

xCIGI

xCIGI - The CIGI Interface for X-Plane

(c) Hans Born, 2007
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This document gives you an overview about the implemented functionality and application of the xCIGI plugin for X-Plane. Please note the licensing information chapter.

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1 Introduction

Welcome to xCIGI, a partial implementation of CIGI V3.2 - Boeing's common image generator standard for professional simulation solutions - for X-Plane.

Fancy to plug and play your home build simulator with the most expensive professional image generator on the market? Do you want a flair of professionalism in your computer game? Or do you have a professional system and consider switching your IG interface to the evolving de-facto industry standard CIGI? You just do not want to invest a huge sum of money for a suitable IG right away but still get going right away with little investment?

Then xCIGI could be a solution for you. You will just need a copy of X-Plane, the CIGI SDK from the website and xCIGI. Under Windows, xCIGI provides you with an easy and rewarding counterpart to help you through your CIGI CCL host implementation.

The story of xCIGI started when I started looking into CIGI for business reasons. The CIGI website did feature a full SDK and very good sample and test software. However I did run into some difficulties with the reference IG software under windows and worked with the console applications. As I was experimenting with the abilities of X-Plane Plugin technology just a few month before I decided to use the open and well documented X-Plane interface to provide a somewhat more suitable graphical test software to myself. This worked rather well and I decided to make it a bit more usable and wrote a few lines of documentation, so other people may get a quick visual feedback from X-Plane's version of their target database area when implementing CIGI into their systems.

Note that xCIGI is a *partial* implementation. It is neither intended to be complete implementation nor has it the ambition to become an official CIGI reference. It has been tested to work with Boeing's Host Emulator software HEMU only. Once you got your interface working with xCIGI you should be able to complete your implementation with the console test implementations from the SDK or any IG officially supporting CIGI.

For an introduction to CIGI please refer to the very good CIGI ICD available on the CIGI web site.

Thanks to Boeing for the brave and pragmatic decision to put their development on Internet and spent a lot of money for the continuous support for the benefit of everybody and the extensibility by all interested parties. Also thanks to Austin Meyer for providing a solid and growing alternative to a rather monopolistic marketplace in consumer flight simulation software and his very customer oriented open information policies. It really is a mystery to me how he manages to reply emails mostly same day over all those years. Finally thanks to Sandy Barbour Ben Supnik and for devoting a lot of spare time into the development and update of the x-Plane Plugin interface. Its great to see their involvement in the forums to maintain a free daily user support on the Internet.

Hans Born

Germany, April 2007

Germany, June 2007 (Update)

2 Overview

2.1 System concept

The environment a CIGI implementation is applied to may look in principle like this 3 channel setup.

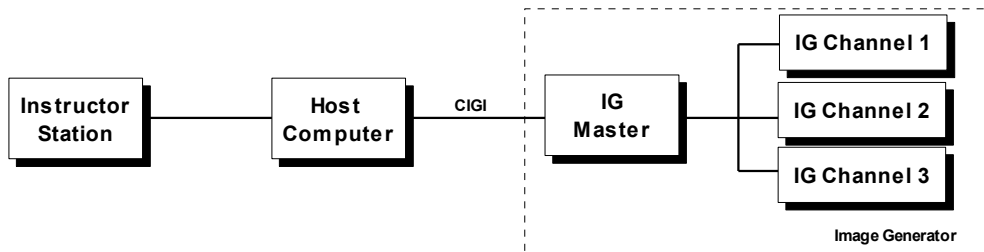


Figure 1: Typical simulator setup

The multiple channels of the IG are addressed via a single CIGI connection from the host computer to an IG master computer. This is linked with each IG channel and distributes the CIGI package information in a synchronized manner between the channels. The Host sends to the IG Master per IG information for all channels as well as per channel information for individual channels. This may be field of view or view orientation information whereas time of day information is applicable to all channels.

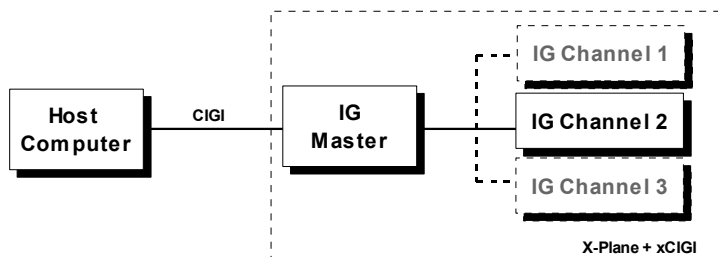


Figure 2: Host-IG interface setup with xCIGI

Testing the IG interface for this application with xCIGI uses a single channel, in the figure above shown as the center channel 2. All information that is sent to other channels is ignored by xCIGI. The channel view port parameters are referred to as view 0. Note that the X-Plane architecture actually combines the IG Master function with an IG Channel function.

2.2 A Plugin for X-Plane

2.2.1 X-Plane Version

The xCIGI is a plugin for X-Plane. It can not run standalone. It does require that you have a license copy of X-Plane for each channel in case of a multichannel system. This version of xCIGI supports a single channel only.

xCIGI requires X-Plane version 8.60 and later.

