Getting Started with PSX

Part 1 — Introduction to PSX and a short preliminary flight

by Brian Cowell
with additional material by Hardy Heinlin

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Introduction

Those who remember PS1 may perhaps also recall The Big Tutorial. Originally published for use with PS1.2c in the year 2000, it was later revised for the changes in PS1.3 — at that time it comprised over 70,000 words on 170 A4 pages (including 14 appendices). It benefited from additional material provided by Hardy Heinlin, and was password protected so that only those who possessed the printed glossy PS1 manual could access it.

Time moves on, and in 2014 we now have the graphical splendour that is PSX. We also have a similar problem to the one we had then, in that many of the people who buy PSX have a considerable learning curve ahead of them. The 600-page manual that comes with PSX is superb; however it can also be slightly daunting to someone unfamiliar with the 744 and/or Precision Simulator's unique approach to simulating the aircraft, so once again we have requests on the forum from those unsure where to start.

Time has moved on in another way, too. Back at the beginning of the 21st century, simmers were less informed than they are today. The availability of complex airliners from other companies has done much to make that sort of information more available, even though the compromises and limitations which those models incorporate may need to be unlearned for PSX. Also, there are nowadays many sources from which simmers may obtain the actual Boeing manuals — FCOM, FCTM, QRH, and so on — which was not the case in PS1's day.

So when I bowed to calls from those asking if The Big Tutorial was going to be reissued for PSX, I quickly realised that this time the word "big" need no longer apply, since much of the material is nowadays known, or else is available from other sources. Furthermore, it seemed to me that there were in fact just two main areas which needed to be addressed: using the PSX simulation; and also a description of a complete flight, described in the order in which activities take place, rather than by subject area as in the PSX manual. Of course, such thinking omitted some necessary intervening activities, notably flight planning....

Anyway, this is my beginner's manual for PSX, which aims to address the questions which arise soon after PSX is first installed — where to start, in other words. It will try to deal with initial questions about layouts and control assignments, and describe the creation of a "Situation" (of the PSX variety) for an extremely brief introductory flight, since many simmers have found it hard to make a situation themselves. Parts 2 and 3 will follow....

I am delighted that Hardy Heinlin has once more graciously agreed to assist me by making his own comments (and indeed those who knew The Big Tutorial will find other similarities in this version). But enough background, let's get down to business.

So, your new copy of PSX has just been delivered? Please read on....

Preliminary comments and caveats

I had to start somewhere, so a certain amount of background in aviation terminology and concepts in general, and airliners in particular, has to be assumed on the part of the reader, or else I will have to spend a lot of time and tutorial space explaining what flaps are or what V_1 means. As noted on the previous page, these days there are many sources from which information about such matters can be obtained, and I therefore feel that the majority of my readers will prefer the newer (briefer) approach.

Also, I should explain that this is being written by an Englishman, using the sort of English that is spoken in England, and so the spelling will also be that of English in its original form. The same applies to weights and measures — in line with U.K. practice I will be using Kg and feet, so if you are more accustomed to lbs and/or metres, or to a different dialect of English, please accept my apologies and convert as needed.

On the tiresome-but-necessary legal side, I retain the copyright in this material, which is entirely and exclusively for the personal use of licensed non-commercial users of PSX only; and the usual FreeWare caveats apply:

- No one is allowed to make any money from this (it may not be used in any published collections, and may not be uploaded to any web site without my written permission — which will in no case be granted if a charge is made for access).

- You read/use it at your own risk. I don't warrant that it's fit for any purpose whatsoever (other than occupying disk space).

- Therefore no responsibility is accepted if you think it has caused any harm whatsoever — to you, your computer, your marital status, mental stability, or *anything*.

- Finally, the traditional disclaimer: this Tutorial is under no circumstances to be used for real world flying! (Would anyone really be that stupid? Still, I suppose it has to be said). <sigh>

The descriptions which follow refer to the use of PSX on Windows. If there are any significant differences on other platforms, then please make the necessary adjustments.

Finally, I must place on record my huge thanks to Hardy Heinlin who has been kind enough to read through this stuff and suggest many changes and improvements — at a time just after release when the forum has been exceptionally busy with Alpha releases and forum questions. With his permission I have included many of his insights in the text, and I am deeply grateful to him for his kindness, and, of course, for the incredibly detailed simulation of the 747 which he has once again provided for us to explore.

Distinctive aspects of PSX

I haven't been in an RAF helicopter squadron crew-room for some years now, but when I used to frequent such places on a regular basis there was always a humorous poster somewhere to the effect that "helicopters are different". No one needed reminding about that, of course, but when you saw the list — "The wings go round and round; The Captain sits on the right; They glide like a brick..." and so on — in a mildly amusing way it did help to focus your mind-set.

Precision Simulator Ten is also different, in fact hugely different from the average 747 simulation. Since, therefore, there will be many simmers whose previous experience has been with FSX, P3D, X-Plane, or whatever, it may be worth just making a few fairly obvious comments at this point to help with your orientation, and prepare you for what is to come.

PSX isn't primarily a world simulator like FSX and the rest. It simulates one aircraft, the Boeing 744 (in unbelievable detail) and allows professional flight training establishments and others to operate something which is incredibly close to the real aircraft, and to inflict various kinds of environmental and functional changes upon the pilot. In that respect it closely resembles what happens in a professional full flight simulator since they, too, have an Instructor Station which can control every aspect of the flying experience.

PSX's outside scenery consists mainly of subtle depictions of horizons and runways with their approach lighting — all you need to be able to land and take off in an airliner. You also see muted variations in lighting in cloud, and some weather effects such as rain and lightning, so you don't require anything to fly worldwide except PSX itself (its database contains all runways longer than 4,600 ft, or 1400m). However, if you absolutely insist on seeing more eye candy, free add-ons written by talented members of the friendly PSX community [http://aerowinx.com/forum/forum.php?id=1] are available which will link PSX to FSX or X-Plane, or even Google Earth. But such measures are a luxury, not a necessity.

(The list of free add-ons is growing all the time: see http://aerowinx.com/html/addons.html).

PSX is also written specifically to accommodate the needs of those who build home (and also professional standard) cockpits. This is evident in many ways, but primarily in the way in which the views are so flexibly implemented (the PSX term used for this is "layouts"), and also in its networking approach. Now I am aware that some simmers are intimidated by IP addresses and the like, so I will be keeping the technicalities to the minimum when I say a little bit about networking later on, although you do need some information to appreciate a little of what's possible. For example, activities such as sharing a cockpit across the Internet (a dream which has long been pursued by flight simmers) become straightforward using PSX.

PSX also incorporates its own planet-wide weather system; as well as its own Air Traffic Control (both voice and CPDLC), TCAS, Pilot Non-Flying (PNF), ATIS, cabin and ground crew.

It's all so good that we'd better start looking into the details. ☺

Prerequisites and installation

By the time you read this, the prerequisites will probably be listed on the main Aerowinx site, but initially they were to be found in this post:
http://aerowinx.com/forum/topic.php?post=14988#post14988

You will obviously have reviewed these carefully before you bought PSX: and although the machine requirements are modest, permit me to draw your attention to a few points.

- Your Operating System (O/S) must support Java version 1.6, or 1.7, or a higher compatible version. The O/S of tablets often doesn't, so beware.
- The more screen area you have, the better your layouts can be made to be. Although many people run PSX very happily on a laptop with a single screen, if you do have a machine with a beefy graphics card (especially one that supports two or three monitors) then Java will take advantage of the available hardware acceleration to improve your performance and frame rate; also, spreading your flightdeck frames over a larger area will also enhance your experience (PSX is graphically gorgeous).
- The need for a numeric keypad on your keyboard should not be underestimated, in my opinion, since apart from anything else this is the easiest method by which to switch between your nine screen layouts (see later...). So if you do have a laptop, it can (I speak from experience, here) drive you slightly crazy if you need to keep switching to using its keyboard's so-called 'embedded keypad' mode and back again, in addition to typing the rest of the (many!) keyboard commands which you will need, in the probable absence of specialised hardware. Either get yourself a USB-pluggable numeric keypad (assuming you have a free USB port), or better still do yourself a favour and plug in a full-sized keyboard if your laptop permits. When things start to happen in a hurry, especially during the take-off or landing phases of flight, the last thing you need is to have to furiously type dozens of keystrokes....
- Mention is made of the need for "3 GB free hard disk space", but if you can make that space available on a Solid State Disk (SSD), then I would suggest that you should do so. In a forum post [1], Hardy said "A fast hard drive and a large hard drive

[1] http://aerowinx.com/forum/topic.php?post=15614#post15614

cache memory definitely supports the PSX performance", and he then went on to list the many file groups which are regularly scanned while PSX is in operation. Clearly, the faster those disk accesses can take place, the better your PSX experience will be. Small SSDs are readily available at amazingly cheap prices, these days.....

- Of course, the more "USB yokes, sticks, pedals, throttles, buttons..." you have, the more flexibly you can assign your control inputs. (More on this topic later, too).

The installation process is so straightforward that it hardly needs mentioning — as far as I am aware no one has ever had the slightest problem with it. So your only "problem" when choosing where to put your PSX installation is to consider whether to install it on an SSD as mentioned above; and of course to avoid protected and special areas of your disk such as `C:\Program Files` and the like: (users of other O/Ss please adjust this advice appropriately).

The PSX manual

Following installation, the very first thing to do is to make a desktop link to the "Aerowinx Operations Manual.pdf" file in the Aerowinx directory (folder) so that you can load it easily. Believe me, you will be looking at it frequently! This 600-page masterpiece is a rather beautiful distillation of the many Boeing manuals into a much more compact and easy to read format, combined with essential information about your new simulator. Be aware, of course, that like all such technical manuals the various sections are arranged in alphabetical order, perhaps with a few surprises for those unaccustomed to aviation technology (information about the engines, for example, is to be found under P for Power Plant).

But, of course, this simulation is written primarily for professional flight training establishments. As simmers, we are fortunate to be able to take advantage of it, but we should always remember that it makes no compromises in its quest for accuracy to the real aircraft. So if you find it hard to fly your virtual 744 at first, you shouldn't be too surprised.

Also in the tradition of technical manuals, the PSX manual tells you exactly what you need to do to achieve a given result. It doesn't, however, tell you *why* you might need to do that, or when, and perhaps not even what might happen as a result. It is in these areas that I hope this document will begin to help. The intention is to ease you gently into the whole ethos of PSX during your initial time with the sim, hoping to smooth and (I hope) expedite the initial part of the learning curve.

This tutorial

First of all I'll be making some suggestions about how you can set up your PSX installation for the smoothest and most satisfactory experience. I'll then be suggesting a scenario for your first PSX trip. It will be an extremely short trip, admittedly, but in following it you will discover the absolute basics of how to get your 744 from one runway to another; and it will also serve as a practical test of the layout and control choices you made. To initiate that flight, you will first need to load a Situation (`.situ`) file —you will find it in the .zip file that you downloaded which also contains this document — that places your 744 on the runway, with all the various aircraft setup done, the time of day and weather set, and so on. PSX calls such a file a situation file (or situ, for short), and I will end this document by showing you exactly how I created that file, so that you can then create any situation file for yourself.

Where to start

Given the asking price of PSX, I think it's fair to say that no one buys it who is not extremely serious about simulating the operations of various models of the Boeing 747-400, or 744 for short. I therefore have to assume that you are going to be equally serious about setting it up so that you can enjoy your virtual flights (a.k.a. "vlights") to the greatest possible extent.

Of course it's very tempting to plunge in and just set things up quickly in order to get to the fun stuff as soon as possible. Whilst entirely understandable, this has the inherent danger that you get to know your first rough attempts so well that you are reluctant to change them.

I've been simming since the first Bruce Artwick wireframe graphics on the Apple][, circa 1980, and if I have learned anything at all in the ensuing decades it has been that setting up your simulation to maximise the effectiveness of your ability to both control the aircraft and also to view the cockpit and windscreen views, is time which repays the effort spent a hundred-fold and more.

Hence the initial part of this manual will concentrate on precisely those aspects: only when you are entirely happy that you have set up your simming environment to be as easy and natural to operate as can be achieved with your hardware will we move on to consider setting up a scenario in which you will take to the air — using and creating a situ file.

PSX file types

On page 15 of the PSX manual you will find a list of the file types which you need to know about. Very occasionally, you may also need to manipulate those files. For example, if you should plan your forthcoming trip in the excellent PFPX flight planner [2] and export the route, at the time of writing you will need to manually copy that route (the ".route" file) into the `Aerowinx\Routes` directory of your PSX setup [3]. (You may need to take some other actions, too, but we'll discuss those in due time).

Generally, therefore, you simply need to know that these file types exist: when you create a situation file, for example, PSX will store it for you in the appropriate place. There may also be a possibility to be aware of relating to layout files, but I'll mention that in the appropriate place later on: for now, simply notice that these files hold the relevant information (as clearly indicated by the name of the directory in which they are held).

Order of business (in more detail)....

First of all we'll look at setting up your screen layout. That has to be the first item of business, for obvious reasons — until you've done that, you won't be able to properly explore your 744's cockpit.

Once you have established your own screen layout 9-pack, we'll then move on to the second important item of preliminary business: how to control your 744 using your hardware. Nothing will affect your subsequent vlying (virtual flying) experience more than the ease with which you can naturally find the relevant controls in a hurry, so this aspect is vital.

I will then ask you to become familiar with your personalised cockpit and screen layouts by taking a very short trip, repositioning a 744 from London Gatwick to London Heathrow. Certain aspects of the flight won't be entirely realistic (e.g. starting and ending the trip parked on two exceptionally busy runways), but it will hopefully give you a taste of the amazing simulation that is PSX. In order to make that trip you will need to copy a small situation file [4] into the relevant directory (see the discussion about file types, above).

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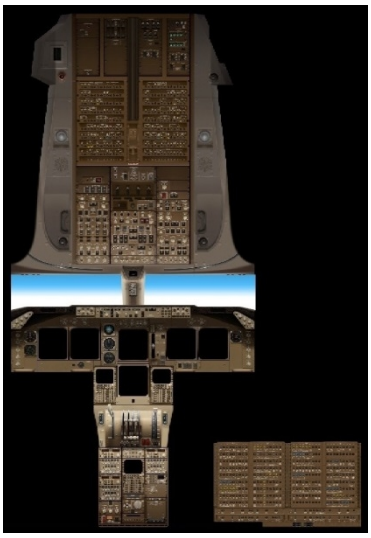
[2] See http://www.flightsimsoft.com/pfpx/ PFPX will also figure prominently in Part 2 of this series.
[3] That will not be the case in the future: the PFPX developers have confirmed that "In one of the next PFPX versions, flight plans/route export function for PSX will be supported as well." (http://forum.aerosoft.com/index.php?/topic/83875-pspxpsx/#entry601617)
[4] Included in the zip package with this pdf file, as previously mentioned.

The tutorial then concludes by walking you through the various actions necessary to create the situation file you have just used. Not only will this familiarise you with the various Instructor pages, but it will also enable you to set up your own situation to vly (virtually fly) anywhere in the world you wish.

Following which, I'll leave you to have fun, while I also get on with enjoying PSX.... ☺

But then, I also have Parts 2 and 3 of this series to write. <gulp>

Layouts, subframes, and 9packs — viewing your PSX world



Just to put things in context before you begin, imagine for a moment that you are going to create a simulator for the 744, and you want to enable the simmers using it to see all of the cockpit interior and controls. On the right you can see a representation of the shape of the cockpit and its controls, including the circuit breaker panels. Now consider the fact that the average computer monitor today is a widescreen rectangle — and you will immediately see the problem.

How is the virtual pilot meant to find his way around that tall and irregular shape whilst using a landscape-oriented monitor screen, also retaining the vital ability to view enough detail of the instruments, as well as longer-range views of less critical areas?

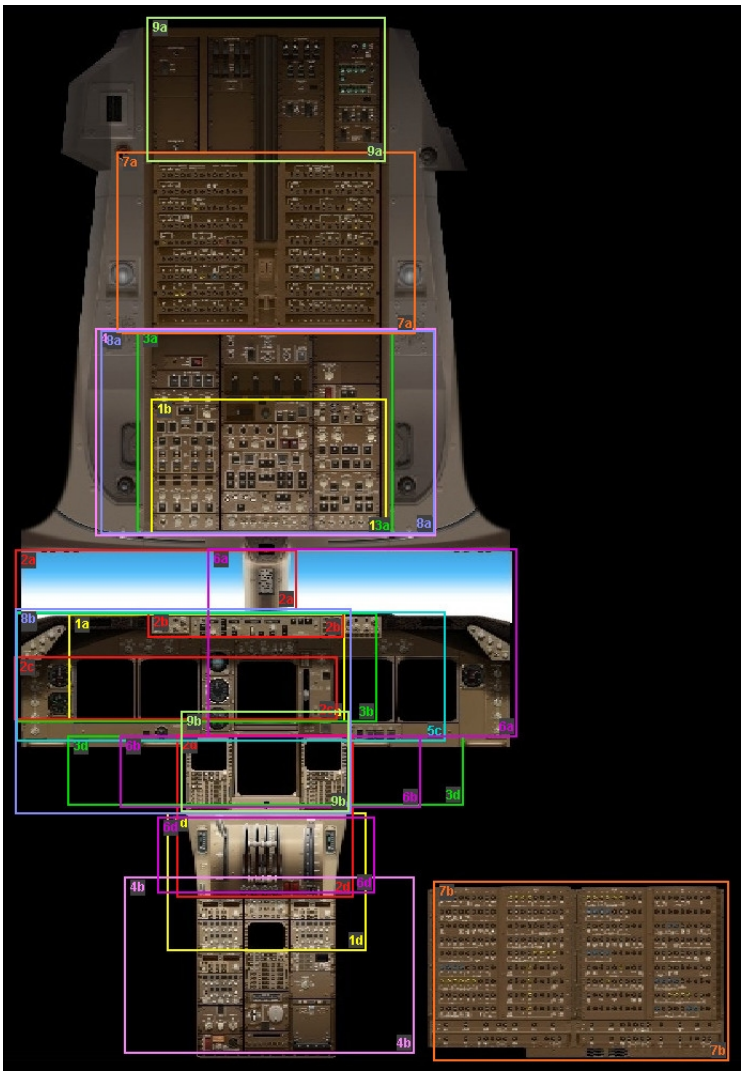
Hardy's ingenious solution (devised with cockpit builders very much in mind) was to allow total flexibility in the way the cockpit interior is viewed — a brilliant achievement. Since the concept is new, and the terminology slightly unusual, let's review it.

