FSR500

Aircraft Manual

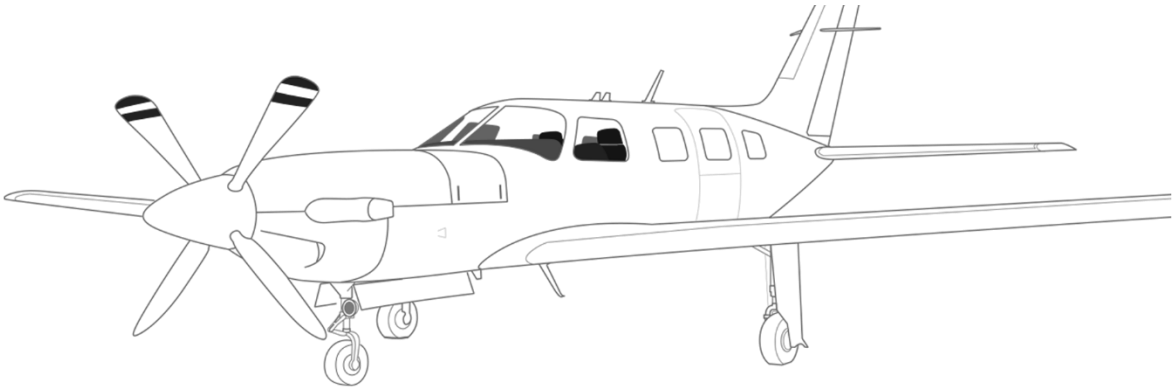
FS Reborn

FSR500

by

Aircraft Manual

V1.011



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Manual words and graphic design by AlpineBRAVO

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1. Introduction

The FSR500 experience

Welcome and thank you for buying the **FSR500** by FSReborn!

Bringing this aircraft to Microsoft Flight Simulator 2020 has been a work of passion for me and the team here at FS Reborn and everything in this aircraft has been made with love and attention to detail. For me and many of my team of testers, flightsim is in our bones. We wanted to bring the community something unique – a high fidelity aircraft with great system depth allowing core simmers to closely follow real-world procedures, but also something that was intuitive, highly configurable, and fun to fly.

The **FSR500** has been developed using the latest tools available in MSFS, including the latest Computational Fluid Dynamics (CFD) flight modelling. As it does not rely on any external software modules, it will be available to all MSFS pilots – both on PC and Xbox. Many of the core systems, such as the turboprop operating temperatures and cabin pressurisation system have been custom coded and are unique to the **FSR500.**

The development of the **FSR500** was made in partnership with pilots who fly single engine turboprops of a similar specification in real-life and the aircraft is as faithful as possible to the systems and performance typical for this class of light, pressurised cabin single-engine turboprops. Development of the **FSR500** will continue, with more exciting features to come in future versions.

Meanwhile, enjoy the unique experience of flying this luxurious, state-of-the-art aircraft – from the moment the VIP passengers roll-up in their limo, to smooth and intuitive flight planning with fully integrated Navigraph flight planning, the whine of the PT6A turbine with accurate start logic and temperatures (and a real risk of a 'hot start' if you have realism on!), the crisp and lively handling that makes hand-flying it a joy all the way up to cruise at FL300 and much, much, more giving a truly immersive start-to-end **FSR500** experience.

Raul, CEO FSReborn

FSReborn – what makes us different?

FSReborn is committed to bringing the best-possible aircraft to MSFS, to as wide an audience of pilots as possible. By making our aircraft both high-fidelity, but also highly configurable, we want everybody to be able to enjoy an FSReborn aircraft, no matter your gaming platform or prior flight sim experience.

Disclaimer

This aircraft has been developed by FSReborn solely for home entertainment purposes only and should not be used for real-world aviation training.

Using this manual

This manual is part pilot's guide and part reference manual. Designed to give you all the information you need to fly the **FSR500**, this is where you will find key information on the aircraft, its main systems, procedures, and performance data. The **Quick Reference Handbook** provides most of the key tables and checklists in one document, but pilots opting to use realism must be familiar with the contents of this aircraft manual.

This is a *big* manual as befits a complex aircraft like the **FSR500**. But don't worry you don't need to read it all to enjoy the aircraft! Just pick and choose the sections as you need them:

- If you are new to the aircraft and just want to get flying, use the official **Tutorial Videos** or the **Quick Start** guide below.
- **Section 2** will get your controls configured and **Section 3** gives some of the essential performance data like maximum range and speed etc.
- The EFB is intuitive to use, but **Section 4** covers the more subtle aspects.
- The cockpit layout is clean and intuitive too, but **Section 5** will give you the complete walk-though of what switch does what.
- If you are new to the G1000NXi avionics, you will want to check out **Section 7**. This also details how the autopilot functions as well as the radios (handy for on-line flying).
- **Section 9** will give you tips on how to start the engine without breaking it and how to best fly the aircraft.
- The **FSR500** comes with fully interactive in-sim checklists, but if you prefer a paper version, then **Section 10** has the normal checklists you can print out.
- If you want to fly with failures and start to really maximise the realism, then you will want to study **Section 6** – this gets into the detail of the aircraft systems. You will also need to study **Section 11** on failures and the emergency checklists.
- For faithful replication of real-world aeronautical decision making and planning, check out the suggestions in **Section 8** on Mission Planning. This shares some thoughts on planning for weather and other factors.
- If you like your numbers and want to know how many digital gallons of JET-A1 you burned, then the performance tables in **Annex A** are for you.
- Home cockpit builders or those with external devices will find all the L:VARS and EVENTS used in **Annex B** as well as some suggestions on how to configure the throttle using SPAD.next.

The design is intended to be easy-to-read and works well with the Adobe Acrobat PDF viewer - even on a phone in Liquid mode. You can also find your way around using the clickable table of contents, or bookmarks if using Acrobat. We've not included an index as you can find anything specific with the search function. Some parts of the manual such as the normal and emergency checklists are designed to be printed out.

Even with such a comprehensive manual as this, the **FSR500** is a hi-fidelity model, and it cannot cover every system or related aspect of aviation. A full explanation of the G1000NXi would probably add an extra 80 pages! For more in-depth information there are many excellent real-world sources of information.

Where possible we try to avoid jargon, but aviation is a technical subject and some is unavoidable. If you come across an unfamiliar term, the internet is your friend. The excellent Skybrary has simple explanations for just about anything aviation related.

When referring to an MSFS setting this will be denoted (for example) as:

MSFS>WORLD MAP>AIRCRAFT>CUSTOMIZATION

- When referring to an MSFS control option, this will be denoted (for example) as:

THROTTLE INC

- When referring to in real life aviation systems, procedures or behaviour, this will be flagged as 'IRL' (when not obvious).
- When referring to MSFS simulated systems, procedures or behaviour this will be flagged as 'sim' (if not obvious).
- Some features/behaviours are limited by the core MSFS code used to model aircraft through the MSFS Software Development Kit (SDK). These are noted as an 'SDK limitation' when core code does not allow the implementation of an IRL behaviour or system or what has described in this manual.
- Notes and Tips will be highlighted at various points with a blue bordered text box.
- Cautions related to aircraft operation are noted in an amber bordered text box.
- Warnings related to critical aircraft operation or procedure that may lead to a failure or aircraft crash are highlighted with a red bordered text box.

Note

When describing systems and processes this manual assumes that all FSR realism settings have been enabled when describing the expected behaviour of the aircraft unless specifically noted otherwise

Official Video Tutorials

If you don't like long manuals like this and want to get started flying, the best thing is to check out our official **FSR500** tutorials here:

Flight deck orientation

Before starting engine & engine start

Before taxi, run-up &before take-off

Flight Plan, Take-Off, Cruise Climb, Cruise & descent

Approach and Landing

Support

Support is available from the FSReborn Discord server – you can join here. Alternatively, you can send us an email via support@fsreborn.com or you can also visit our website www.FSReborn.com for more information about us and other means to contact us.

Nearly all support questions have a simple answer and the most common issues you are likely to encounter will be covered in this manual. Before raising a support question please:

- Check this manual or the video tutorials, in particular the FAQs and Known Issues sections
- Do a search in the FSR Discord server – your question may have already been asked and answered.

General support for MSFS can be found from Microsoft here: https://forums.flightsimulator.com/

G1000NXi support

The **FSR500** uses a custom modification of the stock Garmin G1000NXi avionics suite as developed by Working Title for Microsoft. As a result, many core features and behaviour of the G1000NXi in the **FSR500** are dependent on the latest build by Working Title and specific issues and support for G1000NXi can be found on the Working Title Discord or the official MSFS user forums.

> **Note**
>
> No additional MSFS Marketplace packages or mods are required to use the G1000NXi.

Xbox Optimisation

FSReborn are very excited to bring this high-fidelity aircraft to the MSFS Xbox community with the v1.011 release. The **FSR500** does have many custom features and testing has shown that it places demands on Xbox Series-S platforms in particular that can, without performance optimisation, lead to 'Avionics Screen Blackouts' (ABO). This is due to memory limitations inherent in this particular platform and how scenery developers are implementing LODs ('Levels of Detail') in custom sceneries. The problem seems to occur even more with World Update 15 (Nordics and Greenland) as several of the 'handcrafted' custom airports included have not been optomised for performance.

In order to alleviate these issues, we recommend following performance optimisations for Xbox Series-S users (although they can also help all other users, including PC on low to mid-range systems). Some of them are general and others are for the G1000NXi displays.

General

- Remove any ground texture or airport texture enhancements. These are massive memory drains for the Xbox.
- Make sure you are using default **FSR500** liveries. Never use 8K texture liveries.
- Reduce ground traffic at airports (10% or less)
- Scale back road traffic (10% or less)
- Scale back shipping traffic (10% or less)
- Scale back workers at airports (10% or less)
- Do not allow the sim to use ground and AI traffic models that are not default. Many 3rd party aircraft can end up as AI traffic if the developer did not disable this. This can mean that you have multiple copies of an un-optimized aircraft being represented as AI traffic which can significantly impact performance.
- Some users have reported that getting rid of traffic name tags has increased performance.

G1000NXi

Optimising the G1000NXi can also reduce demands on system memory and increase performance. Essentially you should declutter the MFD map by reducing the number of unnecessary items shown.

a) Spawn in, preferably at a stock airport in a rural area not covered by photogrammetry;
b) Power on the aircraft using the Battery and Avionics switches on the overhead panel (see section 5);
c) On the MFD use Softkey 10 ('Detail') to set a lower level such as 1 or 2 to declutter the MFD map.

On the PFD avoid using the Inset or the HSI map and if you do, also lower the level of detail shown as with the MFD (it actually makes it easier to read/use too).

Not displaying NEXRAD weather or traffic data may also help.

Please note that this issue is not specific to the **FSR500**. It persists across many different aircraft across MSFS equipped with sophisticated glass avionics, including the G1000NXi, G3000, and Proline21 avionics.

Microsoft is aware of this issue and has stated that they are trying to improve performance. More background can be found on the official MSFS forums here.

Livery Pack
To help enhance X-Box performance, we will be releasing an update with "light variants" of the textures, these will be just a copy of all our current packaged liveries but with lower resolution textures aiming to reduce any memory usage for Xbox-S. With this solution you would see a variant livery with the name of for example Aurora - Light, Factory Red - Light, etc. and these textures will be reduced from 4K to 2K.

We want to deliver the option to our pilots instead of forcing all users to have lower resolution aircraft. By making different resolution liveries available, this gives you the choice what resolution to run the **FSR500** at if you are using a Xbox-S. It may be that you have an Xbox-X and do not have the same performance squeeze, or you may be on an Xbox-S and chose to fly outside of photogrammetry or urban areas where the memory demand is less.

This update is currently scheduled for release in January 2024.

Feedback

We love to hear how people are enjoying our aircraft and feedback is always welcome, whether you are an IRL pilot experienced in this type of aircraft, a keen simulator pilot or just starting out on your flightsim journey.

Please send any feedback to our Discord (link above). If it's a suggestion for a new feature, or feedback on some aspect of the aircraft then there are a couple of things you can do to help give your feedback real value:

- If you are highlighting an aircraft system that you feel needs improvement, or reporting a bug, please provide examples of what you think needs changed and the source of your information that shows the correct behaviour.
- If the feedback relates to the handling of the aircraft or its flight model, then please include information on your experience level, any MSFS assistance settings in use, the controllers you are

using, how you have calibrated them and what the weather conditions were. All of these things can have an effect on how you will experience the **FSR500**.

- Videos or screenshots always help!

Piracy

FSReborn takes the illegal copying and distribution of our products very seriously. The ONLY place you can get a genuine copy of the **FSR500** is the MSFS Marketplace – anywhere else and its pirated. Use of pirated products is against the MSFS terms of use and doing so may mean you lose access to MSFS. It is also a criminal offence in most jurisdictions.

Planned Updates

FSReborn is committed to continuous improvement of its products and development does not stop with a version 1 release. For the **FSR500,** it hasn't been possible to do everything we wanted in Version 1.0 and some more features are already in the pipeline:

Item
Optional 2K liveries for Xbox-S performance
Standby flight instrument
Extended failure module, including fail-on-command
GCU476 keypad for the G1000NXi
Manual Override lever (MOR) and FCU failures
Minor exterior model enhancements
Improved prop-drag at low torque
Functional Emergency Fuel Shut-Off
Enhanced External visual effects
Centre of Gravity data via EFB

Known Issues & Fixes/Changelog

Following the release of v1.011 there were several known issues:

Issue	Comment
No Battery voltage state-saving.	SDK limitations. This will require an update to the SDK.
Unreliable centre of gravity information in MSFS weight and balance page.	Custom COG page planned for EFB
Not able to interact with the EFB	This known to be caused by conflicts with unsupported freeware mods such as the now redundant Heavy Division Boeing 78XH mod. Remove this from your community folder. Other similar freeware mods may also cause conflicts.
Ground service vehicles clip the aircraft/scenery	This is a 3rd party scenery developer issue and one we cannot control– see the EFB Ground Ops section for a detailed explanation.
Residual ITT	Remains high after a short engine on time. Improved cooling logic planned. Dry motoring technique can be used.
Prop drag/Stall behaviour	Current CFD and SDK turboprop modelling place limits on drag in low power-pitch conditions. We have added drag, but will develop a more complete solution with IRL data once this is available. Low stall speeds are an MSFS CFD limitation.
METAR searches on EFB return corrupted airport name	Late-stage bug. Will be investigated further.

The following fixes/changes have been made in version 1.011:

Fix/Change	Comment
Aircraft cabin altitude below LFE	Fixed.
Adjusting the Landing Field Elevation also adjusts minimums.	Dest Elevation shown on the EIS Pressurization window is now set to the destination airport automatically from the onboard G1000NXi nav database when selecting the destination airport in the G1000NXi. Changing Destination Elevation via the minimums in the PFD TRM/REF option has been disabled and this will now only change minimums. Please see the pressurisation entry in Section 6: Aircraft Systems for more information.
VNAV Problems when you import SimBrief flight plan.	Fixed.
Minor Typos in the FSR500 checklist.	Fixed.
Passenger Vehicle was not being called when hitting unload realistic	Fixed.
Engine Failure during cruise.	Fixed – previously the limit was set to incorrectly monitor engine stress at 1301lbs-ft. This has been corrected to 1313lbs-ft. Still a bad idea to red-line it!
Airframe icing effects	Fixed. Airframe icing will now develop normally and have the associated impact on aircraft performance.
Strobe lights not volumetric	Fixed. Strobe lights are now volumetric.
G1000NXI Flight Plan windows wrong size.	Fixed. The G1000NXi Flight Plan windows size adjusted closer to IRL units.
Elevator trim tabs animations incorrect	Fixed. Elevator trim tab animations adjusted to reflect counter tab operations
Fuel truck coming when not needed.	Fixed. Using the load realistic will now not call the fuel truck if there is no change between the current and planned fuel values.
Co-pilot visibility	NEW. The co-pilot visibility can now be toggled using the EFB Settings page (persistent).
Engine Start Action Camera	NEW. The Engine Start action camera will not be set to 'off' by default if realistic electrical failures or hot starts are selected in the 'Welcome Wizard'. This is to help reduce the likelihood of a stater/generator burn out by keeping the focus of the pilot inside the cockpit during engine starts. It can be re-enabled at anytime via the EFB Settings page.

Credits

The **FSR500** for MSFS is a product created by Flight Sim Technologies Ltd – a family run business registered in the United Kingdom. The company is owned and managed by our CEO (Raul Morales), better known as Symbol on different forums and well-known flight simulation social media sites and channels. Raul also works with //42 collaborating with many projects, the latest was FreedomFox for MSFS and Campout by //42.

Special words from our CEO

To my wife and my daughter, your endless love, patience and support during this journey have been immeasurable. Thanks for putting up with my incredible endless sleepless nights while working on this project and continuing to be so special no matter what. I hope I didn't keep you both awake too much when I was on my night meetings on voice. Lots of love to both.

To Keven and Edson from //42, thank you so much for all your support all these years. Working with you two ignites my passion for flight simulation to levels I never imagine it would have, looking forward to all those incredible projects we will bring to the platform very soon. Love you both with all my heart… you two are the brothers I wish I would have grown up with. Thank you again for everything.

To Alex Vletsas from SimWorks Studios, Alex I just want to express my most sincere gratitude for all those times when you have extended your knowledge and help with very difficult challenges and problems with many projects. Your experience with Turbo Props is just incredible, many thanks for all your help when I was stuck with issues and problems during this project! can't wait to see what our 727-200 Advance will do. Thank you so much, I admire you work, you are definitely taking simulation to new heights.

Kevin and Beejay from Big Radials, thank you both for all the help provided as well. specially for listening to my rants when I was stuck with issues. Love all your products specially the JRF -6B Goose, can't wait to see what else you guys will bring to MSFS.

To Kaiii3 from AIGM, thanks for all your help and for your friendship all these years. Love our constant chats and discussions about flight simulation, wishing you and your team the best of results with MS.

To ASOBO and relevant Microsoft Team, many thanks for all the help and knowledge provided during the project via the answerhub platform, especially those flying racons which are always so willing to help everyone as soon as it is possible.

To Kevin Firth, Marcus (MPO910), James (Rockview), Guenter and Thorsten thank you so much for all your extensive testing, suggestions and encouragement to keep improving my products all the time.

To the rest of the beta team that did not wish to be mentioned, thank you so much for your incredible input. And please, don't go anywhere!! we have more stuff coming… To everyone else on the Think Tank (you know who you are), thank you so much guys for all the help as well.

And finally, to all our customers, many thanks for given us the opportunity to improve your simulation experience, I hope we managed to put a smile in your face and light up your day with lots of joy and fun.

Cyou all in the sky and don't forget to have a wonderful simulation experience.

Raul Morales, CEO FSReborn.

2. Getting Started

Installation

The **FSR500** is only available for purchase via the MSFS Marketplace. MSFS will install it into the correct folder after purchase – you don't need to do anything else.

> **Tip**
>
> If you experience any issues the first time you load a flight following installation (such as switches not animating), you may want to end the flight and start a new one. This will help ensure that ensure that MSFS has fully compiled all the files.

Compatibility and Updates

As the **FSR500** is only available from the MSFS Marketplace, it will always be certified to be compatible with the latest build of MSFS2020 and will be compatible with MSFS2024 when it is released.

The **FSR500** has been designed to be fully compatible for Xbox and will be released for Xbox once we work through the inevitable bugs flagged by v1.0.

There will be several planned updates to the **FSR500** after initial release bringing further features. There may also be occasional updates to address bug-fixes or in response to MSFS updates/new features as necessary.

Any updates will be available to all users at the same time via the MSFS in-game Content Manager and you will receive an automatic notification when an update is available – simply go to the Content Manager and update from there.

First-Flight Wizard

On you first flight, the EFB will present you with a wizard. How you answer the questions will determine your initial realism settings. These can be changed at any time in the EFB Realism page.

Controller calibration

The **FSR500** was flight-tested using a range of controller devices in their default settings. For most devices little further calibration should be necessary other than for personal preference how light or heavy you want your controls.

Yokes

Yokes that offer full 180 degrees range on the roll axis like the Honeycomb Alpha may benefit from straight (0) curves on the roll axis. Likewise, high-end yokes like the Fulcrum Yoke or Yoko+ with a long 'throw'/range or travel on the pitch axis may also benefit from a straight curve on the pitch axis.

Rudder-pedals

We recommend that rudder pedals be set to have a REACTIVITY of 50% and with -30 curves. MSFS aircraft tend to be very sensitive to yaw-axis inputs and that can make some lighter general aviation aircraft seem 'twitchy' when taxiing or operating in crosswind conditions leading to 'pilot induced oscillation'. Reducing REACTIVITY will counter that and lead to smoother taxiing, take-offs and landings. SDK limitations mean it is not possible to alter the aircraft Flight Model to reduce rudder effectiveness without sacrificing other important aspects of aircraft handling.

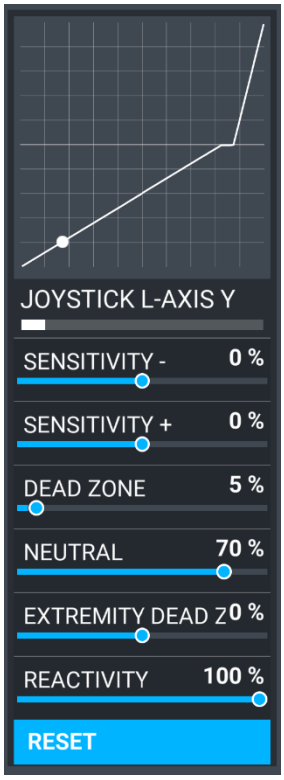
Many rudder pedals also have very sensitive toe-brake axes. Setting a small EXTREMITY DEADZONE will help prevent accidental operation of the brakes when using the yaw axis. Reducing the REACTIVITY of the brake axes will also make them less 'grabby'.

Throttle Configuration

The **FSR500** has a custom-modelled throttle that permits the use of 'beta' and 'reverse' power settings, which are essential features of the ground operation of the aircraft and allow smooth and controlled taxiing and reduction of the landing rollout distance. In the **FSR500**, Beta can only be engaged on the ground.

To take full advantage of this feature you will need to control or configure your throttle axis using one of several methods.

1. Use the mouse to click and drag the throttle in the VC aft past the idle detent.
2. Use the mouse to highlight the throttle in the VC and use the mouse wheel to move the throttle forward/aft.
3. Use a controller device with both a positive and negative axis range. If you bind the MSFS control THROTTLE AXIS to it, MSFS should configure the negative part of the axis to the beta and reverse range automatically.
4. Bind the MSFS action **THOTTLE 1 AXIS (0-100%)** to your preferred axis and check the 'reverse axis box'. Then in sensitivity, set NEUTRAL to 70% and DEADZONE to 5%. This will give you a full throttle range, with the normal range on the top 70% of the axis and beta/reverse on the bottom 30%, with a small software detent at the idle stop (see diagram to the right). This works very well.



5. Bind the MSFS action TOGGLE THROTTLE REVERSE THRUST to a button or key. After triggering the toggle command, pushing your controller throttle axis forward will actually move the VC throttle backwards and so into Beta and then Reverse. Using the button below the axis detent present on most controllers that lack a negative axis is a popular method. This method has the significant disadvantage that if the toggle action is not registered, you will actually add power at a time when you are trying to reduce power and may lead to a failed landing. Using an 'On Release' trigger rather than 'On Press' may reduce the risk of this. There are various other variants of this method, including using the HOLD THROTTLE REVERSE THRUST or DECREASE THROTTLE actions. It is worth experimenting to find something that works for you and your setup.
6. Use MSFS actions INCREASE THROTTLE & DECREASE THROTTLE on key-binds. Using Decrease will allow you to enter Beta & Reverse.

7. Use SPAD. Next or another 3rd party driver to create a custom throttle axis. See Annex B for some examples of what SPAD configurations can be used.

> **What is 'beta' range?**
>
> Beta refers to a range of reduced prop-pitch angle that produces less forward thrust. In the **FSR500**, it is only used on the ground and is entered by pulling the throttle back past the idle detent. Pulling the throttle even further back will put the props into a negative pitch angle and produce reverse thrust. See 'Propeller' in Section 6 for more information.

Condition Lever

The condition lever is controlled using MSFS Mixture events (but not on Xbox -see below). Even though it is a lever on an axis, it actually only has two positions: RUN and CUT-OFF/FEATHER, so you can use the following MSFS events to move it between the two positions:

Other actions such as INCREASE and DECREASE MIXTURE will allow more incremental control. You can also make it an axis. To use the condition lever on an axis use either MIXTURE AXIS or MIXTURE AXIS -100/+100. Which to use depend on the controller device. See Annex B for an example of a custom mixture axis in SPAD.next.

Xbox controllers

Players using an Xbox controllers should also consider reducing REACTIVITY of the shoulder-triggers axes if these are used to control the yaw (rudder) axis (see below for a full set of suggested sensitivity curves).

MSFS have also provided an Assistance setting to reduce sensitivity to aid flying with an Xbox controller:

You may find that using the MSFS auto rudder assistance will help if you are finding it difficult to get smooth yaw control and acceptable take-off/landings:

Both assistance options can be selected in

MSFS OPTIONS > ASSISTANCE OPTIONS > PILOTING ASSISTANCE

Sensitivity Curves

FSReborn Xbox beta testers recommend the following sensitivity curves when flying the **FSR500** using an Xbox controller (this is with ASSISTED CONTROLLER SENSITIVITY set ON):

Xbox Controller Axis/Button	Function
LS X	Ailerons (roll)
LS Y	Elevator (pitch)
LT	Rudder (left)
RS X	Camera/POV -up/down
RS Y	Camera/POV – left/right
RT	Rudder (right)
Button A & B	Throttle increase decrease. Tap for increments. Press and hold to move through the Idle detent to enter or leave the beta/reverse range.

Condition Lever in Xbox

Binding the condition lever to some buttons may help you avoid starter/generator damage or a hot start when realism is on by allowing rapid control of the condition lever. We would recommend binding CONDITION LEVER HIGH IDLE to buttons X + Y and CONDITION LEVER CUTOFF to buttons Y + B.

Keybindings

The **FSR500** uses standard MSFS controls wherever possible and most key controls inside the virtual cockpit (VC) can be mapped to buttons or keys on peripheral devices.

The **FSR500** does also use some custom ‘simevents’. These are listed in Annex B and can be used by third-party driver software such as SPAD.next to bind switches and dials to peripherals.

Tool-tips and Assisted Checklists

A good way to learn the layout of the cockpit and the controls is to use the in-game ‘tool-tips’ and assisted aircraft Checklists:

Tool tips. When starting it can be helpful to turn on instrument name & description tool-tips in **MSFS OPTIONS > GENERAL OPTIONS > ACCESSIBILITY**. This will help you get familiar with the layout of the cockpit switches and controls.

Checklist assistance. You can also use the in-game checklists to help familiarise yourself with the layout and controls. As you select each item on the checklist, the co-pilot will read it out and then confirm the correct setting once you take the requires action. Turn on Assisted Checklists in: **MSFS OPTIONS > ASSISTANCE > PILOTING > ASSISTED CHECKLIST**

Quick-start flight

The following jargon-free quick-start process gives a simplified set of steps to follow to successfully fly a route. You might find it helpful to read some more of this manual first, or better still, go watch the official **FSR500** tutorial videos. Section 7 on the G1000NXi has useful illustrations showing the arrangement of all the control dials and flight instruments.

Default realism

When you first start the **FSR500**, all realism settings are turned to what you set in the initial installation Wizard. If you want to just get flying without worrying about breaking anything on the plane, go to Realism page on the EFB and turn everything off! If you have realism settings turned on in MSFS itself, you may still crash, but that won't be because of an **FSR500** created failure.

> **Note**
>
> if you are hearing a repeating warning 'chime' at any point press the 'Alert' softkey. This is the right-most 'softkey' below the PFD screen.

Flying a route

To fly, simply select an airport and departure runway in the **MSFS WORLD MAP**. If you want to fly a route to another airport, you can also select a destination and MSFS will automatically create a route for you. This can be VFR (visual flight rules) and will be a direct route, or IFR (instrument flight rules), High or Low and if so will have a number of legs and waypoint. You can also select instrument departure, arrival, and approach procedures. Make sure you will have enough fuel on board (you will start with about 500nm worth by default). You can either start on the runway with the engine running or select a parking spot and go through the start-up process yourself.

> **Note**
>
> If you are new to flying, it may be better to start with pre-set weather conditions. In the World Map, go to **FLIGHT CONDITIONS > WEATHER AND TIME > PRESET** and select 'Clear'. This will give you perfect clear skies and very light winds.

After that, simply press **FLY** and then **READY TO FLY**. You will start on the runway with the engine running and the aircraft fully configured for take-off (flaps 10. You can set them to flaps 0 if you prefer). If it's your first flight the view will automatically switch to the EFB and you will get the set-up Wizard. Follow the questions to get the level of realism you want, or skip it and all realism will default to OFF.

You can then get on with the flight and follow these steps:

Take-Off

1. Release the parking brake (push the lever under the yoke in). TIP: If the yoke gets in the way of your view, click on it to make it disappear.

2. Smoothly set maximum power using the Throttle, but try to avoid any flashing red on the 'ITT' or 'Ng' gauges on the MFD. If it's a short runway (less than 3000 feet long), hold down the toe-brakes until you have set the power. Then release the brakes and start to roll.

3. Watch the runway and use the rudder to maintain the dashed white centreline – the aircraft will want to pull to the left at first even if there is no wind, so use some right rudder to correct that. Monitor the airspeed indicator on the left-hand side of the Primary Flight Display (PFD - the main screen in front of you).

4. When the speed reaches 85 knots, smoothly pull back on your stick/controller to no more than halfway, hold it there and let the plane take off. Be patient if it doesn't take off right away and don't keep pulling the stick back or you might put the nose too high, stall and crash.

Climb

5. One you are up in the air, retract the landing gear by pressing the G key or operating the gear position lever in the cockpit to the right of the yoke. You will hear the gear retract and the 3 green lights on the MFD will go out. Retract the flaps if necessary. On the overhead panel, you can put both the fuel pumps and ignition switches to 'AUTO'.

6. You can either hand-fly trimming the aircraft to maintain a steady pitch up, or use the autopilot to manage the climb: first use the ALT SEL knob on the autopilot controller panel (above the MFD) to choose what altitude you want to get to – it will be shown in cyan colour on the top right of the PFD. Then press the VS button on the autopilot panel. This will engage 'Vertical Speed' mode and you will climb at a rate you can set using the UP/DN wheel. A good climb rate is about 1200-1800feet per minute (fpm). Your vertical speed is shown on the right-hand side of the PFD, just to the right of the Altimeter tape that shows your current altitude.

7. The maximum altitude the **FSR500** can go to is 30,000ft. How high you go in the cruise up to you or what you put in your flight plan. Or you will be told by the game ATC if you are using it.

Navigate

8. If you loaded a flight plan via the World Map, use the Multi-Function Display (MFD – the big screen in the middle) to orientate yourself and use the yoke to fly towards the magenta line – this is the currently active leg your route.

9. Whenever you bank the aircraft to turn, look out the front at the horizon and gauge your bank-angle – try not to go over 30 degrees. You can also use the artificial horizon in the middle of the PDF to see how much you are banked or pitched up.

10. Once you get close to your route, you can use the autopilot to follow it. If you haven't already, engage the autopilot by first pressing the 'Nav' and then 'AP' button on the autopilot control panel (above the MFD). If you are close enough a green 'GPS' indicator at the top of the PFD will show, meaning the autopilot is going to follow the GPS route (the magenta line). A green 'AP' and 'YD' will also show meaning the Autopilot and Yaw Damper are engaged. If the GPS stays

white, then you need to get closer to the magenta line before it will 'capture' and track the route.

Cruise

11. Once you reach your target selected altitude, the autopilot will level the aircraft off for you. Now just let it fly your route – all you need to do is to adjust the power to keep the airspeed from going into the red zone. A setting of about 1150 on the torque gauge is usually good.

Descent

12. Once you start getting close to your destination airport, you can start your descent. Make sure to start down in good time. A good rule of thumb is to allow 3nm for every 1000ft you need to descend – so if you are cruising at 30,000ft (or 'Flight level 300') and the airport you want to land at is at sea level, you would need to start descending 90nm from the airport (3 x 30 = 90). A good rate of descent is about 1200-2000 (fpm) and you can set this by pressing the VS button and adjusting the rate of descent with the wheel on the autopilot control panel. Be careful not to overspeed. One trick is to use the FLC button instead and then the UP/DN wheel to set a speed of 175knts. Then, if you reduce the power to about 600lb-ft you will descend at a fast rate but will not exceed 175knots.

13. Either way, be careful to manage your speed in the descent – don't go faster than 180knots. Try not to let the aircraft speed up too much by reducing the power (if you get too fast the autopilot will pitch the aircraft nose up to prevent you from over-speeding). If you cut the power too much (below 300 on the torque gauge) a 'CHECK GEAR' alarm will sound and show on the PFD. Increase your power until you are back above 300 (this is to act as a warning to stop you landing without putting your gear down – the alarm will not sound with the gear down).

Landing

14. Select a runway for landing – try to pick one so you are landing into the wind (tip: tune the airport ATIS via the MSFS ATC window to get information about which runway to use) and get lined up for it in good time.

15. Reduce the power until it is below 158knots. At about 6 nm to the airport, you can put your flaps down by 1 step. This will help you slow down more. At about 3 nm to the airport, you can lower your landing gear (G key) and put the flaps down another step. You will really slow down now with all the extra drag. Descent towards the runway on a gentle (3 degree) descent path (tip: use the green circle on the PFD at the -3 degree position on pitch indicator and use the throttle to maintain a speed of 85 knots.

16. As you approach, maintain the 'extended centreline'. Look at the runway shape – if it looks wide and flat you are too low. If it is long and skinny, you are too high. Look for the big white squares just after the runway starts – these are the 'aiming' points. If you are on a good glidepath they will stay in the same relative position in your view. If they start to slide up, you will land short. If they start to slide down, getting close to the glareshield, you will overshoot and land long.

17. Once you cross the end of the runway (the 'threshold'), smoothly reduce you power to zero as the plane slows, it will sink – pull pack gently on the yoke so it doesn't sink too fast, and just before the plane reaches the runway, pull back on your yoke some more to make sure the two main wheels at the back touch down first (this is the 'flare'). Try not to pull back too much or you will start to climb and 'float' down the runway. Once the main wheels are down, you can relax the stick, let the nose come down and brake once all three wheels are in contact with the runway.

18. If you want to slow down faster, you can use the mouse the drag the power lever back into first the 'Beta' and then 'Reverse' range (you will hear the aircraft noise change as the reverse thrust engages). Let the plane come to a halt or taxi off and park somewhere and congratulate yourself of a successful landing!

Quick Engine Starts

If you started your flight at a parking spot 'cold & dark', you can start the engine using CTRL+E but you will need to make sure 'Hot Starts' are OFF in EFB Realism page or you will blow the engine. If you want to do the engine start yourself, you can follow the following abbreviated quick-start procedure.

> **Caution**
>
> This procedure omits some actions and should only be used when FSR500 realism settings are OFF or you may cause engine damage (EFB Realism page, turn all to OFF).

1. Press the BAT and AVIONICS buttons to power-up the aircraft (overhead, left side)
2. Turn on the NAV light. (overhead, right side)
3. Make sure all covers and the chocks are removed (EFB > Ground Ops)
4. Turn the fuel pumps and ignition switches to MANUAL (overhead, left side)
5. Lift the cover on the START button (overhead, left side), press and release – the button will stay pressed, but will release automatically after the engine has started.
6. With the starter motor running, the prop will start to turn. Look at the engine gauges on the left side of the middle screen (the MFD). When the one marked 'Ng' reaches 16 or above, the engine is ready to receive fuel (or alternatively count to 10 seconds).
7. Now, place the Condition Lever (right of the main throttle with a red handle) from fully down, to fully up (click and drag with the mouse). Fuel will be introduced, ignition occurs, and the engine will continue to spin up to normal power.
8. With the engine started, press the GEN and ALT switches (Overhead, left side) to supply electrical power. If you don't do this the battery will eventually go flat and all the screens go dark.
9. You can turn fuel pumps and ignition to auto. (overhead, left side)
10. Now you can turn on exterior lights such as landing lights, strobes as desired (overhead, right side)
11. Below the pilot's yoke, push in the BLEED AIR lever and above it on the main panel, turn the 'ECS cabin comfort' dial to 'Norm'. This will turn on the cabin pressurisation system.
12. Release the Parking Brake (beside the BLEED AIR lever) by pushing it in, use some throttle to get rolling and begin your taxi, using the throttle to control you speed - you won't need much once rolling. Try not to go above 20knots when going straight and 10 knots when turning. Find your runway and take-off as per the quick start procedure above.

> **Note**
>
> In the rest of this manual any procedures described assume that all realism settings have been turned on and you are following IRL procedure. You can select whatever level of realism you want at any time., but we recommend taking your time to learn the correct procedures step-by-step before experiencing the challenges of system

I can't see my Navigraph charts on the EFB/My SimBrief Flight plans won't load.

Make sure you have entered the correct Navigraph alias/username in the SimBrief Username field in EFB Options page to link to your account. THIS NOT YOUR 6-DIGIT SIMBRIEF PILOT ID. To reset the Username field, toggle the Navigraph charts button in the EFB Options page.

My Garmin units are not working, what could be the cause?

Check you have turned the master battery and the avionics master switch on. If this is the case, check your battery has enough voltage. The **FSR500** has custom electrics failures and it will simulate your battery suffering from severe discharge.

You can check the battery voltage via the gauges on the MFD/PFD or the Pre-flight page in the Electronic Flight Bag (EFB). If your battery doesn't have sufficient charge, proceed to the maintenance section in the EFB and you can either install a new battery or recharge your old battery. If the battery is correctly charged, then a more severe issue with your simulator must be preventing the units from working correctly.

The **FSR500** uses the Working Title G1000NXi implementation and it is well known that some freeware mods of instruments can cause damage to the default glass navigation instruments such as the G1000. A great way to test is by loading the Asobo default Cessna Grand Caravan. If the Garmin units on this default aircraft are also not working (they are the WT G1000NXi), then it means indeed your MSFS install has an issue. The recommended step at this point is to remove all instruments mods from your community folder one by one to identify the culprit.

My airspeed indicator is not working, why?

Check you removed the pitot tube cover before take-off, this can be performed via the EFB Ground Ops page.

Why does the fuel truck / car keeps going in circles and never reaches to me?

This can occur in some airports when the 'taxipoints' put in place are incorrect, making it impossible for the ground ops vehicles to ever reach your parking spot. This can happen very rarely at parking spots in 3rd party airports, and there nothing we can do to fix it. It is up to the scenery developer to create correct taxiways and connect them to each parking spot as per IRL.

