Cirrus SR22
powered by
Reality Expansion Pack

v4.8.4

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Contents

AIRCRAFT GENERAL DESCRIPTION

The Cirrus SR22 is a single-engine five-seat composite aircraft built from 2001 by Cirrus Aircraft of Duluth, Minnesota.

It is a development of the Cirrus SR20, with a larger wing, higher fuel capacity, and a more powerful, 310-horsepower (231 kW) engine.

The SR22 series has been the world's best-selling general aviation (GA) airplane every year since 2003. With 6,149 units delivered from 2001–19, and in combination with the SR20, a total of 7,645, it is the most-produced GA aircraft of the 21st century, and is the single most-produced GA aircraft made from composite material, accounting for over 30% of the entire piston aircraft market.

The Cirrus SR22 is equipped with a whole-plane emergency recovery parachute system: the Cirrus Airframe Parachute System (CAPS). This has contributed to its market success and has given it the nickname "the plane with the parachute".

INSTALLATION & CONFIGURATION

System requirements

This software requires X-Plane 12.00 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.

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

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

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

In order to install this software, the **Default X-Plane 12 Cirrus SR22** 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 SR22 folder inside your X-Plane installation.
2. Clone the SR22 folder and call it "SR22 REP".
3. Extract the contents of this REP package into a temporary folder
4. Move **the contents** of "**into-aircraft-plugins-folder**" into the "**SR22 REP/plugins**" folder
5. Move **the contents** of "**into-aircraft-main-folder**" into the "**SR22 REP**" folder
6. Run X-Plane and load the SR22.
7. Follow the onscreen instructions

NOTE

After reloading the airplane, X-Plane may crash reporting an error related to the "master.bank" file. If that's the case, please follow the instructions stated in this FAQ.

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 **skuncrafts_updater.cfg**. Copy such file into the SR22 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 SR22, overwriting the existing one.
2. Run X-Plane and load the SR22.
3. Reload the aircraft when the automatic update is finished.

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

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 SR22, you should setup your sound settings like the following screenshot.
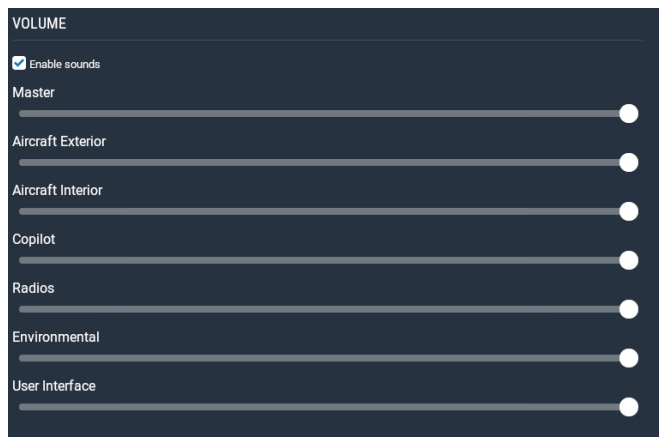

Figure 1: Recommended sound settings

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.
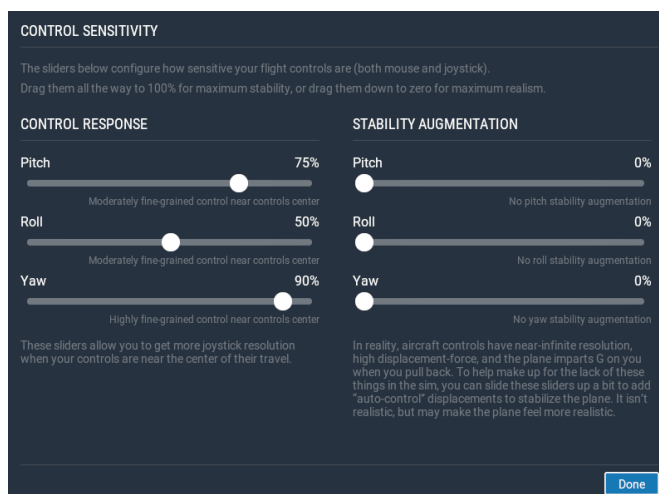
Figure 2: Recommended control settings

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 SR22.

