PA-31 Navajo
powered by
Reality Expansion Pack

v4.8.11

May 24, 2025

Contents

AIRCRAFT GENERAL DESCRIPTION **5**

INSTALLATION & CONFIGURATION **6**
System requirements . . . 6
Linux . . . 6
Base Airplane . . . 6
Install the software . . . 6
Automatic Update of the Software . . . 7
Manual Update of the software . . . 7
Remove the software . . . 7
Recommended sound settings . . . 8
Recommended control settings . . . 8

HARDWARE & SOFTWARE COMPATIBILITY **9**
Headshake . . . 9
Saitek Panels . . . 9
XPRealistic . . . 9
Differential and progressive brakes for X-Plane 11 . . . 9

USER INTERFACE **10**
Lateral Menu . . . 10
Maintenance Report . . . 11
Kneeboard . . . 12
Mass & Balance . . . 14
Walkaround . . . 16
Move the viewpoint while doing the walkaround in 2D . . . 16
Walkaround in VR . . . 16
Towing . . . 16
Move the viewpoint while towing in 2D . . . 17
Towing in VR . . . 17
Engine Autostart . . . 17
Settings Window . . . 18
Use Advanced Steering . . . 19
Use Advanced Braking . . . 19
Use VR Walkaround and Towing . . . 19
Wait for real weather at startup . . . 19
In flight tips vertical offset . . . 19

Economy System **20**
Modes of Operation . . . 20
Enabling the Economy System . . . 20
FSEconomy: Aircraft Key Setup . . . 20
How It Works . . . 20
Maintenance and Repairs . . . 23
Buying and Selling Fuel . . . 25
Earning Money: Rewards . . . 25

VR Support **26**
How to open the plugin windows in VR . . . 26

SOUNDS SYSTEM **27**

PERSISTENT AIRCRAFT AND COMPONENTS WEARING **28**

Reality Expansion Pack – Wear & Tear System **28**
Loading a Worn-Out Aircraft . . . 28
Checking Component Status . . . 28
Hobbs Time and Tach Time . . . 29
Hobbs Time . . . 29
Tach Time . . . 29

SYSTEMS DESCRIPTION **30**
Powerplant . . . 30
Engine Overview . . . 30
Starter . . . 31
Induction System . . . 31
Spark Plugs . . . 33
Oil System . . . 34
Engine Startup Tips . . . 35
Vacuum System . . . 35
Electrical Systems & Avionics . . . 36
Battery . . . 36
Alternator . . . 36
Lights . . . 36
Electrical Gyros . . . 36
Radio Stack . . . 36
Landing Gear . . . 37
System Limitations . . . 37
Tires . . . 37
Brakes . . . 38
Oxygen System . . . 39

HUMAN FACTOR **40**
Hypoxia . . . 40
TUC & EPT . . . 40

HOME COCKPITS/CUSTOM DATAREFS **42**

RESOURCES & HOW-TOs **49**

SUPPORT & CONTACTS **49**

VERSION CHANGELOG **50**

LICENCE **53**
SOFTWARE PRODUCT LICENSE . . . 53
LIMITED WARRANTY . . . 54

LibCURL EULA 55
COPYRIGHT AND PERMISSION NOTICE 55

AIRCRAFT GENERAL DESCRIPTION

The Piper PA-31 Navajo is a family of cabin-class, twin-engined aircraft designed and built by Piper Aircraft for the general aviation market, most using Lycoming engines. It was also license-built in a number of Latin American countries. Targeted at small-scale cargo and feeder liner operations and the corporate market, the aircraft was a success. It continues to prove a popular choice, but due to greatly decreased demand across the general aviation sector in the 1980s, production of the PA-31 ceased in 1984.

Source: (Wikipedia)[https://en.wikipedia.org/wiki/Piper_PA-31_Navajo]

INSTALLATION & CONFIGURATION

System requirements

This software requires X-Plane 11.00 or superior.

The minimum hardware requirements are the same of X-Plane:

- Dual Core, 2.5 GHz or faster
- 2 GB of RAM
- A video card with at least 500 MB of VRAM.

This software is designed to run on Windows, MacOS and Linux.

Linux

If you use REP on Linux, there are some addictional requirements:

- libstdc++6
- libgcc6
- libcurl
- libssl
- libcrypto

On Steam: Right-click on X-Plane 12, select Properties, navigate to Compatibility, check the box for “Force the use of a specific Steam compatibility tool,” and choose “Steam Linux Runtime 3.0 Sniper” or “Legacy Runtime 1.0” from the dropdown menu.

Base Airplane

In order to install this software, the **Piper PA-31 Navajo for X-Plane 11 by Carenado** must be installed on your system.

Install the software

Note: A video tutorial is available on our YouTube Channel

To install the software please follow this procedure.

1. Locate the PA-31 Navajo folder inside your X-Plane installation.
2. Clone the PA-31 Navajo folder and call it “PA-31 Navajo REP”.
3. Extract the contents of this REP package into a temporary folder
4. Move **the contents** of “**into-aircraft-plugins-folder**” into the “**PA-31 Navajo REP/plugins**” folder
5. Move **the contents** of “**into-aircraft-main-folder**” into the “**PA-31 Navajo REP**” folder
6. Run X-Plane and load the PA-31 Navajo.
7. Follow the onscreen instructions

Automatic Update of the Software

The Reality Expansion Pack support the automatic updates via the SkunkCrafts Updater plugin. In order to activate the automatic updates you shall:

1. Install the SkunCrafts Updater plugin as stated in its user manual
2. Inside REP's zip, inside the "into-aircraft-main-folder", you find a file called **skun-crafts_updater.cfg**. Copy such file into the PA-31 Navajo main folder.

NOTE

- Always install REP's skunkcrafts_updater.cfg file even when the airplane already comes with its own cfg. REP updates will automatically install the base airplane updates whenever available.
- Load a non-REP airplane - such as the default Cessna 172 - before applying the automatic updates. Applying the updates on the aircraft that is currently loaded in the sim will not guarantee a successful update.
- After updating the plane, close and relaunch X-Plane to make sure that all the files are unloaded and updated correctly.

Manual Update of the software

NOTE: It is not necessary to remove the older REP files. The software will take care of the update procedure.

1. Copy the "REP" folder contained in this package inside the "plugins" folder of the PA-31 Navajo, overwriting the existing one.
2. Run X-Plane and load the PA-31 Navajo.
3. Reload the aircraft when the automatic update is finished (click on Developer > Reload the Current Aircraft and Art).

Remove the software

To remove the software follow this procedure:

1. In the menu bar click on "Plugins"
2. Click on "SimCoders.com - REP" and choose "Disable Package"
3. Click "Ok" in the confirmation message
4. Reload the aircraft when the uninstallation procedure ends (click on Developer > Reload the Current Aircraft and Art).

At the end of the uninstallation procedure, the original aircraft will be restored to its mint conditions.

Recommended sound settings

To better enjoy the Reality Expansion Pack on the PA-31 Navajo, you should setup your sound settings like the following screenshot.

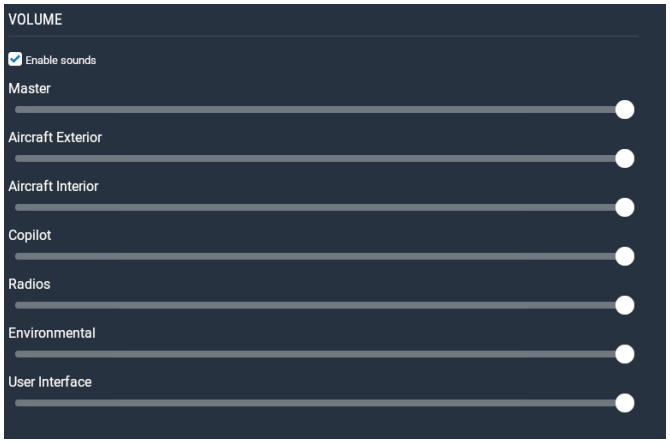

Figure 1: Recommended sound settings

For more information about the sounds, see the Sounds System chapter.

