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AAF MANUAL 51-129-2

PILOT TRAINING MANUAL FOR THE SKYTRAIN C-47

HEADQUARTERS • ARMY AIR FORCES

CHECK TITLE PAGE FOR THE DATE OF THIS MANUAL

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PILOT TRAINING MANUAL FOR THE SKYTRAIN C-47

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 All copies of the latter are rescinded.

Hq. Army Air Forces
Washington 25, D.C., 15 Aug. 45

The use and authentication of this manual are governed by the provisions of AAF Regulation 50-17.
BY COMMAND OF GENERAL ARNOLD:

Ira C. Eaker
Lieutenant General, United States Army
Deputy Commander, Army Air Forces

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, I TROOP CARRIER COMMAND, AIR TRANSPORT COMMAND

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U.S.

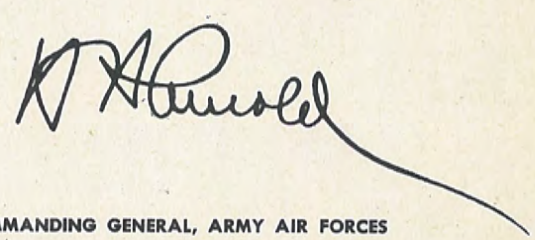
Introduction

This manual is the text for your training as a C-47 pilot and airplane commander.

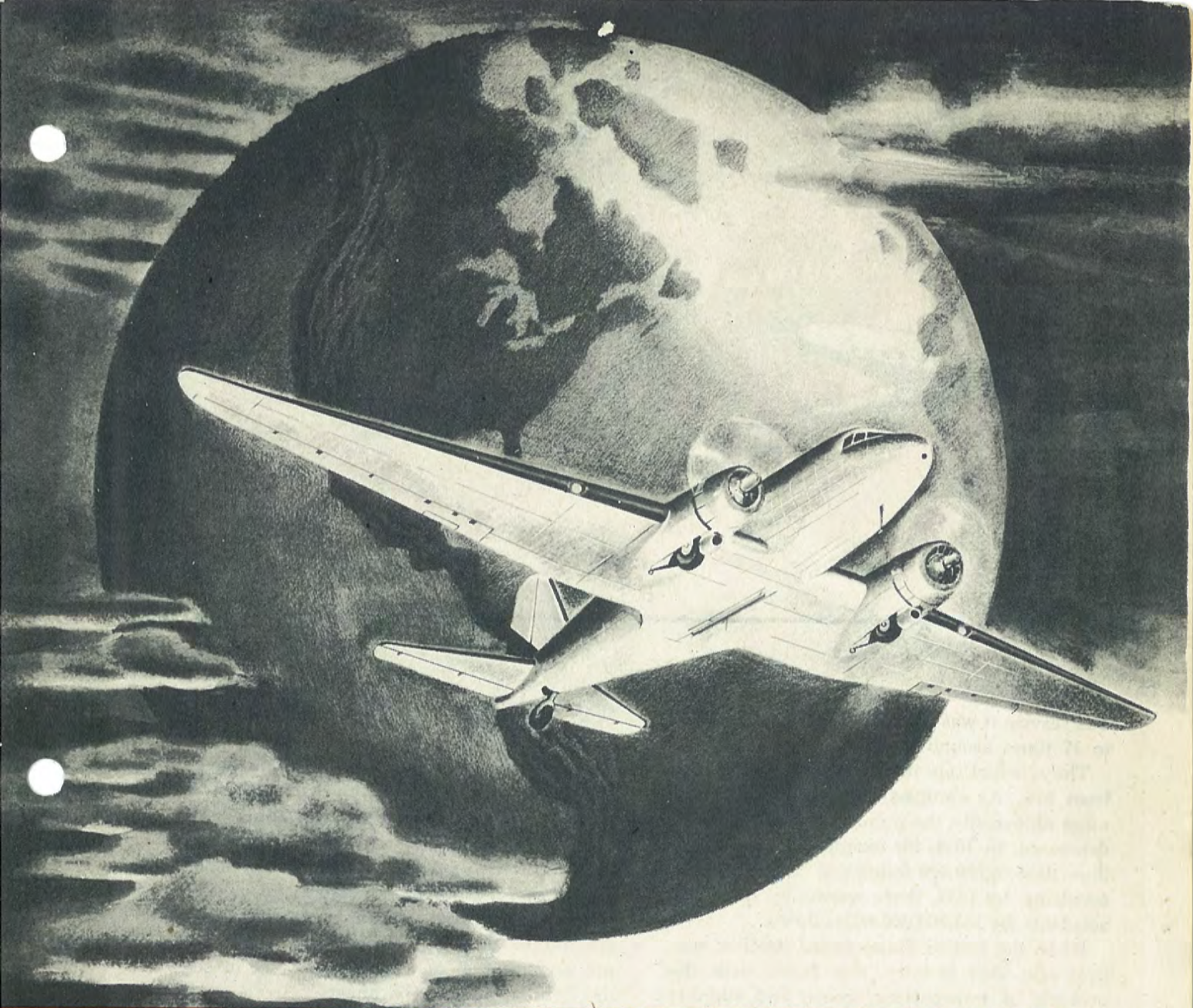
The Air Forces' most experienced training and supervisory personnel have collaborated to make it a complete exposition of what your pilot duties are, how each duty will be performed, and why it must be performed in the manner prescribed.

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-47 so long as you fly it. This is essentially the textbook of the C-47. Used properly, it will enable you to utilize the pertinent Technical Orders to even greater advantage.



COMMANDING GENERAL, ARMY AIR FORCES



YOUR AIRPLANE—WHAT IT HAS ALREADY DONE

Before the United States entered the war, the Douglas C-47 Skytrain, familiarly known as the commercial airline DC-3, already had flown more than 300,000,000 miles in domestic airline service for a total flying time of more than 2,060,000 hours. In addition, the DC-3 was serving 57 countries on 21 foreign airlines. In

this service it was flying daily a distance equal to 17 times around the globe.

The accident rate in this airplane has always been low. As Douglas transports were used more universally, the number of fatal accidents decreased. In 1936, for example, domestic airlines flew 63,000,000 miles and had eight fatal accidents; by 1941, there were only four fatal accidents for 133,000,000 miles flown.

When the United States found itself at war, overnight this country was faced with the problem of transporting troops and supplies and evacuating casualties over long stretches of water and across lands at the far ends of the earth. The DC-3 was the only transport airplane manufactured in large quantities at the time. When it was called into service military men were skeptical that it could do the job. It proved itself without question when in 1942 the Air Transport Command was able to carry 5000% more aerial freight in the C-47 than all domestic airlines had carried during the previous year.

Here are some of the achievements of the C-47 airplane in combat: It evacuated 20,000 wounded from New Guinea in five months, 17,000 from the Guadalcanal-Caledonia area, 1000 from Alaska, 18,000 from Tunisia, and 14,000 from Sicily.

Shortly after the landing of our Marines on Guadalcanal, C-47's, making their final approach over the Japs who held the edge of Henderson Field, flew in anti-personnel ammunition when not a round was left among our forces. During this operation not a single plane was lost. Later these transports rushed gasoline to our fighter planes when there was not enough fuel at Henderson Field to send the fighters against the enemy.

At Salerno, C-47's dropped 2600 paratroopers in 45 minutes to turn the enemy flank and save the beachhead.

When the Burma Road was lost and the only way to send supplies into China was by air transport, at an altitude of 19,000 feet over the Hump, Chiang Kai-shek was said to have remarked: "Give me 50 DC-3's and the Japs can have the Burma Road."

From the fall of the Burma Road until midspring of 1943, C-47's supplied all aviation fuel that the Flying Tigers used. Later they supplied our 10th Air Force, when pre-Pearl Harbor stocks had been exhausted. These airplanes carried ammunition, fuel, food and medical

supplies to Guadalcanal when sea communication had been severed. Except for one 24-hour interruption, they maintained a daily service into this area from September 1, 1942, until February 1, 1943.

In New Guinea, when the Japs poured over the Owen Stanley Mountains to advance within 40 miles of Port Moresby, C-47's rushed 3800 troops from Australia to beat back the enemy. Later these transports flew 7000 troops across the Owen Stanley Mountains. This was the force that cleared the Japanese from North Papua and finally from Salamaua and Lae.

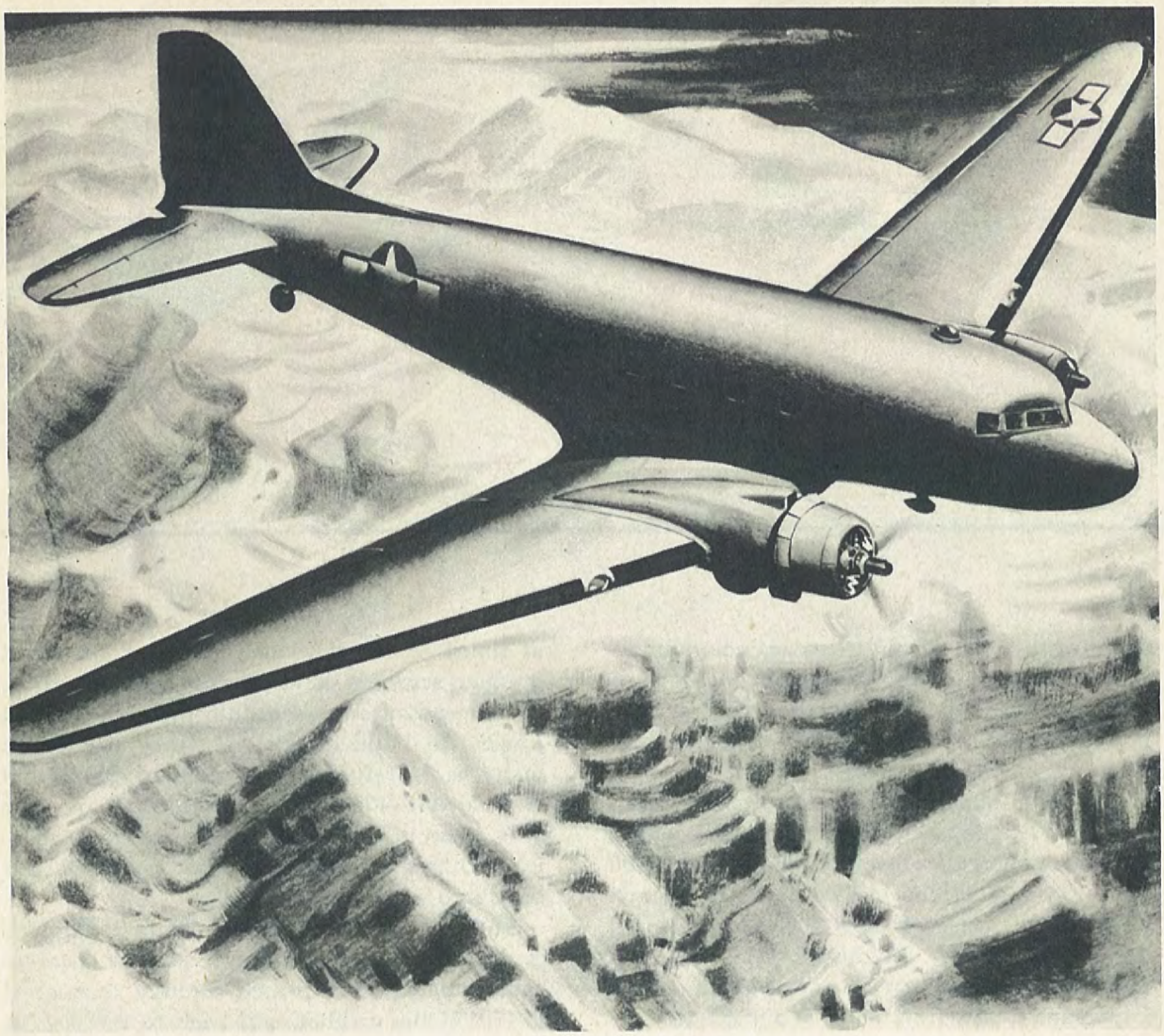
In the North African invasion a group of 44 C-47's made a non-stop flight from England to Oran to drop British paratroopers behind the enemy lines. C-47's supported the 8th Army's drive from El Alamein to Tripoli. At Kasserine Pass, C-47's, flying an aggregate of 1,000,000 miles, carried the munitions that beat back the enemy's most dangerous break-through.

We all know the part C-47's played in Sicily, Italy, and in the invasion of the Normandy coast; they not only transported troops and supplies to the battle fronts but saved thousands of lives by flying out wounded.

The C-47 has performed extraordinary feats at times. C-47's flew 19 bulldozers, 32 jeeps, graders, scrapers, field camp equipment, arms, and a crew of engineers into the New Guinea jungles to build an airfield. They carried as many as 74 refugees a trip out of China and Burma. A C-47 carried a 6100-lb. pinion gear 5300 miles in 3 days so that a damaged American cruiser in a foreign port could be put back into service in a week.

And the C-47 airplane can hold up under punishment. During the Sicilian invasion, a large-caliber naval shell passed directly through a C-47, yet the airplane got back to its base. A C-47 got home after one engine had been completely torn out when it struck a group of high-tension wires. Another C-47 was so riddled by shellfire the pilot decided to ditch, but the airplane bounced from the water and the pilot flew it home.

Time and time again the C-47 has proved itself a reliable and safe airplane. It has done its job well in a civilian role and in combat. It is an easy plane to handle, has no bad flying characteristics and gives maximum performance under the most adverse conditions. However, it is an airplane that you can't stunt or dive. You will find it a pleasure to fly.



FLYING THE C-47

Here is your airplane. As you have seen from the story of its work, it is the workhorse of this war. When the tall tales are spun in the nights to come it will take its place with the *8 chevaux -40 hommes* of the last war.

Your transition training in this airplane covers normal flight procedure, plus the emergency procedures to bring you safely through the tight spots that come to most pilots at one time or another.

The C-47 has no bugs. It has been around a long time doing a magnificent job. The only troubles you will have are those you bring on yourself. Know your airplane. When you check it before a flight know enough about it to spot trouble. Maintenance men are human too—they make mistakes. Your job is to check their work just before you fly.

Know your procedures. Confusion in the cockpit causes far too many accidents. Practice emergency procedures until they are as famil-

iar, and as easily accomplished as normal operation. Some of these procedures you can practice in the airplane. For others, you must use mockups, but know them all.

Make the most of transition training. Spend every hour you can in the cockpit. If you can't take the C-47 up, sit in the cockpit and check yourself on procedures. Get to know your airplane so well that you can close your eyes and visualize every part and just how it works. When you know your airplane that well, you won't make mistakes during tough sledding.

THE AIRPLANE COMMANDER AND HIS CREW

You are the commanding officer of the airplane. It is your responsibility to know your airplane and its accessories and to be familiar with normal and emergency procedures. This manual covers these matters in detail.

As commanding officer of the airplane's crew you must see that each man knows his duties and performs them properly. The airplane and its crew are your responsibility. A C-47 crew normally consists of:

1. Airplane commander or first pilot
2. Copilot
3. Navigator
4. Radio operator
5. Aerial engineer

Your crew must learn to work together as a unit. Under emergency or unpleasant conditions there is no place for lack of understanding of the next man's job, or for clashes of temperament. It is up to you to weld your crew into a working team.

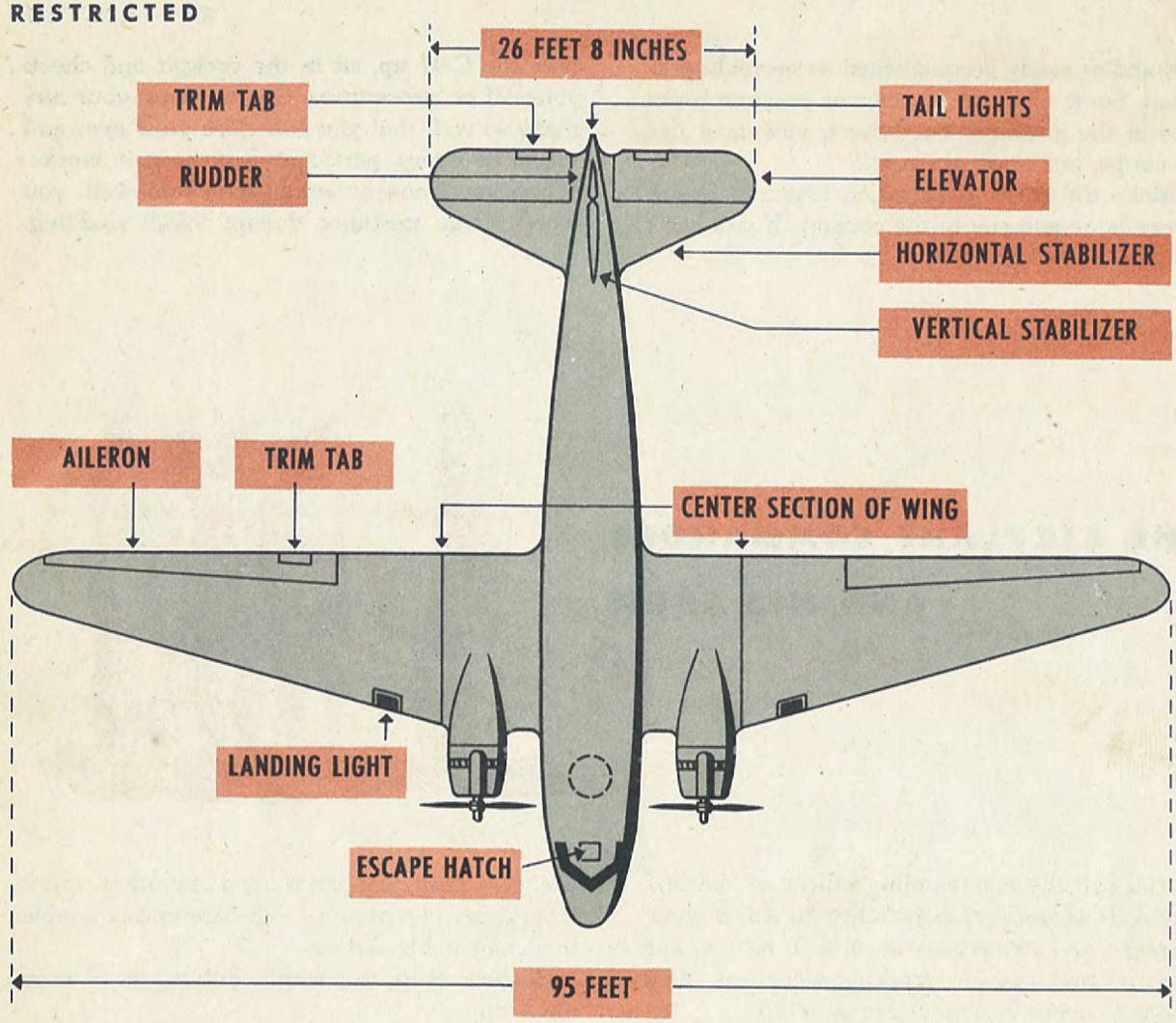
Each member of your crew should learn as much as possible about other crew members' duties so that each can relieve any other under emergency conditions, or in case one is unable to perform his duties.

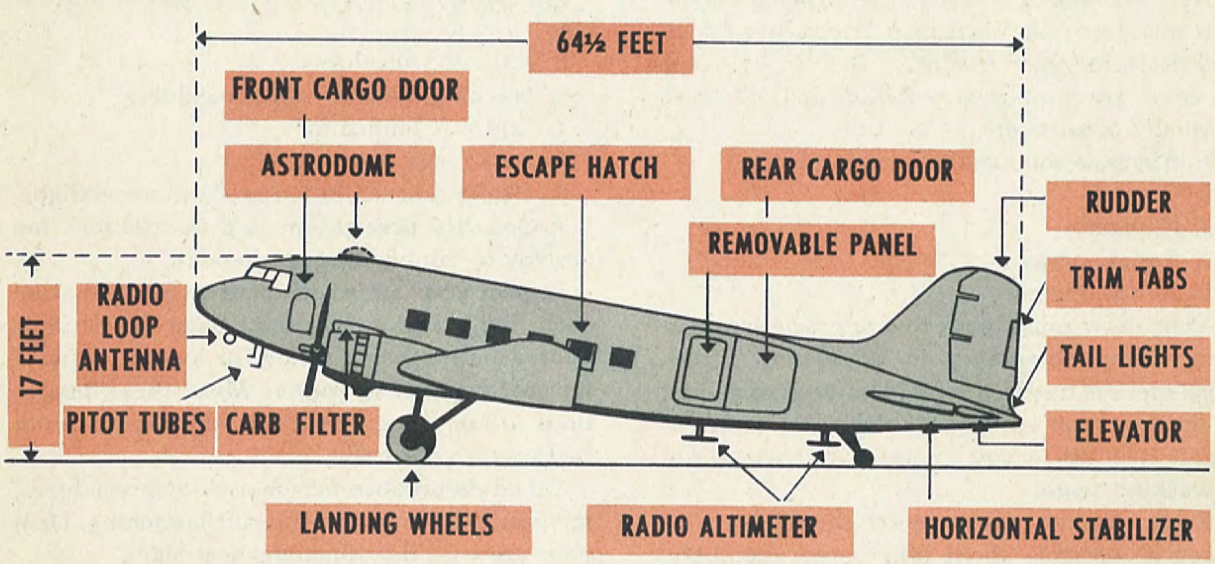
Besides their particular duties, your crew must know:

1. Position of emergency equipment and its use.
2. Bailout procedures.
3. Ditching stations and procedures.
4. Life raft launching.
5. Lost plane procedure.
6. Health and sanitation precautions in flight.
7. Security precautions and instructions for destroying confidential equipment.

Inspect your crew members before and after each flight. Make sure they have fitted parachutes and proper clothing for long flights and for cold weather operation. Make these inspections a habit, beginning with the first training flight with your crew.

Schedule practice for emergency procedures, including ditching and life raft launching. Drill your crew until it functions as a team.


26 FEET 8 INCHES
TRIM TAB
RUDDER
TAIL LIGHTS
ELEVATOR
HORIZONTAL STABILIZER
VERTICAL STABILIZER
AILERON
TRIM TAB
CENTER SECTION OF WING
LANDING LIGHT
ESCAPE HATCH
95 FEET


64½ FEET
FRONT CARGO DOOR
ASTRODOME
ESCAPE HATCH
REAR CARGO DOOR
REMOVABLE PANEL
RUDDER
TRIM TABS
TAIL LIGHTS
ELEVATOR
17 FEET
RADIO LOOP ANTENNA
PITOT TUBES
CARB FILTER
LANDING WHEELS
RADIO ALTIMETER
HORIZONTAL STABILIZER

THE AIRPLANE

The C-47, and its modified versions, C-47A and C-47B, is a 2-engine, all-metal, low-wing monoplane, used for transport of supplies, paratroop operation, glider towing, and the evacuation of wounded.

The airplane has two 1200-Hp Pratt & Whitney, 14-cylinder, R-1830-92, Twin Wasp engines, with Hamilton Standard hydromatic full-feathering 3-bladed propellers. The C-47B is designed for high-altitude flying. It has R-1830-90C engines, each with a 2-speed internal blower.

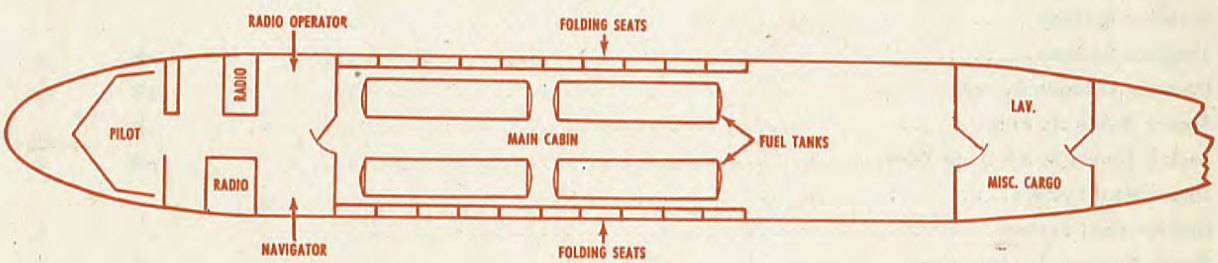
The hydraulic landing gear is of the conventional type. Main wheels retract vertically into the engine nacelles and extend approximately 11 inches out of the nacelles when fully retracted. In this position they are free to rotate and are subject to normal brake action. The tailwheel is non-retractable.

There is a large cargo door at the left of the main cabin and a smaller cargo door on the left side of the airplane behind the pilots' compartment. The plane has four emergency exits: a window on each side of the main cabin, just aft of the wings, an escape hatch over the pilots' compartment, and a removable panel in the main cargo loading door.

The airplane has two main sections.

In the forward section is the pilots' compartment, radio operator's and navigator's compartment, and a space for cargo behind the co-pilot's seat. Radio equipment is in the forward section.

The rear section consists of main cabin, lavatory, and spare parts compartment. The main cabin is marked off in stations for cargo loading; it has two rows of seats for troop carrying and a static line for operation with paratroops. For long-range operation it carries from two to eight auxiliary fuel tanks in the forward part of the main cabin. There are litter attachments in the main cabin for use when the airplane is employed in the evacuation of wounded.



Dimensions:

Span.....95 feet
Length.....64 feet 5½ inches
Height (at rest).....17 feet

Weight:

Empty:
C-47.....17,087 lbs.
C-47A.....17,257 lbs.
Basic:
C-47.....17,400 lbs.
C-47A.....17,700 lbs.
Recommended takeoff, maximum gross.....29,300 lbs.
Restricted takeoff, maximum gross.....31,000 lbs.
Recommended landing, maximum gross.....26,000 lbs.

Other Figures of Interest:

Cruising speed at 10,000 feet.....approximately 185 mph TAS
Stalling speed.....67 mph TAS
Service ceiling.....24,100 feet
Wingloading.....25.3 lbs. per square foot
Power loading.....12.0 lbs. per Hp
Seating capacity.....28 passengers

C-47 SERIES CHANGES

Your airplane, like all airplanes used by the Air Forces, has been changed to meet the ever shifting needs of tactical operations. To fly the Hump run in CBI the C-47 needed more power at higher altitudes, so two-speed superchargers replaced the single speed superchargers then installed. To make long overwater hops additional fuel was needed. Fuselage tanks were added to all airplanes doing this work. Changes were made on all series of the airplane to carry paratroops, to drop supplies, to evacuate wounded.

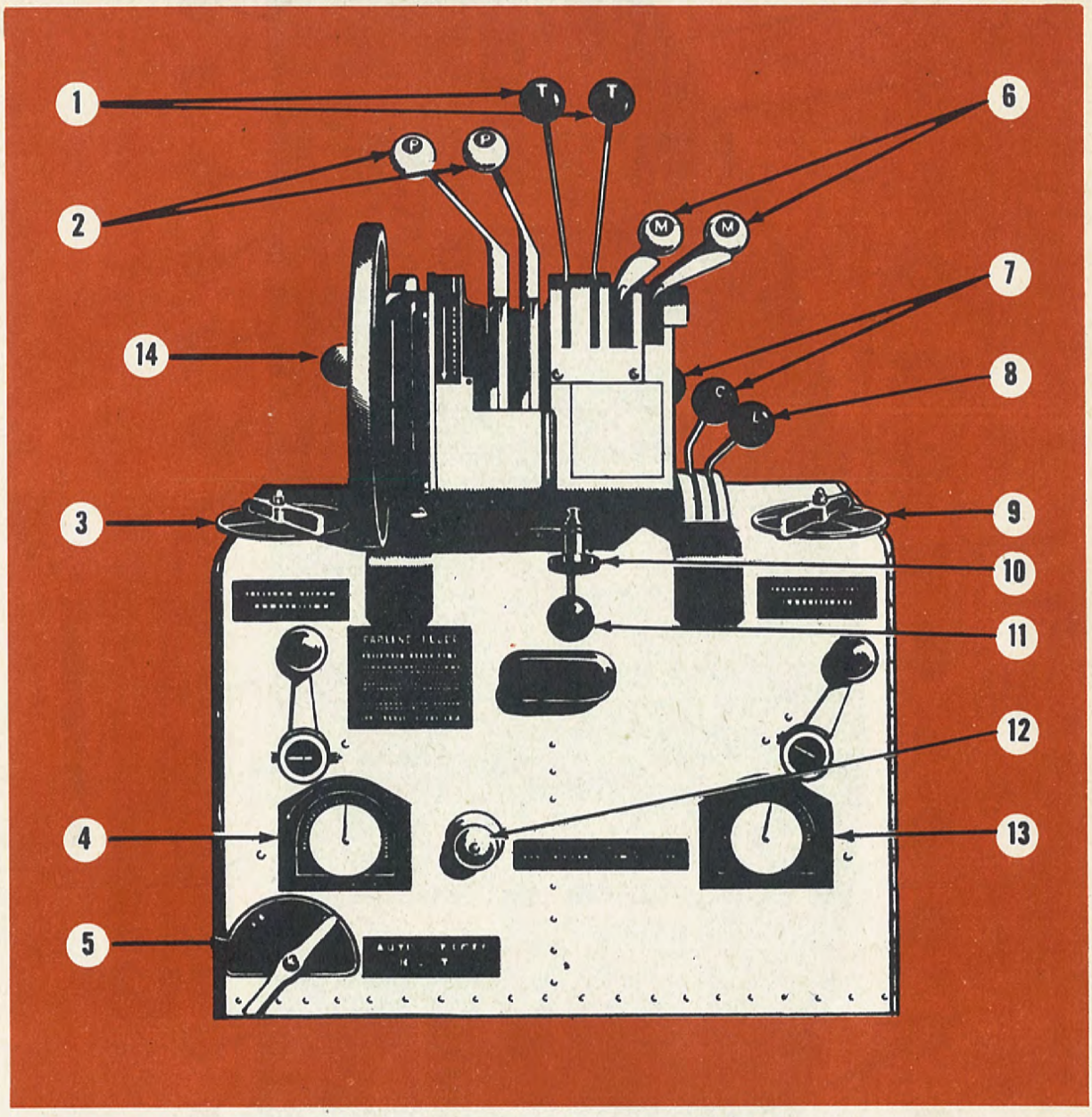
At the present time three series of the airplane are in use, the C-47, the C-47A, and the C-47B. There is an occasional reference in the text of this manual to early and late series airplanes. The following chart gives you the major changes that have been made in the different airplanes.

If at any point the references are puzzling, refer to this chart or to the technical orders for the specific series.

	C-47	C-47A	C-47B
R-1830-92 Engines	★	★	
R-1830-90C Engines			★
Needle Blade Prop	★		
Paddle Blade Prop		★	★
Non-Ram Airscoop			★
Electric Solenoid Primer	★	★	★
Wobble Pump	★	★	
Electric Booster Pumps			★
Cross Feed	★	★	
2-switch Ignition	★		
1-switch Ignition		★B	★
Demand Oxygen System		★B	★
Sperry A-3 Auto Pilot	★	★B	
Jack & Heintz A-3A Auto Pilot		★B	★
Steam Heat System	★		
Hot-Air Heat System		★	★
Elastic Bungee (landing gear)	★	★B	
Hydraulic Cushion (landing gear)		★B	★
Electrical Altimeter		★B	★
Glide Path Indicator		★	★
Remote Indicating Compass		★B	★
Venturi Voltage Regulator Cooling			★
Hydraulic Blower Control			★
Circuit Breakers (Main Elec. Junction Box)			★
Fuses (Main Elec. Junction Box)	★	★	
VHF	★A	★B	★
Wooden Personnel Seats	★B	★	★
Canvas Personnel Seats		★B	★A
Aluminum Litter Racks (3-high)	★A	★A	
Canvas (web-straps) Litter Racks (4-high)		★B	★

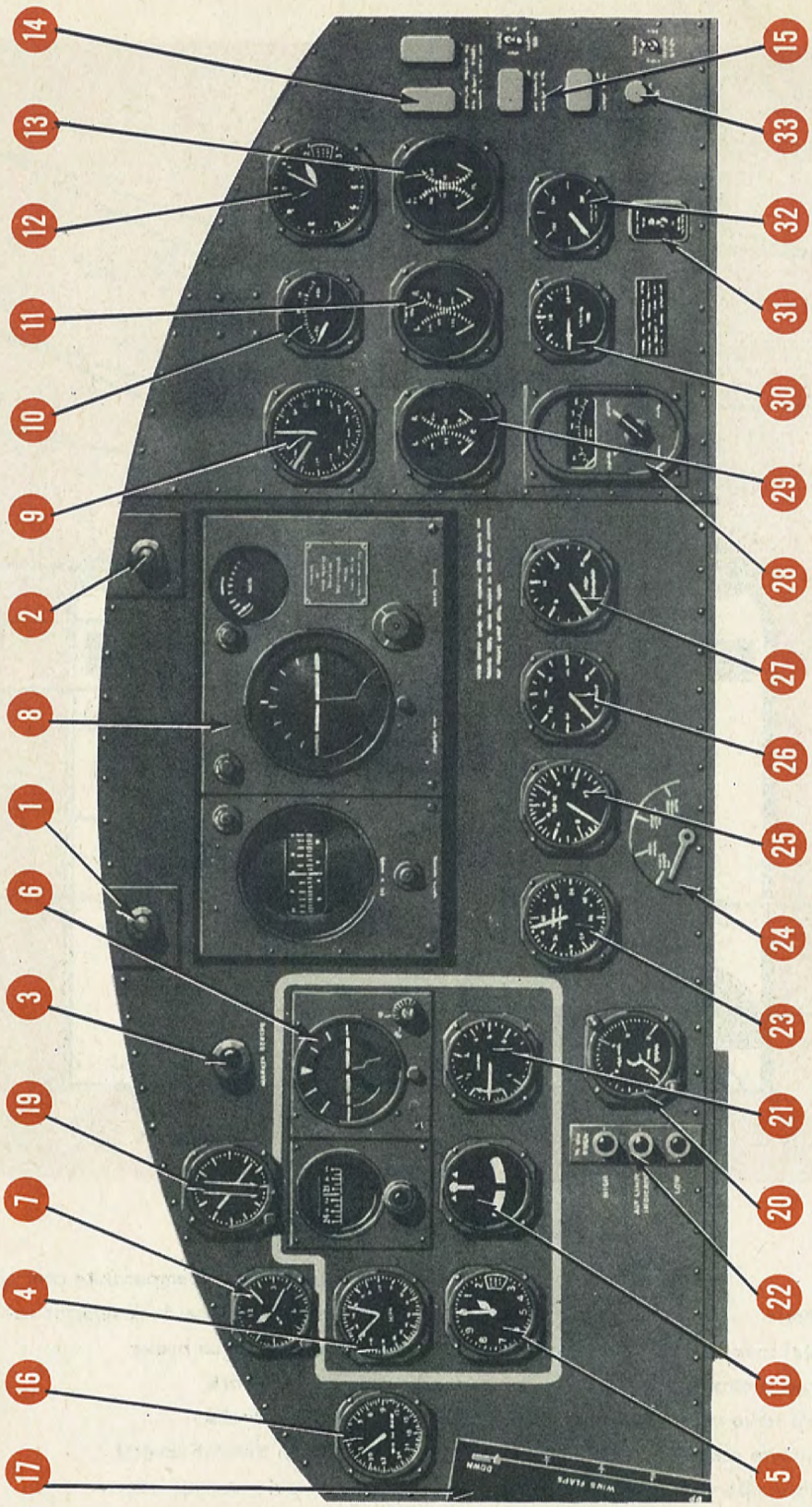
A. INCLUDED IN MODIFICATION

B. PART OF SERIES



CONTROL PEDESTAL

1 Throttles
2 Propeller controls
3 Left engine fuel tank selector valve control
4 Rudder trim tab control
5 Automatic pilot servo units ON-OFF control
6 Carburetor mixture controls
7 Carburetor air temperature controls
8 Carburetor air temperature control lock
9 Right engine fuel tank selector valve control
10 Throttle friction brake
11 Tailwheel lock
12 Parking brake
13 Aileron trim tab control
14 Oil cooler control levers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FRONT PANEL

1 Front windshield anti-icer alcohol valve
2 Windshield wiper control valve
3 Marker beacon indicator
4 Airspeed indicator
5 Altimeter
6 Artificial horizon
7 Clock
8 Automatic pilot
9 Airspeed indicator
10 Free air temperature
11 Cylinder-head temperature
12 Altimeter
13 Carburetor air temperature
14 Heating system warning lights
15 Landing gear warning lights
16 Radio compass
17 Wing flap position indicator
18 Bank-and-turn indicator
19 Magnesyn compass
20 Radio altimeter
21 Rate of climb indicator
22 Altitude limit indicator
23 Manifold pressure gage
24 Manifold pressure selector valve control
25 Tachometer
26 Oil pressure gage
27 Fuel pressure gage
28 Fuel quantity gage
29 Oil temperature gage
30 De-icer pressure gage
31 Static pressure selector valve control
32 Automatic pilot oil pressure gage
33 Door open warning light

