310R USER GUIDE

BLACKBIRD SIMULATIONS

This software is an artistic representation of the subject matter.

Any inquiries regarding academic or other professional use of this software should be directed via e-mail to contact@milviz.com.

Hello there!

Welcome to the ranks of 310R pilots.

This User Guide has been prepared to help you get started with your new Blackbird 310R.

It contains useful information about the 310R's equipment, operating procedures, and performance - it also contains instructions for installation and updating. We recommend that you take some time to read through this guide from cover to cover, and to refer to it as needed.

Our interest in your flying pleasure has not ceased with your purchase of the Blackbird 310R. Worldwide, the Blackbird Sims staff stands ready to assist and serve. For technical support, please post a request on our 310R support forum. Our dedicated and talented staff is ready to help you.

For forum access, please email
support@blackbirdsims.com with your proof of purchase and your preferred (or existing) forum username.

This aircraft has a history.

This isn't the first version of the venerable 310R to leave our hangar: the original version of 310R was released by Blackbird for P3D way back in 2010 to widespread acclaim. Lauded not only for its accurate portrayal of the iconic twin, but also for the carefully-tuned and highly-realistic flight model. A follow-up to this product, the Blackbird 310R Redux, was released in 2018 and brought the twin to the standards of modern simulators.

This new version is a complete, ground-up rebuild for Microsoft Flight Simulator, with enhanced and updated systems programming, an updated virtual cockpit, new model and external textures, and a variety of new tech to take full advantage of the new simulator and its capabilities.

But we haven't forgotten what made the original great, either. Expect the same attention to detail, the same quality workmanship, and the same carefully-replicated handling characteristics that made the original release so lively and lifelike.

Get the most from this guide.

This User Guide is split into several section: the first section deals with installation and configuration of the Blackbird C310R, while the second section provides an overview of the operation of the aircraft within the simulator.

The third section covers aircraft specifications and limitations. The fourth section details emergency procedures, the fifth normal operating procedures, and the sixth provides a wealth of performance charts.

Sections seven, eight, and nine cover aircraft limitations, Frequency Asked Questions (FAQs), and information on hardware assignments.

To navigate this manual, helpful features have been included. In the index, all section titles are live bookmarks that will jump to the appropriate page with a single click. In your PDF viewer, you are also able to browse the sections by use of the bookmarks panel.

NOTE: THIS GUIDE IS NOT TO BE USED FOR REAL-WORLD AVIATION OR TRAINING.

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Section 1
Installation & Configuration

Table of Contents

Introduction

Section 1 of this user guide covers the information needed for successful installation and instructions for accessing support.

System Requirements

The following requirements apply as a minimum to successfully install, configure, and operate the Blackbird 310R.

(Please note that your choice of scenery, location, simulator settings and 3rd-party utilities may place additional demands on your simulation platform and may affect your simulator experience.)

Supported Platforms:

- Microsoft Flight Simulator 2020

(Note: Our product is tested with, and designed to operate in, the most recent updates to the simulator; this includes all hotfixes available at date of release.)

Supported Operating Systems:

- Windows 10
- Windows 11

Processor (CPU):

- 3.0 GHz quad core processor required (higher core counts and clock speeds strongly recommended.)

Video Card (GPU):

- DirectX 11 compliant video card with a minimum of 6 GB video ram.

System Memory (RAM):

- 16 GB RAM minimum (32 GB or greater recommended for Virtual Reality (VR).)

Storage:

- 4.5 GB or greater free disk space.

Gaming Controller:

- Joystick, yoke, or other gaming controller (a means of controlling the aircraft rudder, either with twist joystick function or dedicated pedals, is additionally recommended.)

(Note: All Blackbird products require a minimum of one functioning gaming device such as a joystick for proper operation and control.)

Installation Instructions

Important Information

As with other flight simulator add-ons, pre-installation precautions should involve closing any open applications, as well as temporarily disabling any active antivirus software.

Failure to temporarily disable antivirus software when installing may result in a non-functioning product and/or simulator!!!

Note: *Version numbers shown in any following images may differ from the downloaded product.*

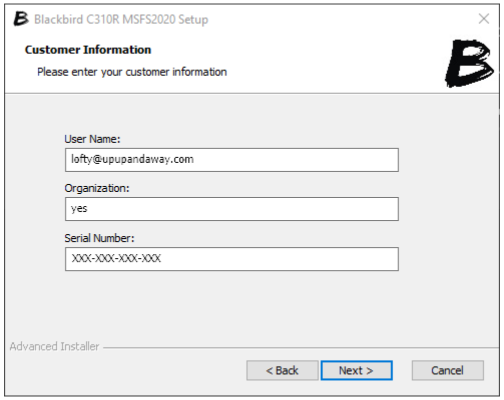
After purchase, you will have been given a link or an option to download a compressed (.zip) file. This compressed file contains an executable (.exe) file, which is the installer for the Blackbird 310R.

Using the Windows File Explorer (or file compression utility of your choice) unzip this file to a location of your choosing.

Once unzipped, you may begin installation by right-clicking on the executable (.exe) file, then selecting "Run as administrator". The installer will run, showing an initial welcome screen. Left click on the "Next" button to continue.

Licence Activation

1

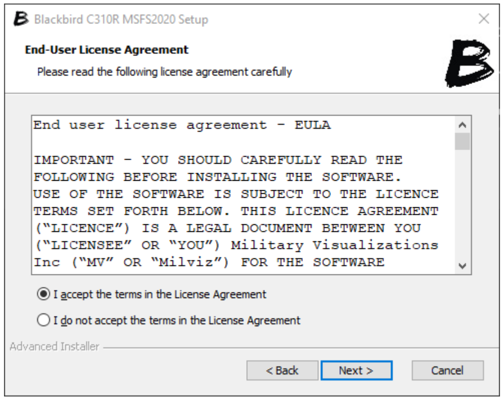


After clicking through on the initial setup screen, you will come to the Customer Information window.

Fill in the fields and enter the 12-digit activation key that was included in the purchase confirmation documentation.

Licence Agreement

2

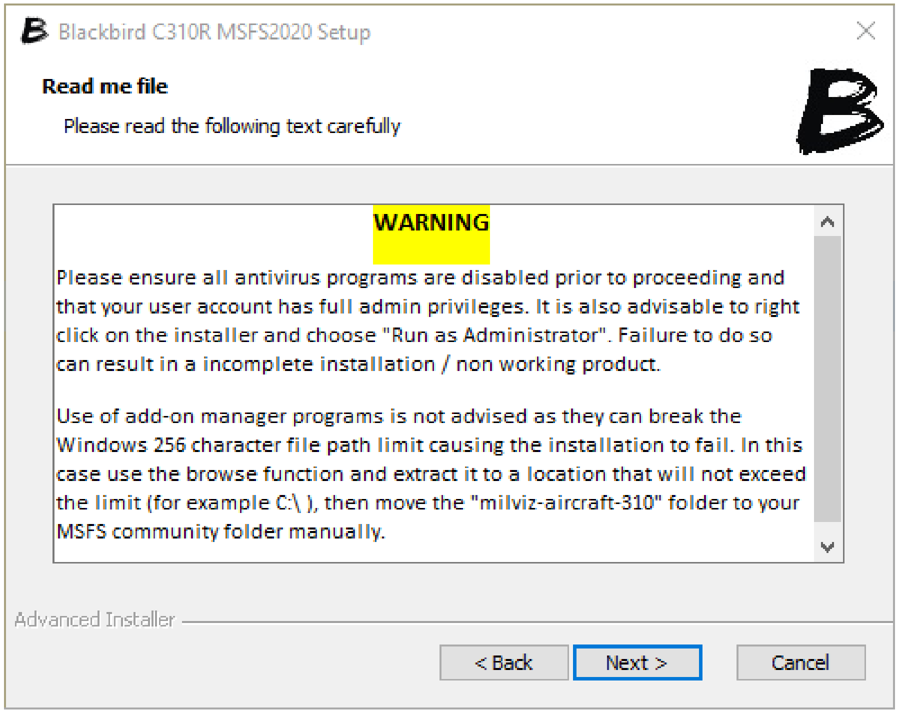


This screen will allow you to view the End User License Agreement (EULA).

Please take the time to review the included details. Clicking "I Agree" at this screen will confirm your acceptance of the license agreement, and will allow you to proceed to the next step of the installation.

Install Location

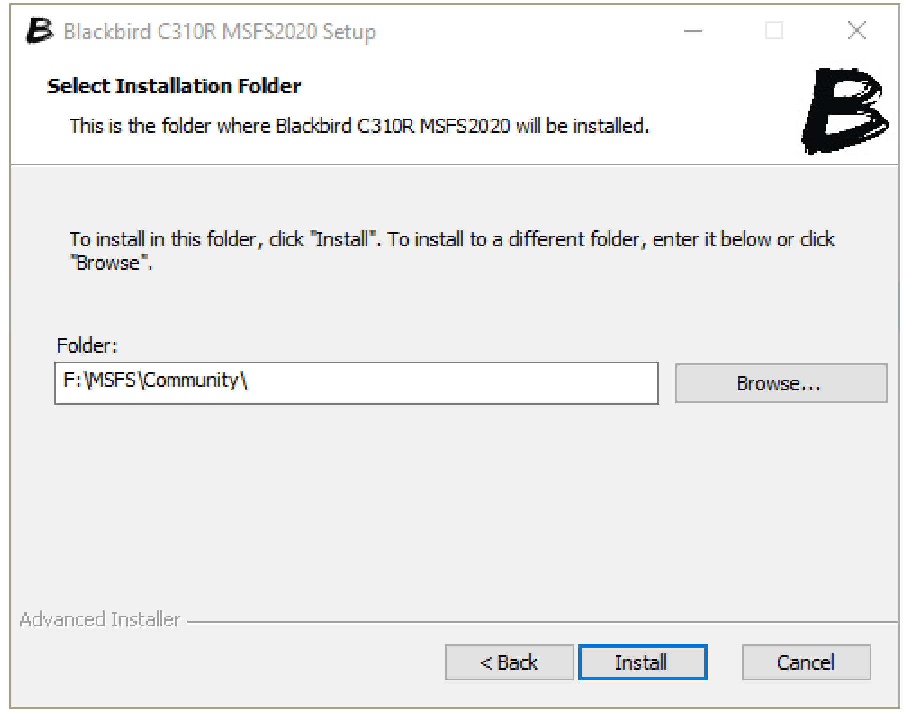
3



For an error-free install, please take a moment to read through the important information shown on this 'Read me' screen.

Review and Install

4



The installer is designed to automatically find MSFS on your system.

If your simulator cannot be automatically located, or if you have a custom installation path, you can may browse to the correct location.

This screen allows final revision before committing to the install.

Post Installation Tasks

- Be sure to turn your antivirus program back to its previous state. Also, ensure that your MSFS directory is off-limits to any automatic antivirus scanning. Failure to do this may result in a non-functioning simulator!
- It may be worthwhile to backup or save a copy of your downloaded installer.
  It's worth noting that as new updates are released, we do not continue to offer older versions for download.

Updating your Aircraft

To update the Blackbird 310R:

- Back up any custom liveries and files
- Uninstall using the method described
- Install the updated version
- Replace custom files

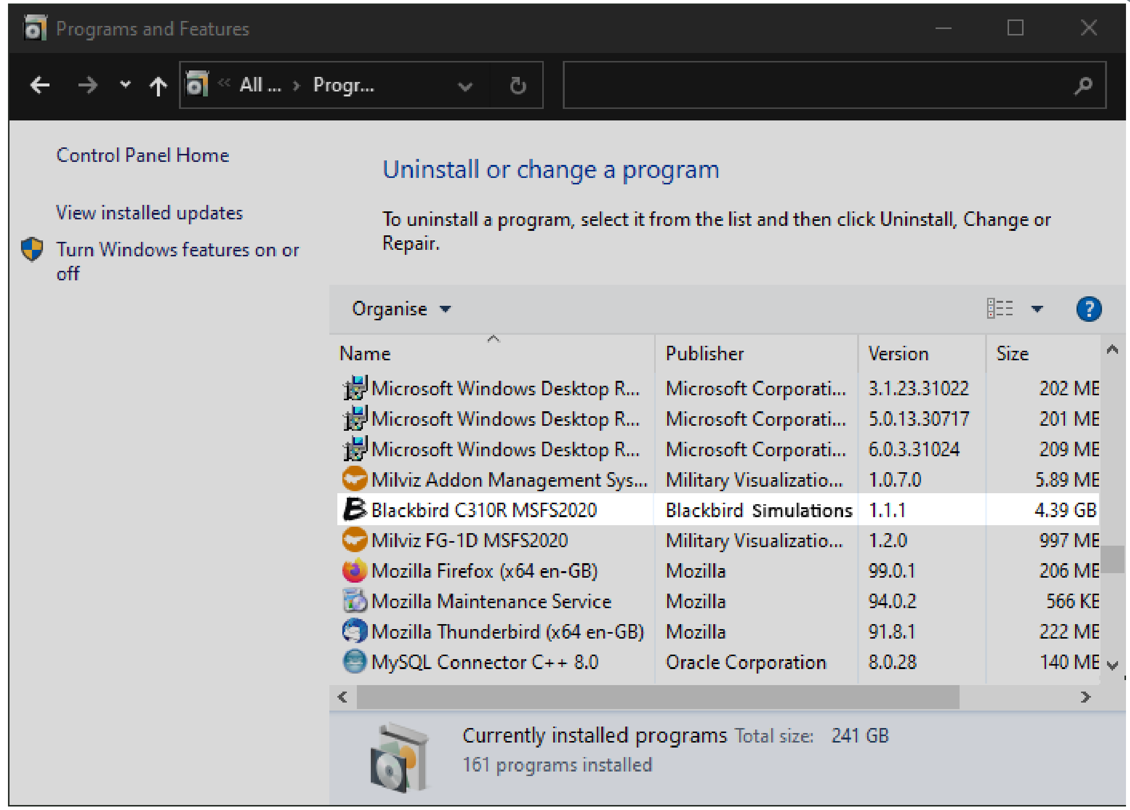
Microsoft Updates

From time to time, Microsoft will update the MSFS platform, which has the potential to break our custom code and cause issues with our 310R simulation.

Blackbird Simulations will always make its best endeavours to ensure a revised build is available as soon as possible following release of sim updates; however, it's not always possible to do this in a timely manner. We thank you for your patience in these circumstances.

Uninstalling

5



The Blackbird 310R may be uninstalled using the Programs and Features screen within Windows Control Panel.

Note: Prior to uninstalling the aircraft, please be sure to back up any customized files, flight plans, or custom liveries you have installed.

Once the uninstall is complete, it is safe to delete any milviz-310 files remaining in the MSFS Community folder.

Section 2
In-Game Configuration

Table of Contents

Introduction

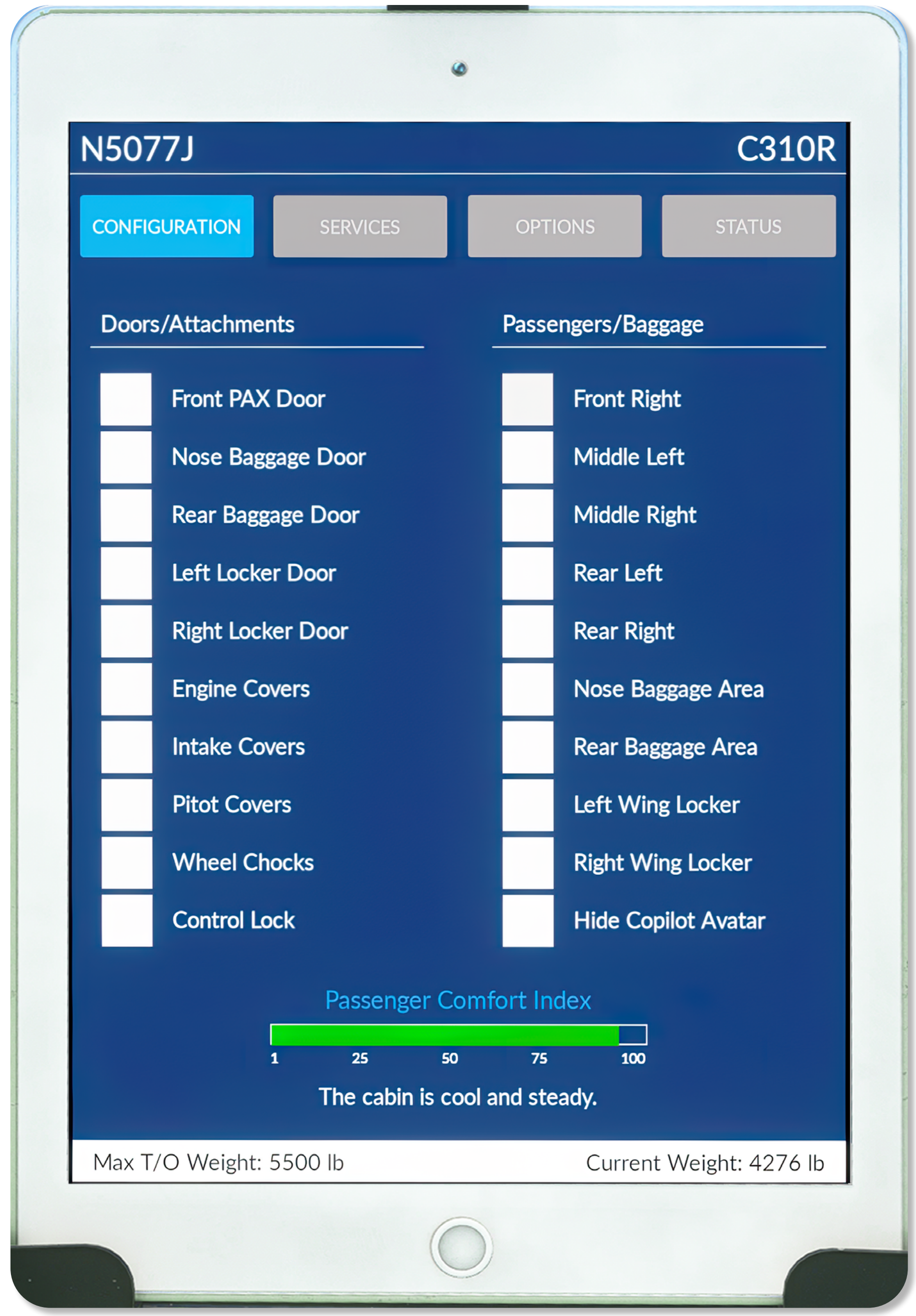
Section 2 of this user guide covers operation of our in-game configuration utility tablet, also referred to as the Electronic Flight Bag (EFB).

EFB Tablet

Click on the column to the left of the front windshield to toggle on and off the tablet that serves as an in-game configuration utility.

- The options on these, and all other, pages apply only to the specific airplane identified by the ATC ID in the top left of the screen.
- All state information about each airplane, and all options, are kept separate based on the tail number.
- Options on the Configuration on p. 2-3) and Options on p. 2-9) tabs are always preserved, except where otherwise noted.
- The aircraft's fuel and the state of its systems and controls (Fuel on p. 2-6 and Status on p. 2-20) are only preserved and restored if you are set as the aircraft's owner in the tablet.

  (see p. 2-11 for a description of the difference between the Default, Owned, and Rental initial state options.)



Configuration

External Configuration

Doors

These are simple toggles that open the specified door when selected and close the door when deselected. The state of the doors will be preserved and persist between loads of the aircraft.

Attachments

These control the attachments and accessories for the aircraft. They are simple toggles that will hide or make appear the attachment in question. Their state will be preserved and persist between loads of the 310R.

Warning: these attachment options are more than cosmetic if you have any level of realism switched on (see the Systems Realism and Engine Realism descriptions below for details). For example, if the pitot covers are not removed prior to flight, there will not be an airspeed indication due to the blockage.

Internal Configuration

Passenger Seating and Baggage/Cargo

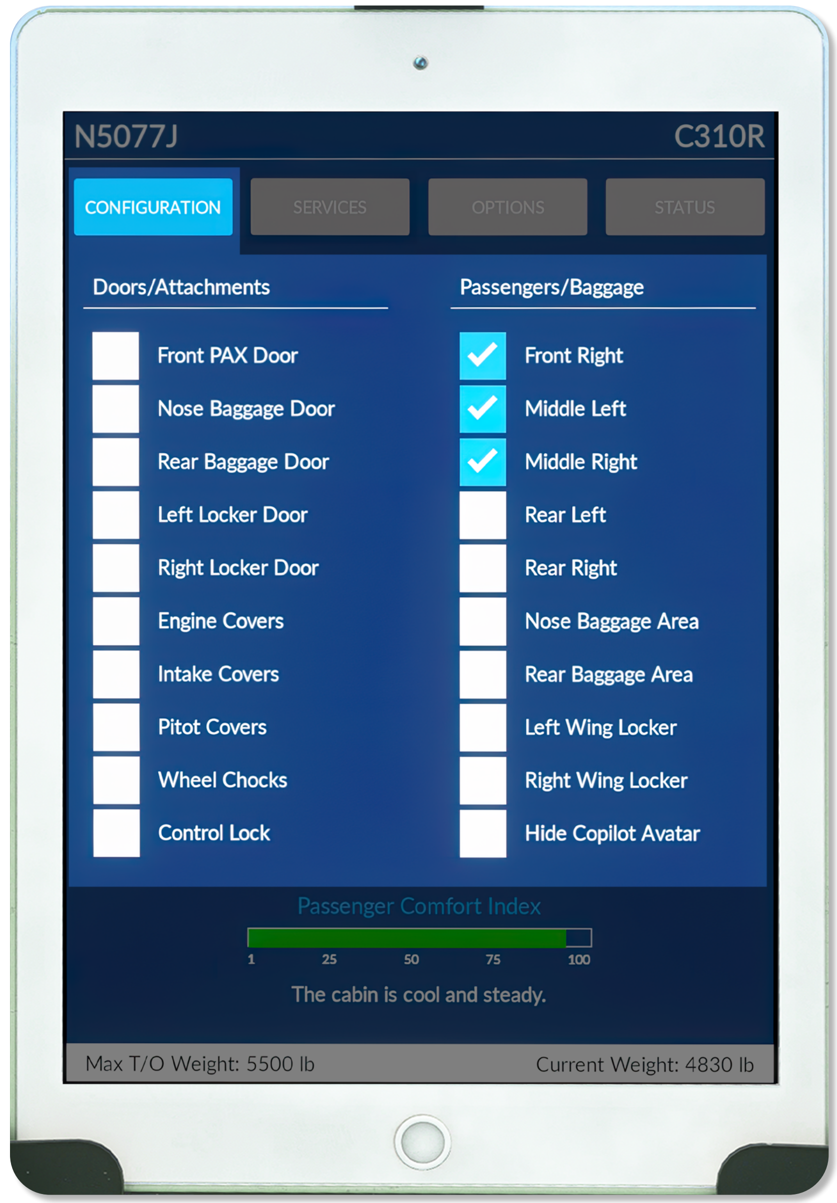
These options allow you to select which seats will be occupied by your passengers and what areas will be used to hold any baggage they may have with them.

If you select a seat, a passenger will be assigned that seat with a weight randomly selected between 100 and 220 pounds (45 to 100 Kg).

The system will tend to place lower weights in the rear seats, so you should fill the seats from front to back to help preserve the center of gravity.

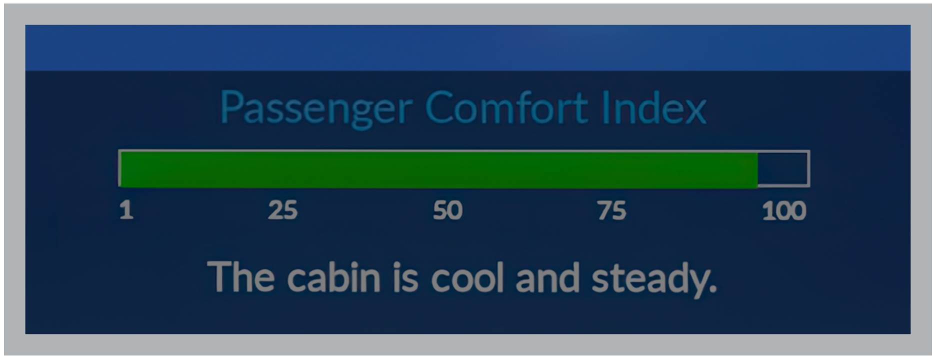
You should seat passengers which are carrying baggage first, then select the baggage areas where you'd like their baggage stored, then seat any passengers without baggage. Be sure that if you select one wing locker, you also select the opposite, otherwise you will imbalance the load.

For a cargo flight without passengers, clear all seats then select the baggage areas where the cargo will be stored; the system will fill them 80-100 percent full. Then, place the remaining cargo in the seats by selecting each one you intend to fill.



Passenger Comfort Index

This bar graph shows how comfortable the occupants of the cabin are at all times. It's a scale from 1 to 100, with above 75 being the green zone, 26 to 74 being the yellow zone, and below 26 being the red zone. Your goal as a professional pilot is to keep your passengers comfortable so they'll fly with you again.



Below the bar graph is a text message. With no power in the airplane, it will remind you how to hide or show the tablet by clicking on the tan column just to the left of it. But once you turn on the battery, the text will tell you the conditions in the cabin, and if they are changing and how that change is happening.

What makes for happy passengers? Smooth, professional flying and keeping them in the cabin temperature comfort zone of 17 to 23 degrees Celsius (63-74 degrees Fahrenheit).

Temperature is our first concern. When you enter the cabin, it will be at the Outside Air Temperature (OAT) and steady. You will see one of these messages:

- The cabin is cold and steady.
- The cabin is cool and steady.
- The cabin is comfortable and steady.
- The cabin is warm and steady.
- The cabin is hot and steady.

If it's anything but comfortable, you'll need to use the cabin air controls to start getting things under control.

The main controls you'll use for cabin comfort are the CABIN HEATER switch, the TEMP CONTROL knob, and the CABIN AIR knob. The heater switch has three positions: HEAT, OFF, and FAN.

Our 310R doesn't have an air conditioner. This can make cabin temperature control a challenge on hot days, but it does have a very powerful gasoline-powered heater. Moving the switch to HEAT ignites the heater (which will work without the engines operating.) Moving it to OFF shuts down the heater. Moving it to FAN turns on the fans to cycle fresh air from the intakes in the nose through the cabin ventilation system.

The TEMP CONTROL knob controls a thermostat to regulate cabin heat; it's only effective for heater operations. For ventilation (cooling), the cabin temperature will depend on outside air temperature and the amount of air being circulated, plus possible help from having the window or door open. With the switch in FAN, the TEMP CONTROL should always be fully closed.

Passenger Comfort Index Continued

The CABIN AIR knob controls the speed of the fans pushing air through the system. In the full closed position, no heat or ventilation will reach the cabin because the fan is off. The more to the right you turn the knob, the faster the fan turns. The FWD CABIN AIR knob acts as an assistant. It doesn't increase the fan speed, but it does direct air to the forward seats. Both AIR knobs fully open (to the right) is maximum fan effectiveness.

The TEMP CONTROL knob sets a target temperature for the cabin.
The AIR controls determine the rate of change until that target is reached.

There aren't any markings for temperature on the TEMP CONTROL, but generally the halfway mark or a little below is the comfort zone.

The heater works very effectively: it can warm the cabin quickly, and it can get it too hot quite easily. Adjust the TEMP CONTROL and CABIN AIR until your passengers are at least in the green zone.

Warning: Do not operate the heater with the CABIN AIR knob fully closed. Doing so can overheat the heater causing automatic shutdown and possible heater damage.

In any case, *no heating or cooling can happen if the CABIN AIR knob is fully closed.*

Managing Hot Cabin Temperatures

Without an air conditioner, keeping the cabin cool on hot days is a challenge. You have two tools: maximum ventilation on the ground, and higher altitudes in the air.

For maximum cooling, set the Heater switch to FAN, the TEMP CONTROL knob fully closed, and the CABIN AIR and FWD CABIN AIR controls fully open. With the engines running, open the window and the passenger door so cool air will blow into the cabin. Note that the passenger door won't remain fully open due to the slip-steam from the propeller, but it will remain cracked open and this will help ventilate the cabin. Remember to close it before takeoff!

In the air, you must close the window and doors (although the window can be left open, it's quite noisy) so consider flying at higher altitudes where the air is cooler. This will reduce the temperature of the air coming in through the intakes and will reduce the temp in the cabin.

Beyond Temperature

Letting the cabin get too hot or cold isn't the only way you can reduce the comfort level. Flying in an unprofessional way will do it too.

Things to watch out for:

- **Climbing or descending too fast**
  When you exceed about 1000 FPM for a sustained period of time in a climb or descent, some passenger's ears may not be able to cope with the rate of change and this can cause significant ear pain.

- **Too high a bank angle**
  Anything over 30 degrees runs a risk of upsetting some passengers.

- **Negative G forces**
  This makes most non-pilots anxious and scares them. When you nose over the airplane, do it gently so as to not cause discomfort and even fear.

If you do cause passenger discomfort with any of these out-of-bounds maneuvers, the effect on the comfort index can be immediate and severe. However, the passengers will forgive you over time if you don't keep doing it and the comfort index will gradually recover.

Fuel

The Services page allows you to change the fuel quantities in the tanks on-the-fly. Any change you make here will have an immediate effect.

You should, obviously, try and keep the tanks balanced. The 310R's fuel system is rather unique, so here are some points to keep in mind about it.

As the reminder on the screen says, the 310R's main fuel tanks are the tip tanks on the wings. In most any airplane with tip tanks, they are optional extra fuel, but not here. When you are filling up the mains, you are adding weight to the ends of the wings which will affect the roll characteristics of the airplane, as you'd expect.

The auxiliary tanks are in the wing but, again, on the outside parts. This was designed to get the fuel away from the cabin so in an emergency landing situation, any fuel fires would be away from the occupants.

The Blackbird 310R is a fuel-injection airplane; it does not have a carburetor. Fuel is injected under pressure, and this pressure is provided by the engine driven fuel pumps. Should one fail, pressure can be maintained by turning the electric auxiliary pump to the high setting. Use of this pressure means that not all fuel flowing from the tanks is used by the engine. The 310R provides a fuel return line from the pumps to the main engines on each side; in cruise, these fuel lines return about 30% of the fuel flow back to the tanks. It's important to know that it only returns fuel to the main tanks. If you are burning fuel from the auxiliary tanks and the main tanks don't have the space to receive the returned fuel, it's vented overboard and wasted.

The manufacturer advises that the aux tanks are not to be selected until at least 90 minutes of fuel is burned from the main tanks.

