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Reality Expansion Pack
for
JustFlight Piper Turbo Arrow III/IV

v5.0.11

November 6, 2026

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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 andfun. 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 Piper PA-28R-201 Turbo Arrow III/IV**.

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 PA-28 series competes with the high-winged Cessna 172 and the similarly low-winged Grumman American AA-5 series and Beechcraft Musketeer designs.

In 1967, Piper introduced the PA-28R-180 Cherokee Arrow. This aircraft was based on the previous Cherokee versions and featured a constant-speed propeller, retractable landing gear and was powered by a 180-horsepower (134-kW) Lycoming IO-360-B1E engine. A 200-hp (149-kW) version powered by a Lycoming IO-360-C1C was offered as an option beginning in 1969 and designated the PA-28R-200. The 180-hp model was dropped after 1971.

The Arrow II came out in 1972, featuring a five-inch fuselage stretch to increase legroom for the rear-seat passengers.

In 1977, Piper introduced the Arrow III (PA-28R-201), which featured a semi-tapered wing and longer stabilator to provide better low-speed handling. It also featured larger fuel tanks, increasing capacity from 50 to 77 gallons. Lately, Piper introduced the Turbo Arrow III powered by the Continental TSIO-360F. After a year, it introduced the Turbo Arrow IV with an improved TSIO-360-FB engine and the iconic T-Tail.

This is the version depicted by the Reality Expansion Pack.

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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 addictional requirements:

- libstdc++6
- libgcc6
- libcurl
- libssl
- libcrypto
- libglu1-mesa

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 Piper PA-28R-201 Turbo Arrow III/IV** 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 Turbo Arrow III/IV 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 Turbo Arrow III/IV folder and call it “Turbo Arrow III/IV REP”.
4. Extract the contents of this REP package into a temporary folder
5. Move **the contents** of “**into-aircraft-plugins-folder**” into the “**Turbo Arrow III/IV REP/plugins**” folder

6. Move **the contents** of “**into-aircraft-main-folder**” into the “**Turbo Arrow III/IV REP**” folder
7. Run X-Plane and load the Turbo Arrow III/IV.
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 **skuncrafts_updater.cfg**. Copy such file into the Turbo Arrow III/IV 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 Turbo Arrow III/IV 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 skuncrafts_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 Turbo Arrow III/IV, overwriting the existing one.
2. Run X-Plane and load the Turbo Arrow III/IV.
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 Turbo Arrow III/IV, you should setup your sound settings like the following screenshot.

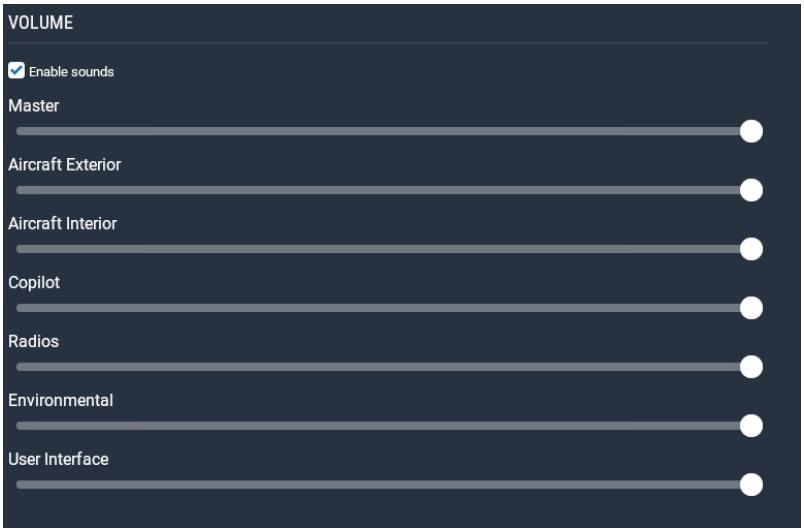

Figure 1: Recommended sound settings

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

Hardware and 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 Turbo Arrow III/IV.

