IDENTIFYING TECHNICAL PUBLICATION SHEET
FOR
COMMERCIAL MANUAL

1. PURPOSE: This technical publication is issued for the purpose of identifying and authorizing the following commercial manual for Navy use.

MANUFACTURER: E&S

CONTRACT NO: N61339-86-C-0164

EQUIPMENT: ESIG-LC Real Time System

TITLE: ESIG-LC Real Time System User's Manual for Version RTS10

ADDITIONAL IDENTIFICATION: Manual Number 901181-725E1

DATE: 2/1/90

USER'S MANUAL

ESIG-LC REAL-TIME SYSTEM

FOR VERSION RTS10

The following pages comprise Change 1, dated 1 February, 1990:

4-10

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INTRODUCTION AND GENERAL INFORMATION

1.1 INTRODUCTION

The ESIG-LC Real-Time System Manual is designed as a reference of commands and procedures for operating the ESIG-LC real-time system (RTS). It is intended to help both experienced and novice users understand the real-time system enough to use correct RTS commands.

The ESIG-LC real-time system is used on all members of the ESIG-LC family, including the ESIG-100, ESIG-200, ESIG-500, and ESIG-600.

(The ESIG-LC system was previously called SPX. All ESIG-LC hardware and software, including the real-time system, operating system, and modeling system, previously used the SPX name.)

It is assumed that the user of this manual has a basic knowledge of the real-time system, its operation, and the ESIG-LC database. For users less familiar with these concepts, Chapter 2 is intended as a quick introduction to the real-time system and Chapter 8 is an overview of the ESIG-LC database.

1.2 RELATED DOCUMENTS

The publications listed below provide information on equipment not covered in detail in this manual. Some related publications are generic in nature, and contain information not applicable to the system.

ESIG-LC Modeling Reference Manual	901181-459
ESIG-LC System Operation and Maintenance	901181-460
ESIG-LC Operating System Manual	901181-833

1.3 DOCUMENTATION CONVENTIONS

The following conventions are used throughout this manual:

- <CTRL/x> means to hold down the CONTROL key while pressing the indicated letter key.

- <RET> means that you should press the RETURN key.

- Computer code, screen messages, menu names and selections, and user input appear in COURIER type.

1.4 DOCUMENT STRUCTURE

Chapter 1 is an introduction to the manual.

Chapter 2 is intended as a quick introduction to the ESIG-LC real-time system. The subject is covered with enough information to get you acquainted with and begin running the system. Step-by-step instructions for starting the system and running a short mission are included.

Chapter 3 is the system overview, covering the parts of the ESIG-LC real-time system in some detail. The various hardware and software elements of the system are examined, along with their interaction.

Chapters 4 through 6 cover the RTS command line interpreter (CLI) commands, site file configuration, and host configuration. These are the commands used to configure and run the real-time system.

Chapter 7 covers the mission recording and playback (MIRP) procedures.

Chapter 8 covers the various objects included in the ESIG-LC database, and how the RTS manages these objects in real time.

The Appendices include an error message list, glossary of terms, and list of system capacities.

BEGINNING OPERATIONS

2.1 INTRODUCTION

This chapter is a quick introduction to the ESIG-LC real-time system. The subject is covered to provide you with enough information to get acquainted with the system and to begin running the system.

The chapter lists some common commands used while running the system, and includes a quick step-by-step guide (Section 2.9) for running a short simulation.

2.2 REAL-TIME SYSTEM OVERVIEW

The ESIG-LC real-time system (RTS) software program runs as a task under the ESIG-LC operating system and controls the display of the database objects on the display monitor in real time (instantaneously responding to commands). The RTS receives and interprets commands from the console or from the host computer. Using this information, the RTS selects from the database those items that should appear on the display, and moves the eyepoint according to the commands entered.

2.3 STARTING UP THE SYSTEM

Start the ESIG-LC system by powering up the computer. This is done by pressing the <Shift> and <F20> keys on the terminal (VT220 or higher) keyboard, or by pressing the power-on button. The computer will automatically boot, run a preliminary diagnostic test, and load the operating system from disk.

2.4 THE LOGIN FILE

After the operating system is loaded into memory by the booting process, it will look on the disk for the file LOGIN.COM, the login file, and execute the commands

in that file. The login file may be created to run a series of commands automatically after booting the system. The file usually includes the commands for loading the real-time system; if the command to invoke the real-time system is included in the file, the real-time system will automatically start after booting. The file LOGIN.COM is included with the system and does not need to be created.

2.5 THE SITE FILE

The ESIG-LC visual system is configured by the site configuration file, which must be present on the system. The site file is used to override any default configuration parameters in the system. By using the site file, a generic ESIG-LC system can be configured to match most applications. The site file SPX.SIT will be loaded automatically by the RTS during startup. See Chapter 5 for more information regarding the site file.

2.6 THE COMMAND/RESET FILE

A command file, also called the reset file, can be created to speed up the process of loading a database and setting system parameters. This command file can be executed from the SPX> prompt after starting the real-time system. The file would contain CLI commands (see Chapter 4 for a list of these), along with the name of the database to load. An example of the command file may be found at the end of Chapter 4.

2.7 STARTING UP RTS

After booting, the operating system looks for the LOGIN.COM file. If this is present, the operating system will run it. If the system is set up as turn-key, the login file will contain the command to start the real-time system automatically; if this is the case, you will need to do nothing to start the real-time system.

If the login file is not present, or does not contain the command RTS, then you must manually enter the command. The real-time system is started from the > operating system prompt by typing the command:

```
> @RTSn <RET>
```

where *n* is the version number. This loads the real-time system as a task under the operating system. The real-time system will take control of the image generator.

2.8 COMMONLY USED CLI COMMANDS

Command line interpreter (CLI) commands are entered via the keyboard of the console or flybox. A complete list of all CLI commands with their options is found in Chapter 4. The following is a list of some of the more commonly used commands:

CLOUDS
This command enables or disables the presence of clouds in the scene. It allows you to select cloud height (both top and bottom) and whether the clouds are scudded.

CONTINUE
This command continues the processing of a reset file that has been halted by the WAIT command. Continues on the next line after the WAIT.

CS
This command allows the user to select and modify the characteristics of the coordinate system he wants to use.

ENGINEER
This command allows the user to select which engineering options he wants to use.

GFOG
This command enables or disables ground fog.

HAT
This command enables or disables height above terrain.

HELP
This command allows the user to get help for each command in the command line interpreter (CLI).

LOBE
This command allows the user to have all or some portion of the aircraft's landing lights illuminated.

MIRP
This command allows the user to record or playback a mission scenario.

MODEL
This command allows the user to select which database he wants to use.

SET
This command allows the user to set various options.

SHOW
This command selects the statistics screen and shows the current state of certain parameters.

STORM
This command enables or disables a storm. It also allows the user to enable or disable lightning and rain.

SYSTEM
This command selects the system state.

VISIBILITY
This command selects the visibility.

2.9 SAMPLE RTS SESSION

Begin by powering up the system. The operating system will automatically load and bring the console screen to a system prompt >. If the LOGIN.COM login file is present and contains the RTS command, the real-time system will start automatically.

If the login file is not present, or does not contain the command to start the real-time system, you must enter the command manually. At the > prompt, type

```
@RTS10 <RET>
```

(Throughout this section, each command line must be completed by pressing the <RET> key on the keyboard, sometimes marked <RETURN> or <ENTER>.) The system will execute the RTS.COM file.

The main routine of the real-time system then takes control of the system, and initializes the system. The site file (which can override default environment parameters by entering new values) is loaded. A generic sky and ground scene will appear on the display.

The system will now display the coordinate screen with an SPX> prompt below it (Figure 2-1).

```
┌─────────── SCREEN 0 — EYE & COORDINATES ───────────┐
│ Eyepoint              │ CSn:                        │
│   x:       ft    lat: │   x:       ft    lat:       │
│   y:       ft    lon: │   y:       ft    lon:       │
│   z:       ft    alt: │   z:       ft    alt:       │
│   h:    deg           │   h:    deg                 │
│   p:    deg    knots: │   p:    deg                 │
│   r:    deg    hat:   │   r:    deg                 │
│   select:      vis:   │   select:   version: <RTSXX>│
└───────────────────────┴─────────────────────────────┘

SPX>
```

914819-0P2

Figure 2-1. The Coordinate Screen

This screen is used by the RTS to display eyepoint and coordinate system positional information. For example, as you navigate the eyepoint or another dynamic

coordinate system through the database, the system will display the eyepoint's coordinates (X, Y, and Z), attitude (H, P, and R), and so forth.

Below the data display area is the SPX> prompt, where you may enter command line interpreter (CLI) commands.

The system is now ready to run. You must first load a database and set up default parameters. The easiest way to do this is with a command file that combines the commands to load the database with other commands setting the environment and default parameters. At the SPX> prompt, type

```
@SPXATP.RST <RET>
```

This is the name of a sample command file that will load a database and various system parameters. After entering this command, the system will execute the commands contained in the file. The display screen will blank for a few seconds, then a new scene will appear.

You are now ready to fly. First use the keys of the keypad, as shown in Figure 2-2, to begin to move the eyepoint. For example, pressing the <8> key will decrease the pitch of the eyepoint (nose down). Pressing the <2> key will increase the pitch. Other keys will move and rotate the eyepoint in other directions. Pressing a key multiple times or holding it down will increase the magnitude of the direction change. The <ENTER> key will move the eyepoint in the direction of the heading, pitch, and roll. (The eyepoint is initially in a position and direction so that pressing the <ENTER> key will bring the eyepoint in for a landing.)

Try moving the eyepoint in all directions, increasing and decreasing speed. The <5> key will stop all heading, pitch, and roll changes, and the <0> key will stop all changes (this is the panic button).

Now try typing in a few commands. Follow each by pressing the <RETURN> key. Try each of these to see what result they produce:

VISIBILITY M 1	(set visibility to 1 mile)
VISIBILITY M 49	(set visibility back to the maximum 49 miles)
CLOUD + T 1800 B 800	(this sequence will turn on clouds with the bottom at 800 feet and the top at 1800 feet)
CLOUD -	(turn the clouds off)
SET DUSK	(set the scene to dusk)
SET NIGHT	(set the scene to night)
SET DAY	(set the scene to day)
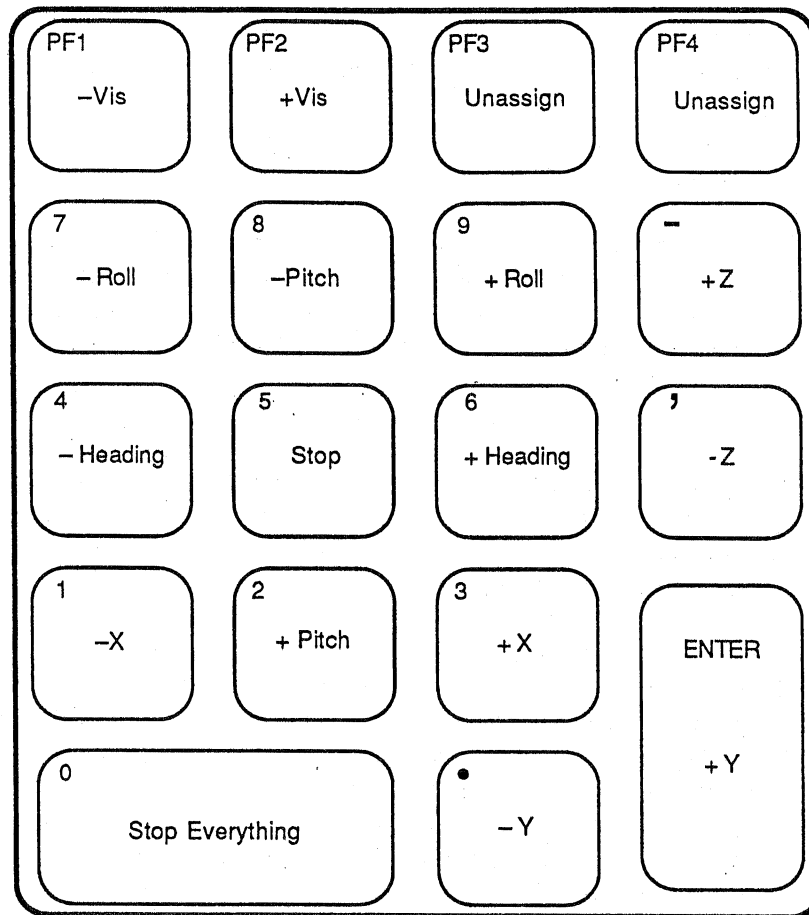
914817-0P0

Figure 2-2. Keypad

Many other commands are available. See Chapter 4 for a complete listing of CLI commands that may be typed in.

At any time, another command file may be loaded by typing

    @*filename* <RET>

at the SPX> prompt, substituting a valid command filename for *filename*. If the filename extension is not included, .RST will be assumed.

To exit the system, type

    SYS E <RET>

The real-time system will shut down and the computer will return to the operating system.

ESIG-LC SYSTEM OVERVIEW

3.1 INTRODUCTION

The ESIG-LC system is composed of both hardware devices and software programs and data. The real-time system, a software program, provides the interface between the user and computer system, allowing the user to control the movement of coordinate systems and change system parameters.

The various parts of the hardware and software systems are discussed in the following sections.

3.2 HARDWARE COMPONENTS

The hardware used and managed by the real-time system includes the following devices.

3.2.1 System Console and Flybox

The system console (or terminal), which includes monitor and keyboard, is the local I/O device used on the ESIG-LC system. The real-time system command line interpreter (CLI) provides the interface between the system console and the real-time system program. This system console can be used in place of or in combination with the host computer to give commands to the ESIG-LC system.

The flybox can be used in place of the console; it has a keyboard, keypad, and small display which are functionally the same as the console's. In addition, the flybox has a joystick, that may be used for entering directional information, and a slidepad, which is used to dynamically change the coordinate system velocity.

3.2.2 Host Computer

The host computer is not part of the image generator (IG) system, but sends information to the IG to modify the display. The host controls the simulation cockpit controls, display gauges, and motion simulators. The trainee sits in a cockpit controlled by the host; the host reads the trainee's movement of the controls and translates these into commands that it sends to the ESIG-LC real-time system. In addition, the host controls the instrument gauges and any motion simulators. The host computer interface section of the real-time system provides the capability to move data from the host to the IG. The host system is discussed further in Chapter 6.

The only part of the IG present in the simulation cockpit is the display monitor(s). Figure 3-1 shows how the different parts of the system relate to one another. Notice that the display is the only part of the IG that is physically present in the host system.
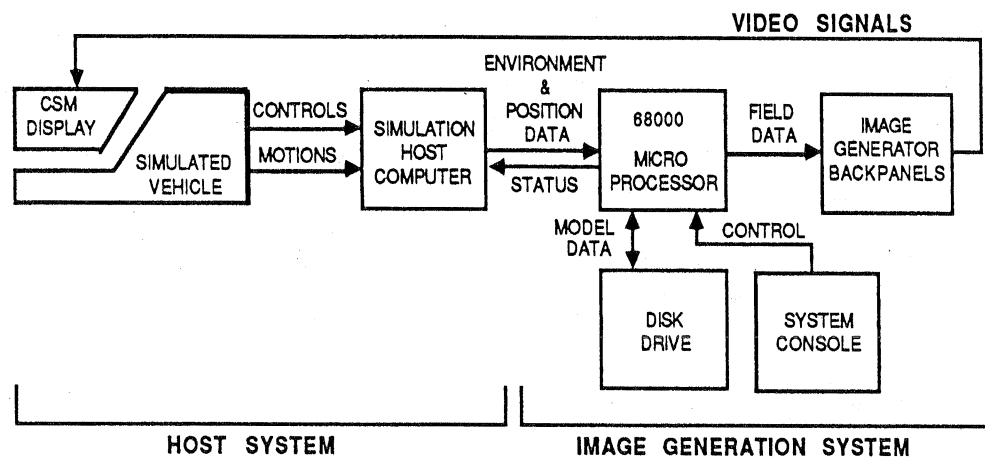
Figure 3-1. Image Generator and Host

3.2.3 Ethernet Interface

All host-to-IG and IG-to-host communication passes through the Ethernet interface. The ESIG-LC real-time system receives positional commands and environmental information from the host computer. Positional commands place the eyepoint and host-controlled dynamic coordinate systems within the database. The environmental information tells the RTS about the time of day, clouds, fog, and light string switch settings. The Ethernet uses industry-standard hardware as the interface between the IG and host computers.

3.2.4 Multiprocessor Card (MP)

The ESIG-LC real-time system runs on an E&S-designed multiprocessor card (MP). The card contains a 68000 microprocessor utilizing a 32-bit internal and a 16-bit

external architecture. The programs for this card are written in 68000 assembly code and in the high-level C programming language.

3.2.5 Channel Processor

The image generator can support up to eight channel processors, each generating a different view of the database. Each channel processor contains an object manager (OM), a geometric processor (GP), environmental memory (EM), and a display processor (DP). The output of the channel processor is the display.

Figure 3-2 shows how the displays are related to the channel processors and other parts of the system.
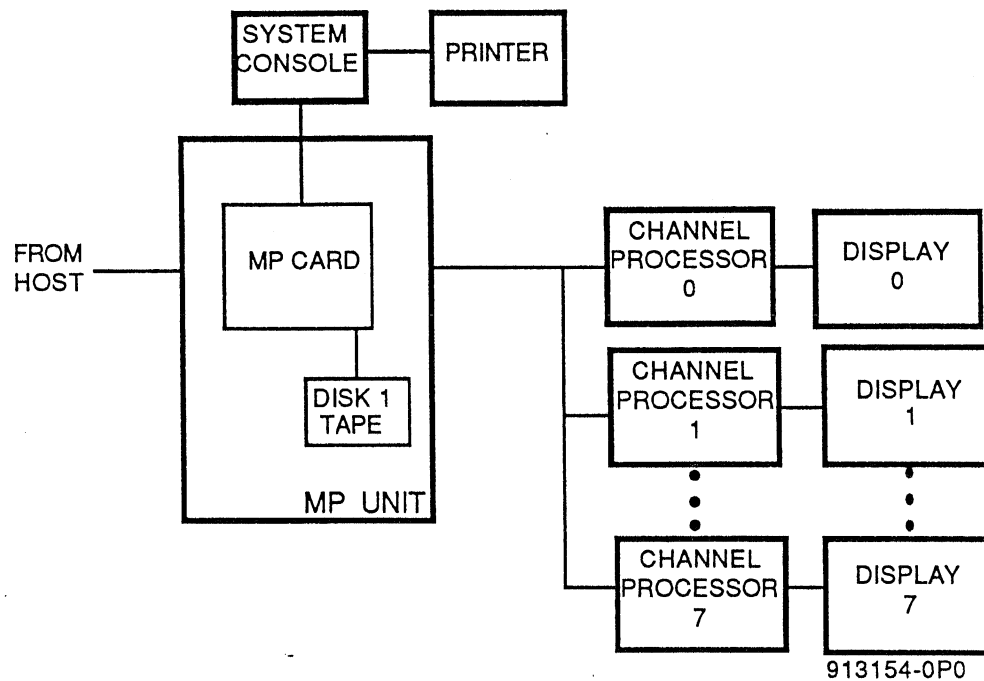
Figure 3-2. Channel Processors

3.2.5.1 Environmental Memory

The environmental memory interfaces with the channel processor. The mesh, cell, and object data are brought directly from disk to this memory so that the OM and GP can use them. The real-time system manages the environmental memory by tracking the position of on-line data and filling vacant memory positions with new data.

3.2.5.2 Object Manager

The object manager takes care of priority processing of the database and database management processing (paging). OM database management consists of determining what portions of the database will be in the field of view within the next few

frames, and sending that portion to be processed; only potentially visible database objects are thus processed, cutting down on processing load and memory requirements.

3.2.5.3 Geometric Processor

The geometric processor works with the individual polygons and light strings that make up an object, calculating how each should appear on the display screen as a result of the eyepoint perspective and environmental information. It performs the following operations on the polygons and light strings, then passes the results to the display processor:

- translational and rotational geometry calculations

- polygon and light string clipping

- light and polygon switch intensity related calculations

- rotating light and directional light calculations

- sun shading calculations

3.2.5.4 Display Processor

The display processor is a frame buffer with two parts, the input (DPin) and output (DPout) sides. The input side is filled with display data by the geometric processor, while the output side is being emptied into the display. The input side performs the fog, texture, ambient, and landing light lobe calculations while the output side is communicating with the display device.

3.2.5.5 Displays

The display is a cathode-ray tube (CRT) device used as the final output for IG scenes. Each display in the system is driven by its own channel processor and given a specific view of the database.

3.2.6 Other Peripherals

The disk is a storage device, usually a Winchester hard disk, used to store the executable programs, databases, diagnostics, and data files required to operate and maintain the IG. The real-time system retrieves only that portion of the database from the disk required for the current display to load into memory.

A streaming tape backup device is usually included for backup and transfer of database information and other data on the disk.

The ESIG-LC system may have other hardware devices attached, depending upon the system configuration. The system console will most likely have a printer attached to produce hard copies of the commands used for missions.

3.3 OPERATING SYSTEM

The ESIG-LC operating system is a general-purpose operating system that provides support for user task scheduling, peripheral I/O handling, and file management.

The ESIG-LC operating system, which resides on the system disk, is automatically loaded and is executed at system power-up/reset. Upon execution, the operating system activates its shell task, which provides the user interface for accepting and processing commands (see the *ESIG-LC Operating System Manual*).

The operating system interacts with the real-time system just like any other user task. It loads the real-time system from the disk, and schedules it for execution. The shell task is suspended, and the real-time system task starts.

During execution of the real-time system task, the following operating system functions are used:

- Serial port (console) I/O handling and file management (during system initialization)

- Timed task management for coordination of real-time system foreground and background tasks

- Direct disk I/O servicing for database management

When the real-time system is terminated, its task is suspended by the operating system scheduler. The shell task is then resumed, and the operating system user interface becomes active again.

Filenames in the ESIG-LC operating system must be in the following format: one through eight characters, with a letter in the first position, followed by an optional three-character extension which is separated from the name by a period.

3.4 REAL-TIME SYSTEM

The real-time system is the software portion of the ESIG-LC system that controls the display of images on the screen in *real time*; that is, with instantaneous timing that simulates what the eye would see in the real world. The real-time system, or RTS, receives commands from the host computer or the console, and interprets these so that the image generator (IG) can select what items from the database will be displayed and in what manner. The IG is the hardware device that actually generates the image that appears on the screen.

The real-time system program, RTS*nn*.EXE, is compiled from many different source programs, most of which are single routines of the RTS. Among these are the main routine, the command line interpreter (CLI), the host interface, and the database manager. These parts of the RTS program link in turn to other programs and data files to produce the ESIG-LC display as shown in Figure 3-3.
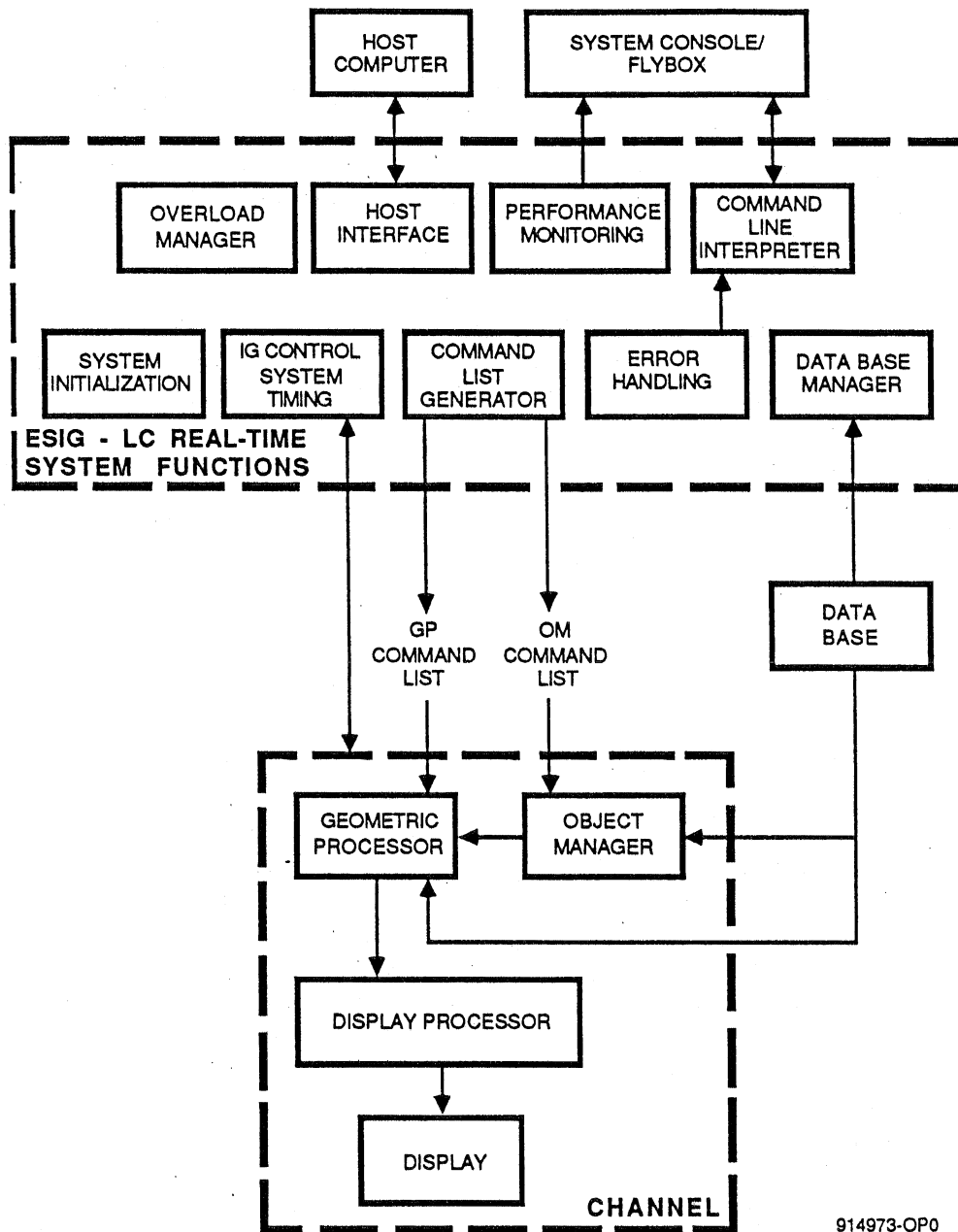
Figure 3-3. Real-Time System Routines

3.4.1 Main Routine

The main routine is a section of the RTS software program which takes control of the system immediately upon execution of the RTS program. The main routine will branch to other parts of the program depending upon the mode of the system at program execution.

3.4.2 Initialization

Before image generation can begin, the system must first be initialized. This consists of assigning the default configuration parameters, reading in and processing the site configuration file, preprocessing the world file, establishing the RTS/IG interface, and loading the channel processor memory.

3.4.2.1 Default Configuration vs. Site Configuration

The default configuration parameters are embedded in an RTS-configuration module assigned at the beginning of initialization. These parameters can be reassigned at any time without reloading the RTS. After these parameters are assigned, the site configuration file is accessed; the site file is used to tailor the real-time system to a particular installation. The new parameters from the site file overlay the default parameters; the only default parameters used are those that are not replaced by the site file (see Chapter 5, Site Configuration.)

3.4.2.2 Preprocessing the World File

The world file (the list of all parcels to be used in the scene) is loaded from disk and preprocessed during initialization. Preprocessing includes checking each parcel for completeness and computing physical disk addresses from ASCII filenames.

3.4.2.3 RTS/IG Interface Initialization

The initialization of the RTS/IG interface puts all channel processors in an initialized mode, enables the done interrupts, and sets up the real-time system done interrupt service routines.

3.4.2.4 Channel Processor Memory Loading

The last step in the initialization process loads the channel processor memory with data. The loading includes the color palette, the landing light lobe patterns, and the visibility curve.

3.4.3 Host Interface

The host computer interface section of the real-time system provides the ESIG-LC system with the capability of receiving data from the host computer. (The host

computer is not part of the ESIG-LC system and is not manufactured by Evans & Sutherland; it is the device that controls the simulation cockpit with its controls, display gauges, and motion simulators.) The host interface is discussed in detail in Chapter 6.

The Ethernet hardware places the information from the host computer directly into the ESIG-LC real-time system memory space. When the host block arrives, the Ethernet interrupt service routine processes an interrupt. The host data remains in the Ethernet buffer until the beginning of the next real-time system field. At this time the Ethernet routine checks to see whether new data has been received; if it has been received, it is brought on-line. The extrapolation routine which corrects the positional data executes next; this routine uses the difference between the current time and the time the host information was received to extrapolate the new eyepoint or DCS position. The real-time system services the Ethernet interrupt, which tags the host data with the time so the extrapolation routine will know precisely when the data arrived.

The Ethernet routine checks to see whether new host data has been received since the last field calculations were made. If so, the new host data is moved into a data buffer and the Ethernet buffer is released; the Ethernet hardware has four buffers with which to work. It rotates through these buffers so that there is no possibility of overwriting data. The Ethernet routine returns the buffer to the Ethernet hardware as soon as it has moved and processed the data.

3.4.4 RTS Modes

The main routine takes control of the system immediately upon execution of the RTS program, then branches to other parts of the program depending upon the system mode. You can change the mode of the system with the command line interpreter (CLI) SYSTEM command, or the real-time system can change its own mode. Figure 3-4 shows the modes that are possible in the system.
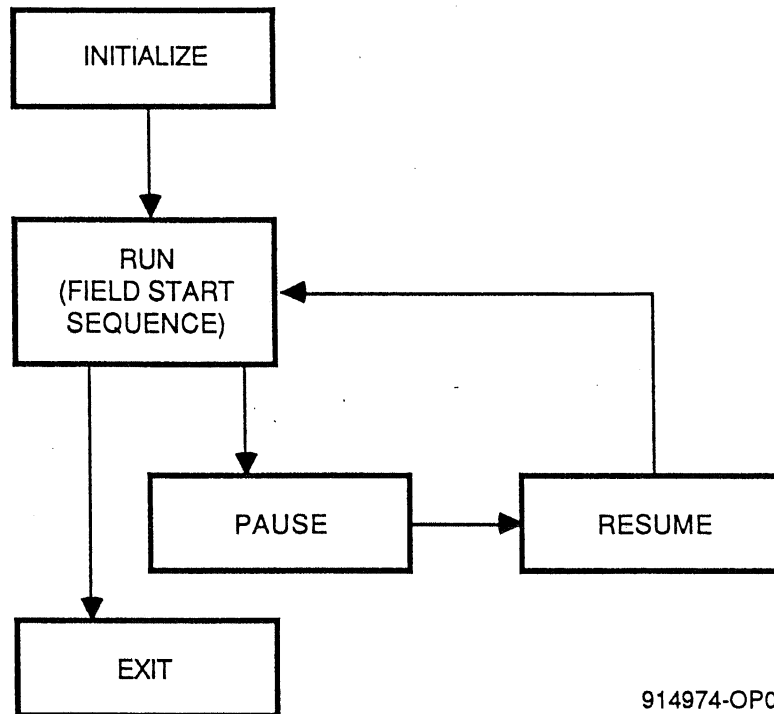
Figure 3-4. RTS Modes

3.4.4.1 Initialize

When the real-time system is first started, it sets the mode to initialize, which initializes the entire image-generating system, including channel processors and the MP card. The site file is then read in (see Chapter 5). There is no image generation during this mode. After initialization has been completed, the real-time system changes to the run mode.

