING

Proceed as follows for forced landing on land. Make the decision to land with the landing gear extended or retracted prior to establishing final approach angle and speed.

1. TRANSMIT MAYDAY
2. LANDING GEAR - UP or DOWN (if in doubt, land gear UP)
3. FUEL TANK SELECTOR - OFF
4. MAG MASTER - OFF
5. FLAPS - DOWN (maintain 85 KIAS)
6. BATTERIES - OFF
7. GENERATORS - OFF
8. SAFETY BELTS/SHOULDER HARNESS - LOCKED
9. Touchdown in open area at slowest speed possible under circumstance. Maintain directional control as long as possible.
10. Evacuate aircraft when all motion has stopped.

NOTE

If forced landing is being made due to low fuel supply, land before the fuel is completely exhausted in order to maintain a power controlled approach and landing.

DITCHING

Normally, the aircraft will not be equipped with a liferaft or other ditching survival equipment. If an overwater flight is to be made, the necessary survival equipment must be installed. If an emergency situation should develop on an overwater flight, the pilot must decide whether to ditch or bailout. Bail out should be considered only if surface vessels are present or there is no change to ditch successfully. Ditching keeps personnel together and any survival equipment onboard the aircraft will be available. The following ditching procedures will apply.

1. TRANSMIT MAYDAY
2. PASSENGERS and/or CREWMEMBERS - take DITCH STATIONS Standby to evacuate the aircraft with liferaft, emergency rations, spare parachutes, or any other useful items.
3. RADIO CORDS - DISCONNECT
4. SAFETY BELTS/SHOULDER HARNESS - LOCKED
5. EMERGENCY EXIT HATCH (on aft right side of passenger compartment) - Instruct passenger or crewmember to JETTISON after final touchdown.
6. BATTERIES - OFF
7. LANDING GEAR - UP
8. FLAPS - DOWN
9. Approach:
 a. If both engines inoperative, feather both propellers prior to starting the flareout while airspeed and control are present.
 b. If one or both engines are operative, use normal power during the approach. Touchdown in a slightly tail-low attitude, just above a stall.
10. Plan landing direction as follows:
 a. Calm sea - Land into the wind.
 b. Moderate swells - Land parallel to the swells (then if possible, turn into the wind)
 c. High swells - Land into the wind attempting to contact the surface on the upwind side of a swell.
11. SAFETY BELTS/SHOULDER HARNESS - RELEASE after aircraft has come to a complete stop. Several impacts may be encountered.
12. EVACUATE AIRCRAFT (when all motion has stopped)

ESCAPE ROUTES

Emergency exit from the aircraft can be made through either the main entrance door or the emergency exit hatch (on the aft right side of the passenger compartment). The main entrance door has an emergency release lever located in the wall at the forward edge of the door (figure 5-2). To release or jettison the door, proceed as follows:

1. Unlatch the door as during normal opening.
2. Open the red spring loaded flap.
3. Lift up on the lever located under the flap. This will release the door hinge pins permitting the door to separate from the aircraft.

CAUTION

Do not operate the door emergency release mechanism in flight unless actual door jettison is desired. The aircraft's empennage section may be damaged when the door is released.

To open or jettison the emergency exit hatch, proceed as follows:

1. Lift the safetied red cover protecting the hatch release button.
2. Depress the hatch release button (this will release an upholstered lever (approximately 10 inches in length), at the forward edge of the door).
3. Pull the upholstered lever out and down. This will open or jettison the emergency exit hatch.

SINGLE-ENGINE LANDING

When it becomes necessary to make a single engine landing (figure 5-4), several basic rules of technique apply in addition to the procedural steps used, they are:

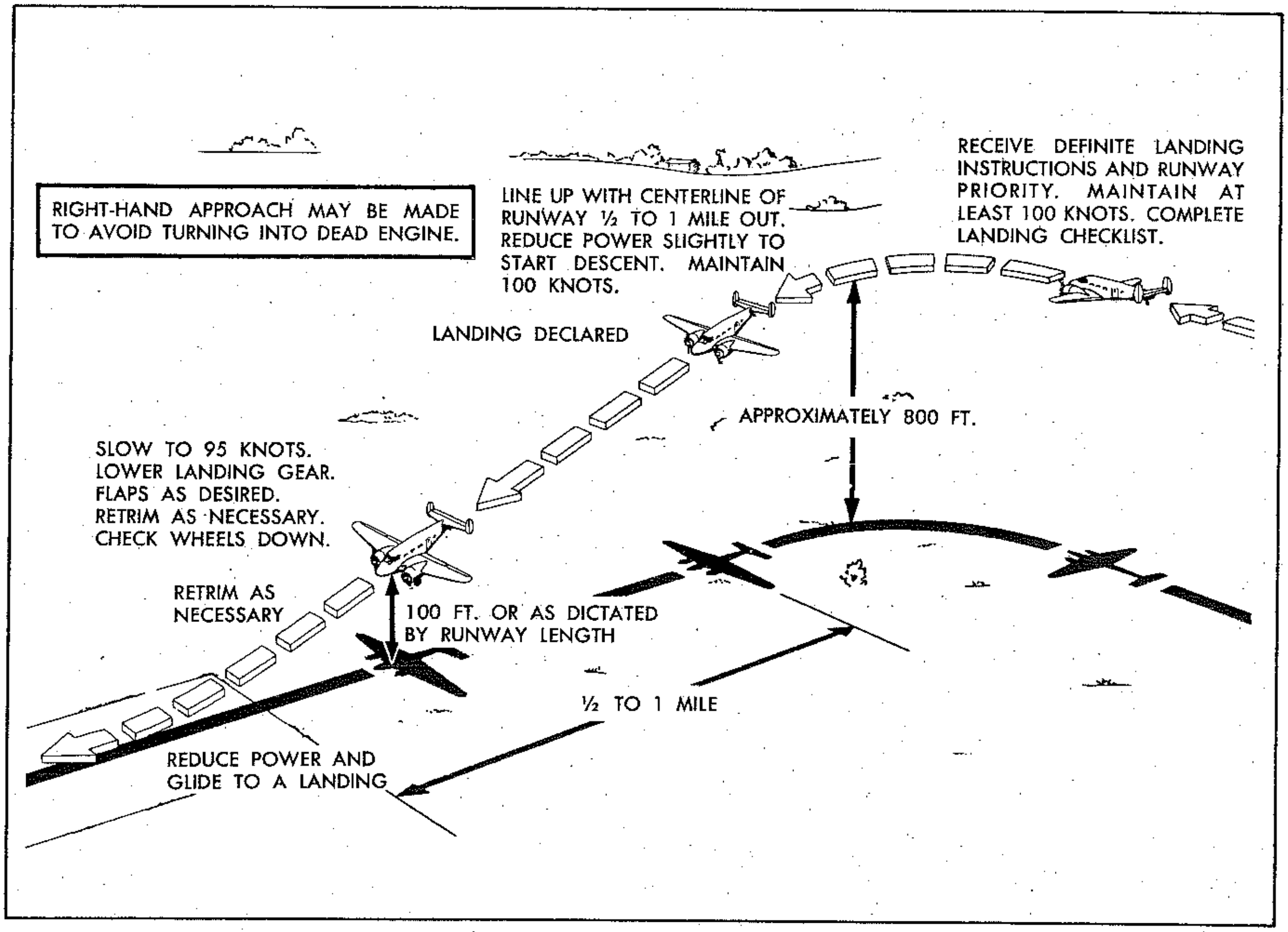


Figure 5-4. Single Engine Landing

1. Maintain a traffic pattern and final approach speed approximately 5 knots faster than normal.

2. Do not extend the landing gear until on final approach and a landing is assured. Keep in mind the effect of added drag on altitude and airspeed.

3. Do not lower more than 15° wing flaps until landing is assured since all added drag will reduce performance in the event of a go-around.

4. Maintain a higher than normal altitude on final. When possible, all pattern turns should be toward the operative engine since control is more positive. When landing is assured, reduce power, retrim, (full flaps if desired), and execute a normal landing.

CAUTION

Never allow airspeed to decrease below Minimum Single Engine Control Speed before the landing is assured and all possibilities of a go-around have been eliminated. Due to the decreased drag of the feathered propeller, the landing roll will be longer than normal. As speed decreases and power is reduced, a directional swerve may develop unless rudder trim is neutralized prior to the landing flare out. Lock the tail wheel during taxi operations to assist in maintaining directional control.

SINGLE ENGINE GO-AROUND

If it becomes necessary to make a single-engine go-around use the following procedures and techniques.

1. THROTTLE (GOOD ENG) - OPEN (Take-off or Maximum Power)
2. LANDING GEAR - UP
3. FLAPS - UP
4. COWL FLAPS - TRAIL
5. AIRSPEED - MAINTAIN SAFE SINGLE-ENGINE SPEED approximately 90 KIAS

If approach speed has been reduced below Safe Single Engine Speed or if the landing gear and wing flaps are fully extended, a go-around should not be attempted unless sufficient altitude is available to retract the landing gear and wing flaps, or Safe Single Engine Speed can be obtained.

NOTE

Safe Single Engine Speed should be attained without gaining altitude and if necessary and feasible, sacrifice a little altitude to attain this speed safely and quickly.

SECTION VI – ALL-WEATHER OPERATION

TABLE OF CONTENTS

TURBULENCE AND THUNDERSTORMS

Flight through a highly turbulent area or thunderstorm should be avoided if at all possible. Routine flight operations, however, will encounter a certain amount of this type flying since it is not always possible to avoid a storm area. At night it is especially difficult to locate the clear areas. When a flight operation is to be conducted into a zone of suspected or known turbulence, a penetration speed must be established. A usable speed can be found by adding 60 knots to the power on stall speed for the weight and configuration being flown. The power setting and pitch attitude for this speed should be established prior to entering an area of turbulence, and if maintained will result in a near constant average airspeed, regardless of any false airspeed indications.

APPROACHING TURBULENT AIR

Prior to actual storm or turbulent air entry, the aircraft should be prepared as follows:

1. LOOSE EQUIPMENT - Secure
2. AUTOPILOT - DISENGAGED (RC-45J only)
3. AIRSPEED - AS REQUIRED to maintain 60 knots above stall speed for weight and configuration being flown
4. PITOT HEAT - ON
5. MIXTURES - RICH
6. MANIFOLD HEAT - AS REQUIRED
7. VACUUM and GYRO INSTRUMENTS - Check
8. SAFETY BELTS - FASTENED (check with all personnel)
9. Turn OFF any radio equipment rendered useless by static.
10. Turn pilots compartment lights to full bright and turn ON pilot's compartment white dome lights to minimize blinding effect of lightning (during night operations).

CAUTION

Do not extend landing gear or lower wing flaps as they merely decrease aircraft aerodynamic efficiency.

11. NAVIGATION LIGHTS - ON
12. Select fullest fuel tank; preferably a MAIN tank.

FLIGHT IN TURBULENT AIR

Penetrate turbulent air as follows:

1. Maintain attitude by reference to the attitude indicators.

NOTE

Maintain power settings and pitch attitude (establish prior to entering the storm or turbulent air) throughout the storm.

