PMDG 737NGX

Tutorial #1

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INTRODUCTION

Welcome to the first tutorial flight for the **PMDG 737NGX**! You've purchased one of the most advanced simulations of a commercial jetliner currently available for the Prepar3D platform – now it's time to learn to fly it!

We've decided to take a slightly different course with the **PMDG 737NGX's** tutorial flights compared to what we've done in the past. Instead of trying to do a single all-encompassing tutorial that contains every detailed procedure and test that a real world crew would perform in the airplane, we're going to start with a simpler introductory flight. The **PMDG 737NGX** is an extremely deep simulation and you'll still be discovering new things with it years down the road, but for now we want to get you up and flying right away.

We're aware many simmers just want to load the airplane on the runway, program a route and go fly – that's what this first tutorial is all about. We're not going to be following the exact normal procedures and flows from the *Flight Crew Operating Manual Vol. 1 (FCOM Vol.1)* that a real life crew would do. This is distilled down to the basic steps you'll need to take ensure correct setup of the FMC and operation of the airplane in flight. You'll be able to have virtually any NG route programmed and be in the air within about 5 minutes using these methods provided you start on the runway with the engines running.

This tutorial document seems long but much of it is supplementary explanations and screenshots. We think it's very important to not only understand *what* to do when operating the airplane but also *why* you're doing it.

The actual procedures don't take much time at all once you're comfortable with them and have them internalized. At the end of this flight, we'll start easing you into more detailed procedures by going through a bonus full shutdown and securing procedure to prepare for the more advanced Tutorial #2 flight, which will pick up right where this one leaves off.

The second flight covers all of the cold & dark startup procedures and contains a more complicated route, advanced FMC use, and a very challenging descent and approach.

OVERVIEW

Our first flight today takes us from **EGKK - London Gatwick, England** to **EHAM - Amsterdam Schiphol, The Netherlands**. This is a common regional route and will take a little over an hour to fly.

We'll be taking off from Runway 08R and joining the Clacton Five Papa (CLN5P) departure. We'll then follow a short series of airway waypoints until we join the REDFA1A arrival and the ILS for Runway 18R into Schiphol.

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

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

If you have not read the P3D SETUP and INTERACTING WITH THE PMDG 737NGX sections of the Introduction Manual, please make sure you do so before proceeding. The sim needs to be properly configured for the airplane to function correctly and it is assumed that you understand the PMDG clickspot and mouse button methodology in general before proceeding. This tutorial also assumes the use of the default **PMDG 737NGX** aircraft configuration as far as options go – if you have changed them, please reset them to defaults on the MENU/PMDG SETUP/AIRCRAFT page.

P3D SETUP

Let's get right into it!

- Start P3D and navigate to the Create Scenario screen (Flights, Create Scenario) if it is not up by default.

There is no need to first load a default aircraft, or use any sort of custom saved flight when loading the **PMDG 737NGX**. Our programming sets up the sim environment properly as the aircraft is loading. You can safely load the airplane straight from Create Scenario and it will load up with the engines running and ready to fly after a brief self-configuration period. The default flight in P3D does need to be one of the P3D default aircraft like the F-35 however. Do not use the 737 or any other complex addon aircraft as your default or you will likely have problems loading the 737.

Selecting the aircraft:

- Click Change under Selected Vehicle.
- If it's set, uncheck the "Show Only Favorites" box. This will allow you to see all the aircraft and liveries you have installed. If it's checked you may not see the **PMDG 737NGX** at all. You may mark it as a favorite and recheck this box, however.
- Select PMDG from the Publisher drop down menu and select the "Boeing 737-800NGX PMDG House Winglet" aircraft.

  It is important that you select the House Livery and not an airline livery for the purposes of this tutorial so that the aircraft options are set correctly.
- If this is your first loading of the aircraft you'll need to enter your license key and authorize the gauges as outlined in the Introduction manual.
- Press OK.

Selecting the airport:

- Click Change Airport under Selected Location.
- Type EGKK into the By Airport ID field. Verify Gatwick is highlighted in the list.

- Select 8R from the Starting Location drop down.
- Press OK.

Setting the time of day:

- Change the time under Selected Time and Season
- Set the Local time field to 09:00:00, which is 9:00AM. (ensure that the GMT Time box is unchecked).

Setting the weather:

- Change the weather under Selected Weather.
- Select the “Clear Skies” preset and press OK.

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

An important note regarding fuel and payload:

Unlike the default aircraft or other addons you may be used to, the **PMDG 737NGX** does not load fuel or payload via the Fuel and Payload dialog in the P3D interface, either at the Select Vehicle screen or while in the sim via the menu. We have created our own custom fuel and payload systems inside the FMC that intelligently load and unload fuel and payload according to actual weight and balance practices used by 737NG operators. You’ll always load fuel and payload via this system, never by the default P3D methods. We’ll see this system in use in a minute!

Entering the cockpit:

- Press FLY NOW!

When P3D loads, you’ll be placed into the **PMDG 737NGX** cockpit on Runway 08R at London Gatwick. This tutorial assumes the use of the virtual cockpit primarily. You may use the 2D panels if you prefer them, but the narrative is written from the VC perspective and the screenshots will be from the VC as well.

The NGX runs a 20 second initialization routine when it first loads into the sim. This routine first appeared in our MD-11 and what the airplane is

doing is setting up the simulator's internal environment and restarting P3D's engine code in order to better initialize the way we control the engine behavior from outside of the normal P3D framework. Our advice is to not touch anything during this 20 second period to ensure everything is set up correctly. You may hear a quick burst of sound when loading the airplane as the countdown starts, this is a normal quirk of the P3D sound engine when restarting the sim's engine code suddenly.

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

Our first order of business is to set up the aircraft's fuel and payload for the flight. As was mentioned in the Introduction Manual, our philosophy with the **PMDG 737NGX** is to minimize the use of the P3D menus as much as possible – this not only keeps the cockpit experience immersive and seamless but it also keeps certain traffic and scenery addons that rely on the sim not being paused from constantly reloading due to the menus being accessed.

The Flight Management Computers (FMCs) and their Control Display Units (CDUs) are the heart of the 737NG's cockpit. They manage nearly every aspect of the flight - the lateral route, the aircraft's performance data and vertical path, its approach settings and so on. We've expanded its functionality for the P3D environment to allow you to handle many other functions such as fuel and payload, cockpit equipment and display options, pushback, ground crew connections such as air and power carts and a few other items.

Without further ado, let's get started with the FMC:

FUEL AND PAYLOAD SETUP

- To make it easier to see the CDU, click on the top of the yoke and it will animate down into a lowered position. This feature does not exist in the real aircraft but we added it to the simulation to assist in viewing the FMC CDU since you can't easily move your "head" position without hardware like Track IR.

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

CDU notation convention:

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

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

Keyboard direct entry mode:

You can click each individual key with your mouse pointer or you can enter data with the keyboard in what we call Direct Entry Mode. To use Direct Entry Mode, hold down the Tab key on your keyboard while typing, similar to holding Shift while typing capital letters. You'll see the scratchpad flash in green when this mode is active.

You can also click the scratchpad area on the CDU screen as well to activate it.

A note on weights:

This tutorial is written using imperial weight units (pounds) because they're what I'm used to as an American and they're what the PMDG House Livery defaults to. I have however included the metric equivalent kilograms wherever applicable in parentheses after the imperial units if you'd like to fly with them instead. Note that these equivalents are approximate and may be very slightly "wrong" in a perfect technical sense due to rounding and conversion etc – it does not matter for our purposes here, if you're down to 1 or 2 lbs or kg making a difference, you have much bigger problems on your flight!

Both Tutorial #1 and #2 would be flown in real life with metric units – imperial units are mostly limited to North American airlines.

- If you would like to use metric units, the option can be changed in the FMC by pressing MENU, then PMDG SETUP at LSK 4R, then AIRCRAFT at LSK 1L, then DISPLAYS at LSK 2L. Press PREV PAGE once to get onto page 9/9. The option is located at LSK 3L.

- The CDU will currently be on the MENU page. We've added two prompts at the lower left – PMDG SETUP at LSK 4R and FS ACTIONS at LSK 5R. FS ACTIONS is the one that currently concerns us, so let's press LSK 5R to select it.

- Press LSK 1L to select the FUEL page.

The fuel page is our custom way of loading and unloading fuel from the **PMDG 737NGX**. The prompts on the right side allow you to load preset fuel levels, and the prompts on the left allow you to type the total fuel level, a percentage, or the individual tank weights and then line select them into place.

- For this flight, we're going to press the SET 1/3 prompt at LSK 5R.

This is a short flight and we don't need much fuel for it. Flying with too much fuel for your trip will just weigh the airplane down and hurt both your climb and descent performance.

As an aside for the future, if you want a good idea of how much fuel to load, enter your route and then check the PROG page's fuel prediction for the destination airport – subtract your current load from the amount it predicts at the destination and add 5500 lbs (2495 kg) for alternate/hold and so on and that'll be a decent estimate. Use

more if you have a long distance alternate or other extenuating circumstances. Detailed fuel planning is covered in Tutorial #2. You'll see the fuel weight total at LSK 1L change to approximately 15,200lbs (6895 kg). Also notice that the fuel load has been automatically distributed properly into the two wing tanks at LSKs 3L and 4L, with the center at LSK 5L empty. The rule on the 737 (and most other airliners) is that the wing tanks get filled first and then the center.

The FUEL page also automatically sets the two center fuel pump switches on the overhead panel to OFF when a preset, the total, or the percentage entries result in the center tank being empty. The switches will not be set automatically if you manually empty the center tank with a weight entry, be aware of this!

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

The PAYLOAD page is like the FUEL page but for passengers and cargo. The prompts on the right side are quick-load presets and on the right side you can type and line select in the exact number of first and coach class passengers and the weight of the cargo in the forward and aft compartments under the passenger cabin.

- For this flight, let's press the SET FULL > prompt at LSK 4R, and then enter 1500lbs (680 kg) into each of the two cargo compartments by typing 1500 into the scratchpad and then line selecting it into the LSK across from each cargo compartment. Change the rear compartment first in a case like this where you're reducing the load to avoid an out of balance situation.

