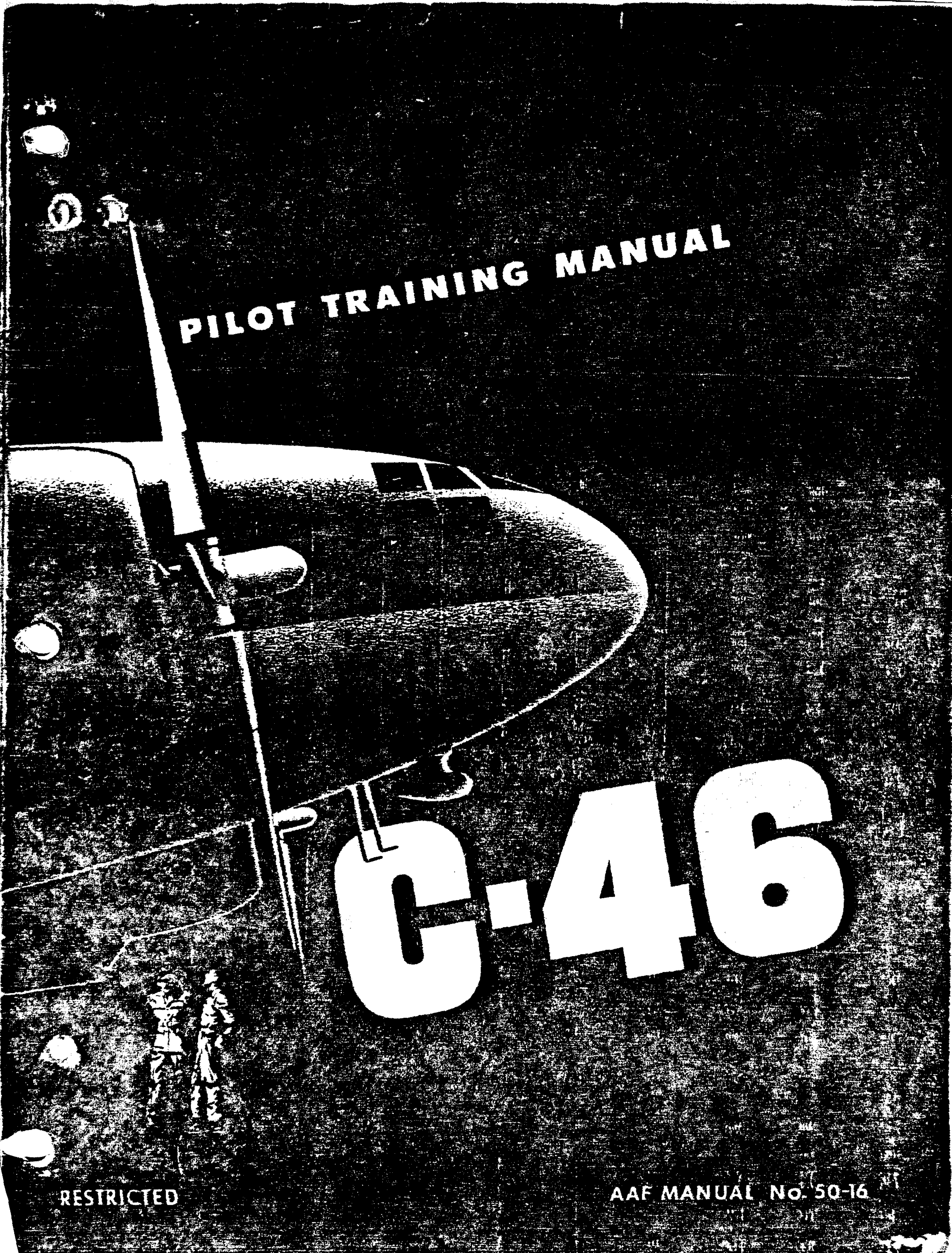

PILOT TRAINING MANUAL
C-46
RESTRICTED
AAF MANUAL No. 50-16

RESTRICTED

PILOT TRAINING MANUAL FOR THE

C-46

COMMANDO

PREPARED FOR HEADQUARTERS AAF

OFFICE OF ASSISTANT CHIEF OF AIR STAFF TRAINING

BY HEADQUARTERS AAF, OFFICE OF FLYING SAFETY

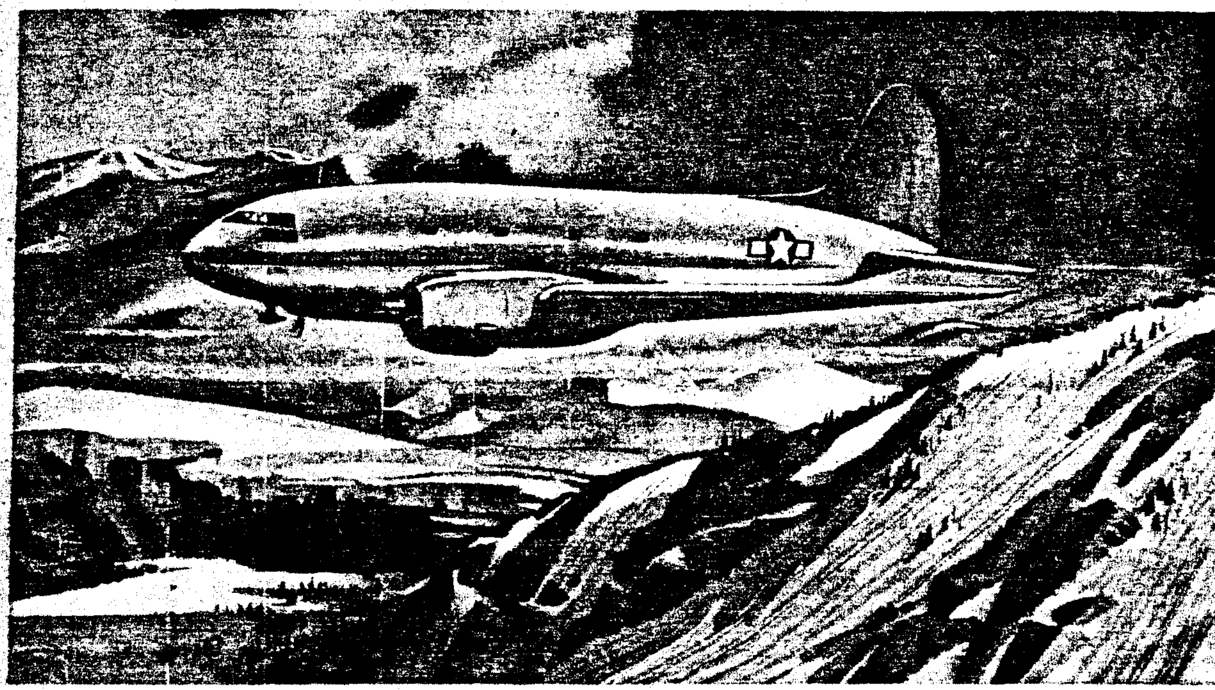
RESTRICTED

AAF MANUAL No. [illegible]

CONFEDERATE AIR FORCE

C-46 F N 53594

INSTRUMENT & CONDITION	MARKING	READING
1) Tachometer-RPM		
Maximum Limit	Red Radial Line	2700
Takeoff or Precautionary-Range	Yellow Arc	2550-2700
Normal Range	Green Arc	1600-2550
2) Manifold Pressure-in Hg.		
Maximum Limit	Red Radial Line	52.0
Takeoff or Precautionary-Range	Yellow Arc	44.0-52.0
Normal Range	Green Arc	20.0-44.0
3) Cylinder Head Temperature-°C		
Maximum Limit	Red Radial Line	260
Precautionary Range	Yellow Arc	232-260
Normal Range	Green Arc	120-232
Minimum Limit	Red Radial Line	120
4) Oil Inlet Temperature-°C		
Maximum Limit	Red Radial Line	93
Precautionary Range	Yellow Arc	90-93
Normal Range	Green Arc	80-90
Minimum Limit	Red Radial Line	40
5) Oil Pressure-PSI		
Maximum Limit	Red Radial Line	100
Precautionary Range	Yellow Arc	90-100
Normal Range	Green Arc	80-90
Minimum Limit	Red Radial Line	25
6) Fuel Pressure-PSI		
Maximum Limit	Red Radial Line	19
Normal Range	Green Arc	16-18
Minimum Limit	Red Radial Line	14
7) Carburetor Air Temp-°C		
Maximum Limit	Red Radial Line	50°C
Precautionary Range	Yellow Arc	0-10°C
8) Hydraulic Pressure-PSI		
Maximum Limit	Red Radial Line	1500
Normal Range	Green Arc	1100-1350
9) Suction Inches		
Maximum Limit	Red Radial Line	4.8
Normal Range	Green Arc	4.3-4.8
10) De-icer Pressure		
Maximum Limit	Red Radial Line	10
Normal Range	Green Arc	6-10
11) Airspeed	Red Radial Line	234
	Yellow Arc	191-234
	Green Arc	80-191
	White Arc	67-117



INTRODUCTION

This book has one purpose: to help you fly the C-46—fly it safely, efficiently, and in a manner that results in a minimum of maintenance on the airplane.

You learn to fly any airplane only by flying it, of course. However, when you use this book in connection with your actual flying of the airplane you'll find that it greatly simplifies your job of getting acquainted with the ship and its peculiarities. Further, it gives you the information you need for getting the optimum performance out of the airplane under all conditions.

Your Airplane

The Commando is a big airplane. It is the largest 2-engine transport airplane in the world. But it is not a difficult ship to fly once you get the hang of it.

The C-46 had a pretty rough time in the early days of the war. Military necessity put it to work in a faraway theater before all the bugs were out of it, with service facilities sketchy and spare parts almost nil.

But this school of hard knocks did a lot for the Commando. Its modifications and improvements came not from the drawing board, but from actual experience in the theater of operations. As a result, today's C-46 is built specifically for the job it has to do if ever an airplane was.

This new C-46 has proven itself in the battle of military supply lines around the world. Day in, day out, good weather and bad, Commandos are delivering the goods over the Hump—the roughest, toughest 600 miles of airway in the world. In other major theaters they are giving the same sturdy, dependable service.

Its huge cargo capacity, its safe operation, its speed, and its dependability all add up to make the C-46 one of the best transport airplanes in the sky.

When you fly a C-46, you are more than just a pilot—you are the commander of your airplane.

Under some circumstances your crew may consist of copilot, navigator, radio operator, and aerial engineer. Or maybe just you and a copilot will have to handle the whole show.

Regardless of the size of your crew, you have certain duties and responsibilities as airplane commander. The first of these is to understand your crew, both as individuals and as members of the team flying your airplane.

Your copilot is your right arm, in a literal sense as well as a figurative one. Never forget that he is a trained rated pilot; treat him as one.

In normal flight, your copilot performs many necessary and important jobs for you, such as handling the checklist, operating controls at your command, watching the instruments, and making radio contacts.

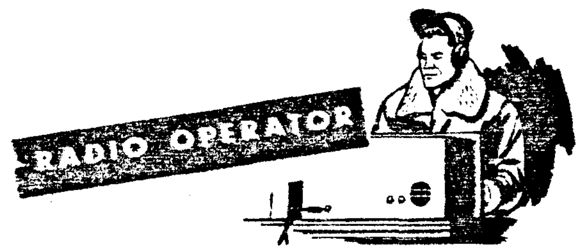
Under certain conditions you may have to call upon him to take over all the duties and responsibilities of first pilot and fly you, your crew, and your ship safely home. How well he performs those duties then will depend on how much training you have given him.

Ordinarily you do not have a navigator in your crew except on long-range flights. If you do have a navigator aboard, remember that he is a specialist. He has spent long months studying his job, just as you have yours. Navigating is his full-time business.

There are certain things you must do to help your navigator perform his work efficiently:

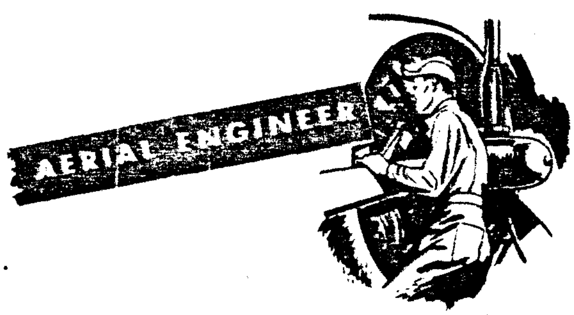
Work out your flight plan with your navigator—the altitudes and airspeeds at which you wish to fly, location of alternate airports, the weather, etc.

During flight, stick to your proposed course and airspeed as closely as possible. It is difficult for your navigator to make his computations unless you do. Notify him immediately of any changes you make. Call on him for position reports frequently, and get together with him if there is any doubt about your location.



There is a lot of radio equipment in your airplane. The one man who is supposed to know all about all of it is your radio operator. In addition to knowing how to operate radio equipment, he should be familiar with all codes that are used, and should be able to do in-flight maintenance and servicing of the equipment.

Like other members of your crew, your radio operator has had extensive training in his specialty. But the more practice he has in his various duties, the more dependable he becomes. See that he gets it.



Blessed is the pilot who has a good aerial engineer! Your engineer is the one man aboard who is supposed to know more about your airplane than you do.

Take a real interest in his work. You can find out a lot about your ship, and equally important, you build up his pride in his job.

Talk over the condition of your airplane with the engineer before takeoff; have him accompany you on your outside and inside inspections of the ship. He's the boy who knows the answers when the nuts and bolts start pulling out. Work with him.

Air Discipline

Regardless of how good a crew you have, getting your airplane to its destination safely is **your responsibility**. Without being dictatorial about it, make it clear that you are the boss . . . your word is final.

Train your crew in the principle that no man is to move any control that affects the operation of the airplane except at your command. **This is important.** A mad scramble in the cockpit during an emergency is disastrous.

Also insist that as soon as any crew member performs any duty which affects the operation of the airplane, he tell you about it. For example, when the radio operator lets out the trailing wire antenna, it is important that he report it to you. **Don't keep secrets from each other.**

Crew Training

As airplane commander, it is your responsibility to see that every man on your crew knows his duties and how to perform them. Brief them on your missions, their importance, and how each man's job fits into getting the airplane there and back. Develop teamwork.

In addition, see that the crew is trained in the proper procedures for bailout, ditching, fire-fighting, and any other emergencies that may be encountered. Work out a bailout plan and practice it on the ground until every man knows exactly what he is to do and is proficient in doing it. Conduct ditching drill in the same manner if you make over-water flights. Brief your crew on survival procedures.

See that every man understands the use of the oxygen equipment on your airplane.

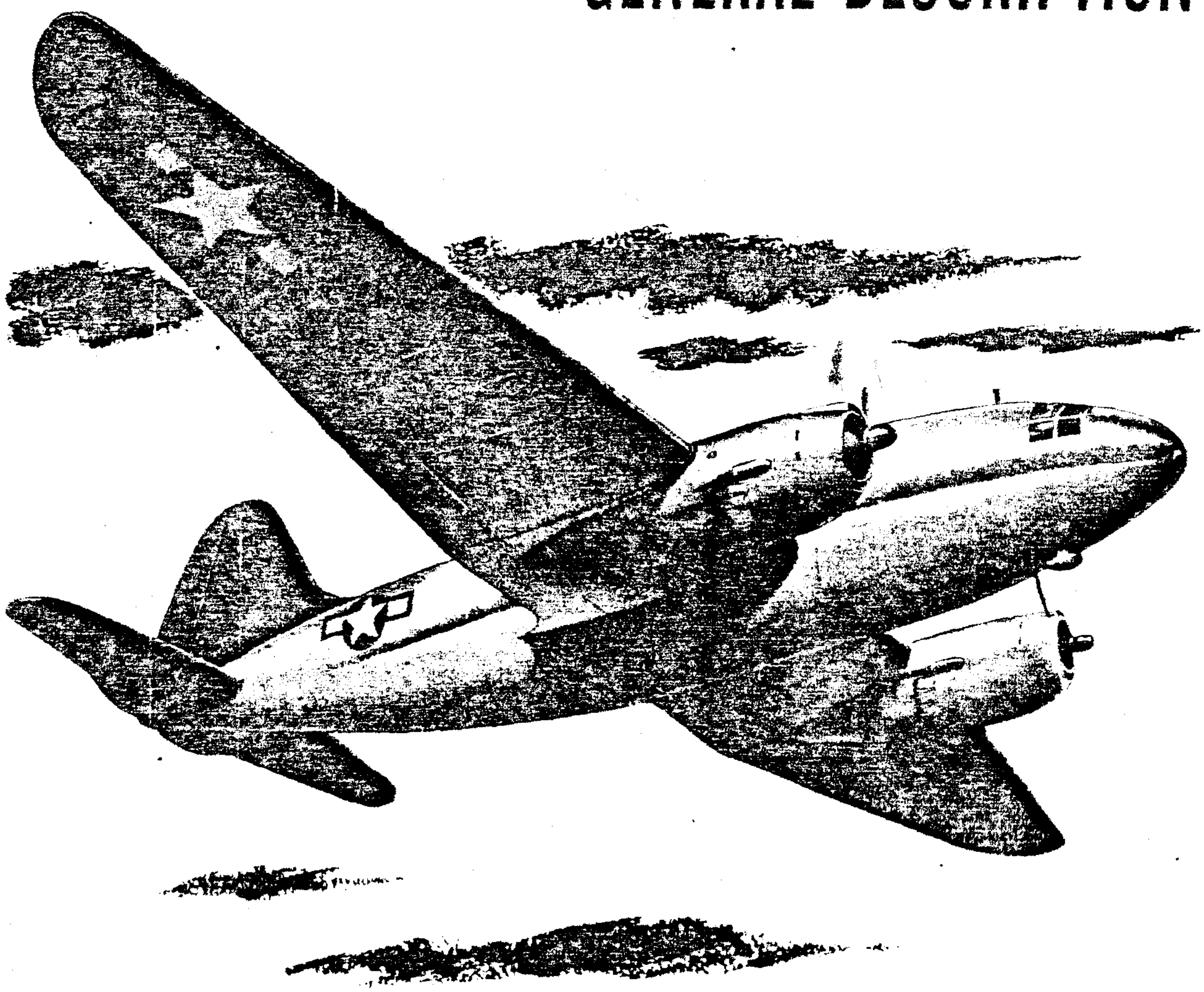
Other Responsibilities

Always make sure that your men have parachutes, proper clothing, and other equipment that they need before every flight. Sure, they're grown men and should look out for themselves —but it's still your responsibility to check.

Take care of the enlisted men in your crew when you are away from your base. See that they get a place to sleep and eat before you start worrying about your own comfort.

Always remember that once you leave the ground, you are commander-in-chief of your little unit of the army. You have the authority, and you have the responsibility and obligations.

GENERAL DESCRIPTION



The C-46 Commando is a cargo and transport airplane. Its principal use is to transport military equipment and supplies. It may also be used as a troop carrier, ambulance, or glider towplane. Manufactured by Curtiss-Wright Corporation, it is a low-mid-wing, all-metal land monoplane.

Fuselage

The fuselage is of conventional construction, except that the cross-section is in the shape of two intersecting circles which are divided by the floor of the main cargo compartment. This design provides two additional compartments in the belly of the plane, suitable for the stowage of small cargo. The total cargo capacity is 2640 cubic feet—greater than that of a standard 36-foot freight car.

Power Plant

The airplane has two 18-cylinder Pratt & Whitney Model R-2800-51 double-row, radial, air-cooled engines developing 2000 Hp each for takeoff. A 2-speed supercharger is built integrally into each engine with speed ratios of 7.60:1 and 9.89:1.

Propellers

Present production models have Curtiss electric controllable 4-bladed propellers. Earlier models have Hamilton hydromatic controllable, 3-bladed propellers. Both types of propellers have constant-speed and full-feathering features.

Landing Gear

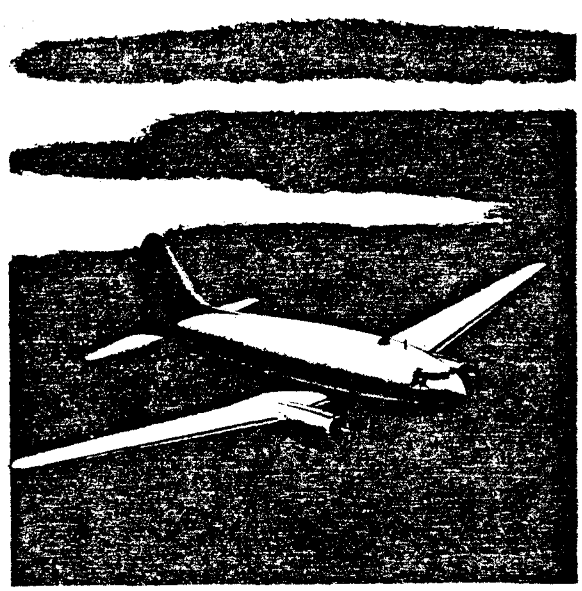
The landing gear is of conventional type, consisting of two main wheels and a tailwheel. The gear retracts hydraulically. The main wheels retract into the nacelles, the tailwheel into the fuselage. When retracted, the gear is completely enclosed by fairing doors.

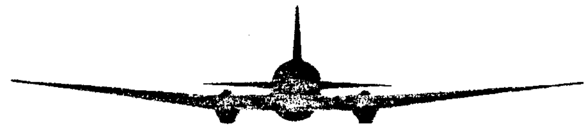
Flaps

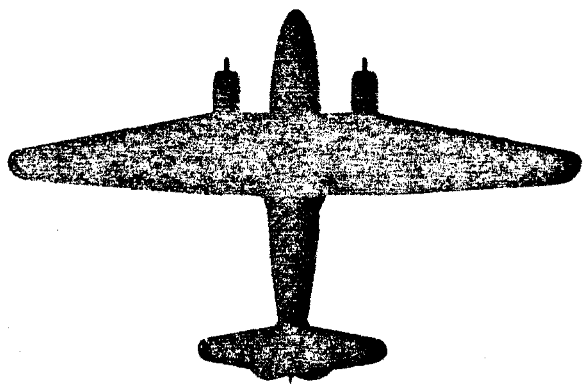
Rearward - moving, hydraulically - operated, slotted-type flaps are installed in each wing. These may be extended to any angle up to 35°

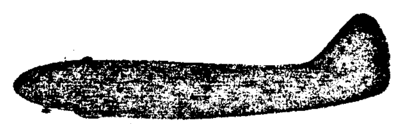
Surface Control System

The control systems are of the direct-connected cable type, with trim tabs on all control surfaces. A hydraulic booster system provides easy handling. Operating controls are conventional wheel, column, and rudder pedal type.









Fuel System

There is a separate fuel system for each engine, with a crossfeed between the two systems. There are three fuel tanks in each wing, with a total capacity of 1400 gallons. Provision is made for extra fuel tanks to be mounted in the fuselage for long-range flights.

Oil System

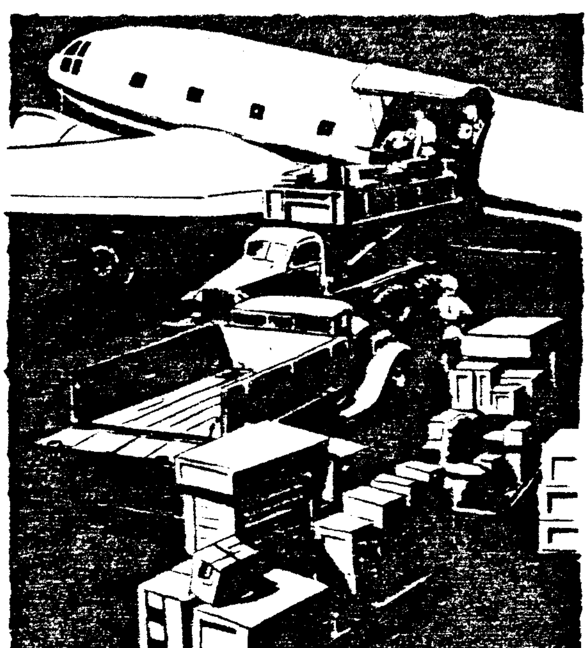
Each engine has a separate and complete oil system, with a hopper type tank holding 39.8 gallons.

Hydraulic Systems

There are two hydraulic systems in the plane, the main system and the booster system. These are connected by a cross-over valve.

The main system has a normal pressure of 1050 to 1350 pounds per square inch (psi), which is maintained by two engine-driven pumps. This system operates landing gear, brakes, cowl flaps, wing flaps and the automatic pilot.

The auxiliary system has a working pressure of 750 to 1050 psi, furnished by an auxiliary pump on the left engine. The auxiliary system operates the surface control boosters only.



Electrical System

The airplane has a 24-volt electrical system with two storage batteries and two 200-ampere generators, one on each engine.

Heating System

Three hot-air combustion type units, which take fuel from the main fuel system, heat the airplane. Normally one small unit heats the cockpit and two larger units heat the main cargo compartment.

Ice Elimination Systems

The following equipment provides protection against icing.

–Standard rubber de-icing boots–for the leading edges of wing and tail surfaces.

–Anti-icer fluid slinger rings for each propeller.

–Defroster vents, fluid spray, and mechanical wipers for the windshield.

–Fluid spray system and standard carburetor heat control for each carburetor.

–Fluid dispersing tubes on pitot masts to prevent ice accumulation.

–Electric pitot heaters.

Fire Extinguisher Equipment

A carbon dioxide (CO_2) fire extinguishing system is installed in each nacelle and is operated from the pilot's compartment. There is a hand type fire extinguisher in the cockpit, two in the main cargo compartment.

Operational Equipment

For loading and securing cargo, the airplane has the following equipment:

A 2-piece loading ramp.

Tie-down rings.

Tracks for engine dollies.

A task floor for heavy equipment.

Fittings for a hydraulic winch to be used in loading heavy cargo.

Fittings for carrying propellers under the fuselage of the airplane.

For troop carrier use, the airplane has collapsible bucket type seats along each side of the fuselage, accommodating 40 troops. Ten additional seats can be placed in the center.

There are provisions for the installation of 33 hospital litters.

Other Equipment

Standard radio equipment
Extra fuel and oil tanks
Life raft installation
Navigator's station
Oxygen equipment
Automatic pilot
Chemical toilet
Signal flares
Blind flying hood

C-46 DATA SHEET

Weight (Lbs.)

Normal gross	48,000
Emergency overload	50,000
Landing (maximum)	46,000
Basic (average)	32,400

NOTE: These weights are operating limits specified by Air Transport Command.

Dimensions

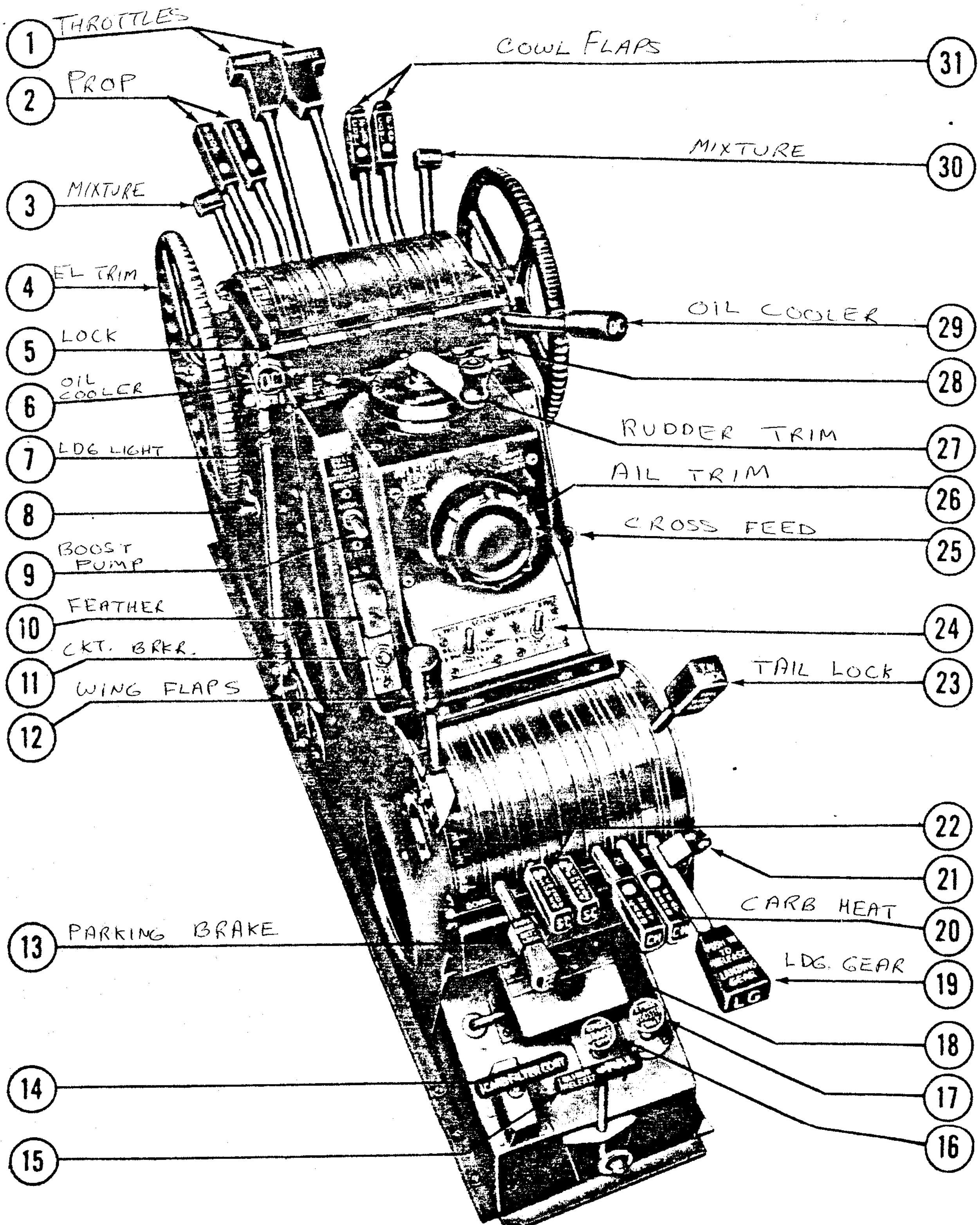
Length	76 feet, 4 inches
Span	108 feet
Height (in 3-point position)	21 feet, 9 inches
Wing area	1360 square feet
Landing gear tread	25 feet, 11 inches

Normal wingloading (48,000 lbs.)............35.29 lbs. per square foot

CAPACITY

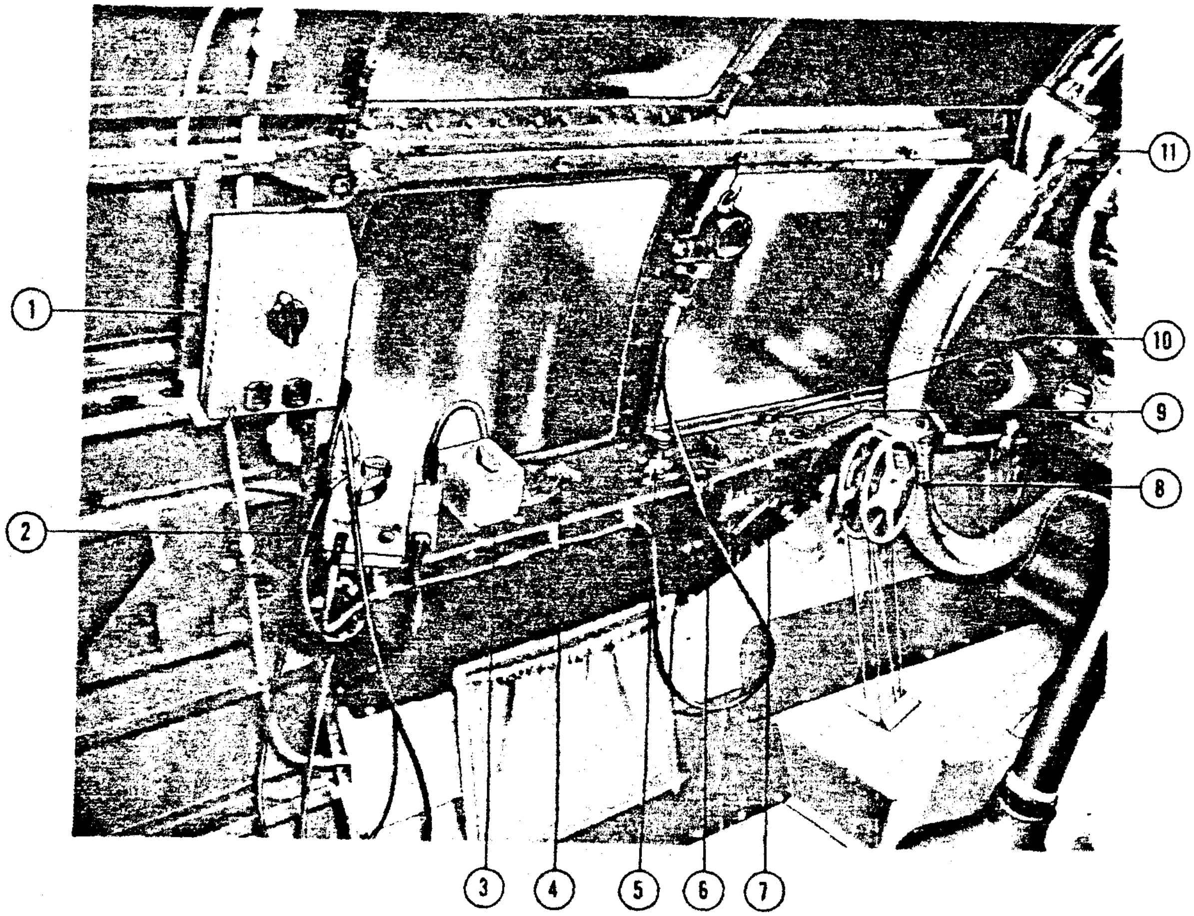
Total cargo capacity	2640 cubic feet
Main cargo compartment	2300 cubic feet
Lower forward compartment	133 cubic feet
Lower aft compartment	207 cubic feet

Normal fuel capacity	1400 gallons
Maximum fuel capacity (with 16 long-range cabin tanks)	3000 gallons
Normal oil capacity	80 gallons
Long-range oil capacity	120 gallons


1 THROTTLES
2 PROP
3 MIXTURE
4 EL TRIM
5 LOCK
6 OIL COOLER
7 LDG LIGHT
8
9 BOOST PUMP
10 FEATHER
11 CKT. BRKR.
12 WING FLAPS
13 PARKING BRAKE
14
15
31 COWL FLAPS
30 MIXTURE
29 OIL COOLER
28
27 RUDDER TRIM
26 AIL TRIM
25 CROSS FEED
24
23 TAIL LOCK
22
21
20 CARB HEAT
19 LDG. GEAR
18
17
16

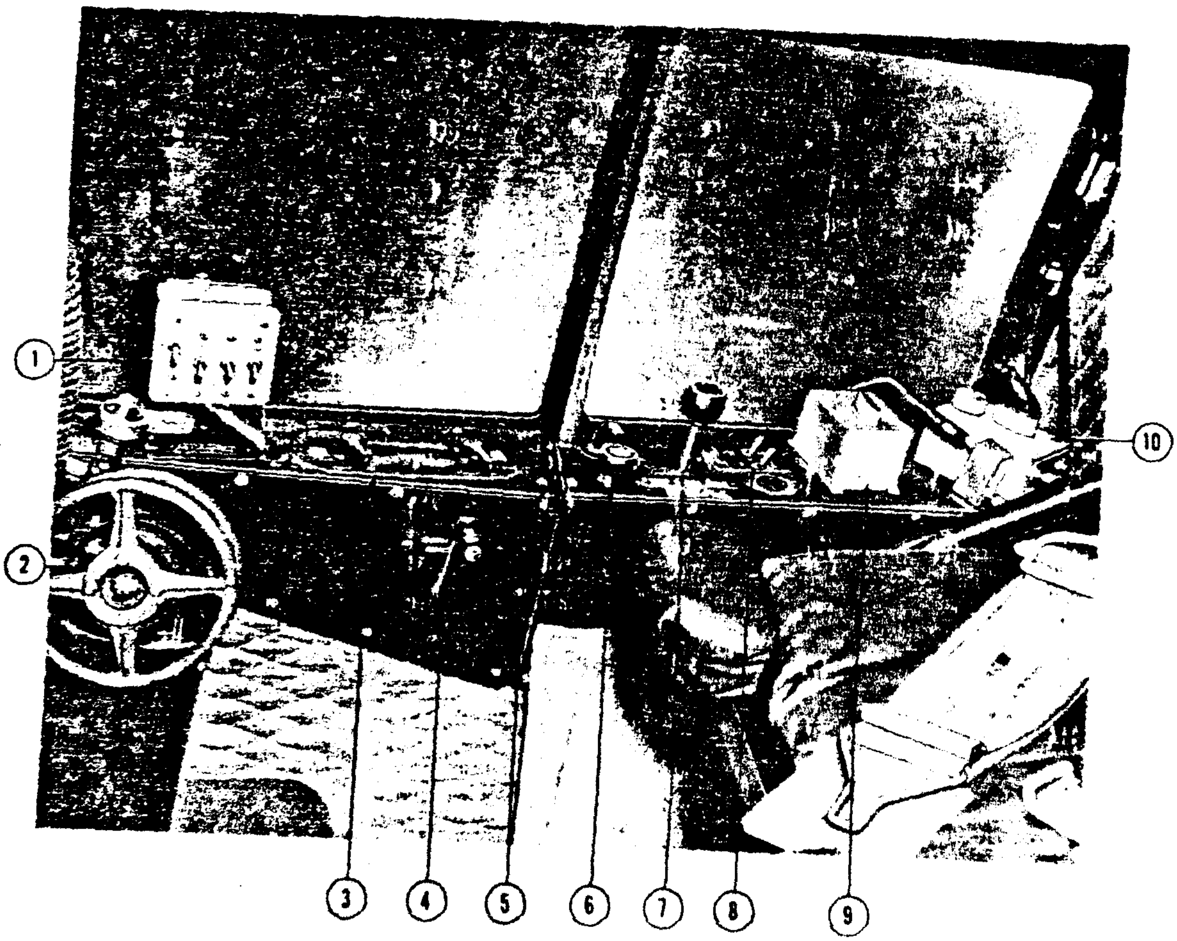
CONTROL PEDESTAL

1. Throttles
2. Propeller governor controls
3. Left mixture control
4. Elevator trim tab control
5. Friction adjustments
6. Left oil cooler shutter control
7. Left landing light switch
8. Control booster shutoff
9. Left sump pump HI-LOW switch
10. Left propeller feather switch
11. Left propeller circuit breaker
12. Wing flap control
13. Parking brake
14. Carburetor filter control
15. Glider release
16. Emergency brake control
17. Booster cross-over control
18. Detonator buttons
19. Landing gear selector valve handle
20. Carburetor heat controls
21. Landing gear handle latch
22. Supercharger controls
23. Tailwheel lock handle
24. Propeller selector switches
25. Fuel crossfeed control
26. Aileron trim tab control
27. Rudder trim tab control
28. Right landing light switch
29. Right oil cooler shutter control
30. Right mixture control
31. Cowl flap controls



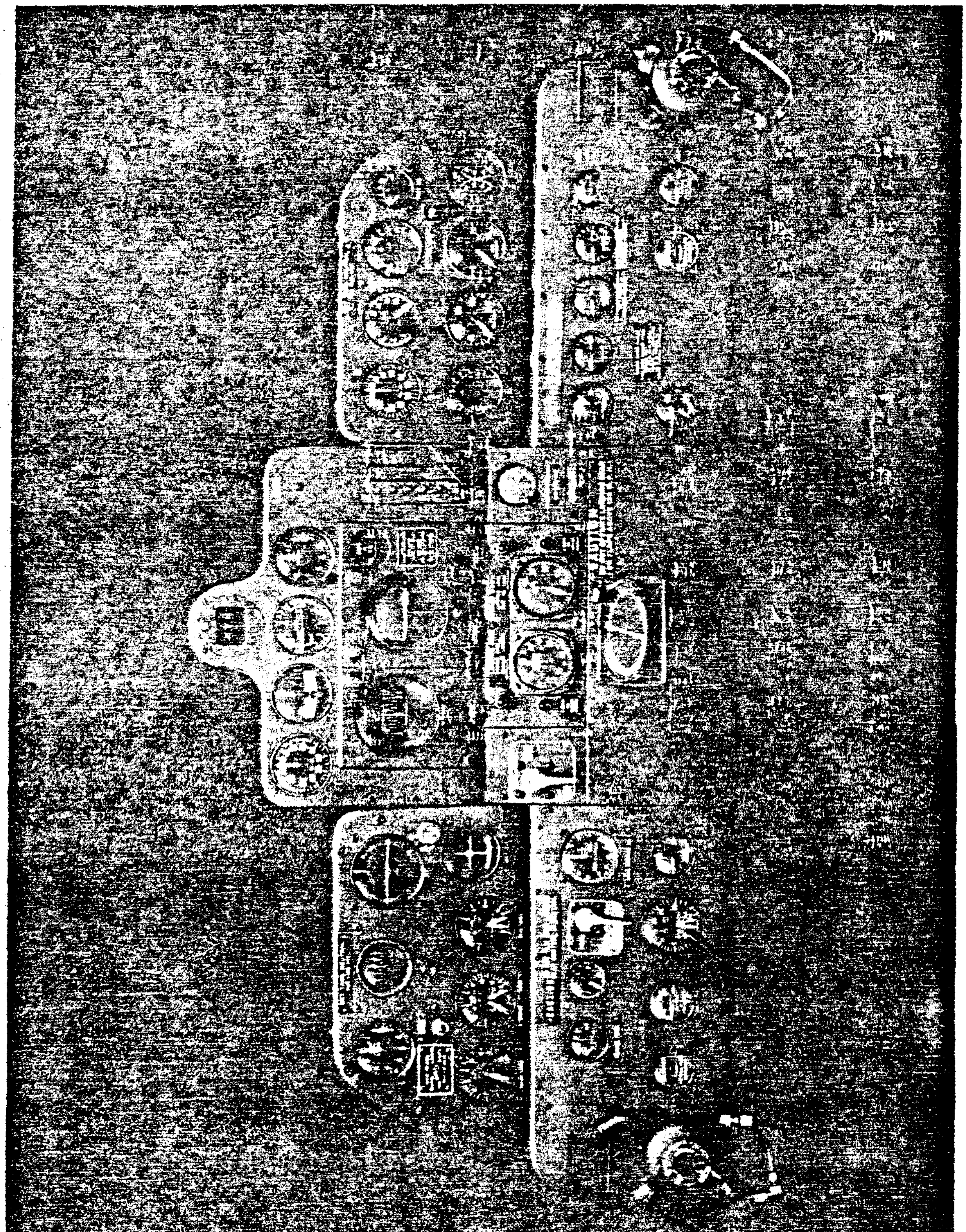
COCKPIT — LEFT SIDE

1. Heated suit control box
2. Jack box
3. Radio filter box
4. Pitot anti-icer shutoff valves
5. Heater air intake valve
6. Ultra-violet light control
7. Pilot's rudder pedal adjustment
8. Fuel tank selector
9. Signal light receptacle
10. Windshield wiper control valve
11. Defroster