2. Maintain original heading. Do not make any turns unless absoutely necessary.
3. Use as little elevator control as possible in maintaining attitude in order to minimize stresses imposed on the aircraft.
4. If heavy precipitation is encountered, close cowl flaps to prevent engines from cooling too rapidly.

COLD WEATHER OPERATION

Normally, cold weather operations and the applicable procedures are considered to be in effect at ambient temperatures of 0°C or less. The following discussions, operating techniques, and procedures are supplemental to the information contained in Section III, Normal Procedures and should be complied with when cold weather conditions are encountered.

CARBURETOR ICING

Carburetor icing is most probable under two common atmospheric conditions; visible freezing or subfreezing moisture, or high humidity conditions. During these conditions, moisture either in the form of ice particles or liquid enters the engine indication system where either due to its already solid state it causes a restriction, or due to the refrigeration effect of the carburetor, it is formed into ice which also causes a restriction. This restriction in carburetor air flow, if allowed to progress to a critical state, will be difficult, if not near impossible to remove with manifold heat. For this reason, preventative action rather than remedial action is emphasized.

CARBURETOR ICING INDICATION

Carburetor ice can usually be detected by a gradual loss of manifold pressure. Normally, ice formation is a relatively slow process, and for this reason, as power decreases slightly, the pilot may advance the throttles gradually by slight increments before realizing ice is being formed. There are extreme icing conditions when ice can form very rapidly. Such conditions, however, are usually rare local instances. Being alert to atmospheric conditions favorable to icing and the early use of manifold heat will normally eliminate ice formations.

CARBURETOR HEAT USE

If it is suspected that carburetor ice has already formed, use the following procedure:

1. MIXTURES - RICH (if below 5,000 feet)
2. MANIFOLD HEAT - HOT (down)
3. Check repeatedly to see if manifold pressure is restored by slowly returning the manifold heat lever to the COLD (up) position. If the rise in manifold pressure from full hot to full cold is consistent during several momentary cycles from HOT to COLD, the ice is gone.

NOTE

If heavy icing has occurred, the loss of power will be accompanied by a loss in manifold heat capacity so that full manifold heat may be required for longer periods. The effectiveness of manifold heat in eliminating the ice may be sharply reduced.

4. Adjust manifold heat levers to maintain carburetor mixture temperatures within the normal operating range.

CARBURETOR ICE PREVENTION

Prior to entering an area of known icing conditions, proceed as follows:

1. Change altitude or course if possible and practical.
2. MANIFOLD HEAT - HOT (down) at least 15 minutes, if possible, before entering icing conditions
3. Since some icing conditions are not as obvious as others, due to temperature, visible moisture, etc., a normal procedure would be to carry enough manifold heat to keep the induction system temperature a few degrees warmer than normal during any flight condition when possible icing may occur.

PREFLIGHT INSPECTION (EXTERIOR)

1. Check for removal of all snow, ice, and frost accumulations from wings, empennage, control surfaces and hinges, propellers, pitot tubes, and fuel and oil tank caps and vents. If hot air has been used, make sure that the areas are dry and ice-free.

CAUTION

Hot water should not be used to remove frost or ice unless the aircraft is sheltered in a warm area, as additional ice may form to aggravate the situation.

2. Check the oil Y-drains and oil tank sumps for free oil flow. If no oil flow is obtainable, preheat the engine, accessory section, and oil flow lines until oil flow is readily obtained.
3. Check the landing gear struts, slide tubes, actuating mechanism, wheels and brakes for freedom from snow, ice, mud, frost, etc. Check landing gear safety switch for freedom from ice. A coating of hydraulic fluid should be applied to the landing gear shock struts and retraction slide tubes.
4. Tires and landing gear shock struts for specified inflation.
5. Check all flight controls for freedom of movement. Check that the drain hole in the bottom of the elevator cone is open. If this hole is plugged, water may collect and freeze in the cone restricting or even blocking elevator travel.
6. Check for engine stiffness to determine when sufficient ground heat has been applied. When one man can rotate the propeller freely the engine is warm enough to start.
7. Check that external power is applied. All cold weather starts should be made with the assistance of an auxiliary power unit.
8. Complete the normal Preflight Preparation procedures established in Section III, Normal Procedures.

BEFORE STARTING ENGINES

Perform the following before starting the engines.

1. Check operation of all instruments which will function without engine operation.

2. Remove all ground heater ducts, engine covers etc. (if installed).
3. Pull the propellers through at least 10 blades by hand.
4. Complete the normal Pre-Start Checks established in Section III, Normal Procedures.

STARTING ENGINES

Except for the following variations, make cold weather starts, using the same procedure as used for normal starts.

NOTE

If a battery start must be made, reduce the electrical load to a minimum.

1. Set throttles approximately 1/8th open or less (approximately 800 rpm) to decrease backfiring tendency.
2. MANIFOLD HEAT - COLD (up)

CAUTION

Use of manifold heat during starting may result in serious damage and fire if the engine backfires. Manifold-heat levers will tend to move into HOT position during backfiring. Return levers to Cold but do not hold or lock in position.

3. OIL BY PASS - HOT (out)
4. Prime the engine immediately before starting and after the propeller starts to rotate. If primed prematurely, the gasoline will not vaporize. In extreme cold, operate the primer intermittently until regularity of engine firing results. It may be necessary to continue priming for a short time after starting to maintain smooth engine operation.

NOTE

If the engine fires and quits several times, ice is likely to form on the spark plug electrodes. When this is suspected, remove several front plugs and heat and dry the points before attempting a restart.

5. If there is no oil pressure after thirty seconds running or if pressure drops after a few minutes of ground operation, shut down and check for blown oil lines or radiators and for congealed oil or ice at Y-drain or oil tank sump drain.

NOTE

Oil pressure will be abnormally high immediately after starting. This is an allowable situation; but as oil temperature increases, the oil pressure should drop rapidly to normal. Do not increase engine rpm until oil temperature and pressure are within limits.

6. MANIFOLD HEAT - HOT (down) when engine is firing evenly. Return to COLD (up) when engine will operate smoothly
7. COWL FLAPS - OPEN at least 2/3rds to prevent overheating in engine accessory section

ENGINE WARM-UP

Warm up the engines as follows:

1. Oil shutters - HOT (down)
2. ENGINE SPEED - 1000 RPM until oil temperature reaches 40°C. Do not exceed oil pressure limits (use decreased engine RPM if necessary)
3. MANIFOLD HEAT - AS REQUIRED to improve fuel vaporization and prevent backfiring

NOTE

When subjected to excessive drain, storage batteries deteriorate rapidly in cold weather; therefore, none but essential electrical equipment should be used until generators are supplying current.

4. Check instrument operation.
5. Exercise propellers from low pitch (high rpm) to high pitch (low rpm) and back to low pitch several times to circulate warm oil through the propeller governing system.
6. When oil temperature reaches 20°C, move oil by-pass T-handle to COLD (in) position very slowly since congealed oil in radiator may block the flow and result in radiator failure. When the oil temperature reaches 20°C, the by-pass valve will be warmed sufficiently to allow oil to automatically by-pass the radiator if the radiator is blocked by congealed oil.

TAXI

Taxi the aircraft as follows:

1. Avoid taxiing through qater, slush, mud, etc if possible.
2. Use the same precautions regarding propeller wash as used during engine warm-up.
3. Watch for formation of frost on the wings.

BEFORE TAKE-OFF

Perform the following before take-off

1. Check control surfaces and trim tabs for full unrestricted travel.
2. FLAPS - CYCLE (to insure correct operation)
3. Check engine operating pressures and temperatures for normal indications.
4. Exercise propellers from low pitch (high rpm) to high pitch (low rpm) and back to low pitch several times to circulate warm oil through the propeller governing system.
5. PITOT HEAT - ON (for take-off)
6. DEICER BOOTS - CYCLE (to insure correct operation)

7. If deep or heavy snow interferes with take-off run but permits taxiing, move slowly up and down the take-off course several times to pack down the runway before attempting actual take-off.
8. TAILWHEEL - LOCKED, check with wheel brakes (frozen slush may prevent locking pin from engaging)

TAKE-OFF

Perform the following during take-off:

1. Run up engines using manifold heat to eliminate any carburetor ice.

NOTE

Manifold heat levers should be in the COLD (up) position for take-off.

2. Abort take-off immediately if full power is not developed.
3. After take-off from a snow or slush covered field, leave the landing gear extended for a few minutes until slush or moisture is either blown off or dries, then operate through several cycles to prevent freezing of the doors, actuator slide tube, etc.

DURING FLIGHT

During flight perform the following:

1. Use manifold heat as required to prevent formation of carburetor ice since prevention is more advisable than removal. Some carburetor heat should be used at all times if compatible with engine power requirements. Rough operation may occur at high power settings when full manifold heat is applied. Manifold heat temperature should be regulated between +10°C and +38°C.
2. Periodically move throttle and manifold heat levers to prevent their freezing in one position.

NOTE

Should the carburetor air doors become frozen by ice, turn the propeller anti-icer on full flow. This will allow sufficient alcohol from the propeller blades to enter the induction system and loosen the ice accumulation.

3. Use anti-icing systems as required to prevent formation of ice on the windshield, propeller blades, and pitot heads.

CAUTION

Do not activate the deicer boots until at least 1/4 inch of ice has formed on the surfaces. Cycle the boots until all residual ice is removed.

4. Unusual stiffness of controls may indicate freezing of moisture in control hinges. If possible descend or climb into a warmer layer of air or move the controls frequently to prevent freezing.

5. Cycle the propeller periodically between 1600 and 2300 rpm to prevent oil from congealing in the propeller dome and either complicating or preventing propeller feathering.

NOTE

If propeller feathering is required and the feathering button "pops out" before the propeller is feathered, do not manually depress the button and hold. Excess pressure, due to the thick cold oil, is causing premature feathering button release followed by a tendency for the propeller to unfeather. Depress the button, let it release and then depress it again. Continue this procedure until the propeller is feathered. When feathering an engine, restart the engine before the oil temperature drops below +40°C (if a restart is planned). Temperatures below this limit will prevent the use of the engine for power until a significant warm-up period has lapsed.

APPROACH AND LANDING

Accomplish the following during approach and landing:

1. During descent, observe engine temperatures closely. Maintain cylinder head temperatures above 100°C by maintaining power and regulating cowl flaps. Use manifold heat to assure good fuel vaporization.

NOTE

Extend landing gear and lower partial flaps prior to approach, to check operation (while altitude remains). This will also permit use of more engine power which will reduce the possibility of carburetor ice.

2. DEICER BOOTS - OFF
3. If the aircraft is heavily iced, make approach at a higher than normal speed.
4. Turn off all electrical equipment possible at least one minute before final approach to save batteries when engine rpm is reduced below generator cut-in speed.
5. Use carburetor heat during landing so that if acceleration is necessary, heat will be available for fuel vaporization, regardless of cylinder head temperature. If full power is required for a go-around, be prepared to return the manifold heat levers to the COLD (up) position.

NOTE

When landing on runways covered with slush or large puddles, avoid using wing flaps. Heavy sprays of slush or water kicked up during landing might impose an excessive load on the flaps if they are extended. The use of wing flaps will not be necessary since the added resistance from the water will assist in braking airplane.

