PMDG 777-200LR/F

Introduction and Use

This manual was compiled for use only with the **PMDG 777-200LR/F** simulation for Microsoft Flight Simulator ™ X. The information contained within this manual is derived from multiple sources and is not subject to revision or checking for accuracy. This manual is not to be used for training or familiarity with any aircraft. This manual is not assumed to provide operating procedures for use on any aircraft and is written for entertainment purposes.

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In all circumstances the aircraft manuals issued by a certified training center for use with a pilot's training course and the manuals located on the flight deck of an aircraft as well as the operational procedures dictated by the aircraft manuals supersede any information taken from this product or the documentation provided with this product.

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THE TESTING TEAM

We take great pride on the cohesion and dedication of our testing team members, and we place significant demands on their time, their expertise and occasionally their patience.

We would like to thank the following individuals for their contributions to the **PMDG 777-200LR/F** project as Technical Advisors:

Captain Andrew Griesbach
Captain Pete Locascio
Captain X
FO David Andrews
FO Cristian Caicedo
FO Rene Pedersen
Islam Alnady
Allan Burek
Sven Kubusch
Alex Cabrerizo Martinez
Jean Remy Ragaru
Bryan Rosier
Joselito Sousa
Robert Szarek

We would also like to thank our dedicated team of wide beta testers who have worked tirelessly to help us improve the quality of this product. Any lapses are ours:

Mark Adeane
Carl Avari-Cooper
Aaron Buchanan
Steve Cotterill
Dan Downs
Josua Duval
Ryan Gamurot
Jhan Jensen
Mats Johansson
Johan Ketting
Aleksi Lindén
Chris Makris
George Morris
Luke Pabari
AJ Pongress
Kyle Rodgers
Mike Roth
Paul Solk
JR Whittaker
Peter Wright

PMDG TECHNICAL SUPPORT

PMDG employs a ticket based support system that allows us to provide you with direct, personal attention from a tech support analyst. If you have trouble with this product, we encourage you to visit our technical support portal:

http://support.precisionmanuals.com

Our policy on answering support tickets is that you should receive a reply from us within 24-48 hrs, depending on the type of request you submit.

Our average reply time to tickets is generally less than 6 hours and our support team is dedicated to getting you up and running as quickly as possible.

Please Note: The support ticket system will require you to create a login that is unique to the ticket system and is not tied to your PMDG Store login.

IMPORTANT – READ THIS PAGE

- **Please read pages 21 through 42 of this manual even if you don't intend to read anything else in it – they contain very important mandatory FSX settings and recommendations for proper functioning of the product.**

- Installation and license activation instructions are on page 22 of this document.

- Liveries are downloaded and installed (among many other functions) through the **PMDG Operations Center** application, which is installed automatically with the **PMDG 777-200LR/F**. You can find it in your Start Menu under PMDG Simulations/PMDG Operations Center.

  Note that an Operations Center update may be triggered the first time you run the application – this is normal and is required.

  The Operations Center has its own separate manual, which can be found on the About PMDG Operations Center page via the link on the left side of the main screen of the program after it runs.

- Full documentation for the aircraft including the Tutorial flight that explains how to operate and fly it can be found in the PMDG Operations Center application by selecting the 777 product from the main drop down menu and then choosing the Documentation module from the menu on the left side.

- Payload and Fuel loading and aircraft options selections are handled through the FMC directly by pressing MENU > FS ACTIONS and PMDG SETUP. There are no external load or fuel managers for this product. Do not modify payload or fuel with any other method than the FMC pages described above.

- If you need to reinstall your operating system, are upgrading your hardware, or are installing on a completely new computer system, please deactivate your license manually first through the FMC on the MENU > PMDG SETUP > LICENSE page. This will eliminate the need for you to submit a support ticket for license reactivation after you reinstall.

THIS IS NOT YOUR NGX ON STEROIDS

In August of 2008, we launched development on what was to become our third generation platform upon which to simulate complex airliners. The result of that effort, the **PMDG 737NGX** product line, was released to customers three years later, on August 4, 2011.

Had you asked us at that time whether or not we would be able to significantly improve upon that product with our next release, we might have been tempted to tell you to expect a natural plateau. One in which the high quality remains, but significant improvement is not quite as obvious or as stark as what we had accomplished with the NGX.

And we would have been wrong.

As we moved further and further into the post-release phase of the NGX series of products, we found that there were items we wanted to refine, improve or completely re-build in order to increase flexibility and accuracy of the product.

We used the **PMDG 777-200LR/F** as the development tool against which we created thousands of improvements on what was already a very advanced product. Many of the changes will be invisible to you, but they will enhance the realism and immersion of this product in ways that you might not be able to describe specifically, but you will know that they are there.

From the physics behind roll and pitch control, to braking, brake pad energy absorption or changes in engine RPM (have you seen how big those fans are? They don't change speed quickly!). From the fluid dynamics behind changes in cabin temperature to the force exerted by hydraulic pressure under varying pressures… The physics is all there, performing in real time to give you a better simming experience.

Then there are more subtle changes, such as the vast improvements in the autopilot control logic to smooth the way the airplane rolls in or out of turns, or how rapidly it changes pitch to enter a climb or level out at a target altitude. All of these little things add up to an even cleaner, more accurate simulation of a modern airliner.

As we approached the release date for this product, we started asking our Technical Testing Team and our Beta Testers, "what do you want our customers to know about this product?" The overwhelming answer was "This is not the NGX on steroids. This is a completely new and different airplane."

And so it is.

You will notice that this airplane has an incredible level of automation. Many tasks that you are used to performing in the NGX will be automated for you now. Simple things like turning generators on or off are now handled by the airplane, so just leave those generator switches in the ON position and let the airplane do what it needs!

You will have some fantastic new tools to help you manage the cockpit, such as the Electronic Checklist system. The ECL will walk you very easily through nearly all phases of flight, and will provide you with detailed step-by-step guidance through how to handle any message that appears as a result of mechanical failure, from a failed fuel pump to a complete catastrophic engine failure, the ECL is your friend. Follow those steps and you will have the airplane reconfigured to complete the mission in no time at all.

The **PMDG 777-200LR/F** is also a smart airplane when it comes to protecting dispatch reliability. Depending upon the phase of flight, the airplane may not present an advisory or caution message if there is not risk to the flight. The wise pilot will monitor the STAT page of the display system occasionally just to see what the general health of the airplane might be, but don't expect her to complain to you about problems you cannot solve.

The **PMDG 777-200LR/F** is a complete simulation as well. We have modeled more than 700 Warning, Caution, Advisory, Status and Memo messages that you may see on the EICAS display at some point during your 777 flying.

Many of those have associated checklists that accompany them, and as previously mentioned, those are included in the **PMDG 777-200LR/F** as well.

All in all, this is the most complete simulation of the 777 currently available for simulation users.

Over the next few months we intend to expand your 777 fleet by adding the 777-300ER, the 777-200ER and possibly a few others. With each expansion will come a completely new set of challenges and quirks to keep you entertained as you learn the differences between the handling techniques required for each airframe type.

We think they will be as much fun for you to manage as they are for us to create!

INTRODUCTION

Along the way with this development cycle, we decided to branch out and start adding some new, “outside the cockpit” or “alongside the cockpit” value to our product line.

This product will kick off the use of the new **PMDG Operations Center.** The Ops Center will be a one-stop shop for you to keep all of your PMDG products up-to-date, download liveries, install liveries, and eventually we will be able to push live incremental updates to you in order to ensure that you always have the very latest fixes and post-release updates for your PMDG products. (As of this writing, the Ops Center is planned to support all PMDG products released after September, 2009. This will include the **PMDG BAe JS4100**, the **PMDG 737NGX**, **PMDG 777** and **PMDG 747-400v2.0** and beyond!)

The **PMDG 777-200LR/F** is also the first product to include a new and “functionality focused” Ground Operations module. Ground Ops is detailed later in this introduction, but it will provide a simulation of all the “Stuff” that goes on around your 777 during the course of a ground turn. You will see the doors disarm, the airplane get fueled in real-time, while cabin and cargo doors open and close in sequence based upon actual Boeing service guidelines, eventually leading to the point where the last door closes, and the only thing left to do is push-back, start up and taxi.

Ground Ops will give you some practice managing your cockpit tasks under a definite time pressure to make a specific departure time, and we have even more functionality planned for it in the near future so stay tuned!

We have added a new feature that will allow the makers of weather engines to export data that you can import directly into the FMS in order to improve climb and descent predictions by the FMS. This feature is documented in a text file located in your <fsx>/PMDG/WX directory. (Requires the weather engine makers to create a data export that matches the prescribed format.)

The **PMDG 777-200LR/F** also brings new features designed to make Long Haul and Ultra-Long Haul flying easier! We call these options collectively PMDG Auto Cruise.

Auto Time Compression will allow you to establish a rate of time acceleration that you would like to use, then the airplane will slowly increase the time acceleration in order to cut down on the amount of real-time required to fly those long range flights. If the airplane reaches some juncture where stability (due to weather import changes most often) is upset, or where pilot interaction is required (a mechanical failure, for

example) or where it simply isn't possible for the simulator to run at such a high rate of acceleration without upsetting the airplane, then the acceleration rate will slow, allowing you to interact with the airplane in real time!

Suddenly those Ultra-Long Haul flights are attainable!

Another first for our product lines is the new Auto Step Climb feature. This feature will do just what it says, allowing the airplane to manage itself along the path of flight in the most optimum manner while you take that important crew rest, meal or break. Auto Step Climb will work equally well when you are using Auto Time Compression, as well!

In other words, we created *some* tools to increase realism, and other tools to increase your flexibility when using the sim.

We hope you enjoy both!

The **PMDG 777-200LR/F** product line is a unique in the ability to accurately portray not just the "book values" of a particular airplane, but also the nuances and subtleties of the 777 airplane that are normally unavailable through manuals and guesswork. Experienced aircrew will notice hundreds of subtle details lending themselves to a complete and satisfying simulation experience. (We have compiled a list of such behaviors for you at the end of this document!)

To this end, we have gone to great lengths to simulate the sophisticated environment that is the modern airliner cockpit. Using many of the same tools employed to teach pilots and mechanics how to support the 777 airplane, we have worked to build a simulation that capitalizes on the strengths of the Microsoft Flight Simulator X™ environment while simultaneously working around the simulator's weaknesses through the use of innovative technology and development.

Invariably there have been times when we needed to make choices between realism and usability. While Microsoft Flight Simulator is a wonderful and dynamic platform for modeling airliners, there are some aspects of Microsoft Flight Simulator that just do not function as well as we would like, and we have worked hard to overcome them while also enhancing the realism of the **PMDG 777-200LR/F** experience. To the greatest degree possible we have attempted to document these shortcomings within this manual.

The **PMDG 777-200LR/F** is a highly complex simulation platform and we have compiled this documentation in order to provide you with the best

information to help you learn how to operate this simulation effectively. We recommend that you read through these documents without trying to retain all details on the first read. It is our experience that even seasoned airline pilots will gain the most from skimming their manuals repeatedly over many months in order to learn everything that is required of them in a new airplane.

We recommend that technique to all PMDG customers as well. Read, learn, and enjoy the results of our hard work!

If you need help or require assistance, please use our support ticket system mentioned earlier or visit our user-to-user customer forum hosted at http://www.avsim.com in the forum section. The PMDG forum is the best place to converse with like-minded PMDG customers and to learn new tips and techniques to operating a complex airliner like the 777!

In conclusion, we would like to leave you with a sincere and deeply personal note of thanks:

The release of the **PMDG 737NGX** was one that will long live in our memories as a favorite experience. We learned very quickly and very strongly just how much you have come to appreciate the work that we do to make these products. This type of development is not easy, and it takes years of practice and strong dedication to simulate a complete airplane without excuses or shortcuts. As we have progressed down the road toward release of the 777, the enthusiasm of our customers has at times been a bit overwhelming.

Without your dedication to our products, and to this hobby as a whole, we simply wouldn't have a reason to do what we do. We cannot thank you enough for the opportunity your enthusiasm represents to all of us at PMDG.

So please let us say without qualification: Thank you.

On behalf of the entire team,

Thank you!

The PMDG Development Team
03SEP13

GETTING FSX SET UP FOR THE PMDG 777-200LR/F

There are hundreds of thousands of possible hardware setups upon which you might run the Flight Simulator X and the **PMDG 777-200LR/F** so it is important that you take a few moments to be certain that Microsoft Flight Simulator X is properly set up to run this advanced airliner simulation in top form.

The following recommendations have been created by our support team and are based upon years of helping customers get the most from their PMDG products.

Yes, You Really Should Read This:

During the beta testing period for the **PMDG 777-200LR/F**, without fail, all of the testers who took the time to follow this section's recommendations to improve FSX performance were very pleased with the results.

Even if you have fast hardware, there is something to be gained by following these instructions to get FSX set up and operating effectively.

Also, we STRONGLY discourage users from trying to "beat the (Windows) system" by disabling services and "turning off functionality" within Windows.

The services running on your local machine serve a purpose and providing that you have properly maintained your Windows installation and you follow the guidelines we present here, turning off services is not going to give you much in terms of performance.

It is important to note that PMDG is using the FlexNET Licensing Service and if you turn this off, the **PMDG 777-200LR/F** will cease working.

In short, leave the services alone…

You can gain far greater performance by running Windows 7 64-bit, and by following experienced guidance for optimization, no matter what operating system you use!

Proper Installation:

When you run the **PMDG 777-200LR/F** installer, it is going to ask you whether or not you should install a few Microsoft runtime libraries on your local machine. The sub-installers for these runtimes are intelligent, and they will only install if your local machine NEEDS the installations- so please do not try to second-guess the Microsoft runtime installers. Select YES, and let the installers determine whether or not you need updates to your machine.

Failure to install the required runtimes will lead to unreliable operation of the **PMDG 777-200LR/F.**

Product Activation:

The PMDG 777-200LR/F requires an active internet connection to activate the product. Upon first run of the aircraft, a window will appear asking for your license key. This key can be found near the bottom of your purchase confirmation email or attached to the inside of your CD/DVD case. It is a long string of 6 groups of letters and numbers that looks like this:

77PD-XXXX-XXXX-XXXX-XXXX where the Xs are letter or number characters. There is no letter “O” in our keys, it’s always the number zero.

The **PMDG 777-200LR/F** is the first PMDG product to allow for user-initiated activation returns. To access this function, press MENU on the CDU, then PMDG SETUP, then LICENSE. The prompt is on this page along with one that will show you your key in case you need it for support.

Please make use of this feature when reformatting, changing hardware or PCs and so on.

Optimal Installation of FSX:

Please Note: If you already have FSX installed, you will find the recommendations in this section to be useful the next time you purchase a new computer or conduct a new-machine installation!

- Do not install FSX into the default installation folder: When installing FSX, do not install the simulator into the default directory that it offers. Instead, customize the folder to something different. (Example: C:\FSX) This will eliminate problems that many users experience resulting from various Windows protection and permission issues forced upon programs placed in the Program Files and Program Files (x86) folders.

- If you're using FSX: Steam Edition (hereafter referred to as FSX:SE) released in late 2014, we recommend installing to a separate SteamLibrary folder that is outside of the Program Files and Program Files (x86) folders for the same reasons as outlined for the Microsoft retail disc version.

- Choose a modern, 64-bit Operating System: We strongly recommend that users run their simulator from a 64-bit operating system. The best operating system currently available (at time of writing) for FSX is Windows 7 64-bit. The advanced memory management capabilities of modern operating systems are far superior when running complex simulations such as the PMDG 777-200LR/F. (More on this a bit later in the section about out of memory errors and VAS on page 31.)

- PMDG has experienced numerous issues with the Windows 8/8.1 platform since its release and we do not offer any official support for these operating systems. We have seen the **PMDG 777-200LR/F** work just fine in Win8 but we have also seen inexplicable strange problems result on it as well. If you'd like to try it, it is at your own risk and we cannot provide support for it.

  If you do decide to try it, keep these guidelines in mind:

  - Disable User Account Control (UAC). This requires registry editing in Win8 to completely disable. We cannot offer instructions on how to do this. Search online for it.

  - Make sure FSX is installed in its own folder such as C:\FSX (or a separate SteamLibrary in the case of FSX:SE), not the default location where the OS's permissions issues with this folder can become a problem.

  - Always run FSX with the right click "Run as administrator option as described below:

Running FSX:

- Set FSX to "Run as administrator." This will give FSX the best opportunity to use system resources effectively and without limitations. To do this, right click on the FSX icon, and then select properties. Click on the Advanced button, and then check the box that reads: Run as administrator. From this point onward, whenever you run FSX, the program will run under the

administrator permissions group. (You can also follow these steps by right clicking directly on FSX.exe) For FSX:SE, this can be accomplished by navigating directly to the Steam install folder for the sim and performing the same operation.

- Do not let your antivirus software actively scan FSX: While we are all concerned about the prevention of malware, it is extremely important that you allow your FSX installation to "opt out" of being actively scanned for viral activity while the software is running. FSX loads thousands upon thousands of graphic files and models into memory while you are flying, and active malware scanning slows this process dramatically. In some cases active scanning can reduce your simulator performance by up to 75%.

  There are too many antivirus suites out there to make recommendations for each one, but if you search for "exclude" in your software's help system, you will find instructions. Simply EXCLUDE your FSX root directory and you should be all set!

  Do not forget to manually run a malware scan on your FSX directory on occasion just to keep you safe!

FSX.CFG Settings:

The FSX.cfg file is a repository of settings used by FSX and many users are intimidated by the wealth of settings contained in the file. There is no reason to be concerned about editing this file. (Indeed, if you do make a mistake and you do not have a backup copy of your previous FSX.cfg file, simply delete the file and FSX will create a new one!)

To locate the FSX.cfg or fsx_se.cfg (if using FSX:SE) file:

First, go to Control Panel\Folder options or the Tools\Folder options menu in any Windows Explorer window (you may have to press and hold the Alt key to see the menus) and change the following two settings on the View Tab:

- Enable "Show hidden files, folders, and drives"
- Disable "Hide extensions for known file types"

If these settings are not changed you likely will not be able to find the file! Once they are changed – look here for it:

C:\Users\(Your Username)\AppData\Roaming\Microsoft\FSX

or

C:\Users\(Your Username)\AppData\Roaming\Microsoft\FSX-SE
(if you have both FSX and FSX: Steam Edition installed)

You will notice that the file is broken into sections by headers such as: [Sound] or [Graphics].

In the [Graphics] Section:

(not needed if using FSX:SE)

Add the following line (if it is not already present)

- HIGHMEMFIX=1

HIGHMEMFIX will prevent you from seeing a “skeleton airplane” under certain high graphics-load circumstances.

In the [DISPLAY] section:

Add the following lines (if they are not already present) if you have a wide-screen monitor running a 16:9 or 16:10 resolution.

- WideViewAspect=True

This setting locks the vertical field of view and allows for additional horizontal field of view. If the simulator looks highly zoomed in with all the default views, having this setting on False is probably the culprit.

UIAutomationCore.dll fix:

(Not needed if using FSX:SE)

We highly recommend the use of a replacement uiautomationcore.dll file if using Windows 7 64-bit. The Windows 7 version of the file is bugged in conjunction with FSX and can cause the sim to crash after repeated menu use over a few hours of flying.

http://downloads.precisionmanuals.com/file_library/UIAutomationCore.zip

Extract the dll contained here into your FSX root folder, the sim will reference it instead of the bugged Windows 7 default version.

FSX tweaks:

There are numerous tweak guides and websites out there in the FSX community that can help you to get more performance out of the

simulator. We recommend reading up on these at the Avsim forums and deciding for yourself which performance tweaks you'd like to use.

NOTE: In the **PMDG 777-200LR/F** we have an option that allows you to place chocks under the wheels in order to hold the airplane in place. We do this by forcing the FSX parking brake on in the background, while allowing you to set/release the airplane's parking brake at will. You will notice the red FSX "Parking Brake Set" message appear whenever you have wheel chocks set, since we are using the brake in this fashion. If you wish to eliminate this red message, simply look in your FSX.CFG for:

InfoParkingBrakesEnable=True

Change True to False and the message will no longer appear!

*We decided not to change your FSX.CFG file automatically, as some users do not appreciate such changes being made without permission!

FSX In-Game Settings:

We recommend the following settings to help you get the most out of FSX.

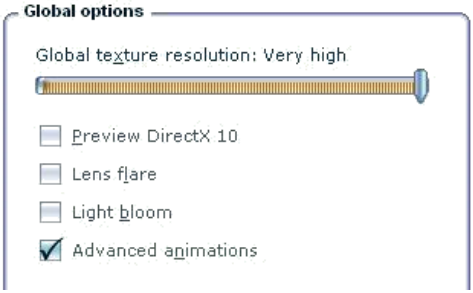
Graphics Page:

- Global Texture Resolution – Very High: This will give you the highest quality virtual cockpit and external model textures. If you see blurry cockpit/model textures in the simulator, it is likely because this setting is not set to Very High.

- Advanced Animations: Check this box in order to see the full range of animations that are included in the PMDG 777-200LR/F. If you are not seeing the wings flexing in flight, you should look at this checkbox.

- Preview DirectX 10: Turn this setting off. DX10 does not significantly enhance the visual quality of the simulator and can cause graphical issues.

- Light Bloom: Light bloom looks incredibly nice, but unless you have incredibly good performance we recommend that you leave this turned off, as it is very hard on performance for most users' machines.



Aircraft Page:

- High Resolution 3-D Virtual Cockpit: Checking this box will give you the highest quality VC possible within FSX. If you are suffering from poor performance, you can uncheck this box and see a reasonable increase in performance for a modest exchange in visual quality. We generally recommend leaving this box checked unless you run out of performance.

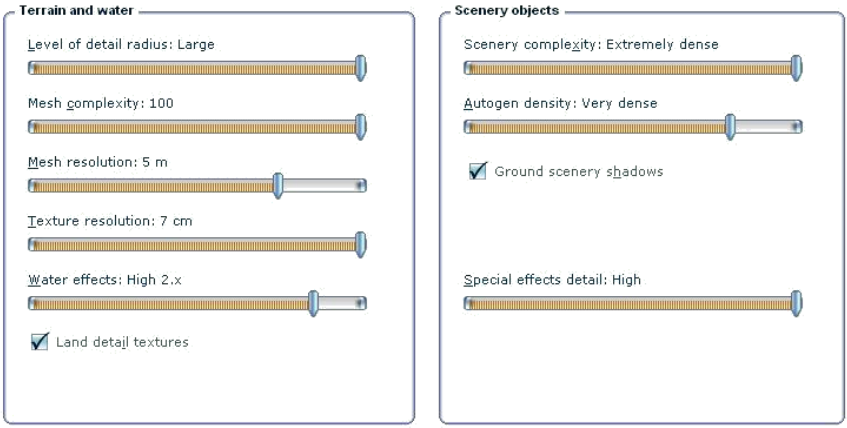
- Cockpit tooltips: Set this checked on to assist with special knob functions and hidden clickspots.

Scenery Page:

If you are experiencing poor performance, this page is one area where you can gain quite a bit of bang for your buck for even small reductions in your FSX scenery settings.

In our experience, customers who are suffering from poor performance are generally expending huge quantities of processor and memory capacity by having settings that are set too high for their hardware capability.

We recommend the following setting for users with HIGH END HARDWARE:



Note: See the section on aircraft “bouncing” on page 52 if you experience this with a mesh setting above 19m.

For users who are unable to obtain acceptable performance with these settings, we recommend that you regain performance by adjusting to the following settings:

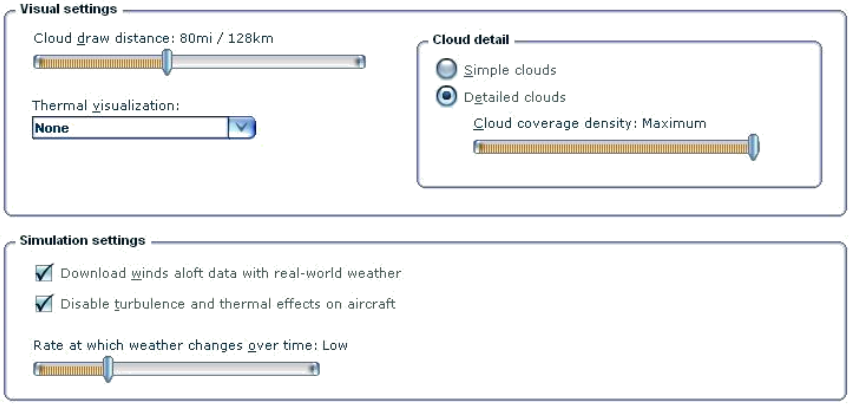
- Reduce Water Effects to Low 2.x or lower.
- Reduce Autogen density.
- Turn off Ground Scenery Shadows

Weather Page:

The settings on this page will not provide many gains in performance, but the turbulence setting in particular is extremely important to mind.

We recommend that all users click the “Disable turbulence and thermal effects on aircraft” when flying the **PMDG 777-200LR/F.** While the flight model used by this simulation is extremely realistic, the turbulence model in FSX is unrealistic. The combination results in poor turbulence behavior, so we recommend that users disable the FSX turbulence capability.

The remaining settings on this page can be set to suit your taste. We recommend the following settings:



If you are suffering from poor performance, we recommend reducing the cloud draw distance to 60. You may also try reducing the cloud coverage setting, but this normally reduces the visual quality without significant gains in performance.

Traffic Page:

The settings you will want to use for managing aircraft and vehicle traffic within the simulator will vary depending upon whether you use a third-party program to produce aircraft traffic within the simulator or whether you use the default FSX mechanism.

Please understand that AI traffic density can have a huge impact on performance, especially at congested airports. We recommend that you experiment with the settings a bit to find the correct balance of traffic density vs. performance for your machine.

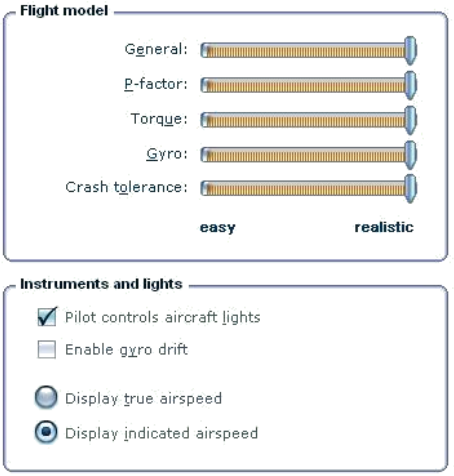
You may find that in order to maintain strong performance in high density traffic areas you need to reduce the traffic density settings slightly.

For land and sea traffic, we generally recommend setting these sliders to “around 15-20%” for realistic results. Higher settings will not necessarily

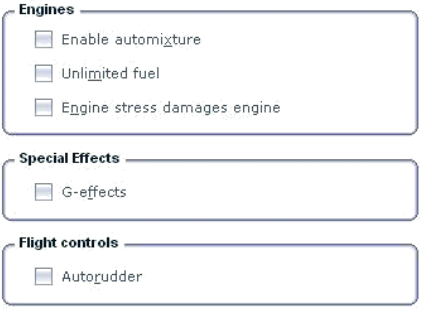
improve the visual quality of the simulation enough to compensate for the impact on performance.

Realism Page:

We recommend that you should set all of the flight model sliders to the right in order to experience the best level of realism when flying the **PMDG 777-200LR/F.**



Pay particularly close attention to the settings displayed in the graphic below. All of the boxes in the ENGINES and FLIGHT CONTROLS window should be cleared if they are checked:



Note: G-Effects can be set to the pilot's preference.

