

*Add-on for Microsoft*

**Flight Simulator**

**X**



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**PMDG**

**777**

**-200LR/F**



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# **PMDG 777 200LR/F**

## **Manual**

Add-on for

**Microsoft Flight Simulator X**

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# Introduction

Welcome to the first tutorial flight for the **PMDG 777-200LR/F!** You've purchased one of the most advanced simulations of a commercial jetliner currently available for the Flight Simulator X platform - now it's time to learn to fly it!

This tutorial follows what was done previously with the tutorials for the **PMDG 737NGX** product. Instead of trying to write a single all-encompassing tutorial that contains every detailed procedure flow and test that a real world crew would perform in the airplane, we're going to start with a somewhat simpler introductory flight. The **PMDG 777-200LR/F** is an extremely deep simulation and you'll still be discovering new things with it years down the road, but for now we want to get you up and flying right away.

We're aware many simmers just want to load the airplane on the runway, program a route and go fly – that's largely what this first tutorial is all about. We're not going to be following the exact normal procedures and flows from the Flight Crew Operations Manual Vol. 1 (FCOM Vol.1) that a real life crew would do. This is distilled down to the basic steps you'll need to take ensure correct setup of the FMC and operation of the airplane in flight. You'll be able to have virtually any route programmed and be in the air within about 10 minutes using these methods provided you start on the runway with the engines running.

Based on customer feedback from the **PMDG 737NGX** tutorials, this tutorial does contain a "cold and dark" startup supplement near the end of the document for users who wish to learn that particular procedure right away.

This tutorial document seems quite long but much of it is supplementary explanations and screenshots. We think it's very important to not only understand what to do when operating the airplane but also why you're doing it. The actual procedures don't take much time at all once you're comfortable with them and have them internalized.



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Tutorial #2, which will be released at a later date, will cover the full normal procedures as well as a more in-depth discussion of ultra-long haul flight planning and Extended Operations (ETOPS), which are crucial aspects of operating a large twinjet like the 777 over the oceans or the polar regions at a long distance away from alternate diversion airports.

## Overview

Our flight today takes us from **VRMM – Ibrahim Nassir International Airport in Malé, Republic of the Maldives** to **OMDB – Dubai International Airport in Dubai, United Arab Emirates**.

The Republic of the Maldives is an archipelago of atolls and islands in the Indian Ocean, with the capital city Malé located approximately 330 nautical miles (nm) southwest of India's southernmost point. Malé is a very popular vacation resort destination.

Over the last few decades, Dubai and the UAE have become the central transportation and commerce hub in the Middle East region. This afternoon we'll be flying tourists who are ending their island vacations to Dubai so that they can catch their overnight flights back home to points beyond.

## Addon sceneries

There are very nice FSX addon sceneries available for both Malé and Dubai which we have used in the development of this tutorial. These are certainly not required but they will significantly enhance the experience and realism:

Aerosoft: Maldives X – The Malé Atolls:

<http://www.aerosoft.com/cgi-local/us/iboshop.cgi?showd,6535108940,11351>

FlyTampa: FlyDubai-Rebooted 2

<http://www.flytampa.org/omdb.html>

The Aerosoft scenery includes VRMM and the main islands in the chain.

The FlyTampa scenery includes an extremely detailed representation of OMDB and the entire Dubai city, skyline and surrounding area. Both sceneries have been very frame-rate friendly in our experience and should not significantly impact your performance in the **PMDG 777-200LR/F**.

## The flight plan

The flight plan we'll be following is based on an exact operational flight plan (OFF) used by a major real-world 777 operator and is completely accurate at the time of this writing with respect to the ATC route, weights, ETOPS entry, equal time and exit points, alternate airports, runways and so on.

We'll be taking off from Runway 18 and flying the LELEM Four Delta (L4D) departure. We'll then follow a series of airway waypoints across the Indian Ocean and Arabian Sea until we join the BUBIN Six Alpha (BUBI6A) arrival and the ILS for Runway 12L into Dubai. We will cruise at FL380.

This flight takes around 3 hours and 45 minutes in the air to complete – you can either fly it in real time or use our exclusive new PMDG Auto Cruise system to intelligently speed up the cruise portion of the flight (this feature will be explained in detail later on in the tutorial).

There are no saved flights included with this tutorial because we want to show you how to do it all from scratch.

We won't be using any wind in the simulator for this flight as doing so requires FMC CDU entries on various pages to get accurate predictions. We tackle wind/weather use in the more advanced Tutorial #2.

If you have not read the FSX SETUP and INTERACTING WITH THE **PMDG 777-200LR/F** sections of the Introduction Manual, please make sure you do so before proceeding. The sim needs to be properly configured for the airplane to function correctly and it is assumed that you understand the PMDG clickspot and mouse button methodology in general before proceeding.



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This tutorial also assumes the use of the default **PMDG 777-200LR/F** aircraft configuration as far as options go – if you have changed them, please reset them to defaults on the PMDG SETUP/AIRCRAFT page.

## A note on FMC navigation data

The **PMDG 777-200LR/F** includes the September 2013 navigation data cycle for the FMC from Navigraph by default (aka the “AIRAC 1309 cycle”). Many simmers update their navdata each month through Navigraph’s service. The data does change over time and thus certain aspects of the route in these tutorials can end up changing with newer data. If you’re using a later navdata cycle you may see differences – just use your best judgment, things do not often change drastically and most terminal procedures will have a similar name if they’ve changed, often moving up one number or letter in the sequence (for example, the B XK2 SID becomes the B XK3 or similar). If you see a NAV DATA OUT OF DATE message on the FMC scratchpad upon loading the IDENT page, the older 1309 cycle included with the product is the reason why.

## FSX setup

Let’s get right into it!

- Start FSX and click “Free Flight”

There is no need to first load the Cessna 172, or use any sort of custom saved flight when loading the **PMDG 777-200LR/F**. Our programming sets up the sim environment properly as the aircraft is loading. You can safely load the airplane straight from Free Flight and it will load up with the engines running and ready to fly after a brief self-configuration period. The default flight in FSX does need to be an MS default aircraft like the ultralight however. Do not use the 777 or any other complex addon aircraft as your default or you will likely have problems loading the 777.

## Selecting the aircraft

- Click Change under CURRENT AIRCRAFT.
- If it's not already set, check the "Show all variations" box. This will allow you to see all the liveries you have installed. If it's not checked you will only see the PMDG House livery for each **PMDG 777-200LR/F** variant.
- Select PMDG from the Publisher drop down menu and select the "Boeing 777-200LRX PMDG House" aircraft (note that the "X" in the name has to be there for proper sorting of the liveries and is not part of the actual name of the aircraft in real life). It is important that you select the House Livery and not an airline livery for the purposes of this tutorial so that the aircraft options are set correctly.
- If this is your first loading of the aircraft you'll need to enter your license key and authorize the gauges as outlined in the Introduction manual.
- Press OK.

## Selecting the aircraft

- Click Change under CURRENT LOCATION.
- Type VRMM into the By Airport ID field. Verify Malé is highlighted in the list.
- Select 18 from the Choose runway/starting position drop down.
- Press OK.



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## Setting the time of day

- Click Change under CURRENT TIME AND SEASON.
- Set the Local time field to 12:30:00, which is 12:30PM.
- Press OK.

## Setting of the weather

- Click Change under CURRENT WEATHER.
- Select the “Clear Skies” preset.
- Press OK.

Note, if you would like clouds present, you can select “User Defined Weather” at the bottom – this will allow you to add clouds while also setting the wind to none/calm. Making sure there’s no wind is the important part for the purposes of this tutorial.

### ***An important note regarding fuel and payload***

Unlike the default Microsoft aircraft or other addons you may be used to, the **PMDG 777-200LR/F** does not load fuel or payload via the Fuel and Payload dialog in the FSX interface, either at the Free Flight screen or while in the sim via the menu. We have created our own custom fuel and payload systems inside the FMC that intelligently load and unload fuel and payload according to actual weight and balance practices used by 777 operators.

You’ll always load fuel and payload via this system, never by the default FSX methods. We’ll see this system in use in a minute!

## Entering the cockpit

- Press FLY NOW!

When FSX loads, you'll be placed into the **PMDG 777-200LR/F** cockpit on Runway 18 at Malé. This tutorial assumes the use of the virtual cockpit primarily. You may use the 2D popups if you prefer them, but the narrative is written solely from the VC perspective and the screenshots are taken in the VC as well.

The 777 runs a 20 second initialization routine when it first loads into the sim. This routine first appeared in our MD-11 product and what the airplane is doing is setting up the simulator's internal environment and restarting Flight Simulator's engine modelling in order to initialize the way we control the engine behavior from outside of the normal FSX framework. Our advice is to not touch anything during this 20 second period to ensure everything is set up correctly. You may hear a quick burst of sound when loading the airplane as the countdown starts, this is a normal quirk of the FSX sound engine when restarting the sim's engine code suddenly.

Once the initialization is complete, press Ctrl+. (period key) to set the parking brake or use the parking break lever in the VC on the pedestal with the mouse – we don't want the airplane slipping forward on its own while we're head down in the FMC CDU during the next sections.

Note that you may hear the Runway Awareness and Advisory System (RAAS) tell you you're on Runway 18. This is normal.

- Once the initialization is complete, press Ctrl+. (period key) to set the parking brake or use the level in the VC on the pedestal – we don't want the airplane slipping forward on its own while we're head down in the FMC CDU during the next sections.
- Note that you may hear the Runway Awareness and Advisory System (RAAS) continually tell you you're on runway 18. This is normal.



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## Aircraft setup

Our first order of business is to set up the aircraft's fuel and payload for the flight. As was mentioned in the Introduction Manual, our philosophy with the **PMDG 777-200LR/F** is to minimize the use of the FSX menus as much as possible – this not only keeps the cockpit experience immersive and seamless but it also prevents the pausing and constant reloading of certain traffic and scenery addons due to accessing the menus.

The Flight Management Computers (FMCs) and their Control Display Units (CDUs) are the heart of the 777's cockpit. They manage nearly every aspect of the flight - the lateral route, the aircraft's performance data and vertical path, its approach settings and so on. We've expanded its functionality for the FSX environment to allow you to handle many other functions such as fuel and payload, cockpit equipment and display options, simulator time compression, push-back, ground crew connections such as air and power carts, automated ground servicing and refueling and a few other items.

Let's get started with the FMC:

## Fuel and payload setup

- To make it easier to see the CDU, click on the top of the yoke and it will animate down into a lowered position. This feature does not exist in the real aircraft but we added it to the simulation to assist in viewing the FMC CDU since you can't easily move your "head" position without hardware such as Track IR. Note that the motion of the yoke when control inputs are made is disabled while it is in the down position.
- This was made a persistent global option in SP1 – the yoke will remain in the down position across all 777 liveries and variants even after shutting down FSX and restarting it.



- Pan and zoom your view down to the captain's FMC CDU. (use your joystick hat and the + key or press and hold spacebar and use the mouse and mouse wheel to do this)





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## CDU notation convention

The six keys along each side of the CDU screen are called “Line select keys” and it’s common to see them referred to using this type of notation - “LSK 4L.” This stands for the 4th line select key from the top on the left side of the CDU. We will use this convention throughout the tutorials.

The space at the bottom of the CDU screen is called the scratchpad. This is where data entered on the keypad appears. The act of entering information from the scratchpad to a data field on the screen is called “line selecting” and is accomplished by pushing the LSK next to the field you want the scratchpad data to go into.