If this happens you can click SKIP in the EFB Ground Ops page and this will force the refuelling or pax loading to complete without having to wait.

The fuel truck/car just hit my airplane, why?

We inject the cars and fuel truck as a real MSFS 'SimObject', this makes them independent from your airplane and allows them to operate much more efficiently in terms of your computer performance. It also allows us to instruct them what to do, such as, send them a list of waypoints they must follow to reach the final destination where your airplane is located.

For the fuel truck, this is 10 meters behind your airplane, this is calculated with 10cm accuracy. For the car, it will aim to the left of your airplane with 80cm accuracy. Testing indicates that this is achieved in nearly all (95%) of cases.

However, due to quirks with the AI systems in MSFS, sometimes the ground vehicles ignores the FSR500 instructed waypoints and they take their own route. Other causes for odd behaviour can be badly configured 3rd party airport taxipoints, tight parking spots or the aircraft being moved by the user after the ground services were requested (e.g., with a slew).

We are working with Microsoft to improve the AI system, however issues with 3rd party scenery design are a matter for the scenery designer and not something we can fix.

It is important to mention, our ground services module doesn't require any configuration of parking spots, locations of services, etc., - it is totally plug-in and play.

When I am at some particular airports, the fuel truck/car spawn just behind my airplane about 50 meters away instead of following any taxiway, why?

This will occur when an airport has ZERO DATA about taxiways and taxipoints, under such circumstances we have no information about where to spawn the vehicles and how to send it to you, so as a backup option, we spawn them 50 meters behind you and drive them to their target locations. If you see this behaviour, is a good indication the airport designer has not included any taxiway points and taxiways data, meaning, this airport is not following MSFS SDK guidelines and will fail to work properly with many systems, including ATC add-ons, AI traffic tools etc.

When I apply power to the aircraft it doesn't move, not matter what I do it seems stuck on the ground. What can I do?

Check you removed the wheel chocks from the front wheel, this can be performed via the EFB Ground Ops page.

My engine refuses to start unless I use CTRL+E.

A possible cause for this behaviour is when you forget to turn on the fuel condition lever check you have pushed it all the way up after Ng is above 13%. When you use CTRL+E, all these steps are taken on your behalf by our custom physics engine, so this is the reason why it only works with this hotkey. But also, if you do use CTRL+E, you must have MSFS engine damage turned OFF in MSFS OPTIONS > ASSISTANCE or you will hot-start the engine.

It is recommended to use the MSFS checklist, they are complete and fully interactive, allowing you to get familiar with the aircraft and procedures with the assistance of the virtual co-pilot.

What is T/O Config mean and how do I get rid of it?

This means that you have not configured the aircraft properly for take-off. It is white (advisory) at first, but will turn red if you apply power. Follow the correct before take-off checklists. See Section 9 for more information on the T/O Config.

I opened the door mid-air and now it is lost!

Correct, this is by design. You will need to land to install a new door. You can do this via the Maintenance page with the engine off and while on ground.

How do I stop the 'beeping' sound?

These are usually 'chimes' indicating a Master Warning or Master Caution – i.e. things to worry about! The Cautions can usually be muted by pressing the right-most ('Alert') softkey on the PFD. The Warnings cannot usually be muted this way and the only way to stop it is to take the necessary corrective action.

What does 'Check Gear' mean and how do I make it stop?

This is a warning to prevent you landing with the gear still up. It will trigger if the power is less than 300 lb-ft and the gear is still up or if the flaps are more than 10°. The full logic that triggers the warning is a little more complex than that though – see Sections 6 and 9 for more information. To make it stop, either increase power, reduce the flaps, or put your gear down.

My engine keeps having severe failures each flight, they occur between 5 to 10 minutes after taking off.

Check you are not constantly running the engine above the required Torque. The PT6-42A engine is rated to run at maximum of 1313 lbs/ft for 1 minute. If you run the engine at the max rated speed for long periods of time it will cause severe damage to the engine.

Remember also you need to perform regular maintenance to your engine in order to ensure its normal operation. This can be done via the maintenance page in the EFB. If you don't, you increase the chances of suffering an engine failure. The more you neglect your engine, higher the risk to suffer a catastrophic failure. You can disable all engine failures via the EFB Realism page.

What is an engine overhaul?

It is an operation which will replace all major parts on your engine, therefore in accordance with FAA and EASA rules, your engine tacho hours get reset to zero. It is the closest you get to have a new engine. When you perform an engine overhaul via the maintenance tab, the mechanic will also perform a change of fluids such as oil and coolant. Engine overhauls are very expensive in real world, and they are only required after many hours of operation of your engine.

Why does the battery need conditioning when I replace it?

Aircraft batteries are made very differently from car batteries. As a result when they are under storage they will start losing voltage and capacity. Part of installing a new aircraft battery procedure requires ensuring the battery is in good condition and that it is holding the required charge. Our maintenance module simulates this by performing a battery conditioning, where the battery gets fully discharged and then fully recharged. In the real world this process of course takes hours, but to provide the best user experience, we do this a bit quicker.

Why when I click battery recharge, nothing happens?

If the battery is already fully charged, then nothing happens. Confirm the battery voltage via your aircraft instruments or the EFB Pre-flight page.

My Garmin instrument shows a different voltage from the EFB sometimes, why?

In order to keep high performance, the EFB query data from MSFS at much slower rate than the instruments, this means under certain circumstances the values will not match. Wait few seconds and it will stabilize and match.

What does the tyre health means? What happens if I leave it go to very low levels?

The tyre health is the indication about how much life you have left on them. If you don't replace them, they can fail in catastrophic ways, such as a full tyre blow out during take-off or landing! Surely you don't want that to happen right?

Why do my tyre pressures keep changing from day to day and when I go high altitude?

Glad you ask! We love attention to detail and accordingly we have simulated what happens to small tyres such as the FSR500. Air pressure varies with temperature and we keep track of these changes since the first day you filled your tyres. So, when the temp changes due to real weather information, it will cause a tyre pressure difference. You can adjust it to be in line with the pilot manual. Don't overdo it thought. you could cause a tyre blow out if you land hard and your tyre pressure is too high!

What happens if I don't maintain my brakes?

Well, you will be unable to brake eventually, and yes, we simulate that too.

I would love to see these failures due to lack of maintenance, but I don't want to wait so many hours to see it, anything I can do?

Yes, go to the EFB Settings page and increase the wear and tear speed. 1x is the default, but if you increase it to 16x for example, you will be required to perform maintenances 16x sooner, your tyres and brakes will be degraded 16x times faster, etc. you get the idea. Good luck!

Why can't the battery charge level be maintained between flight sessions?

This is due to a bug with the MSFS SDK appearing since SU6 or SU7, which prevents the battery voltage to be set via variables under many circumstances. We have opened a ticket with Asobo and as soon as this is fixed we will implement this feature and release an update.

The EFB fuel, weight and payload doesn't match the MSFS fuel panel, why?

There is a bug since SU8 where the fuel panel display the aircraft load incorrectly. We strongly recommend to use only the EFB to configure your aircraft fuel and weight for the best experience possible.

The EFB is located in a place a bit difficult to see. Anything that can be done?

This is due to a limitation with MSFS where clickable spots cannot be staggered. What does this mean? We need to put the EFB in a place where there are no other objects behind the EFB to avoid things being clicked by mistake. This is a bit difficult in the FSR500 since we made everything clickable. The current spot was the safest position. We have created a custom instrument camera to allow you to access the EFB more easily. This is accessible via CTRL+4 on PC and via the required Xbox controller combination to change to the instrument cameras. You can also drag the tablet and change the angle to your preferred position, it will be remembered across flights sessions. In addition, you can enable via Settings the auto position EFB camera.

I have made too many mistakes to my aircraft maintenance, how I start again?

Easy, go to the settings menu, find the aircraft stats sections and click RESET ALL. This will reset all systems for your aircraft as if it was brand new.

My EFB is acting erratically after a MSFS update or installing an addon, what can I do?

Try changing the airplane livery back and forth, this will force MSFS to re-compile special modules of the aircraft. If this fails, remove the add-on you installed and test again. It is possible the add-on has created some incompatibility issue.

Do you support integration with TDS or PMS50 GTN 750 gauges?

No, for this particular aircraft we are currently only supporting the WT G1000NXi avionics.

Love what you did with this aircraft, do you plan to release other products?

Absolutely!, please visit our Facebook page or our website page regularly for news and updates. It is also worth mentioning we work in partnership with //42 (https://parallel42.com/) creating and collaborating with many interesting projects, so don't forget to check all the amazing products and offerings available via their website and also via Microsoft Marketplace under their branding.

I have a question not listed here, where I can get some extra help?

You have many options, you can visit our Discord server where user to user support will be available (see the support section above), you can send us an email via support@fsreborn.com or you can also visit our website www.FSReborn.com for more information about us and other means to contact us.

3. Specification

Overview

The **FSR500** is a low-wing, metal-composite airframe, retractable gear aircraft with a pressurised cabin. It is powered by a Pratt & Whitney PT6A-42A turboprop engine delivering a flat-rated 500shp to a four-bladed, constant speed, variable-pitch propeller. It has a fully integrated Garmin G1000NXi avionics suite. A full suite of ice-protection systems allow for flight in known icing conditions ('FIKI'). The sophisticated avionics allow for single-pilot IFR operation and integrated weather radar and XM radio data-links providing NEXRAD weather information, allow effective weather-avoidance in flight.

The mission profile of the aircraft is diverse. Good fuel economy and single-pilot IFR capability through the sophisticated avionics, and a luxury passenger cabin, make it popular for private owner-pilots and commercial charter operators alike, who can carry up to 4 passengers and 100lbs of baggage in the comfortable, pressurized, cabin. A service ceiling of 30,000 feet and a range of 1000nm at a cruise speed of 265TAS makes it ideal for IFR cruising and this is its primary role. Although the aircraft can operate from grass fields and other hard unsealed surfaces, it is not STOL-capable or intended for off-field utility cargo operations.

Essential performance specifications

Maximum Ramp Weight	5134lb (2329kg)
Maximum Take-Off Weight	5092lb (2310kg)
Maximum Landing Weight	4850lb (2200kg)
Propeller	1 x 4 blade, 82.5 in. Blademaster.
Engine	Pratt & Whitney PT6A-42A turboprop with 500SHP
Ng	Max = 101.8%
Torque (lb-ft)	1313
Seating	Maximum 6 persons (2 crew, 4 passenger) With up to 100lbs of passenger baggage
Avionics	G1000NXi integrated avionics suite with Garmin GFC700 Automatic Flight Control System (AFCS)
Range	1000nm
Operating Ceiling	30,000ft
Fuel	190gal JET-A or JET-A1

TABLE 3-1:PERFORMANCE SPECS

Operating Speeds

The following table sets out all the key operating speeds for the **FSR500**

Operating Speeds (V Speeds)	KIAS		
V_{MO} (maximum operating speed – never exceed this speed)	188		
V_O (maximum manoeuvring speed – no full/abrupt control movements above this speed)	127		
V_{FE} (maximum flap extension speed)			
10°	168		
20°	135		
30°	118		
V_{LO} (maximum landing gear operation)			
Extension	168		
Retraction	129		
V_R (rotation speed)	85		
V_X (best angle of climb)	95		
V_Y (best rate of climb)	110		
Vglide	108		
V_{SO} (stall speed at maximum take-off weight and 0, 30 and 45 bank angle)	0°	30°	45°
Clean (no flaps, gear up)*	78	84	93
Landing (flaps 36°, gear down)*	68	74	83
V_{REF} (landing speed - full flaps)	85		
V_{REF} (landing speed - no flaps)	100		
Maximum demonstrated crosswind velocity	16		
*Due to MSFS SDK limitations, the FSR500 will stall at lower speeds than indicated in this table. See 'Stalls' in Section 9 for further discussion.			

TABLE 3-2: OPERATING SPEEDS

Aircraft Dimensions

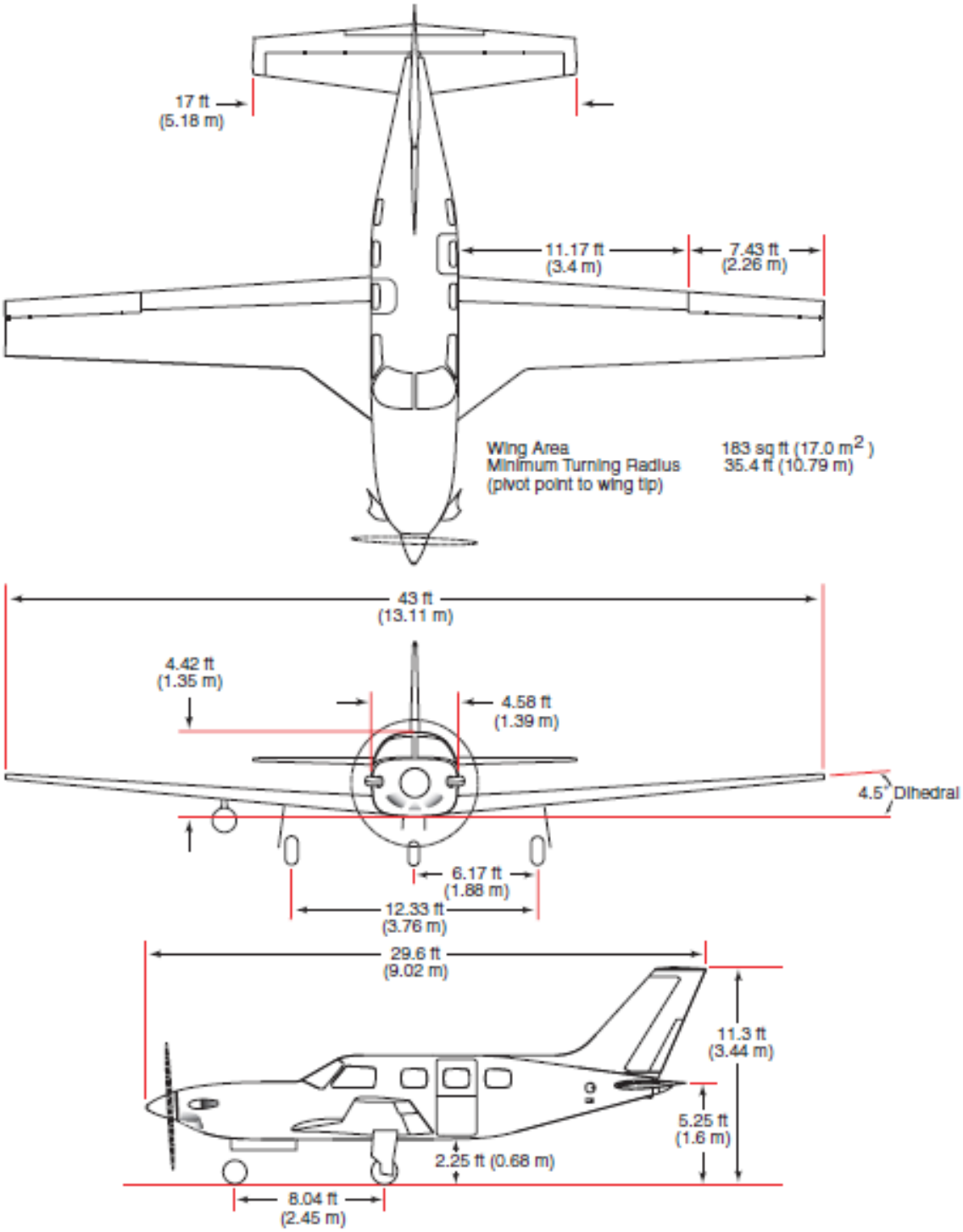
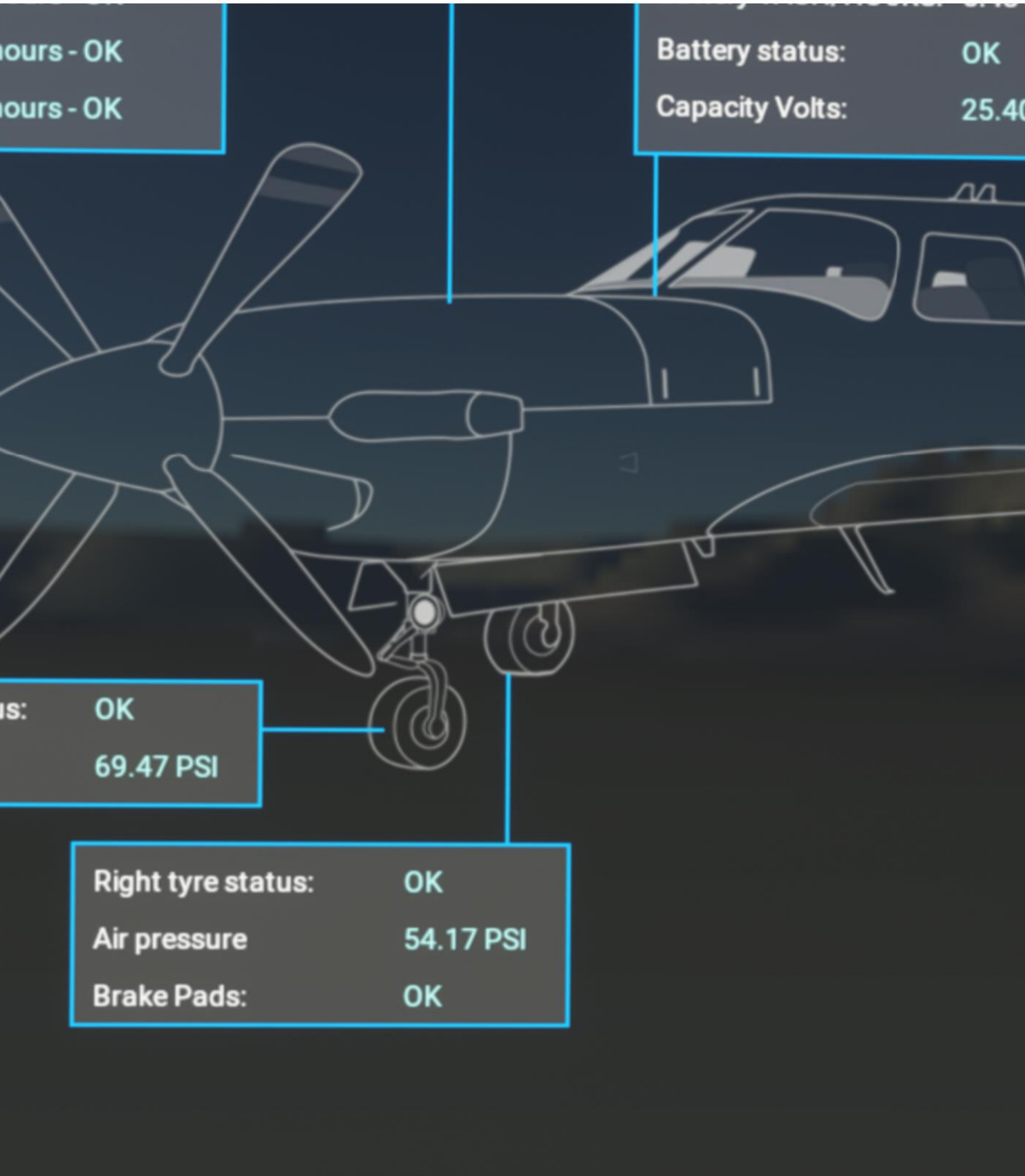


FIGURE 3-1: AIRCRAFT DIMENSIONS

4. The Electronic Flight Bag



Overview

The **FSR500** has an integrated tablet computer running a custom Electronic Flight Bag (EFB). The EFB lies at the heart of the **FSR500** experience – every flight begins and ends with the EFB.

The EFB is where you can set important controls to customise your experience such as realism settings, configure failure options, perform maintenance. It also allows you to plan your flight using fully integrated Navigraph support, including the ability to upload flight plans created in SimBrief, as well as view Navigraph charts (subscription required). Fuel and payload can be set and loaded as well as other pre-flight checks.

All of this lets you choose what kind of experience you want – a simple fun get-in-and-go flight, with no failures to worry about. Or the full, end-to-end, immersive experience, with realistic fuelling and passenger boarding, pre-flight checks, the need for careful systems management and use of proper checklists - or risk damaging critical systems! The **FSR500** offers the full spectrum of experience.

Using the EFB

Using the EFB is simple – just click on the screen. The EFB is mounted to the pilot side window with an arm and ball coupling, allowing you to tilt, twist and rotate the EFB to your preferred viewing position: simply hold the mouse over the left side of the outer frame of the tablet until it is highlighted in blue (in 'lock' interaction mode), left click and hold and then move the mouse to reposition. You can also use the mouse wheel to rotate it. Re-centre with a right-click.

To stow/unstow the EFB, click on the pocket on the lower left side.

The EFB screen itself can be 'popped out' into a separate window by positioning the mouse over the screen, holding down right-ALT then LEFT CLICK (right-ALT is also called the ALT GR key on some keyboards) and left click. A clone of the EFB screen will appear in a new window that can then be re-sized and dragged to a new position as desired, including onto a separate monitor.

The following sections show each of the main EFB screens and describe the less intuitive functions.

> **Note**
>
> If you want to put the EFB on a real touch screen tablet such as an iPad, this is possible using the freeware 'Pop Out Panel Manager' app which enable touchscreen support for popped-out windows and then use screensharing software such as the free 'SpaceDesk' app to allow the window to be displayed on another device.

Pre-flight Page

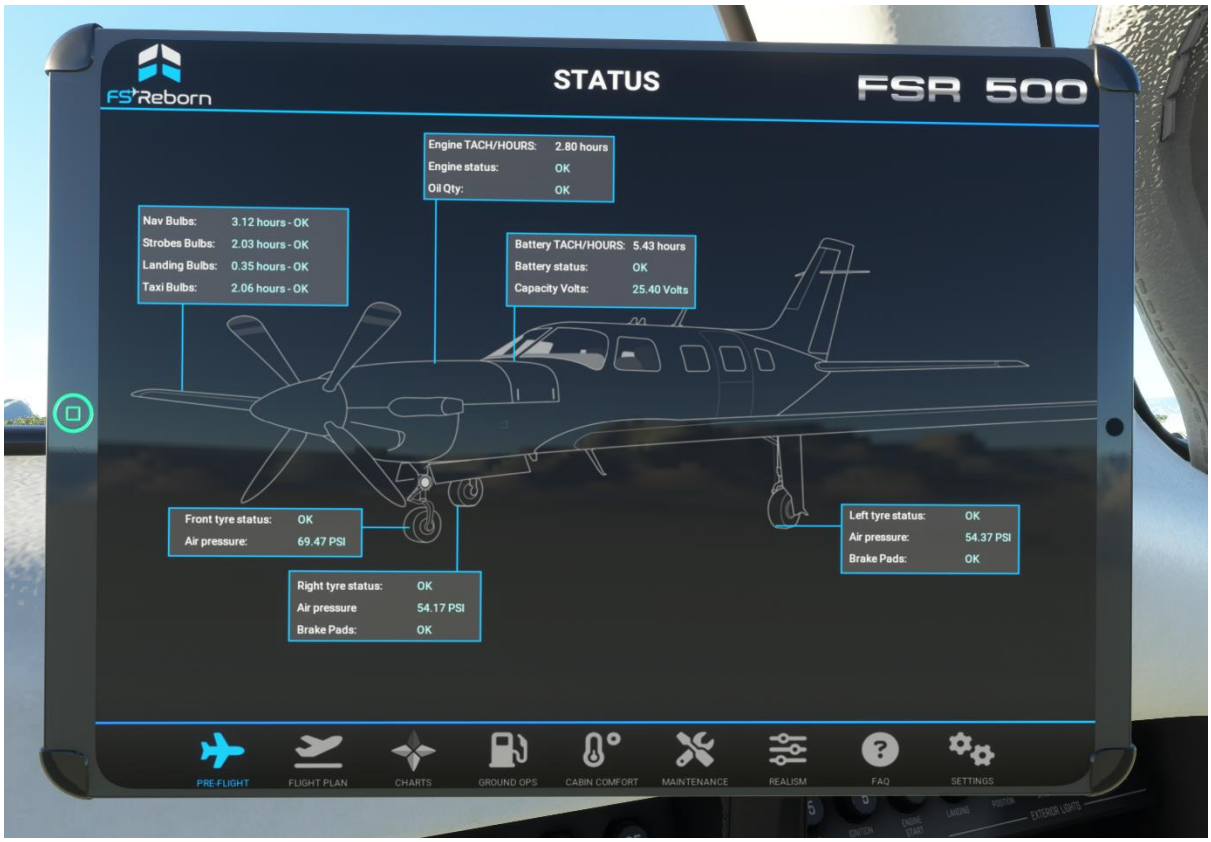


FIGURE 4-1: EFB PRE-FLIGHT PAGE

The pre-flight EFB screen is like the report from your aircraft mechanic when you turn up to take our flight. It highlights all key aircraft systems and their condition. If any system is not shown and 'OK' then you will need to head to the Maintenance screen to order some repair work.

Flight Planning Page

FIGURE 4-2: EFB FLIGHT PLANNING PAGE

The Flight Plan page is where you can import your flight plan from SimBrief – a free flight planning tool provided by Navigraph. To do this, simply create a flight plan in SimBrief, make sure your Navigraph user account is registered in the Options screen and click load.

On the left-hand side of the screen there are buttons to access the route on a chart ('Overview'), information about the assigned runway, current and forecast weather (METAR and TAF) for both departure and arrival, weather (METAR) for your departure and arrival airports, the overall weather situation on your route and the full the Operational Flight Plan (OFP) for your route created by SimBrief. This includes information about times, weights, fuel required etc. Use the excellent guide by SimBrief to help you decode the OFP. As you become a more skilled pilot, you will find the OFP an invaluable reference.

This page also includes a METAR look-up function for airports other than the departure/destination.

Navigraph Page

FIGURE 4-3: EFB NAVIGRAPH PAGE

The **FSR500** has been developed with full native support for Navigraph – the leading supplier of aviation charts for simulation use. If you have a Navigraph Ultimate subscription linked to the FSR500 (see Settings), and have loaded a SimBrief flight plan, this screen will automatically load the charts for your departure and arrival airports. All charts can be zoomed, panned, with your aircraft position shown (if available for the chart type) with day & night modes available. The charts available will update automatically if a new SimBrief flight plan is loaded, even during flight. Charts can also be pinned and unpinned.

Maintenance Page

FIGURE 4-4: EFB MAINTENANCE PAGE

This is where you can perform any routine scheduled maintenance or repair any failed component or system flagged in the pre-flight check. To access a system and initiate a repair click on the dot on the relevant part of the aircraft.

Maintenance is only necessary for the systems that have had been enabled on the Realism EFB page.

For a full discussion of what happens when a system fails due to lack of maintenance or some other mishap, please see Section 11: Failures and Emergency Procedures.

If a system has gone over its scheduled maintenance period, there will be an amber warning stating ‘past due’.

Ground Ops Page

A unique part of the **FSR500** experience is the natively integrated, ground operations which is controlled from the Ground Ops EFB page. This is where you can fuel and load the aircraft and preform a range of other important pre-flight operations. It has three screens, that will change automatically as you progress through the pre-flight process:

1) A load planning screen. This is where you set what fuel and payload you want in what stations.
2) A loading status screen. This will show fuel and payload loading progress (when not loaded instantly)
3) A loading complete screen. This will show the weight of the aircraft once all loading is complete.

On each screen you can also perform other ground operations, such as connecting a ground power unit or opening the cabin door.

Load Planning

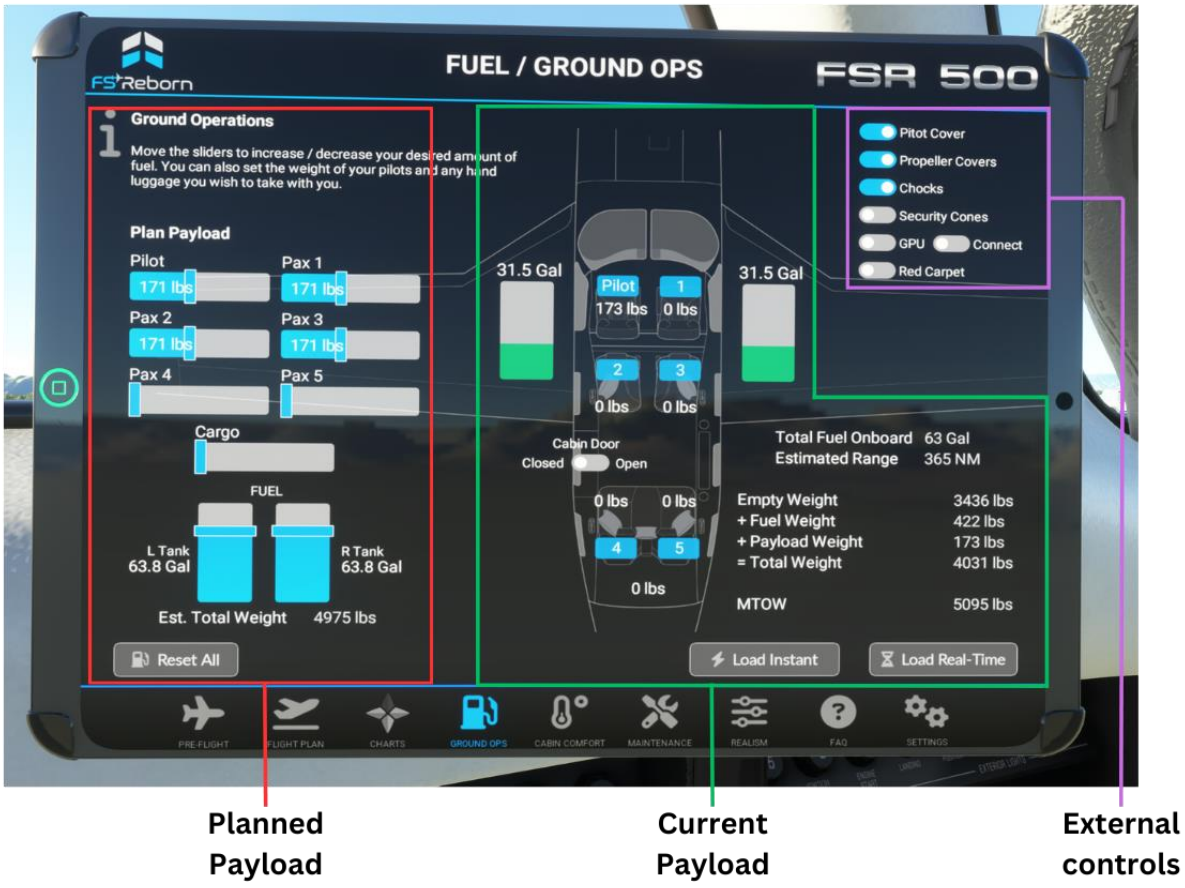


FIGURE 4-5: LOAD PLANNING SCREEN

If you have imported a flight plan from SimBrief via the Flight Plan page, the OFP planned fuel and payload will be shown on the left under 'Plan Payload'.

If you have not imported a SimBrief flight plan, it will start either with:

- the default setting of 1 pilot and 50% fuel; or

- the fuel & payload state at the end of your last flight if you have persistence enabled in the EFB Realism screen.

You can also manually adjust the payload for each station (2 crew seats, 4 passenger seats and one cargo area) using the sliders. Likewise, you can manually adjust the left- and right-wing fuel tanks. The default can be loaded at any time with the reset button.

> **Note**
>
> If using values from the SimBrief OFP, the actual fuel loaded and payload weight will vary, just as with IRL operations.

The centre of the screen shows a plan view of the cabin layout. This shows the actual payload and fuel state of the aircraft as well as the status of the cabin door. You can open/close the door by clicking on it.

Once you have finalised your planned payload, you can either load the fuel and payload instantly or realistically (this can be adjusted in Realism settings).

> **Caution**
>
> We recommend that you load all fuel and payload using the EFB and not the MSFS weight and balance screen as unexpected results may occur otherwise due to SDK bugs.

Loading Status

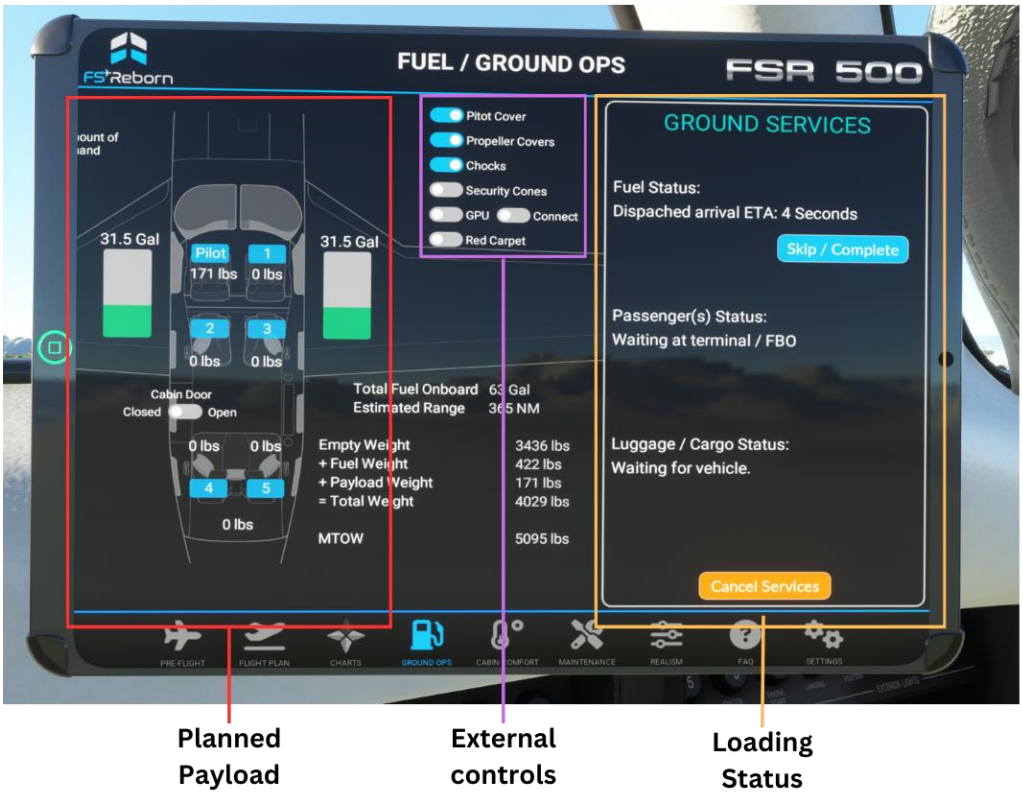


FIGURE 4-6: LOADING STATUS SCREEN

If you select 'instant' for both fuel and payload, the EFB change directly to the 'loaded' screen. If you select 'realistic loading' for either, then the EFB screen will show the 'loading' screen. This will give you an estimate for when the fuel and passengers will arrive and other status updates. Just how long this will take depends on the airport and where you have parked the aircraft: if you are a long way from the FBO at a large airport, then it may take quite some time for them to get to you. This is a good time to brief your flight plan, pick up your IFR clearance and any other pre-flight tasks.

Fuelling. The aircraft will always be fuelled first and this must be completed before the passenger transport is called for. You will see (and hear) a customised JET-A1 fuel truck turn up and connect its hoses to the fuelling port on each wing port in turn. If the aircraft has power, you will get 'fuel imbalance' warnings and tones on the CAS. This is normal and no pilot action is necessary.

When you hear the truck reversing, that's a good sign that the fuelling is complete, and the passengers will soon be on their way.

Passengers. You will see the transport arrive and park to the left of the aircraft, near the main cabin door. The vehicle type used can be selected in the EFB options page and includes a range of luxury vehicles. The driver will sound his horn to let you know he has arrived and the pax will then board with their baggage – but only if you have opened the cabin door! Once everyone is boarded with their bags, the driver will toot the horn again to let you know you can complete any remaining external tasks, close the cabin door and get on with your flight.

If you want to skip either fuelling or the boarding process, simply click 'load instantly' (if you do it mid-fuelling you may be left with a rogue hose attached- this is a known bug).

PC users can add more vehicle types using a free mod from FSReborn available here.

Note

Some 3rd party scenery airports have taxiway and parking spot layouts that can result in unexpected behaviour from the ground vehicles as these use the taxiway and parking spot layout to determine their route to you, and then where to park. They may clip other scenery objects or your aircraft as a result. In some cases, the use of custom ground textures may cause the red carpet may not display correctly. This is not something we can fix – its down to the scenery developer. Please see the FAQs section of a fuller explanation.

Loading Complete

Once all fuel and passengers are on board, the EFB screen will switch to the 'loaded' screen. The status box on the right will disappear the cabin payload diagram will show the actual weight of the aircraft.

Unloading

After landing the Ground Ops EFB page will show the unloading screen – on the right will be a status window and the option to unload passengers and baggage instantly or in real time. On the left it shows the planned payload as at the beginning of the flight and on the completion of unloading it will revert back to the Load Planning screen, ready for your next flight.

Other Ground Operations

You can also perform other external ground ops tasks from any of the screens, including:

- Opening and closing the main cabin door;
- Requesting and connecting a Ground Power Unit;
- Placing safety cones around the aircraft and a red carpet for VIP passengers;
- Remove/place wheel chocks and covers.

Simply click the selector buttons on the top right (the cabin door toggle/status indicator is on the cabin layout)

Caution

If you do not remove the chocks before taxiing, the aircraft will not move.

Warning

Failure to remove covers may compromise the safe operation of the aircraft.

Ground Power Unit (GPU)

Connecting the GPU will supply all necessary power to the aircraft for an engine start. The G1000NXi PFD will start in reversionary mode. You can also use it to power other electrical systems. Consider using a GPU if you expect to be on the ground for longer periods but require the aircraft to be powered (e.g. preparing a flight plan). This will save depleting the battery and extend its useful life. The GPU can be used also to assist with engine starts when the aircraft battery is in poor condition. The GPU must be disconnected before taxi.

Cabin Comfort

FIGURE 4-7: EFB CABIN COMFORT PAGE

The Cabin Comfort EFP page is where you can look after your passengers. They are very quick to let you know when they are not happy!

On the left there are several Cabin Service actions you can perform, from providing food and drink, through to tidying the throw cushions if sharp manoeuvring has left them on the floor.

The centre display shows the Pax Status. This will give the overall number of pax on board and (from 0 to 5). Click to request seatbelts be worn or can be released.

The three box bar charts show levels of thirst (left), hunger (right) and overall satisfaction (centre). These will gradually turn from green to red as they get hungry and will start the moment they have boarded. You will also see feedback from the passengers shown here – they will soon let you know if they are cold, or thirsty and what they made of your landing. You can keep them happy by offering cabin services periodically, maintain a comfortable cabin temperature and fly smoothly.