Each visible PSX "screenful" can consist of either a single screen (in the case of a laptop, for example, when that's all there is) or a virtual screen if graphics hardware is fitted. So since in my case I have a graphics card which allows three monitors to be connected to it, I have a single virtual screen of 5760x1200 pixels. On that virtual screen I usually have a virtual screen for PSX which is 3840x1200 px, so that I can use the third screen for the Instructor station, charts, notes, and so on. But that's utterly flexible: if I wanted to change it, it's easy.

But there's more. Each "screenful" (the correct PSX terminology is a "flightdeck frame") can be divided into two, three, or four subframes, simply by clicking and dragging the borders. Within each subframe, you can then pan the view to anywhere you like within the PSX cockpit, and also zoom the magnification level to whatever you like.

And as if that wasn't enough, you have nine such arrangements that you can define, and then switch between them instantly by using the 1 – 9 keys on the numeric keypad (or by USB buttons, or using the mouse, or via an Instructor page). So you have nine flightdeck frames (each of which may contain subframes, of course) that you can instantly switch to at will. If, therefore, you take care to include views of all parts of the cockpit somewhere within those nine flightdeck frames, you will have your very own series of cockpit views.

Naturally, once you have gone to the trouble of arranging each of your nine frame/subframe combinations, you can save them all — in what is termed a layout file, which on disk has the suffix .9pack. So you could have one 9pack for your laptop, and another for your desktop layouts, and so on.



On the left you see my current two-monitor layouts superimposed on the cockpit layout, and numbered accordingly. (The diagram is generated by another free PSX add-on, this one called ELVis (the Easy Layout Visualiser for PSX — thank you, Martin!), which is extremely useful to view the various contents of your different 9packs). PSX ships with a ready-made collection of example layouts, and when you start to make your own it's often easiest to load the one which corresponds most closely to your own circumstances, and then modify and save it under a different name.

OK, now that you understand the concept, and the terminology, please take a look at pp 17 – 19 of the PSX manual, which fully explains (with diagrams) how to split, zoom, and pan your frames and subframes.

<pause whilst you review the manual>

You now have the information you need to create your own layout and 9pack. All that you need to know now is how to save the results of your careful work for future use.

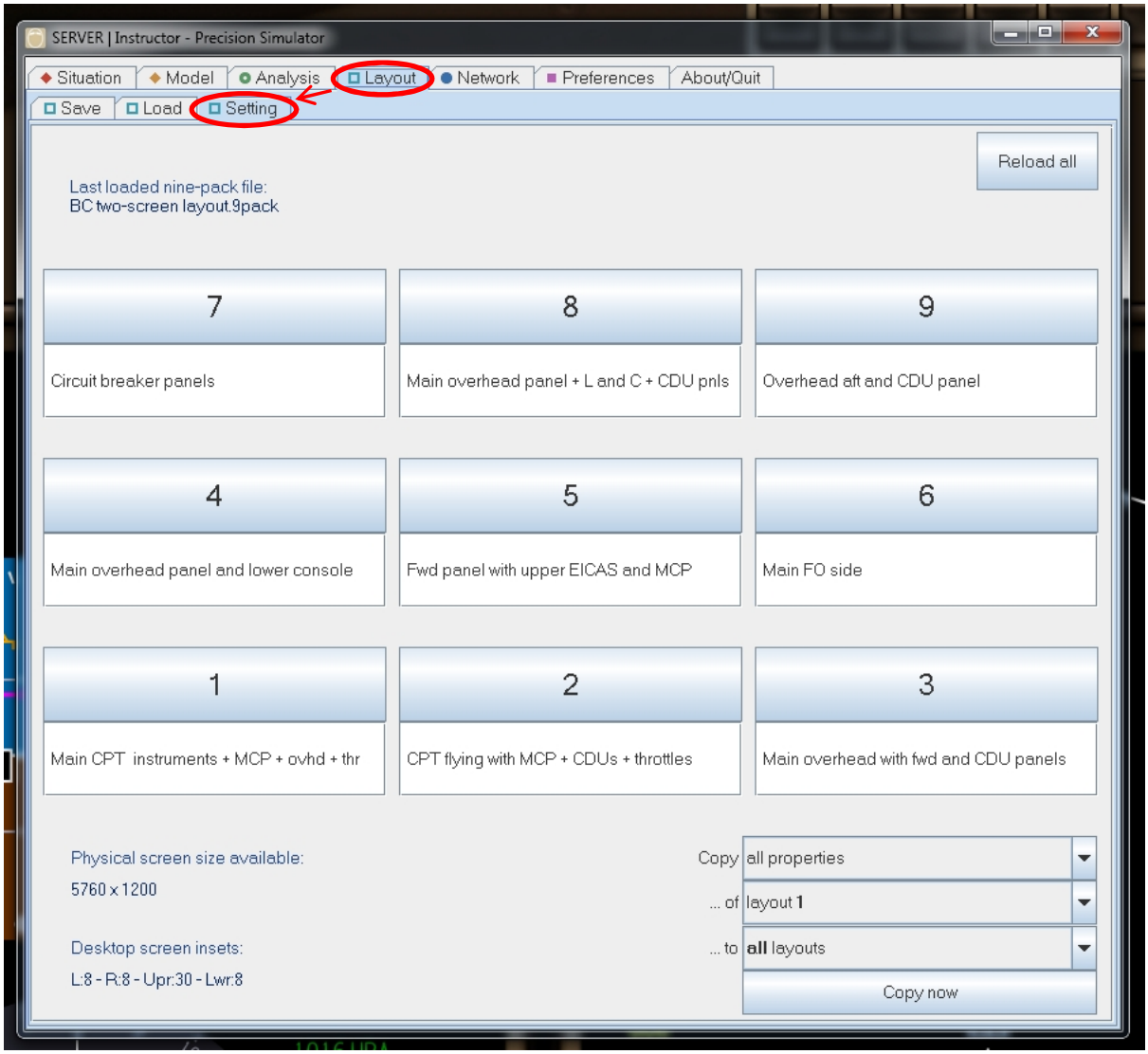
The Instructor pages

PSX works on the concept that the simulator's options are all controlled from the Instructor station, which is summoned and dismissed using the Esc key on your keyboard (later I will show you a way to map the function to a button on your joystick). The relevant manual pages are logically laid out in the sequence in which you see the tabs on the screen, but in the event that you need a simple index to the functions, please refer to Appendix 1.

As you can see, there are three pages in the manual relating to Layout: Save (p.66), Load (p.67), and Setting (p.68). So your approach will be to first of all use Martin's ELVis utility to

review the available layouts (bearing in mind their names and your screen size(s)); then, you can Load the supplied layout which is nearest to your immediate requirements. Work your way through each of the layout's nine flightdeck frames in turn, first resizing each one to your screen if necessary and then adjusting the subframes to suit, panning and zooming the contents of each one until they are just what you need.

To move between the different layout pages, use the Instructor Layout | Setting page.



You can move to each of the nine layouts by clicking the numbers (and once you have adjusted matters to suit your taste you can then retype the description below each number to reflect the result). If you completely mess things up you can start from scratch by reloading the layout file you are using (button, top right). Notice also the helpful information available here: top left you have the name of the layout file you loaded, whilst lower left you have your available screen size. The buttons to the right incorporate dropdowns, and using them you can copy layouts (or just some of their properties) to different numbers, which can also be helpful, as we will see.

Make an initial plan and then work carefully, since it's embarrassing if you want to retract the flaps and suddenly find that you haven't got a view of the flaps lever anywhere — once again, ELVis can help you to check.

Bear in mind also that it's not uncommon for people to spend a week in refining their 9pack layouts until they are as comprehensive and logical as they can possibly be for the way in which they vly, so try not to rush this work. The more you think it through, the more your subsequent enjoyment will be enhanced.

But whatever you do, when you've finished don't forget to go to the Layouts | Save page and **save your efforts** using a name that you'll remember! (You have to click the Save button *twice* after supplying a new name, incidentally, but the prompts will make that clear to you).

Earlier, whilst discussing the rare occasions when you might need to access the files within the Aerowinx directory tree, I mentioned that occasionally you might need to access the layout files, too. By this I had originally meant that it's possible to visit the 9pack file you have just created and use a text editor to edit screenX and screenY which define the corner coordinates, and screenW and screenH which define the size of the screen, so that they're all the same.

But happily, Hardy has pointed out to me that there is a Better Way, so here it is. ☺

During your clicking and dragging and panning and zooming to create your perfect set of layouts it's distinctly possible that some of the nine layouts are now slightly different in size from the rest, which can result in flicker — in Hardy's words "If the frame size changes when switching to another layout, a brown refresh flicker may occur." [5]

So to ensure that no flicker happens, you need to have all nine of your layouts occupying the same size and position on your screen(s). The first step is to select layout 1 by clicking it on the Layout | Setting Instructor page, and then inspect and adjust it to ensure that it is exactly the size and position that you need for all your layouts. In other words, if you have a single screen of 1200x768 pixels, for example, ensure that your Layout 1 fills it completely.

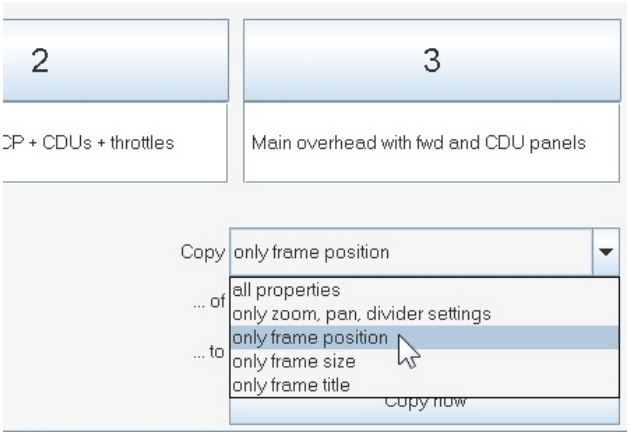
Once you're sure that Layout 1 represents the standard which you want to apply to all your other eight layouts, proceed as follows:—

[5] http://aerowinx.com/forum/topic.php?post=17202#post17202

You're going to use the Copy buttons, lower right on that page, to harmonise all the layouts accordingly.

With layout 1 still selected, then —

- From the top dropdown, select "only frame position" (as shown, right).
- From the next dropdown, select "... of layout 1".
- From the bottom dropdown, select "... to all layouts"



- Then, click the "Copy now" button.

But you also need to ensure that all the sizes are the same, too.

- Return to the top dropdown and this time select "only frame size".
- Leave the other two dropdown boxes as they are, and once more click "Copy now".

Which is an awful lot easier than messing about with a text editor! ☺

There's just one more thing that you may wish to do. Take a look at the Preferences | Basics tab of the Instructor pages. This is where you define which 9pack PSX will load when you start it up (Layouts are not saved with Situations, since everyone's screen layouts are different). If the contents of the "Start with layout" box are not what you wish, do this:

- Go to the Layout | Load page
- Click on the layout you wish to load at startup and copy it:
  - (Ctrl C, in Windows,
  - Cmd C in OS X).

- Go back to the Preferences | Basics page
- Select the previous contents of the "Start with layout" box and paste your layout choice into it.
    - (Ctrl V, in Windows,
    - Cmd V in OS X).

(Incidentally, you can use a similar technique with the Situation | Load page if you would like to change the "Start with Situation" box to suit your preference).

Congratulations!

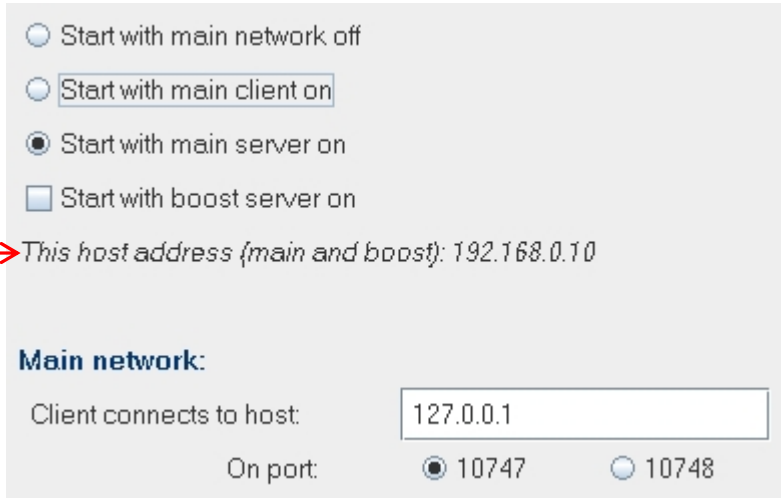
You have now completed the first of the tasks which are essential for maximising your enjoyment of PSX. ☺

Networking issues

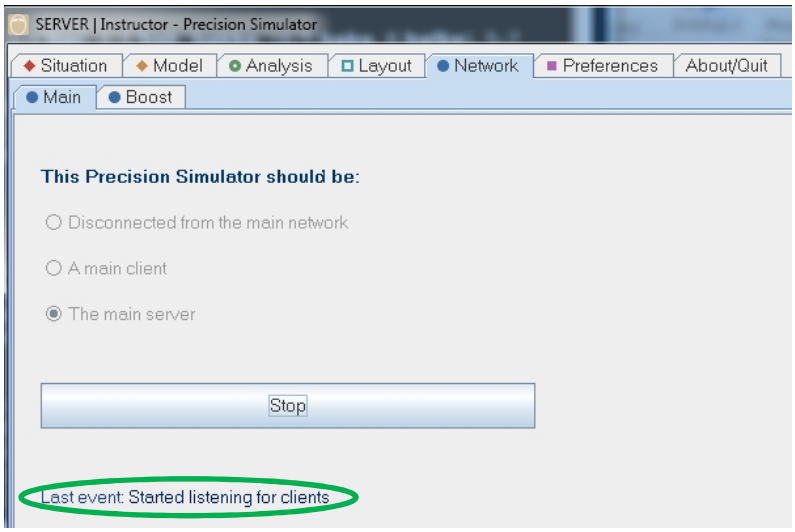
I did mention above that I'd make a brief comment about networking, although this topic can become complex, and so is verging on being outside the scope of this start-up tutorial. Before reading what follows, therefore, may I suggest that you visit pp 72 – 83 of the manual and peruse the examples shown there. Hardy's diagrams explain better than words just how the various options can be made to work, so please check them out and then return here.

<pause>

You're back: OK, go to the Preferences | Basics page of the Instructor if you're not still there, and take a look at some of the options mid-left. Look first at the line in italics: the host address shown will probably not be the same as the one in the example (right), but it will be the one to use if you want a client on another machine to attach to your PSX Main or Boost server.



But *"What's this Main and Boost business?"*, I hear you cry. If you check out the manual (p.86) for this Instructor page, you will find some helpful information towards the bottom of the page, and this also relates to the radio buttons shown above. In my example, I have set my PSX instance to be the Main server when it starts up. You can run more than one PSX instance on your computer, but only one can be the Main server: this allows clients such as the AdaptPSX add-on to attach to it, using port 10747.



However, some add-ons, notably those which allow FSX or X-Plane to be the scenery generator, need a much higher throughput. In such cases (only) you would also check the box to start a Boost server, and let the add-on (VisualPSX, for example) attach to it via port 10749. (Port 10748 is reserved for third party Router-style applications).

Hardy explains all this on p. 83 of the manual, as I'm sure you've noticed.

One final comment — in your version of PSX, the "Client connects to host" box may say simply "localhost", but the IP address 127.0.0.1 is just another (more specific) way of saying the same thing, and specifies "this machine" for the PSX instances and add-ons running on the same computer.

But network comms were ever confusing, I'm afraid, so I'll stop at that point before I get in too deep for anyone's comfort.

That's hopefully enough about setting up your views: it's now time for you to face up to your most significant configuration job of all — that of configuring whatever hardware you may have to control your 744 in the air.

Controlling your 744

Controlling your aircraft is clearly the most important aspect of your simulation experience. Negotiating the many options on the Instructor pages is important, too, but you won't usually be doing that under the same pressure as you will be under when you are landing your 744 on a relatively short icy runway with a gusty cross-breeze. Learning how to control your 744 smoothly and instinctively is paramount.

But, of course, every simmer's setup is different. I don't know what hardware you have, and even if I did I couldn't possibly make specific suggestions for everyone. So what I will have to do is make generalisations, and the examples I give will be based on my own hardware.

My simming space is so small that if I clamp a yoke to my desktop, even with the back of my chair jammed against the bookcases which fill the opposite wall there isn't room for me to sit down. So to achieve a smaller desktop footprint I use a joystick (I chose a HOTAS unit called the Thrustmaster Warthog). Here's a picture of my setup, to give you some idea [6] :

'hog throttle base | VRinsight TT-panel | Aerosoft Australia MCP *(via AdaptPSX)* | 'hog stick

When I came to set up PSX to respond to a combination of the 'hog and the TT panel (the latter comprises just buttons and switches) the process led to some interesting discoveries about the USB controls, so hopefully a brief description of those aspects may be useful as an example — or, perhaps, a cautionary tale — for you, too.

[6] I'm afraid the setup is shown running FSX, but this was while I was waiting for PSX to be released, so please forgive me.

