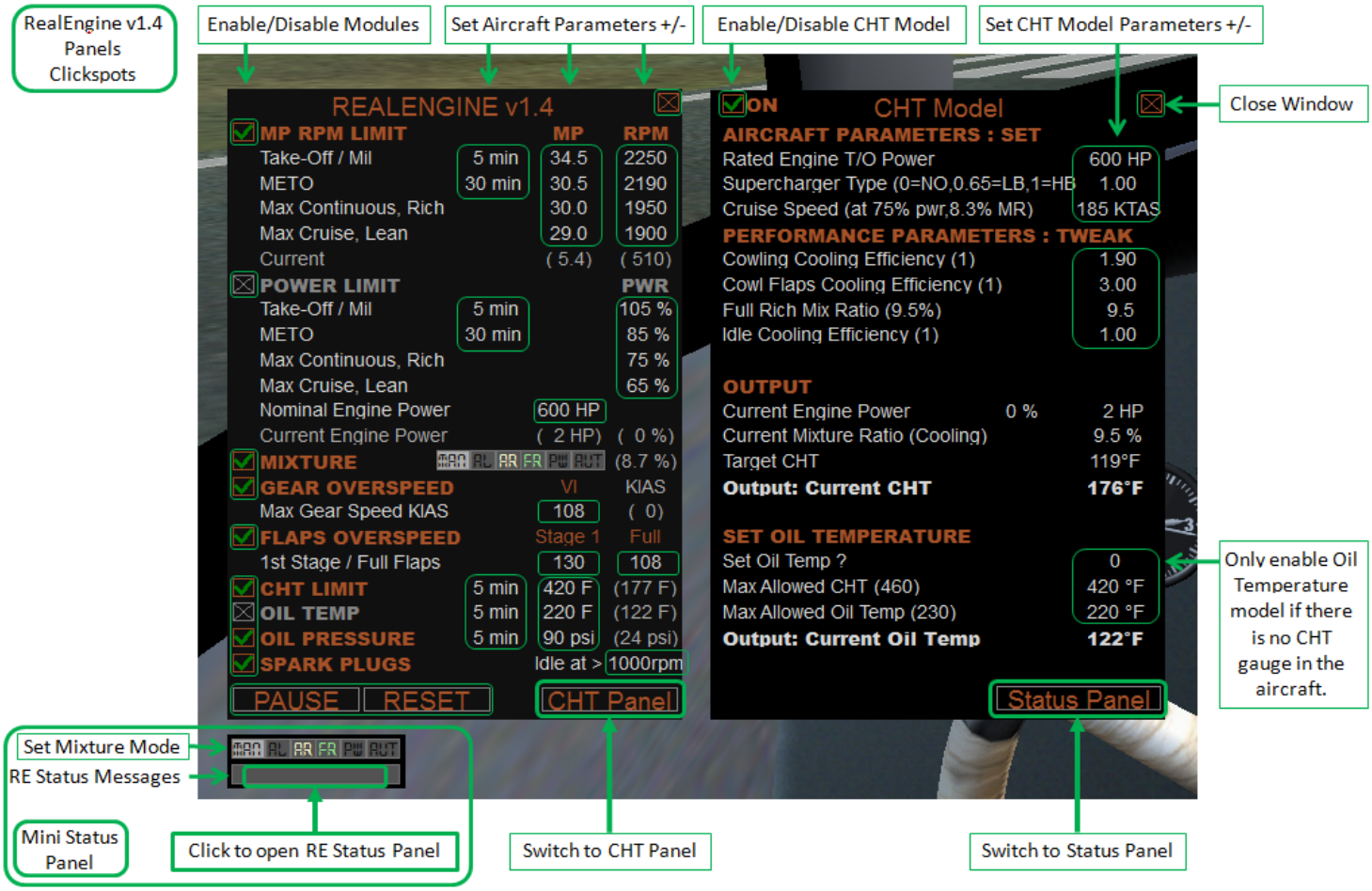
RealEngine v1.4

What RealEngine Does

- **RealEngine will fail aircraft engines and systems of piston engine aircraft if operating limitations/recommendations are exceeded.**
  - I have designed this gauge with the objective in mind to (severely) penalize flying an aircraft under conditions outside of those recommended by the POH.
    Think of it as a strong incentive to respect the limitations and operating procedures recommended in the POH.
  - In the real world there is the fear of dying, and the "high cost in hard earned cash" if the aircraft is operated outside of the recommended operating conditions.