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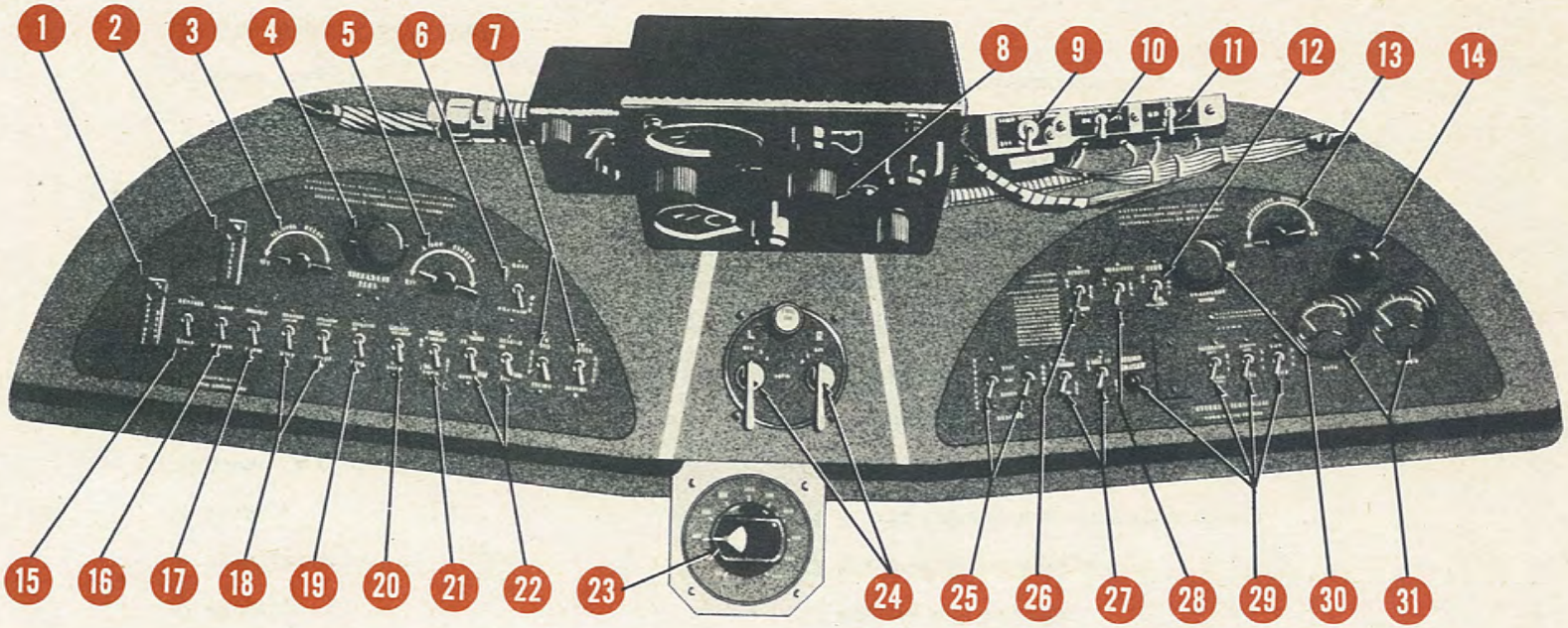
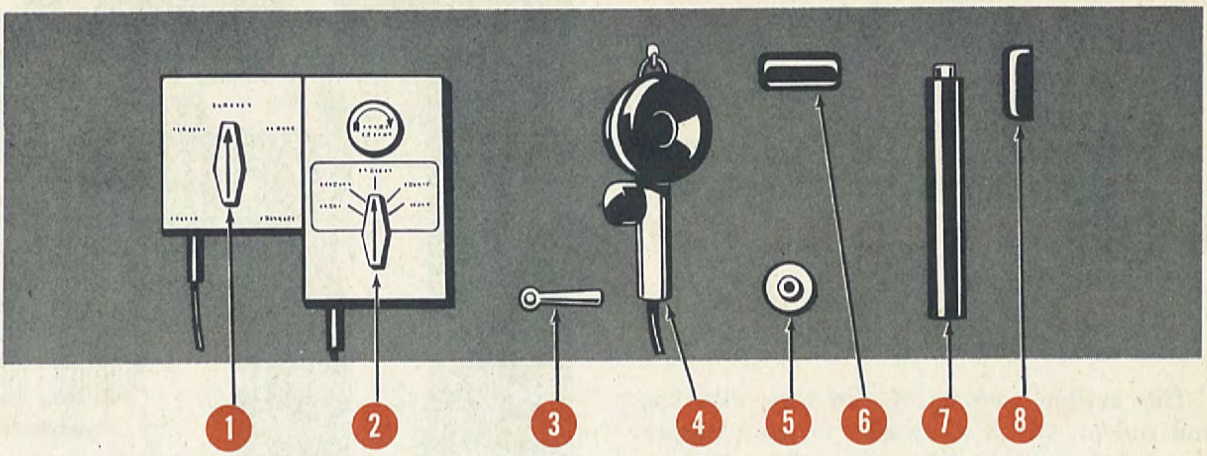


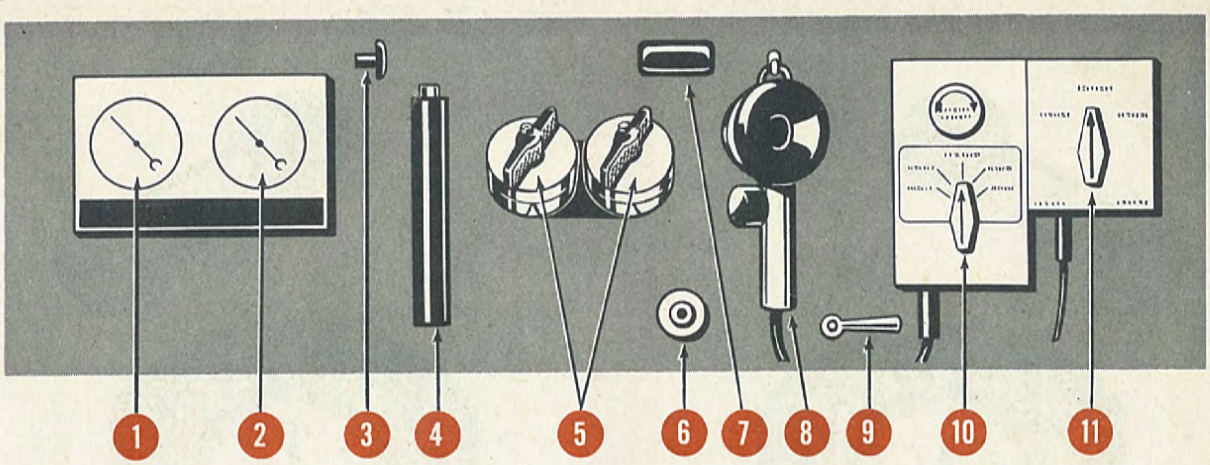
ELECTRICAL PANELS

1 Parachute packs salvo switch
2 Bailout warning bell switch
3 Compass light switch
4 Left propeller feathering control
5 Instrument panel lights switch
6 Propeller de-icer switch
7 Oil dilution switches
8 Radio compass remote control unit
9 VHF command set switch
10 Flux gate compass ON-OFF switch
11 IFF ON-OFF power switch
12 Carburetor de-icer switch
13 Formation lights switch
14 Voltmeter light
15 Parachute troop signal light switch
16 Battery master switch
17 Passing light switch
18 Landing lights switches
19 Running lights switch
20 Tail light switch
21 Windshield de-icer pump switch
22 Pitot heater switches
23 Altitude limit switch
24 Engine ignition switches
25 Engine starter switches
26 Cockpit lights switch
27 Booster pump switches
28 Inverter switch
29 Recognition lights switches
30 Right propeller feathering control
31 Voltmeters



LEFT SIDE PANEL

1 Pilot's radio receiver crystal filter
2 Pilot's interphone jackbox
3 Left side windshield anti-icer valve control
4 Pilot's hand microphone
5 Pilot's oxygen outlet
6 Left-hand pilots' compartment light
7 Fluorescent light
8 Left-hand instrument panel light

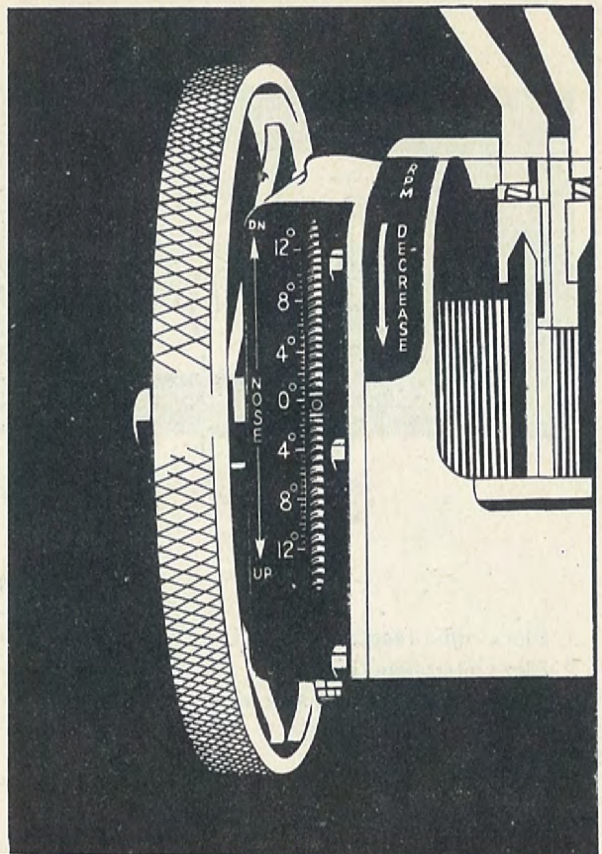


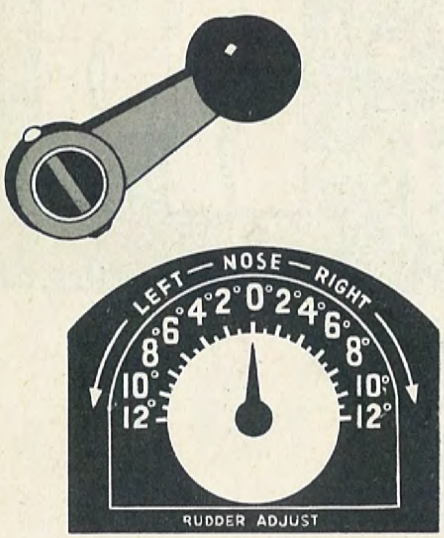
RIGHT SIDE PANEL

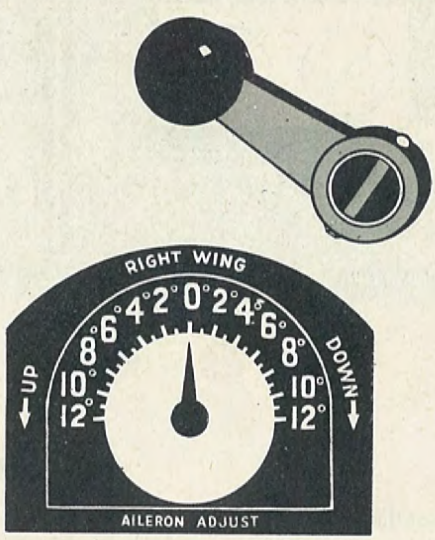
1 Landing gear hydraulic pressure gage
2 Hydraulic system pressure gage
3 Side windshield anti-icer hand pump
4 Fluorescent light
5 Engine cowl flap valve control
6 Copilot's oxygen outlet
7 Right hand pilots' compartment light
8 Copilot's hand microphone
9 Windshield anti-icer valve control
10 Copilot's interphone jackbox
11 Copilot's radio receiver crystal filter

SURFACE CONTROL SYSTEM

This system consists of elevators, ailerons, and rudder, which are made of metal frames covered with fabric. There are all-metal trim tabs on the elevators, the right aileron, and on the rudder. Operate trim tabs for the elevators by means of a wheel on the left side of the pedestal. Operate trim tabs for ailerons and rudder by means of hand cranks on the lower part of the pedestal.







HYDRAULIC SYSTEM

The C-47 has a pressure accumulator type hydraulic system. It operates normally between 675 and 925 psi.

The hydraulic system operates the landing gear, wing flaps, cowl flaps, windshield wipers, automatic pilot, and brakes on all series of the airplane. It operates the non-ram carburetor air filter mechanism when it is installed, and the blower controls on C-47 airplanes using R-1830-90C engines.

The control panel is in the center aisle, behind the copilots' seat. The hydraulic gauges are at the right of the copilots' seat.

Two engine-driven hydraulic pumps supply pressure for the hydraulic system. One pump supplies pressure for the main hydraulic system; the other, for the automatic pilot. You can select either engine pump by means of a selector valve on the hydraulic control panel.

There is a hydraulic hand pump between the pilot's and copilot's seats. A valve on the hydraulic panel controls flow of pressure from the pump. When you open the valve, pressure is built up in the accumulator. When you close it, the accumulator is separated from the hydraulic system and pressure is applied to the hydraulic lines.

Never operate system at less than 500 psi.

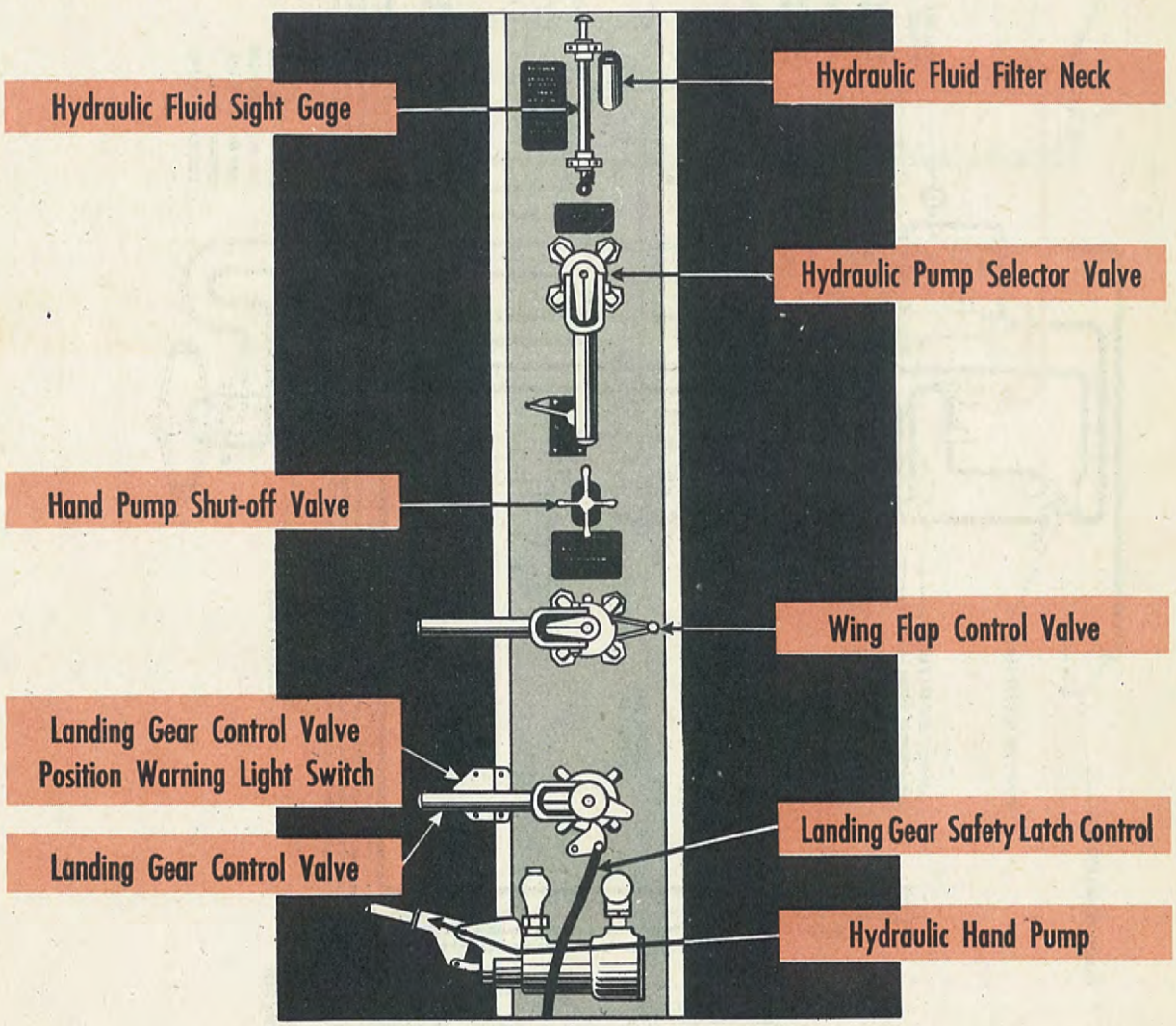
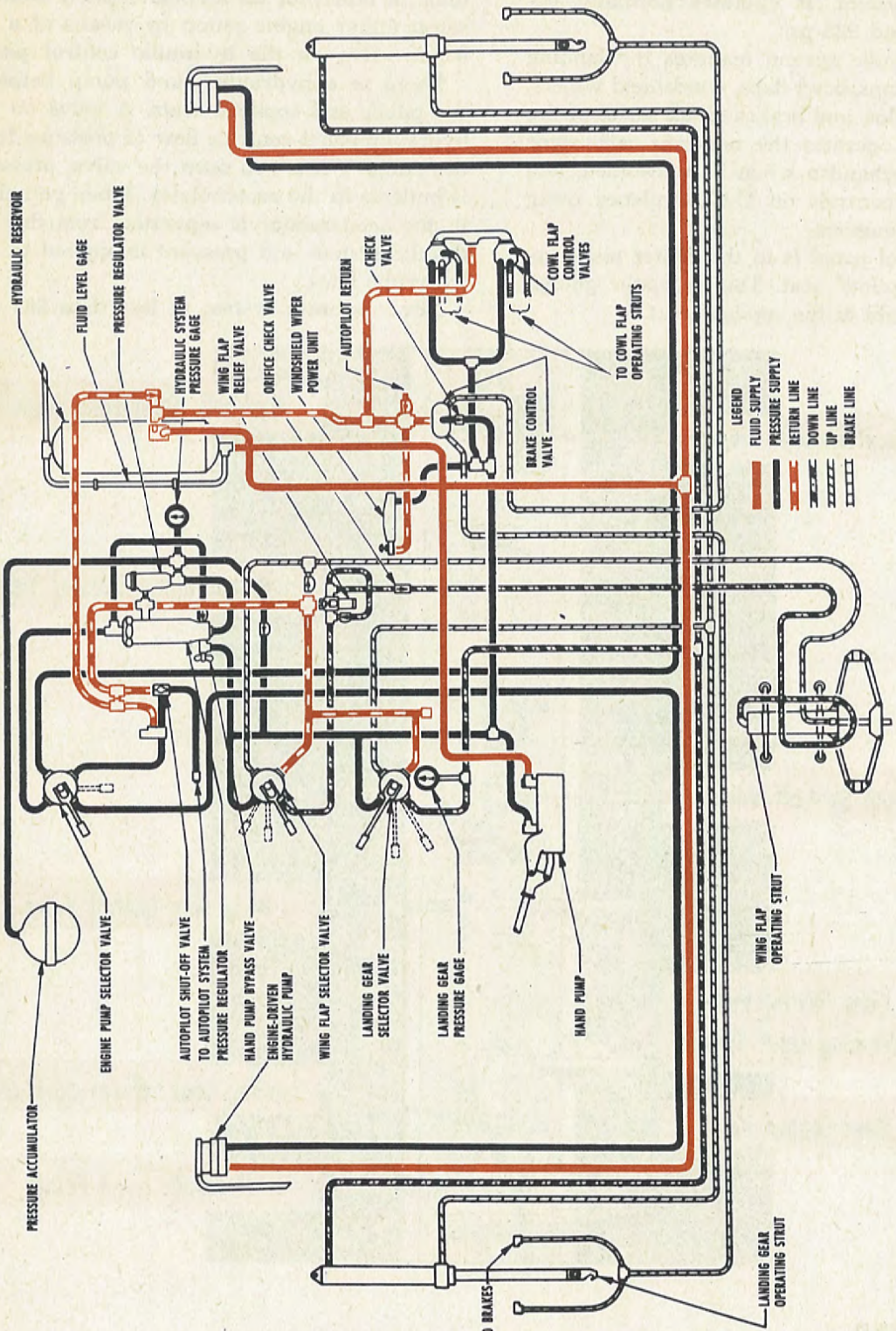
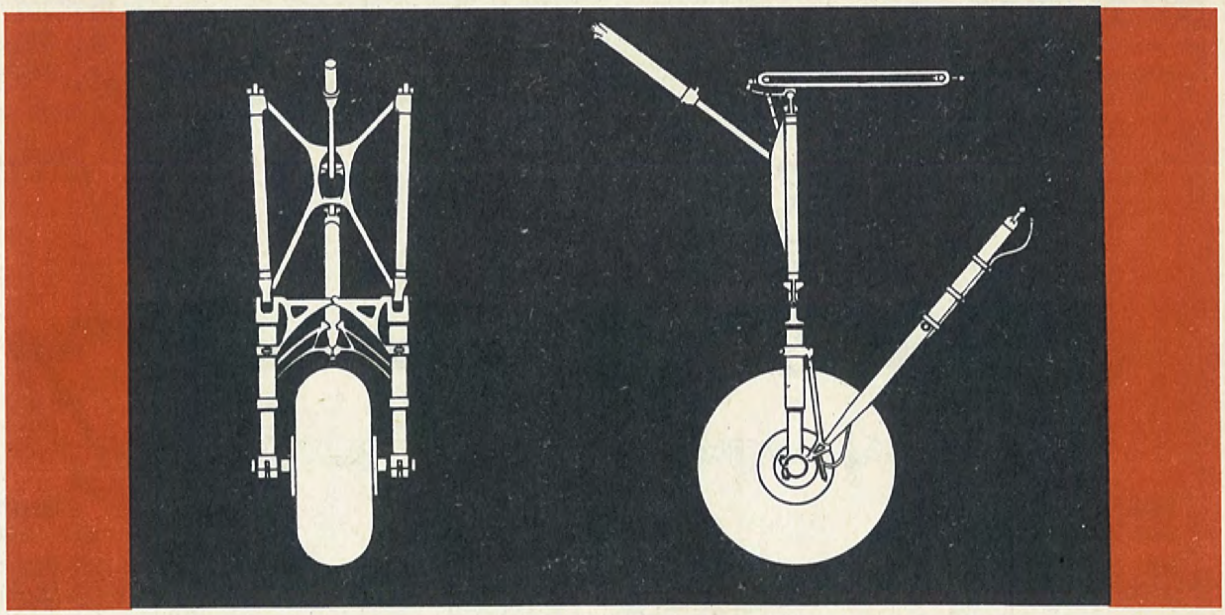


DIAGRAM OF HYDRAULIC SYSTEM





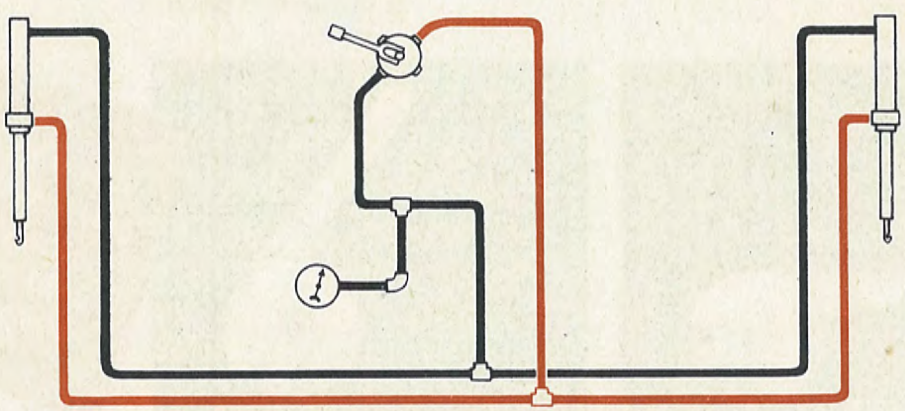
LANDING GEAR

Three controls govern the operation of the C-47 landing gear. A lever on the main hydraulic control panel raises and lowers the two main wheels. A tailwheel lock on the pedestal centers and locks the tailwheel. The tailwheel does not retract, but swivels through 360 degrees when not locked. The third control, a safety latch, on the floor by the pilots seat, controls movement of the safety latch **and the landing gear lever.**

This latch has three positions: full down, half up, and full up.

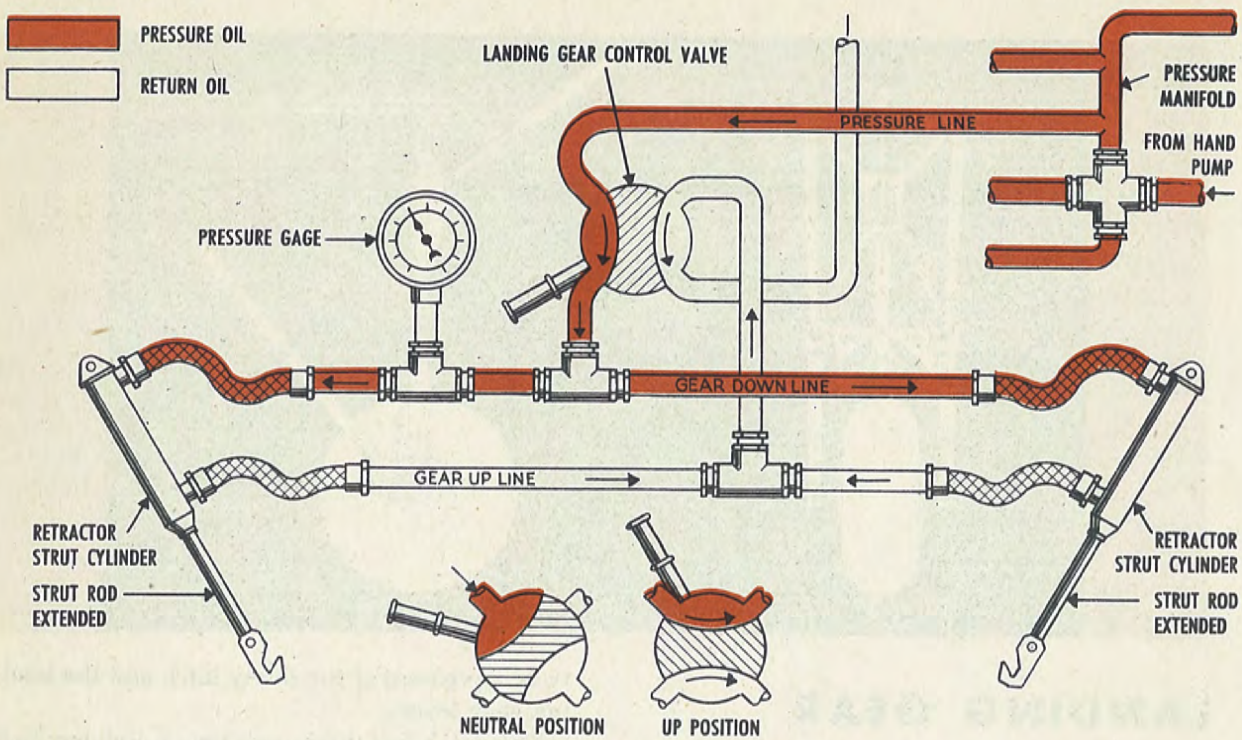
Full down (positive lock)—In this position the latch is locked and can be moved only by the latch control. The landing gear lever cannot be moved UP with the latch full down.

Half up (spring lock)—In this position the latch is spring locked. The landing gear lever cannot be moved UP with the latch spring locked.



Landing Gear Hydraulic System

Landing Gear Down — Landing Gear Up



How Fluid Is Trapped in Lines

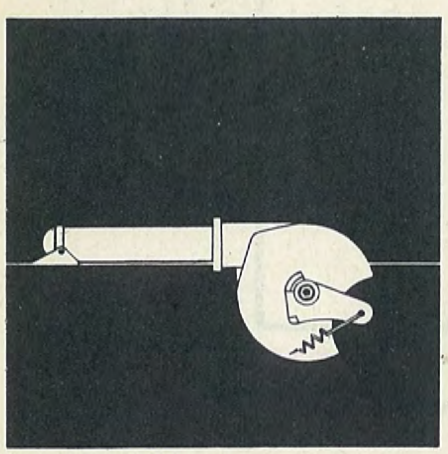
Full up (unlocked)—In this position the latch is unlocked and the gear lever is free to move UP.

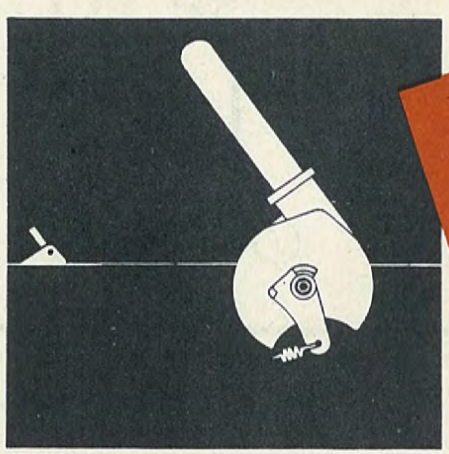
Move the gear lever UP, when the gear raises, move the gear lever to NEUTRAL and the latch will automatically move to spring lock position. The latch lever remains in this position until you have lowered the gear and are ready to lock it down.

CAUTION: Keep the safety latch full down and secured by the catch on the floor until the pilot signals "gear up."

Never move the latch to full down or positive lock until the gear lever is in NEUTRAL.

Keep the gear and flap levers in NEUTRAL for normal operation. This traps fluid in the line and provides a fluid lock to hold gear and flaps in the desired position.





Pressure Drop When Gear Is Down

If landing gear pressure falls below 500 psi, place gear handle in the DOWN position until pressure is equal to the hydraulic system pressure.

Pressure Rises

When gear is retracted and the handle is in neutral, landing gear pressure should be zero. If pressure creeps up, place latch in vertical position and move handle to full UP position, then return to neutral.

Warning horn: Horn sounds when either throttle is closed if:

(a) One or both wheels are retracted.

(b) One or both wheels are unlatched.

(c) Valve handle is not in neutral.

Warning lights: There are green and red warning lights at the right-hand corner of the instrument panel. The green light burns only when the gear is down and latched and the valve handle is in neutral. Under any other condition the red light burns.

2. **Wing flaps:** Your airplane has all-metal wing flaps. A valve lever just above the landing gear lever operates these flaps. To raise or lower the flaps, first clear the slot that holds it in neutral by swinging the lever toward the aisle. Move the lever down to lower the flaps, up to raise them, and return to neutral when flaps are in position. There is a flap position indicator below the instrument panel directly in front of you.

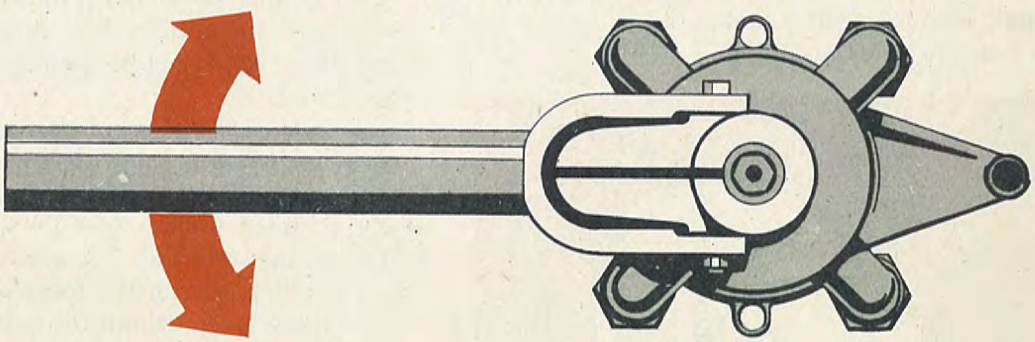
3. **Cowl flaps:** The C-47 has cowl flaps around each engine directly behind the engine cowling. They control engine temperature by regulating airflow through the cowling.

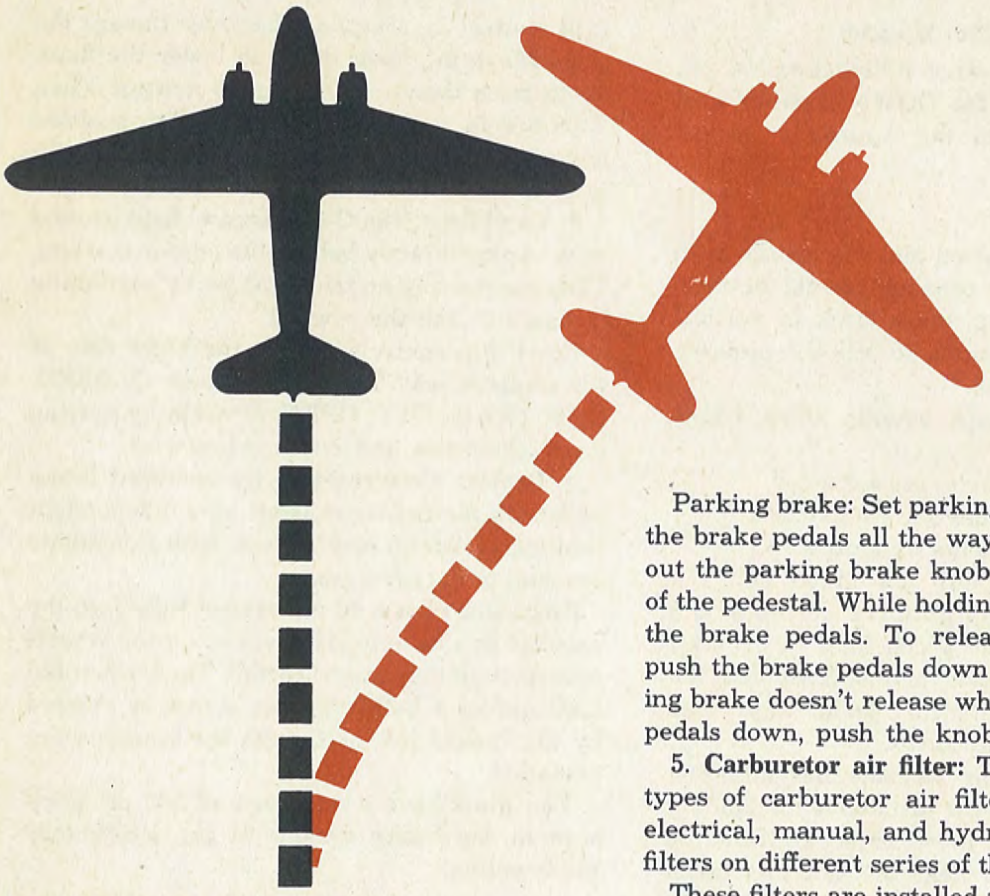
Cowl flap controls are on the right side of the copilot's seat. They are marked: CLOSED, OFF, TRAIL, OFF, OPEN. Operate by moving them clockwise and counterclockwise.

4. **Brakes:** Conventional toe-operated brake pedals on the rudder controls give independent braking action on each wheel, with immediate reaction to toe pressure.

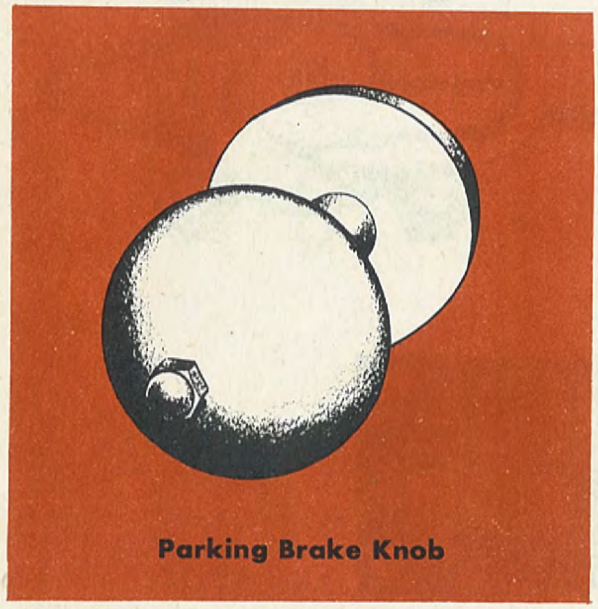
Since the wheels do not retract fully into the nacelles you have braking action on the wheels even though they are retracted. Thus, when the C-47 makes a belly landing, it can be steered by the brakes just as though the wheels were extended.

You must have a minimum of 500 psi pressure in the brake system to get satisfactory brake action.





Apply brakes smoothly and evenly in order to avoid swerving



Parking Brake Knob

Parking brake: Set parking brake by pushing the brake pedals all the way down and pulling out the parking brake knob on the lower part of the pedestal. While holding knob out, release the brake pedals. To release parking brake, push the brake pedals down again. If the parking brake doesn't release when you push brake pedals down, push the knob manually.

5. **Carburetor air filter:** The C-47 has three types of carburetor air filters. You will find electrical, manual, and hydraulically operated filters on different series of the airplane.

These filters are installed to protect the interior of the engine from thick dust and blowing sand. They should not be used under any other conditions.

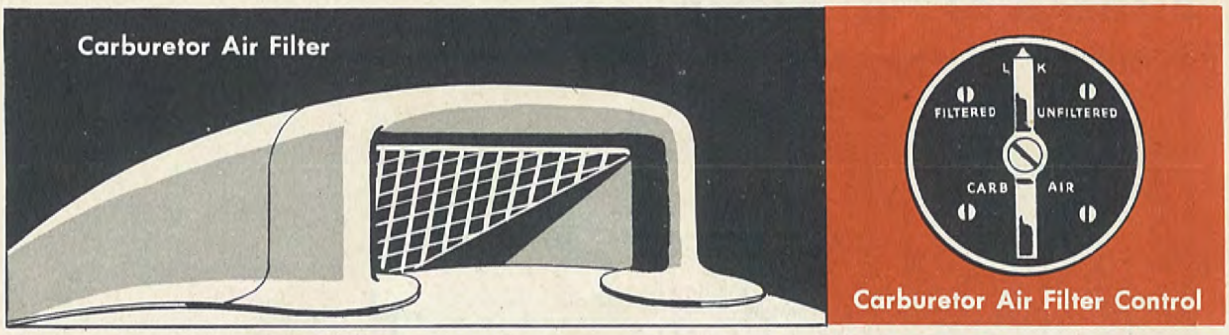
The electrical and manually operated filters are ram filters screening air from the front of the nacelle into the carburetors. The hydraulically operated filters allow the engine to use ram and non-ram air. The non-ram intake is on top rather than in the front of the nacelle.

A control lever behind the pilots seat operates the hydraulically controlled filter. It has 3 positions: Filter, Unfilter, and Lock.

Turn the control to FILTER, then back to LOCK in order to open the filter gate.

Turn the control to UNFILTER, then back to LOCK in order to close the filter gate and use ram air.

6. **Automatic pilot:** The automatic pilot control box consists of a directional gyro, ball bank indicator, bank-and-climb gyro, horizon bar, and suction gauge. It is on a panel in the center



of the instrument board. The automatic pilot keeps your airplane in straight and level flight by mechanical control of the rudder, ailerons, and elevators. Its operation is described in the section entitled "Cruise."

7. **Superchargers:** Early series of the C-47 have integral single-speed blowers with an impeller ratio of 7.15 to 1. For operation at higher altitudes late series were equipped with 2-speed single stage blowers. These superchargers have an impeller ratio of 7.15 to 1 in low blower and 8.47 to 1 in high blower. Controls for the blower are at the pilot's left.

To check for proper operation:

1. Prop controls .....INC. RMP
2. Throttles .....1700 RPM

A **minimum** of 45 psi oil pressure is required to operate the blower clutch. If oil pressure is low at 1700 RPM advance the throttles until oil pressure reaches 45 psi.

3. Blower control .....HI BLOWER

Shift blower controls quickly.

4. Throttles .....30" Hg.
5. Blower controls .....LOW BLOWER

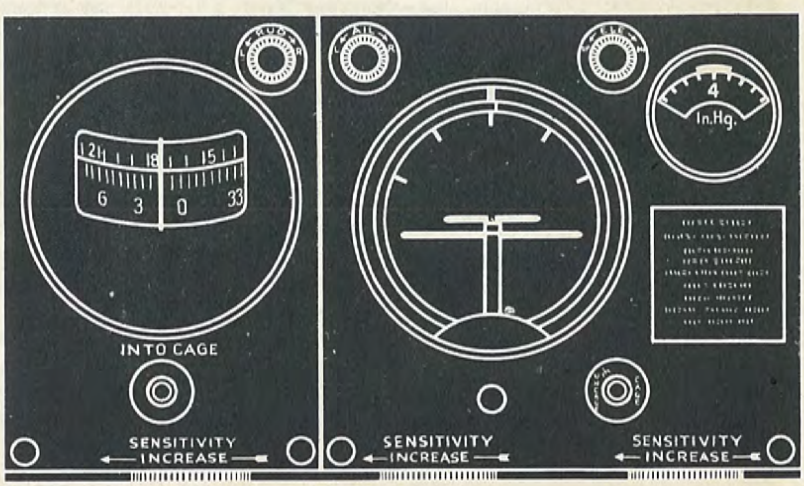
Watch the manifold pressure. A drop in manifold pressure indicates proper clutch operation.

