

# GETTING TO KNOW YOUR DC-3

YOUR COMPLETE  
GUIDE TO FLYING  
THE DOUGLAS DC-3

Microsoft **Flight  
Simulator**



This manual is based on and written in the same style of the original document issued to wartime pilots of the C-47. As the DC-3 was the original design, the C-47 being the military designation, a great deal of the content applies to both aircraft.

## KNOW THE DC-3

Your training covers normal flight procedures plus emergency procedures to get you safely through the tight spots that come to most pilots at one time or another.

The DC-3 has no bugs. It has been around a long time doing a magnificent job. The only troubles you will have are those you bring on yourself. Know your aircraft.

When you check it before flight, know enough about it to spot trouble. Maintenance personnel are human too - they make mistakes. Your job is to check their work before you fly.

Know your procedures. Confusion in the cockpit causes far too many accidents. Practice emergency procedures until they are as familiar as normal operational procedures.

This simulation has been developed with realism in mind. Therefore, just like the real thing it is VITAL that you read this instruction manual thoroughly to understand the correct procedures for starting and running the engines, the various systems such as hydraulics and electrical and general flying properties of your aircraft.

### Autostart and Auto shutdown.

Due to how the simulator implements Auto-start and Auto-shutdown, there are a few

minor glitches that will happen if you decide to use an auto start/shutdown method and then decide to manually start/shutdown later.

The 2 options are to reset/reload the flight after an auto start/shutdown or read the following guide.

#### Auto Start :

If you start the engines using autostart (Cntrl/E) the following items will need to then be set manually if you later want to start/stop the engines manually.

1. Magneto switches should be set to Both.
2. Mixture levers set to auto-rich
3. Fuel tank levers will be using ALL if you use Ctrl+E. Set to any tank that actually has fuel.

#### Auto shutdown :

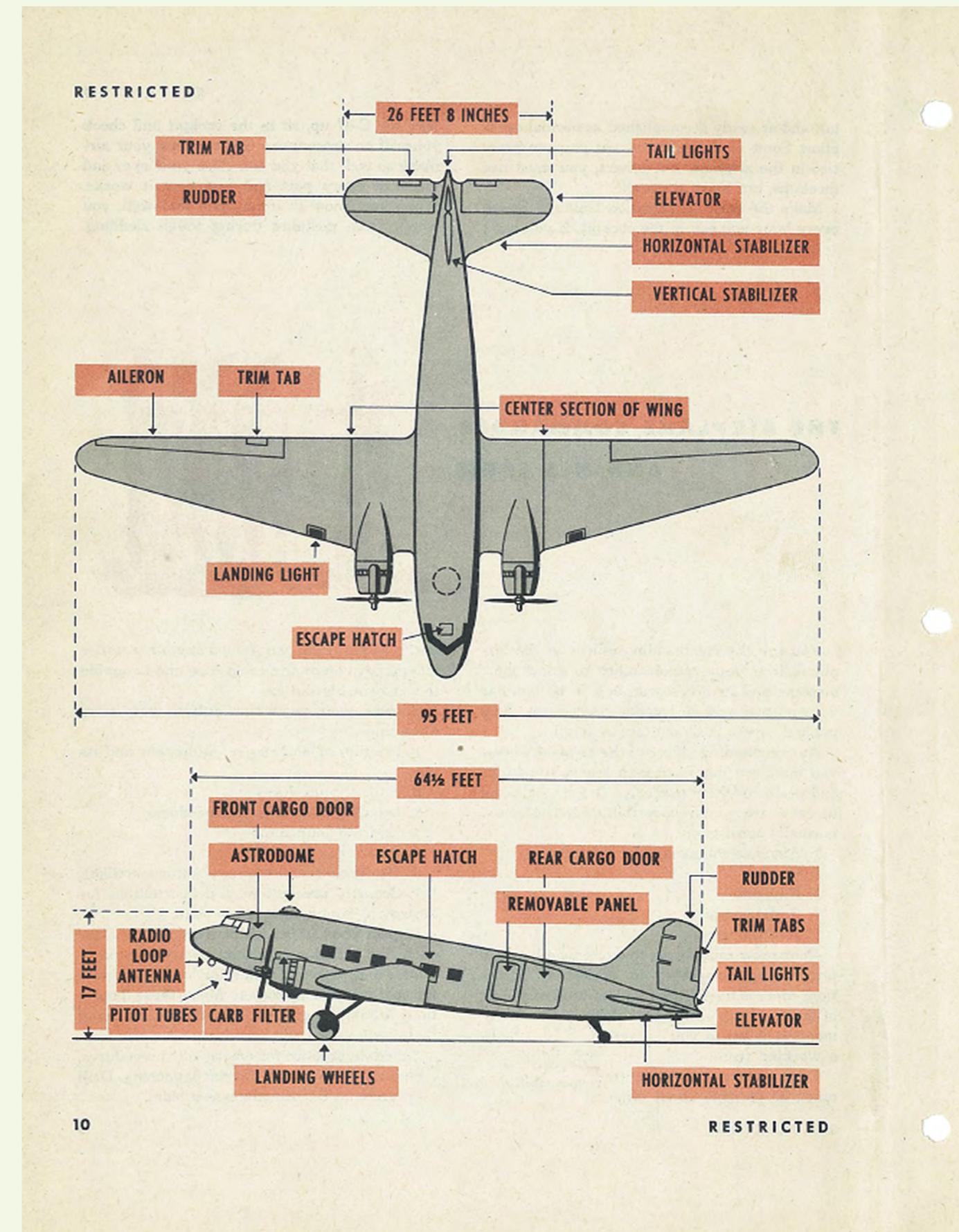
If you have started the engines manually but use auto shutdown (usually Cntrl/Shift/F1) you will need to reset the following items:

1. The magneto switches. They will indicate on but they aren't actually on. Either set to off or to the position ready for a manual start.
2. The mixture levers. They will be locked in the position that you had left them in. They will actually be off. Either set to off or to the position ready for a manual start.
3. Fuel tank selectors. They will be indicating the position that you had left them in. They will actually be off. Either set to off or the position ready for a manual start.

## IMPORTANT!

If starting manually remember that the Energise and Mesh switches return to their OFF position AUTOMATICALLY once and engine has started.

## GENERAL LAYOUT AND FEATURES OF THE DC-3/C-47



# FLYING THE DC-3

The DC-3 is a 2 engine, all-metal, low-wing monoplane.

The airplane has two 1200HP Pratt & Whitney, 14-cylinder, R-1830-90, Twin-Wasp engines with Hamilton Standard hydromatic fully feathering 3-bladed propellers. SOME aircraft are designed for higher altitude flying and have 2-speed internal "blowers" fitted.

The hydraulic landing gear is of the conventional type. Main wheels retract vertically into the engine nacelles and extend approximately 11 inches out of the nacelles when fully retracted.

In this position they are free to rotate and are subject to normal brake action. In the event of a wheels-up emergency landing, the aircraft can still roll and steer (depending on forward speed) with minimal damage. Once stationary, however, engines cannot be used to taxi or manoeuvre. The tailwheel is non-retractable and is of the castoring type.

## DIMENSIONS

WingSpan.....	95 feet
Length.....	64 feet 5 1/2 inches
Height (at rest).....	17 feet

## WEIGHT

Empty:	
C-47.....	17,037 lbs
C-47A.....	17,237 lbs

## Basic:

C-47.....	17,400lbs
C-47A.....	17,700 lbs

Recommended takeoff, maximum gross...	29,300lbs
Restricted takeoff,maximum gross.....	31,000lbs
Recommended landing, maximum gross...	26,000 lbs

Various combinations of doors and hatches are fitted, depending on the variant. The most common variant seen today is the passenger cargo version with large cargo doors fitted to port in the rear of the fuselage.

There are six emergency exits, four at the windows over the main wings, an escape hatch in the cockpit roof and a removable door in the centre of the forward cargo door (when fitted).

The airplane has two main sections.

In the forward section is the pilots' compartment, radio operator's and navigator's compartments and cargo space and radio racks behind the co-pilot's bulkhead.

The rear section consists of a main cabin which is divided into stations for cargo loading. At times, long-distance fuel tanks can be fitted to the cabin area for long-range missions. We do NOT include these tanks in this simulation, however.

The various configurations of the airframe point to the versatility of the DC-3 design. Something which has rarely been matched in over 70 years!

## Other figures of interest:

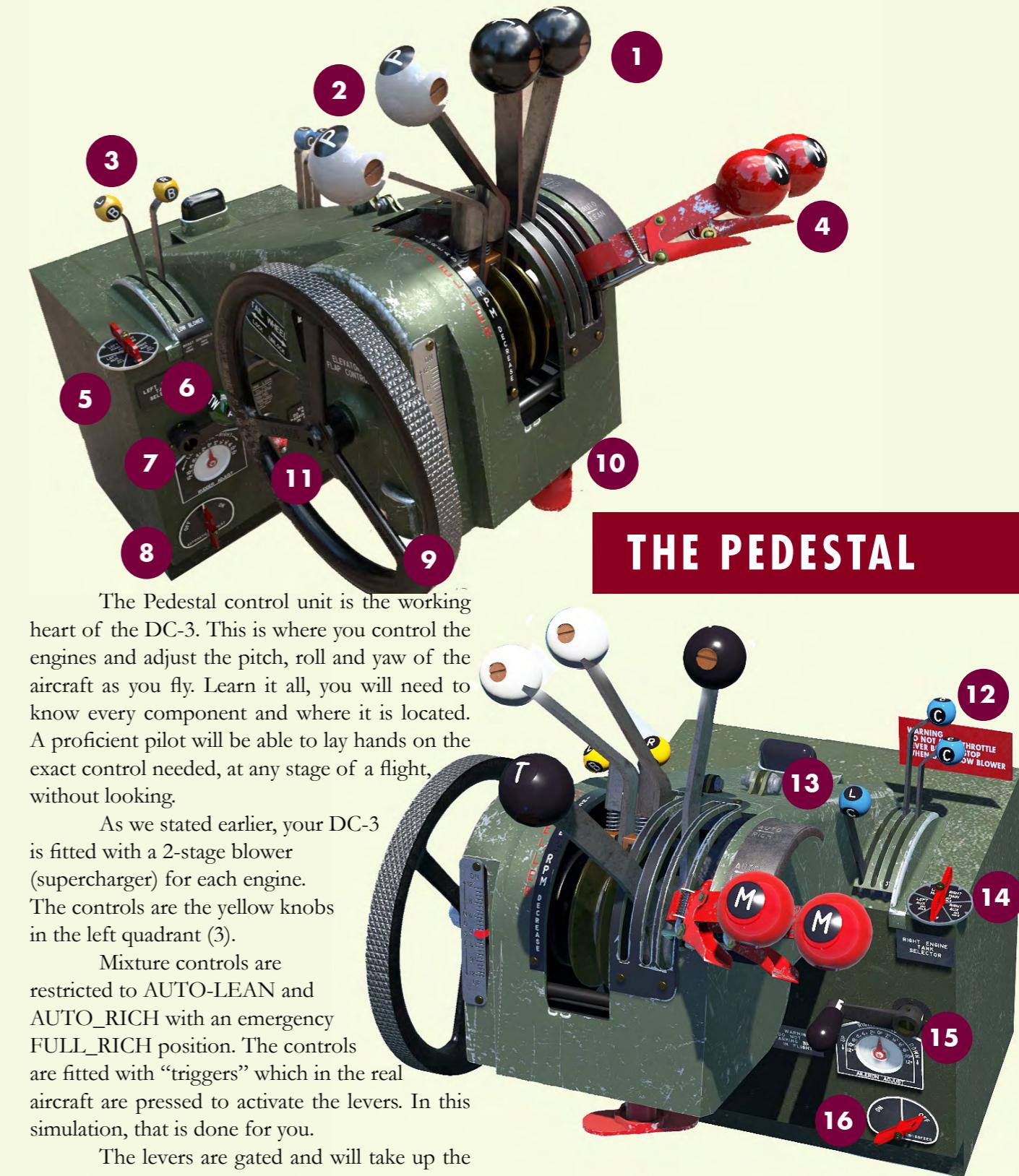
Cruising Speed at 10,000 feet.....	
.....approximately 185 mph TAS	
Stalling Speed.....	67mph TAS
Service Ceiling.....	24,100 feet
Wingloading.....	25.3lbs per sq foot
Power Loading.....	12lbs per HP
Seating capacity.....	28 passengers

