PILOT TRAINING MANUAL FOR THE C-54 SKYMASTER

This revised edition supersedes the original (blue cover) Pilot Training Manual for the Skymaster. All copies of the latter are rescinded.

Headquarters Army Air Forces

Washington 25, D. C., 1 Aug 45

The use and authentication of this manual are governed by the provisions of AAF Regulation 50-17.

BY COMMAND OF GENERAL ARNOLD

HEADQUARTERS ARMY AIR FORCES ☆ OFFICIAL ☆ WASHINGTON, D.C.

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Additional copies of this manual should be requested from Headquarters AAF, Office of Flying Safety, Safety Education Division, Winston-Salem 1, North Carolina.

Initial distribution revised edition: Headquarters AAF, Air Transport Command

T.O.P.—DAYTON, O.—AUGUST, 1945—13,000

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INTRODUCTION

This Manual is the text for your training as a C-54 pilot and airplane commander.

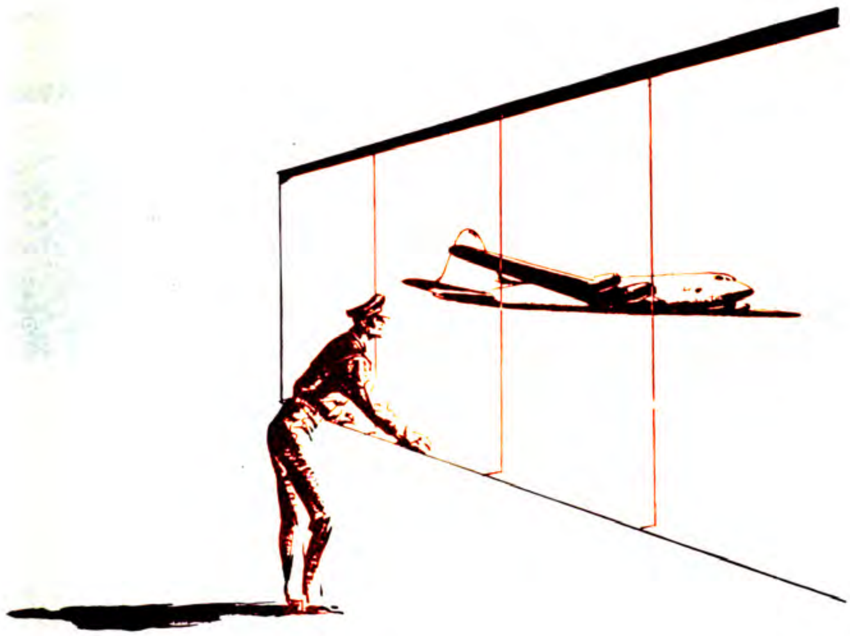
The Air Forces' most experienced training and supervisory personnel have collaborated to make it a complete exposition of what your pilot duties are, how each duty will be performed, and why it must be performed in the manner prescribed.

The techniques and procedures described in this book are standard and mandatory. In this respect the manual serves the dual purpose of a training checklist and a working handbook. Use it to make sure that you learn everything described herein.
Use it to study and review the essential facts concerning everything taught. Such additional self-study and review will not only advance your training, but will alleviate the burden of your already overburdened instructors.

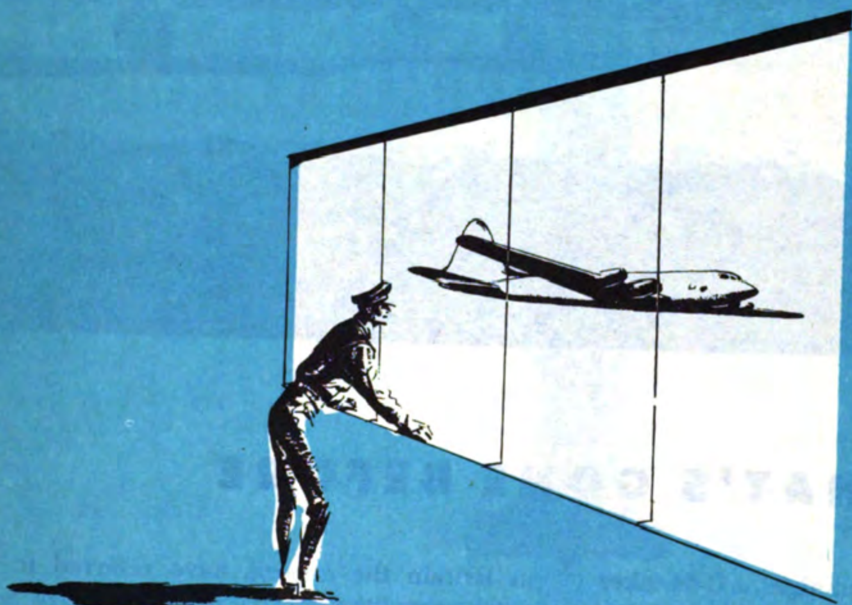
This training manual does not replace the Technical Orders for the airplane, which will always be your primary source of information concerning the C-54 so long as you fly it. This is essentially the textbook of the C-54. Used properly, it will enable you to utilize the pertinent Technical Orders to even greater advantage.

H. H. ARNOLD
COMMANDING GENERAL, ARMY AIR FORCES

SECTION ONE



SECTION ONE



GENERAL

What's Gone Before

Charley Five-Four Slaps a Jap

Crew Duties

WHAT'S GONE BEFORE

Every 30 minutes, day and night, a C-54 takes off to fly across an ocean. They have been doing it month after month.

As soon as they began to arrive in quantity from the manufacturer, shortly after the United States came into the war, the big Douglas Skymasters jumped into transoceanic air traffic. In the last year they have almost completely supplanted other types of land planes on the transocean cargo and passenger runs.

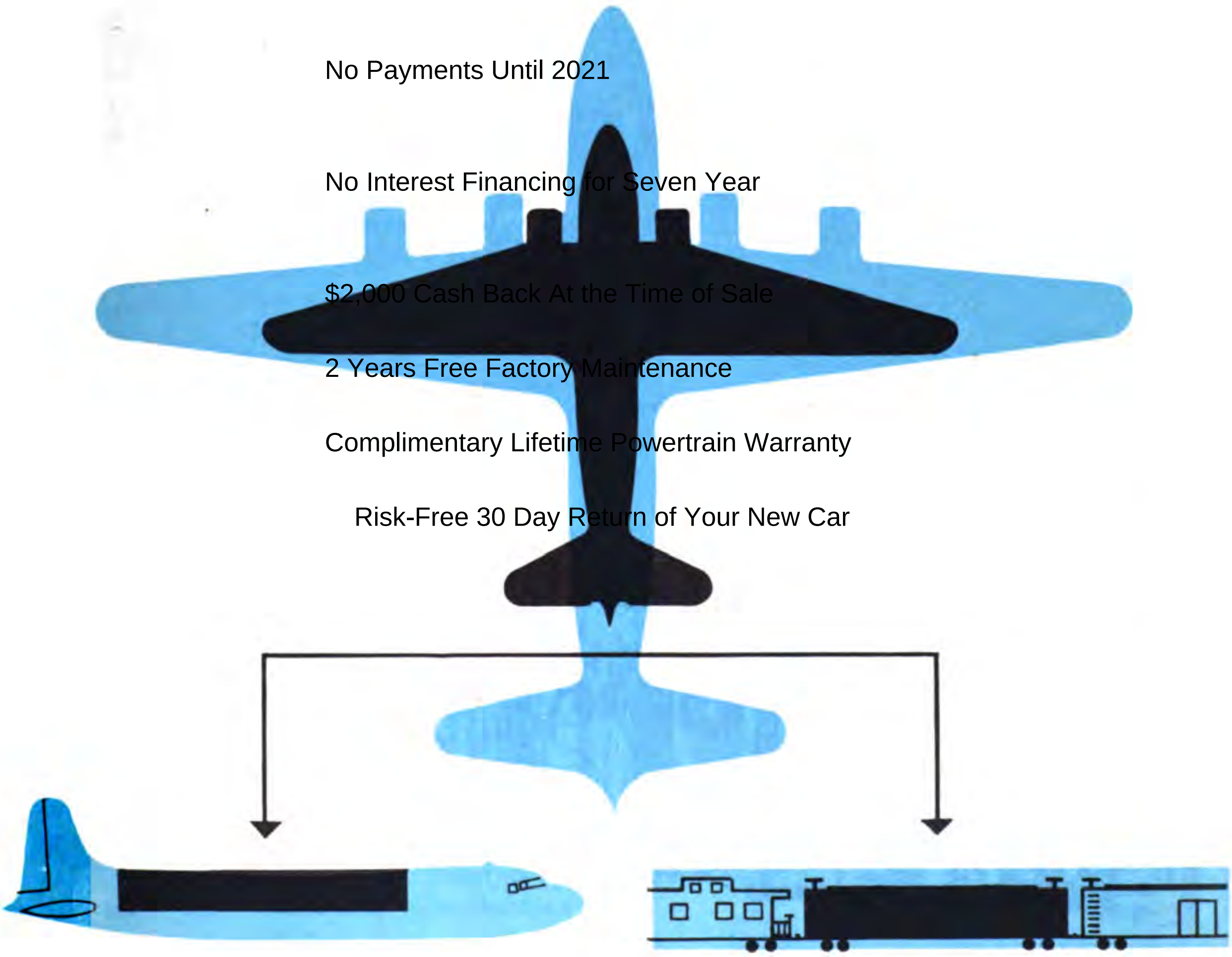
Big, fast, and dependable. Those adjectives describe the C-54, and tell why C-54's fly almost all the ocean schedules. In America and in Britain the experts have referred to this airplane as "the world's best long-range transport."

Douglas built the C-54—DC-4, in the commercial version—at the request of four major airlines for a "larger DC-3." According to Douglas, it represents the most exhaustive and expensive series of prewar experiments in transport aviation. Budgeted at $500,000, it cost the company $8,000,000 before everybody was satisfied, and that ain't wallpaper.

What did we get for their money? Well, the C-54 is twice as big and 25% faster than the

DC-3. It can carry more cargo faster and farther than any other airplane in the world. On its maiden trip from San Francisco to Brisbane, carrying a capacity load of urgently needed parts for big bombers, it broke all existing records by a flight time of 35 hours and an overall time of 39 hours, stopping only at Honolulu and Canton Island. The C-54's cabin dimensions approximate the size of a standard boxcar. It can carry a payload of 20,000 lbs. 1500 miles non-stop. Its maximum speed is 285 mph, and its cruising speed averages about 200 mph in long-range cruise.

Air Transport Command flies the airplane many times daily across both the Atlantic and the Pacific. So does Naval Air Transport Service. Under contract cargo, United operates the Skymaster over the Pacific, and American, TWA and Pan American fly it to Europe and Africa.



It's a Good Airplane

In the conquest of the Marshall and Gilbert Islands, the C-54 was put on regular service in the combat theater, executing scheduled flights to conquered Jap airfields for the purpose of carrying in supplies and evacuating the wounded. Under the banner of NATS, it started scheduled service into Saipan when the conquest of that island was only half completed. It has carried VIP to all theaters of the war, and delivered everything from diamonds to tanks from one continent to another. It can pull gliders and carry troops, and it's dependable: it gets the stuff out there and brings it back.

The pilots like to fly it, and the passengers like to ride it. It's safe, and it's comfortable. It's the airplane the brass hats ride in, and they can get the best. It carried Winston Churchill and his family to the Ottawa conference and back. It carried General Marshall and General Somervell on their respective trips around the world, during which the overwater hop from Columbo to Exmouth Gulf, Australia, was flown in both directions for the first time in history. The late Secretary Knox made his inspection tour of the Southwest Pacific front in a C-54. Secretary Hull made his trip to the Moscow conference in one. Secretaries Stimson and Morgenthau went to Europe and back in the airplane, and Madame Chiang and Queen Wilhelmina came to America and returned to China and England, respectively, in Skymasters.

President Roosevelt and the whole staff of advisers and assistants went to both the Casablanca and Cairo-Teheran conferences in this airplane. Ten C-54's carried a total of 250 American officials to the latter conference.

The list could go on and on. Some of these things you know. You know, in general, what the C-54 has done and where it has been. You have seen it in every corner of the world.

CHARLEY FIVE-FOUR SLAPS A JAP

Maybe you didn't know, however, that your airplane struck an early blow for liberty, before we got into the war . . . long before the Forts and the Libs and the Lightnings were blasting Zeros out of the air. It's a story that not everybody knows.

The present C-54 differs considerably from the old 3-tailed prototype model. Progress in aerodynamics and new Army specifications made the prototype obsolete even as it was being finished. It became practically a white elephant. So—this was back in the days of our innocence—it was sold to Japan.

But Charley Five-Four came through. Just as the Nippos were chuckling over having slipped us another fast one, the 3-tailed grandpa of your present Skymaster slammed into a sea wall at Tokyo, delivered a cabin-full of high-ranking Jap officials to their honorable ancestors, and sank smugly beneath the waters of the bay.

* * * *

These things, briefly, make up the highlights of the C-54's history. This is what's gone before.

Now let's consider your airplane today . . .

CREW DUTIES

You have to have a system to run any business, and the business of flying a C-54 is no exception. This is a crew airplane, and flying it efficiently involves the smooth integration of many kinds of jobs on the part of several men. Get an over-all picture in your mind of the scope of each man's duties. The list presented here is a suggested basis for the division of jobs in order to effect the best cooperation and subsequent saving of time. See that each man is familiar with the duties charged to him.

Remember, however, that you, as pilot, are ultimately responsible for everything about the airplane.

THE PILOT

You are responsible for the safe and orderly progression of the flight. Besides your normal flight duties as first pilot, you are responsible for the following:

1. Whereabouts of your crew members 12 hours before departure, if practicable. Designate a meeting place for 1 hour before departure, at which all members will assemble with complete flight equipment. Operations office is the preferable meeting place.

2. Instruction of each crew member in his specific duties and when they are apt to occur.

3. The conduct of all crew members during the preparation, planning, and execution of the flight.

4. Preparation of the flight plan. You and the navigator and copilot must check the weather and make out a detailed flight plan, including these points:

a. Weather and winds along the regular and alternate courses.
b. Altitude to be flown.
c. Course to be followed.
d. Check points to be used.
e. Time and distance of flight.
f. Fuel available and fuel to be used.
g. Alternate airfield.
h. Power and speed to be used.
i. Point of no return.

5. Submitting flight plan for clearance with operations officer, and filing properly executed and signed clearance form.

6. Knowledge of the facilities, hazards, and restricted areas along the route to be flown.

7. Proper servicing and airworthiness of the airplane and engines.

8. Assurance that all flight equipment, including maps and navigation instruments, is aboard and in serviceable condition.

9. Adequacy of fuel supply to complete the flight under any conditions which might be expected.

10. Knowledge of emergency procedures and the use of equipment for ditching, forced landing, and emergency routes, and assurance that passengers and crew members are familiar with proper procedures and use of equipment.

11. Knowledge of instrument approach procedures.

12. Preservation of secrecy of codes, ciphers, military information, and other classified information that may come into crew members' possession.

13. Specification of health and sanitation precautions to be observed by crew members.

14. Specification of watch periods for all crew members, during flight or on the ground.

15. Procurement before flight of all necessary codes, colors, and identification procedures, and ascertaining that they are understood by crew members.

16. Supervision of airplane and engine logs and all other in-flight data to be made a matter of record.

17. Conformation of passengers and cargo to customs and immigration regulations when boarding or de-planing at other than regular stops.

18. Assurance that passengers and crew members are properly fed and housed.

19. Notice to those concerned of ETA and of any changes of plans while en route.

THE COPILOT

The copilot is directly responsible to you, and he must be able to substitute for you in any of your own duties. In addition, when directed, he performs the following duties:

1. Helps in preparation of flight plan and weather analysis.

2. Acts as pilot during your absence. When acting in the capacity of pilot, the copilot assumes all the authority and responsibility of the pilot.

3. Completes all forms carried in the copilot's kit, and prepares Form 1 for each day of flying.

4. Arranges for refueling, taking particular precautions against sabotage.

5. Familiarizes himself with and handles the checklist according to prescribed procedure.

6. Checks carefully all instruments at all times while in the flight compartment.

7. Makes all radio contacts other than those made by the radio operator. These include a continuous stand-by on the 2-way radio, calls for taxi and takeoff clearance, and necessary contacts en route.

8. Performs such other duties as the pilot may direct.

THE FLIGHT ENGINEER

The flight engineer is responsible to you for the following:

1. Servicing, inspection, maintenance, and security of the airplane while it is away from its home base, and safe and efficient mechanical operation while in flight.

2. Preflight inspection of the airplane for satisfactory flight condition.

3. Check on the proper loading and securing of cargo, and a check to see that seat belts are available and used by all passengers.

4. Check of emergency equipment aboard for accessibility, condition, and stowage.

5. Performance of his proper duties at the prescribed times.

6. Periodic in-flight inspections of the airplane and engines, filling out engineer's flight log every hour. He must also be responsible for handling heater switches and otherwise caring for comfort of crew and passengers.

7. Operation of fuel valves when it is necessary to change sources of fuel supply, making careful note of the time of these operations. He should keep pilot and navigator informed hourly of the fuel used and fuel remaining.

8. Such other duties as the pilot may prescribe.

NOTE:

The duties of the flight engineer tend to bunch up at times. Whenever he is unable to complete necessary duties, he should call on the pilot to assign other crew members to help him.

THE NAVIGATOR

The navigator is directly responsible to you for safe and efficient navigation of the airplane.

The navigator:

1. Assures that all navigational equipment is in its proper place aboard the airplane prior to flight, that his personal equipment is on hand, and that the navigational equipment is adjusted, calibrated, tested, and functioning properly.

2. Confers with the pilot and copilot on weather and flight plan, and helps to plot a point of no return.

3. Assures that calibration cards for airspeed and compass are up-to-date and in place.

4. Has watches and chronometers set to the second.

5. Sees that octant is properly serviced and that spare parts are available.

6. Sees that the face of the drift meter is clean, and checks its functioning.

7. Makes sure all charts, maps, and tables are aboard and stowed where they are easily accessible.

8. Maintains a flight navigation log.

9. Maintains constant check on: fuel consumed, fuel remaining, location of airplane and course, winds, weather, drift, airspeed, and ETA.

10. Exchanges with the pilot information which will contribute to the safety of the flight.

THE RADIO OPERATOR

The radio operator is responsible to you for the safe and efficient transmittal and reception of all communications between the airplane and the ground or other aircraft. The radio operator:

1. Is responsible to the pilot for the secrecy and security of all codes, cipher messages, and other secret information.

2. Makes sure, prior to departure, that all radio equipment is aboard in its proper place and functioning properly.

3. Sends and receives such messages as are necessary and directed.

4. Effects identification and answers challenges as the pilot directs.

5. Is familiar with all codes and their enciphering and deciphering.

6. Stands continuous radio watch.

7. Maintains a complete and accurate radio log.

8. Uses the IFF equipment when necessary.

9. Takes radio bearings when the pilot directs.

10. Turns over to proper officials, on completion of the flight, all secret papers, codes, signals, and other matters.

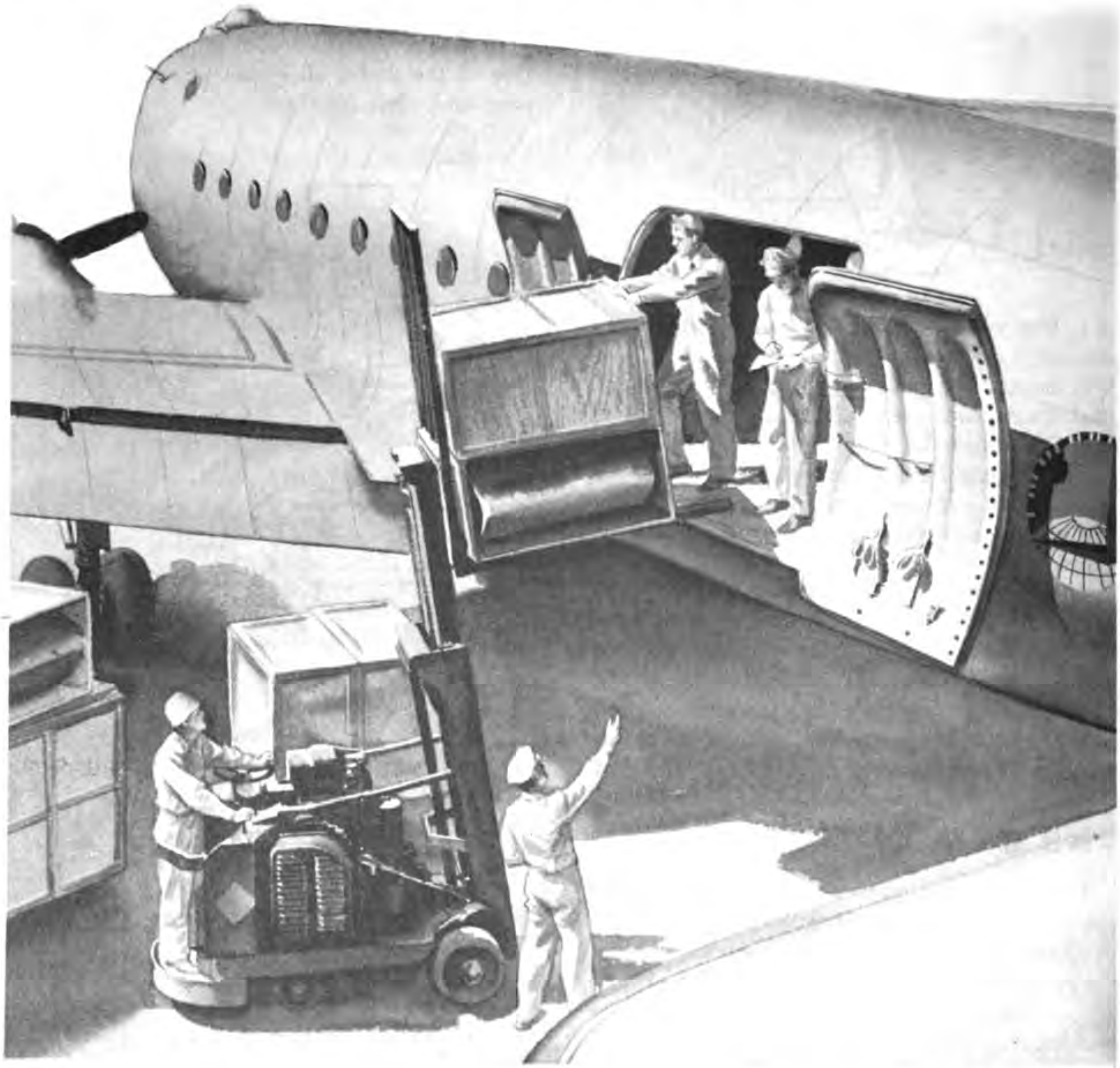
11. Assists the flight engineer in the latter's duties when the airplane is on the ground away from its home station.

12. Performs such other duties as the pilot may direct.

THE TRAFFIC CLERK

On some flights you have a traffic clerk. When there is one aboard, he is a member of the crew, and is responsible to you. He can relieve the flight engineer of some of his duties which pertain to passenger care and comfort. The traffic clerk:

1. Prepares and maintains custody of all traffic and customs forms.
2. Maintains passenger discipline.
3. Distributes food.
4. Keeps the cabin clean.
5. Guards against damage to cargo or equipment.
6. Collects PTR's.
7. Checks loading and off-loading of cargo, passengers, and passengers' luggage.
8. Is familiar with the tie-down system and the location of cargo in the cabin to insure safe loading and expedite unloading.
9. Jettisons cargo when so instructed.
10. Serves as carrier for mail and cargo classified as secret or confidential.
11. Sees that each passenger has a seat and seat belt, that he knows how to operate the seat belt, and that it is adjusted and fastened before takeoff and landing.
12. Performs such additional duties as the pilot may direct.



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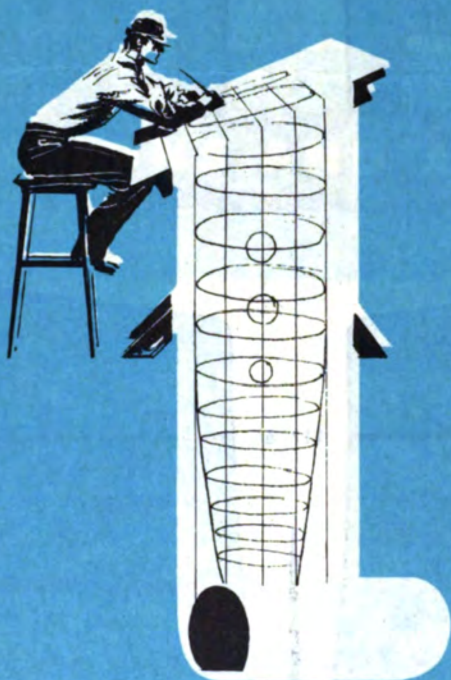


THE AIRPLANE

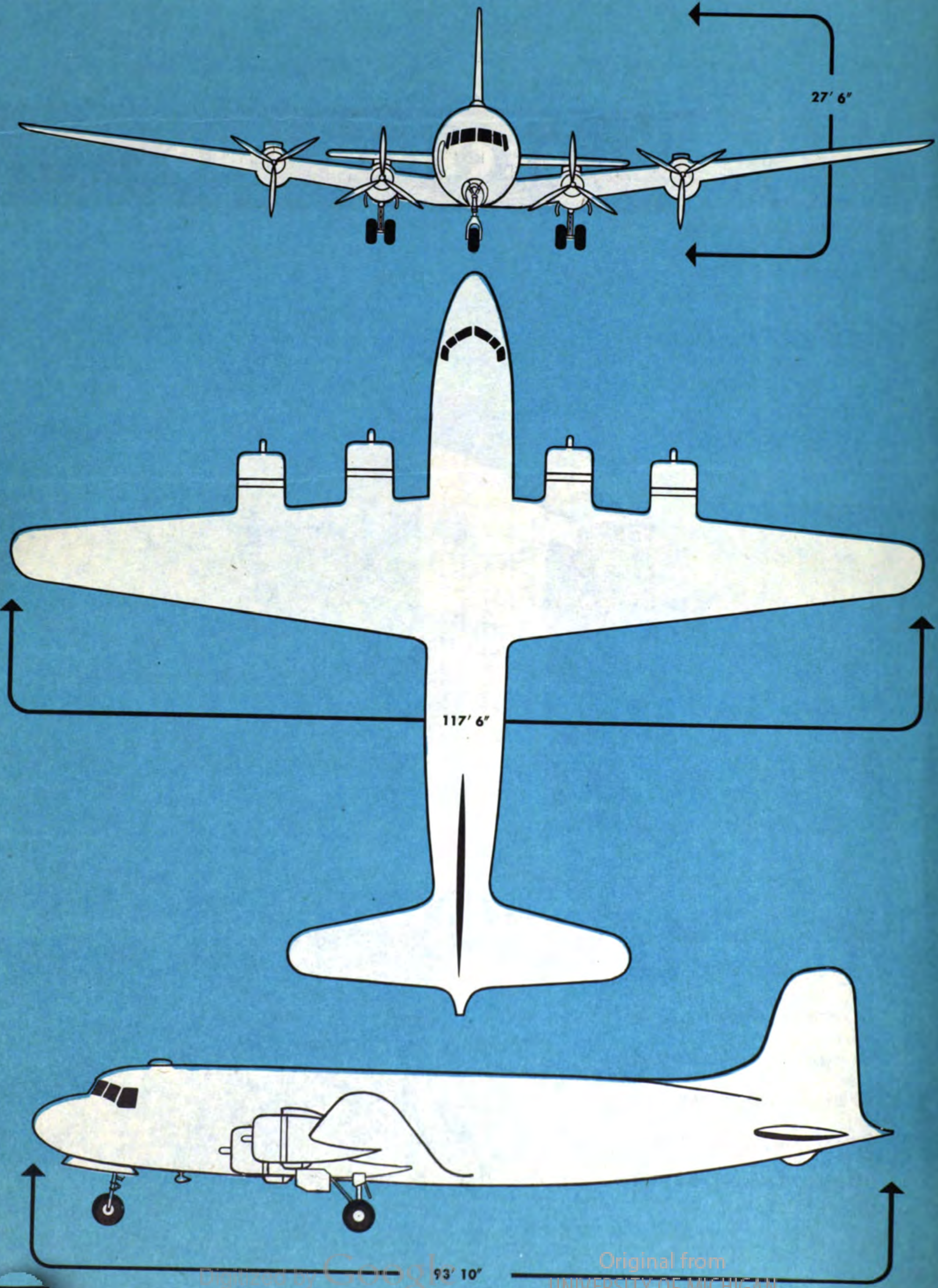
General Description

Cargo Compartments

Fuel Compartment

Crew Compartment

Flight Compartment


27′ 6″
117′ 6″
93′ 10″

GENERAL DESCRIPTION

The C-54 airplane is designed to be used as a cargo carrier, passenger plane, or troop transport. It is a 4-engine, low-wing monoplane with a fully retractable tricycle landing gear.

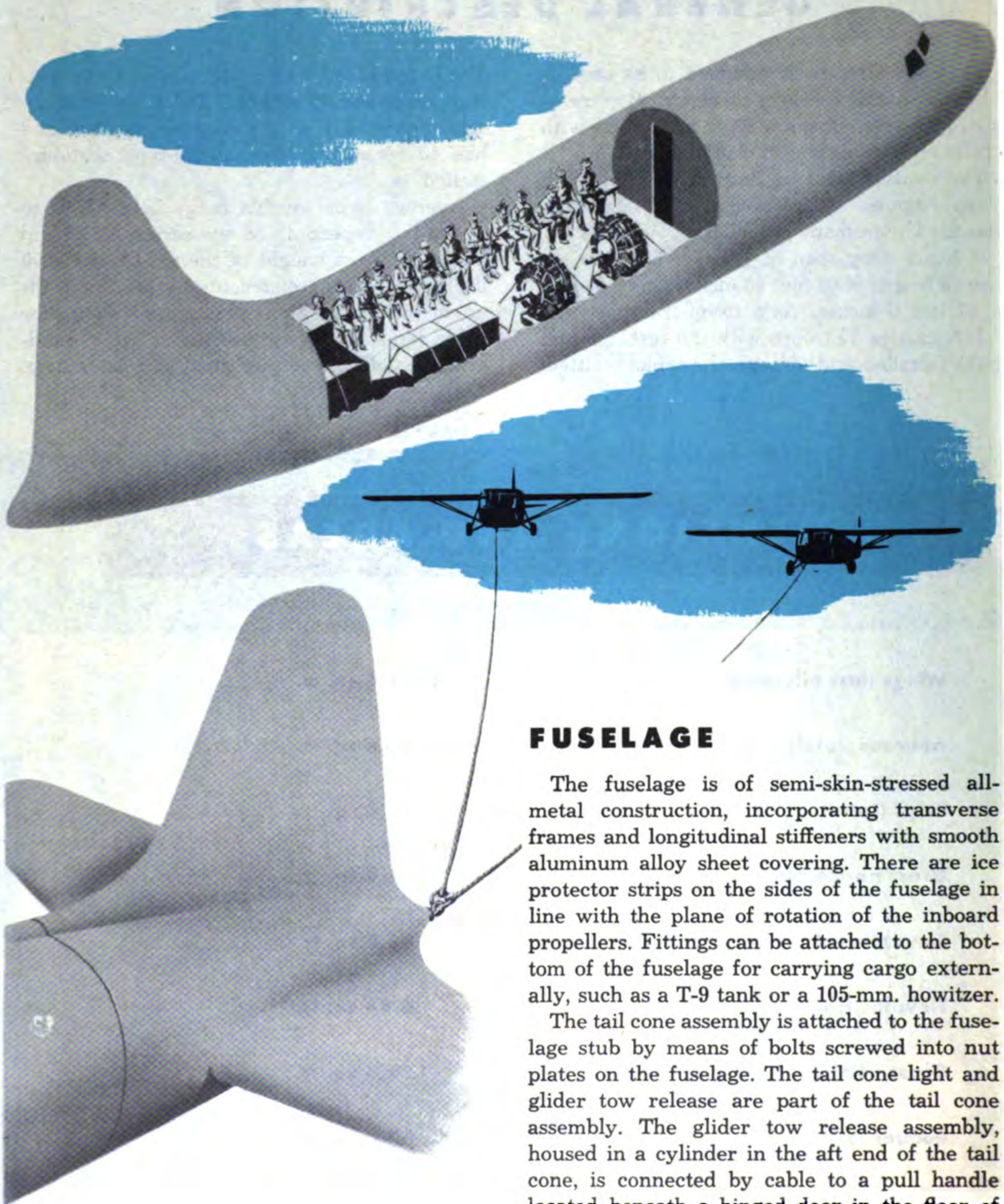
The airplane has four Pratt & Whitney Twin Wasp engines, R-2000 series, and Hamilton Standard hydromatic propellers.

It has a wing span of 117 feet 6 inches, an overall length of 93 feet 10 inches, and a height of 27 feet 6 inches. As a troop transport, the C-54A carries 30 troops with the fuselage fuel tanks installed and 50 with the tanks omitted. The B and D series carry 41 men with the fuselage tanks and 49 without. The E series is designed primarily as a passenger airplane and has 40 removable commercial-type seats installed.

Average basic weights range from 37,000 to 40,000 lbs. depending on the series. Maximum allowable gross weight of the C-54A is 65,000 lbs. Later series are structurally safe for loads up to 73,000 lbs. Maximum gross weights for these series are in the process of being standardized and will be published at a later date.

DIMENSIONS AND AREAS

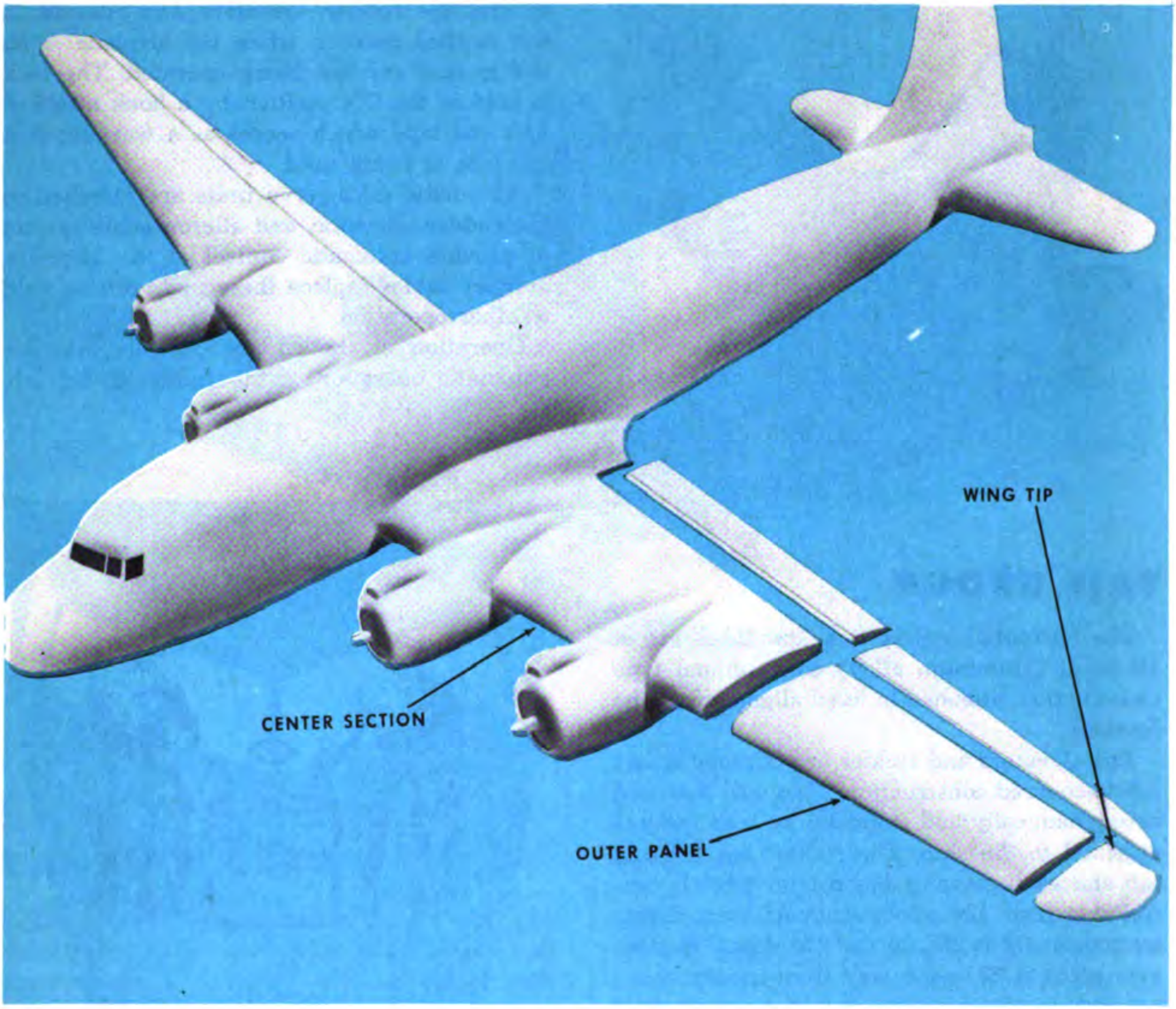
Wings (less ailerons)	**1341.6 sq. ft.**
Ailerons (total)	**120.4 sq. ft.**
Flaps (total)	**214.6 sq. ft.**
Gross horizontal empennage surface	**324.9 sq. ft.**
Elevators (aft of hinge line and including tabs)	**86.5 sq. ft.**
Elevator trim tabs (total)	**6.84 sq. ft.**
Gross vertical empennage surface	**179.3 sq. ft.**
Rudder (aft of hinge line and including tab)	**47.6 sq. ft.**
Rudder flying tab (total)	**4.75 sq. ft.**



FUSELAGE

The fuselage is of semi-skin-stressed all-metal construction, incorporating transverse frames and longitudinal stiffeners with smooth aluminum alloy sheet covering. There are ice protector strips on the sides of the fuselage in line with the plane of rotation of the inboard propellers. Fittings can be attached to the bottom of the fuselage for carrying cargo externally, such as a T-9 tank or a 105-mm. howitzer.

The tail cone assembly is attached to the fuselage stub by means of bolts screwed into nut plates on the fuselage. The tail cone light and glider tow release are part of the tail cone assembly. The glider tow release assembly, housed in a cylinder in the aft end of the tail cone, is connected by cable to a pull handle located beneath a hinged door in the floor of the pilot's compartment, just aft of the control pedestal.



WING GROUP

The wing is of full cantilever all-metal construction. It has a center section permanently attached to the fuselage, two removable outer panels bolted to the center section, and two removable wingtips bolted to the outer panels. The engine nacelles and the wing fuel tanks are built as integral parts of the center section. The main landing wheels retract into the inboard nacelles.

NACA type wing flaps, extending from the inboard ends of the ailerons to the fuselage, are incorporated in the center wing section aft of the rear spar. The flaps, of all-metal construction, operate hydraulically.

Fabric-covered ailerons extend along the trailing edge of each outer panel. They are balanced aerodynamically and statically by lead weights bolted to the aluminum alloy sheet which covers the surface forward of the spar. The right aileron has a trim tab operated by dual control wheels on the control pedestal in the pilot's compartment. The ailerons move 15° up and 11½° down.

TAIL GROUP

The horizontal and vertical stabilizers are of all-metal (aluminum alloy) conventional type construction, attached in fixed alignment to the fuselage.

The elevators and rudder are of metal frame fabric-covered construction. They are balanced aerodynamically and statically by lead weights attached to the skin. The rudder has a flying tab and each elevator has a trim tab, all controllable from the pilot's compartment. Elevator movement is 25° up and 15° down. Rudder movement is 20° each way from neutral.

FLIGHT CONTROLS

The flight controls in the cockpit are of conventional arrangement. You control ailerons by a wheel, elevators by a control column which swings fore and aft, and the rudder by adjustable pedals. Toe pressure on the pedals operates the brakes. The copilot has duplicate controls on his side, with the exception of the rudder tab control wheel, which is in the windshield V within reach of both you and the copilot. You control the wing flaps hydraulically by a handle in the center of the lower portion of the control pedestal, within reach of both pilots.

A cable-operated gust lock mechanically secures the rudder, elevators, and ailerons in the neutral position when the airplane is on the ground and not being operated. The lock is held in the ON position by a hook attached to a red tape which serves as a warning that the lock is being used.

Automatic pilot servo units are attached to the rudder, elevator, and aileron cable system to provide automatic control of the airplane. Jumper cables replace these units during cold weather operation.

Operation of the rudder controls provides automatic operation of the rudder flying tab,

which gives aerodynamic boost for the rudder and reduces the load on the rudder pedals. The flying tab is also used as a trim tab, controlled by the trim control wheel in the flight compartment. Trim control wheels operate the conventional trim tabs on the elevators and on the right aileron.

LANDING GEAR

The landing gear comprises three units: two fully retractable main gears with brakes and dual wheels, a fully retractable nose gear with steerable wheel, and a faired, non-retracting, shock-supported tailskid.

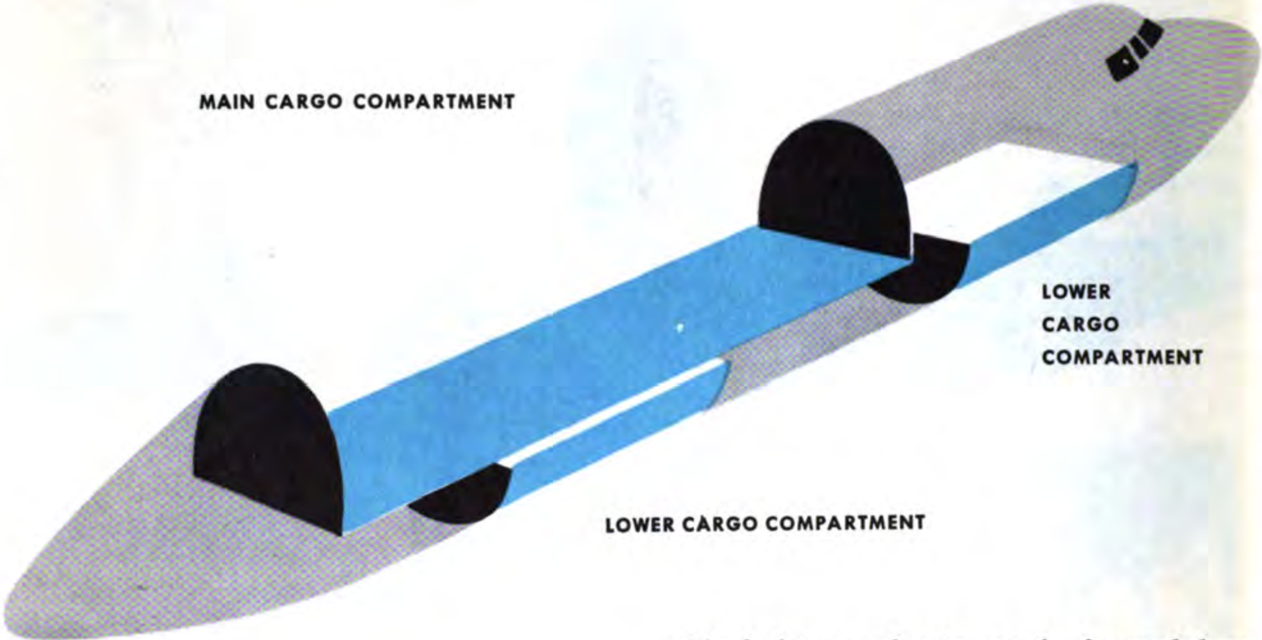
The two wheels of each main gear are mounted on opposite sides of a single oleo pneumatic shock strut which is supported by two drag struts, or links. Each main gear is attached to the wing center section aft of the center of gravity (CG) of the airplane. The main wheels retract forward into wheel wells in the inboard nacelles. When the gear is fully retracted, the doors of the wells close to form the bottom contours of the nacelles.

The nose gear also operates hydraulically, retracting forward into the nosewheel well simultaneously with the main gear. The nosewheel is self-trailing and self-centering and is mounted on a fork and single shock strut which slopes forward like a bicycle fork. For normal operation, stops limit the swivel of the nosewheel to 45° each side of neutral. The torque links may be disengaged to allow the nosewheel a full 360° of swivel for towing on the ground.

The nosewheel has a hydraulic steering device by which you steer the airplane while taxiing. The steering device engages automatically when the weight of the airplane is on the nose gear, disengages when the weight is removed.

The doors of the nosewheel well completely enclose the gear when it is retracted fully, completing the contour of the fuselage nose section. The nosewheel has no brake for ground operation. Retracted, however, the nosewheel fits against a strip of brake lining, which acts as a snubber to stop spinning of the wheel after takeoff.

CARGO COMPARTMENTS

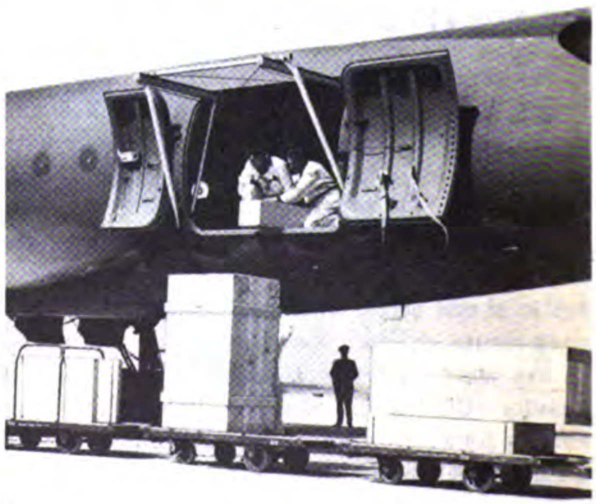


The main cargo compartment of the C-54 accommodates passengers when the airplane is used as a transport, or it provides space for general cargo, engines, combat equipment, and ordnance. The two lower cargo compartments in the belly of the fuselage provide stowage space for cargo or baggage. Separating the two lower cargo compartments is a small accessories compartment extending the width of the fuselage. The main cargo compartment is separated from the fuel compartment, forward, and the tail compartment, aft, by bulkheads. A small service door in the aft end of the main cargo compartment leads to the tail section, which contains the flight control mechanism, glider tow release, and tailskid.

Main Cargo Door

The main cargo double door on the aft left side of the main cargo compartment is connected to the fuselage by two hinges for each door section. The frame is slotted for the attachment of a protective steel plate used during loading operations.

The locking mechanism on the forward door consists of a series of latch-pins attached to bellcranks. The latch-pins make contact with a



safety switch which signals the pilot that the doors are open or closed. The outside handle of the door locks with a key. The inside handle has a lever lock. The aft door is latched in place by four individually operated slip bolts.

The forward door has an emergency release

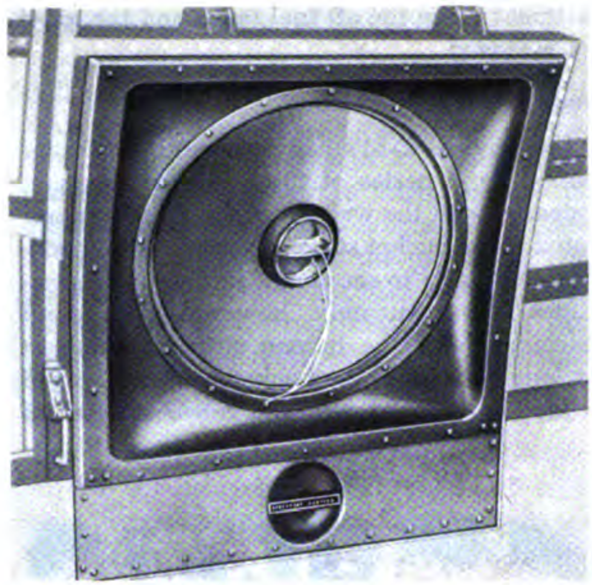
handle on the adjacent fuselage wall. Instructions for using the release are printed on the door. Pulling down on the handle pulls the hinge pins out. Then you can push the door out without operating the door handle.

In normal operation hooks automatically engage the doors and hold them when they are swung fully open. To release the hold-open catch, you push on the ends of the rods adjacent to the door hinges, and pull the doors free.

Windows and Auxiliary Exit Doors

There are individual elliptical windows of single-pane Plexiglas, 13 by 16 inches, in the walls of the compartment. Each window incorporates a gun port, approximately 3 inches in diameter, with a neoprene seal and a removable plastic plug.

There are two auxiliary exit doors in the main cargo compartment, one on each side of



the fuselage. They incorporate the standard cabin windows, the upper part being the window itself and the lower part housing the emergency latch mechanism. To open these exits, turn the handle and pull. The whole exit hatch frame drops inward.

Floors

To support heavy loads the underflooring of the cargo compartment is covered with flat aluminum sheet which has extra reinforcements. Heavier gage flooring is used in the loading area in the vicinity of the main cargo door. Quarter-inch plywood flooring, installed as a protective covering for the aluminum flooring, also makes it easier to handle cargo inside the airplane.

Attachments for securing cargo are built into the floor. These comprise several kinds of tie-down fittings, including brackets into which eye bolts can be fitted for engines and heavy cargo, and fittings for installing troop benches and litter frames.

A trap door in the floor gives access to the aft lower cargo compartment.

Cargo guard rails are installed along the cabin on both sides, approximately 15 inches above the floor. They serve also for the attachment of troop benches. Additional rails are carried in the airplane to be installed along the walls and across the bulkhead of the fuel compartment when the aft fuel tanks and the toilet are removed.

Troop Benches

The original C-54's had conventional airliner seats. The A series of the airplane, however, appeared with the well-known and little appreciated metal bucket seats, designed, as the technical data say, "to accommodate seat-type parachutes." Unfortunately, however, they don't "accommodate" the human sitting equipment for long periods. These bucket seats are hinged to the cargo guard rail, and can be folded up

against the fuselage wall. Benches for 30 passengers are provided, with 30 seat belts which attach by adapter hooks to lugs on the cargo rail attaching fittings. Twenty additional seats, provided as extra equipment with the airplane, can be installed in the fuel compartment when it is adapted for passenger use.

In the C-54B, C-54D, and some of the A se-

ries, canvas troop benches are installed, providing accommodations for 41 troops. Attachments for passenger seats accommodating 46 passengers are also installed. In these airplanes, by removing the fuselage fuel tanks and the partition, two 4-place troop benches or passenger seats may be added to allow carrying of a total of 49 troops or 54 passengers in the cargo compartment.

The C-54E has commercial-type passenger seats with spring cushions and reclining backs. Normally there are 36 to 40 seats installed.

The C-54G uses canvas troop benches, and since there are no fuselage tanks, 49 troops can be accommodated.

Litter Installations

There are three types of litter installations for this airplane, any one of which you may encounter:

1. **Original litters.** The original factory installed litters accommodate only 13 litter patients. Most of the litters are tied to the floor, leaving little aisle space in the cargo compartment.

2. **Evans stanchion litters.** Some C-54A's use the Evans stanchion litter installation, which increases the litter capacity to 24. It provides better aisle space and permanent attachment of all parts to the airplane. The litters are supported on metal rods and fittings, which fold and stow away along the top of the compartment when not in use. The installation provides for four tiers of four litters each on the right side and two tiers of four each on the left side. Normally, litters are not installed in the sections opposite the emergency escape hatches. These Evans litters can also be used in various combinations with rows of canvas seats.

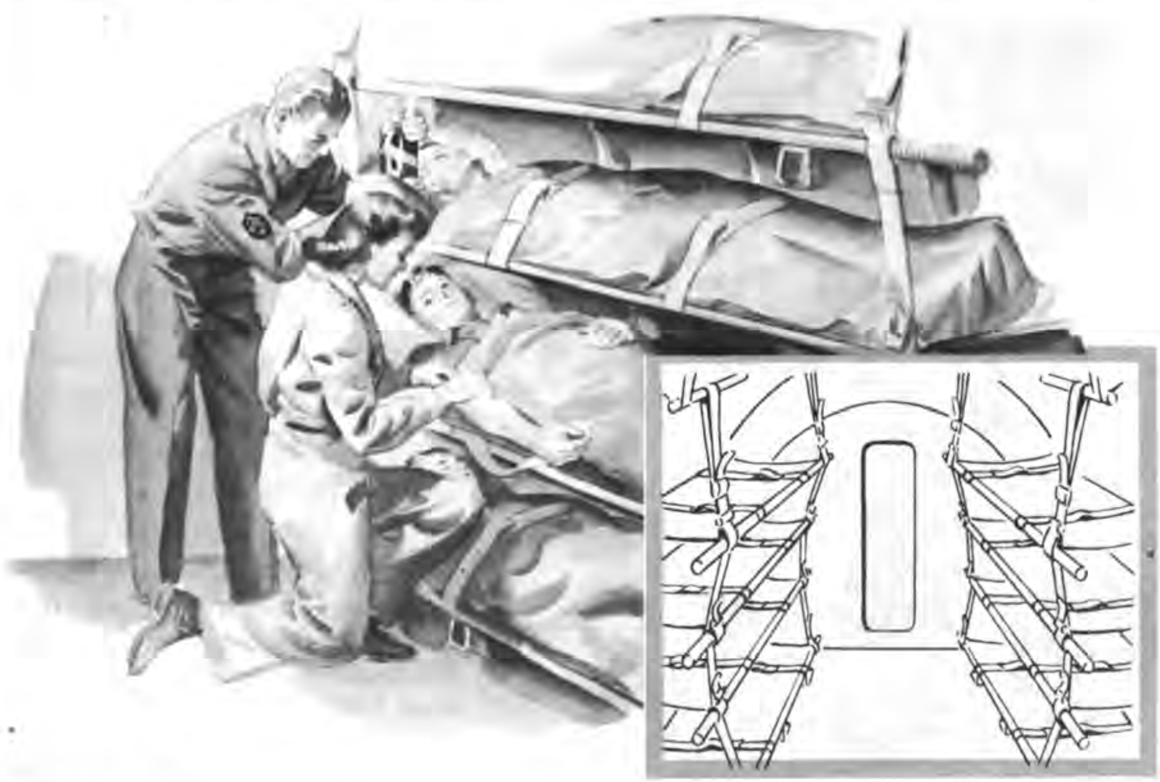
3. **Webbing strap litters.** This type of litter installation has recently been approved by the AAF for all production cargo aircraft. It accommodates a maximum of 20 litters, is permanently attached, and is much lighter than the Evans type. Litter and supports stow neatly in small containers along the top of the compartment. This installation uses webbing straps for support, each strap hung from the litter above, the top one fastened to the compartment.

Removable Toilet

A removable toilet is mounted on a platform on the left side of the rear bulkhead in the main cargo compartment. An assist handle, toilet paper holder, and relief tube are installed on the bulkhead aft of the toilet.

Loading Equipment

The bipod tail support and the emergency ladder are normally stowed in fittings against the forward bulkhead of the cargo compartment. A box is bolted to the floor at the right



side of the rear bulkhead for the stowage of miscellaneous loading equipment. The two gun slide plate bases are stowed on the right wall of the cabin, opposite the main doorway. The ramp platform can be lashed over the main cargo door or tied flat on the compartment floor. The hoist swings in and is stowed against the fuselage wall.

Lights and Heater

On the ceiling of the cargo compartment there are five dome lights and the heating and ventilating duct. Early models also had a dual passenger warning light in the main cabin. Later models have one red and one green jumpmaster lights for paratroop operations.

Lower Cargo Compartments

In the lower cargo compartments there are baggage straps snapped to fittings in the sidewalls and ceilings, and tie-down fittings in the floor as well, for securing cargo. In addition, these compartments have door protector posts which fit into slots in ceiling and floor on each side of the doorways. Web strapping attached to these posts and to the door frames protects the doors from cargo which might shift in flight.

FUEL COMPARTMENT

Windows and Auxiliary Units

There are four windows on each side of the fuel compartment, the aft window on each side being incorporated into an auxiliary exit hatch. Windows and auxiliary exits in this compartment are of the same type found on the main cargo compartment. You can use the auxiliary hatches in the fuel compartment for emergency exit only when the aft fuel tanks are removed.

Fuel Tanks

In the C-54A there are four removable fuel tanks of 1800 gallons total capacity. The tanks are mounted on cradles and held in place by straps with suitcase type fasteners.

A boiler type sight gage is adjacent to each tank. Each gage has a shut-off cock at the bottom, which you turn to let fuel enter the gage to take a reading. Close the cock immediately after the reading to prevent loss of fuel in case the gage is broken.

The C-54B has only the two forward tanks, and the rear bulkhead partition is just aft of them.

There are normally no fuselage tanks in the C-54E and subsequent series.

Floor

The floor is of the same construction as that of the main cargo compartment, with tie-down fittings. The floor and the sides of the compartment to a height of 6 inches constitute a "bathtub" which traps fuel. It is leak-proof except for an inspection plate in the floor. There is a drain pipe in the floor. On the floor between the fore and aft left-hand fuel tanks is a 5-position (3-position in the C-54B) poppet type selector valve for the fuselage fuel tanks. It incorporates a drainage position for each tank and an OFF position.

Baggage Racks

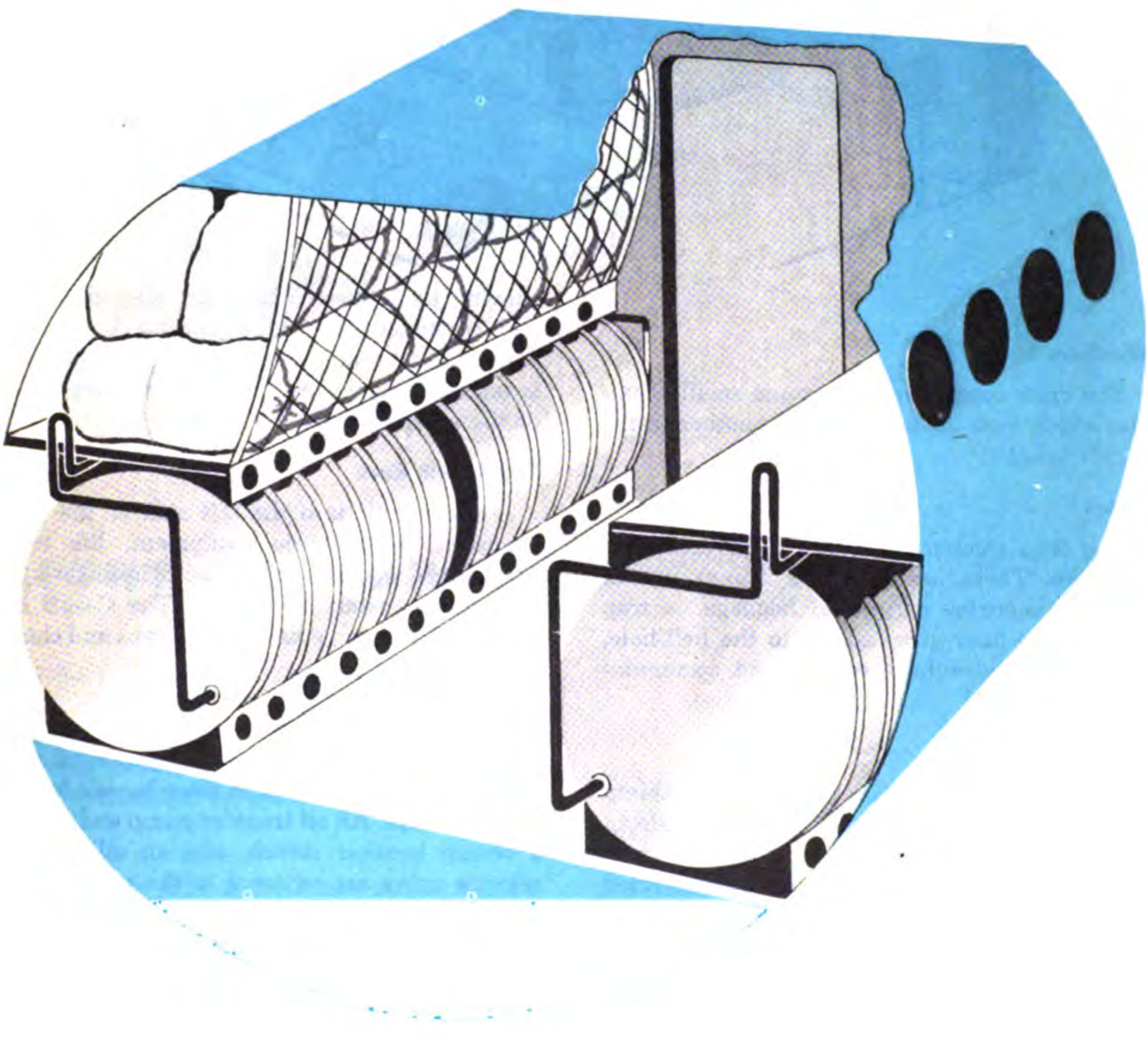
Wooden platforms with nets, for stowage of baggage and small cargo, are mounted on top of the fuel tanks.

Partitions

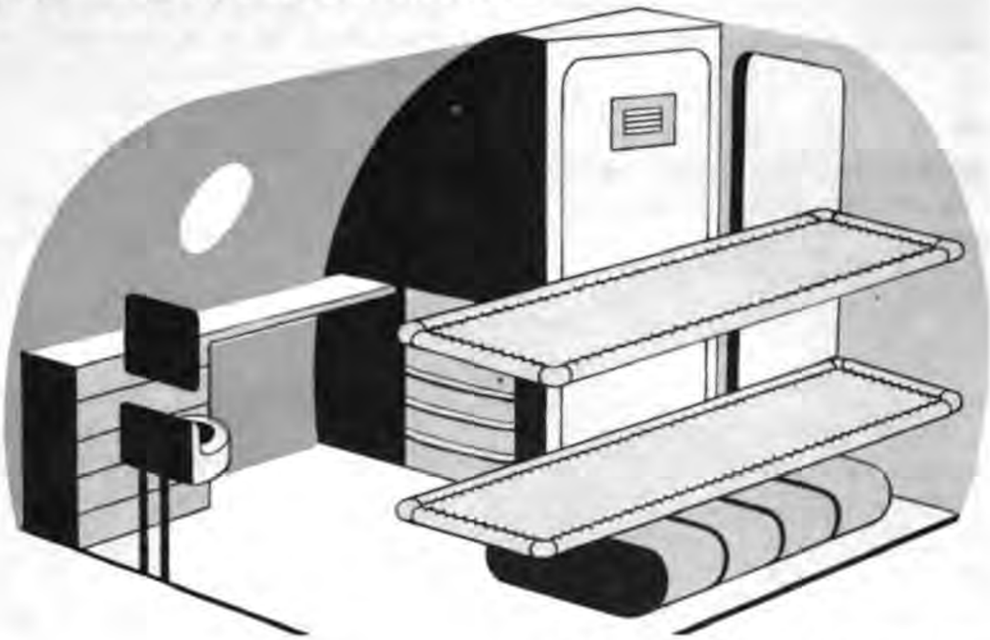
Fume-proof partitions enclose the fuel compartment from the main cargo and crew compartments. The aft partition, of all-wood construction, is completely removable.

Light and Ventilation

A fume-proof dome light and a fume vent are installed in the compartment.



CREW COMPARTMENT



Windows

The crew compartment has one small Plexiglas window on the left side and another in the crew's toilet.

Floors

The crew compartment floor is covered with linoleum. There are tie-down fittings in the floor for securing cargo and baggage. A trap door in the floor gives access to the hell-hole, where the hydraulic reservoir and accumulator are installed.

Bunks

There are two bunks, equipped with safety belts, installed in fittings on the right side of the compartment. The top bunk folds down to form a back rest when the bunks are converted to seats.

Toilet and Lavatory Facilities

The crew's toilet is in the left forward corner of the compartment. It is enclosed by a removable wooden partition. Opposite the toilet door on the aft partition is a wash basin, mirror with shaving light, towel dispenser, soap container, and receptacle for soiled towels. A 10-gallon water tank, to supply water to the wash basin, is installed above the ceiling on the right side of the compartment.

Equipment Rack

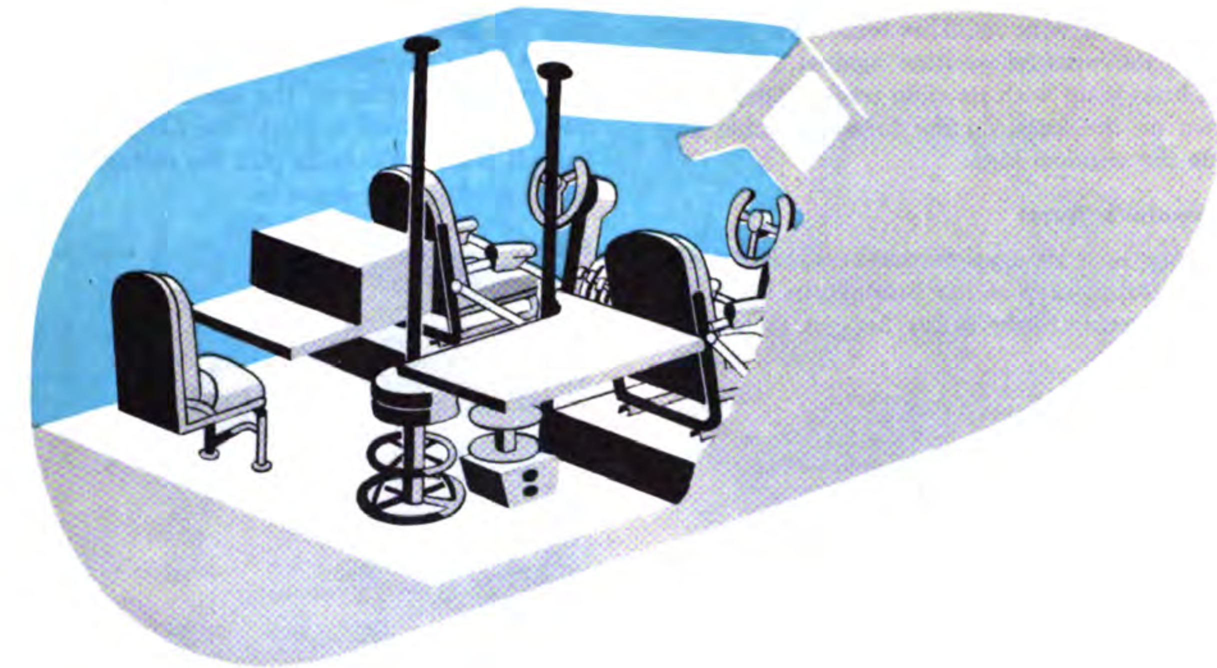
A rack, built into the left side of the compartment, holds radio equipment, life rafts, parachutes, a thermos jug for drinking water, and miscellaneous equipment. The C-54B has facilities for stowing navigation maps and charts in the compartment.

Oil Tank

Under the lower bunk is a 50-gallon oil tank with quantity gage, held in place by reinforced, padded straps. An oil transfer pump and switch, a circuit breaker switch, and an oil transfer selector valve are adjacent to the tank.

Light, Heating, and Ventilation

The crew compartment has a dome light for the compartment and another for the toilet, with small mirror lights mounted above the wash basin. A heating and ventilating unit is installed in the ceiling.



FLIGHT COMPARTMENT

The flight compartment includes the stations of the navigator, radio operator, flight engineer, and the pilot and copilot. The floor contains removable panels for access to controls and various mechanical systems.

Door

On the right side of the flight compartment, behind the navigator's station, is an exterior door for access to the flight compartment on the ground. **Note:** This door is not an emergency exit for bailout, being directly in front of No. 3 propeller.

The door, which includes a small Plexiglas window, is hinged on the forward edge and opens inward by operation of a conventional door handle. It has a safety switch to warn the pilot when the door is open.

Windows

The flight compartment has left and right windshield assemblies, each of a single glass panel, curved corner windows, and sliding side windows. There are detachable Raymond deicer panels for the windows, for cold weather operation.

When visibility is poor because of ice, vapor, or water on the windshield, open the curved corner windows so that you can see for taxiing, takeoff, or approach. The windows are hinged at the forward edge and open in. Rain does not enter the cockpit when the window is open, and you get no effect other than the roar of air.

The side windows may also be opened in flight. The handle is aft of the window. Turn it up to unlock window. This forces the window out of its recessed position against the frame and lines it up with its slide tracks. Then push down on the knob on the forward frame and slide the window back.

Navigator's Turret

There is a navigator's turret (astrodrome) on the top center of the fuselage in the flight compartment. Early series have a metal tur-

ret; later ones incorporate a plastic turret. The metal turret rotates on a roller bearing track, and it includes a laminated glass panel and a small door to reach through for cleaning the panel from the outside. On some ships there is also a hinged hatch cover to cut off noise and light.

The later turret is a single piece of dome-formed plastic, retained by an adapter ring. A swivel-type ball and socket arm is suspended from the center of the dome, with a hook at the end of the arm to hold the navigator's octant.

On the ground, or after ditching, the turret may be used as an exit hatch. To release the turret from the inside pull out and down on the release handle, at the same time pulling down on the strap opposite the handle. To release it from the outside pull the releasing ring while pushing the dome in.

Seats

1. **Radio operator.** The radio operator's seat is not adjustable. Placed aft of the hinged table, it is mounted on a bracket fastened to the floor and the rear bulkhead. A conventional seat belt

is attached to the seat, and some of the airplanes provide a shoulder safety harness.

2. **Navigator.** The navigator's seat is a stool, adjustable in height. It has hooks to engage fittings on the floor, so that the stool may be placed in front of the navigator's folding table, or used as a stand for taking sights through the turret. A safety belt for the navigator is installed on the rear bulkhead behind him.

3. **Flight engineer.** On most of the airplanes a seat for the flight engineer is being installed as extra equipment. It is a folding seat which is attached to the left stanchion behind the pilot. It folds down and hooks to the opposite stanchion, seating the engineer close to the control pedestal. A safety belt is provided with the seat.

4. **Pilot and copilot.** Pilot and copilot have 2-way adjustable seats with conventional safety belts. The control levers for adjustment are on the outboard sides of the seats. The upper lever controls vertical adjustment, and the lower lever controls horizontal adjustment. When you have the seat adjusted be sure that the levers are in the full down position, which locks the seat in position. If the adjustment is not locked, the seat can slip back and leave you in the embarrassing position of not being able to reach the controls.

Rudder Pedal Adjustment

Pilot's and copilot's rudder pedals are adjustable. There is a spring latch on the lower inside corner of each rudder panel. By pushing the latch away from the pedal you can slide the pedal backward or forward. When you have the pedal where you want it, release the latch and the pedal locks into the nearest notch. Be sure pedals are locked into position, and that the pedals are exactly equal when the rudder is in neutral.

Curtains

A vestibule curtain on a rod over the companionway separates the flight compartment from the crew compartment. There is a detachable instrument flying curtain for the pilot, and curtains aft of the pilot's and copilot's seats to cut off the glare on the windshield at night from the lights in the rest of the compartment.

Instruments

The engine, flight, and other instruments necessary for the operation of the airplane are mounted on two major panels and two auxiliary panels. The main instrument panel is at the front of the flight compartment, below the windshield. An upper panel is above the windshield V. The auxiliary instrument panels are the copilot's control panel, to the right of the copilot's seat, and the navigator's instrument panel.

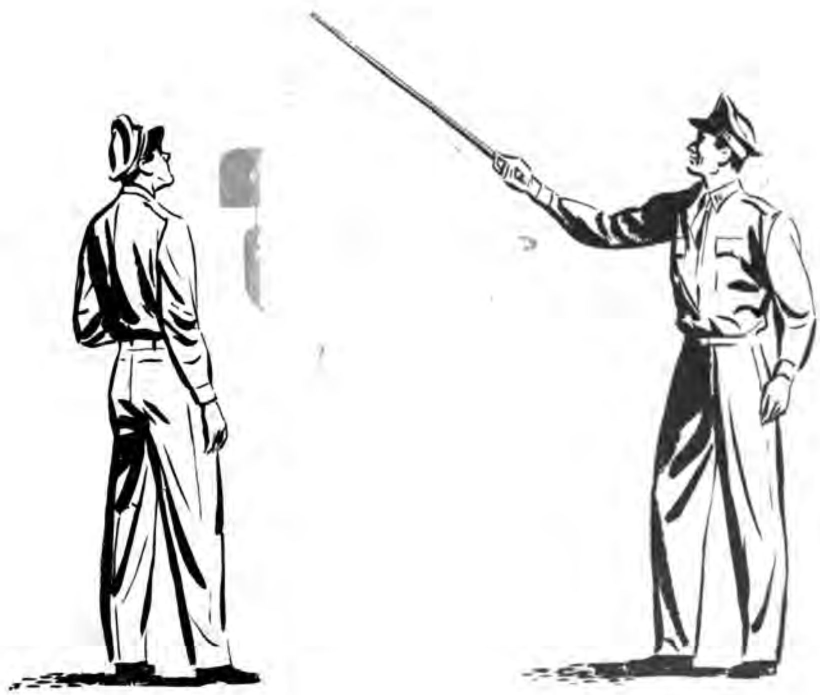
The instrument panels are constructed of non-magnetic materials and, with the exception of the copilot's control panel, are mounted on Lord shock absorber units. The center section of the main panel, the upper instrument panel, and the nagivator's instrument panel are shielded with a box-type structure of non-magnetic material to prevent the electrically operated instruments from interfering with radio reception and transmission.

