SIAI-Marchetti SF.260D
powered by
Reality Expansion Pack

v4.5.9

February 10, 2021
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AIRCRAFT GENERAL DESCRIPTION

The SIAI-Marchetti SF.260 is an Italian light aircraft which has been commonly marketed as a military trainer and aerobatics aircraft. It is known as the “Ferrari of the sky” for its sleek appearance and its relatively high cruise speed.

The SF.260 was designed by Italian aircraft designer Stelio Frati, while production work originally performed by Milan-based aviation manufacturer Aviamilano. On 15 July 1964, the first prototype performed its maiden flight (then designated F.260). Shortly thereafter, responsibility for production was transferred to SIAI Marchetti, who had purchased the rights to the design. Manufacturing continued to be performed by this firm until the company was bought by Aermacchi in 1997.

The SF.260 has been largely sold to military customers as a trainer and light combat aircraft. The Italian Air Force (Aeronautica Militare) and the Belgian Air Force (Composante air de l'armée belge) make a large use of the SF.260 as basic trainer for their pilots.

In the '70s and '80s, Italian flagship airline Alitalia owned a large fleet of SF.260 that were used as both basic and advanced trainers. The entire fleet was then sold to private owners during the late '80s and the '90s. Some of Alitalia's SF.260 featured custom cockpits, equipped with airliners flight instruments - such those from the McDonnell Douglas MD-80, in force on Alitalia's main routes.

In addition, there have been limited civil sales to private operators mainly in Europe. During the late 1960s, the type was marketed in the United States under the name Waco Meteor. Armed military versions, sold as the SF.260W Warrior, proved to be popular with smaller air forces, which could arm the type for use in the close air support role. The main issue with the SF.260W used to be weight. This was the major cause of SF.260W shot-downs as heavy weight made the plane slow and less agile.

Both piston-powered and turboprop-powered models have been developed.
FEATURES LIST

Choose your plane version

- Civilian version powered by Lycoming O-540-E4A5
- Military version powered by Lycomint IO-540-E4A5
- Analog cockpit version
- G1000 cockpit version

Code driven flight dynamics

- Super fun to fly, requires your attention all the time
- Realistic takeoff, landing, cruise, and overall performance
- Realistic aerobatics
- Realistic stall behavior (watch your ailerons!)
- Impressive spin behavior
- Realistic roll speed at both high and low speeds

Outstanding 3D model and liveries

- Very light on FPS
- High performance 4K texture
- 10 Liveries included
- Blank textures with PSD available to create your own livery
- Tire blowout is shown
- Propeller blades bend on belly landing
- 3D modelled engine components
- Custom rain and ice effects

Realistic onboard systems and procedures

- Pre/Post flight walkaround
- Custom hand towing mode: use your joystick to push/pull/steer the aircraft on ground
- Realistic Mass and Balance
- Complete electrical system with working Circuit Breakers
- Custom landing gear warning system
- Custom stall warning system
- Custom vacuum system
- Custom flaps system with realistic "white-arc" behavior
- Custom fuel system
- Custom cabin ventilation and windshield defrost system
- Working Emergency Avionics switch with Emergency Battery
- Working emergency landing gear extraction procedure
- Canopy can stay slightly open during flight

Custom Damage & Maintenance System

- Any system can be damaged if used the wrong way
- Persistent aircraft state: each livery has its own state that is saved between flights. Damage is cumulative.
- Maintenance Report available to check the status of the aircraft and do the maintenance and repairs
Custom Economic System
- Can be enabled or disabled on the fly
- Pay for the maintenance
- Get rewarded for your flight time and good landings
- Compatible with FSEconomy

100% Custom Piston Engine
- The Lycoming I/O-540-E4A5 is modelled down to the smallest bolt and breathes air like a real engine
- Custom fuel pump and fuel filter
- Realistic Oil System affected by Oil Viscosity. Choose the best oil grade for your kind of operation.
- Spark plugs fouling. Change the spark plugs type in the maintenance report.
- Working engine preheater
- A custom algorithm simulates the fuel/air mixture and its combustion
- Custom carburettor system with custom icing behavior
- High fidelity power curve
- Custom system failures
- Realistic startup behavior and procedures
- Automatic startup option for quick start

High fidelity cockpit
- Right and left seat layouts
- All switches work like the real ones
- The cockpit is illuminated by 3D lights
- The instruments wear out and may give incorrect reading. Tap over them to temporarily try to reduce their error. Fix them in the - maintenance report.
- The cockpit light and indicators bulbs may start blinking and fail. Tap over them to temporarily try to light them up again. Replace - them in the maintenance report.
- Realistic phosphorous lights that dim at night as time passes by
- Working Circuit Breakers that you can use to shed the battery load in case of generator failure
- Ability to switch between different avionics layout
- Support for RealityXP GNS and GTN650
- Bendix/King KX165 NavCom
  - Realistic startup animations
  - Active/Standby frequencies mode
  - Active only mode
  - Program mode
  - Channels mode
  - CDI mode
  - Bearing mode
  - Radial mode
  - Timer mode
- Bendix/King KR87 ADF Receiver
  - Realistic startup animations
  - ANT/BFO/ADF modes
  - FLT/ET mode with SET/RST button
• Bendix/King KFC225 Autopilot
  – Realistic Startup Animations
  – ROLL and PITCH mode
  – HDG/NAV/VS/ALT modes
  – Yaw Damper
• Garmin GTX330 Transponder
  – Realistic Startup Animations
  – Altitude Monitor mode
  – Count down mode
  – Count up mode
  – Flight Time mode
  – OAT/DALT mode
  – PA mode

**HeadShake Integration**

• Use a custom lever in the cockpit to strengthen the belts and reduce the G-Force effects during aerobatic flight

**Custom three dimensional sounds**

• Custom sound engine that ensure high performance and quality
• Dynamic immersive sounds in both internal and external views
• Sounds are muffled by closing the canopy and wearing the headsets
• The canopy can stay slightly open during flight to let some fresh air in: you will feel the wind blowing on your face
• Enjoy the engine sound suffering the torque effects during aerobatic flight

**Automatic Updates**

• The airplane is constantly improved
• Issues are quickly fixed

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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.

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

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

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

Install the software

The Reality Expansion Pack is shipped together with the SF.260D so no action is required to complete the installation.

Just run X-Plane, load the aircraft and follow the onscreen instructions (if any).

Automatic Update of the Software

The Reality Expansion Pack support the automatic updates via the SkunksCrafts Updater plugin.

In order to activate the automatic updates you shall install the SkunksCrafts Updater plugin as stated in its user manual. The plugin will then take care of the automatic updates when X-Plane is launched.

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.
Recommended sound settings

To better enjoy the Reality Expansion Pack on the SF.260D, you should setup your sound settings like the following screenshot.

