AIR TO AIR SIMULATIONS

BOEING Stratocruiser

PILOT'S HANDBOOK

WINGS of SILVER
Stratocruiser

BY

A2A simulations

"Passion for Flight"

PILOT'S HANDBOOK

Table of Contents

Chapter 1: Introduction

The A2A Wings of Silver Stratocruiser is unlike any aircraft you have flown in Microsoft Flight Simulator. From the very beginning we here on the A2A team knew that this aircraft was something special, not just in look and design, but in the way the team came together over what initially we believed was quite an odd yet large aircraft.

Many in the team initially had never heard of the Stratocruiser, and many of us also agreed at how odd the “double bubble” shape looked. As time went on, we began to realize the special place the Stratocruiser holds in history, and just how influential it is to today's modern airliners. Many features first realized in the Stratocruiser have become the standard for nearly all commercial aircraft built to date.

In a way, the Stratocruiser is a representation of A2A's dedication at creating the most realistic simulation possible of such an amazing and important aircraft. A2A has crafted and pioneered many new technologies for this aircraft which is the first release and flagship in the Wings of Silver flight simulation line of software simulations for Microsoft Flight Simulator X. Never before has the team worked so diligently to produce what we feel is the most accurate simulator of a true “classic” airliner.

Please take a look at some of the new features listed below and take the time to experience every one of them in the simulator. We feel confident that you, like us, will agree that the A2A Wings of Silver Stratocruiser is indeed an amazing aircraft.

Join us and take a few steps into history....

The Air to Air Simulations Team

Stratocruiser Features

Designed and created by Boeing, the world's premier large 4-engined aircraft builder.

Four crew positions – pilot, co-pilot, flight engineer, and navigator. Fully modeled and functioning positions constructed with down to the rivet detail.

The 3,500 horsepower Pratt & Whitney R4360, the world's most powerful piston aircraft engine ever produced.

Real time Load Manager, with the ability to load individual passengers, cargo, and fuel or select presets.

Custom Cockpit Systems and Gauges for the ultimate in realism taken far beyond what is available by default.

See the world like you have never seen it before through 19 cockpit windows for unprecedented visibility.

Fly high and fast. Fly above the bad weather and cover the ground at 350 mph.

Double-decker airliner carries almost 100 passengers in first class comfort on a level never seen before or since.

As with every A2A aircraft, it is **gorgeously constructed**, inside and out, down to the last rivet.

Built to be flown "**By The Book.**"

Fully clickable cockpits with authentically working systems and gauges.

The latest wind-tunnel technology creates fluid flying qualities.

3D Lights 'M' (built directly into the model.)

- Red, rotating double sided mechanical beacon.
- Under-wing landing lights than can be turned on, deployed, and retracted.
- Pulsing navigation lights.
- Nose-gear mounted taxi light that even shoots a downward beam from the undercarriage doors as it deploys.
- Red passing light.
- Passenger and cockpit lighting for stunning visuals at dawn, dusk, and night.

Pure3D Instrumentation.

- Natural 3D appearance with exceptional performance.
- Smooth movements.

Historically accurate Eclipse-Pioneer PB-10 autopilot which looks and functions like the original. Twist the hand lever to bank, scroll wheel to adjust pitch, and toggle "Altitude Hold" switch.

Stratocruiser Features (Continued)

Auto-Mixture that actually performs as intended. Now you can set for “auto-rich” or "auto-lean" and the aircraft fuel to air ratio will be automatically determined and set by the carburetor based upon various factors such as altitude.

Extensive Fire Extinguisher system with fully functioning overheard panel and controls.

On-board Auxiliary Power Unit (APU) to power systems with engines off and not drain the battery.

Cabin pressurization system controls. You control the target altitude and the rate of pressure change and the system authentically displays and manages cabin pressure.

Hydraulically powered steerable taxi wheel, brakes, emergency brakes, rudder boost, and windshield wipers.

Bulging tires when placed on the ground with weight.

Five different liveries including Northwest Airlines, British Overseas Airways Corporation, United Overseas Airlines, Pan American Airlines and Aero Spacelines Pregnant Guppy.

Pregnant Guppy aircraft included with authentic cockpit, systems, and performance.

All models include A2A specialized bump mapping and specular lighting.

Crew Reports pop-up 2D panel keeps important information easily available

Custom Navigator's map accessible via keystroke or the Navigators station.

Authentic A2A Simulations 3D engineered sound for FSX.

Preface

Each airline that flew the Boeing 377 had a different suite of avionics, interior designs, cockpit layout, etc. The Wings of Silver Stratocruiser closely resembles early Stratocruiser variants, featuring four crew stations and a full engineering instrument panel. Some Boeing 377 examples indicated in the manuals were nearly identical in cabin setup and design, while others differed by combining the engineering stations into the overhead and side pilot and co-pilot instrument panels. The engineering station is reminiscent of certain airlines and early Boeing 377 Stratocruiser models and offered the greatest amount of diversity, variety and commonality while giving a very unique experience within the flight simulation community.

We here at Air to Air Simulations spent a considerable amount of time with two military variants of the aircraft (C97 and KC97) to gather technical data and get some “hands on” experience. We believe the long process of creating a 'certified' A2A Simulations aircraft will be appreciated by both history buffs, pilots, and anyone who loves aircraft. We build our aircraft 'by the book' and test to ensure it is true to the numbers and charts presented in the manuals. Lastly, it has to pass the test of being certified by our own real or former C97, KC97 and 377 pilots. Hundreds of hours were spent with our group of specialists and technical advisers to ensure the best and most thorough simulation possible was given to you, our customers.

Our commitment to the product has lead to multiple new simulation technologies and sits in a class of its own among classic airliners. The technology pioneered by developing the Stratocruiser gives it the distinction of not only being our first plane in the Wings of Silver classic airliner series of products, but also of it being our flagship aircraft for the series.

While the majority of this manual does apply to the real operation of the aircraft, this manual is written and designed specifically for the Air to Air Simulations Wings of Silver Stratocruiser.

Chapter 2: Quick Start Guide

Chances are if you are reading this manual, you have properly installed the A2A Wings of Silver Stratocruiser. However, in the interest of customer support, here is a brief description of the setup process, system requirements and a quick start guide to get you up quickly and efficiently in your new aircraft.

System Requirements

The Air to Air Simulations Wings of Silver Stratocruiser requires the following to run:

REQUIRES LICENSED COPY OF MICROSOFT FLIGHT SIMULATOR X

SERVICE PACK 2 (SP2) REQUIRED
(Note, while the A2A Wings of Silver Stratocruiser may work with SP1 or earlier, many of the features may not work correctly if at all. We cannot attest to the accuracy of the flight model or aircraft systems under such conditions, as it was built using the Acceleration/SP2 SDK. Acceleration is required for manual turbo control.

OPERATING SYSTEM:
Windows XP SP2
Windows Vista

PROCESSOR:
2.0 GHz single core processor (3.0GHz and/or multiple core processor or better recommended)

HARD DRIVE:
250MB of hard drive space or better

VIDEO CARD:
DirectX 9 compliant video card with at least 128 MB video ram (512 MB or more recommended)

OTHER:
DirectX 9 hardware compatibility and audio card with speakers and/or headphones

Installation

Included in your downloaded zipped (.zip) file, which you should have been given a link to download after purchase, is an executable (.exe) file which when accessed contains the automatic installer for the software.

To install, double click on the executable and follow the steps provided in the installer software. Once complete, you will be prompted that installation is finished.

Realism Settings

The Air to Air Simulations Wings of Silver Stratocruiser was built to a very high degree of realism and accuracy. Because of this it was developed using the highest realism settings available in Microsoft Flight Simulator X.

The following settings are recommended to provide the most accurate depiction of the flight model. Without these settings certain features may not work correctly and the flight model will not perform accurately. Figure 2-1 depicts the recommended realism settings for the Air to Air Wings of Silver Stratocruiser.

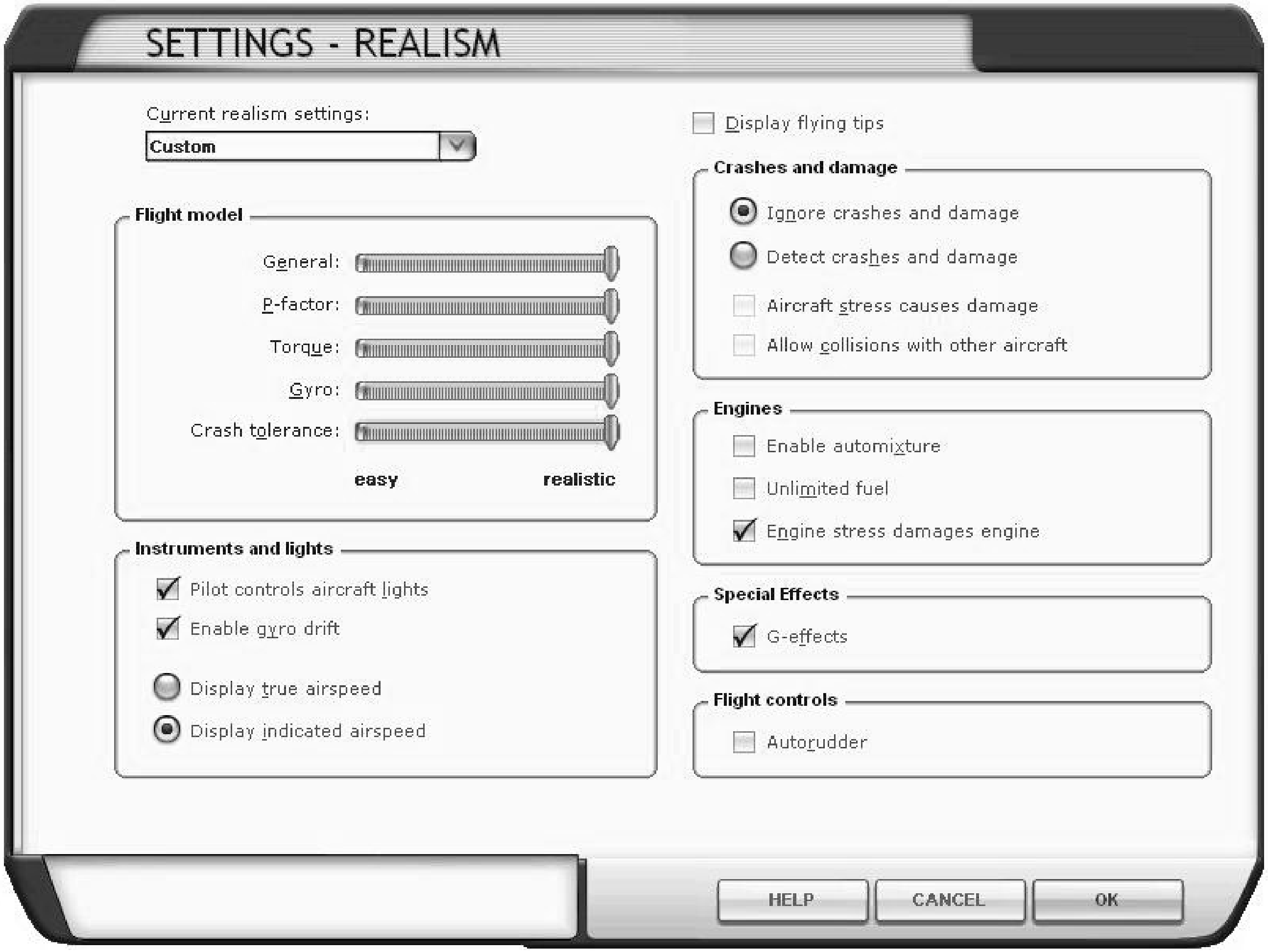


FIGURE 2-1. REALISM SETTINGS

FLIGHT MODEL. To achieve the highest degree of realism, move all sliders to the right. The model was developed in this manner thus we cannot attest to the accuracy of the model if these sliders are not moved as shown above in figure 2-1. The only exception would be "Crash tolerance."

INSTRUMENTS AND LIGHTS. Enable "Pilot controls aircraft lights" as the name implies for proper control of lighting. Check "Enable gyro drift" to provide realistic inaccuracies which occur in gyro compasses over time.

"Display indicated airspeed" should be checked to provide a more realistic simulation of the airspeed instruments.

CRASHES AND DAMAGE. It is recommended that you disable crash detection for maximum effects such as belly landings, etc. Alternatively, you can lower the "Crash tolerance" slider under Flight Model if you so choose to enable crashes. It is our feeling that if you crash, you will certainly know it regardless.

ENGINES. Ensure "Enable automixture" is not checked. The Stratocruiser has a fully working automatic mixture control and this will interfere with our extensively documented and modeled mixture system.

FLIGHT CONTROLS. It is recommended you have "Autorudder" turned off if you have a means of controlling the rudder input, either via side swivel/twist on your specific joystick or rudder pedals.

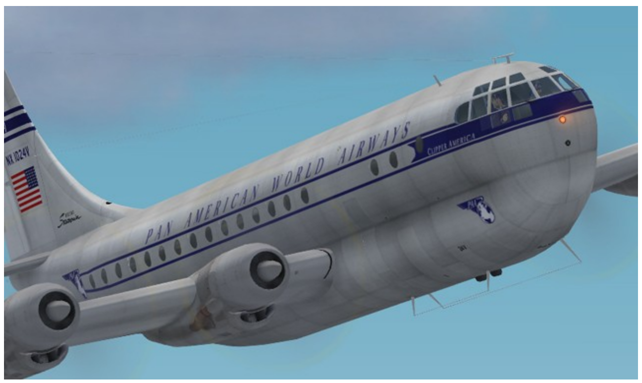
Quick Flying Tips

- **Keep your Crew Reports up** (SHIFT -2). They will provide you with helpful information.
- To **Change Views** Press A or SHIFT + A.
- **Open your cowl flaps when running engines on the ground** or taxiing to ensure the engines don't overheat. This is especially true on very hot days (80-100 F). You can open them with the switches on the engineering panel or the quick 2D "Controls" panel using SHIFT-3.
- **Keep engines at or above 1,000 RPM**. Failure to do so may cause spark plug fouling. If your plugs do foul, try running the affected engines (you will know by the fluctuating RPM displayed on the gauges) at a higher RPM. You have a good chance of blowing them clear within a few seconds by doing so. If that doesn't work, you will have to wait a little while for them to clear properly.
- **DO NOT apply full power without your ADI ON (**water injection switch located on the upper overhead panel). Applying full takeoff power without ADI may damage your engines.
- **Before takeoff, set flaps to 25 degrees** and raise them SLOWLY after takeoff (use F6 and F7 respectively).
- Operate Landing Gear (press G).
- **REDUCE POWER** after takeoff
- Use your autopilot to reduce workload.
- Use AUTO RICH for TAKEOFF / CLIMB and AUTO LEAN for CRUISE. The aircraft features a fully automatic (and realistic) working mixture system. Simply drag the mixture controls for each engine near the various mixture settings and it will "snap" into place and calculate accordingly. Under AUTO LEAN there is a manual control which allows the user greater freedom of mixture control as desired.
- For approaches reduce power and maintain about a 500 feet / minute descent.
- For landings, take the time to line up and plan your approach. Don't use landing gear or flaps as brakes. Keep your eye on the speed at all times.
- To stop quicker after landing, use REVERSE THRUSTERS, (use F4 and F3 respectively)

Chapter 3: Stratocruiser Variants

Included in the A2A Wings of Silver Stratocruiser package are 4 period and airline correct liveries along with the famed Pregnant Guppy. Each variant is complete with historically accurate differences such as round or square passenger windows, differing prop blades or other small variations. Each airline fitted the aircraft in differing ways. Some airlines converted their Stratocruisers into extravagant luxury airplanes with gold trimmed interiors and sleeping births while carrying the traveling elite while others were true passenger haulers with seating for over a hundred. Each airplane is unique and has a history of its own.

Pan American World Airways NX1024V



On 28 November 1945 Pan American ordered 20 Stratocruisers. This made PAA the first airline to put the new Boeing Stratocruiser into service. It was hoped to have the B-377s in service by the end of 1946 but a long drawn out certification process held up service entry until 1949. Boeing B-377 NX1024V was the third Stratocruiser prototype, its first flight took place on October 7th, 1948. Although it was named Clipper America it was actually the 2nd Pan American B-377 to be called Clipper America. The first Clipper America was the second Stratocruiser prototype, NX1023V and was later renamed Clipper Golden Gate. NX1024V was delivered to Pan American as Clipper Bald Eagle N1024V on June 12th, 1949. It was later refitted as a Super Stratocruiser, renamed as Clipper Cathay and used for the Pacific routes. It was eventually sold to Aero Spacelines and was converted to a Pregnant Guppy (N1024V).

British Overseas Airways Corporation G-AKGH

In October 1946 BOAC placed an order for six Boeing Model 377-10-32 Stratocruisers. This order caused quite a bit of controversy in post war Britain, with questions being asked why domestic British industry was not being supported. The fact of the matter was that there was no viable British built aircraft that could be used on the new transatlantic market. BOAC also did a deal with SAS (Scandinavian Airlines) to purchase four Stratocruisers that had been ordered by SILA. BOAC G-AKGH Caledonia was configured with 40 seats for the 'Monarch' service introduced in early 1950. Caledonia had a rear galley, round upper deck windows and square lower deck windows. In August 1958 Caledonia was sold to Transocean Airlines and was re-registered as N137A.

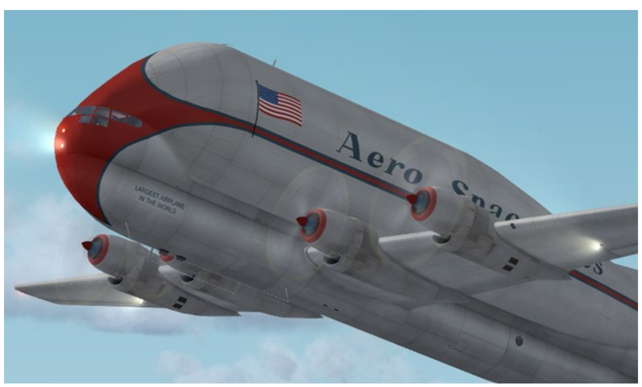
American Overseas Airlines N90947

AOA placed an order for ten B-377 Stratocruisers on 1 April 1946 making it the third Stratocruiser customer. AOA was a well established challenger to Pan American and TWA on the transatlantic routes. AOA holds the distinction of making the first commercial transatlantic flight from the US to Britain. The AOA 377-10-29 Stratocruisers had round upper deck windows, square lower deck windows and Curtiss Electric propellers. On 25 September 1950 AOA was taken over by Pan American and its Stratocruisers were absorbed into the Pan American fleet. Flagship Denmark (N90947) was used by AOA from mid 1949 until September 1950 when it was incorporated into the Pan American fleet. It was later sold to the Israeli Defense Force Air Force (IDF/AF) for conversion to a freighter.

Northwest Airlines N74603

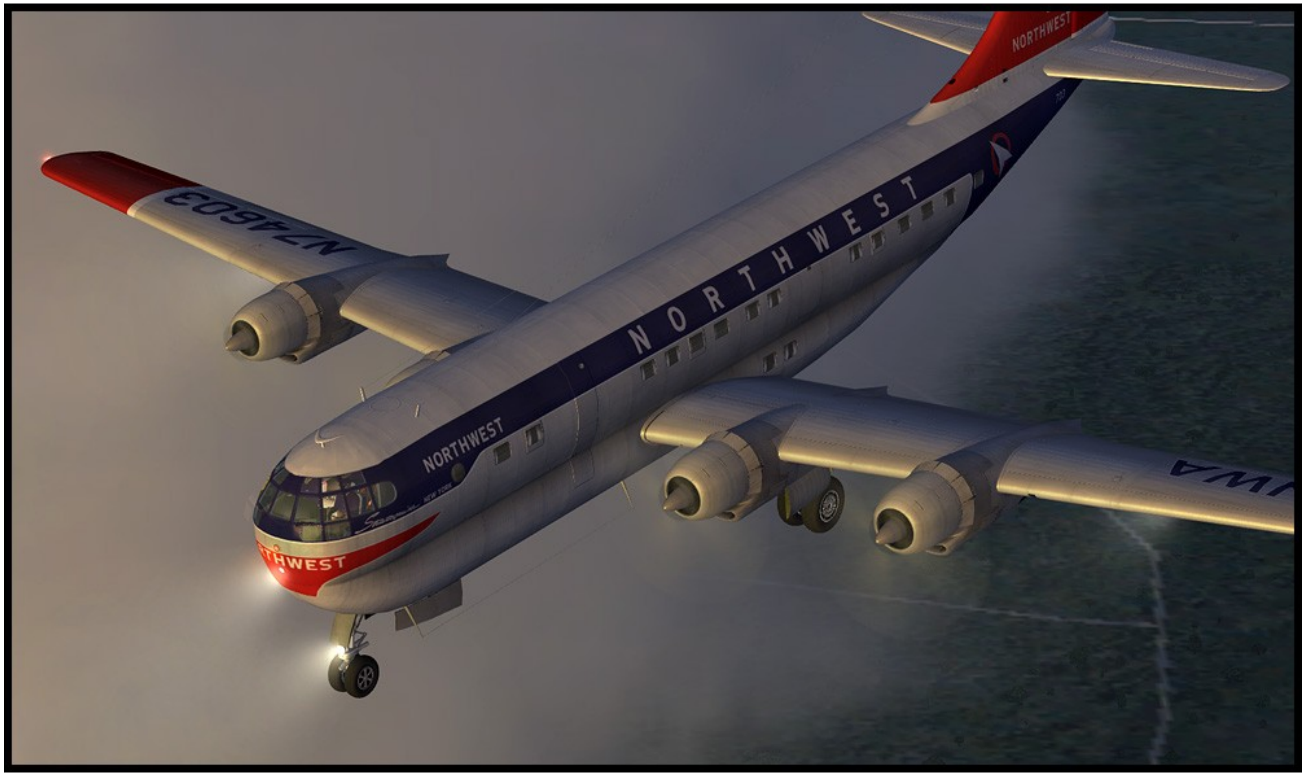
In march 1946 Northwest Airlines placed an order for ten Model 377-10-30 Stratocruisers. Northwest Stratocruisers had square cabin windows and Hamilton Standard propellers and flew commercial services in the mainland United States and to destinations across the Pacific. Stratocruiser New York N74603 was the third aircraft off the production line from the NWA order. Northwest Airlines operated Stratocruisers until the 15th September 1960. Stratocruiser New York was sold to Aero Spacelines for use in Guppy conversions.

Aero Spacelines N1024 “Pregnant Guppy”



This unique aircraft is a modification of the Boeing 377. The aircraft, a former passenger liner with Pan-Am, was stripped of all non-essential systems, including the pressurization system. The fuselage was lengthened by 16 feet, 8 inches and a third “bubble” of 18 feet, 6 inches in diameter was added to the upper fuselage structure. The plane was modified so that the entire rear fuselage and tail could be unbolted and carted away from the forward section, to allow for easy loading of the Saturn V S-IVB booster. The plane flew much as a normal Boeing 377, with the exception of some additional drag. Otherwise, the procedures and characteristics are the same as the standard Stratocruiser.

Chapter 4: General Description



The Boeing Stratocruiser is a double-deck, four-engine, medium to long range, high altitude, high speed, commercial transport airplane. The airplane is designed for a gross weight of 147,000 pounds, a high speed of approximately 305 knots, a service ceiling of 34,000 feet and a maximum range of approximately 4,000 miles.

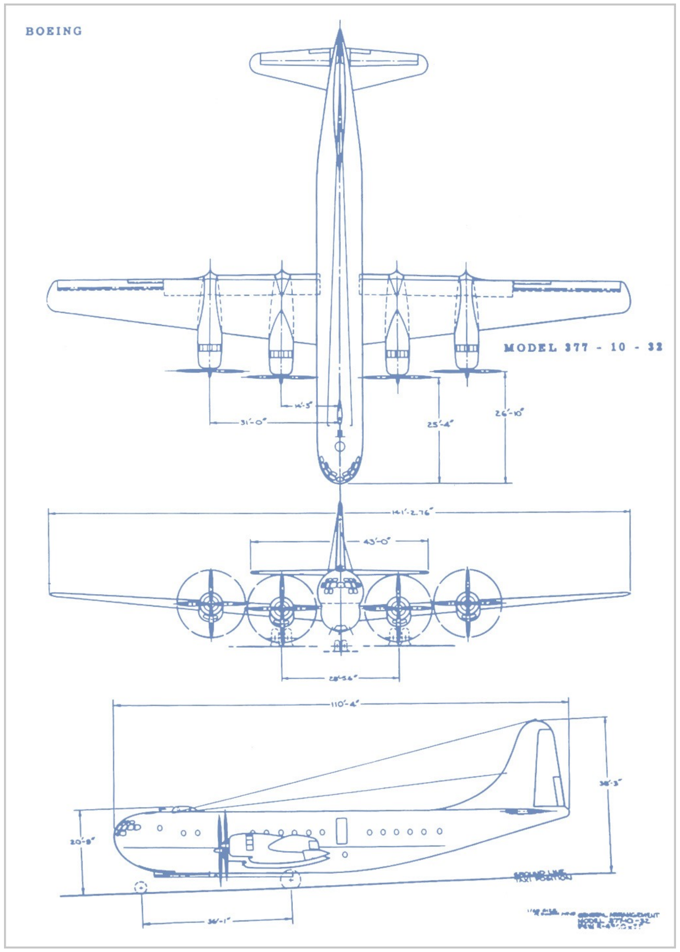
Wings span is 141 feet with a total wing area of 1769 square feet. The airplane is 110 feet long, 20.5 feet high at the nose and 38 feet high at the tail.

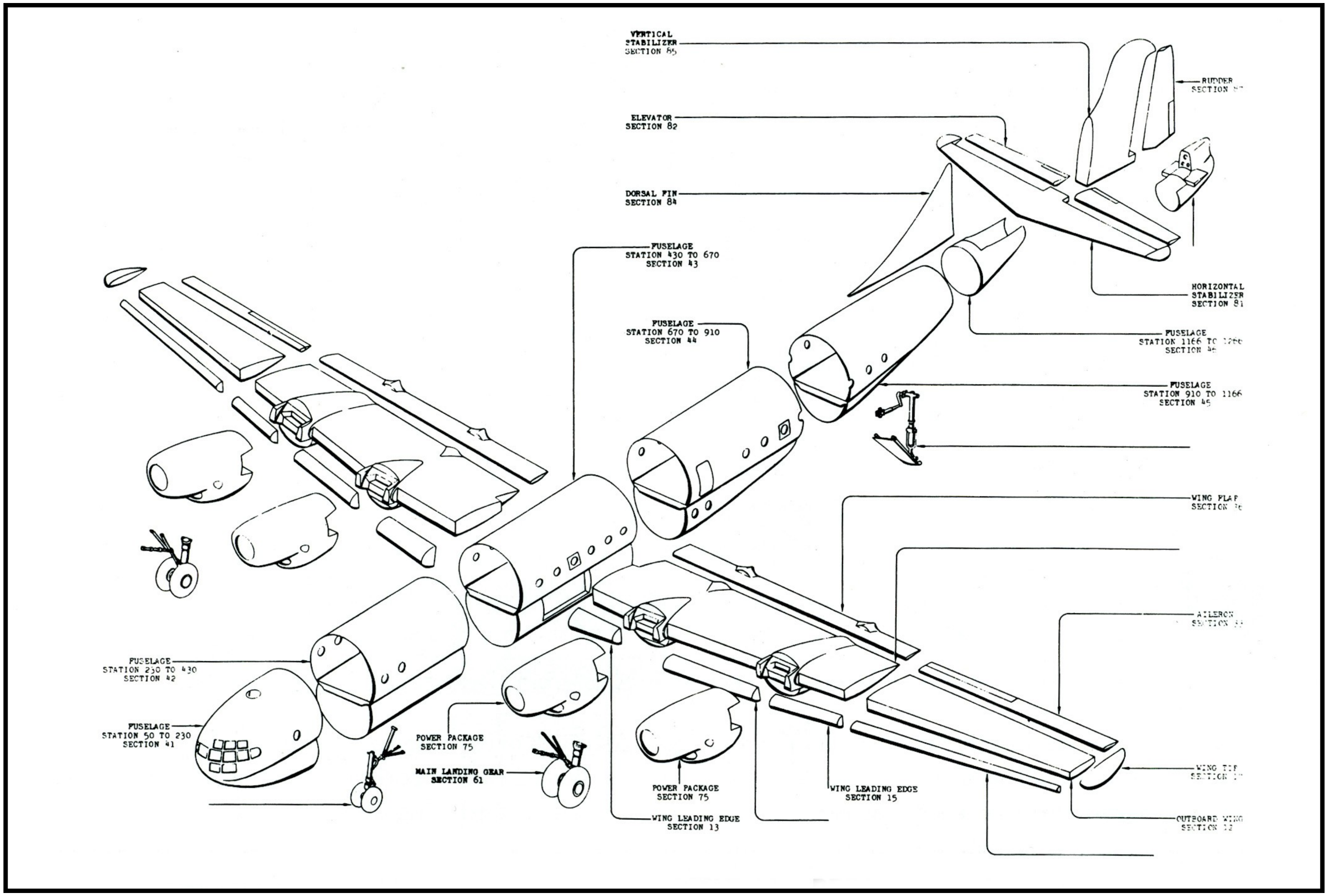
The normal crew consists of a pilot, copilot, radio operator, navigator and attendants for the passenger compartments.

The crew compartment, main cabin, lounge, and both cargo compartments are pressurized and completely air-conditioned, both in flight and on the ground.

