PA-38 TOMAHAWK

OPERATIONS MANUAL

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PA-38 TOMAHAWK

Operations Manual

Microsoft Flight Simulator must be correctly installed on your PC
prior to the installation and use of this PA-38 Tomahawk simulation.

CONTENTS

INTRODUCTION

The Piper PA-38-112 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. Despite this, early examples of the aircraft became so renowned for their unconventional stall and spin characteristics that the aircraft was given the nickname 'Traumahawk' by its pilots. 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 Piper PA-38-112 Tomahawk II based at Goodwood Aerodrome with SportAir.

Aircraft specifications

Dimensions

Length	23.2 ft (7.1m)
Wingspan	34 ft (10.4 m)
Height (to top of tail)	9.1 ft (2.8m)
Wing area	124.7 ft^2 (11.6 m^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 thirteen paint schemes:

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

Cockpit textures

This simulation of the PA-38 Tomahawk is an exact likeness of the real-life G-BNKH, including the significant wear and tear to the cockpit resulting from decades of use as a training aircraft.

For those who would prefer a less worn cockpit, we have included a set of alternative textures. The two texture sets can be found in the '…Community\justflight-aircraft-pa38\Cockpit\' folder and can be used to replace the files found in the '…Community\justflight-aircraft-pa38\SimObjects\Airplanes\JF_PA38_Tomahawk\texture.VC' folder.

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.

Accessing the aircraft

To access the aircraft:

1. Click on 'World Map'.
2. Open the aircraft selection menu by clicking on the aircraft thumbnail in the top left.
3. Use the Search feature or scroll through the available aircraft to find the 'Just Flight PA38 Tomahawk'.
4. After selecting the aircraft, use the 'Liveries' menu to choose your livery.

Uninstalling

To uninstall this product from your system, use one of the Windows App management features:

Control Panel > Programs and Features
or
Settings > Apps > Apps & features

Select the product you want to uninstall, choose the 'Uninstall' option and follow the on-screen instructions.

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 get 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 Just Flight 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.

You can also keep up to date with Just Flight via Facebook and X (formerly Twitter).

SYSTEMS GUIDE

Airframe

The PA-38 Tomahawk is a low-wing, single-engine, all-metal aircraft with fixed tricycle 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.

Doors and exits

The aircraft is fitted with two cabin doors, one on either side of the aircraft.

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 cockpit by clicking on the overhead latch to rotate it to the forward (OPEN) position, clicking on the latch on the respective door to rotate it to the OPEN position and then clicking on the red leather door armrest to push it open.

To close the door, follow the same process in reverse: click on the red leather door armrest to pull the door closed, click on the door latch to rotate it to the LATCH position and then rotate the overhead latch to the aft (LATCH) position.

The doors can also be opened/closed using the 'Doors' button on the Aircraft page of the EFB tablet.

Electrical system

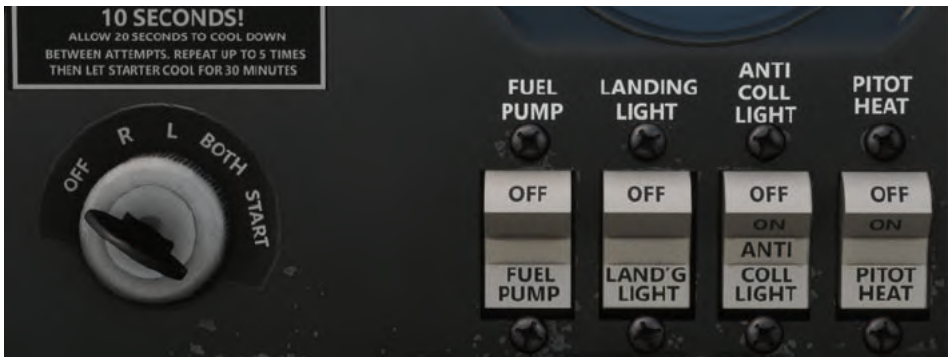
The electrical system includes a 14-volt, 60-ampere alternator, voltage regulator, over-voltage relay, battery contactor and a 12-volt, 25-ampere-hour battery.

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.

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 is located to the right of the control quadrant and the magneto selector is located to the left of the control quadrant.

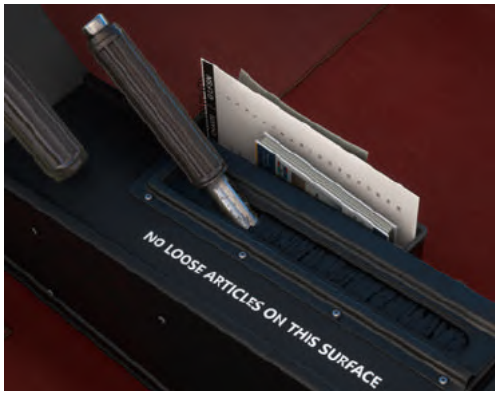
Flight controls

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. Rotating the wheel forward gives nose-down trim and aft rotation 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 by increased control wheel force.

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 and must be retracted to allow the fuel selector to be 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.

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

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 any compatible avionics displays.

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.

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 provides 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.

A pitot head cover can be fitted when the aircraft is parked. This can be toggled on/off using the interactive walkaround mode on the EFB tablet.

Stall warning system

An approaching stall is detected by a stall warning vane on the leading edge of the left wing and is then indicated to the pilot by means of an audible alarm located behind the instrument panel. The indicator activates at between five and ten knots above stall speed.

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.

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 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.

An EFB tablet can be fitted to the right side of the cockpit windshield and can be toggled via the MUSIC ON/OFF switch on the right side of the instrument panel. The tablet hosts a range of features, including Navigraph charts and SimBrief flight plan support, moving map, notes app, aircraft checklists and an Aircraft page with a plethora of customisation options. For full details of the EFB tablet, see the dedicated PA-38 Tomahawk EFB manual which can be found in the same location as this manual.

Interactive paper charts and checklists can be toggled by clicking on the book in the charts holder to the right of the flaps lever. Up to 20 documents can be stored and you can cycle through pages by using clickspots on the paper. Custom documents can also be imported (see the Interactive paper charts section for further information).

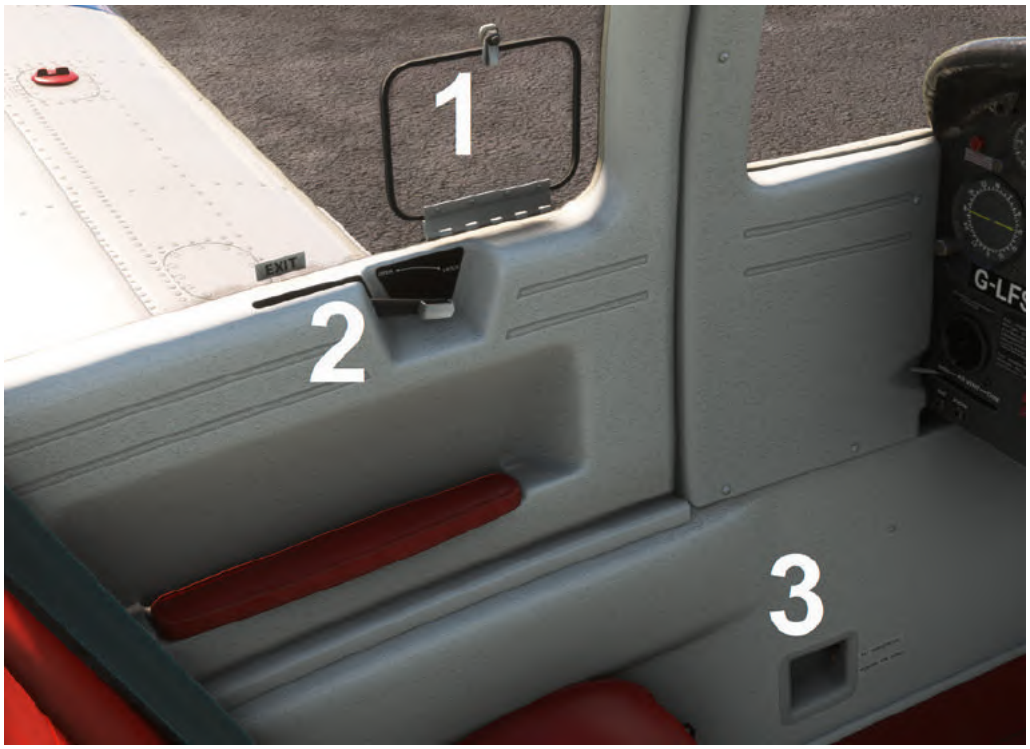
Left main panel

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. NAV 1 OBS – driven by SL30 (or GPS if installed via the EFB).
9. Low voltage warning light
10. ADF indicator (if installed via the EFB)
11. Turn and bank indicator
12. Direction indicator
13. Vertical speed indicator (VSI)
14. NAV 2 OBS – driven by SL30 (if installed via the EFB, or GPS).