Aircraft control using simming hardware

A digression needs to be made, here, for the information of Windows users. Users of other Operating Systems may therefore wish to skip ahead to the section beginning "Assigning USB hardware" on page 23.

OK, Windows users, now that we're alone I can reveal news that may not come as a total surprise to you — sometimes Windows <*cough*> lies to us. So although Hardy does his best to identify the control hardware that is plugged into your USB sockets, all he can do is report what Windows tells him, which.... Hmm. In a moment I'll give you a few examples, the first of which concerns a very simple device: the VRinsight TT panel, which is basically just a collection of buttons and switches — no axes, nothing fancy at all apart from one small peculiarity, as you will see. But nonetheless, Windows gets confused even with that.

Various users have reported problems concerning their USB devices on the PSX forum, so I thought that it might be worthwhile describing my own USB experiences here, in the hope of helping you when you come to set up your own controllers. But it has to be admitted that this is a somewhat confusing area, as you will see.

HID — what's that?

If you take a look within the Device Manager of your Windows installation, you will find a category called Human Interface Devices (or HIDs, for short). To explain it as concisely as possible, let's simply say that these devices came into being as a way to enable input devices designed to be used by humans as controls to be readily connected to a computer, latterly via a versatile plug-in interface which we now know as USB. The original HID devices were of course keyboards and mice, which have obviously been around for a long time, and hence those two are nowadays often recognised by the Windows Operating System without the need for additional drivers [7].

But simmers very quickly found that attempting to control an aircraft using a keyboard and a mouse was far from being the best way to do it, and so it transpired that joysticks and yokes soon came along. Clearly, these also fell within the category of HID devices, and so (like the mice and keyboards) they also came to be connected via USB. Even as flight sim control devices developed and became increasingly varied and complex, they still continued to be identified to the Operating System as HIDs, so please be aware that you may find some of your simming control devices also referred to as HIDs.

---

[7] Those with even longer memories may recall that the very early keyboards and mice (and joysticks) were for a while connected via serial ports, but USB quickly took over as soon as it became available.

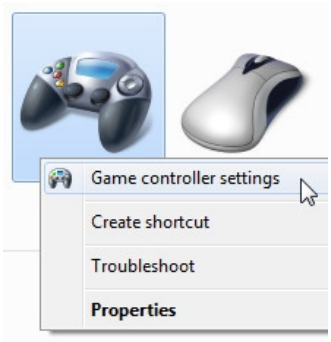
Installing / checking a simple HID device (in this case, the TT panel)

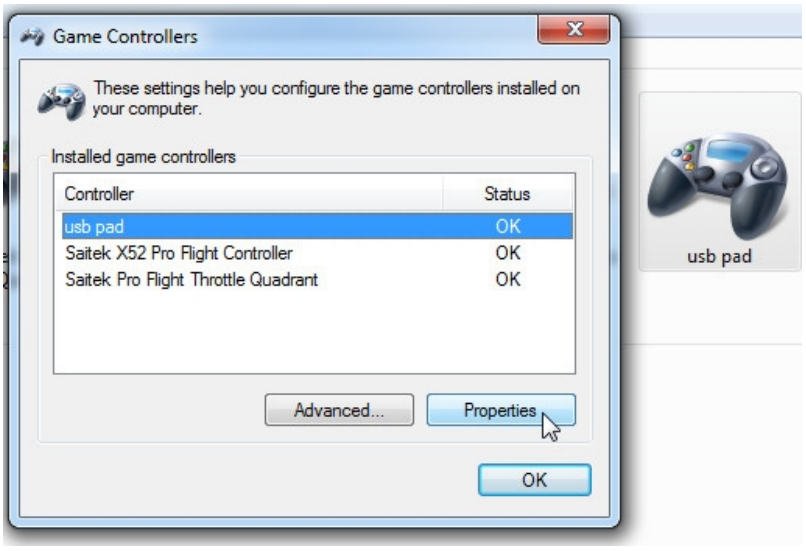
(Once again, this section is written for Windows users — Windows 7 is illustrated. Those with other Operating Systems will need to make different — and, I suspect, simpler — arrangements).

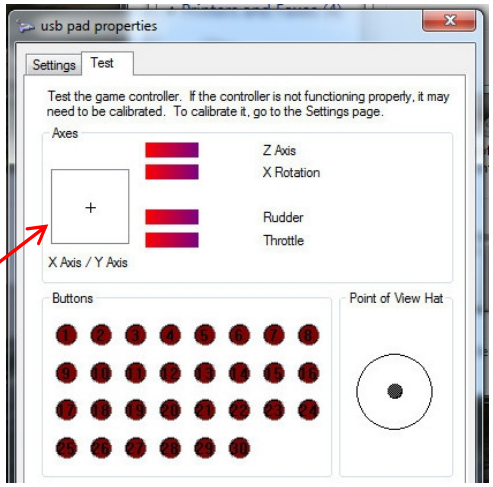
From the Start Orb, select Devices and Printers. A series of devices will be displayed: here's what was presented to me when I went looking for my VRinsight TT panel —

Notice that although Windows does generally try to show an appropriate picture, it doesn't know anything about the TT panel, so it assigns it a simple name ("usb pad") and a picture (which in this case is of a generic hand-held device). Oh well, I suppose it does its best.

Right-click the device, and select "Game controller settings", (right). Then highlight the device and click the Properties button.

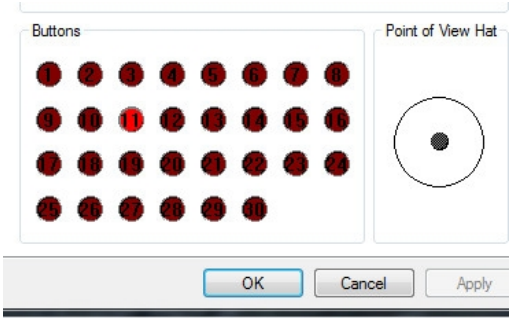




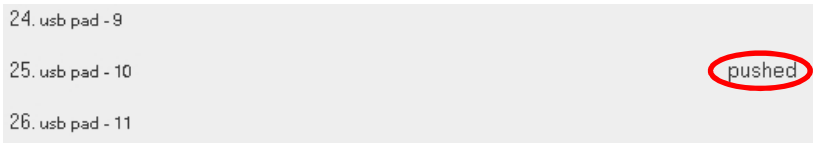


You now see a fairly generic properties page. But Windows is prone to making mistakes in this area. Even though the TT panel has no axes, for example, non-existent axes are shown on the page, along with a number of buttons that do exist. The fact that four of the buttons are assigned as a pseudo-hat (and thus not assignable in the usual way) is something of which Windows is also blissfully ignorant (although this doesn't totally fool PSX, as we shall see).

The actual assignment of the buttons will be done within PSX, of course: what you are doing in this Windows dialog is ascertaining that all the buttons are working [8], as well as determining what Windows calls each one, as a cross-check. Here, for example, I am pressing what the device labels as button C1, and Windows refers to as button 11:

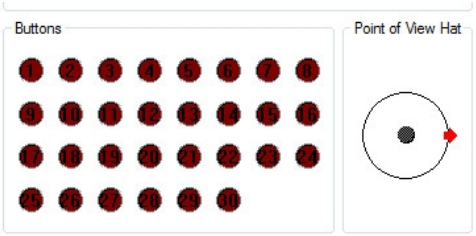


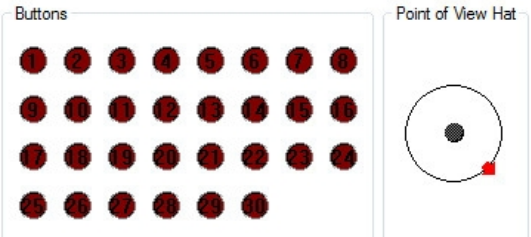
Note, however, that **when we come to use that button in PSX the numbering may well be slightly different**. (Usually the numbers are shifted down by 1 — as I said, always be prepared to take Windows' perceptions of HID devices with the proverbial grain of salt [9]).



Within PSX, the same button is shown as "usb pad – **10**" (the non-existent axes reported by Windows can also be seen).

A peculiarity of the TT panel is that four of the buttons (labelled C2, C3, C4, and C5 on the unit itself) are configured internally as a hat switch, so that pressing C2, for example, generates a right movement of the virtual hat, as shown.





Incidentally, not referred to in the VRinsight documentation (as far as I could see) is the fact that pressing two adjacent buttons generates an intermediate position of the hat — so pressing C2 and C3 together results in the position shown to the left. And, as a study of p.60 will reveal, PSX detects that situation, too....

(You recall that I did warn you that this USB business wasn't straightforward). <sigh>

---

[8] If this device had been a joystick, you could also have taken the opportunity to calibrate it while you're here, using the Settings tab on the Properties dialog.

[9] Outside the context of PSX you may also have noticed a similar difference between Windows' numbering scheme and that adopted by FSUIPC. It depends whether the first device is zero or one....

Windows USB peculiarities

So having checked that your hardware devices are responding normally in Devices and Settings (for the simple reason that if Windows can't see your button presses or axis changes then it obviously won't pass any information about them on to PSX), then you may feel that you are ready to assign some buttons in PSX itself.

But before moving on let me illustrate a few other oddities which may happen to you when using Windows USB devices....

For example, let's consider the Warthog stick. As well as three 4-way hats, the stick also sports an 8-way hat (often used by simmers to change their viewpoint). In this case, Windows can in fact see all eight positions on the hat, but whilst PSX can see the three 4-way hats (although they're named differently) at first sight it doesn't appear to see the 8-way hat: however it *does* list eight items called "hat 9" to "hat 16" — although they seem to be non-functional. (Don't be concerned, though — I'll be telling you about a workaround, soon). ☺

There are even more peculiarities when it comes to the detection of the coolie hat and mouse cursor on the throttle base (i.e. those items are not detected); and also puzzling is the fact that just one of the switches is not detected, either. ?? Hey ho.

Hopefully, the above has illustrated the fact that this area can be something of a minefield. It's always important to check what Windows is seeing — although just because Windows sees a control there seems to be no absolute guarantee that PSX can see it too; so check what works for you before you plan to use a particular control within your PSX environment.

But I'm afraid there's another weird Windows USB quirk that you also need to be aware of.

FSX users have long been puzzled to discover that their control assignments within FSX sometimes seemed to reset themselves unexpectedly. Eventually, it was discovered that this is another "feature" of Windows USB (and of FSX). If you unplug your USB device and then plug it back in again, *there is no guarantee that Windows will see it as the same device number as before* (and furthermore the other device numbers can also change, too, in consequence).

Hence it's the unplugging of USB devices, causing Windows to internally renumber perhaps all of its USB devices, that you need to be wary of. As a result of that, many people (myself among them) nowadays avoid unplugging their USB devices [10] if at all possible — just in case. <sigh> So if you encounter any unexpected problems when assigning your USB devices within PSX, they could well be a result of Windows' erratic support for USB devices.

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[10] FSX then compounds the error by "helpfully" (!) assuming that the re-plugged device is a new one (since the device number has changed), and so it then assigns default values to all the associated controls. (*Ouch!*) Hence that FSX problem is now understood, although not resolved.

Assigning USB hardware within PSX

Having checked to ensure that your Operating System recognises your controls; and also checked that PSX also detects and responds to them (and noted their name within PSX); it's now time to determine how best to utilise your controls in the PSX environment.

Notice that when PSX detects a button push you will see the word "pushed" against it — see the illustration on page 22, where button 10 is being pushed. If the button concerned is not onscreen, though, be aware that you may have to scroll up or down the list in order to be able to see it.

When vlying using PSX, obviously there is no absolute requirement for you to use any controls at all — other than a simple joystick (preferably one with a twist action to control the rudder as well, and a few buttons) — but if like me you have acquired hardware controls for your simming over the years then you will obviously want to make use of them [11].

It has to be said, of course, that personal taste also comes into this. Whilst I will go to considerable lengths to avoid ever needing to touch the keyboard whilst vlying, others have no problem with that — and indeed, PSX's keyboard support is excellent [12].

Naturally, cockpit builders will no doubt avail themselves of PSX's excellent networked messaging system (for more information about this aspect, see the PSX Networkers' forum at http://aerowinx.com/forum/forum.php?id=4). But less affluent mortals basically have two choices: use the USB functions, or else keystrokes.

---

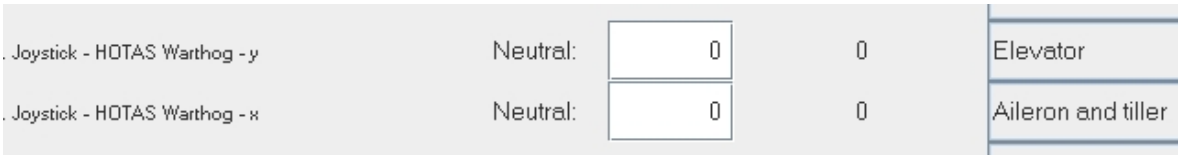
[11] One popular hardware item is the Mode Control Panel or MCP. Back in the days of PS1 many of us used a hardware unit manufactured by Aerosoft Australia (these days, sadly, no longer in business — perhaps they made them too well). Another of the splendid free PSX add-ons, AdaptPSX, can be used to interface those old units to PSX, and I have to say that for me there's something much more satisfying about turning an actual knob to adjust my heading or speed, rather than using a mouse with an onscreen control. Here you can see the Aerosoft unit and the corresponding PSX display:

Well known to today's simmers are the VRinsight units (you can see mine in the picture on page 18, just to the right of the TT panel). Although of a more generic design (I have the original version, but in v2 this did develop into a Boeing version and an Airbus version) they do have an EFIS section on the left and a Comms section on the right. As yet, AdaptPSX doesn't support these, but perhaps one day, John....? ☺

[12] In Appendix 2, I have supplied an alphabetical list of the functions that are supported via the keyboard.

Let's deal with the USB functions first, since these are so easy to use (thank you, Hardy!). The relevant page in the PSX manual is p.92, and although that page doesn't show all the functions available, as you can see it's a simple matter to assign the function you need to the relevant control directly from the dropdown. If you're using several instances of PSX on the same machine, though, do take careful note of the bullet points at the bottom of that page.

One significant matter that I should mention concerns the "Neutral" box which is associated with movement of the axes. After installation it appears to default to a value of 300, which seems somewhat high for many controllers. If you are fortunate enough to have axes with 16-bit Hall Effect transducers, then simply set the value in the "Neutral" box to zero (you're



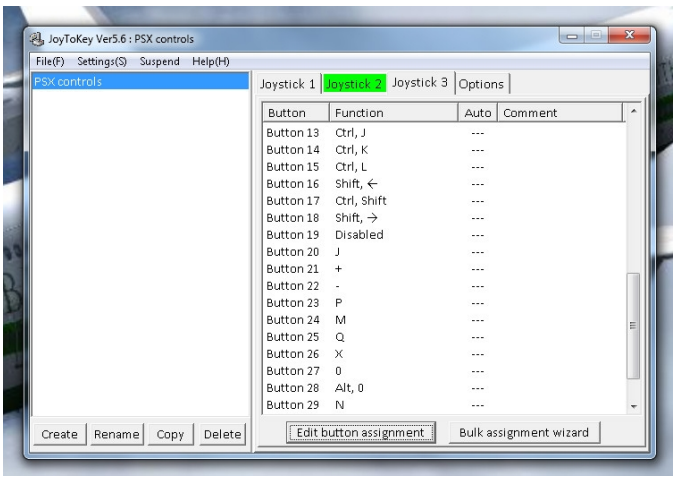
not going to get any spikes at all, quite unlike what can happen with ageing potentiometers).

Otherwise, decide on how many steps you need (perhaps 200 for the elevator, say) and start your experiments by dividing the number of steps into 2000 and using that value [13].

Assign your USB axes — it's usually fairly obvious which axes you will assign to which functions, so there's little more to be said about that aspect. Let's turn our attention to the buttons, therefore.

I have provided you with a list of assignable functions for both axes and buttons in Appendix 3, incidentally. (As already mentioned, the list of functions that are available via keystrokes is in Appendix 2).

Looking down the list of button functions it is hard not to feel that there are a number of functions which are available via the keyboard that don't have a corresponding function to assign to a button — and some of them would surely be nice to have. One thinks immediately of stab trim (and aileron and rudder trim for that matter), A/T arm, gear cycle, autopilot cycle, park brake, and so on.



Since I am fortunate in having plenty of buttons that I would like to use, I was thinking about this and quickly realised that all that is needed is a small utility which turns button presses into keystrokes. A quick Internet search resulted, and I found a utility called JoyToKey (no doubt there are others).

[13] See http://aerowinx.com/forum/topic.php?post=17404#post17404 Hardy points out that the figure of 2000 derives from the fact that the range of values returned is from -1000 to + 1000.

This one is free to try, and soon I paid the princely sum of $7 U.S. to register it. You can see examples of some of the assignments I have made in the picture above.

So now, JoyToKey turns some unused hardware buttons into keystrokes, which are in turn faithfully picked up by PSX and acted upon. I *can* forget my keyboard after all. ☺

Therefore, now that the principle of assigning axes and buttons to useful PSX functions has been dealt with, the only remaining issue concerns how to choose which controls to use.

Selecting which hardware controls to use with PSX

First a rather obvious tip, but it's probably worth saying anyway. From experience, I strongly believe that it is worthwhile configuring your button controls with care. Start by making a list of your available (and detected by PSX) buttons — hopefully, the axes are fairly obvious — and then considering the contents of Appendices 2 and 3, which list the available possibilities. What you now need to do is to make for yourself an optimised plan which connects your hardware controls with the most appropriate PSX functions in the most ergonomic fashion (which is far from being a trivial matter!).

