X-Plane
Lancair Evolution

Pilot's Operating Manual

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The Lancair Evolution

By Laminar Research CEO Austin Meyer

Light airplanes can take off and land on short runways, giving access to every airport in the country… but rarely exceed 200 miles per hour, and usually have a range of well under 1,000 miles, making trips interminable and often paused with fuel stops.

Light business jets run about 400 miles per hour… but with their long takeoff and landing distances, they can't access the short runways, which makes them of much less use if you actually have to go to a specific location that is not near a large airport.

In other words, there does not seem to be a single airplane that runs both far and fast, while accessing all the airports the planet Earth has.

Does this matter?

Let us imagine a figure of merit for an airplane. This merit should be based on how many airports it can access, and how quickly it can access them. Isn't that what we want an airplane FOR? We want an airplane to get anywhere we want to be, quickly, and the shorter the takeoff and landing distance, the more airports we can actually ACCESS, so the more destinations we can rapidly GET TO.

In other words, the figure of merit for an airplane could be the speed, times the range, divided by the greatest of the takeoff and landing distance, since that is a number that will indicate how MANY airports you can get to… and how fast you can get to them.

Most light airplanes fail at turning in a good figure of merit: They are too slow and have too little range! Business jets fail at this as well: Their long take-off and landing distance eliminate access to many airports!

Is there a plane that succeeds in ALL of these parameters: High speed, long range, short take-off and landing distance, allowing rapid access to all airports? The answer is yes, and that plane is the **Lancair Evolution**.

With a speed of 300 knots, a range of over a thousand nautical miles on a single tank of gas, and comfortable takeoff and landing distance of about 2,000 feet, the Evolution can get you into countless airports that no business jet can touch and do it at a speed that exceeds almost all other light planes… the possible exception being TBMs... which use much more runway, eliminating many airports from use!

The Lancair Evolution may have the highest figure of merit of any airplane, allowing a freedom of transportation not available in any other craft.

The Evolution uses a number of technologies to deliver this performance:

- The Pratt & Whitney PT6-a-135 (750 hp) or PT6-a-42 (850 hp) engine, coupled with a huge wood-and-fiberglass MT prop to deliver 4,000 fpm climb rates and a 300-knot cruise speed.
- A pure carbon-fiber construction to have a laughably-light 2,600-pound empty weight for an 850 hp motor (transient to 1,000 hp allowable). Do the math on the power-to-weight ratio and compare it to the Bugatti Veyron… it does not look good... for the Veyron.
- A huge, hi-lift, wet-wing holding Jet-A fuel directly in the carbon fiber structure, allowing a whopping 168 gallons plus slosh fuel to be carried, in a wing structure that is brimming with LIFT.
- Huge high-lift slotted flaps, allowing a stall speed of just 59 knots… the exact same stall speed as a Cirrus SR-22, to the knot.

This huge lift, huge power, light weight, and long range, make the answer to every mission question you ask the Evolution the same: “No problem”.

Only about 70 of these amazing machines were ever built… few would invest the time and money to get this mission capability.

Blade Element Theory

X-Plane breaks the airplane and propellers mathematically down into many small little pieces, and then computes the air speed, angle and density acting on each piece. From this, the FORCE on each little piece of the airplane and propeller is derived. Next, X-Plane computes the TOTAL forces on the airplane, and using the distance from the center of gravity, the moments on the airplane as well. X-Plane then divides these forces and moments by the mass and moments of inertia to find the linear and angular accelerations. These in turn are converted into velocity and position, thus moving the aircraft to a new location. When you think about it, this it actually what flying is all about.

What type of airplane BEST illustrates this blade element theory in X-Plane? Well, it should be one that does NOT have a fly-by-wire system which often MASK the actual physics of the airplane and hide the natural dynamics from the pilot. The ideal airplane to experience ‘Blade Element Theory’ should be single-engined and propeller-driven. The torque, p-factor, slipstream, and other effects of having a huge spinning prop can all be faithfully re-created. The airplane should have a boatload (planeload?) of power, and low weight, so you can really feel the effect of the prop, and a very minimal autopilot so you really fly the airplane through every inch of the flight.

The Lancair Evolution is the PERFECT candidate.

N844X

N844X, presented here in X-Plane, is **PRECISELY** modeled after the real airplane of the same tail number, built by Austin Meyer, the author of X-Plane.

As well, Austin designed the cockpit in N844X, which is perfectly replicated here as well.

Every detail of the real N844X is so perfectly presented here that if you can master this airplane in the simulator, then you will know every switch, knob, and button in the real airplane… right down to the Velcro mounting-pad for the pens… and the color of those pens that Austin grabbed from an FBO in Vermont to use to write-down clearances.

If you are going to fly this airplane, then you really need to know how to FLY. First note: Take off at 1,200 ft-pounds of torque! Any more than that and you will over-load the prop with that massive 850 hp engine that can surge far beyond this! The prop will open up its blades and stall. Take off with 1,200 ft-pounds of torque and only increase power as the speed builds above 150 knots and the prop can absorb all that power! Climb at 150 knots indicated, cruise at 28,000 ft, fly your approaches at 90 knots.

Welcome to the airplane that can take you… anywhere !

Lancair Evolution N844X Specifications

Engines:		
Model	--	1 × Pratt & Whitney PT6A-42 turboprop aircraft engine
Power	--	850 hp (635 kW)
Fuel:		
Capacity	--	168 U.S. gallons (640 Liters)
Type	--	Jet-A
Burn (cruise)*	--	39 US gallons (148 liters) per hour
Weights and Capacities:		
Max. Takeoff Weight	--	4,300 lbs. / 1,950 kg.
Max. Landing Weight	--	4,200 lbs. / 1,90550 kg.
Empty Operating Weight	--	2,650 lbs. / 1,202 kg.
Useful Payload	--	1,900 lbs. / 862 kg.
Maximum Passengers	--	4
Performance:		
Max. Cruise Speed	--	300 KTAS (true)
Stall Speed	--	61 KIAS (full flap/gear down)
Never Exceed Speed	--	256 KIAS (indicated)
Service Ceiling	--	28,000 ft. / 8,534 m
Rate of Climb	--	4,000 ft. per min / 1,219 m per min
Range	--	1,027 nm
Dimensions:		
Wingspan	--	37 ft. / 11.2 m
Length	--	30 ft. / 9.1 m
Height	--	10 ft. / 3 m

- *Representative value depending on conditions*

Views and Controls

The X-Plane Evolution features a detailed 3-D cockpit with many of the primary controls and systems modeled, including: Flight controls (yoke, rudder pedals, thrust lever, prop lever, condition lever), electrical systems, pneumatic systems, navigation aids, radios, autopilot, interior and exterior lighting, and fuel systems.

This cockpit layout was designed by Austin Meyer for his personal airplane and is authentically simulated in X-Plane. Every button and switch are modelled according to the actual aircraft

Creating “Quick Look” views

Before discussing the controls, we suggest that the pilot establish a series of “Quick Look” views that will be helpful later when interacting with this particular aircraft. If you are not familiar with this technique, more information is available in the X-Plane Desktop Manual.

The following “Quick Look” views are recommended for the X-Plane Evolution, in a situation where the pilot is not using a Virtual Reality (VR) headset, or a head tracking device. To some degree, these correspond (on the keyboard Number Pad) with their physical locations in the cockpit - and are therefore logical and easy to recall later.

