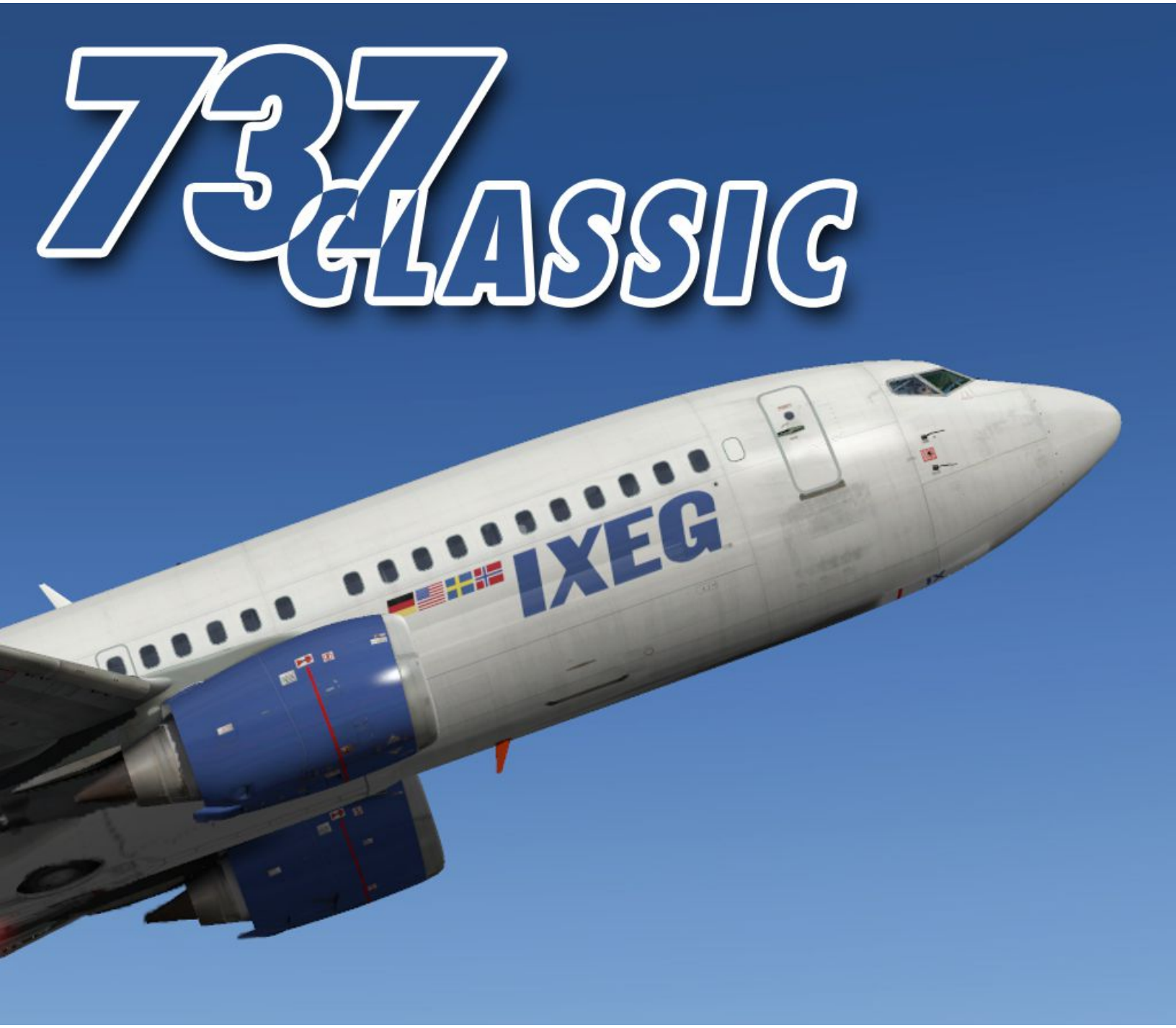
IXEG

international x-plane engineering group

737 CLASSIC



Tutorial Series
Basic Navigation with FMS Assist

RESOURCES

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

http://www.youtube.com

INTRODUCTION

Welcome to your first tutorial flight with IXEG's 737-300 classic aircraft simulation. We have created these tutorial flights to allow you to become familiar with the operation of this aircraft in a gradual manner that is fun and easy. We have created four tutorials for you, with each tutorial flight increasing in complexity of operation. We highly recommend that you repeat the tutorial flights as many times as necessary until you are familiar and comfortable with the concepts introduced in each tutorial.

The IXEG 737 simulation is as comprehensive and thorough as the real aircraft and just as it is for real captains, repetition is key to mastering its operation. Note that it is perfectly fine to pause the simulation frequently during the tutorial if you feel you need to. Also, make sure you are familiar with the custom IXEG menus, commands and cockpit manipulators as outlined in the *IXEG Interface Guide.* Finally, if you are not already familiar with the major components, areas and vocabulary of the cockpit, then you can review those in the pilot operating handbook.

NOTE: In the screenshots you can see the free custom scenery of KLAX by MisterX6.

INSTRUCTOR BRIEFING

This tutorial flight takes place in the state of California in the United States We will fly the 737 manually from the city of San Diego to Los Angeles while using conventional VOR and ILS navigation techniques. Also, through the FMS Control Display Unit *CDU*, we will utilize the flight management system, more commonly called the *FMS*, to calculate some specific operating speeds and thrust settings for us.

In the course of this trip, we will use the auto-throttle to manage engine thrust for some portions of the route, and we will take manual control of the engines for other portions. We will not be using the autopilot during this tutorial so you can expect to be busy hand flying the aircraft during the takeoff, climb-out and approach phases of the flight. The flight time is about 30 minutes.

We will take off from San Diego International airport, turn left to the Oceanside VOR (OCN), roughly heading 320, then from OCN, follow airway V23 to the Seal Beach VOR (SLI) along the OCN 301 radial. From SLI, we will track SLI R-330 towards the MERCE intersection and then

turn left to Los Angeles VOR and finally pick up the ILS to Runway 24R.

PREFLIGHT

FLIGHT SETUP

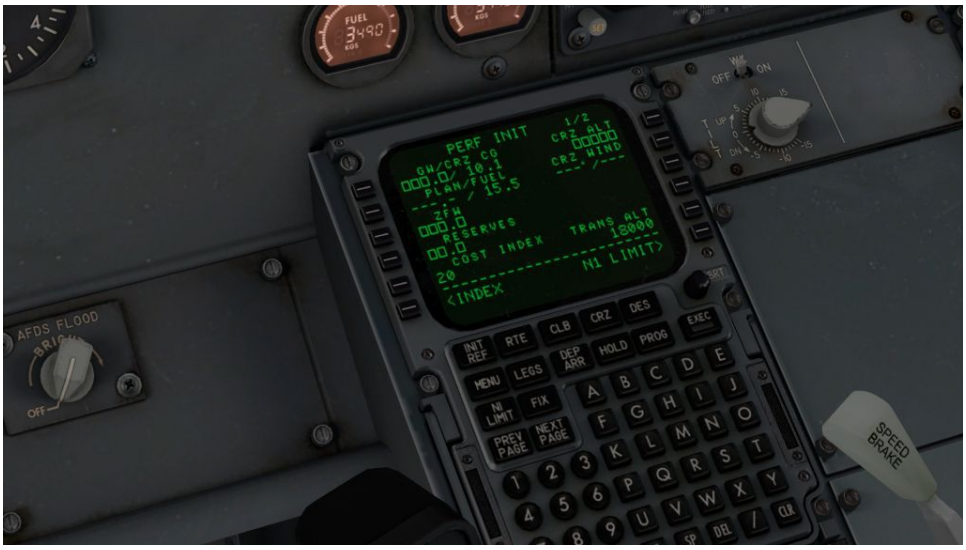
- Load the IXEG 737 Classic
- Locate the 737 at San Diego Airport, KSAN on runway 09. Set the weather to be clear (no clouds, winds, default temperature, sufficient visibility).
- Using the *PREFLIGHT* menu (*bump mouse cursor to the left edge of screen to display the menu*) select the *READY TO FLY* option with the default zero-fuel-weight of 40.000 kg / 88.000 lbs, and total fuel of 7000 kgs / 15.400 lbs in the wing tanks, and no fuel in center tank.
- Click the *Apply Settings* button
- Via the *PREFERENCES* menu, make sure to uncheck *Use 'steam gauge' engine instruments*. We will be using the more modern EIS (Engine Instrument System) equipped variant for this tutorial.
- OPTIONAL: Set up joystick buttons with commands as desired. Consult the IXEG Interface Guide for a list of available commands to use. We recommend the follow commands for this tutorial:
  - *sim/engines/TOGA_power*
  - *ixeg/733/autopilot/AP_disengage*
  - *ixeg/733/flaps/flaps_15*
- Get an aeronautical map of the intended flight area. We recommend using the online site: *www.skyvector.com.* Consult the chart *enroute L-4* and familiarize yourself with the route we intend to fly
- Download the approach chart for KLAX, ILS24R. (Print if desired). You can also enter a flight plan on *www.skyvector.com* to give you a better idea of the routing.