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.
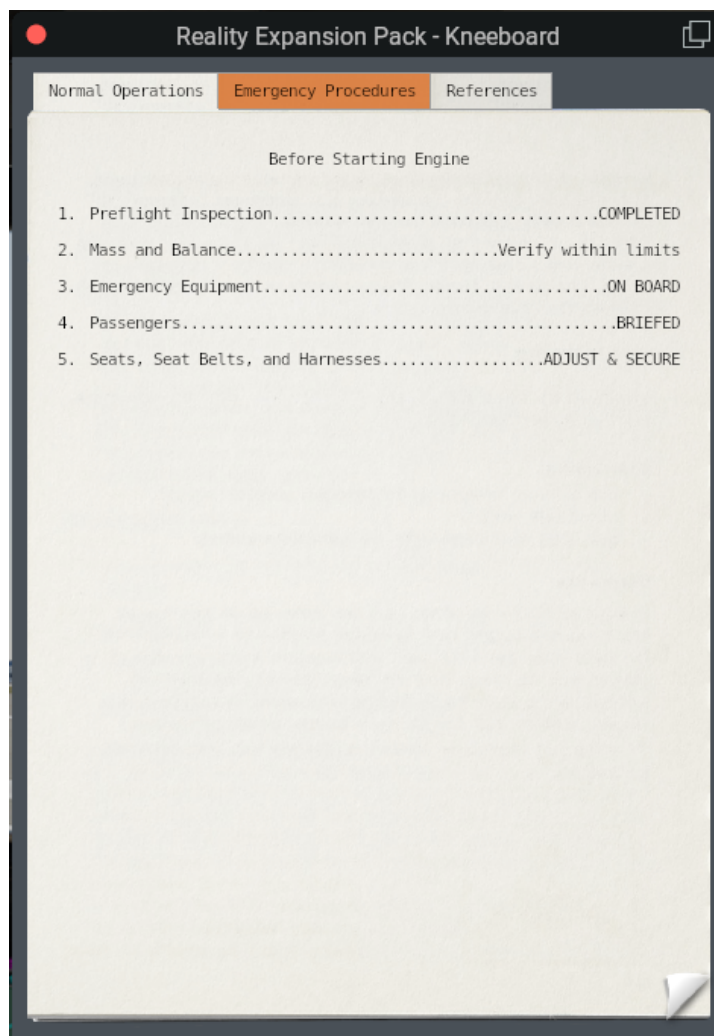
Figure 6: The Kneeboard window

