PA-28-161 WARRIOR II

OPERATIONS MANUAL

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Operations Manual

Please note that X-Plane 12 must be correctly installed on your PC
prior to the installation and use of this PA-28-161 Warrior II simulation.

CONTENTS

INTRODUCTION

The PA-28-161 Warrior II is a four-seater, piston-engine aircraft equipped with fixed tricycle landing gear and a fixed-pitch propeller – ideal for touring and flight training.

The origins of the Warrior start with the Piper Cherokee, which began production in 1961. The Cherokee was introduced as a more affordable alternative to Piper's Comanche and to compete with the popular Cessna 172. Piper continued to develop variants of the Cherokee, renaming the Cherokee 150 to the Cherokee Warrior in 1974.

The PA-28-161 Warrior II was first certified in 1976 and features a more powerful engine than the original Warrior – the 160 HP Lycoming 0-320 – and a semi-tapered wing.

Over 5,000 PA-28 Warriors have been built and they continue to be flown all around the world.

Aircraft specifications

Dimensions

Length	7.3 m (23.8 ft)
Wingspan	10.7 m (35 ft)
Height (to top of tail)	2.2 m (7.3 ft)
Wing area	15.8 m^2 (170 ft^2)

Engine

Type	Lycoming O-320 four cylinder, horizontally opposed, air-cooled piston
Power	160 horsepower at 2,700 RPM
Propeller	Two-blade, fixed-pitch

Weights

Empty weight	1,353 lb (821 kg)
Maximum take-off/landing weight	2,325 lb (1,055 kg)
Maximum baggage weight	200 lb (91 kg)
Maximum useful load	972 lb (441 kg)

Fuel and oil

Fuel capacity	50 US gallons
Usable fuel	48 US gallons
Oil capacity	8 US quarts

Performance

VNE (never exceed speed)	160 KIAS
VNO (max. cruising speed)	126 KIAS
VA (manoeuvring speed)	111 KIAS (at 2,325 lb) 88 KIAS (at 1,531 lb)
VFE (max. flap speeds)	103 KIAS
VSO (stall speed)	44 KIAS (landing configuration)
Service ceiling	11,000 ft
Range (max. payload)	637 nautical miles

Paint schemes

The Warrior II is supplied in the following six paint schemes:

- EC-IOS (Spain)
- G-BNOH (UK)
- G-BUIF (UK)
- HB-PNL (Switzerland)
- N3572M (USA)
- VH-PZN (Australia)

INSTALLATION, UPDATES AND SUPPORT

You can install this Warrior II 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.

Windows users should ensure they have the 2010 Microsoft Visual C++ redistributable package installed. It is available to download from the Microsoft website.

To install the aircraft into X-Plane 12:

1. Download the Warrior II from your Just Flight account.
2. Unzip the downloaded .zip file. The resulting folder will be named 'JF12_PA28_Warrior_II'.
3. Copy the 'JF12_PA28_Warrior_II' folder into your 'X-Plane 12/Aircraft'

Accessing the aircraft

To access the aircraft in X-Plane 12:

1. From the main menu, click 'New Flight' or go to the Flight Configuration window.
2. Click on 'PA28 Warrior II' in the aircraft selection screen.
3. Click 'Customize' and choose a livery from the drop-down menu in the top right.
4. Click 'Start Flight'.

Uninstalling

To uninstall this software from your system:

1. Open your X-Plane 12 folder.
2. Open the 'Aircraft' folder.
3. Delete the 'JF12_PA28_Warrior_II' folder.

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/Twitter.

SYSTEMS GUIDE

Airframe

The Warrior II is a single-engine, all-metal aircraft with fixed landing gear. The aircraft has seating for up to four occupants, a 200-pound luggage compartment and a 160 HP engine.

The basic airframe is constructed out of aluminium alloy. Aerobatics are prohibited in this aircraft since the structure is not designed for aerobatic loads. The fuselage is a semi-monocoque structure. There is a front door on the right side and a cargo door is installed aft of the rear seat.

The wing is of conventional semi-tapered design and employs a laminar flow NACA 652-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. The four-position wing flaps are mechanically controlled by a handle located between the front seats. When fully retracted, the right flap locks into place to provide a step for cabin entry. Each wing contains one fuel tank.

A vertical stabiliser, an all-movable horizontal stabilator and a rudder make up the empennage. The stabilator incorporates an anti-servo tab which improves longitudinal stability and provides longitudinal trim. This tab moves in the same direction as the stabilator but with increased travel.

Fuel system

The fuel system was designed with simplicity in mind. Fuel is contained in two 25 US gallon tanks, one in each wing. Of the total 50-gallon capacity, only 48 gallons are usable.

The tanks are attached to the leading edge of the wing with screws and are an integral part of the wing structure.

A fuel tank selector allows the pilot to control the flow of fuel to the engine and is located on the left sidewall below the instrument panel. It has three positions: OFF, LEFT TANK and RIGHT TANK. The arrow on the handle of the selector points to the tank which is supplying fuel to the engine.

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

Fuel quantity and pressure are indicated on gauges on the instrument panel. There is a separate fuel quantity gauge for each tank.

Electrical system

All switches are grouped in a switch panel above the throttle quadrant. The circuit breaker panel is located on the lower right side of the instrument panel. Each breaker is clearly marked to show which circuit it protects.

Standard electrical accessories include alternator, starter, electric fuel pump, stall warning horn, ammeter and annunciator panel.

The annunciator panel includes alternator, low oil pressure and low vacuum indicator warning lights. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly, and that they should check and monitor the applicable system gauge to determine when or if action is required.

The primary electrical power source is a 14-volt, 60-amp alternator which is protected by an alternator control unit that incorporates a voltage regulator and an over-voltage relay. The alternator provides full electrical power output even at low engine RPM. This provides improved radio and electrical equipment operation and increases battery life by reducing battery load.

Secondary power is provided by a 12-volt, 35-ampere-hour battery. The ammeter as installed does not show battery discharge; rather it shows the electrical load placed on the system. With all the electrical equipment off, and the battery 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. For example, the average continuous load for night flying with radios on is about 30 amperes. The 30-ampere value plus 2 amperes for charging the battery will then show on the ammeter, indicating that the alternator is functioning properly.

An avionics power switch is located above the circuit breaker panel. It controls the power to the avionics through the battery master switch. An emergency bus switch is also provided to supply auxiliary power to the avionics bus in the event of an avionics power switch circuit failure.

Vacuum system

The vacuum system is designed to operate the air-driven gyro instruments. This includes the directional and attitude gyros, when installed. The system consists of an engine vacuum pump, a vacuum regulator, a filter and the necessary plumbing.

The vacuum gauge, mounted on the right instrument panel, provides valuable information to the pilot about the operation of the vacuum system. 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 to 5.1 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM.

Pitot-static system

The system supplies both pitot and static pressure for the airspeed indicator, altimeter and vertical speed indicator.

Pitot pressure is picked up by the pitot head on the bottom of the left wing. The switch for pitot heat is located on the switch panel. Static pressure is sensed by button-type vents on each side of the aft fuselage. Push-button-type pitot and static drains are located on the lower left sidewall of the cockpit.

Lighting system

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

The navigation lights are controlled by a rheostat switch on the main switch panel. This same rheostat switch controls the radio lights.

When the switch is in the fully down position the navigation lights are off and the radio lights are on full brightness. As soon as the switch is rotated up past the click, the navigation lights turn on and the radio lights are dimmed. The radio light brightness can be increased by moving the switch further upwards.

A light mounted in the overhead panel provides instrument and cockpit lighting for night flying. The light is controlled by a rheostat switch adjacent to the light.

The anti-collision and landing lights are controlled by rocker switches on the main switch panel.

Instrument markings

Airspeed indicator markings

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
White arc	44-103	Full flap operating range. Lower limit is maximum weight VSO in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green arc	50-126	Normal operating range. Lower limit is maximum weight VS1 with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow arc	126-160	Operations must be conducted with caution and only in smooth air.
Red line	160	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	----------	----------	500-2,700 RPM	2,700 RPM
Oil temperature	----------	----------	75-245°F (24-118°C)	245°F (118°C)
Fuel pressure	----------	----------	0.5-8 PSI	8 PSI
Oil pressure	25 PSI	25-60 PSI (idle) and 90-100 PSI (start/warm-up)	60-90 PSI	100 PSI
Vacuum gauge	----------	----------	4.8-5.1 inHg	6.0 inHg

Limits

Weight limits

Maximum weight: 2,325 lb (1,055 kg)

Maximum weight in baggage compartment: 200 lb (91 kg)

Centre of gravity limits

Weight (lb)	Forward limit Inches aft of datum	Rearward limit Inches aft of datum
2,325	87.0	93.0
1,950 and below	83.0	93.0

The datum used is 78.4 inches ahead of the wing leading edge at the intersection of the straight and tapered section.

Manoeuvre limits

This aircraft is certificated in the normal category. The normal category is applicable to aircraft intended for non-aerobatic operations. These include any manoeuvres incidental to normal flying, stalls (except whip stalls), lazy eights, chandelles and steep turns in which the angle of bank is no more than 60° and pitch is no more than 30°.

Aerobatic manoeuvres, including spins, are not approved.