VAS management – stopping out of memory errors:

We would like to acknowledge FSX community member Srdan "Kosta" Kostic's research into the OOM problem and VAS usage on which a good portion of this section of the manual is based.

Background and theory:

FSX is a 32-bit application. Even under the recommended Windows 7 64-bit operating system, the FSX.exe process always faces the same mathematical limitations that all 32-bit applications do. One of these is a 4GB hard limit on something called "virtual address space" (VAS). When FSX crashes with an error message saying that your computer has run out of available memory (commonly called an "OOM" in the sim community), it's actually talking about VAS, not physical memory like the amount of RAM in your system. Customers who have huge amounts of RAM like 16GB or 32GB are often baffled by this message for good reason – they certainly aren't running out of physical memory. Microsoft probably should have made the error say, "The application has run out of virtual address space." instead of the vague "memory" term.

VAS is effectively a preallocation of everything the simulator can potentially access during a flight and will fluctuate over the course of using the simulator as you fly between different areas. Note that VAS is *NOT* the same thing as the "virtual memory" swapfile that you can set the size of in the Windows system options – they are two very different things and having a large virtual memory swapfile does not protect you from the 4GB VAS limit. The mathematical limit itself comes from the definition of "32-bit" – a bit is the most basic data structure in computer science and it can have two values, a 0 or 1, which can mean all sorts of things like true or false, on or off, etc. This is why at the core a computer executes "binary" code. The amount of VAS a 32-bit process can access can be calculated by raising the number of possible values for each bit (2) to the power of the number of bits available (32). So 2^{32} equals exactly 4,294,967,296 bytes (not bits). When you do the rest of the conversion math this value comes out to exactly 4 gigabytes of potentially addressable memory for a 32-bit process.

The reason we recommend using a 64-bit operating system like Windows 7 64-bit is due to the fact that it can give FSX.exe that entire 4GB block of VAS. In 32-bit Windows the default is a maximum of 2GB of VAS for FSX and 2GB reserved for the operating system. This can be increased to 3GB for FSX through an edit to the boot environment configuration ("the 3GB switch"), but this is still 1GB lower than you'll get with the 64-bit version of Windows and it makes both OOMs more likely and OS crashes more likely because it reduces the amount of VAS the OS itself has to

work with. 32-bit versions of Windows can also only ever access 4GB of total physical memory, so if FSX is using 3GB itself, there's not much there for the OS and other applications. 64-bit Windows does not have this limit and with a lot of RAM you can essentially run as many other applications outside of FSX (browser, weather apps, flight planners etc) as you want with no effect on the system. There is literally no reason not to run the 64-bit version of Windows 7 on an FSX simming PC.

If you'd like to read more in depth about VAS and the other types of memory used in Windows, Mark Russinovich's blog has an excellent series of articles that detail it:

http://blogs.technet.com/b/markrussinovich/archive/2008/11/17/3155406.aspx

Mark is the author of the Process Explorer tool below, a member of the Windows kernel design team at Microsoft, and one of the most knowledgeable people in the world on how Windows actually works.

Using Process Explorer or FSUIPC to monitor VAS:

With the proliferation of so many high detail aircraft and sceneries for FSX in recent years, the sim can easily approach and in many cases exceed the 4GB VAS limit. As the sim approaches the limit, very odd things start can start happening like disappearing scenery, disappearing or transparent visual models on the aircraft, flashing artifacts, long pauses and so on. If it exceeds the limit you will get the OOM error window or the sim will just crash to desktop (CTD) without any error message at all.

If you're having VAS issues, the first step is going to be to determine how much VAS FSX.exe is actually using throughout your flight. Fortunately Microsoft has a tool that allows you to do exactly this called Process Explorer – you can download it here:

http://technet.microsoft.com/en-us/sysinternals/bb896653.aspx

Once you have it downloaded, unzip the files to a folder of your choosing and run the procexp.exe file. You're going to see a rather bewildering looking list of all the processes running on your computer with various columns full of parameter values that are constantly updating.

The first thing you're going to want to do is enable the VAS display – to do this, right click in the area where the column names are and choose "Select Columns". Go to the "Process Memory" tab in the window that pops up and put a check mark next to the one called "Virtual Size" and press OK. This is going to enable the column, but it will likely be at the far right of the Process Explorer display. I recommend maximizing the window and then dragging the Virtual Size column over so that it's right

next to the CPU column so that you can easily see it. Click the top of the column where it says “Virtual Size” until you see a downward pointing arrow, which means the list is now sorted with the highest VAS using applications first in the list. You can now resize the window to a more manageable size.

Now run FSX and monitor this number for the FSX.exe process while you use the simulator. It should quickly move to the top of the Virtual Size column as the sim loads. If you see it start to get close to 4,194,304K (this is 4GB in kilobytes) – you know you have a VAS problem.

If you have a registered version of FSUIPC, you can place a very handy free VAS meter into the FSX window’s title bar by going to the Logging tab and then entering into one of the lines of the “Specific value checks” section the Offset 024C and Type S32. Check FS Title Bar in the “Display to” section below it. Press OK and you’ll see a readout of the free VAS in kilobytes in the title bar. FSUIPC will play a Windows “ding” sound if the sim is getting close to an OOM error. This is a good time to save your flight.

Causes of high VAS usage:

The **PMDG 777-200LR/F** aircraft itself uses approximately 700 to 800MB of VAS based on our testing, split roughly equally between the VC and external models and the aircraft systems programming. This is in line with other high-end addons aircraft on the market and is not excessive given the advanced capabilities of the product. Great care was taken to optimize and not increase the VAS load of the aircraft beyond what is necessary to simulate it properly. Here are some of the more common causes of high VAS usage we’ve identified:

Large amounts of photoscenery areas

Products that install photoscenery for whole US states or whole European countries are a particularly high source of VAS usage when a lot of them are enabled at once. There are several such packages on the market and all of them will exhibit this issue. FSX unfortunately allocates VAS for these areas *even if you are not flying over them and never go near them.* We have observed almost instantaneous OOM errors upon loading our products on customer PCs where they had for instance the entire eastern United States photoscenery installed. Disabling the photoscenery reduced the total VAS load by well over 1GB and allowed the simulator to function normally. Users have reported success with photoscenery and our products by enabling only the states or countries their route passes over. Use Process Explorer to monitor VAS and see if this works for you.

To the best of our knowledge the reason this happens is because photoscenery uses a unique texture for every single area within it. Normal FSX scenery uses a small group of textures that get repeatedly used via the landclass system. Having to precache and allocate for the presence of that many textures is likely at the root of the problem.

Here is a link to a very good open source utility called SceneryConfigEditor that will allow you to make groups of scenery areas that you can turn on or off with a single click:

http://sourceforge.net/projects/fs-sceditor

High amounts of AI traffic

Be reasonable with the amount of traffic you're putting into the simulator. Often the high 100%-type levels become unrealistic anyway from the fact that FSX's ATC system bunches them up and can't handle vectoring them all. You end up with a ton of go-arounds, a massive line for takeoff and so on. That many airplanes also eats into the VAS allocation. Again, this is not dependent on the specific traffic product you're using.

Ultra high resolution environment textures

Many "environment" type addons (as with the photoscenery and traffic there are several of these available) contain options to install very high resolution textures for things like clouds, water, runways and taxiways and so on. It is our experience that these maximum resolution textures often increase the VAS load disproportionally to the amount of visual improvement they provide. A 4096x4096 resolution texture actually contains 16 times the amount of pixel data that a 1024 resolution version of the same texture does. The 1024 or 2048 versions of the textures you're installing are likely going to be visually indistinguishable to you from the maximum 4096 version and they will result in both lower VAS usage and lower GPU memory usage.

FSX.cfg LOD_RADIUS value

Some tweak guides recommend increasing this setting in the FSX.cfg file above its normal 4.500000 maximum value. While this does improve visual detail into the distance, that improvement comes at the expense of increased VAS usage because FSX has to load in more autogen, more high detail mipmaps for textures etc. Leave this setting at 4.500000 unless you're actively monitoring your VAS usage and are sure that setting it higher isn't putting you into OOM territory.

Autogen, water, weather

The usual culprits for lowered performance in FSX also are the main drivers of VAS usage. Lowering them can significantly reduce the VAS load if you've exhausted the other possibilities.

High detail addon airports

Since the initial RTM release of the 777 in 2013, we've observed several recent addon airports using upwards of 1GB of VAS as they come into view.

Flying a lot of legs without shutting the simulator down:

FSX appears to not fully release the contents of scenery areas that have been used during the session. We have observed OOMs happen when flying around to a bunch of different high detail airports over high detail terrain all over a long period of time. To avoid this simply save your flight after landing and shutdown, close FSX, and then reload it and your flight and you should be in a reset VAS state.

Using the sound preload options in SP1:

SP1 adds options that allow for the caching of 777 sound files in memory. This was done in attempt to eliminate the stuttering that some users have experienced as sound files load. If you are having OOM issues, we recommend selecting the default NONE option. This will only loads sounds into memory as they're needed and releases them from memory 60 seconds after playback. This will significantly reduce the VAS load vs. the SELECTIVE or ALL options. (See page 108 for more information about this feature.)

Using the higher quality sound option in PMDG Operations Center:

In the sound settings module of the PMDG Operations Center application's 777 page, you will find an option for downloading and installing a low quality soundset that will further reduce the VAS load at the expense of sound quality. These files are encoded with a 22 kHz sample rate instead of the default 44.1 kHz sample rate and will take up half as much memory as the default set.

Conclusion:

There are real limits in the 32-bit FSX environment that you have to be aware of and manage. It is likely impossible for you to run every high-end aircraft and scenery addon all together at their maximum settings without making compromises to stop the OOM error from happening. It is up to you to decide what's most important to you and prioritize between different addons using the tools outlined here.

FSX SIMULATOR "PAUSES"

Shortly after the initial release of the PMDG 777-200LR/F, a small number of users began reporting that the simulator would pause for extended periods of time while flying. During this time the sound still plays but nothing actually works – the aircraft doesn't move over the ground, the FSX menus are inaccessible, and so on. The FSX window may turn a white color and there may be an "AppHang" error message from Windows if you continue attempting to click in the window after it goes into this state. The sim usually recovers after a period of 30 seconds up to many minutes worth of time. 8 minutes is a commonly reported time.

We have exhaustively investigated this issue and have come to the conclusion that it is not being directly caused by the 777, but rather that it represents a CPU threading issue inside FSX on some user PC configurations. The exact cause is unclear but we have seen solid evidence of it happening to the simulator during our testing without any PMDG software installed at all.

The good news is that we've found that a large percentage of affected users can fix the issue with a simple FSX.cfg or FSX_SE.cfg edit.

To locate the cfg file:

First, go to Control Panel\Folder options or the Tools\Folder options menu in any Windows Explorer window (you may have to press and hold the Alt key to see the menus) and change the following two settings on the View Tab:

- Enable "Show hidden files, folders, and drives"
- Disable "Hide extensions for known file types"

If these settings are not changed you likely will not be able to find the file!

Once they are changed – look here for it:

C:\Users\(Your Username)\AppData\Roaming\Microsoft\FSX

or

C:\Users\(Your Username)\AppData\Roaming\Microsoft\FSX-SE (if using FSX:SE)

Add the following lines to the top of the file – you may want to check first to see if you already have this section in the file. If it is there, modify it as shown:

[JOBSCHEDULER]
AffinityMask=14

What this setting does is restrict FSX to using the second through fourth physical CPU cores for its extended multithreading, which is used for terrain and AI object loading. (Note that the main FSX thread always runs on the first physical core regardless of this setting.) We found in testing with customers that even if they had hyperthreading enabled (which creates the same number of "virtual" CPU cores as physical cores on the chip) or were using CPUs with six or more physical cores that limiting FSX to running on those first four cores usually stopped the pausing issue.

Other reported solutions users found when the above solution did not work include:

- There are verified issues with a number of recent generation motherboards (notably the Asus brand) where the real time clock (RTC) in the BIOS/UEFI becomes erratic or stops ticking completely. The 777 relies heavily on this clock as a hardware-level source of precision timing information for running and synchronizing the systems of the airplane. If this clock is not behaving itself, all manner of problems can occur including pauses similar to the ones described here. If you suspect this is the cause of your issue, try updating your motherboard BIOS/UEFI firmware to the latest version and try replacing the round CMOS battery on the board, which the RTC relies on for power. If the issue still persists, we highly recommend contacting your motherboard manufacturer and letting them know that they need to fix this issue with their product.

- Some users found that updating their sound drivers or switching to a different type of sound card solved the issue for them.

- A group of users reported that their pauses seemed to be directly caused by issues present in various AI traffic software packages. While this is likely not the same internal issue as described above, the symptoms presented to the user are very similar. If none of the above has fixed your issue, try turning off your AI traffic and see if it stops.

THE PMDG 777-200LR/F AND FLIGHT-SIM HARDWARE/SOFTWARE

When modeling advanced aircraft systems to the degree that we like, we often find that it is necessary for us to "take control" of various aspects of the simulator in order to force the results that are needed in the interest of realism.

Conflicting Software:

One classic example of this "taking control" relates to the fuel system on the airplane. Without getting into complex details, the fuel consumption/management process that is at the core of FSX is based on the theory that all fuel tanks are stacked vertically with a stand pipe running between them. This, combined with the fact that the engine fuel consumption model used by FSX is far from accurate for a turbine gas generator engine (modern turbofan!) means that we must engage in some very complex adjustments to make certain that the fuel management and consumption logic in during the course of your flight results in accurate fuel behaviors.

For this reason, our simulations are generally not compatible with any virtual airline software that monitors the level of fuel in the tanks and deducts "points" for changes to the fuel value. We recommend disabling any such features, or encouraging your virtual airline programmers to contact us for guidance on how to work with this advanced feature within the PMDG simulation product line.

Hardware SDK:

A challenge faced when creating highly complex add-on aircraft for FSX is making certain that our simulation product will be compatible with the broadest swath of flight simulator controls and hardware as possible not just for today's users, but for users three years from now.

There are literally thousands of flight sim controllers and hardware pieces available and it is impossible for us to test the **PMDG 777-200LR/F** with every possible configuration.

In addition, PMDG's products are extremely complex and to a large degree we are using FSX primarily as a world platform for a highly complex external simulation that is running side by side with the FSX platform.

This means that there are circumstances where we choose to work around the standard FSX control interfaces because they are inadequate

to simulate completely the complex environment of a modern airliner cockpit.

Our goal is to allow hardware manufacturers and intrepid users to create their own drivers so that their hardware can be made compatible with our software. We have included a Software Development Kit (SDK) that allows hardware manufacturers to independently create drivers to ensure the highest degree of compatibility.

The only restriction that we place on developers is that these drivers must be provided at no cost to their customers. SDK documentation and code examples are included in the FSX\PMDG\PMDG 777X\SDK folder.

FSUIPC users:

The goal of Microsoft's FSX development team was to create greater interoperability between the FSX platform and add-on developers like PMDG. In theory this should all but eliminate the requirement for users to install and use FSUIPC as an interface between complex add-ons and the FSX platform.

Like most things in the FS world however, the skills of developers like Pete Dowson continue to play an extremely valuable role in the way many add-ons interact with FSX.

Many users have found that FSUIPC continues to provide value for improving the FSX experience by smoothing control axes, wind shifts in weather, etc.

During testing, we came up with some general recommendations that we felt were important to pass along:

- The **PMDG 777-200LR/F** is fully compatible with FSUIPC ***except*** that we recommend that you do not calibrate your flight controllers through FSUIPC. We recommend that you use the driver/software that comes with your hardware. (Calibrating through FSUIPC may not cause any problems, *but in certain circumstances with certain hardware we found that problems existed that could only be resolved by having the user conduct the calibration via the driver/software.)*

- During testing we have found that in ***extremely rare*** circumstances, users with FSUIPC installed would need to delete their FSUIPC4.ini file after installing the **PMDG 777-200LR/F** in order to get everything playing well together. We recommend that you try this if it seems the 777 is not behaving normally after installation. If you see strange issues with engines not producing thrust despite looking like they're running or the aircraft climbing with an unusual nose-down attitude, this is probably the cause.

- Please ensure that you have the latest version of FSUIPC installed – during our testing process, an issue was fixed that caused the mouse cursor to flicker when using the 777's ECL system. If you see this, make sure you have the latest FSUIPC!

In all cases, any "disagreement" between the PMDG 777-200LR/F and FSUIPC was corrected by simply deleting the FSUIPC4.ini file and allowing them to regenerate.

We continue to explore ways to make the PMDG 777-200LR/F interact more smoothly with FSUIPC and we'll make those changes available as they are finalized. Both FSUIPC and the PMDG 777-200LR/F are trying to accomplish the same goals and following the above recommendations should keep you out of trouble.

KNOWN FSX'isms TO AVOID:

The best way to think of the **PMDG 777-200LR/F** is to approach it in terms of a stand-alone simulation that is using your FSX installation in order to provide a world in which to simulate the 777's flight operation.

We have put a tremendous amount of time and energy into make certain that this experience is as seamless as possible, but occasionally we find unintended consequences of our efforts to provide you with the most accurate simulation possible.

A few notes to keep you from running into trouble:

- There is a common misconception that when loading a complex simulation like the PMDG 777-200LR/F that you should first load the default Cessna into the simulator, then load the PMDG 777-200LR/F on top of it. This is not a factual conception and in fact we do not recommend the practice at all. What is required however is for a default Microsoft aircraft to be your default startup flight in FSX. The reason for this is that this flight actually loads in the background invisible to the user – if it's set to a complex addon it can result in the inability to set certain internal variables that the 777 relies on until the simulator is restarted. We identified this issue as far back as 2006 and asked Microsoft to fix it, but it unfortunately never happened.

- One shortcoming of all PMDG products for FSX is that our products do not like to be "reloaded" on top of themselves. This means that if you have one livery or variant of the airplane selected and running within the simulation world (say, a 777F) and you wish to change liveries to a different 777F, you will need to shut down the simulator and then select the new variant or livery you wish to switch to from scratch. If you load a 777 livery or variant on top of itself you will see strange issues in the cockpit, FSX may CTD or otherwise crash, etc. SP1 adds a warning message about this issue if it occurs.

- Setting the PMDG 777-200LR/F as your default flight can cause the same behavior described above from reloading it on top of itself. The default flight is loaded in the background as you start FSX and thus if the 777 is your default flight and you then select another variant, it loads on top of itself even though you may not actually see it happen. Keep the default flight as one using a default Microsoft aircraft and you won't have any issues with this.

- Do not leave the aircraft rotating on the Free Flight screen for a long period of time. It has a tendency to corrupt and show a skeleton/untextured model. This is not a PMDG issue as you can make even the default Ultralight do it if you let it sit there long enough. If this happens you may be able to clear the issue and reset it by going into one of the selection menus for airport, time of day etc, but if this doesn't work, you will want to restart FSX.

- When flying over the ocean, there is a bug in FSX that can cause the displays to freeze in place. It happens as a result of passing through the "Tower" view preset when outside of the range of any suitable actual tower. Flip back between the "Cockpit" and "Virtual Cockpit" views and it should clear. To avoid this, don't use the A and S keys to cycle through views, use the right click menu to select them directly.

- We do not recommend the use of "dll injection" to modify the simulator's graphics capabilities. This includes ENB Series, SweetFX, FXAA Injector etc. While the effects these dlls can add are very impressive, they often destabilize the simulator and cause crashes. If you use these, you do so at your own risk. If you're experiencing strange crashes or anything like that, remove any dll injection files you're using and see if the problem goes away.

- We have modified the functionality of the FSX default "B" key that sets the altimeter. When pressed above transition altitude, it will now preselect the local ground level altimeter setting rather than directly setting it. This makes it easy for you to switch over correctly as you descend through your transition level.

- You must have a sound output device enabled on your PC while using the PMDG 777. This can mean anything from a USB headset to a sound card with speakers or headphones plugged in. Due to issues beyond our control, if there's no sound output device, the airplane can fail to load correctly and display blank gauges and no landing gear on the external model. If you see this, ensure that your sound output device is physically connected to the PC and working.

HOW TO USE THE MANUALS

The **PMDG 777-200LR/F** comes with six documents:

- Introduction (You are reading it now!)
- PMDG 777-200LR/F Tutorial #1
- PMDG 777-200LR/F Flight Crew Training Manual
- PMDG 777-200LR/F Flight Crew Operations Manual Vol. 1.
- PMDG 777-200LR/F Flight Crew Operations Manual Vol. 2.
- PMDG 777-200LR/F Quick Reference Handbook

Taken altogether, this can seem like an intimidating amount of information, but the point that we want to make most clearly is that *if you can fly the default airplanes in Microsoft Flight Simulator, you can fly the PMDG 777-200LR/F!*

We have created a truly scalable experience for simmers who love the 777. If you want to just push up the throttles and fly, you can do this. If you want to dive as deeply into the details as a career airline pilot, you can do this also. The simulation will support you no matter what your goal is for any particular simming session!

Following is a quick rundown on how to get the most out of your manuals:

Introduction:

We have put this document together in order to collect in one place as much information about how to use the **PMDG 777-200LR/F** as possible.

This introduction will give you some tips on how to set up FSX for optimal performance with the **PMDG 777-200LR/F** and it will explain PMDG's proprietary custom icons and cursor symbology as it is used in the **PMDG 777-200LR/F.**

The introduction document will also show you how to use the in-sim capabilities to change your cockpit layout, cockpit displays, the visual appearance of the external model, as well as the use of mechanical reliability, failures, ground services and pushback capabilities.

This document includes a list of “fun to know” quirks that experienced 777 pilots will recognize within the simulation. We thought you’d like to know just how detailed we have made your new **PMDG 777-200LR/F.**

Tutorials:

In order to help new users get acclimated to the capabilities of the **PMDG 777-200LR/F,** we have created a tutorial to get you up and running quickly.

The first part of the tutorial should be viewed as a “Quick-Start Guide” that will take you from loading the sim to launching off on your first flight in the **PMDG 777-200LR/F.** The purpose of the first flight is to keep things simple and straight forward, thus giving you the opportunity to enjoy all that the simulation has to offer without getting lost in details!

The first tutorial will start you in a powered-up and ready-to-go 777-200LR at **VRRM – Malé**, in the beautiful Maldives islands of the Indian Ocean. You will follow along step by step and eventually find yourself parked at **OMDB – Dubai** in the United Arab Emirates with your passengers deplaning!

The second more advanced tutorial will cover ultra-long haul flying and detailed ETOPS planning and will be released at a later date.

Flight Crew Training Manual:

The FCTM is best thought of as your “how to” guide to flying the airplane. If you’d like step-by-step instructions on various aspects of operating a 777, then this document is your guide.

The FCTM can give you easy to follow instructions on just about any maneuver you can perform in the 777, including:

- How to taxi like a professional.
- How do you know when to retract the flaps on takeoff?
- How do you conduct an engine out takeoff?
- What things should you do during climb, cruise and descent?
- How do you set the airplane up for just about any kind of approach you might need to fly?
- What are the best techniques for landing?

All of these types of questions can be found in the FCTM.

When you are ready to dive a bit deeper into your **PMDG 777-200LR/F,** you will find detailed how-to information on such topics as “landing without flaps” and “Approach and Landing on Standby Power.”

We recommend that you spend some time skimming through the FCTM just to see what types of information are presented to you. There are lots of diagrams and visual aids to help you visualize the maneuver being discussed, and these will ultimately help you to improve your own skills flying the **PMDG 777-200LR/F!**

Just remember: When you find yourself wondering “how do I make the airplane do...” the FCTM is going to have your answer!

Flight Crew Operations Manual Vol. 1:

The FCOM is one *extremely* large book that is split into two pieces in order to make it manageable.

Volume 1 of the FCOM provides you with the following information:

- Technical Notes about the 777: These are not important to you, but they do provide a fascinating insight into the evolution of the 777 airplane since it was certified.

- Limitations: This chapter is a one-stop shop for all of the limits that you should never exceed while flying the airplane.

- Normal Procedures: This section of the manual should be thought of as your “step by step detail guide to operating the airplane.” You can start with an airplane in just about any condition and the Normal Procedures will give you a step-by-step process to reaching the next phase of flight. We highly recommend loading up a “Cold and Dark” scenario and working through this chapter. This will give you a really in depth view of the detail level contained in the PMDG 777-200LR/F.

- Supplementary Procedures: This chapter is similar to the Normal Procedures, except that it contains procedures that you won’t perform on every flight. For example, start an engine using a ground-start-cart? The supplementary procedure for performing this task is your go-to location to find out how it should be done properly!

- Performance: This chapter contains all of the published performance data that is available for the 777 type airplane. If you like to go through the mental exercise of planning your own flights down to the last detail, this chapter will give you everything you need! (Note: The performance data for reduced thrust engine types is not published and therefore is not available. All of the data currently available is included in this chapter.)

Flight Crew Operations Manual Vol. 2:

The second volume of the FCOM is your in-depth guide to the inner workings of the **PMDG 777-200LR/F.**

The **PMDG 777-200LR/F** provides you with an unprecedented level of accuracy in the simulation of the mechanical systems on the 777 airplane. We have worked tirelessly with expert input, reams of data and nearly continual verification processes in order that the **PMDG 777-200LR/F** should very precisely behave in the way the real-world airplane behaves.

The Volume 2 portion of the FCOM will give you the insight that you need to truly appreciate the detail level of the **PMDG 777-200LR/F.** If you would like to learn what is happening in the hydraulic system, then simply dive into the HYDRAULICS chapter. Do you want to know more detail on the Automatic Flight Systems? There is a chapter for this…

The FCOM Volume 2 is the place to go for information on what makes the airplane operate. Broken into chapters, you can digest the pieces in the order and in the quantity you want.

Pay attention to the small details described in this manual, however and you will be surprised again and again just how deep the level of simulation runs in the **PMDG 777-200LR/F!**

Quick Reference Handbook:

This is a document that many simmers never open, and in doing so fail to take advantage of a really fascinating part of the simulation!

The Quick Reference Handbook is, for lack of a better description, the approved method for pilots to conduct trouble-shooting while flying the 777 airplane.

Inside this book are the approved procedures that you may perform in response to virtually any situation you might face. From an engine fire all the way down to a simple annunciator light in the cockpit, the Quick Reference Handbook will take you step-by-step through the process of

troubleshooting, resetting and sometimes even fixing any problem that you might experience!

In the **PMDG 777-200LR/F** we have added the ability to activate aircraft mechanical failures for those who are interested in them. Many of these failures are quite obvious and simple to understand. Others may present various symptoms and have various different effects on your flight.

For example, a DOOR warning on the overhead panel might be a failure of the door-closed sensor, or it might indicate something more sinister with a door not being closed properly.

How do you know the difference?

Pull out the Quick Reference Handbook, look up the DOOR warning in the index, then follow the checklist procedure!

There are many mechanical failure scenarios in the **PMDG 777-200LR/F** that behave this way, and learning to use the Quick Reference Handbook will help you find easy solutions to complex problems while also teaching you more about the **PMDG 777-200LR/F** systems than you ever thought you might learn!

We recommend you spend some time playing with the failures and exercise the Quick Reference Handbook. You can't hurt anything, and you can always hit the reset button if you get in over your head!

THE PMDG 777-200LR/F DIDN'T DO WHAT YOU EXPECTED?

Here is a collection of items and features that we saw during development and testing that we think might be likely to trip you up:

In the NGX it worked like this…:

One thing the Beta team consistently noted was that the **PMDG 777-200LR/F** is definitely not what you have become accustomed to with the **PMDG 737NGX**. While there are many similarities in that they are both Boeings, the differences between the two are numerous enough that you will want to be wary of preconceived notions carried over from your earlier experiences with other aircraft.