Model 377 Specifications

Wing Span	141 feet, 3 inches
Length	110 feet, 4 inches
Height	38 feet, 3 inches
Powerplant	4 X 3,500 horsepower (takeoff rating with water injection) Pratt & Whitney R-4360 engines equipped with General Electric BH-4 turbo superchargers
Weights	83,500 lbs operating weight 147,000 lbs gross weight
Service Ceiling	33,000 feet at 110,000 lbs gross weight
Speed	300-340 mph cruising at 25,000 feet
Maximum Range	4,600 miles (no wind, no fuel reserves, 10,500 lb. payload)





STRUCTURAL BREAKDOWN

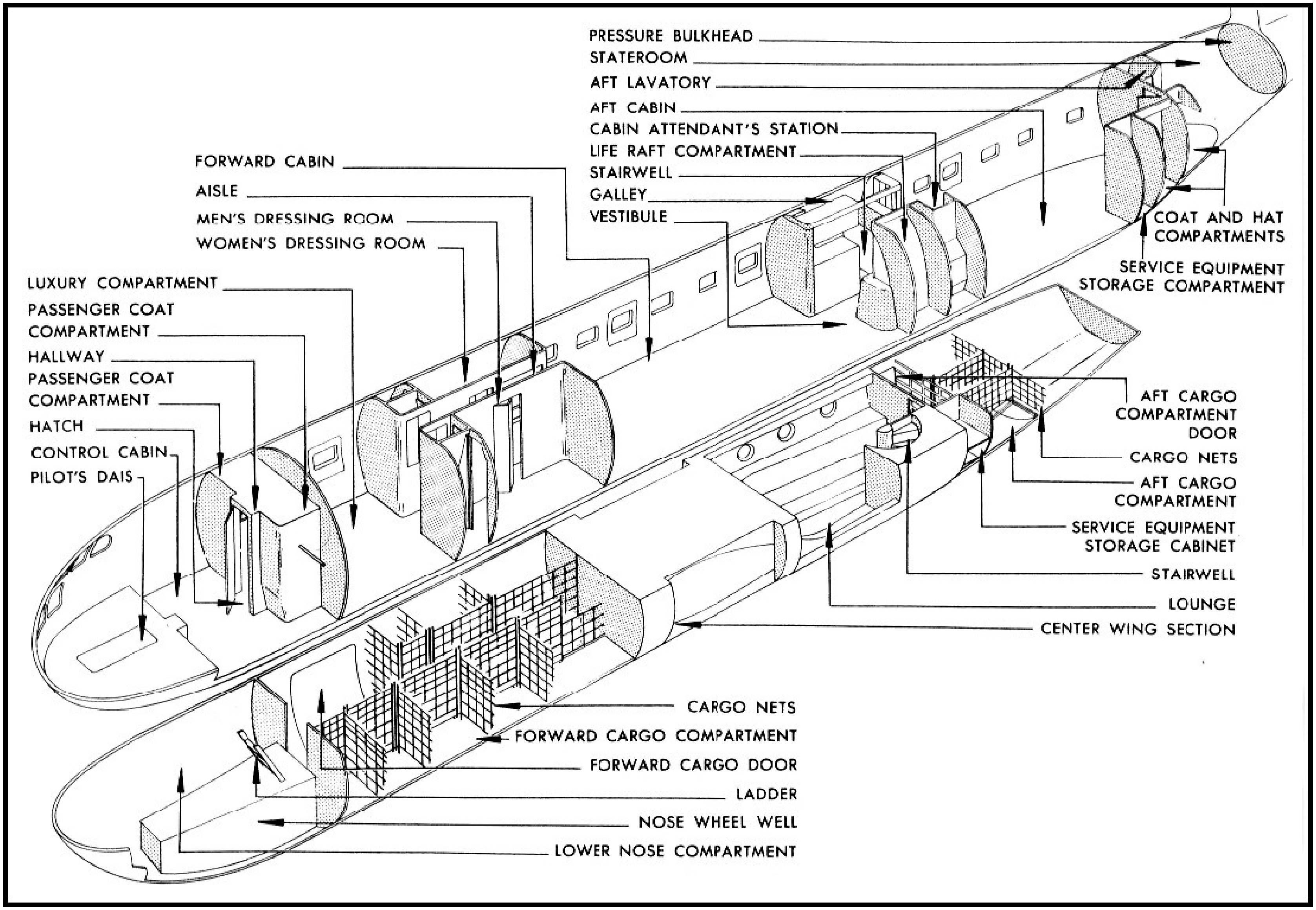


FIGURE 3-1. COMPARTMENT DIAGRAM

(NOTE: Interior and exterior design may differ slightly depending on model)

FIGURE 3-2. CONTROL CABIN

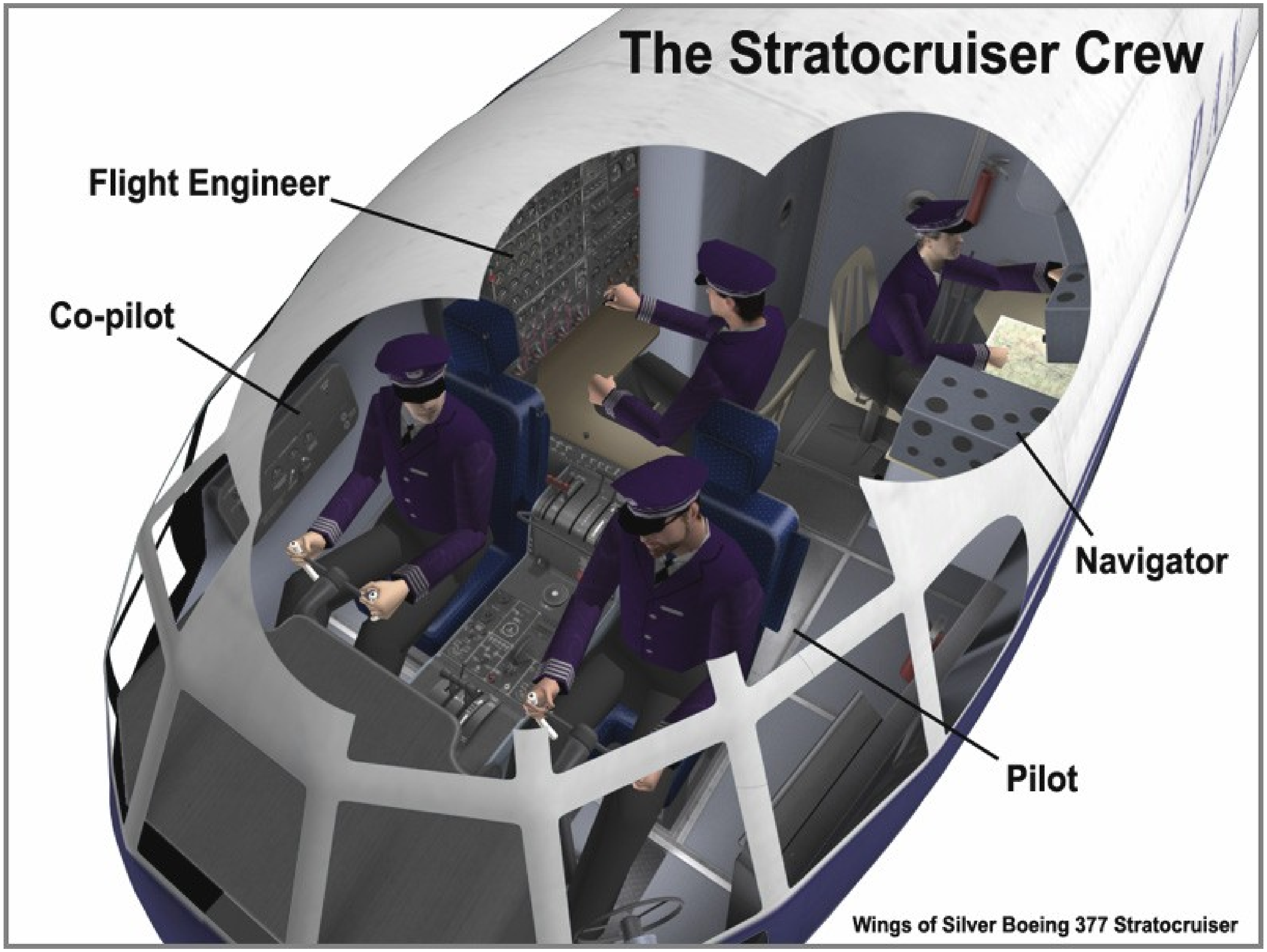
Chapter 5: Crew Stations

THE PILOT'S STATION consists of a forward instrument panel with primary flight instruments, an overhead panel, center console, and a lower-left auxiliary panel.

THE CO-PILOT'S STATION shares the forward instrument panel, overheard panel, and center console. Additionally, the co-pilot has an auxiliary panel on the lower right.

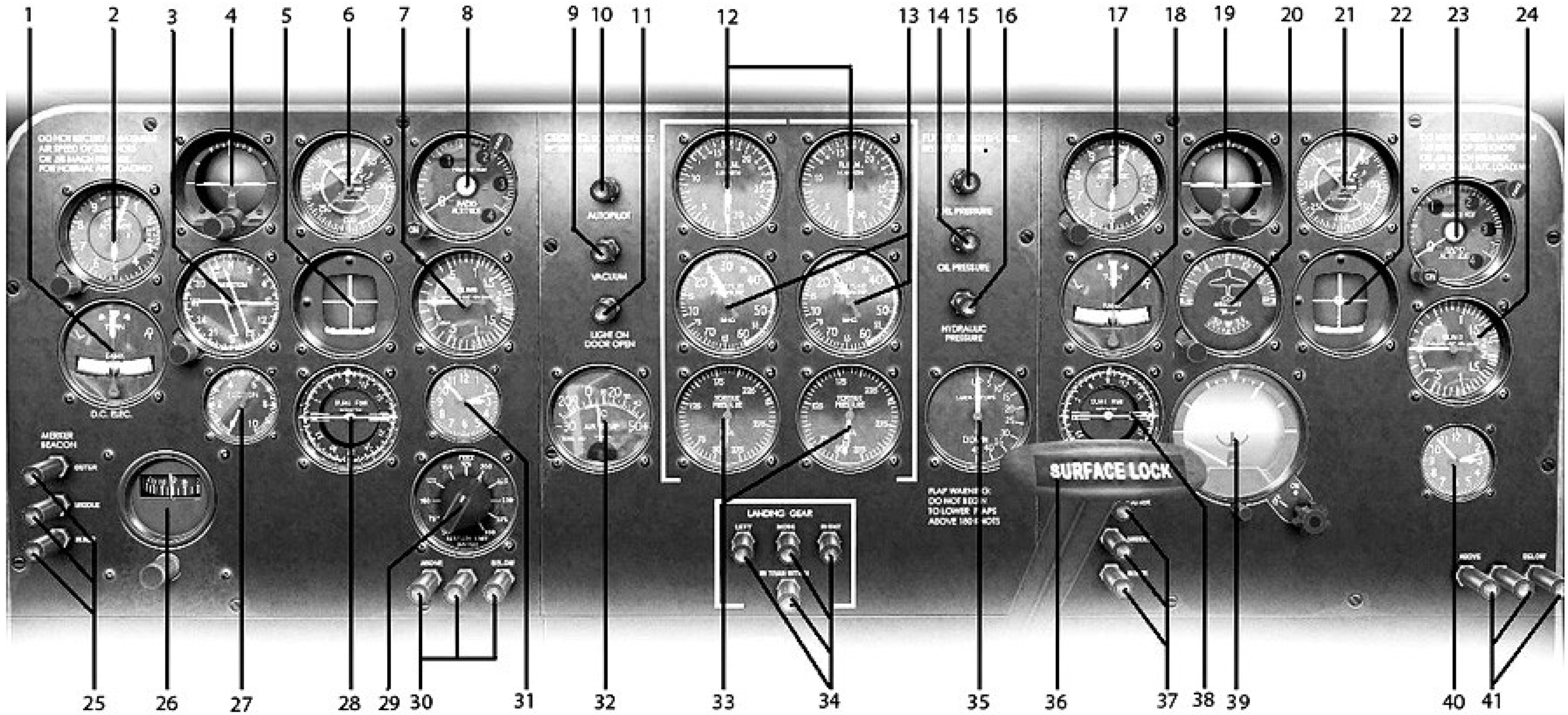
THE ENGINEER'S STATION consists of the main engineering panel with shared access to the engine starting controls in the upper center console and shared access to mixture, propeller, and throttle controls in the center console.

THE NAVIGATOR'S STATION consists of a table with maps, a window, and primary navigation instrumentation.



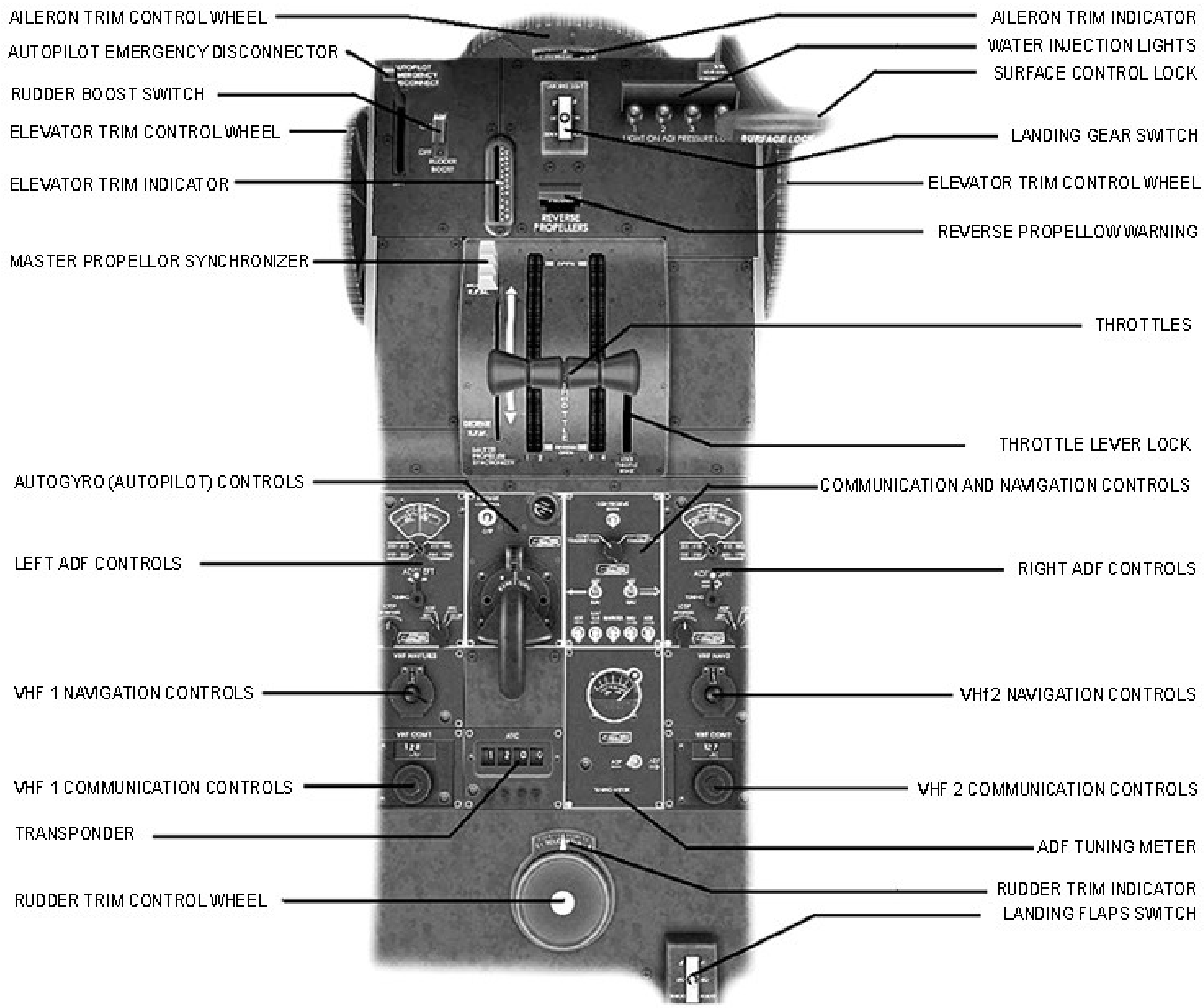
PILOT'S STATION

THE PILOT'S STATION consists of a forward instrument panel with primary flight instruments, an overhead panel, center console, and a lower-left auxiliary panel.

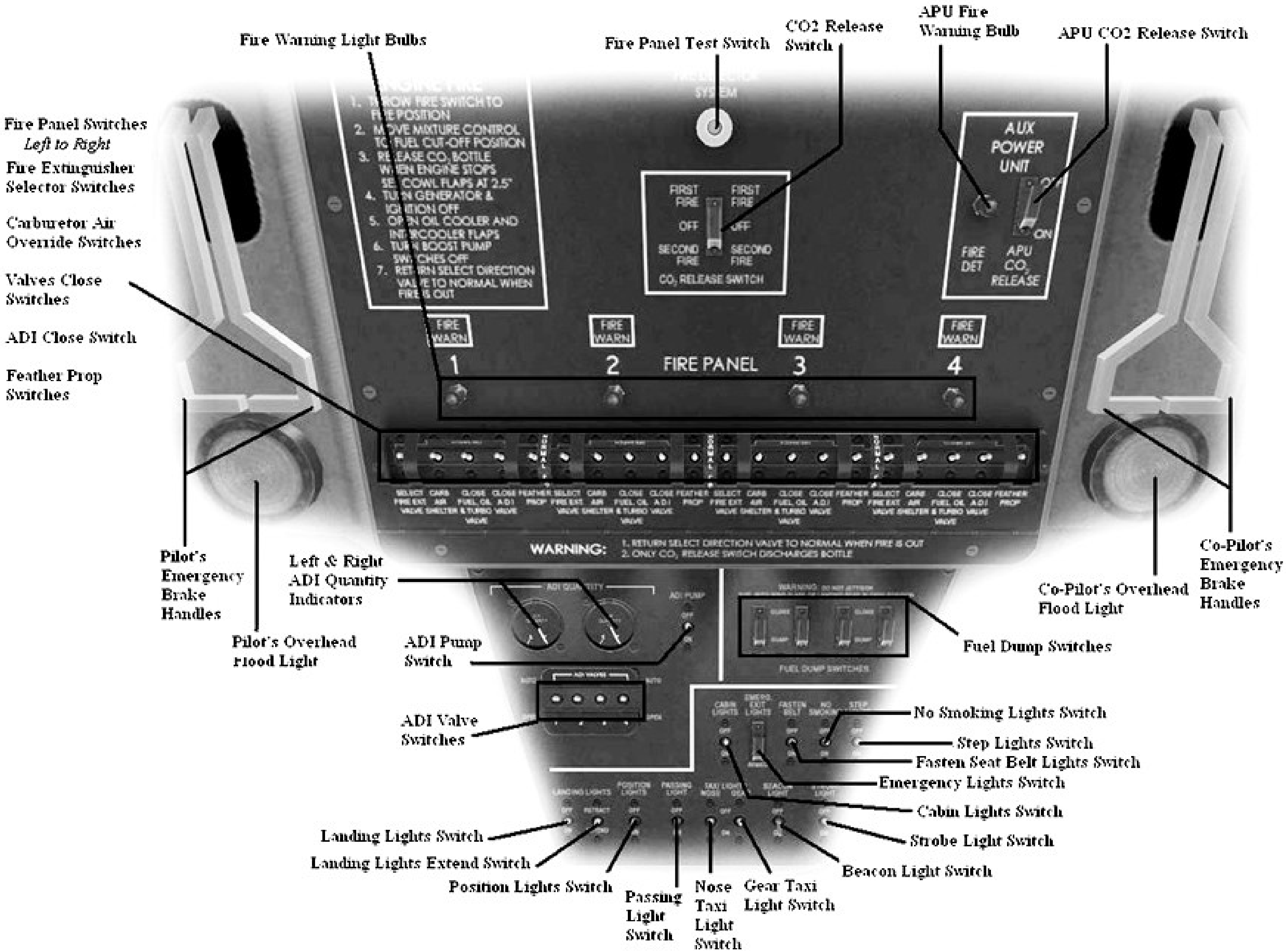


1. TURN AND BANK INDICATOR
2. ALTIMETER
3. COMPASS REPEATER
4. ATTITUDE INDICATOR
5. INSTRUMENT LANDING INDICATOR
6. AIRSPEED INDICATOR
7. VERTICAL SPEED INDICATOR
8. RADIO ALTITUDE INDICATOR
9. SUCTION WARNING LIGHT
10. AUTOPILOT LIGHT
11. OPEN DOOR WARNING LIGHT
12. TACHOMETER
13. MANIFOLD PRESSURE INDICATOR
14. OIL PRESSURE WARNING LIGHT
15. FUEL PRESSURE WARNING LIGHT
16. HYDRAULIC PRESSURE WARNING LIGHT
17. ALTIMETER
18. TURN AND BANK INDICATOR
19. ATTITUDE INDICATOR
20. HEADING INDICATOR
21. AIRSPEED INDICATOR
22. INSTRUMENT LANDING INDICATOR
23. RADIO ALTITUDE INDICATOR
24. VERTICAL SPEED INDICATOR
25. MARKER BEACON LIGHTS
26. HEADING INDICATOR
27. SUCTION INDICATOR
28. DUAL RMI INDICATOR
29. ALTITUDE SELECTOR
30. ALTITUDE SELECTOR INDICATORS
31. CLOCK
32. OUTISIDE AIR TEMP INDICATOR
33. TORQUE PRESSURE INDICATORS
34. LANDING GEAR LIGHT INDICATORS
35. LANDING FLAP INDICATOR
36. SURFACE CONTROL LOCK
37. MARKER BEACON LIGHTS
38. DUAL RMI INDICATOR
39. ATTITUDE INDICATOR
40. CLOCK
41. ALTITUDE SELECTOR INDICATORS

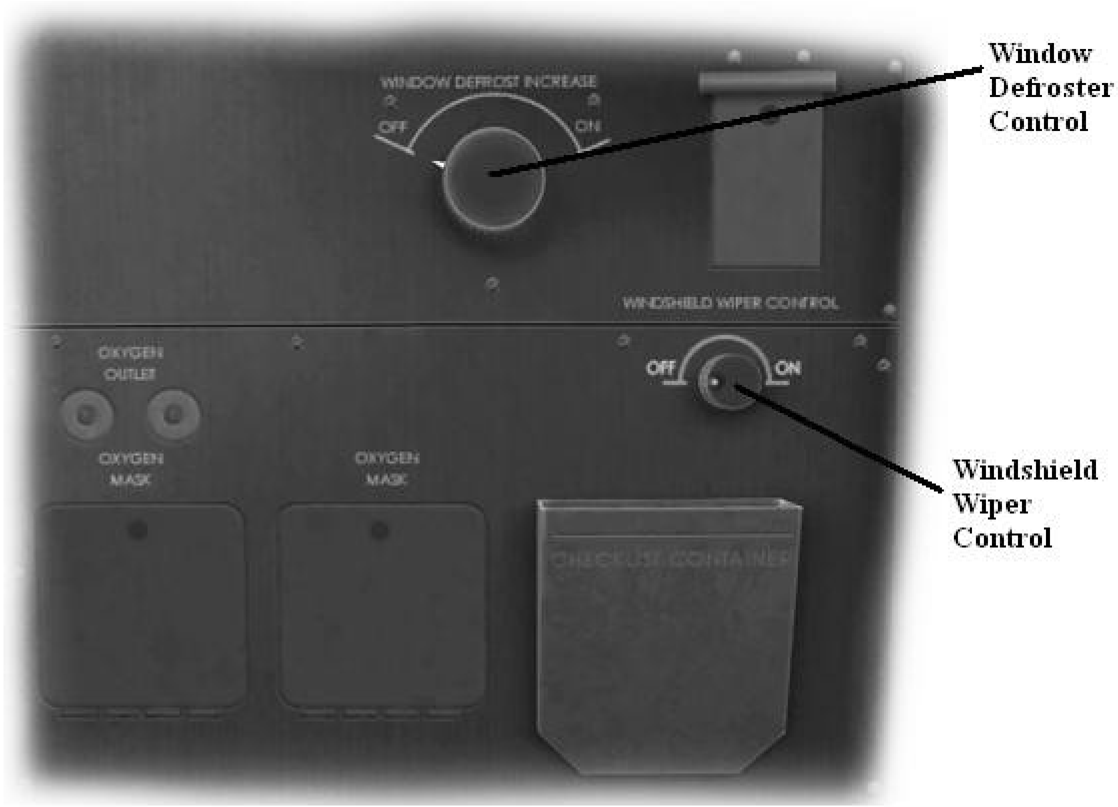
PILOT'S INSTRUMENT PANEL



CENTER CONSOLE



OVERHEAD CONSOLE



PILOT'S AUXILARY CONSOLE (left)

FLIGHT CONTROLS

SURFACE CONTROLS. The surface controls are conventional except for the left elevator trim tab. The rudder controls have a hydraulic boost.

CONTROL SURFACE LOCK. The control-surface lock handle is on the forward end of the engine control stand. When the lock handle is in the locked position the ailerons and rudder are in a neutral position and the elevators are in the down position.

The aircraft must be on the ground and the control stick pushed fully forward to engage the surface control lock.

The control surface locking pins are spring loaded to the unlocked position to prevent accidental locking of the controls.

TRIM TABS. The aileron tabs are conventional. The elevator trim control operates the left elevator trim tab only. The right elevator trim tab is actuated by the flaps. As the flaps are lowered, the trim tab is raised, thus giving a tail high moment to maintain stability. The rudder trim is conventional. Trim controls are on the engine control stand.

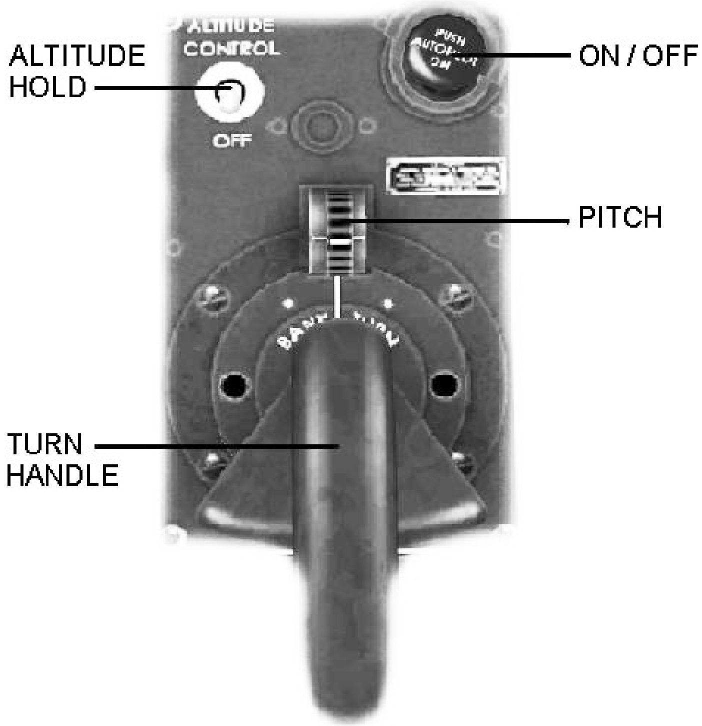
RUDDER BOOST. The airplane is equipped with a hydraulic rudder-boost system to aid in rudder control. When the control surface lock is unlocked the system is in operation. A guarded OFF--ON switch on the engine control stand is used to shut off the system in an emergency and during automatic pilot operation.

WINGS FLAPS NORMAL CONTROLS. The flaps are electrically operated by an UP--OFF--DOWN switch on the engine control stand. The switch is spring-loaded to OFF. A flap position indicator is on the instrument panel. A warning sound will be heard on take off if the flaps are not positioned between 20 and 30 degrees when the throttles are three-fourths or more open. Extending the flaps raises the right elevator trim tab proportionally to correct the nose up pitching condition normally caused by lowering the flaps. When the flaps are fully extended the trim tab is fully raised.

AUTOMATIC PILOT

AUTOMATIC PILOT. The Eclipse-Pioneer PB-10 automatic pilot is a simple and intuitive device. You turn the handle in the direction you want the aircraft to go, use the scroll knob for pitch, and can switch on altitude hold at any time. There is also an autopilot indicator on pilot's instrument panel to show you when the auto pilot is turned on. It is recommended that you use the auto pilot to help make climbing, cruising, and descending smoother and easier.

The autopilot has the following features: magnetic directional control of the airplane course, coordinated rudder and aileron turns, climbs and dives, automatic pressure altitude control, positive gentle flight corrections in all weather, and safety interlocks to prevent faulty manual operation of the control.



CONTROLLER. The autopilot controller is a central control unit which reduces the operation of maneuvering the airplane to the manipulation of a knob and a turn handle.

TURN HANDLE. The turn handle gives rudder and aileron coordinated turns with enough up elevator to maintain altitude. A detent marks the neutral position of the handle. The amount of handle displacement determines the bank angle and rate of turn.

PITCH. The pitch knob (pitch reference) controls the elevators for climb or dive. Forward rotation from the neutral position results in dive and aft rotation results in climb. The angle of climb or dive is proportional to the knob rotation, but maximum angle is 18 degrees in either direction.

ON / OFF (CLUTCH SWITCH). The clutch switch is forward of the controller on the engine control stand. The automatic pilot is engaged by pressing the clutch switch. This operates a clutch in each of the servos and in the master direction indicator. After engaging, the PB-10 will keep the airIplane in the attitude and heading which it had the instant the switch was pressed. As a safety factor, interlocks prevent the autopilot from being engaged if engine power fails or if any other condition is present that would produce malfunctioning of the automatic control.

ALTITUDE CONTROL SWITCH. The altitude control switch controls a barometric unit which automatically controls the elevators to maintain the pressure altitude being flown when the switch is turned ON. The altitude control switch is always ready for operation; it is not necessary to center the trim knobs or fly straight and level before moving the switch to ON. The elevator trim should be checked occasionally to prevent excessive servo operation.

AUTOPILOT INDICATOR. This lamp illuminates when the autopilot clutch switch is engaged. If the clutch or servo disconnect lever is disengaged the light will turn off.

AUTOPILOT EMERGENCY DISCONNECTOR. This lever, on the forward end of the engine control stand, operates the server disconnects which mechanically disengage the autopilot from the airplane control surfaces. These clutches (servo disconnects) completely disengage the servo pulleys from the servo drive shaft so that the pulleys are free to turn with control cable movement.