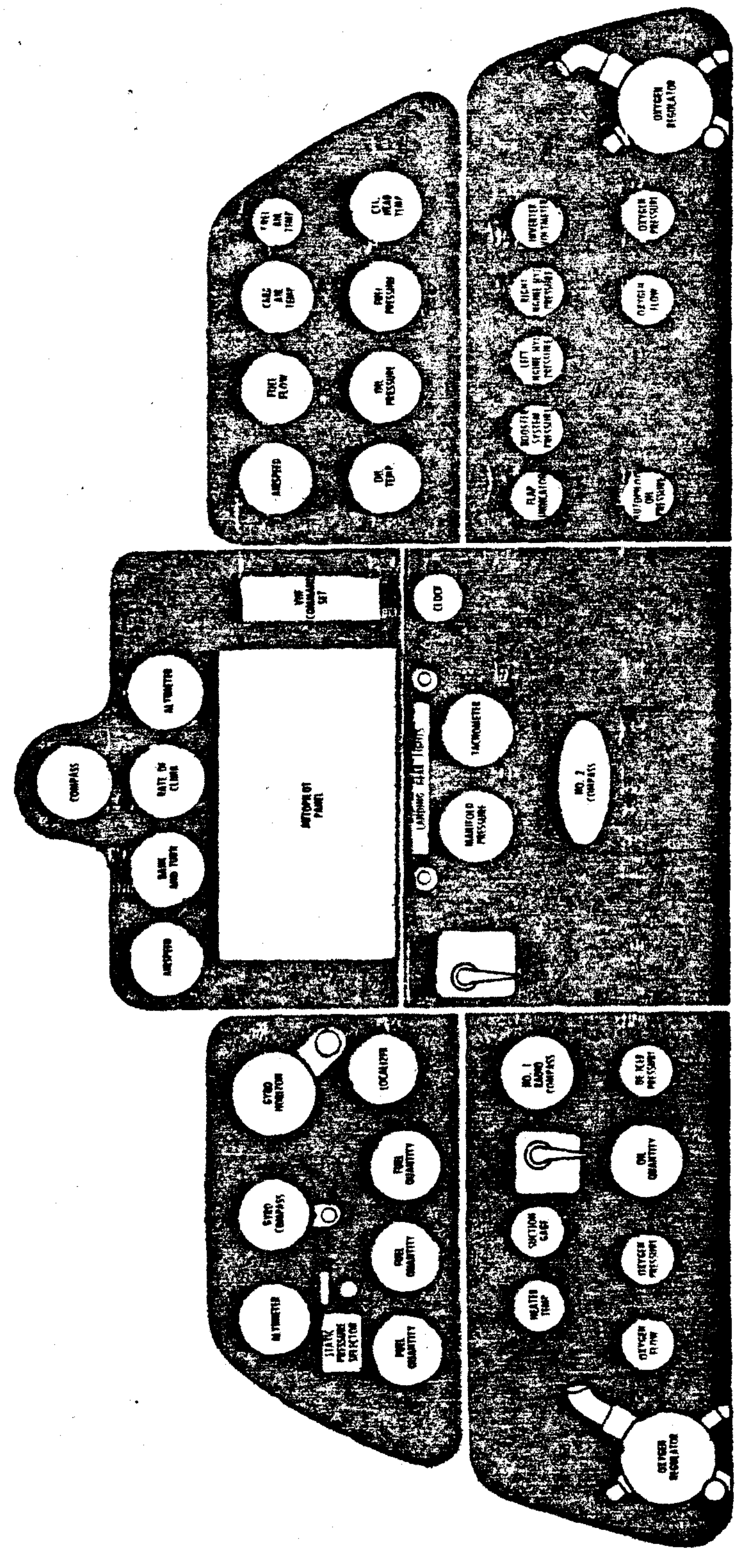


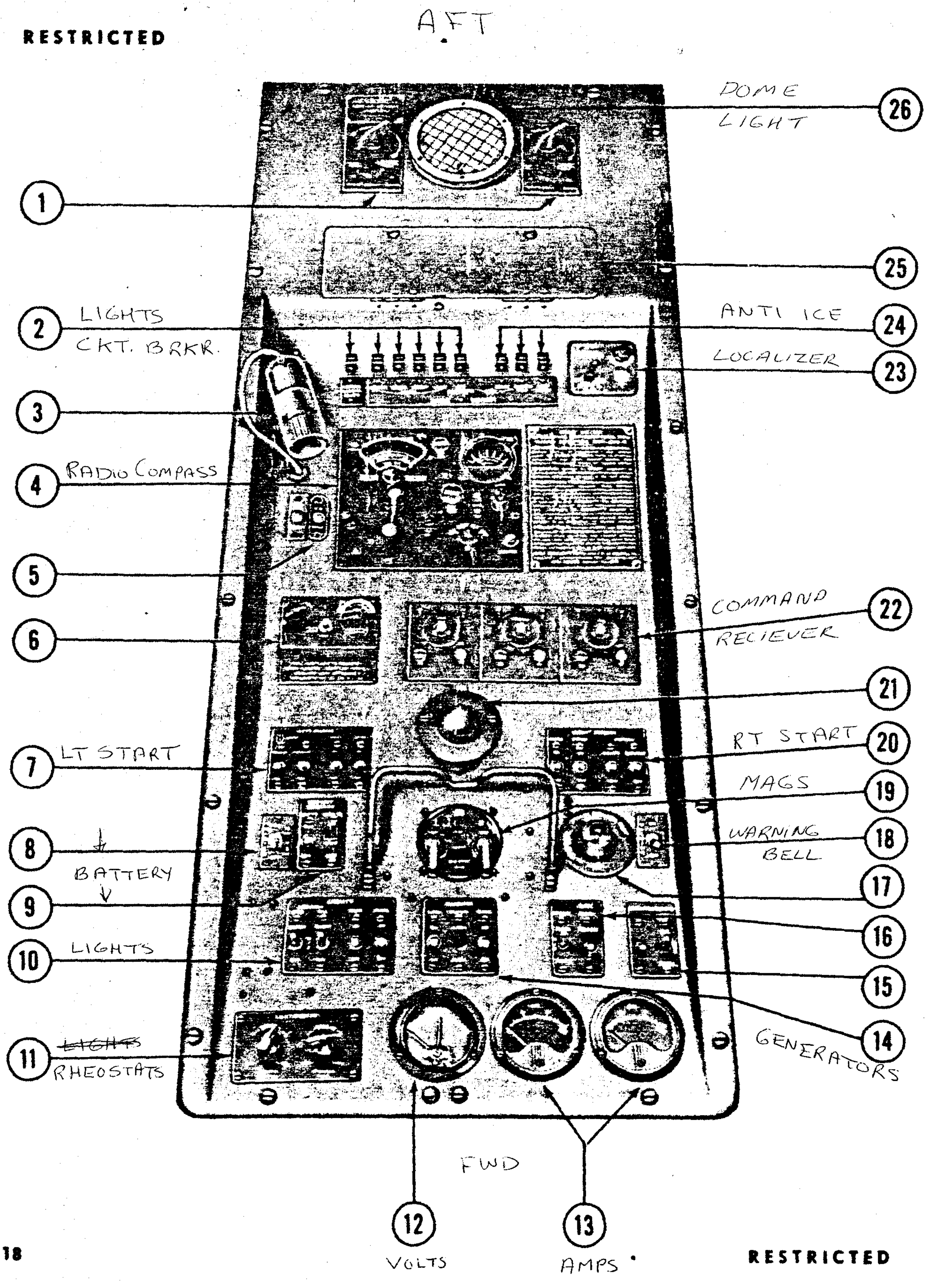
COCKPIT—RIGHT SIDE

1. Recognition light switch
2. Fuel tank selector
3. Pitot blowout valves
4. Copilot's rudder pedal adjustment
5. Ultra-violet light control
6. Pitot blowout pump
7. Main accumulator shutoff
8. Pitot heater switches
9. Radio filter box
10. Jack box



INSTRUMENT PANEL




AFT
DOME LIGHT
26
1
25
LIGHTS CKT. BRKR.
2
ANTI ICE
24
LOCALIZER
23
3
RADIO COMPASS
4
5
COMMAND RECIEVER
22
6
21
LT START
7
RT START
20
MAGS
19
8
WARNING BELL
18
BATTERY
9
17
16
LIGHTS
10
15
14
GENERATORS
~~LIGHTS~~
RHEOSTATS
11
FWD
12
VOLTS
13
AMPS

OVERHEAD PANEL

1. Sump pump controls
2. Lighting system circuit breakers
3. Spotlight
4. Radio compass control box
5. Compass CW-VOICE switch
6. Command transmitter control box
7. Left engine starter panel
8. Battery master switch (optional)
9. Battery selector switches
10. Light switches
11. Compass and overhead light rheostats
12. Voltmeter
13. Ammeters
14. Generator switches
15. Anti-icer pump switches
16. Inverter and horn release switches
17. Propeller anti-icer pump rheostat
18. Warning bell switch
19. Ignition switches
20. Right engine starter panel
21. Panel light
22. Command receiver control box
23. Localizer control box
24. Anti-icer circuit breakers
25. Fuses and spares
26. Dome light

INSPECTIONS AND CHECKS

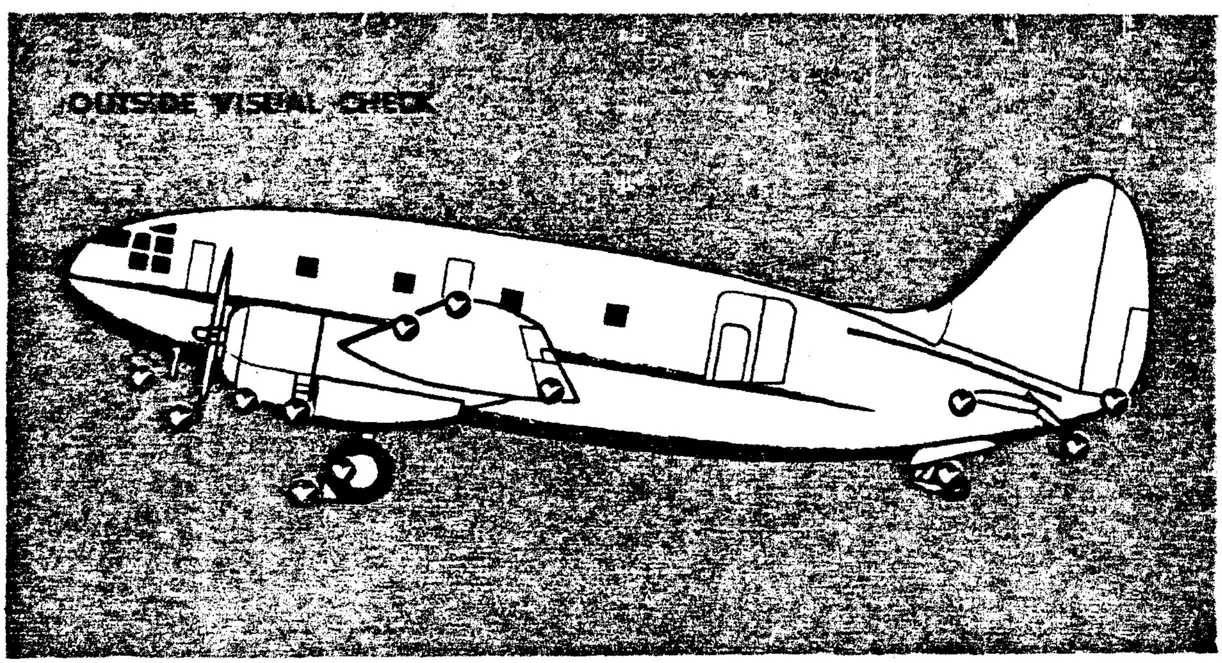
It takes many thousands of man-hours to build a C-46. You can reduce it to a pile of junk in 3 seconds. That 3 seconds may conceivably be 3 seconds you "saved" by skipping some little detail in inspecting and checking your plane before takeoff.

As aircraft get bigger and more complicated, the need for thorough inspections before every flight becomes more important. Probably your plane gets such inspections, for our ground crews are the best in the world. But ground crews are human. They make mistakes, they forget, they overlook things, like everyone else.

So there's only one way to be certain that your plane is in good condition and ready to fly. That's to check it yourself, personally, every time you take it up.

No one expects you to make a 50-hour inspection of your plane before each flight. But there are certain important things, obvious things, that you must check if you want to be sure of flying home.

Your aerial engineer probably has forgotten more about the insides of your airplane than you'll ever know. Get in the habit of talking to him about your ship's condition every time you



go out to take it up. Have him accompany you on your inspection tour of the outside and inside of the plane, so that he can investigate anything that looks doubtful, fix anything that needs fixing.

A thorough inspection of your plane needn't take long, if you adopt a standardized procedure and stick to it. Start at the same place every time, and work around in the same way. Once you have developed the habit of a systematic procedure you'll find that you can make the whole inspection in just a few minutes.

Outside Visual Inspection

Start from the cargo door on the left side of the airplane and move forward to the left wingtip.

Wingtip and leading edge—Check for damage. Someone may have bent a wingtip in parking or taxiing your plane the night before.

De-icer boots—Check general condition.

Flaps—Up.

Pitot covers—Removed.

Propeller—Look for nicks and excessive oil. Ask engineer if props have been pulled through.

Now move in under the left nacelle:

Look up through the landing gear doors. Any fluid dripping? Any frayed cables? Any loose lines? Any leaks in the accessory section?

Fire extinguisher seal—Red disc intact.

Cowling—Buttoned down.

Oleo strut—Inflated to 2½-3½ inches.

Tires—Any cuts? Normal inflation? Any signs of slippage?

Wheel chocks—In place.

Cross under the ship and repeat this inspection on the right wing and nacelle.

As you start back toward the tail, check the lower cargo compartments. Doors and inspection panels secure? Any fluid leaking?

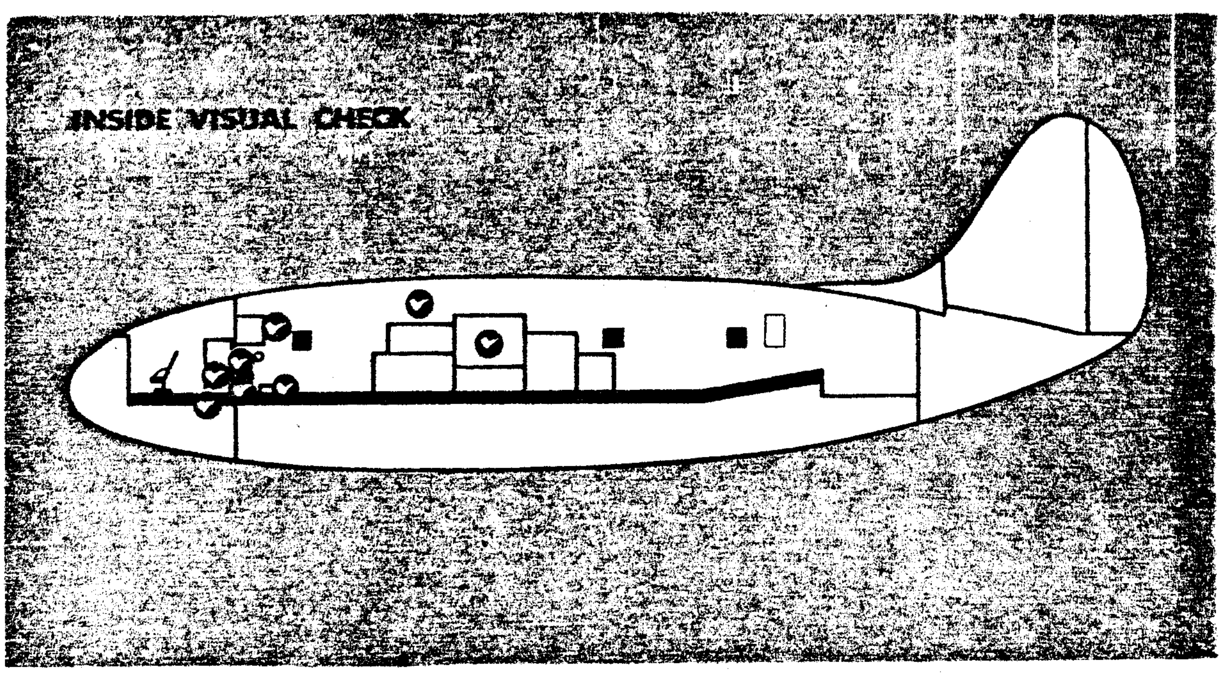
Now for the tail section:

Control locks—Removed from rudder and elevator.

De-icer boots—Check for cuts and general condition.

Elevators—Check both sections to make sure that the torque tube connecting them has not sprung and they are not out of line. Note setting of trim tabs.

Tailwheel tire—Check for cuts. A semi-deflated condition is normal for this tire.



Inside Visual Inspection

Loading—Proper loading is one of the most important things to check in all cargo airplanes.

Has the cargo been checked on the load adjuster for proper balance?

Does the distribution of cargo in the plane agree with its description on Form F?

Is the cargo tied down securely so that it cannot shift on takeoff or in flight?

Checking the loading is your responsibility. You may delegate it to a reliable copilot, aerial engineer, or crew chief, but make sure it has been checked.

Fuel crossfeed valve—This valve is on the left ceiling of the cabin amidship on most C-46's, on the pedestal on some models. See that it is OFF and safetied.

Forms 1 and 1A—Read carefully to check the status of the airplane if on a red diagonal.

Hydraulic reservoirs—Main reservoir is near the cockpit door. Check the level on the glass gage. Remove the booster system reservoir cap and see if the fluid level reaches the bottom of the screen. See that there are spare cans of fluid aboard.

Hydraulic shut-off valve—ON.

Anti-icer fluid—Tank full and spare cans aboard.

Emergency landing gear crank—In place under the cockpit hatch.

Hand hydraulic pump handle—Stowed under the liaison transmitter.

Emergency dump valve—down.

Ask the engineer these final questions:

1. Fuel tank caps secure, and fuel quantity checked visually? Don't trust the gages.
2. Grade 91 fuel in any tanks?
3. Oil tanks serviced?
4. All hatches secured?
5. Passengers and parachutes aboard and safety belts in place.
6. Load secure?
7. Any other defects in the condition of the airplane?

Now you are ready to take your seat in the cockpit.

Adjust your seat to permit full rudder control and best vision without discomfort. Check seat locking mechanism. Rock the seat back and forth and sideways vigorously to make sure that it is securely locked.

Adjust rudder pedals.

USE OF CHECKLISTS

There is a checklist in the cockpit of every C-46 airplane. AAF Regulations require that you use it on every flight.

Common sense, too, requires that you use this checklist. There are too many instruments and controls to check, too many operations to perform in an airplane the size of the C-46 for you to trust your memory. And the possible consequences of omitting one single item are too dangerous to risk.

How to Use

Use the checklist in the following manner:

The copilot holds the checklist in his hand and reads out the question portion of each item. The pilot (or copilot, on items he checks) checks or operates the instrument or control and calls out its status. For example:

Copilot: "Trim tabs?"
Pilot: "Neutral!"
Copilot: "Controls?"
Pilot: "Free!"
Copilot: "Mixtures?"
Pilot: "Auto Rich!"

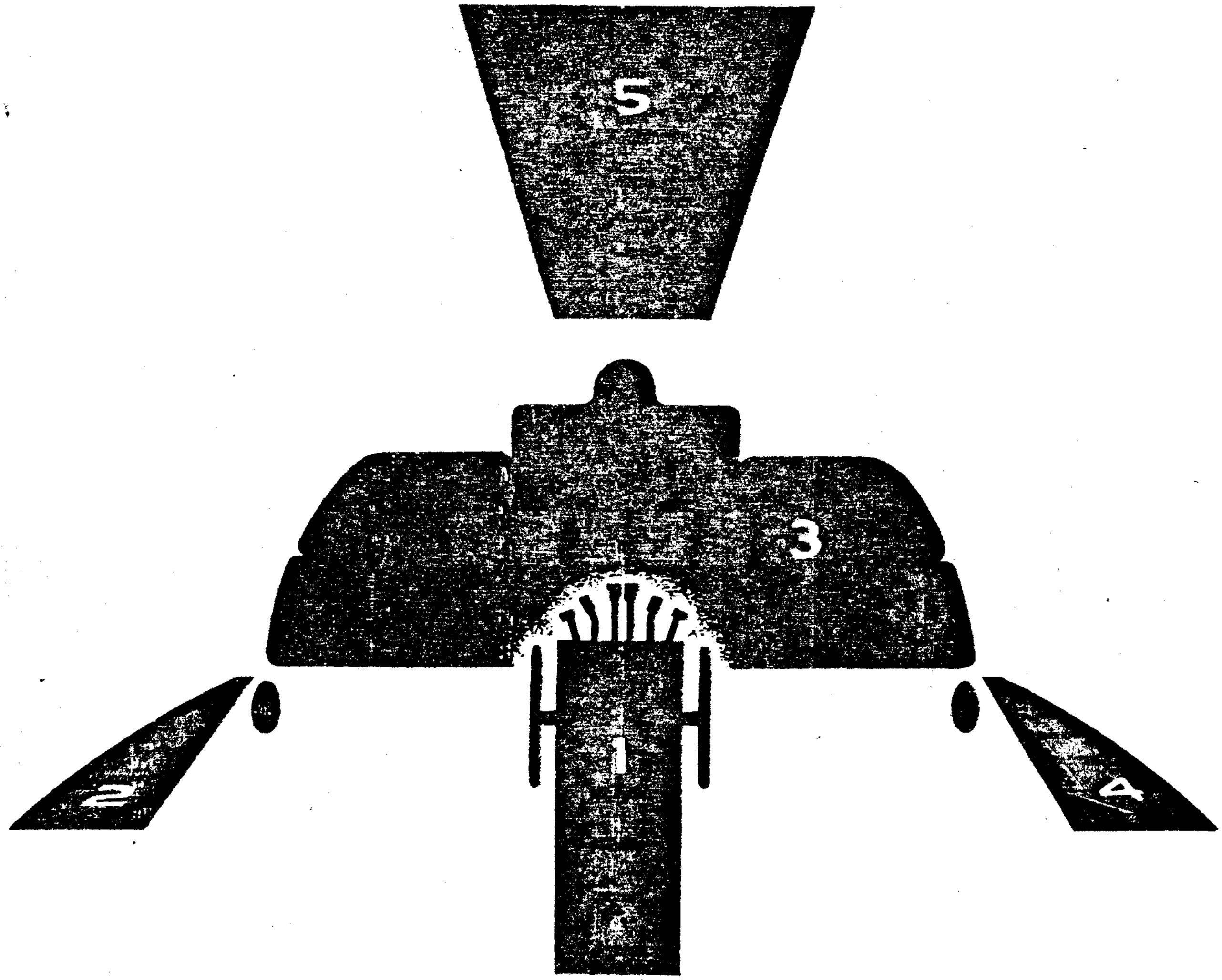
You probably will have most of the checklist memorized after using it a few times. But you always run the risk of omitting some important check or operation when you trust your memory entirely and don't use the printed checklist.

Directional Type Checklist

The before-starting checklist is a directional type one. In using it you follow a definite path around the cockpit:

1. From bottom to top of pedestal.
2. From rear to front of pilot's windowsill.
3. From left to right across the instrument panel.
4. From front to rear of copilot's windowsill.
5. From front to rear of overhead panel.

This checklist eliminates hopping around and makes checking quicker and easier. It also reduces the possibility of skipping items.



C-46 CHECKLIST

BEFORE STARTING ENGINES

Start from the bottom of the pedestal:
Cross-over valve–Down
Emergency brake valve–Down
Glider release–Down
Carburetor filter doors–Down

Parking brake–ON
Superchargers–LOW blower
Carburetor heat–COLD
Landing gear handle–DOWN and latched

Wing flaps–UP
Tailwheel–LOCKED

Prop selector switches–AUTO
Circuit breakers–In
Feather switches–NORMAL

Aileron tabs, Rudder tabs, Elevator tabs – Free and neutral
Control booster shut-off–ON

Oil cooler shutters—CLOSED
Mixture controls—IDLE CUT-OFF
Prop governors—Full forward (high rpm)
Throttles—Cracked (¼ open)
Cowl flaps—OPEN

Now on the pilot's windowsill:
Pitot anti-icer valves—OFF
Nose valve—As desired
Fuel selector valves—Tanks desired

On the instrument panel:
Airspeed selector valve—AIRSPEED TUBE
Autopilot bleed—NORMAL
Autopilot shut-off—OFF

On the copilot's windowsill: (To be checked by copilot)
Pitot blowout valves—INSTRUMENTS
Accumulator shut-off valve—Down
Pitot heat switches—OFF

On the overhead panel:
Light switches—OFF
Anti-icer switches—OFF
Radios—OFF
Circuit breakers—OFF
Heaters—OFF

STARTING ENGINES

Start putt-putt } (Unless battery cart is
Battery switches—ON } used)
Master and ignition switches—ON
Inverter—ON (Check spare)
Generators—ON
Gas gages—Check quantity
Booster (or sump) pumps—ON
Fire guard posted
Call "Clear" to ground crew

Energize starter 15 to 18 seconds, and engage with both switches.

AFTER ENGINES ARE RUNNING

Booster pumps—OFF
Battery switches—ON (Battery cart out)
Putt-putt—Off
Lights—As desired

BEFORE TAXIING

Flight engineer's report—Crew aboard, hatches and doors secured, ladder in.
Hydraulic pressures:
 Booster system—750-1050 psi
 Main system—1050-1350 psi
Radios—ON
Altimeter—Set
Clock—Set
Gyros—Set
Flight controls—Free
Chocks—Removed
Permission from tower to move

Parking brake—OFF
Tailwheel—UNLOCKED
"All Clear" from alert crew

ENGINE RUN-UP

Parking brake—ON
Tailwheel—LOCKED (If straight)
Fuel booster pumps—OFF
Oil cooler shutters—As desired
Mixtures—AUTO RICH
Cowl flaps—OPEN
Fuel selector valves—Takeoff tanks

Check:
Engine gages for proper readings
Superchargers, then return to LOW
Carburetor heat, then return to COLD
Generators
Manual prop controls
Prop governors
Magnetos
Pitot heaters
Suction gage

BEFORE TAKEOFF

Prop selector switches—AUTO
Circuit breakers—In
Booster pumps—ON
Trim tabs—Neutral
Control boost—ON

Mixtures—AUTO RICH
Prop controls—Full forward (high rpm)
Cowl flaps—Trail
Fuel selector valves—Takeoff tanks
Gyro instruments—Set and uncaged
Engine instruments—Normal readings

When lined up:
Friction locks—Tightened
Tailwheel—LOCKED
Flight controls—Free

AFTER TAKEOFF

Gear—UP
Brakes—ON
Power reductions:
    Intermediate—41" Hg. and 2400 rpm
    Climb—35" Hg. and 2300 rpm
Airspeed 120 to 140 mph
Booster pumps—OFF (at safe altitude)

CRUISING

Power—Reduced to cruise setting
Mixtures—AUTO LEAN } When cylinder-head
Cowl flaps—CLOSED } temperatures are below 200°C.
Tanks—Use front tanks for 30 minutes

BEFORE LANDING

Prop governors—2300 rpm
Slow plane to 150 mph
Gear—DOWN
Mixtures—AUTO RICH
Fuel selector valves—Proper tanks
Booster pumps—ON
Gear checked down:
    Visually
    Light—Green (or Selsyn—DOWN)

Copilot checks:
Parking brake—OFF
Superchargers—LOW
Carburetor heat—COLD
Tailwheel—LOCKED
Propeller switches—AUTO
Circuit breakers—In
Autopilot—OFF
Wing de-icers—OFF
Heaters—OFF
Brake pressure—1050 to 1350 psi

AFTER LANDING

Flaps—UP
Cowl flaps—OPEN
Props—Full forward (high rpm)
Booster pumps—OFF
Trim tabs—Neutral
Tailwheel—UNLOCKED (Not above 10 mph)

STOPPING ENGINES

Clear blower clutches
Mixtures—IDLE CUT-OFF
Throttles—Full OPEN
All switches—OFF
Wheel chocks in place
Brakes—OFF (if hot)
Fuel selector valves—OFF

BEFORE LEAVING AIRPLANE

Tailwheel—LOCKED
Control locks installed
Windows and hatches closed
Forms 1 & 1A completed

BEFORE RE-TAKEOFF

Parking brake—ON
Flaps—UP
Prop switches—AUTO
Circuit breakers—In
Trim tabs—Neutral
Props—Full forward (high rpm)
Mixtures—AUTO RICH
Fuel selector valves—Takeoff tanks

Run up engines and check:
    Magnetos
    Prop controls
    Generators
Booster pumps—ON
Cowl flaps—Trail
Friction locks—Tightened
Tailwheel—LOCKED
Flight controls—Free

Techniques

STARTING ENGINES

Before cranking 'er up, perform your before-starting check. This check covers almost every control and instrument in the cockpit. It must be complete and detailed, because you have no other way of knowing in what position some pilot left the various controls after the previous flight.

Following the before-starting checklist protects you from the results of someone else's carelessness.

Auxiliary Power for Starting

Always use auxiliary power for starting the engines. Using the plane's batteries drains them excessively and can cause loss of propeller governor control for takeoff.

Use the auxiliary power unit (the putt-putt). If it is inoperative, use a 135-ampere battery cart.

Note: If battery cart is used, turn the ship's batteries OFF.

Procedure for Starting

Make sure the fire guard is posted before starting the engines.

1. Master and ignition switches—ON.
2. Battery switches—ON (unless battery cart is used).
3. Generators—ON.
4. Inverter—ON (check spare).
5. Gas gages—FULL.
6. Booster pumps ON. On late-model planes there are no standard booster pumps. Turn on the sump pump switches on the overhead panel, and adjust the rheostats or 2-position switch to deliver 17 psi pressure.
7. Call "Clear" to ground crew.
8. Energize the starter for 15 to 20 seconds.
9. Engage starter, holding in both switches, and prime if necessary. Do not overprime. If engine is warm, or if outside temperature is over 60°F, priming is usually not necessary.

If the engine does not start within 30 seconds, release the switches and allow the starter to cool for 2 minutes. Overheating may burn out the starter.

10. As soon as the engine starts, place mixture control in AUTO RICH. If engine does

not continue firing, return immediately to IDLE CUT-OFF and resume engaging.

11. Idle at 800 to 1000 rpm.

12. Watch the oil pressure gage. If pressure does not register within 30 seconds, shut off the engine and investigate.

After engines are running:

1. Booster pumps—OFF.
2. Battery switches—ON (battery cart out).
3. Putt-putt (if used)—Off.

When Engine Won't Start

If the engine does not start readily, move the mixture control from IDLE CUT-OFF to AUTO RICH for **not longer than 3 seconds** and then return. This forces raw gas into the blower, where it is vaporized by rotation of the impeller and serves as additional prime.

Caution: Do not leave in AUTO RICH longer than 3 seconds or you flood the blower section and overprime the cylinders.

When Engine Is Flooded

To clear out a flooded engine, open the throttle wide, with mixture control in IDLE CUT-OFF, and continue turning over the engine with the starter.

TAXIING

Nothing can make a pilot feel so foolish and look so ridiculous as banging up a big, expensive airplane in a taxiing accident.

There is only one reason for taxi accidents: carelessness. Yet the figures show that taxiing accidents and mishaps represent a large proportion of the cost of repairs and maintenance on our aircraft. **So learn the right way to taxi.**

You will find that, in general, taxiing technique for the C-46 differs little from that of other large multi-engine aircraft you have been handling. This plane is big and it's heavy—bigger than some 4-engine ships. Respect its size, and you'll have a minimum of trouble handling it on the ground.

Controls for Taxiing

Like most other heavy aircraft, the C-46 gives little or no response to rudder or aileron action in taxiing. The principal controls are: engines, brakes, and tailwheel.

Use throttles for directional control whenever possible. However, anyone who tries to use only power and no brakes on a C-46 under all conditions is headed for trouble.

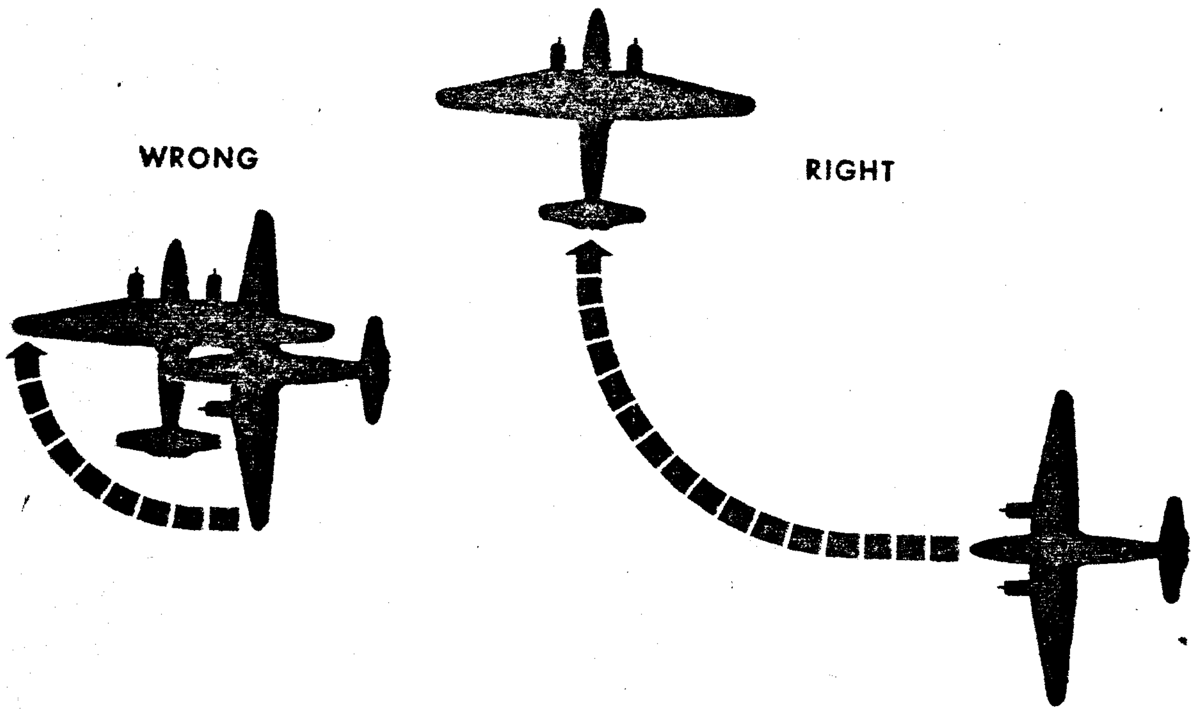
In case of engine fire during starting:

1. Place mixture control in IDLE CUT-OFF.
2. Open throttle wide and keep engine turning. The fire may be sucked through the engine and extinguished.

If fire persists:

1. Pull the handle of the built-in CO_2 extinguisher system for that engine.
2. Turn booster pump OFF.
3. Turn fuel selector valve OFF.
4. Push throttle wide open.

Do not attempt to re-start an engine after using the nacelle fire extinguisher. Another fire may start and you have no way of putting it out.



Turns

Never start a turn from a parked or stopped position. Let the airplane roll a few feet forward first. Pivoting on one wheel wears out the tire and puts a severe strain on the entire landing gear.

For the same reason, don't make your turns too short. Make slow, easy turns with both wheels moving throughout the turn.

Start turns by leading with one throttle well before you reach the turning point. Remember, it takes time for the engine to bring the ship into the turn.

In the same manner, anticipate with the other throttle well before the turn is completed so that you can straighten out with a minimum use of brakes. Use your brakes when necessary, but use them sparingly.

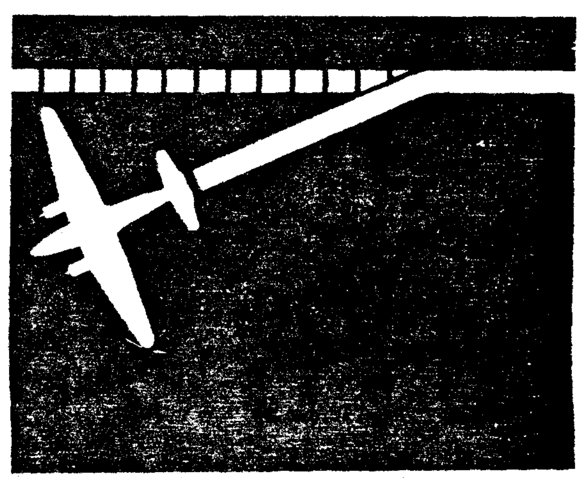
Guard against leap-frogging your throttles. Return the inside throttle to the closed position so that you can make the turn with the least power possible.

Do not ram throttles forward suddenly. Large engines are not built to take sudden applications of power.

Use of Brakes

Keep your feet on the rudder pedals with toes in position to apply brakes. If desired, have your copilot keep his feet on the bottom of the pedals to hold the rudder neutral.

To slow or stop the airplane, apply pressure on each brake gently, to feel out the braking action. Never slam on the brakes on a C-46. The airplane usually swerves to one side or the



other, and in congested areas you may get a wingtip before you can regain control.

Intermittent use of the brakes usually gives adequate braking action with the least amount of wear.

Caution: Abrupt use of brakes at low speeds can cause the airplane to nose over.

The brakes on the C-46 overheat quickly. Use them sparingly and use them gently, or you may find that you have no brakes when you need them most.

Use of Tailwheel Lock

The tailwheel lock is a most important aid to taxiing the C-46. The locked tailwheel helps keep the plane straight, reducing the use of brakes for directional control. Locking the tailwheel is a must in crosswind taxiing.

Have your copilot keep his hand on the tailwheel lock handle at all times during taxiing, ready to lock or unlock it at your command.

Let the airplane roll straight forward for a few feet before locking the tailwheel. This prevents damage to the locking mechanism.

Before beginning a turn, unlock the tailwheel. Starting the turn with the tailwheel locked causes the lock pin to jam and may shear the pin, making the plane unflyable.

Speed of Taxiing

Fast taxiing is the cause of most taxi accidents. **Keep your speed down.** A heavy airplane like the C-46 builds up a lot of momentum, even at low speeds. Excessive speed is not only dangerous, but necessitates continuous use of brakes.

Minimum Engine Speed

Be careful about idling engines below 800 rpm, or you may foul the sparkplugs. This is true regardless of the grade of fuel used.

This does not mean that you cannot pull a throttle all the way back on turns, or in slowing down the airplane. With an occasional runup for cleaning out, it is safe to idle at 400-500 rpm for periods up to 2 or 3 minutes.

In downwind or downhill taxiing, when you must keep power at a minimum to prevent excessive speed, clean out the engines occasionally.

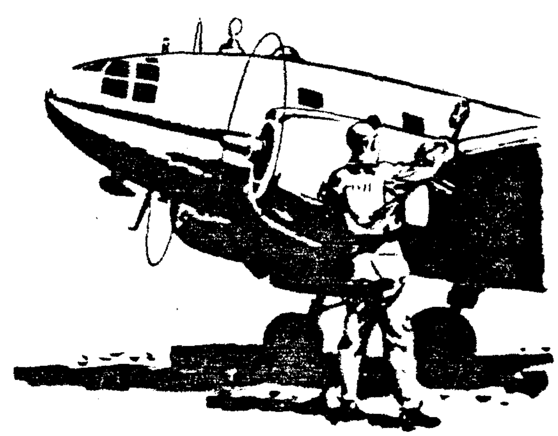
In Congested Areas

Remember that the C-46 has a wingspread of 108 feet. When taxiing close to other aircraft or obstructions, it is difficult to estimate your clearance.

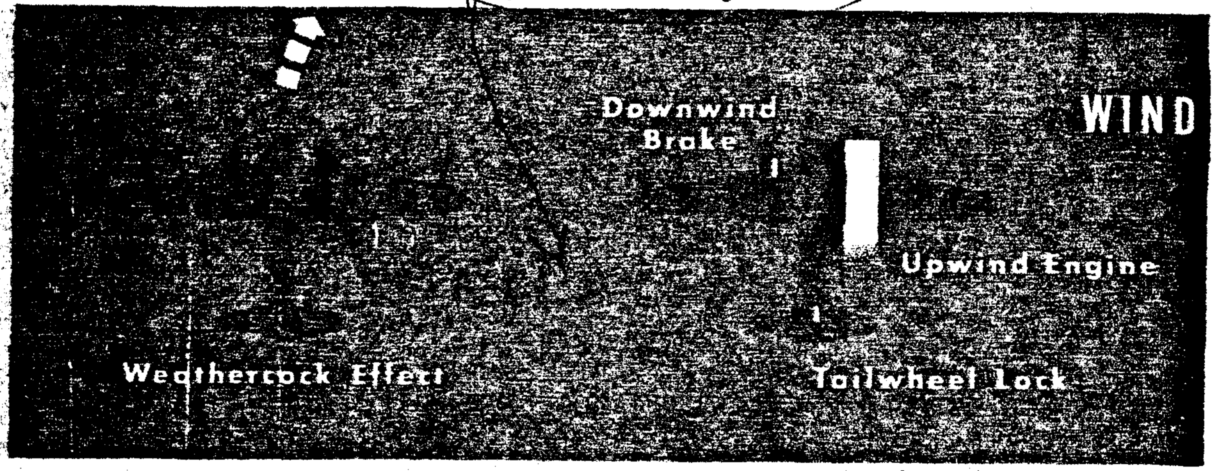
In close quarters, slow down to a crawl. If you have any doubts about whether it is safe to proceed, **stop.** Ask the tower to send the alert crew out to walk your wingtips past the obstructions. If the alert crew is busy, get your own crew on the ground to help.

When the ramp is extremely congested, cut your engines and ask the tower for a tug to tow your plane.

Caution: As airplane commander, you are responsible for the safe movement of your airplane on the ground. If your plane is being towed in, see that the alert crew knows its business, and stay with your plane until it is properly parked.



Correct with



CROSSWIND TAXIING

Because of the large fuselage and tail section of the C-46 there is a definite tendency to weathercock in wind as low as 5 mph. Taxiing in a stiff wind of 20 mph or more presents a major problem.

The locked tailwheel helps materially in keeping the airplane straight in a crosswind. Keep it locked at all times except when making turns.

Lead with the upwind throttle sufficiently to hold the plane straight.

In strong winds, use the downwind brake when necessary to prevent excessive use of power and to curb speed.

TAXIING IN MUD, SNOW, OR SAND

Taxiing in mud, snow, or deep sand requires the same technique used for other large aircraft with conventional landing gear.

On surfaces where there is a minimum of traction, you must rely completely on throttles for directional control. In turns, take special pains to lead with smooth application of power. Rough handling of throttles results in an unmanageable airplane.

Avoid deep mud. If you must go through it, however, keep moving. Taxiing too slowly or making sharp turns causes bogging down in soft spots.

If you get stuck, cut your engines and get a tow. Trying to blast yourself out with power overheats engines and may possibly damage the gear.

Sudden stops may cause noseovers. Keep the wheel back to hold the tail down. If the load has been properly balanced, the possibility of noseovers is minimized. When you must taxi in extremely muddy conditions, extra tail ballast is desirable. But be sure to redistribute the load before takeoff.

ENGINE RUN-UP

Stop the airplane on the taxi strip at a safe distance from the end of the runway for engine run-up. Usually you park at a 45° angle to the runway to get the clearest view of incoming traffic.

Head into the wind to help keep the engines cool during run-up.

As you swing into run-up position, make sure that the area behind you is clear. Your prop wash can do lots of damage.

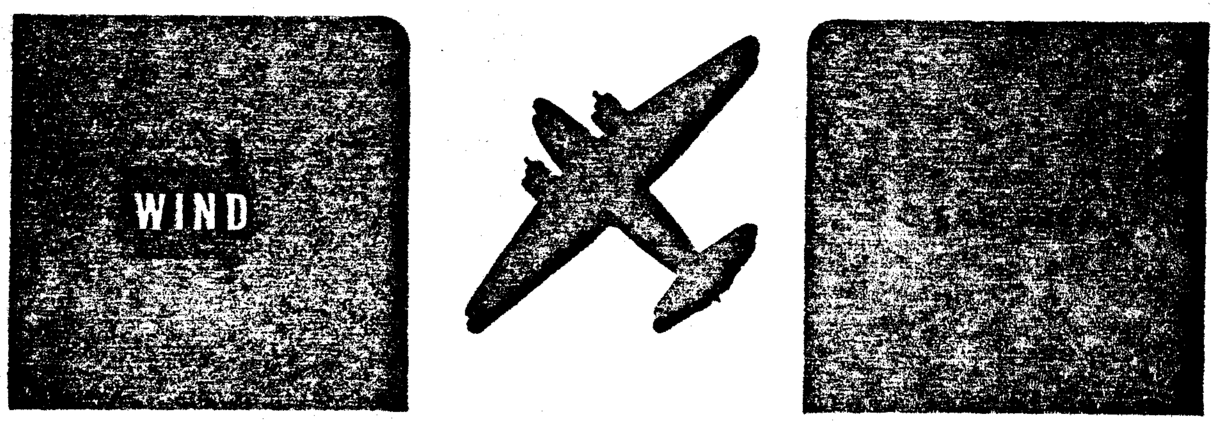
Whenever possible, park so that at least the propellers are over a hard surface to avoid picking up rocks, causing damage to propeller blades or to tail surfaces.

Technique of Run-up

Like the before-starting checklist, the run-up procedure is a directional one. You work upward on the pedestal checking the various controls for proper engine operation.

Before starting run-up, make sure that you

INCOMING TRAFFIC



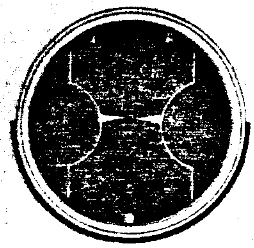
have a minimum cylinder-head temperature of 120°C and minimum oil temperature of 40°C, and that all controls are set properly according to the checklist. Run up each engine separately.

1. Advance throttle to 1400 rpm.
2. Shift into HIGH blower. Make blower shifts without hesitation, to avoid slipping or dragging the clutches. A momentary drop in oil pressure is normal after the blower shift.
3. Place carburetor heat full on.
4. Advance throttle to 2000 rpm.
5. Note rise in carburetor intake air temperature, and then place heat control off.
6. Return to LOW blower. Manifold pressure should drop 1" to 2".
7. Check engine gages for proper readings.
8. Hold prop switch in DEC RPM until a loss of 200 rpm is indicated. Then move switch to INC RPM until you regain normal rpm. This check indicates that the manual control of the propeller is functioning normally.
9. Return switch to AUTO.
10. Operate the feathering switch until there is a noticeable rpm drop and then return the switch to NORMAL immediately.

Note: Make this check only in the initial run-up of the day or of a strange airplane.

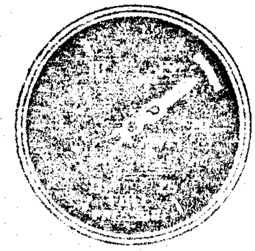
11. Pull the prop governor control back until the rpm drops 200. At this setting the governor should hold the engine at a steady speed without surging. Return the prop control to full forward position and note the increase of rpm.
12. Perform the power check. Advance the throttle until you obtain 2500 rpm. You will need about 36.5" Hg. at sea level with an outside air temperature of 25°C (77°F). Allowing a tolerance of 2.5" Hg. for instrument errors, the maximum permissible manifold pressure is

ENGINE INSTRUMENT READINGS BEFORE TAKEOFF

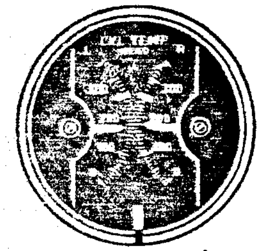


Oil Temperature
50-70°C

Oil Pressure
70-85 lbs.



Fuel Pressure
16-18 lbs.



Cyl. Temperature
150-232°C

39" Hg. When you need more than 39" Hg., this is an indication that the engine is not developing proper power because of a dead cylinder, bad sparkplugs, or similar malfunctioning. Have it checked before flight.

Note: The manifold pressure required to obtain 2500 rpm decreases 1" Hg. for each 1000 feet rise in altitude and .7" Hg. for each 10°C rise of outside air temperature. Take these variations into consideration.

13. Reduce power to 30" Hg. Check magneto operation from BOTH to LEFT and BOTH to RIGHT and return to BOTH. Normal loss in rpm when running on one magneto is 50 to 75 rpm. Maximum allowable loss is 100 rpm. To avoid possible damage to the engine from detonation, never run on one magneto alone for more than 30 seconds.

14. Reduce power to idling speed and repeat the run-up with the other engine.

Before returning power to idling speed on the second engine, check the flaps by full extension and retraction.

Note: The run-up procedure above is for aircraft with Curtiss electric propellers. For planes with hydromatic propellers, the procedure is the same except that: (1) There are no prop selector switches; (2) You must pull out the feathering button to stop feathering action of the propeller.

TAKEOFF

When you have performed your before-takeoff check and are cleared by the tower, you are ready to line up on the runway and proceed with the takeoff. Let the plane roll forward a few feet, then call for the tailwheel to be locked.

