IXEG

international x-plane engineering group

737 CLASSIC

Tutorial Series

Weather Radar, Anti-Ice, EGPWS

RESOURCES

There is a YouTube video of Captain Jan Vogel performing this lesson. The video can be found at:

http://www.youtube.com

INTRODUCTION

In this tutorial, you will bring both the aircraft and dark cockpit to life in the same manner a 737-300 crew does, minus a few checks and tests that do not apply for general flight simulation. You will fly from München, Germany *EDDM* to Salzburg, Austria *LOWS* and along the way, operate and become familiar with the Weather Radar, Anti-Ice and Ground Proximity Warning System, *EGPWS*. You will conclude the tutorial via a visual approach to LOWS runway 34, landing, taxi and shutdown.

INSTRUCTOR BRIEFING

Today, your airline has called you for a special job. A group of wealthy tourists have rented one of your airline's aircraft for a sightseeing tour. Though the weather did not cooperate with the tourists and it is not the best day for them to sight-see, the plane has been paid for so they have decided to go anyways and they will get to see some wet Bavarian landscape while you enjoy the challenge of flying in inclement weather.

If you want to enhance your visual experience, there is scenery available for the region. We used LOWS by the Austrian X-Plane Designer Group from www.x-plane.at. This is the scenery shown in the images in this tutorial. You should also get a map of the region, and since we are only doing a VFR flight, a regular map will do. Again, we do recommend skyvector.com as a great place to go for such maps.

We will be omitting some checks in this tutorial that are done in the real aircraft; however feel free to search for and locate a 737 POH (pilot operators handbook) on the internet if you are interested in following the complete procedures. .

PREFLIGHT

FLIGHT SETUP

- Launch X-Plane at EDDM and load the 737 Classic.
- Select the start location at Terminal 2, pos 220B.
- Bump the main menu and select *PREFLIGHT* to open the preflight dialog.
- In the upper left, choose the *Cold and Dark* option and hit *Apply.*
- Bump the main menu and select *GROUND SERVICES*
- Adjust *REFUEL* to 4.0 tonnes (8.800lbs) and click *Instant* speed.
- Set ZFW to 40.0 tonnes (or 88.000lbs) and close the menu.
- Set up some nasty weather. Using X-Plane's default weather/environment menu:
- Set an overcast cumulus cloud layer at 6.000 to 20.000 feet. Set precipitation to severe and set storms set to light.
- Set temperature to +10C / 50F This will ensure both rain and some icing conditions in the clouds so we can utilize the anti-icing features.
- Set visibility to 20 statute miles.
- Set up a wind layer(s) so that you have a wind of 15kts coming from 300 degrees throughout the planned flight altitudes (ground to 10.000 feet at least).
- Set the local pressure to 1016 / 30.00 so we can practice setting the altimeters correctly.

COCKPIT PREPARATIONS

As you approach the plane, you note that no ground-power is hooked up to the plane. This does not make a pilot happy because that means we have to use the APU for power, which also means suffering through the deafening APU noise while conducting the outside checks. Being a Captain does have its privileges though so you make your first officer do the outside check as you get out of the rain and head for the calm of the cockpit. After fiddling with the cold and wet entry door, you climb into the cockpit, settle into the captains seat and tell yourself it is time get to work! Everything is dark so lets bring this thing to life!

- Turn the battery switch to *ON*

Battery Switch to On

Quite a few lights will come to life as you connect the battery to the battery bus. You have only the most basic DC power now but the battery is short lived and cannot power very much. AC power is the life-blood of the aircraft and it can be supplied by one of 3 sources: A ground-power unit, the generators driven by the engines (which we will use later) or the auxiliary power unit *APU*, which we will start right now. Just as with a automobile, the battery is required in order to start the APU.

- Locate the APU switch on the overhead panel and move the switch to *START* for 1 second and then let go.

After about 10-12 seconds, you can observe the EGT on the adjacent gauge rise, peak and then settle as the APU starts. We wait for a short time until the blue *APU AVAIL* light illuminates. After this light illuminates,

- Move both APU generator switches to the ON position

AC power is now supplied to the aircraft. The loud sound you hear when you connect AC electricity to any bus is the sound of large circuit breakers switching. Many cockpit instruments will come to life instantly and a few others will after they warm up a bit.

Turn your attention now to the overhead panel. We will inspect the panel by starting with the

horizontal row at the bottom, or forward location, and then move to the leftmost column and traverse each column from bottom to top, working from the left column towards the right column.

OVERHEAD PANEL INSPECTION:

Consult the Pilot Operating Handbook for an illustration of the overhead panel if you prefer. Remember, we will inspect each column beginning at the bottom and moving towards the top.

BOTTOM ROW:

- Turn on the position lights.

LEFT-MOST COLUMN:

- Turn on fuel pump switches of all fuel tanks which contain fuel. Consult the fuel gauges to determine which tanks contain fuel. (hint: center one should be empty)
- Move the yaw damper switch to *ON*.