NOTE: The location and types of instruments change frequently as later series of the airplane appear. The instruments in your airplane may be arranged differently from those listed in this section. You can get the general picture of instrument location, however, from these lists.

Vacuum Systems

A vacuum system operates the gyro instruments on the main instrument panel. The vacuum in the system is created by a vacuum pump on each inboard engine. The surface de-icers operate from the exhaust side of these pumps. The two vacuum lines are routed to a vacuum selector valve below the panel in front of the copilot's seat. A relief valve in the line between each pump and the selector valve governs the amount of suction provided to the system.

VACUUM SYSTEM
INSTRUMENTS

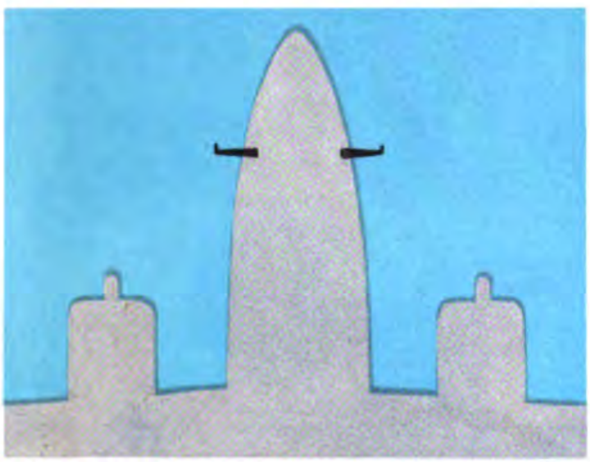


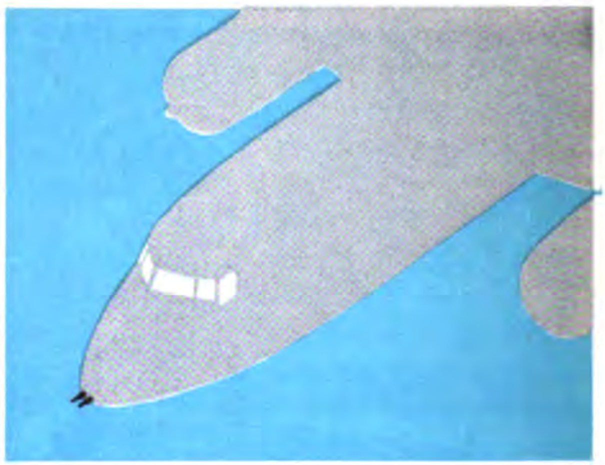
Pitot-Static System

The airplane has a dual pitot-static system to supply static and ram air pressure for the operation of the flight instruments: static pressure to the altimeter and the airspeed and rate-of-climb indicators, and ram pressure also to the airspeed indicator. The left-hand system supplies the pilot's instruments, and the right-hand system supplies the copilot's and navigator's instruments.

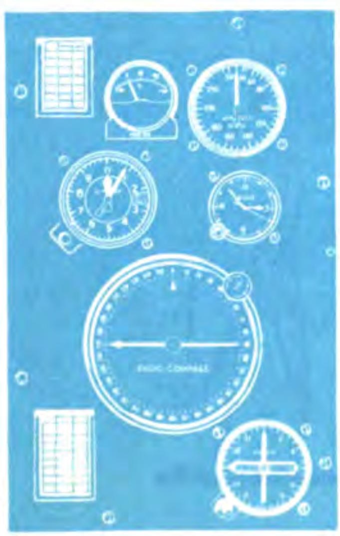
A pitot head is mounted on each side of the fuselage, just aft of the nose tip, in the C-54A. The position of the pitot heads was changed starting with the B series of the airplane. The new heads protrude direct from the tip of the nose. The pitot heads have electric heating elements for use when icing conditions prevail. Switches to control the pitot heaters are on the left side of the upper instrument panel. See **Cold Weather Operation** for use of the pitot head heaters.

From the pitot head, ram pressure goes directly to the airspeed indicators. Static pressure, however, is routed from the pitot head to the static pressure selector switches. An alternate source of static pressure, on the side of the airplane, also routes static pressure to the selector switch through a common drain fitting in the nosewheel well. From the selector switch, the static pressure is routed to the altimeters, rate-of-climb indicators, and airspeed indicators.



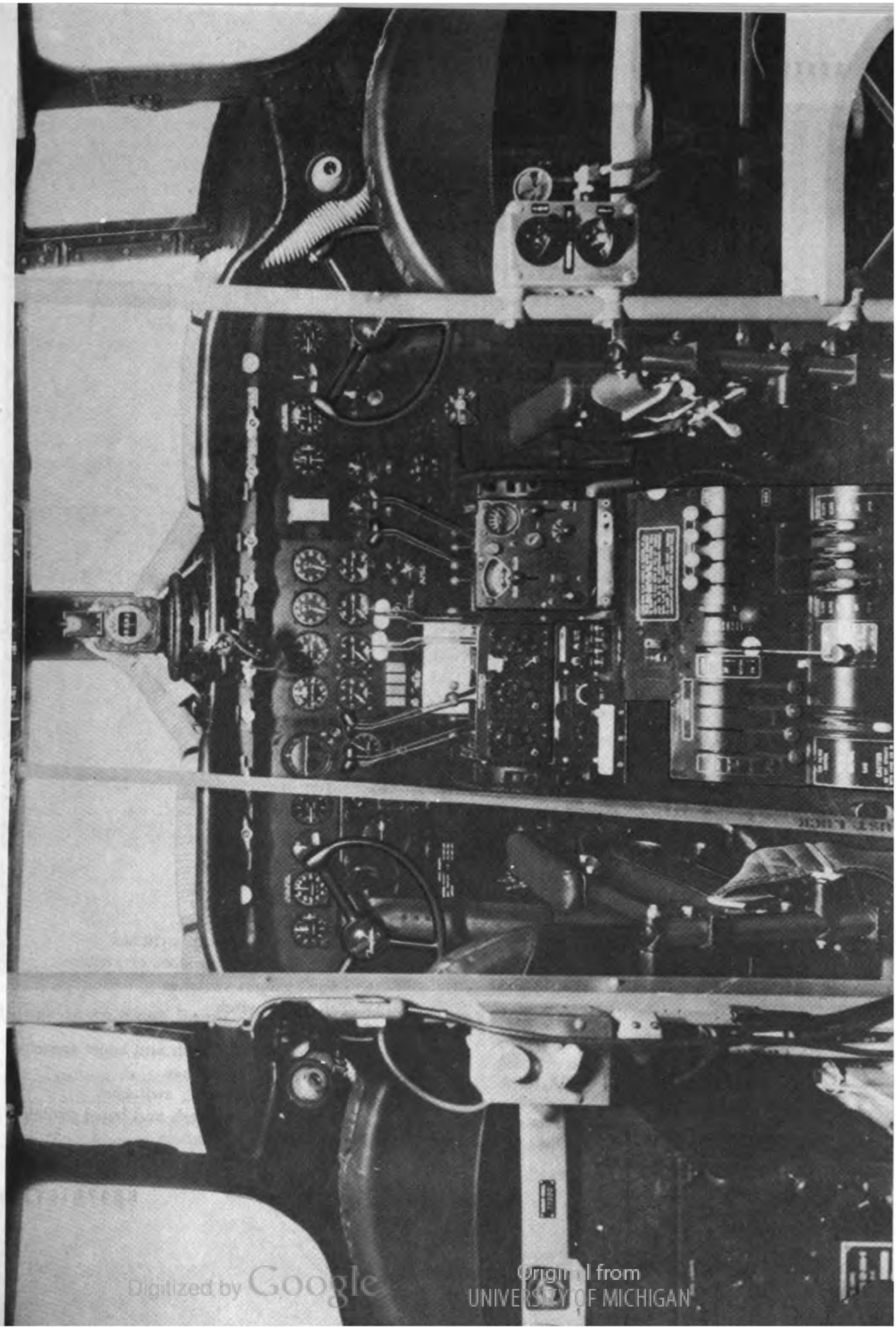


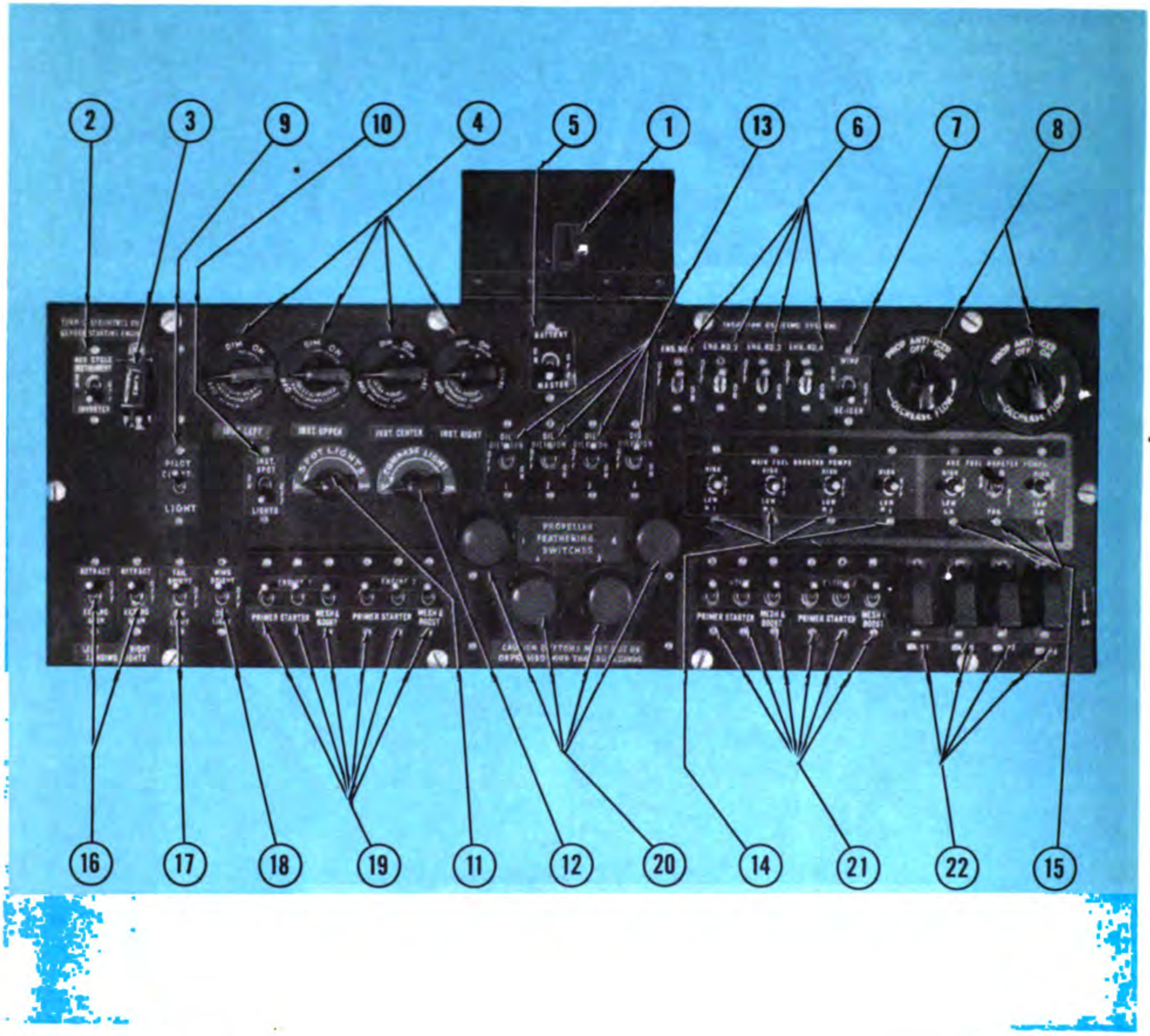
PILOT'S INSTRUMENTS



NAVIGATOR'S INSTRUMENTS

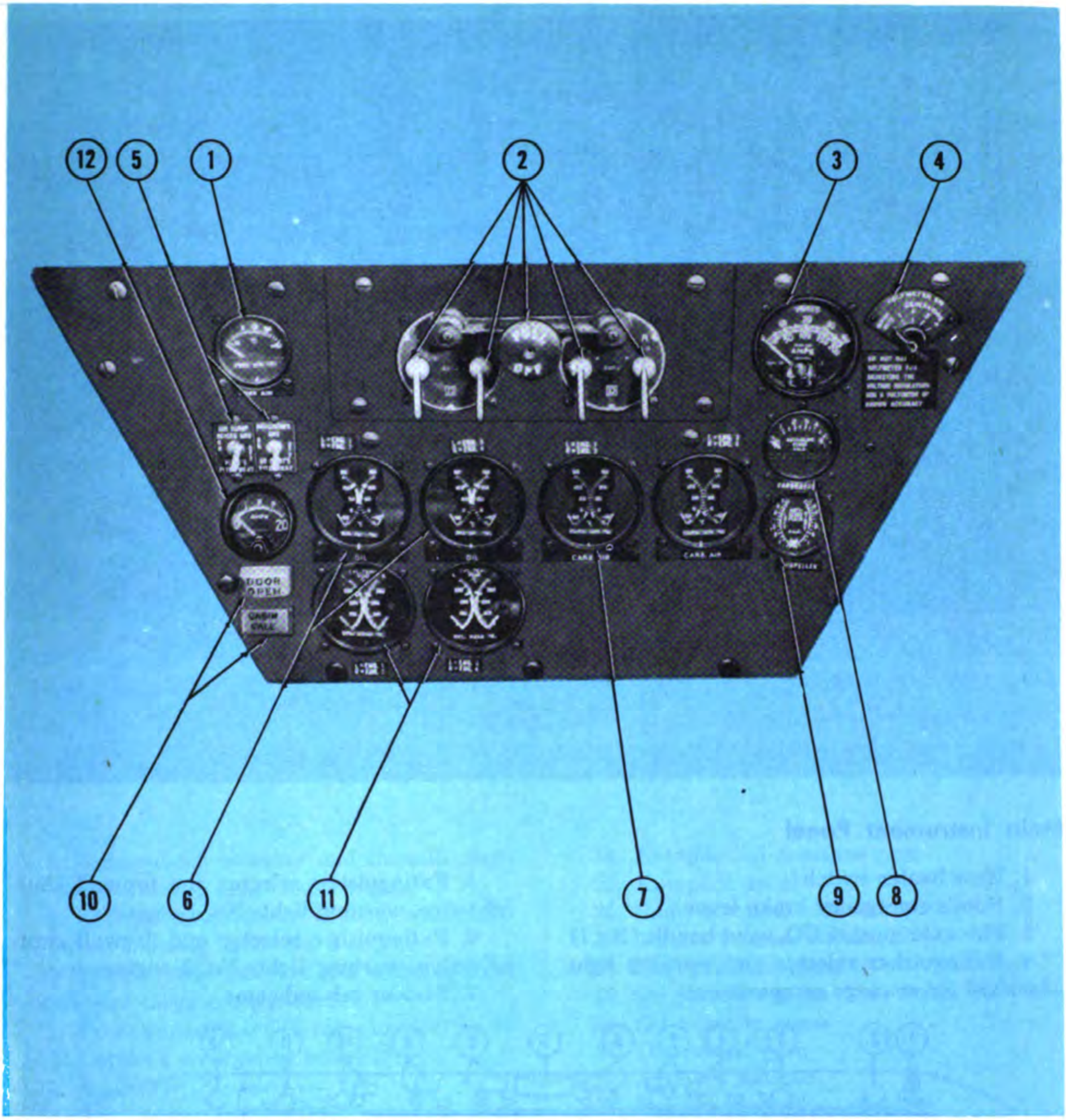
COPILOT'S INSTRUMENTS





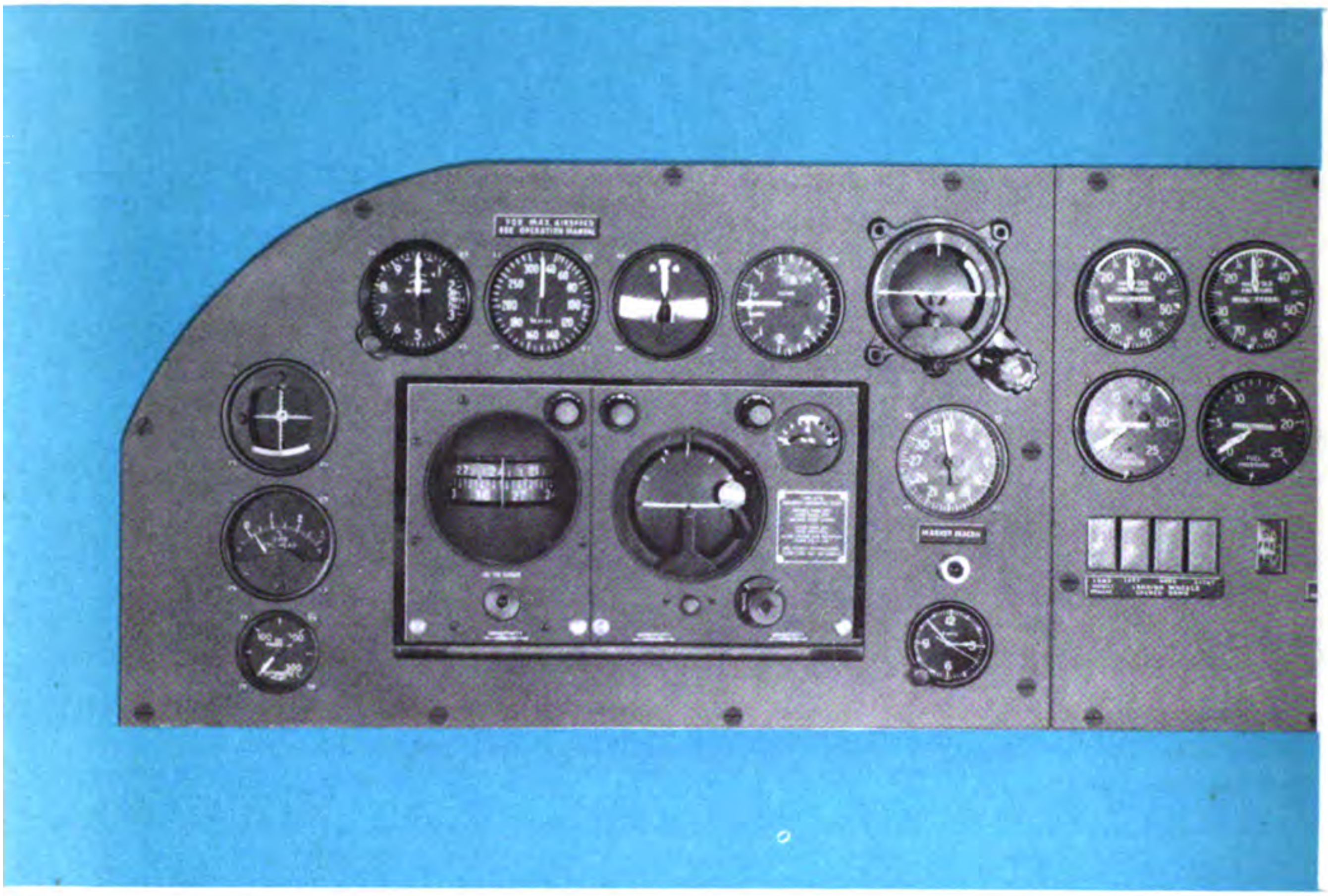
Upper Switch Panel

1. Spotlight
2. Instrument inverter switch
3. Emergency alarm switch
4. Instrument fluorescent light rheostats
5. Master battery switch
6. Induction de-icing switches
7. Wing de-icer switch
8. Propeller anti-icer rheostats
9. Pilot's compartment light switch
10. Instrument spotlight switch
11. Instrument spotlight rheostat
12. Compass light rheostat
13. Oil dilution switches
14. Main booster pump switches
15. Aux. and fuselage booster switches
16. Landing light switches
17. Tail light switch
18. Wing light switch
19. Primer, starter, mesh and boost switches for No. 1 and No. 2 engines
20. Propeller feathering switches
21. Primer, starter, mesh and boost switches for No. 3 and No. 4 engines
22. Generator switches



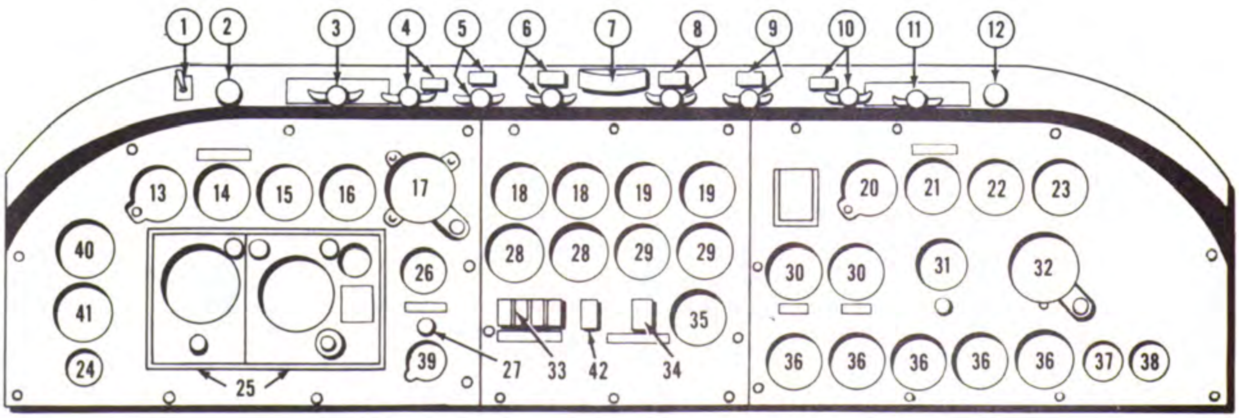
Upper Instrument Panel

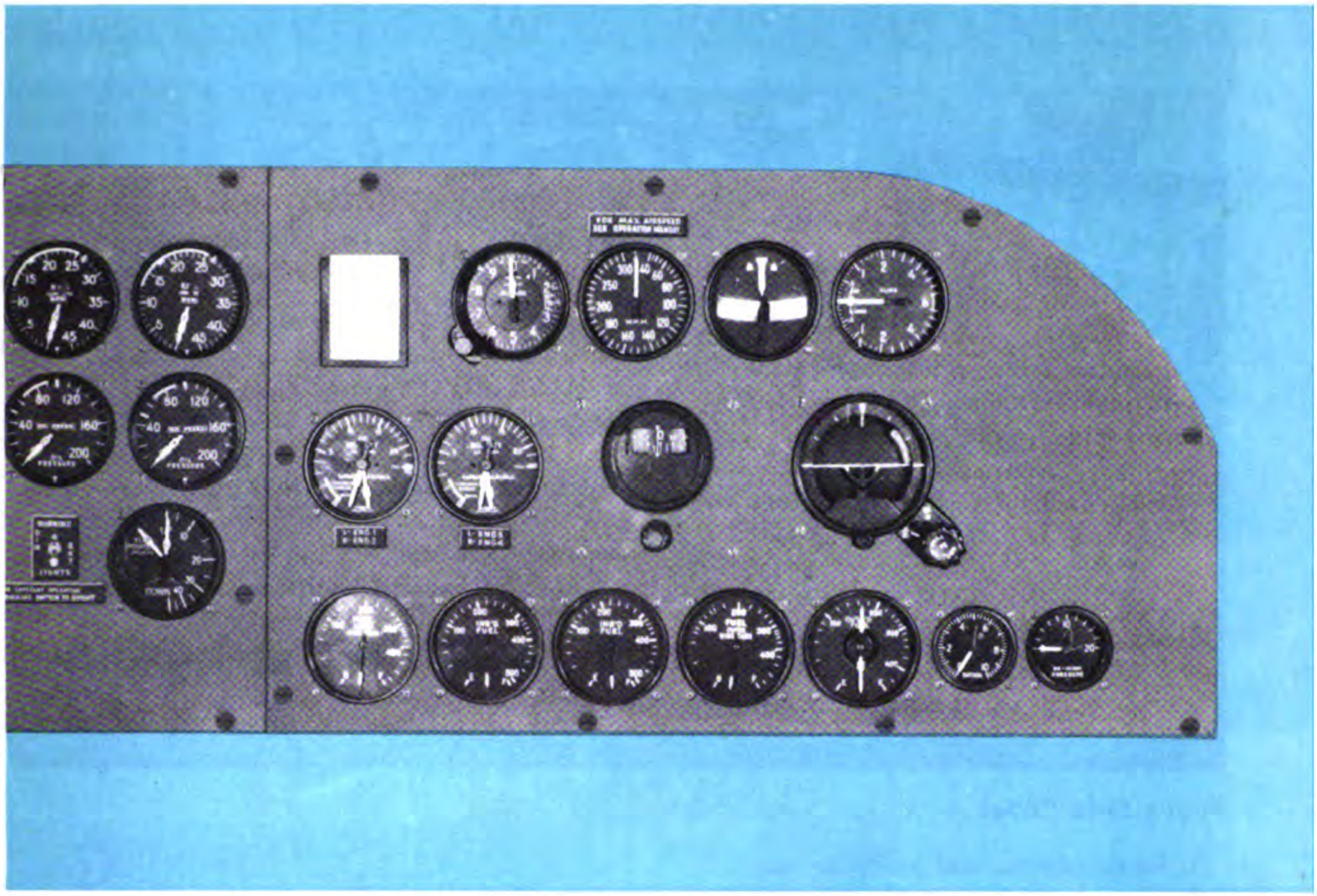
1. Free air temperature gage
2. Ignition switches
3. Voltammeter
4. Voltammeter selector switch
5. Pitot heater switches
6. Oil temperature gages
7. Carburetor temperature gages
8. Induction alcohol capacity gage
9. Propeller anti-icer fluid capacity gage
10. Door open and cabin call light
11. Cylinder-head temperature gages
12. Pitot heater ammeter



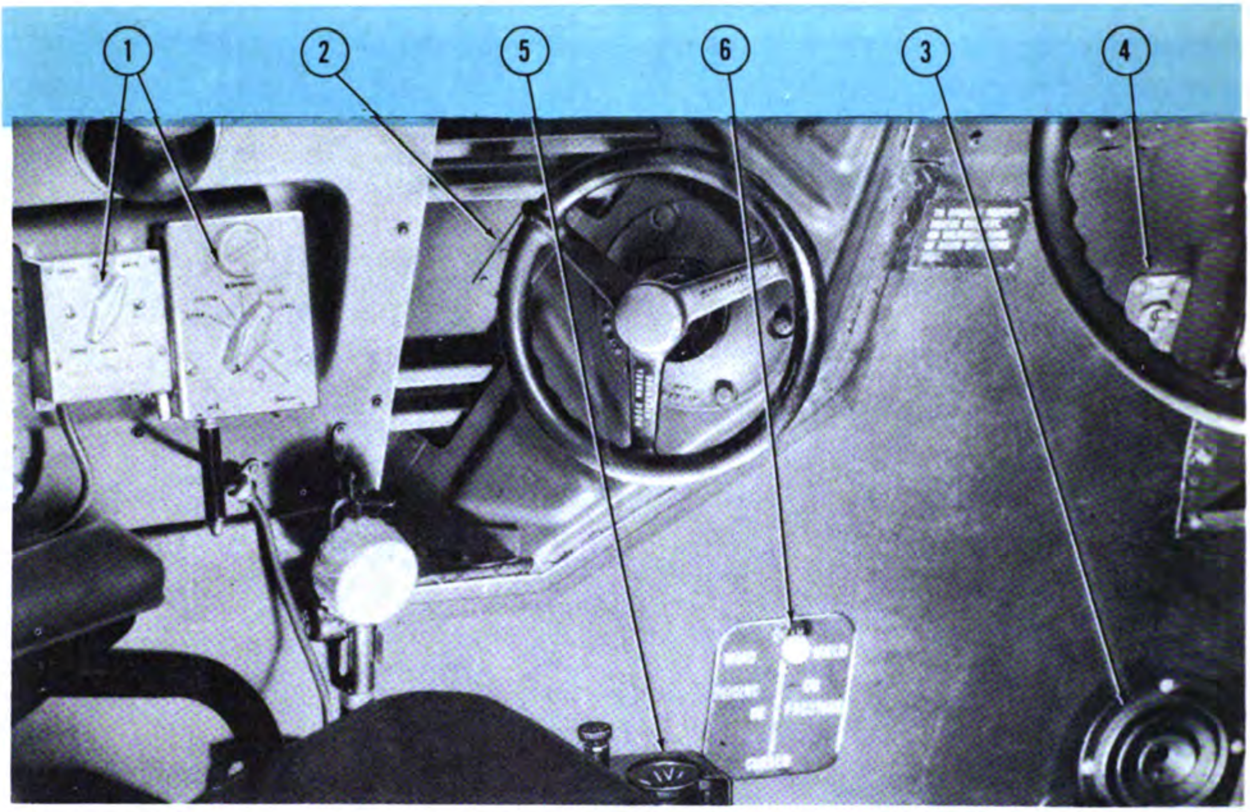
Main Instrument Panel

1. Nose heater switch
2. Pilot's emergency brake lever
3. Fire extinguisher CO_2 valve handle (No. 1)
4. Extinguisher selector and warning light—forward lower cargo compartment
5. Extinguisher selector and firewall shut-off valve, warning light—No. 1 engine
6. Extinguisher selector and firewall shut-off valve, warning light—No. 2 engine
7. Rudder tab indicator



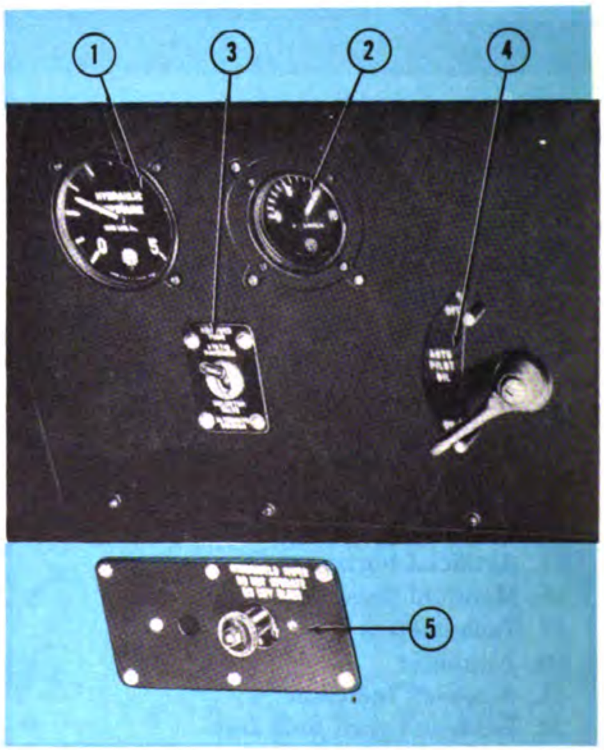


8. Extinguisher selector and firewall shut-off valve, warning light—No. 3 engine
9. Extinguisher selector and firewall shut-off valve, warning light—No. 4 engine
10. Extinguisher selector and warning light—aft lower cargo compartment
11. Fire extinguisher CO_2 valve handle (No. 2)
12. Copilot's emergency brake lever
13. Altimeter
14. Airspeed indicator
15. Bank-and-turn indicator
16. Rate-of-climb indicator
17. Artificial horizon
18. Manifold pressure gages
19. Tachometers
20. Altimeter
21. Airspeed indicator
22. Bank-and-turn indicator
23. Rate-of-climb indicator
24. Autopilot oil pressure gage
25. Autopilot panel
26. Radio compass indicator
27. Marker beacon indicator
28. Fuel pressure gages
29. Oil pressure gages
30. Oil quantity gages
31. Directional gyro
32. Artificial horizon
33. Landing gear warning lights
34. Warning light dimming switch
35. Wing flap indicator
36. Fuel quantity gages
37. Instrument suction gage
38. De-icer pressure gage
39. Clock
40. Glide path and localizer
41. Cockpit heater indicator
42. Oil pressure warning light



Pilot's Side Panel

1. Radio selector and junction box
2. Nosewheel steering wheel
3. Air duct ventilator
4. Static pressure selector switch
5. Oxygen regulator
6. Windshield defroster control

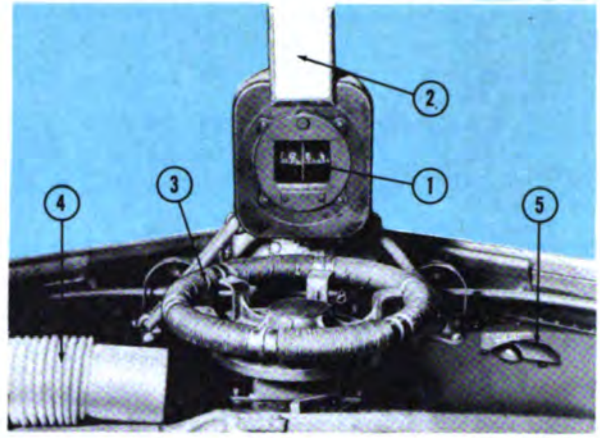


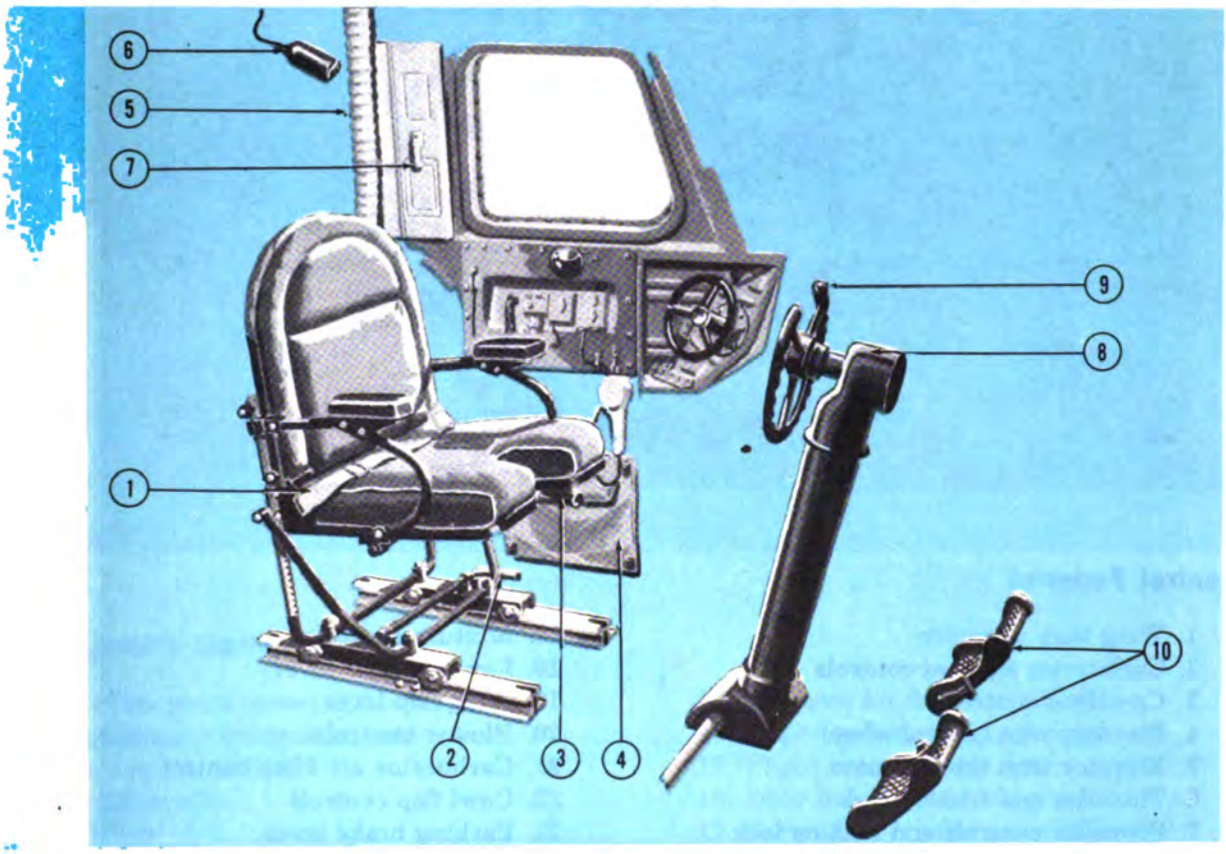
Copilot's Control Panel

1. Hydraulic pressure gage
2. Emergency brake air pressure
3. Static pressure selector switch
4. Autopilot oil shut-off valve
5. Windshield wiper valve

Windshield Section

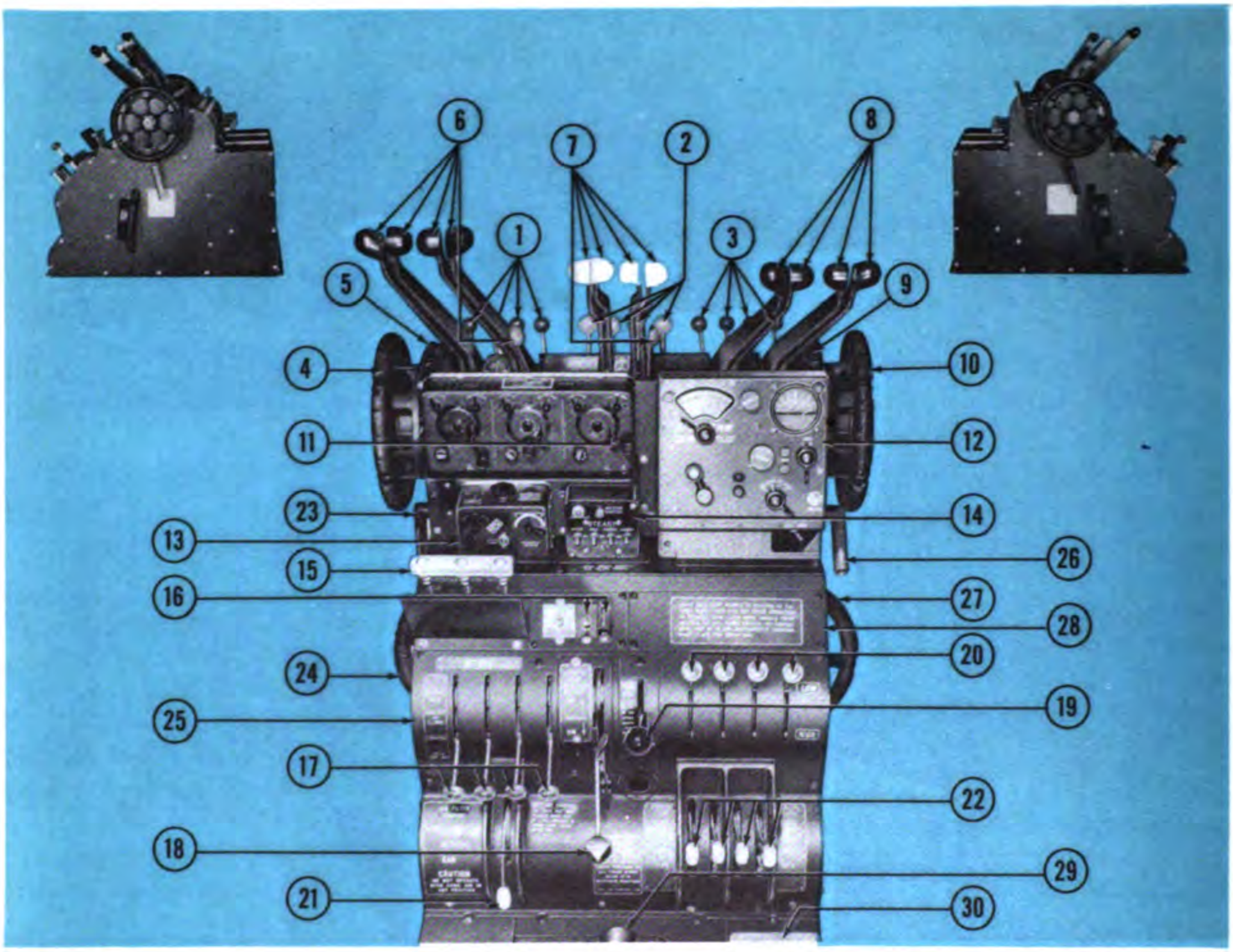
1. Compass
2. Calibration card
3. Rudder trim wheel
4. Defroster tube
5. Air duct blower control for nose heater





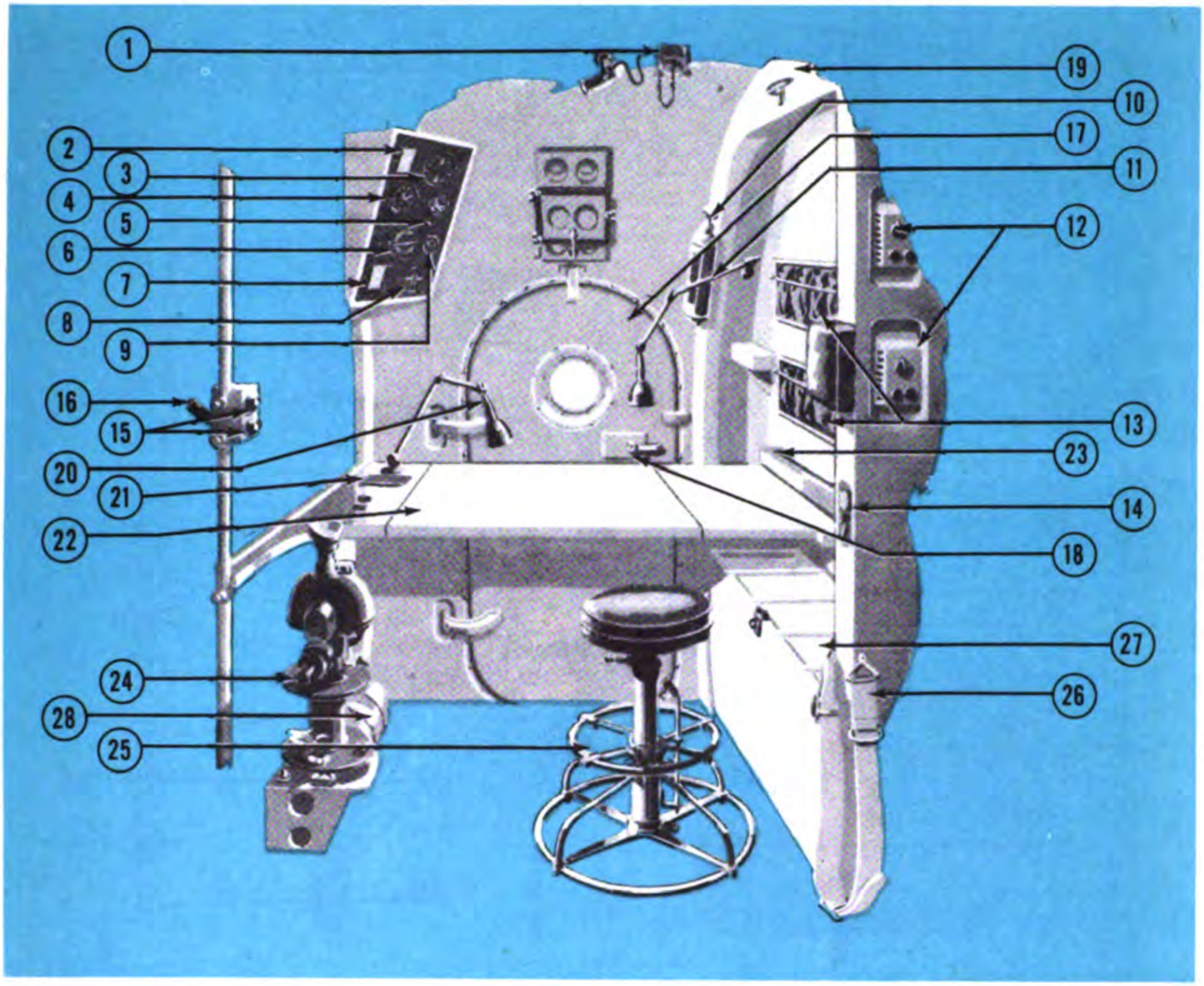
Pilot's Seat Section— Duplicated on Copilot's Side

1. Safety belt
2. Horizontal seat adjustment lever
3. Vertical seat adjustment lever
4. Map case and logbook container
5. Defroster tube
6. Red spotlight, switch, and rheostat
7. Side window handle
8. Control column
9. Emergency cockpit light button
10. Rudder pedals



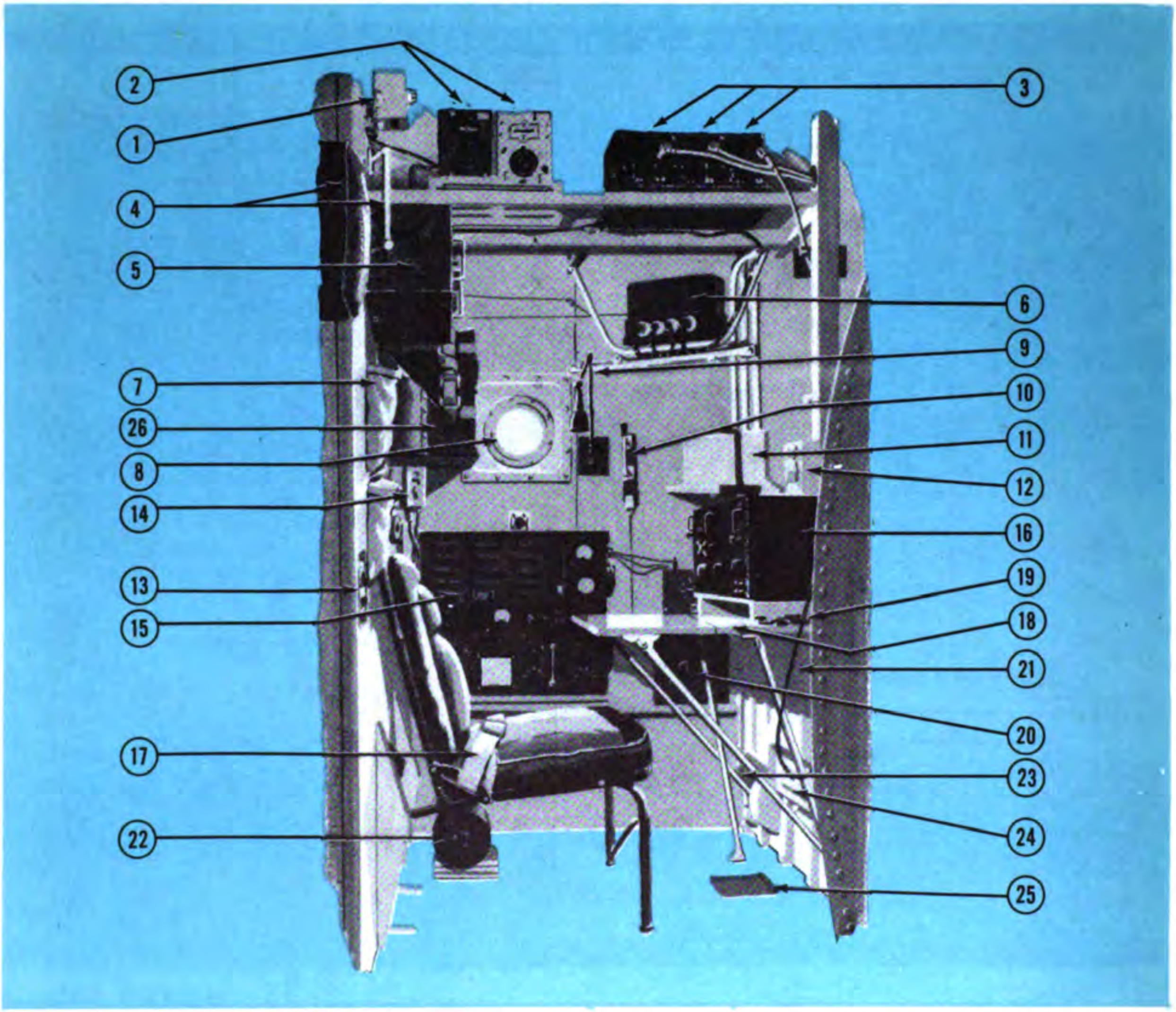
Control Pedestal

1. Wing tank selectors
2. Carburetor air heat controls
3. Crossfeed controls
4. Elevator trim control wheel
5. Elevator trim tab indicator
6. Throttles and friction lock
7. Propeller controls and friction lock
8. Throttles
9. Elevator trim tab indicator
10. Elevator trim control wheel
11. Command receiver control units
12. Radio compass receiver control unit
13. Transmitter control box
14. Recognition light switches
15. Autopilot servo controls
16. IFF switch
17. Mixture controls
18. Landing gear lever
19. Wing flap lever
20. Blower controls
21. Carburetor air filter control
22. Cowl flap controls
23. Parking brake lever
24. Aileron trim control wheel
25. Aileron trim tab indicator
26. Landing gear emergency extension valve lever
27. Aileron trim control wheel
28. Aileron trim tab indicator
29. Door for external cargo and glider release levers
30. Hydraulic bypass valve



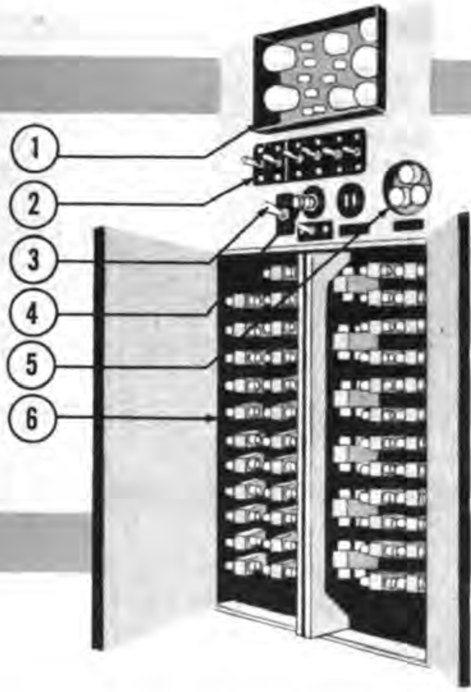
Navigator's Station

1. Flare pistol mount and cover
2. Altimeter calibration card
3. Airspeed indicator
4. Altimeter
5. Clock
6. Radio compass indicator
7. Electric compass calibration card
8. Electric compass
9. Free air temperature gage
10. Fire extinguisher
11. Adjustable work lamp
12. Heated clothing outlet
13. Drift signals and resin lens container
14. Oxygen regulator
15. Rheostat for fluorescent light
16. Upper switch panel spotlight
17. Flight compartment door
18. Door handle and lock
19. Cargo door handle
20. Adjustable table lamp
21. Rheostats for lamps
22. Navigator's folding table
23. Book rack
24. B-3 drift meter
25. Navigator's adjustable stool
26. Navigator's seat belt
27. Map case and logbook container
28. Flare gun container



Radio Operator's Station

1. Antenna relay unit
2. Command transmitters
3. Command receivers
4. Padded head rest and handle
5. Spare tuning unit for liaison transmitter
6. Command transmitter modulator and dynamotor unit
7. Colors of the day cartridge rack
8. Window
9. Adjustable desk lamp
10. Antenna change-over switch
11. IFF control box mounting
12. Interphone jackbox
13. Heated clothing outlet
14. Trailing liaison antenna reel control box
15. Liaison transmitter
16. Liaison receiver
17. Chair and safety belt
18. Folding work table
19. Transmitting key
20. Liaison transmitter antenna tuning unit.
21. Radio junction box
22. Liaison transmitter dynamotor
23. Identification radio inertia switch
24. Radio fuse panel door
25. Drift chute flare door
26. Frequency meter and case



Companionway Electric Panel

1. Spare lamp container
2. Cabin heater control switches
3. Inverter selector switch
4. Cabin heater thermostat
5. Heater warning lights
6. Main junction box fuse panel

Ceiling of Pilot's Compartment

1. Warning horn

Changes—C-54B

1. Ammeter for pitot heater added to upper instrument panel below pitot switches.

2. Crew signal light added to upper instrument panel. (Switch in cargo compartment to left of door into fuel compartment.)

3. Two fuel booster switches for auxiliary wing tanks added to upper switch panel.

4. Two additional fuel quantity gages for auxiliary tanks added to instrument panel.

5. Two propeller feathering oil dilution switches removed from upper switch panel.

6. Oil pressure warning light added to main instrument panel.

7. White recognition light removed.

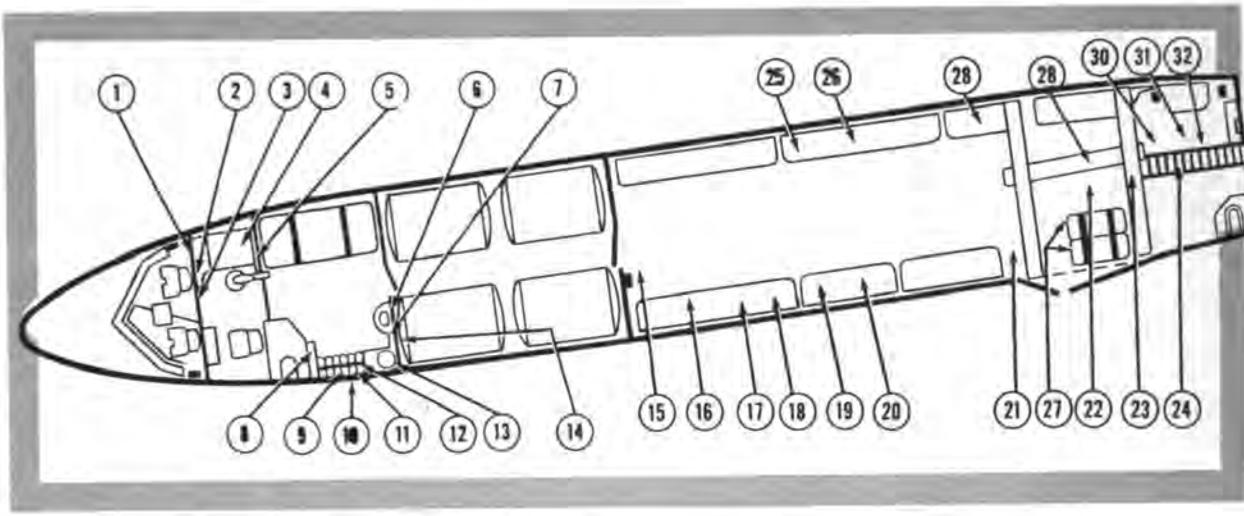
8. Two fuel selector controls for auxiliary wing tanks and crossfeed added to compartment under door in floor.

9. Demand type oxygen regulators and panels installed for all crew members.

10. Astrocompass bracket at navigator's turret changed parallel to center line of airplane rather than vertical.

C-54D

C-54D airplanes have the same equipment, fittings, and systems as the C-54B series, with the exception of engines. R-2000-11 engines are used in this series.



Interior Stowage of Miscellaneous Equipment

1. Load and balance calculator
2. Flare containers
3. Flare pistol containers
4. Cargo door handles (navigator's comp.)
5. Fire extinguisher (navigator's comp.)
6. Instrument flying curtains
7. First-aid kit (crew comp.)
8. Fire extinguisher (crew comp.)
9. Life rafts and parachutes (crew comp.)
10. Box–headsets and microphones
11. Box–instruction books
12. Box–pilot's curtains
13. Radio operator's kit
14. Box–tools, emergency, spare parts
15. Flight engineer's kit
16. Box–Raymond de-icer panels
17. First-aid kit (cargo comp.)
18. Box–troop benches and accessories
19. Box–bench support tubes
20. Gun slide plate stowage
21. Parachute troop static line
22. Lamp
23. Cargo door handles (by main cargo door)
24. Ramp assembly
25. Tank turret platform
26. Cargo guard rail angle assembly
27. Life rafts (cargo comp.)
28. Emergency radio
29. Internal hoist assembly
30. Hoist equipment tube support chock
31. Cargo guard rail stowage
32. Box–hoist equipment and chocks

Additional Miscellaneous Equipment Below Floors

1. **Nosewheel Well**
   Emergency engine crank
   Gear box for emergency engine cranking
2. **Forward Belly Compartment**
   Trailing antenna replacement kit
   Box–external hoisting equipment
   External equipment hoist and latch assemblies
3. **Aft Belly Compartment**
   Chock assemblies for 105-mm. howitzer
   Box–litter cradle assemblies
   Sheet steel bases for loading
   Litter pedestal assembly
   Box–litter pedestal assemblies
   Box–tool kit, aircraft ground equipment, autopilot servo unit jumper cables
   Box–autosyn sump line plates and accessories
   Box–litter tie-down strap and seal assemblies
   Box–hoist loading equipment (internal)
   Jeep hoisting assembly
   Box–105-mm. howitzer external hoisting equipment
   Internal hoist equipment
   Box–2 wrenches
   Engine covers
   Set of carpets for pilot compartment

MISCELLANEOUS CHANGES C-54E

1. R-2000-11 engines installed. The R-2000-11 produces 1350 Hp for takeoff with 2700 rpm and 45.7" Hg manifold pressure instead of the 50" Hg needed for the R-2000-7.

2. Fuel system revised. Fuselage tanks removed and one additional auxiliary tank added to each wing. Fittings for fuselage tanks left intact. Relocation of some fuel system controls. Addition of fuel flowmeters on each engine, with two dual-type indicators in flight compartment. (See pp. 158A-158F.)

3. Hydraulic pressure accumulator installed for brake system, and main selector relief and brake balance relief valves removed. Brake accumulator pressure gage added.

4. Hydraulic reservoir gage added to upper instrument panel.

5. Guards installed over generator switches in some airplanes.

6. Bucket and canvas seats replaced by commercial-type passenger seats with spring cushions and reclining backs. Normally there are 36 to 40 seats installed.

7. Buffet compartment added, with cupboards at top and bottom and with a counter for thermos jugs, hot cups, and hot food box.

8. Cold ducts and outlets provided for all passenger seats, and outlets provided for galley, lounge, rear toilet, bunks in crew's quarters, navigator's and radio operator's stations.

9. Complete lighting system, including dome lights and individual reading lights, installed in cabin.

10. Complete insulation and soundproofing of cabin provided.

11. Structural provisions made for the installation of a swinging boom cargo hoist at the main cabin entrance.

12. Stowage for eight 6-man life rafts provided in the cabin adjacent to the main entrance.

13. Extra water tank mounted on aft bulkhead of cabin.

14. Instruments on pilot's panel rearranged. Directional gyro and instrument suction gage added. Instruments on center panel lowered to make room for the flux gate compass and radio altimeter. Copilot's panel rearranged to standard grouping. Two dual fuel flowmeters and space for a dual auxiliary fuel tank gage provided.

15. Individual controls, one each for pilot and copilot, provided for windshield wipers.

16. Heated air windshield de-icing panel installed.

17. Lines, fittings, and necessary parts for alcohol windshield de-icing system installed.

18. Type A-8 signal flare container assembly installed adjacent to the navigator's station. Mount for firing the signal pistol installed above the entrance door to the flight compartment.

19. Flare chutes provided in the lower portion of the center wing for two parachute landing flares, with two release handles, marked AFT and FORWARD, located on the floor in the flight compartment.

20. Gyro flux gate compass installed, with master indicator located on the navigator's instrument panel and secondary indicator mounted on the pilot's center instrument panel.

21. VHF (very high frequency) command radio set (SCR-522-A) installed. Control box is located on pilot's pedestal.

22. Radio altimeter (SCR-718) installed in the forward belly cargo compartment, with indicator adjacent to the navigator's station.

23. Glide path receiver (R-89/ARN-5A) installed on a shelf in the crew's quarters, with indicator on pilot's instrument panel.

24. Seven static discharger assemblies installed, one on the tip of each vertical and horizontal stabilizer and two on the under side of each wingtip.

25. Blinking unit added to navigation light system, which, when selected, causes the light to flash in predetermined cycles.

The C-54G

The C-54G, now in use, is operationally the same as the C-54E, with the exception of the engines. The C-54G uses R-2000-9 engines, which have 1450 Hp available for takeoff, using 2700 rpm and 48.5" Hg manifold pressure. There are 49 canvas troop seats and provisions for 36 litters. This series has troop oxygen and removable lining.

NOTE

The illustrations of instruments, controls, etc., in this manual are for the most part those of the earlier series of the airplane. For illustrations of the C-54E and later series, consult the Technical Orders.

SECTION THREE

Weight and Balance • Inspections and Checks

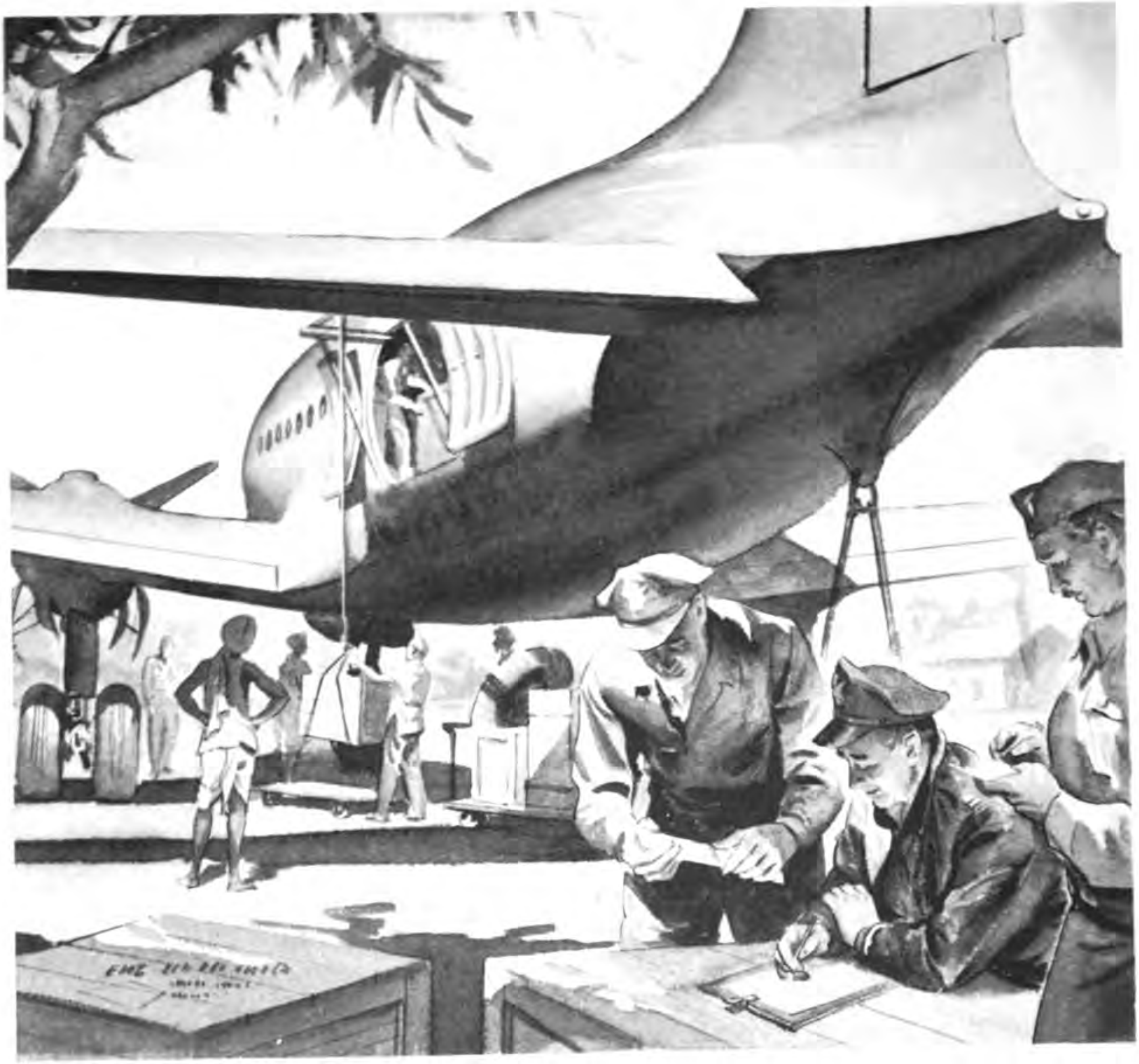
Before Starting Engines • Starting Engines • Taxiing

Engine Run-Up • Takeoffs • Climb • Cruise

Flight Planning and Progression

Flight Characteristics • Landings • Night Flying

Instrument Flying • Cold Weather Operation

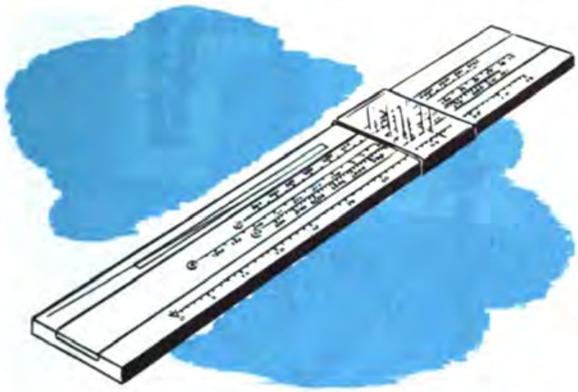


WEIGHT AND BALANCE

Your C-54 must be loaded properly. Besides the obvious danger of an accident resulting from overloading or improper distribution of weight, there are other reasons why weight and balance are extremely important factors in this airplane. Since it is a cargo airplane, the more cargo it can safely carry, the better it justifies its existence; and maximum cargo can be carried only if it is properly loaded. In addition, the airplane has to make long flights in which economy of performance counts. Economy of performance depends on achieving efficient flight attitude, which in turn depends also on proper loading.

Check Weight and Balance

It is your responsibility to check the weight and balance of your airplane carefully, and to satisfy yourself that all safety precautions are observed in the loading and securing of the cargo. Every airplane is supplied with a slide rule load adjuster, and a copy of the weight and



balance manual, AN 01-1-40, or AN 01-1B-40. Familiarize yourself with the instructions for using both of these aids.

At most of your stops there is a weight and balance expert who handles the loading problems. You have to sign the Form F's and see that they accompany the airplane on departure. However, the fact that there is a weight and balance expert, and that you have signed the Form F's, does not mean that weight and balance of the airplane is automatically correct. There can easily be an error of fact or figures in the Form F.

An intelligent pilot should have an over-all mental picture of the amount, description, and position of the cargo he must carry. Then if the figures on the Form F do not tally fairly close with his preconceived picture, he should go into the details of loading with the weight and balance officer for a satisfactory amplification.

Always be extremely careful of weight and balance when you carry many small heavy packages, like gold bars or mica. This kind of cargo can provide unsuspected concentrated weights which might be unsafe for the airplane structure and for flight.

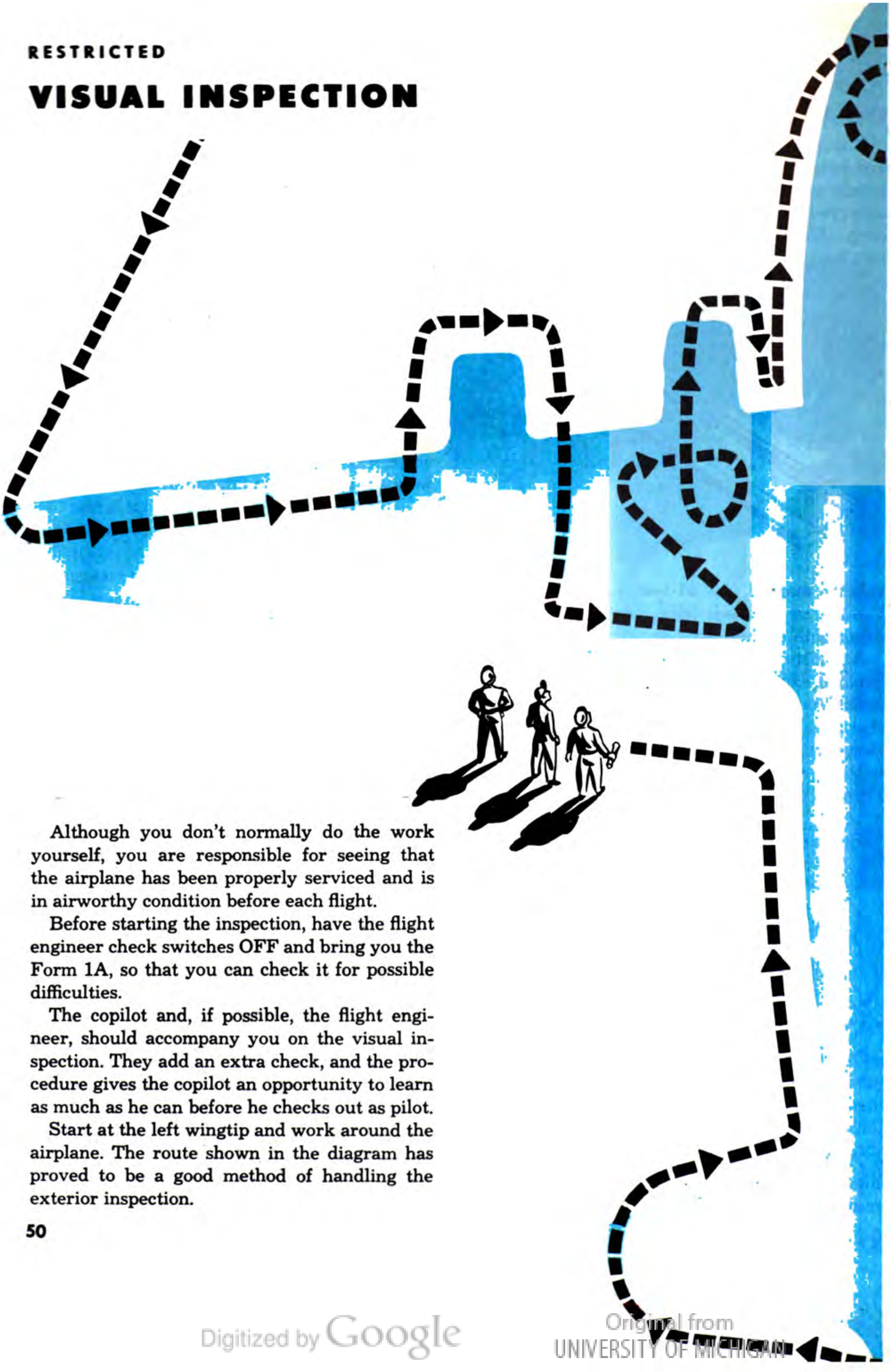
Emergency Weight Check

There are emergency situations when it is necessary to dump the load into the airplane and take off without proper balance figures. An approaching storm, or enemy action, might make such a procedure necessary. It is a dangerous thing to do, and must not be done except in cases of extreme emergency; but when it is necessary to take off without proper loading precautions, there is a quick way for you to find out if the load is aerodynamically manageable.

If the nosewheel steering mechanism works satisfactorily you know that the plane is not unsafe from the standpoint of a tail-heavy condition. That is, as long as the tail load does not cause the shock strut cylinder to expand to a point where you can't steer the airplane, the tail is not too heavy for safe flight.

In addition, if the load in the forward belly compartment is not more than 1825 lbs., and the load in the main cargo compartment is of normal bulk, the airplane is not dangerously nose-heavy. If the main compartment cargo is movable, you can shift it as desired after you are in the air.