Don't let anybody tell you the C-46 takes off "just like a big Cub." It requires constant attention and concentration from the time you start the takeoff run until you complete the takeoff.

Rudder control does not come in until you reach a speed of 50 to 60 mph. The critical period in the takeoff run comes just before you reach this speed. At this time it is extremely easy to veer off the runway or even to groundloop the airplane.

1. In the first part of the takeoff run, before you gain rudder control, you must depend on the ailerons and throttles for directional control. Advance throttles smoothly and not too abruptly. Be ready to correct yawing immediately by rolling ailerons in the direction of the yaw and by leading with the proper throttle.

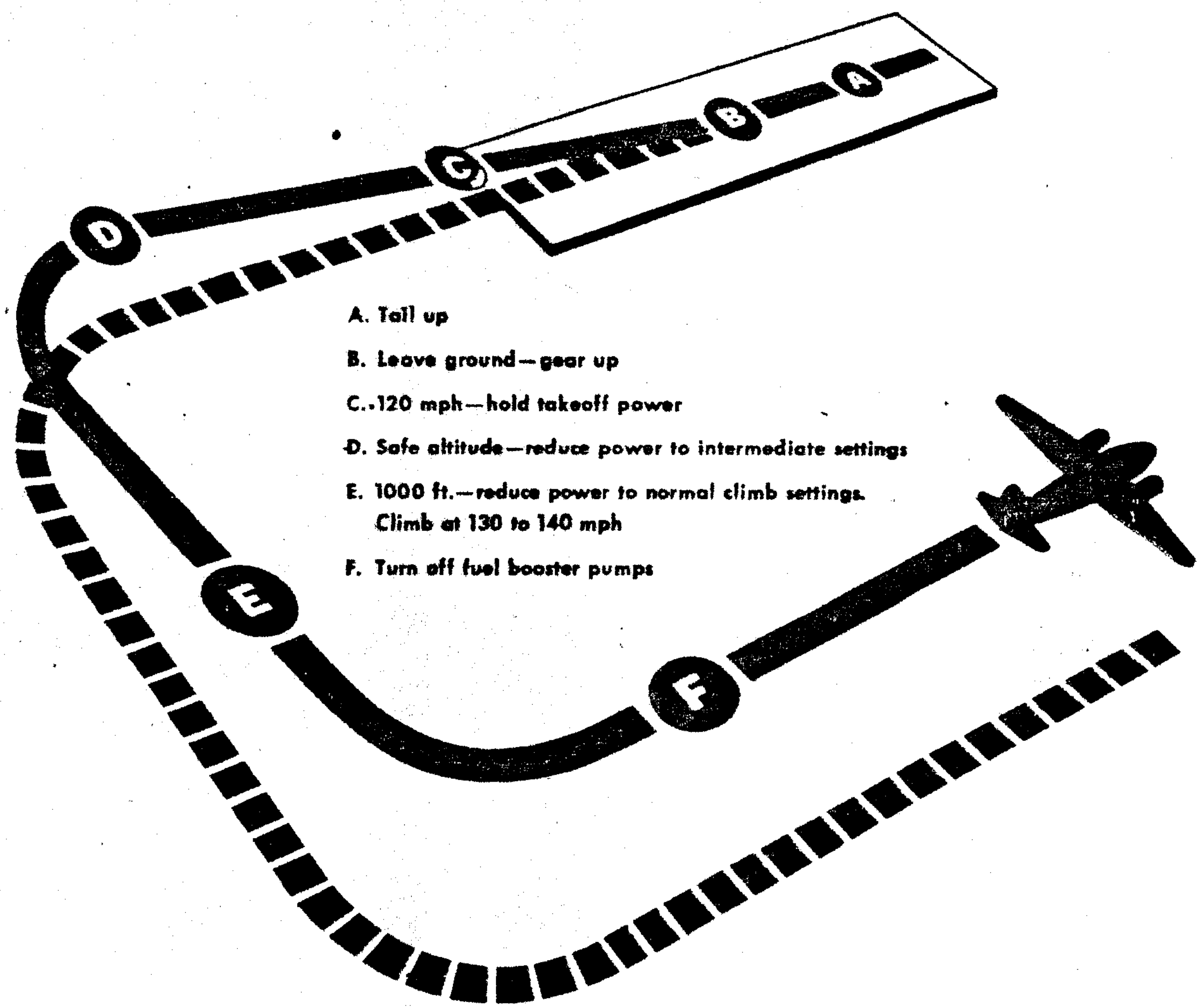
You can usually attain rudder control more quickly by applying full takeoff power early in the run.

Don't trust the friction locks to keep the throttles from slipping back during takeoff. Have your copilot guard them.

After you have advanced the throttles to takeoff power and when you need both hands for other controls, signal the copilot to take over the throttles.

Because of the long travel of the throttle levers in early C-46's, it is difficult for pilots of short stature to push the throttles all the way forward and still maintain good position in the seat to operate other controls. In this case it may be necessary to have the copilot take over the throttles before they are fully advanced and continue pushing them forward.

2. When you attain a speed of about 60 mph, the tail starts to come up of its own accord. A



little forward pressure on the wheel or rolling the trim tab forward helps the tail off the ground.

3. When you have reached a speed of 85 to 95 mph, depending on load and takeoff conditions, back pressure on the wheel produces a clean break from the ground. Use elevator trim at this point to relieve the strain of pulling the wheel back. You can use trim as the principal means of flying the ship off. Apply trim slowly —don't spin the wheel.

4. After you are definitely airborne—10 to 15 feet off the ground—depress brake pedals gradually to stop the wheels from spinning and call "Gear up!"

5. Hold plane to a minimum climb to attain safe single-engine speed of 120 mph. Climb at takeoff power to a safe altitude, 300 feet if necessary, not exceeding 125 mph. This insures that the airplane is not flying back into the ground, a frequent cause of takeoff accidents.

6. Reduce power to intermediate settings and climb to 1000 feet. At this altitude reduce to normal climb settings and continue the climb at 130 to 140 mph.

7. At about 1500 feet turn off the fuel booster pump on one engine. Check the fuel pressure gage to be sure that sufficient pressure is maintained by the engine pump alone. Then turn off the other booster pump.

Copilot Duties

There are controls you can barely reach and instruments you can hardly see in the C-46, so depend on your copilot for help. Use simple, unmistakable signals when you want the copilot to take over the throttles or raise the gear. Always accompany your signals with verbal orders so that there will be no chance of misunderstanding.

Make sure that your copilot watches all engine instruments closely during takeoff. Have him report any abnormal readings to you **immediately.** Loss of fuel or oil pressures or excessive temperatures require instant action on your part.

HEAVILY LOADED TAKEOFFS

In training, you make most of your takeoffs with empty or lightly loaded aircraft and on hard-surface runways. In operational flying you will be confronted at times with heavily loaded ships, and also soft runways, high altitude fields, and excessively high outside air temperatures.

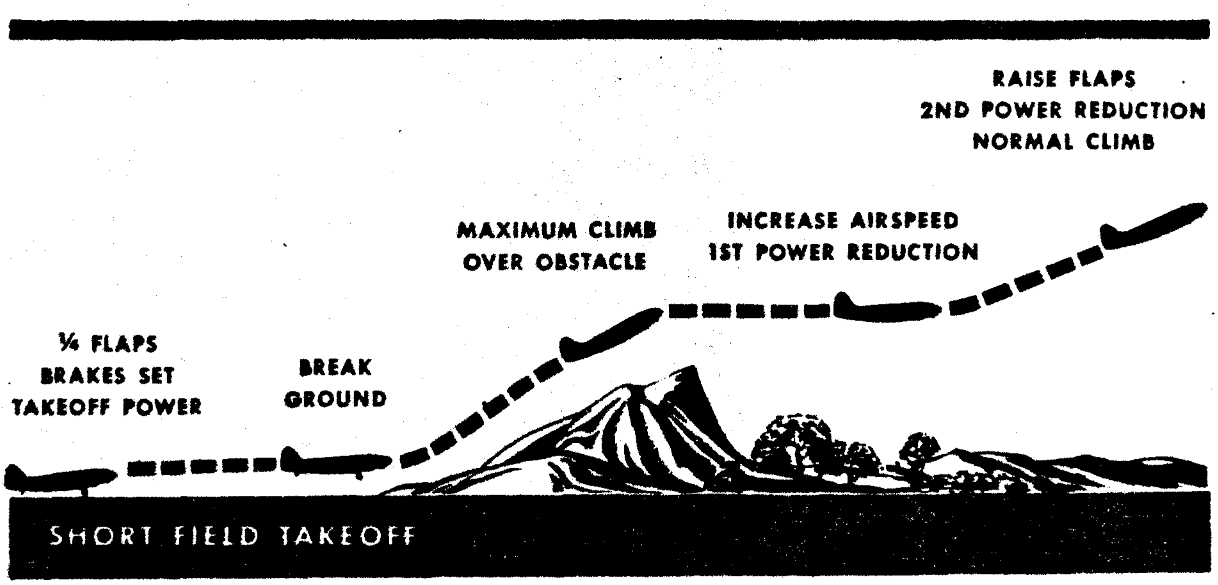
Each of these factors adds length to your takeoff run, and obviously a combination of two or more greatly increases the takeoff run. Vary your takeoff technique to meet these conditions.

1. Use maximum allowable takeoff power—2700 rpm and as much manifold pressure as you can pull, up to 52" Hg.
2. Advance throttles to takeoff power rapidly but smoothly.
3. Hold the ship on the ground until you get ample flying speed. This may be as high as 100 mph under some conditions. After you have lifted the airplane off the ground, the remainder of the takeoff is normal.

SHORT-FIELD TAKEOFFS

The short-field takeoff is a high-performance maneuver. It calls for maximum use of every favorable characteristic of the airplane and the pilot's full ability. The following short-field takeoff technique has been found most effective for the C-46:

1. Set the flaps to the ¼ position. This is the maximum-lift minimum-drag position regardless of load.
2. With brakes set and tailwheel locked, advance power up to the maximum allowable for takeoff. Then release the brakes and start the takeoff run.
3. Bring the airplane off the ground as soon as you reach flying speed.
4. When definitely airborne, retract landing gear and allow the airspeed to build up slightly



in the climb to the point where obstacles are cleared.

5. After clearing obstacles, hold ship to a minimum climb until you reach safe single engine speed and then make first power reduction.

6. Raise flaps slowly before reducing power to climb setting.

Takeoff from a 3-point position is not recommended for the C-46. Because of the weight of the airplane and the heavy controls it is difficult to make a clean break from the ground.

CROSSWIND TAKEOFFS

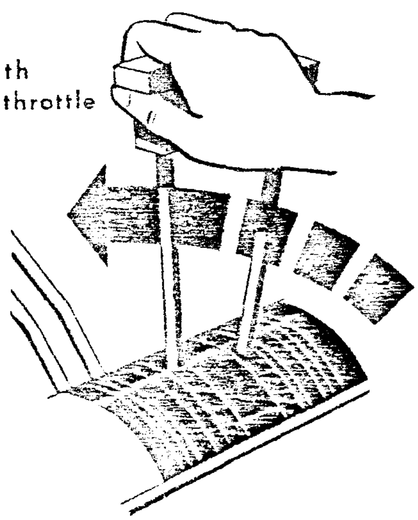
Crosswind takeoffs in the C-46 require plenty of technique. This airplane has a definite tendency to weather into the wind because of the large fuselage and tail surface areas.

Keep the tail on the ground until rudder control comes in. The locked tailwheel is a big help in keeping the ship straight.

As soon as the tail comes up, **use rudder immediately to correct for side thrust.**

Lead with the upwind throttle and roll upwind aileron to correct for the wind. In very stiff crosswinds you may have to use downwind brake as a last resort.

After you have attained rudder control and the tail is up, advance the retarded throttle to match the other for desired takeoff power. Leave the ground with throttles even.



Hold the ship on the ground until you can make a clean break. If you bounce back in a crosswind takeoff the side thrust on the landing gear is likely to damage it.

Power Settings for Takeoff and Climb

	RPM	Manifold Pressure
TAKEOFF (maximum)	2700	52" Hg.
INTERMEDIATE	2400	41" Hg.
CLIMB	2300	35" Hg.

CLIMB AND CRUISE

To climb the C-46, trim the ship for hands-off flight and hit an indicated airspeed (IAS) of approximately 130 mph. Climbs at lower airspeeds may cause the engines to overheat.

Recommended power setting is 2300 rpm and 35" Hg. at sea level. Correcting the manifold pressure gage .3" Hg. for each 1000 feet of climb to maintain approximately the same horsepower results in a setting of 32" Hg. at 10,000 feet.

Unless you need maximum performance, climb in LOW blower as long as sufficient power is obtainable.

Temperature Control

Watch the engine instruments closely for overheating during the climb. Overheating is indicated first by a rise of cylinder-head temperatures above normal. Further indication is the rise in oil temperature.

Maximum desired cylinder-head temperature for climb is 232°C; maximum permissible, 260°C. Desired oil temperature is 70°C; maximum permissible, 90°C.

Start taking corrective measures at the first sign of overheating. The temperature rise may be extremely rapid, and it is usually difficult to reduce temperatures to normal limits.

1. Most effective means of reducing operating temperatures is to increase the IAS. You can add 10 to 20 mph to airspeed without much loss in rate of climb.

2. Open cowl flaps for more effective cooling.

3. Reducing engine speed checks the tendency of oil to overheat.

4. In critical cases you can use FULL (EMERGENCY) RICH mixture to decrease cylinder-head temperatures rapidly.

Get on the Step

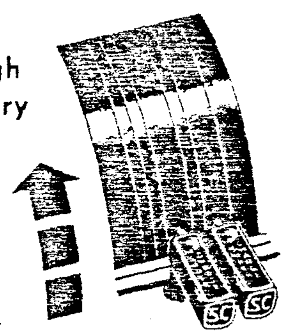
Continue your climb to 300-500 feet above your desired cruising altitude. Then let down gradually, at the same time reducing power to cruising settings. In this way you put the ship up on its aerodynamic step.

Establishing the aerodynamic step is vital for best performance of the C-46. You can lose as much as 20 mph IAS in a heavily loaded airplane by not keeping on the step.

Give the engines a chance to cool off before closing the cowl flaps and changing mixtures to AUTO LEAN. Detonation can occur with a lean mixture if the engines are too hot. Get cylinder-head temperatures down to 200°C or below before changing mixtures.

If operating in low blower, shift to high blower once every two hours to clear the sludge out of the blower clutches. Leave in high blower for at least 10 minutes before returning to low, to allow clutches to cool.

Maximum power permissible for cruising in AUTO LEAN mixture is 1100 HP in LOW blower, 975 HP in HIGH blower. The table below gives power settings for these horsepowers at certain altitudes.



Trimming

In any airplane, every change of attitude, power setting, or airspeed changes the control pressures required. Unless you apply trim promptly to help you you'll find yourself overworked in a very short time.

This is particularly true of the C-46, because of the size of the airplane and the heaviness of the controls.

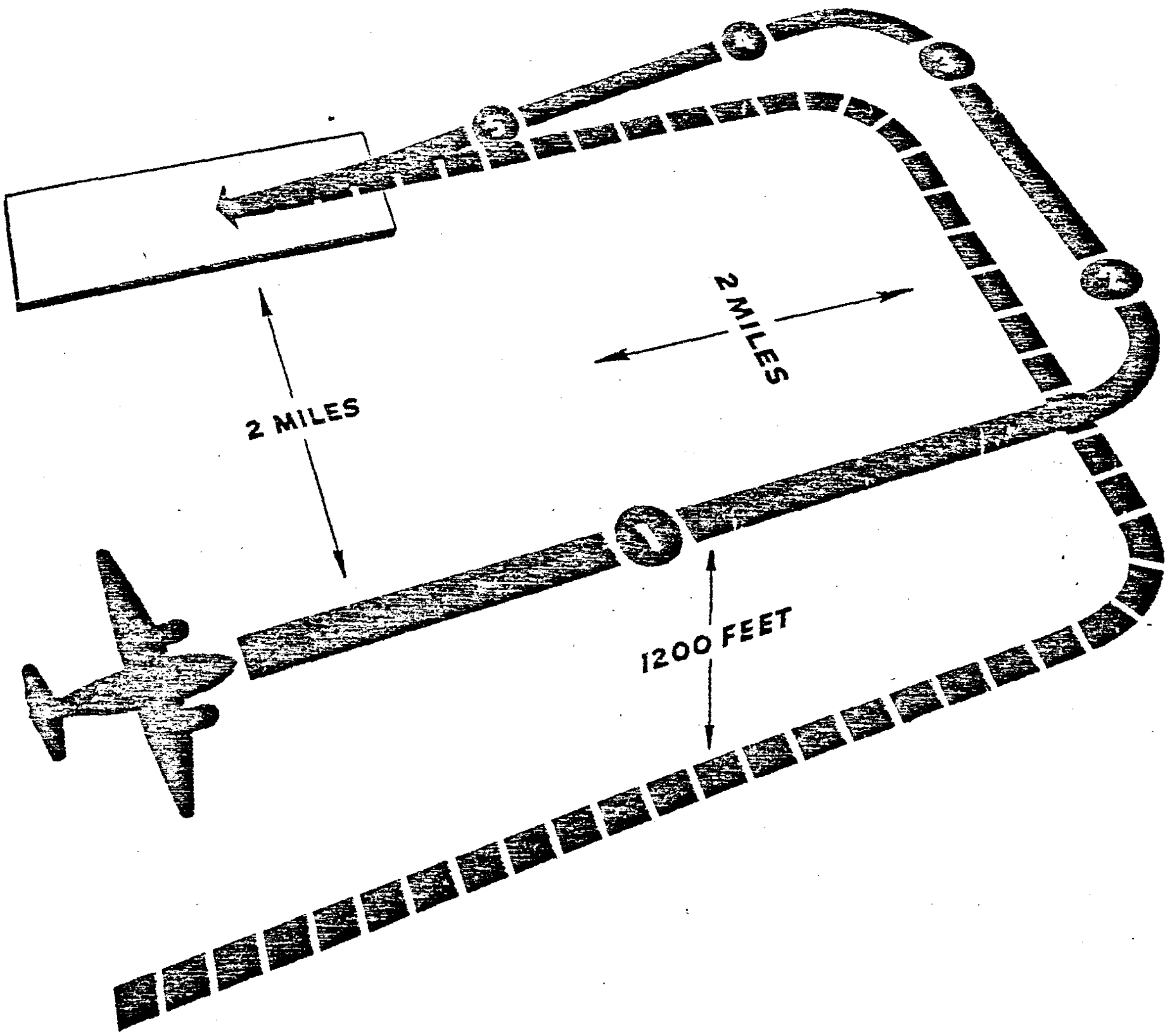
The airplane is easy to trim and keep trimmed properly, because it is sensitive to the trim tab controls. Even a slight movement of the elevator trim tab wheel produces a definite change of attitude.

LANDING

For the purpose of training in a new airplane it is advisable that a pilot learn a standard landing procedure. Once he becomes familiar with the ship and its pecularities, the pilot, while conforming in general to the standard technique, may vary it to suit his own style and requirements.

The recommended normal landing for a C-46 is power-on, with power gradually reduced throughout the approach until it is dissipated entirely by the time you complete the roundout and just before you reach stalling speed.

Altitude	HP	RPM	MP	Blower
S.L.	1100	2100	35.3	Low
10,000	1100	2100	32.3	Low
15,000	975	2100	31.5	High
19,900	975	2100	30.1	High



TYPICAL LANDING PATTERN

1. Airspeed—130 mph
   Gear down
   Power setting—28" Hg—2300 rpm
2. Descending 500 feet per minute
   Power setting—22" Hg—2300 rpm
3. Altitude—800 feet
   Power Setting—15" Hg—2300 rpm
   Flaps lowered after turn
4. Airspeed—110 mph
5. Start flare
   Airspeed—100 mph
   Power pulled all the way off gradually

Make power reductions smoothly and gradually. An abrupt reduction of even 5" Hg. causes an appreciable change of attitude.

Use elevator trim tab constantly throughout the pattern and approach.

Start your before-landing check soon after entering the downwind leg. Complete the check before you begin the turn onto the base leg.

Landing Speed

Fly the pattern at approximately 130 mph until you complete the turn onto the final approach. Final approach speed with a medium loaded airplane is about 110 mph. Bring the airplane over the fence at a speed of about 100 mph. It stalls out at about 77 mph with full flaps and power off.

Use of Flaps

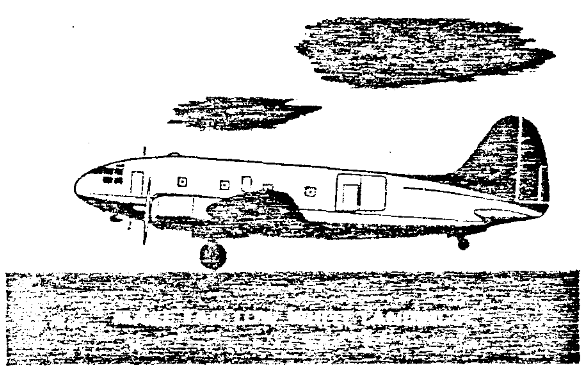
Normally you lower flaps after completing the turn onto final approach. Do not lower them with an airspeed of more than 135 mph.

For average-length runways, use from ½ to full flaps. You can vary your glide path as needed by varying the amount of flaps and the points at which they are used.

Flare

The flare, or roundout, requires plenty of room to complete with the C-46. Begin the flare well back of the field so that you have time to perform it gradually and smoothly. Dissipate your remaining power gradually throughout the flare so that power is full off when you complete it.

Give constant attention to the trim throughout the flare to provide smooth and easy handling.



Landing

Make a tail-low wheel landing. You can make a full-stall 3-point landing, but it is not recommended until you have perfected your landing technique. The weight of this airplane places too much strain on the structure, even in short drops. Tail-high wheel landings can be made very smoothly, but they are necessarily faster and take more runway.

Landing Roll

This is one plane that you don't stop flying until it comes to a dead stop. Keep your head out of the cockpit on the landing roll.

When airspeed drops below 50 mph, you lose rudder control. A violent swerve or even a groundloop can easily result at that point if you are not careful. Be ready to correct immediately with aileron and throttle action. Loosen throttle friction locks to allow smooth movement of throttles.

Use brakes for directional control on the landing roll only as a last resort.

Slowing the Airplane

If runway length permits, do not use brakes to slow down the airplane. If you must use brakes, feel them out well before you near the end of the runway. **Do not apply brakes hard**

while the airplane is moving fast. The heat generated can burn out the brakes quickly. Slow the plane down by intermittent application.

Not touching the brakes at all until close to the end of the field is strictly an invitation to trouble. Even full brakes do not stop you soon enough if you wait until the last 500 feet to apply them.

UNDERSHOOTING

The remedy for undershooting is smooth application of power. Advance power as much as necessary, even up to takeoff limits in extreme cases, to make sure that you reach the field.

Propellers have been set at 2300 rpm in your before-landing check. However, with heavily loaded ships you may find that this setting does not give sufficient power. Don't hesitate to increase rpm to 2500, or even full forward to 2700, if you need to.

In cases of slight undershooting, do not allow the glide angle to change during the power application. Otherwise, when you again reduce power you will find yourself in a nose-high attitude from which normal recovery and landing is difficult.

In extreme cases of undershooting, you must flatten the glide. If there is sufficient altitude as you approach the end of the runway, reduce power and perform a normal flare and landing. However, if you are too low to break your glide normally, reduce power and drag the ship into a power-on wheel landing.

OVERSHOOTING

If you find that your approach is high, your best procedure is to make a power-off landing. This type of landing can be performed without difficulty in the C-46. The airplane does not have an abnormally steep angle of descent with power off if airspeed is kept at 110 mph or better.

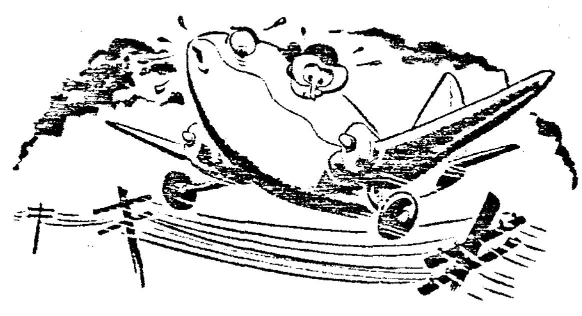
If your power-off gliding speed is less than 100 mph, however, and you are using full flaps, apply some power as you go into the flare. The use of power allows you to level out gradually. An abrupt pull-out increases your wing loading greatly, and in extreme cases can result in a stall.

If you have any doubt about being able to land in the first third of the runway, you must go around.

GO-AROUND PROCEDURE

Go-around procedure for the C-46 is the same as that for most other aircraft.

Remember, though, that this airplane takes time to respond to the controls. As soon as you think you have to go around, get started—don't wait until you are almost on the ground. If you do, you're looking for trouble.



Having decided to go around:

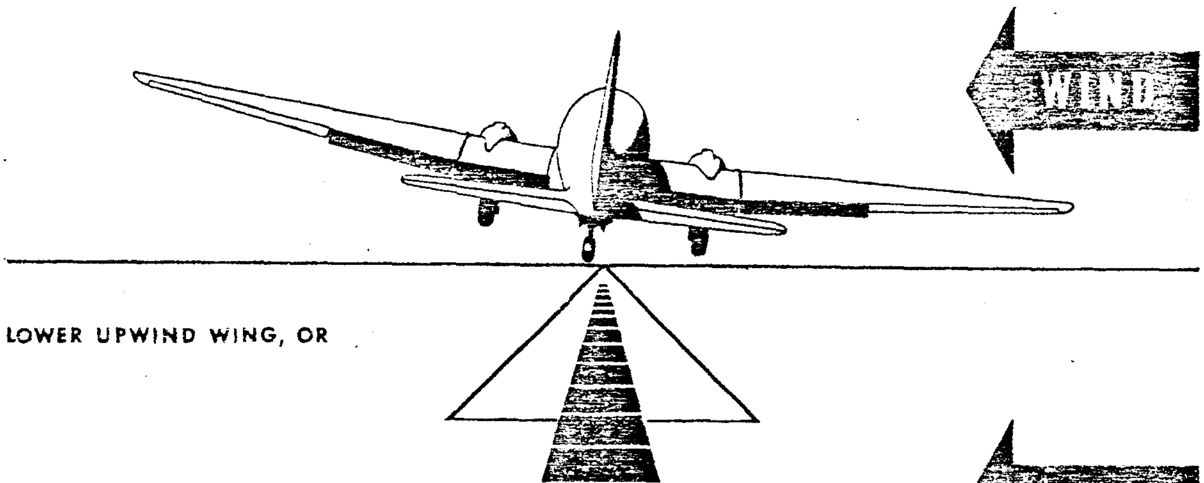
1. Pour on the coal and call "Gear up!" Your propellers are already set for 2300 rpm, so you can use up to climbing power without re-adjustment. If necessary, advance to intermediate or even full takeoff power. pushing the prop governors forward first. Advance slowly, to prevent engine surge. Open cowl flaps ½.
2. Don't let the nose get up too far. It starts up as soon as you advance the throttle. Hold it down with the wheel until you can re-set the elevator trim.
3. Build up your airspeed. With a heavily loaded ship you need plenty of airspeed before you can start climbing.
4. When you have reached a safe airspeed, 120 mph minimum, milk the flaps up gently. As you bring the flaps up, correct for loss in lift by bringing up the nose to increase the angle of attack.

CROSSWIND LANDINGS

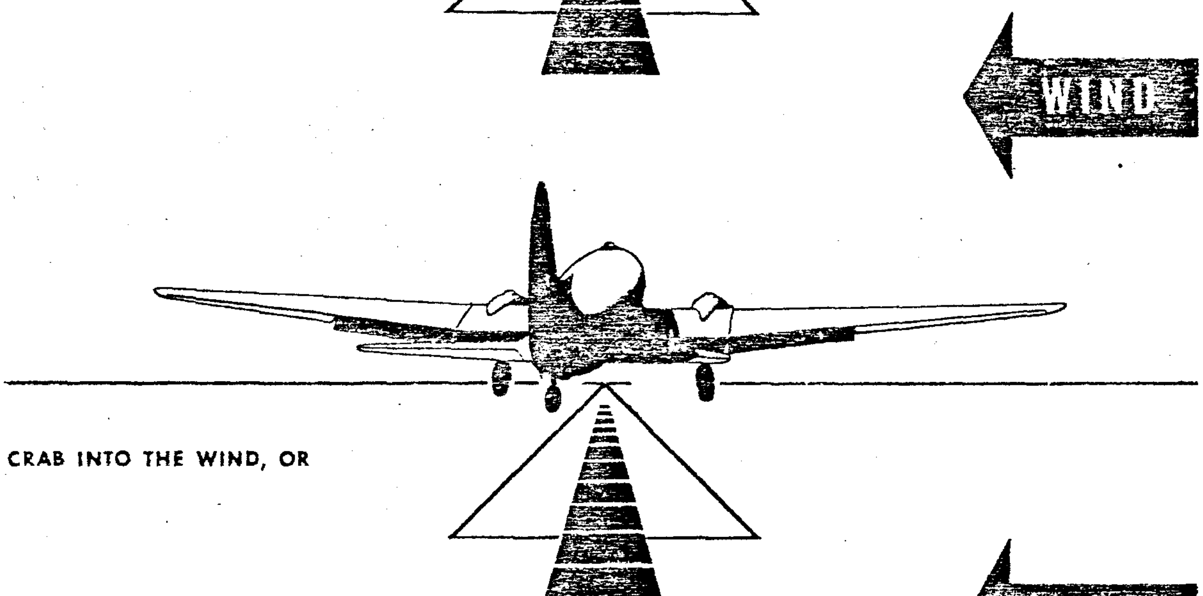
Use standard technique for crosswind landings in the C-46.

1. It is possible to use full flaps for crosswind landings if you dump them as soon as you make contact with the ground. Another method is to choose flap settings according to the angle and strength of the wind. Use less flaps in stronger and more direct crosswinds.
2. Counteract for drift by dropping the upwind wing or crabbing into the wind. Combining the two is the best method—it keeps you

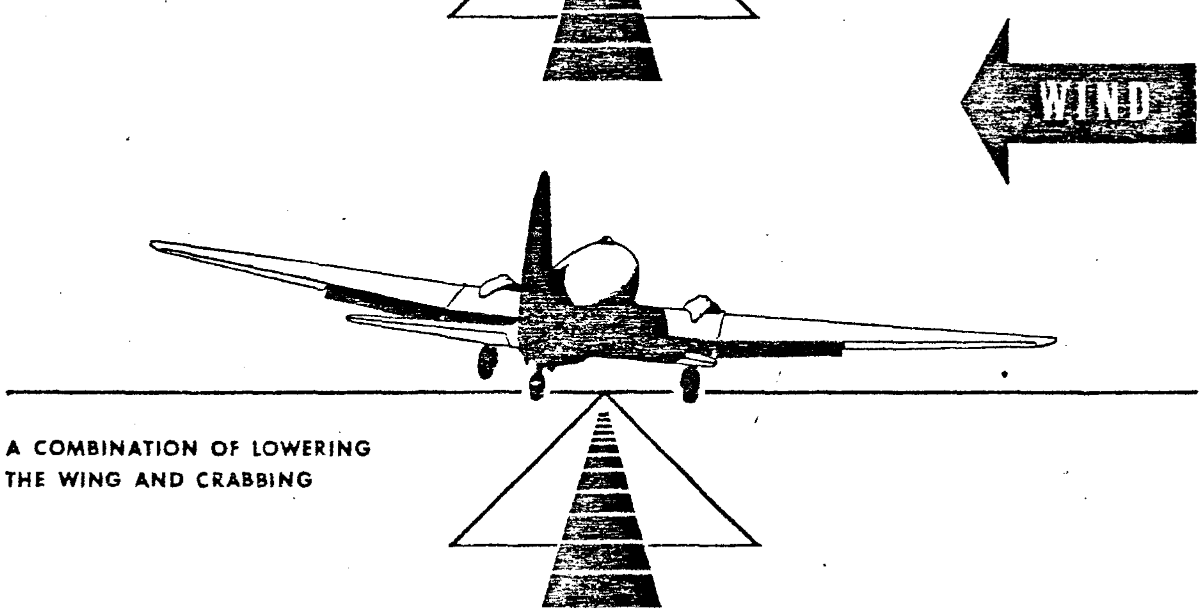
CROSSWIND LANDING TECHNIQUES



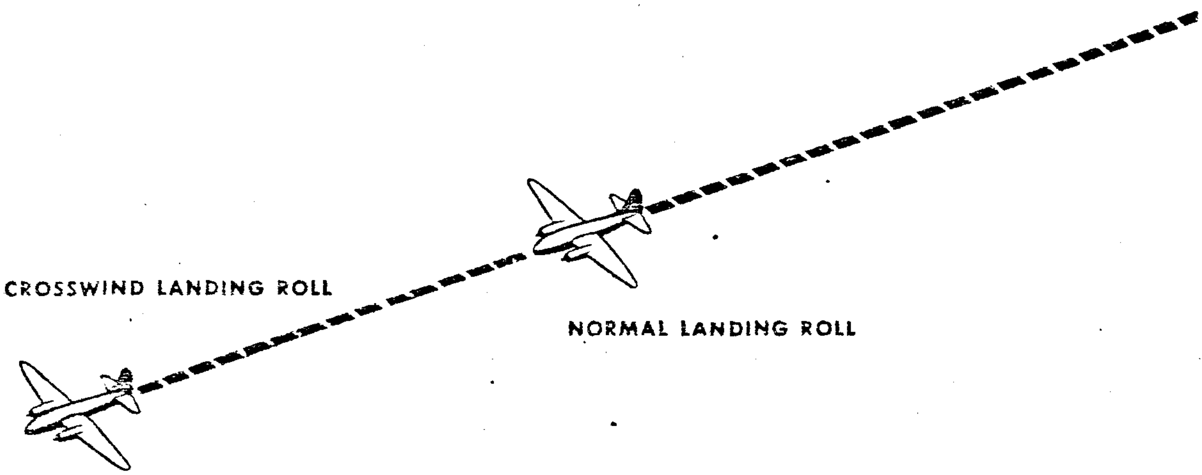
LOWER UPWIND WING, OR



CRAB INTO THE WIND, OR



A COMBINATION OF LOWERING THE WING AND CRABBING



from dropping the wing too low or crabbing too much.

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

4. Make a normal wheel landing. This minimizes the drift after the flare and gives you better control in setting the ship down.

5. Concentrate on the landing roll. The major problem in landing a C-46 crosswind comes after the ship is on the ground. After you lose rudder control you must use upwind throttle and ailerons for control. Always roll ailerons in the direction of the yaw. Use downwind brake if absolutely necessary.

Since the use of throttles is a principal means of control, the landing roll is considerably longer than normal. Some conditions of crosswind may require so much throttle that **you cannot land on a runway less than 6000 feet long.**

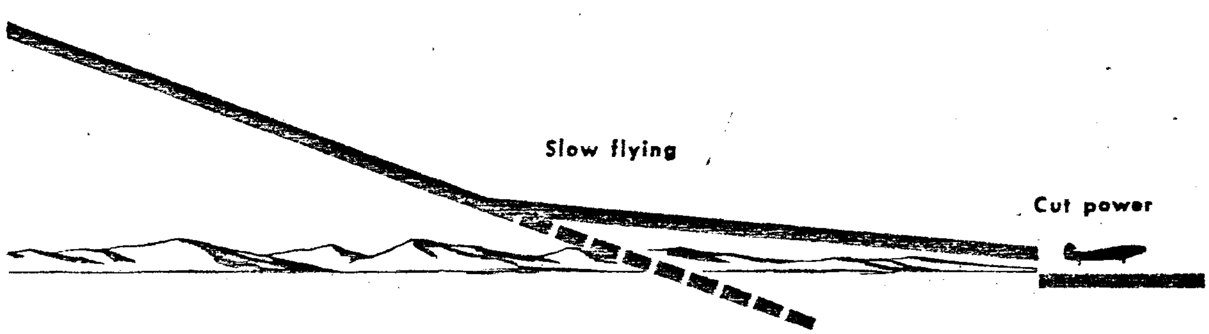
SHORT-FIELD LANDINGS

There are two types of short-field conditions that may confront the C-46 pilot in operational flying: (1) where the field is short but has good approaches for landing; (2) where there is an obstruction close to or at the boundary of the field.

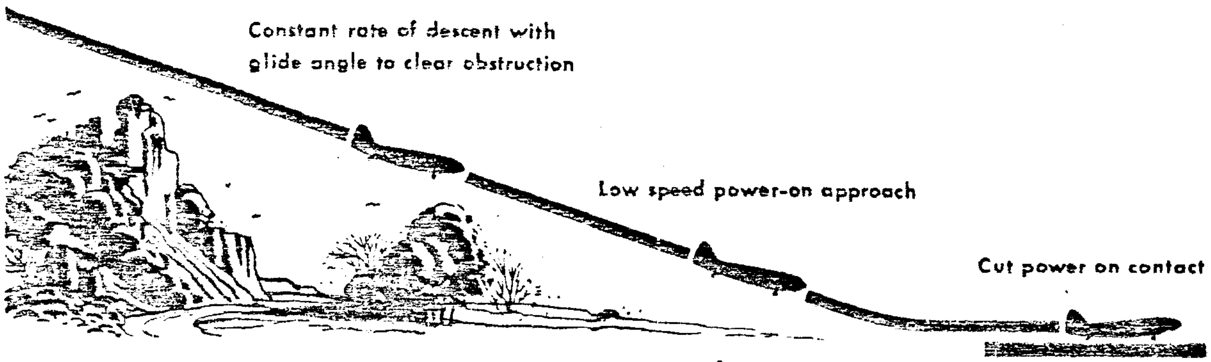
Field Without Obstructions

1. Establish a normal full-flap power approach, aimed to undershoot the end of the runway slightly.

2. Start the flare back a little farther than



APPROACH WITHOUT OBSTRUCTIONS



APPROACH OVER OBSTACLE

usual, and hold normal speed throughout the flare. Gradually pull up the nose and increase power sufficiently to get you over the end of the runway.

3. Once over the runway, ease off power and make a normal tail-low landing.

This technique allows you to land at stalling speed on the first few feet of the runway, leaving the entire length of the runway for the landing roll.

Field With Obstructions

1. Establish a straight glide path which will clear the obstacle.

2. Fly at a minimum safe power-on speed. **Do not go below the power-off stalling speed.** You do not have adequate feel of the ship at low airspeeds.

3. Set the rate of descent not to exceed 500 feet per minute and control it by throttle adjustment.

4. If you see that you cannot clear the obstacle with your established glide path, apply power to get over it. **Do not raise the nose.**

5. After clearing the obstacle, maintain the same attitude until close to the ground. Then bring the nose up slightly and stall the ship, reducing power gradually. Chop power completely after contact and hold the wheel full back.

6. Raise flaps on contact. This helps to keep the tail down when you apply brakes.

Before attempting this maneuver, practice flying just above stalling speeds, at safe altitudes. The heavy handling characteristics of the C-46 are such that experience is necessary for you to recognize just when the ship is approaching the stalling point.

PARKING

Control your final turn into the parking place so that the airplane rolls straight forward a few feet and the tailwheel is in position to lock. Then lock it.

Put on your parking brake and leave it on until chocks are put under the wheels. Then release it. Leaving the parking brake on may cause the brakes to freeze if they are hot from use.

Cooling Engines

If cylinder-head temperatures are over 205°C, cool the engines by idling at 1000 rpm. During idling, set the controls as follows:

Mixtures–AUTO-RICH
Cowl flaps–OPEN
Blower–LOW
Propeller controls–Full forward

Superchargers

Before stopping the engines, clean out the sludge in the blower clutches:

1. Run both engines up to 1500 rpm.

2. Shift both blowers into HIGH and leave for 15 seconds.

3. Return blowers to LOW.

Stopping Engines

1. Move mixture controls to IDLE CUTOFF and advance throttles full forward slowly.
2. Turn all switches OFF after props stop.

Before leaving the airplane: Shut all windows, doors, and hatches, and complete Forms 1 and 1A.

Check control locks on rudder and elevators. Lock ailerons with control wheel strap.

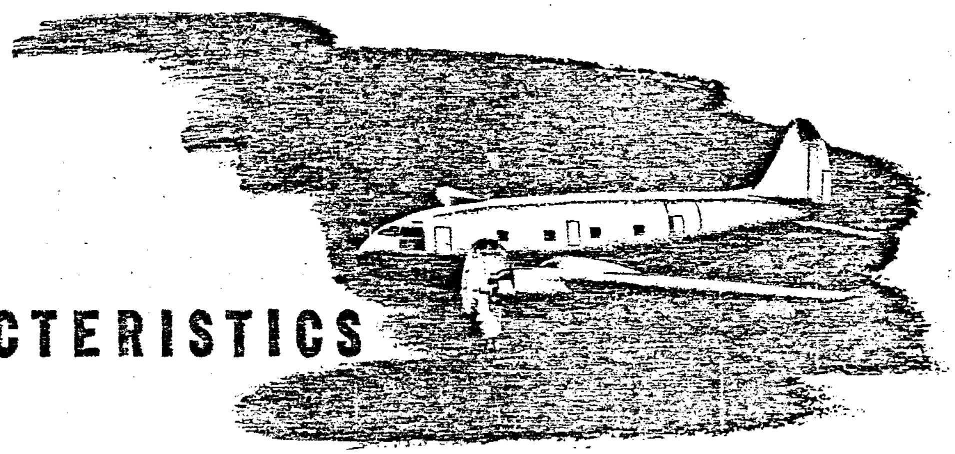
Mooring

Head the airplane into the wind when mooring it in the open. This reduces danger of damage to the control surfaces.

Tie down the airplane, using the mooring rings on the lower surface of each outer wing panel. Tie down the tailwheel.

If there is no fixed mooring anchorage, use the mooring kit furnished with the airplane.

FLIGHT CHARACTERISTICS



The handling characteristics of the C-46 are normal in all attitudes and under all ordinary flight conditions.

Directional and longitudinal stability are normal, as long as the center of gravity (CG) remains within limits. In cruising flight, however, there is usually a vertical hunting tendency, because of the sensitive action of the control boosters.

These control boosters give 3:1 advantage over purely manual control. Even with boosters on, the controls are moderately heavy. A certain degree of heaviness of controls on an airplane of this size is desirable, because it prevents sudden changes of attitude. With control boosters off, the airplane is extremely heavy on the controls.

The airplane is sensitive to trim tabs and is easy to keep in proper trim. Always start takeoff with the trim tabs in the zero position.

Airspeed Limitations

Glide	270 mph
Level flight	240 mph
Wheels down	150 mph
Flaps down	135 mph
Cowl flaps open	165 mph
Landing lights extended	150 mph

Stalls

The stall characteristics of the C-46 are excellent under all conditions. Pronounced buffeting of the tail gives ample warning of an approaching stall. There is no tendency for a wing to drop in any normal power-on or power-off stall.

These same characteristics are noted in single engine stalls and those in turns. Torque causes increased yaw, but this is fully controllable by rudder.

Stall recovery is normal, and you lose little altitude if you apply power immediately after the stall begins. Aileron has little effect until you regain flying speed.

The following stalling speeds have been observed (40,000 lbs. gross):

Flaps up, landing gear up, power off .... 88.2 mph
Flaps up, landing gear up, power on (2100 rpm–975 hp–25" Hg.) ... 80 mph
Flaps down 35°, landing gear down, power off .... 76.5 mph
Flaps down 35°, landing gear down, power on .... 67 mph

Note: These stalling speeds are representative figures only. Because of production variances, no two airplanes are ever exactly alike in performance.

Effect of Bank

In banked turns, centrifugal force increases the wingloading and thereby increases the stalling speed. The percentage of increase for certain degrees of bank is shown in the following table:

Degree of Bank	Percentage Increase in Normal Stalling Speed
10°	0.5
20°	3.0
30°	7.0
40°	14.4
50°	25.0

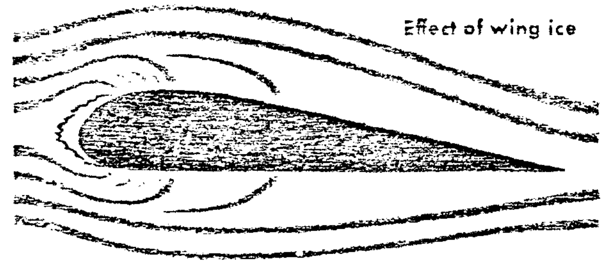
Prohibited Maneuvers

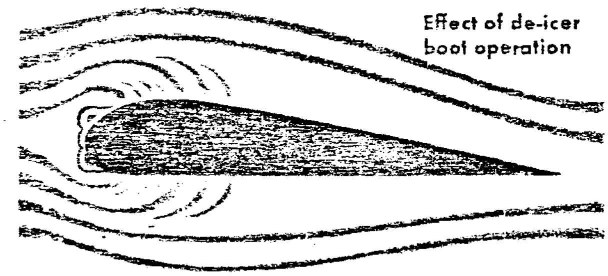
Loops, rolls, spins, dives, and inverted flight are prohibited for the C-46. Do not exceed 270 mph in glides.

Do not let this airplane get into a spin. A spin can result in structural failure. If you inadvertently enter a spin, use normal recovery procedure.

Effect of Wing Icing

Wing ice obviously adds to the weight and increases the stalling speed of the airplane. Further increase in stalling speed results when ice accumulation changes the shape or size of the airfoil, thus altering the lift characteristics of the wing.





Inflation of the de-icer boots affects the flow of air over the wing. At low speeds the operation of the de-icer boots can be more hazardous than ice accumulation itself. Always turn the de-icers off before landing, to attain a more consistent lift characteristic.

SINGLE ENGINE PERFORMANCE

A thorough knowledge of single engine performance and limitations is essential for the safe operation of the C-46. The necessity of knowing what to do when an engine fails, how to maneuver the airplane, and how to make single engine landings is obvious In addition, on long flights the knowledge of proper single engine operation for cruising may be the determining factor in bringing you home safely.