COCKPIT PREPARATIONS

We begin by putting some basic info into the FMS. Before you start punching in numbers though, it is important to set up / confirm your FMS preference setting for *weight units,* either kilograms Open the IXEG *PREFERENCES* menu and set your preferred units with the *Use metric FMC units* option. Be extra careful, if you have it set to pounds but enter your weight in kilograms, then the FMC will assume the aircraft is WAY lighter than it really is, and if you miss this little detail and use the computed speeds, then you will be in for a big surprise when you try to take off!

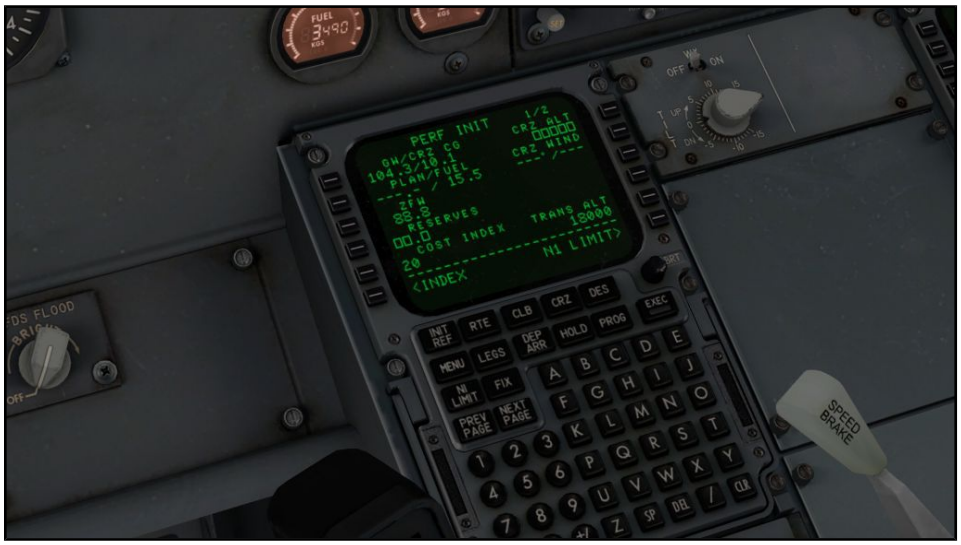
On the CDU

- Hit the *INIT REF* key on the CDU, This will take you to the PERF INIT page.

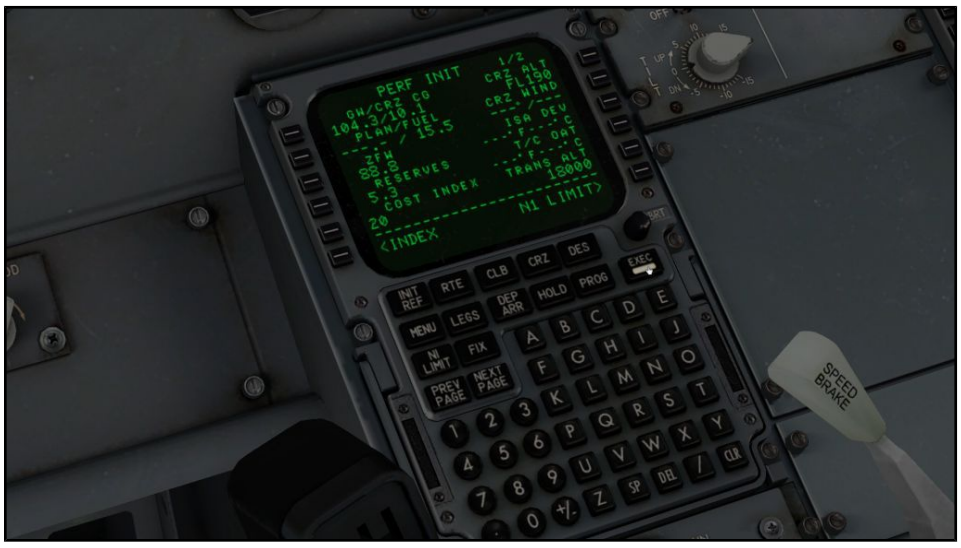


Perf Init Page on the CDU

Enter the airplane zero-fuel-weight (ZFW) underneath the 'ZFW' label. You can find the this weight in the *IXEG GROUND SERVICES* menu if you have forgotten. Type in the weight value via the CDU keys. Use either 40.0 for kg or 88.8 for lbs (unit entry is in thousands). The FMS will automatically calculate the GROSS weight for you since it knows how much fuel is on board. The *PERF INIT* page should now look as shown below (unless you use kgs):

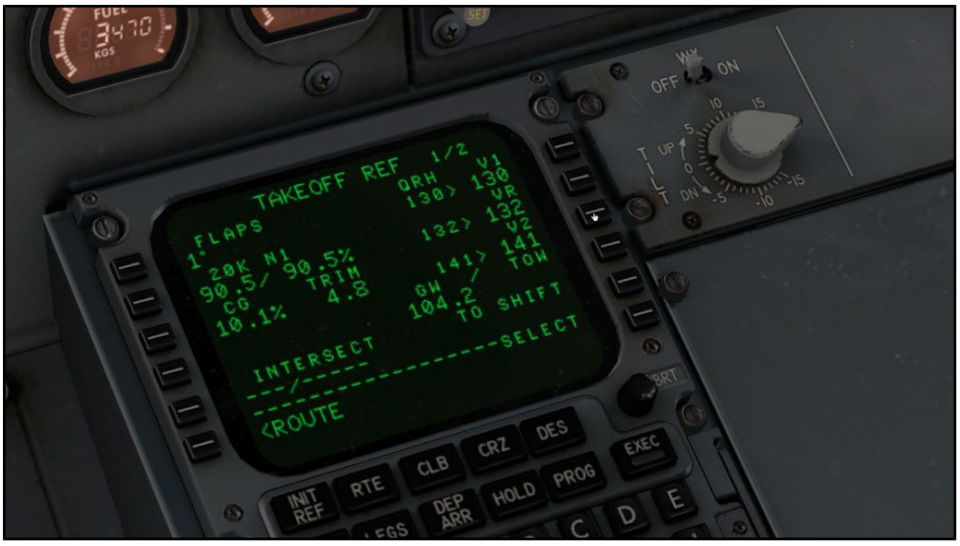


Enter the *RESERVES* fuel value in thousands of kg or lbs. Typical flights use about 2400 kg or 5300 lbs, so enter either 2.4 or 5.3. NOTE: If the FMS calculates that your estimated fuel at arrival is below the "reserves" amount it will display a *USING RESERVE FUEL* warning.

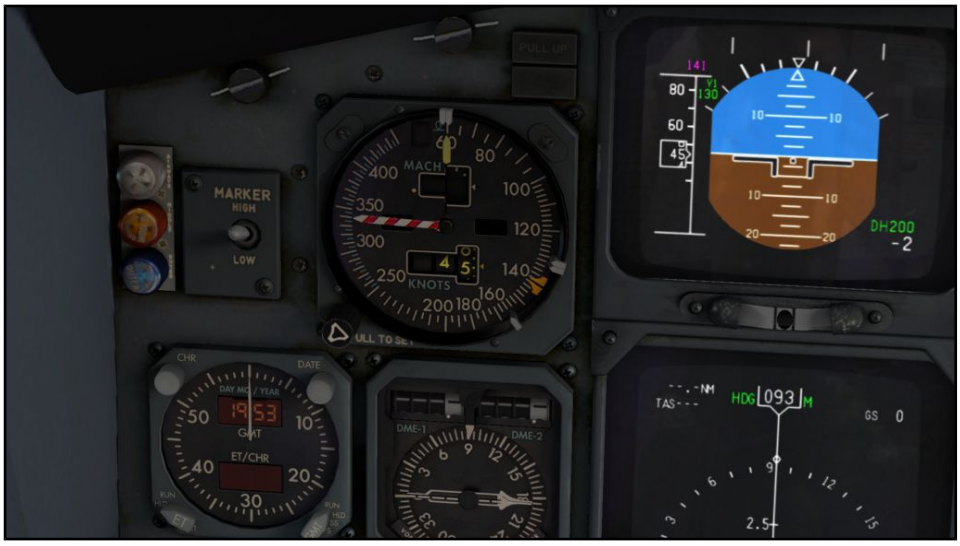


Enter the intended flight altitude of FL190. Enter either *19000* or *190* - the FMS will auto-correct the entry dependent on the transition altitude setting. When done, the FMS will have all data needed to start computing performance values. Press the EXECute key (lit) to confirm your entry.

Step to the N1 limit page using the bottom right LSK (line-select-key), alternatively you can press the CDU button that says *N1 LIMIT*. For this flight we want to use full power on takeoff, so do not change anything on this page and continue to the next page by pressing the bottom right LSK again to go to the *TAKEOFF REF* page. We will use the flap configuration, *flaps 1* for takeoff today so go ahead and overwrite the default value of *5* by pressing the 1 key on the CDU and then pressing the top left LSK next to the number 5. Observe how the takeoff speeds will change to a higher value. Click on the LSKs adjacent to each speed. This step tells the FMS to *accept (use)* the speeds calculated by the FMS and these values will now be displayed on the EADI speed-tape during take-off. Of course you could also enter different speeds manually using the CDU keypad if you like. We will trust the FMS calculations today!