Trim Input Sensitivity Slider

In order to accomodate different hardware input devices, the sensitivity of trim inputs can be modified using the slider.

Moving the slider to the left lowers sensitivity for finer control, moving it to the right will give more deflection per input.

Keeping it Clean

Some like a pristine plane, while others like to see the evidence of their flight hours building up on the aircraft skin as dirt and grime. Whatever your preference, the Blackbird 310R can deliver.

The top slider allows the customization of the amount of dirt showing. The bottom one controls the rate at which dirt is accumulated, from 'None' for those that like to set & forget, to 'Rapid' for those that enjoy maintaining their aircraft.

When the filth gets too much, a quick click on the 'Clean Aircraft' button will return your 310R to a clean, if not exactly showroom, condition.

Options

Avionics Suite

You have three options to choose from, and you can select any of these at any time you're on the ground with the battery off. Note that the KAP140 autopilot and the transponder are present in all configurations.

- Radio Navigation: This is similar to what might be installed from the factory in a late-model 310R. You have dual COM and NAV radios and an ADF. No GPS of any kind.

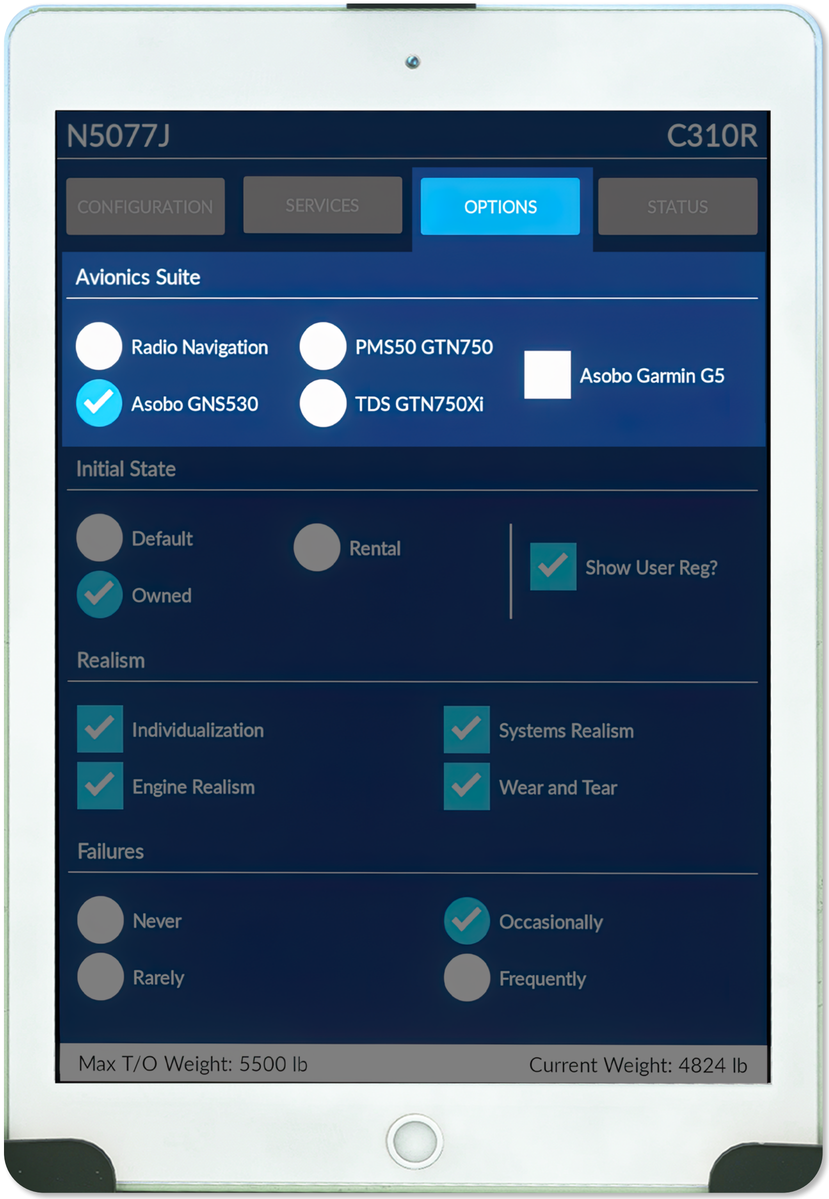
- Asobo GNS530/430: In addition to the dual COM/NAV radios and the ADF, you have a Garmin 530 and a 430 for GPS navigation. By default, this uses the Asobo 530/430, but we recommend the free PMS 530/430 for a more authentic simulation of these devices.

- PMS50 GTN750: This option will only work if you have at least the free version of the PMS750 installed in your Community folder. If you choose this option but don't have the PMS750 installed, your screen will contain a message to that effect.

- Garmin G5: This can be selected in combination with any of the suites in the first three options, and it will replace the classic style attitude and horizontal situation indicators with newer, digital units. Note: these units are standard Asobo instruments and do not fully implement a Asobo Garmin G5 with all its options.

- TDS GTN750X: For owners of this avionics simulation, enable it by checking this box. You must have the software installed from TDS for this to work, and also, if you have the PMS50 GTN750 installed it must be disabled or you won't be able to click on many TDS750XI icons due to a conflict between the two simulations as of the publication of this manual.

Like all the options on this page, the suite you choose only applies to the aircraft identified by the ACT ID in the top left of the page, N5225J in this example. Other airplanes may have differing configurations at the same time.



IMPORTANT NOTE ABOUT 3rd PARTY AVIONICS:

The avionics ‘hot-swap’ capability in the 310’s tablet is intended as a means to allow visible and usable 3D models for a particular GPS suite (PMS, TDS or WT).

This ‘hot-swap’ capability does not, nor is it intended to, solve compatibility and conflict issues between multiple 3rd party products.

Blackbird Simulations does not provide technical support for installation, use of, or compatibility resolution for any 3rd party avionics suite or modification.

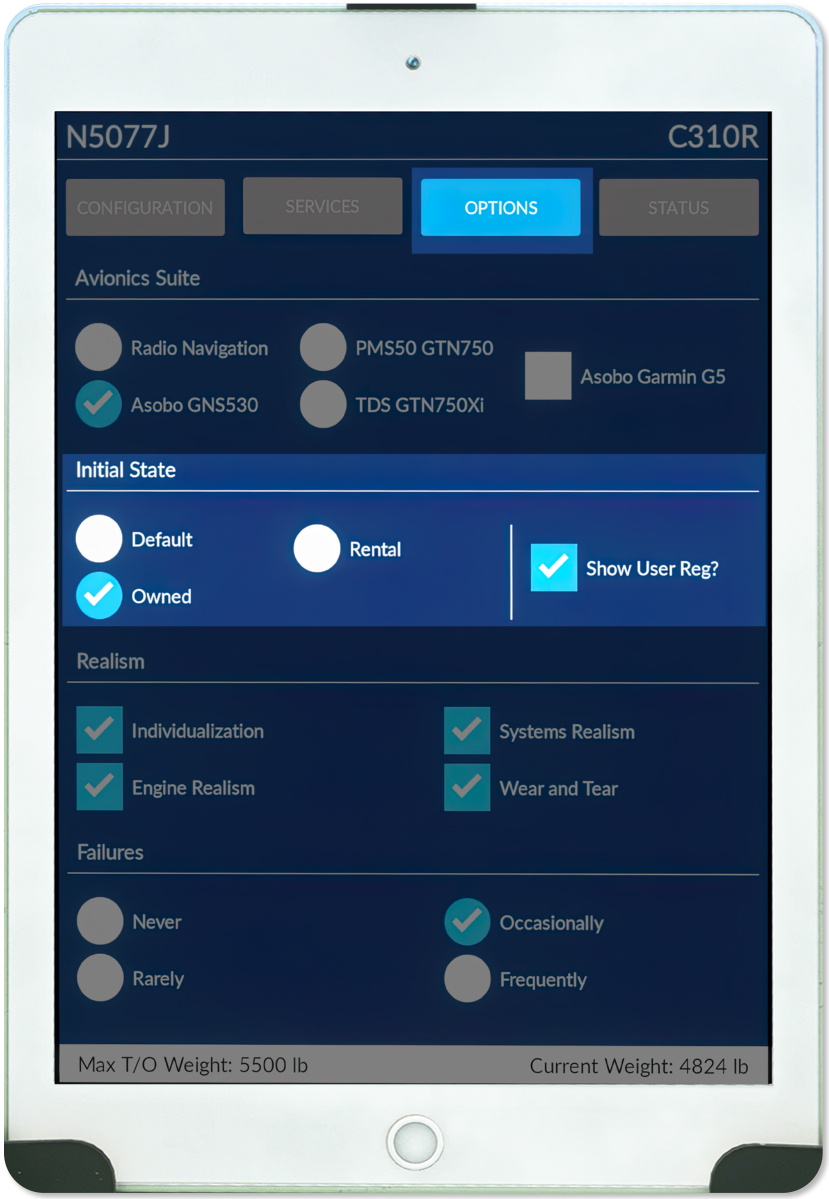
Initial State

This option determines the startup condition for a specific aircraft (in this case, N5077J.) These are the possible options:

- Default: This means there is no special processing done and the aircraft starts like any aircraft in MSFS – Cold and Dark when started in a parking space, and Ready to Fly when started on the runway. It will always start in the same configuration and with the same fuel and payload, which can be modified using the standard simulator facilities. Just like any default aircraft.

- Owned: This is a special condition that has many effects on how the aircraft starts out when you first enter the sim, and how it's maintained. There's too much to put here, for more information read up in the Aircraft Ownership section (p. 2-21.)

- Rental: This startup option simulates the situation where the aircraft is rented rather than owned. The state when you return to the cockpit will not likely be how you left it, it will be how the last person to fly it left it. This means, generally, cold and dark but with possible exceptions; for example, the last pilot may have left switches and controls in conditions that you wouldn't have. In effect, this means you can't trust everything will be just-so like you can with the default setting. Fuel selectors could be on AUX not MAINS and while they shouldn't be, not everyone is perfect all the time.



Custom Tail Number

When you 'own' the aircraft, any custom tail number you choose in the sim Customization options will show on the Custom Tail Number livery when you select the 'Show User Reg' option.

IMPORTANT NOTE ABOUT CUSTOM REGISTRATIONS.

Microsoft Flight Simulator allows a customized registration number to be entered which will apply to all aircraft until changed or removed.

The 310R supports that option, but you will need to be careful how you use it, because unlike almost any other sim airplane, we save state based on the registration number, so each unique number is like a unique aircraft in your hanger.

If you choose to use a custom registration, you should use it with the custom livery provided with the 310R package, or another custom livery that doesn't have the number painted on the side of the aircraft. To get your custom number to appear, select the 'Show User Reg?' option on the Options page of the tablet.

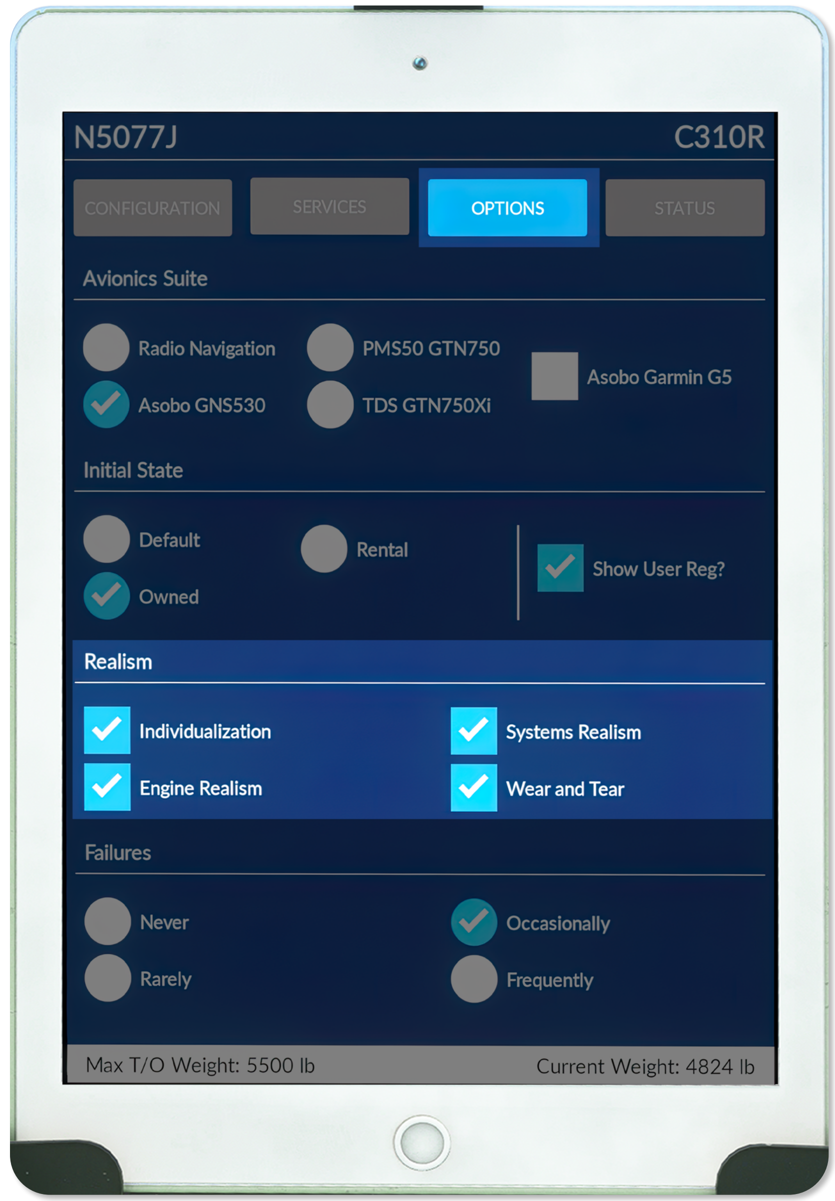
CAUTION: If you use a custom livery, and then intend to fly another aircraft with a different registration, you MUST remember to remove the custom registration number from the options. If you forget, the state of the aircraft will be saved to that custom number, not the registration for the different livery you have selected. Always check the upper left of the tablet to see what registration number the tablet is using for its database, and be sure it's what you expect.

Realism

This set of options allows you to select how realistic you want the engines and systems in your 310R to operate. In effect, you're selecting whether you want to invoke the consequences of your actions or avoid them.

In the default sim, aircraft systems never fail, no matter how you abuse them. If you select these realism options, you're allowing for realistic consequences to happen to you if you commit certain pilot sins, which we'll document thoroughly. These are not "gotcha" traps, but realistic results of actions which receive cautions and warnings in the manual and on placards in the cockpit.

Each of these options can be selected individually and they apply only to the aircraft identified by the ATC ID at the top of the page. The system will remember the options you select here.



Individualization

No aircraft you'll ever fly is perfect unless it's just come from the factory, and even then it's unlikely everything is perfect. Most pilots know that every airplane is a little different from another even of the same make, model, and year. Since the last new 310R left the factory in 1981, we can be sure that applies here even more than usual. All have been heavily modified, repaired, and even rebuilt.

We offer you this option to "individualize" each and every 310R in your hangar. By this, we don't mean we change the look of the airplane – besides the different paints, the visual model is the same. Nor do we change the cockpit environment – except for the avionics suite options, they all have the same layout and controls.

What we mean is that we randomly set the age and condition of the hundreds of components that make up the aircraft. On a certain airplane , the left engine pump might be starting to go bad, one of the gear lights might be close to burning out, or perhaps the right mag on the right engine is a little weak. And so on – the possibilities are almost endless. Each aircraft you choose to individualize will be set up a different way.

We won't hand you a broken airplane; every system will be operational. But if you are the owner (see above) and you choose to individualize, your first stop should be the maintenance hangar for an inspection. There, you'll be able to see the condition of the major components visually. (For details on how to do this, consult the "Status" page below.)

Individualization is permanent, so the option is off by default for each airplane. Once you choose it, the individualization happens instantly and can't be un-done, and likewise a new individualization can't be done. Clicking the option back off won't do it. (You can, however, use the Status page to overhaul the entire airplane and turn off "Wear and Tear" (below) and you'll be restored to a perfect sim plane that won't change.)

Engine Realism

A good many sim pilots don't want to worry about managing a realistic internal combustion engine – they'd rather spend their time flying, and that's perfectly okay. If that describes you, then don't turn on this option! As long as you leave it off, your engines will behave like a typical default airplane. You'll start them by turning on the battery and magnetos, setting mixture and props to full forward, and pressing the start button. Or use the CTRL-E automatic start option. The engine(s) will fire up, and you don't have to worry about them as long as you don't run out of fuel.

If you're the type that wants to experience the 310R close to like it really is, check this box. You'll then need to understand and follow real-world engine procedures. The 310 is a 1950s airplane, it has even fewer "fool-proof" safeguards than a more modern design. It's quite possible to accidentally shut down an engine in flight if you don't do things by the book. You have been warned.

Here's what's most important to keep you out of trouble:

Starting the Engine

1. Ensure that the external Engine Covers are removed.
2. Set the fuel selectors to the MAIN TANKS.
3. Be sure the auxiliary pumps are turned OFF (centered).
4. Turn on the Battery Master and both alternators.
5. Set mixtures and props to full forward.
6. Crack the throttles to about one inch from the bottom.
7. Move the primer switch to the engine you are starting, left or right.
8. IMMEDIATELY press the starter button for the engine and hold it until it fires.
9. The primer switch will return to center when the engine fires automatically.
10. Turn the auxiliary fuel pump for the engine you just started to LOW (down.)

Warnings About Engine Start

It might be tempting out of habit from other airplanes to turn on the fuel pumps before doing the start. Don't do it – you risk flooding the fuel injectors and you'll have to either wait for the fuel to drain out or motor the starter with the magnetos and mixture off and the throttles full to help clear it.

The engines take longer to crank in cold weather. At any temperature below freezing, expect longer start times. If the engine won't crank in 30 seconds, something else is wrong. Be sure you have the primer on (regardless of whether the engine is "hot" or not) and the throttle cracked.

After the engine starts, turn the fuel pump to low. This helps clear any fuel vapor from the lines that could interfere with steady flow. This is especially true on hot days.

General Notes about operations with authentic engine simulation:

1. When on the ground, especially when taxiing, you should lean out the engine. Not doing so will tend to damage the spark plugs over time due to fouling.

2. Except for a short time after takeoff where full power is required, you should avoid running the manifold pressure and RPM outside the green arcs. Doing so will damage the engine over time. Most 310R procedures call for power reduction at 500 to 1000 feet AGL to the top of the green arcs, which is the "cruise-climb" setting.

Understanding the Fuel Pumps

The fuel pumps on the 310R can be a lifesaver when needed, or a flight hazard if they are misunderstood or misused.

Combustion engines with carburetors use gravity to get fuel and mix it with air, but in the 310R the Continental IO-520M engines are fuel injected, which means they rely on a steady pressure provided by a fuel pump. In all non-emergency cases, this is the engine driven fuel pump for each engine. Even when starting the engine, the auxiliary pumps aren't used; the primer injects the fuel and once ignited the engine turns the pump to keep supplying the pressure.

The pilot has no direct control over the engine-driven pumps, but their status can be seen on the fuel flow gauge. This gauge is actually a pressure gauge which monitors fuel pressure in the fuel line, not the flow. (In the IO-520M , pressure correlates to flow rates.) If the pump gets weak, the pressure will fall – look for split needles in the fuel flow when the power settings are the same for both engines to spot this developing problem. If pressure drops to zero, the pump has failed and the remedy is to turn the auxiliary pump for that engine to HIGH.

Warning! This is the only time you should ever turn that switch to HIGH. If you set a pump on HIGH while its engine is running, the over-pressure will (within 30 seconds) flood the engine, shutting the engine down!

Please observe the following for proper use of the pumps:

- Set the pump to the LOW setting after engine start and during takeoff and landing as insurance against fuel vapor issues.

- Leave the pumps off during cruise except when switching fuel tanks.

- When switching fuel tanks with the tank selector: do one tank at a time. Before moving the selector set the fuel pump for that side to LOW and the mixture to FULL RICH. Make the tank change with the fuel selector, then set the pump back off and the mixture back to its appropriate setting.

Warning! If you don't follow this procedure when switching fuel tanks, you risk engine fuel interruption and possible shutdown!

Systems Realism

In most sim airplanes, the systems are a bit simplified so as to make them easier to use and trouble free. While this is appropriate for many modern airplanes where improvements over the years have done exactly that in the real world, the 310R is an older airplane. If you want something much closer to the authentic experience, turn Systems Realism on. It's not as critical to flight as Engine Realism, but it should provide some interesting effects.

Here are just a few examples of some of the changes brought about by Systems Realism:

- If you are the aircraft's owner (see the Aircraft Ownership section below) and you store the airplane for any length of time over a week (that is, you don't fly it) and you do not cover the engine, intakes, and pitot tubes you will have a small risk the components they protect could be damaged when you go to fly again. The risk increases with the length of time the airplane is in the hangar.
- If you leave the pitot tubes covered, your airspeed indicator will not function.
- If your pitot tube freezes, it will realistically freeze the airspeed needle at or near the last airspeed when it froze over – not drop to zero as in the default sim.
- If you retract your gear without remembering to tap the brakes to stop the wheels spinning, you risk damage to your gear or the gear bay.
- If you apply brakes too often and too hard at high speeds, you can overheat your brakes and damage them.
- Gear and flaps can be damaged by extending them over their rated speeds.
- If you turn on the heater but fail to open up the cabin air, the heater could overheat and shutdown with possible damage to it.
- When using the ADF, the needle won't point rock steady at the station but will fluctuate realistically at a rate and amount correlated to the signal strength, unless you're very near to it.
- All the circuit breakers work, and further they are subject to temporary or permanent outage due to short circuits in the systems, as we describe in the "Failures" section.

Wear and Tear

This option, when selected, allows the aircraft's components to slowly deteriorate over time, like they do in the real world. The rate of wear and tear depends on the amount of usage, but it's always happening. Even if you don't fly the airplane, a slow rate of wear happens "in the hangar". In some cases, with Systems Realism" turned on, birds and insects can nest in your airplane and cause more rapid degradation in certain areas.

This option, like all the others, only applies to the aircraft identified by the ATC ID at the top of the tablet. The option is persistent: it stays on until you turn it off.

Wear and tear is divided into two categories: induced and entropy. Induced is damage caused by mishandling, for example engine cylinder damage caused by excessive operation over the tops of the green power arcs, or failing to lean the mixture while taxiing. Entropy is the tendency of organized systems to become disorganized over time. It's a fundamental property of the physical universe. That's the kind of wear and tear you're choosing to permit by turning this option on.

Note: turning off the wear-and-tear option does not prevent induced wear and tear. To turn that off, turn off the "Realism" options for Engine and/or Systems.

It happens slowly, but it happens. Every component has a MTBF (Mean Time Between Failure) and as the airplane is flown, a "service time" is updated for each component. As that service time grows, the operational readiness of the component gradually declines; when it declines enough, it will fail, either partially or completely.

You can see the operational readiness of the major aircraft components on the "Status" page after an inspection. See the "Status" section for details on how to do that and how to repair damage whatever the cause.

Failures

We've discussed the many ways that mishandling and mistakes can provoke failures in the aircraft if the "realism" options are turned on. We call these induced errors.

"Failures" are another thing. If you select any other option than NEVER here, you're allowing things to break more or less randomly, not caused by pilot error. Unfortunately, this happens in the real world too, where things break even when we treat them gently and correctly.

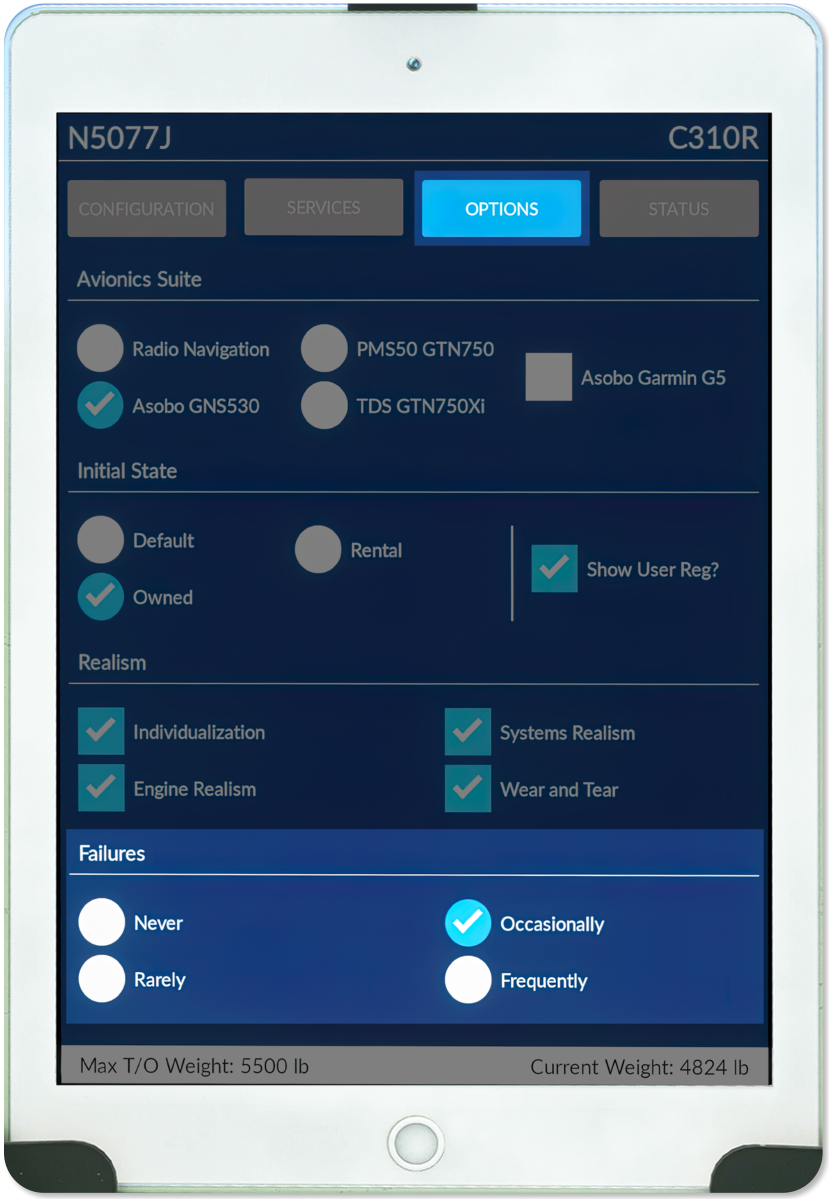
Only one of these options is in effect at a time, and they only apply to the aircraft identified by the ATC ID at the top of the page. This setting is persistent.

Never
This means the 310R systems code won't ever trigger a failure, whether that failure is induced or "random". Regardless of your realism settings, you're safe from the consequences if you check "Never" here. Even if "realism" is on and components are damaged. The damage will be recorded and displayed in the "Status page" (described below) and can be repaired but no actual aircraft component will fail. No random failure will be generated, either.

Rarely
This is the most realistic setting. It allows induced failures to actually fail components, and it will very rarely generate a "random" problem. Most of these problems will be minor, like a circuit breaker popping out or a gauge needle getting stuck. Some can be major, up to and including engine failure. Anything can fail, even light bulbs can burn out. But also, everything can be fixed – see the "Status" page for more options on fixing things.

Occasionally
This option is the same as "Rarely" except failures happen more often. This might simulate an airplane in poor maintenance condition. You aren't guaranteed a failure on every flight, but it would be rare to get two in a row with at least something minor going wrong.

Frequently
This is more for practicing emergency procedures as you are guaranteed at least one major and one minor failure on every flight. You just don't know what they will be.



Failure Identification Code Chart

A click spot in the lower half of the DME allows us to see the status of failures within the aircraft.

The DME readout shows three numbers that identify a failure that has been armed or triggered. If the display shows all zeros no failure has occurred during this flight. If it shows numbers, they will be for the LAST failure armed or triggered: only one failure report is preserved, and any subsequent failure will overwrite any existing report.

Part 1 (DME Miles) 00.0 means no failure, 11.1 means failure.

Part 2 (DME Knots) - Failure Phase Number:

001 Phase 1 Preflight CB pops
002 Phase 2 Preflight Component Failures
003 Phase 3 In-flight CB pops
004 Phase 4 In-flight Component Failures
005 Phase 5 Triggered Component Failures

Phases 1-4 mean the failure has been armed, and 5 means that the consequence has been triggered in-sim.

Part 3: (DME Minutes) - Failure Identifier:

Phase 1:
01 - 32 Permanent CB Pops Preflight

Phase 2:
01 - EN_VACUUM1
02 - EN_VACUUM2
03 - AV_ADF
04 - IN_ASI
05 - IN_ALT
06 - IN_ADI
07 - IN_VSI
08 - IN_HSI
09 - EN_RMAG1
10 - EN_LMAG1
11 - EN_LMAG2
12 - EN_RMAG2
13 - FU_ENG_PUMP1
14 - FU_ENG_PUMP2
15 - LI_LAND_L
16 - LI_LAND_R
17 - EV_HEATER
18 - EL_ALT1
19 - EL_ALT2
20 - EN_CYL1
21 - EN_CYL2
22 - EN_RMAG1
23 - EN_LMAG1
24 - EN_LMAG2
25 - EN_RMAG2

Part 3 (cont'd):

Phase 3:

01 - 32 Permanent CB Pops in-flight

Phase 4:

01 - EN_VACUUM1;
02 - EN_VACUUM2;
03 - AV_ADF;
04 - IN_ASI;
05 - IN_ALT;
06 - IN_ADI;
07 - IN_VSI;
08 - IN_HSI;
09 - EN_RMAG1;
10 - EN_LMAG1;
11 - EN_LMAG2;
12 - EN_RMAG2;
13 - FU_ENG_PUMP1;
14 - FU_ENG_PUMP2;
15 - LI_LAND_L;
16 - LI_LAND_R;
17 - EV_HEATER;
18 - EL_ALT1;
19 - EL_ALT2;
20 - EN_CYL1;
21 - EN_CYL2;
22 - EN_ENGINE1;
23 - EN_ENGINE2;
24 - EN_CYL1;
25 - EN_CYL2;
26 - CB_GEAR_MOTOR;
27 - CB_GEAR_MOTOR;
28 - CB_GEAR_MOTOR;
29 - EN_CYL1;
30 - EN_CYL2;

Phase 5:

01 - LEFT ENGINE
02 - RIGHT ENGINE
03 - ELECTRICAL SYSTEM
04 - VACUUM SYSTEM
05 - LEFT BRAKE
06 - RIGHT BRAKE
07 - ADF
08 - ASI
09 - Altimeter
10 - ADI
11 - Compass
12 - VSI
13 - LEFT ENGINE (External Trigger)
14 - RIGHT ENGINE (External Trigger)
15 - Permanent CB Pop
16 - Aux Fump Pump Left
17 - Aux Fuel Pump Right
18 - Left Starter
19 - Right Starter
20 - Left Mag #1
21 - Left Mag #2
22 - Right Mag #1
23 - Right Mag #2
24 - Left Engine Fuel Pump (Declining)
25 - Right Engine Fuel Pump (Declining)
26 - Landing Light Left
27 - Landing Light Right
28 - Heater
29 - Left Engine Fuel Pump (Fail)
30 - Right Engine Fuel Pump (Fail)

Status

You can think of this page as your "maintenance hangar". It can display a list of the critical systems and components of the aircraft with a bar indicating the current health of each component. The bar can be colored red, yellow, or green. Red components have failed, yellow ones are weakened and headed towards failure, and green components are functioning normally.