3.4.4.2 Run

Image generation is carried out during the run mode. The real-time system can remain in this mode indefinitely.

Each display field, about 50 times per second, the field-start sequence must be run. This consists of starting the real-time system followed by the object manager, the geometric processor, and the display processor in each channel processor unit. Each of these devices must be started each field. The real-time system uses the clocks on the MP card to signal when each of these events must happen.

When a new real-time system field is started, the following events occur:

1. A clock is set to interrupt the real-time system field when it is time to start the OM. The fields for the real-time system and the OM are offset with the amount of time required for the real-time system to get a command list ready for the OM.

2. The two most recently received host packets are used to determine new positional data for the eyepoint and all active dynamic coordinate systems.

3. If the host is providing the IG with lat/lon data (sending latitude and longitude information instead of x/y information), the positional data for the eyepoint and the dynamic coordinate systems must be converted from latitude/longitude data to x/y data before it can be sent to the object manager.

4. A new command list is prepared for the OM. This list includes the new positional data for the eyepoint and each active dynamic coordinate system, the entry point for each active parcel in priority order, and a description of the views to be processed. The same list is provided to each channel processor. See Section 3.4.10 for a description of the command list.

5. A new command list is prepared for the GP. This list includes the light and polygon switch settings, fog system data such as visibility and scud, and ambient data (or time of day). The same list is provided to each channel processor. See Section 3.4.10 for a description of the command list.

6. After the start of the OM, the real-time system handles user keyboard input, CD and HAT processing, ACR, and changing environments, and builds the packets for return over the ethernet.

7. When the clock interrupt is received, the real-time system stops its current process and starts the OM in each channel processor. In addition, it resets the clock to send another interrupt when the GP should start, then restarts its process where it left off. This cycle occurs twice more—once for the interrupt which starts the GP in all channel processors, and once for the interrupt which starts the DP in all channel processors. The amount of offset between the OM and GP fields, and the GP and DP fields, depends on the time required to get the new command list ready.

8. Any time remaining in the real-time system field is allotted to the non-field rate (or background) tasks: selecting and prioritizing the active parcels, servicing disk requests from the hardware pager, and monitoring the system console. When this time is up, the real-time system starts a new field and the process repeats.

3.4.4.3 Pause

The pause mode stops image generation, but allows the CLI to stay active. The RTS forces the pause mode when there is a fatal error. Because the CLI is still active, the user retains control of the real-time system.

3.4.4.4 Resume

The resume mode changes the system from a pause mode back to a run mode, where image generation is restarted.

3.4.4.5 Exit

The exit mode begins the real-time system shutdown routines. Only the user can change the system to this mode; this is done with the SYSTEM EXIT command. At the end of the shutdown routine, the main routine terminates itself and returns control of the computer to the operating system.

3.4.5 Performance Monitoring

The real-time system monitors its own performance as well as the performance of the IG by recording both the start and done times for each field. The statistics processor uses this information to compute the processing times for the real-time system, the object manager, the geometric processor, and the input and output sides of the display processor. This information is provided to the user as part of the system statistics and is also used for overload management.

The real-time system receives four done interrupts, one each from the OM, GP, DPin, and DPout. The done interrupt is a signal issued by a particular device when it has completed processing, and allows the real-time system to record the precise time it took to process the field.

The real-time system monitors both the field rates and the entities processed by the image generator. Field rates are provided for the RTS, the OM, the GP, and the DP. The field rates are further qualified by the number of cells, objects, polygons, and light points processed by a specified channel processor. This capability provides vital information to the database designer about the load on the image generator and the distribution among the channel processors.

3.4.6 Overload Management

The real-time system can support a different field rate for day, dusk, and night. The field rate is tied directly to the display type and the database used with the system. If the system cannot perform at this field rate (because of the scene containing too many high-level-of-detail (HLOD) objects, for example), overload management is invoked. The three forms of overload management are field extension, level-of-detail management, and random light management.

3.4.6.1 Field Extension

Field extension occurs in the system when either the real-time system or one of the channel processors cannot finish its task in the allotted field time; the whole visual system slows down to match the worst-case field rate. The user can specify the maximum length of the field extension through the CLI TABLE command; see Section 5.3.23. If the system still cannot function at the slower field rate, then a timeout message is sent to the system console identifying the section having the problem. The problem field is aborted, and a new field is started. If three successive

fields must be aborted, then the RTS is forced to the pause mode which stops image generation.

3.4.6.2 Level of Detail Management

Some types of displays do not allow field extension, but must run exactly at a prescribed field rate. In these cases level-of-detail management and random light management are the only two forms of overload management available; in level-of-detail management the OM attempts to trim the amount of database being activated by reducing the level of detail to bring the processing time down to normal.

The overload stress signal is communicated to the OM in the form of a constant known as KLOD (Konstant for Level Of Detail) which the real-time system adjusts to reduce the current amount of overload in the system. The user can set the maximum KLOD to restrict the LOD of all objects, and/or set the minimum KLOD to restrict the amount of change that overload management can make to the scene. If KLOD is 100%, then the transition ranges for all objects will be at their modeled distance. Reducing KLOD will reduce the transition range, so the eyepoint will be closer to the object before the high level of detail will be displayed.

The OM uses the KLOD number to adjust object transition ranges so that high-level-of-detail parts of objects come into the scene later. Typically, this eliminates things like numbers on an airplane's fin, black marks on a runway, and other things that are not completely necessary for the integrity of a scene. This means that the channel processors see less of the database, thus reducing the processing time.

3.4.6.3 Random Light Management

Overload management in the form of random light management is necessary if the DP draw time is too high. The DP tries to reduce the draw time by reducing the number of random lights in a fill area and thus reduce the number of calligraphic light points it has to draw.

The overload stress signal is communicated to the DP in the form of a constant known as KRAN (Konstant for RANdom light management) which the RTS adjusts to reduce the DP draw time if it is over the field time. The user can set the maximum KRAN to restrict the percentage of random lights in a fill area, and/or set the minimum KRAN to restrict the lower limit on the percentage of random lights in a fill area.

3.4.7 Command Line Interpreter

The command line interpreter (CLI) is a user-interface routine that allows an operator to interact with the real-time system. The CLI handles command input, flybox control, console screens, and error display. The CLI is discussed in detail in Chapter 4.

3.4.8 Error Handling

All system error reporting is handled via the CLI since it controls the input/output to the system console. Any error detected by the RTS is sent to the global error queue. Each field, the CLI determines whether there are any error messages in the queue; if there are errors, the CLI displays them immediately on the system console, then resumes its normal mode of operation.

3.4.9 Database Management

The database management section of the real-time system performs the following tasks:

- Parcel selection and management

- Coordinate system management such as animation, routed and converging traffic, conversion of latitude/longitude data to x/y data for the image generator, and mesh and object management in conjunction with the hardware pager

- Special effects that are applied to the scene such as fog, clouds, rain, storm, landing light lobes, time of day, horizon brightness, and light and polygon switch settings

The database is discussed further in Chapter 8.

3.4.10 Command List Generation

Command list generation is the final result of the RTS processing. The database management status is sent to the channel processor through the command lists. The commands are organized in two lists in the environment memory: one list for the object manager and another for the geometric processor. There is no direct interface between the RTS and the display processor; the DP receives RTS commands via the object manager and geometric processor.

3.4.10.1 OM Command List

The real-time system builds the object manager command list each field to provide step-by-step instructions for the OM to manipulate the database for each channel view. Included in the list are the database tree entry point for each active parcel in priority order, positional data for each active coordinate system including the eyepoint, and a description of the views to be processed.

The same command list is provided to each channel processor; the channel executes the command only if the ID number accompanying the command matches the ID number assigned to the channel during system initialization.

3.4.10.2 GP Command List

The real-time system and the object manager jointly build the geometric processor command list. This is created each field and provides step-by-step instructions much like the OM command list.

The section of the command list built by the real-time system is duplicated in all channel processors; it contains information about light and polygon switch settings, fog system data, and ambient data (time of day).

The section built by the OM is unique to that channel processor since it can only pass commands to the GP contained in the same unit. Information provided by the OM includes the list of objects to be processed in priority order and the translational and rotational information necessary to transform the objects from their modeled coordinate system into the channel processor's coordinate system.

3.5 DATABASE

A database is a list of objects that may be displayed on the display monitor. Objects may be composed of vertices, polygons, and lights, and are grouped into cells, meshes, and parcels. These objects are modeled to represent objects in the real world, and are processed by the RTS for display. Databases, database objects, and database management are discussed in Chapter 8 and in the *ESIG-LC Modeling Reference Manual*.

COMMAND LINE INTERPRETER

4.1 INTRODUCTION

The command line interpreter (CLI) is the user interface routine for the ESIG-LC real-time system. It communicates with the RTS by accessing common data structures. The user has great flexibility to modify the image-generation features of ESIG-LC during run time.

4.2 COMMAND LINE FORMAT

The ESIG-LC user prompt looks like this:

    SPX>

CLI commands are entered at the prompt, together with their associated qualifiers or options. Entering the command alone without options or qualifiers will return the status or settings for that command, while entering the command with options or qualifiers will change the status or settings for the command. The following syntax is used:

    SPX> COMMAND [switch] [option [qualifier]]...

where: [ ]   refers to optional items on the command line

        ...   means that each [ ] may be repeated

A space or tab must separate each element of the command line. All or enough of the command to make it distinguishable by the CLI may be entered on the command line. If conflicts arise, commands are picked in alphabetical order. For example, SYSTEM may be abbreviated as SYS, and FILE may be abbreviated as F, but SYSTEM may not be abbreviated as S since SET will be picked alphabetically before SYSTEM.

Some commands have switches associated with them; the switch either enables or disables the command. A plus (+) enables and a minus (-) disables a command or option. A command change requires the plus or minus or an option, since the command alone will return the status.

Command options may be entered in the same manner as the command itself; all or enough of the word must be entered to make it distinguishable by the CLI; indistinguishable abbreviations are picked in alphabetical order. For example, ENGINEER KEYPAD 3 could be abbreviated ENG KEY 3, but CS SELECT 20 could not be abbreviated CS SE 20 because the SE would be interpreted as SECONDS.

An option may have a number, a filename, a string, or a switch as a qualifier. If an option which uses a switch is typed on the command line without a qualifier, that option is enabled.

A number may be real or integer. If a real number is given for an option which requires an integer, the fraction portion is truncated to make the real number an integer. All numbers are treated as decimal.

A filename consists of up to eight characters; numbers and the underscore character (_) may appear in the filename, but may not be in the first position. The filename is followed by an up to three-character extension separated from the name by a period. String structure is the same as filename structure except it may not include the extension.

These are some examples of CLI commands:

SPX> EYE X 45.5 Y 34.4 SEL 1
    (eyepoint's x is 45.5, y is 34.4, and select is 1)

SPX> MODEL WORLD FILE2.WF PARCEL 3
    (the model world file becomes FILE2.WF and the parcel is 3)

SPX> STORM + LIGHTNING RAIN -
    (The storm command is enabled, lightning is enabled, and
    rain is disabled)

SPX> CLOUD + B 800 T 1800
    (Clouds with the bottom at 800 and the top at 1800 feet are enabled.)

4.3 COMMANDS

This section describes the command names, the option descriptions, and qualifiers that the CLI uses. The commands are listed in alphabetical order, as are the options for each command. The following CLI commands are valid:

ANIMATION	Animation
AUX	Auxiliary Port
BEACON	Beacon
CHANNEL	Channel
CLOUDS	Clouds
COLD	Collision Detection
COLOR	Color
CONTINUE	Continue Reset File
CONVERGING	Converging Traffic
CS	Coordinate System
DELETE	Delete a file from the directory
DIRECTORY	List files in the directory
ECHO	Echo file execution on console
ENGINEER	Engineer
EYEPOINT	Eyepoint
FILE	File
GFOG	Ground Fog
HAT	Height Above Terrain
HELP	Help
LOBE	Landing Light Lobes
MAN	Help
MIRP	Mission Record and Playback
MODEL	Model Change
PATCH	Patch Address
PICKER	Purple Polygon Picker
REFRESH	Refresh Screen
ROUTED	Routed Traffic
SET	Set
SHOW	Show
SNAPSHOT	Snapshot
STORM	Storm, Lightning, and Rain
STROBE	Strobe Lights
SWITCH	Light and Polygon Switches
SYSTEM	System
TABLE	Table Entries
VECTOR	HPR from eyepoint to testpoint
VISIBILITY	Visibility
WAIT	Reset File Wait

ANIMATION

This command selects an animation sequence for use by the system.

Syntax: **ANIMATION [options]**

Options:

1. CS [0 - number of coordinate systems]. Coordinate system number being bound to the animation sequence.

2. LOAD. Begins loading animation information for the sequence number chosen. The information is brought on-line but is not activated.

3. PARCEL [0 - 255]. Parcel index number in the world file.

4. PLACEABLE [switch]. Selects if the parcel is placeable or local.
    + = placeable parcel
    - = local parcel

5. SELECT [0 - 255]. Select switch within the coordinate system.

6. SEQUENCE [number]. Animation sequence number.

7. START. Begins the animation.

8. STOP. Stops the animation. It overrides any control within the animation sequence itself.

9. UNLOAD. Unloads the animation information.

Example: ANIM LOAD SEQ 0 CS 3 SEL 1 PLACE + PAR 2
(Load animation sequence 0 from placable parcel 2 and tie it to CS 3 with a select of 1.)

AUX

This command enables or disables the auxiliary port. This command may not be used at the command level. This command is **currently not implemented.**

Syntax: AUX [switch]

Switch:
   (+)   A plus key enables the feature.

   (-)   A minus key disables the feature.

Example: AUX -
   (Disable the auxiliary port.)

BEACON

This command enables or disables the ownship anti-collision beacon. The ownship refers to the eyepoint's coordinate system.

Syntax: BEACON [switch]

Switch:
    (+)   A plus key enables the feature.

    (-)   A minus key disables the feature.

Example: BEACON +
    (The beacon is turned on.)

CHANNEL

This command defines the channel processor configuration capability.

Syntax: **CHANNEL [options]**

Options:

1. ACOLOR. Alternate color selection for channel. This is the opposite of MCOLOR.

2. AVIEW. All channel options refer to alternate viewport. This is the opposite of MVIEW.

3. DISPA [switch]. Enable or disable display A.

4. DISPB [switch]. Enable or disable display B.

5. HEADING [-360 - 360 degrees]. Heading orientation for viewpoint.

6. HORIZONTAL [0.5 - 90 degrees]. Horizontal half angle of viewpoint.

7. MCOLOR. Main color selection for channel. This is the opposite of ACOLOR.

8. MVIEW. All channel options refer to main viewpoint. This is the opposite of AVIEW.

9. NUMBER [0 - number defined for system]. Channel number. Default is 0.

10. PITCH [-360 - 360 degrees]. Pitch orientation for viewpoint.

11. ROLL [-360 - 360 degrees]. Roll orientation for viewpoint.

12. VERTICAL [0.5 - 90 degrees]. Vertical half angle of viewpoint.

13. X [number]. X offset of channel to eye.

14. Y [number]. Y offset of channel to eye.

15. Z [number]. Z offset of channel to eye.

Example: CHANNEL NUMBER 2 PITCH 180
       (Set the pitch of channel 2 to 180°.)

CLOUDS

This command enables or disables the presence of clouds in the scene. It allows the user to select cloud height (both top and bottom) and whether the clouds are scudded (jagged tops and bottoms).

Syntax: **CLOUDS [switch] [options]**

Switch:
  (+)   A plus key enables the feature.

  (-)   A minus key disables the feature.

Options:
  1.   BOTTOM [number]. The height in feet of the bottom of the cloud layer.

  2.   SCUDDED [switch]. Scudded clouds are enabled or disabled.

  3.   TOP [number]. The height in feet of the top of the cloud layer.

Example: CLOUDS + TOP 1800 BOTTOM 800
     (Turn on clouds with the top set to 1800 feet and the bottom at 800 feet.)

COLD

This command enables or disables collision detection, and sets the characteristics of the testpoints and collision indicator.

Syntax: COLD [switch] [options]

Switch:
(+)   A plus key enables the feature.

(-)   A minus key disables the feature.

Options:
1. AUTO [switch]. Enable or disable the automatic collision detection indicator.

2. CINDEX [0 - 1023]. Index into the color palette.

3. COLOR [0 - 1023]. Enable or disable color index validity.

4. INDICATOR [switch]. Collision detection indicator switch.

5. TESTPOINT [number]. Select testpoint number 0 - 31, or 255 to clear all testpoints.

6. X [number]. X offset from eyepoint in feet.

7. Y [number]. Y offset from eyepoint in feet.

8. Z [number]. Z offset from eyepoint in feet.

Example: COLD + TESTPOINT 3 X 27 Y -7
(Turn on collision detection, and activate testpoint 3 with an offset of 27 feet in X and -7 feet in Y.)

COLOR

This command allows the user to tune the color palette associated with the model. Use the command TAB O 113 V 1 to enable diagnostics before using the COLOR command.

Syntax: COLOR [options]

Options:
1.   BLUE [0 - 255]. Selects the blue value for that particular color.

2.   GREEN [0 - 255]. Selects the green value for that particular color.

3.   KEYPAD [switch]. Ties the arrow keys to the color number last entered through the NUMBER option. Mutually exclusive with TABLE and PICKER. (up: toggle up/down 1; left: red; down: green; right: blue)

4.   NUMBER [0 - 1023]. Selects which color in the palette to access. For polygons, the number entered is two times the modeled color number for the primary color, and two times the modeled color number plus 1 ((*model**2)+1) for the secondary color (for texture color blending). For lights, the number entered is two times the modeled color number plus 512 ((*model**2)+512).

5.   RED [0 - 255]. Selects the red value for that particular color.

6.   RESTORE. Restores SA to SB. (Undoes the swap).

7.   SA [0 - 1023]. Swap a color with SB.

8.   SB [0 - 1023]. Swap a color with SA.

Example: COLOR NUM 226 RED 100 GREEN 100 BLUE 100
(Set the color palette entry 226 to have red, blue, and green values of 100.)

CONTINUE

Continues the processing of a reset file that has been halted by the WAIT command. Continues on the next line after the WAIT.

Syntax: **CONTINUE**

Example: CONTINUE
(Continue a file that was halted by the WAIT command.)

CONVERGING

This command selects a converging traffic number to be used by the system.

Syntax: CONVERGING [options]

Options:

1. CS [0 - number of coordinate systems]. Coordinate system number being bound to the converging traffic number.

2. LOAD. Begins loading converging traffic information for the traffic number chosen. The information is brought on-line, but is not activated.

3. PARCEL [0 - 255]. Parcel index number in the world file.

4. PLACEABLE [switch]. Specify if the parcel is placeable or local.
    + = placeable parcel
    - = local parcel

5. SELECT [0 - 255]. Select switch within the coordinate system.

6. START. Begins converging traffic.

7. STOP. Stops converging traffic. Overrides any control within the converging traffic itself.

8. TRAFFIC [number]. Converging traffic number.

9. UNLOAD. Unloads the converging traffic information.

Example: CONV LOAD TRAF 2 CS 3 SEL 2 PLACE - PAR 0
(Load converging traffic 2 from local parcel 0 and tie it to CS 3 with a select of 2.)

CS

This command allows the user to select the coordinate system to use or set the CS characteristics and query.

Syntax: **CS [options]**

Options:

1. ALTITUDE [number]. Z offset from base coordinate system.

2. DEGREES [integer]. This command indicates the degrees latitude or longitude. This number must be in the range of 0 to 359.

3. HEADING [-360 - 360 degrees]. Heading angle for coordinate system.

4. LATITUDE [switch]. This command sets the flag indicating that succeeding inputs relating to degrees, minutes, and seconds will affect latitude data.

5. LATLON [switch]. Enable or disable lat/lon.

6. LATLOWER [number]. Lower latitude number. The valid range is $0 - (2^{32}-1)$.

7. LATUPPER [number]. Upper latitude number. The valid range is 0 - 31.

8. LONGITUDE [switch]. This command sets the flag indicating that succeeding input relating to degrees, minutes, and seconds will affect longitude data.

9. LONLOWER [number]. Lower longitude number. The valid range is $0 - (2^{32}-1)$.

10. LONUPPER [number]. Upper longitude number. The valid range is 0 - 31.

11. MINUTES [integer]. This command indicates minutes latitude or longitude. This number must be in the range of 0 to 59.

12. NUMBER [0 - number of coordinate systems]. Selects the current coordinate system. Default is 0.

13. PITCH [-360 - 360 degrees]. Pitch angle for coordinate system.

14. ROLL [-360 - 360 degrees]. Roll angle for coordinate system.

15. SECONDS [real]. This command indicates the seconds of latitude or longitude. Input must be between 0 and 59.99.

16. SELECT [0 - 255]. Select switch for coordinate system.

17. X [number]. X offset from base coordinate system.

18. Y [number]. Y offset from base coordinate system.

19. Z [number]. Z offset from base coordinate system.

Example: CS NUMBER 4 X 100 Y 100 Z 0
(Set the X, Y, and Z offsets of CS 4 to 100, 100, and 0, respectfully.)

DELETE

This command deletes the specified files from the directory [USERS] on disk DR0:. The wild card character (*) may be used in the file name or in the extension. Both a file name and an extension must be specified. The files that are deleted will be listed.

Syntax: DELETE [filename]

Example: DELETE JUNK.*F
    (Delete all files that match the file specification JUNK.*F.)

DIRECTORY

This command displays the directory of files for DR0:[USERS]. The wild card character (*) may be used in the file name or in the extension. The displayed directory information consists of the file name and extension, the file type, the file size and the creation date. If more file names are to be displayed than will fit on the screen, the user will be asked if he wants to continue the display.

Syntax: DIRECTORY [filename]

Example: DIRECTORY *.WF
(Display all files which match the file specification DR0:[USERS]*.WF. Verification for continuing to display more files that match the file specification will be requested if more than a screen full of files match the specification.)

ECHO

This command enables or disables the echo of reset files, environment tuning files, site files, etc. on the system console as they are interpreted. This command will be ignored if it is issued from the console; it is only accepted from within the file. The ECHO switch is automatically enabled after a file has been interpreted.

Syntax: ECHO [switch]

Switch:
    (+)   A plus key enables the feature.

    (-)   A minus key disables the feature.

Example: ECHO +
(Turn off echo.)

ENGINEER

This command allows the user to select an engineering option.

Syntax: **ENGINEER [options]**

Options:
1. FLIGHT [switch]. Enable or disable the flight dynamics mode of the keypad.

2. KEYPAD [0 - number of coordinate systems]. Selects which coordinate system is tied to the keypad.

3. LANDING [number]. The lowest altitude the coordinate system can go (to prevent going below ground level). Applicable in flight mode only.

4. RRATE [number]. Selects the rotation rate for the coordinate system being changed through the keypad. Number is in parts of a circle.

5. SCREEN [switch]. Enables or disables updating of the screen.

6. SLEVEL [number]. The altitude at which the approaching coordinate system will begin to be affected by the smoothing function if the SMOOTH option is enabled.

7. SMOOTH [switch]. Enables or disables the smoothing function when landing. The current coordinate system's altitude and roll values are affected. This option is applicable in flight mode only.

8. SRATE [number]. This is the altitude at which the approaching coordinate system will begin to be affected by the smoothing function. This number is applicable only if the SMOOTH option is enabled.

9. TRATE [number]. Selects the translation rate for the coordinate system being changed through the keypad. This number is in feet/512.

Example: ENGINEER KEYPAD 7
    (The keypad is tied to CS 7.)

EYEPOINT

This command is the eyepoint coordinate system select, and is based on CS 0.

Syntax:　　EYEPOINT [options]

Options:

1. DEGREES [integer]. This command indicates degrees latitude or longitude. This must be in the range of 0 to 359.

2. HEADING [-360 - 360 degrees]. Heading orientation of eyepoint.

3. LATITUDE [switch]. This command sets the flag indicating that succeeding inputs relating to degrees, minutes, and seconds will affect latitude data.

4. LATLON [switch]. Enable or disable lat/lon.

5. LATLOWER [number]. Lower latitude number. This must be in the range of 0 - $(2^{32}-1)$.

6. LATUPPER [number]. Upper latitude number. This must be in the range of 0 - 31.

7. LONGITUDE [switch]. This command sets the flag indicating that succeeding inputs relating to degrees, minutes, and seconds will affect longitude data.

8. LONLOWER [number]. Lower longitude number. This must be in the range of 0 - $(2^{32}-1)$.

9. LONUPPER [number]. Upper longitude number. This must be in the range of 0 - 31.

10. MINUTES [integer]. This command indicates minutes latitude or longitude. This must be in the range of 0 to 59.

11. PITCH [-360 - 360 degrees]. Pitch orientation of eyepoint.

12. ROLL [-360 - 360 degrees]. Roll orientation of eyepoint.

13. SECONDS [real]. This command indicates the seconds latitude or longitude. This must be in the range of 0 to 59.99.

14. SELECT [0 - 255]. Selects select switch tied to eyepoint.

15. X [number]. X offset from ground coordinate system.

16. Y [number]. Y offset from ground coordinate system.

17. Z [number]. Z offset from ground coordinate system.

Example: EYEPOINT HEADING 90 PITCH 15 ROLL 5
(Set the eyepoint's heading to 90˚, its pitch to 15˚, and its roll to 5˚.)

FILE

Changes or queries the filenames in the ESIG-LC file table. See Table 4-1 for a list of the files.

Syntax: **FILE [options]**

Options:
1. INDEX [0 - number of files in table]. Index into the ESIG-LC File Table (below).

2. NAME [filename]. New filename to be entered into the ESIG-LC File Table (below).

Example: FILE INDEX 0 NAME CSM04.LIT
      (Change file 0 in the ESIG-LC File Table to CSM04.LIT.)

Table 4-1. ESIG-LC File Table

File Index	Default	File Description
0	CSM03.LIT	Cal. light intensity/unblank file (CSMs)
1 - 9	Reserved	
10	SPX.RDF	Cal. light range defocus file
11 - 19	Reserved	
20	SIGMA04.DAT	Sigma (visibility) file
21 - 29	Reserved	
30	SPXOM.LLL	ESIG-500 landing light lobe pattern (chn 0)
31	SPX1M.LLL	ESIG-500 landing light lobe pattern (chn 1)
32	SPX2M.LLL	ESIG-500 landing light lobe pattern (chn 2)
33	NULL.LLL	ESIG-500 landing light lobe pattern (chn 3)
34	NULL.LLL	ESIG-500 landing light lobe pattern (chn 4)
35	NULL.LLL	ESIG-500 landing light lobe pattern (chn 5)
36	NULL.LLL	ESIG-500 landing light lobe pattern (chn 6)
37	NULL.LLL	ESIG-500 landing light lobe pattern (chn 7)
38 - 39		reserved
40	NULL	reserved for NIGHT.ET
41	NULL	reserved for DUSK.ET
42	NULL	reserved for DAY.ET
43	NULL	reserved for OV_NIT.ET
44	NULL	reserved for OV_DSK.ET
45	NULL	reserved for OV_DAY.ET
46	NULL	reserved for a future ET file
47	NULL	reserved for a future ET file

Table 4-1. ESIG-LC File Table - Continued

File Index	Default	File Description
48	NULL	reserved for a future ET file
49	NULL	reserved for a future ET file
50	NULL	reserved for a future ET file
51	NULL	reserved for a future ET file

GFOG

This command enables or disables ground fog.

Syntax: GFOG [switch] [options]

Switch:
  (+)   A plus key enables the feature. The default is plus.

  (-)   A minus key disables the feature.

Options:
  1. PATCHY [switch]. Patchy GFOG feature is enabled or disabled.

  2. RVR [number]. The number in feet of the runway visual range.

Example: GFOG + PATCHY RVR 500
  (Turn on ground fog with the patchy feature at an RVR of 500 feet.)

HAT

This command enables or disables height above terrain.

Syntax: **HAT [switch] [options]**

Switch:
   (+)   A plus key enables the feature.

   (-)   A minus key disables the feature.

Options:
1. TESTPOINT [number]. Select test point number 0 - 31, or 255 to clear all testpoints.

2. X [number]. X offset from eyepoint in feet.

3. Y [number]. Y offset from eyepoint in feet.

4. Z [number]. Z offset from eyepoint in feet.

Example: HAT TESTPOINT 12 Z -2
(Leave HAT as it was prior to this command, but activate testpoint 12 and set its Z offset to -2.)

HELP

This command allows the user to get help for each command in the command line interpreter (CLI). This is the same as the MAN command.

Syntax: HELP [options]

Options:
1. An individual command name. The system will list instructions for the specified command.

2. HELP. This will display a list of the valid CLI commands:

ANIMATION	AUX	BEACON	CHANNEL
CLOUDS	COLD	COLOR	CONTINUE
CONVERGING	CS	DELETE	DIRECTORY
ECHO	ENG	EYE	FILE
GFOG	HAT	HELP	LOBE
MAN	MIRP	MODEL	PATCH
PICKER	REFRESH	ROUTED	SET
SHOW	SNAPSHOT	STORM	STROBE
SWITCH	SYSTEM	TABLE	VECTOR
VIS	WAIT		

Example: HELP SHOW
    (Get specific help for the SHOW command.)

LOBE

This command allows the user to have all or some portion of the aircraft's landing lights illuminated.

Syntax: **LOBE [options]**

Options:
1. LIGHTS [number]. Number is a seven-bit binary number. Bit 0 is on the right, bit 6 is on the left. The range is from 0000000 to 1111111. Zero disables the landing light lobes, and is the default.

    Lobe representation:

bit 6	left outboard
bit 5	left turnoff
bit 4	left inboard
bit 3	center
bit 2	right inboard
bit 1	right turnoff
bit 0	right outboard

    For example, to turn on only the right turnoff and the right outboard light lobes, the seven bit number would be 0000011.

Example: LOBE LIGHTS 1011
    (Turn on the center, right turnoff, and right outboard lights, and turn off the rest of the lights.) -

MAN

This command allows the user to get help for each command in the command line interpreter (CLI). This is the same as the HELP command.

Syntax: MAN [options]

Options:
1. An individual command name. The system will list instructions for the specified command.

