RESTRICTED

PILOT TRAINING MANUAL FOR THE C-47

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Pilot Training Manual for the

C-47

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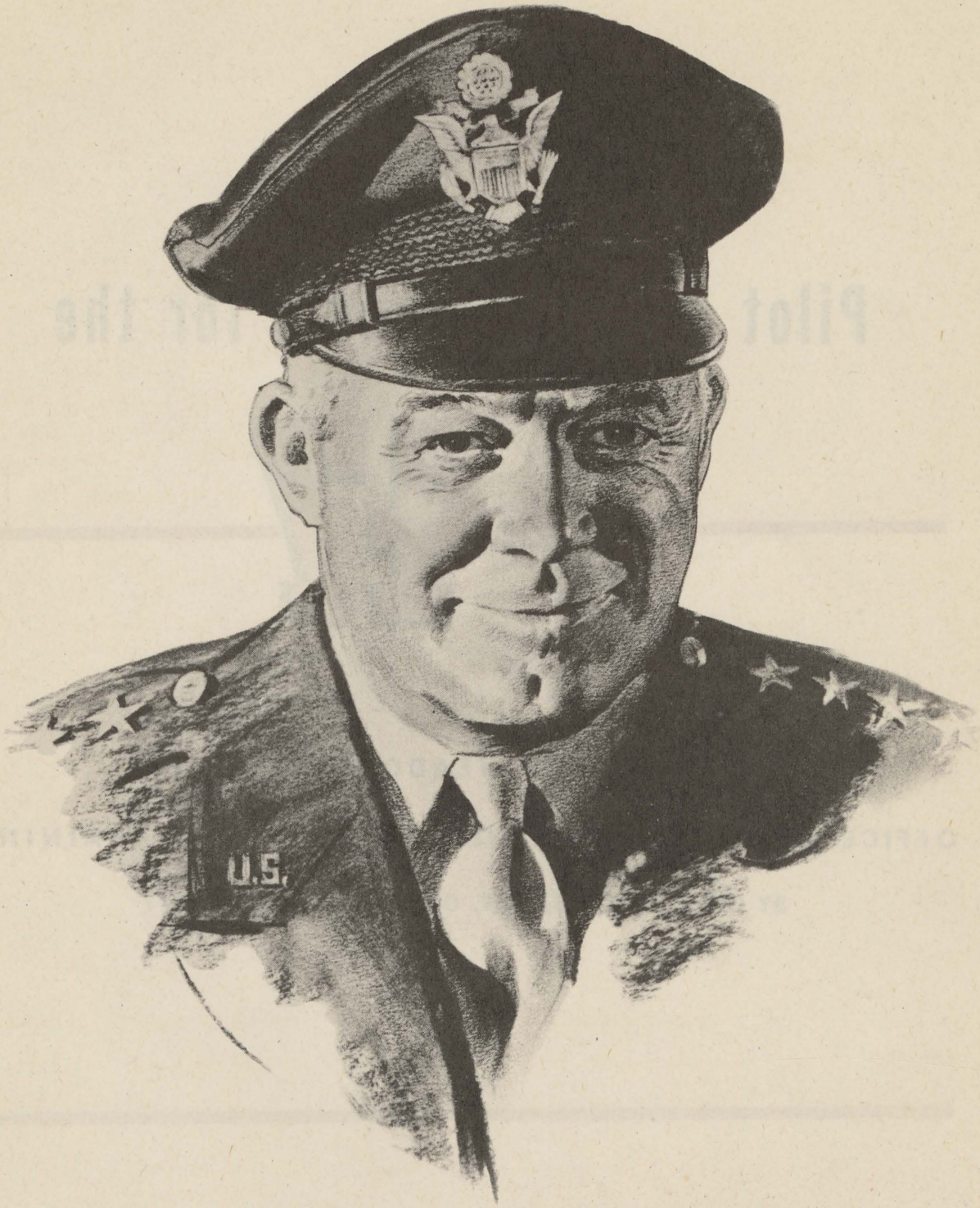

U.S.

Foreword

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.

H. H. Arnold

GENERAL, U.S. ARMY
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.

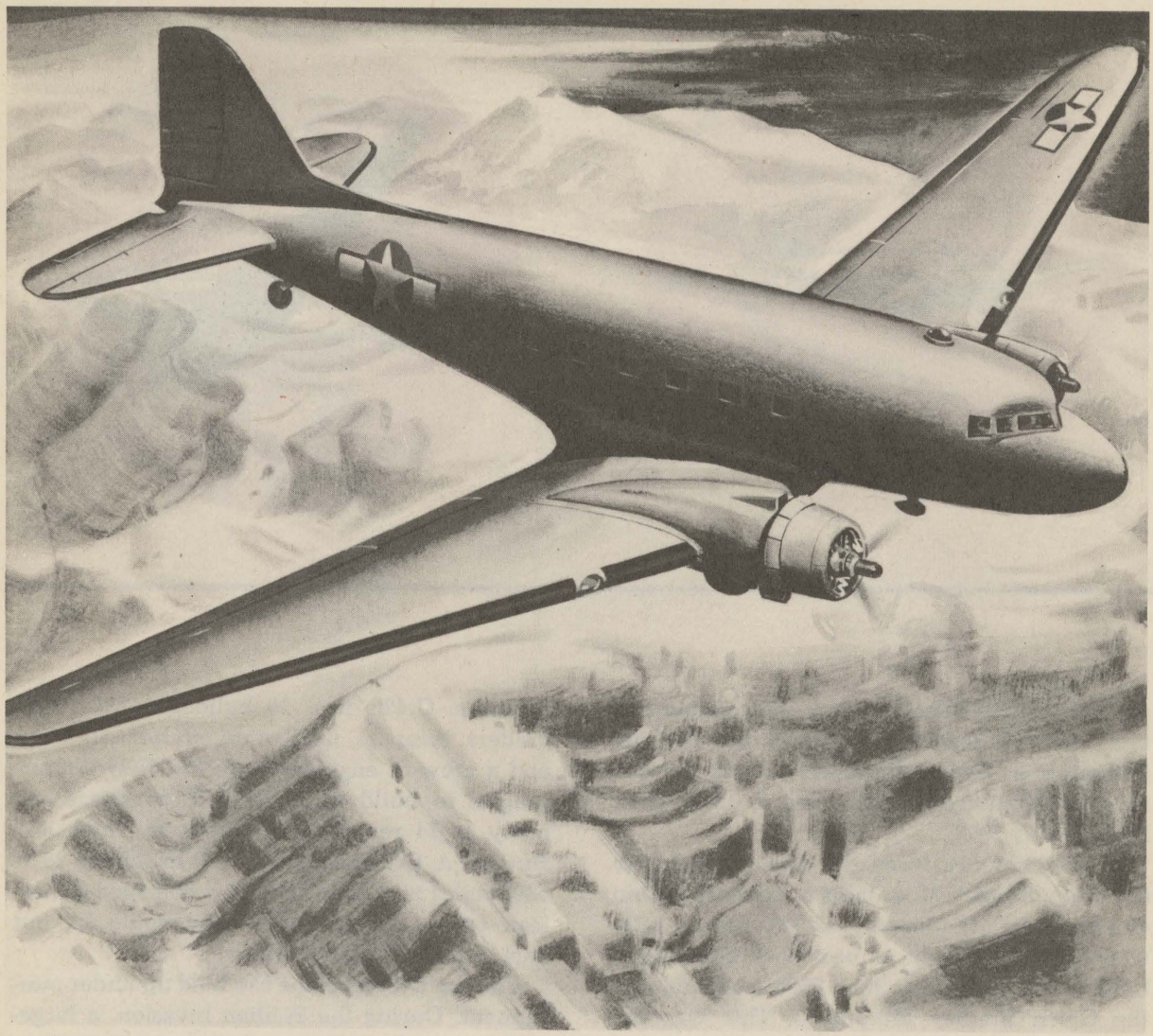
In the North African invasion a group of 44 C-47's made a non-stop flight from England to Oran to drop British paratroopers behind the enemy lines. C-47's supported the 8th Army's drive from El Alamein to Tripoli. At Kasserine Pass, C-47's, flying an aggregate of 1,000,000 miles, carried the munitions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

You are about to fly the C-47 transport airplane. You will receive transition instruction in its normal operation and in emergency procedures. This book is not meant to be a course in how to fly the C-47. It is a supplement to your instruction and a reference manual for you to use now and later when you know your airplane. Nor is this book meant to be a Technical Order, or a volume of instructions for ground crew or for your crew chief. It is a **pilot's operating manual.** As such, it tells you how to operate your airplane under normal and emergency conditions. Also, since you probably will be assigned one or more of these duties, it outlines the essential points of cold weather operation, long-range operation, paratroop carrying, and glider towing.

In this book are descriptions of the various systems in the airplane. These systems are described from the viewpoint of the pilot. You are told how they operate so that you can understand what you are doing and **why** you are doing it when you fly the airplane. The descriptions of the systems are at the front of the manual so that you can read them conveniently before you get into technique of operation.

There is also a checklist in this book. Be-

fore it was set down, all available checklists written on the airplane were studied and many experienced pilots were consulted. It is a workable checklist that you can use day in and day out.

This book is not meant to be a manual on the use of oxygen, or on weight and balance. It is not a manual on advanced 2-engine airplanes. These subjects are covered in such publications as the Handbook of Weight and Balance Data, and the AAF Training Command's Advanced Twin-Engine Manual. Other related subjects are treated in the Pilots' Information File.

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.

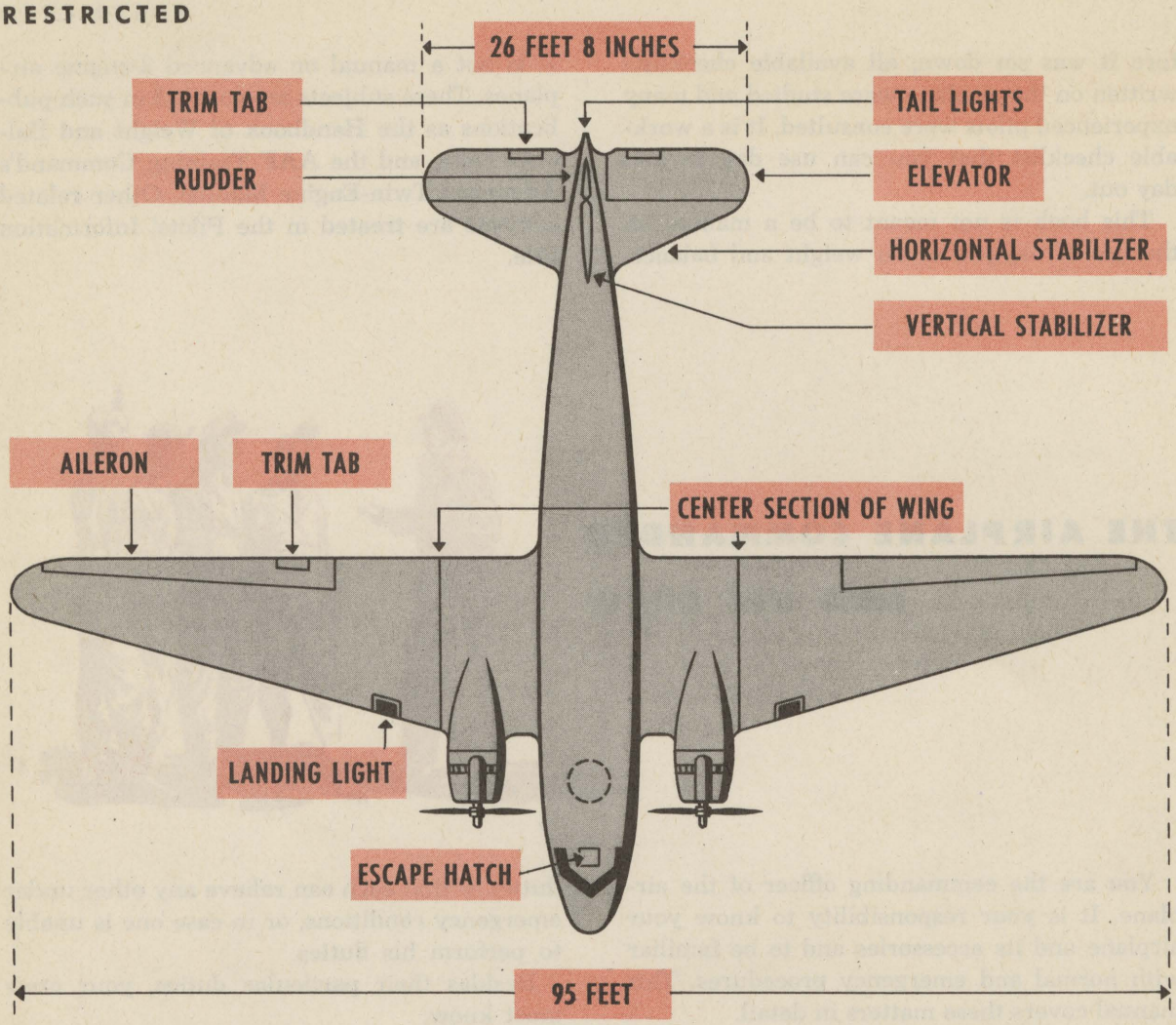
Each member of your crew should learn as much as possible about other crew members' duties so that each can relieve any other under emergency conditions, or in case one is unable to perform his duties.

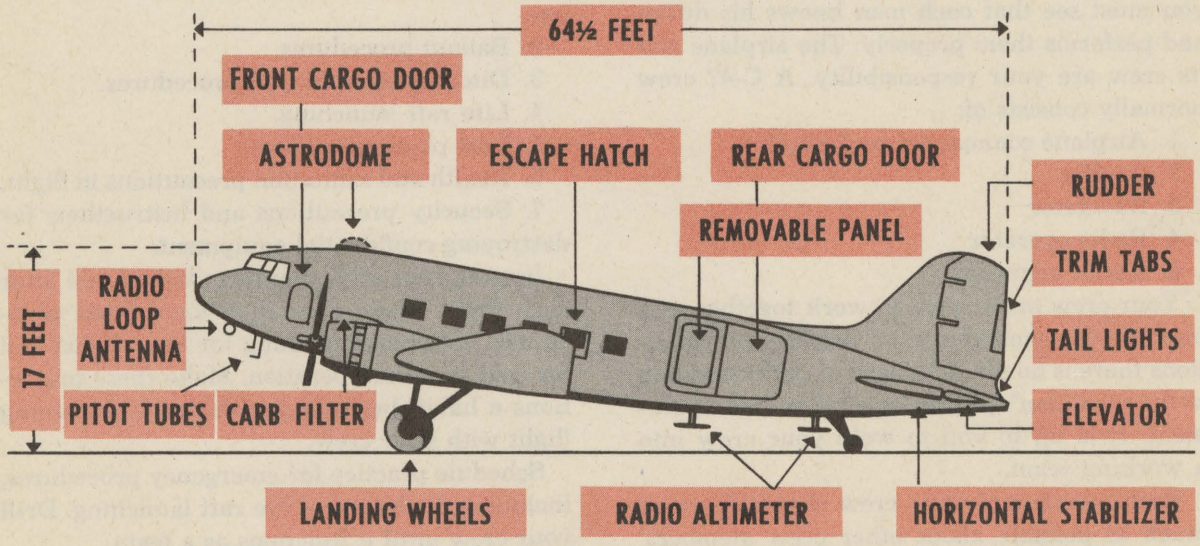
Besides their particular duties, your crew must know:

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
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ESCAPE HATCH
REAR CARGO DOOR
RUDDER
REMOVABLE PANEL
TRIM TABS
17 FEET
RADIO LOOP ANTENNA
TAIL LIGHTS
PITOT TUBES
CARB FILTER
ELEVATOR
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.

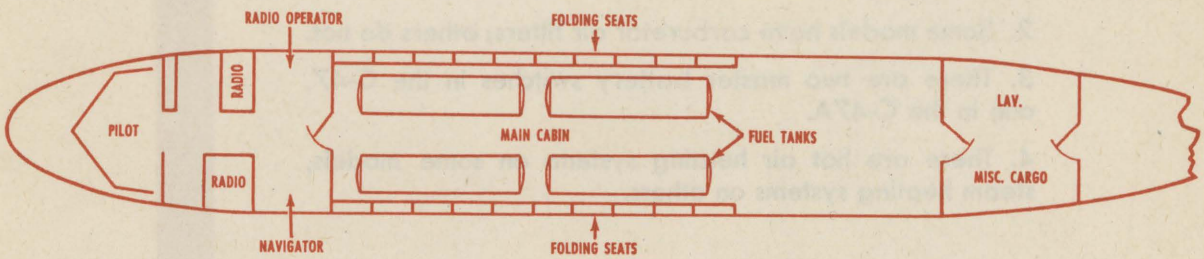
The hydraulic landing gear is of the conventional type. Main wheels retract vertically into the engine nacelles and extend approximately 11 inches out of the nacelles when fully retracted. In this position they are free to rotate and are subject to normal brake action. The tailwheel is non-retractable.

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

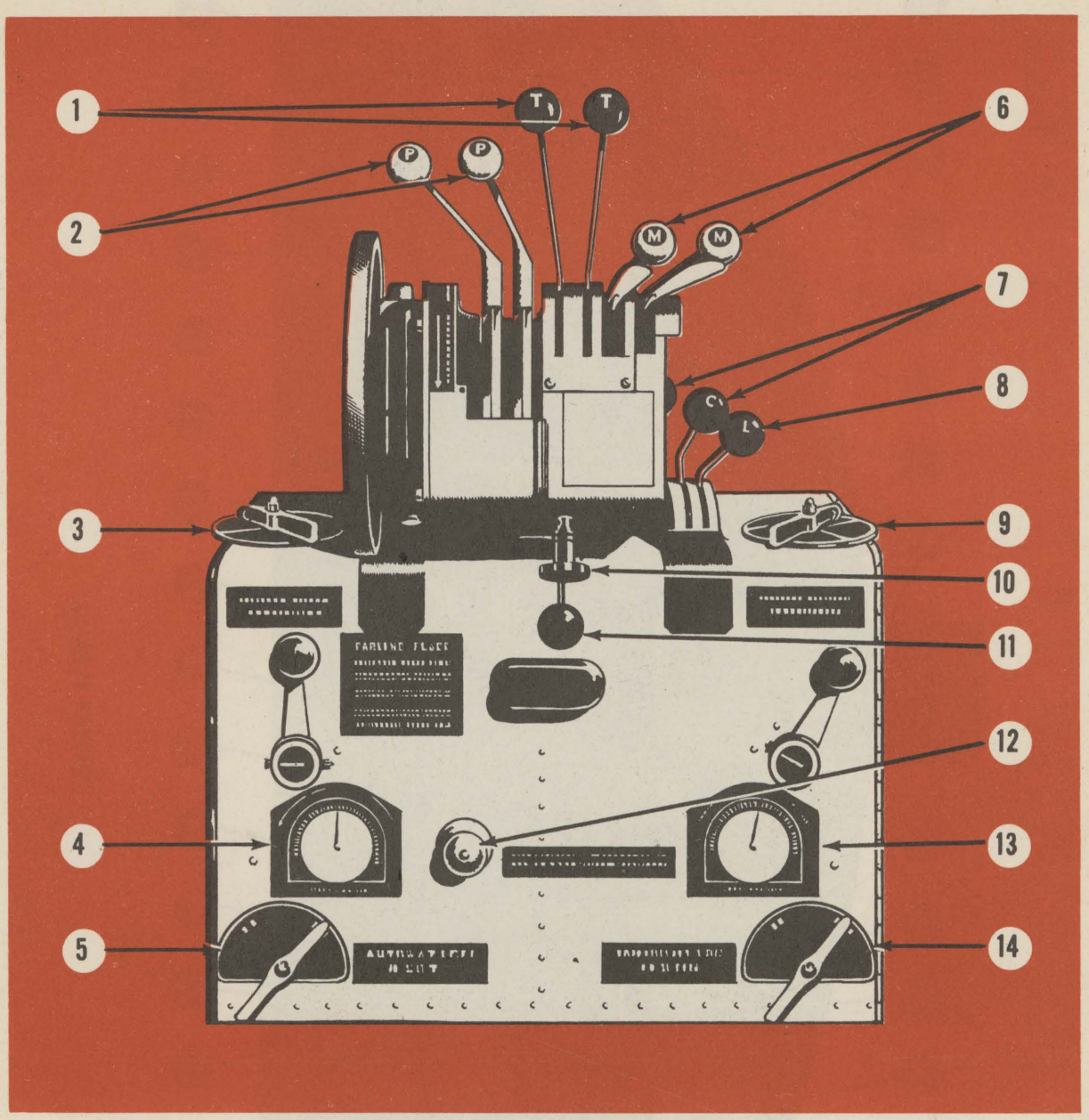
CONTROL SYSTEMS

AND THEIR NORMAL OPERATION

Note: There are variations in instruments and equipment in C-47 models. For example:

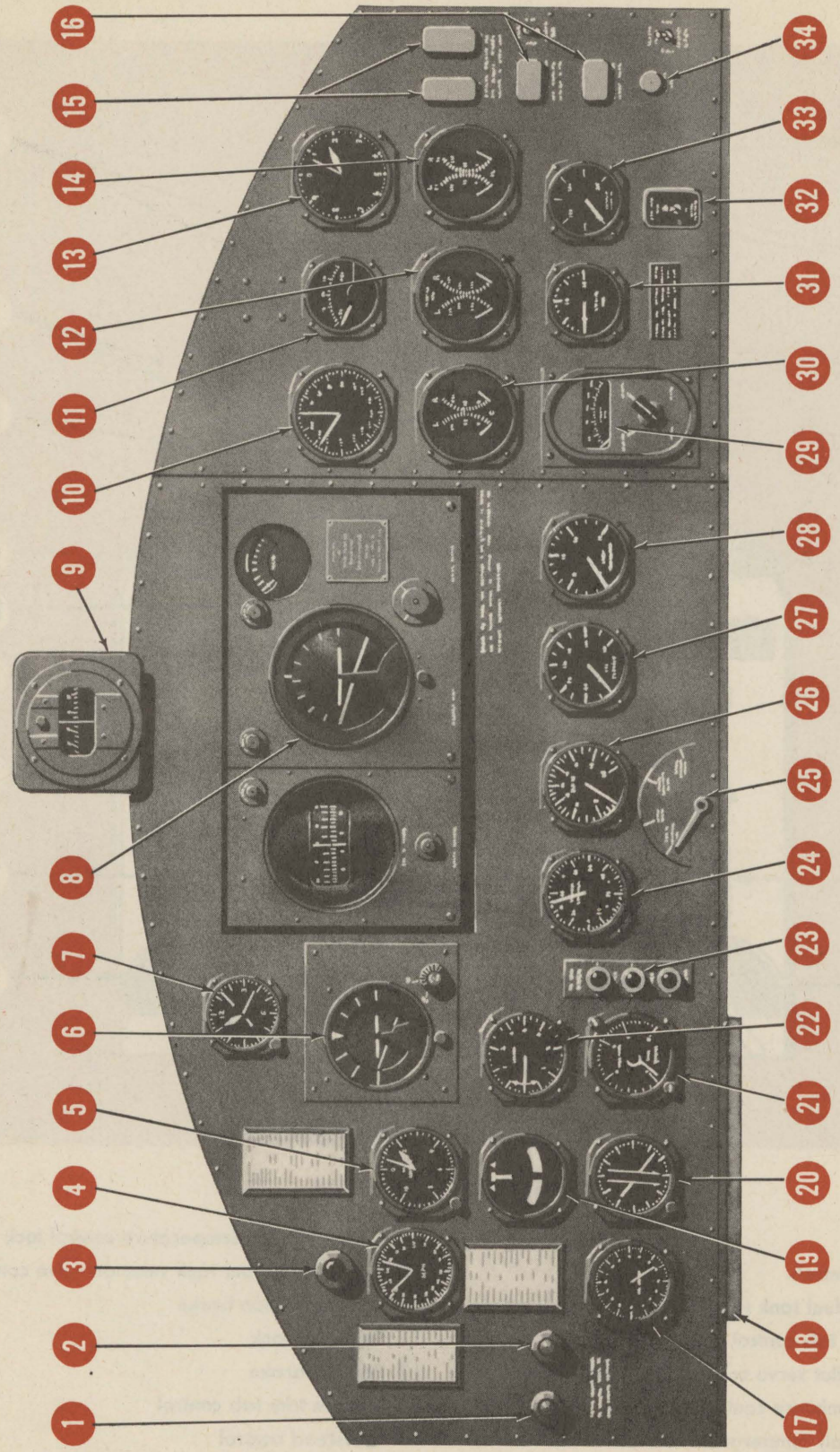
1. Electric fuel booster pumps take the place of the wobble pump in some models.
2. Some models have carburetor air filters; others do not.
3. There are two master battery switches in the C-47, one in the C-47A.
4. There are hot air heating systems on some models, steam heating systems on others.

LOCATION OF INSTRUMENTS AND CONTROLS



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 Crossfeed control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FRONT PANEL

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

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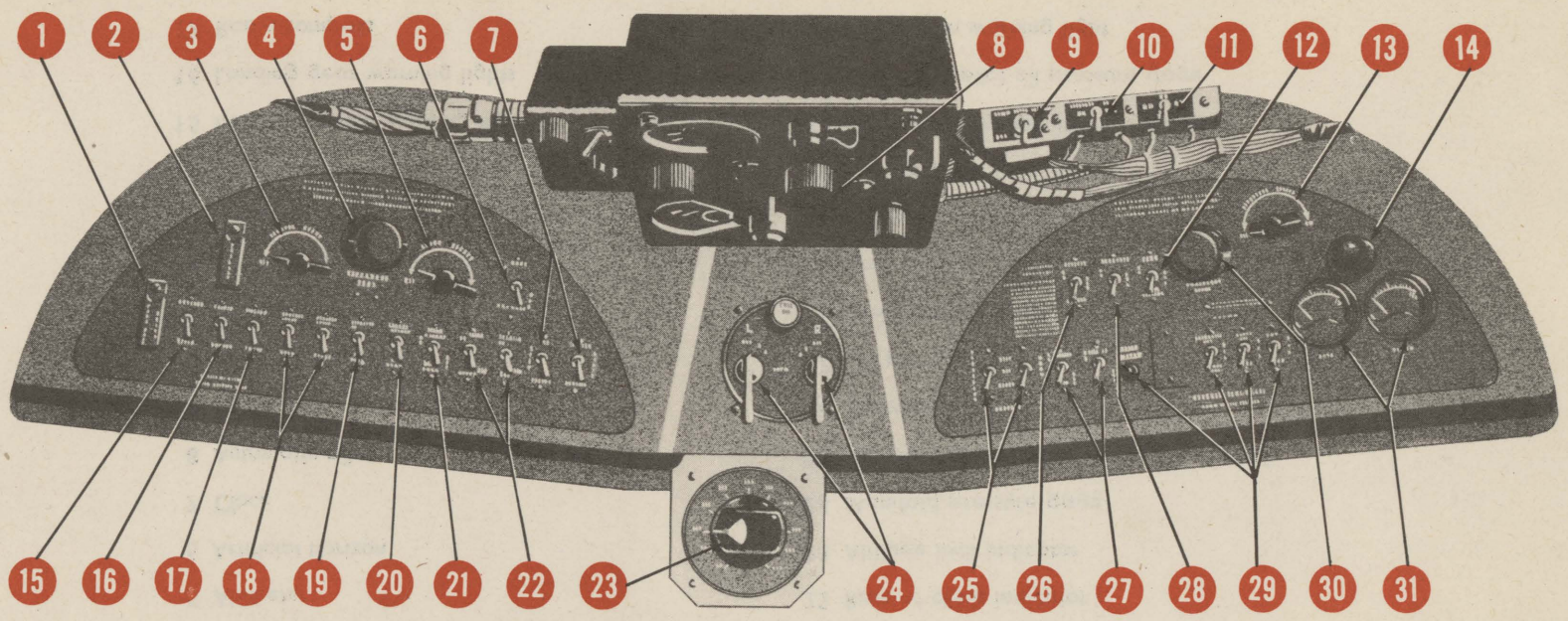

ELECTRICAL PANELS

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

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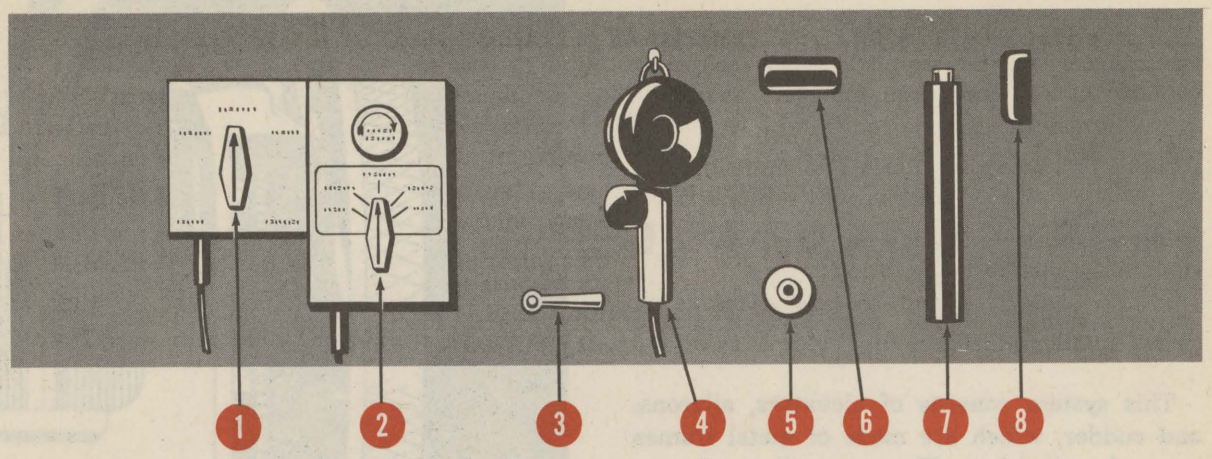
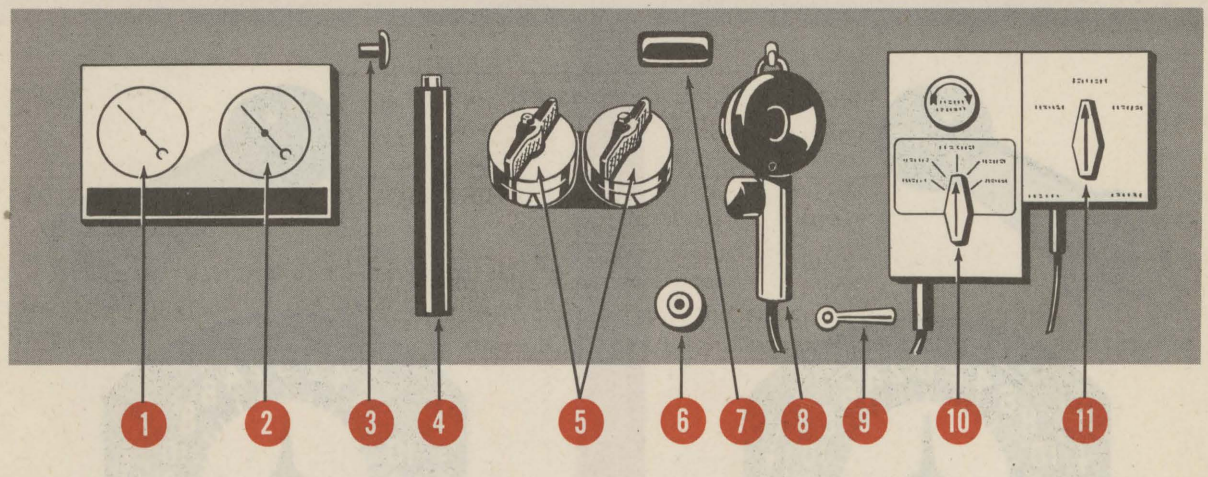


LEFT SIDE PANEL

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

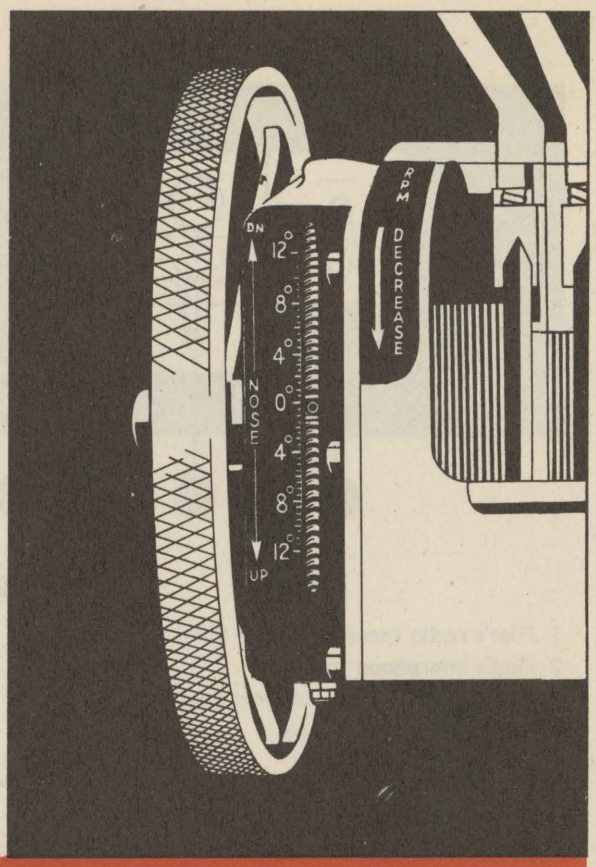


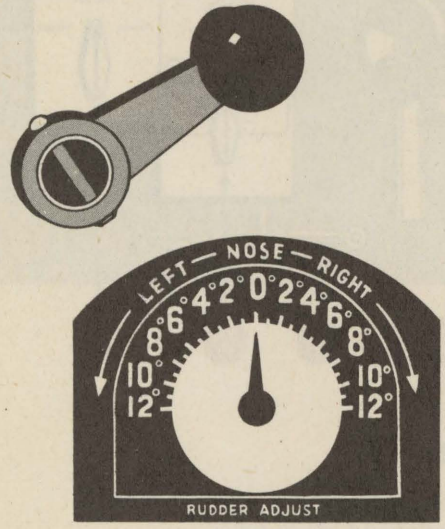
RIGHT SIDE PANEL

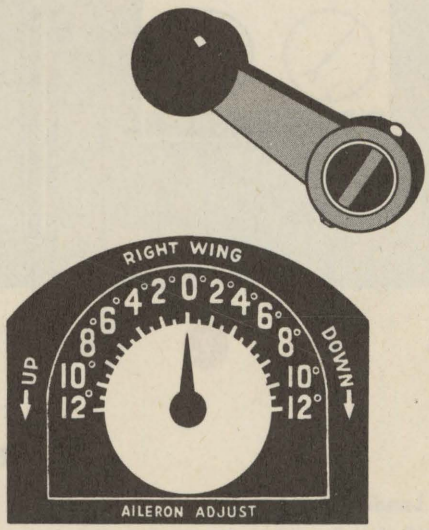
1 Landing gear hydraulic pressure gage
2 Hydraulic system pressure gage
3 Side windshield anti-icer hand pump
4 Fluorescent light
5 Engine cowl flap valve control
6 Copilot's oxygen outlet
7 Right hand pilots' compartment light
8 Copilot's hand microphone
9 Windshield anti-icer valve control
10 Copilot's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

Pressure accumulator type, operated normally at a pressure range between 850 and 900 psi.