Currently only the windows version of X-Plane is supported and tested.

2.2.2 X-Plane Limitations

The following limitations are based on X-Plane design and architecture and X-Plane Plugin design and architecture. These may change with future versions of X-Plane. Only those limitations are listed that are relevant for the supported packets.

- The HAT/HOT is calculated for the CG of the Ownship. Separate HAT/HOT for landing gear positions is not available.
- Time stamp accuracy is several ms.
- Vertical FOV can not be set. The aspect ratio is fixed. xCIGI uses the Top and Bottom FOV values to determine the viewport's vertical angular offset.
- Video off/Standby is not supported.
- There is no stable frame rate. X-Plane provides a minimum frame rate setting that is achieved with LOD control, but no close loop control mechanism to run for example stable 60 Hz. On a fast computer, the Host Emulator software showed in tests up to 100Hz with drops down under 50Hz.

2.2.3 Known issues

The current version is not fully tested in multiple PC configurations and thus might show not the intended behavior on your machine. Please note the following known issues at the time of release.

- Sporadically, X-Plane graphics may show a black screen when xCIGI is disabled after longer use. Restarting X-Plane resolves this.
- xCIGI does not switch from operate to standby mode when new database/scenery tiles are loaded. On very fast motion the network interface does not respond to the host during that time. You might need to experiment with your host timeouts settings.
- The UDP server is limited and has some bugs leading to the following effects:
 - desired local IP address may not work with several NW cards
 - entering a non existing IP address for IG or Host will crash x-Plane on either enabling or disabling of xCIGI. Be sure to enter correct IP addresses.

2.3 Implemented Packets

The scope of xCIGI is just a fraction of CIGI V3.2. It should be enough to approve proper interaction between host and IG as the software is intended for test and debug purposes for an CIGI Host implementation.

In fact, only a few a CIGI packets are necessary to drive a simple flight simulator for basic flying tasks. Please refer to the chapters below to find out about the limitations of the implemented CIGI messaging.

Supported CIGI IG to Host Packets

- ◆ SOF
- ◆ Hat Hot

Supported CIGI IG to Host Packets

- ◆ IG Control
- ◆ View Definition
- ◆ View Control

- ◆ Entity Control
- ◆ Celestial Control
- ◆ HATHOT Request

3 Installation

3.1 Windows

3.1.1 Installation

This is very easy and safe to do. X-Plane searches for plugin files during start up in a certain directory and automatically starts and enables them. Just unpack all files from the archive (e.g. xCigi.zip using unzip or WinZip) into the following directory:

"<x-plane directory>\Resources\Plugins\"

Example: your X Plane is stored in the C: drive in the directory "Games" with the default name. The path would be

"C:\Games\X-Plane 8.60\Resources\Plugins"

Make sure that the plugin directory contains the default file XPLM.dll and XPLWidgets.dll. They are required to run xCIGI. Note that these files are specific to a X-Plane version, so you might need to update your installation with the internet update function to get the correct version. Using old versions for these files might prevent xCIGI from working correctly.

xCIGI itself consists of 2 files:

xCIGI.xpl, the plugin file

xCIGI.cfg, a configuration file

This is how your plugin subdirectory should look like after installation without other plugins:



Figure 3: Minimum files in the Resources\Plugins directory after xCIGI installation

Note that X-Plane looks for any files with the extension '*.xpl'. It also does **not** look in subdirectories, so be sure to keep the original name and place it only in that directory. Once the startup is ready, xCIGI can be operated by Hotkeys or a xCIGI Menu, which the plugin creates during startup.

3.1.2 De-Installation

There are no ties to anywhere in the system. So you can safely delete the files from the plugin directory.

So just delete:

```
"<x-plane directory>\Resources\Plugins\xCIGI.xpl"  
"<x-plane directory>\Resources\Plugins\xCIGI.cfg"
```

When updating an old version of xCIGI with a more recent one, be sure to delete the old file. If two different versions are loaded by X-Plane at the same time, the results are undefined.

3.2 Installation under other OS

Installation for Linux and Mac OS is not supported with this version. However, due to the use of wxWidgets the software is very portable and thus a matter of need.

3.3 Disabling the plugin

During runtime the plugin can be disabled using the X-Plane 'PluginAdmin'. In the disabled state the plugin does not put any load on the system.

Should you encounter problems, the plugin can be disabled without deleting the file by just changing the extension. Then X-Plane will not load the plugin on startup.

Example:



```
"C:\X-Plane 8.60\Resources\Plugins\xCIGI.xpl" is renamed to  
"C:\X-Plane 8.60\Resources\Plugins\xCIGI.xpl_bak"
```

Note that the configuration file is not shown here.