It's important to realize that you're only seeing the most important components listed here. The system tracks over 200 components in total - every circuit breaker, switch, dial, needle, and light bulb, and any of them can fail. This page is where you can inspect and fix the airplane.

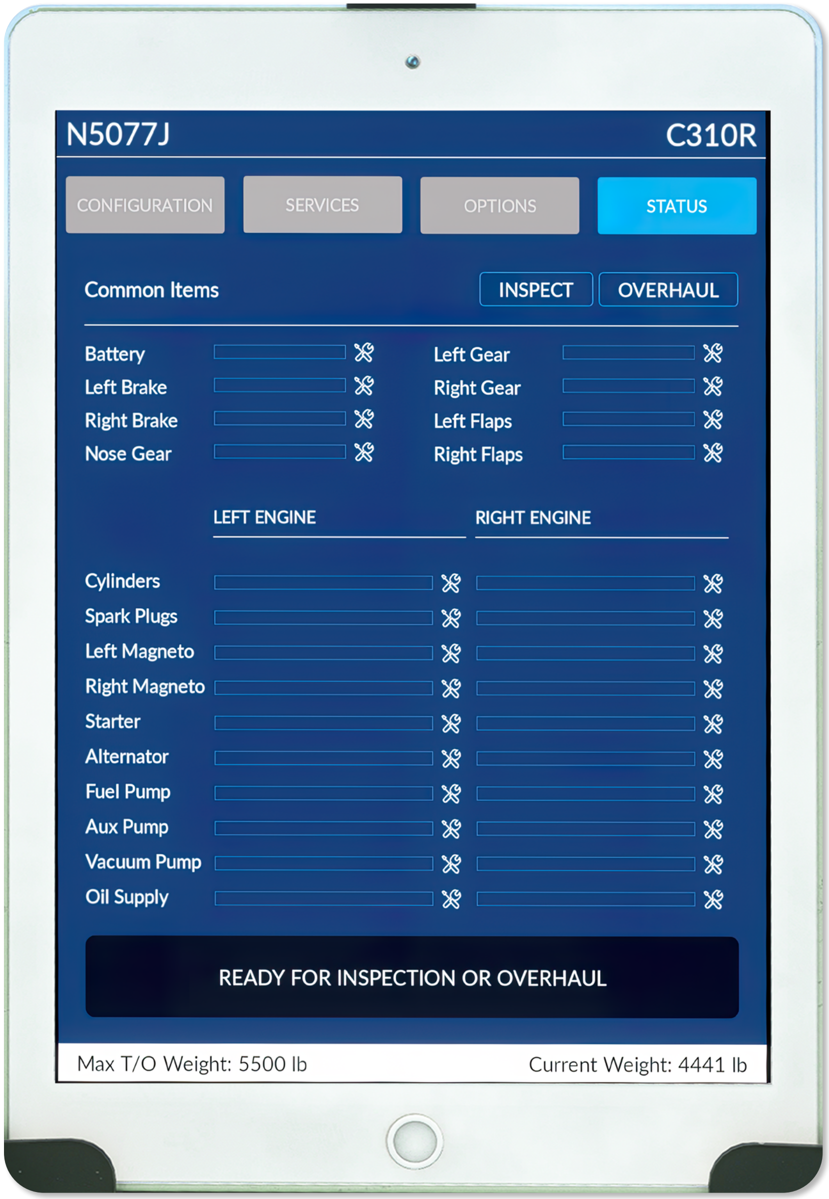
Normally, you only need to use this page if you're the aircraft's owner, although it's possible to configure the options so that wear and tear and failures will happen to a non-owned plane. If you have the option "Failures" set above "Never", or the "Wear and Tear" realism option turned on, you will need to visit this page periodically to check on the status of your airplane.

This page is not a live systems status check. The bars will fill in with status only after your perform an inspection (which takes some time) and the page can't be viewed at all unless you are parked on the ground with the aircraft's battery and engines off. You can't substitute looking at this page for doing the normal checks every pilot must do in an aircraft, like the run-up and monitoring the gauges.

When you first view the page, the bars will be empty (zero) and you have only two options, the buttons marked "Inspect" and "Overhaul".

If you click on "Inspect", an inspection will be performed (a process that could take up to a minute) and when that's complete, the status of all critical systems will be accurately shown. A message will appear in the black message box saying either "NO DEFECTS FOUND" or "INSPECTION COMPLETE – DEFECTS FOUND", depending on the outcome of the inspection.

If you received the message saying defects were found, the "Inspect" button will become a "Repair" button. If you press it a second time, any component yellow or below will be brought to 100%, and any component not listed, but is broken, will be replaced. At the end of the repair process ,the message "ALL DEFECTIVE COMPONENTS REPLACED" will appear and the "Repair" button will revert back to "Inspect".



After an inspection is complete, you also have the option to repair individual components instead of using the "Repair" button. Simply click on the repair icon next to each bar to initiate the repair for that component only.

NOTE: clicking on the repair icon for the battery will fully recharge the battery regardless of its operational readiness state.

Remember, this repair process does not put every component back up to 100% readiness. It only fixes those that are defective, that is, in the yellow band or below.

It's not unusual to have defects be found and reported when the bars are all green. This means components outside the critical systems are weak or have failed. Whenever the 'Inspect' button turns to 'Repair' you should click it to fix those non-critical items (for example warning lamps or shorted circuits in non-critical areas, etc.) If you are in doubt do another inspection until you see "NO DEFECTS FOUND".

The other button is "Overhaul" which will perform an immediate overhaul of the entire airplane. Unlike "Repair", it will place every component in the system back to 100% readiness. The cost is time for you as the sim pilot, but it would be cash for a real owner. That's why we impose the time, so this Overhaul option can't be used in a trivial manner to keep everything at 100%. If you want that, turn off failures, realism, and wear and tear and you won't be bothered with maintenance issues.

A typical example of using this page might be that you discover in flight when you lower the gear, one of the green gear lights won't come on. You press it and discover the bulb is burned out. So after you land and shut down, you come to this status page and do an inspection. The result will be "DEFECTS FOUND". Click "Repair" and the burned out bulb will be replaced with a new one. You can fix any other problems found this way.

Periodic inspections are recommended to ensure there are no surprises.

Remember, you aren't able to view this page unless the airplane is cold and dark.

Aircraft Ownership

Important Note: whenever you change any of these startup options, you should do it from a cold and dark cockpit; and then immediately do a flight restart for the new startup option to take full effect.

Your Blackbird 310R allows you to experience a simplified simulation of aircraft ownership.

Remember, each aircraft with a separate ATC ID (registration number) is tracked and recorded separately and treated as a unique airplane.
There's no limit to how many you can own and you can have a mix of owned and rented ones. This applies equally to third-party repaints you may install. Each of them is treated exactly like the ones distributed with the initial 310R package.

When you choose "Owned" as your start up option for a particular registration, you are the sole owner of this aircraft and its condition is entirely up to you.

When you own it, whenever you exit the simulation normally by returning to the main menu the current state of the aircraft is saved and later restored exactly as it was when you left it when you again "enter the cockpit", even if that's months later.

There is one major exception to this rule: state is not saved if the aircraft is in the air or the engines are running. It's only saved when you shut down normally. If the sim crashes, or you just quit a flight in mid-air, the state on returning will be what is was the last time you entered the cockpit, not as it was during the flight.

(Note that if you choose to start the airplane on the runway and not in a parking spot, none of this applies and it will be "ready to fly" and its state will not be saved when you exit, unless you shut it down to cold and dark.)

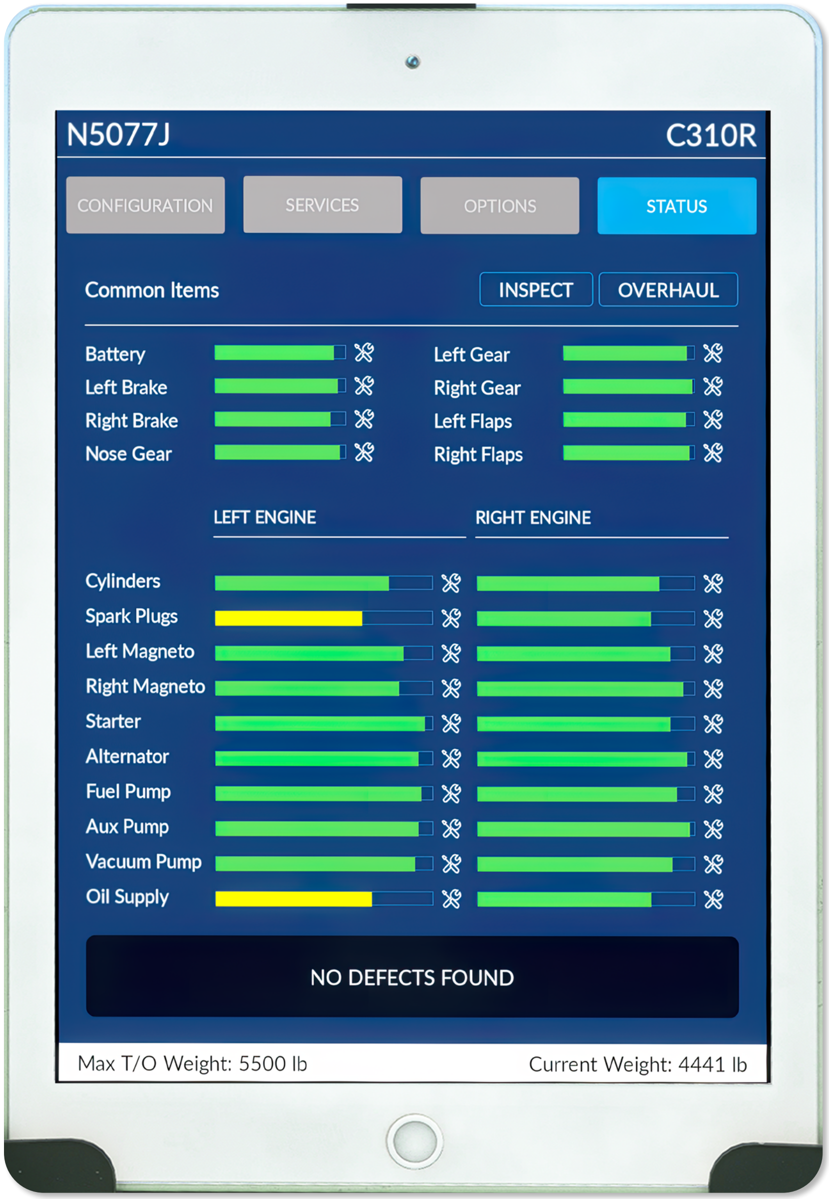
The effect of other options when you choose “Owned”:

Individualize
Each aircraft will be unique in terms of systems condition.

Engine Realism
Engines will start and run more realistically and be subject to authentic limitations and consequences.

Systems Realism
Systems will behave in a more realistic manner.

Wear and Tear
Components will degrade over time and at a greater rate if they are misused.



Aircraft Rental

An alternative to owning the aircraft is renting it. If you choose this option, you give up the state saving feature of ownership – the state of the aircraft when you first enter the cockpit will be the condition the last renter left it in when they shut down. For this reason, you have to pay close attention to your checklist: you can't just assume the controls, switches and dials are left in a known state, like they would be if you chose the "Default" option.

When you rent, you are not responsible for the maintenance of the systems. This will be handled automatically for you. All components will be in working order, but not necessarily in perfect order (like they would be if you chose "Default"). If you chose the other realism options with the "Rental" option turned on, they will all work as documented. If you turn failures on, the aircraft can fail due either to mismanagement or random failures. If you turn on the realism options, you'll be subject to the restrictions they impose (such as a realistic engine start procedure.)

Default Aircraft Option

If you chose the default option, it means the aircraft always starts in a known state and state is never saved or restored. You can chose any of the other realism options and they will be in effect during the flight, but any wear and tear will be erased and the aircraft will be perfect again when you start out on another flight after entering the cockpit. The other options – Systems and Engine Realism and Failures will work as documented. If you leave them all off, you'll experience the 310R as if it were a default MSFS aircraft, with perfect systems, components, and engines that won't fail or give trouble during the flight.

We hope you enjoy flying your new-to-you Blackbird 310R!

Section 3
Operating the Blackbird 310R

Table of Contents

Introduction

Section 3 of this user guide covers the basics of operating the systems and controls of the Blackbird 310R within the simulator environment.

This section will make frequent reference to the use of the left and right mouse buttons and wheel as a means of interacting with the various controls in the aircraft. In all cases, for the function to work as described, the pilot must first hover the mouse pointer over the associated system or switch.

Please also ensure that the MSFS Cockpit Interaction setting under General Options>Accessibility is set to "Lock" instead of "Legacy" to use mouse interactions as intended.

Cabin Overview

The cabin is a rather easy place in which to find your way around. For a twin, the controls are well laid out and not overly complex. This makes the 310R an ideal airplane for those who desire a relaxing flight in an elegant aircraft, or for those learning the ins and outs of flying a twin.

The aircraft is equipped with dual flight controls and is flyable from either the pilot's or the copilot's position. However, the left hand yoke does feature additional controls for the autopilot which the right hand yoke does not have. In addition, the majority of the flight instruments are located on the left hand panel in front of the pilot.

Sweeping from left to right through the cabin:

The electrical and circuit breaker panel is located on the left side of the cabin, beside the pilot's seat. This contains the avionics master switch, exterior and interior lighting controls, as well as the deicing switches.

Next is the flight instrument panel, located in the upper left panel, above the yoke. It contains the following instruments: Airspeed Indicator, Hobbs meter, Artificial Horizon, Altimeter, Turn and Bank Indicator, Horizontal Situation Indicator (HSI), and the Vertical Speed Indicator. Located below the Vertical Speed Indicator to the right of the yoke shaft is an ADF Indicator, while on the left of the yoke shaft is a pair of EDM-700 engine temperature gauges. Above them is a DME Indicator.

At the bottom of the left side front panel, directly under the yoke, is the lower electrical switch panel.

COCKPIT LAYOUT

This panel contains, from left to right, the Auxiliary Fuel Pump Switches, the Left Engine Start Button, the Engine Primer Switch, the Right Engine Start Button, the Left Alternator Switch, the Master Battery Switch, the Right Alternator Switch, followed by the magneto switches for both engines.

The upper center panel area contains the communication and navigation equipment, as determined by the options the user has set in their configuration.

The lower center panel, immediately above the pedestal, contains the Landing Gear Switch and Landing Gear Indication Lights, the ammeter, and the Flap Switch and Indicator.

The center pedestal is topped by the Throttle Quadrant, with dual Throttle, Propeller, and Mixtures to control the left and right engines independently. Bottom aft on the pedestal are the trim wheels for roll and yaw control, while the Elevator Trim Wheel and Indicator is located on the left side. At the bottom center of the pedestal are the Cowl Flap Controls.

At the base of the pedestal is the dual fuel selectors that allow detailed control of the fuel flow.

The front right hand panel holds the primary engine instruments, including the Manifold Pressure Gauge, the dual gauges that display Oil Pressure, Oil Temperature, and Cylinder Head Temperature, the Tachometer, the EGT Gauge, the Suction Gauge, and the OAT Gauge. Also included on this panel are the Fuel Flow and Fuel Quantity Gauges, as well as a backup Altimeter and a clock.

The Cabin Air Controls are located to the right of the pedestal, underneath the front right hand panel.

Pilot's Side Switch Panel

1 The Avionics Master Switch is a two position switch for ON (up)/OFF (down) operation, providing power to the avionics bus. It is normally only turned on once one alternator is online and providing full electrical output. The switch is toggled with the LEFT MOUSE BUTTON.

2 The Surface and Propeller De-Icing Switches should be used when there exists the risk of flight into icing conditions within the simulator.

A three-position switch. Up (Actuate) will inflate the de-ice boots for one cycle. Center is off. Down will turn on a timed series of inflate/deflate cycles for heavy icing situations. Use the MOUSE WHEEL to flip the switch up or down, or hold and drag with the LEFT MOUSE BUTTON.

3 There are five exterior light switches: Anti-Collision, Strobe, Navigation, Taxi, and Landing Lights. With the exception of the Landing Lights, these are all two position switches for ON (up)/OFF (down) operation, toggled with the LEFT MOUSE BUTTON. The Landing Lights switch is a three position switch, toggled up or down with the MOUSE WHEEL or by hold and dragging up or down with the LEFT MOUSE BUTTON.

4 Interior lighting is controlled by the rheostat knobs located to the right of the exterior light switches. The right-most knob, labeled SW PNL, activates the instrument panel backlight illumination and is continuously adjustable from OFF to fully bright. The RADIO knob controls the avionics backlighting.

Pilot's Lower Switch Panel

1 Located in the center of this panel, the Battery Master Switch, flanked by the Left and Right Alternator Switches, supplies essential power to all aircraft systems and must be engaged before successful operation of any of the other lower panel operations.

The Left and Right Alternator Switches allow for the alternators to be connected into the power bus. These are turned on once the engine is successfully running. The metal gang bar above these switches can be flipped down to turn all 3 switches off at once.

All three switches are two position switches for ON (up)/OFF (down) operation, toggled with the LEFT MOUSE BUTTON.

2 The four Magneto Switches, located on the right side of this panel allow for power to be fed to the spark plugs. The left and right engines each feature a Left and Right Magneto Switch. The metal gang bar above these switches can be flipped down to turn all 4 magnetos off at once.

All four switches are two position switches for ON (up)/OFF (down) operation, toggled with the LEFT MOUSE BUTTON.

3 The two Auxiliary Fuel Pump Switches on the left side of this panel are both three position switches, toggled up or down with the MOUSE WHEEL or by hold and dragging up (HIGH) or down (LOW) with the LEFT MOUSE BUTTON.

Warning: do not place switch in HIGH except in case of engine failure.

LOW pump power is normally used for engine starts, taxi, takeoffs and landings, and flight operations above 12,000 feet to prevent vapor lock. The HIGH power pumps are used for hot starting to purge fuel vapors and during any fuel-related emergency situations to ensure positive flow to the engines.

4 The Left and Right Starter Buttons are found in the middle-left of the panel, as is the Engine Primer Switch, located in-between the two buttons.

Starting the engine normally requires the use of fuel priming. The primer switch is a three-position momentary switch that is spring loaded to the center (OFF) position. To prime the left engine, click the switch with the LEFT MOUSE BUTTON. To prime the right engine, click the switch with the RIGHT MOUSE BUTTON.

The starter buttons are momentary switches that are activated by clicking and holding the LEFT MOUSE BUTTON.

Amperage / Voltage Indicator

The 310R features a comprehensive electrical indicator and test system. The rotary switch to the left of the indicator allows the pilot to isolate and test the power draw for either alternator system as well as for the battery. The pilot can also measure the total voltage draw from all engaged power sources.

To rotate the switch use the MOUSE WHEEL.

When rating the amperage draws for the alternators and battery, reference the top white section of the meter. When measuring the voltage draw, reference the bottom blue section of the meter.

In addition to the rotary switch and indicator, the system also has two warning lamps which illuminate when the aircraft detects alternator failure or inadequate alternator power generation. These lights can sometimes illuminate when the engine is idling at an RPM insufficient to provide optimal alternator power output.

With the left alternator switch disengaged, you can reference the left alternator failure light to confirm it is not supplying system power. The same relationship exists for the right alternator switch and light. If during flight operations with the alternator switches engaged, an alternator light illuminates, you should assume that alternator has failed and troubleshoot with the wafer switch to isolate and measure that alternator's power output.

Artificial Horizon / Attitude Indicator

Featured in the 310R on the center top of the flight instrument panel is the Artificial Horizon, or Attitude Indicator.

This instrument informs the pilot of the orientation of the aircraft relative to Earth's horizon. Indicating both pitch (fore and aft tilt) and bank (side to side tilt), it is a primary instrument for flight in instrument meteorological conditions (IMC).

The Artificial Horizon in the 310R is gyroscopically stabilized by a vacuum system driven by either engine.

The instrument features a fixed yellow waterline which can be adjusted up or down manually by the pilot using the knob located at the bottom of the instrument. The "card" behind the waterline pivots and rotates in concert with the aircraft's pitch and roll movements.

The card features pitch indicators marked in five degree increments with the ten and twenty degree marks being wider and labeled.

Indications of bank are shown by the yellow arrow at the top of the instrument. The semicircular scale at the top of the instrument is graduated in ten degree marks to the thirty degree bank indication, and then marked by single marks for 45 and 60 degrees.

When the Artificial Horizon detects insufficient vacuum pressure to operate the gyroscope, it displays a red flag to alert the pilot that the instrument is unreliable.

To set the waterline on the Artificial Horizon, the pilot should use the rotate the knob to manually adjust the waterline so as to lie flush with the white horizon line that separates the blue and the brown sections of the card.

This should be done in stable level flight, under Visual Meteorological Conditions (VMC), with reference to the actual horizon.

Horizontal Situation Indicator (HSI)

The Horizontal Situation Indicator (HSI) in the 310R, located in the flight instrument panel directly below the Artificial Horizon, provides a comprehensive display including course, localizer, and glideslope information referenced from either the number one (NAV 1) or number two (NAV 2) navigational systems.

Use the NAV1/NAV2 Selector Switch to select which navigation system supplies input to the DME display. The HSI and AP are always NAV1 and are not changed by the switch.

On the HSI, the current aircraft heading is shown on the rotating compass card underneath the upper lubber line, which is stationary. The course indicating arrowhead can be set to the desired course using the course input knob located on the lower left side of the HSI, using either the LEFT or RIGHT MOUSE BUTTON or the MOUSE WHEEL to rotate the course indicating arrowhead clockwise or counter-clockwise. The tail of the course indicating arrow shows the reciprocal of the currently set course.

The course deviation bar operates with a VOR/LOC navigation receiver to indicate either left or right deviations from the selected course. On an instrument approach, the course bar will also indicate deviation left and right, but will switch to a more sensitive mode of operation, showing twice the amount of deflection for a given course distance error.

The TO/FROM indicator is a triangular-shaped pointer. When this indicator points to the head of the course arrow, it indicates that the course selected, if properly intercepted and flown, will take the aircraft TO the selected facility, and vice versa.

When flying a precision approach with operating glideslope information, the glide slope deviation pointer indicates the relationship of the aircraft to the glide slope. When the pointer is below the center position, the aircraft is above the glide slope, and an increased rate of descent is required.

The heading indicator on the HSI is slaved to the standby magnetic compass and is interconnected with the autopilot which is capable of following the heading select bug when engaged in Heading Mode. Please refer to the included standalone documentation for operation of the autopilot included in the 310R.

To adjust the heading bug use the heading input knob located on the lower right of the HSI using the MOUSE WHEEL to make fine adjustments and LEFT-CLICK AND DRAG to make coarse adjustments. Drag to the left to rotate counter-clockwise and to the right for clockwise.

When the Heading Mode is engaged on the autopilot and the heading bug does not match the aircraft heading, or if Heading Mode is already engaged on the autopilot and the heading bug is rotated away from the current heading, the aircraft will steer in the direction of the heading bug, selecting a left or right turn depending on which is the shortest turn to the heading indicated by the bug.

The HSI in the 310R includes two red warning flags which alert the pilot when an unreliable navigational or heading input signal is encountered, or when aircraft power is not sufficient to operate the HSI.

Autopilot

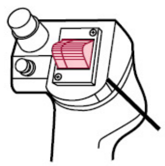
The Blackbird 310R uses the default, MSFS KAP140 autopilot. With this said, issues do exist with the system that are in Microsoft/Asobo's wheelhouse to address and are not fixable by us at Blackbird.

The autopilot is capable of multiple navigation modes such as heading hold (HDG), tracking a navigation source such as a GPS (NAV), altitude hold (ALT) with vertical speed capability, and approach tracking (APR).

Pitch Trim & A/P Disconnect

A Pitch Trim switch is located on the same side of the left hand yoke; this is a three position momentary switch that is spring loaded to the middle position. To apply negative (nose down) pitch, click the switch with the RIGHT MOUSE BUTTON; to apply positive (nose up) pitch, click the switch with the LEFT MOUSE BUTTON.

Also located on the same side on the left hand yoke as the previous two controls is the Autopilot Disconnect button. This button is a momentary switch that disconnects the autopilot, and may be used by clicking it with the LEFT MOUSE BUTTON.



Engine Instrumentation

The Manifold Pressure (MP) gauge features independently-operating needles for the left (L) and right (R) engines and displays the amount of air pressure that each engine is sucking through the throttle manifold aft of the venturi. When the engines are shut down, the MP displayed is equal to the outside air pressure. When the engines are running, then the MP value displayed is affected by the movement of the throttles which open and close the throttle wastegates.

When the throttles are fully closed, the wastegate is rotated to its maximum closed position, which reduces the amount of air that the engine can suck. When the throttle is fully opened, the wastegate is likewise fully opened, and the engine can suck air equal to the outside air pressure. Since this aircraft is not turbocharged, the manifold pressure will reduce as the airplane climbs even if the throttles are fully opened. Manifold pressures over the normal range (25.5 inches) should only be demanded during takeoff and reduced to the normal range as soon as practical.

The Tachometer (RPM) gauge also features independently operating needles for each engine. The Blackbird 310R features constant speed propellers. Therefore, the RPM can be adjusted by the pilot using the associated propeller condition levers located on the throttle quadrant. Full RPM is reached by the pilot moving the prop condition levers fully forward. The propeller hub contains a governor which should not allow the RPM to exceed 2700.

RPM's above the top of the normal range (2500) should only be allowed during takeoff and landing operations. Also, the pilot must be careful not to allow a combination of high manifold pressure and low RPM's as this combination could potentially lead to catastrophic failures.

During cruise operations, the pilot should ensure that the RPM is kept in the normal operating range (the green arc) by moving the associated prop condition levers.

Each engine has its associated Cylinder Head Temperature (CHT) and Oil Temperature / Pressure Instruments. During all phases of engine operation, these instruments should be referenced to ensure no abnormal engine conditions are allowed.

During engine start, the pilot should immediately reference the oil pressure gauge to ensure proper flow of oil through the engine. If no increase to the normal range is seen immediately after start, the engine should be shut down as soon as possible to avoid possible seizure.

In addition, during the propeller feather checks on the ground, the pilot should observe a drop in oil pressure and temperature when he moves the associated prop condition lever aft. This ensures that the oil is flowing through the propeller governor.

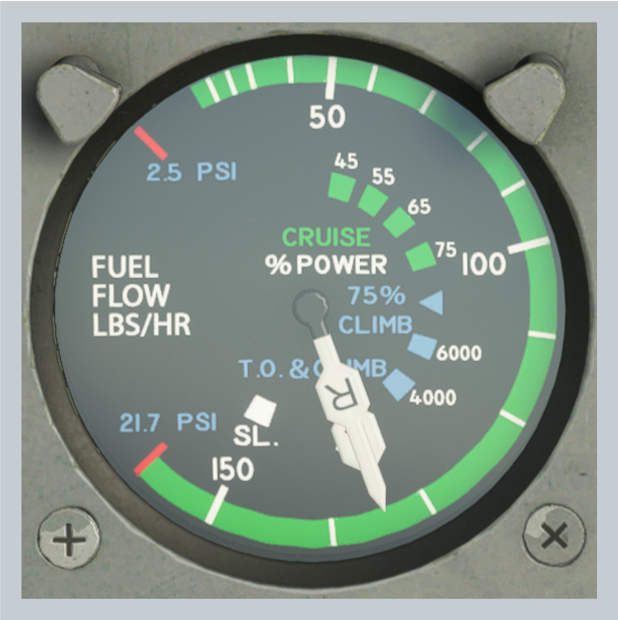
Engine Instrumentation Continued

The Exhaust Gas Temperature (EGT) gauge measures the temperature of the exhaust gases immediately after fuel burn in the ignition phase of engine operations. The gauge features independent indications for each engine. As EGT increases, the associated needle will rise to indicate that engine's exhaust gas temperature.

Note: The gauge measures only the top 250°F degrees of the EGT range.

During cruise operations, the pilot should lean out the fuel mixture to maintain an optimal ratio of fuel to air. EGT can be referenced to ensure this optimal mixture setting is maintained.

During climbs, the pilot will need to lean the fuel mixture by moving the associated fuel mixture lever on the throttle quadrant aft. During descents, as the air pressure increases, fuel will need to be enriched by moving the mixture lever forward. The asterisks located on the EGT gauge can be referenced to help determine optimal fuel mixture.



The Fuel Flow gauge uses independently operating needles for each engine to allow the pilot to easily match the fuel flows to each engine. The outer scale is calibrated from a minimum value of 2.5 PSI to a maximum value of 21.7 PSI. In between these two PSI limits, the outer scale is calibrated in fuel flow in pounds per hour.

The inner scale is calibrated to assist the pilot in setting fuel flows consistent with certain phases of flight. For example, during normal takeoff at airports below 3,000 feet field elevation, the pilot should set a fully rich mixture as indicated by the small white section of the inner scale. The bottom half of the inner scale is in blue and used for takeoffs and climbs as a reference to keep fuel flows high enough to help keep the cylinder head temperatures in normal range (unburned fuel acts as a coolant). During cruise, the pilot can set the fuel mixtures to obtain a flow reading in the green upper section of the inner scale.

The Vacuum Pressure or Suction gauge allows the pilot to measure the amount of air pressure that the engine vacuum pumps are sucking. This vacuum pressure rotates the vanes of all the air driven gyroscopes that stabilize such instruments as the artificial horizon and HSI.

During the engine ground run, and periodically during flight, the pilot should reference this gauge to determine is he is experiencing possible vacuum failure on these critical flight instruments.