VISUAL INSPECTION

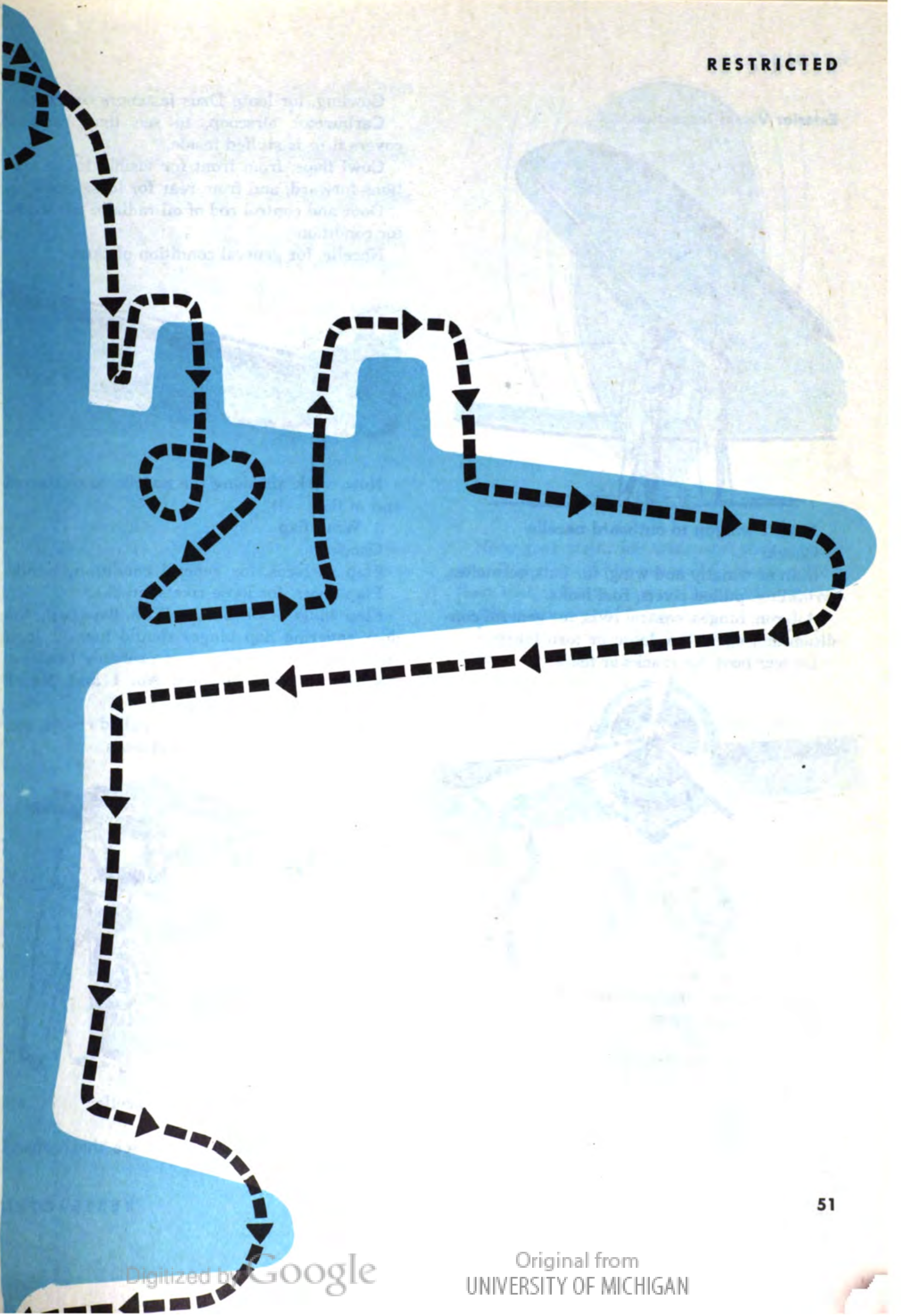


Although you don't normally do the work yourself, you are responsible for seeing that the airplane has been properly serviced and is in airworthy condition before each flight.

Before starting the inspection, have the flight engineer check switches OFF and bring you the Form 1A, so that you can check it for possible difficulties.

The copilot and, if possible, the flight engineer, should accompany you on the visual inspection. They add an extra check, and the procedure gives the copilot an opportunity to learn as much as he can before he checks out as pilot.

Start at the left wingtip and work around the airplane. The route shown in the diagram has proved to be a good method of handling the exterior inspection.



Exterior Visual Inspection

1. **Left wingtip to outboard nacelle**

Check:

Skin of wingtip and wing, for cuts, scratches, wrinkling, pulled rivets, fuel leaks.

Aileron, hinges, control rods, for general condition and operation, loose or torn fabric.

De-icer boot, for cracks or tears.

2. **No. 1 nacelle**

Caution: Be sure switches are OFF before you get close to prop.

Check:

Prop blades, for pitting, nicks, scratches.

Prop dome and nose section of engine, for excessive oil leak.

Front of engine, for loose or frayed ignition cables, or anything (paper, leaves, trash, birds) stuck in engine or oil radiator airscoop.

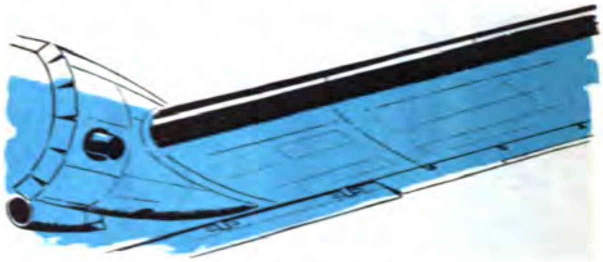
Cowling, for loose Dzus fasteners or cracks.

Carburetor airscoop, to see that nothing covers it or is stuffed inside.

Cowl flaps; from front for visible loose sections forward, and from rear for loose rods.

Door and control rod of oil radiator airscoop, for condition.

Nacelle, for general condition of skin.



Now work aft along the nacelle to outboard end of flap.

3. **Wing flap**

Check:

Flap surfaces, for general condition, bends.

Flap doors, for loose rivets, cracks.

Flap hinges, for bends. With flaps up, the door covering flap hinges should have 1 inch clearance, otherwise hinge is probably bent.

4. **Skin section between No. 1 and No. 2**

Check:

Skin, for wrinkling, cracks, pulled rivets, etc.

De-icer boot, for cracks and tears.

5. **Inside wheel well, No. 2 nacelle**

Check:

Firewall shut-off valves, to see that control rods are secure.

Fuel, oil, and hydraulic lines, for leaks, bent lines, loose lines.

Oil tank, for leaks, dents.

Wiring, fittings, doors, and actuating struts, for general condition.

Landing gear up-latch, for position and signs of wear.

Ground safety lock, to see that it is in place.

Main landing gear strut, for proper inflation. The piston should be exposed 3¼ inches.

Brakes and fittings, for evidence of leakage.

Tires, for general condition, proper inflation, and position of slip mark. Don't depend on visual inspection of inflation, because if one of the dual tires is under-inflated, the other can support it in such a way that it looks properly inflated. Check with a gage. Proper pressure differs with load per tire. Check T. O. 04-10-1 for correct inflation.

Wheel chocks, for proper position.

6. **No. 2 nacelle**

Start at oil radiator airscoop door and repeat in reverse order the inspection you gave No. 1.

7. **Skin section between No. 2 and fuselage**

Check:

Skin, for general condition.

Top side of trailing edge of wing, near fuselage. Double-check this area for loose or sheared rivets.

8. **Fuselage, wing to nosewheel well**

Check:

Skin of fairing between wing and fuselage, and forward fuselage skin, for general condition.

Trailing antenna, to see that guide bracket is secure and that fish is in place.

Fixed antenna, to see that mast and antenna are secure.

Radio compass loop housing, for general condition, bends, or dents.

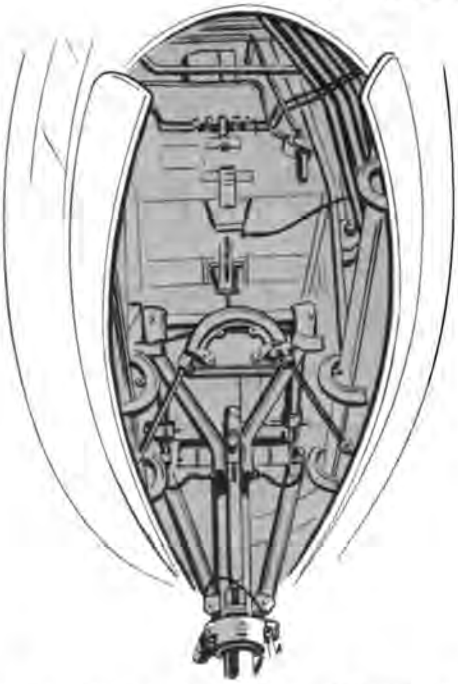
B-3 drift meter lens, clean.

9. **Nosewheel well**

Check:

Hydraulic lines, cables, up-latch, friction brake, wiring, doors, and actuating struts, for position, operation, and general condition.

CO_2 bottles, to see that red ball on knife lever on top of each bottle is intact, indicating bottle has not been discharged.



Nose gear strut, for wear and proper inflation. Piston should be exposed 3⅞ inches. More than that indicates over-inflation of the strut, or too much weight in the tail.

Nosewheel tire, for condition, inflation (check T. O. 04-10-1).

Ground safety lock, to see that it is properly placed.

Torque links and pins, to see that links are engaged and pins properly seated. Try the pins to be sure they are seated.

10. **Nose to right wing**

Repeat fuselage skin inspection, and see that pitot tubes have no coverings and all openings are free from foreign matter.

Check:

Forward belly compartment and hell-hole for snug fit of door.

Oxygen tank, for evidence of oil spilled on tank or lines carried in belly compartment.

11. **Right wing**

Repeat in reverse order the inspection given to left wing.

12. **Wing to tail, right side**

Check:

Skin, for general condition.

Antenna, to see that it is secure on aft mast. Aft belly compartment, for snug fit of door.

13. **Tail**

Check:

Stabilizers, for general condition of surfaces.

De-icer boots, for cracks and tears.

Elevators and rudder, for general condition of surfaces and hinges.

Tailskid, for general condition.

From rear of airplane, glance at wing, elevator, and rudder tabs for position, then check indicators when you get into flight compartment.

Tail support, for proper position.

14. **Left side of fuselage to left wing butt**

Check:

Fuselage surface, for general condition.

Interior Visual Inspection

1. **Main cargo compartment**

Check:

Hinges, emergency latch, for condition.

Fire extinguishers, to be sure there are two Pyrenes or one CO_2 mounted next to door.

Cargo, loose objects, tool boxes, ladder, for stowage and proper securing.

Life rafts and life jackets, for stowage and accessibility.

Emergency exits, for condition, operation, accessibility.

Oxygen pressure, passenger supply, if any.

2. **Fuel compartment**

Check:

Fuselage selector valve, for OFF position.

Hydraulic fluid sight gage, for level in reservoir. Shine a flashlight into the hole on the right side of the walkway floor, opposite the selector valve, to check this gage.

Fuselage fuel tank sight gages, for fuel level. Turn valves OFF after checking.

Baggage on tank racks, for securing and clearance of fuel lines.

Doors to compartment, for proper fit. This is a fume-proof compartment. Doors should be kept closed.

3. **Crew compartment**

Check:

All equipment, for stowage and securing.

Fuselage oil tank gage, for proper oil level.

Fuselage oil tank selector valve, oil transfer switch, and circuit breaker switch, for OFF position.

Cabin heaters, for OFF position.

Circuit breakers set – in C-54B and subsequent series.

CHECKLIST PROCEDURE

Get the full benefit out of your cockpit checklists. You already know the importance of following the checklist exactly: it gets you into the air and back again with no possibility of overlooking a procedure which might contribute to the safety of the flight and the proper operation of the airplane. More than this, the checklist properly used makes possible an organized and efficient procedure which contributes to the morale of the crew, and to their respect for you as the airplane commander.

Have your copilot read off the checklist items in a clear voice and workmanlike manner, exactly as they are written. When you, or the crew member concerned, have completed the required action, see that the specified response to the item is spoken clearly and snappily when a response is required.

The copilot must read off every item, even though no action is required, and he must follow the exact sequence in your printed list. Only by doing this invariably can you be sure that nothing is overlooked.

Remember that you're not operating this airplane alone. Checklist procedures are a 3-man operation. So use your copilot and flight engineer fully in your checklist procedures. If you have a new copilot or flight engineer, unfamiliar with the duties he must perform, see that he learns to do them correctly. Impress him with the importance of the checklist.

You will run into occasions when the flight engineer is not available in the cockpit. This can happen at a remote foreign airfield where the shortage of ground crew men necessitates his being on the ground until takeoff. In cases like this, you and the copilot will have to share the flight engineer's checklist duties. In normal operations, however, utilize your cockpit crew to the fullest extent possible.

Use checklist properly:

1. Copilot reads off the item.
2. After the crew member performs the required duty, he calls off the response.

ABBREVIATED CHECKLISTS

NOTE: See amplified checklists in appropriate sections of this manual for detailed explanation of checklist items.

BEFORE STARTING ENGINES

1. Forms 1, 1A, and F	P: CHECKED
2. Engineer's preflight inspection	E: COMPLETED
3. Props pulled through	E: PULLED THROUGH
4. Fuel, oil, alcohol, hydraulic fluid: quantity and caps	E: CHECKED
5. Pitot covers	E: REMOVED AND STOWED
6. Nosewheel link and pin	E: ENGAGED
7. Gust locks (or gust boards)	P: UNLOCKED (or E: REMOVED)
8. Cargo and emergency hatches, tail support, ladder	E: CHECKED
9. Hydraulic bypass valve	E: CLOSED
10. Hydraulic hand pump valve	E: CLOSED
11. Hydraulic pressure: at least 1800 psi	C: (reads pressure)
12. Parking brakes	P: SET
13. Emergency brake pressure: 950-1050 psi	C: (reads pressure)
14. Landing gear lever and latch	E: DOWN AND LATCHED
15. Wing flaps	E: FLAPS UP, CONTROL OFF
16. Cowl flaps	E: CONTROL OPEN, THEN OFF P: OPEN LEFT C: OPEN RIGHT

17. Wing tank selectors	**P:** ON
18. Crossfeed, fuselage tank selector (and C-54B auxiliary tank selectors)	**E:** OFF
19. Carburetor air	**C:** FULL COLD
20. Filter control	**E:** RAM, CONTROL NEUTRAL
21. Static pressure selector valve	**P:** AIRSPEED TUBE LEFT **C:** AIRSPEED TUBE RIGHT
22. Propellers	**E:** HIGH RPM
23. Mixture controls	**E:** IDLE CUT-OFF
24. Trim tabs	**P:** CHECKED, ZERO
25. Autopilot servos	**P:** OFF
26. Autopilot oil shut-off valve	**C:** ON
27. Blowers	**E:** LOW
28. Generator switches	**E:** OFF
29. Wing and carburetor de-icers, prop anti-icers	**C:** OFF
30. Fuselage and wing tank fuel booster pumps	**E:** OFF
31. Ignition	**P:** OFF
32. Master battery switch	**C:** CART PLUGGED IN, BATTERY CART ON
33. Instrument inverter switches	**E:** ON, SPARE INVERTER CHECKED
34. Pitot heat	**P:** CHECKED, THEN OFF
35. Altimeters	**P,C:** SET
36. Drift meter	**E** or **N:** CAGED AND OFF

[illegible]

1. Fire guard	**C:** POSTED, No. 3 CLEAR
2. Throttles ¼ open	**P:** ONE-QUARTER OPEN
3. No. 3 ignition switch and fuel booster pump	**E:** ON, PRESSURE UP
4. Energize No. 3, mesh and prime as necessary	**E:** PROP TURNING
5. No. 3 mixture control	**P:** TAKEOFF AND CLIMB
6. No. 3 fuel booster pump	**E:** OFF, ENGINE PUMP CHECKED
7. Hydraulic pressure	**C:** (reads pressure)
8. Start Nos. 4, 2, 1	
9. Master battery switch, wheel chocks, ground safety locks, passengers	**P:** BATTERY CART DISCONNECTED, AIRPLANE BATTERY ON, CHOCKS PULLED **E:** GROUND SAFETY LOCKS STOWED, PASSENGERS' BELTS SECURED
10. Radio transmitter and receiver	**C:** ON
11. Landing gear emergency extension valve	**C:** CLOSED
12. Vacuum pumps	**C:** CHECKED, ON RIGHT (or LEFT)

[illegible] TAXIING

1. Seats, rudder pedals, seat belts	P,C,E: CHECKED
2. Tower clearance, flight controls, gyros	P: CONTROLS CHECKED, GYROS CAGED, SET AND UNCAGED
3. Ground crew clearance, parking brake	P: ALL CLEAR, RELEASED
4. Control column forward	C
5. Flight instruments	E
6. Flaps	E

RUN-UP

1. Throttles 1700 rpm	P: 1700 RPM
2. Blowers high	E: BLOWERS HIGH
3. Props	P: FULL LOW—FULL HIGH
4. Carburetor air	C: 40°C EACH ENGINE, THEN FULL COLD
5. Throttles 1000 rpm	P: 1000 RPM
6. Run up engines	
a. No. 1 engine 30", approx. 2350 rpm	P: 30", 2350 RPM
b. Blower low	E: BLOWER LOW, MP CHECKED
c. Magnetos, max. drop 100 rpm	E: CHECKED
d. Oil and fuel pressure, oil temperature	C,P,E: CHECKED
e. Generator	C: CHECKED AND ON

(Repeat for Nos. 2, 3, and 4.)

7. Autopilot oil pressure	E: 125 PSI
8. Gyros	P,E: SET AND UNCAGED

1. Takeoff clearance	C: CLEAR FOR TAKEOFF
2. Flaps 15° to 20°	E: FLAPS (number degrees)
3. Cowl flaps trail	E: COWL FLAPS TRAIL
4. Fuel booster pumps	C: ON

1. Gear up (at pilot's verbal command)	E: GEAR UP
2. Manifold pressure 40", rpm 2550 (at pilot's command)	C: MP 40" E: RPM 2550
3. Flaps up (at pilot's verbal command)	E: FLAPS UP
4. Manifold pressure 35", rpm 2350 (at pilot's verbal command)	C: MP 35" E: RPM 2350

CRUISE CHECKLIST

1. Level off	P
2. Cowl flaps CLOSED	E
3. Reduce mp to desired setting	C
4. Reduce rpm to desired setting	E
5. Trim airplane	P
6. Mixture CRUISE	E
7. Synchronize props	P,C,E
8. Fuselage tanks as desired	E
9. Hydraulic bypass valve OPEN (UP)	E
10. Check blower every 2 hours	P,E
11. Check cowl flap and wing flap droop	E
12. Check generators	E

BEFORE LANDING

1. Wing tank selectors Crossfeed, fuselage tank selector	E: ON E: OFF
2. Drift meter	E (or N): CAGED AND OFF
3. Trailing antenna	R/O: IN
4. Hydraulic bypass valve	E: CLOSED (DOWN)

5. Brakes, hydraulic pressure	P: OFF, 3000 PSI
6. Autopilot	P: OFF
7. Blowers	E: LOW
8. Mixture controls	E: TAKEOFF AND CLIMB
9. Magnetos	E,P: CHECKED
10. De-icers, anti-icers, carburetor heat	C: OFF
11. Passengers, seat belts, heaters	E,P: CHECKED, HEATER OFF
12. Wing flaps (pilot commands degrees desired)	E: (number degrees)
13. (a) Landing gear lever and latch	E: UP, THEN DOWN AND LATCHED
(b) Green light and horn	P: CHECKED
14. 2250 rpm (at pilot's verbal command)	E: 2250 RPM
15. Fuel booster pumps	C: ON
16. Further flaps (pilot commands degrees desired)	E: (number degrees)

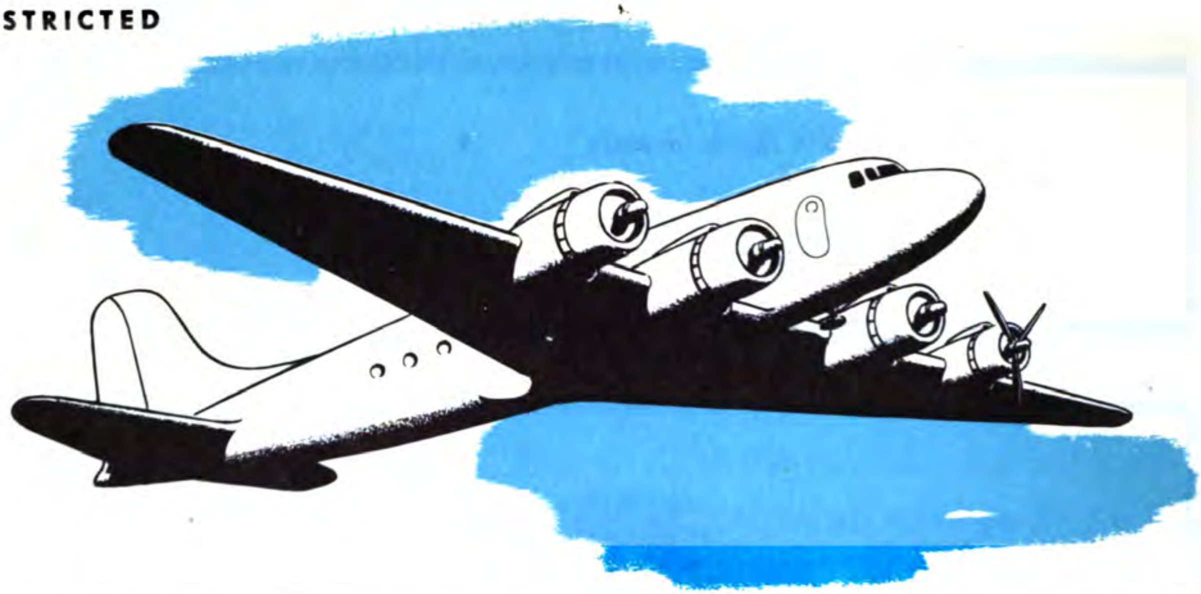
AFTER LANDING

1. Cowl flaps	E: OPEN
2. Fuel booster pumps	C: OFF
3. Propellers	E: HIGH RPM
4. Generators	C: OFF (or as required)
5. Flaps up at end of landing roll (at pilot's verbal command)	E: FLAPS UP

6. Cut No. 1 and No. 4 engines (at pilot's verbal command)	E
7. Nosewheel straight at blocks	

STOPPING ENGINES AND SECURING AIRPLANE

1. Throttles (Dilute oil in cold weather)	P: 1000 RPM
2. Mixture controls	E: IDLE CUT-OFF
3. All fuel valves	C: OFF
4. Ignition switches	P: OFF
5. Wheels chocked, brakes	P: OF F
6. Instrument inverter switch	E: OFF
7. Generators	E: OFF
8. Radio switches	C,R/O: OFF
9. Light switches	E: OFF
10. Landing lights	C: RETRACTED
11. Master battery switch	E: OFF
12. Landing gear ground safety locks, gust lock (or gust boards), tail support	E: IN PLACE
13. Form 1 and 1A	P: EXECUTED



IN-FLIGHT FEATHERING PROCEDURE CHECKLIST

1. Retard throttle.
2. Push feathering button.
3. Turn fuel booster pump OFF.
4. Move mixture control to IDLE CUT-OFF.
5. Turn wing tank fuel selector valve OFF.
6. Switch vacuum pump to live engine (2 or 3).
7. Close cowl flaps.
8. Move propeller controls to LOW RPM.
9. Turn generator OFF.
10. Turn ignition OFF.
11. Pull firewall emergency shut-off valve to CLOSE, after props stop turning.
12. Trim airplane.

IN-FLIGHT UNFEATHERING PROCEDURE CHECKLIST

1. Push firewall emergency shut-off valve to OPEN.
2. Turn ignition ON.
3. Open throttles ¼.
4. Keep propeller in LOW RPM.
5. Turn wing tank fuel selector valve ON.
6. Turn fuel booster pump ON.
7. Push and hold in feathering button to 800 rpm, then pull out.
8. Move mixture control to TAKEOFF AND CLIMB.
9. Warm up.
10. Increase propeller control and throttle to desired settings.

BEFORE STARTING ENGINES

Amplified Checklist

1. **Forms 1, 1A, F.** The pilot examines Form 1 to see that it has been properly executed, and that total flight time has been brought forward to Form 1A. He checks the status of the airplane on Form 1A, signing an exceptional release for a red diagonal if necessary and desirable. He checks Form F, the weight and balance form.

2. **Engineer's preflight inspection.** The flight engineer carries out his preflight inspection just prior to flight. During his inspection he makes his complete report on the status of the airplane on Form 1A.

3. **Props pulled through.** Within 30 minutes before starting engines the flight engineer pulls each propeller through 12 blades, or he supervises ground crew men in the job.

4. **Fuel, oil, alcohol, hydraulic fluid: quantity, and tank caps safetied.** This duty is performed by the flight engineer during his preflight inspection.

5. **Pitot covers.** Prior to entering the airplane, the flight engineer removes the pitot tube covers and stows them in a designated place in the cargo compartment, usually near the door.

6. **Nosewheel link and pins.** The flight engineer checks the nosewheel torsion link and pins to be sure that the link is coupled. He makes this inspection before boarding the airplane.

7. **Gust locks (or gust boards).** If the airplane has interior gust locks the pilot unhooks the

gust lock safety tape, allowing the gust lock lever to return to the UNLOCKED position. Be sure that the lever is DOWN, flush with the floor. The tape rolls up into its receptacle above the windshield.

CAUTION: The tape is on a spring. Don't let it snap up. It might break header panel or instrument dials.

If the airplane has exterior control surface boards, the flight engineer takes them off before boarding, and stows them in the rear of the fuselage.

8. **Cargo and emergency hatches, tail support, ladder.** The flight engineer secures all hatches, including the belly cargo doors, before he comes aboard. He supervises removal and stowage of the tail support and the cargo ladder as soon as all crew members are aboard. There are fittings for stowing the tail support and the airplane step ladder on the forward bulkhead of the cargo compartment. The cargo ladder, however, is carried in the middle of the cargo compartment floor, secured to the tie-down fittings in the floor.

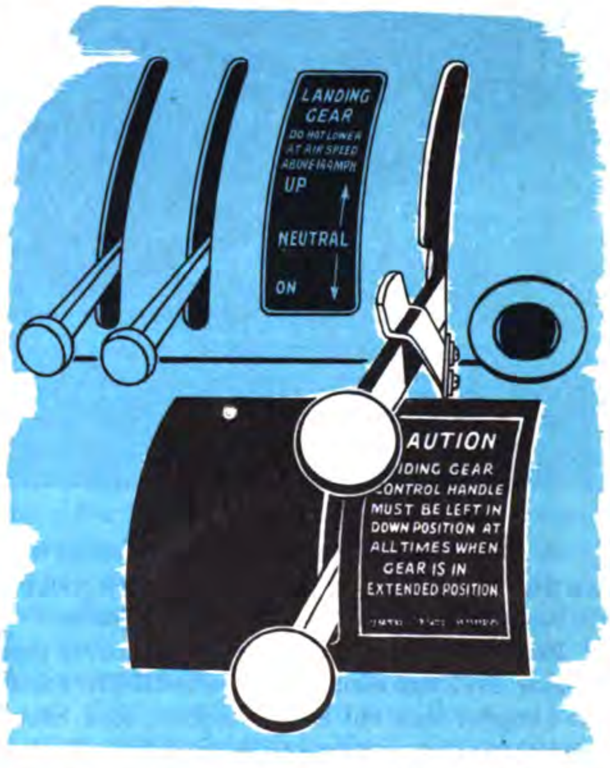
9. **Hydraulic bypass valve.** The flight engineer pushes on the valve to see that it is CLOSED. CLOSED is the full down position, flush with floor.

10. **Hydraulic hand pump valve.** The engineer checks the valve for CLOSED position. The lever is in CLOSED position when it is forward.

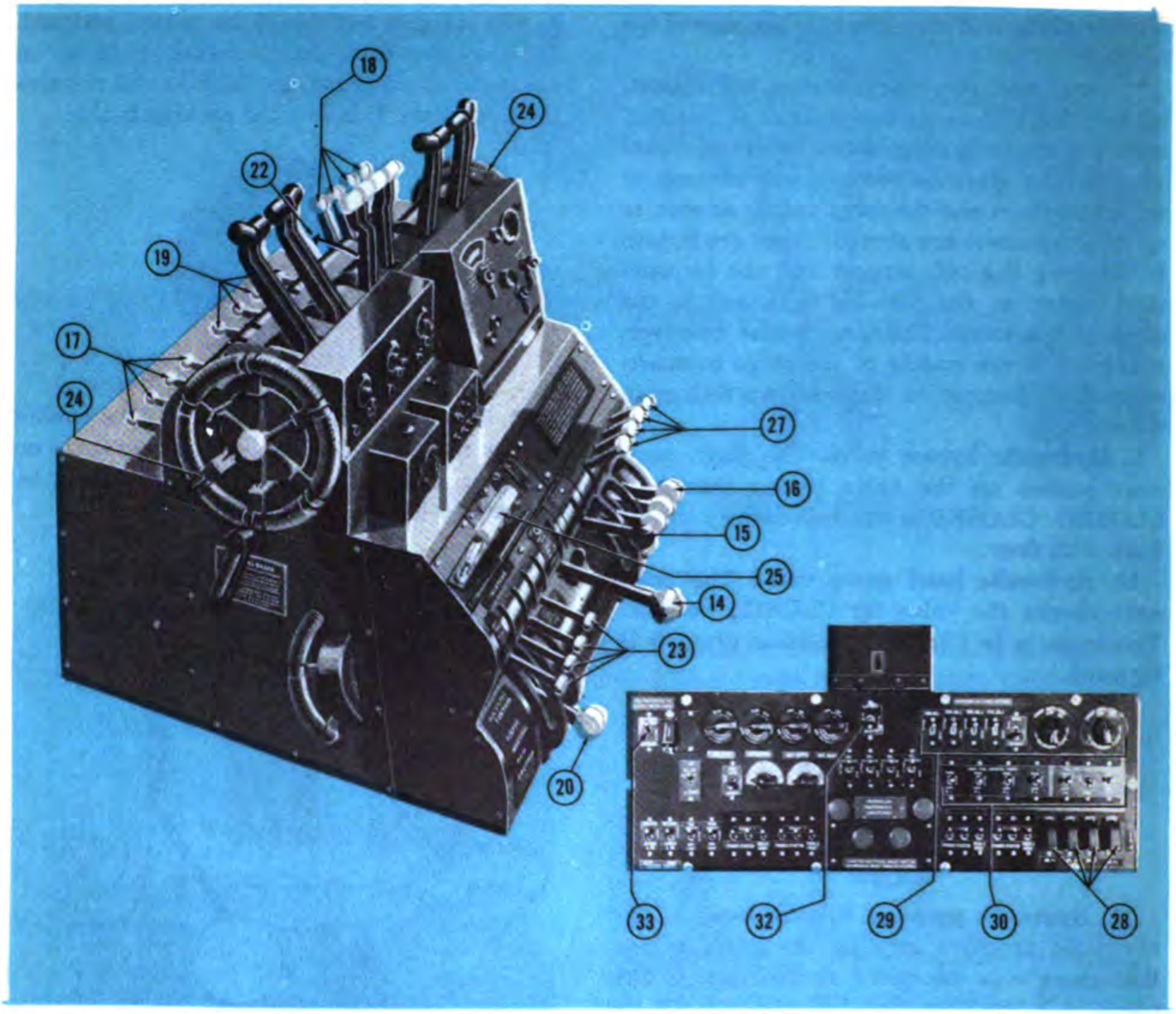
11. **Hydraulic pressure.** Copilot looks at the hydraulic pressure gage on the panel to see that there is a minimum of 1800 psi. If the pressure is less than that, he must bring it up by pumping the hand pump beside his seat. The hand pump valve must be CLOSED when he does this, otherwise he pumps to the accumulator, which is a lengthy and difficult operation, instead of direct to the system.

12. **Parking brakes.** The parking brake handle is on the left side of the control pedestal. The pilot depresses the toe pedals, pulls up on the parking brake handle, holds it and releases the toe pedals. This sets the parking brake.

13. **Emergency brake pressure.** The copilot checks the emergency brake pressure gage on his instrument panel. The pressure should be between 950 and 1050 psi.



14. **Landing gear lever and latch.** In early series of the C-54 the landing gear lever and the up-latch mechanism were actuated by two separate handles. Later series and service-changed airplanes, however, have both these mechanisms incorporated into one control. The flight engineer pushes on the control handle to be sure that it is full DOWN, and in the notch.



15. **Wing flaps.** The flight engineer moves the control handle to the UP position, then moves it back to OFF, watching the flap indicator.

16. **Cowl flaps.** The flight engineer moves the engine cowl flap control handle to OPEN. Pilot and copilot lean out their windows, look back and check the position of the cowl flaps on the respective engines. Then the engineer moves the handle to OFF.

17. **Fuel tank selectors.** The pilot pushes the fuel tank selectors on the pedestal to be sure that they are full forward. These selectors control only wing tanks in airplanes through the D series, control both wing and auxiliary tanks in E and subsequent series.

18. **Crossfeeds, fuselage tank selector valve.** The copilot pulls the cross feed levers, checking to see that they are OFF (aft position).

In airplanes with fuselage tanks the selector valve for them is on the floor of the fuel compartment, between the forward and aft fuselage tanks, on the left side. Pilot, copilot and engineer should all check the valve OFF as they enter the airplane.

In the C-54B and D the selector valve controls for the wing auxiliary tanks are beneath the plate on the floor directly aft of the control pedestal. Engineer checks both valves OFF.

All tank selector controls for the E and subsequent series are on the pedestal. When these controls are full forward, main tanks are selected, auxiliaries off.

19. **Carburetor air.** The copilot moves the control, on the top of the control pedestal, to full COLD. Push down on the knob to release the safety latch on the lever.

20. **Filter control.** The flight engineer moves the filter control lever to RAM, then returns it to NEUTRAL.

21. **Static pressure selector valve.** The pilot checks the static pressure selector valve on his control panel to see that it is in the AIRSPEED TUBE position. The copilot does the same for the valve on his panel.

22. **Propellers.** The flight engineer pushes the propeller controls, checking to see that they are full forward, in HIGH (INC) RPM.

23. **Mixture controls.** The flight engineer checks the mixture control levers, for IDLE CUT-OFF position (full down).

24. **Trim tabs.** The pilot moves each trim tab control wheel in both directions, to insure freedom of movement, and then returns each to ZERO setting.

25. **Autopilot servos.** Pilot pulls the automatic pilot servo control levers to the OFF position.

26. **Autopilot oil shut-off valve.** The copilot checks the automatic pilot oil shut-off valve to see that it is in the ON position.

27. **Blowers.** The flight engineer checks blower controls, pulling up on them to see that they are in LOW position.

28. **Generator switches.** The flight engineer reaches up to check the generator switches on the pilot's switch panel, making sure that they are OFF.

29. **Wing and carburetor de-icers, prop anti-icers.** The copilot checks the de-icer and anti-icer switches to be sure that they are OFF. If icing conditions are anticipated, the copilot turns the propeller anti-icing rheostat switches ON, and checks to see that alcohol drips off the propellers. Then he turns the switches OFF.

NOTE: The first stop clockwise on the anti-icer rheostats starts the pump and gives full flow of fluid. Continuing to turn the rheostat clockwise decreases flow but does not turn off electric pump. A full counter-clockwise turn is necessary to turn it off.

30. **Main and auxiliary tank fuel booster pumps.** The flight engineer reaches up and checks the main and auxiliary tank fuel booster switches to be sure that they are OFF.

31. **Ignition.** Pilot touches ignition switches to be sure that they are OFF.

32. **Master battery switch.** Copilot leans out his window and instructs the ground crew to plug in the battery cart. When the cart is plugged in he turns the master battery switch to BATTERY CART ON. On some airplanes there is an OFF-ON master battery toggle switch, instead of the sliding control with BATTERY CART, AIRPLANE BATTERY, and OFF settings. If you have the OFF-ON toggle switch, turn the switch OFF when the cart is plugged in, and ON for the airplane battery.

33. **Instrument inverter switches.** The flight engineer flips the instrument inverter switch ON. Then he turns the inverter selector switch from No. 1 to No. 2 inverter. The selector switch is on the panel to the left of the companionway as you enter the flight compartment. The engineer checks the spare inverter by listening for its operation, or by watching the operation of the instruments.

34. **Pitot heat.** The copilot turns the generator voltage selector switch to MAIN BUS position. The pilot then flips the two pitot heat switches ON and OFF, one at a time, checking for a deflection on the voltammeter which will indicate that the pitot heat is working.

35. **Altimeters.** Pilot and copilot set their altimeters at the field altitude.

36. **Drift meter.** Either the flight engineer, or the navigator, if the latter is at his station, can cage the drift meter and see that it is OFF.

STARTING ENGINES

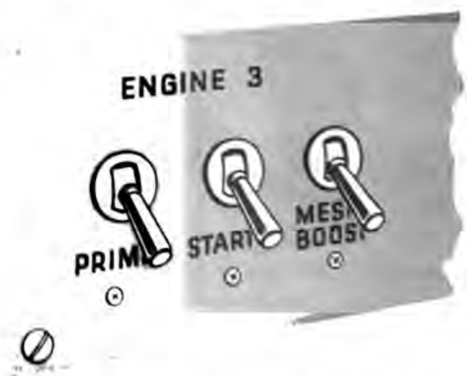
Amplified Checklist

The engine starting sequence is 3, 4, 2, 1. You follow this sequence in starting engines so that the fire guard does not have to get near turning propellers in going to his position.

1. **Fire guard posted.** The copilot looks out the window to see that the fire guard is at the proper position behind the propeller of No. 3 engine, with a fire extinguisher. Then the copilot holds up three fingers as a signal to the ground crew that he is starting No. 3. If it is clear to start, the ground crew man returns an OK signal.

2. **Throttles ¼ open.** The pilot moves the throttles to approximately ¼ open.

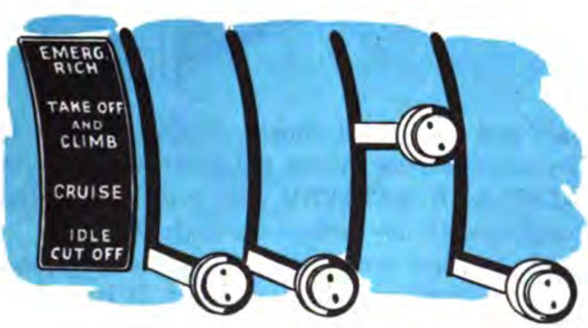
3. **No. 3 ignition switch and fuel booster pump.** In some series of the C-54 there is a master ignition switch. The flight engineer must push the master switch ON first, before he turns the ignition switch ON. Then the engineer turns the booster pump ON (or LOW), and checks for 16 to 18 psi on the fuel pressure gage. The engineer should also flip the mesh switch a couple of times to be sure the starter brushes are seated.



4. **Energize No. 3, mesh and prime as necessary.** The copilot signals the ground crew by rotating his hand that the pilot is about to turn over No. 3. Obviously, he can also just call the information to the ground crew, but it is a good idea to get into the habit of using hand signals at all times, since after the first engine starts, the ground crew cannot hear you.

The flight engineer holds the energize switch down for 10 to 12 seconds. Then, continuing to hold the energize switch down, he depresses the mesh switch until the engine fires, using the priming switch to prime the engine as necessary.

Never prime a warm engine. It causes overloading. You can watch the engine to see when it fires by looking through the small window at the navigator's station, or you can watch your tachometers. Some pilots prefer to have the flight engineer watch the engine and call out when it fires.



5. No. 3 mixture control. After the engine fires the pilot moves No. 3 mixture control to TAKEOFF AND CLIMB (auto rich). To change the setting of the lever, pull out on the knob, releasing the safety catch.

After oil pressure indication has appeared on the oil pressure gage, the pilot adjusts the throttles to 1000 rpm.

Note: If there is no indication of oil pressure within 30 seconds, stop the engine and investigate.

6. No. 3 fuel booster pump. The flight engineer turns the booster pump OFF, then checks the fuel pressure gage to see that the engine pump is providing the required minimum 16 to 18 psi.

If the Engine Fails to Start

If the engine does not start after a few revolutions, move the mixture control momentarily from IDLE CUT-OFF to CRUISE (auto lean). If the engine does not start immediately, return the control to IDLE CUT-OFF. If it doesn't start in the next 5 seconds with the mixture control in IDLE CUT-OFF, continue to turn the engine with the starter and repeat the procedure. One or two repetitions of this usually start the engine.

CAUTION

The engine is apt to load up if the throttle is more than ¼ open and the mixture control is moved from IDLE CUT-OFF more than 2 seconds at a time, or with less than 5 seconds between each movement from IDLE CUT-OFF.

If you still can't get the engine to fire, there are two more immediate possibilities:

a. The engine may be overloaded. A warm engine indicates overloading by a discharge of fuel from the drain valve in the lower part of the engine blower. In this case, **keep the mixture control in IDLE CUT-OFF,** open the throttle wide, and turn the engine over with the starter to clear it out. If the ignition is ON, as it should be, you can often get the engine started while clearing it out with the starter. Therefore, be ready to retard the throttle immediately to prevent overspeeding.

If for any reason the ignition switch is OFF during your clearing-out, 10 seconds of engine turning should be enough to clear the engine. Then repeat the starting procedure, beginning with the mixture control in IDLE CUT-OFF and being more careful this time about moving it out of that setting. Failure to leave the control in IDLE CUT-OFF is the most frequent cause of overloading.

b. The engine may not be getting enough fuel. This situation is possible if the fuel pressure has not been kept up during the starting procedure, or because the mixture control has not been moved out of IDLE CUT-OFF enough times or for long enough periods.

In this case repeat the starting procedure, operating the mixture control with caution so as to feed a little more fuel to the engine, but keep the engine turning over.

NOTE:
See hydraulicking and hand cranking, under Engines and Propellers.

Starting in Extreme Weather Conditions

In extremely high ground temperatures, vapor lock may occur in the carburetor. If the engine won't start normally, follow this procedure:

a. Clean out the engine with the throttle full open and the mixture control in IDLE CUT-OFF.

b. Start engine on electric primer by intermittent priming.

c. When engine fires, move mixture control to CRUISE.

d. Continue to run engine on the primer until the vapor lock is pulled through and the engine fires normally.

For cold weather starting procedure, see **Cold Weather Operations.**

7. **Hydraulic pressure.** As soon as No. 3 is running, the copilot checks the hydraulic pressure gage for a pressure of 3000 psi.

8. **Start Nos. 4, 2, 1.** Repeat the applicable checklist procedures for the other three engines. During the starting of Nos. 2 and 1, the pilot handles all the signals to the ground crew.

9. **Master battery switch, wheel chocks, ground safety locks, passengers.** The pilot signals the ground crew man to pull the battery

cart and the wheel chocks. When the cart is disconnected, he moves the battery switch to AIRPLANE BATTERY. On models with the toggle switch, he turns the switch ON.

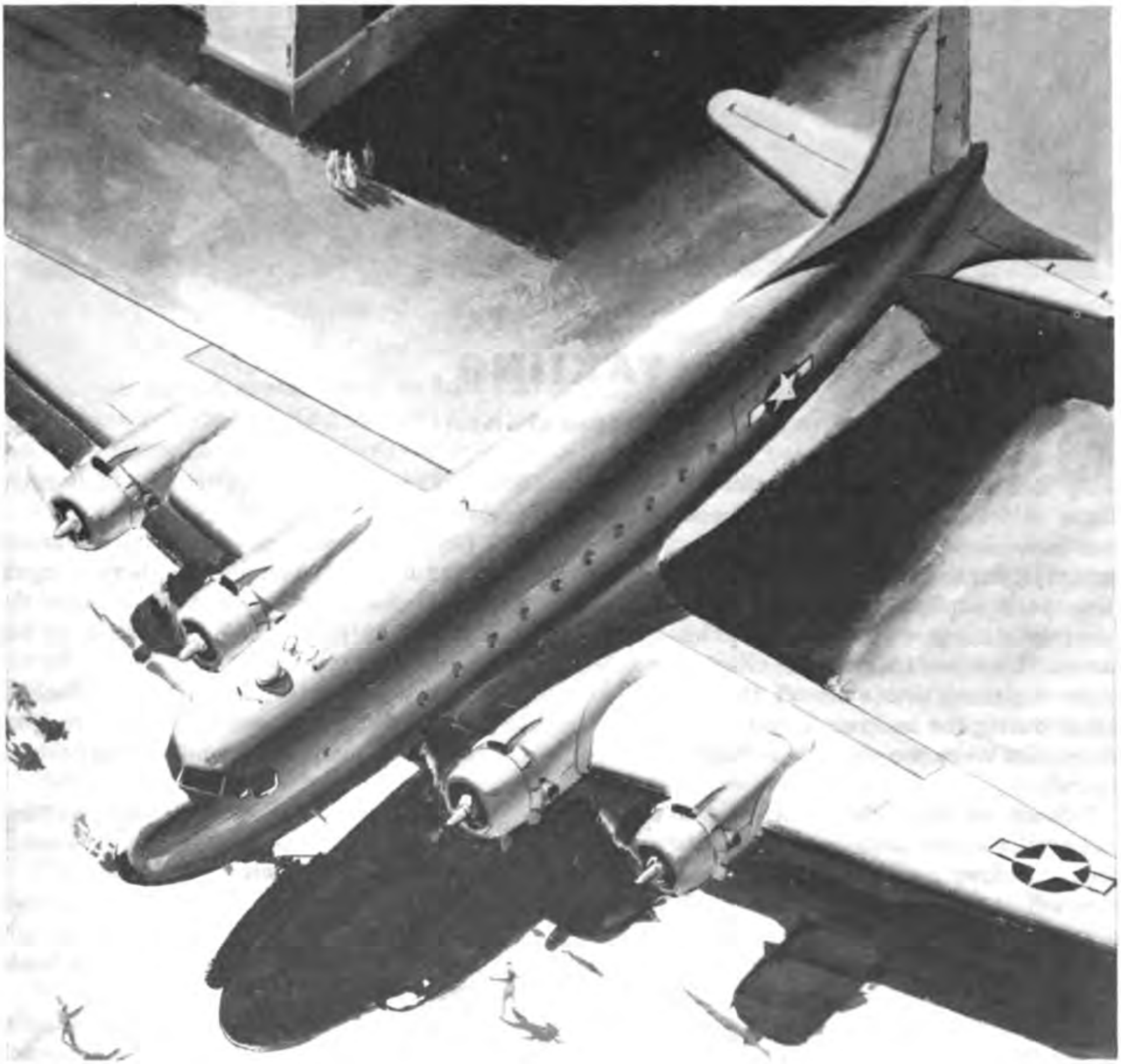
The ground crew man pulls the chocks and removes the ground safety locks. It is a good idea for the flight engineer to instruct the ground crew beforehand on the time and manner of performing these duties.

The flight engineer goes aft to the cargo compartment, opens the cargo door to receive the ground safety locks, and stows them in the rear of the fuselage. He checks the latch on the cargo door to be sure it is secure. He also checks any passengers aboard to be sure that they have their seat belts properly adjusted and fastened and are set to take off. Then he returns to the flight compartment and reports to the pilot.

10. **Radio transmitter and receiver.** The copilot turns the radio transmitter and receiver ON.

11. **Landing gear emergency extension valve.** The copilot checks to see that the valve handle is in the CLOSED position, handle full down.

12. **Vacuum pumps.** The copilot turns the vacuum selector valve handle to the right or left position (ALL INSTRUMENTS LEFT PUMP or ALL INSTRUMENTS RIGHT PUMP), checks the gage for a reading of 4.5" Hg., then turns the valve to the other position and checks the vacuum again. In his response to the checklist item he announces the setting on which he has left the valve, so that he can be prepared to switch the valve in case of loss of that engine.



TAXIING

Amplified Checklist

Up to a point, you can use the same technique in following the taxiing checklist that you have used before. However, once you begin to roll out to the runway, you can no longer have your copilot reading off the checklist items: he must give full attention to his taxiing duties. Therefore, he gives the checklist to the flight engineer, who calls off the designated duties during the taxi run, returning the list to the copilot when the airplane reaches the run-up mat.

1. **Seats, rudder pedals, seat belts.** The pilot and copilot adjust their seats and their rudder pedals, locking both securely. All crew members adjust and check the fastening of their seat belts.

2. **Tower clearance, flight controls, gyros.** The copilot calls the tower for taxi clearance. While he is doing this, the pilot operates the controls to assure free movement of all surfaces. Pilot and copilot cage, set, and uncage their flight gyros.

3. **Ground crew clearance, parking brake.** The pilot looks out and gets an all-clear signal from the ground crew. Then he releases the parking brake by a quick depression of the brake pedals.

At this point the copilot turns the checklist over to the flight engineer. The latter reads off the remaining items at convenient times during the taxi run.

4. **Control column forward.** During taxiing, the copilot holds the control column forward to keep the nosewheel firmly on the ground.

5. **Flight instruments.** While the airplane is taxiing, pilot and copilot check the operation of the two directional gyros and the two bank-and-turn indicators.

6. **Flaps.** At a convenient time during the taxi run the flight engineer runs the flaps through

their full travel to bleed the air out of the lines, returning them to full UP. He checks the flap indicators as he does this to be sure that the flap action is equal. If the needles on the flap indicator show more than 4° difference in the flap action, the flight engineer repeats the procedure until the flaps run down together.

Steering Your Airplane

You can get adequate thrust on hard-surfaced runways with a setting of about 800 rpm on each engine. Use as little power as possible to avoid dragging the brakes. Remember, however, that less than 800 rpm may cause fouling of the plugs. Occasional momentary increases in rpm clear out the engines.

As you taxi, keep your left hand on the nosewheel steering wheel. You steer this airplane as you do an automobile. Keep looking to the left, right, and forward as you taxi to be sure you have clearance all around, and have your copilot do the same.

NOTE: When taxiing the C-54B, make a full stop before making a turn, to prevent spilling fuel from the outboard wing tanks.

The maximum turn of the nosewheel is 45°. Make your turns slowly and steadily to avoid jerky operation of the nosewheel and to avoid excessive wear on tires and brakes.

When taxiing in a crosswind, use an upwind engine to reduce the force you need to hold the nosewheel in position.

Don't taxi fast. Use your brakes only to slow your taxi speed, and not for normal steering. In an emergency situation, where your nosewheel steering mechanism does not work, steer with throttles and rudder, using normal application of brakes.

Easy on the Brakes

Remember, you have a big, heavy airplane. Take it easy in taxiing. Use your brakes as little as possible. Use light pressure on the brakes, and release them before you come to a full stop, to avoid a sudden and jerky stop.

Keep checking the hydraulic pressure gage frequently. Get the copilot and flight engineer into the habit of doing this also, to be sure that you have an adequate braking pressure of at least 1800 psi.

If you lose your hydraulic brake pressure, and have no time to hand-pump the brakes, you can pull the emergency air brake handle. There is an emergency brake handle for the pilot and another for the copilot, each directly in front of the control column, under the glare shield. The emergency air brakes are independent of the hydraulic toe brake action. They are powerful, and they stop your airplane right now, with the possibility of blowing the tires. Use the air brakes only as a last resort. You can't apply the air brakes gradually; they are either on or off. Release them by pushing in on the handle, but not until wheels are chocked. Otherwise wind or slope of the field may start the airplane rolling, and you have no way to stop it.

NOTE: After using the emergency air brakes it is necessary to bleed the system to remove the air before you can use the hydraulic toe brakes again. Have the airplane towed back to the line.

ENGINE RUN-UP

Amplified Checklist

When you get to the run-up mat, head the airplane into the wind for run-up. Stop with the nosewheel straight, because running up the engines with the nosewheel turned puts excessive side wear on the nosewheel strut and tire. If possible, run up your engines in a spot where there is no danger of nicking your own props or damaging other airplanes with a blast of gravel.

1. **Throttles 1700 rpm.** The pilot advances throttles to 1700 rpm.

2. **Blowers high.** The engineer shifts the blower control handles to HIGH position. Move each handle with a quick positive movement to prevent the blower clutch from slipping and causing excessive overheating and burning of the cones. There is an instant and momentary drop of the oil pressure when the blowers are shifted.

3. **Props.** The pilot moves the propeller control levers to full LOW (DEC) RPM and then returns them to full HIGH (INC) RPM. This procedure gets warm oil into the propeller domes and prevents surging on the takeoff. In excessively low outside temperatures it may be necessary to shift the prop controls twice, or to leave them in full LOW for a longer period before shifting them back to HIGH. During this

operation, the flight engineer should watch the tachometers to be sure that a decrease in rpm is indicated when the propeller controls are brought to LOW. There is a time lag in the tachometer reading, and the colder the oil, the longer the lag.

Be sure to return propeller controls to full HIGH RPM.

4. **Carburetor air.** Copilot moves each carburetor heat control lever back toward HOT until he gets an indication of 40°C on the gages.

CAUTION

Never move the carburetor air controls back toward HOT unless the carburetor air filter doors are closed (RAM position).

When he gets 40°C on each carburetor, the copilot returns the controls to full COLD.

By this time oil pressure, oil temperature, and cylinder-head temperature should be within limits for the engine run-up. Oil temperature should be a minimum of 40°C. Head temperatures vary with outside air temperature and no prescribed minimum reading is necessary before run-up.

CAUTION: Never close or trail cowl flaps to shorten time of warm-up.

5. **Throttles 1000 rpm.** Pilot returns all four throttles to 1000 rpm.

6. **Run up engines.**

a. **No. 1 engine 30".** Pilot opens throttle for No. 1 engine to 30" of manifold pressure. This should produce about 2350 rpm at sea level. If you don't get sufficient rpm, it may mean that one cylinder is not firing, and the situation requires investigation.

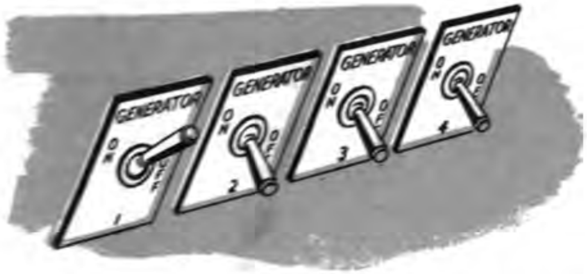
b. **Blower low.** Flight engineer shifts to LOW blower, and watches manifold pressure to see that there is a drop of approximately 2".

c. **Magnetos, maximum drop 100 rpm.** The flight engineer turns each ignition switch momentarily to LEFT mag, then back to BOTH, then to RIGHT, and then returns it to BOTH. The drop in rpm should not exceed 100. The left mag drops more than the right mag.

The flight engineer also visually checks each engine for roughness while he is on one mag. **Never operate the engine for long periods on only one magneto.**

d. **Oil and fuel pressure and oil temperature.** Pilot, copilot, and engineer check gages during run-up for oil pressure of 85 to 100 psi, and oil temperature of 40° to 70°C.

e. **Generator.** The copilot turns No. 1 generator switch ON, then turns the voltammeter selector switch to No. 1 engine, checking for



24 to 28 volts. He depresses the button on the bottom of the voltammeter and checks the amperage. He leaves the generator switch ON.

The pilot then pulls the throttle back to around 1000 rpm. Repeat the same complete procedure of run-up for the other three engines.

7. **Autopilot oil pressure.** On running up No. 2 engine the flight engineer checks the automatic pilot pump gage for a pressure of 125 psi.

8. **Gyros.** The pilot and copilot set their directional gyros to the corrected compass heading and uncage the instruments. Then they cage, re-set, and uncage their artificial horizons. Remember that you have both the conventional artificial horizon and the autopilot horizon to adjust.

NORMAL TAKEOFF

Amplified Checklist

1. **Takeoff clearance.** The copilot calls the tower for takeoff clearance.

2. **Flaps 10° to 20°.** The engineer lowers the wing flaps to the desired setting, calling off the degree of flaps at which he sets them. He checks the flap indicator to see that there is not more than 4° between the two flaps indicated by the needles on the gage.

3. **Cowl flaps trail.** The engineer moves the cowl flap control levers to TRAIL. The position of the cowl flaps does not change as the flight engineer changes the setting of the levers. The increased flow of air on takeoff moves the flaps to TRAIL when the lever is set at that position.

4. **Fuel booster pumps.** Copilot turns fuel booster pump switches ON (or HIGH).

Now you're all set to roll. Line up with the runway, and open your throttles slowly, steadily, and evenly. Use the nosewheel steering wheel to keep directional control. Don't take your hand off the nosewheel steering wheel until you get rudder control, at about 70 mph.

The copilot keeps a slight forward pressure on the control column from the start of the takeoff until the point where the rudder control takes hold. Then you take control of the airplane with the control column and your copilot takes the throttles, evening them up to 50″ of manifold pressure, and setting friction lock on throttles and propeller controls. At this point copilot and flight engineer should check manifold pressure and rpm to determine if the engines are developing full takeoff power.

At a speed of 85 to 95 mph, ease back slightly on the control column to help get the nosewheel off the ground. The airplane leaves the ground between 100 and 115 mph, depending on the load.

CAUTION

Don't exceed these power settings on takeoff (Grade 100 fuel):

R-2000-7 engines—2700 rpm and 50″ MP
R-2000-11 engines—2700 rpm and 45.7″ MP
R-2000-9 engines—2700 rpm and 48.5″ MP

AFTER TAKEOFF

Amplified Checklist

During takeoff and immediately afterwards you can't use the normal checklist procedure. The checklist duties are carried out at your verbal command.

1. **Gear up.** Call for gear up when you are positive that you are off the ground. The three green lights on the instrument panel which indicate that the gear is down and latched go out when the gear is unlocked, and the red light comes on as the gear retracts. When the gear is full up, the red light goes out. Then the flight engineer moves the landing gear control handle to NEUTRAL.

NOTE: If the spinning of the main wheels after takeoff sets up vibration, stop it by a light, smooth, and steady pressure on the toe brakes before you retract the gear. If the nosewheel sets up vibration be sure to have it checked for balance on your next landing. If this nosewheel

vibration is allowed to continue, it can damage instruments.

You may notice the odor of burning rubber when you retract the gear. This results from the nosewheel rubbing against the snubber in the nosewheel well. Don't worry about it.

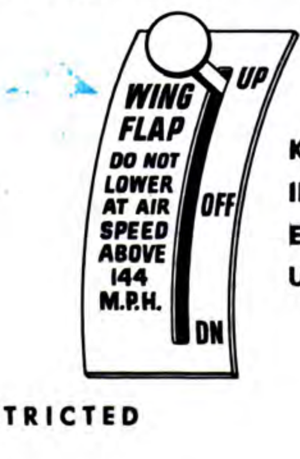
2. **Manifold pressure 40", rpm 2550.** When you attain a safe 3-engine speed, about the time your gear is coming up, call for manifold pres-

sure of 40″, and 2550 rpm. The copilot smoothly retards the throttles to the desired setting, and following closely behind this action, the flight engineer smoothly brings the propeller controls back to the proper rpm.

Always reduce throttle settings before you reduce rpm, to avoid exceeding maximum allowable brake mean effective pressure (BMEP).

NOTE: Under ideal conditions, with light loads, you can make a single power reduction to 35″ and 2350 rpm, instead of using this intermediate setting.

3. **Flaps up.** With an altitude of approximately 500 feet, and an **airspeed not over 144 mph,** call for flaps up. The flight engineer moves the control handle to the UP position. Always keep the handle in the UP position except when the flaps are being used.



KEEP HANDLE IN UP POSITION EXCEPT WHEN USING FLAPS

These flaps have only one speed. Always control flaps by moving the handle to full UP or full DOWN position, then returning it to OFF to stop the flaps at the desired setting. Never try to move flaps slowly by just cracking the valve, or inching the control handle up or down.

Check your airspeed carefully. A lightly

loaded C-54 accelerates fast. Be sure that you keep it under 144 mph while the flaps are down. When the airplane is heavily loaded, anticipate

and prevent it from settling as the flaps come up by pulling up the nose slightly.

4. **Manifold pressure 35″, rpm 2350.** When you are above 500 feet and the flaps are up, call for the copilot and engineer to reduce power to 35″ and 2350 rpm.

NOTE:

Leave booster pumps ON (or HIGH) until you get to cruising altitude, under 10,000 feet.

SHORT-FIELD TAKEOFFS

If you have to take off from a short field, you must consider carefully all of the following factors:

1. Length of runway.
2. Slope and surface of runway.
3. Wind direction and velocity.
4. Gross weight of airplane.
5. Altitude of field.
6. Density of air.
7. Obstructions at the end of the runway.

Check each factor against the rest, remembering that every one of them is critical. Consult your takeoff distance charts. Bring all of your experience and judgment to bear in deciding if it is safe to take off. If you decide that the safety margin is in your favor, use the following takeoff procedure.

Use every inch of available hard surface. Head the plane in the direction of takeoff. Set flaps at 20°. Hold the airplane with the toe brakes and run the engines up to 30″ manifold pressure. Then release the brakes and come up fast with 50″. Don't attempt to ease the airplane off the ground until the runway is almost used up, then pull it off the ground in a decisive manner.

ENGINE FAILURE ON TAKEOFF

Loss of an engine on takeoff requires cool thinking and quick acting, but need not be a cause for alarm. The situation doesn't work itself out in a pat arrangement wherein the copilot reads a checklist and each man performs a particular duty with clockwise precision.

The airplane has good 3-engine characteristics, however, and if you follow the proper procedure, you'll get along all right. Be familiar with the procedure in order to give yourself every break. You won't have time for studying; you'll have to work almost automatically.

If you don't have flying speed, and know that you won't be able to get flying speed on the available runway, chop all throttles back and try to stop. You can't get off now anyway; all you can hope for is that fate and what's at the end of the runway will be as gentle as possible with your airplane.

Each situation of this sort requires different procedure for handling, depending on several things: length of the runway, your speed when the engine goes out, obstacles at the end of the runway, and the gross weight of the airplane. If normal braking does not stop you, remember that you have emergency air brakes. No single procedure is good for all cases. Don't try to groundloop, but whatever else you do has to depend on your evaluation of the situation.

You know immediately whether the dead engine is on the left or right side, because the airplane yaws more or less violently toward the side of the dead one, the amount of slewing usually depending on whether it is an outboard or an inboard engine.

Check the instruments for the engines on the bad side. The gages for the dead engine show a drop in manifold pressure, rpm, and head temperature. You or the engineer can, if necessary, steal a quick glance at the engine itself to check for fire or oil streaming out.

Suppose the failure occurs when you are airborne. You have flying speed, your gear is coming up, and you know you can get around all right, if everything goes well. There are several things you have to accomplish, almost simultaneously. The crew will help you, if they are adequately briefed on what to do and what not to do. Call out the procedures you want the copilot and engineer to handle for you.

Get control, feather, and take out extra power if you need it. Then cut your dead engine.

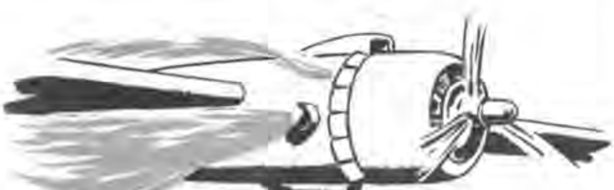
You immediately get your control back with your rudder. Slightly drop the wing with the good engines on it to help correct the yaw. Then follow the feathering procedure.

In the matter of extra power, use judgment. If you still have enough airspeed to climb, you don't need more power. If you haven't, and an outboard engine is dead, advance the throttles on the two inboard engines until you begin to climb again. Extra power on the good outboard engine in this case would tend to slew you around more. If the dead engine is inboard, you can advance all three good engine throttles, slowly and steadily.

There is always a danger of fire in the case of an engine failure. Brief the copilot to stand by in cases like this, ready to pull engine selector valve and then the fire extinguisher control.

If possible, climb steadily to 1000 feet before you try to turn. Then make a cautious shallow turn to come back in and investigate. **So long as you maintain sufficient airspeed and proper trim,** you can turn either way, but turn away from the dead engine whenever practicable. Keep your takeoff flap setting to lower your stall speed.

Fire on Takeoff



The procedure in case of a fire on takeoff is the same as that for a fire any time. The subject is covered in the **Fire** section of this manual. Remember that an engine fire on takeoff involves the loss of the engine; therefore, keep in mind the technique for handling engine failure on takeoff.

Blown Tire on Takeoff

If you blow one tire on takeoff you have little to worry about. Remember that these are dual wheels and you are not likely even to realize the fact if only one tire blows. It does not normally affect either takeoff or landing. If you are heavily loaded, however, and have any suspicion that you have blown one tire on takeoff, make the smoothest landing you can achieve when you come in, since the other tire now has twice as much weight on it.

Having two tires blown on the same side, however, is different. This can result from hitting a hole or an object on the runway. If this occurs you will know, or strongly suspect, what has happened. Stop the airplane if your speed has not exceeded the speed at which you would normally land the airplane. In stopping under these conditions, use the engines on the flat-tire side to overcome the pull, helping out with the brakes on the good-tire side. Put forward pressure on the control column to keep the nosewheel down, and steer with the nosewheel steering gear.

If your speed is past the point where you can stop easily, go ahead and take off, but make your next landing according to the emergency procedures for blown-tire landings.

If the nosewheel tire blows on takeoff, pull the nose high enough so that nosewheel clears ground, and proceed with takeoff.

Miscellaneous Emergency Takeoffs

In taxiing to takeoffs from ice or wet surfaces, go slowly, never faster than a walk. Your steerable nosewheel reacts just as the front wheels of an automobile do on ice, and if a skid starts you can't stop it. On the takeoff itself the rudder becomes effective for steering, and the danger of skidding is considerably less.

On cinder runways and steel landing mats be careful not to use your brakes excessively. Sudden hard braking may cause the cinders or steel mat to bunch up ahead of your wheels.

Takeoffs from mud or deep snow are apt to be critical. The single tire of the nosewheel sinks deeper into soft surfaces than do the double main wheels. There is also danger of damaging the nosewheel by hitting deep mud-holes or deep snowdrifts.

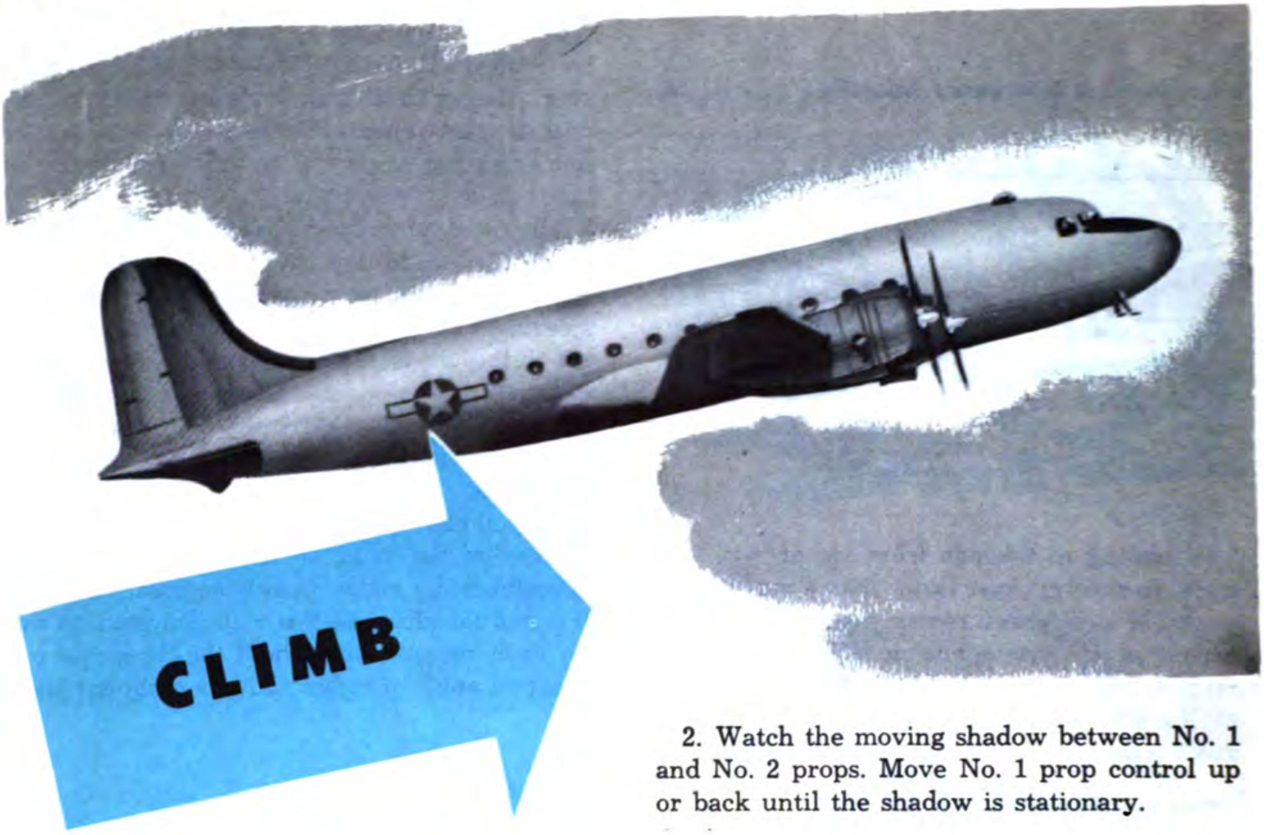
The best procedure for handling takeoffs under these conditions is to get your nosewheel out of the mud or snow as soon as possible, steering with the rudder. This gives positive lift to the wings, instead of the negative angle of attack in the normal nose-down takeoff roll attitude. This lift takes some of the airplane's weight off the main wheels and transfers it to the wings.

As you gain speed and the wheels rise to the surface of the mud or snow, don't hold the nosewheel any higher than is necessary to keep it out of the slush. In this way you get into the air in flying position without the danger of too great an angle of attack, with consequent stall.

CAUTION

In low temperatures slush on the main wheels may cause the gear to freeze. Avoid the situation by lowering or raising the gear a couple of times until the slush dries or freezes, before finally retracting the gear.

NOSEWHEEL OUT OF SNOW—STEER WITH RUDDER

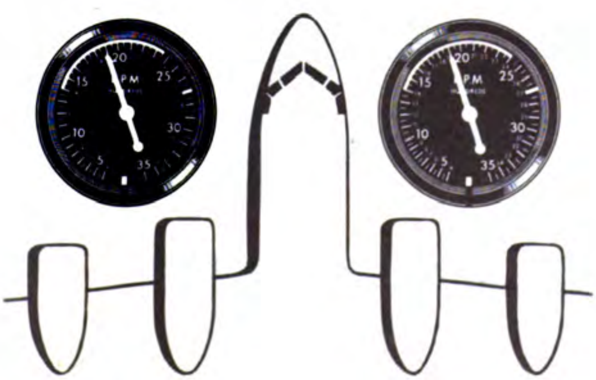


2. Watch the moving shadow between No. 1 and No. 2 props. Move No. 1 prop control up or back until the shadow is stationary.

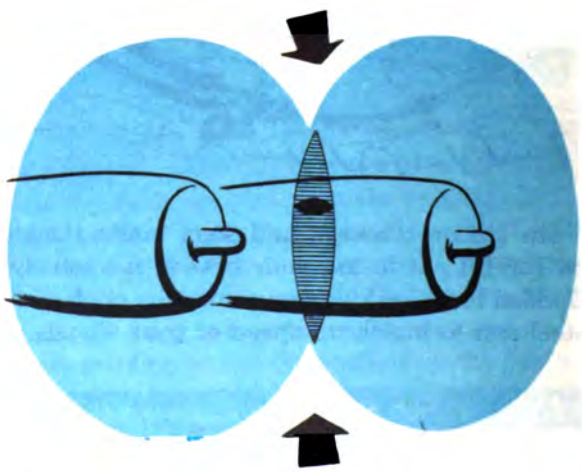
Synchronize Your Props

As soon as possible after changing your propeller settings, synchronize your props. Unsynchronized propellers contribute greatly to your fatigue and that of the crew.

To synchronize propellers:



1. Have the flight engineer get all tachometers reading the same, at the required setting.

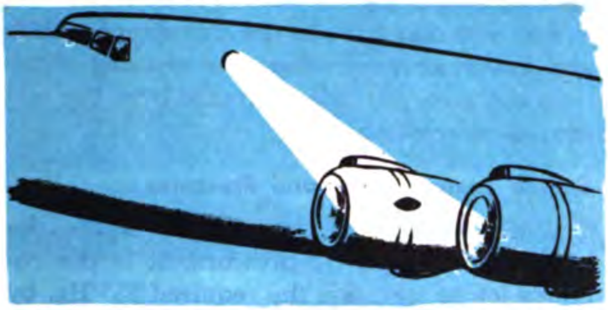


3. Have the copilot do the same thing for No. 3 and No. 4 props, moving No. 4 control only.

4. Have the engineer go back to the crew compartment to listen for the beat between No. 2 and No. 3 props. Following the hand signals of the engineer, move No. 2 prop control up or back until the beat disappears.

5. Now re-synchronize No. 1 with No. 2, moving only No. 1 control and you've got it.

6. If the controls have a tendency to creep, lock them in position by advancing the friction lever on the quadrant.



At night it is more difficult to synchronize propellers. Have the engineer or another crew member shine the Aldis lamp along the props. For synchronizing No. 1 and No. 2 props he can shoot the light out the window in the crew compartment. For Nos. 3 and 4 he can shine the light out the navigator's window. Extend the landing lights if use of the Aldis lamp is impractical.

After you synchronize props, the readings may not be the same on all tachometers. Remember that you have not changed the setting of No. 3 prop, so refer to that tach as the master setting. If, however, the other three tachs show a nearly identical reading, above or below No. 3, then there is apt to be an error in No. 3 tach. In that case, advance or retard all props equally, to bring the more accurate tachometers up or down to the desired setting. Then synchronize again, and during your cruise refer to No. 2 as the master setting.