After being offered refreshments, the cabin table will unfold and the food/drink shown. You will have to stow the table manually before landing.

Cabin Status will show the current cabin temperature and the status of the aircraft environmental systems (but not cabin pressurisation). Please see the Environmental Systems entry in Section 6: Aircraft Systems for more information.

> **Note**
>
> Managing passengers is an important part of any GA pilot's role and these features are included to enhance immersion but have no effect on the sim otherwise. If you are not interested in this aspect of flight management, then simply ignore it.

When starting at a parking spot, the cabin will be at ambient temperature as if it has just been wheeled out of an unheated hanger. It will soon start to warm up if parked in a hot sun and if left for long, the temperatures may exceed the outside air temperature.

Realism

FIGURE 4-8: EFB REALISM PAGE

The **FSR500** has a highly configurable level of realism settings, allowing you to fine-tune your experience.

The Realism EFB page will allow you to set the behaviour of all the major systems in the aircraft and how susceptible they will be to damage and wear and tear.

The first flight wizard will have set realism in line with the answers you gave. You can change any realism setting at any time.

Most of the settings are self-explanatory and, with realism engaged, the systems may fail, either due to pilot behaviour, or wear and tear if scheduled maintenance is not performed. You can set the rate at which a system degrades on the Options EFB page. Failed systems can be repaired on the Maintenance EFB page.

ESP – Electronic Stability Protection

This is turned on by default. ESP is a feature of the G1000NXi avionics suite and is designed to prevent pilots from placing the aircraft in an unsafe attitude. It is normal to leave ESP on unless practicing stall recoveries or flying in conditions that may require steep banks such as mountain flying. Please refer to the ESP entry in Section 7: The Garmin G1000NXi for more information.

FAQs

The FAQs EFB screen is where you can go for help in operating the **FSR500**. You will find links to both this manual and the official tutorial videos as well as answers to the most common questions.

Settings

FIGURE 4-9: EFB SETTINGS PAGE

The Settings EFB page is used to control many of the unique features of the **FSR500**.

Units of Measure – use this to select your units of measure. Gal = US Gallons.

Ground Operations. Use this to select the vehicle type your passengers will arrive in. You can see a preview.

Action Cameras. Selecting an action camera will trigger an automatic switch to an external view for a short time to let you see the action!

Navigraph Configuration. If you want to upload SimBrief flight plans, or view Navigraph charts (if you have a suitable subscription) to the EFB you will need to enter your **Navigraph alias/username** in this field. **THIS IS NOT YOUR 6-DIGIT SIMBRIEF PILOT ID**. Log in to either your SimBrief or Navigraph account to get this. Note – this is only for the EFB charts. Viewing charts on the G1000NXi requires a separate confirmation process.

You can also choose whether to have the SimBrief flight plan loaded into the G1000NXi automatically or not. If you like to load your SimBrief flight plans via the World Map (i.e. to ensure MSFS ATC gives you your planned cruising altitude), or you prefer to enter the routing yourself manually using the G1000 FLP function, un-check this option.

Aircraft Wear and Tear Speeds. This allows you to set the rate at which each major group of aircraft systems ages. Note that this will only apply if wear and tear for that system has been enabled in the Realism EFB page.

Aircraft Stats. Selecting 'Reset All' will return the aircraft and all systems to a 'zero hours' state.

Co-Pilot visibility. The can be set to show the co-pilot (if there is sufficient weight in the co-pilot seat), or to never show the co-pilot on internal views. (Please note this toggle is not shown in figure 4-9)

5. Cockpit & Cabin Layout

Cockpit Overview

The **FSR500** has a modern, all-glass cockpit design built around the Garmin G1000NXi avionics suite, arranged for a pilot (left hand seat) and co-pilot (right hand seat). The operational design has significant systems automation to reduce pilot workload, making it safer for single-pilot operation in IFR conditions.

Stylish, integrated, LED lighting provides excellent illumination of the dials and switches in all conditions, with matte, non-reflective materials used on the main instrument panel to reduce glare. There are two operable sunshades at each pilot position (click and drag, or use the mouse wheel).

The main areas of the cockpit are:

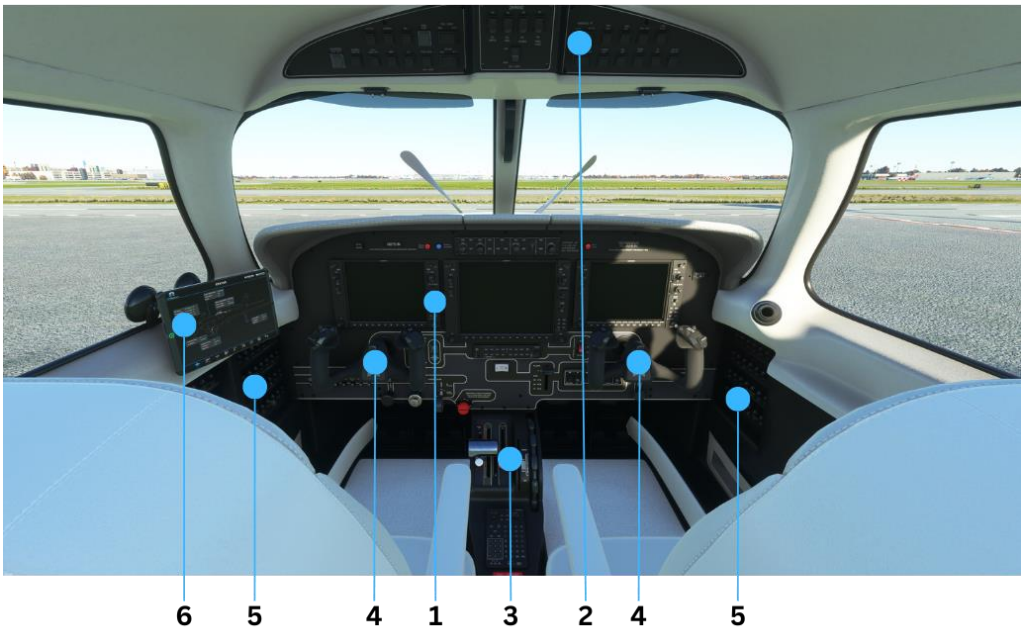


FIGURE 5-1: COCKPIT OVERVIEW

1	Instrument Panel
2	Overhead Switch Panel
3	Control Quadrant
4	Control Wheels (yoke)
5	Circuit Braker Panels
6	Integrated Tablet Electronic Flight Bag (EFB – see Section 3)

TABLE 5-1

Switches and controls

The following diagrams and tables indicate the position of each switch and gives a brief description of its function. For fuller descriptions please see Section 6: Aircraft Systems.

- Most switches are push-button ON/OFF and when pressed down are ON, indicated with a green bar LED.
- Some switches are 3-position rocker switches, as well as a variety of dials and push-pull knobs.
- Reversionary Mode refers to the PFD mode when the MFD display is not on for any reason. See Section 7: The G1000NXi Avionics Suite for more information on Reversionary Mode.

Instrument Panel

These are the main controls and switches on the instrument panel:

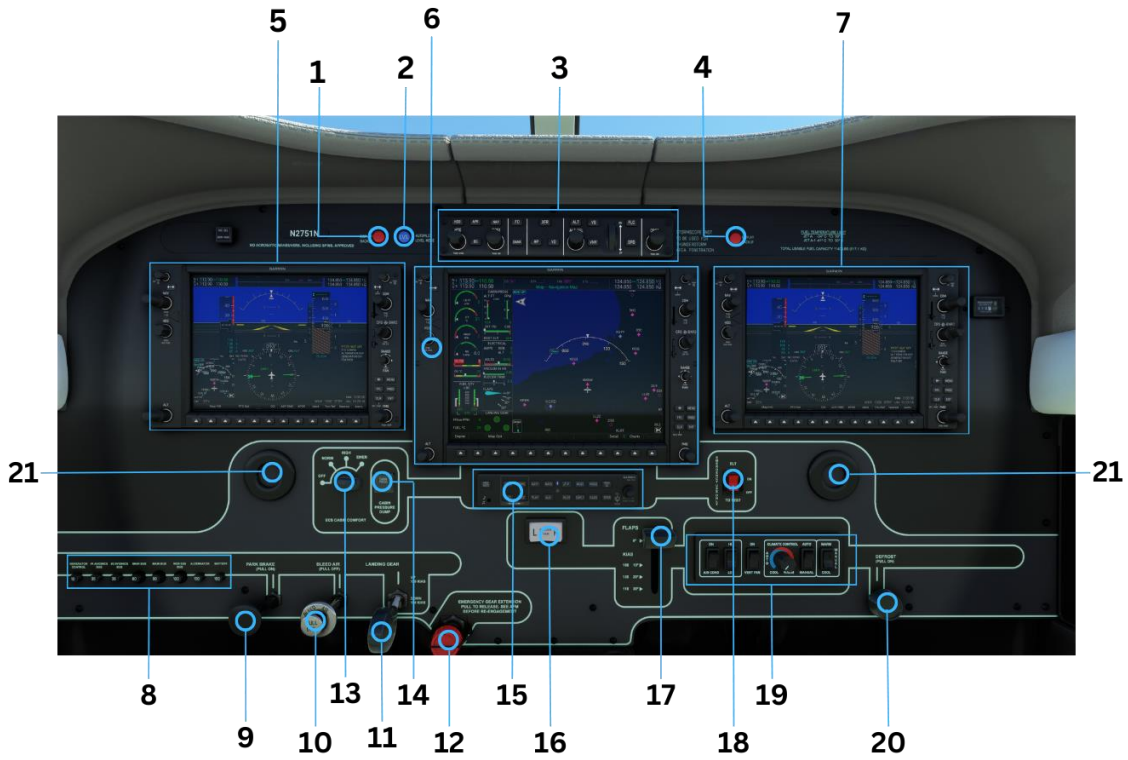


FIGURE 5-2: INSTRUMENT PANEL

1	Display Backup - pilot side	Press if the PFD fails to automatically enter reversionary mode or to command the MFD to enter reversionary mode.
2	Autopilot Level mode	Press to activate the Autopilot LVL mode and bring the wings level and command 0fps vertical speed.
3	GMC-710 Autopilot control panel	The 'autopilot controller'. This panel is used to control the GFC-700 Autoflight control system (AFCS) which is a part of the G1000NXi avionics suite. A full description of this panel is in AFCS entry in Section 7.
4	Display Backup - copilot side	Press if the PFD fails to automatically enter reversionary mode or to command the MFD to enter reversionary mode.
5	PFD1	Pilot side Primary Flight Display – see section 7 for more information.
6	MFD	Multi-function display – see section 7 for more information.
7	PFD2	Co-Pilot side Primary Flight Display – see section 7 for more information.
8	Main Bus Tie CB panel	The main circuit breakers for the electrical bus tie – see section 6 'Electrical System' for more information
9	Parking Brake	Pull out = parking brake SET. Push in = parking brake RELEASE.
10	Bleed Air	Pulled out = bleed air OFF. Push in = bleed air ON. When ON the ECS system will receive bleed air to pressurise and warm the cabin.
11	Landing Gear Selector	Lower position = Landing gear DOWN, Upper position = landing gear UP (retracted). Gear status is indicated on the G1000 MFD or PFD (in reversionary mode).
12	Emergency Gear Extension	This will allow the gear to free-fall into the DOWN position in the event of a failure of gear hydraulic system. To operate, remove the guard and pull the lever fully aft.

13	ECS cabin comfort	Environmental Control System. 4 position dial (OFF, LOW, HIGH, EMEG). Controls the rate at which the cabin pressurisation system will operate using conditioned bleed air drawn from the engine. This bleed air is always warmer than ambient and is also used to heat the cabin.
14	Cabin Pressure dump	Protected by a cover. When pressed this will 'dump' pressurised air out of the cabin until it is equalised with the outside air pressure. This is an emergency system.
15	GMA-310c Audio Control Panel	This is used to control the radio transmit/receive and volume. See Section 7 for more information.
16	Rudder Trim Switch	Operates the rudder trim.
17	Flaps Lever	Electric flap position selector (4 positions: UP, 10°, 20°, 38°)
18	ELT	Emergency Location Transmitter switch.
19	Climate Control Panel	Control the Airconditioning and Vent Fans. See 'Environmental systems in Section 6
20	Defrost	This will use conditioned warm bleed air from the engine to defrost the windshield
21	Yoke click-spot	Click here to un-hide the control wheel.

TABLE 5-2

Standby Flight Instrument

The **FSR500** does not have a standby flight instrument in the V1.0 release, but this will be implemented in a future release.

Overhead Switch Panel

The overhead electrical Switch Panel is where many of the most important switches for controlling electrical systems are located.

The panel is divided into 3 zones – the pilot side switches, the central dimming control switches and the co-pilot side switches. When a switch is in the 'ON' position it is pressed down and a green LED will illuminate.

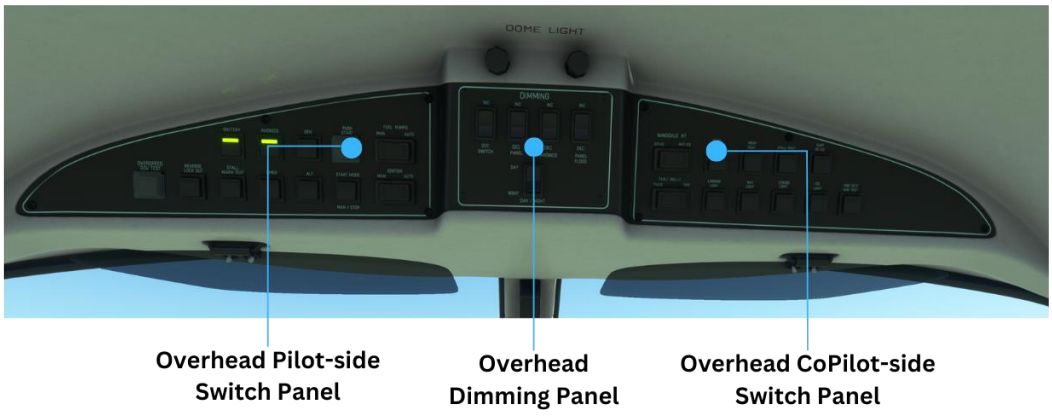


FIGURE 5-3: OVERHEAD SWITCH PANELS

Pilot side switches

These control the major electrical systems of the aircraft

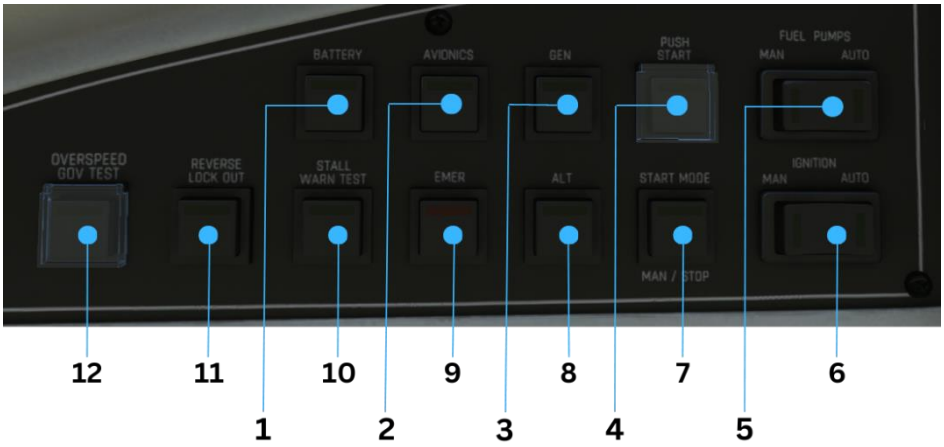


FIGURE 5-4: PILOT SIDE OVERHEAD SWITCHES

1	Battery	This connects the 24V battery which powers all the electrical systems and the starter motor. It will turn on the G1000 PFD1 in reversionary mode and the radios. (Main Bus & Avionics #1 bus)
2	Avionics	This will turn on the MFD and PFD2 and PFD1 will come out of reversionary mode.(Avionics #2 bus and non-essential bus).
3	Generator (GEN)	Turns on the generator which supplies power one the engine has started. See Section 6 for more information.
4	Push Start	Protected by a cover. When pushed this will activate the starter motor and begin the engine start sequence. If in Auto start mode, the button can be released after being pressed momentarily and will cut out when engine Ng = 56%. When in Manual start mode, the button must be held down to operate the starter. It should be held for no more than 10s after moving the condition lever forward and never more than 30s.
5	Fuel Pumps	This is a 3-way rocker switch. Left = Manual (MAN) will run the left & right wing tank auxiliary boost pumps ON, Middle = OFF, Right = Automatic (AUTO). In this mode the pumps will turn on if a low fuel pressure condition is sensed (less than 9 PSIG)
6	Ignition	This is a 3-way rocker switch. Left = Manual (MAN) will spark the dual igniters continuously. Middle = OFF, Right = Automatic (AUTO). In this mode the dual igniters will activate if torque drops below 275ft-lbs and de-activate above 375 ft-lbs.
7	Start Mode	This will set the start mode to MANUAL when pressed (LED will be on). The default starter mode is AUTO (not pressed, LED off). Note: Pressing this will cause an Auto engine start in progress to stop. (necessary in the event of a 'hung-start'/no light-off).
8	Alternator (ALT)	This will turn on the alternator, which will supply DC power to charge the aircraft battery. The alternator acts up as a back-up power source to the generator.
9	Emergency Switch (EMER)	This will activate the Emergency Bus to supply emergency power directly from the battery. If the Battery switch is also ON, a red LED will show. Turn the Battery to OFF to ensure correct operation of the Emergency power supply. See Section 6: Electrical System entry for more information.
10	Stall Warn Test	Press and hold to test the stall warning tone, "STALL, STALL".
11	Reverse Lock Out	Press and hold to test the system preventing the engagement of beta/reverse in the air. See Section 10 – Normal Procedures.

12	Overspeed Gov Test	Protected by a cover. Press and hold to test the correct functioning of the propellor governor and overspeed protection. See Section 10 – Normal Procedures.

TABLE 5-3

Dimming Switches

The are used to control lighting intensity in the interior of the aircraft. All are rocker switches with an increase (INC) and decrease (DEC) position. Press and hold to change the intensity of the lighting to the desired level.

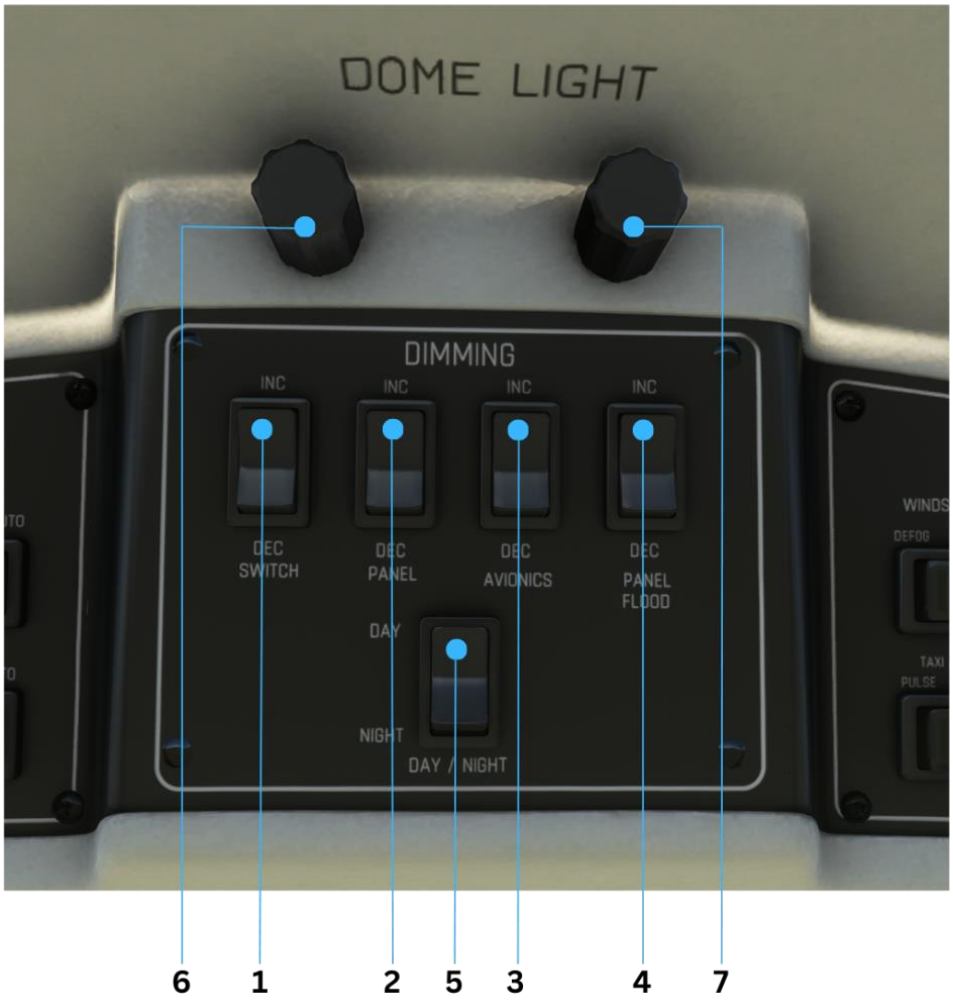


FIGURE 5-5: OVERHEAD DIMMING SWITCHES

1	Switch	Dims Overhead Switch Panel
2	Panel	Dims Circuit Breaker panels and Instrument Panel
3	Avionics	Dims G1000 PFDs and MFD and the GMC-710 autopilot controller panel
4	Panel Flood	Dims Embedded LED light strips
5	Day/Night	Cabin Pressure Dump and MIC SEL switches
6	Dome Light (left)	Anticlockwise = turn on/increase left overhead dome light. Anti-clockwise = decrease/turn off

7	Dome Light (right)	Anticlockwise = turn on/increase right overhead dome light. Anti-clockwise = decrease/turn off

TABLE 5-4

Copilot side switches

These control the ice protection systems and the exterior lights:

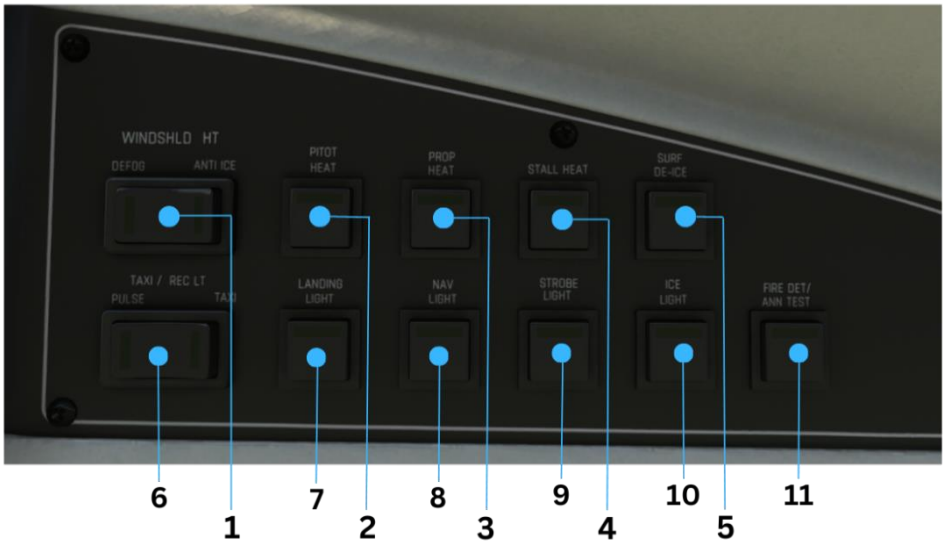


FIGURE 5-6: CO-PILOT OVERHEAD SWITCHES

1	Windshield Heat	Press to turn on the electric windshield heater.
2	Pitot Heat	Press to turn on the heater for pitot-heat system. Extended use on the ground may damage the system.
3	Prop Heat	Press to turns on the electric prop heating elements. Limited to 30s if used on the ground.
4	Stall Heat	Press to turn on the stall heat system. Will be inhibited (CAS advisory message) if OAT 5°C or above.
5	Surf de-ice	Activates the wing and elevator pneumatic de-ice boots.
6	Taxi/Rec Light	This is a 3 positions rocker switch. Left = Taxi lights (wing tip lights), Middle = off, Right = recognition lights (this pulses the wing tip lights)
7	Landing Light	Press to turn on the nose wheel mounted landing light. NOTE: The gear must be extended for the landing light to be visible.
8	Nav Light	Press to turn on the left (red) and right (green) wing-tip navigation (position) lights
9	Strobe Light	Press to turn on the high-intensity strobe light.
10	Ice Light	Press to turn on the ice light to allow observation of the wing leading edge surfaces for ice accumulation at night
11	Fire Det/Ann Test	Press and hold to test the fire detection and annunciation system.

TABLE 5-5

Control Quadrant

This is where all the main control levers for the engine are located.

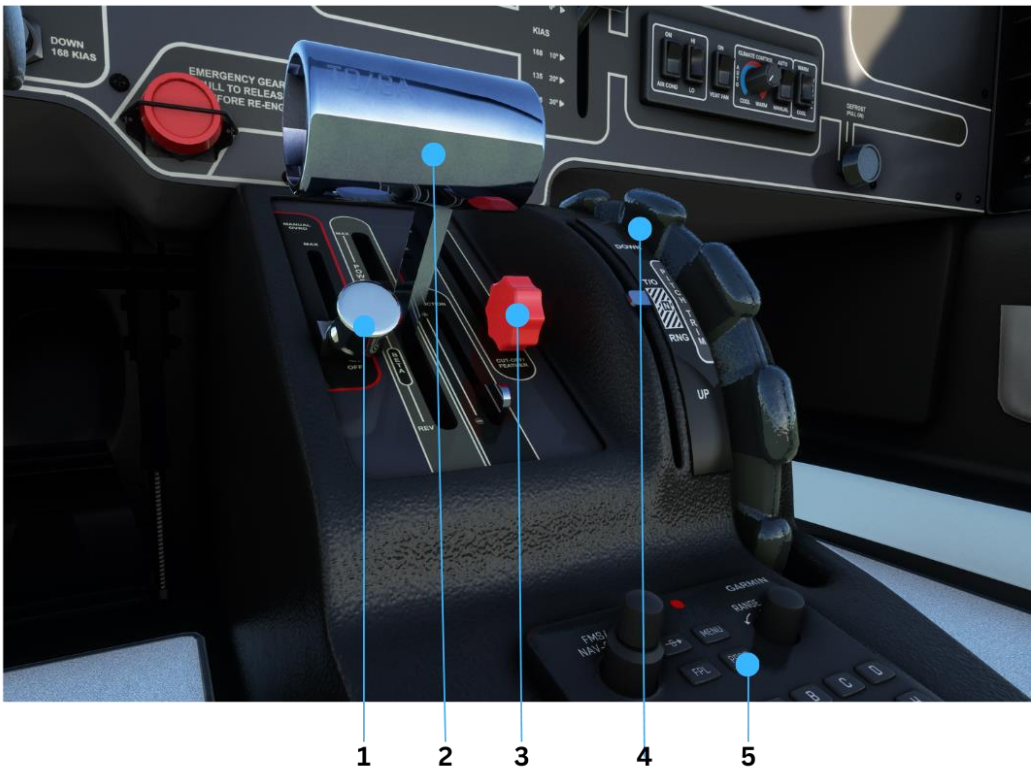


FIGURE 5-7: CONTROL QUADRANT

1	Manual Override Lever (INOP)	The manual override lever (MOR) is used to control supply of fuel to the engine in the event of a failure of the Fuel Control Unit (FCU). It is essentially a back-up throttle. Planned for a future release.
2	Throttle	The main way of controlling the power (torque) produced by the engine. It has 3 ranges: IDLE – MAXIMUM, BETA and REVERSE. There is a detent at the IDLE setting. For a full description of the throttle operation and configuration see Section 6 (Engine) and Section 2 (Throttle configuration). Note: TO/GA button is INOP.
3	Condition Lever	This controls the supply of fuel to the engine. It only has two positions: CUT OFF/FEATHER (fully aft) and RUN (fully forward). Placing the condition lever into CUT OFF/FEATHER will automatically feather the prop also.
4	Elevator Trim Wheel	This supplements the electric elevator trim switches on the control wheel. Take-off range trim is indicated by the white hatched area and current trim position by the white needle.
5	Garmin GCU 476 Keypad (INOP)	This allows the pilot to input data into the Garmin G1000NXi without the need to use the FMS dials on the PFDs or MFDs. Currently INOP (SDK limited). Planned for a future release.
--	Firewall fuel shutoff	Not shown. The red cover and lever when pulled and lifted, will cut the fuel supply. Emergency use only. (INOP)

TABLE 5-6

Control Wheel (yoke)

There are two control wheels – pilot side and co-pilot. They are identical in their arrangement of switches and buttons.

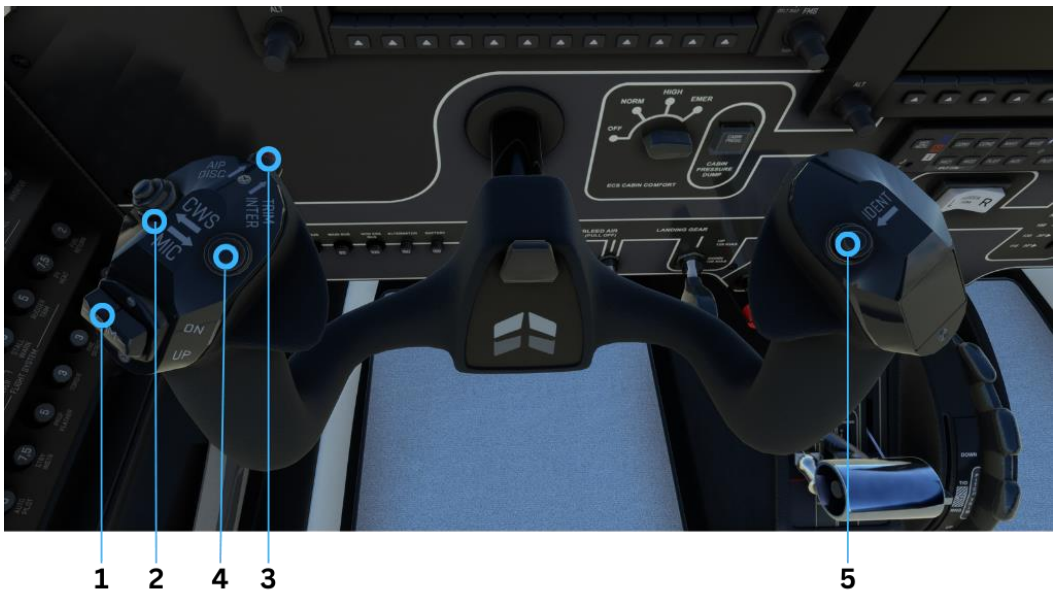


FIGURE 5-8: CONTROL WHEEL (YOKE)

1	Electric Elevator Trim switches	A split rocker switch. Press both forward to move elevator trim nose down and aft to move nose up. Both must be pressed at once to reduce the risks of runaway trim. Pressing one or both in any direction will disconnect the autopilot if engaged.
2	CWS (INOP)	Control Wheel Steering. Pressing this button allows the pilot flying to suspend the autopilot operation allowing them to hand-fly the aircraft without disconnecting the autopilot. The state the autopilot assumes once the CWS button has been released depends on what modes were active when the CWS was engaged. CWS implementation is planned for a future release.
3	Autopilot Disconnect/Trim Interrupt	Pressing this button will disconnect the autopilot and yaw damper. Note it cannot be used to engage the autopilot.
4	Mic (INOP)	Active transmit com Push-to-talk (PTT). INOP.
5	IDENT (INOP)	This will squawk an 'ident' signal via the aircraft transponder.

TABLE 5-7

Circuit Breaker Panels

There are three circuit breaker panels – one on the pilot side (left) fuselage, one on the main instrument panel below and left of the pilot-side yoke and one on the co-pilot side (right) fuselage. Each circuit breaker (CB) protects a particular electrical system as labelled on the panels themselves.

A raised CB means it has 'popped' to protect the system. Push it back in highlighting/selecting and left-clicking. You can also manually pop a CB the same way. This might be to simulate a failure or be a necessary part of a emergency procedure checklist.

The **FSR500** electrical system is fully modelled and each CB for an implemented system is functional. It is therefore important to inspect them before each flight as they can pop, particularly as the aircraft battery ages.

> **Tip**
>
> Inspecting the CB panels can be awkward – try setting up custom cockpit views by positioning your view using 'freelook' mode and the keyboard arrow keys and then use CTLR+ALT+[number from 0-9] to set a cockpit custom camera view. To then move to that view, press ALT+[num] , or bind it to a key or switch in MSFS control settings.

Please refer to the Electrical System entry in Section 6: Aircraft Systems for more information on the Circuit Breaker panels.

Passenger Cabin Overview

The cabin features a polar-white interior, with white leather seating and matched carpeting, all in a factory-fresh condition.

FIGURE 5-9: FSR500 CABIN - FACING FORWARD

There are 4 passenger seats: 2 facing aft and 2 facing forward. There are throw cushions on the seats that will become displaced in strong manoeuvring. They can be stowed/tided using the EFB Cabin Comfort page.

There are 6 windows, with sliding blinds (click and drag), the over-wing right-side window also acts as an emergency exit.

The main cabin door is on the left-hand fuselage, aft of the wing. It can be opened or closed using click spots or via the Ground Ops EFB page. Opening the door in flight will result in the loss of cabin pressurisation and the door itself! If the door is open with the engine running a Warning CAS Message DOOR AJAR will display.

The rear of the cabin has a baggage stowage area for up to 100lbs of baggage.

Individual seat courtesy cabin lighting is provided by and overhead light and can be turned on/off by a switch on each passenger seating control panel.

A folding table is on the right-hand side and can be open and closed by highlighting the click spots on the cover (to fold out) or underside of the table (to stow). The table will be opened whenever drinks or food is served via the EFB but must be stowed manually.

Passenger comfort is managed through the Cabin Comfort EFB page and use of the aircraft Environment Control Systems.

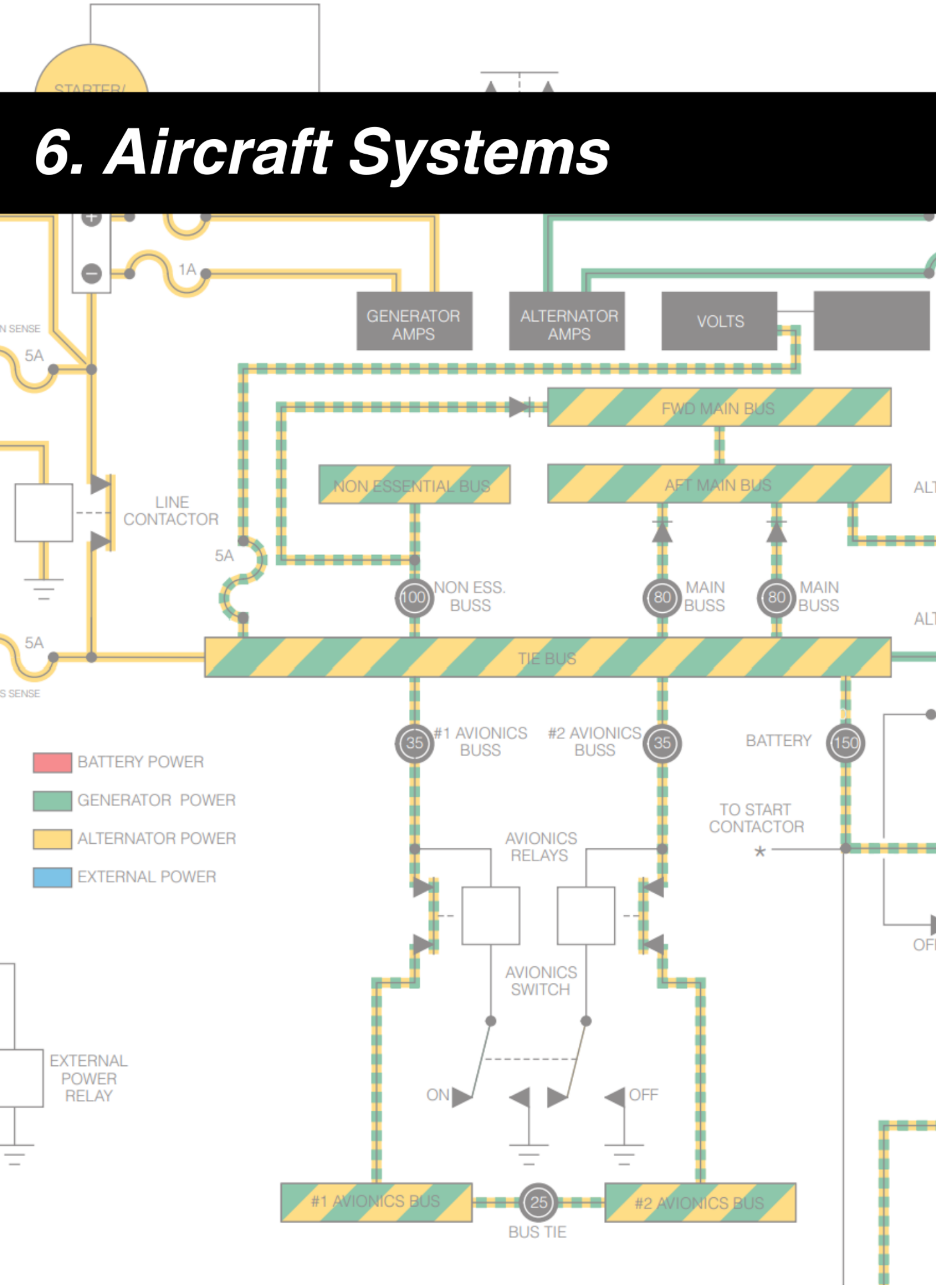
FIGURE 5-10: PASSENGER SEAT CONTROLS

FIGURE 5-11: FSR500 PASSENGER CABIN - FACING AFT

Why no 3D passengers or driver?

At the moment, limits in MSFS mean 3D passenger models are rendered with lower quality than we are happy with. MSFS pilot and co-pilot avatars will appear as normal when viewed from outside the cabin.

6. Aircraft Systems



This section give simplified descriptions all the major **FSR500** systems including:

- Engine and propeller;
- Electrical systems;
- Flight controls;
- Pressurisation;
- Landing gear and hydraulics;
- Brakes and tyres;
- Fuel System;
- Ice Protection systems;
- Environmental System;
- Other secondary systems.

Note: We have only included systems that are, or will be, modelled.