Electrical
Switching Panel

Primary
Switching Panel

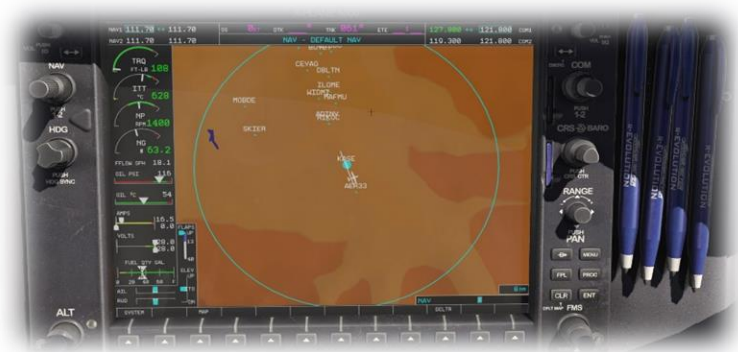
Throttle
Quadrant

Secondary Switching Panel

Primary Flight Display (PFD)

Audio Switching Panel

Multi-Function Display (MFD)



Left Glance View

Forward View

Right Glance View

Operating the controls

This section covers the basic techniques for the operation of the controls that you will encounter in the cockpit of an X-Plane aircraft. Control manipulators are consistent across all X-Plane aircraft. However, the specific illustrations in THIS chapter may differ from YOUR aircraft.

Toggle and Rocker switches are operated with a single click of the mouse. Place the mouse pointer slightly above, or below, the center point of the switch, depending on the direction you intend to move it. A small white arrow is displayed to confirm the intended direction. Click the mouse button to complete the operation.

Levers are operated by assigning a peripheral device to the necessary axes in X-Plane (throttle, prop, mixture etc.). More information is available in the X-Plane Desktop Manual.

Levers may also be operated by clicking and dragging the mouse pointer.

Radio and Navigation frequency rotary dials are grouped together as “twin concentric knobs”. Here, the larger rotary is used to tune the integer portion of the frequency, and the smaller rotary is used to tune the decimal portion. Each works independently, using the same technique, as described above.

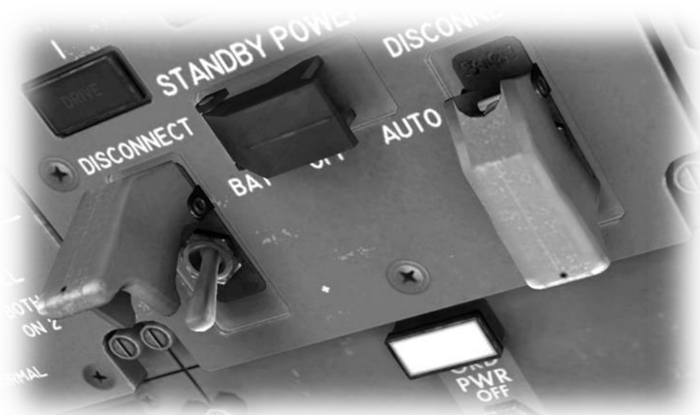
Some rotary dials are operated by positioning the mouse pointer on top of the control, and then a click and drag to the right, or to the left. The same can be accomplished using the mouse wheel - if one is present on your device.

Other rotary controls require finer precision. When the mouse pointer is positioned slightly to the left of such a control, a counter-clockwise arrow appears. This indicates that you are ready to rotate the control counter-clockwise. Correspondingly, a clockwise arrow indicates that you are ready to rotate the control clockwise. After positioning the mouse pointer, changing the frequency in the desired direction is accomplished in two ways:

i) By rolling the mouse wheel forwards, or backwards

ii) By clicking (dragging is not supported here)

Push buttons are operated by pointing and clicking with the mouse.



Guarded switches are used in situations where accidental activation of the switch must be prevented. To operate a guarded switch, the guard must first be opened. Do this by positioning the mouse pointer over the switch until the two vertical white arrows are displayed. Click once. If the switch is currently closed, it will open, and vice-versa. After the guard has been opened, the switch may be operated like a toggle and rocker switch (see earlier in this section).

- Illustration not taken from this aircraft

The Yoke or Sidestick is operated by assigning a peripheral device to the “roll” and “pitch” axes in X-Plane. This is discussed in greater detail later in the guide.

The Rudder Pedals are operated by assigning a peripheral device to the “yaw” axis in X-Plane. If your rudders also support toe braking, create additional assignments to the “left toe brake” and “right toe brake” axes in X-Plane. This is discussed in greater detail later in the guide.

Note that you may also assign keys on your keyboard, or buttons on your external peripheral to move the rudder to the left or right, or to center the rudder.

- Illustration not taken from this aircraft

Assigning peripheral devices

This section of the manual deals with an “ideal” scenario, in terms of the assignment of external computer peripherals to operate the X-Plane Evolution with the highest degree of realism. If you are missing some of these external peripherals, you may elect to choose a different configuration that better suits your hardware.

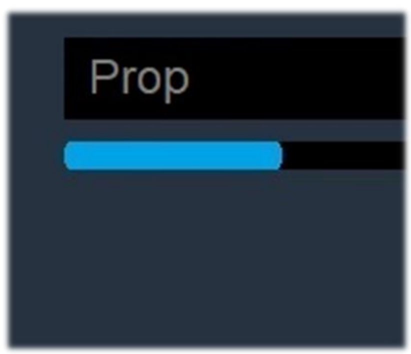
More information is available in the X-Plane Desktop Manual.

This aircraft is equipped with sidesticks, for roll and pitch control.

Assign the lateral axis of your joystick (or yoke) to the “Roll” command in X-Plane, and the vertical axis to the “Pitch” command.

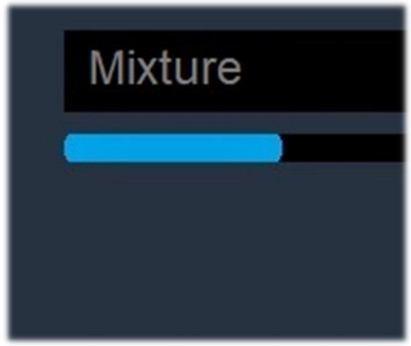
This aircraft is equipped with a single throttle – which controls the torque (power) output by the engine.

Assign the throttle lever on your quadrant to the “Throttle” property in X-Plane.



This aircraft is equipped with a single propeller lever – which controls the propeller RPM.

Assign the propeller lever on your quadrant to the “Prop” property in X-Plane.



This aircraft is equipped with a single condition lever which controls the fuel flow to the engine.

Assign the throttle lever on your quadrant to the “Mixture” property in X-Plane.

This aircraft is equipped with a Flap lever, which controls the deployment of the flaps.

Assign a peripheral lever to the “Flaps” property in X-Plane.

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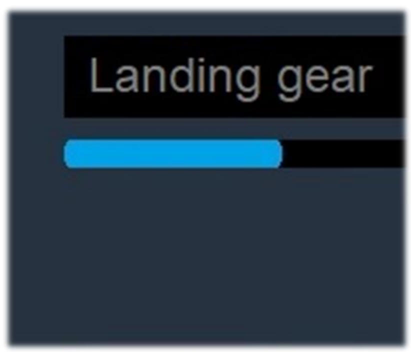

This aircraft is equipped with a Landing Gear lever.