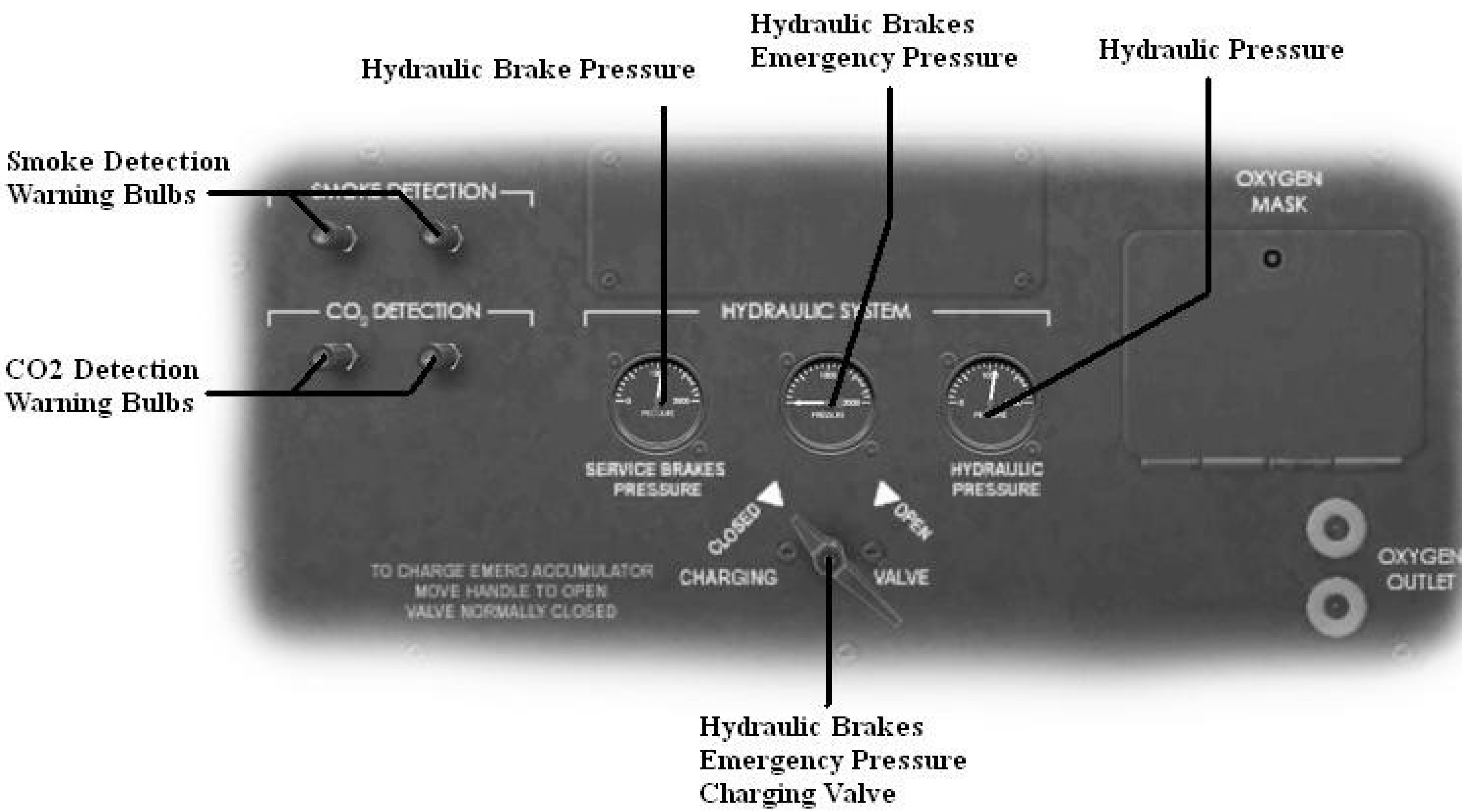
WATER INJECTION (ADI)

WATER INJECTION SYSTEM. The water injection, known as **ADI** (Anti-Detonant Injection), system has two 30-gallon supply tanks; each tank supplies the two engines on its side of the airplane. The supply has a duration of approximately 8 minutes at full takeoff power. An ON--OFF pump switch, four ADI override switches, and four pressure lights are on the forward end of the engine control stand. An ADI quantity indicator is on the forward overhead panel.

WATER INJECTION SYSTEM CONTROLS. An ADI PUMP switch, on the forward overhead panel controls water injection pumps which supply water under pressure to the ADI shutoff valves. When the four ADI VALVE switches, on the engine control stand, are placed in the AUTO position, the shutoff valves are automatically controlled by a manifold pressure switch on each engine. The manifold pressure switches automatically open the shutoff valves when the throttles are advanced to 45 inches of MAP or above. Water is then supplied to the water regulators, carburetor derichment valves, water pressure switches (indicator lights), and subsequently into the engines. The manifold pressure switches automatically close the ADI valves when the manifold pressure is reduced to approximately 41 inches of MAP. The OPEN position of the ADI VALVE switches provides a means of manually opening the shutoff valves in event of manifold pressure switch malfunction. Four water pressure lights on the engine control stand illuminate when the pumps are turned on and will go out when sufficient water pressure is in the line between the regulator and the engine. Four CLOSE ADI VALVE switches on the fire control panel shut off the fluid flow when placed in the FIRE position.

CO-PILOT'S STATION

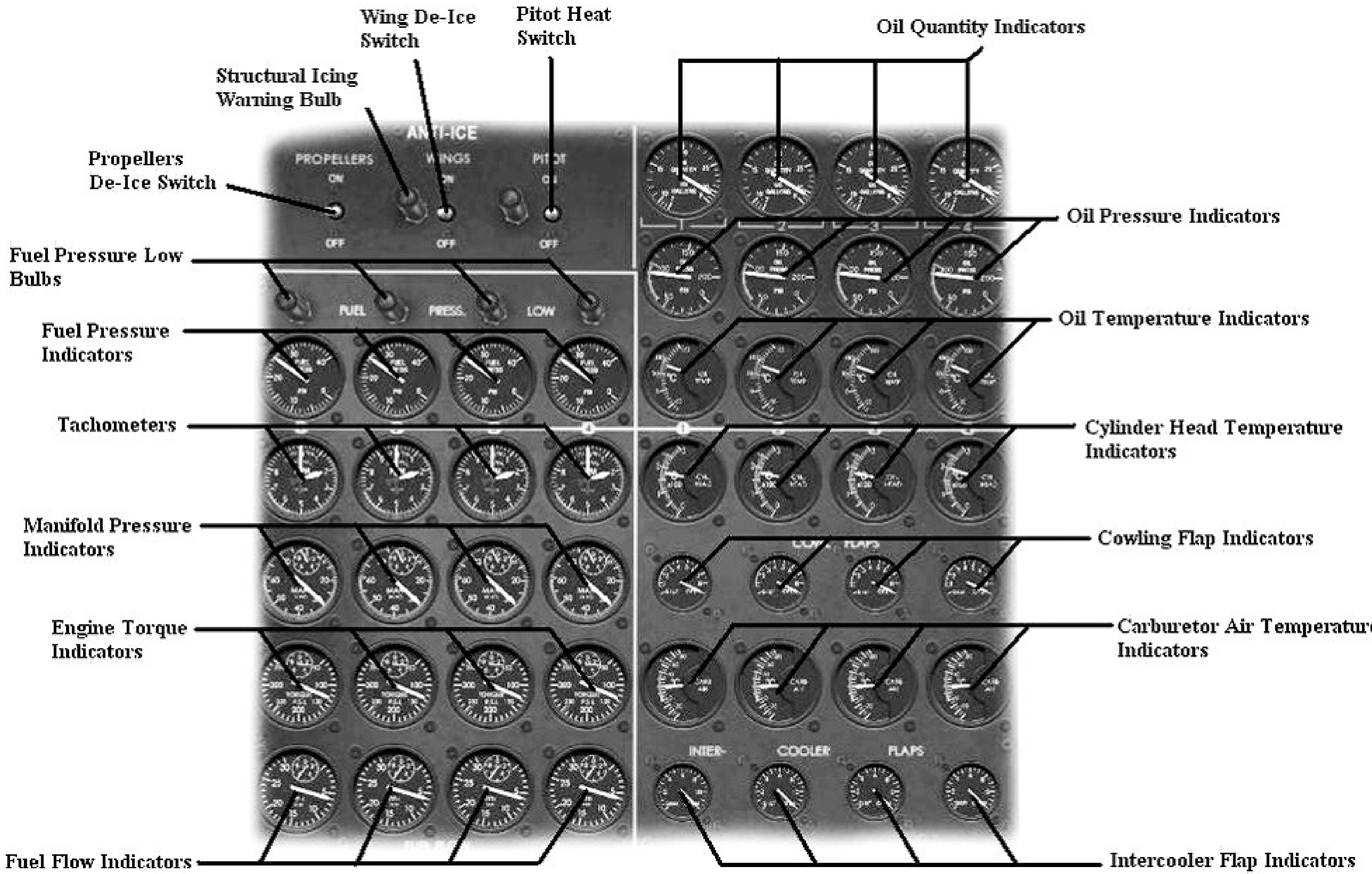
THE CO-PILOT'S STATION shares the forward instrument panel, overheard panel, and center console. Additionally, the co-pilot has an auxiliary panel on the lower right.



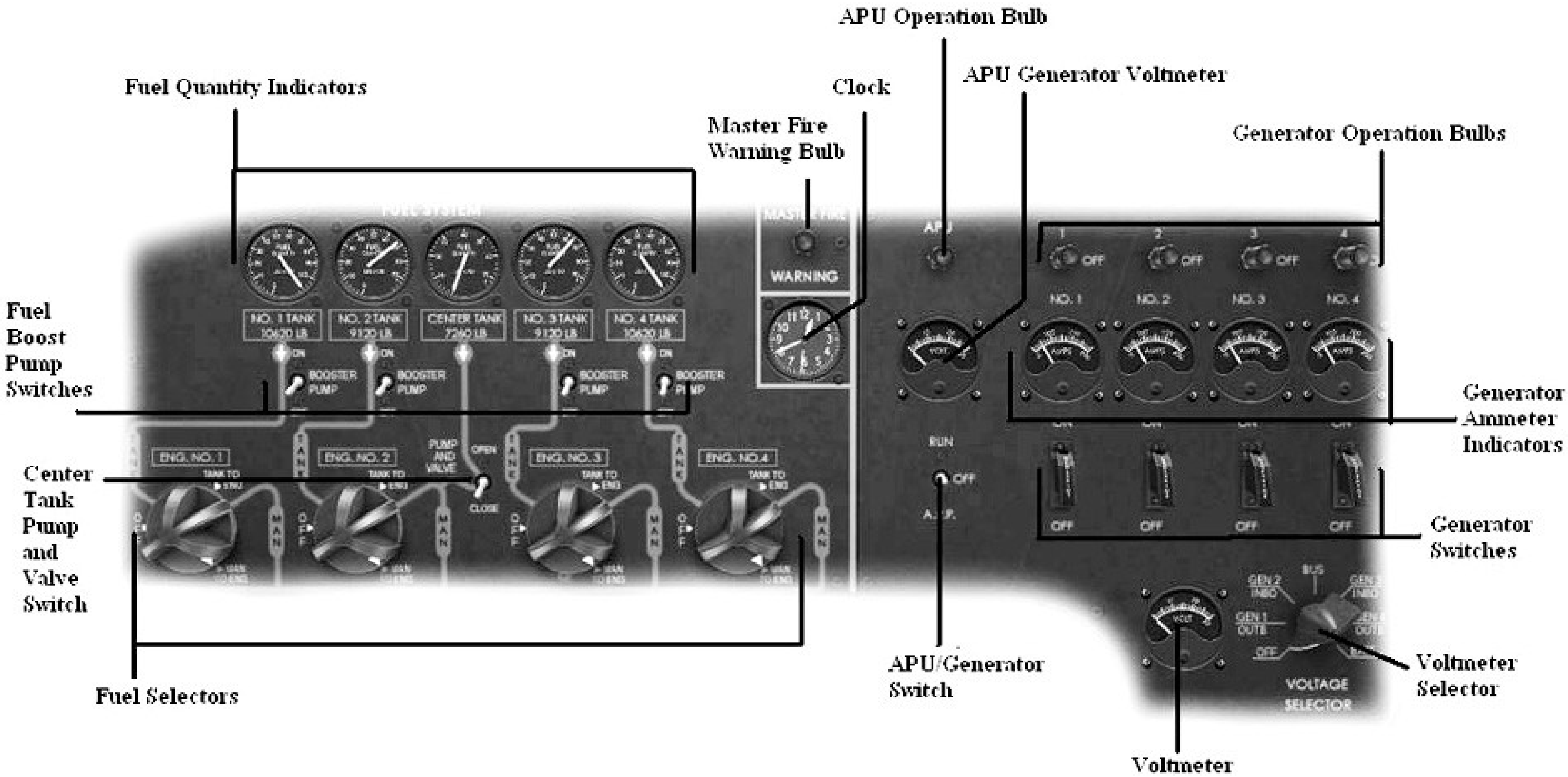
CO-PILOT'S AUXILARY CONSOLE (right)

ENGINEER'S STATION

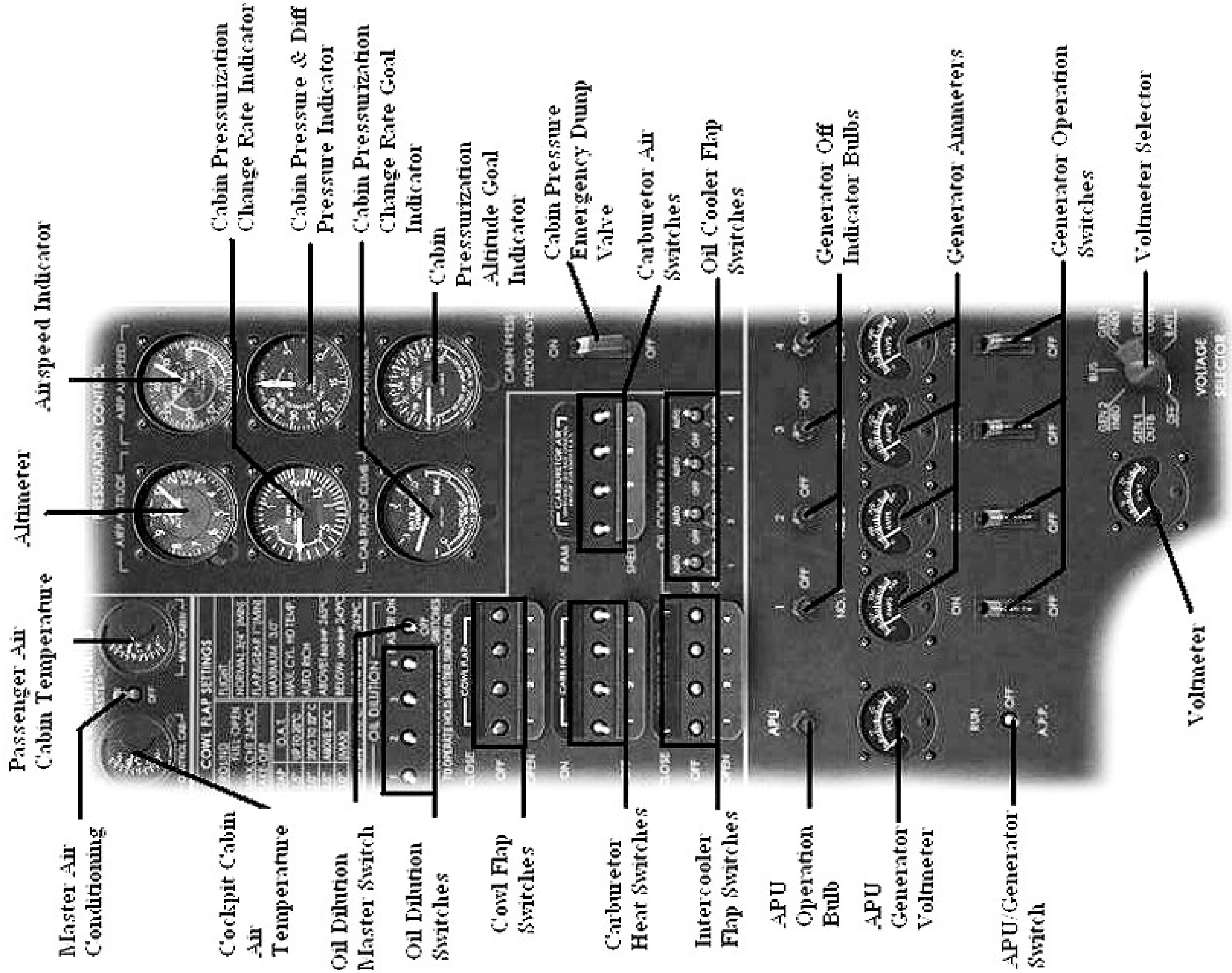
ENGINE INSTRUMENTS. The engine instruments on the engineer instrument panel consist of four torque-meters, tachometers, manifold pressure, cylinder head temperature, fuel flow, fuel pressure, oil pressure, oil temperature, and carburetor air temperature. Four indicating turbo bearing temperature and two dual-indicating exhaust back-pressure indicators are mounted in the turbo bearing temperature alarm panel on the engineer instrument panel.



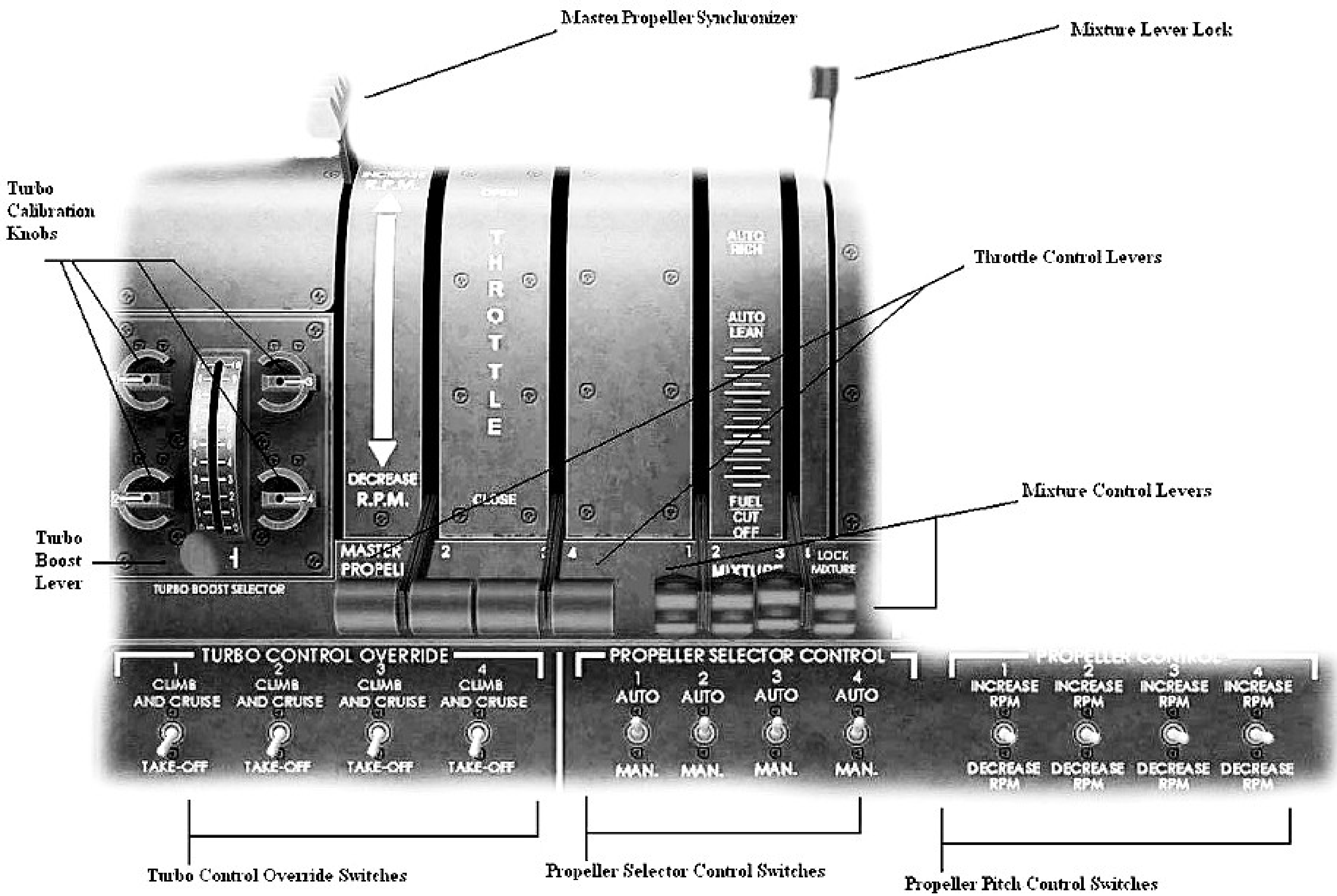
ENGINEER'S PANEL (center)



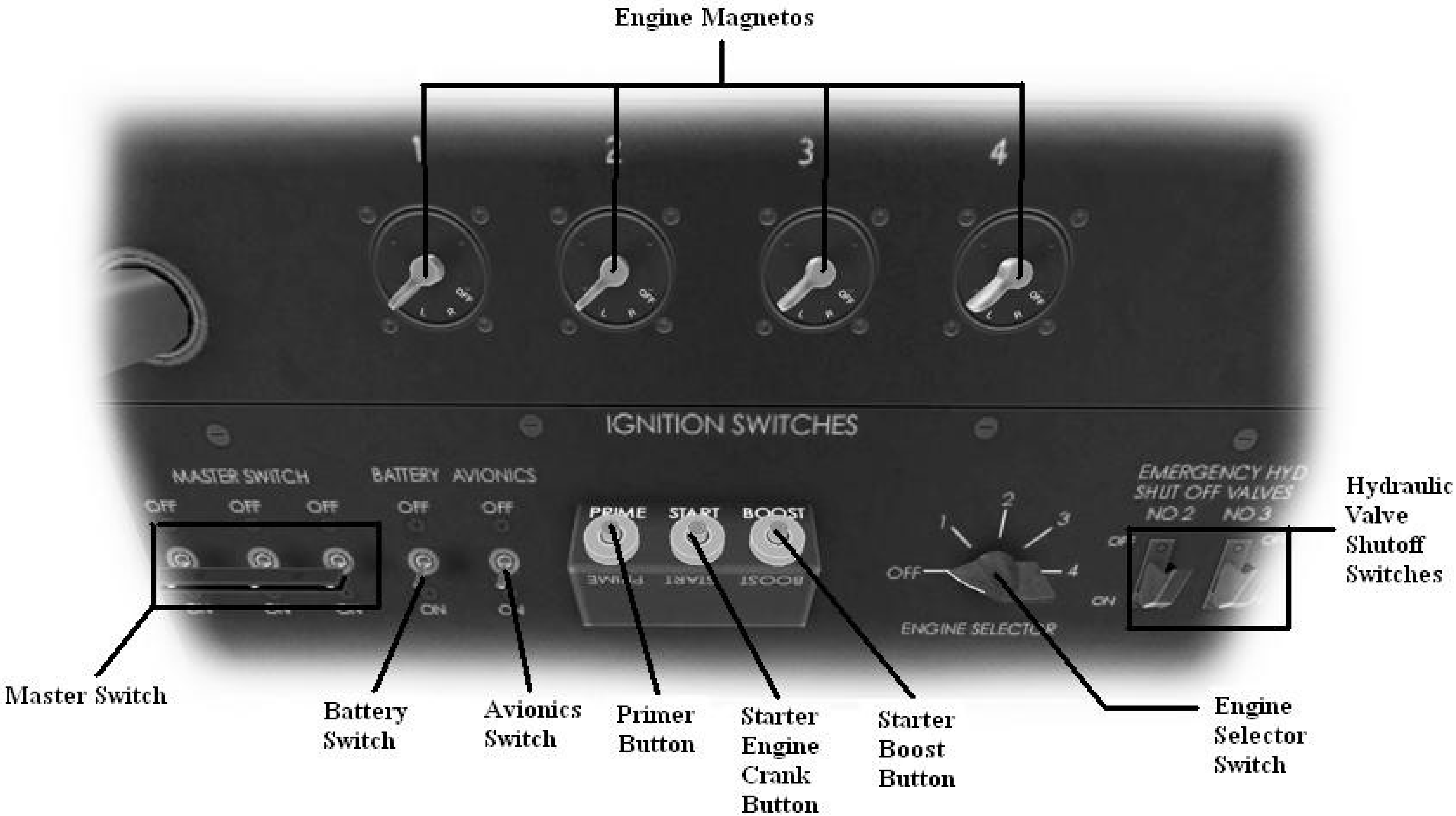
ENGINEER'S PANEL (lower)



ENGINEER'S PANEL (right)



CENTER CONSOLE



UPPER CONSOLE

THROTTLES. Four throttle levers are installed on the engine control stand. The throttles control engine power for both forward and reverse thrust.

Three positions are marked on the throttle quadrant: OPEN, CLOSED, and REVERSE OPEN. Movement of the throttles from CLOSED to OPEN is conventional. Movement of the throttles from CLOSED to REVERSE OPEN, for reverse thrust, is accomplished by raising the throttle levers over the stops and then moving them aft toward REVERSE OPEN. Continued aft movement of the throttles toward REVERSE OPEN increases reverse thrust power. Forward movement of the throttles past the stops toward the OPEN position will return the propellers to normal pitch.

It is not possible to move the throttles to the REVERSE OPEN position while in flight, because of a solenoid-operated catch which stops the throttles at the CLOSED position. The catch releases when any one of the landing gears contacts the ground; therefore, reverse pitch is possible immediately upon landing.

THROTTLE BRAKE. A throttle friction brake is at the right of the throttles

MIXTURE CONTROLS. Four mixture controls are on the aft end of the control stand. The mixture controls feature five distinct positions: FUEL CUTOFF--AUTO LEAN--AUTO RICH and intermediate positions (exactly the same as the real aircraft, and provide the same change in fuel/air ratio as the real aircraft). Placing a lever in FUEL CUTOFF shuts off fuel flow at the carburetor. The AUTO LEAN and AUTO RICH carburetor mixture settings are obtained by placing the mixture levers in the appropriate detent position.

The fuel/air ratios set by the mixture control were derived through many hours of careful testing after consulting the actual aircraft engine performance charts. These ranges very carefully duplicate the fuel flows and engine powers of the real aircraft. In all cases and at all power settings as specified in the actual manual, the Wings of Silver Stratocruiser will reproduce virtually identical real-world powers and fuel flows using the same mixture, RPM, and torque pressure values specified in the aircraft manual. Thus, as with other Wings of Power and A2A aircraft, the actual aircraft manual can be used for flight planning.

PROPELLER CONTROLS. The propeller controls consist of the master synchronizer lever, four propeller selector levers, the auto-feathering system, and the reverse pitch throttle lock on the engine control stand. Two dual-indicating tachometers are on the pilot's instrument panel. See the PROPELLORS section below for more detail.

MANIFOLD PRESSURE GAUGES. Four manifold pressure gauges are on both the pilot's and engineer's instrument panel. These gauges represent the air pressure being fed to the carburetor, and give indication of the amount of power being produced. The manifold pressure gauges give a direct reading of manifold pressure in inches of Hg.

TACHOMETERS. Four single-indicating engine tachometers are on both the pilot's and the engineer's instrument panels. The tachometers are generator motor units. Each tachometer generator is engine-driven and generates its own current which controls the indicator motor at a synchronized speed. The pilot's tachometers measure engine speeds in increments of 100 rpm and the engineer's tachometers measure engine speeds in increments of 20 rpm.

TORQUEMETERS. . The torque meter was introduced to complex piston engine aircraft shortly after World War II. Four individual torquemeters are on both the pilot's and the engineer's instrument panels. It indicate torque pressure in psi and are used as a direct means of measuring the twisting force the engine is outputting. Keep in mind that total torque does not equal total engine power output (horsepower), however, horsepower is directly created when you combine torque and engine RPM.

However, the torque reading, and not the manifold pressure, is the final value to be used in setting power. All manifold pressure (boost pressure) values are therefore approximate and should be used to set initial power. Then, fine-tune your engines so that the torque value is as specified in the power chart provided in the checklists in this manual.

If you have a copy of the actual B377 flight manual, you will find that the torque values specified in the engine power schedule produce precisely the same horsepower in the Wings of Silver Stratocruise as specified in the actual manual when engine RPM and torque settings are followed. For example, the manual calls for 3500 HP at 2700 RPM when the engine is at 247 PSI of torque at 60” of manifold pressure (boost pressure). The shaft horsepower of the A2A B377 is 3500 HP with those power settings. This accuracy is completely consistent across the entire range of possible power settings for the R-4360 engines modeled in the Wings of Silver Stratocruiser, whether they be in manual lean at very low cruise power settings or at maximum climb power, or any setting in between.

A second example is in the 1200 HP maximum range cruise setting. The mixture control can be set to either AUTO RICH, AUTO LEAN, or to a manual lean setting as desired. The engine is set to 1450 RPM and the torque is set to 158 PSI. The engines will produce 1200 HP at this setting. The manifold pressures required to achieve the correct torque value will vary with the mixture setting and with altitude just as in the real aircraft.

The actual manifold pressures need to achieve the rated powers will vary slightly from those specified as these are just approximate values and will vary with air temperature, relative humidity, and altitude.

CYLINDER HEAD TEMPERATURE GAUGES. Four cylinder head temperature gauges of the direct current type are on the engineer's instrument panel. The cylinder head temperature gauges are resistance bulb type units and indicate cylinder head temperature in degrees Centigrade.

FUEL FLOWMETERS. Each engine has a fuel flowmeter, located on the engineer's instrument panel. The flowmeters show rate of fuel flow in hundreds of pounds per hour.

