Turbo 310R

X-PLANE USER GUIDE

MILVIZ

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Main Index

Welcome!

This User Guide has been prepared to help you get started with your new Turbo 310R for X-Plane.

It contains useful information about your Turbo 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 simulation activity has not ceased with your purchase of the MilViz Turbo 310R. Worldwide, the Military Visualizations staff stands ready to assist and serve. For technical support, please post a request on our Turbo 310R X-Plane support forum. Our dedicated and talented staff is ready to help you.

For forum access please email oisin@milviz.com with your proof of purchase and your preferred or existing forum username.

Bringing the 310R to X-Plane

This isn't the first version of the 310R to wear the MilViz label. The original version of the MilViz 310R was released way back in 2010 in Microsoft Flight Simulator X, well known not only for it's accurate portrayal of the iconic twin but also for the carefully tuned and realistic flight model.

In the spring of 2018 we released the 310R Redux, for FSX and Prepar3d. This version was a complete overhaul of the original, with enhanced and updated systems programming, an updated virtual cockpit, new external textures, and a brand new soundset. In other words, pretty much everything required in order to bring this aircraft up to current standards.

In bringing the 310R into the X-Plane world, we've retained the same excellent standards that we're know for, while taking advantage of all of the modern technology available to us in X-Plane 11.

We're happy to be here, and we're very happy that you could join us. Thanks and enjoy the ride!

Product Features

- **Designed for X-Plane 11**
  - Optimized for X-Plane 11 engine and handling behavior
  - Inclusion of PBR materials and textures
  - Advanced FMOD sounds inside and out
- **High Quality Textures & Modeling**
  - Physical Based Rendering (PBR) materials and textures for superb real-time reflections and shine
  - Exterior and interior rendered with exacting detail and precision
  - High resolution, beautiful textures with realistic weathering effects
  - Smoothly animated parts inside and out
- **Realistic Simulation of the Turbo 310R**
  - Behavior designed to closely simulate the real world
  - Authentic turbo performance and handling
  - Realistic fuel load and tank capacities
  - Realistic weight & balance

- **Advanced Autopilot System**
  - Autopilot mimics real world behavior, requiring hands-on operation
  - Simulation of VOR station 'Cone of Confusion' when approaching VOR station, requiring monitoring and switching from NAV to HDG to maintain proper course
  - Authentic servo behavior reflecting realistic speed and accuracy
- **GPS Configuration Options**
  - FPS friendly X-Plane GNS 530 & GNS 430 included by default
  - Includes support for RealityXP's GTN 750* & 650* integrated into the 3D cockpit
- **Custom Aircraft Panel**
  - In-game menu panel allows for display of ground elements, switching liveries and changing the GPS displays

*** RealityXP products not included; may not be available for all operating systems**

System Requirements

The following requirements apply as a minimum to successfully install, configure and operate the MilViz Turbo 310R for X-Plane.

(Please note that these requirements represent the minimum required; your choice of scenery, location, and simulator settings may place additional demands on your simulation platform that may ultimately affect your simulation experience.)

Supported Platforms:	X-Plane 11
Supported Operating Systems:	All operating systems which are supported by the X-Plane 11 platform. At the time of publication, this includes: • OS X: OS X 10.10 or newer • Windows: Windows 7, 8, or 10, 64-bit • Linux (While any distribution which successfully runs X-Plane 11 should be capable of operating this aircraft, distribution specific issues with X-Plane 11 that may causes issues with this aircraft are not supported.)
Processor (CPU):	Intel Core i3, i5, or i7 CPU with 2 or more cores, or AMD equivalent. (Recommended: Intel Core i5 6600K at 3.5 ghz or faster.)
Video Card (GPU):	DirectX 11-capable video card from NVIDIA, AMD or Intel with at least 1 GB VRAM. (Recommended: DirectX 12-capable video card from NVIDIA, AMD or Intel with at least 4 GB VRAM, GeForce GTX 1070 or better or similar from AMD.)
System Memory (RAM):	8 GB RAM (Recommended: 16-24 GB RAM or more.)
Hard Drive:	1.5 GB or greater free hard drive 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).
Internet Connection:	Please note that an active internet connection is required for successful activation of this product.

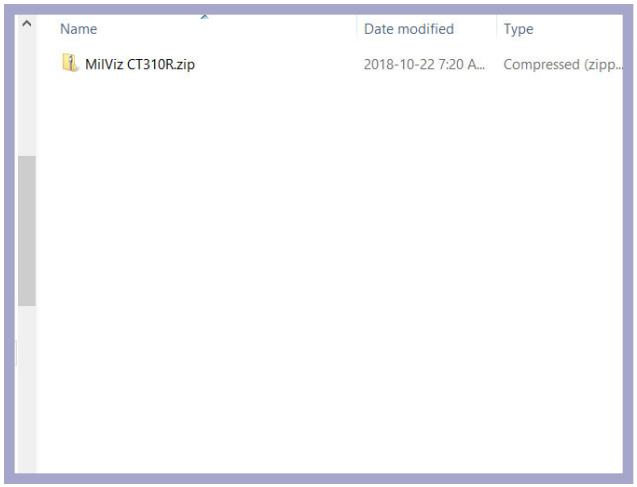
Installation Instructions

1

Beginning Installation

After purchase, you will have been given a link or an option to download a compressed file. This compressed file contains all of the folders and files for the MilViz Turbo 310R for X-Plane.

Using a file compression utility of your choice, decompress this file to a location or folder of your choosing.