The vacuum pump on either engine is capable of supplying enough vacuum pressure to supply the demands of all air driven instruments. When a pump is inoperative, a red SOURCE INOPERATIVE light will illuminate for the failed pump.

EDM-700Digital Engine Temperature Gauge

The Blackbird 310R is equipped with a pair of Digital Engine Temperature gauges. These gauges, located on the left front panel to the bottom left of the flight instrument panel, are an advanced gauge which display a bar graph of Exhaust Gas Temperature (EGT) for each of the six cylinders, the “T” average Exhaust Gas Temperature and a bar graph of the Oil Pressure. At the bottom of the gauge, there is a digital readout of EGT (left) and CHT (right).

The left button toggles between manual and automatic mode, and the right button re-enters automatic mode if pressed in manual mode, and toggles between Fahrenheit of Celsius temperature readings if pressed in automatic mode.

In addition, the Cylinder Head Temperature (CHT) for each of the six cylinders is displayed in the bar graph as a red bar that corresponds to the scale on the left side of the gauge.

By default the EDM gauges operate in automatic mode - they step through each of the six cylinders and then through a set of five other measurements in sequence, pausing for five seconds for each step.

Pressing the LEFT button stops this sequence and you then enter manual mode. Each press of the left button in manual mode steps to the next measurement in sequence.

To exit manual mode and return to automatic mode, press the RIGHT button.

When in automatic mode, pressing the RIGHT button will switch the temperature readings from Fahrenheit (the default) to Celsius. Pressing it again toggles the setting back to Fahrenheit.

Note that the MV310R for MSFS tracks the health of each cylinder individually, and when failures are activated on the Options page of the tablet, the failure of one cylinder will fail the entire engine.

Cylinders often give warning if impending failure by generating higher temperatures and they slowly inch towards failure. Monitoring the indications on these engine monitors can help to predict and deal with cylinder failure before the engine actually stops producing power.

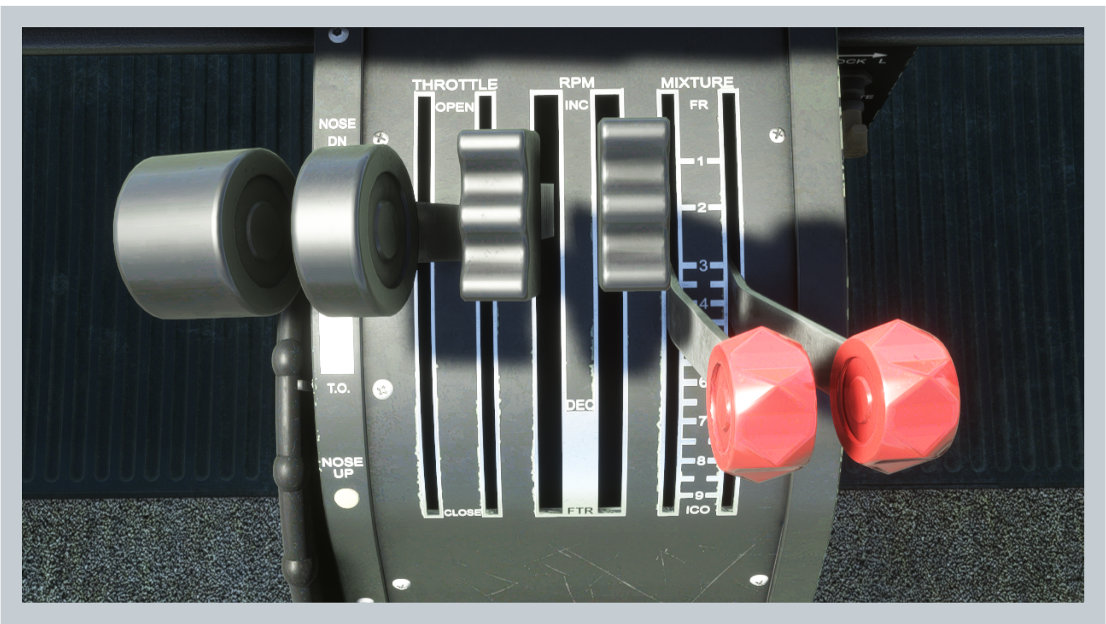
Throttle Quadrant

The top of the pedestal houses the throttle quadrant, with twin levers for the throttle (left, black round knobs), propeller (center, black rectangular knobs), and mixture (right, red ridged circular knobs). This arrangement in the allows for both visual and tactile recognition of the levers to help avoid undesired engine settings.

The throttles control amount of opening in the throttle wastegate. With the throttle fully forward (full open), the wastegate is 100% opened, allowing maximum manifold air pressure to be sucked by the engine. When the throttle is moved aft, the throttle wastegate is closed until at minimum setting (closed throttle) the wastegate is shut as tight as possible, which restricts the airflow to the engines, resulting is the lowest possible manifold pressure. The throttle wastegate cannot be physically closed entirely, and should normally be advanced about "one inch" past the fully closed position when starting the engines.

The propeller condition levers control the amount of blade angle commanded to the propeller governors. Using oil pressure, the governor responds to movements in the prop condition levers and set that blade angle to achieve a fixed RPM setting. Then, the governor makes automatic small corrections to blade angle to maintain that constant RPM setting during ever changing conditions of flight.

The mixtures control how much fuel is sent to the fuel injectors and is used by the pilot to adjust the fuel quantity so that as the aircraft climbs or descends, the optimal ratio of fuel to air is maintained. Only at the optimal ratio is best possible quality of fuel ignition in the pistons maintained. As the plane climbs, the air gets thinner, which requires reducing fuel flow to the injectors (called leaning the mixture). As the plane descends, the air gets thicker, which requires increasing the fuel flow (called enriching the mixture). To lean the mixture, move the mixture lever aft. To enrich the mixture, move the lever forward.

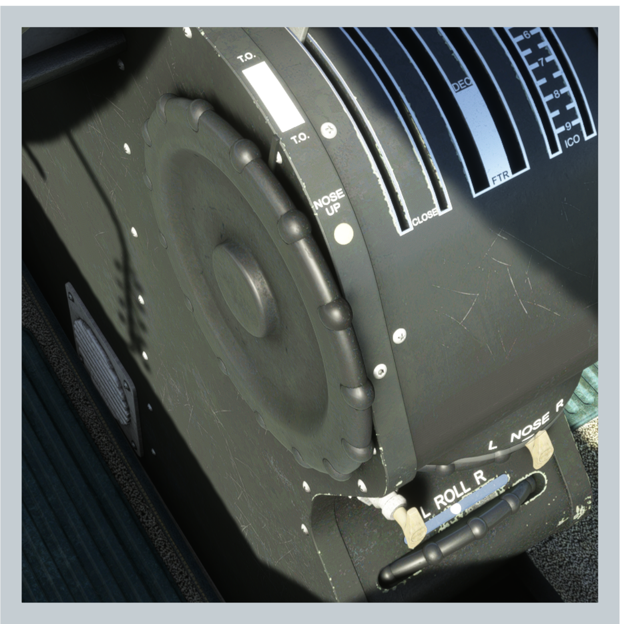


Trim Controls

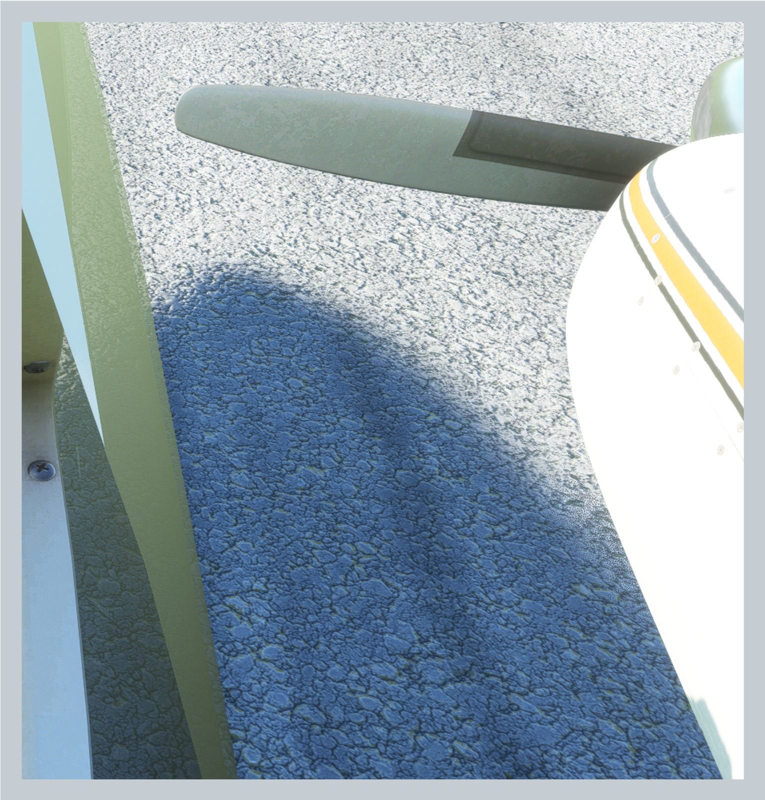
The trim wheels are located on the pedestal, with the elevator trim wheel located to the left of the throttle quadrant, and the rudder (yaw) and aileron (roll) trim wheels located below the throttle quadrant.

There is a template for the elevator trim that allows the pilot to accurately set the takeoff trim by referencing the location of a small indicator needle in relation to the trim template.

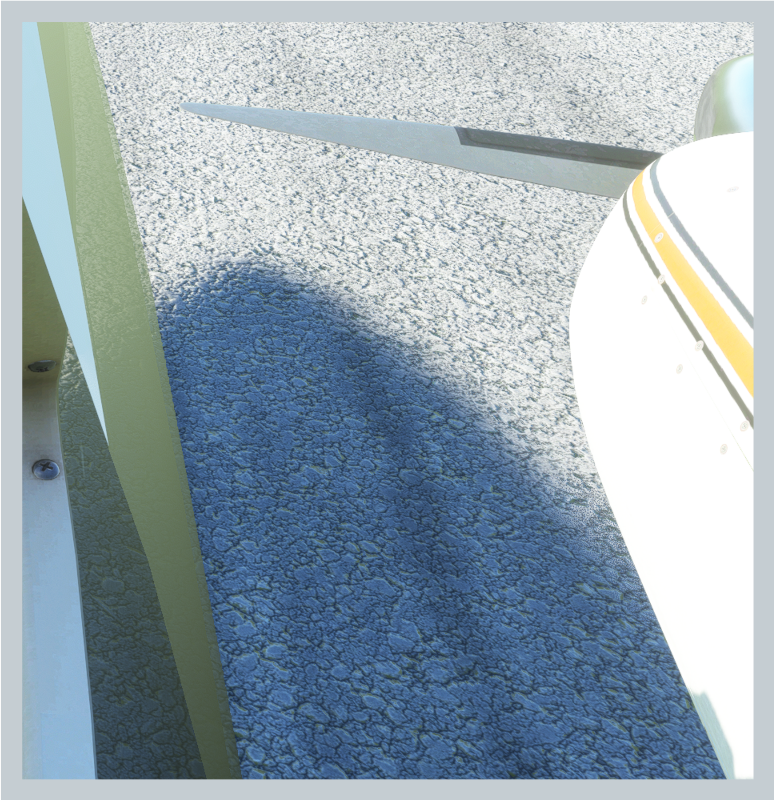
For the yaw and roll trim, there are white dots that move as the trim wheels are rotated left or right. These two trim values should be set and maintained for takeoff and cruise operations with both engines operating in symmetry. They will need to be adjusted for any single engine operations.



Propeller Feathering



FULL FINE



FEATHERED

A propeller blade is similar in airfoil section to a low-drag wing. When rotated by the engine, it produces lift in a horizontal direction (otherwise known as thrust), as well as a small amount of induced drag as the propeller slices through the air. If the engine loses power, no thrust is produced, but all of the induced drag from the now windmilling propeller remains.

This is undesirable when operating with reduced, asymmetrical power (one engine inoperative) or under no power at all (both engines inoperative), as it can rob the aircraft of overall power required to maintain altitude, exacerbate negative control effects resulting from asymmetrical thrust, and shorten glide distances in total power loss situations.

The solution is to eliminate as much induced drag as possible by stopping the propeller rotation and aligning the blades with the air flow.

To accomplish this, the propeller is feathered by pulling the propeller condition levers full aft, causing the propeller blades to rotate to a fully coarse setting parallel to the airflow. This reduces the aerodynamic force of the passing air hitting the prop disc so that the propeller no longer windmills.

Fuel Systems

The fuel system in the Blackbird 310R is intended to provide a very high fidelity experience, modeled after real world usage, in conjunction with the limitations present within the simulator.

The airplane has a two main fuel tanks, often referred to as 'wingtip' or 'tip' tanks. Each main tank has a usable capacity of 50 gallons. In addition, there are also two auxiliary fuel tanks, each with a usable capacity of 31.5 gallons. The total amount of usable fuel available to the pilot is 163 gal.

Each engine is typically fed by the tank on the respective side, but the airplane features the capability to crossfeed the fuel from the main tank on the opposite side from the engine.

Fuel Controls

The Blackbird 310R features a pair of fully-realistic fuel switches and placards located immediately aft of the pedestal. The left fuel selector controls the fuel flow for the left engine, and the right fuel selector controls the fuel for the right engine.

The handles of the switches are rotated by the pilot in order to select a desired position as outlined on the placard around the selector and indicated by the tapered end of the switch handle.

To rotate the LEFT fuel selector CLOCKWISE, scroll UP with your mouse wheel. To rotate it COUNTER-CLOCKWISE, scroll DOWN with your mouse wheel.

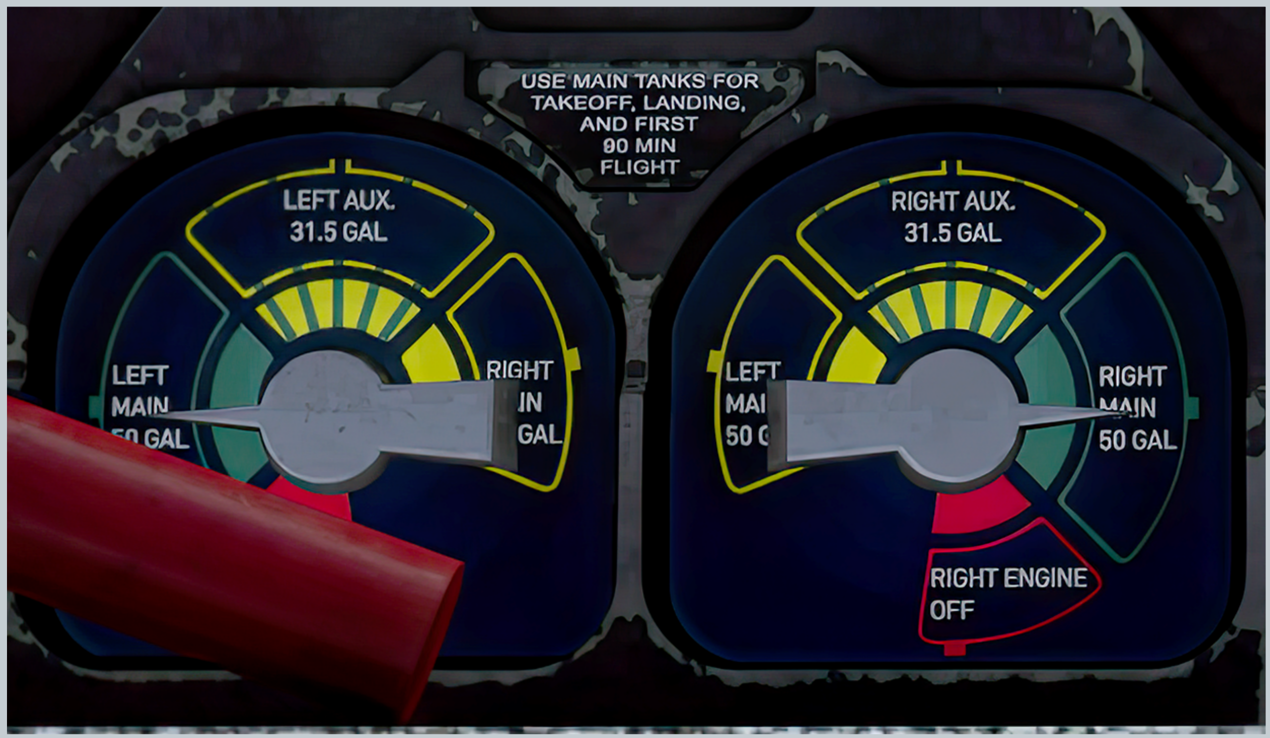
To rotate the RIGHT fuel selector CLOCKWISE, scroll DOWN with your mouse wheel, to rotate it COUNTER CLOCKWISE scroll UP with your mouse wheel.

If you prefer to hold the LEFT button and drag, then hold it and drag in the same directions as specified for the mouse wheel above.

The placard below the switches is color coded, illuminated for night operations, and displays the four positions available for each switch:

a. Fuel Cutoff (Solid Red Outline)
b. Main Tank (Solid Blue Outline)
c. Auxiliary Tank (Blue and Yellow Stripes)
d. Crossfeed (Solid Yellow Outline)

Warning: DO NOT switch fuel tanks with engines running unless you also place the auxiliary fuel pump switch for that engine in LOW before changing the selector. Failing to do this risks an interruption in the fuel supply to the engine.



Fuel Gauge

The fuel gauge featured on the 310R is of a dual needle type, with the left needle corresponding to the left tanks and the right needle corresponding to the right tanks. The gauge is graduated in gallons of fuel remaining on the blue arc, and pounds of fuel remaining on the white arc.

The fuel gauge automatically shows the usable fuel remaining on the tank selected by the fuel control for that engine. If the main fuel tank is selected by the fuel control switch, the gauge will display the remaining usable fuel for the main fuel tank. If the auxiliary fuel tank is selected by the fuel control switch, the gauge will display the remaining usable fuel for the auxiliary tank.

The switch immediately below the fuel gauge is a three position momentary switch that is spring loaded to the center position. To temporarily display the fuel in the main tanks, drag the switch upwards (or rotate the mouse wheel upwards). The switch is spring loaded and will return to center when released. To temporarily display the aux tank quantities, move the switch downward by dragging it or using the down scroll on the mouse wheel.

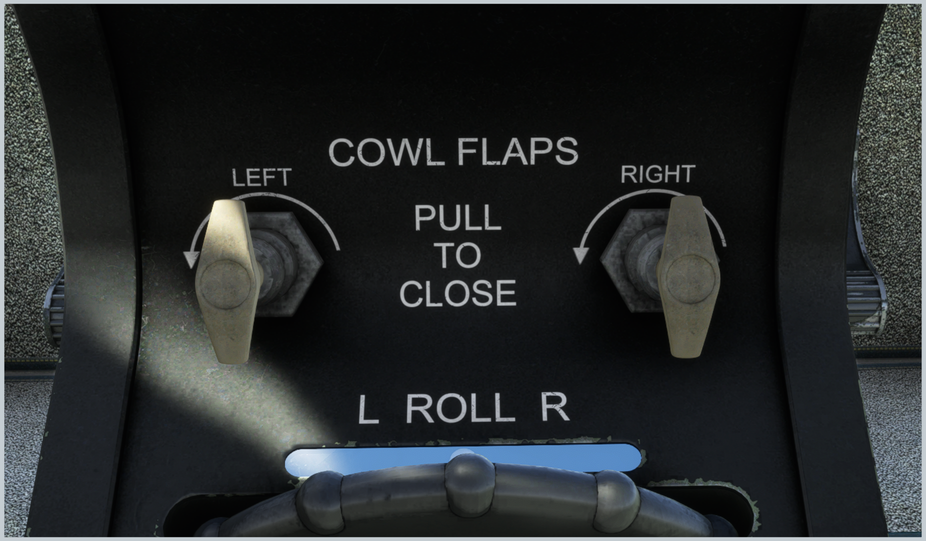
The indicator lamps to either side of the switch will illuminate when the pilot has selected the auxiliary fuel tank for the associated engine.

Separate warning lamps will illuminate to warn the pilot of low fuel in the main tanks only; there is no warning for low fuel in the aux tanks.

WARNING: If the aux tanks are selected and fuel in them is exhausted, the engines will quit due to fuel starvation - these is no automatic switch to main tanks regardless of the quantity in them. The pilot must carefully monitor the fuel status at all times but particularly when on aux tanks.

Caution: The fuel-injected engines of the 310R return about 30% of unused fuel to the main tanks when in operation. If the aux tanks are selected but the main tanks do not have sufficient empty capacity to hold this returned fuel, this 30% is vented outside and lost. The manufacturer recommends that aux tanks not be selected until after ninety (90) minutes of flight time.

Cowl Flaps



The dual cowl flap controls on the 310R are located on the lower portion of the pedestal. They control the cowl flaps, which are internally located in the rear section of each engine nacelle, underneath the prominent grill.

The cowl flaps on the 310R are designed to minimize drag when in the open position and as such, normal operation is for the cowl flaps to be left in the fully open position.

The only times when the cowl flaps require attention is to prevent shock cooling of the engine during rapid descents, during simulated single engine training, or when conduction engine shutdowns for emergencies or training purposes.

To close the cowl flaps, place the mouse cursor over the cowl flap handle for the cowl flap you wish to adjust, then drag the cursor aft to pull out the handle.

To open the cowl flaps, place the mouse cursor over the cowl flap handle for the cowl flap you wish to adjust, then drag the cursor forward to push the handle in.

This action visibly pulls the respective cowl flap handle outwards in the virtual cockpit.

Doors & Windows

The Blackbird 310R has an operable main cabin door, as well as an animated baggage door, nose baggage door, and left and right wing locker doors.

To operate the main cabin door from within the virtual cockpit, click the LEFT MOUSE BUTTON on the door lever located on the right side of the cockpit.

The tablet can be used to open or close any of the doors on the aircraft.

Storm Window

The 310R features a pilot side storm window which is fully animated.

To operate the window, click the LEFT MOUSE BUTTON on the aluminum window latch. This will swing the window open inwards, or closed, depending on the previous position of the window.

Hiding the Yokes

A common issue within the simulator is that it's possible for the yoke to obscure switches and controls, such as those on the 310R's lower switch panel.

To alleviate that issue, both the left and right yokes in the 310R may be toggled on or off.

To hide the yoke, click where the yoke shaft meets the panel. To show the yoke again, simply click in the same location.

Hobbs Meter

The meter can be found just below and to the right of the co-pilot yoke. Any movement over 20 knots will accumulate the Hobbs counter in increments of .1 hours (6 minutes). It starts at zero for any "Default" or "Owned" option, but for Rental, it will start with a random quantity the first time, and count up from there.

Also for a Rental, a small increment will happen between flights, as other renters make use of the plane.

Section 4
Normal Procedures

Table of Contents

Introduction

Section 4 of this user guide outlines the interactive checklists which are accessible at all times via the main in-game drop down menu. Not all checklist items present in this section are found in the in-game checklists due to reasons of practicality for certain items.

It's your choice whether you read the lists and complete each one manually, or click 'Evaluation' to have the sim focus the view on the next item, with the specific control highlighted.

Note that any item with a pilot icon will require input in order to proceed to the next step.

Using the 'Auto Complete' option is not recommended due to inconsistencies with our custom code. Items may appear checked when, in reality, they have not been completed.

For reference purposes, we have included checklists for emergency scenarios that do not exist in the in-game checklist system. These can be found in Section 5.

Cockpit Preflight

1. Control Lock......REMOVE AND STOW
2. Parking Brake......SET
3. All Switches......OFF
4. All Circuit Breakers......IN
5. Fire Extinguisher......CHECK SECURE
6. Voltmeter Selector......BAT
7. Landing Gear Switch......DOWN
8. Left Fuel Selector......LEFT MAIN
9. Right Fuel Selector......RIGHT MAIN
10. Trim Tab Controls (3)......SET FOR TAKEOFF
11. Battery Switch......ON
12. Navigation and Anti-Collision Lights......CHECK OPERATION
13. Navigation and Anti-Collision Lights......OFF
14. Fuel Gauges......CHECK QUANTITY AND OPERATION
15. Wing Flaps......DOWN 15°
16. Pitot Heat......ON 20 SECONDS THEN OFF
17. Battery Switch......OFF
18. External Inspection......COMPLETED
19. Pitot Covers......REMOVE

Before Starting Engines

1. Preflight Inspection......COMPLETE
2. Cabin Door......LATCHED AND SECURE
3. Control Locks......REMOVE
4. Seat and Seat Belts......ADJUST AND SECURE
5. Brakes......SET
6. Fuel Selectors......MAIN TANKS
7. Landing Gear Switch......DOWN
8. Mixtures......FULL RICH
9. Propellers......FULL FORWARD
10. Throttles......OPEN ONE INCH
11. All Switches......OFF
12. Circuit Breakers......IN
13. Emergency Alternator Field Switch......OFF
14. Emergency Avionics Power Switch......OFF
15. Avionics Master Switch......OFF
16. Auxiliary Fuel Pump Switches......OFF
17. Battery and Alternators......ON
18. Lighting Rheostats......AS REQUIRED
19. Landing Gear Position Indicator Lights......CHECK GREEN LIGHTS ON
20. All Warning Lights......PRESS-TO-TEST
21. Altimeter and Clock......SET
22. Cowl Flaps......LOCKED FULL OPEN
23. Fuel Quantity......CHECK
24. Cabin Air Controls......AS REQUIRED
25. Alternate Air Controls......IN
26. External Lights......AS REQUIRED

Starting Engines

1. Propeller....CLEAR
2. Magneto Switches....ON
3. Left Engine....START
   a. Primer Switch....LEFT
   b. Starter Button....PRESS AND HOLD
   c. Auxiliary Fuel Pump....LOW
   d. Throttle....800 to 1000 RPM
   e. Oil Pressure....10 PSI MINIMUM IN 30 SECONDS
4. Right Engine....START
   a. Primer Switch....RIGHT
   b. Starter Button....PRESS AND HOLD
   c. Auxiliary Fuel Pump....LOW
   d. Throttle....800 to 1000 RPM
   e. Oil Pressure....10 PSI MINIMUM IN 30 SECONDS
5. Alternators....CHECK

Before Taxiing

1. Passenger Briefing....COMPLETE
2. Avionics Master Switch....ON
3. Avionics....SET
4. Lights....AS REQUIRED
5. Cabin Temperature....AS REQUIRED
   a. If heating and defrosting is required:
      i. Cabin Air Knobs....OPEN
      ii. Defrost Knob....AS REQUIRED
      iii. Temperature Control Knob....OPEN
      iv. Cabin Heat Switch....HEAT
      v. Heat Registers....AS REQUIRED
   b. If ventilation is required:
      i. Cabin Air Knobs....OPEN
      ii. Cabin Heat Switch....FAN
      iii. Heat Registers and Directional Air Vents....AS REQUIRED
6. Brakes....RELEASE

Taxiing

1. Throttles....AS REQUIRED
2. Brakes....CHECK
3. Flight Instruments....CHECK

Before Takeoff

1. Parking Brake....SET
2. Fuel Quantity....CHECK
3. Fuel Selectors....RECHECK ON MAIN TANKS
4. Alternate Air Controls....IN
5. Cowl Flaps....OPEN
6. Elevator, Rudder, Aileron Trim....SET FOR TAKEOFF
7. Wing Flaps....UP
8. Avionics and Radios....SET
9. Flight Instruments....SET
10. Auxiliary Fuel Pumps....LOW
11. Flight Controls....FREE AND CORRECT
12. Engine Runup:
    a. Throttles....1700 RPM
    b. Alternators....CHECK
    c. Vacuum System....CHECK
    d. Magnetos....CHECK
    e. Propellers....CHECK FEATHERING TO 1200 RPM; RETURN TO FULL
    f. Mixtures....CHECK RICH
    g. Engine Instruments....CHECK IN GREEN ARC
    h. Throttles....1000 RPM
    i. Quadrant Friction Lock....ADJUST
13. Exterior Lights....AS REQUIRED
14. Ice Protection Equipment....AS REQUIRED
15. All Cabin Doors and Windows....CLOSED AND LATCHED
16. Parking Brake....RELEASE

Normal Takeoff

1. Power....FULL THROTTLE AND 2700 RPM
2. Mixtures....LEAN FOR FIELD ELEVATION
3. Engine Instruments....CHECK
4. Air Minimum Control Speed....80 KIAS
5. Elevator Control....RAISE NOSEWHEEL AT 83 KIAS
6. Lift-Off....92 KIAS AT 5500 POUNDS

Maximum Performance Takeoff

1. Wing Flaps....DOWN 15°
2. Brakes....SET
3. Power....FULL THROTTLE
4. Mixtures....LEAN FOR FIELD ELEVATION
5. Brakes....RELEASE
6. Power....CHECK 2700 RPM
7. Elevator Control....RAISE NOSEWHEEL AT 70 KIAS
8. Air Minimum Control Speed....80 KIAS
9. Lift-Off....82 KIAS AT 5500 POUNDS

After Takeoff

1. Brakes....APPLY MOMENTARILY
2. Landing Gear....RETRACT CHECK RED LIGHT OFF
3. Wing Flaps....UP IF MAXIMUM PERFORMANCE TAKEOFF
4. Best Angle-of-Climb Speed....85 KIAS AFTER 50 FT OBSTACLES
5. Best Rate-of-Climb Speed....107 KIAS AT 5500 POUNDS
6. Auxiliary Fuel Pumps....AS REQUIRED

Cruise Climb

1. Power....2500 RPM and 24.5 inches Hg
2. Airspeed....115 to 130 KIAS
3. Mixtures....ADJUST TO CLIMB FUEL FLOW
4. Cowl Flaps....OPEN OR AS REQUIRED
5. Auxiliary Fuel Pumps....LOW ABOVE 12,000 FEET
6. Propellers....SYNCHRONIZE MANUALLY
7. Quadrant Friction Lock....TIGHTEN SECURELY

Maximum Performance Climb

1. Power....FULL THROTTLE AND 2700 RPM
2. Airspeed....107 KIAS AT SEA LEVEL; 99 KIAS AT 10,000 FEET
3. Mixtures....ADJUST FOR ALTITUDE AND POWER
4. Cowl Flaps....OPEN AS REQUIRED
5. Auxiliary Fuel Pumps....LOW ABOVE 12,000 FEET

Cruise

1. Cruise Power....2100 to 2500 RPM and 15.0 to 24.5 inches Hg
2. Auxiliary Fuel Pumps:
   a. Main Tanks....OFF OR LOW IF REQUIRED
   b. Switching Tanks....LOW
   c. Auxiliary Tanks....OFF
   d. Crossfeeding....LOW
3. Mixtures....LEAN FOR DESIRED CRUISE FUEL FLOW
4. Cowl Flaps....OPEN OR AS REQUIRED
5. Propellers....SYNCHRONIZE MANUALLY
6. Quadrant Friction Lock....TIGHTEN SECURELY
7. Fuel Selectors....MAIN TANKS FOR 90 MINUTES
8. Trim Tabs....ADJUST

Descent

1. Fuel Selectors....MAIN TANKS
2. Auxiliary Fuel Pumps....LOW
3. Power....AS REQUIRED
4. Cowl Flaps....AS REQUIRED
5. Mixtures....ADJUST FOR SMOOTH OPERATION
6. Altimeter....SET

Before Landing

1. Seat Belts....SECURE
2. Alternate Air Controls....CHECK IN
3. Wing Flaps....DOWN 15° BELOW 158 KIAS
4. Landing Gear....DOWN BELOW 138 KIAS
5. Landing Gear Indicators....CHECK DOWN LIGHTS ON, UNLOCKED LIGHT OFF
6. Mixtures....FULL RICH OR LEAN AS REQUIRED
7. Propellers....FULL FORWARD
8. Wing Flaps....DOWN 35° BELOW 138 KIAS
9. Minimum Multi-Engine Approach Speed....93 KIAS AT 5400 POUNDS

After Landing

1. Auxiliary Fuel Pumps....LOW DURING LANDING ROLL
2. Cowl Flaps....OPEN
3. Wing Flaps....UP

Shutdown

1. Parking Brake....SET IF BRAKES ARE COOL
2. Avionics Master Switch....OFF
3. All Switches Except Battery, Alternator, and Magnetos....OFF
4. Auxiliary Fuel Pumps....OFF
5. Throttles....IDLE
6. Mixtures....IDLE CUT-OFF
7. Battery and Alternators....OFF
8. Magneto Switches....OFF AFTER ENGINES STOP
9. Control Locks....INSTALL
10. Fuel Selectors....OFF
11. Cabin Door....CLOSE

Section 5
Emergency Procedures

Table of Contents

Introduction

Section of this user guide describes the recommended procedures for a variety of emergency situations.