Now look at the airspeed indicator. Move the little plastic bugs until one is at the *V1 speed*, one at *Vr speed* and one at the *V2 speed* +15kts (see CDU screen again). In this example it would be 130, 132 and 156. (14+15=156). Look up and to the right at the MCP (mode control panel) and adjust the *IAS/MACH* cursor to *V2* (141) using the adjacent knob. Now your speeds for takeoff are all calculated and all your visual cues and references are set.



Speed Bug Setup

1. Radio / Navaid Setup:

   a) We want to track Oceanside VOR first, so tune the VHF NAV 1 radio to 115.3, and in preparation for tracking the Seal Beach VOR after Oceanside, also tune the VHF NAV 2 to 115.7.

   b) On the MCP, set the *COURSE 1* value (it´s on the very left side) to 320, as this is the expected first heading to Oceanside. Set *COURSE 2* (very right side) to 300, which is the expected inbound course to Seal Beach from Oceanside.

2. EHSI (electronic horizontal situation indicator) configuration setup.

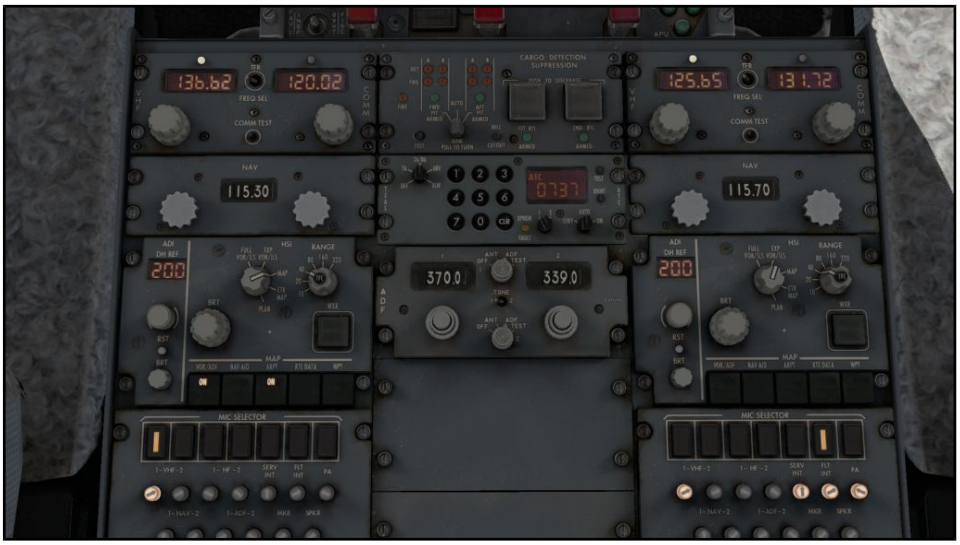
   a) Set the pilot side EHSI mode knob to *MAP* mode (left side of center pedestal)

   b) Set EHSI map range knob to *40 NM*

   c) Enable the navaid and airport symbols to show on the EHSI by pressing the corresponding buttons *VOR/ADF* and *ARPT* on the EHSI control panel.

   d) Set the copilot side EHSI map mode to *EXP-VOR/ILS.*

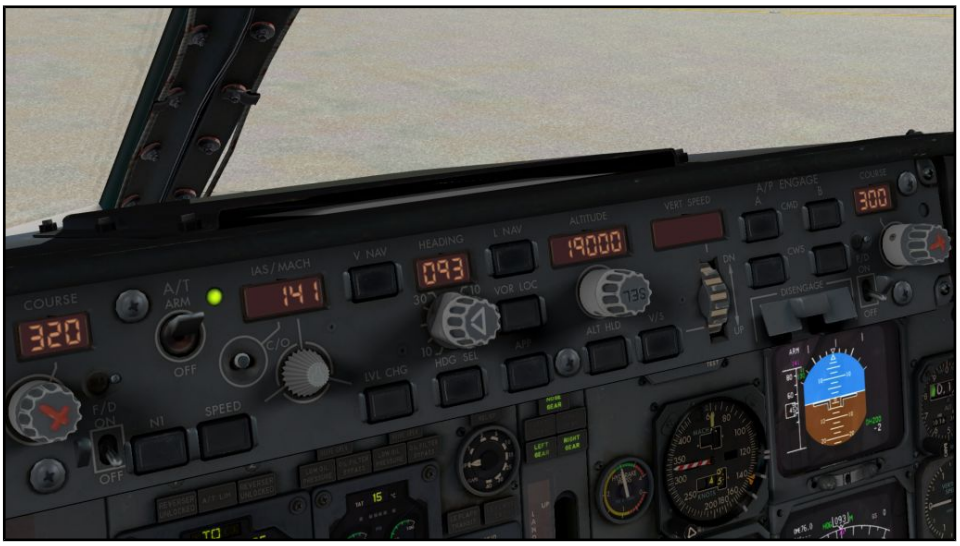
   See illustration next page for what your pedestal configuration should look like now.



Center Pedestal Configuration

3. MCP configuration setup.

   a) Adjust the EHSI heading bug (dashed magenta line) using the *HEADING* knob until it points straight up on the EHSI. Turn the *ALTITUDE* knob until it shows 19000. Arm the auto throttle system by moving the *A/T* switch up to the *ARM* position. The MCP should be configured as shown below.



MCP Configuration

4. Pressure Controller Setup:

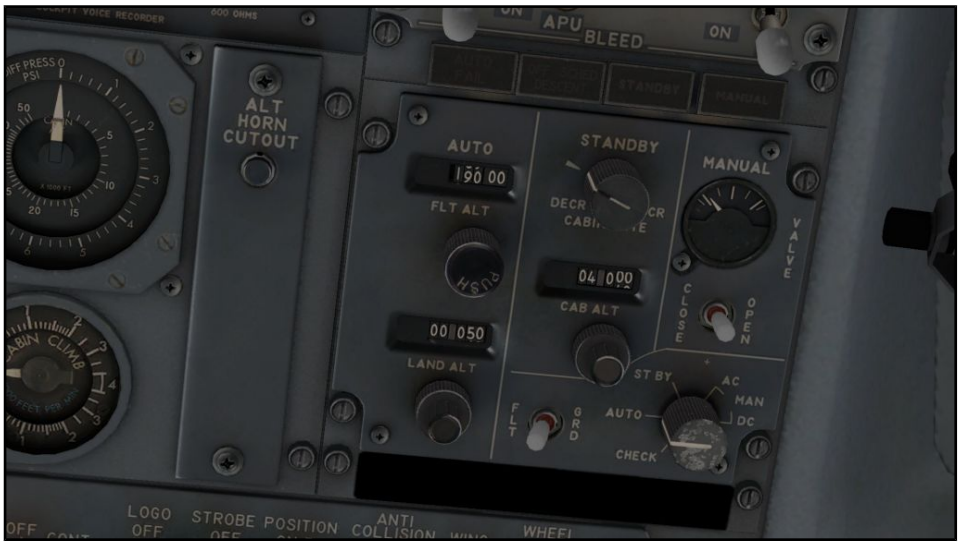
   a) Set the flight altitude on the pressure controller to 19000. Use the knob on the overhead panel labeled, *FLT ALT.* This allows the pressurization system to manage the

cabin altitude properly.

b) Set the landing altitude, *LAND ALT,* to 50' since KLAX is just barley above sea level.

c) Set the *FLT/GRD* switch to FLT (if it is not there already). This commands the cabin pressure controller to start pressurizing the cabin.

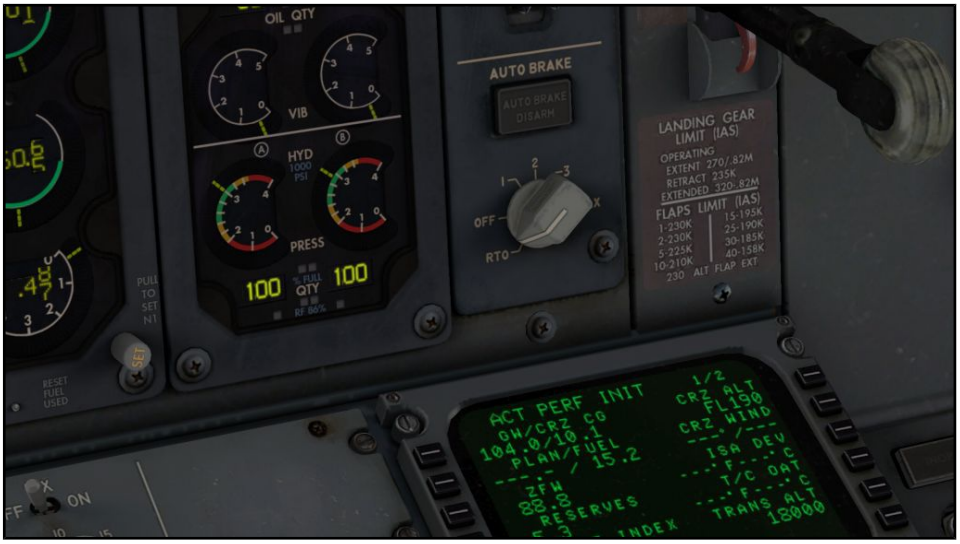
The pressure control panel should be configured as shown below.



