

Some Important Notes to Read:

This is the Aeroworx rework of the original P3D C-47 by Manfred Jahn, Jan Visser and team

Please visit this web page frequently, all updates/news will be posted there:

[MJ C47 News, Updates, Mouse Click Regions](#)

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[Aeroworx Douglas c-47](#)[Aeroworx Douglas c-47](#)

Or

c47@aeroworx.co.za

1. Starting and running the engines.

- Mixture, Prop Pitch fully forward
- Throttles about 1/4 forward
- Engage the Starter, top right panel. Keep pressing down until the Exhaust Gas Temperature (EGT) rises or the fuel pressure raises above 10 psi.

2. **Fuel Selectors.** Only the left hand one is operative and will do both engines. The legend on the selector is not correct, use this table to see what has been selected:

- **LEFT AUX** - Will select "ALL" tanks in X-Plane
- **LEFT MAIN** - Correct, left main
- **RIGHT MAIN** - Correct, right main
- **RIGHT AUX** - **NO FUEL, WILL CUT** engines. Meant to be the center tank, but no tank fitted yet.
- **OFF** - Correct, will cut fuel supply.
- For now, only two (Left/Right Main) tanks installed. I'm not sure if we are going for the 3 tank or 4 tank version.

3. **Carb Heat.** The Carb Heat controls do work with a mouse manipulator or use the following keyboard keys:

- **F9** - Carb heat off
- **F10** - Carb heat on
- **F11** - Carb heat toggle

4. **Cockpit Lighting.** You may want to turn the brightness levels down for daylight flying. It will remember your last settings and your last flight at night can cause too high levels for the day.

5. **Sperry Autopilot.** With the Sperry switched off, you will see the "AIL" and "ELE" knobs moving by itself... just ignore them. With the Sperry switched on, they work as they should.

To use the Sperry:

Take-off and Climb

- Make sure the Inverter is "**ON**", left-hand top panel.
- Take-off and get your aircraft on heading and a climb of about **750ft/min**, indicated airspeed of about **110-115 KIAS**, gear/flaps up. MP at **36"**, RPM at **2350**.
- Switch on the Sperry and it should maintain this attitude. Use the "**AIL**" for aileron control, but most important of all, "**ELE**" for pitch control. Try to maintain a climb speed of **112 KIAS**, if your IAS increase, increase your climb angle (pitch) with a positive "**ELE**" input, if your IAS decreases, reduce climb angle (pitch).
- With the "**RUD**", dial in the heading you want to fly. **Now a non-standard procedure, hit the "HDG" button on the temporary DYNON AVIONICS left bottom of the panel.** Heading lock will now be on and any new heading should just be dialed in with "**RUD**".
- Before you reach your desired altitude, start to decrease the climb rate with "**ELE**" and then get it to as close as possible to a zero on the Vertical Speed Indicator(VSI).

Cruise

- Cruise at MP **30"** and RPM **2050**.
- Regularly check your altitude and with small adjustments, adjust "**ELE**" to maintain your altitude.

Descent

- Throttle back to **22"**, maintain **2050** RPM. When IAS approaches **140** KIAS, start lowering the nose with negative "**ELE**" inputs to about **500**fpm on VSI.

6. **Throttle Quadrant**. There are also mouse manipulators for the throttles, prop pitch and mixture controls. You may use the following keyboard short cuts:

- **F1** - Throttle down
- **F2** - Throttle up
- **F3** - Prop pitch down
- **F4** - Prop pitch up
- **F5** - Mixture down
- **F6** - Mixture up.

7. **Interior Lighting**. Just below the left hand wiper switch, you will see two temporary rheostats controlling the Instrument/Panel brightness levels. As in a real aircraft, turning them higher will brighten them, even in daylight. However this now defaults to a brightness level too high for normal daylight and you will have to turn them down a bit after each restart of X-Plane.

Be aware, when you turn the "Instrument Brightness" completely down, the background light in the Garmin will also be invisible. The complete lighting system will be updated in future.

8. **Important Information**

All updates (including this document) and news will be posted on the website link furnished at the beginning of this document.

Aeroworx Team - Johan van Wyk & Fred Stegmann

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Permission granted on 23 June 2017 by Manfred Jahn and Jan Visser to Aeroworx Design Studios to port this Douglas C-47 model to X-Plane 10 and X-Plane 11.

Beta Notices

Our aim is to give a free aircraft, of better than commercial quality, to the X-Plane community

Why did we opt to keep this release as a public Beta?

The answer is simple... we want ambitious users to help us to test this magnificent aircraft in order to get quality feedback and new ideas.

Although you are not in the official Beta Test Program, **positive** criticism and comments will be welcome. Also, feel free to ask for new things. See web page and email links at the top, in the yellow text box.