The engine

The **FSR500** is equipped with a Pratt & Whitney PT6A-42A turboprop engine delivering a flat-rated 500 shaft horsepower (SHP) and maximum constant propellor speed of 2000RPM. The PT6A has many variants are used in with a wide range of aircraft, delivering high performance and reliability with low fuel consumption, making them a popular choice.

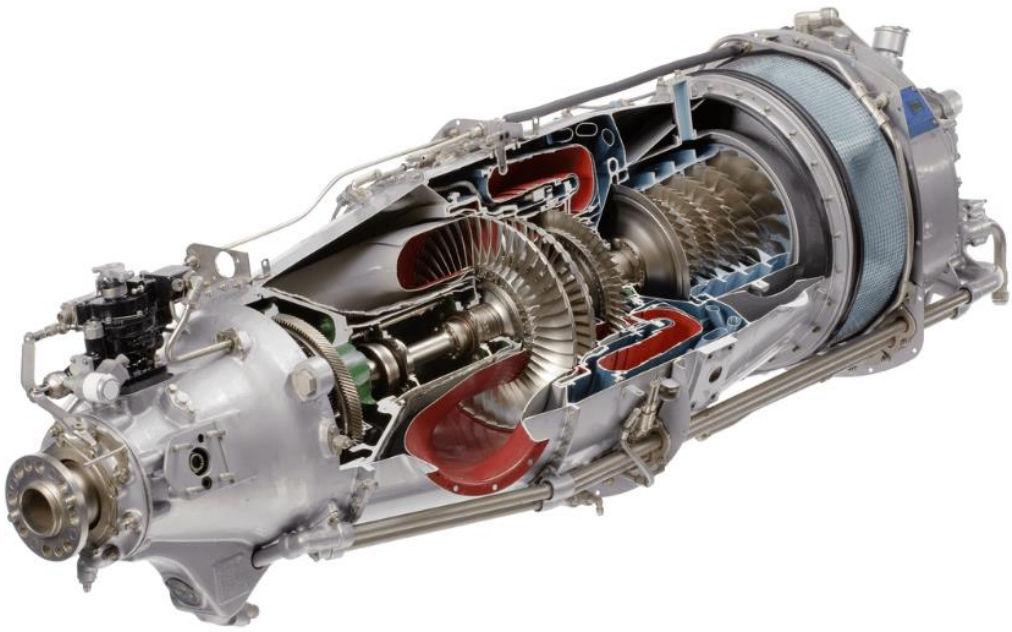


FIGURE 6-1: PRATT & WHITNEY PT6A-42A

For many private owners, progression from a piston-engine to a turboprop marks a significant step up. The extra performance of a turboprop comes at additional cost and following correct procedures and respecting limitations are necessary to avoid very expensive repairs.

Essentially, the PT6A is a small jet engine – by compressing air and mixing it with fuel and igniting the mixture, a jet of hot gas is created that drives the turbine compressor blades, which rotate at very high

speeds. These spinning blades are linked to the propellor via a gearbox and other systems to spin the prop (at a much lower RPM), which then provides thrust.

A full description of the functioning of a PT6A-42A engine is beyond the scope of this manual, but there are many excellent resources freely available online if you would like to learn more about how these engines work.

Torque, ITT & Ng

There are three key measures of the engine's performance available to the pilot:

- **Torque** – the amount of power the engine is sending to the prop (measured in pounds-feet or lb-ft);
- **Ng** – the overall capacity of the engine (measured as a percentage of the maximum RPM of the turbine blades). 101.7% = 38,100 rpm. An Ng reading of 90 means you are using 90% of the engines potential power output. The 'g' in Ng stands for gas-generator, which is another name for that part of the engine;
- **ITT** – Interstage Turbine Temperature. This is the temperature of the combustion chamber and must be carefully monitored.

Engine Systems

Ignition. The Ignition system provides the 'spark' to ignite the fuel at light-off and is controlled using the IGNITION switch on the overhead panel. Manual (MAN) mode will provide continuous ignition and should be selected at engine start, during take-off and landing or when flying in heavy precipitation.

There are two ignitors and there is no time limit on how long the ignitors can be left to run, but leaving them on for extended periods will reduce their life and increase the risk of a failed light-off during engine starts. AUTO mode should therefore be selected in normal flight. When AUTO ignition mode is selected, the ignitors will come on whenever the engine torque drops below 275ft-lbs, helping sustain ignition and avoid an engine 'flame out' (IRL this can occur due to interrupted intake air flow or heavy precipitation). They will turn off automatically should torque rise above 375ft-lbs. Whenever the ignition system is active (MAN or AUTO), the CAS Message **IGNITON** will display.

Engine Accessory systems. The engine has several 'accessory' systems that draw power from it:

- A direct drive Starter/Generator;
- A belt driven Alternator;
- A belt-driven compressor for the air conditioning system.

The Starter/Generator is a single unit – it is used to turn the engine compressor blades during start and then, after start, it is turned by the engine to generate electricity. See Electrical Systems below for more information on these accessory systems.

Inertial separator. The engine has a fixed-position inertial separator. This helps prevent engine damage by preventing foreign objects from entering the engine. This system is not pilot controlled and is always in operation.

Fuel Control Unit. Fuel supply to the engine is controlled through an electronic Honeywell Fuel Control Unit (FCU). This system is not pilot controlled. Fuel pressure can be ensured during engine start and critical phases of flight by turning of the auxiliary fuel pumps by setting the Fuel Pumps switch to MAN.

Oil. The engine has an integral oil lubrication system with a capacity of 12 quarts (11.35 litres). Oil will be consumed over time and, if not replenished in the Maintenance EFB Page, may lead to engine failure. The Engine Information System (EIS – see MFD in Section 7) has oil temperature and pressure gauges. Oil pressure and temperature outside of permitted range may indicate an imminent engine failure and the relevant emergency checklist consulted. The limits on the oil system are:

	Pressure (psi)	Temperature (°C)
Starting	0-200	-40 minimum at start
Take-off/MCP/Cruise	100-135	0-99
Idle	60 minimum	-40 to 99

TABLE 6-1: OIL PRESSURES & TEMPERATURE OPERATING LIMITS

Engine Controls

The engine is controlled by 3 levers located on the centre console/Control Quadrant:

- **Manual Override Lever (MOR)**. This is used to manually control the supply of fuel to the engine in the event of a failure in the FCU or the Throttle linkages. (INOP -planned for future release)

- **Throttle.** This controls the supply of fuel to the engine via the FCU and therefore the power (torque) output of the engine. It has 3 ranges: Normal (Idle to Maximum), Beta and Reverse. Beta and Reverse are accessed by moving the throttle aft of a detent at the idle position. The throttle should never be moved into beta/reverse in the air and a squat switch on the landing gear will prevent this. The correct functioning of the squat switch safety system can be tested on the ground using the Reverse Lock Out switch. See the propeller section below for a description of the Beta and Reverse modes.

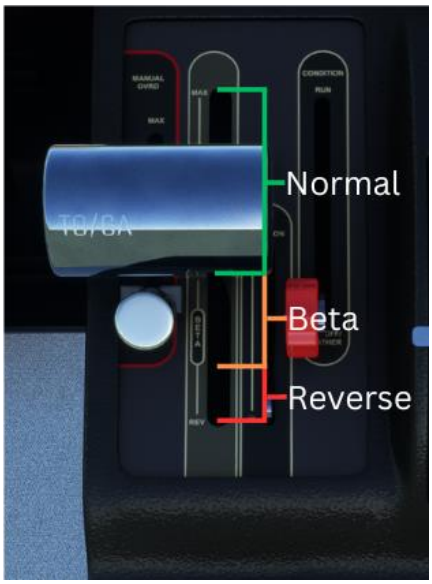


FIGURE 6-2: THROTTLE POSITIONS

- **Condition Lever.** This controls the supply of fuel to the FCU and also the prop feathering. It only has two positions RUN and CUT-OFF/FEATHER. When in RUN, fuel-flow is established to the FCU. Placing it in CUT-OFF will cut the supply of the fuel to the engine (shutdown) and simultaneously feather the prop (if the battery is on).

Engine Instruments

There are 5 engine and 1 prop gauges on the EIS display on the MFD:

FIGURE 6-3: ENGINE INSTRUMENTS

1. **Torque gauge.** This will show engine torque in 100s of pounds-feet (lb-ft) – a measure of rotational force. The upper limit (red) arc begins at 1315 lb-ft. When applying more torque via the throttle, there is normally some lag between moving the throttle and what is shown on the gauge. This lag is typical for turbine engines and should be accounted for. When in idle on the ground the engine will produce more power and the gauge will read 143lb-ft and in the air will idle at 10lb-ft.

2. **ITT gauge**. The ITT gauge will show the current ITT temp in degrees Celsius. It is a dynamic gauge with different temperature arc for engine start and normal operation. The gauge will automatically switch from Start to Normal arcs after engine start has completed. The temperature range of each arch is:

	Start (°C)	Normal (°C)
Green	0-770	0-770
Yellow	775-1000	775-800
Red	1005 +	805+

TABLE 6-2: ITT RANGES

An over-temperature condition (red arc) will be shown with a flashing red ITT CAS symbol on the gauge. Engine damage will result quickly (within seconds).

3. **PROP RPM gauge**. This will show the current rate at which the prop is spinning in revolutions per minute (RPM). The normal operating range is 1200-2000 RPM and in flight the prop governor will maintain a constant speed of 2000 RPM. On the ground at lower power settings, prop RPM will be lower than 2000 RPM. Overspeed of the PROP will trigger a flashing red CAS warning on the gauge. (see the Propellor section below for more information).

4. **Ng gauge**. This will show the operating speed of the gas-generator as a percentage of the maximum RPM of the engine ($101.7\% = 38{,}100$ rpm). Exceeding Ng limits will trigger a flashing red CAS warning on the gauge.

5. **Oil Pressure gauge**. This will show the engine oil pressure in PSI. Any pressure outside of normal range may indicate a failure.

6. **Oil Temperature gauge**. This will show the oil temperature in PSI. Any temperature outside of normal range may indicate a failure.

	Oil Temperature	Oil Pressure (psi)
Green	0-99°C	100-135
Yellow	n/a	136-200
Yellow (lower arc)	-40 to -1°C	60-99 (torque <1100lb-ft) 85-99 (torque > 1100lb-ft)
Red	100°C+	<59 (torque <1100lb-ft) <84 (torque <1100lb-ft)

TABLE 6-3: OIL TEMPERATURE & PRESSURE RANGES

Propeller

The **FSR500** is equipped with a Blademaster, 4 blade, 82.5", all-metal, variable pitch prop. Each blade has an electric de-ice boot. In normal flight operations, the prop operates at a constant RPM of 2000 via a propellor governor which automatically regulates the prop RPM. The correct functioning of the governor can be tested using the Overspeed Governor Test switch. Prop RPM is not pilot controllable.

Blade pitch angle in normal flight is controlled automatically. On the ground it can be controlled via the throttle to obtain low and negative pitch angles (Beta and Reverse). The prop can be feathered using the Condition lever in the CUT-FEATHER position.

Beta

The props enter beta at a pitch angle of less than approximately 19°and goes down to 0° of pitch angle. As the pitch angle reduces, thrust declines until at 0°, the blades are flat and no effective thrust is produced.

What is Beta Range?

'Beta' range on the **FSR500** refers to when the throttle is moved aft of the idle detent and allows the prop blades to automatically reduce their pitch angle to produce less forward thrust.

Reverse

Continuing to move the throttle aft then enters the REVERSE range. Here, the blades enter a negative pitch angle up to a maximum of -9.5° to -10.5° and will produce a reverse thrust effect. The further aft the throttle, the greater the negative pitch and the greater the reserve thrust.

Beta is useful when taxiing to control excessive taxi speeds. After landing it should always be engaged to reduce the ground roll. Reverse range can be used to further reduce the ground roll.

Warning!

Reverse thrust may not be used to reverse-taxi the aircraft and should not be used on unsealed surfaces.

Feathering

Feathering the prop places the blades at a pitch of 85°, so they present the least surface area (and therefore drag) to the relative wind. This is important during engine starts or following a loss of engine power, both to aid any attempted restart and to reduce prop drag and increase glide performance.

As the condition lever controls both prop feathering as well as fuel supply, this helps reduce pilot workload, particularly in an emergency.

> **Note**
> The Battery must be on to feather the prop. The prop will not feather on Emergency power only.

Electrical

Like most modern aircraft, the **FSR500** is heavily reliant on its electrical system for many vital functions. The **FSR500** has a fully modelled electrical system using the new MSFS electrical SDK. This allows the aircraft electrical circuits to be fully mapped, with the correct load and draw – voltage drain on the battery and generator load are all accurately simulated. This section gives a simplified description of the system. Many aspects of what would present in a similar IRL system and have been omitted.

The on-board electrical system consists of the following major components:

Supply

All electrical systems must have a source of supply to power the aircraft system. The **FSR500** has 3 on-board method of supply electricity, providing a high level of redundancy.

1. **24v lead-acid battery**. This is used to provide power pre-engine start, to power the starter motor during engine starts and give limited emergency power. The battery has a charge and a total capacity that will degrade over time and will eventually require replacement. Old batteries can result in electrical failures or hot-starts. The battery condition can be seen on the EFB Pre-flight page, or on the EIS display. The battery can be reconditioned/serviced on the EFB Maintenance page.
2. **Direct drive starter/generator**. This is the main power source for the aircraft electrical systems. The engine must be on for it to supply power.
3. **A belt-driven alternator**. The alternator works in tandem with the generator and as a back-up. If the generator were to fail, the alternator can supply all necessary electrical power. During normal operations it keeps the battery charged. The engine must be on for it to supply power.

Each system has its own on/off switch on the overhead panel. CAS Messages will show whenever the Generator or Alternator are off/failed. If either the Generator or Alternator trip, follow the emergency procedures set out in Section 11. The system also has an inverter, used to convert DC from the electrical supply to AC for systems that require AC (e.g. the EFB or to power the USB ports).

> **WARNING**
> If you fail to turn on the Generator and/or Alternator after engine start, the aircraft systems will deplete the battery and you will eventually experience a total loss of electrical power with no emergency supply.

Ground Power

As well as the 3 on-board systems, electrical supply can also come from a Ground Power Unit (GPU). This can be requested and connected to the aircraft using the Ground Ops EFB Page. When connected it will

provide power to all the aircraft systems. The GPU must be disconnected before the generator and alternator are turned on. This is normally immediately after you have started the engine.

Distribution

The power supply must be distributed to the aircraft systems. This is done through a series of electrical 'busses'. Each bus has an associated set of Circuit Breakers (CBs) of different amperage ratings depending on each system. Typically, each bus is located behind its associated CB panel. There are 7 busses:

1. **Tie Bus** (CBs on instrument panel). The tie bus controls the supply to all the other busses except the Emergency and Battery busses which are kept separate. All the CBs for the Battery, Generator and Alternator plus the Main, Non-Essential and Avionics busses are on the tie bus CB panel.
2. **Emergency Bus.** This is connected directly to the battery and not via the tie bus. It can therefore be used to supply essential systems in the event of a total electrical failure.
3. **Main bus** (CBs pilot side, fore & aft). See the CB panel illustration for the systems supplied by the main bus.
4. **Non-essential bus** (CBs co-pilot side). See the CB panel for the systems supplied by the non-essential bus.
5. **#1 Avionics bus** (CBs co-pilot side). See the CB panel illustration for the systems supplied by the
6. **#2 Avionics bus** (CBs co-pilot side).
7. **Battery Bus** (engine compartment). This bus is used to supply courtesy lighting directly from the battery.

Avionics

Both #1 and #2 Avionics Busses will be energised by the Avionics Switch which will turn on the MFD and other avionics. To reduce draw on the battery, the avionics switch is OFF until after engine start.

Gauges

The electrical supply system has two gauges on the EIS:

FIGURE 6-4: ELECTRICAL SYSTEM INSTRUMENTS

AMPS = load on the Generator & Alternator

Volts = current bus volts available. When on battery only this will be battery volts. When on generator and/or alternator this will read what they supply (28volts).

Emergency Power

The EMER switch can be used to supply power to essential aircraft systems in the event of a total electrical failure. It connects the emergency bus, which is itself connected directly to be battery and not via the Tie Bus. The following systems will be supplied:

- PFD1
- Comm/Nav/GPS
- Audio Panel 1
- #1 AHRS
- #1 ADC
- Landing gear position indicators
- Internal Lighting

The following aircraft systems will NOT be operative in emergency power:

- Flaps
- Rudder trim
- BETA and Reserve range

Some EIS gauges may not function/display invalid:

- Fuel Quantity
- Torque
- Oil Pressure
- Vacuum
- Pressurisation gauges

WARNING

For the Emergency Power supply to operate correctly, the BAT switch must be OFF. If it is ON, a red LED will show on the EMER switch. This is to prevent non-essential systems from drawing from the battery.

Circuit Breakers

Circuit breakers (CBs) are designed to protect electrical systems from damage caused from surges or fluctuations in the electrical supply. There are 4 CB panels:

1. Instrument Panel (tie bus)
2. Pilot side, aft (main bus)
3. Pilot side forward (main bus)
4. Co-pilot side (non-essential buss and avionics 1&2 busses)

With electrical failures enabled in the Realism EFB page, CBs may trip or 'pop' and be in a raised position. It is important to check the CB panel during pre-flight or when a system has failed as it may be the CB. A relevant CAS Message may also be triggered when a CB pops. To reconnect the system, simply push the CB back down. A CB can trip without it meaning the associated aircraft system has itself failed. If

however the effected system does not reenergise when the CB is pushed back down, then it may have suffered a failure.

The following screenshots show each CB panel and the individual system that each CB. Each system can be isolated by pulling the CB. Note CBs for systems not implemented will have no effect (e.g. Iridium):

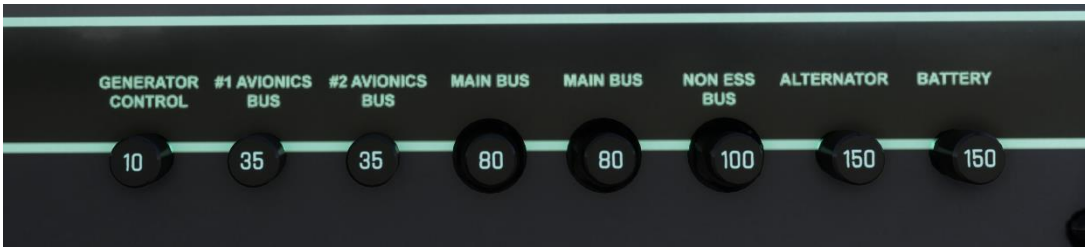


FIGURE 6-5: INSTRUMENT PANEL CBS (TIE BUS)

FIGURE 6-6: PILOT SIDE, AFT CBS (MAIN BUS)

FIGURE 6-7: PILOT SIDE FORWARD CBS (MAIN BUS)

FIGURE 6-8: COPILOT SIDE CBS (NON-ESSENTIAL AND AVIONICS 1&2 BUSSES)

Flight Controls

Primary Flight Controls

The ailerons, elevator and rudder are all conventional and mechanically linked to the control wheels and rudder pedals.

Trim

Pitch (elevator) trim is controlled via the electric trim switches on the control wheels or the trim wheel on the control quadrant. The position of the elevator trim is shown on the gauge to the left of the trim wheel with a blue marker. This should be in the white hatched box for take-off. The neutral (zero trim) position is marked with an N.

FIGURE 6-9: PITCH TRIM INDICATOR

Rudder trim is controlled by dual electric switches on the instrument panel. Rudder trim position is shown by a gauge on the EIS screen on the MFD. Before take-off there is a green take-off arc range at 2.5-3 degrees right trim. The absolute value of the trim is shown in cyan numbers to the right of the gauge.

Rudder trim must be in this range for Take Off – if it is not a **TO CONFIG** CAS advisory/warning message will show. After take-off the green mark is not displayed, although you may find it advisable to keep right rudder trim in place during a maximum continuous power climb.

Aileron trim. The **FSR500** has no in-flight adjustable aileron trim – a fixed trim tab positioned on the ground assists cruise trim (this is factored into the aircraft flight model).

Flaps

The **FSR500** has an electrically operated flaps system. The flaps can be in 4 positions and are controlled by the flap lever. The 4 positions are:

Flap Setting	Maximum Deployment Speed (KIAS)	Typical use
0 °	N/A	Normal take-off
10 °	168	Approach and emergency descents
20 °	120	Short field take-off/Approach
38 °	108	Final approach

TABLE 6-4: FLAPS

FIGURE 6-10: FLAPS POSITION INDICATOR

Flap position is indicated on the MFD EIS or on the flap selector lever.

Other Systems

Vacuum. The vacuum system is used as part of the de-icing system to keep the pneumatic boots deflated. The MFD EIS has a gauge for 'vacuum'. This shows the overall status of the system and a drop in pressure may indicate a fault.

Stall Warning. The left wing contains a lift transducer sensor linked to a system for detecting a stall condition. The correct operation of the system is tested with the Stall Warning Test switch on the overhead panel, which will trigger the STALL…STALL aural warning. A failure in the system will trigger the amber **STALL WARNING FAIL** CAS message.

Emergency Locator Transmitter (ELT). The ELT is used in the event of a forced landing in a remote off-field location to allow the emergency services to locate the aircraft. It is a self-contained unit that transmits on the 121.5MHz frequency. It can be set of OFF/ARM or ON. Activating the ELT has no effect in the sim.

Pressurisation

The **FSR500** has a pressurised cabin, allowing operations up to 30'000ft. The **FSR500** uses custom code to simulate cabin pressurisation according to real-world conditions.

The system is highly automated, requiring little pilot input: with the engine running and the main cabin door fully closed and latched, the pilot simply needs to push the bleed air lever to open the supply of conditioned bleed air from the P3 compressor, switch the ECS Cabin Comfort to NORM. The destination elevation will be set automatically to the destination landing field elevation data stored in the G1000NXi as soon as a destination is entered in the G1000NXi flight plan page. If importing a flight plan via the EFB/SimBrief it will be set automatically and likewise if stating with a flight plan loaded via the World Map. The aircraft will then pressurise and depressurise without any further pilot input required other than monitoring the system. It also has warnings and an emergency back-up in case the pilot fails to follow correct procedure. Failure of the pressurisation system is an emergency and can lead to hypoxia and loss of control.

System Controls and Instruments

ECS Cabin Comfort. This switch will control the mass of bleed air and the rate at which the cabin will pressurise (and also the rate at which the cabin air will warm). It has 4 positions: OFF, NORM, HIGH and EMERG. To pressurise the cabin, it must be at NORM or above. At very high rates of climb HIGH may be selected or if rapid warming of the cabin is required. Selecting the EMRG will open the emergency bleed valve and the cabin will pressurise at a rapid rate.

EIS display. Cabin pressurisation information is provided on the EIS on the MFD in the Cabin Press display:

FIGURE 6-11: PRESSURISATION SYSTEM INSTRUMENTS

ALT FT shows the 'cabin altitude' i.e. the relative altitude of the cabin. In an unpressurised cabin this will equal the aircraft altitude. In a pressurised cabin, this will only start to rise once the cabin differential PSI reaches 5.2-5.3PSI, after which the pressurisation system cannot maintain sea-level pressure. The maximum cabin altitude allowed in 10,000ft. Higher than that and the caution CAS Message **CABIN ALT 10K** will be made. Above 12,000ft and this will be replaced with the warning CAS Message **CABIN ALT 12K** and automated emergency pressurisation will start (see below).

FPM shows the rate at which the cabin is pressurising/depressurising.

DIFF PSI shows the differential pressure between the cabin and outside. The maximum allowed is 5.6PSI.

DEST ELV shows the destination airport elevation. This is set automatically once a valid destination is loaded and cannot be adjusted manually by the pilot other than by selecting a different destination.

Cabin Pressure Dump. Protected by a cover. When pressed this will 'dump' pressurised air out of the cabin until it is equalised with the outside air pressure. This is an emergency system. The depressurisation will occur rapidly. IRL fogging/icing of the windows would likely occur IRL and the crew and passengers would need to use emergency oxygen to avoid hypoxia.

> **Note**
>
> Emergency Oxygen supply is not presently simulated in the FSR500.

Emergency Pressurisation. As a fail-safe, if the cabin altitude exceeds 12,000ft then Emergency Pressurisation will being automatically as soon as the **CABIN ALT 12K** CAS message is shown. An emergency bleed valve will open and the cabin start to pressurise.

Unpressurised operation

The aircraft can be operated in an unpressurised state: simply do not push the cabin bleed lever in and keep the ECS Cabin Comfort switch in the OFF position. The Bleed Dump switch may also be pressed. If warm bleed air is required to heat the cabin, then use the ECS to supply warm bleed air and the Dump switch to keep the cabin depressurised.

> **Caution**
>
> When operating at very high altitudes, the cabin altitude may exceed 10,000ft in normal operations. The CAS **CABIN ALT 10K** will show, but flight can be continued (IRL, special precautions such as donning oxygen masks in case of loss of pressurisation may be taken)

Landing Gear & Hydraulic System

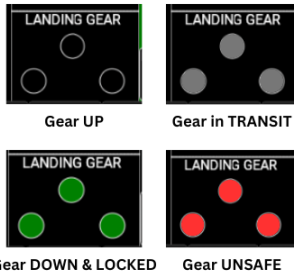
The **FSR500** has a retractable tricycle landing gear assembly. The gear can be raised and lowered using the landing gear selector lever. This lever is an electric switch and activates the motor-driven hydraulic

pump, with hydraulic pressure used to raise and lower the gear. The landing gear is the only aircraft system supplied by the hydraulic pump system.

The gear status is shown on the MFD instrument display (or PFD in reversionary mode).

It can show:

- 3 green: gear down and locked
- 3 hollow white: gear up
- 3 grey: gear in transit
- 3 red: gear fail



Gear UP | Gear in TRANSIT

Gear DOWN & LOCKED | Gear UNSAFE

Gear Unsafe

To prevent gear-up landings, or unsafe gear operations, a caution CHECK GEAR or warning CHECK GEAR CAS message will be shown and an aural 'Check Gear' alert given in the following circumstances:

Condition	CAS	Resolution
Throttle >300ft-lbs in flight, gear not down and locked	CHECK GEAR, aural tone (can be muted)	Lower landing gear, or Increase throttle to above 300ft-lbs; or Mute tone using Alert softkey
Flaps 20 or 36, gear not down and locked	CHECK GEAR, aural tone (cannot be muted)	Lower landing gear; or Raise flaps to 0 to 10 degrees.
On ground and gear lever UP	CHECK GEAR, aural tone (cannot be muted)	Place gear lever into DOWN position
Above 400AGL, the CHECK GEAR CAS will be a Caution. Below 400AGL, it will be a Warning.		

TABLE 6-5: GEAR UNSAFE CONDITIONS

If you should put the gear lever to UP on the ground, a sensor will detect that there is weight on the wheels and will prevent the gear from being raised. The CHECK GEAR warning will be given.

If the position of the landing gear is unknown, then 3 red will be shown and a master Warning (ground) or Caution (in flight) will sound.

Emergency Gear Operation

If the hydraulic system fails (no 3 green after selecting gear down), the gear can be lowered by using the Emergency Gear Extension lever. This is a gravity-based system. Please refer to Section 11: Emergency Procedures for the full checklist. In the sim:

1. Reduce airspeed to 100KIAS or less;
2. Click to remove the wire guard and then pull the lever;
3. Check for 3 green gear indications;

4. Once the gear is down and locked, pull the HYDRAULIC PUMP circuit breaker and leave the emergency gear extension lever pulled.

> **Caution**
> Once the Emergency gear extension lever had been operated, the gear cannot be retracted.

> **Warning**
> Operating the Emergency gear extension lever if the gear is already down and locked can cause a gear system failure.

Brakes & Tyres

Each main wheel is equipped with a hydraulic disc brake system. These are operated from the toe brakes that are on the left and right rudder pedals. These can fail as a result of repeated or excessive heavy braking or if not serviced after a long period of normal use.

Tyres can also fail as a result of heavy landings, incorrect inflation and age.

Fuel System

The **FSR500** is equipped with 2 wing fuel tanks systems. Each wing has 3 tanks:

- outboard 64.2G (243L) outboard tank
- inboard 12.0G (45.4L) inboard tank
- 8.8G (33.3L) header/sump tank.

The total fuel capacity is 190G.

Fuel Return

The system has fuel-return lines that allow some fuel to be returned from the engine. This is primarily to allow some warmed fuel to be recirculated to the wing tanks, allowing sustained operations at high altitudes down to temperatures as low as -54°C with the use of additives (not implemented). The return lines will open automatically:

- During engine starts; or
- When the sensed fuel temperature is -23° of less (but not if there is less than 100lbs total fuel left).

The minimum operational fuel temperature. The lowest permitted fuel temperature for JET-A1 without additives is -41°C (-54°C with additives – not implemented). As the fuel temperature approaches this limit, wax will begin to precipitate from the fuel and clog filters and low fuel pressure may result.

Fuel Pumps

There are two electric fuel boost pumps in each wing root. These are controlled using the FUEL PUMPS 3-way switch on the overhead panel. The pumps can be set to OFF (middle), MAN (left), AUTO (right).

When in MAN the pumps will run continuously. Fuel pumps are set to MAN at take-off and landing or if sustained low fuel pressure is encountered.

In AUTO the pumps will turn on automatically when:

- Overall fuel pressure drops below 9psig – both pumps will run (the pumps will turn off above 12psig).
- When a fuel imbalance of 25lbs or greater is detected. One pump will run automatically to correct the imbalance.

Fuel imbalances are indicated with a CAS Message.

When a pump is running it will be indicated with a CAS Message for either the left or right pump.

Ice Protection systems

Icing can form in any conditions where the outside air temperature is 5°C or colder and there is visible moisture or during ground operations in wintery conditions. Ice accumulations will be visible on the wing leading edges, the prop spinner and the windshield.

The **FSR500** is equipped with a suite of ice protection systems to allow Flight Into Known Icing (FIKI) conditions up to Light and Moderate icing. Severe icing must be avoided. The ice protection system consists of:

Surface De-ice.

This uses pneumatic de-ice boots on the upper and lower wing and the vertical and horizontal stabilisers. They are inflated with engine bleed air and held down by the vacuum system. The system is turned on with the SURF DE-ICE switch. When active, the boots will then inflate/deflate in a 6 second sequence over a 60 second cycle and will continue to do so whilst the switch is on.

Heated Propellor

Each prop blade has an electrical heating element that will melt accumulated ice when the when the PROP HEAT switch is turned ON. If turned on with the aircraft on the ground, the system will heat the elements for 30 seconds and after 60 seconds turn the prop heat off. It will have to be manually turned on again. In the air, the system will stay on.

Heated Windshield

Windshield heating is provided for the pilot side only and is controlled by the 3 position WINDSHLD HT switch. This can be OFF (centre), ANTI-ICE (right) or DEFOG (left). Use the anti-ice position for a more powerful heating effect. Do not operate in either mode for more than 20 seconds on the ground when testing during the run-up checklist. If the windshield temperature exceeds 77°C then the red **WDSHLD OVRTMP** CAS warning message will be displayed until the temperature is reduced (Not currently implemented). Note: due to SDK limitations the whole windshield and all other windows will be de-iced, not just the pilot side.

Heated Pitot

Both pitot tubes have a heating system controlled by a single PITOT HEAT switch. Pitot heading should be engaged whenever in flight regardless of the conditions. Avoid extended ground operations to prevent overheat damage.

Heated Stall Warning

This will deice the stall warning system and is turned on with the STALL HEAT switch. If it is turned on when the OAT is 5°C or greater, the system will be inhibited to prevent an over-temperature damage and the STALL HT INHIB Case advisory message will display.

> **Note**
>
> MSFS recognises the stall heat system as a pitot heat. The in-game interactive checklists will highlight both the Pitot and Stall Heat buttons as a result.

Ice Light

This will activate a light that will illuminate the left-hand wing and allow you to see if there has been any accumulation of ice when flying at night.

Windshield defog lever

Located on the co-pilot side of the instrument panel, this can also be used to supply bleed air to the windshield with a flow of air at the temperate set by the A/C system (see the Environmental System section below).

Ground De-icing

The **FSR500** ice protection systems are not designed to remove ice or snow from a parked aircraft, but MSFS provides no native de-icing ground services. If you are finding that your aircraft is icing up on the ground whilst you work your way through the pre-flight checklists, wait for fuel etc., you have two options to use as a work-around:

1) If on PC, go into Dev mode and set the De-ice slider in the Dev Mode menu > Options to 0. This will instantly deice the aircraft.
2) If on Xbox, or on PC and prefer to avoid Dev mode, swap the current weather to a custom or preset warmer condition and let the sun melt it out, then swap back to your original weather setting. Effective, but not very good for immersion!

Environmental System

The **FSR500** has a custom-coded cabin environment with passenger response - they will react to the temperature levels as shown on the Cabin Comfort EFB page. To help manage their expectations of a comfortable flight, the **FSR500** also has a fully operating cabin climate control system.

Maintaining a comfortable cabin temperature is managed through using three different systems:

1. Engine Bleed air (heat)
2. Ventilation air (ambient)
3. Air conditioning (cooling)

Engine Bleed

To heat the cabin the Engine must be running, the Bleed Air valve must be closed and the ECS Cabin Comfort dial set to NORM or above. Compressor bleed air will then provide warm air that is fed into the cabin.

Ventilation Air

The aircraft has a system of electrical vent fans. These will circulate air at ambient temperature and can be used with the engine off. Typically, they can be used to provide some comfort in the cabin before the engine is started, but they will not either heat or cool the cabin. They can also be used when in unpressurised flight.

Air Conditioning (AC)

The air conditioning system has an engine belt-fed compressor and the engine must be on for it to provide cool air, although the A/C blowers can be operated without the engine running they will only circulate ambient air.

These three systems are controlled through the Pressurisation system (see the Pressurisation System entry above for a description of Bleed Air) and the Climate Control Panel, for A/C, vent air and overall temperature management.

Climate Control Panel

The Climate Control Panel has the following switches:

FIGURE 6-12: CLIMATE CONTROL PANEL

1	Aircon ON/OFF	Selecting ON will engage the engine belt-driven compressor and produced cooled air.
2	Aircon HI/LOW	The controls the air conditioning re-circulation blowers. They can be operated with aircon on or off, but to cool the cabin, the A/C must be ON.
3	Vent Fan	This will blow ventilation air independently of both the bleed-air from the ECS or the air-conditioner systems. It can be used on the ground or when in unpressurised flight. Not typically used in flight.
4	Climate control cool/warm dial	Automatic COOL/WARM rotary dial set the target cabin temperature when in Automatic mode.
5	Climate control auto/manual	AUTO/MANUAL switch. This sets the temperature management to either an automatic mode, where the target temperature is controlled with the dial (4) or one where the pilot has to manually add cold or warm air as required using the warm/cool switch (6).
6	Climate control (manual) warm/cool switch	When in MANUAL mode, this switch is pulsed to obtain cooler or warmer air.

TABLE 6-6: CLIMATE CONTROL PANEL

Using the system

To obtain comfortable cabin temperatures, you must use a blend of both warm bleed air and cool AC air. In Automatic mode this will be managed for you once you have followed the normal procedure below. If you do not turn on the AC, the cabin will get uncomfortably hot.

Normal operation

1. Select AUTO mode;
2. After engine start, AICR COND = ON;
3. AC blowers = HI/LO as required;
4. Set the target temperature on the COOL/WARM rotary;
5. Bleed air will already be available (unless you are planning an unpressurised flight).

Maximum Ground Cooling

If the cabin is very hot, you can maximise cooling on the ground only by:

1. Start the engine;
2. Pull out (close) the Bleed Air Lever;
3. setting ESC Cabin Comfort dial to OFF;
4. AC on with the AC blowers on HI.

> **Warning**
>
> Ensure to reset the Bleed Air Lever to pushed in and ECS Cabin Comfort to NORM once the cabin has cooled sufficiently.

Maximum Heating (air or ground)

1. Set the ECS Cabin Comfort to HIGH;
2. Set AC to off.

Manual Operation

When in Manual mode, the temperature can be controlled by using the Manual WARM/COOL switch. Press and hold the switch to manually introduce more cool or warm air.

> **Note**
>
> When passengers first board, the engine will likely be off and the AC and Bleed air not available. You can use Vent Fans to provide some comfort, but the best thing to do is not to delay engine start – try to have completed all pre-flight tasks (walk-round, IFR clearances and taxi/departure briefing) before the passengers arrive. This will keep to a minimum the time they have to spend sitting in an uncomfortable cabin.

The following schematic shows all the major elements of this complex system:

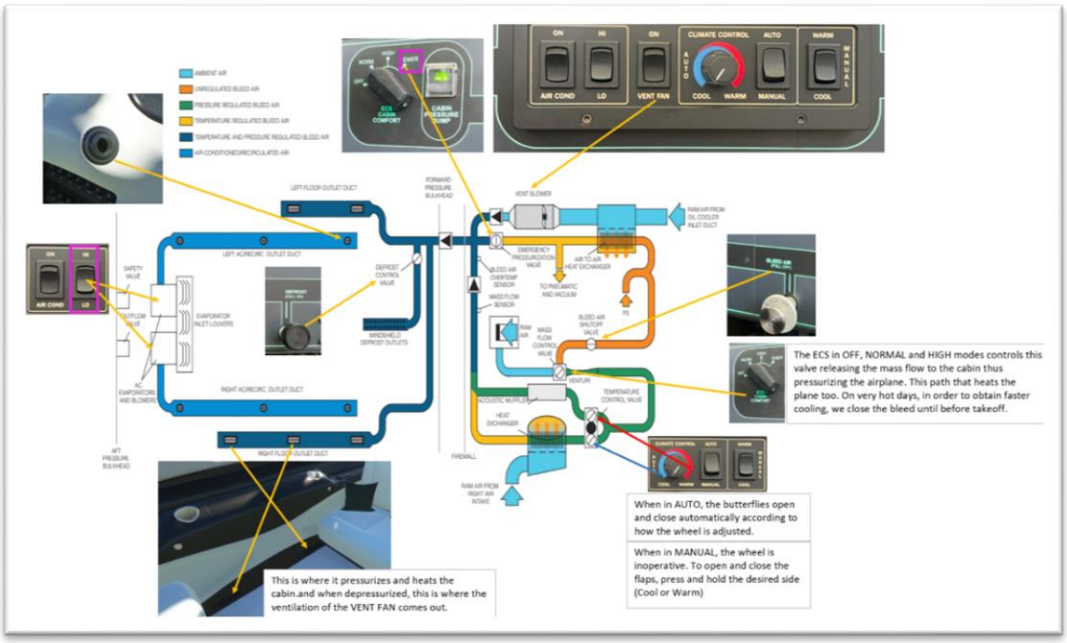
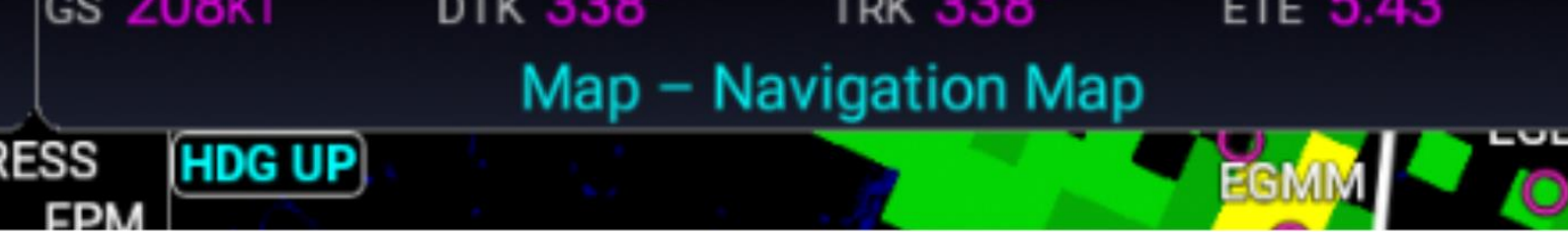


FIGURE 6-13: THE FSR500 ENVIRONMENTAL CONTROL SYSTEM



7. The G1000NXi

The **FSR500** cockpit is built around a customised version of the advanced Garmin G1000NXi avionics suite, developed for MSFS 2020 by Working Title (WT G1000NXi). This provides full IFR capability and coupled with the high levels of automation in the **FSR500** make the aircraft an ideal one for high altitude, single pilot IFR operation. No extra packages are required from the MSFS Marketplace to use the G1000NXi in the FSR500.

