



Visual system tutorial

This is an introductory guide for simulator-builders that want to build a large field of view visual system. I will try to guide you through some of the important aspects related to this. This is not a recipe, so the work is required to be done by you. Lots of patience and work is required to obtain "perfection".

My tutorial is based on the skills I have learned during the build of my 225 degree FOV visual system. So, this is based on a single-computer setup with FSX. But still some of this will be useful for builders using FS2004, and builders using Wideview.

I hope you will enjoy this tutorial and find it useful. I know many people have been waiting for something like this to be published.

Revision 1.0

Planning the system

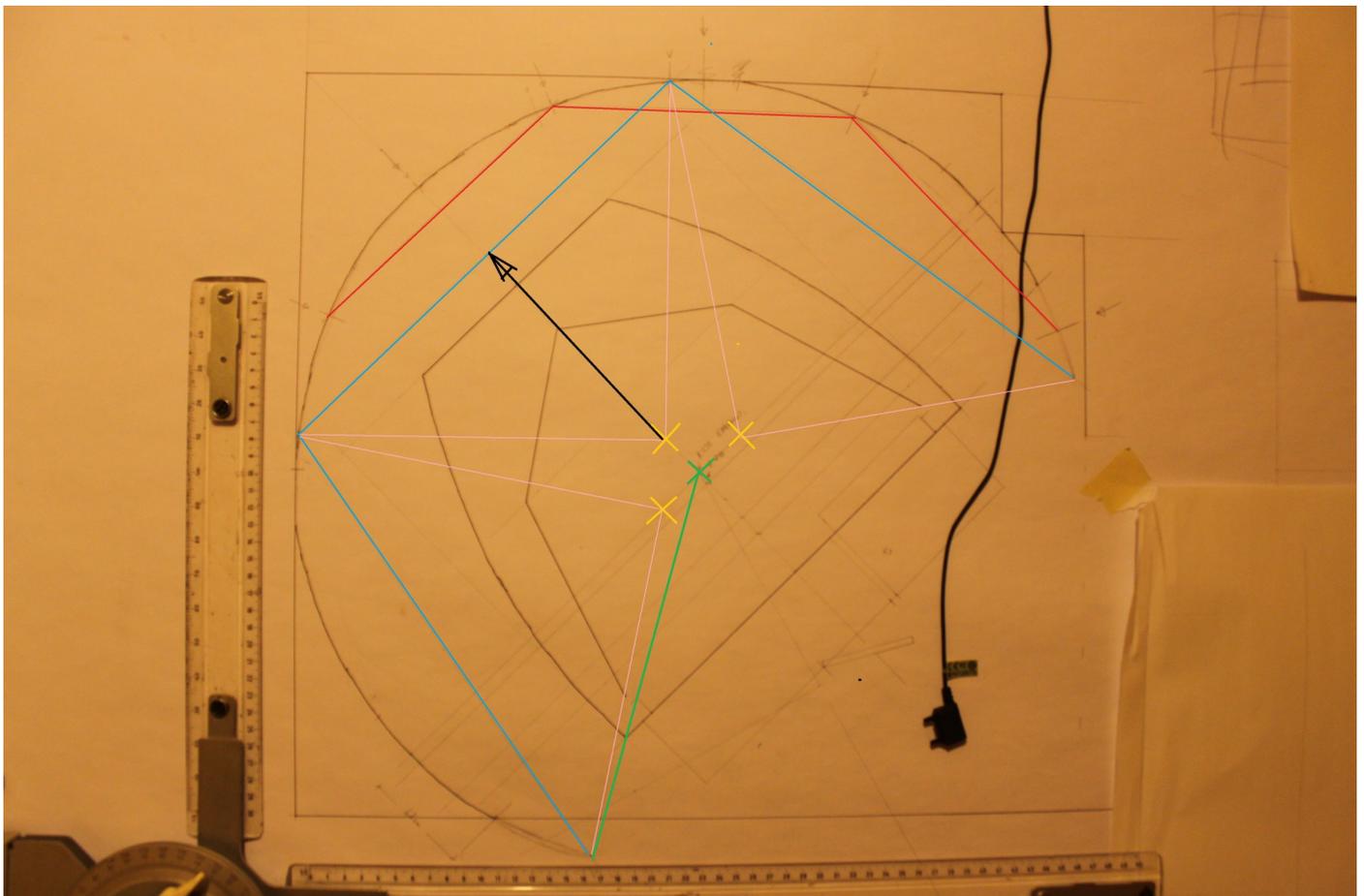
The place to start designing your system, is to make a drawing of the space you have available for your simulator. So the first step is to make a top-down drawing of your room and simulator. This is very useful, and important for the projector calculations. No need to think about the software or FLT-files at this stage.