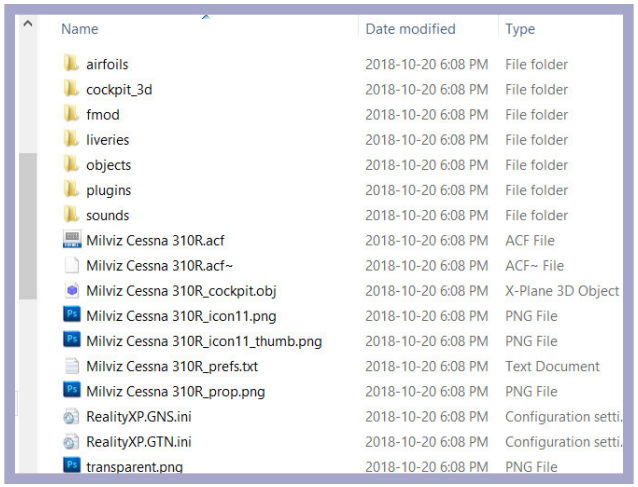
2

Identifying Files to Copy

Within this newly decompressed folder, you will find a sub-folder containing both files and folders.

You'll know that you have identified the correct folder when the contents resemble the below image.

This folder containing the below files is the aircraft folder that needs to be placed within the X-Plane file structure.

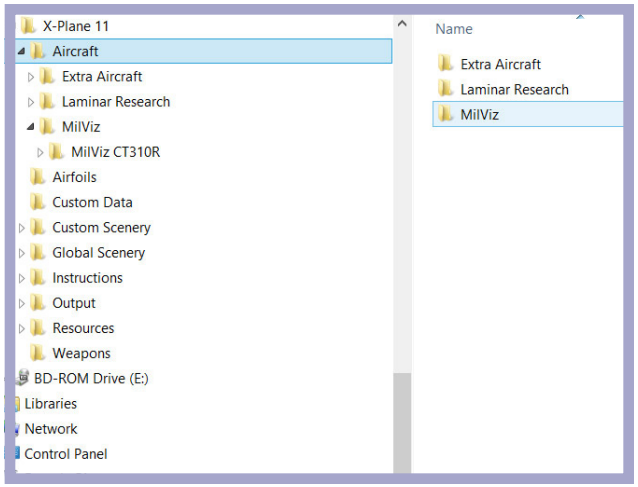


3

Creating a Destination Folder

In the X-Plane 11 file structure, all aircraft are placed within the 'X-Plane 11\Aircraft' folder, generally in developer specific folders. This structure helps to organize your aircraft collection.

While it is largely up to the end user on how they wish to organize their aircraft, we recommend creating a sub-folder within the 'X-Plane 11\Aircraft' folder titled 'MilViz'.



Installation Instructions (continued)

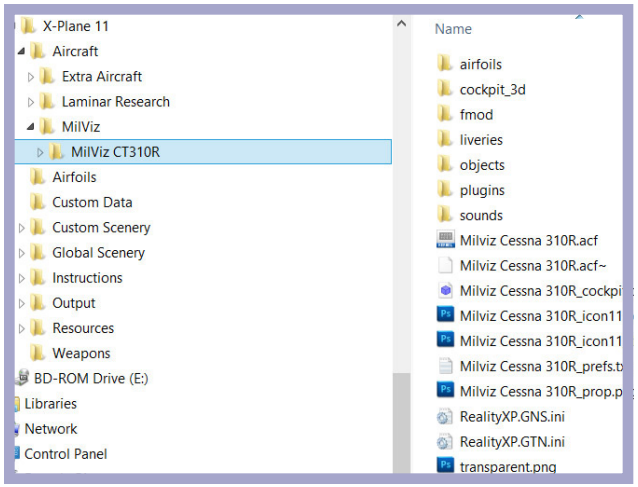
4

Copying the Aircraft

You should now have a folder structure that resembles the following:

'X-Plane 11\Aircraft\MilViz'

Copy the aircraft folder you identified in Step 2 into this newly created MilViz folder. Done correctly, it should closely resemble the following image.



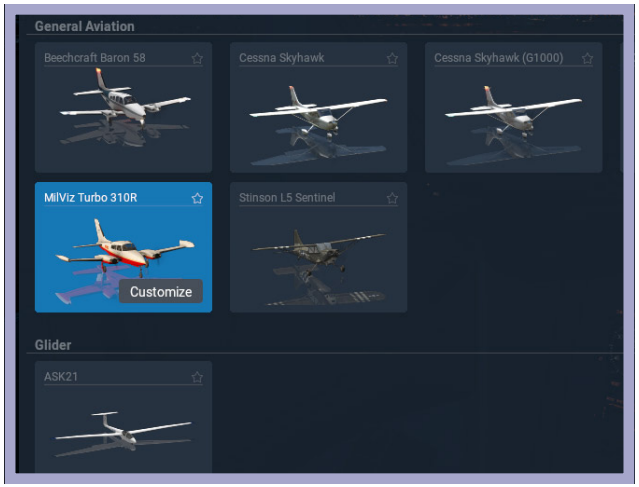
5

Verify Installation

Once the aircraft folder is installed correctly, launch X-Plane 11.

On the left side of the Flight Configuration UI screen, you should be able to find your new Turbo 310R.

You may now select it and start a flight (making any other desired adjustments to starting location & weather, of course).



6

Enter Serial Number

Note: Please ensure that your computer is connected to the internet before continuing.

At time of purchase, you should also have been given a serial number for your aircraft. This serial number is used to register your aircraft, and is tied to your individual purchase.

On the first launch of the aircraft, a window will automatically show, asking for the serial number. Enter the number you received and press the 'Activate' button to continue.