Recommended control settings

To have a better control over the airplane axis, you should setup your control sensitivity as follows.

Figure 2: Recommended control settings

HARDWARE & SOFTWARE COMPATIBILITY

Headshake

If HeadShake v1.5 or higher is installed in your system, it will communicate with REP to improve the simulation realism.

REP will drive HeadShake to simulate the vibrations of the real engine. Using this, you will be able to run the engine at the most comfortable RPMs by simply checking the vibrations it produces.

In the same way, HeadShake will simulate the stall buffeting if the airplane in use shows that kind of behavior.

Saitek Panels

This software is compatible with Saitek Panels. In order to use them, you should install the XSaitekPanels free plugin from Sparker.

This package already includes a INI configuration file for XSaitekPanels. Make sure you copy it inside the main folder of your PA-31 Navajo.

XPRealistic

The Reality Expansion Pack can be used together with XPRealistic.

You might need to disable XPRealistic's wind, touchdown and brakes sound effects as REP already provides them.

Differential and progressive brakes for X-Plane 11

The Reality Expansion Pack detects if Differential and progressive brakes for X-Plane 11 is installed in your system.

If so, REP's differential braking algorithm is disabled in favor of the custom differential brakes algorithm of the third party plugin.

USER INTERFACE

Lateral Menu

When loaded, REP shows a lateral menu on the left-side of the screen. The menu consists of a set of small icons.

By default, the menu partially hides itself until the mouse pointer gets near it.

Figure 3: The menu is partially hidden by default

Figure 4: The menu is shown when the mouse pointer gets closer to it

You can choose to completely hide the menu when the mouse pointer leaves it. To do so, go to “Plugins -> SimCoders - REP -> Settings” menu and tick the “Show side menu on mouse over only” option.

The lateral menu entries are available in the “Plugins -> SimCoders - REP” menu as well.

Maintenance Report

This window is the primary way you have to check the status of your airplane and to fix all the systems that need the mechanic attention.

The report is divided on more pages. Each page relates to a different group of systems.

To act on a system, click on the entry in the “Action” column.

To switch to the previous/next page click over the flipped page corners at the bottom of the report.

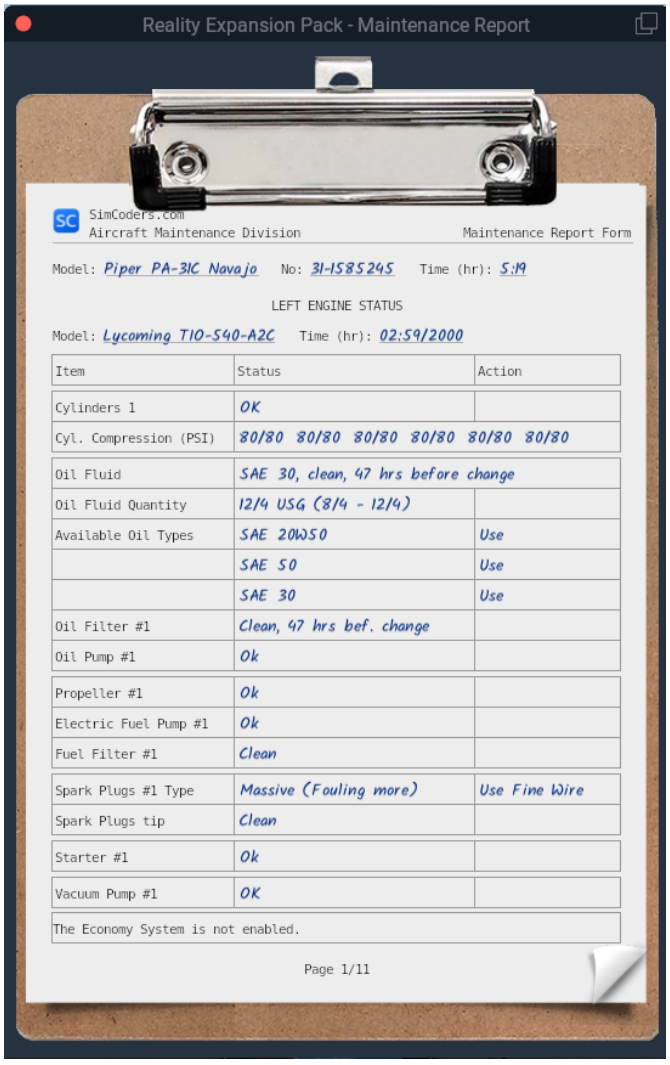

Figure 5: The Maintenance Report window

Kneeboard

The software come with a complete kneeboard window that contains the aircraft normal and emergency checklists together with the performance reference tables.

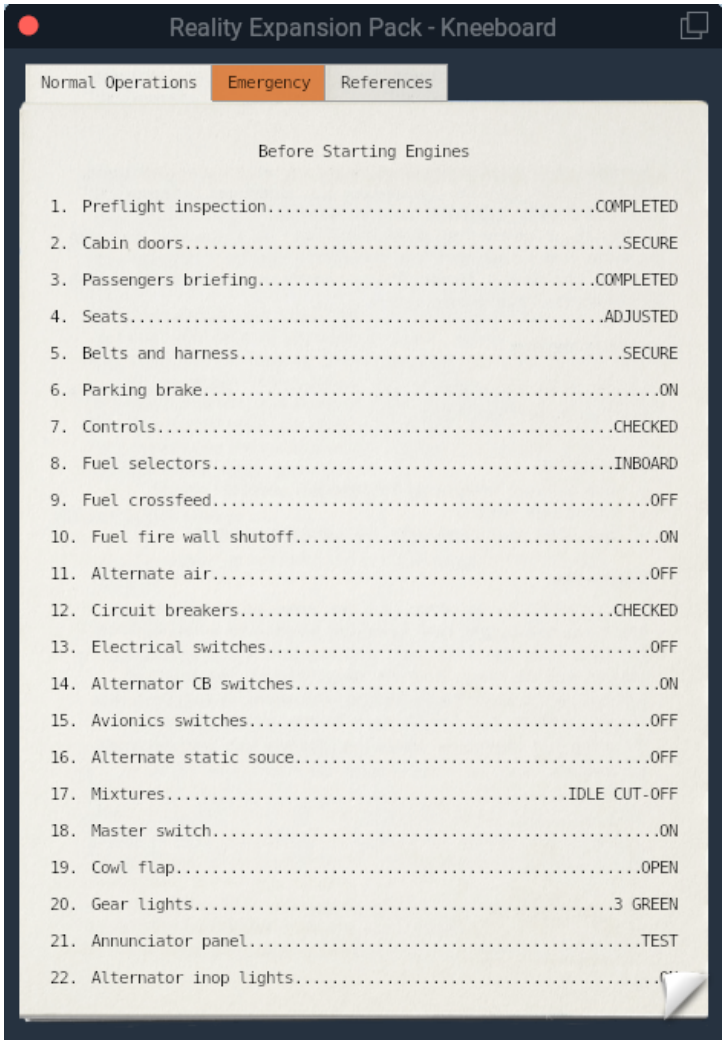

Figure 6: The Kneeboard window

Show the kneeboard using the plugins menu

The kneeboard window may be shown by clicking on the “Plugins” menu, then “SimCoders – REP” then “Show kneeboard”.

Manage the kneeboard using the custom commands

You can also use five different custom commands at which you can assign your custom keys or joystick buttons. The custom kneeboard commands defined by REP are the following:

Command	Description
simcoders/rep/kneeboard/toggle	Show or hide the kneeboard
simcoders/rep/kneeboard/next_section	Show the next kneeboard section
simcoders/rep/kneeboard/prev_section	Show the previous kneeboard section
simcoders/rep/kneeboard/next_page	Show the next kneeboard page
simcoders/rep/kneeboard/prev_page	Show the previous kneeboard page

Mass & Balance

The Reality Expansion Pack provides a Mass & Balance tool to precisely load the plane.

While loading the plane, the goal is to keep the crosses inside the plot section delimited by the blue area, like shown in the screenshot below.