![Recommended sound settings](image1)

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.

![Recommended control settings](image2)

Figure 2: Recommended control settings
HARDWARE & SOFTWARE COMPATIBILITY

Headshake

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

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

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

Moreover, if Headshake v1.11 or higher is installed, you can set the seat belts strength using the lever near your seat. Push the lever forward to strengthen the seat belts.

Strengthening the belts will reduce the head movements during aerobatic flight.

Figure 3: The lever pointed by the arrow controls the seat belts strength
**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 SF.260D.

**XPRealistic**

The Reality Expansion Pack can be used together with XPRealistic.

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

**Differential and progressive brakes for X-Plane 11**

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

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

Lateral Menu

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

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

![Figure 4: The menu is partially hidden by default](Image)

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.

![Figure 5: The menu is shown when the mouse pointer gets closer to it](Image)
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 6: 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 7: 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:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
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<td>simcoders/rep/kneeboard/toggle</td>
<td>Show or hide the kneeboard</td>
</tr>
<tr>
<td>simcoders/rep/kneeboard/next_section</td>
<td>Show the next kneeboard section</td>
</tr>
<tr>
<td>simcoders/rep/kneeboard/prev_section</td>
<td>Show the previous kneeboard section</td>
</tr>
<tr>
<td>simcoders/rep/kneeboard/next_page</td>
<td>Show the next kneeboard page</td>
</tr>
<tr>
<td>simcoders/rep/kneeboard/prev_page</td>
<td>Show the previous kneeboard page</td>
</tr>
</tbody>
</table>
Mass & Balance

The Reality Expansion Pack provides a Mass & Balance tool to precisely load the plane. While loading the plane, the goal is to keep the crosses inside the plot section delimited by the blue area, like shown in the screenshot below.

![Mass & Balance window](image)

Figure 8: The Mass & Balance window

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

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

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

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

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

The unit of measure for the airplane mass and the C.G. arm can be changed by clicking the "Change Units" button.
Walkaround

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

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

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

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

If you do not remove the pitot cover, you will incour in a airspeed indicator failure.

Since version 3.4.5, it is possible to toggle all the static elements - such 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.

<table>
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<th>Command</th>
<th>Description</th>
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<td>Toggle the walkaround mode</td>
</tr>
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<td>simcoders/rep/walkaround/next</td>
<td>Next walkaround station</td>
</tr>
<tr>
<td>simcoders/rep/walkaround/previous</td>
<td>Previous walkaround station</td>
</tr>
<tr>
<td>simcoders/rep/walkaround/action</td>
<td>Execute current action</td>
</tr>
<tr>
<td>simcoders/rep/walkaround/static_elements/toggle</td>
<td>Static elements toggle</td>
</tr>
</tbody>
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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 Reality Expansion Pack
SIAI-Marchetti SF.260D

Engine Autostart

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

Enable the plane damages
When ticked, this option enables the plane damages.

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

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

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

Show side menu on mouse hover only
When ticked, REP will completely hide the lateral menu when the mouse pointer leaves it.

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

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

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

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

Save and restore the windows position between sessions
If checked, the Maintenance Hangar and the Keyboard windows positions are saved and restored between sessions.
Enable hypoxia effect
When ticked, the default hypoxia effect is replaced by REP's custom algorithm. See the Hypoxia chapter to get more information about the custom hypoxia effect.

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

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

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

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

Pilot/Copilot altimeter use InHg
Enable this option to let the altimeters use InHg instead of hPa.

Use Advanced Rain Effect
Enable the advanced rain effect using Skiselkov's (Totoritko) rain library

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.

Smooth Brakes
Enable this option to smooth the brakes when applied. Instead of applying the brakes all at once, they will go from 0 to 1 in two seconds, smoothing the braking action.
Automatic Differential Brakes

Enable this option to enable the automatic differential brakes.

Use VR Walkaround and Towing

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

LOW FUEL On if main tank empty

If checked, the LOW FUEL lamp (available in the military version only), turns on if the main tank contains less than 24lt. If unchecked, the lamp turn on if in total there are less than 34 liters available in all tanks.
ECONOMY SYSTEM

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

The Economy System features two modes of operation:

• **Standalone**: your bank account and maintenance records are locally saved to your PC. They are shared among your REPs. The system rewards you for your flight time and landing skills.

• **FSEconomy**: REP connects to the FSEconomy bank account and drains the required amount of money for maintenance directly from there. There are no rewards for your flight time as they are already provided by FSEconomy.

• **X-CPL-Pilot**: REP connects to the X-CPL-Pilot bank account from which it drains the required amount of money for maintenance. There are no rewards for your flight time because they are paid by X-CPL-Pilot already.

Enable the Economy System

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

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

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

To find the Aircraft Key:

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

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

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

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

The Bank Account is shared among all your REP airplanes. That is, it possible to earn money flying an airplane and use it to fix another airplane that needed maintenance.
Figure 9: This is the screen that allows you to enable the Economy System.

The Economy System is not enabled. When you enable the Economy System, the status of the current livery is saved as a separate file and will be restored if you disable it.

Enable Standalone System
Enable FSEconomy System
How it works

Once enabled, the Economic System page in the Maintenance Report shows your current Bank Account Balance and a log of the last transactions (amount spent for maintenance and fuel or income from a flight).

![Economic System](image)

Figure 10: This is the default screen of the Economic System

Each fix or maintenance you want to do to your airplane must be first added to a quotation. Each page of the Maintenance Report shows a table that reports the available maintenance actions.
For each action, the table reports the price and required work time.

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

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

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

The quotation reports two possible total prices:

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

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

### Buy/Sell Fuel

**This feature is available in Standalone Mode only.**

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

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

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

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

### Earn Money: Rewards

**This feature is available in Standalone Mode only.**

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

In case you make a smooth landing, a “Soft Landing” bonus is added to your reward. The softer the landing, the higher the reward.
Figure 11: Click over one of the Action cells to put that specific action in the quotation. Note: The maintenance report shown here is an example of how the table looks. It may not include the systems modeled in the airplane described in this manual.
Figure 12: A Quotation Example
VR Support

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

How to open the plugin windows in VR

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

- `simcoders/rep/vr/open_menu`: open REP's main menu
- `simcoders/rep/fuelmenu/show`: show the fuel menu when using the economy system
- `simcoders/rep/maintenancereport/show`: show the maintenance report
- `simcoders/rep/settingstimenu/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 informations 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.
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 pins
- Engine exhausts effects
- Fuel pumps
- Electric Gyros
- Avionics effects
- Dynamic touch down
- Dynamic ground roll
- Dynamic wind

Figure 13: The Tech Report shown in VR mode
Canopy and Headsets Muffling

Opening and closing the canopy muffle the external sounds, acting differently over the sounds spectrum.