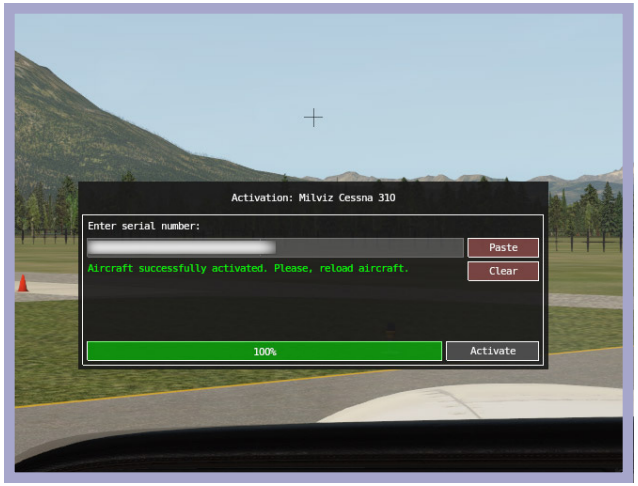
Installation Instructions (continued)

7

Verify Activation

After clicking on the 'Activate' button, a dialog should display in green text which confirms the successful activation of the aircraft.

It also prompts you to reload the aircraft to complete the activation process.

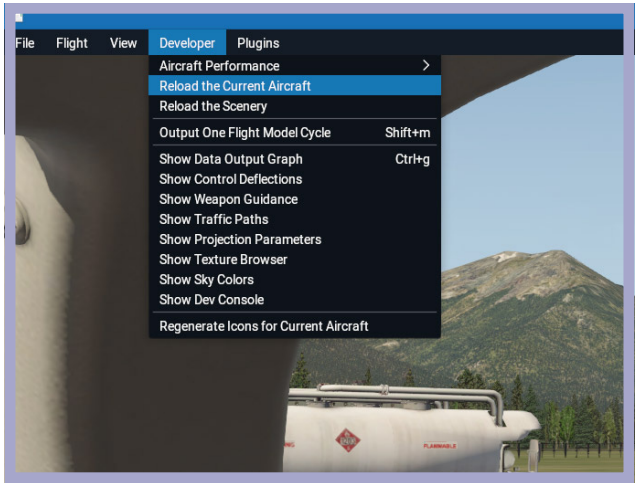


8

Reload Aircraft

To reload the aircraft, go to the Developers tab in the upper system menu, and from there, scroll down to 'Reload the Current Aircraft'. Click on this choice.

You may note that the simulator may seem to momentarily freeze, this is normal behavior while the simulator reloads the aircraft.



9

Go Fly!

Once your aircraft has successfully reloaded, the installation and activation process is complete.

Enjoy your flights!

Uninstalling

The MilViz Turbo 310R may be un-installed very simply by deleting the aircraft folder that you manually copied into the X-Plane 11 file structure.

Note: *Prior to uninstalling the aircraft, please be sure to back up any customized files or custom liveries you have installed if you wish to keep them.*

Updating

In the event that you are notified of an update to the MilViz Turbo 310R, it is highly recommended that you completely uninstall the previous version before you install the newly updated version. This will ensure that the correct versions of any changed files are present.

Product Support

We are deeply committed to the satisfaction of our customers. If you encounter any issues with your product or require assistance, or just have a general question, we encourage you to visit our forums at http://milviz.com/forum/.

Support forums for our individual products are restricted to owners of that product. To register for a specific support forum, please contact oisin@milviz.com for registration information and details. Please note that proof of purchase will be required.

Turbocharging the 310R

One of the primary differences between this aircraft and the version that we have previously published (for Flight Simulator X and Prepar3D) is a bit of a big one: as the name implies, the ***Turbo*** 310R is equipped with turbocharged engines.

Both engines are equipped with a turbocharger and related components; this allows the aircraft to maintain rated power to 16,000 feet. The engines behave like normally aspirated engines would, with some differing engine characteristics. As such, it's worthwhile to explain some of the things affected by turbocharging, as well as note some of the correct procedures to be followed.

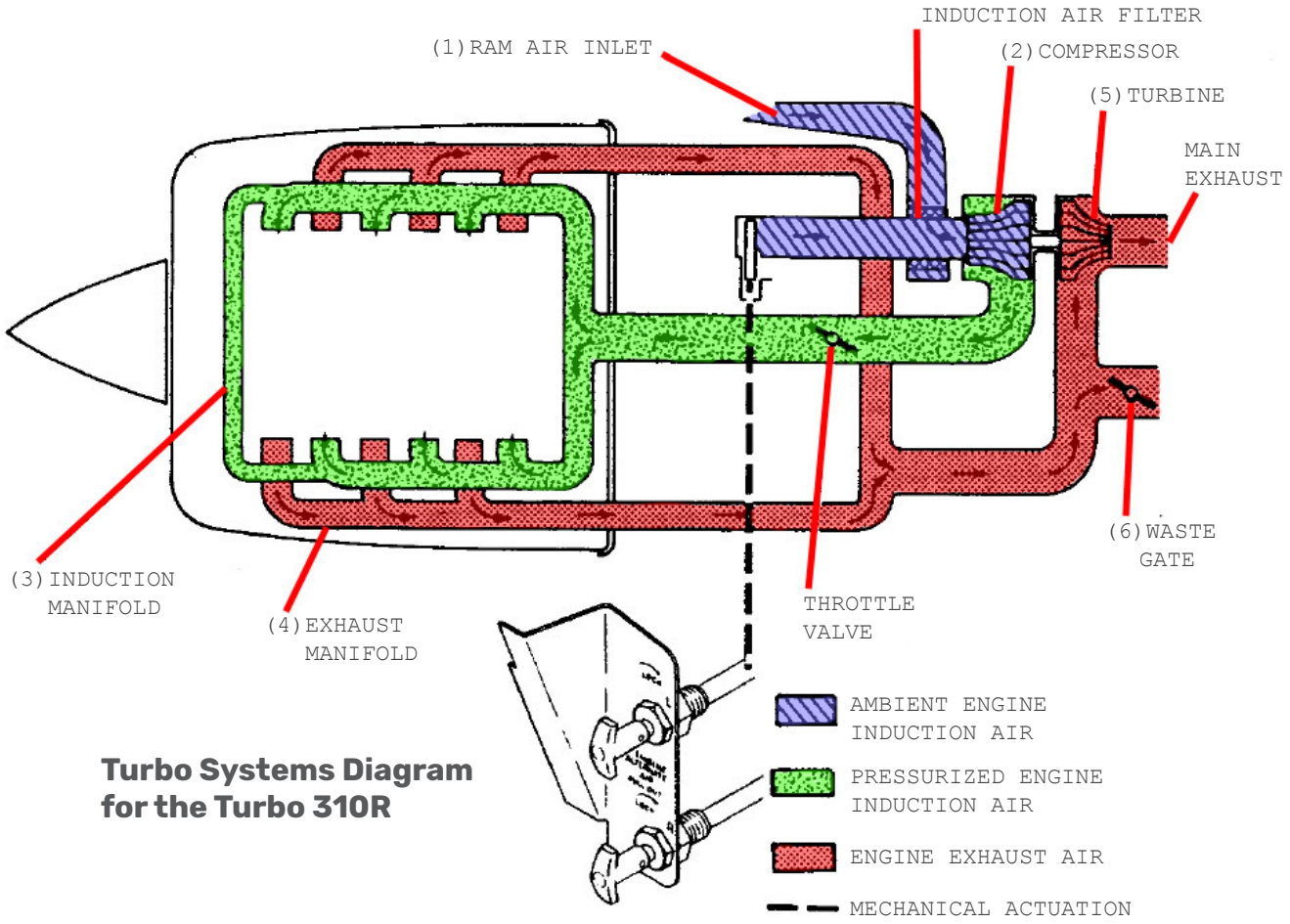
Referring to the diagram on this page, it's useful to follow the path of induction air through the engine up to being expelled as exhaust gases.

