FOR PREPAR3D

PMDG 737NGX

Introduction and Use

This manual was compiled for use only with the **PMDG 737NGX** simulation for *Prepar3D*™ from Lockheed Martin Corporation. 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.

The PMDG Simulations website can be found at:
http://www.precisionmanuals.com

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Please note that this version of the simulation may or may not accurately represent the actual operation of many different aircraft systems and no warranty is made to accuracy or correctness.

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.

This simulation may not be used in any public or private display for which users are charged admission, usage fees or other revenue generating charges. Nor may the simulation be used in any manner which reflects poorly on PMDG, PMDG Simulations, Boeing, Boeing's employees, suppliers or customers.

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THE TESTING TEAM

We take great pride on the cohesion and dedication of our beta 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 this project as Technical Advisors:

Captain Nikos Aposporis
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Chief Aaron Buchanan, USN
Evangelos Dokos
Jim C. Jonesy
George Morris

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

Mark Adeane
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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 18 through 35 of this manual even if you don't intend to read anything else in it – they contain very important mandatory P3D settings and recommendations for proper functioning of the product.**

- Installation and license activation instructions are on page 19 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 737NGX**. 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 two Tutorial flights that explain how to operate and fly it can be found in the PMDG Operations Center application by selecting the **PMDG 737NGX** 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.

PMDG AND THE ART OF SIMULATION

At PMDG we have a reputation for bringing a high degree of realism to desktop simulation. All of us at PMDG are simulation enthusiasts who enjoy the process of bringing our aerospace experience to the simulation community in the form of comprehensive and sophisticated airliner simulations. For us, the process started because each of us as individuals was seeking simulations that were just a bit more involved, a bit more detailed, and a bit more realistic than what was currently being offered to the marketplace.

For the past few years, flight simulation developers have been competing for attention by using phrases like: “most realistic,” “most accurate,” “Certified by Real Pilots,” or “Most Accurate Ever.” While some of these claims have merit, our own experience as flight-sim *consumers* has generally led us to believe that marketing is always marketing, and that the hype of realism and accuracy is hardly ever realized in the final package.

To put it another way: Just because a developer includes a PDF copy of the actual airplane flight manual does *not* mean that the product was developed to that level of detail. In many cases, the flight manual provides an interesting side bar of information that you cannot use because the developers simply didn’t code most of the airplane’s behaviors into the program.

As a result, the community at large has become desensitized and does not often stop to ask the question:

“What makes a high quality add-on?”

If such a question is put to a developer, the answer is often explained by describing texture resolution, the number of switches upon which you can click, the number of polygons used or by cramming a product full of “pretty, but-not-quite-useful” external programs to give the impression that a product is filled with features.

These features are often presented in place of true “simulation” in order to hide the fact that most developers, while good at creating polygons, bits and graphics, just do not know much about modern airliners or how they are operated.

Thus, the term “simulation” gets thrown around loosely, creating confusion for the end user as to what an add-on product truly represents.

At PMDG, we take the term “simulation” seriously and we know what makes a high quality add-on.

On the **PMDG 737NGX** we simulate the whole system, not just the switch, some lights and a few digital readouts. When you turn on

a hydraulic pump for example, there is an entire simulation of electrical connectivity, electrical demand, changes in fluid flow volume, changes in fluid temperature and changes in fluid pressure that takes place “behind the panel.”

We simulate the sensor systems that provide feedback to the displays on the flight deck and we simulate their location within the larger confluence of systems aboard the aircraft and the effects of related system failures, degraded performance resulting from abnormal conditions and the potential for down-stream failures if you mismanage the airplane.

“Simulation” should mean nothing short of incredible depth, detail and feature richness that allows for the proper application of real-world operating procedures and techniques without offering excuses as to why parts of the airplane behave differently than what is described in the flight manual.

“Simulation” means that when you engage the autopilot and put the airplane into LNAV/VNAV, it should behave like it would if you were actually flying the airplane. This means that it behaves not just in easy to manage climbs and descents, but it reacts appropriately when you punish the airplane with rapid changes and demands near the limits of the airplane’s capabilities.

“Simulation” shouldn’t leave you saying: “Well… it is just a flight-sim product.”

At PMDG, we believe that developing a simulation of the 737 requires more knowledge than can be gleaned from simply reading the aircraft flight manual.

The **PMDG 737NGX** is a third generation simulation platform developed with the aircraft enthusiast in mind. This product provides the simplicity of “push up the power and fly” while also providing the depth of simulation that will keep even the most knowledgeable 737 captain entertained and learning for years to come.

Getting the “simulation” details correct inside a product goes a long way toward giving a product the right “feel” of quality. The subtle character of

the 737 shines through in the **PMDG 737NGX** product, and it is this subtle character that allows you to sit back and know that this is a high quality add-on. What makes the NGX high quality? It is hard to define precisely, but you'll know it when you see it.

The **PMDG 737NGX** 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 737 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 737 airplane, we have worked to build a simulation that capitalizes on the strengths of the Prepar3D™ 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 P3D is a wonderful and dynamic platform for modeling airliners, there are some aspects of it 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 737NGX** experience. To the greatest degree possible we have attempted to document these shortcomings within this manual.

The **PMDG 737NGX** is a vastly different simulation platform than any previous PMDG product 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 customer forum hosted at **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 737!

In conclusion, we would like to thank all of our dedicated customers for purchasing this product and supporting our work. While it is never possible for us to give you the “insiders” perspective that you would like into our development process in “real time” we continue to enjoy the discourse we have had with you in our forum during the past decade. Please continue to participate, and continue to pass along your thoughts.

Your interest in our products is reflected in the continual improvements we implement with each new generation of releases. Without your input and without your interest, there would be no PMDG!

On behalf of the entire team,

Thank you!

The PMDG Development Team

04AUG11 (updated 27FEB15 with SP1d)

GETTING P3D SET UP FOR THE PMDG 737NGX

There are hundreds of thousands of possible hardware setups upon which you might run P3D and the **PMDG 737NGX** so it is important that you take a few moments to be certain that P3D 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 737NGX**, without fail, all of the testers who took the time to follow this section's recommendations to improve P3D 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 P3D 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 on your local machine and if you turn this off, the **PMDG 737NGX** 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 737NGX** 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 737NGX.**

Product activation:

The **PMDG 737NGX** 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:

3P38-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. Note that the first 4 characters depend on the specific product and media you own, it’s ok if they’re different than the example shown here.

The **PMDG 737NGX** allows 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 P3D:

Please Note: If you already have P3D 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 P3D into the default installation folder: When installing P3D, do not install the simulator into the default directory that it offers. Instead, customize the folder to something different. (Example: C:\P3D) 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.

- 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 P3D 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 737NGX**. (More on this a bit later in the section about out of memory errors and VAS on page 23.)

- 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 737NGX** 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 P3D is installed in its own folder such as C:\P3D, not the default location where the OS's permissions issues with this folder can become a problem.

  - Always run P3D with the right click "Run as administrator option as described below:

Running P3D:

- Set P3D to "Run as administrator." This will give P3D the best opportunity to use system resources effectively and without limitations. To do this, right click on the P3D 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 P3D, the program will run under the administrator permissions group. (You can also follow these steps by right clicking directly on Prepar3D.exe)

- Do not let your antivirus software actively scan P3D: While we are all concerned about the prevention of malware, it is extremely important that you allow your P3D installation to "opt out" of being actively scanned for viral activity while the software is running. P3D 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 P3D root directory and you should be all set!

  Do not forget to manually run a malware scan on your P3D directory on occasion just to keep you safe!

Prepar3D.CFG Settings:

Lockheed Martin has created a short guide on tweaking the Prepar3D.cfg file available here:

http://www.prepar3d.com/SDKv2/LearningCenter/getting_started/performance/tuning_guide.html

Please do note that the common tweaks used in the past for FSX are not necessarily applicable in P3D. The graphics engine has changed substantially and many of the lines used in FSX are no longer required.

[MAIN] section:

If you are getting out of memory errors in P3D, adding the following line can help with it according to the development team at Lockheed Martin:

AlwaysFullLoad=1

This forces the simulator to completely unload all of its data when the flight is reset or changing airports.

UIAutomationCore.dll fix:

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 P3D 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 P3D root folder, the sim will reference it instead of the bugged Windows 7 default version.

P3D tweaks:

There are numerous tweak guides and websites out there in the P3D community that can help you to get more performance out of the simulator. We recommend reading up on these at the P3D and Avsim forums and deciding for yourself which performance tweaks you'd like to use.

NOTE: In the **PMDG 737NGX** 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 P3D parking brake on in the background, while allowing you to set/release the airplane's parking brake at will. You will notice the red P3D "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 Prepar3D.CFG for:

InfoParkingBrakesEnable=True

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

*We decided not to change your Prepar3D.CFG file automatically, as some users do not appreciate such changes being made without permission!

P3D In-Game Settings:

We recommend the following settings to help you get the most out of P3D.

Graphics Page:

- Wide-view Aspect Ratio – Check this box if you're using a monitor with a widescreen aspect ratio. 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 off is probably the culprit.

General Page:

- Program/Show Scenario Startup Screen – Check this box to ensure the sim loads up on the Scenario screen that lets you select your aircraft, airport and runway, weather, time of day etc. when you first load P3D.

- Program/Panel Serialization – Set this box to off when using the 737 since we perform our own custom panel state save and load operations. We are investigating the use of the built-in system for a future update.

- Information Text/Show cockpit tooltips – set this box to checked on to assist with special knob functions and hidden clickspots.

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 P3D 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.

Scenery and Lighting Pages:

- Bathymetry – turn this off when operating aircraft in P3D. Bathymetry is the terrain under the surface of the ocean. P3D supports submarine simulations and you don't want invisible terrain mesh rendering under the water while you're flying an aircraft.