FSReborn's custom code allows the Engine Information and Crew Alert System (EICAS) to be displayed on the MFD and PFD when in reversionary mode as well as implementation of number of other custom features found in the IRL G1000NXi.

Both the IRL and WT G1000NXi functions are complex, and it is beyond the scope of this manual to describe all (or even many) of these. There are many excellent on-line video tutorials as well as IRL sources freely available from Garmin that describe the detailed functions of the G1000NXi.

Rather than being a complete guide, this section of the manual focuses on helping you navigate all the different panels and buttons – which can be daunting if you are not used to the G1000. It also focuses on core autopilot functions of the GFC-700 AFCS, the custom EICAS and any custom features such as Electronic Stability Protection. It also notes some of the systems that have not been implemented at this time.

> Note
>
> As the G1000NXi is a wholly integrated system in the **FSR500**, no other 3rd party avionics are supported as this would mean most of the information from the custom G1000 EICAS would not be available.

The G1000NXi suite

The G1000NXi avionics suite consists of the following systems:

- Dual 10" GDU1050 Primary Flight Display (PFD)
- Single 12" GDU1250A Multi-Function Display (MFD)
- Custom Engine Information Crew Alerting System (EICAS)
- Dual GDC-72 Air Data Computers (ADC)
- Dual Attitude and Heading Reference System (AHRS)
- GFC700 Auto Flight Control System (AFCS) with a GMC710 AP controller panel
- Dual GPS/WAAS/SBAS receivers
- Dual VOR/ILS receivers
- Dual VHF radios
- GCU476 keypad (inop)
- GMA350C Digital Audio Panel
- GTX 345R transponder (ADS-B)
- GWX-75 integrated weather radar system.

This (incomplete) list illustrates how complex the overall system is. Fortunately, most of these systems work in the background and the main elements of the suite that the pilot will interact with are the PFD, MFD, autopilot control panel and the audio panel.

The G1000NXi PFD/MFD controls ('Bezel')

All three of the G1000 screens (PFD1 & 2 and the MFD) share the same controls on the frame of the screen ('bezel'). This is so the PFD in reversionary mode can provide the same key functions as the MFD and vice versa.

Becoming familiar with the G1000 buttons and knobs can take some time. The following diagram & table sets out the name and function of each control:

FIGURE 7-1: G1000NXI BEZEL CONTROLS

Num	Name	Function
1	NAV VOL/ID knob	Turn to control NAV volume. Press to toggle morse code identifier audio ON/OFF
2	NAV frequency transfer key	Transfers the active and standby nav frequencies
3	NAV knob	Turn to tune the selected standby NAV frequency highlighted by the cyan box. Outer (large) dial for MHz and Inner (small) for kHz. Press to toggle the cyan tuning box between standby NAV1 & 2 frequencies
4	Heading knob	Turn to select a heading with the cyan heading bug on the HSI. Press to synchronise the heading bug with the current aircraft heading.
5	Altitude selector	Turn to change the ALT SEL value
6	FMS Knob	Press to turn the selector cursor ON/OFF. **Data Entry**: with the cursor ON, turn to enter data in the highlighted field (large knob moves the cursor location; small knob changes the data value at the cursor location. **Page selection**. On the MFD, turning the outer knob will cycle through page group menus and the small knob will select a particular page.
7	Softkeys 1 to 11 (1 = most left, 11 = most right)	Context sensitive keys – their function will change depending on what menu/mode has been selected and will be displayed immediately above the key on the PFD/MFD
8	Joystick	Turn to change map range or weather radar scale Press to activate Map Pointer for map panning Will zoom and pan CHARTS
9	CRS/Baro knob	Turn the large (circular knob to select barometric pressure. Turn the smaller, triangular knob to manually select a course on the HSI when in VOR1, VOR2 or OBS/SUSP modes. Press to synchronise the CDI needle on the currently selected station/waypoint
10	COM knob	Turn to tune the selected COM transceiver (radio) standby frequency highlighted by the cyan box. Press to toggle the cyan tuning box between COM1 and COM2 The selected COM (green) is controlled using the COM/MIC keys on the GMA350c Audio Panel.
11	COM Frequency transfer key	Transfers the active and standby COM frequency.
12	COM VOL/SQ Knob	Turn to control the COM volume.
13	Direct-to key	Activates the Direct-to function.
14	FPL key	Displays Flight Plan information
15	CLR key (DFLT MAP)	Press to erase information, cancel entries, clear menus. Press and hold to return to the default Navigation map screen (MFD only).
16	Menu key	Displays a context-sensitive menu of options (inactive choices are greyed out)
17	PROC key	Gives access to IFR and visual approach procedures for a selected airport.
18	ENT key	Confirms a selected menu/data entry.

TABLE 7-1: G1000NXI BEZEL CONTROLS

GCU476 keypad

The GCU keypad located on the control quadrant below the engine control levers offers a convenient way of controlling the functions of and entering data into the G1000NXi without having to use the FMS knob.

It is presently inoperative in the **FSR500** due to limitations in the WT G1000NXi, but it is planned for a future release following further planned improvements to the G1000NXi by Working Title (SU14).

> **G1000NXi keyboard entry**
>
> The WT G1000NXi already has a feature that allows data to be entered using a keyboard and not the FMS knob. After activating the cursor by pressing the FMS knob, a small symbol will be shown to the right of the data field. Click on this and the symbol will turn solid and a keyboard can be used to input data. This mode can be exited by clicking on the symbol again and must be exited before the FMS knob or any other G1000NXi controls become available again.

Primary Flight Display – main instruments

The G1000NXi PFD combines various flight instruments and information displays. The layout of the main instruments is as shown:

FIGURE 7-2: PFD FLIGHT INSTRUMENTS

	Instrument	Function
1	NAV Frequency Box	Shows the active and standby NAV1 & 2 frequencies.
2	Airspeed Indicator (KIAS)	Red = Vso White = Vfe in landing configuration Green = normal operating speed Yellow = approaching Vmo Red/White barber pole = Vne. Current speed is displayed in box and shown by the position of the yellow needle right of the tape. The magenta line is a speed trend indicator.
3	True Airspeed (TAS)	The true airspeed of the aircraft, in knots.
4	Current Heading	The current heading. By default this will be in °MAG.
5	Horizontal Situation Indicator (HSI)	The HSI will show current heading. It has a compass rose, either full circle or an arc if the inset map has been shown in the centre of the HSI. Inside the HSI is a Course Deviation Indicator (CDI) needle as well as several 'dots' in the background used to show the degree of deviation from the current track.
6	Outside Air Temperature (OAT)	The Outside air temperature.
7	Softkey functions	The text indicates what current function of the softkey is. Inactive keys are greyed out or blank.
8	System Time	Time in UTC
9	Generic Timer	A simple timer can be activated through the TMR/REF softkey.
10	Transponder Data Box	This will show information about the current status of the transponder – selected squawk code and mode
11	Selected Heading Bug	Changed using the HDG sel knob on the autopilot panel, or the bezel.
12	Barometric Altimeter setting	The current barometer setting.
13	Turn Rate Indicator	This is used to help conduct standard rate turns. A large tick corresponds to a standard rate turn and a small tick, half-rate turn.
14	Vertical Speed Indicator (VSI)	This will show the current rate of climb or decent.
15	Selected Altitude Bug (partially visible)	The bug will show the altitude selected using one of the ALT sel knobs
16	Altimeter	Barometric altitude above mean sea level.
17	Selected Altitude	The pre-selected altitude
18	COM Frequency Box	The active and standby COM1 and 2 frequencies
19	Navigation Status Box	Information about the current active navigation source
20	AFCS Status Box	Where all active and armed AFCS (flight director and autopilot) modes are indicated
21	Bank Angle Indicator	Tick marks at 10° spaces and a major tick mark at 30°, 45° and 60° (limit) of bank.
22	Slip/Skid Indicator	The line underneath the triangular Bank Angle marker shows the degree of slip or skid. Adjust flight controls to keep it centred under the triangle which will indicate the aircraft is in co-ordinated flight.
23	Attitude Indicator	The yellow bars show pitch and roll position of the aircraft. The Pitch scale has large marks at 10 degrees of pitch up/down and small marks at 5 degrees.
24	CAS Message display area	All CAS Messages will be displayed in this area. Most important will be displayed first. Some messages may be obscured by the inset map when in reversionary mode, or by the flight plan widow.
25	Flight Path Indicator	The green circle will show the predicated flight path of the aircraft if the present attitude/power is maintained

TABLE 7-2: PFD FLIGHT INSTRUMENTS

Primary Flight Display – additional information

The PFD is partially configurable and some additional information can be displayed also, including an inset map and flight plan windows. As the PFD shares all the same buttons as the MFD, it is possible to perform all the same navigation and route planning functions in the PFD, either in normal or reversionary mode. The additional PFD information is as shown:

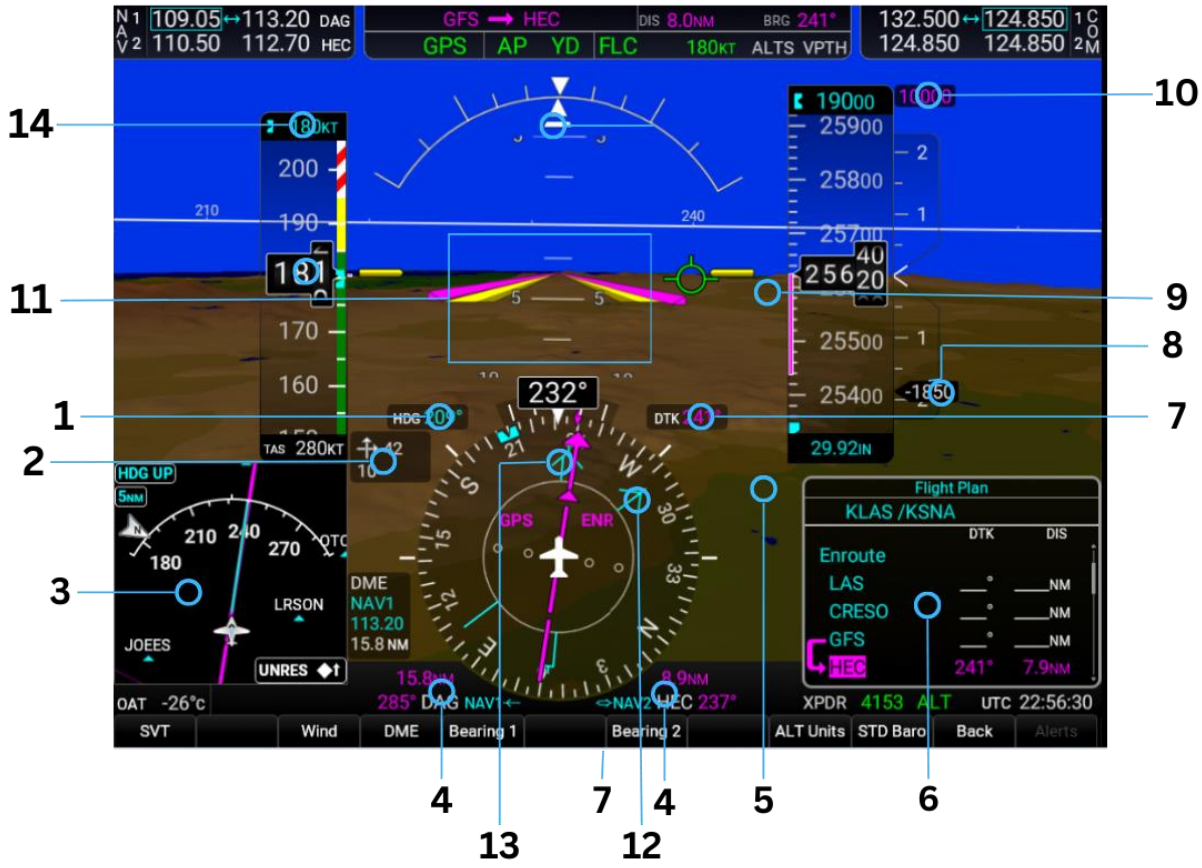


FIGURE 7-3: PFD ADDITIONAL INFORMATION

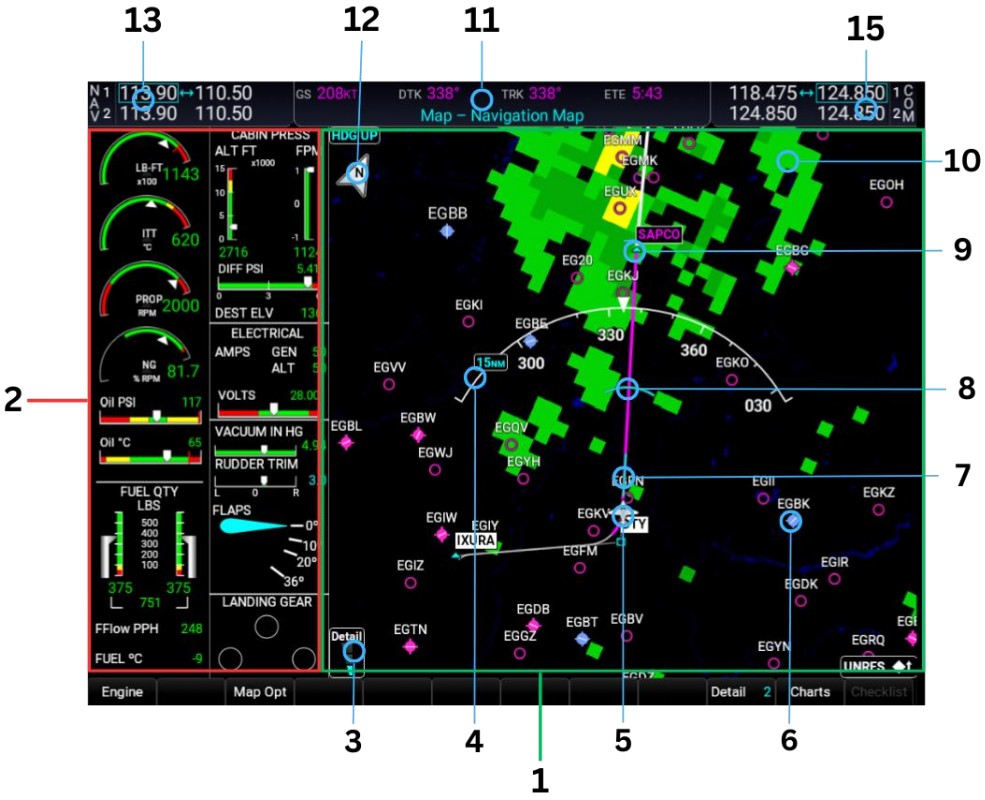
	Additional Information	Description
1	Selected Heading	The position of the heading bug in degrees.
2	Wind data box	This will show information about the wind. Use the softkeys to select different formats or hide it (this is a persistent setting).
3	Inset Map	A mini-map. It can be configured to show traffic, relative terrain etc.
4	Bearing Information Windows	This provides information on Bearing Pointer 1 and 2.
5	Minimum Descent Altitude (MDA)/Decision Height (not shown)	This will show the selected 'minimums' depending on whether it is a decision altitude (baro – AMSL) or radio height (radar altimeter – AGL)
6	Flight Plan window	A condensed view of the flight plan legs and any loaded procedures. The active leg is in magenta. Use the PFD FMS knob to activate the cursor and select a waypoint.

7	Desired Track (DTK)	This is the track you should fly to intercept a navigation leg.
8	Required Vertical Speed Indicator	The target vertical speed as determined by the current autopilot mode.
9	Vertical Deviation Indication (not shown)	Used when flying approaches. This will indicate how far above or below the glide slope/glide path you are.
10	VNV target altitude	In magenta, this shows the next VNAV altitude in descent.
11	Flight Director Command Bars	The magenta inverted V Flight Director command bars. These will move to indicate what attitude the pilot/autopilot should maintain to achieve the active AFCS modes.
12	Bearing pointer needle 1	A single needle will point towards the current Nav source for pointer 1
13	Bearing pointer needle 2	A double needle will point towards the current Nav source for pointer 2
14	Selected FLC speed	This will show the target speed in KIAS when the FLC AFCS mode is active

TABLE 7-3: PFD ADDITIONAL INFORMATION

Multi-Function Display (MFD)

The 12” MFD is the primary source for engine and other systems information via the Engine Information System (EIS) bar on the left. It also provides a configurable moving map display which includes information from the terrain warning and avoidance system (TAWS).



MFD Information	Description

FIGURE 7-4: MFD LAYOUT

radar (select from the Map Page Group). Windows for Flight Plan

		and Procedures can also be displayed using the MFD bezel keys. Use the outer FMS wheel to select other page groups. Navigraph charts can also be displayed with a linked Navigraph subscription.
2	Engine Information Screen	Custom engine information and aircraft system status display.
3	Detail scale	Indicates the current level of map detail – the lower the detail, the less information will be displayed on the map. This is set via the softkeys.
4	Bearing Information Windows	Heading & Range arc.
5	Current Aircraft Position	This shows the current aircraft position. This will always be centred unless in pan mode.
6	Map information	Depending on the level of detail selected and other configurable options, the map will display airports (blue = towered, magenta = untowered. Hollow = soft runway surface).
7	Track Vector	Shows the predicted track of the aircraft. This is not on by default and is selected using the Menu key.
8	Selected ALT arc	Shows the predicted point where the aircraft will achieve the ALTS. This is not on by default and is selected using the menu key.
9	Next active waypoint	The active leg is shown in magenta, with the next active waypoint highlighted in a box. Other track waypoints are named and the other course legs shown in white.
10	NEXRAD data	Ground-based radar Information on precipitation obtained over the XM radio datalink .
11	Navigation data bar	Supplementary navigation data. These fields are configurable.
12	North pointer and map mode indicator	The map can either display with the top always fixed with north at the top (North UP) or so that the map will rotate with the heading of the aircraft (Heading UP). The N arrow shows where North is.
13	NAV Frequency Box	Shows the active and standby NAV1 & 2 frequencies
14	COM Frequency Box	The active and standby COM1 and 2 frequencies

TABLE 7-4: MFD LAYOUT

The MFD Map

The main part of the MFD displays a moving map that can be zoomed by turning the Joystick knob. Pressing the joystick knob will activate a pointer that then allows the map to be panned using the joystick. The map can be configured to show either absolute or relative terrain, be 'North Up' or 'Heading Up'. Options include displaying NEXRAD and having a cyan 'Track Vector' which will show you predicted track based on the time parameter selected, and a cyan 'Select ALT arc' – this will show at what point on your lateral track you will reach the selected ALTS. It will move as your rate of descent changes. These options can be set using a combination of the MFD softkeys and also by pressing the MFD Menu bezel button and selecting Map Settings from the menu using the FMS dial/Ent key.

FIGURE 7-5: MFD MAP SETTINGS MENU

The EICAS system

The **FSR500** is fitted with a custom-coded Engine Information and Crew Alerting System (EICAS) that displays information on the PDFs and MFD and has a number of custom aural alerts.

Engine Information display

Engine and other key aircraft system information is displayed on a dedicated display on the left-hand side of the MFD as shown in the red box above.

Please see Section 6: Aircraft Systems section for a description of the function of each gauge.

Crew Alerting System

The crew alerting system consists of several elements, including warnings and cautions built into the various flight instrument displays, aural tones or messages and CAS messages. The CAS messages are detailed in Section 11 – Failures and Emergency Procedures.

GWX-75 Weather Radar

The **FSR500** has a GWX-75 weather radar. This can be viewed via the MFD. From the Map Page Group, use the upper FMS knob to select 'Radar' from the list of pages. You can then use the MFD softkeys to place the radar into standby mode (this can be done on the ground/before taxi) . Once clear of ground personnel (in the air, during run-up) the radar can be activated. The scale of the radar can be altered with the MFD joystick and softkeys can be used to toggle between a horizontal and vertical radar profile.

The radar draws data from the MSFS weather engine to represent precipitation with green/amber/red indicating the degree of intensity. The operation of the radar is limited by the MSFS SDK in comparison to a true weather radar function, but nevertheless, still provides valuable information.

The radar will be placed into standby automatically on landing to protect ground personnel.

Navigraph Charts

Jeppsen charts provided by Navigraph can now be viewed in the G1000NXi MFD if you have a Navigraph subscription. FSReborn have collaborated with Navigraph to build this functionality into the aircraft directly so there is no need to download any extra packages from the Navigraph Hub app (although may still need to do so to get the charts in other MSFS G1000NXi equipped aircraft). This means that the feature is also available to Xbox users. The **FSR500** has been tested to ensure no there is no conflict with the Navigraph packages.

To access and view the charts, press the 'Charts' softkey on the MFD bezel. This will bring up the Navigraph login QR code or key. Use this to link your account and then you can view the charts. Use the Joystick to pan and zoom the map. Different segments of the chart can be viewed as well as day/night mode.

Note this registration is separate from the EFB Navigraph registration – each requires their own login. But each can also be used to show a separate chart at the same time, enhancing situational awareness.

Reversionary Mode

If the MFD should fail for any reason, the system will place the PFDs into 'reversionary mode'. This is a back-up mode that allows important information from the EIS to still be displayed.

The PFD in Reversionary mode can be seen whenever the battery is turned on but before the avionics switch is also turned on. It is normal to start the engine with the PFD in reversionary mode as this helps reduce load on the battery.

The PFD will enter Reversionary mode automatically whenever the MFD is not operating:

FIGURE 7-6: PFD IN REVERSIONARY MODE

The two Display Backup buttons on the instrument panel are used to manually put the PFD into reversionary mode should it fail to switch automatically. Even if the automatic switch has occurred, a button should be pressed in any case.

When in reversionary mode, critical information from the EIS is prioritized for display and some information is not shown. Map and navigation information is limited to the inset map. This may obscure some CAS Messages and the outside air temperature information.

IRL it is possible to also place the MFD into a reversionary mode if the PFDs should fail, so it will display the flight instruments. MFD reversionary mode is currently not modelled in the **FSR500** due to SDK limitations.

The GFC 700 Autoflight control system (AFCS)

The GFC-700 Autoflight control system (AFCS) uses a series of systems to direct and control the aircraft in the pitch, roll and yaw axes.

The system is complex and powerful, with many features, particularly when linked to the G1000NXi navigation and instrument procedure functions to allow IFR flight. This section only gives an overview of the key features of the autopilot system. Please refer to the other recommended sources, including the official **FSR500** tutorial videos for more information on how to use the full features of the GFC-700.

The GFC-700 system has three main elements:

- Flight Directors
- Yaw Damper
- Autopilot

Flight Directors (FD)

When engaged the Flight Directors (one each on PFD1 and 2) provides direction to the pilot to maintain a desired attitude when hand-flying the aircraft via a magenta 'command bar' on the Attitude Indicator. The command bar will give combined lateral and vertical direction. When the autopilot is engaged, it provides the guidance to the control surface servos/actuators.

The Flight Directors in the WT G1000 are fully synchronised and both pilot and co-pilot side will always display the same FD guidance.

The Flight directors are engaged and disengaged by pressing the FD button on the autopilot controller pane. This will activate the FD in default ROLL & PIT modes.

The Flight Directors can also be engaged by pressing any of the lateral and vertical mode buttons. If activated this way, the FD will give guidance from the mode used to activate it, plus the default mode for the other axis – e.g., if you press the HDG button, the FD will come on in HDG & PIT. If you pressed VS, it would come on in VS and ROLL modes. If you want to clear a mode and revert to the default ROLL & PIT, press the active mode button again – e.g., in the first example above, press the HDG button again: the FD will remain on but the lateral mode will revert to the default ROLL.

Any activation of the autopilot will also turn the FD on.

To use the FD, simply fly the aircraft with the appropriate power, pitch and roll to maintain the attitude indicated by the command bars, staying co-ordinated with the rudder if necessary. What they command will depend on the autopilot modes and associated target values set. A description of all the lateral and vertical modes is given below.

The Flight Directors can be disengaged by pressing the FD button. All autopilot modes will be cleared from the scoreboard. Any selected altitude will remain in the ALT SEL box.

Yaw Damper

When engaged**,** the Yaw Damper provides stability on the yaw axis, helps counteract Dutch Roll and helps coordinate turns requiring less pilot rudder input. The Yaw Damper is engaged by pressing the YD button. 'YD' in green will be indicated in the centre of the AFCS status bar. It will also engage automatically whenever the autopilot is engaged (see below).

The yaw damper should be disengaged for Take Off and Landing and be active during all other phases of flight. The yaw damper will disengage when:

- pressing the YD button when active;
- disengaging the Autopilot; or
- whenever below 100ftAGL

When disconnected, the YD indication on the AFCS status bar will flash yellow for 5 seconds before clearing.

Autopilot

When engaged, the autopilot will take direction from the active autopilot mode. Engaging the autopilot will engage the flight director at the same time if it is not already on. Servo motors on the ailerons and elevator will then respond to the commands from the active mode to maintain the aircraft in the correct attitude to follow those commands as shown by the command bar.

The autopilot can be engaged in three ways:

1. Pressing the AP button on the autopilot control panel
2. Pressing one of the LVL buttons on the instrument panel
3. The ESP system has been active for 10 seconds out of the last 20 seconds, the autopilot will engage in LVL mode.

Engaging the autopilot will also engage the Yaw Damper if it has not already been engaged separately.

Once engaged the AP will take direction from the active mode and will fly the aircraft without the pilot needing to operate the controls.

> **Note**
>
> The autopilot should only be engaged when the aircraft is in trimmed and stable flight, with no pilot pressure on the control wheel.

To disengage the AP:

- Press the AP button when AP is active;
- Press the Autopilot Disconnect/Trim Interrupt button on the control wheel;
- Operate the electric pitch trim on the control wheel;

Disengagement may also occur with:

- Strong inputs by the pilot on the control wheel;
- Excessive pitch or roll;
- When unable to maintain the commanded attitude;
- A fuel imbalance of 125lbs or greater.

When disconnected, the AP indication on the PFD will flash yellow for 5 seconds before clearing, accompanied by a distinctive aural tone.

The GMC-710 autopilot controller Panel

The primary means of controlling the AFCS is through the GMC-710 autopilot controller panel, located in the centre of the instrument panel above the MFD. The following illustration sets out the function of each control key or dial. The lateral modes are grouped on the left, the main modes in the centre and the vertical modes on the right on the panel.

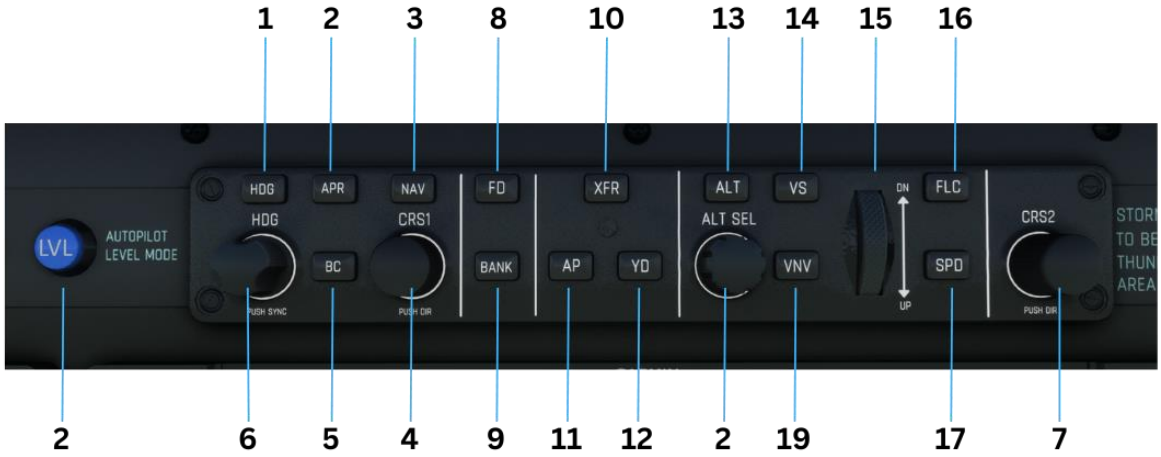


FIGURE 7-7: GMC-710 AUTOPILOT CONTROLLER PANEL

1	HDG key	Selects/deselects Heading Select Mode.
2	APR key	Selects/deselects Approach Mode.
3	NAV key	Selects/deselects Navigation Mode.
4 & 7	CRS1 & 2 knob	Adjust the Selected Course (while in VOR, LOC, or OBS Mode) in 1° increments on the Horizontal Situation Indicator (HSI) of the corresponding PFD Press to re-center the Course Deviation Indicator (CDI) and return course pointer directly TO the bearing of the active waypoint/station.
5	BC key	Selects/deselects Backcourse Mode.
6	HDG knob	Adjusts the Selected Heading and bug in 1° increments on the HSI (both PFDs) Press to synchronize the Selected Heading to the current heading on the pilot-side PFD. (Note there are also HDG knobs on the PFD/MFD bezels also).
8	FD key	Activates/deactivates the flight director only. Pressing once turns on the selected flight director in the default vertical and lateral modes (PIT & ROLL). Pressing again deactivates the flight director and removes the Command Bars. If the autopilot is engaged, the key is disabled.
9	BANK key	Manually selects/deselects Low Bank Mode.
10	XFR key	Transfers between the pilot and copilot flight directors and controls which flight director the autopilot is tracking. This is currently inoperable.
11	AP key	Engages/disengages the auto pilot.
12	YD key	Engages/disengages the yaw damper.
13	ALT key	Selects/deselects Altitude Hold Mode.
14	VS key	Selects/deselects Vertical Speed Mode.
15	UP/DN wheel	Adjusts the reference/target value in Pitch Hold, Vertical Speed, and Flight Level Change modes.
16	FLC key	Selects/deselects Flight Level Change Mode.
17	SPD key	No function on the **FSR500**.
18	VNV key	Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight

		Control.
19	ALT SEL knob	Controls the Selected Altitude in 100-ft increments. (Tip: for faster ALT SEL use the outer ALT SEL knob on the PFD bezel – this increases in 1000ft increments).
20	LVL key	Activates Level (LVL) mode.

TABLE 7-5: AUTOPILOT CONTROLLER PANEL

The G1000 PFD AFCS Status Bar

The status of the AFCS is shown on the top of the PFD, below the Nav status bar. Horizontal modes are shown on the left, vertical modes are shown on the right and the main functions are shown in the centre.

FIGURE 7-8: AFCS STATUS BAR (WITH NAV STATUS BAR SHOWN ON TOP)

- Green indicates the mode is Active;
- White indicates that the mode is Armed;

In Fig. 7-8, the status bar shows that the lateral HDG mode is active, and that an altitude of 6300ft has been selected. ALT is armed as the aircraft has not yet reached 6300ft. The aircraft is being hand flown and the Yaw Damper is disengaged (no AP or YD when in the centre. Also there is no vertical mode, so there will be no vertical guidance from the flight directors (comment - this is not a well configured use of the AFCS!).

Flight Director/Autopilot modes

The buttons on the AP controller panel control different autopilot modes. There are four types of mode:

1. Lateral.
2. Vertical.
3. Combined (Approach mode).
4. Level.

The lateral modes (Roll, Heading, Navigation) are used to navigate the aircraft and direct or control the ailerons. The vertical modes (Pitch, Vertical Speed, Flight Level Change) are used climb or descend the aircraft and direct or control the elevator and electric pitch trim. Approach mode is used when flying an approach procedure and will provide combined lateral and vertical direction to maintain both the localiser and glideslope (for ILS approaches) or the final approach course and glidepath (for GPS/RNAV approaches with vertical guidance). Level (LVL) is a special mode that will bring the aircraft to a wings-level, 0° pitch when active (see below).

The following table describes the function of each control key and if active or armed, what will be indicated in the AFCS status bar.

Control	Mode Function	AFCS Status Indication
AP or FD	**Pitch Hold**. This is the default vertical mode and will be engaged if no other vertical mode has been selected. The FD command bars will indicate a pitch (whatever pitch the aircraft was at then AP or FD was pressed). Use the UP/DN wheel to change the pitch.	PIT
AP or FD	**Roll Mode**. This is the default lateral mode and will be engaged if no other lateral mode has been selected. The amount of ROLL will be synchronised with the roll present when the mode was engaged. The command bars will indicate a bank angle to maintain.	ROL
ALT key	**Altitude Hold**. Pressing this sets the command bars to maintain the current aircraft altitude. When reaching a pre-selected altitude (ALTS)once within 200ft, it will be captured and ALT mode activated automatically to maintain the selected altitude	ALT
VS Key	**Vertical Speed**. Pressing this will allow you to select a rate of climb or descent. Once active, use the UP/DN wheel to set the rate of VS. The selected rate will be displayed on the VSI gauge on the PFD in feet per minute.	VS
FLC Key	**Flight Level Change**. Maintains the current aircraft airspeed (in IAS) while the aircraft is climbing/descending to the Selected Altitude. The target speed can be changed using the UP/DN wheel and is shown in cyan above the Airspeed Indicator. The ability of the aircraft to maintain the selected FLC speed,-and the resulting rate of climb or descent- is determined by the throttle power setting. When climbing apply power and lower the target speed to gain a higher vertical speed. When descending do the opposite: reduce power and increase the target speed to descend faster.	FLC
VNV key	**Vertical Navigation (VNAV)**. Pressing VNV will arm/capture the calculated vertical path (VPATH). This is a descent path calculated by the G1000 which will give a nominal descent. VNAV can only be used in descent. With VNAV mode active, when the aircraft reaches the calculated top of descent (TOD), and a with a lower altitude selected in ALTS, VPATH will become the active mode and will command the aircraft into a descent, pitching to follow the calculated path. The aircraft will descend to either the preselected altitude or a Vertical Path constraint in the flight plan, stopping at whichever is higher.	VPATH
HDG key	**Heading hold**. Captures and tracks the heading selected with the HDG knob. The selected HDG can be changed whilst the mode is active, allowing the pilot to steer the aircraft with the HDG knob to follow ATC vectors etc.	HDG
NAV key	**Navigation mode**. Captures and tracks selected navigation source (GPS, VOR1 & 2, LOC). The active nav source is shown on the HSI on the PFD and is changed using the 'CDI' softkey on the bezel. Note NAV will only become active until the aircraft is within a certain distance of the navigation source track and within a certain angle of intercept. Use other lateral modes (HDG, ROLL) to steer the aircraft towards the desired track. When within capture parameters, NAV will become the active mode.	GPS VOR LOC
APR key	**Approach mode.** This will capture and track an approach procedure loaded into the flight plan or another suitable navigation source (ILS) that has been tuned and set as the active navigation source. How the APR mode behaves depends on the type of procedure loaded or current navigation source in use.	LOC / GS NAV GP GS

	For ILS approaches lateral (LOC) and vertical (GS - Glidescope) guidance will be provided. For GPS approaches lateral (GPS) will be provided and vertical guidance for precision (LPV) procedures (GP – glidepath). For visual approaches lateral (GPS) and vertical (GP) guidance will be provided, although visual approaches cannot be used in IMC conditions. (note: there are several different types of GPS/RNAV approach. Please consult other resources for more detail on this point).	
BC key	**Backcourse mode**. Captures and tracks a localizer signal for backcourse approaches.	BC
Bank Key	**Low Bank Mode**. Limits maximum commanded roll angle to 15 degrees. Note: Bank mode is engaged automatically at high altitudes to prevent sudden manoeuvring.	Green arc on bank angle indicator
Alt Sel knob	**Select Altitude**. Used to pre-select a target Altitude, shown in cyan above the Altimeter. Tip: the Alt Sel knob on the G1000 bezels will provide a faster rate of selection as the outer ring will increase in 1000ft increments. Also, in Lock interaction mode, the mouse wheel can be used to turn the knob more quickly.	ATLS
Level	**Level mode.** This is activated by pressing either of the Level buttons on the main instrument panel. It should only be engaged when the autopilot is not activated. Level mode is a safety system and used to bring the aircraft to straight and level light should the pilot experience disorientation. It will also activate automatically if the aircraft is kept in an unusual attitude for an extended time.	LVL

TABLE 7-6: AFCS MODES

NOTE

TO/GA mode is not currently modelled in the FSR500.

AFCS limitations

The autopilot and yaw damper have the following operational limitations:

Maximum engagement limits:

- **Pitch**: -20°/+25°
- **Roll**: +/-45°

Minimum engagement heights:

- 400ft AGL during takeoff and climbout
- 1000ft AGL during cruise and descent
- 200ft AGL during approach operations

Control Wheel Steering (CWS)

On each control wheel (yoke) there is a CWS button. When pressed and held, this allows the pilot to temporarily interrupt any AFCS commands to the servo motors to take manual control. On releasing the CWS button, the autopilot will resume, although in what way depends on what AP modes were engaged when the CWS button was pressed. The CWS function is not currently implemented in the **FSR500**, but is planned for a future release.

Overspeed Protection

While Pitch Hold, Vertical Speed, Flight Level Change, Vertical Path Tracking, or an altitude capture mode is active, airspeed is monitored by the flight director. Overspeed protection is provided to limit the flight director's pitch command in situations where the flight director cannot follow the active autopilot commands without exceeding Vmo.

When Overspeed Protection is active, the flight director will reduce the pitch down angle and an aural 'AIRSPEED' warning given. Engine power should be reduced and/or the pitch reference adjusted to slow the aircraft.