  You may have noticed that there are real-time weight and balance readouts at the upper right of the screen on both the FUEL and PAYLOAD pages – the fields are the gross weight (GW), the maximum taxi weight (MTW – note, this field says MTOW in the screenshots here because they were made using an earlier development version of the product) the zero fuel weight (ZFW), and the center of gravity (CG). Using these you can see at a glance if your weight and balance are within allowable limits. The fields will turn yellow to warn you if they get out of their limits.

FMC ROUTE SETUP

We now need to talk about the flightplan's lateral route and explain it:

The route we'll be using from EGKK to EHAM is:

CLN5P.CLN.UL620.REDFA.REDFA1A

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

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

In this case, we're going to follow the Clacton Five Papa (CLN5P) SID to the Clacton VOR (CLN) – CLN acts as the interchange onto the UL620 airway. We follow UL620 until the fix REDFA. REDFA is also the first waypoint of the REDFA1A STAR into Amsterdam. **You can see the actual Eurocontrol charts for the SID and STAR attached at the end of this document.**

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

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

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

CLN5P CLN UL620 REDFA REDFA1A

or

CLN5P.CLN UL620 REDFA.REDFA1A

I personally prefer the nomenclature that uses single dots to signify "connected" procedures and airways and double dots to signify direct legs. There isn't a direct leg in this route, but it would look like this if there was – **CLN..REDFA.** The equivalents in the other formats are **CLN REDFA** or **CLN DCT REDFA** with DCT standing for direct.

Let's move on now to initializing the FMC lateral route on the CDU.

The basic sequence we'll be following to accomplish this is:

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

Let's get started!

Position initialization:

- Press MENU, which will back us out to the root menu.
- Press LSK 1L, the <FMC prompt.

We're now on the IDENT page.

The IDENT page doesn't contain any fields for entry, but it does provide you with some valuable information such as your engine thrust rating (in this case 26,000lbs of thrust per engine), the currently installed navigation database and its valid dates, and the FMC software version, known as the Op Program. (Currently the latest one flying on NGs, U10.8A.)

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

The POS INIT page is used during a cold and dark start for aligning the inertial reference system (IRS) gyros. When loading from Free Flight as we've done in this tutorial, the IRS is already aligned, so this page doesn't actually have any real function.

- Go ahead though and enter EGKK into LSK 2L, the REF AIRPORT prompt just to get you in the habit of doing it.

Airport entry:

- Press LSK 6R to select the RTE page.

The RTE page is the primary location for entering the enroute portion of your flight plan. You'll notice that EGKK was already placed into the scratchpad for you. This is a result of having entered it on the POS INIT page above.

- Line select the preloaded EGKK text into LSK 1L, the ORIGIN field.

  You'll see the location of the center of the airport appear on the navigation display (ND).

- Type EHAM into the scratchpad and line select it up with LSK 1R, the DEST field.

- Type PMDG738 into the scratch pad and line select it with LSK 2R, the FLT NO. field

We could enter the runway now on the RTE page, but we're going to do that on the DEP ARR page instead to demonstrate another feature.

The completed RTE page should look like this:

Departure entry:

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

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

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

- Press LSK 1L to get to the EGKK DEPARTURES page

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

- Press LSK 2R to select Runway 08R. Notice that several things happen when you do this:
    - The runway is drawn on the ND.
    - The list of SIDs on the left side of the CDU screen is filtered so that only the SIDs valid for Runway 08R are displayed. This is the reason for not entering the runway on the RTE page 1 earlier – when you enter it there, it doesn't filter the SIDs unless you reselect the runway on the EGKK DEPARTURES page, which is redundant.

- Press LSK 2L to select the CLN5P SID. You will see a series of waypoints representing the path of the SID appear on the ND with dashed blue lines connecting them. The blue color of the line means that the route has not yet been activated.

  The EGKK DEPARTURES page should now look like this:

Enroute entry:

- Press LSK 6R to get back to the RTE page. We're going back to it because the RTE page is where enroute airways are entered.Press the NEXT PAGE button to get to RTE page 2

RTE page 2 and further are where you actually enter route information. The VIA and TO columns on the left and right sides of the screen are what I was referring to earlier with the highway analogy. The right side TO column is where you're going and the left side VIA column is how you're getting there. You can see right now that we have one line that was already filled in automatically by our SID selection – we're going to CLN VIA the CLN5P SID procedure.

Note that if you were to just enter a single waypoint into the TO column, you'd see DIRECT automatically appear in the VIA column, letting you know that there's no specified VIA routing, it's just a direct line from the previous TO column waypoint.

Though we won't use the more advanced features in this tutorial, it is worth nothing that the **PMDG 737NGX** RTE page functionality almost exactly mirrors the real life one. You can actually enter just about anything into the VIA column including directly typing the names of SIDs, STARs and approaches as well as airways and it will take them. The TO column will take uncommon entries such as airport ICAO codes, ILS identifiers, and runways too. See the FCOM Vol. 2 for more info on what you can do here. To our knowledge the Boeing FMC's RTE page has never been modeled this completely before in Flight Simulator.

- Enter UL620 into the scratchpad and line select it into LSK 2L, the VIA column's next empty line down.

  The fact that it "takes" the airway designation lets you know that UL620 is a valid airway that you can get onto at CLN. If it wasn't you'd see INVALID ENTRY in the scratchpad after trying to line select it in.

- Complete the airway segment by entering REDFA into the scratchpad and line selecting it into LSK 2R, directly across from the UL620 entry.

We're now finished with the enroute entries and your RTE page 2 should look like this:

STAR and approach entry:

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

The EHAM ARRIVALS page is similar to what the EGKK DEPARTURES page looked like with a few differences. On the left side of the page are the STARs and on the right are both the approaches and runways.

- Press NEXT PAGE three times and you'll see that the runways are there on page 4 after you get through the three pages of approaches above them. You would normally only select a runway alone if you were doing a visual approach or otherwise not using one of the instrument approaches listed.

- Press PREV PAGE once to return to page 3 and then select the REDFA1A STAR located at LSK 1L.

The page now gets updated to show the approaches at the top

with the other STARs no longer showing.
You may also be wondering what the text at position 2L that says TRANS -NONE- means. Many SIDs and STARs have "transitions" in addition to the common portion of the procedure. The transitions are different branches that lead out of (SIDs) or into (STARs) the main part of the procedure. In this route though, both the SID and STAR have only a common portion and no transitions and that's why you see the text at 2L.

- Press NEXT PAGE once and then select the ILS 18R at LSK 3R.

  A list of transitions can appear below approaches as well as SIDs and STARs. In this case, we do want to select a transition that leads us from the end of the STAR onto the approach.

- Press NEXT PAGE once and then select the SUG3B transition at LSK 4R.

  The SUG3B is an approach transition normally used at night at Schiphol. We're going to use it during the day though for the purposes of this tutorial because it will set you up for the ILS 18R without the need for any self-vectoring to get onto the approach. **The Eurocontrol chart for it is at the end of this document.**

- The completed EHAM ARRIVALS page should now look like this:

We now need to make a few slight modifications to the route before we activate it to correct for navdata inaccuracies and to make sure the plane actually flies from the final waypoint of the STAR, called SUGOL, onto the approach.

- Press the LEGS button.

The LEGS page is a list of every waypoint in the entire flightplan - this is where you can actually see all the other waypoints that are part of the SID, STAR, and airways that weren't explicitly written out in the coded flightplan we learned about earlier. The LEGS page is also the primary location in the FMC for modifying the route. We're going to perform a series of small modifications right now.

- Press NEXT PAGE once to display LEGS page 2.

The waypoint REDFA at the bottom of the page has a 280/FL230B speed and altitude restriction defined in the navdata that isn't there on the actual chart. Errors like this are unfortunately a part of life in flight simming and this is why it's always a good idea to compare against the actual chart. (Pilots do this in real life too.)

- Press the DEL (delete) key at the bottom of the CDU and then press LSK 5R to remove the speed and altitude restriction at REDFA. Make sure you enter the delete on the right side of the CDU and not the left. Doing it on the left side will remove the entire waypoint!

- You should see dashes where the altitude was:

- Press NEXT PAGE again to display LEGS page 3.

There are two issues that need to be corrected on this page.

(Note, these issues *do not* exist if you are flying the tutorial with newer navdata past the 1108 cycle.)

Notice this sequence of waypoints on the page:

SUGOL
(VECTOR)
SUGOL

This exists because SUGOL is a waypoint both near the end of the STAR and at the start of the approach transition. The (VECTOR) waypoint is a “pseudo waypoint” that represents the airplane flying on a 113 degree track indefinitely while awaiting vectors from air traffic control, which is how the STAR ends. For the purposes of this tutorial we don’t want the airplane to do that, we want it to proceed directly from SUGOL to the next waypoint

in the approach transition, EH606. Here's how to accomplish this modification:

- Press LSK 4L next to the 2nd instance of the SUGOL waypoint.

  This copies the waypoint on that line into the scratch pad – this copy contains everything associated with that waypoint including the altitude and speed restrictions that appear on the right side of the CDU display.

- Line select the copied SUGOL from the scratchpad to LSK 2L, overwriting the other SUGOL that's there at that position.

This operation results in the entire flightplan from the point of the copied SUGOL on being pulled up to replace everything between it and the location it was line selected to. This means that the first SUGOL and the (VECTOR) waypoints no longer exist in the flight plan and we've now fixed the issue.

- In addition, the chart specifies that the speed restriction at SUGOL is actually “MAX 250 KTS” – this is an “at or below” restriction, but the navdata has coded it as a “hard” or mandatory 250 knot restriction. This needs to be corrected or the FMC will give an error in flight because it will refuse to violate the 240/10000 global restriction present on the DES page.

- Type 250B/ into the scratchpad and press LSK 2R to enter it in.

This will allow the aircraft to cross SUGOL at any speed below 250 knots.

The issues with the route are now fixed and we can continue.

Route activation:

- Press LSK 6R, the ACTIVATE > prompt.

  We're now telling the FMC that we want to commit to the route and activate it. You'll notice that the light on the EXEC button is now lit up.

- Press the EXEC (execute) button, which is now lit.

  The route turns magenta on the ND and we now have a valid lateral route loaded in the FMC.

  Notice however, that we have numerous blank entries on the right side of the LEGS page – there should be altitude and speed predictions here, but those won't appear until we initialize the aircraft's performance in the next step. The entries that are already filled in are restrictions that were either part of the coded procedure in the navdata or manually entered by the crew during the route construction.