Over the following pages, we explore the engineering and technology employed in an operational DC-3. This will serve as a cockpit guide and useful reference for all pilots.

## NOTE:

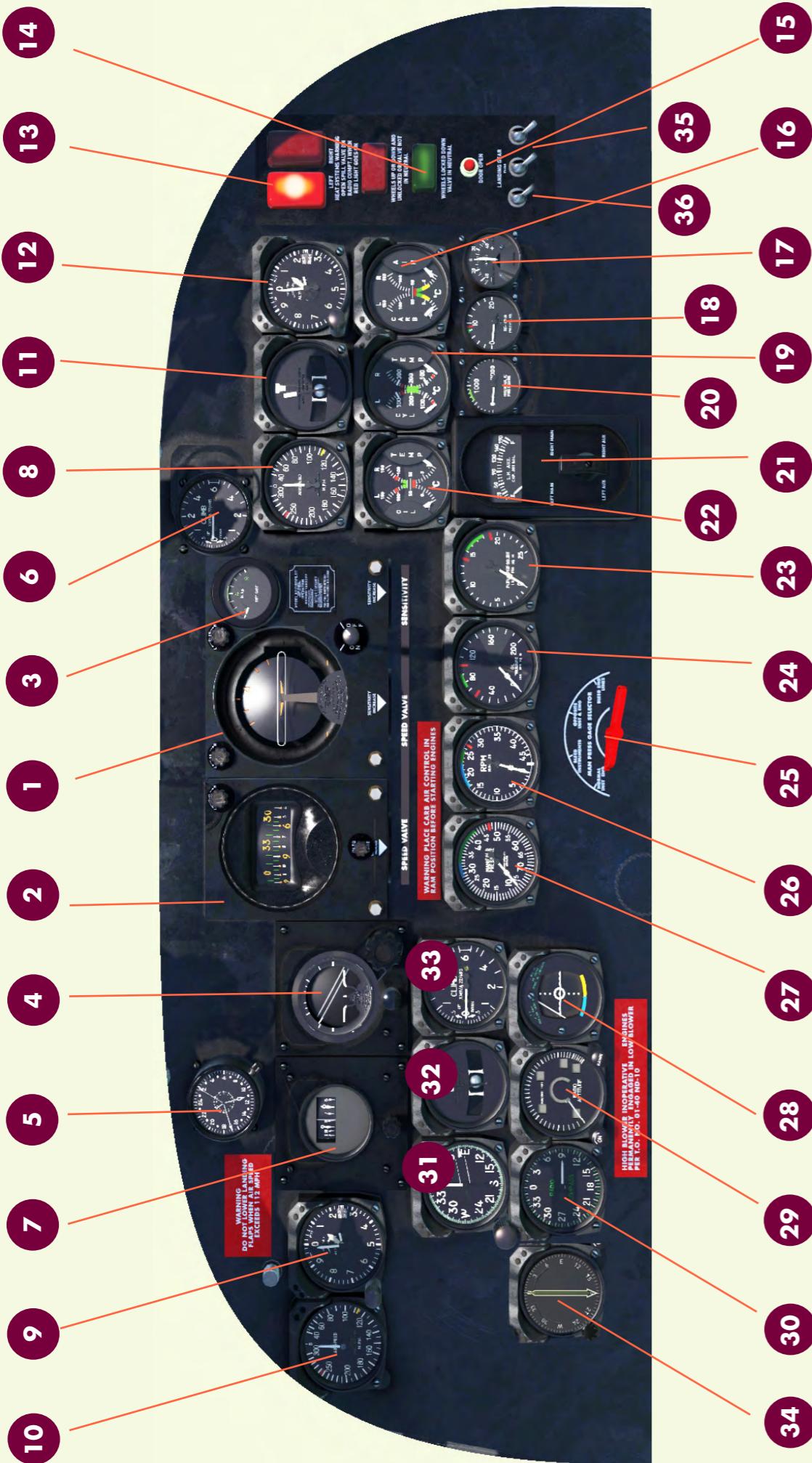
This simulation gives you the choice of aircraft fitted EITHER with a "standard" Gyro-Pilot, otherwise known as the "Sperry" OR with a modern GNS suite of GPS and a modern Auto-pilot.

You can select to fly either of these options when you choose your aircraft from the Liveries section of the Hangar.



## CONTROL PEDESTAL

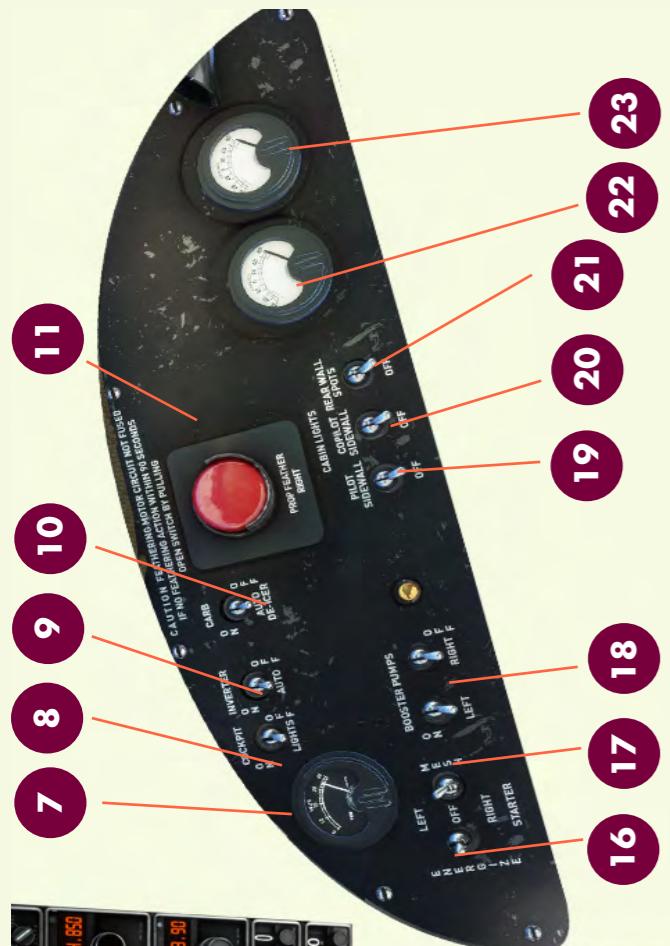
1. Throttles
2. Propeller controls
3. 2-stage blower controls
4. Mixture controls
5. Left engine tank selector
6. Tailwheel lock
7. Rudder Trimtab control
8. GyroPilot master valve
9. Elevator trim adjuster
10. Throttle lever friction control
11. Parking Brake (Pull on)
12. Carburettor Heat controls
13. Carburettor heat control lock
14. Right engine tank selector
15. Aileron trim control
16. Fuel tank cross-feed control



### MAIN INSTRUMENT PANEL

1. Sperry GyroPilot Pitch and Bank
2. Sperry GyroPilot Gyros
3. Sperry GyroPilot suction
4. Artificial Horizon Gauge
5. Chronometer (24hr)
6. CoPilot's VSI
7. Main Gyro Compass
8. CoPilot Airspeed Indicator
9. Altimeter
10. Pilot Airspeed Indicator
11. CoPilot's Turn&Slip Gauge
12. CoPilot's Altimeter
13. Heater Warning lights
14. Landing Gear Warning light
15. Exit Open Warning light
16. Carburetor Temp Gauge
17. Outside Air Temp Gauge
18. De-ice pressure
19. Cylinder Temp Gauges
20. Hydraulic Pressure Gauge
21. Four-way Fuel tank gauge selector
22. Oil Temp Gauges
23. Fuel Pressure dual gauge
24. Oil Pressure dual gauge
25. Manifold Pressure gauge selector
26. Tachometer dual gauge
27. Manifold Pressure dual gauge
28. GlideSlope Indicator
29. Radio Altimeter
30. Radio Compass
31. Magnetic Compass
32. Pilot's Turn&Slip gauge
33. Pilot's VSI
34. ADF/VOR
35. Door switches
36. Secure aircraft switch

**PLEASE NOTE: FOR A BETTER VIEW OF THE PANEL AND  
WHILST FLYING, YOU CAN TOGGLE THE CONTROL COLUMN  
AND YOKE OFF BY CLICKING ANYWHERE ON THE PEDESTAL.  
CLICKING AGAIN WILL RESTORE THE COLUMN AND YOKE.**



1. Quick Start Switch
2. Ground Power Switch
3. Compass light switch
4. Left Propeller Feathering switch
5. Panel Lights switch
6. Propeller De-Icing switch
7. Cockpit lights switch
8. Inverters switch
9. Carburettor De-icing switch
10. Right Propeller Feathering switch
11. Formation Lights switch
12. ADF
13. Ignition Switches
14. Altitude Limit Control
15. Gyro Compass
16. Engine Starters
17. Engine Mesh Switches