With normal loads the C-46 gives excellent single engine performance. You can maintain safe airspeed at low altitudes at power settings only slightly above normal cruising. Heavier loads necessarily require higher power settings.

Tests show that a 45,000 lb. airplane can maintain an altitude of 9,000 ft. at 115 mph IAS, which is safe single engine speed. This requires maximum allowable continuous horsepower for this altitude—2400 rpm and full throttle in LOW blower.

Trimming

The airplane has exceptionally good directional stability and requires a minimum of rudder trim for single engine operation under most flight conditions. At low speeds the yaw is naturally greater than at cruising speed.

Trim the ship for hands-off flight. You must re-trim after each change of power because of the unequal thrust forces created.

The use of a little aileron to hold the good engine down allows better coordination in directional control and reduces the amount of rudder trim needed.

Minimum Speeds

Critical single engine speed is the lowest speed at which the rudder has a safe margin of control over the maximum unbalanced thrust of the good engine. This speed is a variable, depending upon load and flight attitude. With a normal load, when the stalling speed is 80 to 85 mph, the critical single engine speed is approximately 105 mph.

Safe airspeed must be your first consideration in single engine operation. Just critical single engine speed is not enough, as it leaves you little safety margin.

To get and maintain safe single engine speed, pull all the power you need from the good engine—even full military power for an interval not to exceed 15 minutes.

Climbing

There is no "best" airspeed for climbing with one engine. Desirable airspeed is that which gives good performance without using dangerously excessive power. This airspeed varies with different loads and flight conditions.

If you are climbing above 130 mph IAS, with a medium power setting, use lower cowl flap settings as long as cylinder-head temperatures stay within maximum limits. This reduces drag.

Cruising

Trim the ship for straight and level flight. Use your power chart to get best performance. In general, use the least power you can to maintain proper airspeed.

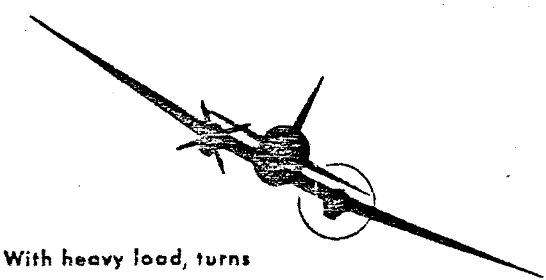
Watch your fuel flow meter. Compute your fuel consumption for your proposed flight and see if your available fuel supply will allow you to make it. Prepare to use the crossfeed to transfer fuel to the good engine when needed.

Handling the Airplane

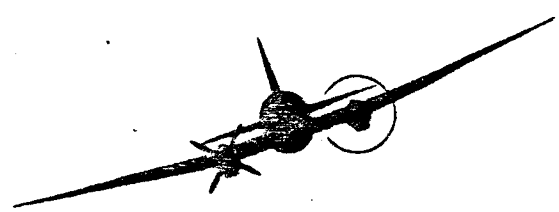
Make all maneuvers and power changes with the utmost smoothness. Upsetting the balance of trim causes a higher stalling speed, and in the case of turns usually results in loss of altitude.

It is safe to make turns into the dead engine as long as you keep airspeed reasonably above the stalling speed for the degree of bank. You can't keep a chart of stalling speeds handy, so just remember to stay above 125 mph in a normally loaded airplane and don't exceed a 30° bank.

If you must make a bank of more than 30°, don't turn into the dead engine.



With heavy load, turns into good engine are best



Hold 125 mph and don't exceed 30° bank when turning into dead engine

Landing

Because of the weight of this airplane it is imperative that you keep adequate airspeed with sufficient power until you are absolutely sure of reaching the field. Recovery from undershooting is precarious.

Establish your base leg as in a normal approach. Drop the landing gear on the base leg if you have sufficient speed and altitude and are sure that you can get into the field with gear down. Otherwise, let your gear down after you have turned onto final approach. The loss of the hydraulic pump on the dead engine does not greatly delay gear extension. Have the engineer check gear down with hand crank.

When you are close to the field, you may drop part flaps. Keep part in reserve; you may need them. Maintain plenty of airspeed. This allows a power-off landing with time to re-trim rudder, or permits going around if necessary.

Cut power and perform a normal power-off landing. The airplane settles quickly without power.

Crosswind landings – If you must make a crosswind landing, choose a runway where the wind is blowing from the side of your good engine. In this way you can use power to offset the tendency of the ship to weather into the wind.

Go-around–If necessary to go around, maintain airspeed at all times above 120. Raise the gear immediately and apply full power. Milk up flaps at any speed over 120, and re-trim for change of attitude. **Don't spare the horses.**

Do not make the mistake of assuming that night flying is no different from day flying. **It is different.** The night flying accident rate alone is adequate proof of this.

Unless you can see a clearly defined horizon at night, or unless lights are properly grouped on the ground to provide an unmistakable reference point, **night flying is instrument flying.** Be sure to check your flight instruments before takeoff.

Preparation for Night Flights

Before starting on night flights, or day flights that are likely to extend after dark, check your lighting equipment. Pay particular attention to your landing, position, and instrument lights.

Keep off any non-essential lights in the cockpit and keep essential lights dimmed.

Pilot, copilot, and engineer must each have a flashlight and spares should be available. Flashlights are necessary in emergencies, and in the C-46 they are required to check on the position of controls and readings of gages which are not illuminated.

It is particularly important at night that your copilot wait for orders from you before changing any control. You can't see the changed settings. **Stress this.**

Night Taxiing

Taxiing the C-46 at night requires care and caution. The landing lights on some airplanes have a high-angle setting and give poor illumination ahead.

For best lighting, you may have to extend and retract the landing lights. The sweep of the beams lights the area in front of you.

The glare from unshielded landing lights makes it difficult to see the wingtips from the cockpit. Watch your wingtips for clearance only when the landing lights are off, or you may be momentarily blinded.

In congested areas get the alert crew or your own crew with flashlights at the wingtips to guide you.

The use of the auxiliary power unit while taxiing prevents excessive drain on batteries and insures power for propeller control during takeoff.

Night Takeoffs

Hold the airplane on the ground until you reach an airspeed of about 90 mph. This allows a clean departure and eliminates the danger of stalling back in because of insufficient speed.

Use your landing lights when taking off over unfamiliar terrain. You may turn them off when you reach an altitude of several hundred feet.

On dark nights, when you cannot see a clearly defined horizon, your takeoff is essentially an instrument takeoff. You must refer to your instruments as soon as you cross the boundary of the field.

Failure of many pilots to rely on airspeed indicator and gyro-horizon instead of the seat of their pants has caused a number of fatal takeoff accidents in C-46 aircraft.

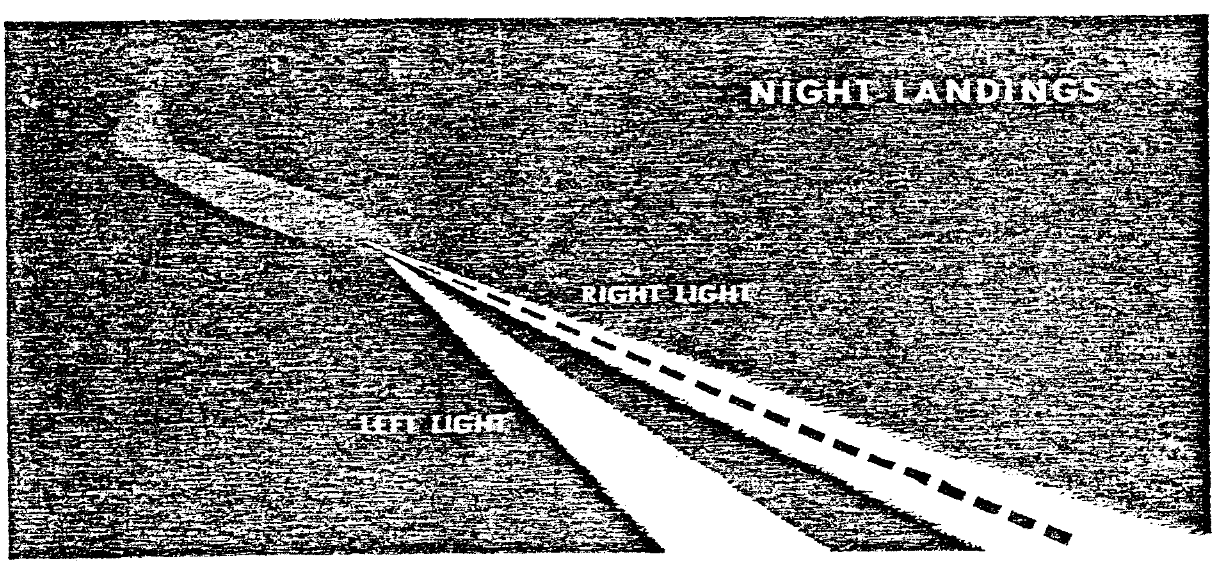
Hold takeoff power until you reach an altitude of 300 feet. Do not allow airspeed to go above 125 mph, as this probably means that the ship is flying level or even diving back into the ground. Remember that any sizable power reduction causes the nose to drop; compensate by holding back-pressure on the wheel and adjusting the elevator trim.

Night Landings

The use of a standard pattern and predetermined power settings is particularly important in landing at night. The accuracy of depth perception at night is considerably reduced and you must place more reliance on mechanical precision than on feel.

If you need landing lights, turn them on after you complete the turn onto final approach. Most installations on the C-46 set the beam of the right landing light along the line of flight, so your approach follows the light beam, contrary to the procedure in most other airplanes.

The actual technique of landing at night is the same as that for daylight operation. You may keep a little power on all the way to the ground if you need it for feeling your way.



When you are flying through turbulent air, relax. Don't try to correct every change of attitude. The ship is inherently stable and usually rights itself after minor changes. Use the elevator trim tab as much as necessary to relieve the strain of moving the control wheel back and forth. Re-trim smoothly; remember that the ship is sensitive to trim.

In severe turbulence, slow down the airplane to reduce the strain on the structure. As long as you keep a margin of about 50 mph above stalling speed, you have sufficient speed for handling gusts. To prevent overcooling of the engine and increased risk of carburetor icing, slow the airplane by letting the gear down rather than by reducing power greatly. Increase rpm to 2100 or even higher in order to have flexibility and power available when needed.

Wing Ice

T.O. 30-100D-1 gives full information on all aspects of weather flying, including ice accumulation. The book you are reading covers icing only as it applies to the C-46.

Wing and surface ice affects the C-46 as it does any other airplane—it increases the weight and increases the stalling speed. However, the airplane, having a moderate wingloading, will carry a comparatively large amount of ice safely.

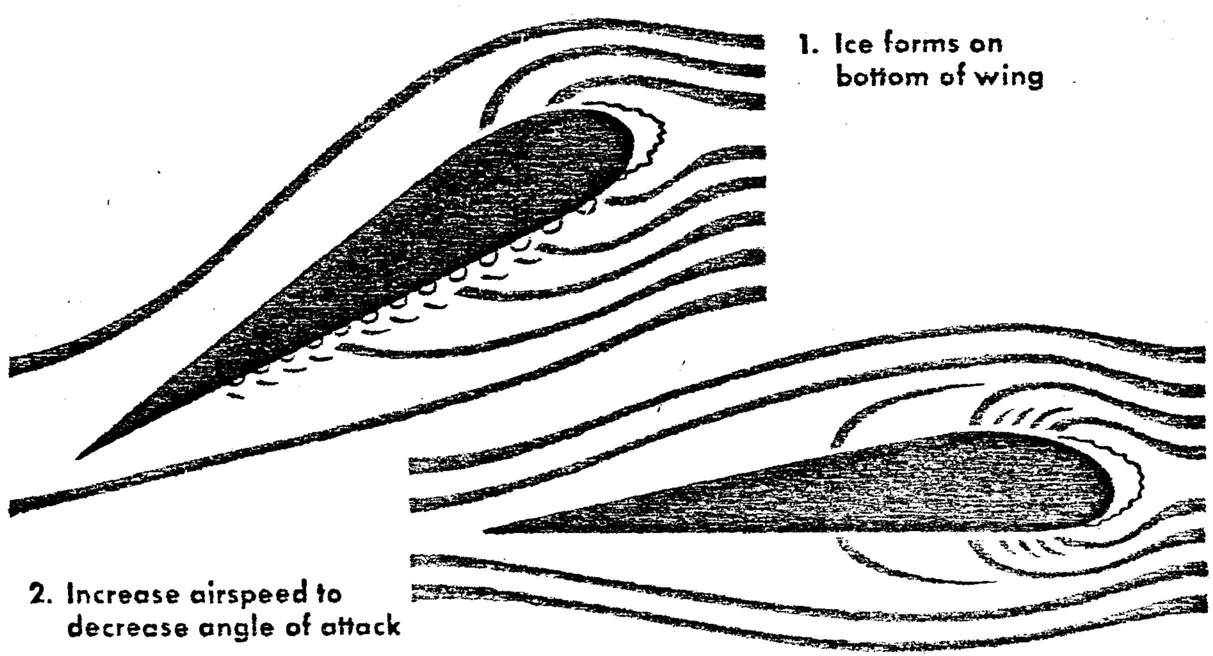
Once heavy ice accumulation starts, you have a tendency to pull up the nose to maintain altitude. When this happens, nodules of ice form around the rivet heads on the bottom surfaces of the ship. These airborne barnacles increase drag. To prevent their accumulation, increase power and airspeed when heavy ice starts to form. This keeps the ship in a level-flight attitude. A speed of 180 mph keeps the airplane level with a heavy load of ice.

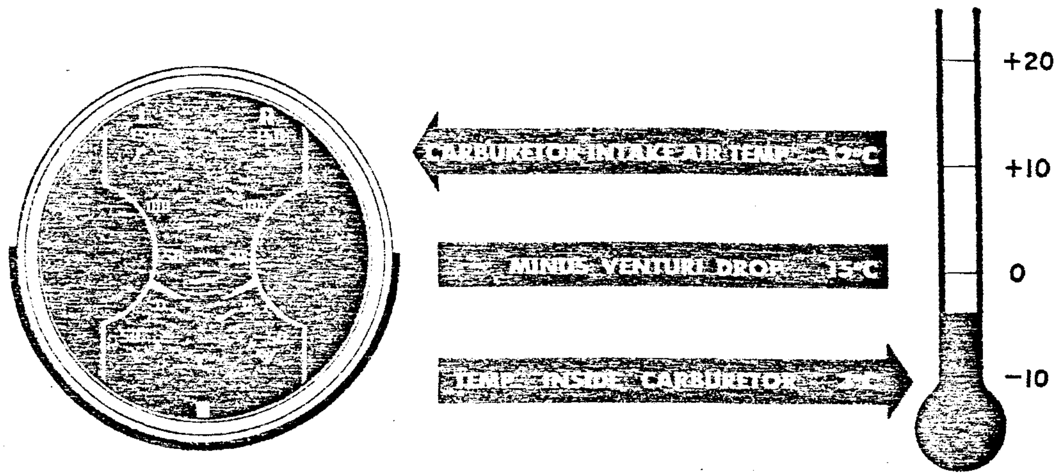
The rubber de-icer boots are quite effective for removing ice from wing and tail surfaces. Use them intermittently as needed for different types of ice.

Remember: De-icing equipment is installed primarily to allow you to fly the ship through icing conditions in order to reach levels where there is no icing. **Get out of icing conditions as soon as you can.**

Carburetor Ice

The fuel injector type of carburetor used in the C-46 tends to be more ice-free than most other carburetors. However, all carburetors ice up under certain conditions.





When you are flying through precipitation or through air with heavy moisture content, ice can form in the C-46 carburetor when the carburetor intake air temperature is as high as +15°C. The venturi effect inside the carburetor lowers the temperature to freezing level. Normally, this temperature drop is 10° to 15°C.

Note: The carburetor air temperature bulb is in the elbow of the air intake and reads intake air temperature, not the temperature inside the carburetor.

When you are reasonably sure that icing conditions exist, use carburetor heat to maintain a carburetor intake air temperature of 15° to 30°C. This prevents icing. Do not use carburetor heat unless there is real danger of icing. Heat cuts down engine power and may cause detonation under certain conditions of high-power operation.

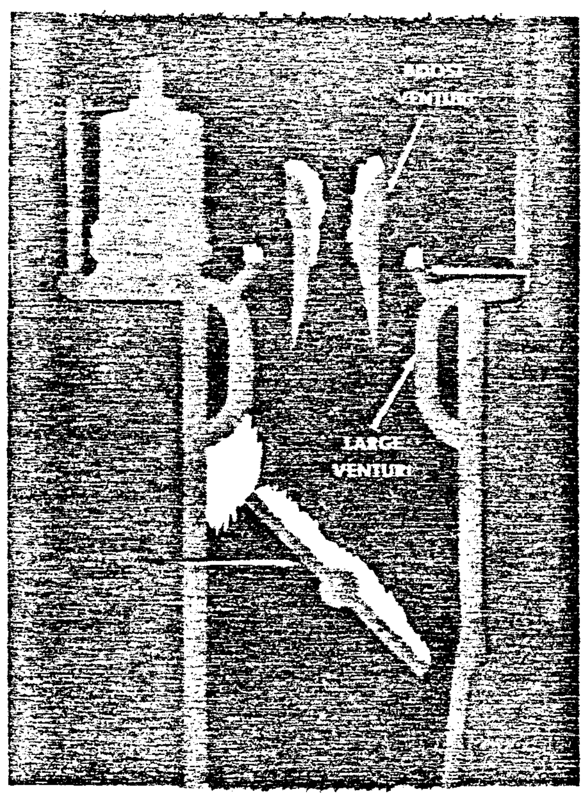
Usually, it is not desirable to use heat when the precipitation is in the form of sleet and intake temperatures are below freezing. Sleet passes on through the carburetor without causing trouble, whereas carburetor heat melts the sleet and it then refreezes inside the carburetor.

There are three symptoms of carburetor icing:

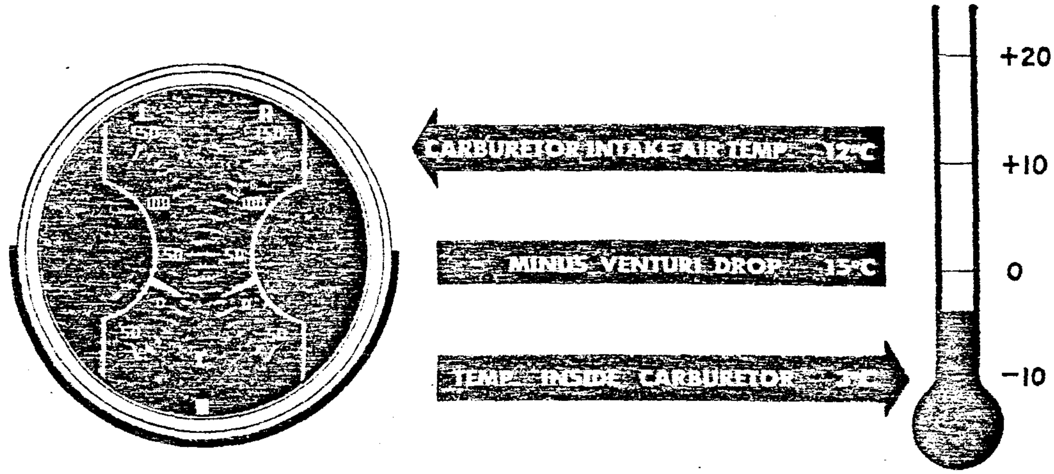
1. Manifold pressure drops because of constriction of the air intake passages.
2. Fuel-flow gages fluctuate because of improper fuel metering when ice clogs the impact tubes and boost venturi.
3. Engine surging or backfire may occur.

Use full carburetor heat when any of these symptoms show up. Application of heat may result in a momentary rise in manifold pressure as ice melts and the carburetor is cleaned out.

Icing is likely to occur at small throttle openings when letting down through an overcast or during an approach for a landing. Use full heat



Carburetor icing



When you are flying through precipitation or through air with heavy moisture content, ice can form in the C-46 carburetor when the carburetor intake air temperature is as high as +15°C. The venturi effect inside the carburetor lowers the temperature to freezing level. Normally, this temperature drop is 10° to 15°C.

Note: The carburetor air temperature bulb is in the elbow of the air intake and reads intake air temperature, **not** the temperature inside the carburetor.

When you are reasonably sure that icing conditions exist, use carburetor heat to maintain a carburetor intake air temperature of 15° to 30°C. This prevents icing. Do not use carburetor heat unless there is real danger of icing. Heat cuts down engine power and may cause detonation under certain conditions of high-power operation.

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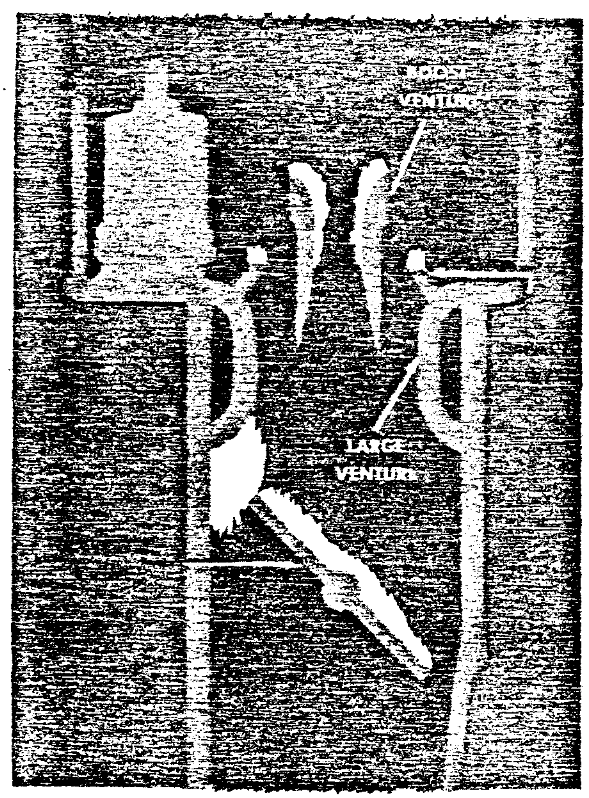


Carburetor icing

during the let-down but place in COLD just before landing in order to have full power available.

The carburetor heater in C-46's does not give a quick rise or a large rise when outside air temperatures are low. Furthermore, if the engine quits because of ice, there is not sufficient heat available to remove the ice, since the heat comes from the engine exhaust.

The carburetor alcohol anti-icer system is an effective method of preventing or eliminating ice. Turn on the system and use continuously as long as is needed.

Use alcohol to prevent ice on takeoff, when carburetor heat is undesirable because of the power loss.

As a last resort, you can sometimes eliminate carburetor ice by leaning the mixture and causing the engine to backfire. This is risky, because of the possibility of damaging the engine. **Be sure to turn carburetor heat off before using this method.**

Propeller Ice

Icing of the propeller blades has as great an effect on the over-all performance of the airplane as wing ice. Propulsive efficiency may drop considerably if the blades lose their airfoil shape because of heavy ice accumulation.

Turn on the propeller anti-icing system **before ice starts to form,** and let it run at full speed for at least 30 seconds to fully coat the blade surfaces with alcohol. Then reduce the rate of flow by adjustment of the rheostat and leave on as long as icing conditions prevail.

If you run out of fluid, or the anti-icer system fails, a sudden increase of engine rpm may sling the ice off the props. Speed up the engines for a few seconds until ice is removed, then return to cruising rpm.

Windshield Ice and Frost

Operation of the cockpit heater provides heated air to the windshield defrosters for removal of any frost and ice.

Some C-46's have an alcohol system. Use the windshield wipers in conjunction with the alcohol to help remove the ice. Distortion results when there is any glaze or liquid left on the windshield.

If it is difficult to keep the windshield clean, be sure to keep the side windows unfrozen by opening and closing them frequently. It is easy for them to freeze tight when flying through freezing rain or sleet.

When it is impossible to clear the windshield sufficiently to see ahead for contact flight or for landings, use the clear-vision panel. Open the sliding side window and turn the panel so that it deflects the wind away from the window. You can then see out the window without being blinded by the air stream. The present panel is 3 inches wide, and for better vision a width of 5 inches to 6 inches is desirable. Some organizations have modified the panel to suit their needs.

Pitot Heaters

Whenever you fly through any type of visible moisture, use pitot heat. Turn on the breaker switch on the overhead panel, and then turn on the individual switches for each pitot mast. This prevents freezing of the pitot head and loss of airspeed indication.

Emergency Flight Procedures

A knowledge of emergency procedures is like a parachute. When you need it, you need it —and it's awfully embarrassing to find that you don't have it.

You've got to learn emergency procedures before the emergency. There's no time then for guesswork, or for looking it up in the book. Either you know the right thing to do, or you're sunk.

Remember, you have a crew and possibly a cabin full of passengers, for whose safety you are responsible. You owe it to them to know what to do and how to do it when you meet an emergency. How to handle your airplane when things begin to happen is the proof of whether you are really a pilot or just another Junior Birdman.

ENGINE FAILURE

The best thing to do about the loss of an engine is **to prevent it.** That's the purpose of detailed engine run-up and checks—to make sure that your engines will operate properly throughout flight, and particularly during the critical period of getting the ship into the air.

But sometimes, despite your careful checks, an engine cuts out on you. It may fail any time between the takeoff run and the approach for landing, so you need to know what to do about it under all conditions.

When to Feather

Don't get featheritis. In most cases of engine failure you can take your time about feathering without endangering the engine or the airplane.

The only times you need to jump for the feathering button are: when an engine fails after takeoff, at critically low flying speed; or when there is severe vibration in the engine which may damage the wing and perhaps tear the engine from its mounts.

In all other cases, take it easy. The cause of engine failure may be minor, and you may be able to re-start the engine immediately.

1. Check to see that ignition switch is ON.
2. Check fuel pressures.
3. Check the fuel selector valve position. Turn it to another tank. Fuel quantity gages

SINGLE ENGINE EMERGENCY PROCEDURE

CONTROL OF AIRPLANE AND GOOD ENGINE	1. Call "Gear up!" 2. Correct for yaw with rudder pressure. 3. Determine which engine is out. You are pressing the rudder on the good engine side. Remember—"Best foot forward." 4. Advance the prop control and throttle on the good engine. (If you have any doubt about which engine is dead, *advance on both engines.)* 5. Move mixture control on good engine to AUTO RICH. 6. Apply rudder trim.

You now have the airplane partially trimmed and power advanced on the good engine. Use standard feathering procedure on the dead engine:

FEATHERING PROCEDURE	7. Retard throttle. 8. Feather the prop. 9. Move mixture control to IDLE CUT-OFF and turn booster pump OFF. 10. Turn fuel selector valve OFF.
FINAL ADJUSTMENTS	11. Retrim airplane. 12. Set cowl flaps and oil shutters on good engine to maintain temperatures within limits. 13. Shut cowl flaps and turn ignition OFF on dead engine.

In practice feathering, when you don't wish to actually feather the propeller, substitute "Pull back prop control" for step No. 8.

Remember that you may have to use fuel from the tanks on the bad engine side and warn the engineer to be ready to turn on the crossfeed valve at your order.

are not accurate and you may be trying to run on an empty tank.

4. Turn fuel booster pump ON.
5. Move mixture control to FULL RICH.

If this check fails to re-start the engine, feather the propeller if necessary. If the loss of power is only partial, it may be desirable to keep the engine running. In general, when manifold pressure remains as high as 12" to 15" Hg. the power in the engine is offsetting the drag of the propeller. Anything above that is giving you some useful work from the engine.

LOSS OF AN ENGINE ON TAKEOFF

On Takeoff Run

If an engine fails before you leave the ground, **chop the throttles immediately** and use brakes to stop the airplane before you run out of runway. You can't take the airplane off the ground with one engine, no matter how light your load, so don't try.

If you see that the brakes won't stop you before you get into trouble, unlock the tail-wheel and groundloop the airplane well before you reach the end of the runway.

When you can't stop with the brakes and can't groundloop because you're too close to other aircraft or obstacles—there's only one thing left to do: Retract the gear and make a belly stop. It's costly, but worth it to prevent loss of life and a complete washout of the airplane.

After Leaving the Ground

1. **Before reaching single engine speed:** Chop the throttles and land straight ahead.

If the wheels are still down and enough runway remains, land wheels-down and stop by using brakes.

If the wheels are still down and not enough runway is left for stopping, retract wheels immediately.

If you have retracted the wheels, land wheels up.

2. **After reaching safe single engine speed:** Follow normal single engine emergency procedure. Bring the ship around and land as soon as possible.

Feathering for Single-engine Practice

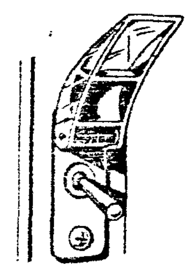
(Curtiss Electric Propellers)

1. Retard throttle and prop control on the side to be feathered.
2. Move mixture control to IDLE CUT-OFF.
3. Feather the propeller by use of the feathering switch or the DEC RPM switch.
4. Advance power on the good engine.
5. Retrim the airplane.

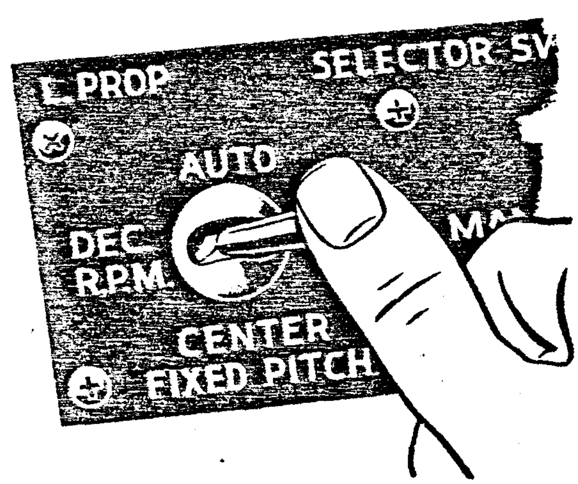
Restarting the Engine

(Curtiss Electric Propellers)

1. Adjust the controls on the engine to be restarted:
   Throttle—Closed
   Propeller control—Full back (low rpm)
   Ignition—ON
   Fuel selector valve—On desired tank
2. Move feathering switch to NORMAL.



3. Hold selector switch in INC RPM until propeller windmills at 800 to 1000 rpm.



4. Mixture—AUTO RICH.

5. Warm up engine at not more than 1000 rpm and 15" Hg. until the cylinder-head temperature reaches 100°C and the oil temperature 40°C.

6. Place selector switch in AUTO and resume normal operation.

Hamilton Standard Propellers

The procedures described above are for Curtiss electric propellers, but apply to Hamilton Standard propellers also, with these exceptions:

To feather, simply press the feathering button. You do not have to hold the button in; it stays in position until the prop reaches the full-feathered position and then pops out.

If the propeller starts to unfeather immediately after reaching the feathered position, because of the switch not cutting out automatically, pull the button out manually. After a few seconds, refeather the propeller and pull the switch out manually again when the propeller reaches the feathered position.

To unfeather, hold in the feathering button until the rpm reaches 1000, and then release.

Failure to Feather

If either type of propeller fails to feather because the feathering mechanism is not working properly, set the propeller control at lowest rpm to reduce drag caused by windmilling. If there is severe vibration, slow the airplane down to lowest safe speed. The lower forward speed reduces windmilling and is likely to cut down the vibration.

RUNAWAY PROPELLERS

Runaway propellers are a result of failure of the governor to increase blade angle to compensate for increased power output of the engine or increased airspeed of the airplane. A runaway propeller overspeeds the engine and can seriously damage it.

CURTISS ELECTRIC PROPELLERS

On Takeoff Run

If rpm exceeds the maximum setting on the takeoff run, before the ship leaves the ground, cut power immediately and bring the airplane to a stop. Then perform the following check:

Selector switch—AUTO

Circuit breakers—In

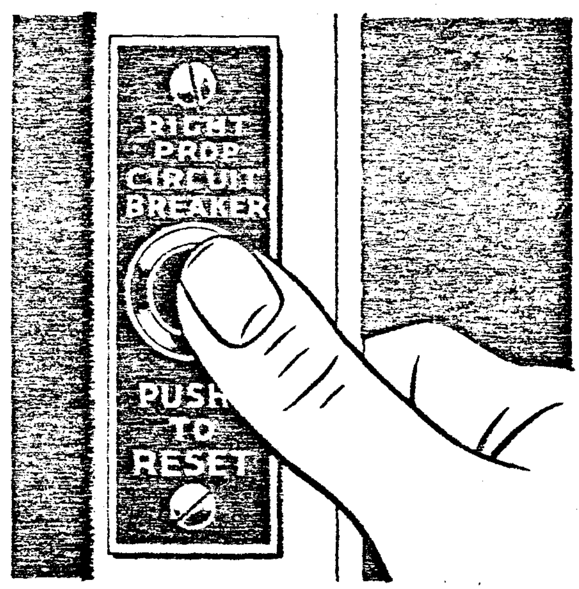
Batteries, generators, and master switch—ON

If you find these controls are properly set, then the trouble is in the governor control or electrical system. Do not take off until the trouble is corrected.

In Flight

If runaway occurs after the ship has already left the ground, or at any time in flight, perform the foregoing check.

If controls are in normal position, try to reduce rpm by using the DEC RPM switch. If the DEC RPM switch won't work, use feathering switch momentarily.



In emergency, hold circuit breaker in

If the circuit breaker is out, indicating an overload in the circuit, hold the circuit breaker button in to reset and operate the DEC RPM switch or feathering switch.

If there is full electrical failure, no readjustment of the prop controls affects the pitch. Reduce throttle setting to hold rpm to a maximum of 3000, but hold manifold pressure above 15" Hg., since any lesser amount causes the prop to create drag.

Slow the airplane as much as possible. Windmilling of the prop increases with the forward speed of the airplane and results in further excess rpm.

HAMILTON STANDARD PROPELLERS

If a propeller runs away on the ground during takeoff, cut power, stop the airplane, and have the governor checked before again attempting to take off.

In flight, either feather the propeller or keep it within normal limits by the following method:

Push the feathering button. When rpm drops to the desired setting, pull the feathering button out manually. If the governor does not take hold, feather again when rpm exceeds 2700 and continue intermittent feathering and unfeathering as long as necessary.

EMERGENCY EXITS

Troop Door

The troop door is in the forward section of the main cargo door. To open, turn handle at bottom and pull inward and upward. Snap on the strap hanging from the ceiling to hold the door up.

The door has pull-type hinge pins so that you can open it in an emergency when cargo prevents it from being swung inward.

Emergency Doors

There are three emergency doors in the fuselage, one above each wing and one on the right side opposite the main cargo door. To open, pull the handles at the top of each door.

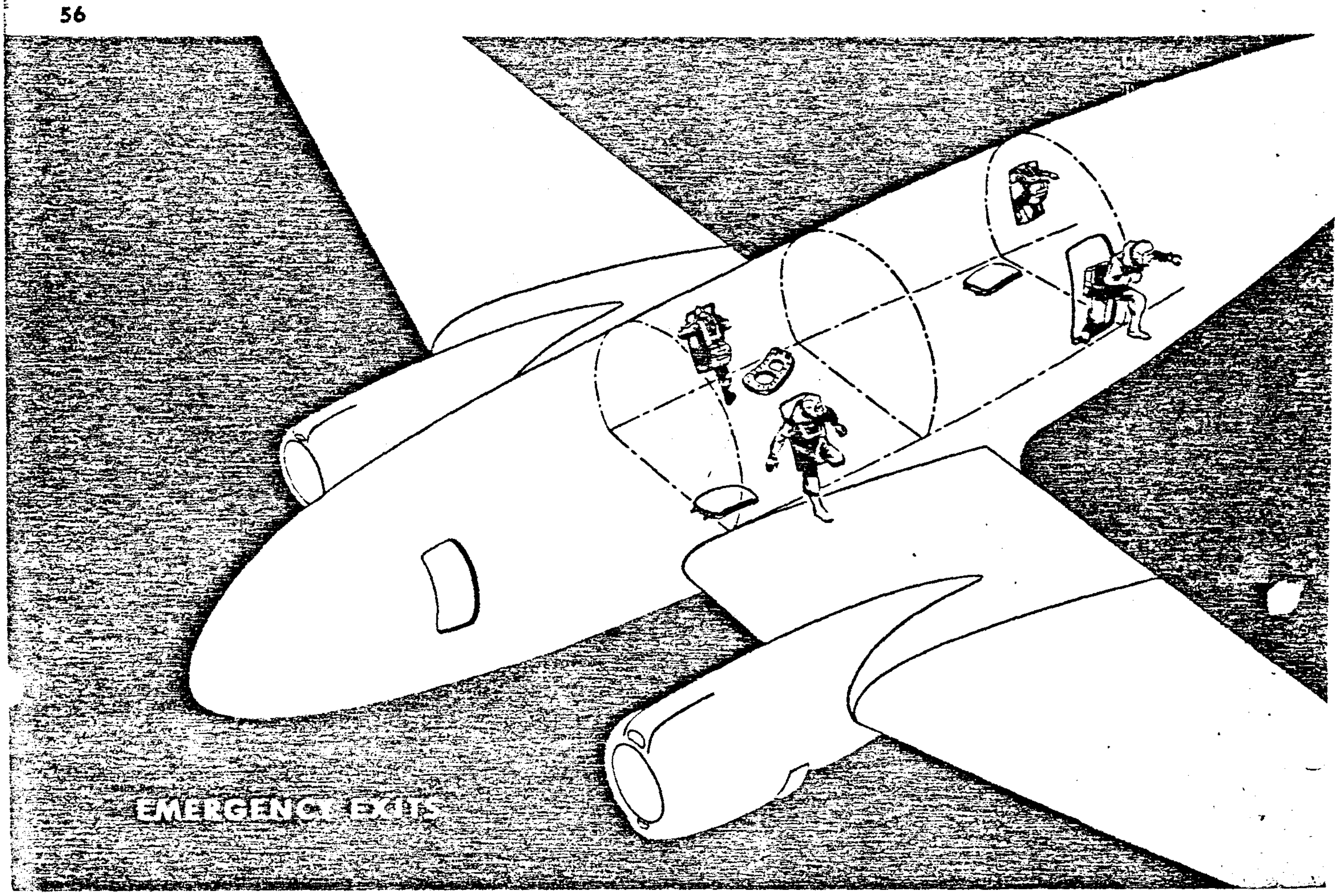
Pilot's Utility Door

There is a door on the left side of the pilot's compartment for emergency use **on the ground only**. Do not open this door in flight.

FIRES IN FLIGHT

Use all fire extinguishers applicable and follow proper procedure at once.

Prepare for emergency. Warn every man on the airplane to get his parachute on and to move to his proper position for bailout. Have crew members stand by to open emergency hatches.



EMERGENCY EXITS

Determine whether to attempt a landing or to abandon the airplane. If airplane is to be abandoned, climb to a safe altitude. if possible, then give the order to bail out.

Engine Fires

At the first sign of a fire, use the following procedure on the affected engine:

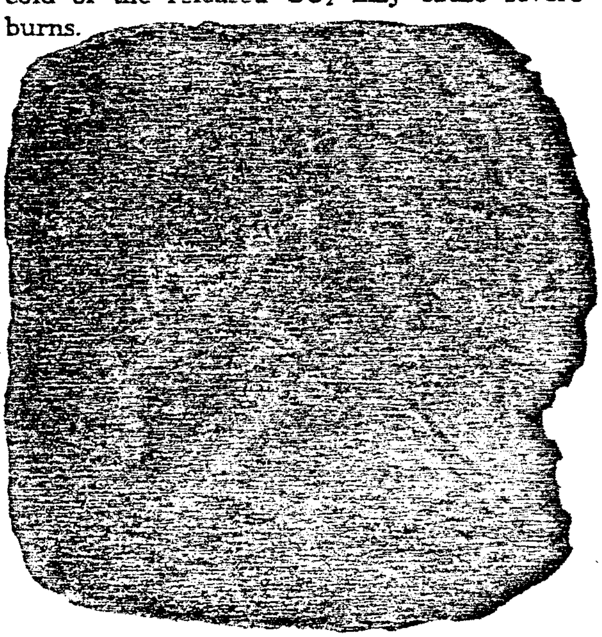
1. Cowl flaps—OPEN.
2. Shut fuel OFF.
3. Feather propeller.
4. Turn ignition OFF.
5. Pull handle to release CO_2 charge.
6. Do not start engine again.
7. Land as soon as possible.

Cockpit and Cabin Fires

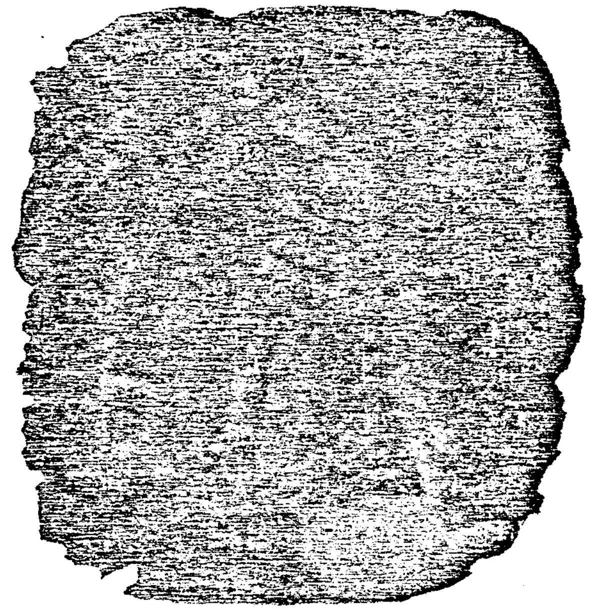
1. Close windows and ventilators.
2. Locate source of fire.
3. If fire is electrical, cut power to affected part.
4. If fuel line is leaking, cut flow through line.
5. Use all extinguishers available.
6. Land as soon as possible.

Hand-Operated Fire Extinguishers

To use CO_2 extinguishers—Move in close and aim at the base of the fire. Do not touch any portion of the discharge nozzle. The extreme cold of the released CO_2 may cause severe burns.



To use the carbon tetrachloride extinguishers—Stand back from the fire, but within effective range. Aim at the base of the fire. Open windows and ventilators after fire is extinguished. **The fumes generated are poisonous.**



BELLY LANDINGS

If you must make a forced landing, land wheels up on anything except a known airport. Landing with the wheels down on rough terrain may cause the airplane to nose over, increasing damage to the airplane and danger to the crew.

Many belly landings have been made in the C-46 with only moderate damage to the airplane and no injury to the crews.

1. Pick a spot to land while you still have fuel enough to bring the plane down with power. **Don't run out of gas if you can help it.**
2. Jettison cargo to lower the landing speed of the airplane and to prevent injury to personnel. The cargo probably will shift when you land. Throw out all loose objects.
3. Open escape hatches. They may jam on impact and delay exit.
4. Warn crew and passengers in time for them to brace themselves for the crash. Positions for a crash landing are the same as those for ditching.
5. Lower flaps to increase lift.

6. Land as nearly into the wind as you can.

7. Push prop controls full forward. Never feather, as a feathered blade does not give easily and may pull the engine out of the nacelle.

8. Fly the ship right down onto the ground with ample speed. Don't try a stall landing.

9. Just before contact with the ground:
Mixtures—IDLE CUT-OFF
Battery switches—OFF
Master switch—OFF
Ignition—OFF
Fuel selector valves—OFF

10. After the airplane has stopped, grab first-aid kits and any other necessary equipment and get out. Get at least 50 feet away. There may be danger of fire and explosion.

BAILOUT

Parachutes are not carried on all transport operations. However, when they are required, it is the pilot's responsibility to see that:

1. Each passenger and crew member aboard his airplane has a properly fitted parachute.

2. Every man's parachute is convenient to his normal station, ready for donning.

3. Each man knows how to put on the chute, how and where to leave the airplane, how to open the chute, and how to land and collapse the chute. (See PIF)

4. Signals for "Prepare to bail out" and "Bail out" are understood by all personnel.

When to Bail Out

In all cases it is your positive responsibility to decide when a bailout emergency exists. Never shirk this responsibility by putting it up to your crew. In case of fire, fuel exhaustion, mid-air collision, weather which makes landing dangerous, or other hazardous circumstances, only you, the pilot, can judge the extent of the danger and whether the crew should bail out.

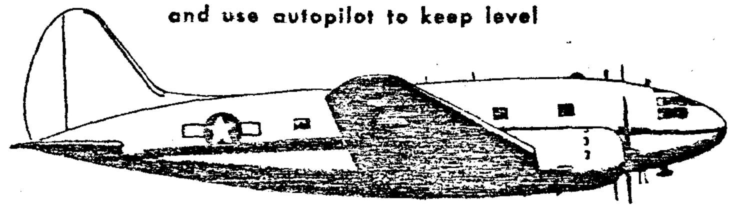
Radio Your Position

The instant you suspect an emergency is developing, have the radio operator broadcast your position and difficulty. This may save hours or even days for rescue parties searching for you.

1. Radio position & difficulty ASAP

2. Warn crew members to prepare for bailout

3.
Gain altitude if possible. Slow down and use autopilot to keep level



Bailout Signals

Warn your crew to prepare for bailout as soon as the emergency becomes imminent. Use the alarm bell if necessary. The approved signal for "Prepare to bail out" is three short rings. The signal for jumping is one long ring.

Bailout Procedure

1. At the signal "Prepare to bail out" the crew and passengers put on parachutes and make immediate preparation to leave the ship.
2. Crew opens all emergency exits.
3. Pilot gains altitude if possible, and slows down the ship as much as he can with safety. Use autopilot to keep the airplane level.
4. Method of leaving the ship depends upon the number aboard, the cargo, and the nature of the emergency.

The troop door is the largest exit, and therefore the easiest to use. When there is time for all the crew to make their way aft to this door and the ship is not pitching violently, use this exit. When passengers are carried they normally bail out through this door.

To exit from the troop door, either jump out feet first or dive out.

If cargo makes it difficult for the crew to get back to the troop door quickly, or the ship is uncontrollable, use the emergency exits above the wings. Go out of these head first onto the wing and slide off the trailing edge.