6. Use brakes sparingly and not until absolutely necessary during landing roll.
7. Turn OFF any anti-icing systems no longer required.
8. MANIFOLD HEAT - HOT (down, while taxiing).

PARKING

When the aircraft is to be parked for a period of time such as over night or longer when the temperature varies between thawing and hard freezing, place a double layer of paper, fabric, or other suitable insulation material under the wheels to prevent their freezing to the surface.

ENGINE SHUTDOWN

1. Normal engine shut down procedures apply.
2. If aircraft is to remain parked overnight, leave either of the pilot's compartment windows partially open to provide air circulation within the aircraft, otherwise windows may frost over on the inside of the aircraft.
3. Drain fuel and oil tank sumps and oil Y-drains to remove any water condensate before it freezes.
4. Remove any dirt and ice from the landing gear shock struts and actuator slide tubes.
5. Install any aircraft protective covering.
6. Approximately 30 minutes after engine shut-down, redrain fuel and oil tank sumps and oil Y-drains.

HOT WEATHER AND DESERT OPERATION

The main concern in hot weather and desert type climates is usually associated with aircraft ground operations. These difficulties are poor engine cooling, overheating of brakes, longer take-off and landing rolls (due to the less dense air), and the maintenance problems associated with blowing sand and dust and the general destructive effect of heat on the aircraft's systems. In addition to the normal procedures given in Section III, the following steps should be observed:

BEFORE ENTERING AIRCRAFT

1. Inspect landing gear shock struts, landing gear actuator slide tubes, and tires for cleanliness and/or proper inflation (landing gear actuator slide tubes for cleanliness). Use a dry cloth to remove sand and dust.
2. Carburetor air intake covers removed and any accumulations of dust and sand removed.
3. Check for fuel, oil and hydraulic fluid leaks.

ON ENTERING AIRCRAFT

1. Operate all movable flight control surfaces.
2. Clean any excessive dust accumulations on or around instrument dials, movable controls, or switches.

ENGINE WARM-UP AND GROUND TESTS

Keep engine ground operation time to a minimum. Complete all ground checks but accomplish this as rapidly as possible. Observe cylinder head and carburetor air temperatures. Do not exceed limits. If run-up area is dusty, make run-up so propeller wash is away from personnel, other aircraft, or ground installations.

TAKE-OFF

Take-off distances will be longer and acceleration will be slower. Observe the cylinder head temperatures and carburetor air temperatures closely in order to avoid exceeding limits.

CAUTION

Loss of power from detonation will probably occur if carburetor mixture temperature exceeds 15°C.

LANDING

Be alert for ground turbulence. The landing ground roll will be longer.

BEFORE LEAVING AIRCRAFT

1. Install wheel chocks and immediately release the brakes to prevent possible warping of the brake discs.
2. When engines have cooled, install protective covers.
3. If blowing sand or dust is not a hazard, leave windows and doors open to permit air circulation.

CAUTION

If the fuel tanks are to be completely filled, fuel expansion may cause fuel overflow thereby creating a fire hazard.

SECTION VII – COMMUNICATIONS PROCEDURES

GENERAL

Operation of communication equipment will be in accordance with the procedures outlined in SECTION I. Communications Procedures (Normal and Emergency) are outlined in Federal Aviation Regulations (FARs), Flight Information Publications (FLIP), ACP, JANAP and NWIP publications. Standard hand signals shall be utilized in accordance with NWP-41 series.

SECTION VIII – SPECIAL MISSIONS

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GENERAL MISSION

Specific missions for the C-45J series aircraft are many. Primarily the UC-45J aircraft is used for personnel transportation and maintaining pilot proficiency while the RC-45J aircraft is especially configured for aerial photography. The following Special Mission information and procedures are applicable only to RC-45J aircraft.

RC-45J CONFIGURATION

Special RC-45J aircraft photography equipment installations and changes to basic aircraft configuration are listed as follows:

NOTE

There are no provisions for either the nose fuel tank or nose baggage compartment. The A-19 camera viewfinder equipment is installed in this area.

1. P-1 Automatic Pilot System.
2. Standard Photographic equipment consisting of:
 a. A-19 Viewfinder.
 b. NR-1A Camera Mounts for support of a 6- or 12-inch focal length CA3-2 camera.
 c. Two camera doors and windows.
 d. Two camera intervalometers.
 e. Two electrical junction boxes.
 f. Control box for the CA3-2 Camera.
 g. Removable panel in the cabin door for taking oblique photographs.
3. Weight and Balance - Consult the specific weight and balance data handbook for individual aircraft.

NOTE

Individual aircraft weight varies between 6,600 and 6,800 pounds depending on the type of photographic equipment installed. Maximum gross weight for all RC-45J aircraft is 9,200 pounds for take-off, and 8,700 pounds for landing.

NORMAL AND EMERGENCY OPERATING PROCEDURES

Ground and flight operating procedures for both normal and emergency conditions are established in preceding sections. Refer to Section III for Normal Procedures, and to Section V for Emergency Procedures:

CREW REQUIREMENTS

A minimum of three and a maximum of five personnel comprise the crew for a normal photographic mission. Crewmember duties are as follows:

NOTE

Refer to Photographer's Mate 1 & C, NAVPERS 10 75.

1. Pilot:
 a. Fly the aircraft as directed by the photo navigator.
2. Photo Navigator:
 a. Plan the mission.
 b. Brief and direct the pilot to the appropriate area.
 c. Determine drift and interval.
 d. Determine true altitude and true heading for each run.
 e. Instruct the photo technician on the operation of the camera.
3. Photo Technician:
 a. Assist the photo navigator in planning the mission.
 b. Operate the camera as directed by the photo navigator.
 c. Open the camera bay doors as instructed by the pilot.
 d. Maintain a log of each exposure.
4. Additional Crewmembers:
 a. Act as lookouts.
 b. Assist the photo technician.

NOTE

The A-19 viewfinder is located in the copilot's instrument panel and is operated by a photo navigator; consequently all photographic missions are flown with one pilot.

VERTICAL PHOTOGRAPHY

1. The pilot climbs the aircraft to the assigned altitude, in the immediate area for the target, as briefed and directed by the photo navigator. The pilot gives permission to the photo technician to open the camera bay doors. Upon completion of this the pilot trims the aircraft for normal cruise.

2. A wind drift check is then performed as follows:
 a. The pilot maintains the desired compass heading for the predetermined flight line.
 b. The photo navigator, in the copilot's seat, will adjust the viewfinder and report, "Starting drift check." He will determine the drift and give the pilot a right or left correction until the aircraft is holding the correct flightpath over the ground.
 c. The photo navigator then reports, "Drift check complete" and requests time, heading, and altitude, which are given him by the pilot.

3. The pilot maneuvers the aircraft over the desired flight line, allowing sufficient distance for the photo navigator to make necessary corrections by use of the viewfinder. Corrections will be given in 20-, 10-, or 5-degree increments, depending on how far the aircraft is off the desired flight line. During these corrections, the pilot will smoothly bank the aircraft.

4. When the aircraft is on course and approaching the start of the flight line, the photo navigator will instruct the photo technician to turn the cameras ON. While the aircraft is on the the flight line, corrections will be given in no more than 3-degree increments, of which 9 degrees is the maximum. During these corrections, the pilot will smoothly skid the aircraft, keeping the wings level. Upon completion of the run, the photo technician will turn the cameras OFF, the photo navigator will report, "Wet run completed," and request heading, time, and altitude, which are recorded by the photo technician.

OBLIQUE PHOTOGRAPHY

1. Oblique photographs are taken with a hand-held camera through the afterhatch after taking out the removable panel. A variety of cameras may be used, the only limitation being the size and weight of the camera. The photographer takes one or a series of pictures at a 90-degree angle to the flightpath of the aircraft. The camera is held between the photographer's legs and operated manually as the target passes abeam the aircraft.

2. Pilot procedure for oblique photography is as follows:
 a. The pilot climbs to the assigned altitude, depending on the scale and type of oblique photography desired.
 b. The aircraft is slowed to 100 KIAS and permission is granted to open the removable panel of the afterhatch.
 c. The flaps are lowered to the 15-degree DOWN position to dispel heat waves from the exhaust stacks.
 d. The cowl flaps are opened to maintain the desired cylinder head temperature.
 e. An airspeed of between 100-110 KIAS is maintained.

Obliques are flown on any headings. No wind drift check is required. The pilot maneuvers the aircraft to a position so that the target passes abeam and to the port side of the aircraft. The distance abeam varies with the altitude and the desired scale of the photography. As a general rule, the distance abeam is such that the propeller hub of the port engine passes through the target. As the target approaches to 90-degree position, the pilot tells the cameraman, "Stand by, target coming up," at the same time skidding the aircraft approximately 10 degrees to starboard. This is done to clear the port wingtip from the camera sight and the resulting photograph. As the target passes directly abeam, the cameraman manually shoots the photograph.

SECTION IX – FLIGHT CREW COORDINATION

INTRODUCTION

To achieve the optimum in aircraft utilization, each member of the crew must be thoroughly familiar with NATOPS procedures and his duties and responsibilities pertaining to the aircraft and the mission in progress. This is especially true for emergency situations.

FLIGHT CREWMEMBER DUTIES

PILOT

1. Responsible for the aircraft, the particular mission, and crew performance.
2. Safe and proper aircraft operation.
3. Delegate individual crewmember responsibility for specific duties.
4. Inspect each crewmember's flight gear prior to flight.

COPILOT (UC-45J ONLY)

1. Accomplish all copilot duties assigned by pilot in command.

PHOTO NAVIGATOR (RC-45J ONLY)

1. Obtain mission weather.
2. Complete the flight and navigation planning.
3. Complete photographic equipment preflight checklist.
4. Navigate aircraft.
5. Operate the photographic system.
6. Supervise the photo technician.

PHOTO TECHNICIAN (RC-45J ONLY)

1. Assist the pilot and the photo navigator in all of their assigned duties.

SECTION X – NATOPS EVALUATION

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CONCEPT

The standard operating procedures prescribed in this manual represent the optimum method of operating C-45 aircraft. The NATOPS evaluation is intended to evaluate compliance with NATOPS precedures by observing the grading individuals and units. This evaluation is tailored for compatibility with various operational commitments and missions of both Navy and Marine Corps units. The prime objective of the NATOPS evaluation program is to assist the unit commanding officer in improving unit readiness and safety through constructive comment. Maximum benefit from the NATOPS evaluation program is achieved only through the vigorous support of the program by commanding officers as well as the flight crewmembers.

IMPLEMENTATION

The NATOPS evaluation program shall be carried out in every unit operating naval aircraft. The various categories of flight crewmembers desiring to attain or retain qualification in the C-45 shall be evaluated in accordance with OPNAVINST 3510.9 series. Individual NATOPS evaluations will be conducted annually; however, instruction in and observation of adherence to NATOPS procedures must be on a daily basis within each unit to obtain maximum benefits from the program. The NATOPS coordinators, evaluators, and instructors shall administer the program as outlined in OPNAVINST 3510.9 series. Evaluees who receive a grade of unqualified on a ground or flight evaluation shall be allowed 30 days in which to complete a reevaluation. A maximum of 60 days may elapse between the date the initial ground evaluation was commenced and the date the evaluation flight is satisfactorily completed.