PERFORMANCE DATA AND VERTICAL PATH INITIALIZATION

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

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

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

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

- Click LSK 3L next to the empty ZFW field. Something close to 122.7 should appear in the scratch pad. Click LSK 3L again to enter it into the ZFW field.

  You'll notice that the gross weight field at 1L is automatically calculated and filled in. The FMC only needs one of these two entries present and the other will be automatically inserted.

- Enter 5.0 and line select it into the RESERVES field at LSK 4L

  This entry is purely advisory, it doesn't affect anything within the fuel system. If the aircraft starts using fuel below this value, you will get a scratchpad message that says USING RSV FUEL. If the destination fuel is predicted to be below 2000lbs, regardless of reserves, you will see an INSUFFICIENT FUEL message appear in the CDU scratchpad.

- Enter 25 and line select it into the COST INDEX field at LSK 5L.

  Cost Index is a measure of how much the FMC values fuel economy vs. the overall speed of the flight. Lower values correlate with lower operating cost at the expense of slower airspeeds and vice versa. Cost Index is a very powerful parameter in the FMC and it affects everything from climb, cruise and descent airspeeds to the maximum attainable altitude for the route. The valid range is 0 to 500.

  Cost Index varies in real life operations (it's calculated by dispatch based on the exact conditions of the flight and the airline's policy.) 25 is a common real world value however and will work fine for the purposes of this tutorial. Many airlines operate in the 20-40 range in real life.

- Enter 6000 and line select it into the TRANS ALT field at LSK 5R.

  Transition altitude is the altitude during the climb at which the FMC starts using standard calibrated flight levels (altimeter set to 29.92 inHg or 1013 HPa) instead of the actual QNH pressure altitude above sea level. The FMC defaults to 18000 feet, which is standard in the United States, but in the UK transition altitude is 6000 feet.

- Finally, enter 250 and line select it into the CRZ ALT field at LSK 1R.

  This sets the cruise altitude for the flight. FL250 is standard for this short route in real life. You can enter it as 250, FL250, or 25000 – all

will work.
After entering the cruise altitude, you'll often see the route on the ND change subtly as curves appear that represent the predicted turn performance of the airplane. Without the performance fully initialized, the FMC can't calculate these and you'll see straight line segments between waypoints.

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

- Press the EXEC button to execute the performance data initialization.

- Press the LEGS button – you should now see predicted altitudes and speeds at any waypoint that doesn't have preset restrictions coded into the procedure. If you see these predictions you now have a valid vertical path initialized and will be able to activate the VNAV autopilot modes after takeoff.

N1 LIMIT AND TAKEOFF REFERENCE DATA SETUP

We now need to set the engine thrust rating for our takeoff and climb and enter our takeoff data.

- Press the N1 LIMIT button on the CDU to proceed to the N1 LIMIT page.

The N1 LIMIT page controls the thrust rating of the engines for takeoff and the initial climb.

We are going to do a combination of a fixed derate and an assumed temperature takeoff to save wear and tear on the engines by limiting them to less than maximum takeoff and climb thrust. In real life the airline's dispatch center would go through detailed calculations to ensure that the use of derated/reduced thrust is safe and permissible for the given runway length, aircraft weight and environmental

conditions. I've already done this calculation in our case using an addon called TOPCAT that we highly recommend.

- Press LSK 4L to select the TO-2 fixed derate mode.

  What we're doing here is effectively turning our 26K engines into 22K engines for the takeoff sequence. This fixed derate is always the same regardless of conditions.

- Type 40 into the scratchpad and line select it into LSK 1L to enter an additional assumed temperature of 40C on top of the fixed derate.

  Assumed temperature is a more complicated concept than the fixed derate, but the basic idea is as follows:

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

- Entering the assumed temperature should have automatically selected the fixed CLB-1 derate too. If it didn't, press LSK 3R to select it.

  This is doing the same thing for the initial climb that we did for the takeoff two steps earlier.

- The completed N1 REF PAGE should now look like this:

- Press LSK 6R to go to the TAKEOFF REF page:

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

- Enter 5 and line select it into the LSK 1L FLAPS field.

  5 is a standard takeoff flap setting for the 737-800 and will work well for most normal flight situations in the **PMDG 737NGX**.

- Click LSK 3L – this is a similar shortcut to the ones for the GW and ZFW earlier on the PERF INIT page. It will place the current CG value into the scratch pad for you. Line select that value back into the LSK 3L field and the FMC will reward you with your calculated takeoff trim setting.

- Click LSKs 1R, 2R, and 3R – this transfers the calculated takeoff V speeds from the FMC's integrated QRH table onto the Primary Flight Display (PFD) speed tape.
  You will notice the flight plan route shift slightly when you enter the V speeds – the **PMDG 737NGX** FMC actually accounts for that small difference resulting from the exact speed you lift off at.

  The completed TAKEOFF REF page should look like this:

The FMC initialization is now complete.

COCKPIT CONFIGURATION

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

- Set the takeoff trim on the pedestal to the left of the throttles to the value seen in LSK 3L from a few steps earlier. (5.04 in this case) You can do this by using the electric trim switches on your joystick, their equivalent keypresses or by actually physically rotating the wheel with your mouse while the cursor is positioned over top of it. A P3D tooltip shows you the current value of the trim.

The **PMDG 737NGX's** trim motion is going to seem very slow if you're used to most other addons. We have exactly recreated the real life trim rates by bypassing the normal P3D trim functions, and yes, they are this slow in the real airplane. This is a huge aid though while handflying as you now have extremely precise control over the trim's range of motion and should be able to trim out control forces perfectly in almost any situation.

- Set the FLAPS to 5. You can do this by pressing F7 three times or by left clicking three times on the physical flap level in the VC. (right clicking will raise them)

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

RTO stands for Rejected Take Off and will automatically apply maximum braking in the event the throttles are retarded to idle while at or above 90 knots during the takeoff roll.

MCP setup:

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

- Pan up and set the MCP SPEED knob to V2, which should be around 143-145 knots, again depending on your exact weight. Set it to whatever the TAKEOFF REF page shows.

- Set the MCP HEADING knob to the runway heading, which is 079 degrees at EGKK 08R.

- Set the MCP ALTITUDE knob to 5000.

  If you're wondering how we know to set this in the absence of an ATC initial altitude clearance – look at the chart for the CLN5P SID again. The number 5000 with solid lines above and below it at TUNBY and at DET means we need to cross those fixes at exactly 5000 feet. If you look at the LEGS page, you can see that it's already present in the SID from the navdata. The airplane will automatically respect this provided you're climbing in VNAV, but it's always a good idea to manually limit the airplane to restrictions by using the MCP altitude knob.

  The plane will never climb above or descend below what you have set in the MCP altitude window while under autopilot control. This is a great safety feature in the cockpit to make sure you don't inadvertently bust your altitudes.

  Our climb is limited to 5000 and 6000 feet until we're well into the departure in order to avoid conflicting with traffic on the departures and arrivals for the larger EGLL - London Heathrow airport that lies to the north of our departure path. There are a lot of airplanes in this airspace in real life and the altitude restrictions are necessary to partition the airspace and avoid any loss of separation incidents.

- Turn the captain's and first officer's FLIGHT DIRECTOR (FD) switches to their ON/UP settings. This allows the autopilot's modes to arm and engage. You'll see a green FD annunciation on the PFD just above the artificial horizon when the switches are on.

It is very important that BOTH flight director switches be on – you'll find many functions such as the takeoff/go-around (TO/GA) mode will not work if one of the FDs is left off.

Notice the green "MA" light below the captain's FD switch as well – this indicates that the captain's side FD is currently the master FD. Normally, the first FD switch to be turned on is the master, but it can change depending on which autopilot you select in CMD as well.

- Arm the AUTOTHROTTLE by clicking the switch on the MCP up into the ARM position. You'll see a green light appear confirming that it's on. The PFD flight mode annunciator (FMA) also shows ARM. (A green box appears around the mode for a few seconds to indicate the change)

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

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

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

EFIS setup:

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

- Before we go to the EFIS panel, pan over and back to the center pedestal, change to the VC pedestal camera preset, or bring up the 2D version with Shift-4 and right click the TRANSPONDER’S TCAS mode selector four times until it’s fully to the right in the TA/RA position. Set the squawk code to 2200 (a standard IFR code you might be assigned by ATC in real life) by right clicking the large knob on the left side of the unit once. (1200 is a VFR code)

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

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

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

- Set the map display to 10nm by turning the EFIS control panel RANGE knob to the left if it's not already set. Turn the traffic display on by clicking the TFC push button that's on the face of this same knob.

- Press the ENG button above the upper engine display unit (DU) twice to display the compact secondary engine indications. The compact display is used at takeoff to avoid making the pilots look down at the lower DU.

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

Overhead setup:

Right click on an empty area and select the Cockpit\Overhead Lower Panel camera view. There's only a few things that need to be set here near the front of the panel:

- Turn the LANDING LIGHTS on by left clicking the gang-bar located above the switches – this will turn all four switches on with a single click.

- Turn the NAVIGATION LIGHTS to the STROBE & STEADY (up) setting.

- Turn the red ANTI-COLLISION light switch to the ON (down) setting.

- Set both ENGINE START SELECTORS to CONT (continuous ignition).

  This is done so that the engines have a better chance of continuing to run in the case of an incident during the takeoff sequence such as a compressor stall or bird strike.

- Set the cruise altitude to 25000 and the landing altitude to 0 on the PRESSURIZATION CONTROLLER. The pressurization controller on the 737NG does not get set automatically by the FMC.

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

We're now ready for takeoff!

IN THE AIR

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

By the way, in case you were wondering why we're so far back from the runway numbers, Gatwick's Runway 08R features what's known as a "displaced threshold" at the start of the runway. You're allowed to start a takeoff roll from the displaced threshold, but you may not land on it.

Takeoff:

- Release the parking brake with Ctrl+. (period key), by clicking the physical parking brake lever in the VC, or by tapping the brake button on your joystick. (defaults to the trigger on most sticks)

- Smoothly advance the thrust levers to 40% N1. The engines will take some time to spool – the CFM56-7B "bites" around 50% N1 and will accelerate very quickly after that point, but it takes a while to get from idle to 40%.