I turned the battery on, but the plane has no power:

The **PMDG 777-200LR/F** is a very power hungry airplane, but it is also a very intelligent airplane in that it is always managing power draw to ensure it always has necessary functions at all times. In the case of turning battery power on, the aircraft is only giving you enough power to start the APU or connect ground power. Once either one of those power sources comes online, the airplane will come to life.

I turned the battery off, but the plane still has power:

As noted in the above note, the **PMDG 777-200LR/F** requires a lot of power, but it also effectively manages power draw to ensure it always has necessary functions at all times. After turning the battery off, the aircraft leaves standby power on in case of an emergency where crash loads are needed.

The logo light switch is on, but the logo light is not showing:

The **PMDG 777-200LR/F** is a very power conscious airplane that has a hierarchy of necessary functions. When its power consumption outweighs the available power, it will automatically shed its load by eliminating unnecessary consumers. You can confirm this behavior by displaying the ELEC synoptic and looking for "load shed" notifications on the main buses. Additionally, when transferring from one power source to another, the airplane takes a few moments to reconfigure itself on the new source. During these times, the logo light may extinguish.

The cockpit lights aren't brightening/dimming enough:

One of the features of the **PMDG 777-200LR/F** is the ability to control all of the flight deck lighting from one master source. The overhead panel has a MASTER BRIGHT knob that controls all panel brightness lights, except flood flights. When using master brightness make sure all individual panel brightness knobs are placed in the middle of their range, which is marked by a dot. A helpful shortcut for this is a middle/wheel click with your mouse. This ensures that the master brightness knob has full range of control. In this configuration, operating the individual knobs results in further individual brightness adjustments of up to 20% above or below the master setting.

To turn off the master bright override and use the individual brightness knobs for full individual control, click the button in the center of it. When loading the aircraft, the knob is by configured for master brightness use by default, since this is most common in the real world.

I turned off the autopilot, but I can't silence the alarm:

You need to press the autopilot disconnect button on your joystick (or the Z key) twice in order to silence the alarm. Make the first press, wait a second or two and then press it again. If you double-press too fast, it won't silence. Always use the disconnect button, don't use the disconnect "bar" on the MCP – you'll have the siren constantly going off if you do.

On aircraft with the RESETTABLE SIREN option set to NO, pressing the master warning button on the glareshield will not stop the alarm – this goes for any master warning in fact, not just the autopilot.

Tail strike protection is not stopping me from tail strikes:

The tail strike protection is set up in a way that will automatically reduce elevator deflection to help avoid a tail strike where possible. This will not absolutely prevent all tail strikes due to poor rotation technique, however. In order to avoid airframe damage, the aircraft should be rotated according to the prescribed method outlined in the FCTM.

It's difficult to taxi:

One of the more difficult transitions from smaller aircraft to larger aircraft is the adjustment to the length of the fuselage. For those who have experience with the **PMDG MD-11**, taxiing should be relatively straightforward. Adjusting to the longer length when coming from the **PMDG 737NGX**, however, will be a slightly more difficult adjustment. The tips outlined in the FCTM will help immensely, with the most helpful hint

likely being that you should taxi past the taxiway centerline until it is in line with the bar between the two side windows.

How do I save my route?

You must have a valid route entered and activated first and you must be on the ground. Then, go to the RTE page 1, and press LSK 4L < ROUTE SAVE. This lights the EXEC button. If you press it now, it will give the file an automatically generated name. You can also type a custom name into the scratch pad and it will save the route under that name. The .rte files are saved to <FSX root folder>\PMDG\FLIGHTPLANS\777.

Why are my tire rims orange?

The **PMDG 777-200LR/F** realistically models brake heating. If you are seeing the brakes glowing orange, you've definitely overused them. They will not be as effective (or effective at all) in this state and if the heat increases further you run the risk of fire and blowing tires.

You can cool the brakes this by bringing up the CDU and going to MENU/FS ACTIONS/GROUND MAINTENANCE, hit NEXT PAGE, then select COOL BRAKES at LSK 1L.

My [insert passenger/VA program here] is flagging me for excessive V/S:

A common misconception is that passengers are sensitive to vertical speed when they are not. The only difference that the passengers would note would be that their ears were popping more frequently. The departure profile is flown in a pitch-for-speed mode, where you set the throttles on the particular throttle limit, and hold speed through aircraft pitch. At lighter weights, these pitch angles may be considerable. In order to reign in some of the thrust for lower pitch and vertical speed, derates may be used.

I couldn't get LNAV to arm/engage:

LNAV has some specific parameters that must be met in order for it to arm/engage. These are:

- To arm LNAV while on the ground: The first waypoint in your flight plan must be within 5 degrees of the departure runway course.

- To arm LNAV in flight: Requires a valid interception point for active leg, interception angle less than 90 degrees OR within 3

miles cross tracks error OR within 3 miles from active. LNAV will stay armed until interception.

I selected LNAV and it went directly to a fix:

When you are within 3 miles from the target waypoint, LNAV goes direct to the active waypoint. Always.

The bank limiter isn't working as I expected in LNAV:

LNAV uses its own auto-bank limit when turning to follow the LNAV course. It will use a minimum of 8.0 and a maximum of 23.0 degrees unless in approach mode or in holding.

The mouse wheel isn't working on certain knobs:

There is no mouse-wheel operation on the bank limiter, BARO or MINS knobs: they were made operable only with left/right mouse clicks on purpose to save you from accidentally triggering them while spinning their inner knobs with your mouse-wheel.

Sometimes I hear strange sound artifacts after switching views:

This is a known bug in FSX, especially with complex add-ons that use lots of custom sounds like the **PMDG 777-200LR/F.** We recommend that you press the Q key twice after switching views, as this always eliminates the problem.

I get a NAV DATA OUT OF DATE message on the CDU:

The navigation data included with the **PMDG 777-200LR/F** is provided by Navigraph and up to date at the time of release. (early September 2013, the AIRAC 0913 cycle) After this cycle expires in mid-September 2013, you will have to upgrade for a small fee if you wish to maintain up to date real world navigation data.

This data can be purchased here:

http://www.navigraph.com/FmsData.aspx

If you don't care about having current data and just want to remove the NAV DATA OUT OF DATE message, you can open up the file fmc_ident.txt, located at <FSX root folder>\PMDG\NAVDATA and edit the third line - OpProgram=AUG22SEP18/13 - to read a different date range that will not trigger the message.

RAAS is calling out the wrong runway numbers:

The RAAS system calls a file called runways.csv that exists in the root FSX folder. This file is generated by a program called MakeRunways.exe, made by Pete Dowson of FSUIPC fame.

It can be downloaded here:

http://fsuipc.simflight.com/beta/MakeRwys.zip

Unzip it to the FSX root folder and then run the exe, it'll generate an update runways.csv that should fix any problems with RAAS calling out the wrong runway numbers.

My windows mouse cursor is flickering when I use the ECL cursor:

This was traced to an issue in older versions of FSUIPC 4 during testing. Simply update to the latest version at Pete Dowson's website and it should fix it:

http://www.schiratti.com/dowson.html

I see a large mass of TCAS targets on the ND around an airport on the ground:

This is caused by the way vehicles are simulated in ground support addons like GSX and AES. (they're "aircraft" objects virtually) This should not occur unless you have increased the TCAS range settings in the options beyond what is realistic.

The aircraft "bounces" on the ground when I change views:

We have traced this issue to using an FSX Mesh resolution setting that is higher in resolution than 19m. These are the 10m, 5m, 2m, and 1m settings. This appears to be an FSX terrain engine bug and isn't something we can fix. If it bothers you, you can set the terrain resolution to 19m or lower. These are the 19m, 38m, 76m, 152m, or 305m settings.

Be aware that lowering this setting can affect the use of sceneries that require the higher setting. For example many airports require high settings to simulate taxiway bridges and similar structures. If you have high resolution terrain mesh installed this will also decrease the detail of mountains and other such features if you go below the mesh's level.

I have service based failures on but nothing ever happens:

Modern jet aircraft are extremely reliable and most airline pilots will go through their entire careers without having a serious failure incident on their airplane. The data that the service based failures feature was created with reflects this – these are rare events.

We recognize however that most simmers probably don't have a lifetime to spend waiting for that one-in-ten-million engine failure at V1, so to improve upon the original way this feature was implemented in the **PMDG 737NGX**, we've created a rate multiplier function that will essentially accelerate the aging of the various parts on the aircraft to give you failures more frequently.

To access this feature, bring up the CDU and then press MENU, then PMDG SETUP, then AIRCRAFT, then FAILURES. Select the ALL SYSTEMS page at LSK 2L:

When service based failures are enabled, the RATE field at LSK 3R allows entry of any number from 1 to 1024. This will accelerate the aircraft's aging and you should see more frequent failures in terms of real usage time.

It takes way too long to enter wind predictions for a long route:

In real life, 777 pilots get their wind data sent to them over the datalink, which eliminates time consuming manual entry of the figures.

We have provided multiple ways to simulate this functionality in SP1 and they are described in the SP1 Supplement section near the end of this manual.

My compass lighting is the wrong color, it should be green!

Actually, the compass lighting is an orange-ish color similar to the flood lights on the main panel. Because the compass inside rotates, it would have been extremely hard for Boeing to use integral backlighting like the rest of the panel, so they are lit by a standard bulb inside the housing.

The weather radar isn't working.

The Collins WXR-2100 simulation present in the **PMDG 777-200LR/F** (SP1 and later) and 777-300ER extension requires the Active Sky Next or later weather engine software from HiFi Technologies Inc. The reason for this is that it is the only weather addon on the market at the time of this writing that outputs a 3D precipitation dataset that we can (finally!) use to realistically simulate radar physics. This is not possible currently with the FSX default weather or any other weather addon. We will be working with other weather addon developers to integrate similar technology if they provide it within their program.

ASN is available for purchase here:

http://www.hifitechinc.com/products/activeskynext

I'm seeing erratic changing fuel loads and autopilot issues.

There is an issue with the BIOS/UEFI clock and high precision event timer on certain recent Asus motherboards at the time of this writing. The timer becomes erratic or stops completely and causes issues with the aircraft systems. We use these timing functions extensively and they must be working correctly for proper operation of the airplane. Check with Asus for a firmware update and consider replacing the CMOS battery on your motherboard if you experience these issues. The problem is not specific to PMDG or to FSX and has been widely reported on the big hardware forums around the Internet. If you are building a new PC for FSX, we recommend staying away from Asus motherboards until this issue is confirmed to be resolved.

I'm getting stutters when sounds load to play:

SP1 introduces sound preload options that can help alleviate this issue on certain configurations prone to it (ie – slower mechanical HDs instead of SSDs, lower end sound chipsets or cards etc). These options are detailed on page 108 of this manual.

THINGS THE WIDE BETA TEAM WANTED YOU TO KNOW

- Do not be afraid to take over with less automated modes like FLCH and HDG SEL in the approach environment. Not everything has to be flown in LNAV and VNAV. In fact in the real world it's very common to go to those "lower tech" modes in the approach environment.

- The ECL is not a substitute for the Amplified Normal Procedures contained in the FCOM Vol. 1 manual. Do not rely on it to show you every single item you need to accomplish.

- The ECL will not detect the AUX PUMP being off during shutdown and it will need to be manually checked off.

- While VNAV is accurately modeled and "rugged" like the real thing, it isn't a miracle worker: if you get messages like DRAG REQUIRED, etc., it usually means the conditions outside (winds) or FMC programming (restrictions) or both are not in agreement on what the airplane can do without extra assistance from the pilot. (Use flight spoilers, manual speed intervention or drop the gear if you really have to!)

- VNAV descent is dedicated to flying a monotonic path: Coming down, it is expected that each waypoint in succession to the previous will be lower and slower. Bottom line: VNAV descent will not speed up in between waypoints, nor will it climb. If you try to make the airplane do this you should anticipate trouble from the FMS.

- Speed exceedances sometimes during VNAV descent are normal and faithful to the real thing.

- The 777 is an extremely slippery airplane and will require planning and aggressive energy management on tight approaches. Plan ahead and if it won't work, go around!

- If you set the autopilot engagement limitations to REALISTIC, then you must be within a small margin of "in trim" (no control forces required to keep airplane on desired path), you cannot be actively trimming, and the flight director should be nearly centered. If you violate any of these conditions, the autopilot will not engage.

- Don't forget to press the MIC button on the ACP panel (below the radios panel) corresponding to the radio you want to transmit on or no-one will hear you online. Yes, it's modeled that closely!

- Proper takeoff procedure with respect to your physical throttle:

    - Advance the throttles to 55%

    - Press TO/GA (don't use the MCP A/T button, it takes half a second or so to "capture")

    - Wait until you see THR REF annunciated on the FMA.

    - Push the throttles fully forward. They are dead now because the AT is active.

- Set up a key command for the EICAS Cancel/Recall button.

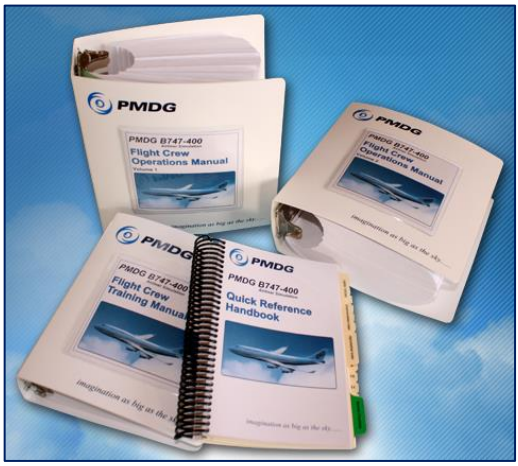
- On landings, be careful with your angle and get used to the landing gear touching down early in comparison to the NGX.

- Don't move the seat position backwards much because this can cause issues where you'll be unable to click due to being "inside" the seat.

- Don't extend the speedbrakes all the way, use the 50% clickspot. Full speedbrake use is rare in the real world and the autopilot has trouble keeping up with that much deceleration that quickly.

WOULD YOU LIKE YOUR MANUALS IN PRINT?

If you want to take your **PMDG 777-200LR/F** flight experience to a whole new level of realism, get your flight manuals in print!



747-400 manuals shown. For illustrative purposes only

The **PMDG 777-200LR/F Chief Pilot's Flight Manual Package** (shown) gives you everything the aspiring 777 captain could possibly need!

- **PMDG 777-200LR/F** Flight Crew Operating Manual Volume 1
- **PMDG 777-200LR/F** Flight Crew Operating Manual Volume 2
- **PMDG 777-200LR/F** Flight Crew Training Manual
- **PMDG 777-200LR/F** Quick Reference Handbook (printed in b/w)
- Three 36" x 18" Cockpit Layout Diagram Posters
- Seven 11" x 17" Aircraft System Schematics with descriptions (two sided: total of 14)
- Collection of Jeppesen charts to use during on your **PMDG 777-200LR/F** Type Training.
- FREE: **PMDG 777-200LR/F** Lights and Switches Guide ($45 value!)
- FREE: **PMDG 777-200LR/F** Laminated In-Flight Checklist ($8 value!)

These manuals have the same look and feel as the manuals provided to crews in training and will provide you with the best set of reference materials available to simmers anywhere.

Also available for purchase is the **PMDG 777-200LR/F Captain's Flight Manual Pac**

kage consisting of

- **PMDG 777-200LR/F** Flight Crew Operating Manual Volume 1
- **PMDG 777-200LR/F** Flight Crew Operating Manual Volume 2
- **PMDG 777-200LR/F** Flight Crew Training Manual
- **PMDG 777-200LR/F** Quick Reference Handbook,
- **PMDG 777-200LR/F** In-Flight Checklist as a free bonus

All manuals can also be purchased separately!

See the **PMDG SIMULATIONS** website for details!

INTERACTING WITH THE PMDG 777-200LR/F

The **PMDG 777-200LR/F** uses a fully custom, highly flexible interface methodology in order to make your **PMDG 777-200LR/F** experience as intuitive as using your own hand.

This section will help you to learn how to push/pull levers, rotate knobs and push buttons within the cockpit. The guidance is identical whether you use the 3D Virtual Cockpit, or whether you use the flat 2D popups.

The **PMDG 777-200LR/F** utilizes a specific cursor shapes that are visible in both the 2D and Virtual Cockpit in order to assist the user to:

- Easily locate the regions where mouse operations are applicable.
- Instantly identify what kinds of mouse operations are applicable for each click spot.
- Identify what each mouse operation can be expected to do.

Push-Pull Operations:

Push-Pull operations apply to pushbuttons and knobs that can be either pushed or pulled in order to effectuate an action. One of three cursor shapes will appear when the mouse is placed over a pushbutton or switch that fits into this category:

Push cursor:

 Only push operation is applicable. Use left or right mouse button.

Pull-Only cursor:

 Only pull operation is applicable. Use **right** mouse button.

The push/pull icon will change to reflect the operation selected by the user. So if, for example, the left mouse button is pressed the cursor will change to the “push” cursor, and if the right mouse button is pressed the cursor will change to the “pull” cursor.

Knob/Switch Turn Operations:

Knob/Switch turning can apply to knobs, dials, wheels and switches that must be turned or rotated. Three different cursor shapes will appear when the mouse is placed over the knob.

Switch/Knob Cursors:

For knobs/switches that turn/move left/right the following applies:

This cursor indicates that the switch may be rotated to the left/right. This is the “neutral” cursor, meaning that you are not currently rotating the switch.

Press either the **left** mouse button or turn the mouse **wheel down** or to **turn the knob to the left.** While doing so the cursor will also rotate to the left as seen here.

Press either the **right** mouse button or turn the mouse **wheel up** or to **turn the knob to the right.** While doing so the cursor will also rotate to the right as seen here.

Note that the mouse wheel does not function for switches, only knobs.

For switches that move up/down the following applies:

This cursor indicates that the switch may be moved up/down. This is the “neutral” cursor, meaning that you are not currently rotating the switch.

Press the **left** mouse button to **move the switch down.** While doing so the cursor will also rotate to the left as seen here.

Press the **right** mouse button to **move the switch up.** While doing so the cursor will also rotate to the right as seen here.

Operating a Two Position Switch/Knob:

On the **PMDG 777-200LR/F** flight deck there are a broad range of knobs and switches that will be moved using the left and right click action described above. For knobs/switches with two positions, left **or** right clicking on the switch will move the switch between the two positions.

Operating a Multiple Position Switch/Knob:

For knobs/switches with multiple positions, or with a range of positions (such as a temperature selector knob) successive right or left clicks (or scrolling of the mouse-wheel) will cause the switch to continue moving in the direction of the click until reaching the full limit of the knob's available motion.

For knobs that do not have distinct position detents, such as a dimmer or a temperature knob, holding down the left or right mouse button will cause the knob to scroll through its available range of motion in the same direction as the mouse click. Additionally, you can use the mouse wheel on your mouse to scroll rapidly.

Some hits to remember when using knobs:

- Using the mouse wheel will let you rapidly enter heading/speed/altitude changes into the MCP!
- Double clicking the left or right mouse button while the mouse is over a rotary knob will cause the knob to move immediately to its full left or right position.
- This functionality applies to all knobs such as dimmers that control brightness (display units brightness knobs on the lower

main panel, as well as PANEL/FLOOD lighting controls on the lower main panel, the overhead and the center console.)

- The middle mouse button can be used to instantly place any rotary panel lighting control in the center 50% position. This is important when using the 777's MASTER BRIGHT system as it requires all other lighting knobs to be in their center positions.

Combined Rotary Knobs:

In some cases, there are multiple rotary knobs embedded into a single location, such as the heading knob found on the MCP. In order to help clarify the operation of these knobs, you should note the color of the Left/Right rotation cursor. The primary rotary function of the knob will use white rotary icons as described above, while the secondary rotary function on the knob will use gray shaded rotary cursors as shown below:

Other applications of gray shaded cursors:

You will notice that in certain places that require special action, such as the landing gear handle unlock switch, or on the guards covering guarded switches, the cursor will appear gray. This is to indicate to you that the action is special as it relates to that switch, guard or knob.

Example:
As an example, the mouse operations on the heading select knob are shown in the following figure:

1. This shaded cursor indicates that you are able to rotate the secondary outside knob that operates the bank limiter, but only using left and right clicks, not the mouse wheel.

2. This un-shaded icon indicates that you can rotate the primary heading select knob both with left and right clicks and with the mouse wheel.

3. This cursor indicates that you can press the button embedded inside the two rotary knobs.

If you spent a few moments feeling around the **PMDG 777-200LR/F** cockpit with your mouse, you will find many different areas where you can click, rotate, move up/down or left/right various controls. Over time, these cursors and their associated actions will become second nature!

Multi-Function Knobs in the Virtual Cockpit:

All of the mouse cursor functions described above work in the Virtual Cockpit or the 2D popup environment. As you move the mouse cursor over a knob or switch, simply watch to see which cursor (primary or secondary rotary cursor, push, move up/down or move left/right cursor) is displayed. This will help you to identify which function you will effect by mouse input.

NOTE: Depending upon your monitor size and resolution, you may have some trouble accurately placing the mouse cursor over a switch while in the VC. If you experience this problem, we recommend that you zoom closely to the switch. This will greatly increase the accuracy of your mouse and is similar to “leaning” toward something on the flight deck in order to make it more accessible. Holding spacebar and rolling the mouse wheel is the easiest way to look around and zoom in FSX.

Using click and drag controls:

Several controls in the cockpit including the MINS and BARO selectors, the manual pressurization Landing Altitude selector, the Fuel to Remain selector, the Rudder Trim knob, and the Flight Deck Temperature selector when moving between MAN and AUTO use a click and drag style logic that moves between different control "levels."

To use the MINS knob as an example:

You will see the normal cursor, but to operate the control you must right or left click and hold, which will produce the tooltip shown above. In the case of both the MINS and BARO selectors, there are two speed levels, slow and fast. To move between the two levels, drag the mouse a short distance while continuing to hold the button down.

Using Pop-Up Panels

The essence of the **PMDG 777-200LR/F** Pop-Up Panel control schema is based around click spots located at strategic locations throughout the Virtual Cockpit (VC). When the user moves the mouse cursor over one of these click spots, the cursor changes in order to help the user understand what options are available via the click-spot.

When accessing the various pop-up panels, the following cursors may be displayed to the user:

Panel Open/Toggle Cursor:

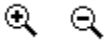
 or 

When either one of these cursors is displayed, the **left or right** mouse button can be used to **open** or **toggle** a panel window. These types of mouse click spots are normally located on the main panel.

Close Panel Cursor:

This cursor indicates that you can use either the **left or right** mouse button to **close** the current panel window. The mouse click spot is usually located on the **top-right corner** of the panel window.

Zoom Display Cursor:



These cursors are displayed when the mouse is moved over the central area of one of the display units or the screens of the CDUs in the VC. A **left or right** mouse click when the **"+"** cursor is displayed will open the display unit or the CDU on a new window of larger dimensions.

When the zoomed window is open a **"-"cursor** will display on both the zoomed window click-spot and the corresponding normal display click-spot. Use the **left or right** mouse click on either click-spot to close the zoomed window.

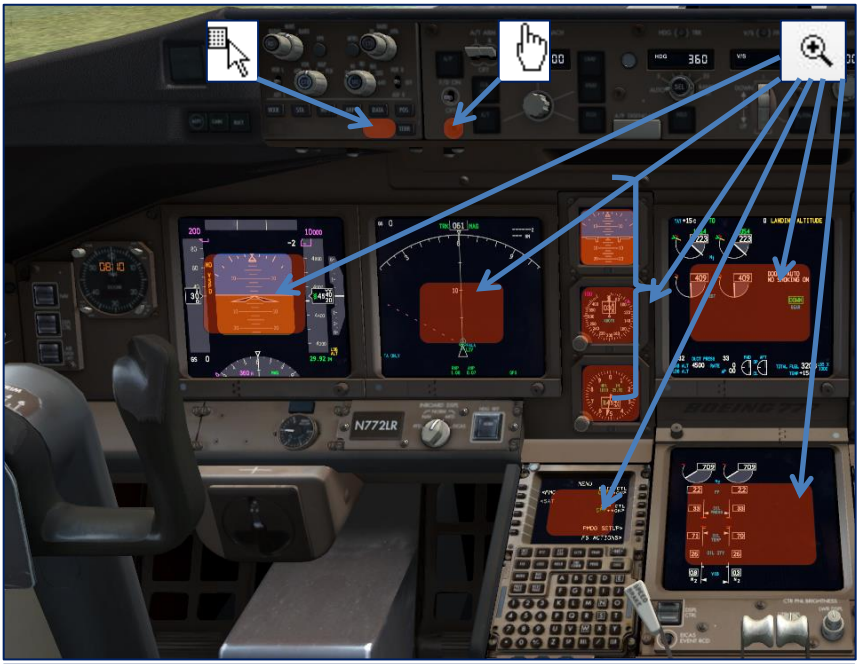
 When a zoomed-in display unit is open, the minus icon shown here will cause the display to close.

NOTE: If you forget what a specific click-spot will do, simply hover your mouse over the spot and a tool-tip will appear to remind you. (Provided you have tool-tips enabled!) They will also tell you what the left/middle/right click functionality of certain clickspots is.

At night, the click locations are illuminated using the MAIN PANEL brightness knob in order to make them easy to find.

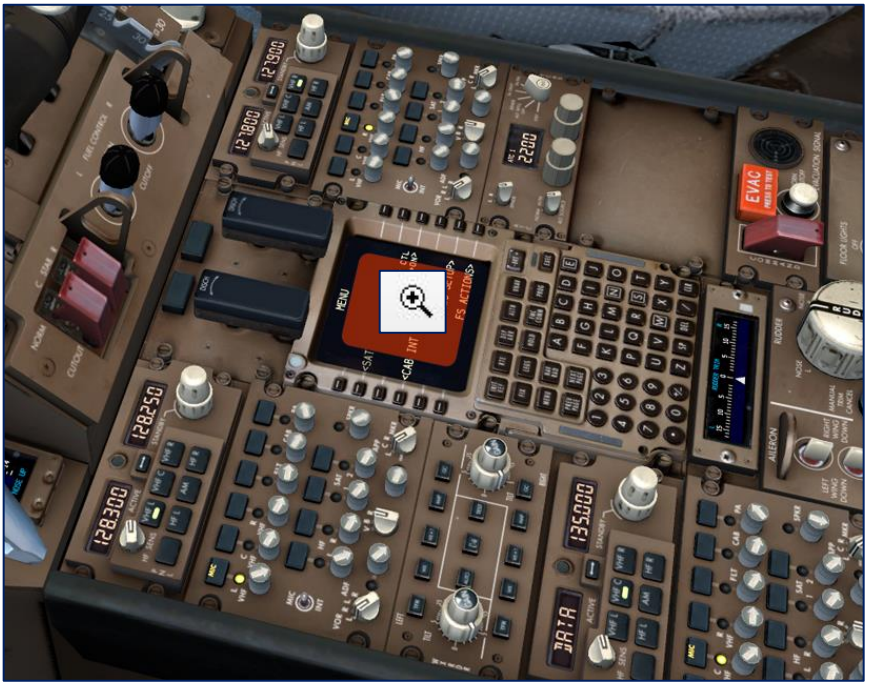
The following pages show/explain the mouse click hotspots that are used to pop up/control the various flight displays, 2D pop-up panels and yokes. The different cursor types that the user will see when the mouse is moved over click spots are also depicted.