Pressure Control Panel Configuration

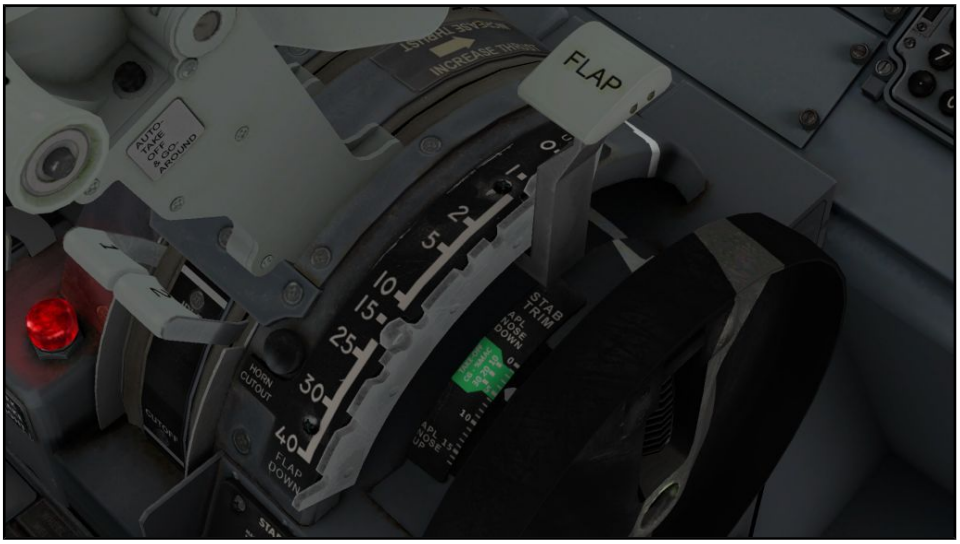
5. Miscellaneous Controls Setup, Flaps, auto-brake, trim, lighting:

   a) Turn the *AUTO BRAKE* knob to the *RTO* position (this only works with engine power set at idle). The auto-brake annunciator will illuminate briefly during a short system self-test and will then extinguish when the auto-brake is ready to go.



   b) Move the flap lever to 1 (*flaps 1*)

   c) Set the elevator trim aft until it is at about 4 units.



   d) For maximum realism, turn on the inboard landing lights via switches at the left front of the overhead panel and also turn on the strobe lights using the light switches on the right front of the overhead panel. Time to get going now!

FLIGHT OPERATIONS

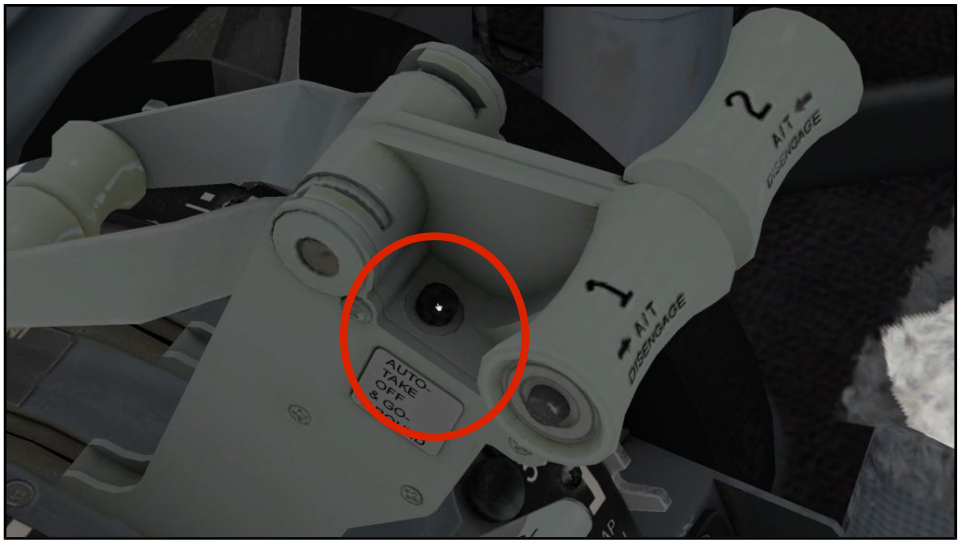
We recommend that you read the following sections at least once beforehand and make sure you understand what you are supposed to do. Things will move quickly and your actions must be timely during the simulation, certainly much faster than it will seem as you read through this tutorial. You are more than welcome to pause the sim anytime you have to of course.

TAKEOFF

Start the stopwatch and elapsed time (ET) on the chronometer. Do this by setting the knob labeled *ET* to *RUN* and pressing the *CHR* button.

Release the parking brake, either by tapping your hardware brake pedals if you have then, or by manipulating the brake handle with the mouse or by using a keyboard shortcut. (*V* key by default). An extinguished red brake light is confirmation that the parking brake is off. You might start rolling forward too!

Advance the thrust levers until the engines achieve @ 40% N1 and then push the *Take off & Go Around* (TOGA) buttons on top of the the thrust levers (or via IXEG custom commands). Do not confuse the TOGA buttons with the *AUTOTHROTTLE DISCONNECT* buttons. Once engaged properly, you will observe the auto-throttle system automatically advance the levers to full takeoff power. If you hear a warning horn as the throttles advance, then you have forgotten a crucial step (either flaps, trim, or parking brake). If this happens, disengage the auto-throttle (button on side of thrust levers), regain control of thrust levers with joystick-throttle, retard thrust lever to idle and check your takeoff configuration to see what you missed.



Take Off Go Around Buttons

If no warning sound goes off and all you hear are the engines revving up, then you are good to continue with the takeoff! Since your joystick throttles cannot move by themselves, you should move your joystick throttles all the way forward manually to match the simulated throttle position. When you move your joystick throttles while in auto-throttle mode, you will see IXEGs *ghost throttle indicator*. You can read about this indicator in the IXEG Interface Guide if you haven't already. Take note that the "rejected takeoff" mode will be triggered if you pull the thrust to idle with your joystick, hence our suggestion to move your throttles forward just to be safe.

You should move your joystick throttles quickly though, because above 84kts the auto-throttle system will enter *throttle hold mode* and in this mode, the ghost throttle system can “attach” to the thrust levers if they align and this will revert to manual control of the throttles and you could accidentally have too much or too little power depending on where your joystick throttle position is set. This is no problem of course. If this happens, you simply continue with the takeoff and set the take-off thrust manually by adjusting the throttles to achieve the takeoff (TO) N1% shown at the top of the EIS). Most likely, you will notice this type of accidental reversion to manual throttle control when the engine N1 is higher than the takeoff N1. (i.e. 93% instead of 90.5%).

At *Vr* (132 kts), begin the rotation and after liftoff, target 20 degrees for the initial pitch angle. Try to increase pitch around 3 deg per second! (6 -7 seconds from rotation to initial climb pitch.)

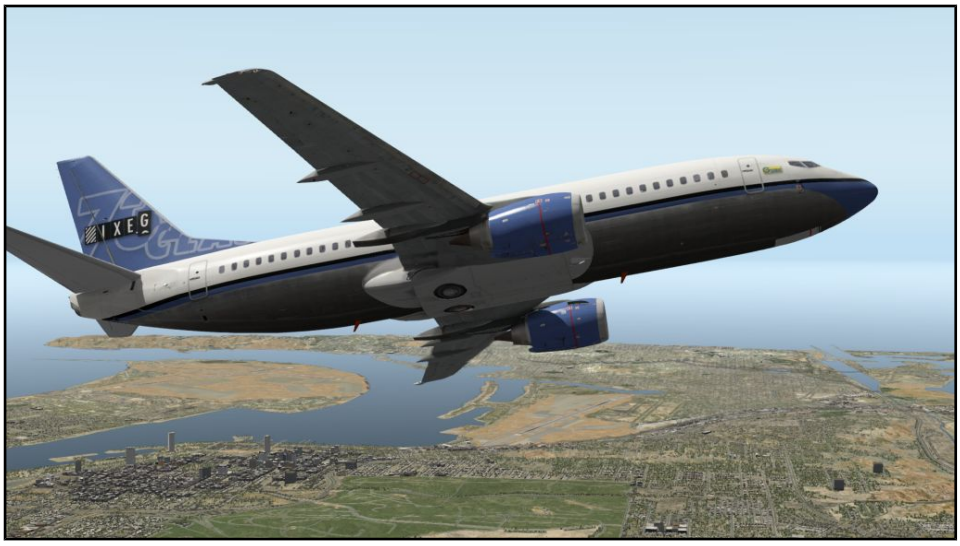
After you are airborne, verify positive climb, raise the gear and try to climb with the speed just above the top plastic speed bug. (approximately *V2* + 20). Note that the plastic speed bug sits at *V2* + 15 (156kts), which is called the *takeoff maneuvering speed.* Above this speed, you can safely bank up to 30 degrees, but between it and *V2* you may only bank up to 15 degrees. This additional maneuvering capability is the reason we want to fly a bit faster than the takeoff maneuvering speed.

After stabilizing at your target climb pitch angle, then trim the aircraft as desired. Note that with the flaps extended, the trim system adjusts the trim surfaces significantly faster than when the flaps are retracted. At about. 1500´AAL, the auto-throttle system will reduce the power to *climb thrust*. One way to verify this thrust mode change is by observing the *N1 mode* indicator symbol appearing in the top left corner of your EADI. Next, lower the nose to about 10 degrees of pitch and start accelerating towards 250kts. It´s always a good practice to set the speed cursor on the MCP to your current target speed as your targets change, so adjust that to 250kts.

