



SimCoders.com

Reality Expansion Pack  
for  
JustFlight Robin DR400-180

v5.0.7

May 31, 2026

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The following statements are applicable **only** to the [LibCURL library](#) used to provide some features of this product.

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## Thank You

Welcome to the ranks of the Reality Expansion Pack users!

Our software has been designed to give you the most in performance and fun. Our desire is that you will find using it a pleasant and profitable experience.

This manual has been prepared as a guide to help you get the most from our software. It contains information about the usage and the features of the Reality Expansion Pack for X-Plane.

## Introducing REP

The Reality Expansion Pack (or REP) is a software developed by real pilots. It is designed to provide the most realistic experience to the X-Plane users. This goal is achieved by providing more realistic flight dynamics, sounds, and on-board systems.

This software is meant to enhance an existing X-Plane aircraft. In this particular case, this REP package is targeting the **JustFlight Robin DR400-180**.

## Legal Notice

Before starting using this software please carefully read the [End-User License Agreement](#) at the end of this manual.



## Aircraft General Description

The Robin DR400 is a wooden sport monoplane, conceived by Pierre Robin and Jean Délémontez. The Robin DR400 first flew in 1972 and is still in production. The current model is designated 'DR401'. It has a tricycle undercarriage, and can carry four people. The DR400 has a 'cranked wing' configuration, with the dihedral angle of the outer wing much greater than the inboard, a configuration which they share with Jodel aircraft. This model is considered easy to fly by many and quiet during flight due to its wooden frame.

The version depicted by REP is the DR400-180 Regent, powered by a 180HP engine.

# 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.

## Use REP on Linux

If you use REP on Linux, there are some additional 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 **JustFlight Robin DR400-180** 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. Install the DR400-180 in your X-Plane.



2. Make sure the airplane is updated to its latest version before installing REP (you can check using the SkunkCrafts Updater plugin)
3. Clone the DR400-180 folder and call it "DR400-180 REP".
4. Extract the contents of this REP package into a temporary folder
5. Move **the contents** of "**into-aircraft-plugins-folder**" into the "**DR400-180 REP/plugins**" folder
6. Move **the contents** of "**into-aircraft-main-folder**" into the "**DR400-180 REP**" folder
7. Run X-Plane and load the DR400-180.
8. 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 DR400-180 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.

### Note

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.

### Note

After updating the plane, close and relaunch X-Plane to make sure that all the files are unloaded and updated correctly.

### Note

The DR400-180 already comes with a skunkcrafts\_updater.cfg file. You must replace that cfg with REP's one. By replacing it with REP's cfg, **\*\*you will still get the plane's updates as well as REP's\*\***. Simcoders and the plane author will coordinate in order to provide updates via REP's skunkcrafts\_updater.cfg.

## 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 DR400-180, overwriting the existing one.
2. Run X-Plane and load the DR400-180.
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 DR400-180, you should setup your sound settings like the following screenshot.

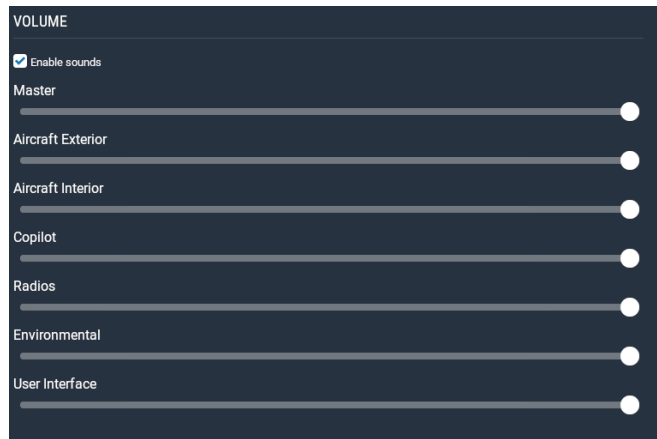


Figure 1: Recommended sound settings

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.

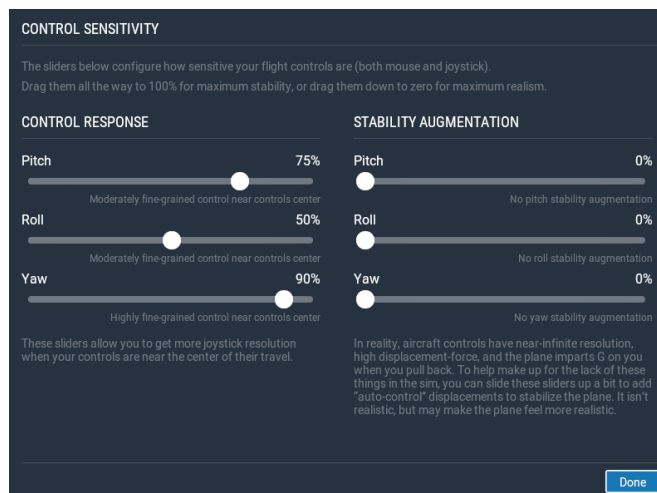


Figure 2: Recommended control settings

## Hardware and Software Compatibility

### Headshake

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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 DR400-180.