Main Panel and Forward Pedestal Clickspots:



Glareshield and Yoke Clickspots:

Rear Pedestal/CDU Clickspot:



MCP Popup Click Spot:

MCP Popup and Close Click Spots:

CA TOGA Click Spot:

FO TOGA Click Spot:

Radio/Audio Panel/XPDR/Weather Radar Popup and Close Click Spots:

CUSTOMIZE YOUR PMDG 777-200LR/F EXPERIENCE

When talking with customers, one topic comes up again and again for simmers that enjoy the immersive nature of PMDG products: “I don’t like having to use menus once I am in the simulator!”

With the **PMDG 777-200LR/F** product line we have finally resolved this customer concern by allowing you to change just about anything in the airplane without ever having to leave the simulation. From your fuel load to the passenger load, cockpit configuration, external model options, failures, maintenance and cockpit equipment: ***everything can be configured live, in FSX, without having to pull down a menu and without having to leave the immersion of the simulation!***

Accessing FMS Based Menus from a Dark Airplane:

Since we have moved all of the configuration options into the FMS in order to promote simulation continuity, we also had to give you a way to access those menus even if the airplane is not currently powered.

To access the FMS based Setup/Configuration menus from a Cold & Dark cockpit, simply press and hold the MENU button on the FMS until the FMS screen comes to life.

PMDG 777-200LR/F Home CDU Menu:

At any time while flying the **PMDG 777-200LR/F**, you can press the **MENU** button on the CDU and you will be presented with the top menu for the CDU system:

On the left side of the screen, you can select the <FMC prompt to enter the aircraft flight management functions. On the right side you will find the SETUP> and FS ACTIONS> prompts. These options are the core of your ability to customize your **PMDG 777-200LR/F** flight experience.

If at any time you get lost in the CDU, simply press the MENU button and you will be brought immediately back to this page!

PMDG SETUP MENU

Pressing the SETUP> prompt at will display the following menu:

The PMDG SETUP page is the “home base” from which you will configure your PMDG 777 to suit your needs. From this menu you can adjust the specific options for your airplane cockpit as well as many options to control various aspects of the simulation experience itself.

There are a few things to keep in mind while learning how to tune the **PMDG 777-200LR/F** to suit your tastes:

- < AIRCRAFT: The **PMDG 777-200LR/F** allows you to configure the equipment options you want on your 777 and in your cockpit and then bind them to the registration number of the livery you are currently flying. This gives you the opportunity to set up the flight deck for individual liveries according to the configuration used by different airlines or on specific airplanes and quickly switch between them. The items listed under <AIRCRAFT are airframe specific, so you can change them when loading different liveries.

- < OPTIONS: The **PMDG 777-200LR/F** allows you to set global options such as the mechanical failures model, performance tuning, key commands and sound options that remain in place even as you switch between different liveries or 777 body types.

- Panel SAVE STATE > and LOAD STATE >: The save/load state prompts allow you to save the current setup of the panel to a file that you can then reload at any time in the future. Saved panel states are independent of specific saved flights so if, for example, you wished to save the current state of the cockpit as you left it at the conclusion of your flight, you can then reload this panel

condition in the future and find all switches and system in the desired settings. (This is not the same as saving a flight because it merely saves the condition of the airplane, thus allowing you to load your panel configuration into any flight you wish.)

- STARTUP STATE: This prompt allows you select a saved panel state that you would like the simulation to use as your default panel condition *every time the simulation is launched.* For example, if you were to select a Cold and Dark scenario as the STARTUP STATE for the airplane, you will be presented with that cold and dark panel state whenever and wherever you choose to load the PMDG 777.

- LICENSE>: This prompt allows you to view your license key or manually deactivate the license on your computer, as mentioned earlier.

- ABOUT>: A short animation with the names of the Development, Tech and Beta teams.

Understanding Panel vs. Flight Save/Load States:

When it comes to saving your flight, there are a few things that you should clearly understand in order to avoid confusion.

Saving a Flight: Saving a flight is done via the FSX File/Save Flight menu. This will save the airplane position, status and configuration into a file that can be loaded at a later time via the FSX File/Load Flight menu.

Saving a Panel State: Saving a panel state is a bit different. Panel states allow you to save the airplane's current configuration without any regard to the phase of flight or location of the airplane. This being the case, panel states are entirely mobile and thus give you great flexibility.

For example, let's say that you want to create a condition in which the airplane is on the ground with the APU running, the IRS's aligned and everything ready to start the engines. You do this by setting the airplane up as you desire, then going to the PMDG SETUP menu in the FMS and pressing STATE SAVE>.

You will be prompted for a name for the panel state, and the FMS will then create the necessary files in your <FSX ROOT>/PMDG/PMDG 777X/PANELSTATE folder.

Once this state is saved, you can have the airplane in any location in the FSX world and use the LOAD STATE> prompt to instantly put the airplane into the desired configuration.

We have created some panel states that we thought might be desired by users:

Cold and Dark
Default
Long Turn
Short Turn

These panel states can be loaded at any time and the airplane will be instantly configured according to the panel state selected. This can be convenient for quickly setting up a flight to start precisely where you want!

Save/Load Effect on Failures:

In the **PMDG 777-200LR/F** the current state of failures is always saved. If you have a particular failures mode saved, and various failures are already active or armed to become active, they will remain as such when you load the flight that was saved in that condition.

This can be useful for saving flights enroute without losing any of the activities that have taken place earlier in the flight sequence.

Some users may not want the failure conditions to transfer to a newly loaded flight. If this is a concern, then please be certain that you clear all failures and disable failures from the FAILURES menu prior to saving the flight.

Save/Load from the FSX menu:

You can also conduct save/load operations from the FSX menu. The **PMDG 777-200LR/F** will intercept the save/load function and create both the FSX save file and the **PMDG 777-200LR/F** panel save file for you using the name you select.

You will then be able to load your flight and panel state from the FSX menu as well and the airplane condition will be just as you left it.

On the PMDG SETUP menu you will notice a STARTUP STATE prompt. You can use this prompt to force FSX to load the **PMDG 777-200LR/F** in exactly the same configuration every time you launch the simulator.

In addition to the 777 DEFAULT engines running state, we have included the following panel states for you to use:

- 777 CLDDRK: This is the airplane completely shut down with the shutdown, securing, and power down procedures complete. The L2 entry door is open since you presumably entered through it. The airplane is chocked.

- 777 SHORT: This is the airplane on a short ground turn. The shutdown procedure has been completed and the APU is running and providing power and air. The securing procedure is partially completed. The L2 entry door and all three cargo doors are open and the airplane is chocked.

- 777 LONG: This is the airplane on a long ground turn. The shutdown and securing procedures have been fully completed. Ground power

and air conditioning are both connected and the airplane is chocked. The L2 entry door and all three cargo doors are open.

AIRCRAFT SETUP MENUS

The AIRCRAFT menu allows you to configure the equipment, displays and mechanical fitness of your airplane to suite your needs.

When using the **PMDG 777-200LR/F** you should think of aircraft options in terms of airframes. Through this menu system we allow you to define the equipment contained on the flight deck of a limitless number of aircraft, defined by airframe tail numbers.

For example, if you wished to define the specific equipment carried on N772LR, you can do so, saving the information via the AIRCRAFT menu. You might then define a different equipment setup on N773LR and save that configuration via the AIRCRAFT menu.

Thus, you can quickly return to whatever configuration you choose by simply loading that aircraft's configuration file via the AIRCRAFT menu.

How this helps you:

The **PMDG 777-200LR/F** tracks everything in terms of individual airframes. As you fly N702DN, for example that airplane will accumulate flight time. Any changes you make to the equipment carried on that aircraft can be saved and the simulator will load those options the next time you choose to fly N702DN.

If you wish to use a different aircraft configuration, simply select it via the AIRCRAFT menu and the changes will be instantaneous.

How this works behind the scenes (For sim techs and nerds!):

You don't need to read this section to use the AIRCRAFT menu, but we are including it for those who want to know details about how the AIRCRAFT menu system works.

Each livery comes with a pre-defined definition ini file that defines all of the options related to that particular airplane. The file is fully editable.

The definition file is named to match the tail number on the livery and gets copied to the **<FSX root>/PMDG/PMDG 777X/Aircraft** folder by the livery installer. A backup original copy is left in the texture folder so that you can use the AIRCRAFT menu to revert to the original configuration file if you make changes that you no longer wish to keep.

When you select a livery, and then launch the simulator, the **PMDG 777-200LR/F** will determine what equipment in installed on the airplane by reading the definition file for that livery's tail number. When the sim launches your cockpit will be set up according to that definition.

If you make changes to the cockpit layout and save the definition file using the AIRCRAFT menu, those changes will be present in the airplane any time you load that livery.

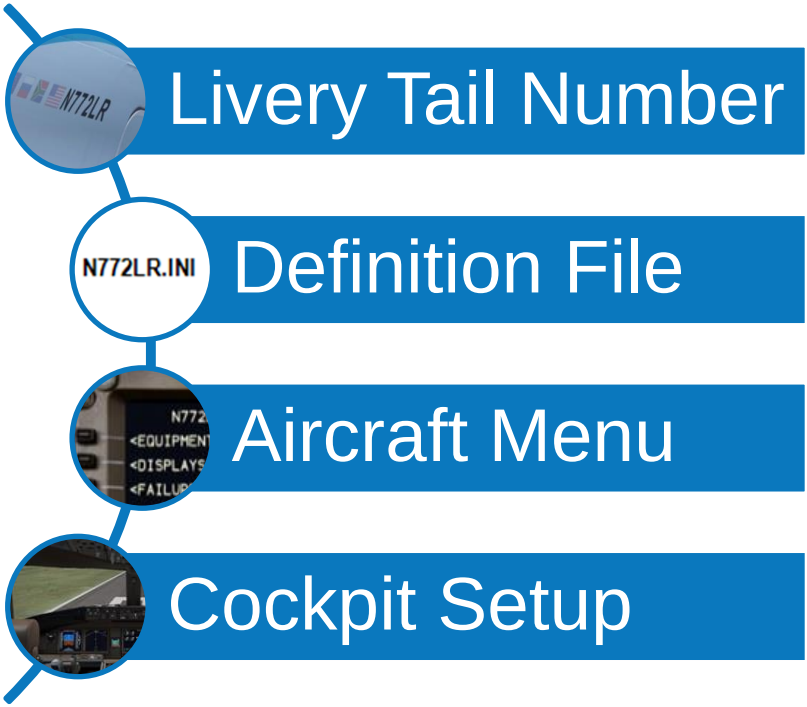
So the key thing to remember is that each aircraft should be viewed in terms of its tail number. When you load a livery, the definition file matching the airplane's tail number will be used to populate your cockpit, display and maintenance options.

If desired, you can save multiple definitions for the same airplane in order to simulate changes in the equipment carried over time. For example you could set one set of options for the N772LR setting, then manually make changes and save the file as N772LR2.ini Then, if you desire to use the second configuration, simply select it from the menus as will be described below.

NOTE: The livery number displayed in the AIRCRAFT menu will always match the tail number installed with the livery. This is because the maintenance and flight time tracking must be tracked for that individual tail number!

Do not manually change the tail number in the DETAILS pane of the aircraft select screen in FSX. This will mess up or otherwise disable the livery options.

The following matrix should help you to visualize how the airplane-specific equipment, display and maintenance options are tracked for individual tail numbers:



Using the AIRCRAFT menu:

When you load a livery from the FSX free flight menu and then launch the simulator, the **PMDG 777-200LR/F** will load the definition file that describes how that aircraft is laid out in terms of cockpit equipment, displays and mechanical fitness.

The AIRCRAFT menu is designed to give you the ability to change the equipment installed in the cockpit, change the way information is displayed to you on the cockpit displays, and to interact with the mechanical reliability of the airplane.

You do this through the following menu prompts:

- < EQUIPMENT
- < DISPLAYS
- < FAILURES

We will explore the content of these menus in a moment, but for now just remember that any time you make a change, the **PMDG 777-200LR/F** will automatically save the change you made to the aircraft's definition file. This has the effect of making the change permanent until you make future changes.

NOTE: There is no danger to changing the contents of the AIRCRAFT menu, even while the aircraft is in flight!

Restoring a Definition File:

In the event that you make changes and later wish to revert to how the airplane was configured at the time you installed the livery, simply press the RESTORE > prompt on the AIRCRAFT page.

This will copy the original definition file from the backup folder to the active folder, replacing the one you have already altered. (This cannot be un-done!)

Using a Different Definition File:

In some circumstances, you may decide that you want to use a different aircraft configuration than the one that is defined for that livery. As an example, if you fly with a particular configuration frequently and have grown comfortable with that cockpit setup, it may not be convenient to have to remember every single configuration change that you made in order to get a different livery configured to match your preferred settings. In order to make things easy, we have allowed you the option to load a different aircaft definition than the one that is loaded by default with any livery. You can do this using the Load From ANOTHER > prompt on the AIRCRAFT menu.

Selecting the ANOTHER > prompt will take you to the following menu:

This menu will list all of the available aircraft definition files currently loaded or that you have created.

To load the N772LR configuration displayed in the example above, you simply press the line select key, and then confirm the entry.

This will cause the configuration definition for N772LR to be used with whatever livery you currently have loaded.

NOTE: If you switch liveries, you will need to re-select the N772LR *definition if that is your wish. Every time you load a livery from the free flight FSX menu, the* ***PMDG 777-200LR/F*** *will load that livery's definition file!*

Using a Fixed Definition File for All Flights:

You may find that you settle into a favorite cockpit configuration that you want to use no matter which livery you are flying. In this case you can set the configuration as your FIXED CONFIG by using the FIXED CONFIG prompt to select it from displayed list.

Once you have selected an airline definition file as your FIXED CONFIG it will remain until you delete. (Press the DEL key, then the FIXED CONFIG prompt to delete.)

EQUIPMENT Options:

When purchasing an airplane from Boeing, the airline customer will choose from a package of equipment options that provide advanced capabilities beyond what the basic airplane is capable of.

These options are available for you to select from in the EQUIPMENT pages so that you can experiment with the mix of data equipment options that are interesting to you as a pilot.

INTRODUCTION

There are numerous pages of options available that will allow you to customize the displays in the cockpit of your 777. You can use the PREV PAGE and NEXT PAGE buttons on the CDU to move forward and back through the pages.

In the list that follows, we have provided images to show you the difference between equipment types when applicable. We also document some of the known conflicts between equipment types (if any) so that you are aware that turning some features ON may disable other features.

You can't hurt anything by experimenting with combinations of features, so feel free to turn things on or off and add/remove equipment capabilities as your needs or interest may allow!

If you get into a simulated flight and decide you'd like to try some changes, you can do so live, in the simulator, without having to worry about disrupting your current flight.

PAGE 1/13 - ADFS, FMS

- GS CAPTURE BEFORE LOC: This option allows you to determine whether the autopilot/flight director will command the airplane to follow the glide-slope on an approach even if the localizer has not yet been captured. Airlines generally provide specific policy guidance on this topic, and they will select the equipment option so that the airplane adheres to corporate policy. Generally speaking, the DENY option is the safer, more conservative option.

- AUTO LNAV ON GO-AROUND: This option allows the AFDS to automatically engage LNAV on a go-around with a missed approach loaded in the FMC.

- GR WT ENTRY ALLOWED: This option determines whether or not the gross weight field on the performance page allows entries. When set to NO, the GW is automatically calculated after the zero fuel weight (ZFW) is entered.

PAGE 2/13 - FMS

- TAKEOFF THRUST DERATES: This option determines whether or not the THRUST LIM page displays the TO-1 and TO-2 fixed percentage thrust derates for use.

- CLIMB THRUST DERATES: This option determines whether or not the THRUST LIM page displays the CLB-1 and CLB-2 fixed percentage thrust derates for use.

- CLB DERATE WASHOUT ALT: This option sets the altitude at which the climb thrust rating returns to its full maximum value when using the fixed CLB-1 or CLB-2 derates.

- FMS CRZ PHAS THR LIM: This option determines whether the cruise flight N1 limit is CLB or CRZ.

- COMPANY SPEED: This is the speed at which the airplane will climb, cruise and drift down with an engine out.

PAGE 3/13 – FMS

- FMS DEFAULT ALTITUDES (list of four): These options allow you to customize the default acceleration altitude, default engine out acceleration altitude, default thrust reduction altitude, altitude and default transition altitude in order to comply with the standards typically used by your airline and/or country.

  For example, the transition altitude in the United States is 18,000 feet, but in other countries this value will vary. If you live in a country where 5,000 feet is normally used then you can set this value to 5,000 and you will not have to change the transition altitude in the FMS on every flight.

  It's important to understand that these values will be overridden by what's saved in a panel state or saved flight due to the way the FMC is initialized. If you wish to have these values in a panel state, load the panel state first, adjust the values, then save the state with a new name such as "(livery name)_CLDDRK" or whatever you'd like.

  Also, with respect to the THRUST RED ALT/FLAPS setting – this can be set to a value of 1 or 5 instead of an altitude, which causes the thrust reduction to happen when the flaps are moved from 15 to 5 (the 5 value) or from 5 to 1 (the 1 value), regardless of altitude.

PAGE 4/13 - INSTRUMENTS

- STANDBY INSTRUMENTS: This option allows you to decide whether you want to have the ISFD or SEPARATE standby instrument option installed. The ISFD (Integrated Standby Flight Display) is an electronic, solid state digital display that contains its own backup battery source of power. The SEPERATE standby gauge configuration provides the AI, ASI and ALT as separate digital instruments, as pictured below.

ISFD

Separate

- ADF INSTALLED: This option determines whether the aircraft has ADF receivers for tuning NDBs installed. INOP stickers will appear over the EFIS ADF pointer selectors if not installed.
  NEW IN SP1

- CLOCK TYPE: This option configures the airplane with either the original analog style chronometers installed beside the PFDs or with the newer digital type that is integrated into the PFD and ND. When using the digital type, the analog chronometers are absent from the panel and the clock and PMDG Auto Cruise functions are controlled by left and right clicking the CLOCK buttons on the glareshield wings.
  NEW IN SP1

- CABIN SIGN SELECTOR: This option allows you to set the cabin sign to 'NOT INSTALLED', 'NO SMOKING' or 'NO ELECTRONICS.'

PAGE 5/13 – PACKAGES

- AUX FUEL EQUIP: This option is used to set up the 777-200LR aircraft with NONE, SINGLE or THREE Auxiliary Fuel Tanks. The 777F and 777-300ER (if purchased and installed) do not have an auxiliary fuel tank option.

  APU TO PACK INSTALLED: This option enables the APU-to-pack takeoff options, which can be used to obtain extra power for takeoff performance under certain conditions such as high outside air temperature at high takeoff weights without having to completely disable the packs and upset the passengers. This option is standard on the 777-300ER (if purchased and installed) and cannot be deactivated on this variant.
  NEW IN SP1

- FLIGHT TEST PACKAGE: We've included this package for those who might enjoy seeing the visual aspects of the standard flight test gear carried aboard an airliner during flight testing. This includes a tail drogue and extra air data sensors protruding through red window plugs in the forward cabin area. This is a visual model enhancement only and does not provide any data display anywhere on the flight deck.

- SATCOM ANTENNA (300ER, if purchased and installed): This option sets the position of the external SATCOM/wifi antenna on top of the fuselage to FORWARD, MID, or NOT INSTALLED.

- TAIL SKID INSTALLED (300ER, if purchased and installed): This option sets whether or not the aircraft is equipped with a tail skid. New 777-300ERs are no longer coming with the skid as the FBW system protections against over-rotation have been deemed enough to mitigate the risk of a tail strike.

PAGE 6/13 – GPWS

- RAAS INSTALLED: Enables the Runway Awareness and Advisory System, which plays aural callouts for a variety of situations on the ground or approaching an airport in the terminal area (runway name callouts, warnings if trying to takeoff on the incorrect runway or a taxiway, etc.)

  The RAAS system was developed by FS2Crew and is locked to the PMDG 777 airplanes. If you would like to use the system on all of your other FSX aircraft, purchase the full version here:

  http://www.fs2crew.com/cart/products/FS2Crew%3A-RAAS-Professional.html

- V1 CALLOUT: Allows you to select the GPWS "V1" callout to ON or OFF.

- BANK ANGLE CALLOUTS: This option allows you to select whether or not you will hear aural bank angle warnings if you exceed prescribed bank angles.

- APPR MINIMUMS CALL: This option selects the aural callout type that plays when approaching your minimum altitude on an approach. The airplane can issue no warning, or it can call out "Approaching Minimums" or "Approaching Decision Height" or "Plus Hundred."

- MINIMUMS CALL: This option selects the aural callout type that plays at your minimum altitude on an approach. The airplane can issue no warning or it can call out "Minimums," "Minimums Minimums," or "Decision Height."

PAGE 7/13 - GPWS

- ALTITUDE CALLOUS: This option determines whether any GPWS callouts play at all.

- 2500 FEET CALL TYPE: Most airlines use the "Twenty Five Hundred" call, but some airlines have adopted the "Radio Altimeter" aural advisory instead. You can choose which you wish to hear.

- CALL 2500: Here you can set 3 options for the 2500 ft call: YES (always on), SMART (call will be made only if you are established on an ILS glideslope), and NO (call will not be made).

- CALL 1000: Here you can set 3 options for the 1000 ft call: YES (always on), SMART (call will be made only if you are established on an ILS glideslope), and NO (call will not be made).

- CALL 500: Here you can set 3 options for the 500 ft call: YES (always on), SMART (call will be made only if you are established on an ILS glideslope), and NO (call will not be made).

PAGE 8/13 - GPWS

- CALL 400: Set the 400 ft call to ON or OFF.

- CALL 300: Set the 300 ft call to ON or OFF.

- CALL 200: Set the 200 ft call to ON or OFF.

- CALL 100: Set the 100 ft call to ON or OFF.

- CALL 50: Set the 50 ft call to ON or OFF.

PAGE 9/13 - GPWS

- CALL 40: Set the 40 ft call to ON or OFF.

- CALL 30: Set the 30 ft call to ON or OFF.

- CALL 20: Set the 20 ft call to ON or OFF.

- CALL 10: Set the 10 ft call to ON or OFF.

- TERR: WATER IN CYAN: This setting allows you to choose whether sea-level bodies of water will appear in cyan on the ND's EGPWS terrain display.

PAGE 10/13 - WARNING SYS

- RESETTABLE SIREN: Allows the Master WARNING/CAUTION siren to be reset by pushing the Master WARNING/CAUTION reset switch.

- AP DISC WARNING: Here you are able to select between the WAILER or SIREN Autopilot Disconnect sounds.

- AP DISC SCHEME: Provides options for the behavior of the yoke AP disconnect button. “1 PRESS” will disconnect the AP with no warning sound, “2 PRESSES” will disconnect the AP with the first press and immediately silence the resulting warning sound with the second press. If the two presses are fast enough, no sound will play. “2 PRESSES UNSILENCED” always plays a cycle of the warning sound and will not silence until the playback is over regardless of how fast the two presses are.
  NEW IN SP1

- ALT ALERT SETTING: This option sets the altitudes at which the airplane will trigger the altitude approach alert and the amount of deviation from the MCP altitude necessary to trigger the alert sound and visuals.

- ALTITUDE APPROACH AURAL: This option allows you to turn the aural altitude approach “C chord” sound ON or OFF.

PAGE 11/13 - WARNING SYS

- CREW ALERTNESS MONITOR: Use this option to turn the monitor ON or OFF. The aircraft continuously monitors switch action on the MCP, EFIS control panel, display select panel, CDUs, and radio transmitter microphone switches. When a predefined time elapses after the last switch action was detected, the EICAS alert message PILOT RESPONSE is displayed. The message is inhibited below 20,000 feet, during climb, and when flaps are not up.

PAGE 12/13 – FMC DATALINK

- AUTO PREFLIGHT UPLINKS: With this option selected, initiating a ROUTE REQUEST from the RTE page during preflight will automatically trigger in sequence PERF INIT, WIND DATA and DES FORECAST requests. The data for each request will become available once data of the previous request in the sequence is loaded and accepted.
  NEW IN SP1

- AUTO ALTN LIST UPLINK: With this option selected, the alternate airports list data (ALTN page 2/2) is automatically updated periodically during the flight.
  NEW IN SP1

- AUTO DES FRCST UPLINK: With this option selected, each time a RTE DATA page WIND DATA REQUEST is performed, a DES

FORECAST data uplink request is automatically triggered following it.
NEW IN SP1

- AUTO POS RPRT DOWNLINK: With this option selected, position reports are automatically downlinked during the cruise phase of the flight each time a waypoint is sequenced. This option is simulated by the presence of the REPORTING and REPORT SENT prompts - there is no sending of an actual report to anywhere.
  NEW IN SP1

PAGE 13/13 – FMC DATALINK (Continued)

- COMPANY COST INDEX: This option sets the preferred company cost index that is used in PERF INIT uplink requests..
  NEW IN SP1

- ALTN MIN RWY LENGTH: This option is used (in conjunction with the next option) to define company preferred airports to be used as alternate destinations in ALTN (ALTN page 1/2) and ALTN LIST (ALTN page 2/2) requests. Any airport that does not have at least one runway longer than the defined length will not be considered as a valid alternate airport by the FMC.
  NEW IN SP1

- ALTN ILS REQUIREMENT: This option is used (in conjunction with the previous option) to define company preferred airports to used as alternate destinations in ALTN (ALTN page 1/2) and ALTN LIST (ALTN page 2/2) requests. With this option selected, only airports that have at least one runway equipped with ILS are considered as alternate destinations.
  NEW IN SP1

DISPLAYS Option Pages:

When purchasing an airplane from Boeing, the airline customer will choose from a package of options describing what data is shown to the pilots on the cockpit displays.

These options are available on the DISPLAYS pages so that you can experiment with the mix of data options that are interesting to you as a pilot.

There are numerous pages of options available that will allow you to customize the displays in the cockpit of your 777. You can use the PREV PAGE and NEXT PAGE buttons on the CDU to move forward and back through the pages.

We have included images where helpful, but you should feel free to turn items on and off while in the simulator- you won't hurt anything by cycling back and forth to see what the options look like or how they change your flying experience!

The following customization options are available from the DISPLAYS menu:

PAGE 1/7

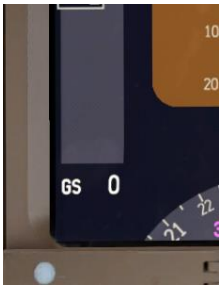
- WEIGHT UNITS: This option selects between metric (KG) and imperial (LBS) weight units throughout the aircraft's systems.
- AIR COND TEMPERATURE UNITS: This option sets the temperatures displayed on the AIR synoptic to either C or F.

PAGE 2/7 - PFD

- FLIGHT DIRECTOR TYPE: Select the style of flight director that will be displayed. The split axis option provides independent pitch

and roll steering cues, while the single cue option provides a single chevron shape.

- GROUNDSPEED DISPLAY: Displays your current ground speed on the PFD as shown here:



- RISING RUNWAY: Turn the rising runway symbol on/off for display on instrument approaches.

- NAV PERF INDICATIONS: Select whether to switch on/off the ANP (Actual Navigation Performance) and RNP (Required Navigation Performance) indications on the PFD and ND.

- FPV HEADING SCALE: Shows a magnetic heading scale along the land/sky transition point on the PFD attitude indicator while the FPV switch is pushed.

PAGE 3/7 - PFD

- ROUND RADIO ALT DIAL: Allows the radio altitude to be shown in round dial format.

- AOA INDICATOR: Display the angle of attack indicator dial at the top right corner of the PFD. (Replaces the round altitude readout indication if that was previously selected.)

- LANDING ALT BAR: Displays the landing altitude bar on the PFD altitude display.