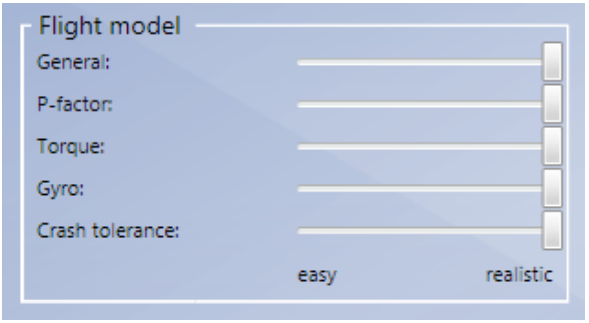
If you are experiencing poor performance, the scenery and lighting pages are one area where you can gain quite a bit of bang for your buck for even small reductions in your P3D scenery settings.

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.

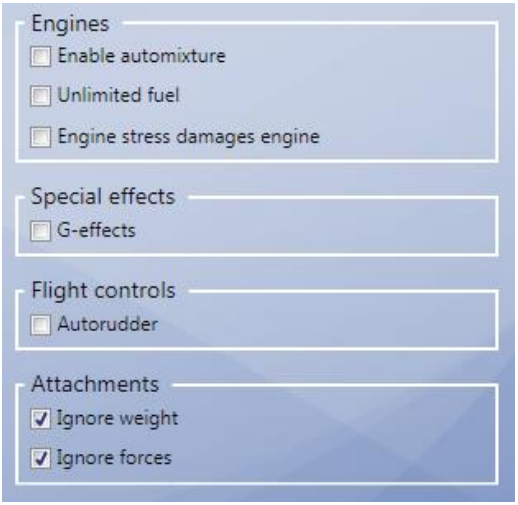
Note: See the section on aircraft "bouncing" on page 47 if you experience this with a mesh setting above 19m.

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 737NGX.**



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. ATTACHMENTS refers to military aircraft stores stations and should remain checked when flying a civilian aircraft like the **PMDG 737NGX**.



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

VAS management – stopping out of memory errors:

We would like to acknowledge sim 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:

P3D is a 32-bit application. Even under the recommended Windows 7 64-bit operating system, the Prepar3D.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 P3D 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. The error probably should 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 Prepar3D.exe that entire 4GB block of VAS. In 32-bit Windows the default is a maximum of 2GB of VAS for P3D and 2GB reserved for the operating system. This can be increased to 3GB for P3D 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 P3D 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 P3D (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 P3D 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 P3D 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 Prepar3D.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 P3D and monitor this number for the Prepar3D.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 P3D 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 P3D 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 737NGX** aircraft itself uses approximately 600 to 700MB 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. P3D 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 P3D 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 P3D'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.

Prepar3D.cfg Level of detail radius value

Some tweak guides recommend increasing this setting on the Scenery page above its standard 4.500000 value via the in-game slider Prepar3D.cfg file. While this does improve visual detail into the distance, that improvement comes at the expense of increased VAS usage because P3D has to load in more autogen, more high detail mipmaps for

textures etc. Leave this setting at Medium or High 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 P3D 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

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:

P3D 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 P3D, and then reload it and your flight and you should be in a reset VAS state.

Conclusion:

There are real limits in the 32-bit P3D 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

THE PMDG 737NGX 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 P3D 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 P3D 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 P3D 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 controls and hardware pieces available and it is impossible for us to test the **PMDG 737NGX** with every possible configuration.

In addition, PMDG's products are extremely complex and to a large degree we are using P3D primarily as a world platform for a highly complex simulation that is running side by side with the P3D platform in order to provide the most accurate simulation experience available.

This means that there are circumstances where we choose to work around the standard P3D 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 <P3D root folder>\PMDG\PMDG 737NGX\SDK folder.

FSUIPC users:

The goal of the developers was to create greater interoperability between the P3D 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 P3D platform.

Like most things in the simming world however, the skills of developers like Pete Dowson continue to play an extremely valuable role in the way many add-ons interact with P3D.

Many users have found that FSUIPC continues to provide value for improving the P3D 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 737NGX** 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 FSUIPC.ini file after installing the **PMDG 737NGX** in order to get everything playing well together. We recommend that you try this if it seems the NGX is not behaving normally after installation.

In all cases, any "disagreement" between the PMDG 737NGX and FSUIPC was corrected by simply deleting the FSUIPC4.ini file found in <P3D root folder>|Modules and allowing it to regenerate.

We continue to explore ways to make the **PMDG 737NGX** interact more smoothly with FSUIPC and we'll make those changes available as they are finalized. Both FSUIPC and the **PMDG 737NGX** are trying to accomplish the same goals and following the above recommendations should keep you out of trouble.

KNOWN P3D'isms TO AVOID:

The best way to think of the **PMDG 737NGX** is to approach it in terms of a stand-alone simulation that is using your P3D installation in order to provide a world in which to simulate the 737'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 737NGX** that you should first load the default Cessna into the simulator, then load the **PMDG 737NGX** 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 aircraft to be your default startup flight in P3D. 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 737 relies on until the simulator is restarted.

- One shortcoming of all PMDG products 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 737-900) and you wish to change liveries to a different 737, 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 737 livery or variant on top of itself you will see strange issues in the cockpit, P3D may CTD or otherwise crash, etc.

- Setting the **PMDG 737NGX** 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 P3D and thus if the 737 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 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 even make 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 P3D.

- When flying over the ocean, there is a bug 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 P3D 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 737NGX**. 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 engine spinners 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 737NGX** comes with six documents:

- Introduction (You are reading it now!)
- **PMDG 737NGX** Tutorial #1
- **PMDG 737NGX** Tutorial #2
- **PMDG 737NGX** Flight Crew Training Manual
- **PMDG 737NGX** Flight Crew Operations Manual Vol. 1.
- **PMDG 737NGX** Flight Crew Operations Manual Vol. 2.
- **PMDG 737NGX** 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 P3D, you can fly the **PMDG 737NGX**!*

We have created a truly scalable experience for simmers who love the 737. 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 737NGX** as possible.

This introduction will give you some tips on how to set up P3D for optimal performance with the **PMDG 737NGX** and it will explain PMDG's proprietary custom icons and cursor symbology as it is used in the **PMDG 737NGX.**

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 ends with a list of "fun to know" quirks that experienced 737NG pilots will recognize within the simulation. We thought you'd like to know just how detailed we have made your new **PMDG 737NGX.**

Tutorials:

In order to help new users get acclimated to the capabilities of the **PMDG 737NGX,** we have created a two-part tutorial the 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 737NGX.** 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 part of the tutorial will start you in a powered-up and ready-to-go 737-800 at **EGKK - London Gatwick**. You will follow along step by step and eventually find yourself parked across the English Channel at **EHAM – Amsterdam Schiphol** with your passengers deplaning!

Phase two of the tutorial will pick up right from the end of the first part, taking you through a detailed flight demonstrating many of the more complex procedures such as starting the airplane yourself, creating a complex flight plan, managing enroute functions with the Flight Management System, a challenging visual approach procedure, landing and finally shutting down at **LOWI - Innsbruck**.

The tutorials don't need to be completed in a single sitting. You can break it into parts by saving your flight enroute, or you can stop in Amsterdam on one day and start up again on a new day!

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 737, 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 737, 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 737NGX,** 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 737NGX!**

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 737: These are not important to you, but they do provide a fascinating insight into the evolution of the 737NG 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 737NGX.**

- 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 737NG 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 therefor 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 737NGX.**

The **PMDG 737NGX** provides you with an unprecedented level of accuracy in the simulation of the mechanical systems on the 737 airplane. We have worked tirelessly with expert input, reams of data and nearly continual verification processes in order that the **PMDG 737NGX** 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 737NGX.** 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 737NGX!**

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 737 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 737NGX** 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 737NGX** 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 737NGX** 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 737NGX DIDN'T DO WHAT YOU EXPECTED?

The 737NG airplane has a few differences from the rest of the Boeing fleet that may trip you up if you do not expect them, and there are a few quirks to operating certain aspects of the airplane's logic. Here is a small collection of items that we saw trip our testing crews, so we thought it might be a good idea to list them for you:

I cannot get TO/GA to activate:

Make sure you have BOTH flight directors active. TO/GA will ignore you unless both are active.

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:

Something that a lot of people do not know is that when you are within 3 miles from target fix, 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.

When I engage the autopilot, sometimes it reverts to CWS R or CWS P instead of CMD. Why?

If the AFDS senses pressure on the flight controls, it may not engage, instead going into Control Wheel Steering mode. (Think: Fly by wire pitch/roll management.) This is a type of reversion. CWS reversion from CMD mode takes 21 pounds of force on the column or 10 pounds of force

on the control wheel. (That's the CWS HI detent value. CWS LO detent is 5 and 3 pounds respectively.) Either of these will trigger the reversion on engagement.

With electric trim, I cannot move the trim all the way to the limit:

This is correct behavior. The stop position will vary slightly depending upon which of the airplane body types you are flying, but generally speaking you will lose the ability to trim nose down beyond about 4.0 ANU. It is worth noting that the trim limits are different when the flaps are UP as opposed to deployed as well. For simplicity, your limits are:

FLAPS DOWN: 0.05 - 14.5 (All variants)

FLAPS UP
600 : 4.13 - 14.5
700 : 4.30 - 14.5
800 : 3.95 - 14.5 [some models 4.00, some models 4.05]
900 : 3.90 - 14.5

How can I test the oxygen mask when it requires that I hold two buttons at one time?:

In some cases we have had to improvise a bit in order to give you the ability to test/operate items that normally require two button presses or two hands. In the case of testing your O2 mask, you can use the red TEST button by pressing and holding the button for 2 seconds. This will simulate the process of holding both test buttons at the same time.

How can I operate the manual gear unlock?

In some cases we have had to improvise a bit in order to give you the ability to test/operate items that normally require two button presses or two hands. In the case of the manual gear unlock, press the click spot on the lock for 2 seconds and it will simulate the operation that normally requires two hands.