4 IG Setup

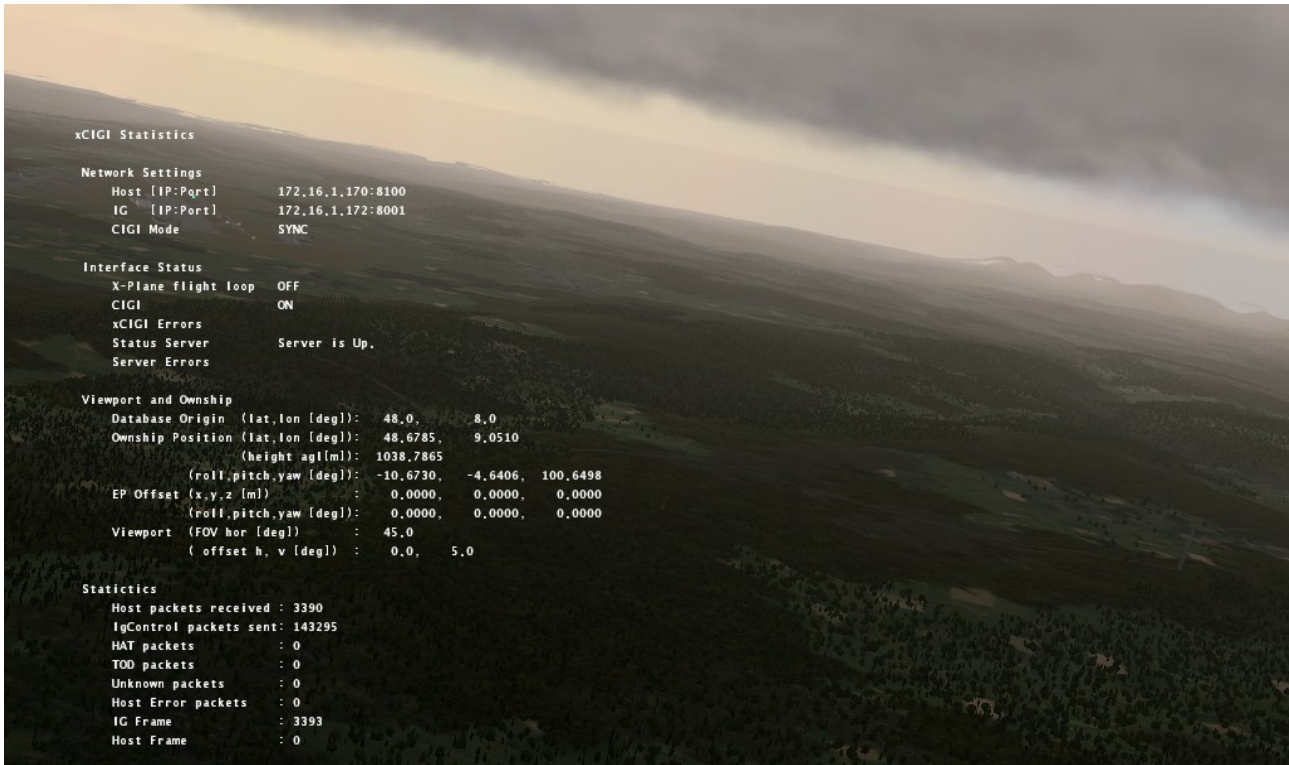


Figure 4: Display of statistics data for development and testing. Note the CIGI coordinate system conventions

4.1 Keyboard functions

Hot key functions allow quick access to two main menu functions in the xCIGI menu.

```
F8 xCIGI enable/disable toggle
F9 Statistics text output toggle
```

4.2 X-Plane setup options when xCIGI is active

As long as xCIGI is active, note that X-Plane functionality is limited as follows:

- Joystick input is being ignored
- Flight control by mouse is not possible
- Using the IOS for repositioning may lead to undefined behavior.

5 xCIGI Operation with X-Plane

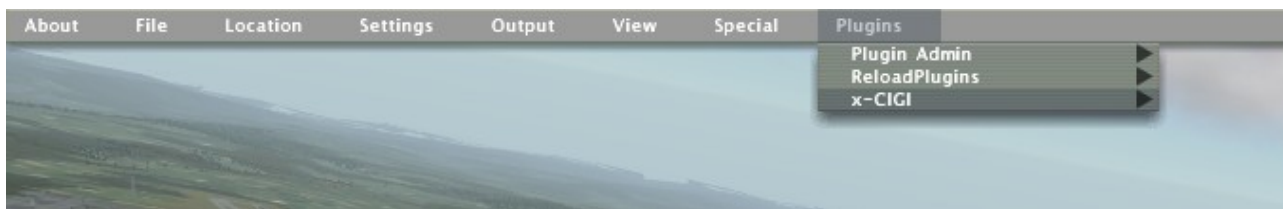


Figure 5: All functions can be accessed via the xCIGI Menu

All menu items refer to the Plugins\}xCIGI menu visible in the X-Plane menu bar, when xCIGI is loaded and enabled. Thus the menu item 'Settings...' refers to Plugins\}xCIGI\Settings...

