x737 Manual for beginners
Approach and Landing

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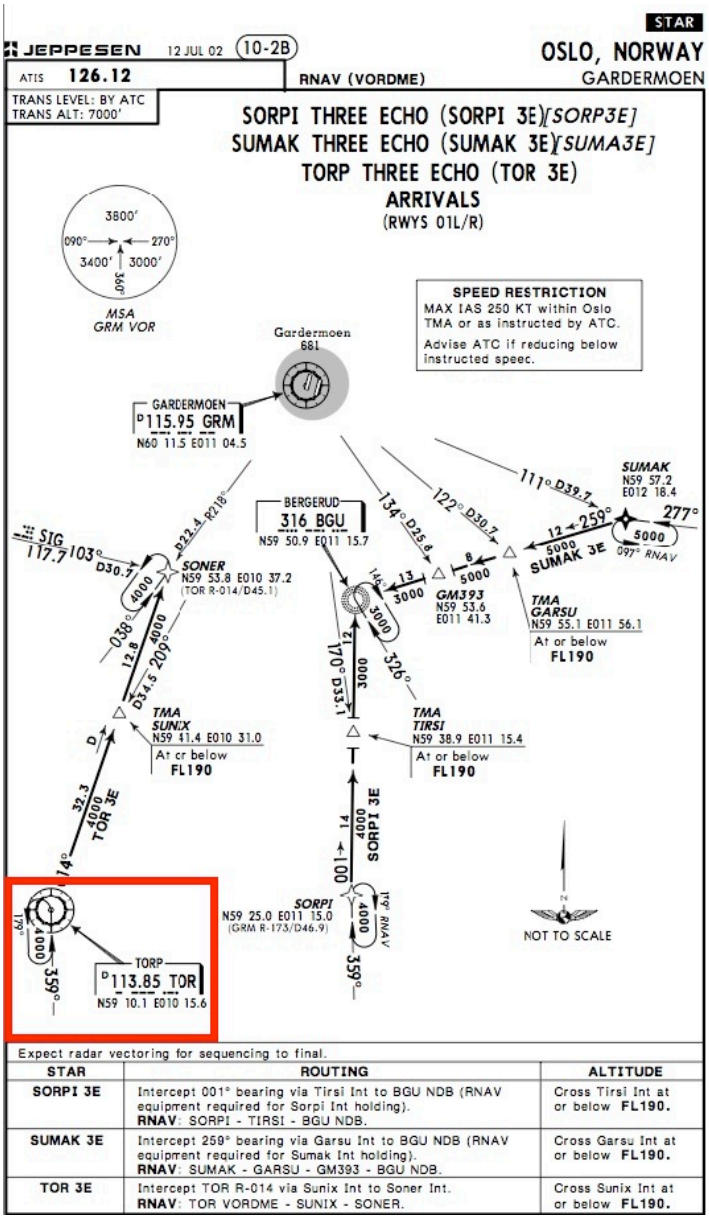
1. Setting up for the tutorial flight

This tutorial is flown from and to ENGM (Gardermoen Oslo, Norway), no flightplan is loaded.

Tank the plane with 4000 kg of fuel and 40 000 lb payload. Take off from ENGM and turn towards the TOR VOR to the south.

The direction to fly is shown by the VOR instrument in the middle of the panel. The skinny arrow points to TOR.

Climb to 35 000 ft (Flight Level 350) and Mach 0.79. Set the NAV 1 radio to 113.85 and the course 1 arrow to 359°.