You also need to find the eyepoint in the simulator. This is important for our drawing, as the screens centre of radius is the same position as your eyepoint. Finding the eyepoint is really easy. Position yourself in the simulator, in "flight-position", and measure the distance from your eye, and to the front or back of your simulator. Then you can insert this to your drawing. As most planes have two pilots, your eyepoint for the visual system is just between the two pilots. For my 737 setup, I ended up around the cutoff levers.

Also measure the eyepoint height from your floor, as you want to make sideprofile drawings of your setup also. The more drawings you make, it will be easier to make sure your projector choice is correct. One keyword to remember for later: The simulators physical eyepoint = FSX software eyepoint.

For calculating throw distances, you need to see the screen as a "flat" screen without the curve.

Tip: Make the drawing in the scale of 1:10 for easy calculations.



- BLUE: Projection line as it would be on a flat screen. (without edgeblending). And also this line indicates three undocked FSX views for a three window setup.
- YELLOW: Projectors lens position. (BenQ MP782-ST)
- GREEN: Eyepoint and screen radius.
- BLACK: Projector throw distance. (From lens to "flat" screen). Please remember that the projector is bigger than only the lens, so try to draw the size of the projector box into the drawing also.
- PINK: Image angle from projector to the screen.
- RED: FSX views if you choose a 5 window setup.

For setup with edge blending, it is recommended to have a 20% image overlap, which will result in a smaller FOV, but image quality improvement. It is always a compromise... Imagine a projector throws 2000 lumens. And you will anyway have some projector overlap. The spot where the two projectors lights up will then have 4000 lumens... Not so nice. But with edge blending, you will get a chance to remove these "lines of sunshine"... Look at the photo below. It is very hard to make a nice "blend" on my setup, because the overlap is so small. Not much space for black-level adjustments... (It is not blended on the picture below).



Projectors and calculators

Choosing the right projector is one of the hardest tasks here. Now you need to compare your drawings with the measurements you will find at the manufacturers projection-calculators. This is a lot of work. But if you spend the time, you will get it right the first time, and not wasting money on "impulse-deals". BenQ has a very good calculator on their website, and their projectors is really good. I will recommend BenQ for your simulators. Your simulators side-profile drawings will help you determine if you will get "shadow" issues...

Tip: If you search on www.boeing.com, you can find the real planes eyepoint measurements... They have drawing collections for all their airplanes for anyone to download...

DLP or LCD?

I have tried both DLP and LCD on my system, and there is no doubt, DLP is the way to go for flight simulators. DLP will give you good black-levels for night flights, where LCD will show black as a grey "soup". But if you use LCD-projectors, the warpalizer will help you to calibrate your colours to make the colours identical on all your projectors.

When you throw a image on to a curved screen, the distance from lens to image center, and image edge is very different. So when you "focus" your projectors, it will be crisp either at the image center or edge... But with the BenQ short-throws, this is a very small problem. You will not notice unless you try to focus on this. I was really surprised how small this issue was actually.

The example below is just an example, and not necessarily the distance calculation as used on my system. You need to do the calculations yourself for your setup.