2. MAN. This will display a list of the valid CLI commands:

ANIMATION	AUX	BEACON	CHANNEL
CLOUDS	COLD	COLOR	CONTINUE
CONVERGING	CS	DELETE	DIRECTORY
ECHO	ENG	EYE	FILE
GFOG	HAT	HELP	LOBE
MAN	MIRP	MODEL	PATCH
PICKER	REFRESH	ROUTED	SET
SHOW	SNAPSHOT	STORM	STROBE
SWITCH	SYSTEM	TABLE	VECTOR
VIS	WAIT		

Example: MAN SHOW
   (Get specific help for the SHOW command.)

MIRP (MISSION RECORD AND PLAYBACK)

This command allows the user to record a scenario for playback later. (See Chapter 7 for a more complete discussion of the MIRP command and its options.)

Syntax: MIRP [options]

Options:

1.   ABORT. Exits current MIRP recording scenario and deletes the recorded file.

2.   AUTHOR [string]. Name of person recording mission.

3.   CHANGE [0-number of coordinate systems]. Changes the coordinate system to the coordinate system associated with the TO option.

4.   CLIP. This clips the current MIRP playback file, and is only used in modes 6 and 7.

5.   CURRENT [0-number of coordinate systems]. The coordinate system to be recorded. Default is 0 (the eyepoint).

6.   FREEZE. Temporarily freeze the MIRP mission.

7.   INTERVAL [integer]. Number of fields between snapshots of the system. Default is 10.

8.   LOAD. Load the accessory initialization parameters.

9.   MASK [decimal equivalent of binary mask]. Indicates which coordinate systems are to be recorded. The mask is the decimal equivalent of a binary bit mask, with each bit representing one of the channels in the system. The LSB represents DCS 0, the eyepoint. A 1 in the CS bit position specifies that the CS will be recorded, a 0 specifies that the CS will not be recorded. For example, the binary value 10010001 specifies that CS numbers 7, 4, and 0 will be recorded because the bits in the 8th, 5th, and 1st positions are set to a value of 1. The value 145 would be entered, since it is the decimal equivalent of the binary 10010001.

10.   MISSION [string]. Name of the mission.

11.   MODE [0-7].

      0.   Records a single coordinate system. The coordinate system number is specified by the CURRENT option.

1. Records multiple coordinate systems. The coordinate system numbers are specified by the MASK option.

2. Add a new coordinate system to a prerecorded scenario. PLAYBACK specifies the mission file that was recorded earlier. The new coordinate system is specified by the CURRENT option. The new mission is saved in the file specified by the RECORD option.

3. Changes a coordinate system on a prerecorded scenario. PLAYBACK specifies the mission file that was recorded earlier. The CHANGE option specifies the old coordinate system number. The TO option specifies the new coordinate system number. The new mission is saved in the file specified by the RECORD option.

4. Play back a mission from the file specified by the PLAYBACK option.

5. Record the eyepoint following the flight path of the CS specified by the CURRENT option. The INTERVAL setting with this mode must be less than 5.

6. Mission front-end clipping. Removes a portion of the recorded scenario from the beginning of the mission. The portion displayed between the MIRP START command and the MIRP CLIP command is removed.

7. Mission back-end clipping. Removes a portion of the recorded scenario from the end of a mission. The portion of the mission which follow the MIRP CLIP command is removed.

12. PLAYBACK [filename]. Filename of mission to play back.

13. RECORD [filename]. Filename of the mission to record.

14. RESUME. Unfreeze a frozen MIRP mission.

15. SECONDS [real number]. Used in mode 5 only. The number of seconds delay between the flight path of the leading DCS and the eyepoint.

16. START. Start the MIRP session. The LOAD option must be completed before this command is given.

17. STOP. Stop the MIRP session.

18. TO [0-number of coordinate systems]. The resultant coordinate system to replace the coordinate system specified by the CHANGE option.

19. XOFFSET [integer]. Used in mode 5. The delta in feet between the leading coordinate system and the eyepoint's x position.

20. ZOFFSET [integer]. Used in mode 5. The delta in feet between the leading coordinate system and the eyepoint's z position.

Example: MIRP MODE 0 RECORD TEST.MRP CURRENT 0 INTERVAL 30 (Record a MIRP mission to the file TEST.MRP. Record the eye every 30 fields.)

MODEL

This command allows the user to load a database.

Syntax: MODEL [options]

Options:
1.   COLOCATE [0 - 7]. Colocatable parcel select number to be used.

2.   ENTRY [0 - 255]. Currently not implemented.

3.   PARCEL [0 - 255]. Parcel number in the database to be used.

4.   WORLD [filename]. Filename of the new database to be used. The system will assume a filename extension of .WF unless a different extension is specified.

Example: MODEL WORLD SPX.WF
   (Change to world file SPX.WF.)

PATCH

Changes or displays memory locations in 16 bit words.

Syntax: **PATCH** [options]

Options:
    1.   ADDRESS [even number]. The address to be examined/ overwritten with data.

    2.   VALUE [0 - 65535]. The value to be inserted into the specified address.

Example: PATCH ADDRESS 104576 VALUE 1457
    (Change address 104576 (decimal) to value 1457(decimal).)

PICKER (PURPLE POLYGON PICKER)

This command controls the Purple Polygon Picker. It allows the user to focus on a specific polygon. (Diagnostics must be enabled to use the PICKER; enter the command TABLE 0 113 V 1.)

Syntax: PICKER [switch] [options]

Switch:
   (+)   A plus key enables the feature.

   (-)   A minus key disables the feature.

Options:
   1. ENTRY [number]. Designates which poly or light in the object to work with.

   2. HPOLY [switch]. Enable or disable halting the system with the particular polygon.

   3. OBJECT [number]. Designates which object to concentrate on.

   4. SKOBJECT [switch]. Enable or disable skipping the particular object.

   5. SKPOLY [switch]. Enable or disable skipping the particular polygon.

   6. STEP [number]. Number by which object number is incremented or decremented.

   7. STRING [switch]. Enable or disable the ability to color objects from number 0 to OBJECT number.

   NOTE: The up and down arrow keys are used to increment and decrement the object count by the step number. The left and right arrow keys are used to increment and decrement the poly count residing in the entry command.

   Example: PICKER + ENTRY 3
   (Turn on the purple polygon picker and color polygon 3 of the current object purple.)

REFRESH

This option refreshes the CLI screen if the image is damaged in some way.

Syntax: **REFRESH**

Example: REFRESH
   (Refresh the screen.)

ROUTED

This command selects a routed traffic number to be used by the system.

Syntax: ROUTED [options]

Options:
1. CS [0 - number of coordinate systems]. Coordinate system number being bound to the routed traffic.

2. LOAD. Begins loading in routed traffic information for the traffic number chosen. The information is brought on-line but is not activated.

3. PARCEL [0 - 255]. Parcel index number in the world file.

4. PLACEABLE [switch]. Selects if the parcel is placeable or local.
    + = placeable parcel
    - = local parcel

5. SELECT [0 - 255]. Select switch within the coordinate system.

6. START. Begins routed traffic.

7. STOP. Stops routed traffic. Overrides any control within the routed traffic itself.

8. TRAFFIC [number]. Routed traffic number.

9. UNLOAD. Unloads the routed traffic information.

Example: ROUTED CS 7 SELECT 13 TRAFFIC 8 START
(Start previously loaded routed traffic 8 tied to CS 7 with a select of 13.)

SET

This command allows the user to set various options.

Syntax: **SET [options]**

Options:

1. DAY. The image scene becomes a day scene.

2. DUSK. The image scene becomes a dusk scene.

3. HORB [0 - 5]. Horizon brightness selection.

4. HORD [switch]. Directional horizon selection.

5. HORH [0 - 360 degrees]. Horizon heading selection.

6. HOST [switch]. Enable/disable the Ethernet host interface. After the host is enabled, the console will report some basic environmental information, then that the Ethernet is initialized. If the host computer fails to transmit, usually meaning that the Ethernet is not hooked up, the message `No data received for 5 fields` will appear.

7. IM [number]. Select which port the instructor monitor is on.

8. NIGHT. The image scene becomes a night scene.

9. SUNH [0 - 360 degrees]. Sun heading selection.

10. SUNP [0 - 360 degrees]. Sun pitch selection.

Example: SET DUSK
(Set the scene to dusk.)

SHOW

This command selects the statistics screen and shows the current state of certain parameters.

Syntax: **SHOW [options]**

Options:
1. CHANNEL [0 - number of channels]. Channel number of the statistics being displayed.

2. HIGH. Displays the high-water mark associated with various statistics. Samples are taken only when the statistics screen is on.

3. LIGHTS. All 64 light switch intensities are displayed.

4. POLYS. All 64 polygon switch intensities are displayed.

5. RESET. Resets the high-water mark levels to zero.

6. STATS [switch]. Enables and disables the statistics screen.

Example: SHOW STATS +
(Show the statistics screen.)

SNAPSHOT

This command allows the user to save the state of the image generator for future use.

Syntax: SNAPSHOT [options]

Options:
1. RECORD [filename]. Saves the state of the image generator into filename.

2. RESUME [filename]. Uses information from filename to restore the image generator to a previously recorded state.

Example: SNAPSHOT RECORD SNAP.SNP
(Record the current state of the system to the file SNAP.SNP.)

STORM

This command enables or disables a storm. It also allows the user to enable or disable lightning and rain.

Syntax: STORM [switch] [options]

Switch:
  (+)   A plus key enables the feature.

  (-)   A minus key disables the feature.

Options:
  1.   LIGHTNING [switch]. Enable or disable lightning.

  2.   RAIN [switch]. Enable or disable rain.

Example: STORM LIGHTNING RAIN
     (Leave the state of the storm as before, but turn on lightning and rain.)

STROBE

This command allows the user to enable or disable the ownship wingtip strobe.

Syntax: **STROBE [switch]**

Switch:
    (+)   A plus key enables the feature.

    (-)   A minus key disables the feature.

Example: STROBE -
    (Turn off the wingtip strobe.)

SWITCH

This command selects switch (light and poly) options.

Syntax: **SWITCH [options]**

Options:
1. INTENSITY [0 - 5]. The intensity associated with the LIGHT or POLYGON option.

2. LIGHTS [0 - 63]. The light switch number. Default is 0.

3. POLYGON [0 - 63]. The polygon switch number. Default is 0.

4. RANDOM [switch]. Enable or disable random light intensities.

Example: SWITCH LIGHTS 37 INT 4 RANDOM
(Change the intensity of light switch 37 to step 4 and enable the random light intensity.)

SYSTEM

This command selects the system state.

Syntax: **SYSTEM [options]**

Options:
1. EXIT. Leave the real-time system.

2. INIT. Reinitialize the system from scratch.

3. PAUSE. Pause the real-time system.

4. RESUME. Resume system operation after a PAUSE.

5. SITE [filename]. Re-initialize the system using the specified site file.

Example: SYSTEM EXIT
     (Exit the real-time system.)

TABLE

This command allows the user to access site configurable variables. See Chapter 5 for more complete information on the use of this command and site configuration.

Syntax: **TABLE [options]**

Options:
1. KEYPAD [switch]. Ties the arrow keys to the table entry last entered through the OFFSET option. Mutually exclusive with COLOR and PICKER. (up: +100; down: -100; right: +1; left: -1)

2. OFFSET [number]. Offset from the beginning of the table (specify the entry number).

3. VALUE [0 - 65535]. Value placed into the offset address of the table.

Example: TABLE OFFSET 32 VALUE 4
    (Enters the value of 4 in table entry number 32; this sets the number of channels in the system to 4.)

VECTOR

Determines the heading, pitch and range between the eye and the current testpoint. It can also position the eye at a specified range, heading or pitch from a testpoint. The given heading and pitch defines the angles between the vector from the eye to the testpoint and the absolute eye heading and pitch vector, i.e. the angles which would cause the eye to point directly at the testpoint if added to the eye's heading and pitch.

Syntax: VECTOR [options]

Options:

1. ALTITUDE [number]. Z offset of testpoint from ground coordinate system.

2. DEGREES [0 - 359]. Degrees latitude or longitude of testpoint.

3. HEADING [0-360]. Degrees difference between the eye heading angle and the eye to testpoint heading angle.

4. LATITUDE [switch]. Indicates whether next degrees, minutes, seconds input refers to latitude or longitude of testpoint.

5. LATLON [switch]. Enable or disable Lat/Lon. Default is disabled.

6. LATLOWER [number]. Lower latitude number for testpoint. $0-2^{32}$ is the appropriate range.

7. LATUPPER [number]. Upper latitude number for testpoint. 0-31 is the appropriate range.

8. LONGITUDE [switch]. Indicates whether next degrees, minutes, seconds input refers to latitude or longitude.

9. LONLOWER [number]. Lower longitude number for testpoint. $0-2^{32}$ is the appropriate range.

10. LONUPPER [number]. Upper longitude number for testpoint. 0-31 is the appropriate range.

11. MINUTES [number]. Minutes latitude or longitude of testpoint. 0-60.

12. PITCH [0-360 degrees]. Difference between eye pitch angle and eye to testpoint pitch angle.

13. RANGE [number]. Feet between testpoint and eyepoint.

14. SECONDS [number]. Seconds latitude or longitude. 0-59.99.

15. TESTPOINT [0 - number of testpoints]. Selects the current testpoint. Default is 0.

16. X [number]. X offset of testpoint from ground coordinate system.

17. Y [number]. Y offset of testpoint from ground coordinate system.

18. Z [number]. Z offset of testpoint from ground coordinate system.

Example: VECTOR TESTPOINT 2 X 500 Y 300 Z 1700
(creates a testpoint at the given coordinates and returns the range between the eye and that point as well as the heading and pitch angle from the current eye position)

Example: VECTOR HEADING 0 PITCH 0 RANGE 5000
(positions the eye such that it is pointing directly at the current testpoint at a distance of 5000 ft)

Limitations:

In LATLON mode, repositioning the eyepoint with the vector command will be increasingly inaccurate at greater distances from the equator.

In LATLON mode, a range of more than 11.49 degrees between eye and testpoint will produce spurious results.

A recalculated eyepoint heading or pitch will be accurate to one degree.

VISIBILITY

This command selects the visibility.

Syntax: **VISIBILITY [options]**

Options:
1.   FEET [number]. Visibility in feet.

2.   KM [number]. Visibility in kilometers

3.   MILES [number]. Visibility in miles.

Example: VISIBILITY MILES 12
(Sets the visibility of the system to 12 miles.)

WAIT

Halts the execution of a reset file until CONTINUE is typed. The WAIT command itself is placed inside the reset file.

Syntax: WAIT

Example: WAIT
(Wait at this place in the reset file until CONTINUE is entered.)

4.4 COMMAND FILES

A command file contains a list of valid CLI commands with switches and options. This file may be executed directly from the SPX> prompt; the commands will be processed in order just as if they had been entered from the console.

Running a command file can speed up the input process, since it can enter a set list of commands each time as well as make a repeatable set of commands for testing or demonstration purposes. Command files are used to change environment settings before the start of a mission or to automatically start a process.

4.4.1 File Execution

Command files can be executed by preceding the command file name with an @. For example:

```
SPX > @filename.RST
```

The extension on a command file or reset file is .RST by default.

4.4.2 Sample Command File

This is an example of a command file that sets up parameters and loads a world model. In this example, comments describing each line of the file are marked by a # sign and precede the line being explained.

```
#       Set the image to a day scene.
SET DAY
#
#       Visibility is set to 49 miles.
VIS M 49
#
#       TABLE Offset 134 Value 10: look up the table entry
#       number 134, and enter a value of 10; the number of
#       coordinate systems is set to 10.
TAB O 134 V 10
#
#       Configure channel number 0 so that heading, pitch, and
#       roll are all 0 degrees, X, Y, and Z are all 0 feet,
#       the horizontal half angle is 24 degrees, the vertical
#       half angle is 18.46 degrees, and display B is enabled.
CHAN N 0 H 0 P 0 R 0 X 0 Y 0 Z 0 HOR 24 VER 18.46 DISPB +
#
#       The eyepoint (CS #0) is offset 500 feet in the X
```

```
#       direction from the ground coordinate system, -8124
#       feet in the Y direction, 410 feet in the Z direction,
#       and has a heading of 0 degrees, pitch of -3 degrees,
#       and a roll of 0 degrees.
EYE X 500 Y -8124 Z 410 H 0 P -3 R 0
#
#       Coordinate system number 7 is set with select 1, and
#       is offset from its base coordinate system 314 feet in
#       the X direction, -1528 in the Y direction, and 0 feet
#       in the Z direction, and has a heading of 78 degrees,
#       pitch of 0 degrees, and a roll of 0 degrees.
CS N 7 SEL 1 X 314 Y -1528 Z 0 H 78 P 0 R 0
#
#       Light switch number 0 has its intensity changed to 0.
SW L 0 I 0
#
#       The landing is set to 15 (15 feet is the lowest
#       altitude possible while in flight mode), coordinate
#       system 0 (the eyepoint) is tied to the keypad, and
#       flight dynamics for the keypad are enabled.
ENG LAND 15 K 0 F +
#
#       The world model ATP04 and parcel 0 are loaded.
MOD W ATP04 P 0
```

4.5 CLI SCREENS

Either of the two following screens may be shown on the display; these are associated with the CLI and allow the user to instantaneously see the eyepoint position, a selected dynamic coordinate system position, and system performance statistics. The screens are continually updated with new positional data and statistics while the RTS is running. Figure 4-1 shows the Coordinates screen, and Figure 4-2 shows the Statistics and Coordinate screen.

```
┌─────────────────────────────────────────────────────┐
│  ┌────────── SCREEN 0 ── EYE & COORDINATES ──────────┐ │
│  │ Eyepoint              CSn:                         │ │
│  │   x:        ft    lat:    x:        ft    lat:     │ │
│  │   y:        ft    lon:    y:        ft    lon:     │ │
│  │   z:        ft    alt:    z:        ft    alt:     │ │
│  │   h:    deg           h:    deg                    │ │
│  │   p:    deg   knots:  p:    deg                    │ │
│  │   r:    deg    hat:   r:    deg                    │ │
│  │   select:      vis:   select:   version: <RTSXX>   │ │
│  └────────────────────────────────────────────────────┘ │
│                                                         │
│                                                         │
│                                                         │
│   SPX>                                                  │
│                                                         │
└─────────────────────────────────────────────────────┘
```
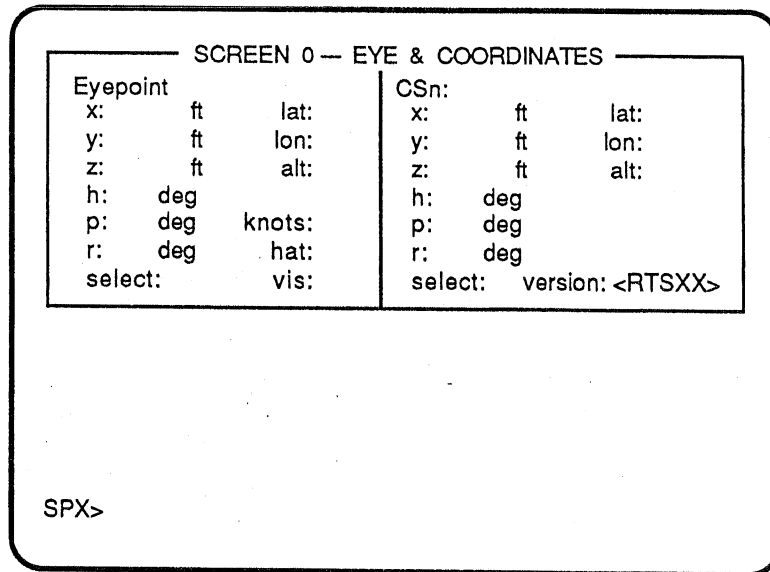
914819-0P2

Figure 4-1. Coordinates Screen

The left half of the Coordinate Screen shows the following:

Eyepoint	The information on this half of the screen relates to the position of the eyepoint, CS 0.
x: ft	This is the X coordinate of the eyepoint in feet away from the ground coordinate system origin.
y: ft	This is the Y coordinate of the eyepoint in feet away from the ground coordinate system origin.
z: ft	This is the Z coordinate of the eyepoint in feet away from the ground coordinate system origin.
h: deg	This is the heading in degrees of the eyepoint relative to the ground coordinate system .
p: deg	This is the pitch in degrees of the eyepoint relative to the ground coordinate system.
r: deg	This is the roll in degrees of the eyepoint relative to the ground coordinate system.
select:	The current model select number for this coordinate system.
lat:	Eyepoint position in degrees, minutes, and seconds latitude.
lon:	Eyepoint position in degrees, minutes, and seconds longitude.

alt:	Eyepoint altitude in feet.
knots:	Aircraft velocity in knots.
hat:	Aircraft height above terrain in feet.
vis:	Visibility in feet.
Version:	The version number of the real-time system software.

The right half of the Coordinate Screen shows the information for the current coordinate system. The number of the CS is shown. The rest of the fields are the same as for the eyepoint on the left half of the screen.

```
┌─────────────────────────────────────────────────────────┐
│  ┌──────── SCREEN 1 — STATISTICS & COORDINATES ───────┐  │
│  │ Chan:          rts proc:   CSn:                     │  │
│  │  cell count:   om proc:     x:    ft      lat:      │  │
│  │  obj count:    gp proc:     y:    ft      lon:      │  │
│  │   poly in:     dpin proc:   z:    ft      alt:      │  │
│  │   poly out:    dpout proc:  h:    deg:             │  │
│  │   lights in:   mesh blks:   p:    deg:             │  │
│  │   lights out:  obj blks:    r:    deg:             │  │
│  │   field rate:  parcels:     select:   version: <RTSXX> │  │
│  │   crit. loop:  klod:        kran:                  │  │
│  └────────────────────────────────────────────────────┘  │
│                                                           │
│                                                           │
│  SPX>                                                     │
└─────────────────────────────────────────────────────────┘
```
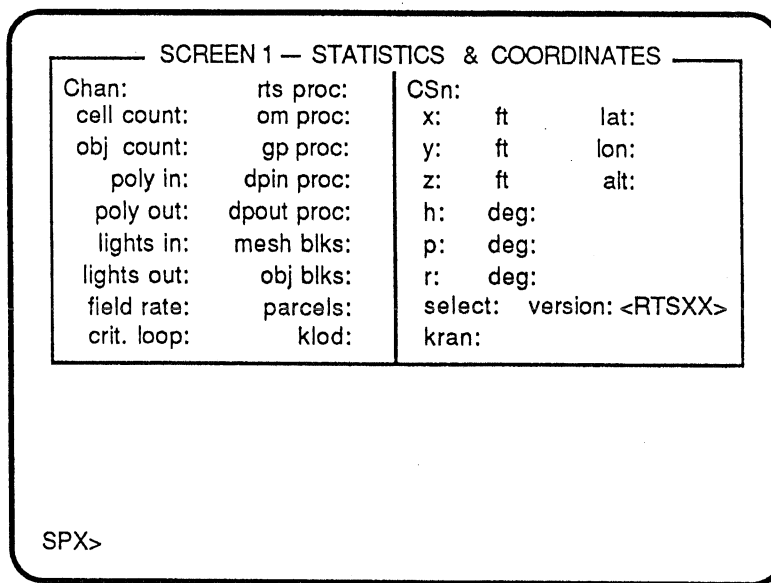
914818-0P2

Figure 4-2. Statistics and Coordinates Screen

The Coordinate and Statistics Screen shows the following:

chan:	Channel number of the statistics being displayed.
cell count:	Number of cells processed by the object manager.
obj count:	Number of objects processed by the object manager.
poly in:	Number of polygons accepted by the object manager and submitted to the geometric processor.
poly out:	Number of polygons accepted by the geometric processor and submitted to the display processor.

lights in:	Number of light points accepted by the object manager and submitted to the geometric processor.
lights out:	Number of light points accepted by the geometric processor and submitted to the display processor.
field rate:	Current system field rate in milliseconds.
crit. loop:	RTS execution time before starting the OM.
rts proc:	Amount of time in milliseconds between start of field and completion of real-time software computations.
om proc:	Amount of time in milliseconds between object manager start and done interrupt.
gp proc:	Amount of time in milliseconds between geometric processor start and done interrupt.
dpin proc:	Amount of time in milliseconds between DPin start and done interrupt.
dpout proc:	Amount of time in milliseconds between DPout start and done interrupt.
mesh blks:	Number of mesh blocks on line.
obj blks:	Number of object blocks on line.
parcels:	Number of active parcels.
klod:	Transition range scalar.
kran:	Random lights fill area scalar.
CSn:	The right half of the Coordinate Screen shows the information for the current coordinate system. The number of the CS is shown. The rest of the fields are the same as for the eyepoint on the left half of the Coordinates screen.

4.6 FLIGHT CAPABILITIES

The CLI also supports limited flight capability via the system console keypad or a flybox with joystick; in other words, the host and its simulation cockpit are not required to fly a database.

4.6.1 Keypad Flight

The user can maneuver the eyepoint or any other coordinate system through the use of the keypad. When various keys are pressed, the respective degrees of freedom are changed corresponding to the appropriate coordinate system. (See Figure 4-3 for a diagram of the keypad.)

In flight dynamics mode, set with the ENGINEER command, the keys are velocity, heading, pitch, and roll. The XYZ components of the coordinate system are calculated using the input from these keys.

You may also use the XYZ keys to change the respective component of the coordinate system in flight dynamics mode. Select which coordinate system to manipulate and whether to enable flight dynamics with the CLI command:

```
SPX> ENGINEER KEYPAD [coordinate system] FLIGHT [+ or -]
```
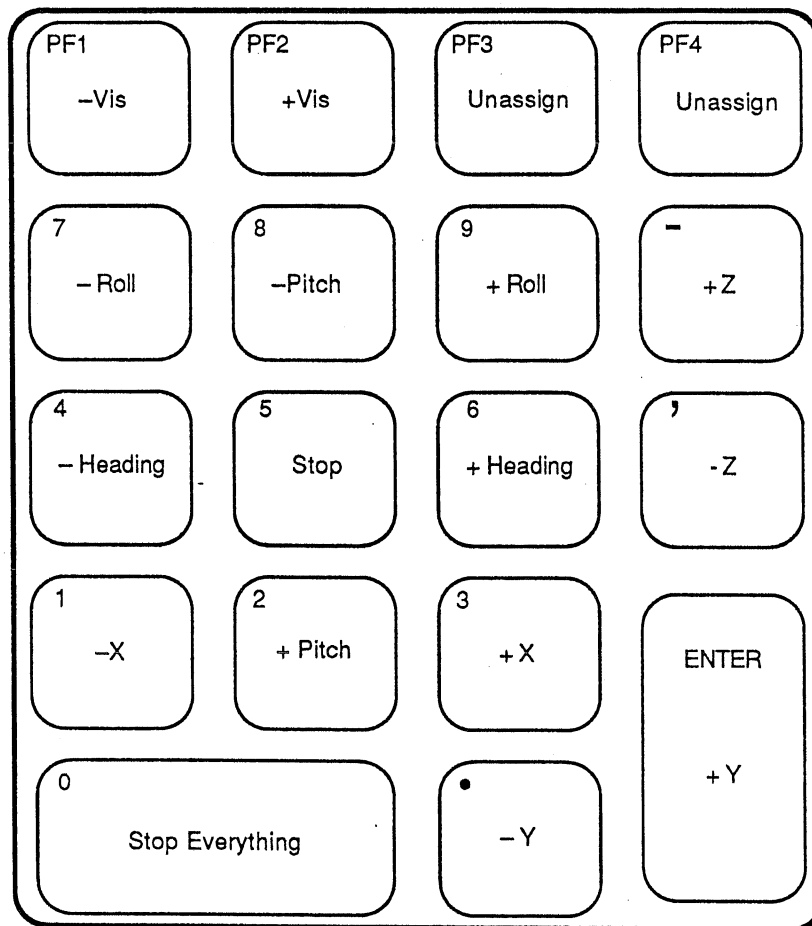

914817-0P0

Figure 4-3. Keypad

You may use the keys of the keypad to move the eyepoint. For example, pressing the <8> key will decrease the pitch of the eyepoint (nose down). Pressing the <2> key will increase the pitch. Other keys will move and rotate the eyepoint in other directions. Pressing a key multiple times or holding it down will increase the magnitude of the direction change. The <ENTER> key will move the eyepoint in the direction of the heading, pitch, and roll.

4.6.2 Flybox Flight

An ICC-100 terminal serves as the ESIG-LC flybox. This is the full-function I/O device for the CLI software that includes a VT100 keyboard, keypad, display, three-axis joystick, slide control, and ten function keys (see Figure 4-4).

914869-0P0
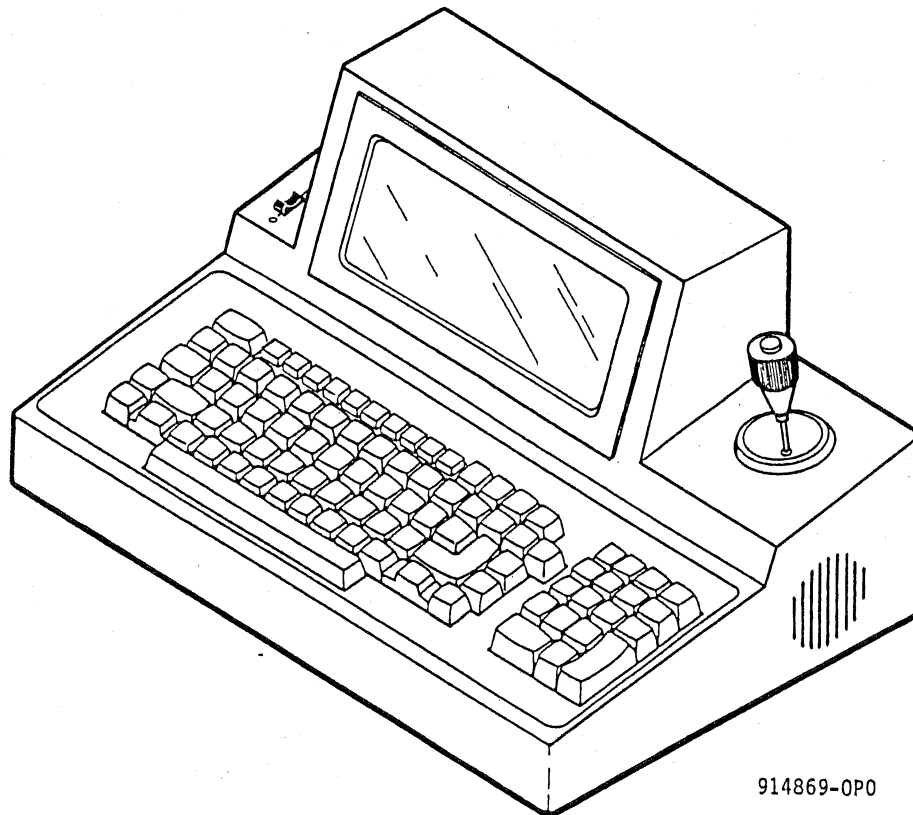
Figure 4-4. Flybox with Joystick

The ICC-100 keyboard, keypad, and display interact with the CLI like the VT100 terminal. The joystick, slide control, and function keys generate additional inputs that provide a convenient way to fly the image generator. The joystick updates any of the six degrees of freedom (DOF) of the eyepoint or a dynamic coordinate system (DCS). The DOF modified by the joystick is determined by which function key is active and the status of the CLI flight mode. The slide control adjusts the velocity of the eyepoint or DCS.