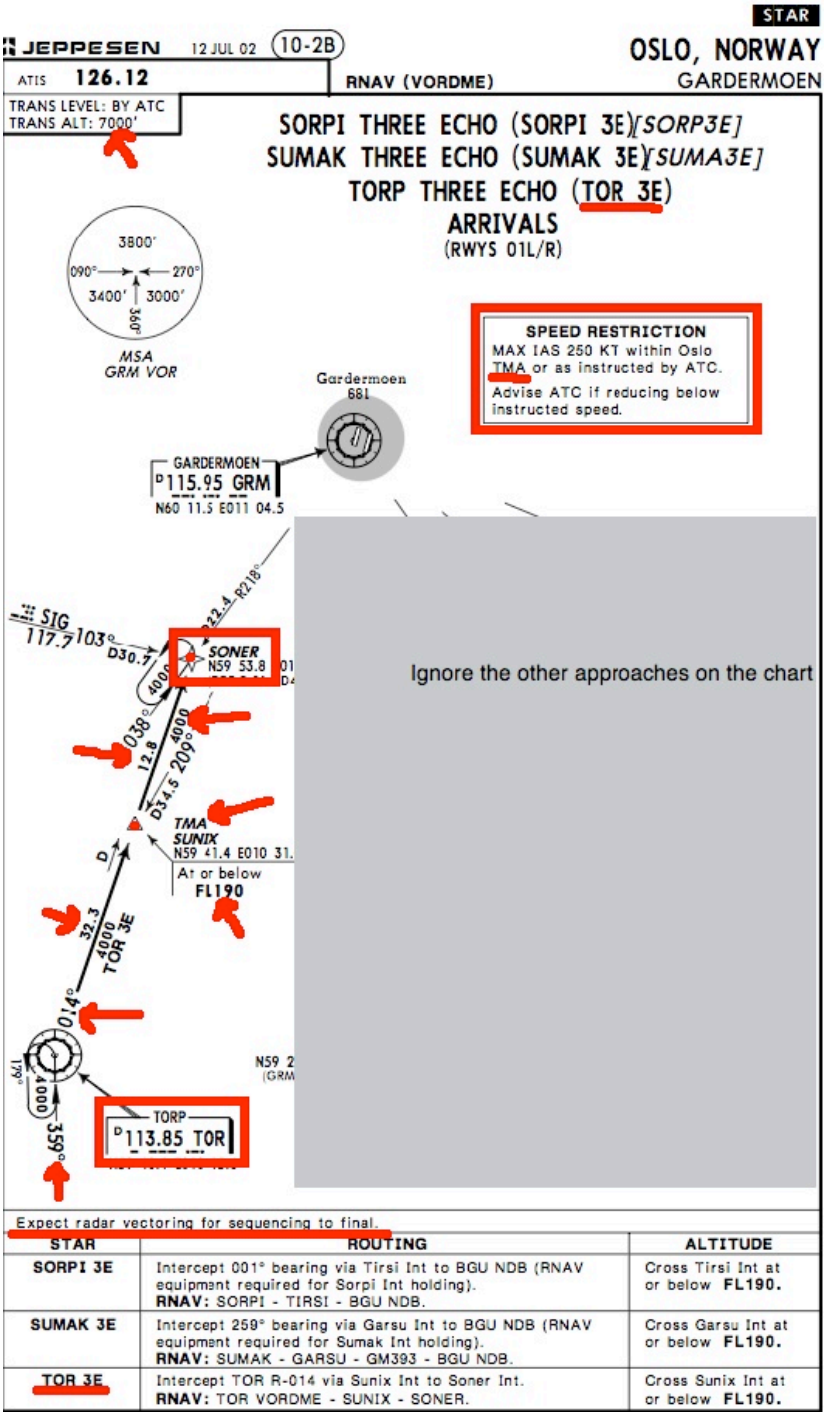
2. Top of Descent / End of Cruise.

Start here if you fly from another airport.

Since the approach and landing phase is a high stress environment it's best to prepare in good time.

Check the approach charts carefully to spot limits and routes and also frequencies for navaids.
Calculate the approximate point where the descent must start to arrive at correct altitude.

Here we use: (Initial FL/10-final FL/10)x3, in numbers: (350/10–3/10)x3=104 nm.
Add 20 nm to the number for margins. We need to be at fix SONER at 4000 ft, that fix is 12,8+32,3 nm from TOR.
Descent should start when TOR DME shows 124–32,3–12,8=79 nm since we approach TOR from the south.