- SHOW LANDING FLAPS: Displays the landing flaps setting on the PFD that has been selected in the FMS for the approach and landing.

PAGE 4/7 - ND

- TRACK UP: This option selects between a track-up navigation display or a heading-up navigation display.

- RANGE ARCS: Display range arcs on the navigation display when appropriate for the selected display mode.

- TCAS 3NM RANGE RING: Display 3nm range ring with TCAS.

- VOR COURSE LINES: Display VOR course lines on the navigation display as appropriate to navigation mode and location.

- GRID HEADING: Shows grid heading values in a box to the right of the ND's main heading display when the aircraft's position exceeds 70 degrees north or south latitude. Grid headings are sometimes used in the polar regions).

PAGE 5/7 - ND

- MIN RUNWAY LENGTH: Airports with runways below this length will not be shown on the ND or listed as alternates on the FMC ALTN page.

- SHOW NEXT ALT CONSTR: Display the next altitude crossing constraint next to the waypoint on the ND without the DATA switch on.

- OTHER TRAFFIC (TCAS): This toggle allows you to choose whether TCAS only shows you proximate traffic (realistic) or shows you all traffic in your vicinity. (Not realistic but convenient for online flying!)

- RANGE: Allows you to manually change the display range for TCAS traffic. (Useful for online fly-ins if you need to limit the number of aircraft displayed on the screen.) We recommend leaving this set to 40nm.

- ALT SEPARATION: Allows you to manually de-clutter traffic that is above/below you. (Useful for online fly-ins if you need to limit the number of aircraft displayed on the screen.) We recommend leaving this set to 2800FT.

PAGE 6/7 - EICAS

- EGT COLOR CHG INHIBIT: Set the elapsed time allowed to trigger an EGT over-temp display.

- LOW OIL QTY INVERSE: Invert the color of the oil quantity display when low oil quantity is detected.

- HIGH VIBRATION ALERT: Show indication of high vibration.

- MAX CONTINUOUS THRUST BUGS: Selects whether to display the amber maximum continuous thrust bugs on the N1 arc.

- SHOW REF N1: Selects whether or not the reference N1 value for the currently selected thrust rating is displayed above the N1 arcs on the upper EICAS.

PAGE 7/7 - MFD

- DOOR ARMING INDICATION: This option determines whether or not the arming status of each entry door is shown on the MFD Doors synoptic.

FAILURES Customization Pages:

The failures and maintenance logic is covered in great depth in the following section “FAILURES AND MAINTENANCE.”

OPTIONS MENUS

The configuration options located under the OPTION menu provide you with the opportunity to modify your simulation experience to suit your tastes. These include performance tweaks, assigning key-driven commands to cockpit functions, adjusting the way the sound environment is simulated and many more. The OPTIONS menu is broken into sub-menus to categorize options for ease of organization.

- <SIMULATION: This menu will allow you to change a number of features in the simulation such as maintenance failures, user interface items and other global features that apply across all aircraft tail numbers to customize the simulation to your tastes.

- <PERFORMANCE: The options contained in this menu will allow you to tweak slightly certain items that may be of benefit to users suffering from poor performance on older machines. Going through these items will help you to avoid using unnecessarily performance hungry options if you are concerned about performance on your computer.

- <KEY COMMANDS: This menu will allow you to assign various key commands to knobs, buttons switches or controls on the flight deck. You can use these key commands to interface actions with your flight simulation hardware, or just to simplify actions while flying the airplane.

- <COLORS: This menu will allow you to customize PFD, MFD, instrumentation and cockpit lighting colors in the simulation.

- <SOUND: This menu will allow you to customize some areas of the sound environment in the simulation.

SIMULATION Configuration Menu:

PAGE 1/7

- CORRECT LOC CRS TO FSX: When it comes to navigation data, FSX has an inherent weakness in that data related to ILS/LOC stations is hard coded into the simulator and is not updated to keep it current with the normal magnetic shift. The end result is that the localizer final approach course in the FSX world will sometimes vary from the real world. Since many users are also using real-world navigation charts, this can create some confusion and can also create problems if the LOC course is not correctly set to match the FSX hard-coded information. (The airplane cannot fly the localizer properly if the CRS on the CDU NAV RAD page is set incorrectly) To compensate for this, we recommend setting this option to ON, and we will read the appropriate FSX localizer course and adjust the setting for you, thus saving you time and frustration.

- REALISTIC AP ENGAGEMENT: This option can be used to simplify the autopilot engagement process if desired. When set to “Realistic Engagement” the autopilot will require that the airplane is in a balanced trim condition prior to accepting a pilot command to activate. Thus, if you are holding control input in place to maintain the desired flight path, you would need to re-trim the airplane until control force is no longer required to maintain the desired flight path. Selecting “OFF” will simplify the engagement logic for those who are just learning how to fly the simulator, thus reducing your workload. If you notice the autopilot failing to take control of the airplane when you press the AP button, refer back to this paragraph as a refresher!

If you set the autopilot engagement limitations to REALISTIC, then you must be within a small margin of "in trim" (no control forces required to keep airplane on desired path), you cannot be actively trimming, and the flight director should be nearly centered. If you violate any of these conditions, the autopilot will not engage.

- SHOW THRUST LEVER POS: When the airplane is being flown using auto-throttles, the throttle position quickly gets out-of-sync with the position of your joystick throttle. This can create an uncomfortable change in thrust when you disconnect the auto-throttle on approach or immediately prior to landing. In order to eliminate the need for you to quickly adjust your throttles to avoid a thrust change we have devised a system that will allow you to easily sync your throttle position to the auto-throttle position:

  By selecting Show Thrust Lever Position to ON, you will notice that moving your throttles while the auto-throttles are engaged will cause a small cyan marker to appear on the inside of the engine N1 thrust rings on the upper EICAS. The cyan mark is showing you the current physical position of your joystick throttle. Simply put the cyan mark to the same location as the white throttle tick mark displayed on the same arc, and you will have your throttles properly synchronized with the current auto-throttle setting.

- SHOW FBW TRIM REF SPEED: This option adds a cyan "-FBW" marker to the PFD speed tape that indicates the precise value of the current fly-by-wire trim reference speed. If the speed is offscale, the actual numeric speed shows next to the caret, similar to how an offscale landing reference speed is shown in green. The trim reference speed will be shown any time the option is turned on and the aircraft is in-flight while being handflown above 100 feet radio altitude. The trim reference speed does not show during autopilot use, as the AFDS takes full control of trim actions at that point. (See the SP1 supplement section at end of this document for more information on the SP1 FBW changes) NEW IN SP1

- <IRS OPTIONS: The IRS Options sub menu at LSK 6R provides you with options to customize the way the Inertial Reference System operates within the simulator. You can choose the length of time it should take for the IRS to align and whether or not the IRS will retain the last known memory position of the airplane at the time it was powered down.

- A/T MANUAL OVERRIDE: This option allows you to decide how you want the autothrottle react to changes in your joystick throttle position. In the airplane, moving the throttles will momentarily change the thrust of the engines, but they will return to the previous position when released, unless the autothrottle is in HOLD mode. You can realistically simulate this by selecting the <IN HOLD MODE ONLY option.

  If you wish to simplify the process a bit while learning to fly the airplane, you can select <NEVER (in which case any movement of your joystick throttle will be ignored by the auto-throttle) or you can select <ALWAYS (in which case the auto-throttle will always allow you to override the desired thrust by simply moving your joystick throttle.

  We recommend setting this to <IN HOLD MODE ONLY.

  NOTE: If the autothrottle is in HOLD mode and you move your joystick throttles, the engine will change power. If you have trouble with this, then simply set this option to NEVER.

- A/T FLARE IDLE OVERRIDE: This option allows the physical throttle to override the autothrotle's retard to idle during the flare sequence. This may be useful to some users who feel their thrust reversers are not engaging fast enough. In the real airplane pilots often manually pull the thrust levers to idle manually quickly during the flare in order to get the reversers activated right as the main landing gear touch down.
  NEW IN SP1

- CTL COLUMN NULL ZONE: This option sets the percentage of your controller's total movement in the pitch axis required before the FBW pitch mode changes to manual control from the hands-off speed stability or path hold modes.
  NEW IN SP1

- CTL WHEEL NULL ZONE: This option sets the percentage of your controller's total movement in the roll axis required before the FBW roll rate demand mode engages.
  NEW IN SP1

- AP/AT TURB MODE TRIGGER: FSX's turbulence modeling is unrealistic and results in constant severe G loads on the aircraft that can interact negatively with realistic autopilots. This option

sets the threshold for engagement of special turbulence stability modes of the autopilot and autothrottle. The threshold is set in knots of average deviation of the tail wind component (a measure of wind fluctuation). The allowable range is 0.5 to 5.0 knots and the default value is 1.0 knot.
NEW IN SP1

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- SERVICE BASED FAILURES: When using service based failures, you will experience a highly realistic statistical model for mechanical failures that uses the airplane's age and operating experience in order to predict equipment failures in a fashion similar to the real world operating experience of 777 operators. This model was created using real world data defining the Mean Time Before Failure for nearly every operational part of the airplane. This being the case, equipment will wear out, and mechanical failures will happen, requiring you to use the Quick Reference Handbook to manage mechanical failures, and the Aircraft Maintenance menus in the FMS to service the airplane as you use it.

- DISPLAY UNITS POWERUP: Realistic mode takes nearly 4 minutes for the cockpit to "boot" from cold and dark. Fast mode significantly decreases the wait time.

- TAB KEY FOR CDU INPUT: This feature uses our Keyboard Direct Entry methodology for simplicity. To activate the function, simply hold down the TAB key and type on your keyboard as you normally would (as if you were holding shift to type capital letters). Releasing the TAB key will return keyboard functionality to normal.

- MINIMUMS & BARO KNOBS: This option selects between realistic spring loaded switches that need to be held and constant rotation rotaries for the MINS and BARO knobs on the EFIS control panel. The realistic option is accurate to the real aircraft but may not be as conducive to the simulator environment as the rotary option.
NEW IN SP1

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- SYNC CAPT AND F/O BARO: Normally both pilots are responsible for setting their own altimeter's barometer setting. For simplicity, we have allowed you the option to have all the

altimeters in the cockpit set to match, without regard to which altimeter you set. This will prevent you from having to move around the cockpit in order to sync the altimeters. Note that we recommend turning this feature off if using a multi-crew cockpit.

- SYNC CAPT AND STANDBY BARO: Same as the above option, only it relates to setting the standby/ISFD altimeter's barometer setting.

- PNF CALLOUTS (3 options): Selects voice callouts by the pilot not flying (PNF) for V1, VR and V2.

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- AUTO STEP CLIMBS: Automatically increase the MCP altitude at step climb points and initiate the climb. Useful if you are flying long haul while not at your computer.

- PAUSE AT TOP OF DESCENT: Some users appreciate having the simulation pause when the aircraft reaches the VNAV Top of Descent for the programmed route of flight. This allows the user to step away from the simulation without having to worry that the airplane will overfly the T/D point. You can select the function on/off here as desired

- AUTO TIME COMPRESSION: Selects the maximum time compression rate for the PMDG automatic time compression feature (this can also be set on the AUTO CRUISE page).

- CHR BUTTON RIGHT CLICK: Selects whether right clicking the clock's CHR button turns on PMDG automatic time compression or standard FSX time compression.

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- PILOTS IN EXT VIEW: You can remove the pilots from the cockpit (such as when parked at the terminal) by selecting HIDE, and place them back in the cockpit by selecting SHOW.

- SPLASHES IN DAYLIGHT: Allows the external model light splashes to function in the daytime. Note that this may cause visual artifacts due to the specifics of the lighting technique used.

- FLOODS IN DAYLIGHT: Allows the cockpit flood lights to function in the daytime. Note that this may cause visual artifacts due to the specifics of the lighting technique used.

- FLOOD LTS DEFAULT LVL: Sets the default value in percent of the cockpit flood lights.
  NEW IN SP1

- MASTER BRT DEFAULT LVL: Sets the default value in percent of the master brightness control on the overhead.
  NEW IN SP1

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- ACP CONTROLLING FSX: In the real aircraft, each Audio Control Panel (ACP) is configured for transmission and reception only for the person using it. If the captain configures the left ACP to transmit/receive on COM1 and the F/O configures the right ACP for COM2, then the captain will not be able to transmit to COM2 or be able to monitor the COM2 frequency, unless the VHF2 receive switch on the left ACP is pressed.

  In FSX there is only one person interacting with the radios. Normally this is assumed to be the captain, meaning the ability to transmit/receive only on radios that are properly configured on the left ACP.

  The ACPs should not be confused with the Radio Tuning Panels (RTPs), which are not side specific.

  Three alternatives are provided for this option:
  - CAPT ONLY (Default – Left ACP controls radios, as above)
  - F/O ONLY (Right ACP controls radios)
  - EITHER CAPT OR F/O (Either ACP can be used)

  In the first two cases, only the selected ACP will be functional. The other two will not interfere with FSX radios at all.

  Example 1:
  If the left ACP is selected, to transmit on VHF2 you have to press the VHF2 MIC switch on the left ACP. If you want to monitor COM1 at the same time you have to also press the VHF1 receive switch on the left ACP. The position of the MIC and receive switches on the right and OBS ACPs will be irrelevant.

  Example 2:
  If the VHF1 receive switch is pressed on left ACP and the VHF1 MIC switch is pressed on the right ACP you will be able to transmit on COM2 and receive on both COM1 and COM2.

Example 3:
If the VHF2 MIC switch is pressed on the left ACP and the VHF1 MIC switch is pressed on the right ACP, you will be transmitting and receiving on COM1. Obviously you can't transmit on both radios, so COM1 is selected (COM1 will be preferred over COM2 in these cases)

- FSX COMMS DISABLED: In case COM1 or COM2 cannot be used, either because of a failure or because the controlling ACP is not properly configured for transmission/reception on this radio, the radio can be disabled in FSX. In these cases the FSX radio is masked by tuning it to a fake frequency of 136.975. The RTPs will still display the selected frequency, but internally the disabled radio will be tuned to 136.975.

  This feature has caused some problems with 3rd party add-ons and radio hardware that use directly the FSX frequencies. This combined with some FSUIPC "features" can create a mess sometimes. So we are providing the following alternatives for this option:

  - WHEN FAILED/MISCONFIG – DEFAULT
  - NEVER

  WHEN FAILED/MISCONFIG will work as described above. NEVER will disable this feature and will never tune FSX to the fake frequency of 136.975.

  If you are experiencing any problems with hardware radio panels, FSUIPC, SquawkBox, FSInn, etc. set this option to NEVER

- FSX PLN FILE FOR WX: Automatically exports the active FMC route into an FSX format WX.pln file saved in My Documents\Flight Simulator X files for loading into external weather programs. This file is created and subsequently updated each time the user selects a CDU page that contains a weather data related REQUEST prompt (RTE DATA, DES FORECAST, ALTN pages).
  NEW IN SP1

- INCLUDE ALTNS IN PLN: Includes the 4 alternate airports from the ALTN page in the exported flight plan so that weather data for them can be accessed by the FMC.
  NEW IN SP1

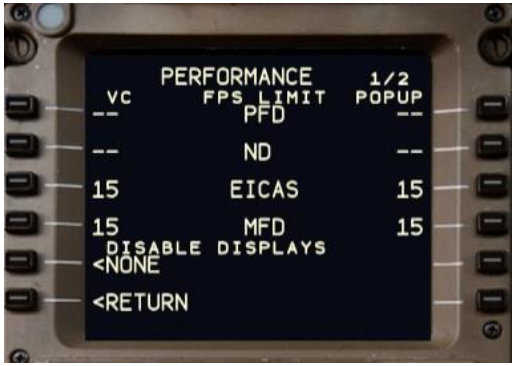
- YOKES: This option controls the default state of the yokes when the aircraft loads between normal and hidden (lowered). Clicking the hidden clickspot on the top of the yoke also controls this option now as of SP1. Note that this is not a real option on the actual 777, the yokes only have one position (normal) in real life. NEW IN SP1

IRS Options Sub-Menu:

Under the SIMULATION menu (page 1) there is an IRS OPTIONS sub-menu at LSK 6R that contains a group of options related to the Inertial Reference Systems on the airplane.

- ALIGNMENT TIME: Normally, the IRS takes approximately ten minutes to align, a period of time during which the airplane cannot be moved. Sometimes this is not convenient in a simulation so we have offered some alternatives to allow you to align the IRS more quickly:
    - REALISTIC: This option will force the minimum ten minute alignment while the IRS senses planetary rotation in order to bring itself to full alignment.
    - FAST (30 SEC): This option will align the IRS in 30 seconds, thus requiring that you be aware of the alignment requirement without making you wait ten minutes.
    - INSTANT: Just as it says.
- USE LAST MEMORY POSITION: A modern ADIRU/FMS is capable of remembering where it was when it was powered off. You can simulate this by setting this feature to YES.

PERFORMANCE Options:



With the performance tuning menu, you can adjust the update rates of the cockpit displays in order to optimize their influence on your simulation experience. You can also turn off the first officer's displays in the VC.

In general, we recommend that users adjust their scenery, traffic and simulator settings in order to improve performance of the simulator. As a last resort, you can adjust the rate of frame updates in on the displays within the **PMDG 777-200LR/F.** The performance tuning methodology operates under the premise that fewer updates to the displays in the cockpit will mean greater performance in the simulator itself. Your results will vary depending upon your hardware and your simulator settings, and we generally recommend leaving this performance as it is set in the default.

For those who are not interested in having all of the displays powered at all times, you can gain back some performance by disabling the first officer's displays in the VC. You do this via the toggle in the PERFORMANCE TUNING menu.

NOTE: We recommend that users follow the optimization guidance provided at the beginning of this document. This will give you the best performance for your machine!

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- FPS LIMIT: Here you can adjust the frame rate (FPS) limit of the PFD, the ND, EICAS and MFD by entering the desired FPS limit. Enter the desired limit into the scratchpad and press the LSK of the value you want to change. When the entries are blanked with two dashes, the display is unlocked and will display the highest FPS it can.

- DISABLE DISPLAYS: This setting allows you to disable the First Officer's display or the Captain's display. To show both displays, set this value to NONE.

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- TERRAIN IMAGE DETAIL: This setting controls the ND range at which the terrain display begins averaging individual terrain samples together so as to not affect performance. If you experience a performance hit with the terrain display on, try setting this option to medium or low.

- TERRAIN IMAGE SIZE: This setting controls the resolution of the internal bitmap terrain cells are drawn to before being displayed on the ND. Higher settings look better at the possible expense of performance.

- TERRAIN DITHER COLORS: This setting determines whether or not the terrain map is dithered, which results in a realistic "dot" type look to the display. If turned off, the display will be drawn with solid colors. This setting is mainly visual and you can set it to your preference.

- TERR SWEEP: This setting turns the raster sweep effect on or off. In the real aircraft, the terrain mode draws to the ND using the same internal hardware that the weather radar does. As of SP1 this is simulated and you will see a sweep effect across the ND simulating the raster hardware's buffered display method.
  NEW IN SP1

KEY COMMANDS Options:

In order to offer the widest variety of functionality to the broadest sector of users, we have made many functions in the cockpit “assignable” to a key command, thus giving you the ability to control various functions using key commands directly or via your flight sim hardware as desired.

You can assign key commands to functions within the cockpit by locating the desired switch from the list of functions presented in the KEY COMMANDS menu. (The available assignments are broken into categories under the KEY COMMANDS menu.)

When you select a component, you will be presented with instructions that will allow you to assign a custom key command to the desired function. The currently assigned key command will be displayed in green in the key command menu.

COLOR Options:

We have included the color option feature in order to offer you the ability to customize PFD, MFD, instrumentation and cockpit lighting colors in the simulation.

In order to adjust a specific item's color value, click on the LSK next to it.

In the above image you will see that there are two different methods to change the color of the PFD SKY:

Method 1:

Enter the RGB (**R**ed, **G**reen, **B**lue) color values in LSK 1 [**R**ed], LSK 2 [**G**reen] and LSK 3 [**B**lue] by entering the values into the scratch pad and then pressing the corresponding LSK.

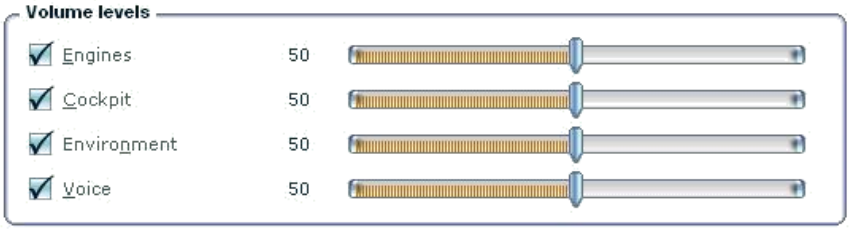
Method 2:

Enter the HEX (hexadecimal) color code into the scratch pad and then press LSK 4.

SOUND Options:

During production of the **PMDG 777-200LR/F** we recorded hundreds of sounds in order to provide the greatest degree of sound immersion possible. As part of the process, we have spent a significant amount of time balancing the sound levels, mixing them based upon volume and location in the cockpit.

To get the highest degree of sound fidelity, we recommend that you go into your FSX sound settings and verify that they are set as shown here:



Next, in the SOUND menu, you will find the following settings and options available to you:

- MASTER VOLUME: This setting controls the overall level of all custom sounds generated by the 777's sound processor, as opposed to the FSX sound engine settings above. We have balanced the cockpit sounds for the 777 at a default setting of 50.

- <VOLUME LEVELS ADJUST sub-menu: You will be presented with a series of options that allow you to set the sound volume levels for various sound components individually. This allows you to achieve a balance that works best for you based upon your own sound hardware.

It is worth noting that the default setup we have provided to you should provide the best overall realism to replicate the sound environment of the 777 type airplane.

- IN EXT VIEW: This setting controls whether the custom cockpit sounds will play while an external view is selected in FSX.

- IN BKGND: This setting controls whether the custom sounds generated by the PMDG sound processor will continue playing while the FSX window is in the background (aka not “in focus”). This is useful for users of addons that force the main FSX sound engine to continue playing while in the background.
  NEW IN SP1

- <DEVICE sub-menu: If you have multiple sound playback devices attached to your computer, you can choose between them using this sub-menu.

- PRE-LOAD SOUNDS: This option allows you to choose which PMDG custom sounds are pre-loaded (cached) into memory at various times. This can be used to prevent stuttering or reduce the airplane’s VAS footprint.

  The options are as follows:

  - NONE: This is the default mode. It does not preload at all and releases sounds 60 seconds after they’re played and reduces VAS issues and out of memory errors. More stutters from sound file loading may result on certain PC configurations however. If you experience stutters and are not having VAS/OOM issues, try SELECTIVE or ALL.

  - SELECTIVE: This mode will precache only the sounds most likely to be needed for each phase of flight.

  - ALL: This mode pre-loads all sounds upon load of the panel or switching of the option on. This option will result in the smoothest experience for users getting frequent sound related stutters. Please be aware, however, that this option can cause a *very significant increase in VAS usage*. If you are close to the VAS limit and an out of memory crash during your flights, this setting will exacerbate the situation! (see pages 31-35 for more information on VAS and out of memory errors)
    NEW IN SP1

FAILURES AND MAINTENANCE

Introduction: With the introduction of the **PMDG 777-200LR/F** product line, we are introducing a new methodology for managing the mechanical reliability of your airplane.

Due to the depth of information required to adequately describe the failures and maintenance system, we are giving this topic its own space in the manual.

For users who do not wish to interact with the potential for mechanical failure in their simming experience, you can simply skip over this section. The mechanical reliability of your **PMDG 777-200LR/F** is set to “perfect” by default.

If you wish to experience the potential for mechanical failures, there are currently three ways in which you can challenge yourself:

1. RANDOM: When you activate random failures, you will have the opportunity to set the rate of random failures while also setting limits on the total number of events that may be triggered. This method will allow you to challenge yourself and your airplane knowledge while also setting limits on the number of times that a failure will be triggered during the scope period.

2. SERVICE BASED FAILURES: When you activate service based failures, you will experience mechanical reliability that closely approximates the mechanical reliability of the airplane in normal service operation. Each mechanical system aboard the airplane has been programmed to operate using a “Mean Time Before Failure” (MTBF) model to determine if/when a component may fail. The MTBF data is compiled from industry experience with the 777 airplane type, and augmented to make the data compliant with the expected utilization rate of this simulation product.

3. Programmed Failures: We have provided you with the ability to set programmed failures for individual sub-systems. You can immediately trigger a specific system failure by choosing it from a list, or you can tell the system to randomly select a failure from within that system.

Failures: Top Menu:

Entering the failures menu from the SETUP menu will display the following menu:

From the FAILURES top menu, you can select from individual systems (use the PREV PAGE and NEXT PAGE to scroll up and down) or you can go into the ALL SYSTEMS to set random or service based failures, or you can select an individual system from within which you can set specific failures.

All Systems: Top Menu:

This menu allows you access to establish the RANDOM and SERVICE BASED FAILURES modes. This page will also allow you to enter the maintenance performance section.

Random Failures Sub-Menu:

The random failures menu allows you to set up a process for random failures to be triggered at a specific rate, with a limit to the total number of events that may be triggered.

To turn the random failures mode on, simply set the RANDOM FAILURES selector to YES. This will turn the random failure settings to white to indicate that they are now active for manipulation.

Use of the random failure feature is pretty straight forward. First, choose the approximate number of failure events you would like to see triggered during an average 10 hour period of simulation. The rate at which failures will occur will roughly approximate the theoretical [EVENTS PER HOUR / 10 HOURS].

Note that the actual rate may vary slightly so it is possible that you might see failures triggered in rapid succession, and you may see more than the desired number of failures in a specific ten hour period, but the average rate of failures will closely approximate your settings.

If you wish to limit the number of events that are triggered you can set this number by turning LIMITED EVENTS to YES and the setting the hard-limit in the EVENT LIMIT line.

You can use this limit if you want to trigger a rapid series of events, but also want to limit the total number failures.

Service Based Failures Sub-Menu:

Service Based failures will provide you with a highly realistic simulation of failures on and operational airplane. As you fly the simulator, the total flight time and system operation of the airplane is tracked. The combination of factors will be compared against known data predicting the Mean Time Before Failure for every component on the airplane.

As failures take place, you will need to use the Quick Reference Handbook to resolve the failures and your judgment as captain to determine whether it is feasible to continue on to your destination, or whether a diversion for maintenance is required.

When operating under the serviced based failures process, you may fly for many hours without seeing any mechanical unreliability in your airplane. Conversely you experience a streak of mechanical failures from the mundane to the critical.

When operating with the Service Based Failures module active, it will be necessary to occasionally have your airplane “serviced” by your line maintenance crews.

Maintenance Sub-Menu:

The following functions are available to you in the maintenance page:

- <CLR ACTIVE: When failures are triggered, you can use the CLR ACTIVE button to reset any failures that have already been triggered.
- <CLR ALL: This will clear failures that have already triggered as well as failures that are armed to be triggered at a later time.
- <NEXT SERVICE IN: This indicates to you the approximate amount of time until the next service period for the airplane is due.
- <SERVICE ALL: This setting allows you to simulate the effect of maintenance personnel servicing the airplane in accordance with the normal maintenance schedule. It is worth noting that flight crews normally have very little interaction with the routine servicing of an airliner. The servicing process is generally managed by the airline maintenance department and is largely transparent to the crew. In this case however, you are responsible for complying with the service requirements for the airplane to ensure that the airplane remains in proper mechanical condition.