It is possible to wear a headset to muffle the sounds even more. You find the headsets in between the front seats. Click over them to wear them. Click over their connection cable to remove them.

![Headsets Location in the Cockpit](image)

Figure 14: Headsets Location in the Cockpit
PERSISTENT AIRCRAFT AND COMPONENTS WEARING

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

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

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

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

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

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

*Tap over an indicator or a bulb light to try to correct its error or fix it while in the cockpit*

How to load a worn out aircraft

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

To do so, go to “Plugins -> SimCoders.com - REP -> Wear out to >” and choose one of the following items.

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

How to check the components status

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

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

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

Hobbs Time

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

Tach Time

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

General Flight Characteristics

The general flight characteristics give this aircraft complete and safe aerobatic capabilities.

Flight Controls

The flight controls, of conventional type, require limited forces to move the control surfaces which are effective in all configurations.

Takeoff

During takeoff the propeller produces a strong yaw moment. Slowly apply full power during the takeoff run, counteracting the yaw using the rudder.

Level Flight Characteristics

Low Speeds

The low speed characteristics and maneuverability of the aircraft are good. The flight controls are always effective near stall conditions.

Extension or retraction of the wing flaps and the landing gear causes only a slight trim change. In the white-arc range, especially with flaps down, the aircraft has a great roll authority. Low stick movements are sufficient to cause a high roll speed. If pilot overcorrections may easily end up in Pilot Induced Oscillations (PIO) around the longitudinal axis.

Cruise and High Speed

The aircraft has good maneuver margin characteristics all over the speed range. The stability is good around all the axes.

Stalls

Anticipated Stall Warning

The natural stall warning is perceived only a few knots above the minimum lifting speed. A stall warning system is provided on the aircraft to give the pilot an indication of an impeding stall. The stall warning system operates at approximately 5 to 10 Kts above stalling speed.
**1g Stall**

A tight buffeting occurs in advance of the stall.

A control softening tendency occurs coincident with the buffeting. Lateral control is adequate during the stall and recovery. During the stall the aircraft is statically stable. As soon as the maximum lift coefficient has been exceeded, the aircraft has a tendency to lower the nose. During the stall all controls remain effective. The stall recovery is easily accomplished by slightly moving the stick forward and, being the case, increasing power.

**Accelerated Stall**

As the stall is approached in a turn a control softening tendency occurs coincident with the onset of buffeting. At higher load factors buffeting increases indicating that the stall is imminent. The aircraft does not exhibit any tendency to drop a wing in accelerated stall unless the stall is combined with a side skid.

In this case the aircraft has a tendency to roll to the same side where the aircraft nose is skidding. The wing drop tendency produced by skid is easily contrasted by the rudder.

**Aerobatic Maneuvers Entry Speeds**

The suggested entry speeds with aircraft in clean configuration are the following:

- Chandelle: 150 KIAS
- Lazy Eight: 150 KIAS
- Steep Turn: 150 KIAS
- Loop: 175 KIAS
- Roll: 160 KIAS
- Immelman: 190 KIAS
LIMITATIONS

Minimum Crew

The minimum flight crew required for all operations is one pilot.

Engine Limitations

The engine is rated at a maximum power of 260HP at 2700RPM.
The engine may be operated continuously under conditions not exceeding the parameters above but this power is normally only to be used when operationally essential.

WARNING

Aerobatic maneuvers are not permitted between 2200 and 2450 RPM.

Airspeed Limitations

Never Exceed Speed (Vne)

Never Exceed Speed (Vne) is 236 KIAS. This speed must not be exceeded otherwise overstressing of the aircraft may occur.
This speed is marked on the airspeed indicator with a red line.

Normal Operating Speed (Vno)

Normal Operating Speed (Vno) is 187 KIAS.
This speed is the maximum structural cruising speed.
This is the maximum allowed speed in severe turbulence.

Maximum Maneuvering Speed (Vp)

Maximum speed at which abrupt, full controls deflection will not exceed design limitations.

- Weight up to 1100 Kg (2425 Lbs): 174 KIAS
Landing Gear Limit Speed

Maximum speed for operation with the landing gear extended, extending or retracting is 108 KIAS.

Wing Flap Limit Speed

Maximum speed for wing flap extension to 20 degrees is 125 KIAS.
Maximum speed for full flaps extension to 50 degrees is 108 KIAS.

Limit speed-opening canopy in flight

For opening the canopy in flight, airspeed is limited to 120 KIAS.

Flight Maneuvering Limitations

- Inverted flight is permitted for less than 10 seconds.
- Intentional spins with fuel in the tip tanks are prohibited.
- Do not fly for more than 10 seconds the following attitudes:
  - Vertical flight, steep dive
  - Inverted flight steep dive
  - Zero G periods
  - Wing-down or knife-edge-flights
- When performing aerobatic maneuvers:
  - Rear seat must not be occupied
  - Shoulder harness must be connected
  - No baggage is allowed
  - Empty tip tanks (< 1/8 indication)

<table>
<thead>
<tr>
<th>FUEL ON AIRCRAFT</th>
<th>INVERTED FLIGHT</th>
<th>INTENTIONAL SPIN</th>
<th>ROLLING PULL-OUT</th>
<th>FLICK ROLL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty tip tanks</td>
<td>10 seconds</td>
<td>Allowed</td>
<td>+4.0 G</td>
<td>Allowed up to 125 KIAS</td>
</tr>
<tr>
<td>Full tip tanks</td>
<td>10 seconds</td>
<td>Prohibited</td>
<td>+3.7 G</td>
<td>Prohibited</td>
</tr>
</tbody>
</table>

Load Factor Limitations

- Max G's (fuel tip tanks empty): +6.0 to -3.0 Gs
- Max G's (fuel tip tanks full): +3.7 to -2.2 Gs
- Aerobatic maneuvers allowed:
  - Steep turns
  - Lazy Eight
  - Stalls
  - Aileron Roll
- Loop
- Immelmann
- Spin
- Chandelle
- Vertical Turn
- Cuban Eight

**Wind Limitations**

The maximum crosswind during take-off or landing is 25 kts.

The maximum crosswind during take-off or landing with one fuel tip tank empty and the other full is 8 kts.
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 SF.260D is powered by a six-cylinders Lycoming O-540-E4A5 normally aspirated, direct-drive, air-cooled, horizontally-opposed, carburettor engine with 540 cubic inches displacement.

This engine outputs a maximum power of 260HP at 29 inHg of manifold absolute pressure and 2700RPM with no time limitations.