BenQ Projection Calculator

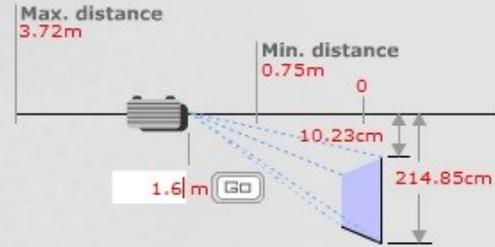
[Check for updates](#)



MODEL
Data Projector
MP782 ST

Calculate the Image Size (by projection distance)

Drag the projector below to your desired projection distance or enter the distance in the box to obtain the projected image size in the diagram and table to the right.



Calculate the Projection Distance (by image size)

Drag the diagonal line on the projected image or enter a desired image size in the box to obtain the projection distance in the diagram to the left.

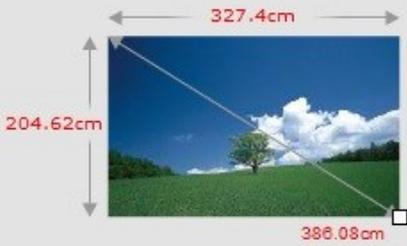


Image Size Range for a Given Distance

	Max.	Min.
Diagonal	386.08 cm	386.08 cm
Width	327.4 cm	327.4 cm
Height	204.62 cm	204.62 cm

UNITS

Imperial

Metric

ASPECT RATIO

4 : 3

16 : 10

16 : 9

15 : 9

LOCATION

Floor

Ceiling

Projector installation

It is tricky to install projectors to the ceiling when the three will be very close to each others, so if you have the option to remove the simulator, or build the screen before simulator is placed, you can easily position the projectors on the floor and do all the aligning there. Then fix them to something, and turn everything upside down for fixing to the ceiling. Then you can adjust all three projectors at the same time, which really make life easier.



I will also recommend to use tape to mark your different angles on the floor for easier positioning of the projectors and simulator. Also apply tape on the screen vertically for your projector alignment. It really helps.



Blank page just for the heck of it...

Working with the FLT files

The FLT file is the file where we will work on tweaking the visual setup. This file is located in "My documents/FSX files". So when you save a flight in FSX, it will be stored in that folder. You can also start the flight directly from this folder, as together with the FLT file, there is also an exe. No need to open FSX menu and launch a flight from there. It is very handy to send a shortcut to the desktop also.

When you start, you will have a normal wide forward view. To make a "undocked window" you go to your "controls section" inside FSX, and you will find a keyboard command for making a new window. You can make as many windows as you want. But because of the way FSX is designed, you will be hit very hard regarding frame-rates. So the less windows we open, the better the overall performance will be. The most common setup in the earlier days was to use 5 undocked windows, simply because the view angles could be set directly from the keyboard and hat-switch. But after some experimenting I managed to make three views to match, and the frame rate gain was the bonus.

Start with making the amount of windows you want. My recommendation is to use 3 or 5. Why not 2 or 4? Well, all the undocked windows will show an image pointing in a direction. So for every image you want to show, they will have a different angle. It is very easy to see this angle when you are looking at a terminal, or building in front of you. For sure you dont want to have this effect in your flying direction, but it would be your choice. If it was not for those black lines and performance impact, it would be perfect to have a window per each 5 degrees FOV, but we are not so lucky unfortunately.

A five window setup will have less angle difference between each window, so the angle problem is not so big. But you will have the black vertical "window" line between every undocked window, and also two projector joints, so that will be 6 disturbing lines on your screen. Below a 225 degree configuration.



The three window setup has some advantages, but also some disadvantage. First this will improve the framerates alot compared to the five window setup. And, a big improvement is that there will be only two black vertical lines, and those two will be in the image joints. So compared to the five window setup, four lines is gone. The drawback is that the angles between each window is larger, but this is only a cosmetic problem when you are standing next to a building/terminal. Any way you go for the ultimate visual system, it will be some kind of a compromise. 225 degree setup below.



I assume that you already know how to "eliminate" the panels for the aircraft model you are using.

First start to make some new windows. Dont bother to stretch or zoom on them at this point. You will have much better control by doing this directly in the FLT-file. Move the first window to the left, put the second window in the middle, and finally window nr three to the right. The center window will now show the forward view. Click on the left window. Click and hold the left arrow key, press and hold shift, release arrow key, and release shift. Now our left window points left. Repeat the procedure for the right window. (Or just write manually in the FLT-file). For performance gain, it is wise to make the background view into something that drain as little performance as possible. No doubt the top-down view is what we want. So click on the background to make it a active window, right click on your screen and select top-down from the drop-down menu.