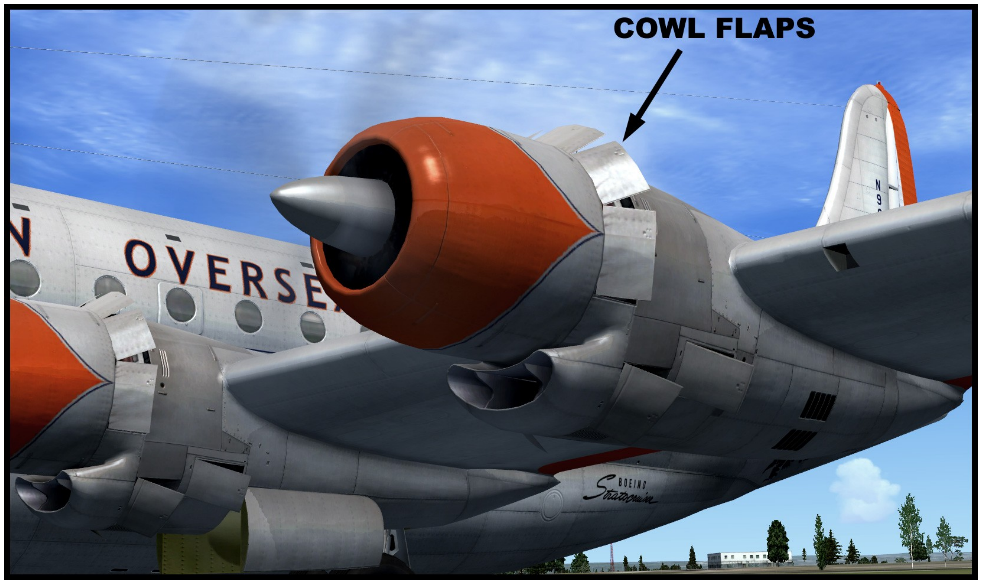
FUEL PRESSURE GAUGES. Four fuel pressure gauges on the engineer's instrument panel indicate fuel pressure in psi for each engine.

FUEL LOW PRESSURE WARNING LIGHTS. A fuel low pressure warning light adjacent to each fuel pressure gauge, illuminates when fuel pressure is low.

ENGINE COOLING SYSTEM

COWL FLAPS. The flow of cooling air for each engine is controlled by two ground-adjustable and seven electrically operated, flight adjustable, cowl flaps. The cowl flaps are actuated by seven jackscrews driven by a single electric motor through a flexible drive shaft system.

COWL FLAP SWITCHES. Four cowl flap switches, one for each engine, are on the engineer's instrument panel. These switches electrically control the opening and closing of the cowl flaps. The switches have OPEN--OFF--CLOSE positions and are spring-loaded from the OPEN and CLOSE positions to the OFF position. Gang flappers permit simultaneous actuation of all four switches to either position. The cowl flaps will remain stationary when the switch is released to OFF.

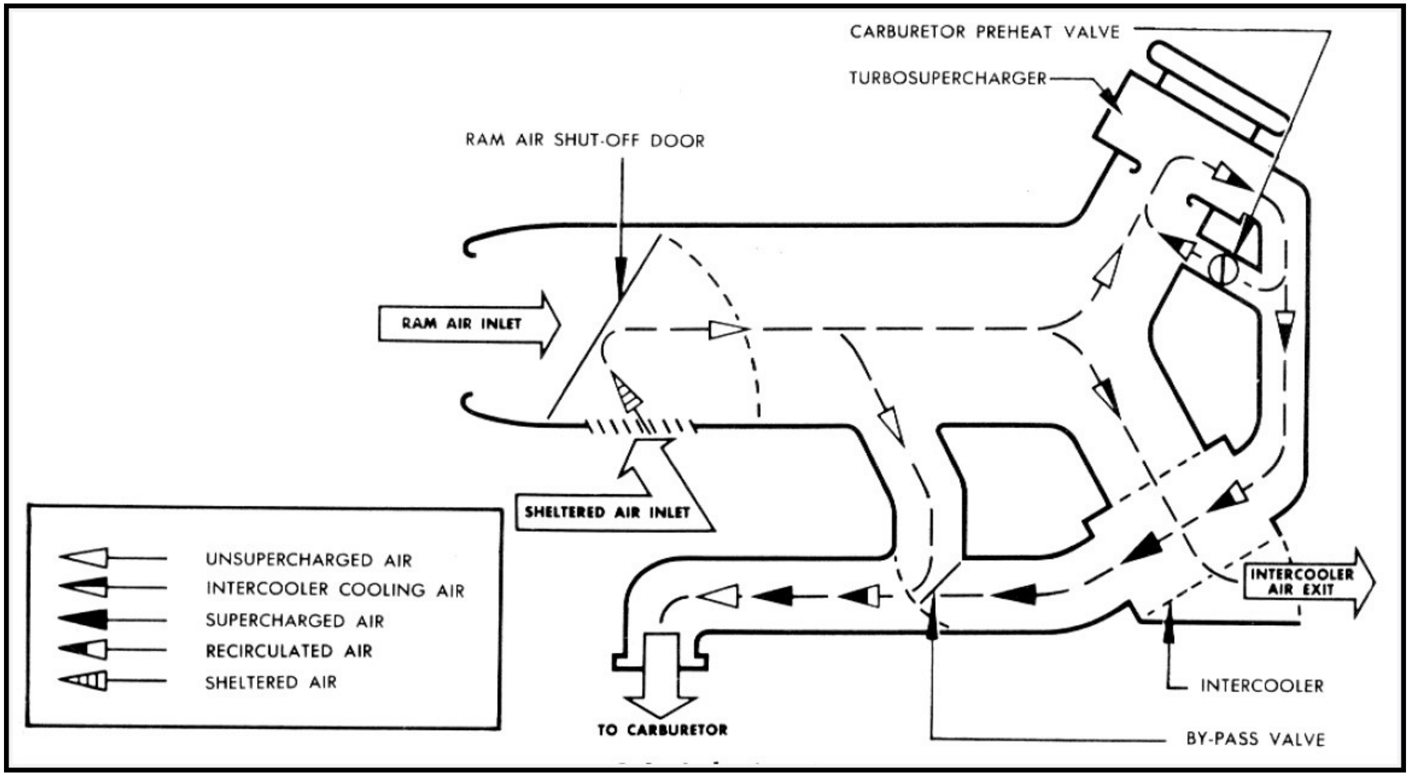


COWL FLAP POSITION INDICATORS. The position of the cowl flaps is indicated in inches of opening by four cowl flap position indicators on the engineer's instrument panel. The reading is taken from the flap screw driving mechanism.

THE INDUCTION SYSTEM

The induction system consists of an entry scoop, a sheltered air door and sheltered air inlet assembly, turbosupercharger, intercooler, carburetor preheat valve, and connecting ducting. Either ram air or supercharged air may be supplied to the carburetor through a bypass door controlled by differential pressure. Supercharged carburetor air temperature is controlled by positioning of the carburetor preheat valve and intercooler flap. For details on turbosupercharger and turbosupercharger controls, see TURBOSUPERCHARGERS Sections below.

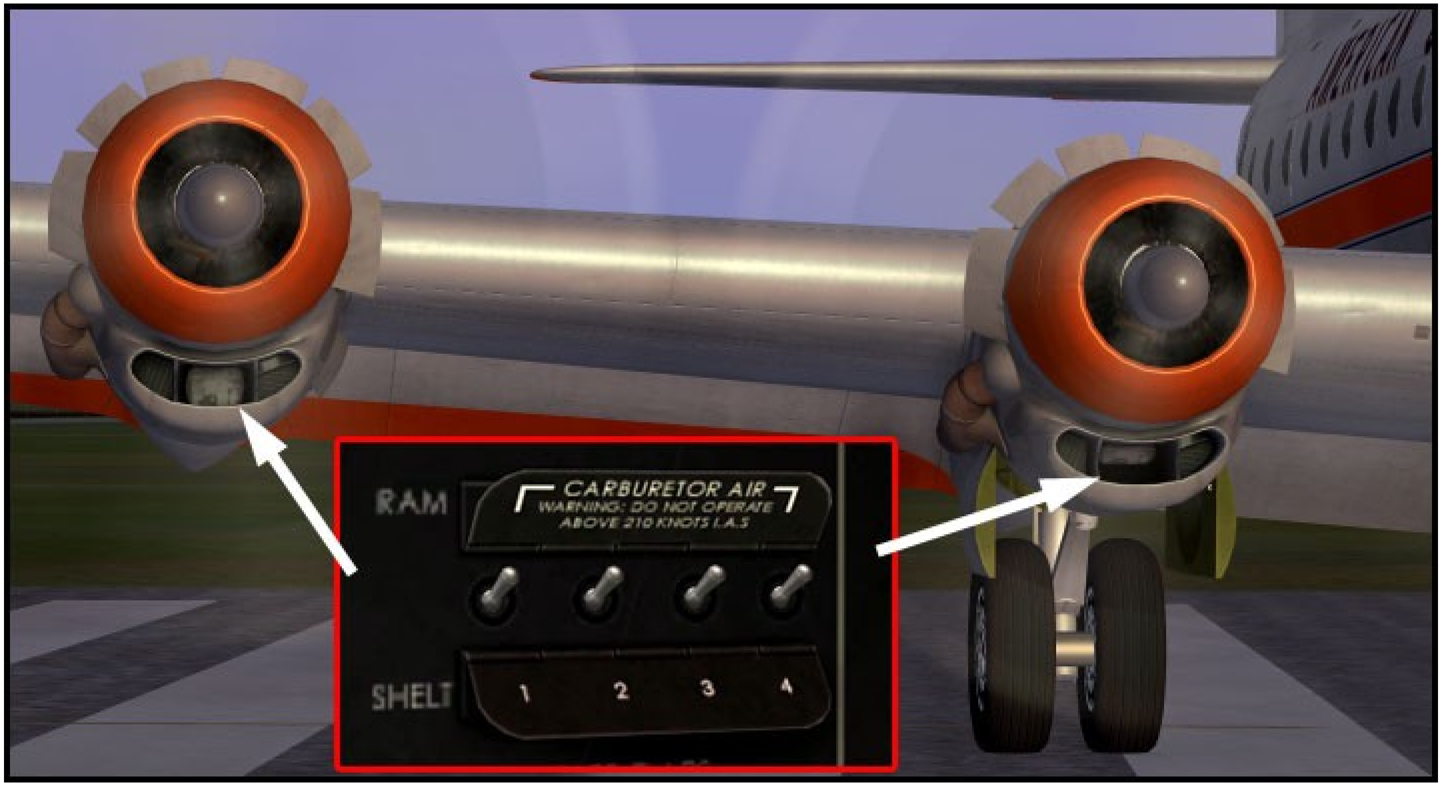
CARBURETOR HEAT CONTROLS. Four ON--OFF switches on engineer's instrument panel control the carburetor preheat valves. A spring loaded gang switch simultaneously operates all four switches. Opening the valve allows recirculation of a portion of the pressurized air through the supercharger. The use of the valves must be in conjunction with carburetor air temperature and manifold pressure indicators. The supercharger must be operating before preheat is possible. Circuit breakers for the system are on the overhead electrical panel.



CARBURETOR AIR CONTROLS. The RAM--SHELTERED switches, on the overhead instrument panel, control the ram air shutoff door. In the RAM position, air enters the air scoop and passes directly into the induction system. In the SHELTERED position, the shutoff door closes the air intake scoop and allows air to enter the induction system from the bottom of the air scoop. Moisture is partially eliminated from the carburetor air by this method. Four fire switches on the overhead electrical fire panel close the ram air door when the fire switches are placed in the FIRE position.

RAM AIR

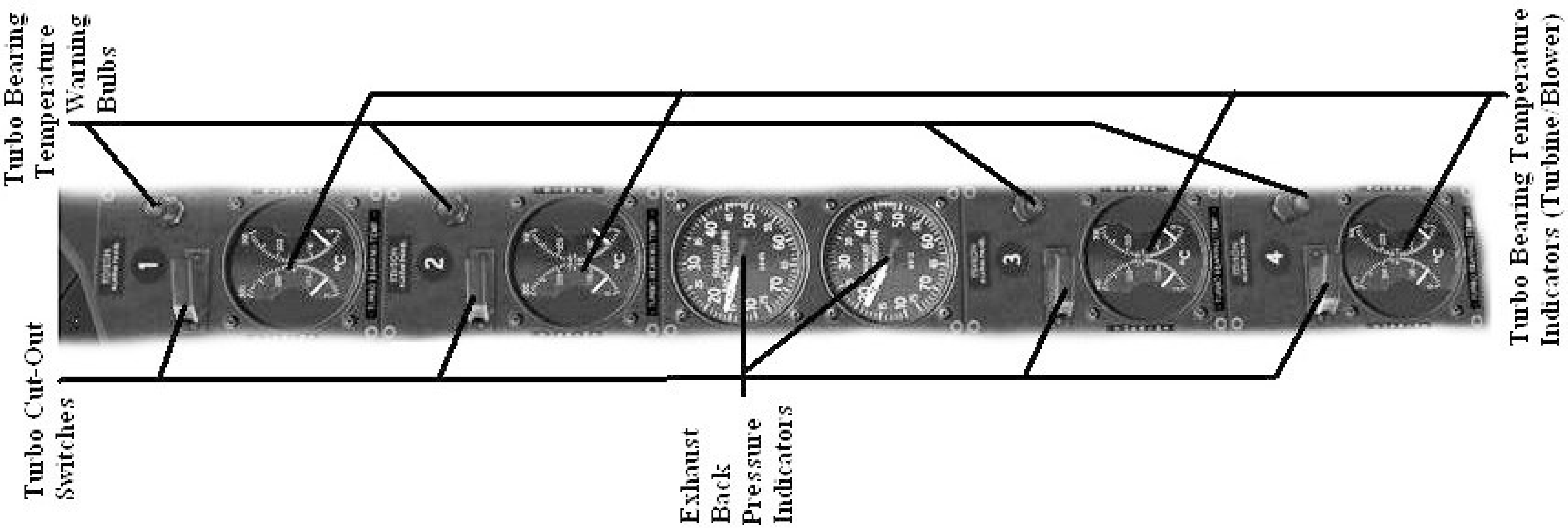
Using RAM AIR ensures a nice flow of air into your engines and actually adds power when the aircraft is in flight. If RAM AIR is OFF, your turbo charger will have to work harder to produce the same power. If you are operating in icing conditions, you may want to turn your RAM AIR OFF at least until your CAT is in the green.



TURBOSUPERCHARGERS

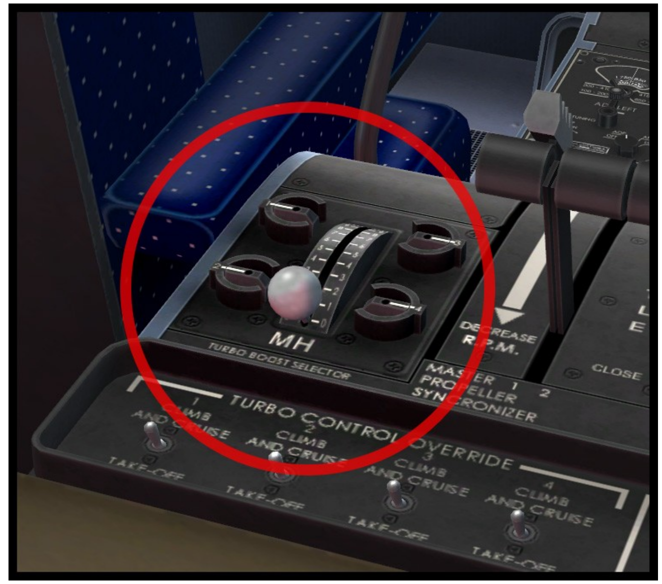
TURBOSUPERCHARGERS. The engine exhaust-driven turbosuperchargers are used for altitude power and cabin pressurization but are not used for takeoff and landing. The turbo controls consist of a turbo selector lever, four calibrating potentiometers (grouped around the selector lever), and four turbo control override switches all on the engine control stand.

The turbo instruments consist of the manifold pressure gauges on the pilot's instrument panel and engineer instrument panel, two dual indicating exhaust back-pressure indicators and four Edison alarm panels. Each Edison panel has a dual indicating turbine bearing and blower bearing temperature indicator, a warning light, and a master fire warning system cutout switch. When either of the maximum allowable bearing temperatures is exceeded, the warning light will illuminate.



ENGINEER'S PANEL (LEFT)
TURBO GAUGES

TURBOSUPERCHARGER SELECTOR LEVER (TBS).

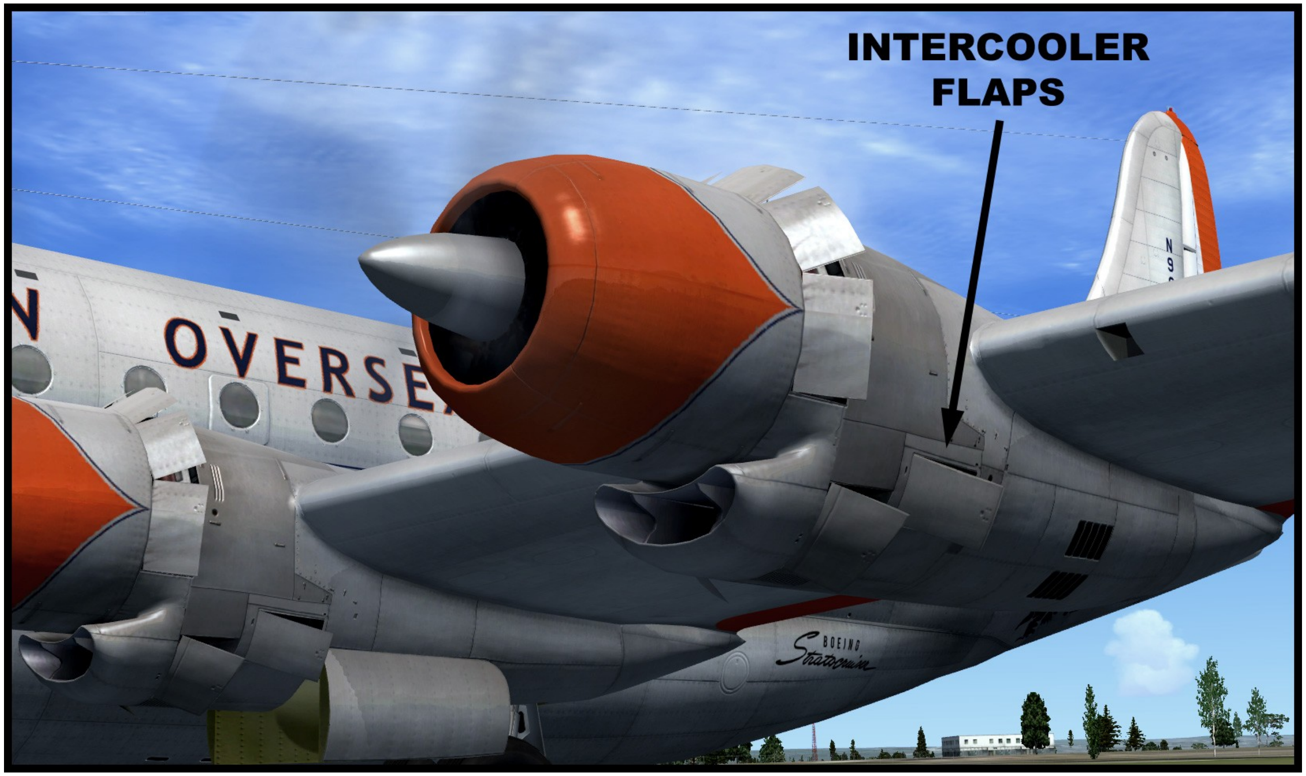


The turbosupercharger selector lever is in the center console within the reach of the pilot and the engineer. This lever is calibrated from 0 to 10. Movement of the lever from the 0 position applies turbo in proportion to the number selected. The four calibrating potentiometers provide a means of setting a uniform manifold pressure on all engines. The four turbo control override switches have a TAKE-OFF position and a CLIMB AND CRUISE position. When the switches are in the TAKE-OFF position, the normal turbo control system is overridden and the waste gates move open. When the switches are in the CLIMB AND CRUISE position, the normal TBS control system functions; however, an automatic pressure switch (actuated by exhaust back-pressure) will override the normal control system and open the waste gate to prevent the exhaust back-pressure from exceeding 49 inches of mercury. The automatic override system incorporates a transformer which boosts the voltage supplied to the waste gate motor. This provides for faster and more positive action in opening the waste gate.

TURBOSUPERCHARGER OVER-BOOST LIMITING SYSTEM. The overboost limiting system is a safety device to protect the powerplant from the effects of accidental overboost or malfunction. The system consists of an exhaust back-pressure sensing switch and a relay for each engine. The exhaust back-pressure sensing switch, sensing an exhaust back-pressure in excess of the maximum operating pressure will cause the wastegate to be driven open. However, engine damage is still possible by over-working the turbo system.

TURBO CALIBRATION KNOBS. Each of the four calibrating knobs permits adjustment of its wastegate control bridge circuit to set a uniform manifold pressure for all engines. They provide a means of compensating for small variations in the individual engine and turbosupercharger control characteristics.

INTERCOOLERS. An intercooler, located downstream from the turbocompressor, is used to provide cooling of supercharged air to the carburetor. Intercooler operation is controlled electrically by positioning of the intercooler flap, which limits the amount of ram air passing through the intercooler.



INTERCOOLER FLAPS. Four OPEN--OFF--CLOSE switches, on the overhead instrument panel, control the intercooler flaps. The switches are spring-loaded to the OFF position. The intercooler flaps are positioned for carburetor air cooling by moving the switches in the desired direction. The intercooler flaps automatically close when the fire switch is actuated and when the carburetor air switches are placed in the SHELTERED position. Four flap position indicators, on the pilot's instrument panel, show intercooler flap position in inches of opening.

ENGINE STARTING CONTROLS

MAGNETOS. Four rotary-type engine magneto switches are on the overhead electrical panel. Each ignition lever selects RIGHT, LEFT, BOTH, and OFF positions for all magnetos.

ENGINE SELECT. Use the Engine Selector to choose which engines the PRIME, START, and BOOST buttons operate.

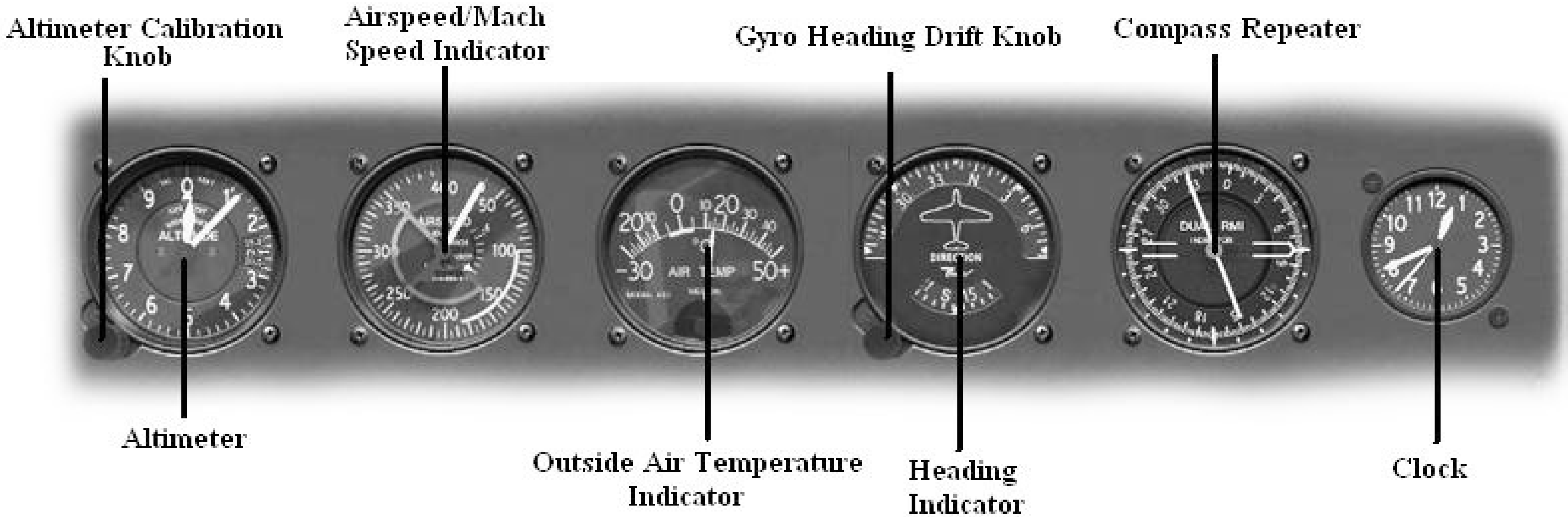
PRIME. The PRIME push button on the left electrically controls engine priming which is accomplished by injecting fuel through the carburetor acceleration pump nozzles.

STARTER. The START button controls the direct cranking starter.

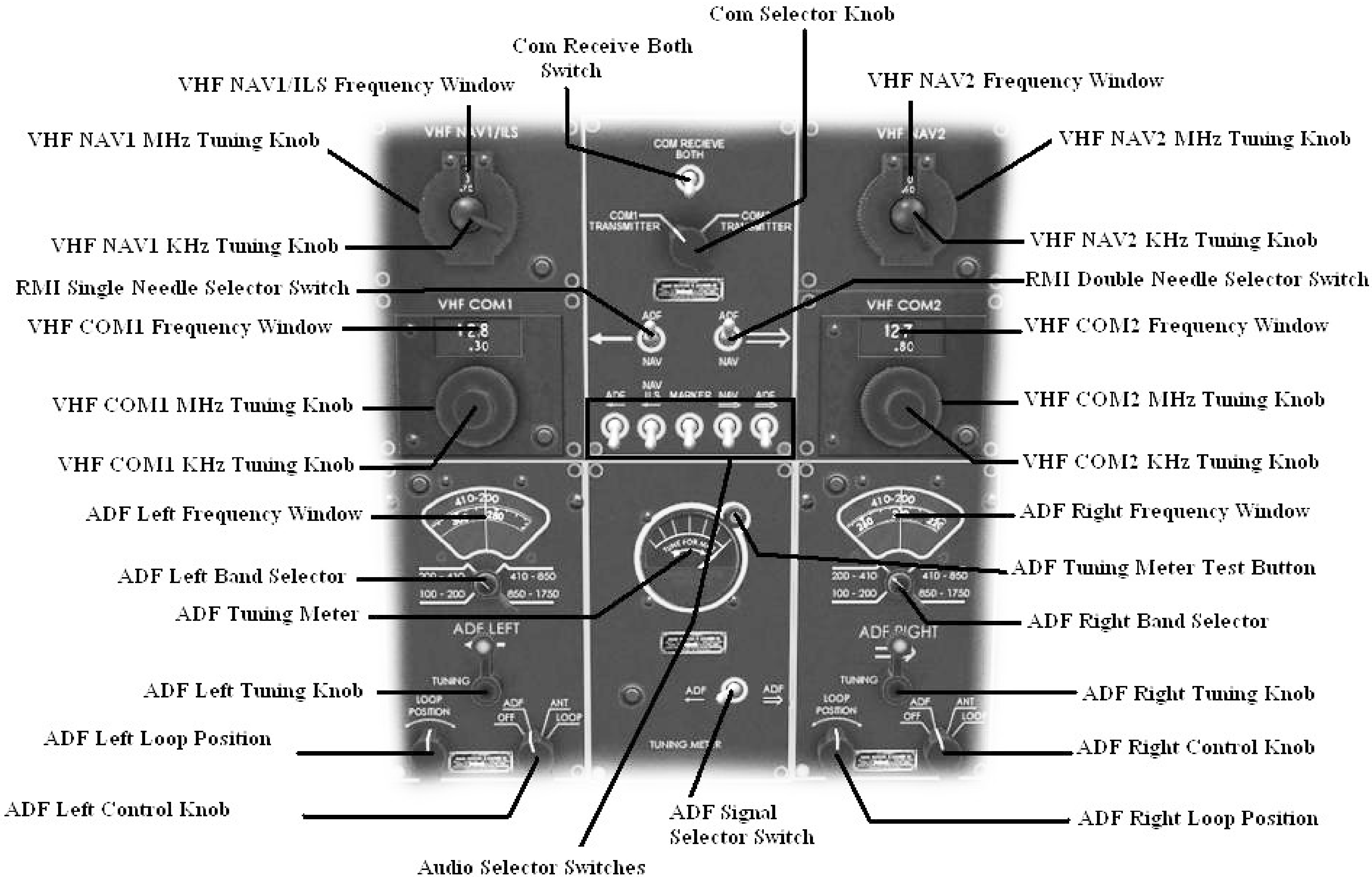
BOOST. The BOOST push button gives extra ignition spark for engine starts.

NAVIGATOR'S STATION

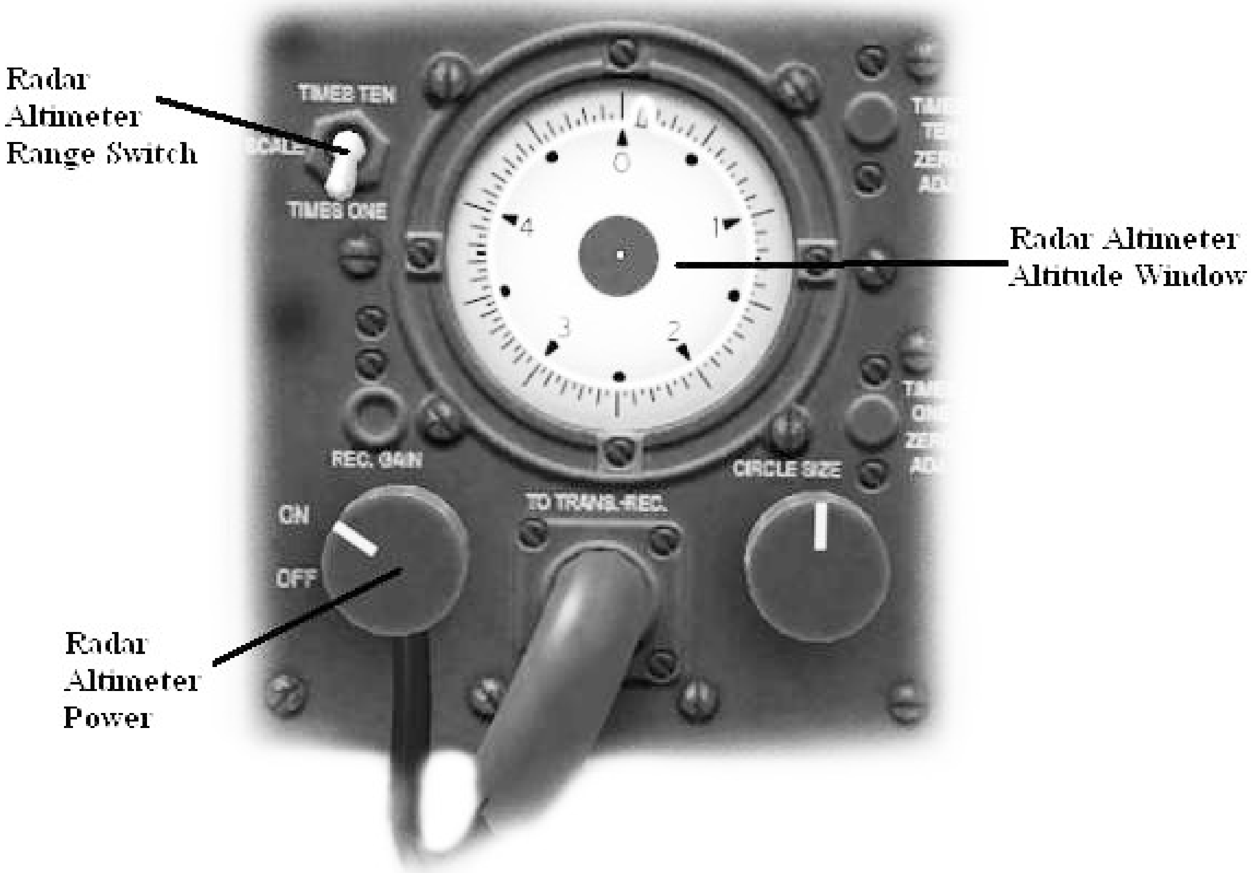
THE NAVIGATOR'S STATION consists of a table with maps, a window, and primary navigation instrumentation.