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.

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 2: The menu is partially hidden by default

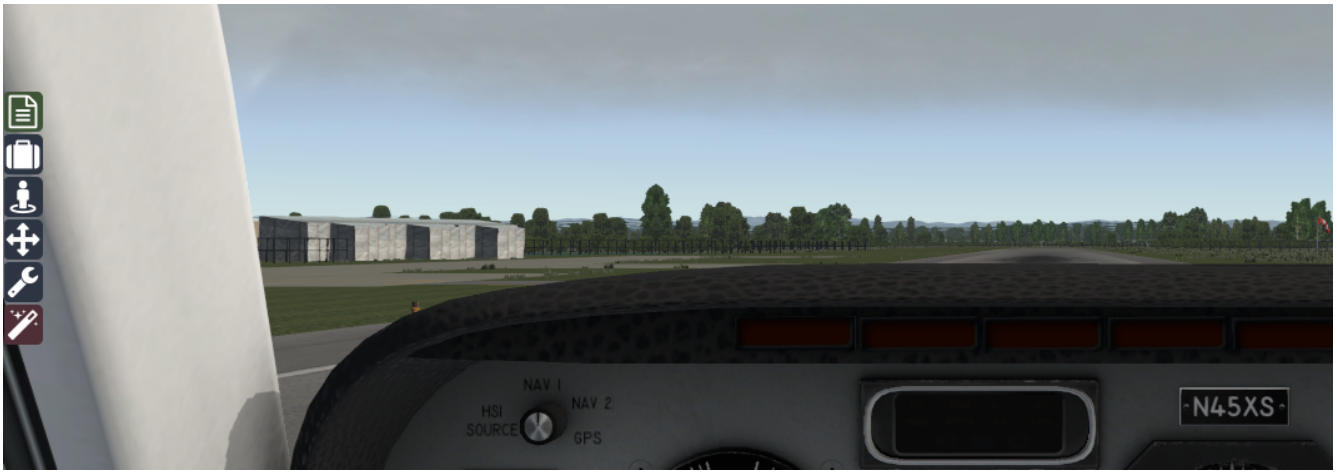

Figure 3: The menu is shown when the mouse pointer gets closer to it

You can choose to completely hide the menu when the mouse pointer leaves it. To do so, go to “Plugins -> Sim-Coders - 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 4: 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.