When your screen looks similar to the below, it is time to save the flight. Call it "Visual-test" or something similar that you remember. You can make as many "saved-flights" as you wish. Good for experimenting. The rest of the work we will do in the FLT-file.



You should open your saved flight file and spend some time looking at it. After a while many of the items become obvious. For example, you can preset how your radios is tuned for each flight.

I will now on the next pages guide you through what the "visual-stuff" in the FLT file is for.

First we have the [Main] section. This is basically the name of your saved flight, and the information you added to it. This can be edited in the FLT-file for your convinience.

```
[Main]
Title=180 Kai Tak          <-----This is the name of your saved flight
Description="cold and dark, at parking, night, 180 visual"    <-----This is the description of your saved flight. Can be edited here.
AppVersion=10.0.61637
FlightVersion=1
```

Next step is to locate [Window.1]. This lines contain all the information for the background window which will span over all your screens, but of course behind the Undocked windows. This window is also the active window. You can set any of your undocked windows to active also, but only one window can be active. For making Aivlasoft EFB to work with your simulator, the "maximized" window MUST be the active. That means none of the undocked windows can be active. So if you plan to use EFB, you can not make a undocked window active for watching outside views and so on.

All your windows will have a Order=x number. If you see all your windows as a sandwich, you get the idea. Window 0 is always the front window, and in our case with three windows, order=3 is the maximized window. (example below is a 5 window setup).

Tip: By setting the center window as order=0, and the side windows to 1 and 2, you can stretch the side-windows underneath the center window (which is the first window in our sandwich), and then be able to make the black border thinner... You will understand this by reading a little more about the screenunicoords...

Active=True This will apply only for the active window. All the others will be Active=False

Undocked=False This will apply to all the windows. Even the undocked ones, as we Maximize them within the screenunicoords we set...

Maximized=True This will only be for the Active background window (Even if the undocked ones are kind of maximized.... Cant even explain why, but what the heck as long as it works...).

Screenunicoords: This is for many the tricky one to understand. But it is a relatively simple thing to deal with.

Basically it describes where each window is located on your screen. X and Y coordinates. Our background

```
[window.1]          <-----window 1 is the screen that you start with. (This is probably your "wide fwd screen", that you probably will make a top-down view.)
Order=5
Active=True        <----- Active window, (True or False)
Undocked=False    <-----
Maximized=True    <-----
ScreenUnicoords= X, Y, X, Y <----- X, Y coordinates for where your window is located, X, Y for window size. Always calculated from top left. (Top left = 0,0)
UndockCoords=0, 0, 0, 0
CurrentCamera={A2849229-938A-448F-8AC6-01EF2291C171} <-----current camera should match one of the cameras below.
```

maximized window will have 0, 0, 8192, 6144. That means it is positioned at top-left, and 8192 wide and 6144 tall. Whatever resolution you will be using, the window will be 8192 wide and 6144 tall. So all your undocked windows will be 6144 tall then, and you can enter this info for the screenunicoords for your undocked windows. If you try to divide 8192 into three, you will not get a "round" number, so you need to experiment. (This is a complicated topic to explain, but the info is in the FSX SDK for really advanced users). But a width of 2731 seems to work fine for each undocked window. Bla bla bla... Boring stuff... Lets put at least one picture on the next page :-)

Currentcamera=[alotofnumbersandletters] This actually tells you which of all the cameras listed below that is being used. So all our angles and zoom settings will be set in the camerasetting with the corresponding [alotofnumbersandletters].

The only thing that you need to experiment with on the maximized (top-down) window is the zoom setting. Go to a place where you have high frame rates, as those places will give a better indication of changes we do regarding frame rate improvements or vice versa. By adjusting the zoom setting up and down, you should see that the frame rates will go up and down. And also the by choosing the correct setting, you will see more trees and outside stuff... I have found a zoom set to 192 is perfect. You should try to see how it will impact on your simulator.