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.
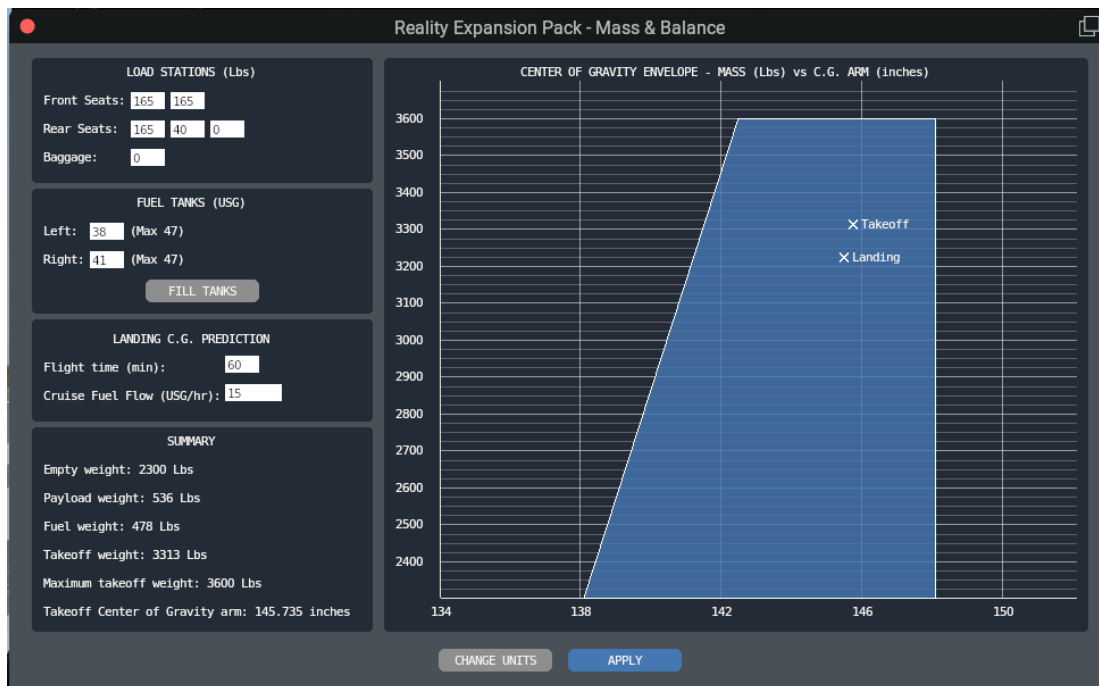
Figure 7: The Mass & Balance window

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.

Show engine monitor

When ticked, REP will show the engine's parameters when the power is above 30% and the engine settings - such as Manifold Pressure, Prop RPM or Mixture - are changed by the user.

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 features a custom Economy System that may rewards you for your flight time and lets you pay to fix the airplane damages and do the everyday maintenance.

The Economy System features two modes of operation:

- **Standalone**: your bank account and maintenance records are locally saved to your PC. They are shared among your REPs. The system rewards you for your flight time and landing skills.
- **FSEconomy**: REP connects to the FSEconomy bank account and drains the required amount of money for maintenance directly from there. There are no rewards for your flight time as they are already provided by FSEconomy.
- **X-CPL-Pilot**: REP connects to the X-CPL-Pilot bank account from which it drains the required amount of money for maintenance. There are no rewards for your flight time because they are paid by X-CPL-Pilot already.

Enable the Economy System

Open the Maintenance Report window then scroll to the latest page available. Click on the "Enable" button corresponding to the economy system you want to enable.

When enabling the FSEconomy System, it is required to enter an **Aircraft Key**.

The Aircraft Key is a 15 chars key provided by FSEconomy that uniquely identifies the aircraft you are flying in the FSEconomy environment.

To find the Aircraft Key:

1. Login to the FSEconomy website: http://server.fseconomy.net/
2. Click the main menu's "**Aircraft**" button
3. Scroll the aircrafts' list down to the plane you want to connect to REP
4. In the "Action" column, click the drop-down menu's "**Edit**" button
5. Generate/Copy the Aircraft Key in the webpage's lower-left corner

When the Economy System is enabled, the aircraft state is saved to a separated file. When you disable the Economy System, that very same file is loaded again.

Thus, there are two different aircraft states that are loaded in relation to the usage of the Economy System. One state is loaded and updated when the Economy System is disabled. The other one is loaded and updated when the Economy System is enabled.

You can switch between the two states by disabling or enabling the Economy System.

The Bank Account is shared among all your REP airplanes. That is, it possible to earn money flying an airplane and use it to fix another airplane that needed maintenance.