I see CUTBACK when setting up the FMS. What does this do?:

Cutback is an automatically managed noise abatement process for the NG airplane. CUTBACK will reduce thrust at CUTBACK altitude and up to the RESTORE to a calculated N1. The calculated N1 is such that at entered V2+20, at restore altitude, present environmental conditions and current weight the aircraft in engine out configuration can maintain a specific (small) climb gradient. Accordingly weight and V2 must at

minimum be entered otherwise the (rather lengthy) iterative calculation for CUTBACK N1 cannot proceed. Turns out that this N1 value is rather small and thus you have a reduced sound footprint. If your V2 is deleted the FMC will cancel CUTBACK (with a warning). If calculated N1 for cutback is excessive then you will also see a warning.

Sometimes I hear strange sound artifacts after switching views:

This is a known bug in, especially with complex add-ons that use lots of custom sounds like the **PMDG 737NGX.** We recommend that you press the Q key twice after switching views, as this always eliminates the problem.

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.

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.

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

The navigation data included with the **PMDG 737NGX** is provided by Navigraph and up to date at the time of original release. (early August 2011, the AIRAC 0811 cycle) After this cycle expires in mid-September 2011, 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 <P3D root folder>\PMDG\NAVDATA and edit the third line - OpProgram= JUL28AUG24/11 - to read a different date range that will not trigger the message.

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 a mesh resolution setting that is higher in resolution than 19m. These are the 10m, 5m, 2m, and 1m settings. This appears to be a 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.

The weather radar isn't working.

The Collins WXR-2100 simulation present in the **PMDG 737NGX** (SP1d and later) 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 P3D 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 P3D and has been widely reported on the big hardware forums around the Internet. If you are building a new PC for P3D, we recommend staying away from Asus motherboards until this issue is confirmed to be resolved.

THINGS THE BETA TEAM WANTED YOU TO KNOW

During the process of beta testing, there were a few “737’isms” that our beta team collected because they thought you should know about them!

- Remember to turn on both F/Ds to be able to get TO/GA mode activation.
- LNAV arming on the ground will not be possible if the first waypoint is more than 5 degrees offset from runway heading.
- It's normal that the F/D bars are biased out of view until TO/GA activation.
- There is no frequency "auto-tune" for the NAV receivers (with the exception of OBS auto-tuning, which is a "sim help" selectable through CDU options.) You have to tune the frequencies and course yourself.
- There is no separate ILS receiver on the 737. It is done with the navigation radios .
- The NG without auto-ignition needs those igniters in CONT mode before takeoff and landing (even when there is no rain present.)
- Engine generators will not take over automatically after engine start. You have to put them online yourself, so make sure you don’t turn the APU OFF before doing so!
- Flare height for the NG 10' (unless you want to balloon on purpose.)
- While VNAV is accurately modeled and "rugged" like the real thing, it isn't a miracle worker: if you get messages like DRAG REQUIRED, NO DES PATH AFTER XXXXX, DES PATH UNACHIEVABLE, 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.

- There is no 2D panel for the Throttle Console area: items like fuel cutoff switches need to be accessed via keyboard shortcuts/button assignments or in the respective VC panel / in VC.
- The NG has a tendency to accelerate rapidly right after leaving the ground as a result of the reduced drag found while in ground effect. The NGX mimics the real airplane, so be ready for it!
- The airplane slowing down to descent speed prior to T/D is how the real thing works.
- Speed exceedances sometimes during VNAV descent are normal and faithful to the real thing.
- There is no mouse-wheel operation on the bank limiter, BARO or MINS knows: they were made operable with left-right mouse clicks on purpose to save you accidentally triggering it while spinning their inner knobs with your mouse-wheel!
- The 737-800, and especially the 800 with winglets is a very slippery airplane and will require planning and aggressive energy management on tight approaches. Plan ahead and if it won't work, go around!
- The Autobrake switch does not move to OFF by itself after wheels off the ground; you have to do this by yourself.
- You must set the pressurization (CRZ and LDG ALT) manually, there is no interaction to cruise/landing altitude setting from the FMC automatically like on the big Boeings.
- On go-around with a single autopilot operating, the autopilot is going to disconnect. BE PREPARED!

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) and the flight director should be nearly centered and you cannot be actively trimming. If you violate any of these you will see CWS_R or CWS_P displayed as the roll or pitch mode….

WOULD YOU LIKE YOUR MANUALS IN PRINT?

If you want to take your **PMDG 737NGX** flight experience to a whole new level of realism, get your flight manuals in print!

The **PMDG 737NGX Chief Pilot's Flight Manual Package** (shown) gives you everything the aspiring NGX captain could possibly need!

- **PMDG 737NGX** Flight Crew Operating Manual Volume 1
- **PMDG 737NGX** Flight Crew Operating Manual Volume 2
- **PMDG 737NGX** Flight Crew Training Manual
- **PMDG 737NGX** 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 737NGX** Type Training.
- FREE: **PMDG 737NGX** Lights and Switches Guide ($45 value!)
- FREE: **PMDG 737NGX** 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 737NGX Captain's Flight Manual Package** consisting of

- **PMDG 737NGX** Flight Crew Operating Manual Volume 1
- **PMDG 737NGX** Flight Crew Operating Manual Volume 2
- **PMDG 737NGX** Flight Crew Training Manual
- **PMDG 737NGX** Quick Reference Handbook,

All manuals can also be purchased separately!

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

INTERACTING WITH THE PMDG 737NGX

The **PMDG 737NGX** uses a fully custom, highly flexible interface methodology in order to make your **PMDG 737NGX** 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 panel cockpit.

The **PMDG 737NGX** 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 Rotation Cursor:

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.

For switches that move up/down the following applies:

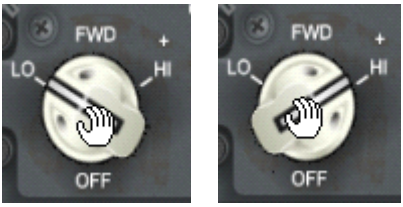
This cursor indicates that the switch may be moved up/down. This is the “neutral” cursor, meaning that you are not currently rotating the switch.

Press either the **left** mouse button or turn the mouse **wheel down** or to **move the switch down.** 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 **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 737NGX** 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 set heading/speed 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.)*

Combined rotary knobs:

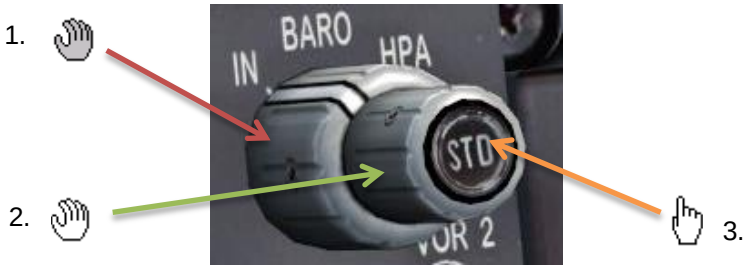
In some cases, there are multiple rotary knobs embedded into a single location, such as the heading knob found on the MCP. In order to help clarify the operation of these knobs, you should note the color of the Left/Right rotation cursor. The primary rotary function of the knob will use white rotary 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 minimums knob are shown in the following figure:



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

2. This un-shaded icon indicates that you can rotate the primary knob using both 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 with a left click.

If you spend a few moments feeling around the **PMDG 737NGX** cockpit with your mouse, you will find many different areas where you can click, rotate, move up/down or left/right various controls. After a few moments interacting with the simulation, 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 cockpit 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 P3D.

USING 2D PANELS

The essence of the **PMDG 737NGX** 2D panel control schema is based around click spots located at strategic locations throughout the 2D panel-set. When the user moves the mouse over one of these click spots, the mouse cursor changes in order to help the user understand what options are available via the click-spot.

These methods are not used in the virtual cockpit because the use has the ability to move freely around inside the cockpit in order to access switches and panels.

When using the 2D panels, the following cursors may be displayed to the user:

Panel Open/Toggle Cursor:

When this cursor is displayed, you can use either the **left or right** mouse button to **open** or **toggle** a panel window. These types of mouse click spots are normally located on the main panel.

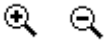
Multiple Panel Open/Toggle Cursor:

When this cursor is displayed, you can use either the **left** or the **right** mouse button to **open** or **toggle** one of two different panel windows. A left mouse click is related to one panel window, the right mouse click is related to another different panel window. These mouse click spots are usually 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-left 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 in the 2D panel or the VC and also over 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. This window will initially be displayed in a preset position but it can be dragged to any location.

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.

2D panel click spots overview:

This image shows the mouse click hotspots that are primarily used to control the 2D panel, as well as the cursor the user will see when the mouse is moved over these click spots. Please refer to the previous discussion to understand what each cursor means.

1. 
   Left Click: Display Aft Electronics (Radios) Panel
   Right Click: Display Quick Access Radio Panel.

2. 
   Left Click: Display Lower Main Panel.
   Right Click: Display Fire Protection Panel.

3. 
   Left Click: Display CDU.
   Right Click: Display Lower Display Unit.

4. 
   Left Click: Display Forward Overhead Panel
   Right Click: Display Aft Overhead Panel

5. 
   Left Click: Lights Panel (Left or Right click)

6. 
   Left Click: Slides the MCP left to display features on the FO side of the panel. (Also uses Right Click)

7. 
   Left/Right: Opens a zoomed-in view captain's Primary Flight Display.

8. 
   Left/Right: Opens a zoomed-in view captain's Navigation Display.

9. 
   Left/Right: Opens a zoomed-in view upper engine display unit.

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

** 
All pop-up windows have an "X" click-spot at the top-right corner for closing. This click spot will display the "X" cursor as shown here.

Other functionality notes:

If you forget what a 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!)

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

CUSTOMIZE YOUR PMDG 737NGX 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 737NGX** 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 P3D, 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 737NGX home CDU menu:

At any time while flying the **PMDG 737NGX**, 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 737NGX** 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 737 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 737NGX** to suit your tastes:

1. < AIRCRAFT: The **PMDG 737NGX** allows you to configure the equipment options you want on your 737 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.