Electronic Stability and Protection (ESP)

ESP provides feedback to the pilot to prevent them from exceeding normal flight parameters (pitch, roll, Vmo). It only functions when the autopilot is OFF. It will engage if the following parameters are met:

Parameter	Activation
Pitch	20° nose-up & 17° nose-down
Roll	45° or above
Speed	188KIAS (Vmo)

TABLE 7-7: AFCS LIMITATIONS

When active IRL, the pilot will receive force-feedback control inputs nudging them away from the exceeded parameter. In the **FSR500** this will be felt as a movement by the aircraft to reduce the excessive pith or roll. This movement can still be overcome by the pilot with more forceful inputs to the control wheel.

When active, a caution CAS Message **ESP ACTIVE** will display. If the ESP condition continues for more and 10 seconds in any 20 second period, the autopilot will engage automatically in LVL mode.

> **Note**
>
> ESP is an optional system and can be activated/deactivated via the Options EFB page. It is on by default.

Under Speed Protection (USP)

Under speed Protection is a feature of ESP. It is a flight director function that will prevent the aircraft from stalling when the autopilot is engaged. USP is not presently implemented in the **FSR500.**

Communications control & GMA350C Radio Panel

The **FSR500** has 2 VHF radio transceivers (COM1 and COM2), both capable of transmitting and receiving. You can only ever transmit (TX) on 1 channel at a time, with the active TX channel selected/indicated by MIC1 or MIC2. But you can receive (RX) on both.

VHF Radio communications are managed both through the PFD and the GMA350C radio panel located in the centre of the instrument panel.

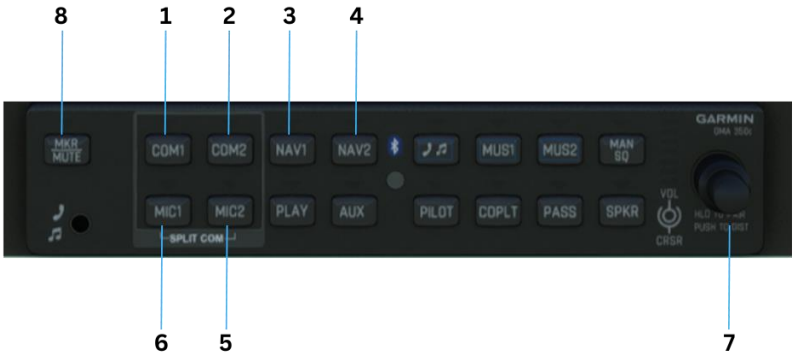


FIGURE 7-9 GMA350C AUDIO CONTROL PANEL

1	COM1	Selects COM1 as a receive channel
2	COM2	Selects COM2 as a receive channel
3	NAV1	Mutes/unmutes the NAV1 morse identifer
4	NAV2	Mutes/unmutes the NAV2 morse identifer
5	MIC2	Selects COM2 as the transmit channel
6	MIC1	Selects COM1 as the transmit channel
7	Vol/CRSR	Controls the volume. Level indicated by an LED bar to the left of the dial (not shown)
8	MKR MUTE	Mutes Outer/Middle/Inner Marker Beacon audio

TABLE 7-8

Frequency Tuning

The transmit/receive frequency is tuned using the COM Knob on a PFD/MFD. Turn the knob to tune the selected COM transceiver (radio) standby frequency highlighted by the cyan box. Use the COM Frequency transfer key to transfer the standby and active frequency. You can toggle between tuning COM1 & 2 by pressing the COM knob.

Channel selection

You can use the GMA350C to select what channels you receive and transmit on. You can use the dual-channel split com feature to receive on two frequencies at once – this is useful if you want to tune an ATIS/AWOS frequency on COM2 whilst leaving COM1 as your active ATC frequency. It is also useful when on-line flying.

Use the MIC1 & MIC2 keys to select a different transmit channel. After selecting a transmit channel, the associated COM (receive) channel will also be selected. You can then select the other COM channel. You can also deselect a COM channel and only receive on a single channel if you only want to hear what is on the other frequency (e.g. to mute ATIS).

Volume control

Volume can be set either from volume knobs on the PFD or on the audio panel. Changing the volume will alter it for both COM1 and COM2. The volume level is shown by the white LED lights to the left of the GMA350c volume control knob.

Nav1 & Nav2

Selecting these buttons will turn on/off the audio morse identification signal from any radio navigation beacon tuned in the NAV1 and NAV2.

Marker Beacon Indicator lights

The panel has three lights: O (for outer), M (for middle) and I (for Inner). These will illuminate and a morse tone played as the aircraft passes over an associated maker beacon when flying an instrument approach equipped with these markers. A matching symbol will also be displayed on the PFD. Many modern instrument approaches no longer make use of marker beacons, but they can still be found at airports across the world, and they serve as aides to situational awareness for the pilot. The Morse tone can be activated/muted using either the MKR mute button or the NAV VOL/ID knob on the PFD.

The other GMA350C buttons are inoperative.

Using the G1000

This section gives some further information on the most common operations on the G1000NXi such as entering a flight plan or procedure, changing a nav source etc.

MFD Page Groups & Pages

The MFD's different functions can be accessed via Pages which are in 'page groups'. To move through the page groups, use the large FMS knob and then the small upper knob to select a specific page – they are displayed on the bottom right. Press the FMS knob to activate the cursor and then use the large FMS know to move between the

The FSR500 MFD has the following page groups and pages:

Page Group	Pages	Function
Map	Navigation Map IFR/VFR Charts Traffic Maps Weather Radar	View Main navigation map View Navigraph charts (if enabled) View air traffic View GWX-75 weather radar
WPT (Waypoint)	Airport Intersections (GPS waypoints) NDB VOR	View information for the different types of point of interest.
AUX	Navigraph settings System Setup	Register/Configure your Navigraph charts Configure basic features of the G1000NXi
FLP (Flight Plan)	Active Flight plan Flight Plan Catalogue	The current flight plan A retrievable list of your recent flight plans

NRST (Nearest)	Nearest Airports Nearest Intersections Nearest NDB Nearest VOR	A list of the nearest points of interest. You can use this in conjunction with the Direct To key to set up navigation to any one of these points.

TABLE 7-9

Flight Plans

Flight plans can be entered into the G1000NXi via the Flight Plan Page:

1. Press FLP button (best on MFD, but can also be done on PFD);
2. Press the FMS to activate the cursor;
3. Use the large FMS knob to select a data field;
4. Use the small FMS knob to change the data value, or click on the 'keyboard' symbol and use your keyboard to enter.
5. Press the ENT key to confirm the entry.

You can also retrieve a recent flight plan from the Flight Plan Catalogue page on the MFD.

Changing Nav source

When using NAV mode, the G1000NXi will navigate to and track whatever source is active. The **FSR500** will start on GPS (magenta) as the NAV source by default, which will follow any entered flight plan. It can also be used to track radio navigation aids such a VOR's, ILS and ADF systems (green).

You can change the nav source using the PFD CDI softkey, from GPS to NAV1 or NAV2. The colour of the Course Deviation Indicator needle will change on the HSI and the mode data in the centre of the HSI will also change.

Bearing Pointers.

There are two additional bearing pointers that you can set to show information from different sources. Pointer 1 has a single line. Point 2 is double. You can select what the source for each pointer will be using the softkeys. As well as the needle, more information for each source will be shown in information boxes just below the HSI compass (if selected from the softkeys).

VOR navigation

To track a VOR radial:

1. Tune and make active the VOR frequency in NAV1 or NAV2,
2. Select VOR1 or VOR2 as the navigation source using the CDI softkey. The CDI needle on the HSI will change colour to green.
3. Use the CRS knob on the PFD to select the desired radial to track. To track directly towards the VOR press the CRS button.
4. Select NAV autopilot source. If you are close enough to capture, VOR will be indicated on the AFCS status bar in green and the autopilot will track the radial.
5. If not close enough to capture immediately, VOR will arm in white. Use another lateral mode such as Heading (HDG) to fly closer to the desired track. Once the CDI needle on the HSI starts to move ('deflect') then the VOR mode should turn from white to green on the AFCS status and the selected VOR radial will be tracked.

Flying Instrument Approaches

The set up an Instrument landing System (ILS) approach:

1. Load an appropriate ILS approach procedure via the PROC page/key – its easier to do this on the MFD, but you can do it on a PFD too. Use the FMS selector to select from the menu of procedures. Set the correct minimums (CAT1). You can then either load or activate the procedures. Use 'load' if you still have some legs in your course to fly. If you are on vectors, then select 'activate'. This will clear your current leg – if you are not on an intercept course you may need to use another lateral mode to control the aircraft until you are close enough.
2. If you selected 'load'. when close enough on an ILS approach, the active nav source will 'auto switch' to LOC (green) and the correct ILS frequency and course will be set on NAV1 and NAV2 radios. If auto switch fails to occur, use the CDI softkey to manually switch to LOC.
3. Once on an intercept course to the Localiser, press the APR key on the autopilot controller. GS will appear in white on the right-hand side of the AFCS status bar.
4. If you are at the correct height (either at or below the correct height at the final approach fix), glideslope (GS) capture when the green diamond on the vertical course deviation indicator (left of altimeter) reaches the centre position. The aircraft will now begin to descend on the glideslope. Monitor and configure the aircraft for landing.
5. At the Decision Height or Altitude - and no lower than 200ft above ground level in all cases - disengage the Autopilot (yaw damper will disengage at the same time) and land the aircraft.

The procedure for RNAV approaches is similar, but with some important differences – particularly that not all RNAV approaches are precision and also that some will have vertical guidance and some will not. This can be a complex area and beyond the scope of this manual. However, for an example RNAV approach, see tutorial video 5.

8. Mission Planning

This section of the manual gives some advice on how to plan flights in the **FSR500** with an emphasis on IFR flight planning.

It is possible in MSFS to use many IRL source of weather data and sophisticated mission planning tools to plan flights in considerable detail and it can be very rewarding to be able to fly them accurately, using real world planning considerations for weather and aircraft performance to work out your route, avoid bad weather, know how much fuel you should burn etc. Tools like SimBrief take out much of the difficulty of these calculations. SkyVector is a great free IRL source – you can use it for weather, NOTAMs as well as getting US IFR and VFR charts. Just be careful never to file an actual flight plan on it!

Using SimBrief profiles

The **FSR500** is designed for IFR cruising and FSReborn have collaborated with Navigraph to ensure seamless integration with the free SimBrief flight planning tool.

When creating a flight plan in SimBrief, select the **P46T** as the aircraft type. This will ensure that the flight plan matches the performance of the **FSR500**. You can further select the cruise profile for the flight from:

- Max Cruise
- 1000
- 800
- 600
- 500

These power settings correspond to the cruise performance table in Annex A.

Note: You should not require to apply any fuel factor as during testing, post-flight analysis has indicated fuel burn estimates produced by SimBrief align very closely with actual fuel consumption.

Using the default SimBrief profile for the P46T may result in reduced operational ranges as it is based on the requirements for commercial airliners. Use this custom profile if you want more typical GA IFR fuel parameters (45 minute reserve, no contingency). The default profile also underestimates the total fuel available to the FSR500 by 132lbs, which this corrects to 1267lbs.

You can adjust the contingency and reserve fuel requirements as well as other operational factors such as alternate destination using the Airframe Editor feature to suit the legal and operational requirements of where you will be operating and we recommend creating and saving and airframe profile that can be used for future flights or shared with other users.

Importing flight plans

Once you have created a SimBrief flight plan, it can be imported using the EFB Flight Planning page (if you have linked your Navigraph/SimBrief account in the EFB Settings page).

You can also import MSFS or other flight plans created in other planning tools by first loading into the World Map before starting the flight.

Real World Routes

One of the FSReborn Discord server users (John.xyz) has prepared a database of IRL routes:

https://docs.google.com/spreadsheets/d/1Fkyxzm1vqSYbx1A012diBSr454s4Qae9Re_08eqfyNE/edit?usp=sharing

> **Note**
>
> If using the MSFS in sim ATC, if you do not load your flight plan *via* the World Map, ATC will only clear you to a standard 16,000ft (IFR). You will need to request altitude changes to get up to typical cruising levels. If loaded via the World Map, you will be given clearances (usually in steps) to your planned cruising altitude and with usually be given an accurate descent instruction when approaching TOD. How closely this matches the G1000NXi calculated TOD will depend on factors such as if you have loaded an arrival or approach procedure into the G1000NXi.

Weather

Planning for the enroute and destination weather is a very important consideration for an aircraft like the **FSR500**. As a light GA aircraft operating at high-altitude, a wide range of weather factors must be considered, including the effect of jet-stream winds on endurance. Icing hazards can be considerable and you may have to pass through altitudes with significant convective weather, turbulence, etc. It is important to remember the **FSR500** is not an airliner and cannot cope with the same weather that a passenger jet can.

When planning a flight, try to take into consideration the weather and other considerations including 'what if' scenarios, like your destination being socked-in below minimums. And even if MSFS will let your fly right through towering cumulo-nimbus (which could easily be fatal IRL), try not to in the sim -this adds to the challenge of going single-pilot IFR in a light GA

Good sources of weather data for enroute planning vary country-by-country, but there are many excellent IRL sources that can be used in MSFS:

- The US government Aviation Weather Centre and particularly the Graphical Forecasts for Aviation are an excellent source for the lower 50 (there is a separate service for Alaska).
- Metoblue is a good source for global weather information and is also the base source for the weather models used by MSFS – if Metoblue have forecast weather, then it is likely to be what MSFS live weather will be showing.
- The Windy.com website and app is another good source for IRL weather.
- For METAR (latest observed) and TAF (forecast) airport weather information, the METAR-TAF.com website is an excellent free source for global data. As MSFS uses METAR data for its live weather whenever this data is available, there is often a very close match between IRL METAR and the weather at your destination airport if it reports METAR data.

As well as the IRL sources, MSFS itself has useful data – the 'Wind layer' in the World Map will provide wind data for various altitudes and is of course what the sim is actually doing as opposed to an IRL weather source that may not match. There is also cloud and precipitation data.

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9. Flying the FSR500

This section discusses the flight model and also provides some 'enhanced procedures' to help you get the most out of flying the **FSR500**.

The Flight Model

The **FSR500** uses the native MSFS SDK to provide its flight model. This allows the aircraft to be available to all users of MSFS regardless of the platform they use to sim on.

The model uses CFD ('computational fluid dynamics') physics provided by Asobo. This is a powerful new means of modelling flight aircraft behaviour based on the geometry of the aircraft and the air mass it is interacting with. Microsoft have announced that they are planning to increase the fidelity of CFD in MSFS2024. We think it's the future of flight simulation physics in MSFS and were keen to use it to model the **FSR500**. Although CFD is a powerful tool, to get best results, it requires careful testing and tuning.

Developing any aircraft flight model is a complex process requiring collaboration between developers who understand the software, pilots with relevant real-world experience and simulator test pilots able to test in a range of conditions and scenarios and provide effective feedback. The **FSR500** flight model is a product of just such teamwork and testing and the model has been tested against real-world benchmarks and known performance parameters in a wide range of weight and weather conditions.

The core physics of MSFS does have deficiencies however that can only be partially mitigated by the tools available in the SDK– e.g. the effect of crosswind on aircraft on the ground remains too powerful by several multiples of what should be expected and the SDK variables only provide limited reduction (unless abandoning any pretence of realistic crosswind effect). In a moderate right crosswind - you may find yourself having to apply an unrealistic degree of left rudder.

Limits with CFD and implementing the new propellor physics in turboprop aircraft, means it takes a lot to get the upwind wing to start rolling in a low-wing turboprop like the **FSR500** and the prop does not create enough drag in low power-low pitch conditions. Stall behaviour too is not what always what we would wish for – a clean aircraft, power-off, will be hard to stall, but when it does, the high AoA necessary will see it depart into a strong nose down with accompanying wing drop and a spin may develop rapidly. Recovery less than 1000AGL may be challenging.

These are all issues we are aware of and working to improve, but we are still very happy with the flight handling achieved, with realistic and stable behaviour. You will feel the torque of the powerful PT6-42A engine pull you to the left as you begin the take-off roll, smoothly easing with increasing airspeed. Controlled crosswind take-off and landings up to the maximum demonstrated (and beyond) are possible with a little practice and without the need for any high-end hardware. Precise and stable trimming make hand-flying a joy. High-power climbs will require P-factor to be catered for. Adverse yaw in turns and increased drag in slips are present to the correct degree and you will need to hone your foot-work during turns and slips. Flap and gear drag have been precisely modelled against real-world approach profiles.

Feedback on the flight model is always welcome – particularly from IRL pilots with experience of similar type of aircraft using the PT6-42A engine. Given the very wide range of possible combinations of controllers, calibrations, experience and expectations of what 'feels right', getting objective (and therefore useful) feedback can be challenging. The more precise and detailed the feedback can be, the more useful it is.

Enhanced procedures

This part sets out some further details of normal operations.

Engine Starts

There are four methods of starting the engine:

1) Battery Power, Auto mode
2) Battery Power, Manual mode
3) Ground Power, Auto mode
4) Ground Power, Manual mode

Battery Power vs Ground Power

Battery powered starts are the normal method, but you may also start the aircraft using a connected GPU if there is concern that the battery may not have sufficient voltage to ensure a good start, or for convenience if a GPU was already connected. The method is largely the same with the the most important to note is that the GPU should be disconnected before engaging the Generator or Alternator.

Automatic Starts

The normal way of starting the engine is in Automatic mode and the in-cockpit checklists show this method. In automatic start mode, a momentary press of the starter button will initiate the starter motor which will then cut out automatically once Ng rises above 56% (actual sim behaviour may vary -SDK limitation). Automatic mode is enabled when the Start Mode switch is not pressed (LED extinguished). This is the default position.

Manual Starts

A manual start requires the starter button to be pressed and held until ignition has occurred. It should not be held for longer than 10 seconds after the Condition Lever has been moved into the RUN position as damage to the starter motor may occur. If ignition has not occurred, release the starter button, wait 30 seconds and follow the DRY MOTOR checklist before attempting another engine start. Manual starter mode is enabled by pressing the Start Mode switch (LED on).

A Manual Start is usually selected either to either:

- Stop a failed automatic start sequence; or
- When it is necessary to 'dry motor' the engine either to vent excess fuel or help dissipate residual ITT.

Automatic starts are preferred to manual starts as there is less chance of damage to the starter.

The in-game Checklists are for a Battery powered automatic start.

The Starting Sequence

You should always carefully follow the starting sequence for the type of engine start you have decided to perform using the Starting Engine Checklist (Section 10: Normal Procedures). All start methods, however, follow the same essential sequence:

1. Ignition and fuel supply ensured by placing Ignition and Fuel Pump switches to manual. (IGNITION and FUEL PUMPS L & R will be indicated on the CAS).

2. The three control quadrant levers are all in the correct position: MOR in Normal, Throttle in IDLE and Condition Lever in CUT-OFF/FEATHER.
3. Starter motor turned on. This starts to spin the engine compressor blades and create the cooling airflow in the combustion chamber. (**STARTER** will be indicated on the CAS).
4. Ng will accelerate to a maximum of ~20%. Fuel can be introduced once Ng is stabilized and greater than 13%. A slow rise in Ng may indicate a risk of a hot start.
5. The Condition Lever is now placed from CUT-OFF/FEATHER to the RUN position and the Fuel Control Unit will introduce fuel into the combustion chamber.
6. Ignition of the fuel will now occur ('light-off'). ITT will rise fairly rapidly – the rate will depend on the environmental conditions (density altitude) and the condition of the engine. Very rapid rise means the risk of an over-temperature condition (hot start) and you should immediately pull the Condition lever to the CUT OFF position and press the Starter Mode switch to put in in manual. If no rise occurs within 10s of introduction of the fuel after putting the condition lever into RUN (no light off), then you should abort the start by pulling the condition lever to CUT-OFF and press the Starter Mode switch to put in in manual.
7. Engine oil temperature and pressure will rise to normal operating ranges (green arc)
8. The ITT will 'peak' – the exact point will vary – and then stabilize at an idle ITT and Ng of ~60%. During a start ITT should not exceed 1005°C for more than 5 seconds.
9. The starter motor will cut out automatically once Ng > 56% to prevent damage to the starter motor. If using Manual start mode, the pilot should release the Starter switch no more than 10 seconds after putting the condition lever into the RUN position.
10. The prop will gain RPM and achieve a minimum of Np > 1200RPM by the time ITT and Ng have stabilized.
11. The engine will now have completed a normal start.

It is possible that the engine may not start normally – see the 'risks and malfunctions' section below for a description of the main problems that can occur.

Dry Motoring

This is a process where the starter is turned on, but no fuel introduced. It is used to clear the engine of excess fuel or help dissipate residual ITT. The procedure is as follows:

N-15 ENGINE DRY MOTORING RUN
Allow minimum of 30 seconds fuel draining period, then:
POWER Lever.....IDLE
CONDITION Lever .....CUT-OFF/FEATHER
FUEL PUMPS Switch .....MAN
IGNITION Switch ..... OFF
BATTERY Switch.....ON
START MODE Switch.....MAN (Switch Light Illuminated)
PUSH START Switch ..... PUSH and HOLD (15 SEC.)
PUSH START Switch ..... RELEASE

Flying Into Known Icing

The FSR500 is capable of flying into known icing conditions where the icing is expected to be mild or

moderate. The various ice protection systems described in Section 6 can be used. Icing may occur in temperatures of 5°C or lower and when visible moisture is present. Flaps are restricted to 20° in icing.

The following checklist should be used when expecting to enter icing conditions:

N-16 FLIGHT INTO KNOWN ICING CHECKLIST

PRIOR to entering icing conditions, the following ice protection systems MUST be activated.

SURF DE-ICE ..... SELECT ON
STALL HEAT ..... SELECT ON
PITOT HEAT ..... VERIFY ON
PROP HEAT ..... SELECT ON
WINDSHLD HT ..... SELECT ANTI ICE
Wing Inspection Light (ICE LIGHT) ..... AS REQUIRED
IGNITION ..... MAN
Windshield Defog (DEFROST) ..... PULL ON
ECS CABIN COMFORT ..... HIGH

During Icing Conditions:

Wing Leading Edge ..... MONITOR
for continual shedding of ice
EIS Indications and CAS Window ..... MONITOR
for correct function of ice protection systems
(no system failures)

After departure from icing conditions with remaining residual/airframe ice:

SURF DE-ICE ..... MAINTAIN ON
STALL HEAT ..... MAINTAIN ON
PROP HEAT ..... MAINTAIN ON
PITOT HEAT ..... MAINTAIN ON
WINDSHLD HT ..... DE-FOG or ANTI ICE as required
IGNITION ..... AUTO
Flaps ..... DO NOT EXTEND BEYOND 20°

After removal of residual ice:

SURF DE-ICE ..... OFF
STALL HEAT ..... OFF
PROP HEAT ..... OFF
PITOT HEAT ..... MAINTAIN ON
WINDSHLD HT ..... DE-FOG or ANTI ICE as required

NOTE

MSFS 2020 icing effects are limited in effect – even heavily iced aircraft will continue to fly with only a moderate decrease in performance.

Risks & Malfunctions

There are various risks when starting the engine. All of these can be mitigated by keeping the aircraft well maintained and following checklists carefully:

"Hot Start". This is when combustion temperatures in the ignition chamber exceed limitations, resulting in an over-temperature condition, damaging the turbine blades. A hot start can develop very quickly and requires the aircraft to be grounded and a full engine overhaul, usually resulting in a very expensive repair IRL.

The root cause of a hot start is not enough cooling air flowing through the combustion chamber when the fuel is introduced, allowing excessive temperatures to develop. This cooling airflow is created by the turbine/compressor blades spinning at an RPM fast enough to provide sufficient cooling effect. Anything which inhibits this may lead to a hot start developing.

As explained above, the 'Ng' gauge indicates how fast the turbine blades are spinning as a percentage of maximum RPM and is therefore an indication of the cooling air-flow available.

This is why in an engine start, the electrical starter motor is engaged first before any fuel is introduced – it spins the compressor blades up to an RPM to provide sufficient cooling. A minimum Ng of 13% is required to avoid a hot start and fuel should not be introduced until this has been reached.

As well as introducing fuel too soon, there are several other factors that may contribute to the risk of a hot start:

- **Throttle not in idle position.** This will result in excessive fuel being introduced when the condition lever is placed into RUN and the available air flow, even with a good battery, will provide insufficient cooling.
- **Low battery voltage**. A degraded battery or low ambient temperature may result in insufficient voltage. The low voltage does not allow the starter motor to get the turbine blades spinning fast enough. A minimum of 24v is required for a battery start. If insufficient voltage is suspected, you should use a GPU to provide power for the start, or have the battery serviced *via* the EFB Maintenance page.
- **High residual engine temperature/ITT** following an earlier period of operation. ITT should be allowed to cool to <150°C before attempting a new engine start. This cooling can be accelerated/achieved using the 'dry motoring' technique (see above), although care must be taken to avoid damaging the starter motor by limiting each period of dry motoring as per the checklist. Note: there is a known issue with residual ITT remaining too high after an aborted engine start. This will be fixed in a future update.
- **Excess pooled fuel** in the ignition chamber following a previously failed start attempt.

You can observe a hot-start developing with the ITT gauge accelerating to the upper limit more rapidly than usual. You must take immediate action to pull the Condition Lever back to the CUT-OFF/FEATHER position and press the Starter Mode switch to put in in manual (to stop the starter from continuing to crank). As This may happen in just 1 or 2 seconds, you should:

- Know what a normal rate of temperature increase on the ITT dial looks like and be ready to respond the instant you suspect something is not normal;

- During the engine start process focus only on the engine gauges (particularly Ng and then ITT) and keep your hand on the condition lever (however you control it in the sim), ready to pull it to CUT-OFF. Do not be distracted by other tasks.
- As soon as you have cut the fuel, shut down the starter motor to prevent damage to it. If starting in Auto mode, press the 'Start Mode' switch on the overhead panel – this will put it into manual mode (LED illuminated) and will stop the auto start sequence, which would otherwise continue to run. If starting in Manual mode, simply release the starter button.

> **Caution**
>
> If you hot-start the **FSR500**, you will not be able to start the engine until it has been serviced via the EFB Maintenance page. **Hot Starts can be disabled in EFB>Realism page and ITT will be capped to 710°C.**

No Ignition. If, once the fuel is introduced, the ITT does not rise then ignition may not have occurred (no 'light off'). This can be caused by: failing to turn the IGNITION switch to ON; a faulty ignition system or inadequate fuel pressure. If ITT does not rise, then abort by pulling the condition lever to CUT OFF and stop the starter by pressing the START MODE switch and follow the dry-motoring process. This will clear any excess fuel that may have pooled and could, if not vented, lead to a hot start. If you fail to get light off, the ignition system may be faulty and need repair.

Hung Start. A hung-start is when engine ignition occurs, but for some reason it does not accelerate to idle RPM. This can be seen by the Ng failing to reach 60%. In this case, the engine start should be aborted. DO NOT advance the throttle in an effort to obtain idle RPM. (hung starts are currently not implemented).

Exhaust pipe Fire. This is caused when excess fuel has accumulated in the exhaust pipes and will be seen as a very visible jet of flame coming from the exhausts. In this case, proceed with the engine start – do not cut the fuel/abort as that may create negative pressure in the engine, sucking the flame back in and damaging the engine. Proceed with the start and once stabilised, shut the engine down in the normal procedure and conduct maintenance checks for damage. (Currently not implemented).

Other engine failures may occur during flight due to exceeding engine limitations as set out above and in Performance section, lack of maintenance/wear and tear.

Starter Motor damage. If the starter is left running for more than 30 seconds, then it may become damaged. You may still have a successful engine start, but as the starter is the same unit as the generator (see section 6), then the warning CAS message **GENERATOR FAIL** will appear once you turn the generator on. If this occurs, follow Emergency checklist E-20 in Section 11 and when parked safely on the ground, have the damaged item replaced (EFB Maintenance page). Make sure that all circuit breakers have been pushed after completing the repair.

If you take no action, then the alternator may not be able to meet the demands of the load on the system, the battery will discharge and after some time in flight you will experience a complete electrical failure, with no emergency power available. If that happens, follow emergency checklist E-22 and reflect on the wisdom of ignoring a red warning CAS!

Taxi

Use Beta range to limit taxi speeds. You should not exceed 20knots ground speed on taxiways, reduced to 10knots in turns.

You will need to use right rudder during taxi to counter the effects of engine torque and propwash.

Take Off

TO Config. Before starting your take off roll, make sure the **T/O CONFIG** CAS advisory is extinguished before starting the take-off roll. This requires you to have:

- Set flaps to less than 30°.
- Rudder trim set to 2-3° (green mark)
- Ignition and Fuels pumps to manual
- Autopilot and Yaw Damper disengaged.

If you do not, then a Master Warning chime will sound and **T/O CONFIG** will be indicated.

TO Roll. Apply power smoothly to reduce the torque effect – there will be a noticeable pull to the left when you first apply power, with the left-pull reducing as speed increases and control surface authority is gained. Above 65KIAs little rudder should be needed in calm wind conditions.

Maintain centre line with active use of the rudder pedals. In strong right crosswinds you may need to use left rudder input.

Crosswind technique. The maximum demonstrated component of crosswind velocity is 16knots. Taking off in strong crosswinds will require plenty of rudder input to counter weathervane effect – this is far stronger in MSFS than torque or prop-wash effects, even in relatively light crosswinds. You should position the ailerons into the wind. The FSR500 does not experience much in the way of rolling effect from crosswinds, but correct positioning of the ailerons will mean you are configured to enter a crab to maintain centreline after take-off.

Rotation should be smooth at 85KIA – a reasonable degree of elevator input is needed in a normal (flapless) take off – about 30-50% of your normal axis range. But you should not need to pitch up more than 10-15°. Be careful not to let the nose to dip after rotation.

Climb-out

Once positive rate of climb is seen and there is no more usable runway beneath you, retract the gear (but before your speed exceeds 128 KIAS) and engage the Yaw Damper. You can engage the autopilot once above 400ft AGL and the aircraft fully trimmed (no control wheel pressure applied).

At high power settings and high angle of attack, significant P-factor and torque/propwash will be felt. This can be countered with rudder trim and it is often possible to leave the rudder trim in the take-off position during the entire climb to cruising altitude.

The **FSR500** pitch trims well and is stable enough to allow hands free flying in smooth air without requiring use of the autopilot.

Cruise

Make sure to take out any right rudder trim you have applied – if you do not the aircraft will fly uncoordinated (the slip/skid indicator bar will not be centred) . The FSR500 has no aileron trim, but is configured to fly wings-level at cruise speeds. If you encounter a gentle roll, compensate with rudder trim.

Manoeuvring

Turns should be limited to 45° of bank. You will experience moderate adverse yaw and should use the rudder to remain co-ordinated. The FSR500 is not rated for acrobatic manoeuvres, and you will quickly over-stress the airframe, which has the following load limits:

Positive Load Factor (Maximum)	
Flaps Up	**3.7 g**
Flaps Down	**2.0 g**
Negative Load Factor (Maximum)	**-1.48 g**

Although not rated for Spins, you should practice spin recovery as they are a feature of how the FSR500 will stall.

Approach and Landing

The FSR500 has reasonably low drag when in clean configuration and will not decelerate as rapidly as a fixed gear aircraft. Use flaps to slow to approach speeds. Also, as the gear can be extended at 168KIAS, you can use this also to help you slow down relatively early in the approach.

Use the following power and configuration schedule to achieve a stabilised 3° approach:

Power setting	Configuration	Speed
300lb-ft	Clean	160KIAS
300lb-ft	Flaps 10	150KIAS
300lb-ft	Flaps 20/Gear Down	115KIAS
300lb-ft	Flaps 38/Gear Down	95KIAS

TABLE 9-1: APPROACH SPEED SCHEDULE

Vref (landing speed) is 85KIAS which you should target on short final.

Make use to include a gust factor in you approach speed calculations. This is Vref + half of the gust speed, to a maximum of 10 KIAS. E.g: if the METAR or ATIS was giving 140@20G30, you would add 5KIAS to Vref, thus 85+5 = 90KIAS.

In strong crosswind or gusty headwind conditions, consider landing with reduced or no flaps. You will land faster as Vso will be higher but will be less prone to buffeting. $V_{REF\ (NO\ FLAPS)}$ = 100KIAS.

Landing. For Landing, smoothly reduce power to idle as you cross the threshold. Flare to ensure the main wheels touch first but be careful not to flare too much – the **FSR500** lands pretty flat.

Roll-out. Once all three wheels are down, you can engage BETA range, apply the BRAKES and put BACK PRESSURE ('3 Bs') on the control wheel to help keep weight off the nose-gear. Be careful to do it in that order – putting back pressure on too soon may lead to an unwanted rotation!

Stalls & Spins

The **FSR500** is a hard plane to stall! This is primarily because the ESP system will prevent you from getting into a stall situation. It's also because the MSFS SDK does not allow us to correctly model the stall behaviour and you will find the aircraft does not enter a full stall break until notably lower than Vso.

Flight testing has indicated that a typical no power, level flight stall occurs in two clear phases:

- **Wing level stall**. At Vso and lower, the wing will get 'tired' and cease to generate enough lift to keep the aircraft at the desired attitude/altitude. No stall warning will sound, although stall buffeting will be present. The effect can be countered with increasing amounts of pitch up, allowing the aircraft to 'mush' along in a high AOA at speeds below 70KIAS.

- **Full Stall**. At a critical point, the aircraft will stall, usually at around 62KIAS in a clean configuration at max weight. The stall warning CAS will sound 'STALL…STALL' immediately prior to the stall. There will be very noticeable stall buffeting. When the stall does occur, it will be with a pronounced wing drop, usually to the left. If no immediate recovery action is taken (lowering the pitch/AOA, then increasing the power), a spin will rapidly develop. This can be safely recovered from by allowing the controls to centre and then applying full rudder opposite to the direction of the spin (see Spin Recovery checklist below). But spin recovery must be prompt otherwise g-loading (particularly then pulling out of the resulting dive) will overstress the airframe. Full Stalls less than 1000ft AGL are usually not recoverable. If practicing stalls, make sure to do so from at least 3000AGL and de-activate the ESP. To get a sense of what is possible, also make sure to turn on aircraft stress damage in the **MSFS Assistance > Realism options**.

E-26 Spin Recovery Checklist

Rudder ..... FULL OPPOSITE TO DIRECTION OF ROTATION
Control Wheel ... FULL FORWARD WHILE NEUTRALIZING AILERONS
POWER Lever ..... CLOSED
Rudder (when rotation stops) ..... NEUTRAL
Control Wheel ..... AS REQUIRED TO SMOOTHLY
REGAIN LEVEL FLIGHT ATTITUDE

10. Normal Procedures

This section contains the normal checklists for the FSR500. You should use these checklists to ensure a safe and efficient flight.

WARNING

The FSR500 is a complex aircraft which closely follows IRL requirements, and it is very easy to trigger failures if not following correct procedure with realism settings on. The following checklists will help but are only a summary. If using realism setting you must also be familiar with Sections 6 (Aircraft Systems) and Section 9 (Flying the FSR500 – Enhanced Procedures). If you encounter a problem or trigger a failure, consult section 11 and follow the correct emergency procedure as required by the suspected failure. If you encounter repeated issues, turn off realism settings until you are more familiar with the aircraft.

There are fully interactive checklists in the sim. If the Assisted Checklist option is selected (see section 2), each control will be highlighted and the co-pilot will confirm when a checklist item has been verified.

If you prefer to use paper copies of checklists, then the following pages have been designed to allow you to print them out. Once you gain familiarity with the cockpit and where all the controls and switches are, paper checklists can be easier to work though compared to the in-sim ones. These have been designed to fit onto two sides of A4 paper for ease of printing and use.

Items not currently simulated have generally been omitted from the checklists. For engine starts in particular, make sure you are familiar with the Enhanced procedures set out in Section 9. This explains the narrow parameters you must follow if starting an engine with full realism on.

Note, there may be some minor differences between the checklists provided here, those in the SIM and those used in the tutorial videos.

Maximum Continuous Power (MCP). The checklists provide for a climb at MCP. This means climbing with the throttle set to a position where none of the following 3 limitations are exceeded:

- Torque: 1313 ft-lbs
- ITT: 770°C
- Ng:101.7%

At lower altitudes you will be limited by Torque. As you climb, the air becomes less dense and the engine less effective and it becomes necessary to apply more power to maintain torque. At a certain point the engine will no longer be limited by torque, but by one of the other values – usually ITT. Exactly at what altitude dictated by the atmospheric conditions.

NOTE

To keep the Normal Checklists to 2 sides of A4, some less common items were omitted. Refer to section 9 for the Flight Into Known Icing checklists and below for engine starts using ground power.

External Power Engine Start Checklist

The provided checklists below are for an automatic engine start using the battery. Use the following checklist if using the GPU.

N-2b -ENGINE START - USING EXTERNAL POWER

BATTERY Switch ..... Verify OFF
External Power Unit..... CONNECT
Voltmeter..... CHECK STABLE 24 to 29 VOLTS
FUEL PUMPS Switch..... MAN
L and R FUEL PUMP ON CAS Messages..... ILLUMINATED
IGNITION Switch..... MAN
IGNITION ON CAS Message ..... ILLUMINATED
Prop Area..... CLEAR
START MODE Switch..... AUTO
(Light in Switch Extinguished)
PUSH START Switch..... LIFT COVER/PUSH
Oil Pressure ..... CHECK RISING
CONDITION Lever..... RUN
ITT..... MAX. 1000°C LIMITED TO 5 SEC.