All of these procedures are critical to simulated flight safety and represent correct responses to emergency situations that can occur as a result of checking any "failures' option on the tablet (EFB) Options page other than "Never". The prudent pilot will study these carefully and commit the most time-critical (such as engine failure on takeoff) to memory. Aerial practice of them is strongly advised.

Balked Landing (Go Around)

1. Power....................2700 RPM OR FULL THROTTLE IF NECESSARY
2. Mixtures....................AS REQUIRED
3. Balked Landing Transition Speed....................85 KIAS
4. Landing Gear....................RETRACT
5. Wing Flaps....................15°
6. Trim....................SET FOR CLIMB
7. Cowl Flaps....................OPEN
8. Wing Flaps....................UP AFTER PASSING OBSTACLES

Engine Securing Procedure

1. Throttle....................CLOSE
2. Mixture....................IDLE CUT-OFF
3. Propeller....................FEATHER
4. Fuel Selector....................OFF
5. Auxiliary Fuel Pump....................OFF
6. Magneto Switches....................OFF
7. Alternator....................OFF
8. Cowl Flap....................CLOSE

Engine Failure During Takeoff

1. Throttles....................CLOSE IMMEDIATELY
2. Brake or Land and Brake....................AS REQUIRED

Engine Failure After Takeoff

1. Mixtures....................AS REQUIRED
2. Propellers....................FULL FORWARD
3. Throttles....................FULL FORWARD
4. Landing Gear....................CHECK UP
5. Inoperative Engine:
   a. Throttle....................CLOSE
   b. Mixture....................IDLE CUT-OFF
   c. Propeller....................FEATHER
6. Establish Bank....................5° TOWARD OPERATIVE ENGINE
7. Wing Flaps....................UP IF EXTENDED
8. Climb to Clear 50-Foot Obstacle....................92 KIAS
9. Climb Speed with One Engine Inoperative....................106 KIAS
10. Trim Tabs............5° BANK TOWARD INOP ENGINE, 1/2 BALL SLIP INDICATION
11. Cowl Flap....................CLOSE (INOPERATIVE ENGINE)
12. Secure Inoperative Engine as Follows:
    a. Fuel Selector....................OFF
    b. Auxiliary Fuel Pump....................OFF
    c. Magneto Switches....................OFF
    d. Alternator Switch....................OFF
13. AS SOON AS PRACTICAL....................LAND

Engine Failure During Flight (Above vMCA)

1. Inoperative Engine....DETERMINE
2. Operative Engine....ADJUST AS REQUIRED
3. Fuel Flow....CHECK
4. Fuel Selectors....MAIN TANKS
5. Fuel Quantity....CHECK
6. Oil Pressure and Temperature....CHECK
7. Magneto Switches....CHECK ON
8. Mixture....ADJUST UNTIL EVIDENCE OF ENGINE FIRING
9. If Inoperative Engine Does Not Start, Secure:
    a. Throttle....CLOSE
    b. Mixture....IDLE CUT-OFF
    c. Propeller....FEATHER
    d. Fuel Selector....OFF
    e. Auxiliary Fuel Pump....OFF
    f. Magneto Switches....OFF
    g. Alternator Switch....OFF
    h. Cowl Flap....CLOSE
10. Adjust Operative Engine:
    a. Power....AS REQUIRED
    b. Mixture....AS REQUIRED
    c. Fuel Selector....AS REQUIRED
    d. Auxiliary Fuel Pump....LOW
    e. Cowl Flap....AS REQUIRED
11. Trim Tabs....5° BANK TOWARD OP. ENGINE, 1/2 BALL SLIP INDICATION
12. Electrical Load....DECREASE TO MINIMUM REQUIRED
13. As Soon as Practical....LAND

Engine Failure During Flight (Below vMCA)

1. Rudder....APPLY TOWARDS OPERATIVE ENGINE
2. Power....REDUCE TO STOP TURN
3. Pitch Attitude....LOWER NOSE TO ACCELERATE ABOVE VMCA
4. Inoperative Engine Propeller....FEATHER
5. Operative Engine....INCREASE POWER AS AIRSPEED PASSES VMCA
6. Inoperative Engine....SECURE
7. Trim Tabs....5° BANK TOWARD OP. ENGINE, 1/2 BALL SLIP INDICATION
8. Operative Engine Cowl Flap....AS REQUIRED

Engine Inoperative Landing

1. Fuel Selector....MAIN TANK
2. Auxiliary Fuel Pump....LOW ON OPERATIVE ENGINE
3. Alternate Air Control....IN
4. Mixture....AS REQUIRED
5. Propeller....FULL FORWARD
6. Approach....106 KIAS WITH EXCESS ALTITUDE
7. Landing Gear....DOWN WITHIN GLIDING DISTANCE
8. Wing Flaps....DOWN WHEN LANDING IS ASSURED
9. Speed....DECREASE BELOW 93 KIAS ONLY IF LANDING IS ASSURED
10. Air Minimum Control Speed....80 KIAS

Engine Inoperative Go Around

1. POWER.....INCREASE 2700 RPM AND FULL THROTTLE
2. Mixture.....AS REQUIRED
3. Positive Rate-of-Climb.....ESTABLISH
4. Landing Gear.....UP
5. Wing Flaps.....UP IF EXTENDED
6. Cowl Flap.....OPEN
7. Climb Speed.....106 KIAS AT SEA LEVEL, 94 KIAS AT 10,000 FEET
8. Trim Tabs.....5° BANK TOWARD OP. ENGINE, 1/2 BALL SLIP INDICATION

Air Start (After Feathering)

1. Auxiliary Fuel Pump.....CHECK OFF
2. Magneto Switches.....ON
3. Fuel Selector.....MAIN TANK
4. Throttle.....FORWARD APPROX ONE INCH
5. Mixture.....AS REQUIRED
6. Primer Switch.....DEAD ENGINE (LEFT OR RIGHT)
7. Starter Button.....PRESS, RELEASE WHEN ENGINE FIRES
8. Auxiliary Fuel Pump.....LOW
9. Propeller.....FORWARD OF FTH DETENT
10. Mixture.....AS REQUIRED
11. Power.....INCREASE AFTER CHT REACHES 200°F
12. Cowl Flap.....AS REQUIRED
13. Alternator.....ON

Dual Engine Failure During Cruise Flight

1. Wing Flaps.....UP
2. Landing Gear.....UP
3. Propeller.....FEATHER
4. Cowl Flaps.....CLOSE
5. Airspeed.....111 KIAS
6. Landing.....COMPLETE FORCED LANDING CHECKLIST

Emergency Descent (Calm Air)

1. Throttles.....IDLE
2. Propellers.....FULL FORWARD
3. Mixtures.....ADJUST
4. Wing Flaps.....UP
5. Landing Gear.....UP
6. Moderate Bank.....INITIATE UNTIL DESCENT ATTITUDE REACHED
7. Airspeed.....220 KIAS

Emergency Descent (Turbulent Air)

1. Throttles.....IDLE
2. Propellers.....FULL FORWARD
3. Mixtures.....ADJUST
4. Wing Flaps.....DOWN 35°
5. Landing Gear.....DOWN
6. Moderate Bank.....INITIATE UNTIL DESCENT ATTITUDE REACHED
7. Airspeed.....138 KIAS

Forced Landing (With Power)

1. Fly over selected field with 15° wing flaps and 100 KIAS, noting terrain.
2. If Surface is Smooth and Hard:
   a. LANDING....NORMAL
3. If Terrain is Rough or Soft:
   a. Approach....100 KIAS AND 15° WING FLAPS
   b. All Switches Except Magneto Switches....OFF
   c. Cabin Door....UNLATCH PRIOR TO FLARE-OUT
   d. Mixtures....IDLE CUT-OFF
   e. Magneto Switches....OFF
   f. Fuel Selectors....OFF
   g. Landing Attitude....SLIGHTLY NOSE HIGH

Forced Landing (Complete Power Loss)

1. Mixtures....IDLE CUT-OFF
2. Propellers....FEATHER
3. Fuel Selectors....OFF
4. All Switches Except Battery Switch....OFF
5. Approach Speed....111 KIAS
6. If Terrain is Smooth and Hard:
   a. Landing Gear....DOWN WITHIN GLIDING DISTANCE
   b. Wing Flaps....EXTEND AS NECESSARY WITHIN GLIDING DISTANCE
   c. Battery Switch....OFF
   d. Cabin Door....UNLATCH PRIOR TO FLARE-OUT
   e. Landing....NORMAL
7. If Terrain is Rough or Soft:
   a. Landing Gear....UP
   b. Approach....92 KIAS AND 15° WING FLAPS
   c. Battery Switch....OFF
   d. Cabin Door....UNLATCH PRIOR TO FLARE-OUT
   e. Landing Attitude....SLIGHTLY NOSE HIGH

Landing Without Flaps

1. Mixtures....AS REQUIRED
2. Propellers....FULL FORWARD
3. Fuel Selectors....MAIN TANKS
4. Minimum Approach Speed....105 KIAS
5. Landing Gear....DOWN

Ditching

1. Landing Gear....UP
2. Plan approach into wind if winds are high and seas are heavy. With heavy swells and light wind, land parallel to swells, being careful not to allow wing tips to hit first.
3. Wing Flaps....DOWN 35°
4. Carry sufficient power to maintain approximately 300 feet per minute rate-of-descent.
5. Airspeed....93 KIAS AT 4600 POUNDS
6. Maintain a continuous descent until touchdown to avoid flaring and touching down tail first, pitching forward sharply, and decelerating rapidly. Strive for initial contact at fuselage area below rear cabin section.

Engine-Driven Fuel Pump Failure

1. Fuel Selector....MAIN TANK
2. Auxiliary Fuel Pump....HIGH
3. Cowl Flap....OPEN
4. Mixture....ADJUST FOR SMOOTH OPERATION
5. As Soon as Practical....LAND
6. Fuel in auxiliary and oppose main tank is unusable.

Alternator Failure (Single)

1. Electrical Load....................REDUCE
2. If Circuit Breaker is Tripped:
   a. Turn off affected alternator.
   b. Reset affected alternator circuit breaker.
   c. Turn on affected alternator switch.
   d. If circuit breaker reopens, turn off alternator.
3. If Circuit Breaker is Not Tripped:
   a. Select affected alternator on voltammeter and monitor output.
   b. If output is normal and failure light remains on, disregard fail indication.
   c. If output is insufficient, turn off alternator and reduce electrical load to one alternator capacity.
   d. Restrict load on remaining alternator to 80% of the rated load.

Alternator Failure (Dual)

1. Electrical Load....................REDUCE
2. If Circuit Breaker is Tripped:
   a. Turn off alternators.
   b. Reset circuit breakers.
   c. Turn on left alternator and monitor output on voltammeter.
   d. If alternator is charging, leave it on. Disregard failure light if still illuminated.
   e. If still inoperative, turn off left alternator.
   f. Repeat steps C through E for right alternator.
3. If Circuit Breaker is Not Tripped:
   a. Turn off alternators.
   b. Turn on left alternator and monitor output on voltammeter.
   c. If alternator is charging, leave it on. Disregard failure light if still illuminated.
   d. If still inoperative, turn off left alternator.
   e. Repeat steps C through E for right alternator.
   f. If both alternators are still inoperative, turn off alternators and turn on emergency alternator field switch.
   g. If still inoperative, turn off alternator, nonessential electrical items and prepare to terminate flight.

Avionics Bus Failure

1. Avionics Master Switch....................OFF
2. Emergency Avionics Power Switch....................ON

Landing Gear Will Not Extend Electrically

1. Before proceeding manually, check landing gear motor circuit breaker with landing gear switch DOWN. If circuit breaker is tripped, allow 3 minutes for it to cool before resetting.
2. If Landing Gear Motor Circuit Breaker Not Tripped....................PULL
3. Landing Gear Select Switch....................NEUTRAL
4. Handcrank....................EXTEND AND LOCK
5. Rotate Crank....CLOCKWISE FOUR TURNS PAST GEAR LIGHT ILLUMINATION
6. Gear Down Lights....................ON, UNLOCKED LIGHT OFF
7. Gear Warning Horn....................CHECK WITH THROTTLE RETARDED
8. Handcrank....................STOW
9. As Soon as Practical....................LAND

Landing Gear Will Not Retract Electrically

1. Do not try to retract manually.
2. Landing Gear....................DOWN
3. Gear Down Lights....................ON, UNLOCKED LIGHT OFF
4. Gear Warning Horn....................CHECK
5. As Soon as Practical....................LAND

Vacuum Pump Failure

1. Failure indicated by left or right red failure button exposed on vacuum gauge.
2. Automatic valve will select operative source.
3. Vacuum Pressure................CHECK PROPER VACUUM FROM OPERATIVE SOURCE

Air Inlet or Filter Icing Emergencies

1. Alternate Air Control(s)..PULL OUT
2. Propeller(s)...INCREASE AS REQUIRED
3. Mixture(s)...LEAN AS REQUIRED

Spins

1. Throttles...CLOSE IMMEDIATELY
2. Ailerons...NEUTRALIZE
3. Rudder................................HOLD FULL RUDDER OPPOSITE SPIN DIRECTION
4. Control Wheel..FORWARD BRISKLY
5. Inboard Engine....................................INCREASE POWER TO SLOW ROTATION
6. After Rotation has Stopped:
7. Rudder..NEUTRALIZE
8. Inboard Engine (If Used).............DECREASE POWER TO EQUALIZE ENGINES
9. Control Wheel...PULL TO RECOVER

Section 6
Performance

Table of Contents

Introduction

Section 6 of this User Guide contains performance information required to operate the airplane safely and to help you plan your flights in detail with reasonable accuracy. Safe and precise operation of the airplane requires the pilot to be thoroughly familiar and understand the data and calculations of this section.

Note that the cruise performance data makes no allowance for wind and/or navigational errors. Allowances for start, taxi, takeoff, climb, descent and 45 minutes reserve are provided in the range profile chart.

To determine pressure altitude at origin and destination airports, add 100 feet to field elevation for each .1 inch Hg. below 29.92, or subtract 100 feet from field elevation for each .1 inch Hg. above 29.92.

The performance charts in this section are not to be used for real-world aviation

Airspeed Calibration
Normal Static Source

NOTE:
1. Indicated airspeed assumes zero instrument error.
2. The following calibrations are not valid in the prestall buffet.
3. The following calibrations are valid for the pilot's and copilot's airspeed indicators when the standard or optional dual static system is installed.

Gear Up Flaps 0°		Gear Down Flaps 15°		Gear Down Flaps 35°	
KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
70	71	70	72	70	71
80	81	80	82	80	81
90	91	90	92	90	91
--	--	--	--	93 *	94 *
100	101	100	102	100	101
110	111	110	112	110	111
120	121	120	122	120	121
140	142	130	132	130	131
160	162	140	142	139	140
180	182	150	152	---	---
200	202	158	160	---	---
220	223	---	---	---	---
223	227	---	---	---	---

*Recommended Minimum All Engines Approach Speed At 5400 Pounds With 35° Wing Flaps.

Airspeed Calibration
Alternate Static Source

Gear Up Flaps 0°		Gear Down Flaps 15°		Gear Down Flaps 35°	
KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
PILOT'S FOUL WEATHER WINDOW CLOSED					
---	---	70	69	70	70
80	80	80	78	80	80
90	90	90	88	90	89
--	--	--	--	96 *	94 *
100	99	100	98	100	98
110	109	110	107	110	107
120	118	120	117	120	117
140	137	130	127	130	126
160	156	140	136	140	135
180	175	150	146	145	140
200	195	160	156	---	---
220	214	165	160	---	---
234	227	---	---	---	---
PILOT'S FOUL WEATHER WINDOW OPENED					
---	---	70	59	70	57
80	69	80	69	80	67
90	78	90	78	90	76
100	88	100	88	100	86
---	---	---	---	109 *	94 *
110	97	110	97	110	95
120	107	120	107	120	105
140	125	130	116	130	114
160	145	140	126	140	123
180	163	150	135	158	140
200	182	160	145	---	---
227	201	176	160	---	---
248	227	---	---	---	---

*Recommended Minimum All Engines Approach Speed At 5400 Pounds With 35° Wing Flaps.

Altimeter Correction
Normal Static Source

NOTE:
1. Add correction to indicated altimeter reading.
2. The following calibrations are valid for the pilot's and copilot's altimeters when the standard or optional dual static system is installed.

Altitude	Sea Level			10,000 Feet			20,000 Feet		
Gear	Up	Down	Down	Up	Down	Down	Up	Down	Down
Flaps	0°	15°	35°	0°	15°	35°	0°	15°	35°
KIAS	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
80	6	14	7	8	19	9	11	26	13
93 *	7	15	7	10	21	10	14	29	14
100	8	19	8	11	26	11	15	35	15
120	10	23	10	14	32	14	19	44	19
140	17	27	13	23	37	19	32	50	25
160	30	30	--	42	41	--	57	55	--
180	37	--	--	51	--	--	69	--	--
200	40	--	--	56	--	--	76	--	--
220	67	--	--	93	--	--	126	--	--

*Recommended Minimum All Engines Approach Speed At 5400 Pounds With 35° Wing Flaps.

ALTITUDE CORRECTION PROCEDURE

[INDICATED ALTITUDE TO FLY] = [DESIRED ALTITUDE (MSL)] - [ALTIMETER CORRECTION]

Altimeter Correction
Alternate Static Source

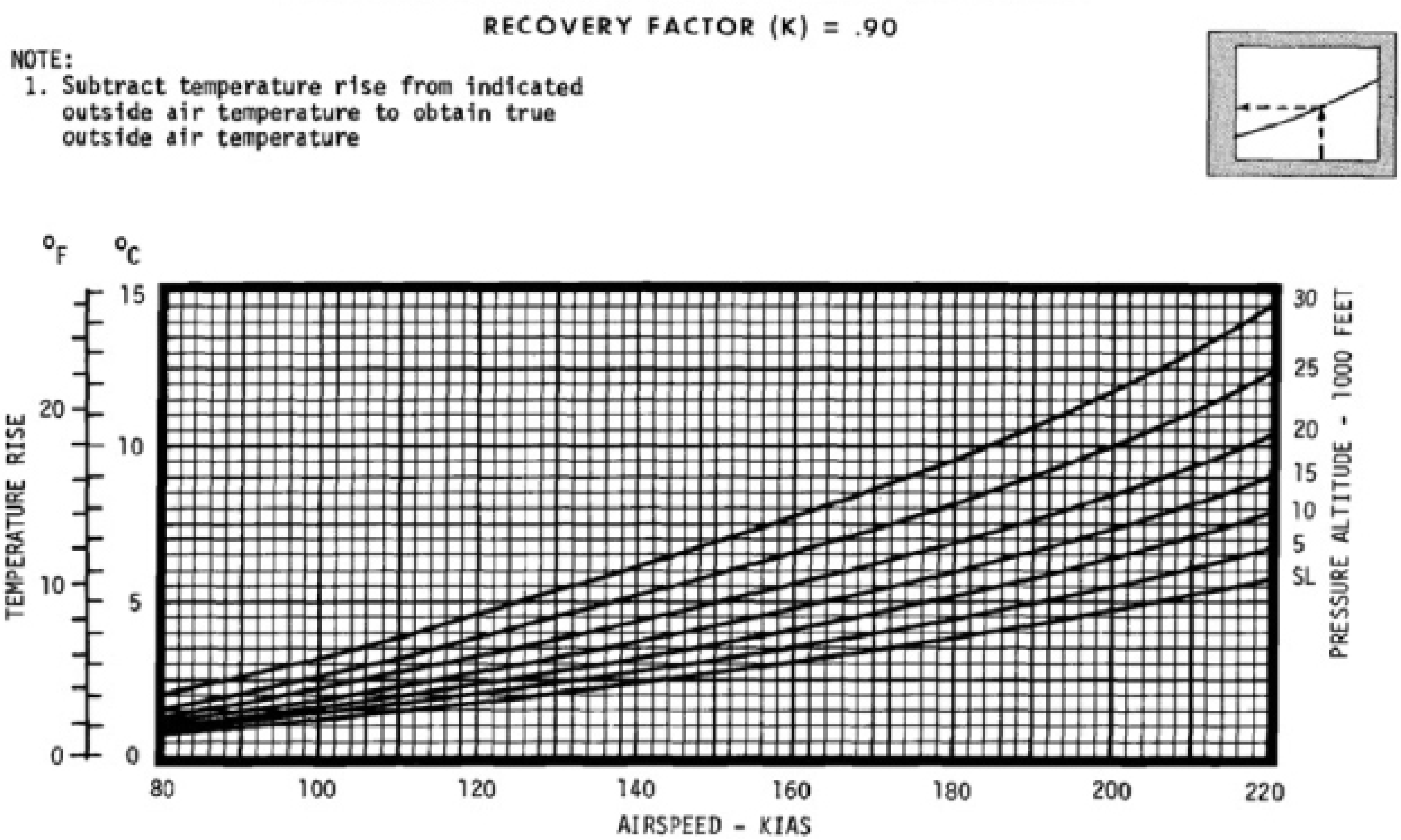
NOTE:
1. Add correction to indicated altimeter reading.
2. The following calibrations are valid for pilot's and copilot's altimeters when the standard static system is installed.
3. An alternate static source is not available for copilot's instruments when the optional dual static system is installed.

PILOT'S FOUL WEATHER WINDOW CLOSED

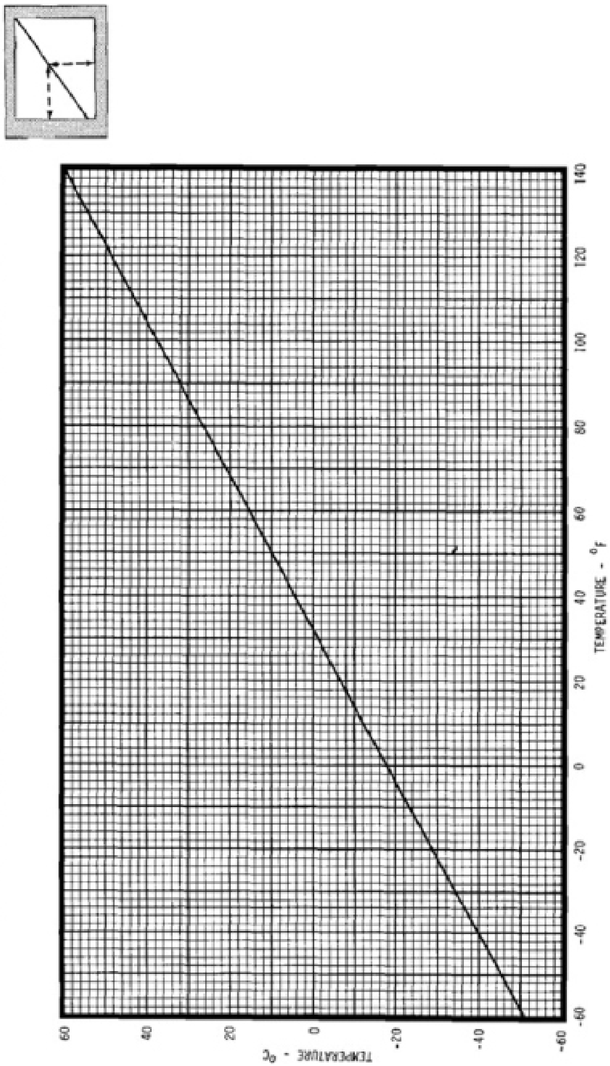
Altitude	Sea Level			10,000 Feet			20,000 Feet		
Gear	Up	Down	Down	Up	Down	Down	Up	Down	Down
Flaps	0°	15°	35°	0°	15°	35°	0°	15°	35°
KIAS	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet
80	0	-13	-4	0	-19	-6	0	-25	-8
96 *	-8	-19	-15	-11	-23	-23	-15	-32	-32
100	-8	-23	-18	-11	-32	-25	-15	-44	-34
120	-20	-34	-34	-28	-46	-46	-38	-63	-63
140	-34	-45	-57	-46	-62	-79	-63	-84	-107
160	-50	-59	----	-69	-81	----	-95	-111	----
180	-74	----	----	-102	----	----	-139	----	----
200	-94	----	----	-130	----	----	-176	----	----
220	-114	----	----	-157	----	----	-214	----	----
PILOT'S FOUL WEATHER WINDOW OPEN									
80	-69	-70	-86	-95	-97	-118	-130	-132	-161
100	-94	-94	-114	-130	-130	-157	-176	-176	-214
109 *	-109	-114	-134	-157	-157	-180	-214	-214	-246
120	-131	-131	-151	-180	-180	-208	-246	-246	-286
140	-174	-168	-194	-241	-231	-268	-328	-315	-365
160	-208	-207	----	-287	-287	----	-391	-391	----
180	-258	----	----	-356	----	----	-485	----	----
200	-304	----	----	-420	----	----	-572	----	----
220	-355	----	----	-490	----	----	-668	----	----

*Recommended Minimum All Engines Approach Speed At 5400 Pounds With 35° Wing Flaps.

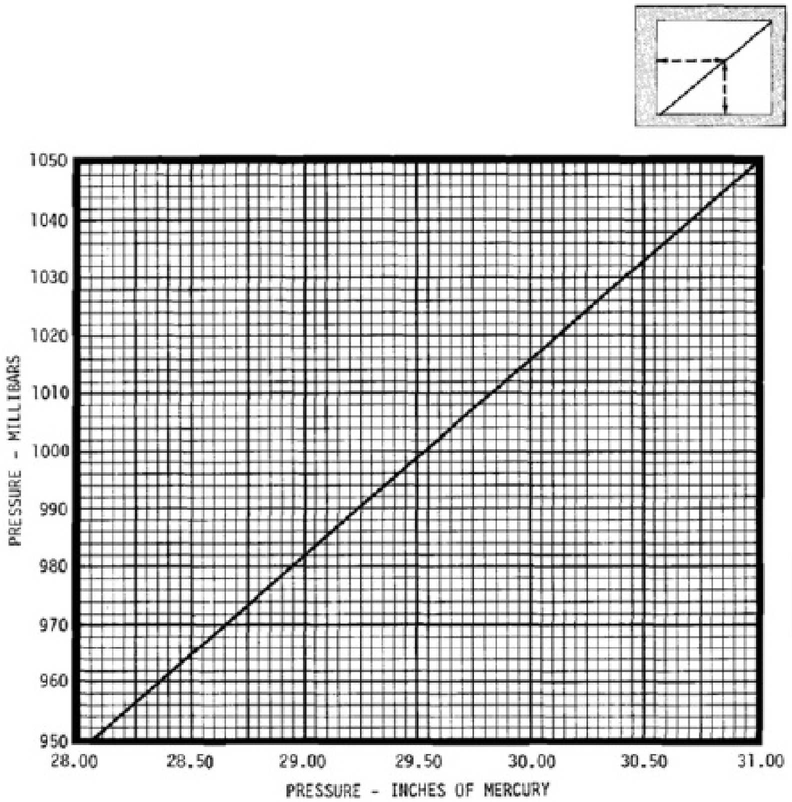
Temperature Rise Due To Ram Recovery



Temperature Conversion
Degrees °F to Degrees °C



Pressure Conversion
Inches of Mercury to Millibars



Stall Speeds

CONDITIONS:

Throttles - IDLE

NOTE:

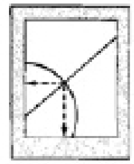
1. Maximum altitude loss during a conventional stall is approximately 320 feet.
2. Maximum nose down pitch attitude and altitude loss during recovery from an engine inoperative stall is approximately 5° below the horizon and 240 feet respectively.