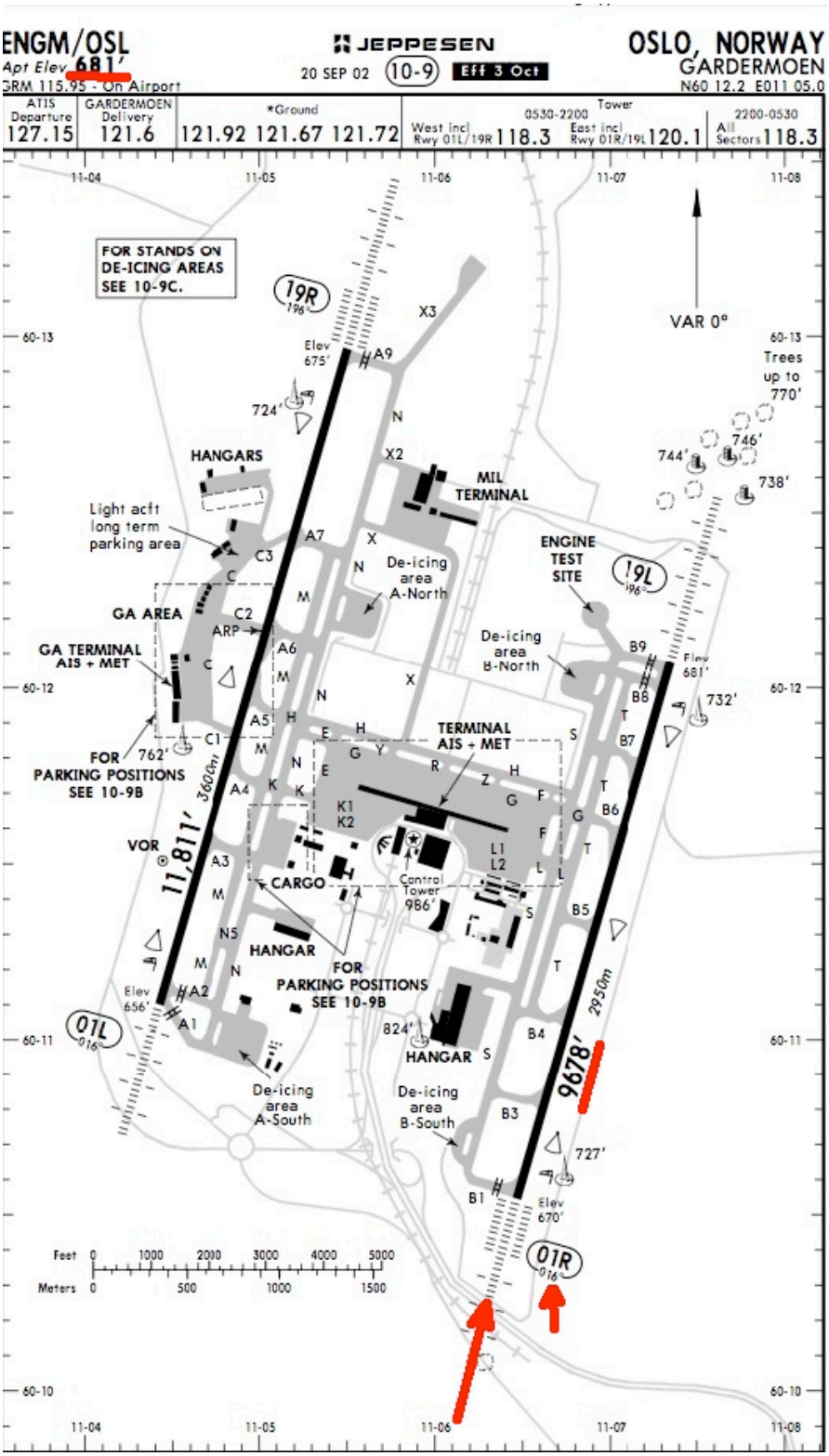


STAR	ROUTING	ALTITUDE
SORPI 3E	Intercept 001° bearing via Tirsi Int to BGU NDB (RNAV equipment required for Sorpi Int holding). **RNAV:** SORPI - TIRSI - BGU NDB.	Cross Tirsi Int at or below **FL190.**
SUMAK 3E	Intercept 259° bearing via Garsu Int to BGU NDB (RNAV equipment required for Sumak Int holding). **RNAV:** SUMAK - GARSU - GM393 - BGU NDB.	Cross Garsu Int at or below **FL190.**
TOR 3E	Intercept TOR R-014 via Sunix Int to Soner Int. **RNAV:** TOR VORDME - SUNIX - SONER.	Cross Sunix Int at or below **FL190.**

At SUNIX (fix not shown in X-Plane) the speed has to be below 250 kt since it's the entrance point of the OSLO radar TMA.

After SONER the aircraft gets radar vectors by ATC to intercept the ILS (not in X-Plane).
4000 ft is the "floor" of this approach since the MSA (minimum safe altitude) is 3400 ft high in our sector as shown by the MSA circle.

Check the weight of the aircraft to find the reference speeds. Here we use 140 000 lb.
Use the spreadsheet and enter the data to get a list of Vrefs.



ENGM wants us to land on RWY01R.

Oslo Gardermoen airport is open all time (H24), and may be used as alternate AD.