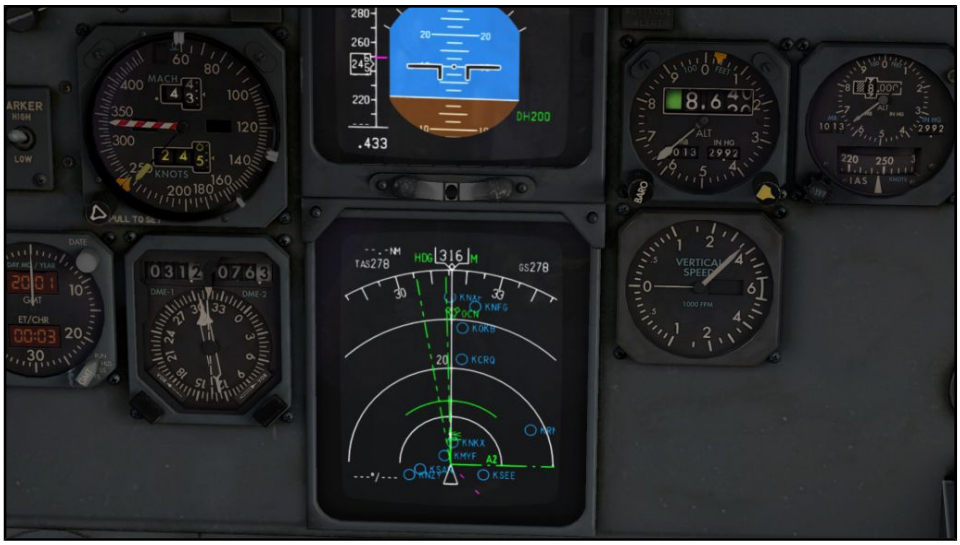
At 190 kias, set the flaps to zero, commonly called, *'flaps up'*. Continue to keep your pitch attitude at 10 deg. The plane will essentially fly itself to the 250 knots you want at this pitch angle and climb power.

After the flaps are fully retracted, start your left turn towards the Oceanside VOR. Look at your EHSI and identify the green line labeled V1 (VOR 1). It should point straight towards Oceanside VOR. Alternatively, use at the RMI or select a larger range on your map and you will find a bright green VOR symbol showing the location of Oceanside VOR. Make your left turn with 25 deg of

bank until tracking inbound towards Oceanside. The heading should be roughly 315 degrees.



Turning left towards Oceanside VOR



Green VOR (V1) indicating line on EHSI

CLIMB

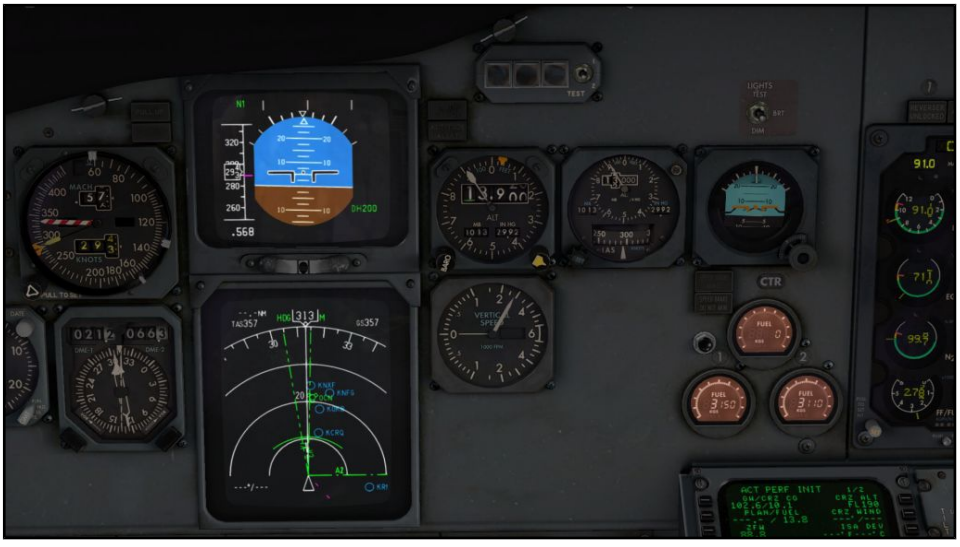
Around the time you are inbound towards Oceanside VOR, you should be approaching 10,000 feet. As you pass through the 10,000', the 250 knot speed restriction is lifted and its now time to accelerate. First, move the speed cursor on the MCP to 290 knots as the next target speed. In addition to setting your speed targets on the MCP, you should also make it a habit to set the heading bug and altitude selector, also according to your current targets. These displays will serve as a valuable reminder and reference when manual flying as we are doing now.

Next, lower the nose to 5 degrees of pitch and observe the aircraft accelerate towards 290 knots. Also note that the auto-throttle continues to maintain climb power as you climb higher and faster. As you approach 290 knots, adjust the aircraft pitch as necessary to maintain 290 knots.

Once the aircraft is climbing nice and stable, move the gear lever to the *OFF* position. This relieves hydraulic pressure from the gear-up line. Turn the auto-brake to *OFF* and turn off the landing lights.

Again, trim the aircraft as needed during the climb. You will find that you only need to toggle the trim switches for a fraction of a second at these higher speeds. If you find that using the trim switch seems to be too much for small adjustments, then we offer you this tip from a seasoned 737 pilot that loves to fly the 737 manually, even at cruising speeds: *Use the trim wheel manually with your hand! (mouse manipulator actually)*

We highly recommend setting up good camera view presets for flying manually with instruments since you will be scanning the instruments a lot. We recommend you set up the view similar to that shown below, and then save this view it to your key of choice. We use the *numpad*-1 key, so for example, we can always jump back to this view by pressing the *numpad-1* key. You can refer to the X-Plane documentation for how to save preset views to keyboard keys.

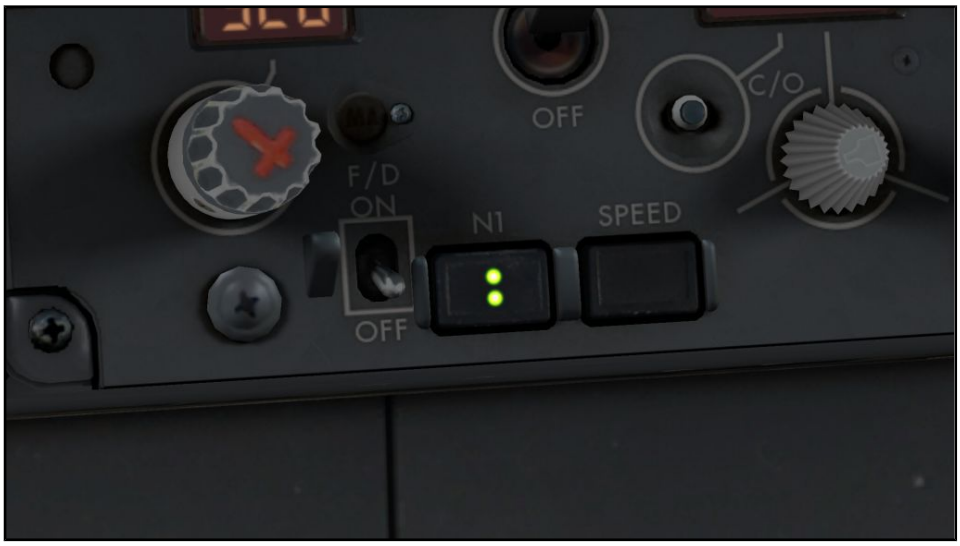


While you climb, you might also notice a green arc moving on the EHSI map. This arc is a prediction of where you are going to reach the selected altitude dialed into the MCP given your current speed and rate of climb. If this line is before OCR for example, then we will be leveling off before making our turn to SLI.

LEVEL-OFF

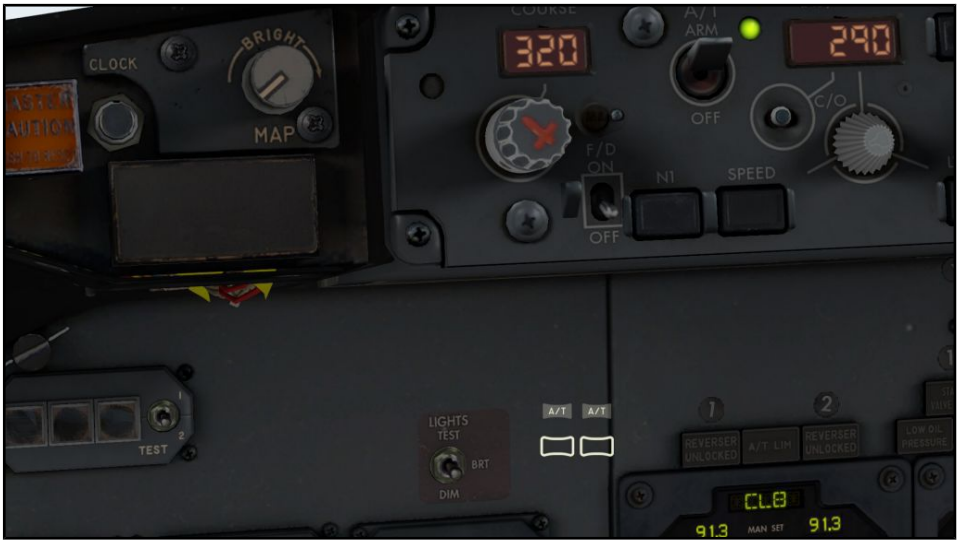
Shortly before reaching the Oceanside VOR, you should also be getting close to the next target altitude of FL190. You need to take manual control of the thrust for level off, so press the *N1* button on the MCP to disengage the auto-throttle .