If combustion is not initiated within 10 sec. of moving Condition Lever to Run then:

a. CONDITION Lever..... CUT-OFF/FEATHER
b. START MODE Switch..... PUSH MAN/STOP
c.. Allow minimum 30s fuel draining, then refer to DRY MOTORING RUN CHECKLIST N-15 (ON BACK). **ITT must ≤150°C before reattempting engine start.**

Starter @ 56% Ng..... Verify START ENGAGED
CAS message extinguished (If not – PUSH START MODE MAN/STOP SWITCH)
Ng ..... STABLE at or above 63%
Np..... VERIFY 1200 RPM MINIMUM
FUEL PUMPS Switch..... AUTO
IGNITION Switch..... OFF
Oil Pressure ..... CHECK (Min. 60 PSI)
BATTERY Switch ..... ON
External Power Unit..... DISCONNECT
GEN Switch ..... ON/CHECK POSITIVE AMPS/28 VOLTS
ALT Switch ..... ON

N-1 BEFORE STARTING ENGINE

Passengers ..... BOARD
Door ..... CLOSE and LATCH
All Electrical Switches ..... OFF
Cabin climate controls ..... OFF
Circuit Breakers ..... All Pushed
ECS CABIN COMFORT ..... OFF
PARKING BRAKE ..... ON
Bleed Air Lever ..... PULL OFF (closed)
Power Lever ..... IDLE
Condition Lever ..... CUT-OFF/FEATHER
EMER Switch ..... ON – check PFD – OFF
Nav light ..... ON
Battery switch ..... ON
Flaps ..... RETRACT
Fuel Gauges ..... CHECK QUANTITY & IMBALANCE
OAT/Fuel/Oil temps ..... VERIFY & CHECK
FIRE DET/ANN TEST ..... PRESS and HOLD, verify ENGINE FIRE CAS, RELEASE
CAS ..... CONSIDER ANY ILLUMINATED

N-2a AUTO ENGINE START – USING BATTERY

Battery Voltage ..... 24-26 VOLTS
Fuel Pumps ..... MANUAL
L & R Fuel Pump ON CAS message ..... ILLUMINATED
Ignition Switch ..... MANUAL
Ignition ON CAS message ..... ILLUMINATED
Prop area ..... CLEAR
Start Mode Switch ..... AUTO (Light in Switch Extinguished)
PUSH START switch ..... Lift Cover. PUSH
Oil pressure ..... Check Rising
Ng (min. 13%) ..... Stabilized
Condition Lever ..... RUN
ITT ..... Max 1000°C, limited to 5s

If combustion is not initiated within 10s of moving Condition Lever to Run then:

a. Condition Lever ..... CUT-OFF/FEATHER
b. Start Mode Switch ..... PUSH (ILLUMINATED)
c. Allow minimum 30s fuel draining, then refer to DRY MOTORING RUN CHECKLIST N-15 (ON BACK). **ITT must ≤150°C before reattempting engine start.**

Starter @ 56% Ng ..... Verify STARTER off (CAS)
If not Press MAN/STOP.
Maximum starter run time=30s
Ng ..... Stable above 63%
Np ..... Verify 1200RPM Minimum
GEN Switch ..... ON. Check Positive Amps & 28 Volts
ALT Switch ..... ON
Fuel Pumps Switch ..... AUTO
Ignition Switch ..... OFF
Oil Pressure ..... CHECK (Minimum 60 PSI)

N-3 BEFORE TAXING

AVIONICS Switch ..... ON
MFD ..... ON (Press ENT)
CAS Messages ..... Consider Any illuminated
Autopilot ..... Pre-flight test
PITOT Switch ..... ON, Check Operation
PITOT Switch ..... OFF
TAXI/REC LT Switch ..... ON
Cabin Climate Controls ..... As required
Radios/Avionics ..... CHECK
Flaps ..... VERIFY RETRACTED
Elevator Trim ..... SET TAKE-OFF RANGE
Rudder Trim ..... SET 2-3 Right Trim (Green mark)
Bleed Air Lever ..... PUSH IN (ON)
Cabin Pressure DUMP Switch ..... Verify Position
ECS CABIN COMFORT Switch ..... NORMAL
DEST ELV (LFE in TMR/REF window) ..... SET
STALL WARN Test Switch ..... Press to Test
Altimeters ..... SET
Parking Brake ..... RELEASE

N-4 TAXIING

Taxi area ..... CLEAR
POWER Lever ..... ADVANCE SLOWLY
Prop RPM ..... Minimum 1200RPM
Brakes ..... CHECK
Steering ..... CHECK

USE BETA RANGE AS REQUIRED

N-5 ENGINE RUN UP

Parking Brake ..... SET
Power Lever 1900RPM
OVERSPEED GOV TEST Switch ..... Push and HOLD
Observe approx. Np drop 60RPM. RELEASE
Power Lever ..... IDLE
REVERSE LOCK OUT Switch ..... HOLD (min 5s)
POWER LEVER ..... RETARD
Confirm beta & reverse not available
REVERSE LOCK OUT Switch ..... RELEASE (light extinguished)
GEN Switch ..... OFF. Confirm Alternator takes load
GEN Switch ..... ON

N-6 BEFORE TAKEOFF

Seats, Armrests & Belts ..... ADJUSTED & LOCKED
GEN Switch ..... ON
ALT Switch ..... ON
BLEED AIR Lever ..... IN
ECS CABIN COMFORT ..... NORM
Fuel Temperature ..... CHECK WITHIN LIMITS
FUEL PUMPS Switch ..... MAN
IGNITION Switch ..... MAN
PITOT HEAT ..... ON
Ice Protection ..... AS REQUIRED
TAXI/REC LT Switch ..... AS REQUIRED
LANDING LIGHT ..... ON
NAV LIGHT ..... ON
STROBE LIGHT Switch ..... ON
Flight Instruments ..... CHECK
CAS/PFD ..... CONSIDER
Engine Instruments ..... CHECK
Radios/Avionics/Transponder ..... SET AS REQUIRED
Flaps ..... SET (0°-20°)
Elevator & Rudder Trim ..... SET
Flight Controls ..... FREE & CORRECT
Timer & HDG bug ..... START & SYNCH

TURN TO BACK

N-7 NORMAL TAKEOFF (0° FLAPS)

Brakes ..... APPLY
POWER Lever ..... SET TO TAKEOFF
Brakes ..... RELEASE
Engine Instruments ..... MONITOR
Indicated airspeed ..... CALL 'AIRSPEED ALIVE' & '60 knots'
Rotation & Liftoff (Vx) ..... 85 KIAS
Obstacle Clearance Speed (OCS) ..... 100 KIAS
Positive Rate of climb
Landing Gear ..... UP, confirm no lights.
Yaw Damper ..... ON
Autopilot ..... AS REQUIRED

N-8 SHORT FIELD / UNPAVED FIELD TAKEOFF

SHORT FIELD: FLAPS 20°, Maintain Vx 85 KIAS & Obstacle Clearance Speed = 95KIAS.

UNPAVED FIELD: FLAPS 20° & elevator back. Vx 85 KIAS & OCS 95KIAS. Consider rolling take-off if LFL permits.

N-9 MAXIMUM CONTINUOUS POWER CLIMB

POWER Lever ..... MCP
(Torque, ITT & Ng limits as below)
FUEL PUMPS ..... AUTO
IGNITION ..... AUTO
LANDING LIGHT ..... OFF
TAXI/REC LIGHT ..... AS REQUIRED
Ice Protection ..... AS REQUIRED
Engine Instruments
a. Torque ..... MONITOR (1313 ft-lbs max)
b. ITT ..... MONITOR (770°C max)
c. Ng ..... MONITOR (101.7% max)
Climb speed (best rate) ..... 125 KIAS
Transponder ..... Verify ALT mode

For CRUISE CLIMB use 140KIAS to 20,000ft and 125KIAS to 30,000ft.

N-10 CRUISE

Cruise Power ..... Set as per power tables in Annex A
Engine/Fuel indication ..... MONITOR
Fuel Temperature/OAT ..... MONITOR
Cabin climate controls ..... AS DESIRED

N-11 DESCENT

WINDSHLD Heat switch ..... DEFOG (if required)
Ice Protection Equipment ..... AS REQUIRED
POWER lever ..... SET TO DESIRED TORQUE
Altimeters ..... SET & CROSS CHECK
DEST ELV ..... CHECK
Cabin Climate Controls ..... AS REQUIRED

N-12 BEFORE LANDING

Approach Check

Autopilot ..... DISENGAGE below 100 KIAS
FUEL PUMPS ..... MAN
IGNITION ..... MAN
LANDING LIGHT ..... ON
Fuel quantity & Balance ..... CHECK
Seats, Armrests & Belts ..... ADJUSTED & LOCKED
Landing Gear ..... DOWN (below 168KIAS)
Flaps ..... SET (10° @ 168 KIAS)

Landing Check

Gear indication ..... 3 GREEN
Brakes ..... CHECK
Flaps ..... SET (36° @ 118 KIAS max)
Airspeed 85KIAS
Autopilot ..... OFF
Yaw damper ..... OFF
LANDING POWER lever ..... IDLE

N-13 AFTER LANDING

Timer ..... STOP
FUEL PUMPS ..... AUTO
IGNITION ..... OFF
PITOT HEAT ..... OFF
Ice Protection Equipment ..... OFF
Landing/Taxi lights ..... AS REQUIRED
Strobe Light ..... AS REQUIRED
WX Radar ..... STBY
Flaps ..... RETRACT
Transponder ..... AS REQUIRED

N-14 SHUTDOWN

PARK BRAKE ..... SET
ECS CABIN COMFORT ..... OFF
POWER lever ..... IDLE
Cabin Climate Controls ..... OFF
FUEL PUMPS Switch ..... OFF
AVIONICS Switch ..... OFF
GEN Switch ..... OFF
ALT Switch ..... OFF
ITT ..... Stabilize for 2 mins @ idle
CONDITION Lever ..... CUT-OFF/FEATHER
"FEATHER" CASE Message ..... CHECK ON
BLEED AIR ..... OUT
Exterior lighting switches ..... OFF
Fuel Remaining ..... NOTE
BATTERY Switch ..... OFF
Wheel Chocks, tie downs and covers ..... AS REQUIRED

N-15 ENGINE DRY MOTORING RUN

Allow minimum 30s fuel draining period, then:
Power Lever ..... IDLE
Condition Lever ..... CUT-OFF/FEATHER
Fuel Pumps Switch ..... MAN
Ignition Switch ..... OFF
Battery Switch ..... ON
Start Mode Switch ..... MAN
Push Start Switch ..... PUSH and HOLD (15s)
Push start Switch ..... RELEASE

Starter should not be engaged for more than 30s maximum in any circumstances. Do not attempt engine restart until ITT ≤150°C

11. Failures & Emergencies

The FSR500 failure engine

The FSR500 has a custom failure engine that will allow a wide range of aircraft systems to fail under two different conditions:

1. After a component has degraded over time due to a lack of maintenance;
2. Pilot behaviour stresses the aircraft systems causing components to fail.

It is planned to add a third 'failure on command' method in a future update. This is when specific systems can be given parameters to trigger a failure.

The Maintenance EFB page has information on what systems will fail and under what conditions. These include:

- Engine failures caused by overstressing the engine either on start-up or during flight or lack of maintenance to the oil system. Note -to get engine failures you need to have the MSFS Engine stress turned on in **MSFS Assistance > Realism**.
- Electrical System failures can be related to any part of the system, from the battery, generator and alternator through to a simple circuit breaker trip. These can cause a myriad of other failures in the electrical systems of the aircraft.
- Hydraulics system failures. This will result in the main gear becoming inoperable
- Tyre and Brake wear and damage. Both under and over-inflated tyres can lead to blow-outs, particularly on heavy landings.

We don't provide a list of failures as they are condition dependent and with all the electrical systems in particular there are simply too many possible combinations to list.

Managing Failures

There are several steps in successfully managing a failure:

1. **Maintain Airplane control** – above all keep flying the plane!
2. **Analyse the problem**. Try to identify the possible failure through EICAS information and aircraft behaviour/state;
3. **Take action**. Use the correct emergency checklist procedure/s or other steps to manage the problem.

Given the myriad of possible failures, pilots who fly with failures enabled are advised to be familiar with the CAS Messages in the following section and have ready access to this manual and the emergency checklists. Knowledge of the aircraft systems detailed in Section 6 will help – it's much easier to appreciate the various alarms and warnings on the CAS if you understand the system it relates to. Pilots should also practice failure scenarios in a controlled manner when possible – this can be a lot of fun!

If you do get a failure in flight then work to remedy it – treat it like it was the real thing, don't just quit in frustration. If you dislike your flights being disrupted, then turn off some or all of the failures in the Realism EFP page.

Persistence and Acceleration

All failures are persistent! They will not go away by restarting the flight – you need to preform the necessary maintenance via the EFB.

These systems are very reliable (so long as you don't abuse the aircraft) IRL and you could rack up many hundreds of hours without experiencing a problem. So if you like the challenge of failures, then you will probably want to accelerate the rate at which they occur in the EFB Options page. At maximum (x16) rate they will occur pretty fast.

MSFS Failures

The MSFS failure system (available via the Aircraft options in World Map) will still function with the **FSR500**, but no failures created by this will be registered by the FSR500 failure engine or shown on the EFB maintenance or preflight pages.

Crew Alert System (CAS)

The Crew Alert System (CAS) is used to display messages and information to the pilot *via* the PFD and MFD. The CAS system includes warning information embedded in PFD & EIS gauges or dials – e.g. excessive temperatures on the EIS ITT gauge, or overspeed on the PFD IAS tape, as well as the aural tones, but the main element of the CAS System that you will see are the 'CAS messages' shown on the right side of the PFD.

CAS Messages

CAS messages convey important information about the state of the aircraft and can be of three types:

- Warning (red)
- Caution (amber)
- Advisory (white)

The following tables sets out each type of CAS message implemented in the **FSR500** with a brief description of what it indicates.

Warning CAS Messages

CAS MESSAGE (WARNING)	MEANING
FUEL PRESS LOW	Fuel pressure is below 10 psi.
FUEL QTY	Total FUEL QTY is equal to or less than 100 pounds.
FUEL IMBALANCE	Fuel quantity imbalance greater than 125 pounds.
ENGINE FIRE	Overtemperature condition in the engine compartment due to fire.
CABIN ALT 12K	Cabin altitude is 12,000 or above.
CHECK GEAR	Landing gear is not down and locked when aircraft is less than 400 ft AGL with engine torque less than 300ft-lb (mutable aural); or flaps greater than 10º (nonmutable aural). Landing gear is selected UP while on the ground.
T/O CONFIG	Engine torque greater then 800ft-lb. Flaps greater than 30°. Rudder trim less than 1° right or greater than 4° right.
DOOR AJAR	Cabin door is not properly closed and latched with the engine running
SURF DEICE FAIL	Surface de-ice system has failed in flight.
ALTERNATOR FAIL	Alternator switch selected ON and alternator control unit detects a failure of the alternator.
GENERATOR FAIL	Generator selected ON and no output.
FLAP FAIL	Wing flap system failure due to an overcurrent condition in the flap motor/actuator circuit.
PITOT HT FAIL	Both left and right pitot heat have failed.
PROP HEAT FAIL	A fault has developed in the propeller heat system in flight.

TABLE 11-1: CAS WARNING MESSAGES

Caution CAS Messages

CAS MESSAGE (CAUTION)	MEANING
CABIN ALT 10K	Cabin altitude is 10,000 feet or above.
CHECK GEAR	Landing gear is not down and locked when aircraft is greater than 400 ft AGL with engine torque less than 300 ft-lb (mutable aural) or flaps greater than 10° (non-mutable aural).
FEATHER	With engine operating, indicates a failure in the propeller feathering electrical system. An uncommanded propeller feathering could occur if additional electrical failures occur in the system.
FUEL IMBALANCE	Fuel quantity imbalance greater than 40 pounds.
FUEL QTY	Total FUEL QTY is between 180 and 100 lbs
L PITOT HT FAIL	Left pitot heat has failed.
R PITOT HT FAIL	Right pitot heat has failed.
PITOT HEAT OFF	Pitot heat has not been selected ON (no chime accompanies this CAS message).
PROP HEAT FAIL	A fault has developed in the propeller heat system while the aircraft is on the ground.
STALL HEAT FAIL	Stall Warning Heat has failed.
SURF DEICE FAIL	Surface de-ice system has failed while the aircraft is on the ground.
STALL WARN FAIL	The lift computer and/or lift transducer has failed.
ESP ACTIVE	The electronic stability protection system is active

TABLE 11-2: CAS CAUTION MESSAGES

Advisory CAS messages

CAS MESSAGE (ADVISORY)	MEANING
ALTERNATOR OFF	The alternator switch is selected OFF.
AV1 FAN FAIL	The Avionics 1 cooling fan has Failed
AV2 FAN FAIL	The Avionics 2 cooling fan has Failed
AV3 FAN FAIL	The Avionics 3 cooling fan has Failed
BETA	Propeller is in Beta range while the aircraft is on the ground.
DOOR	Cabin door is not properly closed and latched while the aircraft is on the ground with the engine not running.
EMER BLEED ON	Emergency bleed system has been activated either automatically at a cabin altitude in excess of 12,000 feet.
GENERATOR OFF	The generator switch is selected OFF.
FEATHER	Propeller is in feather position while the aircraft is on the ground.
L FUEL PUMP ON	Left fuel pump is operating
R FUEL PUMP ON	Right fuel pump is operating
FUEL TEMP	Fuel temperature is equal to or less than -34°C.
IGNITION ON	Ignition switch is selected to MAN and power is applied to the engine ignition unit, or when Auto mode is selected and engine torque is between 275 to 375 foot-pounds.
INVERTER FAULT	The inverter has failed.
MFD FAN FAIL	The MFD cooling fan has failed.
PFD1 FAN FAIL	The PFD 1 cooling fan has failed.
PFD2 FAN FAIL	The PFD 1 cooling fan has failed.
STALL HT INHIB	Stall heat is inhibited when OAT is greater than 5ºC.
STARTER ENGAGED	The starter is engaged normally.
T/O CONFIG	Flaps greater than 20°. Rudder trim less than 1° right or greater than 4° right. Ignition not on. Fuel pumps not in manual. Autopilot or Yaw Damper on.

TABLE 11-3: CAS ADVISORY MESSAGES

Emergency Procedure Checklists

The following 4 pages provide emergency procedure checklists for the FSR500. The are formatted in a way to allow them to be printed out for quick reference. Each checklist is referenced with 'E-' Some checklists require other checklists to be performed.

Please note the checklists contain a number of CAS Messages and actions that are not currently implemented in V1.0 of the FSR500 (e.g. the GEAR SYS CAS message and the FIREWALL FUEL CUT-OFF actions).

Other items have been included for immersion purposes such as passenger briefing, or evacuation items.

The checklists use the following two terms:

Land as soon as possible

A landing should be accomplished at the nearest suitable airfield considering the severity of the emergency, weather conditions, field facilities, and ambient lighting.

Land as soon as practical

Emergency conditions are less urgent, and although the flight should be terminated, the emergency is such that an immediate landing at the nearest suitable airfield may not be necessary.

This table provides an index of the emergency procedure checklists.

Ref	Checklist	Ref	Checklist
E-1	**ENGINE FAILURE BEFORE ROTATION**	E-14	**LANDING GEAR FAILURE**
E-2	**ENGINE IMMEDIATELY AFTER TAKE-OFF**	E-15	**EMERGENCY LANDING GEAR EXTENSION**
E-3	**ENGINE FAILURE IN FLIGHT**	E-16	**GEAR UP LANDING**
E-4	**OIL TEMPERATURE**	E-17	**FUEL QUANTITY**
E-5	**OIL PRESSURE**	E-18	**LOW FUEL PRESSURE**
E-6	**AIR START – STARTER ASSIST**	E-19	**FUEL IMBALANCE**
E-7	**ENGINE FIRE ON GROUND**	E-20	**GENERATOR FAILURE**
E-8	**ENGINE FIRE IN FLIGHT**	E-21	**ALTERNATOR FAILURE**
E-9	**EMERGENCY DESCENT, MAXIMUM RATE**	E-22	**COMPLETE ELECTRICAL FAILURE**
E-10	**CABIN ALTITUDE ABOVE 12,000FT**	E-23	**FLAPS SYSTEM MALFUNTION**
E-11	**POWER-OFF LANDING (ENGINE CUT-OFF/FEATHER)**	E-24	**DUAL FAILURE ON BOTH GENERATOR & ALTERNATOR**
E-12	**OVER PRESSURIZATION**	E-25	**PROPELLOR SPEED**
E-13	**HYDRAULIC FAILURE**	E-26	**SPIN RECOVERY (see Section 9)**

TABLE 11-4: EMERGENCY CHECKLISTS

E-1 ENGINE FAILURE BEFORE ROTATION

POWER Lever ..... **IDLE**
Braking..... **AS REQUIRED**
Stop straight ahead.
If insufficient runway remains for a safe stop:
CONDITION Lever ..... **CUT-OFF/FEATHER**
BATTERY Switch ..... **OFF**
Firewall FUEL SHUTOFF Valve..... **LIFT COVER - PULL OFF**

E-2 ENGINE FAILURE IMMEDIATELY AFTER TAKE-OFF

Airspeed..... **100 KIAS**
Landing Gear..... **DOWN**
POWER Lever..... **IDLE**
CONDITION Lever. ..... **CUT-OFF/FEATHER**
When landing gear is down and time permits:
Flaps..... **DOWN 36°**
Airspeed..... **85 KIAS**
BATTERY Switch ..... **OFF**
Firewall FUEL SHUTOFF Valve..... **LIFT COVER - PULL OFF**

E-3 ENGINE FAILURE IN FLIGHT

Oxygen..... **AS REQUIRED**
MIC SEL Switch ..... **MSK**
Airspeed..... **108 KIAS**
POWER Lever..... **IDLE**
CONDITION Lever ..... **CUT-OFF/FEATHER**
Propeller ..... **VERIFY FEATHERED**

CAUTION

The battery switch must be ON to feather the propeller.

Remaining Fuel ..... **CHECK**
Air Start..... **Refer to Air Start procedure in this section.**

E-4 OIL TEMPERATURE

Indication: Master Warning, Triple Chime, Flashing Red Oil Temperature Indication
POWER Lever..... **REDUCE POWER**

If temperature remains high, continue flight at reduced power and *land as soon as possible.*

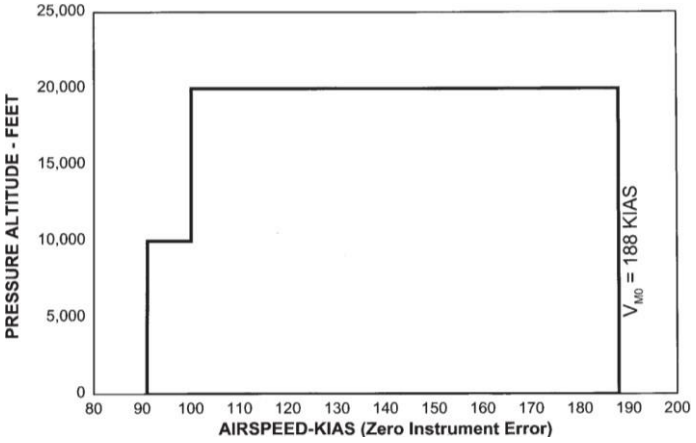
E-5 OIL PRESSURE

Indication: Master Warning, Triple Chime, Flashing Red Oil Pressure Indication
Engine Torque at or above 1100 ft-lb:
Low Oil Pressure, Below 85 PSI

POWER Lever..... **REDUCE TO A MAX. OF 1100 FT - LB OF TORQUE**
Land as soon as practical.
High Oil Pressure, Above 200 PSI:
Land as soon as practical.

Engine Torque below 1100 ft-lb:
Low Oil Pressure, Below 60 PSI
Power..... **REDUCE TO MINIMUM TORQUE REQUIRED TO COMPLETE FLIGHT**
Land as soon as possible.
High Oil Pressure, Above 200 PSI
Land as soon as possible.

E-6 AIR START – STARTER ASSIST



Oxygen ..... **AS REQUIRED**
MIC SEL Switch..... **MSK**
Autopilot ..... **DISENGAGE**
CONDITION Lever..... **CUT-OFF/FEATHER**
Altitude & Airspeed..... **WITHIN THE AIR START ENVELOPE**
POWER Lever. ..... **IDLE**
GEN Switch..... **OFF**
ALT Switch..... **OFF**
Electrical Load ..... **REDUCE**
ECS CABIN COMFORT Switch ..... **OFF**
BLEED AIR Lever. ..... **PULL OUT (closed)**
EMERGENCY PRESSURE Circuit Breaker..... **PULL**
(Located on pilot's aft circuit breaker panel, row B, position 6)
FUEL PUMPS Switch ..... **MAN**
IGNITION Switch ..... **MAN**

CAUTION

To obtain an AUTO air start, the START MODE MAN/STOP switch must not be selected. If the switch is selected to MAN (switch light illuminated), the PUSH START switch must be held ON to keep the starter engaged during the start.

START MODE Switch ..... **AUTO**
PUSH START Switch..... **ENGAGE (Verify START ENGAGED message Illuminated)**
CONDITION Lever (Ng min. 13%) ..... **RUN**
ITT and Ng ..... **MONITOR**
After Engine Relight - Ng ≥ 63%:
GEN Switch..... **ON**
ALT Switch..... **ON**
FUEL PUMPS Switch ..... **AUTO**
IGNITION Switch ..... **AUTO**
EMERGENCY PRESSURE Circuit Breaker..... **RESET**
(Located on the pilot's aft circuit breaker panel, row B, position 6)
BLEED AIR Lever. ..... **PUSH IN (open)**
ECS CABIN COMFORT Switch ..... **NORM**
Electrical Equipment. ..... **AS REQUIRED**

E-7 ENGINE FIRE ON GROUND

POWER Lever ..... **IDLE**
CONDITION Lever ..... **CUT-OFF/FEATHER**
Brakes ..... **AS REQUIRED**
Firewall FUEL SHUTOFF Valve ..... **LIFT COVER - PULL OFF**
BLEED AIR Lever. ..... **PULL OUT (closed)**
ECS CABIN COMFORT Switch ..... **OFF**
FUEL PUMPS Switch ..... **OFF**
IGNITION Switch ..... **OFF**
Radio ..... **EMERGENCY CALL**
BATTERY Switch ..... **OFF**
Aircraft ..... **EVACUATE**
Fire ..... **EXTINGUISH**

E-8 ENGINE FIRE IN FLIGHT

Engine Power ..... **REDUCE TO MINIMUM ACCEPTABLE ACCORDING TO FLIGHT SITUATION**
Oxygen ..... **AS REQUIRED (all aircraft occupants)**
MIC SEL Switch ..... **MSK**
Confirm that fire exists then:
CONDITION Lever ..... **CUT-OFF/FEATHER**
Firewall FUEL SHUTOFF Valve ..... **LIFT COVER - PULL OFF**
ECS CABIN COMFORT Switch ..... **OFF**
BLEED AIR Lever. ..... **PULL OUT (closed)**
Conduct a Normal Descent, or Emergency Descent (E-9)-as appropriate and Power Off Landing, (E-11)

CAUTION

If pressurized, this procedure will result in an immediate loss of pressurization and cabin altitude will rise at an uncontrolled rate.

E-9 EMERGENCY DESCENT, MAXIMUM RATE

Autopilot ..... **OFF**
POWER Lever. ..... **IDLE**
Landing Gear ..... **Below 168 KIAS, DOWN**
WINDSHLD HT Switch ..... **DEFOG**
Smooth air
Airspeed after Landing Gear is Fully Extended ..... **168 KIAS**
Rough air
Airspeed ..... **127 KIAS.**

E-10 CABIN ALTITUDE ABOVE 12,000FT

Master Warning, Triple Chime, CABIN ALT 12K, Red cabin altitude indication.
Oxygen Mask ..... **ON**
MIC SEL Switch ..... **MSK**
ECS CABIN COMFORT Switch ..... **Verify NORM or HIGH**
BLEED AIR Lever. ..... **Verify IN (open)**
If cabin altitude exceeds 14,000 feet:
Emergency Descent. ..... **ACCOMPLISH PER SECTION E-9**
Descend as soon as practical.

E-11 POWER-OFF LANDING (ENGINE CUT-OFF/FEATHER)

Best Gliding Airspeed is 108 KIAS
POWER Lever. ..... **IDLE**
CONDITION Lever ..... **CUT-OFF/FEATHER**
Propeller ..... **VERIFY FEATHERED**
FUEL PUMPS Switch ..... **OFF**
IGNITION Switch ..... **OFF**
Firewall FUEL SHUTOFF Valve ..... **LIFT COVER - PULL OFF**
Electrical Load ..... **REDUCE**
ECS CABIN COMFORT Switch ..... **OFF**
CABIN PRESSURE DUMP Switch ..... **DUMP**
Seats and Seat Backs ..... **UPRIGHT & LOCKED IN POSITION**
Seat Belts and Harness ..... **FASTEN / TIGHT**
CHECK INERTIA REEL
Passengers ..... **BRIEF When committed to landing:**
Landing Gear ..... **DOWN; 3 GREEN**
Flaps ..... **AS REQUIRED**
If landing site is not suitable for gear down landing:
Landing Gear ..... **MAINTAIN UP**
Flaps ..... **FULL DOWN**
Final Approach Speed ..... **85 KIAS**
After Touchdown:
BATTERY Switch ..... **OFF**
After the aircraft has stopped ..... **EVACUATE.**

E-12 OVER PRESSURIZATION

Indication: Master Warning, Triple Chime, Red cabin differential pressure indication.
If cabin differential pressure is above 5.8 psi (or 5.6 psi for greater than 30 sec.):
Oxygen Mask ..... **ON**
MIC SEL Switch ..... **MSK**
ECS CABIN COMFORT Switch ..... **OFF**
BLEED AIR Lever. ..... **PULL OUT (closed)**
If over pressurization continues:
CABIN PRESSURE DUMP Switch ..... **DUMP**
Emergency Descent. ..... **ACCOMPLISH PER SECTION E-9**

E-13 HYDRAULIC FAILURE

On Ground:
Indication: Master Warning , Triple Chime, HYDR PUMP ON

LANDING GEAR Selector. ..... **Verify DOWN**
In Flight:
Indication: Master Caution , Double Chime, HYDR PUMP ON

HYDRAULIC PUMP POWER Circuit Breaker ..... **PULL**
(Located on pilot's forward circuit breaker panel, row C, position 4)

Land as soon as practical and investigate the cause.

Prior to landing, the HYDRAULIC PUMP POWER circuit breaker must be reset to extend the landing gear. If the pump continues to run after the gear is locked down, pull the HYDRAULIC PUMP POWER circuit breaker. If the gear fails to extend, refer to the **Emergency Landing Gear Extension Procedure E-15**

E-14 LANDING GEAR FAILURE

Indication: Master Caution, Double Chime, GEAR SYS

HYDRAULIC PUMP POWER Circuit Breaker. ..... **Verify IN**
(Located on pilot's forward circuit breaker panel, row C, position 4)
BATTERY Switch ..... **Verify ON**
GEN Switch ..... **Verify ON**
ALT Switch ..... **Verify ON**
LANDING GEAR Selector ..... **CYCLE**
If issue not resolved..... **Perform Emergency Landing Gear Extension (E-15)**

E-15 EMERGENCY LANDING GEAR EXTENSION

Indication: One or more of the green gear indications not illuminated.

Airspeed..... **100 KIAS**
HYDRAULIC PUMP POWER Circuit Breaker (25 amp). .....**PULL**
(Located on pilot's forward circuit breaker panel, row C, position 4)
LANDING GEAR Selector. ..... **DOWN**
Emergency Gear Extension Control.....**PULL**

If 3 green gear indications are still not present:

Yaw the aircraft left and right to lock the main landing gear.
Reduce airspeed to minimum safe speed to improve nose gear locking.

If 3 green gear indications are present:..... Land

If not successful, refer to **Gear Up Landing (E-16)**.

E-16 GEAR UP LANDING

ECS CABIN COMFORT Switch..... **OFF**
Cabin Pressure DUMP Switch. ..... **DUMP**
Passengers ..... **BRIEF**
Flaps.....**FULL DOWN**
Final Approach Speed ..... **85 KIAS**

When Runway is Assured

POWER Lever ..... **IDLE**
CONDITION Lever .....**CUT-OFF/FEATHER**
Firewall FUEL SHUTOFF Valve.....**LIFT COVER – PULL OFF**

After Touchdown

BATTERY Switch ..... **OFF**
After the aircraft has stopped .....**EVACUATE**

E-17 FUEL QUANTITY

Indication: Master Warning, Triple Chime, FUEL QTY

Total fuel quantity is less than 100lbs. ***Land as soon as possible***. Reduce power/fuel flow if possible.

Indication: Master Caution, Double Chime, FUEL QTY

Total fuel quantity is less than 180lbs, ***Land as soon as practical***. Reduce power/fuel flow if possible.

E-18 LOW FUEL PRESSURE

Indication: Master Warning, Triple Chime, FUEL PRESS LOW

Power..... **REDUCE**
FUEL PUMPS Switch..... **MAN**
Fuel Quantity and Balance.....**MONITOR**
If fuel pressure annunciator remains illuminated, ***land as soon as possible.***
If fuel pressure annunciator remains illuminated**, *land as soon as possible.***

E-19 FUEL IMBALANCE

Indication: Master Warning, Triple Chime, FUEL IMBALANCE, Red fuel imbalance indication (>125lbs imbalance)

FUEL PUMPS Switch..... **MAN**
If either white **"L FUEL PUMP ON"** or **"R FUEL PUMP ON"** message is NOT illuminated, turn the **FUEL PUMPS Switch to OFF.**
In all cases, Land as soon as possible.

FUEL IMBALANCE 40 pounds

Indication: Master Warning, Triple Chime, FUEL IMBALANCE, Ambar fuel imbalance indication.

FUEL PUMPS Switch..... **Verify AUTO**
Fuel Pump .....**Verify white L or R FUEL PUMP ON (High Fuel Side) message on MFD**
Fuel Quantity .....**MONITOR**

E-20 GENERATOR FAILURE

Indication: Master Warning, Triple Chime, GENERATOR FAIL Zero generator amps indication.

Electrical Load.....**REDUCE UNTIL TOTAL LOAD IS BELOW 130 AMPS & VOLTS ANNUNCIATOR IS EXTINGUISHED**
AIR COND Switch ..... **OFF**
GEN Switch ..... **OFF then ON**

If generator fails to reset:

GEN Switch ..... **OFF**
GENERATOR CONTROL Circuit Breaker.....**RESET**
(Located on the lower left instrument panel.)
GEN Switch ..... **ON**

If circuit breaker opens again or annunciator stays illuminated with zero amps indicated:

GEN Switch ..... **OFF**
GENERATOR CONTROL Circuit Breaker..... PULL/ DO NOT RESET

Land as soon as practical.

E-21 ALTERNATOR FAILURE

Indication: Master Warning, Triple Chime, ALTERNATOR FAIL Zero alternator amps indication.

ALT Switch..... **OFF then ON**

If alternator fails to reset:

ALT Switch.....**OFF**
ALTERNATOR FIELD Circuit Breaker. ..... **RESET**
(Located on pilot's forward circuit breaker panel, row D, position 7)
ALT Switch ..... ON

If circuit breaker opens again or annunciator stays illuminated with zero amps indicated:

ALT Switch.....**OFF**
ALTERNATOR FIELD Circuit Breaker..... PULL/ DO NOT RESET

If generator has assumed the load, limit load to under 200 amps and continue flight while avoiding icing conditions. Repair alternator as soon as possible.

E-22 COMPLETE ELECTRICAL FAILURE

Indication: PFDs, MFD and all equipment, excluding the Standby Instrument, will be unpowered.

Standby Flight Instrument ..... **Verify OPERATIONAL**
Aircraft Control ..... **Use Standby Instrument**
EMER Switch ..... **ON**
BATTERY Switch ..... **OFF**
GEN Switch..... **OFF**
ALT Switch..... **OFF**
AVIONICS Switch..... **OFF**
CABIN PRESSURE DUMP Switch (prior to landing) ..... **DUMP**

Land as soon as possible.

The aircraft will now be on emergency bus power only. Please refer to section 5, 'Emergency Power' for a description of what systems will be powered.

NOTE

With a complete electrical failure, emergency landing gear extension and landing without flaps will be required. Refer to Emergency Landing Gear Extension () and Landing Without Flaps ().

CAUTION

Torque indication will not be available, therefore engine power should be set using throttle lever position, engine sound, airspeed, and the remaining powerplant indications.

CAUTION

During operations on the emergency bus, BETA and reverse are not available.

E-23 FLAPS SYSTEM MALFUNTION

Indication: Master Warning, Triple Chime, FLAP FAIL

FLAP WARN Circuit Breaker..... **PULL AND RESET VERIFY NORMAL FLAP OPERATION**
(Located on pilot's side forward panel, row B, position 4)

If FLAP FAIL remains indicated:
FLAP MOTOR Circuit Breaker..... **PULL AND RESET VERIFY NORMAL FLAP OPERATION**
(Located on pilot's side forward panel, row B, position 3)

TO LAND WITHOUT FLAPS, FOLLOW NORMAL PROCEDURES BUT USE Vref = 100KIAS

E-24 DUAL FAILURE ON BOTH GENERATOR & ALTERNATOR

Indication: Master Warning, Triple Chine ALTERNATOR FAIL And GENERATOR FAIL Zero Amps indicated on both ammeters.

NOTE

Any time total tie bus voltage is below 25 Vdc while Any time total tie bus voltage is below 25 Vdc while illuminate.

GEN Switch..... **OFF**
ALT Switch ..... **OFF**
GENERATOR CONTROL Circuit Breaker ..... **RESET**
(Located on the lower left instrument panel.)
ALTERNATOR FIELD Circuit Breaker..... **RESET**
(Located on pilot's forward circuit breaker panel, row D, position 7)
GEN Switch (after OFF at least one second)..... **ON**
ALT Switch (after OFF at least one second)..... **ON**

If only the generator resets:

ALT Switch ..... **OFF**

Continue flight while avoiding icing conditions. If only the alternator resets:

GEN Switch..... **OFF**
Electrical Load ..... **MAINTAIN LESS THAN 130 AMPS**
Ammeter ..... **MONITOR**

Land as soon as practical.

If neither the generator nor alternator resets:

GEN Switch..... **OFF**
ALT Switch ..... **OFF**
EMER Switch ..... **Verify OFF**
BATTERY Switch ..... **Verify ON**
Electrical Load ..... **REDUCE TO MINIMUM**

Load-shed procedure (for 30-minutes of battery life)

E-25 PROPELLOR SPEED

Indication: Master Warning, Triple Chime, Flashing Red Propeller Speed Indication

For Prop RPM less than 1200:

POWER Lever ..... **INCREASE POWER**

For Prop RPM greater than or equal to 2040 for more than 2 seconds:

POWER Lever ..... **REDUCE POWER**
Airspeed ..... **REDUCE**

Land as soon as practical.

For Prop RPM greater than or equal to 2080 continuously:

POWER Lever ..... **REDUCE AS NECESSARY**
Airspeed ..... **REDUCE TO LOWEST PRACTICAL**

Land as soon as possible.

Should heavy vibration or uncontrolled propeller speed occur, be prepared to shut down the engine.

CONDITION Lever ..... **CUT-OFF/FEATHER**

Conduct a Normal Descent, or Emergency descent (E-9) as appropriate and Power Off Landing (E-11).

