



PA-38 TOMAHAWK



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PA-38 TOMAHAWK

Operations Manual

Please note that X-Plane 12 must be correctly installed on your PC prior to the installation and use of this PA-38 Tomahawk simulation.

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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 m ² (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 fourteen paint schemes:

- D-EEQI (Germany)
- F-HVFA (France)
- G-BMVL (UK)
- G-BNKH (UK)
- G-BPES (UK)
- G-GTHM (UK)
- G-LFSN (UK)
- G-LFSU (UK)
- N2426N (USA)
- N2432G (USA)
- N874MH (USA)
- OO-IWA (Belgium)
- S5-DAZ (Slovenia)
- VH-UFA (Australia)

The PA-38 Tomahawk also comes with Thranda's innovative Dynamic Livery system, allowing you to create and save your own custom liveries from the EFB.



INSTALLATION, UPDATES AND SUPPORT

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

1. Log in to your [Account](#) on the Just Flight website.
2. Select the 'Your Orders' button.
3. A list of your purchases will appear and you can then download the software you require.

To install the aircraft in X-Plane 12:

1. Download the Tomahawk from your Just Flight Account.
2. Unzip the downloaded .zip file. The resulting folder will be named 'JF12_PA38_Tomahawk'.
3. Copy the 'JF_PA38_Tomahawk' folder into the 'X-Plane 12/Aircraft' folder.

Accessing the aircraft

To access the aircraft in X-Plane 12:

1. From the Main Menu, click 'New Flight' or go to the Flight Configuration window.
2. Click on the 'Piper PA38 Tomahawk' in the aircraft selection screen.
3. Click 'Customize' and choose a livery from the drop-down menu in the top right.
4. Click 'Start Flight'.

Uninstalling

To uninstall this software from your system:

1. Go to your X-Plane 12 folder.
2. Open the 'Aircraft' folder.
3. Delete the 'JF12_PA38_Tomahawk' folder.

Recommended X-Plane settings

Joystick/yoke

For maximum enjoyment of this aircraft in X-Plane we recommend setting your joystick 'Stability Augmentation' sliders to 0. This will help prevent control issues, such as running out of pitch trim, and results in more realistic flight behaviour.

To turn off Stability Augmentation, follow these steps:

1. Launch X-Plane and go to the 'Settings' window.
2. Go to the 'Joystick' tab.
3. Click on the 'Control Sensitivity' button along the bottom of the window.
4. Set all three of the 'Stability Augmentation' sliders to 0% to disable them.
5. The 'Control Response' sliders can be set as desired.
6. Press 'Done'.

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 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, [subscribe](#) to our 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.

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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 (SL30, SL40 and GTX).

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 overhead latch to rotate it to the OPEN position and then clicking on an individual door latch to push it open. To close the door, click on the door latch to pull the door closed and then click on the overhead latch to rotate it to the CLOSE 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

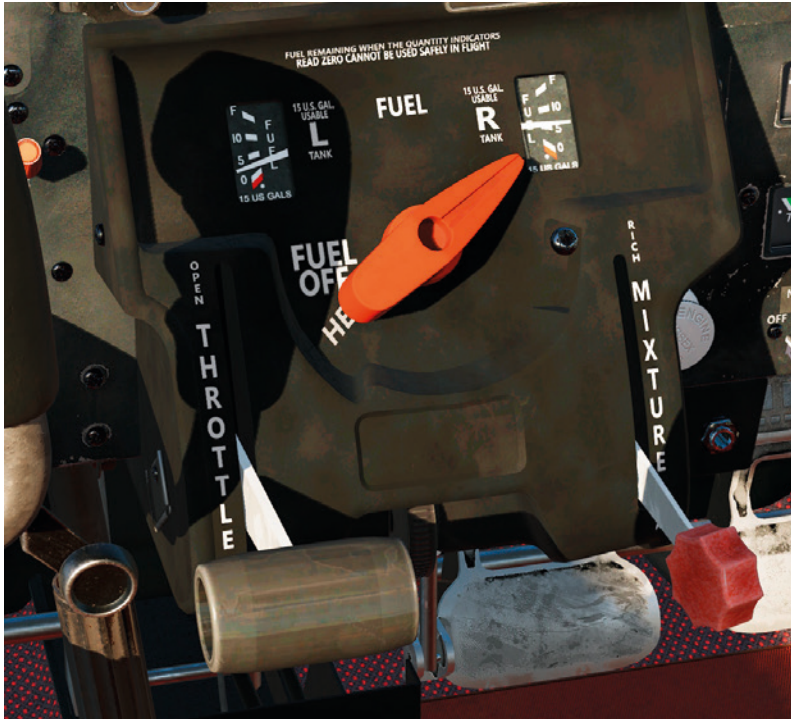
The Tomahawk is powered by a four-cylinder, horizontally opposed Lycoming O-235 engine rated at 112 HP at 2,600 RPM. It is equipped with a starter, 60-ampere 14-volt alternator, two magnetos, vacuum pump drive and fuel pump. The aircraft is equipped with a fixed-pitch propeller.

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.



EFB 2D pop-out

The EFB 2D pop-out arrow appears in the top left corner of the screen every time you load the PA-38 Tomahawk:



Left-click on this arrow to open the 2D EFB pop-out.

This icon can easily be faded out and hidden completely by hovering your mouse over it and moving the scroll wheel. It will re-appear for the next flight.



Please see the dedicated EFB Manual for further details of EFB operation.

Automatic fuel selector

The Tomahawk is capable of flying for several hours so we have included an automatic fuel selector switcher, allowing you to leave your PC for prolonged periods without risking a fuel imbalance.

This system will automatically switch selected fuel tanks every twenty minutes.

The automatic fuel selector can be enabled/disabled using the 'Toggle Auto Fuel Selector' option in the EFB's Engine Config app (see the dedicated EFB Manual).