First, engine induction air is taken in through the Ram Air Inlet (1), passing through a filter into the Compressor (2), where the air is then compressed. This compressed, pressurized air then passes into the engine cylinders via the Induction Manifold (3) where, mixed with fuel, it is burned, exiting the engine cylinders via the Exhaust Manifold (4). The exhaust gases provide driving power for the Turbine (5) which in turn drives the Compressor.

The power created by the turbine would allow the engine to exceed the maximum 32.0 inches Hg. manifold pressure, so therefore a Waste Gate (6) is used so that excess exhaust gases can be expelled prior to passing through the turbine.

In studying this path of induction air through the engine, it makes sense that anything which affects the flow of induction air into the compressor, or exhaust gases into the turbine, will also affect the speed of the turbocharger system.

Now, any change in the flow of induction air will have no effect if the waste gate is open, because the waste gate automatically serves to hold the compressor discharge pressure constant. This occurs below 16,000 feet with full throttle and RPM. Above 16,000 feet, the waste gate is operated by the turbo system to limit the manifold pressure appropriately, at approximately 2.2 times the ambient air pressure.



Turbo Systems Diagram for the Turbo 310R

This automatic control of the waste gate by the turbo system will provide, approximately, the placarded manifold pressure during single engine climb, however all engine climbs at higher speeds or with closed cowl flaps may require some adjustments to the throttle to maintain the proper manifold pressure.

When the waste gate is fully closed, any change in turbocharger speed will equal a change in engine operation. Anything that results in an increase or decrease of turbine speed will cause an increase or decrease in manifold pressure.

Manifold Pressure Variation vs. Altitude

As noted previously, at full throttle the turbocharger is capable of maintaining the maximum allowable 32.0 inches Hg. manifold pressure up to 16,000 feet. The RPM range for maintaining the maximum allowable manifold pressure is 2500 - 2700 RPM; if a lower RPM range is selected for a cruise climb such as 2300 - 2400 RPM, the manifold pressure may start to drop before 16,000 feet.

The turbo system controller does not include a pressure compensated waste gate and therefore only operates automatically at full throttle. If a lower manifold pressure is selected by the pilot, the throttle will require manual advances to maintain the selected manifold pressure as the aircraft climbs.

Manifold Pressure Variation vs. Airspeed

When the aircraft is operated at full throttle at altitudes below 16,000 feet, the waste gate is open, therefore changes in airspeed have little effect on the manifold pressure.

At high altitudes, once the waste gate is closed, differences in airspeed will have a small, but noticeable, effect on manifold pressure.

Fuel Flow Variations vs. Manifold Pressure

This is one area where we are forced to deviate from real world behavior due to a limitation within the X-Plane platform. Proper behavior is that fuel pump output and fuel flow is regulated by engine speed and compressor discharge pressure. The practical (real world) end result is that fuel flow adjustments by the pilot are minimized greatly, reduced to small initial adjustments on takeoff or climb-out for the proper rich setting, lean-out in cruise, and return to full rich for approach and landing.

However, X-Plane does not model this behavior correctly, instead choosing to model ambient pressure only; this causes the turbocharged engine to behave as a normally aspirated engine would in regards to fuel flow.

As such, as the aircraft climbs, the fuel levers will need to be managed by the pilot in order to lean the fuel mixture so as to allow the engines to achieve rated power and proper climb rates.

So - during the climb it is advised that the pilot should strive to maintain an EGT of 1050° F by progressively leaning the fuel mixture, before leaning for cruise power once at altitude.

Momentary Overboost Of Manifold Pressure

Under certain circumstances, such as rapid throttle movement, it is possible that the engine can be overboosted above the maximum allowable 32.0 inches Hg. manifold pressure. This could occur during the takeoff roll or during a change in full throttle operation while in flight. Slight, but momentary, overboosting is not considered detrimental to the engine, but can usually be controlled by slower throttle movements.