5.1 xCIGI Menu Overview



Figure 6: xCIGI Menu functions. Menu items ending with '...' open a dialog window

Menu functions are provided for

- Enabling and disabling xCIGI. The xCIGI is disabled on startup of X-Plane
- Define network settings as IP Address and Port of the host. Also the local Port can be set. Provisions for settings the local IP for multiple network cards are made but ignored at this time. Note that the ports for sending data to the host and receiving data from the host must be different. Also the type of CIGI mode can be defined. Default is synchronous mode.
- Re-Initialization of the network sever. This is needed after changing the network settings. It causes to reset the IG frame number.
- Re-Read CIGI Configuration File. Select this option after you changed the configuration file during runtime. Note that this does *not* Re-Init the server automatically.
- Statistics printout toggles an data output overlay on screen, so geodetic coordinates and packet information can be used during development.
- Quick Information on the plugin, license and disclaimer can be accessed in the About menu.

5.2 Starting and Stopping

xCIGI is loaded on X-Plane startup automatically, provided that the installation has been done correctly. After xCIGI has been loaded it is **not** started automatically.

After startup press F8 to start xCIGI or select the 'Toggle CIGI Enable' menu item. Press F8 or select the same menu item to stop xCIGI. On enabling xCIGI a text window is displayed informing the user that X-Plane controls are limited and how xCIGI can be disabled again. The window vanishes automatically after about 20 seconds. It can not be dismissed manually.

If you are unsure about the run state of xCIGI, press F9 to display statistics information. This information also includes the run state "xCIGI enabled" or "xCIGI disabled". Of course you also can use the menu 'Show Statistics' command in the xCIGI menu.

Note that the xCIGI menu exists only if the plugin is enabled in X-Plane. This can be checked and modified with the PluginAdmin.

5.3 Notes on Overriding xCIGI settings

xCIGI is programmed as state machine, so once a packet is sent by the host, the values are valid until a new packet is overwriting the current values.

So unless the host is sending packets on a regular basis, many CIGI parameters can be overridden using the standard X-Plane GUI and keyboard functions. Some features are disabled by design, for example the flight controls.

Feel free to experiment with the standard X-Plane functions. Should your host implementation omit some packages covered by xCIGI, you can safely use the standard GUI to modify the scenario to suit your needs.

Example:

```
You did not implement the WeatherControl packet. Enabling xCIGI, the default settings of X-Plane are not modified and the Settings/Weather can be fully accessed to modify the scene.
```

5.4 Synchronous and Asynchronous Mode

xCIGI supports the two CIGI modes of synchronous and asynchronous Host-IG communication. Both modes have limitations but should be sufficient for testing purposes.

Note that operation with the CIGI Host Emulator Test Software (supplied with the CIGI SDK) are limited to the synchronous mode.

5.4.1 Synchronous Mode

This is the Default mode of operation.

In the synchronous mode the IG is the active communication partner. It sends out a CIGI message each frame. The host should reply to each message with minimal delay with data updates for the new frame. Note that the IG does not expect a host to be present and continues to send messages even if no response is received.

When the Host is triggered by each IG message, this results in a solid coupling (thus the name). The benefit is a smooth entity motion and no frame jitter. To support the immediate response withing the same frame, the CIGI ICD recommends a time offset to compensate for transport delay time.

xCIGI has *not* implemented such an offset, so it can be assumed that there is a constant delay of 1

frame in synchronous mode operation.

A limitation of X-Plane is that there is no mechanism to assure a fixed frame rate at all times. Overload management, database reloading and operating system interferences cause the frame rate to vary. Should your Host be designed to derive its cycle time control from the IG frame rate, be aware of the effects this jitter may cause in your simulation models.

5.4.2 Asynchronous Mode

In the synchronous mode the IG is the passive communication partner. The Host sends out CIGI messages at will (usually in a fixed frequency). The IG responds with a response message at the next possible start of frame.

The frame counters for Host and IG do not really reflect the frame numbers but rather the packet number. The offset count may differ from host to IG. With the frame numbers both sides can detect if a packet was lost.

Since the timing between IG and Host is different, the IG can counter the resulting visual artifacts by data interpolation (e.g. dead reckoning) based on time stamp information sent with each packet. xCIGI does *not* provide data interpolation, so do not expect a smooth entity motion. However, the time stamp information is evaluated and interpolation might be added in a future version of xCIGI.

5.4.3 Setting the mode

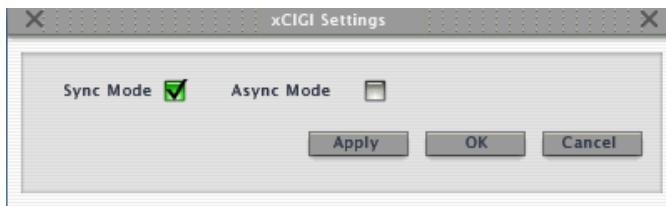


Figure 7: xCIGI Settings Dialog

Set the radio button in the settings dialog which can be accessed from the X-Plane menu

PlugIn/xCIGI/Settings...

In order to take effect you must re-initialize the xCIGI Server by menu or Hotkey.

5.5 Network Setup

The network setup defines the addresses for both IG and Host computer. Each address consist of the IP Address and a Port number as the utilized UDP protocol stack required the port for both communication partners.