Assign a peripheral lever to the “Landing gear” property in X-Plane.

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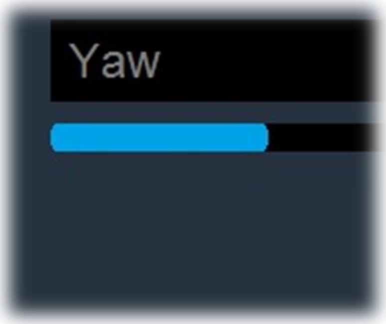


This aircraft has conventional rudder controls, actuated by the rudder pedals.

Assign the yaw axis of your pedals peripheral device (or a joystick axis) to the “yaw” property in X-Plane.

- Illustration not from this aircraft

This aircraft has rudder toe-braking, actuated by the tip of the rudder pedals.

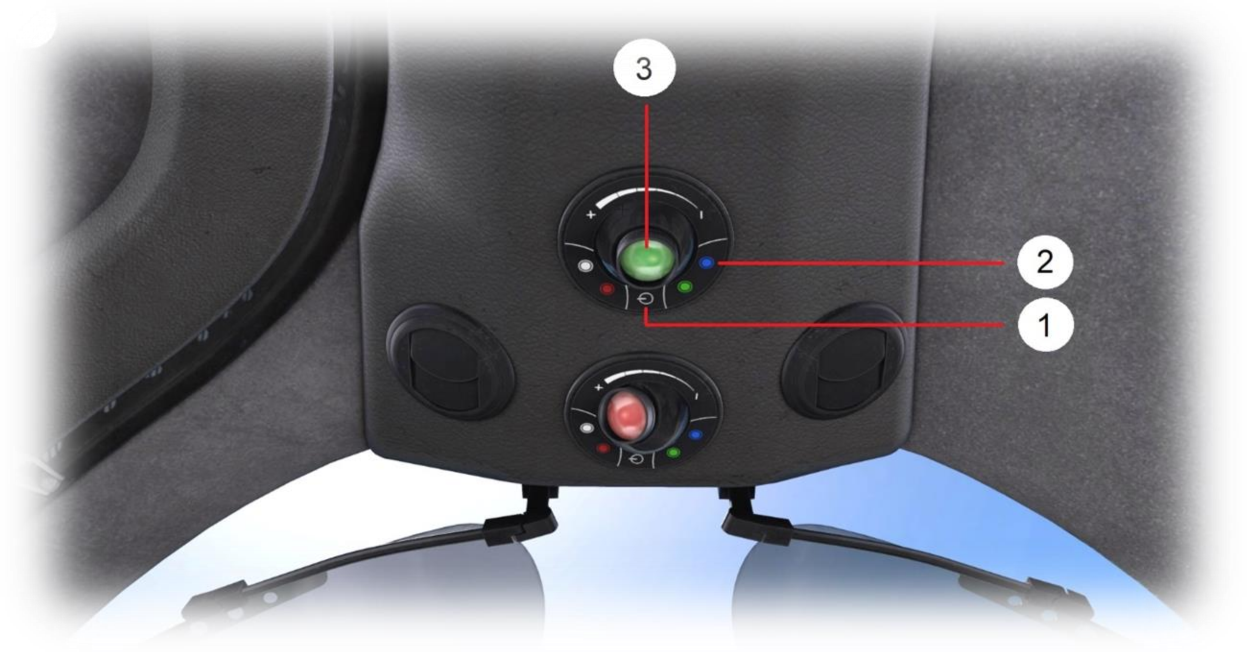
Assign the brake “toe-tipping” motion of each individual pedal (or a joystick axis) to the “left toe brake” and “right toe brake” property in X-Plane.

- Illustration not from this aircraft

A Tour of the Cockpit

In this section of the manual, the cockpit will be broken down into distinct functional areas, and the controls that are featured in those areas will be identified and described. This will assist in locating the necessary instruments and controls later, when working through the aircraft check lists, and flying the aircraft.

Overhead Panel



1	Overhead Light Power (toggle) Button	Click to toggle the overhead-light on and off.
2	Overhead Light Color Button	Click to change the overhead-light color. Options are white, red, green, and blue.
3	Overhead (LED) Light	Each light is directional and may be moved with a mouse-click and drag operation.

Battery and Electrical Panel

Select GND PWR when the aircraft is connected to a ground-based power unit (GPU). The on-board electrical systems will use this as a source of power.

Select BAT 1 to power the aircraft's electrical systems from battery bus 1.

Select BAT 2 to power (or supplement) the aircraft's electrical systems from battery bus 2.

Select GEN to enable the generator to provide power to the aircraft's electrical systems when the engine is running. This aircraft is also equipped with an alternator for redundancy. The generator and alternator are not normally used together.

Select ALT in the event of a generator failure. This enables the alternator that provides power to the aircraft's electrical systems when the engine is running.

Select DC PWR to enable the DC (direct current) electrical bus. This powers devices in the aircraft that utilize DC power (instead of AC).

Systems Panel

Select DOOR SELAS to activate the (inflatable) door seals that provide the necessary integrity for cabin pressurization.

Select IGN to enable the ignition system that uses a high-energy capacitor for engine-start.

Select FUEL PUMP to prime the fuel system during cold-start situations.

Select NAV LTS to activate the (white, red and green) navigation lights.

Select STRB LTS to activate the strobe lights.

Select LAND LTS to activate the landing lights (during takeoff and landing).

Select BLEED AIR to open the bleed-air valve that directs surplus air from the compressor to pressurize the cabin. Cabin pressure is maintained automatically throughout the flight.

Select CBN (cabin) DUMP to de-pressurize the cabin in the event of an emergency descent, smoke contamination, or excessive pressurization differential. The maximum pressure differential (cabin vs ambient) is 6.5 PSID.

Ice and Particle Defence Panel

Select PART SEP to enable the particle separator that removes contaminant particles before they enter the engine air-inlet. Turbine engine performance is compromised when sand, volcanic ash or industrial pollutants are present.

Select PITOT HEAT to warm the pitot-tube that sits underneath the port wing. The pitot-tube uses ram-air pressure to display airspeed to the pilot. The formation of ice can result in unreliable airspeed.

Select PROP HEAT to warm the propellor-blades. This prevents ice forming that can reduce the available thrust.

Select INLET HEAT to warm the engine air-inlet. This prevents ice forming that can reduce the available power generated by the turbine.

Audio Panel

This display manages the active audio sources.

Select COM1 / COM2 / COM3 to enable or disable audio from the COM1 / COM2 /COM3 radios respectively.

Select COM 1 MIC / COM2 MIC / COM3 MIC to enable the microphone associated with the COM1 / COM2 /COM3 radios respectively.

Select NAV1 / NAV2 to enable or disable the audio Morse code identifier for the navigation aid station currently tuned to the NAV 1 / NAV2 radios, respectively.

Select DME to enable or disable the audio Morse code identifier for the Distance Measuring Equipment (DME) tuned to the NAV 1 radio.

Select ADF to enable or disable the audio Morse code identifier for the Automatic Direction Finder (ADF) tuned to the NAV 1 radio.

Select MKR / MUTE to toggle the audio for the inner and outer (approach) marker beacons.

Select HI SENS to toggle the sensitivity of the marker beacon reception (high – illuminated, or normal).