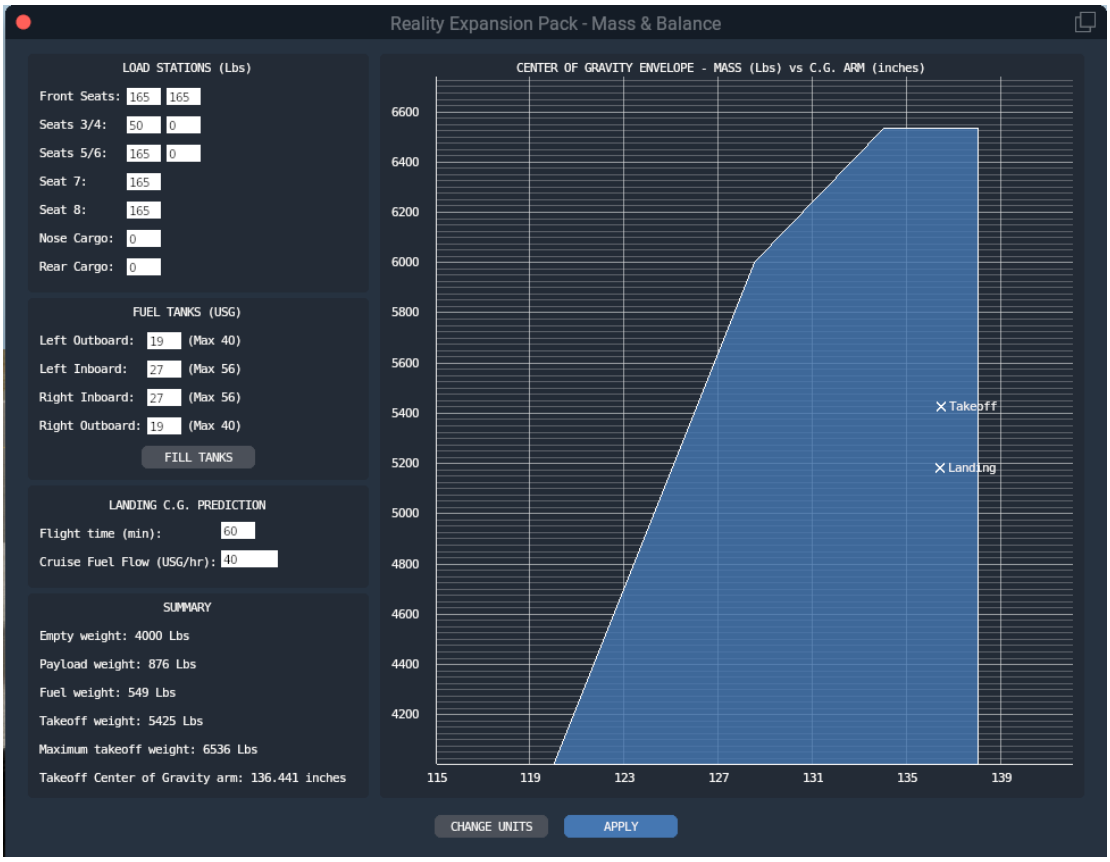

Figure 7: The Mass & Balance window

The blue area is the Center of Gravity Envelope. The mass is reported on the Y axis, the Center of Gravity Arm is reported on the X axis.

If the cross is towards the left side of the plot, it means that the center of gravity will be towards the front of the airplane, that is, the airplane will be nose heavy.

On the other hand, if the cross is on the right side of the plot, the airplane will be tail heavy.

If you overload the airplane and the cross goes outside the blue envelope, the cross becomes red, indicating that the plane is not allowed to fly.

Clicking on the “Apply” button, the selected passengers mass and fuel load will be applied to X-Plane.

The unit of measure for the airplane mass and the C.G. arm can be changed by clicking the

“Change Units” button.

Walkaround

Click on the Walkaround icon in the lateral menu to enter walkaround mode. Click again on the same icon on close the walkaround window to return in the cockpit.

During walkaround you can interact with some external systems of the aircraft using the walkaround window. Click the “Next” and “Prev” buttons at the bottom of the pre-flight checklists to move along the different pre-flight stations.

Always do the walkaround and the pre-flight inspection before each flight.

If you do not remove the tie-down and the chocks, you are not able to taxi and takeoff properly.

If you do not remove the pitot cover, you will incur an airspeed indicator failure.

Since version 3.4.5, it is possible to toggle all the static elements - such as the pitot cover and the tiedowns - using a single entry in the plugins menu or a keyboard command.

Since version 3.3, the following keyboard/joystick commands are available to control the walkaround mode.

Command	Description
simcoders/rep/walkaround/toggle	Toggle the walkaround mode
simcoders/rep/walkaround/next	Next walkaround station
simcoders/rep/walkaround/previous	Previous walkaround station
simcoders/rep/walkaround/action	Execute current action
simcoders/rep/walkaround/static_elements/toggle	Static elements toggle

Move the viewpoint while doing the walkaround in 2D

It is possible to move the viewpoint during towing by using the default camera commands of X-Plane. To pan the view using the mouse, keep pressed the **simcoders/rep/view/pan_with_mouse** command.

Walkaround in VR

REP provides a series of hotspots around the airplane useful to check the plane during the pre-flight, post-flight and lights-check checklists.

Start the walkaround using the **simcoders/rep/walkaround/toggle** command and then move from station to station using your VR controller. Make sure you bring the walkaround window with you while moving from a station to another.

Towing

REP comes with a complete towing simulation. To activate it, click on the towing icon in the lateral menu. Click the icon again to exit from the towing mode.

The towing features a 3D towing bar that will help you driving the airplane on the tarmac.

To move the airplane, push or pull the pitch axis of your joystick. Use the roll axis to turn.

Since REP simulate the force applied by a single man placed in front of the airplane, you may not be able to tow the airplane on the grass, just like in real life.

You won't be able to tow the airplane if it's tied-down or if chocks/brakes are applied.

Move the viewpoint while towing in 2D

It is possible to move the viewpoint during towing by using the default camera commands of X-Plane. To pan the view using the mouse, keep pressed the **simcoders/rep/view/pan_with_mouse** command.

Towing in VR

REP provides an hotspot in front of the airplane (tricycle gear) or close to the tail (taildragger) useful to drive the airplane in VR mode.

Toggle the towing mode using the **simcoders/rep/towing/toggle** command and then move the airplane using your joystick as described above.

Engine Autostart

The Reality Expansion Pack provides you a way to automatically start the engines.

Click on the engine autostart icon in the side menu and wait until the startup procedure is completed.

During the automatic start, REP shows a series of tips that describe the action being done.

Settings Window

The settings windows is shown by clicking over the “Plugins -> SimCoders - REP -> Settings” menu.

Enable the plane damages

When ticked, this option enable the plane damages.

Show generic messages

If ticked, REP will show generic messages related to systems status, when available.

Show failure messages

If ticked, REP will show a message in case of a system failure. The message will explain why the failure happened and what course of action should be taken.

Show tip messages

If ticked, REP will show a tip message. The message will give some hints related to the current pilot actions.

Show side menu on mouse hover only

When ticked, REP will completely hide the lateral menu when the mouse pointer leaves it.

Save and restore the plane status between sessions

If ticked, REP will save the airplane status when unloaded. When the same plane and livery are loaded again, the status will be restored.

The status includes all the switches position, the fuel on-board, the loaded weights, the engine fluids quantity and quality and all the possible values that play part to the systems simulation.

The engine temperatures - such CHT and Oil Temperature - are restored accordingly to the elapsed time since the values where stored.

The status files are backed up before being overwritten. You find the backup in the output/preferences/REP folder.

Save and restore the windows position between sessions

If checked, the Maintenance Hangar and the Keyboard windows positions are saved and restored between sessions.

Enable hypoxia effect

When ticked, the default hypoxia effect is replaced by REP’s custom algorithm. See the Hypoxia chapter to get more information about the custom hypoxia effect.

Roll axis drives ground steering

When ticked, the joystick roll axis will steer the nosewheel on the ground.

Use US Customary

When ticked, REP will use the US Customary units of measure (pounds and inches).

