

The Boeing 737

A Tutorial

Welcome to this Tutorial for handling the Boeing 737 in the Flightsimulator. As there are many variations of the Boeing 737 (Beginning with the -100 Series and ending with the -900 Series) I'm going to make a general tutorial, as those types are all very similar and will care about the difference's when they appear.

We will go through the SystemHandling of the Aircraft from a Cold&Dark Cockpit to the Landing (excluding FMS - with the Flight Management System is dealt in a separate tutorial)

Where to start. If you're new to Flightsimulations and want to fly with a complex aircraft you'll probably be overwhelmed by the complexity of the panel and maybe afraid or whatever.

So let me introduce everything step by step.



Where to start with?

Well, if the Panel is Cold&Dark first thing to do is to Power up the aircraft - meaning putting the Battery-Switch to the ON Position. That's for the easy part.

1.1 Powering the Plane

Now the aircraft can't be fully powered by its battery, it would drain very very fast. Also you shouldn't keep the plane to long on battery power, it will drain within 30 minutes, therefore you need additional power...

Before we can continue turn on all fuel pumps on the left lower overhead panel. (Or the fuelpumps of those tanks, which acutally contain fuel). If the LOW PRESS light remains illuminated after turning on the fuelpumps the tank contains no fuel - therefore the pumps should be turned off. (Also if this occurs during the flight - turn the pumps of the tank in question off).



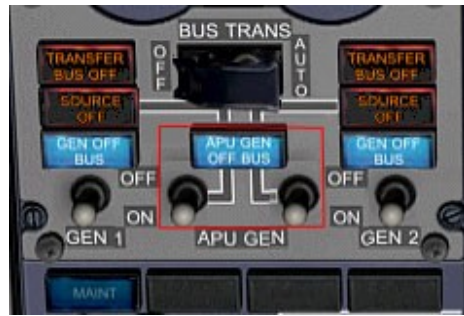
Now we assume, we don't have any external power sources, for such situations the airplane provides help to itself with the so called **APU** (*Auxiliary Power Unit*). The APU is a small turbine in the rear of the aircraft, which provides the aircraft with system power and bleed air. It uses fuel from the aircraft fueltanks. The APU is operated on all Boeing737-Series the same way. You will find a switch in the lower Overhead-Panel with the Options **OFF - ON - START**

Left of it (on the 737-200 Series) and above it (on all other 737-Series), there is a gauge. This gauge is the APU's Exhaust Gas Temperature (short: **EGT**) and indicates the Temperature of the exhaust gases in Celcius and therefore give's information if the APU is running or not.



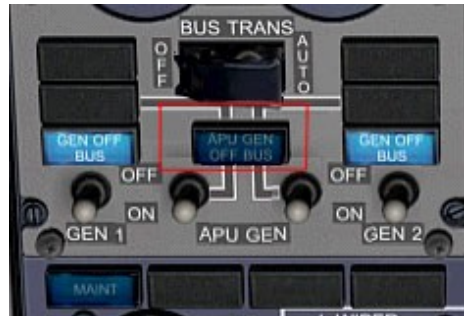
To start the APU, put the switch to the **START**-Position and hold it there until the EGT rises to a stable Value (about 80%, then drop to 40%), thereafter you can release it to the **ON** position.

Now that the APU is running, we have to couple it with the main bus in order to supply the aircraft with power. Therefore we go to the controlpanel **above** the APU EGT-Gauge with four switches, for the moment we need the two, labeled with **APU GEN - ON - OFF**. Above these, there should be a sign illuminated in blue, indicating **APU GEN OFF BUS**. This tells us the APU is not coupled with the main bus. Now we move both APU GEN switches to the **ON** position. The **APU GEN OFF BUS** sign should extinguish and you should hear the compressor sound. Now the plane is fed by the APU.



Now let's summarize the settings for starting the APU:

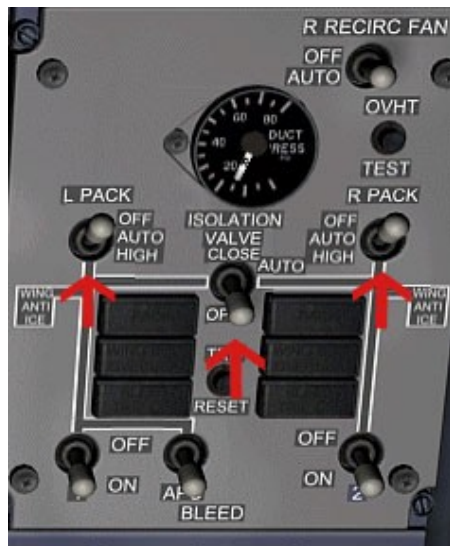
- APU
- START**
- 80% release the button
- APU GEN BUS 1 - 2
- ON**



1.2 Air

Now that the plane is supplied with power we can concentrate on the other systems that are connected with the APU. Which is mainly: the **BLEED AIR**. The aircraft needs bleed air for its air conditioning and the engine startup. The "normal" Air for the air conditioning is normally fed by the engines but if those are not running it has to be taken from the APU. Also the engines need air for their startup, this air is also taken from the APU. As the APU is only an auxiliary device, it is not capable of supplying all aircraft systems with air at once. Therefore we have to turn off the air conditioning for the engine startup. To prepare the engine startup let us go through the steps necessary.