The hydraulic system operates: landing gear, wing flaps, cowl flaps, wheel brakes, automatic pilot, carburetor air filters, and windshield wipers. The control panel for the hydraulic system is in the center aisle, behind the copilot's seat; gages are at the right of the copilot's 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.

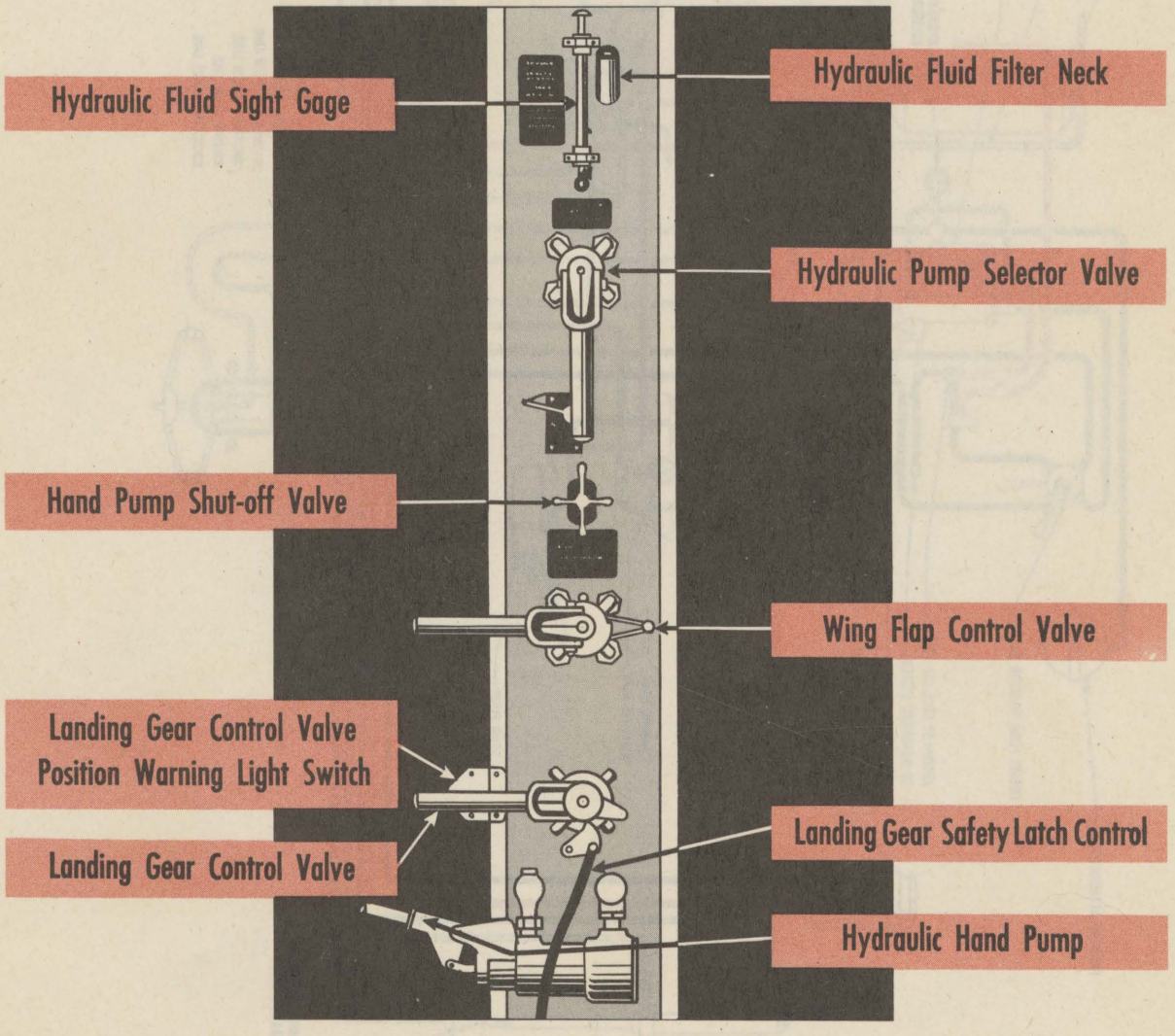
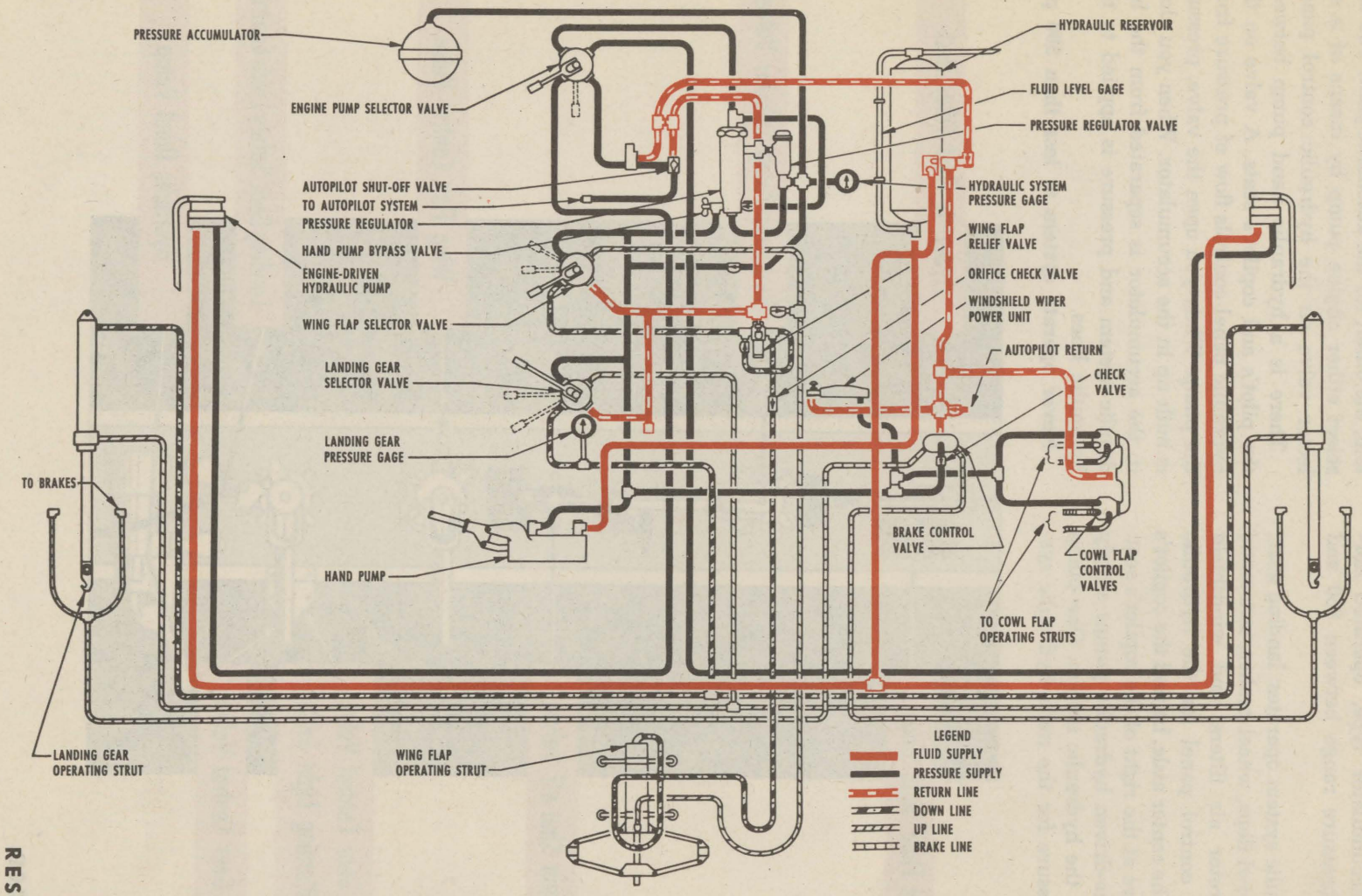
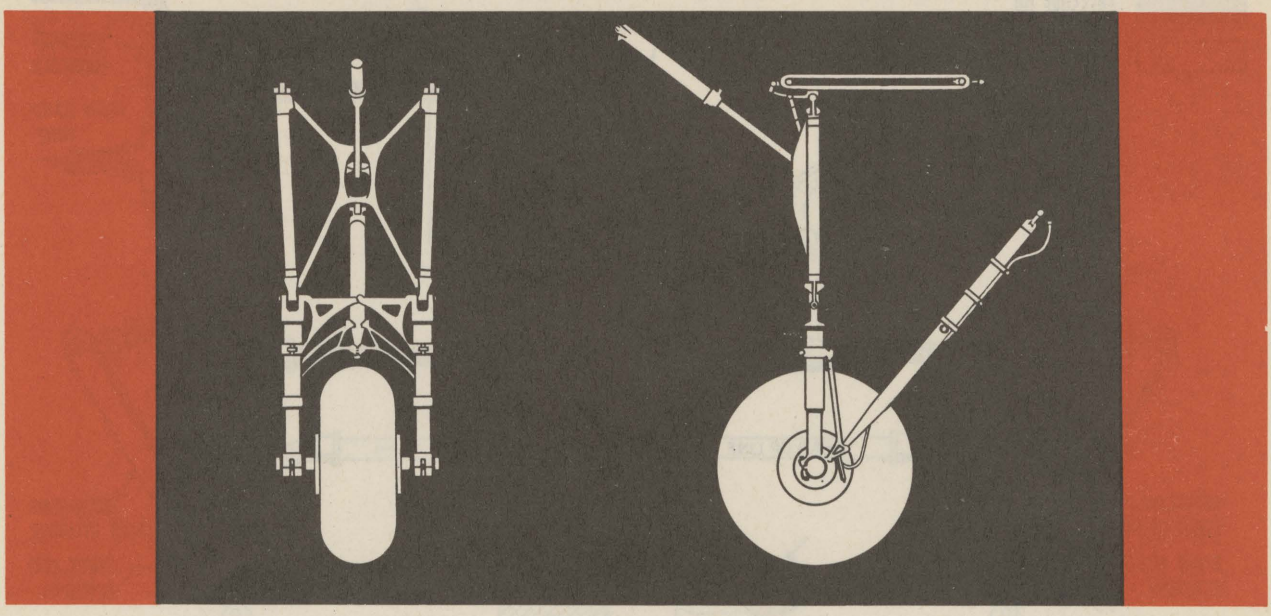


DIAGRAM OF HYDRAULIC SYSTEM



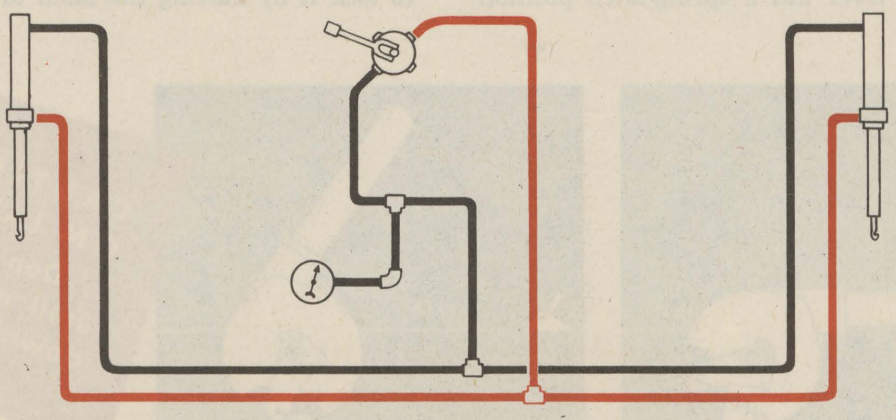
UNITS THE HYDRAULIC SYSTEM OPERATES



LANDING GEAR

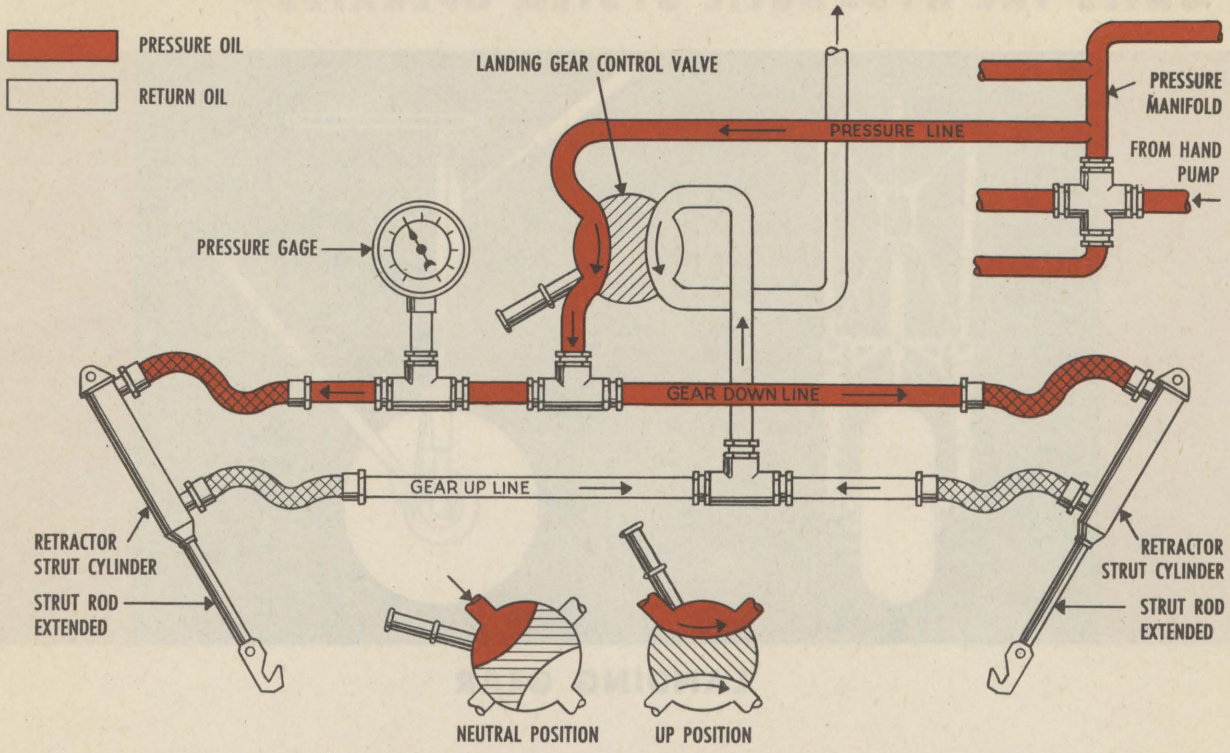
1. **Landing gear:** Your landing gear control is a valve, the handle of which is on the left side of the copilot's seat. Move the handle to the full UP position to raise the gear, to the DOWN position to lower the gear. After lowering or retracting the gear, return handle to neutral to trap fluid in hydraulic lines.

A safety latch, operated by a lever on the floor, locks the gear in place when the gear is extended. This lever is at the right of the pilot's seat. When pressure indicates that your gear is in full DOWN position, lock gear by pushing



Landing Gear Hydraulic System

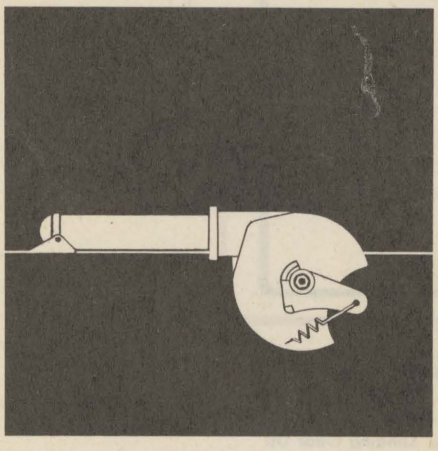
Landing Gear Down — Landing Gear Up

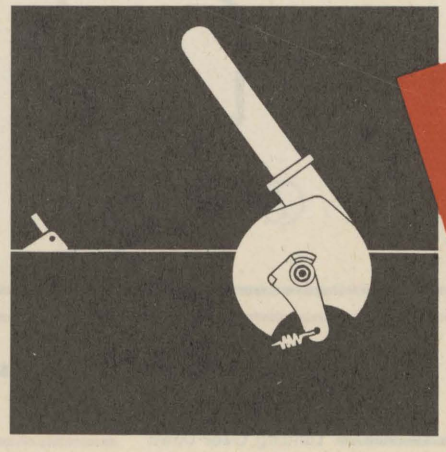


How Fluid Is Trapped in Lines

the lever forward parallel to the floor and securing it in the handle catch. When the latch is secure, return valve handle to neutral. Disengage safety latch by moving latch lever to vertical position.

The latch lever has a spring-latch position at an angle of 50° to the floor. The latch automatically assumes this position when the gear is raised and the valve handle is in neutral. The latch lever remains in the 50° position until you have lowered the gear and are ready to lock it by moving the latch to DOWN.





CAUTION ON LATCH ...Don't lock until gear is down!

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 throttles are closed if:

(a) One or both landing wheels are retracted.

(b) One or both landing wheels are unlatched.

(c) Valve handle is not in neutral.

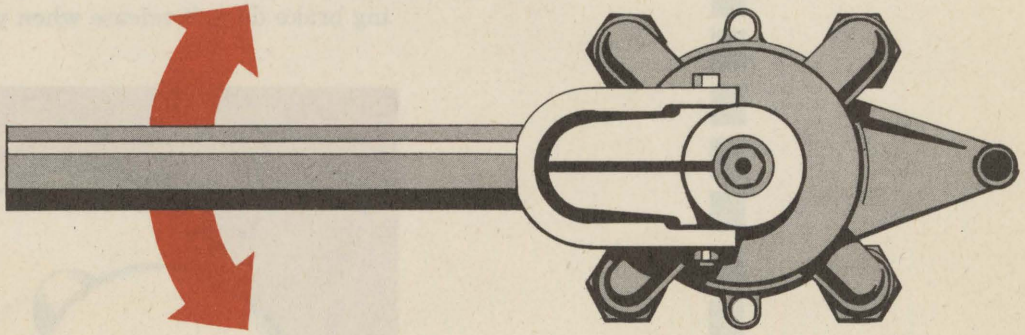
Warning lights: There are green and red warning lights at the right-hand corner of the instrument panel. The green light burns only when the gear is down and latched and the valve handle is in neutral. Under any other condition the red light burns.

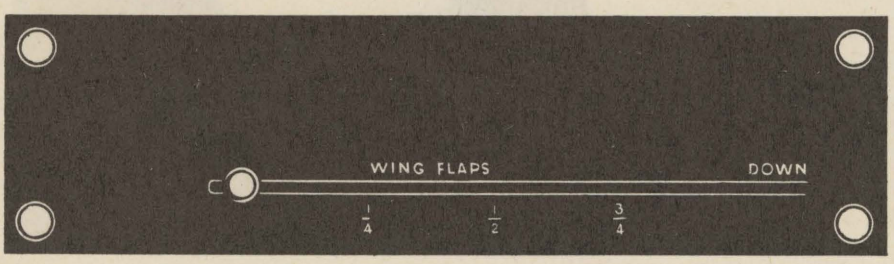
2. **Wing flaps:** Your airplane has all-metal wing flaps. A valve lever just above the landing gear lever operates these flaps. To raise or lower the flaps, first clear the slot that holds it in neutral by swinging the lever toward the aisle. Move the lever down to lower the flaps, up to raise them,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

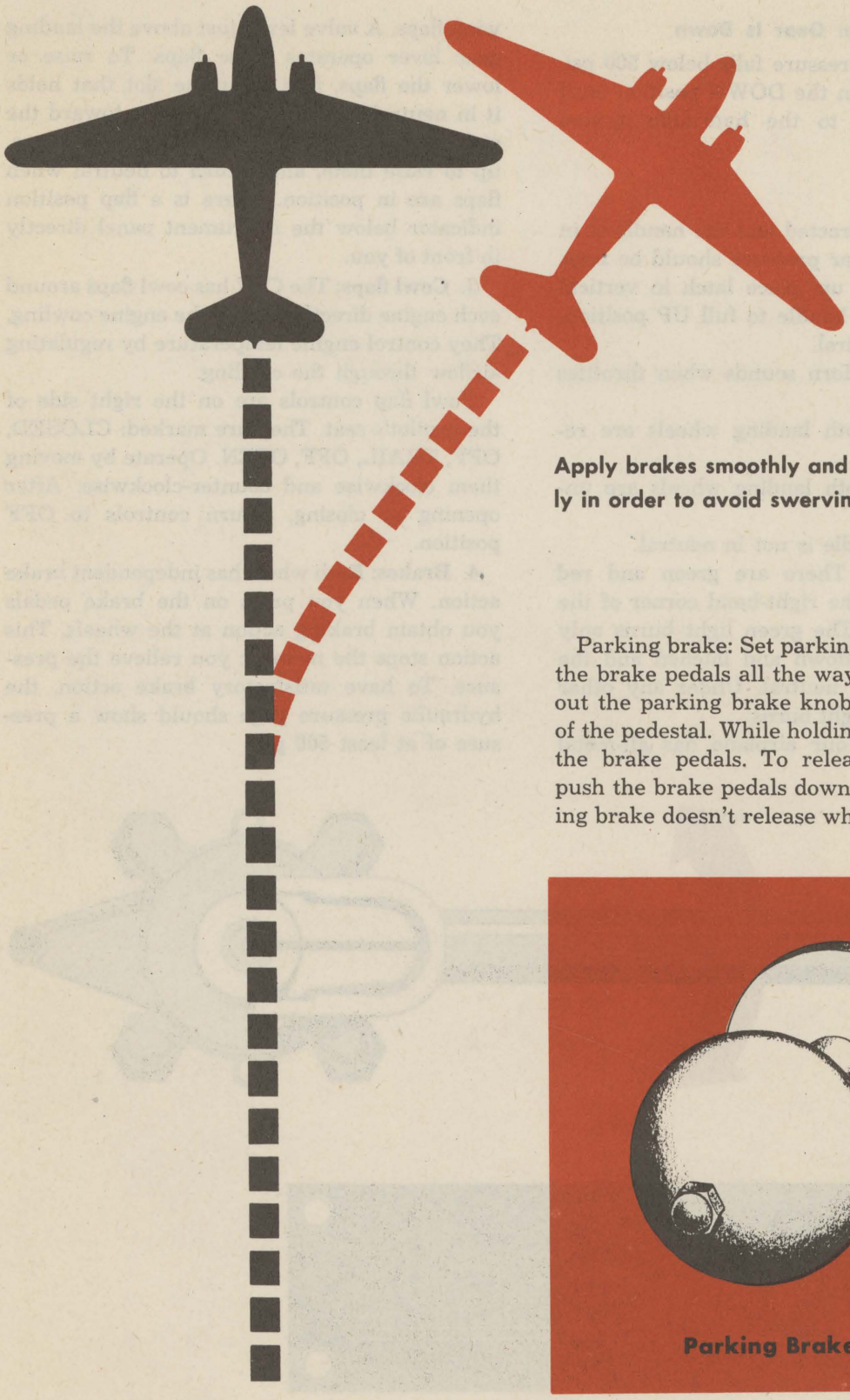
3. **Cowl flaps:** The C-47 has cowl flaps around each engine directly behind the engine cowling. They control engine temperature by regulating airflow through the cowling.

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 counter-clockwise. After opening or closing, return controls to OFF position.

4. **Brakes:** Each wheel has independent brake action. When you press on the brake pedals you obtain braking action at the wheels. This action stops the moment you relieve the pressure. To have satisfactory brake action, the hydraulic pressure gage should show a pressure of at least 500 psi.



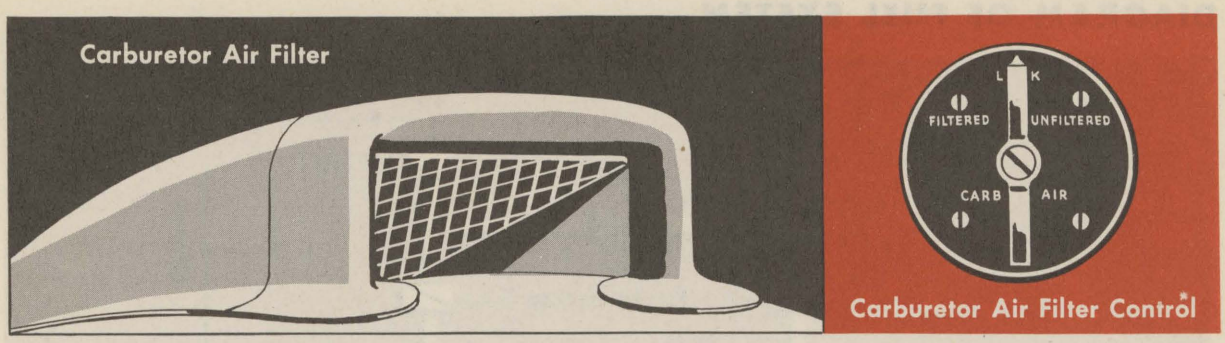




Apply brakes smoothly and evenly in order to avoid swerving

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

Parking Brake Knob



pedals down, push the knob manually.

5. **Carburetor air filter:** Some C-47A models have a carburetor air filter on the top of each engine nacelle.

Control the filters by means of a lever behind the pilot's seat, facing the copilot. The lever has three positions: FILTER, UNFILTER, and LOCK. To open the filter, turn to FILTER, then back to LOCK. To shut off the filter, turn to UNFILTER, then back to LOCK.

Use filters only when dust is thick or sand is blowing.

6. **Automatic pilot:** The automatic pilot consists of a directional gyro, ball bank indicator, a bank-and-climb gyro, and horizontal bar and suction gage. 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. **Internal blowers:** The R-1830-90C engine has a 2-speed internal blower for use in high-altitude flying. Use LOW blower below 11,000 feet, HIGH blower above 11,000 feet. Controls for internal blowers are at the pilot's left.