Left main panel



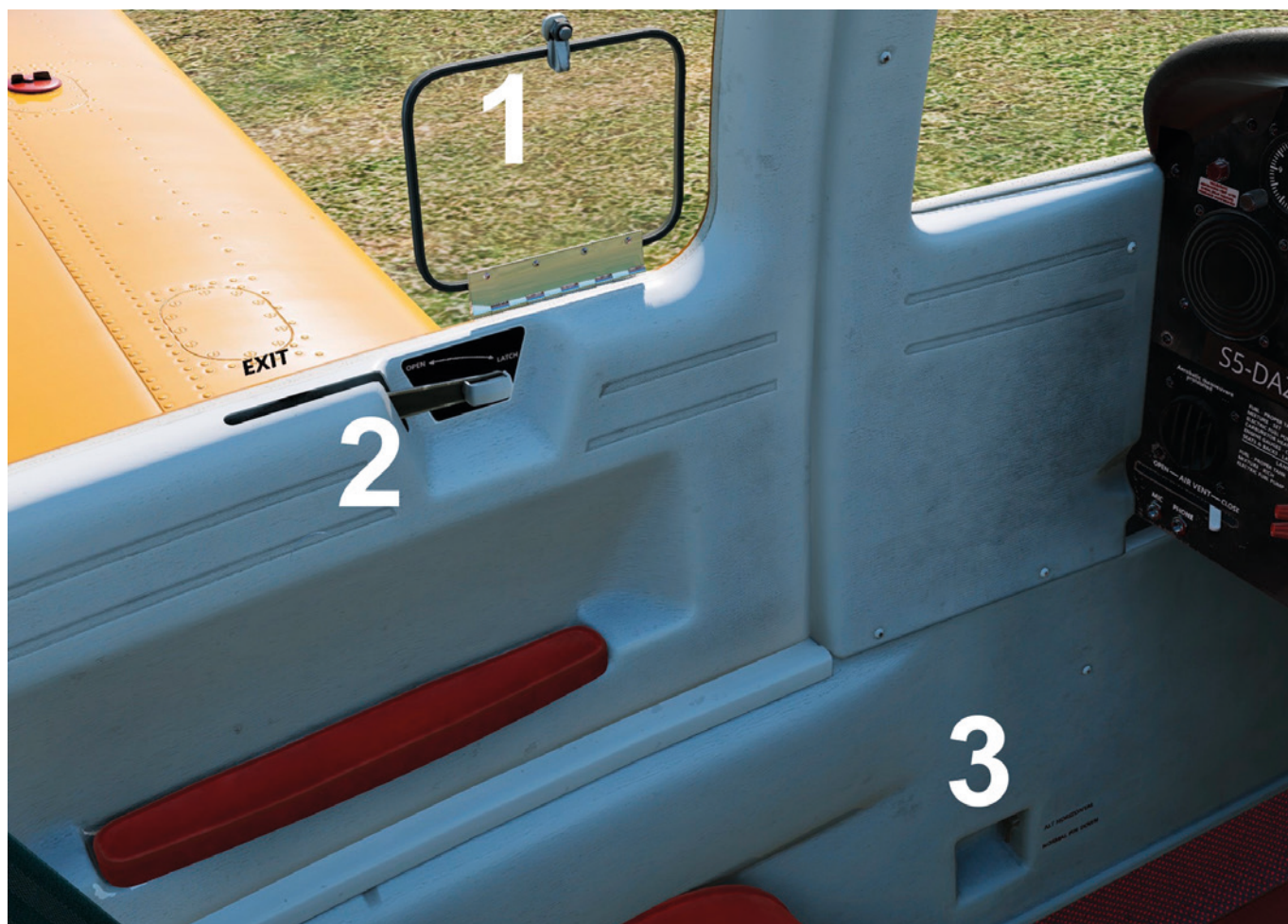
1. Engine starter warning light – illuminates whenever the engine starter is engaged.
2. Clock – a knob allows for adjustment of the hour and minute hands.
3. Airspeed indicator (ASI) – a true airspeed indicator is incorporated into the airspeed indicator. The true airspeed indicator consists of a rotatable 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



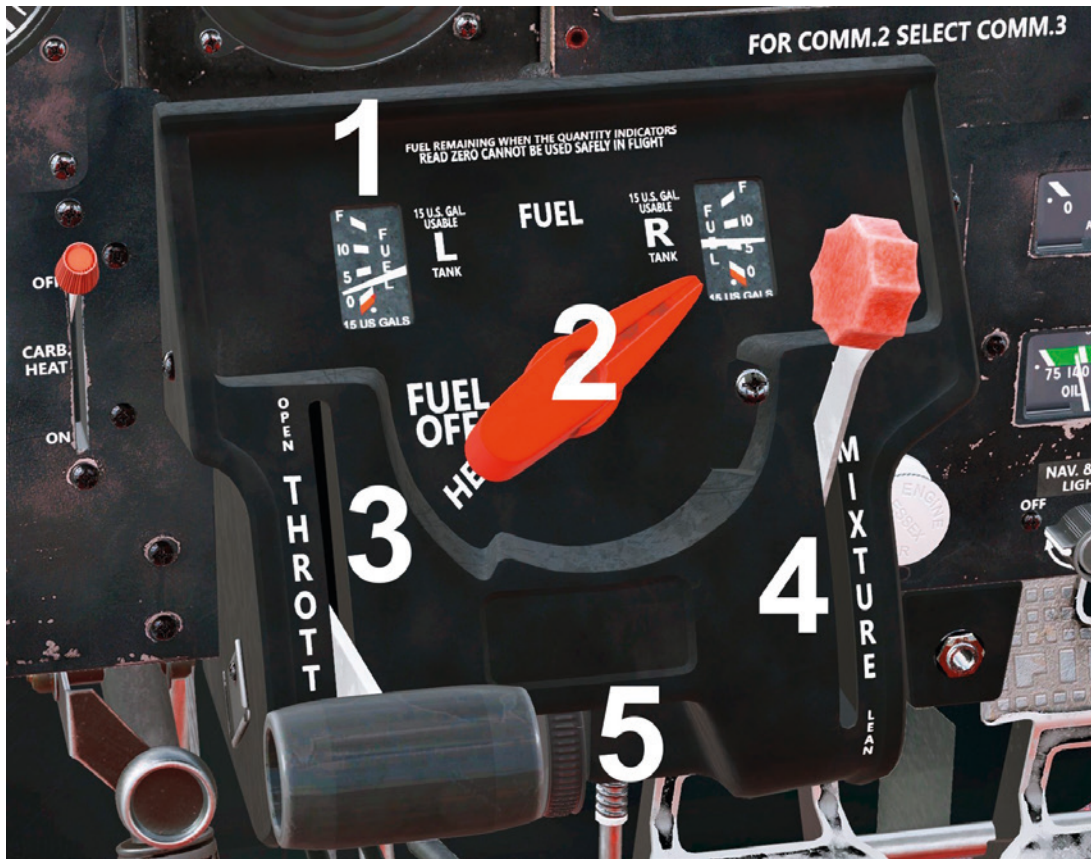
1. Heating controls
2. Yoke toggle clickspot (same location on right yoke)
3. Master switch – consists of a battery and alternator switch.
4. Magneto selector and ignition
5. Electric fuel pump switch
6. Landing light switch
7. Anti-collision light switch
8. Pitot heat switch
9. Tachometer (RPM)
10.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

Left sidewall



1. Storm window (the window can be opened by clicking on the latch)
2. Door latch
3. Static source valve

Control quadrant



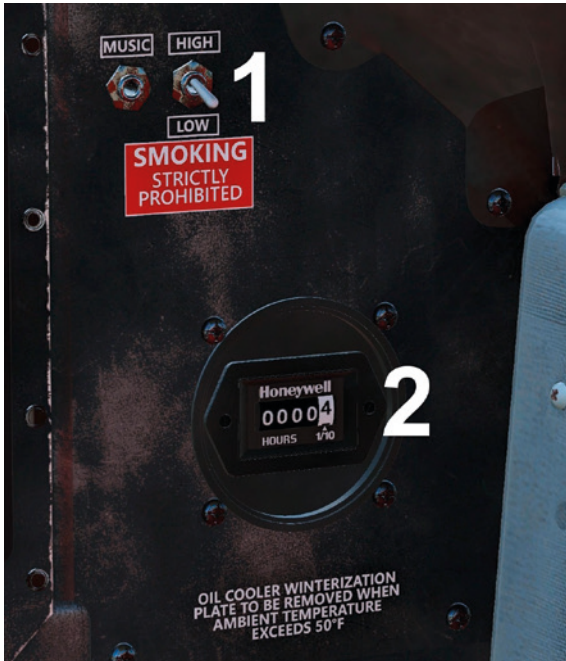
1. Left and right fuel tank quantity indicator
2. Fuel tank selector – the latch must be rotated before the FUEL OFF position can be selected.
3. Throttle lever
4. Mixture lever
5. Friction control