SECOND COLUMN

- Turn the Galley power switch to *ON*, the most important switch! No galley power, no coffee.
- Close the battery switch guard if it is still open. This is one switch you do not want to accidentally turn off in flight!
- Check battery voltage and APU GEN frequency / voltage to verify proper operation.
- Turn both IRS (inertial reference system) mode selector knobs to NAV. See note below.

> Be careful not to turn the IRS knobs too far to ATT! If this happens, then move the knobs back to OFF, wait until the ALIGN light goes out, then try again. This will start the IRS alignment process, which will take somewhere around 13 minutes. Do not set the knobs to ALIGN as that setting is used for either high-latitude alignment or what is called *quick alignment* during turnaround situations between flights if there is not enough time for a full alignment. This is a bit counter intuitive, but it is the same way in the real plane too.

- Set the IRS display selector knobs to HDG/STS to see how many minutes remaining until full alignment is achieved. Note that the IRS display only shows a maximum of 7 minutes in this mode setting so it will stay at 7 for a while.

IRS Alignment in Process

CENTER COLUMN

- Turn FASTEN BELTS switch to ON
- Turn NO SMOKING switch to ON (might as well weld this one to ON nowadays)
- Confirm emergency exit lights switch set to ARM. Set to ARM if not already.

SECOND COLUMN FROM RIGHT

- Turn on all hydraulic pumps. Note that the engine driven pumps will not supply pressure until the engines are started, but it is fine to set the switches to ON at this point. Confirm hydraulic pressure via the pressure indicator gauges.
- Turn on all window heat switches. The cockpit windows need a bit of time to warm up in order to make them less brittle so as to withstand bird strikes.

RIGHT COLUMN

- On the pressurization panel, Turn the mode selector to *STBY* as shown below.

In standby mode, you can set the desired cabin altitude directly instead of having the controller follow a pressure schedule automatically. We are only flying at 10.000 feet today, so the cabin altitude can stay at its current altitude.

To understand this better, examine the placard underneath the panel. It shows a *CAB* altitude for every *FLT* altitude (in thousands of feet). If you have the STANDBY or MANUAL modes selected, the placard tells you what the cabin altitude setting should be for the flight altitude, in order to NOT exceed the maximum differential pressure that the fuselage can handle. You do not want to burst the fuselage from with too much cabin air pressure! Lets take an example.

Say we fly at 22,000 feet, then according to the placard, the cabin should be at 1900 feet of altitude in order to not exceed the maximum 8.5psi the fuselage can handle. For this flight, we fly at 10,000 feet, which is not even on the placard. This means the cabin can stay at a sea level pressure setting and we are still below the fuselage maximum differential pressure. For takeoff and landing we always want the cabin altitude to be 200 feet BELOW the airport altitude,

- Set the *CAB ALT* to 1300 feet, (1500' airport altitude minus 200')
- Ensure air/ground switch is set to *GRD*.

Pressurization Panel

Move up to the Air Conditioning Panel

- Set one air-conditioning PACK to *ON*
- Set APU bleed air to *ON*

More than one AC pack for cooling is not recommended with APU power alone and would overload the APU. If you listen, you can hear the sound of the air conditioning come to life!

- Set the temperature to a comfortable setting. (Straight up to NORMAL).
- Ensure both engine bleed air switches are *ON*

This concludes the inspection of the overhead panel. We now move onto our main panel checks.

MAIN INSTRUMENT PANEL

We typically inspect the main panel from left to right.

- Adjust brightness of instruments and back-lighting
- Set correct altimeter setting of *1016/30.00* on both altimeters . Leave the standby one set to *1013.2/29.92*.
- Move the light test switch to *TST*. In the real plane, light bulbs will fail regularly. Indicators actually use two bulbs for redundancy and using this button, you can scan for indicators with burnt out bulbs because they will only be halfway illuminated.
- Press and hold the fuel *QTY* test for a few seconds, until the fuel gauges change appearance, showing *ERR4*. You can let go of the button then while the gauges perform a short self test for a few seconds.
- Check oil and hydraulic quantities on the gauges.

CENTER CONSOLE, FRONT TO AFT:

Turn on the weather radar system (switch between the CDU´s to on).
Move the TEST switch of the fire warning system to both sides - first to the left to check the failure detection then to the right to test the fire detection. Also check the „bottle discharged“ lights with the corresponding switch to both sides.

Also test the cargo fire detection on the center pedestal (hold the button for a few seconds).

Finally set both ADI DH REF windows from their default 200 to -20 to avoid the “minimum” callout during the visual approach we later intend to do.

FMS SETUP & ENTRIES

Hit INIT REF. It will take you to the POS REF page (instead of the PERF INIT) at this time, because the IRSs are not aligned yet. The FMS wants you to enter the current position now – that´s why it shows you the hollow boxes.