PREFERENTIAL RUNWAY SYSTEM

Runways 01R and 19R are preferential runways for landings. Runways 01L and 19L are preferential runways for take-offs. This preference may, when capacity demand requires, be deviated from, preferably by aircraft with noise certification equal to or below 95 PNdB

Descend calculation

Cruise level	350	Start descend	104	nm before target waypoint
Target level	3			

Landing calculations

Landing weight (lbs)	140 000	Landing weight okay!			
Wind direction (deg)	10		Headwind (kts)	5	
Wind force (kts)	5		Crosswind (kts)	0	
Gusts (kts)	3		Headwind gusts (kts)	3	
Runway heading (deg)	10		Crosswind gusts (kts)	0	
Runway length (feet)	9678				
Airport altitude (feet)	681				
Wet or slippery runway? (y/n)	n				
Icing cond. prior landing? (y/n)	n				
Vref Flaps 15*	154	Vref Flaps 30	146	Vref Flaps 40	139
Vmfa Flaps 15*	160	Vmfa Flaps 30	152	Vmfa Flaps 40	145
Corrected Runway Landing Limit Weight (lbs)					
Flaps 15*	182 900 Runway length okay!	Flaps 30	192 500 Runway length okay!	Flaps 40	192 500 Runway length okay!

*=Non normal operations only

Prepare the Flap manoeuvre speed schedule by looking up the table in the main x737 manual.

Flap Maneuvre Speed 800

Flaps	Bug at	Weight	Flaps 0	Flaps 1	Flaps 2	Flaps 5	Flaps 10	Flaps 15	Flaps 25
0	Vref40+70	180	227	207	197	187	187	177	167
1	Vref40+50	170	223	203	193	183	183	173	163
2	Vref40+40	160	218	198	188	178	178	168	158
5	Vref40+30	150	214	194	184	174	174	164	154
10	Vref40+30	140	209	189	179	169	169	159	149
15	Vref40+20	130	203	183	173	163	163	153	143
25	Vref40+10	120	198	178	168	158	158	148	138
		110	192	172	162	152	152	142	132
		100	186	166	156	146	146	136	126
		90	179	159	149	139	139	129	119

Check the weather at ENGM via internet or the excellent Aviation Weather widget for mac. ATIS in X-Plane is unavailable until the destination sector has loaded up. That's often too late for altimeter settings.

Oslo / Gardermoen, NO (ENGM)

METAR ENGM 152241Z VRB01KT 9999 -SN SCT011 BKN018 M08/M09 Q1018 TEMPO BKN012

TAF ENGM 1521/1621 VRB03KT 9999 SCT015 BKN040
TEMPO 1521/1609 3000 -SN BR VV007

For this tutorial set the weather to 5kt wind from 11° and visibility to CAT3, standard air pressure. (The ILS is valid for CAT2 only in reality but CAT3 is used here since X-Plane isn't simulating ILS inaccuracies.) Check that runways are set as clean and dry.

2b. The Flightdeck Inbound setup.

Turn towards TOR once the DME passes 100 nm. Here the skinny arrow is pointing towards TOR while the course arrow is set for the radial (359°) we will intercept. The VOR LOC mode is armed by clicking the button on the MCP. The autopilot continues to fly HDG mode (340°) until the VOR needle moves in close to center. In the picture it moves towards the right.

3. Approach.

The plane has now turned inbound to TOR, HDG mode is automatically OFF and the autopilot flies the radial set in the course window. Preset the next altitude by clicking the knob downwards. Just leave it at 19000, do not click any buttons yet. The Anti Ice panel can be pulled up in preparation since it's not blocking any other controls.

Click LVL CHG to start the descent at 80 to 70 nm DME. Set Autobrake to 2 or 3 and the start switches to CONT. Set Engine Anti-Ice to ON. Prepare for the next turn by setting heading 14° without clicking the HDG button.

Be ready to switch to IAS speed mode when the KIAS nears 280 kt on the speedtape. Click the changeover button and set speed to 280.

Set the altitude target to 4000, not clicking any buttons as before, when the altitude nears 19000. This simulates a clearance from ATC to descend further.

TOR is now visible on the map display. Names of fixes (triangles) show up at zoom levels of 20 or less. The image can be de-cluttered by turning off the display of items as shown here.

4. Flying the STAR

Once the DME to TOR reaches 5 nm click HDG SEL to make the autopliot turn to 14°. The VOR needle gets erratic when close to the transmitter, HDG mode will ensure a smooth flight.