Cabin and Engine Check

When everything is set and you are into your climb, send the flight engineer back to check the cabin and look at the engines. He should check the engines for oil, fuel, or hydraulic leaks, loose cowlings, or any possible structural difficulties which might have developed on takeoff.

The engineer should also check the fuel compartment for leaks, and look around the cabin to see that no cargo has shifted on takeoff, that everything is secure, and that the passengers are all right.

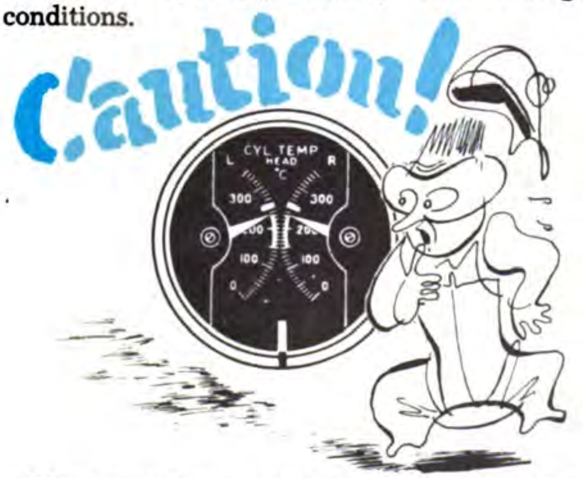
The Climb Is Easy

There is nothing complicated or difficult about a normal climb in a C-54. Reduced to the essentials, the only things to do are to maintain heading, airspeed, and power. Decreasing pressure and temperature with the increase in altitude, however, has an effect on both airplanes and crew and makes certain procedures necessary, in order to maintain efficient climb conditions.

The pilot keeps the airplane on its heading. For best performance maintain smooth and steady flight by constant reference to flight instruments. Keep the ship trimmed to take the load off the controls. Throughout the climb, pilot, copilot and engineer must constantly check all instruments for proper settings.

Airspeed

1. A cruising climb at 155 to 160 mph IAS has the advantage of ground coverage and better engine cooling, and makes it possible to climb with cowl flaps closed, under average conditions.



When you have cowl flaps closed, watch cylinder-head temperatures carefully to be sure that they don't exceed 232°C.

2. If economy is your primary requirement, you get optimum climb conditions at maximum continuous power with an IAS of 140 mph. This steeper climbing attitude gets you up to cruising altitude and auto-lean mixture operation more quickly.

You also may have to use this steeper climb and lower airspeed when the cruising climb does not give you safe clearance over the terrain on your climb path.

Engine Temperatures and Pressures

Manifold pressure decreases with the decrease in atmospheric pressure. It is the copilot's job to maintain the required 35" Hg. by advancing the throttles as needed throughout the climb. If you are going to cruise at an altitude which requires the use of high blowers, the copilot shifts into high blowers at the point where he can no longer maintain 35" Hg. with full throttles.

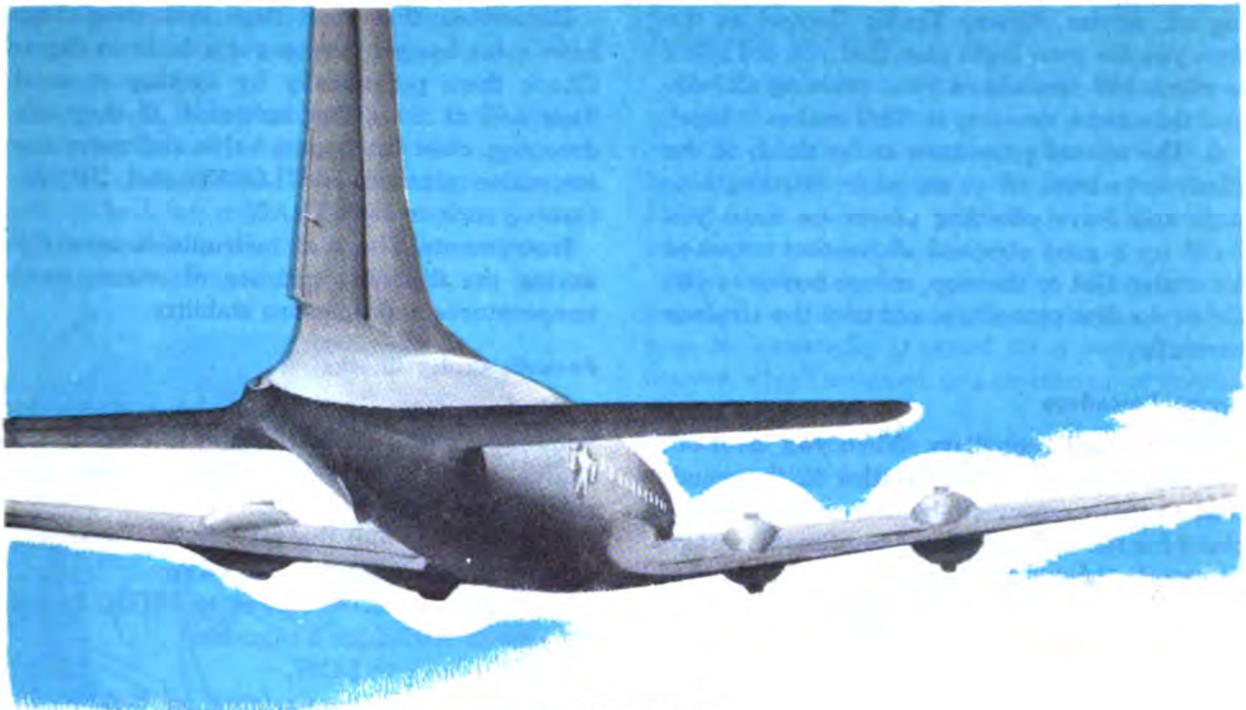
NOTE: Reduce throttles 3" or 4" Hg. before the blower shift to avoid the sudden surge of power. Re-set throttles after shift.

Cylinder-head temperatures drop in cold outside air temperature. Your cowl flaps are at TRAIL. If the cylinder-head temperature gages drop to below 200°C, close the cowl flaps. Remember that base temperatures are approximately 10° hotter than cylinder-head temperatures. Watch the gage. If the temperature gets back up to the maximum reading of 232°C, change the cowl flaps to TRAIL again. If oil temperature exceeds the maximum of 85°C, the oil radiator cooler doors open automatically.

During the climb the flight engineer also checks the generators to be sure they are functioning properly.

Crew and Passengers

The pilot's responsibility extends to checking on the comfort of crew and passengers during climb. The temperature and pressure outside are dropping, and crew and passengers may need cabin heat and oxygen. Have the flight engineer check up on these matters.



CRUISE

Get on the Step

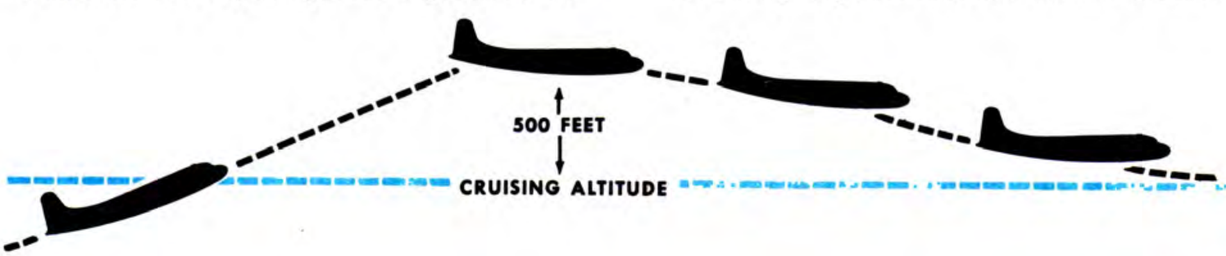
The C-54, like heavy airplanes in general, can maintain altitude in two different attitudes: one with the nose up, mushing; the other with the airplane on the step. In the first case the airspeed is comparatively lower, with poor flight characteristics. In the second case, the airplane is really flying, in a tail-high attitude, with a much higher airspeed.

The extra power necessary to get the airplane up on the step results in a saving of fuel per mile. Therefore, the first economy to achieve is to get optimum performance out of the airplane by the best flight attitude: that is, the best ratio of lift to drag. After this is accomplished, take care of the economy of fuel versus power.

There are two ways to get the airplane on the step. Each has advantages and disadvantages and both are effective in comparatively smooth air only.

1. Climb to 500 feet above your cruising altitude. Level off, and reduce manifold pressure and rpm to the required cruising settings. Losing the extra 500 feet gradually allows you to get the airplane up on the step and lets the engines cool before you go into CRUISE mixture control. Close the cowl flaps and trim the airplane for level flight. When you have your plane trimmed to fly absolutely true, the airspeed indicators have the same readings within allowable tolerances and the ball is in the center of the bank indicator. If you don't get these conditions, you may be in a skid.

NOTE: If you plan to use this method of level-

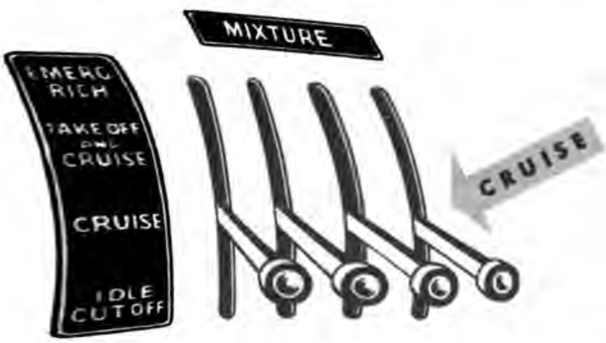


; off, advise Airway Traffic Control at the
ne you file your flight plan that you are going
climb 500 feet above your cruising altitude
id then come down to it. This makes it legal.
2. The second procedure at the finish of the
limb is to level off at the exact cruising alti-
ude and leave climbing power on until you
uild up a good airspeed above that required
or cruise. Get on the step, reduce power as you
lid in the first procedure, and trim the airplane
arefully.

ruise Procedure

Engines and propellers. When you level off,
he copilot adjusts the throttles to the mani-
old pressure specified by the cruise control
hart for the conditions you require. The engi-
eers sets the propeller controls to the rpm re-
uired by the chart, and closes the cowl flaps.
rim up the airplane. Set friction locks on
rottles and propeller controls.

Mixture controls. The flight engineer puts
e mixture controls in CRUISE, and helps the
lot synchronize the props.



uel tanks. The engineer switches fuel source
he fuselage tanks, carefully noting the time
his flight log. (See **Fuel System** for proper
cedure in changing fuel source.) In the
54A, with three or four fuselage tanks, it is
ter to use the aft tanks first, because this
ocedure does not change the CG as draining
forward tanks does. Use the forward tanks
ond.

Hydraulic bypass valve. After moving all
draulic controls to CLOSED position, then
ck to NEUTRAL, to be sure that cowl flaps,
ng flaps, and gear are full up, the flight engi-
er opens the hydraulic bypass valve.

Remember that cowl flaps and wing flaps have a tendency to creep out a little in flight. Check them periodically by looking at cowl flaps and at wing flap indicator. If they are drooping, close the bypass valve and move the respective controls to CLOSED and UP, returning each to NEUTRAL.

Instruments. Check all instruments carefully during the first few minutes of cruise, until temperatures and pressure stabilize.

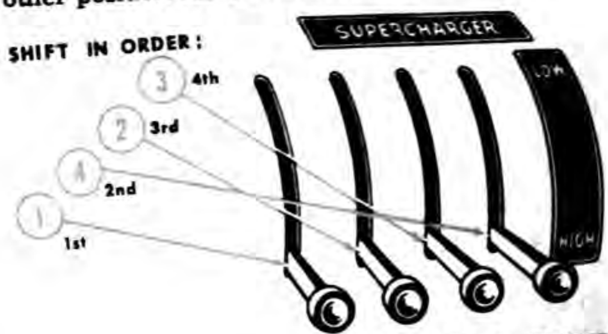
Periodic Cruise Checks

Blowers. Every 2 hours make a check on your blowers. The blowers tend to accumulate sludge, which is removed by this periodic de-sludging operation.

The engineer and the pilot cooperate in the operation, following this procedure:

1. Shift from LOW blower to HIGH. Leave blowers in HIGH for 5 minutes.
2. Shift back to LOW.
3. Note time of de-sludging on flight engineer's log.

The procedure is the same whether you start in LOW or HIGH blower. Just shift to the other position for 5 minutes, then shift back.



NOTE: When you shift from LOW to HIGH blower some engine power is diverted to operate HIGH blower. Manifold pressure rises 2" or 3". Therefore, when the engineer is ready to switch to HIGH blower, you should reduce throttles sufficiently to anticipate the rise in manifold pressure. Always shift blower controls rapidly, without hesitation. Shift Nos. 1 and 4, then Nos. 2 and 3, to keep balanced power. There is a drop in oil pressure as the engineer shifts the blower controls, but the pressure comes up again immediately. In shifting from HIGH to LOW blower, the engineer shifts the controls first, and the pilot then advances throttles to get the desired manifold pressure reading.

Generators. The engineer should check generators periodically during the cruise.

Engines, wings, and cabin. Send the engineer back to look at engines and wings from the cabin periodically. He can check the cargo and passenger situation while he is there.

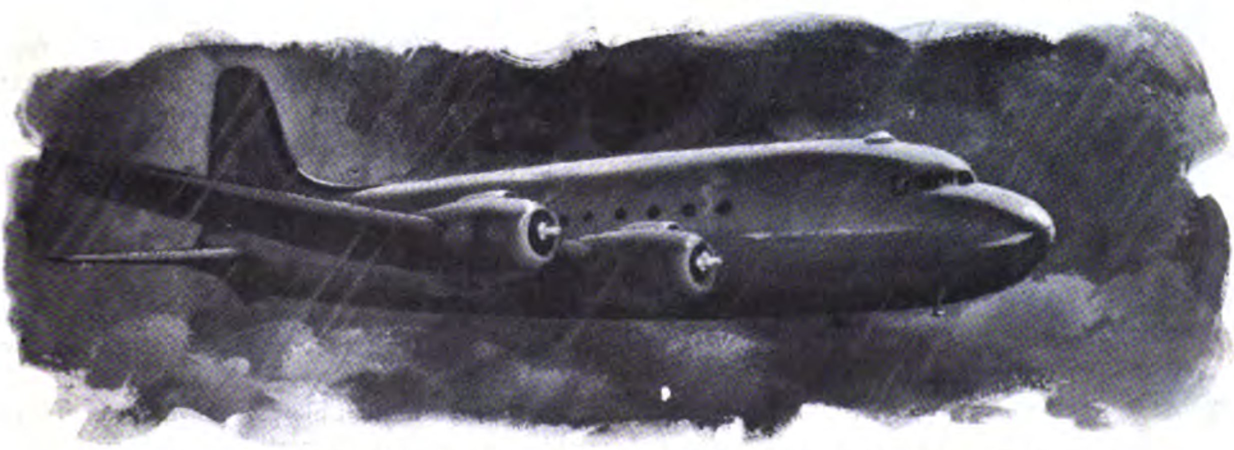
Turbulence in Cruise

The C-54 is built with a safety factor adequate in any turbulence you are likely to encounter, as long as you help the airplane to help itself. The thing to remember is to avoid high accelerations in conditions which may impose severe gust loads.

The loads may be caused by heavy gross loads of fuel or cargo in the airplane, or they may be externally imposed by a violent maneuver, a high airspeed, or a sudden up or down gust of air.

With a gross load of 68,000 lbs., and an airspeed of 220 mph, plus a vertical draft of 40 feet per second, accompanied by a sudden pull up of nose to slow the airplane, you would be likely to tear off the wings. With reduced speed or weight, however, or with more careful maneuvering, there is no reason to expect structural failure in rough air. Better yet, you know you are safe if you stay out of doubtful weather.

It is also essential to avoid a low airspeed which might cause a stall when the gust load drops you. In that case your airplane falls off and attains a dangerous momentum before you can pull it out, again imposing a high load factor. To stay safely above a stall you need an increase of 55% above stalling speed. In this airplane it happens that 55% above stall speed is the airspeed you use in long-range cruise.



Therefore, the ideal speed to hit most turbulent air in this airplane is between 160 and 170 mph. Under the worst possible load conditions, in violent turbulence, 150 mph offers best protection for the airplane structure.

In moderate turbulence, however, don't increase or reduce power, and don't pull up or dive. Usually the gusts hit so fast that whatever you do with power or maneuver is too late anyway. It only causes overcontrolling and seesawing, which is hard on passengers, crew, and airplane.

Keep the ship level regardless of altitude lost or gained. The airspeed indicator may go from 165 up to 210 or down to 130 momentarily, but your power and level attitude keep you at an average of 165.

Don't lower gear or flaps. Sudden accelerations while the gear is in motion can very easily slam the gear up against the latches, causing structural damage. Airspeeds greater than 144 mph in gusts will damage the flaps. If you must reduce power you can pull back No. 1 and No. 4 engines. By doing this you do not appreciably cut down the sound level in the cabin, and your passengers are not unduly alarmed. You thus keep No. 2 and No. 3 engines warm and set at the proper horsepower, and still achieve a 50% reduction in power.

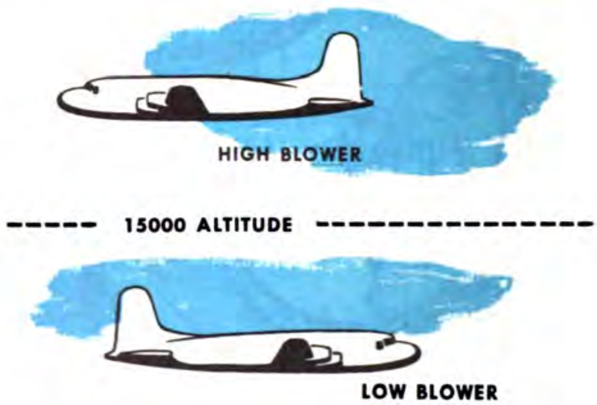
Remember: Try to avoid turbulent air with a heavily loaded airplane; stay out of thunderheads. In rough air keep an airspeed of 160 to 170 mph with the ship level.

Use of High Blower

Use high blower only when the power output is insufficient in low blower.

It takes 55 to 60 Hp to drive the high blower. If you are barely able to get 600 Hp in low, you would have to take out 660 Hp in high blower to get the same power: 600 Hp delivered to your propellers and 60 expended to drive the high blower. This is obviously uneconomical. It amounts to 16 gallons per hour greater fuel consumption.

It is necessary, however, to use high blower



at altitudes above 15,000 feet. This situation is not a matter of choice, being strictly a result of the fact that decreasing atmospheric pressure makes it impossible at these extreme altitudes to get the required manifold pressure.

At altitudes between 10,000 and 15,000 feet, there are some points about the use of high and low blower to consider. At higher rpm you get increased propeller efficiency. For that reason it is sometimes better to increase your rpm within limits, to get extra power in low blower, than to go to high blower with its attendant higher fuel consumption.

Of course, you can achieve the same fuel economy in high blower that you got in low blower, by reducing rpm. The only time you want to go into high blower, however, is at high altitudes. And at these altitudes you operate at full throttle. Therefore you cannot regain the power lost by reducing rpm with more manifold pressure. So you would lose efficiency in terms of gallons per mile.

Mixture Control in Cruise

Always put mixture controls in TAKEOFF AND CLIMB when you exceed 735 Hp, maximum cruise power, or when you have to climb. Use lean mixture for level flight, and flight at or below maximum cruise.

It is dangerous to attempt to lean out the engines manually by putting the mixture control lever beyond the CRUISE setting. If you do this during high-power operation, you get detonation and immediate loss of power. If you do it during low-power operation, you get a loss of power, although cylinder-head temperatures may drop. The drop results from cooling action of the quantity of air which does not combine in a combustible mixture.

Cruising Descent

Always start your cruising descent at the proper time and at the proper rate. You save time and preserve the comfort of your passengers this way. A descent of 300 feet per minute is recommended.

In order to come out over the airfield at 1000 feet, divide the number of feet you want to let down by 300. The answer is the time in minutes which you subtract from your ETA to get the approximate time to start your descent.

During descent your airspeed increases to about 200 mph. Don't allow it to exceed 205 mph. Reduce throttles periodically to keep manifold pressure and airspeed at desired setting. You don't have to adjust any other controls until you are within range of the airfield.

Have the flight engineer make a final check of the cabin during the descent, at which time he can see that passengers' seat belts are fastened.

Engine Failure in Cruise

You can have an engine failure in long-range cruise and not always detect it immediately unless backfiring or vibration accompanies the failure. The drop on the cylinder-head temperature gage is one positive indication on the instrument panel of such a failure. Another indication is gradual loss of airspeed. The automatic pilot absorbs and corrects most of the yawing.

If you suspect a failure, however, you can detect it by moving the throttles rapidly: the needles on the good engine tachometers fluctuate, but the dead engine tach remains steady.

There is nothing to worry about in the loss of one engine in cruise. You have ample power to get to your destination under normal circumstances. Follow the feathering procedure. You don't have to do much re-trimming of the airplane. Use a quick rough power setting of 2000 rpm and 31" manifold pressure until you have time to select the best power setting from the 3-engine operation chart. Or, you can follow this rule of thumb to maintain fuel economy after loss of an engine: use 10% less airspeed for three engines than you did for four. For example, if you were operating at 175 mph on four engines, use 158 mph on three engines.

FLIGHT PLANNING AND PROGRESSION

Cruising Power Control

The most important factor in the operation of transport airplanes like the C-54 is their ability to carry large payloads over long distances. Inasmuch as the payload decreases in direct proportion to the increase in fuel load, it is obvious that in the interest of safety and economy it is essential to carry enough fuel for safe operation, but no more. Therefore, it is imperative to know how much fuel you will use per mile and plan your flight accordingly.

In your flight planning, you have to consider various factors. There is a wide variation in the performance you can attain by using different combinations of power and propeller settings. The power control system you use, and the specific settings you employ within that system, depend on the kind of operation you wish to accomplish. There are four separate basic power control systems, designed to get the best performance out of the airplane under the four following types of operating conditions:

1. **Maximum range.** In maximum range operation you are concerned only with how many miles you can stretch a gallon of fuel, over long or short distances with a given load.

2. **Maximum endurance.** In maximum endurance operation you are concerned only with how many minutes you can stretch a gallon of fuel: i.e., how long you can stay in the air.

3. **Maximum speed.** In maximum speed operation you are concerned with the number of miles you can fly in the shortest time possible. This operation is desirable when economy of operation may have to be sacrificed to get a transport job accomplished quickly.

4. **Scheduled operation.** In scheduled operation you select power settings based on getting the airplane from point to point in a given number of hours.

Maximum Range Operation

There's no truth in the old theory that you get maximum range by pulling 'way back on the power and chugging along with the nose up. Actually, you arrive at maximum range operation by flying at the optimum IAS and rpm combination for each altitude and each gross weight.

Also fallacious is the theory that you can get more range by cutting one or two engines. Actually the decrease in performance in this case, and the extra power needed in the operating engines, ultimately result in less range, not more.

There are three basic factors involved in maximum range: airplane efficiency, propeller efficiency, and engine efficiency. When you reconcile these three factors to the point where the product of them all is the best average obtainable, then you have optimum, or maximum, cruise operation. This is the theory. It would apply in practice to no-wind conditions. Ordinarily, however, the wind factors must also be reconciled.

1. **Airplane efficiency.** The first factor of maximum range, airplane efficiency, depends on angle of attack of the wing. You get airplane efficiency by flying the airplane at the maximum lift-over-drag ratio. If you had an angle-of-attack indicator on your airplane, you would only have to fly at an angle of attack corresponding to the best lift-over-drag ratio, to achieve maximum airplane efficiency. Without such an indicator you have to use your airspeed indicator as the next best guide.

For each gross weight of the airplane, there is a corresponding IAS which gives you maximum airplane efficiency. These best airspeeds for given gross weights apply to any altitude. You pick out the best airspeed for your gross weight and keep that airspeed at all altitudes.

These airspeeds per gross weight, by use of which you get maximum airplane efficiency, are given in the cruising charts. On the charts the airspeeds show as instrument IAS. There is an instrument error and a position error, the latter averaging approximately 5 mph, in the airspeed indicator. Add 5 mph to IAS before converting from indicated to true airspeed.

2. **Propeller efficiency.** The second factor of maximum range, propeller efficiency, depends primarily on the angle of attack of the blade, as airplane efficiency depends on angle of attack of the wing. Propeller efficiency, however, is complicated by the rotation of the blade. Maximum efficiency must be obtained by getting the correct ratio of true velocity to rpm for the blade angle required. Generally speaking, higher rpm results in increased propeller efficiency, up to a point. Low rpm saves in fuel consumption, of course, but only at the sacrifice of some propeller efficiency. Low rpm causes vibration. Generators cut out at 1200 rpm, which is also the minimum governing speed of the props. It is not advisable to go below 1500 rpm in cruise. However, if extreme economy is necessary, you can go down as low as 1300 rpm.

CAUTION:

Propeller rpm is restricted between 1600 and 1700 rpm. Do not operate in that rpm range.

3. **Maximum engine efficiency.** The third factor of long range cruise, maximum engine efficiency, is a function of BMEP. You get this maximum engine efficiency by operating at the maximum BMEP permitted for continuous operation. Operation below maximum BMEP is uneconomical and operating above it is injurious to the engine.

Maximum efficiency of airplane, propeller, and engine do not ordinarily occur at the same values. For example, operating under conditions which produce the settings for maximum propeller efficiency might necessitate flight attitude and power settings below maximum efficiency for airplane and engines.

Therefore, optimum over-all operating efficiency, which means proper operation for maximum range cruise, becomes a compromise among these three factors. You get it by using airplane, propellers, and engines in such a way that each factor allows each of the other two to produce its highest degree of efficiency.

Maximum Endurance

Sometimes certain conditions make it necessary for you to remain in the air as long as possible. These conditions include bad weather at your destination, like fog or a front which will pass at a later time than was expected. Or you may have to wait for winds at your destination to subside, or for daylight before you can land. In these cases, speed is of no point. The only factor you are concerned with is economy of fuel consumption.

Follow these procedures to attain maximum endurance:

1. Maintain the lowest altitude consistent with safety.

2. Use the following table to find the correct airspeed for your gross weight, and as the weight is reduced by fuel consumption, go to correspondingly lower airspeed brackets:

Gross Weight	IAS
70,000	140
65,000	135
60,000	130
55,000	124
50,000	118
45,000	112
40,000	105

3. Set your rpm at 1500 and pull whatever manifold pressure is necessary to maintain correct airspeed.

Maximum Speed

When conditions necessitate the sacrifice of economy factors in order to get somewhere in the shortest possible time, follow these procedures to achieve maximum speed performance:

1. Use maximum allowable horsepower for cruise. Above maximum cruise power, 735 Hp, it is necessary to go into rich mixture. Therefore, for all practical purposes, maximum speed cruising is limited to 735 Hp output with the mixture controls in CRUISE. Fuel consumption is 230 gallons per hour.

2. Use these settings to get the desired horsepower:

5000 feet: 2100 rpm and 33.7" manifold pressure.

10,000 feet: 2150 rpm and 31.7" manifold pressure.

These manifold pressure readings are for standard temperature.

Scheduled Operations

Scheduled operations involve achieving best performance under conditions of regular timed stops and connections at stated intervals. Schedules are based on optimum performance at economical horsepower output under predetermined prevailing winds and full gross loads.

When there are winds stronger than average or when you leave later than scheduled departure time, you have to take out more power —up to maximum allowable cruise settings— to arrive at destination as near scheduled arrival time as possible. Conversely, if you anticipate stronger than average tailwinds, you can make out a flight plan calling for less horsepower.

Therefore, when it is imperative to make up time the basis of your flight plan is the number of hours available or scheduled, divided into the number of miles to the next stop. The result is the rate of groundspeed necessary to make your schedule. Ground time, climb time, and wind velocity must be considered to arrive at the airspeed you need to make your schedule. For simplicity in figuring your flight plan, you can use an arbitrary ground time of 15 minutes for taxi out, engine run-up, and taxi in. Assume a loss of ½ minute per 1000 feet for your climb time. This is not your rate of climb, but time lost in climb. Then apply the effective forecast winds to get your TAS and IAS.

EXAMPLE:

1. Scheduled time between points A and B: 10 hours.

2. Distance between points A and B: 2000 miles.

3. Allowed ground time: 15 minutes.

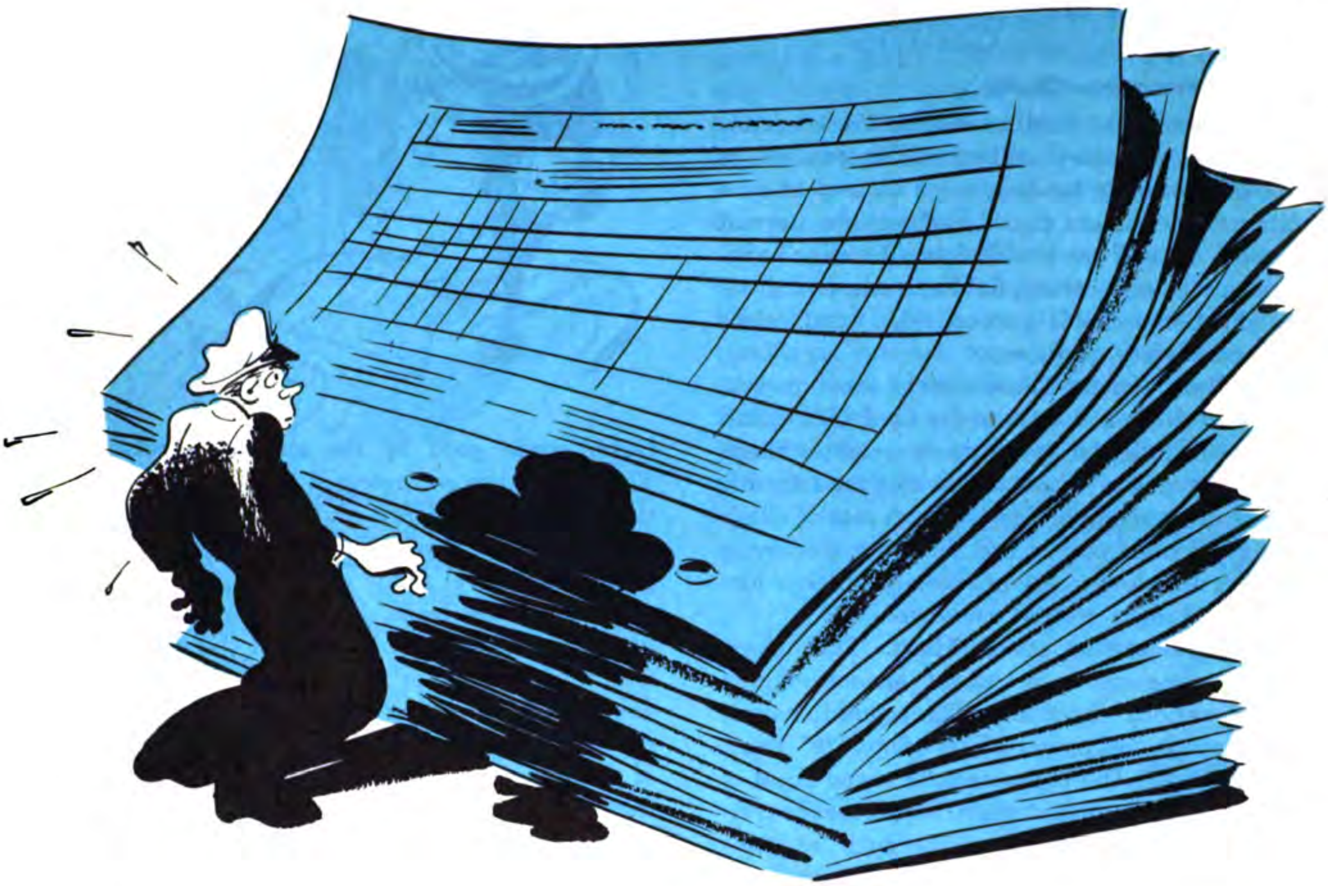
4. Cruising altitude: 10,000 feet.

5. Allowed climb time (½ minute per 1000 feet): 5 minutes.

6. Effective headwind and temperature: 5 mph; —7°C.

Scheduled time (10 hours), less ground and climb time (20 minutes) equals 9 hours 40 minutes. This time, divided into 2000 miles, equals 207 mph groundspeed. Add 5 mph winds and you get the necessary TAS of 212 mph.

Correct this 212 mph for an altitude of 10,000 feet and a temperature of —7°C and you arrive at an IAS of 184 mph necessary for the schedule. Then consult your power charts and take out whatever power is necessary to get this IAS, up to maximum allowable cruise settings.



Charts

It is the airplane designers' job to use propellers and engines of the right design and performance to meet the requirements placed upon them by the type and mission of the airplane. It is the engineers' job to work out the necessary charts and tables which give proper settings for obtaining maximum over-all efficiency under various conditions.

The various charts furnished to you have been worked out by competent authority and represent the best information available. Proper use of the proper chart assures maximum performance and economy.

The charts found in flight operating instructions are of two general kinds:

1. **Flight performance charts,** covering speed limitations for various conditions and attitudes.
2. **Engine performance charts,** covering power settings and fuel consumption.

The charts are presented in either graphic or tabulated form.

Graphic charts have the advantage of a more consolidated presentation. They provide the solutions to many problems all on one sheet of paper. For example, a single graphic chart may show all corresponding speeds and power settings for all weights and altitudes, by sliding scales. The disadvantage of graphic charts is that the maze of engineering curves looks complicated and difficult to understand.

Tabulated charts, on the other hand, have the advantage of simplicity and easy readability. For example, a single tabulated chart concerns itself with the corresponding power settings and speeds for just one gross weight and altitude, or for a small range of weight and altitude. The disadvantage of the tabulated form is that many additional pages are necessary to furnish all the answers and make the charts completely practical.

The following paragraphs describe the types and uses of the common C-54 charts.

Flight Performance Charts

1. **Takeoff and landing charts.** These charts give the necessary rolling distances, before takeoff and after landing, for a variety of conditions. The factors considered include: normal takeoff, takeoff over a 50-foot obstacle, hardness of runway surface, field altitude, and gross weight. Some charts also consider wind velocity and surface gradient.

2. **Climb charts.** These charts show power, airspeed, fuel, and time to be used in a climb to any altitude, for given gross weights. There are two types of climb which call for two different rates of climb. One is a high rate of climb using full rated power, and the other a cruising climb with a lower rate of climb but higher airspeed and more ground coverage.

3. **Characteristic speed chart.** This chart gives stalling speeds in IAS for various weights under various conditions. The conditions include power-on, power-off, no flaps, 20° flaps, and 40° flaps. The characteristic speed chart is a useful and important chart, which merits considerable study. It can give you such information as, for example, the degree of bank at which you stall with a certain airspeed and weight, or safe approach speeds for normal power settings, under different weights and flap settings.

In using the chart, however, remember that the values are given for smooth air. Turbulence raises your stalling speed in proportion to the degree of turbulence. Remember also that a violent movement of the control surfaces raises stalling speeds above those given in the chart.

4. **Speed, load factor, and landing limitations chart.** Curves dealing with flight conditions comprise the speed and load factor limitations chart. A curve dealing with landing conditions is the landing chart. Use these two charts together to insure safety during both flight and landing.

The curves on the speed and load factor limitations chart are cross-plots of five variables: gross weight, permissible indicated level flight speed, permissible indicated diving speed, amount of fuel in the wing tanks, and load factor made good by the airplane structure. The curves are so arranged that if any two of the five quantities are known, you can determine the other three. The curves give you the permissible level flight and diving speeds according to fuel loads, in order to stay under ultimate load factors. Speeds on the chart are maximum speeds for structural safety, not recommended operating speeds. Recommended rough-air speeds for operation under conditions of extreme turbulence are much slower than those indicated in the chart.

The curve of the landing chart is a cross-plot of three variables: gross weight, maximum fuel weight, and load factor made good by the landing gear. Proper use of the chart gives you the maximum landing load factor which the airplane can safely withstand.

5. **The airspeed correction chart.** This chart gives the relationship between the TAS and the airspeed indicator reading for any condition of temperature and pressure altitude. It includes the correction for the position error of the airspeed system, but does not include the instrument error of the airspeed indicator. Airspeed correction tables are also frequently available. These give the corresponding TAS for each IAS reading at different flap settings, under sea level conditions.

Engine Performance Charts

1. **Cruise control charts.** Complete cruise control charts take into consideration the factors of weight, rpm, manifold pressure, airspeed, altitude, fuel consumption, blower ratio, and mixture control.

Of the several accepted types of cruise control charts, the most generally used by the operating Army contract carriers is the tabulated form set up at maximum long-range cruise for a 50-knot headwind. This chart gives a good fast airspeed with power reductions for every 3000 lbs. reduction in fuel. It is corrected for temperature and altitude and gives rpm, manifold pressure, IAS, fuel consumption, and time of power reductions.

A new type of cruise calculator, called the Flight Operations Guide Card, has removable cards in a small bakelite holder. On each card there are five types of operation, from high horsepower cruise to low horsepower cruise. It is set up for altitude blocks of 5000 feet, and gives fuel consumption, IAS, rpm, manifold pressure, and total fuel consumed in range air miles, both statute and nautical. Each card is good for a given 5000-lb. weight bracket, and when you go out of that bracket, you slip in the next card with the data for the following 5000-lb. bracket. This card guide is merely a convenient form of the flight operation instruction charts found in the T. O.

2. **Engine flight calibration curves.** These curves graphs are divided into two sections, low blower and high blower. They show at what conditions you can expect full throttle operation and at what point you exceed proper BMEP. They give power and rpm restrictions, the settings and altitudes at which certain powers are obtained, and specific fuel consumption in auto-lean (CRUISE) and auto-rich (TAKEOFF AND CLIMB) settings.

3. **Engine check chart.** This chart, sometimes called specific engine flight chart, gives temperature and pressure restrictions for proper use of engines under various operating conditions. It also gives mixture control, cowl flap, and blower positions.

4. **Fuel consumption chart.** The fuel consumption chart superimposed on a distance chart is a valuable reference by which to ascertain the number of miles you can get from given quantities of fuel under certain wind velocities.

The following paragraphs describe the types and uses of the common C-54 charts.

Flight Performance Charts

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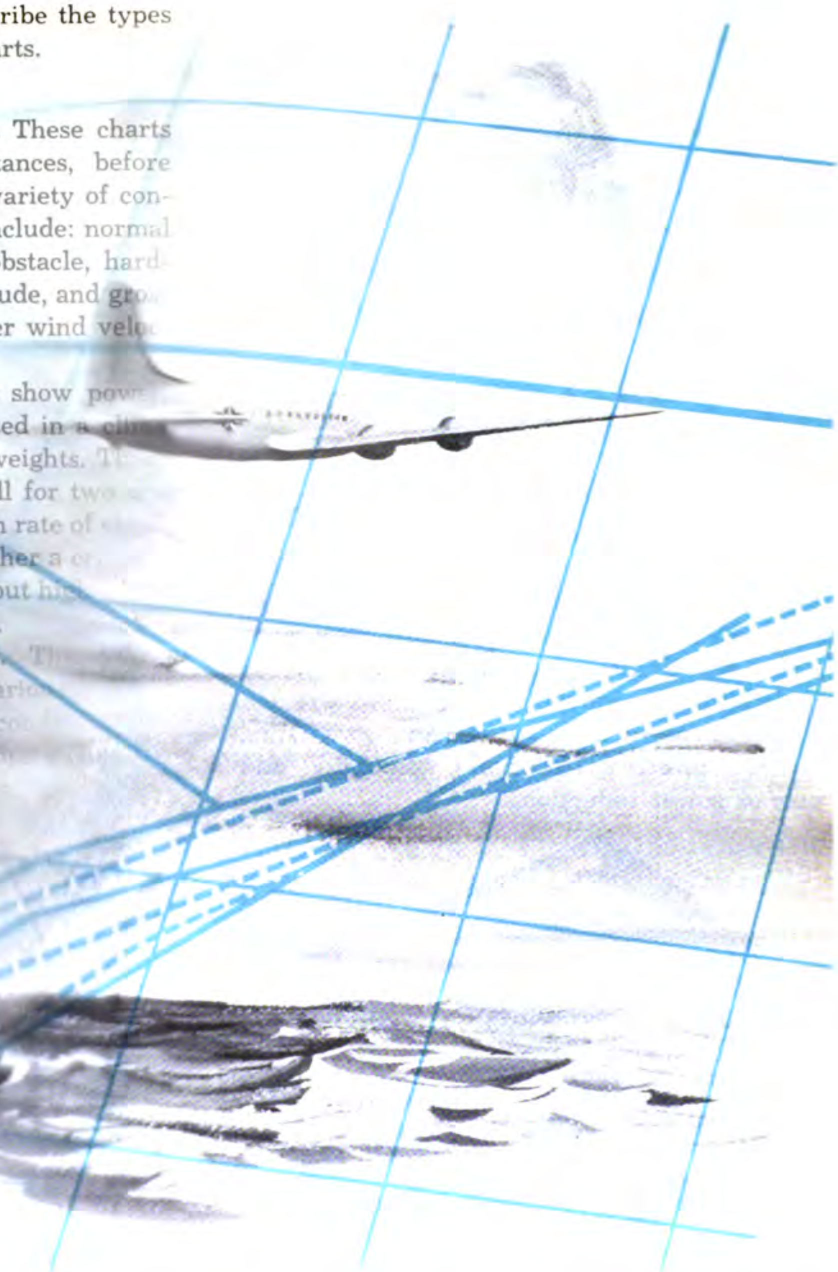
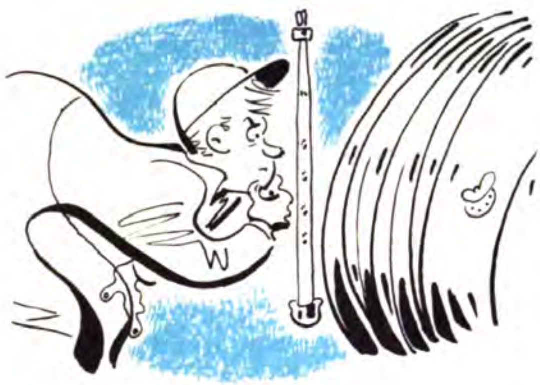


these is the farthest point at which you can turn back and arrive home with dry tanks; the other is the farthest point at which you can turn around and get back with a reasonable amount of reserve fuel. If the wind on the return trip is the same as that going out, the curve can be quite accurate. If, however, you have the misfortune to have a front shift on your course, the curve can be completely inaccurate.

You make up the "How Goes It" chart at the time you make up your flight plan before departure. It is prepared from forecast conditions en route. When you are in the air, you plot your actual conditions against your forecast conditions. The result is a graphic picture of whether you are doing better or worse than anticipated. At any time you know by a quick look at the graph whether you can make it back.

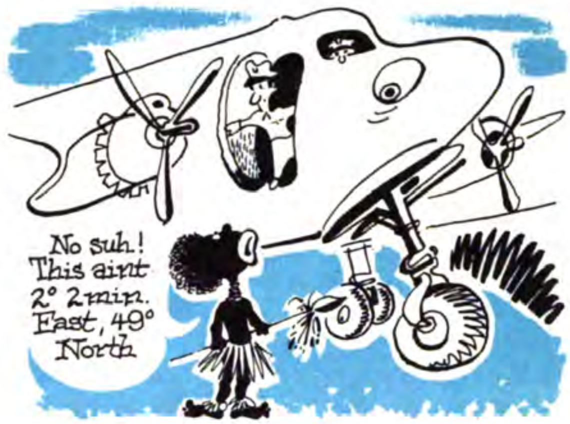
The accurate use of the "How Goes It" chart in flight is just as important as its accurate preparation before flight. When plotting hourly positions, use the miles made good along the course rather than the miles flown.

Take into consideration these five conditions which may adversely change the actual flight curve from the predicted:

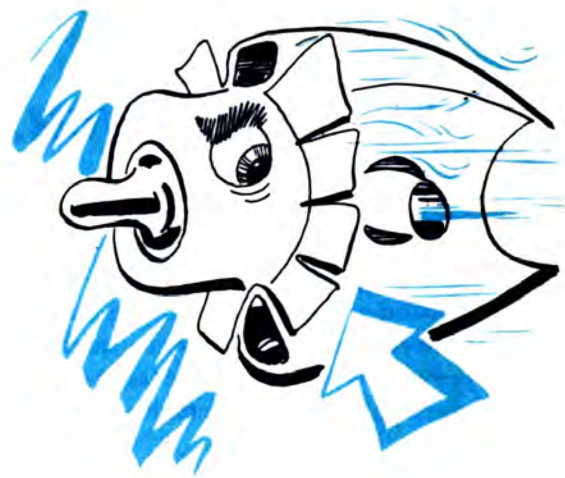


1. Fuel consumption higher or lower than anticipated. Fuel may overflow or a leak may develop.

2. Varying wind conditions, in direction and velocity.



3. Deviations from course and flight plan.



4. Wing flaps drooping, cowl flaps open, ice formation.

5. Turbulence and downdrafts over large areas.

Study an actual "How Goes It" chart and learn how to prepare and use it.

FLIGHT CHARACTERISTICS

The C-54 has smooth, easy, and effective controllability at all speeds from a stall to 200 mph IAS. At speeds greater than 200 mph the elevators and rudder controls become increasingly stiff as the speed increases. This is a safety factor to prevent sudden maneuvers at high speeds, which might place excessive strains on the structure.

Because of this stiffness of the controls at high speeds, it is better to use the elevator trim tab, instead of the control column, to bring the nose up. With the trim tab you get a smoother and more positive action, without the danger of overcontrolling. Move the tab gently, however, because in spite of its definite positive action, you don't get the feel from it which you get from the control column.

The airplane has no dangerous or unexpected stall characteristics.

Restricted Maneuvers

The C-54 is restricted to normal level flight. Regardless of what you have been flying, remember that the Skymaster is a transport, and hasn't the remotest resemblance to a fighter, in appearance or operation. The airplane has safety factors built into it which make it one of the safest ships the Army operates. You lose those safety factors when you ignore the limitations placed on its operation, and then you get into trouble.

Do not exceed the speeds given in the following airspeed limitations table:

65,000 Lbs. Gross Load	IAS
Maximum—level flight	205
Maximum—gear down	144
Maximum—flaps down	144
Maximum—diving	273

Shallow and Steep Turns

1. Use ½ needle width on bank-and-turn indicator to make shallow turns of 10° to 12°.

2. Use between one and two needle widths to make steep turns of 20° to 40°.

Use the bank-and-turn indicator needle to gage rate of turns, and the directional gyro to gage amount of turns.

Stalls

Your airplane will not spring any unexpected stall surprises on you. It always faithfully gives a buffeting and shuddering 3 to 5 mph above falling-off speed. That should be sufficient warning to you to drop the nose and quickly but smoothly apply more power.

When a complete stall occurs, the nose drops fast, and you may get a rolling motion. Be sure to pull power off immediately after the airplane

drops off. You pick up momentum rapidly, and if you leave power on you soon reach excessive airspeed.

If you fall off into a spin, you can get out of it with normal spin recovery procedure. Be sure that your flaps are retracted as you attempt recovery from a spin.

The C-54 has better stall characteristics with power off than with power on. The characteristic speeds chart gives most conditions of power-on and power-off stalls, at gross weights from 40,000 to 65,000 lbs. The difference in power-off and normal power-on stall speeds is approximately 8 to 10 mph with no flaps. As you apply more flaps, the difference between power-off and normal power-on stall speeds becomes greater.

Be careful in applying power when the airplane is close to a stall condition. A sudden application of power at this point can cause the props to stall completely, or cause them to over-rev.

Avoid a stall by lowering the nose of the airplane and applying power smoothly.

Additional factors which cause stalls at higher than normal stalling speeds:

1. **Heavy loads.** A heavily loaded airplane also accelerates faster in a dive and is more vulnerable to structural damage in a quick pullout.

2. **Abnormal configuration factors.** Any bump or obstruction which disturbs the airflow over an airfoil raises the stalling speed of that airfoil. Example: inflated de-icer boots.

3. **Control surface movement.** Violent movement of ailerons or other control surfaces.

4. **Banks.** The greater the degree of bank, the higher the stalling speed. The following table (for C-54A—65,000 lbs.) illustrates this point:

Angle of Bank	Stalling Speed
0°	104.0
10°	105.0
20°	107.3
30°	111.7
40°	118.9
50°	129.7
60°	147.0

Loss of Engines in Flight

Three-engine flight has been discussed in relation to takeoff and to cruise. It is not a serious emergency under otherwise normal circumstances. After you have feathered the dead engine propeller you have to do some, but not much, re-trimming, to maintain hands-off flight. Use roughly 10% less airspeed than that called for with four engines operating. Consult your power charts. Always turn away from a dead engine if practicable. When turn into a bad engine is unavoidable, keep safe margin of airspeed, and remember to give yourself plenty of room to make a wide and shallow turn.

With two engines out in a lightly loaded airplane it is possible to hold normal flight attitude by proper trimming, whether you have both the dead engines on one side, or one on each side. With heavy loads, 2-engine flight is a matter of trying to extend your glide and keep your airspeed at least 15 mph above stalling in smooth air, and 25 mph above stalling in rough air.

Trim for unequal power by relieving the rudder pressure with the rudder trim tab until the ball in the bank-and-turn indicator centers. This procedure assures proper utilization of rudder tab and prevents crabbing.

If you think you may ever find yourself with only one engine left, study the sections of this book on ditching and emergency landings carefully. The proper procedure in this case is to start looking for a clearing.

BEFORE LANDING

Amplified Checklist

Approach to Airfield

At a point 5 to 10 minutes out from the airfield, have the copilot call the tower for landing instructions. Get from the tower the altimeter setting, wind direction and velocity, the runway to be used, and the traffic at or near the airfield. If you have had to change your flight plan and land at a strange field, it is a good idea to get also the length, surface, and condition of the runways.

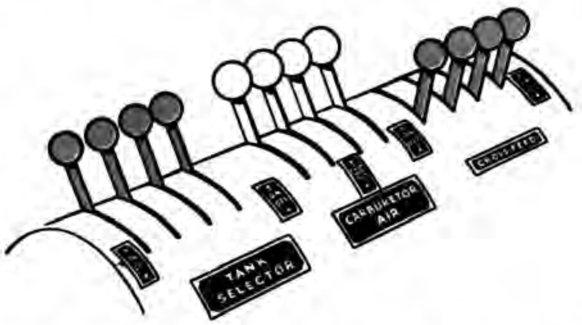
Between this point and somewhere on your downwind leg you have to reduce your airspeed from approximately 200 mph to 144 mph. Start slowing down. It is a long process to get to the lower airspeed by reducing power, and if you have to pull the throttles all the way back later on, the horn blows. So make it easier by starting to reduce speed early.

Downwind Leg

Establish your downwind leg 1½ to 2 miles out from and parallel to the center of the landing runway. In strong winds it may be desirable to set the downwind leg closer to the field to shorten the base leg and avoid excessive drift on that leg.

Remember to have the crew watch for traffic throughout the pattern. Normally, you complete some of the before-landing cockpit procedure before you get to the downwind leg, to avoid too many last-minute duties. Be sure that you utilize the checklist on the downwind leg, however, so that you don't overlook anything. Follow the standard checklist procedure of having the copilot read off each item, getting a reply before he goes on to the next.

1. **Wing tank selectors, crossfeed, fuselage**



tank selector. The engineer turns the wing tank selectors ON, the crossfeeds OFF, and the fuselage tank selector valve OFF.

2. **Drift meter.** The engineer or navigator checks to see that the drift meter is caged and OFF.

3. **Trailing antenna.** Radio operator checks to see that the trailing antenna has been reeled in.

4. **Hydraulic bypass valve.** Engineer moves the hydraulic bypass valve down, to the closed position.

5. **Brakes, hydraulic pressure.** Pilot pushes down the toe brakes, full application, once or twice. This serves the double purpose of releasing the parking brake if it is on, and also of momentarily dropping the hydraulic pressure, giving a check on the operation of the system.

6. **Autopilot.** Pilot checks to see that the automatic pilot servos are OFF.

7. **Blowers.** Engineer checks blowers to see that they are in LOW.

8. **Mixture controls.** Engineer shifts mixture controls to TAKEOFF AND CLIMB.

9. **Magnetos.** Engineer turns each ignition switch on to each magneto in turn. Remember to return switch to BOTH, between checking RIGHT and LEFT mags. Pilot and engineer check tachometers for a momentary drop in rpm. Non-functioning mags and fouled plugs are discernible by resulting engine roughness. The check serves to disclose any difficulties before landing so that ground crews can get at them immediately.

10. **De-icers, anti-icers, carburetor heat.** Copilot turns wing de-icers, prop anti-icers, and carburetor heat OFF. Remember that inflated de-icer boots increase your stalling speed.

11. **Passengers, seat belts, heaters.** Check with the engineer to see if passengers' seat belts are fastened, and that all heaters are OFF. See that the crew's seat belts are fastened.

At this point on the checklist you should have the airplane slowed down to 144 mph.

12. **Wing flaps.** Call for wing flaps when you want them. Engineer lowers the flaps to desired setting. Good maneuvering flap setting is 15°; don't use more than 20° at this point.

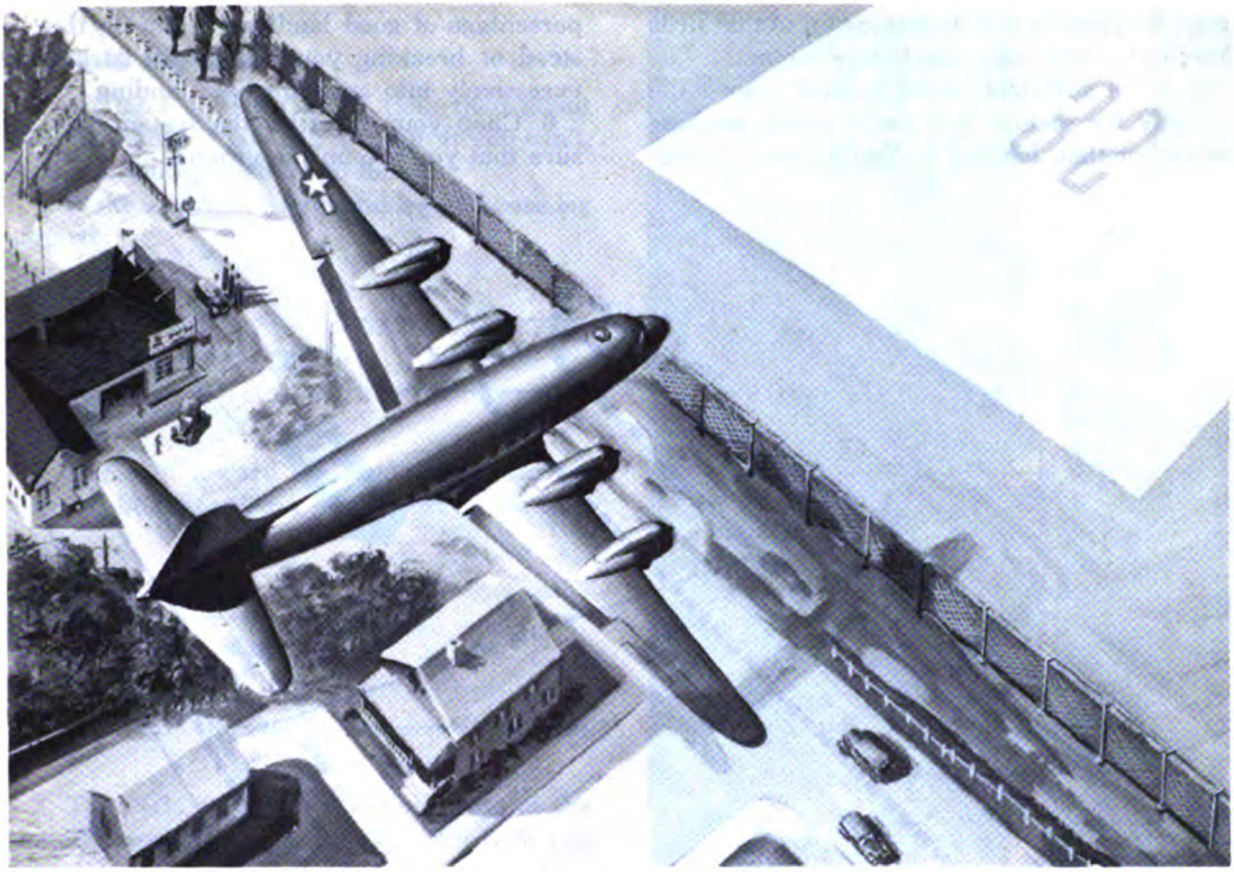
13. **Landing gear lever and latch.** Engineer moves the lever UP, then DOWN and LATCHED. Both engineer and pilot can check the lights: red light shows as the gear is descending, and green light shows when the gear is down and locked. You should also retard one throttle momentarily after the gear is lowered to see whether or not the warning horn sounds. If you get the horn, it means that something is wrong either with the landing gear or with the horn. If you have any suspicion of trouble, the engineer can check the gear through the drift meter. He can see whether or not the main gear is down and latched, and he can tell that the nosewheel is down, but not whether the latter is locked.

14. **RPM.** At your verbal command, the engineer advances the prop controls to 2250 rpm.

15. **Fuel booster pumps.** Copilot turns fuel booster pumps ON (or HIGH).

Remember that you should have all these checklist items completed before you finish your downwind leg. Make your turn onto the base leg, and call the tower for landing clearance.

16. **Further flaps.** On the final approach, call for the flap setting you require.



NORMAL LANDINGS

Normal Approach Technique

As you start your final approach, from an ideal rectangular pattern, you should be about 2 miles out from the end of the runway and heading directly toward the center of it.

From that point, follow this procedure:

1. Point the airplane toward the spot on the runway at which you want to land, and try to maintain that line of aim as a glide path. Don't pull up or drop the nose to hold the airplane on the line. Do it by adjusting power. With nor-

mal load, 20″ Hg. is sufficient to maintain a good glide.

2. Keep a rate of descent of roughly 500 feet per minute, and an airspeed of 120 mph, with some power as necessary.

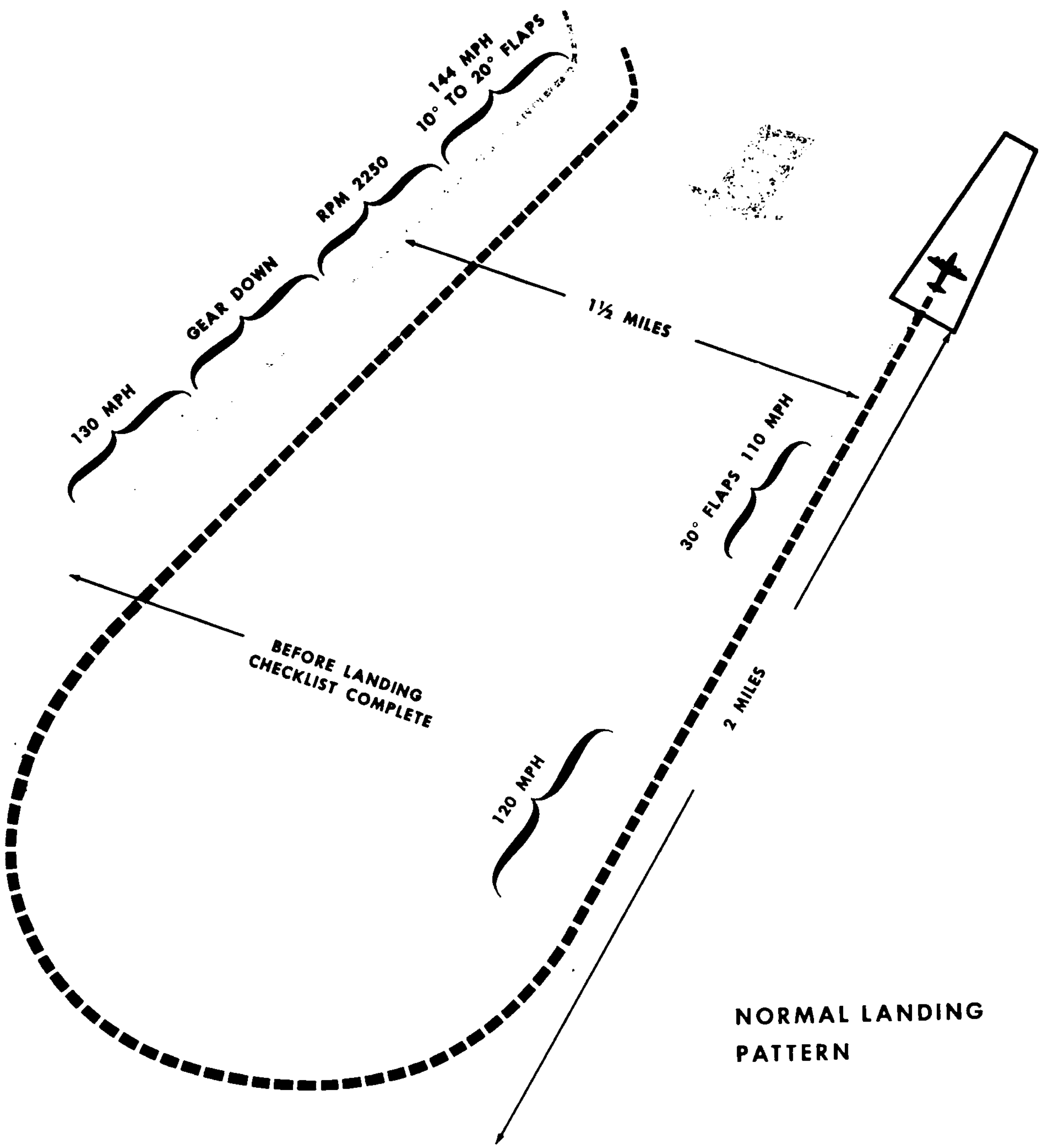
3. Keep the elevator trim tab adjusted so that you don't have to use pressure on the elevators.

4. Call for 30° flaps when you are almost over the fence. This helps to slow you down to 110 mph. Past the fence and almost at the run-

way, the nose should be coming up so that little flare-out is necessary just before contact.

5. Have sufficient speed to skim above the runway for several feet and rub the airplane on rather than landing it. You'll have a better percentage of good landings if you do this instead of breaking your glide and flaring out excessively into an immediate landing.

6. Chop your throttles the instant you are sure that you are on the ground.



NORMAL LANDING PATTERN

Short-field Approach

Don't land on short fields (less than about 3500 feet long) if you can avoid it. If you can't, here is a good procedure to follow:

1. Make a normal downwind leg and base leg pattern.

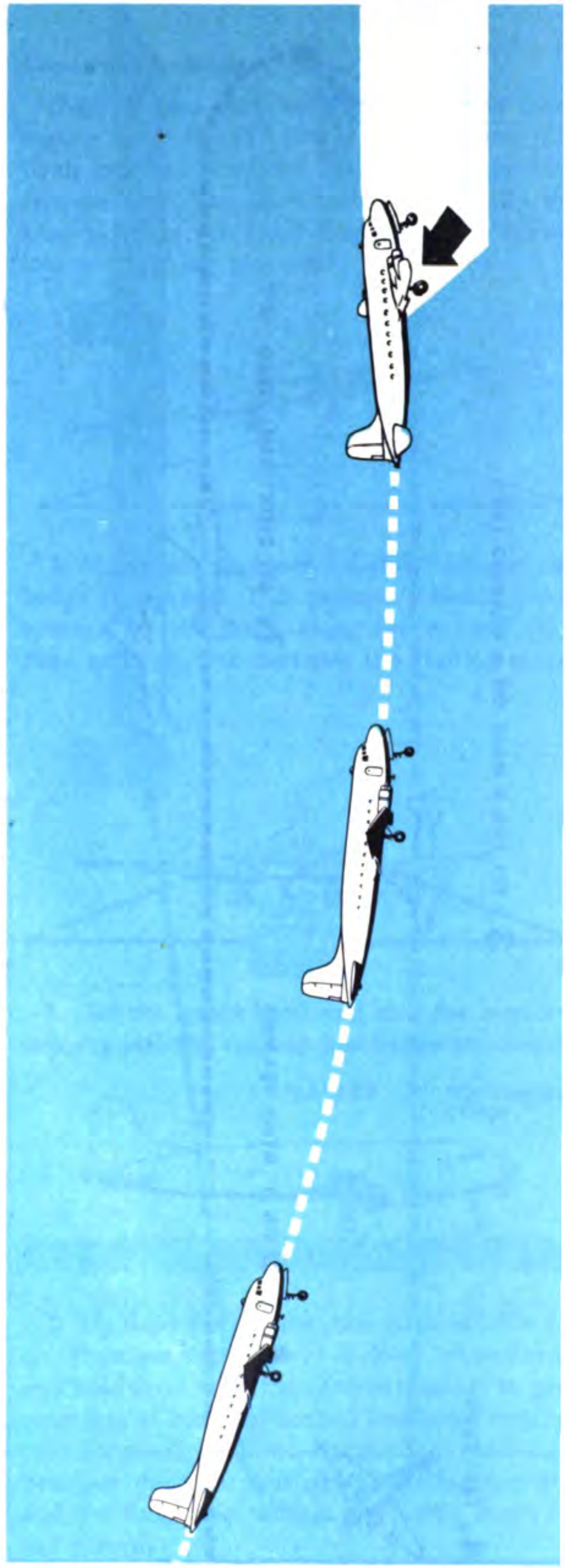
2. Come in toward the field in the normal manner, but shoot for a point short of the runway.

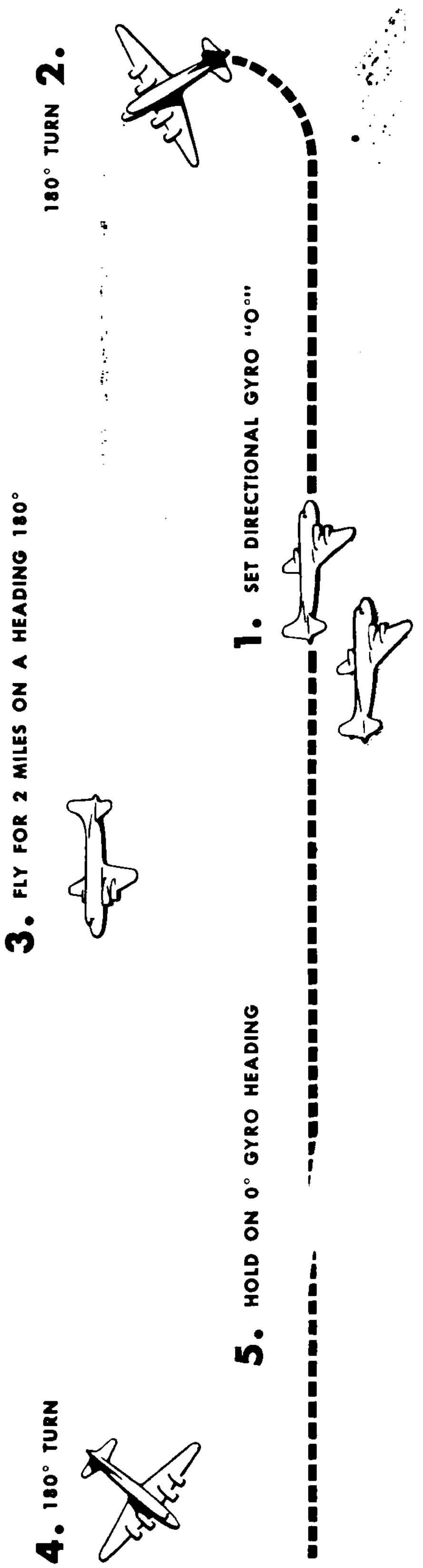
3. Then add power so that you come in the **last 100 yards** in a drag-in approach with full flaps.

4. Keep the nose up as you come in or you build up too much speed and need more runway. Reduce power sufficiently to ease the main gear down on the first safe hard surface.

5. Chop your throttles the instant you make contact, but not before.

6. Get the nosewheel down fast and use brakes as you need them.





Low Visibility Approach

Low visibility approach technique is necessary when these conditions are present:

1. Visibility is such that you can't make a normal pattern and still maintain visual contact with the field.
2. No alternate field is available.
3. There are no radio directional aids for an instrument approach, or your radio is out.

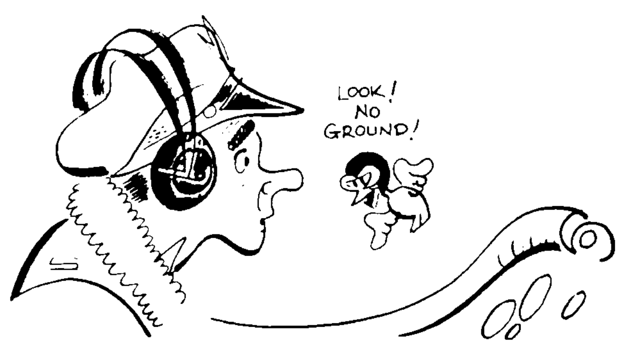
When you have a situation like this, and the visibility is so poor that you must stay close to the runway, follow this procedure:

If possible, contact tower and get a careful briefing on field conditions. Give the tower operators your landing procedure, so that they can clear the field for you and give other assistance.

Fly down the runway, into the wind, in the direction of landing. Set your directional gyro at 0. At the end of the runway start a standard rate 180° turn to the left. On completing the turn, fly 2 minutes on a gyro heading of 180°. Then make another standard rate 180° turn to the left. Hold the 0 gyro heading until you approach the end of the runway. Slow the airplane as much as you can safely. Make a normal landing.

Low visibility approaches may involve the necessity of making steep banks close to the ground. Here again, remember that this is emergency procedure only; if there is any way to avoid the situation, do it.

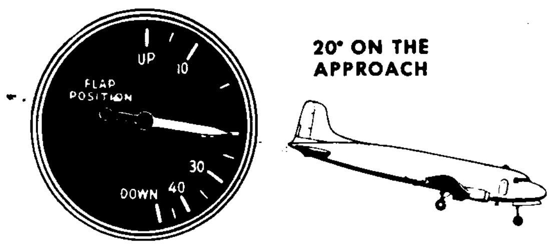
Use 20° maneuvering flaps, and make your turns smoothly and carefully, using the minimum degree of bank necessary to accomplish the turns. Remember that in steep banks your airplane stalls at higher speeds than in level flight.



Use of Flaps

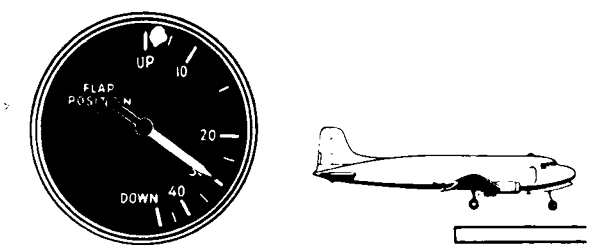
Do not exceed 144 mph when using flaps.

As you extend flaps you get increasing lift with only a small increase in drag—up to 18° setting. Above this point drag increases greatly, without a proportionate increase in lift. More flaps steepen your glide and you need more power to maintain airspeed.



The following procedure is the best way to use flaps in a normal landing:

Use not more than 20° flaps until you are far enough along in your approach to be sure that you won't have to go around. Then lower flaps to a maximum of 30°. This way you don't have to hold so much power, your approach is flatter, and your percentage of good landing is higher.

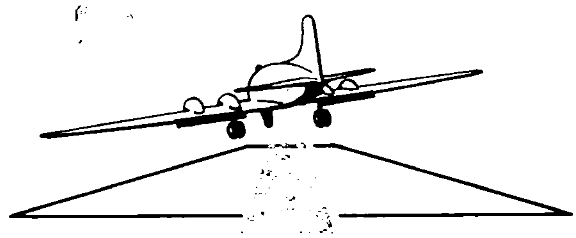


There are situations, of course, in which you must use 40° flaps; for example, in a short-field landing. In a normal landing, however, the use of 40° flaps has these disadvantages:

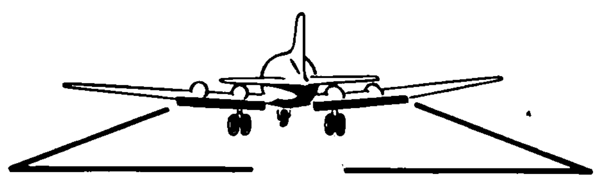
1. There is less time to change from glide to ground contact attitude.
2. You usually have to use both hands and make a quick yank back on the wheel.
3. You don't have time to ease the nose up with the trim tab. Everything happens quickly in the last second, and the result can easily be a nosewheel landing.
4. Finally, if you come in with 40° flaps and discover you have to go around, you are forced to blast power against full flaps. It is possible to damage the flaps by that procedure.