## DC-3

18. Boost Pump switches
19. Pilot Sidewall Light Switch
20. CoPilot Sidewall Light Switch
21. Rear Wall Red Spotlights Switch
22. Left engine Ammeter
23. Right engine Ammeter
24. Engine Primer switches
25. Pilot Heater switches
26. Windshield Dicing Pump switch
27. Tail Lights Switch
28. Wing Lights (Navigation) Switch
29. Right Landing Light switch
30. Left Landing Light switch
31. Passing Light switch
32. Master Battery switch
33. Cold-Dark-Start Switch



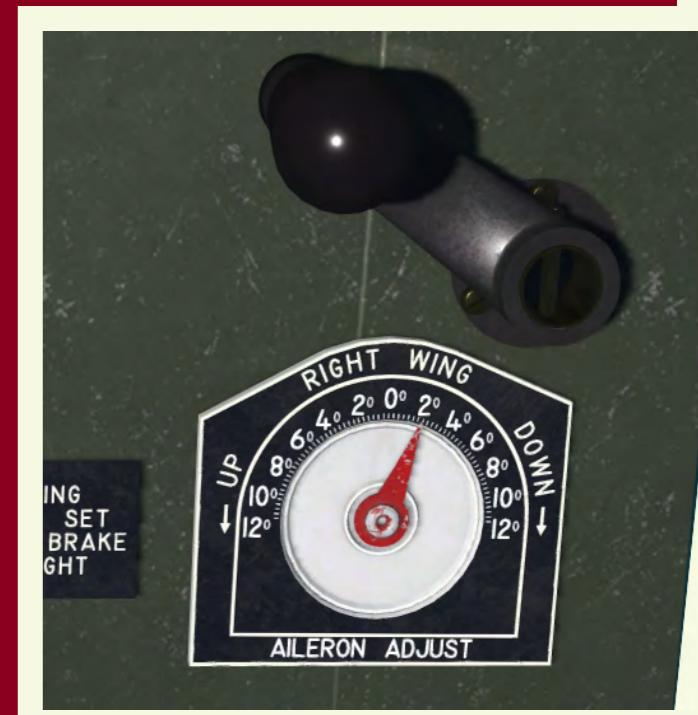
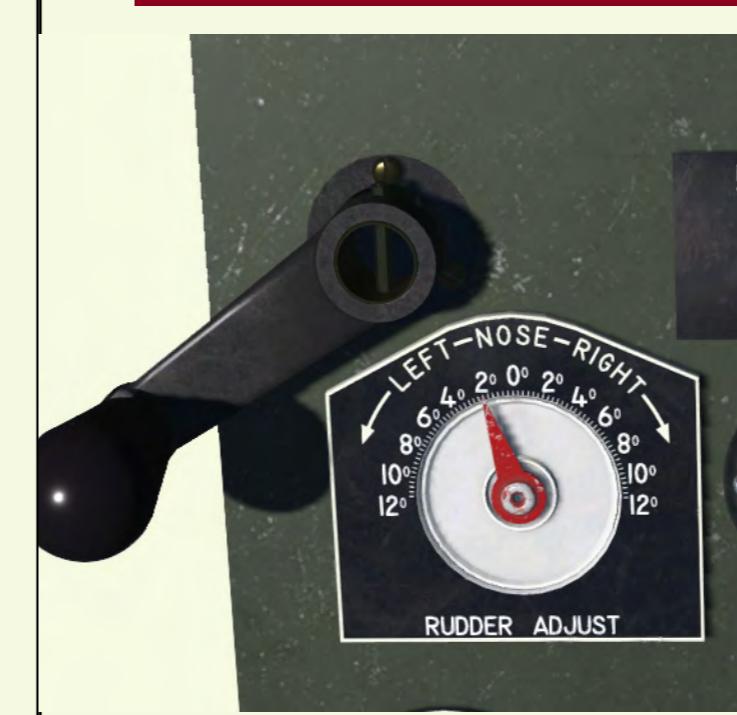
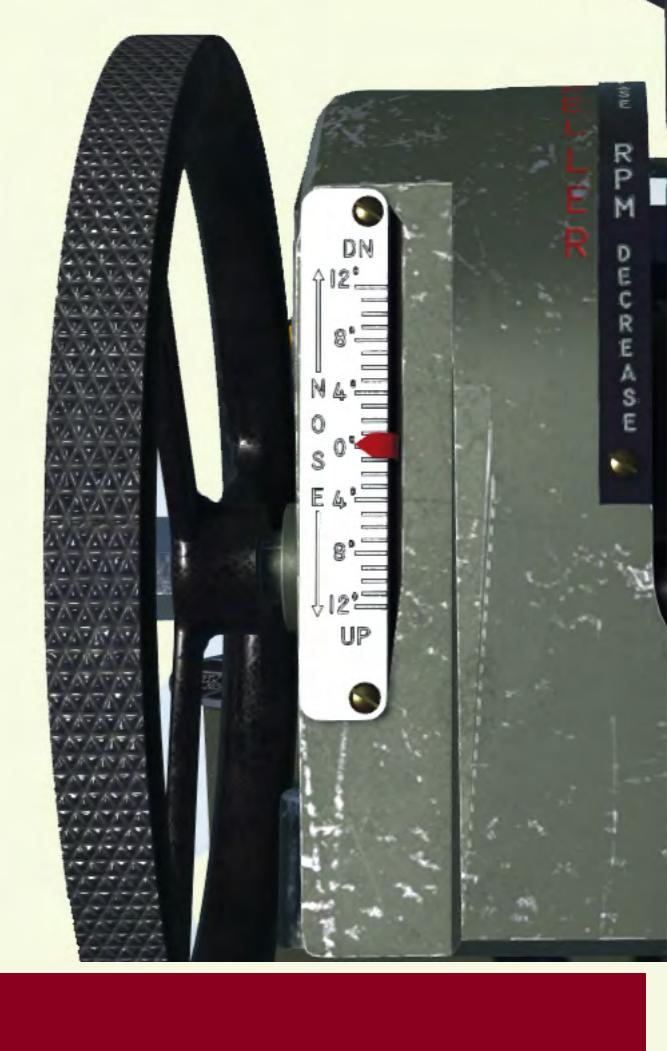
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## SURFACE CONTROL SYSTEM

This system consists of elevators, ailerons and rudder, which are made of metal frames covered with fabric. There are all-metal trim tabs on the elevators, the right aileron and on the rudder.

Operate trim tabs for the elevators by means of a wheel on the left side of the pedestal.

Operate trim tabs for the ailerons and rudder by means of hand cranks on the lower part of the pedestal. Scales indicate amount of deflection on each tab.



## HYDRAULIC SYSTEM

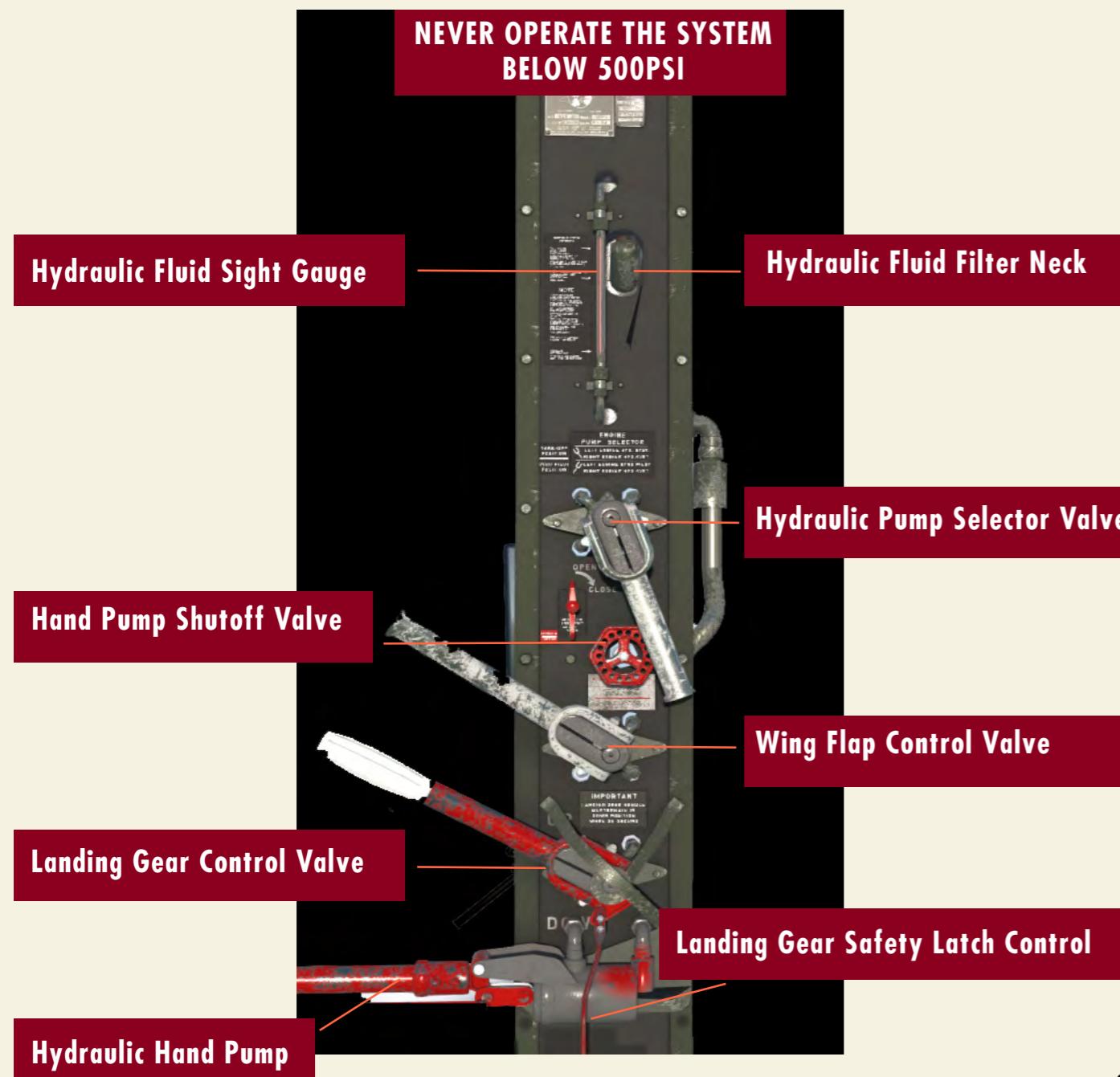
The DC-3 has a pressure accumulator type hydraulic system. It operates normally, between 675 and 925 psi.