CAUTION

Superchargers must be de-sludged before every flight and at least once every two hours in flight.

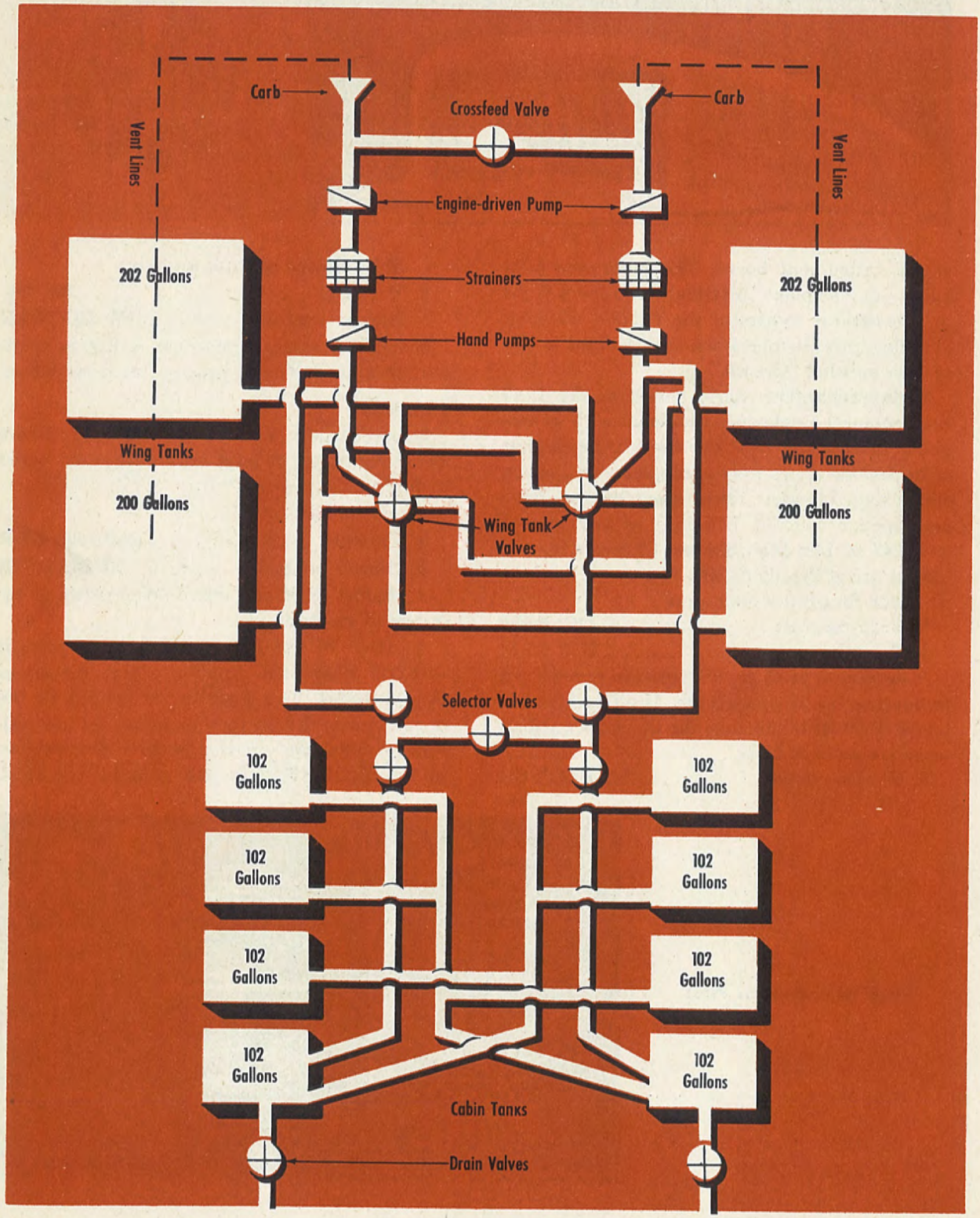
To de-sludge:

1. Throttle .....1400-1600 RPM
2. Blower controls .....HI BLOWER
3. Adjust RPM and manifold pressure as required if in flight.
4. After 10 minutes return blower controls to LOW BLOWER. Don't use high blower at low altitudes. The impeller is geared to the engine and is driven by the engine. At low altitudes it takes more power to drive the impeller in HI BLOWER than you gain by the shift.



Panel of Automatic Pilot

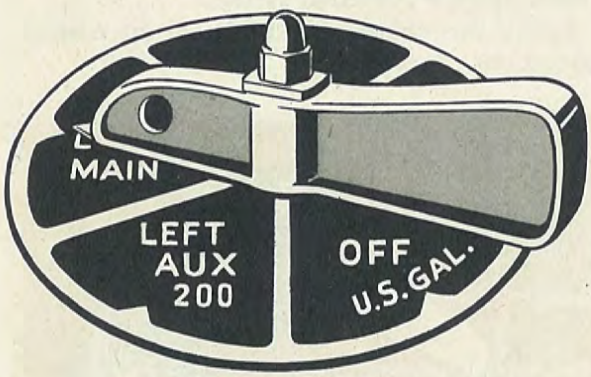
DIAGRAM OF FUEL SYSTEM



FUEL SYSTEM

Use Grade 91 fuel under normal conditions, Grade 100/130 fuel under critical and combat conditions.

1. **Fuel tanks:** The C-47. airplane has four center section tanks, two on each side of the fuselage. Main tanks are forward; each has a capacity of 202 U. S. gallons. Auxiliary tanks are aft of the main tanks; each has a capacity of 200 U. S. gallons. Each tank is independent of the others.

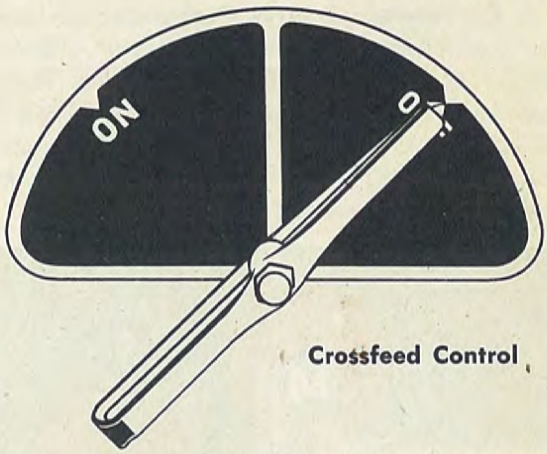


Fuel Selector Valve
(One for Each Engine)

2. **Fuel selector valves:** On each side of the pedestal is a fuel selector valve. The right valve controls flow of fuel to the right engine, the left valve to the left engine. Valves read: LEFT MAIN, RIGHT MAIN, LEFT AUX., RIGHT AUX., and OFF. Select fuel tank for either engine by turning selector valves to the desired position.

3. **Crossfeed system:** Some C-47 series have a fuel crossfeed system that permits either fuel pump to supply both engines. In those series, if one pump fails, you can maintain fuel pressure on both engines by turning the crossfeed system control ON.

Crossfeed control is at the lower right-hand corner of the pedestal. Turn the control ON only when needed; otherwise, keep it in the OFF position.



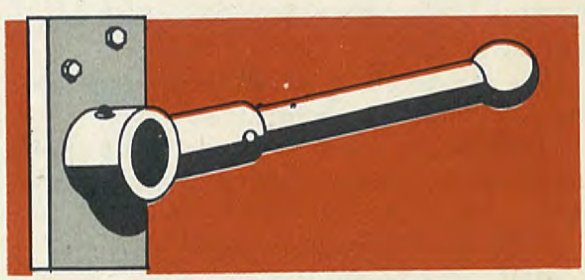
Crossfeed Control

4. **Booster pumps:** On late series of the C-47 booster pumps replace the crossfeed system. The booster pumps maintain pressure in the fuel lines if an engine-driven fuel pump fails. Booster pump switches are on the right-hand electrical panel.

For normal operation, turn the booster pumps ON for all operation below 1000 feet and above 10,000 feet. If fuel pressure drops on either engine, while fuel remains in the tank, turn on that booster pump. If this fails to return fuel pressure to normal, turn the fuel selector valve to the tank from which the other engine is operating. If this fails, feather the engine.

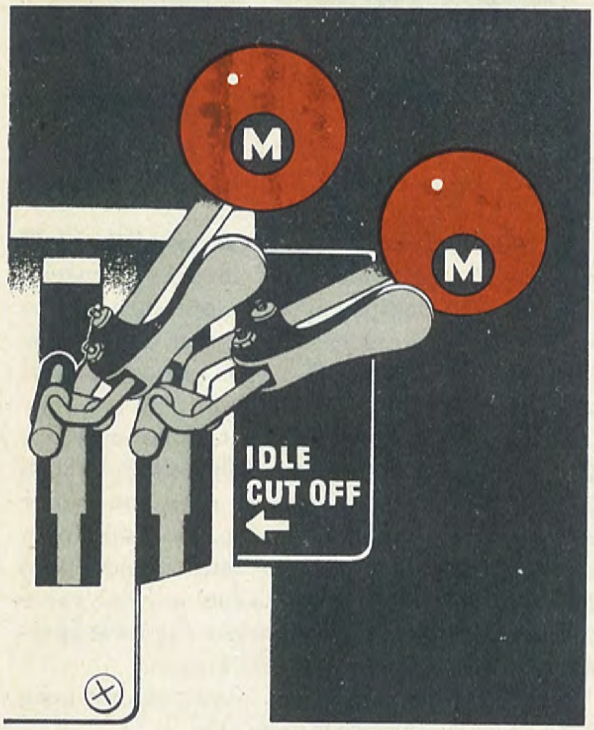
Land as soon as possible if you cannot keep both engines operating normally.

5. **Wobble pump:** C-47 models have a hand or wobble pump to supply fuel pressure manually. It is behind the pilot's seat. Some C-47A airplanes have a wobble pump, others have replaced the wobble pump by electric fuel booster pumps.



Wobble Pump

6. **Carburetor mixtures:** Carburetor mixtures are controlled automatically for most efficient engine operation at different altitudes. There are four mixture control positions: EMERGENCY, AUTO RICH, AUTO LEAN, and IDLE CUT-OFF. Mixture controls are at the right top of the pedestal.



Carburetor Mixture Controls

To lean the mixture move the controls from EMERGENCY to AUTO RICH, and AUTO RICH to AUTO LEAN. Move them back to enrich the mixture.

Here are the effects which the controls produce at different positions:

EMERENCY—full rich mixture. This position eliminates the automatic feature of the carburetor.

AUTO RICH—rich mixture.

AUTO LEAN—lean mixture.

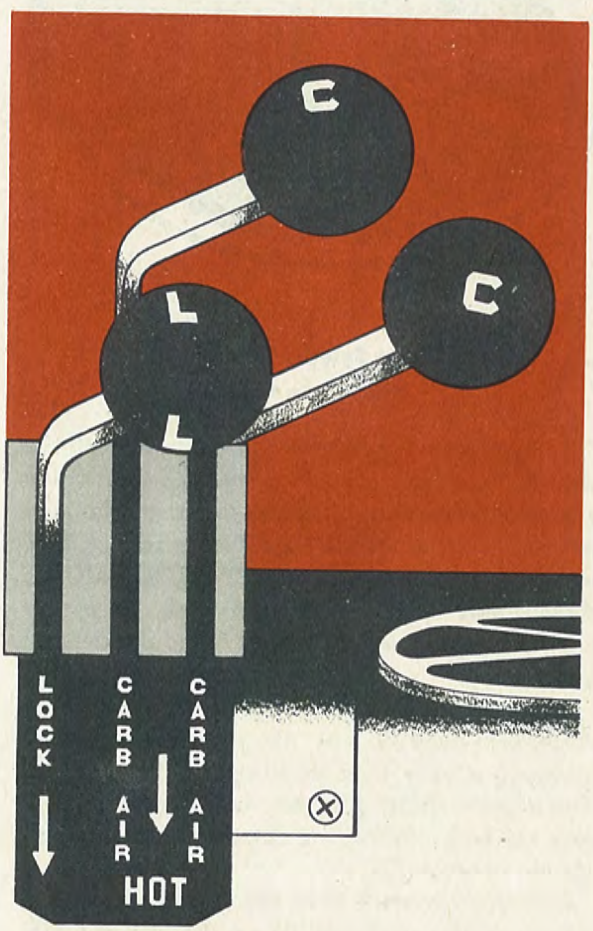
An automatic feature of the carburetor functions in either of these positions. This feature is an altitude compensator unit. As the airplane climbs or descends a diaphragm in this unit measures the pressure of the outside air. It is very sensitive, reacting to the minute changes in pressure and temperature. As the diaphragm expands and contracts, it meters fuel into the induction system to keep the fuel/air ratio at its most efficient level.

IDLE CUT-OFF—stops flow of fuel.

Note: AUTO RICH and AUTO LEAN are sometimes called, respectively, "Takeoff and Climb" and "Cruise."

7. **Carburetor heat controls:** Controls are located below the instrument panel on the right side of the pedestal. Positions: HOT and COLD. When you need carburetor heat to offset icing conditions, move the controls to HOT. This brings heated air from around the cylinder heads into the induction system.

Leave this control in COLD for all normal operations.



Carburetor Heat Controls

OIL SYSTEM

There are two oil tanks, one in each nacelle, with a capacity of 29 gallons each. Servicing these tanks with 25 gallons of oil allows adequate space for foaming and expansion.

Check the quantity in the tank by removing the filler cap and observing the fluid level. When the fluid level is at the top baffle the tank contains 25 gallons of oil.

There is a two-gallon reserve supply in a standpipe at the bottom of each tank. By this means you can feather the prop even though all normal engine oil supply is lost.

Oil pressure and temperature gages and oil pressure warning lights are on the instrument panel in front of the copilot.

Keep oil pressures between 75 and 90 psi in normal flight operation. Don't let them go below 60 or above 100 psi, if you are flying under emergency conditions. If pressure falls below 50 psi, the red warning light above the pressure gage lights.

Oil cooler shutter controls are at the left side of the pedestal. Adjust shutters to keep temperatures within operating limits of between 60°C and 75°C, or, under emergency conditions, between a minimum of 40°C and maximum of 100°C.

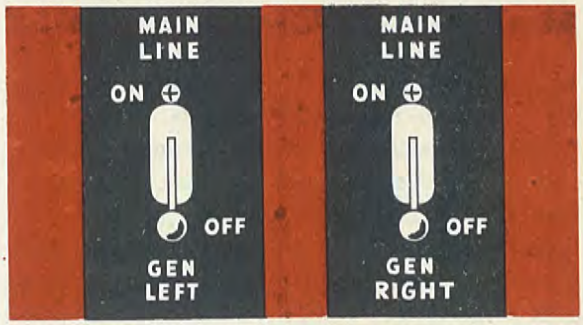
ELECTRICAL SYSTEM

Two engine-driven generators supply electric current to your airplane and charge two 88 ampere-hour batteries. Early series of the C-47 have a 12 volt ground-return electrical system. Late series of the airplane have a 24 volt ground-return system.

There is a generator on each engine. One alone, or both of them, supply current to the batteries. Select generators with one of two switches in the main electrical junction box. On some early series the switches are on the right hand electrical panel.

Open or close battery circuits with switches on the left-hand electrical panel. On late series airplanes there is only one switch.

Fuses or circuit breakers are installed to protect instruments and equipment from overloads.



Generator Switches

Spare fuses for the system are in the main electrical junction box on early airplanes. These have been replaced by circuit breakers on late airplanes.

Battery Cart Plug

Always start engines by use of a battery cart, if a cart is available. Battery cart plug-in is under the fuselage, forward of the leading edge of the wing. When a battery cart is connected, keep the master switch or switches in the OFF position. Turn switches ON only when engines are started and battery cart is disconnected, or when battery cart is not used.

PROPELLERS

The C-47 has three bladed Hamilton Standard Hydromatic propellers. These propellers will feather and unfeather quickly in an emergency. A governor, operated by engine oil pressure keeps the props at a constant speed.

A standpipe in the oil tank retains a two gallon supply for emergency feathering if the engine oil supply is lost. Loss of oil pressure, or oil supply, allows the prop blades to move to full low blade angle.

Don't feather this propeller completely more than once every 15 minutes. The feathering pump motor will heat up and probably burn out if it is not allowed to cool.

Don't keep a prop feathered more than 20 minutes for single engine practice. Oil collects in the bottom cylinder heads making starting dangerous. This fluid can cause a fluid lock and blow off the cylinder heads when you attempt to start.

AUXILIARY EQUIPMENT

1. **Heaters:** Your airplane has either a hot air or a steam type heating system.

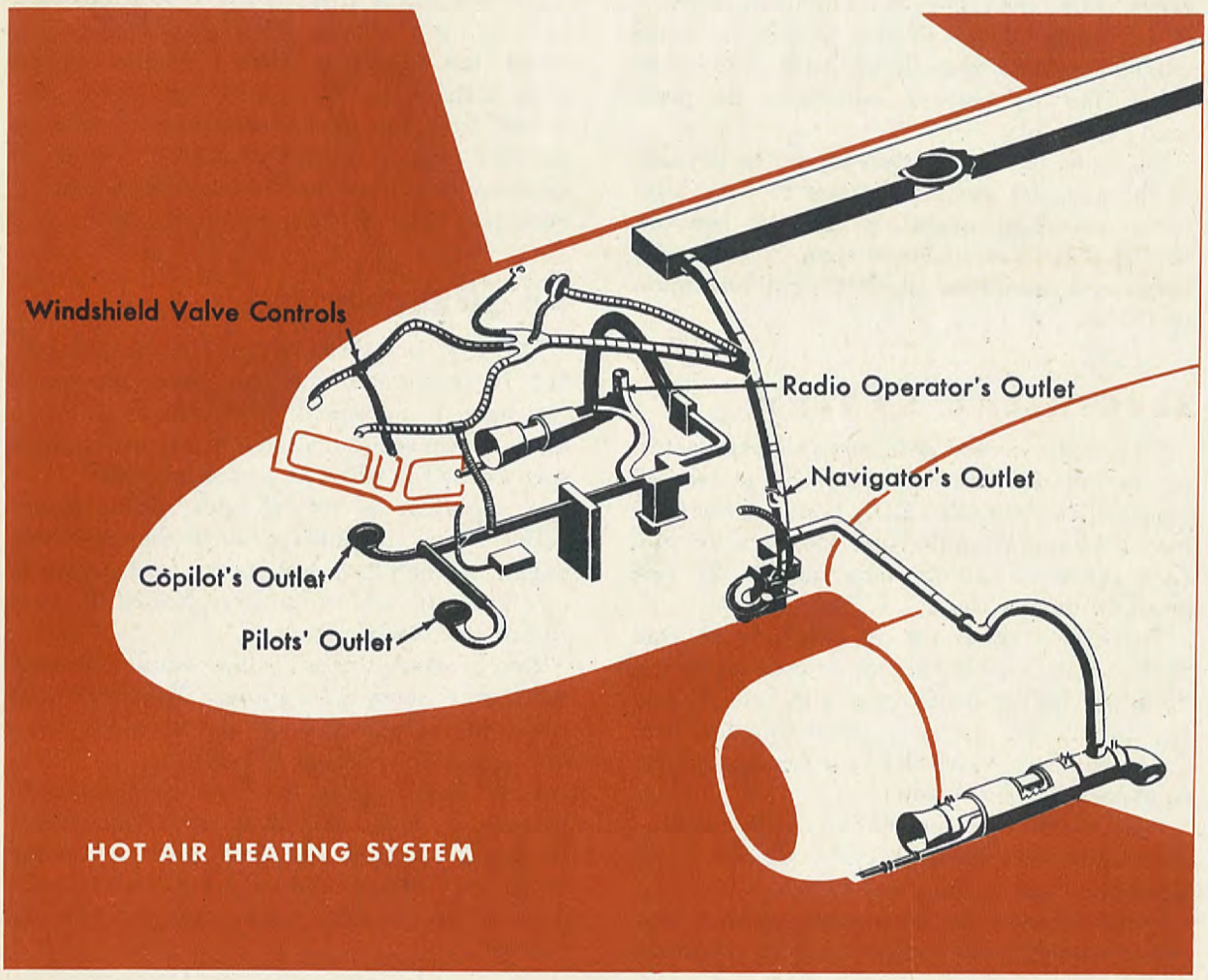
Hot air heating system: In this type of heater, scooped air is warmed by heat exchangers attached to the engine exhaust tail pipes and mixed with cold air to obtain desirable temperatures. Heat from the right engine exhaust goes to the pilots' compartment. Heat from the left engine exhaust goes to the forward cargo, radio operator's, navigator's, and the main cargo compartments, and to the defrosting system. Valves regulate the amount and flow of air, either to the defrosting system or to the main cargo compartment or both. The valves are in the navigator's compartment.

A valve to regulate mixture of heated and cold air, heat controls for the pilots', navigator's and radio operator's compartments; valves to spill excessively heated air, and a red warning light that indicates excessive air temperatures in the system, are all in the radio operator's compartment. A red warning light that indicates excessive temperatures also is on the pilots' right-hand instrument panel.

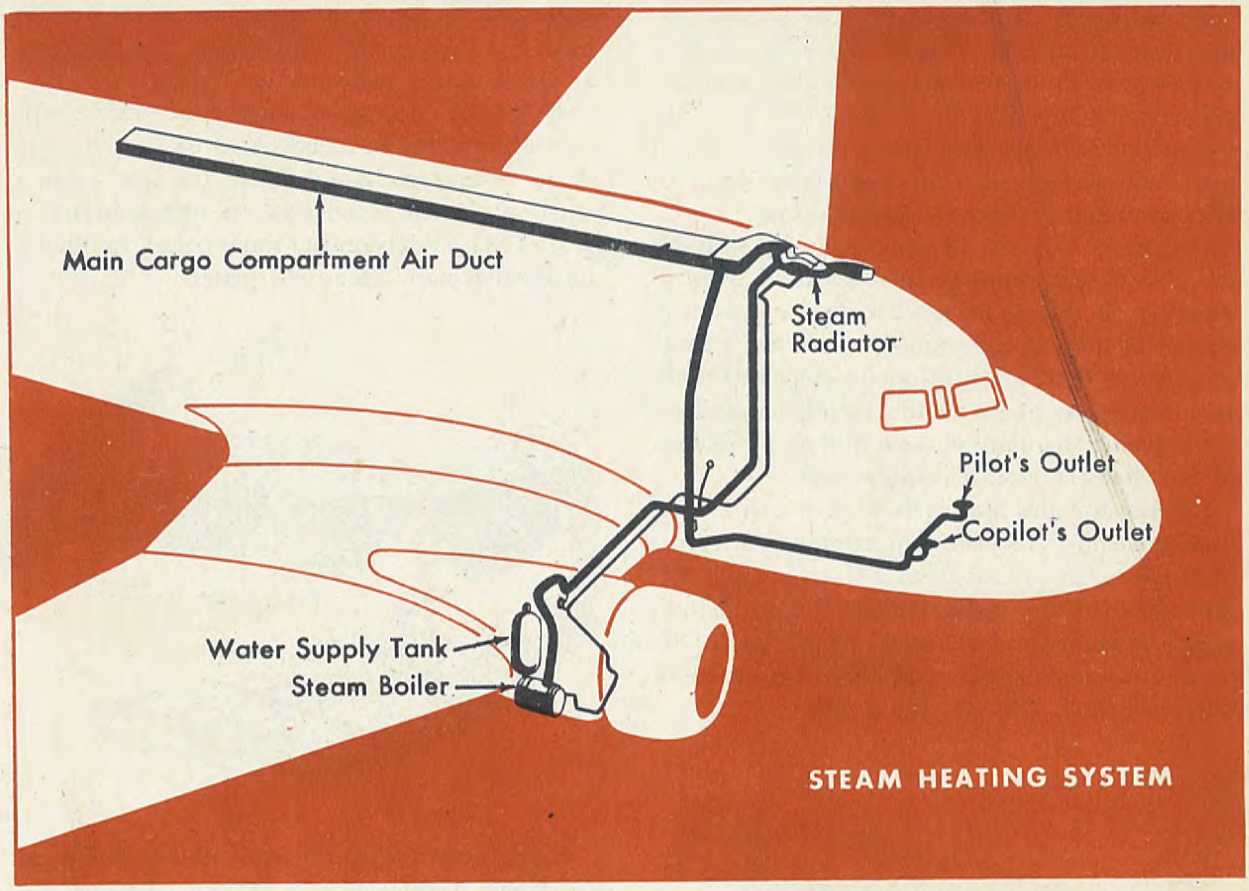
In some series there is a bypass control valve in the radio operator's compartment to direct the flow of hot air from either exhaust to the entire heating system.

Dampers that control the amount of hot air flow are in each outlet.

Restrict system to cold air (ventilation) by valve mixture control in the radio compartment.



HOT AIR HEATING SYSTEM



Steam heating system: In this type of heater, steam, supplied by a boiler in the right nacelle, heats air introduced by airscoop to a radiator in the top left side of the forward section. A valve in the radio operator's compartment controls the flow of steam from boiler to radiator. Flow of air from the radiator to the pilots' and radio operator's compartments is controlled by a valve near the ceiling, between the radio operator's and navigator's compartments. Another valve, to the left of the air duct in the main cargo compartment, controls the flow of air to this compartment. A slide valve, near the floor of the radio operator's compartment, controls the flow of air into that compartment.

Use system for ventilation by bypassing air around radiator. A mixture control, directly forward of the radiator, allows air to flow through the radiator, the bypass duct, or both.

Drain system by opening drain cock in bottom of steam boiler.

2. **De-icers:** De-icers are installed to remove ice from the leading edges of the wings and the vertical and horizontal stabilizers. The de-icer control, behind the copilot's seat, has ON and OFF positions.

To remove ice, turn the control ON after a film of ice builds up on the surfaces. Turn the control OFF after the film is cracked and removed. Repeat this operation until you are out of the icing conditions.

Don't turn the de-icers ON and leave them ON. Ice may form a shield around them leaving the de-icers in operation inside the shield of ice.

When you turn de-icers ON, a vacuum pump on each engine pumps air through a de-icer rotary distributing system, which in turn pulsates the air to bladders within removable de-icing boots that form the leading edge of the wings and tail surfaces. Alternating inflation and deflation of the bladders causes ice to break off these edges.

3. **Anti-icers:** Anti-icers remove as well as prevent ice from forming on a surface of the airplane. A fluid, usually alcohol or alcohol-glycerine, pumped to the surface, spreads and causes ice to loosen and break off. Note: Anti-icer fluid works well with rime ice, is not very effective against freezing rain or snow.

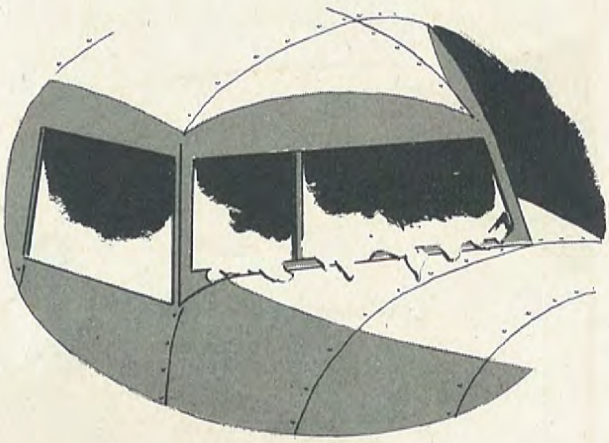
Propeller anti-icer system: A pump behind the pilot's seat supplies anti-icer fluid from a 4-gallon (U. S.) tank, next to the pump, to a slinger ring aft of the propeller hub. Start flow of anti-icer fluid by turning on petcock at tank and turning on pump switch on left-hand electrical panel. Regulate volume of flow by means of the rheostat next to supply tank.

Carburetor anti-icer system: A pump in the forward cargo compartment supplies anti-icer fluid to the carburetor from a 10-gallon (U. S.) tank, also in this compartment. Pump switch is on the right-hand electrical panel. Turn ON for continuous operation, to MOM for momentary operation; OFF to stop pump.

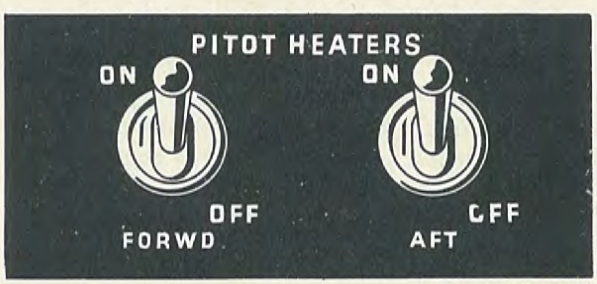
Windshield anti-icer system: There are two windshield anti-icer systems. Each is supplied by a 6-gallon (U. S.) tank of anti-icer fluid in the forward baggage compartment.

To open and close panels frozen tight by ice: Pump fluid to perforated tubing around panels by means of hand pump below the lower right-hand corner of the instrument panel. While using pump, two ON-OFF control valves, below window level on either side of pilots' compartment, allow you to free either one panel or the other or both panels at once. Note: Some models have a plunger under each panel. Use plungers as you would a hand primer.

To remove ice from surface of windshield: Open line valve on small panel on the left side of the instrument panel. When the line is open, turn on electric alcohol pump switch found in some C-47 models on the same panel; in others, on the left-hand electrical panel.

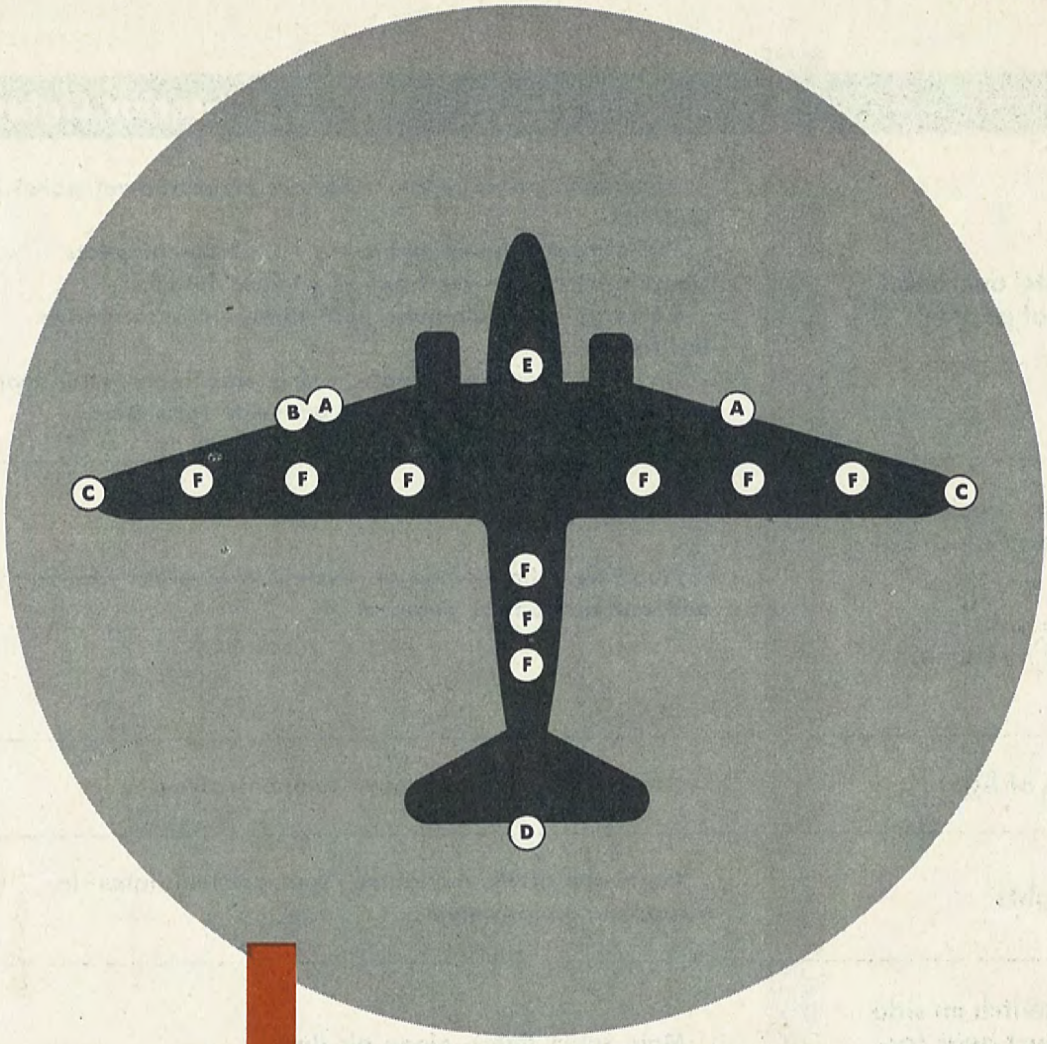


Pitot heater: Two switches on the left-hand electrical panel operate integral heaters, installed in pitot static tube heads. These heaters prevent ice from forming in these heads.



4. **Vacuum system:** Two engine-driven pumps operate the vacuum system. They provide air suction for the operation of the artificial horizon, directional gyros and the turn indicator.

Check suction gage on automatic pilot instrument panel for vacuum indication of 3.75″ to 4.25″ Hg. The normal reading is 4″ Hg. If reading is not within these limits, have system checked.



5. LIGHTS

Exterior Lights

Light Switch Location:

On the pilots' overhead electrical panels

A. Landing lights—on leading edge of the wings.

B. Red passing light—incorporated in left landing light.

C. Navigation lights—red on left wingtip, green on right.

D. Tail light—extreme end of tail, below rudder.

E. Recognition lights—top and bottom of fuselage.

F. Formation lights—(later model airplanes) top of wings and tail assembly.

Interior Lights

On pilots' overhead electrical panels	Instrument panel light—at bottom of instrument panel on pedestal. Pilots' compartment lights—on both sides of pilots' compartment at lower front of window panel. Compass and automatic pilot lights—incorporated in instruments. Command receiver remote tuning unit light—to right of dial. Voltmeter light—above and between voltmeters.
On pilots' upper right-hand electrical panel. *Later models*—on right of instrument panel	Fluorescent lights—one on each side of pilots' compartment, and one at front of pedestal.
On side of light	Companionway light—over companionway.
Near lights	Radio operator's, navigator's compartment lights—in respective compartments.
Single switch on side of air duct near forward bulkhead	Main cabin lights—along air duct.
Pilots' left-hand electrical panel	Parachute troop signal light—right of main cargo door.
Near light	Lavatory light—in lavatory.
Automatic	Door light—on right-hand side of instrument panel. When on, indicates main cargo door is open.
On pedestal, below propeller pitch controls	Red signal light—astrodome.

6. **Oxygen system:** All late series of the C-47 have a low-pressure demand oxygen system. It is supplied either by ten small or five large oxygen bottles located under the main cabin floor. New series have five oxygen outlets: two for the pilots' compartment; one to the right of the companionway, behind the copilot; one in the radio operator's compartment, and one in the navigator's compartment.

Each outlet is an individual unit, complete with pressure gage and flow indicator.

Most new series have three or more A-4 walk-around bottles. Two are in the forward cargo compartment and one in the navigator's compartment.

Some older series have no oxygen outlet in the companionway. As a rule, the oxygen system in these series is of the high-pressure type and is supplied by one large bottle in the forward cargo compartment. On this bottle are a high-pressure oxygen gage, an oxygen regulator, and a shut-off valve. An altitude pressure gage for this system is on the instrument panel.

7. **Communications system:** The following communication equipment is in your airplane: In the radio operator's compartment:

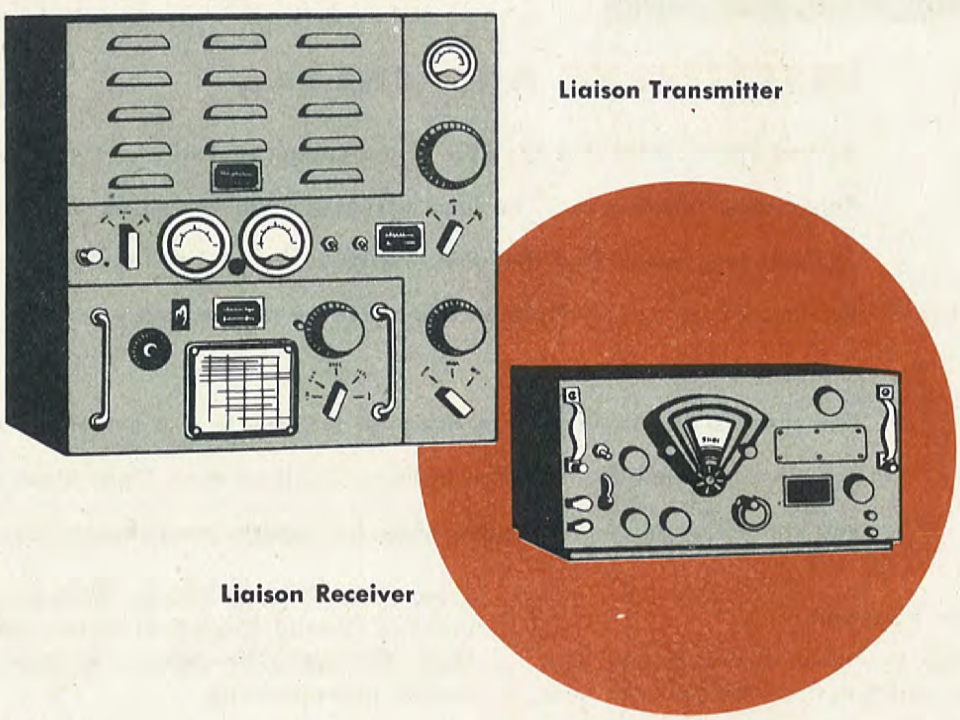
Command Set SCR-274N—For plane-to-plane and plane-to-station short-range voice or MCW communication. Operate from either the pilots' or radio operator's compartment.

Liaison Set SCR-187A or SCR-287A—For plane-to-plane or plane-to-station long-range communication. Operate from radio operator's compartment, and from pilots' compartment once necessary adjustments are made from radio operator's compartment.

Interphone Set RC-36—For communications among crew. Installations at pilot's, copilot's, navigator's, radio operator's and jumpmaster's positions. Intercommunication furnished at all positions with selector at INTER position.