> A design philosophy you may find interesting on this 737 is, that if a button on the MCP is illuminated, then that mode can be disengaged by pushing the illuminated button. So for example, pressing the *SPEED* or *N1* buttons will disengage the auto-throttle and put it in *ARM* mode. In *ARM* mode, the auto-throttle is not doing anything, but it is ready to spring into action should the need arise.



Illuminated N1 button on MCP`

When the auto-throttle is disengaged, it is likely that your joystick throttle position does not match the throttle position in the simulation. Wiggle your joystick throttles to bring up the *ghost throttle indicator* onscreen (*see illustration below*) and align your joystick throttle with the simulator throttle position. Once aligned, you will have control of the throttles with your joystick throttle again.

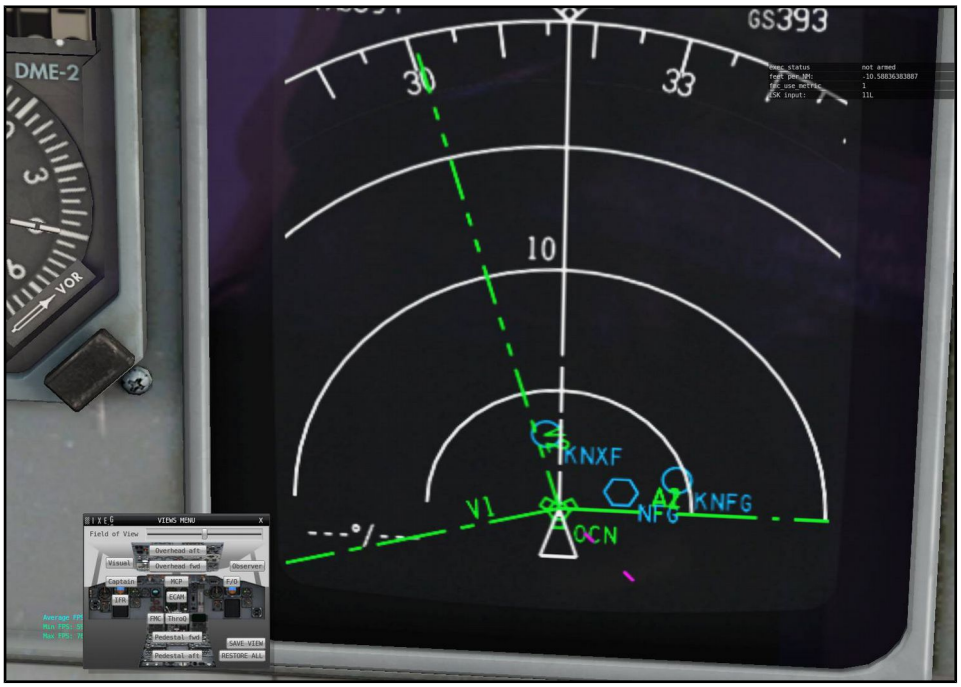


Ghost Throttle Indicator

Pitch the nose down as you approach the target altitude, level off and adjust the throttles to maintain 290kts. You should need about 75% N1 and 1 deg nose-up pitch in this condition. After level off, we begin the cruise phase.

CRUISE

After you pass over OCN VOR, immediately turn left towards SLI (Seal Beach). The approximate heading is 300 degrees. Now because we tuned NAV2 to SLI in advance during preflight, you should see the green VOR indicator line, *V2,* pointing towards SLI. If you do not see the green line, then you are not yet close/high enough to the VOR to pick up the station signal. In this case, fly.....until you do pick up the signal and see the green line for V2. When you do, follow the green line to SLI!



VOR line tuned to SLI

We are well into our cruise phase now and it is time to relax for a whole minute or two before we have to descend for landing. At this point in the tutorial, we recommend that you pause the simulation in order to go over some preparation items for landing unless you have already read through the tutorial and know what to do next. If you choose to pause, we will let you know when its time to un-pause.

You can enjoy the view of the Pacific ocean to the left with the coastline down below or maybe order a coffee while you read ahead!

DESCENT AND APPROACH PREPARATION

First, make note of the distance to SLI on the DME-2. It should show about 40 NM. You can go ahead and tune NAV 1 to the ILS for runway 24R in LAX, which is 108.50 Mhz. Also, set the *COURSE* on the MCP to the inbound course for runway 24R, which is 251.

Next, we plan the descent and prepare for the approach. We will need about 57 NM to get down from our 19,000 altitude. The approach plate tells us that its 20NM from SLI to MERCE and then to touchdown. This means we want to start the descent at 37NM before reaching SLI, which is pretty much NOW!

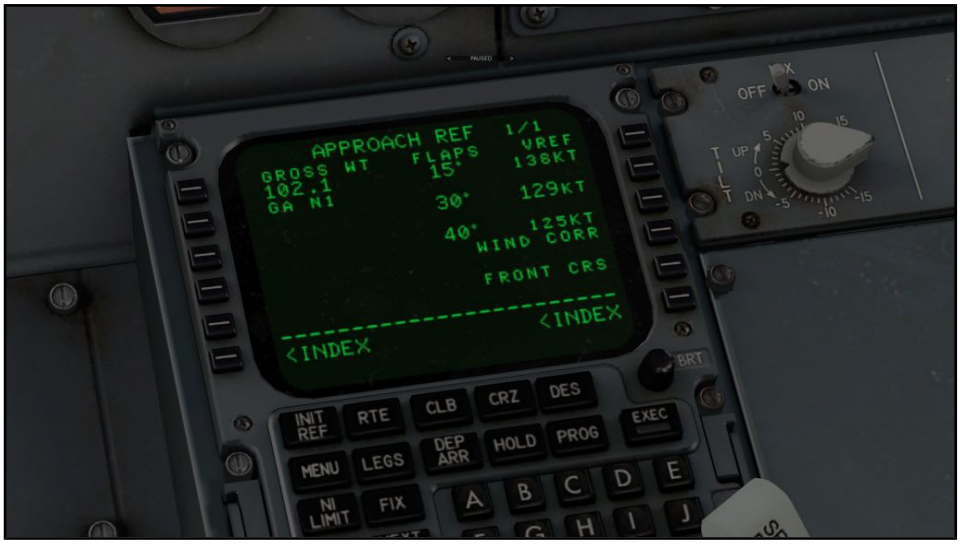
Turn the altitude selector on the MCP to the next target altitude of 4000´. Even then we are not using the autopilot on this flight, this step will prevent the *altitude alerter* from going off. The altitude alerter is that pleasant C-chord tone accompanied by the blinking *ALTITUDE ALERT* light.

A rule of thumb for roughly calculating the descent can be done by multiplying the route distance to the runway (or thereabouts) by 3.3. This result gives you the height above the landing field that you want to be at to make the runway. So at 60 NM out for example, you want to be at about FL200. Next you need to adjust this calculation to account for several factors such as weight (usually heavier weights need more distance to glide down), wind (tailwind needs more distance), descent speed (slower speeds need more distance).

Proper descent planning is 40% science, 40% experience and 20% luck, and few things are more satisfying than pulling the thrust levers to idle at FL370 and arriving at your final descent point with flaps 5 and 180kts without ever having to use the speed-brake or needing to add thrust prematurely. This is the challenge!

Set the MCP speed cursor to 275 knots as the reference airspeed during the descent, also turn on the landing lights again.

Click on the *INIT REF* button on the CDU again to access the *APPROACH* page. (see illustration next page) Select the Vref speed for *flaps 30* by clicking on the LSK (Line Select Key) next to the speed that is calculated for *flaps 30*. This will copy the value to the scratchpad at the bottom of the CDU display. Then click that same LSK again to write overwrite the default speed. Note that small characters denote values that are calculate by the FMS and large characters denote values that are manually entered by the crew. If does not matter if the values are the same as is this case. If you are successful the characters will simply change from small to big. This step will cause a little green *R* symbol to appear on the EHSI speed tape at the *flaps 30* Vref speed, which is very handy as a quick reference later during the approach.