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: 50 US gallons

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

Usable fuel: 48 US gallons (24 gallons per wing tank)

Landing gear

The Warrior II 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. A spring device is incorporated for rudder centring and to provide rudder trim.

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 toe brakes and the handbrake have individual brake cylinders, but all the cylinders use a common reservoir. The parking brake is incorporated in the lever brake and is operated by pulling back on the lever and depressing the knob attached to the top of the handle. To release the parking brake, pull back on the brake lever and then allow the handle to swing forward.

Doors and exits

The aircraft is fitted with a passenger door and a baggage door.

The passenger door can be opened from within the virtual cockpit by clicking on the two door latches to rotate them to the OPEN position and then clicking and dragging on the door handle to push it open. It can be closed by dragging on the door handle to pull it closed and then clicking on the two door latches to rotate them to the LATCH position.

The Warrior's passenger door is programmed in X-Plane to react to environmental forces such as oncoming air (when trying to open the window while flying) as well as G-forces (when yawing the plane on the ground or in flight). If it is not closed and latched properly, this can result in some interesting movement, as it would in real life!

Flight controls

Dual flight controls are provided as standard equipment. A cable system provides actuation of the control surfaces when the flight controls are moved. The horizontal surface (stabilator) features a trim tab/servo mounted on the trailing edge. This tab serves the dual function of providing trim control and pitch control forces.

The trim function is controlled by a trim control wheel located on the control console between the two front seats. Rotating the wheel forward gives nose-down trim and rotation aft gives nose-up trim.

The rudder is conventional in design and incorporates rudder trim. The trim mechanism is a spring-loaded recentring device. The trim control is located on the right side of the pedestal, below the throttle quadrant. Turning the trim control clockwise results in nose-right trim and anti-clockwise rotation results in nose-left trim.

Manually controlled flaps are provided. They are extended by a control cable and are spring-loaded to the retracted (up) position. The control is located between the two front seats on the control console. To extend the flaps, pull the handle up to the desired flap setting of 10, 25 or 40 degrees. To retract the flaps, depress the button on the end of the handle and lower the control.

The aircraft will experience a pitch change during flap extension or retraction. This pitch change can be corrected by either stabilator trim or increased control wheel force. When the flaps are in the retracted position the right flap, provided with an over-centre lock mechanism, acts as a step.

Engine

The Warrior II is powered by a four-cylinder, horizontally opposed engine rated at 160 horsepower at 2,700 RPM. It is equipped with a starter, a 60-ampere 14-volt alternator, two magnetos, a vacuum pump drive and a fuel pump.

The aircraft is equipped with a fixed-pitch propeller, with a 74-inch diameter and a 60-inch pitch, determined at 75% of the diameter.

An oil cooler is located on the left rear of the engine, with the air inlet for the cooler located in the nose section of the engine cowling.

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 right of the control quadrant.

Engine instruments

Indicators enable the pilot to check oil pressure, oil temperature, fuel pressure, RPM and EGT. The engine instruments are located on the upper, mid and lower portions of the left panel.

Ignition and starter system

Engine ignition is provided by a dual magneto on two spark plugs per cylinder. Ignition is controlled by a key-operated rotating selector on the lower left portion of the left panel. The selector operates clockwise, with right, left, left/right and start positions.

Stall warning system

An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall. Stall speeds are shown on a graph in the OPERATING DATA MANUAL.

The stall warning horn emits a continuous sound andis activated by a lift detector installed on the leading edge of the left wing. The battery master (BATT MASTR) switch must be ON for the stall warning system to function.

PANEL GUIDE

The instrument panel is designed to accommodate the customary advanced flight instruments and the normally required powerplant instruments.

The altitude and directional gyros, located in the centre of the left-hand instrument panel, are vacuum-operated. The vacuum gauge is located on the right-hand instrument panel. The turn indicator on the left side is electrically operated.

The radios are located in the centre section of the panel and the circuit breakers are in the lower right corner of the panel.

An annunciator panel is mounted in the upper instrument panel to warn the pilot of a possible malfunction in the alternator, oil pressure or vacuum systems.

Additional features include a pilot storm window and two sun visors.

The cabin door is double-locked. To close the cabin door, hold the door closed with the armrest while moving the side door latch to the LATCHED position, then engage the top latch. Both latches must be secured before flight.

A large baggage area, located behind the rear seats, is accessible either from the cabin or through a large outside baggage door on the right side of the aircraft. When baggage is loaded, it is the pilot's responsibility to be sure that the aircraft's centre of gravity falls within the allowable CG range.

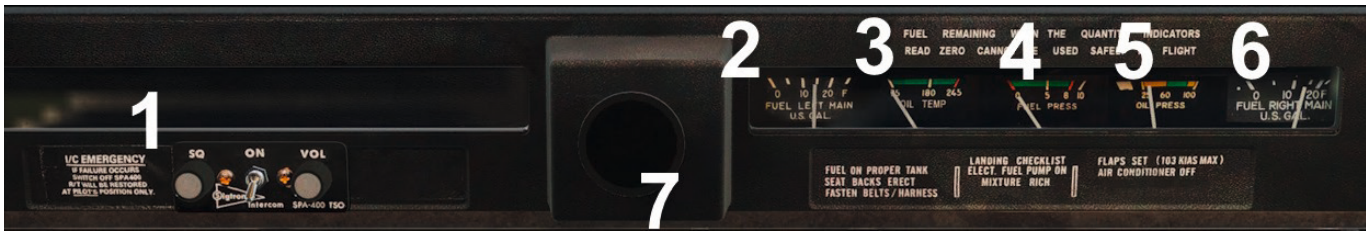
EFB 2D pop-out

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

Left main panel

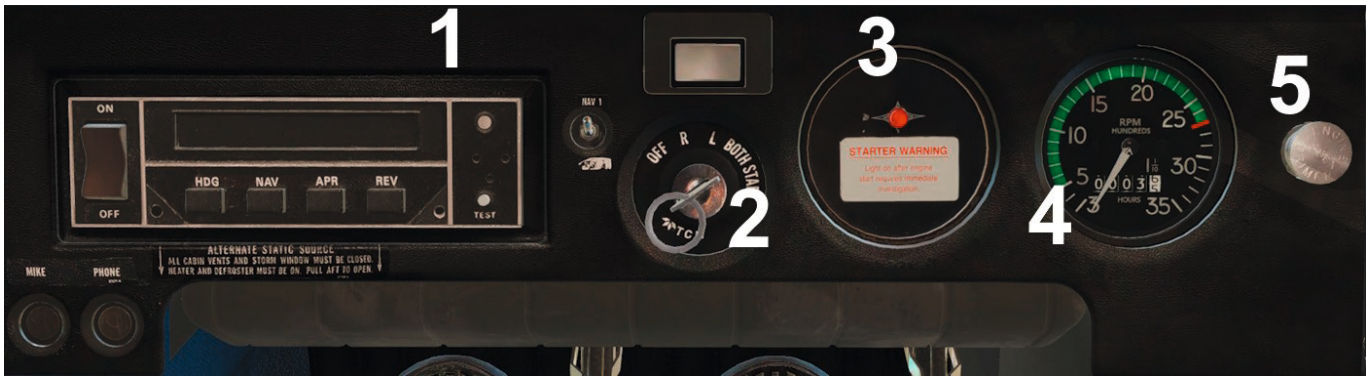
1. Exhaust gas temperature (EGT) indicator
2. Airspeed indicator (ASI) – a true airspeed indicator is incorporated into the airspeed indicator. The true airspeed indicator consists of a rotatable ring which is controlled using the knob located below the ASI. To set the indicator, rotate the ring until 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.
3. Attitude indicator (AI) – a pitch reference knob allows for the pitch bar's (aircraft symbol) position to be adjusted nose-up or nose-down.
4. 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 2D panel selector.
5. Annunciator press-to-test button – press to test annunciator lights
6. Annunciator lights
7. VOR 1 / ILS indicator – driven by the GNS 530
8. Low voltage warning light
9. ADF indicator – driven by KR 85 ADF system. HDG knob controls rotation of the compass card.
10. Turn and bank indicator
11. Direction indicator – caging knob (bottom left) controls rotation of the compass card. HDG knob (bottom right) controls the heading bug.
12. Vertical speed indicator (VSI)
13. VOR 2 indicator – driven by KX 175B

Left mid panel



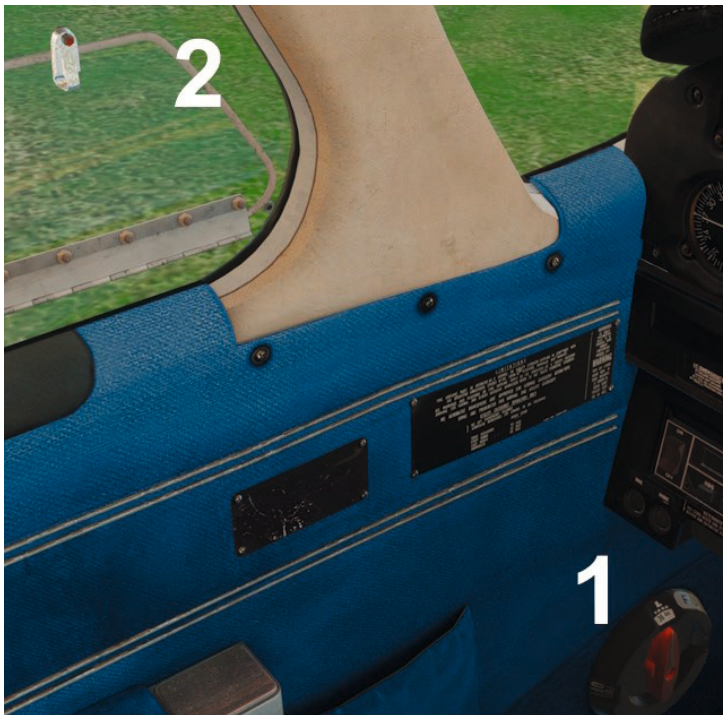
1. Intercom controls
2. Left fuel tank quantity indicator
3. Oil temperature indicator
4. Fuel pressure indicator
5. Oil pressure indicator
6. Right fuel tank quantity indicator
7. Yoke toggle click-spot (same location on right yoke)