The Hydraulic system operates the landing gear, wing flaps, cowl flaps, windshield wipers, automatic pilot and brakes on all series of the airplane. It operates the non-ram carburettor air-filter mechanism when installed and the blower controls when superchargers are installed.

The control panel is in the center aisle, behind the copilot's seat. The Hydraulic Gauges are at the right of the copilot's seat, housed in their own panel box.

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

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



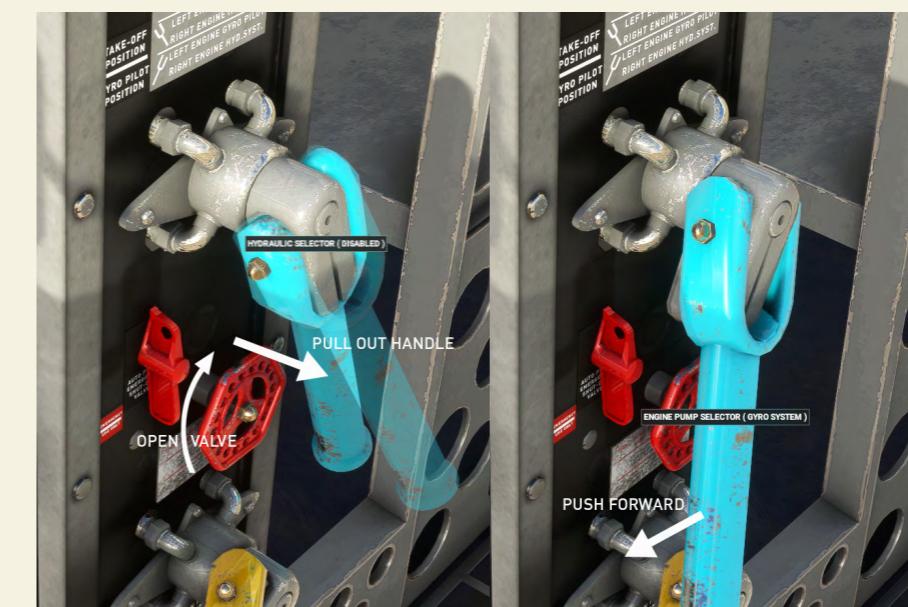
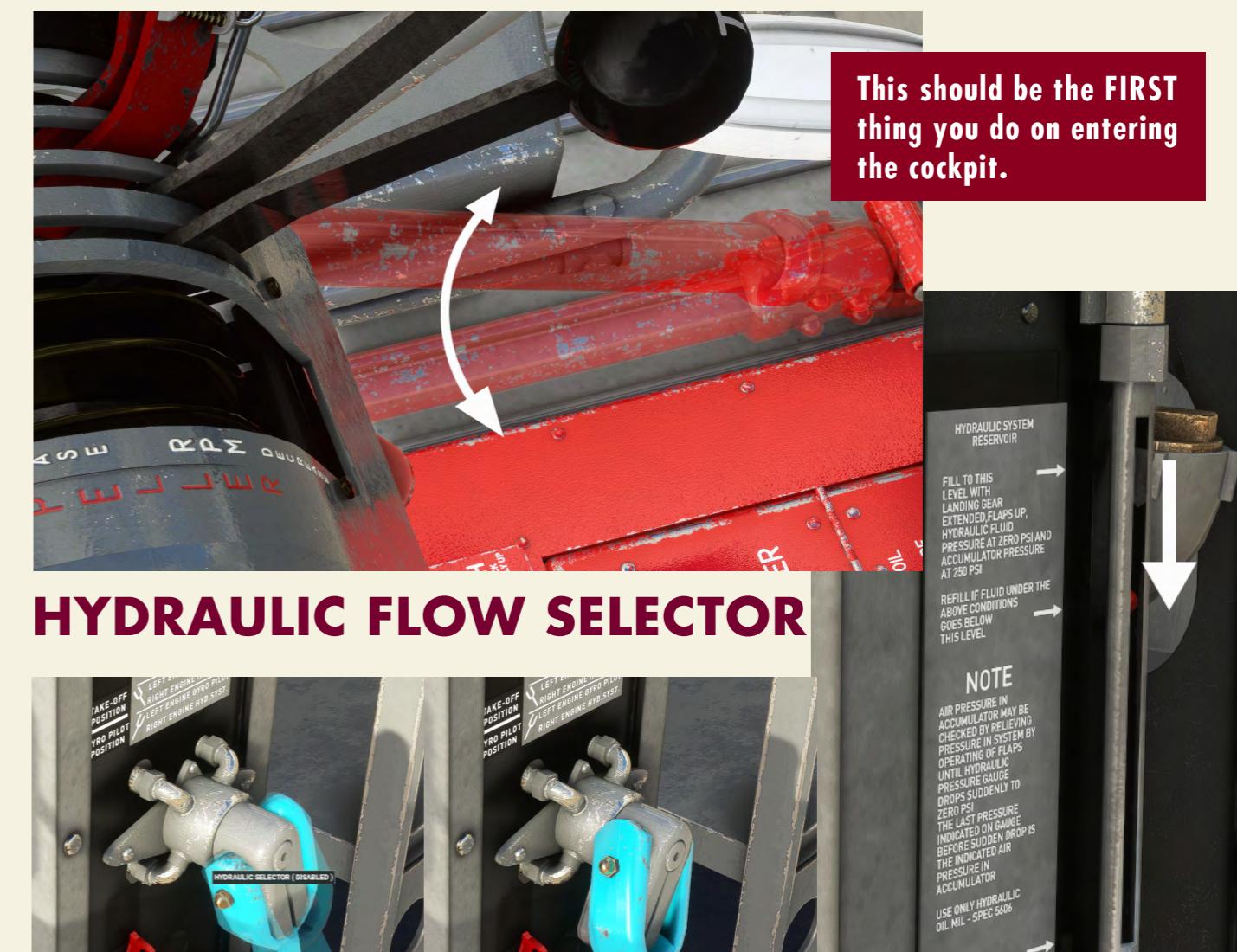
## MANUAL HYDRAULIC SYSTEM

In the event of a total engine failure with resultant loss of hydraulics or for ground operation without engines, The DC-3 has a MANUAL hydraulic pressure pump. This pump will charge the pressure accumulator with sufficient hydraulic pressure to operate flaps, brakes and cowl flaps, along with other hydraulically driven components (such as the Sperry Gyro Pilot) whilst on the ground, with no engine power.

The hydraulic hand pump is situated between the pilots' seats. A valve on the hydraulic control panel controls flow of pressure from the pump to the accumulator.

To operate the system, first open the red wheel hydraulic pressure valve on the pump wall. Now pump the handle up and down 6 times. As you do so you will see the pressure rise in the right hand large pressure dial on the co-pilot wall. Also, you will see the red marker fall in the sight glass to the lower position, indicating that fluid has flowed from the tank to the accumulator.

You can now operate some of the aircraft systems like flaps and cowl flap controls. This is often necessary when the aircraft is being serviced or of course, in emergencies where a loss of hydraulic pressure is suffered.



The Hydraulic Flow selector lever allows you to select between two settings. Pull the handle outward and swing backward for TAKEOFF, LANDING and GROUND. Swing the lever forward to supply pressure to the Sperry Gyropilot in addition to all the conventional systems.

## LANDING GEAR

Three controls govern the operation of the DC-3 landing gear. A lever on the main hydraulic control panel raises and lowers the two main wheels. A tailwheel lock on the pedestal centers and locks the tailwheel. The tailwheel does not retract but swivels through 360 degrees when not locked. The third control, a safety latch, on the floor by the pilot's seat, controls movement of the safety latch and the landing gear lever.

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

To operate the latch, a locking tab must first be moved from the nose of the lever.

**Full up (unlocked)** - In this position the latch is unlocked and the gear lever is free to move. With the gear UP, pull the gear lever out toward the center aisle. Now you can push the lever DOWN to lower the gear. Lock the lever and latch the gear using the latch control.

When on the ground **ALWAYS** leave the gear lever in this DOWN position.

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

Keep the gear and flap levers in NEUTRAL for normal operation. This traps fluid in the line and holds the gear and flaps in the desired positions.

**If the throttles are closed and the landing gear is UP, a warning horn will sound. This can be cancelled by pushing the warning horn switch (18) on the right "eyebrow" panel.**

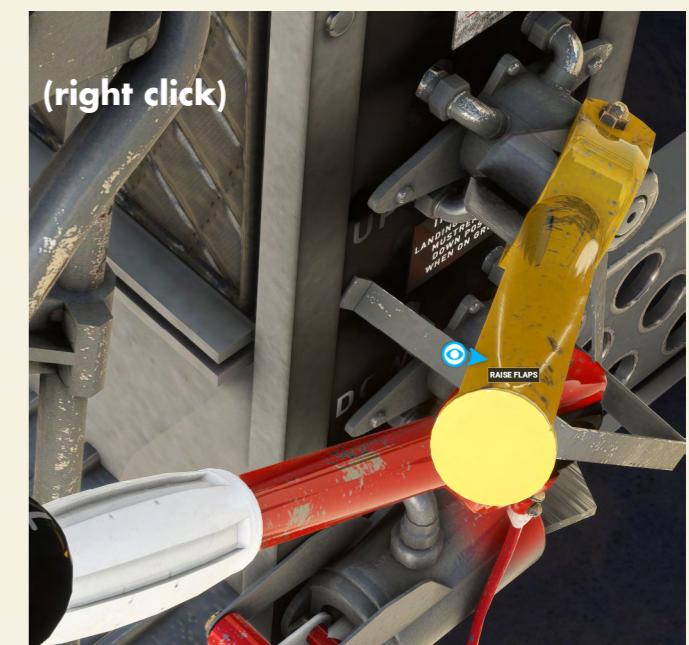
**Warning lights:** There are green and red warning lights at the right hand corner of the instrument panel. The green light burns when the gear is down and the red when the gear is up.



## WING FLAPS

Your DC-3 has all-metal wing flaps. A valve lever just above the landing gear lever operates these flaps. To raise or lower the flaps, first clear the slot that holds it in neutral by swinging the lever out toward the center aisle.

Move the lever DOWN to lower the flaps or UP to raise them. When the flaps are in the desired position, return the lever to the stowed position (DISABLED) and the flaps will remain at the set position. There is a flap position indicator to the left of the main instrument panel.