Wind sound level

Control cabin the wind sound setting the level between 0 (mute) and 100 (full).

Main Monitor Index

This option is visible only if X-Plane is running on two or more fullscreen monitors. Type the index of the monitor over which REP must show its menus and windows. The minimum number you can set here is 1. The maximum number is your monitors count. Each number addresses a different monitor.

Use Advanced Steering

Enable this option to use REP's advanced steering algorithm. You may need to disable this option if you have issues with steering with your hardware pedals.

Use Advanced Braking

Enable this option to smooth the brakes and to enable the automatic differential brakes. Instead of applying the brakes all at once, they will go from 0 to 1 in two seconds, smoothing the braking action. Automatic differential braking is applied if brakes are pressed while steering. Disable this option if you use hardware toepedals.

Use VR Walkaround and Towing

When enabled, this option allows to use the new VR walkaround and towing modes.

Wait for real weather at startup

When this options is enabled together with the simulator real weather, REP waits for the real weather to be correctly loaded before loading the plane status and update the systems' temperatures. This option is not needed in X-Plane 12 therefore it is not shown.

In flight tips vertical offset

Set the vertical offset of the in-flight window. By default, the tips are shown at the top of the main screen.

Economy System

The Reality Expansion Pack (REP) introduces a custom Economy System that rewards you for your flight time and allows you to manage maintenance and repair costs for your aircraft.

Modes of Operation

The Economy System offers three modes of operation:

- **Standalone**: Maintains a local bank account and maintenance records on your PC, shared among all your REP aircraft. Rewards are provided for flight time and landing skills.
- **FSEconomy**: Connects to your FSEconomy account, deducting maintenance costs directly from your FSEconomy balance. Flight time rewards are excluded, as they are handled by FSEconomy.
- **X-CPL-Pilot**: Integrates with your X-CPL-Pilot account to deduct maintenance costs. Flight rewards are not included, as they are managed by X-CPL-Pilot.

Enabling the Economy System

To activate the Economy System:

1. Open the Maintenance Report and navigate to the last page.
2. Click the “Enable” button for your chosen system.

FSEconomy: Aircraft Key Setup

If enabling the FSEconomy mode, an **Aircraft Key** is required. This key is a 15-character identifier unique to your aircraft within the FSEconomy environment.

Steps to find your Aircraft Key:

1. Log in to the FSEconomy website.
2. Select the “**Aircraft**” button from the main menu.
3. Locate your aircraft in the list and click “**Edit**” under the “Action” column.
4. Generate or copy the Aircraft Key from the lower-left corner of the page.

When enabled, the Economy System saves your aircraft state to a separate file. This allows for two independent aircraft states—one for when the Economy System is active and another for when it is disabled. Switching between modes will load the corresponding state.

Your bank account is shared across all REP aircraft, enabling you to use funds earned with one aircraft to repair or maintain another.

How It Works

Once activated, the Economy System displays your bank account balance and transaction history (expenses for maintenance and fuel, and income from flights) in the Maintenance Report.

Figure 8: Enable the Economy System

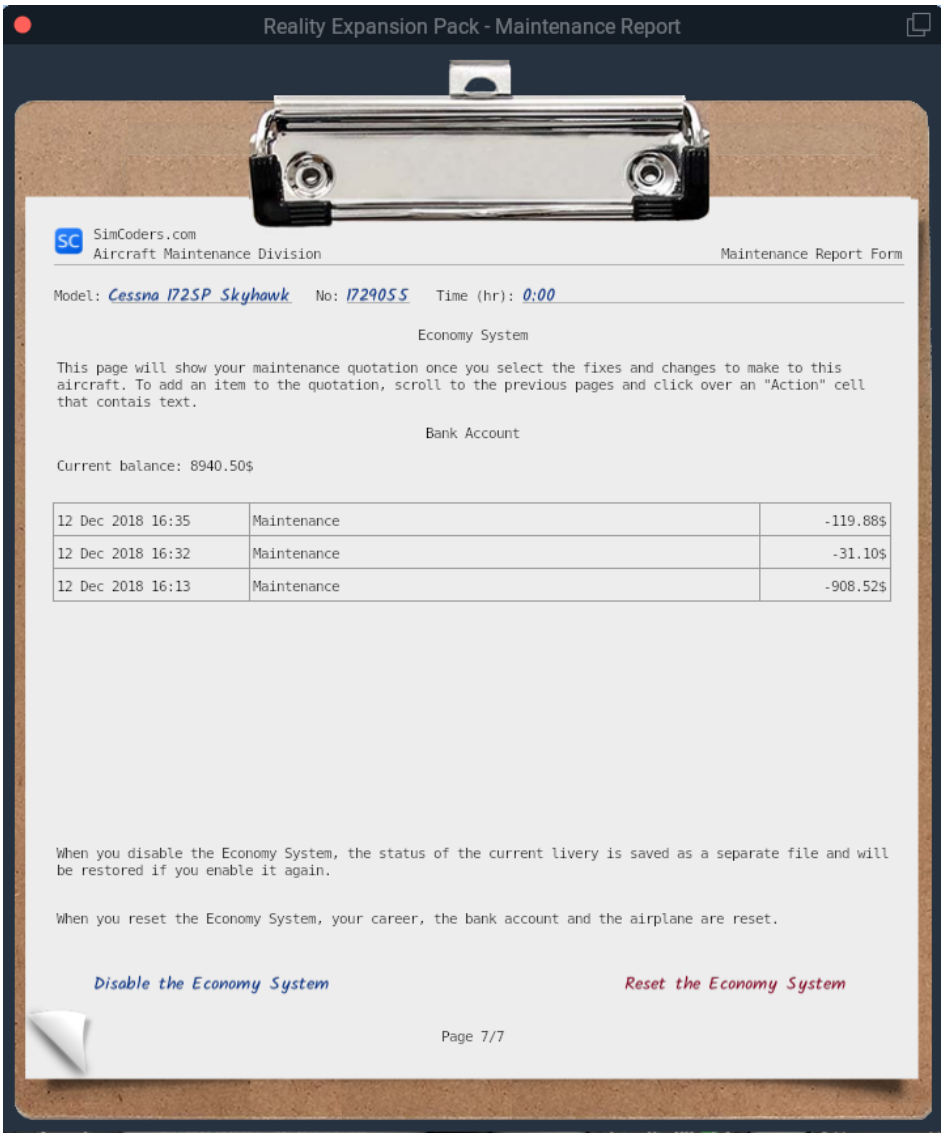

Figure 9: Economy System Overview

Maintenance and Repairs

1. Navigate to the Maintenance Report to view available maintenance tasks.
2. For each task, the table lists the cost and required work time.

Figure 10: Maintenance Report Example

3. Add tasks to your **Quotation** by clicking the “Action” cell for each item. The cell will update to show “In Quote”.
4. To remove a task, click the “Action” cell again.

Once you’ve selected the necessary actions, view your Quotation by clicking “View Quotation” or

scrolling to the last page of the Maintenance Report.

Figure 11: Quotation Example

The Quotation provides two pricing options:

- **Normal Price**: Maintenance is completed **one task at a time** in real-time, even if multiple aircraft require attention. The mechanic will continue working even if the simulator is closed.
- **Quick Fix Price**: All tasks are completed instantly at a higher cost.

Accept a price to proceed with maintenance, or decline to cancel the Quotation.

Buying and Selling Fuel

Standalone Mode Only

In the Weight and Balance window, you can add or remove fuel:

- **Adding Fuel**: Deducts money from your account based on local prices.
- **Removing Fuel**: Sells fuel back to the airport at a slightly lower rate than the purchase price.

Fuel prices vary by region, airport, and time, but can be customized via the `fuel_prices.cfg` file in the `Output/preferences/REP` directory of X-Plane. Note that custom prices are only applied after the next scheduled recalculation (every 4–8 days).

To check fuel prices at a specific airport, use the plugin menu: `SimCoders - REP` -> `Check fuel price at an airport`.

Earning Money: Rewards

Standalone Mode Only

Earn money for flight time, with bonus rewards for smooth landings. The softer the landing, the higher the bonus. Flight earnings are logged in your bank account transaction history at the end of each flight.