    I hope to replace these driving forces in the sim by the fear of a failure of the engine or aircraft systems.
  - RealEngine can be fully tailored to individual preferences.



Main Changes vs. v1.1/1.2

❖ Easier configuration

- The aircraft-specific parameters/limitations are adjusted within FS2004/FSX in the RE status panels, and automatically saved to an aircraft-specific .ini file.
- No more editing of .xml files!

❖ New: CHT model

- CHT depends more realistically on operating parameters like power, mixture, airspeed, cowl flaps etc.

❖ New: Mini Status Panel with Auto Mixture Control Panel

- Provides information about warnings/failures in a small footprint
- Mixture control
  - Manual
  - Full Rich (FR), AutoRich (AR), Best Power (PW), AutoLean (AL)
    - AR: Best power MR (8.3%) up to 75% power, gradually increased for higher power to keep the engine cool.
  - Auto-mode = AL/AR/FR controlled by external mixture lever position.

- Added feature that allows to keep Mini Status Panel open in VC after cycling out, and returning back to VC.

RealEngine modules

❖ Engine MP RPM Limitations

- Simulates damage (first roughness, then failure) to the engine if MP or RPM limitations are exceeded.

❖ Engine Power Limitations

- Simulates damage (first roughness, then failure) to the engine if % power limitations are exceeded.

❖ Mixture State

- Engine runs rough if mixture is too lean or too rich.

❖ Spark Plug Fouling

- Simulates power loss due to spark plug fouling if engine is idled for too long.
- Do a proper run-up!

❖ Gear Overspeed

- Generates gear failure if gear speeds are exceeded.

❖ Flaps Overspeed

- Generates flaps failure if flaps speeds are exceeded.
- Asymmetric failure of flaps is modeled.

❖ Cylinder Head Temperature (CHT) Limitations

- Generates engine failure if CHT limitations are exceeded.

❖ Oil Temperature Limitations

- Generates engine failure if oil temperature limitations are exceeded.

❖ Oil Pressure Limitations

- Generates engine failure if oil pressure limitations are exceeded.

❖ New: CHT Model

RE v1.4 also introduces a more realistic physical model for CHT:

- CHT depends in a more believable way than with default FS on
  - ✓ Engine power
  - ✓ Fuel/Air Mixture
  - ✓ Cowl flaps position
  - ✓ Airspeed
  - ✓ Air temperature

Typical operating procedures for GA piston engine aircraft

These should keep you flying safely and avoid failures with RealEngine.

Adapted from http://aviationinspection.com/engine-inspections/aircraft-engine-operation/

Assure all engine temperatures (CHT, TIT, Oil…) are within the green arc range of engine instruments at all times.

A. Starting and Warm-Up

- ✓ To minimize spark plug fouling, idle engine at 1000 to 1200 rpm.
- ✓ Make a complete run-up, (but keep as brief as possible).
- ✓ Avoid overheating by keeping ground operations to a minimum. Complete run-up into the wind.
- ✓ Cowl flaps should be open for all ground operations.

B. Take-off

- ✓ Use full throttle (with few exceptions).
- ✓ Mixture Full Rich, except at high density altitude airports where you should lean as appropriate.
- ✓ Retract gear when clear of the ground.
- ✓ Retract flaps when clear of obstacles.

C. Climb

- ✓ Reduce to climb power.
- ✓ Lean the mixture during climb for smooth operation and increased power above a density altitude of 5000 feet.