## BRAKES

Conventional toe-operated brake pedals on the rudder controls give independent braking on each wheel. (Differential Braking)

Since the wheels do not retract fully into the nacelles, you have braking action on the wheel even when retracted. Thus, when the DC-3 should make a belly-landing, it can still be steered by the brakes just as if the gear were extended.

A parking brake control is fitted to the lower section of the pedestal.

To apply parking brakes, pull the red knob fully out. DO NOT APPLY THE PARKING BRAKE WHEN ALOFT.



## AUTOMATIC PILOT

The automatic pilot control box consists of a directional gyro, ball bank indicator, bank and climb gyro, horizon bar and a suction gauge.

It is on a panel in the center of the main instrument panel.

The automatic pilot keeps your airplane in straight and level flight by mechanical control of the rudder, ailerons and elevator. Its use is fully described in the section "CRUISE" later in this manual.

## SUPERCHARGERS

Early series of the DC-3 have integral single-speed blowers with an impeller ratio of 7.15 to 1. For higher altitudes, later series are fitted with 2-speed, single stage blowers. These superchargers have an impeller ratio of 7.15 to 1 in low blower and 8.47 to 1 in high blower.

The supercharger controls are mounted in a quadrant on the left side of the pedestal. They have yellow knobs.

To check for proper operation:

1. Prop controls .....INC.RPM
2. Throttles.....1700 RPM
3. Blower control.....HI BLOWER
4. Throttles.....30" Hg.
5. Blower control.....LOW BLOWER

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

At low altitudes there will be little gained by using High Blower. As the impeller is engine-driven, it takes more power to drive it in High Blower than you gain in shifting. Use High Blower in climbing and at higher altitudes only.

## FUEL SYSTEM

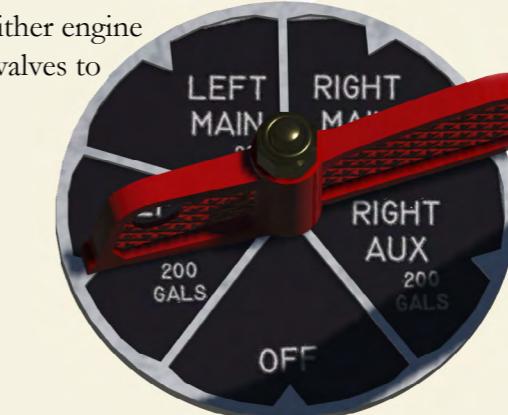
1. Fuel Tanks: The DC-3 has four center-section tanks, two on each side of the fuselage. Main tanks are forward; each has a capacity of 202 U.S. gallons. Auxiliary tanks are aft of the main tanks; each has a capacity of 200 U.S. gallons. Each tank is independent of the others.

The tanks are gauged and indicated by a four-way selector gauge on the main instrument panel



2. Fuel selector valves: On each side of the pedestal is a fuel selector valve. The right valve controls flow to the right engine, the left to the left engine. Valves read: LEFT MAIN, RIGHT MAIN, LEFT AUX., RIGHT AUX. AND OFF.

Select fuel for either engine by turning the selector valves to the desired position.

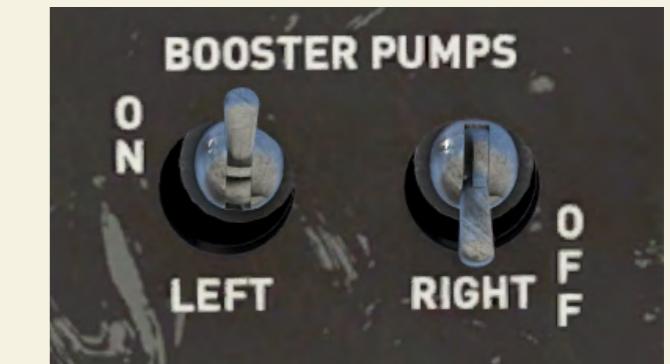


3. Crossfeed or Booster Pumps

Some earlier DC-3s are fitted with a fuel crossfeed system that permits either fuel pump to supply both engines. In this simulation, the Cross-Feed system is inop and the lever should be left in the OFF position.

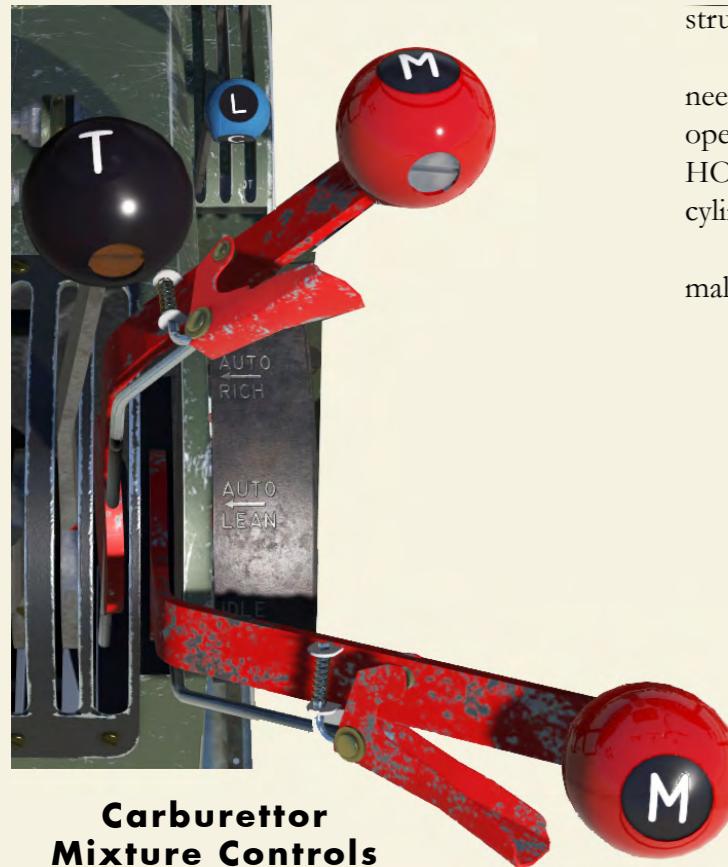


Later DC-3s and converted earlier ones have booster pumps fitted. The switches for these are on the upper right panel. These pumps maintain fuel pressure if an engine pump fails. For normal operations turn them on below 1000 feet and above 10,000 feet.



## CARBURETTOR CONTROLS

Carburettor mixtures are controlled automatically for most efficient engine operation at different altitudes. There are four mixture control positions: EMERGENCY, AUTO RICH, AUTO LEAN and IDLE CUT-OFF. The controls are to the right of the throttles on the pedestal.



**Carburettor Mixture Controls**

To operate the controls, first press the trigger lock fitted to each control and then move the control to the desired position.

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

EMERGENCY - full rich mixture. This position overrides any automatic function.

AUTO RICH - rich mixture

AUTO LEAN - lean mixture

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

to keep the fuel/air ratio at its most efficient level.

IDLE CUT-OFF - stops the flow of fuel. Note: AUTO RICH and AUTO LEAN are sometimes referred to as "Takeoff and climb" and "Cruise".

Carburettor heat controls: These controls are located in a quadrant just below the main instrument panel on the right side of the pedestal.

Positions: HOT and COLD. When you need carburettor heat to offset icing conditions, open the LOCK lever and move each control to HOT. This brings heated air from the around the cylinder heads into the induction system.

Leave the controls in COLD for all normal operations and ALWAYS LOCK them.



**Carburettor Heat Controls**

## OIL SYSTEM

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

Oil temperature and pressure gauges are on the main instrument panel in front of the co-pilot, together with low pressure warning lights.

Keep oil pressures between 75 and 90 psi in normal flight operation. Don't let them get below 60 or above 100 psi, if you are flying in emergency situations. If pressures drop below 50 psi, the red warning lights will glow.

## ELECTRICAL SYSTEM

Two engine-driven generators supply electric current to your airplane and charge two 88-ampere-hour batteries, housed under the nose of the airplane. (The battery compartments are mounted on telescopic arms which extend downwards to enable servicing of the batteries.) In this simulation these are activated when the GROUND-POWER switch is operated.

There is a master battery switch mounted on the left upper panel. This is left OFF while starting engines using an external power source.

Whenever possible, start engines using an exterior battery cart (sometimes called Ground Power Unit). This saves battery power.

You can start engines on battery power alone. If you are going to use the starting cart, switch up the GroundPower switch and check outside to see the cart visible, connected to the batteries

## LIGHTS

There is a variety of exterior lighting on the DC-3. The main groups are:

- A. LANDING LIGHTS
- B. PASSING LIGHT (Red, incorporated in the left landing light housing)
- C. NAVIGATION LIGHTS
- D. TAIL LIGHTS (Red and White)

Some lights have dim and bright filaments which can be switched, others have steady and flash states.

All switches for these lights are located on the left or right upper panels.

## RADIO SUITES

Your DC-3 is fitted with radio sets for communications with the ground and for navigation when used in conjunction with the navigation instruments.

There are two Comms radios (Com1 &

Com2), two Nav radios (Nav1 & Nav2) an ADF receiver and finally, a Transponder.

Immediately above the radio suite is an AUDIO unit for audio signal and marker signal-control.

The suite is mounted centrally, in the roof panel.

**1. Comms1 ON/OFF and Standby-Active switch**

**2. Comms1 Standby Frequency (broad and fine)**

**3. Comms2 ON/OFF and Standby-Active switch**

**4. Comms2 Standby Frequency (coarse and fine)**

**5. Nav1 ON/OFF and Standby-Active switch**

**6. Nav1 Standby Frequency (broad and fine)**

**7. Nav2 ON/OFF and Standby-Active switch**

**8. Nav2 Standby Frequency (coarse and fine)**

**9. ADF**

**10. TRANSPONDER**

**11. AUDIO UNIT**



*For the modern pilot...*

The "original" DC-3 is fitted with basic navigation equipment in the shape of the Radio suite which provides Nav1 and Nav2 frequencies, a Comms Radio with Com1 and Com2 and an ADF. These when coupled to the RMI (VOR) and GSI (glideslope indicator) gauges on the main panel, provide for basic IFR navigation. The RADIO COMPASS is your ADF indicator.

However, if you are more comfortable with modern avionics when flying in the simulator, there is an



option to use the GNS530 and 430 suite, together with a modern Autopilot. A knob at the base of the main instrument panel, immediately below the Manifold Pressure Gauge, toggles between the Sperry Gyro-Pilot and the GNS Suite.