System Failure / Maintenance Menu:

If you wish to work with mechanical failures located within an individual system, you can do so quite easily by selecting the system from the list displayed under <FAILURES.

In the example graphic shown above, we are shown the ELECTRICAL page of the failures menu. There are four items displayed here from which you can choose:

- <PROGRAMMED: This menu will display all of the potential mechanical failures that the system is capable of simulating. You can then individually activate, arm, disarm or deactivate the failures listed.
- <RANDOM: This menu will allow you to activate/deactivate random failures within this system, just as you would with the global random failures method described above.
- <SERVICE BASED FAILURES: Allows you to interact with the service based failures just as you would in the top menu described above. (Will be grayed out if service based failures are not selected active in the top menu.)
- <MAINTENANCE: Allows you to interact with the maintenance functionality for the selected system.

Failures Master List:

The following failures are possible:

Air Conditioning: (24)

- Cabin Temp Control Left
- Cabin Temp Control Right
- Pack Left Overheat
- Pack Right Overheat
- Pack Left Upper Flow Valve
- Pack Right Upper Flow Valve
- Pack Left Lower Flow Valve
- Pack Right Lower Flow Valve
- Trim Pressure Regulating Shut Off Valve Left
- Trim Pressure Regulating Shut Off Valve Right
- Recirc Fan Upper Forward
- Recirc Fan Upper Aft
- Recirc Fan Lower Left
- Recirc Fan Lower Right
- Air Cycle Machine Left
- Air Cycle Machine Right
- Equipment Clog Vent Fan
- Equipment Clog Supply Fan Left
- Equipment Clog Supply Fan Right
- Forward Outflow Valve Fail
- Aft Outflow Valve Fail
- Forward Outflow Valve Control
- Aft Outflow Valve Control
- Rapid Decompression

APU: (10)

- APU Air Turbine Starter
- APU Electric Starter
- APU Overheat
- APU Overspeed
- APU Oil Temperature
- APU Oil Pressure
- APU Oil Leak
- APU Bleed Air
- APU Inlet Door
- APU Severe

Automatic Flight: (5)

- Autothrottle INOP
- Left AFDC INOP
- Right AFDC INOP
- Center AFDC INOP
- AFS Failed

Communications: (12)

- Audio Control Panel Captain
- Audio Control Panel First Officer
- Audio Control Panel Observer
- Radio Tuning Panel Captain
- Radio Tuning Panel First Officer
- Radio Tuning Panel Observer
- VHF Left Radio Fail
- VHF Right Radio Fail
- VHF Center Radio Fail
- HF Left Radio Fail
- HF Right Radio Fail
- SATCOM System Fail

Doors: (15)

- Door 1 Left
- Door 1 Right
- Door 2 Left
- Door 2 Right
- Door 3 Left
- Door 3 Right
- Door 4 Left
- Door 4 Right
- Door 5 Left (300ER, if purchased and installed)
- Door 5 Right (300ER, if purchased and installed)
- Forward Cargo Door
- Aft Cargo Door
- Bulkhead Cargo Door
- Main Cargo Door (777F)
- RAT Deployed

Electrical: (37)

- Generator Left Fail
- Generator Right Fail
- APU Generator Fail
- Backup Generator Left Fail

- Backup Generator Right Fail
- All Engine Generators Fail
- Generator Left Drive Disconnect
- Generator Right Drive Disconnect
- Generator Left Breaker
- Generator Right Breaker
- AC Transfer Bus 1 Fail
- AC Transfer Bus 2 Fail
- AC Main Bus 1 Fail
- AC Main Bus 2 Fail
- AC Ground Servicing Bus Fail
- AC Ground Holding Bus Fail
- AC Utility Bus 1 Fail
- AC Utility Bus 2 Fail
- AC Standby Bus Fail
- Inverter Fail
- Tranformer Rectifier Unit 1 Fail
- Tranformer Rectifier Unit 2 Fail
- Tranformer Rectifier Unit 3 Fail
- Tranformer Rectifier Unit 4 Fail
- Ground Handling Tranformer Rectifier Unit Fail
- Main Battery Charger Fail
- APU Battery Charger Fail
- Main Battery Fail
- APU Battery Fail
- DC Bus 1 Fail
- DC Bus 2 Fail
- Captain Flight Instrument Bus Fail
- First Officer Flight Instrument Bus Fail
- DC Hot Battery Bus Fail
- DC Main Battery Bus Fail
- DC Main2 Battery Bus Fail
- DC APU Battery Bus Fail

Engine: (24)

- EEC Mode 1
- EEC Mode 2
- Engine 1 Severe Damage
- Engine 2 Severe Damage
- Engine 1 Flame-out
- Engine 2 Flame-out
- Engine 1 EGT Exceedance

- Engine 2 EGT Exceedance
- Engine 1 Oil Leak
- Engine 2 Oil Leak
- Engine 1 Oil Pressure
- Engine 2 Oil Pressure
- Engine 1 Oil Temperature
- Engine 2 Oil Temperature
- Engine 1 Vibration
- Engine 2 Vibration
- Engine 1 V_1 Cut
- Engine 2 V_1 Cut
- Engine 1 V_r Cut
- Engine 2 V_r Cut
- Engine 1 V_2 Cut
- Engine 2 V_2 Cut
- Engine 1 Reverser
- Engine 2 Reverser

Fire: (14)

- APU Fire
- Forward Cargo Fire
- Aft Cargo Fire
- Engine Left Overheat
- Engine Right Overheat
- Engine Left Fire
- Engine Right Fire
- Main Deck Cargo Fire (777F)
- Equipment Cooling System Smoke
- Lavatory Smoke
- Lavatory Smoke (300ER, if purchased and installed)
- Smoke Rest Upper Door 1
- Smoke Rest Upper Door 4
- Smoke Rest Upper Door 5 (300ER, if purchased and installed)

Fire Protection: (36)

- Engine 1 Fire Loop A Fault
- Engine 2 Fire Loop A Fault
- Engine 1 Fire Loop B Fault
- Engine 2 Fire Loop B Fault
- Engine 1 Overheat Loop A Fault
- Engine 2 Overheat Loop A Fault
- Engine 1 Overheat Loop B Fault
- Engine 2 Overheat Loop B Fault

- APU Fire Loop A
- APU Fire Loop B
- Forward Cargo Fire Loop A
- Aft Cargo Fire Loop A
- Forward Cargo Fire Loop B
- Aft Cargo Fire Loop B
- Main Deck Fire Loop A (777F)
- Main Deck Fire Loop B (777F)
- Wheel Well Loop Fault A
- Wheel Well Loop Fault B
- Engine Bottle 1 Left Squib
- Engine Bottle 1 Right Squib
- Engine Bottle 2 Left Squib
- Engine Bottle 2 Right Squib
- APU Bottle Squib
- Cargo Dump Bottle 1 Squib
- Cargo Dump Bottle 2 Squib
- Cargo Meter Bottle 1 Squib
- Cargo Meter Bottle 2 Squib
- Cargo Meter Bottle 3 Squib
- Left Engine Fire Bottle Discharge
- Right Engine Fire Bottle Discharge
- APU Fire Bottle Discharge
- Cargo Dump Bottle 1 Discharge
- Cargo Dump Bottle 2 Discharge
- Cargo Meter Bottle 1 Discharge
- Cargo Meter Bottle 2 Discharge
- Cargo Meter Bottle 3 Discharge

Flight Controls: (23)

- PFCs to Secondary
- PFCs to Direct
- Actuator Control Electronics Left 1 Failed
- Actuator Control Electronics Right Failed
- Actuator Control Electronics Center Failed
- Actuator Control Electronics Left 2 Failed
- Flap/Slat Control 1 Fail
- Flap/Slat Control 2 Fail
- Spoiler Actuator 1 or 14 Fail
- Spoiler Actuator 2 or 13 Fail
- Spoiler Actuator 3 or 12 Fail
- Spoiler Actuator 4 or 11 Fail

- Spoiler Actuator 5 or 10 Fail
- Spoiler Actuator 6 or 9 Fail
- Spoiler Actuator 7 or 8 Fail
- Flaperon Actuator L1 Fail
- Flaperon Actuator L2 Fail
- Flaperon Actuator R1 Fail
- Flaperon Actuator R2 Fail
- Rudder Actuator 1 Fail
- Rudder Actuator 2 Fail
- Rudder Actuator 3 Fail
- Actuator Pressure Sensor Fail

Flight Instruments: (9)

- Display Unit Left Outboard Fail
- Display Unit Left Inboard Fail
- Display Unit Upper Fail
- Display Unit Lower Fail
- Display Unit Right Inboard Fail
- Display Unit Right Outboard Fail
- Digital Signal Processor Fail
- EFIS Control Panel Left Fail
- EFIS Control Panel Right Fail

FMS/NAV/ADIRU: (22)

- FMC Left Fail
- FMC Right Fail
- ADIRU Partial Fail
- ADIRU INOP/ Standby Attitude/Air Data Reference Unit ACT
- ADIRU/Standby Attitude/Air Data Reference Unit Attitude INOP
- ADIRU Single Channel
- ADIRU Air Data Invalid
- GPS Left Fail
- GPS Right Fail
- CDU Left Fail
- CDU Right Fail
- CDU Center Fail
- ILS Fail
- VOR Left Fail
- VOR Right Fail
- DME Left Fail
- DME Right Fail
- ADF Left Fail
- ADF Right Fail

- Radio Altimeter Left Fail
- Radio Altimeter Center Fail
- Radio Altimeter Right Fail

Fuel: (21)

- Left Forward Pump
- Left Aft Pump
- Left Jettison Pump
- Center Left Pump
- Center Right Pump
- Right Forward Pump
- Right Aft Pump
- Right Jettison Pump
- Fuel Leak
- Crossfeed Fail Forward
- Crossfeed Fail Aft
- Left Spar Valve
- Right Spar Valve
- Left Engine Valve
- Right Engine Valve
- APU Fuel Valve
- APU DC Fuel Pump
- Auxiliary Fuel Backup System
- Auxiliary Fuel Pump 1
- Auxiliary Fuel Pump 2
- Auxiliary Fuel Pump 3

Hydraulics: (43)

- EDP 1 Hydraulics Fail
- EDP 2 Hydraulics Fail
- ACMP C1 Hydraulics Fail
- ACMP C2 Hydraulics Fail
- ACMP Left Hydraulics Fail
- ACMP Right Hydraulics Fail
- ADP C1 Hydraulics Fail
- ADP C2 Hydraulics Fail
- EDP 1 Hydraulics Leak
- EDP 2 Hydraulics Leak
- ACMP C1 Hydraulics Leak
- ACMP C2 Hydraulics Leak
- ACMP Left Hydraulics Leak
- ACMP Right Hydraulics Leak
- ADP C1 Hydraulics Leak

- ADP C2 Hydraulics Leak
- EDP Left Overheat
- EDP Right Overheat
- ACMP C1 Overheat
- ACMP C2 Overheat
- ACMP Left Overheat
- ACMP Right Overheat
- ADP C1 Overheat
- ADP C2 Overheat
- Hydraulic Isolation Valve Left
- Hydraulic Isolation Valve Right
- Left System Quantity Refill Required
- Right System Quantity Refill Required
- Center System Quantity Refill Required
- System Data Left
- System Data Right
- System Data Center
- EDP Left Pressure XDCR Fail
- EDP Right Pressure XDCR Fail
- ACMP C1 Pressure XDCR Fail
- ACMP C2 Pressure XDCR Fail
- ACMP Left Pressure XDCR Fail
- ACMP Right Pressure XDCR Fail
- ADP C1 Pressure XDCR Fail
- ADP C2 Pressure XDCR Fail
- System Pressure Sensor Left Fail
- System Pressure Sensor Right Fail
- System Pressure Sensor Center Fail

Ice Protection: (24)

- Left Pitot Heat
- Left AOA Vane
- Left Ice Detection Fail
- TAT Probe Heat
- Left WAI Valve
- Left EAI Valve
- Left EAI Leak
- Left EAI Pressure Loss
- Left Side Window Heat
- Left Front Window Heat
- Left Side Window Overheat
- Left Front Window Overheat

- Right Pitot Heat
- Right AOA Vane
- Right Ice Detection Fail
- Right WAI Valve
- Right EAI Valve
- Right EAI Leak
- Right EAI Pressure Loss
- Right Side Window Heat
- Right Front Window Heat
- Right Side Window Overheat
- Right Front Window Overheat
- Center Pitot Heat

Miscellaneous: (10)

- Clock Left Fail
- Clock Right Fail
- ISFD Fail
- Passenger Oxygen Masks Deployed
- Standby Attitude Direction Indicator Fail
- Standby Airspeed Indicator Fail
- Standby Altimeter Fail
- Tail Strike
- Transponder 1 Fail
- Transponder 2 Fail

Pneumatic: (11)

- Left ASCP Controller
- Right ASCP Controller
- Left Engine HPSOV Valve
- Right Engine HPSOV Valve
- Left Engine PRSOV Valve
- Right Engine PRSOV Valve
- APU Bleed Valve
- Left Isolation Valve
- Right Isolation Valve
- Center Isolation Valve
- Bleed Air Leak

Warning Systems: (10)

- Altitude Alert System Fail
- Config Warning System Fail
- Ground Proximity Warning System Fail
- Terrain Warning System Fail

- TCAS Fail
- RAAS Fail
- Weather Radar System Fail
- Weather Radar RT Left Fail
- Weather Radar RT Right Fail
- Predictive Windshear System Fail

Wheels and Brakes: (36)

- Reset Brake Temperatures
- Repair All Brakes
- Repair All Tires
- Nose Tire Balance
- Antiskid Alternate Valve
- Antiskid Normal Valve Left
- Antiskid Normal Valve Right
- Antiskid Transducer Left
- Antiskid Transducer Right
- Autobrake Isolation Valve
- Brake Fail TLAFWL
- Brake Fail TLAFWR
- Brake Fail TLAMWL
- Brake Fail TLAMWR
- Brake Fail TLAAWL
- Brake Fail TLAAWR
- Brake Fail TRAFWL
- Brake Fail TRAFWR
- Brake Fail TRAMWL
- Brake Fail TRAMWR
- Brake Fail TRAAWL
- Brake Fail TRAAWR
- Tire Fail TLAFWL
- Tire Fail TLAFWR
- Tire Fail TLAMWL
- Tire Fail TLAMWR
- Tire Fail TLAAWL
- Tire Fail TLAAWR
- Tire Fail TRAFWL
- Tire Fail TRAFWR
- Tire Fail TRAMWL
- Tire Fail TRAMWR
- Tire Fail TRAAWL
- Tire Fail TRAAWR

- Nose Tire Fail Left
- Nose Tire Fail Right

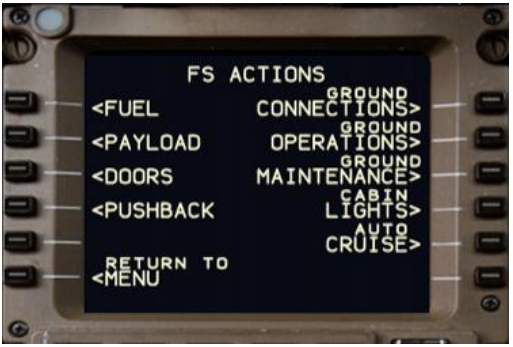
NOTE: For any failure, we strongly recommend that you use the Quick Reference Handbook to practice diagnosing the problem. The QRH makes it extremely easy. Simply look up the warning light or symptoms that you see in the QRH index and then follow the checklist provided!

NOTE 2: Some failures, particularly those related to engine overheat warnings, pneumatic bleed over-pressures and door related warnings can have multiple meanings. For example, and engine overheat warning may require that you shut down an engine, or it may simply require a reduction in thrust. A door warning may simply be a faulty warning, or it may indicate a door seal failure that requires emergency action. This makes the simulation exciting, and encourages you to use the Quick Reference Handbook to follow the trouble shooting procedures to deduce what type of failure you are dealing with!

NOTE 3: We suggest you read the DETAILS AND QUIRKS OF THE **PMDG 777-200LR/F** section. You will learn some interesting things about the simulation you are about to fly!

FS ACTIONS MENU SYSTEM

The FS ACTIONS menu gives you access to various sub-systems that will allow you to adjust aspects of your flight in order to realistically simulate an operational airplane environment.



From the FS ACTIONS menu you can adjust the FUEL, PAYLOAD, DOORS, PUSHBACK, GROUND CONNECTIONS, GROUND OPERATIONS, GROUND MAINTENANCE, CABIN LIGHTS and AUTO CRUISE functionality.

Fuel Menu:

The FUEL page allows you to manually set the aircraft's fuel load. Preset level functions on the lower left side of the display set the load to LONG, MEDIUM or SHORT RANGE levels. The fuel quantity may also be set as a percentage of total quantity or as a total numeric value directly.

In order to set the fuel quantity as a total or percentage, type the relevant number in the scratchpad, and then line select it to the TOTAL LBS (or KGS) LEVEL line. The simulator will automatically distribute the fuel quantity properly between the tanks.

On this menu the current gross weight, takeoff center of gravity location, zero fuel weight and maximum taxi weight values are displayed for your convenience.

Payload:

The PAYLOAD menu allows you to change the aircraft loading as desired right from within the simulator.

You can update the passenger load on your flight by manually line selecting in the number of passengers seated in the first, business and economy class cabins.

You can also manually up-select the cargo weights to the forward and aft cargo holds.

Conversely you can up-select the percentage load factor you would like to carry to the LOAD LEVEL line on the right side of the display.

You may also use the SET FULL, SET EMPTY or SET RANDOM settings to establish your payload.

On this menu the current gross weight, takeoff center of gravity location, zero fuel weight and maximum taxi weight values are displayed for your convenience. You can alter the ZFW by line selecting a value over top of it. The system will distribute the load evenly.

Doors:

The DOORS menu allows you to open and close all of the doors on the aircraft from a single access menu.

You can open, close, and arm/disarm all of the the doors from this menu.

Additionally on page 2/2 you can open and close the cargo doors, the forward access door and the electronics and engineering bay external access door.

Pushback:

The PUSHBACK menu allows you to manage the pushback process from within the simulator.

The pushback functionality allows you to set the parameters to be used during the pushback from the gate. Using this menu you can set the units to FEET or METERS, enter the total pushback distance, the direction the nose will be turned and the number of degrees that will be used in the turn.

Additionally you can determine whether you will hear voice communication only during pushback, a combination of voice and text, or text only via the FSX adventure text process.

Ground Connections:

The GROUND CONNECTIONS menu allows you to determine which ground services are currently available to your aircraft.

From the GROUND CONNECTIONS menu, you can choose whether ground power is available as well as an engine air-start unit, cabin air conditioning unit, wheel chocks and/or pitot covers.

NOTE: It is important to note that all ground services require that the airplane be chocked in place before they will be made available to you by the ground crews. For this reason, you must select CHOCKS SET before you will be able to use any other ground services.

If you have other ground services selected and you remove the chocks, the ground crew will also remove the ground services.

Use of Color:

Note that on this menu, any item that is colored in red indicates that the aircraft is not safe to move. If all items are colored in green, then it is safe to move the airplane.

Ground Operations:

The GROUND OPERATIONS menu allows you to control specific ground operations such as turnaround times, uplifting of fuel based on flight plan, refueling time, pushback and time to pushback.

- Turn Type: You can choose between the following turn types:
    - Manual: In this mode you control turn times, pushback and uploading of fuel at your discretion and without assistance the from ground crew.
    - Short: In this mode turn time is 55 minutes, and pushback can be set to either Manual or Auto.
    - Long: In this mode turn time is 01hr 30mins (90 mins), and pushback can be set to either Manual or Auto.
    - Custom: In this mode you can enter your own desired turn time using the scratch pad. Pushback can bet set to either Manual or Auto.
- Turn Time: This is the total time it will take for your aircraft to be serviced, refueled and ready to push back.
- Plan Fuel: Use the scratch pad to enter the total amount of fuel required as per your flight plan.
- Uplift Fuel: This is the current amount of fuel on board, and will increase once fuel upload starts, until such time that the Plan Fuel amount is reached.
- Time Required to Fuel: This is the amount of time left/required for the uplifting of fuel to be completed.

- Pushback (Type): Here you can choose between the following pushback types:

    - Manual: In this mode you need to manually initiate the pushback. This is useful for people who need some extra time before pushback, or for people who are using a pushback function that is unrelated to PMDG.

      Auto: In this mode, the pushback is going to launch on its own using the internal PMDG pushback process. Shortly after the turn time has expired, you will get a call from the ground crew advising you that pushback is about to commence.

- (Pushback) Time Remaining: Shows the amount of time left before Pushback. This feature is only operational in Short, Long or Custom Turn Type modes.

NOTE: If you are still on ground power as the remaining time to the end of your ground turn winds down, *the ground crew will not disconnect ground power and leave you sitting in the dark*, even though this is what happens in many cases in the real world – especially if your ground crew doesn't like you!

1) If you have the APU Generator available and the auto logic of the electrical system is able to do so, the ground power will disconnect and the APU will take over both sides of the airplane.

2) If you do NOT have the APU generator available (for example - if it is deferred, or your APU itself is INOP,) then the clock will stop at 10 seconds prior to expiration of the turn. This will give you time to start the APU, or conversely, if you have a deferred APU and need to start an engine on the gate, it will allow you to do so before losing ground power.

This is just one of the many ways that PMDG Ground Services makes pilots' lives easier.

NOTE 2: It is important to note that *all ground services require that the airplane be chocked in place before they will be made available to you by the ground crews.* For this reason, you must select CHOCKS SET in the GROUND CONNECTIONS menu before you will be able to use any other ground services.

Ground Maintenance:

The GROUND MAINTENANCE menu allows you to request the maintenance crew to perform specific maintenance tasks on your aircraft.

You can request the following maintenance to be performed:

- Refill Hydraulic Fluid
- Refill Engine Oil
- Service APU SCU Motor
- Refill Fire Bottles
- Cool Brakes
- Replace Brakes
- Replace Tires

NOTE: It is important to note that *all ground services require that the airplane be chocked in place before they will be made available to you by the ground crews.* For this reason, you must select CHOCKS SET in the GROUND CONNECTIONS menu before you will be able to use any other ground services.

Cabin Lights:

The CABIN LIGHTS menu allows you to control the lighting that will appear in the cabin when viewing the external model.

If set to AUTO, the airplane's internal logic will determine the brightness that should be used given the current phase of flight and lighting conditions.

When set to MANUAL, you can choose the desired brightness level desired.

NOTE: You may occasionally see some texture artifacts in the cabin during dusk/dawn and certain cabin lighting settings. This results from certain driver sets and certain hardware configurations, but we thought you would like to see this capability in the simulation.

Auto Cruise:

The AUTO CRUISE menu allows you to set up various cruise related items in your aircraft.

From the AUTO CRUISE menu, you can choose to enable Auto Step Climb and Pause At Top Of Descent.

You can also set the Auto Time Compression option to On or Off, and specify the time compression ratio. You can select between 2X, 4X, 8X and 16X.

The Sim Rate can be increased without having to access the FSX menu. To reset the Sim Rate, press the <RESET LSK and the rate will be set back to 1.

GETTING THE MOST FROM YOUR PMDG 777-200LR/F

We have collected a few pointers to help you get started with the **PMDG 777-200LR/F**. Whether you are a veteran PMDG customer or completely new to flight simulation, these tips will help you get more out of the simulation purchase you have just made!

Virtual Cockpit position and zoom:

Microsoft created an extremely bizarre implementation of “dynamic head movement” in FSX that cannot be turned off. This system causes the camera’s X, Y, Z position in 3D space to shift depending on set of parameters that shouldn’t play any role in such a feature including the aircraft’s compass heading and physical latitude and longitude on the simulator’s model of the Earth. In addition to this, the effect becomes more extreme the further away the cockpit is from the center of the aircraft’s model. As a result, you are likely to see VC camera viewpoints that do not exactly match what we intended.

All of the cockpit view presets were created at EGLL – London Heathrow sitting on Runway 27R. The logic in using this location is that it sits at a fairly representative latitude for northern hemisphere flying and that the due west runway heading is representative of the most common takeoff and approach direction due to prevailing wind flow patterns across the hemisphere.

The correct view in the VC results in the bottom of the checklist holder below the MCP sitting just above the “GRD PROX” text on the main panel and results in the yoke in its raised setting just barely covering up the rudder pedal adjustment housing. It should look like the screenshot on the following page – the blue lines drawn indicate the location of the two reference values.


AILERON TRIM
N772LR
BOEING 777

We recommend using the FSX keystrokes for moving the camera position to account for the FSX engine changing the view away from this proper setting – it may be easier to assign these to a hat switch on your joystick or throttle if you have one available:

Move the view forward: CTRL+BACKSPACE
Move the view back: CTRL+ENTER
Move the view right: CTRL+SHIFT+ENTER
Move the view right: CTRL+SHIFT+BACKSPACE
Move the view up: SHIFT+ENTER
Move the view down: SHIFT+BACKSPACE

A zoom setting of 0.8-1.0 in the main view is most realistic based on our experience in the real life simulator, depending on your distance from your monitor. Adjust it to your taste, but do be aware that extremely zoomed out views where you can see the entire panel and the outside view at once are highly unrealistic. Real pilots develop a “scan pattern” to keep tabs on their instruments and what’s going on outside at the same time. The view should look roughly like this and is similar to what your field of view actually is when sitting in the real life left seat:

Using the Landing Lights:

The Boeing 777 has three landing light switches. To simplify the activation of these lights, a middle/wheel click on any of the three switches will move all three. This simulates the captain reaching up with the side of his hand or three fingers simultaneously to move them all at once. The runway turnoff light switches on the overhead and the autothrottle arm switches on the MCP also have similar functionally.

TrackIR:

One of the limitations that the FSX world places on you as a pilot is the inability to easily lean back and forth, or to move your body around to more easily facilitate reaching or seeing switches, knobs or displays.

We strongly recommend that you explore the possibility of installing a TrackIR package as this greatly improves the sense of “being there” by allowing you to overcome this limitation within FSX:

http://www.naturalpoint.com

For the most part using your mouse to move your head and zoom in/out is perfectly acceptable, but occasionally geometry within the cockpit can impede your ability to enter data into the FMS, for example.

In order to reduce this inconvenience as much as possible, we have made it possible for you to retract the yoke toward the floor of the airplane in order to “free up” a clear line-of-sight to the FMS keyboard from the normal head position. Note that lowering the yoke also disables its animations. This was done at the request of several testers who found it distracting to have both their physical yoke and the on screen one moving in front of them.

Alternate TO/GA Click Spot:

When flying the real airplane, the TO/GA buttons are placed quite comfortable under the tips of your fingers at the top of the throttle columns.

Unfortunately, we don't all have fully operable replicas of the 777 throttles to use with our FSX setups, so we have added a few features to help you manage the TO/GA process as if it were right under your fingertips.

First, you can click on the actual TO/GA button if you like, but this is arguably not very convenient, especially when initiating a go-around at low altitude.

Next, you can assign a key combination using the key commands menu. This will give you a simple key command of your choice to use in place of a TO/GA button.

For those of you who are button-assignment savvy, you can also map this key combination to a button on your flight simulation hardware and this will give you the best replica of a real TO/GA button.

As a last resort we have placed a "TO/GA Click Spot" on an uninhabited corner of the MCP for your ease of use. A left click activates TO/GA, a middle click disconnects the autothrottle, and a right click disconnects the autopilot.

Keyboard Direct Entry to CDU Scratchpad:

To enter characters and numbers into the FMS, you can simply click on the CDU keys with the mouse to simulate your finger.

Conversely, you can also use the Keyboard Direct Entry to CDU methodology that we have included for simplicity.