Centre panel



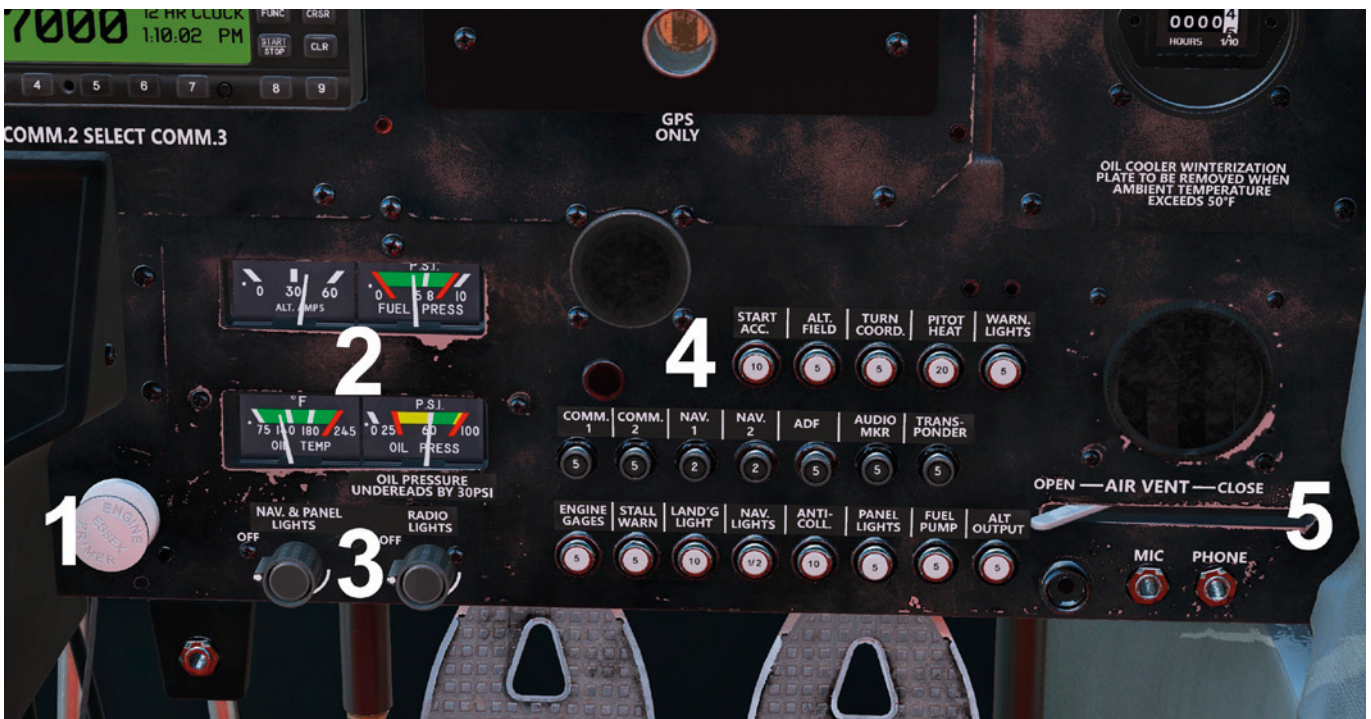
1. GMA 340 audio selector
2. SL30 COM 1 / NAV 1 radio
3. SL40 COM 2 radio
4. GTX 328 transponder

Right main panel



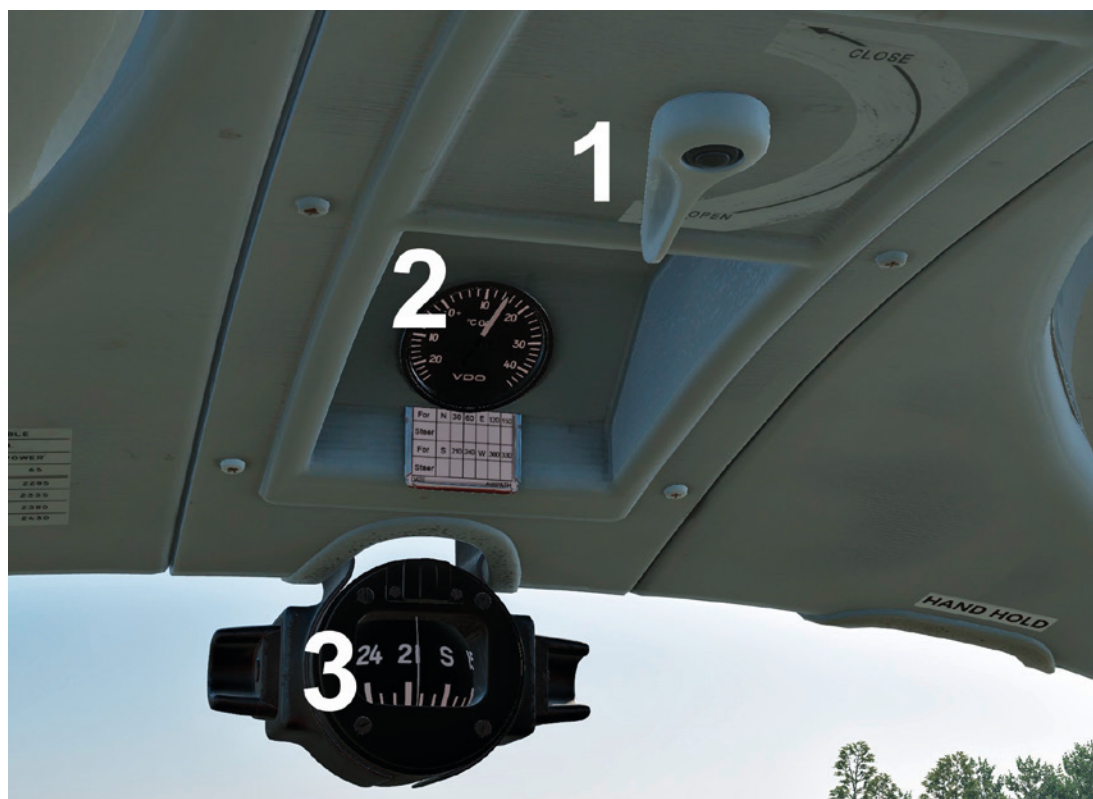
1. Audio HIGH/LOW switch – non-functional in this simulation
2. DATCON hour meter