Left lower panel

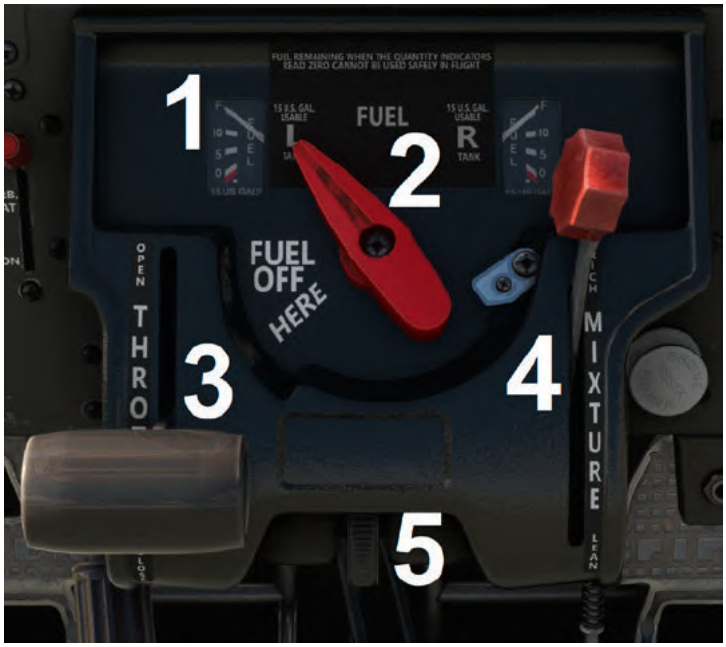
1. Heating controls
2. Yoke toggle clickspot (same location on right yoke)
3. Master switch – consists of a battery and alternator switch.
4. Magneto selector and ignition
5. Electric fuel pump switch
6. Landing light switch
7. Anti-collision light switch
8. Pitot heat switch
9. Tachometer (RPM)
10.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

Left sidewall



1. Storm window – the latch must be rotated prior to opening/closing the storm window.
2. Door latch
3. Static source valve

Control quadrant



1. Left and right fuel tank quantity indicators
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
   (or GPS if installed via the EFB)
2. SL30 COM 1 / NAV 1 radio
   (or GPS if installed via the EFB)
3. SL40 COM 2 radio
   (or GPS if installed via the EFB)
4. GTX 328 transponder
   (or GPS if installed via the EFB)

Right main panel

1. GPS (if installed via the EFB)
2. KR-85 ADF receiver (if installed via the EFB)
3. Audio HIGH/LOW switch – controls visibility of the EFB tablet.
4. DATCON hour meter

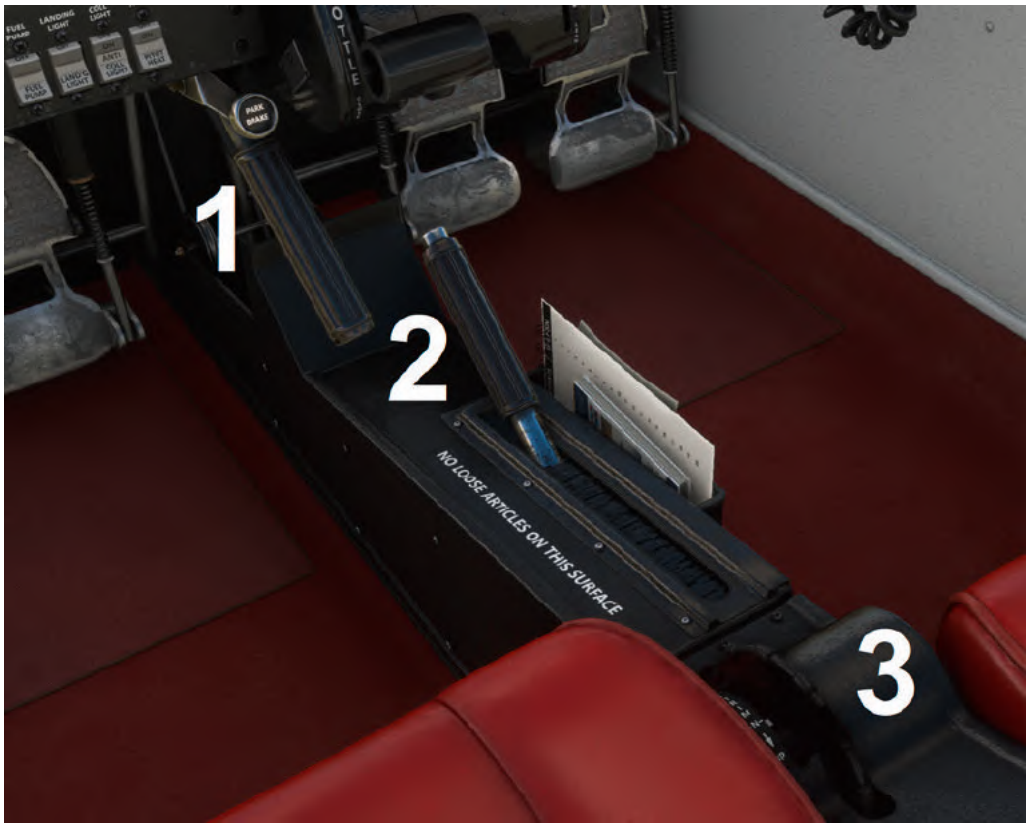
Right lower panel

1. Primer – left-click to unlock and pull out. Left-click again to push and lock.
2. Engine instruments – ammeter, oil temperature, fuel pressure and oil pressure indicators.
3. NAV light and panel lighting control
4. Radio lighting control
5. Circuit breaker panel
6. 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 in Flight Simulator, this knob serves no function.

   Small – this knob is used to switch on/off power to the GMA 340 unit and control the audio panel volume.

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 marker beacon audio and mute function. An initial press will enable the audio, indicated by the illumination of the green LED. If no marker beacon signal is being received, pressing the button again will disable the audio. If a signal is being received, the audio is muted but not disabled, and the green LED will remain illuminated. The audio will be automatically unmuted and disabled once the signal is no longer being received.
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 Tomahawk is only equipped with COM 1 and 2 radios, so COM 3 selections have no impact.*
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 does not simulate 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.

A 'TX' annunciator illuminates whenever you are transmitting on COM 1.

1. **Left knob** – used to control power to the SL30 unit and the volume.
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. The annunciator above the button will illuminate when system mode is selected.
6. **OBS** – this button is used to select the OBS mode, which displays the current OBS setting an a graphic CDI. The right knobs can be used to change the OBS setting when OBS mode is selected. The annunciator above the button will illuminate when OBS mode is selected.
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** – this button is used to select the frequency recall mode, if COM or NAV mode is enabled when pressed, or to change values. To exit the frequency recall mode, press the SEL button again. The annunciator above the button will illuminate when this function is active.
10. **ENT** – this button is used to save selected values, to confirm a prompt or to select the frequency save mode.
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.

Power

The SL30 can be turned on by rotating the left knob clockwise from the OFF (fully anti-clockwise) position. Further clockwise rotation controls the volume.

The SL30 will go through a short initialisation process before entering COM mode. If the SL30 is switched off for less than 15 seconds and then switched back on, it will skip the initialisation process and immediately return the last viewed page.

Selecting frequencies

New COM or NAV frequencies are selected into the standby position before being flipped into the active position with the flip-flop button.

The right outer knob increases/decreases the frequency in 1 MHz increments and the inner knob increases/decreases the frequency in 5 kHz increments (COM) or 50 kHz increments (NAV).