## Keyboard direct entry mode

You can click each individual key with your mouse pointer or you can enter data with the keyboard in what we call Direct Entry Mode. To use Direct Entry Mode, hold down the Tab key on your keyboard while typing, similar to holding Shift while typing capital letters. You’ll see the scratchpad outlined in flashing green when this mode is active. You can also click the scratchpad area on the CDU screen as well to activate it.

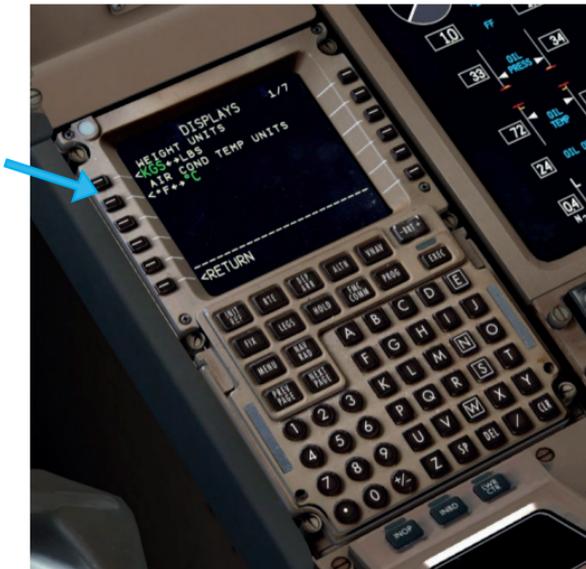


## A note on weight units

This tutorial is written using imperial weight units (pounds) because they're what the PMDG House Livery defaults to. I have however included the metric equivalent kilograms wherever applicable in parentheses after the imperial units if you'd like to fly with them instead. Note that these equivalents are approximate and may be very slightly "wrong" in a perfect technical sense due to rounding and conversion – it does not matter for our purposes here. If you're down to 10 or 20 lbs or kg of fuel making a difference, you have much bigger problems on your flight!

Tutorial #1 would likely be flown in real life with metric units given the carriers who fly this route – imperial units are mostly limited to North American airlines.

- If you would like to use metric weight units, the option can be changed in the FMC by pressing MENU, then PMDG SETUP at LSK 5R, then AIRCRAFT at LSK 1L, then DISPLAYS at LSK 2L. The option is the first one displayed at LSK 1L.





The CDU will currently be on the MENU page. We've added two prompts at the lower right – PMDG SETUP at LSK 5R and FS ACTIONS at LSK 6R.

- FS ACTIONS is the one that currently concerns us, so let's press LSK 6R to select it.







As an aside for the future, if you want a good idea of how much fuel to load, enter your route and then check the PROG page's fuel prediction for the destination airport – subtract your current load from the amount it predicts at the destination and add 15500 lbs (7000 kg) for alternate/hold and so on and that'll be a decent estimate. Use more if you have a long distance alternate or other extenuating circumstances. A rough rule of thumb is to assume the airplane will use around 17,600 lbs (8000 kg) of fuel per hour of flight time.

Detailed fuel planning will be covered in Tutorial #2.

You will need to manually look up at the overhead panel and turn off the two lit center fuel pump switches, which are operating in a tank that no longer has any fuel in it.



- Press RETURN at LSK 6L to get back to the root FS ACTIONS page.
- Press LSK 2L to select the PAYLOAD page.



The PAYLOAD page is similar to the FUEL page but for passengers and cargo. The prompts on the lower right side are quick-load presets. On the left side you can type and line select in the exact number of first and economy class passengers and the weight of the cargo in the forward, aft and bulk compartments that sit under the passenger cabin.

For this flight, our zero-fuel weight (ZFW) is going to be 426,600 lbs (193,500 kg), so go ahead and enter 426.6 (193.5) into the scratchpad and line select it into LSK 2R. This creates a valid randomized passenger and cargo load that equals the ZFW automatically.

You may have noticed that there are real-time weight and balance readouts at the upper right of the screen on both the FUEL and PAYLOAD pages – the other fields are the gross weight (GW), the maximum taxi weight (MTW), and the take-off center of gravity (TOCG). Using these you can see at a glance if your weight and balance are within allowable limits. The fields will turn amber to warn you if they get out of their limits.



---

## FMC Route Setup

We now need to talk about the flight plan's lateral route and explain it. The route we'll be flying from VRMM to OMDB is:

### **L4D.LELEM.L894.KITAL.P570.ITURA.M762.BUBIN.BUBI6A**

This may look confusing if you're not familiar with how to read and decode aviation routes, but it's actually fairly simple.

This route consists of a Standard Instrument Departure (SID), a series of airway segments, and a Standard Terminal Arrival Route (STAR). A good analogy here for understanding how this works is highways – you can think of SIDs, STARS, and airways as the highways themselves and the waypoint names in the coded flight plan as the onramps, exits and interchanges you'll use along the way.

In this case, we're going to follow the LELEM Four Delta (L4D) SID to the LELEM airspace fix (a fix is a just point in space defined by latitude and longitude) – LELEM acts as the interchange onto the L894 airway. We follow L894 until the fix KITAL, at which point we get onto the P570 airway. This logic continues until we reach BUBIN, which is also the first waypoint of the BUBI6A STAR into OMDB. **You can see the actual charts for the SID and STAR attached on CD.**

The key concept to understand here is that there are additional waypoints along SIDs, airways, and STARS that are not explicitly written out in the coded flight plan you saw above.

Keeping with the highway analogy, these are equivalent to the exits and interchanges in towns or cities that you pass by along your drive but don't actually use. The neat thing about the way the FMC works is that those extra waypoints get automatically entered in when you use the DEP ARR and ROUTE pages to enter SIDs, airways, and STARS.

Note that you may see routes written in slightly different formats such as:

**L4D LELEM L894 KITAL P570 ITURA M762 BUBIN BUBI6A**

or

**L4D.LELEM L894 KITAL P570 ITURA M762 BUBIN.BUBI6A**

I personally prefer the FAA-style nomenclature that uses single dots to signify “connected” procedures and airways and double dots to signify direct legs. There isn’t a direct leg in this route, but it would look like this if there were – **LELEM..KITAL**. The equivalents in the other formats are **LELEM KITAL** or **LELEM DCT KITAL** with DCT standing for direct.

Let’s move on now to initializing the FMC lateral route on the CDU. The basic sequence we’ll be following to accomplish this is:

1. Position Initialization
2. Airport entry
3. Departure entry
4. Enroute entry
5. STAR and Approach entry
6. Route activation



## Identification and position initialization

- Press MENU, which will back us out to the root menu.
- Press LSK 1L, the < FMC prompt.  
We're now on the IDENT page.



Note - in case you missed it earlier on page 8 - if you see a NAV DATA OUT OF DATE message in the scratchpad after you bring up this page, it's due to the 777 shipping with the September 2013 navigation data cycle. This is not of any concern to this tutorial, which was written using that exact cycle. Just press the CLR key and continue on.

- The IDENT page doesn't contain any required entries (which are signified by open boxes) but it does provide you with some valuable information such as your engine type and thrust rating (in this case the GE90 at 110,000lbs of thrust per engine) and the currently installed navigation database and its valid dates.

- Press LSK 6R to move on to the POS INIT page.



The POS INIT page is used during a cold and dark start for providing an initial position for the air data inertial reference unit (ADIRU) gyros to align on. When loading from Free Flight as we've done in this tutorial, the ADIRU is already aligned, so this page doesn't actually have any tangible function in this context and an entry isn't required.

- Enter VRMM into LSK 2L, the REF AIRPORT prompt however, just to get you in the habit of doing it.



## Airport entry

- Press LSK 6R to select the RTE 1 page



- The RTE pages are the primary location for entering the enroute portion of your flight plan. If you're familiar with the FMC CDU in the PMDG 737NGX product, you may be expecting it to have automatically entered VRMM into the scratchpad for you. This is not a bug or omission – the real life 777 does not have this feature and you must manually enter it again.
- Type VRMM again and line select it into LSK 1L, the ORIGIN field.
- You'll see the location of the center of the airport appear on the navigation display (ND).
- Type OMDB into the scratchpad and line select it in with LSK 1R, the DEST field.
- Type PMDG77L into the scratch pad and line select it with LSK 2R, the FLT NO. field.

- We could enter the runway now on the RTE page, but we're going to do that on the DEP ARR page instead to demonstrate another feature and to help guard against database errors and runway number changes.

The completed RTE page should look like this:





## Departure Entry

- Press the DEP ARR button to get to the DEP/ARR INDEX page



The DEP/ARR INDEX page contains a series of prompts that take you to the departure and arrival procedure selection pages for the two airports you entered into the RTE page ORIGIN and DEST fields on the RTE page earlier. The reason you have both departure and arrival prompts for the origin airport is to account for a return to the airport after takeoff due to an emergency. Having immediate access to the arrival page for the origin airport allows you to select an arrival and/or an approach quickly and easily.

- At LSK 6L and 6R, you have two prompts that allow you access to any airport's departure or arrival page. You can type the ICAO identifier of the airport in question into the scratchpad and then line select it to the DEP or ARR prompt. This can be useful in the event of an enroute diversion.
- Press LSK 1L to get to the VRMM DEPARTURES page.



The VRMM DEPARTURES page contains all of the runways and Standard Instrument Departures (SIDs) for Malé that exist in the FMC's navigation database.

- Press LSK 1R to select Runway 18. Notice that several things happen when you do this:
  - The runway is drawn on the navigation display (ND).
  - The list of SIDs on the left side of the CDU screen is filtered so that only valid SIDs for Runway 18 are displayed. When the runway is entered on RTE Page 1, SIDs are not filtered unless the runway is reselected on the VRMM DEPARTURES page, which is redundant. This is one reason why it was not entered on the RTE 1 page earlier.



- Press NEXT PAGE twice and then LSK 2L to select the L4D SID. You will see a series of waypoints representing the path of the SID appear on the ND with dashed cyan lines connecting them. The cyan color of the line means that the route has not yet been activated.

The VRMM DEPARTURES page should now look like this:







---

Though we won't use the more advanced features in this tutorial, it is worth noting that the **PMDG 777-200LR/F** RTE page functionality nearly exactly mirrors the real life one. You can actually enter just about anything into the VIA column including directly typing the names of SIDs, STARs and approaches as well as airways and it will take them. The TO column will take uncommon entries such as airport ICAO codes, ILS identifiers, and runways too. See the FCOM Vol. 2 for more info on what you can do here.

- Enter L894 into the scratchpad and line select it into LSK 2L, the VIA column's next empty line down.

The fact that it "takes" the airway designation lets you know that L894 is a valid airway from LELEM. If it wasn't you'd see INVALID ENTRY in the scratchpad after trying to line select it in.

- Complete the airway segment by entering KITAL into the scratchpad and line selecting it into LSK 2R, directly across from the L894 entry.

For the rest of the airway segments, there's a neat trick you can use to cut down on the amount of typing – let's use it now:

- Enter P570 into LSK 3L. Now enter M762 into LSK 4L directly below P570. ITURA, the common "interchange" waypoint between the two airways is calculated and entered in automatically. The FMC will even create a custom intersection waypoint if a named one doesn't exist.

Note that you should always verify that this shortcut is actually loading the proper "interchange" waypoint listed on the coded flight plan. Sometimes it may not and you will have to manually correct it.