Two of the ten function keys are currently defined. These function keys set the joystick update mode: heading/pitch/roll (HPR) or translation (XYZ). Pressing the left function key activates the HPR update mode. The function key immediately to the right of the HPR key sets the XYZ mode. The active function key is illuminated.

While performing HPR updates, the joystick reacts in the same way whether CLI flight mode is enabled or disabled. Moving the joystick to the right or left updates the roll of the own ship or DCS. Moving the joystick forward or backward affects the pitch; twisting the top of the joystick modifies the heading. If flight is enabled, the heading, pitch, and roll can be modified while the eyepoint or DCS is moving (simulating flying).

In the XYZ mode, the joystick responds differently depending on the status of CLI flight. With flight enabled:

- Right/left joystick movements translate the eyepoint or DCS perpendicularly across the heading vector

- Backward/forward movements of the joystick modify velocity along the heading vector

- Top twisting causes Z-axis translation

With flight disabled:

- Right/left joystick movements cause X-axis translation

- Backward/forward movements of the joystick cause Y-axis translation

- Top twisting causes Z-axis translation

The slide control is only active while CLI flight mode is enabled. Moving the slide forward and backward updates the velocity of the eyepoint or DCS along its heading, providing a speed range of 0 to 1890 knots. These speeds are stored in a velocity table; fine tuning of the slide control is possible to achieve speeds in the ranges not stored in the table. This fine tuning is accomplished through use of the <ENTER> and <.> keys on the keypad.

SITE CONFIGURATION

5.1 INTRODUCTION

The ESIG-LC visual system is configured via the site configuration file which must be present on the system. The real-time system reads in this ASCII file during the initialize state of the main routine. It can be used to overlay the default configuration parameters, though individual default parameters will be used by the system unless changed by the site configuration file.

5.2 LOADING THE SITE FILE

The file SPX.SIT is the default site file, and will be used unless the command line starting the real-time system specifies another. For example, the command line

```
RUN RTS10 SITE2.SIT
```

will start the real-time system and load the site file SITE2.SIT instead of the file SPX.SIT. The extension .SIT is optional if the file has this extension, but the extension must be specified if it is not .SIT.

You may also start the RTS and load a different site file from within a command file. In this instance, the line specifying the site file name must follow the line starting the RTS. For example, the following two lines should be placed in the command file:

```
$ RUN RTS10
SITE2.SIT
```

5.3 CONFIGURATION PARAMETERS

The TABLE command (see Section 4.3) is used to enter parameters that configure the visual display. These settings may be entered via the site file or entered during real time through the CLI. See the lookup charts (Table 5-1 by name, and Table 5-2 by entry number) in this chapter to find the table entry number and range for the parameters to be set. The default listed with each of the parameters in the table will be used by the system unless changed by an entry in the site file.

Values entered with the TABLE command are integers, and represent one of the following:

- Number in a range: This number is a unit of measure, and has units such as feet or microseconds. The number entered may be multiplied or otherwise modified by the system before use, so may not be the actual distance or time. For example, to enter a distance, you may be required to enter the number of feet divided by eight.

- Scalars: Scalars are a number in a range, but do not have units; they are simply an arbitrary number representing a value such as an intensity. The number entered could represent a percentage of the full intensity, but would still be an arbitrary number. For example, many entries in the table will have a scalar k, which is entered to represent a value between 0 and 1 multiplied against a system constant; if the constant is 32767, then entering the value 8192 would specify 25% of the full value of the constant. As a scalar has no units of measurement, you may need to determine the number to enter through trial and error.

- Switch: Switches are used to enable or disable a system function, and are set by entering either a 0, usually to disable the function, or a 1, usually to enable the function.

- Binary mask: A binary mask is a set of switches. An eight-bit number has eight switches and a sixteen-bit number has sixteen switches. A 0 or a 1 in each of the positions of a binary number sets the respective switch. The decimal equivalent of the binary number is entered. For example, the eight bit number 00010011 turns on the switches in the first, second, and fifth positions (starting from the right), and is entered as a 19, the decimal equivalent of the binary.

- Choice of entries: Some entries represent a small list of choices, for example the type of display monitor being used. Enter the number corresponding to the choice desired.

An example in Section 5.4 demonstrates how to use the TABLE command with the correct syntax and parameters to build the site file. The following sections describe each of the table entries and how they are used to modify the system.

5.3.1 Ambient Brightness Configuration

Three discrete ambients are allowed in the RTS: day, dusk/dawn, and night. The following parameters are used to fine tune the ambient brightness.

Ambient Day (entry #50) This number indicates the ambient brightness or intensity in a day scene. This entry is in the range of 0-255, and has a default of 255.

Ambient Dusk (entry #51) This number indicates the ambient brightness or intensity of a dusk scene. This entry is in the range of 0-255, and has a default of 50.

Ambient Night (entry #52) This number indicates the ambient brightness or intensity of a night scene. This entry is in the range of 0-255, and has a default of 10.

Minimum fog ambient for glares (entry #58). Landing Light Lobes (LLL), Beacon and Strobe effects require a minimum FOG ambient for the effects to work. Since Fog ambient is a fractional amount of the overall ambient, these effects would not work at low/zero scene ambient levels. To alleviate this problem the minimum FOG ambient table entry will cause the FOG ambient not to decrease past this amount when the glare effects are present. This table entry should be set before tuning the LLL, beacon and strobe effects, since it can effect their intensities.

5.3.2 Channel Configuration

Each channel processor provides a different view of the database. The heading, pitch, and roll angles and the XYZ offset specify the view relative to the eyepoint. The size of the view frustum is defined by the horizontal and vertical half angles. The real-time system has the capability to store two view descriptions for each channel processor: a main view and an alternate view. The view assigned to a channel processor is selected via the main/alternate view select of the CLI command. All of these parameters are under host control and allow run-time magnification and sluing.

In addition to assigning the view to a channel processor, the real-time system also assigns which color is to be applied to the polygons in that view. Each polygon carries both a main and an alternate color. The color that a channel processor uses is selected via the main/alternate color select.

Other view management tasks include assigning which view is to be duplicated on the instructor monitor and blanking/unblanking the displays.

The ESIG-LC system can drive up to eight separate channel processors. Specify the position and size of the viewport with the CHANNEL command. The ratio of the cotangents of the horizontal and vertical half angles *must* match the aspect ratio of the display device.

The TABLE command is also used to specify the resolution and display type for each channel processor. Five entries must be made for each channel processor. To find the correct table entry use the following formulas:

- Resolution select = ((channel number * 4) + 0)

- Pixels/line = ((channel number * 4) + 1)

- Raster lines count = ((channel number * 4) + 2)

- Display type = ((channel number * 4) + 3)

- Horizontal flyback = ((channel number * 5) + 350)

For example, to configure channel 2, use entry number 8 for resolution select ((2*4)+0), use entry number 9 for pixels per line ((2*4)+1), use entry number 10 for the raster line count ((2*4)+2), and so forth.

For all of the following, *i* is the variable representing the channel number. For examples of these commands, see Section 5.4 at the end of this chapter.

Channel Count (entry #32) This parameter indicates the number of hardware channel processors contained in the system (1-8). Channels are numbered 0-7.

Active Channel Mask (entry #33) This eight-bit mask identifies the active channel processors. This command is normally used in the site file, but can also be used interactively to disable channel processors. The system must first be in the pause state (CLI command SYSTEM PAUSE) before disabling a channel. After the system has been paused, type in the appropriate channel processor mask followed by the command to return to the run state (CLI command SYSTEM RESUME).

The channel mask is entered as the decimal equivalent of a binary value, the positions of which represent each of the channels. Channel 0 is on the right, channel 7 is on the left; 1 indicates active, 0 indicates inactive. Non-existent and powered-down channels are always inactive regardless of the channel mask setting. For example:

1) A three-channel system with all three channels enabled is binary 00000111. The decimal equivalent of 00000111 is 7, so the entry is 7.

2) If channel 1 goes down on this three-channel system, the binary mask is now 00000101, and the entry changes to 5.

Channel [i] Resolution Select (entry # (i*4) + 0) This parameter selects which hardware configuration was purchased for that system. The following options are available:

0: Low Resolution
1: Medium Resolution

2: High Resolution
3: Low/High Resolution

Channel [i] Pixels/Line (entry # (i*4) + 1) This parameter selects the number of pixels to be drawn per raster line. This number is directly tied to CHANNEL RESOLUTION SELECT. The following choices are available:

640: Low Resolution
640: Medium Resolution
960: High Resolution
896: Low/High Resolution

Any other numbers must be pre-approved by Evans & Sutherland Computer Corporation.

Channel [i] Raster Lines (entry # (i*4) + 2) This parameter selects the total number of raster lines. This number is tied directly to CHANNEL RESOLUTION SELECT. The following choices are available:

516: Low Resolution
564: Medium Resolution
768: High Resolution
738: Low/High Resolution

Any other numbers must be pre-approved by Evans & Sutherland Computer Corporation.

Channel [i] Display Type (entry # (i*4) + 3) This number indicates the type of display being used. Monitors include:

0: calligraphic CSM
1: calligraphic black/white
2: calligraphic beam penetration
5: raster CSM
6: raster black/white

Projectors include:

3: calligraphic RSI WIDE/SupraWIDE
4: calligraphic Evans & Sutherland high resolution projector (HRP)
7: raster Evans & Sutherland high resolution projector (HRP)

Channel Horizontal Flyback (entry # (i*5) + 350) This number specifies the amount of time the display device needs to re-position at the start of the next raster line after completing the current raster line. The value entered is the desired flyback in microseconds minus 4.17 divided by .133. For instance, to set the flyback to 7.0 microseconds, enter 21 = ((7.0-4.17)/.133).

5.3.3 Cloud and Scud Tuning

The cloud top and bottom heights are used to define a cloud layer. If the eyepoint is above the cloud layer, and table entry #275 contains a 0 (default), then the visibility is set to maximum. If the eyepoint is above the cloud layer and table entry #275 does not contain a 0, the visibility is controlled by the host visibility. If it is below the cloud layer, then the visibility is controlled by the visibility and ground fog RVR values. As the eyepoint enters the cloud the visibility will decrease linearly to 0 through a transition zone. Within the cloud layer, motion queues are depicted by brightness changes in the fog. If scud is applied then the cloud top and bottom heights become irregular simulating peaks that extend outward from the cloud layer. A peak cannot be seen until it is entered. Figure 5-1 shows solid clouds and Figure 5-2 shows scud.

H_T { CLOUD TOP TRANSITION ZONE[1] ——— CLOUD TOP (HOST)

— — — CLOUD TOP TEXTURE

B_G VARIABLE CLOUD DENSITY

— — — CLOUD BOTTOM TEXTURE

H_B { CLOUD BOTTOM TRANSITION ZONE[1] ——— CLOUD BOTTOM (HOST)
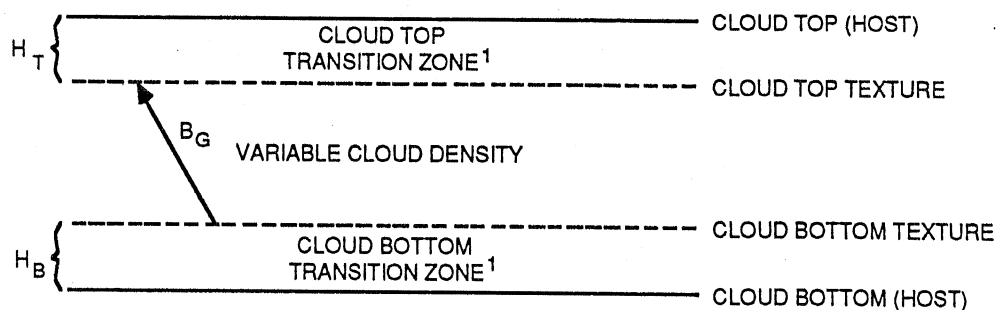
H_T = MAX. CLOUD TOP TRANSITION ZONE
H_B = MIN. (MAX. CLOUD BOTTOM TRANSITION ZONE, X)

WHERE X = CLOUD BOTTOM TRANSITION ZONE SCALAR
x CLOUD BOTTOM HEIGHT

B_G = BRIGHTNESS GRADIENT

1 = TRANSITION IS LINEAR FROM 0 TO FULL SCUD

914202-0P0

Figure 5-1. Solid Clouds
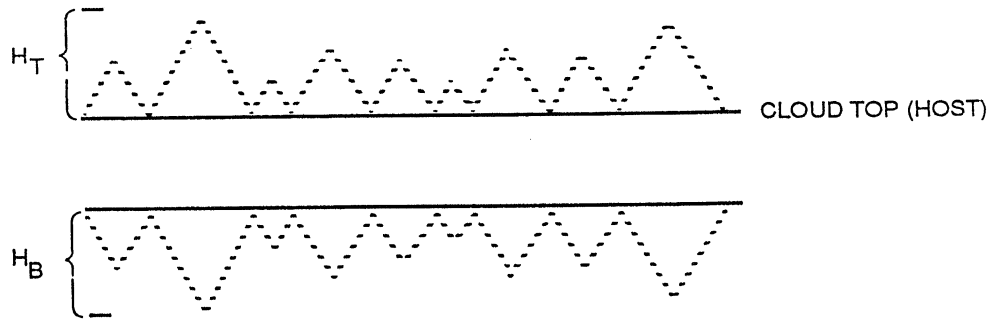
H_T = MAX. CLOUD TOP SCUD

H_B = MIN. (MAX. CLOUD BOTTOM SCUD, X)
    WHERE X = CLOUD BOTTOM TRANSITION ZONE SCALAR
        x CLOUD BOTTOM HEIGHT

NOTE: PEAKS ARE NOT VISIBLE.
    TRANSITION ZONES ARE IN THE PEAKS!   914203-OP0

Figure 5-2. Scudded Clouds

Clouds and scud can be tuned using the following parameters.

Maximum Cloud Bottom Transition Zone (entry #115) This number indicates the maximum thickness of the cloud bottom transition zone. The value in (feet/4) is entered.

Cloud Bottom Transition Zone Scalar (entry #116) This 16-bit scalar is used to determine the thickness of the cloud bottom transition zone as a percentage of the cloud bottom height.

For example: If the scalar was 12.5% then the cloud bottom transition zone thickness would be 12.5% of the cloud bottom height. The value to be entered is (32767 * k) where k is the multiplier and is between 0 and 1.

NOTE: MAX CLOUD BOTTOM TRANSITION ZONE specifies the upper limit of the thickness of the cloud bottom transition zone.

Maximum Cloud Bottom Scud (entry #117) This number indicates the maximum thickness of the cloud bottom scud layer. The value in feet is entered.

Cloud Bottom Scud Scalar (entry #118) This parameter is a 16-bit scalar that is used to determine the thickness of the cloud bottom scud layer as a percentage of the cloud bottom height. For example: If the scalar was 50%, then the cloud bottom scud layer thickness would be 50% of the cloud bottom height. The value to be entered is (32767 * k) where k is the multiplier and is between 0 and 1.

NOTE: The upper limit on the thickness of the cloud scud layer is specified by MAX CLOUD BOTTOM SCUD.

Maximum Cloud Top Transition Zone (entry #119) This number indicates the maximum thickness of the cloud top transition zone. The value in (feet/4) is entered.

Maximum Cloud Top Scud (entry #120) This number indicates the maximum thickness of the cloud top scud layer. The value in (feet/4) is entered.

Maximum Cloud Visibility (entry #122) This number indicates the maximum visibility that is obtained above the cloud layer. The value in (feet/8) is entered.

Minimum Cloud Visibility (entry #123) This number indicates the minimum visibility that is obtained above the cloud layer. The value in (feet/8) is entered.

Maximum Cloud Ambient Scalar Day (entry #124) This 16-bit scalar controls the amount of ambient reduction below the cloud layer for a day scene. The value to be entered is $(32767 * k)$ where k is the multiplier and is between 0 and 1.

Maximum Cloud Ambient Scalar Dusk (entry #125) This 16-bit scalar controls the amount of ambient reduction below the cloud layer for a dusk scene. The value to be entered is $(32767 * k)$ where k is the multiplier and is between 0 and 1.

Maximum Cloud Ambient Scalar Night (entry #126) This 16-bit scalar controls the amount of ambient reduction below the cloud layer for a night scene. The value to be entered is $(32767 * k)$ where k is the multiplier and is between 0 and 1.

Maximum Cloud Intensity Scalar Day (entry #127) This 16-bit scalar controls the amount of fog color reduction below the cloud layer for a day scene. The value to be entered is $(32767 * k)$ where k is the multiplier and is between 0 and 1.

Maximum Cloud Intensity Scalar Dusk (entry #128) This 16-bit scalar controls the amount of fog color reduction below the cloud layer for a dusk scene. The value to be entered is $(32767 * k)$ where k is the multiplier and is between 0 and 1.

Maximum Cloud Intensity Scalar Night (entry #129) This 16-bit scalar controls the amount of fog color reduction below the cloud layer for a night scene. The value to be entered is $(32767 * k)$ where k is the multiplier and is between 0 and 1.

Maximum Scud Change per Field In (entry #273) and Out (entry #274). These entries allow control over both how fast scud builds up going into a scudded cloud peak and how fast it dissipates when leaving a scudded cloud peak.

Host Controlled Visibility Above Clouds (entry #275). This entry allows the host to set the visibility above the clouds. When this entry is set to 0, the visibility above the clouds is set to maximum visibility. Otherwise, the visibility above the clouds is the visibility set by the host.

5.3.4 Number of Coordinate Systems (NCS)

Number of Coordinate Systems (entry #134) This parameter specifies the total number of coordinate systems to be processed. The baseline real-time system supports 6 coordinate systems. Because coordinate systems are very time-consuming to process, no more should be specified than will be used. The default number is 6, and the range is 3-16.

5.3.5 Database Management

The following parameters configure database management.

Latitude/Longitude Constant (entry #132 and #133) This number is the conversion constant used in converting from round earth coordinates (Lat/Lon) to X/Y coordinates. The system requires a number (N) representing the number of feet of the earth's circumference multiplied by 32; the factor of 32 is needed to accommodate the representation of the number in the hardware.

Although this value is stored in 32 bits, it must be entered in the table in two halves. The upper 16-bit value is calculated by dividing N by 65536 and truncating. The lower 16-bit value is computed by subtracting the result of multiplying the upper value by 65536 from N. For example, N is calculated by the formula $2\pi r$, where r is equal to the radius of the earth in feet. The default value for N uses the equatorial radius of the earth (20926752 feet) which yields 131486660. Multiplying this number by 32 results in 4207573142.

Loading this number into the two halves of the parameter table requires the following values: the upper value (4207573142/65536), which is 64202.471 and truncates to 64202, and the lower value (4207573142 - (64202 * 65536)), which is 30870. To load this value into the table, put 64202 in table entry #132 and 30870 in entry #133; these are the defaults.

NOTE: Changing this parameter affects the X/Y displacement of the eyepoint from the model origin. Therefore, all radio aids and etc. which must line up to a known Lat/Lon will need to be modeled with this same constant since they are normally displaced from the model origin in X/Y.

Pager Off-Line Pad Value (entry #130) This value is added to the transition ranges of cells during LOD testing by the OM on cells that are already considered on-line to determine when the cell should go back off-line. The use of this value avoids potential hysteresis problems when using the on-line pad value described above. The value specified is in multiples of 128 feet. For example, if a pad value of 640 feet is desired, the number specified should be (640/128) = 5.

Pager On-Line Pad Value (entry #131) This value is added to the transition ranges of cells during LOD testing by the OM to ensure the pager requests data before it is needed by the real-time visual processing routines. The value specified is in

multiples of 128 feet. For example, if a pad value of 768 feet is desired, the number specified should be (768/128) = 6.

5.3.6 Height Above Terrain (HAT)

The height above terrain feature is used to simulate an altimeter as well as give the host information about the heights of specific test points above the terrain. Terrain rather than ground level is specified because information must be added to a database to specify it as terrain; this added information is necessary for the computation of the height above terrain. If HAT is requested above a piece of database which is not flagged as terrain, no computed values are returned to the host. Only an illegal terrain type (i.e., material code set to 0) is returned.

The host may activate HAT test points before or after HAT is enabled; this is done by sending the correct opcode (see Chapter 5), a test point number, and the test point's XYZ offsets from the eyepoint. Once a test point is activated, it remains activated until testpoint 255 is sent from the host or CLI. Testpoint 255 clears all testpoints without disabling HAT. When HAT is enabled, the HAT value for up to n test points is computed per field. (with the value of n dependent on the number of channel processors in the system.) If more than n test points are activated, the activated test points are cycled through in sets of n ; up to 32 test points can be active. All HAT values computed since the last host interrupt are sent to the host during the host interrupt. If any HAT values are computed for the same test point more than once between host interrupts, only the latest HAT value is sent to the host.

No HAT data is sent to the host unless the host requests it either directly through its request opcode or indirectly through a request without an opcode. The data that is returned to the host consists of the test point number, the equations of the terrain plane, the distance from the terrain plane to the origin, and the computed HAT value. The terrain plane and the distance are returned to the host so that the host can compute the HAT value during a crucial time period.

HAT is a channelized feature and works in any channel. Since HAT can take a substantial amount of processing time, depending on the database and the number of test points activated, a site configurable HAT channel parameter is available to distribute the processing load.

Height Above Terrain (HAT) Channel Mask (entry #281) This eight-bit mask identifies which channel(s) performs the height above terrain (HAT) processing. Channel 0 is on the right, channel 7 is on the left; 1 is active, 0 is inactive. For example, to specify that channel number 3 is used for HAT, the entry would be 8, which is the decimal equivalent of the binary 00001000.

Height Above Terrain (HAT) Points Processed Per Field (entry #284) This value identifies how many HAT test points are processed per field. If a 1 (default) is in this table position, then all active test points are cycled through in groups of one per field. The same test point is not processed more than once per field. Therefore, if

less test points are active than this table's value, only those active test points would be processed per field. Since HAT is processing time intensive, it should be run in its own channel. If HAT is run in the same channel as the visual processor or CD, some reduction in system performance may be seen.

Include HAT Parcel CS In Ethernet Return Packet (entry #526). This table entry includes the CS opcode in the ethernet return packet for HAT/CD for the parcel that the HAT data is relative to.

5.3.7 Collision Detection (CD)

Collision detection (CD) is used by the host to determine if a collision test point has entered a collision volume. Collision volumes are specified in the database during modeling and are the only volumes checked by the collision detection routine. If a collision is detected, an object code for the type of object that was collided with and the test point number are sent to the host. If no collision was detected, an object code of 0 is returned with the test point number.

The host may activate collision test points before or after CD is enabled. To activate collision test points the host sends the correct opcode (see Chapter 5), a test point number, and the test point's XYZ offset from the eyepoint.

CD is both enabled and disabled by sending an opcode. Once a test point is enabled, it remains enabled until testpoint 255 is sent from the host or CLI. Testpoint 255 clears all testpoints without disabling CD. When CD is enabled, it is tested for up to n test points per field. If more than n test points are activated, the activated test points are cycled through in sets of n. (Up to 32 test points can be active.) All CD object codes computed since the last host interrupt are be sent to the host during each host interrupt. If CD object codes are computed for the same test point more than once between each host interrupt, only the latest is sent.

No CD data is sent to the host unless the host requests it, either directly through its request opcode or indirectly through a request without an opcode. The data that is returned to the host consists of the test point number and the CD object code.

CD is a channelized feature which will work in any channel. Since CD can take a substantial amount of processing time, depending on the database and the number of test points activated, a site configurable CD channel parameter is available to distribute the processing load.

To further help control the processing load, a site configurable CD type parameter is available that the user can use to specify how accurate the collision detection process will be.

If the auto indicator flag (default of 1) is 0, then the host has complete control of when a collision detection indicator (i.e., colored fog) is displayed. Generally, this will be in response to receiving a non-zero object collision type in the collision detection response packet. When the host sends an opcode of 8034 (collision

detection indicator enable) to the IG, the visibility will be changed to minimum, and the fog color will be determined by the color valid flag. If the color valid flag (default of 0) is 1, the color of the fog displayed is determined by the color index into the color palette. If the color valid flag is 0, the color of the fog defaults to red.

If the auto indicator flag is 1, then the IG will automatically display the colored fog when a collision is detected. The color of the fog is determined in the same way as above.

The IG will continue to display the colored fog until an opcode of 0034 (collision detection indicator disable) is received from the host. This is true whether or not the collision detection indicator was requested from the host (i.e., auto indicator flag 0 or 1).

Channel Mask (entry #280) This eight-bit mask identifies which channel(s) performs the collision detection (CD) processing. Channel 0 is on the right, channel 7 is on the left; 1 is active, 0 is inactive. For example, to specify that channel number 3 is used for CD, the entry would be 8, which is the decimal equivalent of the binary 00001000.

Collision Detection (CD) Type (entry #282) This flag identifies which type of collision detection is desired. If a 0 (default) is in this table position, the path of the test point from the last field to the current field is tested for a collision with a collision volume. If the test point has passed through a collision volume between the two fields, but is not within a volume during any given field, the collision will still be detected. If a 1 is in this table position, only the test point's current position is tested for being within a collision volume. Therefore, type 0 collision detection is more accurate and will detect some collisions type 1 will not, but type 1 collision detection takes less processing time and will produce acceptable results when the test points are moving slowly.

Collision Detection (CD) Points Processed Per Field (entry #283) This value identifies how many CD test points are processed per field. If a 3 (default) is in this table position, then all active test points are cycled through in groups of three per field. The same test will not be processed more than once per field. Therefore, if less test points are active than this table's value, only those active test points would be processed per field. Since CD is processing time intensive, it should be run in its own channel. If CD is run in the same channel as the visual processor or HAT, some reduction in system performance may be seen.

5.3.8 Diagnostic Tools

A TABLE command is used to enable the run-time diagnostic tools. The diagnostics available to the user are Color Tuning and the Purple Polygon Picker. Each of these has its own CLI command. (Refer to Chapter 3, Command Line Interpreter.) There are also some engineering diagnostics to aid in troubleshooting the system. These include the ability to isolate AP cards in the geometric processor AP card set and turning on/off the interlace in the display processor.

Diagnostic Enable (entry #113) This diagnostic enables or disables the run time diagnostic tools. A 0 will disable the function, and a 1 will enable it.

Fog Color Update Enable (entry #259) This diagnostic enables or disables the real-time updating of the fog color each field. By default, the real-time system calculates a new color for the fog each field. By disabling this function, the user can adjust the fog color to experiment with different combinations of sky and ground fog colors. The ground and sky fog colors are in locations 0 and 1, respectively, in the color palette.

Interlace (entry #40) This diagnostic controls which set of scan lines are drawn. Three options are available:

    0: even lines only
    1: odd lines only
    2: interlace scan lines.

Kill AP Cards (entry #114) This diagnostic controls which AP cards in the GP AP card set are active. A 12-bit mask is used. AP0 is on the right, AP11 on the left, 0 is active, 1 is kill. For example: If AP3 is suspect, the value to be entered is 8, which equals binary 000000001000, and will disable card AP3.

OM Raster Management (entry #94) This parameter enables or disables the OM raster management algorithm. When it is enabled, the OM computes the starting position of the first raster line on the screen in an attempt to minimize field tracking.

ZMOD Fog (entry #95) This switch enables or disables the ZMOD fogging algorithm, which increases the fog visibility as the eyepoint height increases.

5.3.9 Field Coordination Times

The field coordination times are used to schedule activities which must happen during each field (or cycle) of the real-time system. The value that is entered is the delay time in milliseconds divided by .0814, which is the resolution of the system clock. The quotient is then rounded to the nearest whole number, multiplied by 256 and finally added to 1. Example: If the delay time is 4 milliseconds then enter $(((4.0/.0814)*256)+1) = 12545$. Delay times up to 20.5 milliseconds are supported.

OM Delay (entry #42) This number indicates the delay time from the start of the real-time system field to the start of the OM field.

GP Delay (entry #43) This number indicates the delay time from the start of the OM field to the start of the GP field.

DP Delay (entry #44) This number indicates the delay time from the start of the GP field to the start of the DP field.

5.3.10 Field Rates

The field (or refresh) rate is the time in milliseconds that the picture is refreshed. The system is capable of driving separate refresh rates for day, dusk, and night. The value that is entered is the refresh rate in milliseconds divided by .0814 which is the resolution of the system clock. Example: If the refresh rate is 20 milliseconds then enter (20.0/.0814) = 245. Refresh rates up to 5.3 seconds are supported.

Field Rate Day (entry #34) The day field rate.

Field Rate Dusk (entry #35) The dusk field rate.

Field Rate Night (entry #36) The night field rate.

Minimum Background Time (entry #37) This number indicates the minimum amount of time given to the real-time system for background processing each field. Paging and the command line interpreter are executed as part of background processing.

Maximum Background Time (entry #38) This number indicates the maximum amount of time given to real-time system for background processing each field. Paging and the command line interpreter are executed as part of background processing.

Minimum Pager Time (entry #47) The minimum amount of time that is given to the hardware pager each field. The pager is that part of the hardware that moves portions of the database in and out of memory as required for the scene.

Simulate Frame Rate Switch, Table Entry (entry #529). This causes the field rate ESIG-500 IG to simulate a frame rate update machine.

5.3.11 Glares

The following parameters are used to define glare effects. All glare effects are additive, which means that no effects have priority over another. If all effects are present at the same time, then each effect will contribute to the overall scene based upon its own definition.

Maximum Glare Visibility (entry #228) This parameter indicates the maximum visibility distance at which glares will become noticeable. Glare effects are interpolated within the region between the maximum and zero visibility. Distances are entered as (feet/8).

Minimum Glare Scud (entry #229) This parameter indicates the minimum value of scud for glare effects to become noticeable.

Glare Increase Rate (entry #260) This parameter indicates the rate per field that glare increases. The value that is entered is (32767 * k) where k is the multiplier and is between 0 and 1.

Glare Decrease Rate (entry #261) This parameter indicates the rate per field that glare decreases. The value that is entered is (32767 * k) where *k* is the multiplier and is between 0 and 1.

5.3.12 Anti-Collision Beacon

When the anti-collision beacon of the own-ship is enabled, a flash of red beacon glare is introduced into lower visibility scenes at a frequency to simulate the flashing of the strobes. The beacon itself is not directly visible. The following parameters are used to tune the red anti-collision beacon.

Beacon Color Intensity (entry #230) This parameter indicates the base intensity of the beacon color.

