

CHALK RIVER GRAPHICS

# CrgSim Documentation

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## Installation and User's Guide

Chalk River Graphics

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## Forward

CrgSim was written as a programming exercise and to provide an environment that we like to use when flight simming. The environment assumes that there will be no visible main aircraft panel nor will any of the other “sub windows” such as throttle quadrant or radios be visible on the main screen. The only graphics that FSX provides in our setup is the main scenery window.

This assumption has several side effects.

First: some form of input had to be provided to make up for the lack of FSX sub window functionality. As an example: to change radio frequencies it was necessary to use something like the Saitek Radio Module or to provide the functionality in a separate CrgSim program called Keys.

Second: the type of aircraft selected to fly is not apparent from our simulation setup. Flying a default airbus looks the same as flying the default 737 or some other default regional jet. The selected aircraft mainly provides flight dynamics and the absence or presence of some features. For example an aircraft may not have the Nav2 set of radios or may not have “Throttle Arm”.

All interaction, by design, is between CrgSim and FSX (or Prepar3d). So if a third party add-on aircraft operates with the same interaction with the simulator then it should be usable with CrgSim. However, since for our setup, the third party aircraft is not visible the main benefit that we receive is perhaps a different and more realistic set of flight dynamics and improved sound files. Of course, for your configuration you may want to have a cockpit view as well as some of the sub windows visible most or all of the time. It's your flight simulator and you get to configure it anyway you want.

We use this software frequently and have discovered and eliminated many things that detract from the flight simming experience for us.

Your input on what you like, or don't like, or believe to be wrong is most welcome. There is an e-mail address at the end of this document.

## Basics

This software provides the ability to display a “real life” sized Primary Flight Display (PFD), Nav Display (ND), and EICAS Display for users of Flight Simulator X. Two PFDs, two Nav displays, one EICAS display, and one Chart display are provided. One set of PFD and Nav for the Captain, one set of PFD and Nav for the First Officer, and one shared EICAS and Chart. The instruments may be run on a different computer (or computers) than the one the simulator is executing on (and should be for best results).

The NAV displays are independently configurable while flying and each display can have different ranges and modes of operation.

You can run as many or as few of the components as you need. If you are running a single place cockpit then you may want to display just the Captain's PFD and the Captain's Nav Display.

IF you have an older computer that you would like to put to use you may be able to run the CrgSim modules that do not require DirectX10. These include WinKeys, Chart, and CrgSound.

The Boeing 777 PFD and ND were used as models. Some instrument features are absent but hopefully will not detract from your enjoyment. Most of the testing was done with the FSX default 737 providing the flight dynamics and sound. **These instruments and associated programs are toys, do not use them in any way related to real life aviation.**

Since the Chart display, Comm Mgr, and Keys do not use direct X but legacy GDI they should run on a Windows XP machine and can be used as a standalone display with just Crgfsx.exe and Crgcom.exe to support them (see below). The sound module should run on Vista and above.

There are a lot of components to CrgSim, the recommended way to use the system is to take your time and bring up one display at a time. The standard test bed here uses one Sandy Bridge computer to run FSX and crgfsx.exe (the crg interface to FSX), one laptop running the Communications Manager, Charts, and EICAS, and one computer running two PFDs and two Navs. One of the displays on this last computer is a USB attached display that seems to give pretty good resolution and acceptable performance.

The goal of the system was to be able to devote one computer to FSX (the most powerful one) and the view forward. No instruments or other displays are run on the main FSX computer to be able to get the maximum quality view. The main display in the test setup is spread across three 24 inch monitors and provides an acceptable level of immersion for us. Winkeys.exe was written to be able to make changes to the running configuration (autopilot variables, Nav display modes, and radio frequencies) without having to start up other windows on the main display. Saitek radio hardware works just fine in our setup and allows the Keys radio window to be removed.

The GoFlight EFIS and GoFlight MCP Pro interfaces provided by CrgSim allow you to connect these devices to most computers on your local network (see the GoFlight section for more information).

If you have autopilot (MCP/EFIS) hardware from one of the other vendors give it a try. This may eliminate the requirement for the Keys autopilot window.

The Genovation programmable keypad has also been tested with Crgsim. Their 6x4 keypad was programmed to generate the key sequences found in KeyAssign.pdf (included with this distribution) so many functions are available through the keypad such as gear up/down, AP on/off, speed, altitude, and heading functions, and flaps up/down. It is still a keypad but much less intrusive than a typical computer keyboard.

The keys are covered with a removable transparent cap so you can put your own labels on each key.



## Vanilla Windows

We use a GoFLight EFIS and MCP in the lab. For simulators without EFIS/MCP hardware CrgSim provides a vanilla window with clickable options. This window (or optionally four functionally separate windows) is used to provide all interaction between the PC and the flight simulator so that no keyboard on our setup is used on the FSX/Prepar3d computer. This does mean that a number of functions are not used here for day to day simming. One thing being considered for our setup is “yet another screen” that will continuously display some of the sub windows such as the overhead panel and the middle console. A USB connected screen may be just right for this function.

Note that one of the winkeys.exe windows (described further in this document) must be selected for the key sequences entered through the keyboard or through the Genovation keypad to be recognized by CrgSim. If you select a new flight plan be sure to reselect one of the Keys windows so your CrgSim keystrokes will be recognized.

If you find a problem with the software please let us know. The web site is at [www.crgsim.com](http://www.crgsim.com). It is “read only” since we ran out of time trying to clear the spam from the site. We can be reached at [sim30@crgsim.com](mailto:sim30@crgsim.com)

Thanks and enjoy.

## **Prepar3d**

Beta support for Prepar3d is being released with this distribution. Prepar3d version 1.4 is working with Windows 7 here in the lab. Instead of using crgfsx.exe (described in the following documentation) use program crgr3d.exe instead when trying to attach to Prepar3d.



## Our Test Setup

The figure below is an image of our test set up. It consists of 3 larger screens to display the scenery, airports, and cities and a set of screens in the foreground that display the instruments.



The 3 screens in the background are driven by a sandy bridge processor computer with a moderately good display card. There are only two main programs that execute on this computer when testing:

- The FSX program with all the instruments and cockpit display removed. In our test setup this gives the best frame rate. We load an aircraft to provide the flight dynamics and then using the options menus remove all visible trace of the aircraft from the screen.

- The CRG interface program. This FSX interface program communicates with FSX requesting the data it needs and then send the data over the local net to the CRG communication manager on another computer. No further processing is done on the FSX computer to preserve frame rates.

There are 3 foreground 15 inch screens with bezels placed in front of them to give the sense of two separate screens for each 15 inch display.

The outside screens running a PFD and Nav display each are driven by one win7 computer. The leftmost of these displays is a USB attached screen. This was a test to see how well one of these devices performs with the flight sim instruments. Our USB driven display works well, the instruments show up sharper and better looking but the update rate is not as smooth as the other non-usb display. Windows desktop is run on another screen attached to this computer and is not in the image above.

The middle screen with the moving chart display and an EICAS are driven by a Win 7 laptop. The display connector is plugged into the VGA connection on the laptop. On the main laptop screen, the CrgSim sound module and keyboard interface/status screens (Keys) are also running on the laptop.

On top of the instrument displays is a GoFlight MCP Pro and to the left of the mcp is a GoFlight EFIS. Both are connected with the CrgSim GoFlight Interface.

Not visible is a Saitek radio module which is used for compatibility testing.

## **CrgSim Zip File**

The entire set of CRG components is contained in three zip files. One zip files contains everything except the charts program and data. The other two zip files contain the CRG chart program and the data used by that program. Occasionally an update zip will be released

containing either updates to a program or additional charts for the chart program. To get started unzip the distribution file on one of your computers so you can move the individual components to the computer where they will execute.

## **Installation**

CRGSim does NOT modify the registry nor create directories. Installation consists mainly of copying the various components to a directory of your choice on the computer that you plan to execute the component on. To uninstall, just delete the programs and directories that you created during installation.

The first thing to do is to determine where the various components will run. Since installation is relatively easy and since the network components automatically discover where the other components are located there is no complex configuration required. If you later determine you would like the CRG components to run on different computers, no problem, just move their directories to the new computer and start them up.

## **Recommended File Locations**

The simplest way to organize the files on each computer is to create a folder at the highest level called crgsim (c:\CrgSim). To uninstall just delete the crgsim folder on the computer. To update (when a new version comes out) rename the folder to another name of your choice, create a new "c\CrgSim" and install the new version. Assuming you have modified the configuration files copy the config files (.cfg) from the old folder(s) to the new folder(s).

It is not recommended to install CrgSim programs in the "Program Files" or "Program Files (x86)" folder since some versions of Windows will not allow updates to files located in these folders (such as creating and updating program logs).

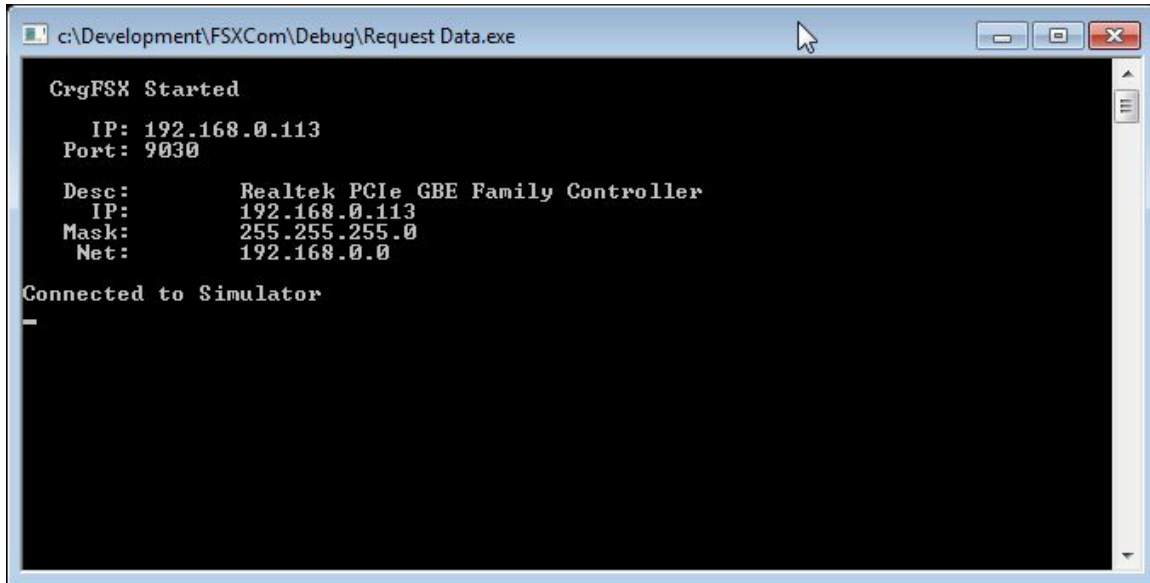
The best way to configure and run CrgSim is to tackle one component at a time. The following sections explain how to install and run each component. If you don't wish to run one of the instruments just skip that section, it is not required that all of the instruments be running. In

fact you could run just the sound module (no instruments) or just the Chart window if you choose. The minimum system would consist of the CrgSim FSX interface or the CrgSim Prepar3d interface program, the Communications manager and one of the instruments or sound module.

Our un-optimized FSX seems to take up 100 % of one of the cores in the 4 core sandy bridge machine and leave the other cores on average pretty much alone. We will be doing some testing with this machine: running crgfsx.exe (the interface to FSX), crgcom.exe (the communications manager), and FSX all on this machine to see if there are any frame rate hits or problems with the graphics.