- Enter BUBIN at LSK 4R to complete the enroute airway segments.
- We're now finished with the enroute entries and your RTE page 2 should look like this:





## Star and approach entry

- Press DEP ARR, then press LSK 2R to get to the OMDB ARRIVALS page.



- The OMDB ARRIVALS page is similar to what the VRMM DEPARTURES page looked like with a few differences. On the left side of the page are the STARS and on the right are both the approaches and runways.
- Press NEXT PAGE two times and you'll see that the runways are there on page 3 after you get through the two pages of approaches above them. You would normally only select a runway alone if you were doing a visual approach or otherwise not using one of the instrument approaches listed above them.
- Press PREV PAGE twice to return to page 1 and then select the BUB16A STAR located at LSK 3L. You may also be wondering what the text at position 2L that says TRANS -NONE- means. Many SIDs and STARs have "transitions" in addition to the

common portion of the procedure. The transitions are different branches that lead out of (SIDs) or into (STARs) the main part of the procedure. In this route though, both the SID and STAR have only a common portion and no transitions and that's why you see the text at 2L.

- Select the ILS12L at LSK 1R. A list of transitions can appear below approaches as well as SIDs and STARs. In this case we do not want to select a transition because the first waypoint of the approach and the last waypoint of the STAR are the same waypoint, a fix called UKRIM. (you can see this on the charts on CD). When this is the case, the FMC will automatically link the two procedures without any route discontinuities.
- The completed OMDb ARRIVALS page should now look like this:



We now need to check the procedures we've selected to make sure that the altitude and speed restrictions automatically entered as part of them correspond correctly to the actual charts, which are always the final authority on such things.



- Press the LEGS button.



The LEGS page is a list of every waypoint in the entire flight plan - this is where you can actually see all the other waypoints that are part of the SID, STAR, and airways that weren't explicitly written out in the coded flight plan we learned about earlier. The LEGS page is also the primary location in the FMC for modifying the route.

We're going to perform a series of checks against the charts right now.

- The entirety of the L4D SID is shown on the first page and the 5500A restriction at MM012 is correct per the Jepp charts. The "A" after the altitude means that it is an "at-or-above" restriction. The plane must make it to at least 5500 feet by this waypoint but it doesn't have to stop the climb there. Similarly a "5500B" restriction means "at-or-below" and would mean that the airplane can cross the waypoint at any altitude up to and including 5500 feet, but not above it.

- Press NEXT PAGE four times to display LEGS page 5/9, which is the start of the STAR. Pages 2 through 4 are cruise waypoints along the airways we entered earlier and do not have restrictions



We can see three restrictions that have been automatically entered here by the STAR procedure. One for 230 knots and at- or-below 13000 feet at GIRMI, one for at-or-above 6000 feet at DB423 and one for 210 knots at TALVI. These are all correct per the Jepp chart.

Note that in the 777, speeds restrictions cannot be manually entered alone, they must always also contain an altitude. Entries such as the 170 knot one at the final approach fix F112L are advisory only. The pilot must always ensure restrictions are met manually. There are a few more restrictions on pages 6 and 7 that are all correct per the STAR chart as well.

- At page 8, we encounter something known as a ROUTE DISCONTINUITY at line 1.



Route discontinuities, or "discos" for short, occur when two selected procedures don't share a common waypoint. In this case the STAR ends at UKRIM on page 7 and the approach begins at UMALI on page 8. If you reached UKRIM with this discontinuity still present the airplane would follow its last track over the ground indefinitely and would not actually sequence the waypoints of the approach. To clear the disco, click LSK 2L to copy UMALI down into the scratchpad. When you do this, the waypoint retains all of its restriction data and so on. Now press LSK 1L and UMALI will close the discontinuity gap.

- Press LEGS again to go back to the first page.

As an aside, you should note that discontinuities aren't always a bad thing. Not all STARs and approaches line up as well as these do and if you were to always close the discontinuity, you could end up with the airplane trying to automatically fly a unwanted course following the last STAR waypoint. In those cases it would be better to take over manually using HDG SEL.

This is often the type of spot where real life pilots will receive radar vectors from air traffic controllers. In the sim you will need to “self vector” in these situations unless you are flying online with live human ATC issuing vectors to you.

- You can avoid this situation by using the PLAN mode of the navigation display in conjunction with LSK 6R, which will change to a STEP > prompt in this mode and allow you to step through the flight plan waypoints on the ND and see how the route is structured near the approach.

The route is now verified, the discontinuity is closed and we can continue.

## **Route activation**

- Press LSK 6R, the ACTIVATE > prompt. We’re now telling the FMC that we want to commit to this route and activate it. You’ll notice that the light on the EXEC button is now lit up.
- Press the EXEC (execute) button, which is now lit. The route turns magenta on the ND and we now have a valid lateral route loaded in the FMC.



Notice however, that we have numerous blank entries on the right side of the LEGS page – there should be altitude and speed predictions here, but those won't appear until we initialize the aircraft's performance in the next step.

## Performance data and vertical path initialization

We now need to initialize the aircraft's performance data calculations and through that, its ability to follow a vertical path for climb, cruise and descent along the route.

- Press INIT REF to proceed to the PERF INIT page.



The PERF INIT page is where the crew tells the FMC what the aircraft's operating weights are and set up parameters that affect the performance and vertical path such as the Cost Index. This is also where the flight's cruise altitude is set.

Open boxes are required entries where the crew must provide data. The crew may also overwrite the boxes that currently contain data, such as RVSM or FUEL.

We've implemented a shortcut on the PERF INIT page that doesn't exist in the real FMC to assist you in entering the weights. Clicking on the LSK next to the zero fuel weight (ZFW) field will place the current correct value into the scratchpad. This saves you from having to go look at the FS ACTIONS FUEL or PAYLOAD pages to get the value. We'll use this feature now.

- Click LSK 3L next to the empty ZFW field. Something close to 426.6 (193.5) should appear in the scratch pad. Click LSK 3L again to enter it into the ZFW field. You'll notice that the gross weight field at 1L is automatically calculated and filled in.



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The FMC only needs one of these two entries present and the other will be automatically inserted.

- Enter 15.5 (7.0) and line select it into the RESERVES field at LSK 4L. This entry is purely advisory - it doesn't affect anything within the fuel system. If the aircraft starts using fuel below this value, you will get a scratchpad message that says INSUFFICIENT FUEL.
- Enter 35 and line select it into the COST INDEX field at LSK 2R. Cost Index (CI) is a measure of how much the FMC values fuel economy vs. the overall speed of the flight. Lower values correlate with lower operating cost at the expense of slower airspeeds and vice versa. CI is a very powerful parameter in the FMC and it affects everything from climb, cruise and descent airspeeds to the maximum attainable altitude for the route. The valid range on the 777 is 0 to 9999. Note that CI is not a linear function, it's logarithmic and most of the change in the CI curve happens at the lower end of the curve (0 to 1800 or so). CI varies in real life operations (it's calculated by the airline's dispatchers based on the exact conditions of the flight and the airline's policy.) 35 is the real world value from this flight plan and will work fine for the purposes of this tutorial. On longer range oceanic flights, values in the 100-400 range are common as well.
- Enter 380 and line select it into the CRZ ALT field at LSK 1R. This sets the cruise altitude for the flight.

The FMC will accept multiple entry formats for the cruise altitude including 380, FL380, and 38000. After entering the cruise altitude and CI, you'll often see the route on the ND change subtly as curves appear that represent the predicted turn performance of the airplane. Without the performance fully initialized, the FMC can't calculate these and you'll see straight line segments between waypoints.

- Here's what the PERF INIT page should look like after you're done:



- If the numbers such as the gross weight and calculated fuel are slightly different than shown here, that's fine – they will vary depending on how long it takes you to get through the previous steps leading up to this point.
- Also note that unlike the CDU in the PMDG 737NGX, the PERF INIT page on the 777 does not generate an EXEC light that you need to press after entering all the required data. The performance automatically initializes as soon as it has all the data it needs.
- Press the VNAV button, which will bring up the CLB page.



- Enter 11000 and line select it into the TRANS ALT field at LSK 3R. Transition altitude is the altitude during the climb at which the FMC starts using standard calibrated flight levels (altimeter set to 29.92 inHg or 1013 hPa) instead of the actual QNH pressure altitude above sea level. The FMC defaults to 18,000 feet, which is standard in the United States, but in the Maldives, the transition altitude is 11,000 feet. This default can be changed in the options to suit local differences in your country.
- Press the LEGS button – you should now see predicted altitudes and speeds at any waypoint that doesn't have preset restrictions coded into the procedure. If you see these predictions you know that you have a valid vertical path initialized and will be able to activate the VNAV autopilot modes after takeoff.



## Takeoff reference and thrust limit data setup

We now need to set the takeoff reference data and select an engine thrust ratings for both our takeoff and climb.

- Press INIT REF and then LSK 6R on the TAKEOFF REF page to proceed to the THRUST LIM page.



The THRUST LIM page controls the thrust rating of the engines for takeoff and the initial climb.

We are going to do an assumed temperature takeoff to save wear and tear on the engines by limiting them to less than maximum takeoff and climb thrust. The **PMDG 777-200LR/F's** GE90-110B engines are extremely powerful and a derate of some kind is almost a necessity at low weights to avoid overspeeding the flaps after liftoff.

In real life, an airline's dispatchers go through detailed calculations to ensure that the use of derated/reduced thrust is safe and permissible for the given runway length, aircraft weight and environmental conditions. We can safely assume that those calculations have been done for this flight without going into it in depth. This will be done in Tutorial #2.

- Type 58 into the scratchpad and line select it into LSK 1L to enter an assumed temperature of 58C (136.4F), which derates the normal TO mode thrust to 89.2% N1 instead of 100.1%.

Assumed temperature is a bit of a complicated concept but the basic idea is as follows:

The engines are designed to produce their rated thrust at an actual outside air temperature of 30C (86F), which is ISA + 15C. If the temperature is higher than this, the air becomes less dense and the engine produces less thrust at the same N1 setting. When we enter an assumed temperature that is higher than the actual outside air temperature, we're telling the engine computers to act as if that the air is less dense than it really is and it will reduce the N1 limit to produce somewhere around level of thrust that it would if the real outside temperature was actually this higher value.

- Entering the assumed temperature should have automatically selected the fixed CLB-1 derate too. If it didn't, press LSK 3R to select it. This happens so as to not produce extreme climb rates that would result in uncomfortable pitch angles and cabin pressure changes for the passengers.
- The completed THRUST LIM page should now look like this:





- Press the LSK 6R to return to the TAKEOFF REF page.



The TAKEOFF REF page 1 contains several required entries for calculating the aircraft's performance during the takeoff.

- Enter 5 and line select it into the LSK 1L FLAPS field. 5 is a standard takeoff flap setting for the 777 and will work well for most short to medium flights in the PMDG 777-200LR/F.
- Click LSK 3L – this is a similar shortcut to the ones for the GW and ZFW earlier on the PERF INIT page. It will place the current CG value into the scratch pad for you. Line select that value back into the LSK 3L field and the FMC will reward you with your calculated takeoff trim settings and V speeds.
- Click LSKs 1R, 2R, and 3R – this transfers the calculated takeoff V speeds from the FMC's integrated QRH table onto the Primary Flight Display (PFD) speed tape.

You will notice the flight plan route shift slightly when you enter the V speeds – the PMDG 777-200LR/F FMC actually accounts for that small difference resulting from the exact speed you lift off.