### XPRealistic

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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.



## THE REALITY EXPANSION PACK

This section describes the features of the Reality Expansion Pack and explains how to use them effectively.

## 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.



## **Kneeboard**

---

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

---

## 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 DR400-180 uses the author's mass and balance system as it provides all the necessary features that would be otherwise duplicated by REP. However, the lateral menu provides access to the Fuel Management Window. This window is meant to allow the user to buy and sell fuel at the correct currency change while using REP coupled to an [Economy System](#).



## 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
<code>simcoders/rep/walkaround/toggle</code>	Toggle the walkaround mode
<code>simcoders/rep/walkaround/next</code>	Next walkaround station
<code>simcoders/rep/walkaround/previous</code>	Previous walkaround station
<code>simcoders/rep/walkaround/action</code>	Execute current action
<code>simcoders/rep/walkaround/static_elements/toggle</code>	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 air-plane status when unloaded. When the same plane and livery are loaded again, the status will be restored.

### Note

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 nose-wheel 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.

**Important:** You must **own** the aircraft in FSEconomy to generate and use the Aircraft Key. Rented aircraft are not valid for this purpose.

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 owned 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.

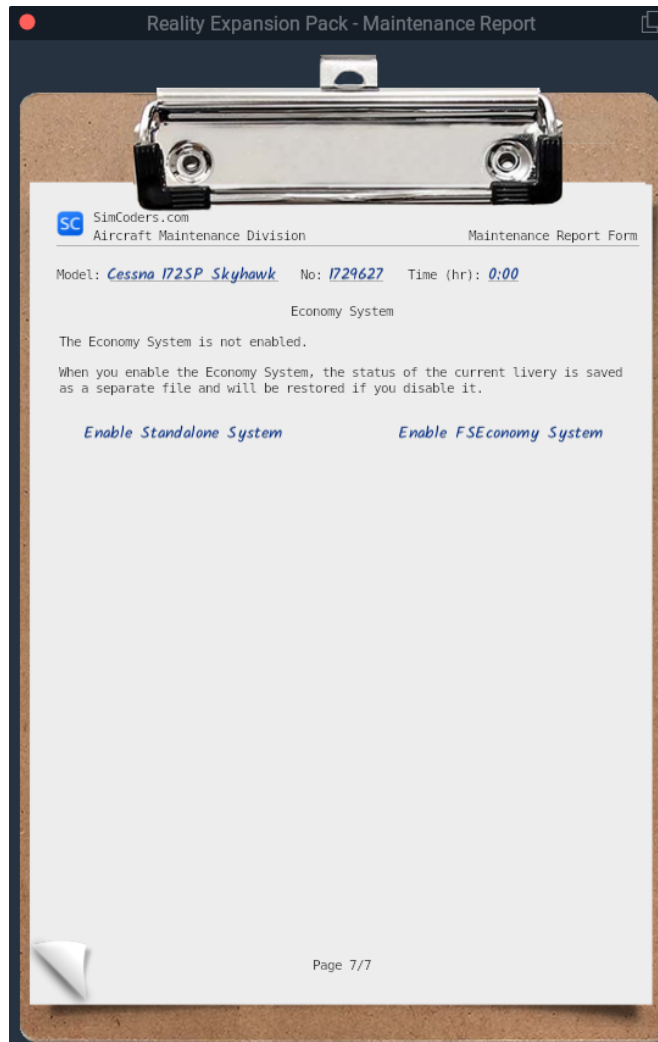


Figure 5: Enable the Economy System

## How the Economy System 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](#).

Reality Expansion Pack - Maintenance Report

SC SimCoders.com  
Aircraft Maintenance Division Maintenance Report Form

Model: *Cessna 172SP Skyhawk* No: *1729055* Time (hr): *0:00*

Economy System

This page will show your maintenance quotation once you select the fixes and changes to make to this aircraft. To add an item to the quotation, scroll to the previous pages and click over an "Action" cell that contains text.

Bank Account

Current balance: 8940.50\$

12 Dec 2018 16:35	Maintenance	-119.88\$
12 Dec 2018 16:32	Maintenance	-31.10\$
12 Dec 2018 16:13	Maintenance	-908.52\$

When you disable the Economy System, the status of the current livery is saved as a separate file and will be restored if you enable it again.

When you reset the Economy System, your career, the bank account and the airplane are reset.

[Disable the Economy System](#) [Reset the Economy System](#)

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Figure 6: 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.