Crosswind Landings

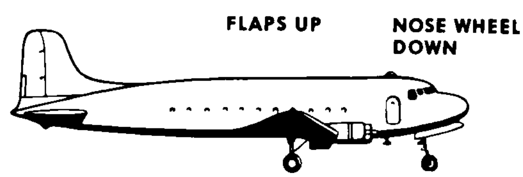
Use standard technique for crosswind landings in the C-54: (1) Lower upwind wing; (2) Crab into the wind; or (3) Combine the first two methods. The third method is usually the best—it keeps you from dropping the wing too low or crabbing too much.



1. Make an approach slightly longer and lower than usual. This permits a heading that gives a ground track along the runway. Use flaps as desired to decrease the stalling speed.



2. Get the wings level and kick the airplane straight with the runway just before you touch.



3. Up flaps the instant your main wheels are on. Then get the nosewheel down immediately and hold it on with the control column, to prevent loss of steering control and side loads on tires. Remember that the danger of a skid occurs between the time you straighten the airplane and the time your wheels are firmly down on the runway.

Abnormal Surface Landings

1. **Steel landing mats.** Avoid sharp edges of the mat to prevent tire cuts. Always land in the center of the mat so that you won't have to roll along the edges. Be especially cautious in the use of brakes. Excessive braking on mats tends to hump the mat up ahead of you.

2. **Icy surfaces.** A steerable nosewheel airplane acts on a slick icy surface as an automobile does. Brakes are generally worse than useless; you get unequal braking which skids and slews the airplane.

If an emergency forces you to land on a completely iced and slick surface, you can try putting passengers or cargo into the tail to keep the nosewheel up and the tailskid on the ground. This must be done with care. Don't have too much weight too far back as you come over the fence, because it might cause a tail stall. Get some of the extra weight back toward the tail for the final approach, and have your passengers and crew briefed to move back quickly and get braced as you make contact.

This tail-down attitude gives you rudder control on the runway until you are rolling fairly slowly. Then try your brakes gently and cautiously. If the brakes don't help, and you know you are going to hit something and damage the airplane anyway, yank up the landing gear.

Taxi at extremely slow speeds on ice. If there are strong, gusty winds it may be impossible to maneuver the airplane on icy surfaces, the great amount of side surface causing it to weathervane into the wind. During high winds this sometimes happens even on dry surfaces.

3. **Wet surfaces.** Wet surface landing areas can provide a variety of hazards, including slick spots, soft spots, holes, and puddles of water.

Get your flaps up immediately as you make contact with the ground, to prevent mud and water damage to the flaps.

If you don't have a hard-surfaced runway and are landing in soft mud or snow, land with the nose high and hold it high. Keep rolling with the control column back in your lap. Don't use brakes. Steer with rudder and power and don't slow down below 15 mph. The lift of wings and engines in this procedure helps keep you from sinking. Holding the nose up prevents damage to the nose gear, and prevents digging it in sideways by attempted steering.

Make wide turns to prevent burying a wheel by pivoting it.

Go-around

If you overshoot, or for any other reason are unable to complete your landing, follow these procedures:

If still airborne:

1. Smoothly apply up to 40" Hg, and advance rpm to 2550.

2. If you have less than 30° flaps down, raise gear first, then raise flaps as needed.
3. If you have more than 30° flaps, raise flaps to 20° first, then bring up gear.
4. Proceed as in normal takeoff.

If you are on the ground:

1. Advance props to full HIGH RPM.
2. Slowly advance throttles to 50" Hg.
3. Raise flaps to 20°.
4. Proceed as in normal takeoff.

Landing Roll

There is nothing tricky about the landing roll in this airplane. Remember that a tricycle landing gear has no tendency to groundloop. Never try intentionally to groundloop the airplane to avoid obstructions in emergency situations. It doesn't work out well.

Follow this procedure in the landing roll:

1. Make a normal main wheel landing down the center of the runway, touching down on the first third of the usable length.
2. Hold the nose up until you slow to the point just before you lose elevator control.
3. Let the nose down slowly. Apply the brakes as sparingly as possible.

CAUTION:

Don't apply the brakes until the nosewheel is firmly on the ground.

Be sure that your hand is on the hydraulic steering wheel as the nosewheel touches the ground. Remember that you can't steer the airplane until weight has compressed the shock strut enough to cut in the 3000 psi hydraulic steering mechanism. If you find you are unable to steer with the nosewheel, then apply the brakes firmly, push forward on the control column, and use a little power. This procedure tends to overcome a tail-heavy condition which might prevent the steering mechanism from taking hold.

4. Turn only when the airplane has slowed to a safe taxi speed.

5. Execute your after-landing checklist, including cutting No. 1 and No. 4 engines to minimize the use of brakes in taxiing.

Use of Brakes

Use a great deal of care in operating brakes. The airplane provides adequate braking for almost any situation in which you need it. When you don't need brakes, don't use them. Excessive use and abuse of brakes is hard on brakes, tires, and nosewheel. You can avoid abuse to the braking system by making good landings and using proper taxi technique.

1. When your nosewheel is on the ground, apply brakes gently and release them. This compresses the nosewheel strut to engage the steering mechanism, and also serves as a check that the brakes are functioning.

2. Roll nearly to the end of the runway or to the turn-off taxiway and apply brakes smoothly and steadily to slow the airplane down to safe turning speed.

3. Avoid using brakes during taxiing if possible, until you arrive at the parking area. Try to stop at the blocks with the nosewheel straight.

4. Release brakes as soon as the wheels are chocked. Your brakes are hot after use, and if you leave the parking brake on, they may seize.

5. See **Taxiing** for proper use of emergency air brake.

EMERGENCY LANDINGS

The formula for safe handling of emergency landings is the same as that for any emergency: knowledge. There is no emergency landing in which there isn't something you can do to help. Safe procedure requires a cool head. The ability to think straight and operate calmly requires knowledge of what to do.

Every emergency situation is different. Supplement these general instructions with any specific information you can add from your experience or that of other pilots.

When you approach the field for an emergency landing, always call the tower as soon as possible and inform the operators of the situation. Keep them posted on your progress so that they can give you full assistance.

Be sure that passengers' and crew's seat belts are fastened and that cargo and baggage is secure. Remember to warn everybody to brace himself before the landing. See **Ditching** for general bracing positions.

Landing With One Engine Dead

One dead engine—outboard or inboard—does not make a great difference in the flight characteristics of the airplane. You must utilize every safety margin available, but if you are careful you won't have trouble.

1. Make a normal approach.
2. Use 15° flaps and put gear down at normal point in pattern.
3. Advance rpm to 2550.
4. Set trim tabs back to neutral on glide path, to neutralize the controls as your power drops.
5. Use more flaps as desired, to full if necessary.
6. Make a normal touchdown and landing roll.

Landing With Two Engines Dead—One on Each Side

One engine out on each side is still not going to give you much trouble, except for the fact that you have only 50% of your total power.

1. Make a normal approach.
2. Use 15° flaps and put gear down at normal time.
3. Advance rpm to 2700. This setting enables you to take out 50" Hg, if you need it.
4. Use more flaps as desired, up to full.
5. Make normal touchdown and landing roll.

Landing With Two Engines Dead—Both on One Side

This situation calls for more judgment and flying ability than the balanced power landings.

1. Make a straight-in approach.
2. Use 15° flaps.
3. Keep your props at full HIGH RPM.
4. Put your gear down when you are positive that you can make the runway.
5. Glide in with power off to give yourself a chance to trim the airplane for landing.
6. Make a normal power-off landing.

NOTE: If you need power at the last minute, get the majority of the necessary power with the inboard engine. In this situation, at low airspeed, too much power on the outboard engine can slew you around and cause loss of control.

Landing With Nosewheel Up

Landing with the nosewheel up is much the same situation as landing in deep mud or snow, where you have to hold the nose up to keep from damaging the nose gear.

1. Make a normal full-flap landing.
2. Utilize passengers or other movable cargo to get weight in the tail as soon as you are on the ground, in order to drag the tailskid.
3. If a collision is imminent in spite of the drag of the tailskid, use your brakes lightly, enough to give some braking action without pulling the nose down.
4. After stopping, don't get the weight out of the tail until the nose is jacked up.

Landing With No Hydraulic Brakes

Landing on a short runway with the hydraulic braking system out is a critical situation. On a long runway you could put weight in the tail and drag the skid, but this would not stop you in time on a short runway. You may have to use your emergency air brake, and this means that you must have the nosewheel on the ground. Therefore, follow this procedure on a short runway:

1. Come in slow with full flaps if your flaps are working. Cut switches on contact.

2. Hold the nose up with the control surfaces until you have used up about ⅔ of the runway.

3. Then drop the nosewheel to the ground and pull the emergency air brake if necessary. Be sure that you do not pull the emergency brake until the nosewheel is on the ground.

4. When you come to a stop, don't release the air brake until the ground crew is ready to tow the airplane off the runway.

NOTE: In some cases it is possible to use the hand pump to apply brakes. Put the hand pump shut-off valve in CLOSED position, depress the brake pedals fully, and work the hand pump continuously until the airplane stops. Don't release the pedals during this operation. You may not have time for this procedure, or it may not work, but be prepared to try it when conditions are favorable.

5. Have the airplane towed off the field.

Flat-tire Landings

1. **Nosewheel tire flat.** Use the same procedure as for nosewheel gear up. Get weight into the tail to hold the nose up and drag the tailskid. Let the nosewheel down slowly and gently after stop.

2. **One main wheel tire flat.** There is not much danger in this situation. Ordinarily you won't even realize the tire is flat. Make a normal landing, being careful to make it as smooth as possible. Taxi slowly.

3. **Two tires flat on right or left main gear.** Striking an object on the runway on takeoff or landing, or possibly fire in the nacelle during flight, can cause two flat tires on one side. If the accident occurs, be alert for more damage than just the flat tires. For example, you might also have a hydraulic brake hose burned or torn loose, or a broken wheel and sprung landing gear. Come in for a careful, smooth normal landing. When you touch down, get the nosewheel on the ground as soon as possible to get steering control.

The airplane tends to swerve to the side of the flat tires. Counteract this tendency by using brake on the good-tire side, and by nosewheel steering with forward pressure on the control column. You can use the outboard engine on the flat-tire side to assist in holding the airplane straight, but use caution, as the extra power increases your landing roll.

Wheels-up Landing

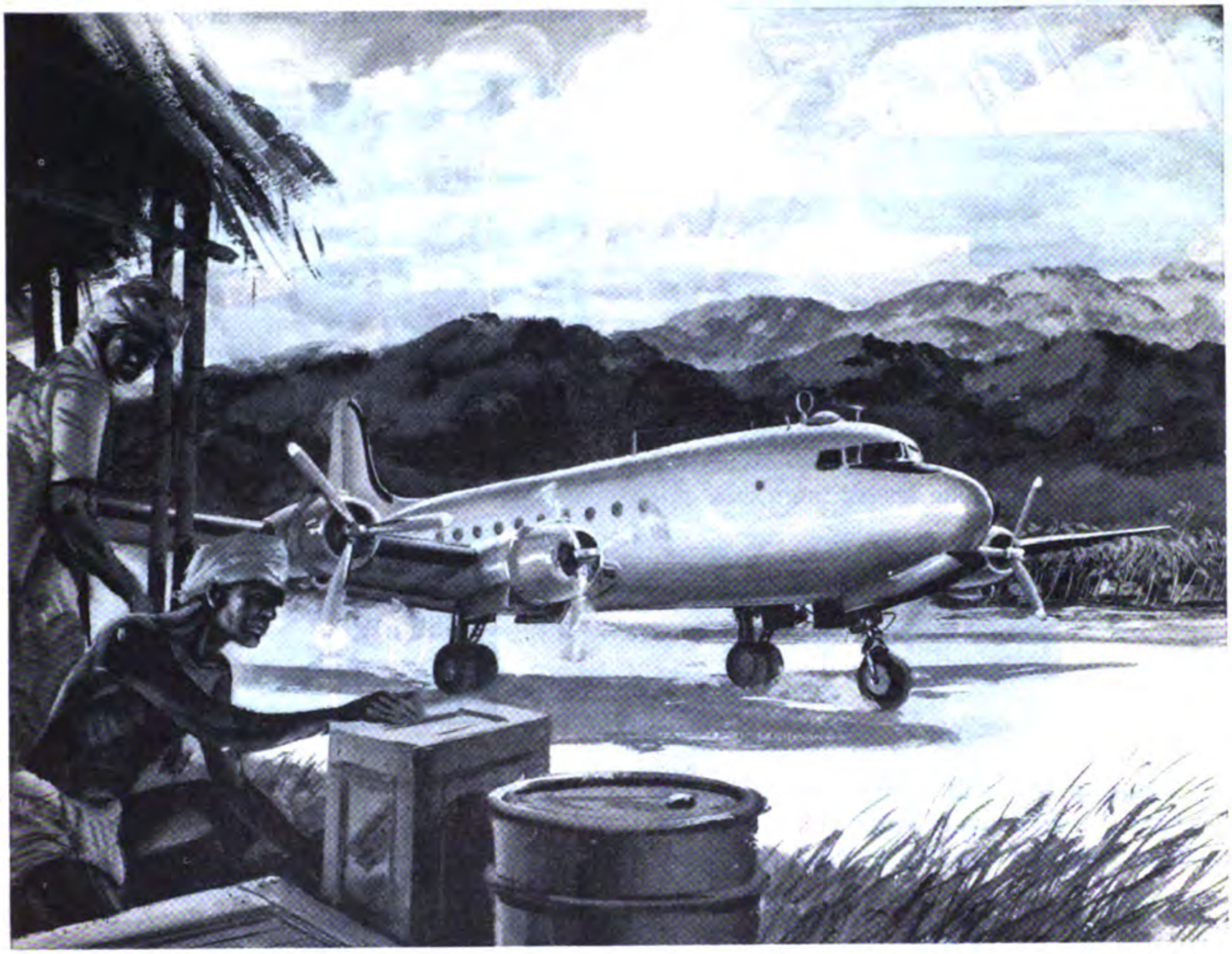
You have two main advantages in wheels-up landings with this airplane over certain 4-engine bombers: you have a low wing, and no bomb bays or belly turrets to stave in. Nevertheless, the impact in even the smoothest belly landing is severe. Take every precaution for the protection of passengers and crew.

1. Tie down all loose equipment. Remember that loose articles can become lethal projectiles on impact. If you can't tie down equipment or small cargo which you know you won't need after the landing, jettison it. Be careful, in jettisoning, that you do it in such a way that the objects won't damage the tail surfaces.
2. Remove all emergency exits and front main cargo door.
3. See that all seat belts are tight, and that all available shoulder harnesses are used.
4. Fly until your fuel tanks are nearly empty if possible.
5. Use full flaps.
6. Land into the wind on the runway, if there is a runway.
7. Glide in with power off and ignition and battery switches OFF.

NOTE: This is the ideal way to make a belly landing because it cuts down two of the possible means by which spilled fuel ignites: hot exhaust stacks and electrical sparks. Make a normal landing with power, however, if you are unsure of your ability to glide into the landing area safely, and cut switches the last second before hitting.

8. Get everybody out and away from the airplane as soon as it stops.

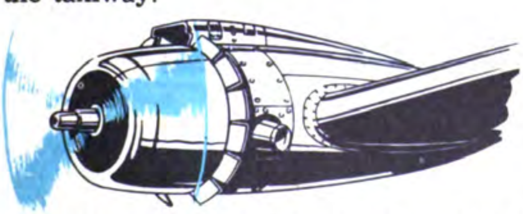
Whenever you are faced with an emergency landing in wild country, be prepared for the possibility of existing on the land for some time without contact with civilization. Designate crew members or passengers to carry out first-aid kits, water, necessary extra clothing, and other usable equipment as soon as you land to prevent possible loss of those articles in a subsequent fire.



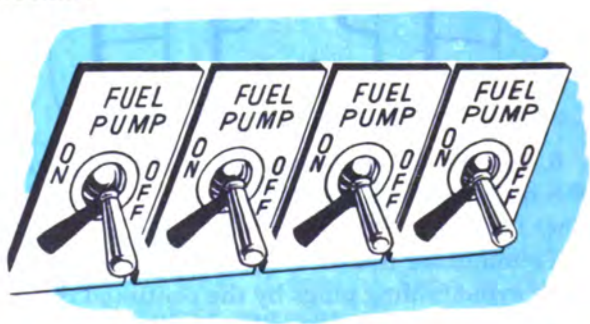
AFTER LANDING

Amplified Checklist

You can start the after-landing checklist at the end of your landing roll. Actually, many of the duties are performed almost simultaneously, most of them by the time you have turned into the taxiway.

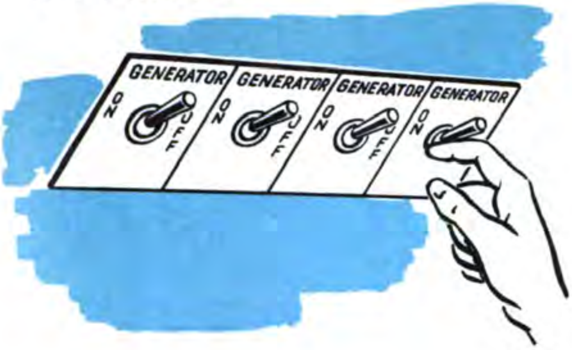


1. Cowl flaps. Engineer opens cowl flaps.



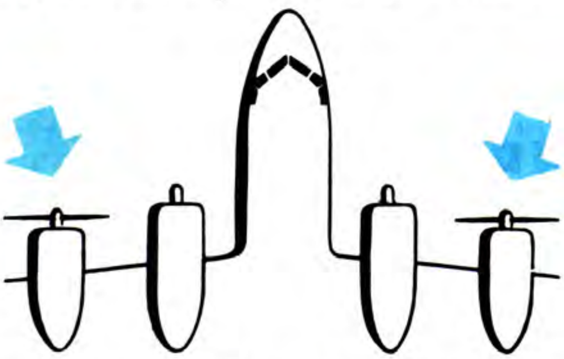
2. **Fuel booster pumps.** Copilot turns fuel booster pumps OFF.

3. **Propellers.** Engineer moves prop controls to HIGH RPM.



4. **Generators.** Copilot turns the generators OFF or leaves them ON, depending on the battery load. At night, when you are using lights, or in extremely cold weather when there is a drain on the battery, he leaves them ON.

5. **Flaps up.** You call for flaps up as soon as you have slowed down to a safe taxi speed. The engineer runs the flaps up at your command.



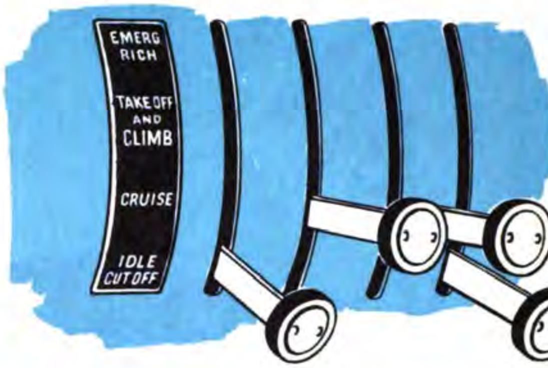
6. **Cut No. 1 and No. 4 engines.** Engineer cuts the outboard engines when you start to taxi. This is done for these reasons:

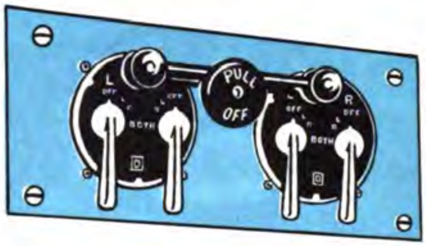
To minimize use of brakes.

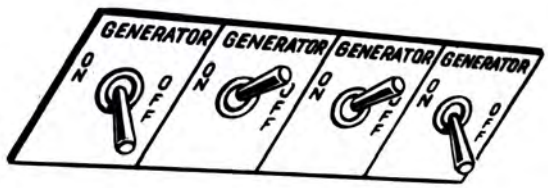
To avoid fouling plugs by the continual throttle reductions necessary when taxiing a lightly loaded airplane on four engines.

To reduce the possibility of hitting anything on the taxiway with the outboard props.

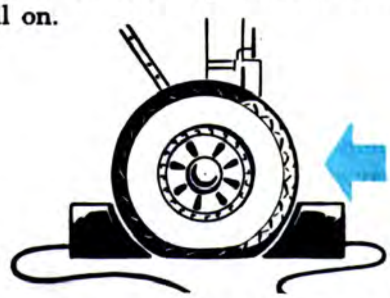
Place mixture controls for No. 1 and No. 4 engines to IDLE CUT-OFF; turn ignition switches OFF when engines stop turning over.







Turn No. 1 and No. 4 generators OFF if they are still on.



7. **Nosewheel straight at blocks.** You always stop with the nosewheel straight. When the wheel is turned, the movements of the airplane in the wind damage the sidewalls of the tire.

STOPPING ENGINES AND SECURING AIRPLANE

Amplified Checklist

Now that you are back on the ground, don't relax your care in following the checklist. Remember, you are going to have to fly the airplane again. Handle these procedures the right way, and don't be afraid to double-check anything.

1. **Throttles.** Advance the throttles to 1000 rpm. In cold weather you must dilute your oil; see **Cold Weather Operation.** Check your cylinder-head temperatures. Normally, they are within safe limits, but if they are above 150°C let the engines idle at 1000 rpm until the temperatures come down.

2. **Mixture controls.** The engineer moves the mixture controls to IDLE CUT-OFF.

3. **All fuel valves.** Engineer turns tank selector valves OFF. It does no harm to check the fuselage tank selectors (if installed) and crossfeeds for OFF position, also.

4. **Ignition switches.** Turn the ignition switches OFF when the props stop turning over. On those models with a master ignition

switch, turn it OFF also as a safety measure.

5. **Wheels chocked, brakes.** Release your brakes as soon as the ground crew puts the chocks under the wheels. Don't leave parking brake set. Releasing brakes prevents the brakes from seizing as they cool.

6. **Instrument inverter switch.** Engineer turns instrument inverter switch OFF.

7. **Generators.** Engineer turns all generators OFF.

8. **Radio switches.** Copilot and radio operator turn all radio switches OFF.

9. **Light switches.** The engineer turns all light switches OFF in night operations. It's a good idea to check them in the daytime also.

10. **Landing lights.** Copilot checks to see that landing lights are retracted.

11. **Master battery switch.** Engineer turns the master battery switch OFF.

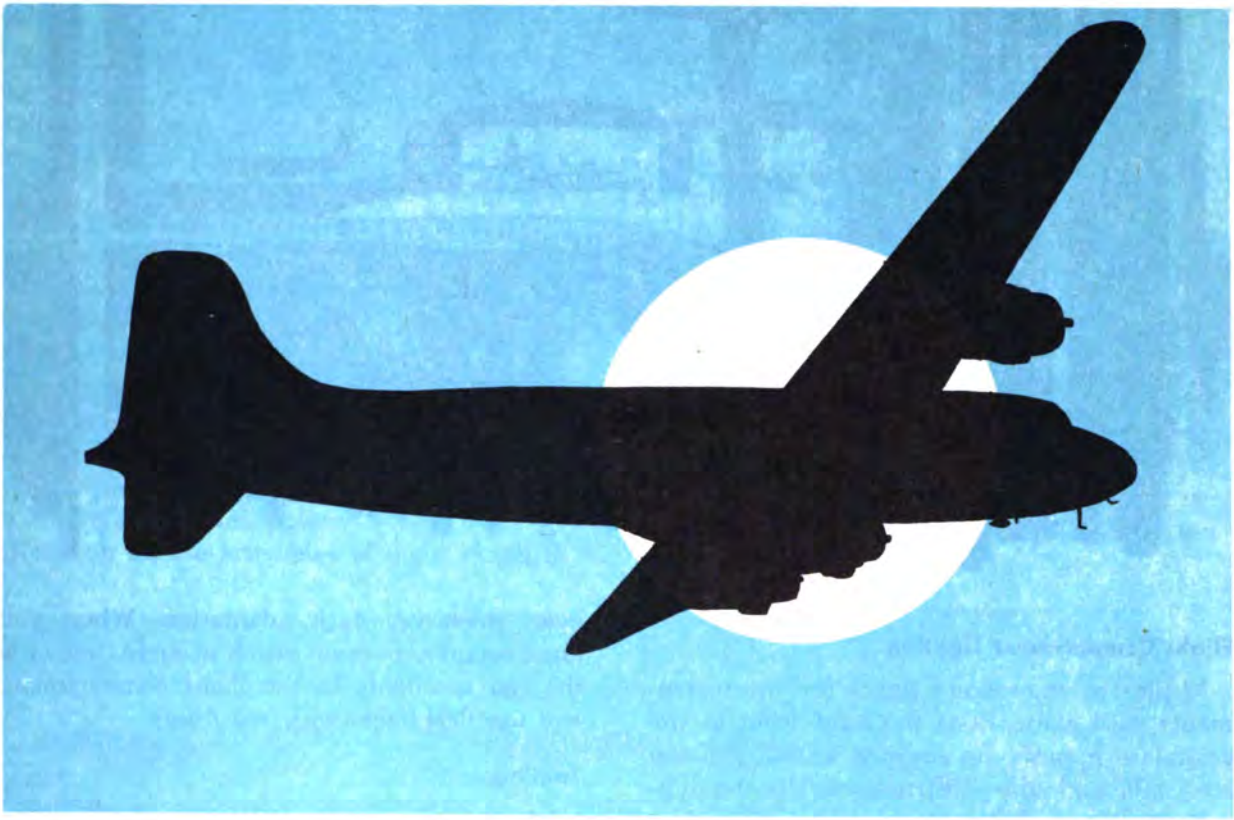
12. **Landing gear ground safety locks, gust lock (or gust boards), tail support.** Make the engineer responsible for seeing that the ground safety locks are put on the landing gear, that the gust lock is locked and retained by the tape, or that gust boards are installed externally, and that the tail support is put in place.

NOTE: Don't use the autopilot to lock the controls. This procedure introduces air into the hydraulic lines.

If there is a wind above 15 mph, head the airplane into the wind. Always do this if you have no gust locks. Remember that this airplane has a large amount of side surface and ground winds can easily cause damage.

See **Cold Weather Operation** for additional securing precautions.

13. **Form 1 and 1A.** Fill out these forms completely.



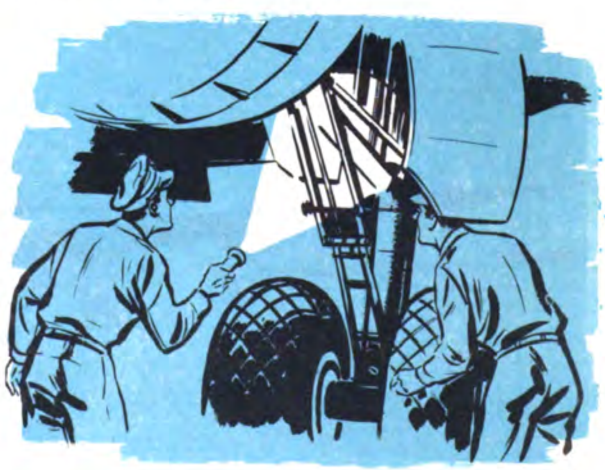
NIGHT FLYING

The difference between flying the C-54 in the daytime and flying it at night is a difference of degree and not of kind. In the daytime you fly partly by instruments, and at night you fly almost wholly by instruments. In the daytime you fly with a good deal of care; at night, since you can't see things coming up quite so soon, you must fly with a lot more care. The following suggestions will help you do just that.

Inspections and Checks

At night, you must handle inspections and checks with even more attention and concentration than in the daytime. It is easier to overlook things in the dark. Make your exterior inspection with the aid of a flashlight, and take enough time with it to be sure you have covered everything. Give additional attention to the checklist; you need it more at night.

Include the checking of lights in your checklist procedure. Have crew members and ground crew men help check the operation of exterior lights before you move out.



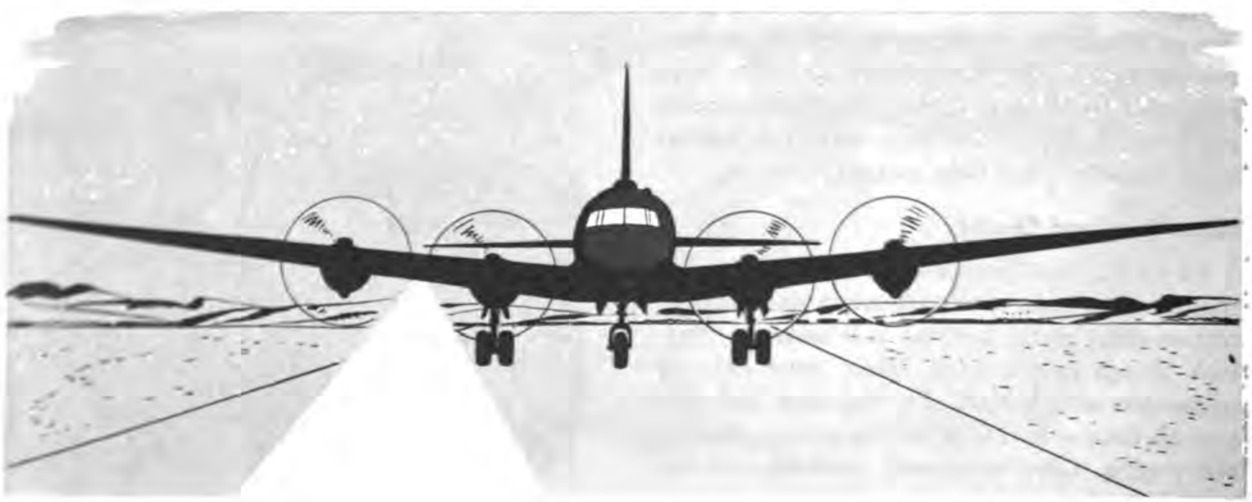
Flight Compartment Lighting

While the fluorescent lights for the instruments ease glare, keep the light level in the cockpit at a minimum anyway, so that you can see traffic and other obstructions. Use the dimming switch on the warning light devices. Use the curtains behind you and behind the copilot to minimize reflections of interior lights on the windshield.

When your eyes become accustomed to darkness or dim light they retain that adaptation until exposed to white light. Red light, however, preserves dark adaptation. When you must retain maximum vision at night, use only the red spotlights in the flight compartment, and use flashlights with red filters.

Taxiing

In taxiing, use the two landing lights alternately to save batteries and bulbs. Taxi slowly. If practicable, put a man in front and a man at each wingtip to guide you through congested areas. Stay in the center of the taxiway. Turn off your landing lights during run-up to save batteries.



Flight

Retract your landing lights when you no longer need them for safe flight. Although the landing lights are supposed to be able to withstand the slipstream up to 250 mph, it's better practice not to have them extended at greater than cruising speeds.

Use the landing lights to check precipitation, ice formation, and to aid in synchronizing the propellers. Don't forget the Aldis lamp; it comes in handy for many night problems.

Don't attempt to fly half instruments and half contact at night. That's how accidents happen. When you are on instruments, stay entirely on them, and let the copilot look outside for traffic and ground points.

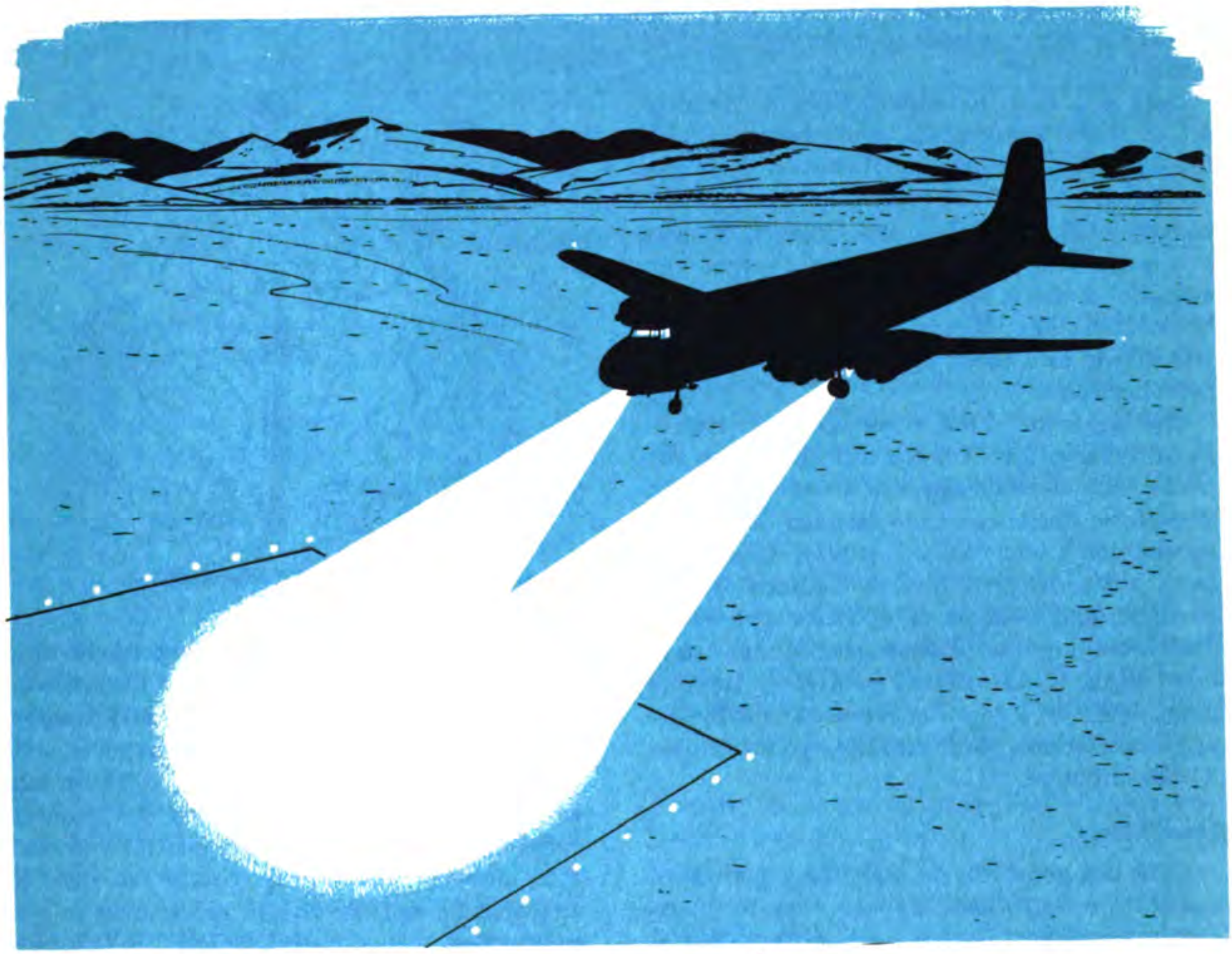
Read up on the principles of night vision in Pilots' Information File to improve your general night flying efficiency.

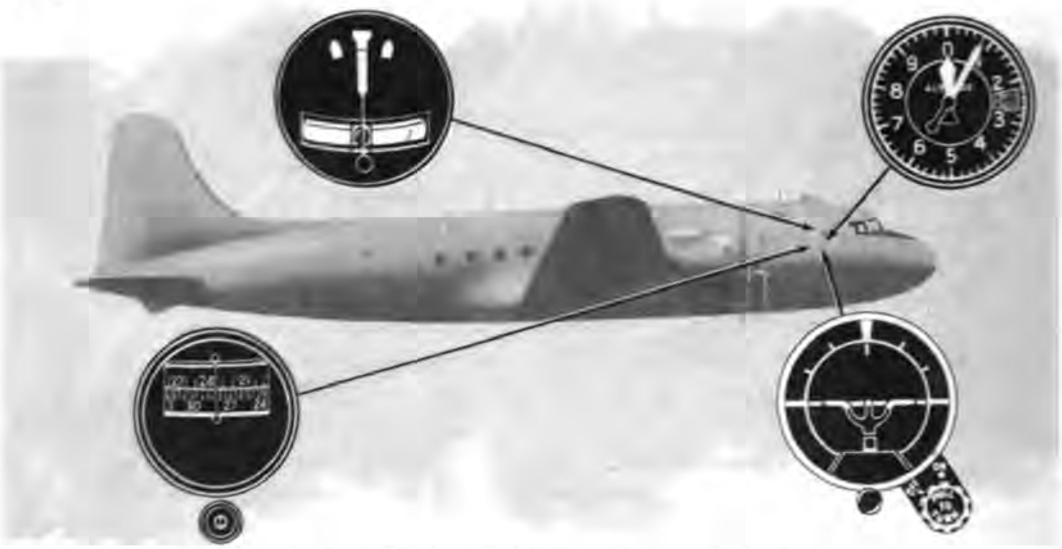
Landings

A slightly steeper glide for night landings makes your landing lights more effective by pointing them at the ground instead of into the air ahead of you.

Depth perception at night is difficult. If you use a little more airspeed for your landing you can hold the airplane off the runway longer and give your eyes a bit more time to accommodate to the situation.

Sometimes it may be better not to turn on your landing lights for the landing, if the atmosphere is obscured by smoke, snow, rain, or heavy dust. The beam of the lights may be reflected. With landing lights off you can see the runway and hazard lights.





INSTRUMENT FLYING

The C-54 is easy to fly on instruments. Much of your normal flying is done on instruments, and the airplane is built to make it as easy as possible.

Both you and the copilot have a complete set of flight instruments, and there are also the autopilot instruments. However, don't use the autopilot artificial horizon in place of the conventional artificial horizon merely because it is larger and more conveniently located. The autopilot horizon spills at a lesser degree of bank, and spills more easily in turbulent air. Use it only as a check against the regular artificial horizon.

The important thing to remember in instrument flying is that it is the attitude of the airplane with which you are most concerned. Therefore, don't make the mistake of concentrating too much on the rate-of-climb indicator. It doesn't show you the attitude of your airplane, and because of updrafts and downdrafts, and lags and inaccuracies in the instrument itself, it can mislead you. Keep the airplane level by a constant airspeed and by the artificial horizon, and maintain your altitude by the altimeter.

Take It Easy

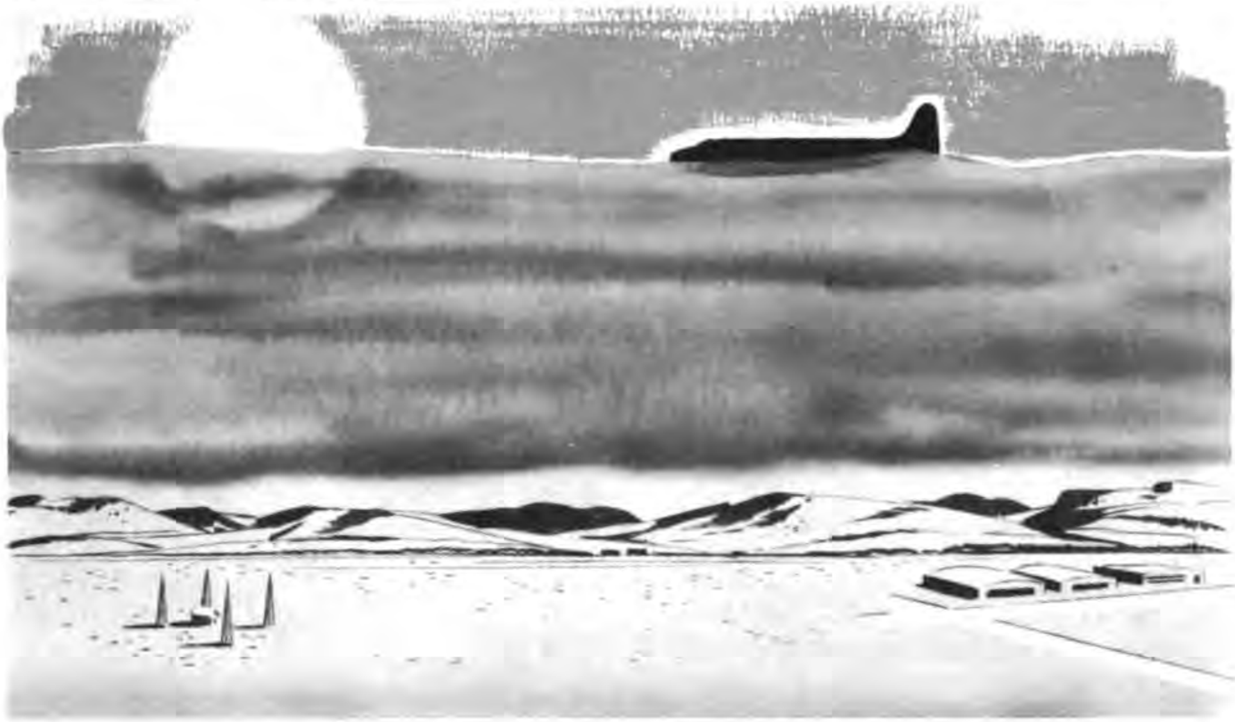
Here is a good way to make long periods of smooth air instrument flight as easy on yourself as possible:

Keep your left hand on the control wheel, your right hand on the elevator tab, and take

your feet off the rudder. You can keep the airplane on course by a slight roll of the aileron control, and you can keep the airplane properly trimmed for maintaining your airspeed and altitude by a slight roll of the elevator trim tab wheel. You don't have to touch the rudder pedals, nor push and pull the control column. This method, however, is strictly for smooth air cruising, not for rough air or instrument approaches.

It is important that the crew be as fresh and alert as possible if you expect instrument weather at the end of a long flight. Therefore, use the autopilot as much as possible at cruis ing altitudes before you get to instrument conditions.

TYPICAL INSTRUMENT APPROACH PROCEDURE



1. Pass over the cone at initial approach altitude, in cruising attitude, so that your ETA is more accurate.

2. Retard your airspeed to 144 mph, put down 15° flaps, and increase rpm to 2250.

3. Have copilot and engineer complete the applicable parts of the before-landing checklist, except that they leave the gear up, while you proceed out for your final approach at 130 to 140 mph.

4. Make procedure turn at the prescribed time out from the initial cone, on the prescribed side of the leg, and at the prescribed altitude.

5. After passing final cone, reduce power and descend to minimum altitude prescribed. Make careful directional corrections, and don't exceed time limit in trying to establish ground contact.

6. Extend your landing gear as soon as you establish ground contact.

An alternate method, for straight-in approaches with very low ceilings, is to lower the landing gear after the completion of the procedure turn. With this method you need only 10° flaps. The advantage of this procedure is that you are set to land immediately upon establishing ground contact.

The advantages of keeping your gear up until you break out into the clear are: it saves fuel because less power is necessary; the airplane handles better; it is easier to make a go-around on a missed approach; the noise level and the buffeting are less; and the gear warning lights are not glaring in your eyes.

NOTE: When it is apparent that a normal approach procedure is to be delayed because of traffic control, it may be advisable to save gas by staying in cruising mixture at endurance power settings.

COLD WEATHER OPERATION

Special servicing and operating procedures are necessary when you operate the C-54 in extremely low temperatures. It is important to be familiar with these procedures, particularly since the kind of operations in which your airplane is used often involve changes from warm climates to arctic conditions, even within a single hop.

The winterization information in this section begins with preflight and starting procedures and progresses chronologically. Remember, however, that the change during a single flight from moderate to extremely cold conditions also involves special procedures. Information applying to that situation is covered in this section under **Preparation for Landing.**

Cold weather operations also necessitate the use of special equipment such as wing and engine covers, snow and ice tires, external heating and power sources.

Preflight

Most of the preflight precautions fall within the duties of the engineer or ground crew. It is your responsibility, however, to know what must be done and to assure yourself that all necessary winterization has been accomplished.

1. Immediately before removing the airplane from a heated hangar to outside cold temperatures, open all fuel tank and fuel system drains to eliminate water.

2. Inspect fuel tank vents with a sealed flashlight to insure that they are free of ice, as condensation may cause drops of water to form in

the fuel line which, upon freezing, result in stoppage of fuel flow.

3. Check oil drain and oil tank sump for fluid oil. If no oil comes out, it is an indication that the drains are clogged with ice or congealed oil. Apply heat to thaw. Be sure to lock the drain immediately after water is taken off, or as soon as oil flow occurs.

4. Refill water tank in crew compartment.

5. Wipe shock strut piston tubes clean of snow, ice, and dirt, after which the pistons should be wiped with a rag soaked in the type of hydraulic fluid used in the strut.

6. Remove snow, ice and frost from all surfaces, checking hinges and controls for freedom from ice.

7. When temperatures fall below –21°C, apply heat to that portion of the airplane where instruments are installed. As soon as the engines start firing, check instruments for irregularities.

8. In cold weather starting when temperatures are below 0°C, apply external heat to both the fore and aft sections of the engine until head temperatures reach 20°C.

9. Under low temperatures the battery loses efficiency, and it is imperative to use an outside battery source.

Starting Engines

Make a normal engine starting, observing these precautions:

1. Always use an external power source.

2. Don't close cowl flaps to speed up engine warm-up.

3. After engaging starter, wet the blower by moving mixture control from IDLE CUT-OFF to CRUISE. Move mixture control back to IDLE CUT-OFF. Then operate primer as necessary. If the engine does not start, move mixture control momentarily out of IDLE CUT-OFF several times until engine starts. Keep engine turning whenever mixture control is out of IDLE CUT-OFF.

4. In extremely cold weather it may be necessary to operate the primer after the engine has been started.

Engine Warm-up

Don't warm up engine to more than 800 rpm until oil has reached a temperature of 40°C.

Taxiing and Takeoff

1. Never turn on electrically heated clothing, or any other electrical equipment not absolutely needed, until the generators are operating.

2. Since storage batteries deteriorate rapidly in cold climates, don't use any electrical equipment, not even the radio, until the engines are in operation.

3. See **Taxiing** and **Normal Takeoff** for operation on snow and ice surfaces.

During Flight

1. Remember the instructions concerning retracting landing gear: lower and raise gear after takeoff to keep accumulated slush from freezing gear up or down.

2. To insure continued propeller governing, increase propeller speeds momentarily by about 200 rpm every half hour. This furnishes warm oil to the system. After operation return propeller controls to desired cruising rpm.

3. There have been no authenticated reports of carburetor ice during flight in the C-54. However, be suspicious of carburetor ice if your manifold pressure unaccountably drops.

Apply heat to carburetor to maintain 40°C for a short period. The application of heat further reduces manifold pressure. If after applying heat, the manifold pressure rises, then you know ice has been present, but is melting with carburetor heat. In this case leave carburetor heat ON continuously until icing conditions no longer prevail; don't use it periodically. If carburetor heat fails, turn the induction de-icing switches ON for those engines affected until the engines are functioning properly.

4. Cabin and nose heating systems differ on different series of the airplane. Consult the instructions which are furnished currently for the type of system on your airplane.

5. To operate wing and tail surface de-icers, turn wing de-icer switch ON. This turns on an electric motor which operates a distributor. The distributor delivers the flow of suction and pressure to the de-icers. There is a surface de-icer gage on the instrument panel. Maintain operating pressure of 7.5 psi, + or — .5 psi.

6. Don't run the wing and tail de-icers continuously. When you notice ice on the wings, turn the de-icers ON until they clear the surfaces. Then turn them OFF until more ice builds up. At night check the wing surfaces for ice by means of a flashlight or the Aldis lamp.

7. Don't take off or land with the de-icer boots operating. They act as spoilers and raise your stalling speed considerably.

8. When you are flying in wing icing conditions be sure to take out enough power to stay on the step, in a tail-high attitude. Otherwise you collect ice under the wing.

9. Use propeller anti-icers before you encounter ice. Set the rheostats at maximum pump speed for approximately 2 minutes. This fills the lines and distributes a quantity of fluid over the propeller blades. Then set the rheostats to deliver 2 quarts of fluid per hour to each propeller. Calculate quantity delivered by the fluid quantity gage on the instrument panel.

10. You can keep windshield free of frost by using the Raymond de-icer panels which can be mounted over the windshield to form a double thickness with an air space between. The nose heater furnishes hot air to this air space. The nose heater also furnishes hot air to a flexible rubber hose which may be directed against the windshield for occasional defrosting.

11. Flexible hoses behind the pilot and copilot, which get their heat supply from the two cabin heaters, can be directed against the flight compartment side windows, or the navigator's

turret, or directed to concentrate heat on feet or hands of crew members. Butterfly valves permit directing the heat to any or all of the hoses as needed.

12. To operate pitot heaters, turn switches ON. Always use pitot heat if you anticipate ice. If one of the pitot tubes fails, and heat does not correct the situation, turn the static selector switch to ALTERNATE SOURCE.

NOTE: The alternate source of static pressure affects airspeed indicator, rate-of-climb indicator, and altimeter. Test your alternate static source during some normal flight, so that you become familiar with its effect on the instruments, in case you ever have to use it.

Preparation for Landing

1. Keep cowl flaps closed when landing, to prevent low engine temperatures which may result from rapid descent.

2. Use cruising power for descent.

3. Before the final approach, turn off electrical suits and other equipment which you can do without to save the battery when you reduce rpm and the generators are cut out.

4. Use a higher landing speed than usual to prevent stalling if you have ice on the wings.

5. See **Normal Landings** section for procedures to follow in landing on icy or snow-covered surfaces.

6. Take full advantage of available runway since the action of the brakes is slower than normal under icing conditions.

After Landing

1. Dilute engine oil.

a. Operate engines at 1000 to 1200 rpm.

b. Maintain oil temperature below 50°C and oil pressure above 15 psi.

c. For temperatures of 4° to –12°C, dilute for 3 minutes.

For temperatures of –12° to –29°C, dilute for 6 minutes.

For temperatures of –29° to –46°C, dilute for 9 minutes.

Add 1 minute dilution for each additional 5° below –46°C.

d. Avoid sparkplug fouling. A short acceleration period—10 seconds at 1100 rpm—after the dilution run is usually enough to clear sparkplugs. Don't let engine oil pressure fall below 15 psi or oil temperature rise above 50°C. Operation of the oil dilution system is indicated by a substantial fuel pressure drop. If you don't get a fuel pressure drop, investigate.

2. Dilute propeller oil:

a. Propeller oil dilution switches are not momentary contact switches. When you turn them ON the oil entering the prop feathering pump is diluted any time the propeller is feathered or unfeathered.

b. During the last minute of engine oil dilution, increase engine speed to 1500 rpm and move the propeller controls from LOW RPM to HIGH RPM at least four times, allowing the propellers to change pitch throughout the entire range.

c. With engines running at 1500 rpm, place each feathering oil dilution switch in ON position, while simultaneously feathering the propellers. Engine rpm should not fall below 500 rpm with propellers feathered.

d. Unfeather propellers, turning oil dilution switches OFF.

e. Set engine rpm at 1000 and shut down by moving mixture controls to IDLE CUT-OFF.

NOTE: On the C-54B and subsequent series, the propeller feathering oil dilution solenoid has been removed and the propeller oil dilution line connected to the oil system dilution solenoid. Consequently, when you dilute engine oil you also dilute propeller oil. Just follow the normal engine oil dilution instructions.

After Landing—Servicing and Securing

1. After completion of dilution, open each sump drain petcock and drain off any condensate or oil sludge. Drain as long as necessary to eliminate water. Usually, a few tablespoonsful is all you get.

2. Clean fuel strainers immediately after landing, and drain all tank sumps.

3. Fill all gasoline tanks at end of each flight to eliminate air spaces in which condensation may occur.

4. As soon as engines are stopped and properly cooled, turn each propeller so that one blade points to the ground. This is necessary to install engine covers. **Caution: Don't move props until engines have properly cooled, or the engine may kick over.**

5. Remove ice and frost from propeller. Move propellers by hand to check for free action. If props rotate with difficulty, remove lower sparkplugs and allow diluted oil to drain from lower cylinders.

6. For long layovers, remove and store batteries. Keep batteries charged above 1290 specific gravity to prevent cracking around edges of case.

7. Install protective covers on airplane surfaces.

8. If necessary to park on snow or ice, place a layer of fabric, straw, boughs, or other insulating material under wheels to prevent tires from freezing to surface.

9. Leave parking brakes OFF to prevent freezing.

10. When airplane is parked for the night, drain all water from water tank in crew compartment by opening filler outlet on forward right side of nosewheel well.

11. If weather conditions permit, leave sliding windows in flight compartment partly open to permit circulation of air and so prevent frosting of windows.

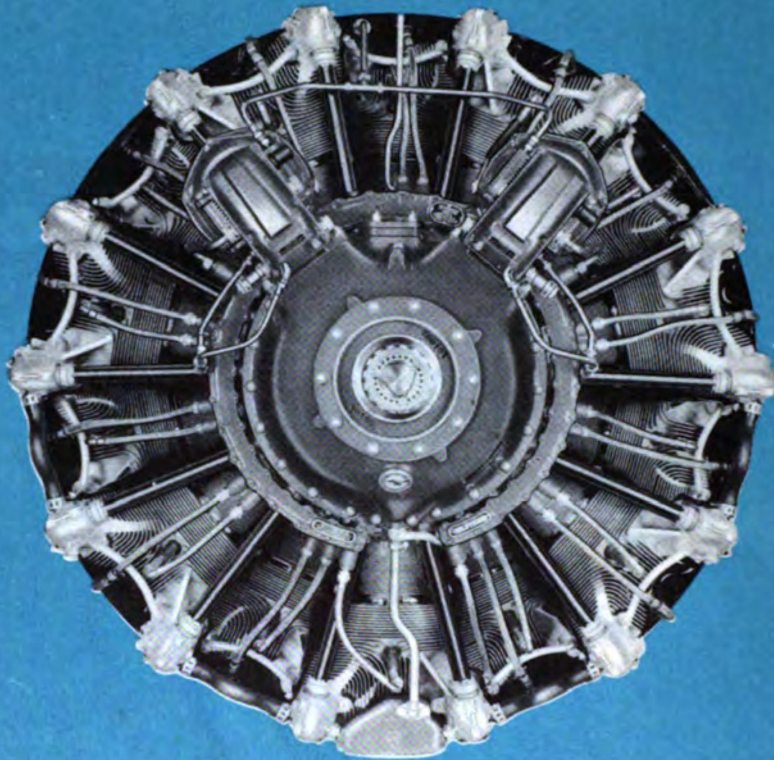
CAUTION: If, after several days layover, the engines have been started and the oil diluted several times, ground-run engines for at least ½ hour at normal temperatures prior to takeoff. Check the oil level, which may have fallen considerably because of evaporation of gasoline. This tends to eliminate the excess dilution which might otherwise cause oil discharge through breathers, or loss of oil pressure during high-power takeoff or operation.

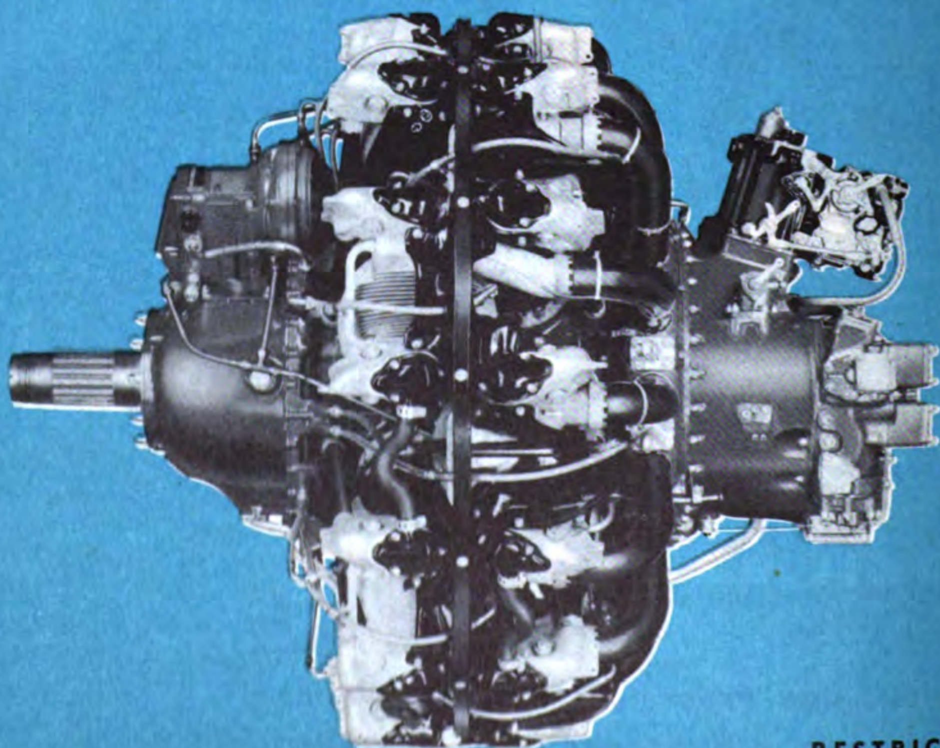
Consult Pilots' Information File for information on protection of personnel against cold.

SECTION FOUR

SYSTEMS AND AUXILIARY EQUIPMENT

Engines and Propellers • Fuel Systems
Oil System • Hydraulic System • Electrical System
Automatic Pilot • Radio Equipment • Oxygen System





ENGINES AND PROPELLERS

Engine Description and Data

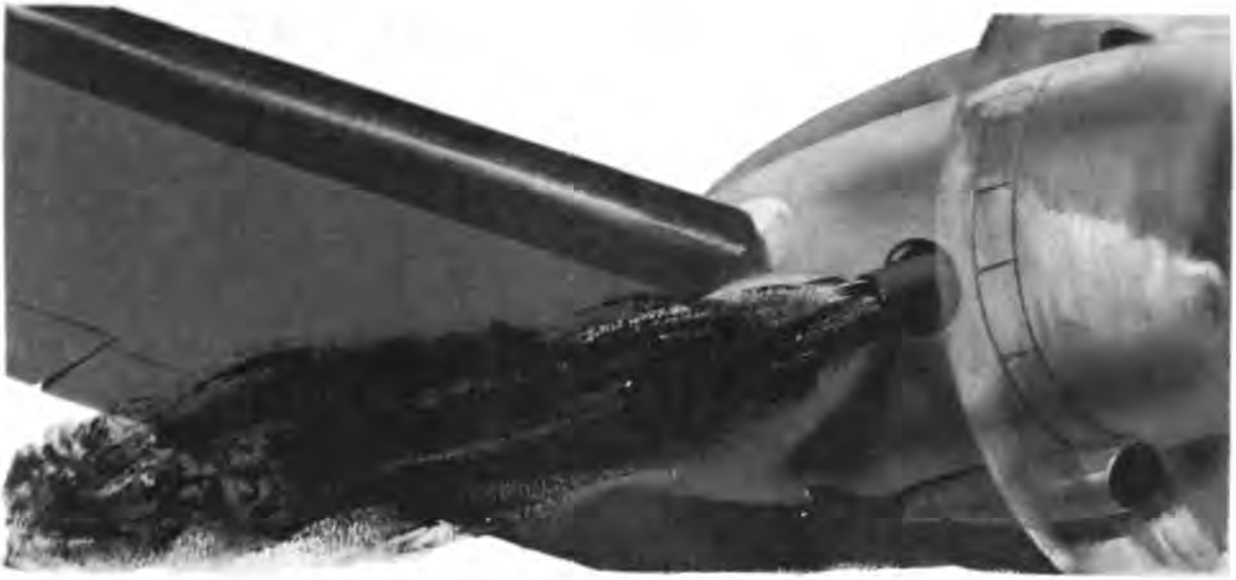
C-54 airplanes have Pratt & Whitney Twin Wasp, R-2000 series, 14 cylinder, radial, air-cooled engines. They incorporate a single-stage, 2-speed supercharger, manually controlled by a selector valve.

The C-54 through C-54B airplanes have R-2000-7 engines; the C-54D and E use R-2000-11 engines, and the C-54G, R-2000-9 engines. It is planned to install R-2000-9 engines on all existing C-54 airplanes eventually.

The operating characteristics of the engine, with the supercharger in the low gear ratio (low blower), are identical to those of an engine with a single-speed supercharger. The low gear ratio allows the engine to operate efficiently at sea level and low altitudes. The high gear ratio (high blower) makes it possible for the engine to maintain higher power at greater altitudes than would be possible with only low ratio.

RATING

	R-2000-7	R-2000-11	R-2000-9
Bore	5.75 in.	5.75 in.	5.75 in.
Stroke	5.50 in.	5.50 in.	5.50 in.
Piston displacement	2000 cu. in.	2000 cu. in.	2000 cu. in.
Compression ratio	6.5:1	6.5:1	6.5:1
Impeller gear ratio	7.15:1 (Low) 8.47:1 (High)	7.15:1 (Low) 9.52:1 (High)	7.15:1 (Low) 9.52:1 (High)
Direction of propeller rotation viewed from rear of engine	Clockwise	Clockwise	Clockwise
Propeller reduction gear ratio	.500:1	.500:1	.500:1
Over-all length of engine	60.09 in.	60.09 in.	60.09 in.
Over-all diameter of engine	49.1 in.	49.1 in.	49.5 in.
Average weight of engine	1580 lbs.	1580 lbs.	1590 lbs.
Carburetor type	Stromberg PD-12F7-10	Stromberg PD-12F7-19	Stromberg PD-12F8
Magneto type	Scintilla SF-14RN-8	Scintilla SF-14RN-8	Scintilla SF-14RN-8



Detonation

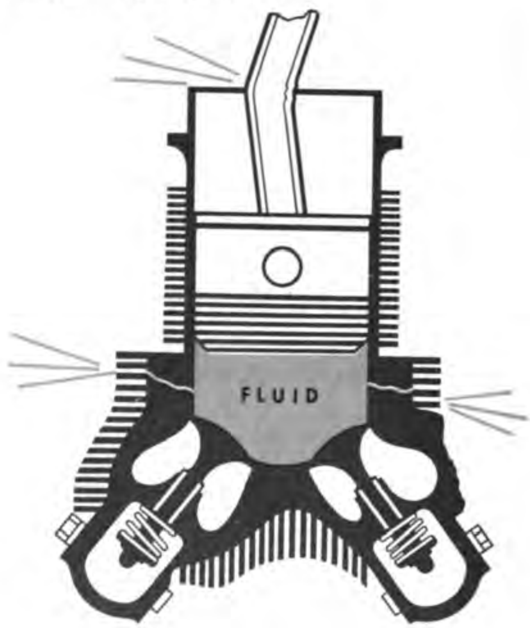
Detonation is one of the principal hazards associated with the operation of any high-output engine. It is a sudden uncontrolled burning of the charge in the cylinder as contrasted to the even and relatively slow rate of burning which occurs during normal combustion. Detonation is accompanied by severe pressure waves and overheating of the various engine parts which form the combustion chamber. The result of continuous or frequent detonation is damage to your engine, the amount depending on the severity of the detonation. In the worst instances it leads to complete engine failure.

The best way to handle detonation is not to get it. The following factors contribute to the tendency of an engine to detonate:

1. Excessive manifold pressure
2. Insufficient cooling
3. Lean fuel-air mixtures
4. Excessive carburetor air temperature
5. Faulty ignition system
6. Fuel of low anti-knock value

Just remember this: If you operate your engines within the specified limits on the recommended grade of fuel, and with carburetor and ignition systems in normal condition, you won't get detonation.

Hydraulicking (Liquid Lock)



Hydraulicking, sometimes called liquid lock, is a term applied to the damage done to the connecting rod, wrist pin, or cylinder head when the piston comes in forceful contact with liquid in the bottom cylinders of an engine. When the piston hits the non-compressible liquid, something has to give. It is usually the connecting rod. Hydraulicking generally occurs as a result of using the starter before the props have been pulled through carefully by hand. Sometimes, however, connecting rods are bent by a too-vigorous pulling through of the props by hand.

CAUTION: Don't try to relieve hydraulicking by pulling the props through backward.

Hydraulicking may be caused by the presence of either oil or gasoline in the lower cylinders.

1. **Oil hydraulicking.** When an engine is shut down there is always oil present which may drain into the bottom cylinders. Oil draining occurs during the first 30 minutes after shut down of the engine. Have the props pulled through whenever the engines have been shut off 30 minutes or more.

2. **Gasoline hydraulicking.** Fuel drains into the lower cylinders when you overprime the blower. This happens, of course, after the props have been pulled through by hand.

Avoid gasoline hydraulicking by doing most of your priming with the electric primers, which prime the upper cylinders and not the lower ones. Momentary wetting of the blower does not produce a hazardous condition as long as the engine is turning over, since the turning engine distributes the fuel and keeps the bottom cylinders fairly well cleaned out. When you stop turning the engine after overpriming, fuel drains into the lower cylinders. This causes the trouble.

If you suspect that you have overprimed and the engine has not started, keep it turning over with the throttle open and the mixture control in IDLE CUT-OFF. This assures the cleaning out of the engine. Then if the engine has not started during this procedure, wait a minute or two and start again, this time being more careful not to move the mixture control out of IDLE CUT-OFF.

In using the electric primer the best practice is to turn the switch ON for a second and then OFF for a second, repeating until the engine starts. Don't leave it ON steadily, nor in ON position longer than a second while priming.

Hand Cranking

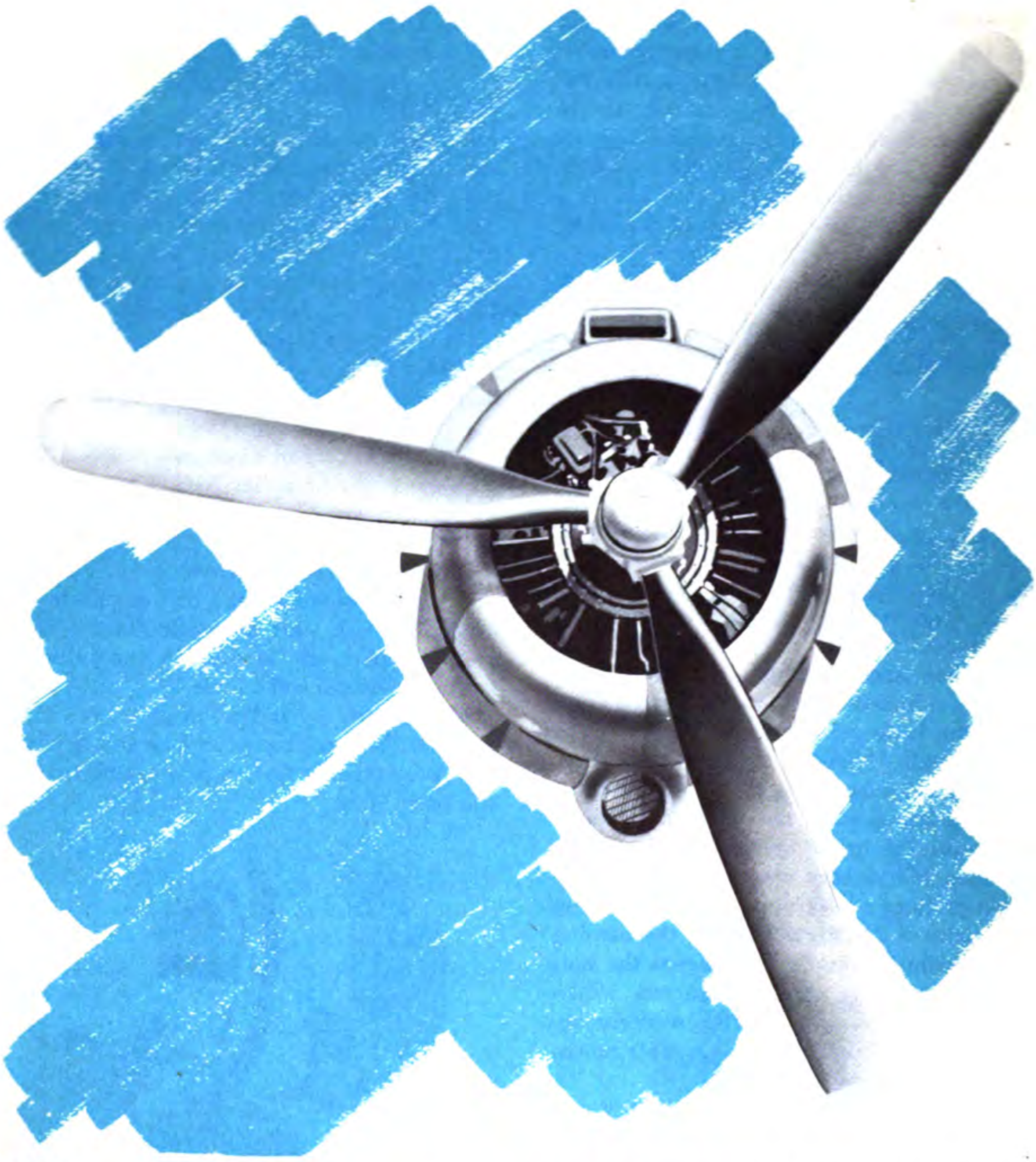
A hand cranking gear box, a hand crank, and a crank extension are carried in the airplane for emergency use only.

To hand crank the engine, install the gear box on the fitting provided for it. Install the hand crank in the gear box. The handle extension is used to clear the nacelle doors when you crank the two inboard engines.

Before cranking, push the manual control which raises the brushes off the motor commutator. Gradually accelerate the hand crank to high speed. Then disengage the crank and get clear of the propeller. Yell "Clear" to notify the cockpit crew to flip the mesh switch and start the engine.

If the cockpit mesh switch does not function, or if you have more than one engine to hand crank, you can start the engine at the nacelle by disengaging the hand crank and pulling the manual mesh control handle.

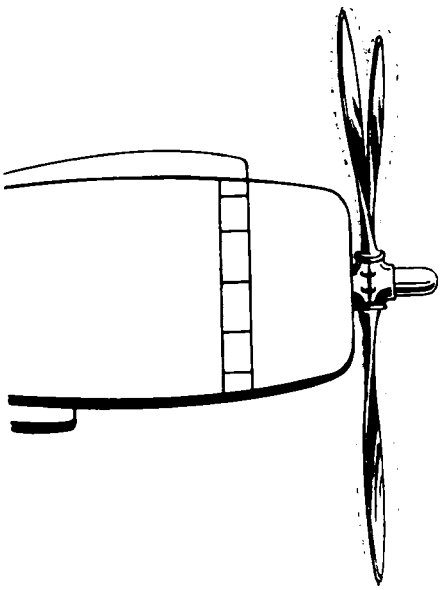
If you have to hand crank an engine in cold weather, be sure that your face and hands are well protected so that they won't be frozen in the prop blast.



Propellers

The airplane has four Hamilton Standard hydromatic full-feathering propellers, 13 feet in diameter. Each propeller is maintained at desired constant speed by a governor mounted on the engine nose section, cable-controlled from the flight compartment. By pumping and metering a flow of oil from the engine oil system, the governor changes propeller pitch as required to maintain any selected engine speed from 1200 to 2700 rpm. The propeller has an operating pitch range of 35° for constant speed control. An electric auxiliary pump, supplying oil at a maximum of 600 psi, shuts off the metered oil from the governor to feather or unfeather the propeller.

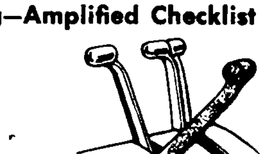
Feathering



Feathering means turning the blades of a propeller to such a high pitch that they lie in the direction of flight. In this position they act as brakes to stop the engine rotation and at the same time offer the least possible drag on the airplane. To return from feathered to normal operation (unfeathering), the blades are turned to a lower pitch, where the pressure of the airflow set up by the forward speed of the airplane causes the propeller to windmill and crank the engine.

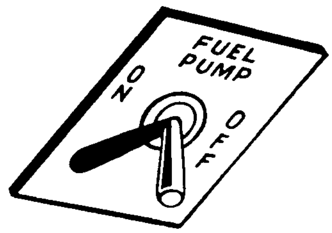
The ability to stop an engine from rotating in case of engine failure is, from the safety standpoint, the greatest asset of a full-feathering propeller. The increase in performance with a feathered propeller over a windmilling or braked propeller is demonstrated by increased ceiling, increased rate of climb, and increased speed during level flight.

Feathering—Amplified Checklist

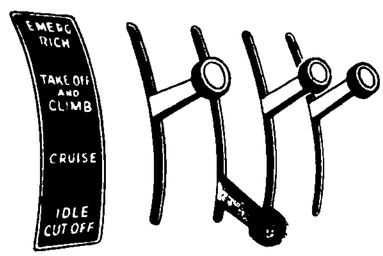


1. Be sure that you know which engine has failed, then retard the throttle for that engine. Pull it back until the horn blows, then advance it slightly until the horn stops.