Emergency Locator Transmitter (ELT) Panel

This aircraft is equipped with an emergency-locator transmitter (ELT).

In the event of an accident, an ELT transmits a distress signal on 121.5 and 243.0 MHz frequencies, or 406 MHz for newer devices.

Move the switch to the TEST position to confirm the device is working. Tests may be conducted only in the first five minutes of any hour, and for a maximum of three cycles. A VHF receiver tuned to the appropriate frequency can be used to confirm the signal. On completion, move the switch to the ARM position.

Move the switch to the ARM position to arm the device. In the event an accident occurs, the associated g-force will trigger automatic activation.

Move the switch to the ON position to manually activate the device if the situation warrants this.

Move the switch to the RESET then ARM positions to cease an ongoing transmission.

The LED adjacent to the ELT switch is illuminated when the device is transmitting.

Throttle Quadrant

Throttle Lever:

Controls the torque (power) transmitted by the engine to the propellers. The throttle **does not change** the propeller RPM, which is set using the Propeller Lever.

Propeller Lever:

This aircraft is equipped with a constant speed (and variable pitch) propeller. The RPM is controlled by a "governor", and the desired RPM setting is made using the Propeller Lever. Once the RPM has been set, this remains the same, irrespective of the throttle position.

Condition Lever:

Controls the fuel flow to the engine, as follows:

- Full Forward / High – for flight
- Middle / Low Idle – for taxi operations
- Aft / Fuel Cut-Off – for engine shutdown

Angle of Attack Indicator

The Angle of Attack (AOA) Indicator displays the angle of attack of the leading edge of the wing to the oncoming airflow.

This assists the pilot in avoiding a dangerous attitude that could result in a stall.

The optimum angle of attack is achieved when the yellow LCD 'bars' intersect the 'donut' in the center of the display.

Green bars indicate an angle of attack that is too low.

Red bars indicate an angle of attack that is too high.

The digital display shows the angle of attack in degrees.

Cabin Lighting & Landing Gear Panel

Left Dimmer Rheostat:

Controls the instrument-panel ambient (flood) light intensity.

Right Dimmer Rheostat:

Controls the instrument-panel back-lighting intensity.

Landing Gear Lever:

Select the UP position to retract the landing gear.

Select the DOWN position to extend the landing gear.

The green LEDs indicate the nosewheel, left and right landing gear are extended.

The yellow LEDs indicate the landing gear is transitioning.

Autopilot Panel

The Autopilot Control Panel provides the pilot with the option to engage the autopilot in one or more of the available modes.

Autopilot operation is described in detail in the section entitled: [Autopilot Operation](#)

Cabin Pressurization Display

This display is used together with the aircraft's pressurization system (activated using the BLEED AIR switch).

Cabin Altitude:

This is a measure of the atmospheric pressure inside the aircraft. A reading of 8,000 feet, for example, would be equivalent to standing on the ground at an altitude of 8,000 ft MSL

Differential Pressure:

This is a measure of the relative pressure of the air inside, and outside the cabin. This information is needed to ensure the door-seals are not stressed beyond their design limits of 6.5 PSI (differential).

Parking Brake

This lever toggles the parking brake on / off/

Pull to set. Push to release.

Note: The parking brake will not keep the aircraft stationary with a throttle setting that exceeds idle.

G1000 Avionics Panels

Primary Flight Display (PFD)

The Lancair Evolution features the Garmin G1000 avionics system, represented here by the X-Plane 'X1000' version.

The X1000 avionics system is comprised of a Primary Flight Display (PFD) on the left, and a Multi-Function Display (MFD) on the right.

The Primary Flight Display incorporates airspeed, altitude, and attitude information, and replaces the traditional 'six-pack' gauges found on older aircraft.

The PFD also incorporates capability for flight planning, route display, and radio operations.

A detailed manual for the operation of the X1000 avionics system is available here:

https://x-plane.com/manuals/G1000_Manual.pdf

Multi-Function Display (MFD)

The Lancair Evolution features the Garmin G1000 avionics system, represented here by the X-Plane ‘X1000’ version.

The X1000 avionics system is comprised of a Primary Flight Display (PFD) on the left, and a Multi-Function Display (MFD) on the right.

The Multi-Function Display incorporates flight-plan input, coupled with GPS, VOR and ILS navigation capability and map display.

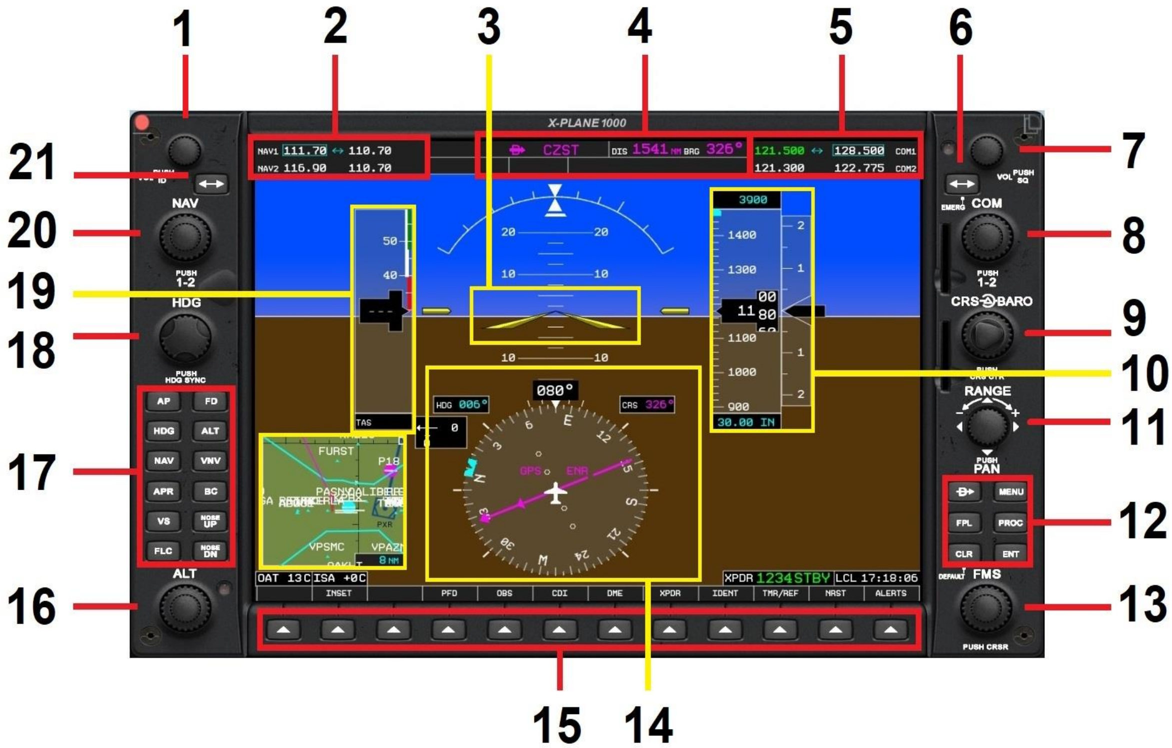
The MFD also incorporates an Engine Indication System (EIS) that displays thrust and diagnostic information that is customized to the engine configuration of the host aircraft.