Altitude Operation

A turbocharged aircraft is capable of climbing faster and higher than a normally aspirated aircraft can, as such, the pilot should be aware of the possibility of fuel vaporization being encountered.

It is recommended that the auxiliary fuel boost pump switches be turned ON when climbing to altitudes above 12,000 feet. In addition, the fuel pumps should be left ON for several minutes after cruise in level flight has been established.

Using the T310R Aircraft Menu

The MilViz Turbo 310R includes a custom aircraft menu panel which is accessible once the aircraft is loaded. From this menu, it's possible to perform the following actions:

- Remove / Attach external features
- Change Aircraft Liveries
- Switch between GPS options

The menu panel may be opened (or closed) by utilizing the X-Plane Menu Bar located at the top of the screen, and choosing "Plugins > MilViz T310R > Show/Hide Options".

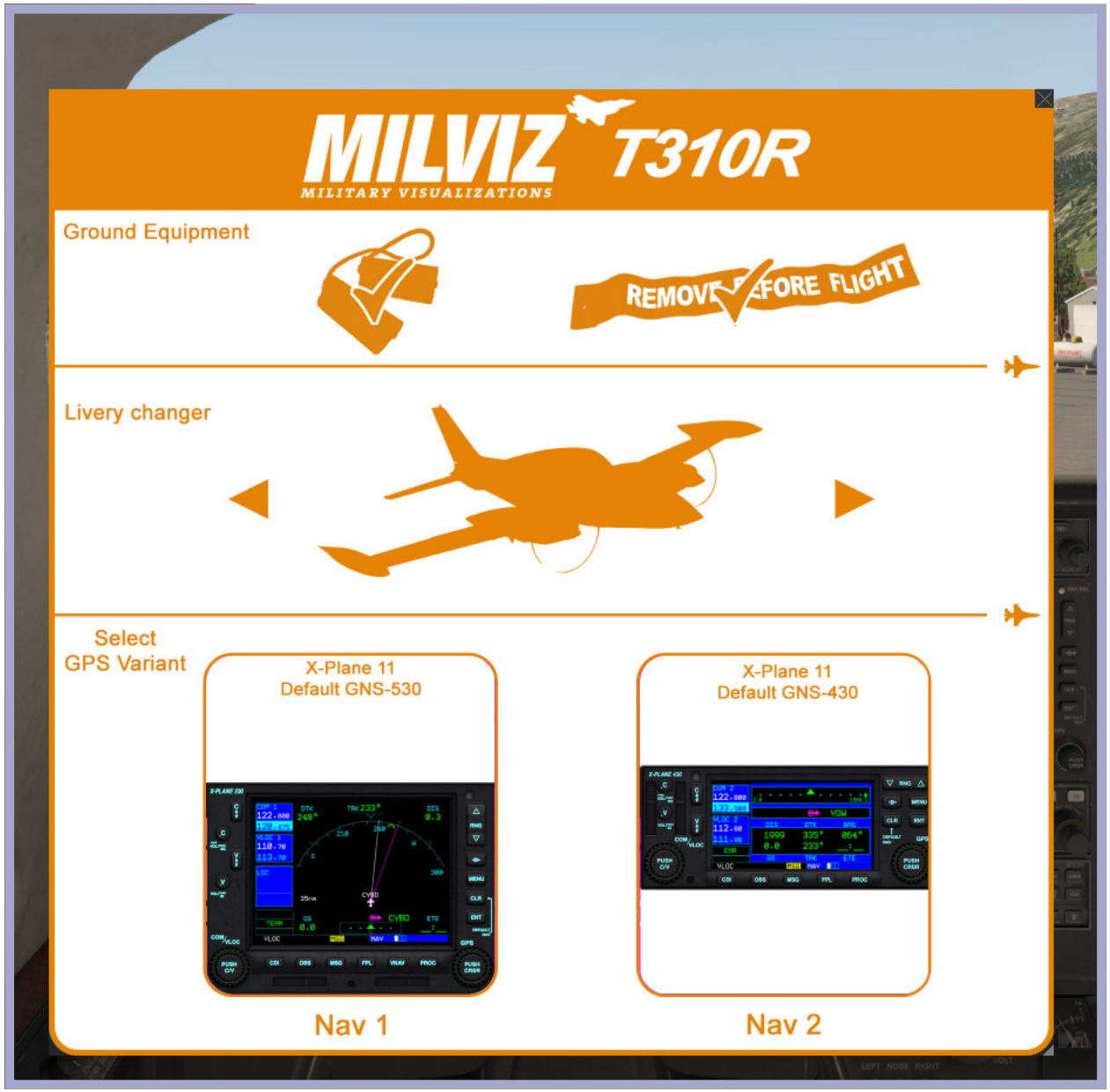
Clicking on the images of the chocks or the 'Remove Before Flight' flag allows you to hide or show those respective features on the aircraft.

The next section allows you to switch aircraft liveries on the fly by clicking the arrows to the left or right of the aircraft image.

The GPS options allow you to switch between the stock X-Plane GNS 530/430 and the RealityXP GTN 750/650 variants (not included).

To switch, click the image shown for either Nav 1 or Nav 2. The changes will immediately be reflected in the aircraft.

IMPORTANT: When transitioning between the Reality XP GTN 750 and the stock X-Plane GNS 530, be sure to turn the GTN 750 OFF in the plugins menu. This is found at 'Plugins>Reality XP GTN> GTN1'.



Rain Effects for Windows

The MilViz Turbo 310R includes a plugin which adds rain effects to all windows.

Rain will accumulate when the aircraft is parked, will be affected by wind while moving or flying, and will realistically affect the appearance of anything viewed through the windows.

These effects add an improved sense of realism and immersion while flying through inclement weather; instead of seeing rain falling around you, rain is now something directly affecting the aircraft itself.