## FSX Interface Program

The program that communicates with FSX is called **crgrfsx.exe** and is located in the FSX directory in the CrgSim distribution. Copy the FSX directory to the computer that you use for FSX. Start FSX and start **crgrsim.exe**. After FSX completes starting up you should see the following window on the computer screen:



```
c:\Development\FSXCom\Debug\Request Data.exe

CrgFSX Started
IP: 192.168.0.113
Port: 9030

Desc:      Realtek PCIe GBE Family Controller
IP:        192.168.0.113
Mask:      255.255.255.0
Net:       192.168.0.0

Connected to Simulator
```

This indicates that the CRG interface program and FSX are communicating with one another. A good start.

## Prepar3d Interface Program

The prepar3d interface window looks almost identical to the window above except that “Crgr3d Started” will display in the upper left part of the window instead of “CrgFSX Started”. If you are using Prepar3d copy the CrgSim Prepar3d folder to the computer running the Prepar3d simulator and start **crgr3d.exe**.

## Communications Manager

The communication manager (crgcom.exe) is the switching point for all data in CrgSim. It takes information from the interface program and distributes it to all of the CRG programs that have registered with it. It is located in the ComMgr folder in the CrgSim distribution. Copy this folder to a computer other than the main fsx computer. An older XP computer may be a good choice since the ComMgr does not use any DirectX graphics although a newer Win7 computer will be just fine. After starting the ComMgr you should see a window similar to the one below:

Screen	Con	IP	Port	Msgs Received	Msgs Missed	Percent Received	Version
Simulator	<input checked="" type="checkbox"/>	192.168.0.113	9030	554	1	99.82	1.1209
Captain's Nav	<input type="checkbox"/>						
First Officer's nav	<input type="checkbox"/>						
Captain's PFD	<input type="checkbox"/>						
First Officer's PFD	<input type="checkbox"/>						
EICAS	<input type="checkbox"/>						
Charts	<input type="checkbox"/>						
Keyboard Interface	<input type="checkbox"/>						
Sound Mgr	<input type="checkbox"/>						
DB Manager		192.168.0.109	9019				

Last Message
10:21:46:149 Sim Connecting
10:21:46:149 IP: 192.168.0.113 Port: 9030
10:21:46:133 Register request from Sim. Ver: 1.1209
10:21:46:133 Sim Connecting
10:21:46:133 IP: 192.168.0.113 Port: 9030

Flight Plan Exit

There should be a check mark next to "Simulator" in the screen since the interface program has just been started in the previous step. At this time you have the CRG support software up and running. Now it's time to start an instrument. This document is going to start with a PFD

but if you would like to try another first just drop down the list below until you find one you like.

## Primary Flight Display (PFD) – Captain's Side

Copy the PFDLeft folder to the computer that it will be executed on and start crgfpdl.exe from within the folder. You should see the program start up and then display a PFD window similar to the one below:



There is a lot of information displayed on the PFD. From the image above we are able to determine that the autopilot target speed is 270 knots, the current speed as 266 knots, the target autopilot altitude was 11,000 feet although the aircraft is now engaged in following the



glide slope down. The ILS receiver is tuned to 111.10 (Denver ILS). The transmitter is 21.2 knots from the aircraft. The  $\frac{3}{4}$  dial just above and to the right of the artificial horizon is the current aircraft attack angle.

Although the vertical speed indicator is positive we can assume that when the glide slope is intersected the vertical speed will become negative as the aircraft follows the glide slope down into the Denver airport.

Similarly we can assume that the aircraft has intersected the localizer center line and will be turning to the right to keep on the center line.

The flight mode annunciator tells us that auto throttle is controlling the speed of the aircraft and that both the localizer and glide slope signals have been recognized and are being used to control the aircraft through the autopilot.

The decision height is 200 feet.

This is a good time to go back to the FSX screen and select an airplane and location. The default 737 is recommended for this startup. The Colorado Springs, Colorado municipal airport is a good airport to start with for this documentation. To verify end-to-end connectivity go the main airplane panel and turn the "Flight Director" switch on and off. If the space just above the artificial horizon on the PFD changes from "OFF" to "F/D" you are good to go.

For now it's time to go on to the next instrument.

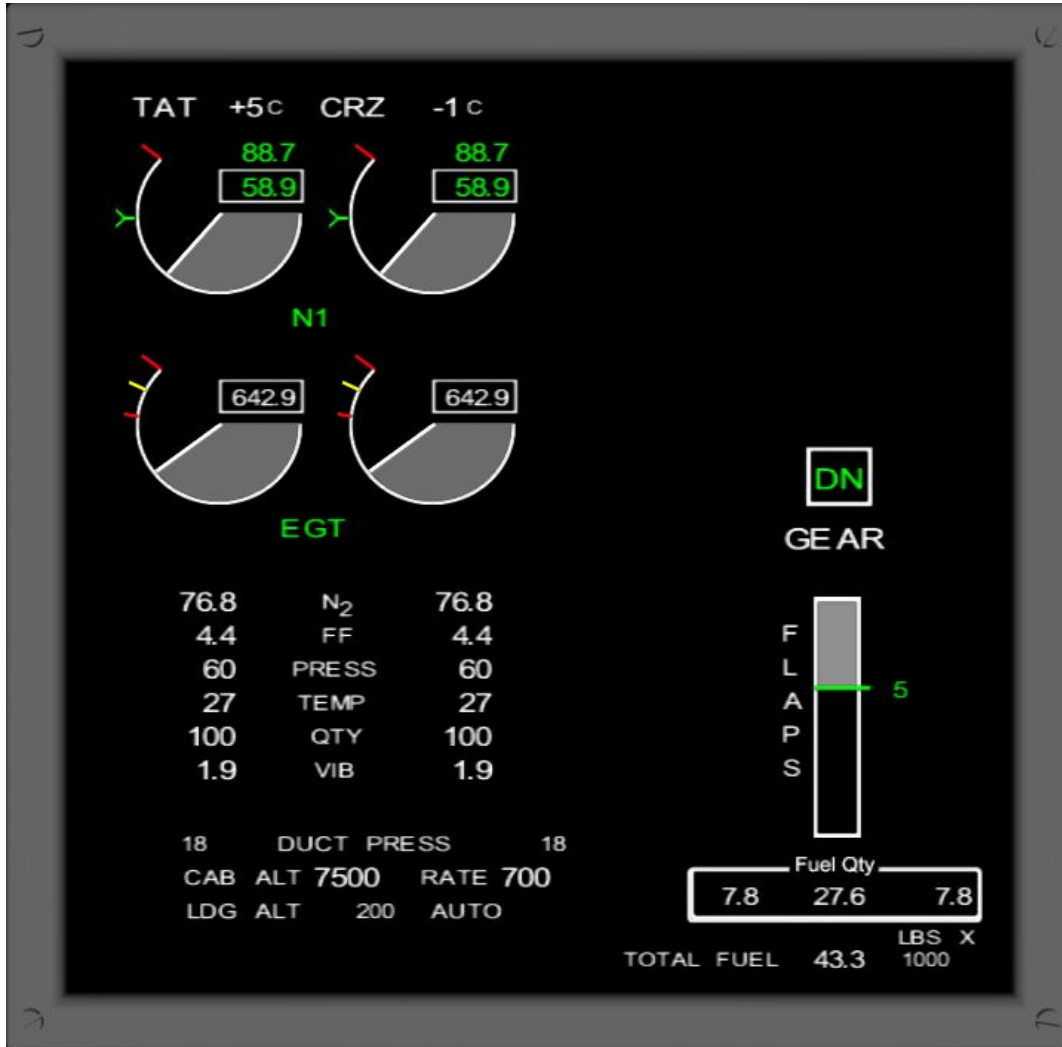
### **Primary Flight Display (PFD) - First Officer's Side**

Since this step is almost identical to the PFD above you may want to move on to other instruments for now or you may need just the pilot's display for your setup. To install, copy the PFDRight folder to the destination and proceed as above.



## EICAS

Copy the EICAS folder from the CrgSim distribution to its destination and start crgeicas1.exe from within the folder. Try moving the throttle on the FSX aircraft and make sure the EICAS instruments change as you do so. Then move the flaps up and down on the simulator main panel, the flaps indicator on the EICAS should follow the changes.



## NAV Display

Copy the NAVLeft folder to the destination computer and start crgnavl.exe. A screen similar to that below (except with a different range and set of airports) will start up. How to modify the range and

other display options will be covered in more detail below.

To start up the First Officer's Nav copy the NAVRight folder to the destination computer and test as above.



In the Nav Display above (expanded map mode) the aircraft has just reached the PYNON waypoint in the flight plan and is turning toward the waypoint HIPPE. HIPPE is located 32.6 NM away and should be reached at approximately 1624 zulu. Nav 1 is tuned to FCS which is 12.2 KM away, Nav 2 is tuned to PUB located 15.7 miles away. The fatter arrow pointer around 138 degrees on the compass points to the PUB VOR. The thinner arrow tail at 136 degrees points to FCS 180 degrees away from the tail. True air speed is 277 knots and there is a 21 knot wind at 270 degrees at this location. The blue circles are

airports. The next waypoint and flight path are magenta. In a real system all active waypoints on the flight path as well as the entire flight path are displayed in magenta.



The image above shows a number of waypoints in the Nav Display in the expanded range circle mode. The aircraft is enroute to PYNON. The display has 10 NM as the selected range.



This is the Nav Display in the expanded VOR mode. Two VORs are being received by the radios. The pilot Nav display shows Nav1 in the upper right on the screen and the pilot selected radial to fly along with the deviation from the selected radial. The first officer's display is similar except that it shows OBS 2 and the VOR tuned by Nav 2 (if any) at the upper right.

There is a 4<sup>th</sup> mode that can be used when ILS signals are present that displays the localizer and glide slope information.

## Sound Module

The Sound Module is great for adding atmosphere and a greater

sense of immersion to a flight simulation. To install, copy the sound folder to a destination computer.

We have not had much luck running it with XP, it seems the longer length sounds do not play or get truncated. If you get it to work with XP and know a fix for this problem please let us know. (In the interim we run the sound module just fine on Win 7.)

Otherwise, assuming you copy it to a Win7 or a Vista computer start crgsound.exe from within the folder. A display similar to that below will appear except in the "Name" column all of the backgrounds will be gray until 15 seconds have passed. Then you should hear some ATC chatter and the top box background will be green as above. In the lower left corner the green box with the text "Connected" indicates that the program is connected to the CrgSim network. If there is no connection "Not Connected" will be displayed on a red background.

To play the MP3 files we installed WinAmp. Then to test: if the first ATC sound is still playing click on the green "Name" field for the top sound. The sound should stop and the background change from green to gray. Then click on the box with "MP3 Example". This action should start WinAmp and WinAmp should start playing an ATC file. You can bundle up a number of ATC sounds into a WinAmp playlist, give the playlist a name, and add it to the sound module sound list as described below.