DEFINITIONS

The following terms, used throughout this section, are defined as to their specific meaning within the NATOPS program.

NATOPS EVALUATION

A periodic evaluation of individual flight crewmember standardization consisting of an open book examination, a closed book examination, an oral examination, and a flight evaluation.

NATOPS REEVALUATION

A partial NATOPS evaluation administered to a flight crewmember who has been placed in an unqualified status by receiving a grade of unqualified for any of his ground examination or the evaluation flight. Only those areas in which an unsatisfactory level was noted need be observed during a reevaluation.

QUALIFIED

That degree of standardization demonstrated by a very reliable flight crewmember who has a good knowledge of standard operating procedures and a thorough understanding of aircraft capabilities and limitations.

CONDITIONALLY QUALIFIED

That degree of standardization demonstrated by a flight crewmember who meets the minimum acceptable standards. He is considered safe enough to fly as a pilot in command or to perform normal duties without supervision but more practice is needed to become qualified.

UNQUALIFIED

That degree of standardization demonstrated by a flight crewmember who fails to meet minimum acceptable criteria. He should receive supervised instruction until he has achieved a grade of qualified or conditionally qualified.

AREA

A routine of preflight, flight, or postflight.

SUBAREA

A performance subdivision within an area, which is observed and evaluated during an evaluation flight.

CRITICAL AREA

Any area or subarea which covers items of significant importance to the overall mission requirements, the marginal performance of which would jeopardize safe conduct of the flight.

EMERGENCY

An aircraft component or system failure or condition which requires instantaneous recognition, analysis, and proper action.

MALFUNCTION

An aircraft component or system failure or condition which requires recognition and analysis, but which permits more deliberate action than that required for an emergency.

GROUND EVALUATION

Prior to commencing the flight evaluation, an evaluee must achieve a minimum grade of qualified on the open book and closed book examinations. The oral examination is also part of the ground evaluation but may be conducted as part of the flight evaluation. To assure a degree of standardization between units, the NATOPS instructors may use the bank of questions contained in this section in preparing portions of the written examinations. Each individual examination phase shall contain questions representative of all applicable areas of the NATOPS Flight Manual.

OPEN BOOK EXAMINATION

The number of questions on the examination will consist of 20 questions for all flight crewmembers. The purpose of the open book portion of the written examination is to evaluate the crewmember's knowledge of appropriate publications and of the aircraft. Maximum time for this examination should not exceed 1.25 hours.

CLOSED BOOK EXAMINATION

The closed book examination shall include questions covering the NATOPS Flight Manual. The examination will consist of 40 questions for pilots and all other crewmembers. There is no specified time limit for this examination.

ORAL EXAMINATION

The questions may be taken from this manual and drawn from the experience of the instructor-evaluator. Such questions should be direct and positive and should in no way be opinionative.

GRADING INSTRUCTIONS

Examination grades shall be computed on a 4.0 scale and converted to an adjectival grade of qualified or unqualified.

OPEN BOOK EXAMINATION

To obtain a grade of qualified, an evaluee must obtain a minimum score of 3.5

CLOSED BOOK EXAMINATION

To obtain a grade of qualified, an evaluee must obtain a minimum score of 3.3.

ORAL EXAMINATION AND OFT PROCEDURE CHECK. (If conducted).

a grade of qualified or unqualified shall be assigned by the instructor/evaluator.

FLIGHT EVALUATION

The number of flights required to complete the evaluation flight should be kept to a minimum, normally one flight. The areas and subareas to be observed and graded on an evaluation flight are outlined in the grading criteria with critical areas marked by an asterisk (*). Subarea grades will be assigned in accordance with the grading criteria. These subareas shall be combined to arrive at the overall grade for the flight. Area grades, if desired, shall also be determined in this manner.

FLIGHT EVALUATION GRADING CRITERIA

Only those subareas provided or required will be graded. The grades assigned for a subarea shall be determined by comparing the degree of adherence to standard operating procedures with adjectival ratings listed below. Momentary deviations from standard operating procedures should not be considered as unqualifying provided such deviations do not jeopardize flight safety and the evaluee applies prompt corrective action.

QUALIFIED

Well standardized; evaluee demonstrated highly professional knowledge of and compliance with NATOPS standards and procedures; momentary deviations from or minor omissions in non-critical areas are permitted if prompt and timely remedial action is initiated by the evaluee.

CONDITIONALLY QUALIFIED

Satisfactorily standardized; one or more significant deviations from NATOPS standards and procedures, but no errors in critical areas and no errors jeopardizing mission accomplishment or flight safety.

UNQUALIFIED

Not acceptably standardized; evaluee fails to meet minimum standards regarding knowledge of and/or ability to apply NATOPS procedures; one or more significant deviations from NATOPS standards and procedures which could jeopardize mission accomplishment of flight safety.

FLIGHT EVALUATION GRADE DETERMINATION

The following procedure shall be used in determining the flight evaluation grade: A grade of unqualified in any critical area will result in an overall grade of unqualified for the flight. Otherwise, flight evaluation (or area) grades shall be determined by assigning the following numerical equivalents to the adjective grade for each subarea. Only the numerals 0, 2, or 4 will be assigned in subareas. No interpolation is allowed.

Unqualified	0.0
Conditionally Qualified	2.0
Qualified	4.0

To determine the numerical grade for each area and the overall grade for the flight, add all the points assigned to the subareas and divide this sum by the number of subareas graded. The adjective grade shall then be determined on the basis of the following scale.

0.0 to 2.19 Unqualified
2.2 to 2.99 Conditionally Qualified
3.0 to 4.0 Qualified

EXAMPLE: (Add subarea numerical equivalents) $(4 + 2 + 4 + 2 + 4)/5 = 16/5 = 3.20$ - qualified.

FINAL GRADE DETERMINATION

The final NATOPS evaluation grade shall be the same as the grade assigned to the evaluation flight. An evaluee who receives an unqualified on any ground examination or the flight evaluation shall be placed in an unqualified status until he achieves a grade of conditionally qualified or qualified on a reevaluation.

RECORDS AND REPORTS

A NATOPS evaluation Report (OPNAV Form 3510-8) shall be completed for each evaluation and forwarded to the evaluee's commanding officer.

This report shall be filed in the individual flight training record and retained therein for 18 months. In addition, any entry shall be made in the pilot/NFO flight log book under "Qualifications and Achievements" as follows:

QUALIFICATION			DATE	SIGNATURE	
NATOPS EVAL	Aircraft Model	Crew Position	Date	Authenticating Signature	Unit which Administered Eval

In the case of enlisted crewmembers, an entry shall be made in "Administrative Remarks" of his Personal Record upon satisfactory completion of the NATOPS evaluation as follows:

(Date) Completed a NATOPS evaluation in (aircraft designation) as (flight crew position) with an overall grade of (qualified or conditionally qualified).

NATOPS EVALUATION WORKSHEETS

In addition to the NATOPS Evaluation Report, a NATOPS Flight Evaluation Worksheet is provided for use by the evaluator-instructor during the evaluation flight. All of the flight areas and subareas are listed on the worksheet with space allowed for related notes.

NATOPS EVALUATION QUESTION BANK

(To be incorporated at a later date)

NATOPS EVALUATION REPORT
OPNAV FORM 3510-8 (8-65) 0107-723-0000

NAME (Last, first initial)	GRADE	SERVICE NUMBER

SQUADRON/UNIT	AIRCRAFT MODEL	CREW POSITION
TOTAL PILOT/FLIGHT HOURS	TOTAL HOURS IN MODEL	DATE OF LAST EVALUATION

NATOPS EVALUATION

REQUIREMENT	DATE COMPLETED	GRADE		
		Q	CQ	U
OPEN BOOK EXAMINATION				
CLOSED BOOK EXAMINATION				
ORAL EXAMINATION				
*EVALUATION FLIGHT				

FLIGHT DURATION	AIRCRAFT BUNO	OVERALL FINAL GRADE

REMARKS OF EVALUATOR/INSTRUCTOR

☐ CHECK IF CONTINUED ON REVERSE SIDE

GRADE, NAME OF EVALUATOR/INSTRUCTOR	SIGNATURE	DATE
GRADE, NAME OF EVALUEE	SIGNATURE	DATE

REMARKS OF UNIT COMMANDER

RANK, NAME OF UNIT COMMANDER	SIGNATURE	DATE

*WST, OFT, COT, or cockpit check in accordance with OPNAVINST 3510.9 (effective edition)

VT PILOT NATOPS EVALUATION WORKSHEET

OPNAV FORM 3510/10 (11/65)

Asterisk (*) denotes a critical area

NAME	GRADE	SERVICE NUMBER
SQUADRON/UNIT	AIRCRAFT MODEL	PILOT
TOTAL PILOT HOURS	TOTAL HOURS IN MODEL	DATE OF LAST EVALUATION

NATOPS EVALUATION

REQUIREMENT	DATE COMPLETED	GRADE		
		Q	CQ	U
OPEN BOOK EXAMINATION				
CLOSED BOOK EXAMINATION				
ORAL EXAMINATION				
FLIGHT EVALUATION				

FLIGHT DURATION	AIRCRAFT BUNO	OVERALL FINAL GRADE
GRADE NAME OF EVALUATOR/INSTRUCTOR		DATE

REMARKS

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OPNAV FORM 3510/10 (11/65)

Asterisk (*) denotes a critical area

1. MISSION PLANNING		ADJECTIVE AREA GRADE				REMARKS
SUB-AREAS		Q	CQ	U	POINTS	
A. PERSONAL FLYING EQUIP.						
B. FLIGHT PREPARATION						
*C. CREW/PASSENGER BRIEFING						
*D. AIRCRAFT TAKEOFF DATA						
NUMERICAL AREA GRADE		TOTAL POINTS				
2. PREFLIGHT		ADJECTIVE AREA GRADE				
SUB-AREAS		Q	CQ	U	POINTS	
A. AIRCRAFT INSPECTION						
B. CHECKLISTS						
NUMERICAL AREA GRADE		TOTAL POINTS				
3. PRE-TAKEOFF		ADJECTIVE AREA GRADE				
SUB-AREAS		Q	CQ	U	POINTS	
A. START						
B. CHECKLISTS						
C. TAXI						
*D. ENGINE RUNUP						
NUMERICAL AREA GRADE		TOTAL POINTS				
4. TAKEOFF		ADJECTIVE AREA GRADE				
SUB-AREAS		Q	CQ	U	POINTS	
*A. TAKEOFF PROCEDURES						
*B. TRANSITION						
NUMERICAL AREA GRADE		TOTAL POINTS				

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OPNAV FORM 3510/10 (11/65)

Asterisk (*) denotes critical area

5. BASIC AIRWORK	ADJECTIVE AREA GRADE				REMARKS
SUB-AREAS	Q	CQ	U	POINTS	
A.					
B.					
C.					
D.					
NUMERICAL AREA GRADE		TOTAL POINTS			