How it works

Once enabled, the Economic System page in the Maintenance Report shows your current Bank Account Balance and a log of the last transactions (amount spent for maintenance and fuel or income from a flight).
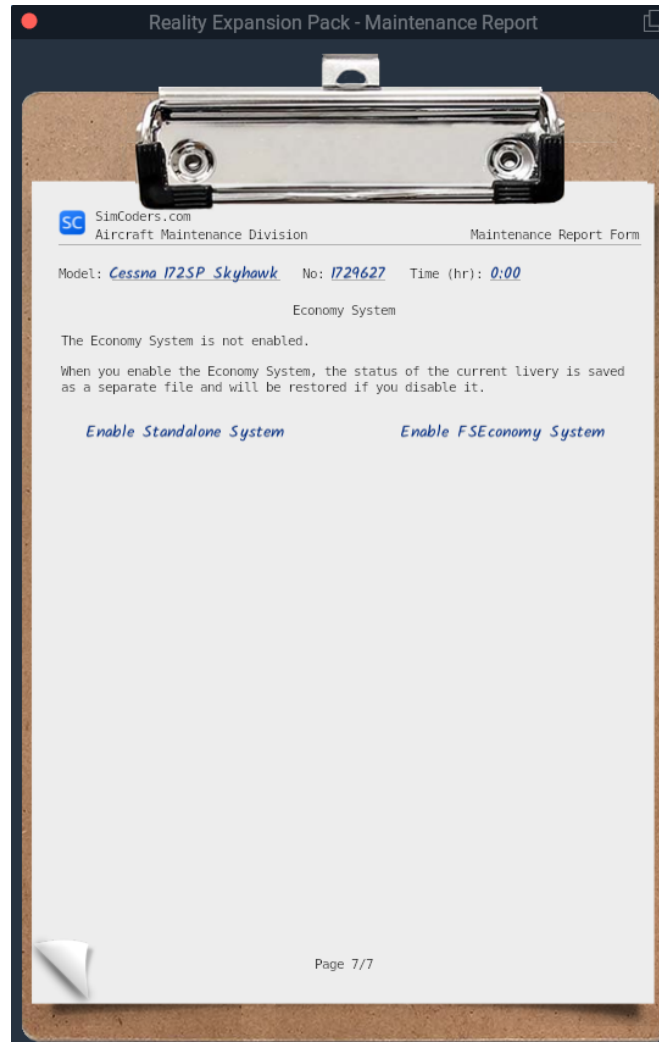
Figure 8: This is the screen that allows you to enable the Economy System

Figure 9: This is the default screen of the Economic System

Each fix or maintenance you want to do to your airplane must be first added to a quotation.

Each page of the Maintenance Report shows a table that reports the available maintenance actions.

For each action, the table reports the price and required work time.

To add a maintenance action to the Quotation, click over its "Action" cell in the Maintenance Report. Once an action has been added to the Quotation, the "Action" cell reports "In Quote". To remove the maintenance action from the Quotation, click the "Action" cell again.

If the "Action" column is empty, it means that no actions are available at that time.

Once all the needed maintenance actions have been added to the Quotation, click over "View Quotation" or scroll to the last page of the Maintenance Report to see the Quotation.

The quotation reports two possible total prices:

- **Normal Price**: This price will be applied for a fix that will take the amount of time reported in the time column. The fixes will be done one at a time in real time. The mechanic will continue his work even when the sim is closed.
- **Quick Fix Price**: This price will be higher but will do all the actions at once in zero time.

You can accept either price or decline the Quotation, in which case no action is done and the quotation is scrapped.

Buy/Sell Fuel

This feature is available in Standalone Mode only.

In the Weight and Balance window, it is possible to add/remove fuel from the fuel tanks.

Adding fuel will drain money from your bank account. Removing fuel from the tanks will result in selling it to the local airport. The selling price will be slightly lower than the local buying price.

Fuel price is based on the current country/region and varies from airport to airport and from time to time. It is possible to specify a custom fuel price in the "fuel_prices.cfg" file found in the "Output/preferences/REP" folder of X-Plane. The file already contains an example of a custom price for two airports. **Once REP calculates a fuel price, it stores is for a random interval between 4 and 8 days, then it recalculates the fuel price again. That is, when you set a new fuel price in the fuel_prices.cfg file, REP will not use it immediately. Instead, it will start using it the next time it will need to recalculate the fuel price for that airport.**

It is possible to check the fuel price in a specific airport by going to the plugins menu and click over "SimCoders - REP" -> "Check fuel price at an airport".