**Engine Overview**

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

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

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

Some of the features include:

- **Correct animations and sounds**: the cylinders compression is simulated to the deepest level, enhancing the propeller movements at very low RPMs and at startup and shutdown
- **Correct power output**: the engine outputs the correct power at every MAP/RPM setting.
- **Correct fuel flow**: reaching the correct power output allows X-Plane to provide the right fuel flow at every phase of the flight, right down to the numbers.
- **Realistic startup procedure**: The engine needs to be primed and prepare for startup following the correct procedures
- **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
  - Carburettor dynamics and ice accretion
  - Engine preheater and winterization kit: the engine may be preheated on winter using the provided electric engine heater. If the engine is not heated correctly, it won't start or may be damaged after start.
Starter

The Reality Expansion Pack replaces the default starter with a custom one. In the "Engine Status" page of the Mainenance Report you can:

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

CAUTION

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

Induction System

The Reality Expansion Pack replaces the Manifold Absolute Pressure (MAP) algorithm of X-Plane with a custom one.

The SF.260D engine is normally aspirated. That is, the maximum air pressure that affects the engine is the outside atmospheric pressure.

During climb, as the atmospheric pressure gets lower the maximum manifold pressure gets lower as well.
Fuel System

The aircraft is provided with 4 tanks.

- Two main tanks in the wings (13USG each)
- Two tip tanks (20USG each)

The way the tanks can/should be used depends on the fuel system configuration.

- **Civilian Version**
  
  The fuel flows from each tank to the fuel selector valve and then to the engine. The fuel selector placed on the throttle pedestal can be used to drive the fuel to the engine from:
  - The left main tank
  - The right main tank
  - The left tip tank
  - The right tip tank
  - Both the tip tanks at the same time

  Takeoff and landings are always accomplished on the fullest main tank.

**Electric Fuel Pump**

The Electric Fuel Pump provides enough fuel pressure to let the engine run in case of a mechanical fuel pump failure. The pump switch must be in the on position during startup, takeoff, landing and fuel tank selection change.

**The electric fuel pump shall be ON whenever the fuel tank selector is turned to change the currently selected fuel tank.**

- **Military Version**

  In this version there is no fuel selector available.

  The fuel flows from the left main tank (feeder) to the engine. An jet pump - powered by the engine motive flow - transfers the fuel from the right main tank to the left main tank. When the **Tip Fuel Transfer** switch is on, fuel is transferred from both tip tanks to the left main tank. In this case, the right main to left main tank fuel transfer is not active.

**Engine Fuel Pumps**

The engine is provided with a mechanical fuel pump. However, there are two more electric fuel pumps (Main and Aux) that work as backup for the main mechanical pump and provide positive fuel pressure from the fuel tanks to the fuel line.

Main and Aux pumps are controlled by the **tri-state fuel pump switch** and by the **Aux Pump Reset Button**.

When the fuel pump selector switch is first set to Main, the Main Fuel Pump is NOT energized, the Aux Fuel Pump comes online and the MAIN OFF warning light comes off.

The Main Fuel Pump is then set online by pressing the Aux Pump Reset Button for 2 seconds. This allows the pilot to check that the Aux Fuel Pump comes online automatically in case of main fuel pump failure when the Fuel Pump Switch is set to Main.

The Main Fuel Pump is then left on for the entire flight.
In case the fuel pump switch is set to Aux and there's an Aux Fuel Pump failure, the AUX OFF warning light comes off.

**Fuel Tip Trans Pump**

The Fuel Tip Trans pump is an electric pump that transfers the fuel from the tip tanks to the left main tank. If there's fuel in the tip tanks this pump can be left on throughout the flight.

If the fuel pump is not energized despite the Tip Trans switch being on, or there's less than 3lt of fuel in the tip tanks and the Tip Trans switch is on, the “NO TIP TRANS” warning light comes off.

**Warning Lights**

- **FUEL PRESS**: the fuel pressure is lower than 14PSI
- **FUEL LOW**: the total fuel quantity is lower than 25lt (6.6USG)
- **MAIN OFF**: the main electric fuel pump is off despite the pump switch being in the Main position (main pump failure or pump reset switch needed to be pressed for 2 seconds)
- **AUX OFF**: the aux electric fuel pump is off despite the pump switch being in the Aux position (aux pump failure)
- **NO TIP TRANS**: the fuel is not transferred from the tip tanks to the main left tank despite the Tip Trans switch being on the On position (fuel transfer pump failure or no fuel in the tanks)

**Fuel Injection System**

*This chapter only applies to the Military version of the SF.260 equipped with the Lycoming IO-540-E4A5 engine.*

The Reality Expansion Pack fully recreates the Bendix RSA Precision Flow Fuel Injection System that powers the real world SF.260D.

This fuel injection system is provided with a Venturi that senses the amount of air that goes to the engine and so regulates the fuel flow accordingly.

With altitude, the air density reduces more than the fuel density. So this metering system still requires the pilot to lean the mixture at high-density altitude.

**Tuned Fuel Injectors**

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

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

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

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

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

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

General Aviation Modifications, Inc. is a real world manufacturer of tuned fuel injectors for many different type of fuel injected engines. For more information, please visit [GAMI's website](https://gami.com).
Carburetor

This chapter only applies to the civilian SF.260 powered by the Lycoming O-540-E4A5 engine.

The Reality Expansion Pack simulates the carburetor dynamics and the carburetor ice accretion.

Carburetor Icing, or carb icing, is an icing condition which can affect any carburetor under certain atmospheric conditions.

Carburetor icing occurs when there is humid air - such during hot summer days or rainy winter days - and the temperature drop in the Venturi causes the water vapor to freeze.

The Venturi effect can drop the ambient air temperature by 30-40 degrees F (16.7-22.2 degrees C), therefore carburetor icing often occurs when the outside air temperature is in the 60-70 degree F (15.6-21.1 degree C) range.

Unfortunately, the warm air temperature often causes pilots of aircraft to overlook the possibility of carb icing. The ice will form on the surfaces of the carburetor throat, further restricting it. This may increase the Venturi effect initially, but eventually restricts airflow, perhaps even causing a complete blockage of air to the carburetor.

To prevent carb icing, a carburetor heating system drives hot, unfiltered air from the engine directly into the engine air intake. Pull the yellow carburetor heat knob to activate the carburetor heat.

Figure 15: Left: the carburetor heat knob is labelled CARB HEAT. Right: carburetor temp gauge

On many aircrafts, the carburetor heat knob can only be fully pulled or fully pushed. When a carburetor temperature gauge is available, however, the knob can be partially pulled just enough to exclude any ice danger.

The carburetor temperature gauge shows a yellow arc that defines the range of carburetor air temperature that most causes carburetor ice. Pull the carburetor heat knob to keep the gauge needle above or below the yellow arc whenever you suspect that carb icing conditions are met.
Detect carburetor icing

Symptoms of carburetor icing include:

- **Quick MAP decrease**: the air intake area is reduced by ice accretion thus reducing the amount of air sucked in by the engine.
- **Engine stutters**: when the ice accretion is large enough, ice is ingested by the engine preventing proper fuel combustion.