Reality Expansion Pack - Maintenance Report

SC SimCoders.com  
Aircraft Maintenance Division Maintenance Report Form

Model: *Cessna 172SP Skyhawk* No: *1729055* Time (hr): *0:00*

ENGINE STATUS

Model: *Lycoming IO-360-L2A* Time (hr): *00:00/2000*

Item	Status	Action	Price (\$)	Time
Cylinders	<i>OK</i>			
Cyl. Compression (PSI)	<i>80/80 80/80 80/80 80/80</i>			
Oil Fluid	<i>SAE 30, clean, 50 hrs before change</i>			
Oil Fluid Quantity	<i>8/4 USG (5/4 - 8/4)</i>			
Available Oil Types	<i>SAE 20W50</i>	<i>Use</i>	<i>120</i>	<i>1:00 hr</i>
	<i>SAE 30</i>	<i>Use</i>	<i>120</i>	<i>1:00 hr</i>
	<i>SAE 50</i>	<i>Use</i>	<i>120</i>	<i>1:00 hr</i>
Oil Filter #1	<i>Clean, 100 hrs before change</i>			
Oil Pump #1	<i>Ok</i>			
Electric Fuel Pump #1	<i>Ok</i>			
Fuel Filter #1	<i>Clean</i>			
Spark Plugs #1 Type	<i>Fine Wire (More effective)</i>	<i>In Quote</i>	<i>290</i>	<i>20 mins</i>
Plugs tip	<i>Clean</i>			
Starter #1	<i>Ok</i>			
Vacuum Pump #1	<i>OK</i>			
Bank Account (\$): <i>8940.50</i>	<a href="#">View Quotation</a>		Quotation (\$): <i>290.00</i>	

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Figure 7: 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 8: 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 9: The Tech Report shown in VR mode

## Sound 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 tailored 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 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 on-board 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

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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 Vs 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**.

### Note

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



## 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 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 10: Hypoxia effect



## 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 DR400-180 is powered by a four-cylinders Lycoming O-360-A3A normally aspirated, direct-drive, air-cooled, horizontally-opposed, carburetor engine with 360 cubic inches displacement.

This engine outputs a maximum power of 180HP at 29 inches Hg and 2700RPM with no time limitations.

### Engine Overview

---

The Reality Expansion Pack completely overrides X-Plane's default engine model. REP does not modify or extend the simulator's engine logic: it replaces it entirely. No part of the original engine simulation is used.

In REP, the engine is built from the ground up as a real mechanical system. Every major component is modeled so that all engine behavior emerges naturally from its internal state, not from precomputed tables or cosmetic corrections. Nothing exists simply to show the "right" values on the instruments.

Each piston is simulated individually. Airflow, fuel mixing, combustion, and power generation are computed on a per-cylinder, per-cycle basis. Engine vibrations are a direct consequence of piston motion and combustion events, not an added effect.

All secondary systems – including power output, cylinder head temperature, oil pressure, and engine dynamics – depend on this core combustion model. The engine truly breathes air, mixes it with fuel, and produces power through a physically coherent combustion process.

As a result, engine behavior in REP is consistent, interconnected, and responsive to every operating condition, exactly as in a real engine.

Some of the features include:

- **Correct animations and sounds:** piston motion and cylinder compression are simulated individually and with correct dynamics. Propeller movement and engine vibrations are therefore direct consequences of the real per-piston combustion process, not precomputed effects.



- **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 fully custom, physically based model.

In REP, the starter draws electrical power from the main bus, exactly like the real system. During engine start, the starter must work against the mechanical resistance of the engine, which is not constant. This resistance varies continuously depending on piston position and on the current phase of the four-stroke cycle. As a result, both the electrical current absorbed by the starter and the mechanical power it delivers are not constant over time.

This behavior directly affects the onboard electrical system. Voltage and current fluctuations during start are therefore a natural consequence of the interaction between the starter, the engine, and the battery.

REP does not simply “simulate” a starter as an on/off device. Instead, it models the starter as a real electromechanical component that applies torque to the engine. Whether the engine successfully starts depends on battery charge, available electrical power, and the resulting starter RPM, which determines how effectively the engine can be cranked.

In the Engine Status page of the Maintenance Report, you can:

- Check the current starter condition
- Replace a worn or 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 implements a custom **Manifold Absolute Pressure (MAP)** algorithm, replacing X-Plane's default system to provide enhanced accuracy and realism.

The REP MAP model accounts not only for throttle position and engine operating conditions, but also for the effects of **ram air pressure**, allowing airspeed to influence the indicated manifold pressure as in the real aircraft.

In addition, the geometry and characteristics of the **engine induction system** are taken into account when computing MAP values. Losses and pressure recovery within the intake are modeled to better reflect real-world behavior across different power settings and flight regimes. As a result, the indicated manifold pressure responds more naturally to changes in airspeed, altitude, and engine configuration, closely matching real aircraft performance and pilot expectations.



## Spark Plugs

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Each cylinder is equipped with two spark plugs, one powered by the left magneto and the other by the right magneto.

In REP, spark plug behavior follows real-world physics. When the engine is operated at low RPM with a rich mixture, carbon deposits gradually build up on the spark plug electrodes. As fouling increases, spark efficiency degrades and combustion becomes less reliable.

