PA-38 TOMAHAWK

OPERATIONS MANUAL

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PA-38 TOMAHAWK

Operations Manual

Please note that Aerofly FS 2 must be correctly installed on your PC prior to the installation and use of this PA-38 Tomahawk simulation.

CONTENTS

INTRODUCTION

The PA-38 Tomahawk is a T-tail, two-seat, piston-engine aircraft equipped with fixed tricycle landing gear, 112 HP four-cylinder engine and fixed-pitch propeller.

The Tomahawk was designed as an affordable two-seat trainer and flight instructors had significant input into its design. 2,484 aircraft were built between 1978 and 1982 and the Tomahawk has been widely used as both a tourer and a flight training aircraft.

This Just Flight simulation is based on G-BNKH, a Tomahawk II based at Goodwood Aerodrome with SportAir.

Aircraft specifications

Dimensions

Length	7 m (23.1 ft)
Wingspan	10.5 m (34 ft)
Height (to top of tail)	2.8 m (9.1 ft)
Wing area	11.6 m2 (125 ft^2)

Engine

Type	Lycoming O-235 four-cylinder, horizontally opposed, air-cooled piston
Power	112 HP at 2,600 RPM
Propeller	Two-blade, fixed-pitch

Weights

Empty weight	1,128 lb (512 kg)
Maximum take-off/landing weight	1,670 lb (757 kg)
Maximum baggage weight	100 lb (45 kg)
Maximum useful load	542 lb (246 kg)

Fuel and oil

Fuel capacity	32 US gallons
Usable fuel	30 US gallons
Oil capacity	6 US quarts

Performance

VNE (never exceed speed)	138 KIAS
VNO (max. cruising speed)	110 KIAS
VA (manoeuvring speed)	103 KIAS (at 1,670 lb) 90 KIAS (at 1,277 lb)
VFE (max. flap speeds)	89 KIAS
VSO (stall speed)	47 KIAS (landing configuration)
Service ceiling	13,000 ft
Range (max. payload)	468 nautical miles

Paint schemes

The Tomahawk is supplied in the following ten paint schemes:

- G-BNKH (UK)
- G-BMVL (UK)
- G-BNNU (UK)
- N2432G (USA)
- N7803Q (USA)
- D-EEQI (Germany)
- C-GTAO (Canada)
- F-HVFA (France)
- PH-MEC (Netherlands)
- VH-UFA (Australia)

INSTALLATION, UPDATES AND SUPPORT

You can install this Tomahawk software as often as you like on the same computer system:

1. Click on the Account tab on the Just Flight website.
2. Log in to your account.
3. Select the 'Your Orders' button.
4. A list of your purchases will appear and you can then download the software you require.

Accessing the aircraft

To access the aircraft:

1. Load Aerofly FS 2 and click the 'Aircraft' tab to open the aircraft selection menu.
2. Use the left and right arrow keys on your keyboard to navigate through the available aircraft until you get to 'PA38 Tomahawk'.
3. Use the left and right arrow icons above the aircraft to select the paint scheme you wish to use.
4. Press your 'Back' button to return to the main menu and finish setting up your flight in the normal way.

Uninstalling

To uninstall this product from your system, select the appropriate option for your version of Windows from the 'Control Panel':

- 'Add or Remove Programs' (Windows XP)
- 'Programs and Features' (Windows Vista or 7)
- 'Apps & features' (Windows 10 or later)

Select the product you want to uninstall and then select the 'Uninstall' option, following the on-screen instructions to uninstall the product.

Uninstalling or deleting this product in any other way may cause problems when using this product in the future or with your Windows set-up.

Updates and Technical Support

For technical support (in English) please visit the Support pages on the Just Flight website.

As a Just Flight customer you can obtain free technical support for any Just Flight or Just Trains product.

If an update becomes available for this aircraft, we will post details on the Support page and we will also send a notification email about the update to all buyers who are currently subscribed to our Newsletter and emails.

Regular News

To get all the latest news about Just Flight products, special offers and projects in development, sign up for our Newsletter and regular emails.

We can assure you that none of your details will ever be sold or passed on to any third party and you can, of course, unsubscribe from this service at any time.

You can also keep up to date with Just Flight via Facebook and Twitter.

SYSTEMS GUIDE

Airframe

The Tomahawk is a low wing, single-engine, all-metal aircraft with fixed landing gear. It has seating for two occupants, a 100-pound luggage compartment and a 112 HP engine.

The basic airframe is constructed out of aluminium alloy. The fuselage is a semi-monocoque structure. There are two cockpit doors, one on each side of the fuselage.

Each wing is a full cantilever construction incorporating a laminar flow, NASA GA (W)-1 airfoil section. The wings are all metal except the removable thermoplastic wing tips. The three-position wing flaps are mechanically controlled by a handle located between the front seats. Each wing contains one fuel tank.

The empennage is a T-tail configuration with a fixed horizontal stabiliser mounted atop the vertical fin.

Fuel system

Fuel is stored in two 16 gallon (15 gallons usable) fuel tanks, giving the aircraft a total capacity of 32 US gallons (30 gallons usable). The tanks are secured to the leading edge of each wing with rivets.

The fuel tank selector control is located in the centre of the engine control quadrant. A latch is fitted to prevent the selector being inadvertently moved to the OFF position.

A fuel quantity gauge for each fuel tank is located on either side of the fuel tank selector, with each gauge on the same side as the corresponding fuel tank.

An auxiliary electric fuel pump is provided in case the engine-driven pump fails. The electric pump should be ON for all take-offs and landings and when switching tanks. The fuel pump switch is located in the switch panel to the left of the throttle quadrant.

The fuel pressure gauge is mounted in a gauge cluster to the right of the control quadrant.

An engine priming system is installed to facilitate starting. The primer pump is located at the lower right of the control quadrant.

Electrical system

The electrical system includes a 14-volt, 60-ampere alternator, voltage regulator, over-voltage relay, battery contactor and a 12-volt, 25-ampere-hour battery.

Electrical switches are located on the lower part of the instrument panel, just left of centre, and the circuit breakers are on the lower right of the instrument panel.

Each circuit breaker on the panel is of the push-to-reset type and is marked according to its function and amperage.

Rheostat knobs to the left of the circuit breakers control the intensity of the instrument and radio lights. The master switch and magneto switch are on the lower left instrument panel below the left yoke.