2. < OPTIONS: The **PMDG 737NGX** 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 737 body types.

3. 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.)

4. STARTUP PANEL 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 the load the NGX.

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 P3D Flights/Save menu and will save the airplane position, status and configuration into a file that can be loaded at a later time via the P3D Flights/Load 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 <P3D root folder>/PMDG/PMDG 737NGX/PANELSTATE folder.

Once this state is saved, you can have the airplane in any location in the P3D 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: It is worth noting that in the **PMDG 737NGX** 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.

It is worth bearing in mind that some users may not want the failures conditions to transfer to a newly loaded flight. If this is a concern, then please be certain that you clean all failures and disable failures from the FAILURES menu prior to saving the flight.

Save/Load from the P3D menu: You can also conduct save/load operations from the P3D Flights menu. The **PMDG 737NGX** will intercept the save/load function and create both the P3D save file and the **PMDG 737NGX** panel save file for you using the name you select.

You will then be able to load your flight and panel state from the P3D 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 P3D to load the **PMDG 737NGX** in exactly the same configuration every time you launch the simulator.

We have included the following panel states for you to use:

NGX_CLDDRK: This is the airplane completely shut down.

NGX_DEFAULT: This is the normal startup state of the airplane with engines running. Note that this state does not need to be selected unless you're trying to go from one of the other states to it.

NGX_LONG: This is the airplane on a long ground turn.

NGX_SHORT: This is the airplane on a short ground turn.

AIRCRAFT SETUP MENUS

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

Before we describe the various changes that you can make, let's first examine the methodology behind how aircraft options are saved.

When using the **PMDG 7373NGX** 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 N804SY, you can do so, saving the information via the AIRCRAFT menu. You might then define a different equipment setup on N805SY 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 737NGX** tracks everything in terms of individual airframes. As you fly N804SY, 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 N804SY.

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!):

NOTE: 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 **<P3D root folder>\PMDG\PMDG 737 NGX\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 737NGX** 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.

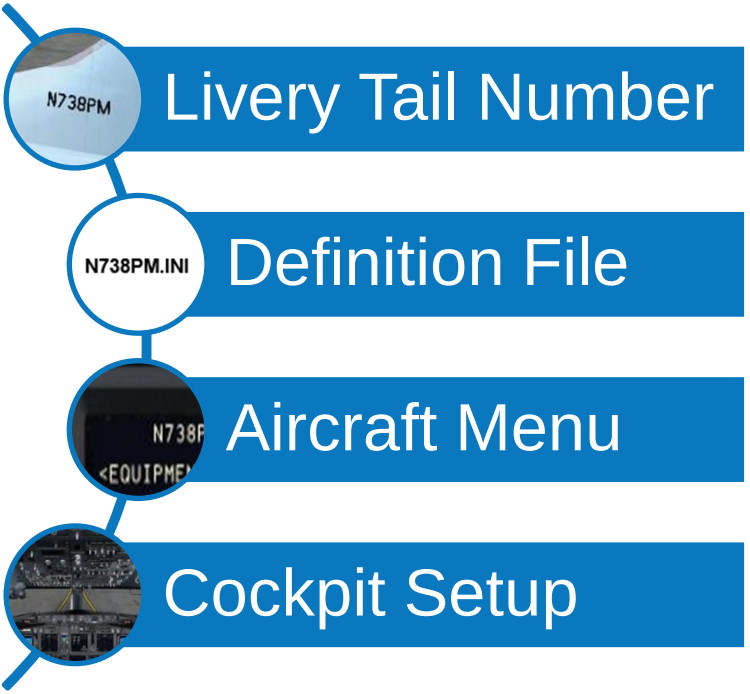
If you make changes to the cockpit layout and save the definition file using the AIRCRAFT menu, those changes will be present in the airplane any time you load that livery.

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 N738PM setting, then manually make changes and save the file as N738PM2.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!

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 P3D scenario screen and then launch the simulator, the **PMDG 737NGX** 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 737NGX** 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 livery's texture directory to the active FMS directory, 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 N738AA 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 N738AA to be used with whatever livery you currently have loaded.

*NOTE: If you switch liveries, you will need to re-select the N738AA definition if that is your wish. Every time you load a livery from the P3D Scenario scree, the **PMDG 737NGX** 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.

There are numerous pages of options available that will allow you to customize the displays in the cockpit of your 737. 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 1/11 – AUTOFLIGHT

- MCP TYPE: Choose between the original Honeywell or newer Collins manufactured autopilot Mode Control Panel.

  Older Honeywell Style MCP:

  Newer Collins Style MCP:

  Conflict Note: "Fail Operational" autoland capability is only compatible with the Collins MCP. It is not compatible with the Honeywell.

- AFTER TAKEOFF – WINGS LEVEL/HEADING SELECT: This option allows you to decide if the airplane will maintain a wings-level attitude, or turn to follow the heading bug immediately after takeoff. Most airlines use the Wings-Level option.

- 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.

PAGE 2/11 – FMS

- FMS DEFAULT ALTITUDES (list of five): This option allows you to customize the default engine out acceleration altitude, default thrust reduction altitude, default thrust cutback altitude, default thrust restore 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.

PAGE 3/11 – INSTRUMENTS

STANDBY INSTRUMENTS: This option allows you to decide what type of standby instrumentation you have installed in your cockpit. The ISFD (Integrated Standby Flight Display) is an electronic, solid state digital display that contains its own backup battery source of power. The analog standby gauges are the traditional "Steam Gauge" format pictured below.

Conflict Note: If you wish to have "Fail Operational" autoland capability, you must have the digital ISFD installed on your flight deck. Fail Operational autoland capability is not possible with the analog standby system, as the analog gauges are not able to provide supplementary pitch/yaw/roll data to the autoland system.

Digital ISFD:

Analog:

- HGS INSTALLED: This option allows you to decide if the Heads Up Guidance System is installed in the flight deck of your 737. The HGS system modeled in the **PMDG 737NGX** is fully functional, fully collimated and provides an incredible improvement in situational awareness during flight.

- HGS AUTO AIII MODE: This option determines whether your HGS includes the Autoland AIII mode for use during instrument approaches. The AIII mode improves pilot situational awareness during low approaches by providing additional information such as the runway outline displayed on the HGS in front of the pilot's eyes during the final phase of an instrument approach.

- HGS GS REF LINE IN PRI: This option allows you to determine whether your HGS installation provides a visual reference to the glide slope in order to simplify flying an instrument approach.

- AUTOLAND: Fail Operational allows for reduction of drift angle during crosswind autoland and provides steering guidance on the runway after touchdown through the rudder servo, thus allowing for CATII-B visibility approaches. Uses a third self-contained inertial reference unit located inside the ISFD (see previous page) and requires the Collins Mode Control Panel.

PAGE 4 – ENGINE

- Engines Double Derate: Allows the reduction of takeoff thrust to that equivalent of the CFM56 engine rated approximately 4,000lbs thrust lower than the engine is actually capable of producing. Hence double derate for the 26,000lb thrust engine results in an N1 takeoff thrust setting corresponding to that of the 22,000lb thrust engine.

PAGE 5 – AIRFRAME

- AIRSTAIRS INSTALLED: Select whether to have the airstairs at door 1L installed and available for use.

- SHORT FIELD PACKAGE: Select whether to have the short-field performance package installed. The short field package provides greater performance capability through a series of aerodynamic improvements, as well as a two position tail skid and increased deflection during ground spoiler operation.

- FLIGHT TEST PACKAGE: We included this package for those who might want enjoy seeing the visual aspects of the standard flight test gear carried aboard an airliner during flight testing. The gear 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.

- BRAKE PACKAGE: Choose between carbon and steel brakes for your 737. Carbon brakes are more expensive to fit than steel brakes, but they last longer. The primary advantage to carbon brakes however, is that you will not get “brake fade” from extremely hot brakes. With steel brakes, as they brakes absorb heat they lose effectiveness. (This is modeled in the NGX)

- ETOPS CARGO FIRE SYSTEM: Boeing offers two cargo fire suppression options for the 737: Single bottle or dual bottle. Obviously the dual bottle system provides greater extinguishing capability than a single bottle system, which is why ETOPS certified aircraft are required to have the dual bottle system.

  Conflict Note: If you elect to have your 737 be ETOPS qualified, you will automatically be given the dual fire bottle system.

- DUAL BATTERY PACKAGE: This is another ETOPS package that you can also select as an option on non ETOPS airplanes. The dual battery system provides a minimum of 1hour of backup battery power to the emergency systems required to safely complete a flight. The single battery airplane will provide at least 30 minutes. It is worth noting that the ETOPS battery system will provide an optimal 1:12 of battery life with normal electrical demand.

  Conflict note: If you elect to have your 737 be ETOPS qualified, you will automatically be given the dual battery package.

- ETOPS: ExTended OPerationS is a regulatory system by which specifically equipped twin engine turbine powered aircraft are allowed to fly extended operations over water or away from suitable landing fields. ETOPS requirements place a number of operational and regulatory compliance mechanisms in place at the operating airline, but the majority are largely transparent to the pilot.

- CABIN LAYOUT: You can use this setting to choose between a single class cabin (all coach) or a two class setup with a mix of first class and coach seating. Your choice here will be reflected in the weight and balance system.

- SECONDARY JUMPSEAT: You can choose whether you will have two cockpit jumpseats, or only one.

- SATCOM ANTENNA: Many airlines are retrofitting their fleets to include onboard internet services for customer use. The airplanes so equipped have a SATCOM antenna mounted on the top of the fuselage. This setting will allow you to choose whether your aircraft has a SATCOM antenna installed, and whether it is located forward or aft on the aircraft structure.

PAGE 7/11 – AIRFRAME

- EYEBROW WINDOWS: Boeing no longer offers eyebrow windows as an option on the 737, and this setting allows you to decide if your airplane has the older style windows, or not.

- YOKE CHECKLISTS: These settings allow you to determine if a checklist appears on the yoke clip of the captain and/or first officer. You can use the yellow marker to keep your place on the checklist if desired.