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**INSTRUMENT*****Markings***

**DC-3**  
**GRADE 100/130 FUEL**

**MANIFOLD PRESSURE**

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

**CYLINDER HEAD TEMPERATURE**

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

**OIL TEMPERATURE**

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

**TACHOMETER**

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

**CARBURETTOR AIR TEMPERATURE**

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

**FUEL PRESSURE**

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

**DE-ICER PRESSURE**

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

**OIL PRESSURE**

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

**AIR SPEED INDICATOR**

Yellow.....112 I.A.S.  
Red.....255 I.A.S.

**HYDRAULIC PRESSURE**

Green.....675-925PSI  
Red.....1200PSI

**INSTRUMENT*****Markings***

# N.B.: It is VITAL that you study and memorise the following information, to ensure trouble-free starts!

## STARTING

Some pilots and operators of the DC-3 differ on the correct procedure to start engines in a DC-3. We have chosen one of the most common. In this procedure, the final prime is used to start the motor.

**Fuel tank selector.....to choice**

**Battery Switch.....OFF (see note)**

Note: You can start the engines using internal battery power, in which case turn the battery switch ON. OR...

**Battery Cart (GPU).....Attached ON**

**Fuel Booster Pumps .... ON**

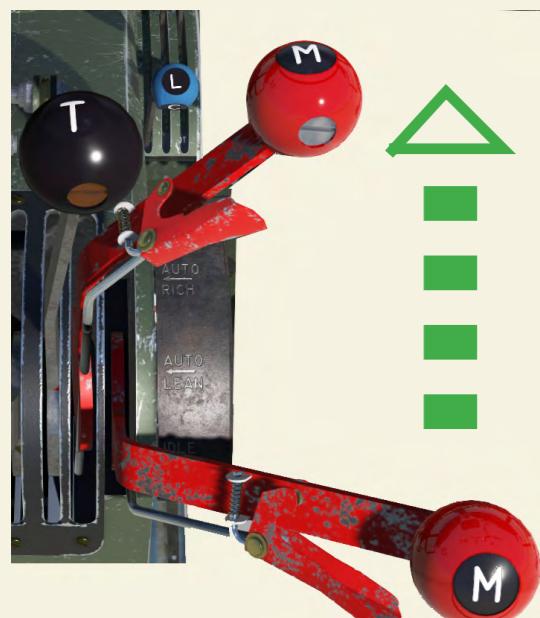
**Throttle ..... 1" open**

**Propeller .....MAX RPM**

**Master ignition switch...ON**

**Right Ignition (Magneto) ...OFF**

**Mixture control.....AUTO RICH**



Full operating  
CHECKLISTS are  
provided later in  
this manual

**Right Ignition (Magneto) ...BOTH**

**Right Engine Starter (energise) ... ON**

**WAIT 4-5 SECONDS!**

**Right Engine Mesh .....ON**

**WAIT 3 SECONDS!**

**Right Engine primer... ON**

As the MESH SWITCH is thrown, the propeller will begin to turn - slowly at first and then gathering speed. You should count "15 blades" at least, before throwing the primer. This is equal to approximately 3 -4 seconds before final priming.

Once the engine is running, return the GroundPower switch to OFF.

**Battery Switch..... ON**

**Fuel Booster Pumps .... OFF**

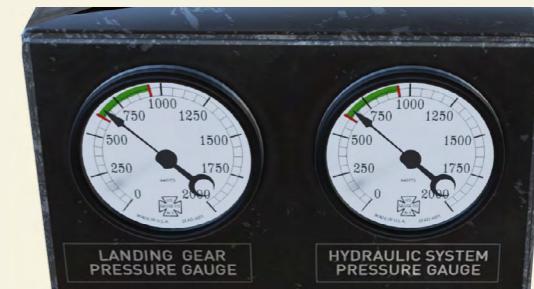
Whilst starting the engine, watch out for:

1. Engine Fire. See that the fire guard's extinguishers are placed properly at each side of the aircraft, before starting. Toggle them with the "Security Switch" (36) on the right side of the main panel.
2. Do not energise and mesh an engine excessively. If the engine won't start on your first or second attempt, leave it and start the other engine.
3. Ensure you have enough (but not too much!) throttle open. (this is required by the special starting code used in this simulation)

## BEFORE TAXIING

Crew and Passengers Aboard and Doors Secured

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



**Hydraulic Pressure...  
675-925 PSI**



**Radio...  
On and Checked**

Call the tower to see that your radio is working properly and get Taxi Clearance from Control Tower



**Clock...Set**



**Altimeters...Set**



**Gyros...  
Set and Uncaged**



**Flight Controls...  
Free**

As soon as all instruments and gauges indicate within safe operating limits, obtain taxi clearance from the Tower and taxi to run-up area.

## TAXYING

Remember, the DC-3 is a large, heavy airplane. Although you taxi like any other 2-engined airplane with conventional landing gear, its size and weight tend to exaggerate its movement in the air and on the ground. You will soon learn its characteristics but until you know the airplane well, handle it with extreme care.

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

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

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

Remember you have differential braking in the DC-3. But do not rely entirely on it, use throttle control instead. It is kinder on landing gear!

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

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

Once in position, make your checks:

**Parking Brake.....On**

**Tailwheel.....Locked**

**Fuel Booster Pumps.....OFF**

**Mixtures.....Auto Rich**

**Cowl Flaps.....OPEN**

**Fuel Selectors.....Main Tanks**

**Propellers .....MAX RPM**

**Carburettor Heat....COLD**

**Generators.....Check Ammeters**

## ENGINE RUN-UP

Advance throttles until RPM reaches 1500. Move propeller controls to MIN RPM. This operation checks governor operation and flushes the prop dome with warm, clean oil.

### Ignition

Increase one throttle at a time until manifold pressure indicates 30" Hg. Check magnetos by turning the requisite engine magneto switch from BOTH to RIGHT and back. There should be a small drop (no more than 100rpm) in revs. Immediately return the control to BOTH. Do the same for the other engine.

### Hydraulic Pumps

Check by using the flaps control lever and selecting DOWN. If all is correct, return the flaps selector to the NEUTRAL position.

Check all instruments for each engine before retarding throttles.

The DC-3 (with Pratt&Whitney engines) has cowl flaps around each engine, directly behind the engine cowling. They control engine temperature by regulating air flow through the cowling.

Cowl flap controls are on the right side of the copilot's seat. They are marked: CLOSED, OFF, TRAIL, OPEN. Operate by moving them using the serrated knob atop each control, clockwise or anti-clockwise.

When set to TRAIL, the flaps will open and close automatically with airspeed and air pressure through the cowlings.

### IMPORTANT!

For all ground operation, the controls MUST be set to OPEN. This maximises the air passing through the engine cowlings and prevents over-heating.

In icy and very cold conditions, you can select CLOSE to assist with engine warming but watch the cylinder head temperature gauge for any signs of overheating and OPEN the cowl flaps immediately.

## COWL FLAPS CONTROLS

CLOSED POSITION; In this position the flaps are closed and lay flat against the body of the engine cowling.



TRAIL POSITION; In this position, the flaps take up an angle dependent on airflow through the cowling. The faster the airflow, the flatter the flaps will lay. Slow speeds will open the flaps to aid engine cooling. This all happens automatically.



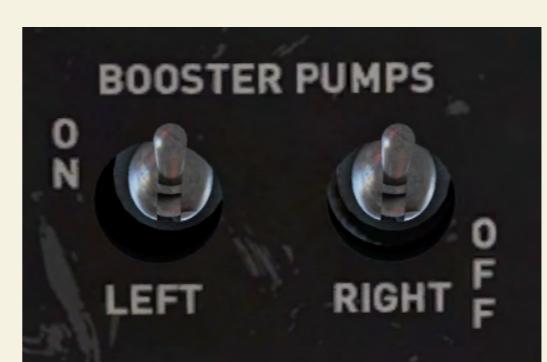
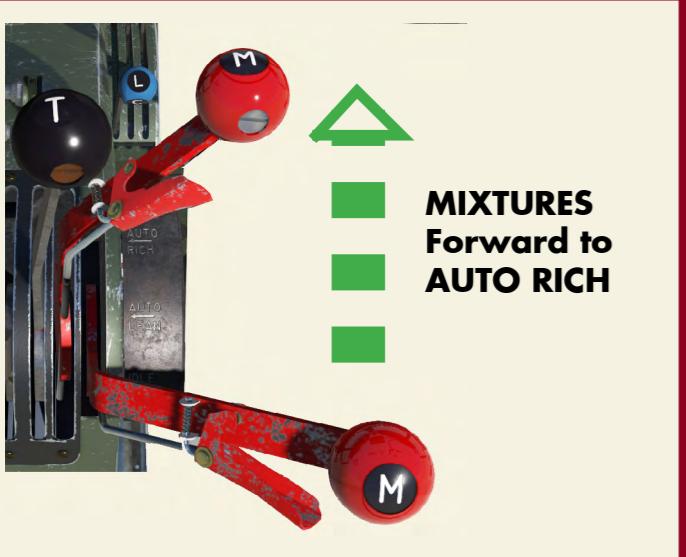
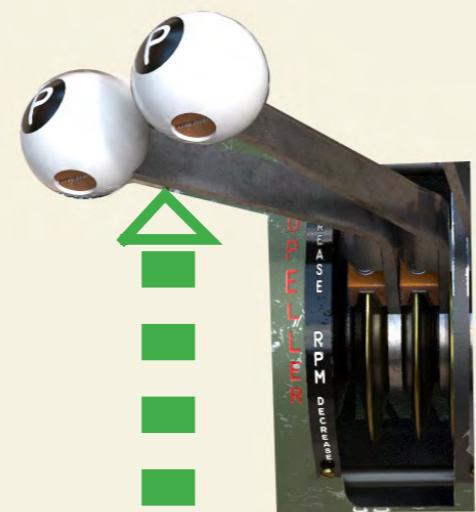
OPEN POSITION; In this position the flaps are fully open and remain so until another selection is made. ALWAYS use this position when engines are running on the ground.



## RESTRICTED

**BEFORE  
TAKEOFF**

**PROPELLERS  
Full Forward  
Max RPM**



Either before takeoff or before you taxi for takeoff, tighten the friction control to prevent throttles from slipping.

**Tailwheel.....locked**

Make sure your tailwheel is locked when lined up on runway.

**TAKEOFF**

**Normal Takeoff  
Power Setting  
...46" Hg.**

Now you are ready to advance your throttles for takeoff. Advance them evenly and steadily until you reach takeoff power. As you do so;

**Parking Brake .....release**

The throttle movement should take a full 5 seconds.