The completed TAKEOFF REF page should look like this:



- There are other optional entry fields on the TAKEOFF REF pages, but they aren't required for the purposes of this tutorial. They will be explained in detail in Tutorial #2.
- The FMC initialization is now complete! If you've been using keyboard direct entry mode, make sure you turn it off now.

## Cockpit Configuration

We now need to configure the rest of the physical cockpit items for takeoff.

- Set the takeoff trim to the value seen in LSK 3L from a few steps earlier (2.75 in this case). You can do this by using the trim buttons on your joystick or their equivalent keypresses. There are two places you can look for visual feedback setting the takeoff trim value – the indicator to the left of the throttles or the flight control (FCTL) synoptic page on the lower EICAS display.



## A note about trim speed

- The PMDG 777-200LR/F's trim motion is going to seem very slow if you're used to most other addons. We have exactly recreated the real life trim rates by bypassing the normal FSX trim functions, and yes, they are this slow in the real airplane. This is a huge aid though while handflying as you now have extremely precise control over the trim's range of motion and should be able to trim out control forces perfectly in almost any situation (see the SP1 Supplement of the Intro manual for a description of how exactly the trim and fly-by-wire system functions).
- Set the FLAPS to 5. You can do this by pressing F7 two times, by left clicking two times on the physical flap handle in the VC, (right clicking will raise them), by clicking the hidden clickspots at each flap number on the track to the right of the handle, or by assigning key commands or joystick buttons.



- Set the AUTOBRAKE knob to RTO by left clicking it once.



RTO stands for Rejected Take Off and will automatically apply maximum braking in the event the throttles are retarded to idle while at-or-above 85 knots during the takeoff roll.

- You will see an AUTOBRAKE RTO message appear on the upper EICAS display.



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## MCP setup

We now need to configure a few items on the autopilot mode control panel (MCP):

- Pan up and set the MCP SPEED knob to V2, which should be around 150-152 knots depending on your exact weight. Set it to whatever the TAKEOFF REF page shows for V2.
- Set the MCP HEADING knob to the runway heading, which is 183 degrees for VRMM Runway 18.
- Set the MCP ALTITUDE knob to 38000. You can flip the inner knob to the 1000 setting to make the knob increment in 1000s rather than 100s. We don't have any climb restrictions on this SID aside from the at-or-above 5500 one at MM012, so we can safely climb straight to our initial cruise altitude. In real life the MCP ALTITUDE window would be set to the initial altitude provided by ATC.
- Turn the captain's and first officer's FLIGHT DIRECTOR (FD) switches to their ON/UP settings. This allows the autopilot flight director system (AFDS) modes to arm and engage.

You'll see a large green FLT DIR annunciation on the PFD just above the artificial horizon when the switches are on. Additionally, TO/GA appears in both the roll and pitch mode columns of the flight mode annunciator (FMA), which is the area at the top of the PFD. The blank column at the far left represents the thrust mode and will become active when we press the TO/GA button during takeoff. It is very important that BOTH flight director switches be on – you'll find many functions may not work correctly or at all unless both switches are on.

- The autothrottle switches in the **PMDG 777-200LR/F** are defaulted to the ARM/UP position. It is very common with most 777 operators to leave these switches on at all times. You should never turn these switches off except in the case of a failure that requires it such as losing an engine.

- Arm the LNAV and VNAV modes by pressing the LNAV and VNAV buttons. You'll see LNAV appear in small white letters at the bottom of the FMA roll mode column and VNAV in the pitch mode column. LNAV will engage and turn green at 50 feet after you lift off and VNAV will engage at 400 feet.

The PFD should now look like this:



Note for future reference that there are conditions where LNAV will not arm on the ground, most notably if the first leg's course is more than 5 degrees away from the runway heading.

- The MCP is now configured and should look like this:





## EFIS setup

The Electronic Flight Instrument System (EFIS, pronounced “E-fiss” with the stress on the first syllable) is the name of the system that comprises the PFD and ND displays and the controls that the crew uses to interact with them.

- Before we go to the EFIS panel, set the transponder squawk code to 2200 (a standard IFR code you might be assigned by ATC in real life) by right clicking the larger outer knob on the left side of the unit once. (1200 is a VFR code)



You can get to the transponder in a number of ways – by panning over and back to the center pedestal, by changing to the VC pedestal camera preset, or on the 2D popup either by clicking the MIC switch on the glareshield or by pressing Shift+7.

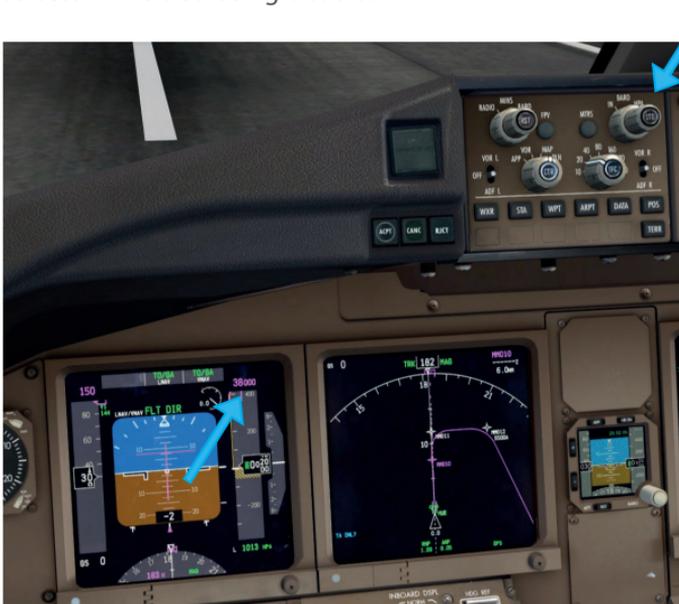
The transponder mode selector is defaulted to TA/RA in the 777, as this is commonly used even on the ground now since most airports 777s operate at use airport surface detection equipment (ADSE) to track aircraft on the ground.

TA/RA sets the TCAS system to provide you with both traffic advisory and resolution advisory messages. TAs simply alert you to the presence of traffic, RAs give you commands to follow during a conflict to provide separation.

- Note that the 777 transponder digits/knobs do not have “rollover” – they will stop at 0 and 7 respectively when rotated left or right.

- Pan back up to the EFIS control panel to the left of the MCP and right click the outer portion of the BARO knob to set it from inches of mercury (inHg) to hectopascals (hPa), which is the metric system's standard unit of pressure used outside of the United States. Since we have not changed the pressure in the sim for this flight, the standard setting of 1013 hPa should be already set at the lower right of the PFD.

Note that the cursor appears grayed out over top of the outer knob. This indicates that the mouse wheel does not function on this knob. We found on past products that these types of controls were commonly changed accidentally while using the wheel and many similar ones like the HDG SEL bank angle selector have also being disabled.



- Similarly, press the HP/IN button on the Integrated Standby Flight Display (ISFD) to set it to hectopascals as well.



- Press the DATA button that's located just below the EFIS range selector. This adds labels below each waypoint on the ND that show you any entered crossing altitudes as well as the predicted time you will pass over them.



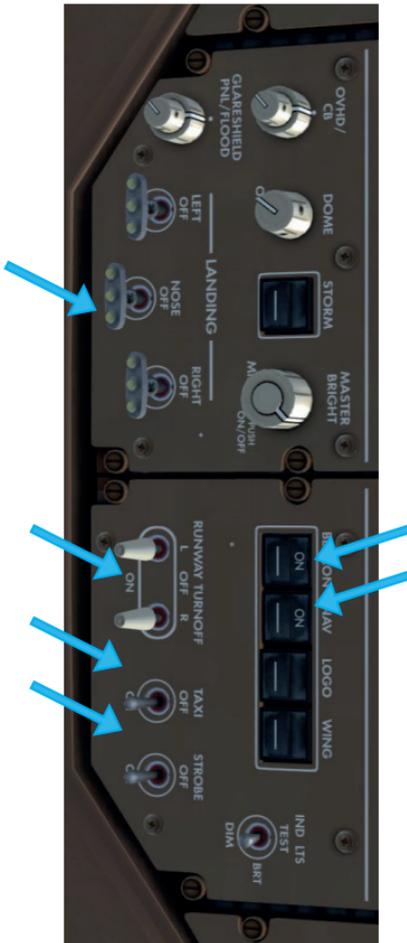
## Overhead setup

Right click on an empty area and select the Cockpit\Overhead Lower Panel camera view. You may need to pan the view slightly due to the way FSX changes camera positions on its own – they can never be totally correct everywhere in the sim world unfortunately. There's only a few things that need to be set here near the front of the panel:

- Turn the LANDING LIGHTS on by middle/wheel clicking any of the three switches – this will move all three switches with a single click. If you don't have a middle/wheel button, then click each one individually.
- Turn the RUNWAY TURNOFF lights on with the same middle/wheel click functionality.
- Turn the BEACON lights on.
- Turn the NAV lights on.
- Turn the TAXI lights on.
- Turn the STROBE lights on.
- At night you would also set the LOGO and WING lights on.



Here's what the overhead should look like when done:



## Electronic checklists

The electronic checklist (ECL) system in the PMDG 777-200LR/F is probably best suited to the full normal procedures we'll be using in Tutorial #2, but we can run a couple of them to get you used to how the system works.

- Press the CHKL button on the control panel on the FO's side of the glareshield.



- This displays the ECL on the lower EICAS screen:





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- When you move your mouse cursor over top of this screen, the normal Windows cursor will disappear and turn into the magenta on-screen ECL cursor. This cursor will automatically move around the screen after click actions to minimize the amount of manual movements you have to do, which can be very useful in the real airplane during turbulence and so on.
  - The ECL will default to the BEFORE TAXI checklist in cases where you start with the engines running – it always defaults to the first uncompleted checklist for the flight phase the aircraft was loaded in, so if you start with engines running as we have here it won't go to the PREFLIGHT or BEFORE START checklists as it assumes those are already complete.
  - Notice that one monitored item is already checked and shown in green because we already set the Autobrake to RTO earlier. The airplane monitors numerous systems and automatically checks them off when it detects the proper state.
  - There are 4 "open loop" items on the Before Takeoff checklist though that we need to manually check.
  - Anti-ice wouldn't normally be needed on a tropical island, so go ahead and click the first line. Notice that the cursor automatically moves down to the box for the second item, Recall.
  - Press the EICAS recall switch and make sure no amber or red entries appear on the upper EICAS screen. You'll see "RECALL" appear and then clear in small white letters below the 4 white status messages that are present.



- Move the flight controls (yoke and rudder) and make sure they're free and clear in all directions with full range of travel. You can bring up the FCTL synoptic again on the lower display to observe the sensed motion of the surfaces.

Click the checklist item when satisfied with the test.

- No ground equipment is present, so we can check off the last item, Ground equipment.
- The checklist completes and the cursor moves down to the NORMAL button. Press it to move on to the BEFORE TAKEOFF checklist.





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- As you can see, this one is pretty easy. We have one item, the flaps, and they are already set to 5 from earlier. The checklist is complete.
  - Press the ENG button to return the lower display to the secondary engine indications. We'll return to the ECL after takeoff.
  - Check your fuel load at the lower right of the upper EICAS display – if it has fallen below 71,400 lbs, use the FUEL page set it back up to 71,400. You may have burned off more than usual due to the time it takes to read through the tutorial and if it remains low you may receive an INSUFFICIENT FUEL message in the air closer to Dubai.