The plugin which adds these effects is compatible with Windows and Mac. If using Linux, the aircraft will still work, but the rain effects will be missing.

This plugin requires the latest VCC distributable from Microsoft. If it is not installed on your system, it can be found at: https://support.microsoft.com/en-us/help/2977003/the-latest-supported-visual-c-downloads

Managing the Fuel System

The fuel system in the MilViz Turbo 310R is intended to provide a very high fidelity experience and closely replicates actual use.

The T310R is equipped with two main fuel tanks, often referred to as 'wingtip' or 'tip' tanks. Each 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 gallons.

Each engine is typically fed by the tank on that respective side, but the airplane also features the capability to crossfeed the fuel from the main tank on the opposite side from the engine. Note that it is not possible to crossfeed fuel from the auxiliary fuel tanks.

Fuel Controls

The MilViz T310R features a pair of fuel switches and placards located immediately aft of the pedestal, between the front seats. The left fuel switch controls the fuel flow for the left engine, and the right fuel switch 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 below the switch and indicated by the tapered end of the switch handle. In the MilViz T310R for X-Plane, the desired tank can be switched to by clicking on the placard area with the LEFT MOUSE BUTTON.

Fuel Gauge

The fuel gauge featured on the T310R is 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 quantity remaining in the main tanks, move the mouse over the upper portion of the switch (an up arrow will display) then click and hold the switch with the LEFT MOUSE BUTTON. To temporarily display the fuel quantity in the auxiliary tanks, repeat the process, except over the lower portion of the switch (a down arrow will display).

The indicator lamps to either side of the switch will illuminate when the pilot has selected the auxiliary fuel tank for the associated engine. Warning lamps on the center area of the panel will illuminate to notify the pilot of low fuel quantity in the selected tank.

All lamps are of the push-to-test type.

Managing the Electrical System

The electrical system in the Turbo 310R is designed to respond in a believable manner in comparison with the real aircraft. There are a few exceptions in that the circuit breakers, although modeled, are not operable, nor are the emergency alternator field switches and the emergency avionics power switch (these being located on the lower right side of the circuit breaker panel).

Electrical power in the T310R is supplied by a 28-volt, negative-ground, direct current system powered by alternators on each engine. A 24-volt battery is located in the left wing outboard of the engine nacelle.

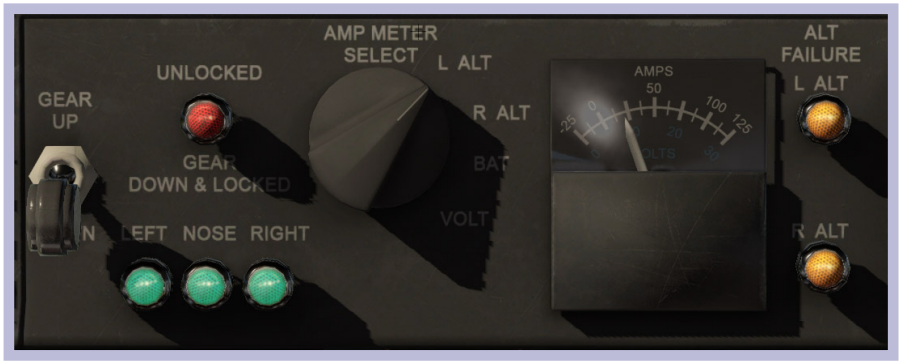
Warning of low system voltage is provided by warning lamps on the instrument panel, next to the voltammeter. The lamps will illuminate when the bus voltage decreases below 25 volts (approximately). These lights can sometimes illuminate when the engine is idling at an RPM insufficient to provide optimal alternator power output. The lamps are push-to-test, and can be tested by clicking them with the LEFT MOUSE BUTTON.

Independent alternator switches and a separate master battery switch is provided as a means of checking for a malfunctioning alternator circuit and to permit that circuit to be turned off. When an engine is not running, the switch for that alternator should be turned OFF.

The master battery switch and the alternator switches are toggled upwards (ON) and downwards (OFF) by clicking the switch with the LEFT MOUSE BUTTON.

Amperage / Voltage Indicator

A voltammeter is located on the instrument panel directly above the pedestal, located between landing gear controls and the wing flaps switch. This gauge provides for monitoring of alternator current output, battery charge or discharge rate and aircraft bus voltage.



An AMP METER SELECT switch, located to the left of the voltammeter indicator, has labelled indications for L ALT, R ALT, BAT, and VOLT. By positioning this switch to L ALT, R ALT or BAT position, the respective alternator or battery amperage can be monitored. By positioning the switch to the VOLT position, the electrical system bus voltage can be monitored.

To position the switch, move the mouse over the rotary switch. Movement to one side or the other will cause a clockwise or counter-clockwise arrow to display; click the LEFT MOUSE BUTTON to rotate the switch in the respective direction.

When measuring the amperage draw for the alternators or the battery, reference the top white section of the gauge. When measuring the voltage draw, reference the bottom blue section of the gauge.

In addition to the voltammeter and the amp meter select switch, the warning lights for low system voltage are positioned in this location.

Tutorial: Starting the Turbo 310R

For this portion of the T310R user guide, we'll present a step-by-step walkthrough of how to take the Turbo 310R from a cold and dark state all the way up to being ready for taxi and takeoff.

The T310R cabin is an 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 T310R an ideal airplane both for those who desire a relaxing flight in an elegant aircraft, or for those learning the ins and outs of flying a twin.

The instrumentation installed in the MilViz T310R panel is quite standard and should be familiar to the majority of simulation pilots.

Equipped with dual yokes, the T310R can be flown 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 traditional flight instruments are located on the left hand panel in front of the pilot, where as the right hand panel is composed primarily of the engine instrumentation.