A detailed manual for the operation of the X1000 avionics system is available here:

https://x-plane.com/manuals/G1000_Manual.pdf

[PFD] Controls & Features

This section identifies the controls and features of the X1000 PFD (Primary Flight Display). A detailed manual for the operation of the X1000 avionics system is available here: https://x-plane.com/manuals/G1000_Manual.pdf



1	**NAV Audio Squelch**	Toggles the Morse code audio identifier (of the selected NAV radio frequency) ON and OFF. Note that when toggling to 'Off', the Morse will finish its cycle before the audio is cut.
2	**Active & Stand-by NAV1 and NAV2 Frequencies**	This area of the display panel features the active and stand-by frequencies for the NAV1 and NAV2 radios. The active frequency is on the right, and the stand-by frequency is on the left.
3	**Attitude Indicator**	Displays the aircraft's attitude, relative to the horizon. In Flight Director mode, displays an inverted-V style Flight Director

4	**Next Waypoint**	This area of the display panel features the next waypoint in your flight plan, together with the distance and bearing to that waypoint from the current location.
5	**Active & Stand-by COM1 and COM Frequencies**	This area of the display panel features the active and stand-by frequencies for the COM1 and COM2 radios. The active frequency is on the left, and the stand-by frequency is on the right.
6	**COM Frequency Toggle**	Toggles between the active and stand-by COM1 or COM2 radio frequency.
7	**COM Audio Squelch**	Toggles the audio of the selected COM radio frequency ON and OFF. Note that when toggling to 'Off', the message will finish before the audio is cut.
8	**COM Rotary**	Click the center of this control to switch between COM1 and COM2 in the 'Active & Standby COM Frequencies' area. Use the outer and inner rotary controls to adjust the numeric and decimal portion of the stand-by COM frequency respectively.
9	**CRS/BARO Rotary**	Use the outer rotary control to set the altimeter barometric pressure. Use the inner rotary control to adjust the CDI (Course Deviation Indicator) when the HSI is in VOR/LOC or GPS-OBS mode. Pressing the inner rotary will reset the selected course to the bearing or the localizer front course, depending on selected navigation source.

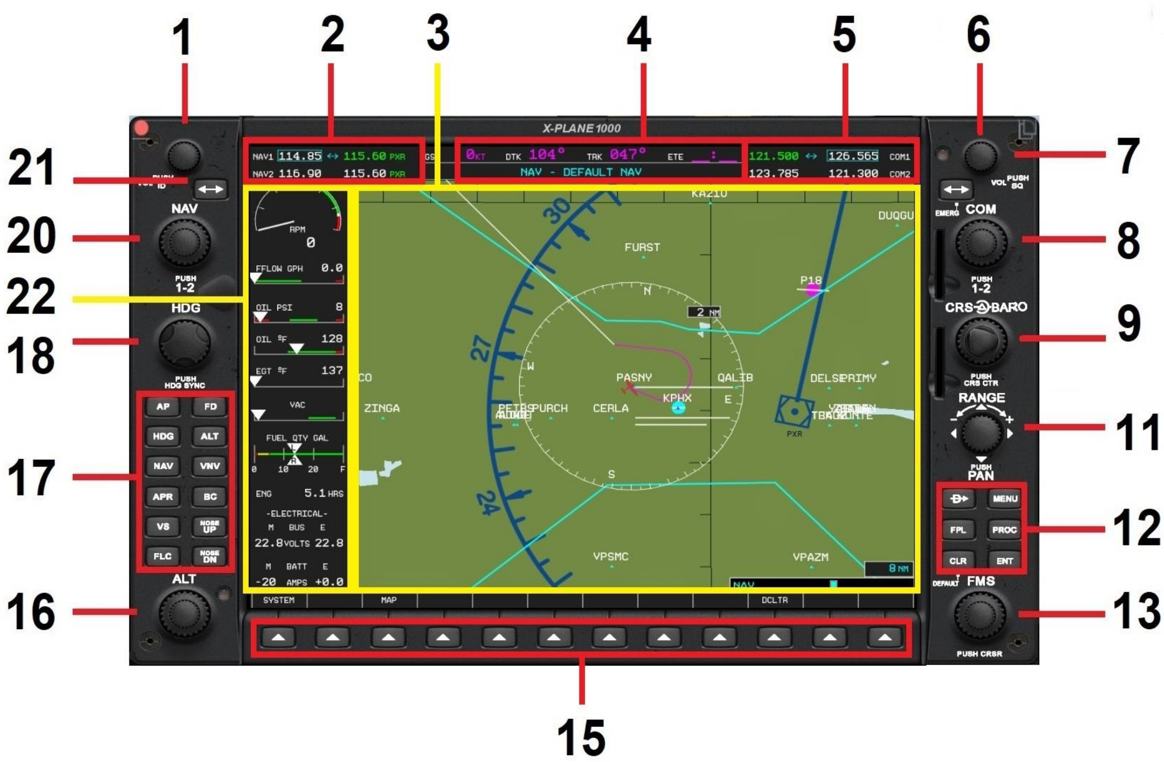
10	**Altimeter**	Displays current altitude, Baro Minimum Reference Altitude, Autopilot Selected Altitude, Vertical Speed, and Barometric Altimeter Setting.
11	**Joystick**	This rotary control adjusts the map range (zoom level) display). Rotate clockwise to zoom out, and counterclockwise to zoom in. Push in the center to activate or de-activate panning.
12	**Flight Plan Key Group**	Direct-to Key: Used to establish a direct course to a selected waypoint, or Map Pointer position. FPL Key: Invokes the Flight Plan Page, to create or edit the active flight plan. CLR Key: Cancel or erase an entry. Click and HOLD this key to clear pages from the main display. MENU Key – Displays menu of options that is context-driven. PROC Key – Selects approaches, departures and arrivals associated with a waypoint in the flight plan. ENT Key – Confirms the current selection or operation.
13	**FMS Rotary**	Click the center of this control to activate the flight plan cursor (when the Flight Plan Page is displayed). When viewing the flight plan, use the outer rotary to SELECT the next or previous waypoint. Use the inner rotary to commence input of a new waypoint, and to change each character in the waypoint identifier. Use the outer rotary to move to the next or previous character within the waypoint identifier.

14	**Horizontal Situation Indicator (HSI)**	Displays the (magnetic) heading currently being flown. Also supported is an adjustable heading bug used together with the autopilot (in HDG mode), and a course indicator (GPS flight plan, or a VOR). Bearing pointers can also be displayed here.
15	**Soft Keys**	Context-driven keys. The function of these keys will depend on the action being performed by the pilot.
16	**ALT Rotary**	Used to select the Autopilot Selected Altitude (displayed above the altimeter). The Autopilot Selected Altitude is used by the Autopilot in certain modes and operations, such as altitude hold or altitude capture. The outer rotary increments or decrements in units of 1,000 feet. The inner rotary increments or decrements in units of 100 feet.
17	**Autopilot Key Group**	Autopilot mode control – see Autopilot Panel
18	**HDG Rotary**	Used to a control the heading bug which forms part of the HSI. Click the center of this rotary to synchronize the heading bug with the current heading. Click the rotary at the 9-o'clock position to move the heading bug clockwise, and the 3-o'clock position to move the heading bug counter-clockwise.