Right lower panel



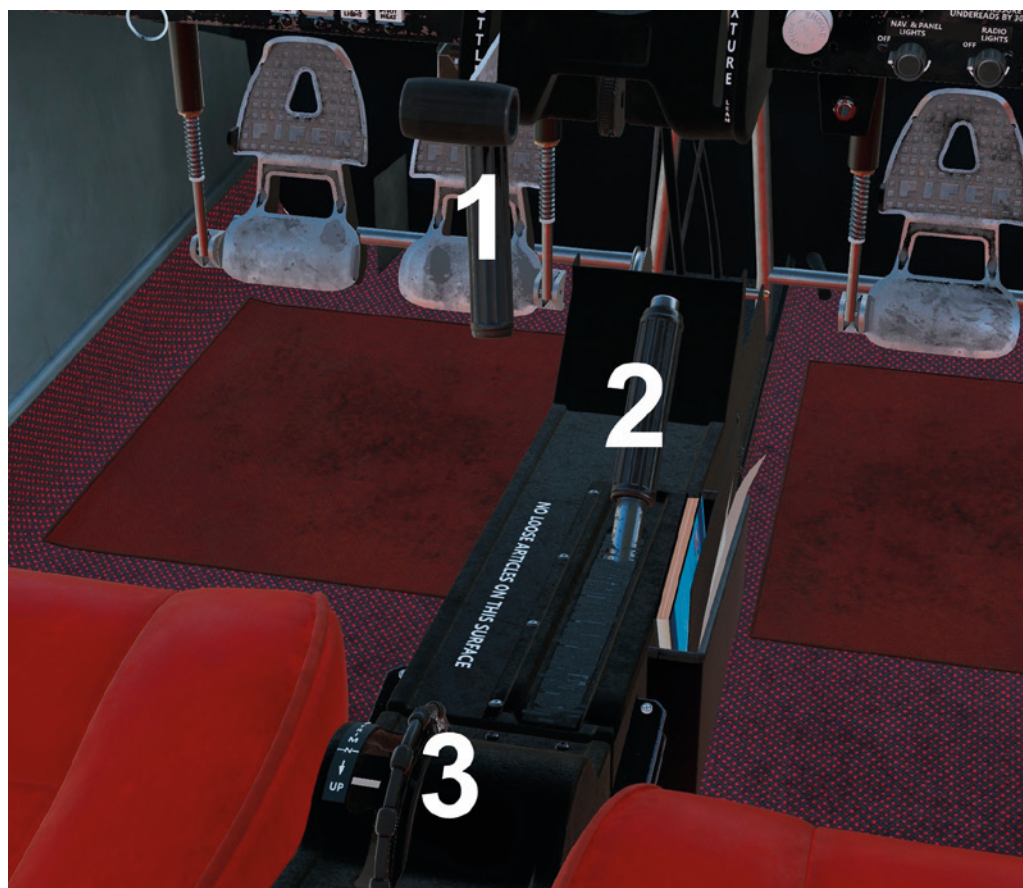
1. Primer – left-click to pump the primer.
2. Engine instruments – ammeter, oil temperature, fuel pressure and oil pressure indicators.
3. Panel light controls
4. Circuit breaker panel
5. Air vent control

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 Flight Simulator, this knob serves no function.
- 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:** The X-Plane ATC system 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.

SL30 – COM 1 / NAV 1 radio



The SL30 acts as a COM 1 / NAV 1 radio. It drives the VOR indicator for navigation purposes.

1. **Left knob** – this knob is used to control power to the SL30 unit; left-click on it to toggle the power on/off.
2. **Flip-flop** – this button is used to transfer the COM 1 standby frequency into the COM 1 active frequency slot, or the NAV 1 standby frequency into the NAV 1 active frequency slot, depending on which mode is selected.
3. **COM** – this button is used to select COM mode. With COM mode active, as indicated by a green LED above the COM button illuminating, the active/standby COM 1 frequency can be altered with the right knob. The active COM 1 frequency is shown on the left and the standby COM 1 frequency is shown on the right, preceded by the letter 's'.
4. **NAV** – this button is used to select NAV mode. With NAV mode active, as indicated by a green LED above the NAV button illuminating, the active/standby NAV 1 frequency can be altered with the right knob. The active NAV 1 frequency is shown on the left and the standby NAV 1 frequency is shown on the right, preceded by the letter 's'.
5. **SYS** – this button is used to select the system mode. With the system mode active, as indicated by a green LED above the SYS button illuminating, you can cycle through the SL30 system menus using the right knob. With SYS mode active, no other mode (COM, NAV or OBS) can be selected.

There are four menu categories with various options within each one:

- System Info
- Nav Options
- Comm Options
- VOR Equipment Test

These menus have no function in this simulation.

6. **OBS** – this button is used to select the OBS mode. With the OBS mode active, as indicated by a green LED above the OBS button illuminating, a VOR CDI will be displayed on the right side of the unit and the current OBS course setting will be displayed in the centre of the unit.

With OBS mode active, the right knob controls the OBS course setting and cannot be used to alter the COM 1 or NAV 1 frequencies. The right outer knob adjusts the course setting in tens (00-35) and the right inner knob adjusts in single degrees.

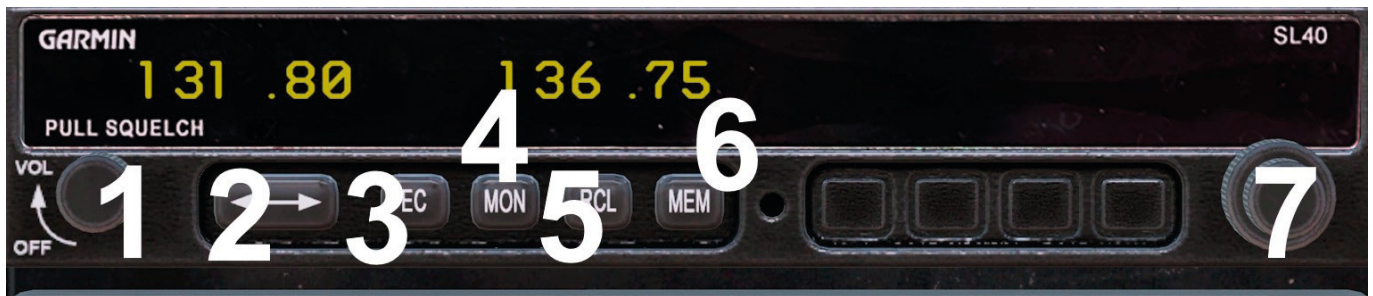
'---flagged---' text will appear in place of the VOR CDI if no valid VOR signal is being received by the NAV 1 radio.

The VOR CDI is shown as an aeroplane icon in the centre of the display. When you are operating on a radial that is more than 85 degrees off the OBS course setting, the aeroplane icon is replaced by a + (cross) icon. The CDI is shown as a bar graph of up to five pairs of short and tall bars, to the right or left of the aeroplane icon. Each of these pairs indicates two degrees of deflection. In order to remain on course, turn in the direction of the bars.

7. **T/F** – this button is used to enable to/from indications on the VOR CDI display. With the indications enabled, 'to' or 'from' will appear in the areas to the left or right of the VOR CDI.
8. **ID** – this button is used to toggle the NAV 1 audio output. With the NAV 1 audio output selected on, as indicated by a green LED above the ID button illuminating, the Morse ident for the active NAV 1 frequency will be audible.

9. **SEL** – with the SYS and OBS modes inactive, the SEL button is used to select the frequency recall mode. This mode is not implemented in this simulation.
10. **ENT** – with the SYS and OBS modes inactive, the ENT button is used to select the frequency save mode. This mode is not implemented in this simulation.
11. **Right knob** – if the knob does not serve a specific purpose on the selected mode, it can be used to alter the standby COM 1 or NAV 1 standby frequency. The outer knob increases/decreases the whole numbers and the inner knob increases/decreases the fractions.