Beacon Day Intensity Scalar (entry #231) This 16-bit scalar multiplies the base intensity of the beacon during the day. The value that is entered is (2048 * k) where *k* is the multiplier and is between 0 and 4.

Beacon Dusk Intensity Scalar (entry #232) This 16-bit scalar multiplies the base intensity of the beacon during dusk/dawn. The value that is entered is (2048 * k) where *k* is the multiplier and is between 0 and 4.

Beacon Night Intensity Scalar (entry #233) This 16-bit scalar multiplies the base intensity of the beacon during the night. The value that is entered is (2048 * k) where *k* is the multiplier and is between 0 and 4.

Beacon Day On time (entry #234) This parameter indicates the number of fields the beacon is on during each period (daytime). This value is tied into the day field rate.

Beacon Day Off time (entry #235) This parameter indicates the number of fields the beacon is off during each period (daytime). This value is tied into the day field rate.

Beacon Dusk On time (entry #236) This parameter indicates the number of fields the beacon is on during each period (dusk/dawn). This value is tied into the dusk/dawn field rate.

Beacon Dusk Off time (entry #237) This parameter indicates the number of fields the beacon is off during each period (dusk/dawn). This value is tied into the dusk/dawn field rate.

Beacon Night On time (entry #238) This parameter indicates the number of fields the beacon is on during each period (nighttime). This value is tied into the night field rate.

Beacon Night Off time (entry #239) This parameter indicates the number of fields the beacon is off during each period (nighttime). This value is tied into the night field rate.

5.3.13 Wingtip Strobe

When the wing tip strobes of own-ship are enabled, a flash of white strobe glare is introduced into lower visibility scenes at a frequency to simulate the flashing of strobes. The strobe itself is not directly visible. The following parameters are used to tune the white wingtip strobe.

Strobe Color Intensity (entry #240) This parameter specifies the base intensity of the strobe color.

Strobe Day Intensity Scalar (entry #241) This 16-bit scalar multiplies the base intensity of the strobe during the day. The value that is entered is (2048 * k) where *k* is the multiplier and is between 0 and 4.

Strobe Dusk Intensity Scalar (entry #242) This 16-bit scalar multiplies the base intensity of the strobe during dusk/dawn. The value that is entered is (2048 * k) where *k* is the multiplier and is between 0 and 4.

Strobe Night Intensity Scalar (entry #243) This 16-bit scalar multiplies the base intensity of the strobe during the night. The value that is entered is (2048 * k) where *k* is the multiplier and is between 0 and 4.

Strobe Day On time (entry #244) This parameter indicates the number of fields the strobe is on during each period (daytime). The value is tied into the day field rate.

Strobe Day Off time (entry #245) This parameter indicates the number of fields is off during the each period (daytime). This value is tied into the day field field rate.

Strobe Dusk On time (entry #246) This parameter indicates the number of fields the strobe is on during each period (dusk/dawn). This value is tied into the dusk/dawn field rate.

Strobe Dusk Off time (entry #247) This parameter indicates the number of fields the strobe is off during each period (dusk/dawn). This value is tied into the dusk/dawn field rate.

Strobe Night On time (entry #248) This parameter indicates the number of fields the strobe is on during each period (nighttime). This value is tied into the night field rate.

Strobe Night Off time (entry #249) This parameter indicates the number of fields the strobe is off during each period (nighttime). This value is tied into the night field rate.

5.3.14 Landing Light Lobes

Seven landing light lobe switches are supported which control the center, left/right inboard, left/right turnoff, and left/right outboard lobes of own-ship. When a lobe is turned on polygons within range of that lobe are illuminated. Under low visibility conditions, glare from the landing light lobes are introduced into the scene. The lobe itself is not directly visible. The following parameters are used to tune the landing light lobe.

Landing Light Lobe Color Intensity (entry #250) This parameter indicates the base color of the first landing light lobe.

Landing Light Lobe Delta Color Intensity (entry #251) This parameter indicates the base color intensity of each additional landing light lobe.

Landing Light Lobe Day Intensity Scalar (entry #252) This 16-bit scalar multiplies the base intensity of the lobes during the day. The value that is entered is (2048 * k) where *k* is the multiplier and is between 0 and 4.

Landing Light Lobe Dusk Intensity Scalar (entry #253) This 16-bit scalar multiplies the base intensity of the lobes during dusk/dawn. The value that is entered is (2048 * k) where *k* is the multiplier and is between 0 and 4.

Landing Light Lobe Night Intensity Scalar (entry #254) This 16-bit scalar multiplies the base intensity of the lobes during the night. The value that is entered is (2048 * k) where *k* is the multiplier and is between 0 and 4.

Landing Light Lobe Dusk (entry #56) This number indicates the dusk landing light lobe brightness or intensity (0-255).

Landing Light Lobe Night (entry #57) This number indicates the night landing light lobe brightness or intensity (0-255).

Switch Landing Light Lobe Outer And Turnoff Bits (entry #519). This table entry switches the LLL outer and turnoff bits, since outer lights are usually displayed in the front channel and the turnoff lights are usually displayed in the outer channels. This was not possible with the bits in their default locations.

5.3.15 Ground Fog and Patchy Ground Fog Tuning

Three types of fog are supported by the real-time system: standard fog, ground fog, and patchy ground fog. Standard fog is controlled by the visibility and is applied to all objects in the scene based on distance from the eyepoint. Ground fog is a thin layer of fog next to the surface of the earth and is applied to objects based on both range and the altitude of the eyepoint. If the eyepoint is inside the ground fog layer, then the amount of fog is specified by the runway visual range (RVR). Immediately above the ground fog layer is a zone which is used as a transition

between the visibility and the RVR values. If the RVR value is greater than the visibility value, then RVR is selected regardless of height.

Patchy ground fog specifies that the RVR within the ground fog layer is not uniform. The amount of fog generated in the scene is computed by the real-time system for each fog system and sent to the display processor.

The following parameters are used to fine tune the ground fog.

Patchy GFOG Frequency (entry #60). Patchy gfog frequency adjusts how quickly the eye will transition from one fog patch to another, by changing the frequency of the patchy gfog curve. This table entry's effect is dependent on table entry 149, which limits the amount of vis change per field. If this table entry is too small, the vis might never reach the desired vis on the curve, since it could only change so much per field. If table entry 149 is too big, however, a popping between the vis points on the curve might occur.

Patchy GFOG Amplitude (entry #61). Patchy gfog amplitude adjusts the amplitude of patchy gfog curve, thus changing how high and how low the peaks and valleys of the curve get. Table offset 149, is also use with this table entry, since the magnitude of the vis change is scaled by table entry 61 and the value of table entry 149 will determine if the vis will actually have time to reach that value. Table entry 60, 61 and 149 must be tuned together to get the desired effect.

Patchy GFOG Midpoint (entry #62). Patchy gfog midpoint sets the midpoint of RVR. The effect of this entry is independent of table entries 60, 61 and 149, since it only adjusts the midpoint of the curve. A 0 in this entry represents a midpoint of RVR, where a 10 in this entry represents a midpoint of 2 RVR and a -10 being a midpoint of 0 vis.

Ground Fog Height (entry #147) This number indicates the height of the ground fog layer. The value in feet is entered.

Ground Fog Transition Zone Height (entry #148) This number indicates the height of the ground fog transition zone above the ground fog height. The transition zone is used to transition between the visibility and the ground fog RVR values. The value in feet is entered.

Ground Fog Change (entry #149) This number indicates the amount of visibility change allowed per field due to various densities in the patches of ground fog if the system is configured for patchy ground fog mode. The value in (feet * 32) is entered.

See GFOG from Above (entry #152) This flag specifies if the ground fog layer will be visible from above. To turn this ability off, enter a 0; to turn it on, enter a 1.

See GFOG from Above Scud Scalar (entry #153) This scalar tunes the thickness of the ground fog layer as seen from above. The layer thickness is a result of the equation ((GFOG Height * GFOG Scalar)/GFOG RVR). The default scalar entry of

4095 results in a multiplier of 1, 2047 will result in .5, and the maximum of 32767 will result in 8.

Start Removing GFOG Scud Here (entry #154) This variable tells the RTS when to begin removing scud as the eyepoint moves through the transition zone. This gives a realistic descent or ascent through the transition zone. The range of this variable is 0-32767; the default of 24576 represents 75%.

5.3.16 Haze Tuning

The following parameters are used to position a haze scalar transition zone which is used for generating a haze scalar. The haze scalar is multiplied against the host visibility to adjust the amount of fog that the display processor is generating.

Haze Transition Zone Top (entry #155) This parameter selects the top of the haze scalar transition zone. A value in feet is entered. The top must be greater than or equal to the bottom.

Haze Transition Zone Bottom (entry #156) This parameter selects the bottom of the haze scalar transition zone. A value in feet is entered.

Haze Select (entry #157) This parameter sets the maximum haze scalar which is multiplied by the input visibility supplied by the host. If the maximum is below the transition zone, then the scalar is set to 1. If the maximum is above the transition zone, then the scalar is set to MAX. If the maximum is inside the transition zone, then the scalar is interpolated between 1 and MAX. Entering a 1 here sets MAX to 1, entering 2 sets MAX to 2, entering 3 sets MAX to 4, and entering 4 sets MAX to 8.

Haze Zone Altered Visibility (entry #158) This parameter is used as a table value against which the haze visibility is compared. If the visibility set by the host or the CLI is above this table value, the haze visibility correction equation will use 0 as the bottom of the transition zone. If the visibility is below or equal to this table value, the equation is unchanged. This results in a sharper horizon at high visibilities. If the haze type is set to -1, this entry is used as the deciding point between set visibility and visibility that is scaled linearly by the haze select.

Haze Type (entry #521). This table entry specifies the type of haze desired. This keeps the lights from reappearing when the eye enters the haze transition zone due to range attenuation. The types allowed are: linear (0), linear proportional (1), squared proportional (2), cubed proportional (3), and non height dependent (-1). Linear (0) is the default and is the same type of haze correction that was done previous to RTS09. Proportional (1-3) haze correction incorporates the (set visibility/max visibility) into the correction algorithm. For example, if a haze type of 2 is specified, the set visibility is 24.82, the eye is 75% up into the haze transition zone, and the haze select is 4 (vis * 8). Then the visibility after haze correction would be:

$$24.82 + (24.82 * (.75 * (8-1) * (24.82/49.64) * (24.82/49.64))) = 57.4$$

The proportional value has a dampening affect at lower visibilities (thus increasing very little the intensity of lights that are just about to fade out) and has very little effect at higher visibilities.

The last type of haze correction, non-height dependent (-1), linearly scales the set visibility by the haze select, if the set visibility is above the value in table entry 158, Haze Zone Altered Visibility.

5.3.17 Horizon Brightness Control

When the directional horizon is enabled, the horizon is brightest at the specified heading angle and slowly tapers off as the heading of the eyepoint deviates from that point. When the directional horizon is disabled, the horizon brightness is uniform regardless of the heading of the eyepoint. The following parameters are used to tune the horizon brightness effects.

Horizon Visibility Cutoff (entry #255) This parameter specifies the visibility at which horizon brightness effects are completely diminished. The value is entered in (feet/8).

Directional Horizon Cutoff (entry #256) The number specifies the heading difference between the eyepoint and horizon brightness origin at which the horizon brightness effects diminish. This value is entered in (degrees * 32767/180).

Horizon Steps Dusk (entry #257) This number specifies the additional ambient to be added at the horizon during dusk/dawn for each step of horizon brightness. This value is multiplied by the horizon brightness and then added to the ambient of the horizon to determine the overall ambient at the horizon.

Horizon Steps Night (entry #258) This number specifies the additional ambient to be added at the horizon during night for each step of horizon brightness. The value is multiplied by the horizon brightness level then added to the ambient of the horizon to determine the overall ambient at the horizon.

Remove Horizon Glow - Transition Zone (entry #520). This table entry specifies the width of a transition zone which lies above the cloud top scud layer for removing horizon glow before the eye reaches the scudded clouds. This transition zone eliminates the popping of the horizon glow band when the eye is in scudded clouds. This entry should be kept relatively low (below 200) to insure that stepping in the horizon glow band intensity is not noticeable.

5.3.18 Host Interface

The following parameters configure the host interface.

Ethernet Address (entry #288) This parameter redefines the last two bytes of the IG Ethernet address. The default is stored in an EPROM on the MP card at address 6FFF6 to 6FFFB. This allows the MP cards to be changed on site without affecting the host program. The first four bytes of this address are always 08005701.

Host Coordinate System Count (entry #289) This parameter specifies the number of coordinate systems being controlled from the host. This parameter is only used in special cases where the flybox and host are enabled at the same time. By setting this valued to be less than the number of processed coordinate systems (see Number of Coordinate Systems, entry #134), the first n coordinate systems will be driven by the host and the remaining are controlled by the flybox. This parameter is internally checked so it is guaranteed to be less than or equal to the number of processed coordinate systems.

Ethernet Byte Swap (entry #290) If this switch is enabled, the chip swaps the high and low bytes so that bits (15:08) are in the least significant byte and bits (07:00) are in the most significant byte.

Ethernet Address Table Entry (entry #490-491). These table entries specify the upper bytes of both the host and IG ethernet addresses. Table entries 490 and 491 define the upper 4 bytes for the IG address that table entry 288 specifies the lower two bytes of.

5.3.19 Host Simulation Parameters

The following parameters allow a second IG to simulate a host computer over the Ethernet interface. The following control words are entered in the host IG to place it in host simulation mode.

Host Simulation Control Word #1 (entry #291) Simulate interrupts flag.

    1: simulate IG interrupts
    0: do not simulate interrupts

With this parameter the host IG can operate on a workstation.

Host Simulation Control Word #2 (entry #292) Host simulation flag.

    1: configures real-time system as a host simulator
    0: normal operation

When the host simulation flag is set, the real-time system builds packets and issues them over the Ethernet just as the host would.

Host Simulation Control Word #3 (entry #293) This parameter defines a unique IG machine address. It is used only when the host simulation flag (entry #292) = 1. It specifies the unique address to which the host IG broadcasts its packets.

Host Simulation Control Word #4 (entry #294) Coordinate system XYZ bit fields. This word is used only when the host simulation flag (entry #292) = 1. With this flag the user can specify which fields are present in the IG host coordinate system opcodes. The range is between 0 and 7.

   Bit 0: 1 means x present, 0 means x not present.
   Bit 1: 1 means y present, 0 means y not present.
   Bit 2: 1 means z present, 0 means z not present.

For example, if Z is present, but neither X nor Y are present, then the binary mask is 100 and the entry would be 4 (the decimal equivalent of the binary 100).

Host Simulation Word #5 (entry #295) Coordinate system HPR bit fields. This word is used only when the host simulation flag (entry #292) = 1. With this flag the user can specify which fields are present in the IG host coordinate system opcodes. The range is between 0 and 7.

   Bit 0: 1 means heading present; 0 means no heading present.
   Bit 1: 1 means pitch present; 0 means no pitch present.
   Bit 2: 1 means roll present; 0 means no roll present.

For example, if pitch is present, but neither heading nor roll are present, then the binary mask is 010 and the entry would be 2 (the decimal equivalent of the binary 010).

Host Simulation Word #6 (entry #296) Extrapolate coordinate system.

   1: extrapolate all coordinate systems
   0: do not extrapolate any coordinate systems

This word is used only when the host simulation flag (entry #292) = 1. With this flag, the user can change the extrapolation fields in the host coordinate system opcodes.

Host Simulation Word #7 (entry #297) Viewport XYZ fields. This word is used only when the host simulation flag (entry #292) = 1. With this flag the user can specify which fields are present in the IG host viewport opcodes. The range is between 0 and 7.

   Bit 0: 1 means x present, 0 means x not present.
   Bit 1: 1 means y present, 0 means y not present.
   Bit 2: 1 means z present, 0 means z not present.

For example, if Z is present, but neither X nor Y are present, then the binary mask is 100 and the entry would be 4 (the decimal equivalent of the binary 100).

Host Simulation Word #8 (entry #298) Viewport HPR fields. This word is used only when the host simulation flag (entry #292) = 1. With this flag the user can specify which fields are present in the IG host viewport opcodes. The range is between 0 and 7.

> Bit 0: 1 means heading present, 0 means no heading present.
> Bit 1: 1 means pitch present, 0 means no pitch present.
> Bit 2: 1 means roll present, 0 means no roll present.

For example, if pitch is present, but neither heading nor roll are present, then the binary mask is 010 and the entry would be 2 (the decimal equivalent of the binary 010).

Host Simulation Word #9 (entry #299) Viewport angle, extrapolation fields. This word is used only when the host simulation flag (entry #292) = 1. With this flag the user can specify which fields are present in the IG host viewport opcodes. The range between 0 and 3.

> Bit 0: 0 means half angles not present; 1 means half angles are present
> Bit 1: 0 means do not extrapolate viewports; 1 means extrapolate viewports

For example, if viewports are not to be extrapolated, and half angles are present, then the binary mask is 01 and the entry would be 1 (the decimal equivalent of the binary 01).

Ethernet Address Table Entry (entry #492-493). These table entries specify the upper bytes of both the host and IG ethernet addresses. Table entries 492 and 493 define the upper 4 bytes for the host address that table entry 293 specifies the lower two bytes of.

5.3.20 Image Generator Configuration

Image Generator Configuration (entry #340) This code identifies which options are present in the image generator. This information is used both for database compatibility checking and for selecting which data load opcodes are required by the IG. To compute this code, sum the values for all options present. If no options apply, enter a code of 0.

Standard texture option   1

(Only the standard texture option is presently available. As more options are added in the future, they will be assigned numbers 2, 4, 8, 16, 32, ... 32768.)

Mask IG/Database Compatibility Warning (entry #341) This switch suppresses the IG/database compatibility warning; this warning signals the user when the

database is not compatible with the IG, as determined with the settings in entry #340.

5.3.21 Instructor Monitor

The instructor monitor is run using an optional matrix switcher. If the hardware switcher is not present, then the following parameters should not be adjusted.

Instructor Monitor Channel (entry #39) This entry indicates the number of the channel processor whose image is to appear on the instructor monitor (0 - 7).

Matrix Switcher Port Number (entry #310) This entry indicates the serial port on the MP card to which the switcher is connected. The port must be dedicated to the matrix switcher only, and cannot be changed during real-time system execution. If another port is to be used, then the appropriate serial port should be specified in the site file.

Matrix Switcher Baud Rate Code (entry #311) This code should be the same as the baud rate setting on the matrix switcher unit. It cannot be changed during real-time system execution and should be specified in the site file. The following codes are used:

Baud Rate	19200	9600	4800	2400	1200	600	300
Code	1	2	4	8	16	32	64

Matrix Switcher Enable (entry #312) This parameter is used to enable the matrix switcher hardware. If the hardware is not present, then the switcher software should be disabled.

NOTE: Do not enable the switcher software during real-time system execution. This should only be done in the site configuration file.

5.3.22 Light Defocus Based on Range

Light Defocus Based on Range (entries #500-509). These entries are used to facilitate the defocus of lights in ground fog at a low RVR or in low vis scenes. The value entered in each entry is the desired defocus at the RVR/vis that table entry represents. The RVR/vis ranges in this table correspond to the RVR/vis ranges for vis tuning.

5.3.23 Overload Management Configuration

Overload management is activated when the field time allocated for either the OM, GP, DPin, or DPout is not sufficient to complete the work required of these hardware devices. When this happens, the system automatically goes into field extension, if allowed by the display hardware, or into level-of-detail management. Either of these two methods can be used to reduce overload.

The real-time system is constantly monitoring the field times of these devices; the field times are used to determine when to start or stop overload management processing. These times are available to the user by enabling the statistics screen of the command line interpreter with the CLI command SHOW STATS +.

The following settings are used to configure overload management:

Overload On time (entry #48) This number indicates the number of milliseconds before field extension takes place to begin overload management, divided by .0814. For example if overload management is to start 1 millisecond before field extension then the value to be entered is $12 = (1.0/.0814)$.

Overload Off time (entry #49) This parameter indicates the number of milliseconds before field extension takes place to stop overload management, divided by .0814. For example if overload management is to stop 2 milliseconds before field extension then the value to be entered is $25 = (2.0/.0814)$.

Level of Detail (LOD) Management (entry #103) This flag enables (1) or disables (0) level of detail management. If it is enabled, the transition ranges will automatically be shortened by a scalar called KLOD when overload management begins. This helps reduce the database load on the image generator (IG), thus freeing up processing time.

Maximum KLOD (entry #104) This parameter indicates the maximum KLOD value. KLOD is calculated on a percentage basis. The value to be entered is $(32767 * k)$ where k is the multiplier and is between 0 and 1. For example, to specify that the maximum amount that any transition range may be is 75% of its modeled value, enter $24575 = (32767 * .75)$.

NOTE: This number is also sent to the OM if level of detail management is turned off.

Minimum KLOD (entry #105) This number indicates the minimum KLOD value. KLOD is calculated on a percentage basis. The value to be entered is $(32767 * k)$ where k is the multiplier and is between 0 and 1. For example, to specify that the most any transition range will be shortened is 75% of its modeled value, enter $24575 = (32767 * .75)$.

KLOD Delta (entry #106) This number controls the delta (or speed) that successive KLOD values can change. The value to be entered is $(32767 * k)$ where k is the multiplier and is between 0 and 1. For example, if KLOD is not to change more than 5% from the previous field's value, enter $1638 = (32767 * .05)$.

Current KLOD (entry #107) This is a display-only parameter which shows on the CLI screen the current KLOD value being sent to the OM. To convert the value into a percentage divide the entry by 32767. For example, if the KLOD value was 26213 then the percentage displayed on the screen would be $(26213/32767) = 80\%$.

Random Light (RAN) Management (entry #108) This flag enables (1) or disables (0) random light management. If it is enabled, the number of calligraphic light points that a random light cluster generates will automatically be reduced by a scalar called KRAN when overload management is activated. This helps reduce the draw time in the DP.

Maximum KRAN (entry #109) This number indicates the maximum KRAN value. KRAN is calculated as a percentage of the cluster density. The value to be entered is (32767 * k) where *k* is the multiplier and is between 0 and 1. For example, if you enter a value of 75%, the maximum percentage of a random light cluster is 75% of its modeled value. The value entered is 24575 = (32767 * .75).

NOTE: This number is also sent to the GP if random light management is turned off.

Minimum KRAN (entry #110) This number indicates the minimum KRAN value. KRAN is calculated as a percentage of the cluster density. The value to be entered is (32767 * k) where *k* is the multiplier and is between 0 and 1. For example, if you enter a value of 75%, the most that any random light cluster can be reduced is 75% of its modeled value. The value entered is 24575 = (32767 * .75).

KRAN Delta (entry #111) This number controls the delta (or speed) that successive KRAN values can change. The value to be entered is (32767 * k) where *k* is the multiplier and is between 0 and 1. For example, if KRAN is not to change more than 5% from the previous value then enter 1638 = (32767 * .05).

Current KRAN (entry #112) This is a display-only parameter which shows on the CLI screen the current KRAN value being sent to the GP. To convert the value into a percentage divide the entry by 32767. For example, if the KRAN value was 26213 then the percentage displayed on the screen would be (26213/32767) = 80%.

Boot Time Timeout (entry #45) This number indicates the maximum allowable field extension during the initialize state before a hardware timeout is declared. If the delinquent device does not finish in this amount of time, then the boot procedure is terminated and the system goes to a pause state, waiting for input from the console.

The value that is entered is the timeout time in milliseconds divided by 20.8 milliseconds which is the new resolution of the system clock. The quotient is then rounded to the nearest whole number and multiplied by 256. Timeout times up to five seconds are supported. If the value is greater than 32767 then subtract 65536 from it. For example: If the delay time is 500 milliseconds then enter 6144 = ((500.0/20.8)*256). To enter 5000 milliseconds enter -4096 = [((5000/20.8)*256) - 65536].

Run Time Timeout (entry #46) This number indicates the maximum allowable field extension during the RUN state before a hardware timeout is declared. If the delinquent device does not finish in this amount of time, then a warm reset is performed. The value that is entered is the timeout time in milliseconds divided by .0814, which is the resolution of the system clock. The quotient is then rounded to

the nearest whole number, multiplied by 256 and added to 1. Timeout times up to 20.5 milliseconds are supported. For example: If the delay time is 4 milliseconds then enter 12545 = ((4.0/.0814)*256)+1.

NOTE: If the computed value is greater than 32767 then subtract 65536 from it. For instance: To enter 20 milliseconds enter -2559 = [(((20/.0814)*256)+1)-65536].

Floating OM And GP Timing Control Table Entries (entry #522, 523). These table entries facilitate a floating OM and GP timing control option. Table offset 522 is simply a switch to turn on or off the option. This table entry should only be changed when the system is paused. Table entry 523 specifies the amount of change to the field length per field if field extension is necessary. This table entry should be left at 1 unless a place in the database is found which requires field extension faster than .0814 mils/field. A timeout will result if this is the case.

5.3.24 Runway Edge Lights

Runway Edge Lights (entry #480, 481, 482, 483, 484) This parameter identifies the special light switches that the real-time system monitors. This parameter defines the edge light switch numbers for five runways. The default switches are 3, 11, 19, 27, and 35. These switches are monitored by the visibility processor. (Refer to Visibility Calibration, Section 5.3.29.) The same switch number can be listed multiple times. For example, if the fifth runway is not needed, and light switch number 35 has been used for something else, then a valid edge light switch number (i.e., 27) should be listed for both the fourth and fifth runways (i.e., 3, 11, 19, 27, 27).

To allow for visibility adjustment based on a range of edge lights rather than the specified switches in table entries #480-484, table entries #820-822 have been added. If table entry #820 is 0 (default), table entries #480-484 will be monitored for visibility adjustments. If table entry #820 is not 0, the light switches in the range of table entry #821 through #822 (inclusive) will be monitored for visibility adjustments.

Edge Light Switch Range (entries #820 - 822). These entries allow visibility adjustment based on a range of edge lights other than those specified in table entries #480-484. If table entry #820 is 0 (default), the edge lights specified in table entries #480-484 will be used for visibility adjustments. If table entry #820 is not 0, the edge lights from table entry #821 through table entry #822 (inclusive) will be used for visibility adjustments.

5.3.25 Storm, Lightning, and Rain

One dynamic coordinate system and a placeable parcel containing the modeled rain squall and lightning are used to produce storm effects. The dynamic coordinate system is host controlled and positions the center of the storm. As the eyepoint moves closer to the storm, the scene ambient and visibility decrease. The random

positional data for the lightning bolts are modeled into the placeable parcel. The real-time system generates pseudo-random intervals between bolts; each time a bolt flashes, lightning glare is generated even if the bolt is not contained in the scene. The dynamic coordinate system positioning the storm defaults to CS 3.

When rain is enabled, the raster and calligraphic light points are defocused to simulate rain buildup on the windshield. This buildup of precipitation remains until rain is disabled, at which time the raster and light points return to their original state.

The following parameters are used to define storm, lightning and rain.

Storm Center CSN (entry #227) This coordinate system number defines the CSN whose origin represents the storm center. This value is defaulted to 3. If a change is made to this table position, a change must also be made to the default model of the storm and lightning since they are modeled on coordinate system 3.

Maximum Storm Range (entry #300) This parameter specifies the maximum distance from the storm center that any special effects will occur. The distance is entered in (feet/8).

Minimum Storm Range (entry #301) This parameter specifies the minimum distance from the storm center that all special effects will reach their full intensity. For instance, if the minimum storm range is half a mile and the minimum storm visibility is 0 feet, then from a half a mile from the storm center to the center, the visibility will be reduced to 0. This distance is entered in (feet/8).

NOTE: The following seven parameters are interpolated between their no-storm value and their full-storm value at the region between the minimum and maximum storm range.

Minimum Storm Visibility (entry #302) This parameter specifies the visibility from the storm center to the minimum storm range. The visibility should be 0 (default) if the storm squall is modeled to prevent flying through the polygon. This distance is entered in (feet/8).

Storm Day Ambient Loss (entry #303) This parameter specifies the amount of ambient loss occurring at the minimum storm range in a day scene. This amount is in addition to any ambient loss due to clouds.

Storm Dusk Ambient Loss (entry #304) This parameter specifies the amount of ambient loss occurring at the minimum storm range in a dusk/dawn scene. This amount is in addition to any ambient loss due to clouds.

Storm Night Ambient Loss (entry #305) This parameter specifies the amount of ambient loss occurring at the minimum storm range in a night scene. This amount is in addition to any ambient loss due to clouds.

Storm Day Lightning Ambient (entry #306) This parameter specifies the amount of additional ambient to be added to a day scene when there is a lightning bolt flash.

Storm Dusk Lightning Ambient (entry #307) This parameter specifies the amount of additional ambient to be added to a dusk/dawn scene if there is a lightning bolt flash.

Storm Night Lightning Ambient (entry #308) This parameter specifies the amount of additional ambient to be added to a night scene if there is a lightning bolt flash.

Rain Raster Defocus Limit (entry #220) This parameter specifies the limit of raster defocus due to rain. A 0 indicates no raster defocus for rain while a 255 (default) indicates full raster defocus for rain.

Rain Lights Defocus Limit (entry #221) This parameter specifies the limit to the calligraphic light defocus due to rain. A 0 indicates no calligraphic light defocus for rain while a 255 (default) indicates full calligraphic light defocus for rain.

Rain Raster Delta Buildup (entry #222) This parameter specifies the amount of defocus increase per field until the raster defocus reaches the rain raster defocus limit (entry #220). A 2 (default) in this table position indicates an increment of raster defocus by 2 each field until the raster defocus reaches the rain raster defocus limit.

Rain Lights Delta Buildup (entry #223) This parameter specifies the amount of defocus increase per field until the calligraphic light defocus reaches the rain lights defocus limit (entry #221). A 2 (default) in this table position indicates an increment of calligraphic light defocus by 2 each field until the calligraphic light defocus reaches the rain light defocus limit.

Rain Raster Delta Clearup (entry #224) This parameter specifies the defocus decrease per field until raster defocus reaches 0. A 10 (default) in this table position indicates a raster defocus decrement of 10 per field until the raster defocus reaches 0.

Rain Lights Delta Clearup (entry #225) This parameter specifies the amount of defocus per field until the calligraphic light defocus reaches 0. A 10 (default) in this table position indicates a decrement of calligraphic light defocus by 10 each field until the calligraphic light defocus reaches 0.

5.3.26 Sun Shading

The sun shading scalars are used to modify a polygon's modeled intensity based on an imaginary sun in the sky. The GP computes the angle between the sun vector and the polygon normal. If the angle is less than 90 degrees, then the polygon is shaded based on direct lighting using the formula KSUN = (COS angle)^2* SUN K1 + SUN OFFSET). If the angle is between 90 and 180 degrees then shading is based on residual lighting where SUN K1 is replaced by SUN K2. In either case the sum of

SUN K1 or SUN K2 and SUN OFFSET must be between 0 and 32767 or an overflow condition will occur.