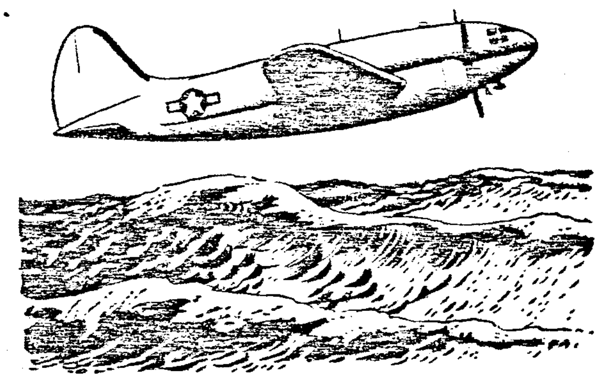
Under some conditions it may be advisable to use all four emergency exits to speed up abandoning the plane.

You, as airplane commander, must designate beforehand which exits are to be used, and which crew members are to use each. Remember that you are the last to leave, so don't take this planning lightly.

Your PIF contains full information on parachute technique.

DITCHING

If you are ferrying C-46's overseas, or are making regular over-water flights, there is always the possibility that you might have to ditch an airplane some day.



Experience has shown that successful ditching is largely a matter of planning and organization—having a standard procedure worked out for the emergency with every man trained in the duties that he is to perform. Because of the nature of cargo and transport missions it is not usually possible for pilots to drill their crews in ditching procedure in the same manner that bomber crews are trained. However, before and during over-water flights you must see that your crew members become familiar with at least the essentials of ditching procedure for this airplane.

Preparation for Ditching

Ditching an airplane can hardly be called a normal flight maneuver. Use every trick you and your crew know to keep the airplane running until you can bail out over land or crash-land the ship. If it becomes obvious that you must ditch, however, don't wait until the last minute to start preparing for it.

Jettison all cargo and everything else that can be thrown out of the ship. This keeps you in the air longer and reduces the danger of injury when you ditch.

Plan to ditch before your fuel runs out. Power is important for a successful ditching.

See that all possible radio contacts are made, in accordance with the procedure prescribed for the theater of operations.

The standard alarm bell ditching signals are:
Six short rings—crew takes ditching positions
One long ring—crew braces for ditching

Ditching the Airplane

Your PIF gives full information on judging wind velocity and direction, general procedure for setting the airplane down, ditching positions, and the use of emergency equipment after ditching. Familiarize yourself with this section of PIF before you start on over-water flights. Here are some additional hints:

Ditch crosswind if wind is under 35 mph—when no spray or streaks of foam are visible on the sea. Ditch into wind if its velocity is over 35 mph.

Bring the airplane in as you would for a normal approach, holding speed above 100 mph.

Set the ship down on the water in a 3-point attitude.

Make the actual touch-down at as slow a speed as you can.

Get personnel and equipment out in the rafts as quickly as possible. The length of time a C-46 floats depends largely on how much damage is done during ditching. Normally, it has good flotation qualities. **But don't stay in the ship.**

CREW DUTIES

Pilot

1. Advises crew to prepare for ditching and gives estimate of time left. Calculates position to give to radio operator if there is no navigator aboard.

2. Checks life vest. Fastens safety harness and seat belt.

3. Warns crew to brace for ditching, just before setting the airplane down.

4. Holds position after airplane touches down, until it comes to rest. Destroys IFF.

5. Supervises abandonment of airplane and assists copilot and navigator in launching equipment.

6. Sees that everyone is out, leaves plane last, and assumes command of rafts.

Copilot

(Assumes duties of flight engineer when necessary)

1. Takes over controls while pilot fastens belt and harness.

2. Checks life vest, seat belt, and safety harness.

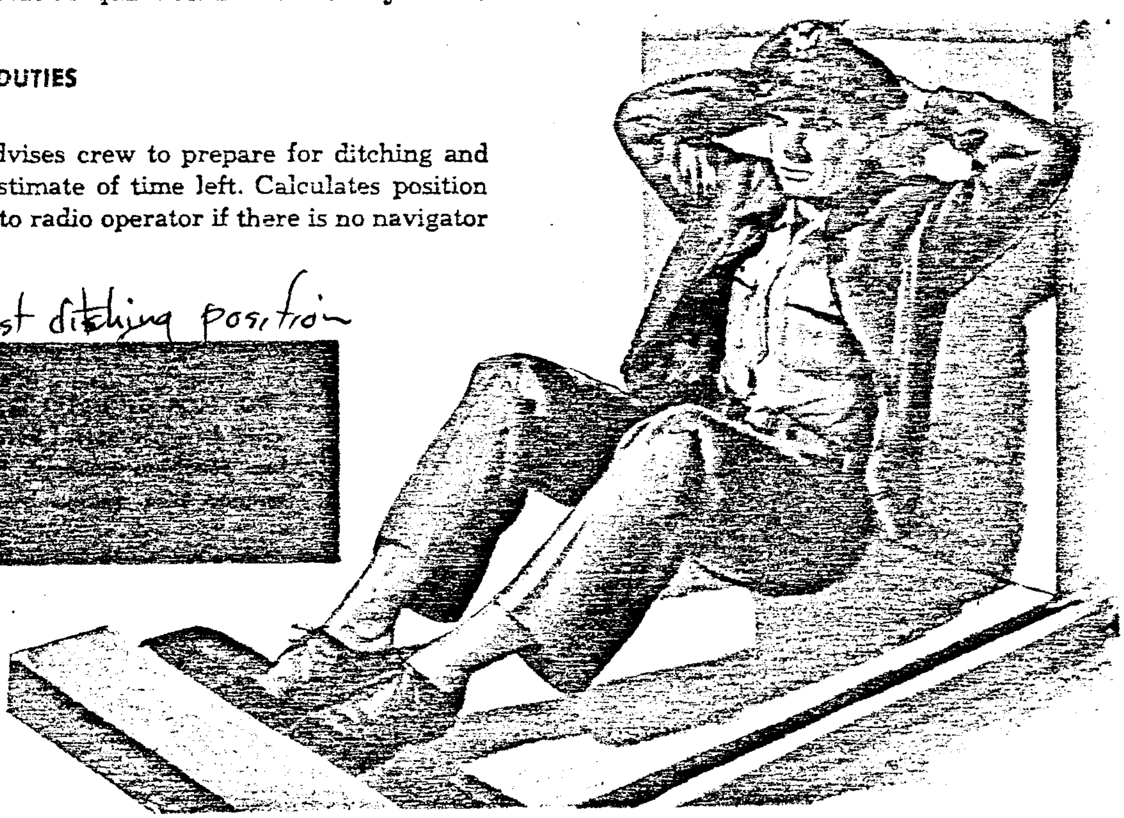
3. Assists pilot.

4. Holds position until airplane comes to rest.

5. Helps pilot and navigator launch equipment and evacuate personnel.

Best ditching position

[redacted]



Navigator

(If absent, duties are assumed by radio operator)

1. Relays estimated ditching position to radio operator.

2. Checks life vest. Stows essential navigation equipment in bag and takes it with him.

3. Opens forward emergency hatches and throws out ditching rope. Assumes ditching position: aft of cargo, sitting on floor with back firmly braced against cargo.

4. Holds position until after airplane comes to rest.

5. Helps pilot and copilot launch emergency equipment, rights rafts and assists passengers aboard.

Radio Operator

(Assumes duties of navigator when necessary)

1. Sends initial distress signal on group frequency on pilot's order to "Prepare for ditching." Puts IFF to distress. Transmits estimated position of ditching as received from navigator or pilot.

2. Transmits nature of trouble if possible. Checks life vest.

3. Locks key down, folds table, secures chair facing left engine and as far to rear as possible. Assumes ditching position: to rear of cargo, sitting on floor with back firmly braced against cargo.

4. Holds position until after airplane comes to rest.

5. Assists engineer in launching emergency equipment through rear emergency exit. Assists passengers and equipment into rafts.

Flight Engineer

(If absent, duties are assumed by copilot)

1. Checks life vest and assists pilot with ditching harness if necessary.

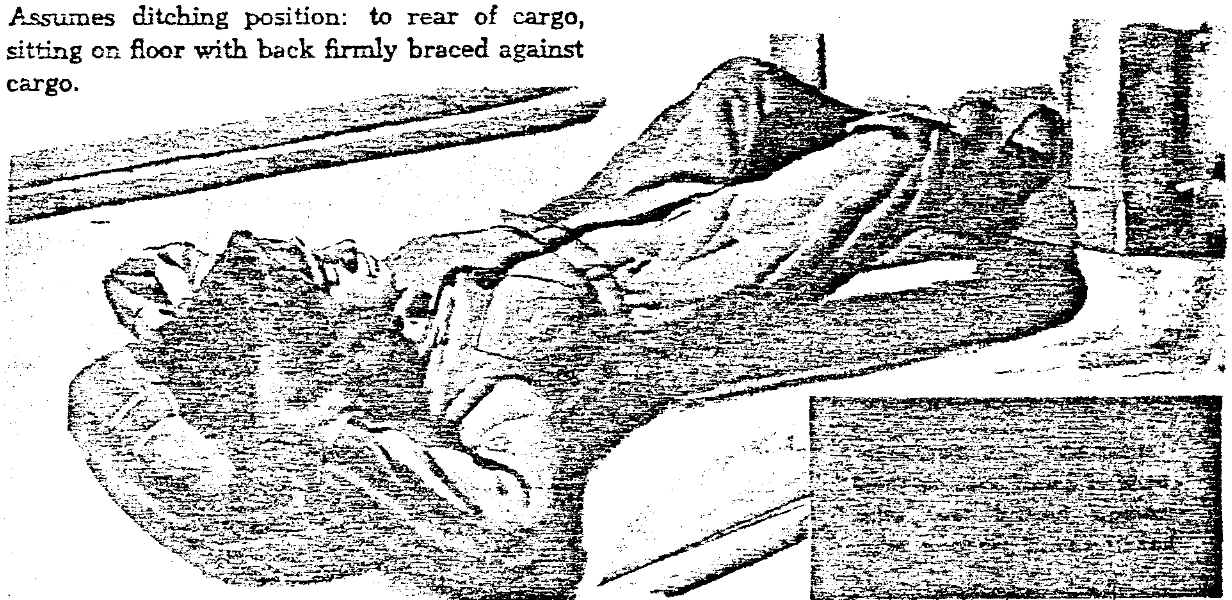
2. Advises passenger of situation. Supervises assuming of ditching positions, keeping in mind that passengers should not be in front of cargo. Sees that each passenger has his life vest on and is seated on floor facing aft with back braced against cargo and hands behind head. Advises passengers of bracing signal and braced positions. Lights emergency lights (if at night). Opens right rear emergency hatch.

3. Assumes ditching position: aft of cargo sitting on floor with back firmly braced against cargo.

4. Holds position until after airplane comes to rest.

5. Observes if tail is riding high enough to use troop door for escape; if so, opens segment of cargo door outward or troop door inward at own discretion. Launches emergency equipment at rear exits.

6. Assists passengers out and boards raft.



Second Best Position

Cruise Control

The various tasks the C-46 is called upon to perform require varying operating speeds and powers. Cruise control consists of proper choice of power to perform the required mission most efficiently. There are four general ranges of cruising with which the pilot must be familiar:

1. Maximum range cruise
2. Normal or intermediate cruise
3. High-speed cruise
4. Maximum endurance cruise

MAXIMUM RANGE CRUISE CONTROL

Maximum range cruise control is the technique of operating the airplane to obtain maximum miles per gallon of fuel.

The C-46 is not a long-range transport, judged by current standards. Many operational flights of the airplane are of short or medium distances, permitting large fuel reserves and use of normal cruising powers and airspeeds.

However, there are some conditions under which it is vital for you to get every mile possible out of your fuel. An obvious condition is when the flight distance is so great that normal cruising will not get you to your destination with a safe fuel reserve. But this is by no means the only time that maximum economy operation is necessary. Other conditions include:

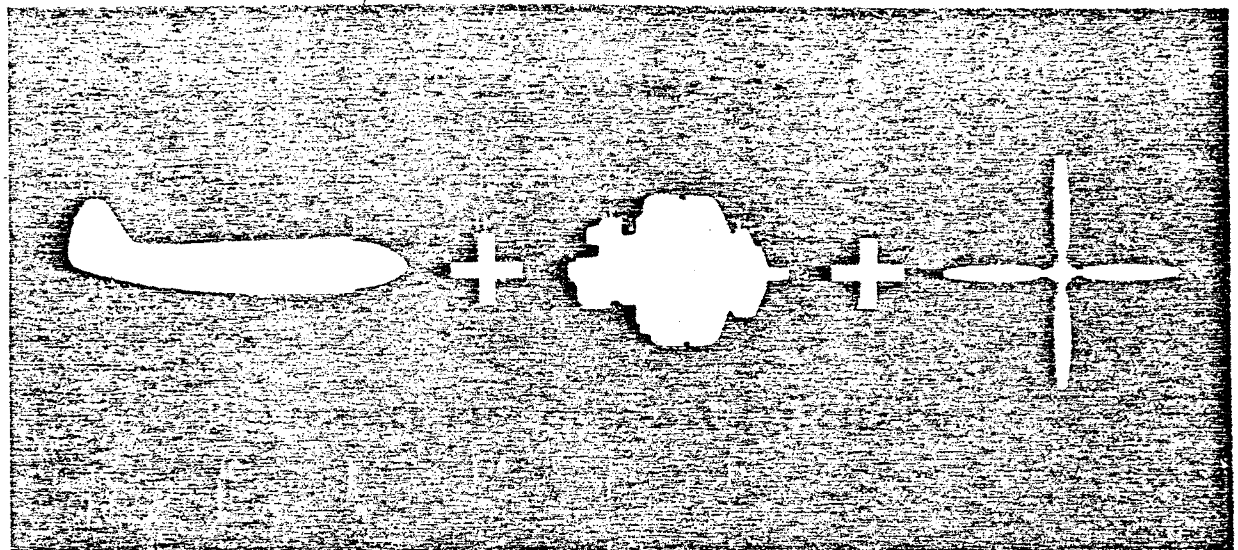
1. When greatest payload is required, reducing fuel load to a minimum.
2. When you are flying over a route where fuel is at a premium.
3. When an emergency during flight makes it imperative to obtain maximum range from the remaining fuel.
4. When strong headwinds prevail.

Factors Affecting Range

Many pilots have the mistaken idea that maximum range cruising consists simply of cutting down airspeed—the lower the speed the greater the fuel saving for a given distance. This is by no means true. Several factors influence the ratio of miles per gallon, and under certain conditions your airspeed for maximum range may be higher than that for normal cruising.

The three basic factors affecting maximum range are: airplane efficiency, engine efficiency, and propeller efficiency. The maximum efficien-

Proper Combination of



Equals Best over-all Efficiency

cies of the airplane, the engines, and the propellers do not usually occur at the same combination of variables. For example, best rpm for propeller efficiency may not be the best rpm for engine efficiency. Consequently, you must compromise by combining these three factors to get maximum over-all efficiency for optimum cruise operation.

Airplane efficiency—An airplane flies most efficiently at any given weight at one airspeed only. This is the speed which provides highest ratio of lift to drag, or maximum L/D.

Engine efficiency—Engines operate most efficiently at high BMEP (brake mean effective pressure). This high pressure on the pistons during the power stroke results in a high engine torque or rotating force on the driveshaft. You obtain a high BMEP by using low rpm and high manifold pressure. Close adherence to manifold pressure limits is important, since operation above maximum BMEP limits is injurious to the engine.

Propeller efficiency—The efficiency of the propeller depends upon a number of variables, of which blade angle is the most important. The angle of attack of the blade affects propeller performance much as that of a wing affects airplane performance. Other variables concerned are forward and rotational speeds, power input, and density altitude.

In addition to the three basic efficiency factors, there are other variables to take into consideration when you want optimum performance for any given flight. These are:

Altitude—Above the critical altitude of the engine, you must increase rpm to maintain a given horsepower. This results in engine operation below design BMEP and reduces engine efficiency.

While engine efficiency may decrease at altitude, the over-all performance of the airplane remains effectively the same. For all practical purposes you can consider maximum range constant with altitude up to 15,000 feet.

Wind—Direction and velocity of wind have an important effect on long-range cruising, since economical operation is nothing more than obtaining maximum ground miles per gallon of fuel. Tailwinds increase this ratio; headwinds cut it down. To offset headwinds, increase speed to shorten the period of time the wind affects you.

Actual flight tests in a C-46 with Curtiss electric propellers have resulted in the following conclusions:

1. Propeller efficiency remains relatively high at low rpm. This permits you to use low rpm and high manifold pressure for required power throughout the entire range of power settings.

Low engine speeds result in better cooling and lessened wear. You can use speeds as low as 1400 rpm safely without causing any harmful vibrations within the structure of the airplane. Nor do these speeds cause excessive BMEP so long as you keep manifold pressures within limits.

2. The optimum specific range for a 45,000-lb. gross weight airplane is approximately 1.40 miles per gallon with no wind. Specific range varies only slightly with altitude up to medium altitudes. The increased true airspeed at higher altitudes is offset by a greater fuel consumption.

3. To obtain maximum specific range you must change airspeed and power for each change of weight and altitude.

Cruise Charts

Maximum range cruise charts are presented in various forms. In general, however, all forms are interpretations of the same basic data. The more detailed presentations take a greater number of variables into consideration and if adhered to rigidly should produce the maximum efficiency of operation. Their disadvantages are that they are more complicated to use and the exact settings they call for are difficult to hold.

Simplified cruise control charts for the C-46 are given in the Pilot's Operating Instructions (T. O. 01-25LA-1). These include both normal and single engine operation.

The more detailed chart reproduced here is representative of the type currently used by Air Transport Command. This particular chart is based on 60 mph headwinds; others in the same series are for 40, 20, and 0 mph headwinds with progressively lower airspeeds and greater fuel economy.

In charts such as this one, the power settings are average for the entire bracket. If gross weight and altitude are on the high side of the bracket, it may not be possible to obtain the desired airspeed with the power settings shown.

Practical Hints on Maximum Range

1. **Wind**—Unfavorable winds greatly cut down economy. Select an altitude with the most favorable wind if practical.

SAMPLE PROBLEM

Given: Pressure altitude—10,000 feet (with altimeter set at 29.92); OAT—−20°C; weight—43,000 lbs.

Find: Power settings, airspeed, and fuel consumption.

1. Enter altitude conversion chart at −20°C.
2. Go up chart to point where −20°C line meets 10,000 feet curve. This gives density altitude.
3. From this point go horizontally to the left and read the settings in the 44,000 to 41,000-lb. bracket.

After 2 hours 57 minutes cruising at these settings you will have burned 2000 lbs. of fuel. Then use the power settings in the next lower weight bracket—41,000 to 38,000 lbs.

2. **Air condition**—Find smooth air if possible. It is impossible to obtain efficiency from the airplane in turbulent air.

3. **Aerodynamic step**—Keep the airplane on the step. The C-46 is especially critical in this respect.

4. **Avoid extra drag**—Even a small amount of ice on the surfaces of the airplane greatly affects maximum range. Check landing gear doors to make sure they are not slipping down. Partially open cowl flaps also increase drag.

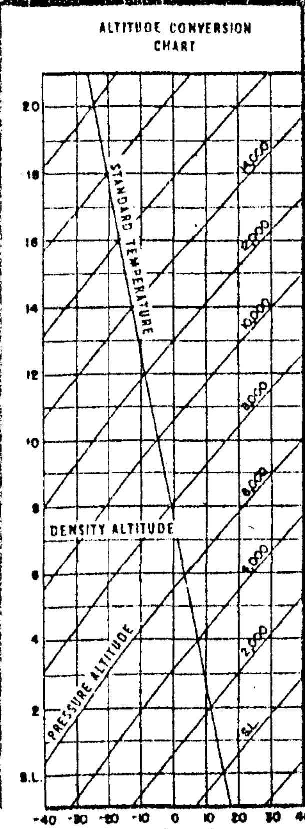
5. **Use of blower**—Operate in LOW blower whenever possible. Use HIGH blower only when you cannot obtain desired manifold pressure with full throttles at maximum cruising rpm.

6. **Fuel density**—Specific fuel consumption is in pounds of fuel, not in gallons. Gas tanks hold

Curtiss Elect. Prop.
Deicer boots & Army Paint

Use high blower
above heavy line

C-46A CONSTANT POWER CRUISE CHART FOR SCHEDULED OPERATIONS



WT	50,000 TO 47,000 LBS.					47,000 TO 44,000 LBS.					44,000 TO 41,000 LBS.					41,000 TO 38,000 LBS.					38,000 TO 35,000 LBS.				
HP/ENG	750	800	850	900	950	750	800	850	900	950	750	800	850	900	950	750	800	850	900	950	750	800	850	900	950
CIAS			130	139	148		133	140	147	153	133	139	147	153	158	139	146	152	158	163	148	152	158	162	167
TAS			*178*	*191*	*203*		*182*	*192*	*202*	*210*	*182*	*191*	*202*	*210*	*217*	*191*	*200*	*208*	*217*	*224*	*200*	*208*	*216*	*222*	*229*
CIAS			135	143	151		136	143	150	156	134	142	149	156	161	143	149	155	160	165	149	154	160	165	169
TAS			*179*	*190*	*200*		*180*	*190*	*199*	*207*	*178*	*188*	*198*	*207*	*214*	*190*	*198*	*206*	*212*	*219*	*198*	*204*	*212*	*219*	*224*
CIAS		130	138	146	154	133	140	147	153	159	141	148	154	159	162	147	154	159	163	167	152	158	162	166	170
TAS		*166*	*177*	*188*	*198*	*170*	*180*	*189*	*197*	*204*	*181*	*190*	*198*	*204*	*208*	*189*	*198*	*204*	*209*	*214*	*195*	*203*	*208*	*213*	*218*
CIAS		137	145	153	158	138	145	152	157	162	144	151	157	163	167	150	157	162	166	170	155	161	168	171	175
TAS		*170*	*180*	*190*	*196*	*171*	*180*	*188*	*194*	*200*	*178*	*187*	*194*	*202*	*207*	*186*	*194*	*200*	*206*	*210*	*192*	*199*	*206*	*212*	*215*
CIAS	131	140	149	158	166	140	148	155	162	168	147	154	160	166	171	153	160	165	170	175	157	163	169	174	178
TAS	*158*	*169*	*180*	*190*	*200*	*169*	*179*	*187*	*195*	*202*	*178*	*186*	*193*	*200*	*206*	*185*	*193*	*199*	*205*	*211*	*189*	*197*	*204*	*210*	*215*
CIAS	135	144	153	160	167	142	151	159	165	171	150	157	163	169	174	156	162	167	173	178	160	165	171	176	180
TAS	*157*	*168*	*178*	*186*	*194*	*165*	*176*	*185*	*192*	*199*	*175*	*183*	*190*	*197*	*203*	*182*	*189*	*194*	*202*	*207*	*186*	*192*	*199*	*205*	*210*
CIAS	139	148	157	164	170	146	156	162	168	174	153	160	166	172	177	158	164	170	175	180	162	168	173	178	183
TAS	*157*	*167*	*177*	*188*	*192*	*165*	*175*	*183*	*190*	*197*	*173*	*181*	*188*	*194*	*200*	*178*	*185*	*192*	*198*	*204*	*183*	*190*	*196*	*201*	*207*
CIAS	142	152	161	168	174	151	159	166	172	179	156	163	169	175	180	161	167	173	178	183	166	170	175	181	186
TAS	*156*	*167*	*177*	*184*	*191*	*166*	*174*	*182*	*189*	*195*	*171*	*179*	*186*	*192*	*198*	*177*	*183*	*190*	*195*	*201*	*181*	*186*	*192*	*199*	*204*
CIAS	148	157	165	172	178	155	163	169	175	181	160	167	173	178	184	164	170	176	181	187	167	173	178	183	188
TAS	*158*	*167*	*176*	*183*	*190*	*165*	*173*	*180*	*187*	*193*	*170*	*178*	*185*	*190*	*196*	*175*	*181*	*188*	*193*	*200*	*178*	*185*	*190*	*195*	*201*
CIAS	152	161	169	176	181	158	166	173	179	186	162	170	176	182	187	167	173	179	184	189	170	176	181	186	191
TAS	*157*	*167*	*175*	*182*	*187*	*163*	*172*	*179*	*185*	*191*	*168*	*176*	*182*	*188*	*194*	*173*	*179*	*185*	*190*	*195*	*176*	*182*	*187*	*192*	*198*
CIAS	157	166	173	180	186	163	170	176	182	188	167	173	179	185	190	170	176	182	187	189	173	179	184	189	191
TAS	*157*	*166*	*173*	*180*	*186*	*163*	*170*	*176*	*182*	*188*	*167*	*173*	*179*	*185*	*190*	*170*	*176*	*182*	*187*	*189*	*173*	*179*	*184*	*189*	*191*

HORSEPOWER CHART					
HP	750	800	850	900	950
RPM	1950	2000	2050	2100	2100
MP	26.0	26.5	27.5	28.0	29.5
P/H	780	843	910	978	1055
RPM	1850	1900	1950	2000	2050
MP	27.0	27.0	29.0	30.0	30.5
P/H	760	825	895	965	1045
RPM	2050	2100	1900	1950	2000
MP	24.0	25.0	30.0	31.0	31.5
P/H	740	810	840	900	975
RPM	1900	2000	2050	1900	1950
MP	25.5	25.5	26.0	31.0	32.0
P/H	730	780	840	880	925
RPM	1850	1900	1950	2050	2100
MP	26.5	27.0	28.0	28.0	28.5
P/H	720	782	845	875	945
RPM	1750	1800	1900	1950	2050
MP	29.0	28.5	29.0	29.5	29.5
P/H	710	745	796	865	945
RPM	1650	1700	1800	1900	2000
MP	29.5	30.0	30.5	30.5	31.0
P/H	700	750	802	870	945
RPM	1600	1650	1750	1850	1950
MP	31.0	31.5	32.0	32.0	31.5
P/H	700	750	807	880	960
RPM	1600	1650	1700	1800	1900
MP	32.0	32.5	33.0	33.0	33.0
P/H	718	755	815	890	960
RPM	1550	1650	1700	1750	1800
MP	33.0	33.5	34.0	34.5	36.0
P/H	725	780	840	895	955
RPM	1550	1600	1650	1700	1800
MP	34.0	36.0	36.5	36.0	36.5
P/H	760	820	875	940	1000

LEGEND

WT	AIRPLANE GROSS WEIGHT
HP/ENG	HORSEPOWER PER ENGINE
CIAS	CALIBRATED INDICATED AIRSPEED
TAS	TRUE AIRSPEED
RPM	REVOLUTIONS PER MINUTE
MP	MANIFOLD PRESSURE
P/H	[illegible]DS PER HOUR FUEL FLOW

DIRECTIONS

1. Set altimeter to 29.92. It then reads pressure altitude.
2. Enter altitude conversion chart with carb. intake air temp. Move upward until temp. line crosses correct pressure altitude line. This intersection gives density altitude.
3. Move to right to bracket which corresponds to airplane gross weight.
4. Read CIAS and TAS (in italics) under desired HP/ENG.
5. For power settings, move further right at same density altitude to HP chart.
6. Read RPM, MP, and total fuel flow u[illegible] HP used.

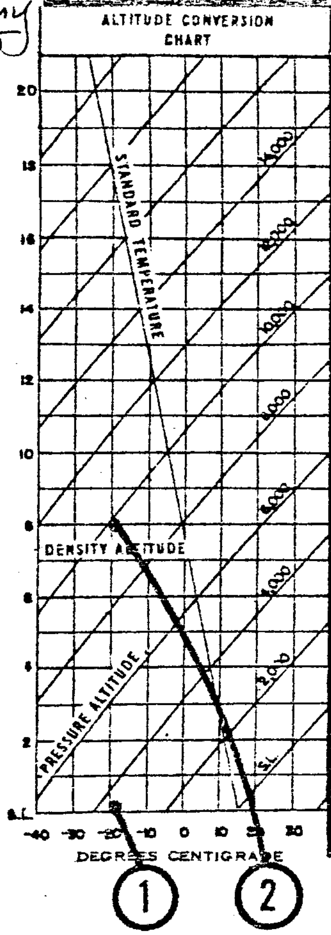
NOTES

1. These performance figures are for an average new C-46A. After the airplane is flown several hundred hours, fuel consumption and airspeed will vary up to +5 or —5%.
2. CIAS is the airspeed indicator reading corrected f[illegible] installation errors.

C 46 A Max Range Chart for 60 MPh Headwind

Deicer boots & Army Paint ON

use high Blower above heavy Line



GROSS WEIGHT	50 000 TO 47,000	47,000 TO 44,000	44,000 TO 41,000	41,000 TO 38,000	38,000 TO 35,000
CIAS	145	143	140	138	137
RPM	2110	2050	1980	1910	1850
MP	29.0	28.4	27.2	26.2	25.2
#PH	982	877	789	739	710
CIAS	148	145	142	140	139
RPM	2050	2000	1930	1870	2080
MP	29.9	28.8	27.6	26.6	20.8
#PH	926	847	767	720	692
CIAS	151	147	144	142	141
RPM	2000	1950	2080	2000	1940
MP	30.8	29.1	23.6	23.0	22.2
#PH	896	820	745	700	625
CIAS	153	143	146	144	143
RPM	1950	2040	1950	1870	1810
MP	31.4	25.0	25.1	24.5	23.8
#PH	872	789	725	683	660
CIAS	156	152	148	146	144
RPM	2040	1920	1830	1760	1690
MP	27.9	27.5	26.7	26.0	25.2
#PH	862	777	707	667	645
CIAS	159	154	150	148	146
RPM	1940	1820	1730	1660	1590
MP	30.2	28.7	28.8	27.2	26.5
#PH	852	761	[illegible]	655	630
CIAS	162	157	152	150	148
RPM	1850	1740	1650	1580	1500
MP	30.9	30.3	29.1	28.5	28.0
#PH	843	750	678	643	619
CIAS	164	159	[illegible]	152	150
RPM	1790	1680	[illegible]	1520	1470
MP	32.2	31.4	[illegible]	29.9	29.1
#PH	837	749	677	646	620
CIAS	167	162	157	153	152
RPM	1740	1630	1540	1480	1450
MP	33.1	32.5	31.[illegible]	30.7	29.9
#PH	833	750	679	653	620
CIAS	170	164	158	153	154
RPM	1720	1610	1520	1460	1440
MP	33.8	33.3	32.[illegible]	31.7	30.8
#PH	830	753	683	662	624
CIAS	173	166	160	157	156
RPM	1710	1600	1510	1450	1430
MP	34.3	34.0	33.[illegible]	32.7	31.6
#PH	827	757	687	670	630

3

substantially more pounds of fuel when it is cool. If tanks are filled during a hot day and takeoff is to be at night, top off the tanks just before takeoff.

NORMAL OR INTERMEDIATE CRUISE CONTROL

Air Transport Command recommends that scheduled cargo flights be conducted at higher speeds than those normally used in long-range economy operation. The faster flight allows greater utilization of the airplane, in addition to speeding up cargo delivery. It also reduces pilot fatigue, since the airplane is easier to fly at medium-power speeds than at maximum-range speeds.

There are two accepted methods for conducting this type of cruising: (1) Use of constant airspeed; (2) use of constant horsepower.

Constant Airspeed

For navigational purposes on long range flights, constant airspeed is ideal. One of the principal drawbacks to this type of operation is that the pilot must change power settings constantly as the flight progresses to maintain the fixed speed. Another drawback is that a low airspeed which will permit economical operation during the latter half of the flight fails to get the airplane on its aerodynamic step during the first part, while the gross weight is still high.

Constant Horsepower

Constant fuel consumption and simplicity of operation are the advantages of constant power cruise. Most scheduled operation flights are conducted at between 50% and 60% of normal rated power.

The Constant Power Cruise Control Chart on Page 66 is based on performance figures supplied by ATC. At the correct density altitude the chart supplies indicated and true airspeeds for a given gross weight and horsepower. Read power settings and fuel consumption from the right side of the chart.

This chart permits selection of a large variety of cruising settings based on horsepower or airspeed desired. It is best to start long flights at higher speeds; then progressively reduce airspeed as fuel is consumed.

HIGH-SPEED CRUISE CONTROL

High-speed cruising is an emergency operation. You use it when emphasis is placed on tactical necessity for speed, with less regard for fuel economy and engine life. Conduct this operation at constant horsepower; you can use up to normal rated continuous power. When you exceed 67% power or 2100 rpm, you must use AUTO-RICH mixture. High fuel consumption limits this operation to short range.

MAXIMUM ENDURANCE CRUISE CONTROL

Maximum endurance cruise is another emergency cruise power, used to keep the airplane aloft as long as possible. Use it when weather or other conditions prevent you from landing for several hours. Keep your airspeed as low as possible, but maintain a safe margin above stalling speed to provide good control.

Engine operation at or near maximum BMEP is important, requiring least fuel for the desired power. To achieve this, use 1600 rpm or less. You will not exceed rated BMEP if you maintain manifold pressures below 32" Hg.

Another important factor in endurance flight is altitude. Choose the lowest practical altitude to allow lowest fuel consumption.

SINGLE ENGINE CRUISE CONTROL

In any 2-engine airplane, the failure of an engine is a serious condition. Your one good engine may burn as much fuel as two engines in normal operation, yet your airspeed takes a considerable drop. For economy, fly at the lowest safe airspeed possible. Decreasing your airspeed a few mph results in an appreciable saving in fuel.

CRUISE CONTROL COMPUTER

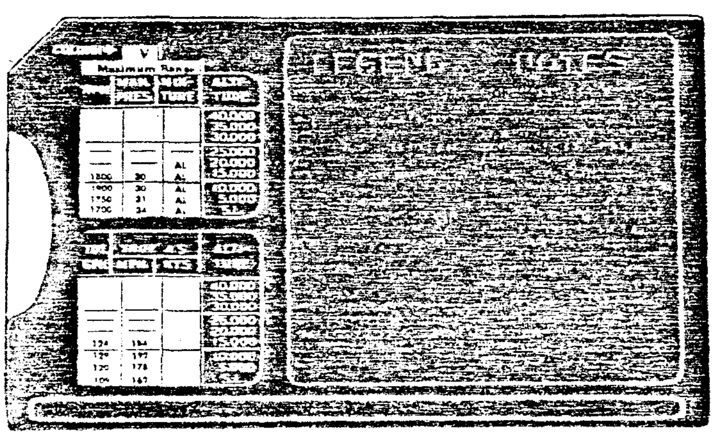
A computer, now standard AAF equipment, simplifies flight planning and cruise control.

The computer consists of a case and a set of cards which give power settings, fuel consumption, and other data. There are separate cards for various weight brackets, and also for single-engine operation.

The data are taken from the flight operation charts in the Pilot's Operating Instructions on the airplane. They give five operating conditions; maximum range; three intermediate conditions in which airspeed increases progressively, with a resulting sacrifice of fuel economy; and maximum continuous settings, which you may use for high speed cruising.

Complete instructions for use appear on the computer.

Cruise control computer



Systems and Equipment

ENGINES

Description

Two Pratt & Whitney R-2800-51 engines furnish power for the C-46. The component parts of the engines are:

Nose Section—This section conveys power from the engine crankshaft to the propeller through reduction gearing. The gear ratio is 2:1. A dual Bendix DF18RN magneto, two distributors, and a propeller governor are mounted on the nose.

Power Section—The crankcase consists of three sections bolted together, on which the 18 cylinders are mounted in two rows of nine each. It contains a double-throw crankshaft supported by three main bearings. Cam drives, cam followers, and valve tappets, all of which operate the intake and exhaust valves, are housed in the crankcase.

The cylinders are of steel and aluminum construction with deep-cut cooling fins. Each has two valves and two sparkplugs. Pistons are dome-shaped, of aluminum alloy, with six piston rings. Baffle plates deflect the air blast to provide cooling for all cylinders, sparkplugs and ignition leads.

Blower and Intermediate Rear—The engine is mounted on six brackets on the outer circumference of the blower section.

The blower and the intermediate rear sections contain the impeller, the diffuser, the ports from which intake pipes convey the mixture to the cylinders, 2-speed blower drive and oil-operated blower clutches, and the gear trains which operate the accessories.

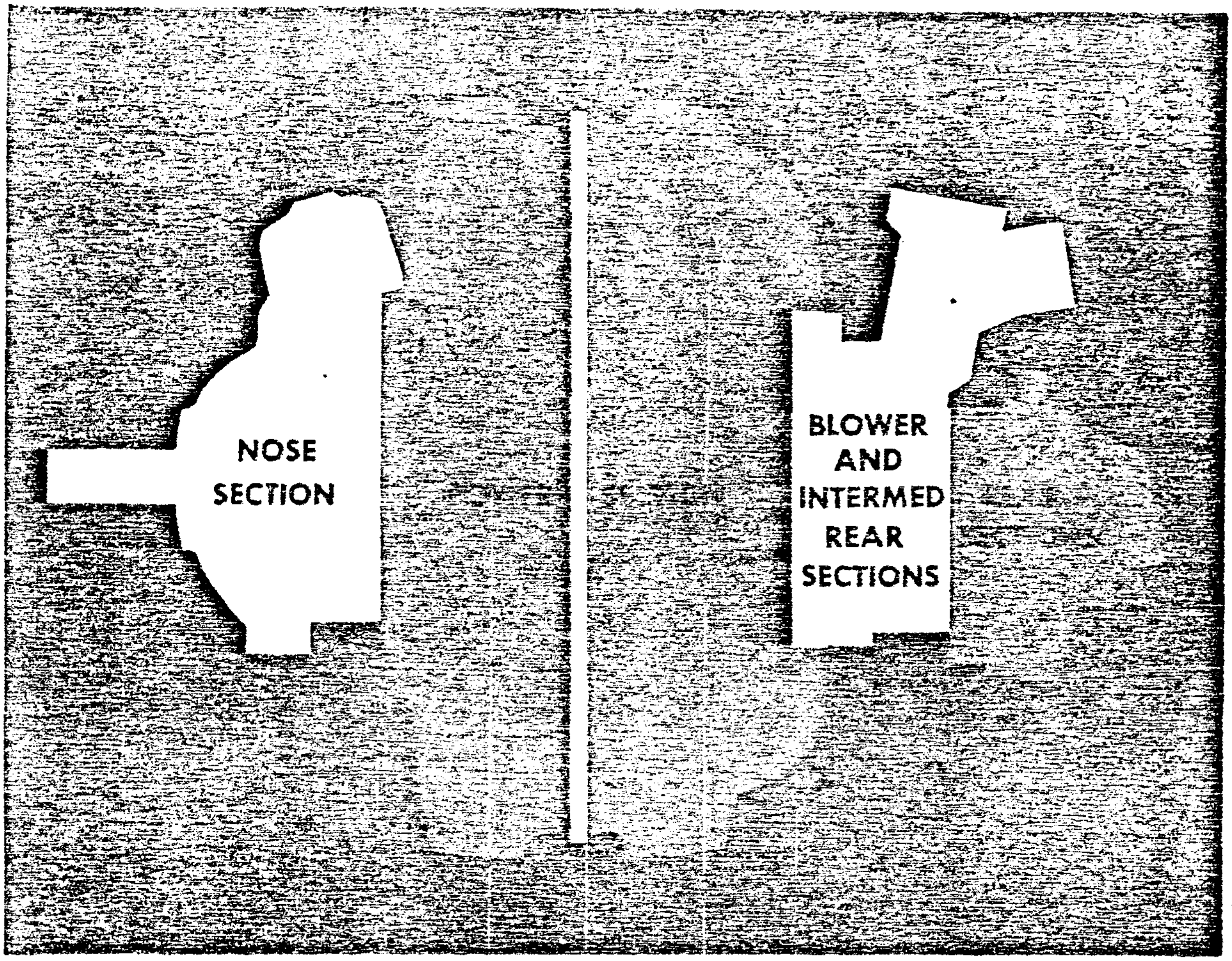
A PT13G1 Stromberg pressure-diaphragm type injection carburetor is also mounted on the intermediate rear.

Rear Section—The rear section holds the following accessories:

Generator	Oil pumps
Starter	Vacuum pump
Fuel pump	Hydraulic pump
Tachometer drive	Blower clutch selector

Lubrication

A high-pressure oil pump in the rear section directs oil through a series of drilled passages to lubricate the power and nose sections. This



pressure operates the blower clutches and hydromatic propellers (if installed). A pressure reducer provides low-pressure oil for the rear section.

Two scavenger pumps, one mounted in the nose and one in the rear section, return drain oil to the tank. Two oil sumps on the bottom of the engine collect oil for these pumps.

Carburetion

The injection carburetor regulates fuel flow according to the mass of air flowing through the throttle body unit, corrected for variation in air temperature and pressure by the automatic mixture control. The fuel is evenly sprayed and vaporized into the airstream through a rotating slinger ring on the impeller hub.

Engine Controls

1. **The mixture controls** have four settings:
IDLE CUT-OFF completely stops all fuel flow through the carburetor and shuts off the engine.

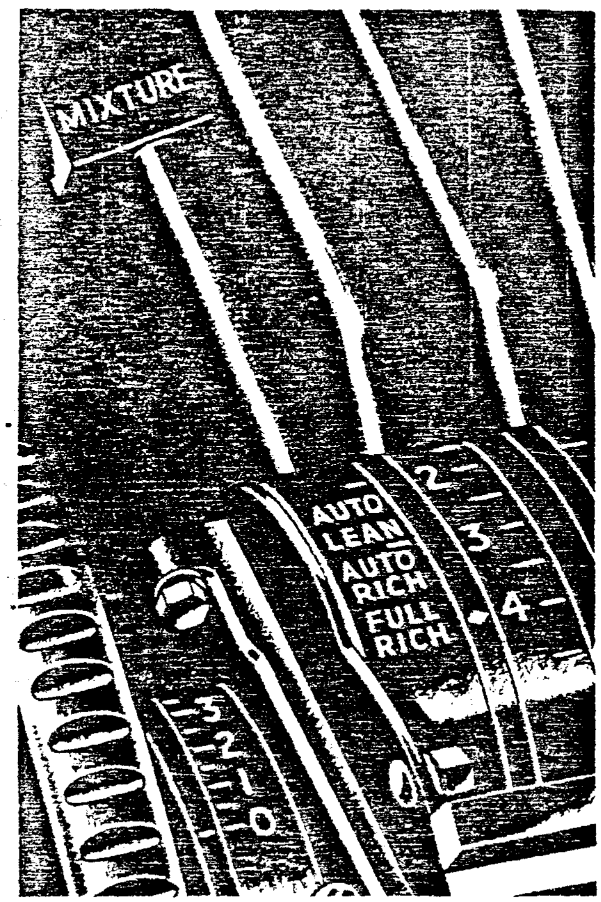
AUTO LEAN position maintains a lean fuel/air ratio for economy operation in cruise and descent.

AUTO RICH maintains a richer mixture than AUTO LEAN throughout the operating range, resulting in slightly higher fuel consumption. It allows you to draw full power from the engine without detonation or overheating, and is used in preference to the leaner setting when any necessity exists for sudden power changes.

An aneroid automatically corrects the mixture in both automatic settings for changes in air density caused by varying altitudes and air temperatures.

FULL (or EMERGENCY) RICH cuts out the automatic mixture control, allowing the mixture to become richer with altitude. This may cause rough engine operation, in addition to a greatly increased fuel consumption. Use it only when the automatic control fails, or to cool the engines when a high rate of climb with rated power causes excessive head temperatures in AUTO RICH position.

In addition to the pre-arranged settings of AUTO LEAN and AUTO RICH, which give best mixtures for various power settings, the mixture control can be set to any intermediate position on the quadrant to obtain some in-between fuel-air mixture. For example, moving the control from AUTO LEAN toward AUTO RICH gives an intermediate mixture in between the two. Throughout this entire operating range, the automatic mixture control corrects for altitude and temperature changes once the mixture is set by the manual control. The aneroid is bypassed only in the FULL (EMERGENCY) RICH position.



Be careful about using intermediate positions. Since there is no fuel-air ratio analyzer, it is easy to lean the mixture excessively. In small engines the mixture may be safely leaned to the point of rough running or a drop in rpm, but a large engine is more critical and may be damaged before the pilot knows it.

2. **The prop governor** mounted on the nose section is manually connected to the control handle on the pedestal.

3. **The throttle** is manually connected to the throttle valves in the throttle body unit of the carburetor and regulates volume of airflow.

4. **The cowl flaps** operate hydraulically through controls on the pedestal. They are adjustable over a continuous range from closed to full open.

5. **The oil cooler shutter control** regulates the flow of air through the coolers, holding oil temperatures within limits.

6. **Carburetor heat** is applied by operating the control at the bottom of the pedestal. A rotary valve cuts off the intake of air through the scoop and allows heated air from around the engine and the exhaust manifold to be drawn through baffles to the carburetor.

7. **Carburetor air filters** can be installed in the air induction ducts leading from the nacelles to purify air drawn to the carburetors. Present installations are impractical and should not be used. There is a considerable loss of manifold pressure when nacelle doors are closed, reducing the flow of air.

8. **The supercharger control** mechanically operates a 2-way oil valve which controls the two clutches for HIGH and LOW blower operation.

ENGINE OPERATION

The chart on the opposite page presents engine operating limitations. In no case should powers, temperatures, or pressures exceed the limitations.

ENGINE OPERATION CHART

Engine Model R-2800-51

Fuel Grade 100/130

Condition	Fuel Pressure psi	Oil Pressure psi	Oil Temp. °C.
Desired	17	70-85	50-70
Maximum	18	90	90
Minimum	16	60	40

Max. permissible diving rpm 2880

Allowable Oil Consumption

Max. cont. power. . . .30.5 qt/hr.

Max. cruise . . . . .15 qt/hr.

Operating Power	RPM	Man. Press.	Horse-power	Crit. Alt.	Blower	Mixture	Fuel flow per Engine	Cyl. Head Temp.
Takeoff	2700	52	2000	1500	L	AR	293	260
Military	2700	51	2000	1500	L	AR	273	260
	2700	47	1600	12,000	H	AR	213	260
Normal Rated	2400	41.5	1600	5300	L	AR	199	260
	2400	42.8	1450	13,300	H	AR	219	260
Climb (85% power)	2300	35	1350	9500	L	AR	150	232
	2300	35	1180	17,800	H	AR	140	232
Maximum Cruise	2100	32.3	1100	10,000	L	AL	100	232
	2100	30.1	975	19,900	H	AL	90	232

Power Definitions

Takeoff Power (5-minute maximum)—Maximum permissible for takeoff.