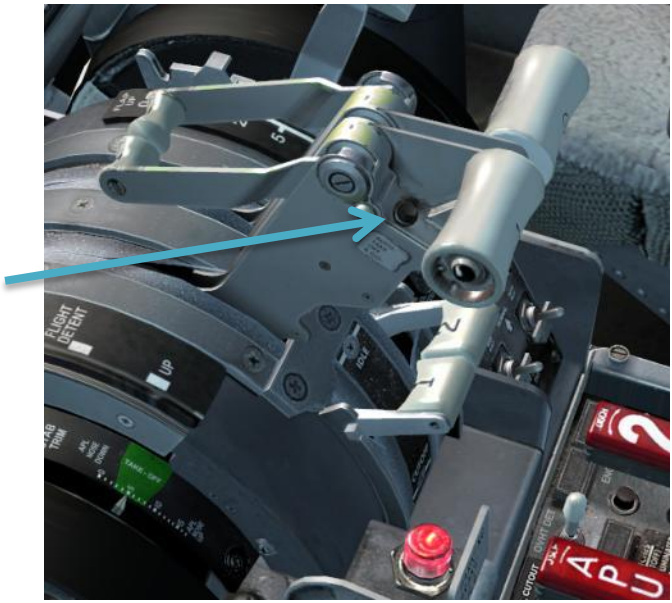
- Once stabilized at 40%, engage TO/GA mode – there are several ways to do this:

    1. Press the keyboard shortcut – CTRL+SHIFT+G by default or your custom joystick button.

    2. Left click the hidden clickspot located on the MCP just below the course knob.

On previous PMDG products, TOGA was the upper left MCP screw, however we were unable to do this in the **PMDG 737NGX** due to the HGS combiner blocking the view of the screw while it's down.

3. Click the actual TOGA button on the thrust levers.



When the TO/GA button is pressed, several things happen:

- The autothrottle increases engine thrust to the takeoff N1 limit – in our case, D-TO 2 +40C , which will be around 88% N1.
- The flight director bars appear on the PFD.

- The flight mode annunciator (FMA) at the top of the PFD will show N1 in the thrust field and TO/GA in the pitch field with VNAV armed below it. The roll field remains blank with LNAV armed in white below. Green boxes are drawn for a few seconds around modes that have just engaged.

- Maintain a small amount of forward pressure on your yoke or stick until reaching 80 knots and use the rudder if necessary to keep the airplane aligned with the runway centerline.

- Upon reaching V1, we are committed to flying. While no failures will happen in this tutorial, in the event anything did on a future flight, you would handle it in the air now instead of attempting to reject the takeoff. If you abort after V1 you run the risk of overrunning the end of runway during the abort and crashing on the ground.

- When you reach VR, smoothly rotate at around 2 to 3 degrees per second toward a goal of 15 degrees nose up after liftoff. Be careful not to rotate too quickly – the 737-800 is a long aircraft and is prone to tailstrikes at high rates of rotation.

- Raise the landing gear by pressing G, clicking the handle in the VC or via a custom keypress/button you've set.

- Follow the flight director's command bars to maintain V2+20 knots, but do not "chase" them - smoothly maneuver to follow them. At 50 feet, LNAV will engage and turn green at the top of the FMA roll mode field.

- Passing 400 feet (look at the radio altimeter readout at the bottom of the PFD) press CMD A on the right side of the MCP to engage the autopilot.

Take your hands off the controls, the autopilot is now flying. This actually is very important – deflecting the controls past a certain amount of force while the AP is engaged will cause it to disconnect or drop into control wheel steering (CWS) mode, which we don't want! The AP CMD will also fail to engage if the controls are not centered when CMD is pushed.

- Set the landing gear to the middle OFF position by left clicking the handle once.

  This depressurizes the landing gear hydraulics. This is important because there are potential consequences to leaving the system pressurized in the event that there's a leak, an overheat, etc.

- Right click the AUTOBRAKES knob to set it to the OFF position.

- Select the LEGS page on the captain's CDU.

- Set the EFIS range selector to a larger range such as 20nm or 40nm for the departure and climb. Once we get near cruise, a setting of 80nm or even 160nm can be used to see more of the route.

Climb:

- At 1500 feet above ground level, the aircraft will reduce to climb thrust and begin accelerating to 250 knots. This is called “acceleration height” and can be modified on the FMC TAKEOFF REF page 2 before departure if so desired.

- Flap retraction on a normal flaps 5 takeoff and climbout is accomplished as follows after reaching acceleration height:

    - At acceleration altitude select flaps 1.

    - Passing the “1” marker on the PFD speedtape, select flaps up.

      The idea here is that the aircraft is expected to be accelerating rapidly, so there’s no need to wait until passing the exact maneuvering speed (which is what the numbers represent) to raise the flaps past the currently indicated point. It’s expected that by the time the flaps finish retracting you’re already at or above maneuvering speed for that setting.

      If you’d like more information about this procedure, check the Flight Crew Training Manual (FTCM) pages 3.32 - 3.34.

- Set the two ENGINE START SELECTORS at the front of the overhead to OFF.

- It is good practice to keep the MCP HEADING aligned with the aircraft’s actual direction of flight when on a leg of sufficient length. This is done in case you have to suddenly engage HDG SEL mode. After reaching the (INTC) interception point on the departure, rotate the heading knob to match the magenta course leg. (You’ll notice that I’m not the greatest at remembering to do this in the screenshots)

- The airplane will level off at 5000 feet due to the restrictions at TUNBY and DET.

VNAV PTH annunciates on the FMA pitch field to indicate that the FMC vertical path is being followed. This is than the VNAV SPD mode we were just in, which does not follow any set path but rather uses pitch to fly the ECON climb speed while holding the thrust constant at the CLB-1 N1 limit. You'll also see FMC SPD annunciated in the FMA thrust mode field. This indicates that the autothrottle is actively controlling the airplane's speed with variable thrust as opposed to a mode like N1 that commands a constant thrust setting.

The reason for these low altitude restrictions way are the busy arrival and departure routes into and out of the city's main international airport, EGLL – London Heathrow, which is about 23nm to the northwest of our current position. Gatwick departures have to be kept below these other flights – this is very busy airspace in real life and the restrictions exist to partition the airspace in order to avoid conflicts and possible loss of separation incidents.

- After passing the Detling VOR (DET), you're going to see VNAV ALT annunciated in the FMA pitch mode box along with an FMC message that says RESET MCP ALTITUDE.

VNAV ALT means that VNAV wants to climb or descend, but it's being limited by what's set in the MCP ALTITUDE window. Our next altitude is a hard 6000 foot restriction at D015E, which is 5nm after passing DET.

- To get us out of VNAV ALT mode and continue the climb, roll the MCP ALTITUDE knob up to 6000 and then press the button labeled ALT INTV to the right of the knob. The click spot extends to the right over top of the lettering to enable you to click it from the captain's seat position without difficulty.

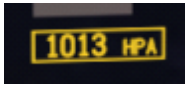
The ALTITUDE INTERVENTION button has several functions but this is one of the main ones - getting out of VNAV ALT and resuming a climb in VNAV SPD.

Be aware in this situation where the airplane is light at low altitude and there's a small change in altitude that real life pilots would likkely use V/S at 1000fpm to accomplish the altitude change. You will see a very steep pitch up using VNAV SPD here due to the airplane's light weight and low altitude.

- You'll see the same VNAV ALT annunciation again after passing D015E. There are no more restrictions after D015E so let's roll the MCP ALTITUDE knob up to 25000 and press ALT INTV to resume the climb.

- 6000 feet (FL060 at standard pressure) is also our transition altitude where we switch to flying flight levels instead of altitudes above sea level based on a local altimeter setting. All aircraft flying flight levels use the standard pressure setting of 29.92 inHg or 1013HPa. Once you climb a bit above 6000, you'll see the altimeter setting at the bottom right of the PFD turn yellow with a box around it. This is a notice to you that you need to switch to standard pressure. Press the STD button embedded into the center of the BARO knob on the EFIS control panel to automatically set standard pressure.

(Note, because we did not change the pressure in the P3D weather settings for this flight, you will already have 1013 HPA as your setting. You still do need to press STD when climbing above 6000 though.) After pressing STD, you'll see STD in green where the yellow altimeter setting was.



- Passing FL100, pan up to the overhead and turn off the LANDING LIGHTS. You can right click the gang-bar to turn them all off, simulating a single motion of the hand backwards on the switches.

  At this point you'll also see the airplane pitch over to accelerate to a higher FMC commanded climb speed since we're now above the mandatory 250 knots below 10000 feet restriction. It accelerates to the FMC's ECON climb speed, which is dynamic and will change depending on aircraft weight and environmental conditions.

- Passing FL150, you'll notice the CLB 1 annunciation on the upper engine DU change to read just CLB. This is the end of our climb derate – the engines now have their full climb power rating available for use as the air thins up higher. Note that this transition actually happens gradually, you may have noticed the N1 slowly increasing through the climb to this point.

- A few miles after passing CLN, we'll reach our top-of-climb point at FL250, which is indicated by a green circle with the letters T/C next to it. The green altitude range arc that you see on the ND is the continuously calculated point at which you will reach the altitude currently in the MCP window. This can be very useful in both climbs and descents for seeing if you'll be able to make restrictions.

Cruise:

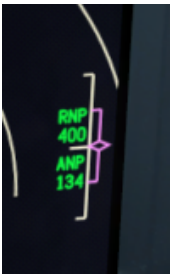
We're now crossing over the southern part of the North Sea at our cruise altitude of FL250. Unfortunately, we don't have much time to admire the scenery as we're already quickly approaching our top-of-descent point on this short flight and we need to prepare for the descent and approach.

- We're coming up on a green circle with T/D written next to it just after the REDFA waypoint. T/D is our top-of-descent point. One minute before top of descent, the airplane will slow from ECON cruise speed to ECON descent speed. This may not always happen with higher cruise altitudes because the two speeds are often the same, but in this case it's going to slow to around 267 knots.

- 5 miles before T/D a message that says RESET MCP ALTITUDE appears in the FMC scratchpad. This is letting you know that VNAV wants to initiate the descent soon and you need to lower the MCP ALTITUDE knob to give it permission. For the purpose of this tutorial, we're going to set it to 2000 feet, which is the glideslope intercept altitude on the approach. In real life you'd set it to the lowest altitude ATC has cleared you down to, but we want to show off the VNAV system's ability to hit a complicated set of speed and altitude restrictions for you here.