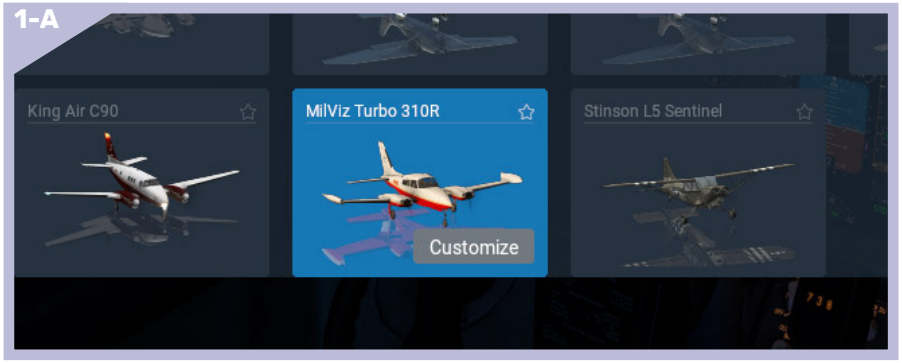
Although the engines and the underlying systems in the T310R are realistic in nature, there is no wear n' tear simulation included, nor are there any custom failures beyond what is a default part of the X-Plane platform.

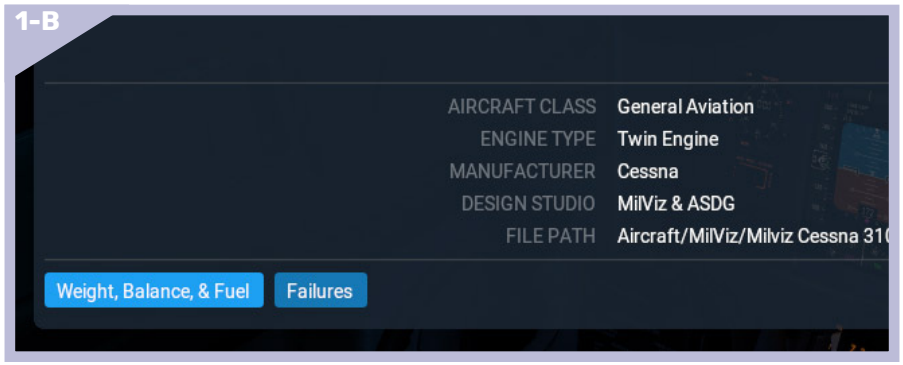
Aside from the specifications and limitations we've listed elsewhere within this user guide, our primary advice is simply to pay attention to the limitations indicated on the instrumentation, primarily the airspeed indicator, the manifold pressure gauge and the RPM gauge.

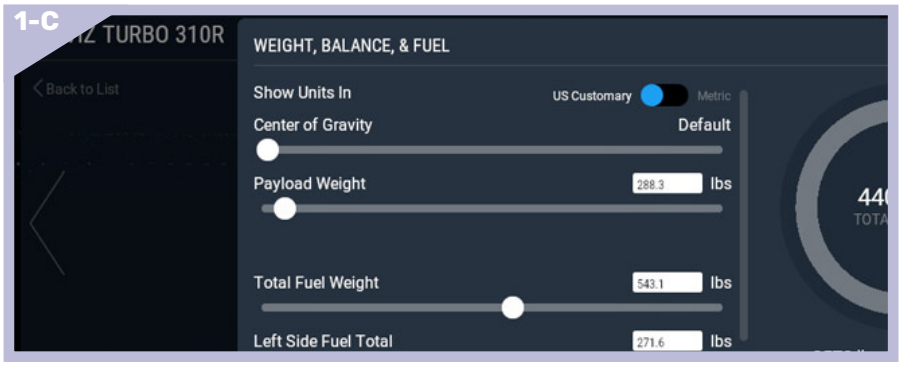
Have fun and keep the blue side up!

Preflight Actions

1) Adjust fuel quantities and weight as desired for flight
   - Adjustments are made through the Flight Configuration UI
   a) When selecting the aircraft, press the "Customize" button
   b) Next, press the "Weight, Balance & Fuel" button
   c) Adjust as desired
   - Tanks 1 & 2 (the main tip tanks) are filled before aux tanks
   - The usable C.G. range is from -1.5" (forward) to +2.8" (aft)







2) Remove wheel chocks and covers
   - This action can be done through a custom menu panel
   - This panel is opened through the top UI menu bar
   - Choose "Plugins > MilViz T310R > Show/Hide Options"

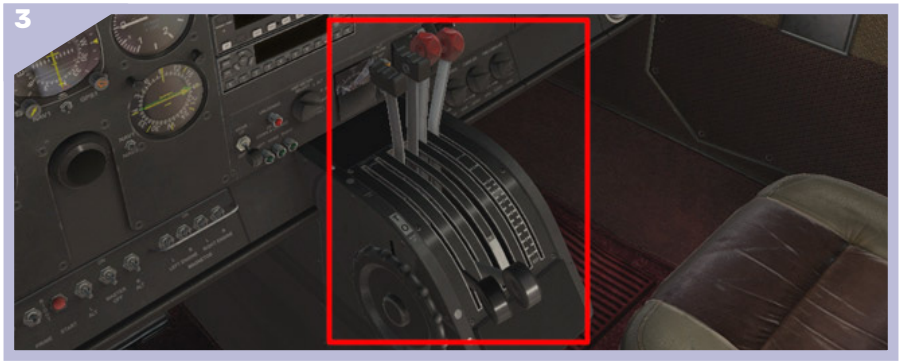
Before Starting Engines

1) Set Parking Brake
   - Hold the left mouse button, pull the lever out to set
2) Switch Fuel Selectors to Main Tanks
   - Left click on the desired placard area to turn the selectors
3) Set Throttle, Propeller & Mixture levers
   a) Set Mixture levers fully rich (forward)
   b) Set Propeller levers fully forward
   c) Set Throttle levers open approximately one inch
4) Turn on Battery and Alternator Switches
   - The lower switch panel is located directly below the yoke
   - For easier access, the yoke may be hidden from view
   - To hide the yoke, left click on the yoke shaft