To reduce the risk of fouling, avoid prolonged operation below 1000 RPM and aggressively lean the mixture during ground operations. These procedures help maintain proper combustion temperatures and keep the spark plugs clean.

During the magneto check, an excessive RPM drop is a clear indication of one or more fouled spark plugs.

Spark plugs can often be cleaned by running the engine at a high power setting while aggressively leaning the mixture. Maintain this condition for approximately 20 seconds, then repeat the magneto check to verify proper operation.

In the Engine Status page of the Maintenance Report, you can:

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



## 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.

### Caution

Using a higher-viscosity oil in cold climates may cause excessive oil pressure, potentially damaging oil system components.



**Note**

Oil pressure may approach its maximum limit during initial engine start when the engine is cold. This is normal and does not cause any harm, provided that oil pressure decreases as the engine warms up.

Allow the engine to warm up to ensure proper oil temperature and pressure before applying full power for takeoff.

## Engine Startup Tips

- If the engine is cold, crank the throttle two or three times before engaging the starter.
- If the engine is warm already, no priming is needed before cranking the starter.
- 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 System

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 section 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.



## Avionics

### Status Saving and Avionics Wear and Tear

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 avionics component
- **Fix** a faulty radio

#### Caution

Never switch the engine or alternator on or off while the avionics master switch is ON. This may cause voltage spikes and damage avionics components. Even modern systems, such as the Garmin GNS 430/530, include protection against electrical overloads, but they are not fully immune.

## 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

## 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 DR400-180 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



## RESOURCES

### Links and 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](#)



## Homecockpits and 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)
-



## TECHNICAL 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](mailto: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

### V5.0.7

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### V5.0.6

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1. Fix: the fuel pump could drain fuel even when the fuel selector was off.

### V5.0.5

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1. Fix: The FSEconomy system could cause a crash in X-Plane 12.4.

### V5.0.4

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### V5.0.3h1

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1. Fix: hot-fix to solve an X-Plane 11 compatibility issue.
2. Fix: hot-fix to solve an illegal call to SDK functions from threads.

### V5.0.3

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1. Improvement: REP text-based engine monitor now displays TIT when a turbosuper-charger or turbonormalizer system is active.
2. Improvement: when possible, REP writes it own data to the default engine indicators datarefs.
3. Improvement: more realisti oil pressure at very low RPM.
4. Fix: Hypoxia visual effect was not always displayed correctly.

### V5.0.2

---

1. Improvement: Overall improvement of engine sounds.
2. Improvement: Overall improvement of the HeadShake integration.
3. Improvement: Overall improvement of the plane vibrations at low engine RPM.

### V5.0.1

---

1. Improvement: The user manual has been reorganized with a new structure and enhanced graphics.
2. Improvement: Fine tuned cylinders compression.

### V5.0.0

---

1. Improvement: All piston engines now feature an enhanced model with significantly refined cylinder data (CHT, EGT, compression, power output, position, vibration, firing order, and more).
2. Improvement: All piston-engine aircraft now benefit from an improved electrical system model, eliminating several quirks found in previous REP versions.
3. Improvement: Improved gyroscopic sound effects for greater realism.
4. Improvement: Better compatibility with macOS, including sound handling and font loading.
5. Fix: Resolved a configuration loading issue that could prevent the package from starting correctly on some systems.

### V4.8.13

---

1. Fix: The Walk Around oil check station didn't show the oil bar label correctly

### V4.8.12

---

No change for this aircraft

### V4.8.11

---

No change for this aircraft

### V4.8.10

---

No change for this aircraft

### V4.8.9

---

1. Fix: on XP12.1+ the landing gear was sinking in the ground



#### 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)

#### V4.8.1

---

1. Fix: engine vibrations at startup were not visible anymore
2. Improvement: better startup sounds

#### V4.8.0

---

1. Support for time and ground speed multiplier
2. Fix: the landing gear animation did not work properly in X-Plane 12.07



#### 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 1. Fix: static run-up RPM restored in XP12

#### 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



### 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
3. Fix: elevator animation in XP12

### V4.7.2

---

1. Fix: crash after replay

### V4.7.1

---

1. Fix: crash after pause

### V4.7.0

---

1. Fix: improved avionics failure tips
2. Improvement: better alternator voltage simulation at low RPM
3. Improvement: support for Apple M\* processors
4. Improvement: better compatibility of the Mass and Balance system with X-Plane 12
5. Improvement: it is now possible to vertically move the in-flight tips windows (no VR support for this feature at the moment)
6. Fix: missing library link if XP12

### V4.6.7

---

1. Fix: improved support for v1.9 version of the base plane

#### V4.6.6

---

1. Improved REP sound compatibility with internal X-Plane sound sliders

#### V4.6.5-h2

---

1. Fixed broken plugin reset

#### V4.6.5-h1

---

1. Fixed broken dataref

#### V4.6.5

---

1. Improved OpenAL errors log
2. Improved braking system compatibility with hardware toe pedals
3. Improved static elements compatibility with third-parties addons