Whenever ice accretion is suspected, the carburetor heat knob must be fully pulled.

---

**WARNING**

When carburetor ice is taking place, pulling the heat knob may temporarily increase the perceived engine stutters and loss of power. That is, the engine ingests melted ice and stutters more than before.

**Do not disable the carburetor heat.** After a few seconds the ice will clear and the engine will run normally.

---

**Spark Plugs**

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

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

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

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

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

In the "Engine Status" page of the Mainantence Report you can:

- Check the spark plugs status
- Manually clean the spark plugs
- Change the default spark plugs with the "fine wire" type.

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

---

**Exhausts System**

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

Factory exhausts 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 exhausts with tuned ones. Tuned exhausts allow for:

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

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

The oil system is made by:

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

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

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

In the “Engine Status” page of the Mainenace 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](https://www.simcoders.com/2016/04/18/how-to-choose-right-oil-engine)

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

---

**NOTE**

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

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

---

**CAUTION**

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

The Reality Expansion Pack replaces the default propeller governor with a custom one.
The propeller governor controls the propeller blades pitch in order to maintain a constant propeller speed.
The governor drives the blades pitch using the engine oil pressure. Make sure to properly warm up the engine before takeoff to ensure a faster response of the governor.
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 big bore engines like the IO-550 and the IO-520 were designed, there were many misconceptions about how to actually manage the engine throughout the normal operating range.
The most common tip was to run 100°F ROP during high power operations, such climb, and 50*ROP during cruise, with the extra rule to almost never run LOP.
When engine monitors started to be normal equipment on most high-end GA aircrafts, pilots finally had some data on which they could base they engine management decisions.
It turned out that the 50/100°ROP rule is – generally speaking – not the best way to take care of your engine.
In fact, the best ranges turned out to be the following:

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

The ranges outside the one suggested above form what is called the ‘red box’.
Running the engine in the red box is not really damaging it, but if you take care of it and stay away from the red box, you may extend the engine life and get an engine that run smoother.
An extensive explanation of how and why you should keep the red box rule in mind is in this article: [https://www.avweb.com/news/savvyaviator/savvy_aviator_59_egt_cht_and_leaning-198162-1.html](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 the Fuel Flow, the EGT and the BHP whenever the engine control lever are moved.
To activate the engine monitor, open the plugin settings and check the “Show Engine Monitor” option.
Preheater

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

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

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

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

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

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

Engine Startup Tips

• If the engine is cold (civilian version only), 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 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 Mainanence Report you can:

• Check the vacuum pump status
• Repair a broken vacuump pump
Mass and Balance Figures

These are the figures you can use to calculate the mass and balance on your own instead of using the Mass and Balance Window.

<table>
<thead>
<tr>
<th>Station</th>
<th>Mass (Kg)</th>
<th>Arm (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty Mass</td>
<td>776</td>
<td>2.268</td>
</tr>
<tr>
<td>Front Row</td>
<td></td>
<td>2.55</td>
</tr>
<tr>
<td>Rear Pax</td>
<td></td>
<td>3.3</td>
</tr>
<tr>
<td>Bagagge</td>
<td></td>
<td>3.8</td>
</tr>
<tr>
<td>Main Tanks</td>
<td></td>
<td>2.68</td>
</tr>
<tr>
<td>Tip Tanks</td>
<td></td>
<td>2.42</td>
</tr>
</tbody>
</table>


Electrical Systems & Avionics

The airplane is equipped with a 28-volt, direct-current electrical system. The system uses a battery as the source of electrical energy. An 60-amp alternator maintain its state of charge.

Battery

The default battery is replaced with a battery that keep its charge between sim sessions and discharge 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 Mainanteance 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.

Emergency Battery/Avionics

This aircraft features an Emergency Battery made by 28 AA batteries. The Emergency Battery is connected to the ESS Bus by switching the “Emergency Avionics” switch to the on position.

The Emergency Battery will provide power to the avionics - whatever the position of the Avionics Master switch - and to the main cockpit lights for about 30 minutes.

CAUTION

The Emergency Battery is not charged by an alternator. Therefore, once discharged the battery must be recharged using the Maintenance Report Window. Use the Emergency Battery with care only in case of alternator failure after the main battery is totally discharged.
Circuit Breakers

Figure 16: The set of Circuit Breakers found in the cockpit

when pulled out, a circuit breaker cuts off the power to one or more piece of equipment. The following is a list of the equipments controlled by each CB.

- RMI: RMI indicator.
- COM 1: GPS.
- COM 2: KX165A Com/Nav 2 radio.
- DME: Distance Measuring Equipment. When excluded, no DME data is provided to the AS399 HSI.
- ADF: KR87 ADF receiver power.
- ATC: GTX-330 Transponder.
- COM: The HSI flux gate/compass. When excluded, the HSI is in free mode and no compass information is sent to it.
- ICS 1/2: Intercom System.
- A/P: KFC225 Autopilot.
- ALT 1/2: Altitude Encoding System.
- ENG INSTR: Engine Instruments.
- FLAPS: Flaps Motor.
- START: Engine Starter.
- WARN: Stall Warning Lights and Horn.
- INT LTS PNL: Interior Panel Lights.
- LDG IND: Landing Gear Indicator.
- LDG POWER: Landing Gear Motor.
Alternator

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

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

Lights

The lights switches position 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.

Cockpit Lights Bulbs

Each cockpit instrument that features night illumination is provided with one or more light bulb. Every light bulb has its own lifespan and can go out after some time.

A bulb that is going to go out blinks for a while before failing completely.

It is possible to replace the light bulbs in the Maintenance Window.

Electrical Gyros

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

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

Radio Stack

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

In the "Electrical System & Avionics Status" page of the Mainenance Report you can:

- Check the status of each radio
- Fix a faulty radio
- Switch avionics layout between Default Garmin GNS430, RealityXP GTN650/GTN750 and No-GPS.
- Switch between right seat and left seat layouts
CAUTION

Never turn on or off the engine or the alternator when the avionics switch is in the “On” position. Doing so may trigger a overvoltage spike that could damage one or more avionics component. The newer avionics such the Garmin GNS430/530 are better protected from overloads but they are not totally immune from them.
Bendix/King KX165A Com/Nav Radio

REP model all the functions of the real KX165A. This Nav/Com radio features a complete set of functions such:

- Active only COM mode
- Active/Standby COM mode
- 32 storable COM channels
- Active only NAV mode
- Active/Standby NAV mode
- NAV Bearing mode
- NAV CDI mode
- Timer mode

To better understand the use of this radio, you should read the Bendix/King radio stack manual.

Bendix/King KFC225 Autopilot

This autopilot features all the functions of the real counterpart.