Earn Money: Rewards

This feature is available in Standalone Mode only.

The more you fly, the more money you earn. At the end of a flight, a new Log entry is added to your Bank Account Log with the amount of money you earned.

In case you make a smooth landing, a "Soft Landing" bonus is added to your reward. The softer the landing, the higher the reward.

Figure 10: Click over one of the Action cells to put that specific action in the quotation. Note: The maintenance report shown here is an example of how the table looks. It may not include the systems modeled in the airplane described in this manual.

Figure 11: A Quotation Example

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

The Reality Expansion Pack features a complete **wearing system** for the **entire airplane**. That is, each component of the airplane wears out when in use and, after a certain amount of time, it may start to show some issues or fail completely.

The status of each component is saved and updated even if the sim is not running.

This is true for things such as engine components, electrical system parts, airframe, and landing gear.

Every component will be affected by time and by **user's handling** in different ways.

If you mistreat the engine by running it above its limits, it will get worn out, showing startup issues, combustion problems and providing less power than expected. It will completely fail over time.

The cockpit instrumentation needles will be more precise in a newly calibrated gauge rather than in an old one.

How to load a worn out aircraft

REP gives you the chance to load an aircraft that is already worn out by its past history.

To do so, go to "**Plugins -> SimCorders.com - REP -> Wear out to >**" and choose one of the following items.

- **Brand New**: this is the status of an aircraft that just left the production line. The engine is brand new and all the onboard systems were just tested.
- **Privately Owned (new)**: this is an almost new aircraft that has been privately owned with care. The engine as well as the other systems will have some hours logged but no issues are in place.
- **Privately Owned (old)**: this is an aircraft that has been owned privately for years. The engine as well as the other systems will have many hours logged but no issues are in place as the private owner kept the plane with good care.
- **Flying Club**: this plane has been in the hands of many pilots, some of them careless. The systems are weared out quite much and some gauges are not working as good as you would like them to do.

How to check the components status

To check each component and fix/replace/calibrate it, use the Maintenance Report.

In there are listed all the aircraft components that can be checked by a mechanic.

Hobbs Time and Tach Time

In the Maintenance Report you find the airframe total time (Hobbs Time) and the engine's total time (Tach Time). The two value may slightly differ after loading a brand new airplane and then flying it for a while. This is because there's an important difference in how the two times are calculated.

Hobbs Time

In most planes, the Hobbs clock is started and stopped based on an oil pressure switch, so it starts when the engine starts, and stops when the engine is shut-down. While it's running, it just ticks off a tenth of an hour every 6 minutes, based on "regular wall clock time". So a tenth of idling on the ramp is the same as a tenth at cruise.

Tach Time

The tach clock isn't really a clock at all, it doesn't actually measure time, it really measures engine revolutions. But it's calibrated such that a tenth of an hour of tach time is clicked off when the engine is at cruise RPM for 6 minutes. In other words, if the plane is at cruise RPM, the tach clock will be clicking off tenths of an hour at the same rate as the Hobbs clock. But if the engine is idling at an RPM speed that's half of what cruise RPM is, then the tach clock will be running at half the speed of the Hobbs clock.

SYSTEMS DESCRIPTION

Within the Reality Expansion Pack, each system has its own life-cycle and can be damaged 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 SR22 is powered by a six-cylinders Teledyne Continental Motors (TCM) normally aspirated IO-550-N or turbosupercharged TSIO-550-K, direct-drive, air-cooled, horizontally-opposed, fuel-injected engine with 550 cubic inches displacement.

This engine outputs a maximum power of 310HP (normally aspirated) at 29 inches Hg and 2700RPM with no time limitations or 315HP in the turbo version.