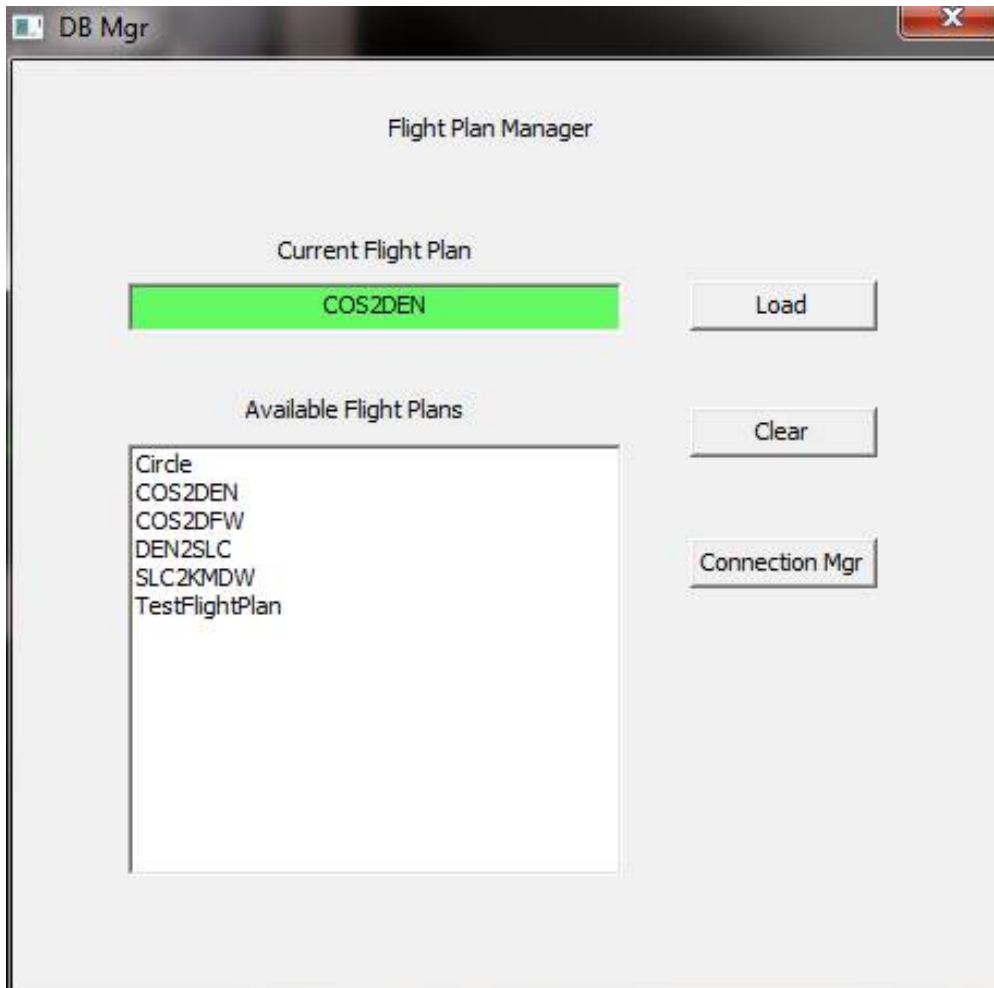
Name	File	Time	Altitude	AGL	Direction
ATC Boston # 1	KBOS1.wav	15			
ATC Boston # 2	KBOS2.wav	1870			
Boston Play List	CrgPlaylist.m3u				
Example	Minimums.wav				
MP3 Example	KBOS-ATC-1.mp3				

Not Connected      Level      Run Time 26      Reset

The ATC files are provided by permission of liveatc.net. This is a great place to get hours of ATC background chatter.

## Flight Plan Manager

If you have installed the ComMgr above then the flight plane manager is already installed. Go to the ComMgr screen and click on the "Flight Plan" button at the bottom of the screen. The ComMgr will disappear and a window similar to the one below will appear (three flight plans are included: Circle, COS2DEN, and COS2JACK).



Initially the fields on the window will be gray. Click on "COS2DEN" and then the "Load" button. This will cause the Colorado Springs to Denver flight plan to be loaded. The name of the flight plan will be displayed under "Current Flight Plan" on a green background. The contents of the flight plan file are covered later in this document.

We are done for now with the flight plan manager so click on the "Connection Mgr" button to go back to the ComMgr window.

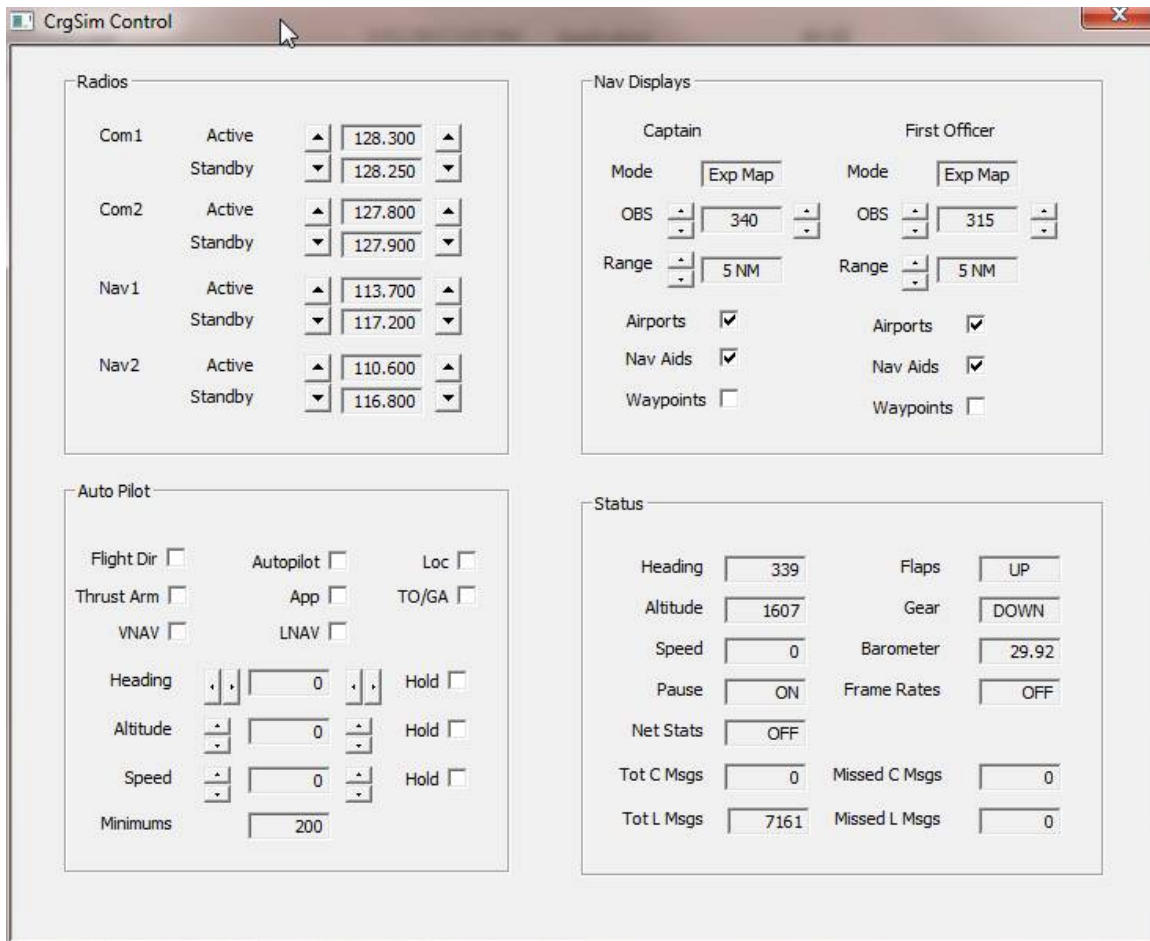
## **Keyboard/Keys Interface**

If we are to meet our objective of using the main FSX computer to only display the view from the cockpit then during flight there will be a need (at some time) to have a keyboard interface.

Instead of having to temporarily bringing up one of the sub windows on the main FSX computer (thus reducing the sense of immersion) to change a radio frequency or a heading, the "WinKeys" program can be used.

To give it a try, copy the "Keys" folder to the computer of your choice. It does not have any DirectX requirement and should run fine on XP, Vista, or Win7. Change directory into the folder and start "winkeys.exe". If you have the FSX interface and the ComMgr running at this time then each click on "Flight Dir" in the autopilot section (lower left part of the window) should toggle the flight director on and off on the PFD.





## Charts

There is one last instrument to install. If you would like a moving chart in one of your windows then download the latest version of CrgCharts. Unzip the file and follow the installation directions described in the PDF accompanying the zip file. There is probably no 777 prototype to compare the chart window to but it is run most of the time here.



## GoFlight Interface

To support the GoFlight EFIS or MCP Pro within CrgSim copy the GoFlight folder to the computer that you want to connect the GoFlight hardware to. Then:

- From the GoFlight web site ([www.goflightinc.com](http://www.goflightinc.com)) click on “Support” and from that page download “GF Config Setup 2.23”
- Install “GF Config Setup 2.23”
- Plug in the USB cables from the GoFlight EFIS and/or MCP Pro.
- In the CrgSim GoFlight folder execute crggf.exe.
- A window should open that displays the number of MCP Pros recognized and the number of EFISs recognized. If the GoFlight hardware is plugged in and the count for both devices is zero then you may have to do one OS restart to have the hardware recognized.

If you have more than one EFIS a small configuration file is used to sort out which EFIS is for the Captain and which EFIS is for the First Officer. The name of the configuration file is crggf.cfg.

If you have more than one EFIS connected then one EFIS will have a hardware number ID of 0 and the other EFIS will have a hardware number of 1.

To determine which hardware number belongs to which EFIS click on the CrgSim GoFlight interface window (opens when you execute crggf.exe) and then press the 'E' key. A debug window should open. When a switch or button on an EFIS is moved the resulting values should display on the debug window. The value of interest here is the ID. For example if you press the ARPT button on the Captain's EFIS

then the value displayed in the ID box (0 or 1) will be the value you use in the configuration file:

```
efisleft <number displayed from above>
```

Do the same with the First Officer's EFIS and enter the value on another line:

```
efisright <number from the EFIS debug window>
```

So assuming that you see a 1 for the Captain's EFIS and a 0 for the First Officer's EFIS then your configuration file would look like:

```
efisleft 1
```

```
efisright 0
```

Restart crgkf.exe and you should be good to go. To test, move the range dial. The range of the CrgSim Nav Display should follow changes made to the EFIS range dial.

If you have one EFIS then switch and button changes on the EFIS are reflected in both the Captain's Nav Display as well as the First Officer's Nav Display.

The GoFlight EFIS and MCP Pro can also be operated in the normal manner, just follow the standard installation instructions provided by GoFlight and do not start the CrgSim program crgkf.exe.

Note that the CrgSim Communications Manager must be running to connect the EFIS and MCP Pro to the CrgSim system. The upper left check box (Com Connected) in the interface window will have a check mark in it if the interface “sees” the communication manager and has established a connection to it.

A check mark in the Sim Connected box indicates that the Communication Manager has established a connection to the flight simulator and you should be ready to fly.

## Configuration

Each of the components or instruments installed above can have a number of options specified in a configuration file to permit customization. The instruments have options to specify window size, window location, and whether or not to display the instrument bezel. The PFD configuration file permits modification to V1, VR, and V2 as well as flap position count and flap percentage. The sound configuration file contains the list of sounds (ATC recordings, alarm sounds, ...) loaded at start time.

So now it's time to look at more detail for each of the components:

**Note: The PFD and NAV displays** are based on Directx 10 and have been tested on Windows 7. They will not work on XP. They have not been tested on Vista but are expected to work if DirectX 10 drivers are installed. Both programs require a Directx 10 compatible graphics card.