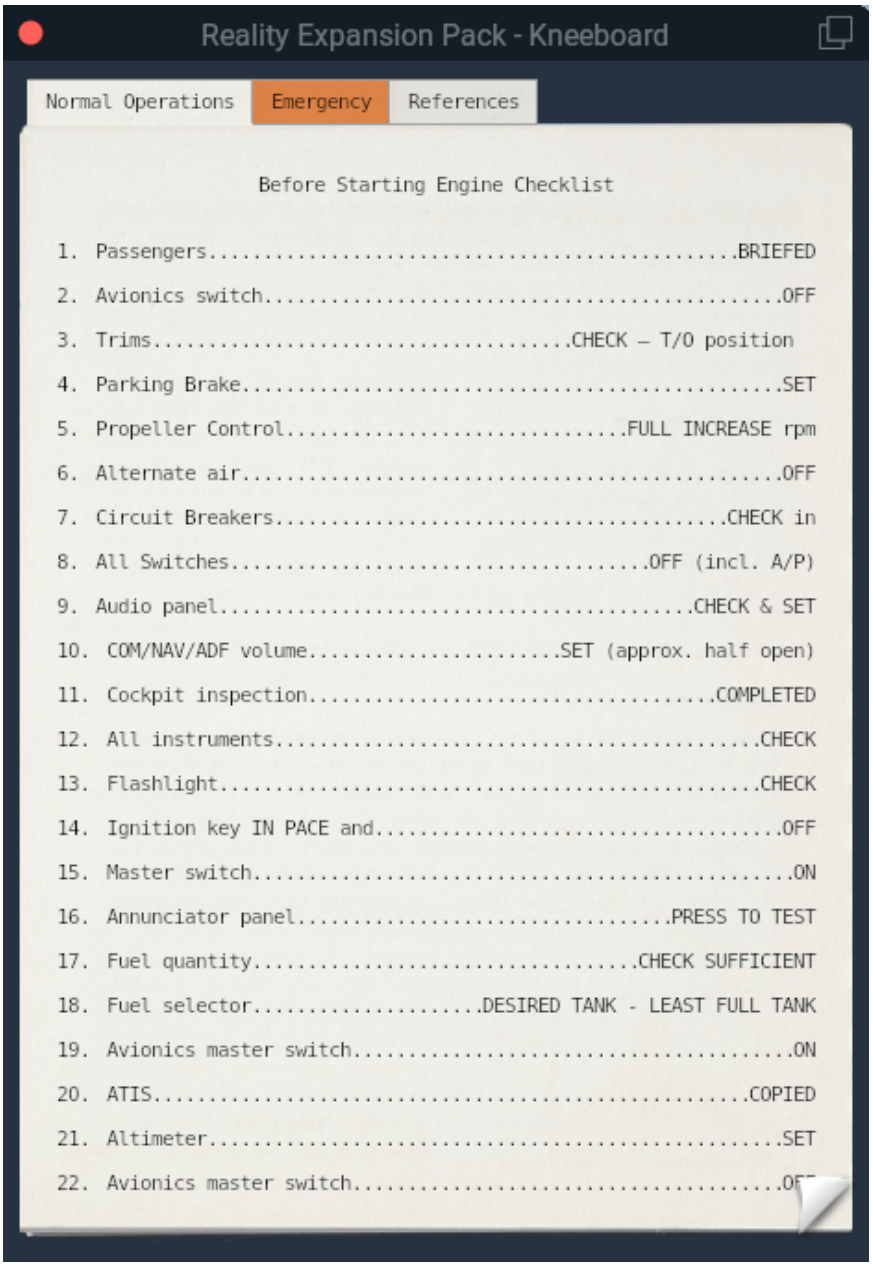

Figure 5: The Kneeboard window

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 Turbo Arrow III/IV 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
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.

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 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).
- **Lateral menu vertical offset**: Control the vertical offset of the side menu. Change this number if REP’s vertical menu position conflicts with other side menus.
- **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 (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.

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.