Maintain takeoff direction by using your rudder and if necessary, your throttles. Rudder control is available directly after you reach takeoff power. Use throttles in cross-winds or to off-set swerve of the airplane. As in taxiing, maintain direction in a crosswind by applying additional power to the upwind engine.

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

**Heavy load Takeoff:** When you are taking off with a heavily loaded airplane, bring the tail up to a straight and level position as soon as possible and holding the airplane on the ground, allow it to attain safe airspeed according to the load.

**Short field Takeoff:** In taking off from a short field, hold the airplane with brakes until you have advanced the throttles from 25" to 30" Hg. manifold pressure. Release brakes, raise the tail to straight and level flight position as soon as possible and ease your airplane off the ground as soon as you attain minimum flying speed. Do not allow the airplane to fly itself off the ground.

Use flaps to shorten your takeoff run.

**Cross-wind takeoff**

When you make a cross-wind takeoff, gain sufficient speed to ensure positive rudder control before lifting the tail. As long as you have rudder control, you can co-ordinate rudder and throttles to maintain a straight takeoff path.

Attain enough speed to remain airborne once you have broken ground.

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

**AFTER TAKEOFF (CLIMB)**

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

**Landing Gear .....Up**

**To retract landing gear**

1. Pilot signals..... "Gear UP"
2. Release the safety latch from the floor catch
3. Safety latch.....Full up
4. Gear lever.....UP
5. When landing gear is up and locked, return the gear lever to NEUTRAL. The red warning light will burn.

**To extend landing gear**

1. Airspeed.....160 mph IAS or less
2. Pilot signals..... "Gear DOWN"
3. Safety latch.....Full up
4. Gear lever.....DOWN
5. Gear lever.....NEUTRAL
6. Green light.....ON
7. SafetyLatch.....DOWN and LOCKED

**Caution**

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

## Remedy

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

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

## Wheels...Stop rotation with brakes

## Power reductions

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

## Note

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

**Normal Climb Power Setting ...42" Hg.**

## CRUISE POWER SETTINGS

At cruising altitudes reduce power to cruise conditions. For Grade 91 fuel, these setting are:

## R-1830-90C ENGINES (WITH 2-STAGE BLOWER)

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

## Cowl Flaps .....Trail or Closed

Cowl Flaps can have a buffeting effect if left open. Trail position is normal or Closed if at higher altitudes or operating in cold conditions.

## Mixtures .....Auto-Lean

## Fuel Selectors.....to Desired Tanks

## Adjust power as required to suit altitude and blower settings.

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

## SPERRY GYRO PILOT

When you are flying long distances you can keep your airplane in straight and level flight by means of the Sperry Gyro Pilot. It detects flight deviations the instant they occur and corrects them immediately and with precision. Use this pilot only in ordinary weather conditions and never in extremely turbulent air.

To set the Gyro-pilot in operation, trim your airplane then:

1. Align the adjustable index card (2) with the gyro card (3) in the directional gyro unit.
2. Check Suction (13). It should read between 3.75" and 4.25" Hg.
3. Turn the shut-off valve control on the hydraulic panel to the ON position.
4. Turn the Power control (1) ON to ON or turn the automatic pilot control on the pedestal base to ON.
5. Press the Heading Hold Button (5)

The airplane will be held in this flight position unless adjusted, using the Sperry controls.

If you wish to enter a climb under Gyro-pilot or if you need to adjust the pitch angle of the nose, use the knob marked "ELEV" (8) which will adjust the pitch reference (7). The orange horizon bar (9) will move to maintain its position in the center of the pitch reference bar and the aircraft's nose will rise (or fall). If you wish to maintain the pitch of the aircraft, press the Pitch Hold knob (6). You can still adjust the pitch using the ELEV (pitch reference) knob (8). If you wish to alter your heading while under automatic pilot control, turn the knob marked "RUD" to adjust the index (upper) card in the gyro. Now TURN OFF the Heading Hold (5). The aircraft will turn to the new heading and the index and gyro cards will align again, to show your new heading.

NOTE: The servo controls (speed valves) are INOP in this simulation.



1. Power
2. Index Card
3. Heading Gyro
4. Index Adjuster
5. Heading Hold (push)
6. Pitch Hold (push)
7. Bank Indicator
8. Pitch Reference
9. Pitch Reference Adjuster
10. RUD
11. Gyro Cage (plate)
12. Attitude Wings Adjuster
13. Suction Gauge

## Note

The Sperry Gyro Pilot is NOT the same as the more modern autopilots you will be used to in flight simulators. It was designed in the late 1930's as a device to maintain an aircraft's flight attitude - that is level flight and direction, once these are set by trimming.

It should be remembered that this unit is not designed as a navigation aid and was never meant to be one. For that, you need more modern equipment or do as the original pilots did - rely on dead-reckoning, sextant and VFR.

## FLIGHT CHARACTERISTICS AND LIMITATIONS OF YOUR AIRPLANE

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

**Manoeuvres:** The following manoeuvres are prohibited: loops, Immelmanns, spins, dives, rolls, vertical banks, inverted flight and all other aerobatic manoeuvres.

**Limit speed and load factors:** The DC-3 is designed to operate within designated limits under various load conditions. If you exceed these limits, you place undue strain upon the airplane and structural damage or failure results.

These limits are:

**26,000lbs.  
Gross Weight**      **29,000lbs  
Gross Weight**      **31,000lbs  
Gross Weight**

Item			
<b>Max. Level Flight (IAS)</b>	<b>204 mph</b>	<b>187 mph</b>	<b>170 mph</b>
<b>Max. Glide (IAS)</b>	<b>255 mph</b>	<b>207 mph</b>	<b>191 mph</b>
<b>Max. for Extending Landing Gear (IAS)</b>	<b>160 mph</b>	<b>160 mph</b>	<b>160 mph</b>
<b>Max. for Extending Wing Flaps (IAS)</b>	<b>112 mph</b>	<b>112 mph</b>	<b>112 mph</b>

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

**Stalls and recovery:** All stalls give warning of their approach with light buffeting.

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

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

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

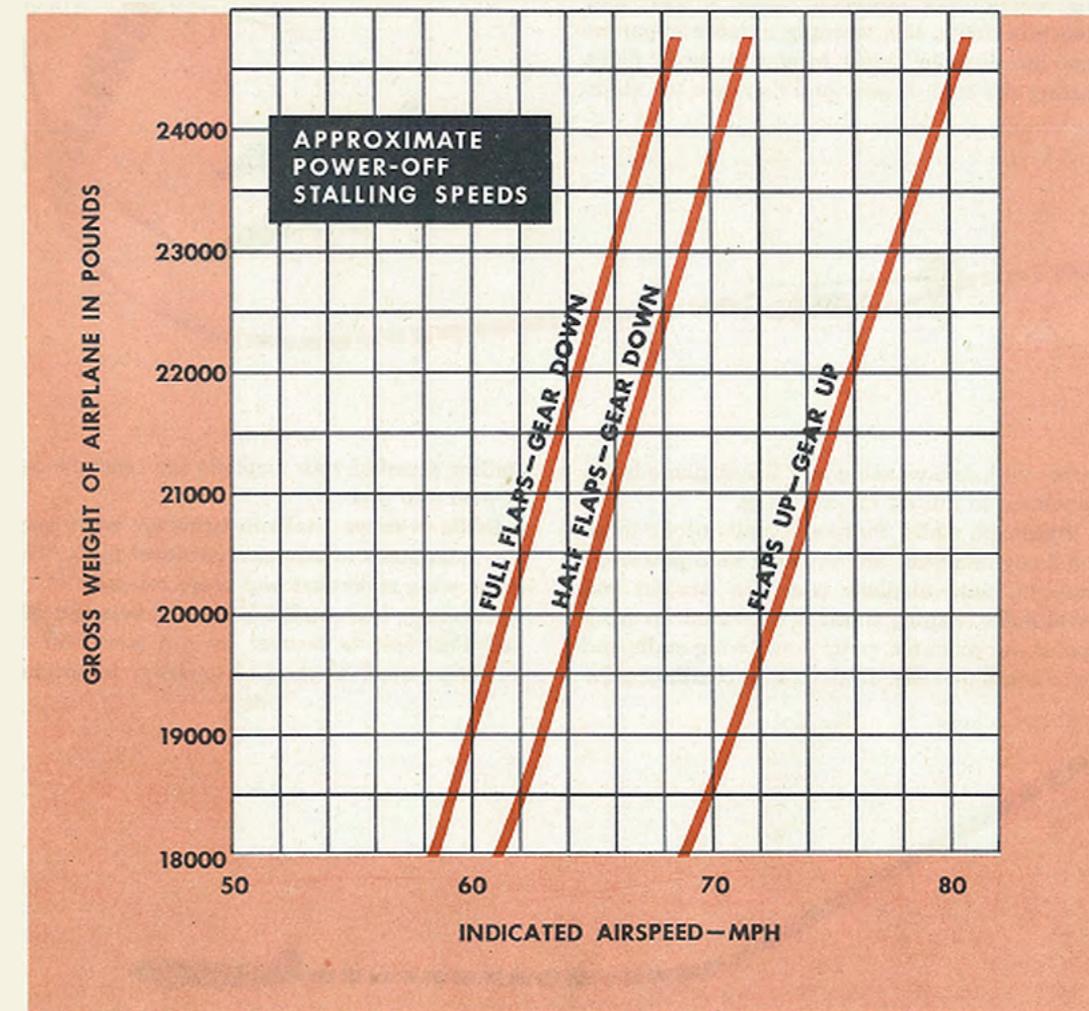
**Recovery from stalls:** You need between 500 and 1500 feet to recover from a power-off or power-on stall. Method of recovery is normal.

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

### STALLING SPEEDS

Stalling speeds of the DC-3 vary greatly under different conditions. Changes in load, power, flap and gear position and even slight changes in pressure and temperature affect the stalling speed. Your own technique also affects the stalling speed. If you fly smoothly, with co-ordinated control pressures, you can fly at slower speeds than another pilot who is rougher on the controls.

The following chart of stalling speed tells you approximately when the airplane will stall power-off. Use the chart until you are thoroughly familiar with your airplane.



## BEFORE LANDING

**Automatic Pilot.....OFF**

**Altimeters .....Set**

**Fuel Selectors.....Left to Left Main,  
right to Right Main**

**Mixtures.....Auto Rich**

Before you enter the traffic pattern, set mixtures to AUTO RICH and change fuel selectors to the main tanks. It is permissible to land on Auxiliary tanks if they are fuller than the Main tanks.