NAVIGATOR'S MAIN INSTUMENT PANEL



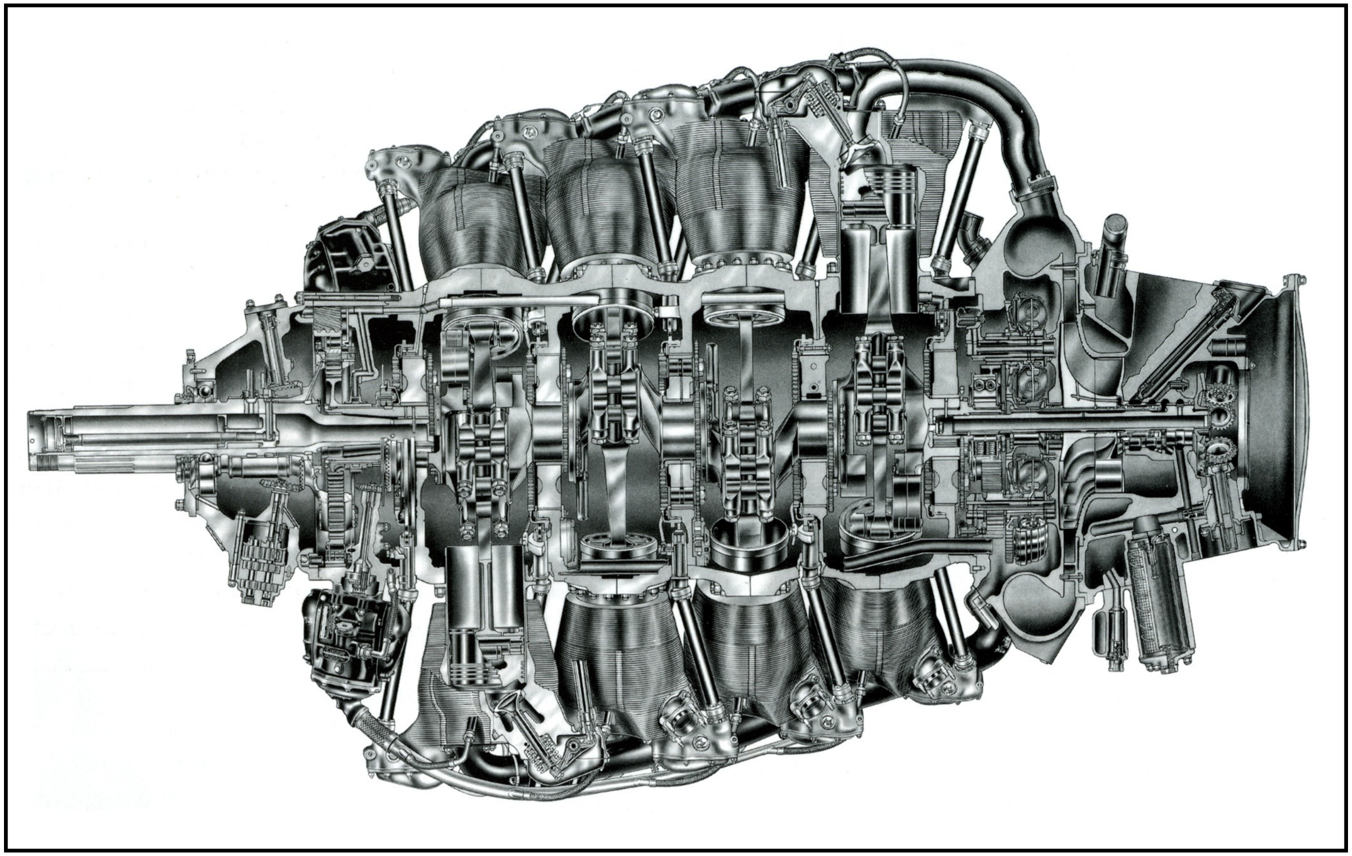
NAVIGATOR'S RADIOS



NAVIGATOR'S RADAR ALT

POWER PLANT

The Stratocruiser is powered with four Pratt and Whitney R-4360, four row, 28-cylinder, Wasp Major radial engines. The engines are equipped with a low tension ignition system and a torquemeter indicating system. Each engine is equipped with a single stage, single speed internal supercharger, and an exhaust-driven turbo-supercharger. Water injection is provided for high power settings. Each engine is capable of developing a maximum (at sea level) of 3250 BHP dry (without water injection) or 3500 BHP wet (with water injection).



Pratt & Whitney R4360 Cutaway
(United Technologies Archive)

Chapter 6: Propellers

Each engine drives a four-bladed propeller with full feathering and reverse pitch features. The propeller reduction gearing ratio is .375 to 1.

PROPELLER CONTROLS. The propeller controls consist of the master synchronizer lever, four propeller selector levers, the auto-feathering system, and the reverse pitch throttle lock on the engine control stand. Two dual-indicating tachometers are on the pilot's instrument panel.

MASTER SYNCHRONIZER LEVER. The master synchronizer lever, when moved from the full DECREASE RPM position with the propeller selector switches in the AUTO positions, energizes the master synchronizer motor. The master synchronizer motor then provides synchronized constant speed governing of the engines through the complete operating range and simultaneous selection of identical RPM of all propellers. The RPM is determined by the relative position of the master synchronizer lever in the graduated scale between INCREASE RPM and DECREASE RPM positions.

PROPELLER SELECTOR CONTROLS. The four individual selector switches provide a means of selecting automatic or manual operation of each propeller. The Propeller selector switches have two positions, AUTO and MAN (manual). The propeller control switches have three positions, INCREASE R.P.M., NEUTRAL and DECREASE R.P.M. The propeller control switches are spring-loaded to NEUTRAL.

PROPELLER FEATHERING CONTROLS. The propellers may be feathered by actuating the FEATHER PROP switch in the fire control section of the overhead panel.

REVERSE PITCH THROTTLE LOCK. The throttles are prevented from entering the reverse pitch range by oleo-operated solenoid locks. A red flag forward of the throttles shows the state of the pitch throttle lock. If the flag is marked LOCKED it indicates the reverse pitch lock is on and reverse pitch is not possible. The flag changes to UNLOCKED when any one of the landing gears contacts the ground, thus indicating the solenoid-operated lock is unlocked and reverse pitch is possible.

Chapter 7: Oil System

ENGINE OIL SYSTEM. Each engine has an individual oil system which includes an engine oil tank, two oil coolers, and an oil control thermostat. The engine oil tank has a capacity of 32.5 U.S. gallons and an expansion space of 7 US gallons. Oil cooler flap switches, when in the AUTO position, cause the thermostat to automatically regulate oil temperature by operating the oil cooler flaps to allow the proper amount of cooling air to flow through the oil coolers. An oil dilution system is incorporated into the oil system to aid in cold weather starting.

OIL COOLER FLAP SWITCHES. The oil cooler flaps for each engine are operated by OPEN--OFF--AUTO--CLOSE switches. The switches are spring loaded from the OPEN and CLOSE positions to the OFF position. When a switch is in the AUTO position, the oil coolers automatically maintain oil temperature within the normal operating range. If extreme operating conditions exist and failure of the automatic circuit causes abnormal oil temperatures, the oil cooler flaps can be operated by the manual OPEN or CLOSE positions. The flaps are held in any desired position by positioning the switches to OFF. Approximately 15 seconds are required to fully open or close the oil cooler flaps when the manual switch positions are used.

OIL DILUTION CONTROLS. Oil dilution is controlled by foil oil dilution ON--OFF selector switches and a master ON--OFF switch on the engineer's instrument panel.

Oil dilution is accomplished by placing the desired selector switches in the ON positions and setting the master switch to ON.

OIL QUANTITY INDICATORS. Oil quantity indicators for each engine oil tank on the engineer's instrument panel, indicate oil quantity in U.S. Gallons.

OIL PRESSURE WARNING LIGHT. A warning light on the pilot's instrument panel will illuminate when the oil pressure falls below 60 PSI.

Chapter 8: Fuel System

The airplane system has four internal main fuel tanks. The main fuel system is arranged so that the engines may be supplied directly from the main fuel tanks, from the main fuel manifold or any combination of tanks. Each main tank contains a submerged fuel boost pump.

The auxiliary fuel system consists of the center wing tank. This tank contains a submerged fuel boost pump. Flow from the center wing tank is controlled by the center tank line valve and may be isolated from the main fuel manifold.

The boost pumps are installed in such a manner that the amount of unavailable fuel in extreme flight attitudes is minimized. The boost pumps are controlled by switches on the engineer's instrument panel. Check valves in the boost pump lines prevent transfer of fuel between tanks. Individual fuel tank capacities are shown below.

TANK	NO OF TANKS	USABLE FUEL (LEVEL FLIGHT)		FULLY SERVICED		
		GAL	Li	GAL	LB	
NO. 1	1	1770	10,620	1779	10,674	
NO. 2	1	1520	9120	1534	9204	NOTE:
NO. 3	1	1520	9120	1534	9204	
NO. 4	1	1770	10,620	1779	10,674	To convert gallons to pounds multiply by 6.0 (standard day only).
CENTER	1	1210	7260	1218	7308	Data Basis: Flight test
USABLE FUEL TOTALS				GAL	LB	
Tanks No. 1, 2, 3, and 4				6580	39,480	
Tanks No. 1, 2, 3, 4, and Center				7790	46,740	

FUEL SELECTOR SWITCHES. Four rotary type selector knobs on the engineer's instrument panel control the fuel selector valves for the four main fuel tanks. The switches have three positions as follows:

1. TANK TO ENGINE
2. MANIFOLD TO ENGINE
3. OFF

Shutoff switches for each engine are on the overhead panel. These switches override normal control of fuel selector valves to shut off fuel to the engines.

FUEL TANK QUANTITY INDICATORS. Five indicators on the engineer's instrument panel show the quantity of fuel in pounds x100 for the main tanks and the center wing tank.

CENTER TANK LINE PUMP AND VALVE SWITCH. An OPEN--CLOSE switch on the engineer's instrument panel controls the center wing tank pump and valve. With the switch open, the fuel selector valves to MANIFOLD TO ENGINE, fuel will flow from the tank into the manifold system. With the switch in the CLOSE position and the fuel selector valves to TANK TO ENGINE, fuel cannot be drawn from the center wing tank.

BOOST PUMP SWITCHES. Each fuel tank has a fuel boost pump. These pumps are controlled individually by ON--OFF switches on the engineer's instrument panel. When the boost pump switches are OFF, the boost pumps are inoperative. The full pressure regulator on the engine-drive fuel pump regulates fuel pressure.

FUEL SYSTEM MANAGEMENT

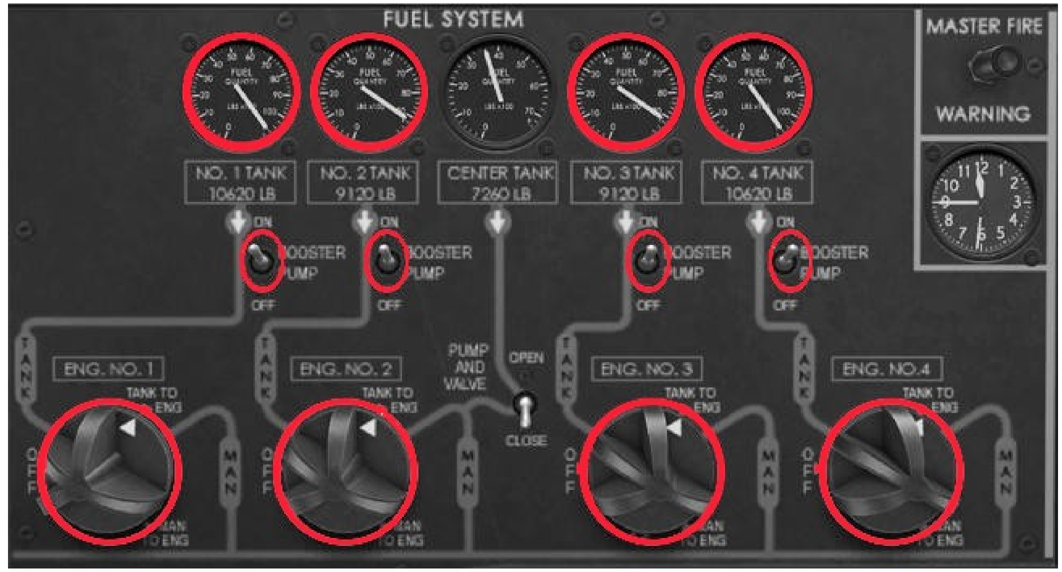
RESTRICTIONS.

a. For takeoff and landing the fuel selector valves must be in the TANK-TO-ENG position and booster pumps ON.

b. **DO NOT** take off with less than 1200 pounds (200 gallons) of fuel in each main tank.

c. **DO NOT** use center tank in climb when fuel quantity is below 1800 pounds.

d. **DO NOT** dump fuel with flaps extended or on the side of the airplane having the landing gear extended.



STARTING, TAKEOFF, LANDING AND IN FLIGHT OPERATION

STARTING, TAKEOFF, LANDING AND IN FLIGHT OPERATION. Set the fuel selectors to the TANK-TO-ENG position and turn booster pump switches ON for each of the main tanks. Leave the center tank PUMP AND VALVE switch OFF.

CENTER TANK OPERATION. After reaching a safe altitude and setting up climb powers, use the fuel in the center tank first. Set the fuel selectors for all engines to MANIFOLD-TO-TANK and turn the center tank pump and valve switch ON. After the center tank is empty, turn one booster pump for each fuel tank ON if flying above 10,000 feet altitude, turn the fuel selector valves to the TANK-TO-ENG position, and then turn the center tank pump and valve switch OFF.

CENTER TANK OPERATION

FUEL BALANCING OPERATION. Balance uneven fuel quantities in the main wing tanks so that tanks No.1 and 4 are either full or their quantities exceed tanks No.2 and 3.respectively. **DO NOT** reduce fuel in tanks 1 and 4 below that in tanks 2 and 3 respectively. Select the main tank or tanks with the greatest amount of fuel and turn the booster pump ON and turn the associated valve to TANK-TO-ENG. Turn the other main tanks booster pumps OFF and set the fuel selectors to MAN-TO-ENG to create a differential pressure that allows the selected tank to supply fuel in preference to the other tanks. When the fuel quantities are equal, return the selectors to TANK-TO-ENG and turn the tank booster pumps OFF, or if flying above 10,000 feet, turn one booster pump in each main tank to ON. Set all selectors to TANK-TO-ENG for approach and landings.

FUEL BALANCING OPERATION

NOTE

A lateral fuel unbalance equal to the moment produced by one-half an outboard tank of fuel (5400 pounds) may be handled with only a portion of the aileron and rudder control being required.

FUEL DUMPING. Fuel may be dumped in climb, level flight, or glide. Fuel may be dumped from any of the selected tank or all tanks simultaneously. If an emergency arises and it is necessary to dump fuel to decrease the airplane gross weight, the following procedure is recommended:

a. An airspeed of approximately 190 MPH (165 knots) IAS is recommended.

b. Do not operate radio transmitters.

c. Avoid changing power during fuel dumping.

d. Dump fuel as desired.

WARNING

Do not dump fuel with flaps extended or on the side of the airplane having the landing gear extended.

e. After the desired amount has been dumped, move the switches to CLOSED and visually check stoppage of flow.

f. Fuel quantities should be observed during dumping to avoid unfavorable lateral control.

CRASH LANDINGS. The center tank valve must be closed before making a crash or belly landing.

Chapter 9: Electrical System

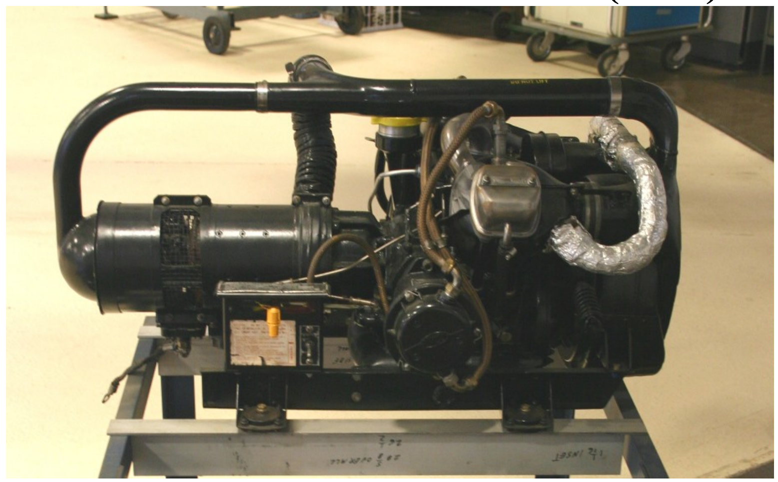
DC POWER SYSTEM. Twenty-eight volt DC power is supplied to the DC distribution system by six engine-driven generators and by an auxiliary power unit. Parallel operation on the DC system is accomplished by an equalizing circuit. This circuit is common to all generators operating in parallel and is designed to cause all generators to take an equivalent share of the load. If an unbalance occurs such that one generator has high voltage with respect to the other generators, a current flow will result in the equalizer circuit to cause the generator with high voltage to be lowered and the generator with low voltage to be raised. A battery in the lower forward compartment is provided as an emergency source of direct current power. An external power supply may be connected to the direct-current distribution system through an external power receptacle. Circuit breakers and fuses provide circuit protection for all direct-current operated equipment.

BATTERY. The airplane is equipped with a 24-volt, 36 ampere-hour nickel-cadmium battery. The battery is in the lower forward compartment of the airplane. Use of battery current is controlled by a switch on the overhead panel. The battery is used for emergencies as a source of power for the flight instrument spare inverter and for the turn-and-slip indicator. The battery may be connected to the airplane bus on the ground only; however, the battery is connected to the emergency (battery) bus at all times regardless of the battery switch position. The nickel-cadmium battery differs from a lead-acid battery in both principle and operation. The electrolyte in a nickel-cadmium battery is a potassium hydroxide solution. During charging and discharging, the specific gravity of the electrolyte does not change; therefore, specific gravity measurements cannot be used to determine the state of charge of the battery.

GENERATORS. Each of the six 28-volt, 300 ampere, engine-driven generators is connected to the main power panel through a current limiter. The current limiter protects the bus against a generator or reverse current relay failure. The voltage is regulated automatically by carbon-pile type regulators. Each generator has an overvoltage control unit which will disconnect the generator from the direct-current distribution system in the event of high generator voltage. Two generators are mounted on the accessory section of each outboard engine and one generator is mounted on the accessory section of each inboard engine. The generators normally supply all of the power required for operation of direct-current operated equipment in the airplane, and also supply direct-current power to the inverters.

ELECTRICAL MASTER SWITCH. The electrical master switch on the center overhead panel completes the control circuit for the battery and generators. This ON--OFF switch must be ON to supply power to the DC power distribution system. If the master switch is off, the circuits to the field coils of the generators are broken and there is no output from the generators. This switch must be on to connect external power to the airplane buses.

AUXILARY POWER UNIT (APU)

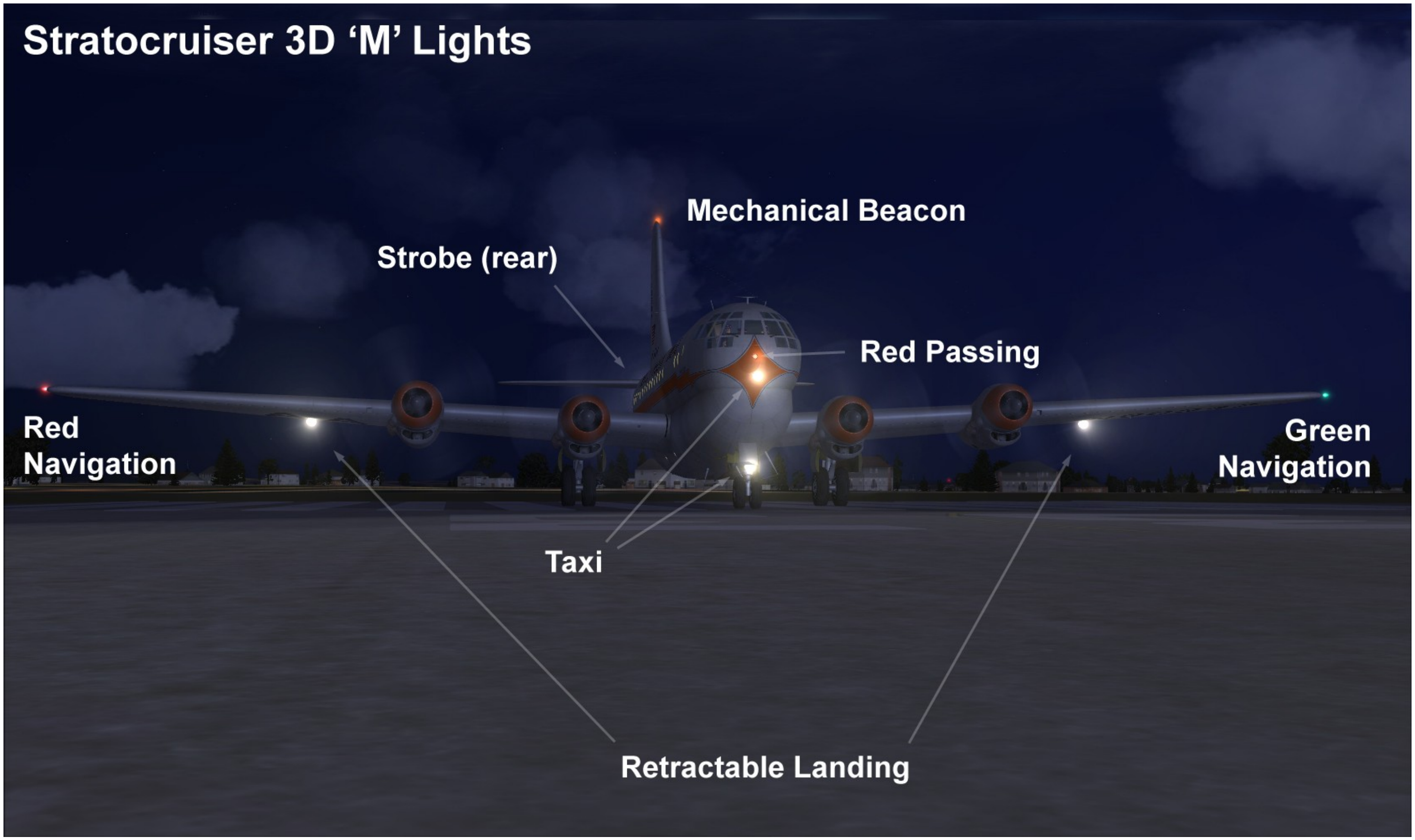


AUXILIARY POWER UNIT (APU). An on-board APU provides electrical power while engines are off, and also for engine starting. The APU drives a 28-volt, 500-ampere, direct current generator which is also used as a starting motor. The APU will operate to altitudes of 20,000 feet with generator output of 14 kilowatts at 28 volt DC. At altitudes under 10,000 feet, the generator can provide a five minute supply of 17.4 kilowatts at 28 volt DC (approximately 620 amp). Fuel is supplied from the tank No. 2 or from the fuel manifold and is automatically shut off whenever the APU is not operating. The APU has a self-contained oil supply. An air intake duct allows air to flow to the turbine compressor, while an exhaust duct provides means for exhausting products of combustion. A valve in each duct is connected by a rod and linkage to operate together (open or close) from a manual control handle next to APU. The handle is spring-loaded to the OPEN or to the CLOSED position to prevent valve gates from creeping. The intake duct valve actuates a micro-switch in the control circuit to prevent APU operation with the intake and exhaust ducts closed.

The APU can also be used as a standby electrical power source for takeoff and landing, or as an emergency power source during flights up to 20,000 feet (cabin must be de-pressurized). A blower is installed in the airplane to pressurize the turbine compartment. The turbine compartment is pressurized to prevent exhaust fumes from entering control cabin. The blower also aids in cooling the APU compartment. The blower is operable in flight or on the ground. The APU generator will continuously deliver 500 amps.

Lighting

Your Stratocruiser is equipped with the finest 3D Lights technology, as the lighting effects are built into the model, creating highly realistic visuals. The underwing landing lights can be retracted and extended independently of being turned on or off, the mechanical beacon actually rotates and casts a 3D beam at the appropriate angle and speed. The red passing light is a carry over from military use, and yes, the navigation lights are actually supposed to pulse.



The Stratocruiser's has a large cabin and requires a sophisticated lighting system for night time operations We installed forward overhead flood lights for the Pilot and Co-pilot, low-light red and a white flood light for the Flight Engineer, and a floodlight for the Navigator's station.

It is in the interest of the pilots to have the cabin lighting as low as possible to maximize night time visibility. In the real aircraft, the lighting is quite dim and the crew can use flashlights to shine in areas that may not have enough light.

We spent time in a real Stratocruiser in the dark with the lights on and matched our interior lighting to the real thing.

Chapter 10: Landing Gear System

The fully retractable tricycle landing gear is electrically operated and consists of two main dual-wheel landing gears and a steerable dual-wheel nose gear. The landing gear is exceptionally friction-free in operation and extends fully in approximately 4 seconds and retracts fully in approximately 10 seconds. The main and nose landing gears are mechanically locked in the up and down positions.

LANDING GEAR SWITCH. A DOWN--OFF--UP switch controls normal landing gear extension or retraction. When the switch is in the UP position, the landing gear will retract provided all wheels are off the ground; when in the DOWN position, the landing gear will extend; and when in the OFF position, the landing gear actuation circuits are de-energized.

TAKEOFF FLAP WARNING HORN. The warning horn will sound at any flap setting when any combination of two throttles for engines on opposite sides of the airplane are advanced more than three-fourths open with the weight of the airplane on the landing gear.

LANDING GEAR POSITION INDICATORS. Three tab-window type indicators on the pilot's instrument panel show, by changeable tabs, the positions of the main and nose gears. When any gear is up and locked, the corresponding UP tab will appear in the window; a landing gear in an intermediate position will be indicated by a tab with slanting alternate red and white stripes; and a down and locked gear will be indicated by a tab showing a symbol of a wheel. When power is off, a slanting red and white stripe tab will show in the window.

NOSE WHEEL STEERING SYSTEM. The nose wheels are steerable to 68° each side of center through hydraulically-operated cylinders while the airplane is on the ground. When the nose wheel leaves the ground, hydraulic pressure is shut off by an oleo-actuated valve, and the nose wheel centers itself. In the event of hydraulic pressure failure, the nose gear has a conventional caster action allowing directional control of the airplane by engine and brake operation.

NOSE STEERING WHEEL. Nose gear steering is controlled by a steering wheel mounted on a pedestal forward and to the left of the pilot's control column. An arrow on the wheel and a mark on the pedestal indicate when the nose wheel is centered. The nose wheel turns in the direction selected by the steering wheel and remains in that position until the steering wheel is returned to center. A cable follow-up system will return the nose wheel to its original course should the wheel be deflected momentarily by some obstacle. Nose wheel must be centered before gear will retract.

Chapter 11: Emergency Equipment

FIRE DETECTOR SYSTEM. An automatic fire detector system is provided to detect a fire condition in any of the power packages or combustion heater areas. The system illuminates red master fire warning lights on the pilot's and engineer's instrument panels if a fire condition exists. The exact area which has a fire condition is indicated by fire warning lights located on the overhead panel. Fire sensing units located behind the exhaust collector ring, around the turbosupercharger, on the engine oil tank, in the accessory section of the power package, in the wing D ducts, in the combustion heater cavities, around the APU and overheat sensing units in the main landing gear wells, cause the fire warning or overheat warning lights to illuminate during a sudden overheat condition such as a fire would cause. The battery switch must be ON BUS. The electrical master switch must be ON.

FIRE DETECTOR SYSTEM TEST BUTTONS. There are three fire detector system push-to-test buttons on the fire section of the overhead panel to test the continuity and operation of the three circuits making up the fire detector system. Pushing either circuit 1 or circuit 2 button will illuminate the power package fire warning lights on the fire section of the overhead panel and the master fire warning lights on the pilot's and engineer's instrument panels. Pushing circuit 3 button will illuminate all four power package fire warning lights, the master fire warning lights, the heater fire warning lights, and the main landing gear wheel well warning lights.

MASTER FIRE WARNING LIGHTS. Two red push-to-test master fire warning lights are provided: one on the pilot's instrument panel and the other on the engineer's instrument panel. Both lights will illuminate in case of a sudden increase in temperature in engine or anti-icing and body heater areas.

FIRE EXTINGUISHER SYSTEM. A C02 fire extinguisher system is provided to supply two separate charges of CO2 to the power packages, wing anti-icing heaters, or empennage anti-icing heaters. The CO2 is stored in two jets of four bottles, each set located in a main landing gear wheel well. Each set of bottles will furnish one complete charge of CO2. The two upper bottles in each set are fitted with solenoid-actuated valves to release the CO2 charge. The CO2 charge released from the upper bottles actuates the release valves on the lower bottles through tubing connecting the two bottles. The upper bottles are also connected with tubing so that if one of the solenoids fails to operate, the other solenoid-actuated valve will release the entire charge of CO2 in the set of four bottles. Actuation of the CO2 release switch in either direction will release the charge from one set of bottles. CO2 is then directed through tubing to a common manifold line which serves most probable fire areas. Select direction switches open directional control valves located in the lines between the manifold and fire areas. These valves direct the CO2 charge to be dispersed in the selected fire area through perforated runs of tubing or directly into the equipment. A CO2 bottle is also located adjacent to the APU. Actuation of the APU CO2 release switch will discharge the entire bottle into the turbine cover.