VR Support

REP supports the native VR implementation since version 3.4.0. VR support was further improved in version 4.5.0.

How to open the plugin windows in VR

REP provides a set of commands to control the plugin windows.

- **simcoders/rep/vr/open_menu**: open REP's main menu
- **simcoders/rep/fuelmenu/show**: show the fuel menu when using the economy system
- **simcoders/rep/maintenancereport/show**: show the maintenance report
- **simcoders/rep/settingsmenu/show**: show the settings menu
- **simcoders/rep/weightandbalance/show**: show the weight and balance (if supported)
- **simcoders/rep/towing/toggle**: toggle the tow mode
- **simcoders/rep/kneeboard/toggle**: toggle the kneeboard
- **simcoders/rep/walkaround/toggle**: toggle the walkaround mode

For more information about how to assign the commands above please read X-Plane's user guide about assigning commands to buttons.

NOTE

Make sure you loaded a REP airplane before looking for the command in X-Plane's settings window.

Figure 12: The Tech Report shown in VR mode

SOUNDS SYSTEM

The Reality Expansion Pack features a custom sound system that provides immersive 3D sounds throughout the entire flight experience.

A custom sounds system has been preferred over the usage of FMOD for the following reasons:

- FMOD could be rather cumbersome from the developer's point of view, requiring more time to produce new features
- A custom engine is more flexible and can be expanded in no time providing new features
- A custom engine is more efficient as it's taylored to our needs

REP's sounds system provides advanced sounds such:

- Engine ignition
- Engine pings
- Engine exhaust effects
- Fuel pumps
- Electric Gyros
- Avionics effects
- Dynamic touch down
- Dynamic ground roll
- Dynamic wind

PERSISTENT AIRCRAFT AND COMPONENTS WEARING

Reality Expansion Pack – Wear & Tear System

The **Reality Expansion Pack** features a comprehensive **wear and tear system** that applies to the **entire aircraft**. Every component experiences wear over time, and after extended use, it may develop issues or even fail completely. The condition of each part is continuously saved and updated, even when the simulator is not running.

This applies to key aircraft systems such as engine components, the electrical system, airframe, and landing gear.

Each component is affected by both **time and user handling** in different ways.

For example, if you push the engine beyond its operational limits, it will degrade faster, leading to startup difficulties, combustion irregularities, and a noticeable loss of power. If neglected, it will eventually fail.

The precision of cockpit instruments also diminishes over time—a **newly calibrated gauge** will be far more accurate than one that has been in service for years.

Loading a Worn-Out Aircraft

With REP, you have the option to start with an aircraft that already has a **wear history**.

To do so, navigate to:
Plugins → **SimCoders.com - REP** → **Wear out to >**
and select one of the following presets:

- **Brand New**: A factory-fresh aircraft, just off the production line. The engine and all onboard systems are in perfect condition.
- **Privately Owned (New)**: A well-maintained aircraft with low flight hours. Some usage is logged, but no issues are present.
- **Privately Owned (Old)**: A privately owned aircraft with significant flight hours. While well cared for, wear is visible on various components.
- **Flying Club**: A well-used aircraft that has passed through many hands—some careful, others less so. Expect worn-out systems and degraded instrument performance.

Checking Component Status

To inspect, repair, or calibrate individual components, refer to the **Maintenance Report**.

This report provides a **detailed overview** of all aircraft components that can be checked and serviced by a mechanic.

Hobbs Time and Tach Time

Within the **Maintenance Report**, you will also find:

- **Hobbs Time** – The total airframe time.
- **Tach Time** – The total engine time.

After flying a new aircraft for a while, you may notice a **slight difference** between these two values due to how they are calculated.

Hobbs Time

In most aircraft, the **Hobbs meter** is triggered by an oil pressure switch, meaning it starts counting when the engine is running and stops when the engine shuts down.

It measures time in **real-world clock intervals**, ticking off **0.1 hours** every **6 minutes**, regardless of whether the aircraft is idling or in cruise flight.

Tach Time

Unlike Hobbs time, the **tachometer clock** does not track actual time; instead, it records **engine revolutions**.

- When the engine runs at **cruise RPM**, the tachometer records time at the same rate as the Hobbs meter.
- If the engine operates at a lower RPM (e.g., idling on the ramp), the tach time accumulates **more slowly** than Hobbs time.
- This means that **the faster you run the engine, the faster the tach time increases**.

By understanding and managing wear and tear, you can extend the life of your aircraft's components and maintain peak performance throughout your flights.

SYSTEMS DESCRIPTION

Within the Reality Expansion Pack, each system has its own life-cycle and can be damanged depending on many factors, including the pilot's behavior.

All systems can be fixed individually using the Maintenance Report or all at once using the **simcoders/rep/systems/fix_all** command.

The following is a brief description of each system onboard.

Powerplant

The PA-31 Navajo is powered by a two six-cylinders Lycoming TIO-540-A2C Turbocharged, direct-drive, air-cooled, horizontally-opposed, fuel-injected engine with 540 cubic inches displacement.

This engine outputs a maximum power of 310HP at 42 inches Hg and 2575RPM.

Engine Overview

The Reality Expansion Pack totally replaces the engine simulated by X-Plane with custom algorithms to the point that not a single bit of the old engine model is left in the sim.

Everything in the engine is made from scratch to provide the maximum realism. This includes the combustion model to which all the other models - such as the Power Output, the Cylinders Head Temperature or the Oil Pressure - depend.

The engine now breathes air, mix it with fuel and produce a realistic combustion.

Some of the features include:

- **Correct animations and sounds**: the cylinders compression is simulated to the deepest level, enhancing the propeller movements at very low RPMs and at startup and shutdown
- **Correct power output**: the engine outputs the correct power at every MAP/RPM setting.
- **Correct fuel flow**: reaching the correct power output allows X-Plane to provide the right fuel flow at every phase of the flight, right down to the numbers.
- **Realistic startup procedure**: The engine needs to be primed and prepared for startup following the correct procedure
- **Realistic engine issues**:
  - The oil type, quality and quantity affects the engine behavior.
  - The spark plugs may foul because of carbon deposits
  - Leaning the mixture at the wrong time or in the wrong way may cause damages to the engine
  - Engine preheater and winterization kit: the engine may be preheated in winter using the provided electric engine heater. If the engine is not heated correctly, it won't start or may be damaged after start.

Starter

The Reality Expansion Pack replaces the default starter with a custom one.

In the “Engine Status” page of the Maintenance Report you can:

- Check the starter status
- Replace a faulty starter with a new one

CAUTION

The starter will overheat and then damage if engaged for too long. Make sure to engage the starter for no more than 30 seconds. Let it cool down between failed starts.

Induction System

The Reality Expansion Pack (REP) implements a custom Manifold Absolute Pressure (MAP) algorithm, replacing X-Plane’s default system for enhanced accuracy and realism.

The **PA-31 Navajo** comes equipped with a **naturally aspirated Continental IO-550-B** engine, meaning its performance is directly affected by altitude. As the aircraft climbs, the available air density decreases, leading to a reduction in **manifold pressure**, power output, and overall efficiency.

With the **Reality Expansion Pack (REP)**, this engine can be **upgraded to a turbo-normalized (TN) configuration** via the **Maintenance Report** window. This modification allows the engine to maintain **sea-level manifold pressure** even at higher altitudes, significantly improving cruise performance and climb efficiency.

Unlike a traditional turbocharged engine, which can generate manifold pressures exceeding standard atmospheric conditions, a **turbo-normalized system** is designed to regulate pressure, ensuring the engine operates within its intended limits while maximizing power retention at altitude. To achieve this, the aircraft is fitted with a **turbocharger and an automatic wastegate**, which carefully manages boost pressure to prevent overboosting and excessive engine stress.

With this upgrade, the **PA-31 Navajo** becomes a more capable aircraft, well-suited for **high-altitude operations, improved fuel efficiency, and enhanced climb rates**, making it ideal for flights over mountainous terrain or extended cross-country journeys.