Note: *The COM radios in the real SL30 increase/decrease in 25 kHz increments. This has been changed to 5 kHz increments in this simulation to allow for maximum compatibility with the 8.33 kHz spacing used in modern-day aviation.*

Saving frequencies

You can save up to ten COM and ten NAV frequencies, which are saved along with their associated ICAO identifier (e.g. EGLL) and type (e.g. TWR) if a signal is being received. After ten COM or NAV frequencies have been saved, you will get a 'Database Full' message and will have to remove frequencies before any more can be saved.

The available COM types are:

- ATIS (ATS)
- Unicom (UNI)
- Common Traffic Advisory Frequency (CTF)
- Ground (GND)
- Tower (TWR)
- Clearance (CLR)
- Approach (APP)
- Departure (DEP)
- Flight Service Station (FSS)
- Automated Weather Station (AWS)

The available NAV types are:

- ILS
- VOR
- Localiser (LOC)

To save a frequency, make it the active frequency before pressing the **ENT** button to select the frequency save mode. The right side of the display will show 'STORE AS', followed by the ICAO identifier and frequency type if a signal is being received.

Press the **ENT** button a second time so save the frequency or press the **SEL** button to exit the frequency save mode.

Recalling frequencies

With COM or NAV mode selected, the **SEL** button is used to select the frequency recall mode. The SL30 can store both COM and NAV frequencies. The frequency mode that is currently selected (COM or NAV) when the **SEL** button is pressed will dictate which frequency list is displayed. To exit the frequency recall mode, press the **SEL** button again.

There are two lists of frequencies that you can recall from memory:

1. The ten most recently used frequencies (AUTOLIST) – the frequencies are stored in chronological order, starting with the most recently used. Duplicates are not saved again but are moved to the front of the list.
2. User-stored frequencies (USERLIST) – the frequencies are shown in alphabetical order by station name. The name and type are shown.

After selecting frequency recall mode, rotate the right outer knob to select a list and then rotate the right inner knob to select a frequency from that list. A diamond symbol is shown next to the selected frequency if multiple frequencies are stored in the list.

Press the **ENT** button to recall the selected stored frequency into the standby frequency position. The flip-flop button is used to transfer the recalled frequency into the active position.

If you are recalling a COM frequency, you will also have the option of recalling the emergency frequency – 121.50. If you are recalling a NAV frequency, you will instead have the option to display DST data (see the DST data display section on the next page).

If the list is empty, an 'AUTOLIST EMPTY' or 'USERLIST EMPTY' message will be shown.

Removing frequencies

You can only remove frequencies stored in the User List.

Press the **SEL** button to select the frequency recall mode. Rotate the right outer knob to select the User List and then rotate the right inner knob to select the frequency to be removed.

Press the **SEL** button again. 'REMOVE?' text will appear. Press **ENT** to remove the frequency from the User List or press **SEL** to exit without making any changes.

DST data display

To enable the DST (Distance-Speed-Time) data display, first select NAV mode and then press **SEL**. Rotate the right outer knob to select the DST data list. 'SHOW DST DATA?' will be shown. Press **ENT** to enable the display of DST data. DST information will replace the NAV information on the NAV mode display.

To disable the DST data display, first select NAV mode and then press **SEL**. Rotate the right outer knob to select the DST data list. 'REMOVE DST DATA?' will be shown. Press **ENT** to disable the display of DST data.

Alternatively, it can be disabled by pressing either **T/F** or **OBS**.

OBS mode

The **OBS** button is used to select this 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.

You can navigate direct to a VOR, if NAV mode is selected and a valid VOR frequency is tuned, by pressing the OBS button twice. The CDI will centre in the TO state.

If a localiser is tuned, OBS mode is not available and the CDI will display 'LOC' to its left.

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

If you enable the 'Display Ident over OBS' option in the System mode, the station identifier will replace the OBS value when a valid signal is received.

The VOR CDI is shown as an aircraft 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 aircraft 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 aircraft icon. Each of these pairs indicates two degrees of deflection. In order to remain on course, turn in the direction of the bars.

Additional information can be displayed to the side of the CDI, as selected in the system mode, including a TO/FROM indicator, a numeric indication of the CDI deflection or nothing at all.

To/From radial

The **T/F** button is used to select the To or From radial display. Press the **T/F** button to enable the radial display and then press it again to toggle between the bearing to and radial from the VOR. This display isn't available if a localiser frequency is tuned.

System mode

Press the **SYS** button to enable the system mode, as indicated by a green LED above the SYS button illuminating.

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

System Info

- Software Versions
- Low Display Intensity (0-100) – the brightness used in darkness
- High Display Intensity (0-100) – the brightness used in bright light

Nav Options

- Nav Audio Level (1-100) – the output volume to the GMA 340 audio panel
- Nav/Com Mix Level (1-100) – not applicable
- Additional CDI Info – NONE, TO/FROM or NUMERIC (see the OBS mode section)
- Display Ident over OBS – YES/NO (see the OBS mode section)

Comm Options

- RF Signal Level (0-255) – strength of active frequency signal
- Com Noise Level (0-255) – noise level of the active frequency signal
- Mic1 Squelch (0-100) – input level necessary to break squelch
- Mic2 Squelch (0-100) – input level necessary to break squelch
- Transmit Using – MIC1 / MIC2 / MIC1+MIC2
- Intercom Level (1-100) – intercom audio level
- Sidetone Level (1-100) – sidetone audio level
- Headphone Level (1-100) – headphone audio level

VOR Equipment Test

- Date of Last Test
- Type of VOR Test
- Location
- Bearing Error
- First Name
- Last Name

When SYS mode is first selected, the first menu category will be displayed: System Info. The right outer knob can then be used to cycle through the four menu categories and the right inner knob can be used to change values, if applicable. Pressing the **ENT** button will select the menu category and the right outer knob can then be used to cycle through the options within the category. To exit SYS mode, press the SYS button a second time.

The data displayed on the VOR Equipment Test pages can be customised by editing the 'JF_PA38_SL30.ini' file located at …\Community\justflight-aircraft-pa38\Data. The VOR test date, location and the tester's first name and last name can be edited within the .ini file. Once saved, these changes will require a restart of the flight to take effect.

SL40 – COM 2 radio

The SL40 is similar to the SL30 and acts as a COM 2 radio. There is no NAV 2 function.

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'. The letter 'm' will appear in place of the 's' when the monitor function is enabled.

A 'TX' annunciator illuminates whenever you are transmitting on COM 2.

1. **Left knob** – used to control power to the SL40 unit and the volume.
2. **Flip-flop** – used to transfer the COM 2 standby frequency into the COM 2 active frequency slot.
3. **EC** – used to load the emergency channel (121.50 MHz) as the standby frequency. The monitor function is automatically enabled.
4. **MON** – enables monitor mode, which allows for the monitoring of both the active and standby frequencies. The annunciator above the button will illuminate when monitor mode is enabled. Due to simulator limitations this is not simulated.
5. **RCL** – toggles frequency recall mode. The annunciator above the button will illuminate when the recall mode is enabled.
6. **MEM** – pressing this button will store the display standby frequency in memory.
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.

Power

The SL40 can be turned on by rotating the left knob clockwise from the OFF (fully anti-clockwise) position. Further clockwise rotation controls the volume.

The SL40 will go through a short initialisation process. If you turn the SL40 off for less than 15 seconds and then turn it back on, it will skip the initialisation process.

Selecting frequencies

New COM frequencies are selected into the standby position before being flipped into the active position with the flip-flop button.

The right outer knob increases/decreases the frequency in 1 MHz increments and the inner knob increases/decreases the frequency in 25 kHz increments.

Saving frequencies

You can save up to eight COM frequencies. Duplicate frequencies are not saved. After eight frequencies have been saved, you will get a 'MEM FULL' message and will have to remove frequencies before any more can be saved.

To save a frequency, make it the active frequency and then press the **MEM** button.

Removing frequencies

You can only remove frequencies stored in the User List.

Press the **RCL** button to select the frequency recall mode. Rotate the right outer knob to select the User (MEM) List and then press **MEM**.

Rotate the right outer knob to select 'REMOVE' and then rotate the right inner knob to select the frequency to be removed.

Press **MEM** to remove the frequency or rotate the right outer knob to select 'ABORT' and press **MEM** again to exit without making any changes.