1

2

3



4

Before Starting Engines (continued)

5) Set lighting switches and dials as required
   - Toggle switches ON/OFF with the left mouse button
   - Rotate dials to adjust brightness with the mouse wheel
6) Set Altimeter to correct barometric pressure or elevation
   - Use the adjustment knob at the bottom left of the altimeter
   - Rotate the mouse wheel when over the adjustment knob
7) Open left and right Cowl Flaps
   - Hold the left mouse button, pull or push control handles

5

6

7

1

2

3

Starting Engines

(left engine is started first, then right engine)

1) Turn on Magneto Switches
   - > Toggle switches ON with the left mouse button

2) Start Engine
   a) Press Start button for desired engine
   - > Click the button using the left mouse button

   b) Engage the Primer left or right, depending on engine
   - > Click and hold the primer switch and drag to left or right

3) Turn Auxiliary Fuel Pump switch to LOW
   - > Toggle switch to LOW with the left mouse button

4) Set Throttle lever to obtain 800 to 1000 RPM

(repeat steps 1 through 4 for right engine)

4

Before Taxi

1) Turn on Avionics Master Switch
   - Toggle switch ON with the left mouse button
2) Turn on and set Avionics as desired
3) Release Parking Brake
   - Brakes will release by pressing the toe brakes
   - Brakes may also be released by using the control handle

1

2

3

You're cleared for takeoff, enjoy your flight!

Aircraft Specifications

Number of Engines	2
Engine Model Number:	TSIO-520-BB
Engine Type:	Turbocharged, fuel injected, direct drive, air-cooled, horizontally opposed, six cylinder, 520 cubic-inch displacement.
Horsepower:	285 rated horsepower at 2700 RPM and 32.0 inches Hg. manifold pressure to the critical altitude of 16,000 feet.
Propellers:	2, 3-blade, 6' 6" diameter, constant speed, full feathering, non-reversible hydraulically actuated.

Maximum Takeoff Weight:	5500 lbs
Maximum Landing Weight:	5400 lbs
Maximum Zero Fuel Weight:	5015 lbs
Standard Empty Weight:	3467 lbs
Maximum Useful Load:	2068 lbs
Main Fuel Tanks - Usable	100 U.S. Gallons (total)
Auxiliary Fuel Tanks - Usable	63 U.S. Gallons (total)
Total Wing Area:	179 square feet
Wing Loading:	30.73 lbs per square foot
Power Loading:	9.65 lbs per horsepower

Recommended Settings & Speeds

Normal Takeoff:	2700 RPM, Full Throttle, Flaps 0°	Raise nosewheel at 80 KIAS, Lift-off at 92 KIAS (5500 lbs Max Weight)
Max Performance Takeoff:	2700 RPM, Full Throttle, Flaps 15°	Raise nosewheel at 70 KIAS, Lift-off at 82 KIAS (5500 lbs Max Weight)
Best Angle-of-Climb Speed (S.L.):		81 KIAS (at 5500 lbs Max Weight)
Best Rate-of-Climb Speed (S.L.):		105 KIAS (at 5500 lbs Max Weight)
Cruise Climb:	2350 RPM, 29 In. Hg.	115 to 140 KIAS
Maximum Climb:	2700 RPM, Full Throttle below 16,000 feet, Max allowable M.P. above 16,000 feet.	105 KIAS
Cruise:	2100 to 2350 RPM and 15.0 to 29.0 In. Hg. or 2200 to 2300 RPM and 15.0 to 30.0 In. Hg.	
Minimum Multi-Engine Approach Speed:		93 KIAS (at 5400 lbs Max Weight)

Aircraft Limitations

Operational Limitations		
Maneuvering Speed VA (knots)	148 KIAS	Do not make abrupt or sudden control movements above this speed.
Maximum Flap Extended Speed VFE (Knots) 15°	158 KIAS	Do not exceed this speed at this flap setting.
Maximum Flap Extended Speed VFE (Knots) 35°	139 KIAS	Do not exceed this speed at this flap setting.
Maximum Gear Operating Speed VLO (Knots)	138 KIAS	Do not operate the landing gear above this speed.
Maximum Gear Extended Speed VLE (Knots)	138 KIAS	Do not extend the landing gear above this speed.
Minimum Controllable Airspeed VMCA (Knots)	80 KIAS	This is the minimum speed at which the aircraft is controllable with one engine inoperative and a 5° bank towards the operative engine
One Engine Inoperative Best Rate-of-Climb Speed Vy (Knots)	106 KIAS	The speed delivering the greatest gain in altitude in the shortest time with one engine inoperative at sea level, standard day conditions and level flight
Never Exceed Speed VNE (Knots)	223 KIAS	Do not exceed this speed in any type of operation
Maximum Cruising Speed VNO (Knots)	181 KIAS	Do not exceed this speed except in smooth air and with caution

Engine Limitations

Altitude (Feet)	Allowable Manifold Pressure (In. Hg.)	Engine RPM	Brake Horse-power
S.L. to 16,000 feet	32.0	2700	285
18,000	30.7	2700	268
20,000	29.0	2700	246
22,000	26.4	2700	222
24,000	24.3	2700	198
26,000	22.2	2700	176
28,000	20.2	2700	155
30,000	18.5	2700	136
32,000	17.0	2700	117

Credits

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Ryan Butterworth
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Rain Effects
Saso Kiselkov Rain Effects
by Cooper LeComp (AFM Simulation)

MILVIZ