Electrical accessories include a starter, electric fuel pump, audible stall warning, fuel gauges, ammeter, alternator warning light, heated pitot head and communication and navigation equipment. The anti-collision and landing lights are controlled by rocker switches on the switch panel.

The master switch is a split-rocker switch. One side of the switch is for the battery (BAT) and the other is for the alternator (ALT). The words ‘master switch’ as used in this manual refer to both the BAT and ALT switches, and they should both be set ON or OFF as directed.

The ammeter is mounted in the instrument cluster to the right of the engine control quadrant. The ammeter indicates the electrical load on the alternator in amperes. With all the electrical equipment turned off and the master switch on, the ammeter will indicate the charging rate of the battery. As each electrical unit is switched on, the ammeter will indicate the total ampere draw of all the units, including the battery.

Vacuum system

The vacuum system is designed to operate the air-driven gyro instruments, including the directional and attitude gyros. The system consists of an engine-driven vacuum pump, regulator and filter.

A vacuum gauge mounted on the upper left instrument panel provides a pilot check for the system during operation. A decrease in pressure, or zero pressure, over an extended period may indicate a problem with the vacuum system.

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 4.8-5.2 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM.

Pitot-static system

The pitot-static system supplies pressure to operate the airspeed indicator, the altimeter and the vertical speed indicator. Pitot pressure is picked up by a pitot head installed on the bottom of the left wing and static pressure is picked up by the pads on both sides of the aft fuselage.

A static valve located below the centre instrument panel, under the left side of the control quadrant, provides an alternate static source for the system when opened. A static drain and static valve on the lower left side panel provide an alternate static source for the system when opened.

A heated pitot head alleviates problems with icing and heavy rain. The switch for the heated pitot head is located on the electrical switch panel to the left of the control quadrant.

Lighting system

Lights fitted to the aircraft include navigation, anti-collision strobes, landing and instrument panel lights.

The control switches for the anti-collision strobes and landing light are located on the lower part of the instrument panel, just left of centre, and the rotary knobs for the navigation and panel lights are located to the left of the circuit breakers.

The NAV & PANEL LIGHTS rotary knob is used to control both the navigation and the panel lights. The navigation lights will be switched on whenever the knob is not in the OFF position. Rotating the knob clockwise will control the intensity of the panel lighting.

The RADIO LIGHTS rotary knob controls the backlighting for the avionics displays.

Instrument markings

Airspeed indicator markings

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
White arc	49-89	Full flap operating range. Lower limit is maximum weight VSO in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green arc	52-110	Normal operating range. Lower limit is maximum weight VS1 with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow arc	110-138	Operations must be conducted with caution and only in smooth air.
Red line	138	Maximum speed for all operations.

Engine indicator markings

INSTRUMENT	Red line or arc Minimum limit	Yellow arc Caution range	Green arc Normal operating	Red line Maximum limit
Tachometer	—	—	500-2,600 RPM	2,600 RPM
Oil temperature	—	—	75-245°F	245°F
Fuel pressure	—	—	0.5-8 PSI	8 PSI
Oil pressure	15 PSI	15-60 PSI (idle) and 90-100 PSI (start/warm-up)	60-90 PSI	100 PSI

Limits

Weight limits

Maximum weight: 1,670 lb

Maximum weight in baggage compartment: 100 lb

Centre of gravity limits

Weight (lb)	Forward limit Inches aft of datum	Rearward limit Inches aft of datum
1,670	73.5	78.5
1,277	72.4	78.5

The datum used is 66.25 inches ahead of the wing leading edge.

Manoeuvre limits

This aircraft is certified in the normal and utility categories.

- Normal Category – all aerobatic manoeuvres including spins prohibited
- Utility Category – approved manoeuvres for Utility Category only

Manoeuvre	Entry speed
Spins (flaps up)	Stall
Steep turns	100 KIAS
Lazy eights	100 KIAS
Chandelles	100 KIAS

Flight load factor limits

Positive load factor (maximum): + 3.8 G

Negative load factor (maximum): No inverted manoeuvres approved

Types of operation

The aircraft is approved for the following operations:

- Day VFR
- Night VFR
- Day IFR
- Night IFR
- Non-icing

Fuel limitations

Total capacity: 32 US gallons

Unusable fuel: 2 US gallons (1 gallon per wing tank)

Usable fuel: 30 US gallons (15 gallons per wing tank)

Landing gear

The Tomahawk is equipped with fixed landing gear.

The nose gear is steerable through a 30-degree arc each side of centre by use of the rudder pedals and toe brakes.

The brake system includes toe brakes on the left and right set of rudder pedals and a handbrake lever located below and near the centre of the instrument panel. The parking brake is incorporated in the lever brake and is operated by pulling back on the lever and depressing the knob attached to the top of the handle. To release the parking brake, pull back on the brake lever and then allow the handle to swing forward.

Doors and exits

The aircraft is fitted with two cabin doors.

Each cabin door has an interior latch below the side window. The latch is engaged when the handle is in the down position. The overhead latch in the centre of the cockpit secures both doors. Before flight, the latches on both doors and the overhead latch should be secured in the latched position.

Each cabin door can be opened from within the virtual cockpit by clicking on the latch to rotate it to the OPEN position and then clicking on the red leather door armrest to push it open. To close the door, click on the red leather door armrest to pull the door closed and then click on the door latch to rotate it to the LATCH position.

Flight controls

Dual flight controls are standard equipment on the PA-38-112. The flight controls actuate the primary control surfaces through a cable system and the controls are balanced for light operating forces.

The horizontal surface of the tail is a fixed stabiliser with a moveable elevator. A trim control wheel mounted between the seats operates the longitudinal trim function of the elevator. Rotation of the wheel forward gives nose-down trim and rotation aft gives nose-up trim. A trim position indicator is mounted adjacent to the trim control wheel.

The rudder is conventional in design and operation. A ground-adjustable trim tab is attached to the trailing edge of the rudder.

The wing flaps are manually operated by the flap control lever between the seats. The flaps are connected to the lever through a torque tube and pushrods. The flaps can be set into three positions: fully retracted, 21˚ and fully extended (34˚).

When the flap setting is changed, there is an associated pitch change in the aircraft. This pitch change can be corrected either by elevator trim or increased control wheel force.

Engine

The Tomahawk is powered by a four-cylinder, horizontally opposed Lycoming O-235 engine rated at 112 HP at 2,600 RPM. It is equipped with a starter, 60-ampere 14-volt alternator, two magnetos, vacuum pump drive and fuel pump. The aircraft is equipped with a fixed-pitch propeller.