Left lower panel



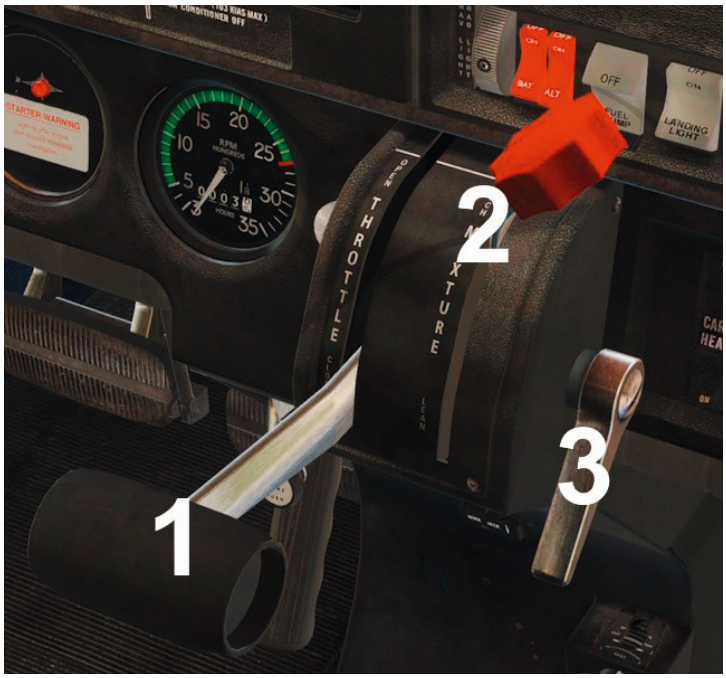
1. Autopilot controls – refer to the AUTOPILOT section for more information.
2. Magneto/start selector
3. Starter engaged light
4. Tachometer (RPM)
5. Primer control

Left sidewall



1. Fuel tank selector
2. Storm window (click on the latch to open or close the window)

Throttle quadrant



1. Throttle lever
2. Mixture lever
3. Friction control

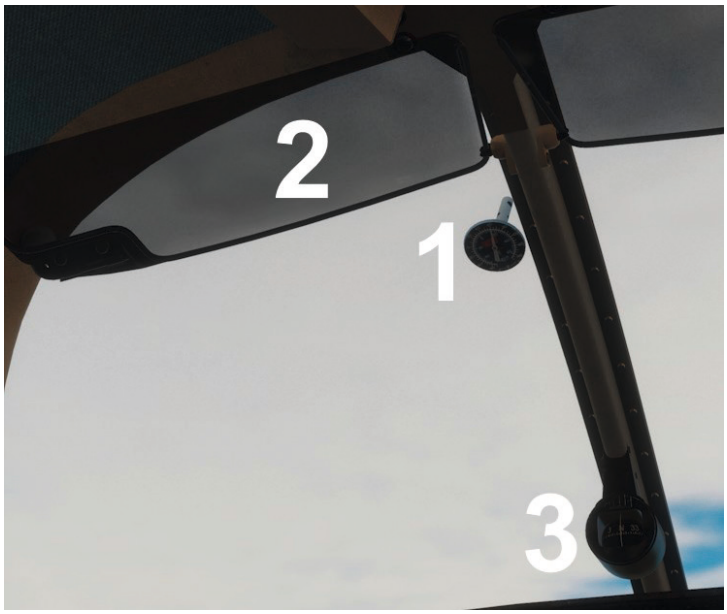
Right panel

1. Intercom switch
2. DME selector switch – selects whether the GNS 530 or KX 175B is used as the input to the KN 62.
3. KX 175B
4. KN 62A DME
5. KR 85 ADF
6. Vacuum gauge
7. DATCON hour meter
8. Heating control levers
9. Emergency bus switch (guarded)
10. Fan control switch
11. Avionics master switch
12. Circuit breaker panel

Centre panel

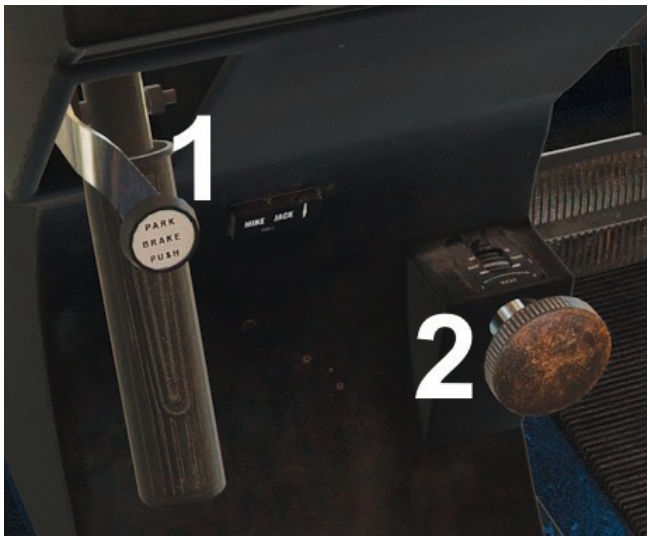
1. KMA 20 audio selector
2. GNS 530 GPS / NAV 1 radio
3. KT 76A transponder
4. Navigation and radio light switch
5. Battery master and alternator switches
6. Fuel pump switch
7. Landing light switch
8. Anti-collision lights switch
9. Pitot heat switch
10. Panel lights switch
11. Ammeter
12. Carburettor heat control lever

Upper cockpit



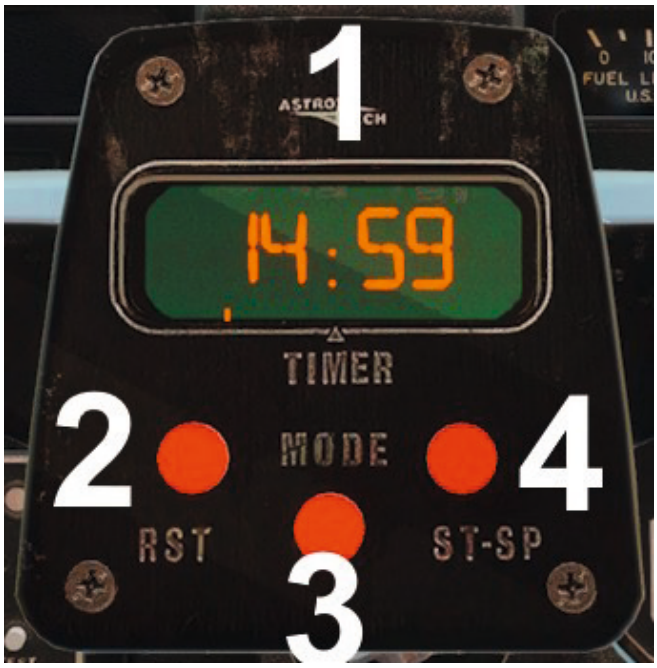
1. Outside air temperature indicator
2. Sun visors
3. Whiskey compass

Lower cockpit



1. Parking brake handle
2. Rudder trim knob and indicator – turning the trim control clockwise results in nose-right trim and anti-clockwise rotation results in nose-left trim.
3. Flap lever
4. Elevator trim wheel and indicator – rotating the wheel forward gives nose-down trim and rotation aft gives nose-up trim.

Yoke timer



1. Timer display
2. Reset button
3. Mode button
4. Start/Stop button

The yoke is fitted with a digital chronometer. The mode button allows you to toggle between either clock mode or timer mode.

With timer mode selected, the start/stop and reset buttons can be used to control the timer. Press the reset (RST) button so that the time reads zero and then press the start/stop (ST-SP) button to start and stop the timer.

With clock mode selected, the current local time will be shown in hours and minutes.

KMA 20 – audio selector

1. Microphone selector switch
2. AUTO switch
3. Receiver selector switches
4. Marker beacon sensitivity and lamp test switch
5. Marker beacon lights

The KMA 20 is an audio control system which provides control over transceiver and receiver outputs through the use of selector switches. The simulator doesn't allow for separate speaker and headphone outputs so both buttons perform the same function.

The COM 1 and COM 2 switches 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 sources to monitor.

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

When the AUTO switch is placed in either the SPEAKER or PHONE position, the unit will automatically match the corresponding receiver audio with the selected transmitter. For example, with COM 1 selected on the microphone selector knob, the COM 1 audio source will be automatically enabled.