The Host IP address and port number is the address of the remote host computer that sends CIGI commands. Make sure that no firewall settings do block either the address nor the port number. It is recommended to choose port numbers above 8000. Note that the Host interface side also needs to know the IG and Host IP addresses as well as the port number. How to define it depends on the implementation of the host interface, of course. In Boeing's HEMU software the respective dialog is File/'Settings..'

The IG IP address is the IP address of the local computer you are running X-Plane with the xCIGI interface. Make sure a TCP/IP network card is configured and enter the IP address of this card. If you use several cards, make sure you are using the correct one. The Port number is the port on which the IG will be listening for Host commands. Also on the IG must not be a firewall rejecting the packets for IP and Port.

XCIGI allows you two ways to set up the network.

- Configuration file
- Dialog

Find the two options described below.

5.5.1 Dialog

You may want to use the dialog when there is a need to modify the network parameters very often. The dialog below should be pretty self explanatory. Make sure all edit fields are filled out for successful operation of xCIGI.

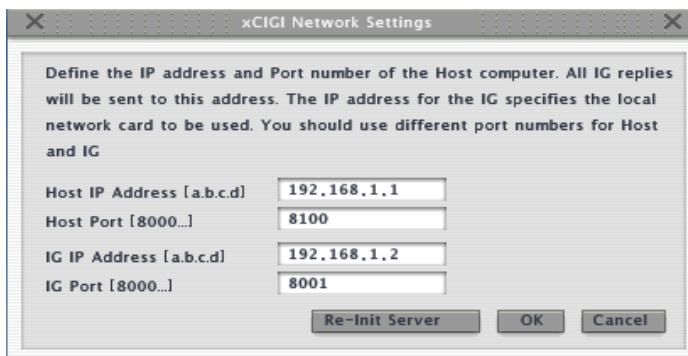


Figure 8: Network Settings Dialog

Use OK to take over the edited values or cancel to leave the former values unchanged. By pressing the Re-Init Server Button you can apply the new settings right away. The server will be stopped and restarted with the new settings instantly. Cancel ignores the changes. Cancel will not restore the old settings when Re-Init Server has been selected before.

All buttons will close the dialog.

5.5.2 Configuration File

With the xCIGI.xpl plugin file itself an ASCII configuration file named

```
xCIGI.cfg
```

is located in the Resources\plugin directory of X-Plane. By editing this configuration file you can specify the network parameters on load. As you see in the following listing the data can be clearly entered as in the dialog. Tabs and whitespace characters are ignored as well as C++ style comments (everything in the same line after '//'). The order of the items may be changed as long as the groups hierarchy remains together. You may use mixed lower and upper case for clarity, the data parser ignores the case.

```

// xCIGI configuration file
// Whitespace, tabs and empty lines are ignored. Case is ignored too.
// Trailing comments with '//' . Entry must fit in a line
// When you delete this file, xCIGI uses default values.
// (c) Hans Born, Germany, 2007

[Network]
IgIP      = 182.168.1.1
IgPort    = 8000           // should be >= 8000
HostIP    = 182.168.1.1
HostPort  = 8001         // should be >= 8000

[CIGI_Settings]
Autostart = false        // true=enabled on X-Plane start
SyncMode  = false        // true=sync

[Multichannel]
SideChannel = false      // a sidechannel does not reply to Host

```

Figure 9: Default xCIGI Configuration File

5.6 Multichannel Operation

For delay minimized multichannel operations it has been proposed to use the broadcast address on the host side. Although synchronization artifacts are expected, such a mode may be useful for a multi monitor application.

While it has not been tested yet, an option has been included to support this proposal. The relevant parameter is available only in the configuration file, but not in the menus.

```

[Multichannel]
SideChannel = false      // a sidechannel does not reply to Host

```

Figure 10: Multichannel section of the Configuration File

In the section [Multichannel] the boolean parameter 'SideChannel' is set the true if the PC is used as a side channel. If so it does not respond to the host at all. However all host packets are received.

Note that at initialization the host must send individual view definition packets to allow an individual setting of the view ports.

X-Plane itself has a build-in feature for multi channel operation. However, this has two disadvantages: First, it does not support asymmetric view ports and secondly would this impose an additional system delay as the master channel must distribute the information after processing the commands itself. As X-Plane does not allow configuration of several network cards for this purpose this all runs over the same network line.

5.7 Selecting Aircraft

xCIGI uses whatever aircraft is loaded on X-Plane startup. If you want a different aircraft loaded on startup, be sure to exit X-Plane using File/Quit while having the desired aircraft loaded. This also applies for the default position.

5.8 Displaying Statistics Information

By pressing F9 or selecting menu "xCIGI/Show Statistics" a semi transparent window will be

displayed. It contains status data and xCIGI settings as well as the number of received packets and frame numbers for Host and IG.

Pressing F9 again or re-selecting menu “xCIGI/Show Statistics” will close this window again.