Since you probably took a bit of time to get here, it already shows the „ENTER IRS POS“ prompt on the CDU (and the ALIGN lights will flash on the IRS unit itself).

Now enter the current position. Either type it in from an airport chart listing the parking positions or the reference on your parking positions billboard – or be lazy and do a copy and paste job from the GPS position on the next page! To do that hit NEXT PAGE, click on the LSK4L (the fourth one from the top on the left side) next to the GPS position, go back to PREV PAGE and hit the LSK4R next to the hollow boxes. Done.

A quick word on positional accuracy. Most 737´sbak, nowadays have a GPS receiver. It is needed to give a high accuracy position for the EGPWS (enhanced ground proximity warning system) – but the aircraft manuf acturer was smart enough to hook it up and use it for the FMS´s position as well.

So on the 737-300, entering and keeping an accurate IRS position is not as paramount as it used to be. The FMS will always „bias“ it´s position estimation heavily towards the GPS position. If that fails, it would use a „scanning DME“ to tune to DME stations around the aircraft to improve the IRS position. Still accurate enough. If that fails it would resort to checking VOR radials and the localizer is also used to improve accuracy.

When you enter a position, the IXEG IRS will reject your entry if it is too far off of the real position. The real IRS does the same, but only for latitude (it can „feel“ the right latitude during alignment as the earth turns underneath it). The real IRS would accept a wrong longitude, but only after warning you twice because the new position differs from the old one significantly (this can also happen if they tow the aircraft across the whole airport while the IRS is not aligned).

The INIT REF key will keep taking you back to POS REF 1/3 until alignment is complete. We don't want to wait that long, so use the LSK6L next to INDEX and then LSK3L next to PERF to get to the performance page.

Now enter performance data as usual. Refer to tutorial 1 if you have to. Pick 5000 as a cruising altitude. Hit the EXEC key after it lights up when data-entry for that page is completed.

Hit LSK 6R to go to the N1 LIMIT page, enter a TASS of 45degrees (hit 45, then LSK1L).

Go to the TAKEOFF REF page (LSK6R) and enter 1 for the takeoff flap setting (hit 1, then LSK1L). 1 is the preferred takeoff flap setting, it saves fuel and yields improved climb performance. If field length is not limiting (it rarely is) or an obstacle is really close by, use flaps 1.

Finally accept the “QRH” values for V1, VR and V2 by clicking the LSKs (1R,2R,3R) next to them – this transfers the “suggested” values into the right column – so they will show on the speed-tape on the EADI during flight.

Pan over to the airspeed indicator, and set two plastic bugs (move the other ones to the top and out of the way) – one to V1, the second to V2+15. Turn the speed selector on the MCP (mode control panel) to V2.

<pic MASI>

Now we will use the RTE page for the first time to enter takeoff and departure airports and runways. This has the nice effect of showing these runways on the map, which makes navigation a lot easier!

Go to the RTE page by pushing the RTE button on the CDU. Enter EDDM into ORIGIN (LSK1L) and LOWS into DEST (LSK1R). Also enter the runway 26L in the respective field (LSK3L). Your RTE page and EHSI map should look like this:

<pic RTE and EHSI>

Now you hit the DEP/ARR button, and then the LOWS ARR (LSK2R).

Select ILS 16, then click the ROUTE prompt (LSK6R) and then the ACTIVATE prompt (LSK6R) and finally the EXECUTE button (lit) again.

EHSI AND NAV SETUP

Now look at your EHSI map (go to EXP MAP or CTR MAP as needed). If you were really fast then no map is shown yet, in this case look up at the IRS status display to check how many minutes remain to full alignment.

Once the alignment is complete, runway 26L is depicted on the EHSI, along with a „dashed“ white line – this is the extended centerline which makes tracking in- and outbound to a runway much easier.

Now choose the EFIS options of your liking. Possibly display airports and navaids to aid with orientation.

Set NAV 1 to DMS 115.0 (DME located at EDDM) and set NAV2 to SBG 113.8 (the Salzburg VOR located about 10NM north of LOWS).

MCP and MASI (mach-airspeed indicator) setup

Leave the flight-director switches off for this takeoff.

Set the CRS 1 to 220, this is the first track you want to fly on your way to the lake „Ammersee“, so we use it as a reminder. Set the heading bug to runway heading (262), the altitude to 5000 feet and the CRS 2 to 085 (track from „Ammersee“ to „Chiemsee“)

While you fiddle with the instruments, the group of tourists has arrived in a surprisingly good mood and boards the plane. Time to make a cheerful announcement with a bunch of jokes about the weather. Your FO gets the start-up clearance from delivery frequency. The ramp agent confirms the weights, then the entry door slams shut.

FLIGHT OPERATIONS

ENGINE START

Before you start the engines you need to turn on the ANTI COLLISION light.
Cancel the master caution (if lit).
Make sure the parking brake is set (red light lit).
Turn off the PACK on the airconditioning panel.
Verify both ducts having sufficient pressure (>30psi).

