Autoland

Version 2.1

Original XML logic by Nick Pike, 2001/2003
Gauge developed and extended by Martyn Becker, November 2005-April 2008
Operating instructions for Flight Simulator 2004 and 2002. Not tested in FSX.

CONTENTS:

OVERVIEW:

MS Flight Simulator has evolved to a state where it is a true simulator rather than a game. There are so many things in it that mirror what happens in real aviation. However there is one aspect of the airliner flying experience that has not been simulated in the standard FS package – that is the type of full autolanding capability that modern airliners have. This small package provides that capability for FS2004, and also for FS2002 which uses the same type of XML coding that forms the engine of this add-on.

Firstly I continue to thank Nick Pike, as it is he that wrote the original XML that forms the basic logic of the control gauge. Nick put together what he called 'autoflare' as part of the panel he constructed for his fictional C4-SST aircraft, and he was only too happy for me to use the XML logic, so thanks very much, Nick. The original FS2002 C4-SST can still be downloaded as freeware from www.simviation.com, and the updated FS2004 version is available from www.FS2x.com.

The original autoflare gauge was written specifically for the C4-SST, a delta-winged supersonic transport, so it was a great learning experience to be able to adapt and amend the gauge to fit today's airliners. The original version 1 of the gauge was designed to take the airliner from around 25 miles out and land it with no further input, which it did - but that was not a realistic representation of what really happens, since real autoland systems are switched in much closer to landing, with the landing configuration already pretty much set. This is modeled more effectively in the revised gauge.

COMPONENTS

The gauge is small in size but does a lot of things during the landing process. Additionally, there are two bitmap files that serve to provide the icon that displays in the airliner's 2D panel in FS.

Autoland icon

The following pictures show the icon in place in a 777 panel: the first in its non-activated condition (grey) and the second, activated (green):

The icon is here in its grey, non-active state.

The icon here is activated.

The three system files (the gauge plus two icon bitmap files) are grouped into a folder within the FS 'gauges' folder. The only other additional work required is the editing of the particular panel.cfg file for the aircraft that you wish to add autoland capability to. The installation instructions assume some familiarity with editing these configuration files.

SUMMARY OF INSTALLATION PROCESS:

Unzip the 'autoland_v21.zip' file to a temporary folder. (You must have already done this to be reading this file!) :

- create a folder called 'Autoland' in the FS 'gauges' folder
- copy all 3 files indicated above to this new folder
- copy and paste appropriate control lines (see below) to the panel.cfg files

If you already have version 1 of this gauge, the icon bitmaps are identical, so may be over-written with no problems. The gauge name is different from those in version 1, and the new version will therefore not conflict.

DETAILED DESCRIPTION:

The autoland gauge provides a fully-automated hands-off autoland system for your passenger aeroplanes that is controlled by a single on/off icon on the panel. The XML gauge operates such that all the control inputs that the pilot would normally make on final approach are simulated so that the landing will happen automatically with no input from you, the pilot, once the icon is clicked and the glideslope intercept point is reached. You can also switch off the system to return to manual approach, as described below. The only difference is that with a manual approach, you would disconnect the autothrottle some way out, and then the autopilot at a couple of hundred feet above the ground, trimming for approach. With the autoland gauge active, the autothrottle and autopilot remain on until deactivated by the gauge after touchdown and flap retraction.

The gauge operation is controlled by the following parameters in the panel.cfg file for the plane you are flying:

The XML gauge itself is activated by placing control lines in the panel.cfg for the panel you are using. The control lines are placed in the [window00] section of the panel.cfg, normally as the last numbered line with sequential gauge numbers. So if the last line of this section in your file is, for example;

gauge33=737-400!Autobrake, 581, 134

then add another line, as follows. Cut and paste this line into your panel.cfg, incrementing the number after 'gauge' by 1:

gaugeXX+1=Autoland!Autoland, W,X,Y,Z
where W and X are the positional coordinates for the top-left-hand corner of the icon on the panel, and Y and Z are the size coordinates for the icon itself. I normally position the icon adjacent to the default icons so that it is easy to find and to locate in the panel.cfg – see the pictures above.

In this example, they would be;

gauge34=Autoland!Autoland, W,X,20,20
as 20 pixels is about the normal size for an icon, but you may need to experiment to find what's best for you.

Remember to increment the control line – this is important. This may all sound a little complicated but is easy to work through if you are systematic. The final effect is worth it!

The landing configuration is for you, the pilot to set. Once done, the gauge then calculates the approach speed based on residual fuel and passenger weights and sets the autopilot IAS window accordingly. The landing parameters provide a slight nose-up attitude on approach that assists the flare. The IAS value may be changed manually on the autopilot at any stage of the descent, with the autoland system active or not. Remember, the autoland system can be switched off at any time, leaving the approach speed as set by the system. This means that the gauge can also be used as an approach speed calculator for manual landings.

File list:
Gauges/Autoland:
Autoland.xml
Autoflare_on.bmp
Autoflare_off.bmp

GAUGE OPERATION:
Fly the plane making a normal descent using the autopilot. Make a normal approach and set your landing configuration. You will typically be around 150 kts close to landing flap setting as the glideslope becomes active. You will already have engaged the APR on the autopilot.