*6. EMERGENCIES	ADJECTIVE AREA GRADE			
SUB-AREAS	Q	CQ	U	POINTS
*A. ENGINE FAILURE				
*B. FIRE INFLIGHT				
*C. SYSTEM FAILURE				
NUMERICAL AREA GRADE		TOTAL POINTS		

7. INSTRUMENT PROCEDURES	ADJECTIVE AREA GRADE			
SUB-AREAS	Q	CQ	U	POINTS
A. HOLDING				
B. APPROACH/PENETRATION				
C. PRECISION RADAR APPROACH				
NUMERICAL AREA GRADE		TOTAL POINTS		

8. LANDING	ADJECTIVE AREA GRADE			
SUB-AREAS	Q	CQ	U	POINTS
*A. CHECKLISTS				
*B. DESCENT				
*C. PATTERN				
*D. LANDING AND ROLLOUT				
NUMERICAL AREA GRADE		TOTAL POINTS		

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OPNAV FORM 3510/10 (11/65)

Asterisk (*) denotes a critical area

9. POSTFLIGHT	ADJECTIVE AREA GRADE			
SUB-AREAS	O	CQ	U	POINTS
A. ENGINE SHUTDOWN				
B. CHECKLIST (NA TO JETS)				
C. POSTFLIGHT INSPECTION				
D. MISSION DEBRIEF				
NUMERICAL AREA GRADE		TOTAL POINTS		

A. TOTAL ALL SUB-AREA POINTS	
B. TOTAL NO. SUB-AREAS GRADED	
C. FLT. EVAL. NUMERICAL GRADE $\frac{A}{B}$	
**EVALUATION ADJECTIVE GRADE	

***See OPNAVINST 3510.9 Series*

REMARKS

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SECTION XI – PERFORMANCE DATA

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INTRODUCTION

This section provides aircraft performance data which will facilitate mission planning and enable the pilot to determine the performance capabilities of the aircraft.

AIRCRAFT CONFIGURATIONS

The performance data in this Section is applicable to both the UC-45J and RC-45J configured C-45J series aircraft within the maximum gross weight limitation of 8,700 pounds established in the following charts. Maximum gross weights for the UC-45J are 8,730 pounds for take-off, and 8,600 pounds for landing; for the RC-45J, 9,200 pounds for take-off, and 8,700 pounds for landing.

FLIGHT PLANNING

The series of charts on the following pages (figures 11-1 thru 11-8) provide the information required to establish the speeds and powers for obtaining various ranges. These charts contain sufficient data to make a safe and efficient flight plan. Inasmuch as the number of variables involved makes accurate range predictions impossible, the ranges and fuel flows are conservative. The speeds quoted on any one chart are those obtained with gross weight equal to the high limit of the weight band shown on the chart. This policy has been followed to allow for variations in aircraft speeds, fuel flows, pilot technique, and other variables not considered in the preparation of the charts. No allowances have been made for wind, navigational error, combat or formation flight or other contingencies. Appropriate allowances for these items should be governed by local policy.

The charts are arranged to give maximum utility for preflight and inflight planning. The following will be noted on inspection:

1. The climb chart, figure 11-4, gives fuel requirements for warm-up, take-off, and climb to any altitude for three typical weights. The fuel tabulated on the column labelled "At Sea Level" shows the allowance for warm-up, taxi, and take-off. Fuel requirements

listed at other altitudes include this allowance plus the fuel required to climb from sea level. If it is desired to determine the fuel necessary to climb from 5,000 feet to 10,000 feet, the difference of the fuel at these two altitudes will be the climb fuel necessary.

2. The Flight Operation Instruction Charts, figure 11-5 , figure 11-6, and figure 11-7, provide the following information.

a. Weight listings in approximately 1000-pound increments for maximum gross weight to minimum possible flying weight.

b. Maximum to minimum practical fuel loadings are entered on each chart under the fuel column.

c. Data listed under Column I are for emergency high speed only. Columns II, III, IV, and V give progressive increases in range with a sacrifice in speed.

d. Ranges shown on the chart are based on fuel flows obtained by resetting power as gross weight decreases to a lower weight bracket shown on succeeding charts. It is essential, therefore, that this practice be adhered to in flight.

USE OF CHARTS

The following sample problem, based on a typical UC-45J Mission (also applicable to RC-45J aircraft, relative to performance, when the aircraft is within the 8,700 pound chart limits) employs actual chart values and demonstrates how the charts should be used.

Problem -- Two passengers and some cargo are to be flown to an airfield 640 nautical miles from base. The first 400 nautical miles must be flown above 3000 feet altitude and the balance above 8000 feet altitude. The following conditions apply:

Required Range	640 nautical miles
Winds	5 knots tailwind at 5000 ft.
	15 knots headwind at 10,000 ft.
Basic Weight (from Form F)	6320 lb.
Crew Weight (2 men at 180 lb/man)	360 lb.
Passengers (2 men at 180 lb/man)	360 lb.
Cargo	60 lb.
Gasoline Weight (253 gal at 6.0 lb/gal)	1518 lb.
Oil Weight (16 gal at 7.5 lb/gal)	120 lb.
Total Weight	8738 lb.
Maximum Allowable Gross Weight	8730 lb.

The calculated gross weight of 8738 pounds slightly exceeds the maximum allowable gross weight of 8730 pounds. A careful estimate shows that the distance can easily be covered using only 240 gallons of fuel. Recomputing the fuel weight shows that 240 x 6 = 1440 pounds, giving a gross weight of 8660 pounds.

FLIGHT PLAN CALCULATION

1. The first 400 nautical miles will be flown at 5000 feet altitude to take advantage of the tailwind and the balance at 10,000 feet due to terrain considerations.

2. Determine the fuel available for flight planning by deducting the necessary fuel allowances and reserve from the actual fuel aboard as follows:

a. Warm-up, take-off, and climb to 5000 feet - 23 gallons.

b. Climb from 5000 to 10,000 feet - 7 gallons. These figures were taken from the Climb Chart, figure 11-4. It will be noted that the fuel quoted at 5000 feet altitude includes fuel used for warm-up and take-off (15 gallons allowed). The fuel consumed in a climb from 5000 to 10,000 feet is calculated by subtracting the fuel quoted at 5000 feet from the fuel quoted at 10,000 feet for a gross weight of 7800 pounds. This gross weight is determined by considering that 23 gallons of fuel were used to reach 5,000 feet (Step I), plus that used to fly 400 miles. Assume a fuel consumption of 3.69 mi/gal (see Column IV of the 8700 to 8,000 pound Flight Operation Instruction Chart, figure 11-5) giving 108 gallons burned while cruising. Total fuel used to climb position is 108 + 23 = 131 gallons. Converting to pounds, 131 x 6 = 786 pounds. Therefore, the gross weight at start of climb to 10,000 feet is 8660 - 786 = 7874 pounds, which is close enough to 7800 pounds to allow use of data listed for that weight. The distances covered in climb are disregarded. The field elevation at starting point also is disregarded unless greater than 5000 feet.

c. Wind reserve - 8 gallons. Normally, tailwinds are treated as no-wind conditions for range planning. The reserve for the 15 knots headwind over the last 240 n/mi of flight may be based on good judgment or approximated as follows:

(1) Assuming the flight will be made at an approximate TAS of 125 knots, the ground speed will be 125 - 15 = 110 knots and the time required to fly 240 nautical miles will be 2.2 hours. The wind will increase the air miles flown by 2.2 x 15 = 33 miles. Assuming approximately 4.13 mpg (see Column IV of the 8000 to 7000 pound Flight Operation Instruction Chart, figure 11-6, the required wind reserve is 33 ÷ 4.13 = 8 gallons.

d. One hour endurance reserve - 22 gallons. This value is calculated by multiplying the rate of fuel consumption under Column V (maximum range) at 5000 feet (8000 to 7000 lb chart) by the number of hours reserve desired or 1 hour 22 gph = 22 gallons.

3. Collect all required fuel allowances:

	Gallons
Warm-up, take-off and climb to 5000 feet	23
Climb from 5000 to 10,000 feet	7
Wind	8
Reserve	22
Total:	60

4. Therefore, the actual fuel available for cruising is 240 - 60 = 180 gallons. Reference to the 8700 to 8000 pound Flight Operation Instruction Chart shows that the required flight of 640 nautical miles can be flown with 180 gallons of fuel with the power settings shown in Columns IV or V.

Since the weight change during the flight will span several charts, it is necessary to divide the problem into several parts. THIS IS ESSENTIAL, SINCE CHART DATA IS COMPUTED ON THIS BASIS. A simple tabulation of data will assist in the calculation and provide a useful reference in flight. This problem will be divided into six parts or stages as follows:

A. WARM-UP, TAKE-OFF, AND INITIAL CLIMB:

Stage	Reference	Initial Weight	Fuel Gal	Condition (ft)	Power Settings	Fuel Con-sumption	ETE	Dist (Naut. miles)	TAS (Knots)	Fuel Used (gal)
1	Fig. 11-4 Climb 5000 ft.	8660	240	Climb	33 in. MAP 2200 RPM FR		5 min.		103	23

Note: Entries whose derivation may not be clear are explained as follows:

Fuel - as previously discussed.

Power settings and fuel used - read directly from chart. The power settings in climb are maximum continuous. However, for greater engine life and lower fuel consumption, it is advisable to use 30 inch Hg and 2000 rpm. Fuel used includes 15 gallons for warm-up and take-off. The time and distance covered in climb are considered negligible.

B. CRUISING AT 5000 FEET WITH GROSS WEIGHT DECREASING FROM 8522 to 8000 LB:

Stage	Reference	Initial Weight (lb)	Fuel Gal	Condition (ft)	Power Settings	Fuel Con-sumption	ETE	Dist (Naut. miles)	TAS (Knots)	Fuel Used (gal)
2	Fig. 11-5 Sheet 1 Column IV 5000 ft	8522	217	Cruise at	24 in. MAP 1800 RPM ML	36 gph	2+24	315	131	87

Note: The length of stage 2 is determined by the required time for the gross weight to become 8000 lb (the low limit of the first chart).

Fuel - 23 gallons of the initial 240 gallons of fuel were used on stage 1, leaving 217 gallons at start of stage 2.

Weight - In using 23 gallons fuel in stage 1, the weight becomes 8660-138=8522 lb. (Weight of fuel is 6 lb/gal.)

Fuel used - Calculated by dividing the gross weight change by 6 lb/gal, i.e., $\frac{8522-8000}{6}$=87 gal.

Consumption and power settings - read directly from chart.

ETE - computed by dividing fuel used by consumption i.e., $\frac{87}{36}$=2.4 hrs=2+24.

Distance - TAS plus or minus wind multiplied by ETE, i.e., (131-0) X 2.4=315 nautical miles. (Normally, tail winds are neglected.)