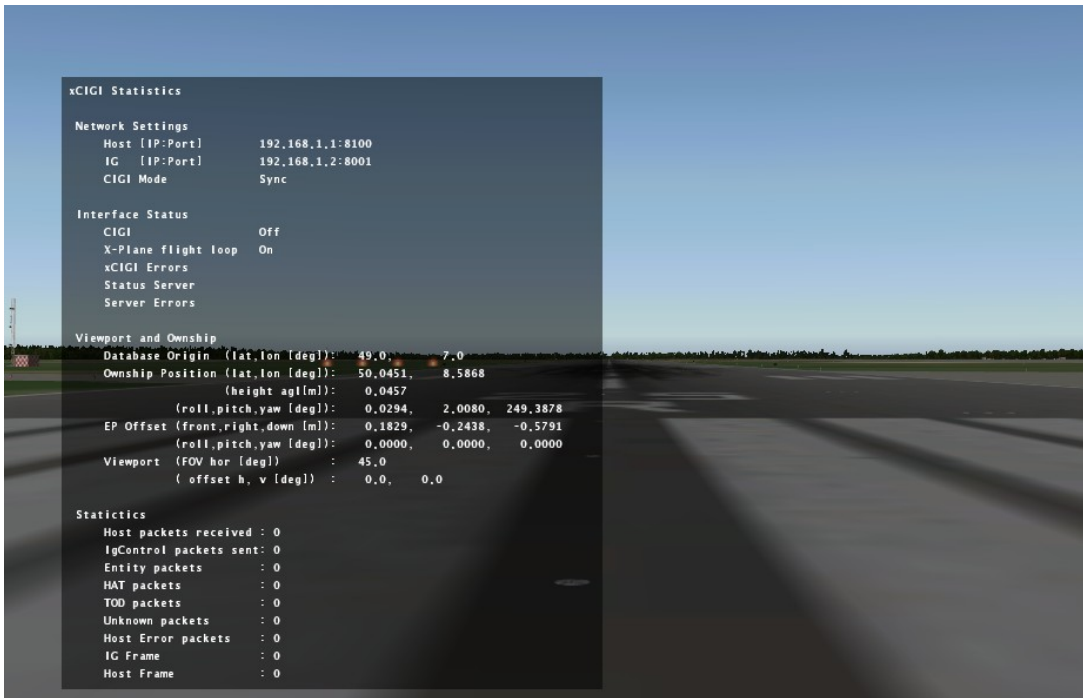


Figure 11: Statistics Screen

6 Conventions

6.1 Coordinate Systems

6.1.1 Differences between native X-Plane and CIGI

X-Plane and CIGI uses different coordinate systems. xCIGI converts the CIGI coordinate system into the X-Plane coordinate system, so that the CIGI documentation should be consulted when coordinate systems are concerned.

The described systems are valid for:

- ◆ views
- ◆ entities
- ◆ submodels

Internally, X-Plane uses a East-Up-South (EUS) approach for the mapping of Lat/Lon/Altitude to local X/Y/Z. Note that from a host point of view, these conventions are not visible.

- ◆ Cartesian origin reference point (0/0/0) is the south east edge of the currently loaded scenery file. (*.env). This point may change at any time during the simulation, usually when a new scenery file has been loaded. In that case, the X/Y/Z changes so the same spatial position is referred to from the new reference point.
- Local axes orientation
 - +X = east
 - +Y = up
 - +Z = south, note that axis is orthogonal only at reference point, due to earth curvature.

CIGI uses a North-East-Down (NED) approach for Cartesian coordinate systems.

- ◆ Height is as MSL, which is taken as above the WGS-84 ellipsoid.
- Local axes orientation
 - +X = north
 - +Y = east
 - +Z = down
- ◆ Order of Rotation
 - 1. Yaw: clockwise about Z-axis (north = 0°, east = 90°)
 - 2. Pitch: between reference plane to X-axis (about Y-axis), positive up
 - 3. Roll: between reference plane to Y-axis (about X-axis), positive right

6.1.2 Using CIGI coordinate Systems

Placement of objects and general positioning towards the IG should be done in Geodetic coordinates. As defined in the CIGI ICD the WGS-84 Geoid is base for all CIGI positions. All entities are positioned by a entity reference point (usually the CG) which is defined by

- Latitude [deg, -180..+180]
- Longitude [deg, -90..+90]
- elevation [meters].

The entity and its parts are oriented using a Cartesian coordinate system which is oriented as given in .

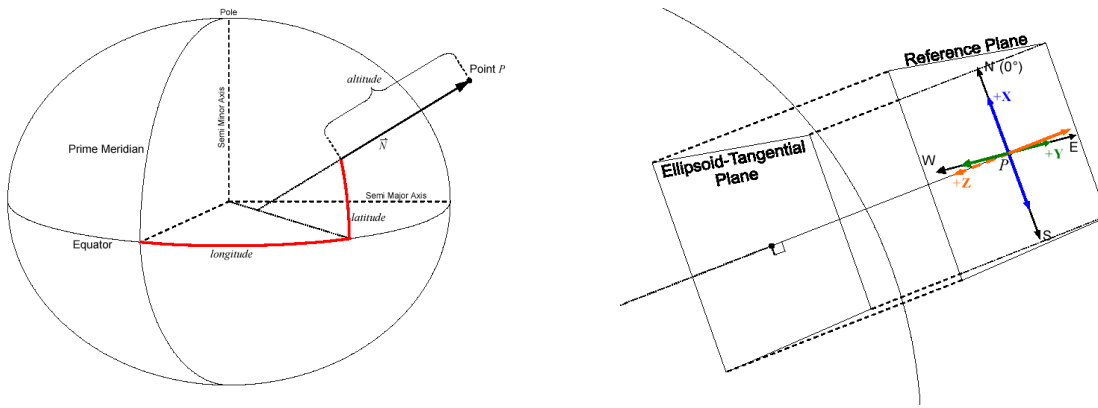


Figure 12: Geo coordinate system used by CIGI.
 (images from xCIGI documentation, courtesy of Boeing)