High Contrast Sun K1 (entry #96) This number indicates the SUN K1 value to be used in a high contrast (day) scene.

High Contrast Sun K2 (entry #97) This number indicates the SUN K2 value to be used in a high contrast (day) scene.

High Contrast Sun Offset (entry #98) This number indicates the SUN OFFSET value to be used in a high contrast (day) scene.

Low Contrast Sun K1 (entry #99) This number indicates the SUN K1 value to be used in a low contrast (dusk/night) scene.

Low Contrast Sun K2 (entry #100) This number indicates the SUN K2 value to be used in a low contrast (dusk/night) scene.

Low Contrast Sun Offset (entry #101) This number indicates the SUN OFFSET value to be used in a low contrast (dusk/night) scene.

5.3.27 Viewport Magnification Scalar

Viewport Magnification Scalar (entry #285) This parameter will modify the LOD transition ranges by the amount specified. This allows the LOD displayed to be different than what would be normal for the eyepoint's position. Combining this with narrowing the viewport has the effect of "zooming in" on an object.

5.3.28 Variable Cloud Density Tuning

These two scalars tune the psuedo-random VCD curve used to simulate motion cues inside the clouds. The ambient inside the clouds is changed according to the curve.

VCD Amplitude Scalar (entry #271) This number tunes the amplitude of the VCD motion (0-128). Enter (amplitude * 4)

VCD Frequency Scalar (entry #272) This number tunes the frequency of the VCD motion (0-31). Enter (frequency / 8)

5.3.29 Visibility Brightness Configuration

These parameters control the brightness of the visibility.

Visibility Intensity Day (entry #53) This number indicates the day visibility brightness or intensity (0-255).

Visibility Intensity Dusk (entry #54) This number indicates the dusk visibility brightness or intensity (0-255).

Visibility Intensity Night (entry #55) This number indicates the night visibility brightness or intensity (0-255).

5.3.30 Visibility Calibration

The following table entries are used to calibrate visibility. The visibility ranges (entries #64-73) are used to set up distances upon which all other visibility steps are based. The scalars entered for entries #74-93, 158-219, 320-339, and 400-439 use these ranges as a base; the values entered for these scalars determine the visibility when the eyepoint is within one of the ranges.

The system has 64 switches for light strings and 64 for polygons. Each switch has six steps: five steps of intensity plus an off state. The step setting specifies an intensity scalar which is multiplied by the modeled intensity.

The host can enable a random intensity function that is applied to certain light strings that have been marked by the modeling system. It causes the individual points of a marked string to be pseudo-randomly assigned intensities based on the modeled intensity. When disabled, all points within a string are assigned the modeled intensity.

Light Switch Step Settings (entries #135-140) Enter the base intensity for each of the six light step switches. Each switch can be set to one of six steps to match airport lighting systems. The step number indexes an intensity modifier which is applied to the modeled intensity. Step 0 should always send a modifier of 0 (off) and step 3 a modifier of 1 (no modification). The value to be entered is (2048 * k) where k is the multiplier and is between 0 and 4.

Polygon Switch Step Settings (entries #141-146) Enter the base intensity for each of the six polygon step switches. Each switch can be set to one of six steps to match airport lighting systems. The step number indexes an intensity modifier which is applied to the modeled intensity. Step 0 should always send a modifier of 0 (off) and step 3 a modifier of 1 (no modification). The value to be entered is (2048 * k) where k is the multiplier and is between 0 and 4.

Visibility Range Table (entries #64-73) This table sets the ten visibility ranges, which define the distances between each of the ten steps; these distances are in the range of 0 to 262,136 feet. The system will interpolate visibility when the eyepoint is between two steps. The value entered here is in (feet/8).

Visibility Light Step 4 Scalar Tables (day: entries #160-169, dusk: entries #400-409, night: entries #420-429) These tables contain the calibration scalars for lights set to step 4. Three scalars exist for each calibration point in the range table--one each for day, dusk and night. The value entered is (32767 * k) where k is the multiplier and is between 0 and 1.

Visibility Light Step 5 Scalar Tables (day: entries #170-179, dusk: entries #410-419, night: entries #430-439) These tables contain the calibration scalars for lights set to step 5. Three scalars exist for each calibration point in the range table—one each for day, dusk and night. The value entered is (32767 * k) where k is the multiplier and is between 0 and 1.

The input visibility is also separately adjusted for lights and polygons based on range. For each calibration point in the range table there is a light and polygon adjustment scalar.

Light Visibility Scalar Tables (day: entries #74-83, dusk: entries #180-189, night: entries #200-209) These tables contains the calibration scalars for lights. These scalars exist for each calibration point in the range table, one each for day, dusk and night. The value that is entered is (8192 * k) where k is the multiplier and is between 0 and 4.

Polygon Visibility Scalar Tables (day: entries #84-93, dusk: entries #190-199, night: entries #210-219) These tables contain the calibration scalars for polygons. Three scalars exist for each calibration point in the range table, one each for day, dusk and night. The value that is entered is (8192 * k) where k is the multiplier and is between 0 and 4.

Sky Visibility Scalar Table (entries #330-339) This table contains the calibration scalars for the sky. A scalar exists for each calibration point in the range table. The value that is entered is (8192 * k) where k is the multiplier and is between 0 and 4.

Star Visibility Scalar Table (entries #320-329) This table contains the calibration scalars for stars. A scalar exists for each calibration point in the range table. The value that is entered is (8192 * k) where k is the multiplier and is between 0 and 4.

Alternate Light Intensity Switch Number (entry #823). This table entry allows an optional table of light intensities for a particular light switch number. Table entry #823 contains the light switch number which will utilize the alternate light switch intensity table. If it contains a -1 (default), the standard light switch intensity table (table entries #135-140) will be used.

Alternate Light Switch Step Settings (entries #824-829). These entries should contain the base intensity for each of the six alternate light step switches. Each switch can be set to one of six steps to match airport lighting systems. The step number indexes an intensity modifier which is applied to the modeled intensity. Step 0 should always send a modifier of 0 (off). The value to be entered is (2048 * k) where k is the multiplier and is between 0 and 4.

5.3.31 Light vs. Polygon Visibility

Visibility Of Lights vs Polygons In The Cloud Bottom Transition Zone (entries #527-528, 530-533, 540-555, 560-575, 600-615, 620-635, 640-655, 660-675, 680-695, 700-

715, 720-735, 740-755, 760-775, 780-795). Twelve sets of table entries along with six other table entries correct for the lights disappearing before polygons when the eye enters the cloud bottom transition zone. The sets are for all combinations of step 3, 4 and 5 lights, low and high cloud bottom heights, day and dusk (night uses the dusk values). The correction works as follows: Two cloud heights are picked for the low and high cloud bottom heights. With the eye transitioning into the cloud bottom at those heights and at specified visibility settings, the correction scalars are modified until the lights disappear just after the polygons. During actual flight these interpolations are performed for intermediate visibilities and cloud heights. A reset file called LVSPCAL.RST helps tune lights against the polygons.

Table offsets 530 and 531 specify the cloud bottom heights mentioned above. While table offsets 532 and 533 were necessary to make the correction effect look realistic. Table offset 532 specifies the maximum change to the lights vs. polygon correction scalars per field. This was necessary to stop the lights from popping in as the eye reached the cloud bottom transition zone in the case where the scalar was very low. Do not set 532 too low or else the scalars may never reach the calibrated points. Table offset 533 was needed for the same problem, but moderates the change in visibility to keep the lights from popping in. The reason the vis changes as the eye enters the cloud bottom transition zone is because visibility is now added in to correct for the apparent bouncing horizon in scudded clouds. Do not set table offset 533 too low or else the correction for the apparent bouncing horizon will not work correctly.

Table offsets 527 and 528 facilitate the tuning of the correction scalars for lights against the polygons. Table offset 527 turns off the correction for the apparent bouncing horizon, thus keeping the visibility constant and allowing the user to change the table entries at the specified visibilities. Table offset 528 reports the current visibility after haze correction has been applied. This was necessary since half the lights versus polygon scalars require the visibility to be above 49.64 miles.

5.3.32 Misc. Switches

NTSC switch (entry #102) This switch is used to configure the RTS for video taping, which requires a constant field rate.

Transport Delay Table switch (entry #226) Transport delay is the amount of time between when a polygon or light string enters the FOV and the time it is displayed. With this switch on, the FOV moves in advance of the eyepoint to find the objects in advance. The eyepoint is moved as follows: in the first field 20 sync pulses will be generated and the eyepoint will be translated +10 feet in the Y direction. In the second field, the eyepoint will be translated -10 feet in the Y direction. In the next three fields nothing will change. This process is then repeated until the switch is turned off.

TMS Available switch (entry #515) This switch must be set if the hardware the RTS is running on does not have the TMS co-processor available. Setting the switch

to 0 specifies that the co-processor is not present and forces all calculations to be made by the 68000 chip.

Switch To Turn On/Off All RSI/RSL Options (entry #525). This table entry turns on/off all RSI/RSL options.

Base Raster Defocus Table Entry (entry #524). This table entry specifies the minimum raster defocus.

New OC Card (entry #518). This table entry must be set when using the new OC card.

Display Blanking (entry #342). This entry turns all active displays (including the instructor monitor) off after the specified time has elapsed without eye motion. Table entry #342 contains the number of minutes before the displays blank. A value of 0 (default) disables this feature. The displays will be turned back on again if any of the following things are done: eye motion in x, y, or z; hitting a carriage return (hence issuing any CLI command followed by a carriage return); or the host explicitly issuing the command to turn the displays on.

5.3.33 Same Point Test Table Entries

These entries tune the intensity of directional lights for various conditions. In the near range, such as looking down a runway, the edge lights and the center line lights at the end of the runway appear much brighter or hotter than real runway lights. A portion of the GP microcode performs a same point test to determine if two or more lights are being displayed on top of or near each other. If they are, the intensity of such lights is attenuated using values from a Same Point table. Lights appearing extremely close together are thrown out to prevent unrealistic light intensity build up. This also helps at far ranges so that the intensity of directional light strings will not persist longer than their surrounding environment lights.

At close range, runway lights look best with a same point table having particular values that do not give good results at medium and far ranges. Lights displayed very close together require small values in the same point table to give good depth perception along the string. At greater ranges the lights actually fade faster than their neighboring environment lights because now lights are being dropped from their strings. A function linear with respect to the range of the eye to the light is used to increase the values coming out of the same point table. As the range increases from a certain initial value, the same point table values are gradually increased until some maximum range. From that point on the same point table values are left constant.

In the case of directional light strings that run horizontally across the screen, the distance between lights is large enough that the same point table values attenuate these lights very little. If the same point values are uniformly increased with eye-to-light range for all light strings, then cross runways can become overly bright. The number used for the intensity value may even go negative and sections of the

light string will disappear all together. A second function is used to filter out the effect of the linear function previously described. If the distance between lights appears to be large on the screen then the linear function should be filtered out completely. As the distance between lights becomes smaller on the screen the linear function should be filtered less and should be able to have a bigger effect on the values out of the same point table.

Same Point Shift Code (entry #805). This entry scales the distances between lights that the same point table acts on. Small negative numbers cause the table to act only on smaller distances, while large negative numbers increase the distance between lights affected by the same point table. The typical range for this entry is from -7 to -9.

Same Point Delete Light Distance (entry #806). This entry determines how close together lights must be for any lights to be thrown out. As this parameter is increased more lights will be thrown out. Light intensity buildup at the end of the runways can be reduced by throwing out lights. Processing time can also be reduced by throwing out lights. As more lights are thrown out the intensity of the light string can become non-uniform. For certain video thresholds, throwing out a few more lights can improve uniformity. As the video threshold is increased, the contrast in the non uniformity usually becomes more pronounced. The typical range for this entry is from 177 to 63.

Same Point Filter Scalar (entry #807). This entry determines how much filtering is done on the linear same point mod function. A larger value filters out light strings with smaller distances between lights, and thus are not effected by the linear same point mod function. If the parameter at entry 808 is increased, this value may need to be increased as well, if cross-runway lights have too much intensity. The typical range for this entry is from 2 to 5.

Same Point Intensity Mod Scalar (entry #808). This value is used by the linear same point mod function to increase values coming out of the same point table. The larger this value is, the brighter the runway lights appear in the distance. The typical range for this entry is from 6000 to 8000.

Same Point Min Mod Range (entry #809). This entry approximately corresponds to the eye-to-light range and is the minimum distance at which a light's same point value may be modified by the linear mod function. If light strings appear to dim at near ranges this parameter may be decreased to slightly increase intensity. The reverse is also true. Lights closer than this min range are not effected by the linear mod function. The typical range for this entry is from 1000 to 2000.

Same Point Max Mod Range (entry #810). This entry approximately corresponds to the eye-to-light range and is the maximum distance at which a light's same point value may be modified by the linear mod function. At all ranges greater than this, the same point values are modified by the constant value in entry 808. If a light at near range were to dim, this value may be decreased to increase the light intensity. This would result in a more rapid change in a light's intensity as eye-to-light range changes. The typical range for this entry is from 9000 to 16000.

Same Point Screen Y Scalar (entry #811). This entry scales the y screen coordinate. This effects how many lights are thrown out in the direction of the y screen axis. It effects which same points values are used to modify a directional lights intensity, according to its y component. It also effects the filter function which is dependent on the screen distance between lights. This value only need be adjusted to compensate for unusual field of views. The typical range for this entry is from 32767 to 32000.

Same Point Screen X Scalar (entry #812). This entry has the same description as the parameter at entry 811. Directional light strings off to the side of the display screen often appear at in a diagonal direction. The screen distance between these lights is somewhat larger than light strings that are head on. These lights will appear brighter because the same point table values effect them less. To compensate the x screen distances are scaled down so that the x component between lights is smaller in the same point calculations. As a result the same point algorithm is fooled into thinking these lights are closer together. The typical range for this entry is from 25000 to 15000.

5.4 CONFIGURATION TABLES

The following two tables list the entries that may be changed with the TABLE command, Table 5-1 in order of name and Table 5-2 in order of entry number. The format for the TABLE command is found in Sections 4.3 and 5.5.

In the tables, the **Entry#** column lists the number used with the TABLE command as the offset. The **Manual** column lists the section of this manual that discusses the entry. The **Range** column shows the acceptable range of values in integers. The **Default** column lists the system default which will be used unless changed by an entry in the site file or by a CLI command. The **Use** column shows when the entry may be made:

- S: this entry may be used in the site file only.

- P: this entry may be entered through a CLI command, but the system must be paused first; enter SYSTEM PAUSE, then change the entry, then enter SYSTEM RESUME to resume system operation.

- R: this entry may be entered through a CLI command while the real-time system is running.

- D: this entry may be entered through a CLI command only after diagnostics are enabled.

Table 5-1. Table Entry Numbers, Range, and Defaults (by name)

Parameter	Entry #	Manual	Range	Default	Use
Active channel mask	33	5.3.2	1-255	255 (8 channel)	P
Alt. light int. switch num	823	5.3.30	-1, 0 - 63	-1 (off)	R
Alt. light switch step 0	824	5.3.30	0 - 8192	0 (disabled)	R
Alt. light switch step 1	825	5.3.30	0 - 8192	500 (.061)	R
Alt. light switch step 2	826	5.3.30	0 - 8192	1000 (.122)	R
Alt. light switch step 3	827	5.3.30	0 - 8192	1500 (.183)	R
Alt. light switch step 4	828	5.3.30	0 - 8192	3000 (.366)	R
Alt. light switch step 5	829	5.3.30	0 - 8192	8000 (.977)	R
Ambient day	50	5.3.1	0-255	255 (1.0)	R
Ambient dusk	51	5.3.1	0-255	50 (.196)	R
Ambient night	52	5.3.1	0-255	10 (.04)	R
Auto display blanking time	342	5.3.32	0, 1 - 1440	0 (off)	R
Base raster defocus	524	5.3.32	0-255	0 (no defocus)	R
Beacon color intensity	230	5.3.12	0-255	180	R
Beacon day intensity scalar	231	5.3.12	0-8192	1000 (0.488)	R
Beacon day off time	235	5.3.12	0-32767	50 (fields)	R
Beacon day on time	234	5.3.12	0-32767	5 (fields)	R
Beacon dusk intensity scalar	232	5.3.12	0-8192	2000 (0.977)	R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Beacon dusk off time	237	5.3.12	0-32767	30 (fields)	R
Beacon dusk on time	236	5.3.12	0-32767	3 (fields)	R
Beacon night intensity scalar	233	5.3.12	0-8192	6000 (2.930)	R
Beacon night off time	239	5.3.12	0-32767	30 (fields)	R
Beacon night on time	238	5.3.12	0-32767	3 (fields)	R
Boot time timeout	45	5.3.23	0-65535	6144 (500 ms)	R
Cal. light defocus: 0 ft.	500	5.3.22	0-255	255	R
Cal. light defocus: 300 ft.	501	5.3.22	0-255	255	R
Cal. light defocus: 700 ft.	502	5.3.22	0-255	200	R
Cal. light defocus: 1200 ft.	503	5.3.22	0-255	100	R
Cal. light defocus: 2640 ft.	504	5.3.22	0-255	0	R
Cal. light defocus: 1 mile	505	5.3.22	0-255	0	R
Cal. light defocus: 3 miles	506	5.3.22	0-255	0	R
Cal. light defocus: 8 miles	507	5.3.22	0-255	0	R
Cal. light defocus: 20 miles	508	5.3.22	0-255	0	R
Cal. light defocus: 49.6 miles	509	5.3.22	0-255	0	R
CD channel mask	280	5.3.7	0-255	2 (chan 1)	S
CD num test points/field	283	5.3.7	0-3	3 (per field)	S
CD type	282	5.3.7	0, 1	0 (on path)	S
Channel [i] display type	(i*4)+3	5.3.2	0-7	0 (Cal. CSM)	S
Channel [i] hor. flyback	(i*5)+350	5.3.2	0-4096	70 (13.5 μs)	S
Channel [i] pixels/line	(i*4)+1	5.3.2	640, 896, 960	640 (Med Res.)	S
Channel [i] raster lines	(i*4)+2	5.3.2	516, 564, 738, 768	564 (Med Res.)	S
Channel [i] resolution	(i*4)+0	5.3.2	0-3	1 (Med Res.)	S
Channel count	32	5.3.2	1-8	8 (8 channels)	S
Cloud bottom tran zone scalar	116	5.3.3	0-32767	4096 (12.5%)	R
Clouds bottom scud scalar	118	5.3.3	0-32767	16384 (50%)	R
Current KLOD	107	5.3.23	0-32767		R
Current KRAN	112	5.3.23	0-32767		R
Current vis after haze cor	528	5.3.31	0-32767	(curr vis/64) ft	R
Diagnostic enable	113	5.3.8	0, 1	0 (disabled)	R
Directional horizon cutoff	256	5.3.17	0-65535	16384 (90°)	R
DP Delay	44	5.3.9	0-65281	28417 (9.0 ms)	P
Edge Light switch range mode	820	5.3.24	0, 1	0 (off)	R
Edge Light upper switch	821	5.3.24	0 - 63	0	R
Edge Light lower switch	822	5.3.24	0 - 63	0	R
Ethernet address	288	5.3.18	0-65535	(from EPROM)	S
Ethernet byte swap	290	5.3.18	0, 1	1 (enabled)	S
Ethernet addr middl 2 bytes	491	5.3.18	0-65535	(from EPROM)	S
Ethernet addr upper 2 bytes	490	5.3.18	0-65535	(from EPROM)	S
Field rate day	34	5.3.10	0-65535	245 (20 ms)	P
Field rate dusk	35	5.3.10	0-65535	405 (33 ms)	P
Field rate night	36	5.3.10	0-65535	405 (33 ms)	P