To better understand the use of this autopilot, you should read the Bendix/King manual.

Bendix King KR87 ADF Receiver

This ADF receiver features all the functions of the real counterpart such

- BFO/ADF/ANT modes
- Active frequency only mode
- Standby frequency mode
- FLT/ET mode
To better understand the use of this receiver, you should read the Bendix/King radio stack manual.

**Garmin GTX330 Transponder**

![Garmin GTX330](image)

Figure 20: Garmin GTX330

REP models all the functions of the GTX-330 transponder such:

- Pressure Altitude mode
- Flight Time mode
- Altitude Monitor mode
- OAT/DALT mode
- Count Up Timer mode
- Count Down Timer mode

To better understand the use of this transponder, you should read the Garmin manual.

**Set a custom VFR Transponder Code**

1. Keep the FUNC button pressed for 1 second or more to enter the Settings page
2. Press the CRSR button to highlight the current VFR Transponder Code
3. Using the digits buttons, insert the new VFR Code
4. To save the settings and exit the Settings page, turn the transponder off then on again
AS399 HSI

Figure 21: AS399 HSI

The AS399 shows the Course and DME data in two windows in the upper-left and upper-right corners.  
The upper-left window always shows the selected course on the HSI.  
The upper-right window can show the DME distance in NM or the DME time in minutes. To select the proper data, use the DME/TIME switch located nearby the light switches.  
To switch the DME source between NAV1/NAV2 use the proper switch labelled NAV1/NAV2 near the master avionics switch.

HDG Flag
The red HDG Warning Flag becomes visible when the speed of the directional gyro is too low.  
The HDG Warning Flag also appears if the gyro has lost synchronization with the master (if a offset of more than 3 degrees is detected between earth magnetic field and the gyro indication).  
It also shows up, if the slaved gyro system is switch to manual mode.

NAV Flag
The red NAV Warning Flag indicates that the CDI indicator is unreliable. It is driven by the signal quality of the received nav station. Do not use the CDI indicator for navigation when the NAV Warning Flag is visible.

GS Flag
The red NAV Warning Flag indicates that the Glide Slope indicator is unreliable. It is driven by the signal quality of the received nav station. Do not use the GS indicator for navigation when the GS Warning Flag is visible.
Landing Gear

The airplane is equipped with a tricycle, hydraulically actuated, retractable landing gear. The landing gear requires approximately 7 seconds for extension or retraction.

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 Mainantence Report you can:

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

Landing Gear Indication Lights

Three green lights are shown in the cockpit if the landing gear is down and locked.

A red/orange light is shown in the cockpit if the landing gear is unlocked or in transition.

Each light can be tested by pressing it when the master battery switch is turned on.

Landing Gear Warning System

The gear warning system is triggered if landing gear is up and:

- A Manifold Pressure lower than 15inHg is selected or
- A flaps setting higher than 30 degrees is selected

When triggered, the landing gear warning system flashes the landing gear unsafe light and activates the warning horn. The warning horn can be silenced by pressing the "LDG WARN HORN SILENCE" button.
Emergency Landing Gear Extension

The landing gear can be manually lowered using an emergency handle placed under a cover between the front seats.

![Image showing the emergency handle](image_url)

**Figure 22: Click in the position indicated by the arrow pointer to remove the handle cover**

To lower the landing gear after a landing gear failure:

1. Ensure speed is 108KIAS or below
2. Set Flaps 20°
3. Check the Landing Gear Switch is DOWN
4. Check Landing Gear Indicator: the gear IS NOT DOWN and LOCKED
5. Pull the LDG PWR Circuit Breaker to disable the landing gear motor power
6. Remove the Landing Gear Manual Extension Handle Cover as shown in the picture above
7. Crank the Manual Extension Handle about 27 times. Each click over the red knob will turn the handle once.
8. Check Landing Gear Indicator: the gear is not DOWN and LOCKED
9. Stow the handle and put the cover in place
10. Perform a normal landing

---

**NOTE**

The emergency handle won't rotate anymore once the landing gear is down and locked.

---

**CAUTION**

If the LND PWR Cirbuit Breaker is not pulled, cranking the handle will not have any effect for the landing gear system will raise the landing gear as soon as the handle is cranked.
CAUTION

During practice, never retract the gear using the emergency system.
Tires

The Reality Expansion Pack simulates the tire status and failure basing 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 Mainenance Report you can:
  • Check the status of each tire
  • Fix a faulty tire

Brakes

The SF.260D 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 Mainenance Report you can:
  • Check the status of the braking system
  • Fix a faulty brake
Wing Flaps

The wing flaps are continuous mode. They can be set at any value between 0° and 50°. The wing flaps are controlled by a three-position switch on the instrument panel. Keep the switch pressed up or down to raise or lower the flaps. The flaps will move until the switch is pressed. The wing flaps actuation from 0° to 50° takes approximately 5 seconds.

The position of the flaps is indicated by the flaps position indicator. The control and position indicator are powered by the primary bus via the FLAPS circuit breaker. The flaps indicator will reach the white mark left of “UP” when no power is supplied.

Figure 23: Flaps indicator represented with no power supplied

NOTE: Flaps Controls

Remember that you must keep the flaps up/down buttons pressed to make the flaps move.

Three more commands are available that toggle the up/down movement of the flaps. Press the command once to make the flaps start moving.

The commands are `simcoders/rep/controls/flaps_down_continuous`, `simcoders/rep/controls/flaps_up_continuous` and `simcoders/rep/controls/flaps_neutral`
With the aircraft on the ground the flap pointer reaches 50° setting. While in flight, it will range between 45° and 50°. This is due to aerodynamic forces acting on the wing flaps.
Canopy

The canopy can be opened and closed by dragging the canopy handle or by using the default X-Plane commands to open and close the aircraft door #1.

The following extra commands are available by REP.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>simcoders/rep/canopy/open_a_bit</td>
<td>Open the canopy a bit</td>
</tr>
<tr>
<td>simcoders/rep/canopy/close_a_bit</td>
<td>Close the canopy a bit</td>
</tr>
</tbody>
</table>

**NOTE**

The canopy can be kept open few inches when the airspeed is below 120KIAS. Above 120KIAS the canopy must be closed and locked.
Cabin Ventilation System

The SF.260D is provided with a cabin ventilation and windshield defrost system controlled by three knobs.

- **Vent Knob**: controls the amount of air that is driven from the air scoop to the cockpit. The highest amount of air reaches the cockpit when the knob is fully pulled. The amount of air scooped depends on engine RPM and airspeed.
- **Heat Knob**: controls the amount of Vent air that passes through the engine heat exchanger. The highest amount of air is heated when the knob is fully pulled. The engine must be warmed up properly to ensure sufficient heat.
- **Defrost Knob**: controls the amount of Vent air that goes to the window defrost outlets. All the vent air is rerouted to the windshield defrost outlets when the knob is fully pulled.