SL40 – COM 2 radio



The SL40 is very similar to the SL30 and 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. This mode is not implemented in this simulation.
6. **MEM** – pressing this button will store the display standby frequency in memory. This mode is not implemented in this simulation.
7. **Right knob** – if frequency recall mode is disabled, the right knob can be used to alter the standby COM 2 or NAV 2 standby frequency. The outer knob increases/decreases the whole numbers and the inner knob increases/decreases the fractions. With frequency recall mode enabled, the knob is used to select the frequency from memory (see below).

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.

Press the ON key to power on the unit.

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. The default code can be set in the Tomahawk’s manifest via the line ‘defaultVFRCode’.

FUNC – changes the page shown on the right side of the display. Display data includes Flight timer, Zulu time, local time (12-hour format), local time (24-hour format).

START/STOP – starts and stops the flight timer.

CRSR – non-functional in this simulation.

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 – non-functional in this simulation.

9 – non-functional in this simulation.

Function display

FLIGHT TIME – timer start and stop can be manually controlled using the START/STOP and CLR keys.

GROUND EQUIPMENT

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



The chocks and tie-downs are activated by the toggle buttons in the EFB's Aircraft Options app. They can appear whenever the aircraft is on the ground and stationary, with the engine off and the parking brake applied.

FAILURES

In addition to supporting the simulator's own failures system, this Tomahawk simulation includes a few of the more common failures found on these aircraft:

- **Spark plug fouling** – this can occur if the engine is kept at low RPM for prolonged periods and symptoms include rough running with a subsequent increase in cockpit vibration. If fouling occurs, increase engine RPM and aggressively lean the mixture. This can be done at low power settings on the ground without harming the engine.
- **Vapour lock** – this can occur for up to approximately 30 minutes after the engine has been shut down. After shutdown, fuel vapour can remain within the fuel lines as the result of high temperatures. This vapour disrupts the operation of the fuel system and creates an incompatible mix of air and fuel, so you might need a few attempts at starting the engine before ignition occurs. This problem is more likely to occur when operating in high temperatures. If vapour lock is suspected, operate the electric fuel pump for 20-30 seconds with the mixture in the idle cut-off position, then repeat the engine starting attempt.
- **Battery failure** – the battery can be quickly drained, either by leaving electrical systems switched on without the engine (and therefore alternator) running, or by repeated attempts to start the engine. The battery can be recharged using the Refill Menu.

These failures are enabled by default and can be disabled/enabled by clicking on 'Simulate Spark Plug Fouling and Vapour Lock' in the EFB Engine Config app.

If you are unable to start the engine, please check the following items:

Fuel flow – to ensure sufficient fuel flow for ignition, confirm that the fuel pump is switched on and the mixture lever is set to rich (forward). Confirm fuel flow using the flow gauge prior to attempting an engine start. Refer to the [NORMAL PROCEDURES](#) section in the manual for more information.

Vapour lock – this can occur for up to approximately 30 minutes after the engine has been shut down. After shutdown, fuel vapour can remain within the fuel lines as the result of high temperatures. This vapour disrupts the operation of the fuel system and creates an incompatible mix of air and fuel. If vapour lock is suspected, operate the electric fuel pump for 20-30 seconds (with the mixture in the idle cut-off position), then repeat the engine starting attempt.

You can also start the engine by using the START ENGINES RUNNING slider in the Aircraft Options app on the EFB.

AVIONICS CONFIGURATIONS

The Tomahawk comes with various equipment options of differing capability:

- **TRAINER** – GMA 340, SL30, SL40, GTX 328 (no GPS)
- **GNS DUAL** – GMA 340, GNS 530, GTX 328, GNS 430
- **GNS 530** – GMA 340, GNS 530, GTX 328, SL40
- **GTN 650** – GMA 340, SL40, GTX 328, GTN 650
- **GTN 750** – GTN 750

The GNS DUAL and GNS 530 options utilise the default X-Plane GPS units. Detailed instructions for the GNS 530 and GNS 430 can be found in your X-Plane 12/Instructions folder.

The GTN 650 and GTN 750 require the separate purchase of the TDS GTNXi.

The different configurations can be selected via the EFB Instrument Options app. As there is only limited space on the panel, the units will replace those standard units that serve a similar purpose and reposition other units.



Also included are options for a KR 85 ADF tuner/gauge and a second CDI which can be enabled when a NAV 2 radio is available on the GNU DUAL, GTN 650 and GTN 750 options.



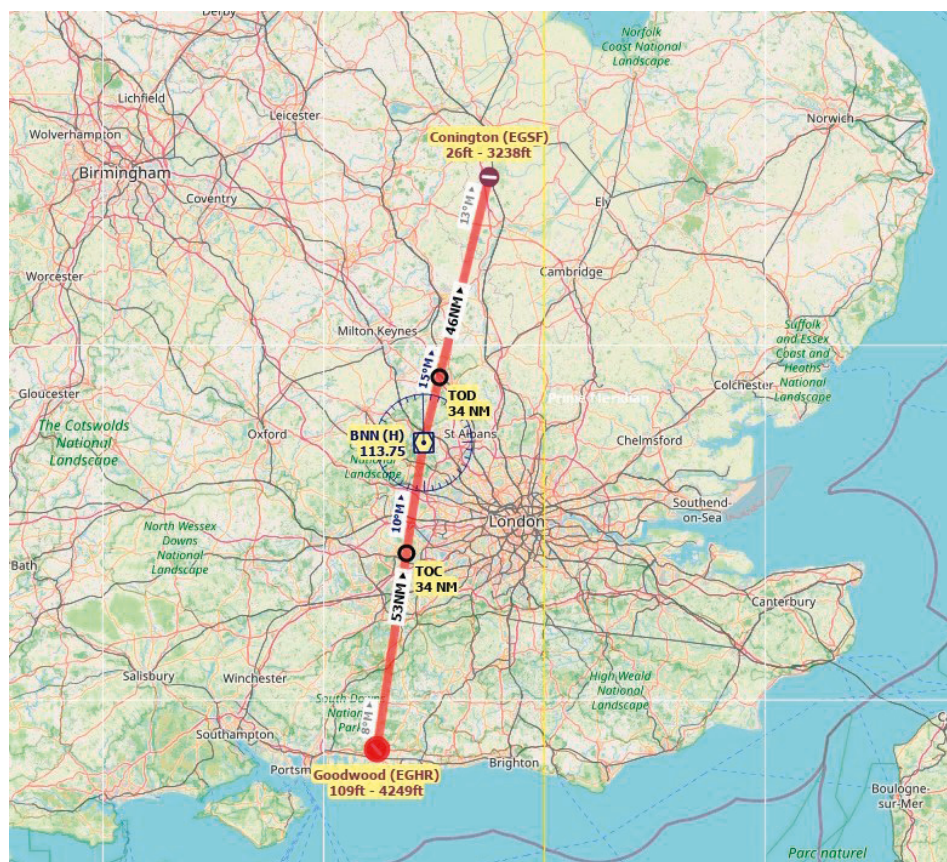
FLYING THE TOMAHAWK

In this tutorial flight we will be departing from Goodwood Aerodrome, home of the legendary Goodwood racing circuit, in West Sussex, England. We will be heading north, passing to the west of London Gatwick, Heathrow and Luton airports and overhead Grafham Water before approaching Conington Airfield from the south.