At 12000 ft start slowing to 250 kt or less. Turn on the Landing Lights.

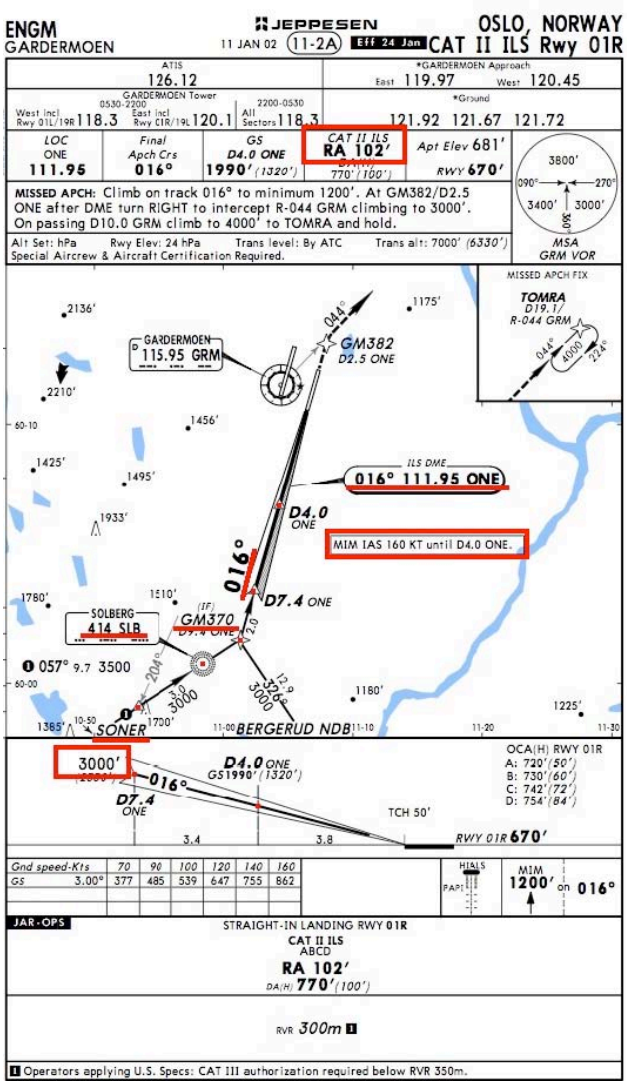
When entering the clouds turn Wing Anti-Ice ON. Keep setting slower speeds down to 200 kt. The TOR DME is now counting upwards since it's behind us.

Once the plane slows to below 200 kt start setting Flaps in increments according to the Vm schedule. Try to arrive at SONER at 180 kt and Flaps 15.

Set Nav 1 radio to the ILS (111.95). Set ADF 1 to 414 SLB, the switch on the instrument sets the needle to show the ADF direction. Set the engine mode to G/A.

5. The ILS

Open the ILS page now to see the detailed procedure.



Speed must be minimum 160 kt until 4 DME on the ILS. 3000 ft is recommended for glideslope intercept. The approach has to be terminated at 102 ft radar altitude if the runway lights cannot be seen at that height.

We will press on to simulate a CAT3 zero visibility capability.

At SONER turn hard right towards SLB by rotating the HDG line until it intersects the NDB symbol on the map display.

Immediately when lined up set 3000 ft in the Altitude window and set a vertical speed of 300 to 350 fpm. A green half circle will show up on the map to show at what point on the map the plane will reach the set altitude. Make the ring cross the SLB by adjusting the rate of descent via the V/S dial.

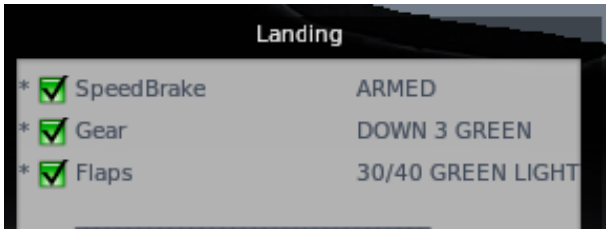
Set the ILS frequency on Nav 2 also now.

Once the ILS Localiser needle activates, click the VOR LOC button to arm the mode. The map is zoomed to 10 nm here.

When the plane turns inbound on the Localiser and the Glideslope needle activates, arm the APP mode. Set speed to 160, drop Gear and set Flaps 25 (one click down from Flaps 15).

When the Glideslope is captured, engage second CMD for dual channel autoland. Set Flaps 30.