Engine controls

The engine controls consist of a throttle control and a mixture control lever. These controls are located on the control quadrant on the lower centre of the instrument panel, where they are accessible to both the pilot and the co-pilot.

The throttle lever is used to adjust the engine RPM. The mixture control lever is used to adjust the air-to-fuel ratio. The engine is shut down by placing the mixture control lever in the fully lean position.

The carburettor heat control lever is located to the left of the control quadrant.

Engine instruments

Indicators enable the pilot to check oil pressure, oil temperature, fuel pressure and RPM. The engine instruments are located to the left and right of the control quadrant.

Ignition and starter system

Engine ignition is provided by a dual magneto on two spark plugs per cylinder. An electrical engine priming system is provided to facilitate starting. The primer and magneto selector are located to the left and right of the control quadrant.

Stall warning system

An approaching stall is indicated by an audible alarm located behind the instrument panel. The indicator activates at between five and ten knots above stall speed.

PANEL GUIDE

The instrument panel is designed to accommodate instruments and avionics equipment for VFR and IFR flight.

Radio equipment is mounted in the centre instrument panel and the flight instruments are mounted on the left. An engine instrument cluster in the lower instrument panel just right of the control quadrant includes a fuel pressure gauge, ammeter, oil temperature gauge and an oil pressure gauge.

Fuel quantity indicators for each tank are mounted in the control quadrant on either side of the fuel selector. The tachometer is located to the left of the control quadrant. The alternator warning light is in the upper left instrument panel.

Circuit breakers are on the lower right of the instrument panel and electrical switches are just left of the control quadrant. Heater controls are to the left of the pilot's yoke. Fresh air vents are located in the extreme left and right lower corners of the instrument panel.

Instruments include a compass, airspeed indicator, recording tachometer, altimeter, the engine instrument cluster, fuel quantity gauges and alternator warning light. The magnetic compass and outside air temperature gauge are mounted in the centre of the cockpit at the top of the windshield.

A suction gauge is mounted on the upper left and an attitude gyro, directional gyro, true airspeed indicator, vertical speed indicator and turn coordinator in the flight instrument group. An aircraft hour meter is on the extreme right of the panel.

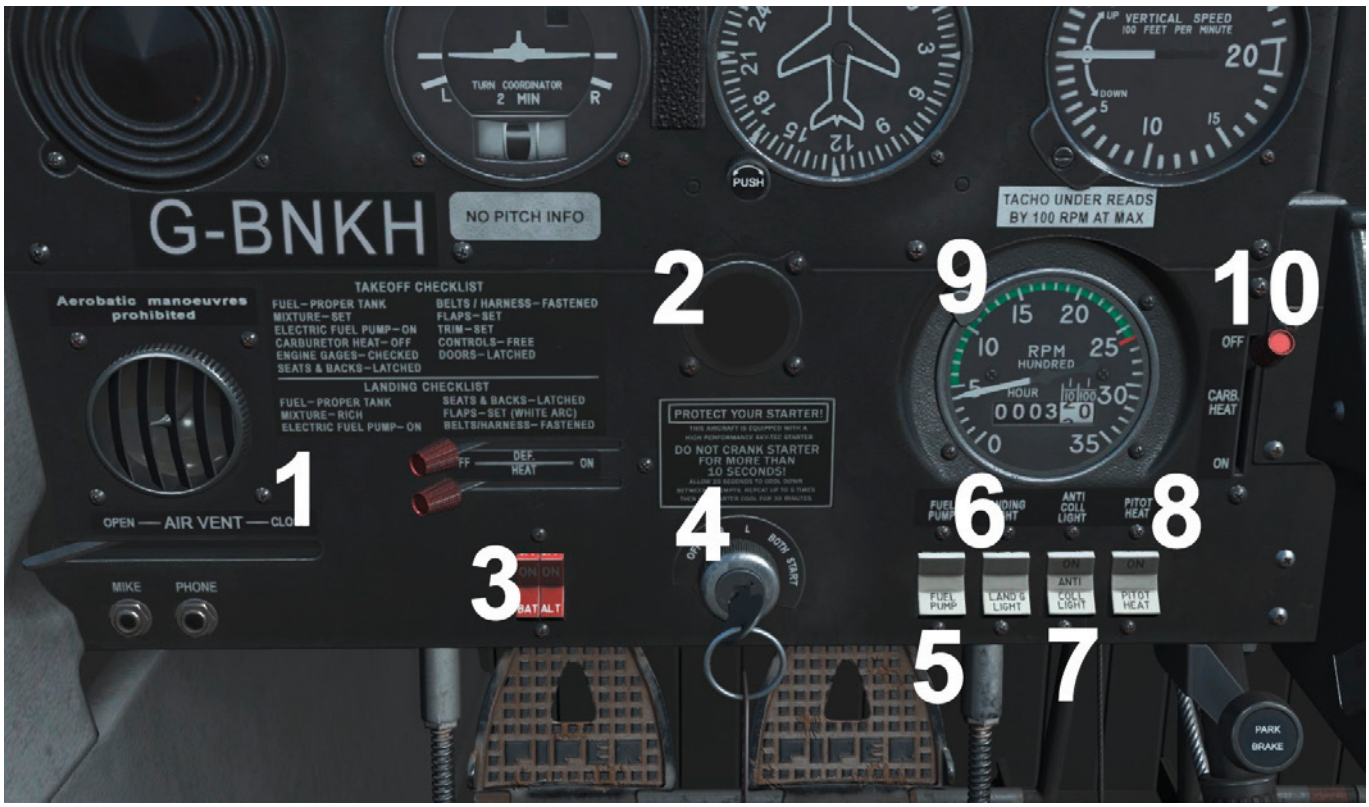
The gyros are vacuum-operated through the vacuum system and the turn coordinator is electric. A primer system is operated by a primer pump to the lower right of the control quadrant. An electric clock is installed in the upper left corner of the panel.

A baggage area, located behind the rear seats, is accessible from the cabin. When baggage is loaded, it is the pilot's responsibility to ensure that the aircraft's centre of gravity falls within the allowable CG range.