Descent:

- The vertical path deviation indicator will appear on the right side of the ND as you pass the T/D point. The diamond shows you how high or below the FMC calculated VNAV path you are. Don't worry about the RNP and ANP numbers - we'll address those in a later tutorial.



- The FMA thrust mode annunciates RETARD while the throttles are being moved back to idle, followed by ARM in white, which indicates that the autothrottle servo is disconnected from the physical throttles.

  The first leg of any VNAV PTH descent is always an idle path – after we reach the restriction at SUGOL however, the airplane will enter geometric path mode and use a constant decent angle for each subsequent leg.

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

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

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

- We're going to do a standard flaps 30 landing today, so let's select that.

  Unlike other FMCs, you need to press LSK 2R *twice* to get it to take the flap setting into the LSK 4R FLAP/SPD field on the 737NG. It's just a quirk of the real unit, but you don't ever line select the setting into 4R unless you're typing a custom

flap/VREF combo in.
Setting the landing flaps transfers a readout of the flap and speed combination to the PFD speed tape, much like we did with the V speeds before takeoff.

- Enter the ILS frequency into the standby windows of both navigation radios on the pedestal – the larger outer knob controls the whole number digits, and the smaller inner knob on top controls the decimal digits. The frequency for EHAM's Runway 18R is 110.10, which you can see on the FMC APPROACH REF page. Press the TFR (transfer) switch to make both radios active on the ILS frequency.

- While we're down on the pedestal, let's set the Head-up Guidance System (HGS) controller options so that we can use it during the approach. (located in the center of the pedestal below the nav radios) It needs two pieces of information, the runway elevation and the runway length.

    - Press the RWY button on the left side of the HGS controller until it says EL>0. This we can leave because the runway elevation actually is around -13 feet, and 0 is as close as we can get to it with the controller.

    - Press the RWY button again until you see LN>10000. We need to set this to the actual runway length, which is 12,467 feet. Key in 12467 on the keypad on the right side of the controller and press enter at the lower left corner of the keypad.

- The HGS is now configured for the approach.

- Pan up to the MCP and enter the localizer front course 184 into both the captain and FO's course windows.

In the event you wanted to do a normal CAT I-style ILS approach where you don't autoland, you would just tune one radio to the ILS frequency. When you engage both autopilots in this case, you'll see SINGLE CH annunciated on the PFD in amber, letting you know that you do not have dual autopilot redundancy and can't perform an autoland. In this case you'd disconnect the AP at the decision height and land manually.

In Europe, transition level for the descent is often different than transition altitude was during the climb. This route is no exception – our transition altitude climbing was 6000 feet, however the chart tells us it's assigned by ATC at EHAM. Most commonly it will be the airport's (climb) transition altitude + 1000 feet. In this case, EHAM has a transition altitude of 3000 feet so add 1000 to it and our transition level will be FL040. (4000 feet at standard 1013 hPa pressure)

- To enter the descent transition level, first press the DES button on the CDU, then press the FORECAST prompt at LSK 6L.

- Enter 040 or FL040, and line select it into the TRANS LVL field at LSK 1L.

- Press LEGS, where we'll stay for the rest of the approach.

- You'll notice now going back to the PFD that we have the ILS frequency and course visible on the left side indented above the artificial horizon and the LNAV/VNAV navigation performance scale (NPS) annunciation.

- Arm the autobrakes for landing by right clicking the AUTOBRAKES knob twice to select AUTOBRAKES 2.

- Set the landing minimums by clicking the outer EFIS control panel MINS knob to its RADIO setting and then turning the smaller inner knob down to 100 feet radio altitude – you'll see the number in the lower right corner of the PFD.

  We're a category D aircraft on this approach (approach airspeed above 141 knots) and the published minimum is 100 feet for a Category II ILS.

Continue the descent.

- You'll see a green circle with no text next to it on the route somewhere around 5 miles prior to SUGOL – this marks the start of the deceleration leg to reach 240 knots at or below 10,000 feet. A second unlabeled circle about 5 miles past the first one marks the end of the deceleration segment.

During the deceleration segment, the FMC commands a shallower path angle to allow the airplane to slow down.

- At FL100, pan up and turn on the LANDING LIGHTS again with a left click on the gang-bar.

- After passing SUGOL, we receive a CDU scratchpad message that says DRAG REQ AFTER NIRSI. This is letting us know that the predicted speed in the absence of drag from the speedbrakes

is going to be 10 or more knots above what it should be to hold the vertical path. In this case, it's because of the 220 knot speed restriction at NIRSI – the airplane would like to be slower than 220 there but can't be because of the mandatory restriction. Take note of the warning and clear it by pressing the CDU CLR key.

Notice too that passing SUGOL, we've entered the geometric path portion of the descent – the HOLD previously in the FMA thrust field is now FMC SPD.

Look out the front window as we're nearing EH606 – that's Schiphol about 10 miles off the nose and we're about to turn onto what is effectively our right downwind leg.

- Set the EFIS control panel range knob to 10nm at EH606.

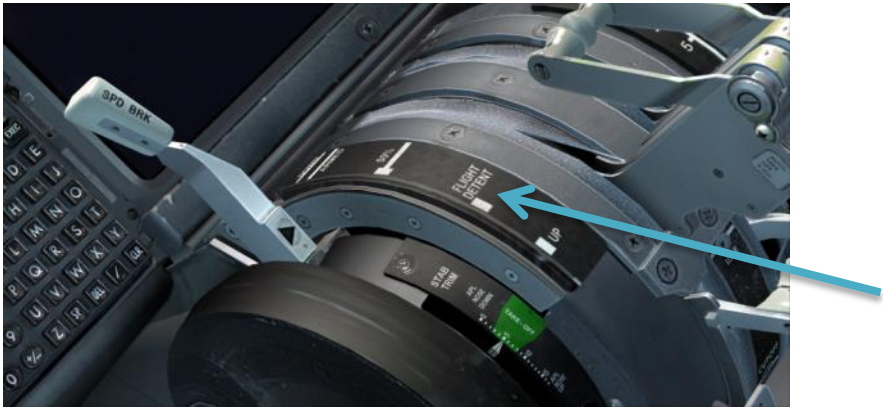
- As we roll out of the turn passing EH606, we come to a DECEL circle about halfway between EH606 and NIRSI – this is the beginning of our deceleration segment for crossing NIRSI at the mandatory 220 knots. You may see the DRAG REQ AFTER NIRSI message again.

DECEL circles can appear in the following conditions:

- Slowing before a hold
- Before a waypoint speed restriction
- The start of the flaps/approach deceleration phase.

- Passing NIRSI, the commanded speed will drop to the flaps up maneuvering speed, which should be somewhere around 206 knots. Deploy flaps 1 as the airplane reaches this speed, which will cause the speed target to drop to flaps 1 maneuvering speed.

  Remember the DRAG REQUIRED AFTER NIRSI advisory message we received a few minutes ago? You may need to extend the speedbrakes to get the airplane to slow down here – this is now a continuous decent path per the SUG3B chart. To extend them, press the / key or click the clickspots located to the right of the physical SPD BRK handle in the VC.



Final approach:

- About 2.5 miles from EH608 we pass our descent transition level of FL040, so reach up on the EFIS control panel and press the STD button on the BARO knob to return us to flying altitudes above sea level based on local pressure setting and not flight levels. You should see 1013 HPA on the lower right of the PFD.

- Around this same time just before reaching EH608, arm VOR/LOC mode on the MCP by pressing the VOR/LOC button, this will set the autopilot to intercept the localizer as we turn onto the final approach course still in LNAV. You'll see VOR/LOC in white below LNAV in the FMA roll field.

  It's always a good idea to intercept the localizer before the glideslope – in fact this particular **PMDG 737NGX** airframe option configuration doesn't even allow the GS to be intercepted before the LOC.

- As you turn onto the localizer you should be reaching flaps 1 maneuvering speed, set flaps 5.

- After the localizer is captured, press the APP button on the MCP to arm the glideslope capture. It should capture almost immediately since this approach transition essentially follows the glideslope while in VNAV up to this point.

  When GS engages, you will see most of the MCP mode button lights blank out – this is letting you know that you are now committed to the approach mode. The only way to get out of it now is by executing a go around or by cycling the flight directors off and back on.

- Press CMD B on the MCP to arm the autoland mode – you should see both CMD A and CMD B lit up.

- We have now left both the LNAV and VNAV modes. We'll need to manually move the MCP SPEED knob down to 147 knots, which will be our final approach speed. The reason it's 147 and not the 142 shown in on the APPROACH REF page is because you always add at least 5 knots extra to your VREF. In a no wind situation like this, 5 knots is fine, but there are situations involving crosswinds, windshear risk and so with manual throttle control where you'd add more than 5 to it. Boeing states however that 5 knots is always sufficient if using the autothrottle.

- Set the engine start switches to CONT. (for the same reason they were on this setting at takeoff)

- As you reach flaps 5 maneuvering speed, select Flaps 15 and lower the landing gear.

  Note that when you lower the landing gear, the engines will spool up to approach idle, higher than they were prior to the gear coming down. This is to account for the extra drag.

The **PMDG 737NGX** correctly predicts speeds for the approach phase. Its target is Flaps 15 maneuvering speed (which is technically the Flaps 40 VREF speed +20 knots) at roughly the published normal glideslope intercept point. In this case, it should be somewhere around 155 knots at EH621. The fact that the FMC will essentially get you to this point automatically is a huge help in getting stabilized correctly on the approach.

- Select flaps 30 once you reach flaps 15 maneuvering speed.

- Arm the automatic landing speedbrakes by either pressing Shift+/, clicking the clickspot preset located to the right of the SPD BRK handle, or by using a custom keypress or joystick button.

- Click the hidden clickspot on the left side window support post – this will lower the HGS combiner into place and you should see the HGS symbology already showing the A III approach mode. A III mode activates once you're properly established on an ILS.

- After passing 1500 feet on the radio altimeter, you'll see LAND 3 annunciated on the PFD where it previously said FD after a short self-test (indicated by the localizer and glideslope diamonds flashing.) You'll also see ROLLOUT and FLARE appear armed in white below the active roll and pitch modes. This tells you that the fail operational autoland system is now armed and will land the aircraft.