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Field extension amount/fld	523	5.3.23	0-20	1 (.0814 ms/fld)	P
Floating OM & GP switch	522	5.3.23	0-1	0 (off)	P
Fog color update enable	259	5.3.8	0, 1	1 (enabled)	R
Frame rate switch	529	5.3.10	0-1	0 (field rate)	R
Glare decrease rate	261	5.3.11	0-32767	1000	R
Glare increase rate	260	5.3.11	0-32767	100	R
GP Delay	43	5.3.9	0-65281	1793 (0.5 ms)	P
Ground fog change per field	149	5.3.15	0-32767	2048 (64 ft.)	R
Ground fog height	147	5.3.15	0-32767	128 (ft.)	R
Ground fog tzone height	148	5.3.15	0-32767	512 (ft.)	R
HAT channel mask	281	5.3.6	0-255	4 (chan 2)	S
HAT num test points/field	284	5.3.6	0-3	3 (per field)	S
Haze select	157	5.3.16	1-4	3	R
Haze type	521	5.3.16	0-3,-1	0	R
Haze tzone bottom	156	5.3.16	0-32767	5000 (ft.)	R
Haze tzone top	155	5.3.16	0-32767	15000 (ft.)	R
Haze zone altered vis	158	5.3.16	0-65535	65535 (max vis)	R
High contrast SUN K1	96	5.3.26	±32767	9216	D
High contrast SUN K2	97	5.3.26	±32767	1280	D
High contrast SUN OFFSET	98	5.3.26	±32767	23040	D
Horizon steps dusk	257	5.3.17	0-255	20	R
Horizon steps night	258	5.3.17	0-255	40	R
Horizon visibility cutoff	255	5.3.17	0-32767	23100 (35 mi)	R
Host coordinate systems ct.	289	5.3.18	0-16	16 (CSs)	R
Host sim control word #1	291	5.3.19	0, 1	0 (disable)	R
Host sim control word #2	292	5.3.19	0, 1	0 (normal)	R
Host sim control word #3	293	5.3.19		0 (not used)	R
Host sim control word #4	294	5.3.19	0-7	7 (XYZ present)	R
Host sim control word #5	295	5.3.19	0-7	7 (HPR present)	R
Host sim control word #6	296	5.3.19	0, 1	1 (extrapolate)	R
Host sim control word #7	297	5.3.19	0-7	7 (XYZ present)	R
Host sim control word #8	298	5.3.19	0-7	7 (HPR present)	R
Host sim control word #9	299	5.3.19	0-3	3 (both)	R
Host addr middle 2 bytes	493	5.3.19	0-65535	(from EPROM)	S
Host addr upper 2 bytes	492	5.3.19	0-65535	(from EPROM)	S
IG configuration code	340	5.3.20	0, 1	1 (Std. Texture)	S
IG/DB compat. warning	341	5.3.20	0, 1	0 (not suppress.)	S
Include HAT parcel CS	526	5.3.6	0-1	0 (not included)	R
Instructor monitor channel	39	5.3.21	0-7	0 (channel #)	R
Interlace	40	5.3.8	0-2	2 (interlace)	D
Kill AP cards	114	5.3.8	0-4095	0 (no kill)	D
KLOD delta	106	5.3.23	0-32767	3276 (10%)	R
KRAN delta	111	5.3.23	0-32767	3276 (10%)	R
Landing light lobe dusk	56	5.3.14	0-255	127 (50%)	R
Landing light lobe night	57	5.3.14	0-255	180 (70%)	R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Lat/Lon scalar lower 16 bits	133	5.3.5	0-65535	30870	R
Lat/Lon scalar upper 16 bits	132	5.3.5	0-65535	64202	R
Level of detail management	103	5.3.23	0, 1	1 (enabled)	R
Light switch step 0	135	5.3.30	0-8192	0 (disabled)	R
Light switch step 1	136	5.3.30	0-8192	500 (.24)	R
Light switch step 2	137	5.3.30	0-8192	1000 (.49)	R
Light switch step 3	138	5.3.30	0-8192	1500 (.73)	R
Light switch step 4	139	5.3.30	0-8192	3000 (1.46)	R
Light switch step 5	140	5.3.30	0-8192	8000 (3.90)	R
LLL color intensity	250	5.3.14	0-255	200	R
LLL day intensity scalar	252	5.3.14	0-8192	1024 (0.5)	R
LLL delta color intensity	251	5.3.14	0-255	20	R
LLL dusk intensity scalar	253	5.3.14	0-8192	2000 (0.977)	R
LLL night intensity scalar	254	5.3.14	0-8192	7000 (3.418)	R
LLL switch outer & turnoff	519	5.3.14	0-1	0 (off)	R
Low contrast SUN K1	99	5.3.26	±32767	9216	D
Low contrast SUN K2	100	5.3.26	±32767	1280	D
Low contrast SUN OFFSET	101	5.3.26	±32767	23040	D
l_vs_p_day_hicb_st3 0 m	540	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 6.2 m	541	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 12.4 m	542	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 18.6 m	543	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 24.8 m	544	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 31.0 m	545	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 37.2 m	546	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 43.4 m	547	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 49.6 m	548	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 99.3 m	549	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 148.9 m	550	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 198.6 m	551	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 248.2 m	552	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 297.8 m	553	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 347.5 m	554	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 397.1 m	555	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 0 m	560	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 6.2 m	561	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 12.4 m	562	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 18.6 m	563	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 24.8 m	564	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 31.0 m	565	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 37.2 m	566	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 43.4 m	567	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 49.6 m	568	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 99.3 m	569	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 148.9 m	570	5.3.31	0-32767		R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
l_vs_p_day_hicb_st4 198.6 m	571	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 248.2 m	572	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 297.8 m	573	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 347.5 m	574	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 397.1 m	575	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 0 m	600	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 6.2 m	601	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 12.4 m	602	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 18.6 m	603	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 24.8 m	604	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 31.0 m	605	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 37.2 m	606	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 43.4 m	607	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 49.6 m	608	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 99.3 m	609	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 148.9 m	610	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 198.6 m	611	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 248.2 m	612	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 297.8 m	613	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 347.5 m	614	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 397.1 m	615	5.3.31	0-32767		R
l_vs_p_day_locb_st3 0 m	620	5.3.31	0-32767		R
l_vs_p_day_locb_st3 6.2 m	621	5.3.31	0-32767		R
l_vs_p_day_locb_st3 12.4 m	622	5.3.31	0-32767		R
l_vs_p_day_locb_st3 18.6 m	623	5.3.31	0-32767		R
l_vs_p_day_locb_st3 24.8 m	624	5.3.31	0-32767		R
l_vs_p_day_locb_st3 31.0 m	625	5.3.31	0-32767		R
l_vs_p_day_locb_st3 37.2 m	626	5.3.31	0-32767		R
l_vs_p_day_locb_st3 43.4 m	627	5.3.31	0-32767		R
l_vs_p_day_locb_st3 49.6 m	628	5.3.31	0-32767		R
l_vs_p_day_locb_st3 99.3 m	629	5.3.31	0-32767		R
l_vs_p_day_locb_st3 148.9 m	630	5.3.31	0-32767		R
l_vs_p_day_locb_st3 198.6 m	631	5.3.31	0-32767		R
l_vs_p_day_locb_st3 248.2 m	632	5.3.31	0-32767		R
l_vs_p_day_locb_st3 297.8 m	633	5.3.31	0-32767		R
l_vs_p_day_locb_st3 347.5 m	634	5.3.31	0-32767		R
l_vs_p_day_locb_st3 397.1 m	635	5.3.31	0-32767		R
l_vs_p_day_locb_st4 0 m	640	5.3.31	0-32767		R
l_vs_p_day_locb_st4 6.2 m	641	5.3.31	0-32767		R
l_vs_p_day_locb_st4 12.4 m	642	5.3.31	0-32767		R
l_vs_p_day_locb_st4 18.6 m	643	5.3.31	0-32767		R
l_vs_p_day_locb_st4 24.8 m	644	5.3.31	0-32767		R
l_vs_p_day_locb_st4 31.0 m	645	5.3.31	0-32767		R
l_vs_p_day_locb_st4 37.2 m	646	5.3.31	0-32767		R
l_vs_p_day_locb_st4 43.4 m	647	5.3.31	0-32767		R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
l_vs_p_day_locb_st4 49.6 m	648	5.3.31	0-32767		R
l_vs_p_day_locb_st4 99.3 m	649	5.3.31	0-32767		R
l_vs_p_day_locb_st4 148.9 m	650	5.3.31	0-32767		R
l_vs_p_day_locb_st4 198.6 m	651	5.3.31	0-32767		R
l_vs_p_day_locb_st4 248.2 m	652	5.3.31	0-32767		R
l_vs_p_day_locb_st4 297.8 m	653	5.3.31	0-32767		R
l_vs_p_day_locb_st4 347.5 m	654	5.3.31	0-32767		R
l_vs_p_day_locb_st4 397.1 m	655	5.3.31	0-32767		R
l_vs_p_day_locb_st5 0 m	660	5.3.31	0-32767		R
l_vs_p_day_locb_st5 6.2 m	661	5.3.31	0-32767		R
l_vs_p_day_locb_st5 12.4 m	662	5.3.31	0-32767		R
l_vs_p_day_locb_st5 18.6 m	663	5.3.31	0-32767		R
l_vs_p_day_locb_st5 24.8 m	664	5.3.31	0-32767		R
l_vs_p_day_locb_st5 31.0 m	665	5.3.31	0-32767		R
l_vs_p_day_locb_st5 37.2 m	666	5.3.31	0-32767		R
l_vs_p_day_locb_st5 43.4 m	667	5.3.31	0-32767		R
l_vs_p_day_locb_st5 49.6 m	668	5.3.31	0-32767		R
l_vs_p_day_locb_st5 99.3 m	669	5.3.31	0-32767		R
l_vs_p_day_locb_st5 148.9 m	670	5.3.31	0-32767		R
l_vs_p_day_locb_st5 198.6 m	671	5.3.31	0-32767		R
l_vs_p_day_locb_st5 248.2 m	672	5.3.31	0-32767		R
l_vs_p_day_locb_st5 297.8 m	673	5.3.31	0-32767		R
l_vs_p_day_locb_st5 347.5 m	674	5.3.31	0-32767		R
l_vs_p_day_locb_st5 397.1 m	675	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 0 m	680	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 6.2 m	681	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 12.4 m	682	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 18.6 m	683	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 24.8 m	684	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 31.0 m	685	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 37.2 m	686	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 43.4 m	687	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 49.6 m	688	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 99.3 m	689	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 148.9 m	690	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 198.6 m	691	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 248.2 m	692	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 297.8 m	693	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 347.5 m	694	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 397.1 m	695	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 0 m	700	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 6.2 m	701	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 12.4 m	702	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 18.6 m	703	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 24.8 m	704	5.3.31	0-32767		R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
l_vs_p_dsk_hicb_st4 31.0 m	705	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 37.2 m	706	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 43.4 m	707	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 49.6 m	708	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 99.3 m	709	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 148.9 m	710	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 198.6 m	711	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 248.2 m	712	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 297.8 m	713	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 347.5 m	714	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 397.1 m	715	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 0 m	720	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 6.2 m	721	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 12.4 m	722	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 18.6 m	723	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 24.8 m	724	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 31.0 m	725	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 37.2 m	726	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 43.4 m	727	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 49.6 m	728	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 99.3 m	729	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 148.9 m	730	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 198.6 m	731	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 248.2 m	732	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 297.8 m	733	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 347.5 m	734	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 397.1 m	735	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 0 m	740	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 6.2 m	741	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 12.4 m	742	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 18.6 m	743	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 24.8 m	744	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 31.0 m	745	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 37.2 m	746	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 43.4 m	747	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 49.6 m	748	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 99.3 m	749	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 148.9 m	750	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 198.6 m	751	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 248.2 m	752	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 297.8 m	753	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 347.5 m	754	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 397.1 m	755	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 0 m	760	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 6.2 m	761	5.3.31	0-32767		R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
l_vs_p_dsk_locb_st4 12.4 m	762	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 18.6 m	763	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 24.8 m	764	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 31.0 m	765	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 37.2 m	766	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 43.4 m	767	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 49.6 m	768	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 99.3 m	769	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 148.9 m	770	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 198.6 m	771	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 248.2 m	772	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 297.8 m	773	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 347.5 m	774	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 397.1 m	775	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 0 m	780	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 6.2 m	781	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 12.4 m	782	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 18.6 m	783	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 24.8 m	784	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 31.0 m	785	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 37.2 m	786	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 43.4 m	787	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 49.6 m	788	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 99.3 m	789	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 148.9 m	790	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 198.6 m	791	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 248.2 m	792	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 297.8 m	793	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 347.5 m	794	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 397.1 m	795	5.3.31	0-32767		R
l_vs_p_high_cloud_bot_ht	531	5.3.31	0-32767	1000 (4000 ft)	R
l_vs_p_low_cloud_bot_ht	530	5.3.31	0-32767	250 (1000 ft)	R
Matrix switcher baud rate	311	5.3.21	2^i, $i<7$	4 (4800 baud)	S
Matrix switcher enable	312	5.3.21	0, 1	0 (disabled)	S
Matrix switcher port #	310	5.3.21	1-3	1 (port #)	S
Max background time	38	5.3.10	0-65535	245 (20 ms)	R
Max cloud amb scalar day	124	5.3.3	0-32767	8192 (25%)	R
Max cloud amb scalar dusk	125	5.3.3	0-32767	0 (0%)	R
Max cloud amb scalar night	126	5.3.3	0-32767	0 (0%)	R
Max cloud bottom scud	117	5.3.3	0-32767	128 (ft.)	R
Max cloud bottom tran.	115	5.3.3	0-32767	64 (256 ft.)	R
Max cloud inten scalar day	127	5.3.3	0-32767	15000 (46%)	R
Max cloud inten scalar dusk	128	5.3.3	0-32767	12000 (36%)	R
Max cloud inten scalar night	129	5.3.3	0-32767	0 (0%)	R
Max cloud top scud	120	5.3.3	0-32767	128 (512 ft.)	R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Max cloud top tran zone scal.	119	5.3.3	0-32767	64 (256 ft.)	R
Max cloud visibility	122	5.3.3	0-32767	32767 (49.65 mi.)	R
Max glare visibility	228	5.3.11	0-32767	660 (1 mi)	R
Max KLOD	104	5.3.23	0-32767	32767 (100%)	R
Max KRAN	109	5.3.23	0-32767	32767 (100%)	R
Max scud change/field in	273	5.3.3	0-32767	1024	R
Max scud change/field out	274	5.3.3	0-32767	1024	R
Max storm range	300	5.3.25	0-32767	32767 (49.64 mi)	R
Max l_vs_p scalar change	532	5.3.31	0-32767	1024 (8/field)	R
Max vis change per field	533	5.3.31	0-32767	2048 (25 mi/fld)	R
Min background time	37	5.3.10	0-65535	24 (2 ms)	R
Min cloud visibility	123	5.3.3	0-32767	16383 (24.82 mi.)	R
Min fog ambient for glares	58	5.3.1	0-255	10	R
Min glare scud	229	5.3.11	0-255	200	R
Min KLOD	105	5.3.23	0-32767	19960 (60%)	R
Min KRAN	110	5.3.23	0-32767	19960 (60%)	R
Min pager time	47	5.3.10	0-65535	25 (2 ms)	R
Min storm range	301	5.3.25	0-32767	330 (2640 ft)	R
Min storm visibility	302	5.3.25	0-32767	0 (0 ft)	R
New OC card switch	518	5.3.32	0-1	0 (old OC card)	S
NTSC switch	102	5.3.32	0, 1	0 (disabled)	S
Number of coord. systems	134	5.3.4	3-16	6 (6 CSs)	R
OM Delay	42	5.3.9	0-65281	28417 (9.0 ms)	P
OM raster management	94	5.3.8	0, 1	1 (enabled)	S
Overload OFF time	49	5.3.23		12 (1.0 ms)	R
Overload ON time	48	5.3.23		6 (0.5 ms)	R
Pager off-line pad value	130	5.3.5	0-16384	5 (640 ft.)	R
Pager on-line pad value	131	5.3.5	0-16384	6 (768 ft.)	R
Patchy gfog amplitude	61	5.3.15	0-255	25	R
Patchy gfog frequency	60	5.3.15	0-31	16	R
Patchy gfog midpoint	62	5.3.15	-10-10	0	R
Polygon switch step 0	141	5.3.30	0-8192	0 (disabled)	R
Polygon switch step 1	142	5.3.30	0-8192	368 (.18)	R
Polygon switch step 2	143	5.3.30	0-8192	839 (.41)	R
Polygon switch step 3	144	5.3.30	0-8192	2048 (1.0)	R
Polygon switch step 4	145	5.3.30	0-8192	3993 (1.95)	R
Polygon switch step 5	146	5.3.30	0-8192	7741 (3.78)	R
Rain lights defocus limit	221	5.3.25	0-255	255	R
Rain lights delta buildup	223	5.3.25	0-255	2	R
Rain lights delta clearup	225	5.3.25	0-255	10	R
Rain raster defocus limit	220	5.3.25	0-255	255	R
Rain raster delta buildup	222	5.3.25	0-255	2	R
Rain raster delta clearup	224	5.3.25	0-255	10	R
Random light management	108	5.3.23	0-1	1 (enabled)	R
Remove horz glow trans zone	520	5.3.17	0-32767	50 (200 feet)	R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
RSI/RSL options switch	525	5.3.32	0-1	0 (off)	S
RSI/RSL Reserved Entries	580-599	—	—	—	—
Run time timeout	46	5.3.23	0-65535	-2815 (20 ms)	R
Runway 0 edge light switch	480	5.3.24	0-63	3	R
Runway 1 edge light switch	481	5.3.24	0-63	11	R
Runway 2 edge light switch	482	5.3.24	0-63	19	R
Runway 3 edge light switch	483	5.3.24	0-63	27	R
Runway 4 edge light switch	484	5.3.24	0-63	35	R
Same Point Tbl del light dist	806	5.3.33	0 - 32767	108	R
Same Point Tbl filter scalar	807	5.3.33	0 - 15	2	R
Same Point Tbl inten mod sclr	808	5.3.33	0 - 32767	6900	R
Same Point Tbl max mod range	810	5.3.33	0 - 32767	9700	R
Same Point Tbl min mod range	809	5.3.33	0 - 32767	1000	R
Same Point Tbl screen x scalar	812	5.3.33	0 - 32767	15000	R
Same Point Tbl screen y scalar	811	5.3.33	0 - 32767	32000	R
Same Point Tbl shift code	805	5.3.33	-15 - 0	-7	R
See GFOG from above	152	5.3.15	0, 1	0 (disabled)	R
See GFOG scud scalar	153	5.3.15	0-32767	4095 (1.0)	R
Start removing GFOG scud	154	5.3.15	0-32767	24576 (75%)	R
Storm center CSN	227	5.3.25	1-15	3 (CSN)	S
Storm day ambient loss	303	5.3.25	0-255	100	R
Storm day lightning ambient	306	5.3.25	0-255	100	R
Storm dusk ambient loss	304	5.3.25	0-255	20	R
Storm dusk lightning amb.	307	5.3.25	0-255	180	R
Storm night ambient loss	305	5.3.25	0-255	0	R
Storm night lightning amb.	308	5.3.25	0-255	220	R
Strobe color intensity	240	5.3.13	0-255	180	R
Strobe day intensity scalar	241	5.3.13	0-8192	700 (0.342)	R
Strobe day off time	245	5.3.13	0-32767	75 (fields)	R
Strobe day on time	244	5.3.13	0-32767	2 (fields)	R
Strobe dusk intensity scalar	242	5.3.13	0-8192	1000 (0.488)	R
Strobe dusk off time	247	5.3.13	0-32767	50 (fields)	R
Strobe dusk on time	246	5.3.13	0-32767	1 (fields)	R
Strobe night intensity scalar	243	5.3.13	0-8192	6000 (2.93 0)	R
Strobe night off time	249	5.3.13	0-32767	50 (fields)	R
Strobe night on time	248	5.3.13	0-32767	1 (fields)	R
TMS Available	515	5.3.32	0, 1	1	S
Transport delay switch	226	5.3.32	0, 1	0 (disabled)	R
Tune l_vs_p scalars	527	5.3.31	0-1	0 (correction on)	R
VCD amplitude scalar	271	5.3.28	0-128	8 (2.0)	R
VCD frequency scalar	272	5.3.28	0-31	16 (128 ft.)	R
Viewport Magnif. scalar	285	5.3.27	0-32767	1024 (1.0)	R
Vis above clouds switch	275	5.3.3	0 - 1	0	R
Vis 0 ft. light day scalar	74	5.3.30	0-32767		R
Vis 0 ft. light dusk scalar	180	5.3.30	0-32767		R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Vis 0 ft. light night scalar	200	5.3.30	0-32767		R
Vis 0 ft. poly day scalar	84	5.3.30	0-32767		R
Vis 0 ft. poly dusk scalar	190	5.3.30	0-32767		R
Vis 0 ft. poly night scalar	210	5.3.30	0-32767		R
Vis 0 ft. sky scalar	330	5.3.30	0-32767		R
Vis 0 ft. star scalar	320	5.3.30	0-32767		R
Vis 0 ft. step 4 day scalar	160	5.3.30	0-32767		R
Vis 0 ft. step 4 dusk scalar	400	5.3.30	0-32767		R
Vis 0 ft. step 4 night scalar	420	5.3.30	0-32767		R
Vis 0 ft. step 5 day scalar	170	5.3.30	0-32767		R
Vis 0 ft. step 5 dusk scalar	410	5.3.30	0-32767		R
Vis 0 ft. step 5 night scalar	430	5.3.30	0-32767		R
Vis 300 ft. light day scalar	75	5.3.30	0-32767		R
Vis 300 ft. light dusk scalar	181	5.3.30	0-32767		R
Vis 300 ft. light night scalar	201	5.3.30	0-32767		R
Vis 300 ft. poly day scalar	85	5.3.30	0-32767		R
Vis 300 ft. poly dusk scalar	191	5.3.30	0-32767		R
Vis 300 ft. poly night scalar	211	5.3.30	0-32767		R
Vis 300 ft. sky scalar	331	5.3.30	0-32767		R
Vis 300 ft. star scalar	321	5.3.30	0-32767		R
Vis 300 ft. step 4 day scalar	161	5.3.30	0-32767		R
Vis 300 ft. step 4 dusk scalar	401	5.3.30	0-32767		R
Vis 300 ft. step 4 night scalar	421	5.3.30	0-32767		R
Vis 300 ft. step 5 day scalar	171	5.3.30	0-32767		R
Vis 300 ft. step 5 dusk scalar	411	5.3.30	0-32767		R
Vis 300 ft. step 5 night scalar	431	5.3.30	0-32767		R
Vis 700 ft. light day scalar	76	5.3.30	0-32767		R
Vis 700 ft. light dusk scalar	182	5.3.30	0-32767		R
Vis 700 ft. light night scalar	202	5.3.30	0-32767		R
Vis 700 ft. poly day scalar	86	5.3.30	0-32767		R
Vis 700 ft. poly dusk scalar	192	5.3.30	0-32767		R
Vis 700 ft. poly night scalar	212	5.3.30	0-32767		R
Vis 700 ft. sky scalar	332	5.3.30	0-32767		R
Vis 700 ft. star scalar	322	5.3.30	0-32767		R
Vis 700 ft. step 4 day scalar	162	5.3.30	0-32767		R
Vis 700 ft. step 4 dusk scalar	402	5.3.30	0-32767		R
Vis 700 ft. step 4 night scalar	422	5.3.30	0-32767		R
Vis 700 ft. step 5 day scalar	172	5.3.30	0-32767		R
Vis 700 ft. step 5 dusk scalar	412	5.3.30	0-32767		R
Vis 700 ft. step 5 night scalar	432	5.3.30	0-32767		R
Vis 1200 ft. light day scalar	77	5.3.30	0-32767		R
Vis 1200 ft. light dusk scalar	183	5.3.30	0-32767		R
Vis 1200 ft. light night scalar	203	5.3.30	0-32767		R
Vis 1200 ft. poly day scalar	87	5.3.30	0-32767		R
Vis 1200 ft. poly dusk scalar	193	5.3.30	0-32767		R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Vis 1200 ft. poly night scalar	213	5.3.30	0-32767		R
Vis 1200 ft. sky scalar	333	5.3.30	0-32767		R
Vis 1200 ft. star scalar	323	5.3.30	0-32767		R
Vis 1200 ft. step 4 day scalar	163	5.3.30	0-32767		R
Vis 1200 ft. step 4 dusk scalar	403	5.3.30	0-32767		R
Vis 1200 ft. step 4 night scal.	423	5.3.30	0-32767		R
Vis 1200 ft. step 5 day scalar	173	5.3.30	0-32767		R
Vis 1200 ft. step 5 dusk scalar	413	5.3.30	0-32767		R
Vis 1200 ft. step 5 night scal.	433	5.3.30	0-32767		R
Vis 2640 ft. light day scalar	78	5.3.30	0-32767		R
Vis 2640 ft. light dusk scalar	184	5.3.30	0-32767		R
Vis 2640 ft. light night scal.	204	5.3.30	0-32767		R
Vis 2640 ft. poly day scalar	88	5.3.30	0-32767		R
Vis 2640 ft. poly dusk scalar	194	5.3.30	0-32767		R
Vis 2640 ft. poly night scalar	214	5.3.30	0-32767		R
Vis 2640 ft. sky scalar	334	5.3.30	0-32767		R
Vis 2640 ft. star scalar	324	5.3.30	0-32767		R
Vis 2640 ft. step 4 day scalar	164	5.3.30	0-32767		R
Vis 2640 ft. step 4 dusk scalar	404	5.3.30	0-32767		R
Vis 2640 ft. step 4 night scal.	424	5.3.30	0-32767		R
Vis 2640 ft. step 5 day scalar	174	5.3.30	0-32767		R
Vis 2640 ft. step 5 dusk scalar	414	5.3.30	0-32767		R
Vis 2640 ft. step 5 night scal.	434	5.3.30	0-32767		R
Vis 1 mi. light day scalar	79	5.3.30	0-32767		R
Vis 1 mi. light dusk scalar	185	5.3.30	0-32767		R
Vis 1 mi. light night scalar	205	5.3.30	0-32767		R
Vis 1 mi. poly day scalar	89	5.3.30	0-32767		R
Vis 1 mi. poly dusk scalar	195	5.3.30	0-32767		R
Vis 1 mi. poly night scalar	215	5.3.30	0-32767		R
Vis 1 mi. sky scalar	335	5.3.30	0-32767		R
Vis 1 mi. star scalar	325	5.3.30	0-32767		R
Vis 1 mi. step 4 day scalar	165	5.3.30	0-32767		R
Vis 1 mi. step 4 dusk scalar	405	5.3.30	0-32767		R
Vis 1 mi. step 4 night scalar	425	5.3.30	0-32767		R
Vis 1 mi. step 5 day scalar	175	5.3.30	0-32767		R
Vis 1 mi. step 5 dusk scalar	415	5.3.30	0-32767		R
Vis 1 mi. step 5 night scalar	435	5.3.30	0-32767		R
Vis 3 mi. light day scalar	80	5.3.30	0-32767		R
Vis 3 mi. light dusk scalar	186	5.3.30	0-32767		R
Vis 3 mi. light night scalar	206	5.3.30	0-32767		R
Vis 3 mi. poly day scalar	90	5.3.30	0-32767		R
Vis 3 mi. poly dusk scalar	196	5.3.30	0-32767		R
Vis 3 mi. poly night scalar	216	5.3.30	0-32767		R
Vis 3 mi. sky scalar	336	5.3.30	0-32767		R
Vis 3 mi. star scalar	326	5.3.30	0-32767		R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Vis 3 mi. step 4 day scalar	166	5.3.30	0-32767		R
Vis 3 mi. step 4 dusk scalar	406	5.3.30	0-32767		R
Vis 3 mi. step 4 night scalar	426	5.3.30	0-32767		R
Vis 3 mi. step 5 day scalar	176	5.3.30	0-32767		R
Vis 3 mi. step 5 dusk scalar	416	5.3.30	0-32767		R
Vis 3 mi. step 5 night scalar	436	5.3.30	0-32767		R
Vis 8 mi. light day scalar	81	5.3.30	0-32767		R
Vis 8 mi. light dusk scalar	187	5.3.30	0-32767		R
Vis 8 mi. light night scalar	207	5.3.30	0-32767		R
Vis 8 mi. poly day scalar	91	5.3.30	0-32767		R
Vis 8 mi. poly dusk scalar	197	5.3.30	0-32767		R
Vis 8 mi. poly night scalar	217	5.3.30	0-32767		R
Vis 8 mi. sky scalar	337	5.3.30	0-32767		R
Vis 8 mi. star scalar	327	5.3.30	0-32767		R
Vis 8 mi. step 4 day scalar	167	5.3.30	0-32767		R
Vis 8 mi. step 4 dusk scalar	407	5.3.30	0-32767		R
Vis 8 mi. step 4 night scalar	427	5.3.30	0-32767		R
Vis 8 mi. step 5 day scalar	177	5.3.30	0-32767		R
Vis 8 mi. step 5 dusk scalar	417	5.3.30	0-32767		R
Vis 8 mi. step 5 night scalar	437	5.3.30	0-32767		R
Vis 10 mi. step 4 dusk scalar	408	5.3.30	0-32767		R
Vis 10 mi. step 4 night scalar	428	5.3.30	0-32767		R
Vis 10 mi. step 5 dusk scalar	418	5.3.30	0-32767		R
Vis 10 mi. step 5 night scalar	438	5.3.30	0-32767		R
Vis 20 mi. light day scalar	82	5.3.30	0-32767		R
Vis 20 mi. light dusk scalar	188	5.3.30	0-32767		R
Vis 20 mi. light night scalar	208	5.3.30	0-32767		R
Vis 20 mi. poly day scalar	92	5.3.30	0-32767		R
Vis 20 mi. poly dusk scalar	198	5.3.30	0-32767		R
Vis 20 mi. poly night scalar	218	5.3.30	0-32767		R
Vis 20 mi. sky scalar	338	5.3.30	0-32767		R
Vis 20 mi. star scalar	328	5.3.30	0-32767		R
Vis 20 mi. step 4 day scalar	168	5.3.30	0-32767		R
Vis 20 mi. step 5 day scalar	178	5.3.30	0-32767		R
Vis 49.6 step 4 night scalar	429	5.3.30	0-32767		R
Vis 49.64 mi step 5 night scal.	439	5.3.30	0-32767		R
Vis 49.64 mi. light day scalar	83	5.3.30	0-32767		R
Vis 49.64 mi. light dusk scal.	189	5.3.30	0-32767		R
Vis 49.64 mi. light night scal.	209	5.3.30	0-32767		R
Vis 49.64 mi. poly day scalar	93	5.3.30	0-32767		R
Vis 49.64 mi. poly dusk scal.	199	5.3.30	0-32767		R
Vis 49.64 mi. poly scal. night	219	5.3.30	0-32767		R
Vis 49.64 mi. sky scalar	339	5.3.30	0-32767		R
Vis 49.64 mi. star	329	5.3.30	0-32767		R
Vis 49.64 mi. step 4 day scal.	169	5.3.30	0-32767		R

Table 5-1. Table Entry Numbers, Range, and Defaults (by name) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Vis 49.64 mi. step 4 dusk scal.	409	5.3.30	0-32767		R
Vis 49.64 mi. step 5 day scal.	179	5.3.30	0-32767		R
Vis 49.64 mi. step 5 dusk scal.	419	5.3.30	0-32767		R
Vis intensity day	53	5.3.29	0-255	170	R
Vis intensity dusk	54	5.3.29	0-255	170	R
Vis intensity night	55	5.3.29	0-255	64	R
Visibility range 0	64	5.3.30	0-32767	0 (0 ft.)	R
Visibility range 1	65	5.3.30	0-32767	37 (300 ft.)	R
Visibility range 2	66	5.3.30	0-32767	88 (700 ft.)	R
Visibility range 3	67	5.3.30	0-32767	150 (1200 ft.)	R
Visibility range 4	68	5.3.30	0-32767	330 (2640 ft.)	R
Visibility range 5	69	5.3.30	0-32767	660 (1 mi.)	R
Visibility range 6	70	5.3.30	0-32767	1980 (3 mi.)	R
Visibility range 7	71	5.3.30	0-32767	5280 (8 mi.)	R
Visibility range 8	72	5.3.30	0-32767	13200 (20 mi.)	R
Visibility range 9	73	5.3.30	0-32767	32767 (49.64 mi.)	R
ZMOD fog	95	5.3.8	0, 1	1 (enabled)	S

Table 5-2. Table Entry Numbers, Range, and Defaults (by number)