It's usually possible to browse the Internet and download a picture or diagram of your control device — if not, take a photo and use that. But you will find it very helpful to label each control visually, as part of your documentation, and this will greatly assist you to learn your new setup in the first few weeks. (I've attached some documentation of my initial setup with the 'hog and the TT panel as Appendix 4, just to give you an example of the sort of thing I mean. The TT panel is of course so simple that it doesn't merit a picture).

When selecting your controls, concentrate in particular on how you'll operate them during the most critical phases of flight — take-off and landing. At those times things are happening very rapidly and it's best not to take your eyes off the screen, so it's a good idea to have controls such as flaps, gear, speedbrakes, TO/GA, brakes, reversers, autopilot, and the like all on control buttons that you can find and operate without having to look.

But it's your cockpit, so design something that you feel will work well for you.

Once you have done the design work, you obviously need to test your design, and a useful trip to make would be a quick take-off and landing — in fact, something remarkably like the Gatwick to Heathrow trip that we're going to deal with next. ☺

Congratulations again!

You have now completed the second of the tasks which are essential for maximising your enjoyment of PSX, and so now you're really ready to vly.

A short flight — London Gatwick to London Heathrow

This section is written to enable the newcomer to PSX and the 744 to get their airliner into the air and safely back down again as soon as possible after installing PSX. Please bear in mind that I have therefore simplified a number of aspects — notably by assuming that we're the only plane in the sky and therefore that no one will mind us taking a Jumbo jet around the southwest edge of London at 6,500 ft <*cough*>; and also by slightly simplifying the BIGgin approach to runway 27R.

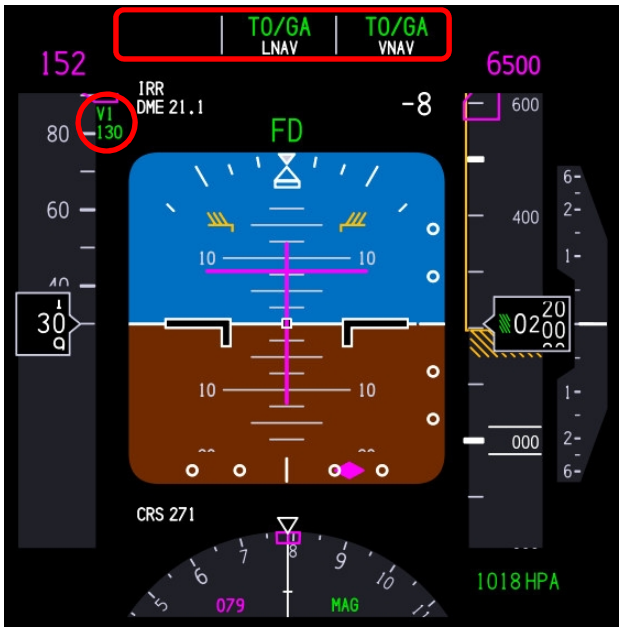
And you're also about to discover just how effective and usable your chosen layouts and control mappings are. ☺

The scenario is that we have a positioning flight to get a 747 from Gatwick to Heathrow, which is about 45 miles away by road (which could be something like two hours' driving via the extremely busy M25). Those knowledgeable about the 744 will probably be appalled at the simplifications I have made and the shortcuts I've taken, but hey — this is just a fun trip.

In the zip file that contained this pdf file you should also have found a small file called "Gatwick2Heathrow01.situ". So please copy that file into your `Aerowinx\Situations` directory (in your PSX installation) so that you'll be able to load it when needed. You'll know you're putting it in the right place if you see a lot of other .situ files in there already.

Now start PSX. Press Escape (or the corresponding button, if you have assigned one), and on the Instructor's Page click the Situation tab followed by the Load tab, and load the Gatwick2Heathrow01.situ that is now in the list into the simulator. You will find yourself sitting at the end of runway 08R at Gatwick, with some kind soul having done all the departure and take-off clearance stuff for you (which will be me if you are using the situation that came with the pdf file, or perhaps yourself if you are using the situation that you made whilst following the last section of this tutorial starting on p.37).

Just before we start, take a moment to look at the Navigation Display. See that magenta-coloured line? That's the Active Route, in other words the start of the trip we're going to take — we go almost straight ahead until we're clear of Gatwick, then we'll turn left over BIGgin hill VOR/DME until we line up with Heathrow's runway 27R, and land. Easy peasy. Well, er... not quite — so don't be discouraged if it takes you several attempts before you master it, since although the flight is very short there's an awful lot going on. I am hoping that you are beginning to be familiar enough with Hardy's excellent manual and your own design of layouts to be able to switch to items such as the upper EICAS display, the Primary Flight Display (PFD), the Navigation Display (ND), and so on whenever you need to, using your carefully-designed control mappings — so let's first take a quick look at the PFD.



The PFD has an electronic version of the attitude indicator (artificial horizon) with which I hope you're familiar, together with the barometric altitude on the right hand side (showing us to be 200 ft above sea level) and the airspeed on the left (we're not moving, but that display is driven by the pitot tube, and never indicates less than 30 knots). You may notice that at the top of the speed scale you see "V1 130" in green — this is our V_1 speed; and note especially the flight mode annunciators at the top: thrust mode (blank at present), roll mode (TO/GA with LNAV armed to engage), and pitch mode (TO/GA with VNAV armed to engage). I'll say more about those soon.

The ND (Navigation Display — to the right of the PFD, if you're sitting in the Captain's seat) also displays a lot of information, which you'll learn more about as you progress. Note that our magnetic track is 79°, and the magenta line represents our intended course. The figure 10 by the tick mark in the middle of the screen tells us that the range knob on the EFIS panel is set to 20 miles at present, and we can see that our first waypoint, KKE02, is just over five miles away.

Hopefully, having followed the previous pages of this tutorial you are now extremely familiar with the location of all the different instruments and controls, since you have set up your 9pack of layouts so as to be able to view them all. However, since readers will be using everything from a laptop (hopefully, with at least a numeric keypad and a joystick) right through to elaborate home cockpit setups with professional flight controls, when I need you to do something I will therefore need to simply refer to "advancing the throttles" (for example), so that you can then translate that into whatever action you need to take in your particular setup, using your own layout views and whatever controls you have.

One last suggestion before we begin: in order to keep things as straightforward as possible for this trip we'll be making heavy use of the automatic systems, so it would be helpful if

you were familiar with the section on Automatic Flight in Hardy's manual (starting on p.126: of course, the section on Flight Instruments starting on p.271 is also extremely helpful — but then, so is the whole manual). ☺ The more you know about this stuff before you begin, the less often you will be using the Pause key....

So it's time for take-off. Be warned — once you take off, things start to happen very quickly!

Apply the brakes briefly to release the parking brake (the "PARK BRAKE SET" message will disappear from the upper EICAS display), and then advance the throttles about a third of the way. When the white fill catches up with the throttle's white line on the EICAS display (and as long as the engine response is looking normal), press the TO/GA button to apply the appropriate amount of take-off power. Your F/O (First Officer) calls "Power set" [14].

Now view the runway — hopefully, you're starting to move along it at increasing speed. If you need to straighten up, use the tiller: gently does it, don't chase the middle of the runway, aim for the far end of it using Hardy's helpful alignment hairs (p.88 of his manual) as your guide. Or consider using the paravisual display — see p.128 of Hardy's manual.

Your F/O announces "80 knots" and then, at V_R, "Rotate" — so gently start to raise the nose. Don't get it moving too fast, though — aim for about 2° a second — and be sure not to exceed 10° nose up until you're well clear of the ground or else you might drag the tail along the runway [15]. Now look at the PFD and gently start to bring the little white square into the centre of the big magenta Flight Director crossbars. Try not to lift the nose to more than about 12 degrees up, though. And if this is your first time vlying the PSX 744, be prepared to work gently and sympathetically with the inertia of this huge aircraft — give her time to start to move in any given direction, and also time to stop moving....

- Once your altitude indication on the PFD begins to increase **and** a positive rate of climb is indicated [16], retract the undercarriage (don't forget to press the key or button *twice*, pausing between presses, to put the lever in the up position).

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[14] Here, I originally wrote ". . . the F/O confirms what you've done", but as Hardy pointed out:— "The F/O doesn't confirm what your hand is doing on the thrust levers (you know this yourself since you won't release your hand from the levers until V1). Actually, the F/O only confirms that the autothrottle has stabilised the engines exactly at the pre-programmed take-off power calculated by the FMC. While they are stabilising at the pre-programmed power setting, your eyes should be on the PFD and the outside view (hence the assisting call from the F/O).

[15] There's an interesting photograph in "Handling the Big Jets" by D.P. Davies which shows a 747 scraping its tail along the runway during Boeing's high attitude take-off tests. (That's high *attitude*, not altitude).

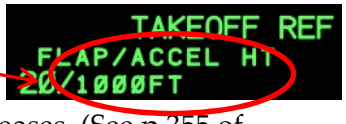
[16] *Both* conditions have to be true. Don't forget — at first, the nose is moving upwards whilst the main gear is still on the runway, and you certainly don't want to retract the gear too early! On the other

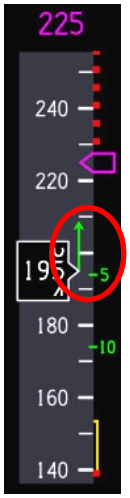
- *Information*: when you're 50 ft above the runway the armed LNAV mode will engage: the FMC will now be rolling the aircraft to follow the active route.

- As you're passing 250 ft, press the centre CMD button on the MCP to turn on the automatic pilot. You may also notice that the "FD" above the centre of the attitude indicator becomes "CMD" [17].

- *Information*: when 400 ft above the runway your armed VNAV mode will engage and start sending the pitch commands to the Flight Director for you, as well as requesting the correct speed. (The annunciated thrust mode on the PFD is now THR REF).

- Above the chosen acceleration height of 1000 ft (you may notice that the nose drops slightly and the speed bug jumps up the scale) you can start to retract the flaps as your speed increases. (See p.355 of Hardy's manual for an explanation of the FLAP/ACCEL HT settings).





- As you gradually retract the flaps, ensure that you comply with the flap manœuvring speed indications on the speed tape of the PFD. Or in simpler language, move the lever to the flaps 5 position, for example, *only* when the little green 5 to the right of the speed tape moves down to be level with (or below) the "pip" of the actual airspeed indication, and the airspeed trend vector is still upwards [18].

- On the next page, we see the PFD and ND at the point where we have just commanded flaps 5 (we're shown as accelerating past 190 kts (with the speed bug at 235 kts) and passing 2,870 ft MSL [19] — whilst the ND shows us as being 1.6 nm from our first waypoint, KKE02. You will also notice that in this case the triangle indicating the aircraft heading is slightly to the left of our track of 077º, because of the wind (see the arrow, top left of the ND).

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hand, you *do* want to retract the gear as soon as it's safe to do so, since it causes massive drag just as you're trying to get the aircraft well clear of the ground.

[17] Your figures may be different, of course. You will also find a very helpful description of what happens during take-off on p.142 of Hardy's manual — the pages which follow it are very informative, too. As you progress beyond this beginner's tutorial you may well prefer to hand-fly the aircraft for a while longer after take-off, before engaging the A/P. But that's for another day....

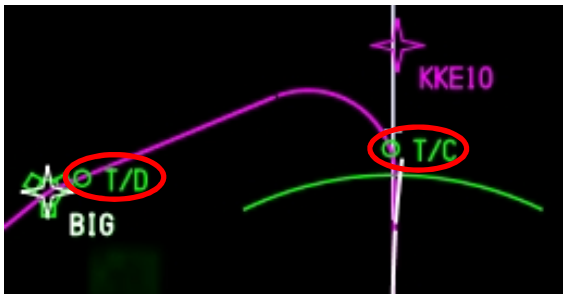
[18] To put it even more simply, as you "pass" the small green number (you're moving upwards so the green numbers are moving down and you seem to be 'passing' them) *then* select that flap setting.

[19] Mean Sea Level: that's Mean as in 'average', not in any other sense of the term . . . . ☺

Information: you may be wondering why I haven't asked you to move the gear handle to the centre position to depressurise the hydraulics, or turn all the packs to NORM. This is because in our Situation the "Makes call-outs" and "Performs silent tasks ..." boxes are checked on the Situation | Human | Pilot Instructor's page [20] — again, in an attempt to minimise the number of things you have to worry about.

OK, that's the initial busy period of the flight taken care of, so you can relax (for a few moments) while you watch the FMC climb the aircraft to our selected cruise altitude of 6,500 ft. (VNAV) whilst it's also following our selected route towards BIGgin hill (LNAV).

On the ND, notice that near to our Top Of Climb point (where we reach our cruising altitude



of 6,500 ft — hence our speed will be limited to 250 kts, since we are below 10,000 ft) we will make a rather sharp left turn past KKE10 (pilot-entered waypoints are fly-by, not fly-over) towards our TOC. Today's cruise doesn't last very long, therefore: a mere 6 nm or so later we reach our Top Of Descent point — at which, as its name suggests, we need to, well, start to descend. Note also the green altitude range arc (the so-called "green banana") predicting that we will reach 6,500 ft very slightly before our TOC — provided the current groundspeed and climb rate remain constant [21]. Make the most of this brief interlude, you'll soon be working again....

---

[20] In the event that you would like to print out the list of PNF tasks, you will find that I have included them here as Appendix 5.

[21] Hardy points out that since they seldom *are* constant, especially over long climb distances, the arc is usually less precise than the FMC-computed TOC, which takes performance predictions into account.

Notice also that we're so light that our four powerful engines mean that we will climb very quickly indeed. Many startled simmers have questioned whether a 744 should really climb at 4,000 ft per minute, but when we're as unusually light as we are now — you bet we can! (And do). ☺

Between the TOC and the TOD there are certain tasks which we need to accomplish, however, so we need to get back back to the vlying.

By this time you should be nearing your cruise altitude of 6,500 ft. In view of the fact that the Transition Altitude in these parts is 6,000 feet, passing 6,000 ft you should press the STD knob on the EFIS panel to set standard pressure — one job that is *not* on your helpful PNF's list of "silent tasks", incidentally. [22]

But no sooner have you passed your TOC and are (briefly!) in the cruise, than there's something which you need to do fairly quickly to help your energy management during the descent. Set flaps 5, press the IAS/MACH knob on the MCP to open the speed window, and turn the knob to select 190 kts. This is owing to the fact that this trip is most unusual — once we start to descend, we have much less time to reduce speed than if we had been descending from 10,000 feet [23]. So we'll give ourselves a fighting chance.

Also at this point, a message appears on the upper EICAS, telling you that 

you have a message from the Flight Management Computer. When you check the CDU (which is your interface to the FMC) you see: 

This means that you now need to change the 6,500 ft indication currently in the MCP window to be your next cleared altitude after the TOD — which in our case is the Final Approach Fix (FAF) for Heathrow's runway 27R. If you look at the chart, you will see the FAF symbol, and the profile confirms that you should be at 2,500 ft at that point [24]. So change the value in the ALT window to 2500 ft. *You won't descend yet*, since the aircraft is under the guidance of VNAV, which is faithfully following the instructions on the LEGS page showing our current speed and altitude to be 250 kts and 6500 ft. But unless you change the ALT setting on the MCP before you get to the TOD, VNAV can't start to descend the aircraft when you reach it — the setting in the ALT window will override what VNAV would like to do. Changing the setting automatically clears the message on the MCP, too.

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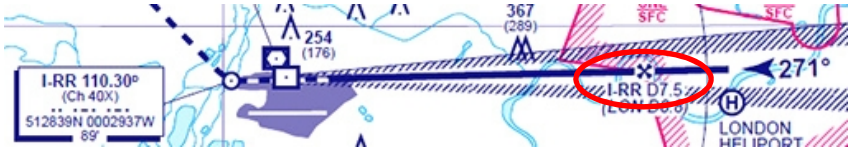
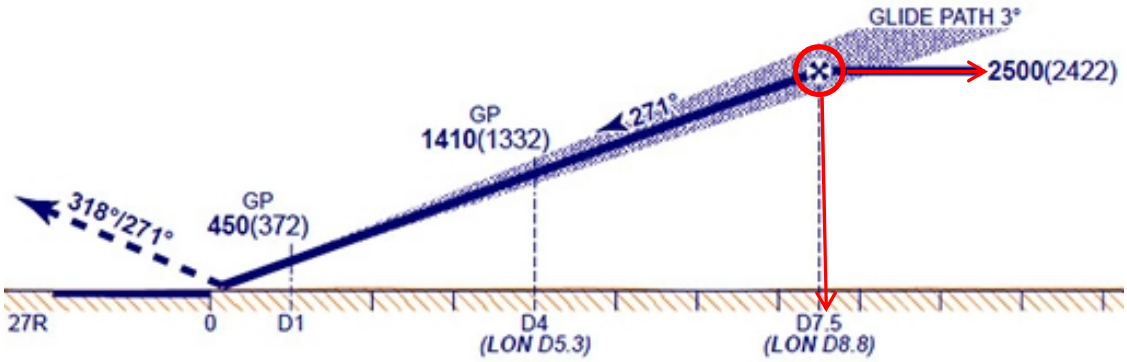
[22] In case you were wondering, today's Transition Level is FL80 (it's already in the FMC's DESCENT FORECAST page — I'll describe how to set it up in the final section of this tutorial).

[23] You will find the rationale for this unusual move in the "creating your own situ file" section which follows this short flight — in particular the section about energy management on p.48.

[24] You'll find more concerning the altitude constraint at FF27R on p.47.