19	**Airspeed Indicator**	Displays the Airspeed in knots (relative to the air around the aircraft). Numeric labels are shown at intervals of 10 knots. Minor increments are shown at intervals of five knots. A color-coded speed range is also displayed, which differs for individual aircraft. The colors denote flaps operating range (white), normal operating range (green), caution range, and never-exceed speed (red). A red range is also present for airspeeds that are dangerously low. On twin-engine aircraft, a red mark for V_{MC} and a blue mark for V_{YSE} will be displayed on the speed tape.
20	**NAV Rotary**	Click the center of this control to switch between COM1 and COM2 in the 'Active & Standby COM Frequencies' area. Use the outer and inner rotary controls to adjust the numeric and decimal portion of the stand-by NAV frequency respectively.
21	**NAV Frequency Toggle**	Toggles between the active and stand-by COM1 or COM2 radio frequency.

[MFD] Controls & Features

This section identifies the controls and features of the X1000 MFD (Multi-Function Display). A detailed manual for the operation of the X1000 avionics system is available here: https://x-plane.com/manuals/G1000_Manual.pdf



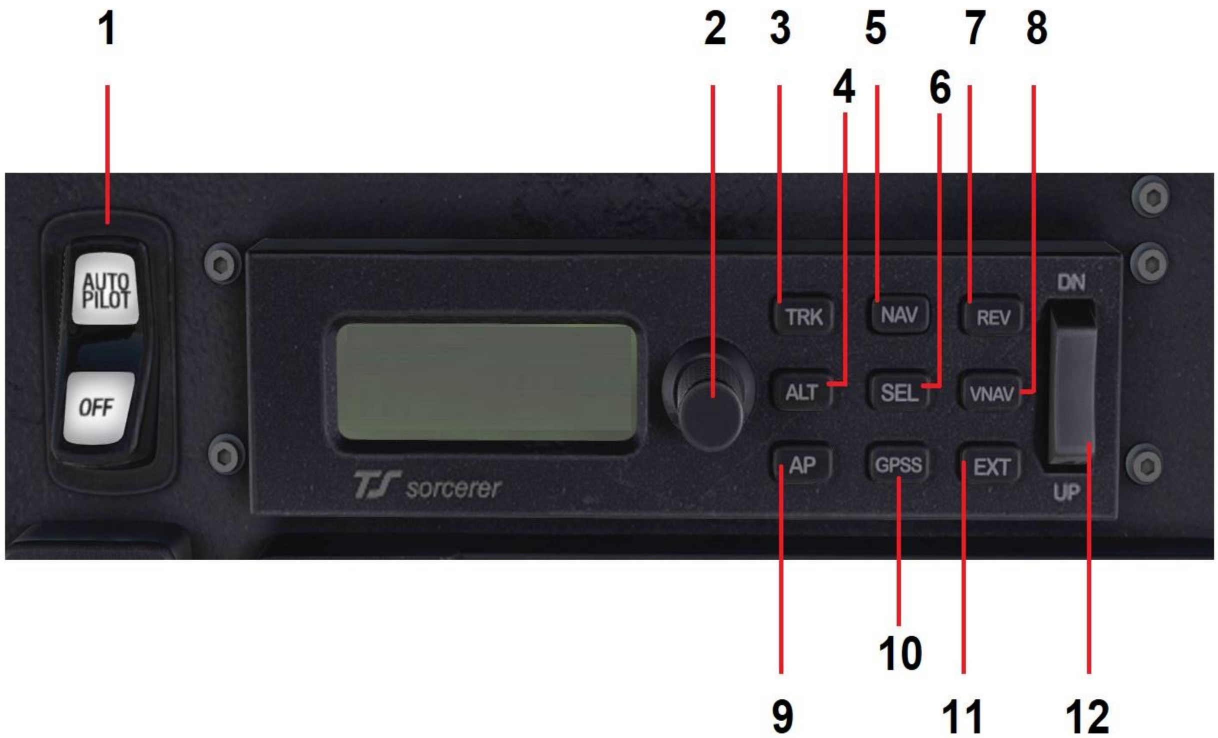
1	**NAV Audio Squelch**	Toggles the Morse code audio identifier (of the selected NAV radio frequency) ON and OFF. Note that when toggling to 'Off', the Morse will finish its cycle before the audio is cut.
2	**Active & Stand-by NAV1 and NAV2 Frequencies**	This area of the display panel features the active and stand-by frequencies for the NAV1 and NAV2 radios. The active frequency is on the right, and the stand-by frequency is on the left.

3	**Navigation Map**	The Navigation Map displays aviation data (airports, VORs, airways, airspaces), geographic data (cities, lakes, highways, borders), topographic data (map shading indicating elevation), and hazard data (traffic, terrain, weather)
4	**Data Fields**	This area of the display panel shows information pertaining the activate navigation leg. It shows ground speed (GS), desired track (DTK) to the active waypoint, ground track (TRK) and estimated time enroute (ETE) to the active waypoint.
5	**Active & Stand-by COM1 and COM Frequencies**	This area of the display panel features the active and stand-by frequencies for the COM1 and COM2 radios. The active frequency is on the left, and the stand-by frequency is on the right.
6	**COM Frequency Toggle**	Toggles between the active and stand-by COM1 or COM2 radio frequency.
7	**COM Audio Squelch**	Toggles the audio of the selected COM radio frequency ON and OFF. Note that when toggling to 'Off', the message will finish before the audio is cut.
8	**COM Rotary**	Click the center of this control to switch between COM1 and COM2 in the 'Active & Standby COM Frequencies' area. Use the outer and inner rotary controls to adjust the numeric and decimal portion of the stand-by COM frequency respectively.
9	**CRS/BARO Control**	Use the outer rotary control to set the altimeter barometric pressure. Use the inner rotary control to adjust the CDI (Course Deviation Indicator) when the HSI is in VOR/LOC or GPS-OBS mode. Pressing the inner rotary will reset the selected course to the bearing or the localizer front course, depending on selected navigation source.

11	**Joystick**	This rotary control adjusts the map range (zoom level) display). Rotate clockwise to zoom out, and counterclockwise to zoom in. Push in the center to activate or de-activate panning.
12	**Flight Plan Key Group**	Direct-to Key: Used to establish a direct course to a selected waypoint, or Map Pointer position. FPL Key: Invokes the Flight Plan Page, to create or edit the active flight plan. CLR Key: Cancel or erase an entry. Click and HOLD this key to clear pages from the main display. MENU Key – Displays menu of options that is context-driven. PROC Key – Selects approaches, departures and arrivals associated with a waypoint in the flight plan. ENT Key – Confirms the current selection or operation.
13	**FMS Rotary**	Click the center of this control to activate the flight plan cursor (when the Flight Plan Page is displayed). When viewing the flight plan, use the outer rotary to SELECT the next or previous waypoint. Use the inner rotary to commence input of a new waypoint, and to change each character in the waypoint identifier. User the outer rotary to move to the next or previous character within the waypoint identifier.
15	**Soft Keys**	Context-driven keys. The function of these keys will depend on the action being performed by the pilot.