If you do not like this aircraft, the designers or the Design Studio, just do the correct thing and delete the aircraft. No need to troll on the media...

This is still a beta product, very much in the beginning phase, do not expect a fully working aircraft full of magic. We will get there in due future...

At the moment, our goal is to get the 3D cockpit and flight model fully operational. We have **not** touched the internal cabin or the outside of the aircraft. What you see is just what you get at this stage. We will start work on this soon..

Always get the **LATEST beta**, see the links at the top of this document.

Always read the **release notes**. Important information will be given in the notes.

Work on the **cockpit lighting** has also not started yet, the same for the cockpit and other shadow effects.

No work has been done on the **sounds**, we will change to FMOD sounds in future.

In X-Plane 11, once you change to the "Bare Metal" livery, all subsequent aircraft will inherit the "metalness" look. To restore to the normal, go to left upper menu bar, choose "**Developer**", then "Reload the current aircraft".

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PILOT'S NOTES

FOR

DOUGLAS C-47

TWO TWIN WASP R1830-90C ENGINES

INTRODUCTION

1. This is very basic notes to familiarise you with the Aeroworx re-worked Manfred Jahn C-47. A comprehensive manual will follow later in the beta test phase.

COCKPIT

PILOT SIDE

2. Pilot side main panel mouse click regions. The manipulators are divided into the following:
 - Hand.
 - Rotate Left/Right.
 - Mouse wheel.
3. Four “cheats” are:
 - **Flaps Up/Down**. Click on the top or bottom of the Flaps Indicator.
 - **Toggle Gear**. Click on the label below the Gear Status Indicator lights.
 - **Instrument/Panel Brightness**. Just to the left of the Sperry Auto Pilot you will find two rheostats to control the brightness levels. The proper ones are on the pilot overhead panel.
4. **Fuel Selectors**. Only the left hand one is operative and will do both engines. The legend on the selector is not correct, use this table to see what has been selected:
 - **LEFT AUX** - Will select "ALL" tanks in X-Plane
 - **LEFT MAIN** - Correct, left main
 - **RIGHT MAIN** - Correct, right main
 - **RIGHT AUX** - **NO FUEL, WILL CUT** engines.
 - **OFF** - Correct



Pilot Side Main Panel



Pilot side Intercom



Pilot Overhead Panel

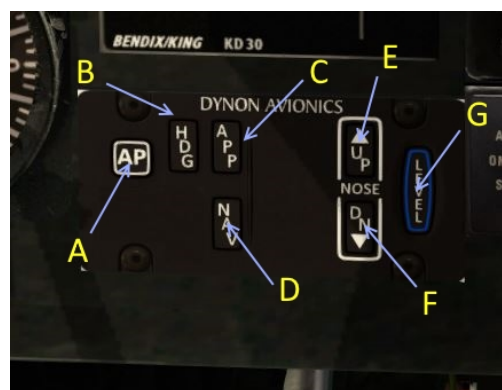
5. Radio Panel. A second ADF will be fitted later to the overhead panel.

- **COMM1/2** – Frequency change by adjusting the knobs or by clicking/mouse-wheel on digits.
- **NAV1/2** – Frequency change by adjusting the knobs or by clicking/mouse-wheel on digits.
- **ADF1** – Frequency change by adjusting the knobs or by clicking/mouse-wheel on digits.
- **Transponder** – Change code by clicking/mouse-wheel on digits.
- **DME Select** – Select the desired radio.



6. DYNON AVIONICS Auto Pilot. This is a temporarily fitted autopilot fitted just to make beta testing a bit easier.

- **A** – On/Off switch, in parallel with the Sperry power switch.
- **B** – Heading-hold. Adjust the heading with the Sperry “RUD” control.
- **C** – Approach mode
- **D** – VOR/LOC arm.
- **E** – Nose up, go into pitch mode.
- **F** – Nose down, go into pitch mode.
- **G** – Level aircraft and hold current altitude.



CO-PILOT SIDE

7. Mouse click regions and manipulators operate the same as in the pilot side.

8. Only one “Cheat” here, it is the label on the Sperry Autopilot as indicated below the green text. This is a toggle manipulator calling up the default Garmin430 in X-Plane 10 and the Garmin530 in X-Plane 11.