D. Cruise

- ✓ Set 65 to 75 percent power for best performance.
- ✓ 55 percent power would be typical for good economy and range.
- ✓ For best power lean to maximum RPM with a normally aspirated engine..
- ✓ For best economy lean till engine runs rough, and then enrich slightly.
  Return mixture slowly to full rich before increasing power setting.
- ✓ (If atmospheric conditions indicate that icing is a possibility engage carburetor heat for 30 – 60 seconds every 10 – 15 minutes. Check for subsequent power increase as sign of carburettor icing.)

E. Descent

- ✓ Reduce power gradually and maintain sufficient power to keep engine temperature in the green arc range.
- ✓ Keep cowl flaps closed.
- ✓ Gradually enrich the mixture for smooth engine operation during descent.
- ✓ (Use carburettor heat if atmospheric conditions indicate that icing is a possibility.)
- ✓ Extend gear and flaps below Vlo and Vfo speeds only.

F. Landing

- ✓ Set mixture to full rich before landing, unless you are landing at a high density altitude airport.
- ✓ Turn off carburettor heat for best power.

Troubleshooting Engine Problems

Issue	Cause	Action
Engine runs rough	Engine damaged	Reduce power and land ASAP
	Mixture too lean	Enrich mixture
	Mixture too rich	Lean mixture
Engine looses power	Spark plugs fouled (on ground)	Perform proper run-up
		Idle at 1000-1200 rpm
Engine temperature is high	Power too high	Reduce power/MP/RPM
	Mixture too lean	Enrich mixture
	Climb too steep	Effect a shallower climb (higher airspeed) to improve engine cooling
	Cowl flaps closed	Open cowl flaps

Installation - Checklist

A. Copy the RealEngine_v14 folder into the FS "gauges" folder.

B. Create a parameter .ini file in the "RE_Parameters" folder for your aircraft.

C. Add the RealEngine gauges and panels to your aircraft's "panel.cfg".

- Create a backup of your aircraft's panel.cfg.
- Add the entries from "RE_panel_cfg_entry_v14 .txt" to the panel.cfg:
  [Window Titles] and [Window08-10] sections.
- Point the panel.cfg to the correct .ini file.
  Edit [Window08] line "gauge02=...\RE_Parameters_AIRCRAFT.ini" to the correct .ini file name.
- Delete lines referring to engines not existing on the plane.

D. Optional: Edit "panel.cfg" to keep Mini Status Panel open in VC.

- [VCockpit01] :
  // Keep RealEngine Mini Status Panel open in VC
  gauge98=RealEngine_v14\dsd\dsd_window_status2!window_status, 0, 0, 1, 1, 1
  gauge99=RealEngine_v14!RE_KeepMiniStatusPanelOpenInVC, 0, 0, 1, 1

E. Optional: Change the aircraft's CHT (or Oil temperature) gauge to display the temperature values calculated by the new CHT model.

F. Adjust aircraft parameters in the status panels from within FS2004/FSX

Installation - Details

A. Copy the RealEngine_v14 folder into the FS gauges folder.

e.g.: \fs9\Gauges\RealEngine_v14***.xml files

Note: The RealEngine_v14 HAS to be in the gauges folder ! RE will not work properly if the RealEngine_v14 is placed in the aircraft's panel folder.

B. If you don't have a preconfigured .ini file for your aircraft, create a copy of an existing .ini file and rename according to your aircraft.

1. Create a copy of any .ini file (preferably of an airplane close to your aircraft) in folder: \fs9\Gauges\RealEngine_v14\RE_Parameters\.
2. Give this copy a unique name (e.g. include the name of your aircraft).
   e.g. \fs9\Gauges\RealEngine_v14\RE_Parameters\RE_Parameters_BeechBaron58.ini

Note: the Aircraft parameters can be edited with Notepad directly in the .ini file, but it is usually more convenient to adjust the parameters from within FS in the Status Panel.
A few secondary parameters that can only be set in the .ini file.