Replacing frequencies

You can only replace frequencies stored in the User List.

To replace a frequency, tune the replacement frequency as active before pressing the **RCL** button to select the frequency recall mode. Rotate the right outer knob to select the User (MEM) List and then press **MEM**.

Rotate the right outer knob to select 'REPLACE' and then rotate the right inner knob to select the frequency that is to be replaced.

Press **MEM** to replace the frequency or rotate the right outer knob to select ‘ABORT’ and press **MEM** again to exit without making any changes.

Recalling frequencies

Press **RCL** to enter frequency recall mode. To exit the frequency recall mode, press the **RCL** button again.

There are two lists of frequencies that you can recall from memory:

1. The eight most recently used frequencies (LST) – duplicates are not saved again.
2. User-stored frequencies (MEM) – duplicates are not saved again.

After selecting frequency recall mode, rotate the right outer knob to select a list and then rotate the right inner knob to select a frequency from that list. You can then press the flip-flop button to transfer the recalled frequency into the active position.

To abort the recall, press the **MEM** button and use the right outer knob to select ‘ABORT RCL’. Press **MEM** again to abort the recall.

If the list is empty, an ‘AUTOLIST EMPTY’ or ‘USERLIST EMPTY’ message will be shown.

System mode

Press and hold the **MON** button to enable the system mode. Rotate the right outer knob to display the available options. Adjustments can be made by rotating the right inner knob.

- Software Versions
- RF Level (0-255) – strength of active frequency signal
- Noise Level (0-255) – noise level of the active frequency signal

- Headphone Level (0-255) – headphone audio level
- Mic1 Squelch (0-127) – input level necessary to break squelch
- Mic2 Squelch (0-127) – input level necessary to break squelch
- Transmit Mic – MIC1 / MIC2 / MIC1+MIC2
- Intercom Level (0-255) – intercom audio level
- Sidetone Level (0-255) – sidetone audio level
- Low Display Intensity (0-50) – the brightness used in darkness
- High Display Intensity (0-50) – the brightness used in bright light

To exit SYS mode, press the **MON** button a second time.

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.

Function display

PRESSURE ALT – displays the altitude data supplied to the GTX 328 in hundreds of feet (i.e. flight level).

FLIGHT TIME – timer start is either manual or automatic. It can be manually controlled using the START/STOP and CLR keys. When in automatic mode, the timer begins when take-off is sensed.

ALTITUDE MONITOR – controlled by the START/STOP key. Activates a voice alarm and warning annunciator when the altitude limit is exceeded.

OAT/DALT – displays the outside air temperature (OAT) and density altitude.

COUNT UP TIMER – controlled by the START/STOP and CLR keys.

COUNT DOWN TIMER – controlled by the START/STOP, CLR and CRSR keys. The initial Count Down time is entered with the 0-9 keys.

Altitude trend indicator

When the PRESSURE ALT page is displayed, an arrow will be displayed to the right of the altitude, indicating that the altitude is increasing or decreasing. One of two sizes of arrow may be displayed, depending on the vertical speed rate.

Timer operation

To operate the **Flight** timer:

1. Press the FUNC key until 'FLIGHT TIME' is displayed.
2. The timer begins automatically when the unit senses that the aircraft has become airborne, or it may be controlled manually.
3. If desired, you can press the START/STOP key to pause or restart the timer.
4. Press CLR to reset the timer to zero.
5. The timer will stop automatically once the aircraft is on the ground.

To operate the **Count Up** timer:

1. Press the FUNC key until 'COUNT UP' is displayed.
2. If necessary, press CLR to reset the Count Up timer to zero.
3. Press START/STOP to begin counting up.
4. Press START/STOP again to pause the timer.
5. Press CLR to reset the timer to zero.

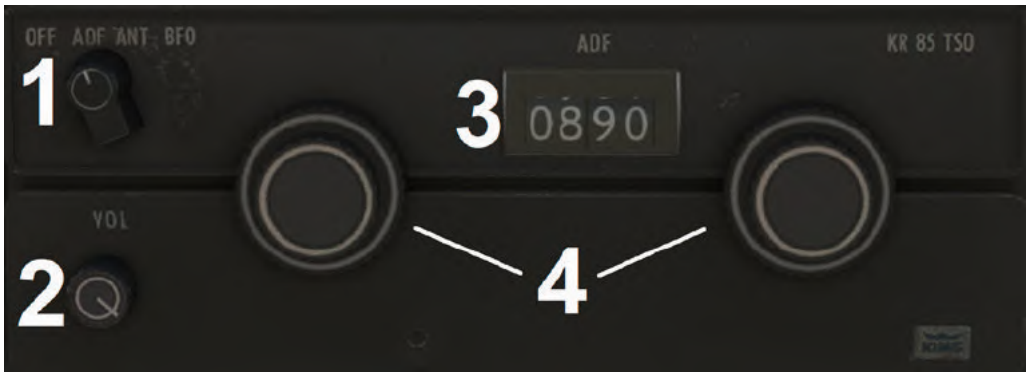
To operate the **Count Down** timer:

1. Press the FUNC key until 'COUNT DOWN' is displayed.
2. Press CRSR and use the 0-9 keys to set the initial time. All digits must be entered (use the 0 key to enter leading zeros).
3. Press START/STOP to begin counting down.
4. Press START/STOP again to pause the timer.
5. When the Count Down timer expires, the COUNT DOWN banner is replaced with a flashing 'EXPIRED' and the time begins counting up.
6. Press CLR to reset the timer to the initial value.

Automatic ALT/GND mode switching

Normal operation of the transponder begins when take-off is sensed. When the aircraft is on the ground the screen automatically displays GND. The transponder does not respond to ATC interrogations when GND is annunciated.

KR-85 – ADF



1. Power/mode selector knob – selects ADF, ANT or BFO mode.
2. Volume knob
3. Frequency display
4. Frequency select knobs – tune the ADF frequency.

The KR-85 ADF receiver and ADF indicator are not fitted to the Tomahawk by default. They can both be fitted to the main instrument panel by enabling the 'ADF' option on the Aircraft page of the EFB.

Frequency selection

The ADF frequency is displayed on three counters.

The frequency is selected using the frequency select knobs which are rotated either clockwise or anti-clockwise. The right inner knob tunes the 1s. The right outer knob tunes the 10s. The left knob tunes the 100s and the 1,000s.

The KR-85 has no controls for the decimal part of the ADF frequency. In the real world, selecting a frequency of 383 kHz would allow for reception of an NDB with a frequency of 383.5 kHz but that isn't simulated in MSFS. We have therefore added our own simulation of this. If there is no valid NDB signal on the selected frequency, it will search through all the fractional frequencies until one is found, e.g. 383.1, 383.2 etc. A tooltip on the right inner selector knob indicates the currently selected frequency.

Operating modes

ANT mode provides improved audio reception from the station tuned and is usually used for identification. The bearing pointer on the ADF indicator will be deactivated and immediately turn to the 90° relative position and remain there during ANT reception.

ADF mode activates the bearing pointer on the ADF indicator, causing it to point in the direction of the station relative to the aircraft heading.

BFO mode permits the carrier wave and the associated Morse code identifier broadcast on the carrier wave to be heard.

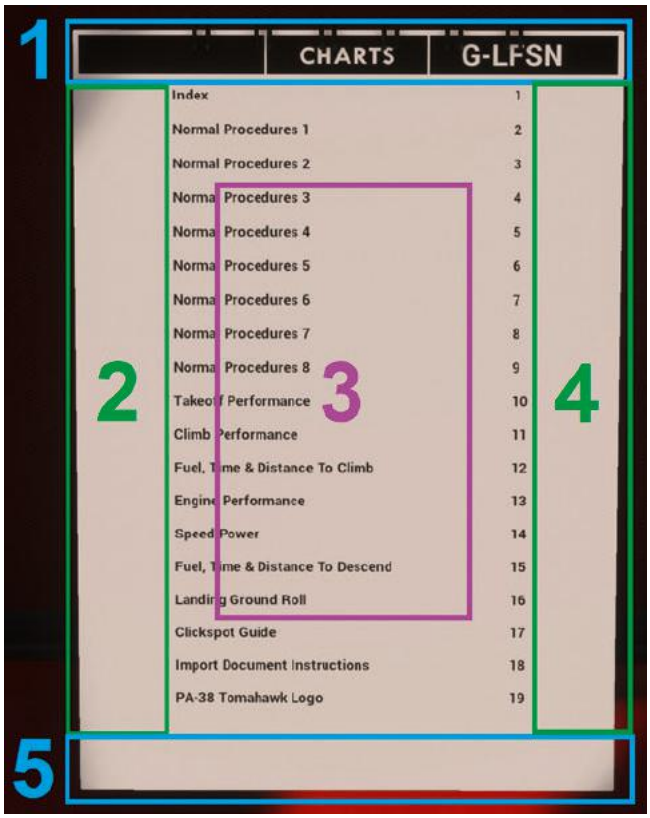
ADF test

Select ANT mode and confirm that the bearing pointer moves directly to the parked 90° position. Make sure that the unit is tuned to a usable frequency and then select ADF mode. Confirm that the needle moves to the station bearing.