In the lab the following configurations have been tested:

**1. Both crgcom and all instruments executing on the same computer.**

FSX Standard - XP machine #1  
crgcom - Windows 7 64 bit machine #2  
Instruments - Windows 7 64 bit machine #2  
Keys - Windows 7 64 bit machine #2

**2. Crgcom and instruments executing on different computers.**

FSX Standard - XP machine #1  
crgcom - Windows 7 64 bit machine #2  
Instruments - Windows 7 64 bit machine #3  
Keys - Windows 7 64 bit machine #3

**3. Crgcom and instruments executing on different computers. Instrument computer is WiFi connected.**

FSX Standard - XP machine #1  
Crgcom - Windows 7 64 bit machine #4  
Instruments - Windows 7 64 bit machine #5 (WiFi)  
Keys - Windows 7 64 bit machine #5 (WiFi)

**4. Simulator running on Windows 7 computer**

FSX Accelerated - Windows 7 machine #6  
crgcom - Windows XP machine #1  
Instruments - Windows 7 64 bit machine #5 (WiFi)  
Keys - Windows 7 64 bit machine #5 (WiFi)



The WiFi connection to machine #5 is relatively weak in the LAB. There is a facility for calculating UDP packet loss. For this configuration UDP loss was about 8%. This packet loss did not detract from the proper operation of the Instruments.

## **Primary Flight Display (PFD)**

Go to the computer and directory where you installed the **Captain's PFD** and run **crgpfdl.exe**. The PFD will appear in a window with no title bar or border. It will have a small black area in each corner. When placed on a solid black background the black will disappear and the corners of the bezel will be rounded. If you wish, use a windows screen configuration utility to set the screen background to black. In Windows 7 right click on an empty spot on the desktop and select "Personalize" from the drop down menu. The all black background selection is on this menu.

In the center of the display is an artificial horizon. The space just above the artificial horizon display is used for status information during start up. The start of the Captain's PFD should also be reflected in the Communications Manager display.

Do the same with **the First Officer's PFD**.

The status of the PFD is displayed just above the artificial horizon.

- " - - - " (four dashes) indicates that the PFD is running OK but not yet connected to the Communications Manager.
- "NO SIM" means that the PFD is connected to the Communications Manager and that the Communications Manager is not yet connected to the Simulator Interface program (crgfsx.exe or crgr3d.exe).

Once the PFD, the Communications Manager, and the Simulator Interface are communicating with each other the space above the artificial horizon reverts to prototypical use and shows the status of the display (OFF, FLT DIR, or A/P).

The instruments will usually not be in the positions where you want them to display and need to be positioned by selecting an instrument and pressing F2. Use the “a”, “d”, “s”, and “w” keys to move the instruments to the proper position on your display. The image below shows the PFD display after the F2 key has been pressed:





The window may be moved with the following keys: (case insensitive)

W	move window up
S	move window down
A	move window left
D	move window right
B	toggle bezel display

The number of pixels the window is moved with one keystroke can be changed by pressing a number key 1 through 9. For example: to move the window one pixel at a time press 1 before using the direction keys. Then each press of a direction key will move the instrument one pixel. To move the window 9 pixels at a time press 9 before using the direction keys. Each press of a direction key will then move the window 9 pixels.

While the Setup Screen is active the window location parameters are displayed on the screen. You can manually transfer these parameters to the configuration file so that the next time the instrument is started it will be located at the location specified.

When finished with the setup function press F2 again and the normal instrument display will appear.

The width and height of the instruments are more tedious to set. It is necessary to set width and height in the configuration file and then restart the instrument to check if the sizes are correct. Repeat this cycle until you are satisfied with the result.

The instruments were tested within a range of sizes centered around 750 pixels. You should be able to vary this size with the configuration file from 550 pixels to 950 pixels and still have a nice look and feel. Fonts on sizes below 600 pixels will not look as nice. This size range should provide a prototypical physical size when used with many (if not most) displays.

The instruments are expected to be relatively square when viewed on screen. Circles will appear out of round on a display that is not square. This is especially noticeable with the Nav Display. Minor adjustments to the window height and width parameters in the

configuration file should allow for deviations of pixel width to pixel height for your specific display.

You will probably want to permanently configure the instrument locations according to the configuration description below.

On startup **each instrument** reads a small configuration file to determine size and location of the display as well as other optional parameters. Parameters are listed in the display configuration file (crgpfdl.cfg, crgpfdr.cfg, crgnavl.cfg, crgnavr.cfg, crgeicas1.cfg) as parameter name/parameter value pairs. The parameter names are case insensitive.

Parameters are:

- **Winx** - the X location of the left side of the window.
- **Winy** - the Y location of the top of the instrument window.
- **Width** - the width of the instrument window
- **Height** - the height of the instrument window.
- **Bezel** - Include or exclude the bezel around the instrument (yes or no). If you integrate the instruments into your forward instrument panel behind your own physical bezel you may want to exclude the displayed bezel to give you more flexibility in integrating the instruments into your panel.
- **Ip** - override IP address (see communications)
- **Mask** - override IP mask (see communications)

For example to locate an instrument 10 pixels from the left on your screen, 10 pixels from the top of the screen with a height and width of 740 and 747 respectively use the following parameters:

```
winx      10
winy      10
width     740
height    747
```

**Bezel** is an optional parameter, the default is to display the bezel. To exclude the bezel add the following line to the instrument configuration file:

```
bezel no
```

Comment lines may be used in the configuration file, they are started with the characters **//** **followed by a space** before the comment:

```
// This is a comment.
```

In addition to the standard parameters covered above the PFD has the following parameters used by the speed tape:

- V1 - maximum speed at which a rejected takeoff can be initiated.
- VR - rotation speed
- V2 - minimum speed that needs to be maintained up to acceleration altitude.
- Fuhi - full flaps up do not exceed speed.
- Fdlo - full flaps down do not exceed speed
- Fulo - full flaps up minimum speed
- Fdlo - full flaps down minimum speed

- Vref - landing reference speed at a point 50 feet above the landing threshold. VRef is indicated to the right of the speed tape by “RF”.

V1, VR, VRef, and V2 are usually provided by a flight computer based on many factors such as passenger load, fuel load, pressure height, slopes, derates, and type of aircraft.

The default values selected for the PFD should work for a few flights but you will inevitably want to select your own depending on the type of aircraft you usually fly. Just modify the values in the configuration files for the PFDs to those you want to use. Be sure to make the same modifications to both PFD configuration files.

CrgSim linearly interpolates the values between flaps full and flaps up based on “flaps percentage” provided by FSX. Not a prototypical calculation but a “better than nothing” calculation.

Our usual setup in the lab:

Flight Simulator X running on the main (most powerful) computer (Windows 7).

Communications Manager running on an XP machine or Win7 laptop.

Instruments running on a Windows 7 machine (different from the simulator host machine).

The lab computer with the instrument displays has two small 15 inch LCD screen connected to the computer with a VGA cables. The screen background is set to BLACK using the windows Control Panel, personalization function. The PFD occupies the left side of the one screen, the right side of the screen is occupied by the ND display. The location parameters in the configuration file for our PFD look like:

```
winx 1610  
winy 13  
width 740  
height 747  
bezel no
```

## **Nav Display (ND)**

To configure the Nav Displays go to the computer and directory where you installed the **Captain's Nav Display** and run **crgpnavl.exe**. The ND display will start up. As above use the F2 key and the "a", "d", "s", and "w" keys to temporarily position the ND instrument.

Do the same with **the First Officer's Nav Display**.

At startup crgnavl.exe and crgnavr.exe begin a one time scan of the data base looking for objects within range of the aircraft. It may take 10 seconds or so at startup for the display to become fully populated. After the initial scan, there is no delay on locating the displayable objects on the screen when the range and/or display content is changed.

Objects beyond 100 NM are not displayed even when the Nav display range is wider. Longer flight plans will, however, display on the wider ranges along with the names of each flight plan point.

Many Nav displays are congested when showing waypoints. The waypoint names overlap one another. To help alleviate this problem the CrgSim Nav display will alternate the display of many of the names when they overlap. Not all overlapped names are eliminated but enough of them to dramatically improve the usability of the waypoint display.

Read the section on Keys to learn how to change the range and display content on each ND. Each ND can be configured via Keys separately with respect to range and content.

The location of the Nav displays can be permanently configured as described for the PFDs above.

You can put the displays in any order you choose but the typical order is (from left to right): Captain's PFD, Captains Nav Display, First Officer's Nav Display, First Officer's PFD.



Above: A Nav Display with a range of 10 KM showing just waypoints.

**Note:** The height and width of the Nav display must be the same to have a round compass. If they are not the same the compass circle will wobble as it rotates.

## EICAS

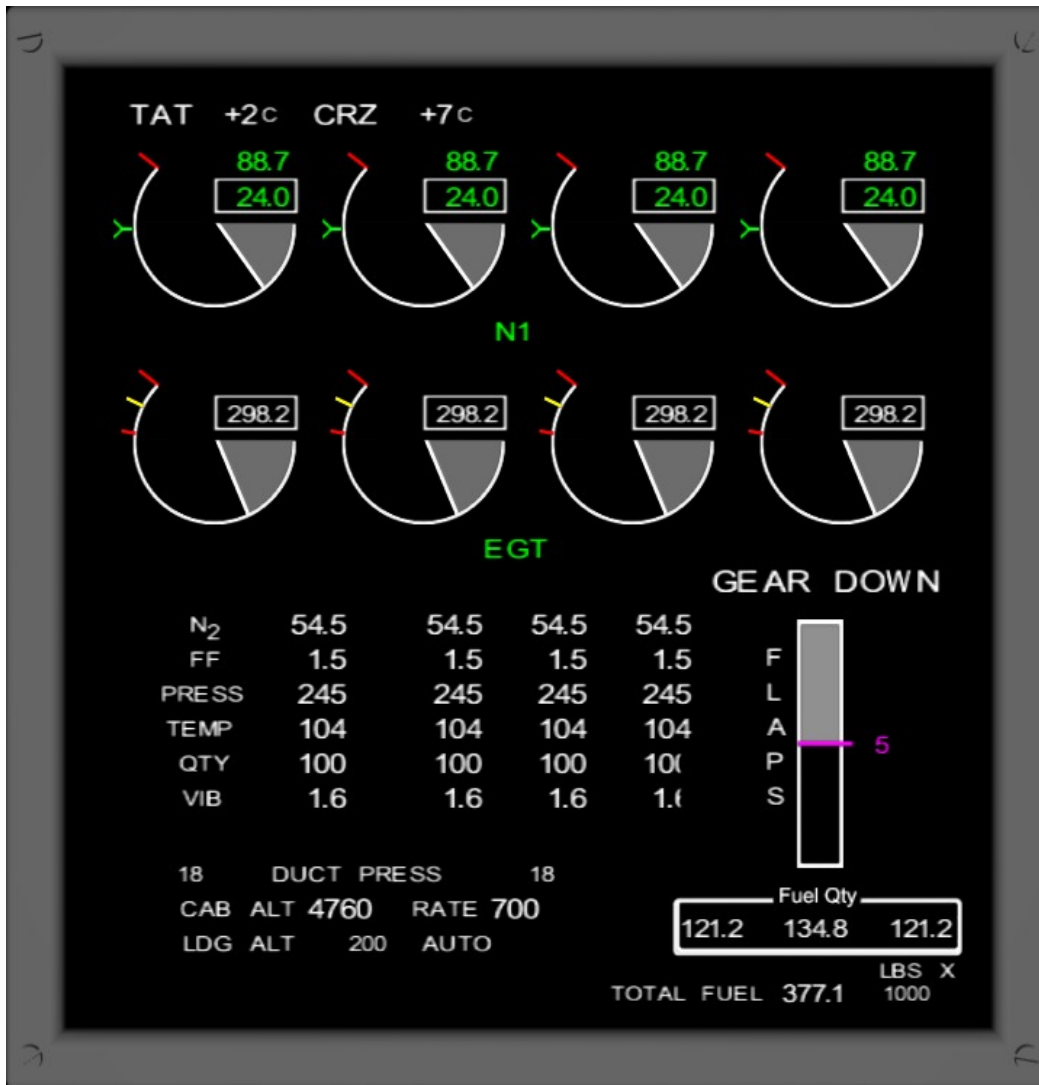
Go to the computer and directory where you installed **EICAS** and run **crgeicas1.exe**. The EICAS display will startup.