C. Add the RealEngine gauges to your aircraft's panel.cfg.

1. At the end of the [Window Titles] section, add as last entry:

(if your last entry is numbered smaller than 8, otherwise renumber)

```
Window08=RealEngine_StatusPanel_Mini
Window09=RealEngine-StatusPanel
Window10=RealEngine_StatusPanel_CHT
```

2. Copy the [Window08], [Window09] and [Window10] sections from the included file

"RE_panel_cfg_entry_v14.txt"

into the panel.cfg. (Renumber if you have done so in step 1. above)

3. Point the panel.cfg to load aircraft-specific parameters from/save to the correct .ini file:

- In the [Window08] section locate the following line:

  gauge02=RealEngine_v14\RE_Parameters\dsd_xml_config_v21!config,5,5,5,,
  .\Gauges\RealEngine_v14\RE_Parameters**RE_Parameters_AIRCRAFT.ini**

- Change the .ini file link to the one created for your aircraft.

  e.g. -> gauge02=RealEngine_v14\RE_Parameters\dsd_xml_config_v21!config,5,5,5,,
  .\Gauges\RealEngine_v14\RE_Parameters**RE_Parameters_BeechBaron58.ini**

4. For single engine aircraft delete all the lines referring to engine 2 – 4 from the [Window08] entry in the panel.cfg (all lines containing "RE2_" to "RE4_").

- For multiengine aircraft leave the entries for the respective engines 2, 3 or 4.
- If you want, you can also leave the complete [Window08] entry from step 2, but that makes FS just execute the additional unnecessary code.

Note: For those who know how to do it there are also ways to add the Mini Status Panel (including the failure gauges) to the VC, but the above is the easiest and most error-proof way.

D. Optional: Keep Mini Status Panel open in VC

If you want to keep the Mini Status Panel open in the VC after cycling out of, and back into the VC, add the following lines to the end of your [VCockpit01] section in the panel.cfg:

```
[VCockpit01]
...
//  Keep RealEngine Mini Status Panel open in VC
```

gauge98=RealEngine_v14\dsd\dsd_window_status2!window_status, 0, 0, 1, 1, 1
gauge99=RealEngine_v14!RE_KeepMiniStatusPanelOpenInVC, 0, 0, 1, 1

This will return the Mini status panel popup in VC to the state it has been at when returning to the VC.

E. Change the aircraft's CHT (or Oil temperature) gauge to display the temperature values calculated by the new CHT model (optional):

- This is still a little complicated, sorry...
- Note 1: Can be skipped if you don't plan to use the new CHT model feature.
- Note 2: If the aircraft has both CHT and Oil temperature gauges, ONLY edit the CHT gauge, not the Oil temperature gauge!

1. Identify which gauge is used to display CHT in the panel.cfg (or Oil temperature if the aircraft has no CHT gauge).

There should be a line referring to engine temperature, CHT (or oil trremperature) similar to

[Window00] and/or [VCockpit01]

gauge08=Beech_Baron!Left Engine Temperature Indicator, 1, 342, 83, 83

2. Look for the location of the gauge file in either the panel folder of the aircraft, or the fs gauges folder.

e.g. here named Beech_Baron.cab or Beech_Baron.gau

❖ Select either one of the following two options:

❖ Option A : If the gauge file is a .cab file: Edit the .xml gauge file included in the cab.

3. Uncompress the .cab file with a standard compression tool (e.g; winzip or 7-Zip) into a folder having the same name as the .cab file in the aircraft's "panel" folder.

e.g. uncompress file "fs9\gauges\Beech_Baron.cab" into folder "fs9\Aircraft\beech_baron_58\panel\Beech_Baron"

4. Open the .xml gauge file included in the folder (e.g. Left Engine Temperature Indicator.xml) with Windows Notepad (or better Notepad++, freeware).