Left main panel

1. Engine starter warning light – illuminates whenever the engine starter is engaged.
2. Clock – a knob allows for adjustment of the hour and minute hands.
3. Airspeed indicator (ASI) – a true airspeed indicator is incorporated into the airspeed indicator. The true airspeed indicator consists of a rotatable ring which is controlled with the knob below the ASI. To set the indicator, rotate the ring until the pressure altitude is aligned with the outside air temperature (OAT). To obtain the pressure altitude, set the barometric scale of the altimeter to 29.92 inHg / 1013.2 hPa and then read the pressure altitude. With the ring set, the true airspeed can be read along the bottom scale.
4. Attitude indicator (AI) – a pitch reference knob allows the position of the pitch bars (aircraft symbol) to be adjusted nose-up or nose-down.
5. Vacuum gauge
6. Alternator warning light
7. Altimeter – a barometric pressure scale is provided for hPa/mb. The pressure setting knob tooltip displays the currently selected pressure in hPa/mb or inHg, depending on which unit of measurement is currently active in the simulator settings.
8. VOR indicator – driven by SL30.
9. Turn and bank indicator
10. Direction indicator
11. Vertical speed indicator (VSI)
12. Low voltage warning light

Left lower panel

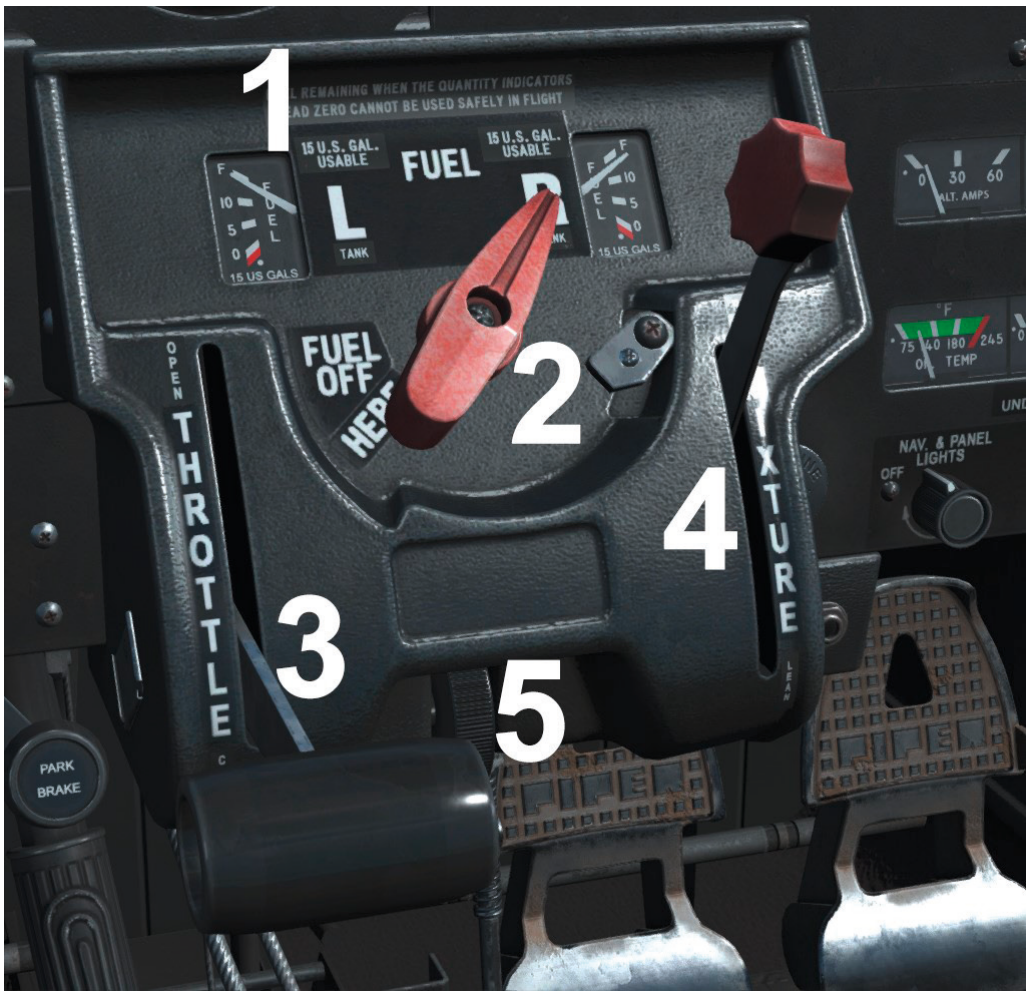


1. Heating controls
2. Yoke toggle clickspot (same location on right yoke)
3. Master switch – consists of a battery and alternator switch.
4. Magneto selector and ignition
5. Electric fuel pump switch
6. Landing light switch
7. Anti-collision light switch
8. Pitot heat switch
9. Tachometer (RPM)
10. Carburettor heat control lever