Panel of Automatic Pilot

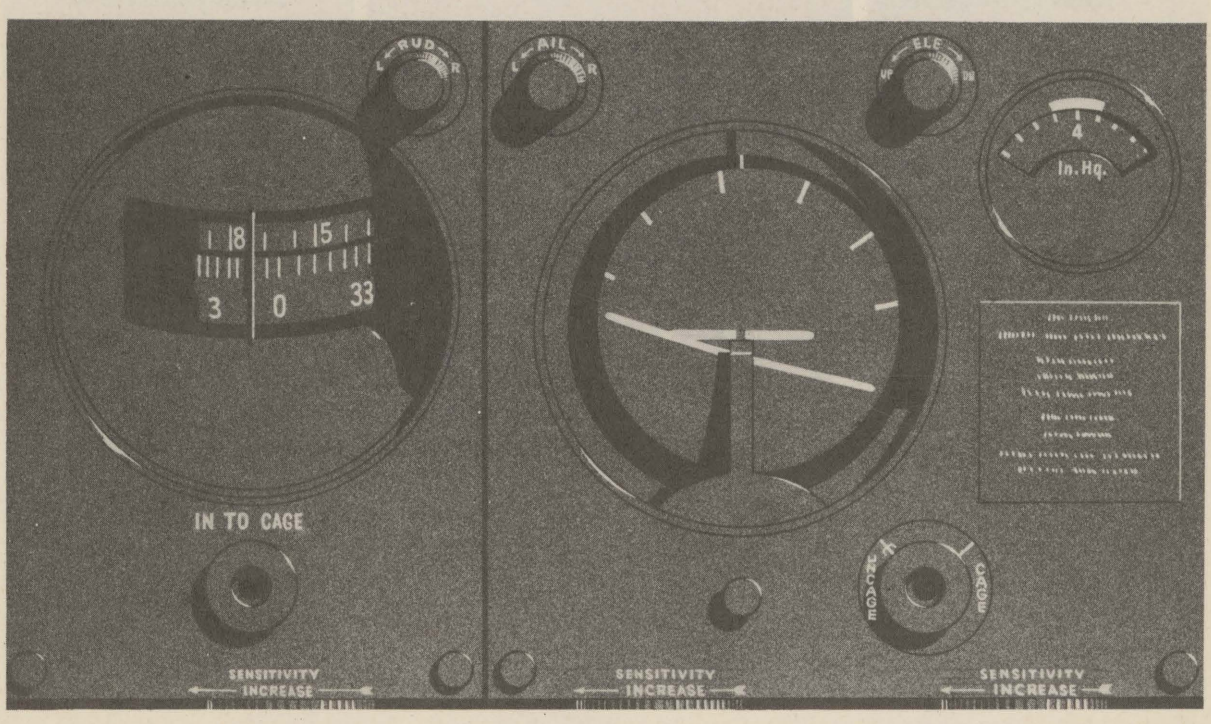
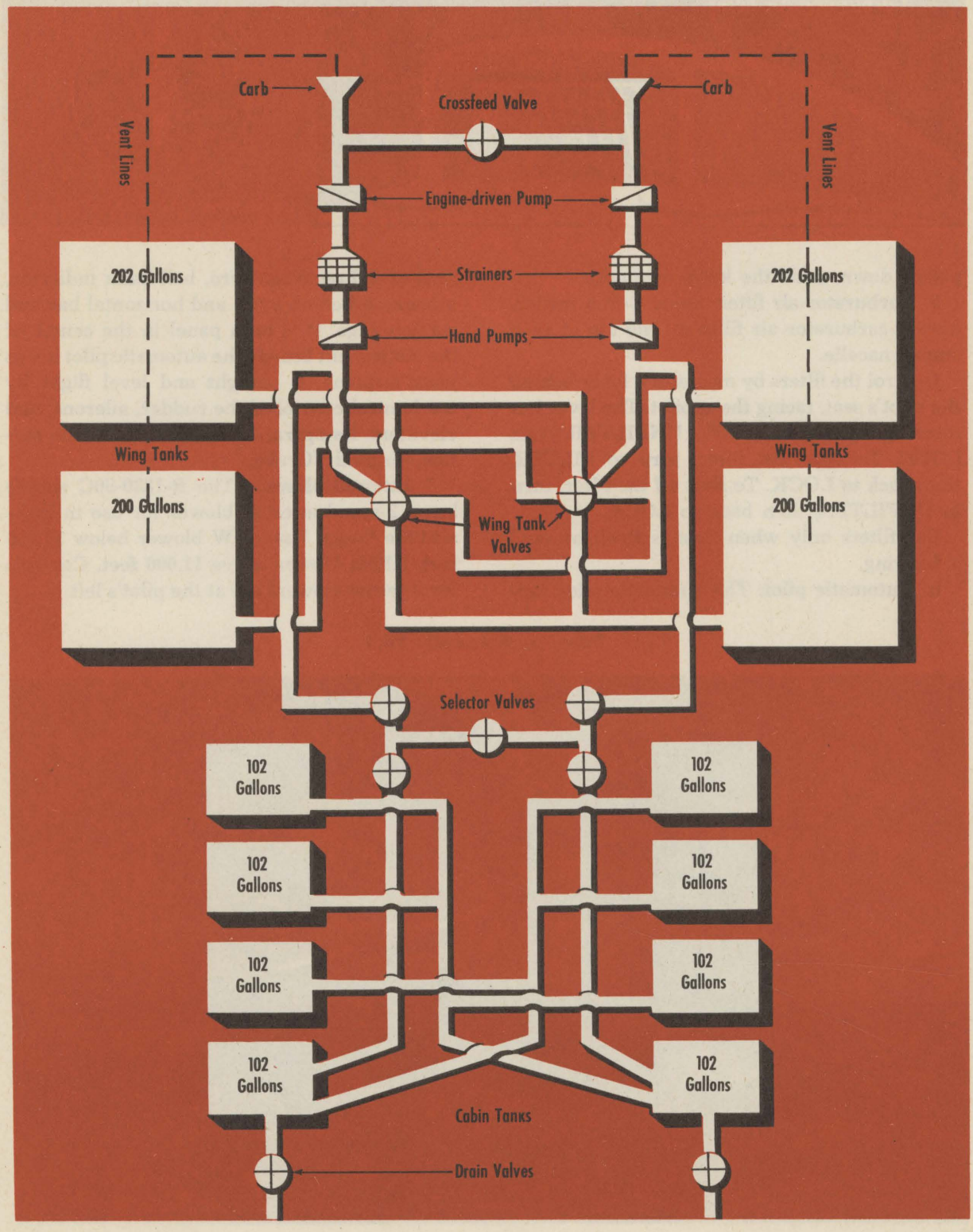


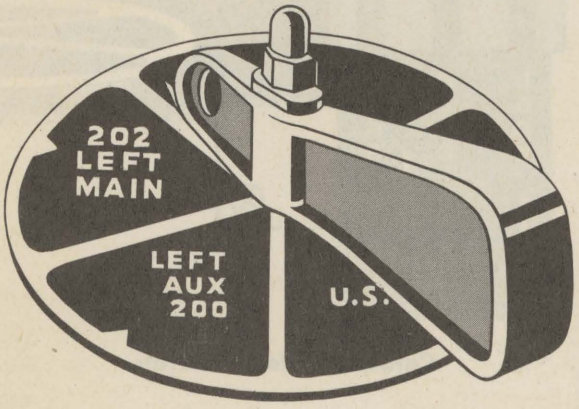
DIAGRAM OF FUEL SYSTEM



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.



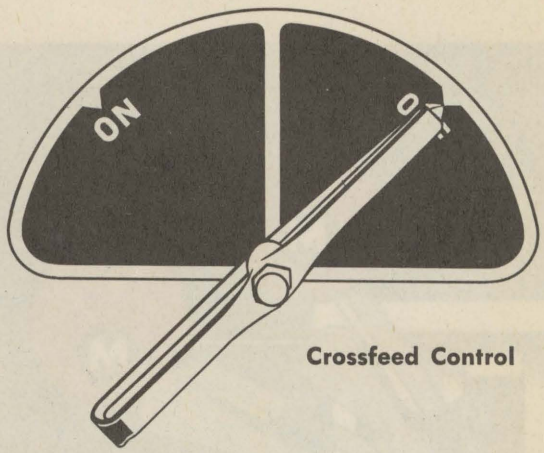
Fuel Selector Valve
(One for Each Engine)

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 models have a fuel crossfeed system that permits either fuel pump to supply both engines. In those models, if one pump fails, you can maintain fuel pressure on both engines by turning the crossfeed system control ON.

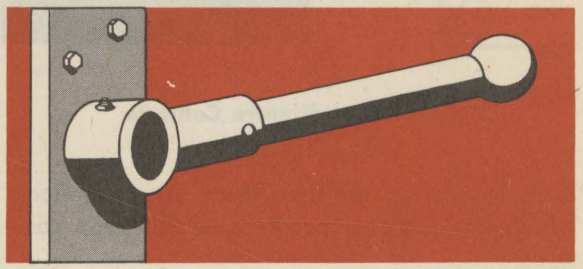
Crossfeed control is at the lower right-hand corner of the pedestal. Turn the control ON only when needed; otherwise, keep it in the OFF position.

Late C-47 models have no crossfeed. They have an electric fuel booster pump for each engine. With it, you can continue to supply fuel to an engine if the fuel pump on that engine fails. Booster pump switches are on the right-hand electrical panel.



Crossfeed Control

4. **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 models have a wobble pump, others have replaced the wobble pump by electric fuel booster pumps.

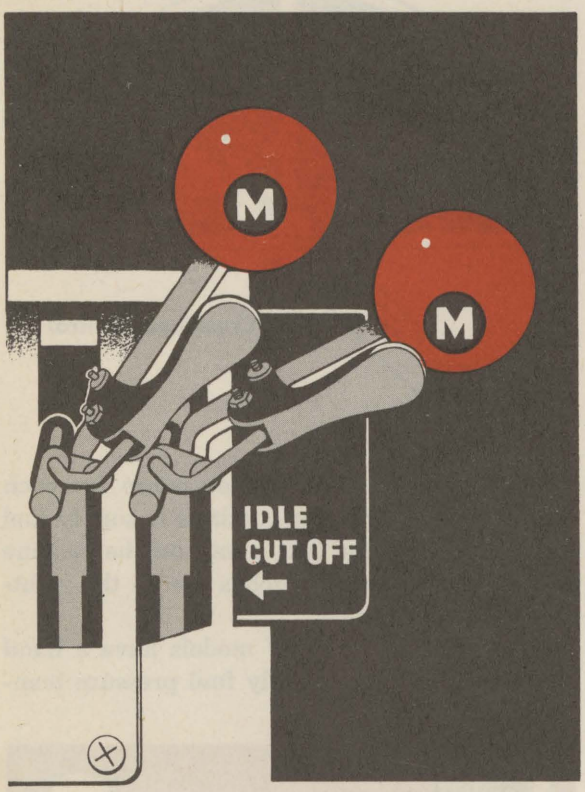


Wobble Pump

5. **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.

Move controls from EMERGENCY toward IDLE CUT-OFF to lean mixture. Move them



Carburetor Mixture Controls

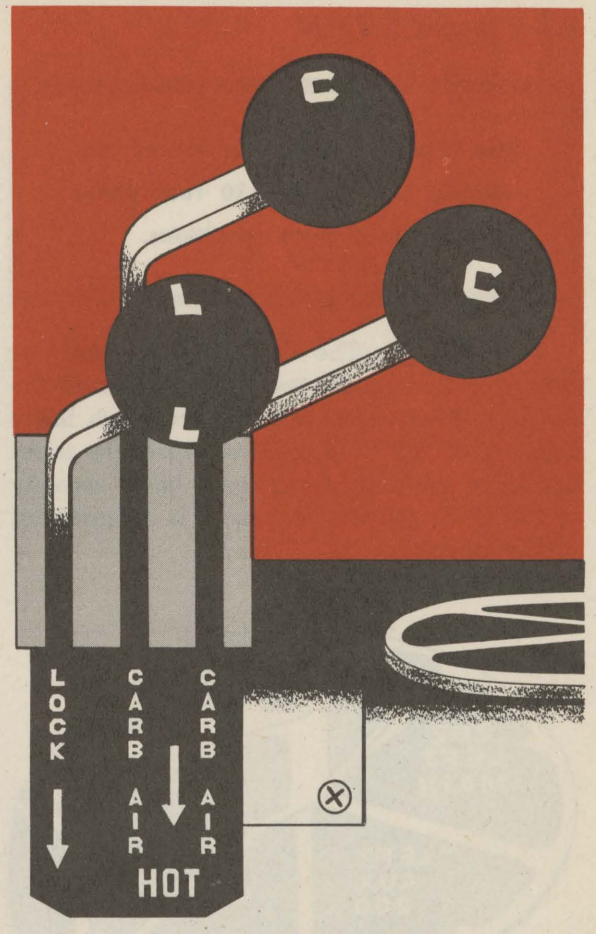
back to enrich mixture. Here are the effects which the controls produce at different positions:

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

AUTO RICH—rich mixture } Automatic
AUTO LEAN—lean mixture } control

IDLE CUT-OFF—stops flow of fuel.

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



Carburetor Heat Controls

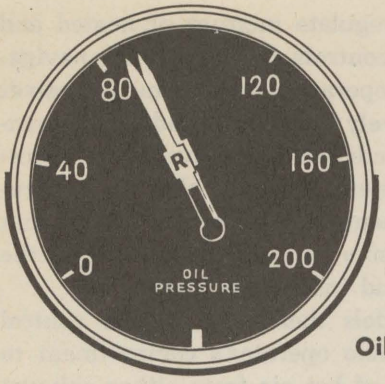
6. **Carburetor heat controls:** Located below instrument panel on right side of pedestal. Positions: From COLD to HOT. When you require carburetor heat to offset icing conditions, apply heat as needed. Otherwise leave this control in COLD position.

OIL SYSTEM

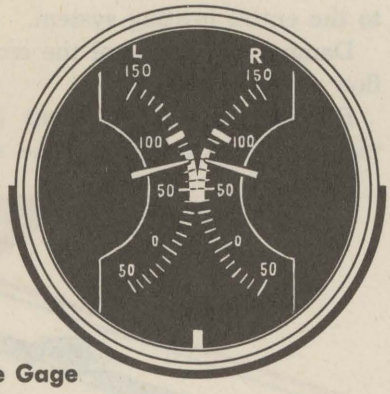
There are two oil tanks, each with a capacity of 29 gallons; one is in each nacelle.

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



Oil Pressure Gage



Oil Temperature Gage

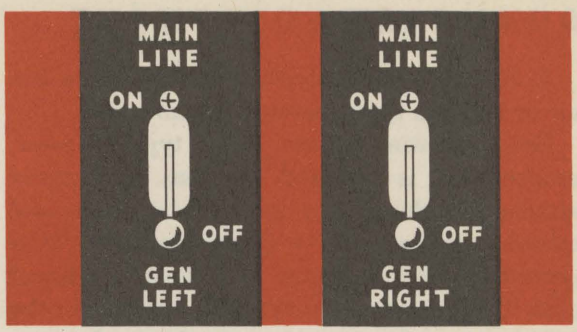
emergency conditions. If pressure falls below 50 psi, the red warning light above the pressure gage lights.

Oil cooler shutter controls are at the left side of the pedestal. Adjust shutters to keep temperatures within operating limits of between 50°C and 70°C, or, under emergency conditions, between a minimum of 40°C and maximum of 95°C.

ELECTRICAL SYSTEM

Two engine-driven generators supply electric current to your airplane and charge two 88-ampere-hour batteries. The C-47 has a 12-volt, ground-return electrical system; the C-47A has a 24-volt ground-return system.

There is a generator on each engine. Either both or one alone supply current to the batteries. Select generators by means of two switches in the main electrical junction box near the floor of the forward cargo loading



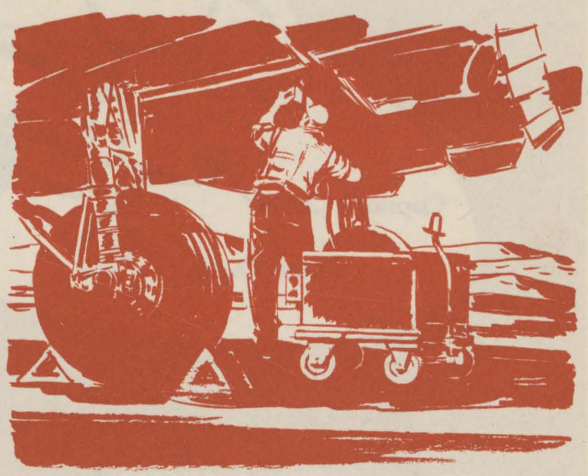
Generator Switches

companionway. On some models the switches are on the right-hand electrical panel.

Open or close battery circuit by means of two switches in the C-47, one switch in the C-47A. These switches are on the left-hand electrical panel.

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.



Spare Fuses

There are spare fuses for the electrical system in the main electrical junction box.

AUXILIARY EQUIPMENT

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

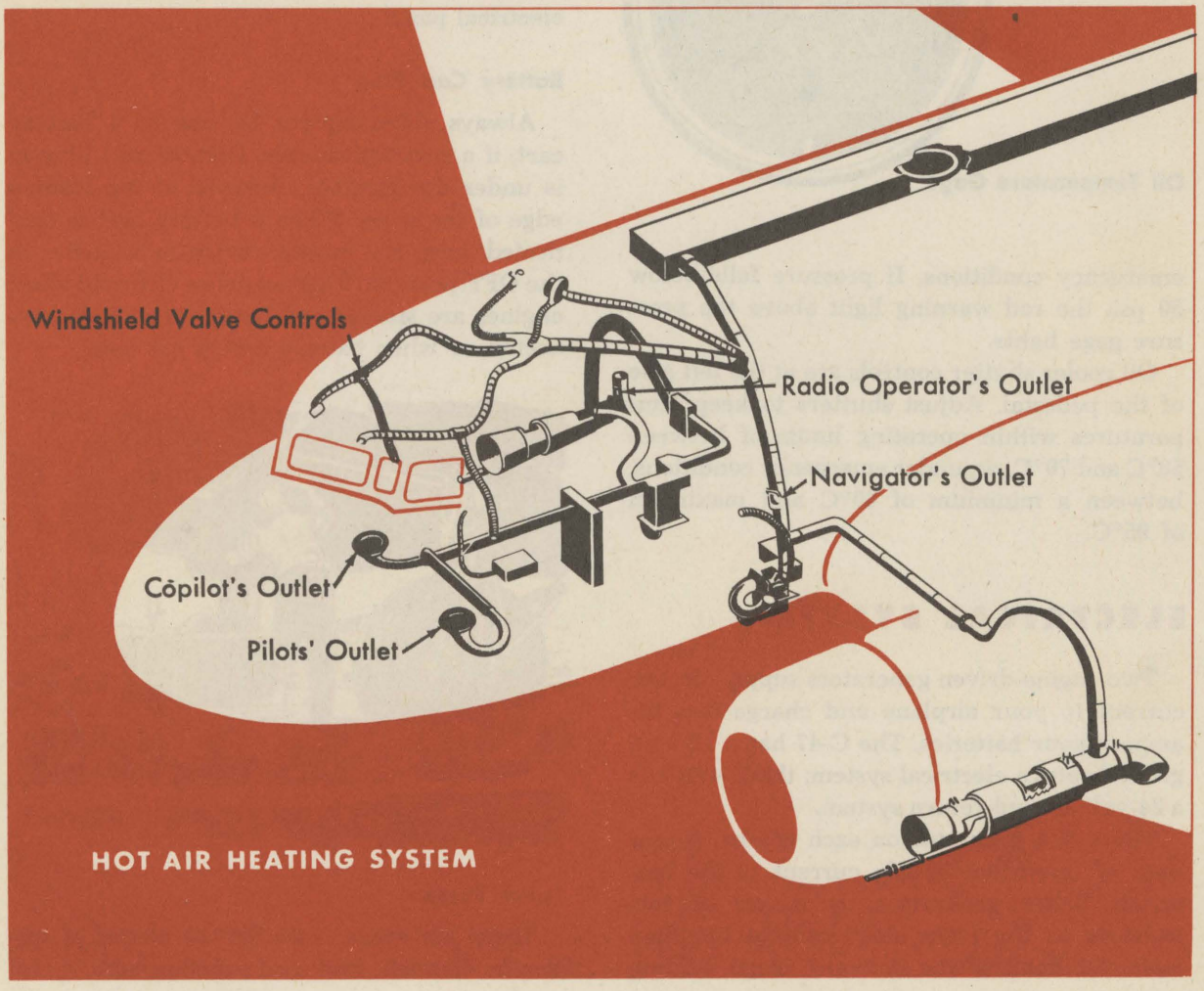
Hot air heating system: In this type of heater, scooped air is warmed by heat exchangers attached to the engine exhaust tail pipes and mixed with cold air to obtain desirable temperatures. Heat from the right engine exhaust goes to the pilots' compartment. Heat from the left engine exhaust goes to the 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 models 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 operator's



HOT AIR HEATING SYSTEM

compartment.

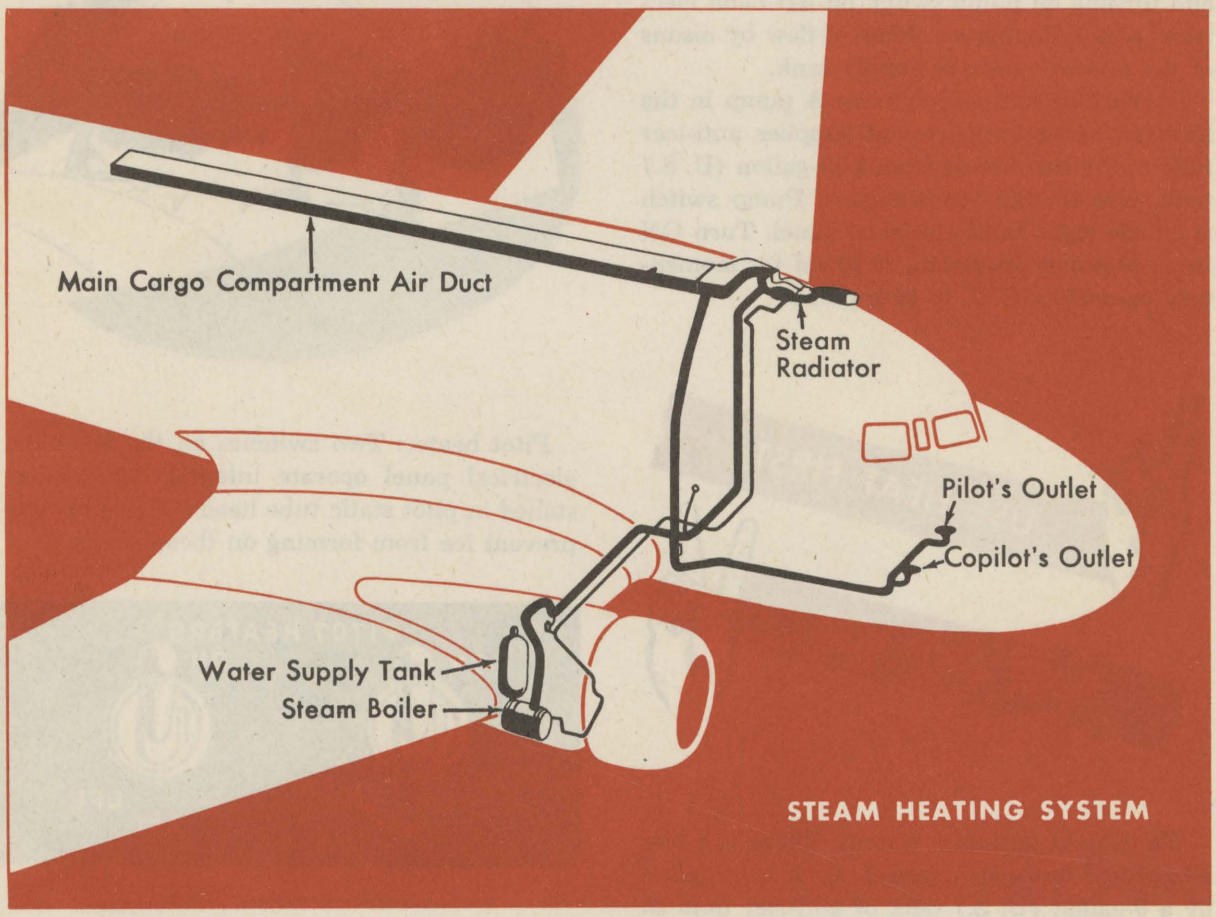
Steam heating system: In this type of heater, steam, supplied by a boiler in the right nacelle, heats air introduced by airscoop to a radiator in the top left side of the forward section. A valve in the radio operator's compartment controls the flow of steam from boiler to radiator. Flow of air from 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, through the bypass duct, or both.

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

2. **De-icers**: To remove ice from the leading edge of the wings and of the horizontal and neutral stabilizers: Turn de-icer control, behind the pilot's seat. This control has ON and OFF positions.

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.

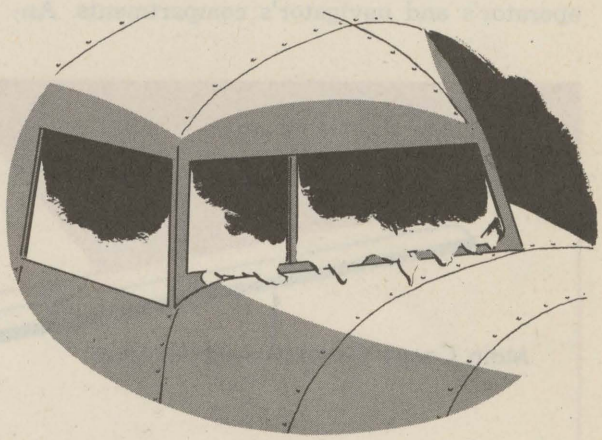
Propeller anti-icer system: A pump behind the pilot's seat supplies anti-icer fluid from a 4-gallon (U. S.) tank, next to the pump, to a slinger ring aft of the propeller hub. Start flow of anti-icer fluid by turning on petcock at tank and turning on pump switch on left-hand electrical panel. Regulate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

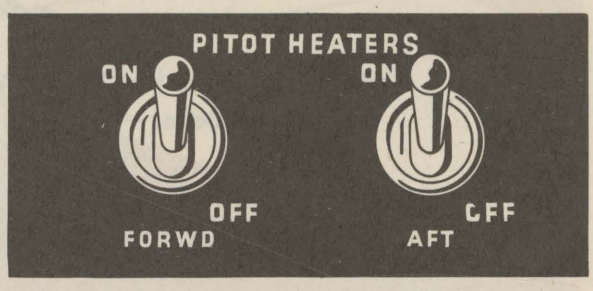
Windshield anti-icer system: There are two windshield anti-icer systems. Each is supplied by a 6-gallon (U. S.) tank of anti-icer fluid in the forward baggage compartment.

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.

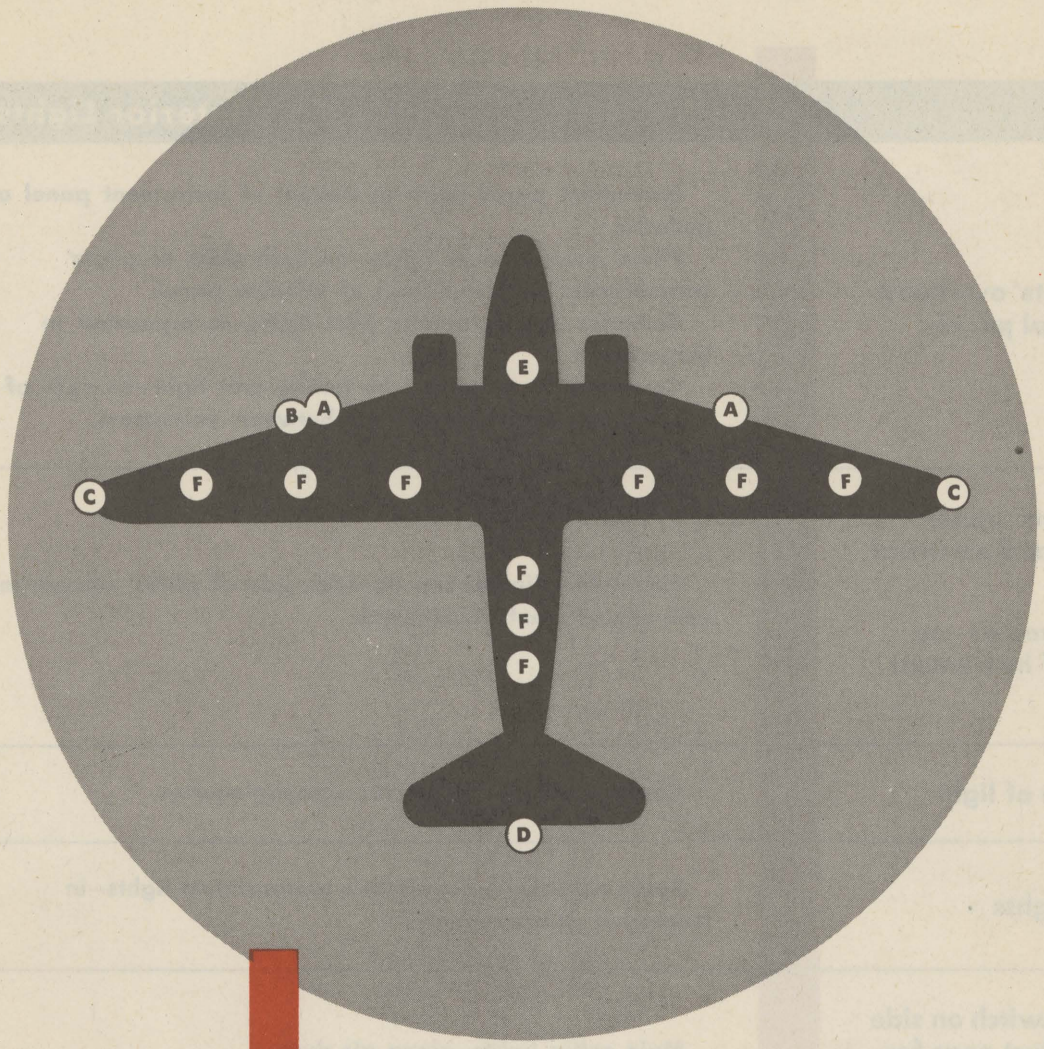


Pitot heater: Two switches on the left-hand electrical panel operate integral heaters, installed in pitot static tube heads. These heaters prevent ice from forming on these heads.



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 2″ to 5″ 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 models 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 models 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 warning light, pressure gage and flow indicator.

Most new models 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 models have no oxygen outlet in the companionway. As a rule, the oxygen system in these models 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 communications equipment is in your airplane:

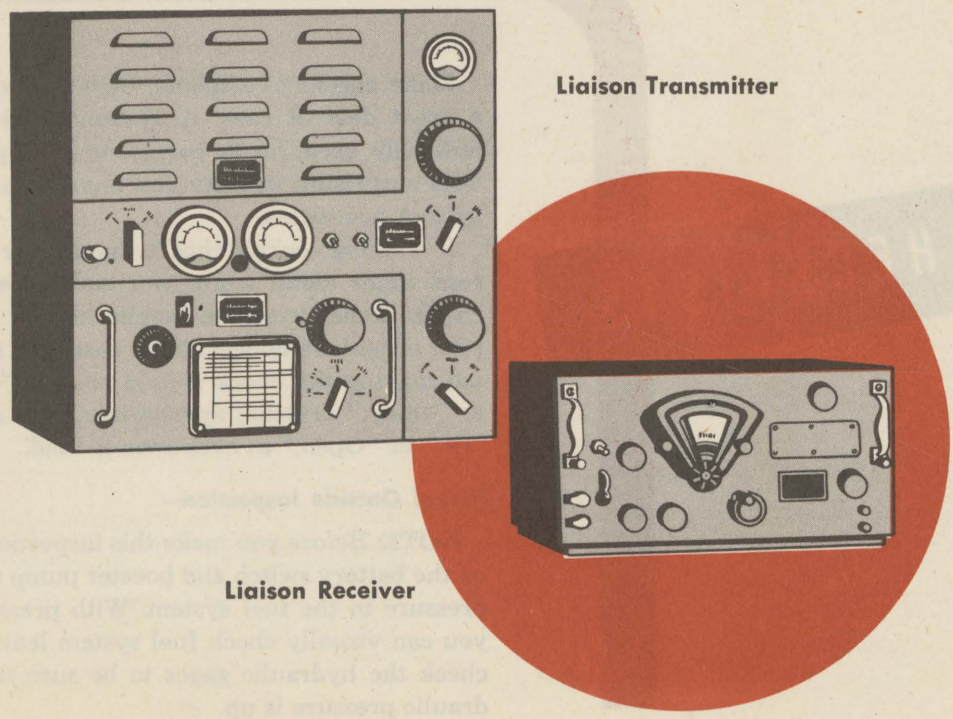
In the radio operator's compartment:

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.

SCR-522 VHF Command Set (voice only)—For plane-to-plane, plane-to-station. Receiver-transmitter unit and dynamotor forward of the radio operator's position. Adjust by means of the radio control box BC-602-A, aft of the copilot's seat, and the VHF-MED FREQ switch at the right of the compass control



Liaison Transmitter

Liaison Receiver

box. To operate, switch must be in the VHF position.