Some additional information about the previous paragraph (you don't need to know this immediately, so skip the following indented section when you vly this for the first few times):

> The FMC knows a lot about the flight, but there are some things that only *you* know — flaps set, wind and weather etc. — and especially **what ATC has just said to you**. So the MCP panel gives you various ways to "intervene" (hence 'speed intervention', 'altitude intervention', etc.) and change the flight plan 'on the fly' (oops). Therefore if ATC haven't cleared you to leave 6,500 feet, you would leave that figure as-is on the MCP: but since they have, you set it to the next constraint, which for us is at the FAF.
>
> Obviously, we don't always choose 2,500 feet as the figure to set in the ALT window. To find the figure we need, we look for the Final Approach Fix (a.k.a. our FAF) on the charts, as denoted by this symbol: ✖ (As always, we must abide by the current charts): so here is the relevant part of the ILS chart for rwy 27R [25]:
>
> 
>
>
> As you can see, the FAF in this case is D7.5 (i.e. 7½ nm DME) from our touchdown point.
>
> When we cross-check that to the approach profile part of the chart, we also find that we need to be at 2,500 feet at the FAF [26]:
>
> 
>
>
> So that's why in this case we set 2500 in the ALT window.

Since you're getting nearer to the TOD, it's also time to set your approach speed. Press the INIT REF button on the CDU, and at this point it will bring up the APPROACH REF page for you. Taking into account 25R's Landing Distance Available (LDA) of 3884m (12,743 ft), we make the decision to land with flaps 25 today, and so we need to tell the Flight Management Computer about that. Action and then clear any existing messages from the

---

[25] I'll review some of this stuff again in the next section, when I discuss how to set up the Situation for this flight.

[26] On the LEGS page, with our flightplan, the FAF for EGLL rwy 27R is denoted as waypoint CF27R.

scratch pad line if necessary (using the CLR key), then left-click the Line Select Key just to the right of the FLAPS 25° line to transfer those values of flap and speed into the scratch pad.

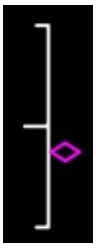
Now left-click on LSK 4R (where the mouse pointer in the screenshot, right, can be seen) by "FLAP / SPEED - - / - - -" to transfer the values into that line, *make a mental note of your* V_{REF} (155 kts in the example above), and you're home and dry. We'll be adding a nominal 5 kts to that figure to allow for wind when we come to use it (another simplification but it's OK for now). Press the LEGS button again to return the Captain's CDU to that page.

To give ourselves an even better chance of success, we'll start our descent a little early. As you get near to the BIGgin VOR/DME, press the ALT knob on the MCP to immediately begin your descent (to 2,500 ft, as you entered into the window). This will close the throttles for an idle descent path, which will be maintained until you reach the selected MCP altitude.

If you are using (unmotorised) hardware throttles, be sure to bring those back to idle, too.

Also, select flaps 10 now, and turn the IAS/MACH knob to 175 kts; and since you are descending below the Transition Level, press the the STD knob on the EFIS panel to set normal barometric pressure.

At this stage, keep a watchful eye on the vertical path deviation indicator at the lower right of the ND: it may indicate that you're a little high at first, but gradually the diamond should make its way back up to the centre tick mark. Always remember to monitor the descent using the vertical path deviation indicator: it will tell you how far you are deviating from the descent profile that the FMC would like you to follow. For example (right), as you can see, I'm just over 100 ft above the planned profile. I certainly don't want to be high on this approach, especially since there's so very little time in which to fix things if they start to go awry, so if the situation gets much worse I'll act swiftly to extend the speedbrakes until I'm back on the vertical profile. (I'll also remember to return the speedbrakes to the ARMED position when they have done their work).



We are currently aiming to be at 2,500 ft at the FAF (check the LEGS page and you will find that there is a constraint of 2500 ft at CF27R). The FAF is 7 ½ nm before touchdown, so let's arm APProach mode when we're 10 nm from IRR, which will be shown top left on the PFD. Of course, if like me you have a bad memory, you might forget to do that, so here's a way of reminding yourself. Press the FIX key on the CDU; type EGLL into the scratchpad and upselect it to the FIX name at LSK 1L; then type /10 into the scratchpad and upselect it to

LSK 2L. This will place a dashed green circle around Heathrow with a radius of 10 nm — so when you cross it, you'll hopefully recall that you were going to press APProach on the MCP at that point [27].

Two other jobs that you might like to get out of the way now (it's perhaps a bit soon, but I won't tell anyone if you don't) — turn the Autobrakes knob until it is set to 2; and also move the speedbrake lever to the ARM position by dragging the mouse to the left of it until you see the "SPD BR" indication turn to "ARMED" (left) [28]. It's sometimes not easy to judge visually whether the speedbrakes are armed or not, so Hardy has kindly implemented that helpful tooltip: simply hover your mouse near the speedbrake lever to see its status.

Both of the above tasks will only take effect when we touch down, of course: the first will help us achieve the appropriate level of steady controlled braking, and the second will provide aerodynamic drag and also kill much of the lift from those huge wings so as to set us down firmly and ensure that the tyres grip the surface, so that we can brake effectively.

But we still have lots more to do to get this aircraft safely onto the runway at Heathrow. At this point you may like to change the range of the ND to 10 nm, using the range knob on the EFIS panel.

OK, you must be approaching the FAF by now, so when you're 10 nm away from IRR (as indicated on the PFD, or when crossing the green circle you created on the FIX INFO page), click on the APProach mode button: this will seek the localizer and glideslope signals from the ILS beams at Heathrow 27R so that we can hopefully follow them right to the runway threshold. You will notice that now all three autopilots are independently monitoring what is happening and cross-checking with each other, which is good to know.

As we start to turn towards the runway, select gear down; set flaps 20; and reduce the MCP speed to 165 kts.

As we lock on to the localizer, you will see that the LOCalizer mode changes from armed to active (whilst G/S may possibly be still armed if we are approaching the glideslope from below).

[27] See p.343 of Hardy's manual for information about more fun things you can do on the FIX page.
[28] Or until you see the "SPEEDBRAKE ARMED" message on the upper EICAS.

Select flaps 25 and V_{REF}+5 kts in the MCP window (that's why I suggested making a mental note of V_{REF}): hopefully you will achieve that speed about a mile before the Outer Marker [29].

Soon, we will intercept the glideslope (from below, in the approved fashion), and G/S mode will then also become active, so that both **LOC** and **G/S** are now annunciated in green on the PFD. This means that you are fully established on the glideslope (with the glideslope diamond centred on the right hand side of the PFD), and of course you have already captured the localizer.

Just to get you into good habits (since we won't be doing a missed approach today), reset the altitude in the ALT window to 3,000 ft. *You won't start to climb* at this point, since the Autopilot currently has control of the aircraft — as you can see from the annunciations on the PFD.

The *good* news is that now you can at long last enjoy the view, since this will be a triple channel autoland. So once you've achieved your designated landing speed you can relax and monitor the computers handling the entire landing sequence for you as the electronic GPWS voice calls the heights on approach. But as soon as the wheels are rumbling along the runway, there are just a couple of final things you need to accomplish.

Monitor the extension of the speedbrakes by seeing and hearing the lever deploy, then engage reverse thrust [30], but be poised to disengage reverse as soon as your F/O calls "80" (knots).

I find that by far the least stressful way of managing the reverse process if you don't own a highly realistic throttle unit is to use Hardy's function which he mapped to the backspace key (or map that key to a button on your throttles, as I have done). As long as the throttles are at idle, one push is then enough to engage the reversers and provide full reverse thrust: at 80 kts you need one push to bring the throttles back to idle, and then another push to stow the reverser levers. (Or if you would rather use the mouse to do this, then see p.23 of Hardy's manual).

Then relax as the autobrakes bring you safely to a halt on Heathrow's runway 27R.

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[29] Hardy points out: "Always try to make a "stabilised approach", i.e. everything must be configured by the time you are over the OM. This is especially important in a Low Visibility approach."

[30] You may wonder how to judge the correct moment to engage reverse thrust. Hardy, of course, has the answer: "In a 747 cockpit you can't hear the tyre screech when the wheels touch down. Your 'touch down sound' on the 747 is the clack of the gear lever lock and the noise of the speedbrake lever moving to the UP position.".

As you know, we are the only plane in the sky today. So if you want to celebrate by parking on Heathrow's runway 27R just this once, feel free. ☺

You have completed the trip and landed safely: well done!

Phew! A celebratory sip of something might be called for....

I hope you enjoyed that short (but busy) trip, and that it has been helpful not only to demonstrate a little of PSX, but also to ascertain how smoothly your own layouts and control mappings work together to enable you to control your virtual airliner.

So that's as far as we go with vlying in this tutorial.

As for the rest of this document.... Since The Big Tutorial was written, the main item for which I have received requests relates to situ files. It's all very well starting with someone else's situ file, but how do you go about making a situ file of your own, that you can use over and over again?

A good question. So that will be the topic for the last section of this document.

Situation files

Congratulations on your short flight to Heathrow! Hopefully it was a useful experience — not only to acquaint yourself with PSX, but also to try out your layouts and control assignments, too.

The remainder of this tutorial will offer you some advice to enable you to build situ (situation) files for yourself [31], so you can set up your own flights. Before doing so, however, it would be remiss of me not to mention how situ files can be created in other ways.

The most obvious one is the "End of last session.situ" which is saved when quitting PSX so that you can, if you wish, elect to continue your next session from that point by loading the file. In addition, two more files, called "-Autosaved[A].situ" and "-Autosaved[B].situ", are auto-saved every 7 minutes, offset from each other by 3½ minutes.

Each time you press the EVENT RCD button (near the EICAS controls — see p.525 of the manual) the sim will create a situation file for you reflecting the state of your aircraft at that moment. You can then load that file from the Instructor | Situation | Load page: its name will be something like `--Event record 2014-AUG-20 08-26-56.situ`. Notice, however, that *you must have enabled this functionality* by checking the "Allow situation saving through EVENT RCD button" box on the Instructor | Preferences | Basics page.

Furthermore, the AdaptPSX add-on has some special abilities with respect to situ files. If you enable the appropriate settings it will —

- Freeze sim motion when a situation is loaded. [32]
- Synchronise the sim time and date with the real world UTC current time and date when a situ is loaded, and set the Captain and F/O's clocks accordingly.
- Automatically push the EVENT RCD button for you (a) when you press TO/GA and (b) when you select gear down. (But don't forget to check the appropriate box on the Instructor | Preferences | Basics page).

(See the AdaptPSX documentation for more details).

But we need to enable you to make a situation all your own....

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[31] There will be a little more about this topic, including a printable summarised list, in Part 2.
[32] It will also produce a message on the EICAS saying > SIM FREEZE — just in case you forget that this has happened and can't understand why your aircraft won't move.

Building a situ

Each time I plan a flight — from Manchester to Madrid, or whatever — I usually save two situation files for subsequent use if I want to re-vly the trip. One is immediately prior to engine start (with the FMC fully programmed and ready to go), and the other is when I'm on the runway and have just been cleared for take-off (to avoid the long taxy out if I want to get into the air as quickly as possible) [33].

But there's a lot of work to be done between planning the route in PFPX and getting to the point where the engines are ready to be started, and that work takes place as much on the Instructor pages as in the cockpit.

As an example, let's make a new situation file for the flight from Gatwick to Heathrow. For a short trip such as this one there are so few waypoints that there's no need for a Flight Planner [34], so instead of loading a .route file we will type the few entries we need straight into the CDU. There are other differences to the norm, as well (such as starting at the end of the runway instead of at a gate <gulp>) but in general the same principles will apply.

So where do we start?

There are a lot of things to set up in the Instructor pages (and elsewhere), so it's often sensible to begin by loading a situation which is close to the one we want. (Work smarter, not harder). ☺

PSX comes with a *lot* of interesting situations (if by any chance you haven't explored the extensive list, you have pleasant surprises in store). But in this particular and rather unusual case we're looking primarily for an everyday situation in which the aircraft is already set up ready for take-off. We'll start looking in the "Basics" situations in the list, all of which are described by Hardy as being "ideal for use as a template to create other situation files". That group begins with:

Basic 000 - Cold and dark cockpit.situ

Basic 001 - On ground and IRS aligned.situ

Basic 002 - On ground and doors closing.situ

Basic 003 - On ground and cleared for engine start.situ

Basic 004 - Cleared for take-off.situ

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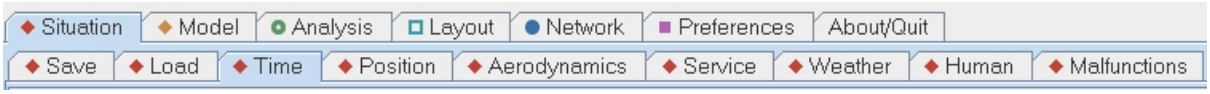
[33] I find that I hardly ever want to go through the whole routine from cold and dark when vlying a trip I have done before, so although I used to save a third situation (at the cockpit prep stage) I no longer do so. YMMV, of course....

[34] Flight planning, and saving the resulting Situation file, will be a major topic of Part 2 of this series.

Depending on how much work you want to do, at different times and for different purposes you might of course choose any of these as your starting point, but in this case "Basic 004 - Cleared for take-off.situ" is exactly what we're looking for, so let's load that one.

As with any situation, this won't bring in a layout 9pack, so no problem there. But there are still a lot of options that we need to check to ensure that this is suitable for what we want. Since we'll be working with the Situation tab, let's work sequentially through the sub-tabs.

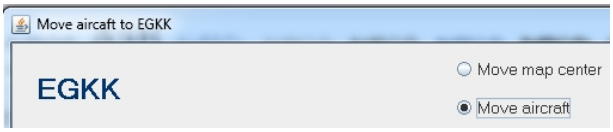


Time

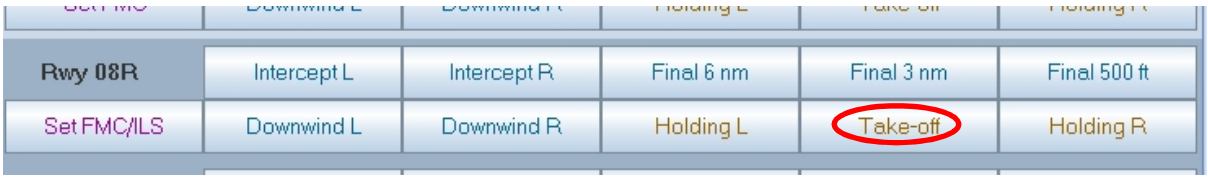
This is where we apply the correct (which usually means the current) UTC time to the sim. Notice first of all the information block, top right, which gives us useful time-related information. Other options here include time acceleration, and the ability to jump to the next waypoint, to speed long flights. Clicking the "Copy real world UTC to simulated UTC" button does exactly that, also setting the daytime and season sliders appropriately. Moving to the next tab on the right —

Position

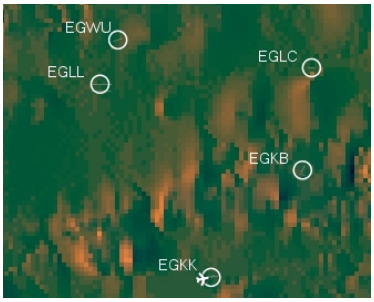
This is where we position our aircraft and map centre to runway 08R at Gatwick. Erase the coordinates in the "Map center" box, top right, type in EGKK (the ICAO code for Gatwick),



and press Enter. A page opens that contains an enormous choice of places: click the "Take-off" button for Rwy 08R to move the centre of the map (at your current zoom range) to the threshold of rwy 08R at EGKK.



You will also wish to move the aircraft to EGKK, so select the "Move aircraft" radio button near the top of the page, then click the "Take-off" button for Rwy 08R again, this time to move the aircraft to that place. Click the Close button on the EGKK page. You can see from the map that our aircraft has indeed been moved. By adjusting the zoom, you will be able to see not only Gatwick, but also our destination, EGLL.



(I could spend a long time on many of these pages, but I have to resist the temption or else this document will be much longer than it already is. Hardy's manual is your reference document, and you also have an index to the Instructor pages in Appendix 1 on p.54).

So, moving right again —

Aerodynamics

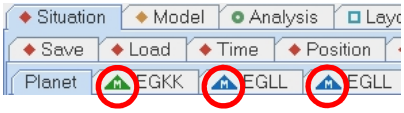
Here, we will adjust just one item, to suit our very short trip. Move the Fuel quantity slider down to, say, 30,000 kg (or 66,000 lbs approx.) [35]. Care is needed: if we had said 50,000 kg, it's likely that when we came to land at Heathrow we'd still be over our Maximum Landing Weight, a prime reason why some simmers seem to have trouble landing their 744....

Service

There are lots of goodies on this page (hover over each item to get Hardy's enormously helpful tooltips), but we must press on, so please ensure the "Select valid FMC nav database" box is checked (I'll explain why later) and also click the Fuel distribution "Normalize" button to ensure that the fuel in the tanks is correctly distributed (you can see the fuel quantities in each tank just below the button). Moving on, we have —

Weather

Oh boy. There's plenty going on here, as you can see from the number of sub-tabs, and you need to read about Hardy's planetary weather system in his manual. But for now, move to the "Planet" tab and ensure that the "Set zones by flight track and downloaded METARs" checkbox does *not* have a tick in it, otherwise the user will get their current weather, rather than the weather in the tutorial [36]. (If you see a small coloured triangle on a tab, look at the bottom of p.44 of Hardy's manual to find why).



Human

This is another tab with many busy sub-tabs. The Dispatcher sub-tab allows you to load a given route, and send it to the aircraft — but we won't need that, just this once. However, for this and probably all tutorials, one important task to do on the Voice-ATC sub-tab is to clear the "Talks to us" checkbox (you could clear the "Talks to others" box too): we don't want any surprises or unplanned events while following along. That having been done, we can ignore the rest of this tab. For the same reason, move to the Traffic sub-tab and click the radio button for Traffic Off. Ah, peace at last. ☺ However, for the purposes of this tutorial you also need to look at the Pilot sub-tab, and ensure that in the left-hand column the "Makes call-outs" and "Performs silent tasks ..." boxes are both checked.