9. Carb Heat. The Carb Heat controls do work with a mouse manipulator or use the following keyboard keys:

- **F9** - Carb heat off
- **F10** - Carb heat on
- **F11** - Carb heat toggle

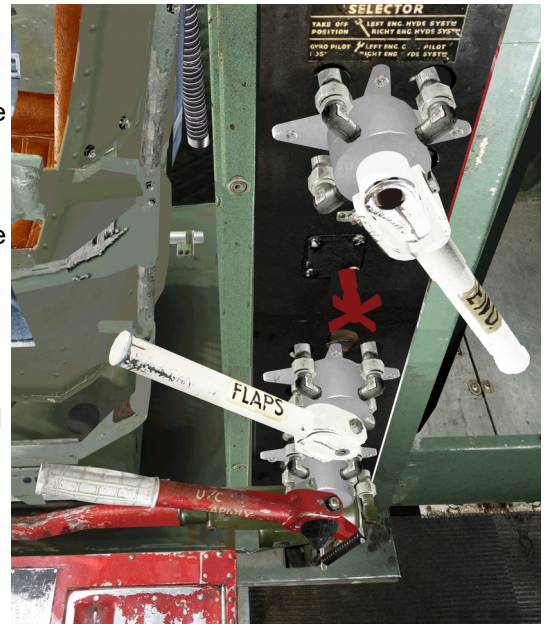


HYDRAULICS

10. Flaps Lever. Animated but no mouse manipulator yet. However, there is a “cheat” available where you can click on the Flap Position Indicator, see paragraph 3 above.

11. Gear Lever. Animated but no mouse manipulator yet. However, there is a “cheat” available where you can click on the label below the 2 Gear tell-tale lights, see paragraph 3 above.

12. Hydraulic Pump Lever. Animated but no mouse manipulator yet. You can assign a key or button to it, use the command “flightcontrols” and “sim/flight_controls/pump_gear”. Use this key/button then to “pump” the hydraulics; you will need at least 20 actions before you will have sufficient pressure.



CENTRE PEDESTAL

13. Rudder Trim.

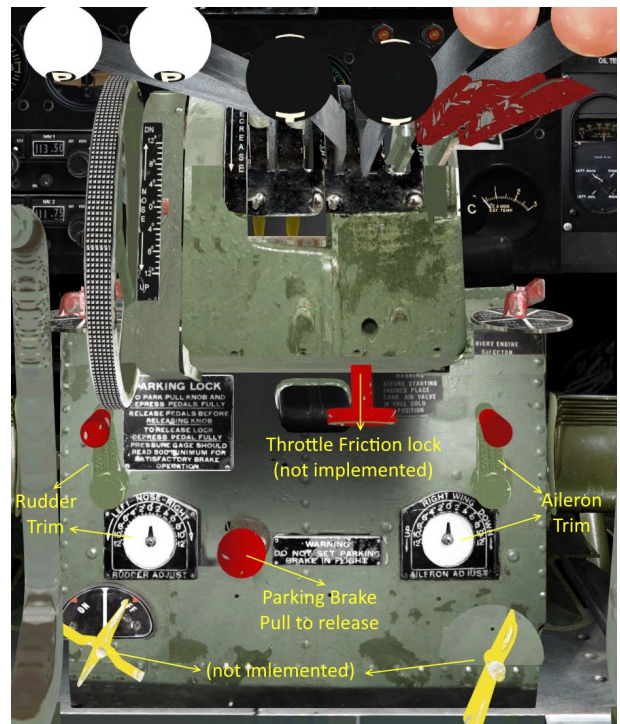
14. Aileron Trim.

15. Parking Brake. Difficult to see, make sure that you move the armrest to the back. Lever pushed **in**, parking brake is **ON**, lever pulled **out**, parking brake is **OFF**.

16. Throttle Quadrant. There are also mouse manipulators for the throttles, prop pitch and mixture controls. You may also use the following keyboard short cuts:

- **F1** - Throttle down
- **F2** - Throttle up
- **F3** - Prop pitch down
- **F4** - Prop pitch up
- **F5** - Mixture down
- **F6** - Mixture up.

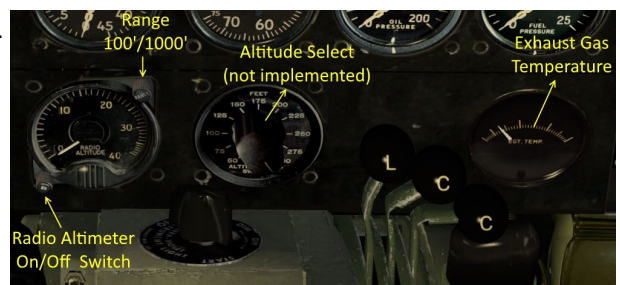
17. At this moment, the Mixture control (RED) operate as a ‘normal’ mixture control. Forward is maximum rich, pulling back the lever is leaning the mixture. Full back will cut the engines.