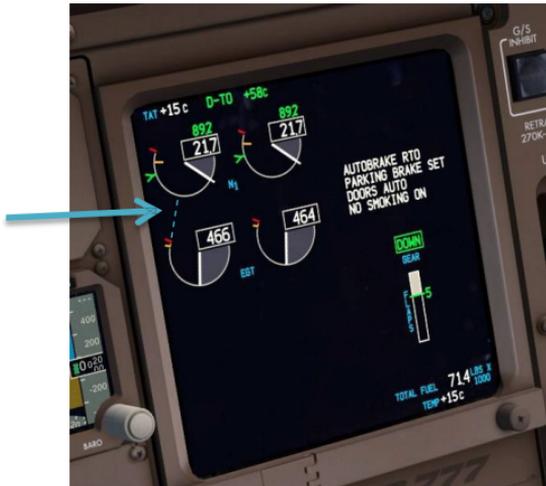
## In the air

It's a good idea to read the takeoff section on the next page once before you do anything. A lot of things are going to happen very quickly once we get the airplane rolling.

## Takeoff

- Release the parking brake with Ctrl+. (period key), by clicking the physical parking brake lever in the VC, or by tapping the brake button on your joystick. (defaults to the trigger on most sticks).
- Smoothly advance the thrust levers to 55% N1. The GE90-110B engines take some time to spool up and are likely slower to react than what you are used to from other addons. They're the largest engines available on any commercial airliner and can't respond instantly to large thrust change commands.

To judge where 55% N1 is, you can imagine a line extending up from the arc of the EGT gauges below the N1 gauges. Where this line would intersect the N1 arc is approximately 55%.



Once stabilized at 55%, engage TO/GA mode – there are several options for doing this – pick one below:

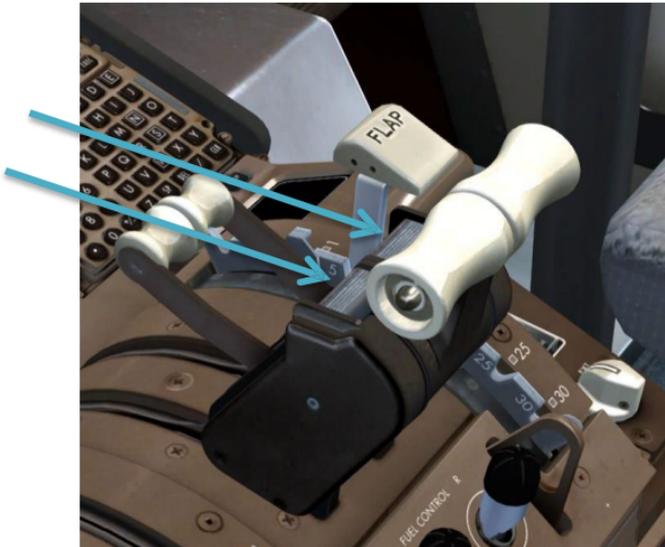
1. Press the keyboard shortcut – CTRL+SHIFT+G by default or your custom joystick button bound to this function.
2. Left click the hidden clickspot located on the MCP screw just below the FD switch and to the left of the A/T button.





Note, the TO/GA screw clickspot has new functionality in the **PMDG 777-200LR/F** compared to past PMDG products. A left click will engage TO/GA, a middle/wheel click will disconnect the autothrottle (same as the button on the side of the thrust levers) and a right click will disconnect the autopilot. (same as the button on the yokes).

Click the actual brown TO/GA paddle switches in front the thrust levers.



When TO/GA is engaged, several things happen:

- The autothrottle increases engine thrust to the takeoff N1 limit – in our case, D-TO +65C , which will be around 92.5% N1.
- After you activate TO/GA, wait for THR REF to be annunciated and then push your physical joystick throttle fully forward, this prevents any mismatch between the throttle position and the AT for the rest of the flight until descent. Listen closely right after you press TO/GA - you can actually hear the sound of the servos advancing the thrust levers. It's a high pitched hissing-type sound.

- The active autothrottle mode (left most column on the FMA) becomes THR REF, followed by HOLD.
- The flight mode annunciator (FMA) at the top of the PFD will show THR REF in the thrust field and TO/GA in the pitch field with VNAV armed below it. The roll field shows TO/GA with LNAV armed in white below. Green boxes are drawn for a few seconds around modes that have just engaged.



- Maintain a small amount of forward pressure on your yoke or joystick until reaching 80 knots and use the rudder if necessary to keep the airplane aligned with the runway centerline.
- Upon reaching V1 speed, which should be around 141 knots or so, we are committed to flying. While no failures will happen in this tutorial, in the event anything did on a future flight, you would handle it in the air now instead of attempting to reject the takeoff. If you abort after V1 you run the risk of overrunning the end of runway during the abort and crashing on the ground. (Or in the water on this particular runway!).



- When you reach VR, smoothly rotate at around 2 to 2.5 degrees per second toward a goal of 15 degrees nose up after liftoff. Be careful not to rotate too quickly – the 777 is a long aircraft and is prone to tailstrikes at high rates of rotation. This is very easy to do if you jerk the elevators up. It should take around 4 seconds to reach lift off attitude.
- Raise the landing gear by pressing G, clicking the handle in the VC or via a custom keypress/button you've set.
- Continue pitching above 15 degrees to keep the airspeed below the Flaps 5 bug and then follow the flight director bars but do not "chase" them. Smoothly maneuver to follow them - they will command a range between  $V2+15$  and  $V2+25$ . At 50 feet, LNAV will engage and turn green at the top of the FMA roll mode field.

## Climb

- At 1500 feet above ground level, the aircraft will reduce to climb thrust and begin accelerating to 250 knots by commanding pitch down. Follow the flight director bar pitch commands for this. This is called "acceleration height" and can be modified on the FMC TAKEOFF REF page 2 before departure if so desired.

As you accelerate, you will need to input nose down trim to stop the aircraft's tendency to return to the trim reference speed it was originally set for, which is  $V2+15$ . It takes approximately 1 second of trim application to get 10 knots of reference speed change.

To assist you in trimming the FBW system, there is an option located at MENU > PMDG SETUP > OPTIONS > SIMULATION called SHOW FBW TRIM REF SPEED. This will place a small cyan -FBW marker on right side of the PFD speed tape that will show you exactly what trim reference speed the FBW system is currently in trim at. It will pitch up or down to return to this speed if the controls are released.

- Flap retraction on a normal flaps 5 takeoff and climbout is accomplished as follows after reaching acceleration height:
  - Passing the "5" marker on the PFD speedtape, select flaps 1.
  - Passing the "1" marker on the PFD speedtape, select flaps up.
  - The idea here is that the aircraft is expected to be accelerating rapidly, so there's no need to wait until passing the exact maneuvering speed (which is what the numbers represent) to raise the flaps past the currently indicated point. It's expected that by the time the flaps finish retracting you're already at-or-above maneuvering speed for that setting.
  - If you'd like more information about this procedure, check the Flight Crew Training Manual (FTCM).
- Once you are stable at 250 knots in the climb with the controls neutral and in-trim, press the AP button on the right side of the MCP to engage the autopilot. You will see green A/P text replace the FLT DIR annunciation on the PFD.

Notice how smooth and deliberate the new PMDG autopilot coding is. We believe this is the most realistic representation of the Boeing AFDS ever made outside of a multi-million dollar full flight simulator. It is the result of countless hours of work and observation of the real aircraft.

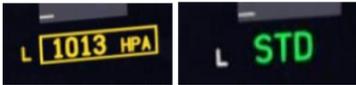


- Take your hands off the controls, the autopilot is now flying. This actually is very important – deflecting the controls past a certain amount of force while the AP is engaged will cause it to disconnect, which we don't want! The AP CMD will also fail to engage if the controls are not centered when CMD is pushed.
- Pull up the ECL again and run the AFTER TAKEOFF checklist.
- As before, there isn't much to do here because the ECL system has already detected that we raised the landing gear and flaps.
- Press the CHKL button again to blank the lower EICAS display. The secondary engine parameters are normally not selected on during flight to reduce display clutter around the cockpit.
- Press the LEGS button on the CDU to get back to the list of route waypoints.
- Set the ND range to your taste.

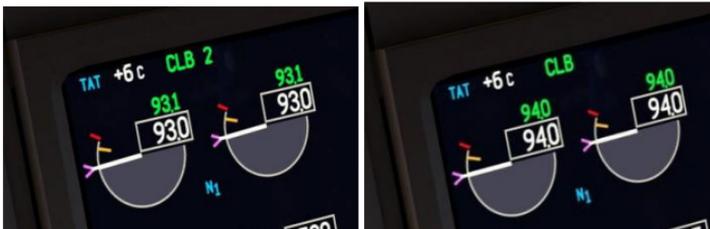
- Pan back up to the overhead and turn off the RUNWAY TURNOFF and TAXI LIGHTS. Passing 10,000 feet, turn off the LANDING LIGHTS. You can middle/wheel click any of the switches as before to turn them all off, simulating a single motion of the hand backwards on the switches.
- At 10,000 feet you'll also see the airplane pitch over to accelerate to a higher FMC commanded climb speed since we're now above the mandatory 250 knots below 10,000 feet restriction. It accelerates to the FMC's ECON climb speed, which is dynamic and will change depending on aircraft weight and environmental conditions.
- It is good practice to keep the MCP HEADING aligned with the aircraft's actual direction of flight when on a leg of sufficient length. In real life the pilot not flying (PNF) is tasked with doing this. This is done in case you have to engage HDG SEL mode because of an ATC vector, weather avoidance etc. As you make the turns at each point on the departure, rotate the heading knob to match the magenta course's track.
- After passing MM012, it's pretty much a straight shot to Dubai from here with no large turns until the arrival passes over the city and turns us back around for the approach. Feel free to increase the ND map range to something bigger.
- 11,000 feet (FL110 at standard pressure) is our transition altitude where we switch to flying flight levels instead of altitudes above sea level based on a local altimeter setting. All aircraft flying flight levels use the standard pressure setting of 29.92 inHg or 1013HPa. Once you climb a bit above 11,000, you'll see the altimeter setting at the bottom right of the PFD turn amber with a box around it. This is a notice to you that you need to switch to standard pressure. Press the STD button embedded into the center of the BARO knob on the EFIS control panel to automatically set standard pressure.



(Note, because we did not change the pressure in the FSX weather settings for this flight, you will already have 1013 HPA as your setting. You still do need to press STD when climbing above 11,000 though.) After pressing STD, you'll see STD in green where the amber altimeter setting was.



- Passing FL120, you'll notice the CLB 2 annunciation on the upper engine DU change to read just CLB. This is called the climb derate "washout" altitude and marks the end of our climb derate – the engines now have their full climb power rating available for use as the air thins up higher. Note that this transition actually happens gradually, you may have noticed the N1 limit slowly increasing through the climb to this point.



A few miles after passing LELEM, we'll reach our top-of-climb point at FL380, which is indicated by a green circle with the letters T/C next to it. The green altitude range arc that you see on the ND is the continuously calculated point at which you will reach the altitude currently in the MCP window. This can be very useful in both climbs and descents for seeing if you'll be able to make restrictions.



## Cruise Flight, ETOPS, and PMDG Auto Cruise

We're now crossing over the northern part of the Indian Ocean at our cruise altitude of FL380, about to cross into the Arabian Sea. At this point we have a little under three hours of cruise flight over the water, so let's take a basic look at extended operations (ETOPS) and how it applies to a flight like this one. After that we'll engage the new PMDG Auto Cruise functionality to speed up the rest of the overwater part of the trip.