Approach page on FMC CDU

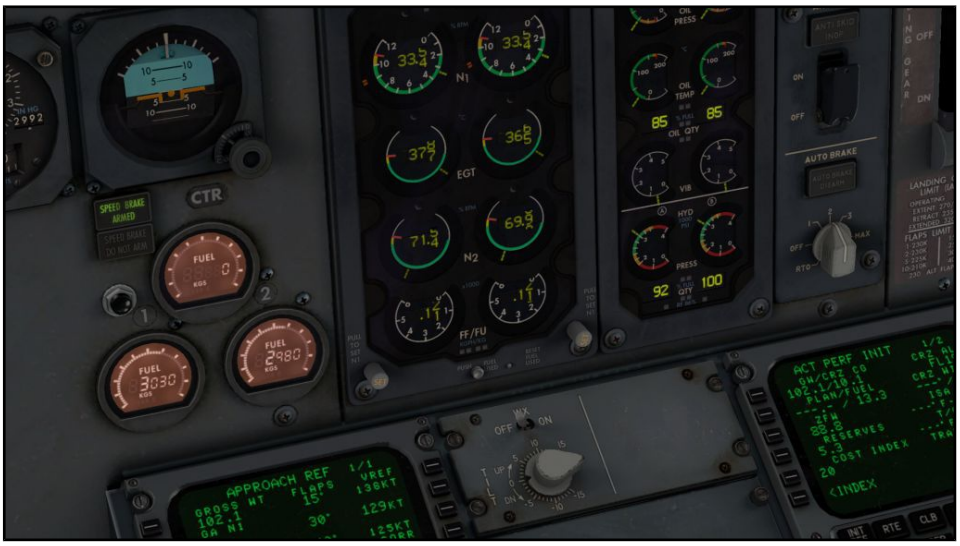
Next, move one little plastic speed bug on the round airspeed indicator to the *flaps 30* Vref value (129 knots in the illustration above) and move another plastic speed bug to the *flaps 30* Vref + 15 knots (144 knots) value. By doing this, we now have two references for the *flaps 30* Vref speed since some pilots prefer to look at this round dial-instrument for speed control, and others prefer the EADI´s speed tape. By having references in both locations, we can use either handily.

Arm the auto-brake by setting it to *2*. Now it is time to descend! Un-pause X-plane and lets get going.

DESCENT

Recall that we need to begin our descent at 39 miles from SLI, so when the distance to SLI as seen on DME-1 indicates 39 NM, then retard the throttle slowly towards idle and start the descent with 275 kias. Aim for a target pitch angle of about -2 degrees.

Arm the speed-brake by "grabbing" it with the mouse cursor, and SLOWLY moving it just a few degrees aft, until the *SPEED BRAKE ARMED* annunciator illuminates. This annunciator is just below the standby artificial horizon. Take care not to move the lever too far aft or the speed-brakes will actually deploy (the aircraft will start shaking slightly!). When the *SPEED BRAKE ARMED* is illuminated, you are good to go.



Speed Brake Armed Light

As you descend through 10,000 feet, the 250 knot speed restriction will take effect so go ahead and dial the MCP speed cursor to 250 knots before you pass through 10,000 feet. As you pass 10,000, then slow to 250 knots by adjusting your pitch angle as needed since your throttles are already at idle. Continue towards SLI.

Turn the MCP heading selector to 330 degrees. This will be your target reference heading to follow when passing over SLI. When you cross over SLI, you should be at 6000 feet or lower . If you are still too high, then use the speed-brakes, set to their flight detent until 4000´ and then retract the speed-brakes. Do not forget to move the speed-brake lever back to the *ARMED* position though. (Remember to watch the annunciator!).

After crossing SLI, then turn right to a heading of 330. Adjust the speed cursor to 180 knots in preparation for the impending slow-down and level off at 4000 feet.

INITIAL APPROACH

When you reach 4000 feet, maintain that altitude and let the aircraft slow to 180 knots. When decelerating through 210 knots along the way though, extend the flaps to *flaps* 1, then when you decelerate further through 190 knots, extend flaps to *flaps 5* (skip *flaps 2*). This sequence will happen relatively quickly.

Now is a good time for a quick word on flap positions and limiting speeds: Every unique flap setting: 1, 2, 5, 10, etc. has both a maximum and a minimum limit speed. The maximum limit speed we call the *flap placard speed* and the minimum limit speed we call the *flap maneuvering speed*. For example, *flaps 5* has a placard speed of 225 knots and a maneuvering speed of 170 knots.

During the flap extension phase, you want to fly as slow as possible before extending the flaps to the next position. This avoids unnecessary aerodynamic stress on the flap mechanisms. In general, you want to extend to the next flap position just before you reach the maneuvering speed of the current flap setting. Unfortunately, you will have to memorize the maneuvering speeds for each flap position. You can find these values in the pilot handbook. There is good news though. The flap placard speeds are listed underneath the gear lever so you do not have to memorize these!

There is a visual aid on the EADI's speed tape that shows the flap placard limits. The placard speed for the current configuration is represented by the bottom of the black and red striped tape. The placard speed for the **next flap setting** of flaps is represented by the bottom of the hollow yellow bar. As an example, the illustration on the following page shows the aircraft at *flaps 5*. Placard speed for this flap setting is 225. The next flap step is *flaps 10,* which has a placard speed of 210. In general, you want your speed to be "*slower than the yellow bar*" before extending the next step of flaps.

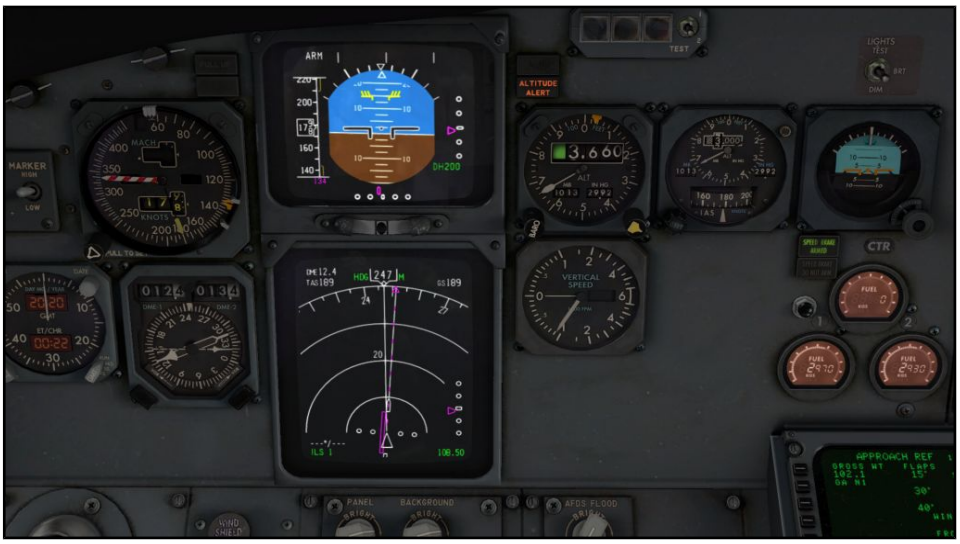
Below is the normal flap extension schedule for approach:

- At 210 knots: Select *flaps 1*.
- At 190 knots: Select *flaps 5* (skip *flaps 2*, it is a holdover from the -200 turbojet days).
- At 170 knots: Extend landing gear, select *flaps 15* (*flaps 10* is only used in some single-engine scenarios).
- At 150 knots: Select flaps 25
- At 140 knots: Select *flaps 30* or *flaps 40* (dependent on your chosen landing flap setting)

For level flight at 4000 feet with flaps 5 you can expect to need about 60%N1 and 7 deg pitch up. Remember that trim is much more sensitive now that the flaps are extended because it the trim actuator is running faster with flaps extended.

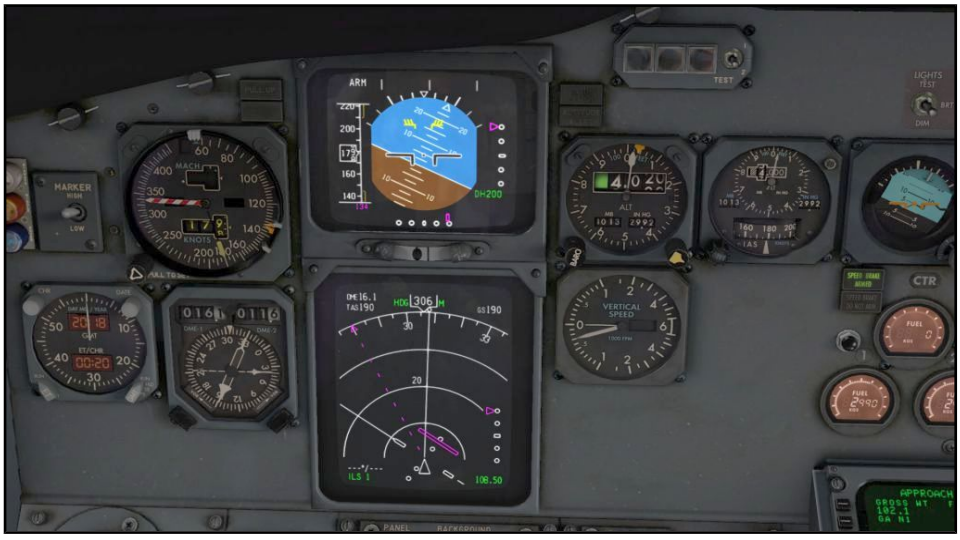
If things are moving too fast, then you can pause the sim for the next step, which is to change the map mode to a mode suitable for the approach. The knob for this is on the center pedestal so you will have to move the camera and *look down* to turn the knob and change the mode. If you feel you can do this quickly and get the camera back to the instruments, then by all means feel free to do so.

So go ahead and turn the map mode knob to *EXP VOR/ILS* on the EFIS control panel. Adjust the MCP heading bug to 280 deg and adjust the speed cursor to 134kts, which will be our final approach speed. If you paused the sim a moment ago, then now is the time to un-pause as we begin the final approach.