PAGE 8/11 – EGPWS

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

- 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).

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

PAGE 9/11 – EGPWS

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

PAGE 10/11 – EGPWS

- 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.
- 2500 FEET CALL: 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.
- 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 11/11 – EGPWS

- APPR MINIMUMS CALL: This option selects the aural callout type that plays when approaching your minimum descision altitude on an approach. The airplane can issue no warning, or it can call out “Approaching Minimums” or “Approaching Decision Height” or “Plus Hundred.”
- V1 CALLOUT: Allows you to select the GPWS “V1” callout to ON or OFF.
- BANK ANGLE CALLOUTS: This option allows you to select whether you will hear the bank angle warnings if you exceed prescribed bank angles.
- TERRAIN PEAKS MODE: This setting allows alter the manner in which the Enhanced Ground Proximity Warning System (EGPWS) will display terrain on the navigation display. With peaks

mode active, the terrain display will continue to show you the location and altitude of the highest terrain in the viewable area of the display even if the aircraft is more than 2,000' above the highest terrain conflict based upon standard EGPWS detection logic.

When not in peaks mode, EGPWS will remove display of terrain related information when the airplane is more than 2,000' above the highest terrain in the viewable area based upon standard EGPWS detection logic.

- SHOW 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.

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 737. You can use the PREV PAGE and NEXT PAGE buttons on the CDU to move forward and back through the pages.

The following customization options are available from the DISPLAYS menu: (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!

PAGE 1/9 – DISPLAYS, PFD

- DISPLAYS TYPE: This option allows you to change the format of the displays between the two following layouts. EFIS/MAP was designed to replicate the instrument positions from the 737-300/400/500 classic series to allow pilots at airlines operating both types to fly them simultaneously.

PFD/ND:

EFIS/MAP:

- FLIGHT DIRECTOR TYPE: Select the style of flight director that will be displayed. The dual cue provides independent pitch and roll steering cues, while the single cue flight director provides a single flying wing.

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

- VREF + 20 BUG: Display the associated bug on the PFD speed tape.

- 100 KNOTS BUG: Display the associated bug on the PFD speed tape.

PAGE 2/9 – PFD

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

- PFD/ND NPS: Turn the RNP/ANP navigation performance scale symbology on/off.

- PITCH LIMIT IND POP UP: Allow the display of the stall pitch limit on the PFD when stall awareness is a factor.

- ROUND RAD ALT DIAL: Display the radar altitude readout at the top right corner of the PFD. (Replaces the angle of attack indication if that was previously selected.)

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

PAGE 3/9 – PFD

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

- 2500 FT HEIGHT ALERT: Shows ALT in white on the PFD when at or below 2500 ft until below 500 agl.

- LOW AIRSPEED ALERT: Flashes the PFD airspeed box in amber for 10 seconds when airspeed decreases into the amber minimum maneuver speed bar.

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

- 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 4/9 – EFIS/MAP

- EFIS/MAP ROUND RAD ALT: Allows the radio altitude to be

shown in round dial format when in the EFIS/MAP layout.

- EFIS/MAP 80 KNOT BUG: Display the 80 knot bug on the airspeed indicator in EFIS/MAP mode.

- EFIS/MAP FPV: Display the flight path vector on the attitude indicator while in EFIS/MAP mode.

PAGE 5/9 – ND

- ND TRACK UP: Alternate between a track-up navigation display or a heading-up navigation display. The normal display used throughout the industry is the track-up display as this provides best situational awareness while operating in LNAV.

- VSD: Allow use of the Vertical Situation Display for terrain awareness. (press the CTR switch twice to display it)

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

- SHOW NEXT ALTITUDE CONSTR: Shows the next altitude constraint in the flight plan under the waypoint's name regardless of whether or not the DATA button is pressed.

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

PAGE 6/9 – ND

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

- OTHER TRAFFIC: 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 7/9 – ENG

- ENG SIDE BY SIDE DISP: Changes the layout of the engine display between the normal and side-by-side formats. Note that use of the side by side format will disable the lower engine DU.

Normal

Side by Side

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

- OIL QTY INDICATION: Choose between percent or quarts.

- 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.

PAGE 8/9 – ENG

- MAX CONT THRUST BUGS: Displays the bugs denoting max continuous thrust when appropriate on the engine display.

- SHOW REF N1: Displays the reference N1 on the engine display always, never or only when a derate or assumed temperature is used.

PAGE 9/9 – FUEL/CTRLS

- FUEL LOW ALERT BELOW: Choose the fuel level that triggers the low quantity alert. (1,000lbs or 2,000lbs)

- FUEL TOTAL DISPLAY: Show the round dial fuel display, or the digital fuel totalizer.
- WEIGHT UNITS: Select pounds or kilograms
- FCS INDICATOR: Display the flight control system position indication on the lower display (press the MFD SYS button.)
- BRAKE TEMP INDICATOR: Display the current brake temperature on the lower display (press the MFD SYS button.)

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.

1. <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.

2. <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.

3. <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.

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

Simulation configuration menu:

PAGE 1/3

- 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 737NG type airplane 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.

- 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 over-fly the descent point. You can select the function on/off here as desired.

- 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 STBY BARO: Same as the above option, only it relates to setting the standby altimeter's barometer setting.

- <IRS OPTIONS: The IRS Options sub menu provides you with some 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.

PAGE 2/3

- SET P3D LOC CRS: When it comes to navigation data, P3D 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 P3D 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 P3D hard-coded information. (The airplane cannot fly the localizer properly if the CRS knob is set incorrectly.) To compensate for this, we recommend setting this option to ON, and we will read the appropriate P3D 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 CMD button, refer back to this paragraph as a refresher!

  Remember, if you have this option set to ON, you should be certain that the airplane is trimmed, the flight director is centered and you are not operating the electric trim at the time you press the autopilot CMD button.

- SHOW THRUST LEVER POS: When the airplane is being flown using auto-throttle, 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 engine display unit. The cyan mark is showing you the current 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.

- 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 or ARM mode. You can realistically simulate this by select the <IN HOLD/ARM 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/ARM MODE ONLY, as this is the most realistic mode.

  NOTE: If the autothrottle is in HOLD or ARM 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.

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

- 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.

- PILOTS IN EXT VIEW: You can remove the pilots from the cockpit (such as when parked at the terminal!) by using this toggle setting.

IRS OPTIONS sub-menu:

Under the SIMULATION menu (page 1) there is an IRS OPTIONS sub-menu 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 POS: A modern IRS/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 737NGX.** 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 really give you the best performance for your machine!

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.

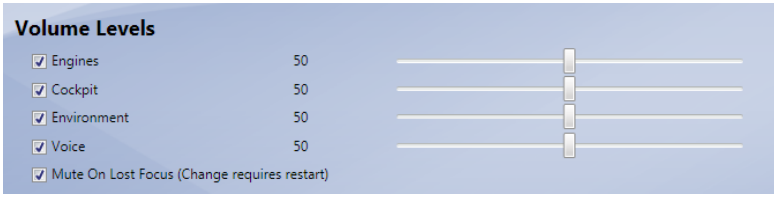
You can assign key commands to functions within the cockpit by locating the desired switch from the list of functions presented in the KEY COMMANDS menu. (The available assignments are broken into categories under the KEY COMMANDS menu.)

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.

Sound options:

During production of the **PMDG 737NGX** we have 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 P3D sound settings and verify that they are set as shown here:



Mute On Lost Focus can be set on or off according to personal preference.

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

The MASTER VOLUME should be set to 50, as this provides the best balance for the vast majority of user systems. We have balanced the cockpit sounds for the NGX based on having this setting at 50.

If you would like to adjust individual channels of sound, you can do so by entering the <ADJUST menu. You will be presented with a series of options that will allow you to set the sound volume levels for various sounds components, allowing you to achieve a balance that works best for you based upon your own 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 737NG type airplane.

You use the PLAY IN EXT VIEW toggle to determine if cockpit sounds will be played while you are in an external view. The default is “NO.”

If you have multiple sound devices attached to your computer, you can choose between them using the DEVICE selector in this menu.

FAILURES AND MAINTENANCE

Introduction: With the introduction of the **PMDG 737NGX** 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 737NGX** 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 737 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 sytems 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:

APU: (2)

- APU Bleed Air
- APU Severe

Automatic Flight: (4)

- Autothrottle
- Flight Control Channel A
- Flight Control Channel B
- Autoflight System

Doors: (7)

- Air Stair Hatch
- Forward Cargo Door
- Aft Cargo Door
- Door 1L
- Door 1R
- Door 2L
- Door 2R

Note: Door failures can manifest either as indication problems or as an actual failure of the door seal with associated impact on the pressurization capability of the airplane. The QRH will help you to determine exactly which you are dealing with.

Electrical: (29)

- Integrated Drive Generator 1
- Integrated Drive Generator 2
- IDG 1 Drive
- IDG 2 Drive
- APU Generator
- Main Battery
- Main Battery Charger
- Aux Battery
- Aux Battery Charger
- Static Inverter
- Transformer Rectifier 1
- Transformer Rectifier 2
- Transformer Rectifier 3
- AC Transfer Bus 1

- AC Transfer Bus 2
- AC Main Bus 1
- AC Main Bus 2
- AC Galley Bus 1
- AC Galley Bus 2
- AC Standby Bus
- AC Ground Service Bus 1
- AC Ground Service Bus 2
- DC Bus 1
- DC Bus 2
- DC Standby Bus
- DC Ground Service Bus
- DC Hot Battery Bus
- DC Hot Battery Bus Switched
- DC Battery Bus

Note: Failure of any electrical bus will cause equipment assigned to that bus to fail. Additionally, failure of any generating or backup power capability will have a realistic impact in terms of load shedding behavior and equipment sustainability. Survival loads supported by the standby electrical system will accurately deplete power from the battery/ies providing a realistic timeframe for standby power support.