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-595A 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

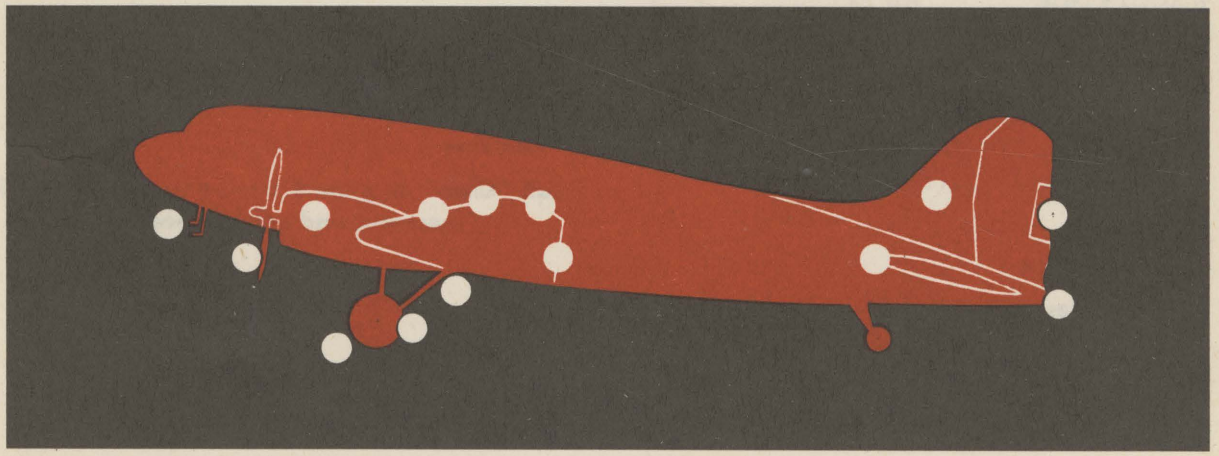
Make checks of airplane, item by item, with a great deal of care. A systematic checklist, faithfully used, forms correct operating habits with surprising rapidity and is your insurance against oversights.

In making cockpit checks, **have your copilot read items aloud while you make the actual check.** Some items can be checked by the copilot or aerial engineer. In all cases the individual making the check should answer "Check" or "Okay," or some appropriate term such as "On" or "Open," as each item is read.

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 IA . . . . . 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.

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

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 . . . . 850-900 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 Pitch Range
Feathering Switch
Carburetor Heat
Generators
Ignition
Hydraulic Pumps
All Instruments and Gages

BEFORE TAKEOFF

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

AFTER TAKEOFF

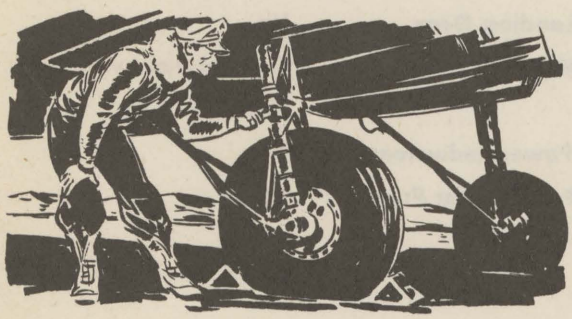
Landing Gear . . . . . Up
Wheels . . . . . Stop rotation with brakes
Power Reductions
Fuel Booster Pumps . . . . Off

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)
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

STARTING

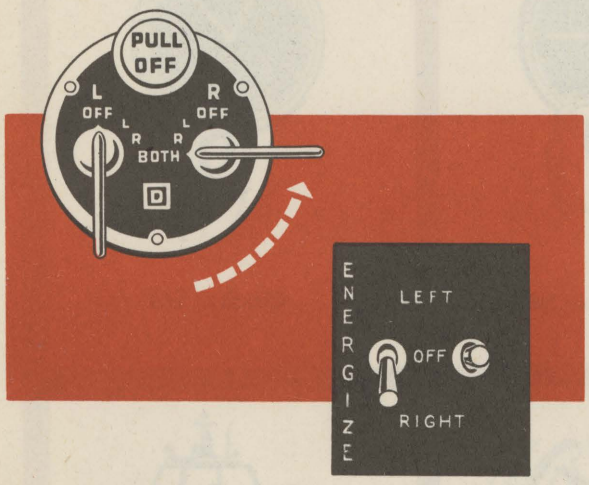
Note: Location and operation of the controls of this airplane are explained in the second section of the manual, "The Airplane." A thorough acquaintance with that section helps you understand this and the following sections that describe the airplane's operation. Technique of operation follows the C-47 checklist.

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

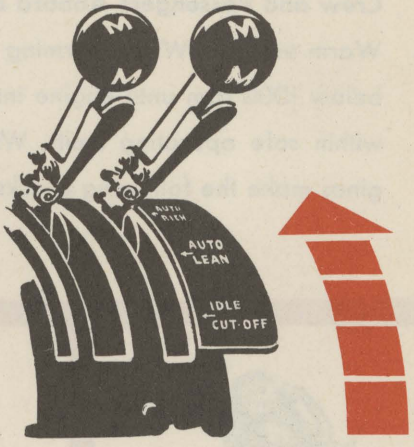


Turn ON the master switch and the ignition switch to the right engine. While the copilot builds up fuel pressure, energize and mesh starters. At the same time you energize, prime engine as much as you feel is necessary. If the engines already are warm, or it is a hot day, you may find it unnecessary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

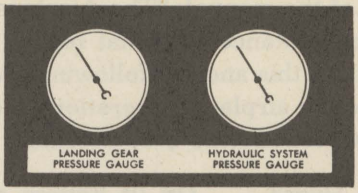
While starting engine watch out for:

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

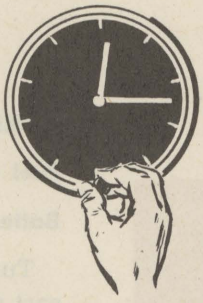
Warm engines. While warming up, keep engines below 1000 rpm until engine instruments indicate within safe operating limits. While warming engines make the following checks:



Hydraulic Pressure...
850-900 PSI

Radio...
On and Checked

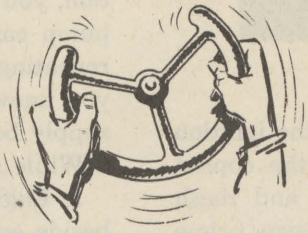
Call the tower to see that your radio is working properly.



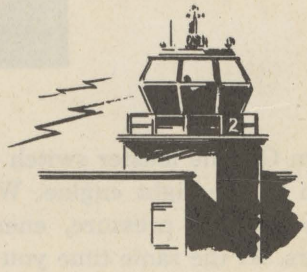
Altimeters...Set

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

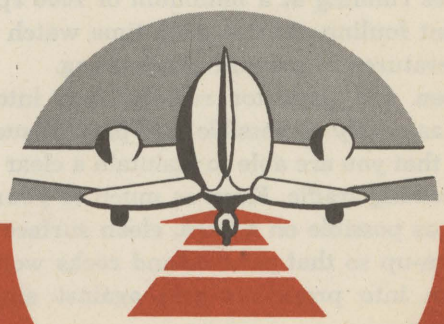
Remember, the C-47 is a large, heavy airplane. Although you taxi it like any other 2-engine airplane with conventional landing gear, its size and weight tend to exaggerate its movement in the air and on the ground. You will soon learn its characteristics, but until you know the airplane, handle it with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

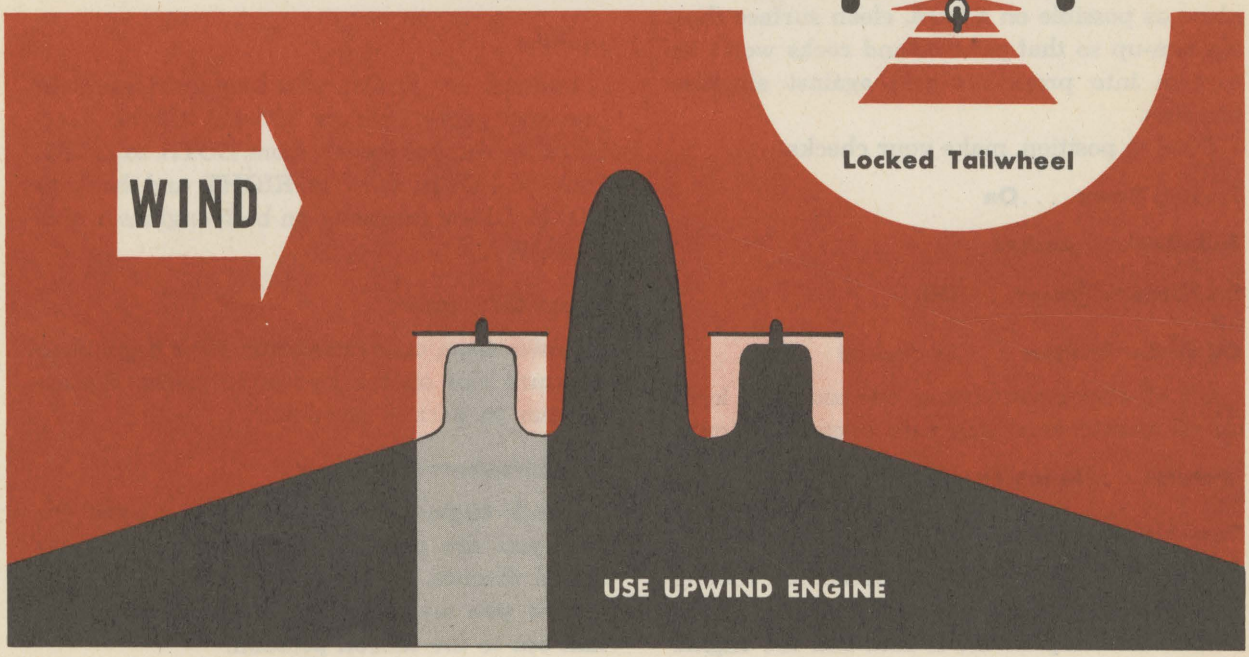
In straight taxiing, keep the tailwheel locked and use throttles as evenly as possible.

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.





TAXIING DON'TS

1. Avoid pivot turns. If you keep your wheels rotating, you save rubber and reduce the chance of tire failure. In a pivot turn it is possible to pull off a tire completely.

2. You have a 95-foot wing span. Don't under-estimate it; give yourself plenty of room.

3. Avoid overloading of one or both engines by excessive idling.

While you are taxiing for takeoff, check the function of your turn-and-bank indicator and your gyro instruments.

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 run-up, face into the wind as nearly as possible, but park at such an angle that you are able to maintain a clear view of incoming traffic. 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

Use of main tanks for takeoff is established procedure. Use your own discretion in this matter.

Propellers Through Full Pitch Range.

Advance throttles until each propeller indicates 1500 rpm, then tighten friction brake with throttles in this position. Run propellers through full pitch range to check proper governor operation.

When propellers have returned to 1500 rpm, check:

Feathering Switch

Push switch on each engine and note tachometer for decrease in rpm. Pull switch out manually when there is a decrease of 200 rpm.

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.

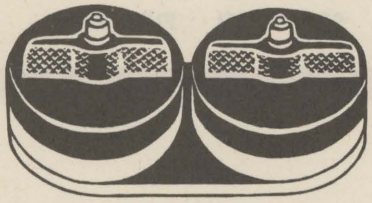
Now you are ready to request clearance to taxi out to the takeoff position.

BEFORE TAKEOFF

Propellers . . .
Full Forward,
High RPM

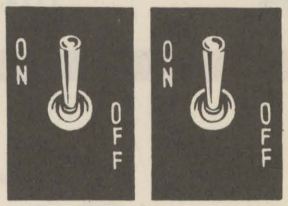
Mixtures . . .
Auto Rich

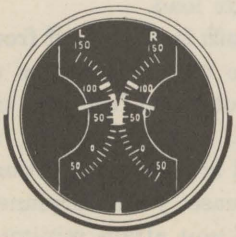
Gyros . . .
Set and
Uncaged



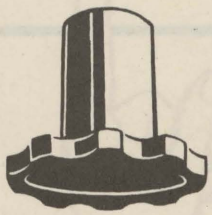
Cowl Flaps . . . Trail

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.

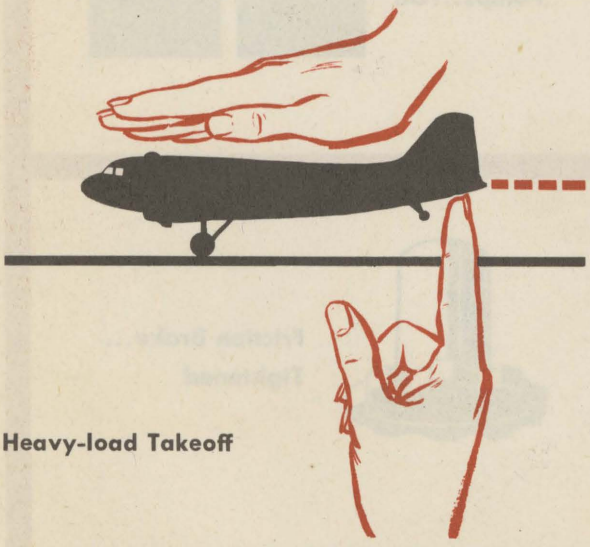
TAKEOFF

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.

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, or pull one throttle back, 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.

C-47, R1830-92	HP	MAX. RPM	MAX. MANIFOLD PRESSURE HG	ALTITUDE	MIXTURE	MAX. CYL. HEAD TEMP.
TAKEOFF	1175	2700	46″	SEA LEVEL	FULL RICH	260°C



Heavy-load Takeoff

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.


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. Release latch from floor and pull to vertical position.
2. Raise gear handle to UP position.
3. When gear has retracted, return gear handle to neutral position.

Note: When you have returned gear handle to neutral the latch automatically assumes the spring-latch (50° to the floor) position.

To extend landing gear

1. Place gear handle in DOWN position.
2. When gear has extended and pressure rises on gage, lock latch to floor.
3. Return gear handle to neutral.

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:

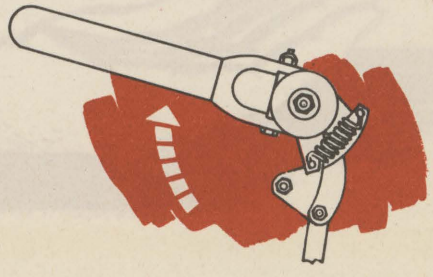
1. Pull latch to vertical position.
2. Raise gear handle to UP position.
3. Return gear handle to NEUTRAL.

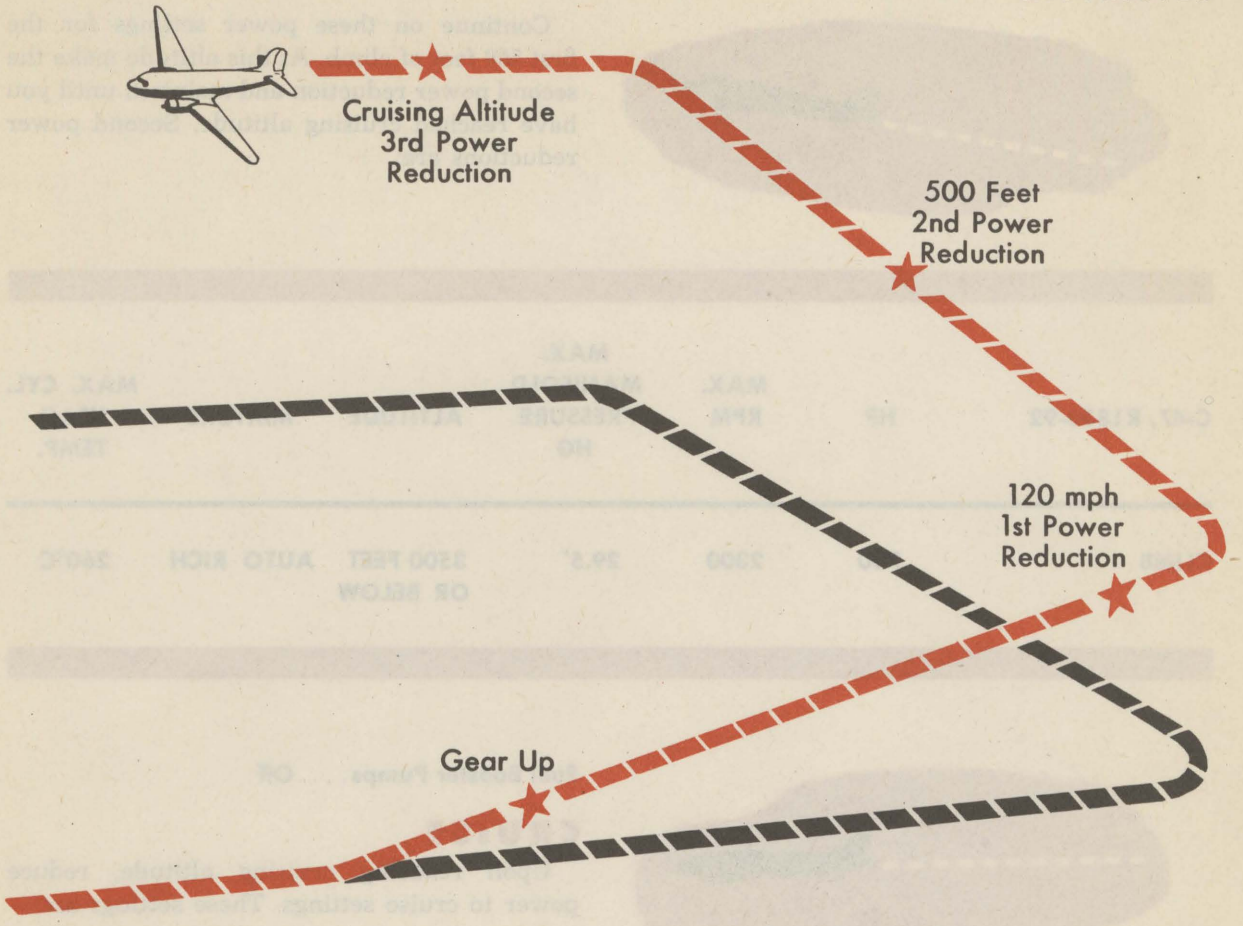
Alternate

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 your airplane is clear of the ground, retract your gear. Hold to a minimum climb until you attain single engine speed of 120 mph.

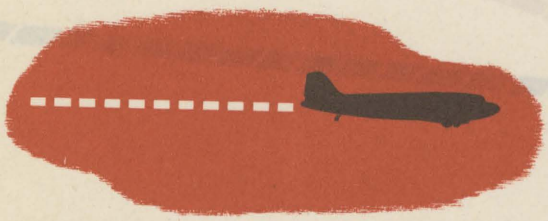
Power reductions

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

C-47, R1830-92	HP	MAX. RPM	MAX. MANIFOLD PRESSURE HG	ALTITUDE	MIXTURE	MAX. CYL HEAD TEMP.
FIRST 500 FEET OF CLIMB AND SINGLE ENGINE POWER	1050	2550	41″	3500 FEET OR BELOW	AUTO RICH	260°C

Continue on these power settings for the first 500 feet of climb. At this altitude make the second power reduction and maintain until you have reached cruising altitude. Second power reductions are:

C-47, R1830-92	HP	MAX. RPM	MAX. MANIFOLD PRESSURE HG	ALTITUDE	MIXTURE	MAX. CYL. HEAD TEMP.
CLIMB	700	2300	29.5″	3500 FEET OR BELOW	AUTO RICH	260°C



Fuel Booster Pumps. . . . Off

CRUISE

Upon reaching cruising altitude, reduce power to cruise settings. These settings are:

C-47, R1830-92	HP	MAX. RPM	MAX. MANIFOLD PRESSURE HG	ALTITUDE	MIXTURE	MAX. CYL. HEAD TEMP.
DESIRED CRUISING	55% OF NORMAL RATED POWER	2000 TO 2150	26″ TO 29″	3500 FEET OR ABOVE	AUTO LEAN	232°C
MAXIMUM CRUISING CONDITION	790	2250	34.5″	3500 FEET OR BELOW	AUTO RICH	232°C
MINIMUM CRUISING	550	1700	32.5″	3500 FEET OR ABOVE	AUTO LEAN	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 the main tanks, use 60 gallons of fuel from each main tank, then shift to auxiliary tanks. By using fuel from your main tanks first, you provide space for fuel coming back to these tanks on the return flow. If this space is not available, excess fuel is lost through the overflow.

Oil Shutters. . . . As required

Adjust power as desired

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

C-47, R1830-92	HP	MAX. RPM	MAX. MANIFOLD PRESSURE HG	ALTITUDE	MIXTURE	MAX. CYL. HEAD TEMP.
TAKEOFF	1175	2700	46″	SEA LEVEL	FULL RICH	260°C
FIRST 500 FEET OF CLIMB AND SINGLE ENGINE POWER	1050	2550	41″	3500 FEET OR BELOW	AUTO RICH	260°C
CLIMB	700	2300	29.5″	3500 FEET OR BELOW	AUTO RICH	260°C
DESIRED CRUISING	55% OF NORMAL RATED POWER	2000 TO 2150	26″ TO 29″	3500 FEET OR ABOVE	AUTO LEAN	232°C
MAXIMUM CRUISING CONDITION	790	2250	34.5″	3500 FEET OR BELOW	AUTO RICH	232°C
MINIMUM CRUISING	550	1700	32.5″	3500 FEET OR ABOVE	AUTO LEAN	232°C

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 2″ and 5″ 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.

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 acrobatics.

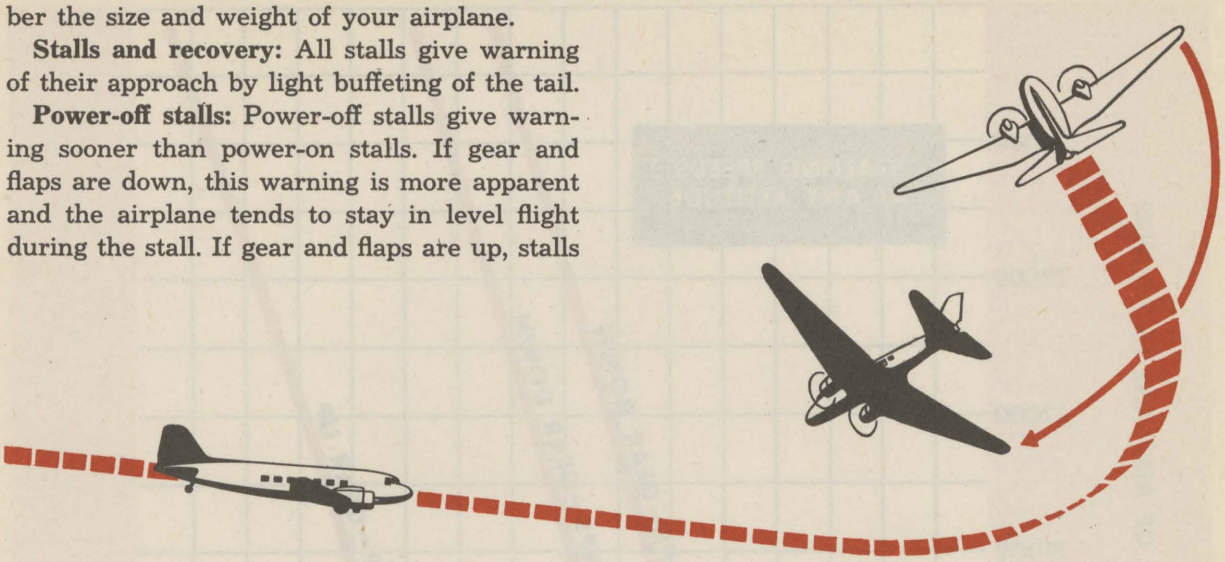
Limit speed and load factors: The C-47 is designed to operate within designated limits under various load conditions. If you exceed these limits you place undue strain upon the airplane, and structural damage or failure results. These limits are:

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

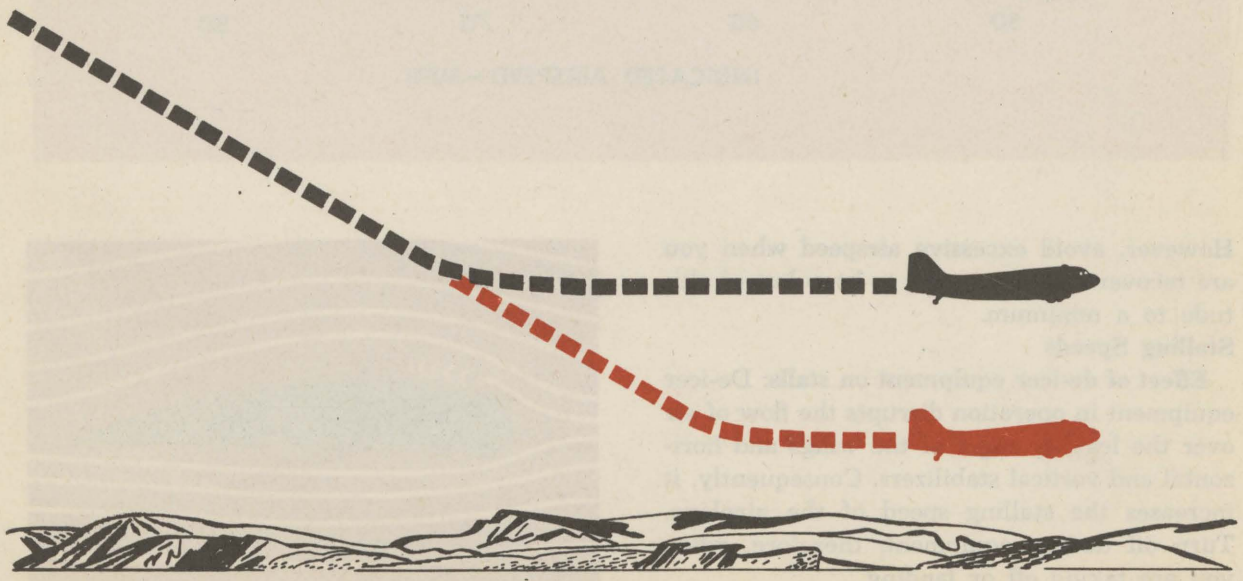
Power-off stalls: Power-off stalls give warning sooner than power-on stalls. If gear and flaps are down, this warning is more apparent and the airplane tends to stay in level flight during the stall. If gear and flaps are up, stalls occur with less warning and the airplane has a tendency to fall off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

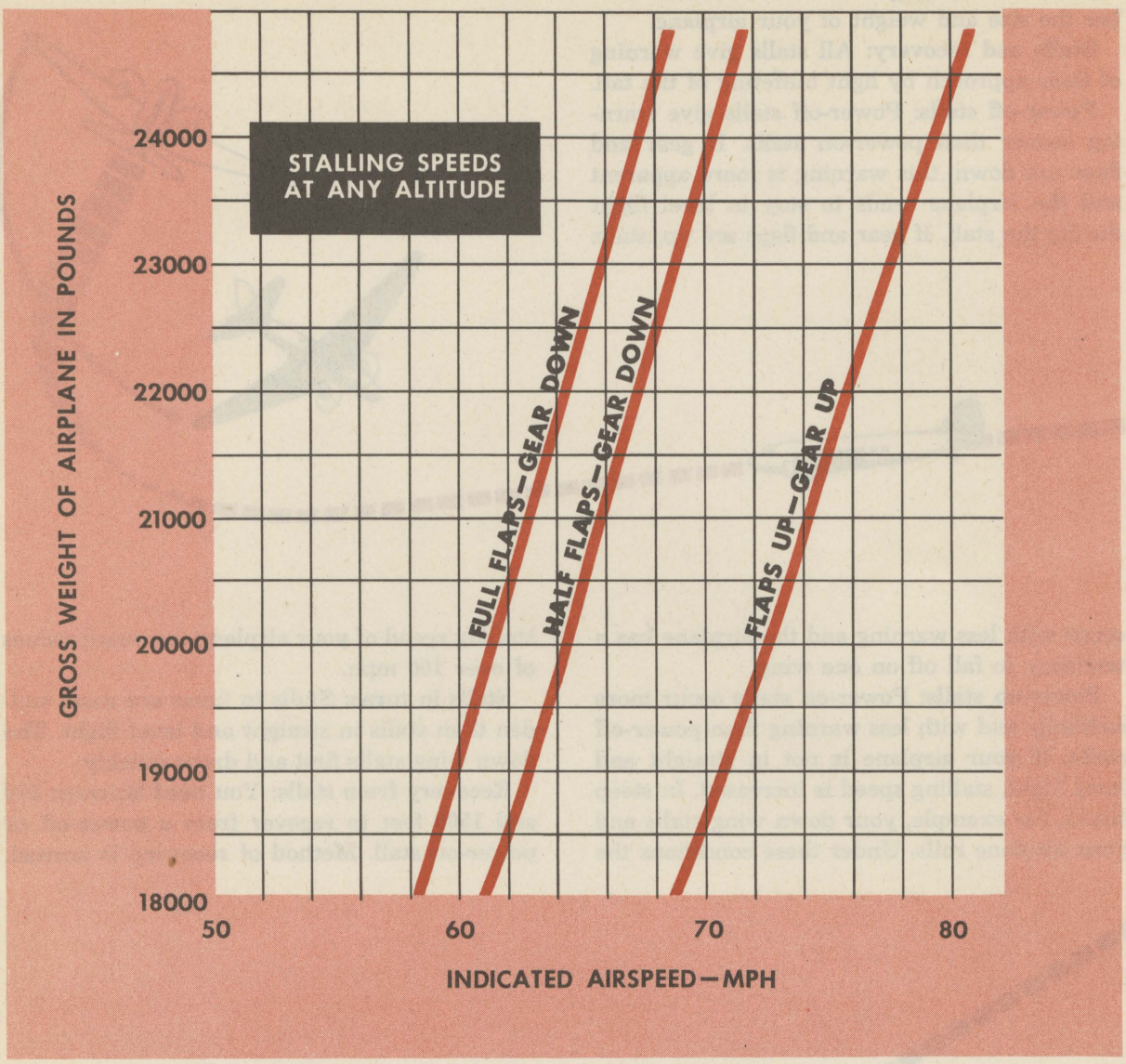


Power-on stalls: Power-on stalls occur more suddenly and with less warning than power-off stalls. If your airplane is not in straight and level flight, stalling speed is increased. In steep banks, for example, your down wing stalls and your airplane rolls. Under these conditions the stalling speed of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

Stalling Speeds

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.

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.

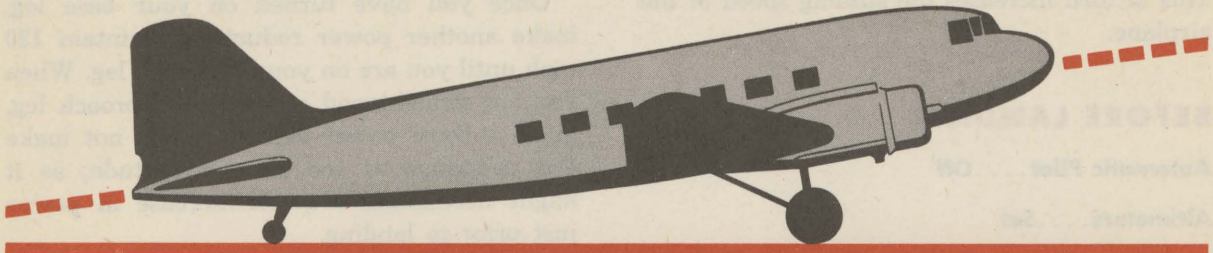
LANDING

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).