There isn't much to do now until we touch down, so enjoy the view while looking through the first fully collimated, fully conformal HGS system ever developed for an MSFS airliner. Watch closely – at 300 feet you'll see guide lines appear projected onto the sides of the physical runway that help you know where to look for the lights if you were landing in actual IMC. At 89 feet you'll hear a "Minimums" GPWS callout. If we were in actual IMC, we'd need to go around if we didn't have the runway in sight by this altitude.

Landing:

- As the airplane flares and touches down, quickly press and hold F2 to engage the thrust reversers. Keep them activated until you're at around 80 knots or so, then press F1 to begin stowing them.

- Disengage the autopilot by pressing Z or your joystick AP disconnect key twice.

- Brake manually below 80 knots, which will disengage the autobrakes.

  Note that due to an issue with P3D, you will need to tap the brakes several times or press and hold them to get the autobrakes to disengage.

- Turn off at Taxiway V1 and hold.

- Raise the HGS by clicking on the left cockpit window support again.

Welcome to Amsterdam and congratulations on the successful conclusion of your first **PMDG 737NGX** flight!

You have a choice now:

You can continue taxiing to the terminal and do the bonus Shutdown and Secure Procedures, or you can leave P3D now and move on later to the more advanced **PMDG 737NGX** Tutorial #2 which takes us from here, **EHAM – Amsterdam Schiphol, The Netherlands** to **LOWI – Innsbruck, Austria** high in the Alps. You'll fly the famous (or infamous depending on who you talk to!) LOC/DME EAST approach with the circle to land visual approach to Runway 08. This is one of the most challenging approaches in all of commercial aviation and we're going to show you how to fly it like a pro using some of the **PMDG 737NGX's** advanced features. The EGPWS terrain display will show you exactly where you are in relation to the huge mountains that surround the airport and the HGS in its primary mode will allow you to easily nail it right on the numbers, even after rolling out of the tight 180 degree turn in the mountain valley.

BONUS:
SHUTDOWN AND SECURE
NORMAL PROCEDURES

We're now going to do the more advanced end-of-flight procedures "by the book" like a real crew would. The book in question is the **Flight Crew Operations Manual Vol 1. (FCOM Vol. 1)** and you can find it in your **Start Menu\All Programs\PMDG Simulations\PMDG 737 NGX** menu as a PDF file. Note that we will be skipping over items in the procedures that aren't applicable – these procedures have a lot of conditional steps in them and many aren't necessary given the current state of our airplane.

Open the FCOM 1 and find Normal Procedures section page NP.21.81 (page 157 of the PDF version) - the After Landing Procedure.

Because the **PMDG 737NGX** is effectively (for now at least) a single pilot aircraft in the P3D environment, we're going to combine the pilot flying and pilot monitoring's actions – in real life there's a division of labor between the two crew members.

After landing procedure:

The 737-800 we're flying has manual ignition, so we're going to use the section at the top of the page under [Without automatic ignition].

- Verify that the SPD BRK lever in its DOWN position, which stows the spoilers.

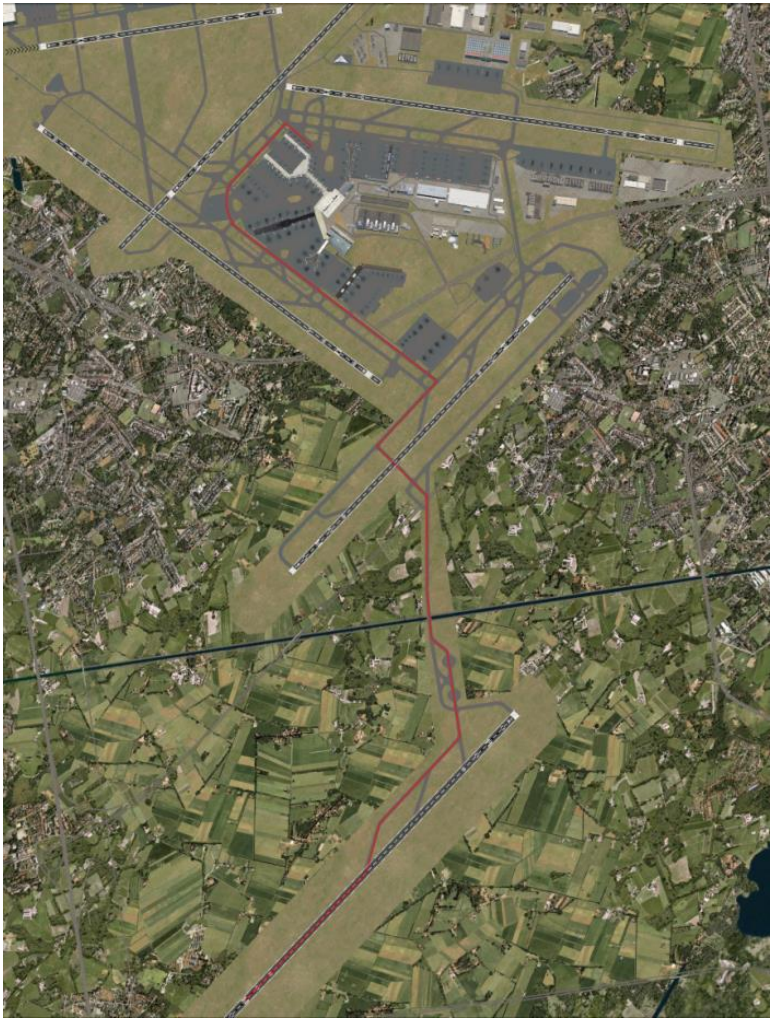
- Start the APU by left clicking twice on the switch at the front of the overhead.

- Set the overhead PROBE HEAT switches to off.

Note that you will get a master caution for ANTI-ICE when doing this. This is normal and you can clear it by pushing on the master caution button.

- Turn off the LANDING LIGHTS, turn on the TAXI LIGHT, and set the POSITION lights switch to STEADY.
- Set the engine start selectors from CONT to off.
- Set the AUTOBRAKES knob to OFF.
- Select FLAPS UP.
- Set the TRANSPONDER mode to ALT since EHAM is an airport equipped with ground radar. (you would set it to standby at an airport not equipped with ground radar)

Runway 18R was built quite far away from the main airport complex for noise abatement during night ops, so we have a bit of a trek to the terminal now. Follow the red highlighted route on the airport diagram below, crossing Runway 18C upon reaching it:



Since we're not simulating any particular airline here, you can pick any gate you'd like on the southeast side of the airport. (also highlighted on the chart above) We'll be departing Runway 24 in Tutorial #2 and this will put us very close to it for a short taxi.

Once we're at the gate, it's time to perform the Shutdown Procedure which starts at FCOM 1 NP.21.82 (page 158 of the PDF version)

Shutdown procedure:

- Set the parking brake either by clicking the handle on the pedestal, or by pressing Shift+.(period key). We don't want our 737's nose making a surprise cameo inside the terminal…

- Set both APU generator bus switches to on.

Verify that the GEN OFF BUS lights for the engine driven generators are lit and the APU GEN OFF BUS light is extinguished – the plane is now receiving its electrical power solely from the APU generators.

- On the pedestal view, move both engine start levers below the throttles to the cutoff position (down) by left clicking them.

This is the action that actually shuts down the engines.

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

- Turn the red anti-collision beacon switch off.

- Turn all FUEL PUMP switches off.

- Leave the engine hydraulic pump switches ON and set the electric demand pump switches to off.

- Set the pneumatic panel isolation valve to open and set the APU bleed air switch to on.

- Turn off both FLIGHT DIRECTOR switches on the MCP.

  Doing this resets the AFDS and clears any modes that may still be present on the FMA.

- Set the pedestal TRANSPONDER switch to STBY.

  This stops us from showing up on ground radar at the gate.

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

- Disengage the PARKING BRAKE by clicking the lever since we're now held in place by the chocks.

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

- Move the APU switch to the off position.

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

- Perform the SHUTDOWN checklist, which you can find on page NC.3 of the QRH (page 27 of the PDF version)

These items are just checking (hence the name!) things we've already accomplished in the Shutdown Procedure.

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

Secure procedure:

The Secure Procedure's purpose is to get the airplane into a condition ready for servicing by the ground crews, but without completely powering it down – we of course will be completely powering it down, but the Secure Checklist has to be done first.

- Rotate both IRS mode selectors on the rear overhead to OFF.

This powers down the inertial reference system's laser gyros. They will now lose alignment and we'll need to fully realign them during our preflight for Tutorial Flight #2.

- Set the EMERGENCY EXIT LIGHTS SWITCH in the center of the forward overhead to OFF. This disarms the cabin exit lighting since there's no longer any chance of a passenger evacuation.

- Set all four WINDOW HEAT switches at the top of the forward overhead panel to OFF.

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

- Perform the SECURE checklist, located on page NC.4 of the QRH (page 28 of the PDF version). As with the SHUTDOWN checklist, we're just checking the items we've already performed as part of the procedure here.

Electrical power down:

The final step that will actually put the aircraft into a cold & dark state is the Electrical Power Down procedure, which is located in FCOM 1's Supplemental Procedures section on page SP.6.4 (page 212 of the PDF version).

- Verify that both the APU and GRD POWER switches are OFF.

Ensure that at least 2 minutes has elapsed since the APU was turned off during the Shutdown Procedure before continuing.

- Set the overhead BATTERY switch to OFF.