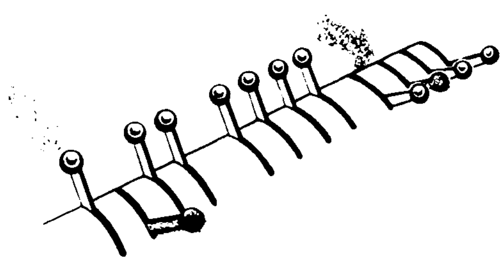
2. Hit the feathering button.



3. Turn the dead engine fuel booster pump OFF if it is ON.



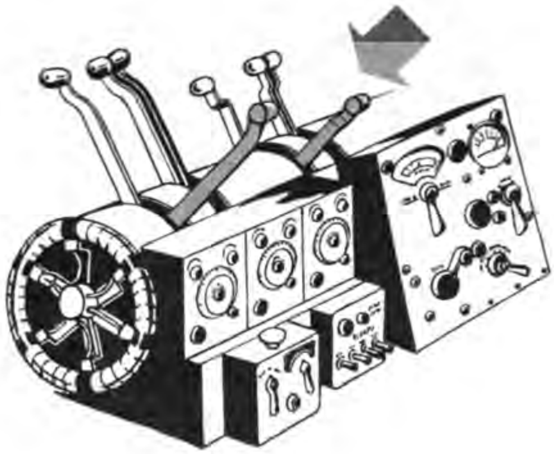
4. Move the dead engine mixture control to IDLE CUT-OFF.



5. Place the wing tank fuel selector control OFF, and see that the crossfeed is OFF.

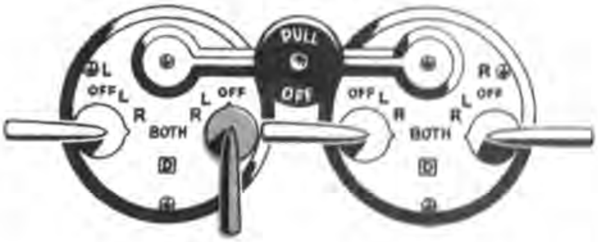
6. Check vacuum pump selector to see that it is on a live engine. Switch to a live engine if the pump is on the engine which has failed. The pumps are on No. 2 and No. 3 engines.

7. Close dead engine cowl flaps to reduce drag. If there is a fire in the engine, closed cowl flaps permit more effective CO_2 action.

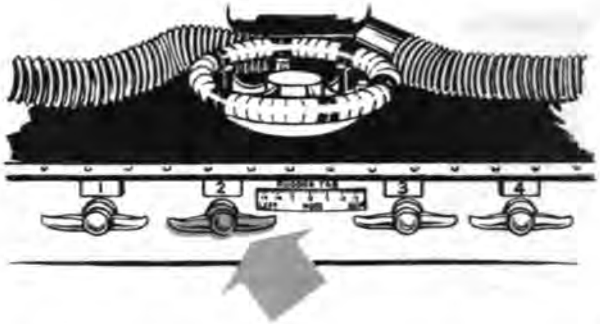


8. Move dead engine propeller control to LOW RPM.

9. Turn dead engine generator OFF.

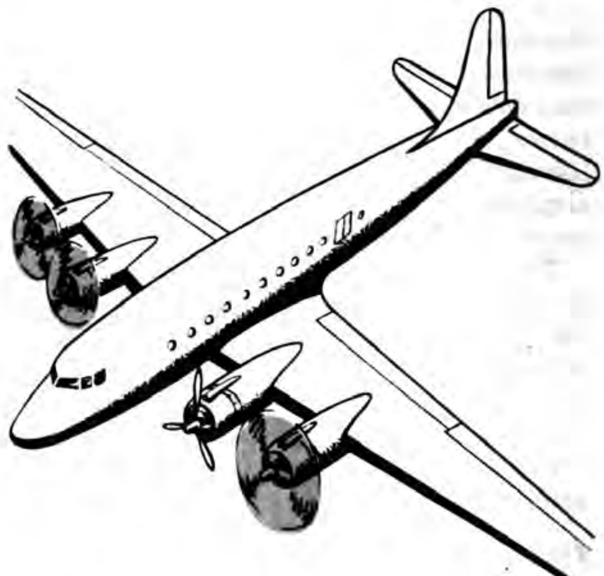


10. Turn ignition switch OFF.



11. Pull proper firewall emergency shut-off valve handle in flight compartment after prop stops turning. This shuts off fuel, oil, and hydraulic flow to engine, and also directs flow of

CO_2 to engine and nacelle when you pull CO_2 control handle. If you have a fire, remember that there are two CO_2 bottles, each with a control handle in flight compartment.



12. When prop is feathered and engine has stopped turning, trim airplane with elevator, rudder, and aileron trim tabs for 3-engine flight to take load off controls.

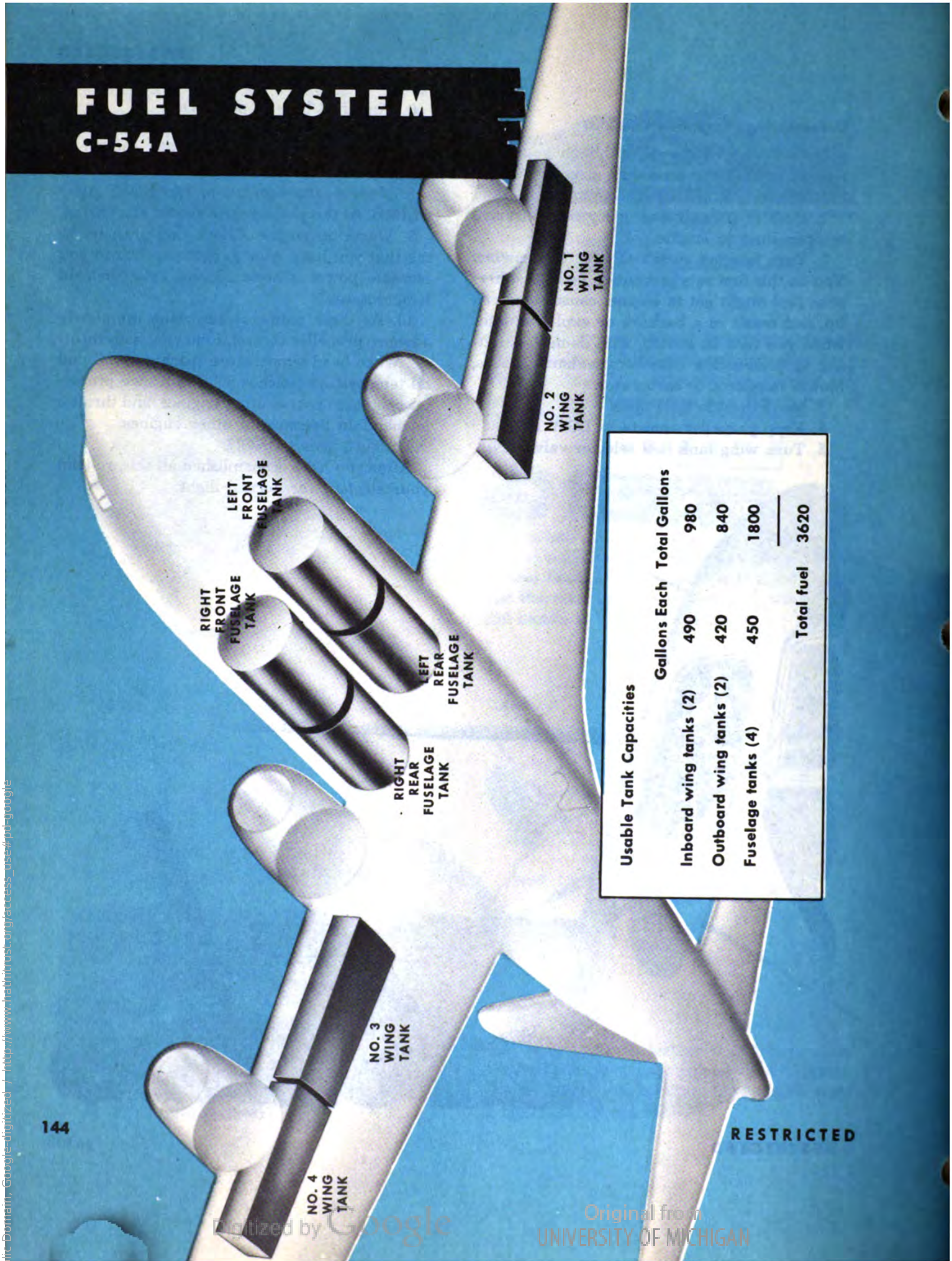
Unfeathering—Amplified Checklist

Unfeathering is simple, although you must remember that the procedure does not follow in exact reverse order from feathering.

1. Push in firewall emergency shut-off valve to open lines to engine.
2. **Turn ignition switch ON for that engine.** You do this first as a precaution because otherwise fuel might get to engine, cause it to load up, and result in a backfire or explosion later when you turn on switch, with damage resulting to combustion chambers, exhaust stacks, blower impellers, or carburetor.
3. Move throttle to ¼ open.
4. Keep propeller control in LOW RPM.
5. Turn wing tank fuel selector valve ON.
6. Turn fuel booster pump ON.
7. Push in feathering button, and hold it in until engine tachometer shows 800 rpm, then pull button out.
8. Move mixture control to TAKEOFF AND CLIMB. At this point engine should start firing.
9. Warm up engine. Check fuel pressure to see that you have enough pressure before you increase power. Check oil and cylinder-head temperatures.
10. As these temperatures come up, slowly advance propeller control, following with throttle. When head temperature reaches 150°C and oil temperature reaches 40°C, advance propeller control to rpm of other engines, and throttle to manifold pressure of other engines.
11. Turn generator ON.

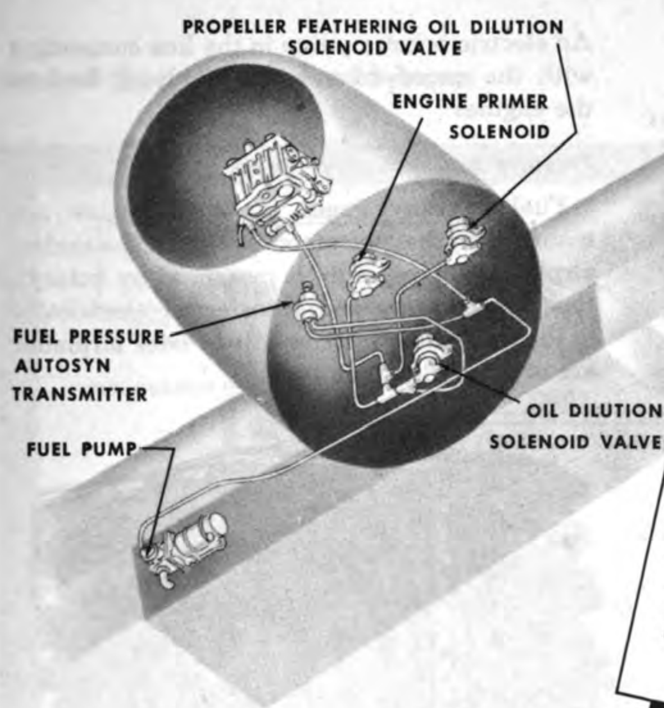
After you have accomplished all this, re-trim your airplane for normal flight.

FUEL SYSTEM
C-54A



Usable Tank Capacities

	Gallons Each	Total Gallons
Inboard wing tanks (2)	490	980
Outboard wing tanks (2)	420	840
Fuselage tanks (4)	450	1800
Total fuel		3620



NOTE: The R-2000-7 engines are designed to operate on Grade 100–130 gasoline. It is possible to damage the engines by unrestricted use of gasoline of lower octane rating. If you have to use Grade 91 gasoline, do not exceed the operating limits in the following table:

Operating Limits Using Grade 91 Fuel

Airplane models C-54A and C-54B. Engine model R 2000-7.

Operating Conditions	Manifold Pressure	RPM (Max.)	Horse-power	Mixture Control	Blower	Maximum Duration (Minutes)
Takeoff	(Max. " Hg) 43.5	2700	1200	TAKEOFF & CLIMB	LOW	5
ALWAYS TAKE OFF IN LOW BLOWER.						
Normal Rated	35	2550	1000	TAKEOFF & CLIMB	LOW	60
	35	2550	900	TAKEOFF & CLIMB	HIGH	60
Maximum Cruising	27.8	2230	670	TAKEOFF & CLIMB	LOW	Continuous
	26.2	2230	610	TAKEOFF & CLIMB	HIGH	Continuous
Desired Cruising	27	1650	500	CRUISE	LOW	Continuous
	26	1650	450	CRUISE	HIGH	Continuous

Fuel Supply

Four wing tank-to-engine systems, a fuselage fuel system, and an interconnecting crossfeed supply fuel to the engines of the airplane. The entire fuel system is designed to withstand the effects of aromatic fuels, except that the T. O. instructions concerning carburetor inspection every 30 days must be observed. None of the tanks or lines is self-sealing.

Wing Tank-to-Engine System

Each wing tank-to-engine system consists of the wing tank adjacent to an engine, lines to connect tank and carburetor, and two pumps: an electric pump for use in starting, takeoff, and emergency or high altitude operations, and an engine-driven pump for normal operation.

Safety devices in each system include:

1. Finger screen outlet in each of fuel tank sumps, installed in a standpipe to minimize amount of sediment taken into system from the tanks.
2. Fuel strainer in each engine supply line to catch any sediment or water which passes tank sump and finger screen.
3. Firewall emergency shut-off valves to prevent fuel from being supplied to engine section in case of fire.

Crossfeed

Crossfeed valves, wing tank selector valves, and a fuselage tank selector valve make it possible for any engine or combination of engines to use fuel from any wing or fuselage tank.

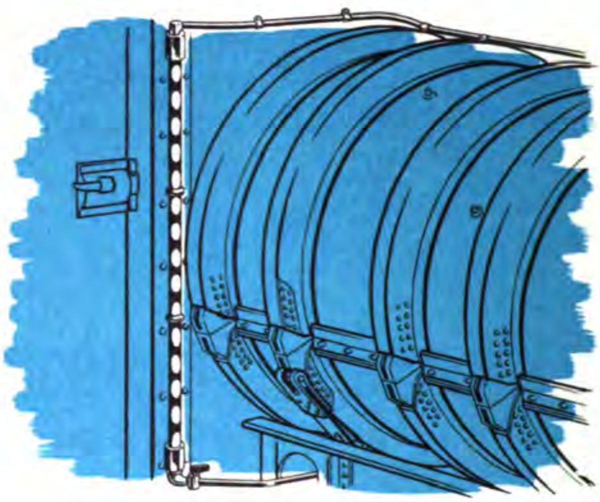
CAUTION: The check valves between the wing tanks and their respective tank selector valves in early series of the airplane have been removed from current series. **During crossfeed operation, the tank selector valve must be OFF for tanks not being used.**

Fuselage Fuel System

Removable fuel tanks are installed in the fuel tank compartment. A removable finger screen is installed in each tank sump. A manually operated selector valve mounted under the fuselage tanks permits fuel to be drawn from any of the tanks and supplied to the crossfeed. An electric booster pump in the line connecting with the crossfeed aids in supplying fuel to the engines.

Pressure and Quantity Gages

Fuel pressure gages for each engine are mounted on the instrument panel. In the earlier airplanes fuel pressure is measured by autosyn type transmitters and transferred electrically to the indicators. Instruments of later airplanes are of the hydrostatic type.



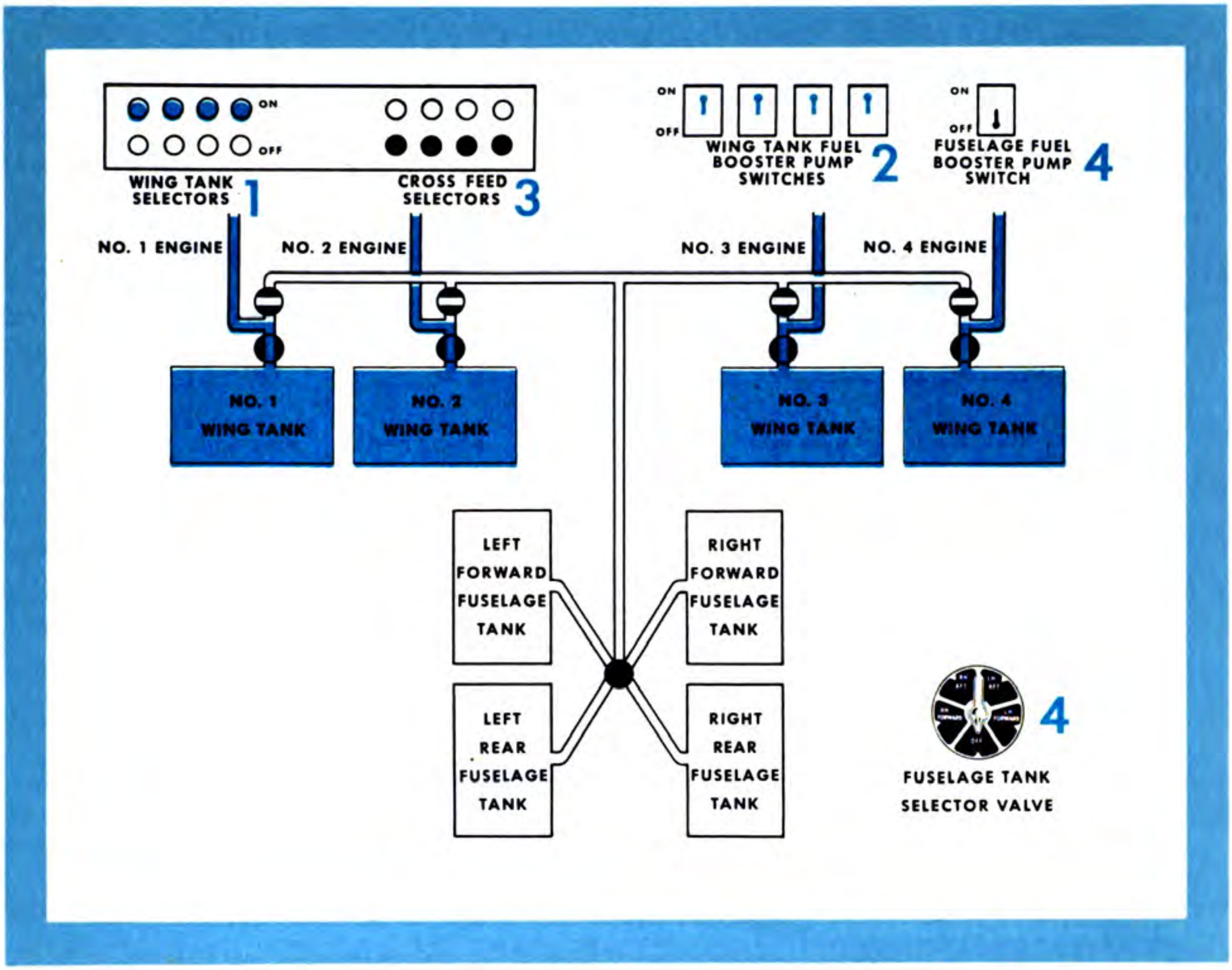
Each fuselage tank has a boiler type sight gage mounted adjacent to it. To read the gage, open the shut-off cock at the bottom, closing it again after reading to prevent loss of fuel if the gage breaks.

MAIN TANK GAGE

AUX. TANK GAGE

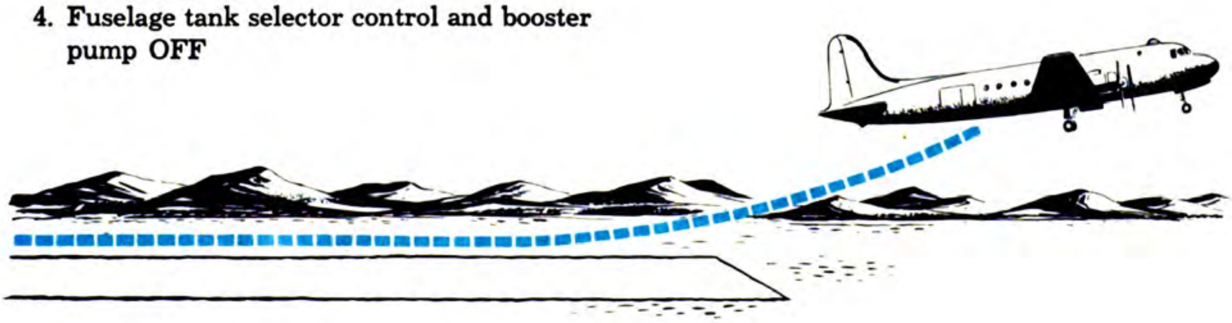
Wing tank quantity gages on the instrument panel indicate the amount of fuel in the tanks. Early airplanes employ a system of measurement by autosyn type transmitters. Measurement in later C-54's is by liquidometer float type transmitters.

Normal Operation of Fuel System:

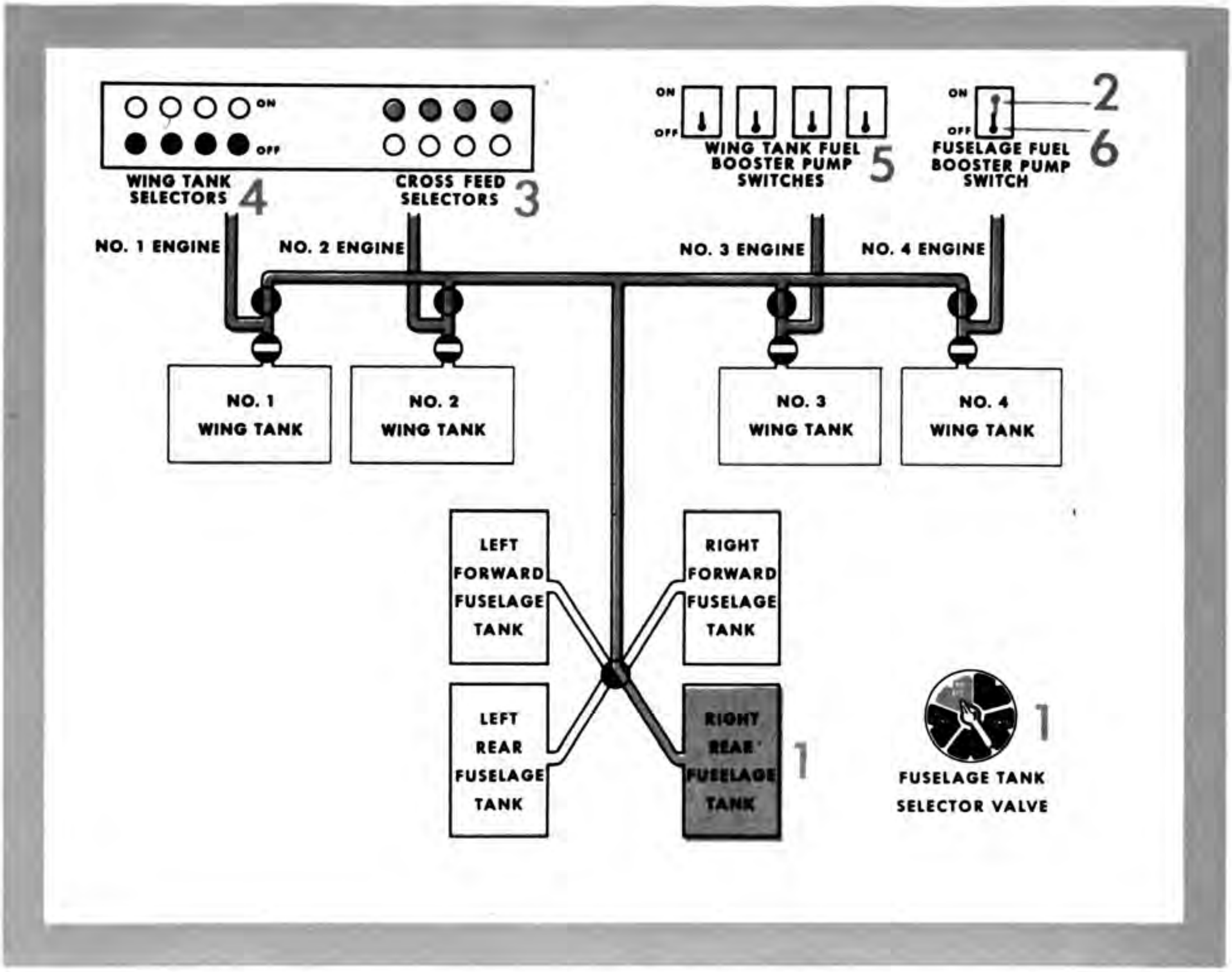


Takeoff:

1. Wing tank selector controls ON
2. Wing tank electric fuel booster pumps ON
3. Crossfeeds OFF
4. Fuselage tank selector control and booster pump OFF



Normal Operation of Fuel System

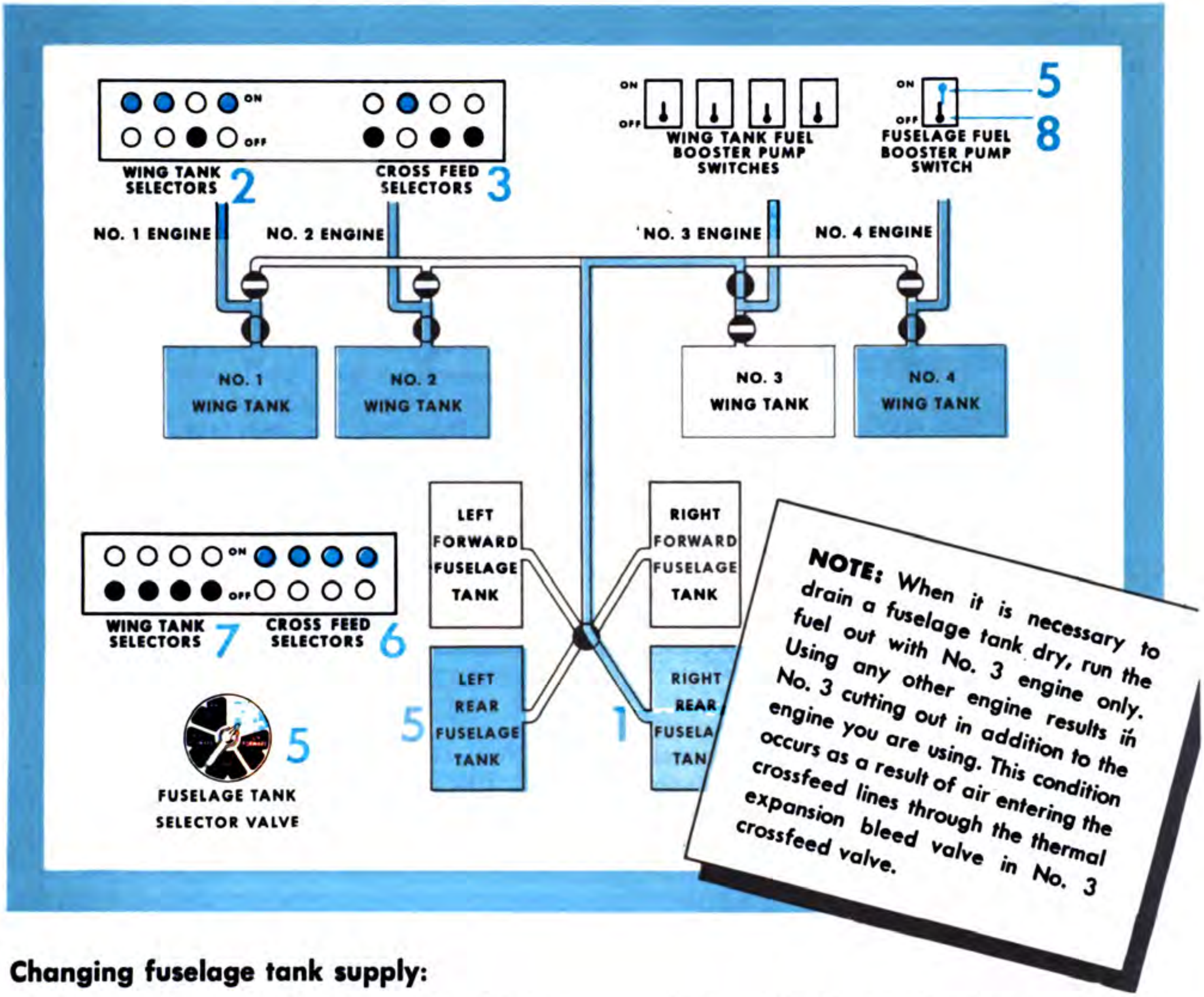


Cruise:

After climbing to desired altitude, level off and operate the fuel system as follows:

1. Fuselage tank selector control to LH or RH aft fuselage tank.
2. Fuselage fuel booster pump ON.
3. All crossfeed controls ON.
4. Wing tank selector controls OFF, one at a time.
5. Wing tank electric fuel booster pumps OFF, one at a time, if the pressure can be maintained without them.
6. Fuselage fuel booster pump OFF is pressure can be maintained without it.

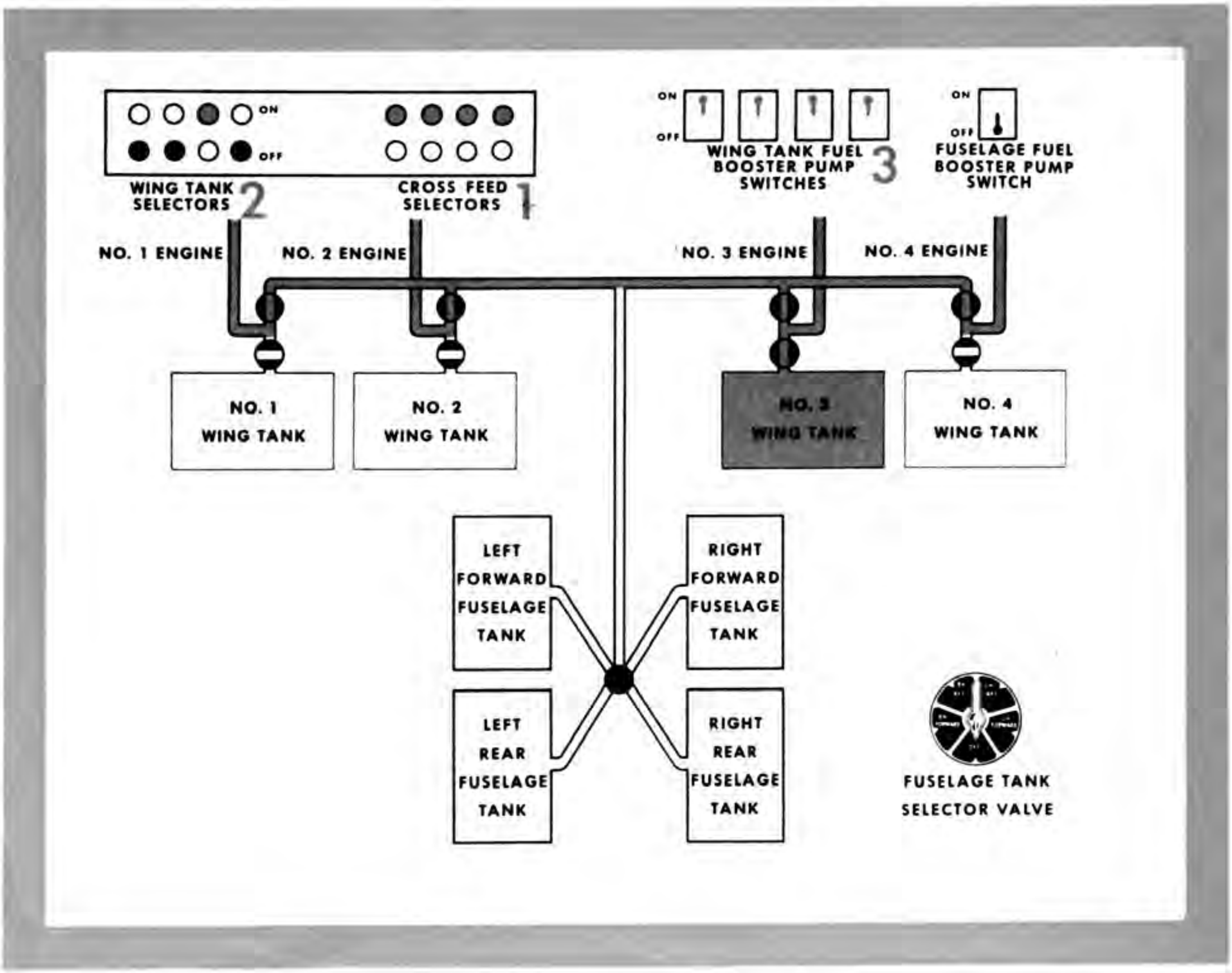
Normal Operation of Fuel System



Changing fuselage tank supply:

1. Run engine on the fuselage tank until the sight gage on that tank registers approximately 50 gallons.
2. Then place wing tank selector controls ON for No. 1, No. 2, and No. 4 engines.
3. Place crossfeed controls OFF for No. 1, No. 2, and No. 4 engines.
4. Allow No. 3 engine to consume all but approximately 10 gallons of the remaining fuel in the tank. Leave the 10 gallons to avoid an engine cutting out. Come back and drain it later if you need it.
5. Then turn fuselage electric booster pump ON and fuselage tank selector control to the unused aft fuselage tank. If the first tank has run completely dry, retard No. 3 throttle to prevent surging and over-revving until the fuel is again supplied to the engine.
6. As soon as No. 3 engine is running smoothly, turn crossfeed controls ON for No. 1, No. 2, and No. 4 engines.
7. Turn No. 1, No. 2, and No. 4 wing tank selector controls OFF.
8. Turn fuselage electric booster pump OFF, unless it is required for pressure.

Normal Operation of the Fuel System



Equalizing fuel in wing tanks:

During this procedure of draining fuselage tanks a certain amount of fuel overflows in No. 3 wing tank. Watch the quantity of this tank carefully. At the end of four draining operations there is approximately 3 hours' more fuel supply in No. 3 wing tank than in any of the others, because you run this engine longer on the fuselage tanks. Return No. 3 engine to the wing tank after draining the last fuselage tank down to 10 gallons. Then use the extra fuel in No. 3 wing tank by this procedure:

1. Turn all crossfeed controls ON.
2. Place No. 1, No. 2, and No. 4 wing tank selector controls OFF one at a time, leaving No. 3 wing tank selector control ON.
3. Use electric fuel booster pump as necessary to maintain desired pressure.
4. When fuel is equalized, place all wing tank selector controls ON, and all crossfeed controls OFF.

Alternate method of using fuselage tank supply: The following system of utilizing the fuselage tank supply is preferred by some operators.

1. Leave all wing tank selector controls ON.
2. Turn fuselage tank selector control to desired tank.
3. Turn fuselage booster pump ON.
4. Place all crossfeeds ON.

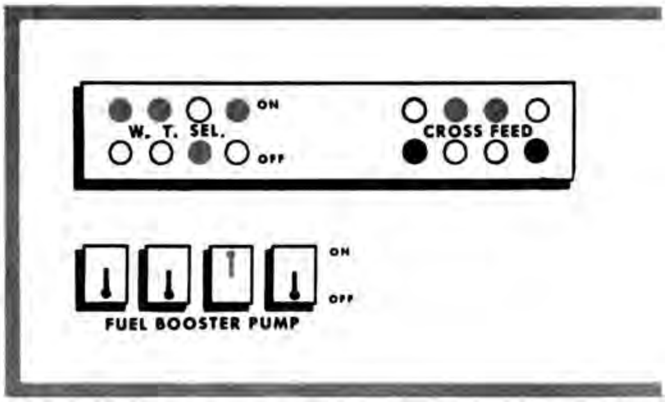
This system makes it possible to operate the engines from the selected fuselage tank, while simultaneously the fuselage booster pump sends fuel from this tank back through the wing tank selector valves into the wing tanks at a rate approximately equal to the total flow to all four engines. When you get the fuselage tank down to 50 gallons by this method, run the remaining fuel out on No. 3 engine, keeping the other three engines on main wing tanks.

The advantages claimed for this system are faster depletion of fuselage tanks and less likelihood of engines cutting, which used to be prevalent with the airplane.

The disadvantages of the system include the following points:

1. You have to cruise on wing tanks for a time until these tanks are low enough to accommodate the flow from the fuselage tanks.
2. The rate of draining is problematic, and you may drain a fuselage tank dry before you expect to, thus introducing air into the system.
3. You have no positive check on fuel consumption, as you do when you drain the known quantity of the fuselage tanks directly to the engines in a known time.
4. You must depend on the accuracy of the wing tank quantity gages to prevent overfilling and overflow of these tanks. In addition you must keep a constant and careful watch on all gages, which is not always practicable.

This method of using fuselage fuel is not recommended for any but highly experienced crews.



Procedure for one wing tank running dry:

1. Tank selector for dry tank OFF
2. Crossfeed control for fullest wing tank ON
3. Crossfeed control for dry tank engine ON
4. Electric fuel booster pump ON if necessary to clear all air from fuel lines of failing engine

CAUTION: When using crossfeed system, turn tank selectors OFF for wing tanks empty or not being used. Otherwise you may get air in lines to all four engines. Also, under low power conditions, fuel can drain from outboard to inboard tanks, because of the difference in fuel pressure and level. Always turn crossfeeds OFF when you are not using them.

Emergency Conditions

If you lose an engine, you can save the fuel for that engine as a reserve by turning the corresponding wing tank selector control OFF. Keep the corresponding crossfeed control OFF. When you have to use this fuel, turn the tank selector valve for that tank ON, turn all crossfeeds ON, and turn all other wing tank selector controls OFF.

CAUTION:

Do not attempt to utilize the remaining fuel from the wing tank of a dead engine if fire caused the failure of the engine.

FUEL SYSTEM
C-54B

Usable Tank Capacities

	Gallons Each	Total Gallons
Inboard wing tanks (2)	490	980
Auxiliary wing tanks (2)	420	840
Outboard wing tanks (2)	500	1000
Fuselage tanks (2)	450	900
Total Fuel		3720

In general, the C-54B fuel system and operation are much like the C-54A. The following points cover the main differences in the new system.

Wing Tanks

In the C-54B the aft fuselage tanks have been removed. There are now six wing tanks. The center tanks in each wing, in the same positions as No. 1 and No. 4 main tanks in the A series, are the new auxiliary tanks. The outboard wing tanks of the B series, in the wing outer panels, are No. 1 and No. 4 main tanks. No. 2 and No. 3 tanks are the same in both series of the airplane.

Each of the six wing tanks has its own 2-speed electric fuel booster pump at the base of the tank. The switches for the auxiliary tank fuel booster pumps are on the upper switch panel, next to the fuselage booster pump switch.

All wing tank booster switches have three positions: HIGH, LOW, and OFF. Use the HIGH boost position for takeoff, climb, and landing, and in case of engine-driven pump failure. Use LOW boost position during periods of flight when the engine-driven pumps alone do not supply sufficient pressure. If LOW boost operation does not supply adequate pressure use HIGH boost.

The auxiliary tanks feed only into the crossfeed system. The two selector valve control handles are beneath the floor plate just aft of the control pedestal. Each valve control handle has three positions: OFF position; LH (RH) to LH (RH) ENGINES; and LH (RH) to ALL ENGINES. The center position (LH to LH ENGINES and RH to RH ENGINES) makes it possible to split the crossfeed system, with the left auxiliary tank feeding to No. 1 and No. 2 engines, and the right auxiliary tank feeding to No. 3 and No. 4 engines. Always use the applicable crossfeed valves with the auxiliary tank selector valves.

FUEL BOOSTER SWITCH

NOTE: The table of operating limits for using Grade 91 gasoline applies to the C-54B as well as to the C-54A.

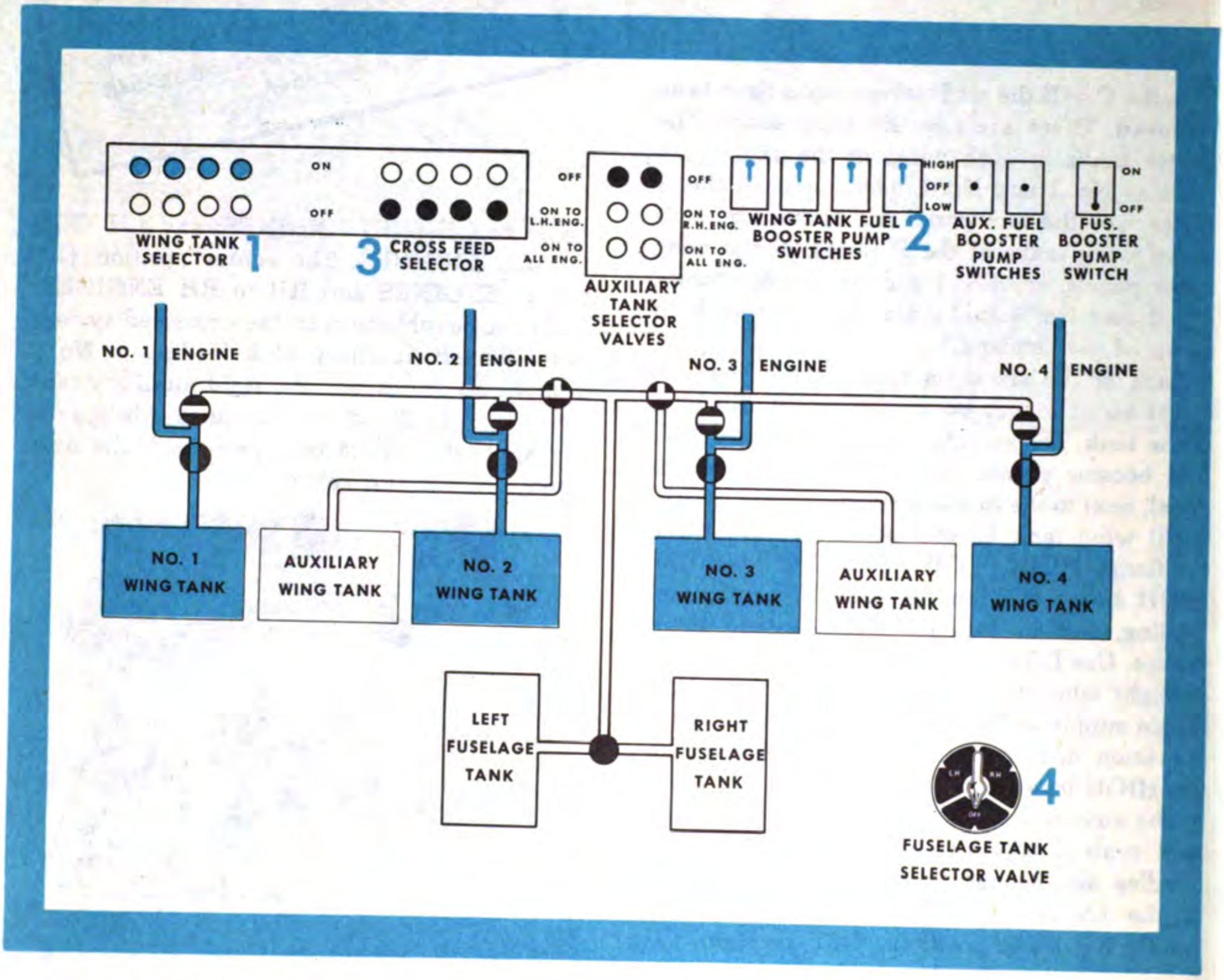
AUXILIARY TANK SELECTOR CONTROLS

Fuselage Tanks

The two forward fuselage tanks are largely unchanged in the B series, although re-evaluated in capacity. They are still removable. You can't use the total capacity of the right fuselage tank for the engines, because it now incorporates a standpipe which reserves a 25-gallon supply for the heaters. Remember this fact when you are running on the right fuselage tank.

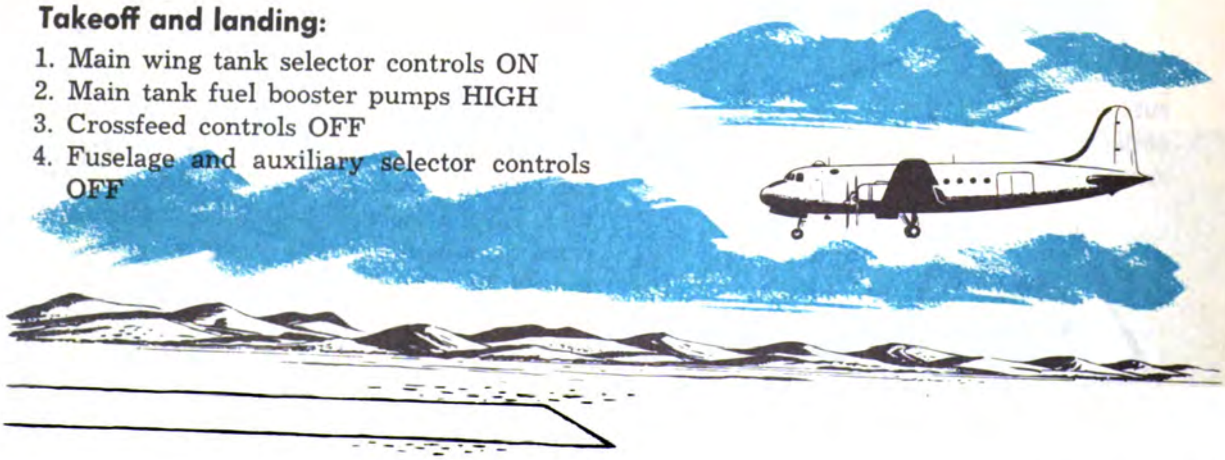
The 5-way fuselage tank selector valve has been replaced by a 3-way valve, with OFF, RH, and LH positions.

Normal Operation of the C-54B Fuel System

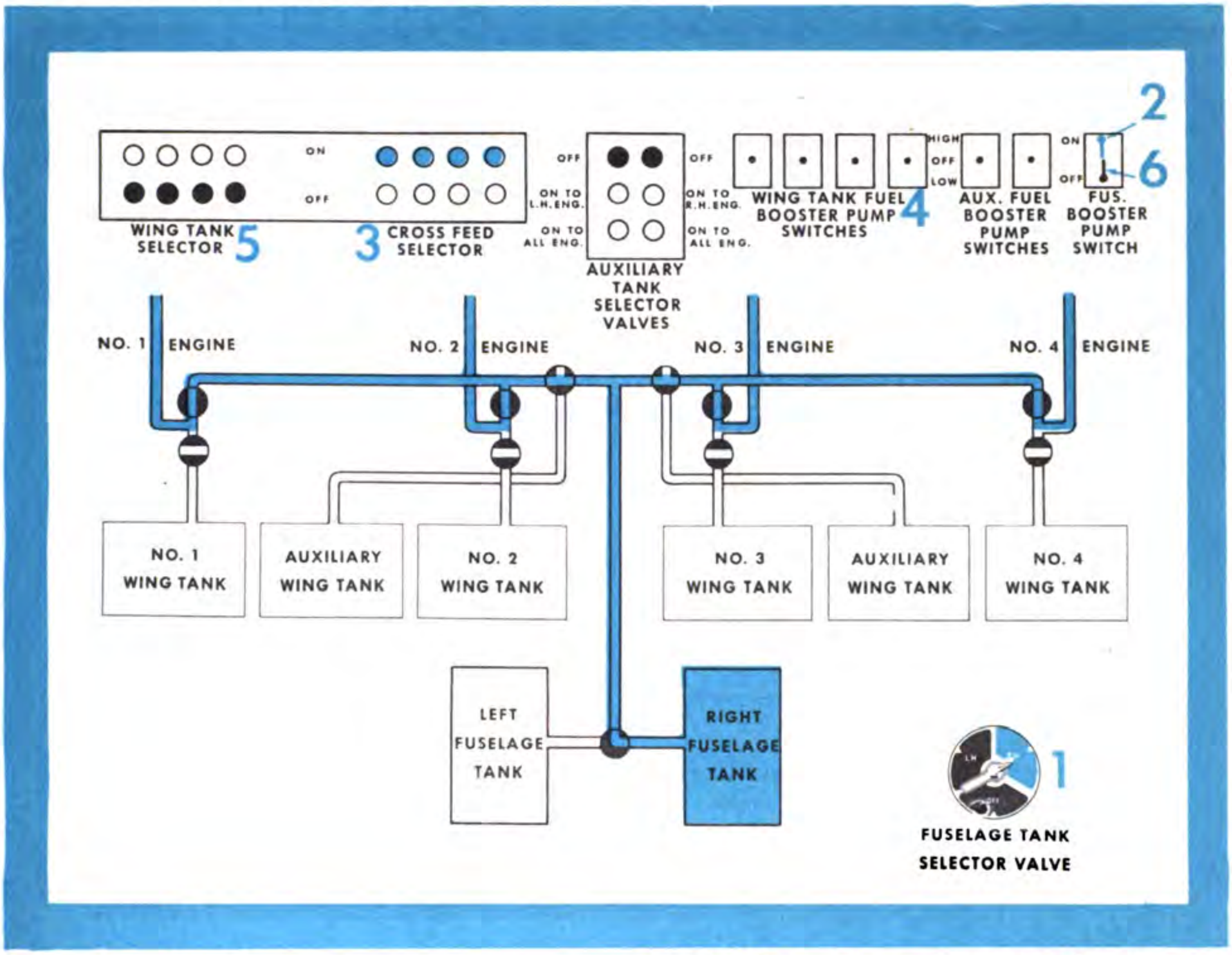


Takeoff and landing:

1. Main wing tank selector controls ON
2. Main tank fuel booster pumps HIGH
3. Crossfeed controls OFF
4. Fuselage and auxiliary selector controls OFF



Normal Operation of the C-54B Fuel System



Cruise:

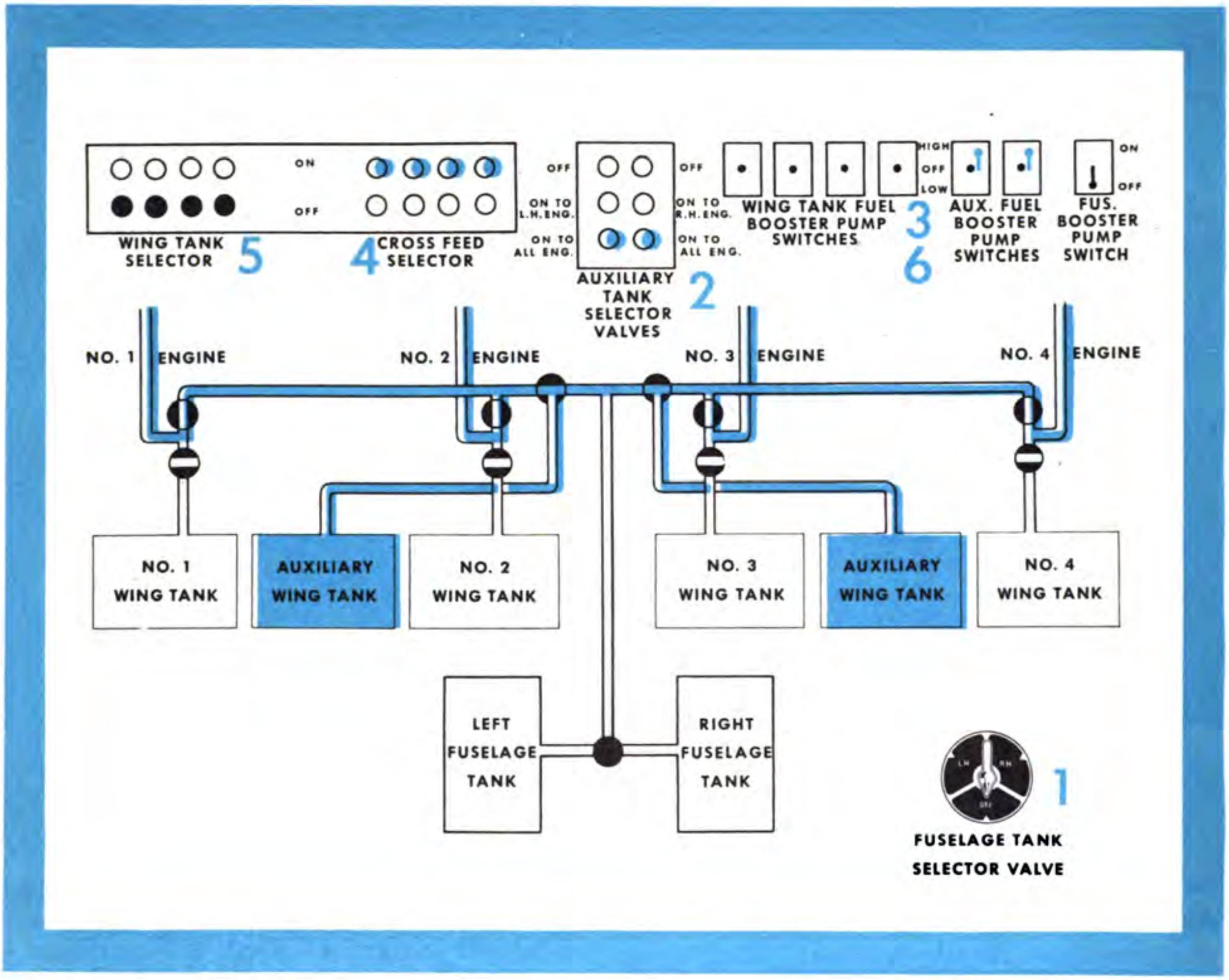
Use fuselage tank supply first:

1. Fuselage tank selector control to LH (or RH) fuselage tank
2. Fuselage tank fuel booster pump ON
3. Crossfeed controls ON
4. Wing tank booster pumps OFF
5. Wing tank selector controls OFF
6. Fuselage booster pump OFF unless necessary to maintain pressure

When your first fuselage tank gets down to 50 gallons (75 gallons in the right fuselage tank), the best and safest procedure to follow is the standard operation of returning valves to takeoff positions on No. 1, No. 2, and No. 4 engines, and draining the fuselage tank down to about 10 usable gallons on No. 3 engine. Then switch to the full fuselage tank, turn fuselage booster pump and all crossfeeds ON, and place wing tank selector controls OFF. Now you are running all four engines on your full fuselage tank.

If you are willing to leave 50 gallons in the fuselage tanks, you can make the switch by merely turning the fuselage booster pump ON and switching the fuselage tank selector valve quickly to the other tank. Don't do this with less than 50 usable gallons remaining: it's too easy to misjudge the remaining fuel and run the tank dry, thereby cutting out all four engines.

Normal Operation of the C-54B Fuel System



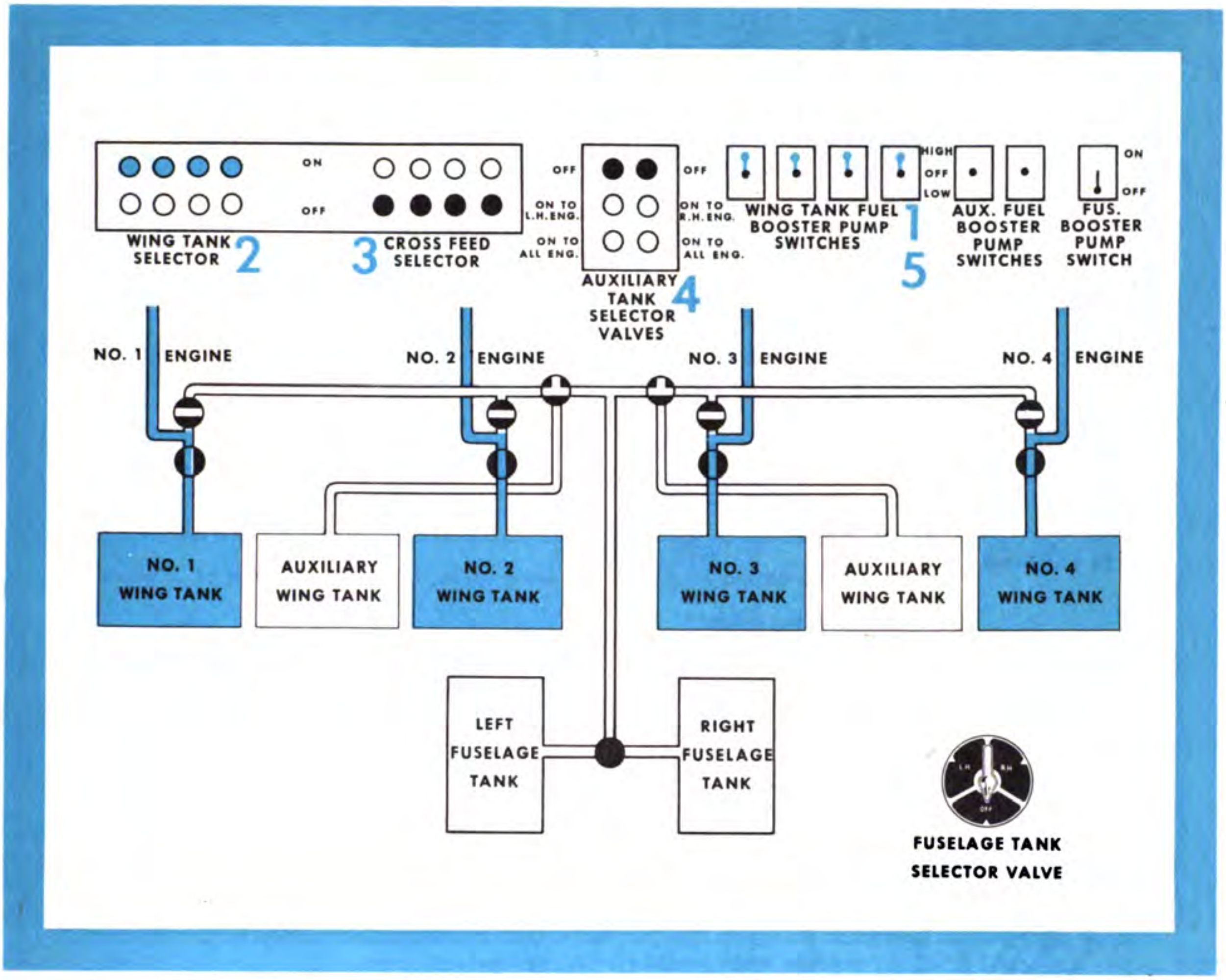
Use the auxiliary tank supply after the fuselage supply:

1. Return all valves to takeoff position.
2. Place both auxiliary tank selector control handles either in center position (LH to LH ENGINES and RH to RH ENGINES); or in aft position (ALL ENGINES).
3. Turn auxiliary fuel booster pump HIGH or LOW, as required.
4. Place crossfeed controls ON.
5. Place wing tank selector controls OFF.
6. Turn auxiliary booster pump OFF unless necessary to maintain pressure.

NOTE: Here again, if you wish to leave at least 50 usable gallons in the fuselage tank, you can shorten this procedure by turning the auxiliary tank booster pumps HIGH or LOW, then turn the auxiliary tank selector control to full or half crossfeed, and after 1 minute turn the fuselage tank selector control OFF. If you do this, however, don't let the fuselage tank get close to dry or you may lose all four engines.

Be careful when using both auxiliary tanks to supply all four engines at the same time. This condition (both auxiliary selector valves in aft position) may result in fuel draining to the tank which is lowest in either quantity or position.

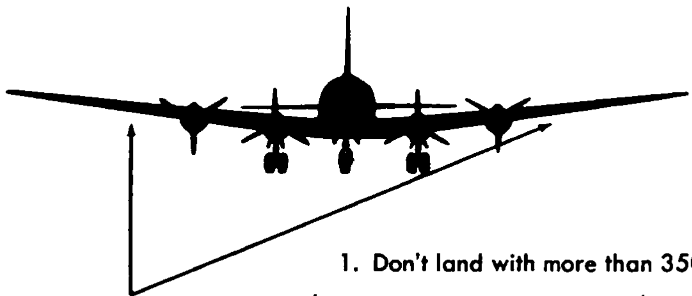
Normal Operation of the C-54B Fuel System



To switch from auxiliary tanks to main wing tanks:

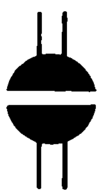
1. Turn wing tank booster pumps HIGH or LOW as required.
2. Place wing tank selector controls ON.
3. Place crossfeed controls OFF.
4. Place auxiliary tank selector controls OFF.
5. Turn booster pumps OFF unless necessary to maintain pressure.

Observe these precautions in using the C-54B fuel system:

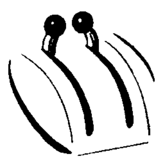


NO MORE THAN
350 GALLONS
IN LANDING

1. Don't land with more than 350 gallons in the outboard wing tanks (No. 1 and No. 4 main tanks) since the additional weight so far out imposes dangerous wing loads. To observe this precaution it is necessary to run on No. 1 and No. 4 wing tanks, if full, a minimum of 3 hours including climb.



2. To avoid the possibility of air entering the system, tank selector and crossfeed valves must be in OFF position except when flow is expected through them.

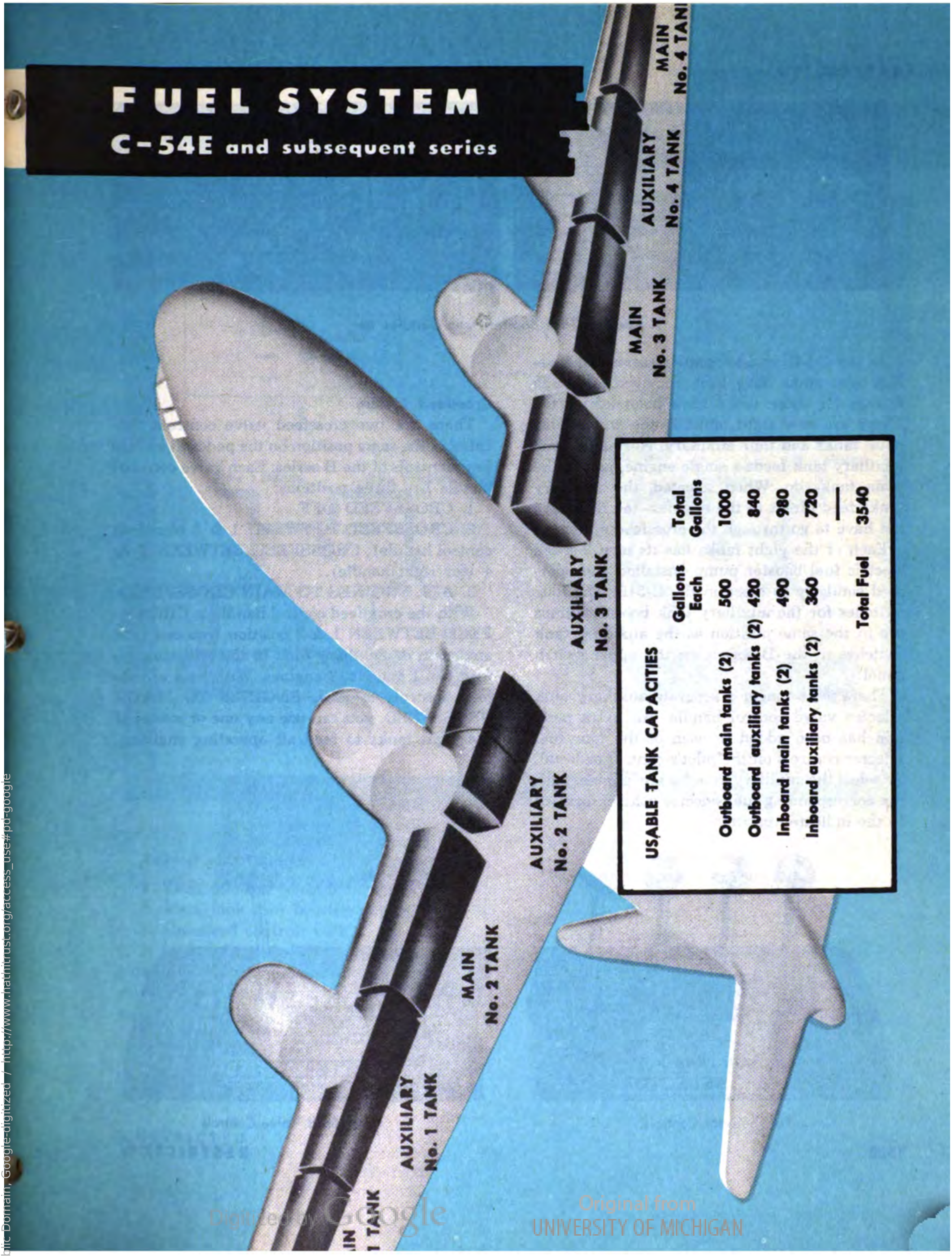


3. Both wing auxiliary tank selector controls must be in the OFF position when you are using the fuselage tanks.

4. Always open valves to a new source of supply before closing valves from the old supply.

5. Whenever you get into trouble with the fuel system, the safe and sure procedure is to place wing tank selector controls ON, and the crossfeed controls OFF. Then study placard diagram and see what is wrong. The usual difficulty is an unexpectedly dry tank, or a source of supply shut off by mistake.

FUEL SYSTEM
C-54E and subsequent series



USABLE TANK CAPACITIES

	Gallons Each	Total Gallons
Outboard main tanks (2)	500	1000
Outboard auxiliary tanks (2)	420	840
Inboard main tanks (2)	490	980
Inboard auxiliary tanks (2)	360	720
Total Fuel		3540

Auxiliary Tank Booster Pump Switches

In the C-54E and subsequent series all fuselage fuel tanks have been removed, although fittings for these tanks have been left intact. There are now eight tanks in the wings, four main tanks and four auxiliary. Normally, each auxiliary tank feeds a single engine, just as the main tanks do. When selected, the auxiliary tanks feed direct to the engines—the flow does not have to go through the crossfeed system.

Each of the eight tanks has its own 2-speed electric fuel booster pump, installed and operated similarly to those in the C-54B. The four switches for the auxiliary tank booster pumps are in the same position as the auxiliary tank switches in the B series, on the upper switch panel.

There is no longer a separate auxiliary tank selector valve control handle. An extra position has been added to each of the four fuel selector controls on the pilot's control pedestal. To select the auxiliary tank for any engine, push the corresponding fuel selector control forward to the indicated position.

Crossfeed System

There are two crossfeed valve controls, located in the same position on the pedestal as the four controls of the B series. Each valve control handle has three positions:

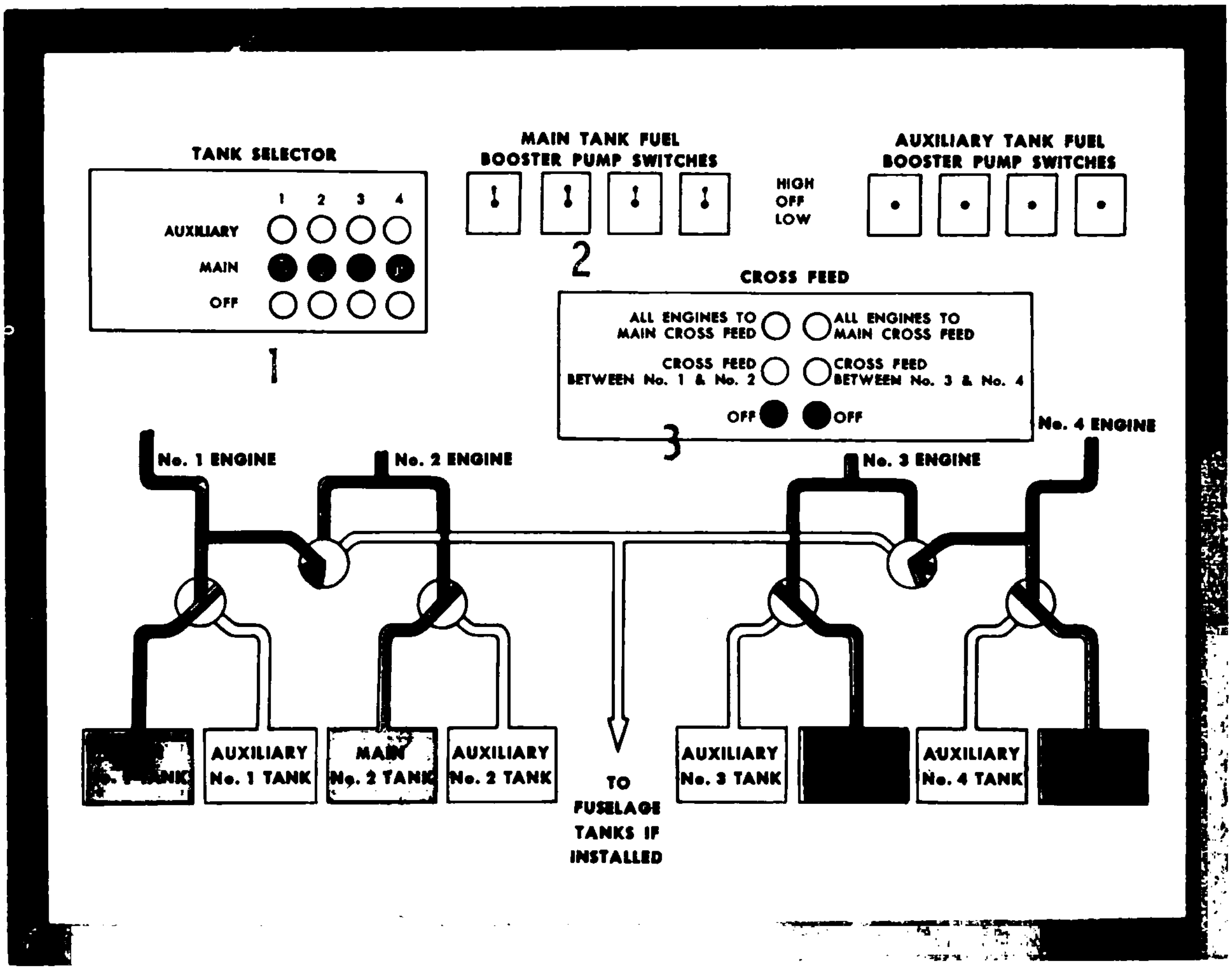
1. CROSSFEED OFF.
2. CROSSFEED BETWEEN 1 & 2 (for left control handle), CROSSFEED BETWEEN 3 & 4 (for right handle).
3. ALL ENGINES TO MAIN CROSSFEED.

With the crossfeed control handle in CROSSFEED BETWEEN 1 & 2 position, you can use any main or auxiliary tank in the left wing to feed No. 1 and No. 2 engines. With both crossfeed controls to ALL ENGINES TO MAIN CROSSFEED, you can use any one or more of the eight tanks to feed all operating engines.

Fuel Selector Controls

Crossfeed Valve Controls

Normal Operation of the C-54E and Subsequent Series Fuel System

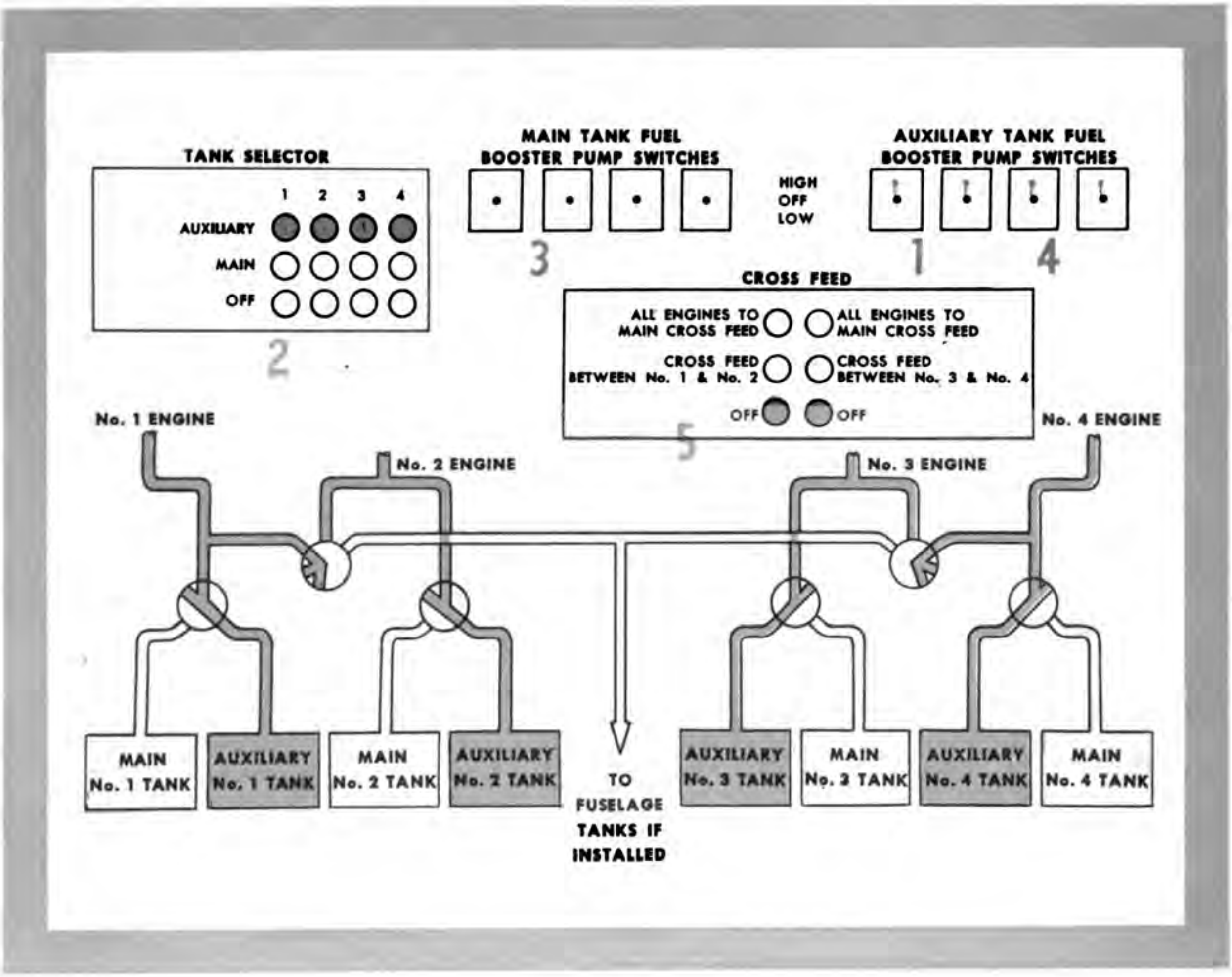


Takeoff and Landing:

1. Tank selector controls to MAIN TANKS.
2. Main tank fuel booster pumps to HIGH.
3. Crossfeed controls OFF.

If for some reason it becomes necessary, it is possible to take off on auxiliary tanks, or on any combination of two or more main and auxiliary tanks, using the crossfeed.