VHF Set SCR 522—For two-way voice communication from plane-to-plane or plane-to-ground station. The receiver-transmitter unit and dynamotor are forward of the radio operator's position.

The VHF control box is aft of the copilot's seat and the VHF-MED FREQ switch is at the right of the radio compass control box. Move this switch to VHF position before operating the VHF control box.



Liaison Transmitter

Liaison Receiver

In companionway:

Radio Compass SCR-269G—For homing, loop work and for other navigational purposes. Operate at radio compass control panel, on ceiling of pilots' compartment.

Marker Beacon Receptor RC-39 or RC-43-2. Operate by turning on radio compass which supplies the necessary power for the receiver. Indicator lamp, on pilots' left-hand instrument panel, lights when passing marker beacon transmitters.

Frequency Meter SCR-211—For checking frequencies on radio receivers and transmitters. To use, attach an antenna to antenna terminal on top of frequency meter cabinet. Plug in headset and turn on set's switch to CHECK position. Once warmed up, rotate tuning control until desired reading is observed.

At rear of main cargo compartment:

Identification Set SCR-595-A or 695A—IFF (Identification, Friend or Foe). Operate by turning ON-OFF power switch in the pilots' compartment and radio operator's compartment. When set is ON, turn selector switch to desired numbered position. For emergency operation, use emergency switch either in pilots' compartment or radio operator's compartment. If necessary, destroy set by simultaneous pressure on two push-switches in pilots' compartment.

Emergency Radio Set SCR-578 A or B (emergency dinghy transmitter)—For emergency use after ditching. Instructions for operation on radio.

AN-APN1—Radio Altimeter. When properly set, it indicates changes in ground altitudes. Set at required altitude by means of altitude limit switch above center of windshield. Red, green, and white lights and an altitude indicator are on the instrument panel in front of the pilot. High and low deviations, above and below set altitude, are indicated by green and red lights.

AN-APN2—Rebecca. Homing device.

CHECKLISTS

INSPECTIONS AND CHECKS

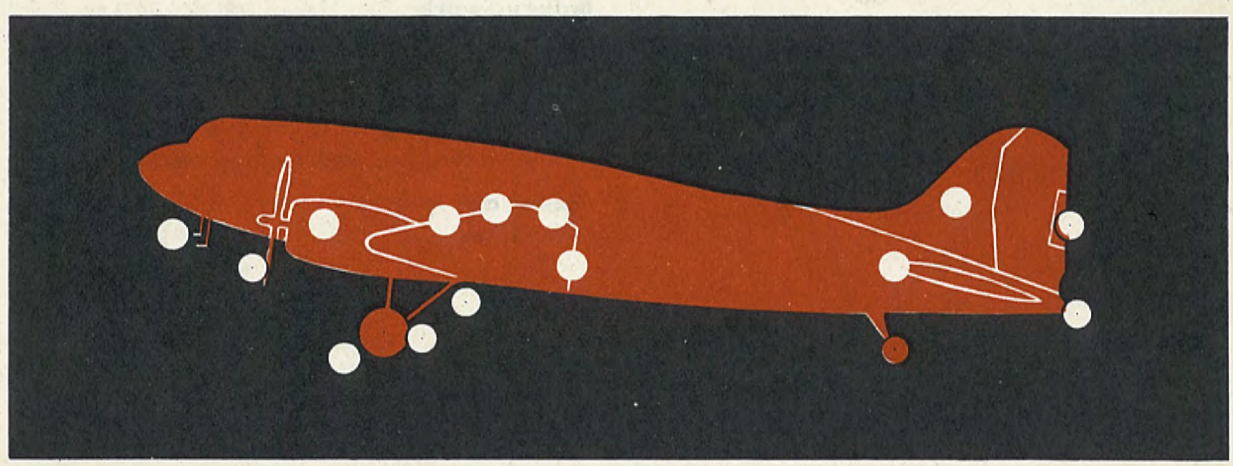
As you know, there is a checklist in the cockpit of every army airplane. AAF Regulations require that it be used on every flight. If you have 200 hours, or 12,000 hours, use it. That checklist is designed for qualified first pilots on a particular series and type airplane. When you are checked out as first pilot on the C-47 use that checklist.

The checklist in this manual is designed for *you*. It is a set of operating instructions you need for transition training. Use it on every flight. It not only gets you into the air safely, and down safely, but teaches you to know your airplane.

Visual Outside Inspection—

NOTE: Before you make this inspection, turn on the battery switch and booster pump to raise pressure in the fuel system. With pressure up you can visually check fuel system leaks. Also check the hydraulic gages to be sure that hydraulic pressure is up.

Wheel Chocks	In place
Control Locks	Removed
Pitot Head Cover	Removed
Landing Gear Pins	Removed (only when hydraulic pressure is up)
Control Surfaces	Freedom of movement, fabric for general condition, hinges for condition, trim tabs for condition
De-icer Boots	For condition and security
Nacelles (outside)	Excessive oil, wheel wells for leaks in fuel and hydraulic lines
Tires	Proper inflation, slippage, general condition
Brake Hydraulic Lines	Leaks, condition
Fuel Sumps	Safetied
Landing and Running Lights	Lenses for condition
Fuel and Oil Caps	Secure
Propellers	Blades for nicks and general condition
Glider Pick-up Equipment (if installed)	Security
Glider Tow Hitch	Metering pin, freedom of action



VISUAL INSIDE INSPECTION

Cargo and Ballast.....Position check against Form F or F-1, security
Cabin Tanks .....Tanks and lines for leaks, valves closed
Safety Belts .....In place for each passenger
Parachutes .....Available for each passenger
Emergency Equipment..As necessary, proper position and security

BEFORE STARTING ENGINES

Forms 1 and 1A.....Status of aircraft (consult aerial engineer)
Hydraulic Fluid Level..Normal
Hydraulic Pump Selector .....Left engine operating hydraulic system
Gear Latch .....Down and locked
Flap Handle .....Flaps up, then to neutral
Gear Handle .....Neutral
Battery Switch .....Off (if battery cart not available, On)
Generators .....On
Fuel Gages .....Amount of fuel
Cowl Flaps .....Open
De-icers .....Off
Anti-icer Pumps and Valves .....Off
Automatic Pilot .....Off
Lights .....On (night only)
Flight Controls .....Free
Carburetor Air Filter...Unfilter, then locked
Crossfeed .....Off
Trim Tabs .....Neutral
Parking Brake .....On
Tailwheel .....Locked
Throttle Friction Brake..Snug
Oil Shutters .....Adjust as required
Carburetor Air .....Cold
Fuel Selector Valves...Left to left main; right to right main
Propellers .....Full forward, high rpm
Throttles .....Cracked
Mixtures .....Idle cut-off
Pitot Heater .....Off
Inverter .....On

STARTING

NOTE: Have member of ground crew pull propellers through at least three revolutions, and post fire guard before starting.

Battery Switch .....Off (if battery cart is not available, On)
Fuel Booster Pumps..On
Call "Clear" to ground crew, energize 10 to 15 seconds, and engage starter
Master and Ignition Switches .....On (after prop is turning)

AFTER ENGINES ARE RUNNING

Fuel Booster Pumps . . . . Off
Battery Switch . . . . . On
Fuel Pumps . . . . . Checked

BEFORE TAXIING

Crew and Passengers Aboard and Door Secured
Hydraulic Pressure . . . . 675-925 psi
Radio . . . . . On and checked
Altimeters . . . . . Set
Clock . . . . . Set
Gyros . . . . . Set and uncaged
Flight Controls . . . . . Free

WHEN GIVEN TAXI CLEARANCE FROM CONTROL TOWER

Parking Brake . . . . . Off
Tailwheel . . . . . Unlocked

ENGINE RUN-UP

Parking Brake . . . . . On
Tailwheel . . . . . Locked
Fuel Booster Pumps . . . . Off
Oil Cooler Shutters . . . . As desired
Mixtures . . . . . Auto Rich
Cowl Flaps . . . . . Open
Fuel Selectors . . . . . Main tanks
Propellers Through Full Range
Carburetor Heat
Generators
Ignition
Hydraulic Pumps
All Instruments and Gages

BEFORE TAKEOFF

Mixtures . . . . . Auto Rich
Cowl Flaps . . . . . Trail
Oil Shutters . . . . . As required
Propellers . . . . . Inc. rpm
Gyros . . . . . Set and uncaged
Fuel Booster Pumps . . . On
Friction Brake . . . . . Tightened
Tailwheel . . . . . Locked (when lined up with runway)

AFTER TAKEOFF

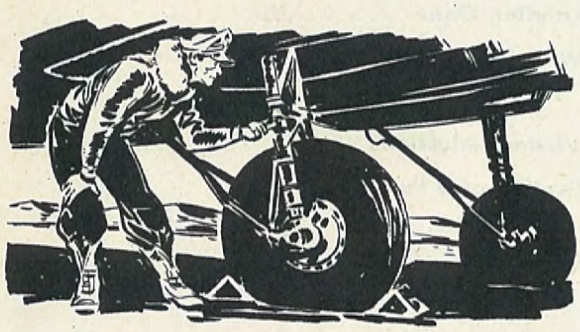
Landing Gear . . . . . Up
Wheels . . . . . Stop rotation with brakes
Power Reductions
Fuel Booster Pumps . . . Off

CRUISE

Cowl Flaps ..... As required
Mixtures ..... Auto Lean
Fuel Selectors ..... To desired cruise tanks
Oil Shutters ..... As required
Adjust Power as Desired

BEFORE LANDING

Automatic Pilot ..... Off
Altimeters ..... Set
Fuel Selectors ..... Left to left main, right to right main or both to full tank
Mixtures ..... Auto Rich
Carburetor Air ..... Cold
Fuel Booster Pumps .... On
Ignition ..... Check
Propellers ..... Set
Landing Gear ..... Down and latched, gear handle neutral, pressure up, green light: check wheels visually



Tailwheel ..... Locked
De-icers ..... Off
Parking Brake ..... Off (brake pressure on pedals)
Flaps ..... As desired

AFTER LANDING

Flaps ..... Up
Cowl Flaps ..... Open
Fuel Booster Pumps .... Off
Elevator Trim ..... Neutral
Propellers ..... Full forward, high rpm
Tailwheel ..... Unlocked

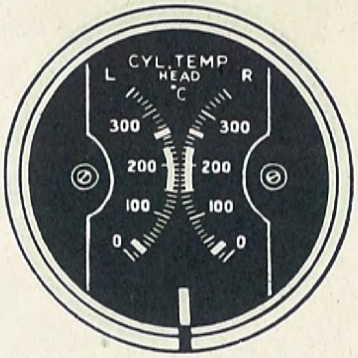
PARKING

Parking Brake ..... On (after chocks are placed, Off)
Cowl Flaps ..... As desired
Tailwheel ..... Locked
Mixtures ..... Idle cut-off
Fuel Selectors ..... Off
Ignition ..... Off
Radios ..... Off
Battery Switches ..... Off
Generators ..... Off
Landing Gear ..... Pins in
Landing Gear Handle .. Down
Flap Handle ..... Up
Flight Control Locks .... On
Pitot Cover ..... On

INSTRUMENT *Markings*

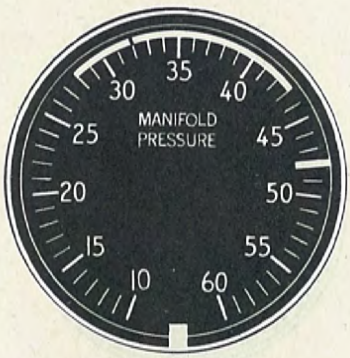
C-47B

GRADE 100/130 FUEL



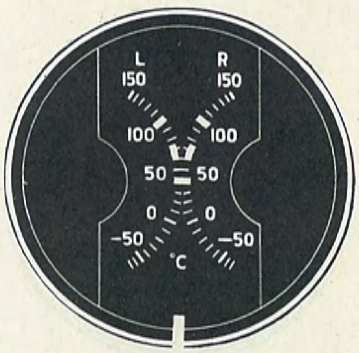
CYLINDER HEAD TEMPERATURE

Short Red	25°C
Green Arc	150-232°C
Short Red	260°C



MANIFOLD PRESSURE

Short red line	48" Hg.
Green Arc	43-32" Hg.
Blue Arc	32-28" Hg.

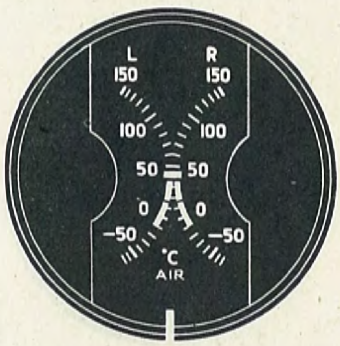


OIL TEMPERATURE

Short Red	40°C
Green Arc	60-75°C
Short Red	100°C

TACHOMETER

Short Red	2700 rpm
Green Arc	2550-2250 rpm
Blue Arc	2250-1700 rpm

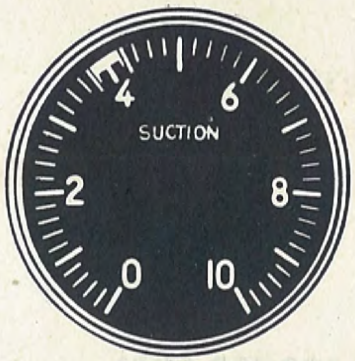


CARBURETOR AIR TEMPERATURE

Yellow	−10°C + 15°C
Green	15-38°C
Red	40°C

FUEL PRESSURE

Red ..... 14 Psi
Green ..... 16-18 Psi
Red ..... 19 Psi



SUCTION

Red ..... 3.75" Hg.
Green ..... 3.75" Hg.-4.25" Hg.
Red ..... 4.25" Hg.

OIL PRESSURE

Red ..... 60 Psi
Green ..... 75-90 Psi
Red ..... 100 Psi

AIR SPEED INDICATOR

Yellow ..... 112 IAS
Red ..... 255 IAS

DE-ICER PRESSURE

Green ..... 7.5"-8.5" Hg.
Red ..... 9" Hg.

HYDRAULIC PRESSURE

Green ..... 675-925 Psi
Red ..... 1200 Psi

STARTING

Note: Location and operation of the controls of this airplane are explained in the second section of the manual, "The Airplane." A thorough acquaintance with that section helps you understand this and the following sections that describe the airplane's operation.

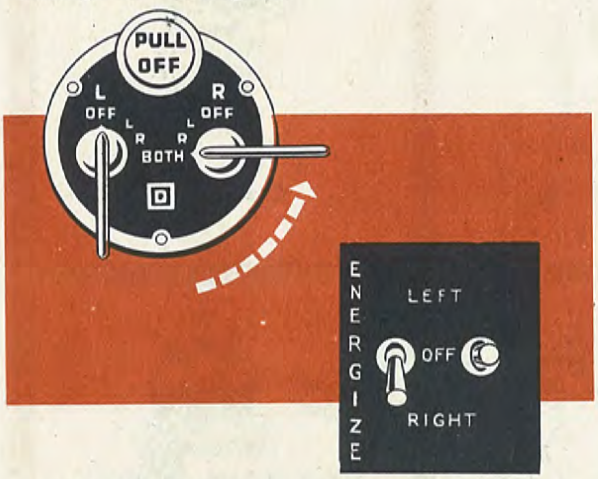
Battery Switch.....Off (if battery cart is not available, On)

Fuel Booster Pumps....On

Copilot builds up fuel pressure by turning on booster pump to right engine or by using wobble pump. Keep pressure built up to between 3 and 5 psi.

Master and Ignition Switches....On

When your C-47 is equipped with an induction vibrator starting coil, leave the ignition switch OFF until the engine is turning over. This prevents a possible kickback and resulting damage to the engine.

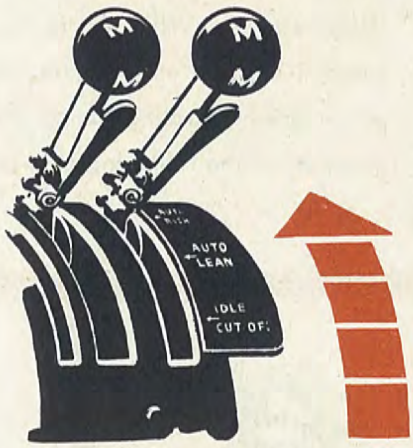


Turn ON the master switch and the ignition switch to the right engine. While the copilot builds up fuel pressure, energize and mesh starters. At the same time you energize, prime engine as much as you feel is necessary. If the engines already are warm, or it is a hot day, you may find it unnecessary to prime.

Be sure not to overprime your engines.

You have left the mixture controls in IDLE CUT-OFF before starting, to keep the engines from flooding. When the engine fires, move mixture control for that engine from IDLE CUT-OFF to AUTO RICH.

Start the left engine in the same manner. If you are using a wobble pump, continue pumping, if necessary, to maintain pressure.



AFTER ENGINES ARE RUNNING

Fuel Booster Pumps....Off

Battery Switch....On

Turn battery switch ON as soon as battery cart plug has been removed.

Fuel Pumps....Checked

Turn fuel selector to one engine OFF. As soon as fuel pressure drops on that engine, turn crossfeed ON. If the engine continues to function, you know at once that the one remaining pump can supply both engines with fuel. By repeating this operation with the other engine, you know whether or not the other pump can supply both engines.

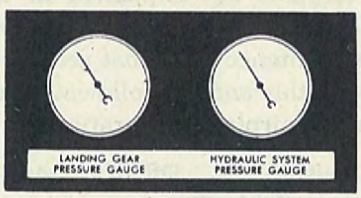
While starting engine watch out for:

1. Engine fire. See that a fire guard is posted beside engine you're starting.
2. Starters burning out. Do not energize and mesh the same starter excessively. If your first or second attempt at energizing and meshing engine does not succeed, start other engine.
3. Overloading. Excessive priming sends too much fuel into the cylinders and causes backfiring. Backfiring, in turn, may result in serious damage to the engine.

BEFORE TAXIING

Crew and Passengers Aboard and Door Secured

Warm engines. While warming up, keep engines below 1000 rpm until engine instruments indicate within safe operating limits. While warming engines make the following checks:



Hydraulic Pressure...
675-925 PSI

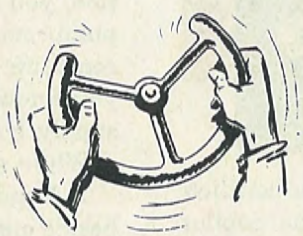
Radio...
On and Checked

Call the tower to see that your radio is working properly.

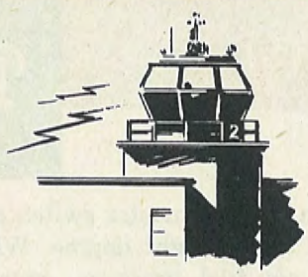
Altimeters...Set

Clock...Set

Gyros...
Set and Uncaged



Flight Controls...
Free



Taxi Clearance
from
Control Tower

As soon as all instruments and gages indicate within safe operating limits, obtain taxi clearance from tower and clearance from lineman. Taxi to run-up area.

TAXIING

Remember, the C-47 is a large, heavy airplane. Although you taxi it like any other 2-engine airplane with conventional landing gear, its size and weight tend to exaggerate its movement in the air and on the ground. You will soon learn its characteristics, but until you know the airplane, handle it with extreme care.

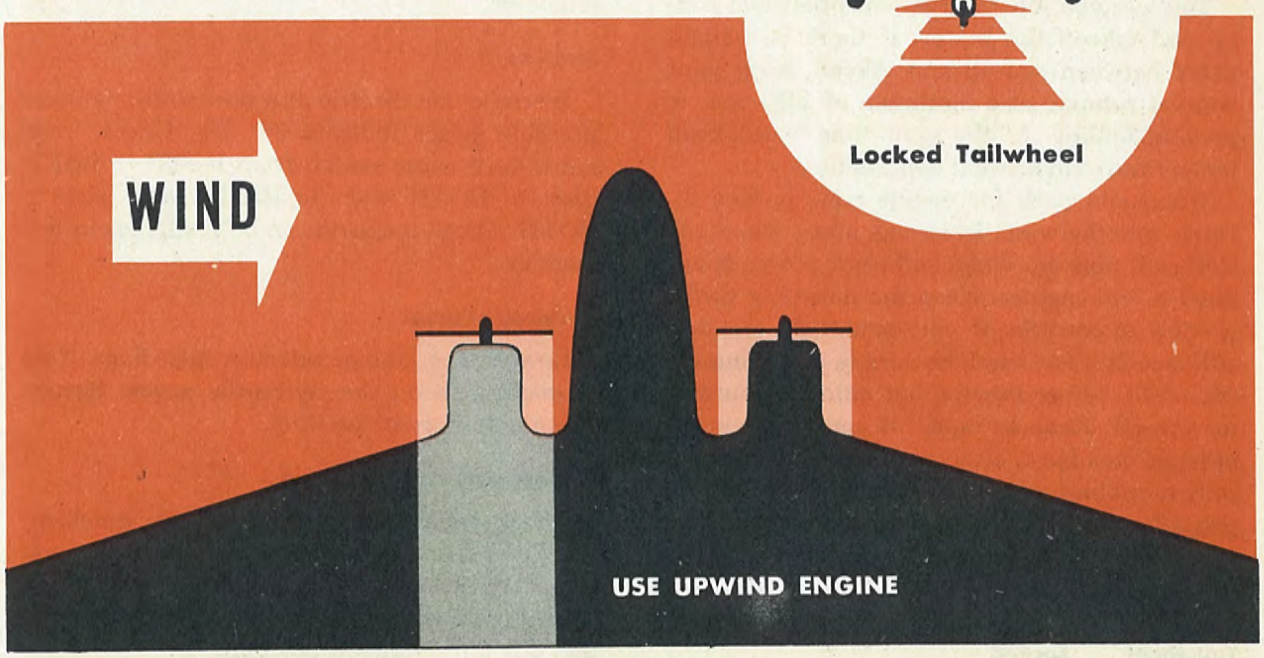
In straight taxiing, keep the tailwheel locked and use throttles as evenly as possible.

In crosswind taxiing, a locked tailwheel and correct use of throttles help you maintain direction with minimum use of brakes. When you are taxiing crosswind, use additional power in the upwind engine.

Anticipate your turns. Momentum gathered in straight taxiing is much greater than in a lighter airplane and carries into your turns. Before you turn, slow your airplane down and unlock your tailwheel. In starting or completing turns, use throttles in coordination with your brakes. If you use throttles properly, you take a great load off your brakes and thereby increase their life.

Keep rudders neutral when braking so that you can apply full action to the brake you are using. You can keep rudders neutral by applying pressure on the opposing rudder pedal; at the same time, you must take care not to apply pressure to the opposing brake.

Locked Tailwheel



TAXIING DON'TS

Don't make pivot turns.

If you keep the wheels rotating through the turn you save rubber, thus reducing the chance of tire failure. Pivot turns can pull a tire off the wheel and may even strain the landing gear.

Don't underestimate the wing span.

It is 95 feet from wing tip to wing tip. Give yourself plenty of room.

Don't taxi too fast.

Taxi accidents still comprise the greatest number of all accidents. Remember, taxi accidents can be prevented. They are caused by carelessness.

Don't overload one or both engines by excessive idling.

While you are taxiing out to takeoff, check your turn-and-bank indicator and your gyro instruments to see that they are functioning.

ENGINE RUN-UP

Normally you make your engine run-up in an area just clear of the runway. If traffic permits and you are cleared to takeoff position, you can make your run-up on the runway.

The less you idle your engines between run-up and takeoff the better. If there is a slight delay between run-up and takeoff, keep your engines running at a minimum of 1000 rpm to prevent fouling. At the same time watch head temperatures to prevent overheating.

When you park for engine run-up, face directly into the wind. In strong, gusty winds the C-47 will nose up when sufficient power is applied to the engines. Keep the incoming traffic in view if possible. If you cannot do this and still face into the wind, be sure to check incoming traffic before moving out onto the runway for takeoff. Keep as much of your airplane as possible on a hard, clean surface during run-up so that pebbles and rocks won't be thrown into propellers and against airplane surfaces.

Once in position, make your checks:

Parking Brake. . . . On

Tailwheel. . . . Locked

Fuel Booster Pumps. . . . Off

Oil Cooler Shutters. . . . As desired

Set oil cooler shutters, as necessary, to keep oil temperatures within safe operating limits.

Mixtures. . . . Auto rich

Cowl Flaps. . . . Open

Open cowl flaps to permit maximum cooling while running up engines on the ground. If the outside air temperature is cold and the engine itself is running cold, adjust cowl flaps as desired.

Fuel Selectors. . . . Main tanks

Propellers. . . . INC. RPM

Advance throttles until RPM reaches 1500. Lock throttles and move control to DEC. RPM. This operation checks governor operation and flushes the prop dome with warm clean oil.

Carburetor Heat

Apply heat and note gages for temperature rise. Return to COLD.

Generators

See that generators are charging by checking ammeter.

Ignition

Increase one throttle at a time until manifold pressure gages indicate 30″ Hg. Check magnetos by turning switch from BOTH to LEFT, back to BOTH, then to RIGHT and back to BOTH. Check magnetos on both engines in this manner.

Hydraulic Pumps

Lower flaps, change selector, raise flaps. Note pressure rise on the hydraulic gages. Return selector to normal position.

All Instruments and Gages

Check engine instruments on the same engine you are checking magnetos before you retard throttle.

Now you are ready to request clearance to taxi out to the takeoff position.

BEFORE TAKEOFF

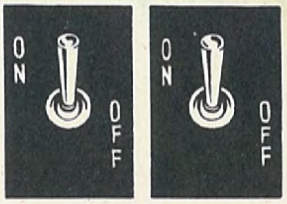
Propellers . . .
Full Forward,
High RPM

Mixtures . . .
Auto Rich

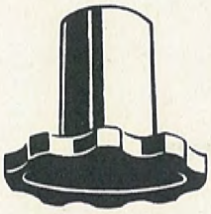
Gyros . . .
Set and
Uncaged

Cowl Flaps . . . Trail

Fuel Booster
Pumps . . . On



Oil Shutters . . .
As Required



Friction Brake . . .
Tightened

Either before takeoff or before you taxi for takeoff position, tighten friction brake to prevent throttles from slipping during takeoff.

Tailwheel . . . . Locked

Lock your tailwheel when you are lined up with the runway.

TAKEOFF

Now you are ready to advance your throttles for takeoff. Advance them evenly and steadily until you reach takeoff power. This forward movement of the throttles should take a full 5 seconds.

Heavy-load Takeoff

Maintain takeoff direction by using your rudder and, if necessary, your throttles. Rudder control is available directly after you reach takeoff power. Use throttles in crosswinds or to offset swerves of the airplane. As in taxiing, maintain direction in a crosswind by applying additional power to the upwind engine. You can advance one throttle ahead of the other by a slight twist of the hand.

In a normally loaded airplane the tail usually comes up by itself. You can assist this tail lift by a slight forward pressure on the control column. When the airplane has attained flying speed (85 to 90 mph under normal load conditions), you can break ground.

Heavy-load Takeoff: When you are taking off with a heavily loaded airplane, definitely bring the tail up to straight and level flight position as soon as possible and hold your airplane on the ground until you attain a safe airspeed as determined by your load.

Short-field Takeoff: In taking off from a short field, hold airplane with the brakes until you have advanced throttles to from 25″ to 30″ Hg. manifold pressure. Release brakes, raise the tail to straight and level flight position as soon as possible, and ease your airplane off the ground as soon as you attain minimum flying speed. Do not allow the airplane to fly itself off the ground. You can use flaps to shorten the length of your takeoff run.

TAKEOFF POWER SETTINGS

RPM	M.P.	MIX.	MAX. CYL. HEAD TEMP.
Grade 100/130 Fuel			
2700	48″	AR	260°C.
Grade 91 Fuel—R-1830-92 Engine			
2700	46″	AR	260°C.
Grade 91 Fuel—R-1830-90°C. Engine			
2700	43″	AR	260°C.

HOLDING
TAIL UP
LEAVING GROUND

Crosswind takeoff: When you make a crosswind takeoff, gain sufficient speed to insure positive rudder control before lifting the tail. As long as you have rudder control, you can coordinate rudder and throttles to maintain a straight takeoff path. Attain enough speed to remain airborne once you have broken ground.

Since your airplane begins to drift when it becomes airborne, you must crab into the wind to maintain straight flight. Once you have begun to crab, do not allow the landing gear to touch the ground. Damage to the gear or to the airplane may result.

AFTER TAKEOFF (CLIMB)

Landing Gear . . . . Up

To retract landing gear

1. Pilot signals . . . . . "Gear UP"

Use the hand signal and a voice command.

2. Release the safety latch from the floor catch.
3. Safety Latch . . . . . Full up
4. Gear lever . . . . . UP
5. When the landing gear pressure gage reads 0 move the gear lever to NEUTRAL. The red light should go out.

Note

When the gear lever is turned to NEUTRAL the safety latch control automatically returns to spring lock position. **On a few early series airplanes the red light stays on even though the gear is fully retracted.**

Occasionally the gear will sag or start to extend in flight. This is caused by a slight pressure leak in the landing gear lines, because there is no positive up lock on the gear.

You can usually tell if your gear is not fully up by these three checks:

1. Red Light . . . . . ON
2. Loss of airspeed
3. Landing gear pressure gage not indicating 0.

To correct simply follow Gear UP procedure.

To extend landing gear

1. Airspeed . . . . . 160 mph IAS or less
2. Pilot signals . . . . . "Gear Down"
3. Safety Latch . . . . . Spring lock
4. Landing gear lever . . . . . DOWN
5. Hydraulic Pressure . . . . . 500 psi minimum
6. Landing gear lever . . . . . NEUTRAL
7. Green light . . . . . ON
8. Safety Latch . . . . . DOWN AND LOCKED

Caution

Proper sequence in operation of the latch and gear handle is important. **Any operation of the latch out of sequence results in inability to latch gear in down position.**

Remedy

If inadvertently you operate the latch out of sequence, return to normal by the following steps:

1. Pull latch to vertical position.

2. Raise gear handle to UP position.
3. Return gear handle to NEUTRAL.

Alternate

If you desire to bring latch and gear handle into sequence without retracting wheels, or if you experience difficulty with the foregoing procedure:

Trip the dog, on the hub of the gear handle, by pulling UP.

Wheels . . . . Stop rotation with brakes

As soon as the airplane is clear of the ground retract the gear. Hold a minimum climb until you get safe single engine speed. This speed varies with the gross weight of the airplane, but is between 110 mph and 120 mph IAS.

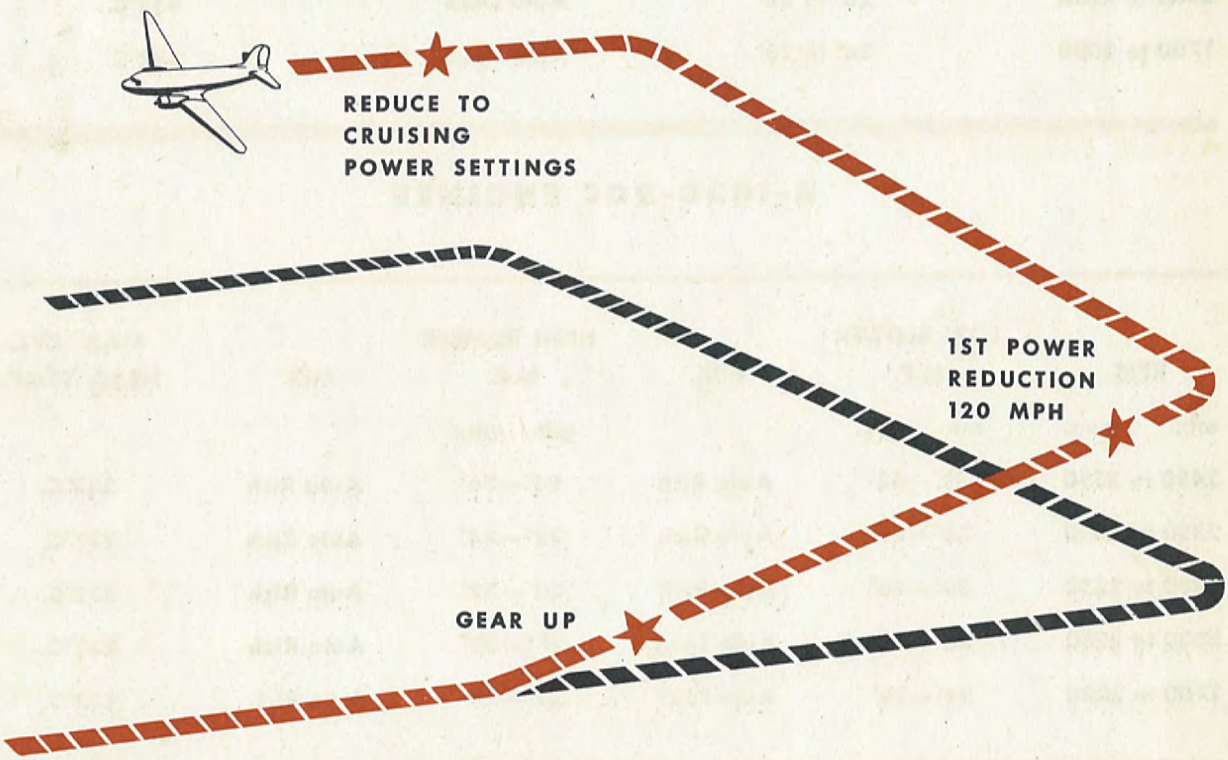
Power reductions

Once you have attained a speed of 120 mph it is safe to make your first power reductions.

REDUCE POWER TO THESE CLIMB SETTINGS

RPM	M.P.	MIX.	MAX. CYL. HEAD TEMP.
Grade 100/130 Fuel 2550	43″	AR	260°C.
Grade 91 Fuel R-1830-92 Engine 2550	42″	AR	260°C.
Grade 91 Fuel R-1830-90C Engine 2550	42″	AR	260°C.

Note **Maximum cylinder head temperature may exceed 232°C., but *only* for takeoff and climb. At no time allow cylinder head temperature to exceed 260°C. For all level flight conditions, regardless of altitude or power, keep cylinder head temperatures at or below 232°C.**



CRUISE POWER SETTINGS

At cruising altitude reduce power to cruise conditions. For Grade 100/130 settings, consult technical orders for the series airplane you are flying.

The recommended power settings for cruise on Grade 91 fuel are:

R-1830-92C ENGINES

RPM min.	RPM max.	M.P. min.	M.P. max.	MIX.	MAX. CYL. HEAD TEMP.
2450 to 2550		39″ to 42″		Auto Rich	232°C.
2350 to 2450		36″ to 39″		Auto Rich	232°C.
2250 to 2350		32″ to 36″		Auto Rich	232°C.
2000 to 2250		28″ to 32″		Auto Lean	232°C.
1700 to 2000		24″ to 28″		Auto Lean	232°C.

R-1830-90C ENGINES

RPM min.	RPM max.	LOW BLOWER M.P. min.	LOW BLOWER M.P. max.	MIX.	HIGH BLOWER M.P. min.	HIGH BLOWER M.P. max.	MIX.	MAX. CYL. HEAD TEMP.
2450 to 2550		39″	42″	Auto Rich	34″	36″	Auto Rich	232°C.
2350 to 2450		36″	39″	Auto Rich	32″	34″	Auto Rich	232°C.
2250 to 2350		32″	36″	Auto Rich	30″	32″	Auto Rich	232°C.
2000 to 2250		28″	32″	Auto Lean	27″	30″	Auto Rich	232°C.
1700 to 2000		24″	28″	Auto Lean	24″	27″	Auto Rich	232°C.

Cowl Flaps. . . . As required

Normally close cowl flaps. Open cowl flaps have a buffeting effect on the tail.

Mixtures. . . . Auto lean

Fuel Selectors. . . . To desired cruise tanks

Since your fuel system has a return line to both main and auxiliary tanks, use at least 60 gallons of fuel from these tanks before using fuel from fuselage tanks. By using fuel from the main and auxiliary tanks first you provide space for return flow fuel as it comes back to these tanks. If this space is not available excess fuel is lost through overflow.

Oil Shutters. . . . As required

Adjust power as desired

You are now ready to trim your airplane for cruising flight.

AUTOMATIC PILOT

When you are flying long distances you can keep your airplane in straight and level flight by means of the automatic pilot. It detects flight deviations the instant they occur and corrects them immediately and with precision. Use this pilot only in ordinary weather conditions, never in extremely turbulent air. To set the automatic pilot in operation, trim your airplane, then:

1. Align index cards in directional gyro.
2. Align bank-and-climb follow-up indicators in bank-and-climb gyro.
3. Check suction gage; it should read between 3.75″ and 4.25″ Hg.
4. Turn shut-off valve control on hydraulic panel to ON position.
5. Turn automatic pilot servo unit's ON-OFF valve control, on the pedestal, to the ON position.

Note: When pilot is in operation, trim ship with automatic control until airplane is in straight and level flight on desired heading.

Servo controls for rudder, aileron, and elevator are on the automatic pilot. They control the speed of reaction of the control surfaces. Adjust these knobs as needed.

To release automatic pilot, turn pilot servo unit ON-OFF valve control to the OFF position. Turn shut-off valve to the OFF position.

Warning

Whenever the autopilot is in operation a rated pilot must be on duty in the cockpit.

FLIGHT CHARACTERISTICS AND LIMITATIONS OF YOUR AIRPLANE

Your airplane has the normal flight characteristics of a 2-engine, low-wing monoplane. It has no unusual tendencies.

Maneuvers: The following maneuvers are prohibited: loops, Immelmanns, spins, dives, rolls, vertical banks, inverted flight, and all other acrobatic maneuvers.