#### V4.6.4

---

1. No changes for this plane

#### V4.6.3

---

1. No changes for this plane

#### V4.6.2

---

1. Improvement: MAP behavior at low RPM

#### V4.6.1

---

#### V4.6.0

---

1. Change: "Smooth Brakes" and "Automatic Differential Brakes" options merged into the "Advanced Braking" option

2. New: REP now includes TXT format checklists too
3. Improvement: better LOP cut-out behavior in piston engines
4. Improvement: more realistic piston engine power response when running ROP
5. Improvement: more realistic manifold pressure behavior at high RPM
6. Improvement: running oversquare when LOP does not damage the piston engines
7. Improvement: REP waits for the real weather to load (if enabled) before updating the engine temperatures at startup
8. Improvement: improved hypoxia recover at low altitude
9. Fix: the manifold pressure was too low at idle
10. Fix: The REP update loop was not always executed correctly in certain configurations
11. Fix: The avionics is less prone to damage if the alternator is turned on/off with the avionics master on

#### V4.5.12-h2

---

1. Fix: missing front wheel steering animation
2. Improvement: better RealityXP GTN Support

#### V4.5.12-h1

---

1. Fix: missing economy page in the hangar window

#### V4.5.12

---

1. Improved towing behavior
2. Added engine cooling down sounds (exhaust ticks)
3. No changes for this plane

#### V4.5.10-h1

---

1. Fix: on Linux the plugin could crash the sim on startup because of a bad library link

#### V4.5.10

---

1. A cancel window is shown before beginning the engine autostart procedure
2. Fix: the instrument wear could not save its state properly on some systems

### V4.5.9

---

1. Improved the FSEconomy implementation reliability

### V4.5.8

---

1. Improved the hardware rudder pedals compatibility (it is now possible to disable the automatic differential braking)

### V4.5.7

---

### V4.5.6

---

1. New: REP Economy System now supports X-CPL-Pilot
2. Fix: in the maintenance window, some text could overflow from the borders
3. Fix: in some configurations, the installer may not properly modify the FMOD .snd files

### V4.5.5

---

1. The static elements are not visible anymore during replay
2. REP reports in X-Plane's log when a damage/failure is taking place

### V4.5.3

---

### V4.5.2

---

### V4.5.1

---

1. Fix: the oil pump failure message was missing

### V4.5.0

---

1. New: improved VR support in walkaround and towing modes
2. The magnetos are forced to "both" when starting the flight with engines running
3. The tiedowns and chocks are removed when starting the flight with engines running



4. Fix: CTD when trying to connect to FSE
5. Fix: Typos in Maintenance Window
6. Fix: excessive oil consumption when a cylinder is partially worn out

#### V4.4.6

---

#### V4.4.5

---

1. The in-flight tips window now resize correctly in VR
2. Optimizations for XP11.50
3. Some sounds (very few) were played using the wrong equalizers resulting in too high or too low volume in relation to their position in the cockpit

#### V4.4.4

---

1. Fix: XP10 crash on reload
2. Fix: CTD on plugin disable

#### V4.4.3

---

1. New: dataref to control the wind volume: simcoders/rep/settings/wind\_volume
2. Fix: memory leak

#### V4.4.2

---

1. New: the standalone fuel market support USA airport codes 3 chars long
2. Fix: large windows did not fit the screen properly

#### V4.4.1

---

#### V4.4.0

---

1. The simulator<->REP interface has been reworked to accommodate future improvements

### V4.3.5

---

1. FSEconomy: fix for HTTPS protocolo update

### V4.3.4

---

1. FSEconomy: fixed connection issue (HTTP 301 not followed properly)

### V4.3.3

---

### V4.3.2

---

1. Fix: the com radio status was not properly restored

### V4.3.1

---

1. New option to show or hide the generic messages
2. Improved the Nav/Com radios status feedback in the maintenance window
3. Fix: the maintenance window could crash during the FSEconomy data update

### V4.3.0

---

1. Fix: the EGT indicator could report negative values
2. Message to warn that the Experimental Flight Model is not supported
3. Engine Monitor shows CHT and Oil Temperature
4. Fix: The preheater did not work properly
5. Fix: the Economy System status could be loaded only partially in some situations
6. Fix: the in-flight tips were not visible in VR. Thanks to [sparker](#) for helping debugging the issue.
7. Fix: workaround CTD
8. Fix: message boxes did not support VR
9. Improved the engine negative torque model

### V4.2.3

---

1. Fix: solved some windows positioning issues
2. Fix: in XP10 REP did not recognize opening a window as a paused sim state
3. Improved startup behavior

## V4.2.2

---

1. Fix: Tach time was not shown correctly in the Tachometer
2. Fix: improved CHT algorithm with X-Plane 11.35
3. Fix: the kneeboard and maintenance windows did not save their position properly, therefore they were not shown correctly after being popped out
4. Fix: and X-Plane 11.35 bug prevented REP from reading the proper airspeed