**Pull all the knobs to ensure the maximum defrost capability.** Pulling the Vent Knob will ensure maximum air intake. Pulling the Heat Knob will ensure maximum heat. Pulling the Defrost Knob will ensure that the maximum amount of air is rerouted to the windshield. **The higher the airspeed, the higher the amount of air scooped and rerouted to the windshield.**

Figure 24: The cabin ventilation knobs are placed near the throttle column
ADVERSE WEATHER OPERATION

Introduction

This section discusses the procedures for flying the aircraft in adverse weather conditions.

Thunderstorms

Flying in thunderstorms must be avoided. If thunderstorm cannot be avoided, proceed as follows:

1. Attitude - Maintain the attitude by reference to the attitude indicator.
2. Airspeed - Adjust power as necessary to stay below 187 KIAS.
3. The altimeter may be unreliable because of the turbulence within the storm.
4. Use pitot heater and alternate air.
5. Adjust the instrument panel light intensity so as to minimize blinding effect of lightnings.

Snow, Ice and Rain

The aircraft is not provided with anti-icing systems for wing, empennage and propeller and therefore the flight in ice conditions shall be avoided.

If ice conditions cannot be avoided use the Pitot tube heater, Alternate Air and windshield defrost systems.

When there's visible moisture, the Carb Heat knob must be operated to avoid carburettor icing at low engine RPMs.

Effects of Snow, Ice and Rain during takeoff

Take-off shall not be attempted with ice and snow on the lifting surfaces or accumulations on any other surfaces that may adversely affect aircraft performances.

When taxiing on ice or snow the directional control requires maximum attention bearing in mind that both steering and brakes could be ineffective and normally only the rudder maintains effectiveness.

Effects of Snow, Ice and Rain during landing

Landing on ice, snow or wet runway requires maximum care.

After good contact apply brakes gently.

Should the aircraft show a tendency to swing, release the brakes and correct the swerving tendency using the rudder pedals.
Cold Weather Procedures

Engine starting is sometimes difficult in cold weather. The use of an external power source, instead of the aircraft battery, is recommended for starting.

Hot Weather Procedures

No particular problem is involved in aircraft operation by hot weather. Ground run should be accomplished as quickly as possible to prevent engine overheating. During prolonged operation at maximum power at low indicated airspeed, monitor oil and cylinder head temperatures.
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 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.

<table>
<thead>
<tr>
<th>Altitude (ft)</th>
<th>EPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>10000</td>
<td>Few hours</td>
</tr>
<tr>
<td>15000</td>
<td>40 minutes</td>
</tr>
<tr>
<td>20000</td>
<td>10 minutes</td>
</tr>
<tr>
<td>30000</td>
<td>30 seconds</td>
</tr>
<tr>
<td>40000</td>
<td>15 seconds</td>
</tr>
<tr>
<td>45000</td>
<td>1-2 seconds</td>
</tr>
</tbody>
</table>

Figure 25: Hypoxia effect
HOME COCKPITS/CUSTOM DATAREFS

In order to work properly, REP uses a set of custom datarefs instead of default X-Plane ones. Here you find a list of datarefs that you can use for your home cockpit.

**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/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

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SIAI-Marchetti SF.260D

- 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

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• 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/indicators/fuel/fuel_flow_0
• Type: float
• Writable: No
• Contents: FF indicator

**Dataref:** simcoders/rep/cockpit2/gauges/indicators/engine_0_rpm
• Type: float
• Writable: No
• Contents: RPM indicator

**Dataref:** simcoders/rep/cockpit2/gauges/indicators/engine_0_egt
• Type: float
• Writable: No
• Contents: EGT indicator

**Dataref:** simcoders/rep/cockpit2/engine/actuators/fuel_pump_0
• Type: int
• Writable: Yes
• Contents: Pump (0 = off, 1 = on)

**Dataref:** simcoders/rep/engine/oil/temp_f_0

• Type: float
• Writable: No
• Contents: Oil temp (F)

**Dataref:** simcoders/rep/engine/oil/temp_c_0

• Type: float
• Writable: No
• Contents: Oil temp (C)

**Dataref:** simcoders/rep/engine/oil/press_psi_0

• Type: float
• Writable: No
• Contents: Oil press (PSI)

**Dataref:** simcoders/rep/cockpit2/gauges/indicators/engine_0_egt_ref_needle

• Type: float
• Writable: No
• Contents: EGT ref. needle

**Dataref:** simcoders/rep/cockpit2/gauges/indicators/fuel_press_psi_0

• Type: float
• Writable: No
• Contents: Fuel press ind.

**Dataref:** simcoders/rep/cockpit2/gauges/indicators/oil_press_psi_0

• Type: float
• Writable: No
• Contents: Oil press ind.

**Dataref:** simcoders/rep/cockpit2/gauges/indicators/oil_temp_c_0
- Type: float
- Writable: No
- Contents: Oil temp (C) ind.

**Dataref:** simcoders/rep/cockpit2/gauges/indicators/oil_temp_f_0
- Type: float
- Writable: No
- Contents: Oil temp (F) ind.

**Dataref:** simcoders/rep/cockpit2/gauges/indicators/cht_c_0
- Type: float
- Writable: No
- Contents: CHT (C) ind.

**Dataref:** simcoders/rep/cockpit2/gauges/indicators/cht_f_0
- Type: float
- Writable: No
- Contents: CHT (F) ind.

**Dataref:** simcoders/rep/engine/fuel/fuel_selector_0
- Type: int
- Writable: Yes
- Contents: Fuel selector pos. (0 = left tip, 1 = left main, 2 = right main, 3 = right tip, 4 = both tips)

**Dataref:** simcoders/rep/engine/fuelline/electrical_feed_0/switch_on
- Type: int
- Writable: Yes
- Contents: Tip Fuel Transfer Pump Switch

**Dataref:** simcoders/rep/engine/fuel/fuel_selector_0_shutoff
- Type: int
- Writable: Yes
- Contents: Fuel selector shut off (0 = off, 1 = on)
**Dataref**: simcoders/rep/settings/wind_volume

- **Type**: int
- **Writable**: No
- **Contents**: Wind volume (0-100)
RESOURCES & HOW-TOs

SimCoders.com blog contains tons of resources that you will find very useful when using REP. Moreover, this is a list of How-Tos available.