Engines: (24)

- Electronic Engine Computer 1
- Electronic Engine Computer 2
- Engine 1 Severe Damage
- Engine 2 Severe Damage
- Engine 1 Flame-Out
- Engine 2 Flame-Out
- Engine 1 EGT Exceedance
- Engine 2 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 V1-Cut
- Engine 2 V1-Cut

- Engine 1 Vr-Cut
- Engine 2 Vr-Cut
- Engine 1 V2-Cut
- Engine 2 V2-Cut
- Engine 1 Reverser
- Engine 2 Reverser

Fire: (7)

- Engine 1 Cowl Overheat
- Engine 2 Cowl Overheat
- Engine 1 Fire

- Engine 2 Fire
- APU Fire
- Forward Cargo Fire
- Aft Cargo Fire

Note: Failure to handle engine fire events can have follow-on consequences.

Fire Protection Systems: (22)

- Engine 1 Fire Loop A
- Engine 2 Fire Loop A
- Engine 1 Fire Loop B
- Engine 2 Fire Loop B
- APU Fire Detection System
- Forward Cargo Fire Loop A
- Aft Cargo Fire Loop A
- Forward Cargo Fire Loop B
- Aft Cargo Fire Loop B
- Wheel Well Fire Detection Loop
- Bottle 1 Squib Left
- Bottle 1 Squib Right
- Bottle 2 Squib Left
- Bottle 2 Squib Right
- APU Bottle Squib
- Cargo Bottle Squib Forward
- Cargo Bottle Squib Aft
- Left Engine Fire Bottle Discharged
- Right Engine Fire Bottle Discharged
- APU Fire Bottle Discharged
- Cargo Fire Bottle 1 Discharged

- Cargo Fire Bottle 2 Discharged

Flight Instruments: (10)

- Display Unit Left Outboard (Captain's PFD)
- Display Unit Left Inboard (Captain's ND)
- Display Unit Upper (Engine Display)
- Display Unit Lower (Lower Center Display)
- Display Unit Right Inboard (FO's ND)
- Display Unit Right Outboard (FO's PFD)
- DEU 1
- DEU 2
- Standby ADI
- RMI

Fuel: (12)

- Left Forward Fuel Pump
- Left Aft Fuel Pump
- Center Left Fuel Pump
- Center Right Fuel Pump
- Right Forward Fuel Pump
- Right Aft Fuel Pump
- Fuel Leak
- Crossfeed Valve
- Left Spar Valve
- Right Spar Valve
- Left Engine Valve
- Right Engine Valve

Note: The location of a fuel leak will be random, requiring the crew to use the QRH procedure to identify and resolve the leak.

Hydraulics: (15)

- Engine Driven Pump (EDP) 1
- Engine Driven Pump (EDP) 2
- Electric Motor Driven Pump (EMDP) A
- Electric Motor Driven Pump (EMDP) B
- Standby Hydraulic Pump
- Engine Driven Pump (EDP) 1 Leak
- Engine Driven Pump (EDP) 2 Leak
- Electric Motor Driven Pump (EMDP) A Leak
- Electric Motor Driven Pump (EMDP) B Leak
- Standby Hydraulic Leak

- Electric Motor Driven Pump A Overheat
- Electric Motor Driven Pump B Overheat
- A SYS Quantity Refill Required
- B SYS Quantity Refill Required
- Standby System Quantity Refill Required

Ice/Rain Protection: (20)

- Captain's Pitot Heat
- Left Elevator Pitot Heat
- Left Alpha Vane Heat
- Temp Probe Heat
- Left Wing Anti Ice Valve
- Left Engine Anti Ice Valve
- Left Side Window Heat
- Left Front Window Heat
- Left Side Window Overheat
- Left Front Window Overheat
- FO Pitot Heat
- Right Elevator Pitot Heat
- Right Alpha Vane Heat
- Aux Pitot Heat
- Right Wing Anti Ice Valve
- Right Engine Anti Ice Valve
- Right Side Window Heat
- Right Front Window Heat
- Right Side Window Overheat
- Right Front Window Overheat

Miscellaneous: (10)

- Transponder 1
- Transponder 2
- TCAS System
- Terrain Detection System Fail
- Integrated Standby Flight Display
- Left Clock Fail
- Right Clock Fail
- Brake Overheat Cooling
- Brakes Failed
- Nose Tire Balance

Note: Brake Overheat Cooling allows the user to reset normal brake temperatures after a brake overheat event. It is not possible to overheat the brakes without appropriate pilot braking action.

Note 2: Nose tire imbalance can be caused by excessive wear on the nose gear tires, or by touching down nose wheel first. If you hear a very loud (and annoying!) rattle as the nose lifts off during takeoff, you likely need to service the nose tires!)

Navigation: (19)

- Flight Management Computer Left
- Flight Management Computer Right
- Inertial Reference System Left
- Inertial Reference System Right
- Inertial Reference System Display Unit
- GPS Left
- GPS Right
- Computer Display Unit Left
- Computer Display Unit Right
- ILS Left
- ILS Right
- VOR Left
- VOR Right
- DME Left
- DME Right
- ADF Left
- ADF Right
- Radio Altimeter Left
- Radio Altimeter Right

Pneumatic: (12)

- Engine 1 Bleed Over Temp
- Engine 2 Bleed Over Temp
- Engine 1 Bleed Over Pressure
- Engine 2 Bleed Over Pressure
- APU Bleed Valve
- Engine 1 Bleed PRSO Valve
- Engine 2 Bleed PRSO Valve
- Left Bleed Duct Leak
- Right Bleed Duct Leak
- Isolation Valve
- Left 9th Stage Bleed Valve
- Right 9th Stage Bleed Valve

Pressurization: (2)

- Pressure Hull Integrity
- Pax Oxygen Masks Deployed

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 737NGX** section at the end of this chapter. You will learn some interesting things about the simulation you are about to fly!

FS ACTIONS MENU SYSTEM

Introduction:

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, GROUND CONNECTIONS, DOORS, CABIN LIGHTING and PUSHBACK functionality.

Fuel menu:

From the FUEL menu you are able to manually set the fuel quantity in each tank. Conversely you can use the preset level functions on the lower right side of the display to set the tanks to FULL, 2/3 or 1/3 levels or you can set the total fuel quantity as a percentage.

To change the fuel level in an individual tank, simply up-select the desired quantity to the desired tank. The fuel quantity will *not* be loaded according to proper loading practices when you manually set the fuel quantity to each individual tank.

To set the fuel quantity percentage, simply up-select the desired percentage to the TOTAL LEVEL line. The simulator will automatically distribute the fuel quantity properly between the tanks.

On this menu the current gross weight, CG location, Zero Fuel Weight and Max Takeoff Weight is 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 up-selecting the number of passengers seated in the First and Coach class cabins (or only the coach class cabin if using a single class configuration.)

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 load factor.

On this menu the current gross weight, CG location, Zero Fuel Weight and Max Takeoff Weight is displayed for your convenience.

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.

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 and close the doors from this menu. You can also extend the air stair from this menu. Additionally you can open the overwing exits as needed.

NOTE: For air-stair equipped aircraft, you must close door 1L before you can retract the stairs into the airplane.

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 comms only during pushback, a combination of voice and text, or text only via the P3D adventure text process.

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.

GETTING THE MOST FROM YOUR PMDG 737NGX

Introduction:

We have collected a few pointers to help you get started with the **PMDG 737NGX**. 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!

Main Panel View – Virtual Cockpit: We have put a significant amount of work into creating the richest virtual cockpit environment possible for the **PMDG 737NGX** user. To get the most use from the cockpit during takeoff, flight and landing, we recommend that you enter the cockpit and while in the captain's view set the zoom factor to 0.60. You should then adjust the pitch of your view (hold down the space bar and move your mouse) until the bottom of the displays rest neatly along the bottom of your display monitor. This will give you a view that closely approximates the following:

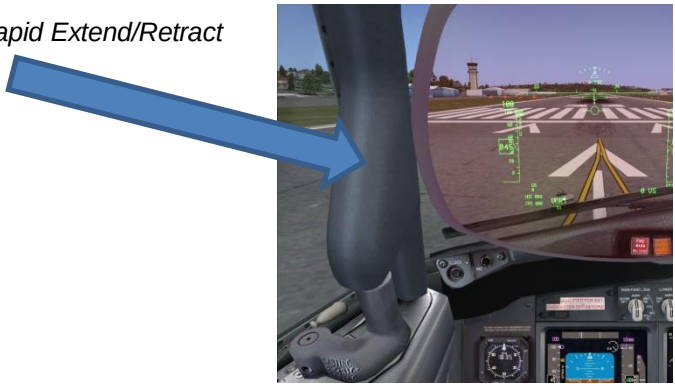
You will notice that this view configuration gives you a clear view of the captain's displays, as well as the main engine instruments.

Working with the Heads-Up-Display:

In order to create a fully collimated heads-up-display combiner glass, while also using the popular technique of creating landing light illumination, we had to make a few compromises that are important for you to know:

You cannot click "through" the combiner glass. In order to click on something that is located behind the combiner, it is necessary to retract the glass momentarily when accessing the switches located behind the glass. To make this easy, we have created an easy-to-use click spot to move the combiner quickly and easily. The click spot is located on the left post of the forward captain's window.

Combiner Rapid Extend/Retract Click-Spot:



Pilot's Head Position Changes Slightly In Turns:

While creating the collimated heads-up-guidance system, we have noticed that the head position within the cockpit changes slightly depending on the heading of the airplane. This is normal for P3D and will not negatively impact your ability to use the heads-up-guidance system because we have taken the time and effort to provide you with a collimated display.

Sometimes the Heads-Up Projector blocks view of the overhead panel:

When sitting in the captain's seat the casing around the heads-up-guidance system projector can block parts of your view of the overhead panel. To minimize the impact, we have put a click spot on the projector housing that will allow you to reduce the size of the projector in order to free up your view of the overhead panel.