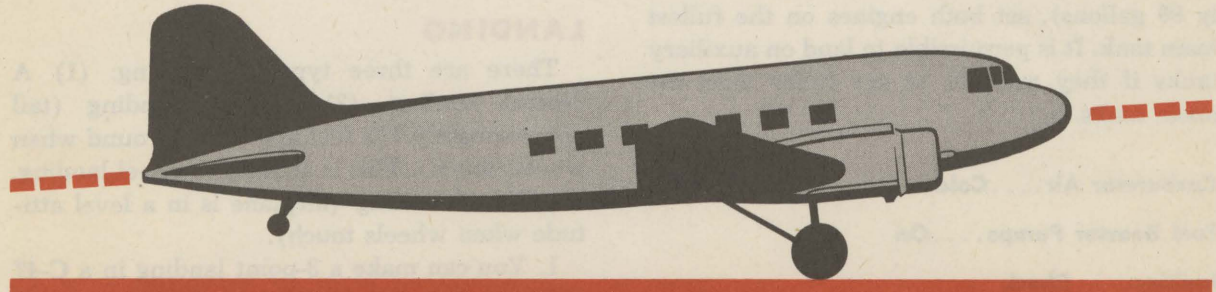
1. You can make a 3-point landing in a C-47 airplane, but this type of landing is not advisable. Reason: Weight of the airplane causes undue strain if you happen to drop in.

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.

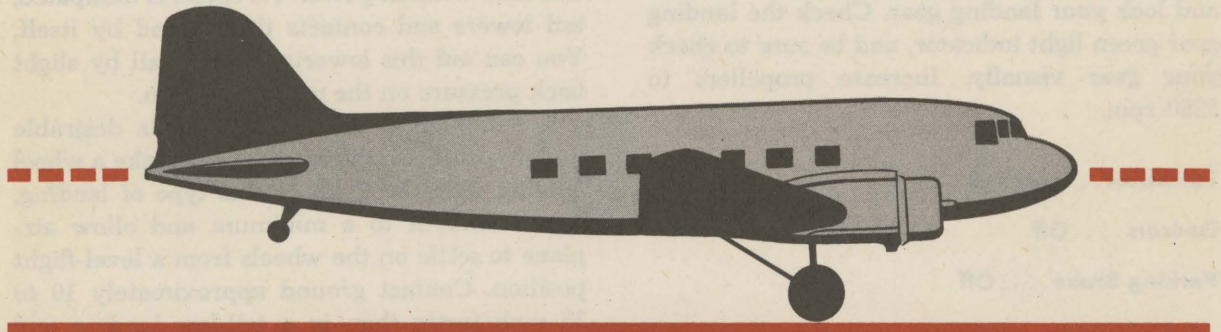
3. Although a tail-low landing is desirable under normal conditions, you can make a wheel landing with the C-47. In this type of landing, hold roundout to a minimum and allow airplane to settle on the wheels from a level-flight position. Contact ground approximately 10 to 15 mph faster than in a tail-low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

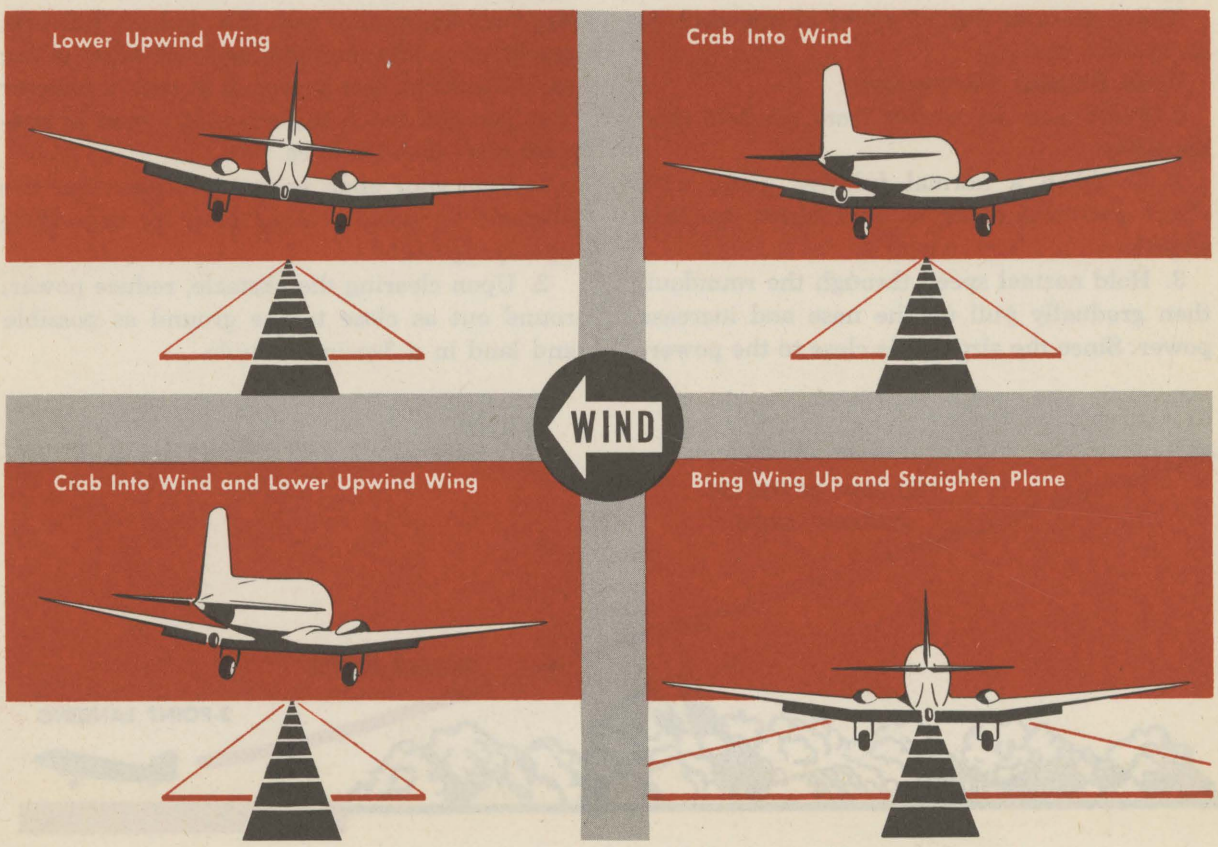
Use flaps at your own discretion. Less flaps should be used in stronger and more direct crosswinds. In a strong 90° wind, or in gusty crosswinds, it is best to use no flaps at all.

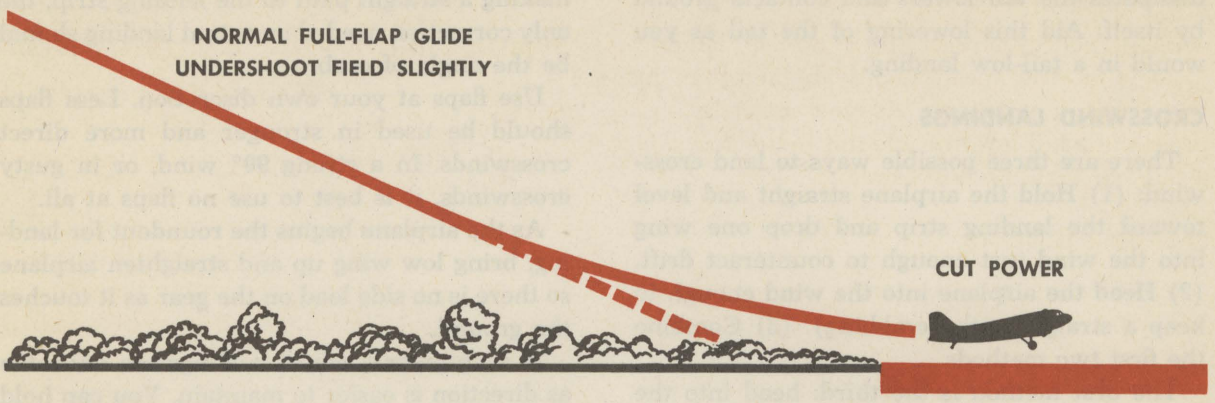
As the airplane begins the roundout for landing, bring low wing up and straighten airplane so there is no side load on the gear as it touches the ground.

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

You may be confronted with two different short-field conditions: (1) where the field is small or has been bombed so heavily there is little space left intact for landing. (2) Where there is an obstruction close to or at the boundary of the field.

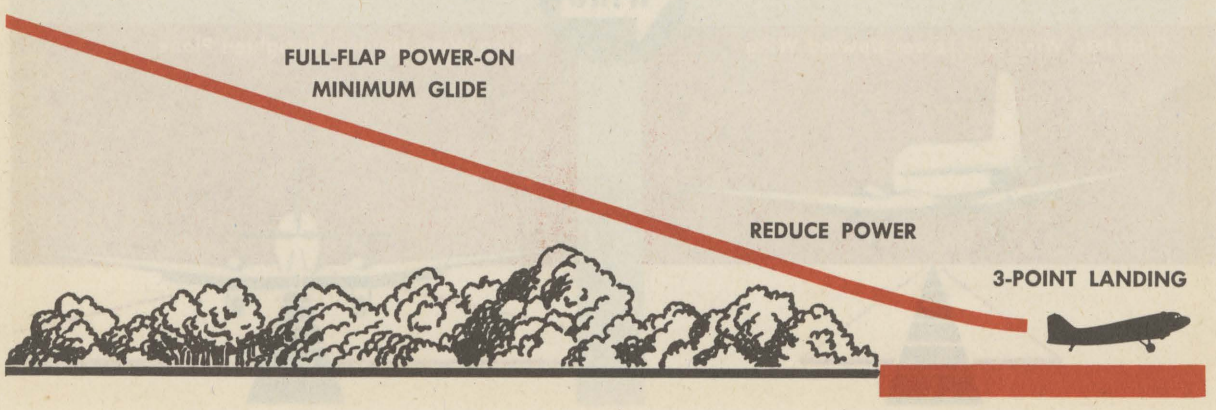
There are two distinct types of approach to short-field landings.

Field Without Obstructions:

1. Place base leg farther from the field than normally.
2. Establish a normal full-flap glide, with slight power in order to undershoot the field slightly.
3. Hold normal speed through the roundout, then gradually pull up the nose and increase power. Since the airplane is close to the power-off stalling speed, pull up the nose and increase the power close enough to the ground to land directly when power is cut.
4. As you approach the desired point of landing, cut the power.
5. Use maximum permissible brakes.

Approach Over an Obstruction: When you approach a field over an obstruction, establish the base leg so that you can make a full-flap, power-on minimum glide approach clear of the obstacle. Make this approach in such a manner that you can touch the wheels as soon as possible after the clearance.

1. Plan your glide so that you can clear the obstacle by power rather than by depending upon judgment.
2. Upon clearing the obstacle, reduce power, round out as close to the ground as possible and land in a 3-point attitude.



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.

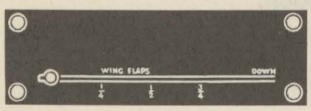
OVERSHOOTING A FIELD....BOTH ENGINES

When you overshoot a field it is important to gain airspeed quickly, and altitude.

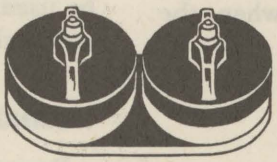
Apply full takeoff power and at the same time call to the copilot: "Gear up!" Your copilot must raise the gear immediately. After you have gained sufficient speed (between 100 and 110 mph), take up your wing flaps slowly and as you raise the flaps increase the angle of attack approximately 7°. Put your cowl flaps at TRAIL.

When you raise your flaps and increase the angle of attack, you prevent settling.

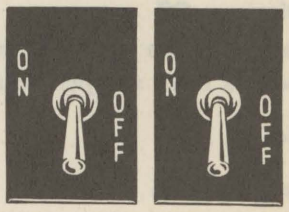
AFTER LANDING



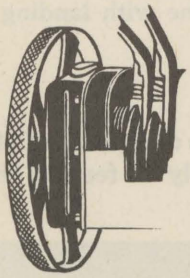
Flaps...Up



Cowl Flaps...Open

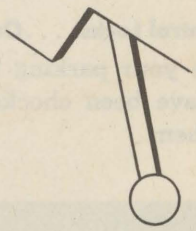


Fuel Booster Pumps... Off



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)

Mixtures....Idle cut-off

When you park your airplane, 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.

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.

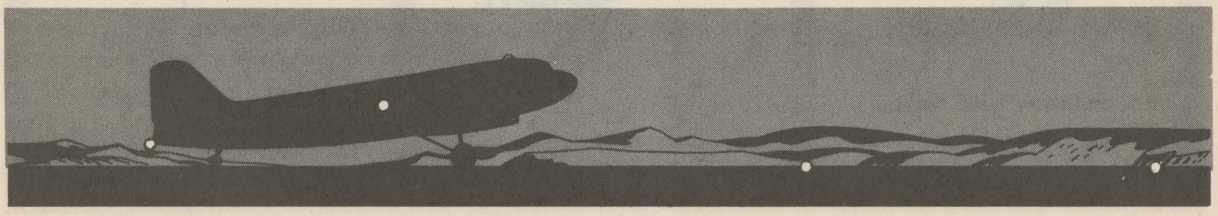
(2) Allow more clearance from other airplanes and obstructions.

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

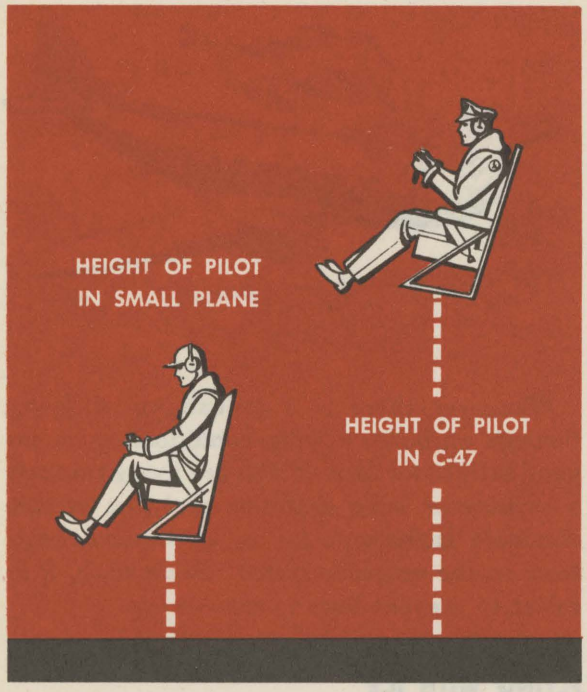
(4) Run up airplane with landing lights off.

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

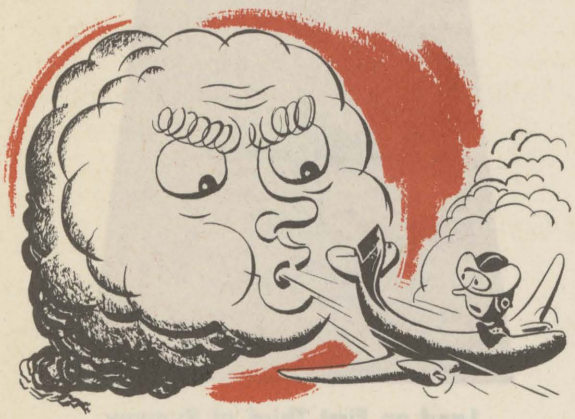
smaller plane. Until you are thoroughly familiar with the airplane, make a normal approach and land within the first third of the runway. Do not attempt to land on the end of the runway. It is easy to undershoot at night. Keep alert at all times.

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

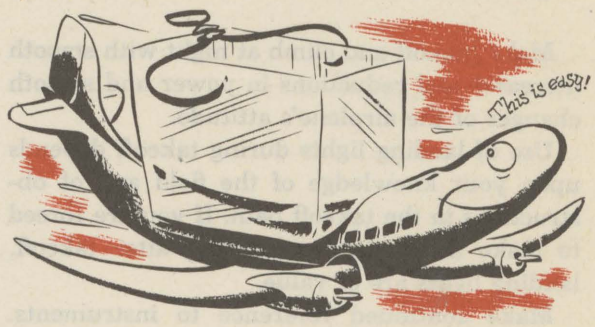


Slow your airplane down in turbulent air in proportion to its gross weight and the amount of turbulence. You can slow your airplane down by power reductions alone, or by lowering landing gear at the same time you reduce power slightly. The second procedure is more desirable, as you are able to maintain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

CARBURETOR ICING

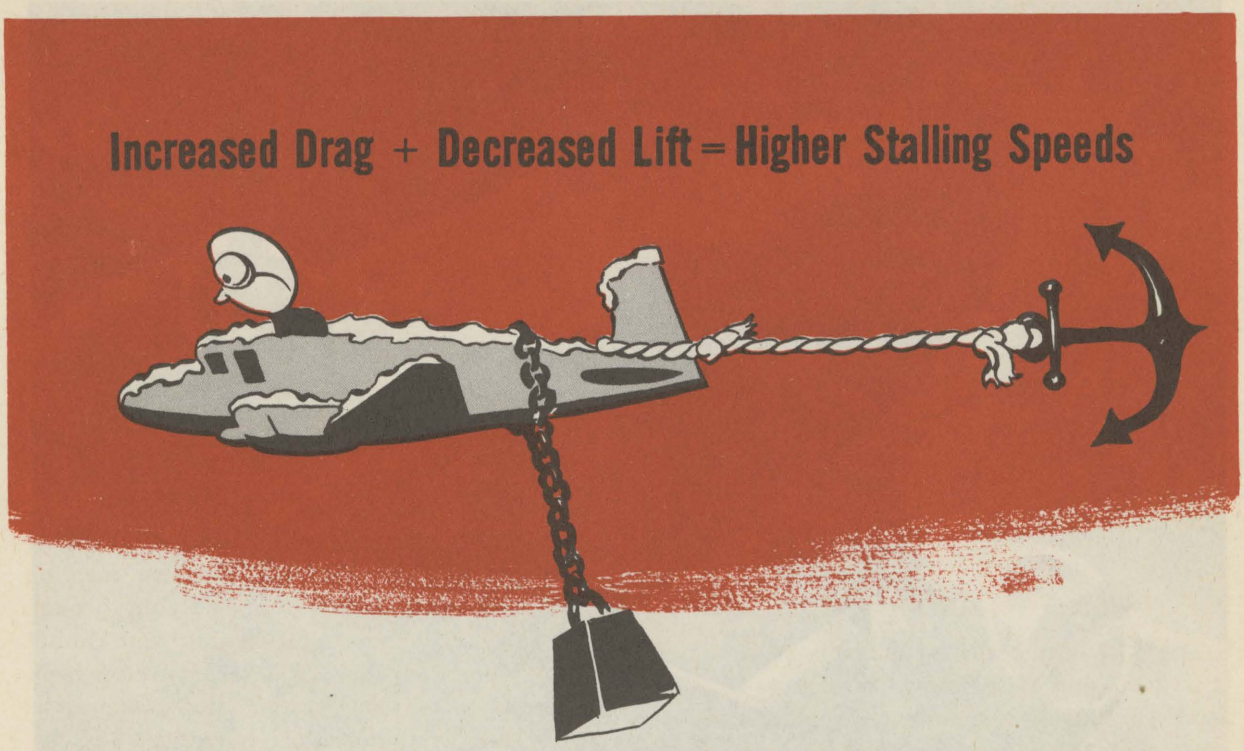
Whenever there is a probability of flying through carburetor icing conditions, turn on your carburetor heat. If you are flying through a carburetor icing condition and you cannot eliminate carburetor ice by carburetor heat, turn on the anti-icer system. Remember, it is easier to prevent than to remove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

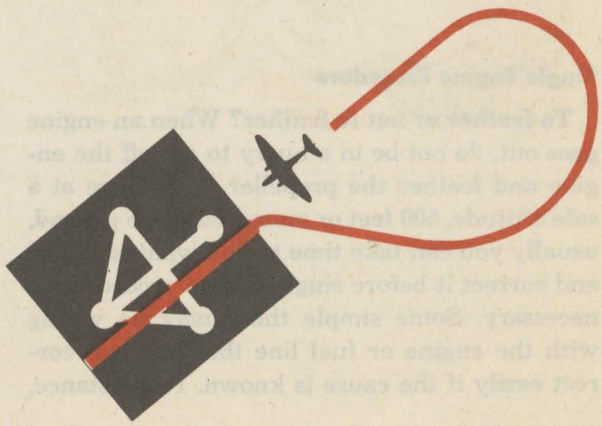
1. Fly along the desired runway in the direction opposite that in which you intend to land, setting the directional gyro on 0°.

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.

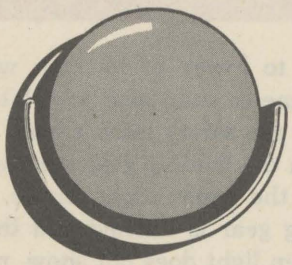
Remember, the important thing is to bring back equipment and people safely.

Steps for Single Engine Procedure

If you have an engine failure and you decide to fly on one engine, here are the steps to take:

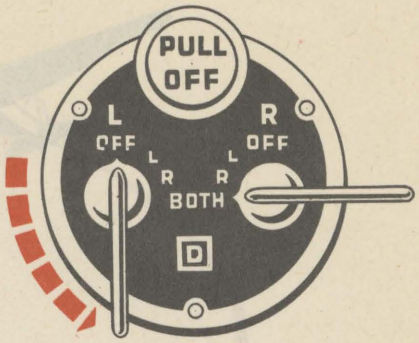
1. Push propeller controls and throttles forward, and mixtures to EMERGENCY. At the same time call to the copilot: "Gear up, flaps up." If the gear and flaps are down, the copilot brings them up immediately.

2. Determine which is the bad engine. Mixture control to IDLE CUT-OFF and pull propeller control and throttle back on that engine.



Feathering Button

3. Feather bad engine. To feather an engine:
   (a) Push the feathering button of that engine. Feathering buttons are on the electrical panels.
   (b) When propeller on engine stops rotating, cut the ignition switch.



4. Turn bad engine fuel selector valve to OFF.

5. Turn fire extinguisher selector switch to bad engine.

6. Trim airplane.

7. Turn cowl flaps and oil cooler to OPEN on good engine.

8. Turn cowl flaps and oil cooler to CLOSED on bad engine.

9. Switch hydraulic and vacuum systems to good engine.

10. Adjust power on good engine to maintain normal single engine airspeed.

11. Adjust cowl flaps as required.

12. Maintain altitude and heading as nearly as possible during entire procedure.

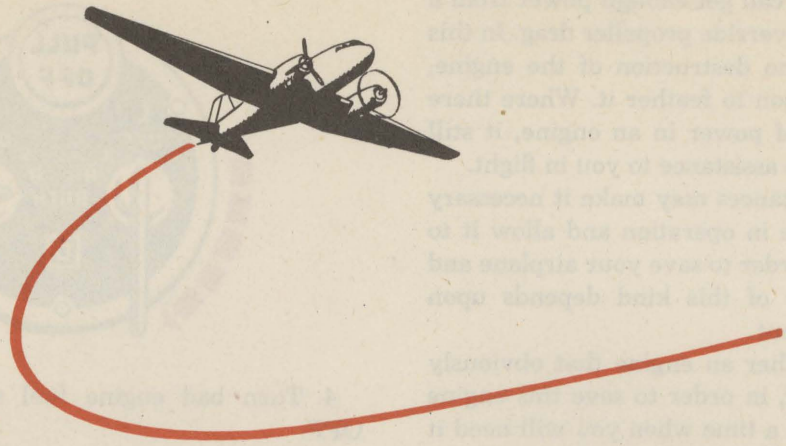
Loss of an Engine on Takeoff

1. If your airplane has left the ground on takeoff, single engine procedure is the same as outlined previously.

2. If your airplane has not left the ground, cut throttles and try to stop the airplane within the limits of the field. If you cannot stop safely by using full brakes, it is possible to pull up your landing gear and slide your airplane on its belly. Sliding an airplane on its belly brings it to a quick stop. This procedure is not advised unless there is danger of collision with other airplanes or objects. **Do not attempt to take off with a single engine.**

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 100 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

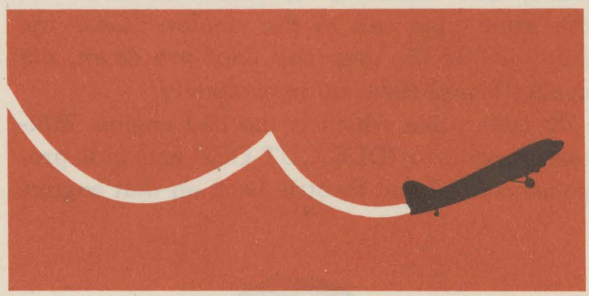
Remember to close the star valve in emergency operations where it is necessary to use the hydraulic hand pump. If the star valve is left open, you build up pressure in the accumulator only.

Landing Without Hydraulic Fluid Pressure

If you wish to land but have no hydraulic pressure:

1. Put star 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 star 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.

Braking When Hydraulic System Pressure Drops

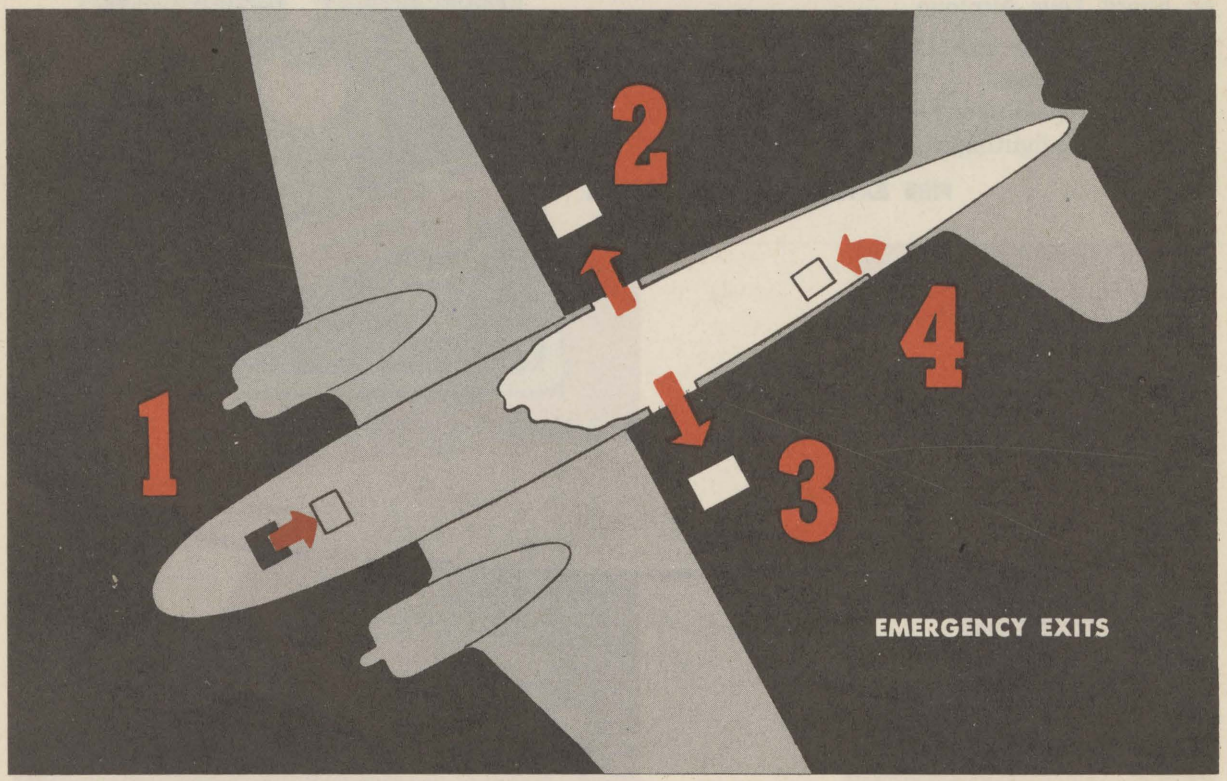
If your hydraulic system drops below 500 psi, use the hydraulic hand pump to build up pressure for emergency braking. Procedure:

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 star 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.

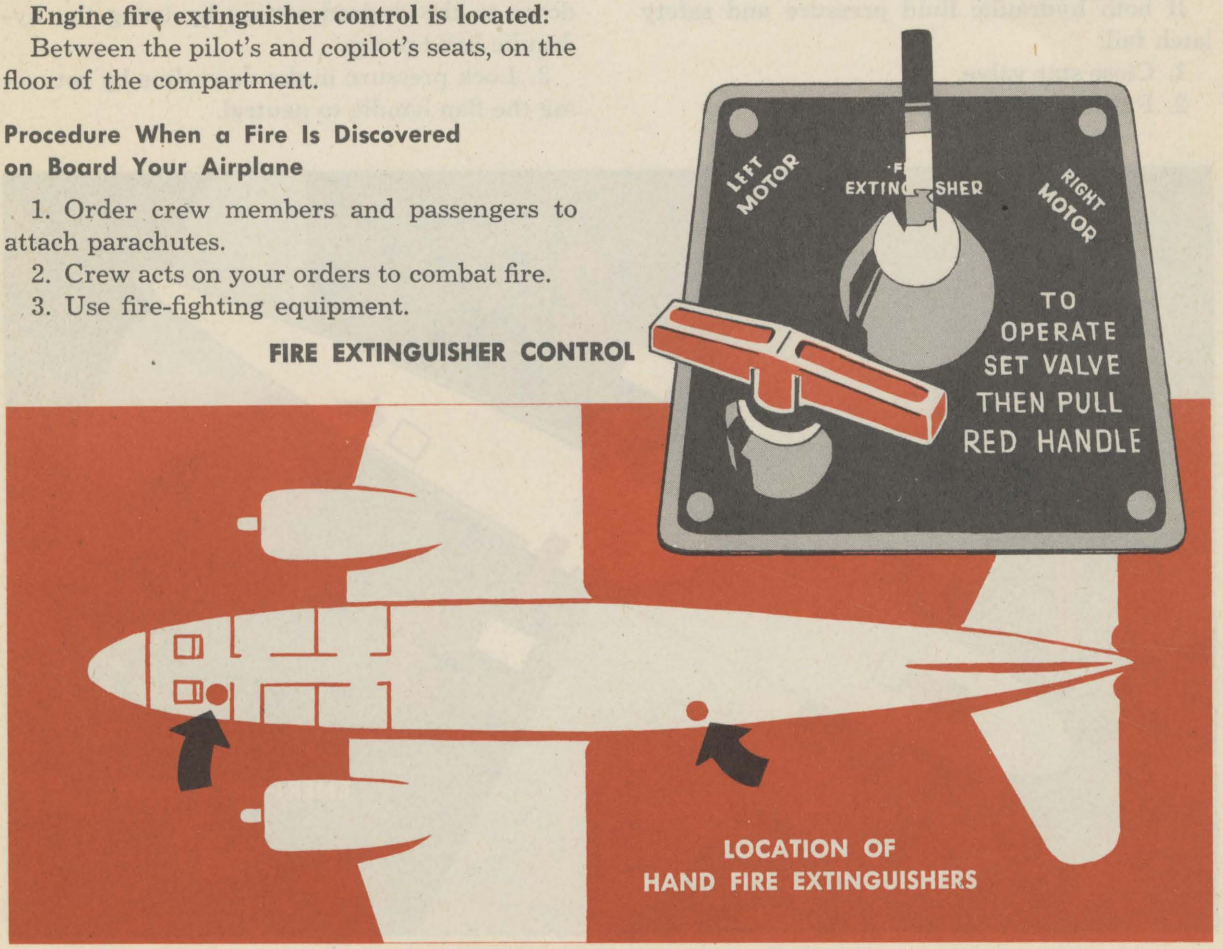
Note: Fire-fighting equipment installed in the C-47 is practical for small fires only. Use as soon as the fire starts.

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.