FINAL APPROACH

When the distance from SLI gets to be somewhere around 11.5 NM as indicated on *DME-2*, then turn left to our target heading of 280deg.



11.6 NM to SLI on DME-2

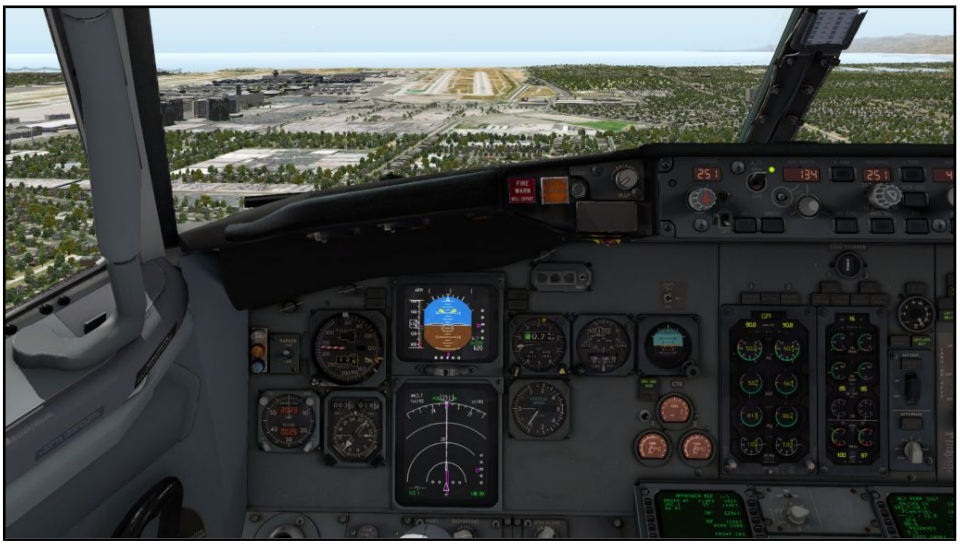
At this point, we are on an intercept course for the ILS24R localizer. Watch the localizer and glideslope indicators move towards their center marks on the EHSI. Remember that the inbound course for ILS24R is 251 degrees so turn the heading bug to 251 and then turn left to intercept the localizer. Turn and pitch as necessary to *fly the needles* as we like to say in the business. Keep both the localizer and glideslope needles centered as best you can.

As you descend, you will hear that pleasant altitude deviation alert and the *ALTITUDE ALERT* annunciator will flash as you start your final descent, because we have strayed off of the altitude we set on the MCP altitude window. You can ignore it as it will reset after our altitude deviation exceeds 750feet. Alternatively, once you are more than 300 feet away from the current setting, you can silence/reset it by changing the selected altitude slightly. Continue to descend on the localizer and glideslope at about 180 knots until the radar altimeter indicates 2300 feet above ground level (AGL). Expect about 40% N1 power during this phase.

Here is a little trick for calculating the rate of descent (in fpm) necessary to stay on a 3 degree glideslope! Look at the GS (ground speed) in the top right corner of the EHSI and multiply that value by 10, then divide by 2 (or multiply by 5 if you like). This will yield the necessary fpm descent rate to maintain a 3 degree descent. For example, a GS of 180 knots requires a 900 feet per minute descent to stay on the glideslope.

At *2500 RA* (radar altitude) pull the throttles to idle, extend the landing gear, and set flaps to *flaps 15* (skip over flaps 10!). Be prepared for the ballooning effect from increasing lift as the flaps extend and counter this effect with more forward yoke so as to maintain your rate of descent, at least 700 fpm. Do not use nose down trim to counter the ballooning effect because the airplane is slowing quickly and the pressure on the yoke will relax again quickly.

At 150 knots, set *flaps 25*, then at 145 knots, set *flaps 30* . This sequence happens in rapid succession and *flaps 30* will be the flap configuration we use for landing today. Now run through the "Final" checklist printed on the yoke if you want to.



Note that you need about 52% N1 on final approach in order to maintain our target approach speed. Also, the thrust levers must be all the way aft at idle power during touchdown or the speed brakes (if armed) will not deploy and the auto-brakes will not engage. Both these systems require that the throttle levers be fully aft upon touchdown.

LANDING AND ROLLOUT

Landings are the most consistent if you aim to always arrive over the threshold with the same conditions every time. Altitude should be 50 feet. Speed should be *Vref* +5. Sink rate should be 700 fpm. Obviously this is not always possible but it is rather a nominal target. Speeds will vary with winds of course. Sink rate will also vary with weight (as will the *Vref* speeds) and each unique case requires you to moderate the ***break*** accordingly also.

> What is the "break"? The idea behind the break is to avoid flaring the aircraft. Flaring leads to a long float times and wastes valuable runway length. The break is done at about 10-20 feet and is a rapid, short nose-up input that will ***break*** your sink rate from 700 fpm to maybe 200 fpm. The break is also when you chop the power to idle before touch down.
>
> If executed perfectly, the ground effect will help reduce the sink rate a bit further and you will have a smooth touch down at about 100-150 fpm. More important than an ultra smooth touch down though is the location of the touch down since runways do not go on forever! Aim to touch down right AT the 1000 foot distance markers (the fat white stripes).

Do NOT cross the runway threshold below 50feet. Do NOT dive for the runway once past the threshold, let the aircraft settle itself onto the runway. DO scold yourself for every foot you touch down beyond the 1000' markers. If it was easy, everybody would be doing it!

After touchdown, and if you had everything set correctly, the speed brakes should deploy automatically. You will know if it does because you can hear the electric servo motor move the speed brake lever full aft for you. In the real aircraft, pilots are taught to manually deploy the speed brakes on touchdown just in case the automatic system fails. Ground spoilers are THE single most important item to help you slow down safely on a slippery runway.

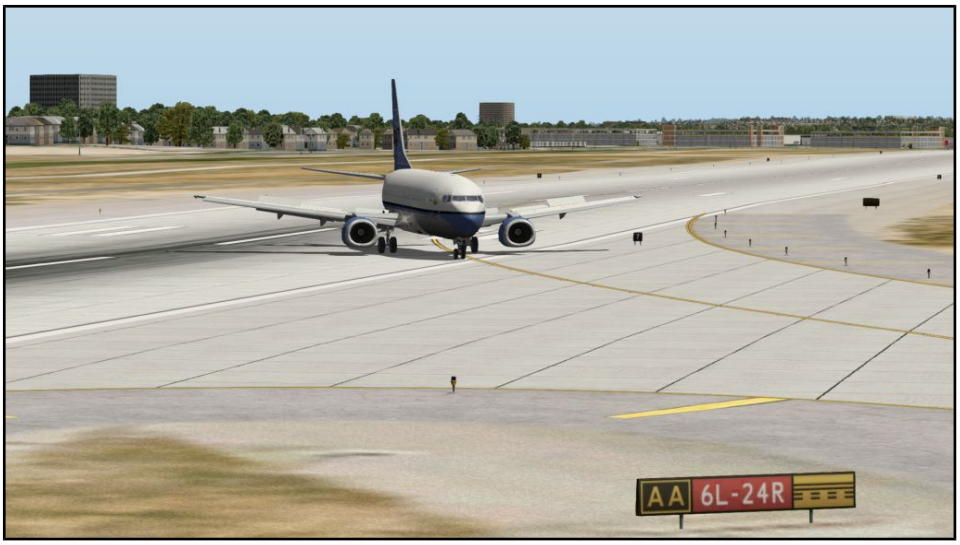
Immediately after touch down, take note of the auto-brake status and if the auto-brake system does not engage for some reason, then apply the brakes manually. You can confirm engagement of the auto-brake system by observing that the *AUTOBRAKE DISARM* annunciator does NOT illuminate. Also the plane will be decelerating appreciably.

You should apply reverse thrust too as the nose wheel touches down. You do not always need full reverse thrust (it uses lots of fuel) so unless the runway is really short and you must use it, just apply idle reverse thrust. For this tutorial, idle reverse thrust plus the auto-brake system should decelerate you adequately so you can exit at taxiway AA. Note that if you apply the brakes manually (even a tap) or add any forward thrust again (go-around feature!) then the auto-brake system will automatically disarm. In such a case, you can verify system disengagement by observing that the *AUTOBRAKE DISARM* annunciator DOES illuminate.

As you turn off the runway, stow the spoilers.

There are two ways to stow the spoilers. One way is to move the thrust levers forward past 40% of lever travel. This will cause the speed brake servo to move the speed brake lever to DOWN and stow the spoilers as the plane thinks you are wanting to take off. The other way is to simply move the speed brake lever to the *DOWN* detent by hand, which is the preferred way since the other way tends to burn fuel unnecessarily and airline companies like to minimize every cost!

After turnoff, you may taxi to the apron if you want. Turn off the landing lights after exiting the runway, turn on the taxi light and move the *FLT/GRD* switch on the pressurization control panel to GRD. Welcome to KLAX!



This concludes your first tutorial flight. If you conduct this tutorial more than once, we encourage you to experiment with alternate settings. Try changing the weather or the weight, or perhaps pick a different departure airport adjacent to the one in this tutorial. When you get bored and feel you have a good grip on manually flying the 737, then you are ready for Tutorial # 2.