## V4.2.1

---

1. No changes for this aircraft

## V4.2.0

---

1. **New:** Simulation of Factory and Tuned exhaust effects
2. **New:** The status file are backed up before being overwritten
3. **New:** It is now possible to save the windows position between sessions
4. Improved manifold pressure behavior

## V4.1.8

---

1. New: it is now possible to set the wind sound volume in REP's settings window

## V4.1.7

---

1. CTD fix

## V4.1.6

---

1. Minor Networking fix

## V4.1.5

---

1. Increased the debug log for the Economic System



#### V4.1.4

---

1. No changes for this aircraft

#### V4.1.3

---

1. No changes for this aircraft

#### V4.1.2

---

1. No changes for this aircraft

#### V4.1.1

---

1. Fix: an alternator did not save its status properly
2. Minor fixes

#### V4.1.0

---

1. **New:** FSEconomy integration with the maintenance system
2. Fix: X-Plane crashed in case of airplane crash
3. Fix: the systems' damages were updated during replay as well
4. Fix: on XP10 some message windows were not shown properly
5. Fix: on multimonitor setups the in-flight tips were shown on the wrong monitor

#### V4.0.3

---

1. Fix: the aircraft serial number is now more randomized
2. Fix: the weight and balance traded "0Lt" of fuel when changing the passengers' masses
3. Fix: the initial status of the aircraft could not be reset properly
4. The spark plugs fouling in-flight tip is now easier to understand
5. Improved instruments behavior once weathered
6. The Tachometer Time is now only based on RPMs

#### V4.0.2

---

1. **New:** it is now possible to deactivate the brakes smoothing
2. Fix: fixed a crash when closing a plugin's window
3. Better gyros behavior

### V4.0.1

---

1. Fix: some mouse clicks were not captured properly in the Maintenance Report window
2. Fix: it was not possible to properly change the oil filter using the Maintenance Report window

### V4.0.0

---

1. **New:** Economic System
2. Improved multimonitor support

### V3.5.11

---

1. Vacuum Pump: the pump failure can be triggered using X-Plane failures menu
2. Attitude Indicator: the indicator failure can be triggered using X-Plane failures menu
3. Fix: changing livery or airport could not allow the aircraft to load its status properly

### V3.5.10

---

1. Minor fixes

### V3.5.9

---

1. The Hypoxia warning is shown only when the TUC is lower than 20 minutes

### V3.5.8

---

1. Minor fixes

### V3.5.7

---

1. Fix: the state loading could load incomplete data on some systems
2. Minor fixes

### V3.5.6

---

1. Better fuel flow at startup
2. It's now possible to paste the text in the licence box



3. Fix: saving a state file could have caused a crash on some specific system configurations
4. Fix: the static elements are better managed after leaving the replay mode
5. Fix: in some cases REP was unable to retrieve the correct system time

### V3.5.5

---

1. Fix: In some cases the plugin was unable to recognize if the sim was paused or not. This could lead to some major issues, such airplane crash after leaving replay mode
2. Fix: the prop governor did not react correctly when controlled using a joystick axis
3. Fix: minor fixes to the sound engine
4. Fix: in some cases the engine temps were not updated correctly if the airplane was loaded in flight, causing the oil pump to seize
5. Fix: in some cases the liveries status were not loaded properly when changing from a livery to another of the same aircraft
6. It is now possible to disable the advanced steering algorithm
7. Minor fixes

### V3.5.4

---

1. Minor Fixes

### V3.5.3

---

1. Fix: fixed a compatibility issue with the sound engine
2. Fix: the parking brake lever was not properly set when parking brake was toggled using X-Plane default commands.

### V3.5.2

---

1. Fix: the new OpenAL equalizer showed some incompatibility with 3rd party plugins. This update will try to work around them and prevent crashes. A better fix will be provided in future releases.
2. Fix: the parking brake lever was not properly set when parking brake was toggled using X-Plane default commands.

### V3.5.1

---

1. Fix: the flaps handle did not move when the battery was off
2. Fix: the flaps motor sound was heard while checking the flaps during the walkaround



3. XP11.30 new hypoxia effect is now overridden and REP's more precise hypoxia effect is used instead

### V3.5.0

---

1. **New:** It is now possible to load a worn out airplane. Checkout the [Persistent Aircraft and Components Wearing](#) chapter.
2. **New:** The cockpit instrumentation wears out with time and can be fixed using the Maintenance Report
3. **New:** [Hobbs Time and Tach Time](#) are now counted separately for the airframe and the engines
4. **New:** It is now possible to move the viewpoint while in walkaround or towing mode. VR not supported yet. See the [Towing](#) and [Walkaround](#) sections for more information.
5. The static elements, such chocks and tie-downs, are now managed during replay
6. The propeller governor dynamics at low RPMs are much improved
7. Improved starter algorithm
8. Fix: under certain conditions, the fuel pump sounds where not stopped with the pump itself
9. Fix: a bug prevented the cylinders to fail properly and to report their compressions in the Maintenance Report
10. Fix: the hypoxia message was shown when the hypoxia was disabled
11. Fix: the oil filter get less clogged when it's past TBO
12. Fix: the autostart broke if the weight and balance configuration was changed while it was running
13. Fix: The Maintenance Report and the Kneeboard were not dimmed correctly at night