C. CRUISING 5000 FEET TO POINT OF CLIMB. CRUISING CONDITION IN 8000 TO 7000 GROSS WEIGHT RANGE:

Stage	Reference	Initial Weight (lb)	Fuel Gal	Condition (ft)	Power Settings	Fuel Con-sumption	ETE	Dist (Naut. miles)	TAS (Knots)	Fuel Used (gal)
3	Fig. 11-6 Sheet 2 Column IV 5000 ft	8000	130	Cruise at 5000	22.5 in. MAP 1800 RPM ML	31 gph	0+40	85	128	21

Note: Computed to climbing position 400 nautical miles from starting point.
Weight - established in computing stage 2.
Distance - miles remaining to the predetermined climb point.
ETE - distance divided by estimated ground speed, i.e., $\frac{85}{128}$ =.66 hours=0+40.

Fuel used - multiply ETE by fuel consumption, .66X31=21 gal.

D. CLIMB FROM 5000 TO 10,000 FEET DUE TO TERRAIN:

Stage	Reference	Initial Weight (lb)	Fuel Gal	Condition (ft)	Power Settings	Fuel Consumption	ETE	Dist (Naut. miles)	TAS (Knots)	Fuel Used (gal)
4	Fig. 11-4 Climb 7800 lb 5000 ft to 10,000 ft	7874	109	Climb 5000 to 10,000	Full Throttle 2200 RPM FR				102	7

Note: The fuel used in climb from 5000 feet to 10,000 feet is the difference in fuel used listed for 7800 lb weight on the climb chart at 5000 feet and 10,000 feet, i. e., 29-22=7 gal. The time and distance are disregarded in this instance. As stated in the note following stage 1, more conservative power settings are recommended for greater engine life and lower fuel consumption.

E. CRUISE AT 10,000 FEET FROM CLIMBING POINT TO DESTINATION:

Stage	Reference	Initial Weight (lb)	Fuel Gal	Condition (ft)	Power Settings	Fuel Consumption	ETE	Dist (Naut. miles)	TAS (Knots)	Fuel Used (gal)
5	Fig. 11-6 Sheet 2 Column IV 10,000 ft	7832	102	Cruising 10,000	19.5 in. MAP 1800 RPM ML	29 gph	2+15	240	122	65

Note: Ground speed is true airspeed less the effective head wind or 122-15=107 knots. The calculated fuel remaining is 102-65=37 gallons. The original reserve was 22 gallons so an excess of 37-22=15 gallons above requirements is available.

F. CONDITION OF AIRCRAFT FOR LANDING:

Stage	Reference	Initial Weight (lb)	Fuel Gal	Condition (ft)	Power Settings	Fuel Consumption	ETE	Dist (Naut. miles)	TAS (Knots)	Fuel Used (gal)
6	Fig. 11-4 Landing	7442	37	Landing	2000 RPM FR throttles as required					

NOTE: Check weight and balance of airplane for landing. In this problem, assuming that weight change is due solely to depletion of fuel, the balance index has decreased approximately 3.7. Refer to landing chart 11-4 to check landing distance.

To illustrate the value of cruise control, the same flight will be used in another example. This time the airplane will land at an intermediate field and refuel. The refueling field is 400 nautical miles from the point of departure and 60 nautical miles out of the way, making the total distance 700 miles. If the pilot flies to refueling point at 5000 feet altitude using 29 inches MAP and 2000 RPM, he will have a TAS of 166 knots and burn 61 gph (reference: figure 11-5, Sheet 1, Column II, 5000 feet). Time en route for 400 miles is 2 + 24 and fuel required is 145 gallons. After landing and refueling (estimated time on ground is 30 minutes), the pilot climbs to 10,000 feet using 33 gallons of fuel (refer to Climb Chart, figure 11-4 weight 8700 lbs., 10,000 feet) to clear terrain. The last 300 miles of the trip are flown at full throttle and 2000 rpm, using 62 gph at 169 knots TAS (144 knots ground speed) in 1/57. On this leg 120 gallons of fuel were burned. The total time required for this flight is 5 + 07 and a total of 321 gallons of fuel was used. In comparison, 203 gallons of fuel and 5 1/2 hours were required for the first example. For a 7 per cent saving in time, 58 per cent more fuel was expended, plus increased engine wear!

Upon completion of a flight, a comparison should be made between the actual and computed data. This will provide a better idea of the margin of safety afforded by the charts and will facilitate more accurate planning on future missions.

The life of an engine is proportional to power drawn out of it. An engine might be thought of as having a set number of power-hours before requiring an overhaul. These power-hours can be used up in a short time by needless high power operation or they can be stretched by reducing the percentage of rated output used continuously. TAKE CARE OF THE ENGINES.

AIRSPEED INSTALLATION CORRECTION TABLE

MODEL(S): UC-45J/RC-45J

ENGINE(S): (2) PRATT AND WHITNEY
R985-AN-14B

ADD CORRECTION TO INSTRUMENT
READING TO OBTAIN CAS

IAS (KNOTS)	CORRECTION (KNOTS)	IAS (KNOTS)	CORRECTION (KNOTS)
60	60 + 16	130	130 + 4
70	70 + 13	140	140 + 3
80	80 + 11	150	150 + 2
90	90 + 9	160	160 + 1
100	100 + 7	170	170 + 1
110	110 + 6	180	180 + 0
120	120 + 5		

Figure 11-1 Airspeed Correction

ENGINE POWER SCHEDULE CHART

AIRCRAFT MODEL (S)	PROPELLER (S)	ENGINE MODEL (S)
UC-45J AND RC-45J		R985-AN-14B

GAUGE READING	FUEL PRESS.	OIL PRESS.	OIL TEMP.
DESIRED MAXIMUM	3.5-4.0 4.0	70-90 100	60-75 90
MINIMUM IDLING	2.0	50	40

MINIMUM RECOMMENDED CRUISE RPM: 1500

OIL GRADE: (S) W-120 (W) 1100

FUEL GRADE: 115/145 (4)

WAR EMERGENCY (COMBAT EMERGENCY)			MILITARY POWER (NON-COMBAT EMERGENCY)			OPERATING CONDITION			NORMAL RATED (MAXIMUM CONTINUOUS)			MAXIMUM CRUISE (NORMAL OPERATION)		
MINUTES			5 MINUTES 260°C			TIME LIMIT MAX. CYL. HD. TEMP.			UNLIMITED 232°C			UNLIMITED 232°C		
			FULL RICH 2300			MIXTURE R. P. M.			FULL RICH 2200			MANUAL LEAN (4) 2000		
MANIF. PRESS.	SUPER-CHARGER	FUEL(1) GAL/MIN	MANIF. PRESS.	SUPER-CHARGER	FUEL(1) GAL/MIN	STD. TEMP. °C	PRESSURE ALTITUDE	STD. TEMP. °F	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH(2)	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH
						−55.0	40,000 FT.	−67.0						
						−55.0	38,000 FT.	−67.0						
						−55.0	36,000 FT.	−67.0						
						−52.4	34,000 FT.	−62.3						
						−48.4	32,000 FT.	−55.1						
						−44.4	30,000 FT.	−48.0						
						−40.5	28,000 FT.	−40.9						
						−36.5	26,000 FT.	−33.7						
						−32.5	24,000 FT.	−26.5						
						−28.6	22,000 FT.	−19.4						
						−24.6	20,000 FT.	−12.3						
						−20.7	18,000 FT.	−5.2						
			F.T.		.64	−16.7	16,000 FT.	2.0	F.T.		38	F.T.		25
			F.T.		.68	−12.7	14,000 FT.	9.1	F.T.		39	F.T.		26
			F.T.		.72	−8.8	12,000 FT.	16.2	F.T.		40	F.T.		29
			F.T.		.76	−4.8	10,000 FT.	23.4	F.T.		44	F.T.		31
			F.T.		.80	−0.8	8,000 FT.	30.5	F.T.		46	27.5		32
			F.T.		.85	3.1	6,000 FT.	37.6	F.T.		47	28.5		31
			F.T.		.90	7.1	4,000 FT.	44.7	33.5		48	29.0		30
			36.5		1.0	11.0	2,000 FT.	51.8	34.0		49	29.5		29
			37.0		1.0	15.0	SEA LEVEL	59.0	35.0		48	30.5		28

GENERAL NOTES

(1) Gal/Min: Approximate U. S. Gallon per MINUTE per Engine

(2) GPH: Approximate U. S. Gallon per Hour PER ENGINE.
F.T. Means Full Throttle operation.

For complete cruising data, see Flight Operation Instruction Charts.

TAKE-OFF CONDITIONS:

37.0 in. Hg., 2300 RPM Full Rich for 5 minutes

CONDITIONS TO AVOID: None

Lean each engine individually and separately.
Do not lean engines simultaneously.

SPECIAL NOTES

(3)

To lean engines proceed as follows:

1. Adjust both throttles to desired cruise settings, synchronize the propellers, and note the cylinder head temperatures.
2. Lean one engine at a time by retarding the mixture lever in small increments until a slight engine roughness is noted; immediately move the mixture control forward (RICH) until the engine is again operating smoothly and synchronization is regained.
3. Monitor cylinder head temperatures and do not exceed the maximum continuous temperature of 232°C.
4. Repeat procedure for other engine.
5. The mixtures must be placed in full RICH and the engines re-leaned whenever any of the following changes occur:
   a. Upon commencing a climb or descent (mixture RICH until desired altitude is reached).
   b. A change in throttle or RPM setting.
   c. A change in manifold heat setting.

(4)

These engines may also be operated on 91/96 or 100/130 grade fuel as an acceptable alternate.