The microphone selector knob connects the microphone to the selected output.

GNS 530 – GPS unit

1. Swap standby and active NAV 1 frequencies
2. ON/OFF knob – controls power to the unit
3. Swap standby and active COM 1 frequencies
4. Range key – zooms the map view in and out
5. Direct-To key – selects a waypoint to proceed directly to
6. Menu key – brings up the context-sensitive menu
7. Clear key – clears the last data entry. Press and hold to return to the main navigation view.
8. ENT key – acknowledge or confirm a data entry
9. GPS knob – used for data entry and to move among pages and page groups
10. Procedures key – allows the selection of instrument arrival, departure, and approach procedures
11. VNAV key – this is an optional feature that is not implemented in this version of the GNS 530
12. Flight Plan key – brings up the Flight Plan page group
13. Message key – view the Messages page
14. OBS key – used to suspend and unsuspend automatic waypoint sequencing during an instrument approach and to engage OBS mode during navigation
15. CDI key – toggle between NAV 1 and GPS as the active navigation source
16. Frequency knob – tune the COM 1 or NAV 1 frequency. Press in to switch between COM 1 and NAV 1.

Detailed instructions can be found in your ‘X-Plane 12/Instructions/X-Plane G530 Manual.pdf’.

KX 175B – COM 2 / NAV 2 radio

1. COM 2 frequency display
2. COM 2 power/test switch
3. COM 2 volume knob
4. COM 2 frequency selector knobs
5. NAV 2 frequency display
6. NAV 2 power/mode switch
7. NAV 2 volume knob
8. NAV 2 frequency selector knobs

The KX 175B is a very simple COM/NAV radio and acts as COM 2 / NAV 2 in the Warrior.

COM controls

Rotate the power/test switch to the ON position. Turn up the volume using the volume knob and then rotate the concentric selector knobs to tune in a COM frequency.

The COM radio will operate with either ON or TEST selected.

NAV controls

Rotate the power/mode switch to the IDENT position. Turn up the volume using the volume knob and then rotate the concentric selector knobs to tune in a NAV frequency.

Activate the NAV 2 switch on the audio selector panel to hear the Morse identifier.

KT 76A – transponder

1. Function selector knob
2. Reply light
3. Identification push-button
4. Code windows
5. Code knobs

Operating the KT 76A

The function selector knob should be in the OFF position before starting the aircraft's engine. Select the required reply code by rotating the four code knobs (one per code digit). The code will be displayed in the four code windows.

After starting the engine, turn the function selector to standby (SBY). The transponder will take approximately 45-50 seconds to become operational. Once you are airborne, turn the function selector to ON, enabling normal Mode A operation.

Turn the function selector to the altitude (ALT) position for altitude reporting (Mode C) to ATC.

Important codes

7700: Emergency

7600: Communications failure

7500: Hijacking

0000: Reserved for military aircraft

Squawk ident

When you are asked to ident by ATC, press and release the ident push-button. Your aircraft will be positively identified to the air traffic controller.

Reply light

During normal operation the reply light will flash to indicate that the KT 76A is functioning properly and replying to interrogations from ground radar. Interrogations occur at 10-15 second intervals, corresponding to each radar sweep.

KN 62A – DME

1. Three-position function switch – determines the information that is displayed and the channelling source.

   On the Frequency (FREQ) setting, the unit can be channelled internally.

   On the Groundspeed/Time-to-Station (GS/T) setting, the unit holds the internally selected frequency and also displays distance, groundspeed and time-to-station information.

   On the Remote (RMT) setting, the DME is channelled when you select your NAV frequency on the NAV 1 receiver (GNS 530) and displays distance, groundspeed and time-to-station.

2. ON/OFF switch – controls power to the unit.

   The KN 62A should be powered on only after engine start-up and should be turned off prior to engine shutdown.

3. Frequency selector knobs – used to alter the internally selected frequency.

   The inner knob tunes the frequency in 0.05MHz steps (0.05, 0.10, 0.15 etc.). Turning the outer knob changes the larger digits (1MHz, 10MHz etc.).

The KN 62A is a Distance Measuring Equipment (DME) system. It can be channelled remotely through the NAV 1 receiver (GNS 530) or the NAV 2 receiver (KX 175B), depending on the position of the DME selector switch, or tuned directly with its own frequency selection knobs. This dual channelling compatibility makes two DME frequencies available to you at all times, allowing for DME holds.

Frequency mode

In this mode the DME displays distance and the internally selected frequency. You can alter the frequency using the frequency knobs.

Groundspeed/Time-to-Station mode

In this position the DME holds the internally selected frequency while displaying distance, groundspeed and time-to-station. A ‘frequency hold’ feature prevents you from accidentally altering the frequency when it isn’t displayed.

Remote mode

With remote mode selected, the DME uses the frequency that is selected on the NAV 1 receiver (GNS 530) or the NAV 2 receiver (KX 175), depending on the position of the DME selector switch. Distance, groundspeed and time-to-station is shown. Dashes will be displayed when there is no valid signal.

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.

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. Since X-Plane's internal ADF logic doesn't support frequencies in the 1000s, the left knob is a single knob that only controls 100s.

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 additionally permits the carrier wave and the associated Morse code identifier broadcast on the carrier wave to be heard, as long as the ADF switch on the KMA 20 audio selector panel has been turned on.

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.

AUTOPILOT

1. Autopilot engage rocker switch
2. Mode push-buttons
3. Mode annunciators
4. Test push-button – click on the push-button to toggle altitude hold mode.
5. Coupler radio selector switch – click on the switch to control the NAV/GPS toggle function. The up position selects NAV 1 and the down position selects NAV 2.

By modern standards the Century 21 is quite a primitive autopilot. It controls the roll axis of the aircraft but is not equipped to control the pitch axis.

Controls

The Century 21 autopilot is activated with the battery master switch and operates in a low power state until autopilot operation is desired. Mode selection is made by pushing the desired mode switch and the selected mode will be illuminated on the annunciator. A test push-button is provided to check the valid operation of the annunciator lights.

Autopilot engagement is accomplished by left-clicking on the momentary engage rocker switch. The autopilot may be engaged in any pre-selected mode.

In HDG (heading) mode the aircraft will track the heading selected on the direction indicator. In NAV, APR or REV mode, the aircraft will intercept and track any valid radio-defined course.

The autopilot can be disengaged by right-clicking on the momentary engage rocker switch or by interrupting power using the battery master switch or circuit breaker(s). Disengagement causes the AP annunciator to flash for five seconds.

If the radio navigation information becomes invalid during an intercept, or at any time after the selected radio course has been intercepted, the appropriate NAV/APR/REV annunciator will flash, but the system will remain in the original radio mode.

Coupler radio selector switch

This switch connects the autopilot to either the NAV 1 or the NAV 2 radio. It can also be placed in the OFF position to disconnect the autopilot from both radios.

Lateral operating modes

Heading (HDG) mode

In HDG mode the autopilot will capture and hold the heading selected on the direction indicator. The HDG annunciator will illuminate with HDG mode engaged.

The heading bug becomes the primary control of the aircraft around the roll axis. When the heading of the aircraft matches the heading bug, the autopilot will maintain the heading. To turn to a new heading, rotate the heading bug to the desired heading and the aircraft will turn to the newly selected heading.

Navigation (NAV) mode

NAV mode has an automatic 45° VOR-LOC intercept angle. The NAV annunciator will illuminate with NAV mode engaged. When executing an intercept, the rate at which the aircraft is closing upon the selected radial is determined by the computer and at the proper time an on-course turn is initiated. The autopilot will automatically intercept, capture, track and correct for crosswind on any desired VOR radial the pilot selects.

The autopilot heading bug should be set to match the selected VOR radial.

Approach (APR) mode

APR mode has an automatic 45° VOR-LOC intercept angle. The APR annunciator will illuminate with APR mode engaged. The autopilot will automatically intercept, capture, track and correct for crosswind conditions during ILS approach work. This mode automatically adjusts for the increased sensitivity that accompanies the ILS system.

Reverse/back course (REV) mode

REV mode is for use in tracking the localiser back course inbound and front course outbound. 45° automatic intercepts, crosswind correction and tracking are as described in the APR mode except that response to radio signals is reversed.

Operation

Ground check – HDG mode

To ground check the autopilot:

1. Engage the autopilot using the rocker switch.
2. Engage HDG mode by pressing the HDG push-button.
3. Rotate the heading bug to the right – observe that the yoke moves right.
4. Rotate the heading bug to the left – observe that the yoke moves left.
5. Centre the heading bug until the yoke ceases to turn to either side.

Ground check – NAV mode

1. Tune in an available VOR station on the NAV 1 radio.
2. Centre the VOR 1 CDI needle with a 'TO' flag using the OBS knob.
3. Set the heading bug to match the selected OBS value.
4. Place the coupler selector switch in the NAV 1 position.
5. Engage NAV mode by pressing the NAV push-button.
6. Rotate the OBS knob to swing the CDI needle to full right deflection – observe that the yoke moves right.
7. Rotate the OBS knob to swing the CDI needle to full left deflection – observe that the yoke moves left.
8. Disengage the autopilot – this completes the ground checks.

Engaging in flight

Before engaging the autopilot, make certain the aircraft is trimmed for hands-off level flight with the slip-ball centred.