18. Radio Altimeter. Just behind the centre pedestal.

- **On/Off** – Power to the unit (not implemented).
- **Range** – Select altitude range: 0-300 ft or 0-3000ft.
- **Altitude Select** – (not implemented).

19. Exhaust Gas Temperature. We have not yet implemented “Auto Mixture”. Use this gauge to adjust mixture to the optimal setting. Slowly **lean** the mixture until you get the **peak** EGT, then adjust to a little richer (or leaner depending on your own preferences).



DAKOTA IV PILOT'S NOTES

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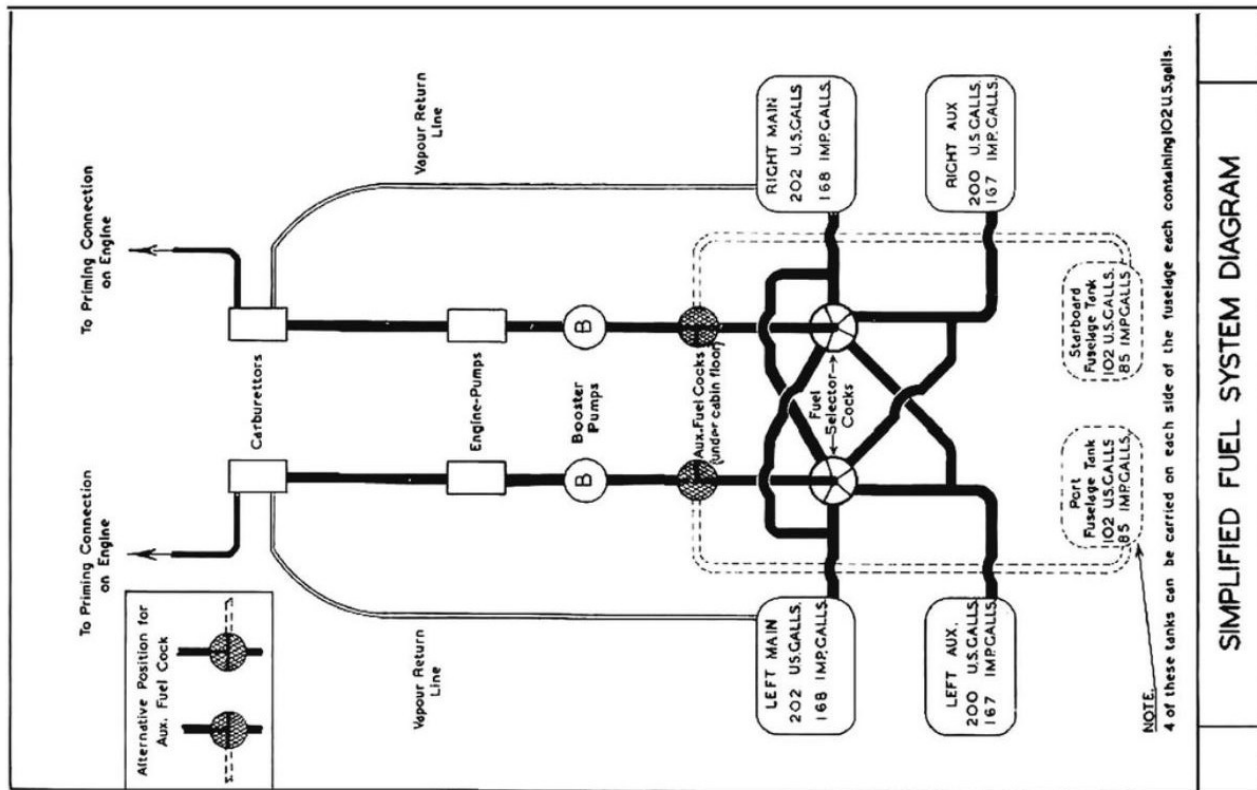
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6A	Loading Charts
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SIMPLIFIED FUEL SYSTEM DIAGRAM

PART I DESCRIPTIVE

INTRODUCTION

1. The Dakota IV is a twin-engined low wing transport aircraft, powered by Twin Wasp R1830-90C engines driving Hamilton paddle-bladed fully feathering propellers.

FUEL AND OIL SYSTEMS

2. Fuel tanks

Fuel is carried in four tanks, two in each wing. The capacities are as follows:

Main tank	
(front) each —	202 U.S. galls. (168 Imp. galls.)
Auxiliary tank	
(rear) each —	200 U.S. galls. (167 Imp. galls.)
Total each side	402 U.S. galls. (335 Imp. galls.)

In addition up to eight long-range inter-connected tanks may be carried in the fuselage, four on each side; each tank has a capacity of 102 U.S. gallons (83 Imp. gallons). The vapour return lines from the Bendix-Stromberg carburettors are vented to the main tanks and these tanks, when full, should be used for starting, take-off and preliminary flying.

