

We bring to your attention an add-on for the An-2 aircraft

(<https://www.avsim.su/f/fs2004-originalnie-samoleti-40/legkiy-mnogocelevoy-samolet-an-2-model-dlya-msfs-2004-73627.html>).

1. Aircraft icing simulation within the difficult weather conditions, as well as carburetor icing and its elimination using an air heating system..
2. Impact of dust on engine operation and dust filter using.
3. Visual effects

I. Icing effect

General information from the FOM

Heating the air at the carburetor inlet serves to prevent carburetor icing, which is possible at an air temperature of $+5^{\circ}\text{C}$ and below, in the presence of clouds, snowfall, rain or drizzle.

During aircraft operation, there are cases of popping, shaking and engine failures due to icing of the grids, diffusers and carburetor throttle valves, it is necessary to use heating to prevent it.

1. Turn on the air heating at the carburetor inlet when taxiing.
2. Take off using full-power with the heating switched off; however it is allowed to take off with the air heating at the carburetor inlet turned on. In this case, the aircraft commander must take into account that when the heating is turned on, the take-off power of the engine decreases slightly, which leads to a corresponding increase to the take-off running and take-off distance. When the air heating is fully turned on, the takeoff length increases by 18-24%, the take-off distance (up to a height of 25 m) - by 20-27%.
3. In horizontal flight, when the air temperature is $+5^{\circ}\text{C}$ and below, during cloudiness, snowfall, rain or drizzle, and also when the mixture temperature is below 0°C , turn on the air heating at the carburetor inlet, maintaining the mixture temperature at $+5^{\circ}\text{C}$.

Implementation

Due to some limitations of the simulator, the simulated scheme is somewhat inconsistent with the actual response to icing.

This effect occurs in the presence of precipitation (rain/snow) and air temperature below $+5^{\circ}\text{C}$ and affects engine operation, as well as partially the dynamics of the aircraft, reducing its speed and lift.

Some time later after the described weather conditions occurred (or starting the engine, if such are present during flight loading), engine malfunctions appear, audible by popping sounds and visually observed by the twitching of the boost and speed arrows; after another few seconds the engine will stall.

Note: Duration of outages is variable; In addition to the random coefficient, there is a component that depends on the temperature of the cylinder block and contributes to the total delay from -2 to +2 s.



To prevent engine stalling at the such conditions, air heating is used at the carburetor inlet, which lever is located on the central panel. However, it should be taken into account that switched on heating reduces the maximum boost and prop RPM by 8%, which makes taking off and flying with it somewhat difficult.

Switching is tied to the standard action carb\heat eng anti-ice on/off, so it can be done with the assigned key ("H" by default).

A gradually increasing negative effect to the aircraft dynamics occurs all the time the aircraft is within the difficult weather conditions and also gradually decreasing when leaving them.

When switching the heating, the Throttle and Prop levers visually are moving due to the redefinition of the axis range. This is normal; the new position corresponds to the old one, adjusted for power loss (and vice versa).

Recommendations for use

1. Starting can be done both with the heating on and off.
2. Due to the reduced power when the heating is on, the take-off length increases slightly, so on short runways it is advisable, as the speed increases, to raise the tail by deflecting the elevator and keep the aircraft in a horizontal position; In addition, to reduce the takeoff running, you can hold the brakes until the speed and boost will reach the maximum.
3. **Important:** with the current dynamics (An2.air), extended flaps do not impart (or almost do not impart) lift to the aircraft, but noticeably slow down the speed, so it is recommended to take off on a "clean" wing.
4. When the heating is turned on, the aircraft with full take-off weight takes off stably at a speed of 100-110 km/h from a runway 800 ft long (tested).
5. Due to the gradual deterioration of the aircraft dynamic properties in icing conditions, it is recommended to constantly monitor the speed and pitch, correcting them in a timely manner to avoid stalling.
6. Flight range in icing conditions is significantly (to twice) reduced; This must be taken into account when planning your route.
7. Short-term heating switches off (in order to increase climbing and acceleration faster) are performed at your own peril and risk. Such switching-off does not bring any particular effect; in addition, increasing RPM and boost will lead to imbalance of the aircraft, and when the icing is re-triggered - to an equally rapid drop in speed and stall.
8. Prolonged engine operation during the "icing" conditions with the heating not turned on can lead to its complete failure (the "chips in oil" lamp on failure, implemented in this model).
9. If there is no precipitation, the heating can be turned off by waiting about a minute; at this moment, be prepared to counter the pitch increasing due to a fairly sharp (2-3 s) boost and RPM increasing; as well as the cylinder block temperature will increase also (if the autopilot was engaged at the moment of the heating is turned off, then the pitch does not occur).