Data as of December, 1950, based on Flight Test

Figure 11-2 Engine Power Schedule Chart

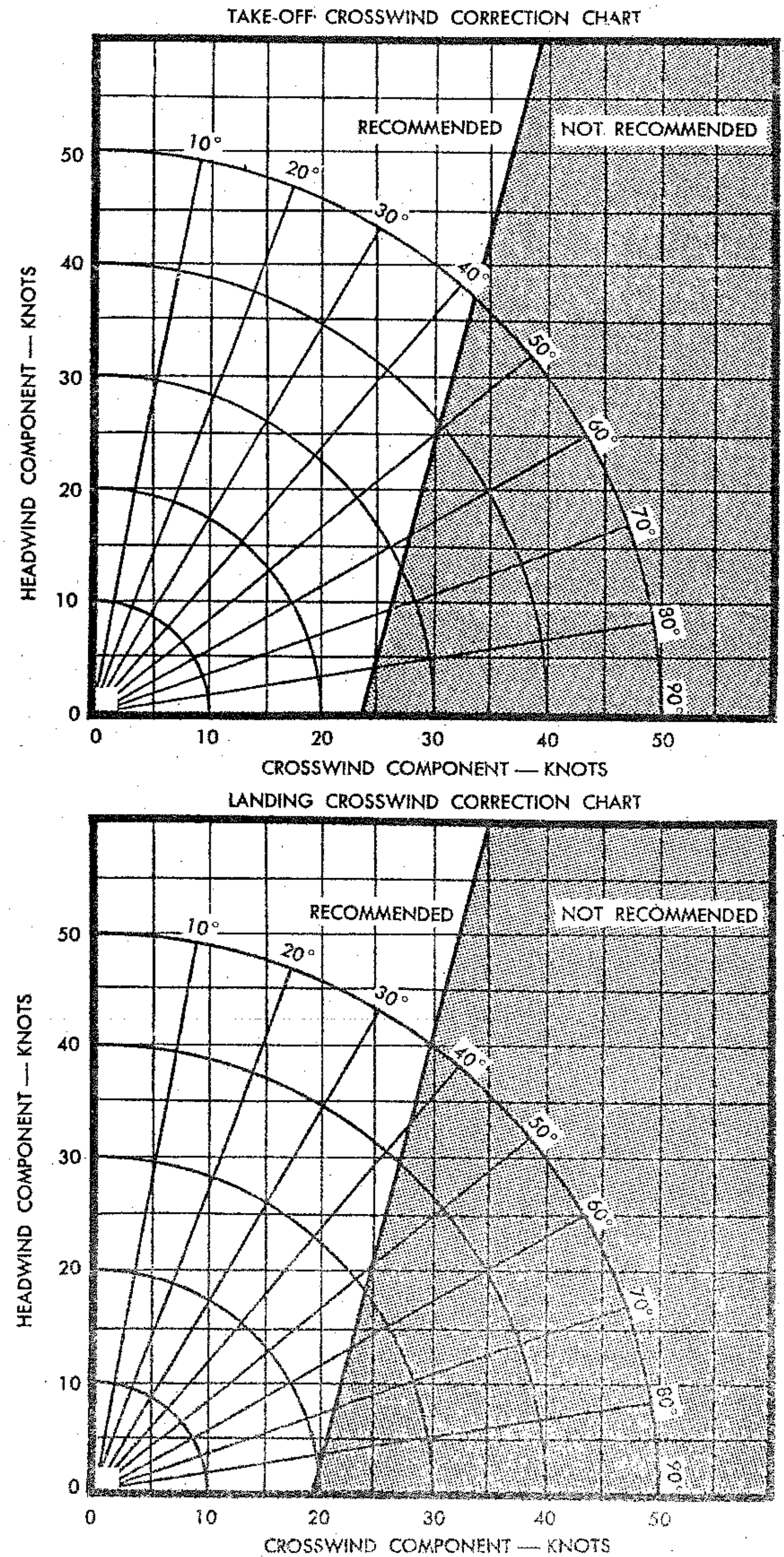

Figure 11-3 Take-Off and Landing Cross-Wind Chart

AIRCRAFT MODEL (S)
UC-45J AND RC-45J

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL (S)
R-985-AN-14B

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	M.P.H.	KTS.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
8700	0	0	1240	1850	1400	2050	1650	2390												
	17	15	830	1310	940	1450	1100	1680												
	34	30	600	940	670	1040	790	1200												
	51	45	450	650	500	730	600	840												
7800	0	0	910	1370	1020	1520	1210	1770												
	17	15	600	960	670	1050	800	1230												
	34	30	430	680	480	750	570	870												
	51	45	320	460	360	510	420	600												
7200	0	0	750	1090	840	1210	990	1410												
	17	15	480	750	540	830	640	960												
	34	30	340	520	380	580	450	670												
	51	45	260	350	290	390	340	460												

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%
DATA AS OF 8-15-46 BASED ON: Flight Test

OPTIMUM TAKE-OFF WITH 2300 RPM, 37 IN. HG. & 11 DEG. FLAP IS 80% OF CHART VALUES

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL				AT 5000 FEET					AT 10,000 FEET					AT 15,000 FEET					AT FEET					AT FEET				
	BEST I.A.S.		RATE OF CLIMB	GAL. OF FUEL	BEST I.A.S.		RATE OF CLIMB	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB	FROM SEA LEVEL	
	MPH	KTS	F.P.M.	USED	MPH	KTS	F.P.M.	TIME MIN.	FUEL USED	MPH	KTS	F.P.M.	TIME MIN.	FUEL USED	MPH	KTS	F.P.M.	TIME MIN.	FUEL USED	MPH	KTS	F.P.M.	TIME MIN.	FUEL USED	MPH	KTS	F.P.M.	TIME MIN.	FUEL USED
8700	118	103	950	15.0	118	103	1050	5.0	23	114	99	720	11.0	33	109	95	420	20.0	45										
7800	118	103	1200	15.0	118	103	1260	4.0	22	114	99	900	8.5	29	109	95	560	16.0	39										
7200	118	103	1350	15.0	118	103	1400	3.5	20	114	99	1050	7.5	26	109	95	670	13.5	35										

POWER PLANT SETTINGS: (DETAILS ON FIG. A-3, Appendix III)
DATA AS OF 8-15-46 BASED ON: Flight Test

Use 2300 RPM Max. 33 In. Hg (F.T. above 5000 feet) and Mixture Full Rich
FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH				HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
	POWER OFF		POWER ON		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	MPH	KTS	MPH	KTS	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.
8700	120	104			1400	1950	1530	2080	1670	2220												
7800	110	96			1270	1800	1390	1930	1520	2090												

OPTIMUM LANDING IS 80% OF CHART VALUES

DATA AS OF 8-15-46 BASED ON: Flight Test

REMARKS:

NOTE: TO DETERMINE FUEL CONSUMPTION
IN BRITISH IMPERIAL GALLONS,
MULTIPLY BY 10, THEN DIVIDE BY 12

LEGEND

IAS : Indicated Airspeed
MPH : Miles per Hour
KTS : Knots
FPM : Feet per Minute

Figure 11-4 Take-Off and Landing Data Chart

AIRCRAFT MODEL (S) UC-45J AND RC-45J	**FLIGHT OPERATION INSTRUCTION**	EXTERNAL LOAD ITEMS NONE
ENGINE (S) R-985-AN-14B	CHART WEIGHT LIMITS: 8700 TO 8000 POUNDS	NUMBER OF ENGINES OPERATING: TWO

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.[1] Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT.) read rpm, manifold pressure (M.P.) and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI.GAL.) (no wind), gallons per hour (G.P.H.) and true airspeed (T.A.S.) are approximate values for reference. Range values are for an average airplane flying alone (no wind).[1] To obtain British Imperial gallons (or G.P.H.), multiply U. S. gallons (or G.P.H.) by 10 then divide by 12.

COLUMN I		FUEL U.S. GAL.	COLUMN II		COLUMN III		COLUMN IV		FUEL U.S. GAL.	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		256	SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]						256		
465	405	220	688	598	816	709	922	802	220	1045	909
425	370	200	626	544	742	645	838	729	200	950	826
380	330	180	563	489	668	581	754	656	180	855	743
340	295	160	500	435	593	516	670	583	160	760	661
295	255	140	438	380	519	451	587	510	140	665	578
250	215	120	375	326	445	387	503	437	120	570	496
210	180	100	313	272	371	323	419	364	100	475	413
170	150	80	250	217	297	258	335	291	80	380	330
125	110	60	187	163	223	193	251	218	60	286	249
85	75	40	125	108	148	129	168	146	40	190	165
40	35	20	62	54	74	64	84	73	20	95	83

MAXIMUM CONTINUOUS						PRESS FEET	(3.13 STAT. (2.72 NAUT.) MI./GAL.)						(3.7 STAT. (3.22 NAUT.) MI./GAL.)						(4.19 STAT. (3.6 NAUT.) MI./GAL.)						PRESS FEET	MAXIMUM AIR RANGE					
R.P.M.	IN.	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.		R.P.M.	IN.	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	R.P.M.	IN.	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	R.P.M.	IN.	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.		R.P.M.	IN.	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.
2200	F.T.	F.R.	74	196	170	15000	2000	F.T.	M.L.	53	184	160	1800	F.T.	M.L.	45	168	146							15000						
2200	F.T.	F.R.	88	208	180	10000	2000	F.T.	M.L.	62	195	169	1800	24.0	M.L.	45	167	145	1800	20.5	M.L.	34	144	125	10000						
2200	F.T.	F.R.	95	212	184	5000	2000	29.0	M.L.	61	191	166	1800	26.5	M.L.	44	167	145	1800	24.0	M.L.	36	151	131	5000	1800	21.0	M.L.	28	132	115
2200	35.0	F.R.	96	206	179	S.L.	2000	30.5	M.L.	57	184	160	1800	29.0	M.L.	43	164	142	1800	26.5	M.L.	35	151	131	S.L.	1800	25.0	M.L.	29	139	121

REMARKS:

(1) Make allowance for warm-up, take-off, and climb, plus allowance for wind and reserve as required. (See Figure 11-3).

(2) There is no 'LEAN' position on mixture control. Lean to point of engine roughness, then enrich slightly.

CAUTION: For maximum engine life, do not exceed manifold pressure for listed rpm.

EXAMPLE

At 8600 lb gross weight with 140 gal. of fuel (after deducting total allowances of 50 gal.). To fly 530 stat. airmiles at 5000 ft. altitude, maintain 1800 rpm and 26.5 in. manifold pressure with mixture set. Manual lean when weight decreases below 8000 lb refer to next weight chart, 8000 to 7000 lb under col III to 5000 ft. Altitude on next chart for new power setting.

LEGEND

ALT	: Pressure Altitude	F.R.	: Full Rich
MP	: Manifold Pressure	A.R.	: Auto Rich
GPH	: U.S. Gal. per Hour	A.L.	: Auto Lean
TAS	: True Airspeed	C.L.	: Cruising Lean
KTS	: Knots	M.L.	: Manual Lean
S.L.	: Sea Level	F.T.	: Full Throttle

DATA AS OF 10-14-48 BASED ON: Flight Test

SUBJECT TO CHANGE AFTER FLIGHT CHECK

Figure 11-5 Flight Operation Instruction 8700 to 8000

AIRCRAFT MODEL (S) UC-45J AND RC-45J

FLIGHT OPERATION INSTRUCTION

EXTERNAL LOAD ITEMS NONE

ENGINE (S) R-985-AN-14B

CHART WEIGHT LIMITS: 8000 TO 7000 POUNDS

NUMBER OF ENGINES OPERATING: TWO

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.(1) Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT.) read rpm, manifold pressure (M.P.) and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI.GAL.) (no wind), gallons per hour (G.P.H.) and true airspeed (T.A.S.) are approximate values for reference. Range values are for an average airplane flying alone (no wind).(1) To obtain British Imperial gallons (or G.P.H.), multiply U. S. gallons (or G.P.H.) by 10 then divide by 12.