FIRE SWITCH GANG PLATES. A switch gang plate is located aft of each group of power package and surface anti-icing heater fire switches on the overhead panel. When a power package switch gang plate is positioned to FIRE, it will actuate the select direction valve switch, the sheltered air door switch, the fuel valve switch, the fuel, oil, hydraulic fluid and cabin air bleed switch, and the propeller feathering switch. When the surface anti-icing heater switch gang plate is positioned to FIRE, it will actuate the surface anti-icing heater select direction valve fire switch and the heater shutoff switch. Each gang plate is spring-loaded from the FIRE position to the NORMAL position.

POWER PACKAGE SELECT DIRECTION VALVE SWITCHES. These switches with NORMAL--FIRE positions are located on the fire section of the overhead panel. One switch is provided for each power package. When the CO2 release switch is placed in FIRE, the select direction valve will open, allowing the charge of CO2 to enter the power package selected.

SHELTERED AIR DOOR SWITCHES. The NORMAL--FIRE positions of these switches control the operation of the sheltered air door. When the switch is placed in FIRE, the sheltered air door stops ram air from entering the induction system. One switch is provided for each power package.

FUEL VALVE SWITCHES. A fuel valve switch with NORMAL--FIRE positions is provided for each power package. When the switch is placed in FIRE, the fuel selector valve is turned to the TANK TO MANIFOLD position. When the switch is returned to NORMAL, the fuel selector valve will return to its originally selected position.

FUEL, OIL, HYDRAULIC FLUID AND CABIN AIR BLEED SWITCHES. One switch with NORMAL--FIRE positions, is provided for each power package. When the switch is placed in FIRE, fuel, oil, and hydraulic fluid are shut off from the power package and the cabin pressurizing air supply from that power package is shut off.

PROPELLER FEATHERING SWITCHES. The NORMAL--FIRE positions of these switches control the propellers. When the switch is placed in FIRE, the propeller feathers. This switch is spring-loaded to the NORMAL position and will return to NORMAL when released, however, the propeller will feather in the same manner as if the pilot's propeller feathering button were pressed.

ANTI-ICING HEATER SELECT DIRECTION VALVE SWITCHES. These switches, one for each set of anti-icing heaters, are on the fire section of the overhead panel. When the CO2 release valve switch is placed in FIRE position, it actuates the directional control valve to allow CO2 charge to enter the heater area from the fire extinguisher system manifold.

ANTI-ICING HEATER SHUTOFF SWITCH. These switches, one for each set of anti-icing heaters, are on the fire section of the overhead panel. The switch, when actuated to FIRE, discontinues heater operation by stopping intake airflow and fuel supply to the heaters and de-energizes the heater ignition circuit.

BODY HEATER FIRE SWITCH. One body heater switch with NORMAL--FIRE positions on the fire section of the overhead panel is used to discontinue heater operation. When this switch is placed to FIRE position it will shut off the fuel supply to the body heaters besides de-energizing the heater ignition circuit. Body heater fires cannot be extinguished from the airplane's fire extinguisher system, but will have to be extinguished with portable hand extinguishers stowed in the airplane.

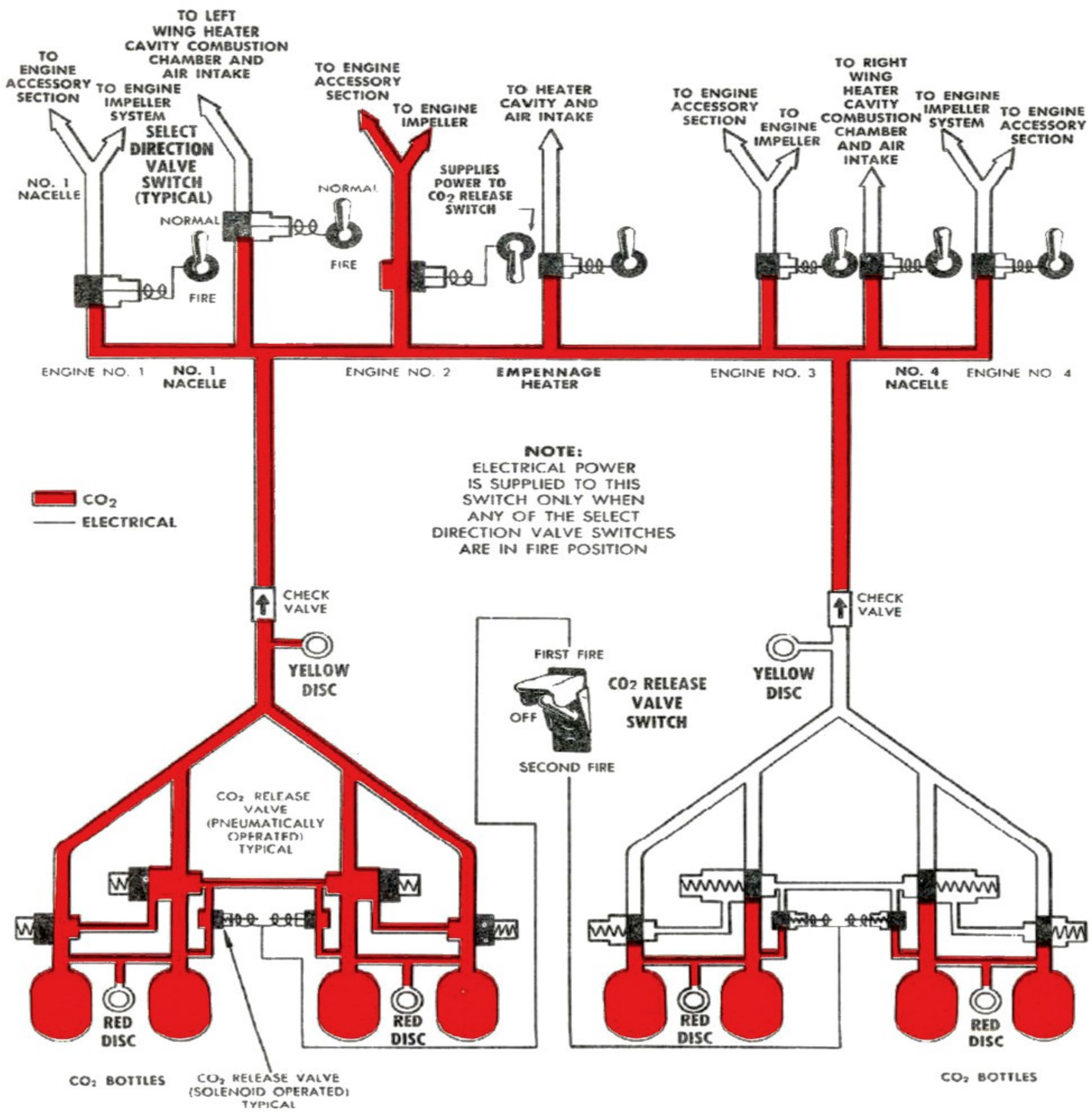
FIRE EXTINGUISHER SYSTEM

C02 RELEASE SWITCH. This guarded switch on the fire section of the overhead panel, releases the two charges of CO2 when one or more select direction valve switches are positioned to FIRE. It has three positions, FIRST FIRE--OFF--SECOND FIRE. By moving and holding the switch to FIRST FIRE position, the charge of CO2 from the left set of the CO2 bottles will be released to the predetermined fire area. By moving and holding the switch to SECOND FIRE position the remaining charge of CO2 will be released.

NOTE: The select direction valve switches must be ON to release the CO2 charges.

In order to use battery power to release the CO2 charges, the electrical master switch must be ON.

APU CO2 RELEASE SWITCH. An on-off toggle switch switch marked AUX POWER UNIT C02 RELEASE when positioned to ON will release the contents of a C02 bottle into turbine cover. The switch is spring-loaded and guarded to the OFF position, and when operated, must be held ON. There is also a CO2 release switch on the APU control panel.



Chapter 12: Normal Operations Checklists

The checklists below are meant to be read from left to right, top to bottom.

ENTERING THE CONTROL CABIN (POWER OFF)

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Overhead light switches as desired.			1. Check passenger and crew system oxygen pressure
2. Battery switch OFF			2. Generator Switches OFF
3. Master switch OFF			3. Pitot heaters OFF
4. Avionics switch OFF	4. Emergency hydraulic pressure valve CLOSED	4. Radar altimeter switch OFF	4. Magneto switches OFF
5. Autopilot disengaged and OFF	5. Emergency exit lights switch ARMED		5. Engine selector switch OFF
6. Landing lights retracted and OFF			6. Carburetor preheat OFF
7. Wing flap switch OFF			7. Intercooler flap switches CLOSED
8. Propeller auto-feathering switches OFF	8. Fuel dump switches CLOSED/OFF		8. Oil dilution switches OFF
9. Rudder boost switch ON	9. Fire control switches OFF		9. Turbo-override switches TAKE-OFF
10. Throttle brake as required	10. Aux power unit CO2 release switch OFF		10. Turbo control 0 (zero)
11. Master propeller synchronizer DECREASE R.P.M.			11. Propeller selector control switches AUTO
12. Propeller reverse pitch indicator UNLOCKED			12. Air conditioning master switch OFF
13. Landing gear switch DOWN for several seconds and ensure it returns to neutral			13. Cabin altitude selector set at 1000 feet above field altitude
14. ADI pumps switch OFF			14. Rate-of-change selector MAX

PILOT	COPILOT	NAVIGATOR	ENGINEER
15. ADI valve override switches AUTO			15. Fuel selector valves OFF
16. Aileron, elevator, and rudder trim tabs free and zeroed			16. Booster pumps OFF
17. Altimeters and flight instruments checked and set			17. DC Voltmeter selector switch on BUS
18. Parking brakes set			18. APU switch to OFF (neutral)
19. Windshield wiper OFF	15. Surface control lock UNLOCKED for pilot check		
20. Check controls for freedom of movement	16. If gustiness prevails after pilot check, surface control lock to LOCKED		

BEFORE STARTING ENGINES (POWER ON)

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Power off check complete and obtain crew reports	1. Turn master switch ON		
	2. Turn battery switch ON		2. Read indicated BUS voltage
			3. DC Voltmeter selector switch on BAT and read indicated voltage
4. Test fire detection system and ensure fire warning lights illuminate when pressed and extinguish when depressed		4. Check gyro heading indicator against pilots magnetic compass	4. Rotate fuel selector valves to TANK-TO-ENG
5. Check instruments	5. Check instruments	5. Check instruments	5. If required set APU switch to RUN and confirm illumination of APU light
6. Avionics switch ON and radios as required	6. Radios as required	6. Set radios and navigation equipment as desired based on flight plan	6. Check turbo bearing temperature alarm panel
7. Check ADI quantity	7. No smoking and fasten seat belts switches ON		7. Hold propeller switches to INCREASE RPM for a few seconds and release to neutral
			8. Turbo-boost lever 0 (zero)
			9. Turbo-override switches TAKE-OFF
10. Move propeller master synchronizer to full INCREASE R.P.M.			10. Cowl flaps open
11. Passengers aboard and seated			11. Oil cooler switches AUTO
12. Doors closed and locked			12. Carburetor heat switches OFF

STARTING ENGINES

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Note manifold pressure for power check reference			1. Mixture FUEL CUTOFF
2. Crack throttles approximately 1 inch	2. Rotating beacon switch ON		2. Check magnetos switches OFF
	3. Exterior lights as required		3. Fuel selector TANK-TO-ENGINE position and turn one booster switch each main tank to ON, leave center tank switch to CLOSED
	4. Check fireguard for all clear on No. 3 engine		4. Engine starting sequence 3, 4, 2, 1
	5. Place fire extinguisher valve selector switch for engine No.3 to FIRE position		5. Set engine starting selector to 3
			6. Move mixture lever on No.3 engine to AUTO RICH.
			7. Press PRIME button 2 to 4 times ABOVE 0°C and 4 to 6 times when BELOW 0°C or as required
			8. Press START button and after propeller has turned approximately three blades turn the magneto switch for No.3 engine to BOTH, then press and hold BOOST
			9. Watch for oil pressure rise and when definite indication of starting is observed release the START and BOOST switches

PILOT	COPILOT	NAVIGATOR	ENGINEER
10. Adjust throttle to 1,000 R.P.M. for engine warmup and to keep plugs from fouling	10. Place fire extinguisher valve selector switch for No.3 to NORMAL/OFF		10. When engine is running smoothly, place the generator switch for No.3 engine to ON.
			11. Turn off booster pump
12. Repeat procedure for remaining engines (Steps 4 to 10)	12. Repeat procedure for remaining engines(Steps 4 to 10)		12. Repeat starting procedure for remaining engines. (Steps 4 to 10)
	13. Check all fire control switches NORMAL/OFF	13. Check all instruments for error	13. Turn starter selector OFF

WARM-UP AND TAXI

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Warm up engines at 1000 R.P.M.	1. Check hydraulic pressures within limits; if emergency pressure is low, open the charging valve until the pressure is equal to the main pressure, then return charging valve to CLOSED		1. Check booster pumps OFF
			2. Turn OFF APU if required
	3. Lock mixture controls		3. Air conditioning master switch ON
4. Check instruments and gyro erection	4. Check instruments and gyro erection	4. Check instruments and gyro erection	4. Check instruments and gyro erection
			5. Check AC voltage by turning AC voltmeter selector switch through all positions then returning voltmeter selector to BUS position
6. Obtain cabin and crew report	6. Door warning light out		6. Check ignition for safety grounding at warm-up R.P.M. by momentarily turning each ignition switch from BOTH to RIGHT and back to BOTH, then to LEFT and back to BOTH; a slight R.P.M. drop when on each magneto bank indicates a safe ignition system and the engine can be operated for a power check
7. Obtain taxi clearance	7. Have chocks removed		7. Report to pilot ready to taxi
8. Taxi to run-up area	8. Check wing flap operation; lower the flaps to approximately 10° and then return them to up		8. Set rate-of-change selector to 0 (zero) and cabin altitude selector to desired value

GROUND TEST

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Turn airplane into the wind for ground test		1. Turn on radio altimeter and check for correct operation; leave on for the duration of the flight	1. When the engine oil temperatures are above 40° C, notify the pilot that engines are ready for ground check
2. Advance all throttles to 1500 R.P.M.			2. With engines at 1500 R.P.M., check generator load
3. Turn autopilot on			3. Place all four engine propeller selector control switches in MAN (manual) and hold each propeller control switch in DECREASE RPM until 1300 R.P.M. is indicated (takes approximately 52 seconds per engine), then move and hold each switch in INCREASE RPM until 1500 is indicated; then place the propeller control switches in MAN (manual)
			4. Move the master synchronizer lever toward DECREASE RPM until 1200 R.P.M. is indicated
5. Return throttles to idle R.P.M. after the synchronizer lever reached full INCREASE RPM			5. Return master synchronizer lever to the full INCREASE RPM position with a rapid movement; the engines should return to 1500 RPM
6. With turbo-override switches in TAKE-OFF, advance one throttle at a time to a manifold pressure equal to the field barometric pressure; engine R.P.M. should be approximately 2050			6. Check magnetos and superchargers when pilot sets power condition; switch magnetos to RIGHT and LEFT and back to BOTH while noting R.P.M. drop; maximum drop should not exceed 100 R.P.M.

PILOT	COPILOT	NAVIGATOR	ENGINEER
			7. Place the turbo selector lever to 0 (zero), the respective turbo control override switch to CLIMB & CRUISE; move turbo boost lever to 7 and align the calibrating potentiometers; check for a manifold pressure increase of 2 inches plus 1.5 inches for each 1000 feet of field altitude above sea level; place the turbo control override switch to TAKE-OFF and note that exhaust back pressure and manifold pressure return to their original values; then move the turbo-boost lever to 0
8. Return the throttle to idle and repeat step 6 for the remaining engines			8. Repeat steps 6 and 7 for the remaining engines
9. Check autopilot operation			9. Check oil temperature
10. Turn ADI pumps on, check ADI pressure lights on and then turn pumps off			10. Check oil pressure

BEFORE TAKE-OFF

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Before taxiing onto the runway, turn the airplane into the wind and ground test the engines if not done previously			
2. Set trim tabs as desired for take-off	2. Check doors and windows and ensure the DOOR OPEN bulb is extinguished	2. Check heading indicator against pilot's magnetic compass	
3. Set altimeter and flight instruments	3. Set altimeter	3. Set altimeter	
4. Check gyro erection	4. Check gyro erection	4. Check gyro erection	4. Check gyro erection
5. Autopilot OFF	5. Radios checked	5. Radios cross checked and navigation radios tuned and tested as necessary	
6. Check rudder boost ON	6. Move wing flap switch to DOWN until 25 degrees is reached		6. Pitot heaters as required
7. ADI override switches AUTO, ADI pumps switch ON (pressure lights illuminated)			7. Propeller control levers AUTO
8. Master synchronizer lever full INCREASE RPM			8. Oil cooler flaps switches AUTO
9. Mixture AUTO RICH			9. Carburetor air RAM
10. Turbo-boost lever 0 (zero)			10. Carburetor heat OFF
11. Turbo-override switches TAKE-OFF			11. Intercooler flaps CLOSED
12. Check engine instruments within limits			12. Check generator switches set ON

PILOT	COPILOT	NAVIGATOR	ENGINEER
			13. Check cylinder heat temperature below 170° C before take-off
			14. Cowl flaps set for take-off
			15. Turn booster pump switches for each main tank to ON; check fuel selectors set to TANK-TO-ENG position and center tank switch OFF
	16. Control surface lock UNLOCKED of not done previously		
17. Controls tested for freedom of movement	17. Obtain take-off clearance		
18. Release brakes and taxi into take-off position			

TAKE-OFF

PILOT	COPILOT	NAVIGATOR	ENGINEER
	1. Position lights, landing lights, beacon light and strobe light on as necessary		
2. Advance throttle to take-off power; do not exceed 60 inches of manifold pressure, 247 PSI torque, and 2700 R.P.M.	2. Check wing flaps at 25 degrees; when manifold pressure exceeds 45 inches, check water-pressure lights out		
3. Control the airplane direction with steering wheel until rudder becomes effective	3. Check propeller levers in AUTO, mixture control AUTO RICH, turbo-boost lever 0, turbo-override switches TAKE-OFF		3. Check boost pumps ON and intercooler flaps closed
4. At 78 knots (90 PMH) IAS ease the control column back to lift the nose wheel off; the airplane will leave the ground between 100 and 113 knots (115 and 130 MPH) IAS depending on gross weight	4. Check instruments during takeoff		4. Check engine instruments during takeoff
5. When airplane leaves the ground apply the brakes and signal copilot to raise the gear	5. On signal from pilot move landing-gear switch UP and confirm red warning light goes out		
6. Reduce manifold pressure to 50 inches, maximum torque 198 PSI, and move synchronizer lever to 2550 R.P.M.	6. When power is reduced by pilot turn ADI pump switch OFF		6. Place turbo-override switches to CLIMB AND CRUISE and advance turbo-boost lever to increase and maintain 50 inches manifold pressure for climb
7. When sufficient altitude and air speed are gained signal copilot to raise flaps	7. On signal from pilot, move wing-flap switch UP until wing flaps are fully retracted		7. Apply intercoolers as required to maintain carburetor air temperature within limits

ENGINE FAILURE ON TAKE-OFF

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Close throttles and apply brakes if sufficient runway remains and/or if below safe three-engine speed			
2. Use propeller reverse thrust on all available engines to aid in stopping	2. Check that propellers reverse		
3. If a safe three-engine speed is reached and the airplane is off the ground, maintain directional control with rudder and ailerons	3. On signal from pilot, move landing-gear switch to UP		
4. Close throttle on failed engine	4. Move mixture to FUEL CUTOFF on failed engine if ordered by pilot		
5. If feathering is desired turn ON the feather switch located on the overhead panel for the appropriate engine			
6. Climb only as necessary to clear obstructions until the air speed builds up	6. On signal from pilot move wing-flap switch to UP when a safe air speed and altitude are reached		6. Set failed engine fuel selector OFF and turn the respective booster pump OFF
			7. Close cowl flaps on failed engine
8. When engine stops turning place the feather switch OFF			8. Turn the failed engine magneto OFF
9. Adjust power on remaining engines			9. Close intercooler flap on failed engine
10. Trim airplane for three-engine operation			10. Turn failed engine generator off and monitor electrical loads

CLIMB

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Climb only as necessary to clear obstacles until air speed of 170 knots IAS is reached, then continue to climb at this air speed; manifold pressure at 50 inches MAP and 2550 R.P.M.		1. Check over instruments and give radio altimeter readouts as necessary or as instructed by the pilot	1. Adjust cowl flaps to maintain normal cylinder head temperatures
2. Alternate Power Setting – 46” MP, 2350 PRM, 197 PSI torque			2. Advance turbo-boost lever as needed to maintain power and cabin air flow
3. Adjust propeller R.P.M. as desired with master synchronizer lever			3. Adjust intercooler flaps to maintain carburetor air temperature below 38° C
	4. Turn off NO SMOKING, FASTEN BELT signs		4. Booster pumps OFF)above 10,00 feet turn one booster pump for each main tank ON)
			5. After climb power has been established and a safe altitude has been reached, use the fuel in the center tank

Climb performance to 30,000 feet (142,000 lbs.)

Torque PSI	RPM	Elapsed Time	Distance
197	2350	67 minutes	230 nautical miles

DURING FLIGHT

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. At completion of climb, reduce manifold pressure and R.P.M. until desired cruising power is reached			
2. Trim airplane for hands off flight			2. Move mixture to AUTO LEAN after engine has cooled to normal temperature
3. Turn rudder boost OFF before and during autopilot operation			3. Adjust intercooler flaps to maintain 30 to 38° C CAT and use carburetor heat if required for anti-icing
4. Engage autopilot		4. Set radios as desired per flight plan	4. Adjust cowl flaps
		5. Every few minutes check gyro heading indicator against pilot's magnetic compass and adjust for gyroscopic drift	5. Decrease cabin pressurization with cabin altitude and rate-of-change selectors in accordance with the flight plan

Cruise Settings: Getting on the "Step"

The "Step" is that range of the plane's angle of attack where the plane is at its most efficient lift/drag ratio. With this plane it is about two degrees angle of attack or "alpha". Exceeding two degrees will cause a large increase in the wing's induced drag and a rapid decay of speed, with the need for a lot more thrust to maintain level flight. The cardinal rule when cruising is to always fly at a speed that maintains an angle of attack of two degrees or less. The more weight you carry, the more power you'll need to get on, and stay on, the step.

To get on the step, climb to a few hundred feet above the desired cruising altitude. Level out and then descend to your desired height, maintaining climb power or a little less. Accelerate to a few knots above your desired cruising speed, establish level flight, and throttle back to your desired cruise power. If the plane will not maintain two degrees or less of alpha (check your artificial horizon), then increase the cruising power slightly, in stages, until the aircraft is cruising in the proper attitude. It is best to start out faster and then gradually reduce power until you've achieve optimum cruise.

Cruise Power Settings: The Torque Meter

The torque meter was introduced to complex piston engine aircraft shortly after World War II. It provides a direct reading of brake mean effective pressure (BMEP) in pounds per square inch (PSI). The torque reading, and not the manifold pressure, is the final value to be used in setting power. All manifold pressure (boost pressure) values are approximate and should be used to set initial power. Then, fine-tune your engines so that the torque value is as specified in the chart.

Cruise Power: Mixture Control Adjustment

For the first time in Flight Simulator history, realistic mixture control is now available on the complex engines of a piston-powered aircraft from the Golden Age of aviation. The mixture controls for the Wings of Power Boeing 377 Stratocruiser work just as they do on the real aircraft, and provide realistic fuel flow and power settings that match the actual aircraft's performance charts. The mixture controls have the following positions:

FULL RICH: Provides maximum fuel flow for cylinder cooling, emergencies, and taxi operations. This position is with the mixture lever fully forward.

AUTO RICH: Provides a rich cruising and climbing mixture for higher power settings. Use the mouse to pull the lever back a bit; it will "snap" into this position.

AUTO LEAN: Provides an optimal mixture for best power. Use the mouse to pull the lever back a bit further; it will "snap" into this position.

MANUAL LEAN: Allows for manual mixture adjustment for maximum range. This position is infinitely adjustable and the fuel/air ratio achieved can be seen in the tooltip, making precise adjustments easy. Use the mouse to pull the lever back beyond the "auto lean" position. It will stay wherever you put it. Occasionally the fuel flows for each of the four engines will not match, even if a single throttle and propeller control are used to set identical throttle and prop settings. If this is the case, advance the mixture controls back to AUTO LEAN and reset the manual setting. While this is not a problem and in fact mimics the real aircraft, for those who like everything to be exactly the same, this technique will allow uniform fuel flows, provided throttle and prop settings are exactly the same for each engine. The reason for this is because the mixture setting displayed when in the manual range reads to only two decimal places. The actual mixture can be vary slightly from this figure. For example, if you had the manual mixture set to 0.066, the actual fuel/air ratio is actually somewhere between 0.065 and 0.67. Technique will allow you to get exactly the same fuel flows for each engine, but keep in mind the real aircraft could not achieve anything like this kind of precision.

The power required for cruise will vary substantially with weight. Cruising speeds range from about 170 KIAS to 200 KIAS depending upon the weight and power setting. The Pregnant Guppy will cruise several knots slower than the Stratocruiser due to higher drag.

Cruise Control Schedule

135,000 pounds, AUTO RICH

Altitude	KIAS	Approximate Boost Pressure	Torque PSI	RPM	KTAS	PPH/Engine	Specific Range
10,000	207	39	158	2350	240	1080	0.056 nm/lb
25,000	190	37	158	2350	281	1072	0.065 nm/lb

115,000 pounds, MANUAL LEAN at 0.066

Altitude	KIAS	Approximate Boost Pressure	Torque PSI	RPM	KTAS	PPH/Engine	Specific Range
10,000	178	31.3	158	1450	208	565	0.091 nm/lb
25,000	205	36.6	158	2100	302	824	0.091 nm/lb

Pregnant Guppy: 125,000 pounds, AUTO LEAN

Altitude	KIAS	Approximate Boost Pressure	Torque PSI	RPM	KTAS	PPH/Engine	Specific Range
10,000	185	36.4	158	2100	216	900	0.060 nm/lb
25,000	177	34.9	158	2100	263	910	0.072 nm/lb

ENGINE FAILURE IN FLIGHT

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Close throttle on failed engine			
2. Feather the failed engine by setting the feather switch OFF on the overhead panel			2. Move the failed engine mixture control to FUEL CUTOFF
3. Trim airplane for three-engine operation			3. Close cowl flaps on failed engine
4. Adjust power and R.P.M. on remaining engines as required			4. Close intercooler flaps on failed engine
			5. Turn engine magneto OFF on failed engine
			6. Place the turbo control override switch in the TAKE-OFF position on the failed engine
			7. Close the booster pump off on failed engine
			8. Set the engine fuel selector on failed engine to TANK-TO-MAN position and balance fuel quantity
			9. Turn generator off on failed engine and monitor electrical loads.