Military Power (15-minute maximum)—Maximum power permitted for military use with less regard for engine life than for tactical need. Equal to takeoff power for R-2800-51 engines.

Normal Rated Power—This is the maximum power at which you can run the engine continuously for emergency or high-performance operation. This rating is considered 100% power as a basis from which other operating powers are calculated.

Maximum Cruise Power—Maximum power and rpm permissible for AUTO LEAN operation.

Detonation

One of the principle hazards involved in operation of high-output engines is detonation.

In normal combustion, the flame begins at the sparkplugs and advances at a comparatively slow rate until all of the mixture is burning. In detonation, as pressure and temperature increase, small flame-fronts spring up in the unburned charge ahead of the normal flame-front, causing the remaining fuel to burn with a sudden explosion.

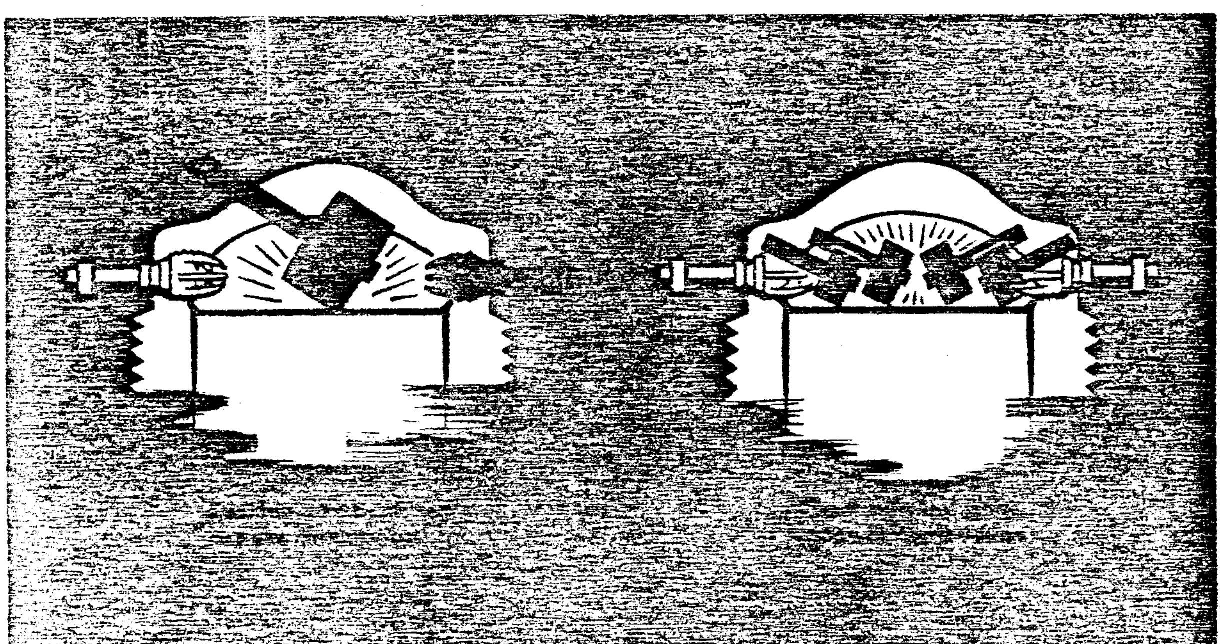
Detonation is accompanied by severe pressure waves and overheating, and causes pitting and burning of pistons and cylinder walls as well as excessive stresses on the entire cylinder assemblies. Extreme cases may result in complete engine failure.

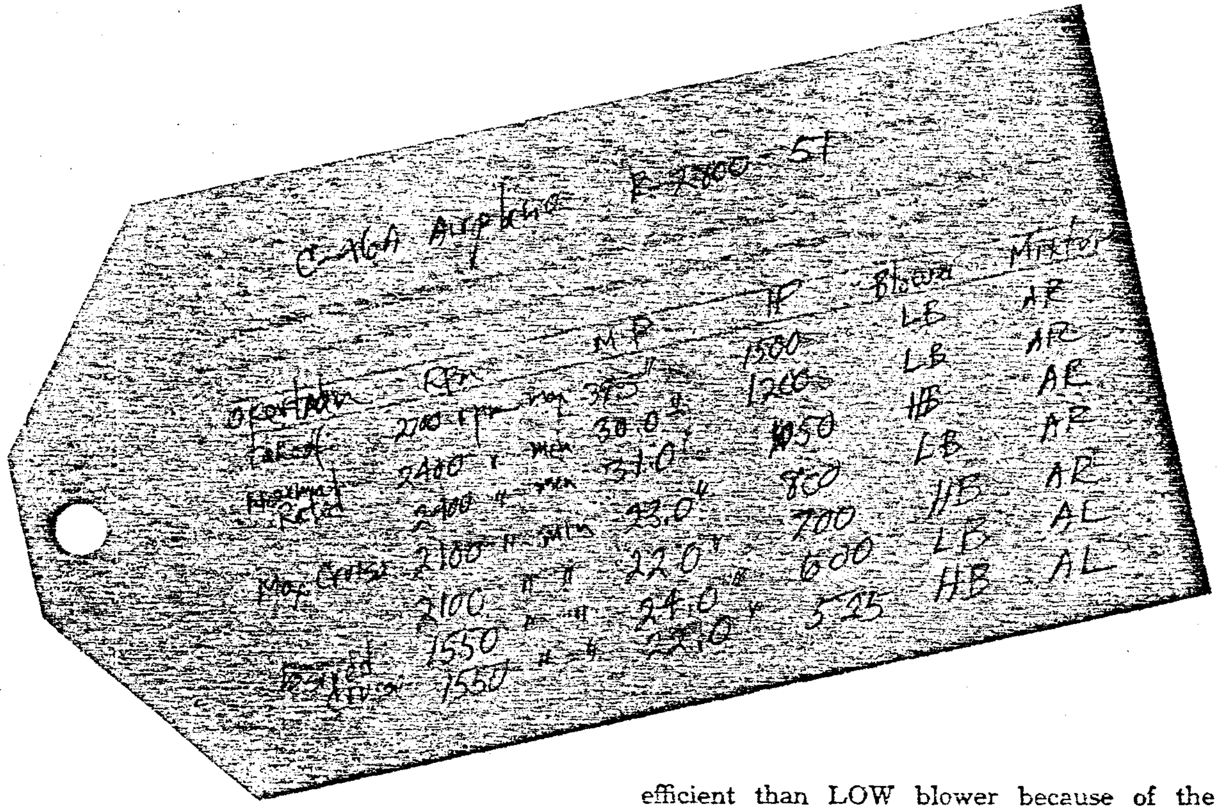
Any of the following factors can cause detonation, and you can control all of them:

1. **Excessive manifold pressure or rpm**—Exceeding limits on power shortens engine life. Increasing manifold pressure above allowable settings for a given rpm increases the internal combustion pressure (BMEP) to a dangerous degree, conducive to detonation.

2. **Insufficient cooling**—An overheated engine causes excessive wear of moving parts. Also, hot spots within the cylinder bring the mixture nearer to its self-ignition temperature. Opening cowl flaps, enriching mixture, increasing airspeed, and reducing power all tend to cool the engine.

3. **Excessively lean mixtures**—Leaning the mixture at higher power output can raise mixture temperature and increase the tendency of the fuel to detonate. For this reason, use AUTO RICH mixture setting for all operation above 67% power, even though cooling may appear satisfactory in AUTO LEAN. An rpm of 2100 is the maximum for cruising in AUTO LEAN.





4. **High carburetor air temperature** has the same effect as increased cylinder-head temperature, increasing the temperature of the mixture.

5. **Faulty ignition**, resulting in operation on only one magneto, causes detonation as well as loss of power. The mixture farthest from the operating sparkplug in the cylinder is self-ignited by high pressures before the flame-front can reach it, and sudden burning occurs.

6. **Low grade fuel** has a lower anti-knock or anti-detonation factor. When using it you must limit power, or detonation results.

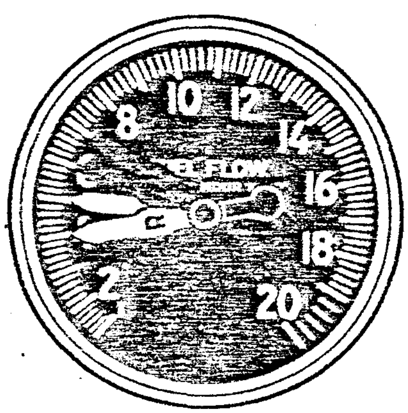
Takeoffs with Grade 91 fuel are not recommended because of increase in takeoff run necessary at lower takeoff power.

Observe the settings on the warning tag when using Grade 91 fuel.

Use of Blower

Stay in LOW blower as long as manifold pressure is sufficient to produce the desired horsepower. HIGH blower operation is less efficient than LOW blower because of the extra power required to run the blower at high speeds. You never need to shift to HIGH blower below 9600 feet (density altitude).

Never use HIGH blower for takeoff or for continuous operation at low altitudes. With no inter-cooler in the induction system, the greater supercharging effect causes higher intake port temperatures, which are conducive to detonation.



High Blower = Higher Fuel Consumption

Shifting

To reduce slippage of the clutches and prevent abnormal wear, make all blower shifts with a quick movement of the control handle.

Allow heat to dissipate by waiting at least 10 minutes between shifts, except during run-up. Shift blower gears during run-up, every 2 hours in flight, and once after flight to clean out accumulations of sludge in the clutches. Failure to do so can result in improper operation of the blower clutches, with consequent loss of all supercharging.

When making shifts in flight, retard throttles if necessary to prevent excessive manifold pressures. At climb power settings a dangerously high surge may result if you do not reduce manifold pressure.

Limits on rpm for shifting are 1200 minimum, 2200 maximum.

Smooth Engine Control

Don't make sudden changes in throttle settings. Abrupt changes in engine speed place severe stress on gear trains and blower clutches. All throttle movement must be gradual and smooth.

FUEL SYSTEM

There is a separate fuel system for each engine in the C-46, with a crossfeed connecting the two. Each system has three wing tanks, with the following capacities:

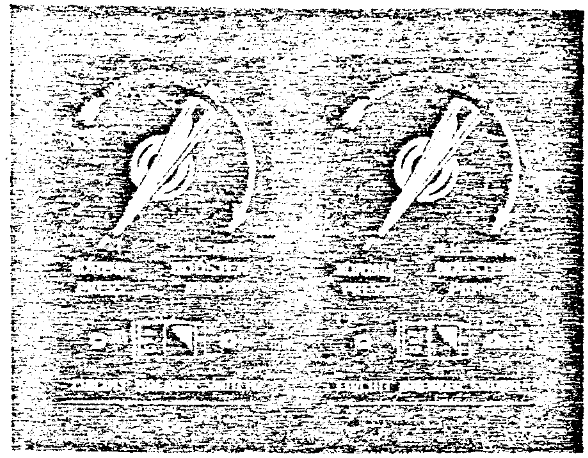
Front tank	245 gallons
Center tank	285 gallons
Rear tank	170 gallons

Total normal capacity is 1400 gallons. In addition, there is provision for the installation of one to sixteen 100-gallon tanks in the cabin for long-range flights.

All C-46 fuel installations have the following standard equipment for each separate system: engine-driven fuel pump, fuel strainer, fuel-flow meter, quantity and pressure gages, and tank selector valve. Normal operating pressure of the system is 16 to 18 psi.

There are three types of fuel booster pump installations in C-46 aircraft:

1. A submerged pump in each wing tank.

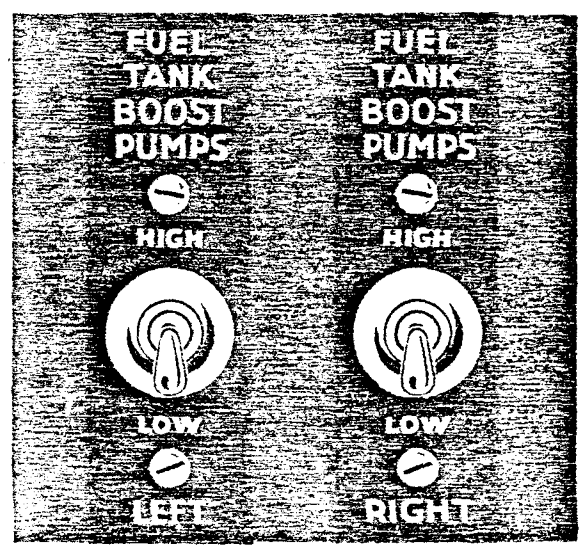


Overhead sump pump controls

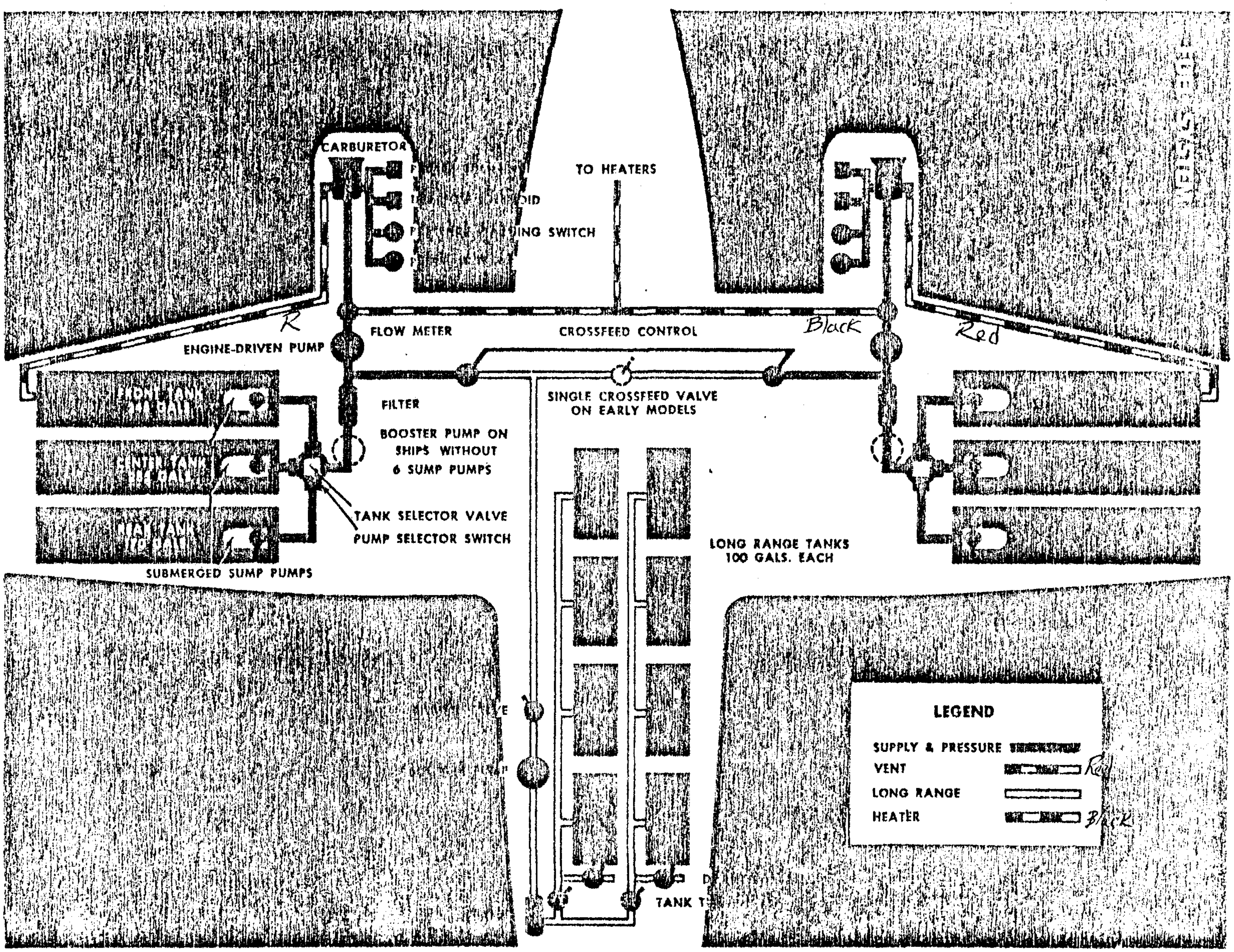
2. Submerged pumps in the center tanks only, supplemented by conventional auxiliary booster pumps in the main supply line.
3. Conventional auxiliary booster pumps only.

Six Sump Pump Installation

The standard installation for current model C-46 aircraft consists of six electric centrifugal pumps, one in the sump of each wing tank. On some models, for each set of wing tanks, there is a circuit breaker switch and a rheostat which regulates fuel pressure to the engine from 8 to 23 psi. On later models the rheostats



Sump pump controls on pedestal


CARBURETOR
TO HEATERS
R
FLOW METER
CROSSFEED CONTROL
Black
Red
ENGINE-DRIVEN PUMP
SINGLE CROSSFEED VALVE
ON EARLY MODELS
FILTER
BOOSTER PUMP ON
SHIPS WITHOUT
6 SUMP PUMPS
TANK SELECTOR VALVE
PUMP SELECTOR SWITCH
SUBMERGED SUMP PUMPS
LONG RANGE TANKS
100 GALS. EACH
LEGEND
SUPPLY & PRESSURE
VENT
Red
LONG RANGE
HEATER
Black

are replaced by 2-position switches on the control pedestal. An electric switch connected integrally to the fuel selector valve automatically selects only the pump in the tank you are using.

This installation was designed to overcome the problem of vapor lock. Vapor lock is caused by hot fuel (over 80°F), flown to high altitudes where low atmospheric pressure allows vaporization. The centrifugal pumps whip air and vapor out of the fuel and also pressurize the fuel in the lines to keep the remaining air and vapor in solution, satisfactorily eliminating vapor lock.

Operation:

Use the sump pumps as you would standard auxiliary booster pumps for starting, takeoff and landing.

On Systems with rheostats: For starting, adjust pressure to 17 psi.

For takeoff and landing, adjust pressure to ½ to 1 psi higher than that supplied by the engine driven pump alone.

On Systems with 2-position switches: Place switch in HIGH position for starting, takeoff, landing, and emergencies.

Use LOW position only for ground operation of heater and to maintain fuel pressure at high altitudes.

To turn on the sump pumps:

1. Turn on the circuit breaker switches on the overhead panel.
2. Adjust the rheostats or 2-position switches as required.

To Eliminate Vapor Lock: You can foretell vapor lock in flight by fluctuations of the flow meter. This begins before actual failure of the system. The next symptom is a drop in fuel pressure, after which the engine may cut out.

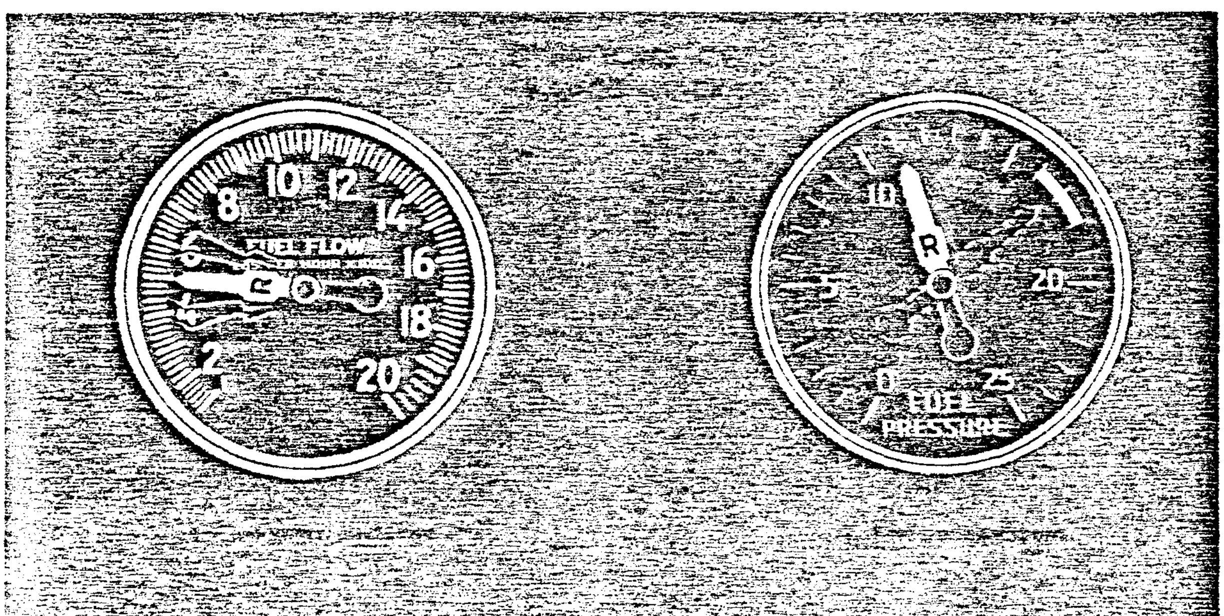
Turn on the sump pumps at the first sign of trouble. Keep the rheostat set at lowest pressure or place switch in LOW position. If fuel flow does not become normal, increase pressure until it does.

Caution: Do not run a sump pump in a dry tank, or it will burn out. The pump depends upon its immersion in fuel for cooling.

Center Tank Sump Pump Installation

Before the use of sump pumps in all tanks became standard, many C-46 aircraft intended for the Pacific and China theater, (PACT aircraft) were built with pumps in the center tanks only. These aircraft also have conventional booster pumps as well as the sump pumps.

In addition, a number of aircraft were modified in the field in this manner.



Aircraft with factory-installed sump pumps have an electric switch connected integrally with the fuel selector valve and a rheostat for controlling pressure, just as in aircraft with six sump pumps. Field-modified airplanes have neither switches on the selector valves nor rheostat controls. Pressure is fixed at 7 to 10 psi on these aircraft.

Operation:

1. For starting, takeoff, and landing, use regular auxiliary booster pumps, not sump pumps.
2. In case of vapor lock, switch to center tanks and turn on sump pumps.
3. Do not run the regular booster pumps while the sump pumps are operating.
4. Don't forget to turn the circuit breaker switch OFF after you shift from center to other tanks. In field-modified models the sump pumps keep running even though you change the fuel selector valve setting.

Conventional Booster Pump Installation

Earlier C-46 aircraft have no submerged pumps, but only the conventional auxiliary booster pump installation. These pumps develop a pressure of about 16 psi. They do not correct serious vapor lock conditions.

Gages

Fuel Quantity Gages—There are three dual fuel quantity gages on the left side of the instrument panel. The gages are calibrated in hundreds of pounds in all early installations; in gallons in latest models. These instruments do not give an accurate reading of fuel quantity in all cases, so **inspect the tanks visually before flight.** Center and rear tank gages on early models indicate only ¾ full when tanks are completely full.

Fuel Flow Meter—A dual gage on the right side of the instrument panel on most models. This is an important instrument. It gives the rate of fuel flow to each engine and warns you of excessive fuel consumption.

The gage is calibrated in hundreds of pounds per hour. To convert to gallons, divide number of pounds by six.

Fuel Pressure Gage—A dual fuel pressure indicator is on the right side of the instrument panel.

Fuel Pressure Warning Light—This red warning light, on the right side of the instrument panel, turns on when the pressure in either system drops to 14 psi or below.

Auxiliary Equipment

Fuel lines run from each carburetor to solenoid valves which control priming and oil dilution.

The heater fuel supply line connects to both engine supply lines, between the engine-driven pump and carburetor.

Operation of any of this equipment requires fuel pressure, either from the engine-driven pumps or the booster or sump pumps.

Servicing and Operating Hints

1. C-46's are usually equipped for use of aromatic fuels. Check the stencil on the side of the fuselage.
2. For short-range flights, wing tanks are normally filled only to the filler neck in each tank. This gives a total fuel supply of about 1100 gallons.

When you need maximum fuel, see that the tanks are filled right to the top. As much as 100 gallons more may then be added by rocking the wings to expel air and then topping off the tanks.

3. To check the amount of fuel visually, note the marker tabs located in the filler necks.

4. If your front tanks are full, operate on these tanks for the first half hour of flight. Return flow from the carburetor vents into the front tanks. This flow is normally 5 gallons per hour but may be as much as 20 gallons an hour, which quickly overflows a full tank and creates a fire hazard.

5. On long flights where you are using maximum fuel from each tank, watch the fuel pressure gage and warning light for indication that the tank is running dry. Switch to another tank as soon as the light goes on. Do not let the engine quit.

If tank should run completely dry and the engine quits:

1. Close throttle.
2. Turn fuel selector valve to a full tank.
3. Advance throttle.

If engine does not start readily:

4. Move mixture control to FULL (EMERGENCY) RICH.
5. Turn on booster pump.
6. Re-adjust mixture when engine is firing properly.

Caution: Never burn out tanks on both engines at the same time. If both engines fail together, you may lose considerable altitude before you can get them operating.

EMERGENCY FUEL SYSTEM OPERATION

Loss in fuel pressure indicates an empty tank, pump failure, or a break in the fuel lines.

To diagnose:

1. Switch to another tank. If the trouble was an empty tank, the fuel pressure and engine operation will return to normal.

2. If this does not correct the trouble, turn on the booster or sump pump. If pressure comes up, the failure was probably in the engine-driven pump. Continue operating the booster pump. If the booster pump fails too, use the crossfeed system.

3. If pressure does not come up when you turn on the booster pump, assume that there is a break in the fuel lines. Turn off booster pump and fuel selector valve. Then turn on the crossfeed system and see if the fuel pressure comes up. If it does, continue to use the crossfeed.

If pressure does not come up to normal when you operate the crossfeed system, fuel is probably escaping from the lines. This creates a serious fire hazard. Do not attempt to operate the engine. Turn off the crossfeed and feather the propeller. See that the fuel selector valve is OFF.

Crossfeed System

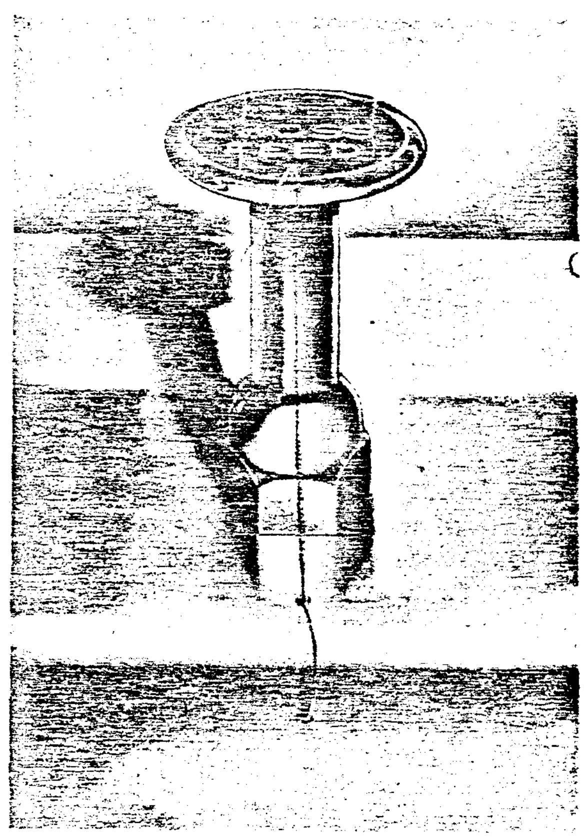
Operation of the crossfeed system allows any tank to supply fuel to both engines in the event of fuel system or engine failure.

The system consists of a line connecting the two main fuel supply lines, controlled by shut-off valves. The crossfeed shut-off valve control is on the right side of the pedestal in current models. In earlier models, the control is on the ceiling of the main cargo compartment.

Operation:

To use the crossfeed system:

1. Open the crossfeed valve.



Overhead crossfeed control

2. Turn on the booster or sump pump for the tank being used.

3. Turn the fuel selector valve on the side not being used to the OFF position. This prevents fuel from backing up into these tanks when no check valves are installed.

LONG-RANGE SYSTEM

Long-range fuel fittings are permanent installations on all C-46 aircraft. From one to sixteen 100-gallon tanks may be installed in the main cargo compartment. Normally, there is an 8-tank installation on the left side, with two tiers of four tanks each. Each tier of tanks is manifolded into a common supply line.

There is a shut-off valve for each tier of tanks, and a master shut-off valve for the entire system. A fuel strainer, booster pump, drain valves, and vent lines complete the system.

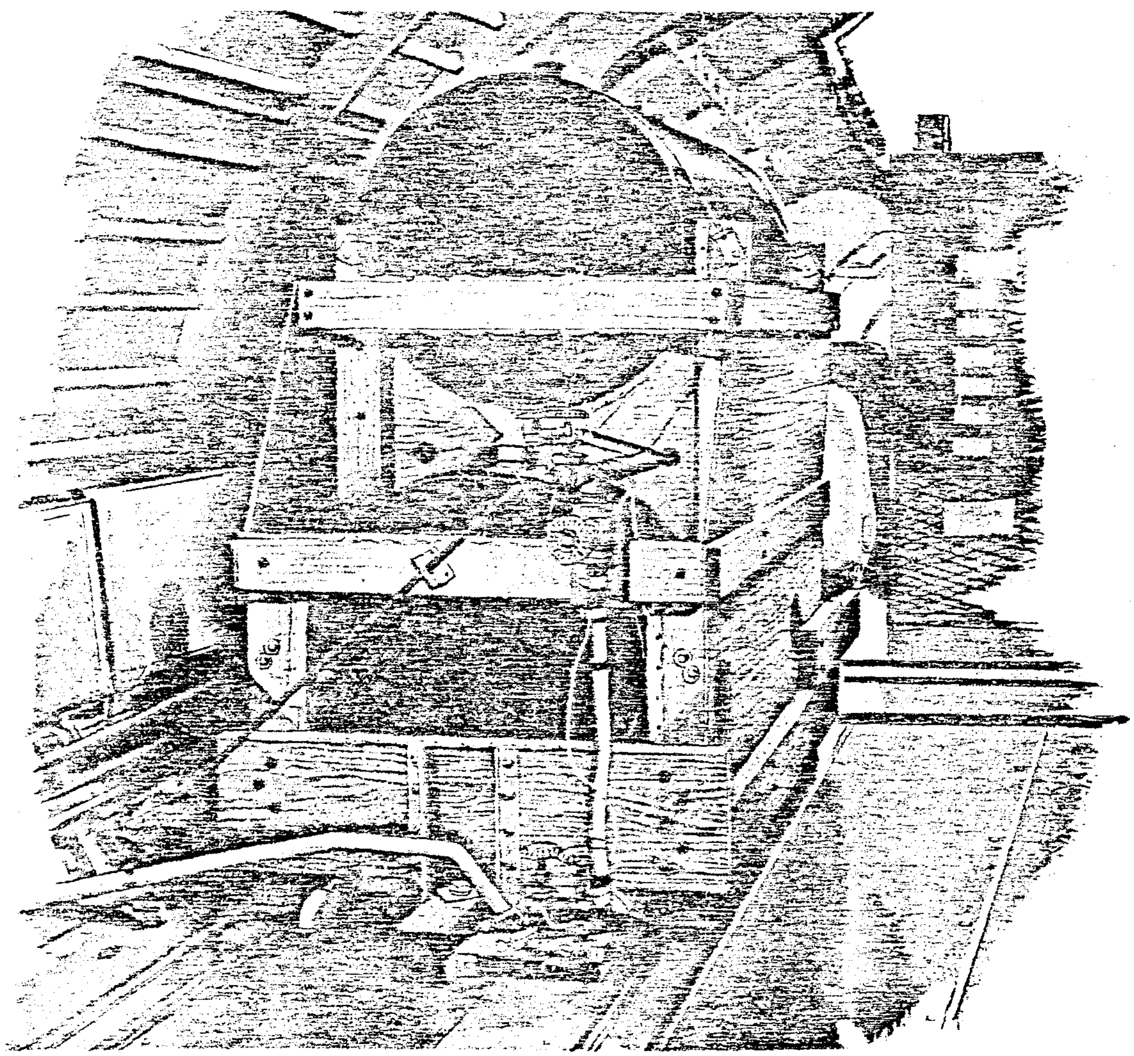
The long-range system connects into the crossfeed line of the main fuel system.

Filling Fuel Tanks

1. Turn all long-range shut-off valves OFF.

2. Fill each tank independently, starting with the rear tanks and working forward.

Note: After tanks are filled, do not remove caps while the airplane is in a 3-point position. Fuel will spill out of any but the forward tanks.



Long-range fuel tanks

Operation

Run the engines on the long-range fuel system on the ground before takeoff, to test the system and to eliminate air or vapor locks in the system. **Do not take off on the long-range system.**

Before switching to long-range tanks in flight, operate on the front wing tanks until you have used at least 50 gallons of fuel. This allows room for the return flow from the carburetor. Then, switch to the long-range system:

1. Open the shut-off valve for the top tier of tanks.
2. Turn on the long-range booster pump. (Switch is on the overhead panel.)
3. Open the long-range master shut-off valve, just aft of the long-range tanks on the left side of the cargo compartment.
4. Open main system crossfeed valve.
5. Check to see that the main fuel booster pumps (or sump pumps) are OFF.
6. Turn one main system fuel selector valve OFF. Check fuel pressure on that engine. If normal, turn the other selector valve OFF.
7. Turn the long-range booster pump OFF, and use gravity feed to the engine pump.

Always switch to the next tier of long-range tanks before the one in use runs dry.

To return to wing tank operation:

1. Turn both fuel selector valves to desired tanks.
2. Turn main booster pumps (or sump pumps) ON.
3. Turn long-range booster pump OFF (if still operating).
4. Turn long-range master shut-off valve OFF.
5. Close shut-off valve on tier of tanks last in use.
6. Close crossfeed valve.

HYDRAULIC SYSTEM

The large amount of plumbing in the C-46 is largely the result of the existence of two hydraulic systems: the main system and the booster system.

Two engine-driven, constant displacement pumps, one on each engine, provide pressure for the main system. This system operates all hydraulic units except the surface control boosters.

There is an auxiliary hand pump to supply pressure in the event of failure of the engine-driven pumps.

The booster system gets its pressure from a third pump installed on the left engine. Its sole function is to operate the surface control boosters. In an emergency, you can use the main system to operate the boosters.

Both main and booster systems are of the standard accumulator type.

How Main System Operates

Hydraulic fluid flows from the 8.25-gallon main reservoir to the engine-driven pumps. The location of the fluid outlet, several inches above the bottom of the tank, allows 3.2 gallons to remain in the reservoir for emergency use of the hand pump. The entire system holds 21 gallons.

A relief valve just beyond the pumps limits the system pressure to a maximum of 1500 psi.

The fluid flows through the unloading valve, which keeps the pressure up to operating limits. When the accumulator pressure drops below 1050 psi, the unloading valve allows the pumps to load up, building pressure up to 1350 psi.

The accumulator itself has 600 psi air pressure in back of the diaphragm.

Flow distribution begins at a T fitting, where fluid pressure is sent in two directions: (1) to the landing gear selector valve; and (2) to the main hydraulic manifold from which the brakes, automatic pilot, cowl flaps, wing flaps, and windshield wipers operate.

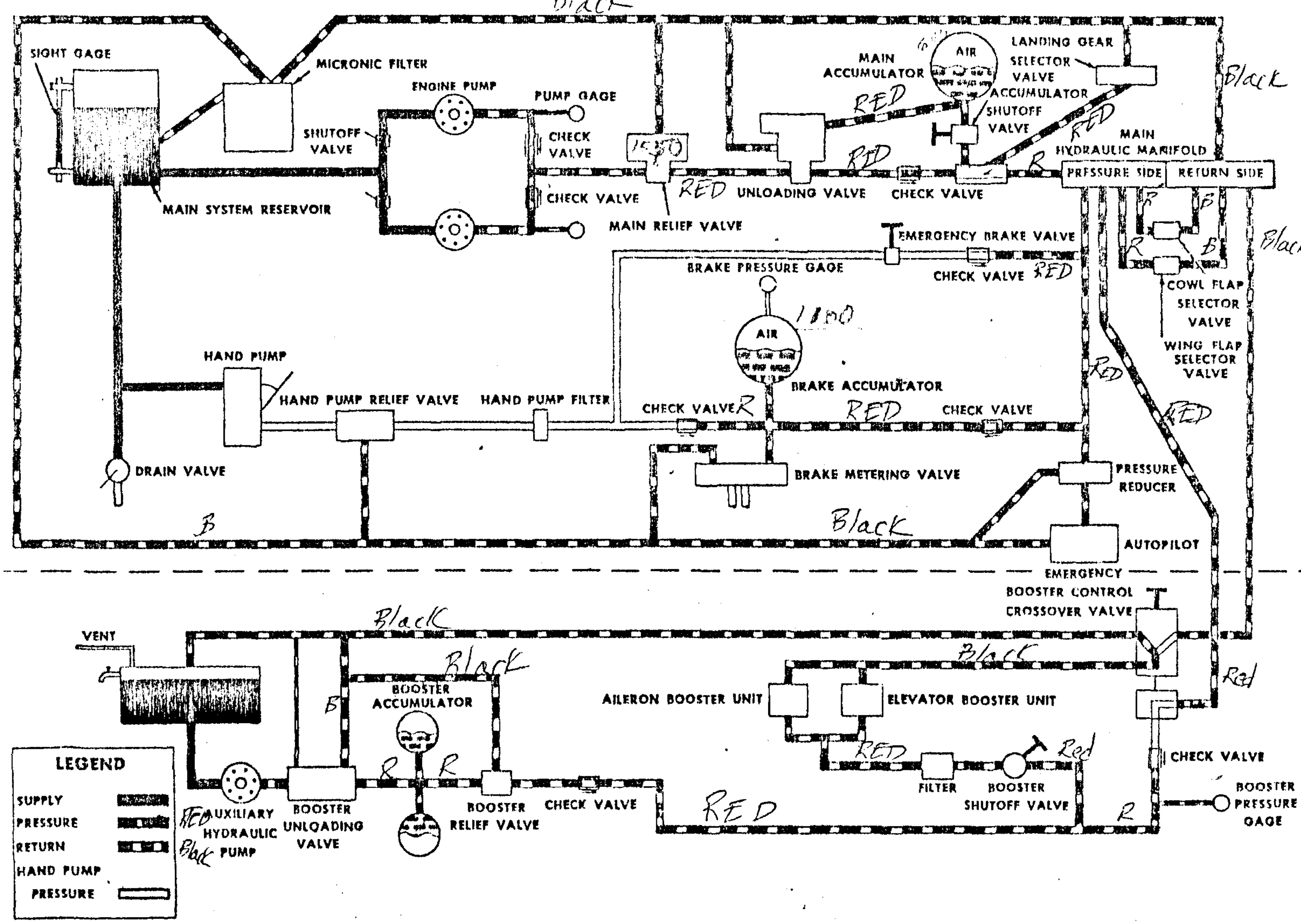
Each unit operating off the main system has its return line which brings the fluid back through a filter to the main reservoir.

Servicing

Add fluid through the reservoir filler opening. Make sure before flight that the reservoir is full and that spare cans of fluid are aboard.

Do not remove the Purolator filter cap when the engines are running. There is pressure inside this filter and you will lose fluid.

See decal on cockpit door for further servicing instructions.


Black
SIGHT GAGE
MICRONIC FILTER
ENGINE PUMP
PUMP GAGE
SHUTOFF VALVE
CHECK VALVE
CHECK VALVE
MAIN SYSTEM RESERVOIR
1500
RED
MAIN RELIEF VALVE
MAIN ACCUMULATOR
AIR
RED
UNLOADING VALVE
RED
CHECK VALVE
LANDING GEAR SELECTOR VALVE
ACCUMULATOR SHUTOFF VALVE
RED
MAIN HYDRAULIC MANIFOLD
PRESSURE SIDE
RETURN SIDE
Black
EMERGENCY BRAKE VALVE
BRAKE PRESSURE GAGE
CHECK VALVE
RED
Black
COWL FLAP SELECTOR VALVE
WING FLAP SELECTOR VALVE
1800
AIR
BRAKE ACCUMULATOR
HAND PUMP
HAND PUMP RELIEF VALVE
HAND PUMP FILTER
CHECK VALVE
RED
CHECK VALVE
RED
RED
DRAIN VALVE
BRAKE METERING VALVE
PRESSURE REDUCER
B
Black
AUTOPILOT
EMERGENCY BOOSTER CONTROL CROSSOVER VALVE
VENT
Black
Black
Black
B
BOOSTER ACCUMULATOR
AILERON BOOSTER UNIT
ELEVATOR BOOSTER UNIT
Red
RED
Red
R
R
CHECK VALVE
FILTER
BOOSTER SHUTOFF VALVE
RED
AUXILIARY HYDRAULIC PUMP
Black
BOOSTER UNLOADING VALVE
BOOSTER RELIEF VALVE
CHECK VALVE
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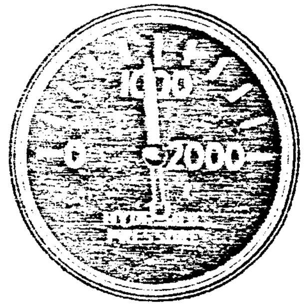
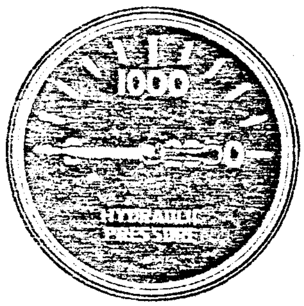
R
BOOSTER PRESSURE GAGE
LEGEND
SUPPLY
PRESSURE
RETURN
HAND PUMP PRESSURE

HYDRAULIC PRESSURE GAGES

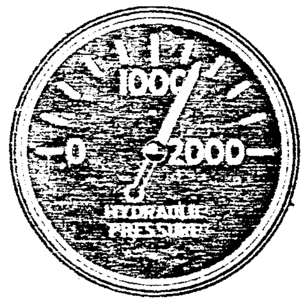


Booster System



Left Engine

Brake System



Right Engine

Gages

There is no main system pressure gage. You can read the pressure of the main system on the brake pressure gage. Work the brakes several times. The brake gage drops to 1050 psi, and then should rise to 1350 psi.

You can also read the main pressure on the booster system gage. Pull up the cross-over valve momentarily. Pressure should rise to 1350 psi.

The two engine pump gages show a reading only when the pumps are momentarily loaded by the unloading valve. Then they drop back to zero.

How Booster System Operates

The booster hydraulic system operates the aileron and elevator boosters. There is no rudder booster.

This system has its own reservoir, unloading valve, two small accumulators, and a separate pump driven by the left engine. Normal operating pressure is between 750 and 1050 psi.

There is a shut-off valve which turns the boosters off and allows the ship to be flown manually.

Servicing

To check quantity of fluid in the booster reservoir, remove cap. Oil should show just above bottom of screen. If it doesn't, add fluid until it shows—not to the top.

Warning:

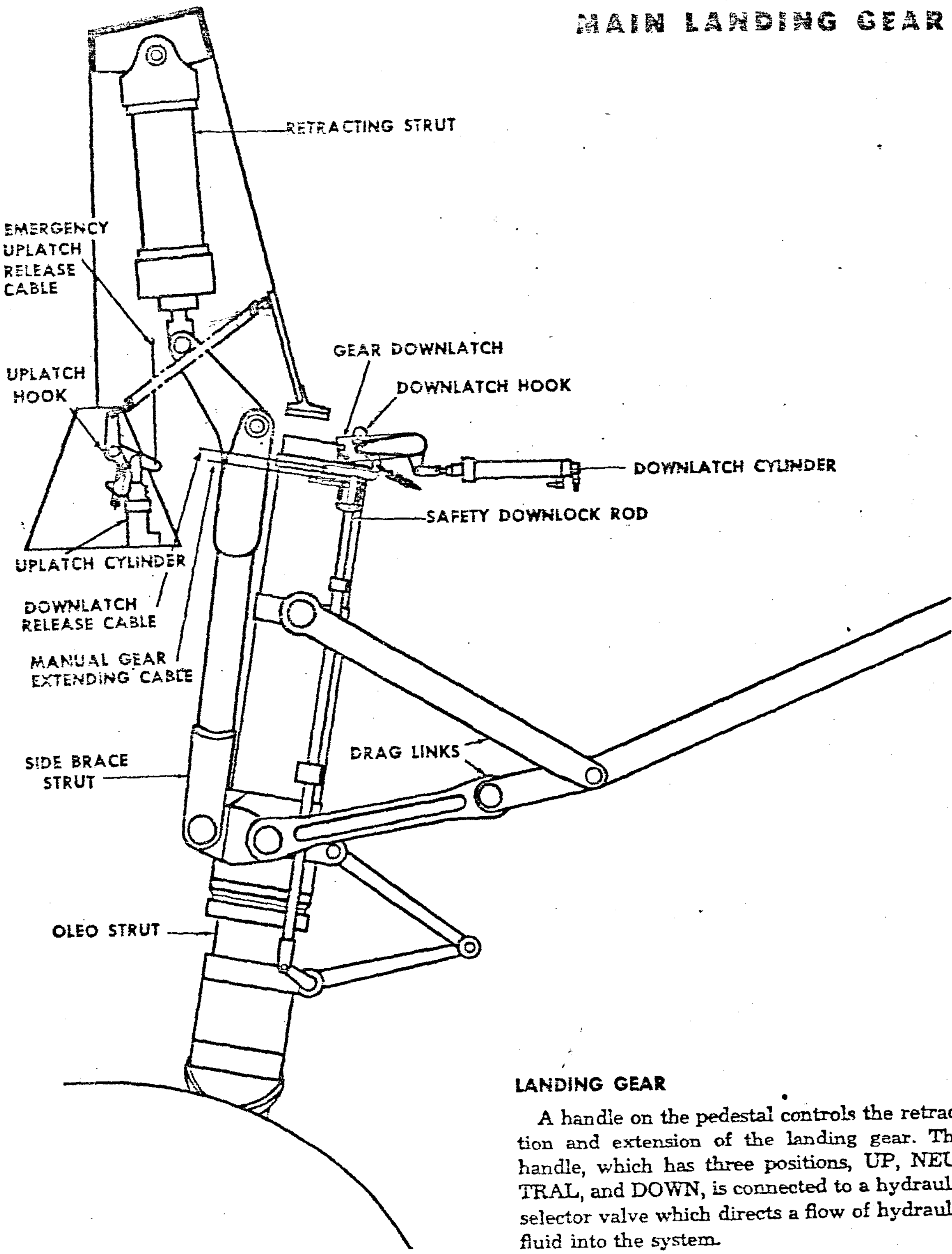
Do not use the cross-over valve for checking main system pressure unless absolutely necessary. The valve may not seat properly when returned to the normal position.