Click on the click-spot on the upper edge of the dashboard to get the laminated checklist. Read both the “Preflight” and the “Before start” checklists, to make sure you didn´t forget anything important.

When you are done with that, request pushback from your ground crew – just bump the mouse on the left edge again to get to the GROUND SERVICES menu. Select PUSHBACK option “Nose left”. The “release brakes” starts flashing, so release them (default key V) or mouse-click the brake lever. Watch the pushback from the SHIFT-4 view as the tourists cheer louder than the APU roars...

When the pushback is done (set parking brake flashes) do so. Close the GROUND SERVICES menu.

After receiving the „engines clear“ from the ground crew on the interphone, start engine 2. (Start switch on overhead to GRD). Look at the air bleed panel and watch how the pressure plummets as the start valve opens and air rushes into the starter turbine. At 25%N2 move the start lever to “idle”.

After the starter cuts out (start switch jumps to OFF, duct pressure rises, START VALVE OPEN light off) you can start engine number 1.

After start procedures

Once both engines run stable, do the “AFTER START ITEMS”. Move your arm in a sweeping arc clockwise on the overhead panel:

- Connect BOTH generators to the generator buses.
- Turn on the pitot heat
- Turn on both airconditioning packs
- Turn off the APU bleed
- Switch the FLT/GRD switch to FLT and watch the outflow valve close and cabin altitude go down.
- Turn both engine start switches to CONT. This ensures continuous ignition in case an engine should flame out.
- Switch off the APU
- Your hand falls down to the autobrake, set it to RTO and observe the short selftest - then the disarm light extinguishes. If that fails, check that your thrust levers are idle!
- Move the flap lever (set to 1)
- Set the trim to 4 units

- Turn on the transponder by moving the rightmost knob to AUTO
- Check the flight controls by moving both yoke and rudder to their extreme positions

Now it´s time again to whip out the checklist once again, read the “Before taxi” this time.

TAXI

Once you received your hand signal from the ground agent you ask for taxi clearance. Turn on the taxi light. In lousy weather we also recommend the runway turnoff lights to warn ground vehicles of your presence. If it rains hard, turn on your windshield wipers!

Release the brakes and taxi as instructed to runway 26L. Once the plane starts moving make a left turn with 35% N1 to a heading of about 140. Reduce thrust to about 30% and after a few meters you should come up on the yellow taxiway centerline “O2” that takes you to exit S7 (170).

Turn left after that immediately to join S taxiway.

While you taxi you can already turn on the weather radar´s transmitter by pushing the WXR pushbutton on the EFIS control panel. Set the „tilt“ control on the weather radar system (in between the CDU´s) to +5.

Read the “Taxi” checklist on the yoke.

Keep going until you see the sign leading to B15, turn right to join B15 (just before the de-icing pad) and hold short of runway 26L.

While we wait for our turn to take off, let´s review how the weather radar works. We have gone quite a ways to replicate this behavior correctly.
The weather radar can ONLY display liquid and solid objects. It will not show turbulence or clouds – only the rain they hold and the ground will be reflected. It will barely show snow or ice crystals. Therefore the operation of the weather radar is an art – much like the sonography is for a physician. We utilize the fact that thunderstorms are able to hold enormous amounts of water with their strong updrafts. This water gets shown on the radar. Little water green, more yellow, a lot is red. Unfortunately the ground also shows green/yellow/red depending on the reflectivity of the terrain – you can even detect rivers, lakes and cities with a little practice.
The ground or a heavy thunderstorm will also reflect most of the energy and block the radar beam from passing through. It is impossible to see what kind of weather is behind a mountain range or a strong cell (shadowing).
It is also possible to „overscan“ a thunderstorm when the tilt is too far up. The radar beam will pass through the icy top of the cloud, not reflecting much. Or you „underscan“ by pointing the beam too far down – only reflecting ground.
Therefore you need to utilize „tilt management“. When flying low, point the beam upwards, so it is not reflected by the ground. Not too much, though, otherwise you will „overscan“ distant weather. When flying high, point the beam down. Not too much, or you will only see ground clutter. Point it down, until the upper edge of your map shows the „rastafari“ green-yellow-red ground return band. Watch for cells appear between that and your aircraft.

It takes some practice and patience. The radar beam sweeps slowly, and you need to wait for the next sweep to see the effect of any changes. You can cheat and look at X-Planes local map to see if you are missing any weather.

Takeoff

Enough of the theory – lets go. As you enter the runway:

- Arm the autothrottle
- Turn on your landing lights
- Turn on the strobe lights
- Taxi lights off (they get damaged if they are on during the bumpy takeoff run).

Start the clock (ET to RUN), hit CHR.

Push the TOGA buttons (you have mapped them to your joystick by now, right?)

During the takeoff run you will feel the airplane trying to weather-vane into the right crosswind – counter that with smooth rudder input to the left. There will be no wind displayed on the EHSI until passing about 100 knots.