As above, use the F2 key and the “a”, “d”, “s”, and “w” keys to temporarily position the ND instrument. For a more permanent location follow the same location configuration instructions for the PFD. The image below shows EICAS with 2 engines.





The EICAS instrument also works with aircraft that have 4 engines. To make room for the additional gauges the gear up/down indication is now text to the right of the screen under the gauges. The EICAS below is connected to the default 747. It does not display a prototypical 747 EICAS but will still display expected values on the gauges.



The EICAS size and screen position is configured the same as the rest of the displays and is covered below. Please read the section on EICAS configuration if you intend to fly more than the default 737.

The EICAS configuration file contains an additional set of parameters to allow customization of the flaps display. Commercial turbine aircraft may have different numbers of detents in their flap settings. Further, detent # 2 on one aircraft may call for a different flap setting than the same detent on a different aircraft. The parameters below are designed to allow the flap display to work appropriately for different types of aircraft. The parameters are grouped in pairs with the first parameter specifying the number that is to appear by the flaps setting line and the second number specifies the percent of flaps (as determined by FSX) for that detent.

For example to specify the settings for the default 737 detent number three:

On the FSX throttle quadrant detent 3 shows flaps “5” by the detent and when the cursor is placed over the flap handle FSX tells us that 38% of flaps will be set. To provide this information to the CrgSim EICAS screen enter:

```
f3id 5  
f3p 0.38
```

“f3id” is the number that appears by the flap setting bar on the flaps display. “f3p” is the flaps percentage (divided by 100) that sets the location of the flaps setting bar.

There are 10 sets of points available: f0id through f9id and f0p through f9p. The EICAS configuration file is delivered with settings for the default 737, 747, and 777.

The flaps portion of the EICAS display operates similar to the real EICAS display. When a new flap setting is set by the pilot flying the setting bar moves to the new location on the flap display and the bar and target flap detent name turn to magenta. As the flaps move to the target setting FSX provides a continuous stream of flaps percentage numbers that show the progress of the flaps to the new value. The EICAS screen uses these numbers to move the flaps “thermometer type of display”. When the actual flaps percentage reaches the target percentage the flap setting bar and flaps detent name change to green.

If the percentage flaps is not set correctly for a given detent then the percentage as reported by FSX will never reach the target percentage specified in the EICAS configuration file and the setting bar and detent name will never turn green and display to the person flying that the flaps have reached their target setting.

A set of flaps parameters is identified by the parameter name “flapset” followed by the flapset name (no spaces in name). For example:

flapset 737

indicates that the following flaps parameters belongs to the flaps for “737”

There are three flapsets in the default configuration file: 737, d747, and 777

To select a set of flap parameters change the following line in the “curflap” parameter in the configuration file. To make the 737 flapset active the entry would be:

Curflap 737

Note that a flapset must be defined before being able to use the flapset name in a “curflap” parameter.

## EICAS notes:

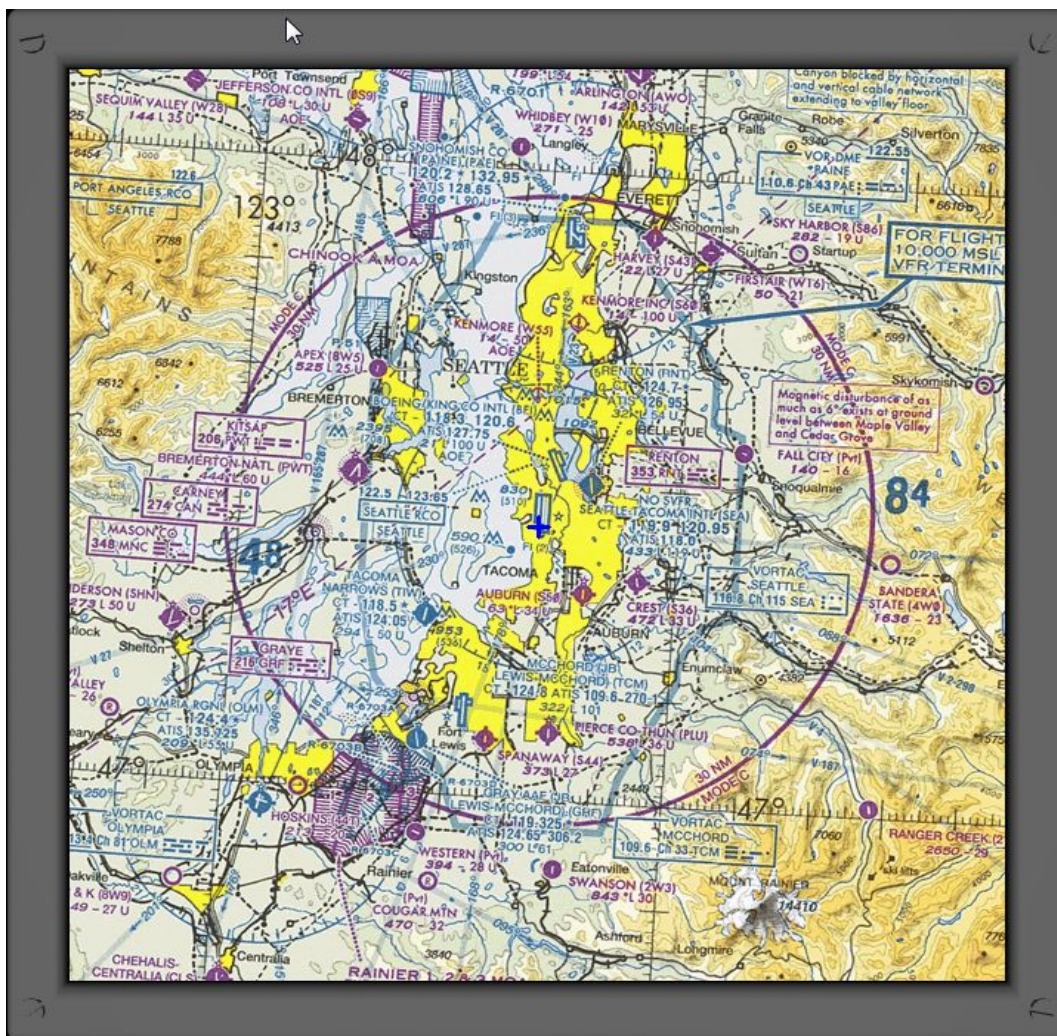
- The display will determine how many engines your current FSX aircraft contains and configure accordingly.
- Since up to 4 engines may be accommodated the area to the right of the instrument gauges will be blank for two turbine aircraft but will be filled if your airplane has 4 engines.
- If you start at a high altitude airport such as Denver or Colorado Springs it will take a few minutes for the cabin pressure to catch up to the airfield altitude. The value displayed on the CrgSim EICAS has no effect on the simulation and may be ignored if you don't want to wait for the pressure to equalize. While you are flying it will stop increasing cabin altitude at 7,500 feet.
- Fuel supply is listed in pounds of fuel X 1000.
- Duct pressure is static at 18
- The EICAS configuration file has flap positions for the default 737, default 747, and a 777. If you want to adjust these flap settings or want to add flap settings for a new aircraft please see the section on EICAS configuration.

The EICAS instrument has the same configuration file format for location and size as described for the PFD above.

## Chart

CrgChart is distributed in a separate zip file that includes the charts, executable, and documentation. To install charts, please download a copy of the latest CrgChart distribution and follow the included instructions.

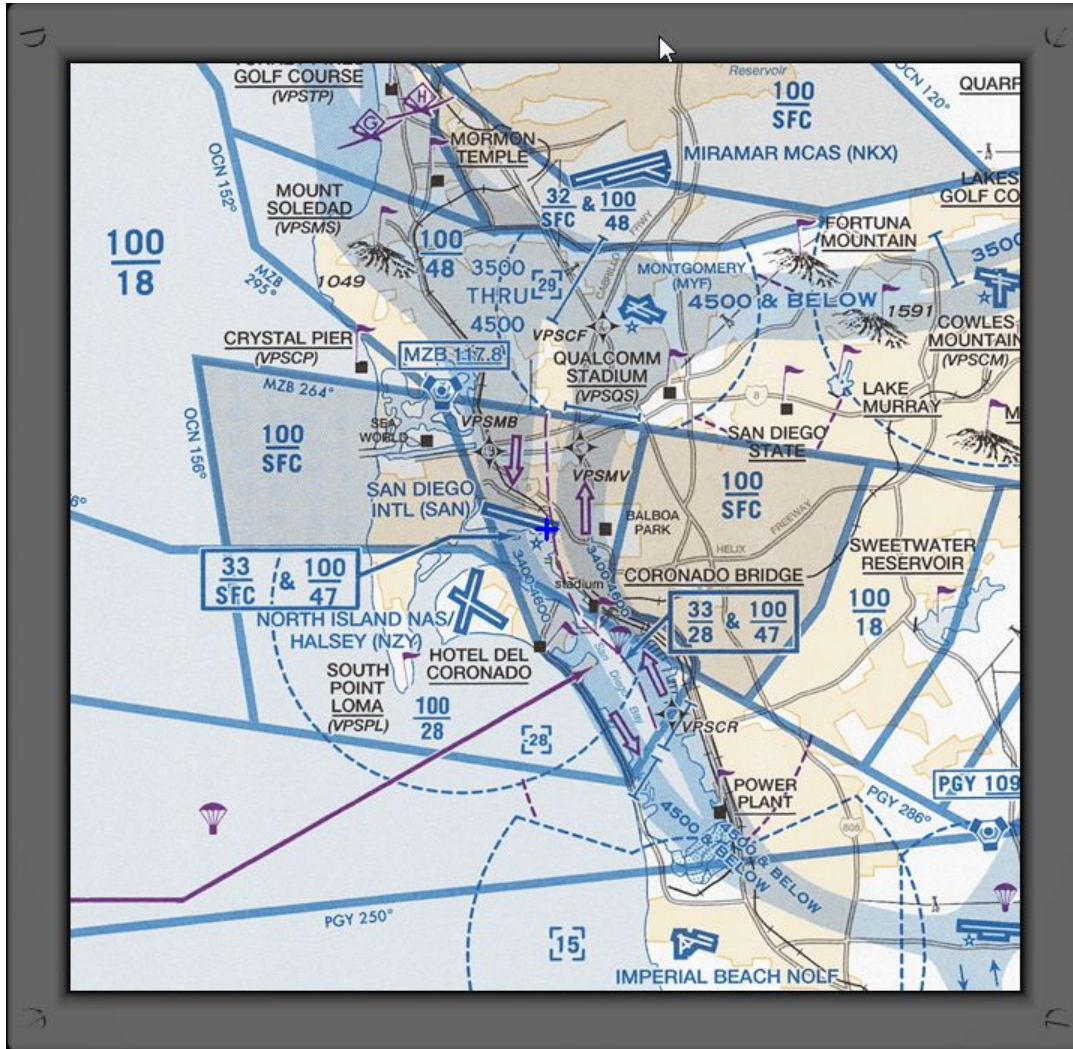
The image below is a Wide Area Chart display of the SeaTac airport area.



Wide Area Charts for most of the United States are included with the CrgSim Charts distribution.



The Figure below shows a typical VFR chart, this one is of the San Diego area.



VFR charts for Baltimore Washington, Chicago, Houston, Los Angeles Seattle, and San Diego are included with the current set of chart releases.