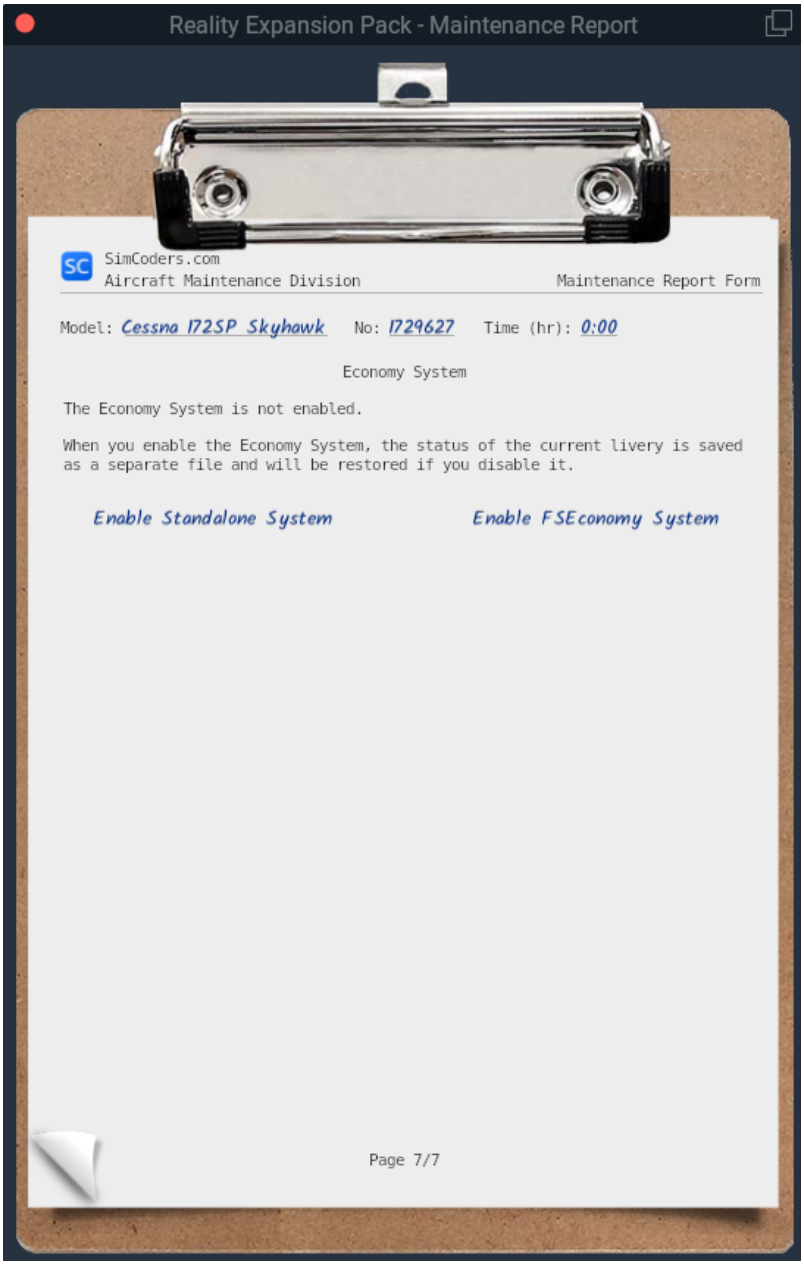

Figure 6: Enable the Economy System

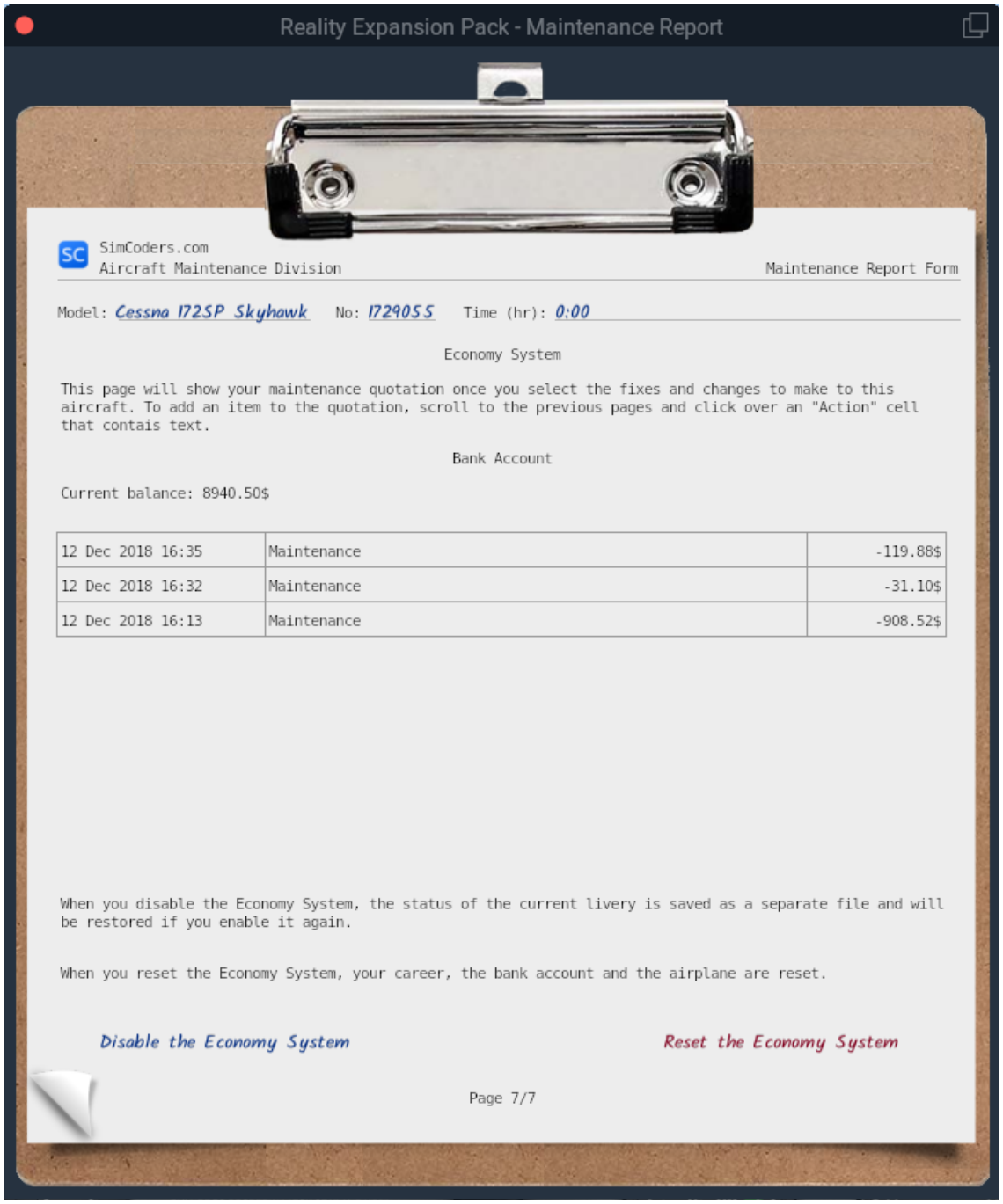

Figure 7: Economy System Overview

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.
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.

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.

Figure 8: Maintenance Report Example

Figure 9: 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 10: 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 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 comprehensive **wear and tear system** that applies to the **entire aircraft**. Every component experiences wear over time, and after extended use, it may develop issues or even fail completely. The condition of each part is continuously saved and updated, even when the simulator is not running.

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

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

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

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

Loading a Worn-Out Aircraft

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

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

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

Checking Component Status

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

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

Hobbs Time 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 adeguate oxygen until a specific degree of impairment, generally taken to be the point when the individual can no longer take steps to help him/herself.

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

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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 11: Hypoxia effect

SYSTEMS DESCRIPTION

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

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

The following is a brief description of each system onboard.

Powerplant

The Turbo Arrow III/IV is powered by a Continental TSIO-360-FB turbosupercharged, direct-drive, air-cooled, horizontally-opposed, fuel-injected engine with 360 cubic inches displacement.

This engine outputs a maximum power of 200HP at 41 inHg of manifold pressure and 2575RPM 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
  - 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 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.

The Piper PA-28R Turbo (P28T) is powered by the **Continental TSIO-360-FB**, a four-cylinder, fuel-injected, turbocharged engine rated at **200 horsepower**. The turbocharging system allows the engine to maintain its rated power up to approximately **14,000 feet**, significantly improving climb and cruise performance at altitude compared to normally aspirated variants.

By compressing the intake air, the turbocharger compensates for the loss of air density with altitude, enabling the engine to sustain higher manifold pressure and power output. As with all turbocharged engines, proper power management and close monitoring of engine parameters are essential for safe and efficient operation.