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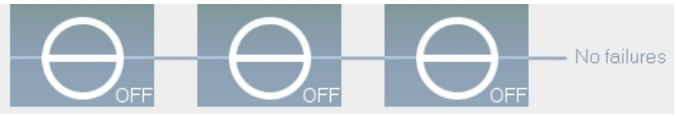
[35] Normally, of course, we'd be entering the amount of fuel calculated for us by our flight planner.
[36] If you were making a situ file for your own use, you would probably always want to vly using the current weather, so in that event you would ensure that the checkbox *did* have a tick in it.

Malfunctions

I would never normally vly without malfunctions (I always think that having no possibility of malfunctions in the sim is like playing Backgammon without using the doubling cube — a different, tame, and altogether less interesting affair). But once again, for the purposes of a tutorial we don't really want to be interrupted by the possibility of failing pumps or engine fires, so please ensure that all three of the big sliders are firmly at the bottom of the range; and also for safety's sake click both the buttons under "Reset" (i.e. both CBs and Malfunctions).



Phew! But you've probably noticed that there are many more tabs that we haven't looked at yet. On this occasion we can leave them alone, but I will offer you a very brief comment about each one, for the sake of completeness.

Model

On the Load sub-tab you could choose a specific 744, configured with the options fitted to that particular real-world aircraft. Or configure your own, using the Airframe, Equipment, and Programming tabs [37] — but today let's use the model from Hardy's original situ.

Analysis

If you click the button to "Show nearest airport", you can discover all the information about that airport in the sim's database (in the case of Gatwick there's a lot of it, so use the scroll bar to see it all). The Navaid tab enables you to get information about those, too. To discover more about the information on the (flight) Profile tab, see p.63 of Hardy's manual: the remaining two tabs are, as the well-known phrase has it, beyond the scope of this tutorial.

Layout

You know something about this one from earlier on in this document (p.11 and following) so no further comment should be needed now. And since your chosen 9pack won't change when you load a situ, you have no need to worry.

Network

I said something about this topic starting on p.17, so again — nothing to add.

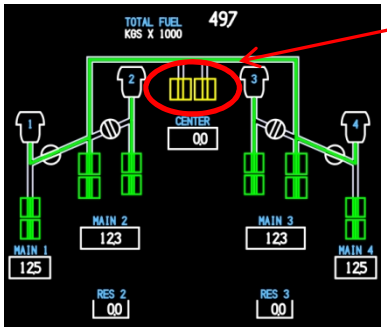
Preferences

You could take a look at Preferences | Basics — with special reference to the checkboxes lower right under "Miscellaneous", to ensure you're happy with them.

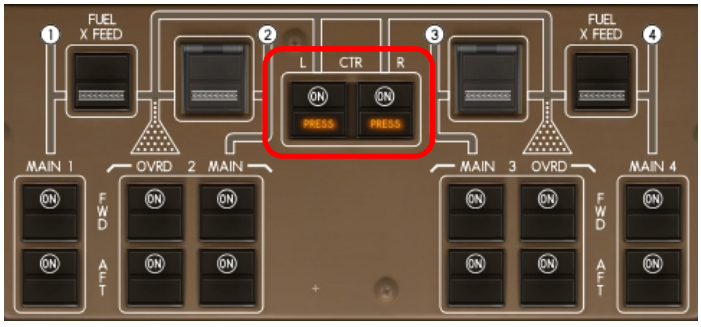
[37] Part 2 of this series will have a section about designing and using your own Model of 744.

Before saving our work so far, move to a layout where you can see the upper EICAS. There are several messages there (since we drastically reduced the amount of fuel on board), so we'd better fix them.

The FUEL OVRD CTR R and FUEL OVRD CTR L messages are telling us that the pressure is low in the centre pumps (since there isn't any fuel in the centre tanks now that we've reduced the amount). If we check the FUEL synoptic view (press the FUEL button to the right of the MCP) we also see that the two centre pumps are highlighted in yellow.

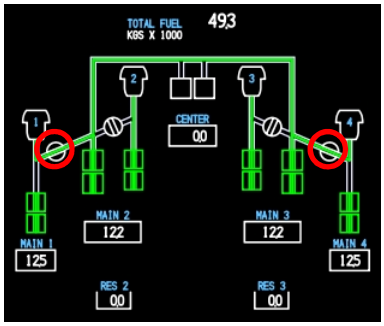


We need to fix this, so go to the overhead panel, and as further confirmation you will see that the PRESSure warning lights are illuminated in the L and R centre pump switches.



Fixing the problem is easy, simply click the two switches to switch them off. The ON caption and the PRESSure warnings disappear, and that's two of our warnings dealt with.

Next on the list is that strange-sounding "FUEL TANK/ENG" message.[38] It's actually saying that with this much fuel the engines *should be* in a tank to engine configuration. If you look at the EICAS diagram of the fuel pumps, it now looks like this, again helpfully showing you in yellow what needs to be fixed:



To fix things, we simply turn off the cross-feeds (click the FUEL X FEED switches) on both sides. The isolating valves are now closed, so that each engine is fed directly by its own tank — hence "tank to engine". That's another of the EICAS messages dealt with.

To discover the remaining "FMC message" we need to check the scratchpad of the CDU. There we see: "INSUFFICIENT FUEL". But to fix that we'll need to do some FMC work.

---

[38] If you can get hold of a QRH — Quick Reference Handbook — for the Boeing 744, it will tell you the meaning of many of these cryptic messages, and how to fix them. Be aware that some are "memory items" — in other words you're expected to know them (and hence they are not included).

Saving our Situation preferences

OK, let's briefly review what we've achieved so far.

- We started with Hardy's situation of a 744 that's cleared for take-off and ready to go.
- We then positioned the aircraft where we wanted it (Gatwick rwy 08R threshold)
- We set the time; and checked that the weather will remain as that in the situ file.
- We reduced the amount of fuel to a significantly lower figure, and normalized the fuel distribution in the aircraft's tanks.

Which is a good start, but now we have to sort out some FMC options. Before moving on, however, why not save your new situ as it is at the moment — we'll then overwrite it with the finished situ when we're done.

You know the drill by now: go to the Situation | Save tab, and overwrite the name in the "Save current situation as" box (it probably says "Basic 004 - Cleared for take-off.situ" at the moment) with the name you want to use. Click the long button at the bottom of the screen once, and again to confirm it. Your work so far is now stored with the other situ files in the `Aerowinx\Situations` directory.

So what else do we need to do? Well, we have our aircraft fuelled up and ready to take off, but the major snag we face is that the Flight Management Computer (FMC) still thinks that we're about to fly from Curaçao to Amsterdam Schiphol, which is definitely not the case. So before we can undertake the short flight from Gatwick to Heathrow that we have in mind we'll need to reprogram the tin brain, as well as checking that a few other things are as they should be, prior to take-off.

Reprogramming the FMC 1: the route

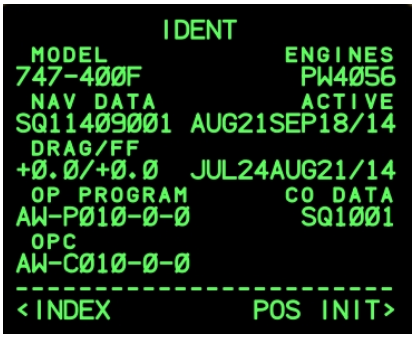
OK, so let's reprogram the FMC for our flight from Gatwick to Heathrow. As we know, at present the FMC is set up for a flight from Curaçao to Amsterdam Schiphol, since that information was in Hardy's "Basic 004 - Cleared for take-off.situ". So on the CDU, click the CLR button, lower right, to acknowledge that we do realise that we haven't any longer got enough fuel for an 8,500 mile journey, and the EICAS and FMC messages then disappear.

In your personal PSX 9pack of layouts, find your favourite view of the Captain's Control Data Unit (CDU), and we'll start to enter the required information for our trip.

Before we input anything we first of all need to completely clear the information that's currently in the FMC. I'm grateful to Hardy for the following technique (which apparently also works on the real aircraft).

Click the CDU's INIT REF button. When you do that, you are taken to one of several pages depending on what stage you have reached: and since in this case the FMC thinks you're ready for take-off to Amsterdam, it therefore takes you to the TAKE-OFF REF page.

To get to the page where we want to be, press the lowest Line Select Key (LSK) on the left-hand side of the CDU screen, known as LSK 6L (counting down from the top). In the index of pages, press LSK 1L to get to the < IDENT page.



(Incidentally: do you remember back on p.41 I asked you to ensure that the "Select valid FMC nav database" box is checked? Well now you will see the effect — look at p.346 of Hardy's manual for an explanation of why this is useful).

To make the FMC clear out the previously-programmed information, click LSK 3R to copy the adjacent line into the scratchpad, then click LSK 2R to upselect it into the ACTIVE line.

Two messages appear in succession in the scratchpad, which you can now clear (press the CLR key until they are gone). If you did check the box as I asked on p.41, however, a virtual engineer will almost immediately reselect the current database for you [39].

But meanwhile the FMC has now erased all its previous information, so we're ready to program our flight. As a precaution, switch off the Captain's Flight Director switch on the MCP and then switch it back on again to clear some MCP settings, and we're ready to go.

Press the RTE key to get to the RTE 1 page [40].

Now we enter our current and destination airports. Type EGKK into the scratchpad again, and press LSK 1L to upselect it to ORIGIN. (A RUNWAY prompt will appear, but ignore it — this is not the best place to enter the runway, we'll be doing that in a moment). Then type EGLL into the scratchpad and upselect it to the DESTination field by pressing LSK 1R. Type the flight number you want to use into the scratchpad (I used AEROWINX, although you can obviously choose your own), then upselect it to LSK 2R.

Don't be tempted to action the ACTIVATE prompt yet, though — the FMC will only complain that we haven't stipulated a route, so let's do that, first.

---

[39] If you didn't check the box, you'll need to swap the dates back again yourself.

[40] Originally, I had wrongly assumed that at this point I would need to update the reference airport line on the POS INIT page, but Hardy pointed out — "Position initialisation is not required when the IRS is already aligned. Go directly to RTE."

Press the NEXT PAGE button on the CDU to reach RTE 1 page 2 of 2. For this short hop, it will only take a minute to type in the few waypoints we need, so let's do it [41].

Type KKE02 (that's *zero* two) into the scratchpad, and upselect it to LSK 1R; then KKE10 (one zero) to 2R. (Notice that since you didn't type an airway in the VIA column, the FMC assumes you will be flying DIRECTly from KKE02 to KKE10 — which, indeed, we will.

Now enter BIG and try to upselect it to 3R: you will be presented with a page offering you a choice of identifiers for BIG. You should always check carefully that you select the correct one from the list, of course, or else you may find yourself taking a diversion for hundreds or even thousands of miles. The one we want is Biggin Hill VOR/DME (a VOR combined with a DME transmitter), whose frequency is 115.10 (notice that the closest choice is usually at the top of the list — but always double-check the frequency to be completely certain). So in this case click LSK 1L to select Biggin Hill.

You are then returned to the RTE 1 2/2 (Route 1 page 2 of 2) page, with the first three waypoints entered in the TO column, so we can continue. Type and upselect IRR10 (one zero) to 4R, and CF27R into 5R — and once again we need to make a choice. Clearly, it won't be the one in the southern hemisphere, so select the one at the top of the list by pressing LSK 1L.

We have entered our route from Gatwick to Heathrow, but we haven't yet stipulated which runways we want to use at the start and end of the trip. To do that, press the CDU's DEP ARR (Departures and Arrivals) key, and then press LSK 1L for EGKK (Gatwick) DEPartures.

We're not flying any of the Standard Instrument Departures (SIDs) today, so simply click LSK 2R to select runway 08R at Gatwick.

Now press the < INDEX key (LSK 6L), and this time select LSK 2R for EGLL (Heathrow) ARRivals. Again, don't select any STAR (or TRANSition) — just click the LSK adjacent to ILS27R to make it <ACT>ive for an ILS approach to Heathrow's runway 27R.

That's great: you have now told the FMC the basics of how you would like to fly from Gatwick to Heathrow. Press the RTE button followed by NEXT PAGE, and you will find a pleasant surprise: in addition to the information you entered before there's also now a page 3/3 (use NEXT PAGE again to see it) where you will find Heathrow's runway 27R followed by a missed approach (you must always plan for one, though hopefully you won't need it).

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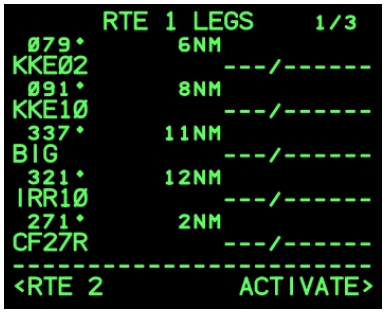
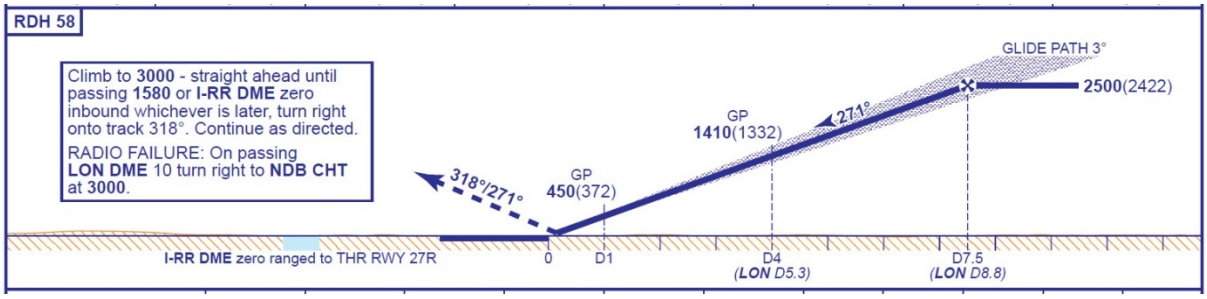
[41] As mentioned above, normally at this point we'd load a .route file — either one that came with PSX, or a previously-vlown route that we've saved, or else one that we've just planned ourselves using PFPX and transferred into Aerowinx\Routes. Whichever — load your route using CO ROUTE , grab the current charts, and then proceed with checking your route and following the checklists.

But, of course, before we ACTIVATE our route we need to check what the FMC has done. We'll do this in two ways. The first way is by looking at the LEGS pages, so press the LEGS button on the CDU. Here you see not only the waypoints that we entered, but also the distance between them and the heading information. The dashes on the right are used to enter the constraints, so to see whether there are some we check the profile for the runway on the current approach plate [42]:—



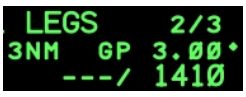


Ignoring (I won't be covering a go-around in this tutorial) the missed approach instructions in the box on the left, we can see at once that when we're 4 miles away (according to the Distance Measuring Equipment (DME) readout) then we should be at 1410 ft, and when 7.5 miles away at 2,500 ft.

So we need a constraint of 2500 ft at CF27R, and 1410 ft at FF27R (you can see the distance to the runway, right).

But the screenshot also shows that a constraint of 2500 ft at FF27R has been automatically added for us — that's obviously incorrect: I want to see a constraint of 1410 ft that corresponds to the profile on the chart (above). [43]

If you also need the lower figure, enter a constraint of 1410 into the scratchpad, then upselect it to the LSK to the right of FF27R (where the Navtech constraint is currently showing), although in such a case we will need to be sure to capture the G/S before descending below 2,500 ft.



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[42] http://www.ead.eurocontrol.int/eadbasic/pamslight-6A09B29961D620A8968591B350C30D55/7FE5QZZF3FXUS/EN/Charts/AD/AIRAC/EG_AD_2_EGLL_8-13_en_2012-07-26.pdf (at the time of writing).

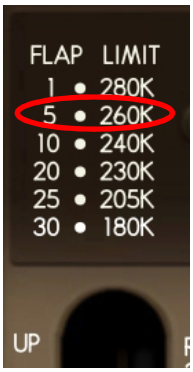
[43] Seemingly high fixes like this on the EGLL approach have also been commented upon in the forum. When Hardy investigated, he found it to be an issue with the ARINC-424-to-FMC-binary converter which affected some final approach legs, displaying the data incorrectly. This issue will be corrected in a later update of PSX — for the moment, therefore, I would advise you to adopt a cautious approach (oops, sorry), and if necessary change any unusual-looking constraints to match the charts, as suggested above. But then, you will of course always double-check your constraints against the latest charts anyway, so my apologies — I didn't really need to mention it.

Now press PREV PAGE and add an altitude constraint of 2500 to the right of CF27R.

Well that takes care of our altitude constraints, but we also need to give some serious thought to our speeds. Normally we start down at 250 kts from 10,000 ft, but today we only have 6,500 ft in which to slow down prior to landing, so we'd better think carefully about that aspect, too.

My usual rule of thumb is 10/10 — by that I mean that by the time I'm 10 miles from the airport I like to be at flaps 10 (and hence near to flaps 10 speed). Now believe me, this big bird is seriously heavy — which means lots of momentum, which in turn means that she takes quite a while to slow down. And if you're trying to lose height too, and you don't have a lot of time before you're overhead the runway — well this isn't going to be easy. And if you get it wrong, you'll be arriving at the runway travelling much too fast. Or, the worst case scenario, you're going to arrive both fast *and also* high. Not good. Time to reset the simulation and try again (or make your explanations and excuses to the Training Captain in the morning).

So what can we do to help ourselves? Well, what slows an aircraft down is, of course, drag. So we're going to add more than the usual amount of drag — and add it unusually early — in a spirited attempt to keep out of trouble. Adding drag is what the speedbrake is for, of course, but perhaps we don't really need to use it this time (since it does make a few ripples on the drinks in first class).



Boeing have very kindly provided us with a list of the flap limiting speeds [44], and nailed it just above the flaps lever so we can't possibly miss it. Anyone might think they were trying to tell us something....