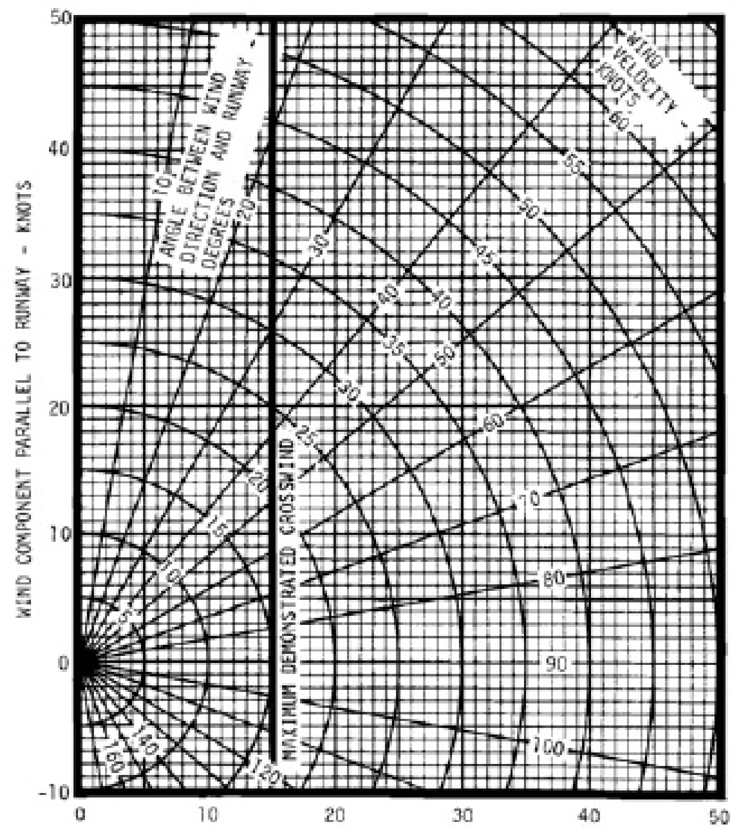
WEIGHT Pounds	Configuration		ANGLE OF BANK							
			0°		20°		40°		60°	
	Flaps	Gear	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
5500	0°	Up	79	78	82	81	91	90	112	111
	15°	Down	77	76	79	78	88	87	109	108
	35°	Down	72	70	74	72	82	80	101	99
5100	0°	Up	76	75	79	78	87	86	108	107
	15°	Down	74	73	77	76	85	84	105	104
	35°	Down	69	67	72	70	79	77	97	95
4700	0°	Up	73	72	76	75	84	83	103	102
	15°	Down	71	70	74	73	81	80	100	99
	35°	Down	67	65	69	67	76	74	94	92
4300	0°	Up	70	69	72	71	80	79	99	98
	15°	Down	68	67	70	69	78	77	96	95
	35°	Down	64	62	66	64	73	71	90	88

Wind Component

NOTE

Maximum Demonstrated Crosswind Velocity is 15 Knots (Not a limitation).





Normal Takeoff Distance

CONDITIONS:
1. Power - FULL THROTTLE and 2700 RPM Before Brake Release.
2. Mixtures - LEAN for field elevation (See Figure 5-27).
3. Wing Flaps - UP.
4. Cowl Flaps - OPEN.
5. Level, Hard Surface, Dry Runway.

NOTE:
1. If full power is applied without brakes set, distances apply from point where full power is applied.
2. Decrease distance 7% for each 10 knots headwind.
3. Increase distance 5% for each 2 knots tailwind.
4. Increase total distance 7.9% for operation on firm dry sod runway.

WEIGHT-POUNDS	TAKEOFF TO 50-FOOT OBSTACLE SPEED-KIAS	PRESSURE ALTITUDE-FEET	-20°C (-4°F)		-10°C (14°F)		0°C (32°F)		10°C (50°F)	
			GROUND ROLL - FEET	TOTAL DISTANCE TO CLEAR 50 FEET	GROUND ROLL - FEET	TOTAL DISTANCE TO CLEAR 50 FEET	GROUND ROLL - FEET	TOTAL DISTANCE TO CLEAR 50 FEET	GROUND ROLL - FEET	TOTAL DISTANCE TO CLEAR 50 FEET
5500	92	Sea Level	1330	1650	1440	1760	1550	1890	1660	2020
		1000	1470	1810	1580	1940	1700	2080	1830	2240
		2000	1610	1990	1740	2140	1880	2300	2020	2470
		3000	1780	2200	1920	2360	2070	2540	2300	2800
		4000	1970	2430	2130	2620	2370	2900	2550	3120
		5000	2180	2700	2430	2980	2620	3220	2820	3470
		6000	2490	3080	2690	3320	2900	3590	3130	3880
		7000	2770	3440	2990	3730	3240	4040	3500	4380
		8000	3090	3880	3350	4220	3620	4590	3920	5000
		9000	3470	4420	3760	4830	4080	5290	4420	5800
		10,000	3880	5050	4220	5550	4580	6130	4980	6810
5100	88	Sea Level	1110	1380	1200	1480	1290	1580	1380	1690
		1000	1220	1510	1320	1620	1420	1740	1520	1860
		2000	1340	1660	1450	1780	1560	1910	1680	2040
		3000	1480	1820	1600	1960	1720	2100	1850	2250
		4000	1630	2010	1760	2160	1900	2330	2050	2500
		5000	1800	2220	1940	2390	2100	2570	2330	2840
		6000	1990	2460	2150	2650	2400	2930	2580	3160
		7000	2210	2730	2470	3030	2660	3270	2870	3530
		8000	2540	3140	2750	3400	2970	3680	3210	3980
		9000	2840	3540	3080	3840	3330	4170	3610	4530
		10,000	3170	3990	3440	4340	3730	4730	4040	5160
4700	85	Sea Level	920	1140	990	1220	1060	1300	1140	1390
		1000	1010	1250	1080	1340	1170	1430	1250	1530
		2000	1100	1360	1190	1460	1280	1570	1370	1670
		3000	1210	1500	1310	1600	1410	1720	1510	1840
		4000	1340	1650	1440	1770	1550	1900	1670	2030
		5000	1470	1810	1590	1940	1710	2090	1840	2240
		6000	1620	2000	1750	2150	1890	2310	2030	2480
		7000	1800	2210	1940	2380	2090	2560	2260	2760
		8000	1990	2460	2160	2650	2330	2860	2600	3170
		9000	2230	2750	2490	3060	2690	3300	2900	3560
		10,000	2560	3160	2770	3420	3000	3700	3240	4010
4300	81	Sea Level	750	930	800	1000	860	1060	920	1130
		1000	820	1020	880	1090	940	1160	1010	1240
		2000	890	1110	960	1190	1030	1270	1110	1360
		3000	980	1210	1050	1300	1130	1390	1220	1490
		4000	1080	1330	1160	1430	1250	1530	1340	1630
		5000	1180	1460	1270	1560	1370	1680	1470	1790
		6000	1300	1600	1400	1720	1510	1840	1620	1980
		7000	1440	1770	1550	1900	1670	2040	1800	2190
		8000	1590	1960	1720	2100	1850	2260	2000	2430
		9000	1770	2180	1910	2340	2060	2530	2230	2720
		10,000	1960	2420	2120	2610	2290	2810	2560	3120

Maximum Performance Takeoff Distance

CONDITIONS:
1. Power - FULL THROTTLE and 2700 RPM Before Brake Release.
2. Mixtures - LEAN for field elevation (See Figure 5-27).
3. Wing Flaps - DOWN 15°.
4. Cowl Flaps - OPEN.
5. Level, Hard Surface, Dry Runway.

NOTE:
1. If full power is applied without brakes set, distances apply from point where full power is applied.
2. Decrease distance 3% for each 4 knots headwind.
3. Increase distance 5% for each 2 knots tailwind.
4. Increase total distance 7.9% for operation on firm dry sod runway.

WEIGHT-POUNDS	TAKEOFF TO 50-FOOT OBSTACLE SPEED-KIAS	PRESSURE ALTITUDE-FEET	-20°C (-4°F)		-10°C (14°F)		0°C (32°F)		10°C (50°F)	
			GROUND ROLL - REET	TOTAL DISTANCE TO CLEAR 50 FEET	GROUND ROLL - FEET	TOTAL DISTANCE TO CLEAR 50 FEET	GROUND ROLL - FEET	TOTAL DISTANCE TO CLEAR 50 FEET	GROUND ROLL - FEET	TOTAL DISTANCE TO CLEAR 50 FEET
5500	82	Sea Level	1040	1340	1120	1440	1200	1540	1290	1650
		1000	1140	1480	1230	1580	1320	1700	1420	1820
		2000	1250	1620	1350	1740	1460	1870	1570	2000
		3000	1380	1780	1490	1920	1610	2060	1730	2210
		4000	1520	1970	1650	2130	1780	2290	1910	2460
		5000	1680	2180	1820	2350	1960	2540	2120	2740
		6000	1860	2420	2010	2620	2170	2830	2350	3060
		7000	2070	2710	2240	2940	2420	3180	2620	3460
		8000	2300	3060	2500	3320	2700	3620	2930	3940
		9000	2580	3480	2800	3800	3040	4160	3410	4690
		10,000	2880	3970	3140	4370	3530	4950	3830	5490
5100	78	Sea Level	870	1130	940	1210	1010	1290	1080	1380
		1000	960	1240	1030	1320	1110	1420	1190	1520
		2000	1050	1350	1130	1450	1210	1550	1310	1660
		3000	1150	1490	1240	1590	1340	1710	1440	1830
		4000	1270	1640	1370	1760	1480	1890	1590	2030
		5000	1400	1800	1510	1940	1630	2090	1750	2240
		6000	1540	1990	1670	2150	1800	2310	1940	2490
		7000	1710	2210	1850	2390	2000	2580	2160	2790
		8000	1900	2480	2060	2680	2220	2900	2400	3140
		9000	2120	2790	2300	3030	2490	3280	2700	3570
		10,000	2360	3140	2570	3420	2780	3730	3020	4070
4700	75	Sea Level	720	940	770	1000	830	1070	890	1140
		1000	790	1030	850	1100	910	1170	980	1250
		2000	860	1120	930	1200	1000	1280	1070	1370
		3000	950	1230	1020	1310	1100	1410	1180	1500
		4000	1040	1350	1120	1440	1210	1550	1300	1660
		5000	1140	1480	1230	1590	1330	1700	1430	1820
		6000	1260	1630	1360	1750	1470	1880	1580	2020
		7000	1390	1800	1510	1930	1620	2080	1750	2240
		8000	1550	2000	1670	2150	1810	2320	1950	2500
		9000	1720	2230	1860	2410	2010	2600	2180	2820
		10,000	1910	2490	2070	2700	2240	2920	2430	3170

Accelerate Stop Distance

CONDITIONS:
1. Power - FULL THROTTLE and 2700 RPM Before Brake Release.
2. Mixtures - LEAN for field elevation (See Figure 5-27).
3. Wing Flaps - UP.
4. Cowl Flaps - OPEN.
5. Level, Hard Surface, Dry Runway.
6. Engine Failure at Engine Failure Speed.
7. Idle Power and Maximum Effective Braking After Engine Failure.

NOTE:
1. If full power is applied without brakes set, distances apply from point where full power is applied.
2. Decrease distance 3% for each 4 knots headwind.
3. Increase distance 5% for each 2 knots tailwind.

WEIGHT - POUNDS	ENGINE FAILURE SPEED - KIAS	PRESSURE ALTITUDE - FEET	TOTAL DISTANCE - FEET						
			-20°C -4°F	-10°C +14°F	0°C 32°F	+10°C +50°F	+20°C +68°F	+30°C +86°F	+40°C +104°F
5500	92	Sea Level	3020	3190	3370	3550	3740	3930	4120
		1000	3220	3400	3590	3790	3990	4210	4490
		2000	3430	3630	3830	4050	4340	4570	4820
		3000	3660	3880	4100	4400	4650	4910	5180
		4000	3920	4160	4480	4730	5000	5290	5590
		5000	4200	4530	4810	5090	5390	5700	6030
		6000	4590	4880	5180	5490	5820	6170	6530
		7000	4950	5270	5600	5940	6310	6700	7110
		8000	5360	5710	6070	6460	6870	7310	7780
		9000	5830	6210	6630	7060	7530	8020	8560
		10,000	6330	6770	7230	7720	8250	8810	9420
5100	88	Sea Level	2540	2680	2830	2980	3140	3300	3470
		1000	2710	2860	3020	3180	3350	3530	3710
		2000	2880	3050	3220	3390	3580	3770	3970
		3000	3070	3250	3440	3630	3830	4040	4330
		4000	3290	3480	3680	3900	4190	4420	4660
		5000	3520	3730	3950	4250	4500	4750	5020
		6000	3770	4010	4320	4580	4850	5130	5430
		7000	4060	4390	4660	4950	5240	5560	5890
		8000	4470	4750	5050	5360	5690	6050	6420
		9000	4840	5160	5490	5840	6220	6610	7030
		10,000	5250	5600	5970	6370	6790	7230	7710
4700	85	Sea Level	2110	2230	2350	2470	2600	2740	2870
		1000	2250	2370	2500	2640	2770	2920	3070
		2000	2390	2520	2660	2810	2960	3120	3280
		3000	2540	2690	2840	3000	3160	3340	3510
		4000	2720	2880	3040	3210	3390	3580	3780
		5000	2900	3080	3260	3440	3640	3840	4130
		6000	3110	3300	3500	3700	3910	4210	4450
		7000	3340	3550	3760	3990	4300	4550	4820
		8000	3600	3830	4070	4390	4660	4940	5230
		9000	3900	4230	4490	4770	5070	5380	5710
		10,000	4300	4580	4870	5180	5510	5860	6240
4300	81	Sea Level	1730	1820	1920	2020	2120	2230	2340
		1000	1830	1940	2040	2150	2260	2380	2500
		2000	1950	2060	2170	2290	2410	2530	2660
		3000	2070	2190	2310	2440	2570	2710	2850
		4000	2210	2340	2470	2610	2750	2900	3060
		5000	2360	2500	2640	2790	2950	3110	3280
		6000	2520	2680	2830	2990	3160	3340	3530
		7000	2710	2870	3040	3220	3410	3600	3880
		8000	2910	3090	3280	3470	3680	3970	4200
		9000	3140	3340	3550	3760	4070	4310	4570
		10,000	3390	3610	3830	4150	4410	4680	4970

Accelerate Go Distance

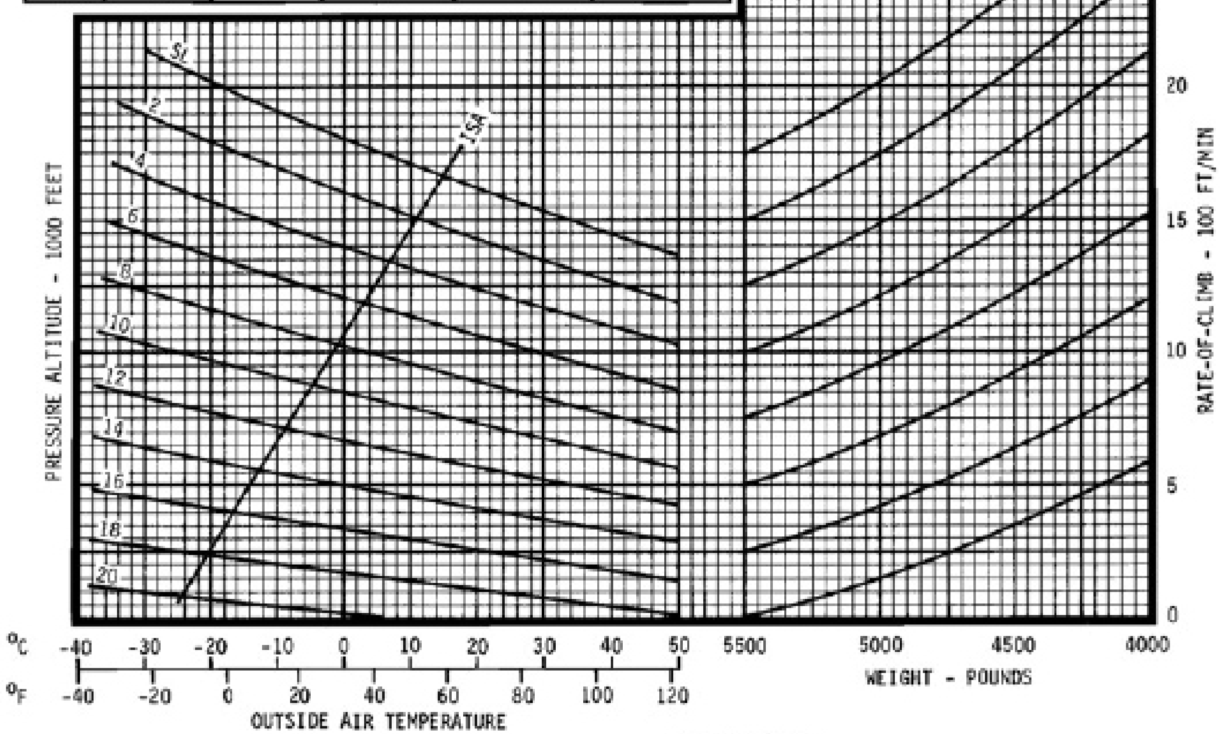
CONDITIONS:
1. Power - FULL THROTTLE and 2700 RPM Before Brake Release.
2. Mixtures - Lean for field elevation (See Figure 5-27).
3. Wing Flaps - UP.
4. Cowl Flaps - OPEN.
5. Level Hard Surface Dry Runway.
6. Engine Failure At Engine Failure Speed.
7. Propeller Feathered and Landing Gear Retracted During Climb.
8. Maintain Engine Failure Speed Until Clear of Obstacle.

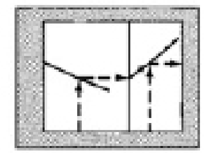
NOTE:
1. If full power is applied without brakes set, distances apply from point where full power is applied.
2. Decrease distance 6% for each 10 knots headwind.
3. Increase distance 2% for each knot of tailwind.
4. Distance in boxes represent rates of climb less than 50 ft/min.

WEIGHT - POUNDS	ENGINE FAILURE - SPEED - KIAS	PRESSURE ALTITUDE - FEET	TOTAL DISTANCE TO CLEAR 50-FOOT OBSTACLE						
			-20°C -4°F	-10°C +14°F	0°C 32°F	+10°C +50°F	+20°C +68°F	+30°C +86°F	+40°C +104°F
5500	92	Sea Level	2600	2850	3120	3450	3840	4320	4950
		1000	3010	3330	3700	4160	4760	5560	6810
		2000	3530	3970	4520	5250	6370	8080	11,540
		3000	4310	4990	5950	7520	10,350	------	------
		4000	5650	7020	9550	$\boxed{15,790}$	------	------	------
		5000	8470	$\boxed{13,010}$	------	------	------	------	------
		6000	------	------	------	------	------	------	------
		7000	------	------	------	------	------	------	------
		8000	------	------	------	------	------	------	------
		9000	------	------	------	------	------	------	------
		10,000	------	------	------	------	------	------	------
5100	88	Sea Level	2030	2190	2360	2560	2780	3030	3320
		1000	2280	2470	2690	2940	3220	3540	3940
		2000	2580	2820	3090	3400	3770	4230	4810
		3000	2960	3270	3630	4060	4600	5330	6430
		4000	3490	3910	4430	5110	6130	7620	10,430
		5000	4200	4820	5680	7030	9280	$\boxed{14,630}$	------
		6000	5350	6500	8480	12,550	------	------	------
		7000	7800	11,240	------	------	------	------	------
		8000	------	------	------	------	------	------	------
		9000	------	------	------	------	------	------	------
		10,000	------	------	------	------	------	------	------
4700	85	Sea Level	1600	1720	1840	1980	2130	2290	2460
		1000	1780	1910	2060	2210	2390	2580	2800
		2000	1980	2130	2300	2490	2700	2930	3200
		3000	2210	2400	2600	2830	3090	3390	3740
		4000	2510	2730	2990	3280	3620	4030	4540
		5000	2860	3140	3460	3850	4320	4930	5820
		6000	3320	3690	4130	4700	5450	6610	8370
		7000	3960	4500	5200	6190	7820	10,780	------
		8000	4990	5920	7350	10,020	$\boxed{16,800}$	------	------
		9000	7040	9510	$\boxed{15,370}$	------	------	------	------
		10,000	$\boxed{13,110}$	------	------	------	------	------	------
4300	81	Sea Level	1270	1360	1450	1550	1650	1760	1890
		1000	1400	1500	1600	1710	1830	1960	2100
		2000	1540	1650	1760	1890	2030	2180	2340
		3000	1700	1820	1960	2110	2270	2440	2640
		4000	1890	2040	2190	2370	2560	2770	3020
		5000	2100	2270	2460	2670	2900	3170	3470
		6000	2360	2570	2790	3050	3340	3690	4100
		7000	2690	2940	3220	3550	3950	4430	5110
		8000	3110	3430	3810	4280	4860	5720	6850
		9000	3690	4150	4710	5460	6610	8330	11,760
		10,000	4490	5190	6160	7730	10,510	------	------

Rate-of-Climb
Maximum Climb

WEIGHT	CLIMB SPEED - KIAS				
Pounds	Sea Level	5000 Feet	10,000 Feet	15,000 Feet	20,000 Feet
5500	107	103	99	95	91
5100	103	99	96	92	88
4700	99	95	92	88	85





CONDITIONS:
1. 2700 RPM and Full Throttle.
2. Landing Gear - UP.
3. Wing Flaps - UP.
4. Cowl Flaps - OPEN.
5. Mixture - ADJUST for Altitude and Power (See Figure 5-27).

Rate-of-Climb
Cruise Climb

CONDITIONS:
1. 2500 RPM and 24.5 Inches Hg.*
2. Landing Gear - UP.
3. Wing Flaps - UP.
4. Cowl Flaps - AS REQUIRED.
5. Airspeed - 120 KIAS.
6. Mixtures - Recommended Fuel Flow.

*Above 5200 feet, use full throttle.

RATE-OF-CLIMB - FT/MIN

WEIGHT-POUNDS	PRESSURE ALTITUDE-FEET	OUTSIDE AIR TEMPERATURE						
		-20°C (-4°F)	-10°C (14°F)	0°C (32°F)	10°C (50°F)	20°C (68°F)	30°C (86°F)	40°C (104°F)
5500	Sea Level	1101	1034	969	906	844	784	726
	1000	1131	1062	995	930	867	805	744
	2000	1160	1089	1020	953	888	824	762
	3000	1189	1115	1044	976	909	843	779
	4000	1216	1141	1068	997	929	861	796
	5000	1239	1162	1087	1015	944	876	808
	6000	1167	1093	1021	951	883	817	752
	7000	1063	993	925	859	795	732	670
	8000	964	899	835	773	712	652	594
	9000	866	804	744	686	629	573	518
	10,000	770	712	656	601	548	495	443
	11,000	674	621	569	518	468	418	370
	12,000	577	528	480	433	386	340	295
	13,000	487	442	397	354	310	268	226
	14,000	394	353	312	272	232	193	154
	15,000	306	267	230	194	157	121	85
	16,000	215	182	148	115	82	49	16
5100	Sea Level	1264	1189	1116	1046	977	910	844
	1000	1297	1220	1145	1072	1002	933	865
	2000	1329	1250	1173	1098	1025	954	885
	3000	1362	1280	1201	1124	1049	976	905
	4000	1391	1307	1226	1147	1070	996	923
	5000	1419	1333	1250	1169	1090	1014	939
	6000	1337	1254	1174	1096	1020	946	874
	7000	1229	1150	1074	1000	929	858	790
	8000	1121	1047	975	905	837	771	706
	9000	1015	946	878	812	748	686	624
	10,000	910	845	782	720	660	601	543
	11,000	808	747	688	630	574	519	464
	12,000	706	650	595	541	489	437	386
	13,000	607	555	504	455	406	357	310
	14,000	509	461	414	368	323	278	234
	15,000	412	369	326	284	242	200	159
	16,000	316	277	238	199	161	123	85
4700	Sea Level	1449	1364	1283	1204	1127	1052	979
	1000	1485	1398	1314	1233	1154	1077	1002
	2000	1520	1431	1344	1261	1179	1100	1023
	3000	1556	1464	1375	1289	1206	1124	1045
	4000	1587	1492	1401	1313	1228	1145	1064
	5000	1622	1525	1432	1341	1253	1168	1085
	6000	1537	1444	1353	1266	1181	1099	1018
	7000	1425	1336	1250	1167	1086	1008	931
	8000	1315	1231	1149	1070	994	919	846
	9000	1208	1128	1051	977	904	833	763
	10,000	1097	1023	950	880	811	744	678
	11,000	993	923	855	789	724	660	598
	12,000	891	825	761	699	638	578	519
	13,000	791	730	670	611	554	498	443
	14,000	691	634	578	524	470	418	366
	15,000	594	541	490	439	389	340	292
	16,000	496	448	400	353	307	262	217

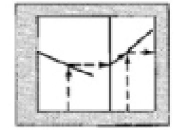
Rate-of-Climb
One Engine Inoperative

NOTE:
Approximate Effect of Configuration on Single Engine Rate-of-Climb.

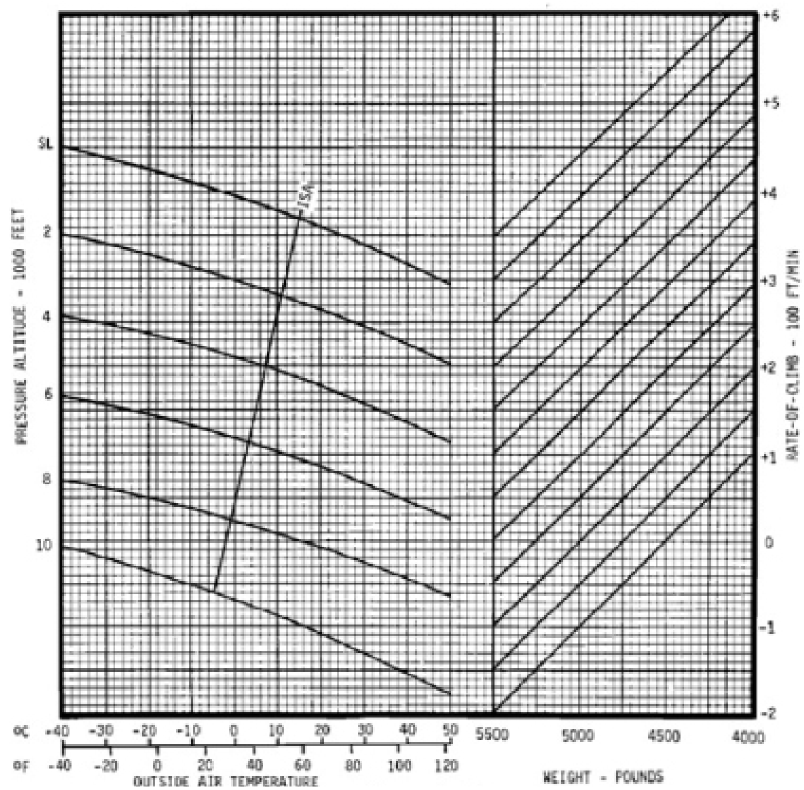
Subtract values listed below from value obtained in the graph. Effects for a combination of gear, flap or windmilling propeller may be obtained by adding the effects for each.

Inoperative Engine Windmilling	400 Ft/Min
Gear Down	300 Ft/Min
Flaps - 15°	150 Ft/Min
Flaps - 35°	550 Ft/Min

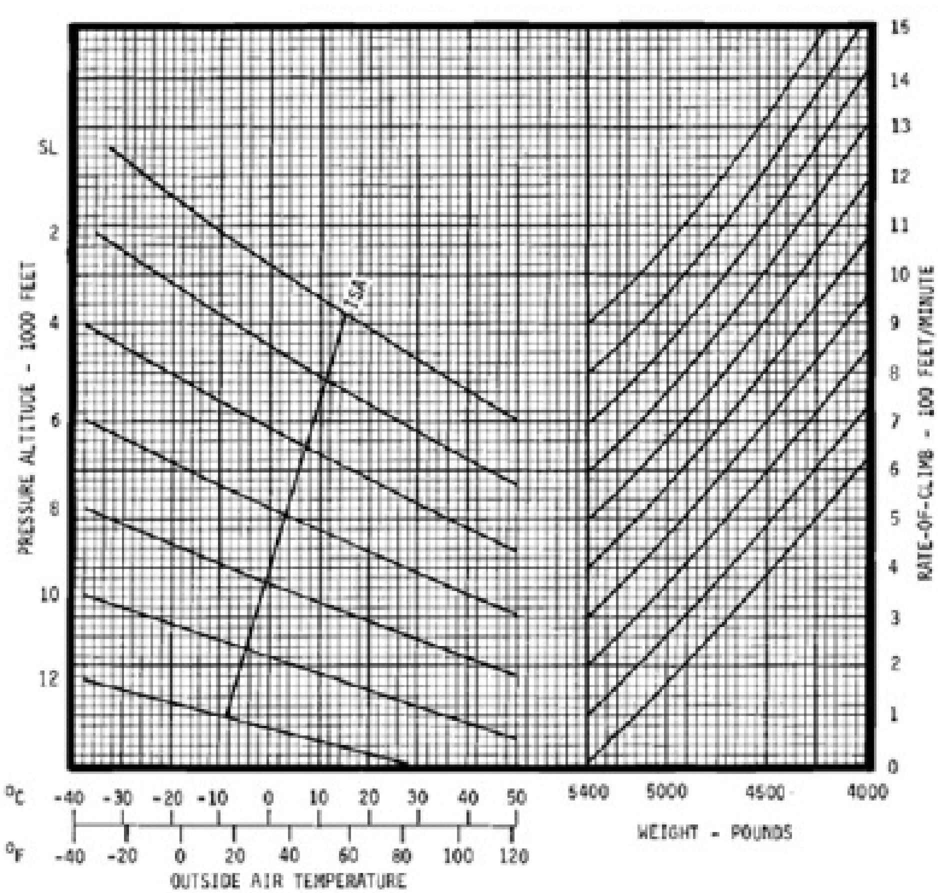
CONDITIONS:
1. 2700 RPM and Full Throttle.
2. Mixture - CHECK Full Power Fuel Flow (See Figure 5-27).
3. Landing Gear - UP.
4. Wing Flaps - UP.
5. Inoperative Propeller - FEATHERED.
6. Wings Banked 5° Toward Operative Engine with Approximately 1/2 Ball Slip Indicated on the Turn and Bank Indicator.
7. Cowl Flaps - CLOSED on Inoperative Engine.

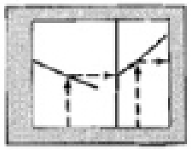


WEIGHT-POUNDS	CLIMB SPEED - KIAS				
	Sea Level	2500 Feet	5000 Feet	7500 Feet	10,000 Feet
5500	106	103	100	97	94
5100	102	99	96	93	90
4700	98	95	92	89	86



Rate-of-Climb
Balked Landing Climb

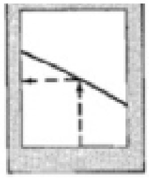




CONDITIONS:
1. 2700 RPM and Full Throttle.
2. Mixtures - AS REQUIRED.
3. Landing Gear - DOWN.
4. Wing Flaps - 35°.
5. Cowl Flaps - OPEN.