Do the takeoff, as usual, rotate smoothly to 18 degrees. Disregard the magenta line snaking off to the left, we will see it again when we get to Salzburg.
When passing 2500 feet turn on autopilot „A“. Observe how it defaults to CWS P and CWS R – it simply does not know which modes you want, this is the default.
At 3000 feet gently push on the joystick to get about 10 degrees of pitch, then retract flaps on schedule (up at 190kts) as the plane accelerates. Bank the plane using the yoke to stay on the extended centerline of the runway (the white dashed line on the map).
Move the gear lever to OFF (relieves hydraulic pressure from the gear-up line) and move the autobrake to OFF.

The autopilot will level off at 5000 feet, the autothrottle will engage in MCP SPD mode at that time. Set speed to 220kts by using the knob on the MCP (mode control panel).

Your passengers want to enjoy the view and you want to have some time to spot the occasional crazy Cessna pilot who is challenging this weather in airspace E.

Enroute

Now watch the DME distance to DMS tick up on the left side of the RMI (DME-1).

At 8 NM from DMS turn left to the track of 220. You will use HDG SEL (click the button below the heading knob on the MCP) and a heading of about 224 to fly that track. Due to the wind you can see that heading and the white track line are quite at an angle. The magenta heading line shows which direction your plane is POINTING at – the white track line shows the TRACK that your airplane is making over the ground (drift by the wind). So to fly the planned track, just turn until the white track line point to track 220.

WORKING THE WEATHER RADAR

While we head to the Ammersee and it´s famous monastery-brewery „Kloster Andechs“, we want to spare our guests the worst turbulence and check out the weather radar. Set your EHSI to EXP MAP and the range to 40NM. Work the tilt to experiment. Point it down to -5. Observe the ground returns. Point it up to +10. You see basically no returns (overscanning). Move it down to find the „sweet spot“ at about +2 degrees. Ground returns on the upper edge, good weather returns in between. By the way – if you spot yellow and red weather – those are the big ones!

At about 20 NM from DMS we should be approaching the Ammersee. Use your weather radar to look for it with the ground returns. Reduce range to 20NM and tilt to -1 degrees.

Here is what it should look like, you can see the two small lakes before the big one (green):

Fly right over the lake while telling your passengers how great the beer tastes when sitting in the Biergarten in the sun on top of that hill, but today the benches are empty.

Once over the lake, turn straight to the south (180). Tilt your weather radar to +1 degrees and increase range to 40NM. You get this picture:

The alps are reflecting your radar beam. You can see the entrance to a valley in green right in the middle.

Time to turn to the Chiemsee. Turn left to a track of 085. As you roll out of the turn you should see the famous „Starnberger See“ straight ahead – this is where King Ludwig II, builder of castle „Neuschwanstein“ drowned under unclear circumstances in 1886.

WORKING THE ANTI-ICE

Let´s look at the anti-icing features of the 737-300. Climb to FL120. Turn the MCP altitude to 12000, hit LVL CHG. Turn your altimeter to 1013.2/29.92. Remember, in Europe the transition altitude is usually about 5000 feet above terrain, not 18000 as in the U.S.

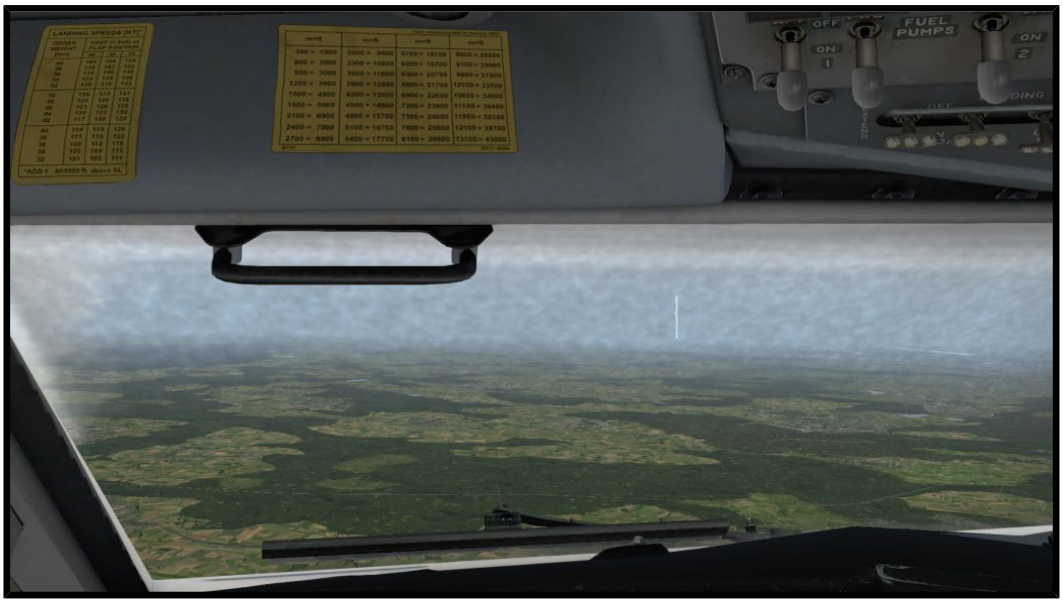
Turn on engine-anti-ice and wing anti-ice.