So let's use MCP Speed Intervention to slow us down to 190 kts even while we're still in the (unusually low level) cruise, thus further improving our chances — we'll need to select flaps 5 first, of course, so we don't stall. Since the limit for flaps 5 is 260 kts (as seen on the Boeing list) that's OK. In addition to that, rather than using the speedbrake (except as a last resort) let's apply lots of flap much earlier than usual. In fact, let's go straight to flaps 20 as soon as we start to descend.

A traditional "belt and braces" solution, then. ☺

And let's also tell the FMC that we'd like to be doing 170 kts at CF27R — that ought to be sufficient, since beyond that we'll be setting the speed according to the flaps schedule anyway. So enter 170/2500 into the scratchpad and upselect it to be the constraint for CF27R.

(Don't forget to EXECute your changes).

[44] Which are slightly different for ER and non-ER aircraft, incidentally.

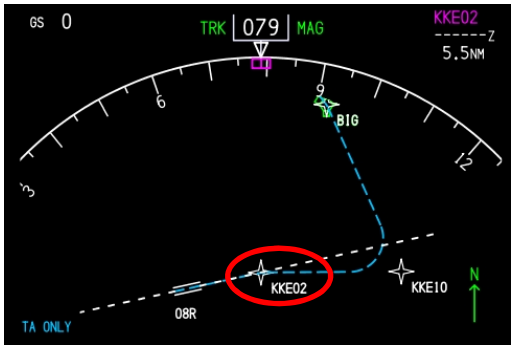
Come to think of it, why don't we start an early descent, too, just to give us even more time and space to get things right? All those measures should be a big help, when the time comes.

We're nearly finished with the route, but we do need to look carefully through all the LEGS pages to ensure that there are no disconnects between any of the waypoints. With any luck, all should be fine — so now we'll double-check the route (just to make sure that we didn't enter the wrong BIG, for example, which would give us a long and unwanted diversion for which we may well not have enough fuel — not good!). Switch to a PSX layout where you can see these three items all on the same flightdeck frame:

- the Navigation Display (ND)
- the EFIS panel to the left of the Mode Control Panel (MCP)
- the Captain's CDU

Turn the left-hand of the two lower knobs on the EFIS panel from MAP to PLaN, and you'll notice that the presentation on the ND changes (north is now up). Also reset the range knob to the right to 20 nm.

On the CDU, click the LEGS key and notice that the waypoint at the top of the LEGS page (KKE02, in this case) is now centred on the ND display. By clicking the STEP > prompt at LSK 6R you can literally step through your route. Keep watching the ND as you do, and you will see the route that you'll be following to Heathrow — without any unexpected deviations or surprises (if you do see any of those, go back and correct your tiepyng). When you're absolutely sure that this is the route you want the aircraft to follow, return the EFIS selector knob back to MAP, and then go back to the CDU again, this time to definitely confirm that this is really *really* what you want to do.



Press the RTE key (you'll notice that the runway has now been entered for you in the correct way), and then press LSK 6R to ACTIVATE > your route. The light above the CDU's EXECute key comes on, so press EXEC [45] — the heading now becomes ACTive RTE 1, and on the PFD your route is shown in magenta.

Phew! So now we have the route information entered — but the FMC still needs even more information from us.

[45] It is said that the ranks of former pilots are being continually added to by forlorn creatures who made a change but forgot to execute it....

Reprogramming the FMC 2: the other stuff

The FMC now knows where we want to go, but we have to give it some additional information before it can help us to fly that route.

Return the EFIS range knob to 10 nm.

Press INIT REF and then LSK 6L for the index page: now select PERFormance (LSK 3L). Most of this information is fine as it stands, but we do need to change two items — cruise altitude and thrust limits. Type 6500 into the scratchpad and upselect it to LSK 1R (CRZ ALT, our cruise altitude — which for this trip is extremely low, since we are alone in the sky. You will notice that it is displayed as a Flight Level, since it is above the Transition Altitude of 6,000 ft — which might have meant that we were lower than the TL if there was low pressure around. Fortunately for us, ATC set the TL to FL80 before taking the day off.

The other thing to do is to type 30 into the scratchpad and upselect it to LSK 5L: this sets the Cost Index to 30 (our Company clearly prefers fuel economy to performance).

To check the Transition Altitude (which should be 6,000 ft, in our case) press the VNAV button and then check or set the TA to 6000 at LSK 3R.

In this particular tutorial, we also want the Transition Level to be clear of both the Transition Altitude of 6,000 ft and our cruising altitude of 6,500 ft. Usually, we'd wait until ATC at our destination informs us about the TL, but (this is a very unusual scenario, of course) just to be sure we'll set it up now.

Press NEXT PAGE twice to reach the VNAV DEScent page; then press LSK 5R adjacent to the FORECAST > prompt to arrive at the DESCENT FORECAST page. Type 8000 into the scratch pad, and upselect it to LSK 1L: you will notice that it's displayed there as a Flight Level.

Now press the INIT REF key on the CDU, followed by LSK 6L and LSK 4L to reach the THRUST LIMits page.

We're fairly light (for a Jumbo), and with our four massively powerful engines we could and probably will achieve rates of climb that might be quite startling, so let's derate the take-off and climb power a little. (In the next flight we'll worry about runway length and an assumed temperature take-off, but for now we're keeping things simple. No, really!). So click on LSK 3L for a Take-off 1 derate of -8%, and LSK 3R for a Climb 1 derate as well; and then press LSK 6R to finally get to the TAKE-OFF page.

After our labours so far, everything should already be pretty much set up, here. However, having offloaded all that fuel we do need to ensure that the aircraft is going to be in trim for the take-off.

Go to a layout view where you can see the stab trim settings, and use your controls to adjust the stab trim until the white bar is in the centre of the green band.

Return to your view of the Captain's CDU. We're still on the TAKE-OFF REF page, and our next task is to confirm the V-speeds by pressing LSKs 1R, 2R, and 3R, so that the figures appear in large font.

Make a mental note of the V_2 figure, since we need to enter that into the MCP, so now switch to a layout which shows the MCP, and adjust the IAS MACH window to your V_2 speed. While you're there, also set the ALT window to 6,500 feet, since we are (I assure you ☺) cleared directly to that altitude.

Finally, press the LEGS button on the Captain's CDU so that the LEGS page is displayed during the take-off; and also press the PROG button on the F/O's MCP. Notice that the Distance To Go (DTG) to Heathrow is 46 miles (not exactly a long trip — it will take us all of about 12 minutes) and the distance to the Top of Climb (our cruising altitude of 6,500 ft) is 16 nm.

Some pre-take-off checks

Normally, you would have been following the checklists throughout the process, right up to this point, but we have cheated by using the existing situ, so we need to make sure that everything is ready for take-off. So whilst we we definitely have some things to check, for this gentle exercise we won't use the checklists, but let's look at some of the basics.

There are three items in particular (sometimes known as "the three killers", although there are others, of course) which can seriously spoil your day at take-off time. These are:

- the aircraft being out of trim
- the wrong flaps setting
- the speed brakes being extended

So always check those first of all (and check that you've checked).

You should be in trim (middle of the green band), at flaps 20, and with the speed brakes retracted.

But there are some other items which we also need to check [46] —

- Ensure that the autobrakes are set to RTO (Rejected Take-Off)
- On the MCP, the runway heading of 79° should already be in the heading window. All that's left is to ensure that both Flight Director switches are on and the autothrottle is armed — and then press the buttons on the MCP to arm LNAV and VNAV. (You should then see VNAV and LNAV annunciated on the PFD as armed, in white). Don't press one of the three CMD buttons to engage the autopilot yet — you'll do that after take-off.
- You have already set V_2 in the IAS/MACH window, and our cruise altitude (6,500 ft in this case) in the ALT window. (Have you? Are you sure?)

OK, we're almost there. To save the situation that you have created, go to the Instructor pages and select Situation | Save. You can overwrite your previous save by clicking the long button at the bottom (don't forget to click Save *twice*).

You might also want to save your route separately, for use in a different Situation: in that event go to Situation | Human | Dispatcher. Lower left you will find an option for "Route shown on left CDU" to Archive, with checkboxes for "Include cruise altitude" and "Include cost index" — you have entered that information, but by using those checkboxes you may now choose whether to include it with the Situation or not. Then select (or type) an appropriate two-digit suffix, and click the Overwrite button.

Many congratulations!

You have now created and saved your own Situation.

So obviously, my task is done. It's time for you to go vlying.... ☺

[46] Normally there'd also be a check that your transponder was set to TA/RA, but you may remember that we turned all other aircraft off, so this time we can forget about that one.

End of Tutorial

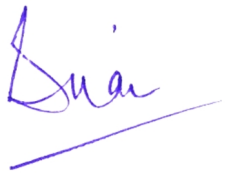
In the words of the famous wabbit, "That's all, folks!".

I hope that you have found the foregoing to be helpful, and that it has speeded your path to acquiring the necessary knowledge to begin to use PSX. But in closing may I also encourage you to read Hardy's manual with considerable attention — it really is a most remarkable (and beautiful) distillation of essential knowledge about the 744, even though Hardy says that nonetheless there are many aspects which are not included. All I can say is that almost every time I start to read through it I find another fascinating nugget of information of which I was previously unaware.

My grateful thanks to Hardy, therefore — not only for his amazing simulation, but also for his patient sharing of knowledge with us, both in his manual and in the PSX forum. And, of course, for being so kind as to add considerably to the value of this short tutorial with his comments.

Special thanks go out also to those who have taken the time to create and donate wonderful free add-ons which further enhance our experience of PSX. Your generosity is remarkable, gentlemen [47], and I salute you for it!

And finally, my thanks to you, dear reader, for persevering through the foregoing and reaching this point. I sincerely hope that your efforts will be rewarded by an increased appreciation of the amazing creation that is Precision Simulator Ten.



Brian Cowell

Hampshire, England.

September, 2014

v1.02 (a few small typographical errors fixed, and references to Part 2 added).

[47] No ladies so far. As far as I know, anyway. ☺

Appendix 1 — Index to the PSX manual's Instructor pages

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Appendix 2 — PSX keystroke summary (alpha sequence of function names)

F6	A/P disengage bar on MCP
T	A/T ARM switch
PgUp	A/T disconnect switch
CTRL + F8 *	ALT HOLD switch
CTRL + D	ALT switch
CTRL + F10 *	APP switch
ALT + B	ARPT switch
ALT + J	BARO mode selector
ALT + H	BARO STD switch
ALT + 9	CANC switch
R	Causes the PNF to say the last checklist title
V	Causes the PNF to say the next checklist item
CTRL + K	CMD C switch
CTRL + J	CMD L switch
CTRL + L	CMD R switch
Q	COM frequency transfer switch
H	COM push-to-talk switch
CTRL + Shift	Connects the keyboard to CDU C
Shift (left)	Connects the keyboard to CDU L, or disconnects any connected CDU.
Shift (right)	Connects the keyboard to CDU R, or disconnects any connected CDU.
Backspace	Cycles reversers: Deploy-&-max-reverse, idle, stow, ...
C	Cycles the chronograph: Start, stop, reset, ...
G	Cycles the gear lever: DN, OFF, UP, OFF, ...
A	Cycles: Autopilot engaged, disconnected, alert reset, ...
ALT + N	DATA switch
ALT + 7	DRS switch
ALT + F10	ECS switch
CTRL + Backspace	Elapsed time (ET) reset switch
ALT + F8	ELEC switch
ALT + F6	ENG switch
(country spec.)	Flap alert override switch
CTRL + F5 *	FLCH switch
ALT + U	FPV switch
M	Freezes the aircraft motion, including the strut compression.
ALT + F9	FUEL switch
(country spec.)	Gear alert override switch
ALT + 8	GEAR switch
CTRL + F6 *	HDG HOLD switch
CTRL + T	HDG SEL switch
ALT + 6	HYD switch
CTRL + Q	IAS/Mach blank switch
CTRL + W	IAS/Mach SEL switch
CTRL + F3 *	LNAV switch
CTRL + F9 *	LOC switch
Enter	Master warning reset switch & G/S alert inhibit switch
Enter (num pad)	Master warning reset switch & G/S alert inhibit switch
ALT + G	MINS mode selector

ALT + D	MINS RST switch
Arrow Dn	Moves the elevator stick aft
Arrow Up	Moves the elevator stick forward
F10	Moves the flap lever aft
F9	Moves the flap lever forward
F8	Moves the speed brake lever aft
F7	Moves the speed brake lever forward
ALT + I	MTRS switch
CTRL + Enter	ND CTR switch
End	Neutralizes the rudder pedals
B	Park brake lever
P	Pauses/unpauses the entire simulation, including the flight deck controls.
ALT + M	POS switch
Space	Pushes both brake pedals
Minus (num pad)	Pushes the alternate stabilizer trim switches to nose down
Plus (num pad)	Pushes the alternate stabilizer trim switches to nose up
Delete	Pushes the left rudder pedal
PgDn	Pushes the right rudder pedal
Z	PVD switch
F5	Quickly advances all thrust levers
F1	Quickly advances thrust lever 1
F2	Quickly advances thrust lever 2
F3	Quickly advances thrust lever 3
F4	Quickly advances thrust lever 4
5	Quickly retards all thrust levers
1	Quickly retards thrust lever 1
2	Quickly retards thrust lever 2
3	Quickly retards thrust lever 3
4	Quickly retards thrust lever 4
CMD + Q	Quits Precision Simulator in Apple OS X
ALT + F4	Quits Precision Simulator in Microsoft Windows
ALT + 0	RCL switch
0 (num pad)	Reloads the last layout file
ALT + S	Reloads the last loaded situation file
CTRL + End	Rudder trim centring switch
1 ... 9 (num pad)	Selects one of nine layouts
N	Sets all altimeters to QNH of nearest airport, or STD when above TA/TL.
J	Sets both pilot clocks to the simulated earth's UTC
CTRL + Arrow L	Sets the aileron trim switch to left
CTRL + Arrow R	Sets the aileron trim switch to right
0	Sets the MCP HDG to the current heading
X	Sets the MCP HDG to the next suitable runway heading
CTRL + Del + PgDn	Sets the rudder trim selector to fast left
CTRL + PgDn + Del	Sets the rudder trim selector to fast right
CTRL + Del	Sets the rudder trim selector to slow left
CTRL + PgDn	Sets the rudder trim selector to slow right
CTRL + Arrow Up *	Sets the yoke stabilizer trim switches to nose down
CTRL + Arrow Dn *	Sets the yoke stabilizer trim switches to nose up
Esc	Shows or hides the Instructor (also works when a CDU is connected)
ALT + F5	Slowly advances all thrust levers

ALT + F1	Slowly advances thrust lever 1
ALT + F2	Slowly advances thrust lever 2
ALT + F3	Slowly advances thrust lever 3
ALT + F4 *	Slowly advances thrust lever 4
ALT + 5	Slowly retards all thrust levers
ALT + 1	Slowly retards thrust lever 1
ALT + 2	Slowly retards thrust lever 2
ALT + 3	Slowly retards thrust lever 3
ALT + 4	Slowly retards thrust lever 4
CTRL + F2 *	SPD switch
ALT + C	STA switch
ALT + F7	STAT switch
ALT + ,	TERR switch
(country spec.)	Terrain alert override switch
(country spec.)	TFC switch
CTRL + F1 *	THR switch
Home	TO/GA switch
F	Toggles both flight director switches
Arrow L	Turns the aileron control wheel left
Arrow R	Turns the aileron control wheel right
O	Turns the ALT selector by +100 ft
CTRL + G	Turns the ALT selector by +1000 ft
I	Turns the ALT selector by –100 ft
CTRL + F	Turns the ALT selector by –1000 ft
(country spec.)	Turns the autobrake selector left
(country spec.)	Turns the autobrake selector right
CTRL + U	Turns the bank limit selector left
CTRL + I	Turns the bank limit selector right
ALT + Y	Turns the BARO selector by +1 unit
ALT + T	Turns the BARO selector by –1 unit
K	Turns the gear steering tiller left
L	Turns the gear steering tiller right
9	Turns the HDG selector by +1°
CTRL + P	Turns the HDG selector by +10°
8	Turns the HDG selector by –1°
CTRL + O	Turns the HDG selector by –10°
CTRL + R	Turns the IAS/Mach selector by +10 units
CTRL + E	Turns the IAS/Mach selector by –10 units
D	Turns the inner COM standby frequency selector down
E	Turns the inner COM standby frequency selector up
ALT + E	Turns the MINS selector by +1 ft
ALT + R	Turns the MINS selector by +10 ft
ALT + Q	Turns the MINS selector by –1 ft
ALT + W	Turns the MINS selector by –10 ft
ALT + K	Turns the ND mode selector left
ALT + L	Turns the ND mode selector right
ALT + A	Turns the ND range selector left
ALT + Z	Turns the ND range selector right
S	Turns the outer COM standby frequency selector down
W	Turns the outer COM standby frequency selector up

7	Turns the SPD selector by +1 unit
6	Turns the SPD selector by –1 unit
U	Turns the V/S selector by +100 fpm
CTRL + S	Turns the V/S selector by +1000 fpm
Y	Turns the V/S selector by –100 fpm
CTRL + A	Turns the V/S selector by –1000 fpm
CTRL + F7 *	V/S switch
CTRL + F4 * **	VNAV switch
ALT + O	VOR L switch
ALT + P	VOR R switch
ALT + V	WPT switch
ALT + X	WXR switch

** May be inhibited in Apple OS X by user system preferences.*
*** Cannot be used in Microsoft Windows.*

(N.B. functions shown in brown font refer to the captain's side when the first officer is the PNF, otherwise to the first officer's side).