5. Find the lines referring to the CHT variable like "A:Eng1 cylinder head temperature" or "A:RECIP ENG CYLINDER HEAD TEMPERATURE:1".

e.g. <Value Minimum="50" Maximum="250">(A:Eng1 cylinder head temperature,celsius)</Value>

Replace by the code included in file "RE_CHTModel_GaugeCode.txt" for FS's CHT variable and save.

6. **There likely also is a code for the tooltip**

   e.g. <Tooltip ID="TOOLTIPTEXT_ENG1_CHT_CELSIUS"
   EnglishID="TOOLTIPTEXT_ENG1_CHT_FARENHEIT"/>

   Replace this one as well by the code included in "RE_CHTModel_GaugeCode.txt".

7. **Repeat for the other engines 2-4 if a gauge indicating these is present.**

8. **Delete all bmp files, and all .xml files that have not been edited from the folder (optional).**

   Only the edited .xml files have to be in the gauge folder in the panel folder.

The aircraft should now display the CHT (or oil temp) calculated by the RE CHT model if this option is activated within RE.

❖ Option B : If the gauge is a .gau file (can not be edited): Replace the gauges displaying CHT (or Oil temperature) by one of the supplied edited gauges for fs9 default aircraft.

3. **Edit the line in the panel.cfg to display one of the the supplied gauges**

   e.g. replace line

   [Window00] and/or [VCockpit01]

   gauge08=Beech_Baron!Left Engine Temperature Indicator, 1, 342, 83, 83

   by

   gauge08=RealEngine_v14\Aircraft\beech_baron_58\panel\beech_baron!Left Engine Temperature Indicator, 1, 342, 83, 83

   For replacement gauges see the Realengine\Aircraft\...\panel folders.

   Depending on fit this gauge may be distorted, not fit the air of the aircraft/panel, or display other information than the aircraft's gauge. Some experimentation may be necessary.

General Notes on Adjusting Aircraft-Specific Limitations and Parameters

Note 1: After loading the aircraft the failure effects will only become active after the Mini Status Panel had been opened in the active window. If the panel is not open after loading a flight cycle to the 2D panel after loading the aircraft, or open the Mini Status Panel with Shift + one of the F keys (default, e.g. Shift-F9) or by menu "Views-Instrument Panel".

Note 2: Aircraft configuration files are included for a few default FS aircraft (see "RealEngine_v14\Aircraft" folder).
See instructions there. Included configurations are just suggestions. Adjust as needed.

❖ Open the Full Status Panel

1. Open "Mini Status Panel"
2. Click on lower part of the Mini Status Panel window to open the full Status Panel.

❖ Adjust Aircraft-specific parameters by the clickspots in the full Status Panel and CHT Control Panel

1. Click the checkboxes to activate/deactivate a module.
2. Click on the +/- clickspots to adjust a limitation/parameter
3. Switch between RE Status Panel and CHT Model Control Panel by clicking in the lower right.
4. Parameters adjusted are automatically saved to the .ini file after ending the flight.

❖ General suggestions for finding information on aircraft limitations

Detailed information on limitations and recommended operating parameters may be difficult to come by, and may vary significantly between similar aircraft models using different engine models, as well as by source.

Possible sources:

- POH for the specific aircraft model
- Engine operating manual (by the engine manufacturer) for the specific engine model used, if available, provides detailed information.
- Sources: www.avialogs.com

You also may/should also consider gauge markings:

- Redline typically is the maximum allowed value. Often this determines Max T/O MP and RPM, Max CHT, Max Oil Temperature and Pressure, Vf.
- End of green bar for MP/RPM is often METO.

For GA aircraft often:

- Max T/O power = 100%
- METO power:
  - 100% (non-supercharged)
  - 85% (super/turbocharged)
- Max recommended continuous cruise rich = 75%
- Max continuous cruise lean
  - 75%
  - or at same MP/RPM values as Max recommended continuous cruise rich (but lower power due to leaner mixture)
  - or 65% for (super/turbocharged engines)

Unless POH specifies %power AND MP/RPM limitations I suggest to use EITHER the MP/RPM module OR the Power module for engine limitations, and pause the other.