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 pre-injected using the electrical fuel pump (see the operating tips)
- **Realistic engine issues**:
  - The engine startup may be prevented by vapour locks or fuel floodings.
  - 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
  - Realistic wastegate operations: the turbocharger's wastegate is automatic operated by a mechanical controller that keeps the MAP constant while the airplane climbs or descends.
  - 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 replaces the Manifold Absolute Pressure (MAP) algorithm of X-Plane with a custom one.

The SR22 engine is normally aspirated but, using the maintenance report window, it can be upgraded and, therefore, turbonormalized. That is, it can provide the same amount of power at low altitude as well as at high flight levels.

To do so, the engine is then equipped with a **supercharger**.

Note If the engine is provided with a turbonormalizer, the propeller speed is automatically fixed to 2500RPM.

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.

System Limitations

1. Maximum MAP: 31 InHg

Fuel Injection System

The Reality Expansion Pack fully recreates the TCM Continuous Flow Fuel Injection System that powers the real world SR22.

This fuel injection system is as simple as it can be. That is, the throttle position controls the amount of fuel that goes into the engine. It does not compensate for altitude or density changes, nor does it correct for MAP.

It's then really important to properly lean the mixture, especially at altitude.

Tuned Fuel Injectors

The cylinders and air induction positions lead to a different amount of air being sucked in each cylinder for a given throttle position.

That is, more air goes into the #1 and #2 cylinders than in #3 and #4. In a 6 cylinders engine, the spread between #1 and #6 is quite wide.

Factory fuel injectors deliver the same amount of fuel to each cylinder. That is, cylinder #1 runs leaner than #2. The richer cylinder is usually #5 or #6.

This spread affects the engine performance, especially when running lean of peak with only one EGT probe. Usually, leaning LOP for the hottest cylinder (#5 or #6 in a 6 cylinders, #3 or #4 in a 4 cylinders) means being widely LOP for the #1 cylinder, thus experiencing a loss of power together with a rough running engine.

In the Maintenance Report, it is possible to replace the factory injectors with tuned ones, made to properly release the correct amount of fuel based on the cylinder number. Tuned injectors allow for:

 • Smoother LOP operations
 • Fewer vibrations
 • **Lower fuel burn of about 1 GPH**

General Aviation Modifications, Inc. is a real world manufacturer of tuned fuel injectors for many different type of fuel injected engines. For more information, please visit GAMI's website.

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
- Change the default spark plugs with the "fine wire" type.

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

Exhaust System

The main goal of the Exhaust System is to emptying each cylinder of spent exhaust gases.

Factory exhaust usually aren't length-tuned. That is, the length from the cylinder's outlet valve to the end of the exhaust is not the same for each exhaust tube. This causes the formation of shock waves when the exhaust gases from one cylinder hit those from another cylinder. That is, the emptying effect is lower than desired.

Using the Maintenance Report it is possible to replace the factory exhaust with tuned ones. Tuned exhaust allow for:

- ~10% more power
- Fewer vibrations
- Lower fuel burn
- Lower CHTs

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.

Propeller Governor

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

The propeller governor controls the propeller blades pitch in order to maintain a constant propeller speed.

The governor drives the blades pitch using the engine oil pressure. Make sure to properly warm up the engine before takeoff to ensure a faster response of the governor.

The Reality Expansion Pack simulates the SR22 "power lever". That is, a single lever controls both the propeller RPM and the Manifold Pressure.

When the normally aspirated engine is selected in the maintenance window, the upper part of the throttle controls the RPM. Full throttle selects 2700RPM. Reducing throttle, the selected RPM is lowered down to 2500RPM. After that, further reducing throttle will keep 2500RPM while reducing the manifold pressure.

When the turbonormalized engine is selected, the propeller RPM is fixed to 2500RPM.

The Red Box

When the big bore engines like the IO-550, IO-540 and the IO-520 were designed, there were many misconceptions about how to actually manage the engine throughout the normal operating range.

The most common tip was to run 100°F ROP during high power operations, such climb, and 50°ROP during cruise, with the extra rule to almost never run LOP.