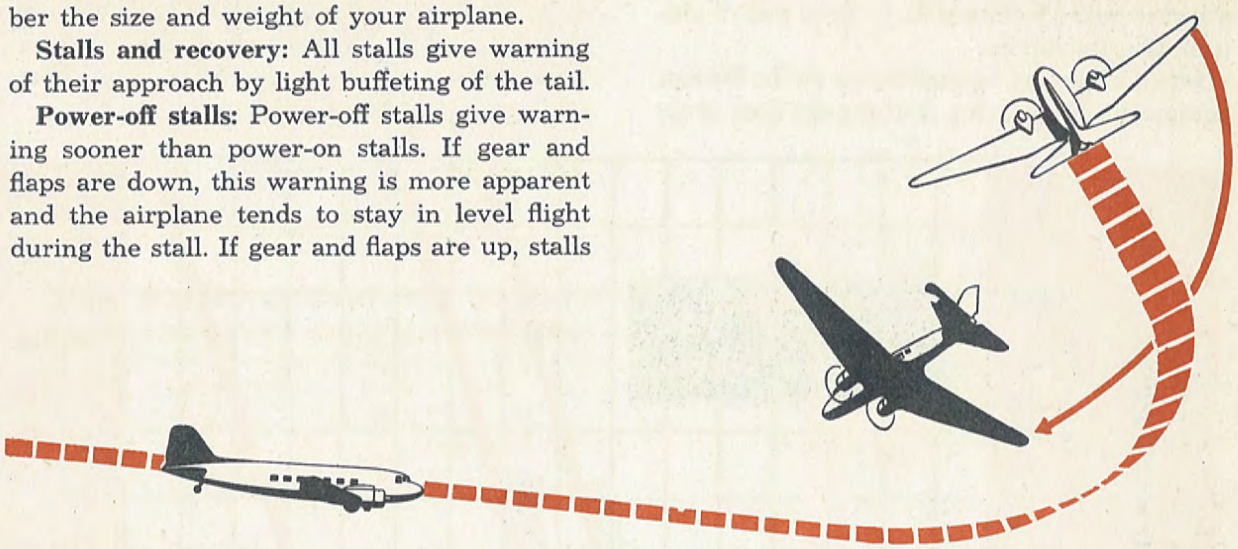
Limit speed and load factors: The C-47 is designed to operate within designated limits under various load conditions. If you exceed these limits you place undue strain upon the airplane, and structural damage or failure results. These limits are:

Item	26,000 lbs. Gross Weight	29,000 lbs. Gross Weight	31,000 lbs. Gross Weight
Max. Level Flight (IAS)	204 mph	187 mph	170 mph
Max. Glide (IAS)	255 mph	207 mph	191 mph
Max. for Extending Landing Gear (IAS)	160 mph	160 mph	160 mph
Max. for Extending Wing Flaps (IAS)	112 mph	112 mph	112 mph

Turns: Normal flight characteristics. Remember the size and weight of your airplane.

Stalls and recovery: All stalls give warning of their approach by light buffeting of the tail.

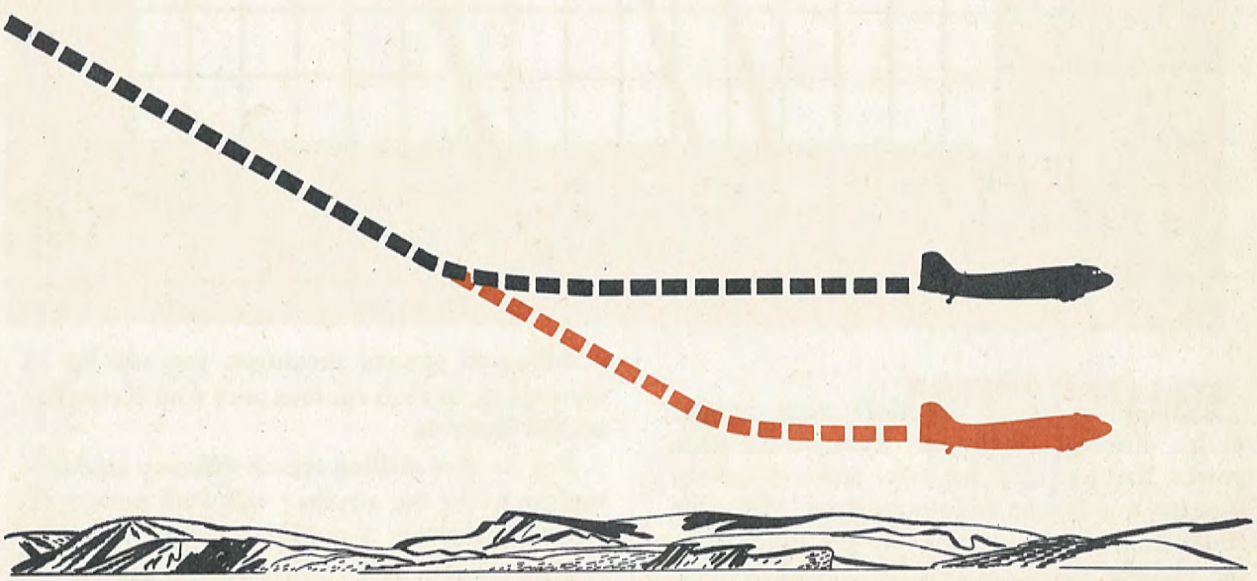
Power-off stalls: Power-off stalls give warning sooner than power-on stalls. If gear and flaps are down, this warning is more apparent and the airplane tends to stay in level flight during the stall. If gear and flaps are up, stalls occur with less warning and the airplane has a tendency to fall off on one wing.



Power-on stalls: Power-on stalls occur more suddenly and with less warning than power-off stalls. If your airplane is not in straight and level flight, stalling speed is increased. In steep banks, for example, your down wing stalls and your airplane rolls. Under these conditions the stalling speed of your airplane can reach values of over 100 mph.

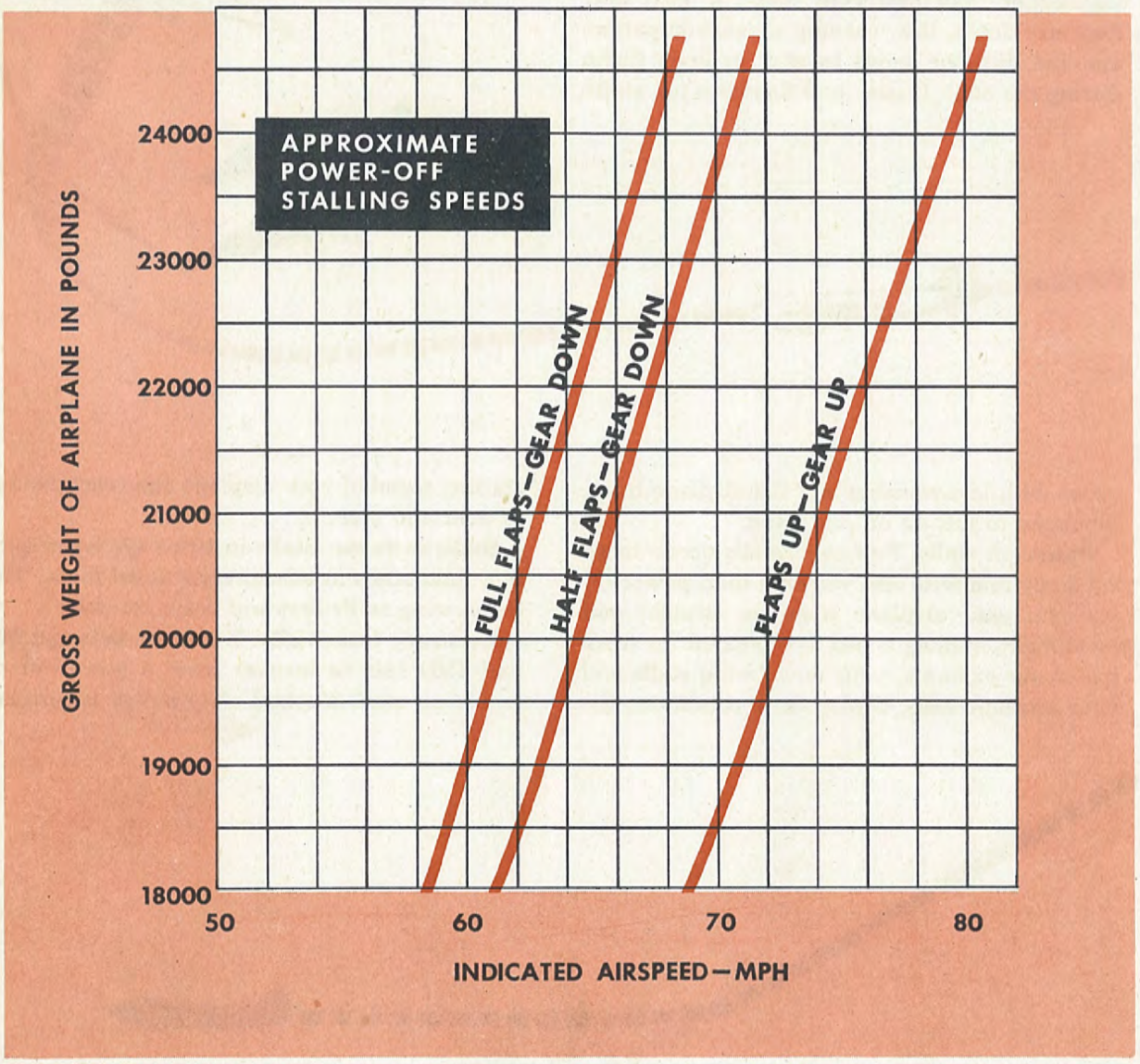
Stalls in turns: Stalls in turns are more sudden than stalls in straight and level flight. The down wing stalls first and drops quickly.

Recovery from stalls: You need between 500 and 1500 feet to recover from a power-off or power-on stall. Method of recovery is normal.



However, avoid excessive airspeed when you are recovering from a stall, to keep loss of altitude to a minimum.

Effect of de-icer equipment on stalls: De-icer equipment in operation disrupts the flow of air over the leading edges of the wings and horizontal and vertical stabilizers. Consequently, it increases the stalling speed of the airplane. Turn off de-icer equipment, therefore, when you are taking off or landing.



STALLING SPEEDS

Stalling speeds of the C-47 vary greatly under different conditions. Changes in load, power, flap and gear position, and even slight changes in pressure and temperature affect the stalling speed. Your own technique also affects the stalling speed. If you fly smoothly, with coordinated control pressures, you can fly at slower speeds than another pilot who is rougher on the controls.

The chart of stalling speeds tells you **approximately** when the airplane will stall power-off. Use this chart as a guide until you are thoroughly familiar with your own airplane.

Effect of cowl flaps on stalls: When cowl flaps are open during flight they cause tail buffeting. This in turn increases the stalling speed of the airplane.

BEFORE LANDING

Automatic Pilot . . . . Off

Altimeters . . . . Set

Fuel Selectors . . . . Left to left main, right to right main, or both to full tank

Mixtures . . . . Auto rich

Before you enter the traffic pattern, set mixtures at AUTO RICH and change fuel selectors to the main tanks. If one main tank contains less fuel than landing minimum (approximately 90 gallons), set both engines on the fullest main tank. It is permissible to land on auxiliary tanks if they are full or are fuller than the main tanks.

Carburetor Air . . . . Cold

Fuel Booster Pumps . . . . On

Ignition . . . . Check

Propellers . . . . Set

Landing Gear . . . . Down and latched, gear handle neutral, pressure up, green light: check wheels visually

When you have turned on the downwind leg and have arrived opposite the runway, extend and lock your landing gear. Check the landing gear green light indicator, and be sure to **check your gear visually.** Increase propellers to 2250 rpm.

Tailwheel . . . . Locked

De-icers . . . . Off

Parking Brake . . . . Off

When you have extended your landing gear and have increased your propeller rpm, make a power reduction sufficient to lose altitude at between 300 and 400 feet a minute.

Once you have turned on your base leg, make another power reduction. Maintain 120 mph until you are on your approach leg. When you are straightened out on the approach leg, make a third power reduction. Do not make this reduction at too low an altitude, as it might necessitate a quick increase in power just prior to landing.

Note: As every pattern differs in altitude and distance from the field, and as wind conditions vary, use your own judgment in making power reductions.

Flaps . . . . As desired

Approach runway at airspeeds of between 85 and 95 mph.

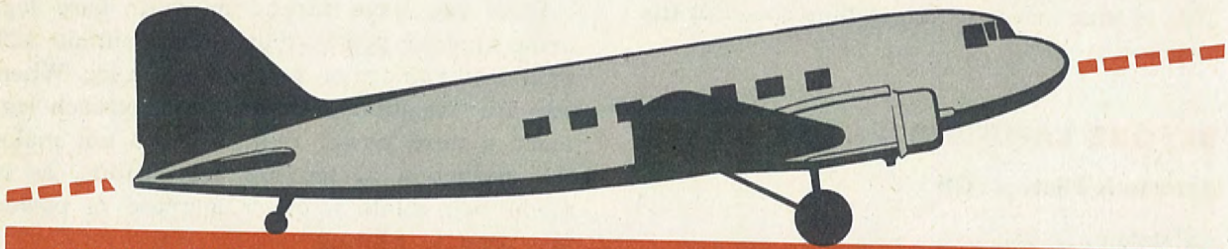
LANDING

There are three types of landing: (1) A 3-point landing. (2) Tail-low landing (tail approximately 1½ feet above the ground when wheels touch). This is actually a wheel landing. (3) Wheel landing (airplane is in a level attitude when wheels touch).

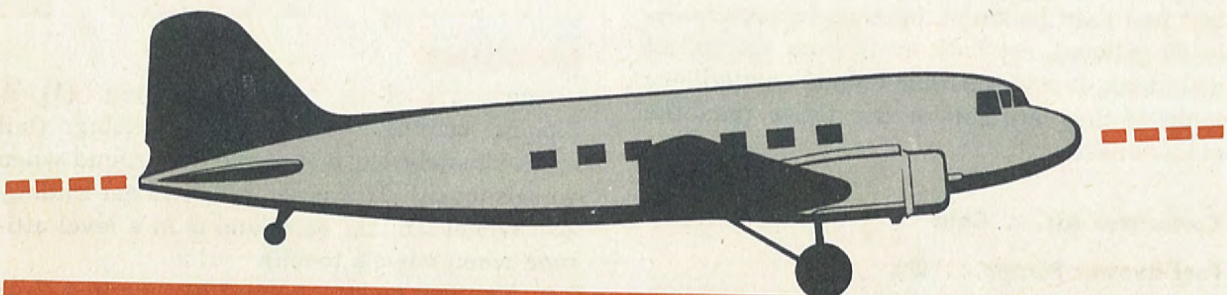
1. You can make a 3-point landing in a C-47 airplane, but this type of landing is not advisable. Reason: Weight of the airplane causes undue strain if you happen to drop in.

2. Normally, make a tail-low landing. You can reduce manifold pressure to a minimum during roundout in this type of landing, and cut engines after making contact with the ground—or you can cut power before roundout and land without power. As speed is dissipated, tail lowers and contacts the ground by itself. You can aid this lowering of the tail by slight back pressure on the control column.

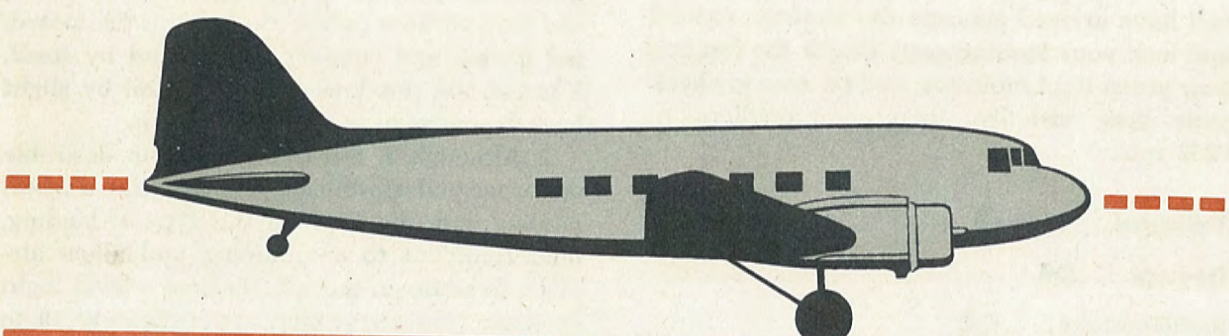
3. Although a tail-low landing is desirable under normal conditions, you can make a wheel landing with the C-47. In this type of landing, hold roundout to a minimum and allow airplane to settle on the wheels from a level-flight position. Contact ground approximately 10 to 15 mph faster than in a tail-low landing and hold the wheels on the ground by a slight forward pressure on the control column. As speed



3-POINT LANDING



TAIL-LOW LANDING



WHEEL LANDING

dissipates the tail lowers and contacts ground by itself. Aid this lowering of the tail as you would in a tail-low landing.

CROSSWIND LANDINGS

There are three possible ways to land crosswind: (1) Hold the airplane straight and level toward the landing strip and drop one wing into the wind just enough to counteract drift. (2) Head the airplane into the wind enough to keep a straight path (crabbing). (3) Combine the first two methods.

The best method is the third: head into the wind and lower the upwind wing. This method keeps the bank and the crab to a minimum and makes it easier to straighten the airplane when close to the ground. Crab just enough to avoid slipping. Any uncoordinated movement may raise the stalling speed of the airplane.

In crosswind landings correct for drift as soon as possible on the approach. If the airplane is making a straight path to the landing strip, the only correction needed on actual landing should be the angle of crab.

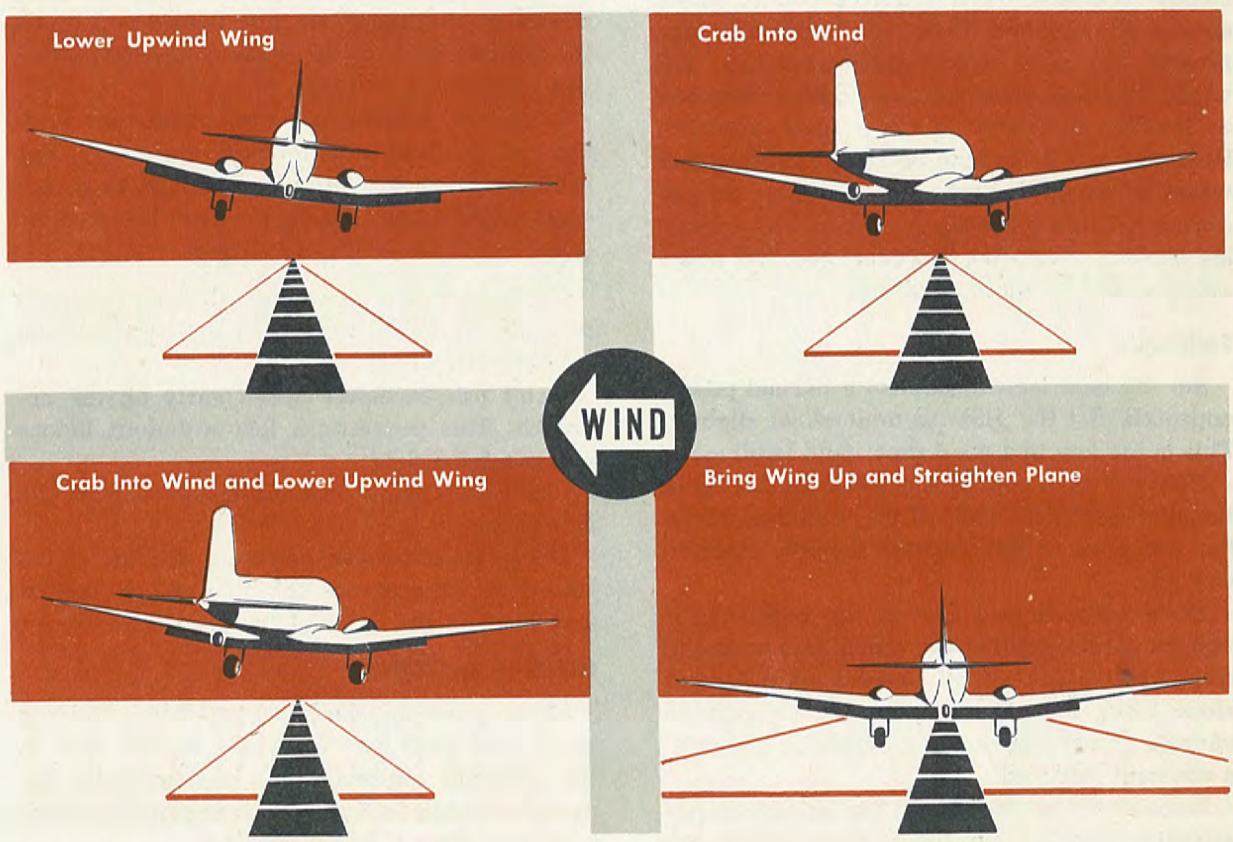
Use flaps at your own discretion. Less flaps should be used in stronger and more direct crosswinds. In a strong 90° wind, or in gusty crosswinds, it is best to use no flaps at all.

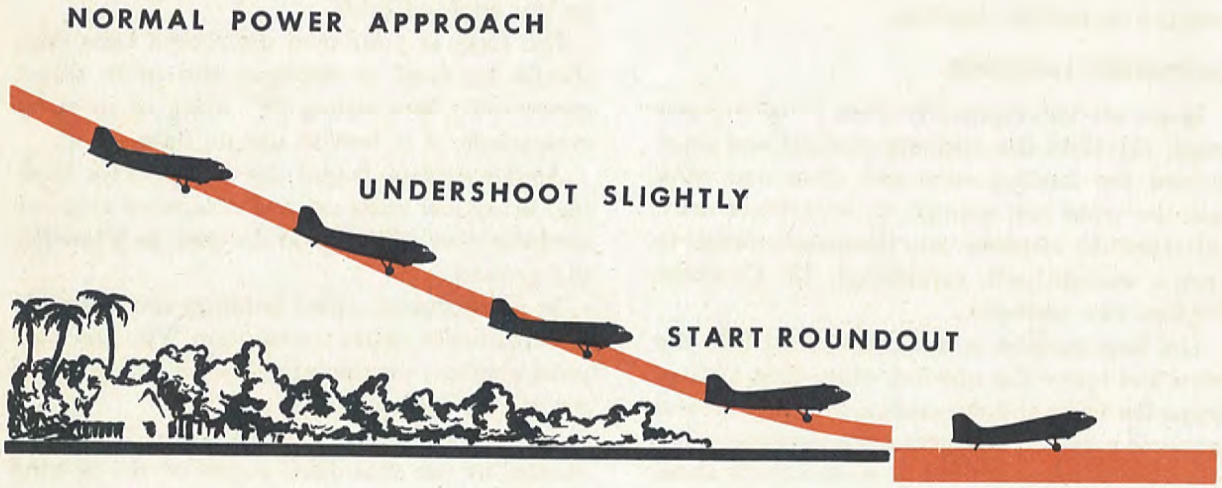
As the airplane begins the roundout for landing, bring low wing up and straighten airplane so there is no side load on the gear as it touches the ground.

In a crosswind, wheel landings are desirable as direction is easier to maintain. You can hold your airplane on the wheels by slight forward pressure on the controls.

Once on the ground, maintain directional control by use of rudder, power on the upwind engine, and by use of brakes.

Remember, you have not finished flying your airplane until you have come to a full stop—especially in a crosswind.





SHORT-FIELD LANDINGS

Tactical operation of the C-47, especially in combat theaters, often requires you to make short-field landings. Field conditions and approach clearances vary in different parts of the world. Landing fields may be small, or bombed so heavily that little landing space remains. Runways and fields may be rough, making fast wheel-landings dangerous, or they may be ice-coated, making the brakes useless. The following landing technique, however, gets you down safely under all these conditions.

Technique

Set the base leg to establish a normal power approach. Set the glide to **undershoot slightly.** This is the key to a good short-field landing.

Hold a normal approach speed from the top of the approach to the start of the roundout. Make the roundout in the shortest possible forward distance.

Make corrections early on the approach, if you are undershooting too much. Use power to clear obstructions—don't depend on judgment alone from high on the approach. Correct by varying power and angle of glide to maintain a constant airspeed.

Increase the power slowly, and go into an approach to slow flying as the airplane approaches a tail-low attitude. Keep the airplane in this attitude for as short a time as possible. You should be slow flying, at an airspeed at or slightly above power-off stalling speed, just before you touch the ground. Reduce the power completely when you contact the ground.

If you are making an actual short-field landing, use the brakes as much as necessary. For practice, however, let the plane roll to a stop as you would if the brakes were not functioning.

Tips

Don't undershoot and slow fly long distances to reach the field. This leaves you helpless if an engine fails.

Don't use excessive speed early on the approach. This prevents a low roundout before you reach the field.

Don't drop below a safe airspeed early on the approach.

Don't use excessive power in the last of the roundout. This causes the airplane to balloon and destroys the value of the procedure.

NO-FLAP LANDING

Make your approach to a no-flap landing lower and with speed slightly higher than in the ordinary approach. As you normally approach in a tail-low attitude it is better to make a tail-low than a wheel landing.

FLAT TIRE LANDING

Make normal approach and a normal tail-low landing. Keep the weight of your airplane off bad tire as long as you can, by use of the ailerons. Be sure the tail is on the ground before you allow weight to settle on bad tire. The airplane turns into the bad tire. Control its direction by using the opposite brake.

OVERSHOOTING A FIELD....BOTH ENGINES

When you mess up an approach and find yourself overshooting, don't be too proud to go around.

Increase rpm and apply power as necessary. Get the gear up immediately.

Hold the nose down as you raise the gear and apply power. With trim tabs set to hold the airplane in an approach glide, there is a strong tendency for the C-47 to lift her nose. Correct as you apply power. Retrim as soon as possible.

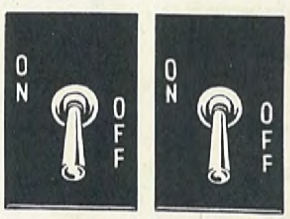
Raise the wing flaps slowly as you gain airspeed (100 to 110 mph IAS). As the flaps come up they decrease the angle of attack of the wings. Use back pressure on the elevators to hold this angle constant, thus preventing uncontrolled sinking and loss of altitude.

Reduce drag further by setting the cowl flaps at trail. Use normal climb procedure and go around for another crack at landing.

AFTER LANDING

Flaps...Up

Cowl Flaps...Open



Fuel Booster Pumps... Off

Elevator Trim Tab... Neutral

Propellers... Full Forward, High rpm

Tailwheel...Unlock Near End of Your Roll

During the roll, pull your flaps up, open cowl flaps, turn off booster pumps, place elevator trim tab in neutral, and put your propellers in high rpm.

Rudder control is available for the major part of the roll. Use your rudder rather than your brakes to maintain direction. At the end of the roll, apply your brakes evenly.

PARKING

Parking Brake . . . . On (after chocks are placed . . . . Off)

Cowl Flaps . . . . As desired

Mixtures . . . . Idle cut-off

When you park your airplane, lock tailwheel, lock parking brake and pull mixtures to IDLE CUT-OFF to stop your engines. Once your engines have stopped firing, push the throttles forward to the stops.

Fuel Selectors . . . . Off

Ignition . . . . Off

Turn off the ignition switches when the propellers have stopped rotating.

Radios . . . . Off

Battery Switches . . . . Off

Generators . . . . Off

Landing Gear . . . . Pins in

Landing Gear Handle . . . . Down

Place gear handle in full DOWN position.

Flap Handle . . . . Up

Flight Control Locks . . . . On

Release your parking brake only when the wheels have been chocked and you have inspected them.

Pitot Cover . . . . On

MOORING

If it is necessary to moor your airplane, see that it is tied down by ropes attached to each landing gear chassis and to the tailskid. Keep airplane level by attaching ropes to the tie-down rings in the slots in each wing. Be sure all ropes are tied at an angle from the ground, never straight up, and that sufficient slack is left in them in case they tighten. Main stress of wind should be taken by the landing gear lashings, rather than by the wings.

Tie-down cable for the tailskid is kept in a canvas bag next to the rear wall of the forward cargo compartment.

NIGHT FLYING

CHECKS ON LIGHTING EQUIPMENT

If you intend to fly at night, make visual checks of all external lights before you start to taxi. Check formation lights, if they are to be used. Check all cockpit lights necessary to safe night operation.

TAXIING HINTS AND PRECAUTIONS

Remember these points when you taxi at night:

(1) Have on running lights and passing light.

(2) Allow more clearance from other airplanes and obstructions.

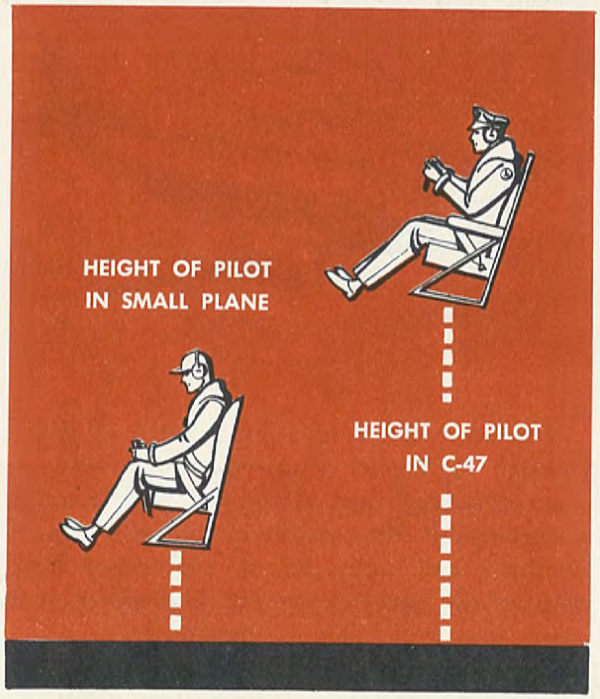
(3) Never shine landing lights into traffic approaching the field for landing.

(4) Run up airplane with landing lights off.

NIGHT TAKEOFFS

When you sit in the cockpit of a C-47 airplane you are approximately 12 feet off the ground.

Consequently, it is considerably different from a smaller airplane in reference to ground lights. Bear this in mind, especially during takeoff.



Make takeoff and climb at night with smooth increases and reductions in power and smooth changes of the airplane's attitude.

Use of landing lights during takeoff depends upon your knowledge of the field and of obstructions in the takeoff path. If you are forced to make an emergency landing after takeoff, landing lights are of value.

Make continued reference to instruments. Depth perception at night is poor and ground lights can create illusions. Do not rely upon them for reference, particularly when you are unfamiliar with the airplane.

NIGHT VISION IN THE C-47

There is considerable reflection on the windshield of this airplane from cockpit lights. Adjust these lights to a minimum glare before takeoff. Turn off all cockpit lights and all lights aft of the pilots' compartment that are unnecessary to the safe operation of your airplane. Unless you need other cockpit lights, use fluorescent lights only.

Caution your crew against turning on any unnecessary light. Your copilot, for instance, might inadvertently turn on a flashlight and cut off your vision just as you are making an approach. Warn him to be careful.

NIGHT PATTERNS AND LANDINGS

Land on First Third of Runway

In flying night patterns, be especially careful to maintain correct altitudes and airspeeds and be alert for other aircraft. Use compass to line up with the runway. Remember, you are flying a large airplane and recovery from a mistake takes much longer than if you were flying a

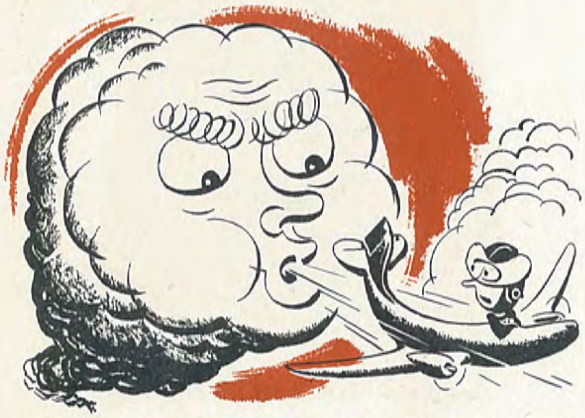
smaller plane. Until you are thoroughly familiar with the airplane, make a normal approach and land within the first third of the runway. Do not attempt to land on the end of the runway. It is easy to undershoot at night. Keep alert at all times.

During night operation make continued reference to your instruments in this and other large airplanes.

WEATHER FLYING

The C-47 is an excellent instrument airplane. It is stable and easily controlled. Bear in mind, especially during instrument approaches, however, that the airplane needs more room to maneuver than a smaller airplane.

HANDLING AIRPLANE IN TURBULENT AIR



Slow your airplane down in turbulent air in proportion to its gross weight and the amount of turbulence. You can slow your airplane down by power reductions alone, or by lowering landing gear at the same time you reduce power slightly. The second procedure is more desirable, as you are able to maintain engine power and pressures while you are reducing your airspeed to the desired rate.

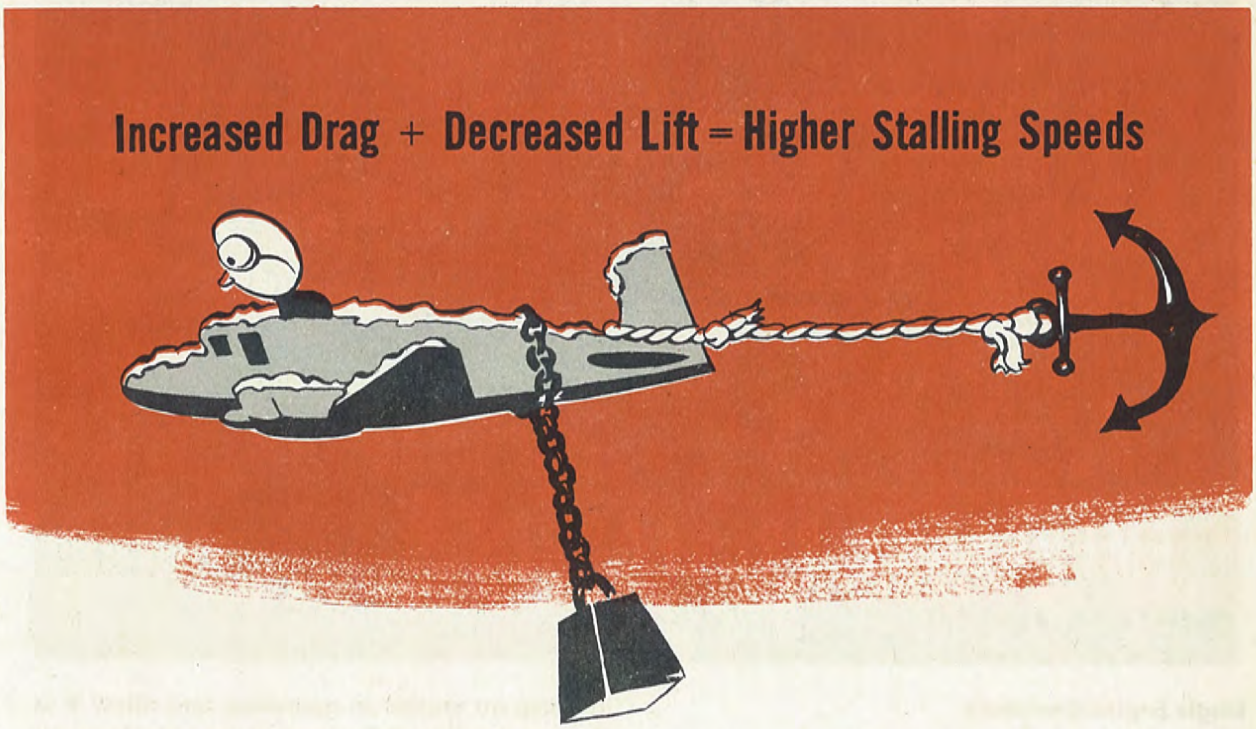
CARBURETOR ICING

Whenever there is a probability of flying through carburetor icing conditions, turn on your carburetor heat. If you are flying through a carburetor icing condition and you cannot eliminate carburetor ice by carburetor heat, turn on the anti-icer system. Remember, it is easier to prevent than to remove ice.

FLYING WITH ICE

The C-47 is stable even with an appreciable load of ice. However, because the stalling speed of your airplane is higher under ice load, decrease the amount of bank in turning by increasing the radius of your turn. Remember, a proportionate amount of airspeed is required to compensate for the increase of stalling speed, resulting from the ice load.

Note: Be sure that de-icer equipment is turned off and that de-icer boots are deflated before making a landing.



INSTRUMENT APPROACHES

On instrument approaches, maintain airspeed to provide ease of control. On low approaches, establish airspeeds according to the gross weight of the airplane. When you have made visual contact with the ground on a low approach, avoid slow airspeeds, quick turns and steep banks.

APPROACHES WITH PRECIPITATION

When you are making a contact approach, forward visibility is often restricted even though windshield wipers are operating. Under this condition, make continuous reference to instruments when you approach for landing so that you can maintain correct pattern and altitude.

On approaches with low visibility, follow this technique:

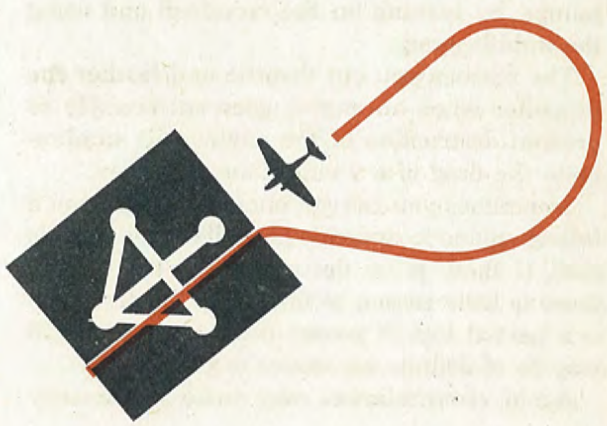
1. Fly along the desired runway in the direction opposite that in which you intend to land, setting the directional gyro on 0°.

2. As you pass the edge of the airport, turn 45° to the right (or left). Fly for 45 seconds on this heading, then start a standard-rate turn in the opposite direction.

3. Turn until you reach a heading of 180°. This heading should put the airplane on the landing approach lined up with the runway. Lower landing gear and ½ flaps.

4. Small corrections with this heading line up the airplane exactly with the runway, once it has come into view.

5. Take wind direction and velocity into consideration in executing this maneuver.



EMERGENCY PROCEDURES

Single Engine Procedure

To feather or not to feather? When an engine goes out, do not be in a hurry to cut off the engine and feather the propeller. If you are at a safe altitude, 500 feet or more above the ground, usually you can take time to find what is wrong and correct it before single engine procedure is necessary. Some simple thing may be wrong with the engine or fuel line that you can correct easily if the cause is known. For instance, if an engine goes out because a fuel pump stops functioning, you can continue to supply fuel to the dead engine by an electric booster pump, or, if the model you are flying has no booster pumps, by turning on the crossfeed and using the wobble pump.

The reasons you cut throttle and feather the propeller when an engine goes out are: (1) to prevent destruction of the engine; (2) to eliminate the drag of a windmilling propeller.

Sometimes you can get enough power from a failing engine to override propeller drag. In this case, if there is no destruction of the engine, there is little reason to feather it. Where there is a partial loss of power in an engine, it still may be of definite assistance to you in flight.

Again, circumstances may make it necessary to keep an engine in operation and allow it to damage itself in order to save your airplane and crew. A decision of this kind depends upon your own judgment.

You might feather an engine that obviously is damaging itself, in order to save this engine for landing or for a time when you will need it most during the flight. Again the decision rests with yourself.

Remember, the important thing is to bring back equipment and people safely.

Steps for Single Engine Procedure

A simple 7-step procedure is the basis of single engine operation:

1. Airspeed
2. Directional control
3. Adjust power
4. Reduce drag
5. Reduce fire hazard
6. Trim
7. Trouble Search

1. Airspeed

Get safe single engine speed (110-120 mph) even though you have to lower the nose and lose altitude to do so. It is better to fly into the ground under control than to spin in.