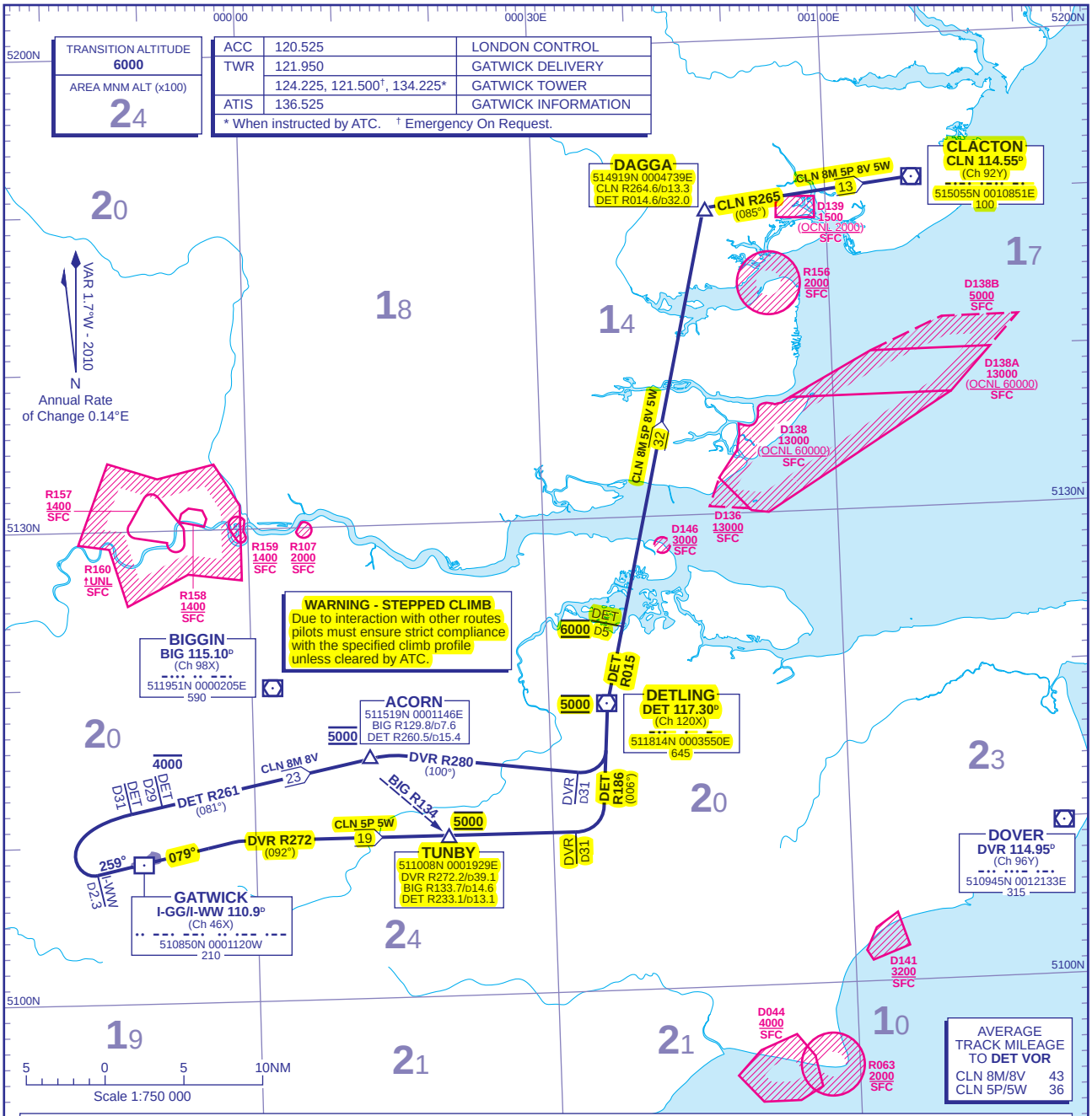
The airplane is now powered down to its cold & dark state. You can now continue without even reloading the sim with Tutorial #2 to Innsbruck, or you can quit and come back later and load the Tutorial #2 saved flight that will bring you right back to this position and panel state.

This concludes the **PMDG 737NGX** Tutorial #1, see you in Tutorial #2!

STANDARD DEPARTURE CHART - INSTRUMENT (SID) - ICAO

DISTANCES IN NAUTICAL MILES
BEARINGS, TRACKS AND RADIALS ARE MAGNETIC
ALTITUDES AND ELEVATIONS ARE IN FEET

LONDON GATWICK CLACTON



CLN 8M/8V RWY 26L/R†	Straight ahead until **I-WW** D2.3, then turn right to intercept **DET VOR** R261 by **DET** D31. Crossing **DET** D29 at **4000** or below. At **DET** D15 (**ACORN**) turn right onto **DVR VOR** R280. Crossing **DET** D31 turn left to **DET VOR**. Crossing **DET VOR** at **5000**. At **DET VOR** turn right onto **DET VOR** R015 to **DAGGA**. Crossing **DET** R015/D5 at **6000**. At **DAGGA** turn right onto **CLN VOR** R265 to **CLN VOR**.	via **CLN** L620 eastbound.
CLN 5P/5W RWY 08R/L†	Straight ahead, maintain track 079° to intercept **DVR VOR** R272. Crossing **DVR** D39 (**TUNBY**) at **5000**. At **DVR** D31 turn left to **DET VOR**. Crossing **DET VOR** at **5000**. At **DET VOR** turn right onto **DET VOR** R015 to **DAGGA**. Crossing **DET** R015/D5 at **6000**. At **DAGGA** turn right onto **CLN VOR** R265 to **CLN VOR**.	via **CLN** L620 eastbound.

OBSTACLE CLEARANCE

† RWY 08L: Maintain minimum 5·5% climb gradient to 396 QNH (200 QFE).
† RWY 26R: Owing to proximity of a 30FT high earth bank to the end of the clearway, it is not possible to publish a minimum required climb gradient for departures from this RWY. See Aerodrome Obstacle Chart ICAO Type A - Operating Limitations.

GENERAL INFORMATION

1 SIDs reflect Noise Preferential Routeings. See EGKK AD 2.21 for Noise Abatement Procedures.
2 Initial climb straight ahead to 702 QNH (500 QFE).
3 Cross Noise Monitoring Points not below 1202 QNH (1000 QFE) thereafter maintain minimum climb gradient of 4% to 3000 to comply with Noise Abatement requirements.
4 Callsign for RTF frequency used **when instructed** after take-off 'London Control'. Report callsign, SID designator, current altitude and initial cleared altitude on first contact with 'London Control'.
5 En-route cruising levels will be issued after take-off by 'London Control'. **Do not climb above SID levels until instructed by ATC**.
6 Maximum 250KIAS below FL100 unless otherwise authorised.
7 SIDs for RWYs 26R and 08L are identical to those for RWYs 26L and 08R respectively. RWY codes V and W are allocated to 26R and 08L.
8 CLN 8M/8V: In order to alleviate airspace congestion pilots may be offered TIGER 2M/2V SID at a late stage of taxiing. Pilots unable to accept TIGER SID when offered must inform ATC and will be allocated CLM 8M/8V.
9 **Also for positioning flights to London Luton and London Stansted. Follow CLN SID to DET then join ABBOT 1E STAR maintaining 5000.**

CHANGE: COM.

AERO INFO DATE 18 MAY 10

CHANGE : designated point VEREL renamed ROBVI, related STAR designators, editorial.

ICAO STAR DESIGNATORS AND CORRESPONDING ARINC 424 CODES

DENUT 1A	[DENU1A]	NORKU 2B	[NORK2B]
EELDE 1A	[EEL1A]	PESER 2A	[PESE2A]
EELDE 1B	[EEL1B]	PUTTY 1A	[PUTY1A]
HELEN 1A	[HELE1A]	REDFA 1A	[REDF1A]
LAMSO 1A	[LAMS1A]	REKKEN 2A	[RKN2A]
MOLIX 2A	[MOLI2A]	REKKEN 2B	[RKN2B]
NORKU 2A	[NORK2A]	TOPPA 2A	[TOPA2A]

TRANSITION LEVEL BY ATC
TRANSITION ALTITUDE : 3000 ft AMSL

AVERAGE VAR 1°W (2005)
DISTANCES IN NM
ALTITUDES IN FEET
DIRECTIONS ARE MAGNETIC
23 SPY 304 DME SPY 23 NM
VOR SPY RADIAL 304
ATS ROUTE
CDR
SID ROUTE AS DESCRIBED
STAR

Detailed information concerning ATS-routes see ENR 6-3.1

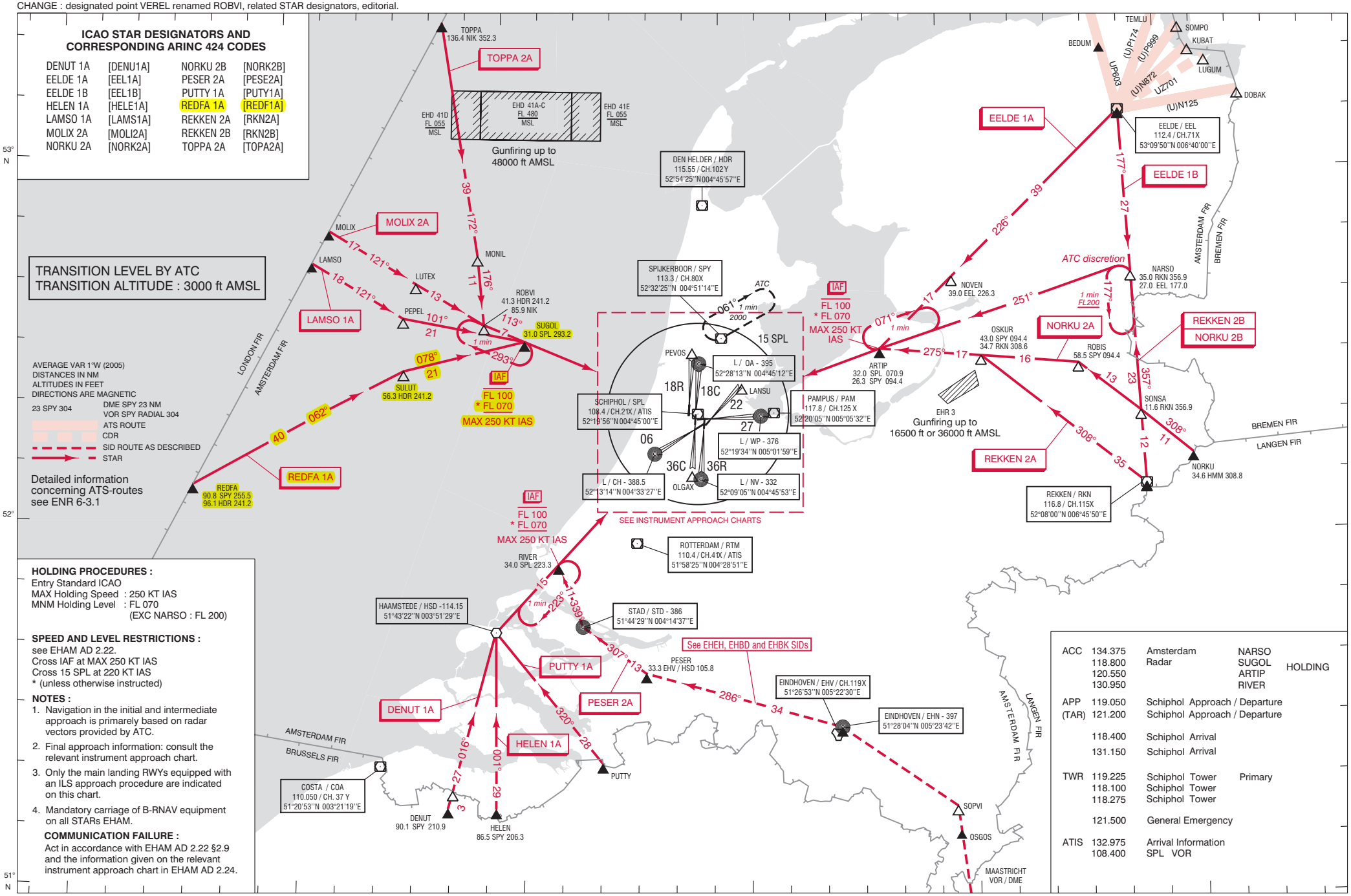
HOLDING PROCEDURES :
Entry Standard ICAO
MAX Holding Speed : 250 KT IAS
MNM Holding Level : FL 070
(EXC NARSO : FL 200)