First we have to open the **APU BLEED VALVE/APU BLEED** in order to feed the airplane with APU BLEED AIR. The air conditioning panel can be found on the **upper right** overhead panel. In the lowest row of this panel there should be three switches, labeled **ENG 1 BLEED - APU BLEED - ENG 2 BLEED**, should be in the **ON** position.



Above the bleed air row, there are the PACK-Switches and the ISOLATION VALVE. The ISOLATION VALVE switch should be in the Position OPEN. While the two pack switches should be OFF. The Packs supply the air conditioning with air, as the air provided by the APU is needed for the engine startup, we have to turn the air conditioning off.

Now let's summarize the settings on the Air conditioning panel:

- APU BLEED
- ON**
- 1 & 2 BLEED
- ON**
- ISOLATION VALVE
- OPEN**
- L & R PACK
- OFF**

And now, just for your understanding, let's summarize what we've done so far: We have turned on the aircraft's battery to supply it with power for the basic systems. Thereafter we have started the APU to supply the aircraft with additional energy and air. And after that, we prepared the aircraft (basically) for the engine startup.

1.3 Misc

Before we continue with the engine startup, there are other things to take care about, which are not necessary but should be mentioned. First as a general rule, every switch on the Overheadpanel that is illuminated is considered as **OFF** and **should be turned on** before the flight. Check the **CAUTION/MASTER CAUTION** lights before departure for any illuminated lights. Switches that should be **ON** on the overheadpanel before startup:



EMER EXIT LIGHTS (the emergency exit lights).....**ARMED**



YAW DAMPER (as the name says, damps the yaw movements)...**ON**



ENG&ELEC 1 & 2 Hydraulic Pumps
(The hydraulics are one essential system of the plane)... **ON**



The Lightsystems are not that important, just be sure to turn on the **BEACON LIGHT** before engine startup

Now let's summarize the settings on the overhead panel:

EMER EXIT LIGHTS
ON

YAW DAMPERS
ON

ENG HYD 1 & 2
ON

ENG HYD 1 & 2
ON

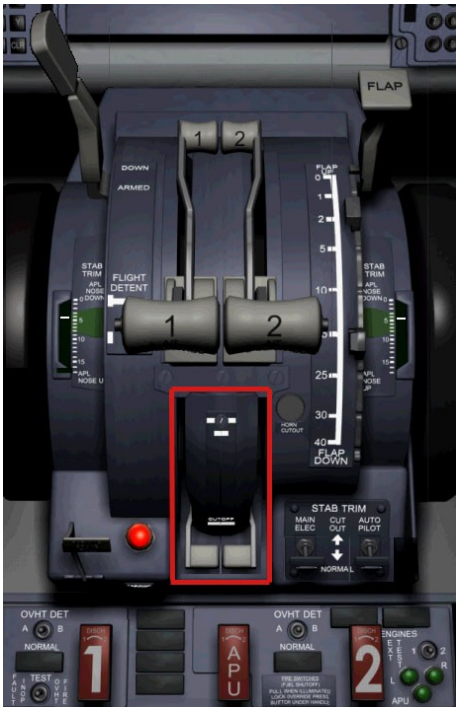
ELEC HYD 1 & 2
ON

2.1 Engine startup

As we fulfilled all necessary conditions for the engine startup in 1.2 we may now proceed with the startup.

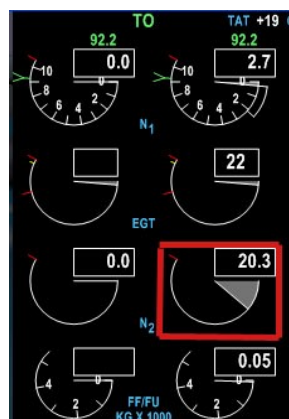
The engine startup itself is very simple. **Right** off the APU START switch we have the two engine starter switches. Each switch has four options: **GND** - **OFF** - **CONT** - **FLT**. Normally it should be in the OFF Position. The **GND** Position is needed for the Startup on the ground, the **CONT** for a continuous ignition during takeoff, landing and cold weather operations and the **FLT** setting for a in-air-startup.

As we have to monitor some engine instruments during the startup let me now briefly introduce you to the engine displays. We have four or five analogue or digital gauges (depending on the 737-Series). The first, which is not available on all Types is the EPR Gauges, it's a kind of pressure measuring and used to "control" the engine. The second, mostly common on all types is the NI-Gauge, which indicates the Rotation of the Fanblades in percent. The Second is the EGT, which is basically the Exhaust Gas Temperature of the Engine in Degrees of Celcius. The third gauge should be labeled with N2 and provides information about the rotation of the inner turbine and the last gauge should be the FF or Fuel Flow, providing information about the Fuel Flow per Hour. The Measure that is used here, varies from aircraft to aircraft, according to the country they are used in. It can be KG or LBS.