Override

Applying a large control input will override the autopilot when engaged.

The override should be checked prior to each flight:

1. Engage the autopilot.
2. Engage HDG mode.
3. While the heading bug is set for a left turn, apply a large right input to the yoke.
4. While the heading bug is set for a right turn, apply a large left input to the yoke.
5. Disengage the autopilot.

Procedures

Intercepting VOR radials

1. While flying with the autopilot engaged and operating in the heading (HDG) mode, tune in a VOR and set the OBS to the desired radial.
2. Rotate the heading bug to align with the selected OBS.
3. Engage navigation (NAV) mode.
4. The aircraft will turn to intercept the desired radial at an angle not exceeding 45°.
5. The autopilot will roll the aircraft onto the selected radial and will establish a crosswind-corrected heading.

Note: *When flying with a crosswind, the heading bug will not align with the course flown by the autopilot. The difference between the two is the wind correction (crab) angle.*

VOR navigation

1. The aircraft is inbound and coupled to the 045° radial to VOR ‘A’.
2. When flying over VOR ‘A’, the autopilot will bank the aircraft left and right to indicate passage over the station. At this point, select the desired outbound radial (140° in this example) using the OBS knob and align the heading bug to the same course.
3. The autopilot will bank the aircraft left to intercept the 140° radial of VOR ‘A’, compensating for any crosswind.
4. As the aircraft moves out of range of VOR ‘A’, tune VOR ‘B’ into the KX-175B (NAV 2) radio and rotate the OBS knob to select the desired inbound radial.
5. Move the coupler radio selector switch to the NAV 2 position.
6. The autopilot will continue to bank the aircraft to maintain the radial to VOR ‘B’.
7. This procedure is repeated, as described, from VOR to VOR as the aircraft progresses along its route.

Note: *If you wish to use the same VOR receiver for navigating to VOR ‘B’, heading (HDG) mode should be used while VOR ‘B’ is tuned in.*

ILS approach

1. When receiving vectors to the localiser, engage heading (HDG) mode and use the heading bug to maintain the provided headings.
2. When the aircraft is in a position for the localiser intercept, select the inbound heading of the localiser using the heading bug before engaging navigation (NAV) mode.
3. The autopilot will intercept the localiser and correct for crosswinds.
4. It is important to note that the autopilot only controls the heading of the aircraft and cannot adjust the rate of descent for the glideslope. You must make pitch changes to maintain the glideslope.
5. When passing over the middle marker, disengage the autopilot and take over control of the aircraft. Pre-select heading (HDG) mode on the autopilot in case of a go-around.

Note: *The heading bug must be set to the inbound heading of the localiser.*

ILS back course approach

1. When receiving vectors to the back course of the localiser, engage heading (HDG) mode and use the heading bug to maintain the provided headings.
2. Set the inbound heading of the back course using the heading bug and engage reverse (REV) mode.
3. The autopilot will intercept the back course and track inbound on the localiser, correcting for crosswinds.

GROUND EQUIPMENT

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

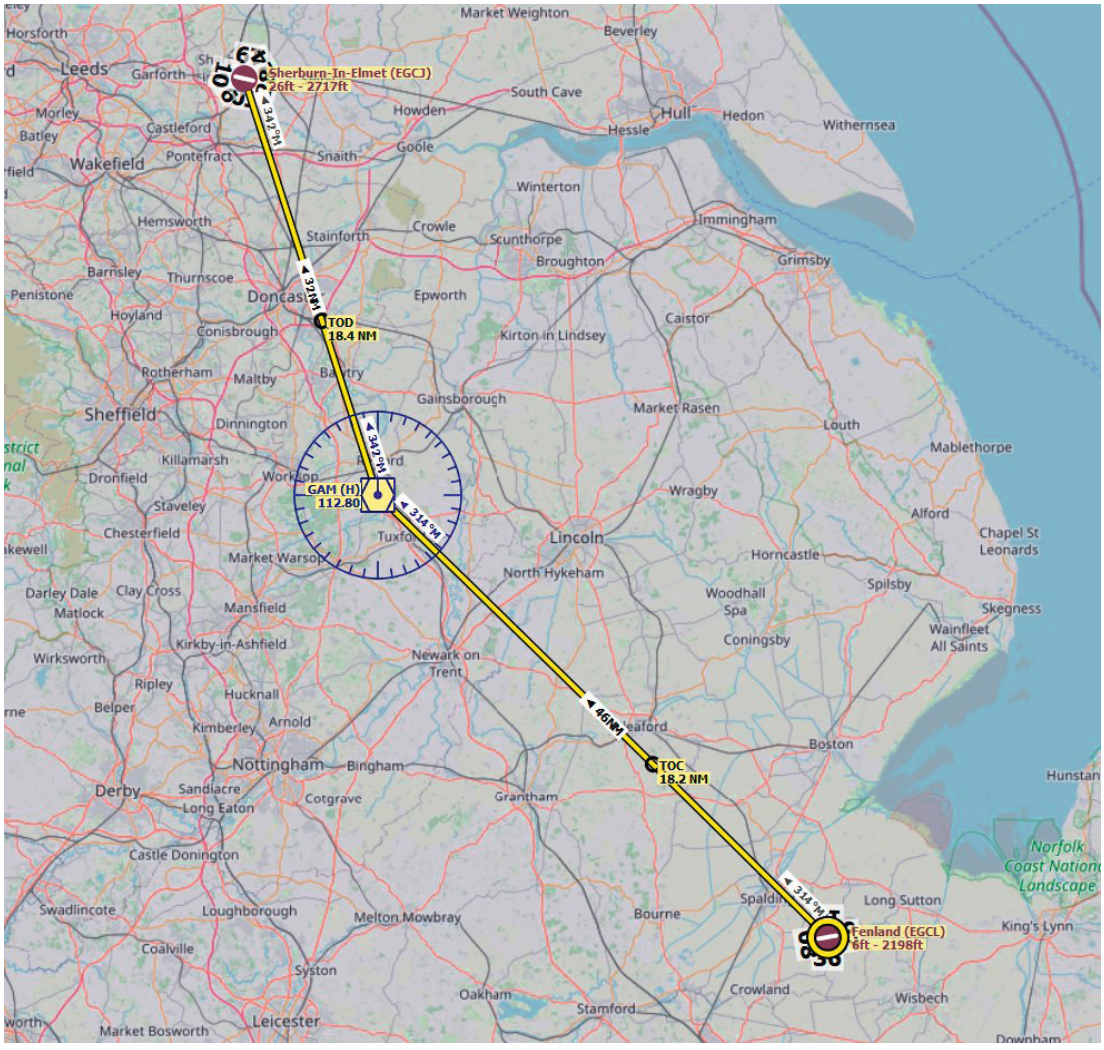
The chocks and tie-downs can be fitted to the aircraft by toggling the ground equipment sliders in the AIRCRAFT OPTIONS app of the tablet EFB.

FLYING THE WARRIOR

In this tutorial flight we will departing from Fenland airfield, a rural setting located 10 miles north-east of Peterborough, UK. We will be heading north-west, passing over Gamston in Nottinghamshire and Doncaster in South Yorkshire before approaching Sherburn in Elmet from the south-east. Covering approximately 78 nautical miles, this short flight is the ideal length for learning about the essential systems on board the PA-28 Warrior II.

Here are the details for today's flight:

EGCL – GAM (112.80) – SBL (323.0) – EGCJ



Estimated time en route: 40 minutes

Route distance: 78 nautical miles

Departure time: 1200 (local time)

Weather: Clear

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-28 Warrior II tutorial flight, follow these steps:

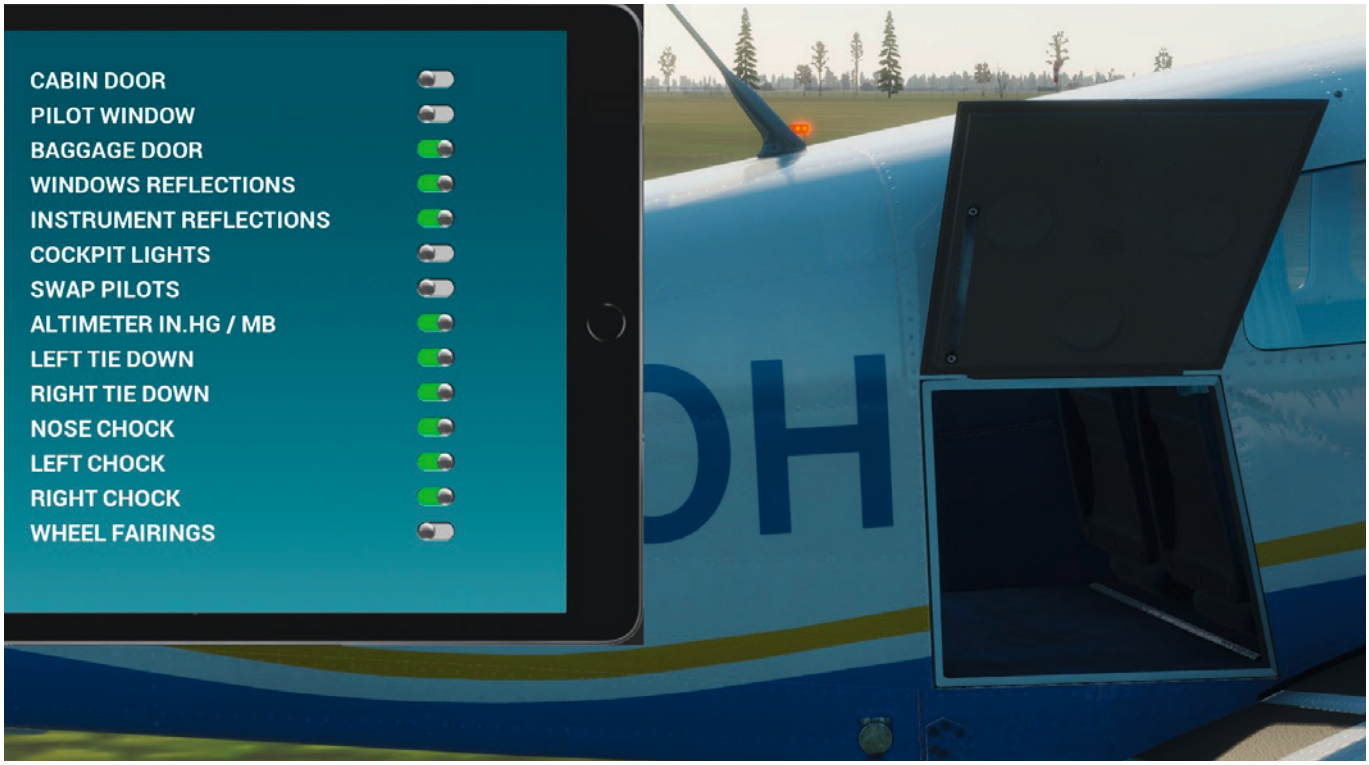
1. Start X-Plane 12.
2. From the Main Menu click **New Flight** or go to the Flight Configuration window.
3. Click on **PA28 Warrior** in the Aircraft Selection screen.
4. Click **Customize**, choose the **G-BNOH** livery from the drop-down menu in the top right and untick the box labelled **Start with engines running**.
5. Under the Location box, type **EGCL** and select **Fenland**. Click the **Customize** button.
6. Under 'Starts' select **Ramp** and choose a ramp start location. Press **Confirm** when done.
7. Click **Start Flight**.

You should now find yourself sitting in the cockpit at Fenland airfield. The aircraft is configured in a 'cold and dark' state, with all the cockpit systems switched off, as you would find the aircraft prior to the first flight of the day. By beginning in this configuration, 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 this light aircraft.

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.

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

Switch to the exterior (chase) view and use the pop-out EFB Aircraft Options to open the baggage door. Confirm that the baggage door has opened and then return to the cockpit.



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

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

Check that the magneto selector is set to **OFF** (rotated fully anti-clockwise).

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

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

Check the left and right fuel quantity gauges to confirm that we have full tanks (25 gallons per tank).

Switch **ON** the navigation, anti-collision and landing lights.

Switch to the exterior (chase) view and confirm that all of the lights are illuminated before returning to the cockpit and switching them all **OFF**.

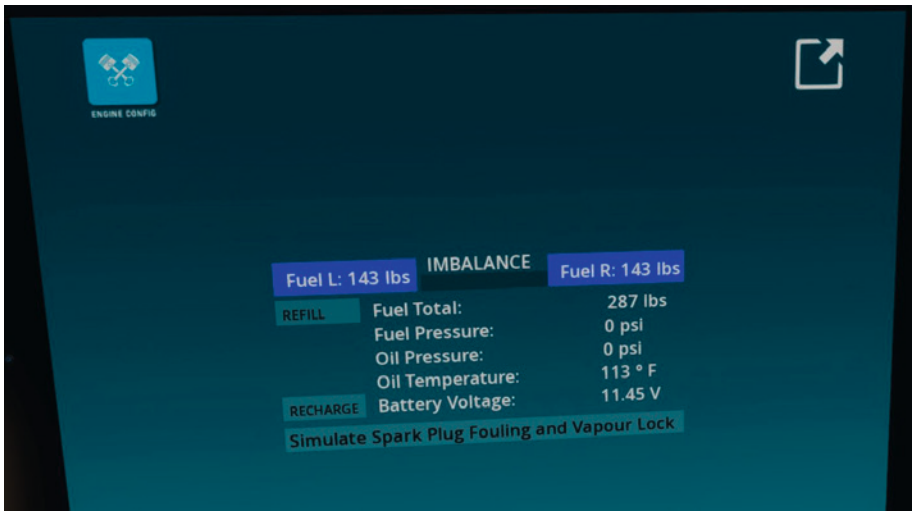
Confirm that all annunciator lights and the low voltage light are illuminated and then switch **OFF** the BATT MASTR.

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

Move the elevator and rudder trims to the centre/neutral position.

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

Open the Engine Config menu on the EFB. This menu allows you to refill the fuel, recharge the aircraft battery and check the engine stats.



Use the menu to recharge the battery in case it has discharged while you've been finding your way around the cockpit.

We are now finished here, so click the arrow to close the EFB.

Starting the engine

To avoid battery draining, we will start the engine before configuring the avionics for our departure.

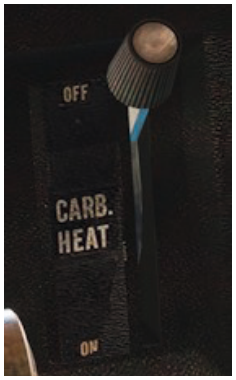
Close the baggage door via the EFB and then close the passenger door by first clicking on the door to pull it shut and then clicking on the door latches to rotate them to the **LATCH** position. Use the EFB Aircraft options to remove the chocks and tie-downs.

Check that the parking brake is set and that all circuit breakers are pushed in.

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

On the throttle quadrant, move the mixture lever to the **FULL FORWARD** position and advance the throttle lever to approximately **1/4" open**.

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



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

Turn **ON** the anti-collision lights, warning anyone in the area that we are about to start the engine.

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

Check that the area surrounding the aircraft is clear of obstructions and then rotate the magneto/start selector to the **START** (fully clockwise) position.

When the engine starts, release the magneto/start selector and it will return to the BOTH position. Check that the oil pressure and temperature are rising.

Switch **ON** the ALT (alternator) and confirm that the associated warning light on the annunciator panel extinguishes.

Adjust the throttle to maintain approximately **1,200 RPM** and check that the vacuum gauge shows suction within the given limits.

With the engine running and the alternator charging the battery, we can now switch on the avionics.

Switch on the main avionics power switch to the right of the co-pilot's yoke.

Starting at the top of the centre panel and working down, switch on the GNS 530, KT 76A, KX 175B, KN 62A and KR 85 units.

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

Configuring the avionics

We now need to configure the avionics for our departure.

We are going to take off on runway 36 and for the initial climb we are going to maintain the runway heading. To align the direction indicator (DI) with the magnetic compass, click the centre of the left knob and then rotate the HDG knob until the white bug rests on 0 degrees (North) to set our runway heading.

Once we get settled into the climb we will be making a turn left toward our first waypoint on route, Gamston VOR. In preparation, tune **122.80** into the GNS 530 (NAV 1) unit. To do this, you will first need to press the Push C/V knob and then rotate the outer knob to tune **122.80**. Finally, press the V key to swap to the active frequency.

Rotate the OBS knob on the VOR 1 indicator to select **314 degrees**. This is the course inbound to the Gamston VOR from Fenland.

Check that the function switch on the KN 62A is set to the **RMT** (remote) position and that the DME selector switch, located above the KX 175B unit, is set to **NAV 1**.

Selecting the remote function allows the KN 62A to display DME information from either NAV 1 (GNS 530) or NAV 2 (KX 175B), rather than from its own internal NAV receiver. The DME selector switch controls which of the two radio units the KN 62A receives its DME information from – in this case the GNS 530, which we have just tuned to the Gamston VOR.

Taxi

We can now taxi to the runway. Check that the area around the aircraft is clear of obstacles and then release the parking brake. Apply power slowly to get the aircraft rolling and then start your taxi to the threshold of runway 36.

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

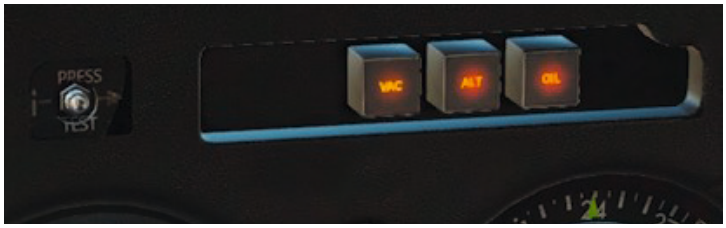
Check the operation of gyroscopic instruments (horizontal attitude, heading and turn and bank indicators) by means of alternate turns.

Stop at the holding point just short of runway 36. We can carry out the power (ground) checks here.

Set the parking brake and advance the throttle lever to obtain 2,000 RPM and then rotate the magneto selector to the **LEFT** position, note the RPM drop and then rotate it back to the **BOTH** position. Repeat the process for the right magneto.

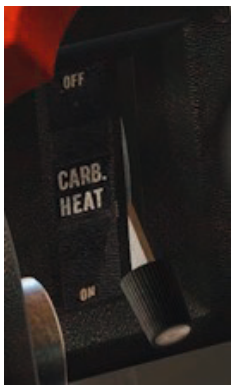
Check that the vacuum, oil temperature, oil pressure and ammeter readings are within limits.