Look at the TAT. This indicates the „total air temperature“ - it is usually higher than OAT (outside air temperature) since the air gets pushed against the airplane by it´s speed – therefore experiencing compression heat. That´s why jet airplanes are less prone to icing – the greater speed warms the air!

Nevertheless, at about 10000 feet we enter negative TAT´s and moisture (clouds). What kind of effect do these „icing conditions“ have on the aircraft?

Ice will start forming on everything protruding into the airstream. Leading edges, windows, pitot tubes, engine inlets, etc. Some parts are considered more important than others, and those important parts are protected by anti-ice.

Cockpit windows – always heated electrically. Turn off heat and see what happens.



Pitot tubes – always heated electrically. Don´t turn off heat – unreliable airspeed/altitude information would likely make you crash.

Engine icing – always needs to be on whenever in moisture and TAT < +10C. The venturi effect of the engines sucking in air can lead to icing even at TAT´s above 0C. Kind of like the carburetor icing in prop planes. Hot bleed air from the engines is used for anti-icing. Can be turned off once SAT is < -40C (too cold for liquid supercooled water) – unless in a descent.

Wing anti-icing – Used periodically to „shed“ ice that accumulates on the wing´s leading edge. Uses A LOT of bleed air – therefore it turns off automatically on ground to not overheat the leading edges. Also carries a lot of performance penalty, because the engines need to work harder to create enough bleed air for that. X-Plane lacks a visual model for wing icing. You can „visualize“ it by creating a DATA OUTPUT on the screen. Or you just run the wing-anti-ice whenever in clouds with cold temperatures. X-Plane models the effect of wing icing with decreasing lift and increasing drag and you can notice it when the engines need to turn faster to maintain altitude and speed.

PREPARING FOR THE APPROACH INTO SALZBURG

Enough of the mucking around in the clouds. This is a sightseeing flight, so get back down to 5000feet (dial in MCP ALT, hit LVL CHG) – don´t forget to set the altimeters to local pressure (1016 or 30.00) again.

Get ready for the visual approach in Salzburg – a town many of you will know for the famous „The sound of music“ movie or the birthplace of Wolfgang Amadeus Mozart.
If you look at the map, you can see that the airport is just west of the city, with the runway at the entrance of a valley into the alps. We plan to fly to SBG VOR, track towards the airport, and then turn to a right-hand (meaning on the east side) downwind, pass the airport and then turn right to base and right to final for runway 34. While a pattern on the other side would be easier for you, the captain (airport on your side), there is a huge mountain blocking that side.

Use the APPROACH page (click INIT REF) to set the Vref for flaps 40. Click on LSK3R twice to first copy the suggested Vref into the scratchpad, then“set” the VREF, the font becomes big. It should be approximately 120kts.

Set the plastic speed bugs on the MASI´s accordingly (Vref, Vref +15).

The runway might be wet, so we want to be as slow as possible – hence the choice of flaps 40.

Use the orange altitude marker on the altimeter to set the „pattern height“ of 3000 feet (1500AGL). They can´t show “thousands”, so just move them to the 0 (12 o´clock).

We are also running the cabin pressure in STANDBY mode, so set the landing elevation -200 feet in the cabin altitude window now (1200 feet). Observe how the cabin climb/descent indicator dips

down as the cabin alt drives to the new target value.

EGPWS

As we get closer to Salzburg we want to switch over to the terrain display of the EGPWS. The mountains are now a much bigger threat than the occasional rainshower.
Turn on the terrain display by pushing the pushbutton just underneath the CDU (FMS control-display-unit). The EGPWS uses a worldwide terrain elevation database (kind off like the one Ben Supnik uses to bring us the X-Plane scenery) in combination with accurate GPS positional information to depict obstacles and terrain on the map display.

At 27NM inbound to SBG VOR you should spot the Chiemsee ahead.

Turn to fly overhead the island. If you can´t seem to find the lake, just continue with the next step, but your heading to SBG VOR might be different.

Over the Chiemsee and it´s telltale island turn towards the SBG VOR (about heading 065). Map range should be 40NM. You can see the runway and extended centerline on the map – also the mountains are coming into view now.

Descend to 4000 feet.

As you approach the VOR, reduce the map range to the minimum range and turn southbound to intercept the extended centerline of the runway. Initiate the turn (HDG 155) when the range to SBG is about 3NM. Look how the „turn path predictor“ can be used to make a smooth intercept:

VISUAL APPROACH

Descend to 3000 feet pattern altitude. Drop the flaps to 5 and slow to 180kts. Arm the speedbrakes and set the autobrake to 3.