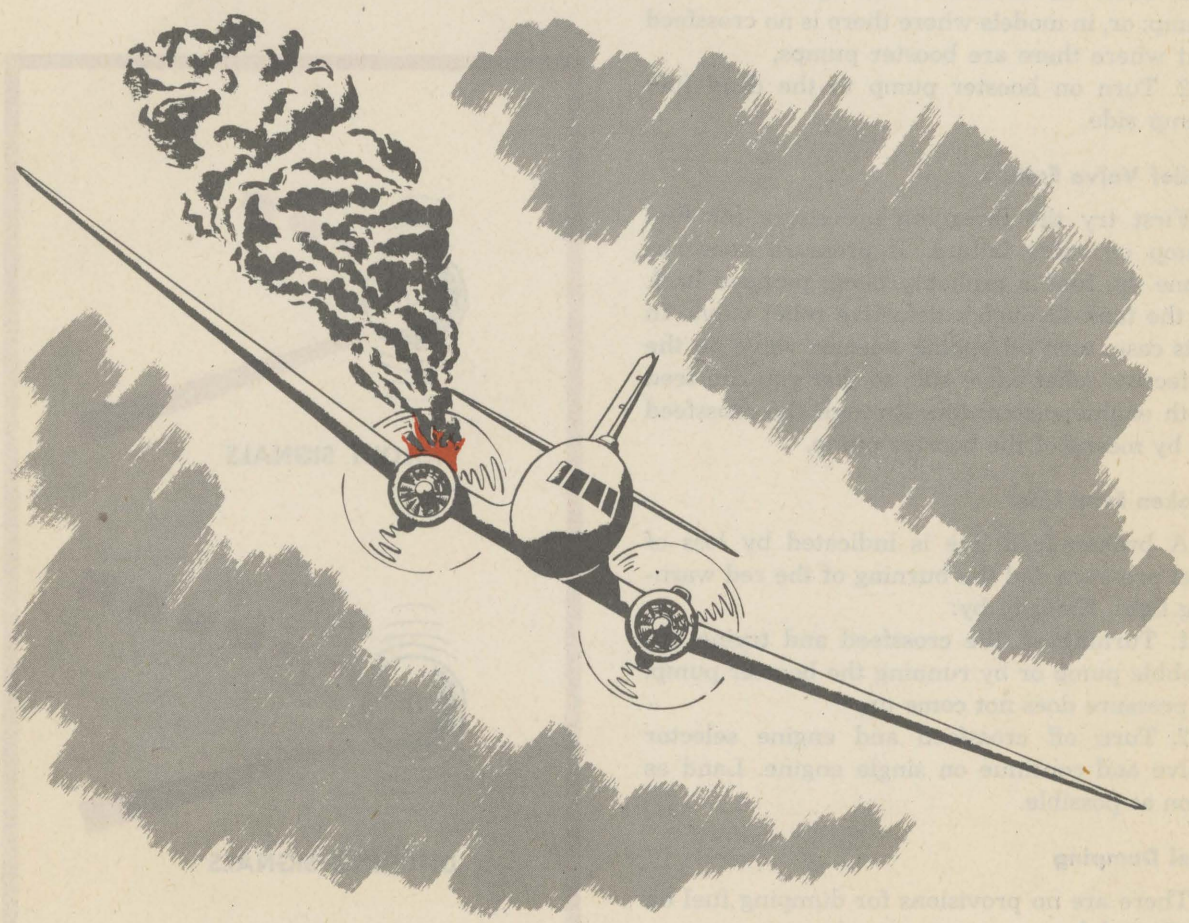
4. If there is a leaking fuel line, turn off valves to stop fuel flow.

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

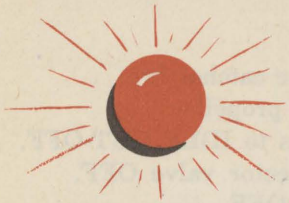
Engine Fires

If an engine catches fire:

1. Feather propeller.
2. Mixtures to IDLE CUT-OFF.
3. Fuel selector valve OFF.
4. Ignition OFF.
5. Open throttle to engine, to force all fuel remaining in the lines through the carburetor and out.
6. Cowl flaps CLOSED.
7. Turn fire extinguisher control to engine.
8. Pull up on release handle.
9. Open all emergency exits.
10. Land as soon as possible after the fire is extinguished, to determine cause.



Fuel System Failures



Know the indications of your fuel pressure gage. A red warning light above this gage means fuel pressure has fallen below safe operating limits.

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 Feed Line

A broken feed line is indicated by loss of fuel pressure and the burning of the red warning light. Remedy by:

1. Turning on the crossfeed 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.

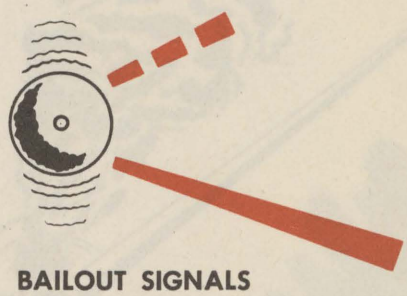
(b) 1 long ring, crew bails out ("Abandon airplane").

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.

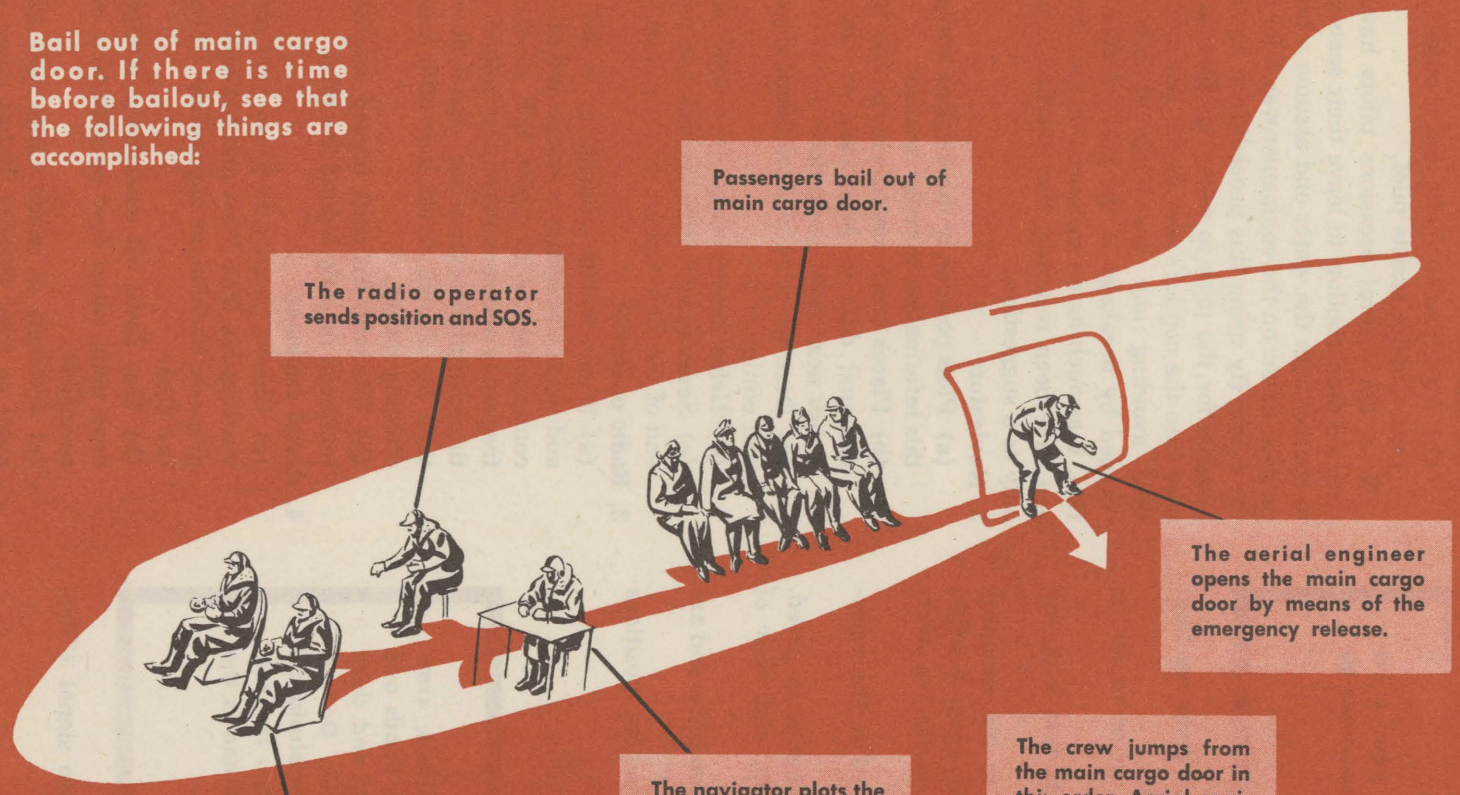
While you are giving the alarm on the emergency warning bell, use interphone to contact all crew members possible.



BAILOUT SIGNALS

DITCHING SIGNALS

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



Passengers bail out of main cargo door.

The radio operator sends position and SOS.

The aerial engineer opens the main cargo door by means of the emergency release.

The crew jumps from the main cargo door in this order: Aerial engineer, navigator, radio operator, copilot, pilot.

The navigator plots the position of the airplane.

The pilot, assisted by the copilot, turns off all switches.

BAILOUT

RESTRICTED

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) 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) Plots position of the airplane and gives this information to 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) Seats himself with his back against the end of the right main cargo rear fuel tank.
3. **Radio operator:**
   (a) Tunes liaison transmitter to MF DF and sends emergency message and call sign continuously. Also tunes IFF to distress frequency and remains on interphone. Continues until pilot gives final signal, at which time he clamps down key and assumes ditching station.
   (b) Sits with his back braced against the bulkhead directly behind the pilot.
4. **Aerial engineer:**
   (a) Checks passengers to see that each is wearing his Mae West and 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) Seats himself with his back against the

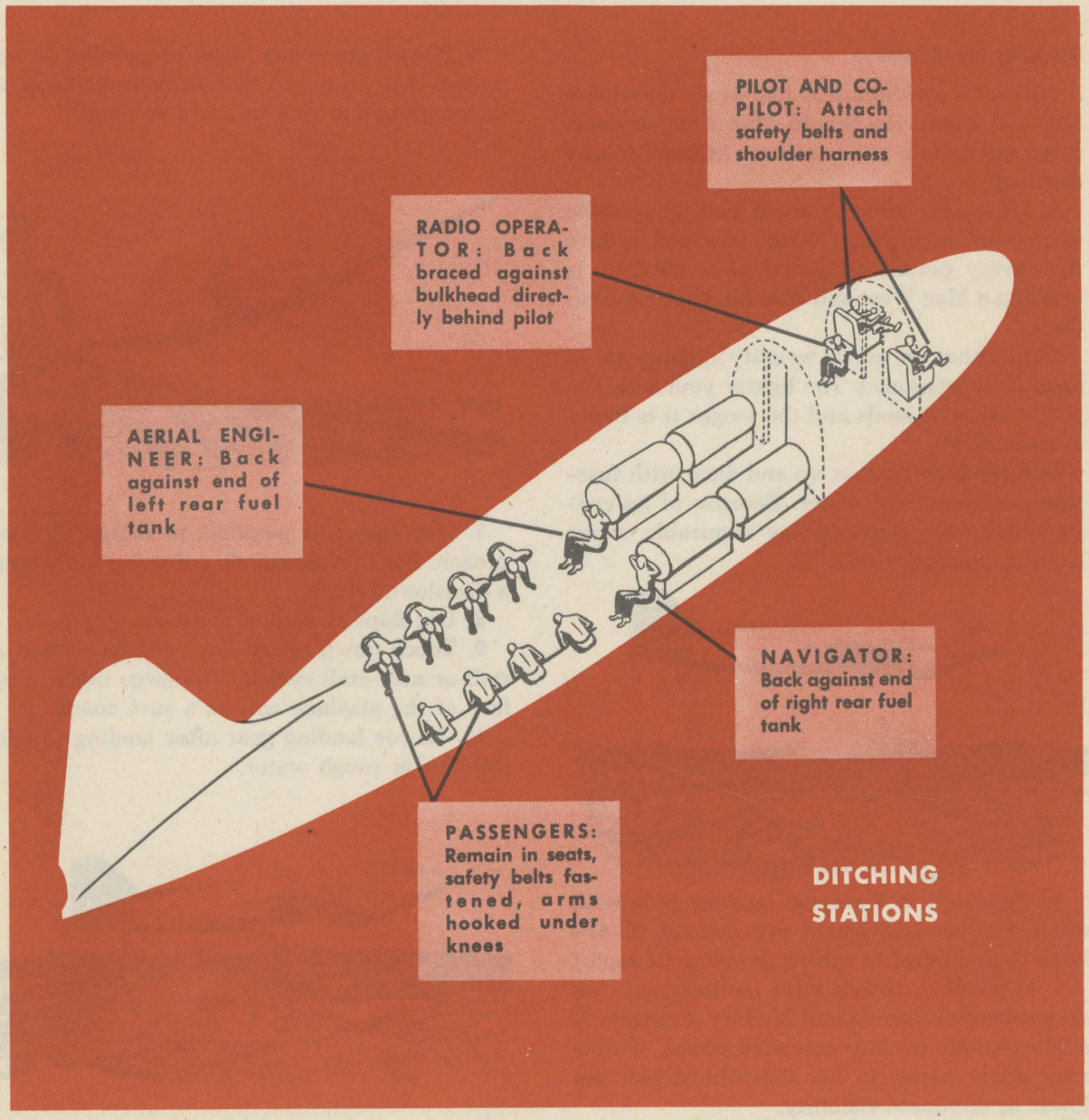
end of the left rear fuel tank in the main cargo compartment.

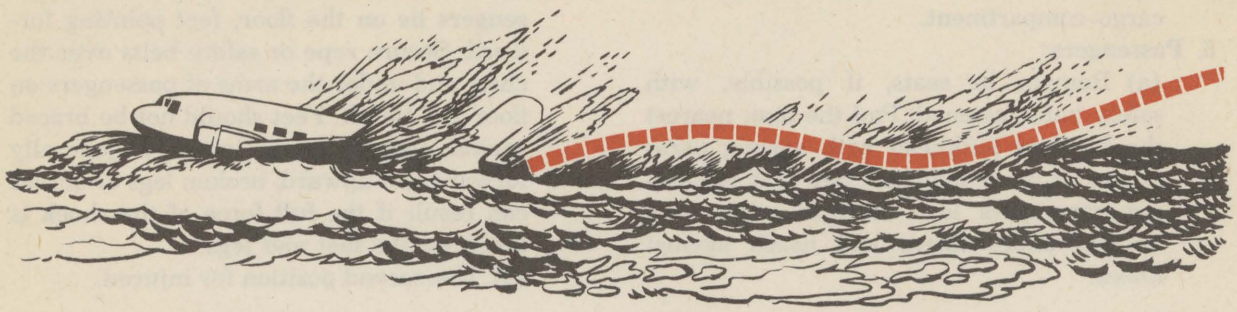
5. **Passengers:**

(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.

(b) If seats cannot be used, see that passengers lie on the floor, feet pointing forward. Secure rope or safety belts over the chest and under the arms of passengers on floor and tie aft. Feet should not be braced against objects. As the impact is generally forward and upward, broken legs or ankles can result if the full force of the shock is taken by the feet and legs.

(c) Use second position for injured.





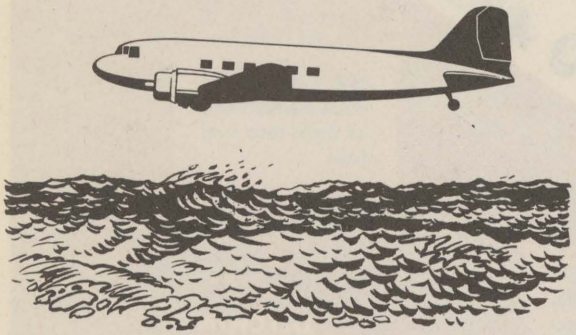
Ditching the Airplane

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.

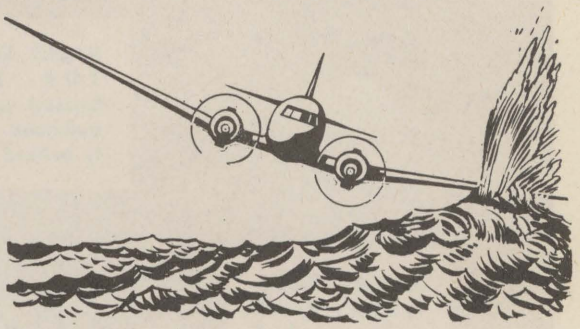
3. Keep landing gear up and ditch with fuselage parallel to the water. Because of its construction your airplane has admirable water landing characteristics.



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.



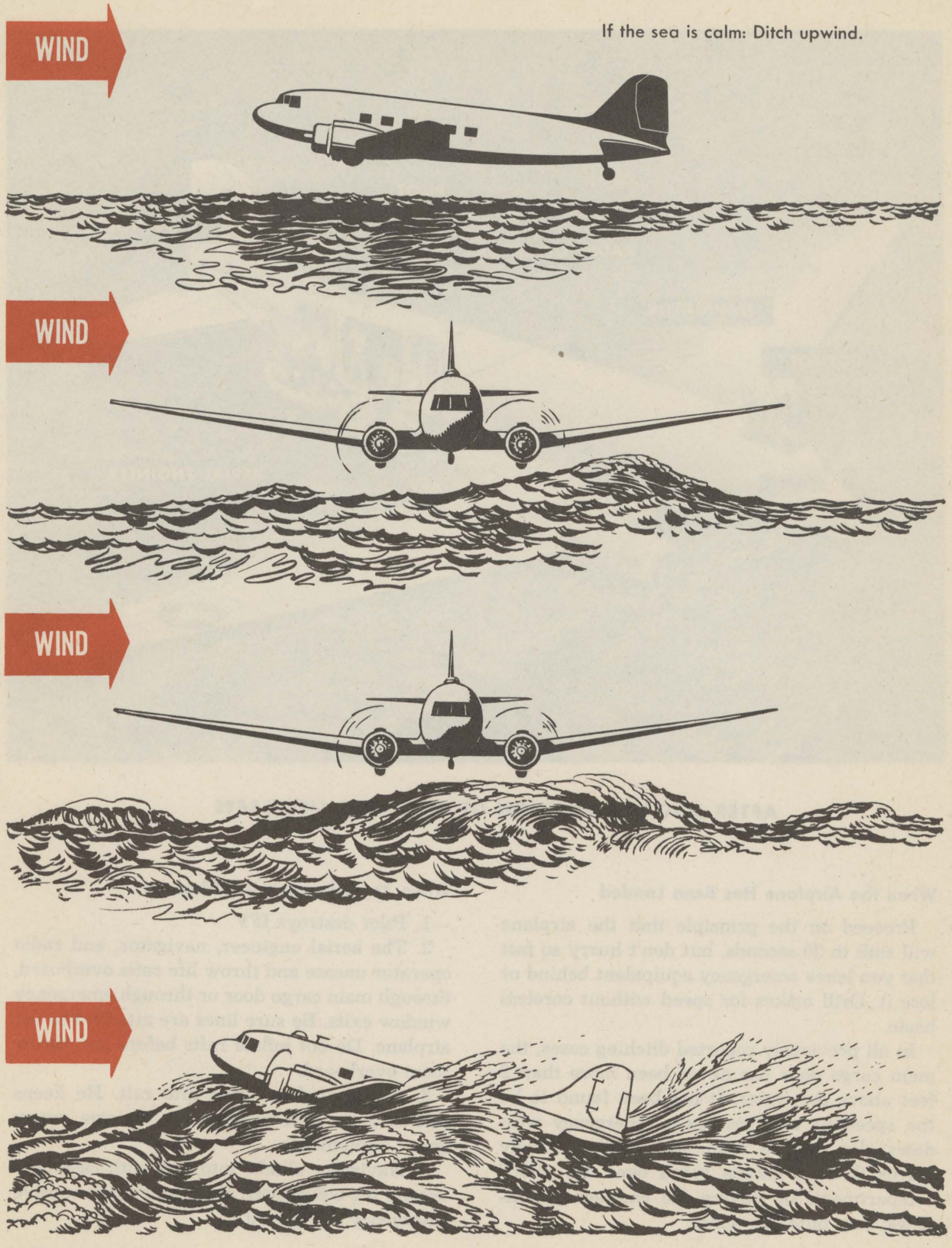
7. Use power, if possible, to flatten the approach. For this reason, do not delay in making a decision to ditch.

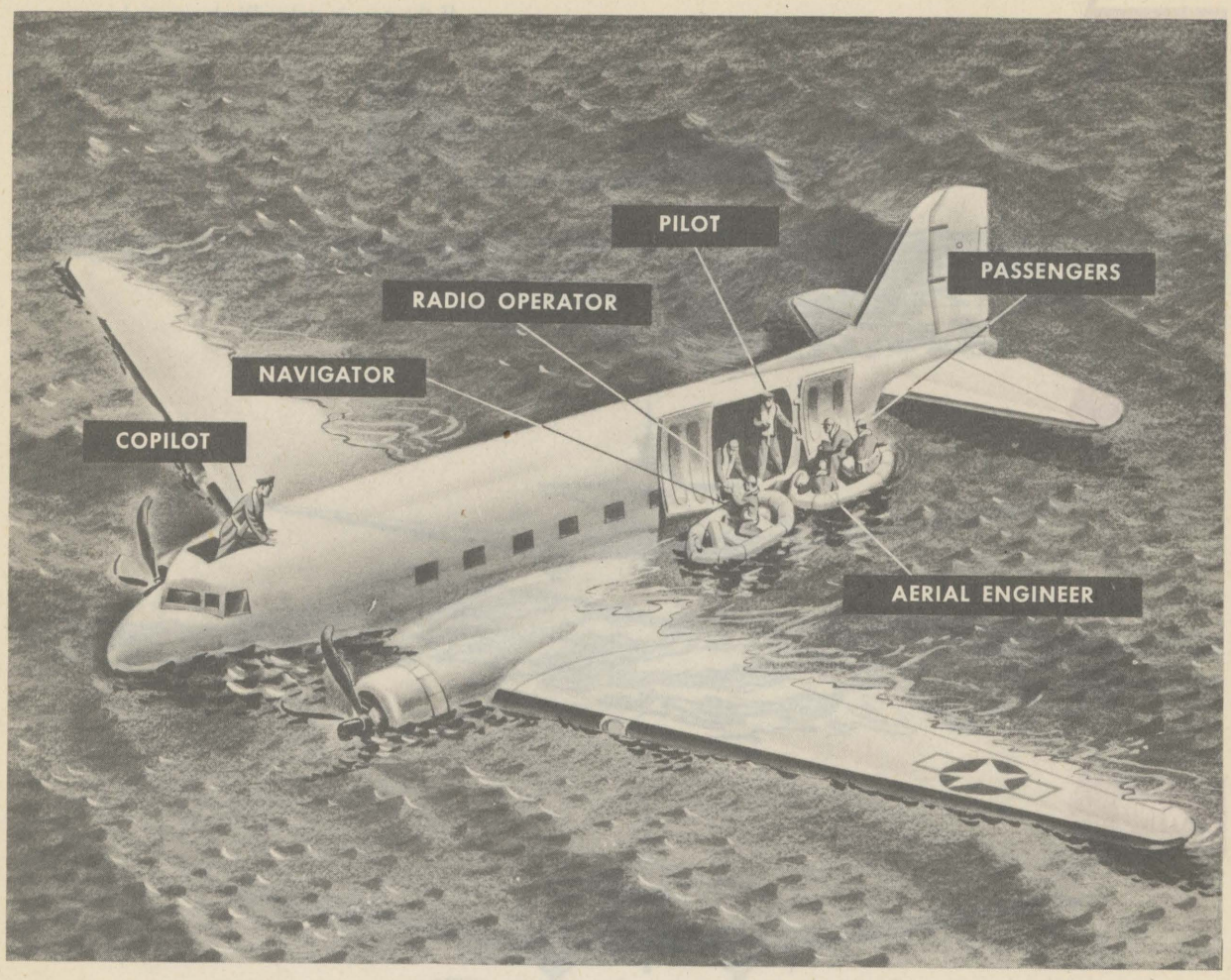
8. Use flaps at your discretion.

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.

If the sea is calm: Ditch upwind.





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.**

If you are making an emergency landing at a friendly airfield, it is not necessary to destroy secret or confidential papers or equipment, or to send a position report.

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).

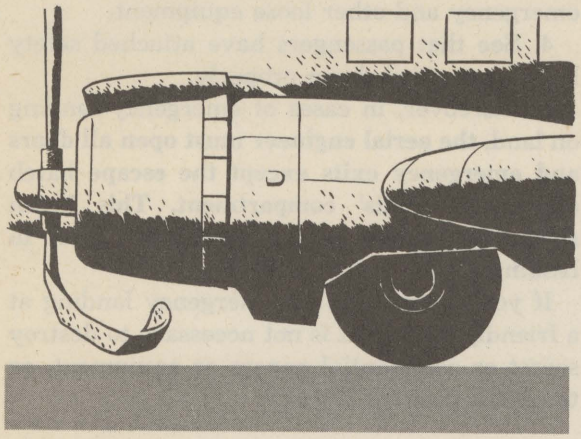
2. Lower flaps.

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

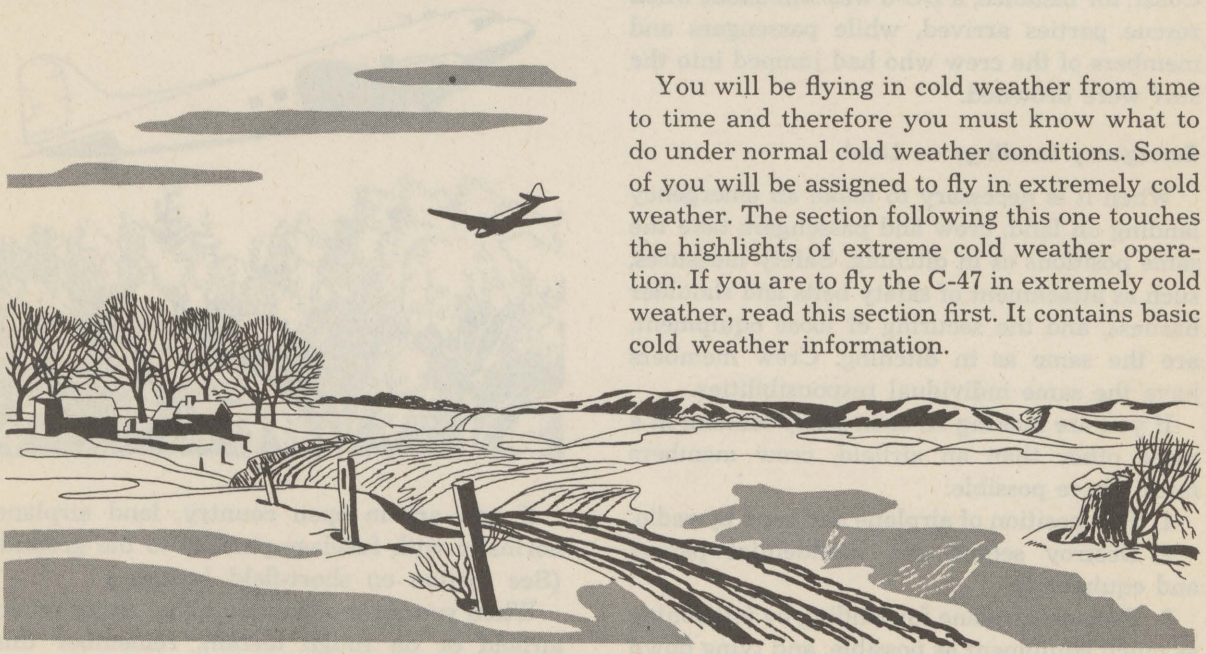


point: Your landing gear extends approximately a foot when retracted. Not only does it take the greater part of the shock of a belly landing, but you can use the wheels and brakes as you would if the gear were extended. Because of this fact, you **never** actually make a belly landing!

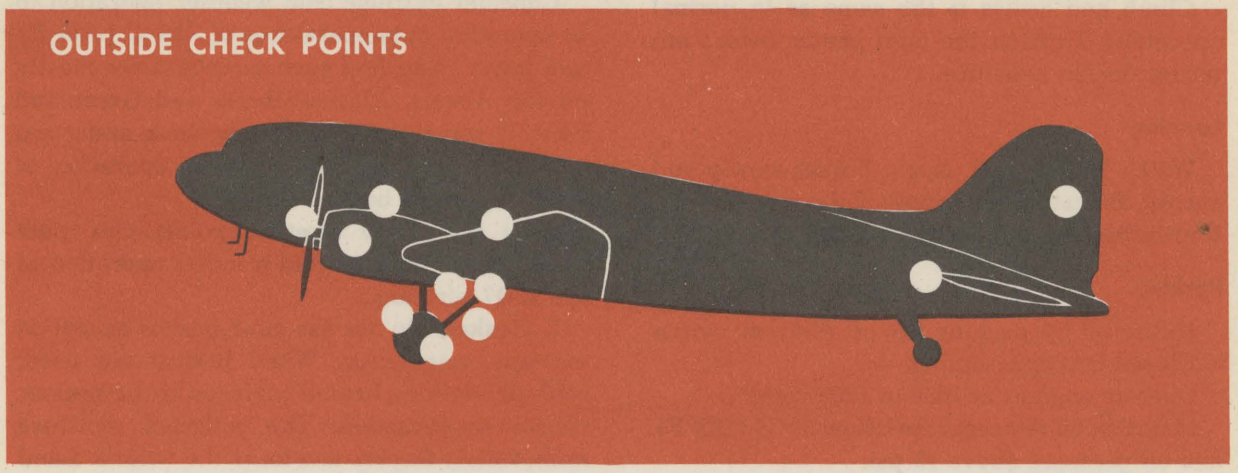
Additional Notes on Ditching and Emergency Landing

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

When there is snow or ice on runways, avoid fast taxiing speeds. Remember, you are taxiing a heavy airplane. If you once start sliding, you slide a good distance before you stop. When you bring the airplane to a stop, allow yourself sufficient room.

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.

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.

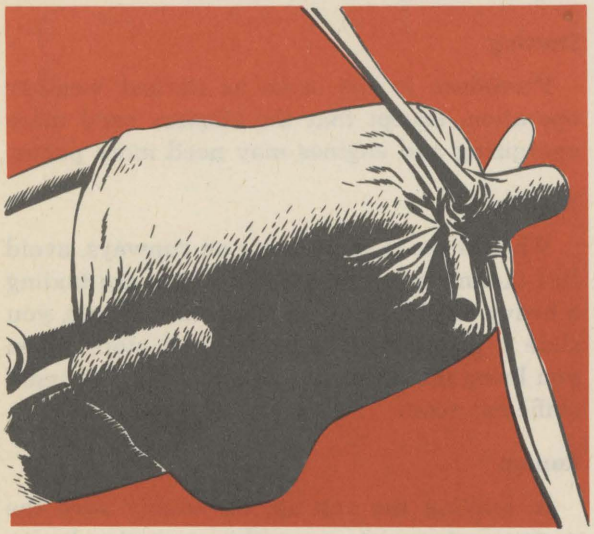
Maintain oil temperature below 50°C (122°F) and oil pressure above 15 psi.

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.

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.