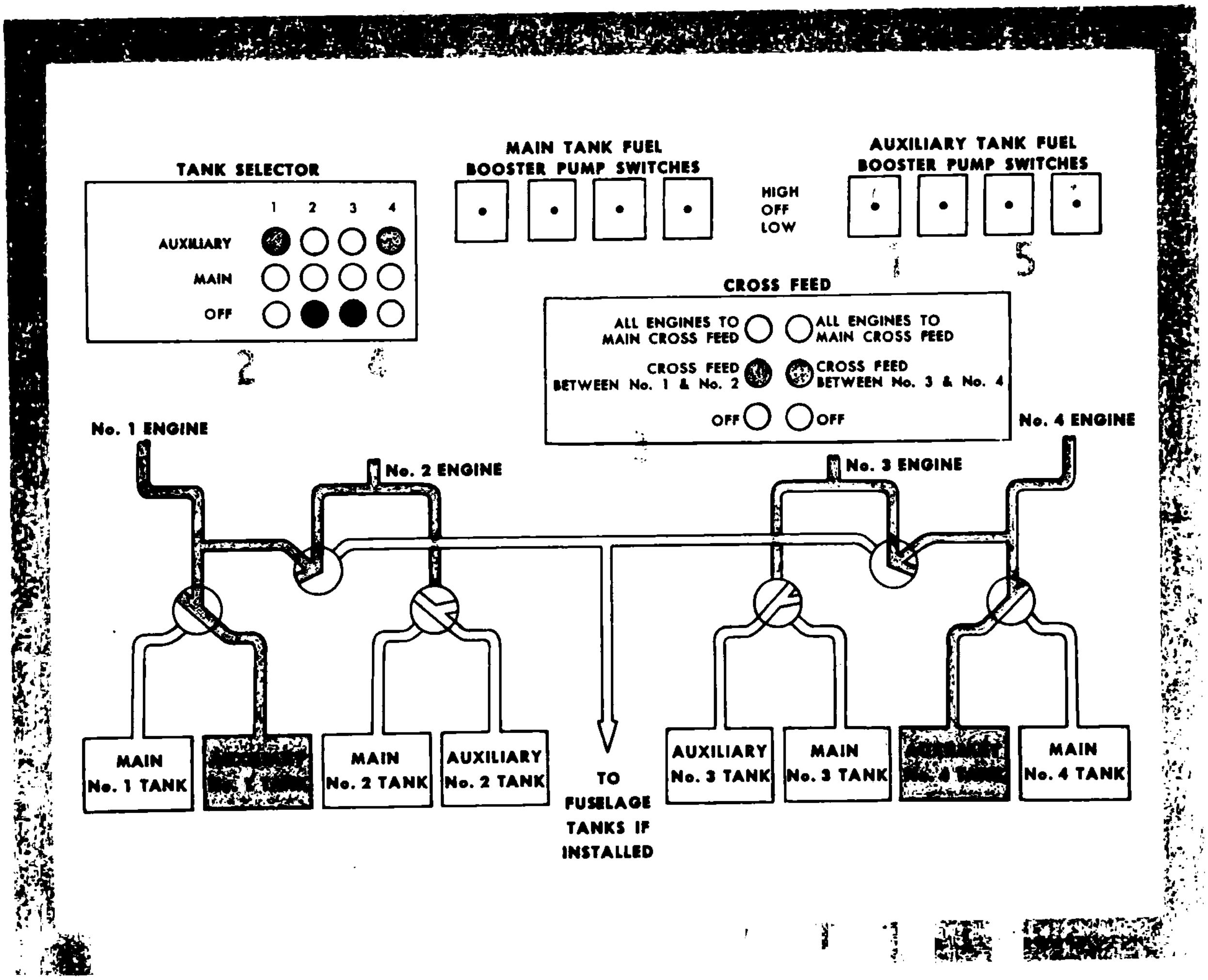
Normal Operation of the C-54E and Subsequent Series Fuel System



Cruise:

1. Auxiliary tank booster pump switches to HIGH.
2. Tank selector controls to AUXILIARY TANKS, one at a time.
3. Main tank booster pump switches to OFF.
4. Auxiliary tank booster pump switches to OFF, unless needed to maintain pressure.
5. Check crossfeed valves OFF. Remember that you do not use the crossfeed system for normal operation on auxiliary tanks.

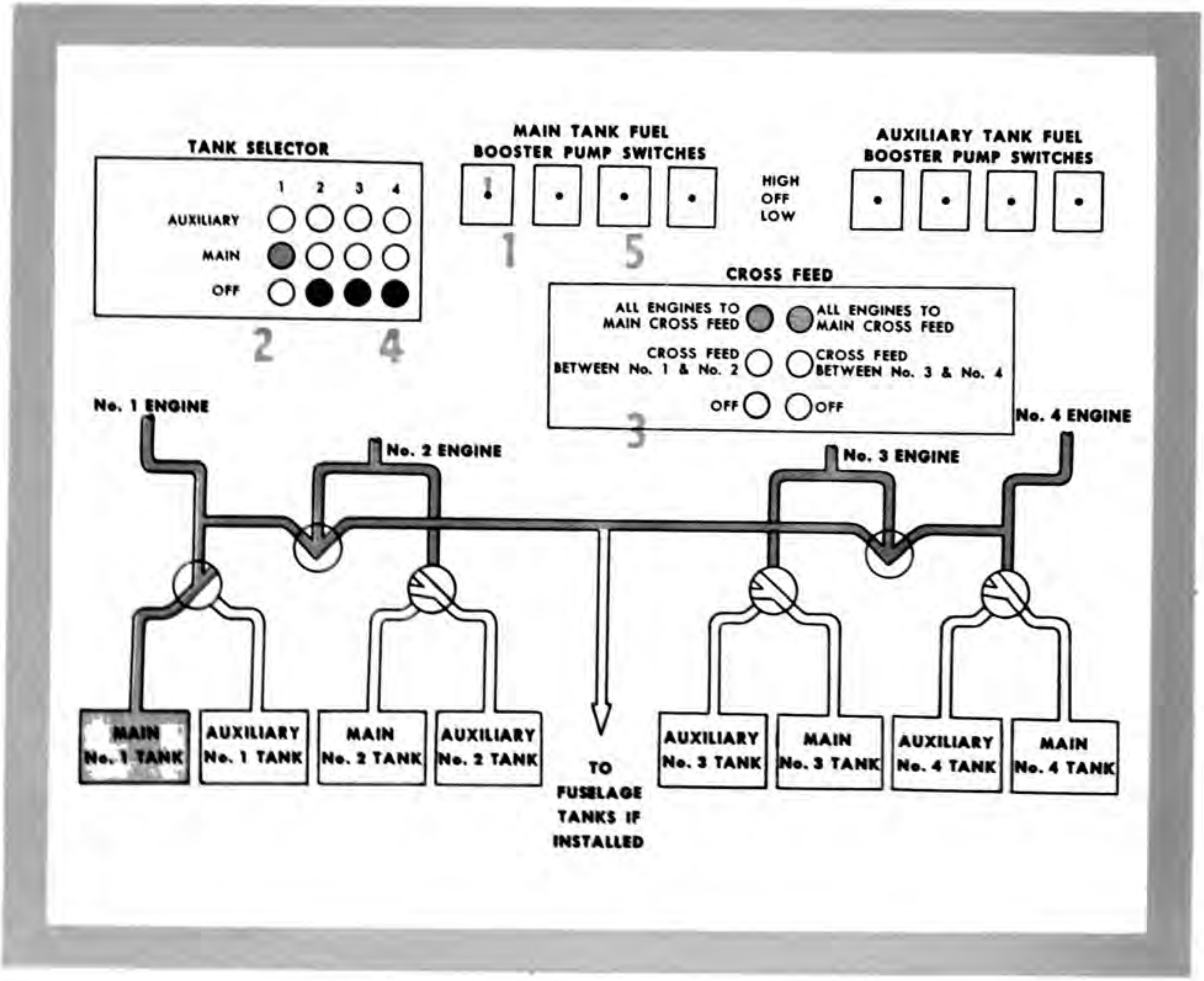
Example of Use of Crossfeed



Switching from all main tanks to outboard auxiliaries to two engines:

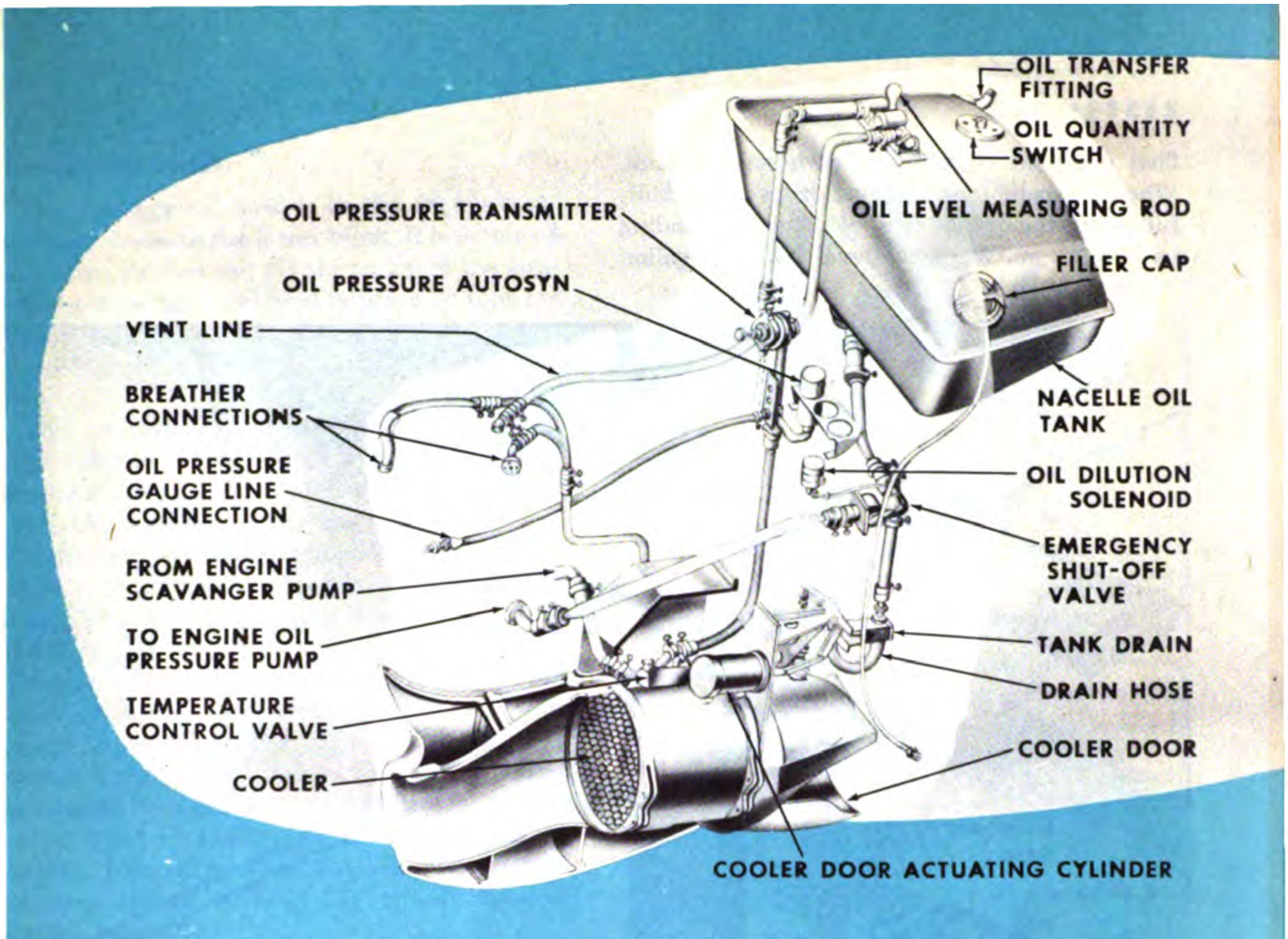
1. Auxiliary tank fuel booster pumps No. 1 and No. 4 to HIGH.
2. No. 1 and No. 4 tank selector controls to AUXILIARY TANKS.
3. Crossfeed controls to CROSSFEED BETWEEN 1 & 2 (3 & 4 on right control).
4. No. 2 and No. 3 tank selector controls to OFF.
5. Auxiliary tank fuel booster pumps No. 1 and No. 4 to OFF, unless needed to maintain pressure.

Example of Use of Crossfeed



Switching from all auxiliary tanks to No. 1 main tank to all engines:

1. No. 1 main fuel tank booster pump to HIGH.
2. No. 1 tank selector control to MAIN TANK.
3. Both crossfeed controls to ALL ENGINES TO MAIN CROSSFEED.
4. No. 2, No. 3, and No. 4 tank selector controls to OFF.
5. No. 1 main fuel tank booster pump to OFF, unless needed to maintain pressure.



OIL SYSTEM

Four independent nacelle oil systems supply lubricating oil to the engines. A fuselage oil system provides an auxiliary oil supply, a pump, and a selector valve with lines which transfer the oil to any of the nacelle system tanks as needed during flight.

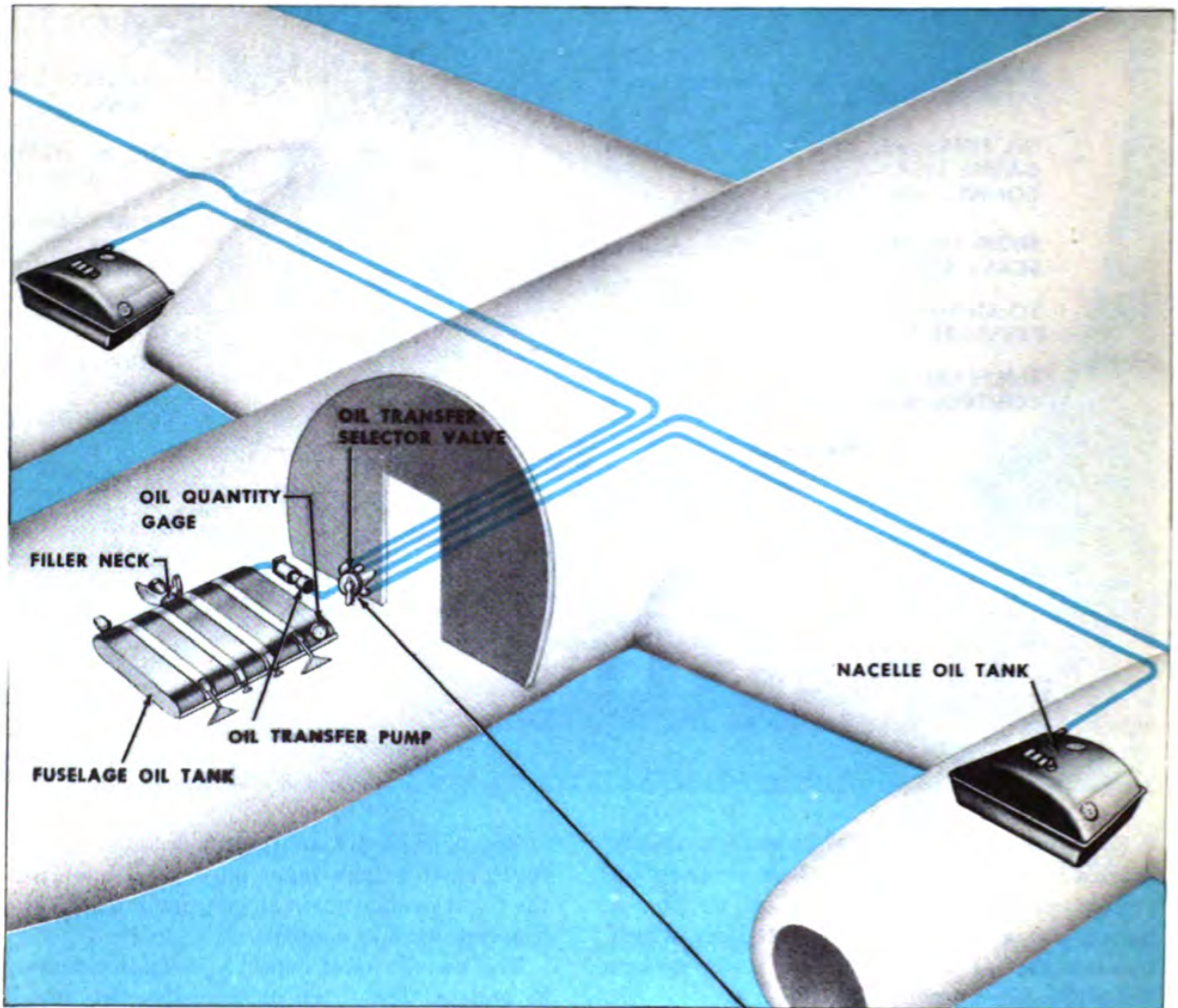
Nacelle System

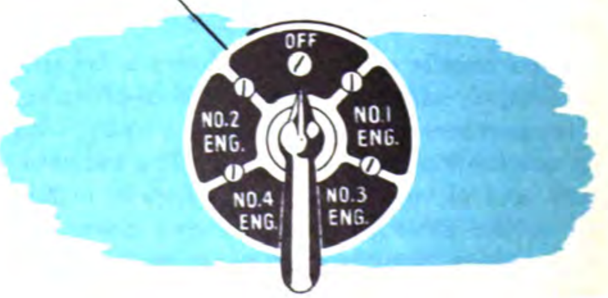
Each nacelle oil system includes a hopper-type supply tank, an emergency shut-off valve, a temperature control valve, and a cooler with an automatically operated door. The temperature control valve controls the flow of engine oil to the strut which opens and closes the cooler door, thereby automatically maintaining proper oil temperature range.

You operate the emergency shut-off valve in the tank-to-engine main oil supply line from the flight compartment in conjunction with the fire extinguisher controls.

The nacelle tank capacity is approximately 22 gallons. The sump incorporates two standpipes. The engine oil flows out through a tall standpipe, leaving a reserve of approximately 1.4 gallons for the propeller feathering system. The reserve flows out of the tank through a shorter standpipe, below which sludge is trapped in the sump.

Oil quantity and pressure are indicated by different systems in different airplanes. Earlier ones incorporate four pairs of warning lights on the main instrument panel, and arm-and-float operated switches in each nacelle tank. When a nacelle tank oil level drops to the half-full point, the orange light of the corresponding pair comes on. When the level falls to 1 gallon





above the propeller feathering reserve, the second light comes on. This second lamp also lights when the oil pressure falls below 45 psi. The warning lights are replaced by oil quantity and pressure gages in most airplanes.

Temperature bulbs in each engine transmit oil inlet temperature to the indicators on the upper instrument panel.

Fuselage Oil System

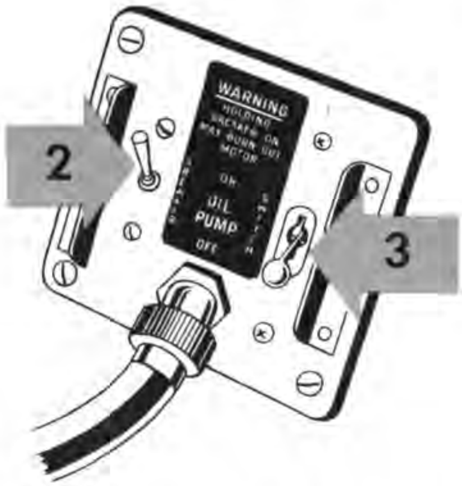
The fuselage oil tank is in the crew's compartment beneath the lower bunk. It is mounted on a foam rubber pad placed on top of the supporting structure, and held in place by four reinforced, padded straps. The tank has a capacity of 50 gallons and a foaming space of 5 gallons.

The function of the fuselage oil tank is to replenish the supply of any of the nacelle tanks during flight. The main units of the system are the tank, with a quantity gage mounted on it, the electric transfer pump, and the selector valve with connecting lines to the four nacelle tanks. The transfer pump is shock-mounted on the floor just aft of the tank. There is a circuit breaker switch of the 2-position type which must be snapped ON before the pump switch can operate the motor. The circuit breaker switch automatically cuts out when the motor overheats. You can hold the switch ON to continue pump operation at the risk of pump failure. Normally, allow the motor to cool 10 minutes before turning the circuit breaker switch back ON.

Operation of the Fuselage Oil System

When the warning light on the main center instrument panel flashes on to indicate that a nacelle tank is half full, or the liquidometer gage on the instrument panel shows half full, transfer oil from the fuselage tank to the indicated low nacelle tank by this procedure:

1. Set the 4-way selector valve to the indicated low nacelle tank.

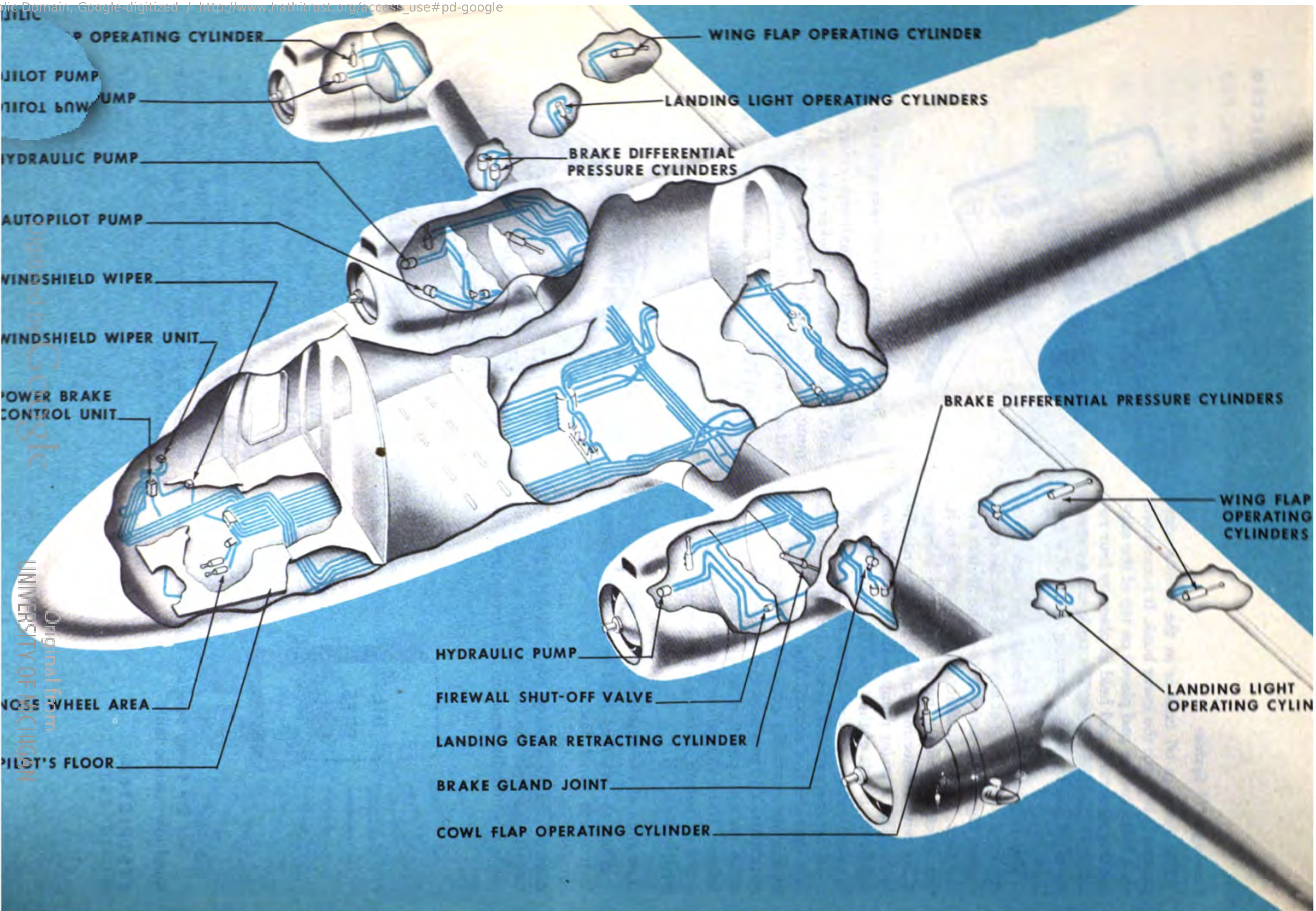


2. See that the circuit breaker switch is ON.

CAUTION: Except in extreme emergencies, don't hold the circuit breaker switch ON. The pump may fail if the switch is not allowed to cut out when the motor overloads.

3. Hold the momentary contact switch ON to operate the transfer pump.

4. Watch the fuselage tank sight gage on the aft inboard end of the tank to be sure that not more than 8 gallons are pumped to the nacelle tank after the warning light on the panel goes out. In airplanes with quantity gage, pump to nacelle tank until it shows ¾ full. If you don't stop then, you may exceed the capacity of the nacelle tank.



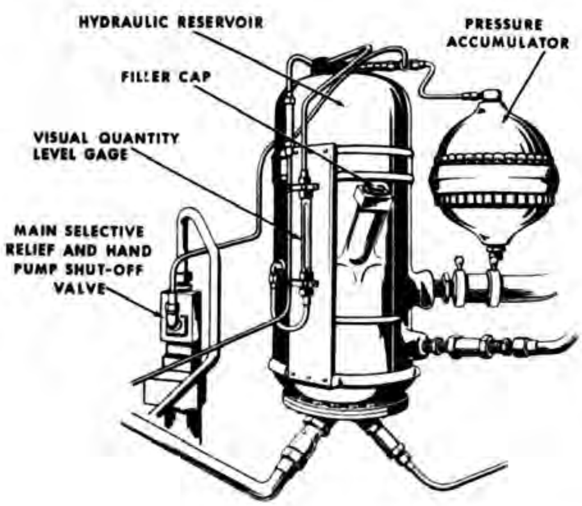
OPERATING CYLINDER
PILOT PUMP
UMP
HYDRAULIC PUMP
AUTOPILOT PUMP
WINDSHIELD WIPER
WINDSHIELD WIPER UNIT
POWER BRAKE CONTROL UNIT
NOSE WHEEL AREA
PILOT'S FLOOR
WING FLAP OPERATING CYLINDER
LANDING LIGHT OPERATING CYLINDERS
BRAKE DIFFERENTIAL PRESSURE CYLINDERS
BRAKE DIFFERENTIAL PRESSURE CYLINDERS
WING FLAP OPERATING CYLINDERS
HYDRAULIC PUMP
FIREWALL SHUT-OFF VALVE
LANDING GEAR RETRACTING CYLINDER
BRAKE GLAND JOINT
COWL FLAP OPERATING CYLINDER

HYDRAULIC SYSTEM

Hydraulic power is used in this airplane to apply the wheel brakes, raise and lower the wing flaps, extend and retract nose and main landing gear, open and close the engine cowl flaps, and operate carburetor filter doors, windshield wipers, and the nose gear steering mechanism. The hydraulic system contains approximately 23 gallons of fluid.

Essentially, the hydraulic system consists of:

1. Three engine-driven pumps that supply hydraulic fluid at 2700 to 3000 psi pressure.



2. The hydraulic reservoir, a tank to supply fluid to the pumps. The fluid capacity of the reservoir is 5.4 gallons. A quantity of fluid is reserved in the reservoir for emergency operation of all units. This reserve is available only for hand pump operation.

3. A pressure accumulator that stores fluid under 3000 psi. With zero psi hydraulic pressure, the accumulator is inflated to an initial air pressure of 1000 pounds.

4. A pressure regulating valve to restrict the operating pressure of the system to predetermined limits.

5. A relief valve, to limit the extreme pressure to which the system may be subjected in case of failure of the pressure regulator.

Engine-driven Pumps

The three engine-driven pumps are on the accessory sections of No. 2, No. 3, and No. 4 engines. At cruising speed they require about 12 Hp to operate at approximately 3000 rpm. The displacement of each pump is .507 cubic inches, or at cruising speed, approximately 7 gallons per minute.

Hydraulic Reservoir

The hydraulic reservoir is located at the power panel in the fuselage accessories compartment. It provides a reserve of 5.4 gallons to offset the fluid-volume change which takes place during the operation of the various units of the system; to allow for volume change from temperature expansion; and to provide emergency hand pump supply in case of hydraulic failure. The outlet to the hand pump is placed below the outlet to the engine-driven pumps. This assures a reserve supply of 2.5 gallons available only for hand pump operation, in case the engine pumps have forced fluid through an external leak.

The vent and filler lines for the hydraulic reservoir are under the bunks in the crew compartment. To fill the reservoir during flight without going down into the hell-hole, remove the caps from both lines, insert the funnel which hangs near the line into the filler line, and pour in the fluid. Check the level on the gage by looking down through the inspection plate in the fuel compartment. Replace caps on vent and filler lines snugly to prevent reservoir air charge from leaking out.

Pressure Regulator

The pressure regulator is on the power panel. It maintains pressure in the hydraulic system between 2600 and 3050 psi by bypassing the fluid from the pumps to the reservoir when the required pressure is reached.

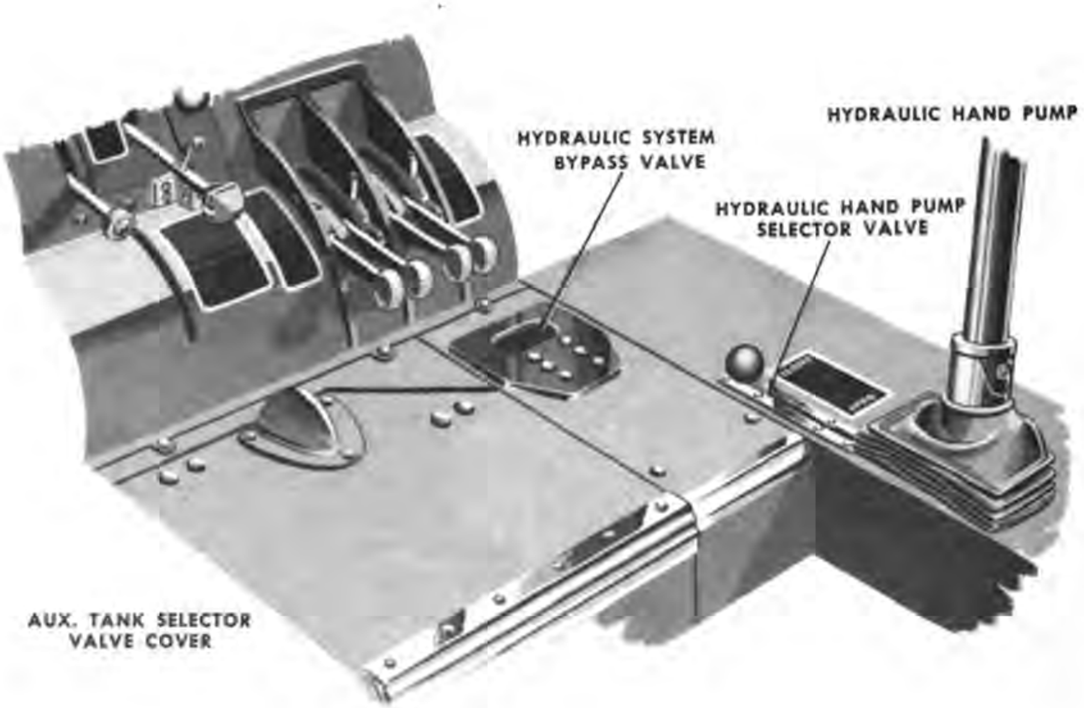
Manual Bypass Valve

When the manual bypass valve is opened, it permits the hydraulic fluid to be pumped from the engine pumps directly to the reservoir, bypassing the pressure regulator. You open the valve after the airplane has taken off, when the landing gear and flaps have been raised, and you have placed all other units in proper flying position. If you don't expect to use the system for a long period of time it is not necessary to maintain pressure. The pressure regulator, under normal conditions, operates at intervals of from 1 to 5 minutes. Opening the bypass valve stops this action and also saves wear on the engine-driven pumps. You get normal operation by closing the bypass valve.

Main Selective Relief Valve and Hand Pump Shut-off Valve

The main selective relief valve insures braking by directing fluid, under at least 1800 psi, to the brake control valve before other systems are supplied. When the system pressure falls below 1800 psi, the valve closes. This shuts off the landing gear and wing flap control valves from the pressure supply furnished by the pumps and accumulator, making it available to the brake control valve only, thus insuring pressure for the brakes. (This valve is not installed on C-54E's and subsequent series.)

When you are using the hand pump, it is usually more desirable to position a unit without pumping up the pressure accumulator at the same time. You can accomplish this by closing the hand pump shut-off valve. You can open the valve if it is necessary to charge the accumulator. The position of the valve does not affect the operation of the system when it is being supplied by the engine-driven pump. However, the normal position is CLOSED.



NOTE: In C-54A's you have to pump up the accumulator to 3000 psi first in order to lower the wing flaps with the hand pump. This situation results from check valves in the up pressure lines to each wing flap. The check valves were installed to prevent the flaps from creeping. To lower the wing flaps with the hand pump, turn the hand pump shut-off valve to OPEN position and pump up the accumulator to 3000 psi. Then place flap selector handle DOWN to lower the flaps approximately 20°, and return handle to OFF. Continue this procedure until you get the desired flap position. When the flaps are set, turn the hand pump shut-off valve back to the CLOSED position.

You can operate the cowl flaps by use of the hand pump with the shut-off valve CLOSED.

In the C-54B and subsequent series you can hand pump the wing flaps down directly without pumping up the accumulator.

System Relief Valve

The system relief valve assures that the pressure will not rise to a dangerous point if the pressure regulator fails to bypass fluid when the pressure reaches 3000 psi. The relief valve opens at 3000 plus 100 minus 0 psi, and permits the fluid to flow to the reservoir. Continued flow through this valve causes the fluid to heat up and endanger the operation of the engine-driven pumps. To prevent damage in this case, open the system bypass valve.

Pressure Accumulator

The operation of some of the large units of the system or combinations of units requires a large amount of fluid for a brief period of time. The output of the pumps cannot furnish the required amount. Therefore, the pressure accumulator stores 1.12 gallons of fluid under system pressure where it is available for instantaneous demands. In addition, if there were no accumulator in the system, the pressure would rise from 0 psi to 3000 psi almost instantaneously, subjecting the units and lines to extremely high impact loads. The regulator would operate constantly and the speed of the units, landing gear or flaps, for example, would be governed by the amount of fluid the pumps could supply. The accumulator relieves this situation by absorbing the shock of the pumps, and it maintains the pressure in the system for the brakes while the airplane is parked with engines shut off.

Brake Balance Relief Valve Manifold

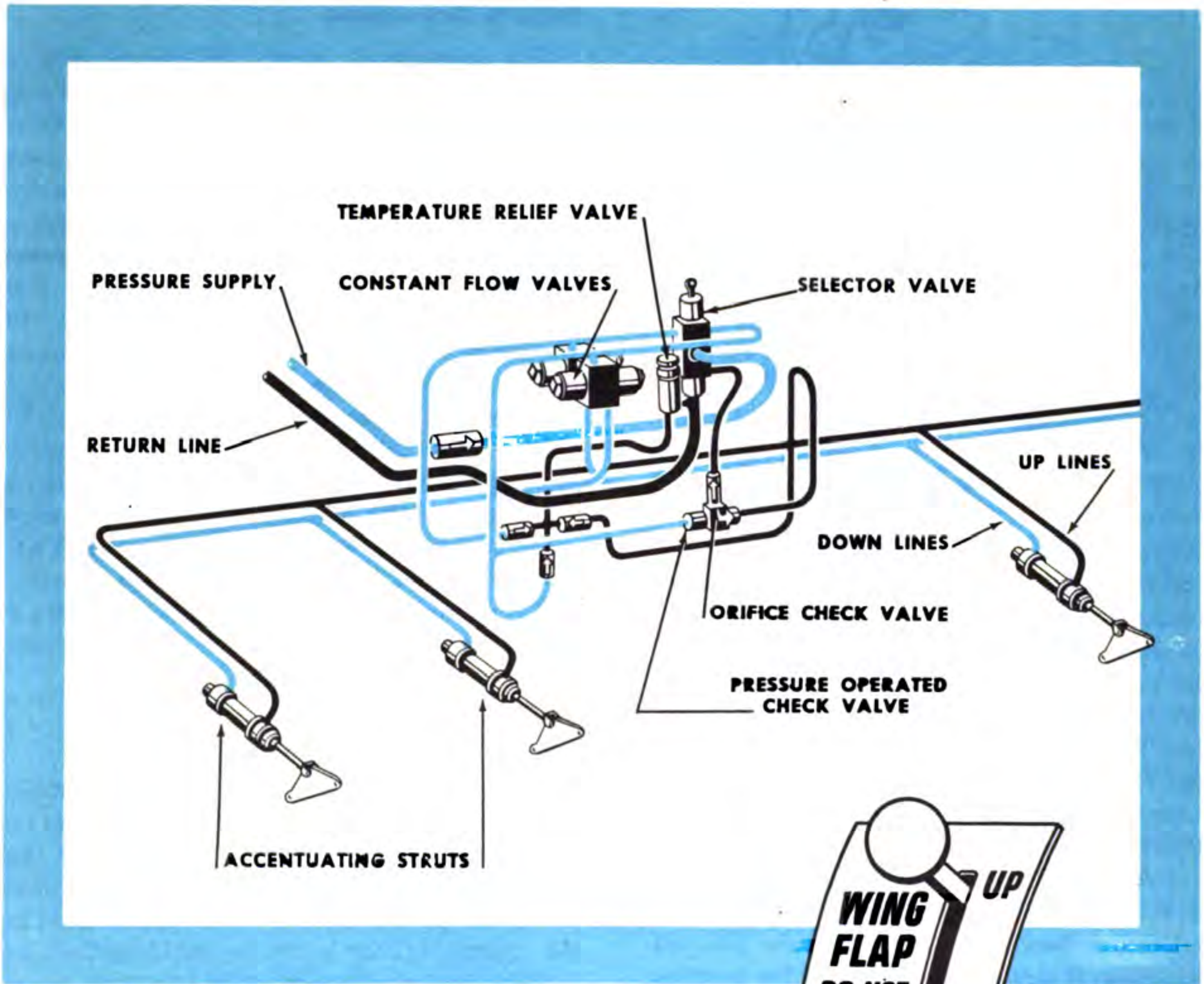
The selective relief valve in this assembly operates in conjunction with the main selective relief valve to assure fluid pressure to the brakes. It closes at 1800 psi and directs all fluid to the brakes and away from the other units in the system. (This valve is not installed on C-54E's and subsequent series.)

Cowl Flap Constant Flow Valve

The cowl flap constant flow valve is under the flight compartment floor behind the copilot's seat. This valve restricts the amount of fluid reaching the cowl flap and carburetor air filter door control valves, controlling the speed of operation of the units. It may be adjusted by turning the adjusting nut to provide the desired speed of cowl flap movement. Screwing the nut in increases the speed of movement.

Hydraulic Hand Pump

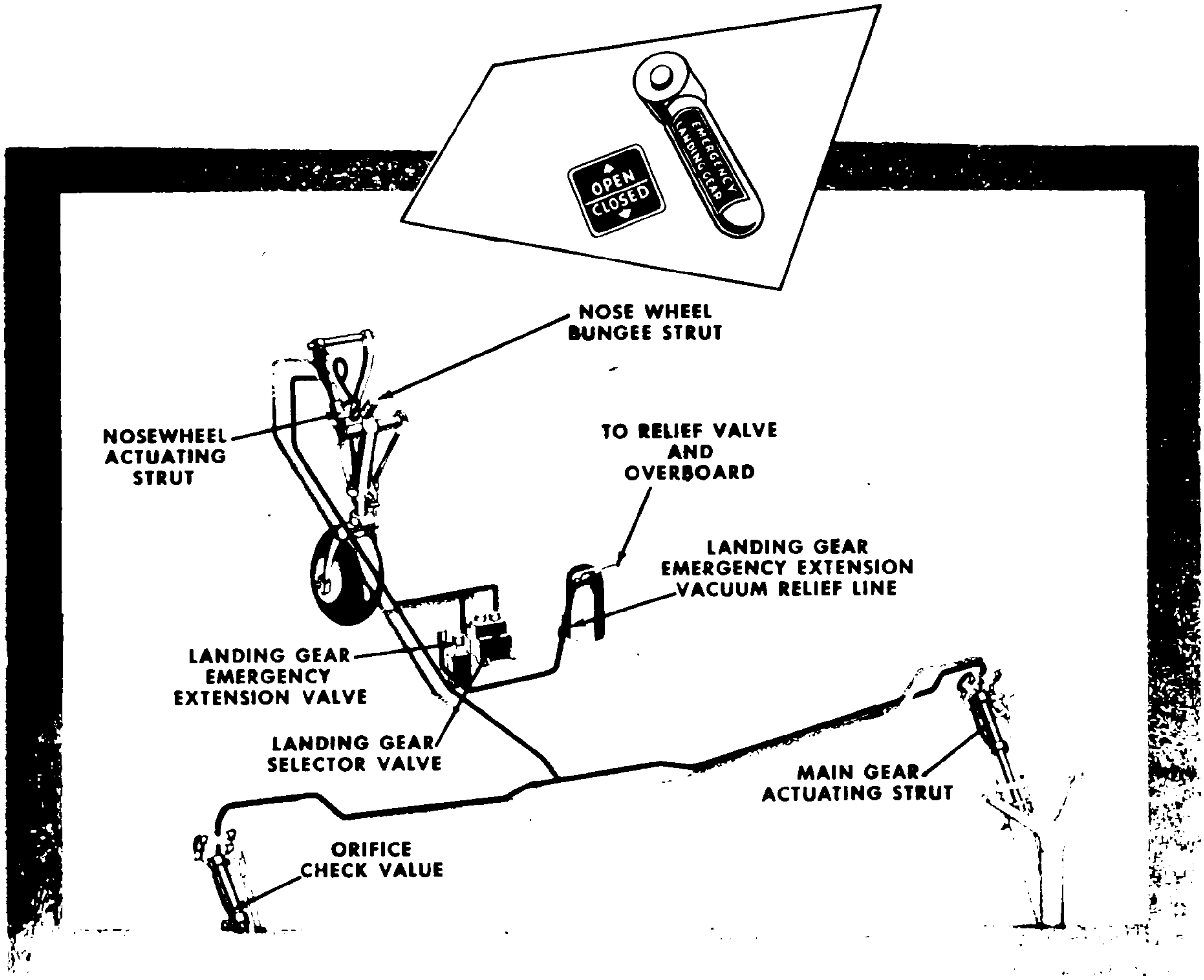
The hand pump provides an auxiliary source of power for the system. Use the hand pump if the engine-driven pumps fail, or if you need pressure on the ground while the engine-driven pumps are not working.



Wing Flap Hydraulic System

The flaps are operated entirely by a slide type selector valve. To open the valve, operate the flap lever on the pedestal; move the lever to full UP or full DOWN; and stop the flaps at the desired position by returning the control lever to OFF. Do not meter the action of flaps by partial operation of flap handle. Returning the lever to OFF stops the flow of fluid. Constant flow valves determine the speed at which the flaps operate and keep them synchronized with each other. The struts which operate the flaps, installed at each end of each flap, are conventional 2-way operating struts, composed of a cylinder and piston assembly. A relief valve in the line returns pressures above 3750 psi, built up by heat expansion, to the return port of the manifold.

Late airplanes have a mechanical bus system instead of the constant flow valves. This provides a more positive means of controlling equalized flap movements. On airplanes with this modification, however, you must keep the wing flap control lever in the UP position at all times when the flaps are up. Do not leave in the OFF position. Also, do not leave flaps in full down position for longer than 15 minutes.



Landing Gear Hydraulic System

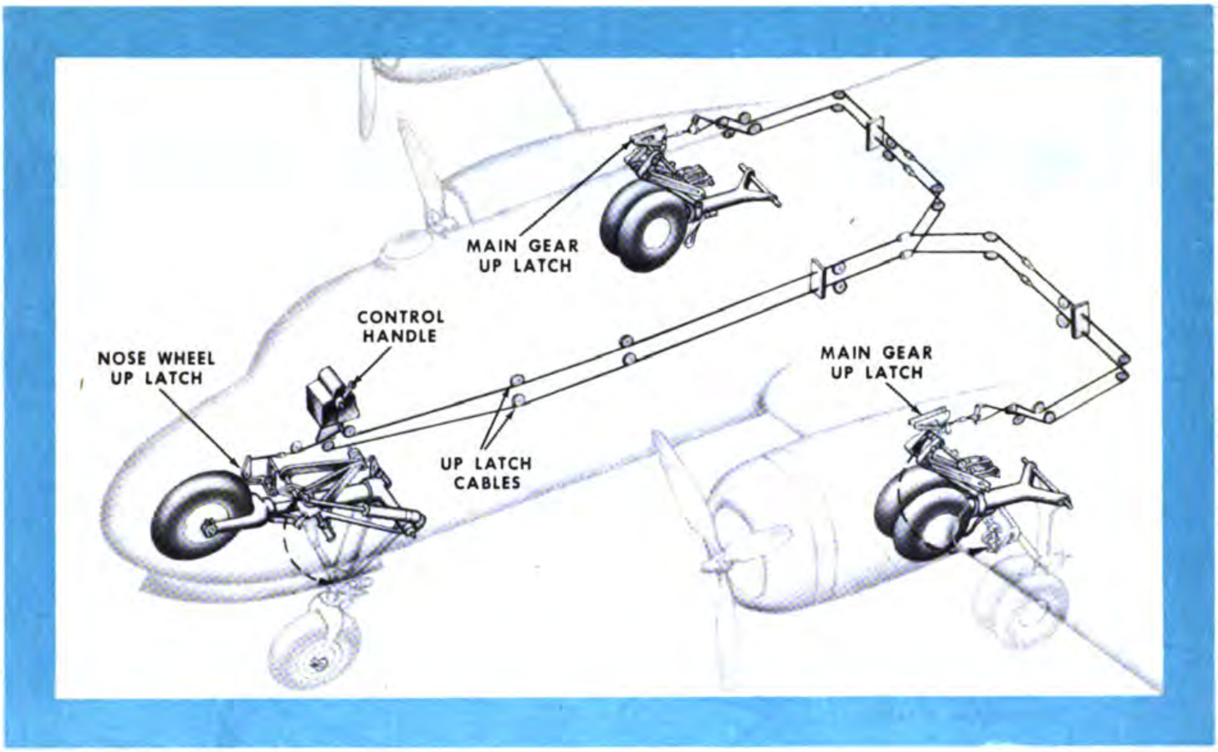
The landing gear is hydraulically retracted and extended under full system pressure. The selector valve on the control pedestal controls the flow of fluid to both main and nose gear. With the control valve at NEUTRAL, fluid is trapped in the lines, locking the gear either up or down.

The main and nosewheel gear actuating struts are conventional 2-way operating struts of piston and cylinder assemblies. A nosewheel bungee strut, at the top of the nosewheel shock strut, is attached to the down-latch. Hydraulic fluid is admitted to one side of the bungee piston only, for the purpose of breaking the knee joint of the drag links to start the actuating strut in the retraction operation. When the gear is lowered, no fluid pressure is applied on the bungee piston. When the gear lowers, the springs, on the opposite side of the bungee piston, force the down-latch into down position.

A temperature relief valve relieves the landing gear system up- and down-lines of excessive pressures built up by thermal expansion of the fluid.

Landing Gear Emergency Extension Valve

An emergency landing gear extension valve is built into the system so that in case the landing gear control valve fails, the gear can be lowered into latch position by relieving fluid from the retracting side of the cylinder. The emergency landing gear extension valve handle on the copilot's side of the control pedestal operates the valve.



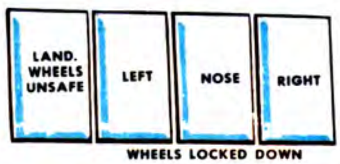
Landing Gear Safety Latches and Warning Lights

1. **Gear up.** Upon full retraction, the main gear and nose gear snap mechanical latches into place. This prevents the gear from extending in flight in case of hydraulic pressure failure on the UP side of the retracting piston. There are pins in these latches, stressed to shear at approximately 800 pounds. To extend the gear normally, it is necessary to unsnap the latches first before applying down pressure. Otherwise the hydraulic pressure shears the latch pins.

If the up-latch were accidentally snapped into place while the airplane was on the ground with gear extended, the gear would smash the latches as it came up during flight. To prevent shearing or smashing the latches, the latch handle and landing gear lever have been incorporated into one control lever on later ships and the latches work automatically.

In the gear UP and LATCHED position, no warning lights show, but the warning horn blows if you retard any or all of the throttles.

2. **Gear moving—up or down.** When the gear is moving, red warning lights on the main instrument panel go on, and, with the throttles retarded, the warning horn blows. The red lights go out only when the gear is full UP or full DOWN, and latched. The horn stops blowing, with throttles retarded, only when the gear is down and latched.



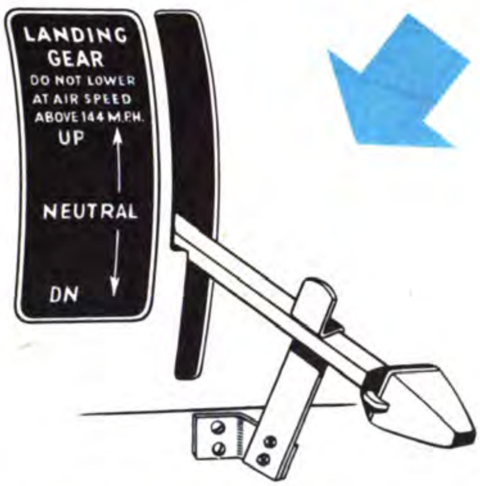
3. **Gear down.** When the gear is down and latched, green lights on the main instrument panel go on.

On the C-54B and subsequent series, there is a micro-switch contact on the landing gear lever which causes the green lights to go on only when the landing gear lever is placed in the full DOWN position. If the gear handle is moved out of the full DOWN position, the green lights go off and the red lights come on.

The main gear is locked in the full DOWN position by means of a safety latch, which operates through a series of lugs on the lower drag link and on the safety latch lever. The latch lever is held in place by the last inch of travel in the actuating strut, and by the action of the double spring bungee which keeps the latch engaged as long as the back pressure in the landing gear hydraulic system does not exceed 50 psi.

The nosewheel is locked in the full DOWN position by two small locking links which are connected between the knee joint of the upper and lower drag links and the yoke on the shock absorber strut.

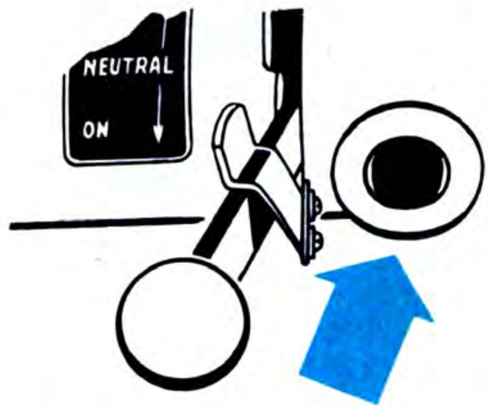
There is a mechanical thumb latch across the landing gear control lever in the flight compartment, which you must press aside before



you can move the handle out of the full DOWN position. This is one of the safety features which prevents accidentally knocking the lever out of the DOWN position.

A solenoid type safety lock pin is placed across the landing gear lever slot in the flight compartment, to prevent an accidental retraction while the airplane is on the ground. As long as weight compresses the main gear, this solenoid lock pin remains in place and makes it mechanically impossible to move the gear handle up. When the airplane is airborne, and weight comes off the gear, this pin clears the landing gear lever slot.

In case the solenoid does not retract the pin, there is a hole in the control pedestal adjacent

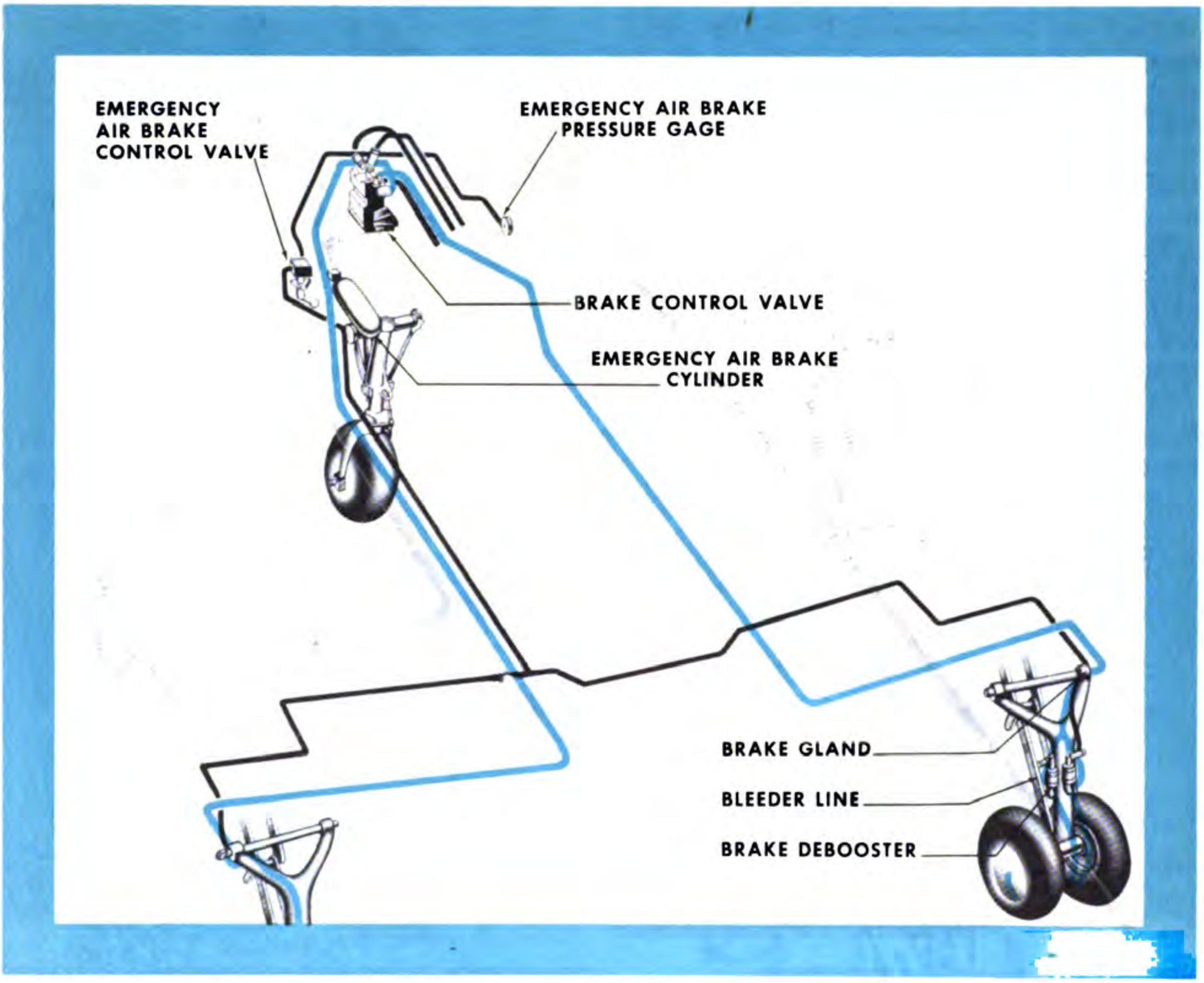


to the landing gear lever, through which you can shift the pin out of the way with your finger.

CAUTION:

If the gear is extended for a period of 15 minutes or longer in the air, it is possible to burn out the solenoid which actuates the safety lock pin.

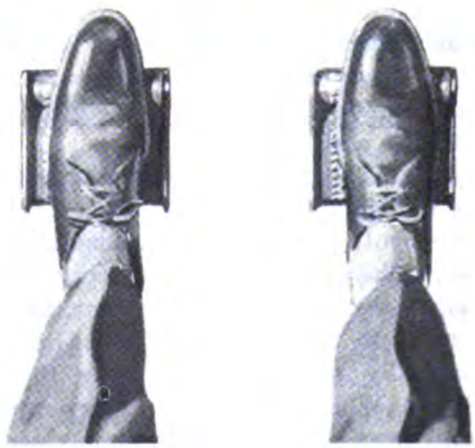
This solenoid safety lock pin is another of the safety features which prevents accidentally knocking the lever out of the DOWN position.

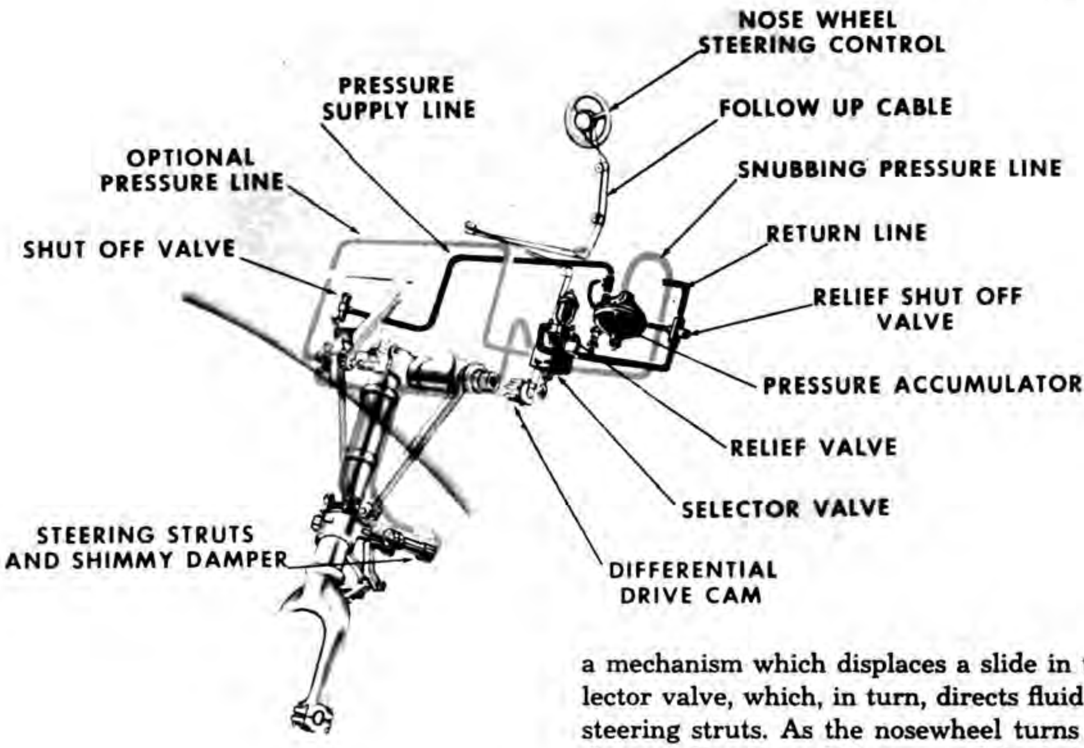


Hydraulic Brake System

Each wheel of the main landing gear has two hydraulic disc-type brakes. Through the action of the brake selective relief valve, pressure is supplied to the brake control valve as long as there is fluid pressure in the hydraulic system. Likewise, the hand pump pressure goes first to the brake control valve.

The brakes themselves operate under a reduced pressure of 390 to 410 psi with brakes fully applied. Brake deboosters accomplish this pressure reduction. In the C-54E and subsequent airplanes there is a pressure accumulator for the brake system and a separate brake accumulator pressure gage. Toe pressure on the rudder pedals operates the brake control valve. You set the brakes for parking by applying the parking brake lever, which causes cable operated cams to act on spring tuning-fork levers of the brake control valve.





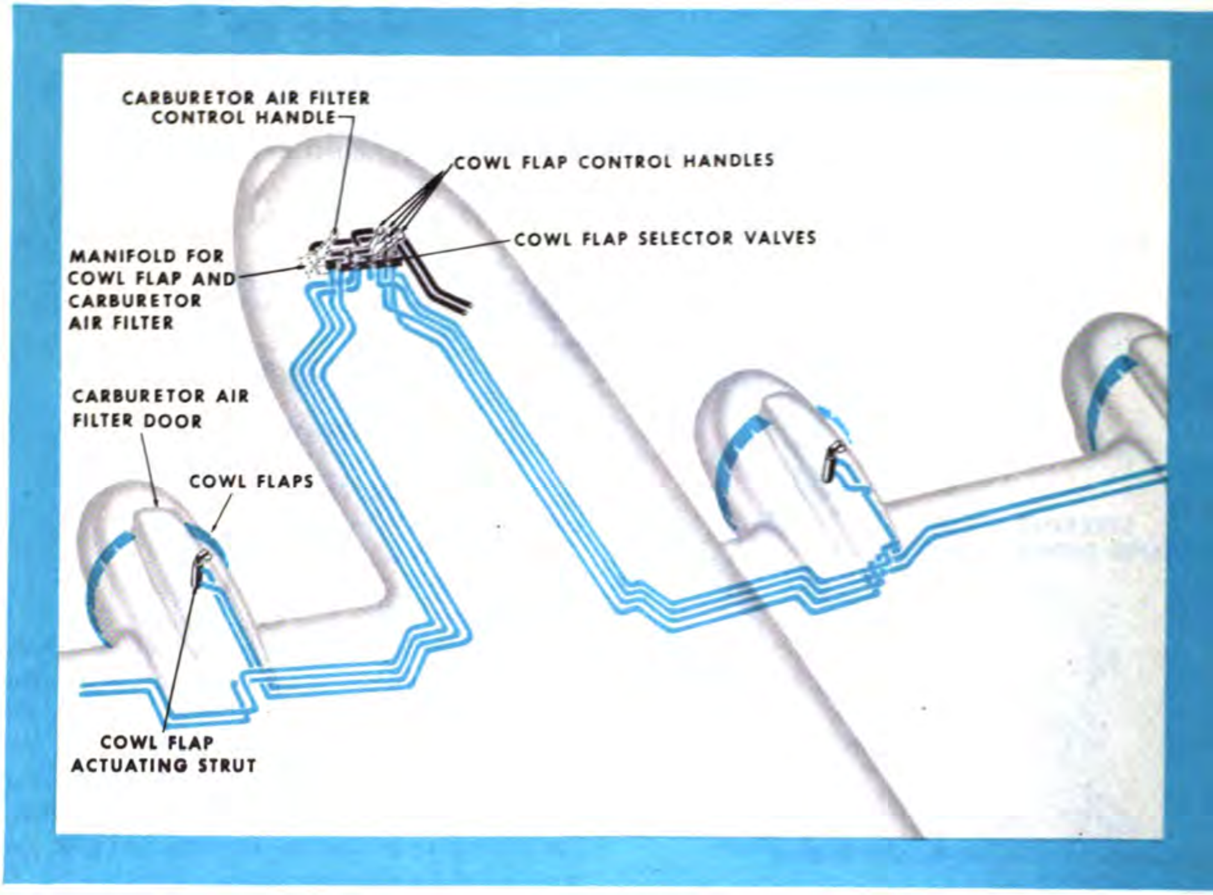
Nosewheel Steering Hydraulic System

The nosewheel is steerable from the flight compartment through a combined hydraulic and mechanical system. The system operates only when the airplane is on the ground, when the system pressure is automatically released to the steering selector valve. Maintenance of steering system pressure by the separate accumulator results in a snubbing action on the steering struts, which damps and relieves any tendency for the nosewheel to shimmy during taxiing.

A shut-off valve operates from the nosewheel torque links. When the airplane is on the ground the shock strut is compressed and a control opens the shut-off valve to provide pressure to the selector valve. When the airplane takes off, and weight is lifted from the nosewheel, the valve closes and cuts off the pressure supply to the steering selector control.

The selector valve is controlled by cables from the nosewheel steering wheel in the flight compartment. Movement of the wheel operates a mechanism which displaces a slide in the selector valve, which, in turn, directs fluid to the steering struts. As the nosewheel turns in the desired direction, follow-up cables bring the selector valve back to neutral. This stops the flow of fluid completely when the nosewheel has moved to a position corresponding to the position of the steering wheel.

A steering relief valve maintains a snubbing pressure of 150 psi in the accumulator and on the steering struts. A steering relief shut-off valve permits fluid to flow from the steering relief valve after the 150 psi snubbing pressure is reached. During flight the steering relief shut-off valve is closed, preventing any possible relief valve leakage, which might lower the snubbing pressure and allow nosewheel shimmy when the airplane lands.



Cowl Flap Hydraulic System

The cowl flap system consists of four control valves, four actuating struts, and connecting lines. You move each set of flaps the desired amount by opening the corresponding control valve. When the flaps reach the desired position, you put the control valve in the OFF position. This traps the fluid on both sides of the actuating strut and locks the flaps in place. To close the flaps, place the control valve in CLOSE position, and return it to OFF when the flaps have closed. In the TRAIL position, both ports of the struts are connected to the return line and the flaps are permitted to assume a balancing attitude with the airstream. On some airplanes, flap position is indicated by a pointer on each top inboard flap, visible from the flight compartment. Each pointer moves against a scale painted on the side of the carburetor airscoop fairing.

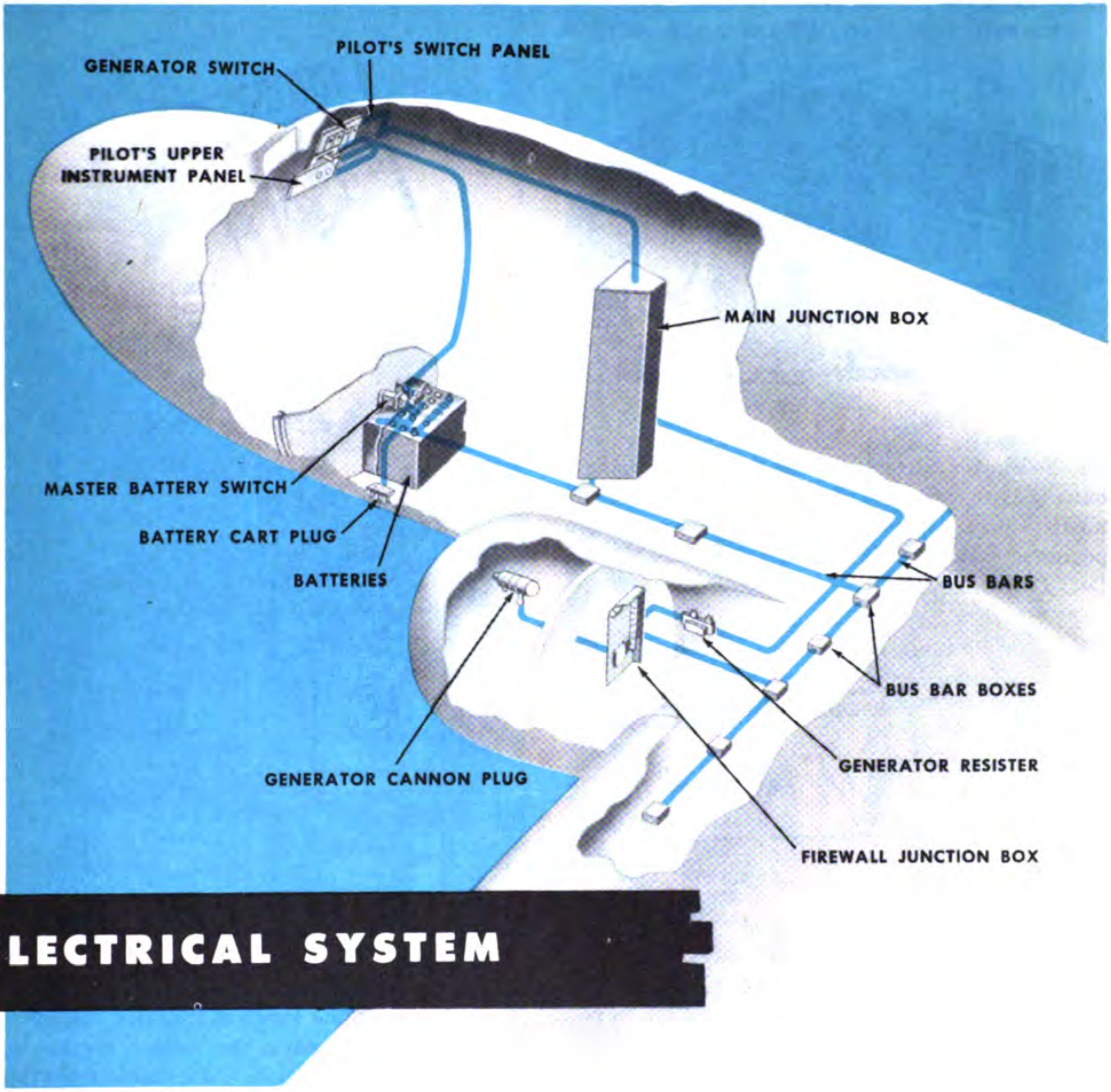
Carburetor Filter Door System

The carburetor filter doors operate hydraulically, the system consisting of selector valves, actuating struts, and connecting lines. After setting the filter doors, return the control handle to the OFF position to lock them in place.

Windshield Wiper System

The windshield wiper system operates under reduced pressure from the main system. Control is by a needle valve on the copilot's control panel. The system on the E and subsequent series is controlled by two needle valves, one under the pilot's radio volume control box, the other under the copilot's control box. A pressure reducer drops the 3000 psi main system pressure to the 750 to 1000 psi required by the wiper hydraulic motor unit.

NOTE: Do not operate the windshield wiper blades against a dry windshield.



ELECTRICAL SYSTEM

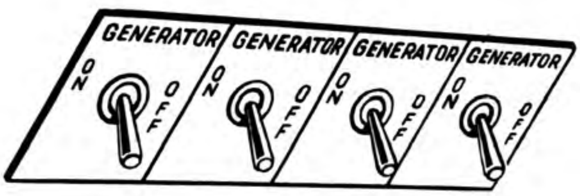
Most of the airplane's electrical equipment operates on 24-volt direct current. The remote indicating compass and the autosyn instruments require 26-volt, 400-cycle current. The directional radio compass receiver and loop motor and the driftmeter operate on 115-volt, 400-cycle current. The airplane structure is the ground return of all circuits, except those near the magnetic compass.

Batteries

Two 12-volt batteries, connected in series, are located on spring-loaded elevators housed in the belly of the airplane just aft of the nosewheel well. A battery cart plug-in receptacle is adjacent to the batteries, with British and Army type adapters kept in a canvas bag in the nosewheel well. There is a hot air tube to raise the battery temperature in cold weather.

Some models have an OFF-ON toggle switch

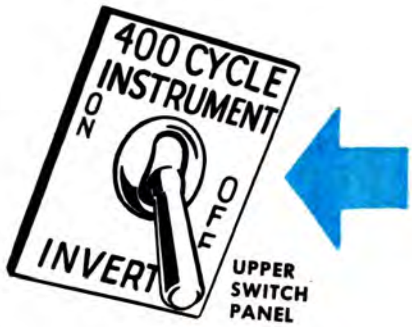
for the master battery switch, with the outside battery cart making its own connection. Other models incorporate a slide handle with three positions: BATTERY CART, AIRPLANE BATTERY, and OFF.