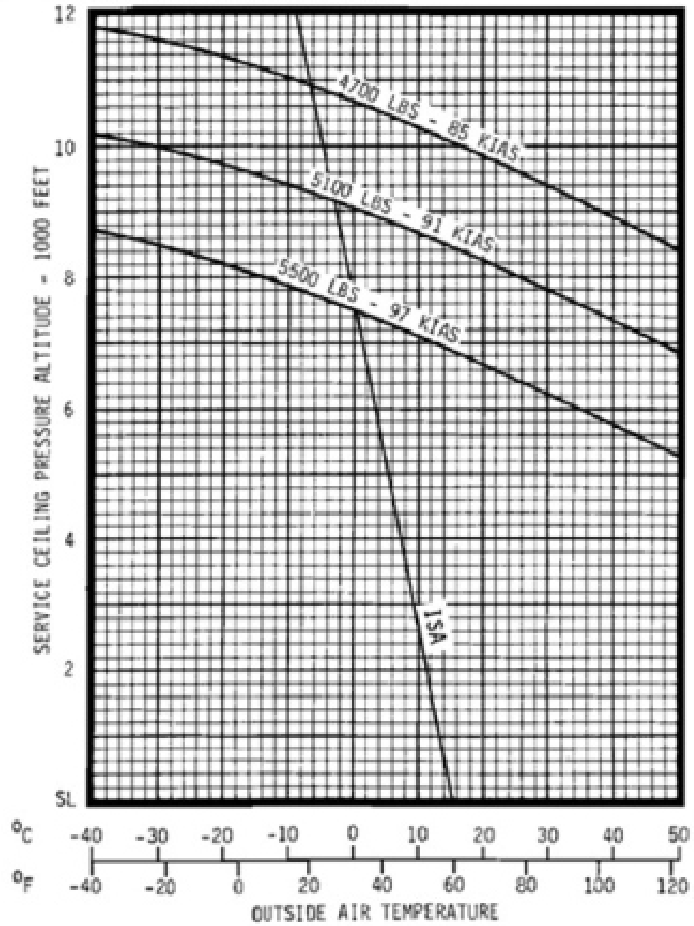
CLIMB AIRSPEEDS	
PRESSURE ALTITUDE - FEET	AIRSPEED - KIAS
Sea Level	85
5,000	80
10,000	72
12,000	70

One Engine Inoperative
Service Ceiling

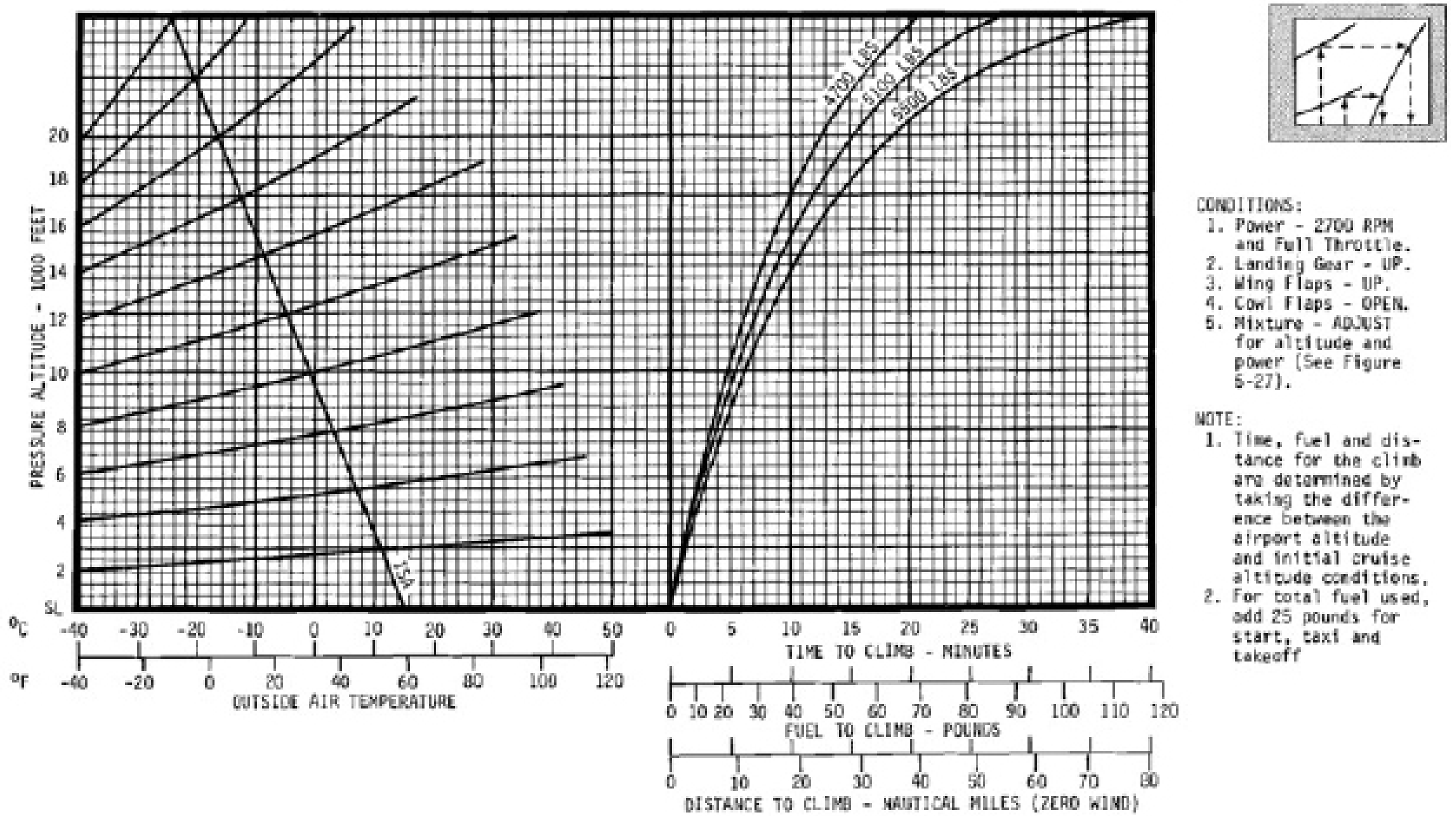


CONDITIONS:
1. One Engine Inoperative Climb Configuration.

NOTE:
1. Engine inoperative service ceiling is the maximum altitude where the airplane has the capability of climbing 50 feet per minute with one engine inoperative and feathered.
2. Increase indicated service ceiling 100 feet for each 0.10 inches Hg. altimeter setting greater than 29.92.
3. Decrease indicated service ceiling 100 feet for each 0.10 inches Hg. altimeter setting less than 29.92.
4. This chart provides performance information to aid in route selection when operating under FAR 135.181 and 91.119 requirements.



Time, Fuel and Distance to Climb
Maximum Climb

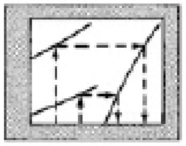


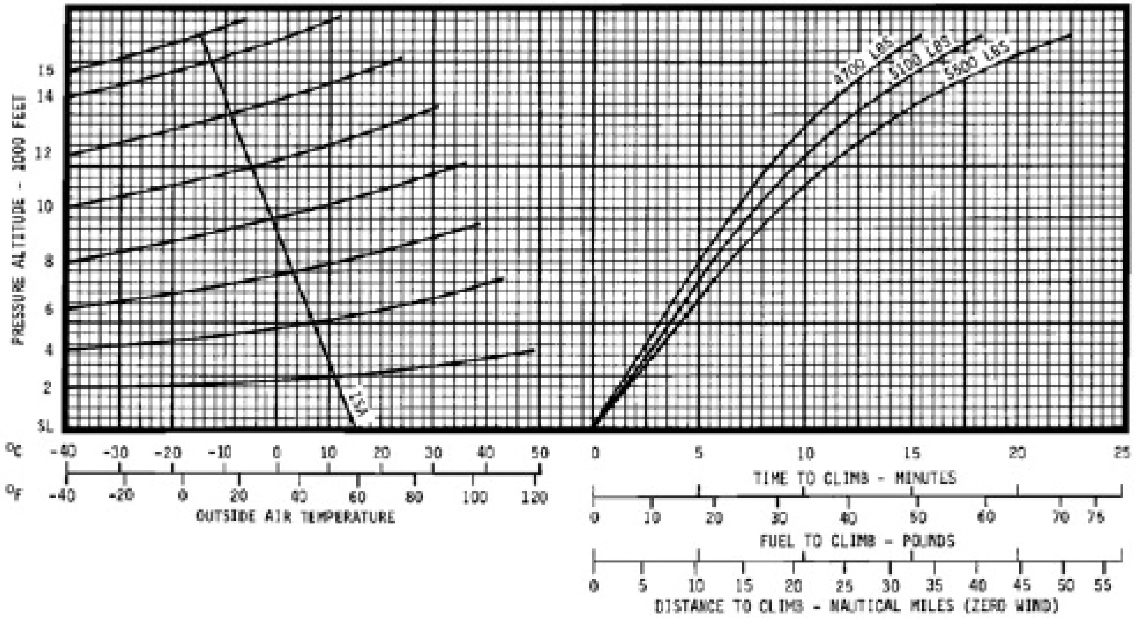
CONDITIONS:
1. Power - 2700 RPM and Full Throttle.
2. Landing Gear - UP.
3. Wing Flaps - UP.
4. Cowl Flaps - OPEN.
5. Mixture - ADJUST for altitude and power (See Figure 5-27).

NOTE:
1. Time, fuel and distance for the climb are determined by taking the difference between the airport altitude and initial cruise altitude conditions.
2. For total fuel used, add 25 pounds for start, taxi and takeoff

Time, Fuel and Distance to Climb

Cruise Climb





CONDITIONS:

1. 2500 RPM and 24.5 Inches Hg.*
2. Landing Gear - UP.
3. Wing Flaps - UP.
4. Cowl Flaps - AS REQUIRED.
5. Airspeed - 120 KIAS.
6. Fuel Flow - Adjust to climb fuel flow (See Figure 5-27).

*Above 5200 Feet, Use Full Throttle.

NOTE:

1. Time, fuel and distance for the climb are determined by taking the difference between the airport altitude and initial cruise altitude conditions.
2. For total fuel used, add 25 pounds for start, taxi and takeoff.

Cruise Performance

With Recommended Lean Mixture

1. At 2500 feet, increase speed by 2 KTAS for each 400 pounds below 5500 pounds.
2. At 5000 feet, increase speed by 2 KTAS for each 400 pounds below 5500 pounds.
3. Operations at peak EGT may be utilized with power settings within the boxes if the airplane is equipped with the optional EGT system.

ALTITUDE	RPM	MP	-10°C (14°F)			10°C (STD TEMP) (50°F)			30°C (86°F)		
			PERCENT BHP	KTAS	TOTAL LB/HR	PERCENT BHP	KTAS	TOTAL LB/HR	PERCENT BHP	KTAS	TOTAL LB/HR
2500 FEET	2500	24.5	76.5	181	191	73.8	182	185	71.1	184	179
	2500	23.0	69.9	175	176	67.4	176	170	65.0	177	164
	2500	22.0	65.8	171	166	63.5	172	161	61.1	172	156
	2500	21.0	61.5	166	156	59.3	167	152	57.2	167	147
	2400	24.5	73.3	178	184	70.7	179	178	68.1	180	171
	2400	23.0	67.1	172	169	64.8	173	164	62.4	174	158
	2400	22.0	63.1	168	160	60.9	169	155	58.7	169	150
	2400	21.0	59.2	163	151	57.1	164	147	55.0	164	142
	2300	24.5	68.3	173	172	65.9	174	166	63.5	175	161
	2300	23.0	62.7	167	159	60.5	168	154	58.3	169	149
	2300	22.0	59.1	163	151	57.0	164	146	54.9	164	142
	2300	21.0	55.3	158	143	53.4	159	138	51.4	159	133
	2200	24.5	63.9	169	162	61.7	170	157	59.4	170	152
	2200	23.0	58.7	163	150	56.7	163	146	54.6	163	141
	2200	22.0	55.4	158	143	53.4	159	138	51.5	159	134
	2200	21.0	51.9	154	135	50.1	154	130	48.2	153	126
	2200	20.0	48.4	149	126	46.7	148	122	45.0	147	118
	2100	24.5	58.7	163	150	56.7	163	146	54.6	163	141
	2100	23.0	53.8	156	139	51.9	157	135	50.0	156	130
	2100	22.0	50.6	152	131	48.8	152	127	47.0	151	123
	2100	21.0	47.2	146	123	45.5	146	119	43.9	144	115
	2100	20.0	44.0	141	116	42.4	140	112	40.9	138	108
	2100	19.0	40.8	134	108	39.4	133	105	37.9	130	101
			-15°C (5°F)			5°C (STD TEMP) (41°F)			25°C (77°F)		
5000 FEET	2500	24.5	80.7	188	201	77.8	190	194	75.0	192	188
	2500	23.0	73.6	182	185	70.9	184	178	68.4	185	172
	2500	22.0	69.1	178	174	66.7	179	168	64.2	180	162
	2500	21.0	64.5	173	163	62.3	174	158	60.0	174	153
	2400	24.5	76.9	185	192	74.2	187	186	71.5	188	180
	2400	23.0	70.4	179	177	67.9	181	171	65.4	181	165
	2400	22.0	66.1	175	167	63.8	176	161	61.5	176	156
	2400	21.0	62.0	170	157	59.8	171	153	57.7	171	148
	2300	24.5	71.4	180	179	68.9	182	173	66.4	182	167
	2300	23.0	65.5	174	165	63.2	175	160	60.9	176	155
	2300	22.0	61.9	170	157	59.7	171	152	57.5	171	147
	2300	21.0	57.8	165	148	55.8	165	144	53.7	165	139
	2200	24.5	66.5	175	168	64.2	176	162	61.8	177	157
	2200	23.0	61.2	169	156	59.0	170	151	56.9	170	146
	2200	22.0	57.8	165	148	55.8	165	144	53.7	165	139
	2200	21.0	54.3	160	140	52.4	160	136	50.5	160	131
	2200	20.0	50.7	155	132	48.9	154	127	47.2	153	123
	2100	24.5	61.0	169	155	58.8	170	150	56.7	170	146
	2100	23.0	56.2	163	145	54.2	163	140	52.2	163	135
	2100	22.0	53.0	158	137	51.1	158	133	49.2	157	128
	2100	21.0	49.7	153	129	47.9	153	125	46.2	151	121
	2100	20.0	46.4	147	121	44.8	146	117	43.1	145	114
	2100	19.0	43.1	141	113	41.6	139	110	40.0	136	106
	2100	18.0	39.9	134	106	38.5	131	102	37.1	126	99

NOTE:

1. At 7500 feet, increase speed by 3 KTAS for each 400 pounds below 5500 pounds.
2. At 10,000 feet, increase speed by 4 KTAS for each 400 pounds below 5500 pounds.
3. Operations at peak EGT may be utilized with power settings within the boxes if the airplane is equipped with the optional EGT system.

ALTITUDE	RPM	MP	-20°C (-4°F)			0°C (STD TEMP) (32°F)			20°C (68°F)		
			PERCENT BHP	KTAS	TOTAL LB/HR	PERCENT BHP	KTAS	TOTAL LB/HR	PERCENT BHP	KTAS	TOTAL LB/HR
7500 FEET	2500	23.2	77.9	190	194	75.2	192	188	72.4	194	182
	2500	22.0	72.2	185	181	69.7	187	175	67.1	187	169
	2500	21.0	67.3	180	170	64.9	181	164	62.6	181	159
	2500	20.0	63.0	175	160	60.8	176	155	58.5	176	150
	2400	23.0	73.4	186	184	70.8	188	178	68.2	189	172
	2400	22.0	68.9	182	173	66.5	183	168	64.0	183	162
	2400	21.0	64.7	177	163	62.4	178	158	60.1	178	153
	2400	20.0	60.6	172	154	58.4	172	150	56.3	172	145
	2300	23.0	68.2	181	172	65.8	182	166	63.4	183	160
	2300	22.0	64.4	176	163	62.1	177	158	59.8	178	153
	2300	21.0	60.2	171	153	58.1	172	149	56.0	172	144
	2300	20.0	56.5	166	145	54.5	167	141	52.5	166	136
	2200	23.0	63.4	175	161	61.2	176	156	58.9	176	151
	2200	22.0	60.1	171	153	57.9	172	148	55.8	172	144
	2200	21.0	56.5	166	145	54.5	167	141	52.6	166	136
	2200	20.0	52.8	161	137	50.9	161	132	49.0	159	128
	2200	19.0	49.3	155	128	47.6	154	124	45.9	153	120
	2200	18.0	45.7	148	120	44.1	147	116	42.5	144	112
	2100	22.0	55.3	165	143	53.4	165	138	51.4	164	133
	2100	21.0	52.0	160	135	50.2	159	130	48.3	158	126
	2100	20.0	48.7	154	127	47.0	153	123	45.3	151	119
	2100	19.0	45.3	148	119	43.7	146	115	42.1	143	111
	2100	18.0	42.0	141	111	40.5	138	107	39.0	133	104
			-25°C (-13°F)			-5°C (STD TEMP) (23°F)			15°C (59°F)		
10,000 FEET	2500	21.0	69.9	187	176	67.5	188	170	65.0	189	164
	2500	20.0	65.5	182	165	63.2	183	160	60.9	183	155
	2500	19.0	61.1	176	156	59.0	177	151	56.8	176	146
	2500	18.0	56.8	170	146	54.8	170	142	52.8	169	137
	2500	17.0	52.4	163	136	50.5	163	131	48.7	161	127
	2400	21.0	67.0	184	169	64.7	185	163	62.3	185	158
	2400	20.0	62.9	179	159	60.7	179	155	58.5	179	150
	2400	19.0	58.7	173	150	56.6	173	146	54.6	172	141
	2400	18.0	54.5	167	141	52.5	166	136	50.6	165	131
	2400	17.0	50.2	159	131	48.5	158	126	46.7	157	122
	2300	21.0	62.6	178	158	60.3	179	154	58.1	179	149
	2300	20.0	58.7	173	150	56.7	173	146	54.6	173	141
	2300	19.0	55.0	168	142	53.0	167	137	51.1	166	133
	2300	18.0	51.1	161	133	49.3	160	128	47.5	158	124
	2300	17.0	47.2	153	123	45.5	152	119	43.8	149	115
	2200	21.0	58.4	172	150	56.4	173	145	54.3	172	140
	2200	20.0	54.7	167	141	52.8	167	137	50.8	165	132
	2200	19.0	51.1	161	133	49.3	160	128	47.5	158	124
	2200	18.0	47.5	154	124	45.8	153	120	44.2	150	116
	2200	17.0	43.9	147	115	42.4	144	112	40.8	139	108
	2100	21.0	54.3	166	140	52.4	166	136	50.4	165	131
	2100	20.0	50.9	161	132	49.1	160	128	47.3	158	124
	2100	19.0	47.4	154	124	45.7	153	120	44.0	149	116
	2100	18.0	44.0	147	116	42.4	144	112	40.9	140	108
	2100	17.0	40.5	138	107	39.1	133	104	37.6	123	100

Cruise Performance

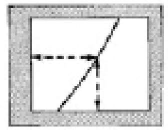
With Recommended Lean Mixture (Cont.)

NOTE:
1. At 15,000 Feet, increase speed by 4 KTAS for each 400 pounds below 5500 pounds.
2. Operations at peak EGT may be utilized with power settings within the boxes if the airplane is equipped with the optional EGT system.

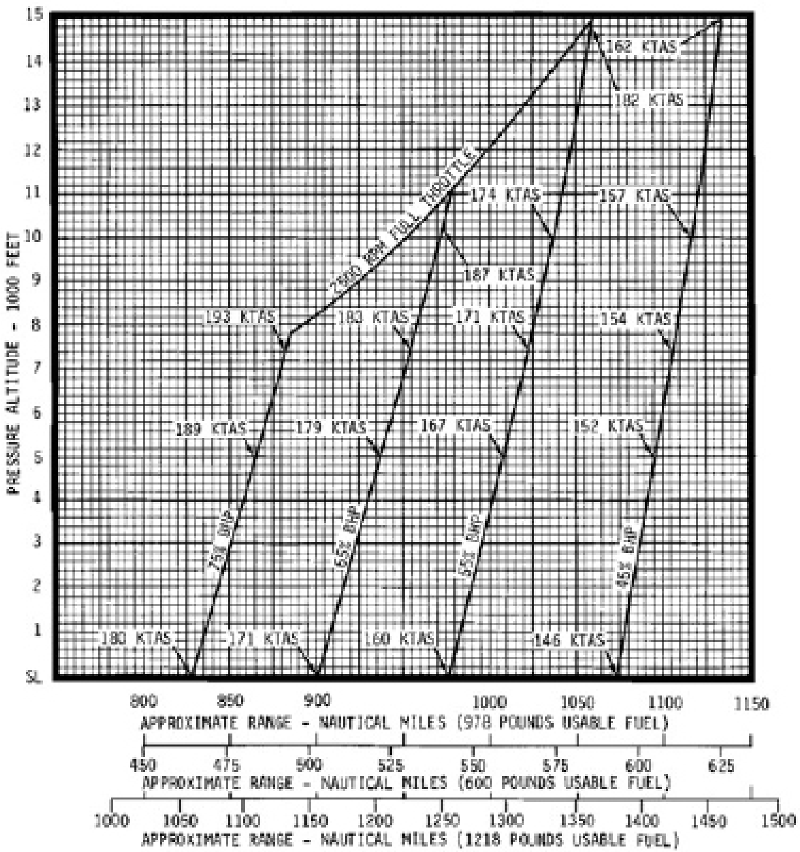
ALTITUDE	RPM	MP	-35°C (-30°F)			-15°C (STD TEMP) (6°F)			5°C (42°F)		
			PERCENT BHP	KTAS	TOTAL LB/HR	PERCENT BHP	KTAS	TOTAL LB/HR	PERCENT BHP	KTAS	TOTAL LB/HR
15,000 FEET	2500	16.0	52.7	170	137	50.9	168	132	49.0	165	128
	2500	15.0	48.1	160	125	46.4	157	121	44.7	153	117
	2500	14.0	43.4	148	114	41.8	143	110			
	2400	16.0	50.9	166	132	49.1	164	128	47.3	161	124
	2400	15.0	46.4	156	121	44.8	153	118	43.2	147	114
	2400	14.0	42.2	144	111	40.7	138	108	----	---	---
	2300	16.0	47.2	158	123	45.5	155	119	43.9	150	115
	2300	15.0	43.3	147	114	41.7	142	110	----	---	---
	2200	16.0	42.9	146	113	41.4	141	.109	----	---	---
	2100	16.0	40.6	139	107	39.2	127	104	----	---	---

Range Profile

CONDITIONS:
1. Starting Weight - 5500 Pounds.
2. Cruise Climb to Desired Altitude.
3. Recommended Lean Fuel Flow.
4. Zero Wind.
5. Standard Day.

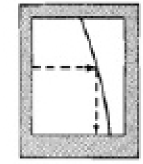


NOTE:
1. Range computations include fuel required for start, taxi, takeoff, cruise climb to altitude, cruise, descent and 45 minutes holding fuel at 45% power.
2. The distances shown are the sum of the distances to climb, cruise and descend.

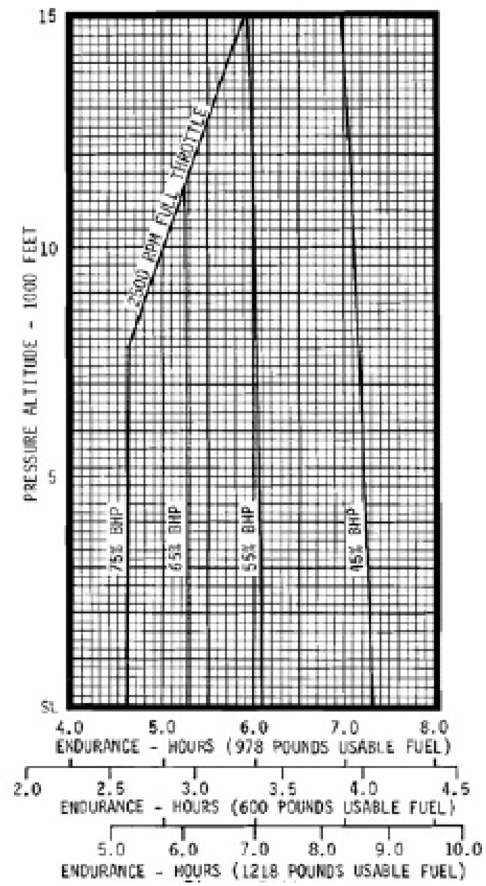


Endurance Profile

CONDITIONS:
1. Starting Weight - 5500 Pounds.
2. Cruise Climb to Desired Altitude.
3. Cruise Fuel Flow - Recommended Lean Mixture.
4. Standard Day.



NOTE:
1. Endurance computations include fuel required for start, taxi, takeoff, cruise climb to altitude, cruise, descent and 45 minutes holding fuel at 45% power.
2. The endurance shown is the sum of the time to climb, cruise and descend

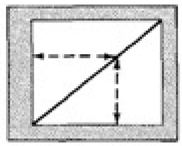


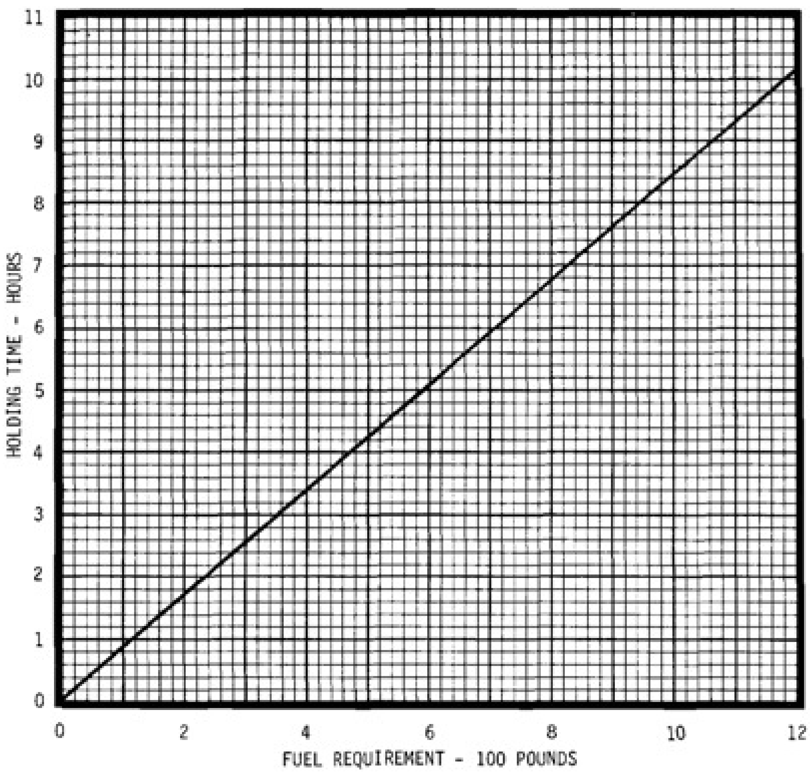
Holding Time

CONDITIONS:
1. Power - 45% *.
2. Recommended Lean Fuel Flow (118 Pounds Per Hour Total).

*45% power can be maintained at 2100 RPM with the following manifold pressure.

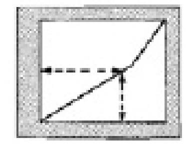
PRESSURE ALTITUDE	MANIFOLD PRESSURE
Sea Level	21.5
5,000	20.0
10,000	19.0
15,000	18.0

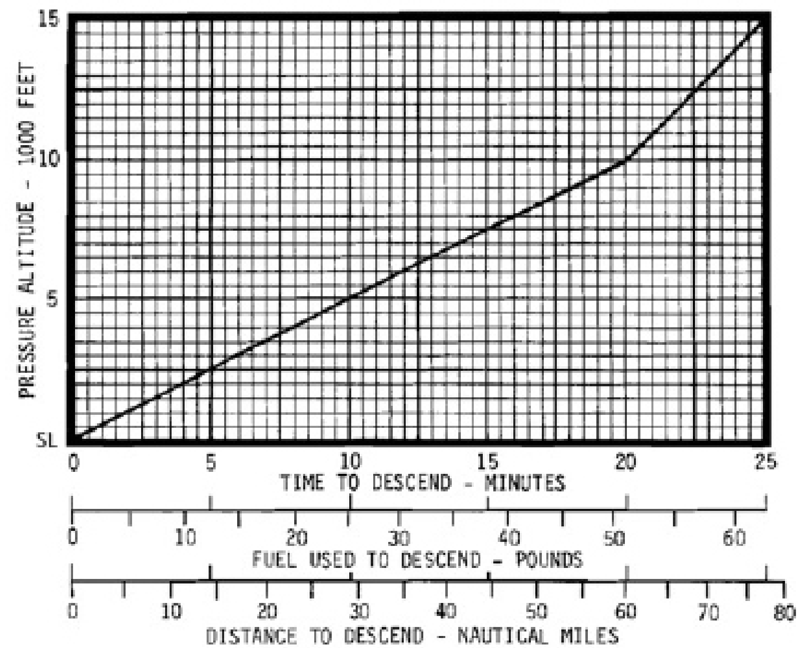




Time, Fuel and Distance to Descend

CONDITIONS:
1. Power - As Required.
2. Above 10,000 Feet, Descend at 1000 Feet Per Minute.
3. Below 10,000 Feet, Descend at 500 Feet Per Minute.
4. Landing Gear - UP.
5. Wing Flaps - UP.
6. Airspeed - 170 KIAS.





Normal Landing Distance

CONDITIONS:
1. Throttles - IDLE.
2. Landing Gear - DOWN.
3. Wing Flaps - 35°.
4. Cowl Flaps - CLOSE.
5. Level, Hard Surface Runway.
6. Maximum Effective Braking.

NOTE:
1. Increase distance by 25% of ground run for operation on firm sod runway.
2. If necessary to land with wing flaps UP, the approach speed should be increased above the normal approach speed by 12 knots. Expect total landing distance to increase by 35%.
3. Decrease total distances by 3% for each 4 knots headwind. For operations with tailwinds up to 10 knots, increase total distances by 5% for each 2 knots wind.