Click on the autoland icon at any point in the approach before the glideslope intercept. The icon will glow green. The gauge will do nothing until you intercept the glideslope at which

point it will calculate and set the approach speed in the autopilot. Complete your flap assignment and make sure the gear is lowered. (The gauge will actually do it for you in the event that you forget!) As you make the final approach, the gauge carries out the following operations when the glideslope is captured:

  - Reduces airspeed for approach to the calculated IAS value.
  - Arms the autobrake.
  - Sets trim for landing – the plane will flare as it nears the runway.
- At 5-10 feet above the runway:
  - Cuts the throttle.
  - Switches off autopilot functions.
  - Engages wing leveler until touchdown.
- On touchdown:
  - Applies reverse thrust.
  - Applies autobrakes.
  - Deploys the spoilers.
- At 55-60 kts:
  - Cuts reverse thrust.
  - Releases autobrakes.
  - Raises flaps.
  - Lowers spoilers.
  - Switches off the yaw damper, pitot heat, ice detection and landing lights.
  - Switches off the autopilot master.
  - Switches itself off.

At this point, you are slowing down on the runway below 55 kts, with the autoland system switched off and all controls returned to you. Make sure that your throttle control has been set to zero to make sure that the engines don't 'surge' when the gauge switches itself off.

MANUAL APPROACH USING Vref CALCULATION

The gauge also doubles as an approach speed calculator that can be used for manual approaches, such that the gauge will suggest an optimum landing speed for all sizes of plane, calculated from its actual residual payload/fuel weight on approach. When making a manual approach, simply activate the gauge before the plane intercepts the glideslope. On interception, the gauge will set the optimum approach using the plane's recommended flap settings (set by you). Then simply turn the gauge off again and continue the approach at the set speed.

As the gauge sets the speed slightly lower than normal to increase the nose attitude a little to assist with flare, you may wish to increase the recommended speed by 3-4 knots for a manual approach.

CENTRE OF GRAVITY ADJUSTMENT

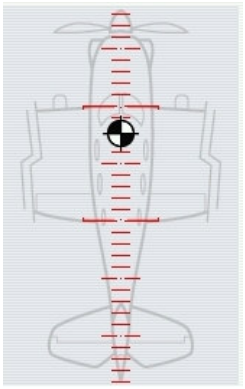
The flight dynamics (FDE – Flight Dynamics Engine) of the aircraft that you are flying will have an effect on the autoland gauge at flare and touchdown. If you are having trouble with the nose wheel hitting the tarmac too hard and the plane crashing, it is well worth checking this for your plane, and adjusting if necessary.

The reason is that in real planes, the CG is located at a point around the centre of the engine locations on the fuselage (or the front engines on a 4-engine plane), with a slight variation for

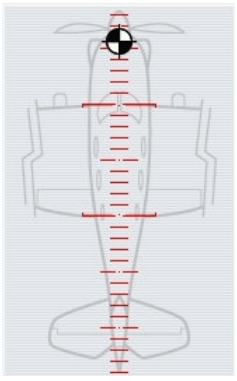
passenger and cargo load. When you flare for landing, the plane rotates around this point, with the nose then gently and gradually returning to the trimmed point, resulting in a smooth touchdown. If however the CG is too far forward (as it is on many freeware plane FDs) then the rotation will occur around a point close to the nose. In cruise, this has the effect of 'shuttlecocking' which although not realistic, is not life-threatening (from a virtual perspective!). On flare, this has a potentially serious effect in that although the attitude does change when the gauge applies flare:

- The rear of the plane swings down (not serious, as the plane is still more than 100 feet in the air).
- The nose goes up with the flare, but then like a pendulum, comes down again swiftly. This downward movement can bring the nosewheel into hard contact with the runway and can cause a crash.

You can easily check the CG of the plane you're in. If you go to the fuel/payload selection menu option, for a CG that's in the right place, you will see a graphic that should look like this:



If you see a graphic like this;



then the CG is incorrectly placed (too far forward in this case) and you may have problems using the autoland. Although a true fix would involve a FD re-write, there is a workaround that is easy to do, if you know how to edit an aircraft.cfg file. Follow these steps:

- Make a back-up of your original aircraft.cfg file.
- Look in the [airplane_geometry] section for a line similar to this;

  wing_pos_apex_lon= 0.00

- Increase the number to move the CG position backwards or vice versa.
- Start by increasing from say 0.00 to 10.00 and see where that puts the CG.
- Adjust until you get it as per the first illustration above.

This might be a little 'fiddly' but will have the added benefit of generally improving the plane handling, as the CG will be where it should be.

LIMITATIONS:

This is a generic gauge, and is dependent on the accuracy of the plane's flight dynamics (see above) – however it works well enough with most. I have tested it with Airbus A318s to A380s, from Boeing 737-300s to 747-400s and it works with all of these as long as the CG is right – although I have created my own more realistic (IMHO) FDs for many of these!

As is normal with the FS autopilot you should be below the glideslope for it to be captured successfully, but this should not be an issue if you make the approach as defined.

NOTES

Please note that these are recommendations only. As indicated above, you can set the final touchdown speed manually after the gauge has suggested the optimum speed, so please experiment.

The gauge is not perfect because it is being applied to many different planes/panels of different sizes from different sources. It should do pretty well for most of them however, so enjoy! Please contact me if you have a suggestion for further improvement.

ACKNOWLEDGEMENTS:

Nick Pike for his generous permission to modify the XML code from his C4-SST Autoflare gauge and use it for this gauge.

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