Interactive paper charts

Paper charts can be placed on the pilot's lap by left-clicking the book in the chart holder to the right of the flap lever, or by enabling the 'Charts' option on the Aircraft page of the EFB. The same options can be used to return the paper charts to the chart holder.

Once in view, up to 20 chart pages can be selected from the Index page and you can cycle through the pages by using a variety of clickspots located around the page:



1. Rotate anti-clockwise
2. Previous page
3. Index page
4. Next page
5. Rotate clockwise

The chart can be rotated to be in a horizontal or vertical orientation by clicking the relevant clickspots.

A useful tooltip will briefly appear at the bottom of the page when the mouse is over a clickspot, indicating that clickspot's purpose.

The paper charts will automatically move between the left and right seats depending on which camera is selected in the MSFS Camera menu.

A selection of charts are included by default with our PA-38 Tomahawk and additional documents can be added by placing a .PNG file in the following file directory: …\Community\justflight-aircraft-pa38\Data\Images\Chart

In order for the documents to display correctly in the simulator, the document should be A4 size (724 x 1024) and in a .PNG format.

If you wish to change the file names of the charts, or add any additional charts, the PA38_chart_list.ini file (located in the same file directory) must be updated to reflect the change in file name and chart numbers.

If the simulator is running when document changes are made, a restart of the flight will be required to see any changes to the charts.

FLYING THE TOMAHAWK

In this tutorial flight we will be departing from Liverpool John Lennon Airport, the former home of the Liverpool Flying School, on the estuary of the River Mersey in the United Kingdom. We will be heading east across the entire width of the country to Humberside, passing overhead Liverpool, Manchester Airport and the rolling hills of the Peak District before passing to the south of Sheffield, overhead Retford and finally approaching Humberside from the south.

Covering approximately 100 nautical miles, this 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:

EGGP > MCT (113.55) > GAM (112.80) > KIM (365.0) > EGNJ

Estimated time en route: 60 minutes

Route distance: 110 nautical miles

Departure time: 1000 (local time)

Weather: 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 Microsoft Flight Simulator.
2. Select the **World Map**.
3. Click **MORE** and then click **Load/Save**.
4. Choose **LOAD FROM THIS PC**.
5. Browse to …Community\justflight-aircraft-pa38\Documents\Tutorial
6. Select the **'Just Flight PA38 Tomahawk Tutorial Flight'** file.
7. Click **OK**.
8. Click **Fly**.

You should now find yourself sitting in the cockpit at parking space 60 at Liverpool John Lennon Airport in the flying school's resident G-LFSN. As we are starting the flight from a parking area, the aircraft has automatically loaded into the simulator in a 'cold and dark' state, with engine shut down and the electrical power switched off. 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.

For today's flight we will be navigating using the 'traditional' methods for which the PA-38 was originally designed. We will be making extensive use of the aircraft's VOR and ADF radios in this tutorial, but the aircraft can also be configured with a selection of more modern GPS units via options on the EFB.

Pre-flight checks

The first step in getting the Tomahawk ready for flight is to open the doors to allow entry into the cockpit. We can do this by clicking on the upper and lower door latches to rotate them to the **OPEN** position and then clicking on the red leather armrests to push them open.

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

We will begin in the cockpit. 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.

On the lower instrument panel, ensure that the ignition switch is set to **OFF**.

Switch **ON** both battery and alternator switches.

With the battery supplying electrical power to the aircraft, we only have a finite amount of time before the battery drains, so we must ensure the battery is only ever switched on when absolutely necessary prior to engine start and that it isn't switched on for any extended period of time.

Whilst the aircraft has electrical power, check that both fuel quantity gauges on the control quadrant show both tanks full (15 US GAL each) and confirm that the alternator warning light at the top of the instrument panel is illuminated.

Once these checks are complete, switch **OFF** both the battery and alternator switches.

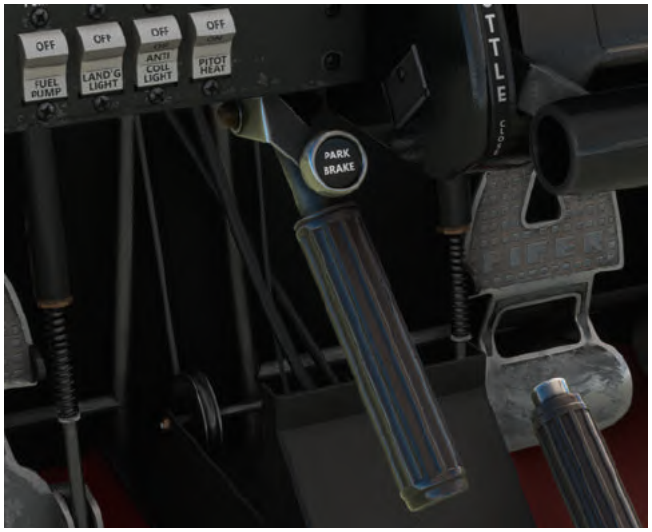
Confirm full and free movement of the flight control surfaces with the yoke and visually confirm the proper operation of the flight controls. Note that due to friction between the nose-wheel and the ground, movement of the rudder will not be possible when the aircraft is stationary on the ground. Forceful movement of the rudder pedals may result in damage to the nose-wheel steering system.

We can also perform an extension and retraction of the flaps to confirm proper operation.

Moving across to the EFB tablet on the right side of the instrument panel, open the Aircraft page. This page has a variety of options that are available for you to fully customise your Tomahawk experience. We'll be covering a few of these options throughout this tutorial. For now, let's enable the co-pilot by clicking the button at the bottom left corner of the page.

Having a co-pilot on board will make our lives a little bit easier during this tutorial flight as we will have equal weight distribution on both sides of the aircraft, meaning that the aircraft will have less of a tendency to roll to one side during the flight.