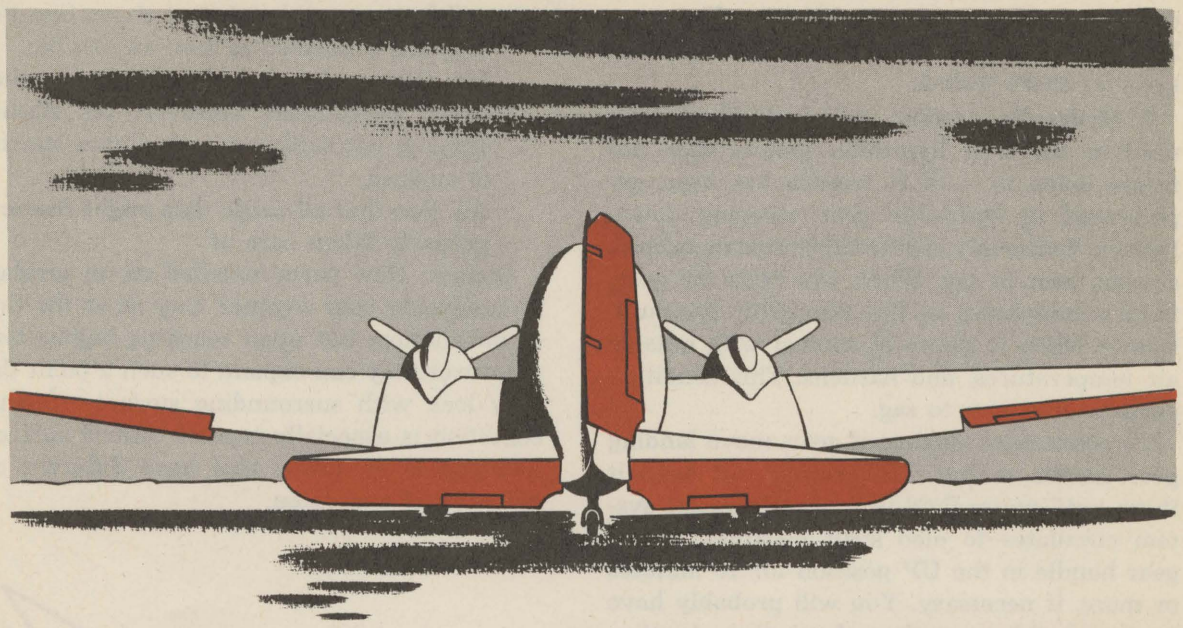
(b) **Bank-and-turn indicator.** It slows down, but usually does not freeze.

(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



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.

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.

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.

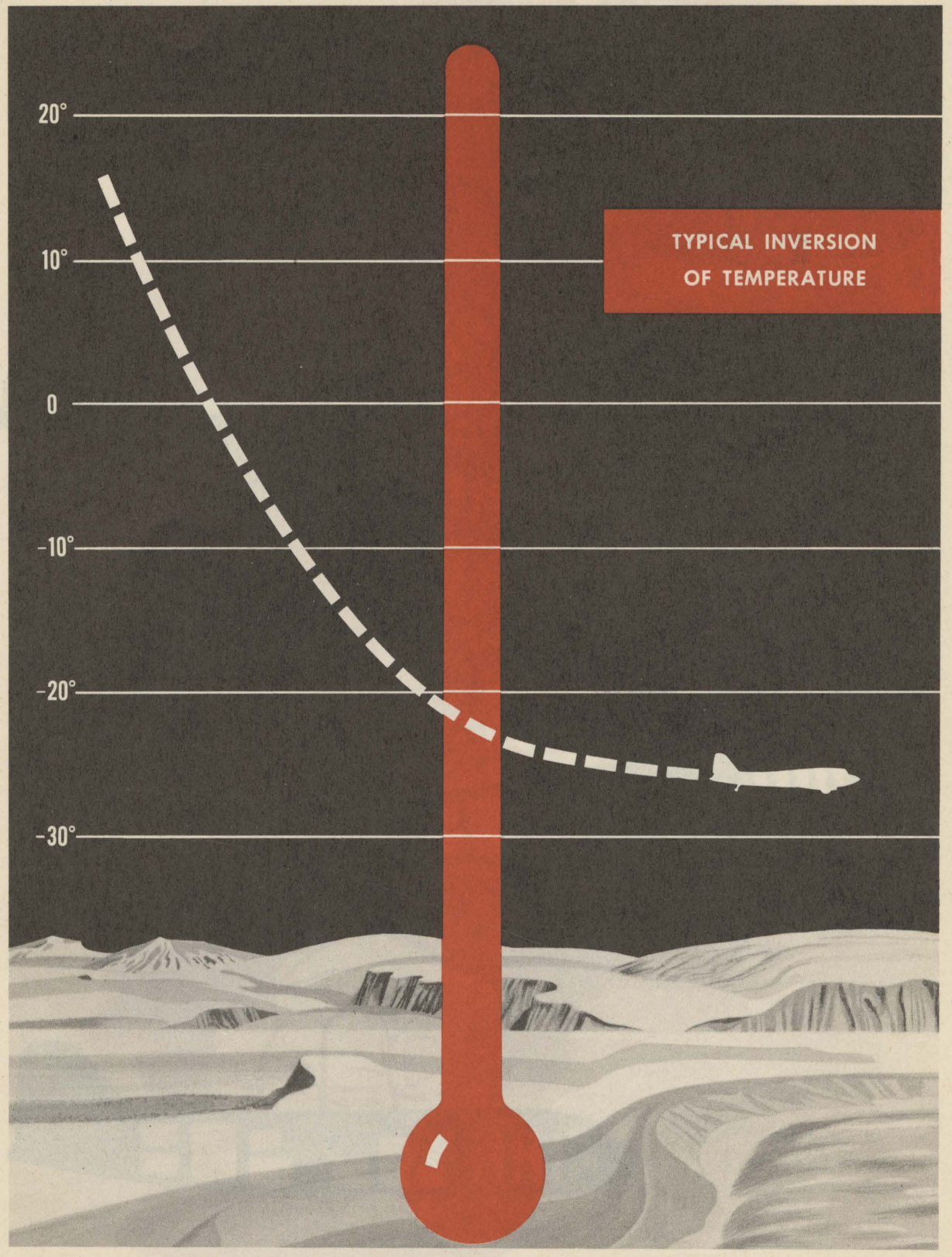
(d) Dilute oil to help keep it from solidifying. Remember, however, oil dilution alone is not sufficient to facilitate starting of engines.

(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

As commander of your airplane it is up to you to learn all you can about weight and balance. Although your airplane is loaded under the direction of a Weight and Balance Officer at point of departure, you are responsible for proper distribution of cargo in your airplane.

If cargo must be redistributed during flight it is up to you to know when to make the cargo shift and what cargo is to be shifted.

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

Points to Remember in Cargo 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, check with your Weight and Balance Officer.

What Is Weight and Balance?

If you could lift your airplane up and balance it on one of your fingers, the point where it balanced would be the airplane's center of gravity (CG).

When you add disposable load (gasoline, oil, cargo, crew and passengers) to your airplane you must place them on board in such a way that the CG of your airplane remains within certain predetermined limits.

Too much weight fore or aft of these limits throws your airplane out of balance and makes it inefficient in operation, or in extreme cases, unsafe to fly.

Total Load

Before loading your airplane you must see that the total load does not exceed the maximum allowable gross weight, and that, upon landing, your airplane is at or below the allowable maximum landing 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.

Effects of Proper Loading

The more conscientious you are about weight and balance, the more stable is your airplane and, consequently the more efficiently you can accomplish your mission.

Stability, then, is the prime factor in long-range operation. If you allow your airplane to become unstable, you increase your own work in keeping the airplane in trim, which causes fatigue and consequent loss of efficiency.

Redistribution of Cargo as Fuel Is Consumed

Normally, you remain within weight and balance limits during consumption of fuel. Therefore, your safety factor does not decrease. When you burn large amounts of fuel from main and auxiliary tanks, however, weight is taken from the front of the airplane and it becomes tail-heavy. Under this condition stability of your airplane decreases. To offset the loss of weight, shift cargo forward.

As fuel is consumed shift cargo forward

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

Note: Before you depart on a mission you will receive instructions as to redistribution of cargo as you progress.

Helps in Obtaining Proper Weight and Balance

All that you are concerned with in determining weight and balance is keeping your loaded airplane within CG limits. To enable you to determine if you are loading within CG limits and to make proper adjustments when the CG is not within limits, your airplane carries:

1. A Handbook of Weight and Balance Data (AN-01-1-40 or AN-01-1B-40)
2. A weight and balance load adjuster for the C-47 airplane.
3. A booklet of instructions on how to use the load adjuster.

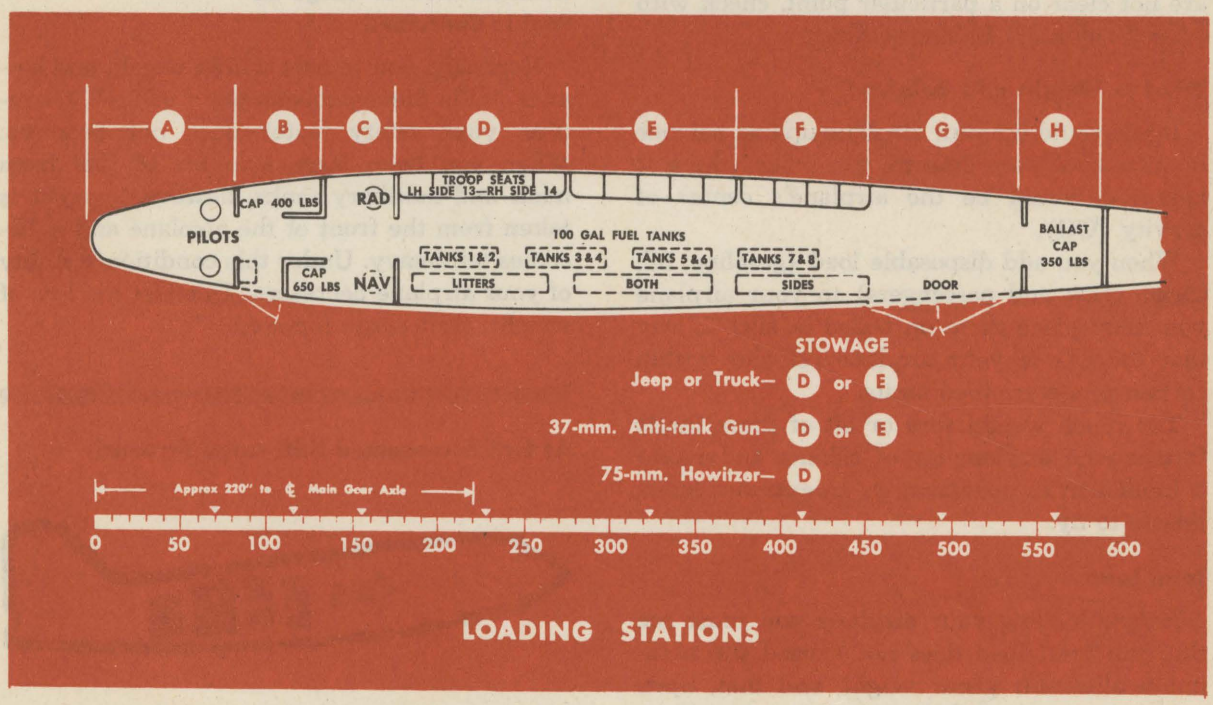
With given basic weights found in the handbook, and with weights of various items of disposable loads known, by means of the load adjuster you can determine just where to place items in your airplane so that your airplane remains in balance.

Loading Stations

To help you determine load placement, your airplane is divided into loading stations. There are eight loading stations in your airplane, designated A, B, C, D, E, F, G, and H. When you place an item of disposable load in one of these compartments, the CG or index of your airplane changes, depending upon how far the item is from the CG of your airplane and how much the item weighs. Since your load adjuster takes distance and weight into consideration in making its calculations, by means of this adjuster you can determine the CG or index of your airplane each time you place an item of weight in one of the cargo stations.

Handbook of Weight and Balance Data

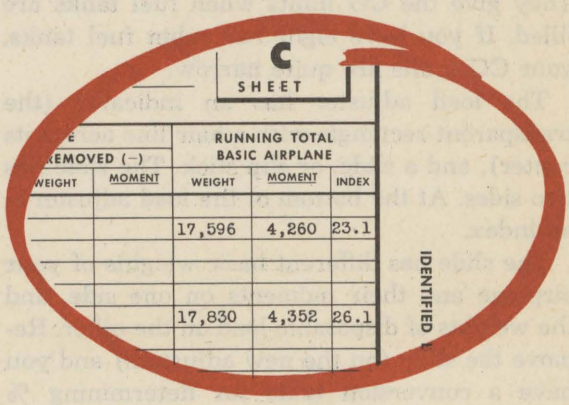
The Handbook of Weight and Balance Data contains the following forms:

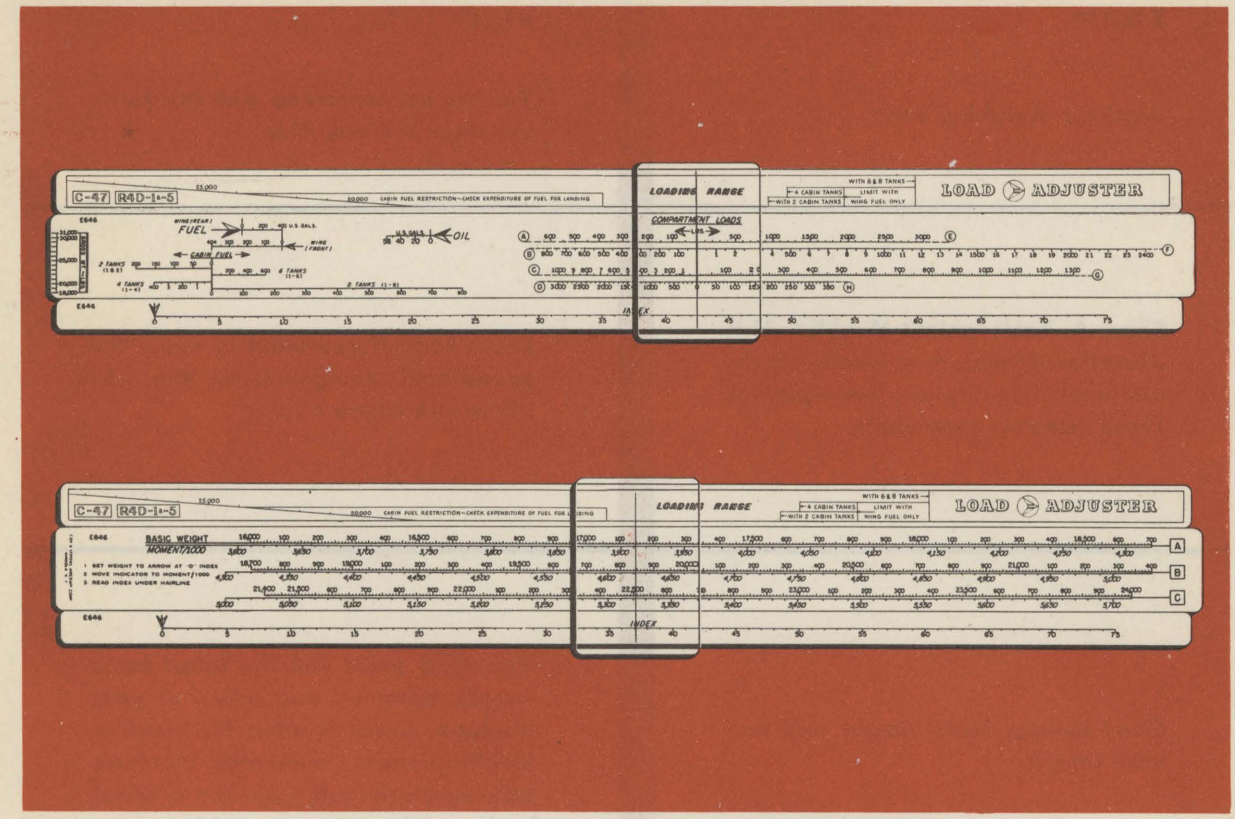


LOADING STATIONS

FORM	PILOT
Airplane Weighing Form.	You are not concerned with this form, but check it if you like.
Chart A—Basic weight checklist. Lists operational items, their location in the airplane when airplane was weighed. These items are removable.	Check form if you want to know the operational equipment in the airplane and where it is.
Chart C—Log. Basic weight and balance record.	This chart gives you the latest basic weight, moment, and index of your airplane. Check it often for security. Modifications are numerous. This form adds and subtracts from the original basic weight, moment, and index.
Form F. Tactical transport and cargo.	You are responsible for this form. Fill it in as indicated.

The last item on Chart C gives you the weight, arm and moment, and index of your airplane as it is at the present time. They are the starting points of your calculations. Any loads placed in your airplane are in addition to the figures given in this item.


C
SHEET
REMOVED (−)
RUNNING TOTAL
BASIC AIRPLANE
WEIGHT
MOMENT
WEIGHT
MOMENT
INDEX
17,596
4,260
23.1
17,830
4,352
26.1
IDENTIFIED



Load Adjuster

The load adjuster helps you calculate the CG of your airplane as you add each item of weight and, consequently, the final CG of the airplane when fully loaded.

Notice the red limits at the ends of the adjuster. They correspond to the nose and tail of ship; the left one forward, the right one aft. Your final CG must not fall beyond these limits. Notice, too, the yellow limits on the adjuster. They give the CG limits when fuel tanks are filled. If you have eight full cabin fuel tanks, your CG limits are quite narrow.

The load adjuster has an indicator (the transparent rectangle with a hair line across its center), and a slide, or slip stick. The slide has two sides. At the bottom of the load adjuster is an index.

The slide has different basic weights of your airplane and their moments on one side, and the weights of disposable load on the other. Remove the slide (on the new adjusters) and you have a conversion table for determining % MAC (mean aerodynamic chord), index, and distance of an item of cargo from the datum line (in the C-47, the nose of the airplane).

Form F

This form, called "Transport and Cargo Weight and Balance Clearance," is the sheet of paper you use in figuring cargo load and in determining the CG of your airplane as it is loaded. You must sign it when the airplane is loaded and the form is completed.

Notice that the basic weight of your airplane and its moment are listed as Item 1. Copy these figures from your C chart as explained previously. To this weight and moment, add the weight of oil, crew, crew's baggage, and other items listed. Use your load adjuster to calculate total weight and moment of your airplane with these items added to your basic weight.

Now you have the total weight and moment of your airplane, before it is loaded with cargo or passengers. These totals are entered on the

TRANSPORT AND CARGO WEIGHT and BALANCE CLEARANCE

FORM F

6-1-44

DATE _____ AIRPLANE C-47A FROM _____

FLIGHT _____ SERIAL NO. _____ TO _____

PRELIMINARY ESTIMATE	WEIGHT
ALLOWABLE GROSS WEIGHT	29,000
TOTAL AIRPLANE & FUEL WT. (Ref. 10)	25,589
ALLOWABLE LOAD (Ref. 11)	3,411

LIMITS

Recommended Max. Take-off Gr. Wt. 29,000 LB.
Recommended Max. Landing Gr. Wt. 26,000 LB.
Permissible CG Limits 14 to 28 % M.A.C.

REF.	ITEM	WEIGHT	INDEX OR MOMENT/
1	BASIC AIRPLANE (from chart C)	17830	26.1
2	OIL (58 Gallons)	435	22.7
3	CREW (No.) 2 A / 2 C	400 / 400	15.0 / 10.7
4	CREW'S BAGGAGE B	200	7.8
5	STEWARD'S EQUIPMENT		
6	EMERGENCY EQUIPMENT		
7	EXTRA EQUIPMENT H	300	16.7
8	OPERATING WEIGHT	19565	16.7
9	TAKE-OFF FUEL (1004 Gallons)	6024	8.4
10	TOTAL AIRPLANE & FUEL WEIGHT	25589	
11	DISTRIBUTION OF ALLOWABLE LOAD		

COMPT.	PASSENGERS NO.	PASSENGERS WEIGHT	BAGGAGE	MAIL	CARGO	WEIGHT	INDEX OR MOMENT/
A							
B							
C							
D					300	300	7.4
E	2	400			66	466	10.2
F	8	1600				1600	34.0
G					925	925	55.2
H							
I							
J							
K							
L							
M							
N							
O							
P							

• REMARKS •

COMPUTER PLATE NO. 97878 (If Used)

CORRECTIONS (Ref. 13)

COMPT.	ITEM	CHANGES (+ or −) WEIGHT	INDEX OR MOMENT/
H	Extra Equip.	− 300	46.2
B	Extra Equip.	+ 300	41.8
TOTAL WEIGHT REMOVED		− 300	− 46.2
TOTAL WEIGHT ADDED		+ 300	+ 41.8
NET DIFFERENCE (Ref. 13)		0	41.8

12	TAKE-OFF CONDITION (Uncorrected)	28880	55.2
13	CORRECTIONS (If required)		41.8
14	TAKE-OFF CONDITION (Corrected)	28880	41.8

TAKE-OFF CG IN % M.A.C. 23.2%

NOTE: Moment will be used only when the balance computer is not available.

COMPUTED BY _____

WEIGHT & BAL. OFFICER _____

PILOT _____

(FOR TACTICAL MISSIONS, USE OTHER SIDE)

New Form F dated 1 June 1944
Note difference in sequence of load calculations

4-1-43

WEIGHT and BALANCE CLEARANCE

FORM F

DATE _____ MISSION _____

AIRPLANE C-47A FROM _____

AF SERIAL NO. _____ TO _____

COMPARTMENT	ITEM	WEIGHT	INDEX
Y	Basic Airplane	17,830	26.1
A	(_____ lb. STRUCTURAL CAPACITY) Crew 400 Cargo TOTAL 400	400	18.3
B	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo 200 TOTAL 200	200	15.4
C	(_____ lb. STRUCTURAL CAPACITY) Crew 400 Cargo TOTAL 400	400	11.0
D	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo 300 TOTAL 300	300	9.9
E	(_____ lb. STRUCTURAL CAPACITY) Crew 400 Cargo 66 TOTAL 466	466	12.8
F	(_____ lb. STRUCTURAL CAPACITY) Crew 1600 Cargo TOTAL 1600	1,600	36.6
G	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo 925 TOTAL 925	925	57.9
M	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo 300 TOTAL 300	300	66.8
I	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
J	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
K	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
L	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
M	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
M	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
O	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
P	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
TOTALS TO BE CARRIED FORWARD		22,421	66.8

COMPARTMENT	ITEM	WEIGHT	INDEX
Y	Totals Brought Forward	22,421	66.3
Q	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
R	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
S	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
T	(_____ lb. STRUCTURAL CAPACITY) Crew Cargo TOTAL		
AMMUNITION (By Compartment)	( ) Rd. ( ) Cal.		
BOMBS	Forward		
	Aft		
	External		
FUEL (U. S. 6 & Imp. 7.2 lb./gal.)			
	400	2,400	69.3
	404	2,424	64.4
	200	1,200	58.6
Bomb Bay:			
OIL (U. S. 7.5 & Imp. 9 lb./gal.)			
	58 gal.	435	55.2
TOTAL WT. & INDEX (Uncorrected)		28,880	55.2
Corrections (If required)			13.4
TAKE-OFF WEIGHT & INDEX		28,880	41.8

LIMITS

Max. Alternate Gross Weight	29,000	LB.
Max. Allowable Landing Weight	26,000	LB.

COMPUTED BY _____

APPROVED BY _____

PILOT _____

300# Equipment moved from Comp't 'H' to 'B' Index change of 13.4 Forward

Old Form F dated 1 April 1943
Illustrative problem follows this form

RESTRICTED

form. You also enter identifying information and the recommended maximum takeoff and recommended maximum landing gross weights and the permissible CG limits. You can obtain these figures from Chart E in the Handbook of Weight and Balance Data.

Now you are ready to figure load according to cargo station. Place each item to be loaded in each station and its weight under that station on Form F. As you place items and their weights in the stations, use the load adjuster to determine airplane index. An example of the method of determining these and the final index of the airplane loaded is given herewith. If your loaded airplane is within CG limits, it is in balance. If not, items of cargo must be shifted back or forth from one station to another to bring the CG within proper limits.

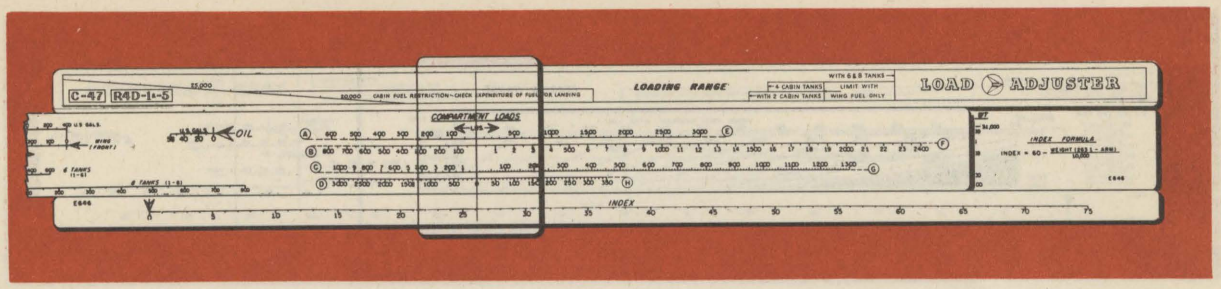
Calculating With the Load Adjuster

On the case of your load adjuster are the basic weight and index of your airplane. To calculate the index of your airplane loaded, follow the steps of the accompanying problem.

(Note: This example is taken from the booklet of C-47 load adjuster instruction that comes with your airplane. Index and weights given, of course, **are different in your airplane.)**

ITEM	Sub-Total (lbs.)	Total (lbs.)
Basic Airplane	....	17,830
Pilots' Compartment (A)		
2 Pilots at 200 lbs. each	....	400
Forward Cargo Compartment (B)		
Cargo	....	200
Radio Compartment (C)		
1 Radio Operator	200	.....
1 Navigator	200	400
Cargo Section (D)		
1 Parapack—External Stowage	....	300
Cargo Section (E)		
1 pair litters	66	
2 patients at 200 lbs. each	400	466
Cargo Section (F)		
8 passengers of 200 lbs. each	....	1600
Cargo Section (G)		
Cargo	....	925
Ballast Compartment (H)		
Cargo	....	300
Oil		
Full—58 U. S. gallons	....	435
Fuel		
Main Tanks—404 U. S. gallons	2424	.....
Auxiliary Tanks—400 U. S. gallons	2400	.....
Cabin Tanks Nos. 1 & 2, 200 U. S. gallons	1200	6024
Gross Weight	....	28,880

Note: When moving slide, be sure that the indicator does not move. Conversely, when moving the indicator, be sure the slide does not move.



Loading Scales of Slide

Given: Index (CG) = 26.1

1. Move indicator until hairline is over 26.1 on the index scale.

Move slide until vertical starting line of compartment loads scale is under hairline.

Move indicator until the hairline is over 400 on the pilots' compartment (A) scale. This loads 400 lbs. in pilots' compartment (A). Index reading should be 18.3.

2. Repeat operation 1 for each compartment loading, always starting a new loading with vertical starting line of the compartment loads scales under the hairline.

(a) Load 200 lbs. in forward baggage compt. (B).....Read Index 15.4

(b) Load 400 lbs. in radio compt. (C).....Read Index 11.0

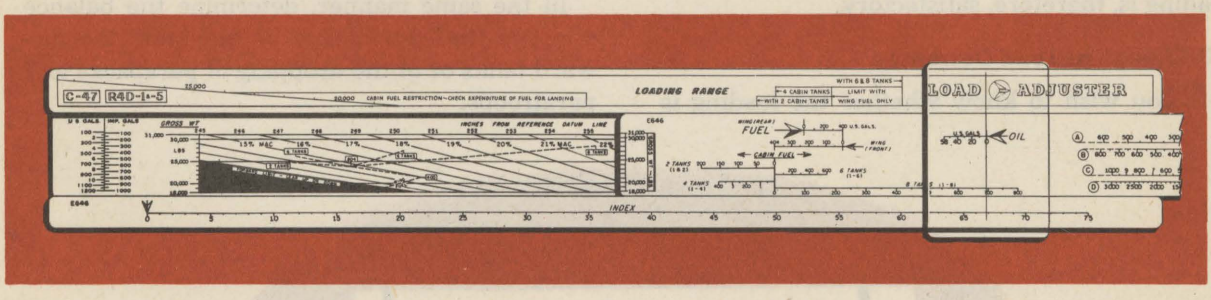
(c) Load 300 lbs. in cargo section (D).....Read Index 9.9

(d) Load 466 lbs. in cargo section (E).....Read Index 12.8

(e) Load 1600 lbs. in cargo section (F).....Read Index 36.6

(f) Load 925 lbs. in cargo section (G).....Read Index 57.9

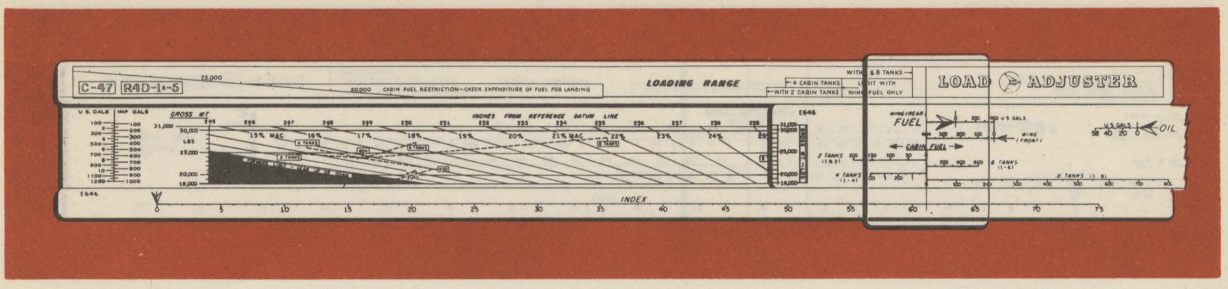
(g) Load 300 lbs. in ballast compt. (H).....Read Index 66.8



3. Move slide until vertical starting line of oil scale is under hairline.

Move indicator until hairline is over 58 on oil scale. This adds 58 U. S. gallons of oil. Read Index 63.3

Note: Arrangement of fuel scales on the rule permits you to make the fuel setting in one motion of the indicator when the tanks are filled in the order: (1) auxiliary tanks (wing, rear); (2) main tanks (wing, front); (3) cabin tanks.



4. Move the slide until the hairline is over the vertical starting line of the Auxiliary (wing, rear) Fuel Scale.

Move the indicator to the 200 mark on the cabin fuel tanks #1 and #2 scale. Read the final Index 55.2.

When you complete the balance check, note that the hairline is over the yellow section (caution range) for two cabin tanks of fuel. Therefore, you must readjust the load to bring the hairline within the loading range. Readjust by shifting 800 lbs. of cargo from cargo section E forward to cargo section C.

Proceed as follows:

1. With hairline over final Index of 55.2,
2. Move slide until hairline is over 800 mark on Section G scale.
3. Move indicator until hairline is over 800 mark on Section E scale.
4. Hairline is now in the full white portion of the loading range (Index 41.7) and the above loading is, therefore, satisfactory.