16	**ALT Rotary**	Used to select the Autopilot Selected Altitude (displayed above the altimeter). The Autopilot Selected Altitude is used by the Autopilot in certain modes and operations, such as altitude hold or altitude capture. The outer rotary increments or decrements in units of 1,000 feet. The inner rotary increments or decrements in units of 100 feet.
17	**Autopilot Key Group**	Autopilot mode control – see Autopilot Panel
18	**HDG Rotary**	Used to a control the heading bug which forms part of the HSI. Click the center of this rotary to synchronize the heading bug with the current heading. Click the rotary at the 9-o'clock position to move the heading bug clockwise, and the 3-o'clock position to move the heading bug counter-clockwise.
20	**NAV Rotary**	Click the center of this control to switch between COM1 and COM2 in the 'Active & Standby COM Frequencies' area. Use the outer and inner rotary controls to adjust the numeric and decimal portion of the stand-by NAV frequency respectively.
21	**NAV Frequency Toggle**	Toggles between the active and stand-by COM1 or COM2 radio frequency.
22	**Engine Indication System (EIS)**	Displays dial gauge(s), horizontal bar indicators, and other readouts for critical engine and electrical systems. This is context-driven and depends on the aircraft-type. See: [MFD] Engine Indication System (EIS)

Autopilot Operation



1	**Power Switch**	
2	**Altitude Track Rotary**	Used together with the SEL (Altitude Select mode) button (6) and Vertical Speed Switch (12) to pre-select a desired altitude. Used together with the TRK (Track mode) button to pre-select a desired heading.
3	**TRK (Track) Mode Button**	Engages Track mode. The aircraft will steer according to the selected heading (see 2). Note: On the LCD panel, the graphic 'TRK' is always displayed even if Track Mode is OFF. A detailed manual for the operation of the X1000 avionics system is available here: https://x-plane.com/manuals/G1000_Manual.pdf
4	**ALT (Altitude) Button**	Levels the aircraft at the current altitude. Note: On the LCD panel, the graphic 'ALT' is always displayed even if Altitude Mode is OFF.
5	**NAV (Navigation) Mode Button**	Engages NAV mode. The aircraft will follow a flight plan, ILS Localizer, or VOR Radial. A detailed manual for the operation of the X1000 avionics system is available here: https://x-plane.com/manuals/G1000_Manual.pdf
6	**SEL (Altitude Select) Button**	Used together with the Altitude Rotary (2) and Vertical Speed Switch (12) to ascend or descend to a pre-selected altitude.

7	**REV (ILS Reverse Course)**	The aircraft will follow the back-course of an ILS Localizer when selected using the G1000 PFD. A detailed manual for the operation of the X1000 avionics system is available here: https://x-plane.com/manuals/G1000_Manual.pdf
8	**VNAV Mode Button**	Engages VNAV mode. The aircraft will adhere to the vertical component of a flight plan input using the G1000 PFD. A detailed manual for the operation of the X1000 avionics system is available here: https://x-plane.com/manuals/G1000_Manual.pdf
9	**AP Button**	Used to couple, or disable the autopilot.
10	**GPSS (GPS Steering) Mode Button**	Engages GPS Steering mode. The aircraft will steer towards the next waypoint. A detailed manual for the operation of the X1000 avionics system is available here: https://x-plane.com/manuals/G1000_Manual.pdf
11	**EXT Button**	Not modelled.
12	**Vertical Speed (Rocker) Switch**	Used together with SEL (Altitude Select) mode to control the vertical speed when a pre-selected altitude is in effect.

ILS Approach

An **Instrument Landing System** (ILS) is a ground-based instrument **approach** system that provides precision lateral and vertical guidance to an aircraft approaching and landing on a runway, using a combination of radio signals and, in many cases, high-intensity lighting arrays to enable a safe landing during instrument conditions. The system provides the pilot with a ‘localizer’ (for lateral guidance) and a ‘glideslope’ for vertical guidance.

Set the Nav1 or Nav2 frequency for the ILS approach

- Click the CENTER of the NAV Rotary to select either NAV1 or NAV2.
- Click the NAV Outer Rotary at the 3 O’clock or 9 O’clock position to increment/decrement the frequency - numeric portion.
- Click the NAV Inner Rotary at the 3 O’clock or 9 O’clock position to increment/decrement the frequency - decimal portion.
- Click the NAV Frequency Toggle Key to swap the standby and active NAV frequency.

The Course Deviation Indicator (CDI)

If the ILS frequency was tuned to NAV1, click the CDI button once to select LOC1. If the ILS frequency was tuned to NAV2, click the CDI button again, to select LOC2.

With the appropriate selection made (LOC1 or LOC2), the ILS localizer course deviation indicator (CDI) is superimposed on the Horizontal Situation Indicator (HSI).

Steer a course to intercept the localizer. If this is displayed to the left of the aircraft (within the HSI), steer left. If this is displayed to the right of the aircraft, steer right. In the example above, the aircraft is currently to the left of the localizer - the pilot must steer right to intercept.

The Glide Slope Indicator and Vertical Speed Pointer

Climb, or descend, to intercept the glideslope. If the Glide Slope Indicator (1) is above center, you are low, and should increase the rate of ascent. If the Glide Slope Indicator (1) is below center, you are high, and should increase the rate of descent.

The Vertical Speed Pointer (2) indicates to the pilot if the aircraft is currently ascending (above center) or descending (below center). The value displayed inside is the current rate of ascent, or descent, in feet per minute.

In the example above, the aircraft is currently above the glideslope and descending at a rate of 200 feet per minute.

Autopilot Assisted ILS Approach

After following the steps earlier in this chapter to establish an ILS approach, the pilot may elect for the autopilot to execute this. With the autopilot armed (AP button), and in Navigation mode (NAV button), the autopilot will follow the localizer and glideslope.

However, during the approach the pilot must maintain the appropriate airspeed manually using the throttle. At the runway threshold the pilot should dis-engage the autopilot (AP button) and conduct a manual flare and braking maneuver.

Flight Planning

Flight planning is the process of determining a route from origin to destination that considers fuel requirements, terrain avoidance, Air Traffic Control, aircraft performance, airspace restrictions and notices to airmen (NOTAMS).

General information about flight plans is available on Wikipedia at http://en.wikipedia.org/wiki/Flight_planning

Flight plans can be generated by onboard computers if the aircraft is suitably equipped. If not, simulation pilots may elect to use an online flight planner. A web search for the phrase “Flight Planner” will yield a great many options, many of which are free services.

A good online flight planner will utilize the origin and destination airports, together with the aircraft type and equipment, the weather conditions, the chosen cruise altitude, known restrictions along the route, current NOTAMS, and other factors to generate a suitable flight plan. The waypoints incorporated into the flight plan can be subsequently input into the aircraft’s Flight Management Computer (FMS), or Global Positioning System (GPS). Some online flight planners provide the option to save the plan as an X-Plane compatible file, with an ‘fms’ extension. A saved flight plan can be loaded into the GPS or Flight Management System (FMS).

It is recommended the pilot generate a flight plan for the chosen route before using the FMS or GPS units.

Instructions for operating the Laminar Research FMS and GPS units can be found in separate (dedicated) manuals.

Weight & Balance

THIS CHAPTER IS DELIBERATELY LEFT BLANK PENDING REVISIONS TO WEIGHT AND BALANCE UI EXPECTED IN XP12.

Checklists

The following check lists are designed with the convenience of the simulation pilot in mind and customized to the X-Plane Lancair Evolution. These differ from those of the real aircraft.