6.1.3 Placing the Ownship

The Ownship and any other entity are affected with their reference point, i.e. the center of gravity. The EntityControl packet is sent to the host with a position update for every frame for creating a smooth motion.

If the eye point should be put at the pilots position a ViewControl packet must have been sent once to define the pilots position and view direction relative to the entity coordinate system.

Should you operate a head tracker to position pilots view point orientation, the ViewControl packet must be sent at every frame in addition to the EntityControl packet.

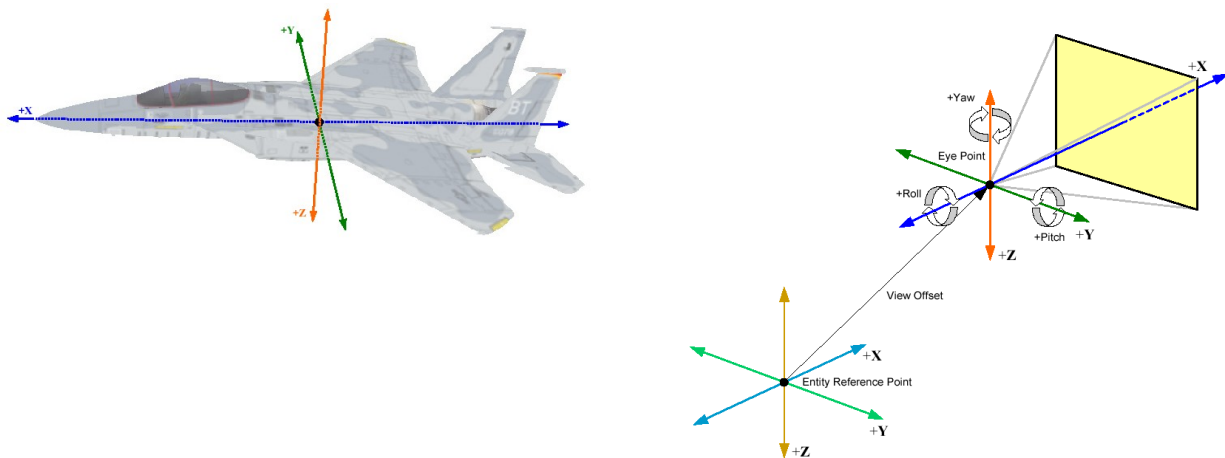


Figure 13: Entity coordinate systems: The eye point is defined by the chain: entity reference point, entity orientation, view vector and view orientation.
 (images from xCIGI documentation, courtesy of Boeing)

6.2 Endianess

The Endianess is assumes Little Endian (Intel Platforms), however the implementation trusts the CIGI class library (ccl) that the Endianess is handled internally in a correct manner. It has not been tested on Big Endian or mixes Endian systems, though.

7 Reference of Supported CIGI Packets

The packet parameters used in xCIGI are given in the tables per packet. Note that not all values may be given. The documentation should not replace the CIGI ICD, but rather define the structure of the xCIGI packets.

7.1 IG Packets

Only the mandatory SOF and the HATHOT response packed are considered required to set up a test simulation scenario for CIGI.

7.1.1 SOF

All parameters of the SOF are fully implemented, but not all functionality is fully supported by either X-Plane or xCIGI. For one the database is whole world and thus is always set to one.

The IG mode is not operated by xCIGI. This is due to the constant reload-on-the-fly that the IG is after initial startup mostly in operative condition. Only exception is a repositioning to a far place, when an entire set of new scenery files and models must be loaded.

Parameter	Value	Meaning	Comment

Table 1: Parameter table – tbd

7.1.2 Hat Hot

The HAT/HOT value is returned only for the Ownship CG. Note that the eye point is translated about the view control vector.

An automatic response is supported as described in CIGI documentation.

Parameter	Value	Meaning	Comment

Table 2: Parameter table – tbd

7.1.3 Host Packets

7.2 IG Control

This packet must be sent to the IG for every message. It must be always the first packet.