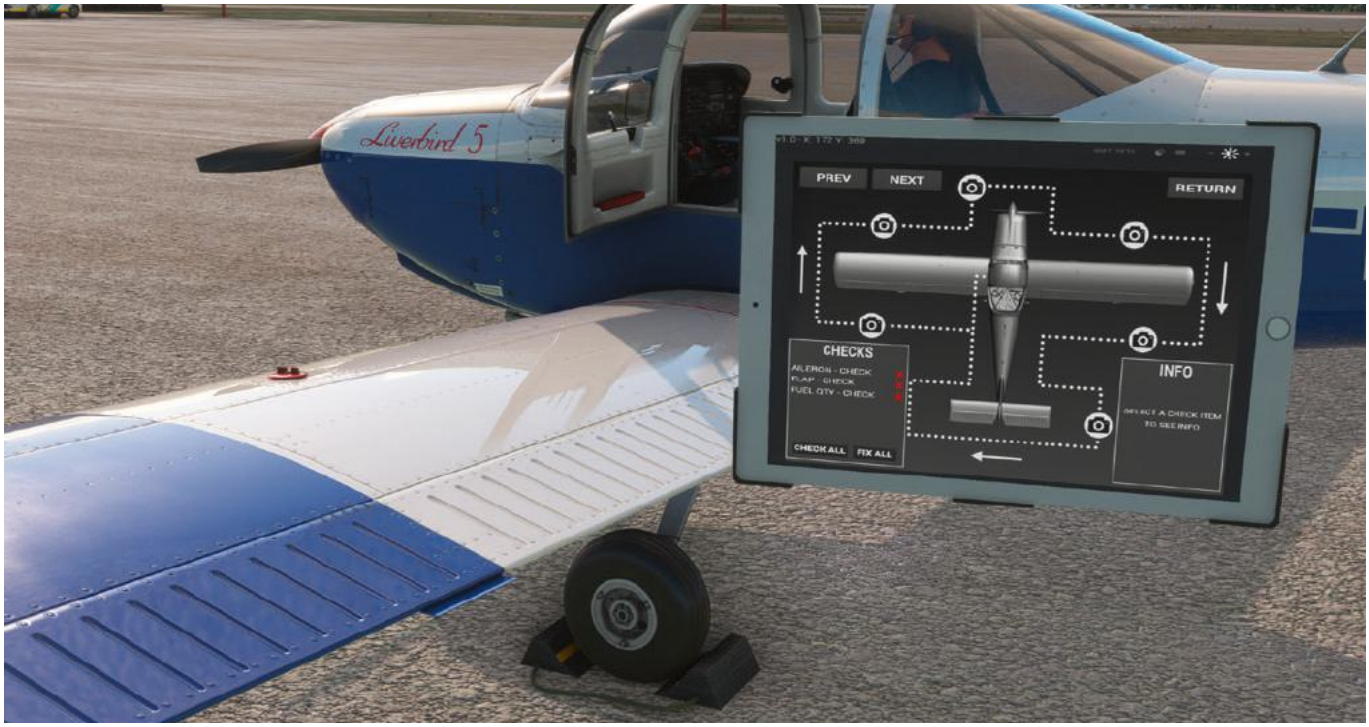
Confirm that the parking brake handle is **ON**.



With the cockpit checks complete, we can now move to the exterior of the aircraft to complete our pre-flight walkaround.

Go to the Aircraft page of the EFB and press the ‘Start Walkaround’ button. A menu will open showing a top-down view of the aircraft and various camera angles that represent each point of the walkaround. The walkaround is to be conducted in a clockwise direction, starting with the left wing, so to begin the walkaround click the camera icon immediately behind the left wing.

The camera and the EFB will now move to the exterior of the aircraft.



On the EFB we can see that there are three checks to be completed at this position. The first is to check the condition and operation of the ailerons. Left-click on the aileron to move it fully up and down to check for proper operation and check for any visual defects.

If the aileron passes the pre-flight check, a green tick will appear next to that item on the EFB and we can move onto the next item.

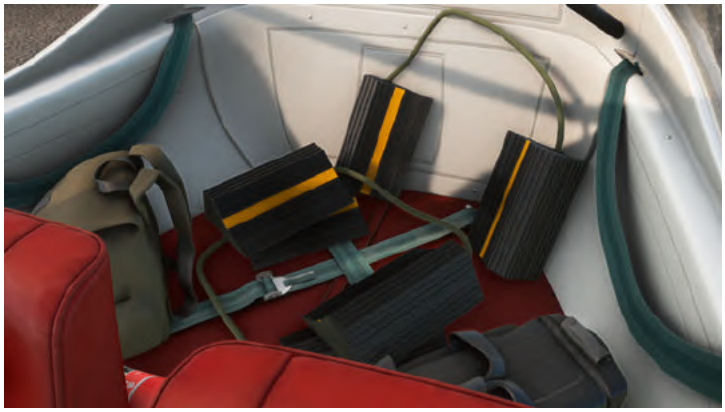
If the aileron fails the pre-flight check, a red cross will appear next to that item on the EFB and information regarding the fault will be displayed in the INFO box on the right side of the EFB. If a fault exists, it must be repaired before we conduct our flight. We can repair the fault by pressing the REPAIR button. Once repaired, the component will show a green tick on the EFB and we can move onto checking the next item.

Continue conducting the remainder of the walkaround, using the controls on the EFB to move to the next area. Once you return to the starting position, press the RETURN button at the top right corner of the page to return to the cockpit.

Engine starting

Now that we have returned to the cockpit, we can prepare the aircraft for engine start.

During the walkaround we should have already removed the chocks and tie-downs, but to ensure that this is the case we can check their status on the Aircraft page of the EFB, or we can take a look behind us to confirm that they are stowed in the rear baggage compartment.



We can now close the cabin doors by clicking on the red leather armrests and then rotating the lower and overhead door latches to the **LATCH** position.

On the lower right side of the instrument panel, check that all circuit breakers are pushed in.

To the left of the control quadrant, ensure the carburettor heat switch is **OFF**.

On the control quadrant itself, rotate the fuel selector clockwise one notch to the **LEFT** position, move the mixture lever to the **FULL RICH** (forward) position and advance the throttle lever to approximately **1/4 open**.

As we are starting the aircraft with a cold engine, we can prime the engine by cycling the primer knob in/out two or four times, depending on the amount of priming required. On the last stroke, leave the primer in the **OUT** position.

Switch **ON** the battery and alternator switches to provide electrical power to the aircraft and turn **ON** the navigation lights, warning anyone in the area that we are about to start the engine.

Switch **ON** the electric 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 turn the key to the **START** position.

As the engine splutters into life, push the primer in slowly and slightly advance the throttle to keep the engine running.

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 indicates 5 Hg +/- 0.1 Hg.

Switch **OFF** the electric fuel pump, confirming that the fuel pressure falls but is still within the green sector.

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.

Finally, 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.

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. Alternatively, use the ‘SET HEADING INDICATOR’ control assignment.

We will be departing from runway 27 today and then briefly flying north up the River Mersey for a short sightseeing trip over the city of Liverpool before making a right turn to fly towards the first navaid on the route, Manchester VOR (**MCT – 113.55**).

This VOR is located at Manchester Airport and should provide for some great views of this airport as we pass overhead. In preparation, tune the MCT VOR into the NAV 1 (SL30) radio by first pressing the **NAV** button to display the current active and standby NAV frequencies, and then using the inner and outer knobs on the right side of the unit to input the frequency into the standby field. Once inputted, use the flip-flop button to move the frequency into the active field.

Taxi

We can now begin our taxi to runway 27 via taxiways A and G.

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 runway.

Steering the aircraft with only the rudder pedals is generally sufficient. Combined use of the rudder pedals and the brakes permits tight turns if required.

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 27 and point the aircraft into the wind. 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, ensure the RPM drop is less than 175 RPM with a maximum difference of 50 RPM 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. However, with only a few clouds and moderate temperatures for our flight, that should not be an issue.

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

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

Confirm that the battery and alternator switches are both set to **ON**.

Check that all flight instruments are reading correctly and that the altimeter is set to the airport's local barometric pressure by pressing the [B] key on your keyboard.

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

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.

The normal flap setting for take-off in the Tomahawk is **UP** unless we are taking off from a short runway or a soft field runway. As we have most of the 7,500 ft (2,200 m) runway available to us today, we can safely keep our flaps UP.

Rotate the pitch trim wheel until the indicator sits slightly aft of neutral.

Finally, confirm that both doors are **LOCKED** and that you have full and free movement of the flying controls (remembering that due to friction on the nose gear, you should not attempt to move the rudder pedals when stationary).

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** gently raise the nose of the aircraft.

Make elevator inputs and adjust elevator trim as required to maintain the Tomahawk's best rate of climb speed of **70 knots**.

Continue to fly the runway heading (**266 degrees**).

Climb

When passing through 1,000 feet, switch **OFF** the electric fuel pump and landing light.

We can now begin a right turn to follow the River Mersey to the north and the city of Liverpool should start to come into view on the east side of the river. We will continue flying north for now until we reach our cruising altitude of **4,000 ft**.

Once level at 4,000 ft, reduce the throttle to the standard cruise position of 75% rated power (approximately 2,450 RPM based on the current altitude and temperature) and maintain an airspeed of **100 KIAS**.

Cruise

As we pass the city of Liverpool at 4,000 ft and 100 KIAS, we can now begin a right turn towards our first waypoint, Manchester (MCT) 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 **100 degrees** in this case – and turn onto that heading to fly directly towards it (there is zero wind in this tutorial flight, so no heading correction is required).