3. Fuel cocks

- (i) A separate five-position selector cock, controlling the fuel supply from the wing tanks, is fitted for each engine. These cocks (13) and (18) are mounted on either side of the control pedestal and are marked OFF, LEFT AUX., LEFT MAIN, RIGHT MAIN, and RIGHT AUX.
- (ii) Two cocks mounted on the floor just aft of the navigator's compartment control the supply of fuel from the long-range tanks.

PART I—DESCRIPTIVE

4. Fuel booster pumps

Two electrically-driven fuel booster pumps are fitted. They are controlled by switches mounted on the right-hand electrical panel (25). These pumps, which deliver fuel at a pressure of 17 lb./sq. in., may be left ON at all times when the engines are running, but in any case they should be ON for starting, take-off and landing, when climbing, and at any time when the fuel pressure begins to fall. They must never be switched ON when the engines are not running, unless the mixture controls are in the IDLE CUT-OFF position.

5. Priming system

Two electrically-operated priming valves are fitted, one for each engine. They are controlled by spring-loaded switches mounted on the left-hand electrical panel (23). The switches are held DOWN to prime the engines.

NOTE.—In the UP position the same switches operate the oil-dilution valves.

6. Fuel contents gauge

A liquidometer fuel contents gauge (12) is fitted on the right-hand side of the instrument panel. To read the contents of any wing fuel tank, switch on the BATTERY MASTER switch and turn the fuel selector to the appropriate tank. The contents of the long-range tanks can be checked by the dip-stick attached to the filler cap in each tank.

7. Fuel pressure gauge

A dual reading fuel pressure gauge is mounted on the right-hand side of the instrument panel.

8. Oil system

- (i) Oil is supplied from a separate tank mounted in each engine nacelle. The capacity of each tank is 29 U.S. gallons (24 Imp. gallons) of oil and 2.9 U.S. gallons (2.4 Imp. gallons) airspace.

The tanks incorporate "hot pots" and must, therefore, always be filled to their correct capacity; otherwise, during take-off (when the oil temperature is low) the hot pots may become exhausted, thus leading to oil starvation.

- (ii) Oil temperature is controlled automatically by a thermostat fitted to each oil cooler. Some aircraft have oil cooler shutters manually operated by two levers on the port side of the control pedestal. The levers are set forward to open, and aft to close, the shutters and can be set to any intermediate position. The locking lever to the right of these levers is inoperative.

- (iii) Oil dilution:
An oil dilution system is fitted. It is controlled by two switches mounted on the left-hand electrical panel (23); the switches are held UP to operate the oil dilution valves.

MAIN SERVICES

9. Hydraulic system

- (i) There are two hydraulic systems, the main system and the Sperry Gyropilot system. These systems are fed by two engine-driven pumps, one on each engine. The engine pump selector, on the hydraulic control panel, should normally be in the down position; the port engine-driven pump then supplies the main hydraulic system, and the starboard engine-driven pump the Sperry Gyropilot system. With the engine pump selector handle in the up position the functions of the engine-driven pumps are reversed. At any time when hammering or vibration of the pressure regulator occurs, the engine pump selector should be changed to the alternative position.

- (ii) The main hydraulic system operates the

Brakes
Cowling gills
Flaps
Undercarriage
Windscreens wipers

A hydraulic accumulator is fitted, and there is a pressure regulator which maintains pressure in the system between 650 and 850 lb./sq. in.; this pressure will be shown on the rear hydraulic pressure gauge (7) mounted on the right-hand cockpit wall. The forward gauge (6)

shows the pressure in the undercarriage down lines. A handpump which will operate all the normal services in the event of failure of the engine-driven pumps, is fitted between the pilots' seats. This pump draws fluid from the bottom of the hydraulic reservoir, whereas the engine-driven pumps draw fluid from an outlet at a higher level; a reserve of fluid for the handpump is thus always ensured. A handpump by-pass valve is mounted on the centre of the hydraulic control panel; with this valve in the OFF (normal) position, the handpump will operate any hydraulic service selected, but it will not charge the accumulator, and the handpump pressure will not, therefore, be recorded on the rear hydraulic pressure gauge. To charge the hydraulic accumulator when the engines are not running, set the by-pass valve to the ON position and operate the handpump; the rear hydraulic pressure gauge will then record the handpump pressure. After charging the accumulator in this way, the by-pass valve must be set to the OFF position.

- (iii) The level of the fluid in the hydraulic reservoir is shown on a direct reading gauge mounted on the hydraulic control panel.

10. Vacuum system

Two vacuum pumps, one driven by each engine, together operate the gyro instruments and automatic pilot. The pressure from the exhaust side of the vacuum pumps operates the Goodrich de-icing system.