Suggestions for adjusting CHT model parameters

Note: This is just a generic approach in case no detailed information about CHT in the different flight regimes is available for an aircraft.

I hope it gives more believable behavior of CHT, more close to reality than FS implementation, forcing to pay more attention on parameters like power management, mixture, cowl flaps and climb speed to keep the engine cool.

A. Open Status Panel "CHT Model Parameters"

B. Set Aircraft-specific parameters

Setting these parameters appropriately should bring the CHT of the plane into the right ballpark figure.

CHT response can be fine-tuned in the tweaking step (C).

Note: Approximate (+/-10%) values are sufficient - module can be tweaked with tweaking parameters if needed.

1. Set Parameter "Rated Engine T/O Power" to rated Take-off engine HP (horsepower) of aircraft.

Either use literature values published for the aircraft, or note the power reached at Take-off with full throttle/recommended take-off MP/RPM settings.

Note: This entry is independent of the "Nominal Engine Power" entry in the RE Status Panel. So you have to enter it in the CHT again.

2. Set parameter "Supercharger Type" if the aircraft has a supercharger (or turbocharger).

0=none, 0.65=low blower, 1=high blower

Note: There's possibility for aircraft designers to set low/high blower impact on CHT by setting variable 0/0.65/1 (>L:RE_CHTmodel_Ksuperch,number).

3. Establish Cruise at 75% power, 0.083 F/A mixture, cowl flaps closed at 2000 ft with FS weather theme "Clear".

Set parameter "Cruise Speed" to the recorded cruise speed KTAS (knots true air speed), e.g. measured by GPS GS.

C. Tweak performance

1. 1. Establish cruise at 2000 ft (75% power, 0.083 F/A, cowl flaps closed at 2000 ft, see A3).

Adjust parameter "Cowling Cooling Efficiency" so that "Target CHT" is about 380 °F (or higher/lower if you prefer the engine to run rather high/low CHTs).

2. 2. Go to a sea-level airport and run the engine at 1300 rpm (or typical RPM for warm-up) with full brakes set, cowl flaps open.

Set parameter "Idle Cooling Efficiency" such that "Target CHT" is at 380 °F or lower.

For planes that tend to run hot on the ground you can adjust this parameter to higher temps.

3. 3. Set mixture to full rich and cowl flaps fully open, and try a take-off and climb at POH recommended power settings with airplane at maximum Take-Off weight.

Establish a typical climb depending on aircraft and your preference.

Verify that CHT doesn't run too high neither during take-off nor during climb (see parameter “Target CHT” in the “CHT Model” panel).

If CHT runs too high (or too low) adjust parameter "Cowling Cooling Efficiency" or "Idle Cooling Efficiency" (to start at lower temperatures for T/O).

Further tweak at will to better represent CHT behavior of real-world aircraft.

D. Set Oil Temperature

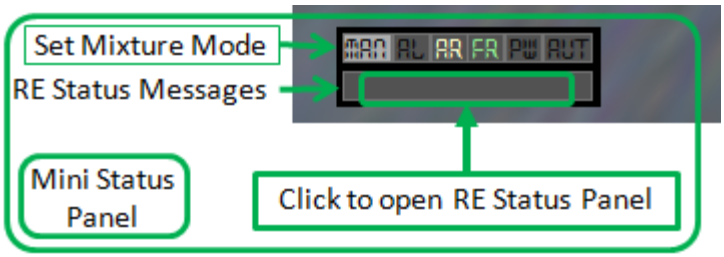
- For Aircraft which have no CHT gauge, but only an Oil Temperature gauge, the CHT model can return a value to display in the oil temperature gauges that mimics the CHT value calculated, and is just rescaled to exceed the Oil temperature limitation value at the same time CHT limit is exceeded. This Oil Temperature value is not realistic about oil temperature in a real plane itself.
- The Oil temperature gauge has to be edited as described above to display the calculated oil temp value.
- If the aircraft has a CHT gauge, set the parameter "Set Oil Temp?" to "0" - it does not make sense to control CHT and oil temp displayed by the CHT model at the same time, as they both indicate the same information – how close is CHT to its limitation.