### V3.4.6

---

1. **New:** Automatic updates via [SkunkCrafts Updater](#) plugin
2. **New:** REP is now compatible with the [Differential and progressive brakes for X-Plane 11](#) plugin
3. Improved documentation
4. Improved gyros spin-down behavior
5. Fix: failures and damages were triggered while in replay mode
6. Fix: the oil pressure needle was not visible if the airplane was loaded with the engines running
7. Minor improvements

### V3.4.5

---

1. **New:** It is possible to manage the static elements from the plugins menu
2. **New:** Command to toggle the static elements

3. **New:** Command to fix all systems
4. **New:** REP correctly recognizes the engine failures triggered by X-Plane
5. Fix: In the latest X-Plane versions the in-flight tip messages may have been not shown correctly
6. Fix: Some entries in the tech report were not clickable
7. Fix: Minor typos in kneeboard
8. The installer has been improved to work with all the airplane mods available over the Internet
9. More realistic hypoxia effect at lower altitudes
10. Improved documentation

### V3.4.4

---

1. Minor fixes

### V3.4.3

---

1. **New:** Improved engine torque algorithm
2. **New:** Improved sparkplugs fouling algorithm
3. **New:** Removed the mouse gestures to open the kneeboard
4. **New:** The checklists/mass and balance/towing mode/autostart are now accessible from the plugins menu as well as the lateral menu
5. **New:** a new command has been added to switch on the HI fuel pump
6. Improved multimonitor compatibility
7. Fix: oil pressure was sometimes too low
8. Minor fixes

### V3.4.2

---

Internal test build – not released to the public

### V3.4.1

---

1. Fix: missing input chars in textbox
2. Fix: input on multimonitor setup was not working as expected
3. Minor fixes

### V3.4.0

---

1. **New:** Experimental VR Support



2. **New:** SDK 3.0 (Detachable) windows
3. Improved engine model
4. Minor fixes

### V3.3.1:

---

1. Fix: Too rich mixture at full power
2. Minor fixes

### V3.3.0

---

1. **New:** 100% custom engine model to replace the internal X-Plane piston engine
2. **New:** Engine monitor enables engine fine tuning during flight
3. **New:** Improved drag model
4. **New:** Improved walkaround oil system check
5. **New:** Improved ground roll sounds
6. **New:** Improved ADI spoolup model
7. **New:** Walkaround keyboard commands
8. Minor fixes

### V3.2.1

---

1. Fix: Loading and unloading the plugin more times caused a crash
2. Fix: If the flight was started with engine running, the mixture was set to idle-cutoff
3. Minor fixes

### V3.2.0

---

1. **New:** 3D sounds
2. **New:** Advanced gyro wander
3. **New:** You can now check the pitot probe temperature during walkaround
4. **New:** Postflight walkaround
5. **New:** Lights check during walkaround
6. **New:** More information about the cylinders status
7. **New:** The hobbs hour are now saved in the airplane state file and restored the next session
8. Improved steering algorithm
9. Better startup sounds
10. Fixed a bug that caused the cylinders to not being fixed correctly after an engine seizure
11. The landing gear failures are based on actual gravity acceleration. Now the landing on sloped strips are more realistic.

12. Fix a bug that may caused the engine to not fail when it should have
13. Minor fixes and improvements

### V3.1.1

---

1. **New:** The chocks and tie downs are checked before automatic start
2. **New:** The lateral menu can now be completely hidden (see the plugin settings window)
3. Improved flooded engine message
4. Better compatibility with the "Start with engine running" setting
5. Fix: the label colors in some walkaround views were incorrect
6. Fix (XP11 only): the wind sound volume is controlled by the environment sounds volume
7. Minor fixes

### V3.1.0

---

1. **New:** Dynamic ground roll sounds
2. Minor fixes

### V3.0.0

---

1. **New:** reworked user interface and graphics
2. **New:** automatic startup procedure
3. Improved flight dynamics in X-Plane 11
4. Fix: some throttle quadrants did not work correctly with REP
5. Minor fixes and improvements

### V2.6.4

---

1. **New:** Flight dynamics improvements in both X-Plane 10 and 11
2. Fix: Minor fixes

### V2.6.3

---

1. Fix: The right toebrake did not couple properly with external rudder pedals
2. Fix: The oil system "Refill" button was not clickable

### V2.6.2

---

1. Fix: Minor fixes



## V2.6.1

---

1. Fix: Checklists typos
2. Fix: Improved fuel pump sounds
3. Fix: The wheel brakes may be stuck after towing
4. Fix: Improved engines doppler and distance sounds
5. Fix: Damages disabled during replay
6. Fix: Improved the joystick compatibility with the new propeller governor