### ETOPS

This flight is operated under ETOPS-120 rules. This effectively means that the aircraft can never be more than 120 minutes of flight time from an adequate alternate airport in the event of several near-worst case scenarios such as an engine failure and decompression simultaneously at cruise. This would force the aircraft down to 10,000 feet with a windmilling engine, creating a lot of drag and inefficiency.



A complicated set of factors go into actually planning an ETOPS route and what we're going to look at here is just the end result of the planning. A more complete discussion will appear in Tutorial #2.

Here is an overview map of our route, shown in the new flight planning and dispatch application Professional Flight Planner X (PFPX) from FlightSimSoft and Aerosoft. The program has full support for ETOPS planning and is available at:

<http://www.flightsimsoft.com/pfpx/>



You can see the route line with our waypoints in red - what you may not have seen before are the large rings around various points on the map and the special waypoints in black. These rings and waypoints are critical to the ETOPS concept.

The large rings represent the 120 minute flight range around our departure airport VRMM and an airport called OOMS – Muscat, Oman. The two smaller rings are 60 minute ranges. These are drawn around an airport on the west coast of India called VOCL – Calicut and around OOMS. These airports are chosen for a variety of reasons, but collectively they define the ETOPS profile for the flight.

Notice that the point where our route intersects the far end of the small ring around VOCL is labeled with a waypoint called (ENTRY). This is the point where we enter the ETOPS segment of the flight – past this point we are more than the normally allowed 60 minutes from the nearest suitable airport, VOCL.

Due to weather concerns in western India when this route was actually planned, the preferred ETOPS alternates on this flight plan are actually going back to our departure airport, VRMM, or continuing on to OOMS in Oman. The critical point that determines which one we would go to in the event of a failure is the point labeled (ETP1) near the midpoint of the region where the two 120 minute rings intersect. This point is called the “equal time point” (ETP). Before reaching the ETP, we would turn around and go back to VRMM, after reaching it we would continue on to OOMS.

There is one more point of interest located where our route first intersects the 60 nm ring around OOMS. This point is labeled (EXIT) and as you might have already guessed, it marks the end of our ETOPS segment of the flight. After passing this point, we’re within 60 minutes of a suitable alternate, OOMS.

It would probably be a good thing if we knew where these points were in the cockpit, so let’s do that now.

- Press the FIX button on the FMC CDU.



- The FIX page allows the pilots to designate locations on the ND and draw DME rings, radials, abeam points and so on using them.
- Press Next Page once to get to the second FIX page. It is a common technique among real world pilots to put the ETOPS information into FIX pages 2 through 4 so that page 1 is left open for things that might come up during the course of the flight such as ATC assigned reporting points.
- Enter VOCL into the LSK 1L. This draws VOCL on the ND. You will need the maximum 640 nm range setting to see it.
- Enter /420 into LSK 2L. This draws a dashed 420 nm ring around VOCL. 420 nm is how far a 777 flies in 1 hour at 10,000 feet doing 300 knots, which would be the situation we'd be in with an engine out and a decompression. The point where this ring intersects your route is your ETOPS segment entry point.



- If you're wondering what the circle with the letter A inside it that you might see to the south of the VOCL FIX page entry is, that's an airport that currently appears on the FMC's ALTN page (VOTV). The FMC constantly runs a search for the closest four alternates and the closest one is always displayed on the ND. Pilots will often manually enter airports into this page due to company policy, weather considerations and so on. A company datalink function also exists to automatically update the list throughout the flight. (See the SP1 Supplemental section in the Intro manual for more information on using it.)
- Press NEXT PAGE to get to FIX page 3.
- Enter N1359.7E06541.4 into LSK 1L. This is the coded latitude and longitude of the ETOPS ETP point. This location is calculated during the flight planning process and there isn't really a



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way to precisely determine its location just using the avionics in the cockpit. Pilots get its location information from their OFP packages. You will not be able to see this point yet without using the ND's PLAN mode and the STEP prompt on the FMC CDU LEGS page. There are usually three ETPs calculated for each ETOPS segment in a flight plan - one for a single engine failure, one for decompression, and one for a single engine failure and a decompression simultaneously. Usually it's the last one that ends up being used in the final flight plan because it has the highest fuel burn due to the extra drag mentioned earlier.

- Press NEXT PAGE one more time to get to FIX page 4.
- Enter OOMS into LSK 1L.
- Enter /420 into LSK 2L. This puts another 420 nm ring on the display, this time around OOMS. The point where our route line intersects the near side of this circle is the ETOPS exit point.

You now have something that looks quite similar to a simplified version of the PFPX map display shown a few pages ago on your ND, enabling you to easily see where your ETOPS segment is located and where the critical ETP point is for diverting in case of a failure.

Here's what it should look like with the FMC STEP centered on DONSA.



The ICAO codes you can see at the lower left part of the display area with arrows next to them are pointing to your alternates

## PMDG Auto Cruise

Since the PMDG 777-200LR is an aircraft capable of extremely long range flights, we developed a feature to assist simmers in completing such routes without forcing you to sit at your computer watching the ocean roll by for 17 hours. We'll use that feature now to get through the rest of the cruise phase of this flight.

- Press MENU on the FMC CDU, then FS ACTIONS at LSK 6R, then AUTO CRUISE at LSK 5R.



- You could use the prompt at LSK 4L to turn the feature on, but we've coded in a rather neat shortcut to controlling the system right from the main instrument panel.
- Set the CDU back to the LEGS page and pan over to the clock that sits to the left of the PFD.



- Right click the CHR button in the upper left corner and it will engage the automatic time compression. You will notice the clock digits turn to a green/teal color to indicate that the automatic mode is engaged. A left click disables the feature and returns to 1x. Note that the time compression can take some time to engage.



- For future reference, if you're in manual mode and you right click this button, the clock digits will turn amber at 2x and red at 4x and above.

Continue the cruise either in real time or using Auto Cruise until you see the top of decent (T/D) point coming up. Adjust the ND MAP mode range to taste as you go. Note, you may see an S/C point in green along the route near the KITAL waypoint depending on your exact gross weight and optimum altitude. This is a step-climb point and will result in FL400 predictions for the subsequent cruise waypoints past it. We are not going to deal with step climbs in this in this tutorial however since it's such a short route. They'll be covered in Tutorial #2.

Note that it's highly unlikely you'll see this S/C point in SP1 because of bug fixes and adjustments to the step climb calculation algorithm.

- If you would like to do it though, roll the MCP altitude window up to 40000 and left click directly on the altitude knob. This will initiate a step climb to FL400 for slightly better fuel efficiency.

The sand of Oman's southeastern coast should be visible off our nose in the distance after passing KITAL – we need to cross Oman and begin our descent into Dubai.



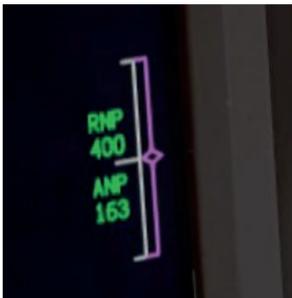
## Descent

At 2 minutes before T/D an amber FMC MESSAGE EICAS caution and a message that says RESET MCP ALTITUDE will appear in the FMC CDU scratchpad. This is letting you know that the FMC wants to initiate a VNAV PTH descent soon and you need to lower the MCP ALTITUDE knob to give it permission.

- For the purpose of this tutorial, we're going to set it to 2000 feet, which is the glideslope intercept altitude on the approach. In real life you'd set it to the lowest altitude ATC has cleared you down to, but since there's no ATC here, we'll just let it go all the way down automatically as if we were cleared to do that.



- Turn off automatic time compression if you're using it by left clicking the clock's CHR button.
- The vertical path deviation indicator will appear on the right side of the ND as you pass the T/D point. The diamond shows you how high or below the FMC calculated VNAV path you are. Don't worry about the RNP and ANP numbers - we'll address those in a later tutorial.



- The FMA thrust mode annunciates IDLE while the throttles are being moved back to idle, followed by HOLD in white, which indicates that the autothrottle servo is disconnected from the physical throttles. You should move your physical throttle back to its idle position now as well while it says IDLE. Once in HOLD mode, the physical throttle is active and if you were to jostle it slightly you could suddenly find your engines surging if the physical throttle was left at maximum.

The first leg of any VNAV PTH descent is always an idle path – after we reach the 230/13000B restriction at GIRMI, however the airplane will enter geometric path mode and use straight line segments between all subsequent restriction waypoints. It will use idle thrust to fly all segments unless the path gets so shallow that the autothrottle must add thrust to maintain speed, in which case you'll see SPD as the active thrust mode. If the path is steep you will have to use speedbrakes to control the acceleration. Speedbrake use is very common in the 777 because it is such an aerodynamically efficient design, though we shouldn't have to use them here.

Now that we're stable in the descent, we need to accomplish a few tasks to prepare for the approach:

- Press INIT REF on the CDU – this button is context sensitive and since we're now in the descent, it takes you to the APPROACH REF page.



The APPROACH REF page gives you essential information for the approach and landing, including your current gross weight, the runway and ILS information, and the available flap setting and VREF combinations.

- We're going to do a standard flaps 30 landing today, so let's select that by pressing LSK 3R to copy the values into the scratchpad, then pressing LSK 4R to insert them into the FLAP/SPEED field.
- Setting the landing flaps creates a speed and flap setting bug on the PFD speed tape, much like we did with the V speeds before takeoff.



- When a ground navaid based approach like an ILS, VOR etc is selected in the FMC, the proper navaid and course will be automatically tuned. In normal operation manual tuning of approach nav aids is not necessary, but you should make a habit of verifying them on the CDU NAV RAD page.



- We can see here that the ILS frequency is auto tuned to 110.10 and a course of 120 degrees is set. This matches the chart for the ILS 12L, (on CD), so we are good here.

In many parts of the world, transition level for the descent is different than transition altitude was during the climb. This route is no exception – our transition altitude climbing was 11,000 feet but OMDB has a transition level of FL150. (15,000 feet at standard 1013 hPa pressure).

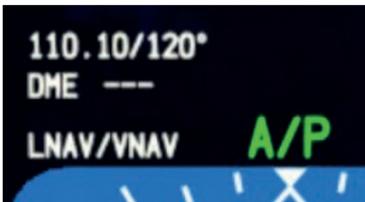
- To enter the descent transition level, first press the VNAV button on the CDU, then press the FORECAST prompt at LSK 5R.



- Enter 150, 15000 or FL150, and line select it into the TRANS LVL field at LSK 1L.



- Press LEGS, where we'll stay for the rest of the approach.
- You'll notice now going back to the PFD that we have the ILS frequency and course for OMDB's ILS 12L visible on the left side above the artificial horizon and the LNAV/VNAV navigation performance scale (NPS) annunciations.



- Arm the autobrake for landing by right clicking the AUTOBRAKE knob four times to select AUTOBRAKE 3.



- We'll be performing a Category IIIA ILS approach with an autoland today, so we will set the set the landing minimums by clicking the outer EFIS control panel MINS knob to its RADIO setting, clicking the RST (reset) button in the center of the inner knob and then turning and holding the inner knob to the left to select 50 feet radio altitude – you'll see the number in the lower right corner of the PFD.