**Carburettor Air.....Cold**

**Fuel Booster pumps.....ON**

**Propellers.....Set**

**Landing Gear.....Down and latched,  
gear handle NEUTRAL, Green light,  
check wheels visually.**

When you have turned on the downwind leg and are opposite the runway, extend and lock the landing gear. Check green light and wheels visually. Increase propellers to 2250 rpm.

**Tailwheel.....Locked**

**De-icers.....OFF**

**Parking Brake...OFF**

**Flaps.... As desired.**

With landing gear extended, reduce power to achieve a descent of 300-400 feet per minute

Once on the base leg make another power reduction and maintain 120 mph until you are straight, on the approach leg. Then make a further power reduction to approach at 85-95 mph.

# LANDING

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

1. You can make a 3-point landing in a C-47 BUT this type of landing is NOT ADVISED. Reason: Weight of the airplane causes undue stress on the airframe and gear.

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

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

## CROSSWIND LANDINGS

There are three possible ways to land cross-wind: (1) Hold the airplane straight and level toward the landing strip and drop one wing into the wind, just enough to counteract drift. (2) Head airplane into the wind enough to keep straight (crabbing). (3) Combination of both.

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

In cross-wind landings, correct for drift as soon as possible on the approach. If the airplane

is making a straight path to the landing strip, the only correction needed on actual landing should be the angle of crab.

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

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

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

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

Remember, you have not finished flying your airplane until you have come to a complete stop, especially in a cross-wind.

## CROSSWIND LANDINGS

Tactical operation of the C-47, especially in combat theatres, often requires you to make short-field landings. Field conditions and approach clearances vary in different parts of the world. Landing fields may be small where little landing space remains.

Runways and fields may be rough making fast wheel landings dangerous or they may be ice-covered making brakes useless. The following landing techniques, however, are designed to get you down safely under all these conditions.

### Technique

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

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

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

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

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

### Tips

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

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

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

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

## NO-FLAP LANDING

Make your approach to a non-flap landing lower and with speed slightly higher than in an ordinary approach. As you normally approach in a tail-low attitude it is better to make a tail-low landing than a wheel landing.

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

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

## PARKING

### Parking brake.....ON

### Cowl Flaps.....as desired

### Mixtures.....Idle Cut-off

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

**Fuel selectors.....OFF**

**Ignition ..... OFF**

**Radios..... OFF**

**Battery Switch.....OFF**

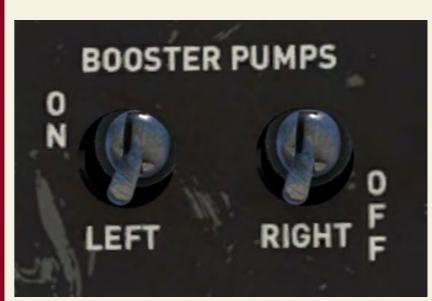
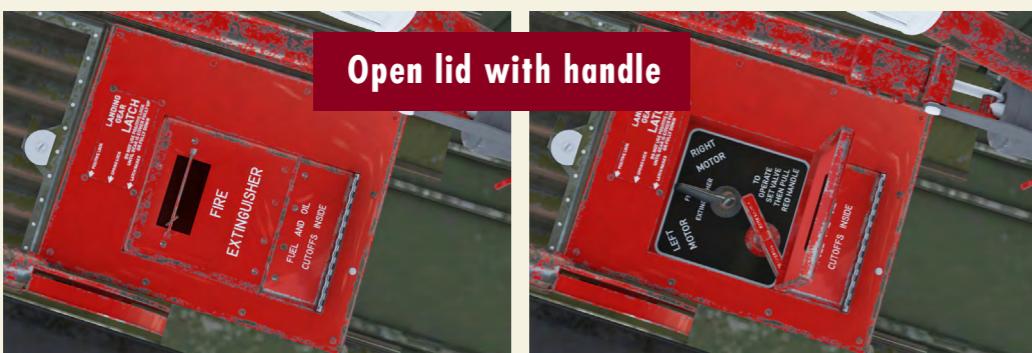
**Landing Gear Handle ....DOWN**

**Flap handle ....UP**

(FOR THIS SIMULATION)

**Security Switch .....ON**

**This will leave your airplane with chocks set, battery boxes lowered and extinguishers deployed.**

**AFTER LANDING****COWL FLAPS.....OPEN****FLAPS....  
UP****FUEL BOOSTER PUMPS...  
OFF****ELEVATOR TRIM TAB....  
NEUTRAL****PROPELLERS  
Full Forward  
Max RPM****FIRE CONTROL****Select affected engine****Pull extinguisher handle****Turn cut-off valves OFF****Checklists**

**NOTE:** These checklists are for simulation purposes ONLY. In no way are they intended for real-world aviation use.

**WEIGHT AND BALANCE**

It is important to make sure that the configuration of the airplane selected, matches the fuel/payload data listed in the simulator drop-down menu. The simulation will react to any changes in the data that you make or enter.

Once you have established your intended flight and have fuel and payload data available, enter these values in the boxes provided. Adjust the payload fore and aft to achieve a good CoG balance as indicated on the plane graphic of the drop-down. Doing this will decrease the amount of time required to trim the aircraft for level and balanced flight.

**BEFORE STARTING ENGINES****Hydraulic Pump  
selector.....LEFT ENGINE****Gear Latch.....Down and Locked****Flap Handle.....Flaps UP and then  
to Neutral****Gear Handle.....Neutral****Battery Switch.....OFF****Battery cart (GPU).....ON****Fuel Gauges.....Check ALL****Cowl Flaps.....OPEN****De-icers.....OFF****Automatic Pilot.....OFF****Lights.....As required****Flight Controls .....FREE****Crossfeed.....OFF****Trim Tabs.....Neutral****Parking Brake.....ON****Tailwheel.....Locked****Carburettor Air.....Cold****Fuel Selector Valves....Left to Left  
Main; Right to  
Right Main****Propellers.....Full Forward High RPM****Throttles.....Cracked (5-10%)****Mixtures.....Full Rich****Pitot Heaters.....OFF****STARTING ENGINES****Fuel Booster pumps.....ON****Right Engine Primer.....ON (5 secs)  
then OFF****Master Ignition Switch.....ON****Right Engine Magneto.....BOTH****Right Starter (energiser)... ON (wait)****Right Engine Mesh...ON (wait)****Right Engine Primer.....ON (after 15  
blades)****Battery Switch.....ON****Ground Power Switch ....OFF****REPEAT PROCEDURE FOR LEFT  
ENGINE**

**BEFORE TAXIING****Hydraulic Pressure....675-925 psi****Radios..... ON and tuned****Altimeters.....Set****Clock.....Set****Gyros.....Set and un-caged****Flight Controls.....Free****Parking Brake .....OFF****Tailwheel.....Unlocked****TAXI TO RUN-UP AREA.****ENGINE RUN-UP****Parking Brake.....ON****Tailwheel.....Locked****Fuel Booster Pumps.....OFF****Mixtures.....Auto Rich****Cowl Flaps.....OPEN****Fuel Selectors.....Main Tanks****Propellers.....Through Full Range****Magnets.....Check****BEFORE TAKEOFF****Mixtures.....Auto Rich****Cowl Flaps.....TRAIL****Propellers..... Inc. RPM****Gyros.....Set and un-caged****Fuel Booster pumps.....ON****Tailwheel.....Locked (when lined up with runway)****AFTER TAKEOFF****Landing Gear.....UP****Wheels.....Stop rotation with brakes****Power reductions....as advised****Fuel Booster Pumps.....OFF****CRUISE****Cowl Flaps.....As required****Mixtures.....Auto Lean****Fuel Selector Valves....Cruise tanks****Power adjustments....as advised****Automatic Pilot.....as required****BEFORE LANDING****Automatic Pilot.....OFF****Altimeters.....Set****Fuel Selector Valves....Left to Left Main; Right to Right Main****Mixtures.....Auto Rich****Carburettor Air.....Cold****Fuel Booster Pumps.....ON****Ignition.....Check****Propellers.....Set****Landing Gear.....Down and latched, gear handle NEUTRAL, Green light, check wheels visually.****Tailwheel.....Locked****De-icers.....OFF****Parking Brake .....OFF****Flaps.....as desired****AFTER LANDING****Flaps.....UP****Cowl Flaps.....Open****Fuel Booster Pumps.....OFF****Elevator Trim.....Neutral****Propellers....Full Forward high RPM****Tailwheel.....Unlocked****PARKING****Parking Brake.....ON****Cowl Flaps.....as desired****Tailwheel.....Locked****Mixtures.....Idle cut-off****Fuel Selectors.....OFF****Ignition.....OFF****Radios.....OFF****Battery Switch.....OFF****Landing Gear Handle.....Down****Flap Handle.....UP**

## AUTO-START

If you are going to use ctrl/E to start the engines (auto-start), PLEASE READ THE FOLLOWING:

Using the keystroke combination ctrl/E will OVERRIDE most of the specially written programming code in the C47/DC-3.

The following specific items will not function correctly:

- 1) Mixture levers. These are “gated” and programmed to simulate Auto-Lean and Auto-Rich states. The programming code behind them will not function with ctrl/E and they are not designed to work with standard keystrokes for mixtures.

You will have default mixture settings ONLY.

- 2) Magneto switches. These are by-passed when ctrl/E is used and will not function. They have been specially programmed to replicate the start procedure in a real DC3/C-47. They will NOT function under ctrl/E.

- 3) Fuel tank selectors. These are by-passed completely by ctrl/E which simply defaults to an “ALL” tank selection state. Visually, the tanks selectors will remain “OFF” even though fuel is flowing.

If you have used ctrl/E to start and are considering saving the flight, you MUST return all levers, switches and controls to their default state before saving. You can do this in two ways:

- 1) Return everything manually
- 2) Use the “Cold/Dark” switch on the OPTIONS panel

If you do not do this, when you reload, you will not have full function in your cockpit.

## AUTO-SHUTDOWN

Similarly, if you plan to “auto-shutdown” this will also override any specially coded functions. If you save a flight after auto-shut-down (ctrl/shift/F1) again, nothing will function properly when you load up again. To have the aircraft load properly again, you MUST return everything to its default state.

## COLD-DARK

A special switch marked “CD” on the left eye-brow panel (33) will toggle a Cold-Dark state for the cockpit. This automatically sets all switches and controls to their default OFF positions and the cockpit is now ready for a full manual start OR:

## QUICK START

A special switch marked “QS” on the left eye-brow panel (1) will toggle on a Quick-Start state for the cockpit. This automatically sets everything to the states necessary to carry out a manual start. So things like ignition, magnetos etc. are already ON ready for you to commence energizing the engines.