Use the PRESS-TO-TEST button to confirm that all the annunciator lights illuminate.



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** and check for a small drop in RPM, then push the carburettor heat lever to **OFF**. If the RPM increases to significantly more than the original 2,000 RPM, it is likely that icing conditions are present. With clear skies and moderate temperatures for our flight, however, that shouldn't be an issue.



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

Finally, reduce the throttle to idle, check for rough running and then set it back to 1200 RPM.

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

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

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

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

Confirm the magneto selector is in the **BOTH** position and that the primer is pushed in and locked, and then switch **ON** the landing light.

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

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

Switch **ON** the PITOT HEAT switch.

Finally, set the flaps to 25 degrees by pressing the [2] key twice.

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 **55 knots** start to raise the nose of the aircraft.

Make elevator inputs as required to maintain an initial climb speed of approximately **63 knots**, holding the runway heading (360 degrees).

At 200ft, carefully select the flaps up by pressing the [1] key twice. Increase airspeed to 79 knots, which will give us our best rate of climb.

Climb

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

As we climb through 1,000ft we should now pick up the signal from the GAM VOR. This can be noted by the presence of the TO flag now visible on the CDI. Start a gentle left-hand turn to 300 degrees so that we can intercept the radial which we set earlier.

As the CDI slowly becomes centred we can engage the autopilot to reduce our workload. Left-click on the autopilot engage rocker switch to engage the autopilot, then press the NAV button to allow the autopilot to intercept our course to GAM.

Note: *The autopilot is not controlling aircraft pitch, so continue to make pitch and elevator trim changes as required to continue climbing at 79 KIAS.*

Cruise

As you approach 4,000ft, place your mouse cursor over the spot above the autopilot test button and press the left button on your mouse.

This toggles altitude hold mode. The autopilot will capture and hold the current altitude (rounded to the nearest hundred feet).

The real-world Century 21 autopilot doesn't feature altitude hold mode but it has been included for convenience.

As the aircraft levels out and begins to accelerate, reduce the throttle to obtain approximately **2,200 RPM**. This is a typical cruise power setting.

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

If you want to avoid worrying about switching fuel tanks, enable the automatic fuel selector from the Configuration menu in the EFB.

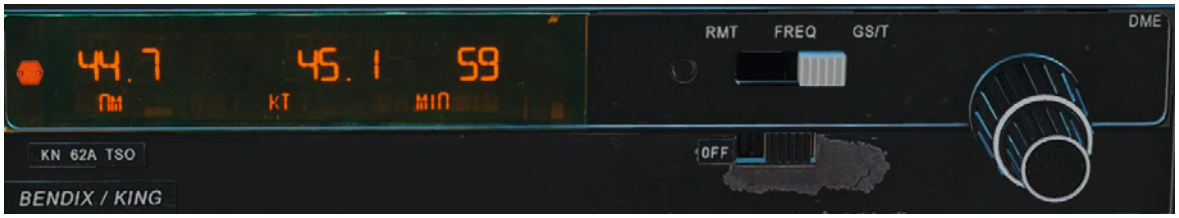
With the aircraft stabilised in the cruise, and at a range of approximately 30 nautical miles from GAM VOR, RAF Cranwell will become visible just to the left of our track.

You can now relax for a while as the autopilot takes care of controlling the aircraft. From here the rest of the leg to the Gamston VOR should take approximately 18 minutes, as displayed on the KN 62A. This is the ideal opportunity to take a quick look at some of the features of the aircraft.

The Warrior has some very useful IFR-capable avionics. We'll take a quick look at some of the features of those avionics. Make sure you keep an eye on the distance remaining to the Gamston VOR, as we'll need to return to navigating the aircraft once we are five miles from the VOR.

Sliding over to the KN 62A unit, move the function switch to the **FREQ** (frequency) position. With this function selected we can tune the KN 62A's internal receiver (NAV 3).

Rotate the frequency selector knobs to tune in **113.90**, the frequency for the Ottringham VOR/DME which is commonly used by airliners transiting into the UK from Europe. The DME distance (nautical miles) to the VOR will be shown on the left of the display. Move the function switch to the **GS/T** (groundspeed/time) position to show the DME distance (nautical miles), groundspeed (knots) and time-to-station (minutes) to the Ottringham VOR. Note that the display is identical to that shown with RMT (remote) selected, but this display shows the information for the internally tuned frequency rather than the remote frequency (NAV 1 – GNS 530, or NAV 2 – KX 175).



Return the function switch to the **RMT** (remote) position so we can continue to monitor the distance to the next waypoint.

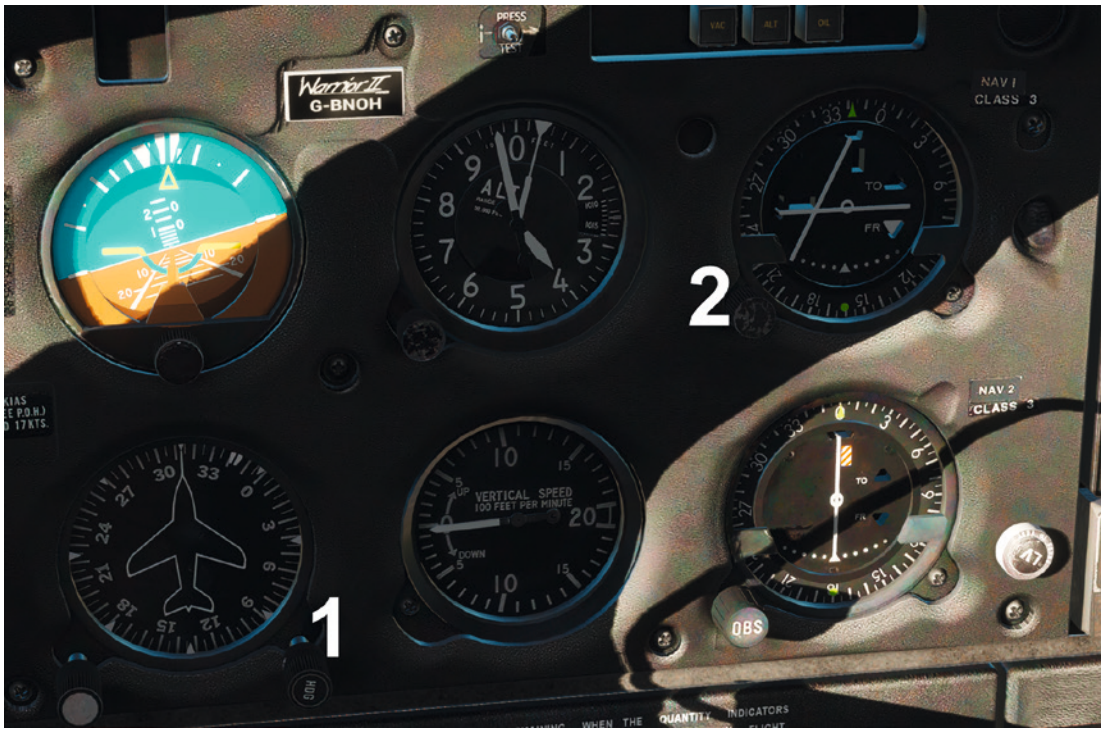
Another useful feature for navigation is the Flight Computer panel, which can be opened from the 2D panel selector. The flight computer shows a variety of real-time information related to everything from speed to fuel burn/flow and range/endurance.

With some time until we reach the Gamston VOR, take the opportunity to explore the cockpit, using the EFB manual for reference.

As we approach the GAM VOR, we will need to prepare to change course when passing overhead. With 5 NM to run, rotate the HDG bug on the DI to our current heading of 314 degrees and select Heading mode on the autopilot panel. We do this because close to the VOR the signal becomes unreliable; this is known as the ‘cone of confusion’.

Turning our attention to the CDI as we pass over the VOR, watch for the TO flag changing to a FROM flag. Now turn the heading bug to our outbound course of 342 degrees (1). The autopilot will execute a right-hand turn.

On the CDI, rotate the OBS knob until **342** is at the top of the compass card (2).



Now re-engage NAV on the autopilot panel; the autopilot will now fly the 342 radial outbound from the VOR.

Enjoy the view as we pass just to the west of Doncaster Airport (formally RAF Finningley) and over the city centre, with the Pennine hills just about visible on the horizon to the west.

There is a non-directional beacon (NDB) located on the airfield at Sherburn (SBL). We can tune this by using the KR85 ADF. Tune 323, using the two knobs.

When in range, the arrow on the ADF indicator will point directly to the airfield, giving us better situational awareness of our position. The compass card needs to be manually rotated to give us our bearing to the NDB.

Descent

We need to begin our descent when we are approximately ten miles from the airport, approximately 22 NM outbound from GAM VOR.

Reduce the throttle to obtain **2,000 RPM** and, once the airspeed has reduced to 100 knots, start the descent by disengaging altitude hold mode and then pitching down to obtain a **-500ft/min** descent rate.

As the aircraft stabilises in its descent, adjust the throttle to maintain **100 knots**.

Adjust your rate of decent to hit 1,000ft at 25 NM outbound from GAM VOR.