This is not a free rotating knob, it is a spring loaded rotary switch that has two detents, a slow and a fast one that you get by turning it to its stops. To replicate this functionality in the PMDG 777-200LR/F, we've implemented a system where if you click and hold, then drag slightly to the left or right, the knob will switch between the two detents. This is how Boeing designed it and we've replicated it faithfully here. Because this isn't convenient for some users however, we've introduced an option in SP1 to make them operate as free rotating knobs (see the Intro manual for details).





- Now open the ECL page on the lower EICAS and run the DESCENT checklist:



- Press RECALL and verify no EICAS cautions or warnings, we'll note the altitude and speed restrictions at GIRMI, DB423 and UKIM, Autobrake is set to 3, we've entered our landing Vref and Minimums, and we've briefed that we'll be shooting a Cat III approach with an autoland. Check all those items off to complete the DESCENT checklist.

Notice in contrast to the before takeoff checklist that the Autobrake setting is no longer a sensed item because the setting used for landing is up to the pilots.

- Press the CHKL button on the control panel to clear the ECL. The next time it is pressed it will advance to the next checklist, APPROACH, which we will do a bit later as we get lower.

Continue the descent.

- Passing FL150, you'll see the STD altimeter indication on the PFD go amber with a box around it. Press the STD button

embedded into the inner BARO knob to go back to flying altitudes based on ground altimeter settings. Since we have no weather in the sim, the correct value will still be 1013 hPa.



- Set the ND range to 40 nm and adjust to your preference as the descent and approach continues.
- You'll see a green circle with no text next to it on the route somewhere around 10 miles prior to GIRMI – this marks the start of the deceleration leg to reach 230 knots at GIRMI.





- During the deceleration segment, the FMC commands a shallower path angle to allow the airplane to slow down.
- Notice too that passing GIRMI, we've entered the geometric path portion of the descent – the HOLD previously in the FMA thrust field is now SPD due to the shallow path.
- At 10000 feet, pan up to the overhead and turn on the LANDING LIGHTS again with a middle/wheel click on one of the switches. Do the same with the RUNWAY TURNOFF lights.

Look out the front window as we're nearing MESGA – that's the city of Dubai about 20 miles off the nose and we're about to turn onto what is effectively our left downwind leg. Set the ND to 20 nm range here.

- Passing DB423 notice that the airplane hasn't overflown it at 6000 feet. The "soft" 6000 at-or-above restriction here has allowed it to pass it at a higher altitude that results in a more efficient path for reaching the 2000 foot restrictions later on.
- As we pass DB423, we come to another unlabeled deceleration circle about two thirds of the way between DB423 and TALVI – this is the beginning of our deceleration segment for crossing TALVI at the mandatory 210 knots.



These circles can appear in the following conditions:

- Slowing before a hold
- Before a waypoint speed restriction. You will need to deploy flaps 1 to be able to slow completely to 210 knots since our clean maneuvering speed (the UP bug on the speed tape) is currently 212 knots, which limits the deceleration

The airport is now off to our left and visible just below us.

The downwind and final legs at Dubai are quite long and provide us plenty of time to decelerate at a low rate of descent. We'll reach another decel circle for the 185 knot restriction at DB417 just after SOGAP. Once again we'll need to change flap settings to 5 in order to fully decelerate because the flaps 1 maneuvering speed is higher and limits us.





- As we roll into the left base turn, set the ND range to the minimum 10 nm. The waypoints are starting to get too closely spaced for the 20nm setting.

## Final Approach

You may want to pause the simulator with the P key and read the following section first. As with the takeoff earlier, a lot of things happen in a short period of time as we turn final.

- As we roll out of the short base leg and onto our final approach course, let's use the MCP speed intervention feature to begin slowing toward our  $V_{ref}+5$  speed of 142 knots. Click directly on the face of the MCP SPEED knob and the speed window will open. Since we are in the approach phase with flaps out, VNAV will remain in PTH mode. (normally it would revert to VNAV SPD mode upon opening the window)



- The 777's FMC does not calculate automatic slowing to landing reference speed the way you may be used to with the **PMDG 737NGX** and the Vref+5 speed does not get transferred into the FMC LEGS page at the runway waypoint. Speed intervention is the method used for setting approach speeds in the 777 and what's in the FMC effectively doesn't matter at this point.
- Roll the MCP SPEED knob down to the flaps 5 maneuvering speed of 177 knots. We'll fly this speed for a bit until we get closer to glideslope intercept
- Press the MCP LOC button to arm the localizer capture mode. You'll see LOC armed in white below LNAV in the FMA roll field and then quickly LOC active in green. The MCP heading will slew to the runway heading of 120 upon mode activation as well.



It's always a good idea to intercept the localizer before the glideslope – in fact, the configuration options of this particular **PMDG 777-200LR/F** airframe does not even allow for the GS to be intercepted before the LOC. We are also too far away to pick up the GS signal. (FSX unfortunately has lower ILS radio ranges than real life).



- Let's now run the APPROACH checklist on the ECL. The only item is the altimeters, which we already set back at FL150 to 1013 hPa. So go ahead and check it off and press NORMAL to bring up the LANDING checklist, which we'll do after we start down the glideslope.
- At around 20 DME from the runway, the glideslope signal will become active. Press the APP button on the MCP to arm the glideslope capture (G/S in white), which won't happen for a while yet still.



- Passing REREK, deploy flaps 15 and then roll the MCP ALTI-TUDE knob down to the flaps 15 maneuvering speed of 157 knots. Our goal is to be at flaps 20 for glideslope intercept, which should happen at the UMALI fix.





- Roll the MCP SPEED knob down to 142 knots, which will be our final approach speed. The reason it's 142 and not the 137 shown in on the APPROACH REF page is because you always add at least 5 knots extra to your VREF. In a no wind situation like this, 5 knots is fine, but there are situations involving crosswinds, windshear risk and so on with manual throttle control where you'd add more than 5 to it. Boeing states however that 5 knots is always sufficient when using the autothrottle.
- Lower the landing gear and then select flaps 25.
- Select flaps 30 once you reach 142 knots.
- Arm the automatic landing speedbrakes by either pressing Shift+/, clicking the clickspot preset located to the right of the SPD BRK handle, or by using a custom keypress or joystick button.



- Run the LANDING checklist on the ECL. As before everything should be completed. The speedbrake is armed, the landing gear are down, and flaps 30 is selected.



- Close the ECL with the CHKL button.
- After passing 1500 feet on the radio altimeter, you'll see LAND 3 annunciated on the PFD where it previously said A/P. You'll also see ROLLOUT and FLARE appear armed in white below the active roll and pitch modes. This tells you that the autoland system is now armed and will land the aircraft.



- You will hear the RAAS announce "Approaching one two left." on short final. This aids in positively identifying the runway you're landing on.



There isn't much to do now until we touch down, so enjoy the view of Dubai! Off to your right dominating the skyline is the world's tallest building, the Burj Khalifa at 2,722 feet.



## Landing

- As the airplane flares and touches down, wait for the autothrottle to bring the thrust levers fully to idle (the thrust mode column on the FMA will go from IDLE to blank) and then press F2 to activate the reversers. Keep them activated until you're at around 60 knots or so, then press F1 to stow them.
- Disengage the autopilot by pressing Z or your joystick AP disconnect button twice.

- Brake manually below 60 knots, which will disengage the autobrake.

Note that due to an issue with FSX, you will need to tap the brakes several times or press and hold them to get the autobrake to disengage.

- Turn off at the next available high-speed taxiway and hold. For me it was taxiway M9 about three quarters of the way down the runway.

Welcome to Dubai and congratulations on the successful conclusion of your first **PMDG 777-200LR/F** flight!

You have a choice now:

You can continue taxiing to the terminal and learn the Shutdown, Secure, and cold and dark startup procedures contained in the following two supplements, or you can leave FSX now and wait for the more advanced Tutorial #2 for those items.

## **Shutdown and Secure Procedures Supplement**

We're now going to do the more advanced end-of-flight procedures "by the book" like a real crew would. The book in question is the **Flight Crew Operations Manual Vol 1. (FCOM Vol. 1)** and you can find it with the Documentation link within the PMDG 777 module of our new PMDG Operations center application, which is available in the Start Menu at PMDG Simulations/PMDG Operations Center. We will be skipping certain items that aren't applicable to the aircraft's current state.

Open the FCOM 1 and find Normal Procedures section page NP.21.50 (page 248 of the PDF version) - the After Landing Procedure.



Because the **PMDG 777-200LR/F** is effectively (for now at least) a single pilot aircraft in the FSX environment, we're going to combine the pilot flying and pilot monitoring's actions – in real life there's a division of labor between the two crew members.

## After Landing Procedure

- Verify that the **SPEED BRAKE** lever in its **DOWN** position, which stows the spoilers. This may have already happened if you've increase engine thrust after landing. They automatically stow with a small amount of thrust lever motion.



- Start the APU by right clicking twice on the overhead APU switch. Hold the mouse button on the second click until you see the switch spring back to the ON position.



- Turn off the LANDING LIGHTS, RUNWAY TURNOFF LIGHTS, STROBE LIGHTS and turn on the TAXI LIGHT.
- Set the AUTOBRAKE knob to OFF.
- Select FLAPS UP.
- Leave the TRANSPONDER mode set to TAVRA since OMDB is an airport equipped with airport surface detection equipment. You would set it to standby at an airport not equipped with ASDE.
- Taxi via M10, cross Runway 12R/30L, then taxi via K7 and K and pick any available gate that you wish to park at on the northern side of the terminal. We picked F23 here, but you can go wherever you'd like, it doesn't matter.

Notice again how the RAAS alerts you as you approach the runway. This system helps the crew avoid runway incursions on the ground, which are a major source of accidents.

Once we're at the gate, it's time to perform the Shutdown Procedure which starts at FCOM 1 NP.21.52 (page 250 of the PDF version)



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## Shutdown Procedure

- Set the parking brake either by clicking the handle on the pedestal, or by pressing Shift+.(period key). We don't want our 777's nose making a surprise cameo inside the terminal.
- On the pedestal, move both engine start levers below the throttles to the cutoff position (down) by left clicking them.



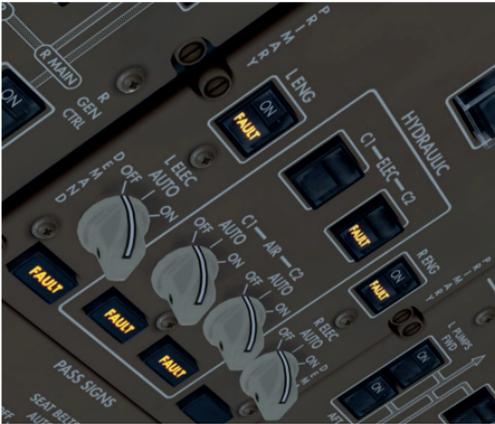
This is the action that actually shuts down the engines.

- Turn the fasten seat belts knob on the overhead off.

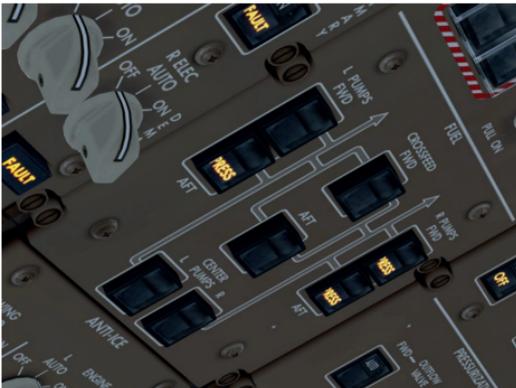


Turn off the hydraulic pump switches in the following order:

- C1 and C2 AIR DEMAND
- L ELEC DEMAND
- C1 and C2 ELEC PRIMARY
- R ELEC DEMAND
- The L and R ENG PRIMARY switches stay on.