Left sidewall

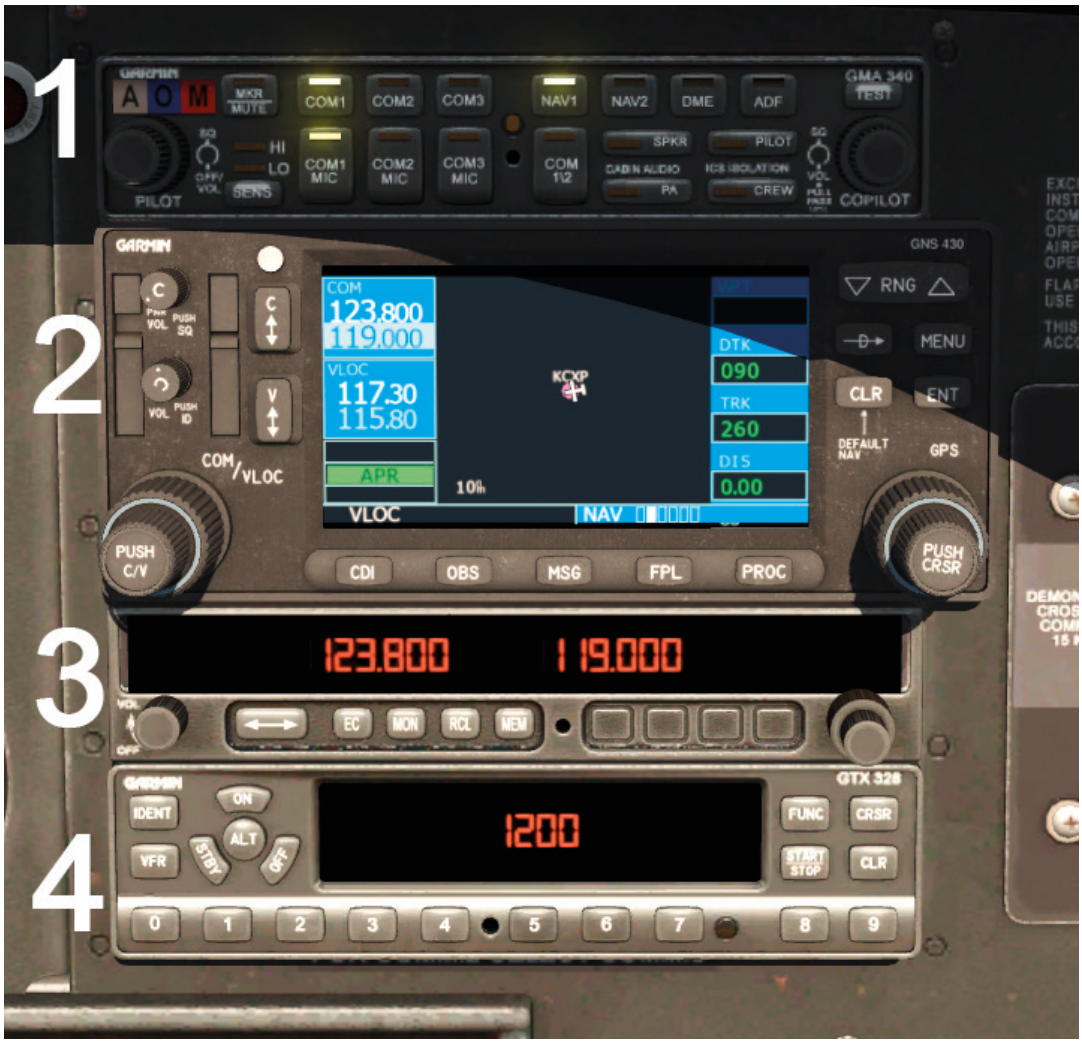
1. Storm window (note that the latch must be moved prior to opening/closing the window)
2. Door latch
3. Static source valve

Control quadrant



1. Left and right fuel tank quantity indicator
2. Fuel tank selector – the latch must be rotated before the FUEL OFF position can be selected.
3. Throttle lever
4. Mixture lever
5. Friction control

Centre panel



1. GMA 340 audio selector
2. GNS 430
3. SL40 radio
4. GTX 328 transponder

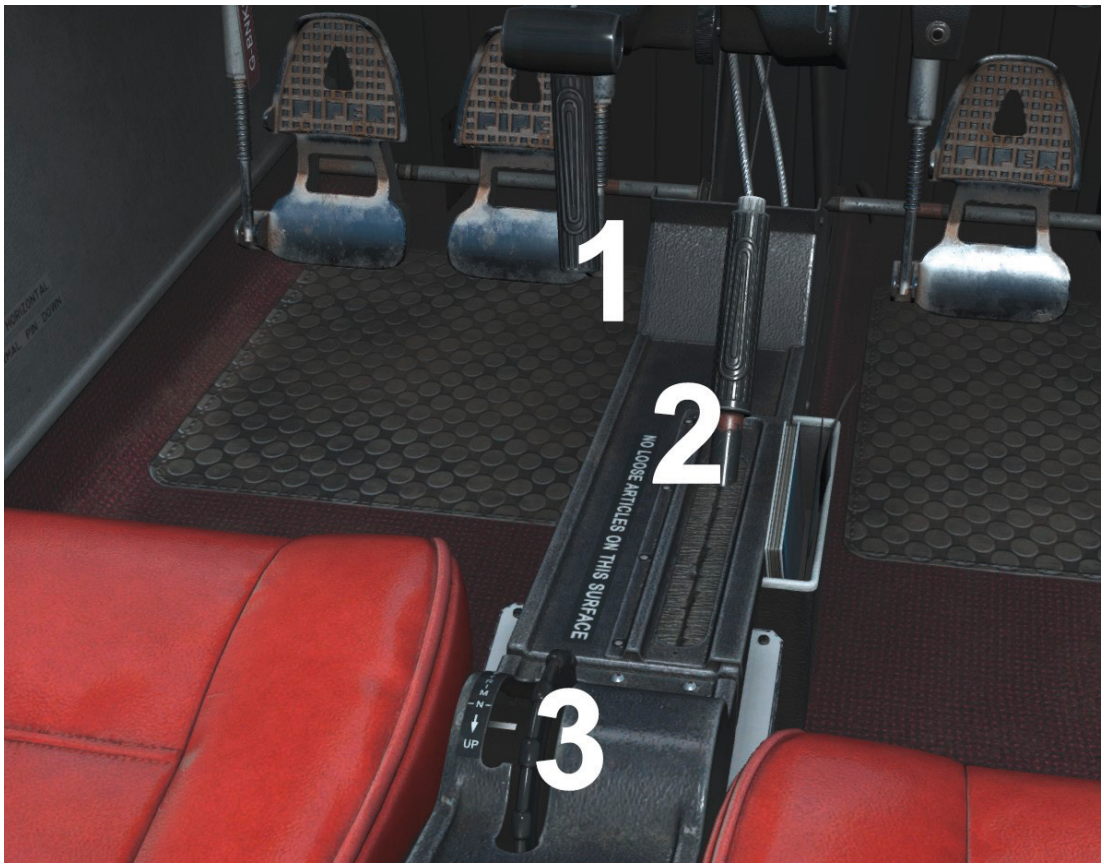
Right lower panel

1. Primer – left-click to unlock and left-click again to pull out the primer. Right-click to push in the primer and right-click again to lock it.
2. Engine instruments – ammeter, oil temperature, fuel pressure and oil pressure indicators.
3. Panel light controls
4. Circuit breaker panel
5. Air vent control