Note: The entries "Max allowed CHT" and "Max allowed Oil temp" in the “CHT Model” panel are independent of the entries "CHT Limit" and "Oil Temp Limit" in the RE Status Panel, although most time they should have the same numerical value. So you have to reenter CHT limit and Oil temp limit in the CHT panel again..

Notes

A. Mini Status Panel

- You can open the Mini Status Panel by two means if it is closed:
    1. Shift + one of the F keys (e.g. Shift + F9).
    2. FS menu "Views - Instrument Panel – Mini Status Panel"
- Displays operating parameters/warnings/failures for engine 1 only.
- Beware: Other engines may be less healthy and fail before engine 1!



B. Typical maximum Power settings

General guidelines from Lycoming technical notes

http://www.lycoming.textron.com/support/tips-advice/key-reprints/pdfs/Key%20Operations.pdf

	Normally Aspirated		Supercharged or Turbocharged
	Fixed Pitch Prop	Variable Pitch Prop	
Take-off	Full power	Full power	Full power (max 5 minutes)
Climb	100 %	85 %	85 %
Cruise Best power	75 %	75 %	75 %
Cruise Best Economy	75 %	75 %	65 %

- For GA piston engine aircraft cruise settings are generally considered to be 55% - 75% of maximum rated engine power.
- Assure that all engine temperatures (CHT, TIT, Oil…) are within the green arc range of engine instruments at all times.

C. MP / RPM Limitations

- If no POH/information is available on the aircraft, a starting point would be to select likely MP/RPM values for continuous/climb/take-off which achieve the engine power % as listed in the table “Typical maximum power settings” above.
  Or use the “Engine Power Limitations” module right away.

- Note: Typically either module "Engine Power Limitations" or "Engine MP / RPM Limitations" should be used for engine limitations, depending on which best suits the operating recommendations for the aircraft, or personal preference..
- Only in rare cases does it make sense to have both modules active. But do as you like.

D. General recommendations for Leaning

http://aviationinspection.com/engine-inspections/aircraft-engine-operation/
http://www.lycoming.textron.com/support/tips-advice/key-reprints/pdfs/Key%20Operations.pdf

General guidelines from Lycoming technical notes:

	Normally Aspirated		**Supercharged**	**Turbocharged**
	Fixed Pitch Prop	Variable Pitch Prop		
Start and Taxi	Full Rich*	Full Rich*	Full rich	Full rich
Take-off	Full Rich*	Full Rich*	Full rich	Full rich
Climb	Full Rich*	Full Rich*	As per POH	Full rich
Cruise Best power	Lean to maximum RPM	Lean to 100 °F rich of peak EGT	Lean to 100 °F rich of peak EGT	125 °C rich of peak TIT
Cruise Best Economy	Lean till roughness, then enrich till smooth	Lean to peak EGT	Peak EGT, Below 65%	Peak TIT
Descent	Lean, rich enough so engine runs smooth			
Landing	Full Rich*	Full Rich*	Full Rich	Full Rich

* Above 5000 ft density altitude, for non-Super/Turbocharged engines:

- At high altitude airports, lean for taxi, take-off, traffic pattern entry and landing.
- Startup and Taxi: Lean at 1000 RPM until RPM peaks, then enrich slightly.
- Before Takeoff: Go to full throttle and lean mixture for smooth operation and increased power.