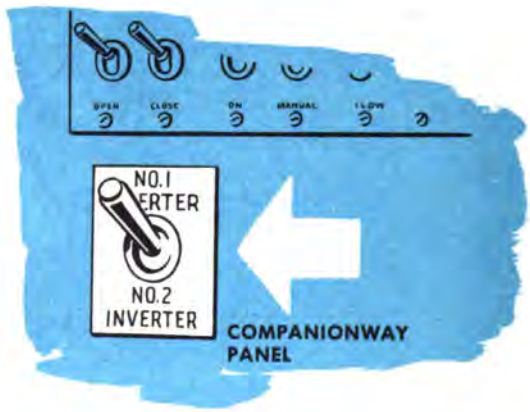


The generators deliver 100 amperes of direct current at 28 volts. Four voltage regulators in the main junction box control generator output. You can cut out any one of the generators by a switch on the upper instrument panel. Don't cut out a generator unless it is out of order. The voltammeter on the upper instrument panel registers the output of any generator, through a selector switch.

Inverters

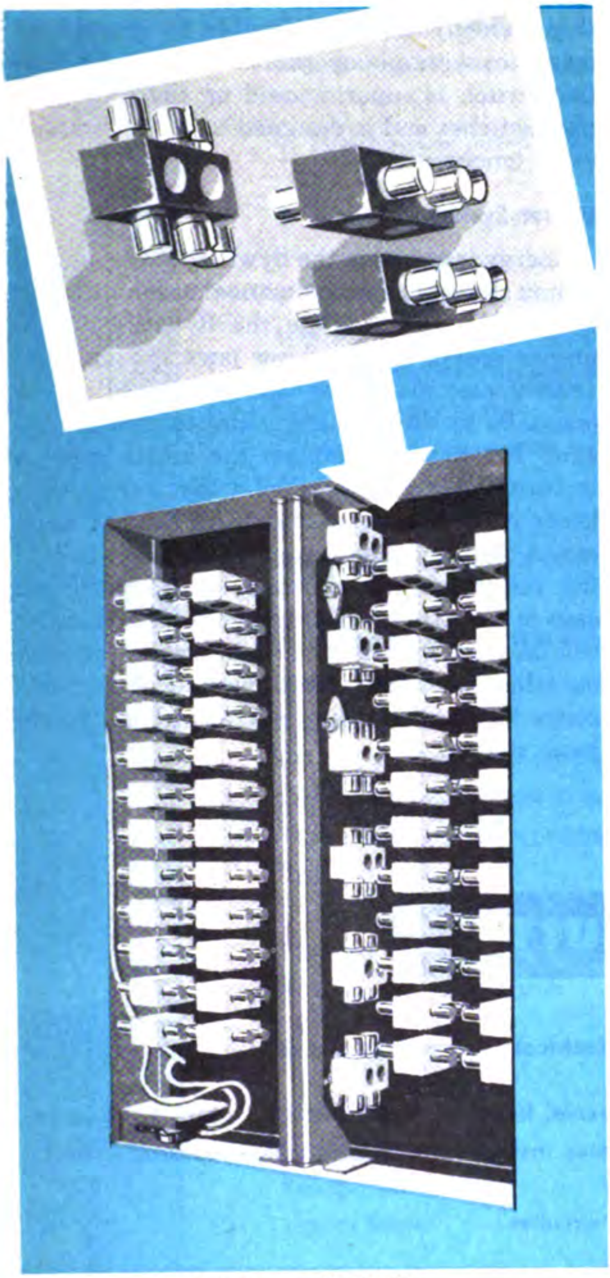
Either of the two rotary inverters supplies both 26 and 115 volts at 400 cycles. The inverters are turned on by a switch on the upper switch panel, and a selector switch on the panel in the companionway permits the use of either inverter.



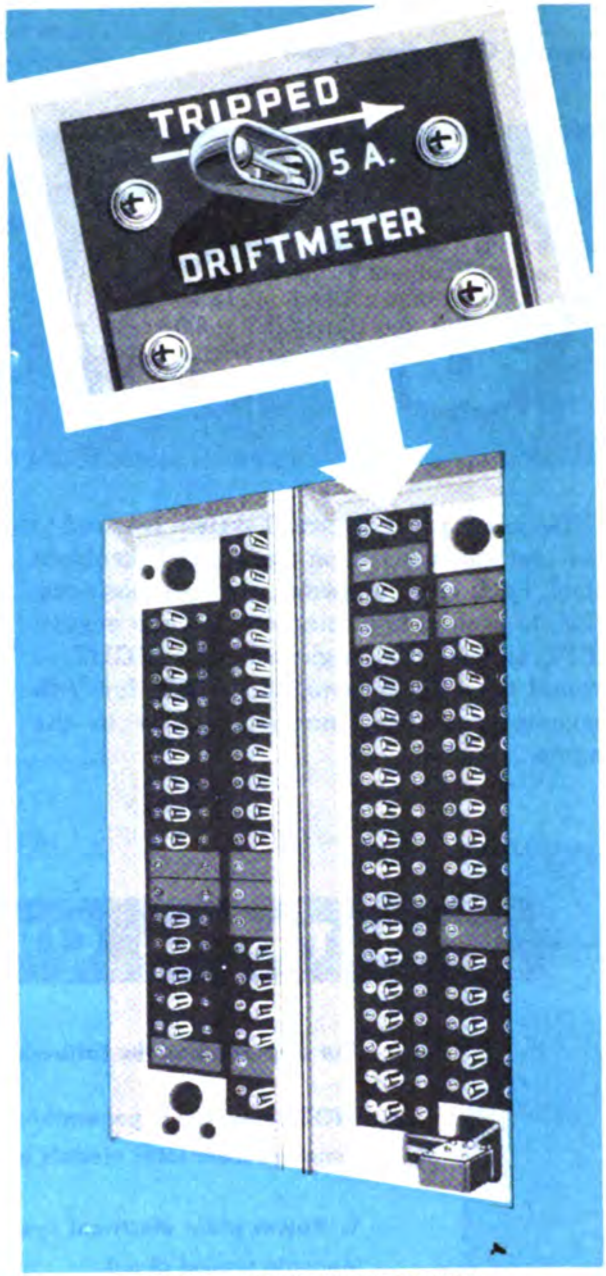


Main Junction Box

Electrical power is delivered to the main junction box in the forward lavatory compartment. The box contains the voltage regulators and the fuse panel, which is accessible from the panel in the companionway between crew's compartment and flight compartment. The fuse box contains all fuses except those for the generator, communications equipment, and (on some series) landing lights. Diagrams on the inner side of the fuse box doors identify the fuses. Each fuse is equipped with a rubber plug by which it can be removed, with an extra fuse fitted into the plug. The main junction box also contains numerous relays, resistors, switches, and a box for spare lamps with a diagram identifying the lamps.



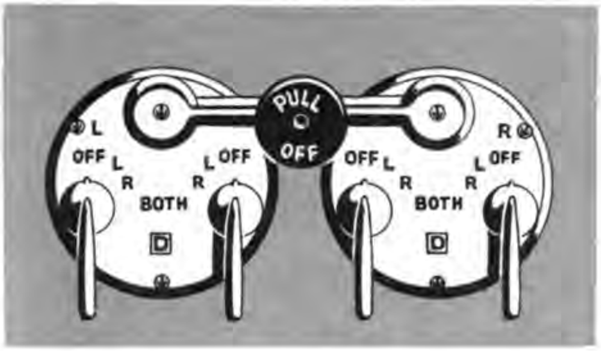
A SERIES FUSE PANEL



B SERIES CIRCUIT BREAKER PANEL

NOTE: In some later C-54B's and subsequent series airplanes, circuit breakers replace all 1-ampere to 50-ampere fuses. The re-set switches for these circuit breakers are on the face of the main junction box. Circuit breakers for the radio equipment and for the interphone system are under the radio operator's table.

Magneto Grounding Circuit



The power plant electrical system is wired to four ignition switches on the upper instrument panel. Each ignition switch has four positions: OFF, to ground both magnetos on one engine; LEFT, to ground the right magneto; RIGHT, to ground the left magneto; and BOTH for both magnetos to supply normal ignition to the engine.

There is a master ignition switch on some ships which makes it possible to ground all magnetos with one operation. This master ignition switch is superimposed on the four ignition switches and is designed to cut all engines in an emergency.

Starter System

Energy is stored in the flywheel of the Jack & Heintz starter, either by manual cranking or by its electric motor. When the flywheel attains proper speed, the meshing jaws are engaged (either electrically by the mesh switch, or manually by the meshing cable) to turn the engine. The flywheel imparts the initial impetus to turn the engine over, and the starter then keeps it turning long enough for normal starting. A multiple-disc clutch in the last stage of the reduction gear releases automatically in case of backfire or electric overload. A booster coil on some models, and an induction vibrator on others, supplies a hot spark to the spark-plugs for starting. They operate off the mesh-boost switch.

ELECTRICAL CIRCUITS

The airplane has the following electrical systems and circuits:

(NOTE: This list is generally inclusive. It includes some circuits which have been removed from later models and also includes the circuits which replaced them.)

1. Power plant electrical system circuits:

Magneto ground circuit
Auxiliary ignition system circuit
Starter system circuit
Propeller feathering system circuits
Solenoid valve circuits (oil dilution, priming, heating, and ventilating)

2. Ice elimination system circuits:

Wing de-icer circuit
Propeller anti-icer circuit

Carburetor and windshield anti-icer circuits
Pitot anti-icer circuit

3. Fuel booster pump circuit

4. Fuselage oil transfer pump circuit

5. Warning circuits:

Landing gear lever safety latch circuit
Landing gear warning light and horn circuit
Door warning circuits
Oil quantity and pressure warning circuits
Dimming relay circuits
Fire warning circuits
Crew signal light circuit (C-54B)

6. Instrument electrical circuits:

Liquidometer circuits (fuel quantity, alcohol quantity)
Engine thermocouple circuit
Oil and carburetor air temperature circuits
Outside air temperature circuit
Tachometer and synchroscope circuits
Drift meter circuit
Remote indicating compass circuit
Fuel and oil pressure indicating circuits
Wing flap autosyn circuits

7. Lighting circuits:

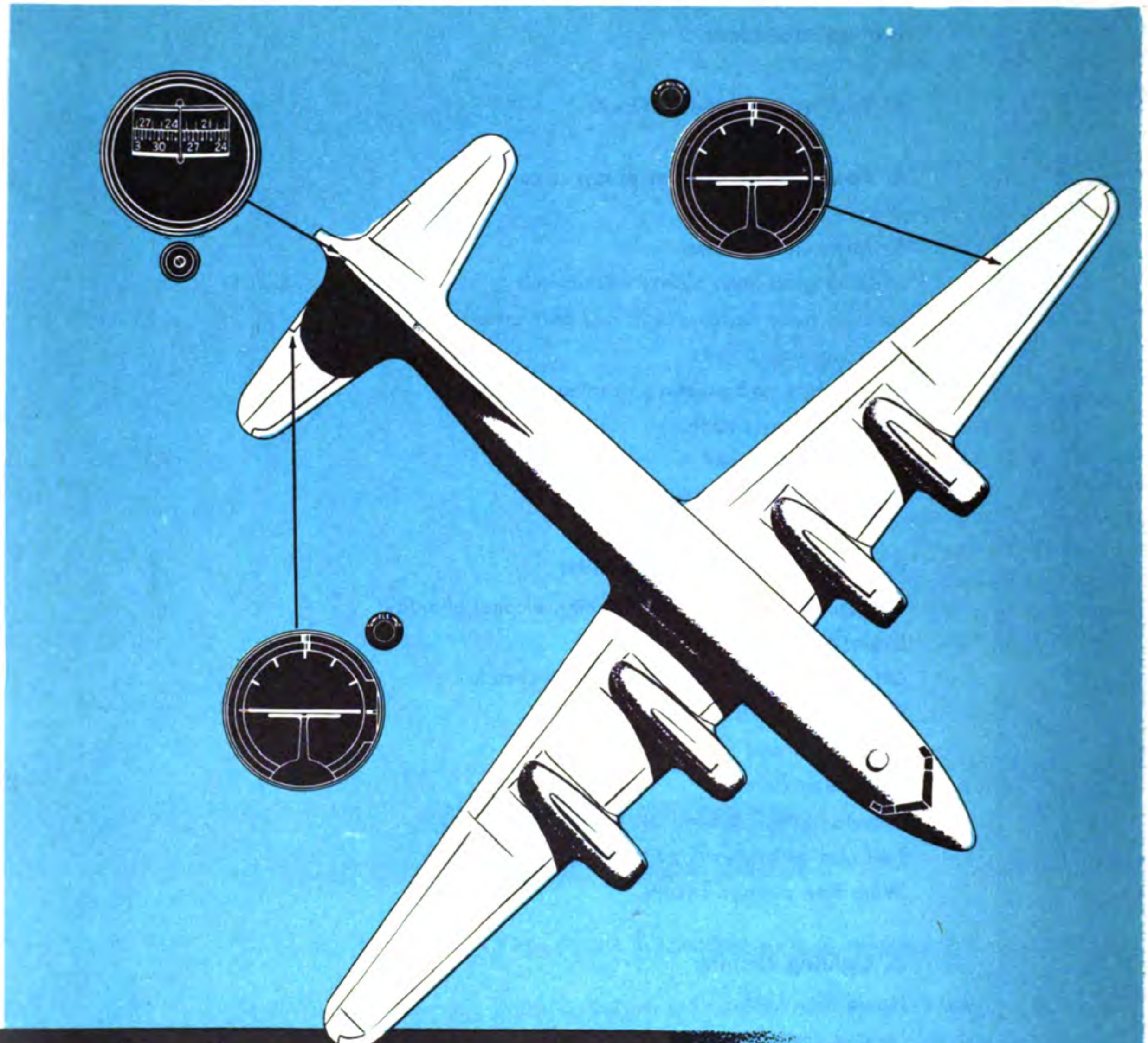
Navigation lights
Landing lights
Recognition lights
Interior lights

8. Heating and ventilating control system circuits:

Stewart-Warner heater electrical system circuit
Surface combustion heater electrical system circuit

9. Miscellaneous circuits:

Bailout alarm bells circuit
Cigar lighter circuit
Electrically heated clothing circuit
Aldis lamp circuit



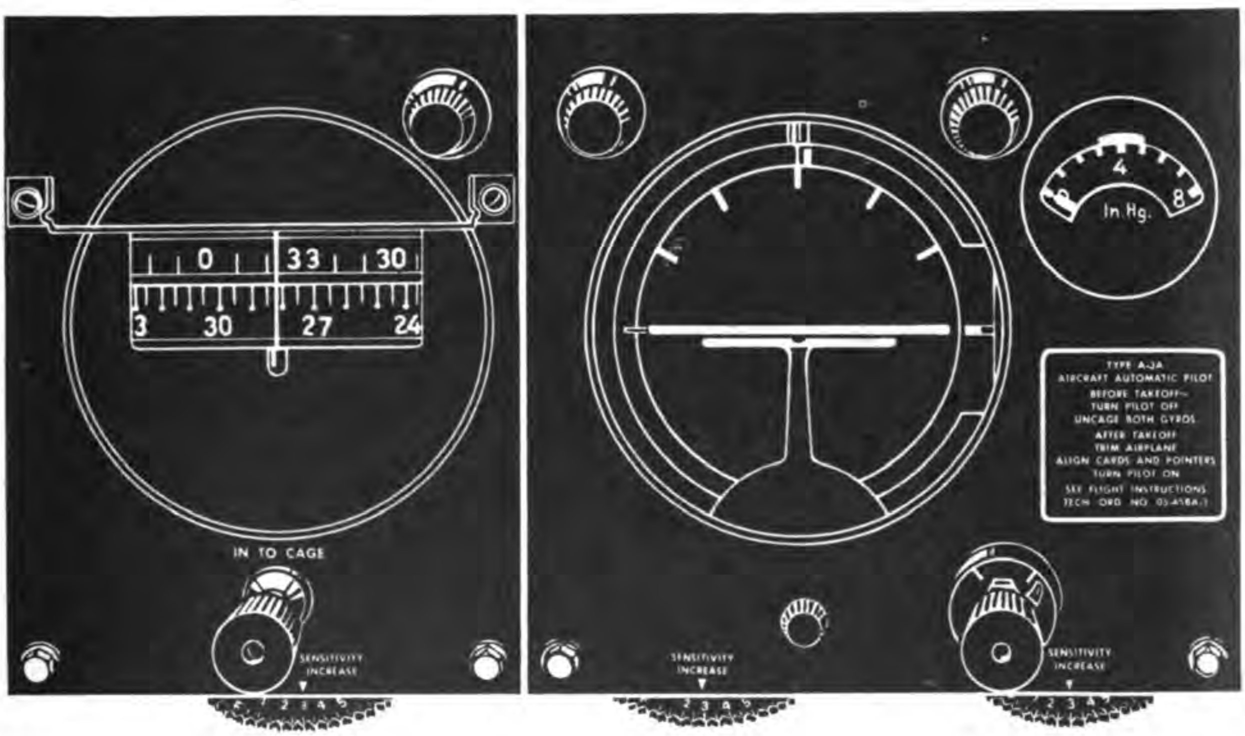
AUTOMATIC PILOT

The C-54 has one of two types of automatic pilot: the Sperry A-3 or the Jack & Heintz A-3A. These are identical with the exception of their speed controls. The knobs which control the hydraulic speed control valves of the A-3 autopilot are on the control pedestal. The A-3A employs airspeed valves, regulated by discs on the bottom of the gyro control mounting unit on the instrument panel.

The autopilot permits gyroscopic action to operate the surface controls of the airplane and keep it on a set course. The gyroscopic units operate from the instrument vacuum system, on a suction of 4.2" Hg. Hydraulic oil pressure to operate the servo actuating units is created by an engine-driven oil pump on No. 2 engine. Operating pressure is 125 psi, + or —5 psi. The servo units act on the surface controls to correct the course or attitude of the airplane.

The speed valves in the A-3 autopilot control the sensitivity of the autopilot by regulating the return flow of oil from the units to the hydraulic reservoir. Turning a knob clockwise closes the valve and produces slower control. Counter-clockwise opens the valve and produces faster action. The speed valves in the A-3A autopilot control sensitivity by governing the airflow through the gyro units.

HYDRAULIC OIL PRESSURE GAGE ON MAIN INSTRUMENT PANEL
AUTOPILOT OIL SHUT-OFF ON COPILOT'S AUXILIARY PANEL



SERVO CONTROLS ON PEDESTAL

Operation of the Autopilot

1. Trim airplane to fly hands-off.

2. Check vacuum for 3.75" to 5" Hg.

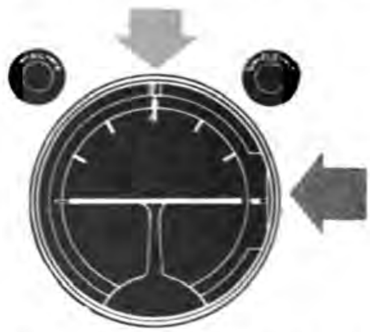
3. Check servos for OFF.

4. Turn oil pressure valve ON, and check autopilot oil pressure gage for 125 psi, + or —5 psi.

5. Check to see that the autopilot horizon is uncaged and erect.

6. Set and uncage directional gyro controls.

7. Turn upper rudder knob on directional gyro unit, and align upper card with lower card.



8. Turn aileron knob until its follow-up index matches the zero point on the banking scale at the top of the autopilot artificial horizon.

9. Turn elevator knob until follow-up index matches the elevator alignment index at the side of the artificial horizon.

CAUTION:
Don't align follow-up index with horizon bar.

10. See that all three speed control valves are turned counter-clockwise to 3 or AVERAGE on the dial.

CAUTION: If you turn speed controls full clockwise (full slow), the controls lock. Operate with the controls as fast as possible, consistent with comfortable flight.

11. Re-trim airplane to fly hands-off.

12. Keep hand and feet on controls to prevent sudden movement, and slowly move servo controls to ON position (down), engaging the autopilot.

13. After the autopilot takes over, it may be necessary to rotate rudder, aileron, and elevator knobs slightly to get exact course and altitude.

14. Set speed controls for best flight by turning toward SLOW until oscillation stops. Remember that full SLOW locks the controls.

15. Disengage the autopilot every 2 hours and re-trim airplane. This is necessary to compensate for changes in flight altitude, power, and load shifts which affect the trim.

16. Periodically check on directional gyro units, which have a slight amount of normal precession. Check with compass regularly.

17. While flying in icing conditions, disengage autopilot at short intervals to check for free movement of controls, and to insure a supply of warm oil to the autopilot.

AUTOPILOT DON'TS

Don't use autopilot below 1500 feet.

Don't make turns or changes in altitude with autopilot engaged. Disengage servo before these maneuvers.

Don't use autopilot when wing de-icers are working, unless you can turn it off frequently to check trim.

Don't use autopilot unless engines are delivering normal power.

Don't use the autopilot as a gust lock.

Bleeding the Autopilot

Before flight, bleed the autopilot by following instructions 1 through 12 (omitting trimming) under **Operation of the Autopilot,** with these additions:

1. Check control movement for springy feeling caused by air or slack cables.
2. Check indices for movement. If they move, there is air in the system.
3. Turn servos OFF.
4. Move controls full length of travel with oil supply ON.
5. Set up autopilot again and re-check for springy feeling and index movement.
6. Repeat if necessary.

RADIO EQUIPMENT

All radio equipment on the C-54 is standard government equipment. Most of the units which do not require the immediate attention of the radio operator are mounted at convenient positions in the airplane other than the radio operator's station.

Remote radio controls are accessible to the pilot and copilot.

There is an interphone system provided, which provides for communication between the various stations of the airplane. The interphone system also provides switching facilities which connect it with the liaison, command, and radio compass sets. The four interphone jackboxes are mounted in the following positions: beside the pilot, beside the copilot, above the radio operator's table, and forward of the main cargo door in the main cargo compartment.

Equipment Provided

Radio equipment includes the following:

1. Command set, type SCR-274
2. Liaison set, type SCR-287
3. Remotely controlled antenna reel assembly, H42G4623
4. Radio compass, type SCR-269
5. Marker beacon receiving equipment, type RC-43
6. Interphone, multiplace, type RC-36
7. Filter equipment, type RC-32 or RC-198
8. Emergency transmitter, type SCR-578
9. Identification equipment, type SCR-595, SCR-695, or SCR-515
10. Frequency meter, type SCR-211
11. VHF command radio set, type SCR-522-A
12. Radio altimeter, type SCR-718
13. Glide path receiver, type R-89/ARN-5A
14. Static dischargers, type AN/ASA-1A

Radio Junction Box and Power Source

The radio junction box is directly behind the radio operator's table. A fuse panel in the lower right corner of the junction box is easily accessible through a door in the junction box cover.

On airplanes with the master battery selector switch, the switch must be in either BATTERY CART or AIRPLANE BATTERY position before any of the units of the communications equipment can function.

On airplanes with the toggle battery switch, the switch must be ON before any of the units can function, unless a ground source of power is connected.

The 115-volt, 400-cycle alternating current for the radio compass is drawn from the main junction box fuse panel through a 5-ampere fuse. The instrument inverters provide the current. The instrument inverter switch must be ON before the inverters can function.

Frequency Meter

The frequency meter is a separate radio unit used for checking signal frequency. It is stowed in a container beside the dynamotor beneath the radio operator's seat. It is completely portable and self-contained and is adaptable for adjusting the transmitters and receivers to any desired frequency in the range from 125 to 20,000 Kc.

VHF Command Set

The VHF (very high frequency) transmitter-receiver radio set provides 2-way radio-telephone communication between aircraft in flight and between aircraft and ground stations.

Receiver and transmitter are mounted under the radio operator's seat. The control box is on the pilot's pedestal. The forward mast of the command antenna serves as the antenna for the VHF set.

Radio Altimeter

The radio altimeter receiver and transmitter are installed in the forward belly cargo compartment. The indicator is mounted adjacent to the navigator's station.

Glide Path Receiver

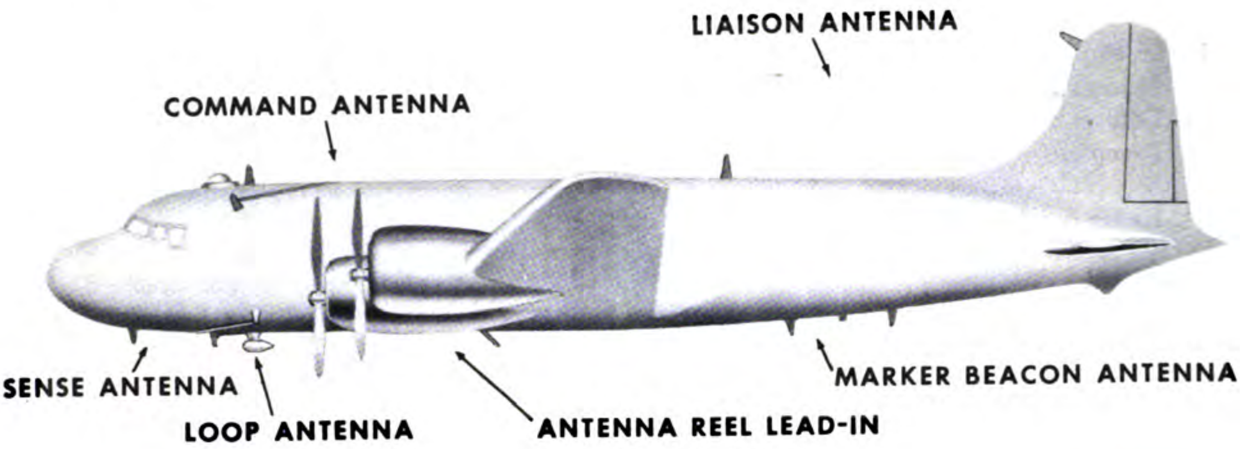
The glide path receiver is installed on a shelf in the crew's quarters above the life rafts. The indicator is on the pilot's instrument panel.

Static Dischargers

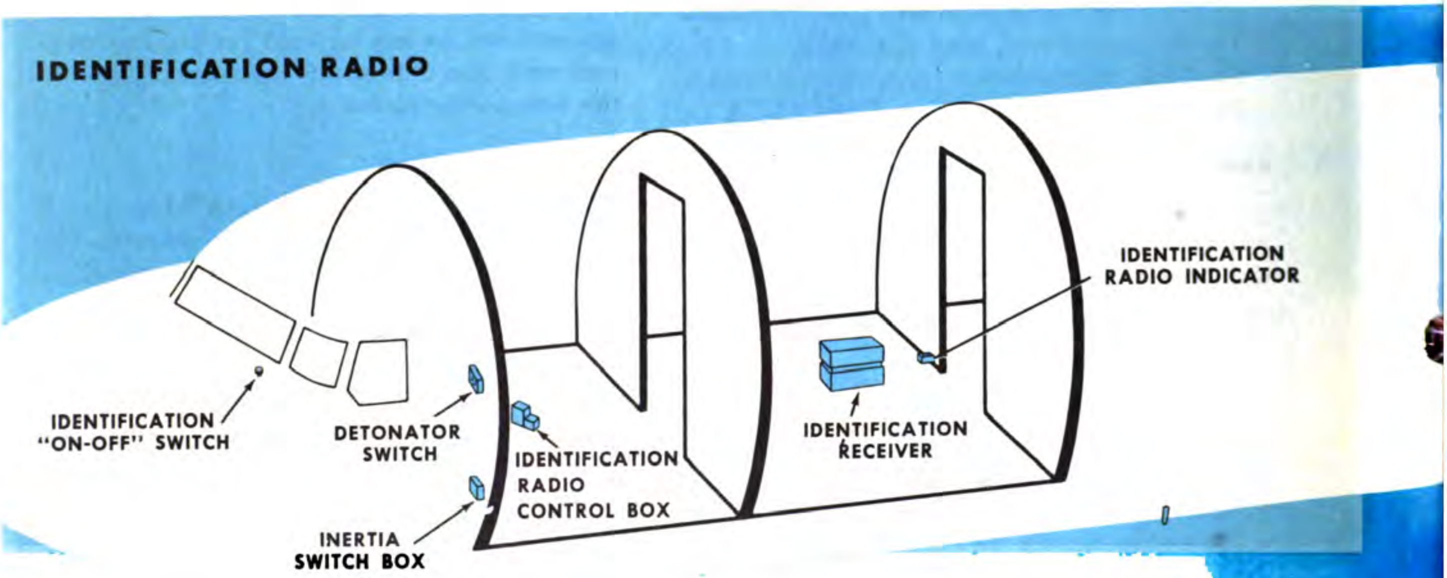
Seven static discharger assemblies are installed, one on the tip of each vertical and horizontal stabilizer and two on the under side of each wingtip.

Portable Emergency Transmitter

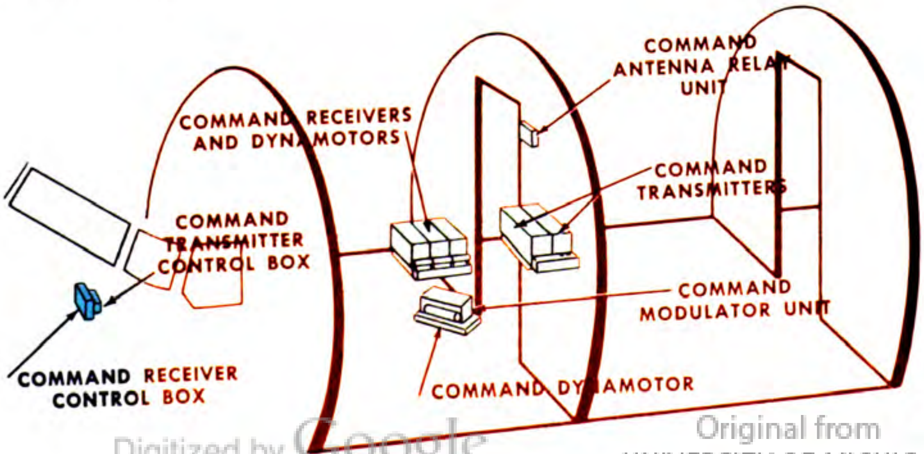
In addition to the installed radio equipment, the airplane carries a portable emergency radio transmitter. It is principally for use in life rafts, but may be used anywhere. Current is supplied by a hand turned generator. A kite and hydrogen balloon kit are furnished to raise the antenna.



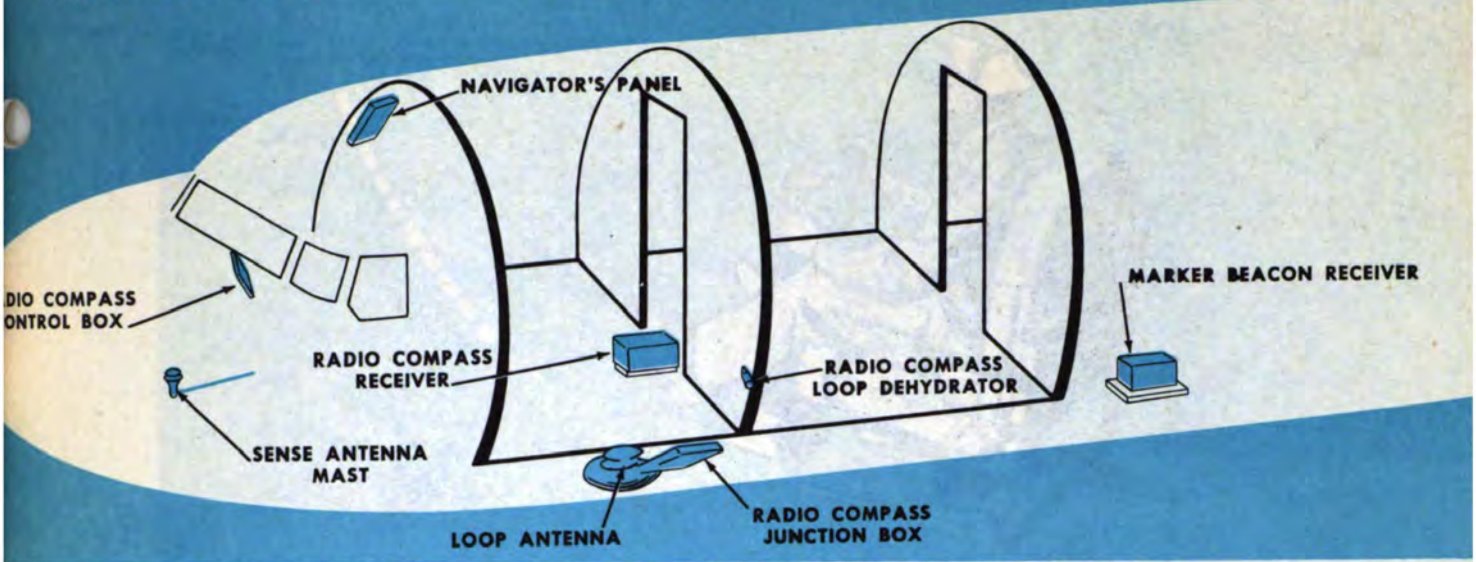
IDENTIFICATION RADIO



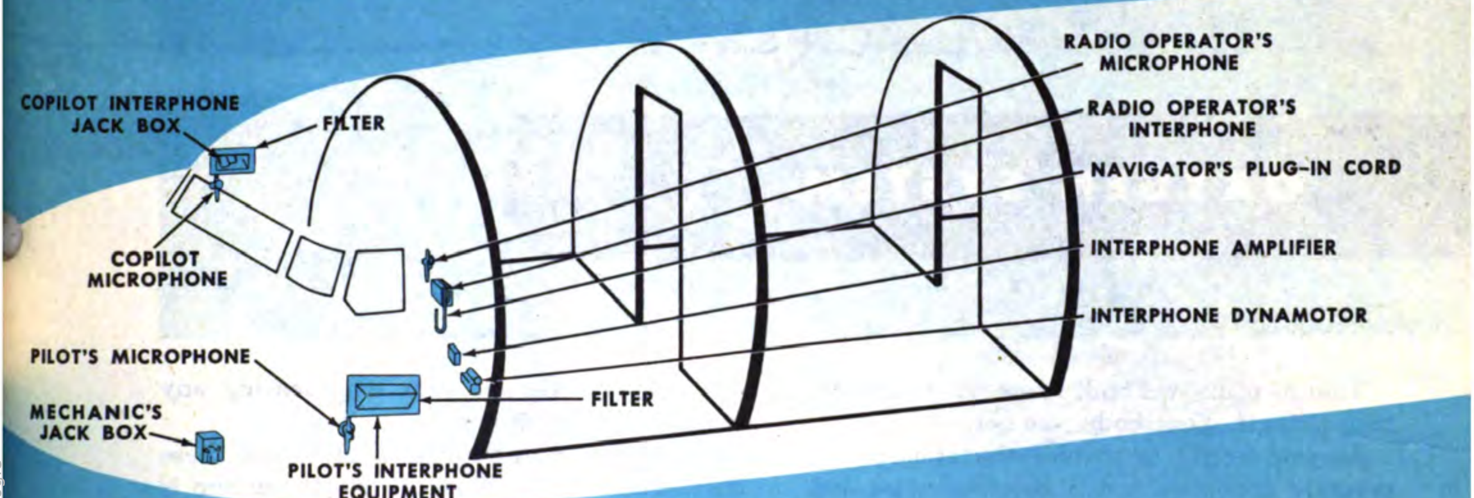
COMMAND RADIO



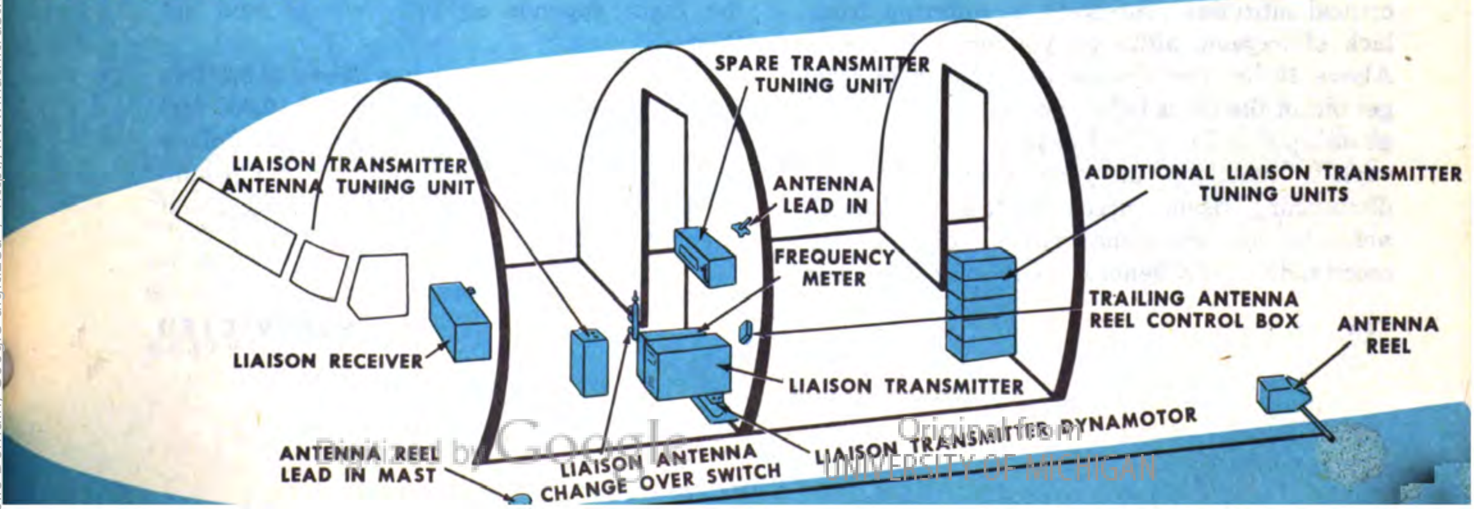
RADIO COMPASS



INTERPHONE EQUIPMENT



LIAISON RADIO



OXYGEN SYSTEM

Your airplane was built to operate at a fairly high altitude. Your body was not.

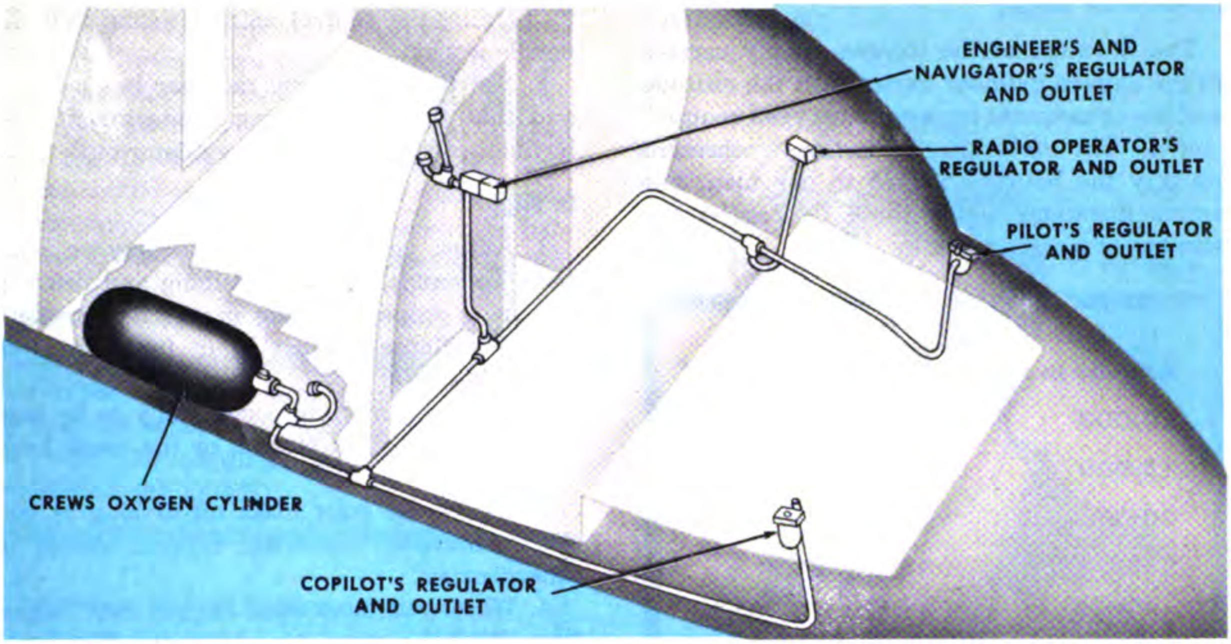
As you ascend to altitude the atmospheric pressure decreases and it becomes more and more difficult for the body to get the required amount of oxygen out of the air, until finally there isn't even enough oxygen to support life.

Now, in the C-54 you won't be going to altitudes where less than a minute without oxygen means death. But long before you reach vitally critical altitudes your body is suffering from lack of oxygen, although you don't know it. Above 10,000 feet the oxygen your body can get out of the air is below normal need. As you go on up this diminished oxygen supply causes various reactions in your body, including diminishing vision, increasing fatigue, lack of muscular and emotional control, difficulty of coordination, and general decreasing efficiency—**all usually without your experiencing any recognizable symptoms.**

You can't fly an airplane safely under these circumstances; therefore, an oxygen system is provided on the airplane to supply the oxygen which you can't get out of the atmosphere.

Since activity of any kind brings on anoxia (lack of oxygen) more quickly, it is more important that crew members have oxygen before the passengers, especially since the safety of the flight depends on your efforts, and not theirs.

This is the rule: Use oxygen above 10,000 feet on all flights, and between 8000 and 10,000 feet on flights of 4 hours or longer duration. Follow the rule. At night, use oxygen from the ground up to preserve visual acuity, since anoxia first affects the organs of night vision.



Continuous Flow Oxygen System

The oxygen system in the C-54A is of the continuous flow type, which involves the use of type A-8B oxygen mask with the inflatable rubber rebreather bag. The system includes a low-pressure oxygen tank, equipped with a shut-off valve usually installed in the forward belly compartment, manifolding, and a regulator outlet for each crew member.

The regulators incorporate a pressure gage and a flow indicator. The latter is calibrated in thousands of feet. Operate the regulator by turning the knob on it until the flow indicator needle corresponds to the altitude at which you are flying. If you think you need more oxygen, turn it up higher.

Duration of Supply

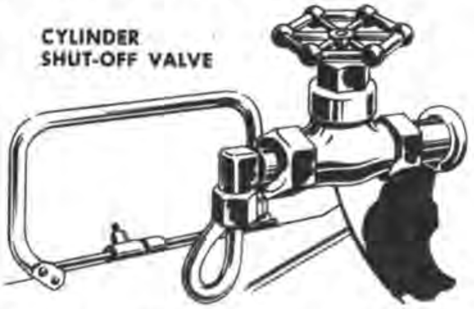
The duration of the oxygen supply carried in the oxygen cylinder varies with the altitude and the consequent increase in oxygen requirements. The following durations represent roughly the hours available to one man. For actual duration, divide these figures by the number of men in the crew.

Altitude in Feet	Man-hours Supply
10,000	76
15,000	60
20,000	50
25,000	43
30,000	37

Preflight Check

Before flights on which you are going to use oxygen, make the following check:

1. Have each crew member check his regulator control to be sure it is OFF.



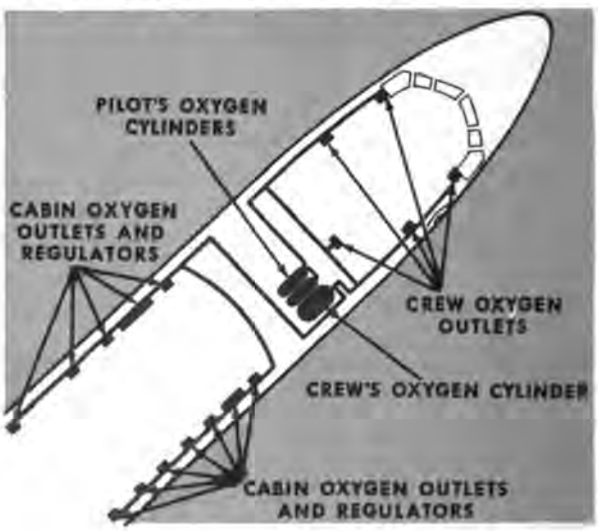
2. Turn the cylinder shut-off valve, at the mouth of the cylinder, ON.
3. Have each man check his gage and see that he has a pressure of 425 to 450 psi. This indicates that the cylinder is full, and that the regulator gage is working.
4. Close the shut-off valve and have each man watch the gage needle to see that it drops when he opens his regulator valve momentarily, indicating proper operation. Then turn the shut-off valve ON again.
5. Have each man check his flow indicator by turning the control on and seeing that the needle works.
6. See that each crew member has a mask, and that the mask tubing connector fits the bayonet connection on the regulator outlet.

In Flight

1. Adjust your mask to fit snugly on your face. To test it, pinch the tubing and draw in air. In a properly fitting mask the facepiece should collapse against your face, with no noticeable leak.
2. Check your mask occasionally to be sure that the hose is not kinked, or the mask loose on your face.
3. Don't take your mask off as long as you are at altitudes requiring oxygen, except in emergencies.
4. When you don't need oxygen any longer, turn OFF the regulator. After the flight, see that the shut-off valve at the cylinder is turned OFF.

Demand System

Changes starting with the C-54B series include the installation of a demand oxygen system for the crew and a continuous flow system for passengers. In a demand system the oxygen is furnished to the wearer of the mask each time he inhales, instead of continuously, and the flow stops as he exhales. It is a more economical system at certain altitudes.



The demand system includes cylinders, manifolds, regulators, and oxygen panels. Starting with the C-54B, extra cylinders have been installed so that the pilot has a small cylinder supply of his own. The pilot can get oxygen from the forward permanently installed crew cylinders, and also from the main cabin supply if necessary, but check valves prevent the passengers from drawing on the forward supply.

Duration of Supply

The following man-hours of oxygen are available to the crew members from the crew supply cylinder when the cylinder is charged to 400 psi, with the regulator auto-mix lever ON (NORMAL OXYGEN):

Altitude in Feet	Man-hours Supply
10,000	59
15,000	48
20,000	40
25,000	36
30,000	38

Because of the arrangement of check valves, the pilot may draw additional oxygen from the crew supply and from the cabin supply when extra cylinders are installed in the main cabin. The following approximate supply is available from the two pilot cylinders alone, when charged to 400 psi, with the regulator auto-mix lever ON (NORMAL OXYGEN):

Altitude in Feet	Man-hours Supply
10,000	15
15,000	11½
20,000	9½
25,000	8½
30,000	9

Demand Mask

The demand system employs a different mask than the continuous flow. Each crew member should have his demand mask fitted by the Flight Emergency Officer, or other trained man, because a leak is more critical in a demand mask than in a continuous flow mask.

Demand Regulator

The demand regulator supplies oxygen to your mask whenever you inhale. This is an automatic action. It also has an auto-mix lever with ON and OFF positions (NORMAL OXYGEN and 100% OXYGEN in newer models). When the auto-mix lever is ON (NORMAL OXYGEN), the oxygen is being diluted with air in the proper proportions for the altitude you are flying. When the auto-mix lever is OFF (100% OXYGEN), you are getting pure oxygen. Keep the lever ON at all times, except in emergencies, such as giving a man pure oxygen in case of shock from wounds, or to avoid breathing poisonous gases in the airplane.

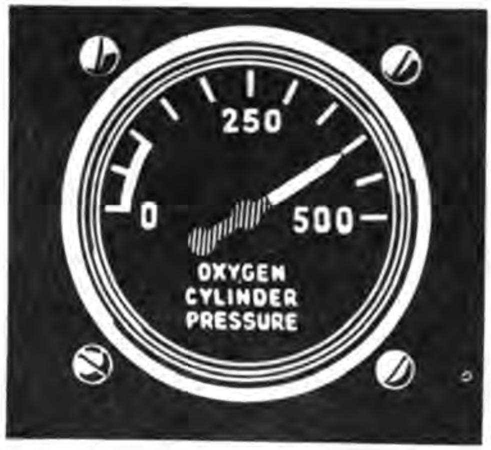
The regulator also has a red emergency knob, by which you can cause the oxygen flow to bypass the demand mechanism. Opening the

Emergency Knob

emergency valve converts the regulator to continuous flow. This is extremely wasteful of oxygen and bleeds the whole system quickly if the emergency valve is left open. Keep the emergency valve closed at all times, except in case of an obvious failure of the regulator.

Demand Panel

The oxygen panel in the demand system includes a pressure gage which indicates system pressure, and a blinker or ball-and-tube type of



flow indicator which operates when the oxygen is flowing. The regulator no longer works when the pressure gets down to 50 psi.

Walk-around Equipment

Portable oxygen equipment in the form of walk-around oxygen bottles fitted with demand regulators is provided for use when it is necessary to move from one oxygen station to another. Walk-around bottles are located at the stations of the pilot, copilot, radio operator, and near the wash basin in the crew compartment.

When you are using oxygen and have to move from one station to another in the airplane, disconnect your mask hose from the regulator hose and plug it into the female opening on the walk-around bottle. Be sure the fit is tight. Clip the bottle to your jacket to carry it around. Duration of supply of walk-around bottles is variable, but watch the pressure gage on top of the walk-around regulator and recharge it when it gets low.

There is a recharging hose at each station in the airplane. You can recharge a walk-

around bottle while you are using it, without disconnecting. Simply snap the recharging hose fitting onto the nipple of the walk-around regulator. Push it home until it clicks and locks. The bottle fills to the pressure of the airplane system. Then turn the recharging hose clamp clockwise and remove the fitting from the nipple.

Preflight Check of Demand System

Have each crew member perform this check before an oxygen flight:

1. Be sure the mask fits.
2. Check pressure at each regulator. Pressure should be between 400 and 450 psi.
3. Crack emergency valve to be sure you get a flow; then close it. Never pinch the hose with the emergency valve open.
4. Check the knurled collar at the outlet of the regulator. It should be tight.

5. Check the quick-disconnect fitting between mask hose and regulator hose. Be sure the rubber gasket is in place, and that the male end of the fitting fits into the female tightly enough so that it takes a strong pull to separate them.
6. Clip the regulator hose to your clothing with enough slack to prevent kinking hose or pulling mask.

7. Be sure the auto-mix lever is ON (NORMAL OXYGEN).

Additional Oxygen Supply

In late C-54B's, lines along each side of the main cabin connect to the crew's oxygen system through a hand shut-off valve located near the three constant flow regulators on the left side of the main cabin. Six A-11 constant flow regulators, a pressure gage, and 46 bayonet-type outlets are installed in the cabin lines. Six additional outlets may be installed in the fuselage fuel compartment when fuselage tanks are not carried. When no additional oxygen cylinders are installed and the cabin system is not in use, the system may be isolated by closing the hand shut-off valve.

Oxygen Precautions

Never lend or borrow an oxygen mask, except in emergencies.

Keep your mask clean. Wash it frequently with soap and water, unless it has a microphone in it, in which case wipe it out with a damp cloth.

See Pilot's Information File for additional facts about use of oxygen.

Consult your Flight Emergency Officer on your oxygen problems.

Keep oil and grease away from oxygen;

otherwise a violent explosion may result.

Don't be too much of a wise guy to use oxygen;

wise guys seldom retire.

SECTION FIVE

GENERAL EMERGENCIES

Ditching

Emergency Evacuation of Litter Cases

Fire

DITCHING

Out of the experiences of many AAF crews have come good tips on ditching. The best suggestion, which applies to all situations and to all airplanes, is to be prepared with a ditching plan.

There have been two ditchings of C-54's to date. In both, the airplane stood up comparatively well. In both cases the situation was such that the ditching was unexpected and unplanned; gear was down and crew and passengers were not sufficiently forewarned for adequate bracing. One of these ditchings was not a fair test of the airplane's ditching characteristics, inasmuch as it landed in shallow water. In the other incident, however, the airplane floated longer than expected without breaking up, and there was no serious injury among crew or passengers.

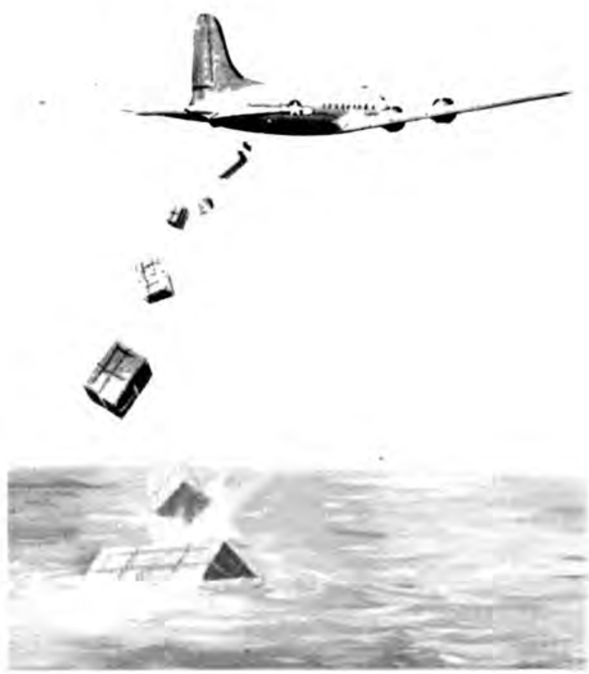
A single ditching, however, is no criterion on which to predict the airplane's characteristics. Each case is different, and the next C-54 to ditch might fare far worse than these.

General Ditching Procedure

1. Every time you fly over water, keep in mind what you must do if you have to ditch, and see that every crew member and passenger knows what he is supposed to do.

2. Utilize every opportunity to study exhibits of emergency equipment, which should be displayed in your organization. Familiarize yourself with contents of raft accessory kits, with operation of emergency radio and other equipment, and with ocean survival instructions contained in official AAF survival manual.

3. Remember that loose cargo and small articles fly around the interior like flak when you hit. Assign someone to jettison unnecessary equipment, if practicable, and to see that everything else is adequately secured against the impact.



4. Use as much of your fuel as possible, to lighten airplane and make flotation aids out of tanks. But ditch before you run completely out of fuel, because you need power to help you pick your best landing spot.

5. Use the following table to help you estimate wind speeds:

A few white crests	**10 to 20 mph**
Many white crests	**20 to 30 mph**
Streaks of foam along water	**30 to 40 mph**
Spray from waves	**40 to 50 mph**

6. Determine direction for your approach well in advance. In winds up to 35 mph, approach parallel to the lines of crests and troughs. Ditch into the wind only when the wind is stronger than 35 mph, or when the wind is extremely light and there are no swells.

DITCHING—NORMAL COMPLEMENT

DITCHING-EVACUATION OF SICK AND WOUNDED

7. Leave landing gear up, and make an otherwise normal approach. Use power and flaps to obtain minimum safe forward and down speeds, and touch down in normal landing attitude.

Specific Ditching Procedure

The following tables give the specific duties of each crew member in ditching. See that each person aboard your airplane is familiar with his part in the ditching procedure.

NOTE: These procedures are compiled from the best sources of information available, but in view of various conditions of loading and number of personnel carried they should be adapted to meet best the particular requirements of each over-water flight.

SEQUENCE OF ACTION	PILOT	COPILOT	NAVIGATOR
1. "EMERGENCY"— FIRST ACTION	Warns crew to prepare for ditching, giving approximate time left. Alerts cabin personnel by signal No. 1. Orders R/O to start emergency procedure. Takes emergency action on VHF (transmits "Pan" 3 times, identification 3 times, and requests fix or bearing). Checks and dons life vest. Fastens shoulder harness and seat belt. Loosens collar and tie. Takes over from copilot and prepares to ditch airplane. Orders copilot to cabin.	Takes over controls while pilot adjusts his equipment. Gives over controls to pilot. Loosens collar and tie. Checks and dons life vest. Goes to cabin and takes charge.	Passes speed, course, altitude, position and estimated ditching position to radio operator for inclusion in distress signal. Removes astrodome, draws curtains and lights forward emergency light. Checks and dons life vest. Loosens collar and tie. Continues to pass new data to radio operator every 10 minutes.
2. "DISTRESS"— WHEN DITCHING IS IMMINENT (10 minutes left)	Orders radio operator to send final distress signal. Orders flight engineer to assist him as required. Orders all on board to secure themselves in their ditching positions. Immediately prior to ditching gives signal No. 2.	In charge of cabin.	Passes final position to radio operator. Fastens seat down in fully extended position. Stows essential nagivation kit in bag and takes with him to cabin. Closes doors, removes and secures emergency exit hatches.
3. DITCHING STATIONS	In pilot's seat.	In a rear seat, if available, or seated on floor facing rear, back against cargo; or seated on floor facing rear with back against forward bulkhead, right side.	In a rear seat, if available, or seated on floor facing rear, back against cargo; or seated on floor facing rear with back against forward bulkhead, left side.
4. DURING DITCHING . . . ALL ABOARD REMAIN BRACED UNTIL FINAL IMPACT			
5. AFTER DITCHING	Destroys IFF. Aids radio operator and flight engineer with raft, going out through astrodome after radio operator. Boards raft, paddles to cabin door and assumes command of all rafts.	Assists passengers into rafts. Assists in launching and enters raft No. 3 first. Receives passengers. Ties on to raft No. 4 as soon as it is launched and inflated.	Assists flight traffic clerk in launching raft and enters raft No. 1 first and receives passengers. Ties onto raft No. 2 as soon as it is launched and inflated.

NOTE 1. If conditions are favorable with regard to time, stowage of cargo, and condition of plane, the crew should proceed to rear cargo door and exit from that point. Carry crew raft aft if number of passengers warrants.

NOTE 2. Personnel in cabin must never be positioned forward of cargo.

NORMAL CREW-PASSENGER COMPLEMENT

FLIGHT ENGINEER	RADIO OPERATOR	FLIGHT TRAFFIC CLERK
Checks cockpit windows to see that they are closed and locked. Checks and dons life vest. Loosens collar and tie. Stands by to assist pilot if required.	On pilot's orders sends emergency signal (XXX) followed as soon as possible by emergency message containing position, flight time, nature of emergency, and any other information available. Turns IFF to emergency, obtains D/F service, bearings, fixes, etc., on normal air-ground frequency if possible. Checks and dons life vest. Loosens collar and tie. Continues outlined emergency procedure every 10 minutes.	Orders passengers to don life vests, fasten safety belts, loosen collars and ties, remove eye glasses and any sharp objects from their persons. Jettisons loose equipment and cargo at discretion of pilot.
Assumes ditching position, fastens seat belt, and dons shoulder harness, when provided.	Sends distress (SOS) signal, position, altitude, course, speed and intention of airplane commander as to ditching or bailing out. Screws key down. Proceeds to ditching station.	Unlocks passenger door. Turns on emergency cabin lights. Proceeds to ditching station, fastens seat belt. Warns passengers against smoking, using matches or lighters.
In copilot's seat.	In lower crew bunk.	In last seat on right side.

AND AIRPLANE HAS COME TO REST IN THE WATER.

FLIGHT ENGINEER	RADIO OPERATOR	FLIGHT TRAFFIC CLERK
Throws ditching rope out and goes through astrodome. Inflates life vest and stays on top prepared to receive raft. Receives raft, opens cover where necessary, and launches raft, holding on to painter while others board raft. Boards raft last.	Brings raft to navigator's stool. Hoists raft on stool with help of pilot and engineer. Passes raft through opening to flight engineer. Climbs out, inflates life vest, assists pilot through astrodome and boards raft.	Jettisons passenger door, releases all life rafts and emergency radio kit, assists in launching rafts. Boards last life raft after insuring all extra rations and water are placed in rafts.

WARNING SIGNALS

No. 1: "Prepare for Ditching" on interphone, or 6 short rings (approximately 2 seconds each) on alarm bell.

No. 2: "Brace for Impact" on interphone, or one long ring (approximately 6 seconds) on alarm bell.

NOTE

Because parachutes are not normally carried in C-54 airplanes, no section on "Bailout" is carried in this manual. Bailout alarm bell signals are, however, 3 short rings for "Prepare to bail out"; one long ring for "Bail out."

DITCHING PROCEDURE

SEQUENCE OF ACTION	PILOT	COPILOT	NAVIGATOR	FLIGHT ENGINEER
1.	Warns crew to prepare for ditching, giving approximate time left. Alerts cabin personnel in accordance with signal No. 1. Orders radio operator to start emergency procedure. Takes emergency action on VHF (transmits "Pan" three times, identification three times and requests fix or bearing). Checks and dons life vest.	Takes over controls while pilot adjusts his equipment. Gives controls over to pilot. Checks and dons life vest. Loosens collar and tie. Goes to cabin and takes charge.	Passes speed, course, altitude, position and estimated ditching position to radio operator for inclusion in distress signal. Removes astrodome, draws curtains and lights forward emergency light. Checks and dons life vest. Loosens collar and tie. Continues to pass new data to radio operator every 10 minutes.	Checks cockpit windows to see that they are closed and locked. Checks and dons life vest. Loosens collar and tie. Stands by to assist pilot if required.
2.	Orders radio operator to send final distress signal. Orders flight engineer to assist him as required. Orders all on board to secure themselves in their ditching positions. Immediately prior to ditching, gives signal No. 2.	In charge of cabin.	Passes final position to radio operator. Fastens seat down in fully extended position. Stows essential navigation kit in bag and takes with him to cabin. Closes doors, removes and secures emergency exit hatches.	Assumes ditching position, fastens seat belt, and dons shoulder harness, when provided.
3.	In pilot's seat.	In a rear seat, if available, or facing rear, seated on floor, back against right side of doorway, forward cabin bulkhead.	In a rear seat, if available, or facing rear, seated on floor, back against left side of doorway, forward cabin bulkhead.	In copilot's seat.
4.	ALL ABOARD REMAIN BRACED UNTIL FINAL IMPACT			
5.	Destroys IFF. Proceeds to cabin, taking crew raft with him and assumes command. Assists flight traffic clerk to launch and inflate raft No. 5. Assists passengers into raft and enters last. Takes command of all rafts. Responsible for distributing additional water and rations to all rafts.	Assists passengers into rafts. Assists in launching and enters raft No. 3 first. Receives passengers. Ties on to raft No. 4 as soon as it is launched and inflated.	Assists flight traffic clerk in launching first raft. Enters raft No. 1 first and receives passengers. Ties on to raft No. 2 as soon as it is launched and inflated.	Proceeds to cabin. Assists pilot in taking crew raft to cabin and assists passengers into rafts. Enters raft No. 4 first and receives passengers. Ties on to raft No. 5 as soon as it is launched and inflated.

NOTE 1. Pilot, Flight Surgeon, Flight Nurse and Flight Traffic Clerk, in conference prior to departure, will determine distribution of personnel in rafts and order of unloading of patients in event of ditching. Schematic plan for distribution in rafts is predicated on presence of 4 litter-fast patients. When this number is exceeded, assignment of litter-fast patients in rafts will be determined at this conference.

NOTE 2. Escape rope, one on each side of exit door, 20 feet, three-quarter inches in diameter, with knot every 14 inches, to be provided.

EVACUATION OF SICK AND WOUNDED

RADIO OPERATOR	FLIGHT TRAFFIC CLERK	NURSE	TECHNICIAN
On pilot's order sends emergency signal and messages (see page 199). Turns IFF to emergency, obtains D/F service, bearings, fixes, etc., on normal air-ground frequency if possible. Checks and dons life vest. Loosens collar and tie. Continues outlined emergency procedure every 10 minutes.	Orders passengers to don life vests, fasten seat belts, loosen collars and ties, remove eye glasses and any sharp objects from their persons. Secures loose equipment. Assists nurse to fasten life vests on patients.	Advises patients of the situation. Checks and fastens life vests on patients and checks safety straps on litters. Checks and dons life vest. Loosens collar and tie. Calms patients.	Aids nurse in checking and fastening life vests on patients and checking safety straps on litters. Checks and dons life vest. Loosens collar and tie. Helps to calm patients.
Sends distress (SOS) signal, position, altitude, course, speed and intention of airplane commander as to ditching or bailing out. Screws key down. Proceeds to ditching station.	Unlocks passenger door and turns on emergency cabin lights. Proceeds to ditching station, fastens seat belt. Warns passengers against smoking, using matches or lighters.	Gives final warning to patients. Fastens seat belt.	Fastens seat belt.
In lower crew bunk.	In rear seat on right side.	Third from last seat on right side.	Second from last seat on right side.

AND AIRPLANE HAS COME TO REST IN THE WATER.

RADIO OPERATOR	FLIGHT TRAFFIC CLERK	NURSE	TECHNICIAN
Proceeds to cabin and collects emergency radio and kit. Assists flight traffic clerk in launching, enters raft No. 2 first, and receives passengers. Ties on to raft No. 3 when it is launched and inflated.	Jettisons passenger door, releases all life rafts and emergency radio kit. Launches rafts in order, steadying them while patients enter. Launches crew raft uninflated, and boards raft No. 5 immediately before pilot.	Enters raft No. 1 last.	Assists patients into rafts. Enters raft No. 5, receives patients and secures crew raft to No. 5.

TYPE OF RAFT TO BE CARRIED—5 E-2A RAFTS OR 5 E-2 RAFTS MODIFIED

RAFT NO. 1	RAFT NO. 2	RAFT NO. 3	RAFT NO. 4	RAFT NO. 5
Navigator	Radio operator	Copilot	Flight Engineer	Technician
1 litter-fast patient	1 litter-fast patient	1 litter-fast patient	1 litter-fast patient	4 other patients
2 other patients	3 other patients	3 other patients	3 other patients	Flight Traffic Clerk
Nurse				Pilot

FIRE

The fire extinguisher system on the airplane comprises two CO_2 cylinders; lines to carry the CO_2 to each nacelle and the lower cargo compartments, with valves to control the flow; fuel, oil and hydraulic shut-off valves on each firewall; and a fire warning light system. Four hand-type extinguishers are mounted at various positions in the airplane.

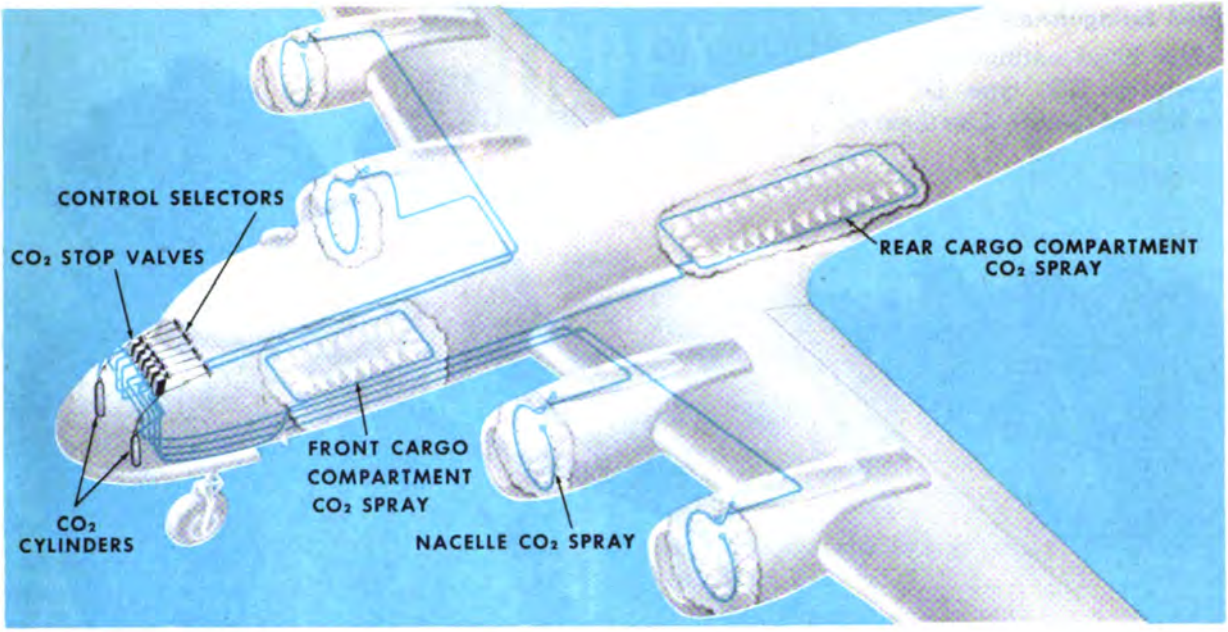
Operation

Combating a fire in flight by the use of the fixed extinguisher system involves a procedure which is the same whether the fire occurs on takeoff, cruise, or any other time.

Warning lights above the selector control in the flight compartment come on when a fire occurs in any nacelle or the lower cargo compartments. Pulling the corresponding selector control handle shuts off fuel, oil, and hydraulic flow at the firewall in the case of the engine selectors, and it also directs the flow of CO_2 to the area of the fire.

If the fire is in the lower cargo compartments, pull the selector handle for that compartment, then pull the handle which opens one of the two CO_2 bottles.

If the fire is in an engine, follow feathering procedure, open cowl flaps, and pull the proper selector valve. Wait 30 seconds for excess fuel and oil to burn out, then pull the CO_2 bottle control handle.

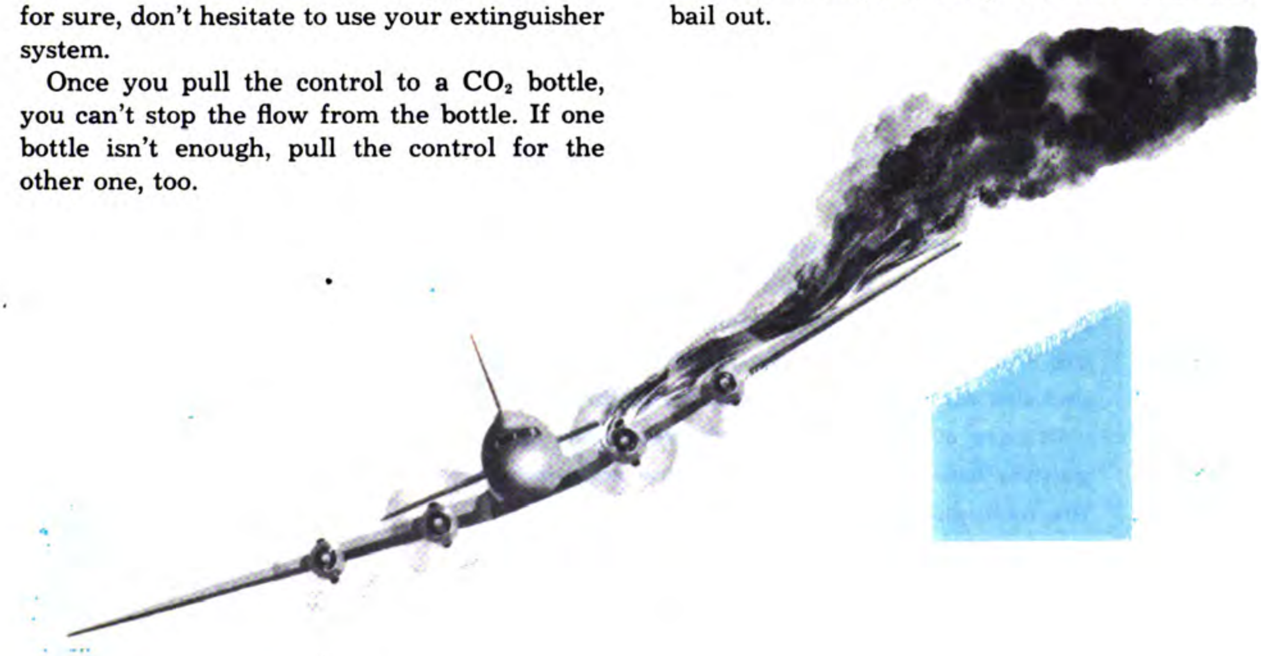


The color of smoke issuing from the nacelle helps to identify the kind of fire. Black smoke comes from a fuel fire; white smoke from hydraulic oil, and bluish-white from engine oil. If you get a broken hydraulic line, a white smoke issues which is from the fluid itself and not from a fire. However, unless you know that for sure, don't hesitate to use your extinguisher system.

Once you pull the control to a CO_2 bottle, you can't stop the flow from the bottle. If one bottle isn't enough, pull the control for the other one, too.

Wing Fire

If you have a wing fire which you can't control with the extinguisher equipment, bail out the crew if you have parachutes. You and the copilot can try to extinguish the fire by sideslipping the airplane away from it. If this fails, bail out.



Hand Extinguishers

The hand extinguishers are either of the Pyrene or CO_2 type. Direct extinguishers at the base of the fire. Use them early.

CAUTION

Frost from CO_2 extinguishers is dry ice. Don't touch it. Fumes from Pyrene extinguishers produce phosgene. Stay as far away from the fire as possible and open windows and ventilators after you have put the fire out. Use CO_2 hand extinguishers on heater fires. If you use Pyrene extinguishers the fumes enter the heat and vent ducts and are distributed throughout the airplane.

In case of a heater system fire, insert the nozzle of a CO_2 extinguisher into trapdoor in the crew compartment ceiling and turn on the extinguisher.

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