## Keys

With crgwinkeys.exe you can modify a number of FSX variables

without the need to go to the FSX display and startup a FSX sub window. `crgwinkeys.exe` is a mouse interface and keyboard interface. `Crgwinkeys.exe` should run on XP and newer versions of Windows.

We like to run FSX with just the scenery displayed on the main window and the instruments displayed on other monitors. Since we do not have any add-ons like an MCP or EFIS hardware it was still necessary to select the main window, bring up the instrument panel, and then make the required change (Auto Pilot On/Off, Auto Thrust On/Off). Not an immersion inducing activity. To get around this problem **crgwinkeys** was created. These are simple windows that provide the display of some FSX variables and allow modification of certain auto pilot settings as well as other flight parameters without going to the main screen. Since there is a “brake” function on our joystick after selecting an airport and aircraft a flight can be made without using the FSX keyboard thus increasing the sense of immersion. The FSX main keyboard is only used to press the escape key to end the flight. If you decide to use **Keys** there is a PDF file (KeyAssign) that can be viewed online or printed out to use as a reference to the allowable keys that may be used. Be sure that one of the 4 windows has been selected with the mouse so that windows will properly direct the keystroke to the main program, otherwise there will be no response to any keystrokes by CrgSim.

For example: you can use **Keys** to change radio frequencies and then swap the frequencies of the active and standby radio.

Some functions of the CRG Nav Displays are only changeable from **Keys**. For example the CRG Nav Display range and modes cannot be changed from the FSX screen(s) and can only be changed with **Keys**.

When execution begins either four separate windows are created or all functions are included in one combined window depending on a parameter set in the configuration file. Manually move the windows to the positions that you prefer on the screen or set each window's location in the configuration file. You can also specify not to show one or more of the windows with the configuration file if you don't need (or care to see) the variables in the window. For example if you have the Saitek radio module then there is no need for the Keys radio window.

## **Status Window**

The Status window displays some basic FSX information such as current heading and current altitude. It also displays certain CRG internal variables such as number of messages sent from FSX to the CRG Com Mgr (Tot C Msgs) as well as the number of those messages that have been dropped.

## **Autopilot Control**

With the Autopilot window you can change the values of the autopilot setting for altitude, speed, and heading. The control to the left of the value makes larger changes, the control to the right of the value makes smaller changes.



VNAV and LNAV are controls found at the 777 and must be on to fly a flight plan. These controls are not sent to the simulator so your single engine light plan can fly with both of these functions enabled. Using the default 737 a typical takeoff could be:

Using the autopilot Keys window turn on flight director, auto throttle arm, VNAV and LNAV. Set flaps for takeoff. Increase throttle part way, when the engines have spooled up click on TO/GA. Control the aircraft down the runway. At approximately 80 knots the annunciator will announce HOLD. Continue to control the aircraft, on positive altitude gain raise the gear. At approximately 400 feet AGL speed control will be activated and altitude hold and heading hold will be armed. Click on autopilot when desired. If a flight plan has been loaded and is activated you can set back and watch. If a flight plan has been loaded but is not yet activated use the autopilot controls to fly toward the first waypoint.

Note that the TO/GA switch will not be activated on takeoff if the flaps are full up.

## **Nav Display Control**

The Nav Display window is the only place where changes can be made to either of the CRG Nav Display instruments. Each Nav Display is individually configurable with respect to range, mode, OBS setting, and displayed items. If you use the CRG Nav Display then this window will be necessary for configuration.

## **Radio Control**

The control to the left of the frequency changes the frequency for 1 Mhz. The control to the right of the frequency changes the frequency by either 50 or 100 Khz depending on the radio type. Click on either active or standby frequencies to swap them.

## Keys Configuration File

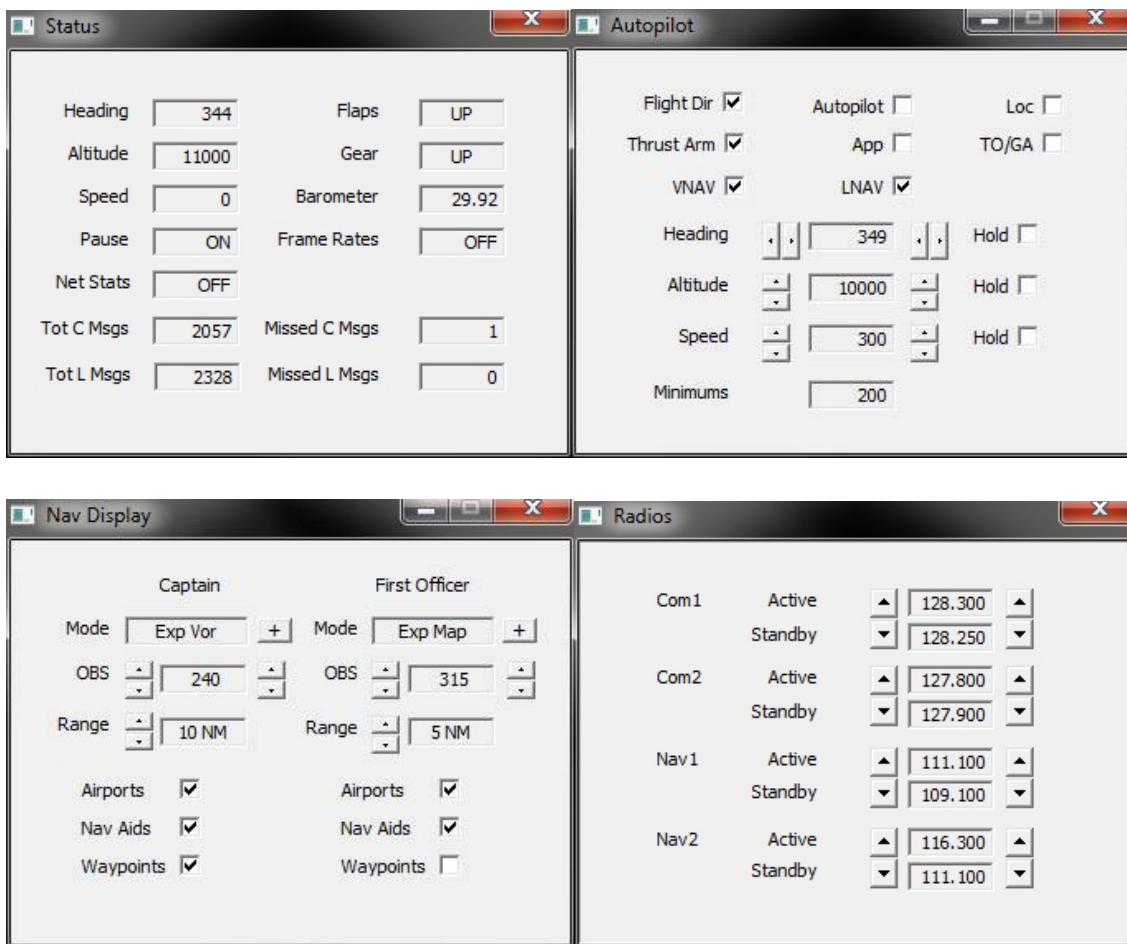
The optional configuration file for Keys contains the following parameters:

- win - one or four (show 4 separate or 1 combined window)
- statusx - status window x location
- statusy - status window y location
- autox - autopilot window x location
- autoy - autopilot window y location
- navx - nav window x location
- navy - nav window y location
- radiosx - radio window x location
- radiosy - radio window y location
- showstatus - yes or no (show status window)
- showautopilot - yes or no (show autopilot window)
- showradios - yes or no (show radios window)
- shownav - yes or no (show nav window)

Notes:

- if one combined window is selected the parameters for individual window locations are ignored as well as the “show” parameters.
- The “win” parameter must be “four” or “one”, not 4 or 1.

If “win four” is specified in the configuration file then 4 separate windows will appear as below:



The lines below are an example of how to specify starting locations for the Keys autopilot, status, nav, and radios windows.

```
statusx      10
statusy      10
autox        300
autoy        10
navx         10
navy         300
radiosx      300
radiosy      300
```

## Functions:

### Status Window

Toggle frame rate displays on CRG instruments - key 'f'

Toggle simulator pause - press the key 'p'

### Autopilot Control

Toggle "flight director" - click mouse button on "Flight Dir" check box.

Toggle "autopilot" - click mouse button on "Autopilot" check box.

Toggle "thrust arm" - click mouse button on "Thrust Arm" check box.

Toggle "App Mode" - click mouse button on "App Mode" check box.

**Autopilot Heading** - the spin control to the left of the autopilot heading value changes it by 10 degrees. The spin control to the right of the value changes heading by -1 degree. The Left Arrow key changes heading by one degree negative. Ctrl-left arrow (press the Ctrl key and the left arrow at the same time) changes heading by -10 degrees, Ctrl-right arrow changes heading by +10 degrees.

**Autopilot Altitude** - the spin control to the left of the altitude value changes it by 1000 foot increments. The spin control to the right of the value changes it by 100 foot increments. Up arrow changes autopilot altitude by +100 feet. Down arrow changes by -100 feet. Ctrl-Up Arrow changes altitude by 1000 foot increments. Ctrl-Arrow Down changes altitude by -1000 foot increments.

**Autopilot Speed** - the spin control to the left of the value changes speed by 10 knots, the spin control to the right of the value changes it by 1 knot. The 'z' key changes autopilot speed by -1 knot, the 'x' key changes speed by +1 know. Ctrl-z changes speed by -10 knots, Ctrl-x changes speed by +10 knows.

Note: Thrust Armed must be "On" for the autopilot to begin controlling speed for some aircraft.

## **Radio Control**

Use the controls on the left of the frequencies to change values by 1 Mhz. The controls to the right of the values changes frequencies by 100 Khz or 50 Khz depending on radio type. To swap standby and active frequencies click on either the standby or active frequency value.

## **Nav Display Control**

To change mode for the nav display, click on the small button with a “+” in the center located to the right of the mode window. It will cycle through supported nav modes.

OBS values are changed with the controls to the left and right of the OBS value. Left controls change value by 10 degrees, right controls change value by 1 degree.

Range for each individual Nav Display can be controlled by the control to the left of the range display. Select which items you want displayed on the Exp Map mode by clicking the appropriate check box under the nav display you want to control.

## **Sound Module**

The Sound Module provides basic altitude callouts on landing as well as “minimums” and “approaching minimums” announcements. Crgsound.exe also allows you to add your own wave files and specify when to play them based on time, or altitude, or manual selection from the Sound Module window.

When the sound module is started the sound configuration file will be read and a window similar the one several pages below will be displayed. Actual window size will depend on the number of sound files specified in the configuration file. The window has a number of columns:

- Name - this is the name you give to the sound file. If the name in the configuration file is too long this column will display as blanks.
- File - this is the actual name of the wave file on disk. If the file name in the configuration file is too long this column will display as blanks.
- Time - The sound file will start playing when Run Time is greater than or equal to this value.
- Altitude - The sound file will play when this altitude is reached on descent or ascent depending on the value in the direction column.
- AGL - The sound file will play when this altitude AGL is reached on descent or ascent depending on the value in the direction column.
- Direction - Specifies weather the sound will play on ascent or descent.

There are four fields across the bottom. From left to right:

- Connected indicator: shows “Connected” on a green background if there is a connection to FSX. “Not Connected” on a red background will show if there is no connection to FSX.
- Climb/Descend indicator: If the aircraft is climbing “Ascending” will display, if the aircraft is descending “Descending” will display, and “Level” will display if the aircraft is flying reasonably level.
- Run Time displays the number of seconds that the sound module has been running.
- The right most field is the reset button. Clicking this button will reset the run time to 0 and cancel all sounds that are currently playing.