Turbo-supercharger

It consists in a small turbine powered by the engine’s exhaust gas. The gas spins the turbine that sucks in fresh air from the other side and compress it, pushing it inside the engine.

This allow the engine to maintain its power at high altitude. The Lycoming TIO-540-A2C can provide 310HP up to 20.000 feet.

The TIO-540-A2C turbocharger features an automatic wastegate that dumps the pressure in excess to avoid an engine overboost.

The automatic wastegate keeps the MAP constant as far as possible. That is, once the throttle is set it should not be reset during altitude changes.

The automatic wastegate is oil driven using the same oil that lubricates the engine. It opens through a spring and closes thanks to the engine's oil pressure. Since the oil pressure takes some time to build up, the maximum MAP limitations can be exceeded if the throttle is advanced too fast towards the maximum value.

System Limitations

Spark Plugs

Each cylinder is provided with two spark plugs, one connected to the left magneto and the other connected to the right magneto.

Carbon deposits form on the spark plugs pointers if the engine is run at low RPMs with rich mixture. That is, the spark plugs foul.

To avoid fouling, always keep at least 1000RPM and aggressively lean the mixture when on ground.

A big drop in RPM during the magnetos check is a sign of a fouled spark plug.

To clean the spark plugs, set a high power setting and aggressively lean the mixture. Run the engine with this setting for about 20 seconds then recheck the magnetos.

In the “Engine Status” page of the Maintenance Report you can:

- Check the spark plugs status
- Manually clean the spark plugs

Fine wire spark plugs are less prone to fouling but not immune to it.

Oil System

The oil system has the main role to lubricate the engine thus reducing the friction between engine components. It also helps reduce the engine temperature.

The oil system is made by:

- An **oil tank**
- A **screening filter**
- A set of **oil lines** that go to the cylinders
- An engine-driven **scavenging pump** that moves the oil from the bottom of the oil sump - below the engine - back to the oil tank
- An **oil radiator**.

The Reality Expansion Pack simulates all these components as well as the oil fluid properties.

The pilot must check the quantity and quality of the oil before each flight. This should be done during the walkaround.

In the “Engine Status” page of the Maintenance Report you can:

- Check the **type of oil fluid** in use
- Check the **quantity of oil fluid** in the oil tank
- **Change the oil** fluid type
- Check the **status of the oil filter**
- **Change the oil filter** with a new one
- Check the **oil pump status**
- Overhaul the **oil pump**

A higher grade oil - such SAE50 - is thicker than a lower grade - such SAE30 - and meant to be used in hotter climates.

The following article is a guide to choose the correct oil grade depending on the type of flight operations in progress: https://www.simcoders.com/2016/04/18/how-to-choose-right-oil-engine

If the oil is not changed regularly (about every 40 hours) it may get dirty and have a lower lubricant action. That is, the engine will run hotter and wear more than before.

NOTE

The oil pressure may get closer to its maximum value when a cold engine is first started. This is normal and do not cause any harm to the engine as long as the oil pressure gets lower during engine warmup.

Warmup the engine to ensure the correct oil temperature and pressure before applying full power for takeoff.

CAUTION

Using a higher grade oil in cold climates could lead to high oil pressure, thus damaging the oil system components.

Engine Startup Tips

- If the engine “pops” during the startup it means it’s flooded. Just close the mixture and set the throttle full open, then engage the starter. The engine should start in a few revolutions. If not, repeat the normal startup procedure.

Vacuum System

Each is provided with a vacuum pump used to power up the vacuum gyros.

A vacuum pump is connected to the engine via a quick-break shaft. In case of vacuum pump seizure, the shaft breaks and no harm is done to the engine.

Use the vacuum gauge to check that the vacuum pump is properly working. A normal vacuum reading is about 4 to 6 when the engine is running at cruise power.

In the “Engine Status” page of the Maintenance Report you can:

- Check the vacuum pump status
- Repair a broken vacuum pump

Electrical Systems & Avionics

The airplane is equipped with a 28-volt, direct-current electrical system.

The system uses a battery as the source of electrical energy. An 100-amp alternator maintains its state of charge.

Battery

The default battery is replaced with a battery that keeps its charge between sim sessions and discharges at a realistic rate. The battery state is updated even when the simulator is not running. This means that if you leave your battery on, it will discharge even if X-Plane is closed.

In the “Electrical System & Avionics Status” page of the Maintenance Report you can:

- Check the battery **charge**
- **Recharge** the battery
- **Disconnect** the battery poles from the electrical system

If you plan not to fly the airplane for a while, you should disconnect the battery via the Maintenance Window. This will avoid self-discharging and extend the battery life during storage.

Alternator

The alternator switch position is saved through all X-Plane sessions. Make sure it is switched in the correct position according to the checklists throughout the entire flight.

The alternator switch operation may affect the avionics. Check the Avionics paragraph below to get more information.

Lights

The light switch positions are saved through all X-Plane sessions.

If the airplane is not provided with strobe lights fmod sounds, the Reality Expansion Pack adds the strobe lights sounds when the lights are switched on.

Electrical Gyros

The Reality Expansion Pack replaces the default X-Plane electrical gyros with custom ones with a more realistic spin up/down dynamics.

The typical spin up/down sounds are reproduced when the battery switch is turned in the “On” position. The instruments provided with an electrical gyro and therefore depending on the electrical supply are the turn/slip indicator, the standby attitude indicator and the HSI, if they are provided.

Radio Stack

The radio components save their own state - such as frequencies and knobs position - during X-Plane sessions.

In the “Electrical System & Avionics Status” page of the Maintenance Report you can:

- Check the **status** of each radio
- **Fix** a faulty radio

CAUTION

Never turn on or off the engine or the alternator when the avionics switch is in the “On” position. Doing so may trigger a overvoltage spike that could damage one or more avionics components.

The newer avionics such as the Garmin GNS430/530 are better protected from overloads but they are not totally immune from them.

Landing Gear

The airplane is equipped with a tricycle, hydraulically actuated, retractable landing gear. When in good shape, the landing gear requires from 6 to 8 seconds to fully extend or retract.

The Reality Expansion Pack introduces the following changes to the default landing gear:

- **Improved ground roll physics**: REP corrects the default behavior of X-Plane on ground in cross wind conditions, when the airplane tended to steer against the wind.
- **Custom touchdown sounds**: The touchdown sounds tone and volume are related to the touchdown speed. A harder touchdown will produce different sounds than a soft landing.
- **Brakes sounds**: Actuating the brakes produces the typical whining sound. Also the classic squeaking sounds are reproduced when the brakes are not in perfect shape.

In the “Landing Gear & Brakes Status” page of the Maintenance Report you can:

- Check the **status** of the landing gear struts
- **Fix** a faulty strut

System Limitations

- Maximum Gear Operating Speed (Retraction): 129KIAS
- Maximum Gear Operating Speed (Extension): 156KIAS
- Maximum speed with gear extended: 156KIAS

Tires

The Reality Expansion Pack simulates the tire status and failure based on the landings done in the past.

A flat tire can cause the plane to yaw during the landing run or get it stuck on the ground before taxi.

In the “Landing Gear & Brakes Status” page of the Maintenance Report you can:

- Check the **status** of each tire

- **Fix** a faulty tire

Brakes

The PA-31 Navajo has a single-disc, hydraulically-actuated brake on each main landing gear wheel. Each brake is hydraulically connected to a cylinder attached to each of the pilot's rudder pedals.

The brakes are operated by applying pressure to the top of the rudder pedals, which are interconnected. When the airplane is parked the brakes may be activated using the parking brake switch located under the pilot's yoke.

To avoid brake failures, keep the brake system properly maintained and minimize brake usage during taxi operations and landings.

Do not apply the brakes for a long time. If the runway is long, let the plane slow down by itself.

In the "Landing Gear & Brakes Status" page of the Maintenance Report you can:

- Check the **status** of the braking system
- **Fix** a faulty brake

Oxygen System

The plane is equipped with an oxygen system that provides oxygen to the pilot and the passengers through oxygen masks.

The oxygen system is operated using an switch in the cockpit.

An oxygen pressure indicator is placed near the handle.