11. Electrical system

- (i) Two generators, one driven by each engine, and two 12-volt batteries connected in series, supply electric power at 24 volts for the operation of the services listed below.

An inverter supplies power for the alternating current operated equipment. On some aircraft alternating current is supplied by an alternator instead of by an inverter; it replaces the generator fitted to the port engine.

Cabin lighting
Door warning light
Engine starter motors
Fuel booster pumps
Fluorescent lighting
Instrument lighting

Instruments

Navigation and landing lights
 Paratroop warning lights
 Pitot-head heater
 Propeller feathering motors
 Priming valves
 Propeller de-icing pump
 Oil dilution solenoids
 Radio

Undercarriage warning horn and lights

- (ii) The BATTERY MASTER switch is on the left-hand electrical panel (23). This switch must be OFF when a ground starter battery is in use. The latter can be plugged in to a socket on the underside of the fuselage just forward of the leading edge of the wing. The generator switches are in the main junction box on the forward side of the port bulkhead, behind the pilots compartment.
- The INVERTER switch, on the right-hand electrical panel (25), must be ON in addition to the BATTERY MASTER switch for the operation of the alternating current operated equipment.

12. Heating and ventilating systems

Cabin heating is provided by air which is passed through exhaust-heated mufflers. The system is controlled by two spill valves and a heat regulator in the wireless operator's compartment. Warning lights in the wireless operator's compartment, and on the right-hand instrument panel, come on when the cabin temperature becomes unduly high. The spill valves should then be opened. A separate heat regulator for the cockpit is fitted behind the first pilot's seat.

AIRCRAFT CONTROLS

13. Flying controls

The flying controls, which are duplicated for the first and second pilot, are conventional. Each rudder pedal may be adjusted for reach during flight by depressing the lever (20) on the outboard side of it.

14. Flying controls locking gear

The flying controls are locked by external detachable blocks which engage with the control surfaces themselves. Stowage for the locking gear is provided in the rear of the fuselage. There is no nuisance bar or any other indication in the cockpit that the controls are locked, and it is, therefore, essential that the locks are removed before the aircraft is entered.

15. Trimming tabs

The trimming tab controls, mounted on the control pedestal, all operate in the natural sense and corresponding indicators show the setting of the tabs.

16. Automatic pilot

A Sperry-type A-3 gyropilot is fitted. For operation see A.P.2095 Part III, Note C. The engaging lever is on the bottom left-hand face of the control pedestal, but before the gyropilot can be engaged the oil shut-off valve on the hydraulic control panel must be ON. The automatic pilot oil-pressure gauge is mounted on the lower right centre of the instrument panel; normal operating pressure is 120 lb./sq. in.

17. Undercarriage controls

- (i) The undercarriage selector lever, mounted on the hydraulic control panel, has three positions, UP, NEUTRAL, and DOWN. It engages in a slot in each position and must first be pressed outwards before it can be moved. In flight the selector should always be returned to the NEUTRAL position after any operation.
- (ii) No undercarriage mechanical uplocks are fitted and the wheels have a tendency to lower under their own weight. When this occurs the hydraulic pressure will slowly rise in the undercarriage pipe lines. Periodically as the pressure builds up to about 150 lb./sq. in. on the forward hydraulic gauge, reselect UP and then return the selector to NEUTRAL. On the ground, if the aircraft is to be left standing for some time, the selector should be set to DOWN, for if it is left in the NEUTRAL

position any rise in temperature will cause the fluid trapped between the selector and the undercarriage jacks to expand and thus subject the pipelines to excessive pressures.

NOTE.—The undercarriage selector lever must always be moved smartly and without pause; intermediate settings between UP, NEUTRAL, and DOWN must never be used.

(iii) The safety-latch control (for the undercarriage downlocks), which is linked with the undercarriage selector, is on the floor between the pilots' seats. It has three positions, POSITIVE LOCK (fully forward), SPRING LOCKED (lever inclined at about 45° to the cockpit floor), and LATCH RAISED (lever vertical). In the POSITIVE LOCK position the lever is retained by a clip; this position should always be used when the undercarriage is fully lowered since it engages the downlocks positively. The selector lever cannot be moved to the UP position with the lever at POSITIVE LOCK or at SPRING LOCKED. In flight the latch lever should not be set to the former position once the undercarriage has been retracted for it will prevent the downlocks engaging when the undercarriage is lowered again. The latch lever automatically returns to the SPRING LOCKED position when the selector lever is returned to NEUTRAL after undercarriage retraction. With the latch lever in this position the undercarriage downlocks engage by spring action when the undercarriage is fully lowered. In the LATCH RAISED position the downlocks are completely disengaged and the undercarriage selector can be set to UP or DOWN. The latch lever is locked in the LATCH RAISED position by a dog at the undercarriage selector. After the undercarriage has fully retracted and the selector has been returned to NEUTRAL the dog is automatically disengaged and the latch lever springs back to the SPRING LOCKED position. If the lever fails to spring back from the LATCH RAISED position or the lever is at LATCH RAISED and it is desired to return it to SPRING LOCKED without retracting

the undercarriage, the dog can be disengaged by pulling forward the small knob on the undercarriage selector against the spring, or alternatively by moving the selector slightly to UP and then returning it to NEUTRAL.