Covering approximately 98 nautical miles, this short flight is the ideal length for learning about the essential systems on board the PA-38 Tomahawk.

Here are the details for today's flight:

EGHR > BNN (113.75) > EGSF



Estimated time en route: 60 minutes

Route distance: 98 nautical miles

Departure time: 0900 (local time)

Weather: VFR Few Clouds

Now that we are prepared for the flight, we can proceed to the cockpit to begin our pre-flight checks. To load up the PA-38 Tomahawk tutorial flight, follow these steps:

1. Start X-Plane 12.
2. From the Main Menu click **New Flight** or go to the Flight Configuration window.
3. Click on the Tomahawk in the Aircraft Selection screen.
4. Click **Customize**, choose the G-BNKH livery from the drop-down menu in the top right and uncheck the box labelled **Start with engines running**.
5. In the Location box, type **EGHR** and select **Chichester Goodwood**. Click the **Customize** button.
6. Under 'Starts' select **Ramp** and choose a ramp start location. Press **Confirm** when done.
7. Click **Start Flight**.

You should now find yourself sitting in the cockpit at Goodwood Aerodrome. The aircraft is configured in a 'cold and dark' state with all the cockpit systems switched off, as you would find the aircraft prior to the first flight of the day. Beginning in this configuration means we will need to spend some additional time setting up the cockpit but doing so will allow you to learn a considerable amount about the features and functions on board the Tomahawk.



This tutorial will cover the necessary steps for you to get from point A to point B, but it will not explore each system in depth. Please refer to the rest of this manual for details of each system.

Getting started

The first step is to open the doors to allow entry into the cockpit. In the virtual cockpit, click on the upper and lower door latches to rotate them to the **OPEN** position.

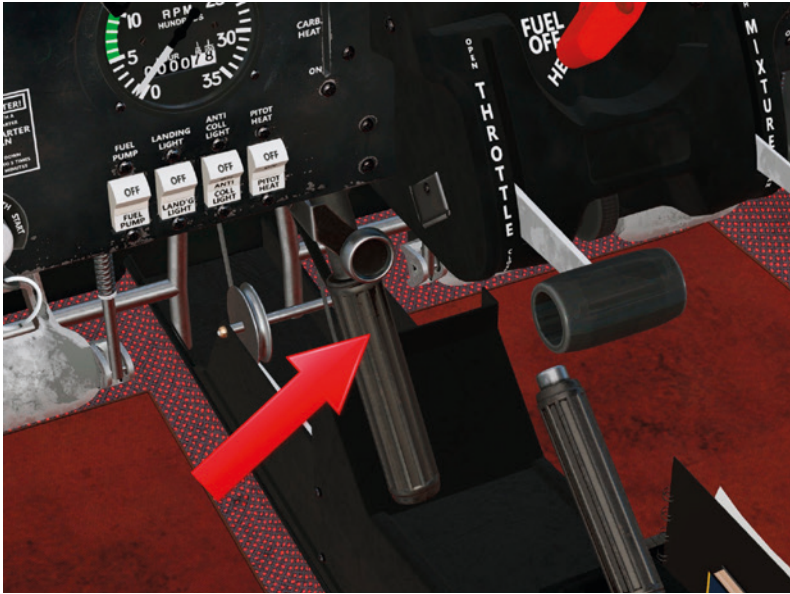


We can now start working through the pre-flight inspections.

To enable easier access to the controls, you may want to hide the yoke by using the clickspot at the base of the yoke, where it is mounted to the panel.

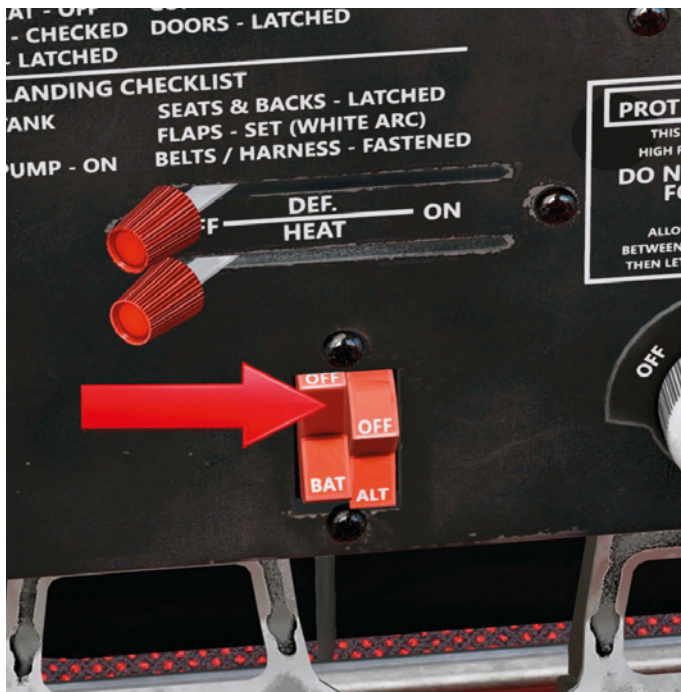


Confirm that the parking brake handle is **ON**.



Check that all avionics are **OFF**, the mixture lever is set to **IDLE CUT-OFF** and the ignition is **OFF**. Then switch **ON** the master switch.

Confirm that the alternator warning light is illuminated and check the left and right fuel quantity gauges to confirm that we have full tanks (15 gallons per tank).



Switch **ON** the navigation, strobe (anti-collision) and landing lights using the controls on the left and right lower panels.



Switch to the external (Chase) view and confirm that all of the lights are illuminated before returning to the cockpit and switching them all **OFF**. Switch **OFF** the master switch.



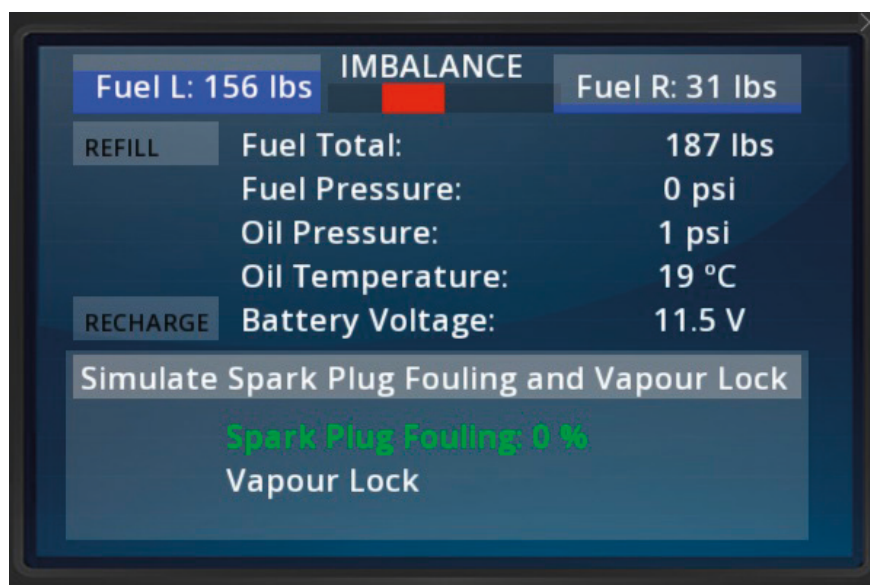
Confirm that the elevator trim is in the centre/neutral position.