Approach and landing

As Sherburn Aerodrome comes into view at 28 NM outbound from GAM VOR, engage heading mode on the autopilot and position the aircraft to base leg for runway 29, using the heading bug to turn the aircraft right, to 020 degrees. Disengage the autopilot with the rocker switch when you feel comfortable doing so.

Switch **ON** the landing light and fuel pump.

Confirm that the mixture lever is fully forward and that the fuel selector is set to the fullest tank.

Once established on base leg for runway 29, begin to reduce your airspeed to **80 knots** and extend the flaps to the **25°** position (press the [2] key twice). Slight forward pressure will be required so that that aircraft does not balloon and gain altitude.

Keeping our eyes out of the left window, when the runway is in sight make a left turn onto final approach, taking care to maintain our airspeed.

As we roll wings level onto final approach, lower the flaps to 40 degrees (fully down) and reduce our airspeed to 65 knots. Reduce power and descend towards the runway at roughly 500ft/min vertical speed.

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. When you are safely off the runway, raise the flaps and switch **OFF** the landing and anti-collision lights.

You can also switch **OFF** the fuel pump and pitot heat.

Shutdown

Begin your taxi to the nearest available parking spot.

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

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

Once the engine comes to a stop, rotate the magneto selector to the **OFF** position.

Switch **OFF** the navigation lights and then switch **OFF** the alternator and battery to disconnect the electrical power.

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

Congratulations – you have completed the Warrior tutorial flight!

NORMAL PROCEDURES

Airspeed (IAS) for safe operations

Best rate of climb	**79 KIAS**
Best angle of climb	**63 KIAS**
Operating speed in turbulent air	**111 KIAS**
Maximum flap speed	**103 KIAS**
Final approach speed (flaps 40)	**63 KIAS**
Maximum demonstrated crosswind	**17 KIAS**

Pre-flight

Cockpit

Parking brake	**SET**
Avionics	**OFF**
Mixture	**IDLE CUT-OFF**
Magneto switch	**OFF**
BATT MASTR switch	**ON**
Fuel gauges	**CHECK QUANTITY**
Annunciator panel	**CHECK**
BATT MASTR switch	**OFF**
Primary flight controls	**CHECK OPERATION**
Flaps	**CHECK OPERATION**
Trim	**NEUTRAL**
Baggage door	**CLOSED**

Left/right wing

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

Nose section

Chocks	**REMOVED**
Towbar	**REMOVED (NOSE GEAR)**

Oil	**CHECK LEVEL**
Propeller	**GOOD CONDITION**
Air inlets	**CLEAR**
Landing light	**CHECK**

Tail section

Fin	**CHECK CONDITION**
Rudder	**CHECK CONTROLS**
Stabilator and trim tab	**CHECK CONTROLS**
Tail cone	**CHECK CONDITION**

Before starting engine

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

Engine starting

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

Cold engine

Throttle	**¼ INCH OPEN**
ALTR switch	**ON**
BATT MASTR switch	**ON**
Fuel pump	**ON**
Mixture	**FULL RICH**
Propeller	**CLEAR**
Starter	**ENGAGE**

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

When the engine starts:

Magneto selector	**BOTH**
Throttle	**ADJUST**
Oil pressure	**CHECK**
Throttle	**800-1,200 RPM**

Hot engine

Throttle	**½ INCH OPEN**
ALTR switch	**ON**
BATT MASTR switch	**ON**
Fuel pump	**ON**
Mixture	**FULL RICH**
Propeller	**CLEAR**
Starter	**ENGAGE**
When the engine starts:	
Magneto selector	**BOTH**
Throttle	**ADJUST**
Oil pressure	**CHECK**
Throttle	**800-1,200 RPM**

Taxiing

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

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

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

Ground check

Parking brake	**SET**
Throttle	**2,000 RPM**
Magnetos	**CHECK (max. drop 175 RPM)**
Vacuum	**4.8-5.1 inHg**
Oil temperature	**CHECK**
Oil pressure	**CHECK**
Ammeter	**CHECK**
Annunciator panel	**PRESS-TO-TEST**
Carburettor heat	**CHECK**
Fuel pump	**OFF**
Fuel pressure	**CHECK**
Throttle	**RETARD**

Before take-off

BATT MASTR switch	**ON**
ALTR switch	**ON**
Flight instruments	**CHECK**
Fuel selector	**AS REQUIRED**
Fuel pump	**ON**
Engine gauges	**CHECK**
Carburettor heat	**OFF**
Mixture	**SET**
Primer	**LOCKED**
Flaps	**SET**
Trim	**SET**
Controls	**FREE**
Doors	**LATCHED**

Take-off

Lined up on runway	**CHECK COMPASS**

Normal technique

Flaps	**SET**
Trim	**SET**
Accelerate to 40-55 KIAS.	
Yoke	**Back pressure to rotate smoothly to climb attitude**

Short field/obstacle clearance technique

Flaps	**25° (second notch)**
Accelerate to 52 KIAS.	
Yoke	**Back pressure to rotate smoothly to climb attitude**
Maintain 52 KIAS until obstacle is cleared then accelerate to 79 KIAS	
Flaps	**Retract slowly**

Climb

Best rate (flaps up)	**79 KIAS**
Best angle (flaps up)	**63 KIAS**
En route	**87 KIAS**
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 ofthe 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.

The pilot 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.

Descent

Normal

Throttle	**2,000 RPM**
Airspeed	**100 KIAS**
Mixture	**FULL RICH**
Carburettor heat	**ON if required**

Power off

Carburettor heat	**ON if required**
Throttle	**CLOSED**
Airspeed	**AS REQUIRED**
Mixture	**AS REQUIRED**

Apply engine power every 1,500ft to prevent excess engine cooling and spark plug fouling.

Approach and landing

Fuel selector	**FULLEST TANK**
Fuel pump	**ON**
Mixture	**SET**
Flaps	**SET (103 KIAS max.)**
Trim to 70 KIAS.	
Final approach speed (flaps 40°)	**63 KIAS**

Shutdown

Flaps	**RETRACT**
Fuel pump	**OFF**
Avionics	**OFF**
Electrical switches	**OFF**
Throttle	**CLOSED**
Mixture	**IDLE CUT-OFF**
Magnetos	**OFF**
ALTR switch	**OFF**
BATT MASTR switch	**OFF**
Parking brake	**SET**

Stalls

The stall characteristics of the Warrior are conventional. An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall.

The gross weight stalling speed of the Warrior with power off and full flaps is 44 KIAS. With the flaps up, this speed is increased. Loss of altitude during stalls varies from 100 to 275 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 (2,325 lb, flaps 0)	**44 KIAS**
Manoeuvring speed (2,325 lb)	**111 KIAS**
Manoeuvring speed (1,531 lb)	**88 KIAS**
Never exceed speed	**160 KIAS**
Power off glide speed (2,325 lb, flaps 0)	**73 KIAS**

Engine failures

Engine fire during start

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

Engine failure during take-off

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

If sufficient altitude has been gained to attempt a restart:

Fuel selector	**SET TO FULLEST TANK**
Fuel pump	**ON**
Mixture	**CHECK RICH**
Carburettor heat	**ON**

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

Engine failure in flight

If at low altitude:

Airspeed	**63 KIAS minimum**

Prepare for power off landing.

If altitude permits:

Fuel selector	**SWITCH TO FULLEST TANK**
Fuel pump	**ON**
Mixture	**RICH**
Carburettor heat	**ON**
Primer	**LOCKED**
Engine gauges	**Check for indication of cause**

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

When power is restored:

Carburettor heat	**OFF**
Fuel pump	**OFF**

If power is not restored, prepare for power off landing. Trim for 73 KIAS.

Power off landing

Trim for 73 KIAS. Locate suitable field and establish spiral pattern 1,000ft above field at downwind position for normal landing approach.

When field can be easily reached, slow to 63 KIAS for shortest landing.

Fires

Engine fire in flight

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

Proceed with power off landing procedure.

Electrical fire

BATT MASTR switch	**OFF**
ALTR switch	**OFF**
Cabin heat	**OFF**

Land as soon as possible.

Low oil pressure

Oil annunciator light	**ON**
Pressure indicator	**IN LOW SECTOR**
Throttle	**REDUCE AS FAR AS POSSIBLE**
Oil temperature	**CHECKED**
If oil temperature in red sector	**REDUCE THROTTLE**

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

Low fuel pressure

Fuel pump	**ON**
Fuel quantity	**CHECKED**
Fuel selector	**SWITCH TANKS**

Electrical failures

Check the circuit breakers panel. If the circuit breaker is open, close it only once. If it opens again do not try to close the circuit breaker as the equipment has failed.

ALT annunciator light illuminated:

Ammeter	**Check to verify inoperative alternator**

If ammeter shows zero:

ALTR switch	**OFF**

Reduce electrical loads to minimum:

ALNTR. FIELD circuit breaker	**Check and reset as required**
ALTR switch	**ON**

If power is not restored:

ALTR switch	**OFF**

If alternator output cannot be restored, reduce electrical loads and land as soon as 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

Intentional spins are prohibited, but if an inadvertent spin does occur, the following recovery procedure is recommended:

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

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.

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Special thanks to all the testers and to Flying Club Conington for giving us permission to photograph their aircraft.

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