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

SUPPORT & CONTACTS

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

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

V4.5.9
1. Improved the FSEconomy implementation reliability
2. Improved manifold pressure algorithm
3. It is possible to choose the behavior of the Low Fuel lamp (military version only)

V4.5.8
1. Improved the hardware rudder pedals compatibility (it is now possible to disable the automatic differential braking)

V4.5.7
1. Fix: in the G1000 version, the GFC700 flight director was not behaving as expected

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
3. The damage caused by running the engine in the redbox was not always calculated properly
4. Fix: missing magnetic compass reference line
5. Fix: the magnetos texture did not report the "Push" text

V4.5.4
1. Fixed the headset not muffling the engine sounds
2. Attempting to fix a crash while switching to VR

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. New: it is now possible to fix the propeller in the maintenance window
5. Fix: wrong HDG manipulator in the G1000 cockpit
6. Fix: in the military version, in some situations the tip trans pump did not switch off properly
7. Improved the “Fuel System” chapter of this user manual
8. Improved compatibility between GTX330 and GTN750 transponders
9. Fix: CTD when trying to connect to FSE
10. Fix: Typos in Maintenance Window
11. Fix: excessive oil consumption when a cylinder is partially worn out

V4.4.6

1. Improved pitch stability with modern joysticks
2. Fix: leaving the replay with gear up could cause a plane crash if replay was started on the ground
3. Fix: the O-540 version showed the improper fuel pressure values
4. Fix: checklists typo
5. Fix: removed the carburetor air temperature gauge from the BAF version

V4.4.5

1. Fix: the BAF version alternate engine air knob did not work properly
2. Fix: the fuel injectors state was not saved properly
3. BAF Version: added the aileron trim support
4. Added keyboard commands to control the EGT gauge reference needle
5. The in-flight tips window now resize correctly in VR
6. Optimizations for XP11.50
7. 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
3. Fix: fuel selector did not work properly since v4.4.3

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 protocol update

V4.3.4
1. FSEconomy: fixed connection issue (HTTP 301 not followed properly)

V4.3.3
1. Added the pitch and power settings table in the kneeboard
2. Fix: The KFC225 autopilot did not show the REV status properly

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. **New**: improved engine sounds
2. **New**: military BAF version powered with fuel injected engine IO-540-E4A5
3. **New**: G1000 cockpit version
4. Improved mixture system behavior
5. Updated librain effect plugin
6. Fix: the GTX330 did not respond properly to the press of the 8, 9, CRSR, and CLR keys while entering the TX code
7. Fix: The GTX330 was always loaded switched on even when it was switched off during previous session
8. Fix: some textures had typos
9. Fix: the pilot arm could pop out of the canopy at certain stick position
10. Fix: the commands to control the ignition key were reversed
11. Fix: the EGT indicator could report negative values
12. Message to warn that the Experimental Flight Model is not supported
13. Engine Monitor shows CHT and Oil Temperature
14. Fix: The preheater did not work properly
15. Fix: the Economy System status could be loaded only partially in some situations
16. Fix: the in-flight tips were not visible in VR. Thanks to sparker for helping debugging the issue.
17. Fix: walkaround CTD
18. Fix: message boxes did not support VR
19. 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. Fix: the KFC225 autopilot did not provide pitch angle control via the up and down buttons in pitch mode
4. Improved startup behavior

**V4.2.2**

1. Fix: the tuned exhausts caused a CHT drop
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 exhausts 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
5. Fix: the HSI source was not reset to NAV when switching from a GPS cockpit to a non-GPS one

**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: FS Economy 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
7. Improved startup behavior
8. Fixed the rain effect under Mac OS

V4.0.2
1. **New**: advanced rain effect using Skiselkov's (Totoritko) rain library
2. **New**: World March livery
3. **New**: RealityXP GTN750 support
4. **New**: it is now possible to deactivate the brakes smoothing
5. Fix: fixed a crash when closing a plugin's window
6. 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. **New**: Added a settings page to the GTX 330 Transponder to set the custom VFR Code. See the User Manual's Garmin GTX330 Transponder section to see how.
3. 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. Fix: Lights glow position in the right-seat cockpit
2. Fix: Bendix/King KX165A did not activate VOR1 properly
3. Minor fixes

V3.5.9
1. The Hypoxia warning is shown only when the TUC is lower than 20 minutes
2. Improved engine sounds
3. Improved carburetor icing behavior
4. Improved canopy "open/close a bit" commands behavior
5. **New**: Right seat cockpit layout
6. **New**: Support for RealityXP GTN650
7. **New**: Printable short checklists included in the package
8. Fix: the KX165A Nav Com 1 prevented the GNS430 to startup properly
9. Fix: the GTX330 Transponder did not properly switch to GND mode after landing

V3.5.8
1. Minor fixes

V3.5.7
1. New: It's now possible to switch between a GNS430 and No-GPS avionics layout.
2. Fix: the state loading could load incomplete data on some systems
3. 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
6. Improved user manual: added the Limitations section
7. Improved user manual: added the aerobatic figures entry speeds
8. Improved checklists
9. Improved fuel pressure behavior
10. Improved carburettor icing behavior
11. New commands are available to control the fuel selector
12. Fix: an X-Plane bug could have let the engine run with no fuel in the tanks!
13. Fix: the stall buffeting sound was audible at the outside
14. Fix: Correction of inverted manipulation of Flaps at certain angles of view.
15. Fix: Changed order of Time and DME in switch to not produce mistakes.
16. Fix: Shorten ADI pointers to allow better reading of numbers that were behind the arrows.
17. Fix: Corrected Fuel selector gauge labels of I-LELM and Stormo70 New liveries
18. Fix: the propeller animations broke other aircraft's animations
19. Fix: Added Night illumination to 15 CB
20. Fix: Corrected reference card label speeds to actual SF260D
22. Fix: Added VRUsers.zip with files with better compatibility in VR mode. Joystick won't hide with hands controllers and REP menu hit point in base of 3D Joysticks.
23. Fix: minor fixes to the Bendix/King KX165A Nav/Com radio
24. Fix: better fuel flow behavior
25. Fix: corrected the turn indicator dataref

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. Fix: under some conditions the flaps sounds was played when not necessary
7. Fix: the KFC225 autopilot did not follow the set NAV course properly
8. Fix: artifacts in livery registration (SF260_Matricula.obj)
9. Fix: the Bendinx/King KR87 did not apply the ADF mode properly
10. Fix: the Bendinx/King KR87 and KX165A timers did not properly format the elapsed time when counting hours
11. Fix: artifact on Night illumination with Nav1/Nav2 and Avionics label switch
12. Fix: left disappearing of Nav2 vor indicator.
13. Fix: F260 ICAO designator missing in the acf file
14. Allow GNS430 Popup touching the screen (it will popup 2 GNS430 in RealityXP option)
15. The “Toggle all batteries” command does not affect the Emergency Avionics switch anymore
16. It is now possible to disable the advanced steering algorithm
17. 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 informations 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
**Reality Expansion Pack**

**SIAI-Marchetti SF.260D**

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**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

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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.
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
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