Occasional Artifact Conflicts between combiner image and panel:

As part of our work to provide you with a realistic, fully collimated heads-up-display, we have had to accept a few minor artifacts that will occasionally take place between the top of the glare shield and the combiner image. You will also notice at night when the landing lights are on that the windshield wiper will show subtle signs of illumination. These are artifacts that we chose to accept within the simulation in order to provide our customers with the best balance of having a full collimated heads up display while also having the popular exterior illumination capability of custom volumetric landing lights.

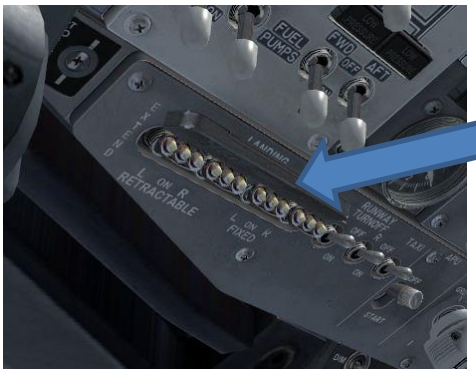
Discoloration viewing through the combiner screen:

During previews of this product some customers wondered about the tint of color seen through the combiner glass. This is a realistic visual artifact that you would see while sitting in the real airplane and we have preserved this tint in the **PMDG 737NGX**.

Using the landing lights gang-bar:

The Boeing 737 has four landing light switches to activate the fixed and retractable landing lights. To simplify the activation of these lights, Boeing saw fit to install a “gang-bar” that allows you to throw all four lights on with a single effort.

You can use the Gang-Bar to extend the lending lights in the **PMDG 737NGX** by left clicking anywhere on the Gang-Bar.



Landing Lights Gang Bar

We have added some additional functionally by allowing you to right click on the Gang-Bar to turn all four landing lights off in a single click. The Gang-Bar does not operate this way in the airplane, obviously, but we thought this additional bit of convenience made sense to incorporate.

Retractable yoke:

The yoke size, scale and position relative to the pilot view is accurate in the **PMDG 737NGX.** This is why you can clearly read the displays over the top of the yoke while flying. (A factor commonly missed in add-on airplanes.)

One of the limitations that the P3D 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 P3D:

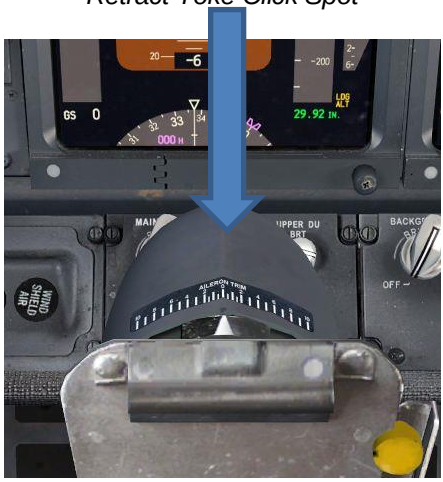
http://www.naturalpoint.com

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-site to the FMS keyboard from the normal head position.

You can retract the yoke by simply clicking on the top of the yoke column.

Retract Yoke Click Spot



Alternate TO/GA click spot:

When flying the airplane, the TO/GA button is 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 737 throttle column to use with our P3D 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. Clicking on this location in the 2D or VC will give you full TO/GA functionality.

TO/GA Alternate Click Spot

Keyboard Direct Entry for 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 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-F12) to simulate the 1L -6R line select keys.

P3D VIEW SYSTEM AND THE PMDG 737NGX

Internal P3D camera:

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.

We should note also that we have pre-positioned the CAPTAIN and FIRST OFFICER viewpoints so that they are correctly located according to the “Eye Position” requirements established by Boeing in the flight manual.

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

1) Cockpit Views
   a) VC Captain’s Position.
   b) VC First Officer’s Position
   c) VC Aft Overhead Panel
   d) VC Lower Overhead Panel
2) Spot View (scroll though user selectable options using “A” key.)
3) Tower View (Scroll through user selectable options using “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

Overview:

In the process of developing this highly sophisticated simulation, it became apparent to us that many of the default 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 functionality.

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

- Autopilot Functions
- Engine Performance Model
- All Mechanical Subsystems

Limiting our dependence upon the simulator has allowed us to use it as 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 8x to ensure proper autopilot function.
- Time Acceleration should be limited to 8x 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 8x, so we have not tuned the autopilot or fuel system for operation at acceleration rates faster than 8x.)

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 add-on aircraft use the erroneous concept of placing the model's reference point in 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 visual models:

The **PMDG 737NGX** has more than 1000 animated parts. With the exception of a few basic functions, all part animations are controlled by PMDG's internal simulation operation and are not controlled by P3D. If you attempt to replace the **PMDG 737NGX** visual model with a non PMDG model, you will lose nearly all animation and function for the external model.

Hardware toe brakes users:

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 P3D 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:

Flightplan .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 were inserting nonsensical terminal procedure data that would 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 737NGX

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 737NG 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 737NGX** that are simulated precisely as they appear in the actual airplane:

Anti-ice system:

- During ground turns in areas with high temperatures, you may notice the window heaters cycling off/on to maintain window heat target temperature. You may also notice that the windows require no heat at all to maintain the target surface temperature. This requires you to use the WINDOW HEAT TEST switch as a confidence test that the heaters are actually working.

- An engine anti-ice OVERPRESSURE warning lets you know that the pressure inside the ring cowl on the respective engine is too high. Follow the QRH to resolve the problem, but also take a look at the engine in the external view as the high pressure blow-out duct will be visible, allowing excess pressure to vent overboard.

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.

- Forward cabin zone temperature changes if forward doors are open and ambient OAT is significantly different than cabin temp.

Auto-flight system:

- While any autopilot is engaged in CMD mode, yanking at the controls really hard will result in "breaking" the controller shear rivets (real value 110lbs of force) and destroy the onside FCC (flight control center). The associated autopilot cannot be re-engaged.

- If the "realistic autopilot engagement" option is active the autopilot will not engage in CMD mode unless the aircraft is in trim, control deflection is minimum, attitude is within certain margins of the flight director commands and the elevator trim is not pressed.

- TOGA requires **BOTH** flight directors ON. TOGA also engages if BOTH flight directors are OFF and IAS > 80 knots and at less than 2000' and within 150 seconds from lift off. *(The key word here is **BOTH**)*

- If the IRS transfer switch is not in the center position no AP can be engaged but the flight director will work for basic lateral/vertical modes. The auto-flight system is relying heavily on ADIRU (with IRS at the heart of it) to supply pitch, yaw and roll data. There two autopilots and two flight directors modeled. The onside IRS provides data related to pitch and direction, while the offside IRS provides roll and bank data. If no IRS unit is at least in ATT mode, CMD will disconnect and never reengage regardless of the IRS XFER switch. Track based lateral modes (LNAV and VOR/LOC) require the onside IRS to be in NAV else upon mode selection or IRS malfunction the AP will revert to base mode (CWS_L).

- The AFS requires uninterrupted electrical power from both the onside DC BUS and the onside AC transfer bus. If AC power is lost for more than 0.5 seconds then within 40 milliseconds the AP will disconnect. At more than 7 seconds AC power failure the FD will also cease to operate. Subsequently AP/FD cannot be reengaged unless electrical power is restored. If the onside AC XFER BUS switches source side due to a failure but remains powered the AP will only temporarily disconnect and can be reengaged.

- When you press a CMD/CWS button the AP will not engage

instantly but with a small time delay necessary to pressurize the FCC hydraulic actuators. If you eventually switch CMD sides (e.g. CMA A to CMD B) then the new side will engage with a slightly greater delay: the system needs to pressurize the recently selected side AND depressurize the old side.

- Near the low speed buffet limit and eventually stall the aircraft will try its best to recover. Increase thrust (AT active), switch to LVL CHG (if the vertical mode is appropriate), flash the MCP speed indication, trim down automatically, extend slats and finally activating the elevator shift module (EFSM) in manual flight to add extra pressure to the control column when pulled back.

- The auto-throttle system requires either DC BUS 1 or DC BUS 2 to be powered, the thrust difference between the two engines to be less than 2000lbs, at least one IRS in NAV when in SPD mode, the stall management yaw damper system powered and operational and reversers locked. Otherwise the AT will disconnect. The AT will automatically drive the throttles to IDLE position during auto-land when radio altimeter less than 24 feet or not in auto-land and flaps equal or greater to 15 degrees and radio altimeter less than 27 feet. After landing the AT will disconnect after 2 seconds.

- The VOR roll mode comprises 4 sub-modes : arming, capturing, on-course and over-the-station (OSS). VOR capturing requires beam deviation less than 22 degrees and at least 3 seconds to have elapsed since the last OBS change. Capture will occur instantly when within 0.5 degrees deviation or within 2 degrees for at least 10 seconds or through FCC calculations of the capture point. The OSS mode is triggered by measuring the beam divergence rate and in cases where DME is collocated with the VOR station a combination of altitude and distance. The OSS mode can last up to 23 seconds and ensures stable crossing or turning over the VOR station or in the "confusion zone".

Doors:

- Transient warning for the over-wing exits is possible due to an occasional slow latching mechanism on the over-wing hatch locks. The indication is transient and can be ignored provided that it extinguishes almost immediately. You will see the indication as a transient illumination of the Master Caution from

the captain's perspective, but if flying from the first officer's perspective you will also see the DOORS caption illuminate.

- 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 the Quick Reference Handbook procedure carefully to avoid aircraft damage or loss of pressurization.

Electrical system:

- You can choose between a single battery and dual battery airplane. If you select an ETOPS configured airplane you will be given the two battery configuration.

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

- The Generator Control Breakers require various sources of DC power to operate. Thus, if you fail certain DC Busses, you may not be able to reconnect a specific generator to the system.

- You can run a realistic BITE test on the electrical system by setting both selectors to TEST then pressing the MAINT button.