Picturetime. Lots of funny stunts can be made by writing numbers in your FLT-file. You dont even need hardware to make a complete sim...



Now we will continue to work on our undocked windows. Or example window four. Notice the screenunicoords. 0, 0, 0, 2731, 6144 means this window is positioned top-left, and it is 2731 wide and 6144 tall. You can see that the Currentcamera= matches the Guid= for [Camera.4.1]. So there we will do our final editing.

Zoom=... Selfexplaining. But 0.63 is pretty good for 225 degrees of visual on a 3 window setup. You need to experiment if your screens field of view is different or you are using a different amount of windows.

Translation: X, Y, Z eyepoint settings. By adjusting the center number, you will raise or lower your camera. Positive and negative values. This is the same thing as using some of the keyboard commands. Try to experiment within the flightsimulator, then save the flight and see which numbers that changed. It is useful... I have adjusted on both the Y and Z settings for vertical and lateral positioning of camera. Depends of how successful you were when you installed your projectors... You might want to see more of the ground without raising projectors... Experimentation is needed.

Rotation: Pitch, heading, bank

If you change on the Translation "Y" setting, you might also want to adjust the Pitch. Experimentation needed. The pitch is useful if you also have raised your camera. Compensate with the pitch until you see enough runway out

```
[window.4]
Order=2
Active=False
Undocked=False
Maximized=False
ScreenUniCoords=0, 0, 2731, 6144
UndocCoords=0, 0, 0, 0
CurrentCamera={B1386D92-4782-4682-A137-738E25D1BAB5}
```

```
[Camera.4.1]
Guid={B1386D92-4782-4682-A137-738E25D1BAB5}
Zoom=0.63
Translation=0, 0, 0
Rotation=0, -75, 0
```

```
[Camera.4.2]
```

your front windows. Heading is the easy one. This is the angle you want to set each window to. Positive or negative value. You might be able to correct crab-effect by setting the centerwindow to a few degrees positive or negative. I have not tried that yet though. My center is at 0. and the sides is 75 and -75. The bank you dont want to use, as it tilt the image to the left or right. So this should be 0.

Google is a good friend for finding useful stuff.... I found the below info on some forum, and I paste it in here. Very useful :-)

Eyepoint

To move the eyepoint this way type this

Reset* CTRL + SPACEBAR

Tilt down* CTRL + Q

Tilt up* CTRL + SHIFT + Q

Periscope up SHIFT + ENTER

Periscope down SHIFT + BACKSPACE

Zoom backward CTRL + ENTER

Zoom forward CTRL + BACKSPACE

Dolly left CTRL + SHIFT + BACKSPACE

Dolly right CTRL + SHIFT + ENTER

Reset* CTRL + SPACEBAR

In terms of motion-picture camera movements, tilting means aiming the camera up or down without changing its position in space (and panning means aiming the camera left or right without changing its position in space, but FSX does not offer that eyepoint adjustment). Dollying means moving the entire camera left or right.

Zooming here means to get closer to or farther away from the center of the screen. I don't know the proper term for moving the entire camera up and down, so I've used "periscope."

One more thing to think about when you calculate angles for your screen/windows. You will normally set the center window to angle 0. This means that whatever FOV that window will have, the center of the window is the 0.

On a three window 225 degree setup, then our left and right window will have -75 and 75. This means that the center of these windows is positioned at -75 degrees (left window) or 75 degrees for the right window. You will adjust the zoom settings to make the windows match each other. When all three is matched, then you will also know that the center window has a 75 degree FOV.

By playing with the things I have explained here, you should be able to master your visuals in no time. The hardest part is to plan the physical screen and projector setup. The FLT-stuff is a breeze when you learn to use it, and you should be able to setup a basic 225 visual in 15 minutes. Perfection takes a lot of time, but is also very entertaining.

Another one for keeping your printer busy...

FSX.CFG tweaks

First of all to find the fsx.cfg you need to go to windows controlpanel and to your files and folder settings. Then make sure that "show hidden files and folders" is ticked. Then you can search for the file and actually be able to find it.