The real Tomahawk doesn't have the luxury of an autopilot, so you will need to hand fly the climb, cruise and descent portions of the flight. However, as a quality-of-life feature, we have provided basic autopilot controls on the Aircraft page of the EFB.

During the cruise portion of any flight, 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, an automatic fuel selector option is provided on the Aircraft page of the EFB.

When hand flying, ensuring that the aircraft is trimmed correctly and regularly switching between fuel tanks to prevent a fuel imbalance will provide a stable hands-off aircraft.

With the aircraft stabilised in cruise, we can sit back and take in the views across Merseyside and Greater Manchester.

Before long we should start to see Manchester Airport coming into view directly ahead of us. At this altitude any departures or arrivals will pass safely below our aircraft.

As we pass overhead Manchester Airport and the MCT VOR, the VOR To/From indicator will switch to a ‘From’ indication, indicating that we are now flying away from the VOR.

Make a slight left turn now to a heading of **096 degrees** to fly outbound from the VOR towards Retford/Gamston. Rotating the OBS knob on the VOR indicator to 096 degrees will help us maintain an outbound course of 096 degrees from the MCT VOR.

Shortly after passing the VOR we will be able to see the city of Manchester off the port (left) wing.

This leg of the flight between the Manchester and Retford/Gamston VORs is the longest leg of the flight and should take approximately 40 minutes. During this leg we will pass over the rolling hills of the Peak District National Park, where we will see landmarks such as the Dove Holes Quarry and Hope Cement Works before passing to the south of the city of Sheffield.

During the cruise portion of the flight it is a good idea to periodically run through the 'FREDA' checks:

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 (away from the MCT VOR and towards the Retford/Gamston VOR in this case).

A – check that the barometric pressure setting is correctly set on the altimeter (press the [B] key on your keyboard if it's not already set).

Now is also an ideal opportunity to take a quick look at some of the extensive features we have included in the MSFS PA-38 Tomahawk.

Like the real PA-38, our Tomahawk has a basic avionics fit as standard which is well suited to its role as a training and VFR 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 more capable GPS units for GPS navigation such as the GNS 430/530 and GTN 650/750 (the latter requires the PMS-50 GTN and/or the TDS GTNXi, available separately).

We'll start by looking at some of the SL30 features. Press the **NAV** button to select NAV mode and then press the **OBS** key to display the CDI. The OBS setting is now shown in the centre of the display, with the CDI on the right. The aircraft icon is pointing down, indicating that we're flying FROM the VOR, and no deviation bars should be shown because we're centred on an outbound course.

Additional information can be shown by selecting either TO/FROM or NUMERIC from the 'Nav Options > Additional CDI Info' system menu. If you have 'Display Ident over OBS' set to YES in the Nav Options menu, the station identifier (MCT) will be shown instead of the OBS setting.

The SL30 is also able to display DME information, allowing us to monitor our distance from the tuned VOR. With NAV mode selected, press the **SEL** button and then rotate the right outer knob until the SHOW DST DATA? option is shown. Press **ENT** to enable the display of distance data.

From left to right, the distance from the VOR is shown in nautical miles, the ground speed relative to the VOR is shown in knots and the estimated time to the VOR is shown in hours and minutes.

The SL40 is a very similar unit to the SL30, but with less functions. Its primary purpose is to control the COM 2 radios, but as we are not communicating with ATC on this tutorial flight, there isn't much to cover here that is relevant to our flight today. You can read all about the SL40 and its features in its own dedicated section of this manual.

We'll now take a look at the GTX 328 transponder. Apart from turning it on earlier, we haven't used the GTX as a transponder during this flight because we've flown without ATC, but we'll explore some of its other useful functions. Press the **FUNC** button to cycle through the available functions.

The first function page displays pressure altitude as a flight level (approximately 4,000 ft in this case).

Pressing the FUNC key again will display the flight timer. This timer automatically started counting when the GTX sensed take-off, so it is showing our total flight time so far.

Pressing the FUNC key again will display the altitude monitor. Pressing the **START/STOP** button will enable the altitude monitor and any deviation from the current altitude will now be shown in hundreds of feet, with the 'BELOW' or 'ABOVE' message flashing if the deviation exceeds 200 ft. Pressing the **START/STOP** button again will cancel the altitude monitoring.

Pressing the FUNC key again displays the current outside air temperature (OAT) and density altitude.

Finally, pressing the FUNC key two more times displays the Count Up and Count Down timers. As their names suggest, these timers count up or down and can be started with the **START/STOP** key. A starting time can be entered into the Count Down timer by pressing the **CRSR** key and typing in the required time.

Moving away from the avionics stack, one other useful feature for navigation is the Flight Info section on the Aircraft page of the EFB. This section shows a variety of real-time information related to everything from speed to fuel burn/flow and range/endurance.

Take the opportunity during the remaining time in the cruise to explore the cockpit, using the PANEL GUIDE for reference.

Once we are approximately 25 NM from the MCT VOR, as indicated by the distance data on the SL30, we can now tune our final VOR of this flight, GAM VOR (112.80), into the NAV 1 (SL30) radio. On the SL30, press the **NAV** key and enter **112.80** into the standby field and then press the flip-flop key to place it into the active field.

Continue flying to the GAM VOR on a course of 096 degrees for now. Adjust the OBS knob on the VOR indicator as necessary to align the CDI needle with the aircraft's current course to the VOR. Alternatively, on the SL30 we can press the OBS button twice to not only display the OBS page, but also to synchronise the NAV 1 course so we can now fly directly to the VOR from our present position.

As we pass overhead Retford/Gamston, the VOR To/From indicator will again switch to a 'From' indication. We now need to make a left turn to a heading of **050 degrees** to fly outbound from the VOR towards Humberside Airport. We can set the OBS knob on the VOR indicator to 050 degrees to assist us in flying the outbound of the GAM VOR on a course of 050 degrees.

For additional situational awareness as we head towards Humberside, we can tune into the KIM NDB located at Humberside airport.

By default, the Tomahawk isn't fitted with an ADF receiver, but a KR-85 ADF system can be fitted by enabling the 'ADF' option on the Aircraft page of the EFB. Once this is enabled, the KR-85 control unit will be fitted to the right side of the instrument panel and an ADF indicator will be fitted to the left side of the instrument panel.

On the control unit, input the frequency of the KIM NDB (**365.0**) and set the mode switch to ADF. On the ADF indicator, rotate the compass card to match the aircraft's current heading and, once in range of the NDB, the needle will indicate the direction to the NDB.

Descent

We will begin our descent as we pass over the town of Gainsborough, which is situated approximately 10 miles outbound of the GAM VOR and with 20 miles to run until Humberside Airport.

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 carburretor heat **ON**.

Approach and landing

With only light winds today we will carry out an approach onto runway 02 at Humberside, so we now need to position ourselves on the approach.

Turn right to a heading of **090 degrees** to bring us onto the base leg, flying roughly parallel to the M180 motorway and the Cleethorpes to Lincoln railway line.

Switch **ON** the electric fuel pump.

As we 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 **1,000 ft** and, once established on the base leg, reduce airspeed to **70 knots** and extend the flaps to the **21°** position (first notch).

Turn the aircraft onto final approach and extend the flaps to the **34°** (fully extended) position. Pitch the nose down to maintain **67 knots** on the final approach.

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 we are safely off the runway, raise the flaps and push the carburettor heat to **OFF**.

Once off the runway, switch **OFF** the landing and strobe lights, pitot heat and electric fuel pump.

Shutdown

Begin taxiing to the nearest available parking spot.

Once the aircraft has 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 alternator and battery switches to disconnect the electrical power.

Rotate the fuel selector to the **FUEL OFF** position (remembering to remove the latch) and open the doors.

We can now set the wheel chocks, either by enabling them on the Aircraft page of the EFB or by clicking on the chocks themselves in the rear baggage compartment.