The information displayed under the columns is specified in the sound configuration file (crgsound.cfg):

- snddef - begin each sound file definition with this keyword.
- sndname - your display name for the sound.
- sndfile - the name of the sound file on disk.
- sndtime - an optional parameter that specifies the runtime at which to start playing the sound.
- sndalt - an optional parameter specifying the altitude at which to play the sound. (see snddir below).
- sndagl - an optional parameter specifying the altitude above ground level at which to play the sound (see snddir below).
- snddir - this parameter specifies whether to play the sound on ascent or descent. For example one would expect the “prepare for descent” announcement to play on descent instead of on

climb out. To play on descent enter “down”, to play on ascent enter “up”.

- sndend - this indicates that configuration for this sound is complete.

The following is an example of a valid sound definition in the sound configuration file:

```
snddef  
sndname cruising  
sndfile Electronics Ok.wav  
sndalt 10000  
snddir up  
sndend
```

This could be the specification for a cabin announcement indicating that it is OK to start using “approved” electronic devices. The sound file would play as the aircraft passed through 10,000 feet on ascent

Notes:

- Sound files can be played at any time by clicking on the sound name.
- Once a sound file has played automatically based on altitude (or AGL) and direction it will not play again except for clicking on the sound name. Clicking the Reset Button will reset the run time and will rearm the play on altitude feature.
- There are a number of cabin announcement available on the net. Once you find and download a set that you like copy the sounds files that will be used to the same directory that crgsound.exe is executed from. Try searching for vsswacol.zip, vskaua1.zip, vsajcthy.zip, and English.zip on some of the flight sim forums. If you find some interesting announcements please let us know.
- [www.LiveATC.net](http://www.LiveATC.net) is a good place to get long archived



recordings (30 minutes or so) of ATC traffic from many different airports. The download files are MP3s so they will have to be converted to wav files to be used by CrgSound unless you create a playlist in WinAmp and use as described below.

- Mp3 and m3u (playlists) are played by WinAmp. Only one playlist or mp3 file may be playing at a time. Multiple sounds are possible with wave files. For example an ATC playlist can be playing with WinAmp and at the same time altitude callouts can be made on descent with wave files.

CrgSound has been tested on Windows 7 and Windows XP. On XP the longer files did not play, it seems there is a length restriction (at least on our test computer) so if you have a large wave file that does not play you can try cutting the file into segments with an audio editor. Try including one of the included short sounds (Minimums.wav) in the crgsound.cfg file as a test of XP.

To provide the ability to play long sounds during flight CrgSound can start WinAmp with a playlist (m3u file). To use the WinAmp feature (assuming you have WinAmp installed on your computer):

- Create a playlist in WinAmp with the mp3 files you want to hear.
- Save the playlist with a name of your choice.
- Add the m3u playlist name to the crgsound.cfg file (per the example included with the distribution)

When crgsound is started the playlist can be started by clicking on the playlist name. A second click should terminate WinAmp. If a playlist or mp3 file is being played then other mp3/m3u entries cannot be started until the currently playing mp3/m3u file completes or is terminated by clicking on the entry in the name column.

Name	File	Time	Altitude	AGL	Direction
atc1	atc1.wav	15			
atc2	atc2.wav	300			
minimums	minimums.wav				
cruising	electronicsok.wav		10000		UP
approach	approach.wav			2500	Down
dia-aprch-1	dia-aprch-1.wav				
dia-aprch-1-30-min	dia-aprch-1-30-min.wav				
dia-aprch-2-30-min	dia-aprch-2-30-min.wav				

Connected    Level    Run Time 55    Reset

## Flight Plan

The CrgSim supports a simplified flight plan. There is only one required line for each point and that is the identifier “ID” followed by the point. If there are no more fields associated with the flight plan point then the point name is looked up in the data base and the latitude/longitude from the data base is used. This implies that if a point is not in the data base then the latitude and longitude must be supplied (see below). The format for entries is <field identifier> followed by <field value>.

Not prototypical, the first point on the flight plan is not activated until approaching within about 3.0 NM. If you want the flight plan to be activated immediately on loading then select the first waypoint to be within that distance to the aircraft as it initially sets on the runway. For example in the flight plan COS2DEN the waypoint “tunte” is selected as the first waypoint.

The flight plan supports the following fields which are case insensitive:

- ID - Name of the point (caps sensitive, HFF is not the same as hff).
- Lat - latitude of the flight plan point if the point is not in the data base or if a different latitude is desired.
- Long - longitude of the flight plan point if the point is not in the data base or if a different longitude is desired.
- Alt - altitude to fly on the way to the point.
- Speed - speed to fly on the way to the point
- Nav1 - frequency to set the Nav 1 radio to.
- Nav2 - frequency to set the Nav 2 radio to.
- OBS1 - degrees to set the OBS 1 to
- OBS2 - degrees to set the OBS 2 to.
- Vertspd - vertical speed to use when changing altitudes between flight plan points. This is a positive number. If the new altitude is less then the current altitude the system will automatically set the sign of the number. If this field is missing or set to 0 then the system will calculate the approximate vertical speed to arrive at the next flight plan point at the designated altitude.

The flight plan provides the ability to create custom flight plan points. The following will create a point in the Colorado Springs area:

```
ID  MYPOINT
Lat 38.8339
Long 104.8208
```

The 3 lines above in a flight plan file define a point called “MYPOINT” located at the latitude and longitude specified by the next two lines.

A flight plan from Colorado Springs to the Denver area (not to the Denver International Airport) could look something like this:

id KCOS

id MOGAL  
speed 230  
alt 9000

id FQF  
speed 280  
alt 10000

id DVV  
speed 160  
alt 9000

All of the points in the flight plan above must exist in the data base or must be manually provided with latitude and longitude. Once the flight plan above has been activated the aircraft will attempt to fly to the 2<sup>nd</sup> point (MOGAL) at an altitude of 9000 feet with an air speed of 230 knots.

The CrgSim flight plan computer evaluates the current aircraft location, speed, and altitude and then issues commands to the simulator autopilot and other simulator systems.

At this time there is a maximum of 15 points in the flight plan.

**The CrgSim flight plan computer is part of Keys so if you plan on using flight plans then crgwinkeys.exe must be running somewhere in your network.**

Note: the flight plan exists just within the CRG system. FSX is not aware of the existence of the CRG flight plan nor can it display it.

## Activating a Flight Plan

After a flight plan has been loaded one or more points will be displayed on the Nav Display if they are within range of the Nav Display. The flight plan is activated by flying within approximately 2.5 miles of any of the points on the flight plan. Once activated the next active point is displayed in magenta and the line to the point is also displayed in magenta. Intersecting a flight plan path will not activate the flight plan.

To automatically fly the flight plan, turn on Autopilot, VNAV, and LNAV on the Keys autopilot window. The Keys program has a basic flight plan computer that will issue commands to the FSX/Prepar3d program to fly the flight plan. The routine will also attempt to compensate for moderate crosswinds to remain on the track from one point to the next.

Once the last point on the flight plan has been reached VNAV and LNAV will turn off and the last heading and altitude will be maintained.

One of the flight plans included in the distribution called "Circle" will continually fly around a closed loop until the flight plan is manually terminated by selecting a Keys window and pressing the F3 key.

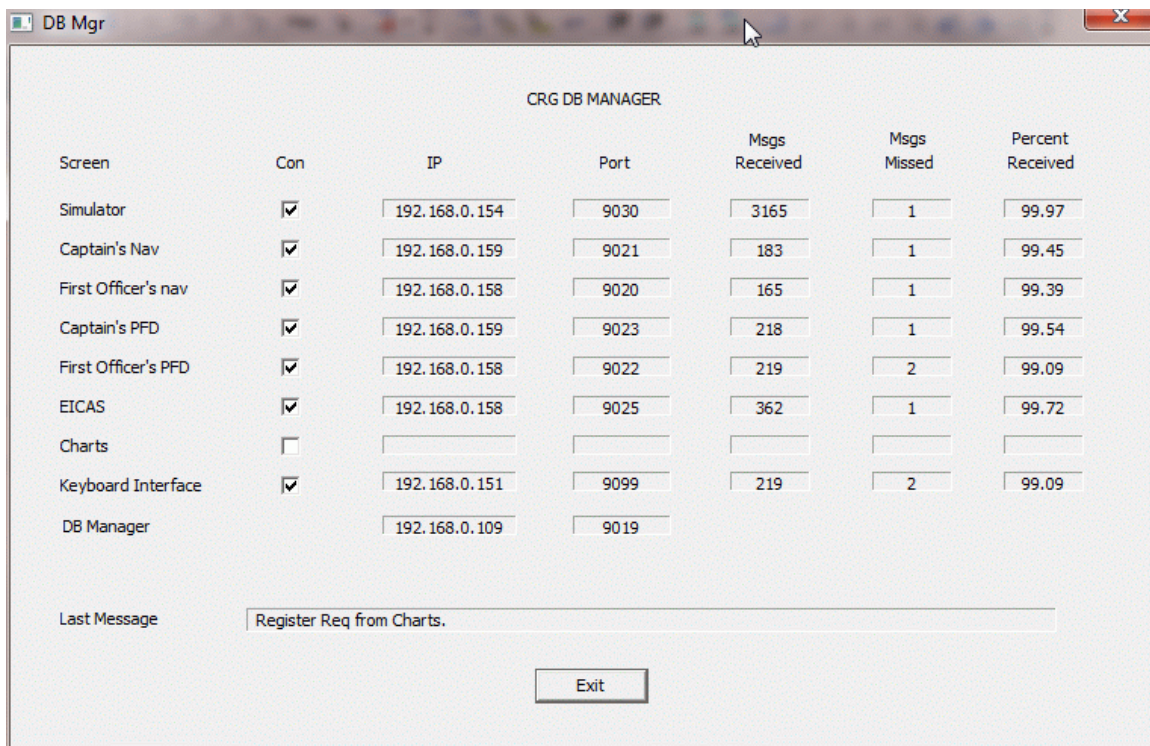
Flight plans can be reset by reloading them or pressing the F3 key while a Keys window has focus. They can be reloaded or changed while flying. When a flight plan is reloaded or changed VNAV and LNAV are turned off. If you want to use either or both VNAV or LNAV turn them on again on in the Keys autopilot window.

CrgSim travels the flight plan by sending altitude and heading commands to the autopilot in FSX/Prepar3d. When flying to the next active point CrgSim sends the specified autopilot target altitude to the A/P and then calculates the rate of ascent/descent necessary to reach this altitude before encountering the next flight plan point. This vertical speed is sent to the A/P. A maximum of plus or minus 1800 feet per minute is used.

## Communications Manager

The Communications Manager looks at the available communication interfaces on the computer and selects one. The port and IP for the Communications Manager are displayed at the bottom of the component list in the window

The Figure below shows a system with all instruments and programs running except for Chart which has just requested a connection:



The screenshot shows a window titled "DB Mgr" with a sub-header "CRG DB MANAGER". It contains a table with 7 columns: Screen, Con, IP, Port, Msgs Received, Msgs Missed, and Percent Received. The rows list various components: Simulator, Captain's Nav, First Officer's nav, Captain's PFD, First Officer's PFD, EICAS, Charts, Keyboard Interface, and DB Manager. The 'Charts' row shows a status of 'Register Req from Charts' in the 'Last Message' field.