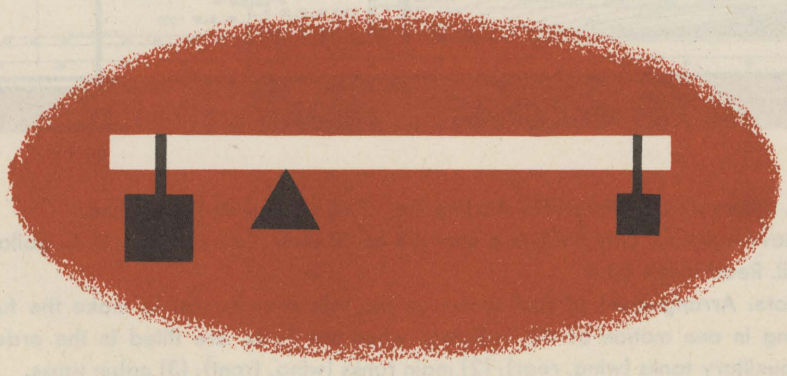
CG Change as Load Decreases

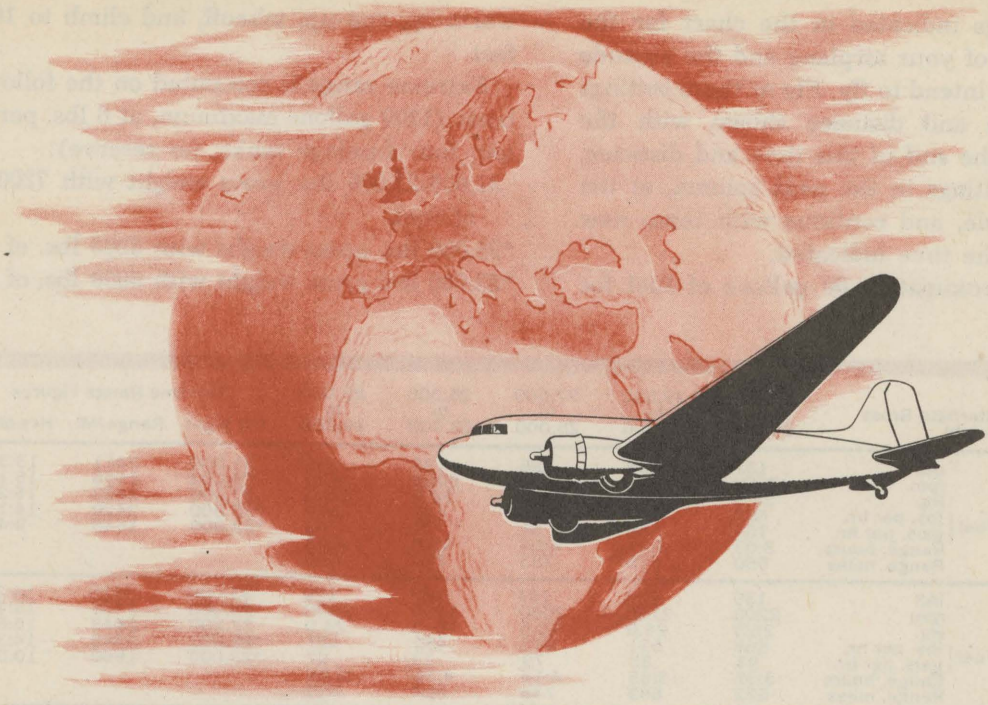
If you wish to know whether the loading is still satisfactory after 200 gallons of fuel have been used from the cabin tanks No. 1 and No. 2, use the following procedure:

1. Set the indicator hairline over the final Index 41.7.
2. Move the slide until the 200-gallon mark on the cabin tanks No. 1 and No. 2 fuel scale is under the hairline.
3. Move the indicator until the hairline is over the 0-gallon mark on the scale for the cabin tanks No. 1 and No. 2.
4. Read the Index 47.5 on bottom of rule.

The hairline remains in the white section (loading range) and the loading continues satisfactory.

In the same manner, determine the balance effect of the expenditure of fuel from the forward tanks or of the dropping of parapacks and paratroops.





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.)			

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.

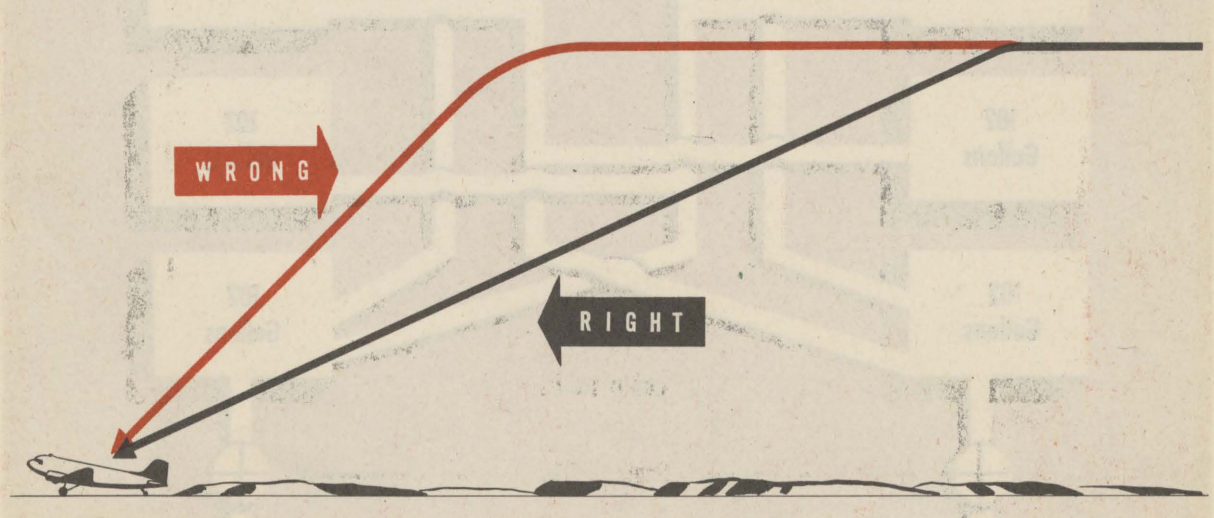
2. Use proper power setting as set forth in cruise charts.

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.

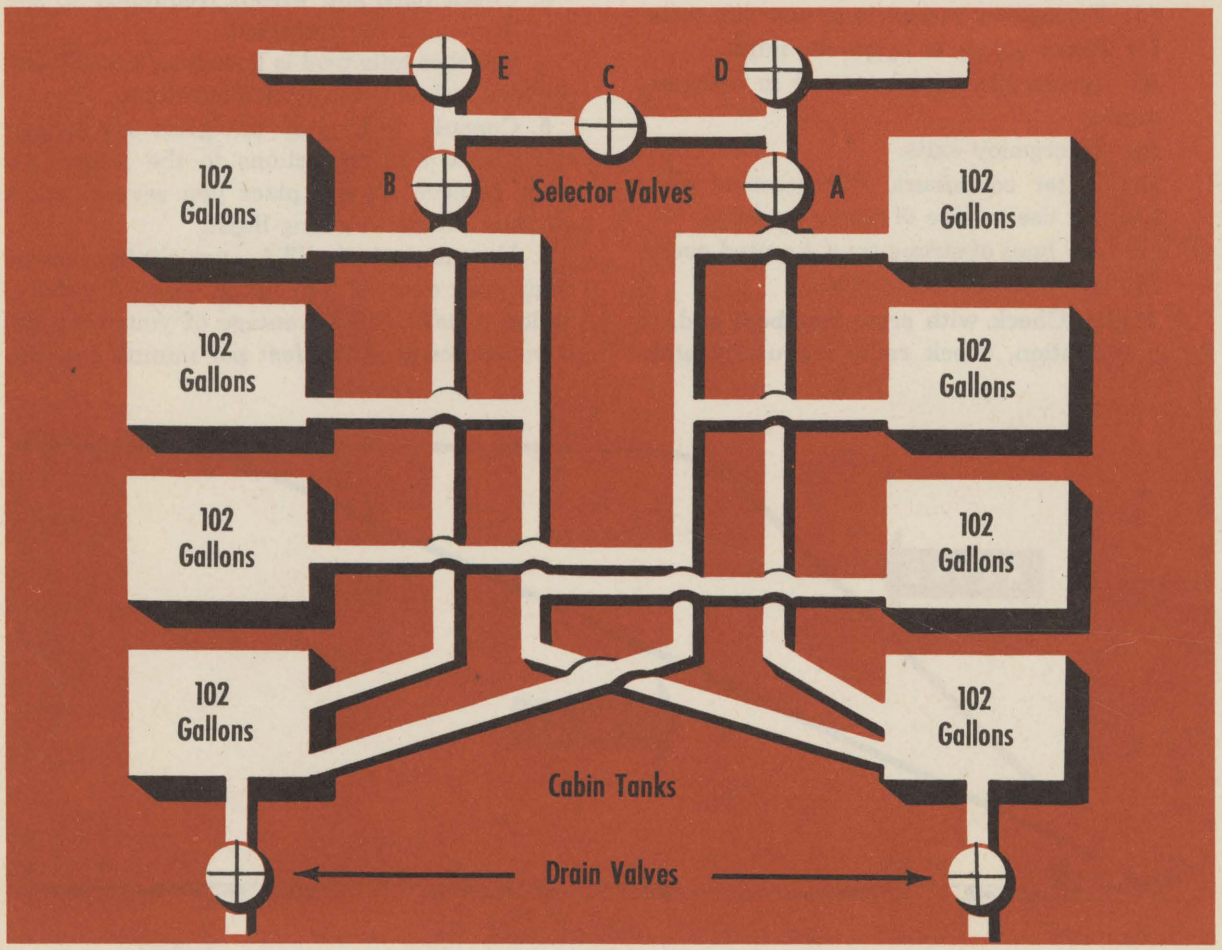
To place the cabin tank fuel system in operation, follow this procedure:

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.

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 with paratroops 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.

Procedure 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. Throttle back left engine to approximately 12″ to 13″ Hg. Reason: To avoid severe shock to jumpers from propeller blast.
4. Advance right engine throttle 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

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.

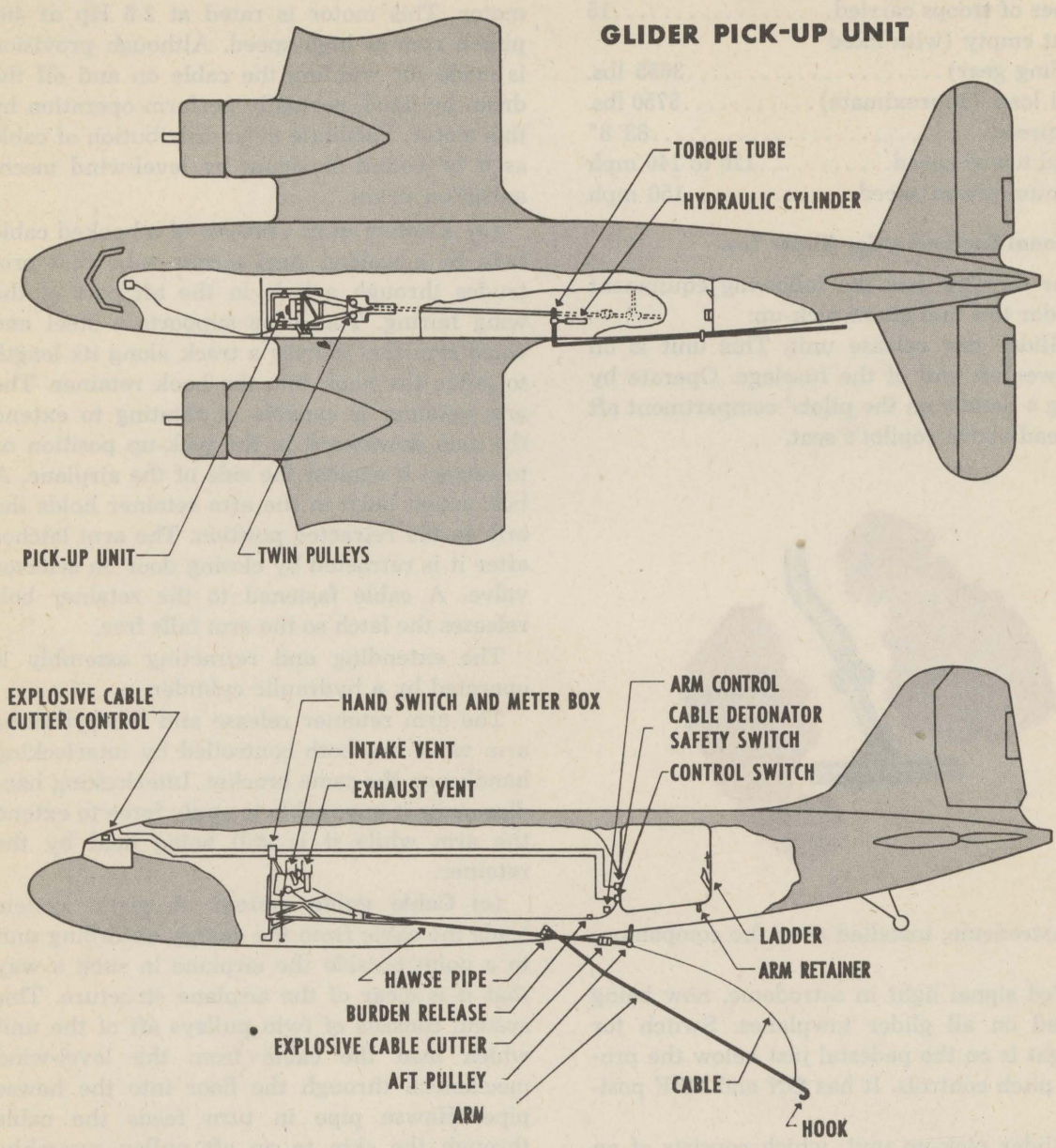
(b) **Contact unit:** Consists of a hooked cable held by a welded steel torque tube that protrudes through a hole in the aft part of the wing fairing. This tube supports a steel and wood arm that carries a track along its length to guide the hook into the hook retainer. The arm retainer is capable of 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.

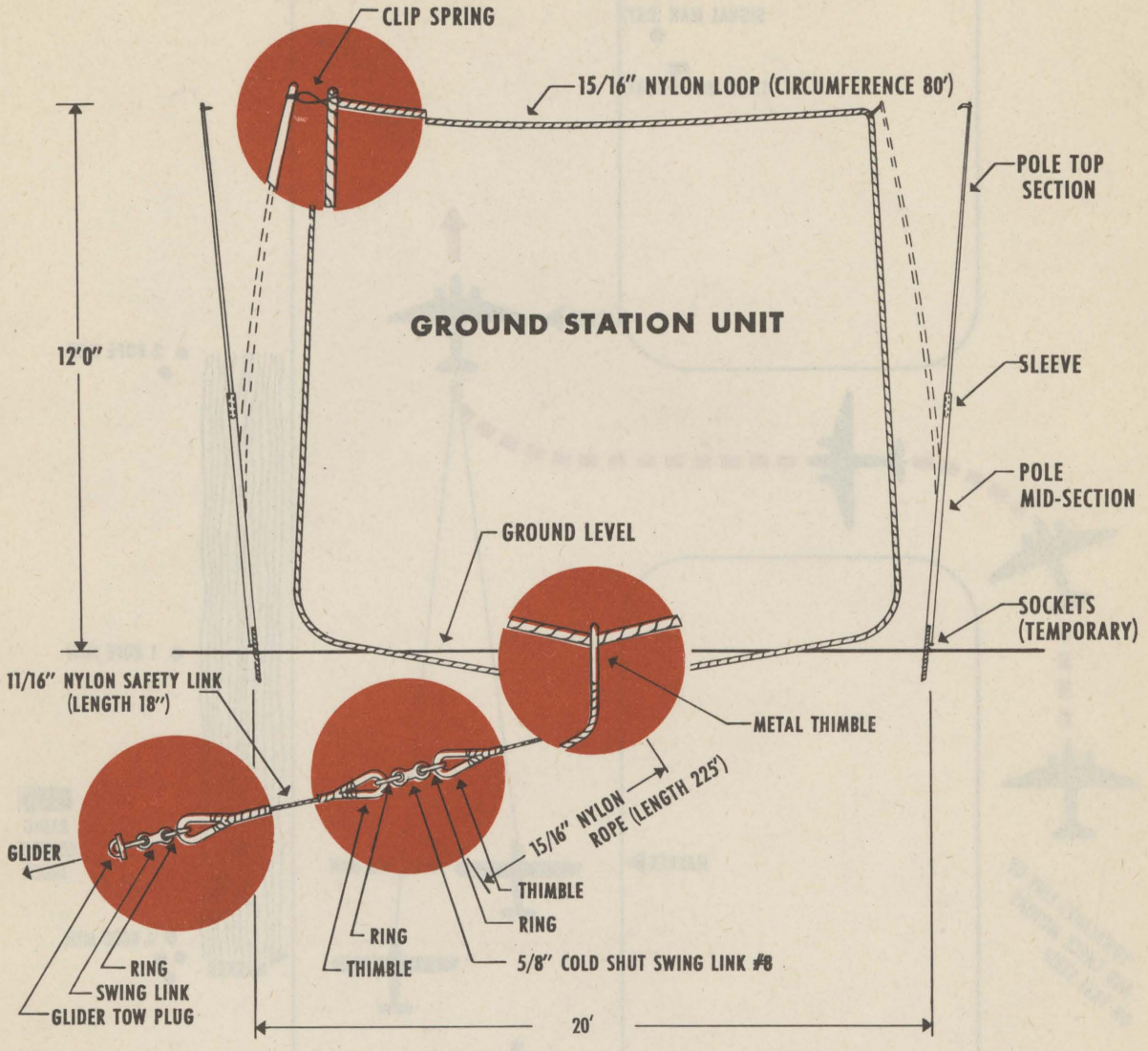
(c) **Cable guide system:** A guide system leads the cable from the energy absorbing unit to a point outside the airplane in such a way that it is clear of the airplane structure. This system consists of twin pulleys aft of the unit which lead the cable from the level-wind mechanism through the floor 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.

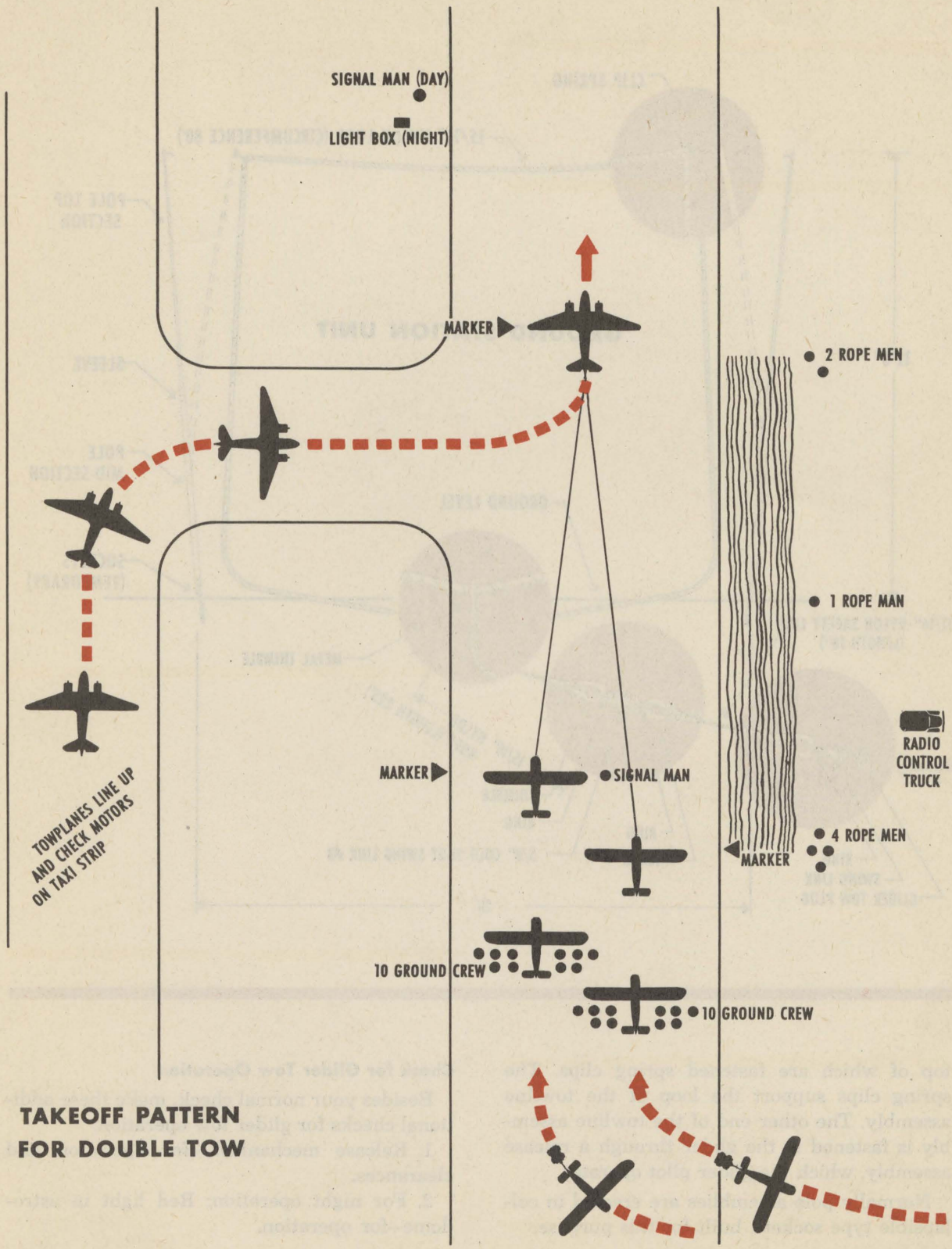
Normally pole assemblies are erected in collapsible type sockets, built for this purpose.

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	Full Low	Full Low
Crossfeed	OFF	OFF
Trim Tab	0	0
Landing Gear	Positive Lock	Positive Lock
Tailwheel	Locked	Locked
Takeoff	47″ Hg., 2700 rpm	46″ Hg., 2700 rpm

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

helps you maintain directional control of the towplane.

6. Take off at 85 mph airspeed, minimum 80 mph. Do not take off at less than 80 mph except under extreme emergency conditions.

7. Retract landing gear immediately upon becoming airborne, **never before you leave the ground.**

Warning: When you begin takeoff on an uphill, graded runway, the sensation is similar to that of leaving the ground. Do not retract landing gear before definitely becoming airborne.

Climb

1. Hold airplane to a minimum climb until you reach an airspeed of 100 mph.

2. When you reach an airspeed of 100 mph, make your first power reductions. Power reductions at this speed are:

Single tow	39″ Hg.	2550 rpm
Double tow	*39″ Hg.	2550 rpm

*After you attain 100 mph IAS.

3. Continue at these reductions until you have gained an altitude of approximately 250 feet above the ground. At this point make your second power reductions, or apply enough power to maintain a minimum IAS between 100 and 110 mph. Second power reductions are:

Single tow	*30″ to 32″ Hg.	2300-2350 rpm
Double tow	34″ to 37″ Hg.	2350 rpm

*Or enough to maintain a minimum IAS of 100 mph.

4. Climb at the rate of approximately 300 feet per minute until you reach tactical altitude of approximately 400 feet above the ground.

Cruise

1. Maintain between 115 to 120 mph IAS during tow, never more than 150 mph.

2. Do not exceed a 30° bank in any turn, except in an emergency. Make each turn with a smooth entry and smooth carry-through. Smooth, shallow banks with smooth carry-through enable the glider pilot to control his glider with ease and in turn make it easier for you.

3. Keep cylinder-head temperatures within the following limits:

Minimum	70°C
Maximum	250°C
Desired	180-200°C

To cool cylinder heads, use cowl flaps as necessary.

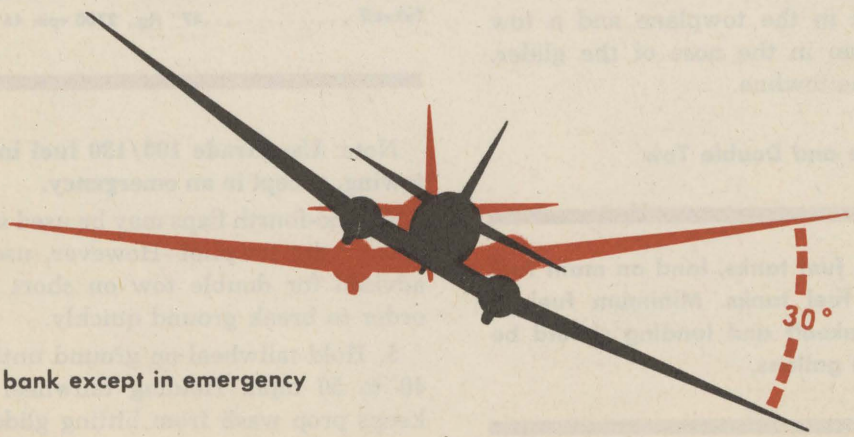
4. Keep oil temperatures within the following limits:

Minimum	40°C
Maximum	95°C
Desired	50°-70°C

5. Formation flying:

(a) Use ¼ wing flaps at your discretion. Use of flaps gives your airplane stability while flying in-trail formation in rough air and reduces the stalling speed of the towplane approximately 8 mph.

(b) Unless you are in the leading airplane, set your propellers at 2300 rpm. This setting maintains power necessary to keep formation during single or double tow without having to change propeller setting constantly to conform with changes in manifold pressure.



Maximum bank except in emergency

TABLE OF POWER SETTINGS[1]

	SINGLE TOW		DOUBLE TOW	
	M/P	RPM	M/P	RPM
TAKEOFF	47″ HG.	2700	47″ HG.	2700
FIRST REDUCTION	39″ HG.	2550	39″ HG.[2]	2550
CLIMB	30″ TO 34″ HG.[3]	2200	34″ TO 37″ HG.	2350
CRUISE	27″ TO 31″ HG.[4]	2150	31″ TO 34″ HG.[5]	2200

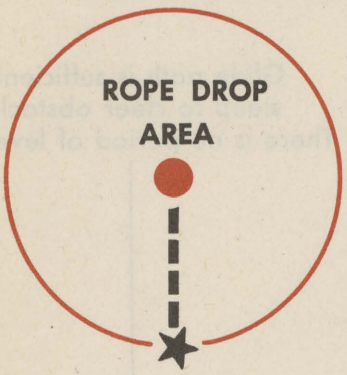
[1]This table assumes that Grade 100/130 gasoline is used.

[2]After you attain 100 mph IAS.

[3]Or enough to maintain a minimum IAS of 100 mph.

[4]Or sufficient power to maintain an IAS of 115 mph.

[5]Or power sufficient to maintain IAS of 105-110 mph.



To drop rope in center of area:
If no wind...release rope approximately 150 feet from center of area
If there is a wind... adjust point of release so that direction and velocity of wind carries rope to center of area.

Emergency Precautions

1. Copilot must have one hand on or near the glider release handle during takeoff and the initial part of the climb in case it is necessary to release glider or gliders in tow. If you have a partial or total engine failure on takeoff, you must give an emergency signal **immediately** and release gliders **within 3 seconds.**

If you have an engine failure on takeoff and do not release gliders immediately, there is extreme danger of both towplane and gliders crashing.

2. If you have an engine failure below safe minimum altitude of 800 feet with two gliders in tow, or 400 feet with one glider in tow, signal individually and release gliders.

3. If it is possible to establish single engine procedure and maintain a minimum airspeed of 100 mph, you may attempt to tow glider or gliders to a safe landing field, so long as you maintain safe minimum altitudes.

4. In case of partial engine failure (substantial loss of power) do not assume that the engine will not go out entirely or will have sufficient power to tow gliders to a landing field.

5. If a glider releases from your towplane at an altitude below 400 feet above the ground, climb immediately and sharply to between 400 and 500 feet to prevent fouling of towline on trees, buildings, wires, or other obstructions. Fouling of a towline can result in injury or

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.

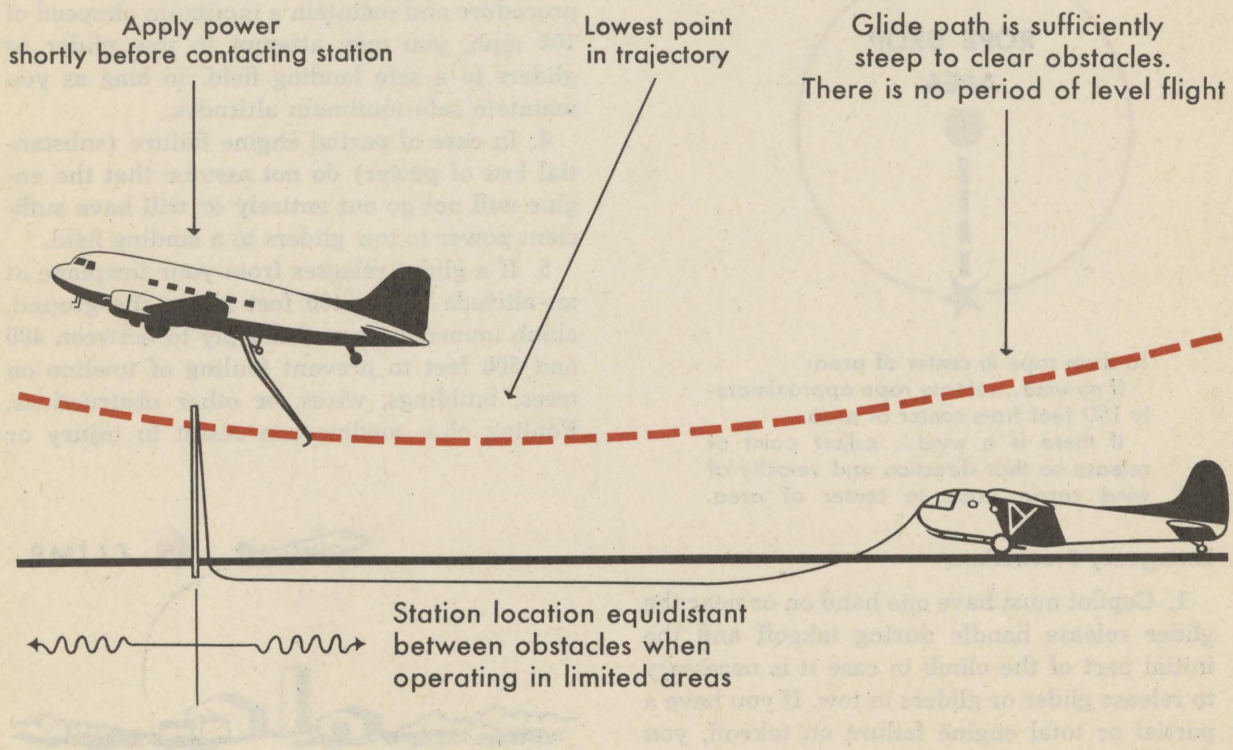
Note: Glider towlines stretch approximately 15% of their length during tow. If released from the towplane before the glider makes release, a towline may snap back and severely damage the nose of the glider or foul glider controls.

Procedures for Glider Pick-up

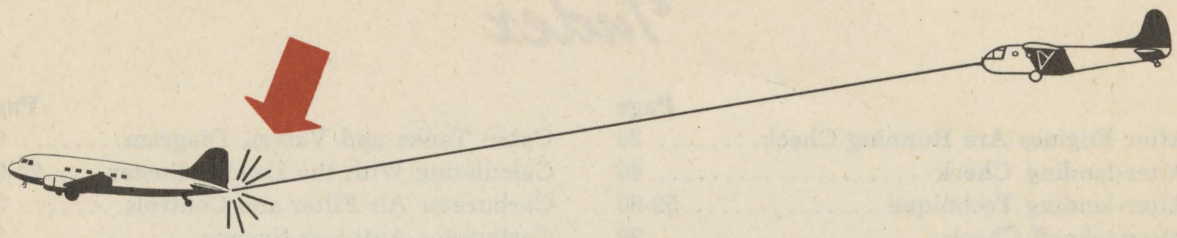
1. Pilot signals the pick-up unit operator to prepare for a pick-up. Maintain an airspeed not in excess of 110 mph in order to facilitate pick-up unit operators' work.

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.

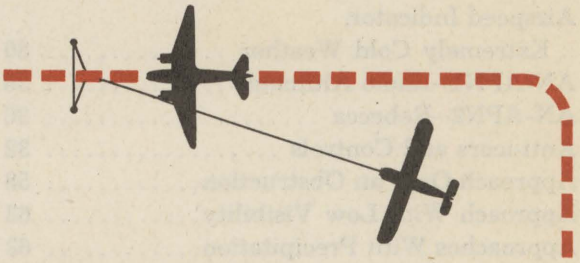
Do not exceed 15° in pull-up. Maintain a minimum airspeed of 105 mph except in cases of emergency.

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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