(iv) On the ground, when the engines are not running, safety locking pins with red flags attached are inserted in the joints between the hydraulic rams and the undercarriage radius rods. These must be removed before flight.

18. Undercarriage warning lights

Two undercarriage warning lights (8) are fitted on the right-hand side of the instrument panel; they indicate as follows:

Undercarriage locked	DOWN, selector	
NEUTRAL	Green light
Undercarriage locked	DOWN, selector	
not NEUTRAL	Red light
Undercarriage UP, selector	NEUTRAL...	No light
Undercarriage between the UP and DOWN	positions	Red light

The lights may be tested by depressing their holders into the panel; dimming for night flying is afforded by rotating them.

19. Undercarriage warning horn

A warning horn sounds

- (a) when the undercarriage is not locked down and either throttle is nearly closed.
- (b) when the undercarriage is locked down but the selector is not set to NEUTRAL.

20. Flaps control

- (i) The flaps selector lever on the hydraulic control panel, has three positions UP, NEUTRAL, and DOWN. The selector lever engages in a slot in these positions and must first be pressed outwards before it can be moved. The flaps can be set to any intermediate

position by returning the lever to NEUTRAL when the desired position is indicated on the flaps position indicator. In flight the selector lever should always be returned to NEUTRAL after any operation, but when the aircraft is standing on the ground for long periods it should be set to UP, for if it is left in the NEUTRAL position any rise in temperature will cause the fluid trapped between the selector and the flap jacks to expand and thus subject the pipelines to excessive pressures. The flaps selector lever must always be moved smartly and without pause: intermediate settings of the lever between UP, NEUTRAL, and DOWN must never be used.

21. Flaps position indicator

The flaps position indicator (1) is fitted in the left-hand corner of the instrument panel and shows the position of the flaps at all times.

22. Brakes

(i) The brakes are operated by toe extensions on the rudder pedals. The minimum hydraulic pressure for effective operation of the brakes is 600 lb./sq. in. If the pressure on the rear hydraulic gauge is below this figure turn ON the handpump by-pass valve and raise the pressure with the handpump.

(ii) To apply the parking brakes, depress the brake pedals fully and pull out the parking brake handle fitted on the front face of the control pedestal, then release the pedals. To release the parking brake depress the rudder pedals.

NOTE.—The parking brakes should not be left on in hot weather since the hydraulic fluid will expand and thus subject the pipelines to excessive pressures.

23. Tailwheel locking control

The tailwheel locking control lever is on the control pedestal on the under-side of the throttle quadrant. To lock the tailwheel, move the lever to the right and allow it to spring forward to the locked position; the tailwheel will then lock when it is centralised.

ENGINE CONTROLS

24. Throttles

The throttle levers (15) are mounted in a quadrant on the top of the control pedestal. No automatic boost control is fitted and care must be taken to avoid over-boosting on take-off and at all times in flight. A friction damper is provided on the under side of the throttle quadrant.

25. Propeller controls

(i) The propeller speed control levers (16) are mounted in a quadrant on the left of the throttle levers and are moved forward to INCREASE R.P.M. and backwards to DECREASE R.P.M.

(ii) The propeller feathering pushbuttons (22) and (24) are mounted on the electrical panels above the windscreen.

26. Mixture controls

Two mixture control levers (14) are mounted on a quadrant on the right of the throttle levers.

They have four positions, FULL RICH, AUTO RICH, AUTO LEAN, and IDLE CUT-OFF. The levers should only be set to FULL RICH if the automatic regulation of mixture strength is found to be faulty. The IDLE CUT-OFF position is used only for starting and stopping the engines.

27. Carburettor air-intake heat controls

(i) Two combined air-intake heat and filter control levers, together with a locking lever, are mounted on the right-hand side of the engine control pedestal.

The levers, which move in a quadrant marked HOT, RAM, and FILTERED, are locked in the HOT and FILTERED positions by the locking lever, and in the RAM position by a notch in the quadrant.