COLUMN I		FUEL U.S. GAL.	COLUMN II		COLUMN III		COLUMN IV		FUEL U.S. GAL.	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		256		SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)					256		
475	415	220	715	620	905	785	1090	950	220	1255	1090
430	375	200	650	565	815	705	980	850	200	1130	980
385	335	180	585	510	730	635	870	755	180	1005	870
345	300	160	520	450	640	575	760	660	160	880	765
300	260	140	455	395	560	485	665	580	140	770	670
260	225	120	390	340	480	415	570	495	120	660	575
215	185	100	325	280	400	345	475	410	100	550	480
170	150	80	260	225	320	280	380	330	80	440	380
130	115	60	195	170	240	210	285	245	60	330	285
85	75	40	130	115	160	140	190	165	40	220	190
45	40	20	65	55	80	70	95	80	20	110	95

MAXIMUM CONTINUOUS						PRESS	(3.25 STAT. (2.82 NAUT.) MI./GAL.)						(4.00 STAT. (3.47 NAUT.) MI./GAL.)						(4.75 STAT. (4.13 NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
			APPROX.							APPROX.						APPROX.						APPROX.							APPROX.		
R.P.M.	IN.	MIX-TURE	TOT. G.P.H.	T.A.S. M.P.H.	T.A.S. KTS.	FEET	R.P.M.	IN.	MIX-TURE	TOT. G.P.H.	T.A.S. M.P.H.	T.A.S. KTS.	R.P.M.	IN.	MIX-TURE	TOT. G.P.H.	T.A.S. M.P.H.	T.A.S. KTS.	R.P.M.	IN.	MIX-TURE	TOT. G.P.H.	T.A.S. M.P.H.	T.A.S. KTS.	FEET	R.P.M.	IN.	MIX-TURE	TOT. G.P.H.	T.A.S. M.P.H.	T.A.S. KTS.
2200	F.T.	F.R.	75	205	178	15000	2000	F.T.	M.L.	53	192	167	1800	F.T.	M.L.	45	175	152							15000						
2200	F.T.	F.R.	88	212	184	10000	2000	F.T.	M.L.	62	201	175	1800	23.0	M.L.	43	172	149	1800	19.5	M.L.	29	140	122	10000						
2200	F.T.	F.R.	99	216	188	5000	2000	29.0	M.L.	61	195	169	1800	26.0	M.L.	43	172	149	1800	22.5	M.L.	31	147	128	5000	1800	20.0	M.L.	22	121	105
2200	34.5	F.R.	95	208	181	S.L.	2000	30.5	M.L.	57	187	162	1800	28.5	M.L.	41	167	145	1800	25.5	M.L.	31	150	130	S.L.	1800	23.5	M.L.	24	134	116

REMARKS:

(1) Make allowance for warm-up, take-off, and climb, plus allowance for wind and reserve as required. (See Figure 11-3).

EXAMPLE

At 7800 lb gross weight with 100 gal. of fuel (after deducting total allowances of 50 gal.). To fly 475 stat. airmiles at 5000 ft. altitude, maintain 1800 rpm and 22.5 in. manifold pressure with mixture set. Manual lean when weight decreases below 7000 lb refer to next weight chart, 7000 to 6000 lb. Refer to column IV on next chart for new power setting.

LEGEND

- ALT : Pressure Altitude
- MP : Manifold Pressure
- GPH : U.S. Gal. per Hour
- TAS : True Airspeed
- KTS : Knots
- S.L. : Sea Level
- F.R. : Full Rich
- A.R. : Auto Rich
- A.L. : Auto Lean
- C.L. : Cruising Lean
- M.L. : Manual Lean
- F.T. : Full Throttle

DATA AS OF 10-14-48 BASED ON: Flight Test

SUBJECT TO CHANGE AFTER FLIGHT CHECK

Figure 11-6 Flight Operation Instruction 8000 to 7000

AIRCRAFT MODEL (S)
UC-45J AND RC-45J

ENGINE (S) R-985-AN-14B

FLIGHT OPERATION INSTRUCTION

CHART WEIGHT LIMITS: 7000 TO 6000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: TWO

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising.(1) Move horizontally to right or left and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite value nearest desired cruising altitude (ALT.) read rpm, manifold pressure (M.P.) and MIXTURE setting required.

NOTES: Column I is for emergency high speed cruising only. Columns II, III, IV and V give progressive increase in range at a sacrifice in speed. Air miles per gallon (MI.GAL.) (no wind), gallons per hour (G.P.H.) and true airspeed (T.A.S.) are approximate values for reference. Range values are for an average airplane flying alone (no wind).(1) To obtain British Imperial gallons (or G.P.H.), multiply U. S. gallons (or G.P.H.) by 10 then divide by 12.

COLUMN I		FUEL U.S. GAL.	COLUMN II		COLUMN III		COLUMN IV		FUEL U.S. GAL.	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING(1)								
385	335	180	585	510	790	685	990	850	180	1125	975
345	300	160	520	450	705	610	880	765	160	1000	870
300	260	140	455	395	615	535	770	670	140	875	780
260	225	120	390	340	530	460	660	575	120	750	650
215	185	100	325	280	440	380	550	480	100	625	540
170	150	80	260	225	350	300	440	380	80	500	435
130	115	60	195	170	265	230	330	285	60	375	325
85	75	40	130	115	175	150	220	190	40	250	215
45	40	20	65	55	90	80	110	95	20	125	110

MAXIMUM CONTINUOUS						PRESS FEET	(3.25 STAT. (2.82 NAUT.) MI./GAL.)						(4.40 STAT. (3.82 NAUT.) MI./GAL.)						(5.50 STAT. (4.78 NAUT.) MI./GAL.)						PRESS FEET	MAXIMUM AIR RANGE					
R.P.M.	IN.	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. M.P.H.	T.A.S. KTS.		R.P.M.	IN.	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. M.P.H.	T.A.S. KTS.	R.P.M.	IN.	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. M.P.H.	T.A.S. KTS.	R.P.M.	IN.	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. M.P.H.	T.A.S. KTS.		R.P.M.	IN.	MIX-TURE	APPROX. TOT. G.P.H.	T.A.S. M.P.H.	T.A.S. KTS.
2200	F.T.	F.R.	74	208	181	15000	2000	F.T.	M.L.	53	198	172	1800	19.5	M.L.	38	170	148							15000						
2200	F.T.	F.R.	88	215	187	10000	2000	F.T.	M.L.	62	204	177	1800	22.0	M.L.	38	168	146	1800	17.5	M.L.	23	127	119	10000						
2200	F.T.	F.R.	99	216	188	5000	2000	29.0	M.L.	61	197	171	1800	25.0	M.L.	38	167	145	1800	21.0	M.L.	25	139	121	5000	1800	19.0	M.L.	19	120	104
2200	34.5	F.R.	95	208	181	S.L.	2000	30.5	M.L.	57	188	163	1800	27.5	M.L.	37	163	142	1800	24.0	M.L.	26	143	124	S.L.	1800	22.0	M.L.	21	130	113

REMARKS:

(1) Make allowance for warm-up, take-off, and climb, plus allowance for wind and reserve as required. (See Figure 11-3).

(2) There is no 'LEAN' position on mixture control. Lean to point of engine roughness, then enrich slightly.

CAUTION: For maximum engine life, do not exceed manifold pressure for listed rpm.

EXAMPLE

At 7000 lb gross weight with 80 gal. of fuel (after deducting total allowances of 50 gal.). To fly 500 stat. airmiles at 5000 ft. altitude, maintain 1800 rpm and 19 in. manifold pressure with mixture set Manual lean.

LEGEND

ALT : Pressure Altitude	F.R. : Full Rich
MP : Manifold Pressure	A.R. : Auto Rich
GPH : U.S. Gal. per Hour	A.L. : Auto Lean
TAS : True Airspeed	C.L. : Cruising Lean
KTS : Knots	M.L. : Manual Lean
S.L. : Sea Level	F.T. : Full Throttle

DATA AS OF 10-14-48 BASED ON: Flight Test

SUBJECT TO CHANGE AFTER FLIGHT CHECK

Figure 11-7 Flight Operation Instruction 7000 to 6000

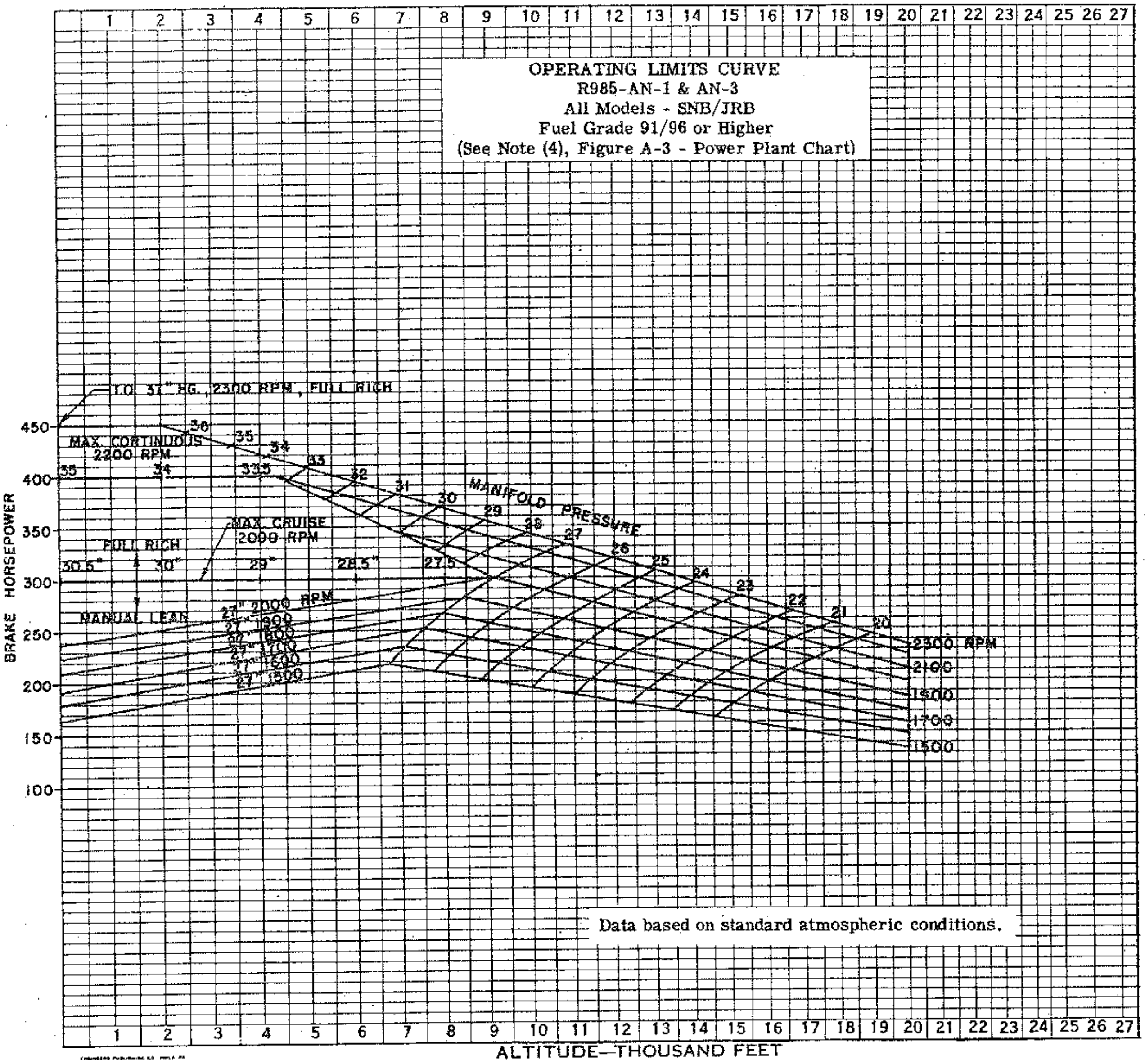

Figure 11-8 Engine Operating Limits Curve

INDEX

A

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C

*Denotes Illustration

D

E

*Denotes Illustration

M

N

O

P

*Denotes Illustration

T

U

V

W

Y

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