E. Avoiding Spark Plug fouling

http://www.lycoming.textron.com/support/tips-advice/key-reprints/pdfs/Key%20Operations.pdf

- It is not good practice to idle an engine below 1000 RPM at any time.
- Engines should be idled between 1000 and 1200 RPM. This will also allow for efficient engine warm-up
- Avoid prolonged idling on the ground
- Avoid power-off descents
- Lean out during cruise
- If in doubt about the power output, a brief, smooth full throttle check is recommended.

F. Cylinder Head Temperature (CHT) limitations

http://www.lycoming.textron.com/support/tips-advice/key-reprints/pdfs/Key%20Operations.pdf

- Heat is enemy #1 of the engine

- Keep CHT within the green band, typically 150 °F to 460 or 500 °F.
- Keeping CHT below 400 °F is recommended for best service life.
- Control CHT:
  - ✓ Enrich the mixture
  - ✓ Adjust cowl flaps
  - ✓ Reduce power
- During climb:
  - ✓ Climb at higher speed (lower fpm)
- On the ground:
  - ✓ Make run-up thorough, but as brief as possible.
  - ✓ Avoid overheating by keeping ground operations to a minimum. Park and complete run-up into the wind.
  - ✓ Cowl flaps should be open for all ground operations.

G. Oil Temperature (CHT) limitations

http://www.lycoming.textron.com/support/tips-advice/key-reprints/pdfs/Key%20Operations.pdf

- Typical green band 120_245 °F (recommended 165° F_220° F).

H. Gear Overspeed module

Generates gear failure if Vl gear speeds are exceeded.

- The module actually generates a complete failure of the hydraulic and electric systems.

  Unrealistic I know, but let's say the hydraulic lines rupture due to the gear stress, stuff starts to fly around, and creates a short in the electrical system... (and btw I didn't find another way to fail flaps/gear on any aircraft across the board than to cut the electric and hydraulic circuit…)
  Now, this should get the pilot's attention ☺

Make sure you know how to extend that gear manually.

Note: The flaps will not be operational either…

I. Flaps Overspeed module

- The module actually generates a complete failure of the hydraulic and electric systems.
- Note: The gear will not be operational either…
- Flaps failure may also be asymmetric.

Troubleshooting

A. Whole or parts of the status panel are blank. Verify the entries in the panel.cfg are exactly as they should be:

1. Best is you copy the [Window Titles] and [Window**YY**] entries from the text file.
2. Check the numbering of [Window Titles] Window**YY**=RealEngine… and [Window**YY**] entries are the same.

B. Plane starts with engines off when it should be on, or does not start. Try the following:

1. At high (density) altitude airports pull back the mixture lever some before starting.
2. Look in the aircraft Realism Settings/Failures (Alt – Menu Aircraft/Realism/Failures) if engine failure is turned on – turn off and restart. Sometimes that seems to happen.
3. Reload the aircraft
4. Reload the flight

C. Plane does continue to spin to the ground after an asymmetric flap failure

- … although you have hit the reset button in the status panel.
  That's the way it is. Tough world. Don't fail your flaps. ☺

Credits

- Doug Dawson: Can't thank you enough for freeware sound gauge dsd_fsx_xml_sound_RE.gau, parameter .ini functionality dsd_xml_config.gau and window_status gauges ! http://www.douglassdawson.ca/
- Asymmetric flaps failure: Idea by A2A Accusim.
- Power loss effect: TooLowGear http://www.fsdeveloper.com/forum/showthread.php?t=16339
- Roughness effect has been inspired by Warwick Carter's Gee Bee Model Z / effect by Robert Sanderson (http://www.flightsim.com/kdl.php?fid=99404).
- Brett Henderson for testing in FSX, advice and for suggesting a way to implement individual failures for the engines of multiengine aircraft. http://www.sim-outhouse.com/sohforums/showthread.php?t=23054&p=400009&viewfull=1#post400009
- The good people at fsdeveloper.com, Sim-Outhouse, Simviation and flightsim for help, suggestions and advice.

License

Hope you like it.

And keep an eye open for an emergency landing site at all times.

Gunter (teson1), 2012