Upper cockpit

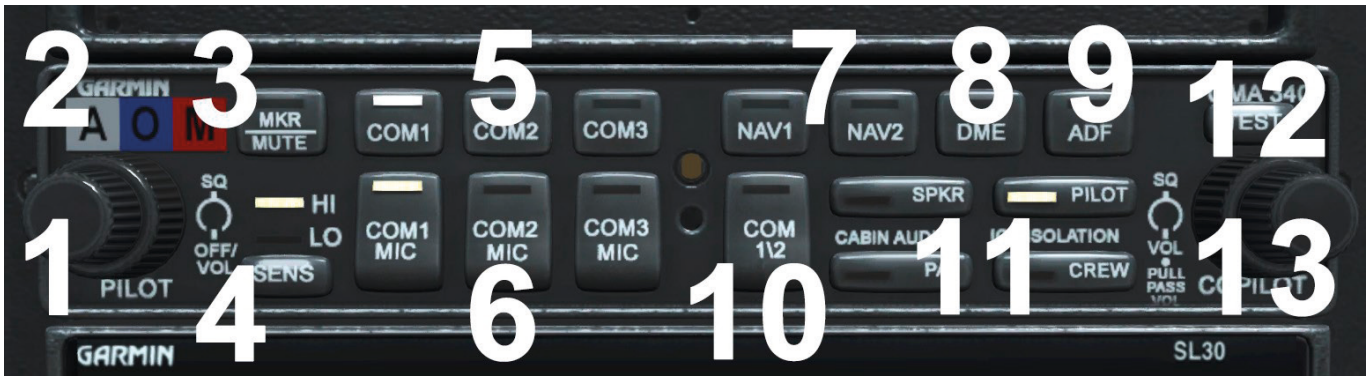
1. Upper door latch
2. Outside air temperature gauge
3. Whiskey compass

Lower cockpit



1. Parking brake handle
2. Flap lever
3. Elevator trim wheel and indicator – rotating the wheel forward gives nose-down trim and rotation aft gives nose-up trim.

GMA 340 – audio selector



1. **Left knob**
   - Large – in the real aircraft this knob is used to control the squelch level. As this functionality is not possible within Aerofly, this knob is non-functional.
   - Small – this knob is used to switch on/off power to the GMA 340 unit.
2. **AOM lights** – these marker beacon lights will illuminate when the aircraft passes over Airway/Inner, Outer or Middle marker beacons.
3. **MKR MUTE** – this button is used to toggle the mute function for the marker beacon audio. If a valid marker beacon signal is being received by the unit but you wish to mute the audio, press this button and confirm that the green LED illuminates. Press the button once more to un-mute the sound.
4. **SENS** – this button is used to select either high or low marker beacon sensitivity. The HI and LO LEDs located above the SENS button indicate which sensitivity level has been selected. Low sensitivity is used on ILS approaches and high sensitivity used when operating over airway markers.
5. **COM 1/2/3** – these buttons are used to select COM 1, 2 and 3 transceiver audio sources. LEDs on the buttons indicate which sources are selected.
6. **COM 1/2/3 MIC** – these buttons are used to select COM 1, 2 or 3 MIC, allowing you to transmit on the selected COM frequencies. LEDs on the buttons indicate which are selected. The corresponding transceiver audio will be automatically selected when COM 1, 2 or 3 MIC are selected.

   Note: *Aerofly does not provide for the facility of a COM 3 radio, so although the COM 3 controls are functional, they will not have any impact on ATC operations.*
7. **NAV 1 / NAV 2** – these buttons are used to toggle the NAV 1 and 2 audio sources. LEDs on the buttons indicate which sources are selected.
8. **DME** – this button is used to toggle the DME audio source. DME audio is selected if the LED is illuminated.
9. **ADF** – this button is used to toggle the ADF audio source. ADF audio is selected if the LED is illuminated.
10. **COM 1/2** – this button is used to toggle the Split Com function, which when enabled will automatically select the COM 1 MIC and COM 2 MIC. Pressing the button a second time will disable the function. Split Com is enabled if the LED is illuminated.
11. **SPKR / PA / PILOT / CREW** – these buttons are used to toggle cabin audio functions. LED lights will illuminate on each switch when they are selected.
12. **TEST** – pressing this button with the unit switched on will activate the test mode. All LEDs and the AOM lights on the unit should illuminate for several seconds before extinguishing.
13. **Right knob** – this knob is used to control the volume and squelch levels for the co-pilot.

The GMA 340 is an audio control system which provides control over transceiver and receiver outputs through the use of selector switches. The simulator doesn't allow for separate speaker and headphone outputs so both buttons perform the same function.

The COM 1 and COM 2 buttons are used to toggle the COM 1 and COM 2 transceiver audio, allowing you to select COM 1 and/or COM 2 as the audio source(s) to monitor.

The NAV, DME, MKR and ADF buttons are used to toggle the associated audio sources.

The microphone selector buttons connect the microphone to the selected output. Due to simulator limitations, transmissions can only be made on COM 1.

SL40 – COM 2 radio

The SL40 acts as a COM 2 radio.

The active/standby COM 2 frequency can be altered using the right knob. The active COM 2 frequency is shown on the left and the standby COM 2 frequency is shown on the right, preceded by the letter 's'.

1. **Left knob** – this knob is used to control power to the SL40 unit. Left-click on it to toggle the power on/off.
2. **Flip-flop** – this button is used to transfer the COM 2 standby frequency into the COM 2 active frequency slot.
3. **EC** – this button is used to load the emergency channel (121.50 MHz) as the standby frequency. The monitor function is automatically enabled.
4. **MON** – this button enables monitor mode, which allows for the monitoring of both the active and standby frequencies. Due to simulator limitations this is not simulated.
5. **RCL** – this button toggles frequency recall mode.
6. **MEM** – pressing this button will store the display standby frequency in memory.
7. **Right knob** – the right knob is used to alter the COM 2 or NAV 2 standby frequency. The outer knob increases/decreases the whole numbers and the inner knob increases/decreases the fractions.

GTX 328 – transponder

1. Mode selection buttons
2. Identification (IDENT) button
3. VFR button
4. Function (FUNC) button
5. Start/stop button
6. Cursor (CRSR) button
7. Clear (CLR) button
8. Number buttons

The GTX 328 is a Mode S transponder. It also features several other functions such as an altitude monitor, flight timer and outside air temperature (OAT) display.

The unit is powered on by pressing the ON key. After the unit is powered on, a start-up page is displayed while it performs a self-test.

Mode selection keys

OFF – powers off the GTX 328. Pressing the STBY, ON or ALT key powers on the transponder, displaying the last active identification code.

STBY – selects the standby mode. When in standby mode, the transponder will not reply to any interrogations.

ON – selects Mode A. In this mode the transponder replies to interrogations, as indicated by the reply symbol (R).

ALT – selects Mode A and Mode C. In ALT mode the transponder replies to identification and altitude interrogations as indicated by the reply symbol (R).

Code selection

The transponder code is inputted using the 0-7 numeric keys. Pushing these keys begins the code selection sequence. The new code is not activated until the fourth digit is entered.