When engine monitors started to be normal equipment on most high-end GA aircrafts, pilots finally had some data on which they could base they engine management decisions.

It turned out that the 50/100°ROP rule is – generally speaking – not the best way to take care of your engine.

In fact, the best ranges turned out to be the following:

- Above 80% of power: richer than 200°F ROP or leaner than 60°F LOP
- Between 75% and 80% of power: richer than 180°F ROP or leaner than 40°F LOP
- Between 70% and 75% of power: richer than 125°F ROP or leaner than 25°F LOP
- Between 65% and 70% of power: richer than 100°F ROP or leaner than peak EGT
- Below 65% of power: no restrictions, lean as you like

The ranges outside the one suggested above form what is called the 'red box'.

Running the engine in the red box is not really damaging it, but if you take care of it and stay away from the red box, you may extend the engine life and get an engine that run smoother.

An extensive explanation of how and why you should keep the red box rule in mind is in this article: https://www.avweb.com/news/savvyaviator/savvy_aviator_59_egt_cht_and_leaning-198162-1.html

Engine Monitor

The Reality Expansion Pack provides an engine monitor that shows the engine parameters such as the Fuel Flow, the EGT and the BHP whenever the engine control levers are moved.

To activate the engine monitor, open the plugin settings and check the "Show Engine Monitor" option.

Preheater & Winterization Kit

To engage the engine preheater, open the Maintenance Report window and activate the electrical heater by going into the "Engine Tools" section.

The electrical heater will warm up the engine (CHT) and the oil to a temperature that is suitable for startup is 30/60 minutes, depending on the outside air temperature.

A "Fast Warmup" button is available in the Maintenance Report window. Once clicked, the engine will be warmed up instantly.

Keeping the cowl plugs mounted will provide a faster and better warmup. To mount the cowl plugs, enter the walkaround mode and move to the engine checks.

If operating in very cold climates, keep the engine preheater on until the walkaround is completed and startup the engine as soon as the preheater is turned off.

The engine preheater state is kept between X-Plane sessions. If you turn on the heater and then close X-Plane, the engine will be warmed up even when the simulator is not running.

Engine Startup Tips

- Before starting the engine, always apply full mixture and full throttle and then switch the electrical fuel pump on for a variable time between half (warm engine) and two seconds (cold engine). After this pre-injection phase, close the throttle and proceed with the normal engine startup.
- 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

The engine 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 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 fixed landing gear.

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

Free castoring nose wheel

The nose wheel will freely turn right or left.

The airplane direction on ground should be maintained using the brakes as well as the steering pedals.

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 SR22 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.

The SR22 is provided with an oxygen system that can prevent the effects of hypoxia. Make sure that the oxygen system is active whenever you fly above 10.000 feet.

More information about the oxygen system is available in the Systems Description section.

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 adequate 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

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- 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 asking for support please read the FAQs we published on our site. They contain information about installation troubles and general usage.

If you encounter any kind of technical problem with our software, please write to support@ simcoders.com providing as much information as possible and including your X-Plane's Log.txt file.

VERSION CHANGELOG

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)

V4.8.1

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

V4.8.0

1. Support for time and ground speed multiplier
2. Improvement of the super charger behavior at high RPM

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. Fix: more realistic fuel flow with boost pump on
2. Fix: in the documentation and UI the turbo engine was shown as TNIO-550-N. REP now shows TSIO-550-K.
3. Improvement: more realistic CHT values
4. Improvement: automatic yaw damper
5. Improvement: the tie downs should better lock the plane to the ground

V4.7.10

1. New: the TKS system page in the hangar window uses the customary units when the option is activated by the user
2. Fix: the turbonormalized version has a higher empty weight

3. Improvement: pitch trim authority 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
3. Improvement: more realistic CHT temps
4. Fix: the CHT in-flight tip was mentioning the cowl flaps

V4.7.7

1. Default XP12 Cirrus SR22 support

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