II. Dust filter

The dust filter (hereinafter referred to as D\f) is used to reduce wear of parts of the cylinder-piston group in the dust-in-air conditions.

Excerpts from FOM

D\f turns on during startup, warming up and testing the engine on the maneuvering platform only if there is dust in the air.

Taxiing should be carried out with the D\f switch on and do not allow the aircraft to be in a dust cloud. Do not turn it on at an airfield with snow cover or during precipitation (snowfall, ice).

In summer, take off with the obligatory inclusion of D\f switch on.

With dust in the air, it is allowed to climb with the D\f switch on up to the design altitude (up to 1,500 m).

Implementation

Working with D\f in the simulator is also different from the real thing. The following diagram of the need to enable D\f was modeled:

- snow surface absence, no precipitation
- temperature above +10°C
- taxiing, takeoff or landing on unpaved surfaces and up to a height of 10m according to the radio altimeter



When the D/f is turned off under the specified conditions, the engine has the same symptom as during icing: malfunctions and shutdown.

Switched on D/f causes a drop in engine power by 5%

Recommendations for use

1. Switching on the D/f at engine startup is not required.
2. With the start of movement under the above conditions, turn on the D/f and turn it off at an altitude of either at least 20 m or higher (if there is increasing terrain along the take-off course)
3. When landing, the actions with D/f are similar.

III. Visual effects

The package includes the visual effects of dust and snow clouds that occur when the aircraft moves over unpaved surfaces at the appropriate times of the year (effects are based on the dust effect for the model Casa-212 by V. Zhigulsky).

Both effects, in addition to external views, are also distinguishable from 2D (in the case of a dust cloud, this can serve as a signal to turn on the D/f). From VC view, due to the spinning propeller halo, the effects are observed only when looking to the sides.

The third effect, cabin glass freezing, occurs during icing; its density gradually increases in the presence of appropriate conditions and also gradually decreases when they disappear. This effect is available from 2D and upon forward view only, on the both pilots panels.



General note: the previously imposed restriction on the use of a pause at the overheating is removed. Now it can be used in both overheating and icing processes; all state changes are suspended for this time.

Installation

This addon is installed over of previously released updates No. 1 and No. 2; their presence is mandatory. Both updates are additionally included in this package (1_Update folder).

1. Place the contents of the 2_Icing folder in FS root folder, having previously created backup copies of the existing ones in case of a rollback.
2. Edit aircraft.cfg in the ..\Aircraft\Antonov An-2\ folder by adding the following lines to the [lights] section:
light.8 = 8, 28, 0, 1.0, An2_dustsummer
light.9 = 9, 25, 0, 1.0, An2_dustwinter

If your panel.cfg (..\Aircraft\Antonov An-2\panel) is different from the original one, you can make changes to it manually, instead of what is offered in the package:

- in the [Window Titles] section after `Window05=GPS` add `Window11=ice_left` and `Window12=ice_right`
- delete lines: `gaugeXX=An-2_XML!StvorKapot_L, 608,328,372,215` in the [Window00] section and `gaugeXX=An-2_XML!StvorKapot_R, 940,328,372,215` in the [Window01] section; arrange the gauges numbering.
- add the following content after the [Window05] section:

```
[Window11]
Background_color=0,0,0
size_mm=1920,1080
window_size_ratio=1.000
position=7
visible=1
ident=10100
render_3d_window=1
nomenu=1
window_size= 1.000, 1.000
window_pos= 0.000, 0.000
zorder=0
```

```
gauge00=An-2_XML!Ice_window, 0,0,1920,1080
```

```
//-----
```

```
[Window12]
Background_color=0,0,0
size_mm=1920,1080
window_size_ratio=1.000
position=7
visible=0
ident=10200
render_3d_window=1
nomenu=1
window_size= 1.000, 1.000
window_pos= 0.000, 0.000
zorder=0
```

```
gauge00=An-2_XML!Ice_window_r, 0,0,1920,1080
```

```
//-----
```

Enjoy your extreme flights!