CRASH LANDINGS

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Order crew to jettison all cargo and loose gear if time permits			
2. Check that passengers are in the main cabin and secure in the best means possible; no persons should be in the lounge in an emergency	2. Check emergency exits light switch is ARMED and step lights switch ON		2. Close center tank pump and valve
3. Signal copilot to lower wing flaps	3. On pilot's signal move wing flap switch DOWN and hold until flaps are fully extended		
4. Land with as slow a forward speed as possible with a normal nose-high attitude			5. Turn off air conditioning and anti-icing equipment
5. On impact, move mixture control to FUEL CUTOFF, move magneto switches OFF, and 5 seconds after CO2 bottles have been discharged, move the master switch to OFF	5. On impact place gang fire switches to FIRE position and discharge all CO2 bottles		5. On impact, shut off all fuel valves

APPROACH

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Notify crew to prepare for landing		1. Check gyro heading indicator against pilot's magnetic compass to adjust for gyroscopic drift	1. Start cabin depressurization sufficiently early to allow the cabin to reach field altitude prior to landing
2. Check weight and CG limits	2. Apply brakes and check hydraulic pressure and fluid quantity		
3. Altimeter set, radio altimeter on and set	3. Altimeter set, radio altimeter on and set to pilot's settings	3. Altimeter set, radio altimeter on and set	
4. Autopilot as required	4. Check ADI quantity		4. Check fuel quantity
			5. Set fuel selectors to TANK-TO-ENG and turn booster pumps for each main tank ON; check center tank pump and valve switch OFF
6. Move master synchronizer to 2300 R.P.M.	6. Turn on NO SMOKING, FASTEN BELTS signs		
7. Mixture AUTO RICH		7. If available set appropriate ILS frequency for landing on NAV1 radio	7. Check magnetos
			8. Anti-ice switches OFF
			9. If preheat is desired on final approach check the turbo control override switches to CLIMB & CRUISE, the turbo-boost lever to 0 (zero), and place the carburetor air switch to SHELTERS; if more heat is necessary, place carburetor heat switches ON until carburetor air temperature meets acceptable levels

PILOT	COPILOT	NAVIGATOR	ENGINEER
			10. If preheat is not desired on final approach, place the turbo-control override switches to TAKE-OFF, the turbo-boost lever to 0 (zero), and check carburetor air to RAM and carburetor heat switches OFF
			11. Intercooler flaps CLOSED
12. Signal copilot to extent landing gear when air speed is reduced below 200 knots (230 MPH) IAS	12. On pilot's signal move landing gear switch to DOWN and check green position lights on		
13. Signal copilot for wing-flap extension and amount when air speed is reduced below 188 knots (217 MPH) IAS	13. On pilot's signal move wing-flap switch to DOWN until desired amount is reached		
14. After extending full flaps, make approach at 25 knots (30 MPH) above power-off stalling speed			14. Cabin depressurizing complete
15. Autopilot OFF	15. ADI valves AUTO, ADI pumps ON, lights on		
16. Rudder boost switch ON			16. If preheat is being used, move turbo boost lever to 0 (zero) at approximately 200 feet

GO-AROUND

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Advance throttles smoothly, do not exceed 50 inches MAP; signal copilot to raise the landing gear	1. On pilot's signal move landing gear switch to UP		
			2. Check turbo-boost lever to 0 (zero) and turbo control override switches in TAKE-OFF
3. Advance master synchronizer to 2700 R.P.M. and advance throttle as required but do not exceed 60 inches MAP	3. Check ADI indicator lights out as power is increased		3. Check temperatures and pressures within limits
4. Signal copilot to raise the flaps to 25 degrees	4. On pilot's signal, move wing-flap switch to UP until 25 degrees is reached		
5. Check rudder boost ON	5. Check landing-gear red warning light off		
6. Reduce power to 50 inches manifold pressure and 2550 R.P.M. when a safe speed is reached, at least 131 knots (150 MPH) IAS			6. Adjust cowl flaps as required
7. Signal copilot to raise the wing flap when sufficient air speed and altitude have been gained	7. On pilot's signal move wing-flap switch to UP until flaps are fully retracted	7. Set radios as required	

LANDING

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Contact the ground with the main gear first, keep the nose for a time then ease the nose down; if landing is made in a cross-wind lower the upwind wing and crab into the wind with some rudder; just before ground contact, lever the wings and correct the airplane direction	1. Check hydraulic pressures up and landing gear switch DOWN		1. If reverse thrust is to be used, shut off all anti-icing heaters
2. Immediately after ground contact, close throttles	2. ADI pumps OFF		2. Cowl flaps OPEN when ground contact is made
3. If desired, use reverse thrust to slow the airplane roll; immediately upon contact with the ground place engines in reverse thrust; listen for reversal cycle; make a gradual and continual application of thrust and apply sufficient power to obtain the desired reverse thrust			
4. Return the propellers to normal pitch			
5. Move master synchronizer to full INCREASE RPM			5. Anti-icing may be turned back on if desired
			6. Turn booster pumps OFF
	7. When power is applied to the engines for taxiing off the runway, move the wing-flap switch to UP until flaps are fully retracted		
8. Trim tabs zeroed			8. If oil is to be diluted on shut-down, open oil cooler flaps for taxi

Landing

Calculate the power-off stalling speed based on the aircraft weight. Set engines to 2300 RPM and adjust power as required to achieve an airspeed of 190 KIAS. Landing gear may be lowered below 200 KIAS. Begin lowering flaps at 188 KIAS. Enter the pattern at either the crosswind or downwind leg at an indicated airspeed of 170 KIAS and 1,500 feet AGL, depending on clearance and type of approach. If possible, enter the pattern on the crosswind leg and fly 2-3 miles out from the runway. This will provide ample room to maneuver the aircraft. Fly the downwind leg at 165 KIAS, lowering flaps to 25 degrees abeam the runway threshold and reducing speed to 150 KIAS. Turn base 2-3 miles beyond the runway threshold at 150 KIAS and reduce speed on the base leg to 140 KIAS. Allow the aircraft to descend to 1,000 feet AGL on the base leg, turning to final at 140 KIAS. Do not lower the flaps fully until the runway is made, and maintain a speed of at least 25 KIAS above the calculated power-off stalling speed until the runway threshold is crossed. A normal final approach at 100,000 pounds is made with full flaps, propellers at 2300 RPM, and about 20" of power at a speed of 120 KIAS. Do not chop the power at any time. Reduce power and land smoothly, holding the nose off as long as possible. To reduce landing roll, engage reverse by pulling throttles back beyond the stop (F1 command).

LANDING WITH LANDING GEAR FAILURE

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Land with as light a gross weight as possible and after every effort has been made to lower the landing gear	1. Turn off all equipment not necessary for flight	1. Turn off all equipment not necessary for flight	1. Turn off all equipment not necessary for flight
2. Check that all passengers and crew in lower compartments are moved to the main cabin and braced for crash landing	2. Check emergency exits light switch is ARMED and step lights switch ON		3. Turn booster pumps OFF
3. Signal copilot to lower wing flaps	3. On pilot's signal, move wing-flap switch DOWN until desired amount of flaps is reached		
4. Land in a normal nose-high attitude			
5. On contact with the ground, close throttles, move mixture control to FUEL CUTOFF, turn magneto switches OFF and turn OFF master switch 5 seconds after CO2 has been discharged	5. On contact, place fire gang switches in the FIRE position and discharge all CO2 bottles		5. On contact shut off all fuel valves

LANDING WITHOUT BRAKES

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Land with as slow a forward speed as possible	1. Check wing flaps fully extended		
2. Land as short on the runway as possible	2. Check emergency hydraulic pressure and if required charge the system		2. Check all anti-icing heaters are off
3. Make contact with the main gear first then ease the nose down	3. Check emergency exits light switch is ARMED and step lights switch ON		3. Open cowl flaps on contact with ground
4. As soon as the nose gear makes contact, move all four throttles to REVERSE OPEN			
5. If necessary for stopping use the overhead emergency brake levers			
6. After airplane slows down, reduce reverse thrust and follow emergency taxiing instructions if necessary			

STOPPING ENGINES

PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Check parking brake on			
2. If oil dilution is desired, and when required temperatures are established, adjust throttles to obtain 1000 R.P.M.			
			3. When cylinder head temperatures are below 190° C, move mixture control to FUEL CUTOFF while idling between 800 and 1000 R.P.M.
4. Close throttles			4. Turn magneto switches OFF when engines stop turning
			5. Turn APU on if desired
			6. Leave cowl flaps open for at least 15 minutes after engines are stopped

BEFORE LEAVING THE AIRPLANE

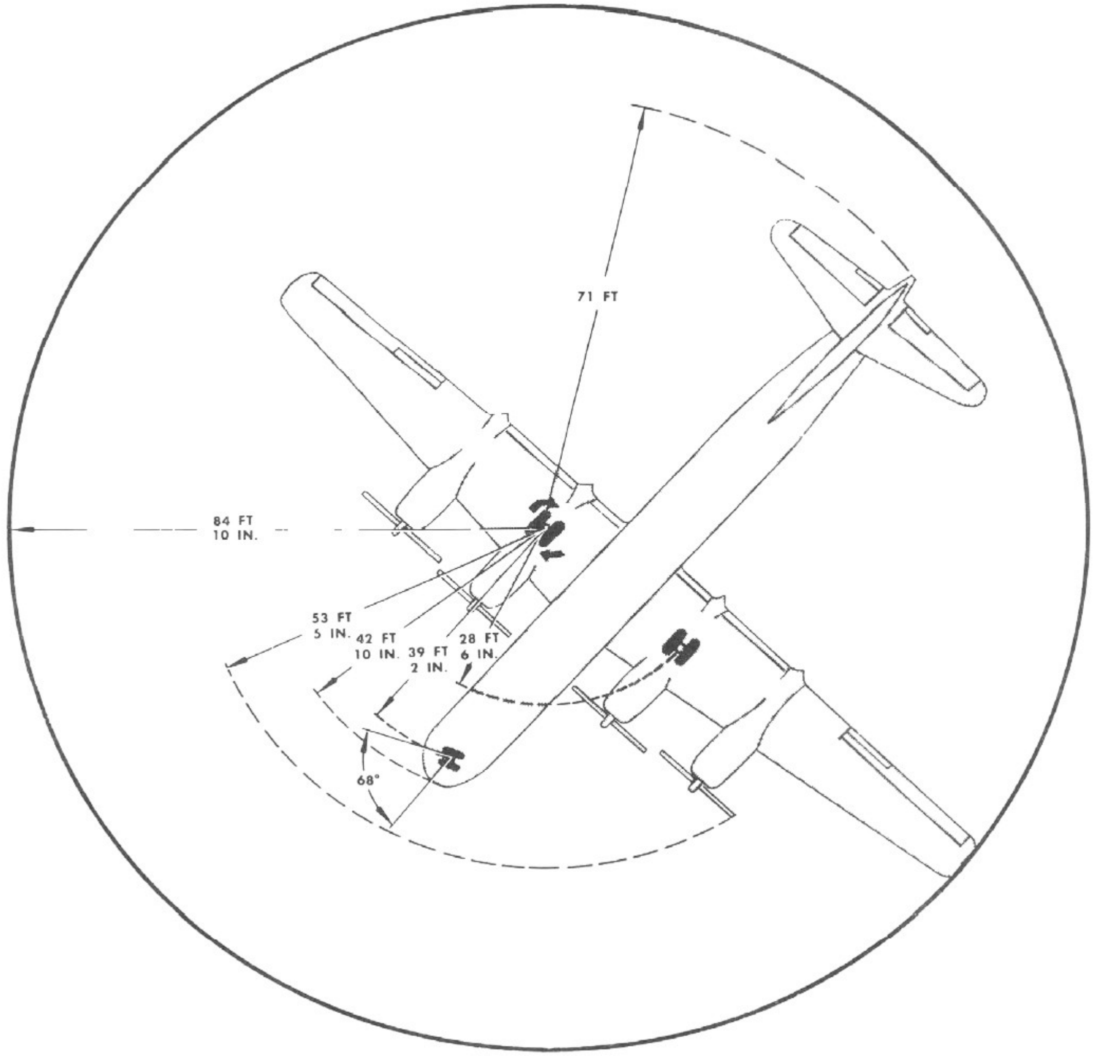
PILOT	COPILOT	NAVIGATOR	ENGINEER
1. Parking brakes ON			
2. Master synchronizer lever to full DECREASE RPM	2. Control surface lock LOCKED (press yoke fully forward before engaging lock)		
3. Avionics switch OFF		3. Radios and navigational equipment set as necessary	3. Turbo boost 0 (zero)
4. Trim tabs zeroed			4. Fuel selectors OFF
			5. Cowl flaps CLOSED
			6. Intercooler flaps CLOSED
7. All switches OFF except rudder boost switch	7. All switches OFF	7. All switches OFF	7. All switches OFF

Engine Limitations and Characteristics

The R-4360 Wasp Major is the most powerful engine ever fitted to a production piston aircraft. It produces 3,500 HP with water injection. It has both a gear-driven supercharger and an exhaust-driven turbosupercharger. The two systems worked together automatically to produce the power needed for flight, up to altitudes above 30,000 feet. The characteristics of the boost systems will require slight adjustments to the throttles as the aircraft climbs or descends to maintain the desired manifold pressure.

ENGINE POWER CHART	TAKEOFF MAXIMUM	MAXIMUM CLIMB POWER	ALTERNATE CLIMB POWER	MAXIMUM CRUISE	NORMAL CRUISE
Torque PSI	247	198	197	172	158
MP	60"	50.4"	45"	43"	37"
RPM	2700	2550	2350	2350	2100

MINIMUM TURNING RADIUS (TYPICAL)

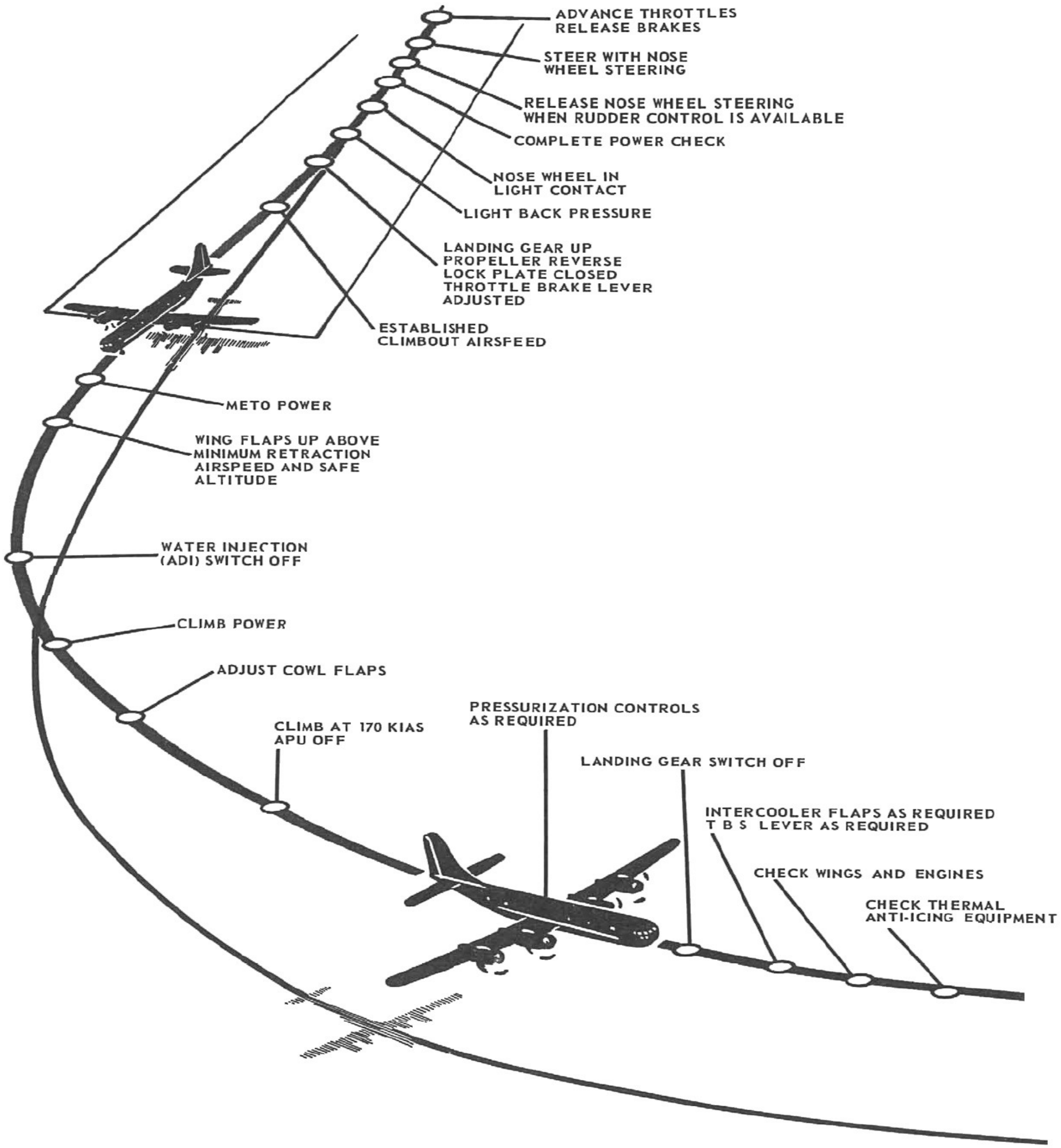


NOTE

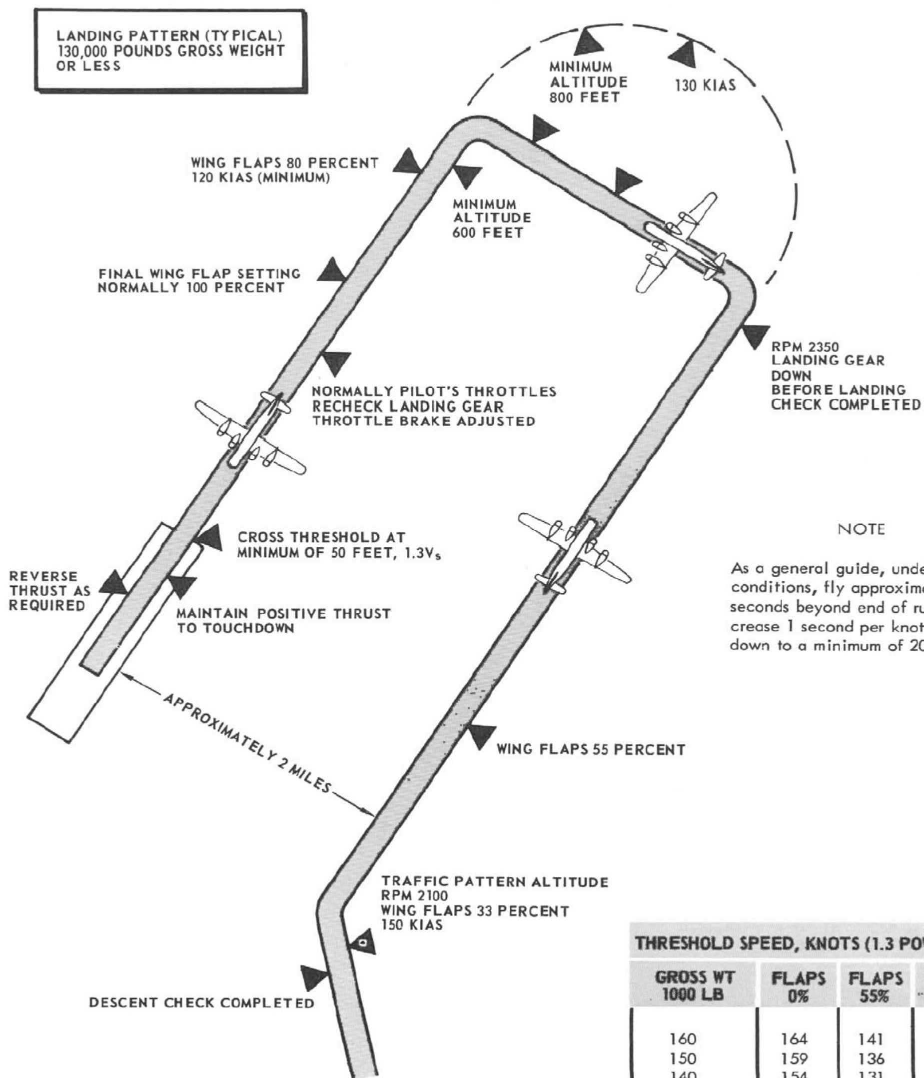
AVERAGE GROUND CLEARANCE

INBOARD PROPELLERS . . . . . . 1 FOOT 5 INCHES
OUTBOARD PROPELLERS . . . . 2 FEET 7 INCHES
FUSELAGE . . . . 2 FEET 9 INCHES

TAKEOFF AND CLIMB (TYPICAL)



LANDING PATTERN



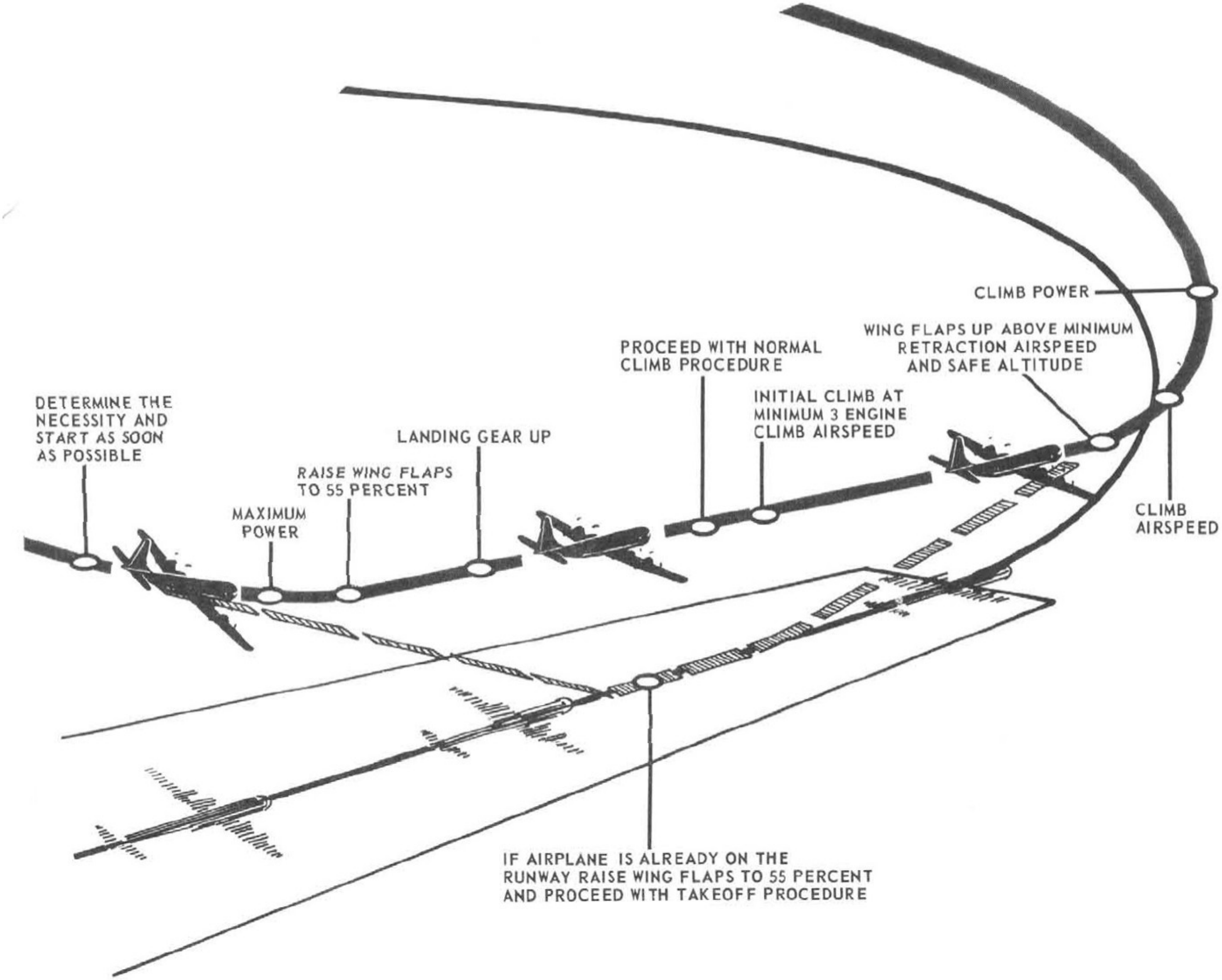
NOTE

As a general guide, under no-wind conditions, fly approximately 30 seconds beyond end of runway. Decrease 1 second per knot of wind down to a minimum of 20 seconds.

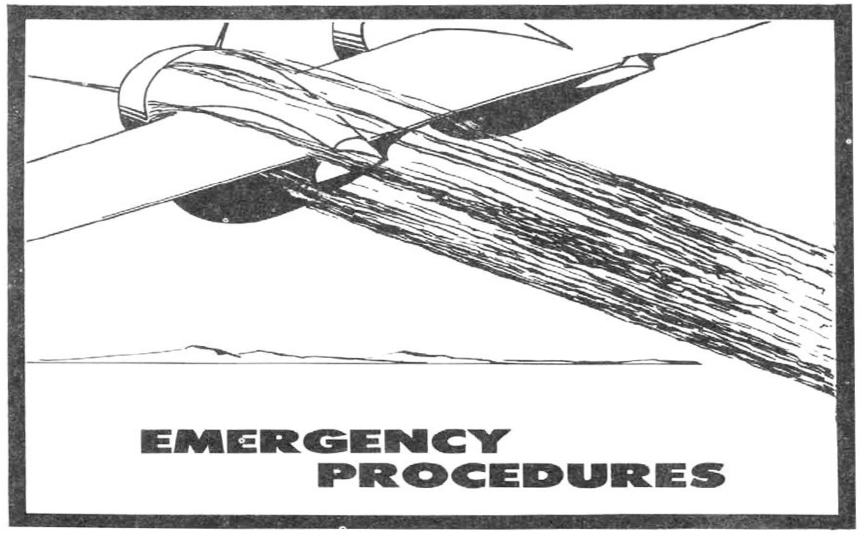
THRESHOLD SPEED, KNOTS (1.3 POWER-OFF STALL)

GROSS WT 1000 LB	FLAPS 0%	FLAPS 55%	FLAPS 80%	FLAPS 100%
160	164	141	134	129
150	159	136	130	125
140	154	131	125	121
130	148	126	120	116
120	142	121	116	112
110	136	116	111	107
100	130	111	106	102
90	123	105	100	96

GO AROUND


CLIMB POWER
WING FLAPS UP ABOVE MINIMUM RETRACTION AIRSPEED AND SAFE ALTITUDE
PROCEED WITH NORMAL CLIMB PROCEDURE
INITIAL CLIMB AT MINIMUM 3 ENGINE CLIMB AIRSPEED
DETERMINE THE NECESSITY AND START AS SOON AS POSSIBLE
LANDING GEAR UP
RAISE WING FLAPS TO 55 PERCENT
MAXIMUM POWER
CLIMB AIRSPEED
IF AIRPLANE IS ALREADY ON THE RUNWAY RAISE WING FLAPS TO 55 PERCENT AND PROCEED WITH TAKEOFF PROCEDURE

Chapter 13: Emergency Procedures



ENGINE FAILURE / FIRE DURING FLIGHT

IMPORTANT:
In order to avoid compounding the emergency, carefully select the correct engine controls.

As a result of recent tests, special emphasis has been placed on feathering the propeller of an engine prior to accomplishing other engine fire procedures. In view of these tests, the fire switch gang bar of the engine on fire must be placed to the FIRE position as soon as the fire is detected. When the engine stops or when it is obvious that the engine will not slow down any further, the fire extinguisher system may be utilized as necessary.

CAUTION:
DO NOT feather the propeller when all available power is needed, unless absolutely necessary. If torque pressure is above 65 psi, usable thrust is being delivered.

During takeoff or while airborne, **DO NOT** except in an emergency and then only with extreme caution, move any throttle back into the idle range unless the propeller reverse warning flag shows the word LOCKED and the propeller reverse lock plate is closed.

In case of engine failure/fire during takeoff, immediately apply full power.

ENGINE FAILURE / FIRE DURING FLIGHT (CONT)

1. **IF FIRE IS PRESENT**, POSITION FIRE SWITCH GANG BAR TO FIRE. When the engine will not slow down any further and indications of fire continue to exist, position the CO2 fire extinguisher switch to FIRST FIRE position and hold. If fire is not extinguished in 10 seconds, hold switch to SECOND FIRE position. SKIP TO PROCEDURE #5

2. SHUT DOWN ENGINE

3. Close throttle on failed engine

4. FEATHER propeller on failed engine

5. AUTOPILOT AND RUDDER BOOST-DISENGAGE

6. Set POWER as required on remaining engines

PERFORM STEPS 7 through 15 on the FAILED Engine:

7. MIXTURE LEVER- FUEL CUTOFF

8. MIXTURE LEVERS (ALL OTHER ENGINES) -AUTO RICH

9. Cowl Flap Switch - 3/4 INCH

10. Intercooler Flap Switch – CLOSED

11. Oil Cooler Flap Switch – CLOSED

12. Fuel Boost Pump Switch – OFF

13. Fuel Selector Valve Switch - TANK TO MANIFOLD

14. Ignition Switch – OFF

15. Turbo Switch - TAKEOFF (bypasses Turbo)

RESTARTING ENGINE IN FLIGHT

CAUTION:
DO NOT restart an engine unless it can be determined that it will be reasonably safe to do so.

1. Airspeed - "160 KIAS MAXIMUM"
2. Power Package Fire Switches – NORMAL
3. Throttle – CLOSE
4. Turbo Switch - CLIMB / CRUISE
5. Fuel Selector Valve Switch - AS REQUIRED
6. Oil Cooler Flap Switch - AS REQUIRED
7. Cowl Flap Switch - 3/4 INCH
8. Verify Prop featuring switch is OFF
9. Ignition Switch – BOTH
10. Mixture Lever - AUTO RICH
11. Slightly move PROP PITCH lever and verify propeller is no longer feathered
12. Press START
13. Hold BOOST button until Oil Pressure rises
14. Engine – WARMUP
15. Throttle - AS REQUIRED

EMERGENCY DESCENT

1. Throttles – CLOSE
2. Landing Gear Switch – DOWN
3. Wing Flap Switch – DOWN
4. Airspeed - 155 KIAS

NOTE:
Landing gear and wing flaps can be started down immediately after closing throttles from normal cruising airspeed. Airspeed will be down to wing flaps extension airspeed by the time wing flaps are fully extended.

CAUTION:
In an extreme emergency, where engine damage is not a factor, a faster rate of descent may be obtained by using 2700 rpm with the throttles closed.

CRASH LANDING

1. Landing Gear - AS REQUIRED

NOTE:
On hard or soft flat terrain, landing should be made with the landing gear fully extended. Extended landing gear will absorb some of the initial impact loads of crash landings in rough terrain. However, roughness of terrain, power requirements, gear down drag, and other pilot judgment factors should be considered prior to electing to crash land with gear up or down.

2. Wing Flaps - DOWN

3. Throttles - CLOSE

4. Fuel Boost Pump Switches - OFF

5. Battery Switch - OFF

6. Mixture Levers - FUEL CUTOFF

7. Ignition Switches - OFF

8. Master Switch - OFF

With no nose gear extended:
TOUCH DOWN ON MAIN LANDING GEAR AND HOLD NOSE UP AS LONG AS POSSIBLE

With nose and a single landing gear extended:
TOUCH DOWN ON NOSE GEAR AND EXTENDED MAIN LANDING GEAR AND HOLD WING UP AS LONG AS POSSIBLE

With one main landing gear retracted, make contact on the nose gear and extended main landing gear simultaneously; hold control column forward and use aileron to hold wing tip off the ground as long as possible. Be prepared for a ground loop.

Chapter 14: Anti-Icing

PITOT HEAD ANTI-ICING SYSTEM. Ice formation on the pitot heads is prevented or removed electrically by 28V DC heating elements in each of the two pitot heads.

PITOT HEAT SWITCHES. A single switch on the engineer's panel operates the pitot heaters. Power is supplied from the 28 volt DC bus. Operation of the pitot heaters should be limited to brief maintenance checks and extreme cold weather ground operation.

CARBURETOR ICING IN FLIGHT

INDICATIONS OF CARBURETOR ICING. Under conditions of high atmospheric humidity, carburetor icing can occur with carburetor air temperature between -10°C and 7°C. If icing does occur it will be indicated by one or more of the following:

1. Change in fuel flow and change in torquemeter pressure

2. Intercoolers - Close

If Necessary:

3. TBS setting – Increase

4. Throttle - Retard (to maintain manifold pressure within limits)

As Ice is Removed:

5. Engine Instruments - Monitor (carefully)

6. Engine Controls - Adjust

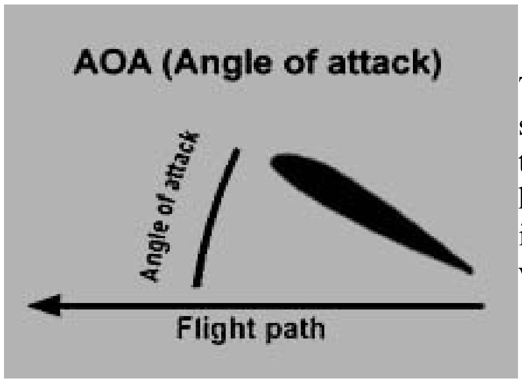
PREVENTION OF CARBURETOR ICING. If icing is anticipated on takeoff use sheltered air. In flight icing may be prevented with the turbo on by maintaining a carburetor air temperature of 15°C. If the icing conditions are extreme the carburetor air temperatures may, if desired, be maintained between 35°C and 38°C.