2. Directional control

Once you have safe single engine speed, directional control is simply a matter of coordinating rudder and aileron properly. Use the trim tabs to aid control if it is difficult to hold the airplane manually.

3. Adjust power

If the power settings are high and the airspeed low (as in takeoff) you may have to reduce power to prevent loss of control. If the power settings are low and the airspeed high (as in normal cruise) increase the power on the good engine. Use as much power as you need. 120 mph IAS is a safe single engine speed, but any additional speed you can get and maintain without overworking your good engine is highly desirable.

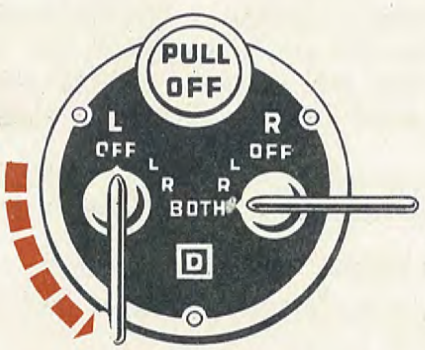
4. Reduce drag

Check the gear and flaps. Get them up if they are down.

Cut the throttle, mixture control, and prop control.

Feather the prop.

Readjust trim tabs if necessary.



5. Reduce fire hazard

Fuel shut-off valve to bad engine OFF.

Fire extinguisher selector switch to bad engine

Ignition switch OFF after prop stops turning.

Cowl flaps and oil cooler CLOSED on bad engine.

Hydraulic and vacuum systems to good engine.

6. Trim

Make final adjustments on trim tabs.

7. Trouble search.

In case of abrupt engine failure, check ignition switches and fuel valve positions while starting single engine procedure. Try to find out what caused the trouble and make temporary repairs. Check all fuses, switches, circuit breakers, valves, lines and wiring as well as you can.

Don't try to start the bad engine if you don't **know** what is wrong. It is much simpler to make a single engine landing than to fight a fire in the air.

Reduce weight if the plane is excessively heavy. Drop tools, cargo, and anything that will come loose, if it is necessary, to maintain safe flight.

Now let's apply this procedure to the varying test of flight conditions.

Engine Failure on Takeoff

Observe these three rules when an engine fails on takeoff:

1. Cut the throttles and stop straight ahead if an engine fails before you leave the ground.

2. Cut the throttles and land straight ahead if an engine fails after you leave the ground, but before you reach safe single engine speed.

If you have not retracted the gear and enough runway remains, land and stop the plane with the brakes. If you have not retracted the gear and there is **not** enough runway remaining, **retract the gear immediately.**

3. If you have reached safe single engine speed before the engine fails, follow normal single engine procedure.

Engine failure during normal flight.

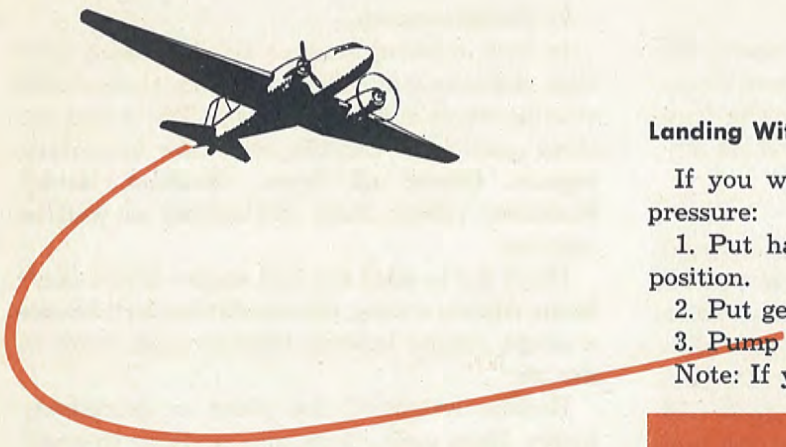
Use normal single engine procedure.

Engine failure in, or approaching a stall.

Cut the power and lower the nose if an engine fails at low speed. Make your recovery exactly as you would for a power-off stall recovery. As soon as you reach safe single engine speed use the normal single engine procedure.

Single Engine Approach and Landing

In making an approach on single engine, it is better to turn into the good engine and to keep the degree of bank to a minimum. Therefore, you have to make a wide approach.



Maintain sufficient altitude to reach the field in case your good engine fails. Lower your gear only when you are sure of reaching the field; do not delay lowering gear too long, however, or there is danger of overshooting.

Make your final approach slightly higher than usual so that you can keep your good engine at minimum power and can straighten your rudder tabs before getting too close to the field. Keep airspeed at 110 mph until you are sure of getting into the field. Use flaps only when you are certain of reaching the field without power.

Once you have lowered your landing gear and your flaps, with airspeed approximately 100 mph, it is imperative that you land. When you have reached this point, get your airplane on the ground. Do not attempt to go around.

If you have landed on single engine, do not taxi your airplane with your good engine.

Failure of Hydraulic System

Remember to close the hand pump shut-off valve in emergency operations where it is necessary to use the hydraulic hand pump. If this valve is left open, you build up pressure in the accumulator only.

Landing Without Hydraulic Fluid Pressure

If you wish to land but have no hydraulic pressure:

1. Put hand pump shut-off valve in closed position.
2. Put gear handle down.
3. Pump landing gear down by hand pump.

Note: If you cannot lower gear by pumping,

allow gear to lower of its own weight, then zoom airplane to snap gear into latch position.

4. Fasten the safety latch down.
5. Return the landing gear handle to neutral.
6. When the green light burns, you know that landing gear is latched and that you can land. If green light does not show, repeat operation.
7. Remember, when you have no hydraulic pressure, **you have no brakes on landing.**

Landing Without Safety Latch Engaged

You can land without the safety latch being engaged if:

1. Your wheels are down.
2. Fluid in the struts is under pressure (at least 500 psi).
3. You return the landing gear handle to neutral to lock pressure in down lines.

If you land without the safety latch engaged, the red warning light burns and the warning horn sounds, because they are connected to the latch.

Do not use brakes if you land with the safety latch disengaged. Limit pressure on the landing gear hydraulic pressure gage to 1500 psi.

As soon as you have brought your airplane to a stop, and before taxiing, insert landing gear pins. Do not use parking brake if your hydraulic system gage shows pressure of less than 500 psi.

Landing With Simultaneous Failure of Hydraulic Fluid Pressure and Safety Latch

If both hydraulic fluid pressure and safety latch fail:

1. Close hand pump shut-off valve.
2. Put landing gear handle down.
3. Pump hydraulic hand pump several minutes, until just before you touch the ground.
4. Do not use brakes.
5. Make belly landing if necessary. You cannot trust gear to remain extended without pressure and safety latch.

Loss of Normal Hydraulic Fluid

Do **NOT** use the hydraulic hand pump unless absolutely necessary. Save the fluid for brakes and wing flaps.

1. Airspeed .....160 mph IAS or less
2. Safety latch.....Spring locked
3. Landing gear lever.....DOWN
4. Shake the gear down
5. Landing gear lever.....NEUTRAL
6. Green light .....ON
7. Safety latch.....DOWN AND LOCKED

Braking When Hydraulic System Pressure Drops

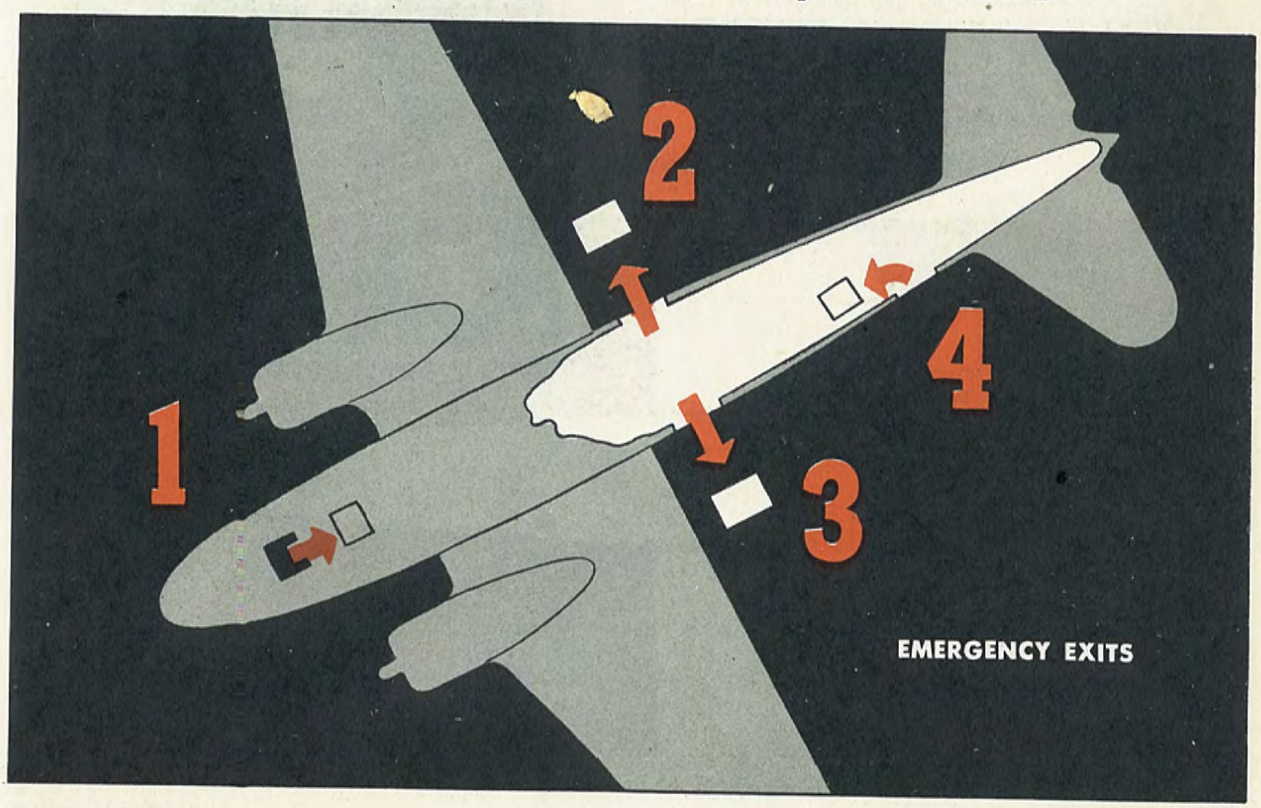
If your hydraulic system drops below 500 psi, use the hydraulic hand pump to build up pressure for emergency braking. Procedure:

1. Place all hydraulic valves in neutral or off.
2. Operate the hand pump while depressing brakes.

Emergency Operation of Wing Flaps

If you cannot lower wing flaps:

1. Close the hand pump shut-off valve if it is open.
2. Lower the flap handle and pump flaps down to the desired setting by using the hydraulic hand pump.
3. Lock pressure in the down-line by returning the flap handle to neutral.



Emergency Exits

There are four emergency exits:

1. **Escape hatch**—above pilots' compartment. To open, twist emergency handles and push from airplane.
2. **Main cargo door**—removable panel. To open, turn emergency release on door and pull panel into airplane.
3. **Two windows in main cabin.** To open, turn handle at bottom of windows and push out and up to clear airplane.

Fire on Board Airplane

You and your crew must know where hand fire extinguishers and engine fire extinguisher control are located.

Hand fire extinguishers are located:

1. One behind the pilot's seat.
2. One to the right of the main cargo door.

Engine fire extinguisher control is located:

Between the pilot's and copilot's seats, on the floor of the compartment.

Procedure When a Fire Is Discovered on Board Your Airplane

1. Order crew members and passengers to attach parachutes.
2. Crew acts on your orders to combat fire.
3. Use fire-fighting equipment.
4. If possible, make a normal safe landing immediately, or
5. Gain as much altitude as possible.
6. If the fire continues to burn, it is up to you to decide whether to land or abandon the airplane. Your decision is final.

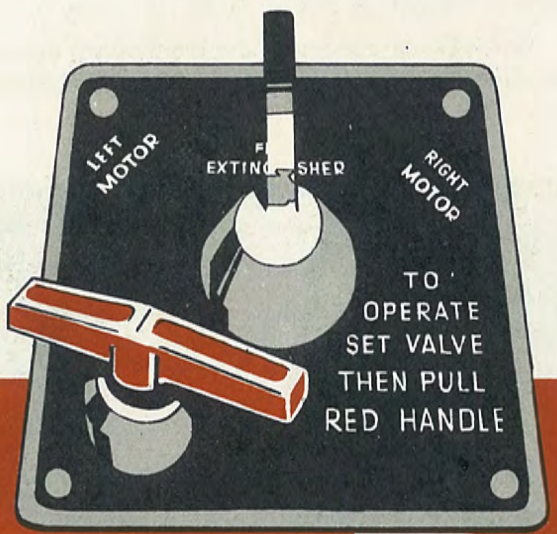
Note: Fire-fighting equipment installed in the C-47 is practical for small fires only. Use as soon as the fire starts.

Cabin Fires

To combat cabin fires:

1. Close all windows, exits and vents.
2. Turn fire extinguishers on fire.

Note: Extinguishers of carbon tetrachloride type upon release cause gases which, if inhaled, result in drowsiness, headache, and inability to keep the eyes open. For this reason,



FIRE EXTINGUISHER CONTROL

LOCATION OF HAND FIRE EXTINGUISHERS

open windows immediately after the fire has been extinguished.

3. If the fire is electrical, turn off main switches.

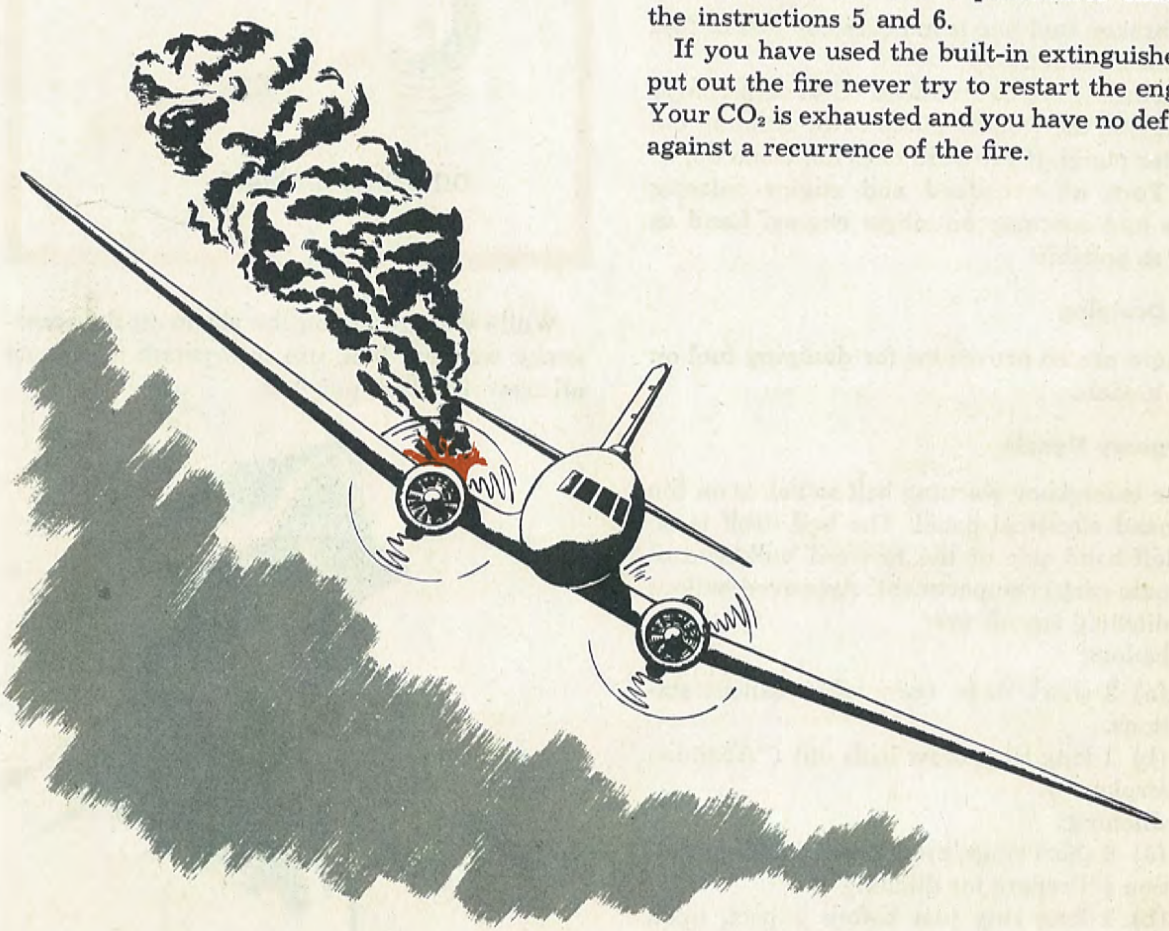
4. If there is a leaking fuel line, turn off valves to stop fuel flow.

5. Use carbon dioxide extinguishers, if available, on fuel or oil fires.

Engine Fires

1. Open cowl flaps
2. Shut off fuel and oil
3. Feather propeller
4. Turn off ignition
5. Set extinguisher selector valve to the proper engine
6. Pull release handle
7. Lower landing gear
8. Do not start engine again
9. Open emergency exits
10. Land as soon as possible to determine the cause of the fire and correct the conditions before continuing the flight.
11. If engine fire extinguishers are not installed, follow the above procedures omitting the instructions 5 and 6.

If you have used the built-in extinguisher to put out the fire never try to restart the engine. Your CO_2 is exhausted and you have no defense against a recurrence of the fire.



Engine Fuel Pump or Valve Failure

If an engine fuel pump or fuel valve fails:

1. Turn on crossfeed and operate wobble pump; or, in models where there is no crossfeed but where there are booster pumps,
2. Turn on booster pump to the dead fuel pump side.

Relief Valve Failure

First try the foregoing procedure for fuel pump or valve failure. If pressure does not come up, fuel is probably being pumped back to the tank through a defective relief valve. In this case, turn off engine selector valve on the defective relief valve side so that you can feed both engine carburetors through the crossfeed or by means of the booster pump.

Broken Fuel Line

A broken fuel line is indicated by loss of fuel pressure. Remedy by:

1. Turning on the crossfeed (C-47 series only) and trying the wobble pump or by running the booster pump. If pressure does not come up,
2. Turn off crossfeed and engine selector valve and continue on single engine. Land as soon as possible.

Fuel Dumping

There are no provisions for dumping fuel on C-47 models.

Emergency Signals

The emergency warning bell switch is on the left-hand electrical panel. The bell itself is on the left-hand side of the forward bulkhead of the main cargo compartment. Approved bailout and ditching signals are:

For bailout:

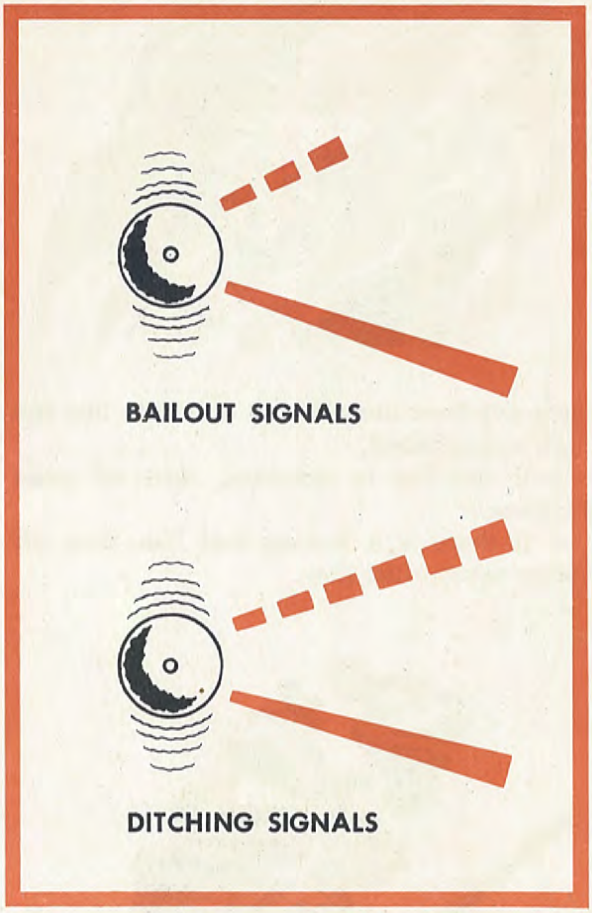
(a) 3 short rings, crew takes bailout stations.

(b) 1 long ring, crew bails out ("Abandon airplane").

For ditching:

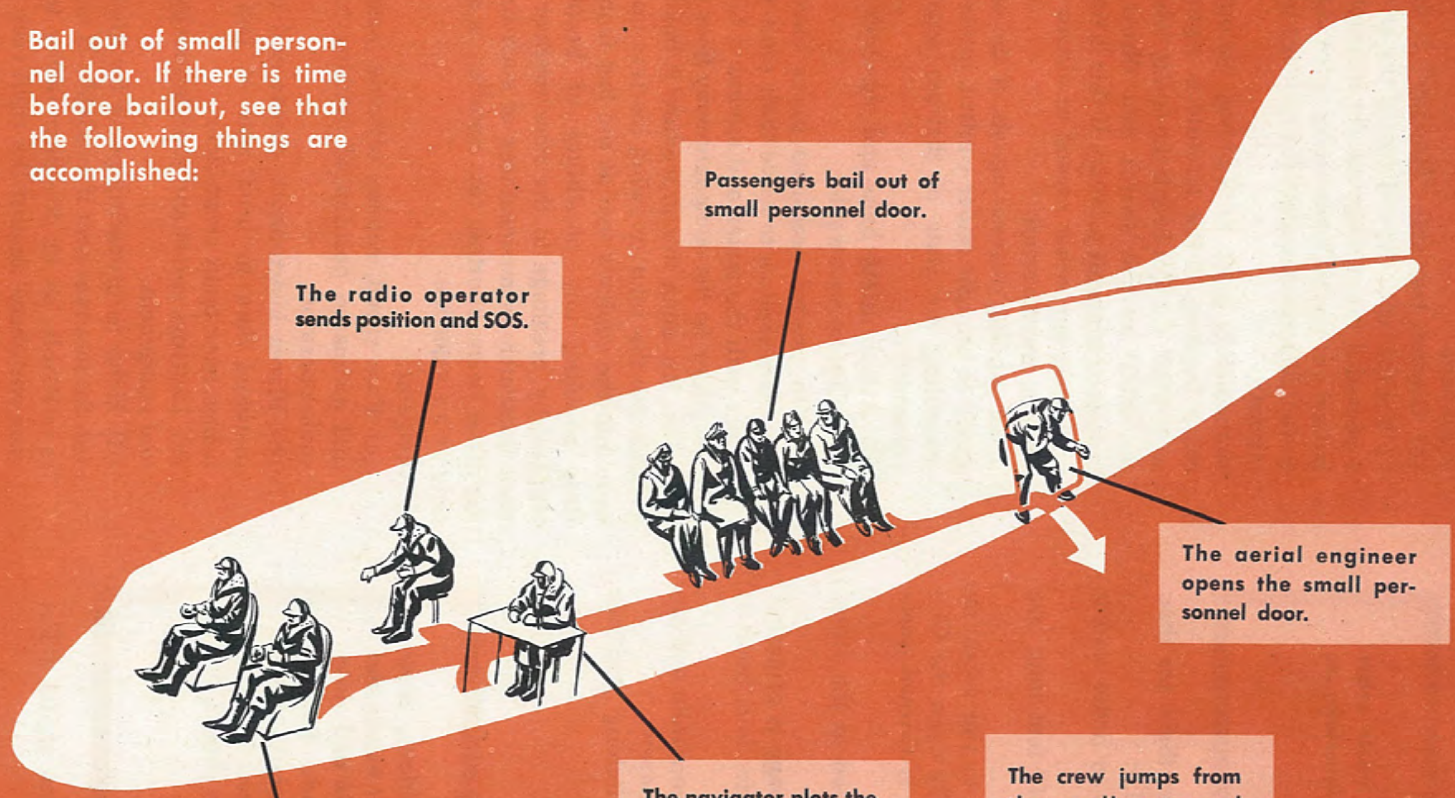
(a) 6 short rings, crew takes ditching position ("Prepare for ditching").

(b) 1 long ring just before impact, upon which crew braces for ditching.



While you are giving the alarm on the emergency warning bell, use interphone to contact all crew members possible.

Bail out of small personnel door. If there is time before bailout, see that the following things are accomplished:



BAILOUT

Ditching

Practice ditching until your crew knows its positions and functions as a team.

Before making an over-water flight see that:

1. Water containers are full.
2. Emergency equipment is in order and is lashed down near exits.
3. Retaining lines, at least 12 feet long, are attached to lift rafts.
4. A static line is attached to the retaining line so that it will automatically open the CO_2 cylinder valve when the raft is thrown overboard.
5. A retaining line is attached to the emergency radio set.
6. An emergency radio message is prepared. Leave blank the location, date, and hour of ditching.
7. Mae Wests are in usable condition and are being worn by passengers and crew.
8. Crew members know ditching positions and duties.

Ditching Stations and Duties

On taking ditching positions, crew members should pad their heads and backs as much as possible and clasp hands behind their heads. Do not leave ditching stations after airplane's first contact with the water. The second shock is more severe and is the important one.

When you give the attention signal ("Prepare for ditching"):

1. **Pilot and copilot:**

(a) Pilot gives any necessary instructions to copilot or aerial engineer about disposition of passengers and cargo or equipment to jettison.

(b) Copilot—transmit "Mayday" 3 times. Follow this with the call sign of the aircraft repeated 3 times. Depress the microphone button but do not transmit by voice. At the end of 20 seconds repeat the call sign of the aircraft.

Immediately prior to ditching, bailout, or crash landing, if the aircraft is equipped with VHF: Copilot break the safety wire on the VHF control switch and throw the switch to transmit position. If this is impossible, use any other means to obtain continuous transmission.

After sending distress signals, if the emergency is brought under control, a message cancelling the state of distress must be transmitted.

(c) Attach safety belts and shoulder harness. Copilot assists pilot.

Note: On several occasions pilots have instructed their copilots to leave their seats prior to contact with the water and assume a braced position either on the companionway floor or in the cabin. By using this procedure it has been possible for the pilot to swing his feet up and over into the copilot's seat at the last moment, thus avoiding any possibility of becoming trapped by breakage in the nose or floor section. Inasmuch as no instances of such breakage have been reported, this notation is given only as a suggestion.

2. **Navigator:**

(a) Pass speed, course, altitude, position, and estimated position of ditching to the radio operator.

(b) Places instruments, charts and informational data in brief case or bag and lashes near main cargo door.

(c) Destroys secret and confidential papers and equipment.

(d) Helps in preparing plane for ditching.

(e) Sit in a rear seat if available. If no seat is available, sit on the floor facing to the rear with back against the right rear main cargo fuel tank, cargo, or against the right forward bulkhead in the main compartment.

3. **Radio operator:**

(a) If emergency is not imminent, transmit information furnished by the navigator on air-ground frequency and request a fix.

(b) Turn IFF to EMERGENCY, if ditching is imminent. Transmit SOS 3 times, followed by the call sign of the aircraft repeated 3 times. Transmit a 20 second dash and the call sign of the aircraft on CW. Make the first transmission on the liaison set on the assigned air-ground frequency. If contact is not established on the assigned air-ground frequency, use one or more of the following:

(1) The international distress frequency—500 kc.

(2) U.S. emergency and safety frequency —8280 kc.

(3) Any other available frequency in an effort to establish contact with a ground station.

Immediately prior to ditching, bailout, or crash landing, tie down the CW key.

After transmitting distress signals, if the emergency is brought under control, a message cancelling the state of distress must be transmitted on each of the frequencies used.

(c) Remain on interphone until time to assume ditching position.

(d) Assume ditching position in radio operators seat facing to the rear.

4. **Aerial engineer:**

(a) Checks passengers to see that each is wearing his Mae West, and has his safety belt properly buckled, or is properly braced on the floor.

(b) Ties down all emergency equipment near main cargo door so that it is easily accessible.

(c) Jettisons as much cargo and equipment as time permits; lashes down what equipment he cannot dispose of.

(d) Place an article, glove, anything, in crew compartment doorway to prevent jamming.

(e) Sit facing the rear, with back against the end of the left rear fuel tank, cargo, or left forward bulkhead in the main compartment.

5. **Passengers:**

(a) Remain in seats, if possible, with safety belts fastened. Pad the man nearest the forward bulkhead with sprung parachutes or other material. See that remaining passengers lean forward with arms hooked under knees and heads against knees.

6. **Nurse and medical technicians:**

(a) Assist patients with safety belts, litter straps, and life vests.

(b) Prepare first-aid equipment for removal to rafts.

(c) Assume ditching positions authorized for passengers, or positions recommended in paragraph 7 below.

7. **Approved ditching positions:**

(a) Secured by safety belt and harness.

(b) Sit facing the rear, back braced against a forward bulkhead, hands clasped behind head.

(c) Lie on the floor feet forward, braced against a forward bulkhead, knees slightly bent.

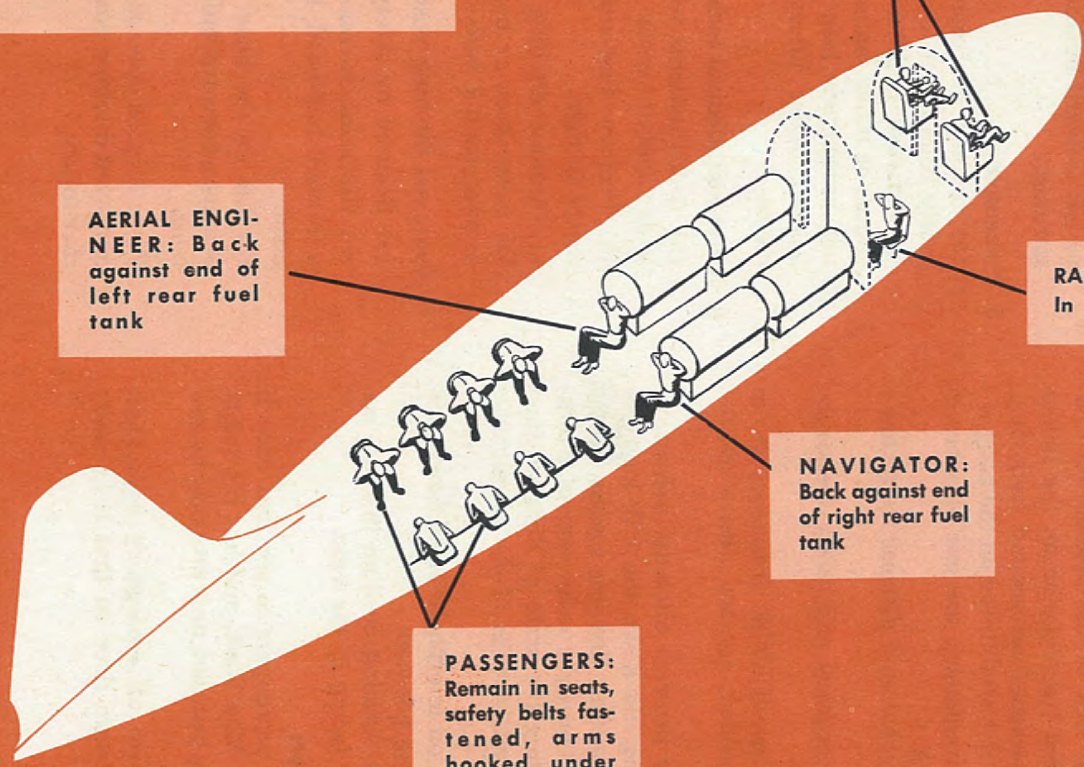
Place injured crew members in one of the approved ditching positions to prevent further injury.

SEE DIAGRAM ON NEXT PAGE FOR APPROVED DITCHING POSITIONS

ALTERNATE DITCHING POSITIONS

Secured by safety belt and harness facing rear, back braced against a forward bulkhead, hands clasped behind head. Lie on floor, feet forward, braced against a forward bulkhead, knees slightly bent.

PILOT AND CO-PILOT: Attach safety belts and shoulder harness



AERIAL ENGINEER: Back against end of left rear fuel tank

RADIO OPERATOR: In seat facing aft

NAVIGATOR: Back against end of right rear fuel tank

PASSENGERS: Remain in seats, safety belts fastened, arms hooked under knees

DITCHING STATIONS

Ditching the Airplane

Although conditions of the water determine how and where you should ditch your airplane, there are certain points to bear in mind in **any** ditching:

1. Give your crew as much time as possible to prepare for ditching. Before you land be sure that every person on board your airplane is wearing a Mae West and is in his ditching position.

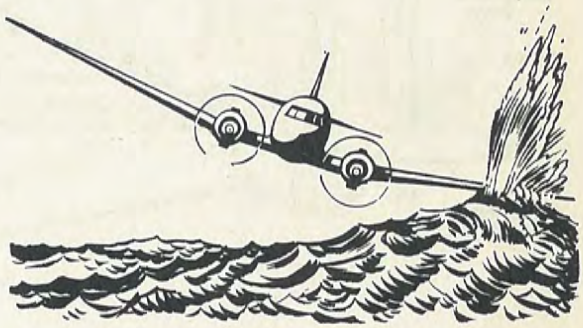
2. See that as much weighty equipment as possible is jettisoned. The lighter your airplane is, the easier it lands and the longer it is likely to stay afloat.

3. Keep landing gear up and ditch with fuselage parallel to the water. Because of its construction your airplane has admirable water landing characteristics.

4. Approach in a normal landing glide with minimum speed consistent with control. (C-47's have been ditched at speeds as low as 75 mph.)

5. If possible, choose your landing spot, but do not be indecisive about landing. Progress at a low altitude for any extended period of time may allow spray to hit the windshield and lower or eliminate visibility.

6. Keep your wings level or parallel to the water. If a wing hits, the airplane is likely to disintegrate and sink in a few seconds.



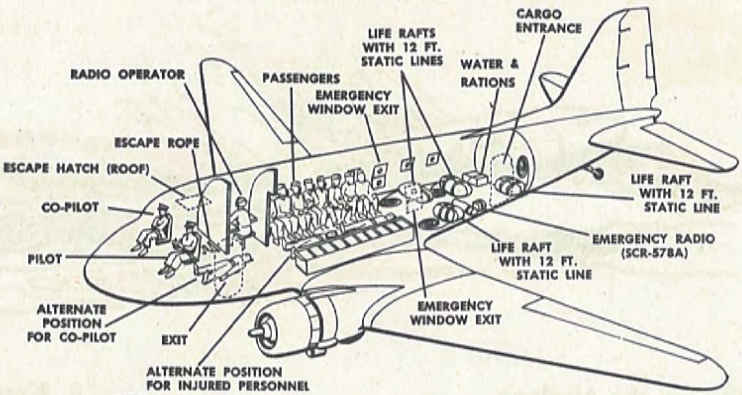
7. Use power, if possible, to flatten the approach. For this reason, do not delay in making a decision to ditch.

8. Use flaps at your discretion.

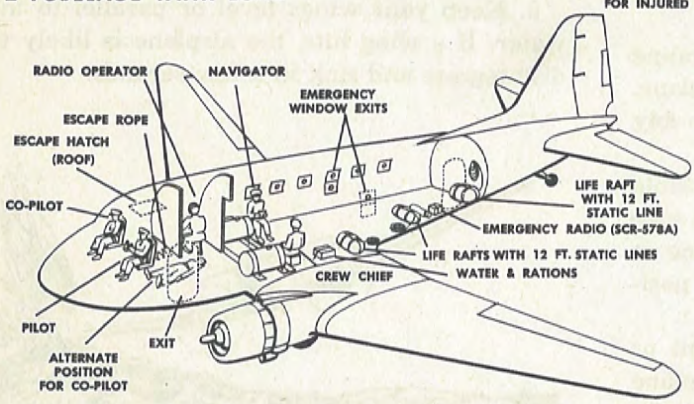
9. Touch down in tail-low attitude so that a stall or near-stall results. The large under surface of the airplane acts as a surf board.