To activate the Keyboard Direct Entry capability, simply hold down the TAB key, then type on your keyboard as you normally would.

When holding down the TAB key, you will see a green rectangle illuminate around the CDU scratch pad, indicating that direct entry of text is now possible.

If you wish to manipulate the line select keys in this method, simply hold down the TAB key, the press any of the Function keys (F1 to F12) to simulate the 1L through 6R line select keys.

FSX VIEW SYSTEM AND THE PMDG 777-200LR/F

Internal FSX Camera: FSX provides a much greater degree of freedom for viewing the aircraft than was possible in previous versions of the simulator. We have included a number of pre-formatted views for you to use. You can scroll through the view types using the "S" and "SHIFT+S" combination, and then scroll through individual view positions using the "A" and "SHIFT+A" combination.

Pre-Formatted views included with this version are as follows:

- Cockpit Views
  - VC Captain's Seat Position (called "Virtual Cockpit" by FSX)
  - VC First Officer's Seat Position
  - VC Upper Overhead Panel
  - VC Lower Overhead Panel
  - VC Pedestal
    VC ECL and CDUs
- Spot View (scroll though cameras using the "A" key).
- Tower View (scroll through towers using the "A" key).

We have found during our own testing of the aircraft that the Virtual Cockpit is generally easier to use if you can turn your head to look around the cockpit using the hat-switch on a joystick or the mouse while holding spacebar. To reset the view position, simply press "CTRL+SPACE," to reset the zoom press BACKSPACE.

LIMITATIONS OF THE SIMULATOR

In the process of developing this highly sophisticated simulation, it became apparent to us that many of the “Default Microsoft Flight Simulator” functions are simply not effective for use when producing a realistic simulation of a complex airliner. As such, we have developed a simulation that to that largest degree possible does not use any default Microsoft Flight Simulator functionality.

Systems that have been completely customized for realism and functionality include:

- Autopilot Functions
- Engine Performance Model
- All Mechanical Subsystems

Limiting our dependence upon Microsoft Flight Simulator has allowed us to use this very popular simulation platform as a worldwide operating environment without being severely limited by the original design of the simulation. Occasionally however, this means that we had to accept certain limitations on our simulation in order to accomplish our goals.

The vast majority of limitations we have found will never be experienced by most users. A few should be kept in mind however, as they are essential and important to the simulation:

Time Acceleration Limit:

- Time Acceleration should be limited to 16x to ensure proper autopilot function.

- Time Acceleration should be limited to 16x to ensure proper fuel system function. (The mathematical iterations required for damping and control law become prohibitive for most desktop machines when run at speeds at greater than 16x, so we have not tuned the autopilot or fuel system for operation at acceleration rates faster than 16x.)

External Load/Fueling Programs:

- Do not use any non PMDG product to alter the aircraft.cfg file.

- Do not use any non PMDG product to alter the fuel load of the airplane.

- Do not use any non PMDG product to alter the loading of the airplane. (PMDG uses actual manufacturer data to model the Cl/Cd, moment influence and drag models for our aircraft. Using this data, the aircraft's reference point is placed realistically ahead of the nose of the airplane as per the manufacturer's specifications. Most MSFS addon aircraft use the erroneous concept of placing the model's reference point at the center of the airplane. This results in reduced realism and impacts negatively the accuracy of the airplane's behavior.)

Do not use non-PMDG external models:

The **PMDG 777-200LR/F** has more than 1000 animated parts. With the exception of a few basic functions, all part animations are controlled by PMDG's internal simulation code and are not controlled by Microsoft Flight Simulator. If you attempt to replace the **PMDG 777-200LR/F** visual model with a non-PMDG model, you will lose nearly all animation and function for the external model.

Flight recording and playback issues:

Because of the aforementioned custom coding of the airplane animations, the default FSX flight recorder functionality is not able to track and play back most of the animations present in the simulation. Many users have had success using a free utility called FS Recorder, which is able to track and record most of the custom animations we use.

You can download it here:
http://www.fs-recorder.net

Hardware toe brakes:

If you use hardware toe brakes such as those created by CH Products, we would like you to be aware that in order to implement the proper "tripping off" of the auto-brake system, we had to put some limitations in place in order to prevent the inherent FSX logic from inadvertently taking over the autobrake release logic inappropriately:

To release the autobrake with your hardware toe brakes you must:

- Apply the brakes twice, quickly; and
- Apply greater pressure than the autobrake is currently applying.

This is different than the brake-directed disengage function on the airplane, but it was unavoidable.

External route export programs:

Flight plan .rte files created with external flight planning programs or websites will have the runways, SIDs, STARs and approaches contained within them stripped when importing into the FMC, resulting in just the enroute portion being entered. Routes saved with the FMC itself will still retain these items.

This was done because these programs in many cases insert nonsensical terminal procedure data that will either crash the FMC or cause general weirdness in the route. In addition, COROUTES do not contain runways and terminal procedures in real life because they often change with the prevailing winds and the day's departure routing. The runways, SIDs, STARs and approaches are manually entered by the crew when assigned by ATC even if a COROUTE was used for the enroute portion of the flight.

DETAILS AND QUIRKS OF THE PMDG 777-200LR/F

During the design and development of PMDG products, we integrate input from a number of experts and users of the aircraft. This combined with our detailed research and design process allows us to add behaviors, quirks and nuances to our simulations that add a true flavor of realism to the simulation.

These behaviors are the kinds of items that an experienced 777 pilot or maintenance technician will see and recognize them as hallmarks of a truly detailed simulation product.

The following behaviors are a non-conclusive list of behaviors that you will find in the **PMDG 777-200LR/F** that are simulated precisely as they appear in the actual airplane:

Air Conditioning System:

- Cabin temperature will stabilize at a normal rate depending upon air volume and outside temperature, and whether the airplane is subjected to sunlight heating.

- If ground air conditioning/heating is selected from the GROUND CONNECTIONS menu, the conditioned air is pushed into the cabin via the cabin air mix manifold, just like the airplane.

Auto-flight System:

- The autopilot/flight director system on a modern airliner is a very precise instrument, but it is not foolproof. You may see the airplane vary slightly from the desired speed, track or altitude as the airplane works to manage energy in order to accomplish the path-defined goal. It will make decisions to turn slightly inside or outside of the path, accept a slightly fast or slow condition, or even pass through an altitude slightly in order to prevent exceeding acceleration limits or engine spool up/down capabilities.

- When you press a switch on the MCP, that mode may not engage instantly, but instead will exhibit a small time delay necessary to bring all of the various components through their self-checks prior to actuating.

Doors:

- Most door warnings that you receive while on the ground will result from faulty, cluttered or obstructed sensors. While on the ground, cycling a door open/closed will usually cure the problem for you. If the problem does not clear, takeoff is inadvisable.

- Door warnings received in the air have potentially serious consequences. Follow ECL procedure carefully to avoid aircraft damage or loss of pressurization.

- If you allow GROUND OPERATIONS to run, the flight attendants will manage the cabin doors automatically, including the arming, disarming opening and closing of doors at the appropriate time.

Electrical System:

- The 777 powers down differently than it powers up. If you aren't ready for this, you might be inclined to think that something is broken when it is not! If you are powering the airplane down, it is going to try and leave as much power "on" as it can, just in case you need it for an emergency. As you remove AC power, the standby power system will run in order to keep your displays going. When you first apply batter power to the airplane, on the other hand, the airplane assumes you don't need all those power-hungry displays, and it leaves them off until you provide a source of AC power to run everything.

- The airplane will power down differently depending upon whether the APU has recently been running, or not. You may find that after selecting the battery off, you still see some annunciator lights illuminated on the flight deck. Just sit back and watch… They will extinguish on their own!

- You can fail any bus on the airplane, and suffer the appropriate penalties as equipment powered by that bus falls offline.

- The PMDG 777-200LR/F has a live, real-time amperage consumption model. Every system on the airplane has its real-world electrical consumption tracked in real-time. Many items use only 0.005 amps, but the airplane has many thousands of electrical consumers, so load shedding behavior will vary depending upon what systems you have consuming power at the time load shedding occurs!

- The generators on the airplane go through a very complex self test process when started. You can see this self test take place by watching the electrical synoptic display.

- If you are performing an autoland and suffer an engine failure of the left engine during LAND 3, the airplane will continue in LAND 3. If you are performing an autoland and the right engine fails during LAND 3, the airplane will degrade to LAND 2. This happens because the airplane is able to maintain three sources of electrical power if the left engine fails because the battery charger (the third source) traces power back to the AC Main R bus. If the right engine fails, that bus goes unpowered for just a moment, which causes the battery charger to drop offline for a moment. Your airline can purchase a pin option to prevent this and allow LAND 3 regardless of engine failure, but they figured you could live without it…

Engines:

- If you have failures enabled, monitor your engine oil pressure/temperature, EGT and vibration readings regularly. Unhandled failures result in a cascade of other failures. For example, an engine oil leak will eventually trigger an electrical generator failure, an oil pressure failure and inevitably (in a probabilistic manner) result in increased vibration, fuel flow and finally complete engine seizure.

- Failures such as an ENG OVHT are dynamic, and will be triggered slightly differently each time, requiring that you follow the ECL to resolve them effectively. The ECL will help you to identify and deal with the failure you are seeing, provided that you follow the steps described in the procedure.

- The 777 is capable of performing an autoland even with an engine out!

Fire Controls – Engines:

- Bottles and Squibs are tracked. If you fire the bottle for one side, it won't work for the other side.

- Fire Bottle Squibs can and do fail to test. If this happens, you should catch it during the TEST function.

- Engine overheats may not necessarily result in the need to shut down an engine... but you will have to follow the procedure in the ECL to find out.

Flight Controls:

- Electric Trim operates at realistic speeds. The electric trim is shockingly SLOW compared to all FS planes except for the PMDG MD11 and PMDG 737NGX. Precise manual flight stability is thus greatly facilitated. Trim rate (units per second) is even lower when flaps are up. Electric/FCC trim rate is modeled accurately to the last millisecond.

- Flap deployment speed is affected by the mode that the system is operating in. When the trailing edge flaps are moved using the ALTERNATE or SECONDARY flap system, they are EXTREMELY slow. And you lose access to the full range in some cases!

- Rudder control inputs are moderated by aerodynamic forces. Full rudder deflection in even moderate IAS is thus impossible. This Q-System model facilitates yaw stability and prevents inadvertent yaw induced roll. Nevertheless, rudder authority is sufficient to allow for runway alignment (de-crab) or even a sideslip (wing low) approach even at high cross winds.

Flight Management Computer:

- The RTE 1 page 1 shows an ACTIVATE prompt at LSK 6R even when there is no route entered. If you press it, the EXEC light is lit and if you press the button it just reverts to the previous state. This is realistic and is a quirk of the real life unit.

- Unlike the FMC in the **PMDG 737NGX**, you do not need to execute the performance data and the EXEC light stays out. As soon as the page has all the data it needs, the performance calculations are valid without any pilot input.

- Also unlike the FMC in the **PMDG 737 NGX**, the flap setting/Vref speed combination you select on the APPROACH REF page is advisory only. The airplane will not automatically slow to this speed – you need to speed intervene manually on the MCP to do it. The FMC by default places a 170 knot speed at the runway, which is also advisory only. In real life, pilots don't enter in their Vref into this restriction or anything like that, it's all done with speed intervention on the MCP.

- All speed restrictions in the 777 FMC are treated implicitly as at-or-below restrictions. For example, if you have a 300 knot restriction but your ECON descent speed is 275, the airplane will cross the restriction at 275, it will not speed up to 300.

Fuel System:

- If the fuel level in the center tanks gets too low, the fuel will begin to momentarily trigger the low fuel sensor as it sloshes around. You will see this on the EICAS. At most airlines the center pumps are turned off with a significant amount of fuel still remaining in the tanks to prevent pump cavitation and potential safety issues stemming from explosive fuel vapors in empty tanks.

Hydraulic System:

- Violating operating limitations on pumps will cause the case drain fluid to overheat, resulting in an OVERHEAT warning.

- We have used realistic times for pumps to come online and drop offline.

- Engine Driven Pumps (EDP) turn if the engine is turning. The "pump switch" on the overhead is not actually turning the pump on or off. Instead, this switch controls a solenoid that cuts off fluid flow to the system respectively from the EDP. That solenoid is held in the closed (off) position by DC power, so loss of that associated DC bus will cause the solenoid to fail-open, thus allowing the EDP to provide pressure to fluid on that side of the airplane once again. This could be bad if you had that pump disconnected for a reason!

- Overheat sensors in the Electric Motor Driven Pumps (EMDPs) will trip pumps offline to protect them from overheat. It is important to note that these are different sensors (and different temperature ranges) than those that control the OVERHEAT lights- so even when the overheat LIGHTS go out, you still may not be able to activate the EMDP because for a while longer while it is still cooling.

- EMDP cooling time will depend upon whether the pump is running, or whether the pump is OFF. (Should take approximately 5 minutes to cool to normal temps when running, but approximately 30 minutes when off because the fluid provides cooling to the pump. This of course will vary slightly, depending

upon fluid temperature and wheel well temperature depending upon condition.)

- Hydraulic Quantity indication is affected by gear/flap/spoiler/flight control position, as well as thermal shrinking. You will notice changes in hydraulic quantity indicated during flight as you change the configuration of the airplane, set the parking brake, etc.

- Hydraulic quantity is displayed as measured to the standpipe within each reservoir. You may retain some pressure and functionality even when the system shows no quantity because there is fluid below the standpipe!

Landing Gear:

- Brakes are subject to Brake Temperature Soak. The brake temperature will climb for a period of time after heavy brake use.

- Wheel well fire warning can be triggered by sucking hot brakes up into the gear bay. Follow the ECL if you get a wheel well fire indication!

- We have simulated the full alternate gear extension for the 777. You will notice that the landing gear doors remain open during an alternate extension. To retract them after landing, simply power up the hydraulics, push the landing gear lock override, then cycle the handle up and then back down.

- You will notice that the volume of the gear-bay turbulence sound changes as the nose gear forward bay doors open and close during extension and retraction. This sound is entirely code controlled and dynamic, so if you lower the gear using the alternate extension, the turbulence noise will be louder on the flight deck than it is when those doors close as they normally do during extension.

Lighting Systems:

- The diagram used to determine the power source for every bulb on the flight deck takes up 171 standard sized print pages.

Pneumatic System:

- The bleed pressure produced by each engine is directly computed based upon bleed production of the engine for current

RPM and appropriate combination of high and low pressure stages bleed air as controlled by the HPSOV (High Pressure Shut-off Valve), and the PRSOV (Pressure Regulating and Shut-off Valve). The logic of these two valves (condition to open/close, target pressure values to regulate, etc.) is simulated in detail, resulting in highly accurate bleed pressure production values for each engine.

- In the case of a duct leak, a detection/isolation routine will be initiated automatically. Engine and APU bleed valves and isolation valves will be turned on or off in sequential stages until the area causing the leak is identified. Once identified, the pneumatic system will be configured so that the leak area is isolated and an appropriate BLEED LOSS EICAS message will be displayed.

Sounds:

- This package uses over 640 digitally recorded sounds to replicate the living, breathing work environment of a 777 pilot.

- While in the external views, you will hear sounds made by ground equipment, wing fuel pumps, electric hydraulic pumps, air conditioning packs and the APU. All of these sounds layer together to provide a very realistic exterior sound environment.

- We recorded sounds for nearly every switch on the flight deck and then linked them in such a way as to ensure that they are synchronized to switch movements whether fast or slow.

- Many sounds in the product have multiple recordings that trigger randomly to produce a subtle different in the sounds each time a particular one plays. This is a technique borrowed from music production (Armen and Ryan are both musicians), where randomized drum samples are often used to produce a more human sounding programmed drum performance.

- Some mechanical systems on the airplane can be faintly heard from the flight deck (electric hydraulic pumps, for example) and you will hear them from the flight deck if you listen closely.

- Sound level mixing was done over many hundreds of hours in order to provide the best mix of sounds to accurately replicate the cockpit sound environment.

SERVICE PACK 1 (SP1) SUPPLEMENT

The **PMDG 777-200LR/F** SP1 release features the largest number of new features and changes that we've ever placed into a single product update.

Aside from the hundreds of smaller changes, tweaks and bug fixes, the update includes several major new features including:

- A simulation of the Collins WXR-2100 weather radar system.
- Reworked handling of FSX turbulence.
- A simulation of the FMC datalink system that sends routes, performance data, wind prediction updates and so on to the airplane over ACARS and SATCOM.
- A major reworking of our simulation of the 777's fly-by-wire flight control system.

We'd like to describe these large changes and additions in more detail on the following pages.

THE COLLINS WXR-2100 WEATHER RADAR

SP1 includes for the first time in PMDG's history a realistic simulation of an aviation weather radar system - in this case the Collins WXR-2100 unit commonly found on the 777 and other airliners. Most of the major functions are simulated including manual tilt, auto tilt, gain, WX+T turbulence detection mode, and the Predictive Windshear System (PWS).

Active Sky Next requirement:

The WXR-2100 simulation in SP1 requires the most recent version of the Active Sky Next (ASN) or later weather engine by HiFi Simulations. ASN is the first weather addon to output an external 3D precipitation model, which we've used to accurately model the operation of the radar. The weather radar does not currently function with default FSX weather or with any other weather addon. We will evaluate supporting other weather addons on a case-by-case basis if they can provide similar 3D precipitation data output.

ASN can be purchased here:

http://www.hifitechinc.com/products/activeskynext

Many simmers are under the assumption that radar shows the locations of clouds and could not understand our insistence for many years that realistic radar wasn't possible in FSX, mainly due to the presence of other products on the market that showed the position of clouds or used cloud positions to make guesses about precipitation levels. This ASN-based radar system is not showing cloud positions and this is immediately apparent in the sim.

Basic radar concepts and theory:

Though it's become a word in its own right in the seven decades since its inception, radar is actually an acronym standing for **RA**dio **D**etection **A**nd **R**anging. Radars pulse waves in the radio band of the electromagnetic spectrum out into space where they reflect off objects and return back to a dish that collects and focuses them. By measuring the precise timing and signal strength differences between the pulses and their returns, the radar is able to calculate and display information about what's in front of the aircraft. In the case of a weather radar, the objects it is looking for are precipitation returns – essentially rain, snow, or ice (hail).

There are physical limitations inherent in how radar works that you need to be aware of when using the radar in the 777.

Radar beams are emitted from the nose in a 3-dimensional cone shape. The cone is very narrow close to the aircraft and spreads out with increasing distance. Because of this, the radar is showing a larger vertical cross section of the sky depending on the distance the returns are located at. This has important implications for determining precisely where precipitation is vertically in relation to the aircraft. If a return is far away, the actual precipitation could be within a large block of potential altitudes and you will need to make use of the tilt control and/or wait for the range to decrease to determine exactly where the return is vertically.

The physical locations of the radar controls are described in detail in the FCOM2 on pages 11.10.21 to 11.10.22. (pages 857 to 858 in the PDF file)

Tilt:

Antenna tilt is one of the key parameters you have control over with the radar system. Tilt controls the vertical angle that the radar beam pulses are sent out at by physically pivoting the transmitter and dish in the vertical plane.

The WXR-2100 is equipped with an auto tilt function that is engaged by default. For most users, this will be sufficient, but in real life some pilots

like to set their tilt manually. In general here are some guidelines for manual tilt settings:

Before takeoff and lower part of the climb: +2 to +5 degrees.

The idea here is to see heavy precipitation that you may be climbing into since you're gaining altitude so rapidly. You want to keep the tilt high enough to avoid ground clutter (in real life, clutter is not yet modeled in the sim version).

Mid to high altitude climb: -2 to +2 degrees.

Here you're more concerned with storms that are in the in general straight line path of the aircraft as it climbs at a slower vertical speed up higher.

Cruise: -5 to 0 degrees.

In cruise, you will most often be looking at precipitation that's either at or below your current altitude. A storm is still very dangerous even if there's not precipitation from it at your current altitude due to powerful updrafts and turbulence in the core. Pilots will often scan with a downward tilt at cruise in order see down into the precipitation area of a storm, which makes it visible for avoidance.

Descent: 0 to +10

In the descent phases, the nose is pointing at the ground so you're going to need to have the radar tilted even more than it was during the climb to avoid ground clutter and see the main precipitation core of a storm, which may be thousands of feet above you.

Gain:

"Gain" is a term that essentially means amplification of the radar's return signals. As the gain is turned up, lighter areas of precipitation (green color) will show on the radar display. Think of it like a radio's squelch control – you're setting a "noise floor" where nothing below the setting gets through. Since light precipitation isn't generally dangerous to an airplane, the standard practice is to set the gain so that only the more severe yellow and red areas show. The default 0 setting generally accomplishes this and should be sufficient for most use.

WX vs. WX+T modes:

The WX mode shows only precipitation returns. WX+T overlays magenta areas of suspected severe turbulence over the precipitation returns by using the Doppler capability of the radar to see areas where the

precipitation is moving quickly (suggesting strong updrafts, downdrafts or windshear) You will generally only see these magenta areas near the core of heavy thunderstorms. Many pilots use WX+T mode exclusively because there's no downside to having it on vs. the standard WX mode.

Predictive Windshear System (PWS):

The PWS uses the Doppler radar information from particulate matter (dust, water vapor, etc.) in the air just in front of the airplane when in the terminal area in an attempt to detect windshear activity. If such activity is detected, a symbol appears on the ND showing the approximate magnitude and direction of the windshear and the EGPWS calls out "WINDSHEAR! WINDSHEAR!" Full TOGA power should be immediately selected and the airplane flown through the event with careful attention paid to airspeed and pitch. ASN is capable of simulating windshear and microburst events and you should be prepared if one happens.

Limitations:

Active Sky Next range settings:

The radar will technically work out to a maximum range of 250 nm depending on how high you have the ASN Minimum cloud draw distance and Maximum cloud draw distance sliders set (note that this does not imply that our radar is actually showing clouds – the clouds have to be there for the precipitation to be there).

Please be aware that setting these sliders above their default values can drastically affect FSX performance on even the highest end computers. There's unfortunately nothing we can do about this. It isn't coming from the radar itself but rather from the sim's graphics engine processing and rendering cloud sprites out to such extreme distances. In real life, the weather radar is rarely useful for making course deviation decisions beyond around 100 nm and we feel this is a reasonable level to leave the maximum range set at.

Future features:

The weather radar is currently considered an "in-progress" feature and certain functions are not yet simulated. We intend to keep developing it over time and more features will be added.

Among these planned are:

- Simulation of radar shadows and the path attenuation compensation (PAC) feature that alerts pilots to the possible presence of shadows.

- More realistic depiction of longer range radar returns. (beam spread/loss of resolution)

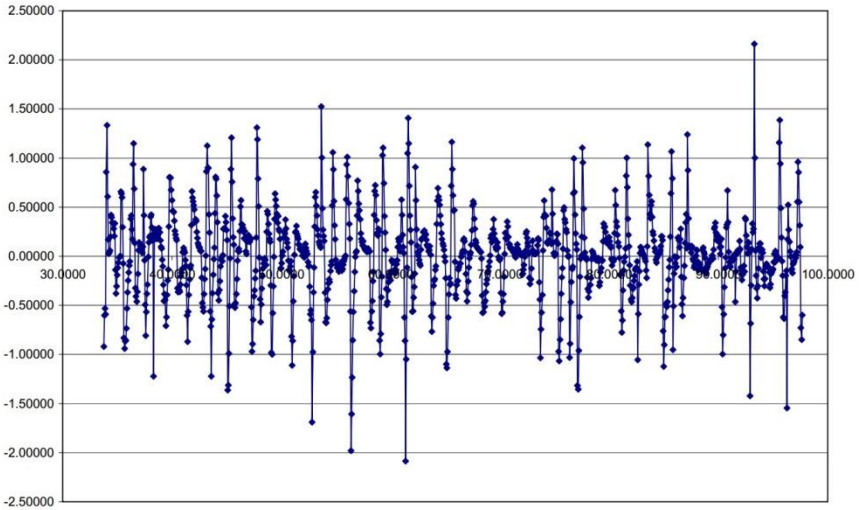
- Simulation of ground clutter in the WX and WX+T modes and simulation of returns from the ground MAP mode.

THE 777 AND TURBULENCE IN FSX

With the inclusion of the weather radar, many SP1 users will probably seek out heavy weather to fly through. It is important to understand the limitations of FSX's modelling of turbulence and the likely side effects you'll experience if you choose to do this. (It's worth pointing out that real life pilots go out of their way to avoid flying through such weather!)

What FSX turbulence does:

Below is a graph recorded over a few minutes of standard turbulence in FSX. On the Y axis is G-load and on the X axis is time.



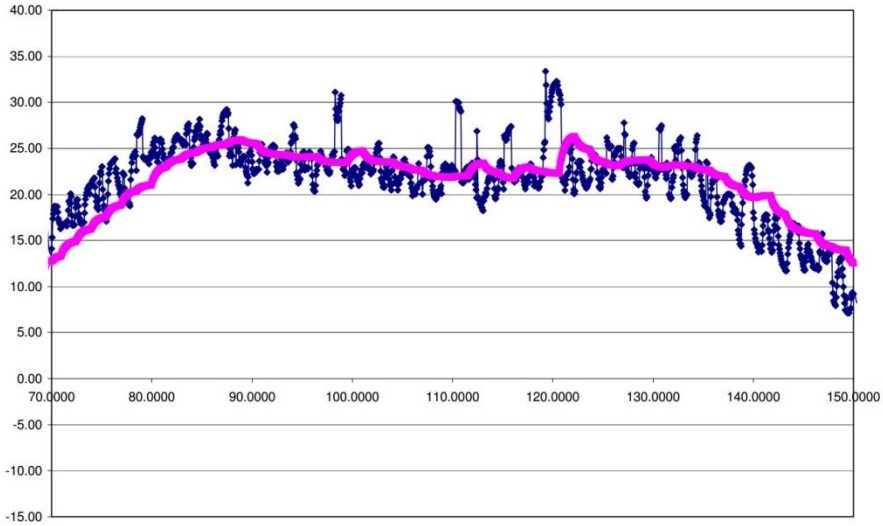
FSX is constantly hitting the airplane with G-loads in excess of 2.0 Gs in both the positive and negative directions. What's more, the magnitude of these "hits" actually remains the same regardless of the level of turbulence happening – the only thing that changes is how frequently they occur. 2.0+ Gs is extremely excessive and would constitute incredibly severe turbulence or windshear in real life. No real life autopilot system could possibly compensate for this. The PMDG 777's autopilot is programmed in the same way the real life one is and naturally, it has

issues with these kinds of instantaneous forces jarring it out of its “comfort zone” so to say.

The biggest side effect you are likely to see is an inability for the flight director to precisely maintain speed with pitch while such turbulence is occurring. The reason is highly technical and involves esoteric concepts such as the relative contribution of PID controller gains, but the real life autopilot would react in exactly the same way if put into a situation like this.

Turbulence filtering:

Despite the above description, we have attempted to average out FSX’s frenetic G-load hits and make the airplane react better to them. Below is another graph, this time with the Y axis showing instantaneous tailwind component resulting from the turbulence and the X axis again showing time over the course of a few minutes.



The magenta line is the result of a sophisticated mathematical filtering algorithm we developed to try to deal with the FSX turbulence. This line is what the flight director and autothrottle are actually “seeing” and reacting to instead of the wild raw fluctuations. This makes things better, but it’s not (and can’t be) perfect. Always remember that you are the pilot, not the computers. If you don’t like what the flight director or the autopilot are doing, take over manually and make it do what you want it to.