If you must use, do not leave the cross-over valve OUT, or you may lose all the fluid in the booster system.

Main system pressure drops down to as low as 650 psi when you operate the gear or flaps. The higher pressure in the booster system forces fluid into the main system, emptying the booster system.

When both systems are functioning normally, open the cross-over valve momentarily only, and do not operate any hydraulic units while it is open.

MAIN LANDING GEAR



LANDING GEAR

A handle on the pedestal controls the retraction and extension of the landing gear. The handle, which has three positions, UP, NEUTRAL, and DOWN, is connected to a hydraulic selector valve which directs a flow of hydraulic fluid into the system.

Retracting Gear

Lift the safety catch and move the landing gear handle to the UP position. This first releases a cable-connected hook which normally prevents the down-latch from being raised. Further movement of the handle upward operates the selector valve and allows pressure to enter the landing gear circuit in the following sequence of operations:

Fluid enters the down-latch cylinder and releases down-latch.

It then enters the retracting strut and extends it, retracting the gear into the nacelle, where it is held by the up-latch hook.

The nacelle doors are then closed by their actuating struts.

When the operation is complete, move the gear handle to the NEUTRAL position. This allows the gear to drop back onto the up-latch hook, relieving strain on the retracting strut.

If the nacelle doors creep down because of a leak, move the gear handle to the UP position occasionally, to keep the doors retracted. On long-range flights leave the handle UP.

Extending Gear

Move the handle to the DOWN position. Hydraulic pressure first opens the nacelle doors. It then releases the up-latch hook, allowing the gear to drop. Pressure then retracts the actuating struts, extending the gear. The down-latch snaps into place under 230 lbs. spring tension, and the gear is down and locked.

Gear Position Indicators—Note that there are two steps on the down-latch. If the gear catches on the first step of the latch only, because of misalignment, only the amber light on the instrument panel goes on. It is safe to land with the gear in this position, but it is better to retract the gear and try to lock it fully down.

When the gear is fully down and locked on the second step of the latch, the green light goes on, indicating its position. Both lights are operated by switches on the face of the latch.

Early-model C-46's have selsyn indicators which show the position of the landing gear.

Further warning is given by a horn, which blows when you retard throttles below 15" Hg. if the gear is not fully extended.

If you have any doubt about the gear being down and securely locked, have the engineer test it with the manual emergency crank.

Tailwheel

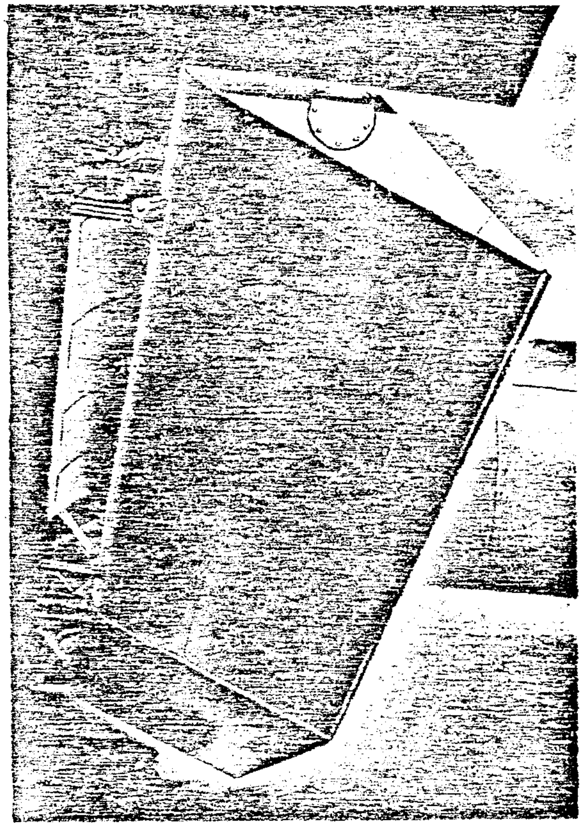
The tailwheel extends and retracts along with the main gear, and in a similar manner.

Safety Down-lock

Late-model airplanes have a landing gear safety down-lock to prevent retraction of the gear on the ground. A rod connected to the oleo strut prevents the down-latch hook from being moved when there is weight on the gear. After takeoff, the oleo strut extends 16 inches and the rod is withdrawn, allowing the hook to move and the up-latch to be raised.

WING FLAPS

The C-46 wing flaps are the rearward-moving, trailing-edge type, similar to the Fowler



Flaps extended

flap. These flaps not only provide increase of effective incidence angle of the airfoil, but also increase the area of the wing, further lowering the stalling speed.

A relief valve automatically allows the flaps to retract if airspeed exceeds 150 mph while the flaps are down, protecting them from damage. Built-in equalizers provide for equal extension of the flaps.

Operation of Flaps

You can extend the flaps to any angle up to 35°. The control handle has four marked positions: ¼, ½, ¾, and FULL. A spring-loaded stop halts the handle as it reaches the ¼ position. Push the stop back with your thumb to extend the flap beyond this position.

A fixed stop at the FULL position holds the maximum allowable travel of the flaps to 35°. If this stop is removed, flaps may be extended to 45°. This is not necessary and is not recommended.

A gage on the instrument panel gives a constant indication of the angle of extension of the flaps.

BRAKES

Brakes on the C-46 are of the single Hayes expander-tube type. Metering valves connected to the rudder pedals operate the right and left wheel brakes independently of each other.

The parking brake applies pressure to the brakes to a value of 60% of maximum brake line pressure. The parking brake control handle is on the pedestal.

The main hydraulic manifold supplies pressure for brake operation. A brake accumulator supplies pressure in event of failure of the main system.

A gage below the right-hand side of the instrument panel indicates the pressure in the brake system.

OTHER HYDRAULIC ACCESSORIES

Automatic pilot, cowl flaps, and windshield wipers all operate off the main pressure manifold.

The ON-OFF control for the autopilot is on the left side of the instrument panel.

The two cowl flaps control handles are on the pedestal. These controls allow any variation of cowl flap setting from full OPEN to CLOSED.

The windshield wiper control is on the pilot's windowsill.

EMERGENCY HYDRAULIC OPERATION

Booster System Failure

If the booster hydraulic pump, or the left engine on which this pump is installed, fails—use the main hydraulic system to operate the boosters.

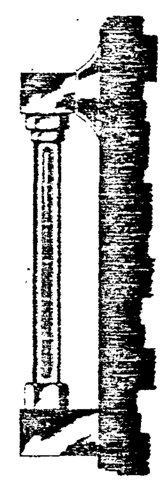
Pull up the cross-over valve at the bottom of the pedestal. This cuts the main system pressure into the booster lines and also isolates the booster pump and accumulators.

Warning: Failure of the boosters may be caused by a leak in a booster or a line leading to one. After pulling the cross-over valve, keep a constant check on the glass quantity gage on the main reservoir; you may be losing all the fluid. If the level drops abnormally, push in the cross-over valve, shut off the boosters, and fly the ship manually.

Main System Failure

1. If the main system pressure drops and stays below normal, check for the trouble as follows:

Check fluid level gage on main hydraulic reservoir



Fluid Level—If the glass indicator gage shows no fluid in the main reservoir, fill at once.

If the addition of 5 or 6 gallons does not fill the tank, a large leak in the system is indicated and considerable fluid has been lost.

Visual Check—In case of a large leak, have the engineer inspect as much of the system as he can reach.

If the leak is in the accumulator line, pull up the accumulator shut-off valve.

Unless the leak can be repaired, land as soon as possible. Operating hydraulic pumps dry overheats and damages the pumps.

If fluid level is normal but the pressure is down to zero, either the unloading valve or relief valve is stuck open. Have the engineer feel the return lines from each of these valves. If one of them is warm, that valve is stuck open, bypassing all the fluid.

Tapping the faulty valve may loosen it and return the system to normal operation. If not, use the hand pump to operate needed units.

2. If main system pressure goes to 1500 psi the accumulator shut-off valve is closed (in the up position), or the unloading valve is stuck closed. If the accumulator shut-off valve is closed, reduce pressure by operating some hydraulic unit and then open the valve.

If the trouble is in the unloading valve, have the engineer tap it to try to get it working again. If this does no good you can still operate all units at relief valve pressure. Have the engineer reduce the relief pressure to 1300 psi by re-setting the adjusting screw on the valve.

Use of Hydraulic Hand Pump

Use the hydraulic hand pump to operate hydraulic units in cases of main system failure. The hand pump utilizes the 3.2-gallon reserve supply of fluid in the main reservoir, and supplies pressure through the manifold to any part of the circuit to be operated.

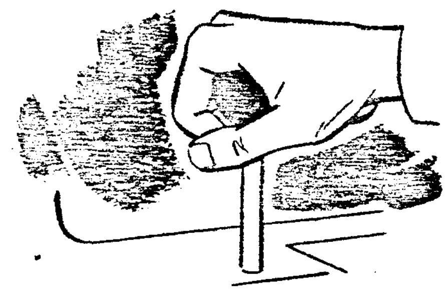
The pump handle is stowed in clips on the liaison radio rack. Lift up the small door behind the copilot's seat on the cockpit floor and insert the pump handle into the socket.

Before using the hand pump, pull out the main accumulator shut-off valve. This cuts out the accumulator and allows the pressure generated to go into the manifold.

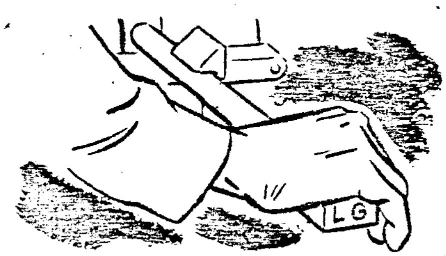
Note: Do not use hydraulic hand pump for operation of landing gear or flaps unless the brake accumulator gage indicates full pressure. You may use up all the fluid and have no pressure for braking.

EMERGENCY LOWERING OF LANDING GEAR

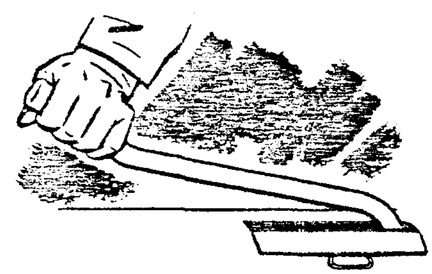
With Hydraulic Hand Pump



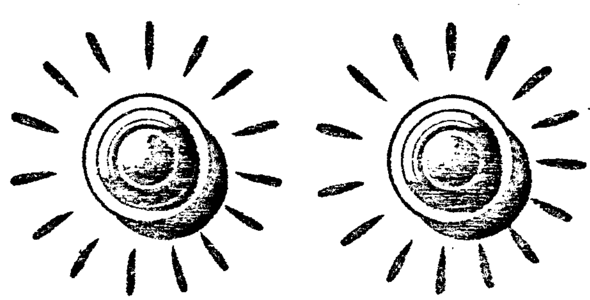
1. Pull up accumulator shut-off valve.



2. Place gear handle in DOWN position.



3. Use hydraulic hand pump to extend gear.

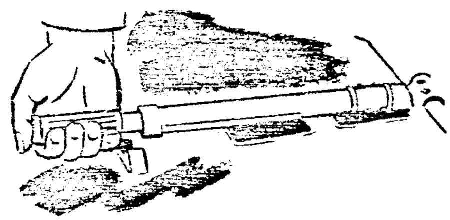


4. Check gear down and locked by horn and light indicators, and have engineer test with hand crank.

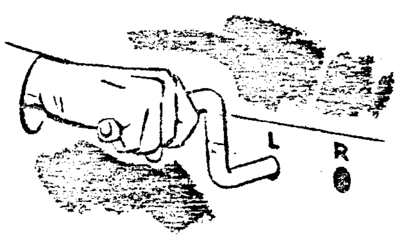
With Hand Crank

If the type of hydraulic failure prevents use of the hydraulic hand pump, crank the gear down by hand:

1. Place gear handle in DOWN position.



2. Pull up emergency dump valve handle under the liaison radio rack. This releases back pressure in the retracting struts by dumping the fluid. It also releases the up-latches on all three wheels, allowing them to fall part way from their locked-up position, forcing the fairing doors open.



3. Crank each wheel down separately with the hand crank. The crank is stowed on the under side of the hatch in the cockpit floor just aft of the pilot's seat. Insert it in the holes just below the hatch sill, and turn counter-clockwise with steady force.
4. Pull tailwheel into locked position, using rod stowed in aft cabin bulkhead. Hook rod near folding joint of gear strut and pull until gear locks.
5. Check the gear down and locked.

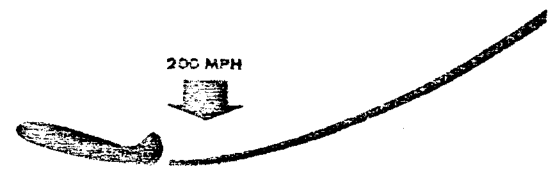
When Lines Are Restricted

In some instances the gear does not extend normally, because of restrictions in lines or maladjusted pressures, even though the hydraulic system operates normally.

Place gear handle in DOWN and have engineer check alignment of selector valve.

Use hand crank to assist extension. If this won't work, centrifugal force, plus increased hydraulic system pressure, may help:

1. Pull up accumulator shut-off valve. Operate some hydraulic unit to drop pressure below 1050 psi. This closes the unloading valve and the system delivers relief valve pressure of 1500 psi.



2. Climb to a safe altitude and enter a shallow power glide until you reach a speed of 200 mph. Pull up sharply, at the same time placing gear handle in DOWN position.

When Gear Won't Lock

When the gear fails to lock, even though fully extended, use any of the previously discussed emergency measures to try to lock it down. If all fail, you may be able to push the wheels back to a locked position by touching them on the runway. Maintain at least 130 mph with ¼ flaps and start climbing immediately after contact.

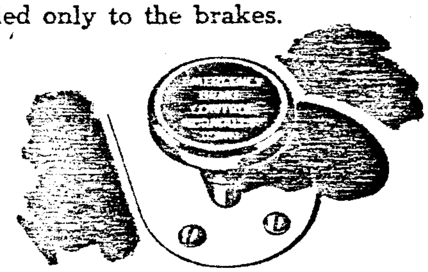
EMERGENCY WING FLAP OPERATION

To work the flaps by hand pump:

1. Shut accumulator.
2. Place flap handle in desired position, and pump.

EMERGENCY BRAKE OPERATION

To operate the brakes by use of the hand pump, pull the brake emergency shut-off valve under the pedestal. This isolates the hand pump circuit from the rest of the main hydraulic system, and allows all pressure pumped to be supplied only to the brakes.



A stored pressure of 1300 psi in the brake accumulator allows four or five applications of the brakes without the necessity of hand pumping. To conserve the pressure, make the first application the only one necessary by bringing the ship to a stop without releasing the brakes at all.

OIL SYSTEM

There is a separate oil system for each engine. Oil flows from a hopper type tank of 39.8-gallon capacity directly to the engine. Engine-driven pumps force the oil through the engine, then through a cooler, and back into the hopper section of the tank.

Dual gages on the instrument panel indicate oil pressure and temperature, and there is a warning light to show when oil level is low. Late C-46's also have an oil quantity gage.

A solenoid valve allows addition of gasoline from the fuel system for oil dilution when required.

The oil cooler, or radiator, contains a thermostatic temperature control valve which allows the oil to bypass or to flow through the cooler, according to its temperature after leaving the engine. Shutters on the cooler, operated by a handle on the pedestal, may be opened or closed, providing further temperature control.

Watch oil temperature carefully in flight. If you are flying with oil cooler shutters OPEN, close them if temperature either rises or drops materially.

Temperature rise may be caused by chilled oil congealing in the cooler, bypassing the hot oil from the engine back into the tank without cooling it.

Temperature drop is caused by the oil being chilled too much in the cooler, but not to the point of congealing.

If the oil cooler shutters are CLOSED and oil temperature rises, open the shutters.

Oil System Failure

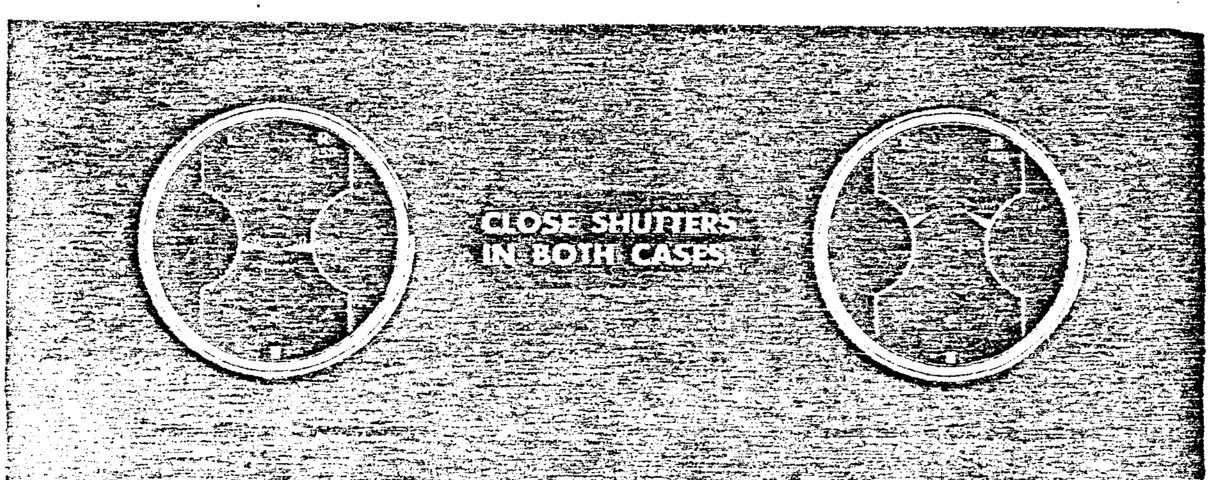
A partial drop in oil pressure indicates that something is wrong with the oil system. Operate the engine at reduced power, keeping close watch on the oil pressure gage, and land as soon as possible.

If the oil pressure drops to zero, the oil system has failed completely. **Do not operate the engine.** Use standard procedure to shut the engine off and feather the propeller.

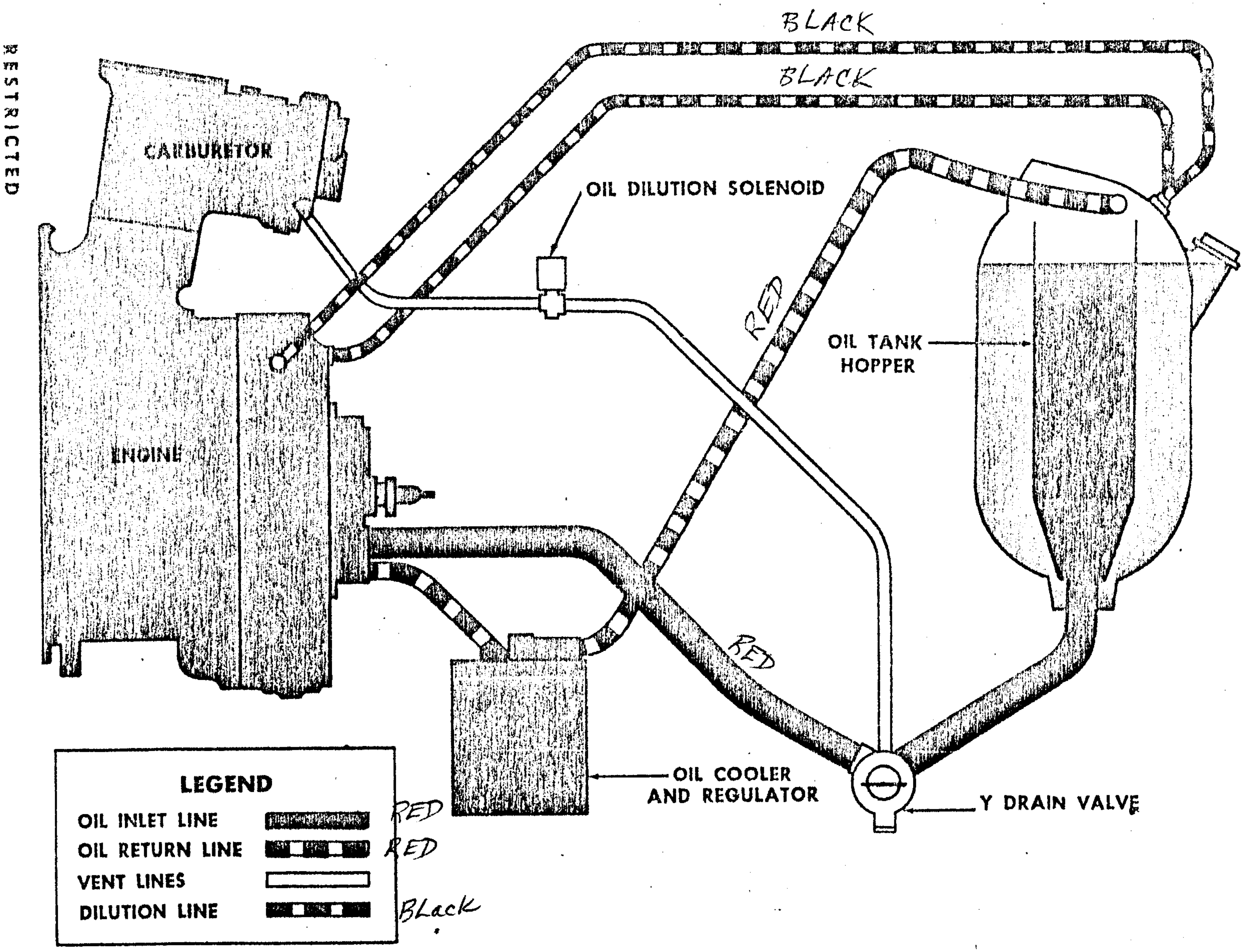
In an emergency where it is vital to use both engines, you may re-start the dead engine and run it at reduced power for a short time.

Long-range Oil System

A 40-gallon long-range oil tank may be installed in the cabin to feed oil to the nacelle oil tanks by use of a hand operated pump. The tank, which may be filled in flight, is connected by built-in lines to each nacelle tank.



OIL SYSTEM


BLACK
BLACK
CARBURETOR
OIL DILUTION SOLENOID
RED
OIL TANK HOPPER
ENGINE
RED
OIL COOLER AND REGULATOR
Y DRAIN VALVE
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DILUTION LINE
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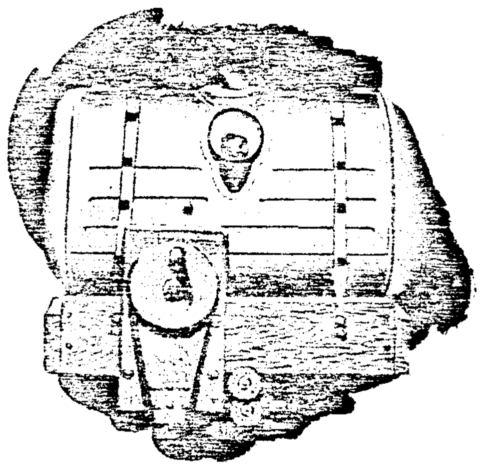


Long-range oil tank

Start using the long-range oil system when the oil level warning light on the instrument panel goes on, indicating that the regular oil tanks are ¾ empty. To use:

1. Open the shut-off valve for one engine. These valves are on the long-range tank installation.
2. Pump 15 gallons of oil into the nacelle tank by turning the hand crank. Check the quantity pumped by the difference in bayonet gage readings on the long-range tank.
3. Shut the valve, open the other, and fill the other nacelle tank in the same manner.

Normal oil consumption for R-2800-51 engines varies from 9 to 15 quarts per hour for cruise horsepower.

ELECTRICAL SYSTEM

The C-46 has a 24-volt direct current electrical system, powered by two engine-driven generators with two 34-ampere-hour storage batteries.

A receptacle in the lower right side of the fuselage provides for external power from a battery cart, and there is an auxiliary power unit in the airplane.

Most of the switches for the electrical system are on the overhead panel. Fuse boxes are located at various points in the airplane.

Generators

The generators are 24-volt 200-ampere type, one on each engine. Rated output voltage is 28.5, which is reduced to 28 by voltage regulators. Reverse current relays prevent battery current from reversing flow to the generators and thus draining the batteries.

Generators are set to cut in at an engine speed of 1400 rpm.

Batteries

The storage batteries are in the forward cargo compartment. To use the batteries you must turn on the master switch and also the battery selector switches, which control battery-disconnect solenoids.

Inverters

There are two inverters which convert direct to alternating current, supplying 26 volts to the autosyn instruments and 115 volts to the radio compass. Use the main inverter for all normal operation; use the spare in case of failure of the main.

Checking Electrical System

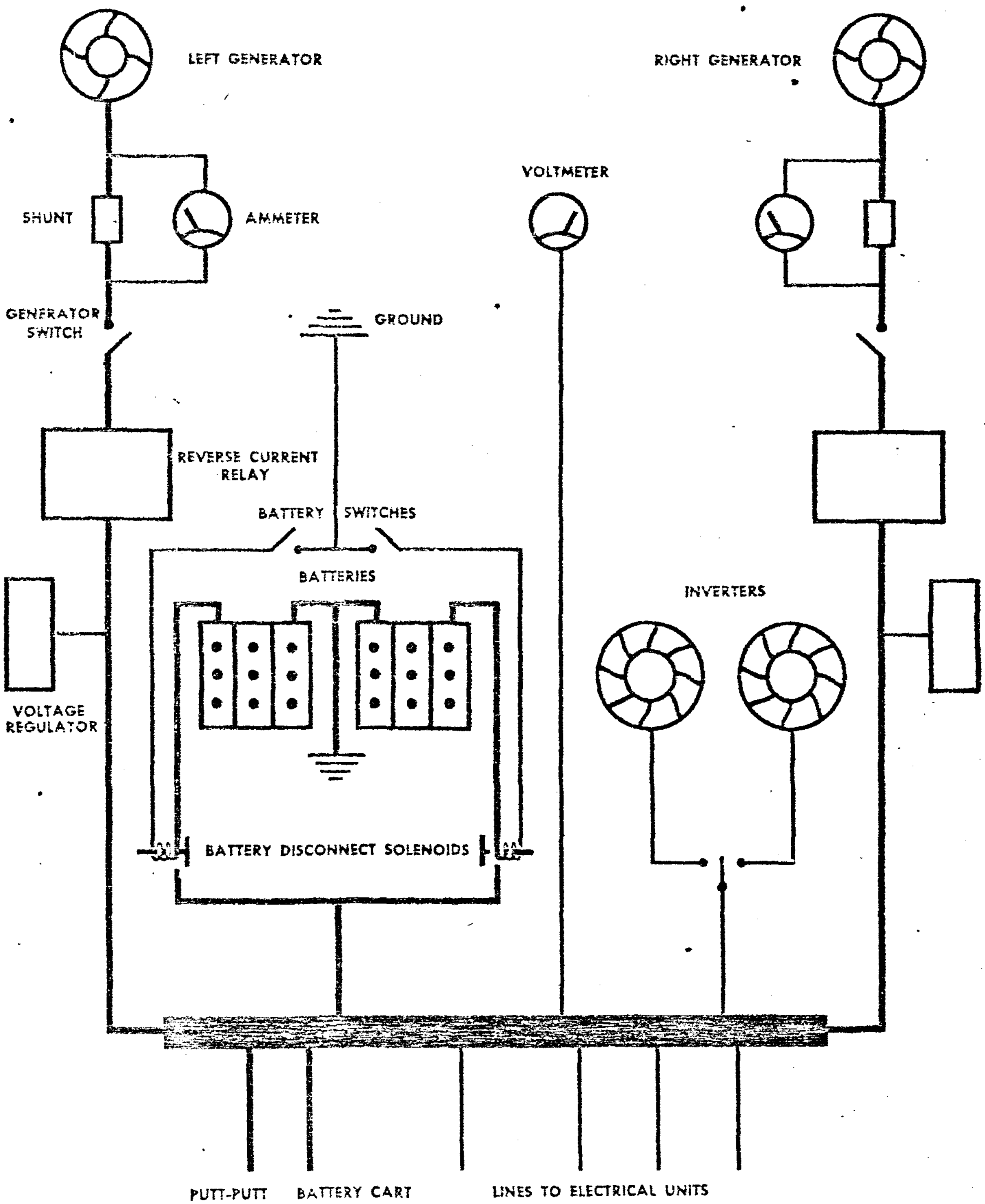
Turn battery switches OFF when checking the generators for voltage and current output during run-up. In most installations the voltmeter is connected to the main bus line and shows voltage from the batteries even when the generators are not working.

If current readings are small because the battery is fully charged, turn one generator OFF. This throws the entire load on the other generator, and if it is working normally a definite charge is indicated.

Electrical Equipment

The electrical system operates the following units: Engine starters; Electric propellers; Booster coils or induction vibrators; Autosyn instruments; Radio equipment; Lights; Warning signals; Heater ignition system and heater supercharger motor; De-icer distributor; Carburetor, propeller, and windshield anti-icer pumps; Fuel booster pumps; Solenoids for oil dilution, engine primers, and heater fuel shut-offs; Pitot tube heaters.

ELECTRICAL SYSTEM



Engine Starters

The C-46 has combination inertia-direct cranking electric starters. Energizing the starter builds up inertia in the flywheel. When you engage the starter the flywheel gives the engine its initial start. The starter motor continues turning the engine over by direct drive once rotation starts.

AUXILIARY POWER UNIT

There is a type HRU-28 auxiliary power unit in the left side of the forward cargo compartment. This is a single-cylinder, air-cooled gasoline engine driving a 28-volt, 70-ampere DC generator.

The auxiliary power unit (or putt-putt) is normally used to charge batteries when the ship is on the ground and to furnish power for starting. You can also use it in emergencies as the main power source.

When using the putt-putt to start the engines, remember that the starter draws 121 amps and the putt-putt's output is only 70 amps. Use the airplane batteries to help it.

Starting Putt-Putt

You can start the auxiliary power unit electrically by using the ship's batteries, or manually by pull rope on the flywheel.

1. Place shut-off valve in ON position.
2. Choke.
3. Turn equalizer switch ON if generators are operating. Otherwise, switch OFF.
4. **To start electrically:**

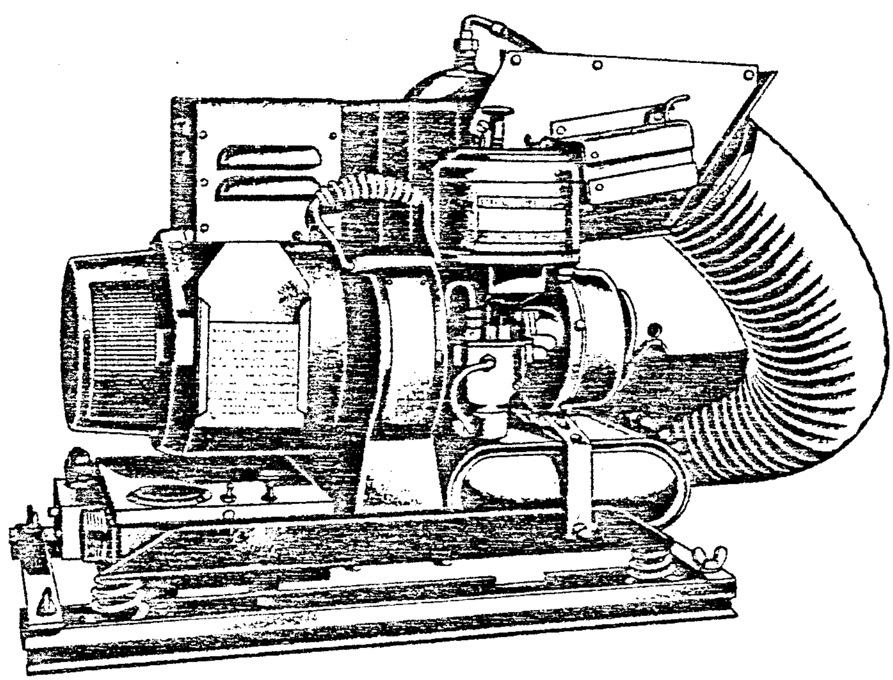
Turn on master switch and both battery switches. Turn circuit breaker located over the generator unit ON, depress starting button on the control box, releasing when engine starts.

To start manually:

Wind starting rope on pulley and start as you would an outboard motor.

Stopping Procedure

1. Turn fuel shut-off valve OFF.
2. Turn circuit breaker OFF.
3. For emergency stopping, or if unit is to be re-started soon. Press red stop button on the magneto stator plate and hold firmly until the engine stops.



Auxiliary power unit

Servicing

Mix ½ pint of lubricating oil, Spec. No. AN-VV-O-446 grade 1065A, with a gallon of gasoline and pour into fuel tank. This fills the tank and will operate the unit for 1½ hours.

EMERGENCY OPERATION OF ELECTRICAL SYSTEM

Use Putt-putt

If the generators fail in flight, use the putt-putt to supply current to the batteries. Remember that this unit runs for only 1½ hours on a tank of gas, and conserve its use unless you have spare fuel aboard.

Conserve Power

If the putt-putt is not available, conserve electric current as much as possible. Shut off radios, lights, inverters, and other equipment not absolutely needed, and make sure that battery switches are OFF. Place the prop selector switches in FIXED PITCH.

Save your batteries for essential uses, such as re-setting propeller pitch when necessary and making short radio contacts. Complete discharge of the batteries leaves you without any control over the pitch of the propellers. Land as soon as possible.

Circuit Breakers

Circuit breakers of the toggle or push-button type work on the thermal principle: Excessive current load heats the switch, causing it to jump off, or out. To restore current to the circuit, re-set the circuit breaker.

If the switch continually jumps to the OFF position, there is a short in the circuit and repairs are needed. If you need the circuit in an emergency, hold the switch in the ON position momentarily.

LIGHTING EQUIPMENT

Cockpit

A variety of dome lights, spotlights, and fluorescent lights illuminate the cockpit of the C-46. Most of these lights operate off the circuit breaker marked COCKPIT on the overhead panel, but have their own ON-OFF switches. Five minutes' study in the cockpit will familiarize you with all these various controls.

The cockpit lights include:

Fluorescent spotlights for reading certain instruments.

Three incandescent lights above the instrument panel.

Two spotlights, one on the overhead panel and one on the radio rack.

Two overhead panel lights.

Magnetic compass internal light.

Cargo Compartments

The main cargo compartment has 13 lights controlled by the circuit breaker marked CABIN.

The two forward lights and one near the main cargo door can also be operated by individual switches.

There is a rheostat-controlled light on the navigator's table.

The lower forward cargo compartment has four lights controlled by either of two switches: one just below the hatch door in the cockpit, the other in the upper left side of the forward compartment door frame.

The lower rear compartment has three lights controlled by a switch on the upper right side of the rear cargo door frame.

Exterior Lights

The retractable landing lights are controlled by switches on the control pedestal.

The red passing light in the fuselage nose cone is controlled by the circuit breaker marked PASSING, on the overhead panel.

The position lights, one on each wingtip and one on the tail cone, are controlled by two switches on the overhead panel. The lights may be turned on dim or bright. The circuit breaker marked POSITION must be on.

The identification lights on the outside of the fuselage are operated by the control box on the copilot's windowsill.

PROPELLERS

All C-46 aircraft except some of the earliest models have Curtiss electric full-feathering, constant-speed propellers. This is a 4-bladed propeller, with a diameter of 13 feet, 6 inches. Power for the pitch-change motor is supplied by the main electrical system of the airplane.

Constant Speed

A governor mounted on the engine nose controls the propeller when the selector switch is in AUTO, its normal operating position. The governor works on the principle of centrifugal flyweights.

When engine speed increases beyond the rpm you have set, the flyweights extend, opening a pilot valve which allows engine oil to flow under pressure into a servo cylinder. A contact on the end of the servo piston operates an electric switch, changing the pitch of the propeller and decreasing rpm to the desired setting. When proper rpm is attained, the switch cuts out.

The governor increases rpm to the selected setting in a similar manner.

Propeller governor controls on the pedestal connect by linkage to the governors, enabling you to set them for the desired rpm.

Manual Operation

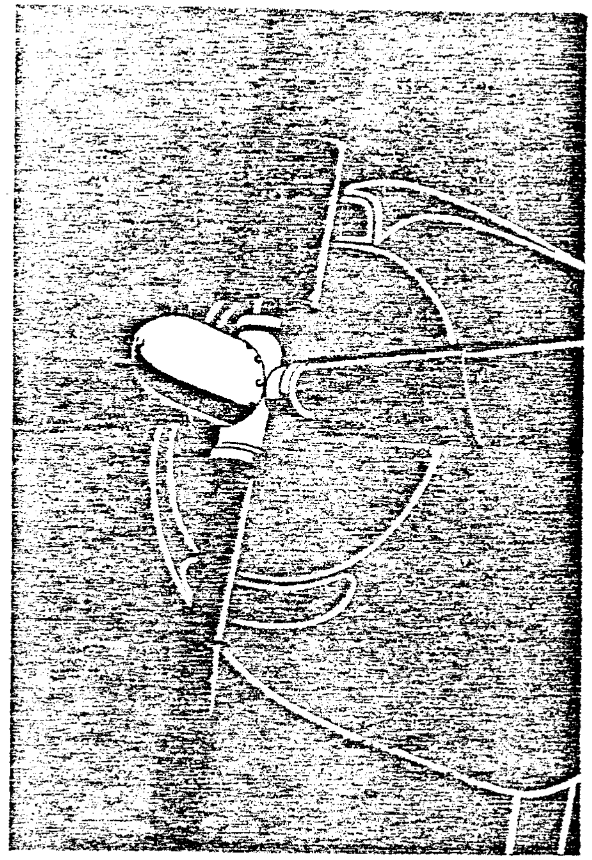
For all normal operation, keep the propeller switches in the AUTO position. When a switch is in FIXED PITCH, the propeller blade angle is held constant by magnetic brakes and it is no longer a constant speed propeller.

To change the pitch of the propeller when the automatic feature is inoperative, hold the selector switch in DEC RPM or INC RPM until you attain the desired rpm.

Feathering

Switches on the pedestal control feathering of the propellers. When you move the switch to the FEATHER position, you apply stepped-up voltage to the "decrease rpm" side of the pitch-change motor. The propeller blades quickly move to the full-feathered position.

You can also feather the propeller by holding the selector switch in the DEC RPM position. This takes longer than using the feathering switch. Use this method for feathering for single engine practice to avoid wear on the feathering mechanism.



Failure of Electric Power

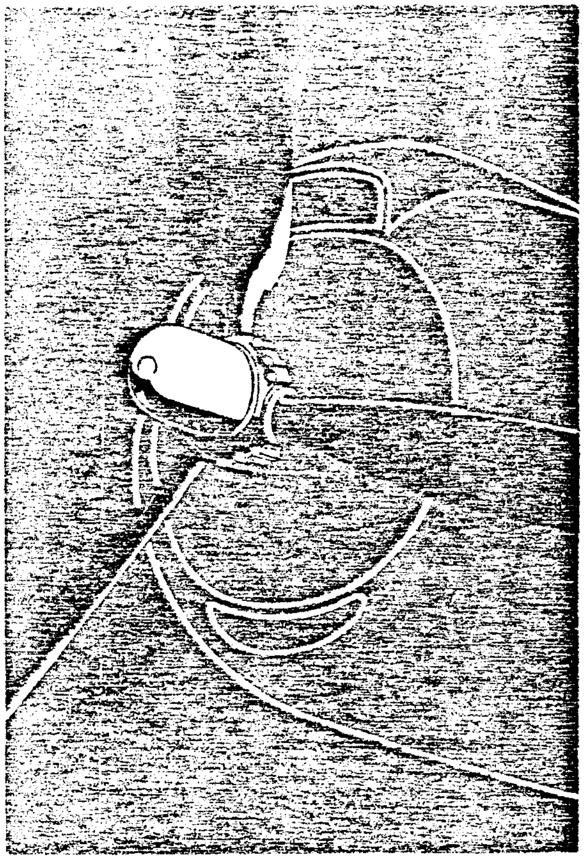
If the electrical system fails in flight, set the propeller selector switches in FIXED PITCH position. This disconnects the governors from the electrical system, eliminating drain on the batteries. It also sets the pitch brake, holding the propellers in fixed pitch.

If the pitch brake slips, allowing the propellers to change pitch and speed up, hold the selector switch in DEC RPM to bring the rpm down, if batteries have sufficient current.

Circuit Breakers

Circuit breakers prevent damage caused by overloads or short circuits. Excessive current flow heats the circuit breaker, causing it to pop out and open the circuit.

If a circuit breaker pops out because of momentary overload, wait a few seconds for it to cool, then re-set by pushing it in.



Hamilton Standard Propellers

A few of the early C-46's with Hamilton Standard propellers are still in use. The Hamilton is a 3-bladed, full-feathering, constant speed, hydromatic propeller, with a diameter of 15 feet, 1 inch.

Pilot operation of the governor controls for this propeller is exactly the same as that for Curtiss electric propellers. There is no provision for manual or fixed pitch operation of the propellers.

HEATING AND VENTILATION

Three gasoline fired, combustion type heaters supply plenty of heat to keep the cockpit and big cabin of the C-46 warm. The cockpit heater and defroster puts out 40,000 B.T.U. (British thermal units); the two cabin heaters, 100,000 B.T.U. each.

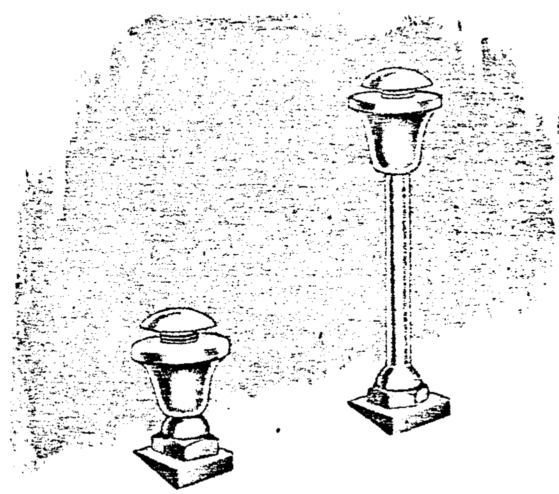
The heaters get their fuel from the main fuel system of the airplane. Air for ventilation and combustion comes through the ram air duct in the nose of the ship. The main electrical system furnishes current needed for normal heater operation. There is a heater temperature gage on the instrument panel of some airplanes.

Cockpit Heater and Defroster

You can use the cockpit heater on the ground as well as in flight. For ground use, an electric blower furnishes air, and a special fuel pump in the left nacelle (or the regular tank sump pump in late model ships) supplies fuel flow. After takeoff, a ram air pressure switch turns off the blower when you reach 120 mph IAS, the ram air pressure being sufficient to supply the heater at that speed. This switch also turns off the special fuel pump if there is one.

Starting: Use a battery cart, the putt-putt, or run one of the airplane's engines to provide electricity for operating the heater on the ground. **Do not use airplane batteries alone.**

1. Turn left fuel selector valve to desired tank.

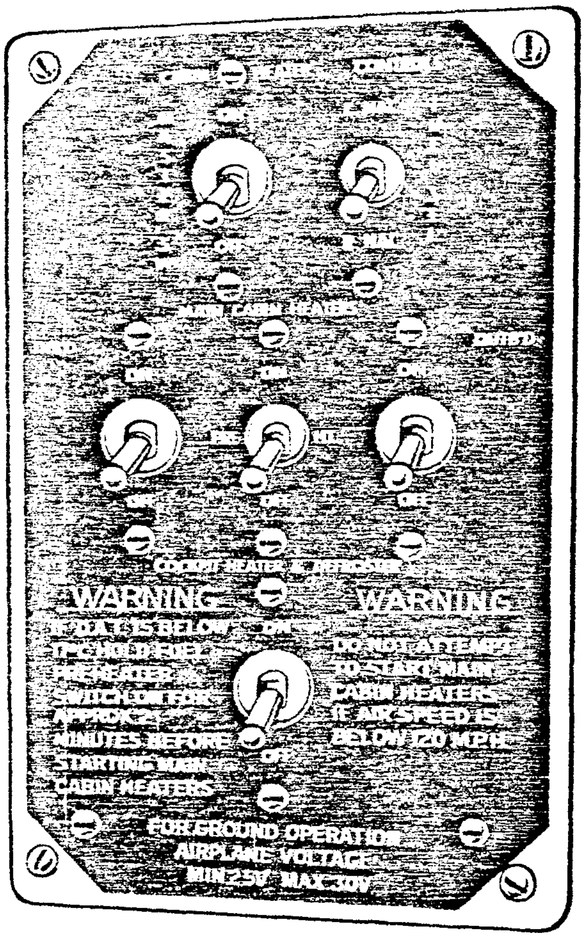


Left, heater emergency shut-off valve
Right, hot air directional flow valve

2. On cabin floor, aft of hydraulic reservoir: Check heater emergency shut-off valve in DOWN position. (This valve is normally safetied in the DOWN position.)
   Pull warm air control up to supply hot air to the cockpit.
3. Turn airplane master switch ON.

4. Open nose valve control on pilot's windowsill.

5. Open pilot's defroster valve or foot warmer, on left side of pedestal.



Heater control panel

6. On heater control panel:
   Heater master switch ON.
   Cockpit heater switch ON.

Note: If warm air is not available in 3 minutes, turn cockpit heater switch OFF. This cuts off the fuel and allows the blower to ventilate the combustion chamber. Wait 3 minutes and then turn switch ON again to re-start.

The procedure for starting the heater in flight is exactly the same, except that some of the controls are already set in the proper positions.