Check that you have full and free movement of the flying controls and that the mechanically controlled flaps extend and retract fully.

Switch to the external (Chase) view and carry out a visual inspection of the aircraft. The wheel chocks and tie-downs should be visible.



On the EFB open the Engine Config menu.



Use the menu to recharge the battery, in case it has discharged while you've been finding your way around the cockpit, and add fuel via the REFILL button.

We are now finished with the EFB so return to the Home page by clicking the Home button on the right-hand bezel.

Starting the engine

We will start the engine before configuring the avionics for our departure.

Close the doors by first clicking on the door latches to pull them shut and then clicking on the overhead latch to rotate it to the **CLOSE** position.



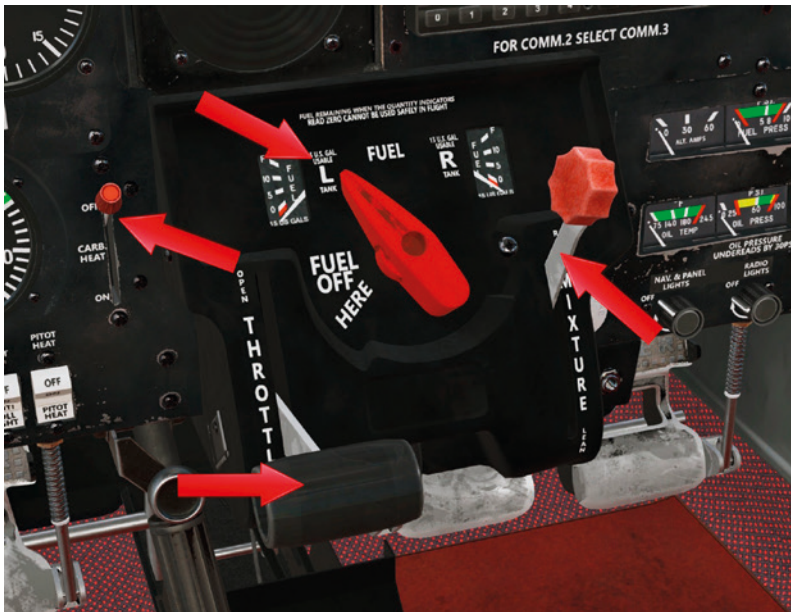
Check that all circuit breakers are pushed in.



On the control quadrant, right-click on the fuel selector to rotate it to the **LEFT** position.

Move the mixture lever to the **FULL RICH** (forward) position and advance the throttle lever to approximately **1/4 open**.

Confirm that the carburettor heat lever is set to **OFF** (up) and that all avionics are still **OFF**.



Switch **ON** the master switch to provide electrical power to the aircraft.

Turn **ON** the navigation lights, warning anyone in the area that we are about to start the engine. Switch **ON** the radio lights, otherwise the avionics displays will remain blank!

Switch **ON** the fuel pump and confirm that a positive fuel pressure is shown.



Rotate the magneto selector to the **BOTH** position.



Check that the area surrounding the aircraft is clear of obstructions and then rotate the key to the **START** position.

Check that the oil pressure and temperature are rising.



Confirm that the alternator and starter warning lights have extinguished.



Adjust the throttle to maintain approximately **1,000 RPM** and check that the vacuum gauge shows suction within the given limits.



With the engine running and the alternator charging the battery, we can now switch on the avionics. Starting at the top of the centre panel and working down, switch on the GMA 340, SL30, SL40 and GTX 328 units.



Finally, rotate the fuel selector switch to the **RIGHT** and then the **LEFT** position, checking that the engine operates correctly on both tanks before selecting the fullest tank.

Configuring the avionics

We now need to configure the avionics for our departure.

Using the knob on the direction indicator, rotate the compass card to ensure that it matches the heading shown on the whiskey compass. For ease, you can also click the centre of the knob to align. Alternatively, use the 'vacuum DG sync to magnetic north' keyboard assignment.



Once we are settled into our climb we will make a turn to fly towards our first waypoint on the route, Bovington VOR (**BNN – 113.75**). The VOR is one of four used by aircraft holding for the approach into London Heathrow. In preparation, tune the VOR into NAV 1 (SL30).



Taxi

We can now taxi to the runway. Check that the area around the aircraft is clear of obstacles and then release the parking brake. Apply power slowly to get the aircraft rolling and then start the short taxi to the threshold of runway 32.

Steering the aircraft with the rudder pedals only is generally sufficient. Combined use of the rudder pedals and the 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.

Stop at the holding point just short of runway 32. We can carry out the power (ground) checks here.

Set the parking brake and advance the throttle lever to obtain **1,800 RPM**. Switch **OFF** the left magneto, note the RPM drop and then switch it back **ON**. Repeat the process for the right magneto.

Check that the vacuum, oil temperature, oil pressure and ammeter readings are within limits.



Make sure that the mixture lever is set to **FULL RICH** (fully forward) and that the fuel selector is set to the fullest tank.

To carry out a carburettor heat check, pull the carburettor heat lever to **ON** (down) and check for a small drop in RPM, then push the lever back to **OFF** (up). If the RPM increases to significantly more than the original 1,800 RPM, it is likely that icing conditions are present. With clear skies and moderate temperatures for our flight, however, that shouldn't be an issue.



Check the operation of the fuel system by switching the fuel pump **OFF** and confirming that the fuel pressure falls but is still within the green sector.

Finally, reduce the throttle to idle and check for rough running.

We can now run through the before take-off checks.

Confirm that the master switch is set to **ON**.

Rotate the fuel selector to the fullest tank and switch the fuel pump back **ON**.

Check that the carburettor heat lever is set to **OFF** and that the mixture lever is in the **FULL FORWARD** position.

Confirm that the magneto selector is set to **BOTH** and then switch **ON** the landing and strobe lights.

Rotate the pitch trim wheel until the indicator sits in the neutral/centre position.

Confirm that both doors are **LOCKED** and that you have full and free movement of the flying controls.

Finally, switch **ON** the PITOT HEAT switch.



With the before take-off checks complete, have a look left and right, verify that nothing is on approach and that the runway is clear, and then taxi onto the runway.

Take-off

Line up with the runway centre line and then come to a stop. Smoothly apply full power and, as the aircraft starts to gather speed, keep it running down the centre line with rudder inputs. As you approach **53 knots** start to raise the nose of the aircraft.

Make elevator inputs as required to maintain an initial climb speed of approximately **70 knots**, holding the runway heading (320 degrees).



Climb

Switch **OFF** the fuel pump and landing light on reaching 1,000 feet.

We can now begin a right turn towards the first waypoint, Bovingdon (BNN) VOR. With the VOR now in range, the CDI needle on the VOR indicator will indicate our deviation from the selected course. Rotate the OBS knob to identify the course to the VOR – approximately **010 degrees** in this case – and turn onto that heading to fly directly towards it (there is zero wind, so no heading correction is required).



The Tomahawk doesn't have the luxury of an autopilot, so you'll need to hand fly the climb, cruise and descent! However, ensuring that the aircraft is trimmed correctly and regularly switching between fuel tanks to prevent a fuel imbalance will help provide a stable hands-off aircraft.