WINDOW DEFOGGING. The Stratocruiser has 19 cockpit windows which provide exceptional visibility, however, with a crew in the one area, moisture can cause the windows to fog up.

WINDOW DEFOGGING CONTROL KNOB. A single knob on the pilot's auxiliary panel controls the window defrosting valves and air is directed through tubes and onto the upper and lower windows.

Chapter 15: Stalls

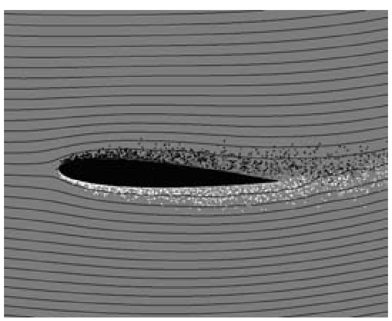
WHAT IS A STALL? In order for a wing to produce efficient lift, the air must flow completely around the leading (front) edge of the wing, following the contours of the wing. At too large an angle of attack, the air cannot contour the wing. When this happens, the wing is in a "stall."



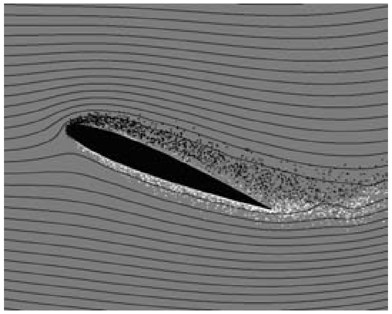
Typically, stalls in civilian aircraft occur when an airplane loses too much airspeed to create a sufficient amount of lift. A typical stall exercise would be to put your aircraft into a climb, cut the throttle, and try and maintain the climb as long as possible. You will have to gradually pull back harder on the stick to maintain your climb pitch, and as speed decreases, the angle of attack increases. At some point, the angle of attack will become so great, that the wing will stall (the nose will drop).

Below are some graphical representations of a wing traveling though the air in various conditions:

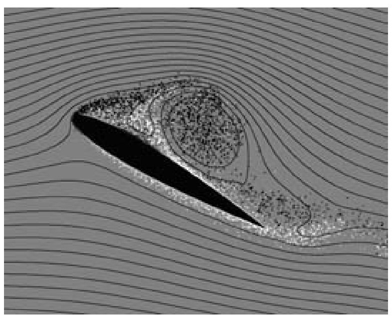
LEVEL FLIGHT.
A wing creating moderate lift. Air vortices (lines) stay close to the wing.



CLIMB.
Wing creating significant lift force. Air vortices still close to the wing.



STALL.
The angle of attack has become too large. The boundary layer vortices have separated from the top surface of the wing, and the incoming flow no longer bends completely around the leading edge. The wing is stalled, not only creating little lift, but significant drag.



STALLING THE STRATOCRUISER

STALL CHARACTERISTICS. The stall characteristics of the airplane are good. Recovery from stalls should present no problem to the average pilot provided the recommended recovery procedures are followed and the proper cautions are observed. The stalling speed increases with the angle of bank. Therefore, care must be exercised in banking the airplane at low airspeeds or with a nose-high attitude. The extended landing gear has no appreciable effect on the stalling speeds.

NOTE:
During stalls, at a medium gross weight, the airplane can be expected to lose at least 750 feet of altitude before being returned to level flight, if the proper recovery procedures are begun immediately after the complete stall has been reached.

STALL WARNING. Warning of the impending power-on or power-off stall comes in the form of a comparatively mild buffeting of the horizontal stabilizer and elevator and occasional light buffeting of the ailerons.

NOTE:
Stall speed is not affected by landing gear position.

Power-on stall speeds are 5 to 10 knots lower.

Should stall warning occur during flight, act immediately to avoid completely stalling the airplane. If in level flight increase the airspeed; in a turn, decrease the angle of bank.

IN THE STALL. At the full and complete stall, if a rapid roll occurs, the control wheel may momentarily move hard over, placing the ailerons in their maximum travel position, and remain there until flying speed is regained. A reversal of elevator force may take place during a complete stall, but the force tending to keep the control column back is usually comparatively light and should present no problem to the pilot in pushing the control column forward to recover from the stall. However, with a deliberate attempt by the pilot to obtain a very high angle of attack, and under an abnormal combination of conditions, such as a rearward center of gravity, power on the engines, and wing flaps up, it might be possible to encounter a somewhat high elevator force reversal, which would require considerable force by the pilot to push the control column forward during stall recovery. A combination of these conditions, which might induce a high elevator force, is considered to be far out of the normal operating range. Normally no abrupt rolling action either precedes or accompanies a power-off or low power-on stall. However, as in the case of most 4-engine airplanes, stalls encountered with unsymmetrical or high power on the engines will result in an abrupt roll either just before or at the stall.

WARNING:
Never use power and a nose-high approach to reduce the landing speed, except when required in emergency procedures. Under these conditions sufficient power should be used to maintain a safe airspeed above the stall warning speed.

The ailerons are effective up to the point of stall. Use of the ailerons in the stall will not aggravate the stall as is experienced in some types of airplanes. With boost on, rudder control is effective through the stall range even with one engine out, since the minimum directional control speed is below the stall speeds except at weights below approximately 100,000 pounds. With boost off, rudder control is similar to that of large airplanes with conventional or unboosted controls.

STALL RECOVERY. When the airplane is stalled, recovery should always be made by nosing the airplane down sufficiently to regain flying speed with minimum loss of altitude. In general, recovery from stalls at safe altitudes with low cruise powers should be made by leaving the power unchanged or by closing the throttles if serious difficulty is encountered. If the airplane is stalled with a large amount of power on, the power should be chopped immediately to prevent roll and an excessive loss of altitude during recovery. A stall with unbalanced power could cause a rapid roll; under this condition the power should be chopped immediately. If power is required for recovery, use symmetrical power. Only at lower altitudes when recovery with a safe altitude margin is questionable, should power be applied during recovery. Avoid excess airspeeds, abrupt pullouts and rough handling of controls during recovery; any or all may result in an accelerated secondary stall.

PRACTICE STALLS. For both power-on and power-off stalls, set propellers at 2100 rpm with landing gear up, and 2350 rpm with landing gear down, and manifold pressure necessary to produce a stall. **DO NOT** allow stall to progress beyond the buffeting stage. Practice all stalls with and without rudder boost operating and conduct all practice at least 5000 feet above terrain altitude. Monitor CHT closely since low airspeeds and turbulent airflow will hinder proper engine cooling.

WARNING:
Stall characteristics are greatly affected by position and gross weight. **DO NOT** practice stalls when the center of gravity is near the aft limit or when the gross weight is over 130,000 pounds.

To become completely familiar with the stalling characteristics of the airplane practice stalls may be made with the wing flaps up, wing flaps full or partially down, landing gear up, landing gear down, power on, power off, or any combination of the above configurations. When making power-on stalls avoid abrupt pull outs. To minimize rolling tendencies avoid excessively nose high attitudes during the approach to the stall. Since the rolling tendency is most pronounced in a turn, it is recommended that all stall practice be conducted straight ahead.

SPINS. Spins are a prohibited maneuver and must not be done intentionally. However, if a spin is entered accidentally and the landing gear and wing flaps are down, **DO NOT** attempt to raise them. While rotating, the airspeed indicator may indicate a much higher airspeed than the actual indication should be. A spin might occur if a stall is allowed to progress into heavy buffeting. A spin might result from asymmetrical power at low airspeeds, such as one engine out or reduced power on both engines on one side. Always eliminate the asymmetrical power condition. If a spin begins to develop with one engine out reduce power to idle on the opposite engine. If power has been reduced on both engines on one side, reduce power on the other engines. **DO NOT** attempt to bring up power on retarded engines; engine acceleration is too slow and the increased power may aggravate a full spin condition. Lower the nose and level the wings to place the airplane in a streamlined flight attitude (a spin is a stalled condition). Make a normal recovery from the dive. If a fully developed spin occurs, use normal recovery techniques, i.e. reduce all power to idle, apply full opposite rudder followed after a two-second interval by forward control column. Full forward column may be necessary to streamline the airplane. When rotation stops, center the rudder and pull out of the dive. **DO NOT** make an abrupt pull up as this may over-stress the airplane or produce a secondary stall. Avoid violent control movements at all times.

FLIGHT CONTROLS. The flight controls enable the airplane to be controlled without undue effort by the pilot under any reasonable load, flap and power combination. No unusual reactions of any controls will be experienced except for possible light elevator reversal during power-on stalls. The rudder is effective with or without rudder boost on. However, with rudder boost off considerably higher rudder pedal forces will be required. Wing flap position changes have little effect on the trim requirements of the airplane, since the left hand elevator tab is used to provide automatic trimming during changes in flap position. Trim requirements on all controls are slight during normal operation of the airplane. To properly trim, set up the flight attitude, power and airspeed desired, relieve all elevator pressure first, then rudder pressure and finally aileron pressure. Minimize the use of aileron trim; use it only when elevator and rudder trim are not completely effective.

WARNING:
Use of excessive trim during letdowns or approaches is dangerous, since power changes result in high control forces until the airplane is re-trimmed.

Chapter 16: Level Flight Characteristics

GENERAL CHARACTERISTICS. The flight characteristics are excellent for a heavy airplane. Maneuvering and control of the airplane do not require undue force by the pilot. The airplane is very stable and trims out very easily. Up to four units of aileron trim may be required for some off-center fuel loadings; this trim may be rolled in easily during takeoff and climbout. Only small changes in trim are required for normal operation to maintain the desired airplane attitude. Rudder control is excellent with the rudder boost switch ON. Response to power changes is immediate and positive.

SLOW FLYING. No control abnormalities will be discovered during low speed flight. Maintain a close watch on engine CHT due to poor cooling air flow and be alert for possible engine malfunction, since engine failure during low speed flight will result in a dangerous condition. Turns at low speeds are critical and controls should be well coordinated at all times.

CRUISING FLIGHT. No control or other flight peculiarities are evident during cruising flight. Avoid abrupt control movements at all times. Lowering the landing gear will increase the airplane drag and should be accompanied by a symmetrical increase in power to counteract this effect. Slight nose up trim will also be required. Wing flap position will have little effect on trim, but will greatly increase the airplane drag when between the 55% and 100% down positions. Oil cooler flap, intercooler flap and cowl flap position affect airplane performance, resulting in a loss of airspeed when open. Cowl flap drag is very apparent and non-symmetrical cowl flap operation will require changes in airplane trim. Cowl flap opening in flight is limited to a maximum of three inches due to excessive buffeting at larger openings.

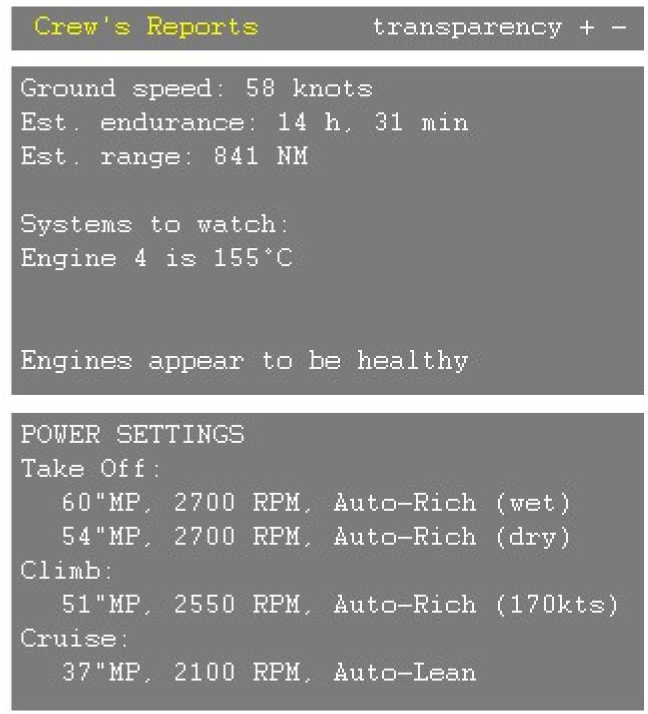
DIVING. Diving is prohibited. If the airplane inadvertently enters a dive, extreme caution should be used during recovery when at or near the limiting airspeed. Avoid abrupt pull-outs at any time.

Chapter 17: 2D Panels
CREW REPORTS

CREW REPORTS (SHIFT-2). Important information is readily available with the Crew Reports screen.

Ground Speed is the actual speed your aircraft is moving over the ground surface.

Estimated Endurance is the amount of time your aircraft can fly at the current rate of fuel consumption. Take into account, as you are climbing to your cruise altitude, this estimated endurance will be less than once you level off, throttle back, and settle into a cruise.



Estimated Range is the distance your aircraft will fly at the current speed and rate of fuel consumption. Again, take into account this will change based on climb, cruise, and descent operations.

Distance to Sea Level (not displayed) is only displayed when your aircraft is in a descent. This can help you establish a steady descent. For example, if you are 100 miles out from your destination, you would descend at a rate that would put you on the ground at 100 miles. This is a sea level calculation, so take into account your airfield height when using this calculation.

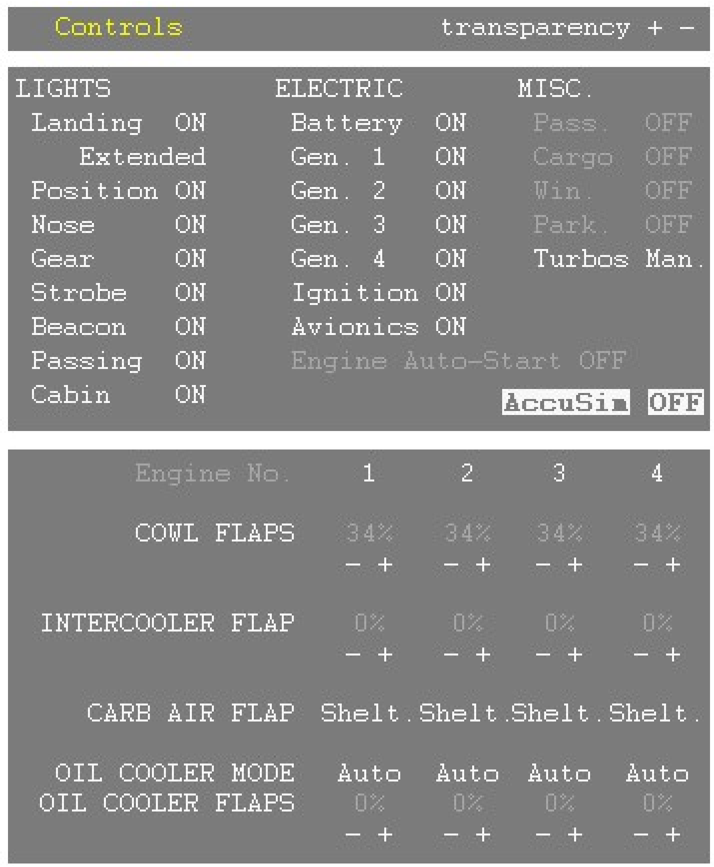
Systems to Watch displays the hottest engine and hottest turbo bearing temp. This becomes vital information if you install the Accu-Sim B377 Expansion Pack as high temperatures can damage your engines.

Engineer's Comments appear below. This is again vital information for Accu-Sim Expansion Pack users as engine checks, damage, etc. would be shown here.

Power Settings represent your clipboard showing you important info to quickly establish a proper takeoff, climb, and cruise. Note that “wet” means “ADI-ON” and “dry” means “ADI-OFF.”

CONTROLS

CONTROLS (SHIFT-3). This control panel was initially created to allow you to operate systems like lights, doors, and engine flaps while in the external view. It soon became a nice little place where we could put anything we wanted to have quick access to. You can hand your turbo control over to your engineer here, operate all four engine flaps types, turn your parking brake on, and Accu-sim users can enable or disable the entire expansion pack with a single click.



PAYLOAD and FUEL MANAGER (Realtime)

PAYLOAD AND FUEL MANAGER (SHIFT-4)

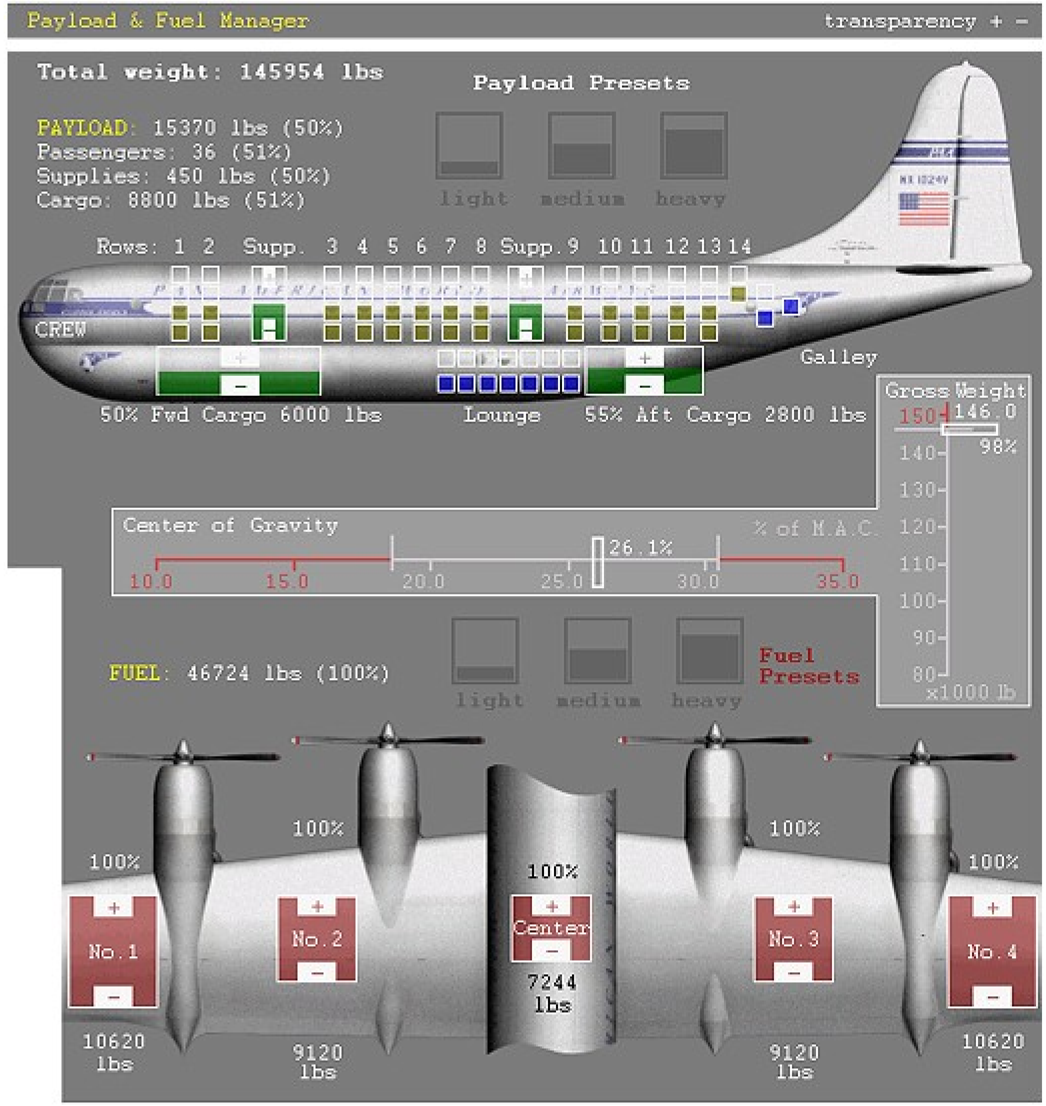
The Boeing 377 was designed to carry both passengers and fast freight, like mail and express cargo. This payload and fuel manager allows you to manage your payload in real time. You can click on individual rows to add / remove passengers, manage cargo, and fuel.

Center of Gravity is calculated in real time. If your center of gravity is too far forward, you will have to use extra back pressure on takeoff to lift the nose. If it is too far back, the aircraft may fly itself off the ground. The more rearward the center of gravity, the less stable (more maneuverable) the aircraft is**.**

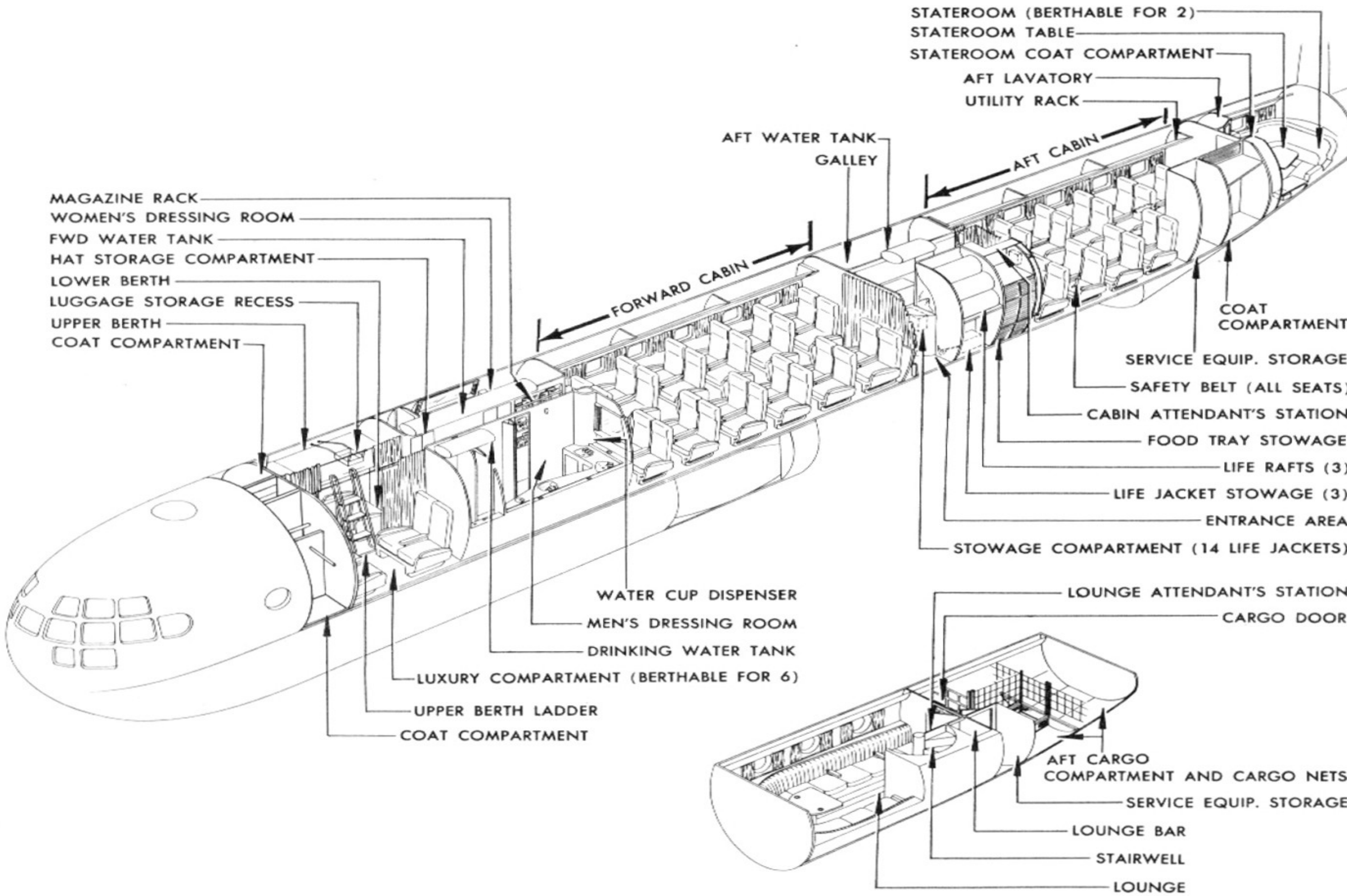
Gross Weight is also calculated in real time. If you exceed 147,000lbs, the scale will turn red. It is not recommended to fly an aircraft that is over it's gross weight limit.

Fuel can be loaded into individual tanks.

Presets are available for both payload and fuel for your convenience.



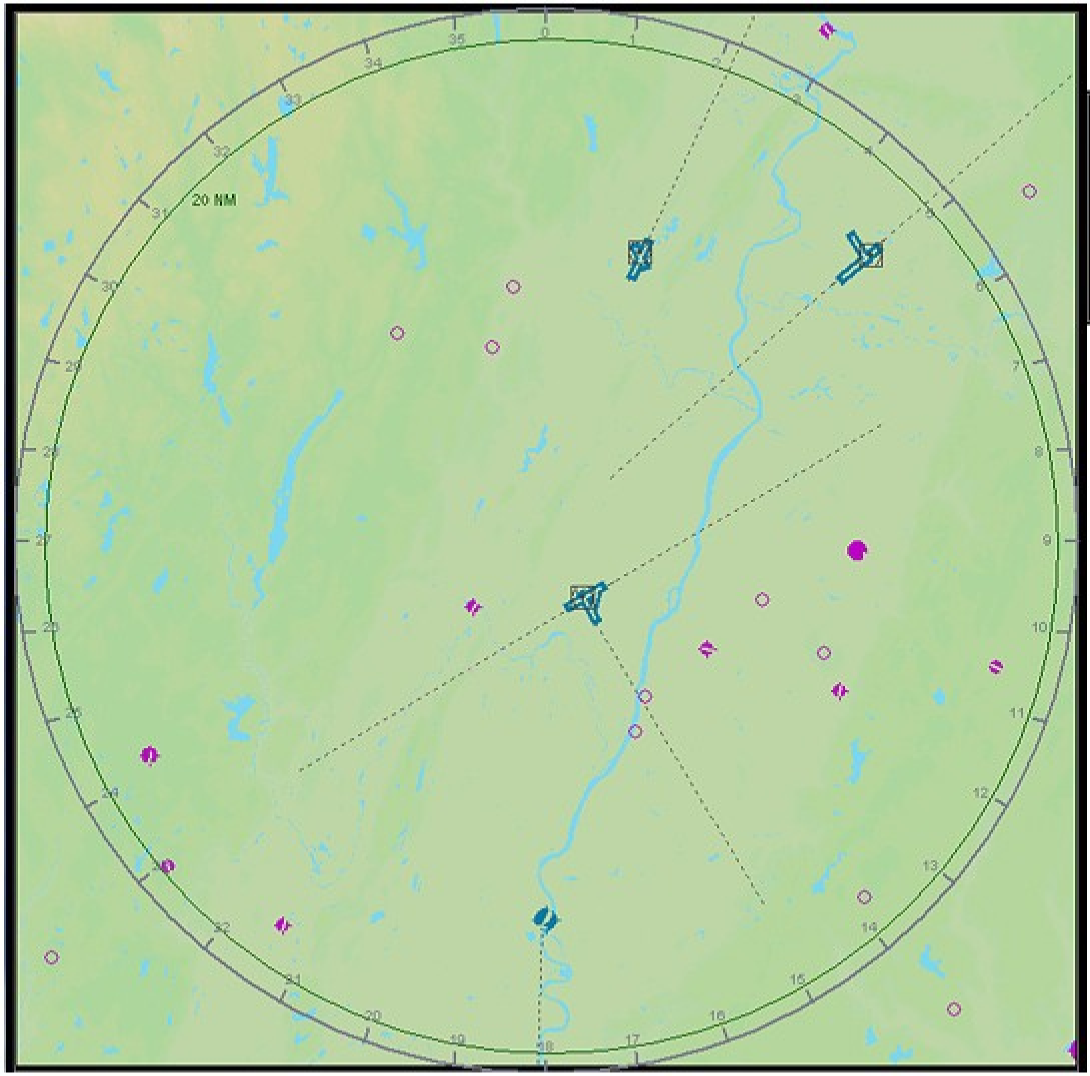
While the Stratocruiser was custom built for many different configurations, below is the setup we created for the Wings of Silver Stratocruiser. This shows you just how luxurious an aircraft this was with both a men's and women's dressing room that could fit three at a time, sleeper berths, stateroom, downstairs lounge, spiral staircase, and even the crew had a little place below with a table and bed to get some rest. Yes, Boeing set a standard for first class travel that the world had never seen before or since.



PASSENGER ACCOMODATIONS

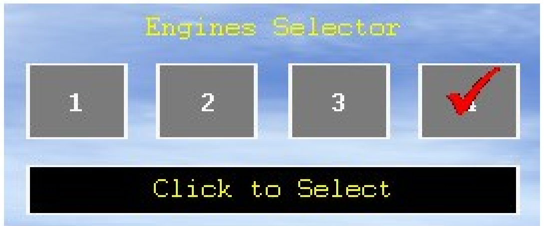
NAVIGATOR'S MAP

NAVIGATOR'S MAP (SHIFT-5). This map was created with Microsoft-provided functions and gives full access rather than have to use the default map from the upper menus. This is a period aircraft, so we tried to create this in the true light of a navigator needing to still use visualization or VOR to know precisely where the aircraft is over the map, hence, we did not include the little aircraft icon in the middle. You can access this map by clicking on the map sitting on the navigator's table.



ENGINE CONTROL SELECTION

ENGINE SELECTOR (SHIFT-6). This is a priceless little utility that allow those with a single throttle to select and control a specific engine or group of engines. To use, click on the engine number (here shown after clicking on the #4 engine), then click on the "Click to Select" bar below to activate. Once activated, in this example, moving your throttle would control engine #4.



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Very Special Thanks to our friends and families who stuck by us and worked hard to support our efforts

What an amazing aircraft this was.

We leave you with a shot of the Pregnant Guppy, undoubtedly carrying something very important to somebody. This aircraft shows that nothing is impossible if you put your mind to it.

From all of us at A2A Simulations, thank you.