Above 12000 feet, make sure that the switch is on the pressure indicator reports a positive pressure.

The oxygen flow pressure varies with the oxygen tank pressure.

The oxygen lasts for a different amount of time, depending on how many passengers are on-board. Use Mass and Balance tool to set the number of people on-board the aircraft. The more people are on-board, the less will the oxygen last.

HUMAN FACTOR

Hypoxia

Hypoxia is a condition in which the body or a region of the body is deprived of adequate oxygen supply at the tissue level.

As altitude is gained, the partial pressure of Oxygen gets lower and lower to the point that the human body is unable to absorb enough quantity of it to sustain life.

The symptoms of hypoxia are:

- Apparent personality change
- Impaired judgement
- Headache
- Tingling
- Increased rate of breathing
- Muscular impairment
- Memory impairment
- Visual sensory loss
- Tunnel vision
- Impairment of consciousness
- Cyanosis
- Unconsciousness
- Death

The Reality Expansion Pack simulates some of the symptoms above, such as the tunnel vision, the increased rate of breathing and the muscular impairment.

TUC & EPT

Time of Useful Consciousness (TUC) is the time available for the development of hypoxia and the pilot to do something about it. It is not the time to unconsciousness but the short time from a reduction in adeguate oxygen until a specific degree of impairment, generally taken to be the point when the individual can no longer take steps to help him/herself.

Effective Performance Time (EPT) is always within and shorter than TUC. Its quantification however depends on the individual.

The following is a table that represent the EPT simulated by REP.

Altitude (ft)	EPT
10000	Few hours
15000	40 minutes
20000	10 minutes
30000	30 seconds
40000	15 seconds
45000	1-2 seconds

Figure 13: Hypoxia effect

HOME COCKPITS/CUSTOM DATAREFS

In order to work properly, REP uses a set of custom datarefs instead of default X-Plane ones.

Here you find a list of datarefs that you can use for your home cockpit.

This list includes all REP's datarefs. Some of them might not be present on some REP, depending on the systems depicted by the package.

Dataref: simcoders/rep/stallwarning/on

- Type: int
- Writable: No
- Contents: 0 = off, 1 = on

Dataref: simcoders/rep/stallwarning/level

- Type: int
- Writable: No
- Contents: 1 = low, 2 = high

Dataref: simcoders/rep/cockpit2/gauges/indicators/vacuum

- Type: float
- Writable: No
- Contents: Vacuum gauge value

Dataref: simcoders/rep/cockpit2/gauges/indicators/attitude_indicator_0_pitch

- Type: float
- Writable: No
- Contents: Main attitude indicator pitch

Dataref: simcoders/rep/cockpit2/gauges/indicators/attitude_indicator_0_roll

- Type: float
- Writable: No
- Contents: Main attitude indicator roll

Dataref: simcoders/rep/cockpit2/gauges/indicators/attitude_indicator_1_pitch

- Type: float
- Writable: No

- Contents: Stdby attitude indicator pitch

Dataref: simcoders/rep/cockpit2/gauges/indicators/attitude_indicator_1_roll

- Type: float
- Writable: No
- Contents: Stdby attitude indicator roll

Dataref: simcoders/rep/cockpit2/gauges/indicators/airspeed_kts_pilot

- Type: float
- Writable: No
- Contents: Pilot airspeed

Dataref: simcoders/rep/cockpit2/gauges/indicators/airspeed_kts_copilot

- Type: float
- Writable: No
- Contents: Copilot airspeed

Dataref: simcoders/rep/cockpit2/gauges/indicators/altitude_ft_pilot

- Type: float
- Writable: No
- Contents: Pilot altitude

Dataref: simcoders/rep/cockpit2/gauges/indicators/altitude_ft_copilot

- Type: float
- Writable: No
- Contents: Copilot altitude

Dataref: simcoders/rep/cockpit2/gauges/indicators/vvi_fpm_pilot

- Type: float
- Writable: No
- Contents: Pilot VSI

Dataref: simcoders/rep/cockpit2/gauges/indicators/vvi_fpm_copilot

- Type: float

- Writable: No
- Contents: Copilot VSI

Dataref: simcoders/rep/cockpit2/switches/avionics_power_on

- Type: int
- Writable: Yes
- Contents: Avionics switch

Dataref: simcoders/rep/indicators/fuel/fuel_quantity_0

- Type: float
- Writable: No
- Contents: Fuel kg in tank 0

Dataref: simcoders/rep/indicators/fuel/fuel_quantity_ratio_0

- Type: float (ratio 0..1)
- Writable: No
- Contents: Fuel ratio in tank 0

Dataref: simcoders/rep/indicators/fuel/fuel_quantity_1

- Type: float
- Writable: No
- Contents: Fuel kg in tank 1

Dataref: simcoders/rep/indicators/fuel/fuel_quantity_ratio_1

- Type: float (ratio 0..1)
- Writable: No
- Contents: Fuel ratio in tank 1

Dataref: simcoders/rep/indicators/fuel/fuel_quantity_2

- Type: float
- Writable: No
- Contents: Fuel kg in tank 2

Dataref: simcoders/rep/indicators/fuel/fuel_quantity_ratio_2

- Type: float (ratio 0..1)
- Writable: No
- Contents: Fuel ratio in tank 2

Dataref: simcoders/rep/indicators/fuel/fuel_quantity_3

- Type: float
- Writable: No
- Contents: Fuel kg in tank 3

Dataref: simcoders/rep/indicators/fuel/fuel_quantity_ratio_3

- Type: float (ratio 0..1)
- Writable: No
- Contents: Fuel ratio in tank 3

Dataref: simcoders/rep/engine/fuelline/electrical_feed_0/switch_on

- Type: int
- Writable: Yes
- Contents: L tip pump switch (1 = on)

Dataref: simcoders/rep/engine/fuelline/electrical_feed_1/switch_on

- Type: int
- Writable: Yes
- Contents: R tip pump switch (1 = on)

Dataref: simcoders/rep/indicators/fuel/fuel_flow_0

- Type: float
- Writable: No
- Contents: L FF indicator

Dataref: simcoders/rep/indicators/fuel/fuel_flow_1

- Type: float
- Writable: No
- Contents: R FF indicator

Dataref: simcoders/rep/cockpit2/gauges/indicators/engine_0_rpm

- Type: float
- Writable: No
- Contents: L RPM indicator

Dataref: simcoders/rep/cockpit2/gauges/indicators/engine_1_rpm

- Type: float
- Writable: No
- Contents: R RPM indicator

Dataref: simcoders/rep/cockpit2/engine/actuators/fuel_pump_0

- Type: int
- Writable: Yes
- Contents: L pump (0 = off, 1 = on)

Dataref: simcoders/rep/cockpit2/engine/actuators/fuel_pump_1

- Type: int
- Writable: Yes
- Contents: R pump (0 = off, 1 = on)

Dataref: simcoders/rep/cockpit2/engine/actuators/low_fuel_pump_0

- Type: int
- Writable: Yes
- Contents: L LO speed pump

Dataref: simcoders/rep/cockpit2/engine/actuators/low_fuel_pump_1

- Type: int
- Writable: Yes
- Contents: R LO speed pump

Dataref: simcoders/rep/cockpit2/engine/actuators/high_fuel_pump_0

- Type: int
- Writable: Yes
- Contents: L HI speed pump

Dataref: simcoders/rep/cockpit2/engine/actuators/high_fuel_pump_1

- Type: int
- Writable: Yes
- Contents: R HI speed pump

Dataref: simcoders/rep/engine/electrical_fuelpump/switch_on_0

- Type: int
- Writable: Yes
- Contents: L pump (0 off, 1 LO, 2 HI)

Dataref: simcoders/rep/engine/electrical_fuelpump/switch_on_1

- Type: int
- Writable: Yes
- Contents: R pump (0 off, 1 LO, 2 HI)

Dataref: simcoders/rep/engine/cowl/handle_ratio_0

- Type: float (ratio 0..1)
- Writable: Yes
- Contents: L cowl flaps handle

Dataref: simcoders/rep/engine/cowl/handle_ratio_1

- Type: float (ratio 0..1)
- Writable: Yes
- Contents: R cowl flaps handle

Dataref: simcoders/rep/engine/oil/temp_f_0

- Type: float
- Writable: No
- Contents: L oil temp (F)

Dataref: simcoders/rep/engine/oil/temp_f_1

- Type: float
- Writable: No
- Contents: R oil temp (F)

Dataref: simcoders/rep/engine/oil/temp_c_0

- Type: float
- Writable: No
- Contents: L oil temp (C)

Dataref: simcoders/rep/engine/oil/temp_c_1

- Type: float
- Writable: No
- Contents: R oil temp (C)

Dataref: simcoders/rep/engine/oil/press_psi_0

- Type: float
- Writable: No
- Contents: L oil press (PSI)

Dataref: simcoders/rep/engine/oil/press_psi_1

- Type: float
- Writable: No
- Contents: R oil press (PSI)

RESOURCES & HOW-TOs

SimCoders.com blog contains tons of resources that you will find very useful when using REP.