- The **PMDG 737NGX** 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 the demand you see on the overhead electrical meter is an accurate reflection of power consumption by the airplane. When turning high power consuming devices such as electrical hydraulic pumps or recirculation fans on/off, you will see the electrical demand change reflected in the number of amps the generators are producing.

- The **PMDG 737NGX** has an accurate load shedding model. If amperage demand is too high for a source of electrical power, the load shed management system will reduce power load to protect the producer from over-demand.

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 QRH to resolve them effectively. The QRH will help you to identify and deal with the failure you are seeing, provided that you follow the steps described in the procedure.

Fire controls – cargo:

- Bottles and Squibs are tracked. If you fire the cargo fire bottle, it is expended...

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

- If a fault exists in the cargo fire detection loops, misconfiguration of the detection system is possible by the crew, causing cargo fires to go undetected.

- When a cargo fire is detected, the pressurization controller will begin forcing the cabin down at 750'/min without crew interaction.

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 QRH to find out.

- If a fault exists in the engine/APU fire detection system,

misconfiguration of the detection system is possible by the crew, causing an overheat/fire to go undetected.

Flight controls:

- Spoiler DO NOT ARM light illuminates at <60 knots wheel speed. This is normal for the NG.

- Electric Trim operates at realistic speeds. The electric trim is shockingly SLOW compared to all sim airplanes except for the PMDG MD-11. 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.

- Speed trim will operate automatically during manual flight and particularly right after takeoff. You will find the FCC trimming the plane automatically, sometimes against your manual input to the control column. The speed trim input is higher at low IAS, high N1 and flaps down. If you press the electric trim button the system will resume after 5 seconds.

- Rudder trim deflects your rudder (see your pedals in the VC) and aileron trim deflects your control wheel. In general all control inputs are intercepted before they reach the sim-engine and filtered/interpreted as appropriate. When required, variable control "weight" is added. For example, if you lose hydraulic pressure flying will become extremely difficult.

- You can see the effect of Mach trim when crossing the Mach 0.615 boundary in the external model (watch the elevator neutral shift point change).

- Trailing edge flap deployment speed is affected by hydraulic pump flow rates. The engine drive pumps move fluid at ~37gpm, while the electric motor driven pump only produces ~5gpm. This being the case, if you move the trailing edge flaps with only the EMDP running, you will notice that they move significantly more slowly than if the EDP is in operation. Keep this in mind when planning your approach with the right engine inoperative. Moving the trailing edge flaps is going to take more time than normal!

- Similar to above, when the trailing edge flaps are moved using the ALTERNATE flap system, they are EXTREMELY slow. (2:39 to deploy full range.)

- 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:

- You cannot enter a cruise altitude less than the highest altitude restriction. In case of a CLIMB restriction the altitude entry shall be rejected with an ALT CONTRAINT AT XXXXX CDU message (where XXXXX is the climb restricted waypoint). In the case of a DESCEND restriction the cruise altitude will automatically be increased to the highest altitude restriction with a CRZ ALT CHANGED TO YYYYY CDU message (where YYYYY is the altitude of the restriction)

- You cannot enter an altitude restriction or a procedure containing altitude restrictions higher than an entered cruise altitude.

- The FMC assumes that a monotonic climb and descend path geometry is entered, i.e. during climb the plane shall be accelerating and increasing altitude and during descend altitude and speed restrictions are in decreasing order (with possible temporary level offs). However, while altitude monotonicity is enforced, irrational speed restrictions ARE allowed. CAUTION: The FMC will ignore such speed entries and only issue a CDU warning when flying towards that particular waypoint if computed VNAV IAS target difference is greater than 10 knots.

- Your flight path is very much dependent on entered wind and temperature/ISA deviation forecast data. In flight the aircraft will perform advanced interpolation and "wind mixing" between actual and pilot entered data to obtain the final value used in calculations.

- The FMC will automatically limit the speed commanded by VNAV (when SPD INTV is not active) to no more than Vmo - 5 and

MMo - 0.01 in climb and cruise and VMO - 10 and Mmo - 10 in descend. If flaps or gear are extended then the limiting speed is placard speed -5 knots. Furthermore if leading edge devices are extended then speed is limited to the minimum of placard speed - 5 and 230 KIAS.

- Interestingly if any CRZ phase target Mach is lower than 0.6 then, while the FMC internally operates in Mach mode, all related predictions in the CDU LEGS page and AFS VNAV targets are shown in IAS.

- A cost index entry is mandatory for FMC vertical path calculations. However, a constant cost index does **not** imply a constant CRZ Mach number.

- Soft speed restrictions entries are allowed and honored if not violating monotonic path (see above) i.e. entering 180B/ or 230A/ and uploading to a WPT.

Fuel system:

- Engine Valves and Spar Valves have emergency power packs attached to the valve actuator unit. These serve as emergency backup power to close the fuel shutoff in an emergency if no other source of power is available, and explains why you can still actuate those valves even if their primary source of power is offline.

- FMS Fuel quantity will read slightly more fuel than the FQIS. This is an airplane idiosyncratic behavior.

- Center Wing Tank fuel quantity measuring system capacitance error modeled in the Center Wing Tank. The quantity will vary accurately during climbs/descents. This is an airplane idiosyncratic behavior.

Hydraulic system:

- Violating operating limitations on the Electric Motor Driven Pumps (EMDPs) 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 A or B 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 EMDP's 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.
- In the event you lose engine #1 on takeoff, the A system EMDP cannot provide enough pressure to raise the gear quickly enough to satisfy second stage climb requirements. As such, the Landing Gear Transfer Unit will provide pressure from the B hydraulic system to get the gear up normally.
- Cycling the landing gear in the condition described above will cause fluid transfer between the B and A system and could cause a significant loss of fluid to the B system, with excess fluid being dumped overboard from the A system. This will result in a net loss of hydraulic fluid that must be replenished by maintenance! You will see this fluid loss displayed on the hydraulic quantity indication.

- Fluid can be passed from the B system to the A system through the thrust reverser shuttle valve on the Left thrust reverser. If the standby hydraulic system is used to actuate the #1 reverser, it pulls fluid from the standby system to open the reverser but returns that fluid to the A system when the reverser is later stowed. Since the Standby system and the B system are connected by a standpipe, you will most often see this fluid loss appear as a drop in fluid quantity on the B system, but as an increase on the A side. (The percentage lost/gained will vary between the two systems since they are of different sizes!) This fluid transfer behavior is only true up to a point, however… If the B system drops below the standpipe, then you can run the standby hydraulic reservoir dry through actuating the reverser. This is probably not a good idea...
- The normal brake system operates of the B system hydraulics. If that side is depressurized, then the alternate source for parking brake fluid is the A system... If the parking brake is then released, the fluid always returns to the B system, resulting in fluid transfer between the two systems.
- When shutting down an engine, you generally leave the EDP pump switches ON. In this configuration it is not uncommon to see fluid get trapped in the hydraulic pressure line downstream of the EDP, thus causing a delayed indication of low pump output pressure on the overhead panel. This is normal and correctly modeled behavior. It is caused by the location of the EDP output pressure sensors in the hydraulic system.
- The standby Hydraulic pump can be activated in three ways, one of which requires wheel speed input from the antiskid system. Thus, if the antiskid is inop, you won't have the standby pump system available until the airplane is airborne. (See the standby hydraulic system description in the manual for more details on this vital backup system...)
- The Electric Motor Driven Pumps are HUGE power consumers (7.824 amps each) when working in normal operation. In the event the same-side Engine driven hydraulic pump fails however, the EMDP must carry a larger share of the hydraulic pressure load and as a result the pump consumes 4.3 amps more, for a total of 12.124 amps. This power consumption is reflected on the electrical meter on the overhead panel, and can have consequences for load shedding if operating on a single engine/generator combination.

Landing gear:

- Carbon and Steel brakes will absorb and dissipate energy differently. Steel brakes are subject to high temperature brake fade, while the carbon brakes are not.
- 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 QRH if you get a wheel well fire indication!

Lighting system:

- The diagram used to determine the power source for every bulb on the flight deck takes up 212 standard sized print pages.
- To get the proper strobe timing, it was necessary to pull a number from the parts manual and contact the part manufacturer. As a result, the NGX strobes are correctly timed.

Pneumatic system:

- The bleed pressure produced by each engine is directly computed based upon the engine RPM and whether the engine is using the low pressure 5th stage bleed or the high pressure 9th stage bleed as the source of bleed air. The resulting bleed pressure production for each engine is highly accurate.
- High RPM without any bleed consumers (such as the air conditioning packs) will cause a bleed overpressure condition and BLEED TRIP OFF. Follow the QRH procedure to alleviate this condition.
- Unattended bleed duct leaks have the potential to create leaks in either the hydraulic EDP supply or pressure lines OR the case fluid drain lines- resulting in fluid loss or outright pump seizure.
- Duct pressure indication shows the effects of variable stage bleed source changing from low to high pressure stages in the engine during spool-down. As the engine RPM falls, the bleed system will switch from the low pressure 5th stage bleed valve to the high pressure 9th stage bleed valve. You will see this effect appear as a "bounce" in pressure as the valves switch. The reverse effect can be seen on spool up, but it is far less obvious.

- The amount of bleed pressure you receive from an air start cart will vary based on outside temperature, and airport altitude.
- Bleed pressure is heavily affected by consumption. If you have insufficient pressure to start an engine, consider shutting down the air conditioning packs.

Sounds:

- This package uses 521 digitally recorded sounds to replicate the living, breathing work environment of a 737 pilot.
- While in 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 have recorded sounds for nearly every switch on the flight deck, and then linked these sounds in such a way as to ensure that they are synchronized to switch movements whether fast or slow.
- Some mechanical systems on the airplane can be faintly heard from the flight deck (wing fuel pumps and 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.
- The airflow sound into the cockpit of the NG is easily the greatest contributor to noise. The sound volume you will experience is directly related to the amount of airflow being provided by packs and recirc fans. (HINT: You can greatly reduce the cockpit noise level by turning the recirc fan off in the 600/700 and the right recirc fan off in the 800/900.)