- Turn off all FUEL PUMP switches.





- Turn the BEACON switch off.
- Turn both FLIGHT DIRECTOR switches on the MCP off.
- Set the TCAS mode selector on the pedestal to STBY.
- Bring up the lower EICAS STATUS page and ensure no maintenance status messages are show. If there were they would need to be written up for the maintenance personnel to investigate.



- Press MENU, FS ACTIONS, and then GROUND CONNECTIONS. Set the CHOCKS with LSK 1L.



- Disengage the PARKING BRAKE by clicking the lever since we're now held in place by the chocks. Note that you will still see the red PARKING BRAKES text in the lower left corner of the screen due to FSX limitations.
- Press return at LSK 6L and then DOORS at LSK 3L.



This is another page that doesn't exist in the real aircraft that allows you to control the opening and closing of the aircraft's various entry and cargo doors in FSX.

- Open the Entry 2L door (click once to disarm, then again to open).
- Press next page and open the FWD, AFT and BULK cargo doors.

At this point some time would pass at the end of a real flight - the passengers are being deplaned, the catering and cleaning crews are beginning to perform their jobs and so on. We're going to pretend that some amount of time for those activities has passed and proceed with the final Shutdown Procedure items after our passengers have left the airplane.



- Move the APU knob on the overhead to the OFF position.

The APU shutdown process will take approximately 60 seconds to begin.

- We have lost the display we were using for the ECL due to the APU going offline. We can display it in the position where the ND was before by pressing the L INBD button on the control panel:



- Bring up the SHUTDOWN checklist on the ECL.

These items are just checking (hence the name!) things we've already accomplished in the Shutdown Procedure. The only one you need to manually check off is the PARKING BRAKE.

This completes the shutdown and we'll now move on to the Secure Procedure, which is performed before the crew leaves the aircraft.

## Secure Procedure

- The Secure Procedure's purpose is to get the airplane into a condition ready for servicing by the ground crews, but without completely powering it down – we of course will be completely powering it down, but the Secure Checklist has to be done first.
- Turn the ADIRU switch on the overhead OFF. This switch is located at the far back of the right side of the overhead, so you'll have to crane your virtual neck a bit to get to it.



This powers down the inertial reference unit laser gyros. They will now lose alignment and we'd need to fully realign them to get our normal displays back.

- Set the EMER LIGHTS switch in the center of the forward overhead to OFF by right clicking both the guard and the switch itself. This disarms the cabin exit lighting since there's no longer any chance of a passenger evacuation.





- Set both PACK switches on the overhead pneumatic panel to OFF.



- Pull up the ECL one last time and select the SECURE checklist. To do this you'll need to select it from the NORMAL MENU. This is a quirk of the real airplane that the loss of AC power from shutting down the APU resets the ECL.

The only item remaining is to confirm that we've turned the PACK switches off. We have, so check that item off.

- Press CHKL to turn the ECL off (showing the ND again), and press the LWR CTR button on the MFD control panel to place things back onto the lower EICAS for the next flight.

## **Electrical Power Down**

- The final step that will actually put the aircraft into a cold and dark state is the Electrical Power Down procedure, which is located in FCOM 1's Supplemental Procedures section on page SP.6.1 (page 283 of the PDF version).
- Verify that both the APU and EXTERNAL POWER switches are OFF.
- Turn the NAV lights switch off.
- Set the overhead BATTERY switch to OFF.



If you look around the cockpit you'll notice certain items still lit like the BRAKE SOURCE light on the captain's side main panel and the L and R GEN CTRL lights on the overhead. These stay lit for 90 seconds if the APU was running, which gives the APU time to shutdown and the APU door next to the tail on the right side of the airplane time to close.

The airplane is now powered down to its cold and dark state.



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# Cold and dark start procedures supplement

We'll now start the airplane back up from a cold and dark state.

It is worth mentioning that while simmers have a particular fascination with this process, real life 777 line pilots almost never encounter an aircraft that is fully cold and dark. In the real world these airplanes are in the air nearly 24 hours a day and only sit on the ground at the gate between flights for an hour or two. The plane is kept powered and basically ready to go aside from programming the FMC and starting the engines. The long and short turn panel state configurations are much more common than a completely shut down aircraft. The exception is the 777F, as freighters often do sit shut down for a good part of the day because of the way the international freight schedule works.

We will not go through the process of entering a route again – you can refer to the earlier parts of this tutorial for that. We also will not be talking about all of the checks and tests that are performed. If you want to do those, you can refer to the actual procedures in the FCOM Vol 1.

The goal here is just to show you how to get the airplane up and running with the minimal number of steps. Tutorial #2 will contain the full procedure with checks and tests and the route entry.

## Electrical power up

The process begins with the Electrical Power Up Supplementary Procedure located on page SP.6.2 (page 284 of the PDF) of the FCOM Vol. 1. We are assuming use of the APU here, not external power.

- Turn the overhead BATTERY switch on



- Turn the NAV lights switch on the overhead on.
- Start the APU by right clicking twice on the overhead APU switch. Hold the mouse button on the second click until you see the switch spring back to the ON position.



- Prepare yourself to witness the most detailed representation of an aircraft startup sequence that's likely ever existed in FSX. Make sure you have the sim selected and in focus while this happens so that you hear all the interesting sounds and tests that happen.
- After the APU switch clicks to ON, you'll see the BRAKE SOURCE and L and R GEN CTRL lights turn on. It's going to look like nothing's happening for around 1 minute and 20 seconds while the APU door opens and the APU starts. At this time you'll hear some of the equipment cooling and 400Hz power relays come online and the clocks and the MCP windows will appear. The ISFD appears next and begins its



alignment procedure. You will hear a series of changes in the intensity of the rushing air sounds in the cockpit as the bleed air system is tested. The CDUs will appear with their screens dimmed and the FMC prompts not immediately available. You will hear various “clunk” sounds as the yoke backdrive actuators are tested. The ISFD alignment completes and shortly after you will see both CDUs come to full brightness and the main displays will flash in a series of test patterns. Finally, you will hear a rather obnoxious sounding microphonic feedback and static sound as the cockpit aural systems test runs. The entire process takes over 4 minutes to complete and matches the real world aircraft exactly.

## Preflight

- Once the initial startup is done, we can begin running the relevant items starting with the Preliminary Preflight Procedures located on page NP.21.1 (page 199 of the PDF). Again, this is an abbreviated list of steps with no pilot initiated tests or checks of items that are known to already be set correctly given that we just put the airplane in the state it’s in.
- Turn the ADIRU switch ON



- This starts the alignment process for the ADIRU laser gyros.

- Pan down to the CDU and press LSK 1L, (the <FMC prompt), followed by LSK 6R to get to the POS INIT page.



- Press LSK 5R to copy the aircraft's current GPS position into the scratchpad, then line select it into the SET INERTIAL POS field below at LSK 6R.

This gives the ADIRU the airplane's current position to align on. It will take approximately 6-7 minutes to align if using the realistic option. The default in the simulation is a compressed 30 seconds though.

- **At this point continue with the FMC setup that we went through at the start of the tutorial (pages 21-47), changing the specifics to suit your flight. After you are finished with that process, continue below:**

- Close the guard on the EMERGENCY LIGHTS switch to arm



them.



- Set the SEAT BELTS knob to AUTO.



- Press both PACK switches to place them in the AUTO position.



- **At this point set up the MCP as described earlier in the tutorial using the values from your particular flight. (pages 50-52) After you are finished with that process, continue below:**
- Test the oxygen system located on the left wall by pressing the button. We're running this test because it's a PREFLIGHT checklist item. You should hear a hiss and see the test port open.



- Set the AUTOBRAKE knob to RTO by left clicking it once.





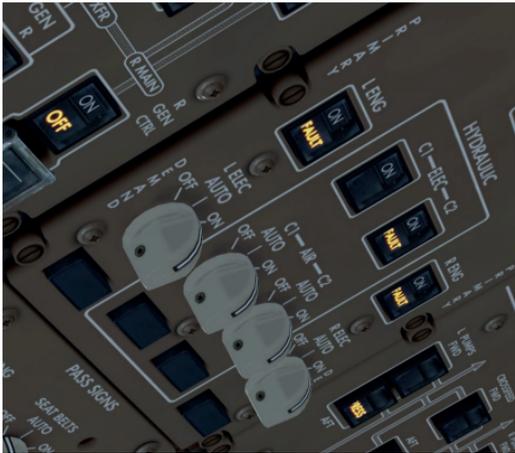
- Open the ECL and complete the PREFLIGHT checklist.



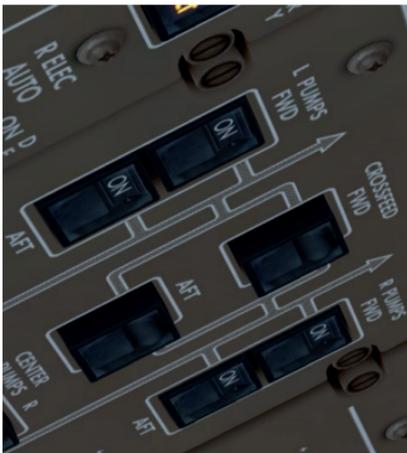
- Use the CDU DOORS page as before to close and arm any entry doors that are open and close any cargo doors that are open.

## Before start

- Turn on the hydraulic pump switches in the following order:
  - R ELEC DEMAND
  - C1 and C2 ELEC PRIMARY
  - L ELEC DEMAND
  - C1 and C2 AIR DEMAND



- Turn on all fuel pumps for tanks that have fuel in them. (if starting from the end of the VRMM-OMDB flight, it will be the four wing pumps)



- Turn the BEACON light switch on.
- Set the takeoff trim noted on the CDU TAKEOFF REF page.
- Open the ECL and run the BEFORE START checklist.



## Pushback and engine start

- On the CDU, press MENU, then FS ACTIONS, then PUSHBACK at LSK 4L.



- Press LSK 5L, which takes you to the GROUND CONNECTIONS page where you can remove the chocks at LSK 1L.





- 
- The engine will accelerate and stabilize. As soon as you hear a click sound and the R START selector moves to NORM, repeat the procedure for the left engine.
  - While the second engine is starting, the pushback will likely complete. Set the parking brake and wait for the left engine to stabilize and set the CDU back to the TAKEOFF REF page.
  - Once all lights are extinguished on the overhead, continue with the before taxi procedure.

## Before taxi

- Rotate the APU selector to OFF.
- Set the flaps to the selected takeoff setting. (usually 5)
- Check the flight controls.
- Set the transponder to TAVRA if at an ASDE equipped airport.
- Turn on the TAXI light.
- Bring up the ECL and run the BEFORE TAXI checklist.

You are now in the same configuration the airplane loads up in by default from FSX Free Flight and are ready to taxi and take off.

## Conclusion

Tutorial #2 will be available at a later date. It will be available in PMDG Operations Center and integrated into future versions of the product installer after it's finished.

We would like to extend a very special thanks to 777 Captain X, 777 FO Rene Pedersen and to the PMDG Wide Beta Team (especially Kyle Rodgers for his editing and publishing layout adjustments) for their advice and assistance in creating this tutorial.

This concludes the **PMDG 777-200LR/F** Tutorial #1.

See you in Tutorial #2!

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