Pressing the CLR key moves the cursor back to the previous digit. Pressing the CLR key when the cursor is on the first digit of the code, or pressing the CRSR key during code entry, removes the cursor and cancels data entry, restoring the previous code.

You can press the CLR key up to five seconds after code entry is complete to return the cursor to the fourth digit. The numbers 8 and 9 are not used for code entry, only for entering a Count Down time.

Important codes

1200 – VFR code used in North America

7000 – VFR code used in Europe

7500 – Hijack code

7600 – Loss of communications

7700 – Emergency

Keys for other GTX 328 functions

IDENT – pressing the IDENT key activates the 'special position identification' pulse for 18 seconds, identifying your transponder return to an ATC unit. The word 'IDENT' will appear in the upper left corner of the display while the IDENT mode is active.

VFR – sets the transponder code to the VFR code (7000). Pressing the VFR key again restores the previous identification code.

FUNC – changes the page shown on the right side of the display. Display data includes Pressure Altitude, Flight Time, Altitude Monitor and Count Up and Count Down timers.

START/STOP – starts and stops the Altitude Monitor and the Count Up, Count Down and Flight timers.

CRSR – initiates starting time entry for the Count Down timer and cancels transponder code entry.

CLR – resets the Count Up, Count Down and Flight timers. Cancels the previous keypress during code selection and Count Down entry. Returns cursor to the fourth code digit within five seconds after entry.

8 – Enters the number eight into the Count Down timer.

9 – Enters the number nine into the Count Down timer.

GROUND EQUIPMENT

The aircraft can be fitted with chocks and tie-downs whilst on the ground.

The chocks and tie-downs will appear when a flight is started from a parked position. They can also be controlled via the clipboard that is stowed between the pilot and co-pilot.

NORMAL PROCEDURES

Airspeed (IAS) for safe operations

Best rate of climb	**70 KIAS**
Best angle of climb	**61 KIAS**
Operating speed in turbulent air	**103 KIAS**
Maximum flap speed	**89 KIAS**
Final approach speed (flaps 40)	**67 KIAS**
Maximum demonstrated crosswind	**15 KIAS**

Pre-flight

Cockpit

Parking brake	**SET**
Avionics	**OFF**
Mixture	**IDLE CUT-OFF**
Ignition	**OFF**
Master switch	**ON**
Fuel quantity gauges	**CHECK**
Alternator warning light	**CHECK**
Master switch	**OFF**
Flight controls	**CHECK OPERATION**
Flaps	**CHECK OPERATION**

Left/right wing

Flap and aileron	**CHECK**
Wing tip and lights	**UNDAMAGED**
Tie-down	**REMOVED**
Fuel tank	**CHECK LEVEL**

Nose section

Chocks	**REMOVED**
Towbar	**REMOVED (NOSE GEAR)**
Oil	**CHECK LEVEL**
Propeller	**GOOD CONDITION**

Air inlets	**CLEAR**
Landing light	**CHECK**

Tail section

Fin	**CHECK CONDITION**
Rudder	**CHECK CONTROLS**
Stabiliser and elevator	**CHECK CONTROLS**
Tail cone	**CHECK CONDITION**

Before starting engine

Brakes	**SET**
Circuit breakers	**IN**
Carburettor heat	**OFF**
Avionics	**OFF**
Fuel selector	**DESIRED TANK**

Engine starting

Caution: *If a positive oil pressure is not indicated within 30 seconds after an engine start, stop the engine and determine the cause of the trouble. In cold weather it will take a few seconds longer to get a positive oil pressure indication.*

Cold engine

Throttle	**¼ INCH OPEN**
Master switch	**ON**
Magnetos	**BOTH**
Electric fuel pump	**ON**
Mixture	**FULL RICH**
Propeller	**CLEAR**
Starter	**ENGAGE**

If engine does not start within 10 seconds, prime and repeat starting procedure.

When the engine starts:

Throttle	**ADJUST**
Oil pressure	**CHECK**
Throttle	**800 RPM**

Hot engine

Throttle	**½ INCH OPEN**
Master switch	**ON**
Magnetos	**BOTH**
Electric fuel pump	**ON**
Mixture	**FULL RICH**
Propeller	**CLEAR**
Starter	**ENGAGE**

When the engine starts:

Throttle	**ADJUST**
Oil pressure	**CHECK**
Throttle	**800 RPM**

Taxiing

Avionics	**ON**
Taxi area	**CLEAR**
Parking brake	**RELEASE**
Throttle	**APPLY SLOWLY**
Brakes	**CHECK**
Steering	**CHECK**

Steering the aircraft with the rudder pedals only is generally sufficient. The combined use of rudder pedals and brakes permits, if necessary, tight turns.

Check the operation of gyroscopic instruments (horizontal attitude, heading and turn and bank indicators) by means of alternate turns.

Ground check

Parking brake	**SET**
Throttle	**1,800 RPM**
Magnetos	**CHECK (max. drop 175 RPM)**
Vacuum	**4.8-5.2 inHg**
Oil temperature	**CHECK**
Oil pressure	**CHECK**
Ammeter	**CHECK**
Carburettor heat	**CHECK**
Electric fuel pump	**OFF**
Fuel pressure	**CHECK**
Throttle	**RETARD**

Before take-off

Master switch	**ON**
Magnetos	**BOTH**
Flight instruments	**CHECK**
Fuel selector	**AS REQUIRED**
Mixture	**SET**
Electric fuel pump	**ON**
Carburettor heat	**OFF**
Engine gauges	**CHECK**
Static source	**NORMAL**
Flaps	**SET**
Trim	**SET**
Controls	**FREE**
Doors	**LATCHED**

Take-off

Lined up on runway	**CHECK COMPASS**

Normal technique

Flaps	**SET**
Trim	**SET**
Accelerate to 53 KIAS.	
Yoke	**Back pressure to rotate smoothly to climb attitude**

Short field/obstacle clearance technique

Flaps	**21° (first notch)**
Accelerate to 53 KIAS.	
Yoke	**Back pressure to rotate smoothly to climb attitude**
Maintain 61 KIAS until obstacle is cleared then accelerate to 70 KIAS.	
Flaps	**Retract slowly**

Climb

Best rate (flaps up)	**70 KIAS**
Best angle (flaps up)	**61 KIAS**
Electric fuel pump	**OFF**

Cruise

Refer to the OPERATING DATA MANUAL for cruise power settings.

The normal maximum cruising power is 75% of the rated horsepower of the engine.