Cruise

Level off the aircraft at **4,000ft** and once the aircraft has reached **90 knots**, reduce the throttle to maintain that airspeed.



It is important to remember that the engine is only being fed with fuel from a single tank at any given time, therefore the fuel quantity in each tank should be carefully monitored. It is recommended that you change fuel tanks every half hour and do not exceed a fuel imbalance of five US gallons.

If you want to avoid worrying about switching fuel tanks, enable the automatic fuel selector from the EFB Engine Config app.

With the aircraft stabilised in cruise, you can sit back and take in the views across the South Downs National Park. You should be able to see Gatwick Airport on the horizon to the east of the aircraft.



It is a good idea to periodically run through the 'FREDA' checks whilst in the cruise:

F – check the fuel gauges to ensure that there is enough fuel for the remainder of the flight.

R – check that the correct radio frequency is selected and that the transponder is set as required.

E – check the engine instruments (oil temperature and pressure).

D – check that the direction indicator is correctly aligned with the whiskey compass reading and that you are on the correct heading (towards the Bovingdon VOR in this case).

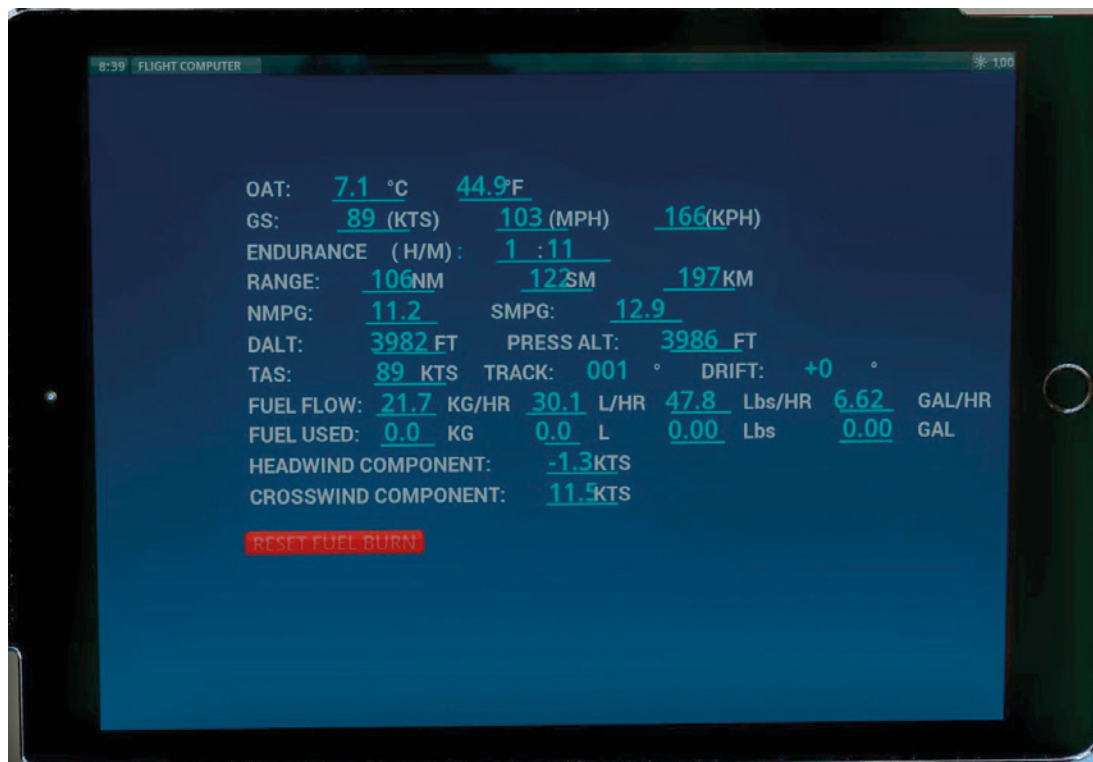
A – check that the barometric pressure setting is correctly set on the altimeter.

The leg to the VOR should take approximately 25 minutes. This is the ideal opportunity to take a quick look at some of the features of the aircraft.

The PA-38 has a basic avionics fit which is well suited to its role as a training and touring aircraft. In addition to the primary instruments, the cockpit is fitted with an omni-course (VOR 1) indicator for navigation purposes.

In the centre of the panel is the radio stack which features the GMA 340 audio selector, SL30 COM 1 / NAV 1 radio, SL40 COM 2 radio and GTX 328 transponder. It can also be equipped with the more complex TDS GTNXi GTN 650 and 750 units for GPS navigation if you own them.

Another useful feature for navigation is the Flight Computer panel, which can be opened from the EFB app. The flight computer shows a variety of real-time information related to everything from speed to fuel burn/flow and range/endurance.



Before long you should see Heathrow Airport coming into view to the north-east. Any departures or arrivals should pass below our aircraft.

As we pass abeam Heathrow Airport with the London skyline in the distance, we have 15 miles to run.

As you fly overhead the VOR the To/From indicator will switch to a From indication. Make a right turn to a heading of **014 degrees** to fly outbound from the VOR towards Conington.



Shortly after passing the VOR you should be able to see Luton, the last of the major London airports on our trip.



Take the opportunity during the remaining time in the cruise to explore the cockpit using the [PANEL GUIDE](#) for reference.

Descent

We will begin our cruise descent as Grafham Water passes below the nose of the aircraft, with approximately 15 miles to run until Conington Airfield.



Reduce the throttle to obtain **1,800 RPM** and once the airspeed has reduced to **80 knots**, start the descent and trim to maintain airspeed. Pull the carburetor heat **ON**.

Approach and landing

We will carry out an approach onto runway 10. Turn onto a heading of 360 degrees to bring us onto an extended base leg, flying roughly parallel to the A1 motorway.

Switch **ON** the fuel pump.

As you descend, confirm that the landing light is switched **ON**, the mixture is set to the **FULL RICH** (fully forward) position, the primer is pushed **IN** and the parking brake is **OFF**.

Level off the aircraft at **1,000ft** and, once established on the base leg, raise the nose to reduce your airspeed to 70 knots and extend the flaps to the **21°** position. Pitch the nose down to maintain **67 knots** and continue your descent.

Turn the aircraft onto final approach and extend the flaps to the **34°** (fully extended) position.



As the aircraft arrives over the runway, start to bring the aircraft into a flare, gently raising the nose just above the horizon. Reduce the throttle to idle and the aircraft should touch down smoothly.



Apply gentle braking and, once the aircraft has slowed to a fast walking pace, turn left off the runway at the first available taxiway. When you are safely off the runway, raise the flaps and push the carburettor heat to **OFF**.

You can also switch **OFF** the landing and strobe lights, pitot heat and fuel pump.

Shutdown

Begin your taxi to the nearest available parking spot.

Once you have come to a stop at your chosen parking spot, engage the parking brake and switch **OFF** the avionics.

Bring the throttle lever back to **IDLE** and then bring the mixture lever back to **IDLE CUT-OFF** to shut down the engine.

Once the engine has come to a stop, set the magneto selector to the **OFF** position, switch **OFF** the navigation lights and then switch **OFF** the master switch to disconnect the electrical power.

Rotate the fuel selector to the **FUEL OFF** position and open the doors.

Congratulations – you have completed the Tomahawk tutorial flight!



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

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Sounds	SimAcoustics
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