Appendix 3 — assignable functions for USB axes and buttons

Assignable to USB axes:	*Assignable to USB buttons:*
Aileron	A/P disconnect
Aileron and tiller	A/T disconnect
Elevator	Checklist: Next item
Reverser 1	Checklist: Rewind to top
Reverser 2	Chrono Capt
Reverser 3	Chrono F/O
Reverser 4	Comm PTT Capt
Reversers all	Comm PTT F/O
Rudder	Flaps DN
Speedbrake	Flaps UP
Throttle 1	Gear cycle
Throttle 2	Layout 1
Throttle 3	Layout 2
Throttle 4	Layout 3
Throttles all	Layout 4
Tiller	Layout 5
Toe brake left	Layout 6
Toe brake right	Layout 7
Toe brake both	Layout 8
	Layout 9
	Layout cycle +
	Layout cycle -
	Rudder trim left
	Rudder trim right
	Speed brake EXT
	Speed brake RET
	Stab trim nose DN Capt
	Stab trim nose DN F/O
	Stab trim nose UP Capt
	Stab trim nose UP F/O
	Throttles all +
	Throttles all -
	Thrust reverser cycle
	Tiller nose left
	Tiller nose right
	TO/GA
	Toe brake left
	Toe brake right
	Toe brakes both
	Warning reset switches

Appendix 4 — an example of control documentation

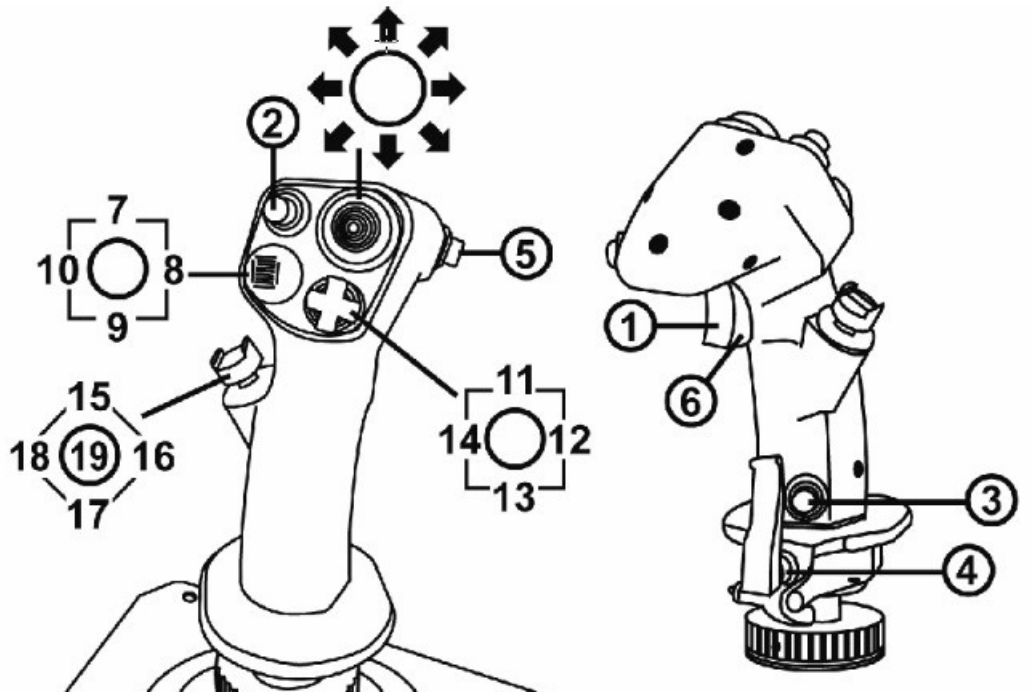
TT Panel assignment worksheet for PSX

Description	USB pad #	Assignment
Btn A1	0	**Checklist: rewind to top**
Btn A2	1	**Layout 1**
Btn A3	2	**Layout 2**
Btn A4	3	**Layout 3**
Btn A5	4	**Layout 4**
Btn B1	5	**Layout 5**
Btn B2	6	**Layout 6**
Btn B3	7	**Layout 7**
Btn B4	8	**Layout 8**
Btn B5	9	**Layout 9**
Btn C1	10	**Checklist: Next item**
Btns C2 – C5	—	(simulated 4-way hat, Right, Down, Left, Up)
Btn C2	hat 4	
Btn C3	hat 6	
Btn C4	hat 8	
Btn C5	hat 2	
Red sw 1	12	**CMD L "Ctrl J"**
Red sw 2	13	**CMD C "Ctrl K"**
Red sw 3	14	**CMD R "Ctrl L"**
Red sw 4	15	**K/B to L CDU (or disconnect the connected CDU) "Shift ←"**
Red sw 5	16	**K/B to C CDU (or disconnect the connected CDU) "Ctrl Shift"**
Red sw 6	17	**K/B to R CDU (or disconnect the connected CDU) "Shift →"**
Toggle sw 1	18	**Chrono Capt**
Toggle sw 2	19	**Set both pilot clocks to UTC of simulation "J"**
Toggle sw 3	20	**Alternate stab trim + "+"**
Toggle sw 4	21	**Alternate stab trim - "-"**
Toggle sw 5	23	**Pause ("P")**
Toggle sw 6	24	**Freeze movement "M"**
Toggle sw 7	25	**COM frequency transfer "Q"**
Toggle sw 8	26	**MCP heading to next suitable runway heading ("X")**
Toggle sw 9	27	**MCP heading to current heading ("0" [top row, not numpad])**
Toggle sw 10	28	**RCL "Alt 0"**
Toggle sw 11	29	**Altimeters to QNH of nearest airport, or std pressure ("N")**

N.B. **Assignments made via JoyToKey-injected keystrokes are shown in blue. Assignments via USB functions are shown in green.** No Z axis, X rotation, rudder, or throttle (although Windoze imagines they exist). Also switch 22 is not detected, it jumps from 21 to 23.

(N.B. **Currently unused**: C2 + C3 = hat 5; C3 + C4 = hat 7; C4 + C5 = hat 1; and C5 + C2 = hat 3
These could be useful for hard-to-press-accidentally safety assignments for functions such as Pause, etc.)

Warthog PSX control assignments



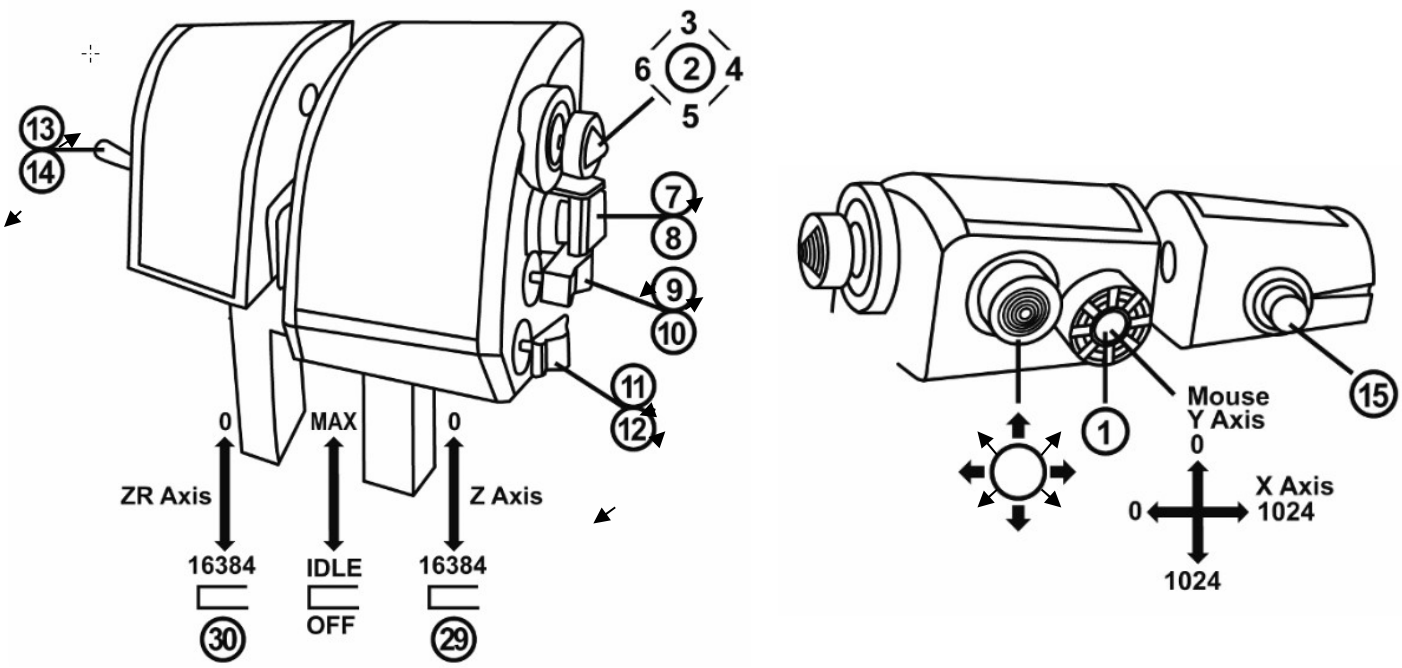
Joystick button/switch numbers &c — **N.B.** ***In PSX these differ from the numbers shown in the diagrams. Mostly (but not invariably: viz. 23 – 28), they are one less than shown above.***

Assignments made via JoyToKey-injected keystrokes are shown in blue. USB assignments shown in green.

Control	No.	Assignment
Trigger 1st pressure	0	*(Unused, since 2nd pressure is required to avoid accidental braking)*
Trigger 2nd pressure	5	**Toe brakes both**
Red btn, top left	1	**A/P disconnect**
Grey pinkie btn, rear	2	**Master warning reset ("Enter")**
Back lever	3	**Comm PTT Capt.**
Grey btn, top rt side	4	**Pause ("P")**
Hat below red btn ↕	↑ 6, 8 ↓	*(do not use — just in case trim should be accidentally applied)*
Hat below red btn ↔	←9, 7 →	**← Rudder trim left, → Rudder trim right**
Hat below 8-way ↕	↑ 10, 12 ↓	**↑ Stab trim nose UP, ↓ Stab trim nose DN**
Hat below 8-way ↔	←13, 11 →	*(do not use — just in case trim should be accidentally applied)*
Left angled hat ↕	↑ 14, 16 ↓	↑ , ↓
Left angled hat ↔	←17, 15 →	**← Layout cycle - , → Layout cycle +**
Left angled push-btn	18	Reserved (I tend to find that I always miss one obvious thing at first…)
8-way hat, top right	hat 10 - 16	**NOT DETECTED… but** the main four directions *are* seen by **JoyToKey**. So:
	↑ , ↓	*(do not use — just in case trim should be accidentally applied)*
	← , →	**← Aileron trim ("Ctrl ←"), → Aileron trim ("Ctrl →")**
AXES:		
Elevators	Y axis	**Elevator**
Ailerons	X axis	**Aileron**

So one 2-stage trigger, four buttons (one in 4-way hat), one 8-way POV hat, three 4-way hats — and two rather important axes! (The numbering on the rest of this page conforms only to the above diagram).

1 and 6: first and second stage trigger | 2 and 3 and 5 : buttons (2 is red, the others grey) | 4 : pinky switch | 7 – 10 (black, under red btn) and 11 – 14 (to the right) and 15 – 18 (angled, left side): all 4-way hats | 19 : button



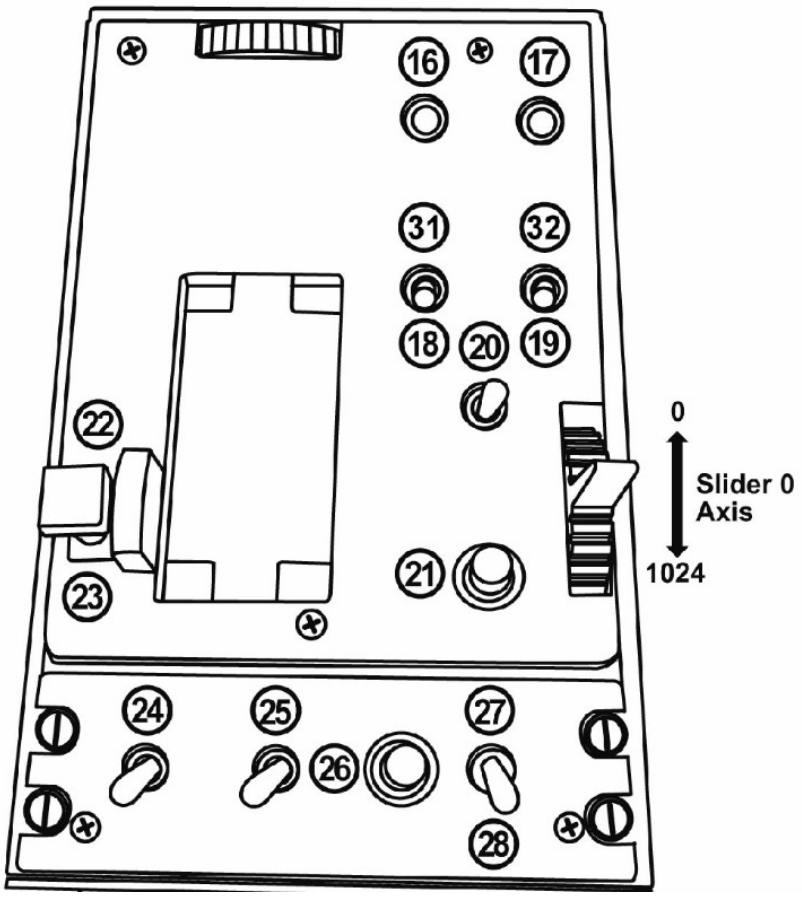
Below: ^ indicates a centre off position; S means sprung to return to centre when pressure released.

Throttle levers — button/switch numbers &c

Control	No.	Assignment
Button in mouse axis	0	**TO/GA**
Hat, rear rt of rt thr.	"Coolie sw"	**NOT DETECTED**
Button - RHS top hat	1	**Thrust reverser cycle**
RHS top hat ↕	↑ 2, 4 ↓	↑ , ↓
RHS top hat ↔	←5, 3 →	← , →
Top grey fwd/back	← 7S, ^, 6→	← (sprung), ^ → (latches) | **← (sprung) Rudder trim centre "Ctrl End"**
Lower grey fwd/back	← 9, ^, 8→	← , ^ →
Bottom red fwd/back	←11S, ^, 10S→	(both sprung) ← , ^ → | **← (sprung) A/T ARM switch "T"**
Side switch	12,^, 13	, ^,
Red btn, left thr back	14	**A/T disconnect**
	(15 – 28)	*(See base, next page)*
Left throttle reverse	29	
Right throttle reverse	28	
AXES:		
Mouse cursor	X and Y axes	**NOT DETECTED**
Left throttle	Z rotation	*(For PSX, this will be mechanically coupled to the right throttle)*
Right throttle	Z Axis	**Throttles all**

So three buttons (two in 4-way hats), one 8-way hat, two 4-way hats, one 2-way with centre switch, one fwd and back switch with centre off, two similar with spring position back to centre when fwd, two buttons actuated by lifting throttles into reverse (over the detent) — two throttle axes, mouse cursor XY axes, and a rotary control axis.

1 : button in mouse cursor
2 : red button with (3 – 6) in 4-way hat
7 – 8 : switches (sprung from 8) 3 position with centre off
9 – 10 : ("boat switch") 3 position with centre off
11 – 12 ("china hat") 3 position sprung from 12 with centre off
13 – 14 : switch (with centre off)
15 : red button (at rear)



Below: ^ indicates a centre off position; S means sprung to return to centre when pressure released.

Throttle base — button/switch numbers &c

Control label	No.	Assignment
ENG L switch	↑ 15 on, off↓	↑ , ↓
ENG R switch	↑ 16 on, off↓	↑ , ↓
IGN LEFT switch	↑30S, ^, 17↓	↑(sprung), ^, ↓ | **↑(sprung) Rudder centre "End"**
IGN RIGHT switch	↑31S, ^, 18↓	↑ (sprung), ^, ↓| **↑(sprung) Reset simulation "Alt S"**
APU START/OFF sw	↑19 on, off↓	↑ , ↓
Silence Horn btn	20 (grey button)	**Gear cycle** (Dn – off – Up – off ....)
FLAPS switch	↑21 UP, ^, 23 DN ↓	**↑ Flaps UP, ^, ↓ Flaps DN**
EAC switch	↑24 on, off↓	↑ **Both FD switches ("F")** (toggle)
RDR ALTM switch	↑25 on, off↓	↑ **Autopilot cycle ("A")** (engaged – reset – alert reset ...)
A/P toggle button	26 (black btn, front)	**Park brake lever ("B")**
A/P mode switch	↑27, ^, 28↓	**↑ Speed brake EXT,** (*centre off*), **↓ Speed brake RET**
AXES:		
"Incr Decr" lever	Slider	**Rudder**

So two buttons, five on/off switches, two 2-way (1 sprung) w/ centre off switches, two 2-way with centre off switches — one rotary axis.

With PSX, switch 32 (in the above diagram) is **not detected**.

Appendix 5 — Pilot Non-Flying's tasks

(This information is taken directly from the Situation | Human | Pilot Instructor's page).

Makes call-outs

Standard call-outs
Engine failure call-outs
Reminders when deviating from selected speed, altitude, or heading, or when rudder is unnecessarily out of center

Performs silent tasks

PNF will set ...

- Anti-ice when in flight
- Stby & PNF's baro when PF's baro is set
- PNF's clock when PF's clock is set
- Packs to NORM when CLB THR is set
- Gear to OFF when CLB thrust is set and gear up
- Ldg & logo lights when passing 10000
- Fuel pumps & valves according to EICAS
- PNF's minima when PF's minima are set
- PNF's F/D when PF's FD has been moved

When descending 15000, PNF will set ...

- V REF on PNF's CDU if not set already
- Autobrakes for landing if not set already
- TCAS mode to BLW

If A/P is disengaged, PNF will set ...

- SPD to flap spd+10 for ldg if MCP not blank
- SPD to V_{REF}+5 for landing if MCP not blank
- SPD, HDG, ALT according to Voice ATC