Use of the mixture control in cruising flight reduces fuel consumption significantly, especially at higher altitudes. The mixture should be leaned during cruising operation when 75% power or less is being used. If any doubt exists as to the amount of power being used, the mixture should be in the FULL RICH position for all operations.

You should monitor weather conditions while flying and should be alert to conditions which might lead to icing. If icing is expected, place the carburettor heat control in the **ON** position.

To keep the aircraft in best lateral trim during cruise flight, fuel should be used alternately from each tank at 15-minute intervals. Always remember that the electric fuel pump should be set to **ON** before switching tanks and should be left on for a short period thereafter.

Approach and landing

Fuel selector	**AS REQUIRED**
Electric fuel pump	**ON**
Mixture	**SET**
Flaps	**SET (89 KIAS max.)**
Trim	**Trim for 70 KIAS**
Final approach speed	**67 KIAS**

Shutdown

Flaps	**RETRACT**
Electric fuel pump	**OFF**
Avionics	**OFF**
Throttle	**CLOSED**
Mixture	**IDLE CUT-OFF**
Magnetos	**OFF**
Master switch	**OFF**
Parking brake	**SET**

Stalls

An approaching stall is indicated by a stall warning horn which is activated between 5-10 knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall.

The stalling speed at 1,670 lb gross weight with power off, outboard flow strips installed and full flaps is 49 KIAS; with flaps up, this speed is increased by 3 knots. Loss of altitude during stalls can be as great as 320 feet, depending on configuration and power.

Note: *The stall warning system is inoperative with the battery master switch OFF.*

EMERGENCY PROCEDURES

Airspeed (IAS) for safe operations

Stall speed (1,670 lb, flaps 0)	**52 KIAS**
Stall speed (1,670 lb, full flap)	**49 KIAS**
Manoeuvring speed (1,670 lb)	**103 KIAS**
Manoeuvring speed (1,277 lb)	**90 KIAS**
Never exceed speed	**138 KIAS**
Power off glide speed (1,670 lb, flaps 0)	**70 KIAS**

Engine failures

Engine failure during take-off (not airborne)

Sufficient runway remaining:

Throttle	**CLOSE**
Brakes	**APPLY**

Insufficient runway remaining:

Throttle	**CLOSE**
Brakes	**APPLY**
Mixture	**IDLE CUT-OFF**
Fuel selector	**OFF**
Master switch	**OFF**
Magnetos	**OFF**

Engine failure during take-off (airborne)

If sufficient runway remains for a normal landing, land straight ahead.

Insufficient runway remaining:

Airspeed	**ABOVE STALL**
Throttle	**IDLE CUT-OFF**
Mixture	**IDLE CUT-OFF**
Fuel selector	**OFF**
Master switch	**OFF**
Magnetos	**OFF**
Flaps	**AS REQUIRED**

If sufficient altitude has been gained to attempt a restart:

Airspeed	**ABOVE STALL**
Fuel selector	**Switch to other tank**
Electric fuel pump	**ON**
Mixture	**RICH**
Carburettor heat	**ON**

If power is not regained, proceed with power-off landing.

Engine failure in flight

Fuel selector	**Switch to other tank**
Electric fuel pump	**ON**
Mixture	**RICH**
Carburettor heat	**ON**
Engine gauges	**Check for indication of cause of power loss**
Primer	**LOCKED**

If no fuel pressure is indicated, check tank selector position to be sure it is on a tank containing fuel.

If power has not been restored:

Ignition switch	**L then R then back to BOTH**
Throttle and mixture	**Try different settings**

When power is restored:

Carburettor heat	**OFF**
Electric fuel pump	**OFF**

If power cannot be restored:

If power is not restored, prepare for power-off landing. Trim for 70 KIAS (best glide angle).

Power-off landing

Trim for 70 KIAS (best glide angle). Locate suitable field and establish spiral pattern 1,000ft above field at downwind position for normal landing approach.

When field can be easily reached, slow to 67 KIAS for shortest landing.

When committed to landing:

Ignition	**OFF**
Master switch	**OFF**
Fuel selector	**OFF**
Mixture	**IDLE CUT-OFF**

Fires

Engine fire during flight

Starter	**CRANK**
Mixture	**IDLE CUT-OFF**
Throttle	**OPEN**
Electric fuel pump	**OFF**
Fuel selector	**OFF**

Engine fire in flight

Fuel selector	**OFF**
Throttle	**CLOSED**
Mixture	**IDLE CUT-OFF**
Electric fuel pump	**OFF**
Cabin heat	**OFF**
Defroster	**OFF**

Proceed with power-off landing procedure.

Electrical fire

Master switch	**OFF**
Cabin heat	**OFF**
Defroster	**OFF**

Land as soon as possible.

Low oil pressure

Throttle	**REDUCE AS FAR AS POSSIBLE**
Oil temperature	**CHECKED**
If oil temperature is high	**REDUCE THROTTLE**

Prepare for a forced landing and land as soon as possible.

Low fuel pressure

Electric fuel pump	**ON**
Fuel selector	**Check on full tank**

Alternator failure

Reduce electrical loads to minimum.

Alternator circuit breaker	**Check and reset as required**
ALT switch	**OFF then ON**

If power is not restored:

ALT switch	**OFF**

If alternator output cannot be restored, reduce electrical loads and land as soon as it is practical. The battery is the only remaining source of electrical power.

Icing

IMPORTANT! *Flight into known icing conditions is prohibited.*

Carburettor heat	**ON**
Cabin heat	**FULL HOT**
Pitot heat	**ON**
Engine	**MAX. POWER/RPM**

Adjust course and/or altitude to obtain best outside air conditions. Divert to nearest airport.

Spin recovery

Rudder	**HOLD OPPOSITE DIRECTION OF ROTATION**
Yoke	**FULL FORWARD, AILERONS NEUTRAL**
Throttle	**IDLE**
Flaps	**RETRACT**

When spinning stops, centralise rudder, level the wings and ease out of the dive.

Airspeed indicating system failure

In case of erroneous indications in flight:

Pitot heat	**ON**

If erroneous indications persist, carry out a precautionary approach, maintaining an adequate airspeed margin above stall warning activation speed.

CREDITS

Project management	Richard Slater
Aircraft modelling and design	3D Reach
Aircraft systems and cockpit programming	Propair Flight
Aircraft liveries	David Sweetman
Flight dynamics	Propair Flight
Sounds	SimAcoustics
Manual	Richard Slater
Installer	Martin Wright
Design	Fink Creative

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