Screen	Con	IP	Port	Msgs Received	Msgs Missed	Percent Received
Simulator	<input checked="" type="checkbox"/>	192.168.0.154	9030	3165	1	99.97
Captain's Nav	<input checked="" type="checkbox"/>	192.168.0.159	9021	183	1	99.45
First Officer's nav	<input checked="" type="checkbox"/>	192.168.0.158	9020	165	1	99.39
Captain's PFD	<input checked="" type="checkbox"/>	192.168.0.159	9023	218	1	99.54
First Officer's PFD	<input checked="" type="checkbox"/>	192.168.0.158	9022	219	2	99.09
EICAS	<input checked="" type="checkbox"/>	192.168.0.158	9025	362	1	99.72
Charts	<input type="checkbox"/>					
Keyboard Interface	<input checked="" type="checkbox"/>	192.168.0.151	9099	219	2	99.09
DB Manager		192.168.0.109	9019			

Last Message: Register Req from Charts.

Exit

On startup crgcom.exe will make one attempt to check if a newer version exists. If you do not want the program to check for new versions start the program with:

`crgsim.exe -nochk`

The ComMgr.log will contain an entry confirming the new version check choice.

## **FSX Add On Compatibility**

If a third party add-on exchanges all variables with FSX then CrgSim and the third party product should work together. For example if a third party aircraft sets a radio frequency by sending the frequency to FSX then CrgSim is able to read that frequency from FSX so for this particular variable the two products can be considered compatible.

Assume though that a 777 add-on uses VNAV and LNAV and does not send these variables to FSX (where would they go anyway?) then CrgSim cannot read those variables. Some add-on aircraft keep a large number of variables private. These are not good candidates for inter operating with CrgSim. In cases where an SDK is available from the manufacturer then the possibility of compatibility increases.

Interoperability may not be a big issue since the default aircraft (or add-on aircraft) provide just the flight model if you do not display the cockpit on the main FSX/Prepar3d screen. The 2d or 3d cockpit is not used in this case. This form of operation with a flight simulator may not be desired by many people though. CrgSim running without a cockpit display is just one of many options.

## **Auto Land**

We use a short flight between Colorado Springs, Co. and Denver, Co. as a test flight to check out a release. It is a fun and short flight ending with auto land at Denver. Here's how to set it up:

In the Communications Manager screen click on the "Flight Plan" button at the bottom center of the window. Select COS2DEN and click "Load".

- Select the Colorado Springs Airport (COS) and runway 35R.
- Turn on the flight director
- Set A/P speed to 300 knots
- Arm auto throttle
- Set A/P altitude to 10,000 feet and click the Alt Hold button
- Set A/P heading to 349 degrees and click the Heading Hold button



- Nav1 and Nav2 will automatically be set to a Denver ILS frequency when getting close to Denver.
- Turn on VNAV and LNAV (Keys autopilot screen)
- Increase throttle to about 60%. Then a few seconds later click on TOGA (Keys autopilot screen) or press FK5 (one of the Keys windows must have focus to recognize keystrokes)
- Take off and after verifying a positive rate of climb raise the gear.
- After the gear is up, set auto throttle to on, this should begin controlling your air speed to the value set above.
- Click the Cmd button to turn on the A/P. Raise the flaps.

The Denver signal should be acquired about 27 NM out after passing waypoint BOOBU or CORDE. When you see the glide slope diamond appear on the Primary Flight Display to the right of the artificial horizon click on App (Keys autopilot screen) and the plane should begin to automatically set up for landing. When APP (Approach) is activated both Altitude Hold and Heading Hold will be automatically turned off. VNAV and LNAV will automatically be cancelled. Wait until both the localizer diamond and the glide slope diamond appear before clicking APP.

You will have to control the speed, flaps, and gear. Set auto brake if desired if you have a cockpit display, otherwise apply brakes after touch down. At 1500 feet AGL LAND 3 should appear above the artificial horizon. On touch down turn auto throttle off, set throttle to zero, turn A/P off and start braking. You can turn off Speed Hold some distance out to begin controlling the throttle yourself. You can also disconnect the autopilot at 200 to 300 feet AGL to finish the flare yourself.

**Any similarity between this flight and reality is purely coincidental.**

## **Colorado Springs To Jackson Hole**

Similar in setup to the Autoland at Denver, load the COS2KJAC flight plan and take off as you would above. This flight plan takes longer but

is more of a challenge at the end. The last leg ends up in Jackson, Hold at 25,000 feet is you stay on the flight plan the whole time.

But 25,000 feet is not where you want to be on arrival! The challenge is to descend to a lower, but still safe, altitude and use the final flight plan position to line up on the Jackson Hole airport. When, not if, you land successfully take a look to the North West at the magnificent Grand Tetons. As a final effort you may find waypoints and/or NavAids in the Jackson Hole area that you can use to descend to and to line up with for the final approach into the Jackson Airport.

### **An Infinite Flight Plan**

A flight plan called **circle.fpf** is included in the distribution in the same directory as the Communications Manager. This flight plan is used here for extended testing since it will vector the aircraft around in a continuous loop until cancelled or until the aircraft runs out of fuel.

To run this flight plan:

- select Circle from the flight plan list.
- select runway 17 (left or right) at the Colorado Springs Airport.
- Arm Auto Throttle (Keys autopilot window)
- Set the Nav display range wide enough to be able to see the PYNON waypoint (Keys Nav window)
- Rotate Auto Heading to intersect PYNON. (Keys autopilot window)
- Set auto speed to 250 knots. (Keys autopilot window)
- Set auto altitude to 9,000 feet (Keys autopilot window)
- Turn on VNAV and LNAV (Keys autopilot display) (Keys autopilot window)
- Turn on the Flight Director (Keys autopilot window)

Set throttle to around 60%, then a few seconds later click on TOGA (Keys autopilot window). Rotate at VR, raise the gear on positive rate of climb, and click on Speed hold. Turn on the autopilot.

Use auto heading adjust to fly to PYNON, when within approximately 3.6 miles the flight plan will be activated and VNAV and LNAV will begin controlling the aircraft. The next waypoint should turn from white to magenta and the aircraft should turn in the direction of waypoint HIPPE. Feel free to experiment with different Nav frequencies, altitudes, speeds, and vertical speeds in this flight plan. Probably a good idea to cancel the flight plan (turn VNAV and LNAV off) when fuel gets low and then return to the airport of your choice.

## **15 Inch LCD Panels**

It seems that 15 inch LCD displays (and smaller) are getting hard to find and can be expensive. As an experiment we obtained some used 15 inch displays from a local computer repair store for very low prices. The displays were removed from their plastic cases, mounted behind panel cut outs, connected to the computer through VGA cables, and look great. For this size, high resolution displays are not a requirement.

## **Running a charts only system**

If you want to use just the charts capability of CrgSim then you will need just one extra computer running XP or above. Install the Communications Manager and Charts on the same (non FSX) computer and install the FSX Interface on the FSX computer.

## **Running a sound only system**

If you want to use just the sound capability of CrgSim then you will need just one extra computer running Vista (see note about XP and long sound files) or above. Install the Communications Manager and Sound on the same (non FSX) computer and install the FSX Interface on the FSX computer. Enjoy your aircraft with altitude call outs, even the Cessna 172 will now have altitude call outs.

## In Case of Trouble

1. Communications Manager does not list any Register Requests from the simulator.
  - Make sure that `crgfsx.exe` or `crg3d.exe` are running on the simulator computer.
  - Verify that the Communication Manager startup IP address and port number in `crgcom.log` are correct. Use the windows command line “`ipconfig`” to list the available adapter addresses.
  - Ensure that the port number is not in use by another program.
  - Examine the `CrgFsx.log` file in the Flight Simulator X computer.
    - The start time should reflect the local computer time that the simulator was last started.
    - Make sure the listed IP address and host name are correct.
2. Communications Manager does not list any Register Requests from the PFDs or NDs.
  - Examine the instrument logs (`CrgPfdR.log` is the log file for the right PFD) located in the directory that the PFD executable is located:
    - Ensure that the Host Name and IP are correct. Verify by using the command “`ipconfig /all`” in a command line window.
    - There should be a line starting with “REG” which contains the IP and port number of the computer that the PFD is executing on.

- There should be an entry containing “Received address from DB...” which contains the IP and port number of the computer that the Communications Manager is executing on.

Make sure that **crgcom.exe** (the Communications Manager) is running and that no anti virus packages are blocking messages. The CrgSim components communicate with UDP. No messages are sent to anywhere outside of your local net except once on startup from the Comm Manager when optionally checking for a newer version.

## Display Considerations

In our lab there are 5 windows: PFD right, PFD left, EICAS, ND right, and ND left. Each display is a separate program and creates a separate movable resizable window. The displays used here in the lab are small 15 inch monitors. Each monitor has a black background and displays one PFD and one NAV. The windows do not have a border or title bar and therefore are not moveable or resizable by the usual way of grabbing the border or title bar and dragging. The position and size of the displays are specified by a configuration file so you do not need to move things around every time your system is started. Once set the PFDs and NDs will start up in the same location specified by the configuration files.

Each instrument includes a bezel by default. If you place your instrument behind a physical cutout in your forward cockpit panel you can specify removal of the bezel to provide a little more flexibility for you.

The PFDs and NDs are designed to be a relatively square display on the screen. For displays where the pixel aspect ratio is not square the width and height in the config file can be adjusted to produce a square display. The display will look presentable down to about 550 pixels square but looks best close to 700 pixels square and above.

## Network Considerations

All CrgSim components have to be run on computers located on the same local network as the simulator. The components locate one another via UDP messages so any intervening routers or switches on the local net must pass these messages. Local net (192..., 172...) UDP broadcast messages are not routable so they will not be passed on to the internet. After connecting, inter CrgSim component communication is via UDP.

On startup each CrgSim component inspects the computer's internet adapter to determine available IP addresses and net masks. It then selects one to use. This is successful most of the time. Since a computer may have multiple IPs and multiple Ethernet adapters it is possible that the component will chose one that has no connectivity to either the simulator local net or to the other components. You can override the IP and/or net mask with either command line parameters or by configuration files depending on the component. Most local nets will probably have an address beginning with 192.168.x.x.

To find out information about your computer's network interface open a (MS Windows) command line window and type "ipconfig /all".

## **Units Conversion**

At this time altitude units are in feet. A PFS "meters box" is on the list of changes to make.

## **Performance**

There are two computers in the lab that have been used to check performance. One computer has an AMD Phenom II X4 840T processor and the other has an AMD Phenom II X4 820 processor. Neither of the processors is considered high performance but they are decent performers. Both computers run Windows 7 and DirectX 10.

The target fps for all instruments at this time has been set to 20. Just below the fps there is another line that begins with "PAUSE". This line displays the sleep time necessary to maintain a 20 fps update rate. Note that the display image is updated at a much faster rate, the rate that fps is referring to here is the screen content update rate.

On our slower machine (820) with all of the instruments running (two PFDs and two NDs), the Communications Manager, and Keys fps is 20 and Pause is 32. Looking at the process monitor the load on the CPU is minimal. However, right after startup there is something causing the fps rate to drop to 7 or 8 and the pause value to go to zero. The instruments perform choppy and the look and feel is not satisfactory. CPU core 3 is loaded to around 25% while the other cores hover around zero. By terminating some of the background programs the performance rate eventually jumps to desired values. This has not been associated with any particular program and remains a mystery.

Lab performance is almost always improved significantly by turning off the “Themes” service with the task manager. Start the task manager, select services tab, right click on Themes and select “Stop Service”. On reboot the Themes service will restart normally.

On the faster machine (840) things have always run with the system configured normally.

## **Contact**

You can contact us at [sim30@crgsim.com](mailto:sim30@crgsim.com). We are especially interested in your comments, any problems you might have with the programs, and things that you like (or don't like) about them.

After spending a large amount of time removing non-flight sim posts (drugs, counterfeit boots, ... for sale) we reluctantly had to convert the web site to read only.