10. Lower landing gear **after** landing to add stability in rough water.

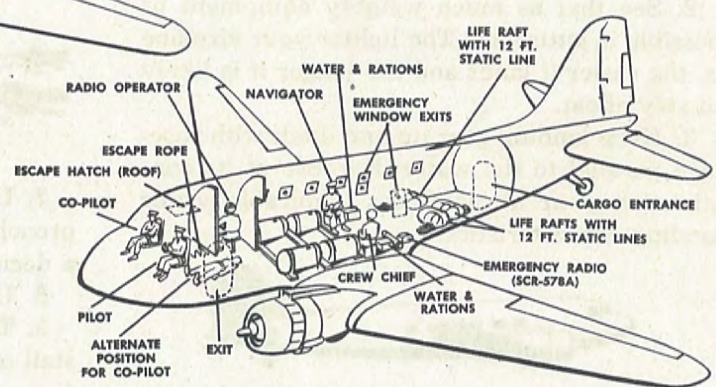
PERSONNEL LOAD



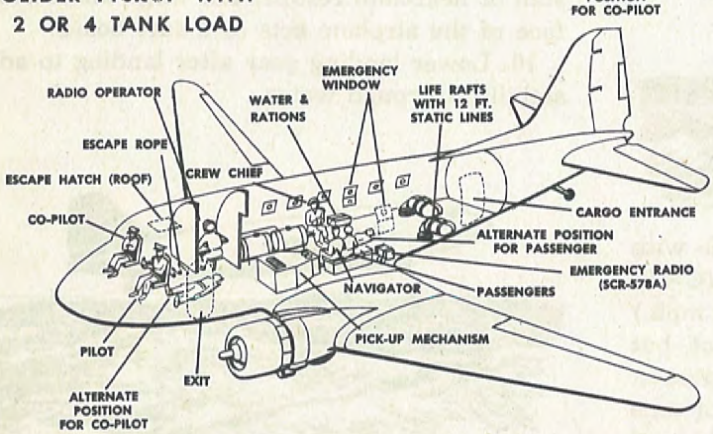
2 FUSELAGE TANK LOAD



4 FUSELAGE TANK LOAD

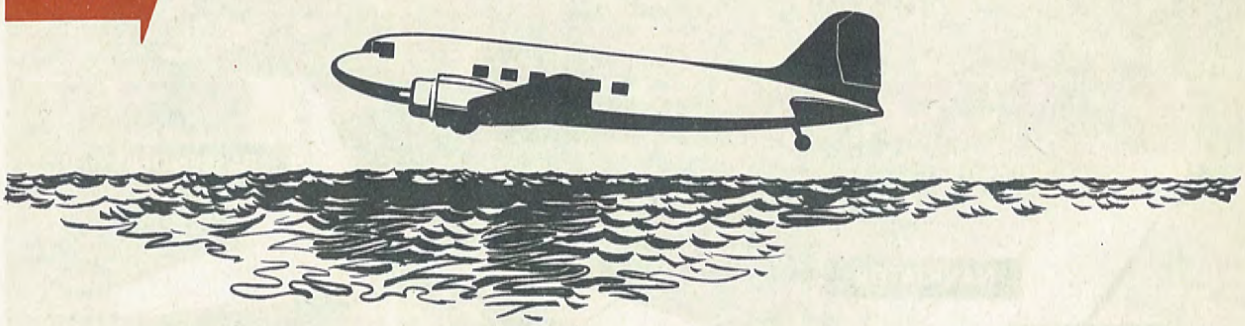


GLIDER PICKUP WITH 2 OR 4 TANK LOAD



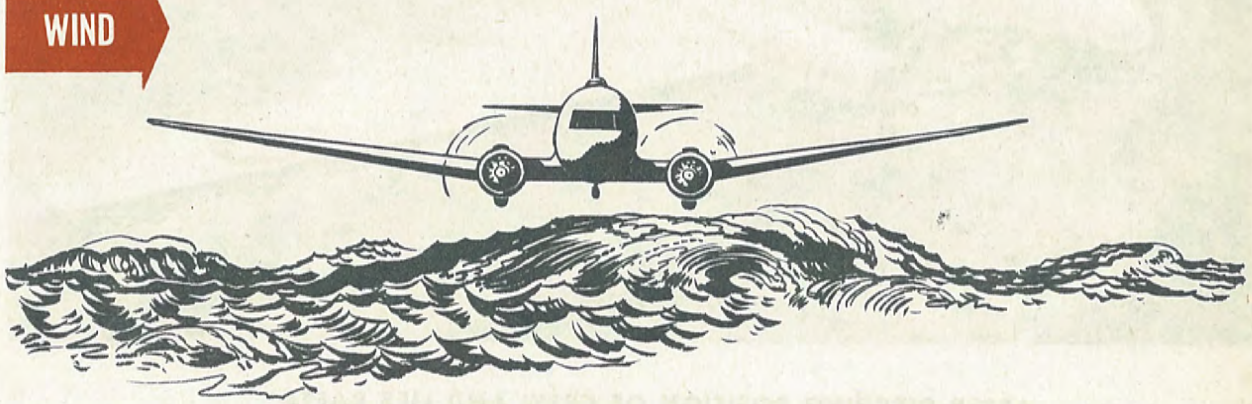
WIND

IF THE SEA IS CALM—DITCH UPWIND



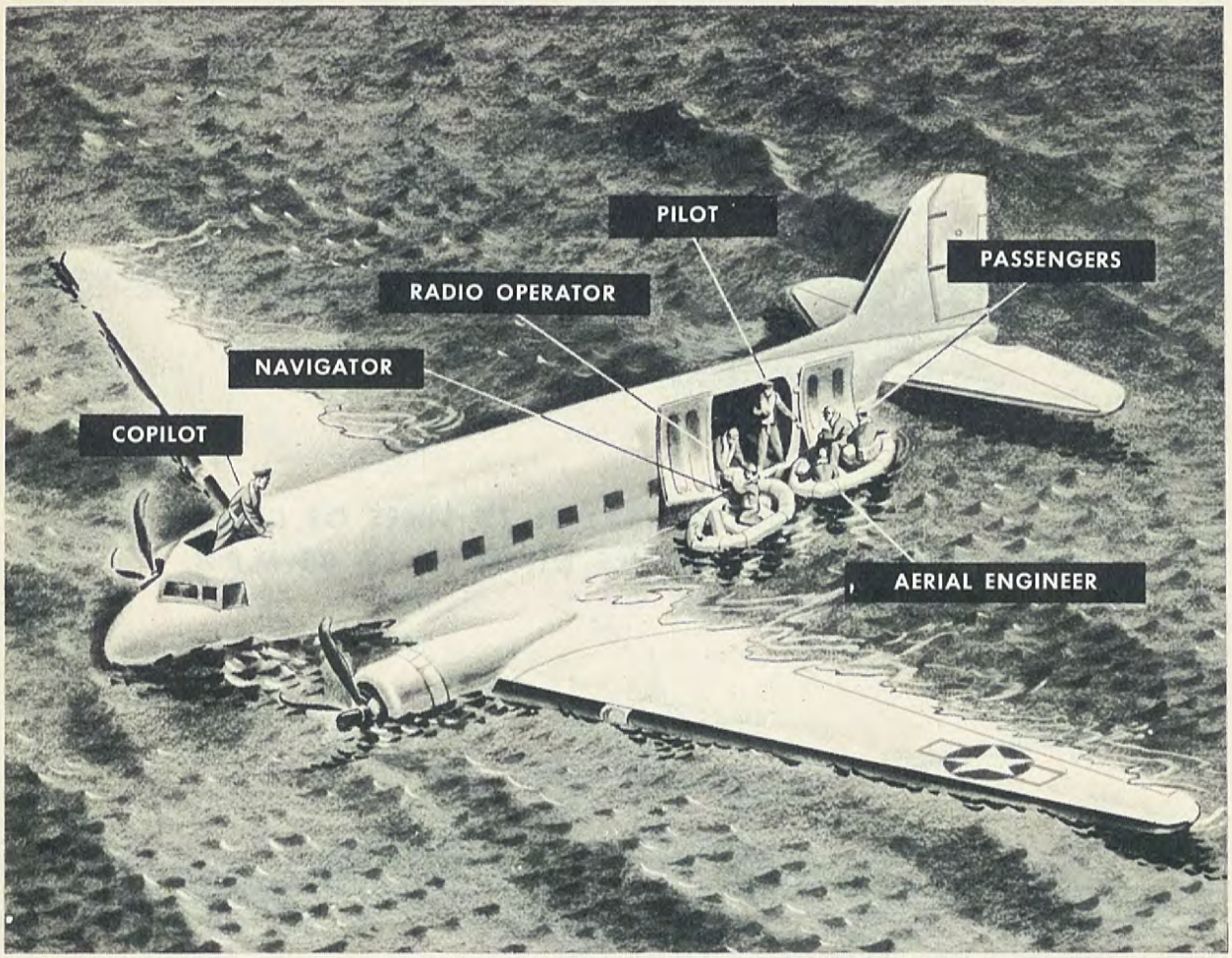
DITCH PARALLEL TO LINES OF CRESTS AND TROUGHS IN WINDS UP TO 35 M.P.H.

WIND



DITCH INTO THE WIND IF IT IS STRONGER THAN 35 M.P.H.

WIND



AFTER DITCHING POSITION OF CREW AND LIFE RAFTS

When the Airplane Has Been Landed

Proceed on the principle that the airplane will sink in 30 seconds, but don't hurry so fast that you leave emergency equipment behind or lose it. Drill makes for speed without careless haste.

In all previously reported ditching cases, the main cargo door has never been more than 2 feet above the water. It has been found to be the speediest and best exit. Emergency windows also can be used, and copilot usually leaves through escape hatch over the pilots' compartment. In leaving the emergency windows, step onto the wings.

When You Abandon the Airplane

1. Pilot destroys IFF.
2. The aerial engineer, navigator, and radio operator uncase and throw life rafts overboard, through main cargo door or through emergency window exits. Be sure lines are attached to the airplane. Do not inflate rafts before you throw them overboard.
3. Aerial engineer gets into raft. He keeps raft straight and prepares to receive emergency equipment.
4. Navigator climbs into raft with case containing his equipment. He stands by to receive emergency equipment.

5. Radio operator makes sure that the emergency radio set (SCR-578A or B) is stowed in life raft. He helps to pass out emergency equipment before he abandons the airplane.

6. Copilot climbs out through emergency hatch above pilots' compartment and stands on wing where he helps stow emergency equipment on board life raft.

7. Pilot goes into main cabin to supervise and aid in passing out emergency equipment. He makes final visual check of cabin and is the last to get into a life raft.

8. Passengers climb into life rafts in an orderly manner, after emergency equipment has been stowed. They climb from the main cargo door directly into the rafts, or climb through the emergency windows onto the wings and then onto the rafts, whichever is expedient.

After Airplane Is Abandoned

1. Lash all emergency equipment onto the rafts as soon as it is stowed.

2. Tie all rafts together.

3. Cut rafts loose from the airplane. Put out sea anchor and stay near the airplane until it sinks or until you are rescued.

Note: C-47 airplanes have been known to stay afloat for long periods. On the Pacific Coast, for instance, a DC-3 was still afloat when rescue parties arrived, while passengers and members of the crew who had jumped into the surf were drowned.

Emergency Landings on Land

When it is necessary to make an emergency landing on land, crew and passengers take the same positions as in ditching. Safety measures, such as attachment of safety belts and shoulder harness, and the securing of loose equipment, are the same as in ditching. Crew members have the same individual responsibilities.

If you are making an emergency landing in a place other than an airfield, crew members must where possible:

1. Plot position of airplane and send by radio.

2. Destroy secret and confidential papers and equipment.

3. Prepare airplane for landing by jettisoning as much equipment as possible, and tying down emergency and other loose equipment.

4. See that passengers have attached safety belts or are tied down properly.

5. Moreover, in cases of emergency landing on land, **the aerial engineer must open all doors and emergency exits except the escape hatch above the pilots' compartment. This hatch should be opened by the copilot just prior to landing.**

Landing the Airplane

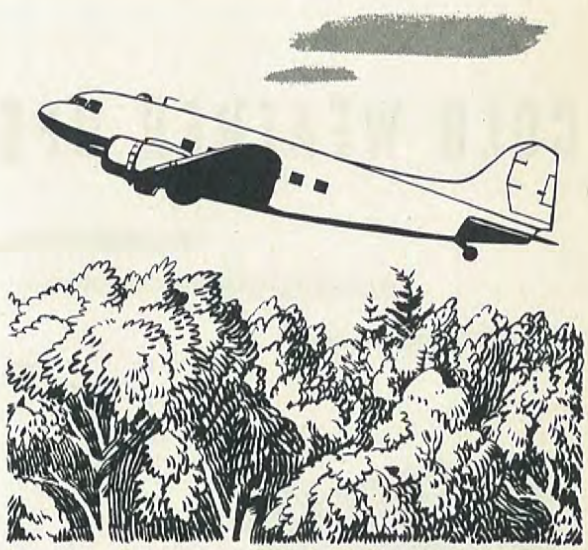
When you make an emergency landing on land:

1. Make a normal approach, with gear up (unless you are absolutely sure you can accomplish a safe landing with gear extended).

2. Lower flaps.

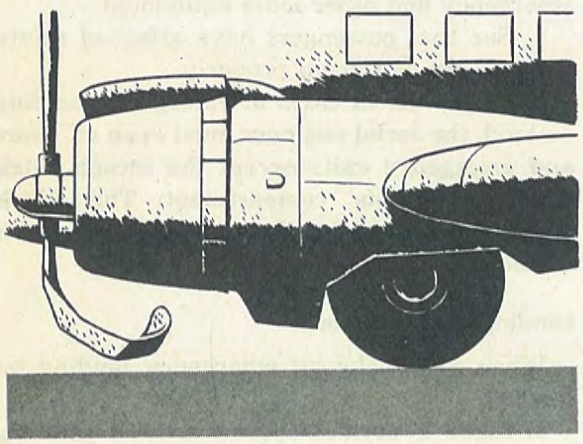
3. Cut all switches just before touching.

4. If you are landing in densely wooded terrain, stall airplane out directly over the tops of the trees and mush into the trees.



If you are in open country, land airplane normally with fuselage parallel to the ground. (See section on short-field landing.)

When you make a belly landing, either on an airfield or on rough terrain, remember this

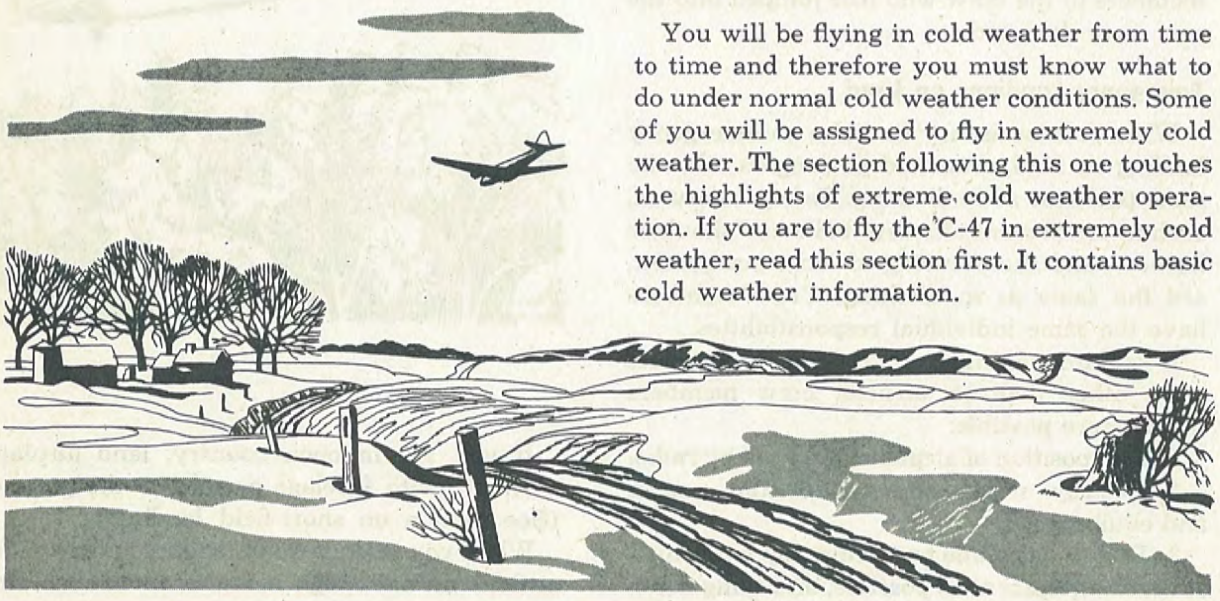


point: Your landing gear extends approximately a foot when retracted. Not only does it take the greater part of the shock of a belly landing, but you can use the wheels and brakes as you would if the gear were extended. Because of this fact, you **never** actually make a belly landing!

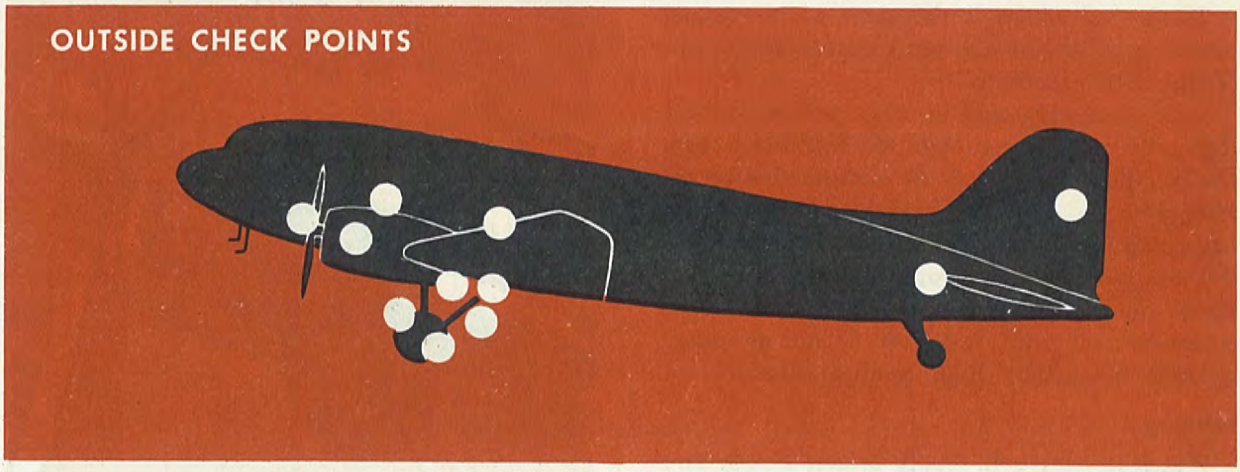
Additional Notes on Ditching and Emergency Landing

Emergency stations for crew members vary with the load carried. If the plane does not carry cabin fuel tanks, the navigator and aerial engineer brace themselves in the main cabin by sitting with their backs against the forward bulkhead. **However, they must not place themselves between this bulkhead and cargo that cannot be jettisoned.** If cargo is in the main cabin, they take positions with backs against the most solid cargo in the rear of the airplane, or tie each other down with feet pointing towards front of airplane, **between cargo and back of airplane.**

COLD WEATHER OPERATION



You will be flying in cold weather from time to time and therefore you must know what to do under normal cold weather conditions. Some of you will be assigned to fly in extremely cold weather. The section following this one touches the highlights of extreme cold weather operation. If you are to fly the C-47 in extremely cold weather, read this section first. It contains basic cold weather information.



CHECKS FOR NORMAL COLD WEATHER OPERATION

If you are flying under normal cold weather conditions make these additional checks:

Outside Check

1. Engine sections for freedom from ice.
2. Landing gear and landing gear latch mechanism for freedom from snow and ice.
3. Airplane for freedom from excessive amounts of ice, snow and frost. Even a small amount of ice or snow or frost on or within a wing or tail control surface causes a change in balance and a loss of flight performance.
4. Normal position of shock absorber struts.
5. Check around oleo strut for leaks. Note: Cold weather hardens the oleo packing and may cause hydraulic oil leaks.
6. Propeller dome for freedom from ice and snow.
7. All flexible hydraulic lines to see that they are not frozen. Freezing makes them brittle and they can break easily. Do not check hydraulic lines by kicking.
8. Brakes for freedom from ice and snow.
9. See that engines have been preheated.

Inside Check

1. Preheating engine covers installed in the airplane.
2. Tanks full of anti-icing fluid and a sufficient reserve supply in the airplane.
3. Pilots' compartment sliding windows for freedom.
4. Move all controls, including trim tabs, through their entire range to check for ice that may have lodged in the controls.

Starting

Procedure is the same as normal weather operation, except that the starters need more energizing and engines may need more prime.

Taxiing

Taxi slowly when there is snow or ice on the runways. Remember, you are taxiing a heavy airplane. If you start sliding, you may not be able to stop short of an accident. When you get ready to stop anticipate the need for space. Slow down and taxi very slowly.

Run-up

In making the run-up, be doubly sure the engine instruments are within operating limits. Run propellers through pitch range two or three times to make sure the oil in the propeller domes is warm. The rest of the run-up is the same as in normal operation.

Climb and Cruise

Climb and cruise is the same as in normal operation. Turn on the pitot heater before entering visible moisture.

If in extremely cold weather you encounter high oil temperatures, open the shutters to cool the oil. This may result in continued high oil temperatures, caused by oil congealing in the coolers. If this occurs, close the oil shutters until the oil temperature drops. Keep a constant check on engine instruments to be sure that congealed oil, and not loss of oil or other trouble, is causing high temperatures.

Landing

Watch landing roll. Apply brakes slowly and evenly. Release and reapply if the wheels skid. Remember the weight of your airplane.

Parking

Dilute oil by pushing the oil dilution switch while engines are running

Operate engines at 1000 to 1200 rpm.

Maintain oil temperature below 50°C (122°F) and oil pressure above 15 psi.

DILUTION TIME IN MINUTES		
4°C to —12°C (40°F to 10°F)	—12°C to —29°C (10°F to —20°F)	—29°C to —46°C (—20°F to —50°F)
2 minutes	4 minutes	7 minutes

Add 1 minute dilution for each 5°C (9°F) below —46°C.

Caution

Be sure to dilute the prop feathering system, when diluting your engine oil in cold weather. Check the technical orders for your series airplane for the proper procedure.

If the plane has a steam heater, drain water from boiler and from the heater system. Drain water by opening drain in wheel well of right nacelle and by opening control valves in companionway.

See that engine, wing, and empennage covers are placed on the airplane, if the covers are available, to protect these parts.

Extreme Cold Weather Operation

Consider extreme cold weather operation to be operation in temperatures of —29°C (—20°F) and lower. You find such temperatures mostly

on the Alaska, Alaska-Siberia and Greenland runs. If you are assigned to fly these areas you will be briefed in cold weather operation at your departure base.

Here are a few essential points you must know about extreme cold weather operation of the C-47 airplane:

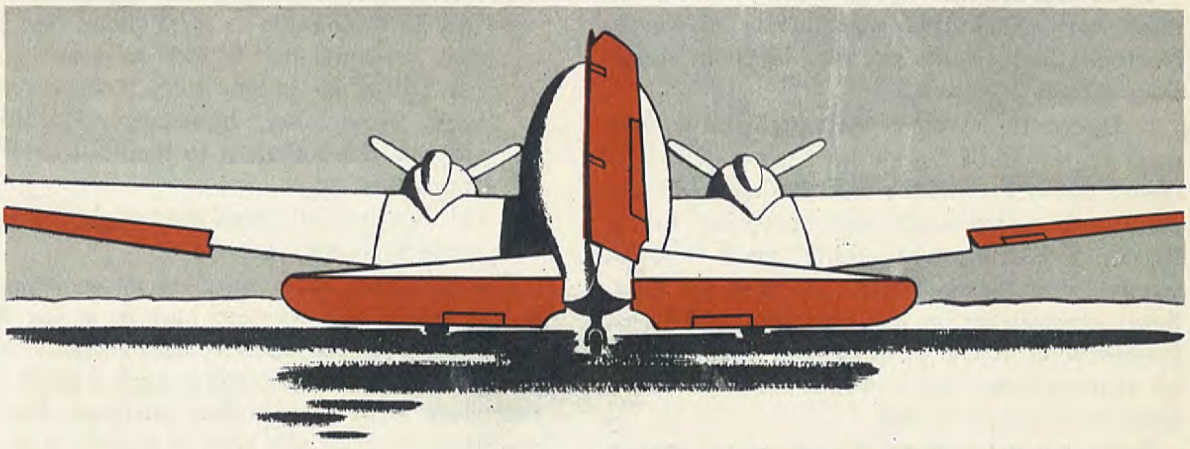
1. **Brakes:** Do not use your brakes except in extreme emergency. When brakes are used, cold air, striking heated surfaces in the brakes, causes condensation. The collected moisture immediately freezes and locks the wheels. Land slower and shorter than normally. In taxiing and in landing use motors rather than brakes. If it is imperative that you use your brakes, continue to taxi around until brakes have cooled off.

2. **Instruments and gages:** Until your engine is heated your instruments do not function or function sluggishly. The colder it is, the slower the instruments react. Gages that are actuated by liquid pressure can freeze in flight. In particular, extremely cold weather affects your:

   (a) **Gyro instruments.** They will probably be slowed by contraction. Check during taxiing and run-up.

   (b) **Bank-and-turn indicator.** It slows down, but usually does not freeze.

   (c) **Manifold pressure gages.** They may not give a correct reading as a result of congealing and freezing of oil and fuel in the lines. To check reading, bleed the line.



(d) **Magnetic compass.** Lag in this instrument increases because of a tendency of instrument fluid to solidify. However, it is very seldom that the fluid becomes fully solid. In cases where this has happened, solidification resulted from too much mineral oil in the fluid mixture. Check instrument in turns while taxiing.

(e) **Airspeed indicator.** Cold weather has very little effect on this instrument. Any trouble comes from the pitot tubes and can be remedied by the pitot heaters.

(f) **Oil pressure gages.** They can freeze while in flight because of congealing of oil in lines.

(g) **Temperature gages.** They are electrical and consequently there is no trouble.

(h) **Hydraulic pressure gages.** There is no trouble with these gages because fluids now in use are non-freezing down to —70°F.

(i) **Magnesyn compass (installed in C-47A).** Transmitter in wing has tendency to freeze.

(j) **Other pressure gages.** As gages are activated by liquid pressure, congealing of fluid in the lines can make them sluggish or cause them to cease functioning in flight.

3. **Controls:** When you move an airplane from a heated hangar and allow it to stand for a few minutes in extremely low temperatures, there is condensation and subsequent freezing of moisture on heated surfaces. As a consequence, unless controls are kept free they freeze so tight it is impossible to move them.

Keep moving controls from the moment the airplane is taken from the hangar. If controls are frozen or are difficult to move, do not get rough with them.

Procedure in extremely cold weather is to allow an airplane that is taken from a heated hangar to freeze on the ground while **keeping controls free.** Reason: It is better to discover failures resulting from freezing on the ground, where they can be remedied, than later when the airplane is in the air.

4. **Oil radiators:** Oil radiators can burst as a result of solidification of oil. To prevent bursting of radiators, see that they are drained when you park your airplane in the open.

(a) **Freezing in flight:** An excessive rise in oil temperature indicates an oil radiator freezing in flight. Under normal conditions you would open oil shutters to lower oil temperature. With such an indication in extremely cold weather, however, you reverse the procedure. Close oil shutters in order to build up heat around oil radiator and prevent complete freezing. When oil temperature has been reduced, open the oil shutters as needed.

5. **Communication equipment:** Cold weather does not affect this equipment. However, Northern Lights cause extreme blackout conditions for short periods.

6. **Hydraulic system:** Although fluid now used in the C-47 hydraulic system does not freeze down to —70°F, trouble has been experienced in hydraulic gear creeping down. Reason: Extremely cold weather contracts fluid, causing gear to sag. When you raise the gear, fluid accumulates on the oleo strut packings, freezes when it comes in contact with outside air temperatures, and hardens. This condition again causes gear to sag.

To counteract sagging of gear, move landing gear handle to full UP position and keep it there until warm fluid from the hydraulic system circulates to oleo strut packings. Leave gear handle in the UP position for 10 minutes or more, if necessary. You will probably have to repeat this procedure from time to time while you are flying in extremely cold weather.

In extremely cold weather you experience inversions of temperature. That is, at times you have low temperatures near the ground, relatively high temperatures at altitude. Temperatures may vary as much as 30 to 50°F. When you are climbing or descending into low temperatures, hydraulic fluid sometimes contracts and causes your gear to sag. When climbing or ascending into higher temperatures, landing gear hydraulic pressure can build up.

Watch gages closely. Re-circulate fluid frequently by moving the landing gear handle to the UP position.

7. **Heaters:** In temperatures of —20°F and lower, steam type heaters freeze and are of no use. Airplanes used in extremely cold climates are now equipped with hot air type heaters, rather than steam heaters.

8. **Landing and taxiing:** You will do much of your landing and taxiing on packed snow. Packed snow is entirely safe and provides a firm, hard surface.

9. **Parking in extremely cold weather:** When you park your airplane in the open:

(a) Do not set parking brake. Use chocks.

(b) Put on engine covers.

(c) Use portable heaters to keep engines warm while your airplane is parked, or it will be impossible to start them. See that they are connected as soon as possible.

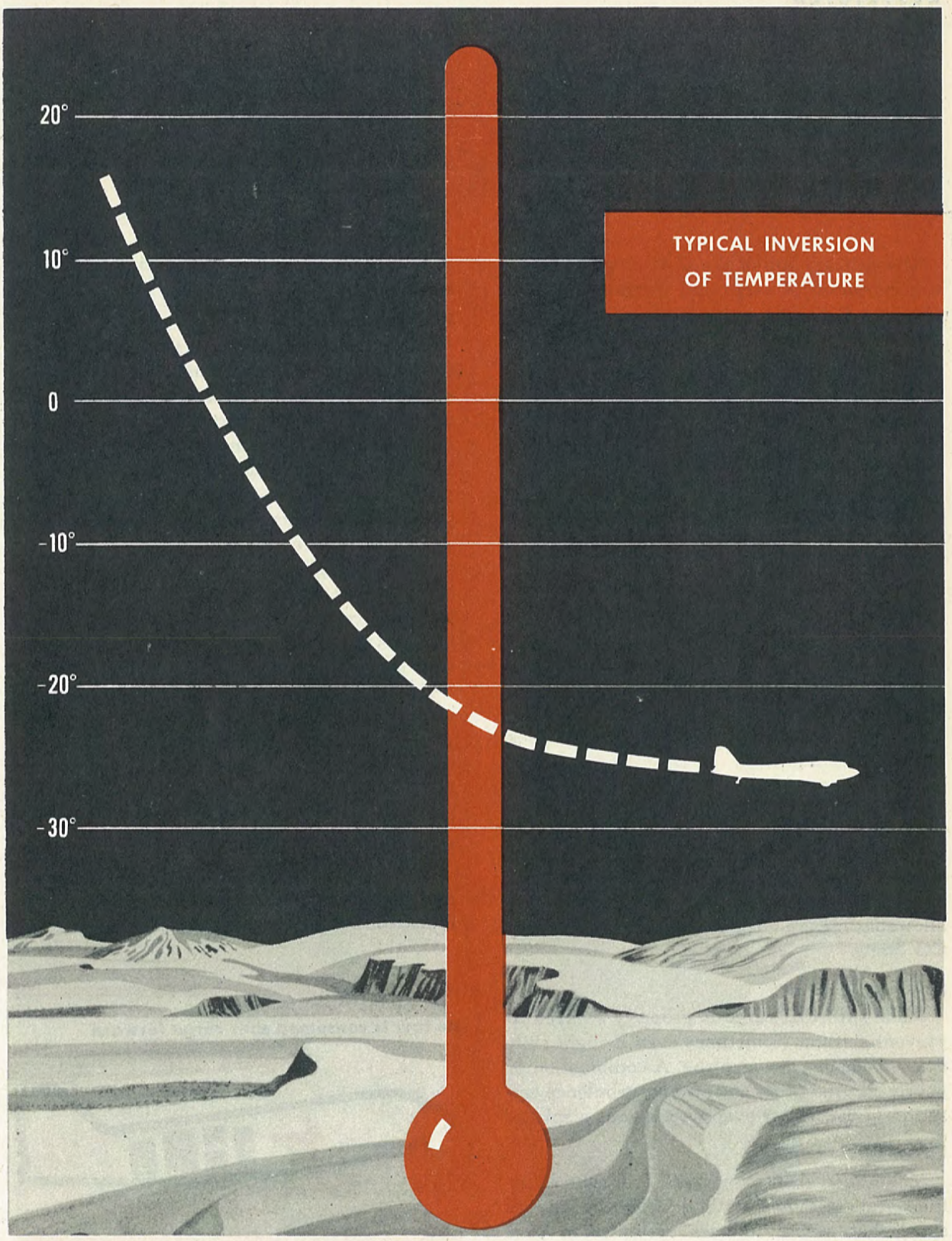
(d) Dilute oil to help keep it from solidifying. Remember, however, oil dilution alone is not sufficient to facilitate starting of engines.

(e) See that all cargo that might freeze is properly taken care of.

Danger: New parts installed on an airplane in extremely cold weather may fit at the time of installation, but upon reaching higher temperatures they can expand to such a point that they lock with surrounding surfaces. Such a condition is especially true of control surfaces constructed of metals that have different coefficients of expansion.

10. **Operations that are the same as under normal conditions:** Single engine operation, operation of propellers, use of tires, anti-icing and de-icing operation, removal of frost and snow, and mooring are the same in extremely cold weather as in normal operation.

11. **Cold weather emergency equipment:** Airplanes flying in extremely cold climates carry special emergency equipment you can use if forced down. Equipment consists of such articles as special signal rockets, a toboggan, and cooking units. If you are flying across cold weather countries it is up to you to see that this equipment is on board your airplane and is in working order.


20°
10°
0
-10°
-20°
-30°
TYPICAL INVERSION
OF TEMPERATURE

WEIGHT AND BALANCE

The primary job of the C-47 airplane is the transportation of cargo and personnel. Therefore, as a C-47 pilot, you must learn all you can about weight and balance. Although your airplane is loaded under the direction of a weight and balance officer at the point of departure, you will often need to redistribute cargo in flight. You must know when to make the shift and what cargo must be shifted.

Again, it is possible that you may have to take cargo or passengers on board your airplane at a remote place where no one but yourself knows the principles of loading.

Undoubtedly you have already taken a course in weight and balance and are familiar with the load adjuster, charts, form F, and the method of calculating load distribution. If you are not clear on a particular point consult your weight and balance officer.

Here are a few things that you should check before every flight:

Total Load

Before takeoff you must know that your airplane does not exceed the maximum gross weight for safe flight. Before landing you must know that your airplane is at, or below, the allowable maximum gross weight, and within CG limits.

Securing Cargo

Make sure that cargo is properly secured to prevent shifting. Sometimes even a slight shift can unbalance your airplane. A combination of poorly secured cargo and strong turbulence can seriously damage or even wreck your airplane.

Passengers

Make sure that passengers are secured in their seats or riding stations. Accident reports show that severe injuries occur when passengers are not protected during turbulent weather.

Fuel Consumption

During most normal flights you remain within safe weight and balance limits as fuel is consumed. Therefore, your safety factor does not decrease. When you start with a critical loading, however, or when you make extremely long flights, CG position shifts through greater ranges. Under these conditions the stability of your airplane decreases, and cargo must be shifted to restore balance.

As an example, when you burn large amounts of fuel from main and auxiliary tanks weight is taken from the front of the airplane and it becomes tail heavy. To offset the loss of weight, shift cargo forward.

If there are main cabin tanks in your airplane, you normally burn fuel from these tanks before you use an appreciable amount from main and auxiliary tanks. In this case the airplane becomes nose-heavy. Shift cargo to rear to restore balance.

Note

When your loading is supervised by a weight and balance officer, he will instruct you as to redistribution of cargo in flight.

As fuel is consumed shift cargo forward

LONG-RANGE OPERATION

Planning

When making a long-range flight, particularly with a cargo load, have a definite plan in mind as to range, ceiling, climb, speeds and maneuverability of your airplane. Know your safety limitations in regard to maximum landing weights, permissible airspeeds, proper CG and minimum takeoff and landing distances. A long-range flight presents enough problems to occupy the pilot without adding problems by ignorance and lack of planning.

Cruising Charts

Your best insurance of a safe flight, properly planned, is to make use of long-range cruising charts. These charts are designed from the viewpoint of safe operation in takeoff and climb, cruise and landing. They give proper power settings for takeoff and climb and for maximum range.

When you are flying long distances it is important for you to get maximum performance from your fuel as you use it. By using proper power settings, with a given amount of fuel you can reach your objective easily. On the other hand, with the same given amount of fuel, you can fall short of your objective if you disregard power settings, even though you maintain the same airspeed.

Note: On certain long runs, pilots who have not planned their flights, and have disregarded power settings established after long experience, have failed to obtain efficiency in fuel consumption, and as a consequence have been unable to reach their destinations.

LONG-RANGE LEVEL CRUISING CHART (ZERO WIND)

Use settings indicated in the chart for the gross weight of your airplane and the altitude at which you intend to fly. Fly at these settings for the time and distance shown with the settings. At the end of this time and distance, change to settings in the next column, at the proper altitude, and continue with these new settings for the time indicated.

Allow approximately 60 gallons of fuel for warm-up, run-up, takeoff, and climb to 10,000 feet.

Extreme range is computed on the following basis (1200 gallons maximum, at 6 lbs. per gallon; four fuselage tanks; no reserve):

31,000-27,000 lbs. gross weight with 7200 lbs. of fuel.

*25,000 lbs. gross weight with 5200 lbs. of fuel.

*23,000 lbs. gross weight with 4000 lbs. of fuel.

Extreme Alternate Gross Weight		31,000 to 29,000	29,000 to 27,000	27,000 to 25,000	25,000 to 23,000	23,000 to 19,000	Extreme Range Figures T-O Wght	Range/Mi	Hrs-Mins
14,000 to 16,000 feet	IAS	137	136	135	133	128	31,000	2411	13:37
	rpm	2350	2200	2100	2000	1900	29,000	2668	15:13
	Hg.	26.5	25.0	25.0	24.0	23.0	27,000	2823	16:23
	Fuel lbs. per hr.	657	529	488	447	410	*25,000	2420	14:14
	Fuel gals. per hr.	109	88	81	75	68	*23,000	1640	9:45
	Range, hours	3:03	3:47	4:06	4:29	4:53			
	Range, miles	550	676	733	780	820			
12,000 to 14,000	IAS	139	138	137	135	129	31,000	2515	14:26
	rpm	2200	2100	2000	1900	1800	29,000	2705	15:45
	Hg.	26.5	26.0	25.5	25.0	24.0	27,500	2848	16:50
	Fuel lbs. per hr.	566	511	473	435	401	*25,000	2448	14:36
	Fuel gals. per hr.	94	85	79	73	67	*23,000	1660	10:00
	Range, hours	3:32	3:55	4:14	4:36	5:00			
	Range, miles	622	689	736	782	830			
10,000 to 12,000	IAS	141	140	138	136	130	31,000	2551	14:58
	rpm	2000	2000	1900	1800	1700	29,000	2701	16:07
	Hg.	28.5	27.0	27.0	26.0	25.5	27,000	2835	17:13
	Fuel lbs. per hr.	530	497	459	427	392	*25,000	2418	14:53
	Fuel gals. per hr.	88	83	76	71	66	*23,000	1640	10:12
	Range, hours	3:47	4:01	4:22	4:41	5:07			
	Range, miles	654	690	742	778	823			
8,000 to 10,000	IAS	143	141	139	136	131	31,000	2552	15:27
	rpm	1950	1850	1800	1700	1700	29,000	2700	16:42
	Hg.	29.5	29.0	28.0	27.5	25.0	27,000	2825	17:49
	Fuel lbs. per hr.	519	482	447	412	381	*25,000	2408	15:22
	Fuel gals. per hr.	87	81	74	69	64	*23,000	1630	10:30
	Range, hours	3:51	4:09	4:32	4:52	5:15			
	Range, miles	651	692	742	778	813			
6,000 to 8,000	IAS	145	143	140	137	132	31,000	2557	15:49
	rpm	1900	1800	1750	1700	1700	29,000	2707	17:05
	Hg.	30.0	29.5	28.5	27.5	25.5	27,000	2822	18:09
	Fuel lbs. per hr.	508	467	436	402	374	*25,000	2406	15:41
	Fuel gals. per hr.	85	78	73	67	63	*23,000	1625	10:42
	Range, hours	3:56	4:18	4:36	4:59	5:21			
	Range, miles	648	700	740	781	813			
4,000 to 6,000	IAS	146	144	141	138	133	31,000	2556	16:06
	rpm	1900	1800	1750	1700	1700	29,000	2697	17:20
	Hg.	30.0	29.5	29.0	27.5	25.5	27,000	2812	18:25
	Fuel lbs. per hr.	495	460	430	396	369	*25,000	2395	15:55
	Fuel gals. per hr.	83	77	72	66	62	*23,000	1615	10:51
	Range, hours	4:03	4:21	4:40	5:04	5:26			
	Range, miles	656	696	737	780	810			
2,000 to 4,000	IAS	147	145	142	139	134	31,000	2528	16:17
	rpm	1900	1800	1700	1700	1700	29,000	2659	17:31
	Hg.	30.5	30.0	29.5	28.5	27.0	27,000	2761	18:35
	Fuel lbs. per hr.	489	456	423	392	366	*25,000	2347	15:02
	Fuel gals. per hr.	82	76	71	65	61	*23,000	1582	10:56
	Range, hours	4:06	4:24	4:44	5:06	5:28			
	Range, miles	652	690	728	765	792			
S - L to 2,000	IAS	149	147	144	140	135	31,000	2501	16:31
	rpm	1900	1800	1700	1700	1700	29,000	2828	17:44
	Hg.	30.5	30.5	30.0	28.0	26.0	27,000	2747	18:55
	Fuel lbs. per hr.	476	456	416	385	360	*25,000	2313	16:19
	Fuel gals. per hr.	79	76	69	64	60	*23,000	1550	11:07
	Range, hours	4:12	4:23	4:49	5:12	5:34			
	Range, miles	651	670	722	763	790			
Maximum Endurance IAS		137	136	132	126	120 (Min.)			