Now is probably a good time to pause the SIM and read ahead – things get very intense on a visual approach, especially without a real second pilot.

Read the “approach checklist” on the yoke.

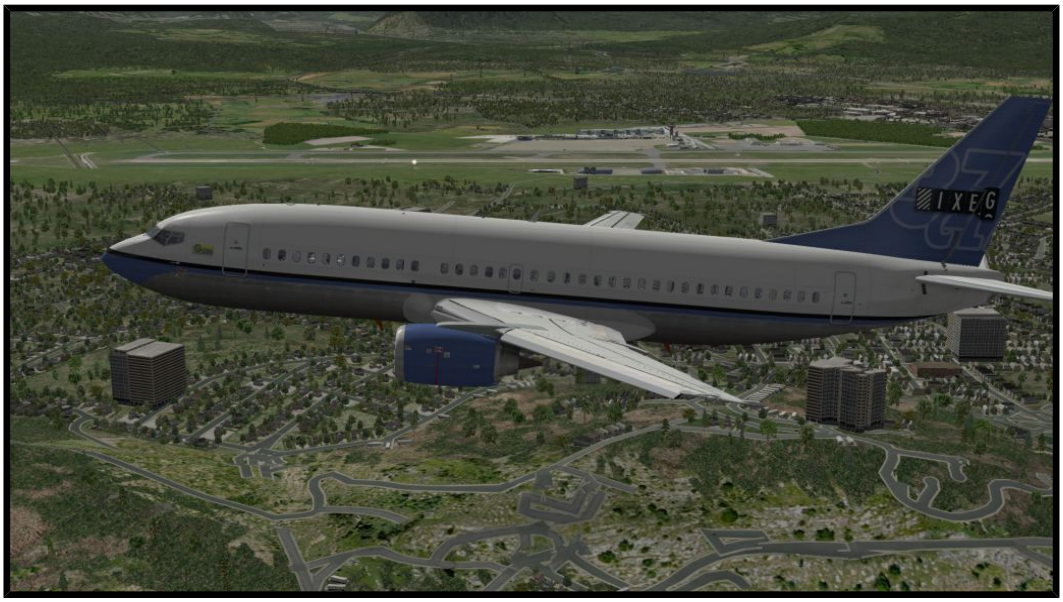
Once you have reviewed the things that will happen soon, unpause and continue.

As soon as you are inbound to the field on the extended centerline at maybe 3NM, break off to the left to a heading of about 075, maintain that for 5 seconds and then turn back to the right to 155. You should be more or less on the downwind track.

Aim to pass the airport at track 160 about 2.5 NM offset from the runway. You can use your map in CTR mode at range 10 for that – the outer ring shows a distance of 5NM – so you want your runway centerline to run between you and that at the halfway point.

Don´t stray out too far – there are mountains close by. You will pass right overhead the famous „Kapuzinerberg“ mountain with the castle on top that is inside the city center. If you have time,

look at the terrain looming on your EHSI in yellow and red. Not much room for error...



Get ready to start the stopwatch (reset the pointer to 0 by pushing the CHR button. Now you will be able to start it with just one push).

Also get ready for manual flight. Disengage the autothrottle speed mode (push SPD on the MCP) and regain thrust lever control (wiggle joystick throttle to show ghost throttles). Move the MCP speed cursor to Vref+5 (ca. 125Kts). Keep flying 180 for a bit longer, though!

When you pass abeam the landing threshhold, start the stopwatch and drop the landing gear, followed by flaps 15 (skip the 10 notch).
You will slow to 150kts gradually. Engine thrust can stay at about 60% N1 throughout this maneuver with a little practice.

When 40 seconds have elapsed, disengage the autopilot, turn right to base heading (ca. 250 deg), start the descent (ca. 500 feet per minute) and extend flaps to 25 in the turn.

On base extend flaps to 40 and turn to final heading (340). The base leg is a very short “wings-level” at best – often you will just keep turning towards final. This depends on the wind component during the base leg, of course.

Look at the map and utilize the turn indicator (segmented snake at the tip of the triangle-airplane position) to help you with turning onto the extended centerline as you can see on the picture below.

The airplane will need about 59%N1 and 1 degree pitch to stabilize on final.

Read the “Final” checklist on the yoke.

If you did everything right, this pic should greet you now:

There is a bit of a crosswind from the left, but nothing major.