Annex A: Performance Tables

Take-off performance: Take-Off Field Required

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 5000LBS					
	SEA LEVEL	2000	6000	8000	10000	
40	2190ft	2390ft				FLAPS 0
30	1980ft	2210ft	3090ft	3510ft	4010ft	
20	1860ft	2100ft	2830ft	3240ft	3770ft	
10	1750ft	2010ft	2630ft	3060ft	3530ft	
0	1610ft	1810ft	2430ft	2820ft	3370ft	
-10	1550ft	1790ft	2290ft	2630ft	3070ft	

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 4600LBS					
	SEA LEVEL	2000	6000	8000	10000	
40	1910ft	2190ft				FLAPS 0
30	1800ft	2020ft	2790ft	3100ft	3690ft	
20	1700ft	1900ft	2590ft	2980ft	3450ft	
10	1600ft	1830ft	2410ft	2810ft	3200ft	
0	1490ft	1770ft	2210ft	2620ft	3010ft	
-10	1380ft	1600ft	2070ft	2430ft	2790ft	

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 4200LBS					
	SEA LEVEL	2000	6000	8000	10000	
40	1820ft	1990ft				FLAPS 0
30	1610ft	1830ft	2480ft	2800ft	3370ft	
20	1520ft	1770ft	2290ft	2670ft	3090ft	
10	1410ft	1650ft	2210ft	2550ft	2960ft	
0	1350ft	1570ft	2010ft	2370ft	2680ft	
-10	1230ft	1420ft	1850ft	2190ft	2490ft	

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 3800LBS					
	SEA LEVEL	2000	6000	8000	10000	
40	1570ft	1770ft				FLAPS 0
30	1440ft	1640ft	2230ft	2510ft	2980ft	
20	1360ft	1590ft	2080ft	2390ft	2720ft	
10	1250ft	1510ft	1990ft	2290ft	2610ft	
0	1200ft	1350ft	1790ft	2090ft	2370ft	
-10	1090ft	1240ft	1610ft	2010ft	2230ft	

Table A-1: Normal take-off – distance required (ft) (no flaps)

- **SUBTRACT 200ft TO LANDING ROLL DISTANCE PER 10KT OF HEADWIND**
- **ADD 450ft TO LANDING ROLL DISTANCE PER 10KT OF TAILWIND**
- **MULTIPLY LANDING ROLL DISTANCE BY:**

  x1.2 FOR GRASS; x1.3 FOR WET GRASS

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 5000LBS					FLAPS 20
	SEA LEVEL	2000	6000	8000	10000	
40	1990ft	2300ft				
30	1890ft	2100ft	2800ft	3200ft	3700ft	
20	1700ft	1990ft	2700ft	3100ft	3650ft	
10	1600ft	1900ft	2500ft	2900ft	3400ft	
0	1500ft	1750ft	2300ft	2700ft	3100ft	
-10	1400ft	1600ft	2100ft	2500ft	2750ft	

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 4600LBS					FLAPS 20
	SEA LEVEL	2000	6000	8000	10000	
40	1800ft	2100ft				
30	1700ft	2000ft	2600ft	3100ft	3590ft	
20	1600ft	1800ft	2500ft	2900ft	3300ft	
10	1400ft	1700ft	2250ft	2600ft	3100ft	
0	1300ft	1600ft	2100ft	2500ft	2900ft	
-10	1200ft	1500ft	2000ft	2250ft	2600ft	

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 4200LBS					FLAPS 20
	SEA LEVEL	2000	6000	8000	10000	
40	1700ft	1900ft				
30	1600ft	1800ft	2450ft	2700ft	3200ft	
20	1500ft	1700ft	2250ft	2600ft	3000ft	
10	1420ft	1550ft	2000ft	2400ft	2700ft	
0	1250ft	1450ft	1900ft	2200ft	2600ft	
-10	1190ft	1400ft	1800ft	2090ft	2400ft	

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 3800LBS					FLAPS 20
	SEA LEVEL	2000	6000	8000	10000	
40	1500ft	1800ft				
30	1400ft	1650ft	2150ft	2550ft	2900ft	
20	1350ft	1550ft	2050ft	2400ft	2800ft	
10	1250ft	1400ft	1900ft	2150ft	2500ft	
0	1150ft	1350ft	1700ft	2000ft	2390ft	
-10	1050ft	1300ft	1650ft	1850ft	2150ft	

Table A-2: Short-field take-off – distance required (ft) (flaps 20)

- **SUBTRACT 200ft TO LANDING ROLL DISTANCE PER 10KT OF HEADWIND**
- **ADD 450ft TO LANDING ROLL DISTANCE PER 10KT OF TAILWIND**
- **MULTIPLY LANDING ROLL DISTANCE BY:**
  x1.2 FOR GRASS; x1.3 FOR WET GRASS

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 5000LBS					
	SEA LEVEL	2000	6000	8000	10000	
40	2790ft	3110ft				FLAPS 20 50ft Obstacle
30	2610ft	3050ft	4000ft	4620ft		
20	2420ft	2830ft	3770ft	4400ft	5100ft	
10	2300ft	2590ft	3520ft	4070ft	4770ft	
0	2170ft	2430ft	3220ft	3780ft	4400ft	
-10	2000ft	2370ft	3050ft	3570ft	4100ft	

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 4600LBS					
	SEA LEVEL	2000	6000	8000	10000	
40	2600ft	3100ft				FLAPS 20 50ft Obstacle
30	2490ft	2820ft	3790ft	4220ft	4820ft	
20	2290ft	2590ft	3430ft	4070ft	4650ft	
10	2130ft	2450ft	3220ft	3690ft	4350ft	
0	1980ft	2230ft	3050ft	3430ft	3990ft	
-10	1830ft	2170ft	2820ft	3200ft	3750ft	

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 4200LBS					
	SEA LEVEL	2000	6000	8000	10000	
40	2390ft	2780ft				FLAPS 20 50ft Obstacle
30	2230ft	2590ft	3380ft	3870ft	4400ft	
20	2090ft	2230ft	3080ft	3580ft	4230ft	
10	1990ft	2190ft	2880ft	3370ft	3900ft	
0	1780ft	2050ft	2750ft	3100ft	3610ft	
-10	1620ft	1990ft	2610ft	2840ft	3400ft	

TEMP(C)	TAKEOFF DISTANCE - WEIGHT 3800LBS					
	SEA LEVEL	2000	6000	8000	10000	
40	2070ft	2430ft				FLAPS 20 50ft Obstacle
30	1980ft	2230ft	2990ft	3340ft	3970ft	
20	1790ft	2110ft	2780ft	3230ft	3790	
10	1710ft	1990ft	2570ft	3000ft	3400ft	
0	1600ft	1820ft	2410ft	2780ft	3200ft	
-10	1450ft	1730ft	2270ft	2440ft	3080ft	

Table A-3: Short Field Take-Off Distance – to clear a 50’ Obstacle (flaps 20)

- **FLAPS 20**
- **SUBTRACT 200ft TO LANDING ROLL DISTANCE PER 10KT OF HEADWIND**
- **ADD 450ft TO LANDING ROLL DISTANCE PER 10KT OF TAILWIND**
- **MULTIPLY LANDING ROLL DISTANCE BY:**

  x1.2 FOR GRASS; x1.3 FOR WET GRASS

Cruise Performance – Maximum Cruise Speed

	-54	-52	-50	-48	-46	-44	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24
15000											1154	1159	1164	1169	1173	1178
16000										1173	1178	1184	1189	1194	1199	1204
17000									1194	1199	1205	1210	1215	1220	1225	1230
18000								1215	1220	1226	1231	1236	1241	1247	1253	1257
19000							1236	1241	1246	1252	1257	1262	1268	1274	1280	1285
20000						1257	1263	1270	1274	1280	1286	1292	1299	1303	1309	1313
21000					1281	1287	1293	1300	1306	1311	1311	1312	1312	1313	1313	1313
22000				1303	1305	1308	1309	1312	1313	1313	1313	1313	1313	1313	1311	1310
23000			1313	1313	1313	1313	1313	1313	1313	1313	1313	1313	1310	1302	1294	1285
24000		1313	1313	1313	1313	1313	1312	1307	1301	1298	1293	1287	1276	1262	1254	1234
25000	1312	1309	1306	1303	1300	1295	1285	1276	1267	1257	1248	1237	1227	1217	1207	1197
26000	1290	1279	1272	1263	1254	1245	1234	1227	1218	1208	1199	1187	1181	1171	1162	1152
27000	1239	1230	1221	1213	1204	1196	1187	1179	1170	1161	1152	1143	1135	1126	1116	1107
28000	1188	1179	1173	1163	1155	1147	1138	1132	1121	1112	1104	1096	1089	1078	1069	1060
29000	1131	1123	1115	1107	1099	1091	1083	1074	1066	1058	1049	1041	1032	1023	1014	1005
30000	1077	1068	1060	1053	1045	1040	1029	1021	1012	1004	997	987	978	970	961	955

Table A-4: Maximum Speed Cruise – Power Setting (OAT -54 to -24)

	-22	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6
15000	1183	1188	1190	1192	1195	1197	1201	1202	1204	1206	1209	1211	1214	1216	1218	1221
16000	1209	1213	1216	1218	1221	1223	1225	1227	1230	1233	1235	1237	1239	1242	1245	1247
17000	1234	1239	1241	1244	1247	1249	1252	1254	1257	1260	1262	1265	1267	1270	1273	1276
18000	1262	1268	1271	1274	1276	1280	1282	1285	1288	1291	1295	1296	1298	1300	1301	1304
19000	1291	1293	1296	1298	1300	1303	1305	1307	1310	1312	1313	1313	1313	1313	1313	1313
20000	1313	1313	1313	1313	1313	1313	1313	1313	1313	1312	1312	1311	1311	1311	1311	1310
21000	1313	1313	1313	1313	1313	1311	1308	1306	1303	1300	1297	1294	1291	1288	1286	1280
22000	1309	1307	1306	1303	1298	1292	1287	1279	1276	1271	1265	1260	1252	1248	1241	1235
23000	1277	1267	1262	1256	1251	1245	1240	1234	1229	1223	1218	1212	1206	1200	1194	1188
24000	1233	1222	1216	1208	1206	1200	1195	1189	1181	1178	1173	1167	1162	1154	1151	1145
25000	1187	1176	1171	1166	1160	1155	1147	1144	1139	1134	1129	1124	1119	1114	1109	1103
26000	1139	1132	1127	1122	1114	1112	1107	1102	1098	1091	1088	1084	1079	1074	1067	1065
27000	1097	1088	1083	1078	1074	1069	1065	1060	1056	1051	1047	1042	1039	1033	1029	1024
28000	1051	1044	1037	1032	1028	1023	1021	1014	1010	1005	1001	998	992	987	983	978
29000	996	987	983	978	974	969	965	961	956	952	947	943	938	934	932	
30000	944	935	933	927	922	918	914	911	905	901	896	892	890			

Table A-5: Maximum Speed Cruise – Power Setting (OAT -22 to -6)

Cruise Performance – Maximum Cruise Speed

	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
15000	1224	1225	1228	1230	1232	1235	1237	1240	1242	1244	1248	1249	1252	1254	1256	1259
16000	1249	1252	1254	1258	1260	1262	1265	1268	1271	1272	1274	1275	1277	1279	1280	1281
17000	1279	1282	1285	1288	1291	1293	1296	1296	1294	1292	1291	1289	1287	1285	1283	1282
18000	1305	1307	1309	1311	1313	1310	1306	1301	1297	1291	1288	1284	1279	1275	1269	1266
19000	1313	1313	1313	1310	1304	1298	1292	1287	1281	1275	1269	1263	1258	1252	1246	1240
20000	1310	1305	1298	1291	1284	1273	1269	1262	1255	1247	1237	1233	1226	1218	1211	1201
21000	1273	1266	1259	1251	1244	1267	1230	1223	1216	1209	1201	1194	1187	1180		
22000	1228	1218	1214	1207	1201	1194	1184	1180	1174	1167	1160	1150				
23000	1181	1175	1169	1163	1157	1151	1145	1139	1133	1127						
24000	1140	1134	1126	1123	1118	1112	1107	1098								
25000	1098	1093	1088	1083	1078	1071										
26000	1060	1056	1051	1044												
27000	1020	1015														
28000																
29000																
30000																

Table A-6: Maximum Speed Cruise – Power Setting (OAT -5 to +10)

	11	12	13	14	15	16	17	18	19	20	22	24	26	28	30
15000	1261	1264	1266	1269	1271	1274	1276	1278	1281	1285					
16000	1283	1284	1286	1287	1289	1290	1292	1294							
17000	1280	1278	1276	1274	1273	1271									
18000	1262	1257	1253	1247											
19000	1235	1229													
20000															
21000															
22000															
23000															
24000															
25000															
26000															
27000															
28000															
29000															
30000															

Table A-7: Maximum Speed Cruise – Power Setting (OAT +11 to +30)

ISA	-20				-15				-10				-5				ISA			
Altitude	OAT	TQ	Fuel Flow	TAS	OAT	TQ	Fuel Flow	TAS	OAT	TQ	Fuel Flow	TAS	OAT	TQ	Fuel Flow	TAS	OAT	TQ	Fuel Flow	TAS
0	-5	943	350	177	0	949	351	178	5	956	353	180	10	962	355	182	15	969	355	183
2000	-9	964	337	182	-4	970	339	184	1	977	340	185	6	985	342	187	11	993	344	189
4000	-13	985	324	187	-8	993	326	189	-3	1000	327	191	2	1008	329	193	7	1016	331	194
6000	-17	1011	313	193	-12	1019	314	195	-7	1027	316	197	-2	1036	318	198	3	1045	320	200
8000	-21	1037	302	199	-16	1046	304	201	-11	1056	306	203	-6	1065	308	205	-1	1074	310	207
10000	-25	1066	293	205	-20	1077	295	207	-15	1088	297	209	-10	1096	299	211	-5	1106	301	213
12000	-29	1098	285	211	-24	1109	287	214	-19	1121	289	216	-14	1132	291	218	-9	1142	293	220
14000	-33	1134	280	218	-28	1146	283	221	-23	1158	285	223	-18	1170	288	225	-13	1182	290	227
16000	-37	1171	279	225	-32	1184	282	228	-27	1197	284	230	-22	1209	287	232	-17	1221	289	235
18000	-41	1213	279	233	-36	1226	282	235	-31	1239	284	238	-26	1253	287	240	-21	1266	289	243
20000	-45	1255	281	241	-40	1270	283	243	-35	1285	286	246	-30	1299	288	248	-25	1313	291	251
22000	-49	1302	285	249	-44	1308	286	251	-39	1313	287	253	-34	1313	287	254	-29	1313	287	256
24000	-53	1313	282	255	-48	1313	282	256	-43	1313	282	258	-38	1301	280	259	-33	1289	278	260
26000	-57	1301	278	259	-52	1279	273	259	-47	1256	268	259	-42	1234	264	259	-37	1211	260	259
28000	-60	1214	258	258	-55	1194	254	258	-50	1173	250	258	-45	1153	246	258	-40	1132	242	258
30000	-64	1112	237	255	-59	1094	233	255	-54	1077	230	256	-49	1058	226	255	-44	1040	222	255

Table A-7: FSR500 MAXIMUM CRUISE PERFORMANCE (ISA -20 to ISA)

- **Altitude = ft**
- **ISA = degrees Celsius**
- **OAT = Outside Air Temperature**
- **TQ = Torque, lb-ft**
- **Fuel Flow = Pounds Per Hour**
- **TAS = True Air Speed, in Knots**

ISA	+5				+10				+15				+20				+25			
Altitude	OAT	TQ	Fuel Flow	TAS	OAT	TQ	Fuel Flow	TAS	OAT	TQ	Fuel Flow	TAS	OAT	TQ	Fuel Flow	TAS	OAT	TQ	Fuel Flow	TAS
0	20	976	358	185	25	983	360	186	30	989	361	188	35	996	363	189	40	1002	364	191
2000	16	999	345	190	21	1006	347	192	26	1014	349	194	31	1021	351	195	36	1028	352	197
4000	12	1024	333	196	17	1032	335	198	22	1040	337	199	27	1048	339	201	32	1056	340	203
6000	8	1053	322	202	13	1061	324	204	18	1070	326	206	23	1079	328	208	28	1088	330	209
8000	4	1083	312	208	9	1092	314	210	14	1102	316	212	19	1111	318	214	24	1120	320	216
10000	0	1116	303	215	5	1127	305	217	10	1137	307	219	15	1148	310	221	20	1157	312	223
12000	-4	1153	296	222	1	1163	298	224	6	1175	301	226	11	1187	303	228	16	1197	305	230
14000	-8	1192	292	229	-3	1203	294	231	2	1214	297	234	7	1226	299	236	12	1239	302	238
16000	-12	1233	291	237	-7	1245	294	239	-2	1258	296	241	3	1271	299	244	8	1279	301	245
18000	-16	1280	292	245	-11	1295	295	248	-6	1304	297	250	-1	1313	299	252	4	1291	295	251
20000	-20	1313	291	252	-15	1313	292	254	-10	1311	291	255	-5	1310	292	257	0	1273	285	255
22000	-24	1310	286	257	-19	1306	286	259	-14	1279	280	258	-9	1252	275	258	-4	1218	269	257
24000	-28	1262	273	259	-23	1235	268	259	-18	1208	263	258	-13	1181	258	258	-8	1154	253	257
26000	-32	1187	255	259	-27	1164	251	259	-22	1139	246	258	-17	1114	242	257	-12	1091	238	257
28000	-35	1111	238	258	-30	1089	234	258	-25	1067	230	257	-20	1044	226	256	-15	1021	221	256
30000	-39	1018	218	255	-34	997	214	254	-29	976	210	254	-24	955	207	253	-19	933	202	252

Table A-8: FSR500 MAXIMUM CRUISE PERFORMANCE (ISA +5 to +25)

- **Altitude = ft**
- **ISA = degrees Celsius**
- **OAT = Outside Air Temperature**
- **TQ = Torque, lb-ft**
- **Fuel Flow = Pounds Per Hour**
- **TAS = True Air Speed, in Knots**

ISA	-20				-10				ISA				+10				+20			
Altitude	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**
0	-5		-	-	5		360	184	15		361	186	25		362	188	35		364	190
5000	-15		319	191	-5		320	193	5		321	196	15		323	198	25		324	200
10000	-25		283	201	-15		284	203	-5		285	206	5		286	208	15		287	210
15000	-35	1000	255	211	-25	1000	256	214	-15	1000	257	216	-5	1000	258	219	5	1000	259	221
20000	-45		236	222	-35		237	225	-25		237	228	-15		238	230	-5		239	233
25000	-55		222	233	-45		222	237	-35		223	240	-25		223	242	-15		223	245
30000	-64		215	246	-54		215	249	-44		214	252	-34		215	255	-24		212	258

Table A-9: FSR500 1000 lb-ft CRUISE PERFORMANCE (ISA -20 to +20)

ISA	-20				-10				ISA				+10				+20			
Altitude	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**
0	-5		331	165	5		332	168	15		333	170	25		334	172	35		355	174
5000	-15		291	174	-5		292	177	5		293	179	15		294	181	25		295	183
10000	-25		254	184	-15		255	186	-5		255	188	5		256	191	15		257	193
15000	-35	800	225	193	-25	800	226	196	-15	800	227	198	-5	800	228	201	5	800	228	203
20000	-45		204	203	-35		204	206	-25		205	209	-15		205	211	-5		206	213
25000	-55		188	214	-45		188	217	-35		189	219	-25		189	222	-15		190	224
30000	-64		178	225	-54		178	228	-44		178	230	-34		178	233	-24		179	235

Table A-10: FSR500 800 lb-ft CRUISE PERFORMANCE (ISA -20 to +20)

- **Altitude = ft**
- **ISA = degrees Celsius**
- **OAT = Outside Air Temperature**
- **TQ = Torque, lb-ft**
- **Fuel Flow = Pounds Per Hour**
- **TAS = True Air Speed, in Knots**

ISA	-20				-10				ISA				+10				+20			
Altitude	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**
0	-5	600	306	144	5	600	306	146	15	600	307	148	25	600	308	150	35	600	308	152
5000	-15		264	154	-5		265	155	5		266	157	15		267	159	25		268	161
10000	-25		227	162	-15		227	164	-5		227	166	5		228	168	15		228	170
15000	-35		197	170	-25		198	173	-15		199	175	-5		199	177	5		200	179
20000	-45		175	179	-35		175	182	-25		176	184	-15		176	186	-5		177	188
25000	-55		157	188	-45		157	191	-35		158	193	-25		158	195	-15		159	197
30000	-64		145	197	-54		145	199	-44		145	202	-34		145	204	-24		146	205

Table A-11: FSR500 600 lb-ft CRUISE PERFORMANCE (ISA -20 to +20)

ISA	-20				-10				ISA				+10				+20			
Altitude	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**	**OAT**	**TQ**	**Fuel Flow**	**TAS**
0	-5	500	292	129	5	500	292	131	15	500	292	133	25	500	293	136	35	500	293	137
5000	-15		252	138	-5		252	140	5		253	142	15		254	144	25		254	146
10000	-25		213	147	-15		214	149	-5		215	151	5		215	153	15		216	155
15000	-35		185	155	-25		185	157	-15		185	159	-5		185	161	5		186	163
20000	-45		161	164	-35		161	166	-25		162	167	-15		162	169	-5		162	171
25000	-55		143	171	-45		143	173	-35		143	175	-25		143	177	-15		143	178
30000	-64		129	178	-54		129	180	-44		129	182	-34		130	183	-24		130	184

Table A-12: FSR500 500lb-ft CRUISE PERFORMANCE (ISA -20 to +20)

- **Altitude = ft**
- **ISA = degrees Celsius**
- **OAT = Outside Air Temperature**
- **TQ = Torque, lb-ft**
- **Fuel Flow = Pounds Per Hour**
- **TAS = True Air Speed, in Knots**

Annex B: Controller bindings & events

This annex provides some examples of different ways of configuring a throttle axis in SPAD.next to take advantage of the functioning Beta range. It also provides a list of the main simevents and L:VARS used in the FSR500 cockpit controls (there are many other custom L:VARS related to aircraft systems).

Throttle configuration in SPAD.next

The following screenshots show two examples of the throttle configured to an axis using SPAD.next. The first example shows the axis configured to give Normal & Beta, with reverse mapped to a button below the hardware detent (a Honeycomb Bravo in example 1) and the second shows the axis mapped to give Normal, Beta and Reverse on one normal Axis on a Logitech FlightPro Throttle Quadrant.

Note: in MSFS control settings > sensitivity, the throttle axis should be a straight 'curve' and with no extremity dead

The first example allows the upper part of the normal axis to command forward thrust, the lower part of the axis to command beta. Full Reverse is commanded by dropping the throttle through the detent to 'press' the button below to give maximum reverse thrust. The second has the advantage of being able to control the amount or reverse thrust, but the disadvantage of a shorter normal range as a result. Which to use is a matter of personal preference and the controller you are using.

The downside to both methods is that there is no hardware/physical detent at the Idle stop. Setting small deadzones will help. Fortunately, the **FSR500** will not allow Beta or Reverse to be engaged in flight!

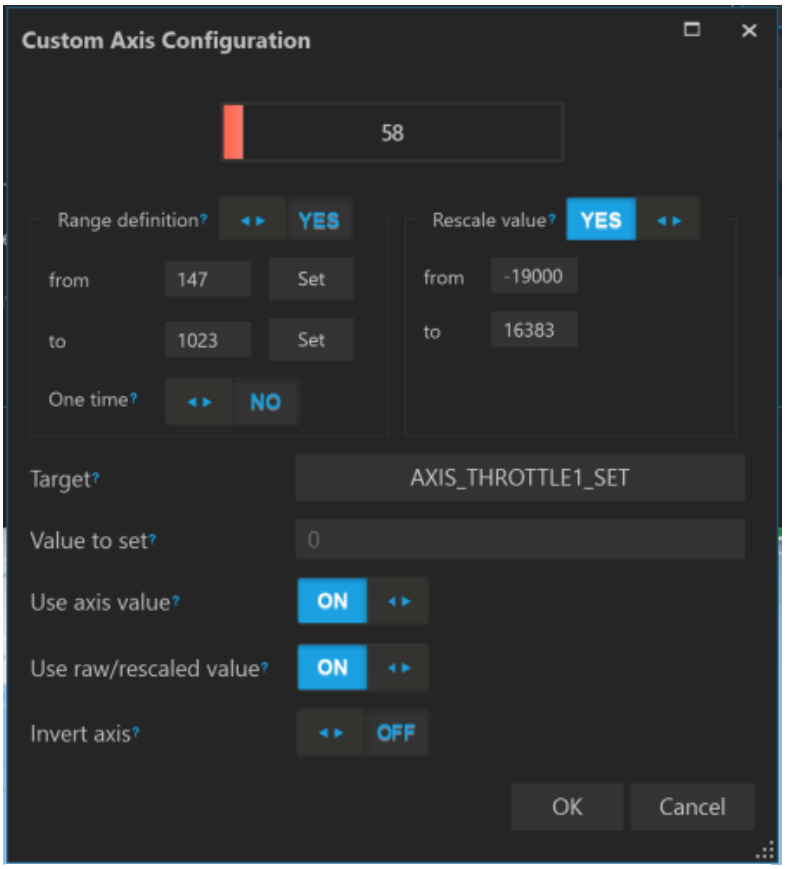


Figure B-1: Example 1: Axis with normal & beta

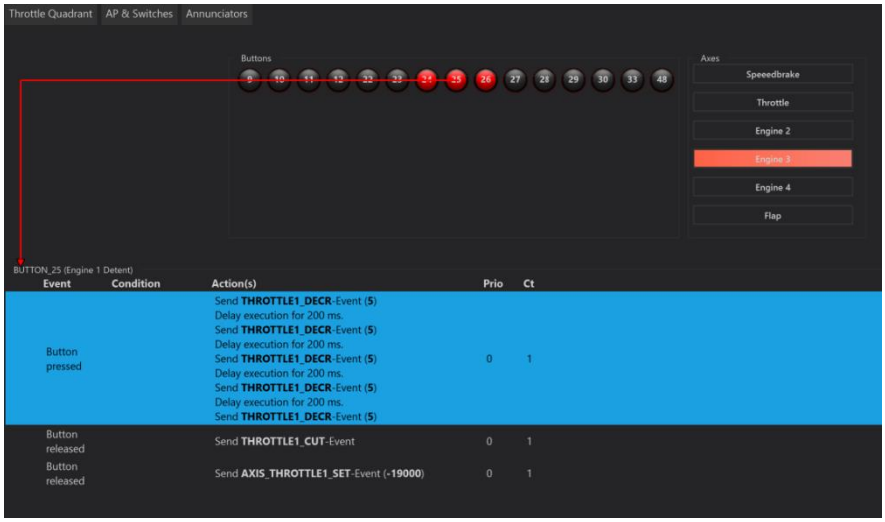


Figure B-2: Example 1: reverse thrust on button

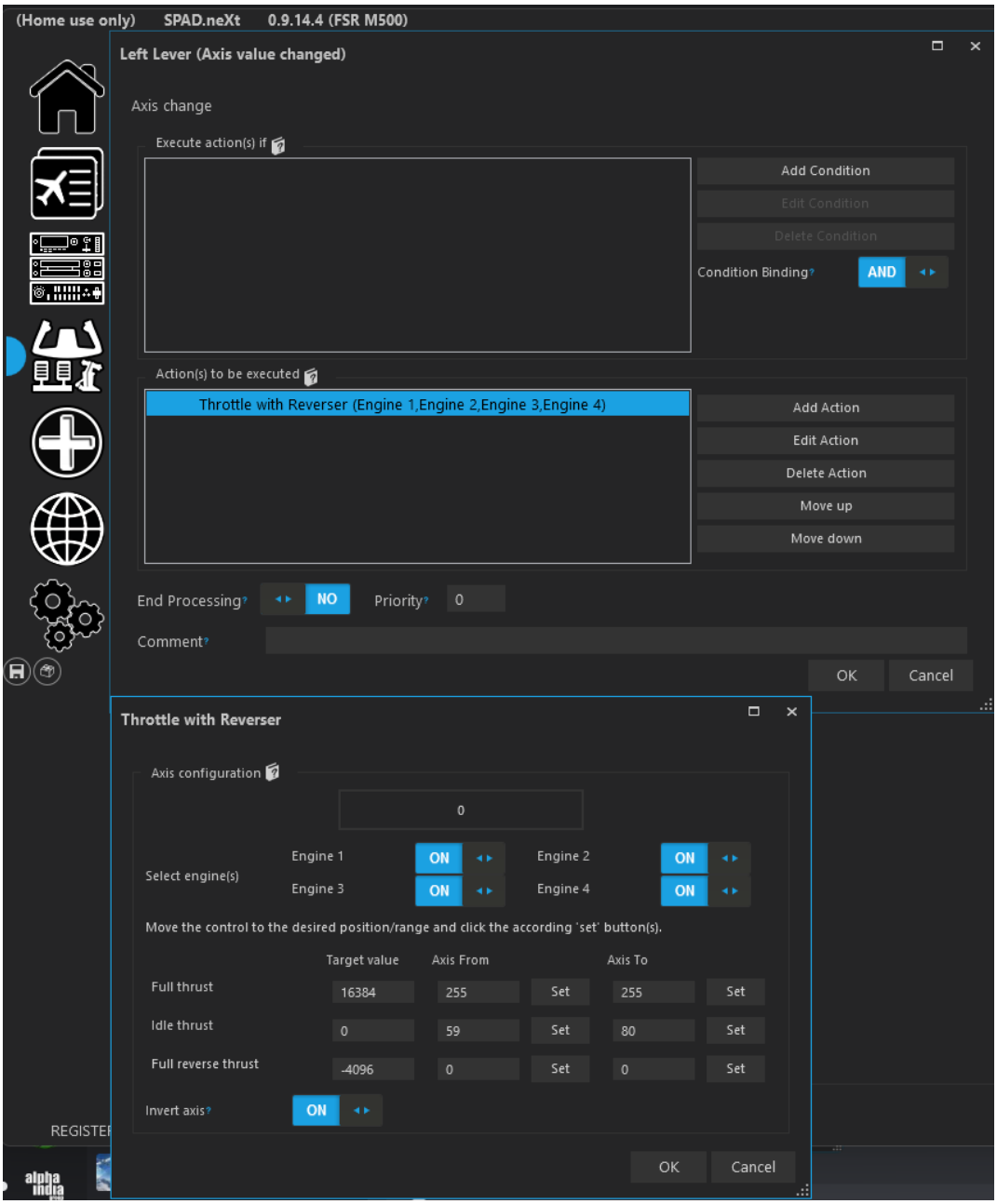


Figure B-3: Example 2: Axis with Normal, Beta and reverse

Condition lever

The condition lever is controlled using MIXTURE events. This is an example of a custom axis that will allow full range. Normal MSFS actions will work equally well.

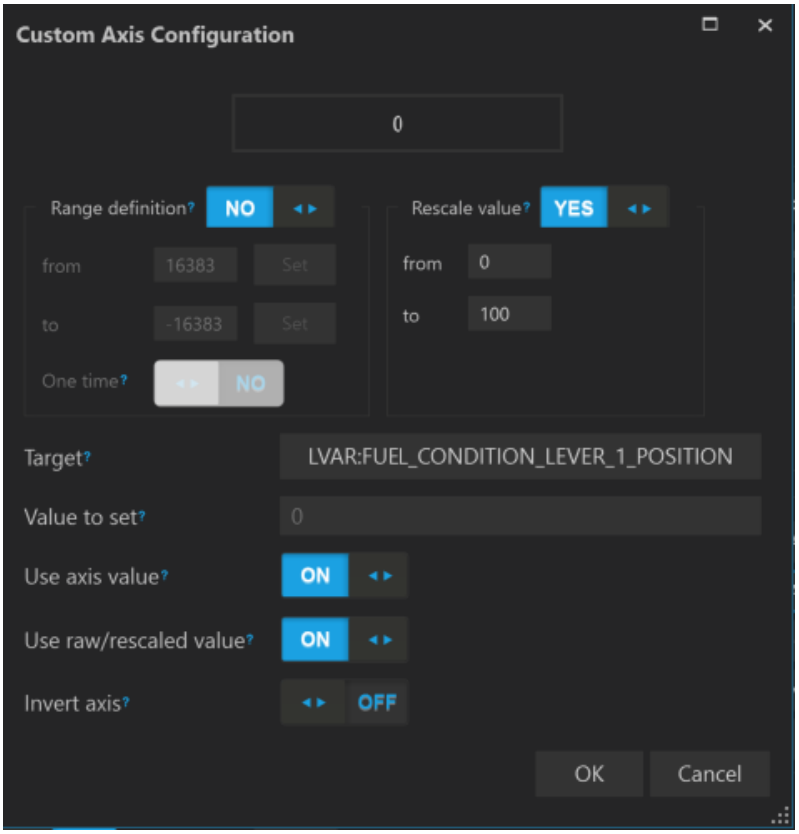


Figure B-4: condition lever on axis

Table of Events and Variables

The following table sets out many of the most useful events and variables used by the **FSR500.** The are a mix of standard simevents and custom local variables (L:VARS). All of the custom L:VARS begin with FSR_M500. If not indicated otherwise, 1=ON and 0=OFF.

If you don't want to programme your own, then several full SPAD.next profiles have been posted by FSR testers as well as Axis & Ohs scripts.

Note – there are L:VARS for the switch covers but these may not bind well, so have not been included. It's possible to use the STARTER1_SET event to activate the starter without lifting the cover.

Switch/Control	Event/Variable
Flight Controls	
Rudder trim switch	RUDDER_TRIM_LEFT/_RIGHT
Flaps lever	FLAPS_INCR /FLAPS_DECR
Overhead Electrical Panel - pilot side	
Battery	FSR_M500_BATTERY_SWITCH_ON FSR_M500_BATTERY_CIRCUIT_ON
Avionics	AVIONICS MASTER SWITCH CIRCUIT AVIONICS ON
Generator (GEN)	GENERAL ENG MASTER ALTERNATOR:1
Push Start	STARTER1_SET
Fuel Pumps rocker switch	ELECT_FUEL_PUMP1_SET (0=OFF, 1=ON, 2=AUTO)
Ignition	FSR_M500_ENGINE_IGNITION_1 (0=OFF, 1=AUTO, 2=ON,
Start Mode switch	FSR_M500_STARTERSTOPBUTTON
Alternator (ALT)	GENERAL ENG MASTER ALTERNATOR:2
Emergency Switch (EMER)	FSR_M500_EMERGENCY_POWER
Stall Warn Test	FSR_M500_ELECTRICAL_SWITCH_STALL_TEST
Reverse Lock Out	FSR_M500_ELECTRICAL_SWITCH_REVERSE_LOCK
Overspeed Gov Test	FSR_M500_ELECTRICAL_SWITCH_GOV_TEST
Overhead Electrical Panel - dimming	
Switch	FSR_M500_LIGHTING_SWITCH_DIMMER_SWITCHES (0-100)
Panel	FSR_M500_LIGHTING_SWITCH_DIMMER_PANEL (0-100)
Avionics	FSR_M500_LIGHTING_SWITCH_DIMMER_AVIONICS (0-100)
Panel Flood	FSR_M500_LIGHTING_SWITCH_DIMMER_PANEL_FLOOD (0-100)
Day/Night	FSR_M500_LIGHTING_SWITCH_DIMMER_DAYNIGHT (0-100)
Dome Light (left)	FSR_M500_LIGHTING_knob_pilot (0-100)
Dome Light (right)	FSR_M500_LIGHTING_knob_copilot (0-100)
Overhead Electrical Panel - co-pilot side	
Windshield Heat	FSR500_M500_DEICE_SWITCH_WINDSHIELD (ON=2, OFF=1)
Pitot Heat	PITOT HEAT ON/OFF
Prop Heat	PROP DEICE SWITCH

Stall Heat	PITOT HEAT ON/OFF
Surf de-ice	FSR500_M500_DEICE_SWITCH_AIRFRAME
Taxi/Rec Light	LIGHT TAXI (note – REC lights presently not configurable)
Landing Light	LANDING_LIGHTS
Nav Light	LIGHT NAV
Strobe Light	STROBES ON/OFF
Ice Light	[---]
Fire Det/Ann Test	FSR_M500_ELECTRICAL_SWITCH_FIRE_TEST
Instrument Panel	
Autopilot Level mode	AUTOPILOT WING LEVELER
Parking Brake	PARKING_BRAKES
Bleed Air ON (PUSHED)	FSR_M500_BLEED_LEVER =0 BLEED AIR SURCE CONTROL =3
Bleed Air OFF (PULLED)	FSR_M500_BLEED_LEVER =100 BLEED AIR SURCE CONTROL =1
Landing Gear	GEAR_UP/DOWN
Emergency Gear Extension	1.FSR_M500_HANDLING_EMERGENCY_GEAR_LEVER_COVER 2. EMERGENCY_GEAR_LEVER (0-100)
ECS cabin comfort	FSR_M500_PRESSURIZATION_ECS_KNOB (OFF=0, NORM =1, HI=2, EMERG=3)
Cabin Pressure dump	PRESSURIZATION DUMP SWITCH
Cabin Pressure dump cover	[---]
Aircon on/off	FSR_M500_AIRCON_SWITCH_MASTER
Aircon hi/low	FSR_M500_AIRCON_SWITCH_MASTER_SPEED (hi = 2 off = 0) FSR_M500_AIRCON_SWITCH_MASTER_SPEED_ON (LO = 1 off = 0)
Vent Fan	FSR_M500_AIRCON_SWITCH_VENT
Climate control cool/warm dial	FSR_M500_CLIMATECONTROL_KNOB_TEMP
Climate control auto/manual	FSR_M500_CLIMATECONTROL_SWITCH_MASTER
Climate control (manual) warm/cool switch	FSR_M500_ClimateControl_Switch_Temp
Defrost	FSR_M500_ClimateControl_Defrost_Lever
Control Quadrant	
Manual Override Lever (INOP)	N/A
Throttle	See entry on throttle axis
Condition Lever	L:VAR: Fuel_Condition_Lever_1_Position. Also, see above for custom condition lever axis in SPAD You can also use MIXTURE AXIS controls in MSFS – either MIXTURE AXIS or MIXTURE AXIS -100/+100 – which to use seems to depend on your controller.
Elevator Trim Wheel	ELEV_TRIM_UP/_DN
Fuel Shut-off cover/lever (INOP)	N/A
Yoke - pilot side	

Electric Elevator Trim switch	ELEV_TRIM_UP/_DN
CWS (INOP)	N/A
Autopilot Disconnect	AUTOPILOT_OFF
Ident (INOP)	N/A
Yoke - copilot side	
Electric Elevator Trim switch	ELEV_TRIM_UP/_DN
CWS (INOP)	N/A
Autopilot Disconnect	AUTOPILOT_OFF
Ident	N/A
Cabin	
Main cabin door	TOGGLE_AIRCRAFT_EXIT_FAST
Folding table	FSR_M500__FOLDING_TABLE