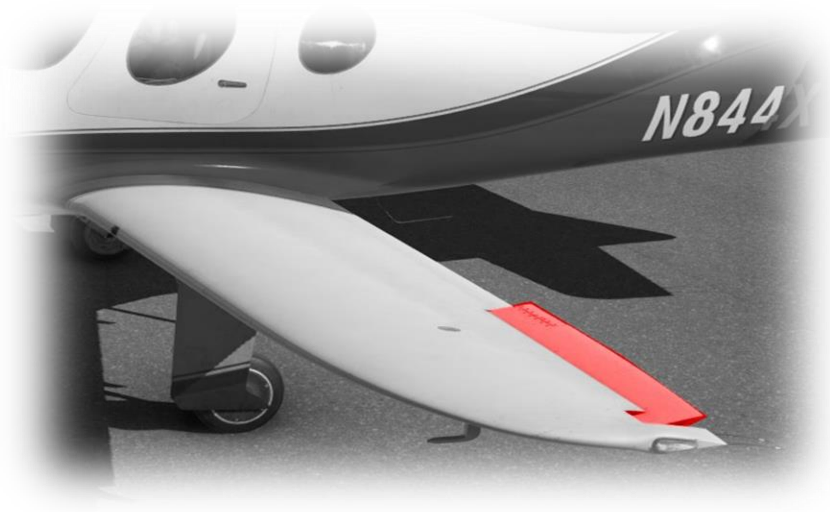
Pre-Flight Exterior Inspection

A Pre-Flight Inspection should always precede flight in any aircraft. The purpose of this inspection is to ensure the aircraft is in a state of readiness for the upcoming flight.

In X-Plane, a pre-flight inspection is not merely undertaken to simulate reality, but does in fact have real purpose, because the control surfaces of the aircraft interact directly with the airflow over and around them, just as in real life. As such, correct movement of all control surfaces is necessary for normal flight.

Hold roll axis at full deflection.

Visually check corresponding movement of ailerons.

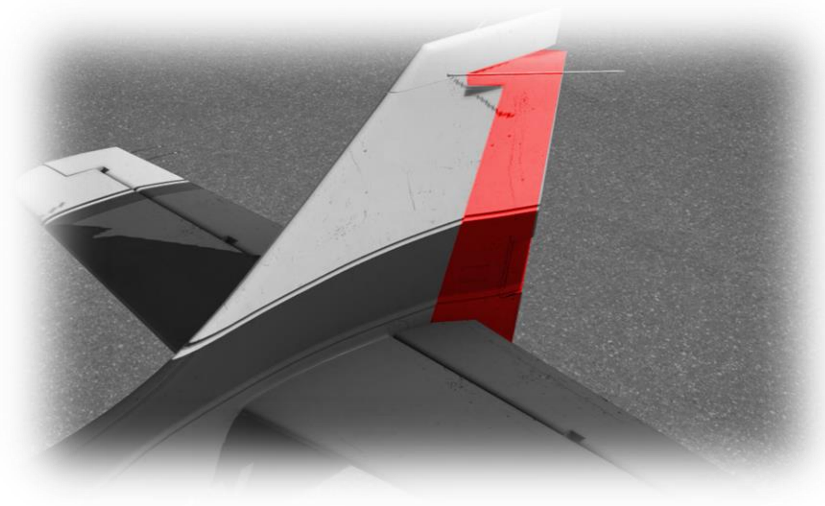


Hold pitch axis at full deflection.

Visually check corresponding movement of elevators.

Hold yaw axis at full deflection.

Visually check corresponding movement of rudder.



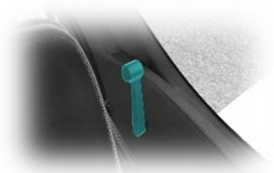
Cold and Dark to Engine Start

The following check list is a sub-set of the real procedures, and includes only the essential steps leading to engine start:

> A video clip featuring the engine startup for this actual aircraft can be found [here]

CABIN DOOR – CLOSED

Hint: When <u>inside</u> aircraft, use click-spot on interior door handle to open or close cabin door.



CONDITION LEVER - CUTOFF

PROPELLER LEVER - FEATHER

POWER LEVER - IDLE

BATTERY 1 - ON

FUEL QUANTITY - CHECK

STROBES – ON

Note: This aircraft does not have a beacon light. The FAA allows the use of strobe lights in place of a beacon, to warn persons in the area that engine start is imminent.

IGNITION – ON

FUEL PUMP – ON

ENGINE START – PRESS AND HOLD

CHECK OIL PRESSURE MOVES OFF ZERO

WAIT FOR NG OF 13 % OR GREATER

CONDITION LEVER – LOW IDLE

RELEASE ENGINE START

(WHEN ENGINE IS RUNNING)

IGNITION – OFF

FUEL PUMP – OFF

STROBE LIGHTS – AS REQUIRED

CABIN DUMP – CHECK OFF

DOOR SEALS - ON

BLEED AIR - ON

CONDITION LEVER – FULL FORWARD

(HIGH IDLE)

GENERATOR - ON

DC POWER – ON

PROPELLER LEVER – FULL FORWARD

(HIGH RPM)

Before Taxi

ELEVATOR TRIM – TAKEOFF

Hint: This aircraft does not feature a trim wheel.

Map a peripheral device to the 'Trim Up' and 'Trim Down' commands to move the elevator trim.

Use the indicator on the MFD to determine trim position.

FLIGHT CONTROLS – CHECKED

(Pitch / Roll / Yaw)

See: Assigning peripheral devices

NAV LIGHTS – ON

LANDING LIGHTS – ON

Note: This aircraft does not have separate taxi and landing lights. Landing lights are therefore used for both purposes.

TRANSPONDER – ON

PARKING BRAKE – OFF

Before Takeoff

FLAPS – SET (25 Degrees)	
ALTIMETER - SET	

TRANSPONDER – ALT

After Takeoff

LANDING GEAR – UP

FLAPS – RETRACTED

THRUST – SET AS REQUIRED

PROPELLER RPM – SET AS REQUIED

Cruise

LANDING LIGHTS - OFF

ALTIMETER - SET

Before Landing

ALTIMETER - SET

LANDING LIGHTS - ON

PROPELLER LEVER – FULL FORWARD

(HIGH RPM)

Landing

FLAPS – SET (50 Degrees)	
LANDING GEAR – DOWN	

After Landing

FLAPS – RETRACTED	
TRANSPONDER – ON	
CONDITION LEVER – LOW IDLE	

Parking

PARKING BRAKE – ON

DC POWER – OFF

GENERATOR - OFF

BLEED AIR - OFF

CONDITION LEVER – CUT OFF

LANDING LIGHTS – OFF

STROBES – OFF

NAV LIGHTS - OFF

TRANSPONDER – STBY

DOOR SEALS - OFF

BATTERY 1 - OFF

Operating-Speeds

Rotate Speed *	Vr	77 KIAS
Stall Speed, Flaps 100%, Power Off	Vso	61 KIAS
Minimum Controllable Speed	Vs	76 KIAS
Best Angle of Climb	Vx	85 KIAS
Best Rate of Climb	Vy	105 KIAS
Best Glide Speed	Vbg	110 KIAS
Maximum flaps Extended Speed - (50% / 100%)	Vfe	160 / 140 KIAS
Maximum Maneuvering Speed	Va	190 KIAS
Maximum Structural Speed	Vno	220 KIAS
Never Exceed Speed	Vne	256 KIAS
Enroute Climb Speed		85-105 KIAS
Maximum Landing Gear Operating Speed	Vlo	150 KIAS
Maximum Demonstrated Crosswind		25 IAS

- *Representative value depending on conditions*