## V2.6.0

---

1. **New:** Custom propeller governor

## V2.5.1

---

1. Fix: Corrected the toe brakes algorithm

## V2.5.0

---

1. **New:** Improved torque effect
2. **New:** Improved CHT and Oil Temperature algorithm
3. **New:** Oil temperature tips
4. **New:** Improved hypoxia effect & algorithm
5. **New:** Fuel & Oil check in walkaround mode
6. Minor Fixes

## V2.4.0

---

1. **New:** Spark plugs dynamics:
  - The spark plugs get fouled when the engine runs at low RPMs
  - The default spark plugs can be replaced with the fine-wire ones
2. **New:** Hypoxia can now be disabled in the settings panel
3. **New:** The engine may be damaged by wrong ROP/LOP operations
4. Minor Fixes

## V2.3.0

---

1. **New:** Hypoxia simulation
2. **New:** Oil filter simulation: need to replace it at every oil change
3. **New:** Oil pump damage simulation

4. **New:** Fuel filter simulation: need to replace it after TBO
5. **New:** Vacuum pump casual failure simulation
6. **New:** More realistic engine priming dynamics
7. **New:** Improved W&B simulation during flight
8. Fix: Minor bug fixes

### V2.2.1

---

1. Fix: the installer did not apply some changes correctly

### V2.2.0

---

1. **New:** Simplified installation
2. Fix: The analog and digital fuel flow gauges were not reporting the correct fuel flow under certain circumstances
3. Fix: Minor fixes

### V2.1.0

---

1. **New:** Engine pre-heating and winterization kit
2. **New:** The avionics settings are restored after reloading the airplane
3. **New:** Better compatibility with other plugins that manage the state of the airplane (such as X-Bookmark)
4. **New:** The sounds volume is controlled by the Carenado volume knob
5. **New:** The lateral menu is dimmed at night
6. Fix: More realistic ground physics
7. Fix: The oil system is now reporting the correct oil quantity
8. Fix: Minor fixes

### V2.0.3

---

1. Fix: The cowl flaps lever cannot be moved using the mouse wheel
2. Fix: The kneeboard images were cutted and not shown correctly

### V2.0.2

---

1. **New:** Improved cylinders physics
  - The CHT temperature is now provided by a custom algorithm
2. **New:** Improved oil system
  - The oil temperature is now provided by a custom algorithm

- The oil temperature and pressure depends also on oil quantity and quality
- 3. **New:** Improved touchdown sounds
- 4. Minor Fixes

## V2.0.1

---

1. Fix: It was not possible to enter the walkaround mode if the "Cold and Dark" option was disabled
2. Fix: Typos in the towing tips
3. Fix: The Walkaround checklists were not correctly visible on smaller screens.

## V2.0.0

---

1. **New:** Custom interactive walkaround and pre-flight procedures.
2. **New:** Custom airplane towing system
3. **New:** More advanced engine physics (especially for engine startup)
4. **New:** More complex damages system for the avionics, the engine and the landing gear such as:
  - Oversquare operation of the engine is not always allowed
  - The tires are damaged if the brakes are active on touchdown
5. **New:** More in-flight tips
6. **New:** Custom menu that provides an easy access to REP's features
7. **New:** Stall buffeting effect (improved if HeadShake 1.5+ is installed)
8. Minor changes to the sounds system
9. Minor changes to the graphics system
10. Bug fixes

## V1.0.2

---

1. **New:** Correct steering and ground roll physics, especially in cross wind conditions.
2. **New:** The Weight & Balance tool now predicts the C.G. position at landing.
3. **New:** HeadShake and REP integration to better simulate the engine vibrations of the TSIO-520 (Headshake v1.5 or higher required).
4. Fix: Improved compatibility with Saitek products.
5. Fix: Minor fixes.

## V1.0.1

---

1. **New:** A tip is shown if the pilot is managing the plane's system in the wrong manner.
2. **New:** Some failures (such as the avionic's) are behaving in a more realistic way.
3. **New:** The parasite roll moment incorrectly reproduced by X-Plane is reduced.

4. **New:** The flooded engine behavior is now more realistic. If flooded, the engine may actually start with closed mixture.
5. **New:** Engine manufacturer and model in the Hangar window.
6. **New:** Better oil color report in the Hangar window.
7. **New:** Added the "About" menu.
8. **Fix:** Sometimes, the joystick mixture axis was not correctly recognized.
9. **Fix:** Cranking a running engine does not reduce the engine's RPM anymore.
10. **Fix:** Cranking a running engine does not cause an avionics failure anymore.
11. **Fix:** The pilot altimeter's barometer was rendered incorrectly.
12. **Fix:** The propeller joystick axis was not working as expected.
13. **Fix:** The oil pressure was too high during flight.
14. **Fix:** Minor changes to improve performance and correct typos.

## V1.0.0

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1. Initial Release