Turbosupercharger

The TSIO-360-FB is equipped with an exhaust-driven **turbosupercharger**. Exhaust gases leaving the cylinders drive a turbine wheel, which in turn powers a compressor mounted on the same shaft. The compressor draws in ambient air, compresses it, and delivers it to the engine's induction system at a higher pressure, increasing the mass of air available for combustion.

In REP, the turbocharger is modeled according to its **real-world operating principles**, rather than as a simplified pressure multiplier. Turbocharger **RPM, internal pressure, and temperature** are dynamically computed based on actual engine parameters such as delivered power, exhaust gas temperature (EGT), and mass airflow. This results in realistic turbocharger behavior, including spool-up lag, thermal inertia, and power response across different operating conditions.

Fixed Wastegate

By default, the TSIO-360-FB installation features a **fixed wastegate**. In this configuration, **manifold pressure must be regulated manually by the pilot** using the throttle, particularly during climb and altitude changes.

If manifold pressure exceeds **41 inHg**, the **BOOST** warning lamp illuminates in the cockpit, indicating that the maximum allowable turbo boost has been exceeded and that engine damage may occur if corrective action is not taken promptly.

A **pressure relief valve** is installed to protect the engine from severe overboost conditions. However, its response may be relatively slow, especially when engine oil is cold and more viscous. As a result, careful and progressive throttle movements are essential, particularly at low altitude and high power settings.

Automatic Wastegate

Because manual control of a fixed wastegate can be demanding and prone to error, some third-party manufacturers have developed **automatic wastegate controllers**, which can be optionally enabled in REP.

The automatic wastegate modulates its position to maintain the **target manifold pressure (MAP)** selected by the pilot via the throttle. Once the desired MAP is set, it is generally maintained during altitude changes—within system limits—without the need for continuous throttle adjustments. With the throttle fully closed, the target manifold pressure is approximately **8 inHg**, while with the throttle fully open, the system targets a maximum MAP of approximately **41 inHg**.

The wastegate is **oil-pressure actuated** and **spring-loaded to the open position**. Engine oil pressure acts against the spring to close the wastegate as required. Because oil pressure does not build instantaneously, **rapid throttle application** can temporarily outpace the controller's response, potentially resulting in a short-lived **overboost**. For this reason, throttle inputs—especially toward maximum power—should always be made **smoothly and progressively**.

Caution

Since the wastegate is oil-pressure actuated, cold and highly viscous oil slows its response time. As a result, manifold pressure limits may be exceeded more easily during rapid power changes when the oil is not yet at normal operating temperature.
For this reason, the engine should be properly warmed up and all engine instruments should be within the green arc before proceeding to the active runway.

Note

Proper engine oil pressure is essential for normal wastegate operation. A loss of oil pressure (for example due to an oil leak) may cause the wastegate to move toward the open position, resulting in an unexpected reduction in manifold pressure. If manifold pressure does not behave as expected, engine oil pressure should be monitored closely.

In addition to reducing pilot workload, the automatic wastegate improves **exhaust backpressure management**, particularly at altitude. This leads to more efficient turbocharger operation and can provide **approximately a 5% increase in available power** for the same throttle setting compared to a fixed, manually controlled wastegate.

Switching between the **fixed** and **automatic** wastegate configurations can be performed via the Maintenance Report.

Manifold Pressure Variation with Engine RPM

When the **wastegate is open**, a turbocharged engine behaves similarly to a normally aspirated engine with respect to changes in engine RPM. Increasing RPM results in a slight **decrease in manifold pressure**, while decreasing RPM causes a slight **increase in manifold pressure**.

When the **wastegate is closed**, the relationship is reversed. In this condition, an **increase in engine RPM** results in an **increase in manifold pressure**, while a **decrease in RPM** leads to a **decrease in manifold pressure**. This occurs because higher engine RPM increases exhaust mass flow, driving the turbocharger faster and increasing compressor output.