Moreover, this is a list of How-Tos available.

- How to lean the mixture
- How to keep the spark plugs clean
- How to choose the right oil for your engine
- How to quickly startup the engine with REP
- How to manage an emergency
- How to calculate the required fuel for your flight

SUPPORT & CONTACTS

Before requesting support, please check our FAQs, where you'll find answers to common questions about installation issues and general usage.

If you experience any technical problems with our software, feel free to contact us at support@simcoders.com. To help us assist you efficiently, please provide a detailed description of the issue and include your X-Plane Log.txt file.

VERSION CHANGELOG

V4.8.11

No change for this aircraft

V4.8.10

No change for this aircraft

V4.8.9

1. Improvement: added SBAS receiver in XP12

V4.8.8

No change for this aircraft

V4.8.7

V4.8.6

No change for this aircraft

V4.8.5

V4.8.4

1. Fix: the Settings menu was not managed properly in VR

V4.8.3

1. No changes for this airplane.

V4.8.2

1. Fix: the system time was not always read correctly, therefore some features (like the time-based maintenance actions may not always work propely on some systems)
2. Fix: the slaved gyro (HSI) was not aligned correctly to the magnetic heading

V4.8.1

1. Fix: engine vibrations at startup were not visible anymore

V4.8.0

1. Support for time and ground speed multiplier

V4.7.14

1. No change for this airplane

V4.7.13

1. No change for this airplane

V4.7.12

V4.7.11

1. Improvement: the tie downs should better lock the plane to the ground

V4.7.10

Fix: after loading a saved flight, the alternator may not work properly

V4.7.9

1. Fix: in some engine configuration and bus loads, the alternator could not charge the battery completely

V4.7.8

1. Fix: In X-Plane 12 the plugin forces could bump the plane at engines stop
2. Fix: memory leak in datarefs handling

V4.7.7

V4.7.6

1. Fix: some sounds would not stop playing after plane crash
2. Fix: fuel totalizer fix in XP12
3. Fix: the supercharger did not provide enough boost after last update

V4.7.5

No changes for this airplane

V4.7.4

No changes for this airplane

V4.7.3

1. Fix: Some components of the maintenance window were misplaced
2. Fix: Mass And Balance could not be applied correctly if the flight was started with the engines running

V4.7.2

1. Fix: crash after replay

V4.7.1

1. Fix: crash after pause

V4.7.0

1. **New**: improved XP12 Flight Dynamics
2. Improvement: support for new XP12 rain effects
3. Fix: the landing gear didn't retract in XP12
4. Improvement: better alternator voltage simulation at low RPM
5. Improvement: support for Apple M* processors
6. Improvement: better compatibility of the Mass and Balance system with X-Plane 12
7. Improvement: it is now possible to vertically move the in-flight tips windows (no VR support for this feature at the moment)
8. Fix: missing library link if XP12

V4.6.6

1. Improved REP sound compatibility with internal X-Plane sound sliders
2. Improvement: multiple batteries simulation

LICENCE

End-User License Agreement for SimCoders.com Reality Expansion Pack

---

This End-User License Agreement (EULA) is a legal agreement between you (either an individual or a single entity) and the mentioned author (SimCoders.com) of this Software for the software product identified above, which includes computer software and may include associated media, printed materials, and “online” or electronic documentation (“SOFTWARE PRODUCT”).

By installing, copying, or otherwise using the SOFTWARE PRODUCT, you agree to be bounded by the terms of this EULA. If you do not agree to the terms of this EULA, do not install or use the SOFTWARE PRODUCT.

SOFTWARE PRODUCT LICENSE

The Reality Expansion Pack is being distributed as payware licenced software for personal, commercial use, non-profit organization, educational purpose. It may not be included with CD-ROM/DVD-ROM distributions. You are NOT allowed to make a charge for distributing this Software (either for profit or merely to recover your media and distribution costs) whether as a stand-alone product, or as part of a compilation or anthology, nor to use it for supporting your business or customers without the written permission of the author. It may not be distributed freely on any website or through any other distribution mechanism.

1. GRANT OF LICENSE.

This EULA grants you the following rights: Installation and Use. You may install and use an unlimited number of copies of the SOFTWARE PRODUCT.

Reproduction and Distribution. You may not reproduce and distribute an unlimited number of copies of the SOFTWARE PRODUCT.

2. DESCRIPTION OF OTHER RIGHTS AND LIMITATIONS.

Limitations on Reverse Engineering, Decompilation, Disassembly and change (add,delete or modify) the resources in the compiled the assembly. You may not reverse engineer, decompile, or disassemble the SOFTWARE PRODUCT, except and only to the extent that such activity is expressly permitted by applicable law notwithstanding this limitation.

Update and Maintenance

The Reality Expansion Pack minor upgrates are FREE of charge.

Separation of Components.

The SOFTWARE PRODUCT is licensed as a single product. Its component parts may not be separated for use on more than one computer.

Software Transfer.

You may permanently transfer all of your rights under this EULA, provided the recipient agrees to the terms of this EULA.

Termination.

Without prejudice to any other rights, the Author of this Software may terminate this EULA if you fail to comply with the terms and conditions of this EULA. In such event, you must destroy all copies of the SOFTWARE PRODUCT and all of its component parts.

3. COPYRIGHT.

All title and copyrights in and to the SOFTWARE PRODUCT (including but not limited to any images, photographs, clipart, libraries, and examples incorporated into the SOFTWARE PRODUCT), the accompanying printed materials, and any copies of the SOFTWARE PRODUCT are owned by the Author of this Software. The SOFTWARE PRODUCT is protected by copyright laws and international treaty provisions. Therefore, you must treat the SOFTWARE PRODUCT like any other copyrighted material. The licensed users or licensed company can use all functions, example, templates, clipart, libraries and symbols in the SOFTWARE PRODUCT to create new diagrams and distribute the diagrams.

LIMITED WARRANTY

NO WARRANTIES.

The Author of this Software expressly disclaims any warranty for the SOFTWARE PRODUCT. The SOFTWARE PRODUCT and any related documentation is provided “as is” without warranty of any kind, either express or implied, including, without limitation, the implied warranties or merchantability, fitness for a particular purpose, or noninfringement. The entire risk arising out of use or performance of the SOFTWARE PRODUCT remains with you.

NO LIABILITY FOR DAMAGES.

In no event shall the author of this Software be liable for any special, consequential, incidental or indirect damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information, or any other pecuniary or physical loss) arising out of the use of or inability to use this product, even if the Author of this Software is aware of the possibility of such damages and known defects.

LibCURL EULA

The following statements are applicable **only** to the LibCURL library used to provide some features of this product.

COPYRIGHT AND PERMISSION NOTICE

Copyright (c) 1996 - 2018, Daniel Stenberg, daniel@haxx.se, and many contributors, see the THANKS file.

All rights reserved.

Permission to use, copy, modify, and distribute this software for any purpose with or without fee is hereby granted, provided that the above copyright notice and this permission notice appear in all copies.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OF THIRD PARTY RIGHTS. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Except as contained in this notice, the name of a copyright holder shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Software without prior written authorization of the copyright holder.