AP/AT TURB MODE TRIGGER option:

The above filtering algorithm is activated when an average tailwind component threshold is measured. We have included a new option accessible at MENU > PMDG SETUP > OPTIONS > SIMULATION on page 2/7 that allows you to set the exact threshold for the activation of this filtering mode in knots. We've set it to what we feel is a happy medium with the 1.0 knot default, but if you aren't happy with its performance you can play with this setting and tweak it to your liking. Valid values are 0.5 to 5.0 knots.

Other ways of mitigating turbulence effects:

FSX turbulence settings

In the FSX weather options there is a setting called "Disable turbulence and thermal effects on aircraft." This (despite its name) doesn't actually disable those things, but has helped users in the past with control issues in turbulence and seems to help tamper down the wild effects described earlier.

In the FSX.cfg or FSX_SE.cfg file there is a line under the [Weather] section that reads TurbulenceScale=1.000000

This setting can be decreased and does seem to lower the severity of the turbulence "hits" FSX applies to the airplane.

Weather addon settings

Virtually all the commercial weather addons on the market have a setting or slider for turbulence level or strength. If you're having difficulties, try lowering this option – it's likely defaulted to FSX's 100% setting and may be excessive.

FMC SAVED FLIGHT PLAN CHANGES AND COMPANY DATALINK ADDITIONS

SP1 introduces changes in the way flight plans are saved and loaded and adds the simulation of many of the functions of the FMC company datalink. This builds on the wind import feature in the original release and includes functionality for routes, performance data, alternate lists, alternate weather, and position reports.

Flight plan file management:

In SP1 we have added additional functionality to the way that flight plan files are stored and retrieved.

Flight plan files for all PMDG products are saved in the PMDG .rte format and are located in the FSX\PMDG\FLIGHTPLANS folder. In the original release of the **PMDG 777-200LR/F**, flight plan files were located either in this folder or in a subdirectory (FSX\PMDG\FLIGHTPLANS\777) that is created automatically.

In SP1, the system is able to load or save flight plans from any folder in the PMDG\FLIGHTPLANS folder. This includes subfolders already created by other PMDG products (such as the **PMDG 737NGX**) or folders created by the user. You can create any number of additional folders to arrange your flight plan files in any way that is convenient, for example, by airline routes, short or long range, destinations, local or international, and so on.

Loading flight plan files

Loading an FMC route is accomplished through the FMC CDU's RTE page, using either the CO ROUTE (LSK 3R) or the ROUTE REQUEST (LSK 3L) prompt.

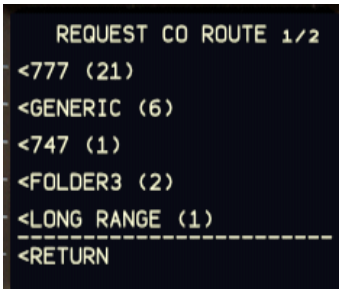
CO ROUTE is used to directly load a route for which you already know the file name. Enter the name into the scratchpad without the extension and press LSK 3R. Initially, the PMDG\FLIGHTPLANS\777 folder is searched and if the file is not found, the root level PMDG\FLIGHTPLANS is searched.

ROUTE REQUEST will allow you select a flight plan file located in PMDG\FLIGHTPLANS or any subfolder within it. Once the file is selected the route will be loaded by simulating the FMC datalink procedure used to load routes on the real life aircraft.

The ORIGIN (LSK 1L), DESTINATION (LSK 1R) and FLT NO (LSK 2R) fields of the RTE page are used to define the request. If you press the ROUTE REQUEST with these 3 fields empty you will be able to select any flight plan file manually. If you have already filled in the origin field, both the origin and destination fields, or the flight number field the FMC will filter the available routes it displays based on the criteria you've entered.

Initiating a ROUTE REQUEST at LSK 3R will bring up a new page titled "REQUEST CO ROUTE" that lists all the subdirectories that include flight plans meeting the selection criteria and also indicate how many flight plan files were found in each subdirectory. The PMDG\FLIGHTPLANS folder is listed as "GENERIC". Selecting one of the subfolders will bring up a new page listing all the relevant flight plans in it. Once you select one of the flight plans the name will be highlighted and a REQUEST> prompt will

appear in 6R. Pressing LSK 6R will return to the RTE page and initiate the uplink procedure for the selected route.

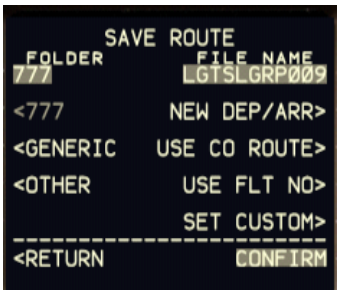


While in the REQUEST CO ROUTE page or in the subfolder files listing pages, you can further filter the displayed routes by typing on the scratchpad. Any characters typed on the scratchpad will filter the displayed routes to those with a file name starting with the entered characters.

If there is only one flight plan file matching the RTE page selection criteria (origin + destination or flight number) the REQUEST CO ROUTE page is not displayed and the uplink procedure is initiated immediately, directly from the RTE page. This opens up a lot of interesting methods of organizing your flight plans – you could make a folder with routes organized by flight number, simply enter that number into the FMC and press ROUTE REQUEST and the datalink simulation will load the correct route automatically.

Saving flight plan files

You can save the current flight plan from the ROUTE SAVE prompt on the FMC RTE page. Pressing LSK 5L will bring up a page named "SAVE ROUTE", where you can set the name and the location of the flight plan file.



The top line fields (1L and 1R) show the folder and file name that will be used to save the flight plan.

On the left side of this page you can select the desired folder:

<777: The file will be saved in the PMDG\FLIGHTPLANS\777 folder

<GENERIC: The file will be saved in the root PMDG\FLIGHTPLANS folder

<OTHER: Brings up a new page on which you can select any of the other folders that may exist under the PMDG\FLIGHTPLANS directory.

On the right side of the page you can select the desired file name:

NEW DEP/ARR>: The file name will be constructed from the ICAO codes of the origin and destination airports followed by a 3-digit index, selected so that there is no conflict with any other existing flight plan file for the same origin-destination pair.

USE CO ROUTE>: The file name will be determined by the CO ROUTE field of the RTE page. In case the flight plan was originally loaded from a file (by CO ROUTE or ROUTE REQUEST) this will be the name of the existing file. Selecting this option will result in overwriting the original flight plan file.

USE FLT NO>: The file name will be determined by the FLT NO field of the RTE page. Flight plan files saved using a flight number can be retrieved by filling the required flight number in the RTE page FLT NO field before selecting ROUTE REQUEST.

SET CUSTOM>: A custom user entered file name will be used. Type the desired file name in the scratchpad (with no extension) and press 5R.

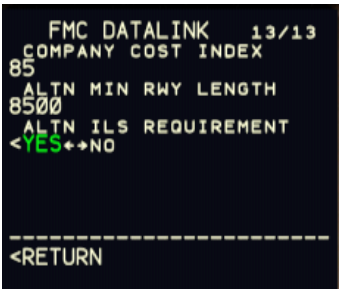
Selecting a folder and/or file name option will update the fields in 1L & 1R. Pressing the EXE key will save the flight plan file.

FMC company datalink functionality and options

In SP1 we have simulated the FMC company datalink. This functionality is described in detail in the provided documentation in the FCOM2 on pages 11.34.1-11.34.12 (pages 925-936 of the PDF). This includes RTE, FLT NO, PERF INIT, WIND DATA, DES FORECAST, ALTN, ALTN WX and ALTN LIST uplinks and RTE REPORT and POS REPORT downlinks. The optional TAKE OFF datalink functionality is not presently modeled in the PMDG 777 product line.

INTRODUCTION

There are several options regarding the FMC datalink configuration that can set from MENU > PMDG SETUP > AIRCRAFT > EQUIPMENT on pages 12 & 13.



AUTO PREFLIGHT UPLINKS: With this option selected, initiating a ROUTE REQUEST from the RTE page during preflight will automatically trigger in sequence PERF INIT, WIND DATA and DES FORECAST requests. The data for each request will become available once data of the previous request in the sequence is loaded and accepted.

AUTO ALTN LIST UPLINK: With this option selected the alternate airports list data (ALTN page 2/2) is automatically updated periodically during the flight.

AUTO DES FRCST UPLINK: With this option selected, each time a WIND DATA request is performed, a DES FORECAST data uplink request is automatically triggered following it.

AUTO POS RPRT DOWNLINK: With this option selected, position reports are automatically downlinked during the cruise phase of the flight each time a waypoint is sequenced. This option is simulated by the presence of the REPORTING and REPORT SENT prompts - there is no sending of an actual report to anywhere.

COMPANY COST INDEX: This option sets the preferred company cost index that is used in PERF INIT uplink requests.

ALTN MIN RWY LENGTH: This option is used (in conjunction with the next option) to define company preferred airports to be used as alternate destinations in ALTN (ALTN page 1/2) and ALTN LIST (ALTN page 2/2) requests. Any airport that does not have at least one runway longer than the defined length will not be considered as a valid alternate airport by the FMC.

ALTN ILS REQUIREMENT: This is used (in conjunction with the previous option) to define company preferred airports to used as alternate destinations in ALTN (ALTN page 1/2) and ALTN LIST (ALTN page 2/2) requests. With this option selected, only airports that have at least one runway equipped with ILS are considered as alternate destinations.

Weather Forecast Data

For all weather related uplink requests, (WIND DATA, DES FORECAST, ALTN WX) weather data is retrieved either directly from FSX or from third party weather addon applications.

When there is no weather addon application running, data is retrieved from FSX directly. If the FSX weather is set from the FSX Weather menu to real-world weather (either static or update every 15 minutes) you must make sure that you have enabled the following FSX option:

Settings > Display > Weather > Download winds aloft data with real-world weather.

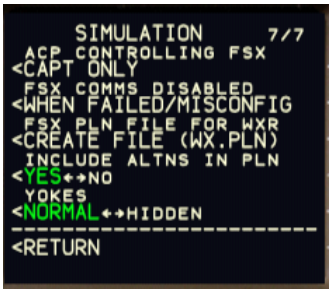
If any of the FSX Weather Themes are used instead of the real-world weather option, you must be aware that although you will receive forecasts that will correspond to the weather that you will encounter along the route, themes apply the same weather globally and will usually contain wind data only for a couple of low altitude flight levels.

If you are running a 3rd party weather add-on application, there will be some actions you must take in order to retrieve the correct weather data from the add-on application using the datalink simulation.

The PMDG 777 looks in the [FSX]\PMDG\WX folder for a file named XXXXYYYY.wx, where XXXX and YYYY are the active route's origin and destination airport ICAO codes. This file should contain wind and temperature data for the waypoints along the route in a specific format.

Depending on the weather addon application, this file will be created automatically or by manual action. The MENU > PMDG SETUP > OPTIONS > SIMULATION page 7 provides two options at LSK 3L and

LSK 4L that can help to automate the process and reduce the required user actions.



The following 3 steps are required:

1. Create a flight plan file

Create a flight plan file in FSX format (.pln). This file may be created by any means. (flight planner applications, waypoint-by waypoint entry in FSX, a file downloaded from the internet etc.)

You can skip this step if you set the FSX PLN FILE FOR WX option (3L) to either CREATE FILE (WX.PLN) or CREATE AND LOAD TO FSX. In this case the PMDG 777 will automatically export the active FMC route into an FSX format .pln file. This file is named WX.pln and is saved in the default FSX flight plans directory (My Documents\Flight Simulator X files). This file is created and subsequently updated each time the user selects a CDU page that contains a weather data related REQUEST prompt (RTE DATA, DES FORECAST, ALTN pages).

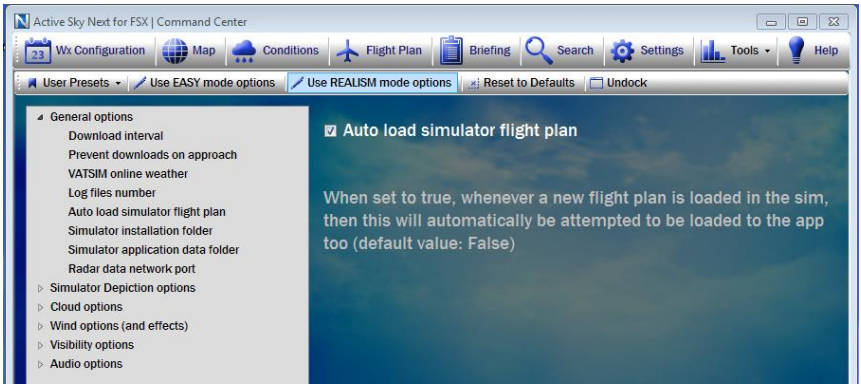
Note that if you want to be able to access weather data for the 4 alternate destination airports (displayed in the ALTN CDU page) these alternate airports must be included in the created .pln file as waypoints and be placed anywhere between the origin and destination airports. In case the option for automatic FSX .pln file is selected, you may also set the INCLUDE ALTNS IN PLN option on to automatically include the alternates in the exported flight plan file.

2. Load the flight plan file into the add-on application

Once the .pln flight plan file is created, either manually or automatically, it must be loaded into the weather add-on application so that weather forecasts are produced for each waypoint of the flight plan.

You can automate this process if you are using Active Sky Next. Set the FSX PLN FILE FOR WXR option at LSK 3L to CREATE AND LOAD TO

FSX and at the same time set the Active Sky Next "Auto load simulator flight plan" option in Settings > General Options. (screenshot on the next page) In this case the PMDG 777 will automatically create the .pln file and then load it into FSX triggering an automatic loading of the FSX flight plan into Active Sky Next. This may work with other add-on weather applications if they provide a similar option for automatically loading the simulator flight plan.



3. Create the WX file in PMDG\WX folder

Most of the add-on applications (currently confirmed for Active Sky 2012, Active Sky Next, PFPX, Opus FSX, and FS Global Real Weather) will automatically create the WX file in the required format and place it in the [FSX]\PMDG\WX folder. In this case you are now ready to make the REQUEST from the relevant CDU page and the data will be retrieved.

If the add-on application you use does not yet support automatic creation of the required WX file, you must extract the wind data manually and create the file yourself. For details see the PMDG-WIND-DATA-REQUEST-readme.txt file in the FSX\PMDG\WX folder.

Important Note:

If you have an add-on application running but the required WX file is not created because you have not followed properly followed the steps described above, the 777 PMDG will try to retrieve weather data directly from FSX. Since the add-on applications generally only set the FSX weather for an area of 60-100 NM around the current aircraft position and clear the weather in the rest of the world, you will get wind data only for a few waypoints ahead, some of the alternate destinations (depending on distance) and, unless the destination airport is in range, no data at all for

the DESCENT FORECAST (you'll get an INVALID FORECAST UPLINK message on the CDU).

Tip:

When you request waypoint winds or descent forecast data for the first time (the relevant CDU pages contain no data), wind data will be retrieved for a predefined set of 4 altitudes depending on the cruise level. Subsequent requests will update the wind data for these altitudes.

If you want to get data for a different set of altitudes you can delete the altitude rows that you are not interested in and enter new desired altitudes without making any wind data entry. On request, wind data for these altitudes will be retrieved.

777 FLY-BY-WIRE (FBW) SYSTEM CHANGES

With the release of the SP1 update, our simulation of the 777 fly-by-wire system has changed significantly from how it operated in the original release version of the product. The deep inner workings and logic of this part of the aircraft are a closely guarded secret and unfortunately some wrong information about its operation was funneled to us during the original development of the product by what appeared to be a highly credible source. This information led us to believe that the system operated in a manner that it doesn't in reality.

Pitch speed stability and FBW theory:

The immediate major effect you will notice in SP1 is that you now have to trim for all airspeed changes while handflying, just as you would in any of Boeing's mechanically-linked aircraft like the 737 or 747. The difference is that on the 777, the use of the yoke trim switches in-flight actually commands the FBW system to select a new "trim reference airspeed" within the primary flight computers. They do not command the stabilizer directly unless on the ground or in the degraded secondary or direct modes. The rate of change is approximately 10 knots of trim reference speed per 1 second of trim switch application. For example, if you accelerate from 250 knots to 300 knots in manual flight, you will need to input approximately 5 seconds of nose-down trim for the reference speed to move from 250 knots to 300 knots, a 50 knot change. This is now modeled correctly and there are no situations under manual flight where the aircraft will autotrim or otherwise change the trim reference speed on its own.

The precise pitch speed stability behavior of the FBW system was extensively tested and tuned during SP1 development via observation in

level D full-flight 777 simulators and on the real aircraft. With hands off the controls in an out of trim state, the real airplane exhibits a tendency to pitch in the direction that will return it to the trim reference speed. It was common in our real life tests when increasing or decreasing airspeed with thrust held constant to see the airplane go into what's known as a "phugoid" oscillation pattern when out of trim. It pitches up until slower than the trim reference speed, then pitches down until faster than it and repeats this cycle, with the oscillations becoming smaller and smaller until the aircraft settles back at the trim reference airspeed. We have modeled this type of out of trim phugoid behavior to the best of our abilities within the confines of FSX in SP1.

Remember that in the real airplane this is all a simulation of sorts occurring within the primary flight computers. It's under computerized FBW control at all times but simulates a normal mechanically linked airplane. The 777 FBW pitch algorithm at its core is what's known as a C* (pronounced "see star") control law that actually is virtually identical to what Airbus aircraft use in their own FBW systems. Boeing, however, added additional functionality on top of this base level C* law to cause it to simulate a conventional airplane with control forces and phugoid tendencies that requiring trimming to alleviate (the 777 control law is called C*U – "see star you" with U representing the speed stability function). All of this is now properly simulated in SP1. You truly have a "simulation of a simulation inside a simulation" now with the way this system of the airplane is modeled within FSX.

Bank compensation:

A prime culprit in the impression that the original version was autotrimming all the time was a misunderstanding on our part of how the bank compensation feature of the 777 FBW actually works. Previously, the system was holding the last flight path angle of the airplane when it was put into a bank, regardless of its trim state. The real aircraft only compensates for the component of pitch change in turns stemming from the natural aerodynamic tendency for the airplane's nose to drop due to the turn itself, not the entire pitch axis tendency including out of trim forces from being above or below the trim reference speed. This has been tested and verified on the real aircraft and the simulated airplane will now feel out of trim and need trim application while banking in an out of trim state in SP1.

Control force simulation:

SP1 simulates the build-up of force or pressure on the control column as airspeed deviates from the trim reference speed. You will notice reduced elevator authority in the direction that opposes the trim force as a stand-in for the physical force that exists in the real airplane. This was the best compromise we could make for something that is inherently difficult to simulate without a sophisticated force feedback hardware system. As you trim in SP1 you should feel the elevator effectiveness move back to normal authority.

There are several other situations that will also result in control force loading:

- During rotation at takeoff as the pitch approaches the tailstrike limit.
- Flare compensation mode below 25 feet radio altitude. The FBW commands the nose down slightly during flare to prompt the pilot to pull back on the yoke. This is done because the C* control law doesn't normally take ground effect into account.
- When the aircraft exceeds 30 degrees of bank (this is felt in the roll axis).
- When the aircraft is near the flight envelope limits (stall, overspeed, or g-limits based on flap and gear configuration)

  The real airplane maintains full elevator and aileron authority at all times but it takes an increasing amount of force by the pilot's arms on the controls to attain it as the loading increases.

Configuration change compensation:

The 777 FBW system compensates for the adverse pitch effects of aircraft configuration changes including:

- Flap extension and retraction.
- Landing gear extension and retraction.
- Speedbrake/spoiler use.
- Thrust changes where there is no airspeed change (for instance beginning a climb)

As with the bank compensation feature, these functions exist on top of the speed stability layer and these compensations will no longer result in the cancelation or “autotrimming” of the entire pitch tendency of the airplane if done when in an out of trim state as they did previously.

Stall and overspeed protection

It is no longer possible to trim the airplane into an overspeed or stall condition. The real airplane will only go into the stall or overspeed range with considerable force on the control column, not with trim application.

“Blip” trim:

The real life 777 has an undocumented feature pilots call “blip trim” that allows for very precise setting of the trim reference speed to the current airspeed. If the current airspeed and the current trim reference speed are separated by 5 knots or less, a short momentary application of the trim switch in either direction will automatically set the trim reference speed to the exact current airspeed. This feature is extremely useful for fine tuning once the aircraft is close to being in trim and we have simulated it in SP1.

FBW assists for the FSX environment:

SHOW FBW TRIM REF SPEED option

To assist **PMDG 777** pilots in understanding and operating the FBW trim system in the desktop simulator environment where physical control forces aren’t present, we have implemented a new global simulation option called “SHOW FBW TRIM REF SPEED” found in the FMC options under MENU > PMDG SETUP > OPTIONS > SIMULATION on page 1. This option adds a cyan **-FBW** marker to the PFD speed tape that shows the precise location of the current FBW trim reference speed. If the speed is offscale, the actual numeric speed shows next to the marker, similar to how an offscale landing reference speed is shown in green. The trim reference speed will be shown any time the option is turned on and the aircraft is in-flight while being handflown above 100 feet radio altitude. The trim reference speed does not show during autopilot use, since the AFDS takes full control of trimming.

Joystick FBW null zone options

Two new global options have been added for tuning the null zone for engagement of the FBW flight path hold mode of the system after release of the controls, both in the pitch and roll axes. These options are intended to simulate the aspect of the real life system whereby the controls must be deflected with a certain amount of force to push the FBW system out of its hands-off path following and speed stability modes and into fully

manual control. During testing it was noted that there was a large variance in how much deflection was needed depending on the specific joystick in use and that often the system would remain in manual control mode even with the joystick released. If you experience the airplane acting as if the speed stability out of trim function never engages to cause the aircraft to pitch to return to reference speed, play around with these settings – your joystick likely needs different values than the defaults.

The options are located at MENU > PMDG SETUP > OPTIONS > SIMULATION on page 2/7 and are labeled CTL COLUMN NULL ZONE and CTL WHEEL NULL ZONE (for pitch and roll respectively).

A note on low weight takeoff trim settings

The 777 (particularly the 200LR) is prone to very nose down takeoff trim settings at low gross weights due to the highly aft (30+%) CG. This is most commonly encountered on short flights with light fuel loads.

FSX's flight dynamics engine unfortunately has an issue with this type of configuration that will cause the airplane to still feel like it's out of trim in the nose down direction immediately after takeoff even with the takeoff trim set on the numbers. When the FBW system engages at 100 feet, there can be a noticeable pitch up motion – this is simply the system compensating and correcting for the FSX issue and not any sort of "autotrim" happening. If you find this effect annoying, you can add an extra unit or two of trim to the calculated one at low weights / aft CGs. Even in the real world, anywhere within the green band is acceptable for takeoff, so this isn't completely out of the realm of realistic anyway.

PMDG 777-300ER SUPPLEMENT

Released in July of 2014, the **PMDG 777-300ER** product extension adds the stretched extended range 777-300ER aircraft to the base **PMDG 777-200LR/F** package. There are some key additions and differences you should be aware of when flying this variant of the airplane.

Ground Maneuvering Cameras:

Due to the extreme length of the 777-300ER fuselage, a system of three ground maneuvering cameras were designed into the airplane to give the pilots a visual reference of the landing gear position while taxiing for adequately judging turns. The system can be engaged by pressing the CAM button on the EICAS control panel as shown below:

This system was extremely difficult to model in FSX and due to limitations in the simulator we've had to limit the camera views to a 2D popup panel that appears in the lower left corner of the screen. This method generates a very large performance hit due to the fact that the FSX world is being rendered four separate times while it's on. Unless you have a very high end PC, it may be more advisable to just use spot view to taxi.

The system also requires the use of a separate partial external model, which exists in the FSX\SimObjects\Airplanes\PMDG 777-GMC folder. Do not modify this folder – the placement of the proper textures into it is automated by PMDG Operations Center when you install a livery and no user interaction with the folder is required.

We noticed a tendency among viewers of pre-release beta screenshots of the camera popup to think that we'd incorrectly or poorly drawn the "frame" that separates the three camera views. This is actually a digitally drawn graphic that exists on the display in the real airplane – it is not a

physical frame. It does in fact look very simple and flat in real life, exactly as we've drawn it in FSX.

Tailstrike avoidance:

The 777-300ER fuselage is significantly longer than the 777-200LR or 777F are and is at a greater risk for tailstrikes on takeoff and landing. Older 777-300ER models have a tailskid installed to protect the fuselage while newer versions of the aircraft are omitting the tailskid and relying purely on the FBW system's tailstrike protection mode that increases control loading to prevent the tail from hitting the ground. The latter option reduces weight and increases maximum payload. Both options are simulated in the **PMDG 777-300ER.** You will notice a distinct difference in the feel of the 300ER vs. the 200LR/F during takeoff and landing because of the system's more aggressive control loading.

GE90-115B engines:

Boeing offers the 777-300ER with only one engine, the General Electric GE90-115B. This is the single most powerful jet engine currently in existence and has the maximum thrust rating for the GE90 series. The GE90-115BL1 variant with the takeoff bump option has been modeled here.

Lower climb and cruise performance:

Despite its huge engines, the 300ER can be a bit more sluggish in the climb and it generally cruises at lower altitudes than the 200LR/F due to its higher gross weight. It's not uncommon to see a heavy 300ER max out at FL330 or 340.

APU to pack takeoffs:

The 777-300ER comes standard with an option that allows the APU to feed bleed air to the air-conditioning packs during takeoff so that the engines can develop their full rated thrust without any bleed air being siphoned off. This is important in places like Dubai where the outside air temperature is extremely hot and 777-300ERs are constantly leaving at or near max takeoff weight. Turning the packs off even for a minute or two for takeoff would result in an uncomfortably warm cabin for the passengers, so the APU to Pack takeoff option is used to keep the packs working during the takeoff sequence.

Main landing gear differences:

The 777-300ER's main landing gear trucks are different than those on the 200LR/F in that they are cantilevered. This was done so that the airplane

can pivot on the rear wheel pair of each axle, which increases the clearance between the tail and the ground. This allows for a higher deck angle at rotation and a shorter takeoff and landing distance than an airplane of this length would normally require.

This feature of the main landing gear was painstakingly modeled and animated on the **PMDG 777-300ER** external model – go to spot view during a takeoff or landing and watch it!

Things the wide beta team wanted you to know:

- The 300ER is a heavier bird and is not as overpowered as the 200LR/F is. At heavier loads, it requires more thrust to break away and maintain taxi speeds. V speeds are going to be a little higher, climbs are going to be slower, and initial cruise altitudes are going to be in the low 30's. All part of hauling more aircraft into the air!

- The extra length requires more oversteer during taxi. For a 90 degree turn, wait until the centerline of the taxiway passes the window pillar by your shoulder (or the FO's) before you start turning. Pay close attention to taxi speed and avoid entering turns at more than 10 knots, or you're going to get NOSE TIRE BALANCE messages on the EICAS and a horrible clatter from the nose wheel on rotation and landing! Good runway alignment and taxiing into the gate requires practice too.

- The extra length also makes the native FSX head movement issue somewhat worse. If you have a spare hat switch on your joystick, map it to the fore/aft and left/right head position keys to make correcting the position easy. After a short while it becomes a non-issue.

- The deck angle at which a tailstrike will occur on rotation is lower than it is on the 200LR/F. While there are built-in FBW protections to mitigate the risk, a disciplined rotation technique is ever more important to avoid a necessary return to base.

- The 300ER doesn't have the same range as the 200LR. Make sure you are planning a route that the aircraft can actually handle at the weight you are carrying. A tradeoff in payload vs. fuel load is required to get it to stretch its legs fully.