Manifold Pressure Variation with Altitude

At **full throttle**, the turbocharger is capable of maintaining a maximum continuous manifold pressure of **35 inHg** to well above **17,000 feet**, depending on engine condition and atmospheric parameters. However, engine operating limitations define the maximum allowable manifold pressure. Above **17,000 feet**, manifold pressure must be reduced in accordance with the aircraft operating placard, typically by **subtracting 1 inHg from 35 inHg for each**

additional 1,000 feet.

At **partial throttle**, the turbocharger can maintain **climb power settings of 2,500 RPM and 30 inHg** from sea level up to approximately **20,000 feet** under standard atmospheric conditions. Under hot-day conditions, this same power setting can typically be maintained from sea level to approximately **8,000 feet** without throttle adjustment once established after takeoff. Above this altitude, maintaining 30 inHg requires **progressive throttle advancement**, in a manner similar to climb operations in a normally aspirated engine.

Manifold Pressure Variation with Airspeed

When the **wastegate is closed**, manifold pressure varies with changes in **airspeed**. The compressor section of the turbocharger operates at pressure ratios of up to **3:1**, meaning that even small variations in inlet pressure caused by changes in airspeed are amplified at the compressor outlet. These pressure changes affect exhaust flow and turbine speed, resulting in corresponding variations in manifold pressure.

Fuel Flow Variations with Changes in Manifold Pressure

The engine-driven fuel pump output is regulated by **engine speed** and **compressor discharge pressure**. Fuel flow is then metered by the throttle and mixture controls.

When the **wastegate is open**, fuel flow varies directly with **manifold pressure, engine RPM, mixture setting, and throttle position**. In this condition, manifold pressure is primarily controlled by throttle position and wastegate operation, while fuel flow responds directly to throttle movement and pressure changes.

When the **wastegate is closed** and changes in manifold pressure are driven by turbocharger output rather than throttle movement, **fuel flow follows manifold pressure automatically**, even if the throttle position remains unchanged. As a result, pilot fuel-flow management is typically limited to:

1. Initial mixture adjustment for proper rich climb after takeoff,
2. Leaning during cruise,
3. Returning the mixture to full rich for approach and landing.

Manifold Pressure Variation with Increasing or Decreasing Fuel Flow

When the **wastegate is open**, movement of the mixture control has little or no effect on manifold pressure in a turbocharged engine.

When the **wastegate is closed**, any change in fuel flow results in a corresponding change in manifold pressure. Increasing fuel flow increases exhaust mass flow, which drives the turbocharger faster, increases induction airflow, and raises manifold pressure. Conversely, reducing fuel flow decreases exhaust energy, slows the turbocharger, and results in a reduction in manifold pressure.

System Limitations

1. Maximum MAP: 41

Fuel System

Fuel Pump

The fuel system is provided with a primer and an electrical fuel pump that can be used to prime the engine.

The fuel pump should not be used in flight unless required by the checklists.

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

- Check the fuel pump **status**
- **Repair** the pump in case of failure

Caution

Engaging the fuel pump during flight will cause an increase of the fuel flow. That is, the EGT will raise or drop depending on your current mixture settings.
Be sure to reset the mixture setting when the fuel pump switch is being turned on or off.

Vapor Locks

A vapor lock is a fuel vapor bubble in the fuel lines that prevents cool fuel to reach the combustion chambers.

If the engine was shut down in the last 10-15 minutes and should be restarted, a vapor lock is in place if the engine starts up for a moment and then dies.

To clear the vapor lock, close the mixture and switch on the electrical fuel pump for at least 30 seconds to up to one minute. Then repeat the startup procedure.

The fuel pump will recirculate the fuel in the continuous flow fuel system, dumping the fuel vapor inside the fuel tanks.

Fuel Injection System

The Reality Expansion Pack fully recreates the TCM Continuous Flow Fuel Injection System that powers the real world Turbo Arrow III/IV.

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 but it does compensate for MAP.