To Turn Off:

1. Turn cockpit heater switch OFF.
2. Wait 3 minutes to allow the heater to ventilate and then turn the heater master switch OFF.

Main Cabin Heaters

You can operate the main cabin heaters separately or together, but only in flight. It is all right to turn the switches on while the airplane is on the ground, but the ram pressure switch does not start the heater until you reach 120 mph IAS. The cabin heaters get air for ventilation and combustion by ram pressure only; there is no blower.

Starting:

1. Follow the procedure for starting the cockpit heater.
2. Then turn one main cabin heater switch ON.
3. If you need more heat, turn other cabin heater ON.

Start the heaters before reaching 20,000 feet, as they may not start above that altitude.

Note: If the outside temperature is below 0°F (—17°C), hold the fuel pre-heater switch ON for 2 minutes. This preheats the fuel to aid ignition.

To turn off main cabin heaters, place main cabin heater switch in OFF position.

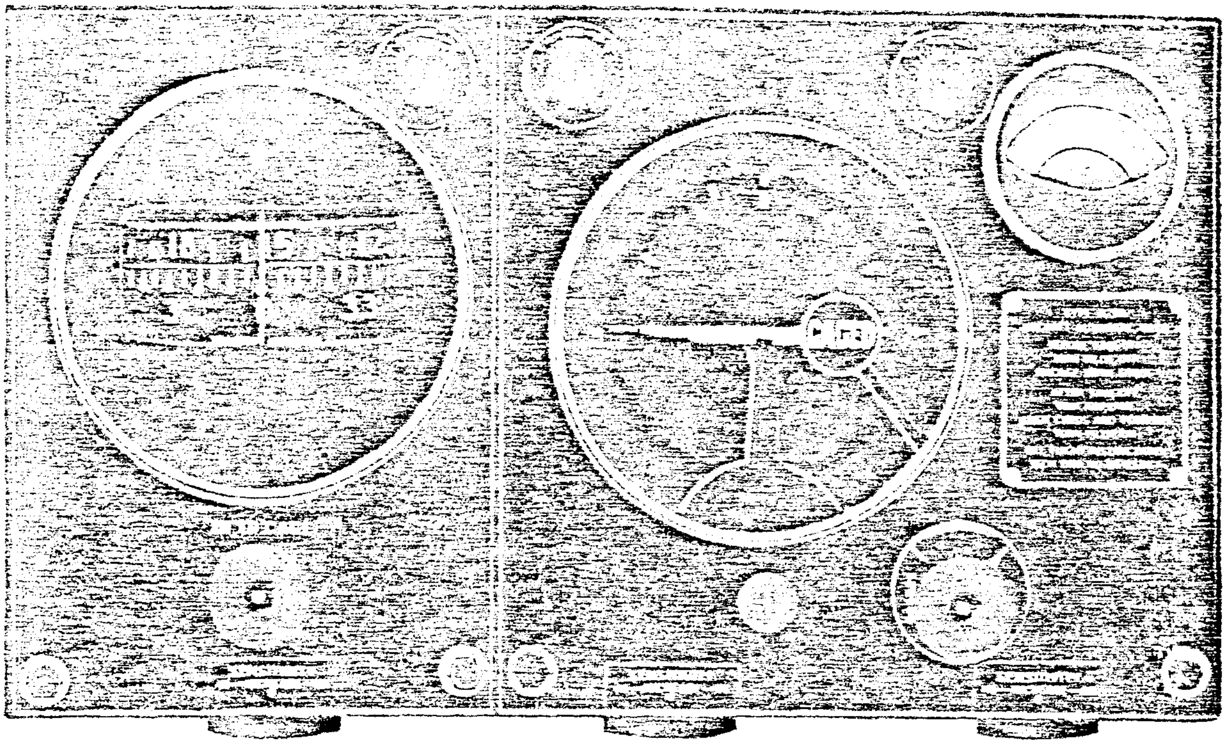
Controlling Heat Flow Direction

If the cockpit heater fails, you can use the main cabin heaters to warm the cockpit and supply hot air for the windshield defrosters. Just push **down** the warm air T valve aft of the hydraulic reservoir. The normal position for this valve when cockpit heater is working is **up.**

The warm air from the cabin heaters normally comes out through the main cabin ceiling duct and is split to go forward and aft. To direct the entire flow to the navigator's station and to the cockpit overhead auxiliary defroster tubes, re-set the control handle, which is aft of the cockpit door over the radio tuning unit rack.

Controls on each side of the pedestal allow you to regulate the flow of air to windshield defroster outlets and to the foot warmers.

There are no temperature controls on the heaters. Turn the heaters on and off as needed.



Automatic pilot

Ventilating

In hot weather you can bring in cool air and direct it through the heating system to various parts of the airplane. Open the nose valve on the pilot's windowsill and operate the duct controls as you would for heated air.

AUTOMATIC PILOT

C-46 aircraft have either Sperry type A-3 or Jack & Heintz type A-3A autopilots.

The autopilot provides automatic control for vertical, longitudinal, and directional motion of the ship, bringing it back from all deviations away from the course and attitude set by the human pilot.

How Autopilot Works

The autopilot works off the vacuum and hydraulic systems of the airplane. As the airplane varies from its predetermined course or attitude, the gyroscopes remain in their original planes. This action controls the operation of oil valves, which in turn regulate the flow of hydraulic fluid to the servo cylinders. These servos work the surface controls to correct the course or attitude.

Adjustable speed valves regulate the return flow of hydraulic fluid from the servo cylinders to the reservoir. The volume of flow determines the speed of correction or sensitivity.

In the A-3 autopilot the speed valves are mounted as a separate unit on the instrument panel. In the A-3A, the valves are built into the main control unit; you operate them by adjustment wheels on the autopilot panel.

Preflight Check

Before taking off on a flight on which the autopilot will be used, make the following check, or be sure that the engineer makes it:

1. With engines running at 1000 rpm, check the vacuum gages. The main gage should read 5.5" Hg., the autopilot gage, 4.8" Hg.
2. Check all gyros uncaged, align all indices, and set speed valves to medium sensitivity.

3. Turn the servo bypass valve to BLEED and the autopilot ON.
4. Check the autopilot oil pressure for 150 (+ or — 10) psi.
5. Move all surface controls manually through their entire range six or eight times. This expels air from the servo cylinders.
6. Realign the indices, and turn the bypass valve from BLEED to NORMAL.
7. Using the index knobs, run all surface controls through their full movement.
8. Change speed valves to maximum and try to overpower. This should be possible.
9. Turn autopilot OFF and check the controls manually for freedom of movement.

Using Autopilot

Elmer can keep the ship straight and level and on course much more accurately than you can, so use him whenever you need him. The autopilot relieves you of much strain and tension on long flights.

Keep these don'ts in mind, however:

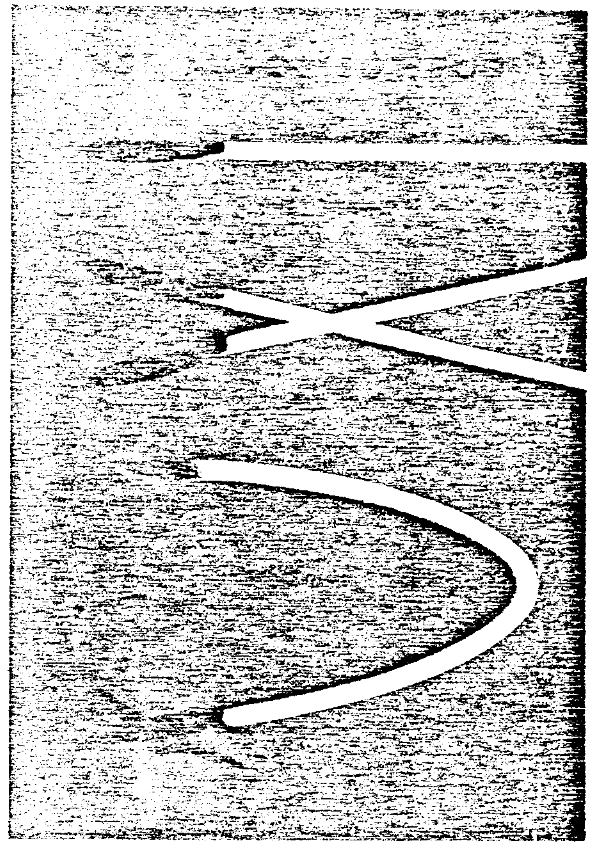
Don't use below 2000 feet.
Don't use in extremely turbulent air.
Don't use when wing de-icer boots are working.
Don't use unless both engines are delivering normal power.
Don't go to sleep!

To Turn ON:

1. Check gyros uncaged and make sure that they are working.
2. Trim the ship to fly hands off.
3. Align the indices, and match the upper and lower cards of the directional gyro unit.
4. Set speed valves on 1.
5. Turn pilot ON, and adjust speed valves for desired sensitivity.

While Operating:

1. Turn off the autopilot occasionally and retrim the airplane. **Don't re-trim with the autopilot ON.** This makes the autopilot fight the trim tab forces and puts a strain on it.
2. Make all changes of attitude smoothly.
3. Use the autopilot only for level flight, climbs, and descents, and for gradual turns.
4. You can make small course changes with flat turns, moving the rudder knob only. Use aileron knob to coordinate large turns. Use elevator knob if necessary to maintain altitude.



VACUUM SYSTEM

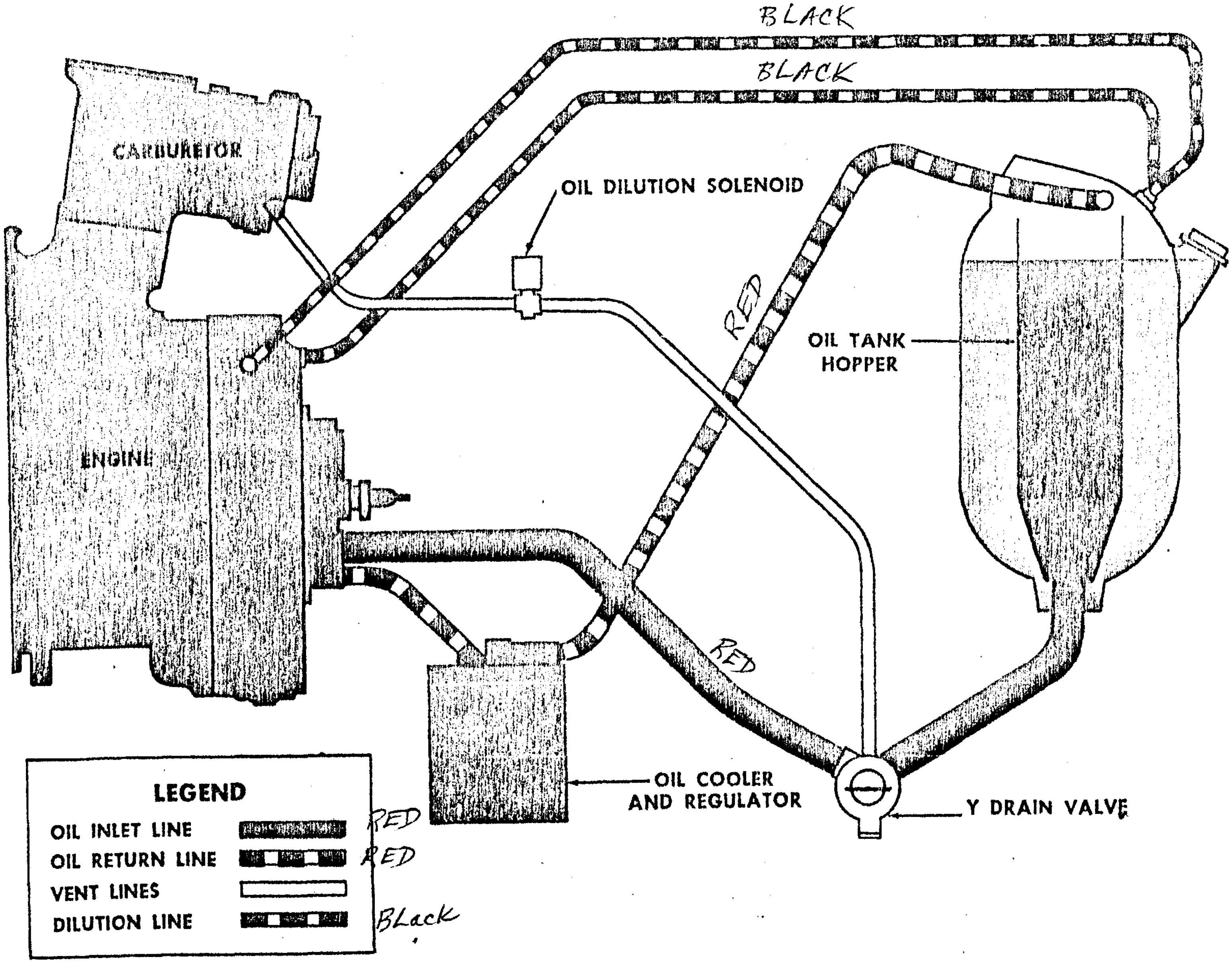
Vacuum pumps, one on each engine, supply suction to operate the autopilot and other gyro instruments. Check valves in the line to each pump allow the instruments to continue operation despite failure of an engine or of a pump. A gage on the instrument panel gives system suction. Normal reading is 5″ to 6″ Hg.

PITOT SYSTEM

The heads on the two pitot masts have both static and impact pressure openings. The impact pressure lines run to the two airspeed indicators, and the static lines provide atmospheric pressure to altimeters, rate-of-climb, and airspeed indicators.

The alternate source selector valve changes the source of static pressure from the pitot tubes to an open-end tube which terminates in the wing. Changing to alternate source may cause up to 12 mph increases in airspeed indi-

OIL SYSTEM


BLACK
BLACK
CARBURETOR
OIL DILUTION SOLENOID
RED
OIL TANK HOPPER
ENGINE
RED
OIL COOLER AND REGULATOR
Y DRAIN VALVE
LEGEND
OIL INLET LINE
RED
OIL RETURN LINE
RED
VENT LINES
DILUTION LINE
Black

cation and can cause the rate-of-climb indicator to show a 300-feet-per-minute rate of climb in level flight.

A blowout pump on the copilot's windowsill clears out the static lines. Observe the placarded caution when changing the selector valves to the desired blowout position.

DE-ICER SYSTEM

There are rubber de-icer boots on the leading edges of wings, stabilizer, and fin.

The vacuum pumps which operate the gyro instruments also work the de-icers. Air from the exhaust side of the pumps goes through two oil separators and then into an electrically driven snap-action distributor valve which intermittently feeds the air to the de-icer boots.

A gage on the instrument panel shows the operating pressure of the system. Normal pressure is 7½ to 8 psi.

To start the de-icers, turn the de-icer circuit breaker on the overhead panel ON.

A complete cycle of inflation and deflation takes 40 seconds. After you turn off the operating switch, the distributor valve continues working until it completes its cycle and all boots are deflated.

ANTI-ICER SYSTEMS

There are three anti-icer systems in the C-46: propeller, carburetor, and windshield or pitot mast.

A 22-gallon tank located over the hydraulic reservoir supplies all of these systems with the anti-icing fluid: isopropyl alcohol, No. AN-F-13. The tank is divided into three compartments at the bottom by 9-inch-high plates. Each system draws from a separate compartment, preventing any one system from draining the entire tank.

Each system has its own electric pump.

To operate any of the units, you must first turn on the main anti-icer circuit breaker at the back end of the electrical panel.

Propeller Anti-icer

The propeller anti-icer system is the conventional slinger type. Fluid from the middle outlet of the tank runs to the pump and is forced to each propeller slinger assembly. The slinger rings feed the leading edge of each prop blade.

To operate:

1. Turn main anti-icer circuit breaker ON.
2. Turn the propeller anti-icer pump rheostat on the overhead panel to the desired setting.

At the maximum rheostat setting the rate of flow is 1½ gallons per propeller per hour.

Carburetor Anti-icer

The carburetor anti-icer pump supplies fluid from the supply tank to four outlets in each carburetor airscoop. Rate of flow is 4 gallons per carburetor per hour. A 3-way toggle switch on the overhead panel controls the pump, allowing continuous or momentary fluid flow.

To operate:

1. Turn main anti-icer circuit breaker ON.
2. Place carburetor anti-icer pump switch in ON or hold in MOM, as required.

Windshield or Pitot Mast Anti-icer

A third anti-icer pump supplies fluid to the windshield or to the pitot masts, depending upon the installation.

Older ships have alcohol anti-icing for the windshield. Current models do not have this system, relying on the hot-air defrosters to keep the windshield free of ice. In these late models the anti-icing system supplies fluid to the outside of the pitot masts through perforated tubes to prevent ice formation, which might break the masts off.

The toggle switch for the pump is on the overhead panel, next to the carburetor anti-icer switch, and is labeled WINDSHIELD or PITOT, according to the type of installation.

To operate windshield anti-icer:

1. Turn main anti-icer circuit breaker ON.
2. Turn windshield anti-icer pump ON.
3. Open flow control valve on pilot's windowsill.

To operate pitot mast anti-icer:

1. Turn main anti-icer circuit breaker ON.
2. Turn pitot anti-icer pump ON.
3. Open RIGHT and LEFT pitot mast selector valves on pilot's windowsill.

FIRE EXTINGUISHERS

Engine Fire Extinguisher System

There are four built-in CO_2 cylinders in each nacelle. Each carries a CO_2 charge of 5 lbs.

Two T-type release handles on the instrument panel, one for each nacelle, control the operation of the system. To operate, just pull out the proper handle.

When you pull the handle, CO_2 flows under pressure through manifolds to the base of each engine cylinder. A perforated ring near the carburetor and a spray nozzle at the oil cooler allow effective blanketing of these areas. An auxiliary line leads to the tail cone section of the nacelle, where fuel booster pumps and selector valves are located in some models.

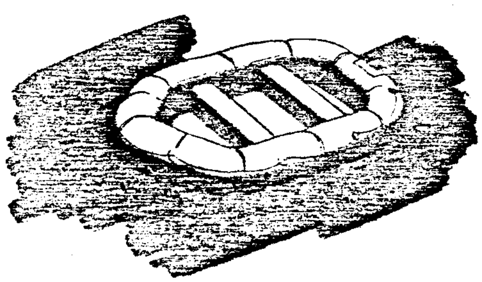
A red indicator seal on the inboard side of each nacelle blows out only when the system has been discharged by expansion of the gas. (The seal does not blow out when the system has been manually discharged.)

Hand-operated Extinguishers

Normally, there are three hand-operated fire extinguishers in the airplane: two CO_2 and one carbon tetrachloride. They are located as follows:

One in the cockpit on the liaison radio rack.
One in the cabin near the hydraulic reservoir.
One just aft of the main cargo door.

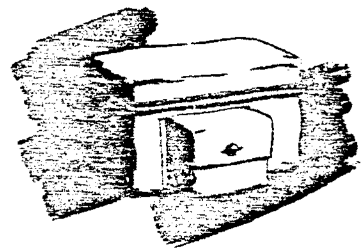
MISCELLANEOUS EMERGENCY EQUIPMENT



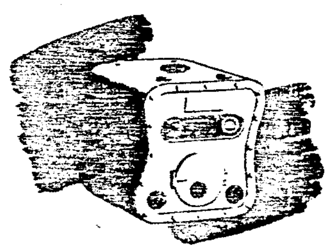
Life rafts—From one to 11 type A-3 life rafts may be installed in the airplane for over-water flights, depending on number of passengers.

The life raft for the crew is stowed at the right of the radio rack in the main cargo compartment. Other life rafts are stowed against the aft fuselage bulkhead.

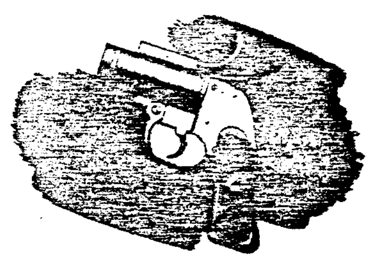
See your Personal Equipment Officer (Flight Emergency Officer) for information on the use and care of these life rafts.



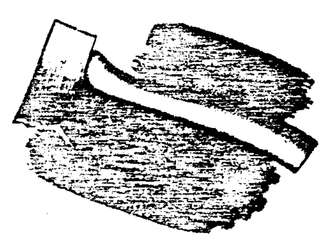
First-aid kit—A first-aid kit is stowed back of the pilot's seat. Others are in the main cargo compartment.



Emergency radio—An emergency radio, SCR 578A (Gibson Girl), is stowed on the left side of the main cargo compartment, near the cargo door.



Flares and pyrotechnic pistol—Signal flares and pyrotechnic pistol are kept on the left side of the cockpit, within reach of the pilot.



A fire ax is stowed on the left wall of the pilot's compartment.

COMMUNICATIONS EQUIPMENT

The radio equipment in the C-46 is basically the same as that in other Army aircraft. Standard installations include:

- Command set
- Liaison set
- Radio compass receiver
- Marker beacon receiver
- Interphone system
- Identification installation (IFF)
- Frequency meter
- VHF command set

Remote control boxes for the command and compass radio sets are located on the overhead panel.

Command Set

The command set is a multi-channel receiving and transmitting set. Transmission is over two pre-tuned channels, with a power output of 30 to 40 watts. Reception on one to three channels is available to the pilot or any member of the crew through the interphone circuits.

Liaison Set

The liaison transmitter in the C-46 is a medium-power 75-watt radio with an approximate range of VOICE of 250 miles. Frequency range is from 150 Kc to 12,500 Kc. The radio operator uses it to maintain contact with stations beyond range of the command set and the pilot may also use it in case of command set failure.

The liaison receiver is an 8-tube, superheterodyne receiver covering a range of frequencies of 200 Kc to [illegible] Kc and 1500 Kc to 18,000 Kc, broken down into six bands.

Compass Set

The radio compass is a 15-tube superheterodyne receiver, with certain circuits added for compass operation. The frequency range is covered by three bands, calibrated in kilocycles: No. 1 band, 200-4[illegible] Kc; No. 2 band, 41[illegible] Kc; and No. 3 band, 850-1750 Kc.

The compass set may be used for automatic bearing indication or aural null bearings.

Most C-46's have a second radio compass to facilitate multibearing fixes.

Marker Beacon Receiver

The marker beacon receiver detects the signals transmitted by fan markers and the marker beacons in cones of silence. The receiver flashes a light when you are over such a marker beacon.

Interphone System

The interphone system permits communication among crew members. It also allows crew members to receive and transmit from any interphone station.

Identification Installation

The IFF transmits identification signals according to a predetermined code. It also has an emergency switch for sending distress signals. There is a built-in detonator to destroy the set in the event of a forced landing or crash.

Frequency Meter

The radio operator uses the frequency meter to check the frequency calibration of radio transmitters and receivers. The frequency meter is accurately calibrated by means of pre-tuned crystal circuits and has self-contained batteries.

VHF Command Set

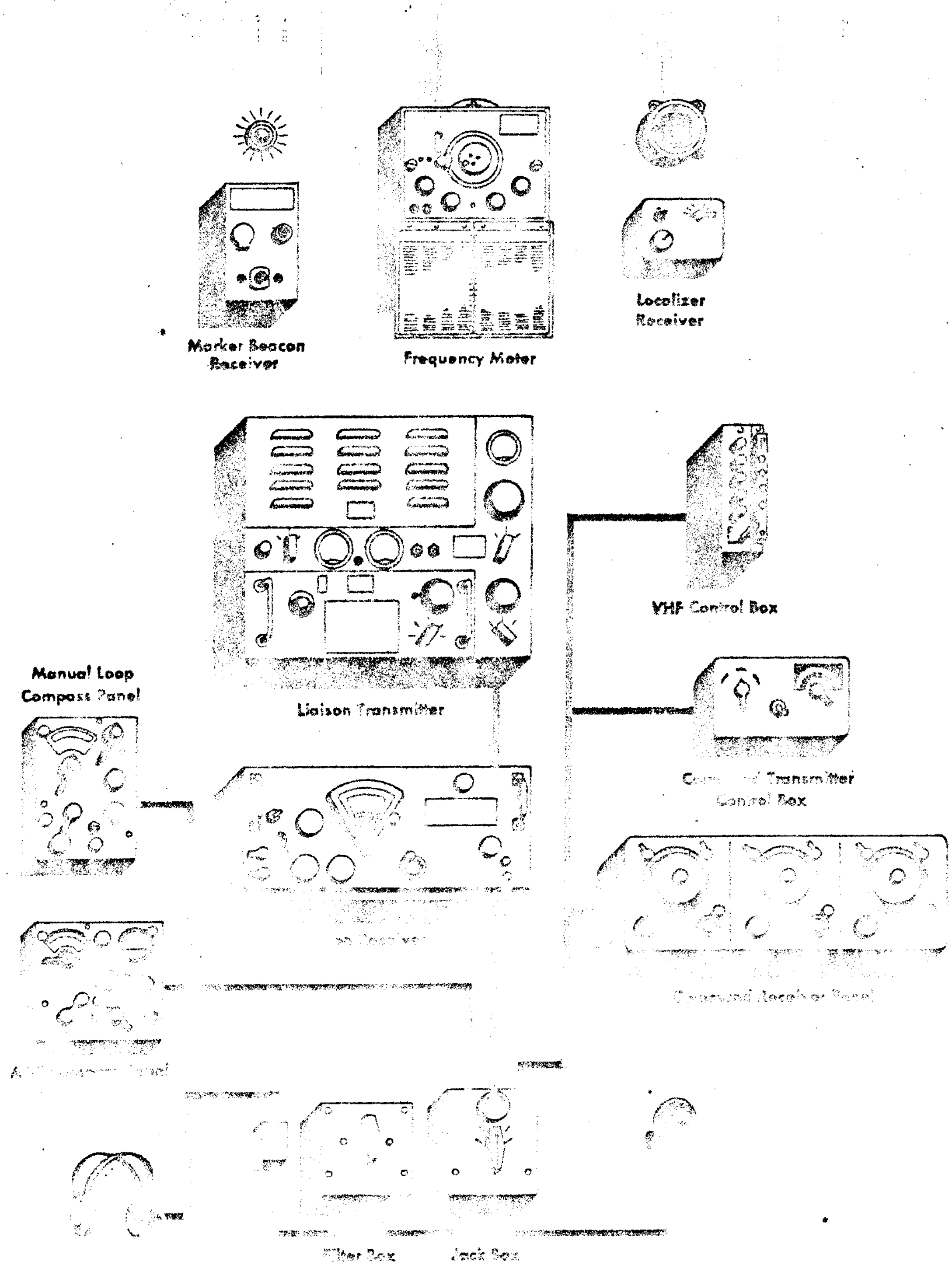
The VHF (very high frequency) transmitter-receiver radio set provides 2-way radio-telephone communication between aircraft in flight and between aircraft and ground stations. Provision is made for voice communication and continuous audio-tone modulation.

The set operates on any one of four pre-set crystal-controlled frequency channels lying within the range of [illegible] Mc. Line-of-sight communication is normally necessary for satisfactory operation of the radio set.

Portable Emergency Radio

In addition to the installed radio equipment, the airplane carries a portable emergency radio transmitter. It is principally for use in life rafts, but may be used [illegible]. Current is supplied by a hand turned generator. A kite and hydrogen balloon kit are furnished to raise the antenna. Set and accessories are packed in waterproof bags.

RADIO EQUIPMENT



OXYGEN SYSTEM

There are two types of oxygen systems installed in C-46 airplanes. Early models have the continuous flow; later models, the demand. Both are designed for a crew of four. For additional crew members or passengers, you must carry portable equipment.

Demand System

Demand system installations include eight type G-1 cylinders manifolded so that there are two cylinders for each member of a 4-man crew, supplying outlets at the following locations:

Left side of instrument panel
Right side of instrument panel
Radio operator's station
Navigator's station

Each outlet has a type A-12 regulator and a gage panel. The regulator is fully automatic, requiring no adjustment for altitude. However, it has two controls for specialized uses:

The auto-mix lever has two positions: ON and OFF (marked NORMAL OXYGEN and 100% OXYGEN on some regulators). ON is the normal position for this lever. When you move it to the OFF position the regulator furnishes 100% oxygen when you inhale, regardless of altitude.

The emergency valve enables you to get a continuous flow of 100% oxygen when you need it for an emergency.

Note: Using the emergency valve is wasteful of oxygen. Use it only in real emergencies.

The gages at each outlet are:

A flow meter, which blinks open and shut when oxygen is flowing.

A pressure gage, which shows the pressure in the system.

You must use one of the following types of oxygen masks with the demand system: A-10, A-10 Revised, A-10A, or A-14. Your mask must fit perfectly, or the system won't work properly. Have it fitted by your Personal Equipment Officer (Flight Emergency Officer).

Continuous Flow System

There are six type G-1 cylinders in continuous flow installations, manifolded together, supplying four outlets in the same locations as those in the demand system.

A type A-9A regulator is at each station. This regulator is not automatic; you must adjust it to correspond to your altitude. The lower dial on the regulator gives you the pressure in the system.

Wear a type A-8B oxygen mask with the continuous flow system.

Oxygen Duration

Oxygen duration depends on a number of variable factors. On the average, however, either system fully charged gives more than 9 hours' duration for a crew of four at 20,000 feet. Both systems have 400-425 psi of oxygen when full, and both are filled from a single valve, inside an access door on the fuselage below the left center panel.

Portable Equipment

Aircraft with the demand oxygen systems carry four of the small green type A-4 walk-around bottles. You can recharge these from the demand oxygen system.

In aircraft with the continuous flow system you usually find small high-pressure cylinders [illegible] continuous flow regulators. This type of assembly is [illegible] for the use of passengers.

[illegible] **Personal Equipment Officer** [illegible] Emergency Officer) and [illegible] for instruction [illegible] using oxygen properly. You [illegible] oxygen [illegible] operational flights.

Weight and Balance ★ Op[illegible]

WEIGHT AND BALANCE

Weight and balance control of your airplane is the distribution of the load—gasoline, oil, cargo, crew, and passengers—in such a manner that the center of gravity (CG) remains within certain predetermined limits.

Weight and balance control of your airplane is your responsibility. At most stations the Weight and Balance Officer supervises the loading of your plane. You still must check it. If you are not satisfied with the loading, it is your privilege to have the loading changed or refuse to fly the ship.

Many times you take on cargo when there is no Weight and Balance Officer present. Then you have to understand weight and balance thoroughly to load the plane properly.

Effects of Improper Loading

Improper loading affects every phase of flight. Overloading or a nose-heavy or tail-heavy condition cuts down maneuverability and airplane efficiency from the standpoint of rate of climb, ceiling, range, and speed.

If the airplane is badly overloaded or critically out of balance, you may not be able to get it off the ground, or it may stall out on you unexpectedly on takeoff or landing.

Principles of Balance

If you were to suspend your empty airplane so that it hung perfectly level, the point of suspension would be the CG. There are definite limits fore and aft of this basic CG within which the CG of the loaded ship must fall if the airplane is to fly safely.

In loading the plane, you take into consideration both the weight of the cargo and its distance from the CG. Heavy loads near the CG can be balanced by much lighter loads at the nose or tail of the airplane.

Weight and Balance Forms

There are several standard AAF forms which apply to weight and balance. Copies of each and full instructions for their use appear in T. O. AN 01-[illegible]-40. Spend a few minutes reading this T. O. for a worthwhile introduction to the problems of weight and balance.

The form in which you are particularly interested is Form F—the weight and balance clearance. Form F is the summary of the actual disposition of load in the airplane and records the balance status step by step. It is your responsibility to see that this form is properly completed. You must submit it for approval with your aircraft clearance form.

Load Adjuster

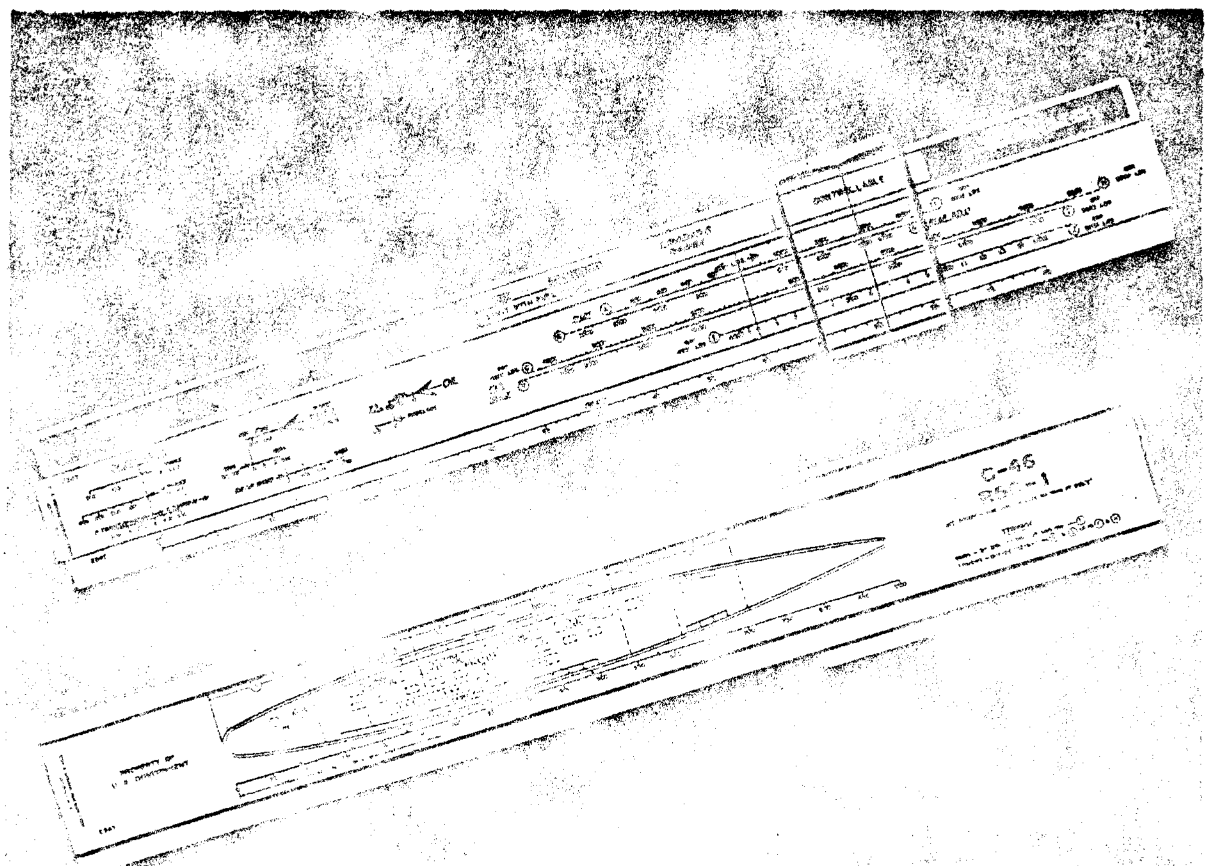
There is a load adjuster in the pilot's compartment of every C-46. Its purpose is to give you a quick and accurate method of checking your load to make sure it is properly balanced.

The case of the load adjuster bears the airplane serial number, its basic weight, and the airplane index number, which gives you the location of the CG of that particular airplane empty. Check the serial number on the case with that of the airplane to be sure that the index is the proper one to use.

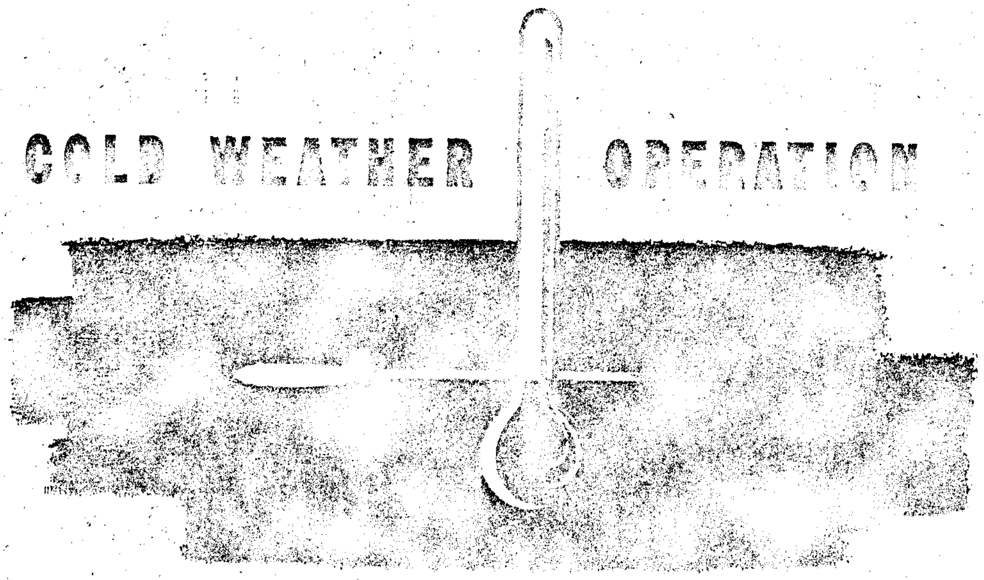
T. O. AN 01-1B-40 gives complete instructions for the use of the load adjuster. Study these directions, then practice using the load adjuster by working out sample problems. Remember to use the index number shown on the practice form and not the one on your load adjuster case.

Shifting Cargo in Flight

It is sometimes necessary to shift cargo in flight to maintain proper balance. Don't hesitate to change cargo around to reduce excessive elevator trim made necessary by consumption of fuel or other expended load.



COLD WEATHER OPERATION



There are two kinds of cold weather conditions under which you may have to operate C-46's: normal winter flying, with temperatures seldom below 0°F, and arctic type operation.

The instructions in this manual apply to normal winter operation. If you are flying in arctic type regions, study T. O. 01-25LA-15, the "Handbook of Cold Weather Operation for C-46 Series Airplanes," for complete information on the care of the airplane.

Preheating

In extremely cold weather you may have to preheat the engines and other parts of the airplane for easier starting and proper operation.

To preheat the engines, use ground heaters connected to the air ducts on the engine nacelle covers. Use for two hours, or until cylinder-head temperatures reach 20°C. To preheat the cockpit, connect the ground heater to the air duct on the nose of the airplane.

If oil in the tanks is congealed, use an electric oil immersion heater in each tank to warm it up.

Turn on the control booster heater as soon as you enter the cockpit to warm up the booster cylinders for easy operation of the controls during takeoff. The control booster heater circuit breaker is on the overhead panel.

Warning: Use an external source of electric power—a battery cart or the putt-putt—for all ground maintenance and preflight running of the engines. Do not use the airplane's batteries. Cold weather places extra heavy loads on the electrical system.

Preflight Inspections

In addition to your normal inspections of the airplane, see that the following preflight checks are made in cold weather:

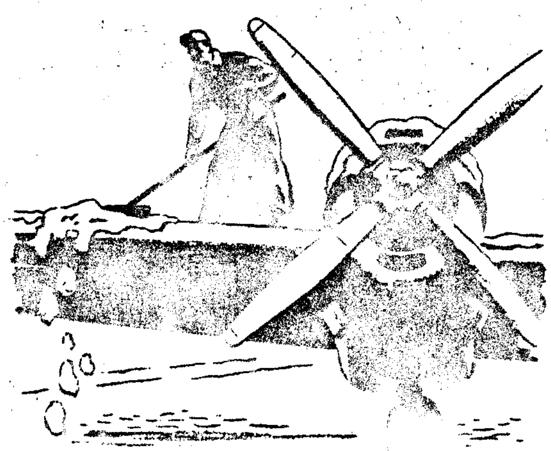
Oleo Struts—Clean all snow, ice, and dirt from oleo struts to prevent cutting the packing, which loses much of its resiliency in cold weather. Use a rag soaked in hydraulic fluid.

Surfaces—Remove all covers from surfaces. If any ice or frost has formed, clean it off. No matter how small the amount, it seriously affects airplane performance. Use light brushes or small wooden slats to brush off ice; never a knife or ax. Use a broom or rope passed back and forth across the surface to take off snow. A solution of anti-icing fluid with water can be used to wash ice from the wings when other means of removal are ineffective. Never take off with frost or ice on wings or tail.

Propellers—Remove ice and frost from propellers and move them by hand to check for freedom of movement. They should move as freely as in normal temperatures after preheating the engines.

Tires—Check all tires for normal pressure since extreme temperature changes cause pressure variation. Also make sure that tires are not frozen to the ground, and if necessary break them loose before starting engines.

Oil System—Open the oil Y drain and check for free oil flow. Open oil tank sump drain and check for ice. If no flow occurs, apply heat. Check oil radiator core for ice accumulation. Make sure that the plywood discs are installed on the cooler to restrict the air flow.



Fuel System—Check the fuel tank sumps and strainers to remove water and insure free flow. Icing can cause fuel system failure.

Antenna—Clean ice, snow, and moisture off antenna.

Latches—Check and free all safety latches and emergency exits.

Starting Engines and Warm-up

You must use extra care in starting engines in cold weather. Pull the props through by hand at least 16 blades. If the props are extremely hard to pull, use ground heat on the engines.

Priming:

1. Operate priming switch [illegible] a maximum of 2 seconds while energizing the starter. This fills the priming lines with fuel but does not inject any into the cylinders.
2. When engaging, after the engine starts turning over, prime as needed. First operation of the switch injects the fuel.
3. **Never prime until engine is turning.** In cold weather, fuel does not vaporize readily and may run into the lower cylinders, causing a hydraulic effect which bends connecting rods.

Energize the starter for at least 15 seconds. Additional time is required for lower temperatures.

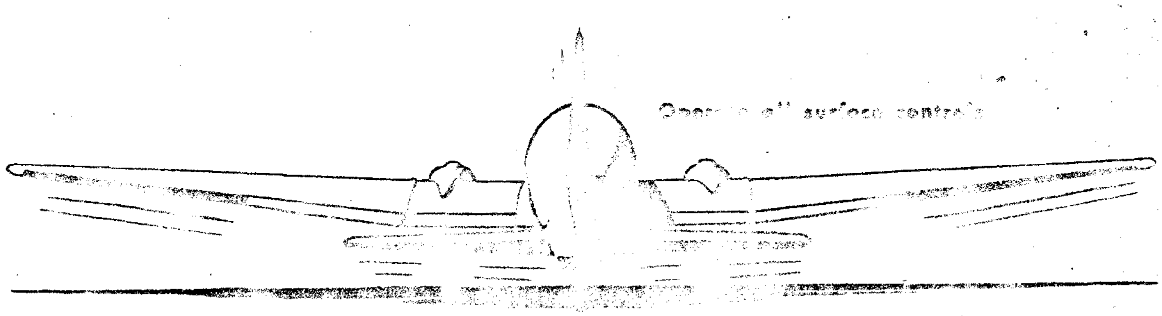
When the engine starts, oil pressure may reach 300 psi. This is normal. Oil pressure returns to 60 to 80 psi when the oil inlet temperature rises to 40°C. If no oil pressure is indicated within 30 seconds after starting, shut off and check for broken lines and for congealed oil or ice in the Y drain or in the oil tank sump drain.

Keep cowl flaps open for all ground operation, regardless of outside air temperature.

During Warm-up

Apply carburetor heat to facilitate warm-up. Heating the fuel vaporizes it more readily.

Operate all engine and surface controls to check freedom of movement.



Open autopilot bypass valve to circulate oil and prevent sluggish operation.

Note hydraulic pressure when operating hydraulic units. If pressure drops intermittently, the accumulator diaphragm may be broken.

Electrical system short circuits indicate possible condensation between contacts.

Flight Instructions

If snow is too heavy for a good takeoff run, move slowly up and down the runway to pack down the snow before takeoff.

Keep cowl flaps open at least 1/4 during takeoff, regardless of temperature. There is no possibility of the engine cooling excessively during takeoff and climb.

When icing conditions exist, use carburetor heat immediately before takeoff to remove ice from the induction system. Return control to COLD and turn on the alcohol anti-icer switch on the overhead panel. This prevents ice from forming.

Do not use carburetor heat during takeoff unless it is necessary for vaporizing fuel at very low temperatures.

After takeoff from a snowy or slush-covered field, operate gear and flaps several times to prevent freezing in the up position. Operate the throttles and other engine controls periodically to keep them from freezing.

Although instruments tend to become sluggish at low temperatures, most of them work satisfactorily down to —35°C. Check them by cross-reference to other flight and engine instruments, especially when cockpit temperatures go below freezing.

If the engines run roughly with mixture control in AUTO LEAN, incomplete vaporization is indicated. Maintain carburetor air temperature just below 0°C by applying heat.

Maintain comfortable cabin and cockpit temperature; 10°C (50°F) is recommended.

Plan your landing to use the full length of the runway, because brake action may be slower than normal. Try to use no brakes at all on slippery runways, as skids at low speed are almost impossible to control. Use throttle and rudder only.

Post-flight Instructions

Use brakes as little as possible and use chocks instead of putting parking brakes on.

Shift to HIGH blower to clean sludge out of the clutches. Then return to LOW.

Dilute the oil in the engines before stopping if you anticipate temperatures of +4°C or less for starting. Engine oil temperatures must be below 50°C for effective dilution. If too high: stop the engine, allow to cool, and then re-start. Do not allow oil pressure to drop below 15 psi.

Idle engines at 1000 to 1200 rpm.

Press dilution switches and hold for 3 minutes for anticipated temperatures down to —12°C. Lower temperatures require longer dilution periods.

Hold dilution switches on until engine stops turning.

If necessary to service the oil tank, accomplish part of the dilution before servicing and the remainder afterward.

On aircraft using hydromatic propellers, depress feathering button for a maximum drop of 400 rpm and then pull it out. Repeat three times. This provides diluted oil in the feathering lines.

After engines are stopped, leave cowl flaps fully open to circulate air and prevent burning of insulation.

Service fuel tanks fully right after each flight to minimize condensation.

Clean Off Airplane:

Wipe the oleo struts clean.

Remove oil from de-icer boots with soap and water, or with a cloth soaked in gasoline. Do not scrub, just wipe.

Wash prop blades, hubs, and any other parts of the airplane which are coated with anti-icer fluid.

After engines cool, drain fuel and oil sumps and strainers to remove any water accumulation.