Now to start the Engine check if both **ENGINE CUTOFF** levers are **CUTOFF**

then we move the #2 Engine Starter to the **GND** Position (the right one). Now we need to monitor the Engine Displays, especially the **N2 Gauge**. We have to wait for a certain value until we can add fuel to the engine. If we add fuel to early, well, we risk a hot start and this could cause engine problems. Now after moving the starter to the **GND** Position, we watch the N2-Gauge rise. When it's at about 20% we can add fuel to the engine.





This is done by moving the **CUT OFF** lever beneath the thrust levers, to the "up" position (**IDLE**).

Once that happens, we should see the **N1-Gauge** rise and stabilize around 30-40% and the **EGT** should also rise (**EGT** and **N1/N2** values depend on engine types and can vary).

Shouldn't the engine ignite, there is probably something wrong, check if:

APU BLEED
ON

PACKS
OFF

ISOLATION VALVE
OPEN

Now this process is repeated for the second engine.

2.2 Engines running

Now that the Engines are running we need to couple them with the main bus, so that they can supply the airplane with power. After the engines were started, the **GEN OFF BUS** signs should be illuminated in BLUE in the overhead panel. Put the corresponding switches to the **ON** position to couple the Engines with the **main bus**. The **GEN OFF BUS** lights should extinguish, while the **APU GEN OFF BUS** should illuminate. This means that the engines are now feeding the aircraft with power and the APU is no longer needed.

Set the **A&B PROBE HEAT** (heating of the probes which are needed for the altimeter etc) to ON





Then turn the **APU BLEED OFF** set the **ISOLATION VALVE** to **AUTO**

Now you can put the APU starter switch to **OFF** position. The EGT Gauge should decrease as the APU is cooling down.

Now one could say, OK the engines are capable of that and we can turn on Both Packs. **WE CAN** but we should at least have one pack turned off for the takeoff - in case one engine fails during takeoff, we might need the Bleed air of the other to restart the engines. Therefore the decision is up to you to turn on the Packs before or after the Takeoff. Once safely airborne they should be both turned on.

Oooooo kay ... So much for the "Hardware" Stuff, we managed to get the engines running and know everything we need, wow not too bad. We could fly the airplane now...but if you want to make a planned flight, you're probably going to fly IFR and that means with the Autopilot. With this (and all its variations) will be dealt in the next chapter.

3.1 The Autopilot

There are two kinds of autopilots on the 737-Series. On the 200-Series there is just a Basic CWS-Based Autopilot and a "normal" Autopilot which is also capable of CWS.

To start Chronologically, I should start with the Speyrr-77 Autopilot. However as this is not the best system for beginners and as it's not that widely spread, I'll just give a brief description of the Autopilot and then continue with the conventional 737 Autopilot. The Speyrr-77 is based on the CWS - Control Wheel Steering - meaning that you give inputs to the autopilot with your controllwheel (Steering horn) and the Autopilot holds these values.

3.12 737 CL & NG Autopilot



1. Course selector: Rotate this button to set the course of a VOR or ILS.

2. A/T ARM: When selected ON, this switch arms the autothrottle for mode engagement. The autothrottle will engage a speed intervention/vertical or navigation modes are engaged #

3. F/D: This button is used to use the autopilot if the F/D (flight director) is off you will be unable to use the autopilot.

4. NI: Pressing the NI switch changes the thrust limit to the CLB thrust setting. This setting will be displayed on the EICAS. This does not affect the autothrottle mode, but changes the thrust limit allowed.

5. SPEED: If pressed, the autothrottle is engaged in speed mode. SPD will be annunciated on the FMA and the throttle will control thrust to maintain the IAS/Mach displayed in the IAS/Mach window. SPD mode will not exceed minimum or maximum speed limits.

6. LVL CHG: this function will calculate the best climb / descend rate to get at the selected altitude with the selected speed.

7 HDG SEL: The aircraft will turn to the selected heading (see N° 10 for setting the heading knob)

8. VNAV: Or Vertical Navigation is the function that will hold the speed and altitude selected in FMC see FMC guide.

9. LNAV: Or Lateral Navigation is the function that fly's the pre programmed route in FMC see FMC guide.

10. HDG KNOB: Rotate this knob to set the heading

11. VOR LOC: this is used to intercept a radial of a VOR

12. APP: the APP or Approach button is only used during the approach you press it when the localizer is alive and you got ATC clearance. The APP will intercept the radial setted on the COURSE SEL and G/S (Glide slope) of the ILS.

13 ALTITUDE SEL: rotate this knob to set the cleared altitude

14 ALT HOLD: this holds the current altitude. F.E: you are at 6000ft and atc instructs you to climb to 10000ft then you do not use ALT HOLD u use V/S (N°15) ,LVL CHG (N°6) or VNAV (N°8)

15. V/S: Or vertical speed can be used for descend at certain rate or climb at a certain rate. This rate can be selected at the V/S selector right of that button

16 CMD A & B: Or Command A & B are the autopilot engage buttons use 1 autopilot (normally CMD A) for the flight and in case of a CATIII autoland use the both autopilots

17 CWS A & B: Control wheel steering

18. DISENGAGE: this disengages the complete autopilot except the A/T