SPEED AND LEVEL RESTRICTIONS :
see EHAM AD 2.22.
Cross IAF at MAX 250 KT IAS
Cross 15 SPL at 220 KT IAS
* (unless otherwise instructed)

NOTES :
1. Navigation in the initial and intermediate approach is primarily based on radar vectors provided by ATC.
2. Final approach information: consult the relevant instrument approach chart.
3. Only the main landing RWYs equipped with an ILS approach procedure are indicated on this chart.
4. Mandatory carriage of B-RNAV equipment on all STARs EHAM.

COMMUNICATION FAILURE :
Act in accordance with EHAM AD 2.22 §2.9 and the information given on the relevant instrument approach chart in EHAM AD 2.24.

ACC	134.375	Amsterdam Radar	NARSO, SUGOL, ARTIP, RIVER — HOLDING
	118.800		
	120.550		
	130.950		
APP	119.050	Schiphol Approach / Departure	
(TAR)	121.200	Schiphol Approach / Departure	
	118.400	Schiphol Arrival	
	131.150	Schiphol Arrival	
TWR	119.225	Schiphol Tower	Primary
	118.100	Schiphol Tower	
	118.275	Schiphol Tower	
	121.500	General Emergency	
ATIS	132.975	Arrival Information	
	108.400	SPL VOR	



- **ATC may deviate from the transitions by radar vectors.**
- **Rejoining the transition may take place at NIRSI.**
- **ILS must be available.**
- **ILS not equipped with markers.**
- **Given EH waypoints beyond the FAP must be considered to be supplementary information.**

Altitudes / Speeds
ENTRY LEVELS SCHIPHOL TMA: Cross IAF at FL 100
During the transition, descend to or maintain a level as instructed by ATC.

When cleared for NIRSI / NARIX approach RWY 18R :
- Continue via the transition.
- Switch to QNH at NIRSI/NARIX.
- Establish a continuously descending flight path without level segments.
- The minimum altitudes shall be respected.
- The published speeds are mandatory at the specified waypoint.
- Execute the ILS approach RWY 18R.

P-RNAV approval required (see EHAM AD 2.22 paragraph 2.6)

EH603 — 271° — EH602 MNM FL 070 — 271° — EH601 MNM FL 070 — 293° — NARIX MNM FL 060 250 KT IAS — ARTIP 3B TRANSITION — FROM ARTIP (IAF)
ARTIP 2C TRANSITION — 296° — 290° — EH600 MNM FL 070

181° — EH607 — 091° — 133° — NIRSI MNM FL 055 220 KT IAS
EH604 MNM 4000 AMSL 220 KT IAS — 234° — 234°
325 — 325
CASTRICUM — IF EH608 MNM 3400 AMSL — 184°
SPIJKERBOOR / SPY 113.3 / CH.80 X 52°32'25"N 004°51'14"E

SUGOL (IAF) At FL 100 MAX 250 KT IAS — 113° — SUGOL 3B TRANSITION — 026° — EH606

364 — 453 — 509 — 522 — GAS COMPRESSOR STATION Avoid overflying below 1000 ft AGL
FAP EH621 6.2 VPB 7.9 SPL
EH622 5.8 SPL 160 KT IAS
469 — 417 — 416 — 338 — 587 — 479

AD ELEV -11 — VAR 1° W (2005)

SCHIPHOL / VPB CH.38X 52°21'26"N 004°42'50"E — 341 — 436
PAMPUS / PAM 117.8 / CH.125 X 52°20'05"N 005°05'32"E
THR 18R
EH624 7.5 SPL — MNM 2000 AMSL — 280° SPL 280 — SPL 240
344 — 495 — 479
IN CASE OF MISSED APPROACH INFORM ATC IMMEDIATELY
LANGEVELD — 320
WARNING! Do not overshoot SPL 240 due to departures RWY 24.
SCHIPHOL / SPL 108.4 / CH.21 X / ATIS 52°19'56"N 004°45'00"E
683

N O R T H S E A

VALKENBURG — 377

RIVER 3B TRANSITION — 026° — EH605 — 357° — FROM RIVER (IAF)

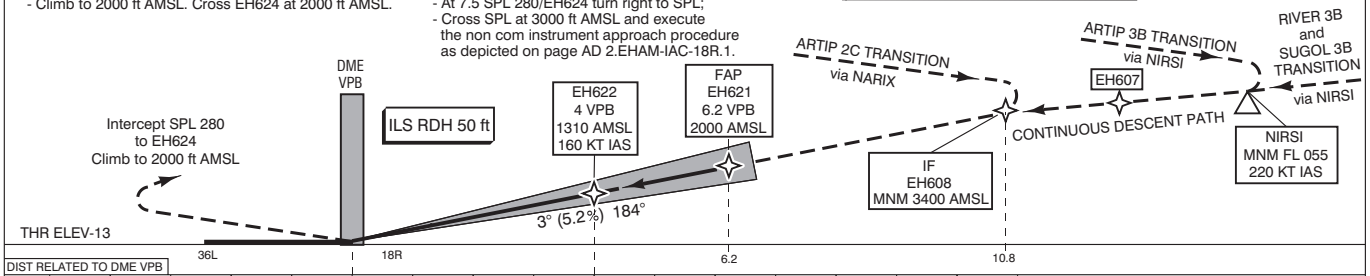
APP (TAR)	119.050	Schiphol Approach / Departure	
	121.200	Schiphol Approach / Departure	
	118.400	Schiphol Arrival	
	131.150	Schiphol Arrival	
TWR	119.225	Schiphol Tower	Primary
	118.100	Schiphol Tower	
	118.275	Schiphol Tower	
	121.900	Schiphol Ground	Ground Control
	121.500	General Emergency	
	243.000	in Amsterdam FIR	
ATIS	132.975	Arrival Information	
	108.400	SPL VOR	
GP	334.400		
LOC	110.100	VPB	
DME	CH 38X	VPB	

52° 40' N — 52° 30' — 52° 20' — 52° 10' — 52° 00' N
4°E — 4°10' — 4°20' — 4°30' — 4°40' — 4°50' — 5° — 5°10'E

1. Missed approach:
- Inform ATC immediately.
- Turn right as soon as practicable to intercept SPL 280 and do not overshoot SPL 240;
- Climb to 2000 ft AMSL. Cross EH624 at 2000 ft AMSL.

2. Missed approach in case of communication failure:
- Turn right as soon as practicable to intercept SPL 280 and do not overshoot SPL 240;
- Climb to 3000 ft AMSL;
- At 7.5 SPL 280/EH624 turn right to SPL;
- Cross SPL at 3000 ft AMSL and execute the non com instrument approach procedure as depicted on page AD 2.EHAM-IAC-18R.1.

TRANSITION LEVEL BY ATC
TRANSITION ALTITUDE 3000 ft AMSL



GS IN KT	100	120	140	160	180	200	220
VERTICAL SPEED	530 ft/min	635 ft/min	745 ft/min	850 ft/min	955 ft/min	1060 ft/min	1165 ft/min

OCA *(OCH)* ELEV THR 18R: -13.1 ft

ACFT CAT	CAT I Press Alt	CAT II Radio Alt	CIRCLING*
A	129 *(142)*	*50*	620 *(630)*
B	138 *(151)*	*60*	780 *(790)*
C	152 *(165)*	*73*	880 *(890)*
D	165 *(178)*	*89*	890 *(900)*
DL	168 *(181)*	*96*	

CEILING AND VISIBILITY MINIMA

TAKE-OFF	DAY:	NIGHT:	
LANDING	DAY:	NIGHT:	

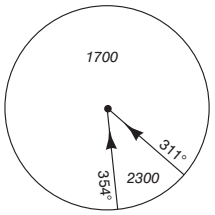
NA — NA

* Circling procedures to and landing on RWY 18L and 36L is not permitted, except in case of an emergency.

BEARINGS ARE MAGNETIC
DISTANCES IN NM
ALTITUDES AND ELEVATIONS IN FEET

THR 18R	52°21'37"N	004°42'42"E
EH600	52°35'44"N	005°10'49"E
EH601	52°41'17"N	004°50'57"E
EH602	52°41'18"N	004°40'48"E
EH603	52°41'17"N	004°30'48"E
EH604	52°35'22"N	004°50'14"E
EH605	52°03'59"N	004°06'58"E
EH606	52°25'21"N	004°23'16"E
EH607	52°35'02"N	004°38'49"E
EH608	52°32'22"N	004°43'41"E
EH621	52°27'46"N	004°43'16"E
EH622	52°25'36"N	004°43'04"E
EH624	52°21'10"N	004°32'55"E

MSA BASED ON SPL VOR/DME



CHANGE: missed approach procedure, editorial.