WEIGHT-POUNDS	SPEED AT 50-FOOT OBSTACLE KIAS	PRESSURE ALTITUDE - FEET	-20°C (-4°F)		-10°C (14°F)		0°C (32°F)		10°C (50°F)	
			GROUND ROLL - FEET	TOTAL DISTANCE TO CLEAR 50-FOOT OBSTACLE	GROUND ROLL - FEET	TOTAL DISTANCE TO CLEAR 50-FOOT OBSTACLE	GROUND ROLL - FEET	TOTAL DISTANCE TO CLEAR 50-FOOT OBSTACLE	GROUND ROLL - FEET	TOTAL DISTANCE TO CLEAR 50-FOOT OBSTACLE
5400	90	Sea Level	570	1720	590	1740	610	1760	630	1780
		1000	590	1740	610	1760	630	1780	660	1810
		2000	610	1760	630	1780	660	1810	680	1830
		3000	630	1780	660	1810	680	1830	710	1860
		4000	660	1810	680	1830	710	1860	730	1880
		5000	680	1830	710	1860	730	1880	750	1910
		6000	710	1860	730	1880	760	1910	790	1940
		7000	730	1880	760	1910	790	1940	820	1970
		8000	760	1910	790	1940	820	1970	850	2000
		9000	790	1940	820	1970	850	2000	880	2030
		10,000	820	1970	850	2000	890	2040	920	2070
5000	89	Sea Level	480	1630	500	1650	520	1670	540	1690
		1000	500	1650	520	1670	540	1690	560	1710
		2000	520	1670	540	1690	560	1710	580	1730
		3000	530	1680	560	1710	580	1730	600	1750
		4000	550	1700	580	1730	600	1750	620	1770
		5000	580	1730	600	1750	620	1770	640	1790
		6000	600	1750	620	1770	640	1790	670	1820
		7000	620	1770	640	1790	670	1820	690	1840
		8000	640	1790	670	1820	690	1840	720	1870
		9000	670	1820	700	1850	720	1870	750	1900
		10,000	700	1850	720	1870	750	1900	780	1930
4600	86	Sea Level	400	1550	420	1570	430	1580	450	1600
		1000	410	1560	430	1580	450	1600	460	1610
		2000	430	1580	450	1600	460	1610	480	1630
		3000	450	1600	460	1610	480	1630	500	1650
		4000	460	1610	480	1630	500	1650	520	1670
		5000	480	1630	500	1650	520	1670	540	1690
		6000	500	1650	520	1670	540	1690	560	1710
		7000	520	1670	540	1690	560	1710	580	1730
		8000	540	1690	560	1710	580	1730	600	1750
		9000	560	1710	580	1730	600	1750	620	1770
		10,000	580	1730	600	1750	620	1770	650	1800
4200	82	Sea Level	330	1480	340	1490	350	1500	370	1520
		1000	340	1490	350	1500	370	1520	380	1530
		2000	350	1500	370	1520	380	1530	390	1540
		3000	370	1520	380	1530	390	1540	410	1560
		4000	380	1530	390	1540	410	1560	420	1570
		5000	390	1540	410	1560	420	1570	440	1590
		6000	410	1560	420	1570	440	1590	460	1610
		7000	420	1570	440	1590	460	1610	470	1620
		8000	440	1590	460	1610	470	1620	490	1640
		9000	460	1610	480	1630	490	1640	510	1660
		10,000	480	1630	490	1640	510	1660	530	1680

Fuel Flow Schedule

FULL POWER FUEL FLOW VERSUS ALTITUDE

Power - FULL THROTTLE and 2700 RPM	
PRESSURE ALTITUDE - FEET	FUEL FLOW - POUNDS/HOUR
Sea Level	147
2000	134
4000	124
6000	116
8000	108
10,000	101
12,000	94
14,000	87
16,000	80

CRUISE CLIMB FUEL FLOW VERSUS ALTITUDE

Power - 24.5 Inches Hg. Manifold Pressure and 2500 RPM to 5200 Feet then FULL THROTTLE and 2500 RPM	
PRESSURE ALTITUDE - FEET	FUEL FLOW - POUNDS/HOUR
Sea Level to 5200	107
6000	103
8000	96
10,000	88
12,000	83
14,000	78
16,000	73

Section 7
Specifications & Limitations

Table of Contents

Introduction

Section 7 of this user guide covers both the basic specifications of the airplane, as well as an abbreviated list of limitations. The full scope of the specifications and limitations are not reproduced here as some areas are simply not applicable within the simulator, nor are they of great interest for general reading.

Also included in this section is a very useful list of the symbols, abbreviations and terminology used throughout the rest of this user guide.

SPECIFICATIONS

ENGINES

Number of Engines: 2

Engine Type: Fuel injected, direct drive, air-cooled, horizontally opposed, six cylinder, 520 cubic-inch displacement.

Horsepower: 285 rated horsepower at 2700 RPM.

PROPELLERS

Number of Propellers:

2

Number of Blades:

3

Propeller Diameter:

6' 4.5"

Propeller Type:

Constant speed, full feathering, nonreversible hydraulically actuated.

Blade Range:

a. Low Pitch 13.9° +/- 0.2°
b. Feather 81.7° +/- 0.3°

MAXIMUM CERTIFIED WEIGHTS

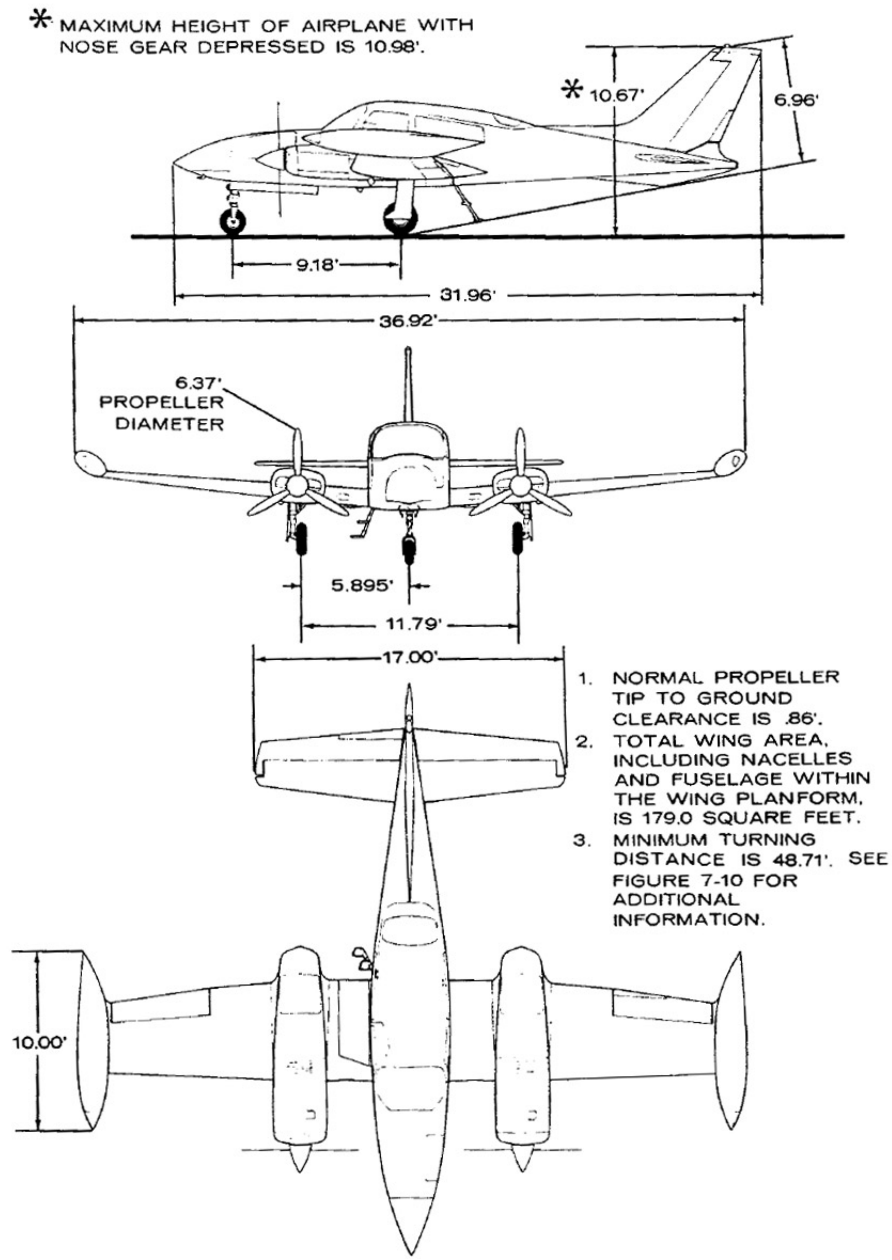
Maximum Ramp Weight: 5,535 pounds

Maximum Takeoff Weight: 5,500 pounds

Maximum Landing Weight: 5,400 pounds

Maximum Zero Fuel Weight: 4,900 pounds

(FIGURE 3-1) THREE-VIEW DRAWING



STANDARD AIRPLANE WEIGHTS

Standard Empty Weight: 3,358 pounds
Maximum Useful Load: 2,177 pounds

SPECIFIC LOADINGS

Wing Loading: 30.73 pounds per square foot
Power Loading: 9.65 pounds per horsepower

SYMBOLS, ABBREVIATIONS & TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY & SYMBOLS

CAS — Calibrated Airspeed is the indicated speed corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.

G — G is acceleration due to gravity.

IAS — Indicated Airspeed is the speed shown on the airspeed indicator. IAS values shown in this user guide assume zero instrument error.

KCAS — Calibrated Airspeed expressed in knots.

KIAS — Indicated Airspeed expressed in knots.

KTAS — True Airspeed expressed in knots.

TAS — True Airspeed is the airspeed relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.

V_A — Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.

V_{FE} — Maximum Flap Extended Speed is the highest speed permissible with wing flaps a prescribed extended position.

V_{LE} — Maximum Landing Gear Extended Speed is the maximum speed at which an airplane can be safely flown with the landing gear extended.

V_{LO} — Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.

V_{MC_A} — Air Minimum Control Speed is the minimum flight speed at which the airplane is controllable with a bank of not more than 5° when one engine suddenly becomes inoperative and the remaining engine is operating at takeoff power.

V_{NE} — Never Exceed Speed is the speed limit that may not be exceeded at any time.

V_{NO} — Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.

V_{SSE} — Intentional One Engine Inoperative Speed is a minimum speed selected by the manufacturer for intentionally rendering one engine inoperative in flight for pilot training.

V_X — Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.

V_Y — Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

METEOROLOGICAL TERMINOLOGY

°C — Temperature in degrees Celsius.

°F — Temperature in degrees Fahrenheit.

ISA — International Standard Atmosphere in which:
1. The air is a dry perfect gas.
2. The temperature at sea level is 15° Celsius (59° Fahrenheit).

1. The pressure at sea level is 29.92 inches Hg. (1013.2 mb) and decreases 1 in Hg per 1000 ft increase.

2. The temperature gradient from sea level to the altitude at which the temperature is -56.5°C (—69.7°F) is -1.98°C (-3.5°F) per 1000 feet.

OAT	Outside Air Temperature is the free air static temperature, obtained either from inflight temperature indications adjusted for instrument error and compressibility effects or ground meteorological sources.
Pressure Altitude	Altitude measured from standard sea-level pressure (29.92 inches Hg.) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this user guide, altimeter instrument errors are assumed to be zero.
Wind	The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

POWER TERMINOLOGY

BHP	Brake horsepower means the power delivered at the propeller shaft of an airplane engine.
Critical Altitude	The maximum altitude at which in standard temperature it is possible to maintain a specified power.
Maximum Continuous Power	The power developed in a standard atmosphere from sea level to the critical altitude at the maximum RPM and manifold pressure approved for use during periods of unrestricted duration.
RPM	The revolutions per minute (RPM) of an engine refers to the rotational speed of the propeller shaft, as shown on a tachometer.

AIRPLANE PERFORMANCE & FLIGHT PLANNING TERMINOLOGY

Accelerate-Go Distance	The distance required to accelerate an airplane to a specified speed and, assuming failure of an engine at the instant that speed is attained, continue takeoff on the remaining engine to a height of 50 feet.
Accelerate-Stop Distance	The distance required to accelerate an airplane to a specified speed and, assuming failure of an engine at the instant that speed is attained, to bring the airplane to a stop.
Acrobatic Maneuver	An intentional maneuver involving an abrupt change of an airplane's attitude, an abnormal attitude, or abnormal acceleration, not necessary for normal flight.
Balked Landing	A balked landing is an aborted landing (i.e., all engines go—around).
Balked Landing Transition Speed	The minimum speed at which transition to a balked landing climb should be attempted.
Demonstrated Crosswind Velocity	The demonstrated crosswind velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. The value shown is not considered to be limiting. This value is not an aerodynamic limit for the airplane.
Maximum Effective Braking	The maximum amount of braking pressure that can be applied to the toe brakes without locking the wheels.

LIMITATIONS

AIRSPEED LIMITATIONS

(See figure 3.2).

(FIGURE 3-2) AIRSPEED LIMITATIONS TABLE

SPEED	KIAS	KCAS	REMARKS
Maneuvering Speed V_A (Knots)	148	150	Do not make abrupt control movements above this speed.
Maximum Flap Extended Speed V_{FE} (Knots) 15^o 35^o	158 139	160 140	Do not exceed this speed with the given flap setting.
Maximum Gear Operating Speed V_{LO} (Knots)	138	140	Do not extend or retract landing gear above this speed.
Maximum Gear Extended Speed V_{LE} (Knots)	138	140	Do not exceed this speed with landing gear extended.
Air Minimum Control Speed V_{MC_A} (Knots)	80	81	This is the minimum flight speed at which the airplane is controllable with one engine inoperative and a 5^o bank towards the operative engine.
One Engine Inoperative Best Rate-of-Climb Speed V_Y (Knots)	106	107	This speed delivers the greatest gain in altitude in the shortest possible time with one engine inoperative at sea level, standard day conditions and 5500 pounds weight.
Never Exceed Speed V_{NE} (Knots)	223	227	Do not exceed this speed in any operation.
Maximum Structural Cruising Speed V_{NO} (Knots)	181	183	Do not exceed this speed except in smooth air and then only with caution.

(FIGURE 3-3) AIRSPEED INDICATOR TABLE

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
Red Radial	80	Air minimum control speed.
White Arc	72 to 139	Operating speed range with 35° wing flaps. Lower limit is maximum weight stalling speed in landing configuration. Upper limit is maximum speed permissible with wing flaps extended 35°.
Green Arc	79 to 181	Normal operating range. Lower limit is maximum weight stalling speed with flaps and landing gear retracted. Upper limit is maximum structural cruising speed.
Blue Radial	106	One engine inoperative best rate-of-climb speed at sea level standard day conditions and 5500 pounds weight.
Yellow Arc	181 to 223	Caution range. Operations must be conducted with caution and only in smooth air.
Red Line	223	Maximum speed for all operations.

ENGINE LIMITATIONS

Number of Engines: 2

Engine Operating Limits for Takeoff and Continuous Operation:

a. Maximum power for all operations (All Altitudes)

Engine RPM	Manifold Pressure	Time	Max. Head Temp. (°F)	Max. Oil Temp. (°F)
2700	Full Throttle	Continuous	460	240

Powerplant Instrument Markings:

a. Tachometer:
   (1) Normal Operating 2100 to 250 RPM (Green Arc)
   (2) Maximum 2700 RPM (Red Radial)

b. Manifold Pressure:
   (1) Normal Operating 15.0 to 24.5 Inches Hg. Manifold Pressure (Green Arc)

c. Oil Temperature:
   (1) Normal Operating 75 to 240°F (Green Arc)
   (2) Maximum 240°F (Red Radial)

d. Oil Pressure:
   (1) Minimum Operating 10 PSI (Red Radial)
   (2) Normal Operating 30 to 60 PSI (Green Arc)
   (3) Maximum 100 PSI (Red Radial)

e. Cylinder Head Temperature:
   (1) Normal Operating 200 to 460°F (Green Arc)
   (2) Maximum 460°F (Red Radial)

f. Fuel Flow:
   (1) Minimum Operating 2.5 PSI (Red Radial)
   (2) Normal Operating 0.0 Pounds per hour (3.4 PSI) to 155.0 Pounds per hour (21.7 PSI (Green Arc)
   (3) Maximum Operating 155.0 Pounds per hour (21.7 PSI) (Red Radial)

WEIGHT LIMITS

Maximum Takeoff Weight: 5,500 Pounds

Maximum Landing Weight: 5,400 Pounds

Maximum Zero Fuel Weight: 4,900 Pounds

Maximum Weights in Baggage Compartments:
a. Left and Right Wing Lockers - 120 pounds each.

b. Nose Bay - 350 pounds less installed optional equipment.

c. Aft Cabin (Station 89 to Station 109) - 200 pounds.

d. Aft Cabin (Station 109 to Station 132) - 160 pounds.

MANEUVER LIMITS

This is a normal category airplane. Acrobatic maneuvers, including spins, are prohibited.

FLIGHT LOAD FACTOR LIMITS

The design load factors are 150% of the following and in all cases, the structure exceeds design loads.

At Design Takeoff Weight of 5500 Pounds:
a. Landing gear up, wing flaps 0°: +3.8G to -1.52G

b. Landing gear down, wing flaps 35°: +2.0G

FLIGHT CREW LIMITS

Minimum flight crew is one pilot.

OPERATION LIMITS

The standard airplane is approved for day and night operation under VFR conditions. With the proper optional equipment installed, the airplane is approved for day and night IFR conditions.

Section 8
FAQ & Troubleshooting

Table of Contents

Introduction

Section 8 - concise solutions to often encountered problems!

Visuals

Q. How do I make the tablet disappear?
A. Click on the tan column to the left of the tablet to show or hide the tablet.

Q. How can I change the brightness of the tablet?
A. Rotate the light dial marked "RADIO" on the right of the side panel to adjust the brightness.

Q. Can I make the copilot and passengers disappear?
A. Select "Hide Avatars" on the bottom right-hand set of options on the 'Configuration' page of the tablet.

Q. Why doesn't my custom registration show up on my custom livery?
A. Check the "Show User Reg?" checkbox on the Options tab of the tablet to show the custom registration number on the side of the airplane. Important: This will display the current registration on ANY livery, so don't check this for any livery that already has its registration painted on the side or the custom display will show over the painted one.

Startup

Q. Why doesn't the sim's weight dialog show data I entered on the tablet?
A. This is a known MSFS simulator bug.
That dialog doesn't read the existing data from the payload stations but instead starts from the default data coded in the aircraft's configuration.

Q. What's the big red line on the sim's weight dialog (a max payload of 19,711)?
A. We believe it's related to the bug mentioned in the answer above. It does show up on some other aircraft than the 310.
A good rule is to use the tablet to fill passenger seats and baggage, or use the sim's payload and fuel dialog, but not mix using them.

Q. Why aren't the state of my switches and dials being saved and restored?
A. Remember, partial state (the tablet options and some visibility options like the yokes) is saved and restored for every livery. But full state is only saved and restored for liveries you chose to "own" on the tablet options. Even if you own the aircraft, state is NOT saved if you are in the air, or on the ground with your engines running. State is only saved when you exit the aircraft by returning to the main menu when on the ground with the engines off. This is the only valid condition for an owned aircraft following a flight; anything else is assumed to be an aborted flight with no state saved.

Avionics

Q. Why does the tablet show a black screen when turned on?
A. The background intensity is probably set to zero. Rotate the light dial marked "RADIO" on the right of the side panel to adjust the brightness.

Q. Why doesn't the transponder turn on?
A. It could be turned off (it has separate on/off buttons), or it may be set so that the backlighting is turned too far down. Rotate the light dial marked "RADIO" on the right of the side panel to adjust the brightness.

Q. Why can't I click on some of the icons on the screen with my TDS 750Xi?
A. This happens when you also have the PMS50 GTN750 product installed (free or payware) alongside the TDS 750Xi. You must disable the PMS50 to access the TDS icons.

Q. Why are some real world functions missing or incorrect in some of the avionics?
A. We are using the standard Asobo avionics for the transponder, autopilot, ADF, GNS530 and GNS430, as well as the simple radios. These, in their current state, have bugs and lack features to make them fully realistic. For example, the ARM button on the KAP140 autopilot doesn't work like it does in real life. The GNS530/430 are currently unrealistic in their default form, and we recommend the freeware product from PMS50 to replace them. Unfortunately, we are unable to offer support for these units.

Flight

Q. What is the correct elevator trim setting for takeoff?
A. Place the trim indicator at the aft end of the white zone, or at a 0.0 indication on the elevator trim tooltip. A load with heavy passengers in the middle and rear seats may require the trim to be slightly forward (like in the middle of the white area) to compensate for the aftward CG.

Q. Why does the airplane sometimes want to rotate on its own?
A. You are likely waiting too long to put back pressure on the yoke, allowing airspeed to build up too quickly. Rotate just as the airspeed reaches 90 knots, or slightly above, and no later than 100 knots.

Q. Why is the airplane a bit "twitchy" at low airspeeds (like on landing)?
A. This is a characteristic of the real 310R. It will be made more intense by an aft CG setting.

Q. Why do the struts seem so stiff on touchdown?
A. The real 310R aircraft has stiff struts making the landing feel rather "solid".

Q. How can the passenger comfort index decline when the cabin is comfortable?
A. There's more to comfort than just temperature. Other factors that can drive it downward are:

1. Excessive rate of climb or descent (greater than 1000 FPM for more than 30 seconds duration),
2. Excessive bank angles (greater than 35 degrees),
3. Negative G's (pushing the nose over forcefully.

Q. Why did my engine sputter (or quit) when I switched fuel tanks?
A. You must turn the auxiliary fuel pumps to LOW (down) when switching tanks.

Q. Why doesn't the analog EGT gauge on the co-pilot side show accurate EGT? It's zero until the engine is at least half power.
A. The EGT gauge we're accurately simulating only measures the top 250°F degrees of the EGT range. It will register zero otherwise. It's used to adjust mixture setting during cruise by moving the lever until the needles register their highest setting then adjusting for 25°F lower (for lean-of-peak) or for 25°F higher (for rich-of-peak) cruise.

Q. Why won't the propellers unfeather when I restart the engine?
A. The unfeathering procedure is an exact sequence documented on p. 5-4. The most important thing is that you must restart the engine first before you move the prop out of the feather position. Once the engine is running again, smoothly move the prop up out of the feather position, then adjust the throttle from its start position to the desired setting for flight.

Maintenance

Q. Why do I get 'Defective Items Found' after an inspection when all bars are green?
A. The green bars only show you the critical aircraft systems, not every component that can be weak or broken. If the button changes from "Inspect" to "Repair" and the bottom message indicates "DEFECTS FOUND" then you should always click on the Repair button even if it's only one little light bulb burnt out.
If you get the message "NO DEFECTS FOUND" there's no need to repair (but you can still click the gear icon next to any critical system's bar to bring it to max.)

Q. I have a bulb burned out in the cockpit. How do I fix it?
A. Go to the Status page on the tablet, with your power off and parked, and click on the 'INSPECT' button. You should get a "DEFECTS FOUND" reply. Click on "Repair" to fix the bulb(s). You should get a "ALL DEFECTIVE ITEMS REPLACED" message. Test the bulb now, it should work.

Q. What is the difference between 'Repair' and 'Overhaul'?
A 'Repair' only fixes currently defective items. Components that are weak but not yet defective (safely in the green sone) are not repaired.
An Overhaul fixes everything but it can take a significant delay to do it.

Q. Are there any tablet parameters I can edit myself outside the sim?
A. Unfortunately, due to current limitations within MSFS, we are unable to expose these settings.

Miscellaneous

Q. How can I tell if a failure was triggered by the failure system in the 310R?
A. You can, but it takes a bit of work. After your flight. check the contents of the following folder:

Microsoft Store Version:
C:\Users\[username]\AppData\Local\Packages\Microsoft.FlightSimulator_8wekyb3d8bbwe\LocalState\packages\milviz-aircraft-310\work

Steam version:
C:\Users\[username]\AppData\Roaming\Microsoft Flight Simulator\Packages\milviz-aircraft-310\work

Look for a file named: Logs_[registration number]_Failures.log
Open up that file and if a failure or failures were triggered on that flight, you'll see the message to that effect, listing the nature of the failure and the time it occurred. Failures not yet triggered won't show of course. Your last flight will be listed at the bottom of this log, which records all flights you've made with this livery.

Installation

Q. How can I fix a 'specified filepath is too long' installer error?
A. This is caused by symbolic linking. To remedy, you have a choice:

- Disable the linking addon
- Modify your OS. Use the internet to find a solution that works with your system. There are a number of methods available and not all of them are guaranteed to resolve the issue. e.g. Maximum Path Limitation

Hardware Inputs

Any input other that these listed uses standard MSFS input signals, any output other than these listed uses standard MSFS A: variables.

Input

Control	Variable	Values
Fuel Tank Gauge Selector Switch	(L:C310_SW_FUEL_IND, enum)	0=Up, 1=Center, 2=Down
NAV Selector Switch	(L:C310_SW_NAV_SELECTOR, bool)	0=Up, 1=Down
Left Fuel Selector	(L:C310_SW_FUEL_SEL_LEFT, enum)	0=Opposite Main, 1 =Main, 2=Aux, 3=Off
Right Fuel Selector	(L:C310_SW_FUEL_SEL_RIGHT, enum)	0=Opposite Main, 1 =Main, 2=Aux, 3=Off
Storm Window	(L:C310_Window_OPEN, number)	0-100
Passenger Door	(L:C310_Handle_Position, bool)	0=Closed, 1=Locked
Landing Light Switch	(L:C310_SW_LIGHTS_LANDING, enum)	0=On & Extend, 1=Off, 2=Retract
Left Cowl Flaps Lever	(L:C310_SW_COWL_LEFT, enum)	0-100
Right Cowl Flaps Lever	(L:C310_SW_COWL_RIGHT, enum)	0-100
Left Alternate Air Lever	(L:C310_SW_ALTERNATE_AIR_LEFT, enum)	0-100
Right Alternate Air Lever	(L:C310_SW_ALTERNATE_AIR_RIGHT, enum)	0-100
Left Fuel Pump Switch	(L:C310_SW_FUEL_PUMP_LEFT, enum)	0=Up ,1=Center ,2=Down
Right Fuel Pump Switch	(L:C310_SW_FUEL_PUMP_RIGHT, enum)	0=Up, 1=Center, 2=Down
Primer Switch	(L:C310_SW_PRIMER, enum)	0=Left, 1=Center, 2=Right
Left Alternator Switch	(L:C310_SW_ALTERNATOR_LEFT, bool)	0=Off, 1=On
Right Alternator Switch	(L:C310_SW_ALTERNATOR_RIGHT, bool)	0=Off, 1=On
Left EDM Left Button	(L:C310_SW_EDML_L, bool)	0=Off, 1=On
Left EDM Right Button	(L:C310_SW_EDML_R, bool)	0=Off, 1=On
Right EDM Left Button	(L:C310_SW_EDMR_L, bool)	0=Off, 1=On
Right EDM Right Button	(L:C310_SW_EDMR_R, bool)	0=Off, 1=On

Control	Variable	Values
De-ice Wing Lights	(L:C310_SW_LIGHTS_DEICE, bool)	0=Off, 1=On
Windshield De-Ice	(L:C310_SW_DEICE_WINDSHLD, bool)	0=Off, 1=On
Surface De-ice Switch	(L:C310_SW_DEICE_SURFACE, enum)	0=Actuate, 1=Off, 2=Surface (Auto)
Defrost Control Dial	(L:C310_SW_DEFROST)	0-100
Temp Control Dial	(L:C310_SW_TEMP_CONTROL)	0-100
Cabin Air Dial	(L:C310_SW_CABIN_AIR)	0-100
Forward Cabin Air Dial	(L:C310_SW_FWD_CABIN_AIR)	0-100
Heater Switch	(L:C310_SW_HEATER, enum)	0=Up, 1=Center, 2=Off
Flight Instrument Intensity Dial	(L:C310_SW_LIGHTS_FLT_INST, enum)	0-100
Radio Backlight Intensity Dial	(L:C310_SW_LIGHTS_RADIO, enum)	0-100
Engine Instrument Intensity Dial	(L:C310_SW_LIGHTS_ENG_INST, enum)	0-100
Side Panel Intensity Dial	(L:C310_SW_LIGHTS_SIDE, enum)	0-100
Emergency Alternator Switch Cover	(L:C310_SW_COVER_EMG_ALT_FLD, bool)	0=Closed, 1=Open
Emergency Avionics Switch Cover	(L:C310_SW_COVER_EMG_AVN_PWR, bool)	0=Closed, 1=Open
Emergency Alternator Switch	(L:C310_SW_EMG_ALT_FLD, bool)	0=Off, 1=On
Emergency Avionics Switch	(L:C310_SW_EMG_AVN_PWR, bool)	0=Off, 1=On
Engine Crash Bar	(L:C310_Engine_Crash_Bar, bool)	0=Up, 1=Down
Electrical Crash Bar	(L:C310_Electrical_Crash_Bar, bool)	0=Up, 1=Down

Output

Indicator	Variable	Range
Airspeed Needle	(L:C310_Airspeed_Indicated, knots)	0-300
Ammeter Needle	(L:C310_ELEC_AMMETER_NEEDLE, number)	0-150
Analog EGT Gauge	(L:C310_ENG_EGT1, number)	0-250 (top 250F of EGT)
Left Manifold Pressure	(L:C310_ENG_MANIFOLD_PRESSURE_1, number)	0-35
Right Manifold Pressure	(L:C310_ENG_MANIFOLD_PRESSURE_2, number)	0-35
Left CHT	(L:C310_ENG_CHT1, number)	0-500
Right CHT	(L:C310_ENG_CHT2, number)	0-500
Left Fuel Flow	(L:C310_Fuel_Flow_Left, number)	0-160
Right Fuel Flow	(L:C310_Fuel_Flow_Right, number)	0-160
Left Fuel Quantity Gauge	(L:C310_FUEL_DISP_L, number)	0-50
Right Fuel Quantity Gauge	(L:C310_FUEL_DISP_R, number)	0-50
Left Oil Pressure	(L:C310_ENG_OIL_PRESSURE_1, number)	0-120
Right Oil Pressure	(L:C310_ENG_OIL_PRESSURE_2, number)	0-120
Suction Gauge	(L:C310_SUCTION, number)	0-6
Left RPM Gauge	(L:C310_ENG_RPM_1, number)	0-3500
Right RPM Gauge	(L:C310_ENG_RPM_2, number)	0-3500
Left Oil Temperature	(L:C310_ENG_OIL_TEMPERATURE_1, number)	0-100
Right Oil Temperature	(L:C310_ENG_OIL_TEMPERATURE_2, number)	0-100
Outside Air Temperature	(L:C310_OAT, number)	-105 to +105

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