Parameter	Value	Meaning	Comment
Major Version	3		ignored
Database No	int	DB ID	ignored. There is always the whole Earth available

Parameter	Value	Meaning	Comment
IG mode	0 1 2,3	reset/standby operate	Commanded state. Ignored, since IG always in Operate Rem: not really true, since during bootup and Repos the mode is also operate, but all packets are ignored (=lost).
Time stamp valid	1	1= valid 0= invalid	If 1 timestamp is collected. Is used only for statistics display.
Minor Version	2		ignored
Byte Swap	0x8000	Endian magic number	Must be this value.
Host Frame	int32	Host Frame number	Any frame count by the host. It is solely used to see if packets are lost. Rollover detection is not implemented (do not run your test too long...).
Time stamp	int32	µs Ticks	is used because needed in asynchronous operation. Note that the X-Plane accuracy is several ms only
Last IG frame number	int32		Should contain IG Frame number from recent SOF packet from IG. Currently not evaluated by IG

Table 3: IG Control parameters

7.2.1 View Definition

xCIGI supports the definition of the a single field of view, addressed as View 0. This is always a perspective projection. Mirror mode and pixel replication is not supported. The view Group is not evaluated.

This may be modified at any time during the simulation. The FOV applies to the variables Top, Bottom, Left and Right. The Far plane is modified by X-Plane internal overload controls, the Near plane can not be modified.

Asynchronous FOV settings are not fully supported. The FOV angle is defined by the horizontal boundaries of the viewing volume (i.e. |Top|+|Bottom|). The window ratio width to height thus defines the vertical FOV.

From asymmetric settings of the viewing volume boundaries a view direction offset is calculated.

Example:

The settings Left = -30, Right = 30, Top = 10°, Bottom = -30 yield a FOV of 60° horizontally. The vertical FOV is defined by the window aspect ratio. The viewport is centered horizontally and tilted downwards by 10° vertically.

Parameter	Value	Meaning	Comment

Table 4: Parameter table – tbd

7.2.2 View Control

This is one of the most important packets together with the entity control. To allow settings the correct view from a cockpit, the entity control packet and the view control packet must be set accordingly:

- ◆ Entity control contains to position of the aircraft reference point (CG)
- ◆ View Control Packet contains 6D offset from aircraft CG to pilot eye.

In case dynamic head motions are supported by the host, the pilots viewing direction affect the view control data. Typically for fixed OTW visual channels the view control packet is defined once per aircraft per channel.

Only packets addressed to View 0 are evaluated. The view Group is not evaluated.

Parameter	Value	Meaning	Comment

Table 5: Parameter table - tbd

7.2.3 Entity Control

xCIGI supports only entity 0, which is assigned to the Ownship. Note that other entity numbers are stored internally and not assigned to the Ownship, e.g. messages sent for entity 1 are ignored at this time.

Parameter	Value	Meaning	Comment

Table 6: Parameter table – tbd

Provisions are made for entity controls 1..8, but it is not yet decided how to assign the entity models

7.2.4 Celestial Control

xCIGI supports the time of day (TOD) and date fields. Other fields are ignored as there is not real star field simulation.

Note that X-Plane does not require to reload the database when the TOD changes from day to night and vice versa.

Parameter	Value	Meaning	Comment

Table 7: Parameter table – tbd

7.2.5 Hat Hot Request

xCIGI supports only the entity HAT request, but not HOT and extended HATHOT requests. The update mechanism is supported. Offset coordinates and free geodetic coordinates are not supported: any given coordinates are ignored.

The returned HAT is defined as the HAT from the entity(0) reference point, usually the center of gravity (CG). Note that this is not the eye point position if you set the view control packet to valid displacement vector and orientation.

Parameter	Value	Meaning	Comment

Table 8: *Parameter table – tbd*

8 License

8.1 License Conditions

The xCIGI software is free for personal use. All rights fully remain with the author. You are granted a free license to download, install and operate the software. As a plugin it can not be used stand alone, but is designed to be used with the commercial software X-Plane.

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1. all files of the original distribution must be contained unaltered.
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9 Appendix

9.1 Glossary:

CIGI	Common Image Generator Interface
CG	Center of Gravity
EP	Eye Point, position and orientation for current view port
FOV	Field Of View
HAT	Height Above Terrain
HOT	Height Of Terrain
IOS	Instructor Operator Station
ICD	Interface Control Document
IG	Image Generator
NED	North-East-Down, specifying the x,y,z axes of a Cartesian coordinate system
OTW	Out of The Window, the outside view to the naked eye (no sensors)
Ownship	technical term in simulation for simulator's own craft. If Sim can control multiple craft (one at a time) the term refers to the actually selected craft.
RePos	Re-Positioning a simulated aircraft to another place in the scenario, possibly in an altered configuration

9.2 Technologies and Links

xCIGI proudly uses **wxWidgets** and the **X-Plane Plugin SDK** from Ben Supnik and Sandy Barbour. Please see the following links for the respective web pages. This document was written with Open Office 2.0.

CIGI: <http://cigi.sourceforge.net>

X-Plane: <http://www.xplane.com>

X-Plane plugin SDK : <http://www.xsquawkbox.net/xpsdk/phpwiki>

9.3 Document Version History

Version	Change Description	Date	Author/Editor
0.1	First Draft	2007-04-20	Hans Born
0.2	Completed for draft release	2007-05-13	Hans Born
0.3	Documented config file and minor fixes.	2007-07-08	Hans Born