The most popular tweak is to set the affinitymask=14. This makes sure that FSX is running on all the cores of your CPU. Some people also set to 13 as the "fibre-frame" is already running on Core-1, but I didnt understand any of that, and it did not improve my setup.

Then there is the bufferpools. If it is not there, add the [bufferpools] to your file. Here it is popular to set :

```
[bufferpools]
```

```
Poolsize=0
```

Framerates is awesome, and stutterfree, but what happens is that it might overload your graphicscard. See the photo of what happened in my sim after 30 minutes of flying in dense scenery with heavy weather. Not entertaining to restart the sim... I have a GTX285. Might be better with other cards.



So to help/prevent the graphics card from overloading we can delete the poolsize=0, and use the "RejectThreshold" parameter.

"The RejectThreshold is a cutoff. Calls from the CPU that are above this amount bypass the bufferpool and are sent straight to the GPU. with no bufferpool or threshold, all calls are sent directly to the GPU, which is the cause of instability. Anything below the threshold amount is sent to the bufferpool".

```
[BUFFERPOOLS]
RejectThreshold=524288
```

Start with the 512kb, and experiment with tougher settings if you dont have issues. I am at the moment using the 128kb with success.

```
524288      //512kb (kind to the GPU)
262144     //256kb (medium kind to the GPU)
126976     //128kb (Meaner to the GPU, and closer to the option poolsize=0).
```

This is my settings today. Works very good and is stable.

```
[JOBSCHEDULER]
AffinityMask=14
[BUFFERPOOLS]
RejectThreshold=126976      //128 byte
```

Imagewarping

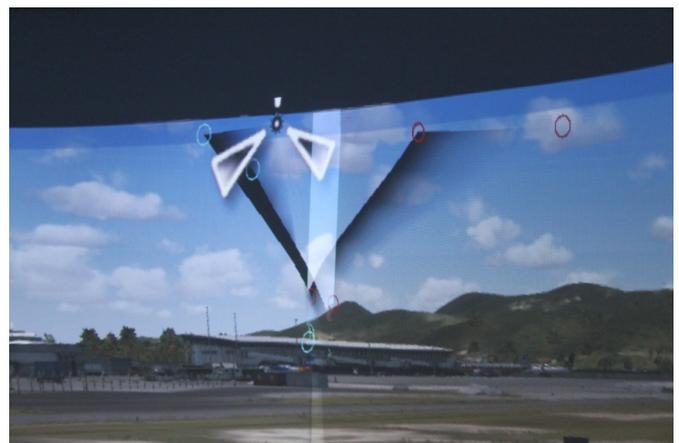
I did several attempts with curved mirrors from cars, trucks and whatever I could find to see if I could succeed with a cheap low-cost solution, but after many weeks of various testing I gave up that approach.

Imagewarping software is what you need to make a projected image onto a curved screen to look like if the screen was flat.



Now there is finally available an inexpensive and advanced solution for us cockpit-builders and gamers. I have been using the warpalizer for several months now, and this software will warp your image to your needs. You can also adjust the colors for each image channel, together with many other nice features. You can even remove FSX black borders for undocked windows with this software. Very handy!!! And of course, full edge-blending functionality is included. On-screen menu for adjustments and warping/blending.

There is also available a special version for people running FSX over a network. You dont need to buy three complete versions. Anyone running wideview?



Also this software is using a USB-dongle for anti-piracy protection. No fuzzing around with reg-codes, and easy transition if you want to change or upgrade computer. For information about buying the warpalizer, look at the next page.



Please have a look at the website for video-samples.

Let us help you get the image straight.

For more information and to make sure the software will work on your system, please contact me on.

Lighthouse.flight@gamewarping.com

You will also receive a very good discount on the base price...



Resources

[NickN`s mandatory guide for setting up your computer and FSX.](#)

[Panel tutorial. Explains about Screenunicoords... Very useful.](#)

[Gamewarping.com Your ultimate warping software](#)

[My webpage](#)

[BenQ projectors](#)

[Projection calculator for many brands and models](#)