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 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
- Fine-wire spark plugs are less susceptible to fouling than standard plugs, but they are not immune and can still foul under unfavorable operating conditions.

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 walka-round.

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.

Propeller

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.

During the engine run up, three prop governor cycles will ensure a better oil recirculation inside the propeller governor oil circuit.

The Red Box

When the IO-360 was firstly 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.

Engine Startup Tips

- Before starting the engine, always apply full mixture and full throttle and then prime the engine using the primer button. Keep the primer button pressed for as long as required by the priming table provided in the checklists. After this priming 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 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.

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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, hydraulically actuated, retractable landing gear. When in good shape, the landing gear requires from 6 to 8 seconds to fully extend or retract.

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

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

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

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

System Limitations

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 Turbo Arrow III/IV 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. To help us assist you efficiently, please provide a detailed description of the issue and **include your X-Plane Log.txt** file.

Version Changelog

V5.0.11

1. Fix: the audio library could cause a crash on some systems.
2. Fix: the turbo overboost light did not work correctly on ground.
3. Fix: the “Reset economy” button did not work properly in some screen configurations.

V5.0.10

V5.0.9h3

1. Fix: It was not possible to connect to the FSEconomy server anymore.

V5.0.9

1. Improvement: slightly tuned fuel system shutoff dynamic
2. Improvement: the plugin does not rely anymore on SSL/CURL/CRYPTO external libraries

V5.0.8

1. Improvement: Linux version do not rely on libcurl anymore.
2. Improvement: More realistic lean of peak behavior.

V5.0.7

No change for this aircraft

V5.0.6

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

V5.0.5

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

V5.0.4

No change for this aircraft

V5.0.3h1

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

1. Improvement: REP text-based engine monitor now displays TIT when a turbosupercharger 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

No change for this aircraft

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

V4.8.0

1. Support for time and ground speed multiplier

V4.7.14

1. No change for this airplane

V4.7.13

1. No change for this airplane

V4.7.12

V4.7.11

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

V4.7.10

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

V4.7.9

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

V4.7.8

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

V4.7.7

V4.7.6

1. Fix: some sounds would not stop playing after plane crash
2. Fix: fuel totalizer fix in XP12

V4.7.5

No changes for this airplane

V4.7.4

No changes for this airplane

V4.7.3

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

V4.7.2

1. Fix: crash after replay

V4.7.1

1. Fix: crash after pause

V4.7.0

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

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
3. Fix: it was not possible to set the transponder to ON/ALT when using the honeycomb hardware
4. Fix: the emergency landing gear extension did not work properly after the last JF basemodel update

V4.5.9-h2

1. Improved the gear drag curve

V4.5.9-h1

1. Reduced the pitch-up moment at high speed

V4.5.9

1. Improved the FSEconomy implementation reliability
2. Improved manifold pressure algorithm
3. Improved the pitch trim time
4. Improved the cruise pitch attitude

V4.5.8

1. Improved the hardware rudder pedals compatibility (it is now possible to disable the automatic differential braking)
2. Improved the drag model with gear down

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 oveflow 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
3. The damage caused by running the engine in the redbox was not always calculated properly
4. Update the JustFlight base model to v1.8.1
5. Fix: the DME did not save its power switch position between flights
6. Fix: some performance charts were missing in the kneeboard

V4.5.4

1. Restored the the A/P hold hidden button with a fix to avoid the sound loop
2. The rudder check during walkaround takes rudder cables stiffness into account
3. Improved the drag curve at low speed
4. Improved the yaw moment at low speed
5. Improved the flaps extension/retraction speed
6. Fix: EGT indicator going out of scale
7. Fix: Overboost light randomly going off
8. Attempting to fix a crash while switching to VR

V4.5.3 hotfix 1

1. Added the side menu vertical offset option in REP's settings

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 comsuption 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: walkaround 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 overwrited
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 where 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 visibile 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 walkround 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 an 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 tire 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 starts 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

1. Initial Release