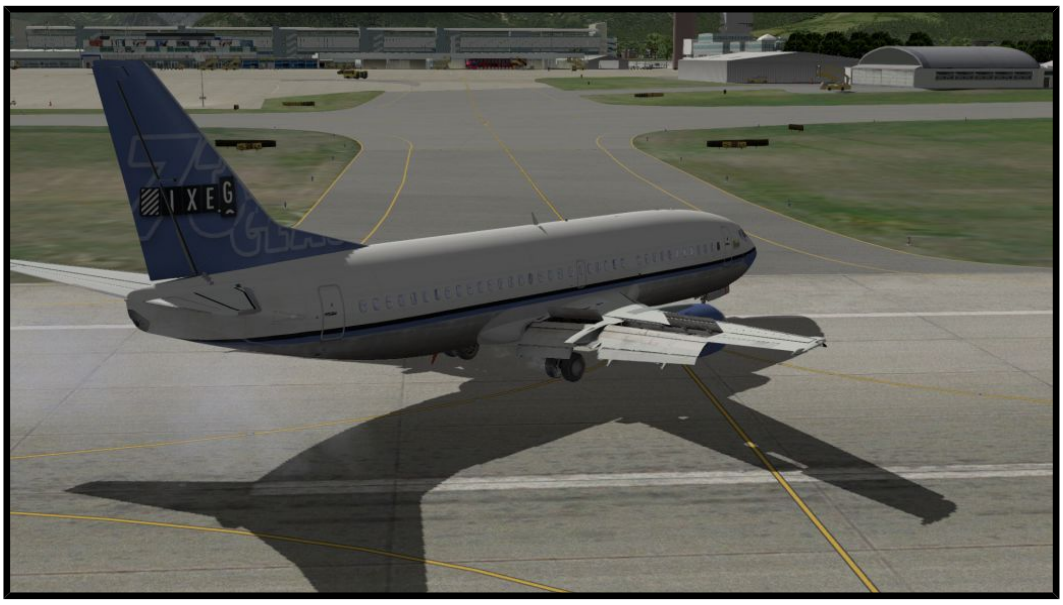
Don´t get frustrated if this doesn´t work out perfectly the first time around. A visual approach is a complex maneuver, and if you aren´t feeling good about the approach, add thrust, raise the flaps to 15, raise the gear and climb straight ahead to 3000 again. Keep trying until satisfied or your fuel runs out.

Here is a bullet-list of things to do after you establish on the centerline in opposite direction at 3000 feet (1500AGL):

- Extend flaps to 5
- Set speed 180
- Arm Speedbrake
- Arm Autobrake (set to 3)
- Stop and reset Stopwatch (pointer straight up)
- Read “Approach” checklist on yoke
- Set MAP to CTR, Range 10NM (smallest setting)
- Break off to the left (turn by 80deg, so heading ca. 75 deg), maintain for 5 sec, then back to 155
- When on downwind heading, check approximate distance from airport (ca. 2.5NM), adjust heading

- Disengage speed mode and regain thrust lever control with joystick
- Set Speed cursor to Vref +5 (ca. 125Kts), but keep flying 170 kts
- Check to the right for “abeam” the threshhold, when abeam start stopwatch
- When abeam, drop landing gear
- Extend flaps to 15 (skip over 10)
- When 40 seconds have elapsed, turn to base (245 deg), start descent (500fpm)
- Extend flaps to 25
- Slow to 140
- Extend flaps to 40
- Turn final, slow to 125
- Read the “Final” checklist

Do the landing, and turn left off the runway at taxiway „C“ towards your parking position. If you can´t make „C“ just turn off at the end and use the parallel taxiway to taxi back.



Use “EXIT 3” to enter the apron, then stick to the right side to get to parking position W1.

After landing

Stop for a second after exiting the runway to get the following done:

- Turn off the landing lights and strobe lights, turn on the taxi light and runway turnoff lights.
- Lower the speedbrake (remember the trick?)
- Move the autobrake switch to OFF
- Raise the flaps.
- Move the FLT/GRD switch to GRD.
- Turn OFF the pitot-heat.
- Turn the ignition off (start switches to OFF).
- Turn off the weather radar system.
- Start the APU.

Parking

Continue taxiing to W1 parking spot.

When approaching the parking position turn of taxi and runway turn-off lights to not blind the ground crew.

Once in position:

- Set the parking brake
- Shut down both engines.
- Turn of the rotating beacon and the transponder.
- Turn off the fasten seat-belt signs.
- Turn on the APU bleed and one pack to give the passengers some fresh air while they get out into the rain...
- Move the pressurization mode controller back to “AUTO”.

Shutdown

Okay, everyone had a great time despite the lousy weather and your landing. Time to head to the hotel, so let´s shut the bird down:

- Turn off the IRS mode selectors.
- Turn off the fuel pumps.
- Turn off the galley power (they have better coffee in Salzburg anyway!).
- Turn off the emergency exit lights (they would drain the battery over night).
- Turn off the window heat.
- Turn off the electrically driven hydraulic pumps (we call them ELEC pumps).
- Turn off the packs and the APU bleed.
- Turn off all external lighting.

Now it´s time to turn off the APU. Just move the switch to off. Immediately the generator disconnects, both generator busses are unpowered and you are back at battery power only.

Before you turn off the battery, make sure to wait 30 seconds for the APU inlet door to close. If you don´t you might have problems getting the APU to start again in the morning!

BATTERY OFF – if you forget that one the battery might deplete over night.