Congratulations – you have completed the PA-38 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

Control wheel	**RELEASE RESTRAINTS**
Ignition	**OFF**
Master switch	**ON**
Fuel quantity gauges	**CHECK**
Alternator warning light	**CHECK**
Master switch	**OFF**
Primary flight controls	**PROPER OPERATION**
Flaps	**PROPER OPERATION**
Static drain	**DRAINED**
Windows	**CHECK CLEAN**
Baggage	**STOWED PROPERLY**
Required papers	**ON BOARD**
Parking brake	**SET ON**

Left wing / right wing

Surface condition	**CHECK**
Flaps and hinges	**CHECK**
Aileron and hinges	**CHECK**
Wing tip	**CHECK**
Lights	**CHECK**
Fuel cap	**OPEN**
Fuel quantity and colour	**CHECK**
Fuel cap	**CLOSE AND SECURE**
Fuel vent	**OPEN**

Fuel tank sump	**DRAIN**
Pitot head	**UNOBSTRUCTED**
Stall warning	**CHECK**
Landing gear and tyre	**CHECK**
Brake block and disc	**CHECK**
Chock and tie-down	**REMOVED**

Nose section

Fuel strainer	**DRAIN**
General condition	**CHECK**
Propeller and spinner	**CHECK**
Air inlets	**CLEAR**
Engine compartment	**CHECK**
Oil	**CHECK QUANTITY**
Dipstick	**CHECK**
Hydraulic fluid level	**CHECK**
Alternator belt	**CHECK TENSION**
Cowling	**CLOSED AND SECURE**
Nose-wheel tyre	**CHECK**
Nose gear strut	**PROPER INFLATION (3 in. exposure)**
Windshield	**CLEAN**

Fuselage (left side / right side)

General condition	**CHECK**
Antennas	**CHECK**
Side and rear window	**CLEAN**
Static vents	**UNOBSTRUCTED**

Empennage (tail section)

General condition	**CHECK**
Hinges and attachments	**CHECK**
Tie-down	**REMOVED**

Before starting engine

Cabin doors	**CLOSED AND LATCHED**
Overhead latch	**ENGAGED**
Seats	**ADJUSTED AND LOCKED**
Seat belts and harnesses	**FASTENED**

Circuit breakers	**IN**
Parking brake	**SET**
Carburettor heat	**FULL OFF**
Fuel selector	**DESIRED TANK**

Engine starting

Starting engine when cold

Prime	**AS REQUIRED**

On last priming stroke leave primer in the out position.

Throttle	**HALF INCH OPEN**
Master switch	**ON**
Electric fuel pump	**ON**
Mixture	**FULL RICH**
Starter	**ENGAGE**
Prime	**PUSH IN SLOWLY AFTER ENGINE START**
Throttle	**ADVANCE SLIGHTLY**
Oil pressure	**CHECK**
Electric fuel pump	**OFF**
Fuel pressure	**CHECK**
Primer	**LOCKED**

Starting engine when hot

Throttle	**CRACKED**
Master switch	**ON**
Electric fuel pump	**ON**
Mixture	**FULL RICH**
Starter	**ENGAGE**
Throttle	**ADJUST**
Oil pressure	**CHECK**
Electric fuel pump	**OFF**
Fuel pressure	**CHECK**

Starting engine when flooded

Throttle	**OPEN FULL**
Master switch	**ON**
Electric fuel pump	**OFF**
Mixture	**IDLE CUT-OFF**
Starter	**ENGAGE**

Mixture	**ADVANCE**
Throttle	**RETARD**
Oil pressure	**CHECK**
Fuel pressure	**CHECK**

Warm-up

Throttle	**800-1200 RPM**

Taxiing

Radios	**ON**
Taxi area	**CLEAR**
Brakes	**CHECK**
Steering	**CHECK**

Ground check

Brakes	**SET**
Throttle	**1800 RPM**
Magnetos	**MAX. DROP 175 RPM – MAX DIFF. 50 RPM**
Vacuum	**4.9-5.1 inHg**
Oil temperature	**CHECK**
Oil pressure	**CHECK**
Carburettor heat	**CHECK**
Throttle	**RETARD**
Magnetos	**CHECK GROUND AT LOW RPM, SET BOTH**

Before take-off

Master switch	**CHECK ON**
Flight instruments	**CHECK**
Fuel selector	**PROPER TANK**
Mixture	**SET**
Electric fuel pump	**ON**
Carburettor heat	**OFF**
Engine gauges	**CHECK**
Static source	**NORMAL**
Seats	**SECURELY LATCHED IN TRACK**
Seat backs	**ERECT**
Belts/harness	**FASTENED**

Empty seat	**SEAT BELT SNUGLY FASTENED**
Flaps	**SET**
Trim tab	**SET**
Controls	**FREE**
Doors	**CLOSED AND LATCHED**
Overhead latch	**ENGAGED**

Take-off

Normal

Flaps	**SET**
Tab	**SET**

Accelerate to 53 KIAS.

Control wheel **BACK PRESSURE TO ROTATE TO CLIMB ATTITUDE**

Short field – obstacle clearance

Flaps **21° (FIRST NOTCH)**

Accelerate to 53 KIAS.

Control wheel **BACK PRESSURE TO ROTATE TO CLIMB ATTITUDE**

Accelerate to 61 KIAS until obstacle clearance.

Accelerate to 70 KIAS after obstacle clearance.

Flaps **RETRACT SLOWLY**

Short field – no obstacle

Flaps **21° (FIRST NOTCH)**

Accelerate to 53 KIAS.

Control wheel **BACK PRESSURE TO ROTATE TO CLIMB ATTITUDE**

After breaking ground, accelerate to best rate of climb speed 70 KIAS.

Flaps **RETRACT SLOWLY**

Soft field – obstacle clearance

Flaps **21° (FIRST NOTCH)**

Accelerate and lift off nose gear as soon as possible.

Lift off at lowest possible airspeed.

Accelerate just above ground to 61 KIAS to climb past obstacle height.

Continue climbing while accelerating to best rate of climb speed 70 KIAS.

Flaps **SLOWLY RETRACT**

Soft field – no obstacle

Flaps	**21° (FIRST NOTCH)**

Accelerate and lift off nose gear as soon as possible.

Lift off at lowest possible airspeed.

Accelerate just above ground to best rate of the climb speed 70 KIAS.

Flaps	**SLOWLY RETRACT**

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	**PROPER TANK**
Seat backs	**ERECT**
Belts/harness	**FASTEN**
Electric fuel pump	**ON**
Mixture	**SET**
Flaps	**SET (89 KIAS MAX.)**

Trim to 70 KIAS.

Final approach speed:

Full flaps (outboard flow strips Installed):	**62 KIAS**
Full flaps (outboard and inboard flow strips Installed):	**67 KIAS**

Stopping engine

Flaps	**RETRACT**
Electric fuel pump	**OFF**
Radios	**OFF**
Throttle	**FULL AFT**
Mixture	**IDLE CUT-OFF**
Magnetos	**OFF**
Master switch	**OFF**

Parking

Parking brake	**SET**
Control wheel	**SECURED WITH BELTS**
Flaps	**FULL UP**
Wheel chocks	**IN PLACE**
Tie-downs	**SECURE**

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 1,000 ft 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 start

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.

MSFS CONTROL ASSIGNMENTS

Microsoft Flight Simulator allows users to customise the controller scheme of their external hardware, which can allow for a much more immersive experience. You can set up these controls in MSFS by navigating to Options > Controls Options.

The following table shows a list of non-normal MSFS control assignments that can be used in conjunction with the Just Flight PA-38 Tomahawk:

Aircraft control	**MSFS control assignment**
Directional Indicator Sync	SET HEADING INDICATOR
Fuel Selector Latch	TOGGLE SPOILERS

Note: *This is not a complete list of all MSFS control assignments for the PA-38 Tomahawk and it does not include the basic control assignments for controls such as Pitch, Roll, Yaw, Throttles etc. which are shared between all aircraft.*

LVARs

Home cockpit users who require the use of LVARs to set up external hardware can find a complete list of LVARs used in the simulator by enabling Developer mode and then, on the menu bar at the top of the screen, navigating to Windows > Behaviours > Local Variables.

Entering instrument names or abbreviations into the 'Filter' box will vastly speed up the process of finding LVARs. For example, if you are trying to find the LVARs used for the Landing Light switch, you can search for 'LDG' and you will find the following LVAR: **LEFT_MISC_LDG_LIGHT**.

Alternatively, with the BehaviourDebug menu open, moving your mouse over a switch and pressing [Ctrl]+[G] on your keyboard will automatically populate the search fields with that control's LVAR. If you then copy and paste the LVAR name into the LocalVariables menu, it will show the value for each switch position.

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