If the engines are started with the control levers set to FILTERED, any backfiring may cause serious damage to the air-intake shutters. The RAM position should, therefore, always be used for starting, but the levers should be set to FILTERED, and locked in that position, for all ground running, take-off, landing and flying in dusty or sandy conditions.

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The RAM position should be selected for all other flying except when carburettor icing conditions prevail.

- (ii) A dual reading carburettor air temperature gauge is mounted on the right-hand side of the instrument panel.

28. Carburettor anti-icer control

- (i) A three-position spring-loaded switch which is marked ON, OFF, and MOM (momentary) is mounted on the right-hand electrical panel. It controls the flow of anti-icing fluid to the carburettors and should only be used if carburettor icing cannot be prevented by use of the normal air intake heat controls.

- (ii) Anti-icing fluid is contained in a tank of 10 U.S. gallons (8 Imp. gallons) capacity, mounted in the right-hand baggage compartment.

29. Supercharger control

A single supercharger control lever for both engines is mounted on a shelf on the left-hand cockpit wall. It is marked LOW BLOWER in the rear position and HIGH BLOWER ON in the forward position. When high gear is engaged two red warning lights next to the control lever come on. When changing gear the control must always be operated smartly and without pause.

30. Cowling gills

The cowling gills are operated hydraulically by the two controls (27) mounted on the right-hand cockpit wall; these are marked CLOSE, OFF, TRAIL, OFF, and OPEN. The TRAIL position, which gives about 15° of gill opening, is used for take-off and climb and the OPEN position only for ground running. When the OPEN or CLOSE position has been selected and the operation is complete the controls should be returned to OFF.

31. Engine starting controls

- (i) Jack and Heinz inertia-and-direct cranking starters are fitted. They are controlled by two spring-loaded switches mounted on the right-hand electrical panel, marked ENERGISE and MESH respectively.

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- (ii) The starters can be hand-cranked and engaged by a manual engaging cable in each nacelle. If the starter is engaged by operating the manual engaging cable, the brushes are lifted off the starter motor, which cannot then be energised electrically until the brushes are lowered; to do this operate the MESH switch in the cockpit and release it again before energising.

OTHER CONTROLS

32. Leading edge de-icers

An ON—OFF control for the Goodrich de-icers is fitted on the bulkhead behind the second pilot's seat. To operate, pull out and then turn to starboard.

33. Propeller anti-icers

An electric pump supplies anti-icing fluid to both propellers from a tank of 4 U.S. gallons (3.3 Imp. gallons) capacity, mounted behind the first pilot's seat. The pump is controlled by an ON—OFF switch on the left-hand electrical panel. A rheostat controlling the rate of flow of fluid is mounted on the bulkhead behind the first pilot's seat.

34. Windscreen de-icers

Two independent systems are provided :

- (i) Sliding panel de-icers : To operate this system turn ON the two green cocks, one on each cockpit wall, together with the cock behind the first pilot's seat, and operate the handpump mounted on the right-hand cockpit wall.
- (ii) Main windscreen de-icers : To operate this system first open the de-icer control valve on the top centre of the instrument panel and then switch ON the electric pump by operating the DE-ICER ON—OFF switch mounted on the left-hand electrical panel.

NOTE.—Both systems are supplied from the same tank, which is fitted in the right-hand baggage compartment. It has a capacity of 6 U.S. gallons (4.9 Imp. gallons) of fluid.

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35. Windscreen defroster system

Three windscreen defrosters are fitted, one each for the left-hand and right-hand sides of the cockpit windscreen, and one for the astrodome.

When the heating and ventilating system is in use the defrosters may be turned on by opening the butterfly valves at the ends of the flexible tubes. An emergency control for the defrosters is provided in the navigator's compartment.

36. Windscreen wipers

The two windscreen wipers are hydraulically operated and are controlled by the valves mounted on the centre of the instrument panel. Rotation of the valves controls the rate of operation of the wipers. The wipers must not be used when the windscreens are dry.

37. Cabin door warning light

A red warning light (9) on the right-hand instrument panel comes on when the cabin door is open. This light will only operate when the BATTERY MASTER switch is ON.

38. Oxygen

A low-pressure demand oxygen system is installed for all crew positions and a constant flow system can be installed, if required, for passengers.

39. Static pressure selector switch

A two-position switch (11) at the bottom centre of the instrument panel is labelled STATIC TUBE, STATIC PRESSURE SELECTOR VALVE, and ALTERNATE SOURCE.

The switch should normally be set to STATIC TUBE in which position the static pressure for the altimeter, A.S.I. and Rate of Climb Indicator is drawn from the pitot head, which is the normal source. If the switch is set to ALTERNATE SOURCE the instruments will function but readings will not be so accurate.