Passing DME 4.0 set Vref plus gust speed (139+5=144). Set Flaps 40. Watch the radar altimeter. Flare mode armed automatically.



1000 ft check, Arm speedbrakes (push up on the handle).

6. Landing and Parking

Automatic Flare ensures a smooth touchdown. "Retard" means that throttles must be retarded to Idle speed. Pull them all the way back if you use joystick throttles or use the F1 function key on the keyboard.

Touchdown in the soup. Speedbrakes pop up automatically and wheelbrakes activate once the nosegear is on the ground.

Apply Reverse thrust on touchdown. Always at least Idle power (just open the reversers without moving the throttles).

Stow the reversers at 60 kt. Apply toebrakes lightly and turn off the runway when able.

Stop at the first intersection to get your bearings if the visibility is bad. Use the local map for taxiways if signs are not visible. Do the After landing checklist while taxiing to the gate.

The approach as seen from above

Taxi to Parking and do the Parking checklist

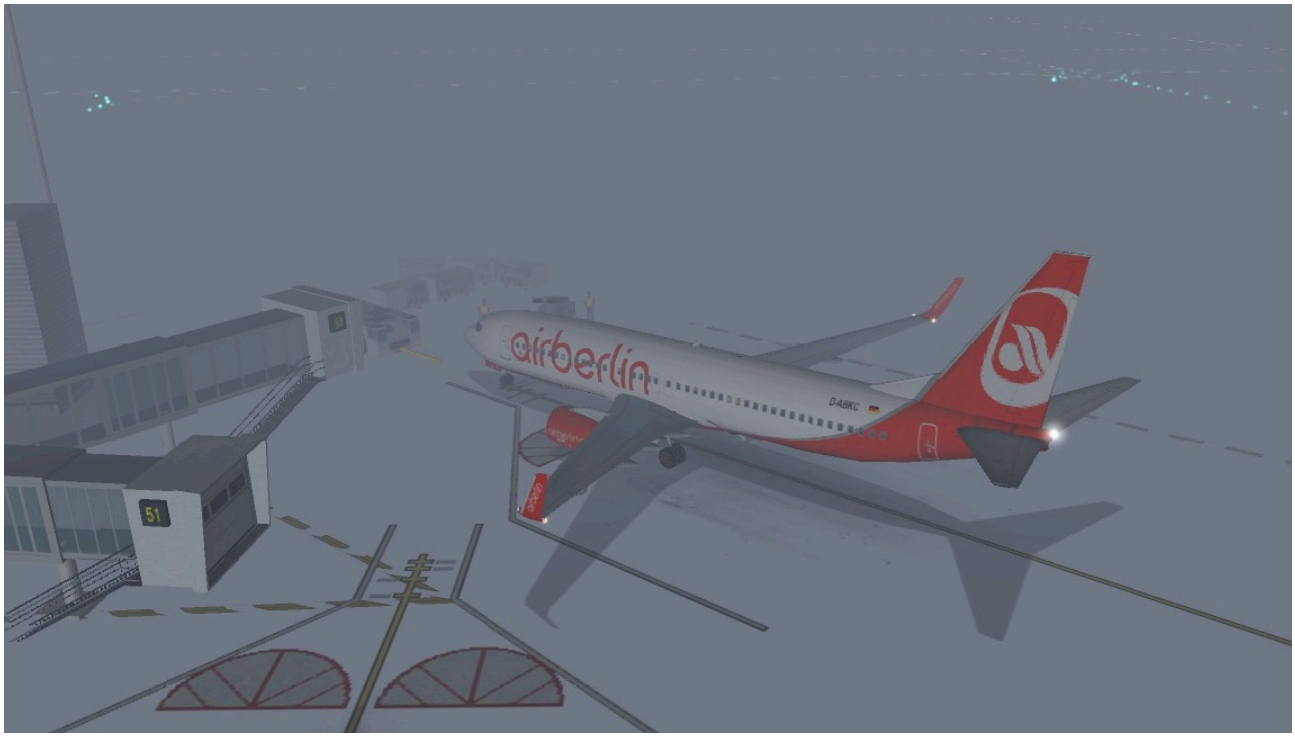
GPU on Busses

Shut down the engines

Park for overnight

Nav/Position lights are usually left on to show that the plane has power connected.

Galley power is also left on to allow cleaning crews to use electricity. It also speeds up the coffee heaters in the morning.



Hope this picture intensive manual can help in operating this jet.

Benedikt & Pierre