SAMPLE CHART
ATC LONG RANGE CRUISE

CRAFT MODEL(S)
C-47B
-1830-90C

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 23000 TO 19000 POUNDS

EXTERNAL LOA
NONE
NUMBER OF ENGINES O

WER TION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
LOW	A. R.	5 MIN	260°C	300
HIGH	A. R.	5 MIN	260°C	290

FOR DETAILS SEE POWER PLANT CHART (FIG. 91 SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE, (M. P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY II, III, IV AND V GIVE PROGRESSIVE IN SPEED. AIR MILES PER GALLON (G.P.H.). AND TRUE AIRSPEED (T.A. REFERENCE. RANGE VALUES ARE FOR (NO WIND).[1] TO OBTAIN BRITISH IM U.S. GAL. (OR G.P.H.) BY 10 THEN

LES UTICAL	FUEL U.S. GAL.	COLUMN II RANGE IN AIRMILES STATUTE	COLUMN II RANGE IN AIRMILES NAUTICAL	COLUMN III RANGE IN AIRMILES STATUTE	COLUMN III RANGE IN AIRMILES NAUTICAL	COLUMN IV RANGE IN AIRMILES STATUTE	COLUMN IV RANGE IN AIRMILES NAUTICAL	FUEL U.S. GAL.
		SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]						
390	804[2] 600	660	570	870	760	1080	940	804[2] 600
300	450	490	430	650	560	810	700	450
200	300	330	290	440	380	540	470	300
100	150	160	140	220	190	270	230	150

OUS APPROX. T.A.S. MPH.	T.A.S. KTS.	PRESS ALT. FEET	(1.10 STAT. (.96 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	(1.45 STAT. (1.25 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	(1.80 STAT. (1.56 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	R.P.M
		40000 35000 30000	SET	COWL	FLAPS	TO	GIVE	MAXIMUM CYLINDER TEMPERATURE														
200	174	25000	2550	24.0	A. R.	145	200	174	2550	24.0	A. R.	115	200	174	2500	23.5	A. R.	110	197	171	25000	
214	186	20000	2550	29.0	A. R.	150	214	186	2550	28.5	A. R.	145	212	184	2300	25.5	A. R.	110	196	170	20000	21
222	193	15000	2500	34.5	A. R.	200	220	191	2300	31.5	A. R.	140	205	178	2050	28.0	A. R.	105	188	163	15000	21
226	196	10000	2500	33.5	A. R.	195	212	184	2300	31.0	A. R.	140	201	175	2150	30.5	A. L.	105	191	166	10000	19
217	188	5000	2250	37.0	A. R.	185	205	178	2100	33.5	A. R.	130	190	165	2000	32.5	A. L.	100	180	156	5000	17
212	184	S. L.	2100	40.0	A. R.	175	195	169	2100	34.0	A. R.	125	179	155	1950	34.0	A. L.	95	169	147	S. L.	17

SPECIAL NOTES

ANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. 79)
ANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

L. IS TOTAL FUEL CAPACITY WITH NO
NKS

EXAMPLE

AT 22,000 LB. GROSS WEIGHT WITH 300 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 140 GAL.) TO FLY 500 STAT. AIRMILES AT 25,000 FT. ALTITUDE MAINTAIN 2500 RPM AND 23.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET AUTO-RICH AND WITH HIGH BLOWER RATIO.

LE
ALT. : PRESSURE ALTITUD
M.P. : MANIFOLD PRESSUR
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL

BASED ON: FLIGHT TEST

USE HIGH BLOWER ABOVE HEAVY LINE ONLY.

Check for the Proper Chart

Series C-47B

Weight 23,000 to 19,000 lbs.

External Load — None

Work the Problem

1. **Fuel available — 300 gals.**
2. **Distance — 500 miles**
3. **Settings for Altitude**
   25,000 feet
   2500 rpm
   Auto-Rich
   23.5" Hq.

The accompanying cruise chart was worked out by Headquarters, Air Transport Command, Washington, D. C., for the C-47 and C-53 airplanes. It is presented here as an example of a chart used in long-range operation. If you are flying long range you will be given this or a similar chart by your organization.

Preflight Inspection

Before leaving on a long-range flight, check:

1. **All emergency and auxiliary equipment.** See that it is properly installed and is operating satisfactorily. This equipment consists of:
   (a) Main cabin tanks and main cabin fuel system.
   (b) Life rafts (two) secured in rear of cargo compartment, near main cargo door.
   (c) Emergency radio lashed down near life rafts.
   (d) Emergency rations in or near life rafts.
   (e) Extra supply of hydraulic fluid.
   (f) Pyrotechnic pistol stowed in companionway.
   (g) Emergency exits.
   (h) Water containers. Fill personal canteen for use in case of water landing.
   (i) Life lines of strong rope, knotted every 24 inches, placed near exits.

2. **Radio.** Check with crew members and, if flying formation, check radio frequency with other pilots. See that your radio operator has a distress signal prepared in advance for quick transmission.

3. **Navigation.** See that navigator has all necessary charts and maps and that his equipment is in working order. If astrocompass is not aboard, swing compass.

4. **Weight and balance.** Check weight and balance of cargo in airplane against Form F for proper distribution of cargo weights. (See previous section on weight and balance.)

Points to Remember in Flight

1. Proper attitude of your airplane is important. Keep the wings level and trim your airplane to fly hands-off. Any irregularities in attitude may shorten the range seriously.

2. Use proper power setting as set forth in cruise charts.

3. Check flaps and wheels frequently to see that they are fully retracted.

4. See that tailwheel is locked on takeoff and remains locked throughout your flight.

5. Consult with your navigator frequently and follow his instructions to the letter. An error of even 1° will place you several miles off your course in a long flight.

6. Use navigator's ETA over destination to begin your descent far enough from your destination to take full advantage of your altitude. If you descend at 200 feet per minute you can

conserve fuel that may be necessary for continued flight.

There are from two to eight extra 102-gallon (U.S.) fuel tanks in the main cabin for long-range flying.

Switch to these tanks only after using 60 gallons from each main tank, followed by 20 gallons from each auxiliary tank. Reason for using fuel from forward tanks first: To provide enough room in these tanks for the return flow of fuel which otherwise would be lost through the overflow.

Five valves control the flow of fuel from the cabin tanks to the main fuel system. Use these valves to route fuel from all tanks to one or both engines, or from a combination of tanks to one or both engines.

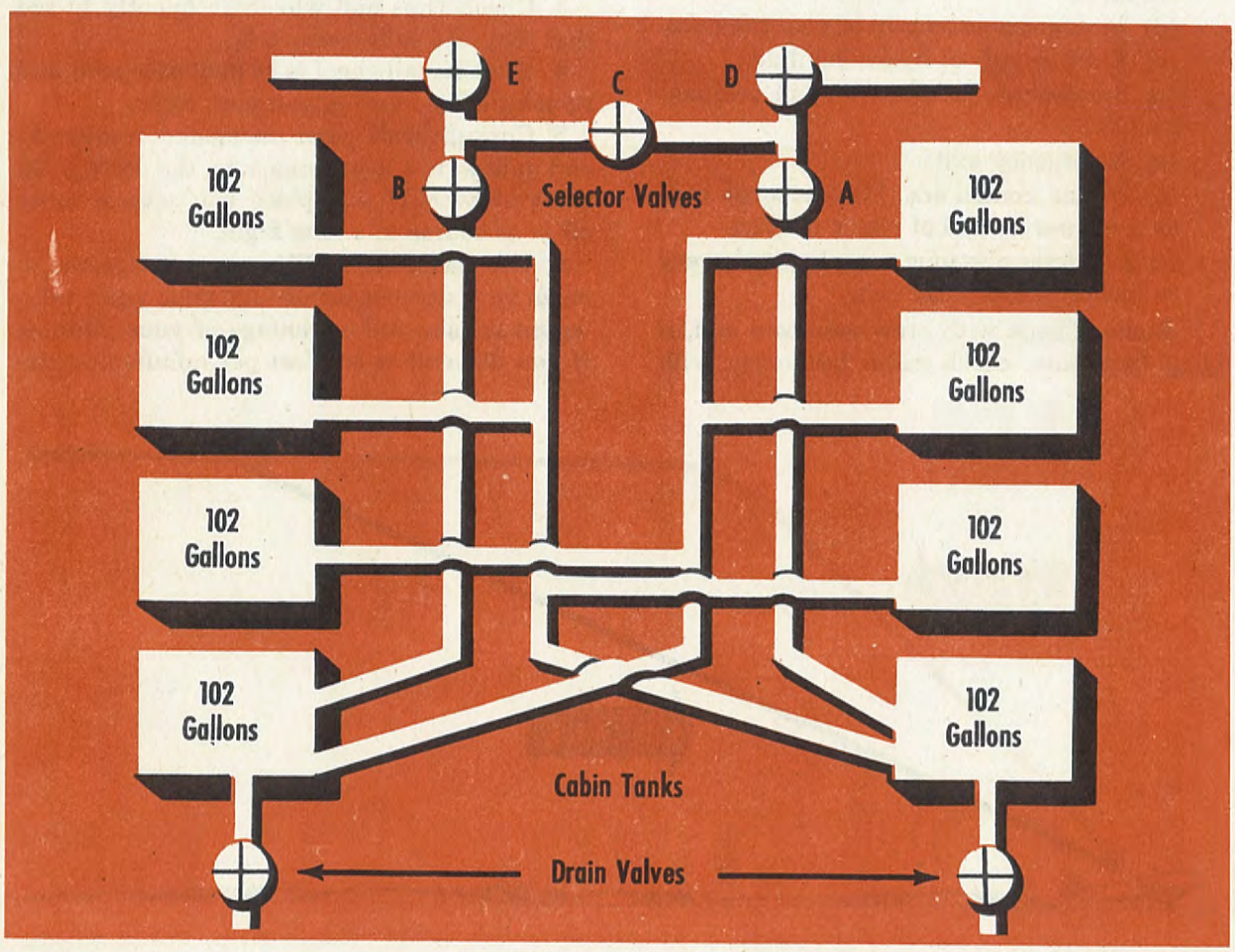
To place the cabin tank fuel system in operation, follow this procedure:

1. See that the crossfeed valve is closed.
2. Open the main line selector valves (there are two for each bank of tanks).
3. Immediately after you open selector valves, turn off the engine selector valves in the cockpit. Never use wing tanks in conjunction with cabin tanks.
4. Use wobble pump or booster pumps to aid in starting flow of fuel.

For Single Engine Operation

1. Close selector valve on line to dead engine.
2. Open crossfeed valve if you desire to feed live engine from all cabin tanks.

Drain cabin tanks by opening two drain valves at rear of cabin tanks. When tanks contain fuel, be sure that these valves are closed and safetied.



AIRBORNE OPERATIONS

Operation With Paratroops

The C-47 is equipped to carry 28 paratroops, including the jumpmaster. However, the number of paratroops can vary, depending upon type and length of mission, equipment carried, gliders in tow (one or two) and the number of paratroops carried in gliders.

Normally paratroopers jump at an altitude of 800 feet. Again, this altitude can vary, depending upon terrain, weather and combat conditions.

Except for procedures detailed in this section, operation with paratroops is the same as normal operational technique.

Airplane Check in Paratroop Operation

Besides the normal checks, outlined in this book, the pilot makes additional checks when operating with paratroops. These additional checks are made together by pilot and jumpmaster. But bear in mind that, as commander of your airplane, **you** as well as the jumpmaster are responsible for seeing that paratroop equipment is in order.

Outside Check

1. Aircraft fittings and external projections in the vicinity of the exit (cargo) door are completely masked.
2. If parapack racks are used, racks must be checked for positive operation before takeoff.

Inside Check

1. The **red** (caution) and **green** (jump) lights are in working order.
2. Emergency bell is in working order.
3. The static line is not frayed or defective in any way.
4. Matting around the exit (cargo) door is unwrinkled and fastened securely to the floor.
5. All loose equipment is stowed so that it does not interfere during the jump.
6. Each seat and safety belt is in correct working order. (Pilot's responsibility alone.)
7. Sufficient buckets are in the aircraft.

Procedure Before Paratroop Drop

Before paratroop drop, you must:

1. Alert the jumpmaster 10 minutes before arrival at drop zone by ringing a predetermined signal on the alert (emergency) bell.
2. Flash **red** caution light ("Stand to the door" signal) approximately 2 minutes before reaching drop zone.
3. Flash **green** jump light ("Go" signal) when the airplane is at the proper speed and proper altitude, on the prescribed course, and over the assigned drop zone.

Proeedure During Drop

During paratroop drop, you must:

1. Maintain an indicated airspeed of 110 mph, with wheels and flaps up.

2. Maintain airplane in jumping attitude (level to slightly tail-low position) and take particular care to maintain a constant altitude and gyro heading.
3. Advance throttles to maintain jump attitude.

Note: During combined operations with paratroops and glider tow, drop tow line before paratroops jump.

Operation With Pararacks

From two to six pararacks may be installed at designated positions under the fuselage of the C-47. These racks are used to transport equipment and supplies that may be dropped from the airplane.

Installed pararacks increase drag and materially affect the performance of your airplane. It has been found that six installed pararacks are equivalent to the approximate drag of one glider in tow.

In loading pararacks, compute weight and balance by including load of:

First two racks.....in loading station D
Second two racks.....in loading station E
Third two racks.....in loading station F

Note: When you install two pararacks only, it has been found that because of airflow conditions you obtain better flight performance by placing racks in Positions 3 and 4.

Operation With Gliders in Tow

Either one or two gliders are used in glider tow operations. The C-47 is commonly used to tow the CG-4A glider, although it can tow the large CG-13 and the British Horsa glider.

For your information, here are some facts about the CG-4A glider:

Crew.....pilot and copilot
Number of troops carried.....15
Weight empty (with fixed landing gear).....3655 lbs.
Useful load (approximate).....3750 lbs.
Wingspread.....83' 8"
Normal towed speed.....120 to 140 mph
Maximum towed speed.....150 mph

Note: When towing the CG-15 glider, maximum towing speed increases to 180 mph IAS.

Additional Equipment for Glider Tow

Your airplane has the following equipment for glider tow and glider pick-up:

1. Glider tow release unit. This unit is on the lower aft end of the fuselage. Operate by pulling a handle on the pilots' compartment aft bulkhead above copilot's seat.

2. Astrodome, installed over the companionway.

3. Red signal light in astrodome, now being installed on all glider towplanes. Switch for this light is on the pedestal just below the propeller pitch controls. It has ON and OFF positions.

4. Glider pick-up unit, which consists of an energy absorbing unit, a contact unit, and cable guide system.

(a) **Energy absorbing unit:** Located on the forward left-hand side of the main cargo compartment. This unit is made up of (1) a drum around which is wound the pick-up cable. This drum incorporates a brake, a time adjustment mechanism, and a brake adjustment mechanism to determine the interval of brake delay and the final brake pressure; (2) a built-in reversible, 2-speed, 24-volt DC, compound-wound electric motor. This motor is rated at 2.6 Hp at 460 pinion rpm at high speed. Although provision is made for winding the cable on and off the drum by hand, normally perform operation by this motor. Facilitate even distribution of cable as it is wound on drum by level-wind mechanism on drum.

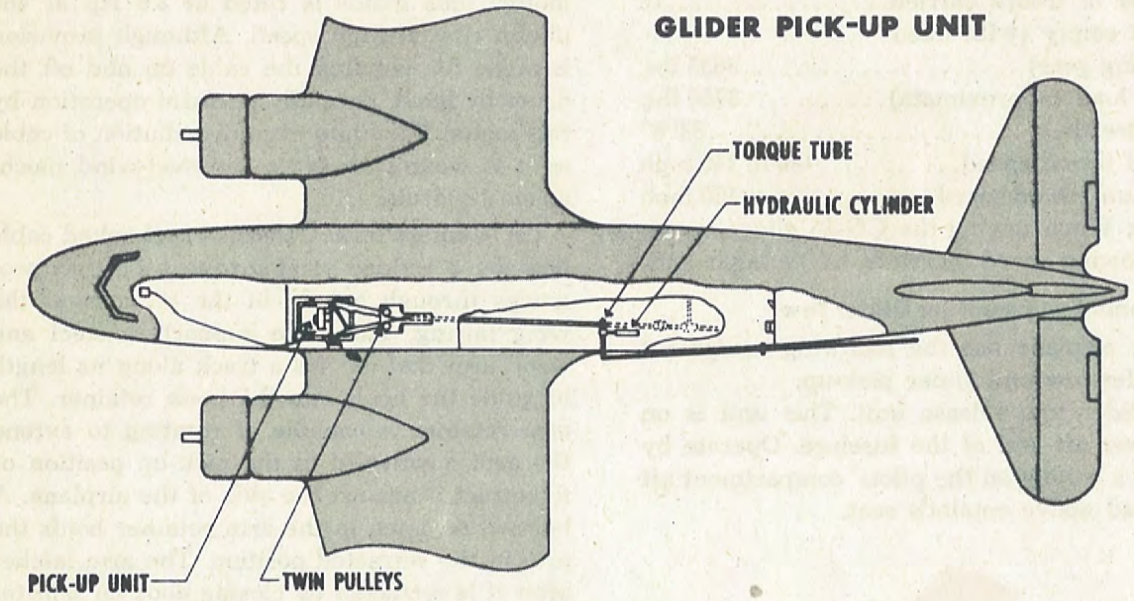
(b) **Contact unit:** Consists of a hooked cable held by a welded steel torque tube that protrudes through a hole in the aft part of the wing fairing. This tube supports a steel and wood arm that carries a track along its length to guide the hook into the hook retainer. The arm retainer is capable of rotating to extend the arm downward in the pick-up position or to retract it against the side of the airplane. A bolt action latch in the arm retainer holds the arm in the retracted position. The arm latches after it is retracted by closing door on selector valve. A cable fastened to the retainer bolt releases the latch so the arm falls free.

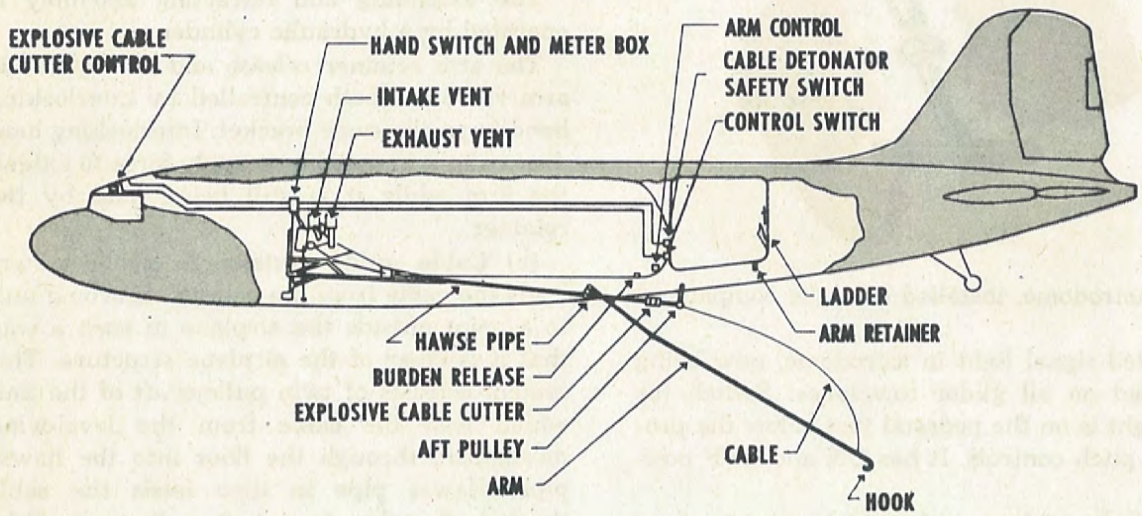
The extending and retracting assembly is operated by a hydraulic cylinder.

The arm retainer release and the hydraulic arm valve are both controlled by interlocking handles on the same bracket. Interlocking handles make it impossible to apply force to extend the arm while it is still being held by the retainer.

(c) **Cable guide system:** A guide system leads the cable from the energy absorbing unit to a point outside the airplane in such a way that it is clear of the airplane structure. This system consists of twin pulleys aft of the unit which lead the cable from the level-wind mechanism through the floor into the hawse pipe. Hawse pipe in turn feeds the cable through the skin to an aft pulley assembly, just outside and below the forward end of the main cargo door. The aft pulley is placed in such a way that it prevents the cable from fouling the tail group or the tailwheel when the airplane and the glider are in normal flight attitude. The pulley also provides easy accessibility to the hook, so that it can be gaffed from the pulley and placed on the track while the airplane is in flight.

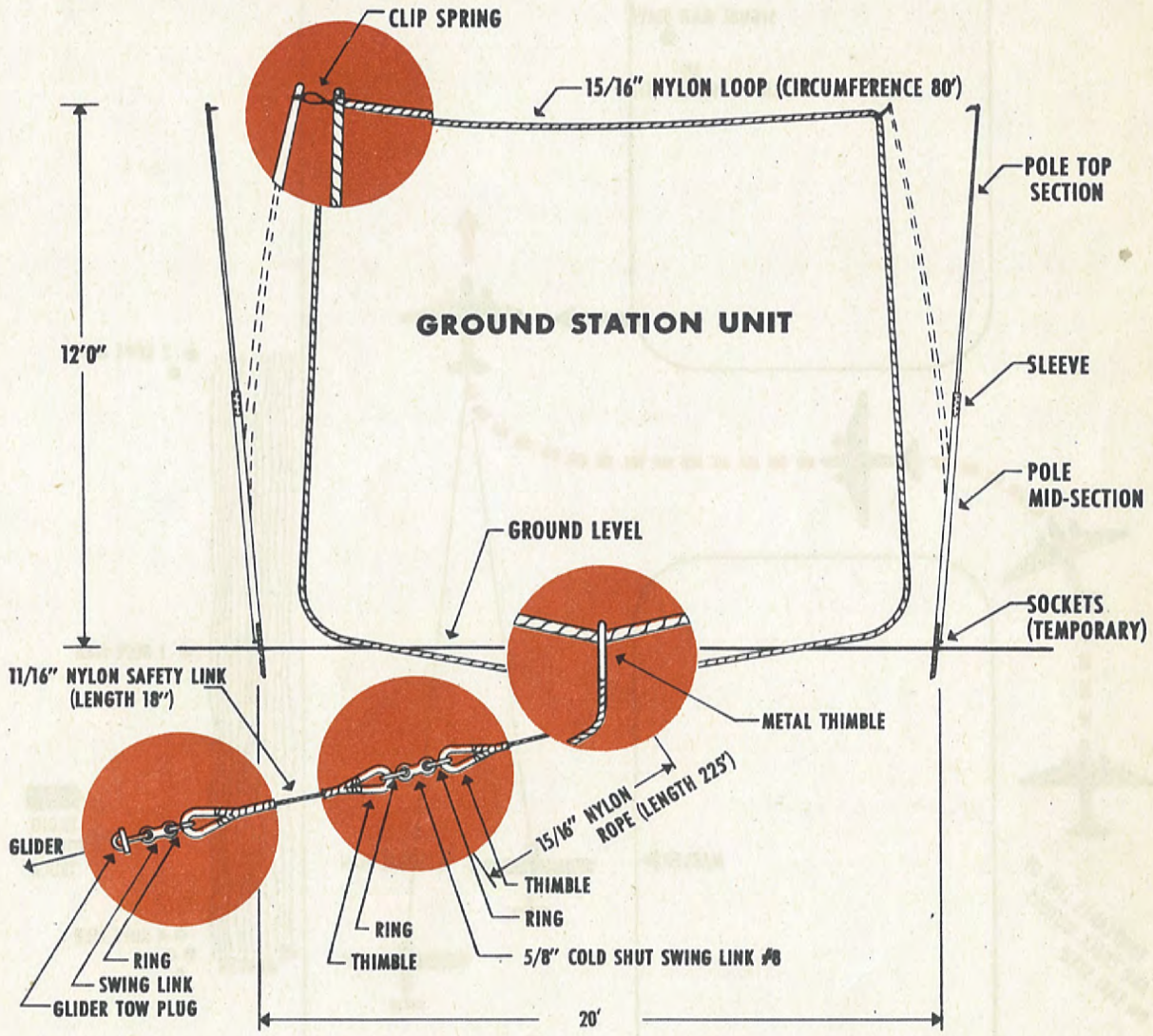
Note: An explosive cable cutter is installed





near the end of the torque tube to enable the pilot to disconnect the glider quickly in an emergency. Operate cutter by a 2-button switch located on ceiling of pilots' compartment above pilot's head. A toggle switch, above the arm retracting hydraulic selector valve, must be in the ON (armed) position before the button detonator operates.

(d) **Ground station unit:** This unit is made up of two steel and wood pole assemblies, to the



top of which are fastened spring clips. The spring clips support the loop of the towline assembly. The other end of the towline assembly is fastened to the glider through a release assembly, which the glider pilot operates.

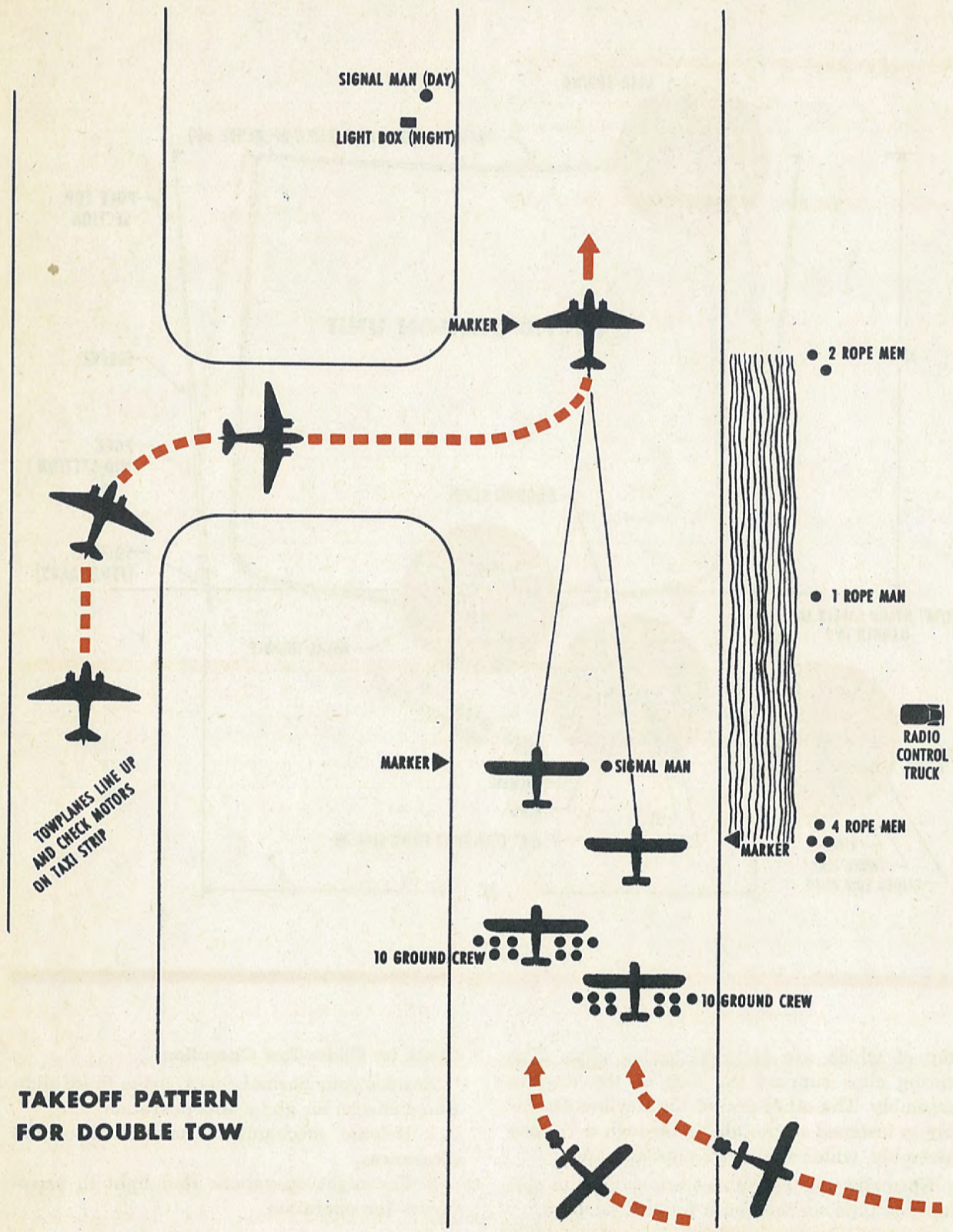
Normally pole assemblies are erected in collapsible type sockets, built for this purpose.

Check for Glider Tow Operation

Besides your normal check, make these additional checks for glider tow operation:

1. Release mechanism – **for operation and clearances.**

2. For night operation: Red light in astrodome—for operation.



TAKEOFF PATTERN FOR DOUBLE TOW

Readying for Glider Tow

Be sure exit (cargo) door is not removed during glider tow. Absence of door reduces airspeed 3 to 5 mph.

Here are the steps prior to takeoff in glider tow:

1. See that a crew member, usually the aerial engineer, is stationed in the astrodome to observe and inform you of any trouble glider might encounter during takeoff.

2. When airplane ahead has taken off with glider or gliders in tow, taxi from feed-in area to position on runway or feed-in strip. Position is designated by a flag in the daytime and flarepots at night.

3. Signal man stands by runway approximately 100 feet ahead of the towplane.

4. Glider towlines are laid on field to one side of the runway, between the towplane and the gliders.

5. Gliders are parked between 350 and 425 feet behind towplane and are moved into position by jeeps or other vehicles. In single-tow operation, gliders are stationed in one or more lines behind tow plane. They are attached to the towplanes by 350-foot lines. If there is double-tow operation, gliders are parked in a double row behind the towplane. Glider on the left is attached by 350-foot line; glider on the right is attached by a 425-foot line.

6. Towline ends are attached to the tow release mechanism in the towplane and a tow release mechanism in the nose of the glider. Slack is left in the towline.

Takeoff for Single and Double Tow

Take off on main fuel tanks, land on main fuel tanks or fullest fuel tanks. Minimum fuel in main tanks for takeoff and landing should be approximately 90 gallons.

1. Upon first motion from signalman, release brakes and apply 12″ to 15″ manifold pressure until slack is taken from towline. Move forward slowly.

2. Upon receiving clear for takeoff, or highball, signal from the signalman, immediately apply throttles smoothly and rapidly until you reach 47″ Hg. and 2700 rpm. **Have full power on at the end of 5 seconds.** Your engines are so constructed they can take power rapidly if you apply it smoothly. Reasons for rapid acceleration of power:

   (a) Glider pilots get more and quicker control of their gliders, thereby becoming airborne sooner.

   (b) You shorten takeoff run and consequently quickly gain airspeed sufficient for engine cooling.

   (c) You vacate takeoff position quicker, so that succeeding airplane can move into position sooner. Five to ten seconds of time gained is valuable, particularly in formation takeoffs.

3. Position of controls before and during takeoff:

	Grade 100	Grade 91
Mixture	AUTO RICH	AUTO RICH
Cowl Flaps	TRAIL	Full Open
Carburetor Heat	COLD	COLD
Prop Control	INC. RPM	INC. RPM
Crossfeed	OFF	OFF
Trim Tab	0	0
Landing Gear	Positive Lock	Positive Lock
Tailwheel	Locked	Locked
Takeoff	48″ Hg., 2700 rpm	46″ Hg., 2700 rpm* 43″ Hg., 2700 rpm†

*R-1830-92 Engine †R-1830-90C Engine

Note: **Use Grade 100/130 fuel in all 2-glider towing, except in an emergency.**

4. One-fourth flaps may be used at the discretion of the towpilot However, use of flaps is advised for double tow on short runways in order to break ground quickly.

5. Hold tailwheel on ground until you reach 40 to 50 mph. Holding tailwheel on ground keeps prop wash from hitting gliders and also

death to people in the air and on the ground and damage to your airplane and equipment.

6. Emergency signals for glider release are:
Day—rocking of wings.
Night—red light in astrodome.
Do not allow more than a 3-second interval between the emergency signal and the glider release. Glider pilots are cautioned to keep alert for emergency signals. Immediately upon observing an emergency signal they cut loose.

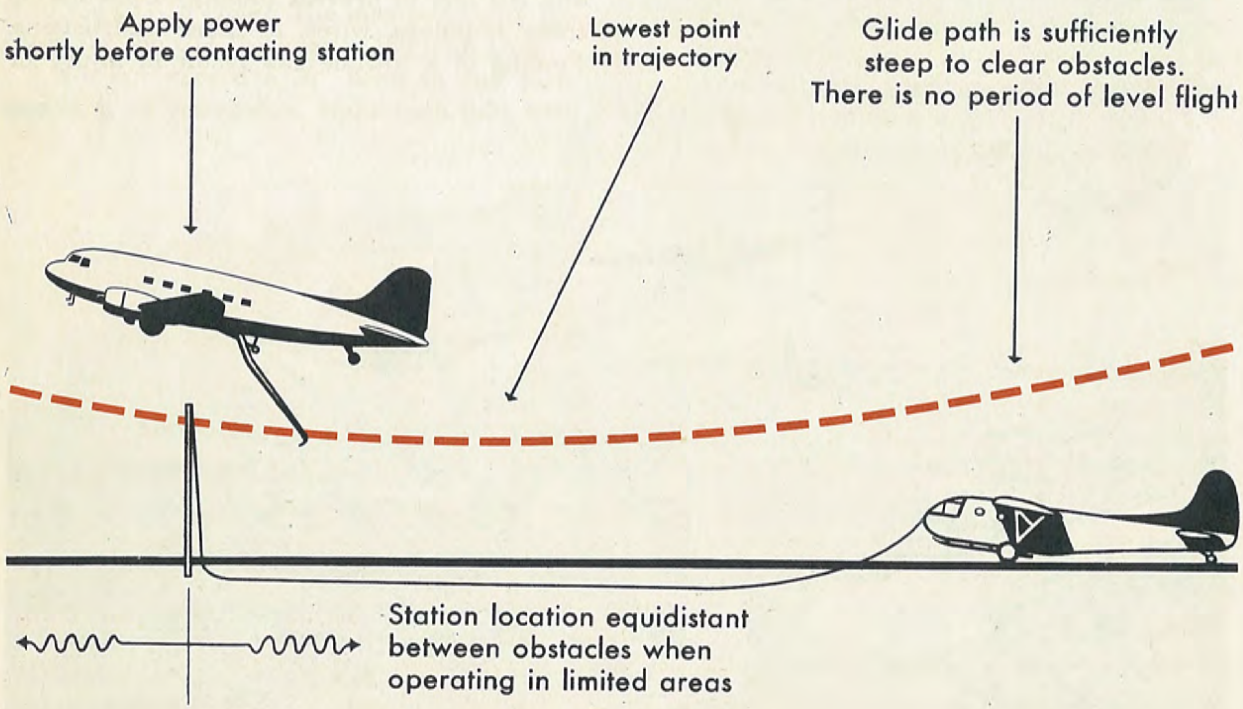
Note: Glider towlines stretch approximately 15% of their length during tow. If released from the towplane before the glider makes release, a towline may snap back and severely damage the nose of the glider or foul glider controls.

Procedures for Glider Pick-up

1. Pilot signals the pick-up unit operator to prepare for a pick-up. Maintain an airspeed not in excess of 110 mph in order to facilitate pick-up unit operators' work.

The unit operator then notifies pilot that unit is prepared for a pick-up.

2. Upon visual signal or radio message from the ground station that all is ready and the pilot of the glider is in his seat, approach the ground station on the right of the glider at the following indicated airspeeds:



Excessively sharp pull-ups may result in damage to the tail surfaces or may stall the airplane.

Glider weight in lbs.	Conditions	Contact Speed in mph
4900	On wheels in firm ground	130
4900	Skids or wheels in soft ground	135
6000	Skids or wheels in firm ground	130
6000	Wheels in soft ground	135
6000	Skids in soft ground	140
7500	Wheels in firm ground	135
7500	Wheels in soft ground	140
CG-4A of unknown weight	Unknown	140

3. Use a power glide to keep the engines clean and warm.

4. Start increasing power approximately 100 feet before contacting the station.

5. Use takeoff power for the pull-up and continue until you clear all obstacles. Reduce power to 40" and 2550 rpm and continue the climb until there is no danger of dragging the towline because of a safety link failure or because of emergency cut-off by the glider pilot.

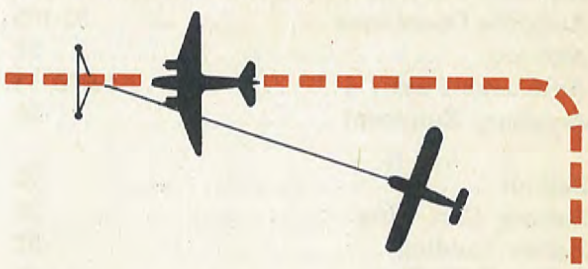
Do not exceed 15° in pull-up. Maintain a minimum airspeed of 105 mph except in cases of emergency.

6. If you intend to fly cross country, hold reduced airspeed in order to allow the unit operators to reel in the glider to a distance of approximately 350 feet. Normal towing procedure follows.

Hints for Pick-up

1. Warn all aircraft in the vicinity by radio of your activities and the presence of a 1000-foot trailing cable during part of maneuvers.

2. Circle left and use a close 90° approach to keep the ground station well in sight.



3. If in doubt about the glider and ground station being ready, stay in the vicinity until receiving a definite radio or visual signal.

4. Do not turn during the pull-up after contacting the ground station.

5. If you think you missed the station or made a knockdown, climb to 500 feet to eliminate the danger of dragging the loop and leader. The glider pilot may have released his end of the rope and you are trailing from 250 feet to 350 feet of rope and cable.

6. Communicate with the unit operators by conversation method rather than by bells or lights, with the exception of dropping the line loop and leader. (Flash the jump light to signal this operation.)

7. After some experience you will be able to maintain a constant glide or rate of descent during let down towards the ground station. There should be no period of straight flight. Go from a glide to a climb and apply the right amount of power in one smooth continuous motion.

8. Before landing, signal unit operator to prepare for landing and allow him time to retract the pick-up arm.

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