Parameter	Entry #	Manual	Range	Default	Use
Channel [i] resolution	(i*4)+0	5.3.2	0-3	1 (Med Res.)	S
Channel [i] pixels/line	(i*4)+1	5.3.2	640, 896, 960	640 (Med Res.)	S
Channel [i] raster lines	(i*4)+2	5.3.2	516, 564, 738, 768	564 (Med Res.)	S
Channel [i] display type	(i*4)+3	5.3.2	0-7	0 (Cal. CSM)	S
Channel count	32	5.3.2	1-8	8 (8 channels)	S
Active channel mask	33	5.3.2	1-255	255 (8 channel)	P
Field rate day	34	5.3.10	0-65535	245 (20 ms)	P
Field rate dusk	35	5.3.10	0-65535	405 (33 ms)	P
Field rate night	36	5.3.10	0-65535	405 (33 ms)	P
Min background time	37	5.3.10	0-65535	24 (2 ms)	R
Max background time	38	5.3.10	0-65535	245 (20 ms)	R
Instructor monitor channel	39	5.3.21	0-7	0 (channel #)	R
Interlace	40	5.3.8	0-2	2 (interlace)	D
OM Delay	42	5.3.9	0-65281	28417 (9.0 ms)	P
GP Delay	43	5.3.9	0-65281	1793 (0.5 ms)	P
DP Delay	44	5.3.9	0-65281	28417 (9.0 ms)	P
Boot time timeout	45	5.3.23	0-65535	6144 (500 ms)	R
Run time timeout	46	5.3.23	0-65535	-2815 (20 ms)	R
Min pager time	47	5.3.10	0-65535	25 (2 ms)	R
Overload ON time	48	5.3.23		6 (0.5 ms)	R
Overload OFF time	49	5.3.23		12 (1.0 ms)	R
Ambient day	50	5.3.1	0-255	255 (1.0)	R
Ambient dusk	51	5.3.1	0-255	50 (.196)	R
Ambient night	52	5.3.1	0-255	10 (.04)	R
Vis intensity day	53	5.3.29	0-255	170	R
Vis intensity dusk	54	5.3.29	0-255	170	R
Vis intensity night	55	5.3.29	0-255	64	R
Landing light lobe dusk	56	5.3.14	0-255	127 (50%)	R
Landing light lobe night	57	5.3.14	0-255	180 (70%)	R
Min fog ambient for glares	58	5.3.1	0-255	10	R
Patchy gfog frequency	60	5.3.15	0-31	16	R
Patchy gfog amplitude	61	5.3.15	0-255	25	R
Patchy gfog midpoint	62	5.3.15	-10-10	0	R
Visibility range 0	64	5.3.30	0-32767	0 (0 ft.)	R
Visibility range 1	65	5.3.30	0-32767	37 (300 ft.)	R
Visibility range 2	66	5.3.30	0-32767	88 (700 ft.)	R
Visibility range 3	67	5.3.30	0-32767	150 (1200 ft.)	R
Visibility range 4	68	5.3.30	0-32767	330 (2640 ft.)	R
Visibility range 5	69	5.3.30	0-32767	660 (1 mi.)	R
Visibility range 6	70	5.3.30	0-32767	1980 (3 mi.)	R
Visibility range 7	71	5.3.30	0-32767	5280 (8 mi.)	R
Visibility range 8	72	5.3.30	0-32767	13200 (20 mi.)	R
Visibility range 9	73	5.3.30	0-32767	32767 (49.64 mi.)	R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Vis 0 ft. light day scalar	74	5.3.30	0-32767		R
Vis 300 ft. light day scalar	75	5.3.30	0-32767		R
Vis 700 ft. light day scalar	76	5.3.30	0-32767		R
Vis 1200 ft. light day scalar	77	5.3.30	0-32767		R
Vis 2640 ft. light day scalar	78	5.3.30	0-32767		R
Vis 1 mi. light day scalar	79	5.3.30	0-32767		R
Vis 3 mi. light day scalar	80	5.3.30	0-32767		R
Vis 8 mi. light day scalar	81	5.3.30	0-32767		R
Vis 20 mi. light day scalar	82	5.3.30	0-32767		R
Vis 49.64 mi. light day scalar	83	5.3.30	0-32767		R
Vis 0 ft. poly day scalar	84	5.3.30	0-32767		R
Vis 300 ft. poly day scalar	85	5.3.30	0-32767		R
Vis 700 ft. poly day scalar	86	5.3.30	0-32767		R
Vis 1200 ft. poly day scalar	87	5.3.30	0-32767		R
Vis 2640 ft. poly day scalar	88	5.3.30	0-32767		R
Vis 1 mi. poly day scalar	89	5.3.30	0-32767		R
Vis 3 mi. poly day scalar	90	5.3.30	0-32767		R
Vis 8 mi. poly day scalar	91	5.3.30	0-32767		R
Vis 20 mi. poly day scalar	92	5.3.30	0-32767		R
Vis 49.64 mi. poly day scalar	93	5.3.30	0-32767		R
OM raster management	94	5.3.8	0, 1	1 (enabled)	S
ZMOD fog	95	5.3.8	0, 1	1 (enabled)	S
High contrast SUN K1	96	5.3.26	±32767	9216	D
High contrast SUN K2	97	5.3.26	±32767	1280	D
High contrast SUN OFFSET	98	5.3.26	±32767	23040	D
Low contrast SUN K1	99	5.3.26	±32767	9216	D
Low contrast SUN K2	100	5.3.26	±32767	1280	D
Low contrast SUN OFFSET	101	5.3.26	±32767	23040	D
NTSC switch	102	5.3.32	0, 1	0 (disabled)	S
Level of detail management	103	5.3.23	0, 1	1 (enabled)	R
Max KLOD	104	5.3.23	0-32767	32767 (100%)	R
Min KLOD	105	5.3.23	0-32767	19960 (60%)	R
KLOD delta	106	5.3.23	0-32767	3276 (10%)	R
Current KLOD	107	5.3.23	0-32767		R
Random light management	108	5.3.23	0-1	1 (enabled)	R
Max KRAN	109	5.3.23	0-32767	32767 (100%)	R
Min KRAN	110	5.3.23	0-32767	19960 (60%)	R
KRAN delta	111	5.3.23	0-32767	3276 (10%)	R
Current KRAN	112	5.3.23	0-32767		R
Diagnostic enable	113	5.3.8	0, 1	0 (disabled)	R
Kill AP cards	114	5.3.8	0-4095	0 (no kill)	D
Max cloud bottom tran.	115	5.3.3	0-32767	64 (256 ft.)	R
Cloud bottom tran zone scalar	116	5.3.3	0-32767	4096 (12.5%)	R
Max cloud bottom scud	117	5.3.3	0-32767	128 (ft.)	R
Clouds bottom scud scalar	118	5.3.3	0-32767	16384 (50%)	R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Max cloud top tran zone scal.	119	5.3.3	0-32767	64 (256 ft.)	R
Max cloud top scud	120	5.3.3	0-32767	128 (512 ft.)	R
Max cloud visibility	122	5.3.3	0-32767	32767 (49.65 mi.)	R
Min cloud visibility	123	5.3.3	0-32767	16383 (24.82 mi.)	R
Max cloud amb scalar day	124	5.3.3	0-32767	8192 (25%)	R
Max cloud amb scalar dusk	125	5.3.3	0-32767	0 (0%)	R
Max cloud amb scalar night	126	5.3.3	0-32767	0 (0%)	R
Max cloud inten scalar day	127	5.3.3	0-32767	15000 (46%)	R
Max cloud inten scalar dusk	128	5.3.3	0-32767	12000 (36%)	R
Max cloud inten scalar night	129	5.3.3	0-32767	0 (0%)	R
Pager off-line pad value	130	5.3.5	0-16384	5 (640 ft.)	R
Pager on-line pad value	131	5.3.5	0-16384	6 (768 ft.)	R
Lat/Lon scalar upper 16 bits	132	5.3.5	0-65535	64202	R
Lat/Lon scalar lower 16 bits	133	5.3.5	0-65535	30870	R
Number of coord. systems	134	5.3.4	3-16	6 (6 CSs)	R
Light switch step 0	135	5.3.30	0-8192	0 (disabled)	R
Light switch step 1	136	5.3.30	0-8192	500 (.24)	R
Light switch step 2	137	5.3.30	0-8192	1000 (.49)	R
Light switch step 3	138	5.3.30	0-8192	1500 (.73)	R
Light switch step 4	139	5.3.30	0-8192	3000 (1.46)	R
Light switch step 5	140	5.3.30	0-8192	8000 (3.90)	R
Polygon switch step 0	141	5.3.30	0-8192	0 (disabled)	R
Polygon switch step 1	142	5.3.30	0-8192	368 (.18)	R
Polygon switch step 2	143	5.3.30	0-8192	839 (.41)	R
Polygon switch step 3	144	5.3.30	0-8192	2048 (1.0)	R
Polygon switch step 4	145	5.3.30	0-8192	3993 (1.95)	R
Polygon switch step 5	146	5.3.30	0-8192	7741 (3.78)	R
Ground fog height	147	5.3.15	0-32767	128 (ft.)	R
Ground fog tzone height	148	5.3.15	0-32767	512 (ft.)	R
Ground fog change per field	149	5.3.15	0-32767	2048 (64 ft.)	R
See GFOG from above	152	5.3.15	0, 1	0 (disabled)	R
See GFOG scud scalar	153	5.3.15	0-32767	4095 (1.0)	R
Start removing GFOG scud	154	5.3.15	0-32767	24576 (75%)	R
Haze tzone top	155	5.3.16	0-32767	15000 (ft.)	R
Haze tzone bottom	156	5.3.16	0-32767	5000 (ft.)	R
Haze select	157	5.3.16	1-4	3	R
Haze zone altered vis	158	5.3.16	0-65535	65535 (max vis)	R
Vis 0 ft. step 4 day scalar	160	5.3.30	0-32767		R
Vis 300 ft. step 4 day scalar	161	5.3.30	0-32767		R
Vis 700 ft. step 4 day scalar	162	5.3.30	0-32767		R
Vis 1200 ft. step 4 day scalar	163	5.3.30	0-32767		R
Vis 2640 ft. step 4 day scalar	164	5.3.30	0-32767		R
Vis 1 mi. step 4 day scalar	165	5.3.30	0-32767		R
Vis 3 mi. step 4 day scalar	166	5.3.30	0-32767		R
Vis 8 mi. step 4 day scalar	167	5.3.30	0-32767		R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Vis 20 mi. step 4 day scalar	168	5.3.30	0-32767		R
Vis 49.64 mi. step 4 day scal.	169	5.3.30	0-32767		R
Vis 0 ft. step 5 day scalar	170	5.3.30	0-32767		R
Vis 300 ft. step 5 day scalar	171	5.3.30	0-32767		R
Vis 700 ft. step 5 day scalar	172	5.3.30	0-32767		R
Vis 1200 ft. step 5 day scalar	173	5.3.30	0-32767		R
Vis 2640 ft. step 5 day scalar	174	5.3.30	0-32767		R
Vis 1 mi. step 5 day scalar	175	5.3.30	0-32767		R
Vis 3 mi. step 5 day scalar	176	5.3.30	0-32767		R
Vis 8 mi. step 5 day scalar	177	5.3.30	0-32767		R
Vis 20 mi. step 5 day scalar	178	5.3.30	0-32767		R
Vis 49.64 mi. step 5 day scal.	179	5.3.30	0-32767		R
Vis 0 ft. light dusk scalar	180	5.3.30	0-32767		R
Vis 300 ft. light dusk scalar	181	5.3.30	0-32767		R
Vis 700 ft. light dusk scalar	182	5.3.30	0-32767		R
Vis 1200 ft. light dusk scalar	183	5.3.30	0-32767		R
Vis 2640 ft. light dusk scalar	184	5.3.30	0-32767		R
Vis 1 mi. light dusk scalar	185	5.3.30	0-32767		R
Vis 3 mi. light dusk scalar	186	5.3.30	0-32767		R
Vis 8 mi. light dusk scalar	187	5.3.30	0-32767		R
Vis 20 mi. light dusk scalar	188	5.3.30	0-32767		R
Vis 49.64 mi. light dusk scal.	189	5.3.30	0-32767		R
Vis 0 ft. poly dusk scalar	190	5.3.30	0-32767		R
Vis 300 ft. poly dusk scalar	191	5.3.30	0-32767		R
Vis 700 ft. poly dusk scalar	192	5.3.30	0-32767		R
Vis 1200 ft. poly dusk scalar	193	5.3.30	0-32767		R
Vis 2640 ft. poly dusk scalar	194	5.3.30	0-32767		R
Vis 1 mi. poly dusk scalar	195	5.3.30	0-32767		R
Vis 3 mi. poly dusk scalar	196	5.3.30	0-32767		R
Vis 8 mi. poly dusk scalar	197	5.3.30	0-32767		R
Vis 20 mi. poly dusk scalar	198	5.3.30	0-32767		R
Vis 49.64 mi. poly dusk scal.	199	5.3.30	0-32767		R
Vis 0 ft. light night scalar	200	5.3.30	0-32767		R
Vis 300 ft. light night scalar	201	5.3.30	0-32767		R
Vis 700 ft. light night scalar	202	5.3.30	0-32767		R
Vis 1200 ft. light night scalar	203	5.3.30	0-32767		R
Vis 2640 ft. light night scal.	204	5.3.30	0-32767		R
Vis 1 mi. light night scalar	205	5.3.30	0-32767		R
Vis 3 mi. light night scalar	206	5.3.30	0-32767		R
Vis 8 mi. light night scalar	207	5.3.30	0-32767		R
Vis 20 mi. light night scalar	208	5.3.30	0-32767		R
Vis 49.64 mi. light night scal.	209	5.3.30	0-32767		R
Vis 0 ft. poly night scalar	210	5.3.30	0-32767		R
Vis 300 ft. poly night scalar	211	5.3.30	0-32767		R
Vis 700 ft. poly night scalar	212	5.3.30	0-32767		R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Vis 1200 ft. poly night scalar	213	5.3.30	0-32767		R
Vis 2640 ft. poly night scalar	214	5.3.30	0-32767		R
Vis 1 mi. poly night scalar	215	5.3.30	0-32767		R
Vis 3 mi. poly night scalar	216	5.3.30	0-32767		R
Vis 8 mi. poly night scalar	217	5.3.30	0-32767		R
Vis 20 mi. poly night scalar	218	5.3.30	0-32767		R
Vis 49.64 mi. poly scal. night	219	5.3.30	0-32767		R
Rain raster defocus limit	220	5.3.25	0-255	255	R
Rain lights defocus limit	221	5.3.25	0-255	255	R
Rain raster delta buildup	222	5.3.25	0-255	2	R
Rain lights delta buildup	223	5.3.25	0-255	2	R
Rain raster delta clearup	224	5.3.25	0-255	10	R
Rain lights delta clearup	225	5.3.25	0-255	10	R
Transport delay switch	226	5.3.32	0, 1	0 (disabled)	R
Storm center CSN	227	5.3.25	1-15	3 (CSN)	S
Max glare visibility	228	5.3.11	0-32767	660 (1 mi)	R
Min glare scud	229	5.3.11	0-255	200	R
Beacon color intensity	230	5.3.12	0-255	180	R
Beacon day intensity scalar	231	5.3.12	0-8192	1000 (0.488)	R
Beacon dusk intensity scalar	232	5.3.12	0-8192	2000 (0.977)	R
Beacon night intensity scalar	233	5.3.12	0-8192	6000 (2.930)	R
Beacon day on time	234	5.3.12	0-32767	5 (fields)	R
Beacon day off time	235	5.3.12	0-32767	50 (fields)	R
Beacon dusk on time	236	5.3.12	0-32767	3 (fields)	R
Beacon dusk off time	237	5.3.12	0-32767	30 (fields)	R
Beacon night on time	238	5.3.12	0-32767	3 (fields)	R
Beacon night off time	239	5.3.12	0-32767	30 (fields)	R
Strobe color intensity	240	5.3.13	0-255	180	R
Strobe day intensity scalar	241	5.3.13	0-8192	700 (0.342)	R
Strobe dusk intensity scalar	242	5.3.13	0-8192	1000 (0.488)	R
Strobe night intensity scalar	243	5.3.13	0-8192	6000 (2.93 0)	R
Strobe day on time	244	5.3.13	0-32767	2 (fields)	R
Strobe day off time	245	5.3.13	0-32767	75 (fields)	R
Strobe dusk on time	246	5.3.13	0-32767	1 (fields)	R
Strobe dusk off time	247	5.3.13	0-32767	50 (fields)	R
Strobe night on time	248	5.3.13	0-32767	1 (fields)	R
Strobe night off time	249	5.3.13	0-32767	50 (fields)	R
LLL color intensity	250	5.3.14	0-255	200	R
LLL delta color intensity	251	5.3.14	0-255	20	R
LLL day intensity scalar	252	5.3.14	0-8192	1024 (0.5)	R
LLL dusk intensity scalar	253	5.3.14	0-8192	2000 (0.977)	R
LLL night intensity scalar	254	5.3.14	0-8192	7000 (3.418)	R
Horizon visibility cutoff	255	5.3.17	0-32767	23100 (35 mi)	R
Directional horizon cutoff	256	5.3.17	0-65535	16384 (90°)	R
Horizon steps dusk	257	5.3.17	0-255	20	R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Horizon steps night	258	5.3.17	0-255	40	R
Fog color update enable	259	5.3.8	0, 1	1 (enabled)	R
Glare increase rate	260	5.3.11	0-32767	100	R
Glare decrease rate	261	5.3.11	0-32767	1000	R
VCD amplitude scalar	271	5.3.28	0-128	8 (2.0)	R
VCD frequency scalar	272	5.3.28	0-31	16 (128 ft.)	R
Max scud change/field in	273	5.3.3	0-32767	1024	R
Max scud change/field out	274	5.3.3	0-32767	1024	R
Vis above clouds switch	275	5.3.3	0 - 1	0	R
CD channel mask	280	5.3.7	0-255	2 (chan 1)	S
HAT channel mask	281	5.3.6	0-255	4 (chan 2)	S
CD type	282	5.3.7	0, 1	0 (on path)	S
CD num test points/field	283	5.3.7	0-3	3 (per field)	S
HAT num test points/field	284	5.3.6	0-3	3 (per field)	S
Viewport Magnif. scalar	285	5.3.27	0-32767	1024 (1.0)	R
Ethernet address	288	5.3.18	0-65535	(from EPROM)	S
Host coordinate systems ct.	289	5.3.18	0-16	16 (CSs)	R
Ethernet byte swap	290	5.3.18	0, 1	1 (enabled)	S
Host sim control word #1	291	5.3.19	0, 1	0 (disable)	R
Host sim control word #2	292	5.3.19	0, 1	0 (normal)	R
Host sim control word #3	293	5.3.19		0 (not used)	R
Host sim control word #4	294	5.3.19	0-7	7 (XYZ present)	R
Host sim control word #5	295	5.3.19	0-7	7 (HPR present)	R
Host sim control word #6	296	5.3.19	0, 1	1 (extrapolate)	R
Host sim control word #7	297	5.3.19	0-7	7 (XYZ present)	R
Host sim control word #8	298	5.3.19	0-7	7 (HPR present)	R
Host sim control word #9	299	5.3.19	0-3	3 (both)	R
Max storm range	300	5.3.25	0-32767	32767 (49.64 mi)	R
Min storm range	301	5.3.25	0-32767	330 (2640 ft)	R
Min storm visibility	302	5.3.25	0-32767	0 (0 ft)	R
Storm day ambient loss	303	5.3.25	0-255	100	R
Storm dusk ambient loss	304	5.3.25	0-255	20	R
Storm night ambient loss	305	5.3.25	0-255	0	R
Storm day lightning ambient	306	5.3.25	0-255	100	R
Storm dusk lightning amb.	307	5.3.25	0-255	180	R
Storm night lightning amb.	308	5.3.25	0-255	220	R
Matrix switcher port #	310	5.3.21	1-3	1 (port #)	S
Matrix switcher baud rate	311	5.3.21	$2^i, i<7$	4 (4800 baud)	S
Matrix switcher enable	312	5.3.21	0, 1	0 (disabled)	S
Vis 0 ft. star scalar	320	5.3.30	0-32767		R
Vis 300 ft. star scalar	321	5.3.30	0-32767		R
Vis 700 ft. star scalar	322	5.3.30	0-32767		R
Vis 1200 ft. star scalar	323	5.3.30	0-32767		R
Vis 2640 ft. star scalar	324	5.3.30	0-32767		R
Vis 1 mi. star scalar	325	5.3.30	0-32767		R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Vis 3 mi. star scalar	326	5.3.30	0-32767		R
Vis 8 mi. star scalar	327	5.3.30	0-32767		R
Vis 20 mi. star scalar	328	5.3.30	0-32767		R
Vis 49.64 mi. star	329	5.3.30	0-32767		R
Vis 0 ft. sky scalar	330	5.3.30	0-32767		R
Vis 300 ft. sky scalar	331	5.3.30	0-32767		R
Vis 700 ft. sky scalar	332	5.3.30	0-32767		R
Vis 1200 ft. sky scalar	333	5.3.30	0-32767		R
Vis 2640 ft. sky scalar	334	5.3.30	0-32767		R
Vis 1 mi. sky scalar	335	5.3.30	0-32767		R
Vis 3 mi. sky scalar	336	5.3.30	0-32767		R
Vis 8 mi. sky scalar	337	5.3.30	0-32767		R
Vis 20 mi. sky scalar	338	5.3.30	0-32767		R
Vis 49.64 mi. sky scalar	339	5.3.30	0-32767		R
IG configuration code	340	5.3.20	0, 1	1 (Std. Texture)	S
IG/DB compat. warning	341	5.3.20	0, 1	0 (not suppress.)	S
Auto display blanking time	342	5.3.32	0, 1 - 1440	0 (off)	R
Channel [i] hor. flyback	(i*5)+350	5.3.2	0-4096	70 (13.5 μs)	S
Vis 0 ft. step 4 dusk scalar	400	5.3.30	0-32767		R
Vis 300 ft. step 4 dusk scalar	401	5.3.30	0-32767		R
Vis 700 ft. step 4 dusk scalar	402	5.3.30	0-32767		R
Vis 1200 ft. step 4 dusk scalar	403	5.3.30	0-32767		R
Vis 2640 ft. step 4 dusk scalar	404	5.3.30	0-32767		R
Vis 1 mi. step 4 dusk scalar	405	5.3.30	0-32767		R
Vis 3 mi. step 4 dusk scalar	406	5.3.30	0-32767		R
Vis 8 mi. step 4 dusk scalar	407	5.3.30	0-32767		R
Vis 10 mi. step 4 dusk scalar	408	5.3.30	0-32767		R
Vis 49.64 mi. step 4 dusk scal.	409	5.3.30	0-32767		R
Vis 0 ft. step 5 dusk scalar	410	5.3.30	0-32767		R
Vis 300 ft. step 5 dusk scalar	411	5.3.30	0-32767		R
Vis 700 ft. step 5 dusk scalar	412	5.3.30	0-32767		R
Vis 1200 ft. step 5 dusk scalar	413	5.3.30	0-32767		R
Vis 2640 ft. step 5 dusk scalar	414	5.3.30	0-32767		R
Vis 1 mi. step 5 dusk scalar	415	5.3.30	0-32767		R
Vis 3 mi. step 5 dusk scalar	416	5.3.30	0-32767		R
Vis 8 mi. step 5 dusk scalar	417	5.3.30	0-32767		R
Vis 10 mi. step 5 dusk scalar	418	5.3.30	0-32767		R
Vis 49.64 mi. step 5 dusk scal.	419	5.3.30	0-32767		R
Vis 0 ft. step 4 night scalar	420	5.3.30	0-32767		R
Vis 300 ft. step 4 night scalar	421	5.3.30	0-32767		R
Vis 700 ft. step 4 night scalar	422	5.3.30	0-32767		R
Vis 1200 ft. step 4 night scal.	423	5.3.30	0-32767		R
Vis 2640 ft. step 4 night scal.	424	5.3.30	0-32767		R
Vis 1 mi. step 4 night scalar	425	5.3.30	0-32767		R
Vis 3 mi. step 4 night scalar	426	5.3.30	0-32767		R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) - Continued

Parameter	Entry #	Manual	Range	Default	Use
Vis 8 mi. step 4 night scalar	427	5.3.30	0-32767		R
Vis 10 mi. step 4 night scalar	428	5.3.30	0-32767		R
Vis 49.6 step 4 night scalar	429	5.3.30	0-32767		R
Vis 0 ft. step 5 night scalar	430	5.3.30	0-32767		R
Vis 300 ft. step 5 night scalar	431	5.3.30	0-32767		R
Vis 700 ft. step 5 night scalar	432	5.3.30	0-32767		R
Vis 1200 ft. step 5 night scal.	433	5.3.30	0-32767		R
Vis 2640 ft. step 5 night scal.	434	5.3.30	0-32767		R
Vis 1 mi. step 5 night scalar	435	5.3.30	0-32767		R
Vis 3 mi. step 5 night scalar	436	5.3.30	0-32767		R
Vis 8 mi. step 5 night scalar	437	5.3.30	0-32767		R
Vis 10 mi. step 5 night scalar	438	5.3.30	0-32767		R
Vis 49.64 mi step 5 night scal.	439	5.3.30	0-32767		R
Runway 0 edge light switch	480	5.3.24	0-63	3	R
Runway 1 edge light switch	481	5.3.24	0-63	11	R
Runway 2 edge light switch	482	5.3.24	0-63	19	R
Runway 3 edge light switch	483	5.3.24	0-63	27	R
Runway 4 edge light switch	484	5.3.24	0-63	35	R
Ethernet addr upper 2 bytes	490	5.3.18	0-65535	(from EPROM)	S
Ethernet addr middl 2 bytes	491	5.3.18	0-65535	(from EPROM)	S
Host addr upper 2 bytes	492	5.3.19	0-65535	(from EPROM)	S
Host addr middle 2 bytes	493	5.3.19	0-65535	(from EPROM)	S
Cal. light defocus: 0 ft.	500	5.3.22	0-255	255	R
Cal. light defocus: 300 ft.	501	5.3.22	0-255	255	R
Cal. light defocus: 700 ft.	502	5.3.22	0-255	200	R
Cal. light defocus: 1200 ft.	503	5.3.22	0-255	100	R
Cal. light defocus: 2640 ft.	504	5.3.22	0-255	0	R
Cal. light defocus: 1 mile	505	5.3.22	0-255	0	R
Cal. light defocus: 3 miles	506	5.3.22	0-255	0	R
Cal. light defocus: 8 miles	507	5.3.22	0-255	0	R
Cal. light defocus: 20 miles	508	5.3.22	0-255	0	R
Cal. light defocus: 49.6 miles	509	5.3.22	0-255	0	R
TMS Available	515	5.3.32	0, 1	1	S
New OC card switch	518	5.3.32	0-1	0 (old OC card)	S
LLL switch outer & turnoff	519	5.3.14	0-1	0 (off)	R
Remove horz glow trans zone	520	5.3.17	0-32767	50 (200 feet)	R
Haze type	521	5.3.16	0-3,-1	0	R
Floating OM & GP switch	522	5.3.23	0-1	0 (off)	P
Field extension amount/fld	523	5.3.23	0-20	1 (.0814 ms/fld)	P
Base raster defocus	524	5.3.32	0-255	0 (no defocus)	R
RSI/RSL options switch	525	5.3.32	0-1	0 (off)	S
Include HAT parcel CS	526	5.3.6	0-1	0 (not included)	R
Tune l_vs_p scalars	527	5.3.31	0-1	0 (correction on)	R
Current vis after haze cor	528	5.3.31	0-32767	(curr vis/64) ft	R
Frame rate switch	529	5.3.10	0-1	0 (field rate)	R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) - Continued

Parameter	Entry #	Manual	Range	Default	Use
l_vs_p_low_cloud_bot_ht	530	5.3.31	0-32767	250 (1000 ft)	R
l_vs_p_high_cloud_bot_ht	531	5.3.31	0-32767	1000 (4000 ft)	R
Max l_vs_p scalar change	532	5.3.31	0-32767	1024 (8/field)	R
Max vis change per field	533	5.3.31	0-32767	2048 (25 mi/fld)	R
l_vs_p_day_hicb_st3 0 m	540	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 6.2 m	541	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 12.4 m	542	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 18.6 m	543	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 24.8 m	544	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 31.0 m	545	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 37.2 m	546	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 43.4 m	547	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 49.6 m	548	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 99.3 m	549	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 148.9 m	550	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 198.6 m	551	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 248.2 m	552	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 297.8 m	553	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 347.5 m	554	5.3.31	0-32767		R
l_vs_p_day_hicb_st3 397.1 m	555	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 0 m	560	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 6.2 m	561	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 12.4 m	562	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 18.6 m	563	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 24.8 m	564	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 31.0 m	565	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 37.2 m	566	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 43.4 m	567	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 49.6 m	568	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 99.3 m	569	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 148.9 m	570	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 198.6 m	571	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 248.2 m	572	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 297.8 m	573	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 347.5 m	574	5.3.31	0-32767		R
l_vs_p_day_hicb_st4 397.1 m	575	5.3.31	0-32767		R
RSI/RSL Reserved Entries	580-599	—	—	—	–
l_vs_p_day_hicb_st5 0 m	600	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 6.2 m	601	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 12.4 m	602	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 18.6 m	603	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 24.8 m	604	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 31.0 m	605	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 37.2 m	606	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 43.4 m	607		5.3.31	0-32767		R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) - Continued

Parameter	Entry #	Manual	Range	Default	Use
l_vs_p_day_hicb_st5 49.6 m	608	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 99.3 m	609	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 148.9 m	610	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 198.6 m	611	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 248.2 m	612	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 297.8 m	613	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 347.5 m	614	5.3.31	0-32767		R
l_vs_p_day_hicb_st5 397.1 m	615	5.3.31	0-32767		R
l_vs_p_day_locb_st3 0 m	620	5.3.31	0-32767		R
l_vs_p_day_locb_st3 6.2 m	621	5.3.31	0-32767		R
l_vs_p_day_locb_st3 12.4 m	622	5.3.31	0-32767		R
l_vs_p_day_locb_st3 18.6 m	623	5.3.31	0-32767		R
l_vs_p_day_locb_st3 24.8 m	624	5.3.31	0-32767		R
l_vs_p_day_locb_st3 31.0 m	625	5.3.31	0-32767		R
l_vs_p_day_locb_st3 37.2 m	626	5.3.31	0-32767		R
l_vs_p_day_locb_st3 43.4 m	627	5.3.31	0-32767		R
l_vs_p_day_locb_st3 49.6 m	628	5.3.31	0-32767		R
l_vs_p_day_locb_st3 99.3 m	629	5.3.31	0-32767		R
l_vs_p_day_locb_st3 148.9 m	630	5.3.31	0-32767		R
l_vs_p_day_locb_st3 198.6 m	631	5.3.31	0-32767		R
l_vs_p_day_locb_st3 248.2 m	632	5.3.31	0-32767		R
l_vs_p_day_locb_st3 297.8 m	633	5.3.31	0-32767		R
l_vs_p_day_locb_st3 347.5 m	634	5.3.31	0-32767		R
l_vs_p_day_locb_st3 397.1 m	635	5.3.31	0-32767		R
l_vs_p_day_locb_st4 0 m	640	5.3.31	0-32767		R
l_vs_p_day_locb_st4 6.2 m	641	5.3.31	0-32767		R
l_vs_p_day_locb_st4 12.4 m	642	5.3.31	0-32767		R
l_vs_p_day_locb_st4 18.6 m	643	5.3.31	0-32767		R
l_vs_p_day_locb_st4 24.8 m	644	5.3.31	0-32767		R
l_vs_p_day_locb_st4 31.0 m	645	5.3.31	0-32767		R
l_vs_p_day_locb_st4 37.2 m	646	5.3.31	0-32767		R
l_vs_p_day_locb_st4 43.4 m	647	5.3.31	0-32767		R
l_vs_p_day_locb_st4 49.6 m	648	5.3.31	0-32767		R
l_vs_p_day_locb_st4 99.3 m	649	5.3.31	0-32767		R
l_vs_p_day_locb_st4 148.9 m	650	5.3.31	0-32767		R
l_vs_p_day_locb_st4 198.6 m	651	5.3.31	0-32767		R
l_vs_p_day_locb_st4 248.2 m	652	5.3.31	0-32767		R
l_vs_p_day_locb_st4 297.8 m	653	5.3.31	0-32767		R
l_vs_p_day_locb_st4 347.5 m	654	5.3.31	0-32767		R
l_vs_p_day_locb_st4 397.1 m	655	5.3.31	0-32767		R
l_vs_p_day_locb_st5 0 m	660	5.3.31	0-32767		R
l_vs_p_day_locb_st5 6.2 m	661	5.3.31	0-32767		R
l_vs_p_day_locb_st5 12.4 m	662	5.3.31	0-32767		R
l_vs_p_day_locb_st5 18.6 m	663	5.3.31	0-32767		R
l_vs_p_day_locb_st5 24.8 m	664	5.3.31	0-32767		R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) – Continued

Parameter	Entry #	Manual	Range	Default	Use
l_vs_p_day_locb_st5 31.0 m	665	5.3.31	0-32767	'	R
l_vs_p_day_locb_st5 37.2 m	666	5.3.31	0-32767		R
l_vs_p_day_locb_st5 43.4 m	667	5.3.31	0-32767		R
l_vs_p_day_locb_st5 49.6 m	668	5.3.31	0-32767		R
l_vs_p_day_locb_st5 99.3 m	669	5.3.31	0-32767		R
l_vs_p_day_locb_st5 148.9 m	670	5.3.31	0-32767		R
l_vs_p_day_locb_st5 198.6 m	671	5.3.31	0-32767		R
l_vs_p_day_locb_st5 248.2 m	672	5.3.31	0-32767		R
l_vs_p_day_locb_st5 297.8 m	673	5.3.31	0-32767		R
l_vs_p_day_locb_st5 347.5 m	674	5.3.31	0-32767		R
l_vs_p_day_locb_st5 397.1 m	675	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 0 m	680	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 6.2 m	681	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 12.4 m	682	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 18.6 m	683	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 24.8 m	684	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 31.0 m	685	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 37.2 m	686	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 43.4 m	687	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 49.6 m	688	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 99.3 m	689	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 148.9 m	690	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 198.6 m	691	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 248.2 m	692	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 297.8 m	693	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 347.5 m	694	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st3 397.1 m	695	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 0 m	700	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 6.2 m	701	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 12.4 m	702	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 18.6 m	703	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 24.8 m	704	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 31.0 m	705	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 37.2 m	706	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 43.4 m	707	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 49.6 m	708	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 99.3 m	709	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 148.9 m	710	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 198.6 m	711	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 248.2 m	712	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 297.8 m	713	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 347.5 m	714	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st4 397.1 m	715	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 0 m	720	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 6.2 m	721	5.3.31	0-32767		R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) - Continued

Parameter	Entry #	Manual	Range	Default	Use
l_vs_p_dsk_hicb_st5 12.4 m	722	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 18.6 m	723	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 24.8 m	724	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 31.0 m	725	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 37.2 m	726	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 43.4 m	727	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 49.6 m	728	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 99.3 m	729	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 148.9 m	730	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 198.6 m	731	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 248.2 m	732	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 297.8 m	733	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 347.5 m	734	5.3.31	0-32767		R
l_vs_p_dsk_hicb_st5 397.1 m	735	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 0 m	740	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 6.2 m	741	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 12.4 m	742	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 18.6 m	743	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 24.8 m	744	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 31.0 m	745	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 37.2 m	746	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 43.4 m	747	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 49.6 m	748	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 99.3 m	749	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 148.9 m	750	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 198.6 m	751	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 248.2 m	752	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 297.8 m	753	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 347.5 m	754	5.3.31	0-32767		R
l_vs_p_dsk_locb_st3 397.1 m	755	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 0 m	760	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 6.2 m	761	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 12.4 m	762	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 18.6 m	763	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 24.8 m	764	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 31.0 m	765	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 37.2 m	766	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 43.4 m	767	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 49.6 m	768	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 99.3 m	769	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 148.9 m	770	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 198.6 m	771	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 248.2 m	772	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 297.8 m	773	5.3.31	0-32767		R
l_vs_p_dsk_locb_st4 347.5 m	774	5.3.31	0-32767		R

Table 5-2. Table Entry Numbers, Range, and Defaults (by number) - Continued

Parameter	Entry #	Manual	Range	Default	Use
l_vs_p_dsk_locb_st4 397.1 m	775	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 0 m	780	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 6.2 m	781	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 12.4 m	782	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 18.6 m	783	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 24.8 m	784	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 31.0 m	785	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 37.2 m	786	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 43.4 m	787	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 49.6 m	788	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 99.3 m	789	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 148.9 m	790	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 198.6 m	791	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 248.2 m	792	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 297.8 m	793	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 347.5 m	794	5.3.31	0-32767		R
l_vs_p_dsk_locb_st5 397.1 m	795	5.3.31	0-32767		R
Same Point Tbl shift code	805	5.3.33	-15 - 0	-7	R
Same Point Tbl del light dist	806	5.3.33	0 - 32767	108	R
Same Point Tbl filter scalar	807	5.3.33	0 - 15	2	R
Same Point Tbl inten mod sclr	808	5.3.33	0 - 32767	6900	R
Same Point Tbl min mod range	809	5.3.33	0 - 32767	1000	R
Same Point Tbl max mod range	810	5.3.33	0 - 32767	9700	R
Same Point Tbl screen y scalar	811	5.3.33	0 - 32767	32000	R
Same Point Tbl screen x scalar	812	5.3.33	0 - 32767	15000	R
Edge Light switch range mode	820	5.3.24	0, 1	0 (off)	R
Edge Light upper switch	821	5.3.24	0 - 63	0	R
Edge Light lower switch	822	5.3.24	0 - 63	0	R
Alt. light int. switch num	823	5.3.30	-1, 0 - 63	-1 (off)	R
Alt. light switch step 0	824	5.3.30	0 - 8192	0 (disabled)	R
Alt. light switch step 1	825	5.3.30	0 - 8192	500 (.061)	R
Alt. light switch step 2	826	5.3.30	0 - 8192	1000 (.122)	R
Alt. light switch step 3	827	5.3.30	0 - 8192	1500 (.183)	R
Alt. light switch step 4	828	5.3.30	0 - 8192	3000 (.366)	R
Alt. light switch step 5	829	5.3.30	0 - 8192	8000 (.977)	R

5.5 SAMPLE CONFIGURATION

This is an example of a site configuration file. Comments may be placed in the file ahead of the line they describe if preceded by a number sign (#).

```
#
#   TABLE Offset 32 Value 3: look up the table entry number 32,
#   and enter a value of 3; channel count (number of channels
#   in the system) is set to 3.
TAB O 32 V 3
#
#   TABLE Offset 33 Value 7: look up the table entry number 33,
#   and enter a value of 7; active channel mask is 7 (binary
#   00000111).
TAB O 33 V 7
#
#   TABLE Offset 0 Value 2: look up the table entry number 0,
#   and enter a value of 2; channel 0 resolution is set to 2,
#   which is high resolution. The channel number comes from the
#   entry number; ((i*4)+0) equals 0 if i equals 0.
TAB O 0 V 2
#
#   TABLE Offset 1 Value 1000: look up the table entry number 1,
#   and enter a value of 1000; channel 0 pixels/line is set to
#   1000. The channel number comes from the entry number;
#   ((i*4)+1) equals 1 if i equals 0.
TAB O 1 V 1000
#
#   TABLE Offset 2 Value 800: look up the table entry number 2,
#   and enter a value of 800; channel 0 raster lines is set to
#   800. The channel number comes from the entry number;
#   ((i*4)+2) equals 2 if i equals 0.
TAB O 2 V 800
#
#   TABLE Offset 3 Value 0: look up the table entry number 3,
#   and enter a value of 0; channel 0 display type is set to 2,
#   which is Calligraphic CSM. The channel number comes from
#   the entry number; ((i*4)+3) equals 3 if i equals 0.
TAB O 3 V 0
#
#   TABLE Offset 350 Value 28: look up the table entry number
#   350, and enter a value of 28; channel 0 horizontal flyback
#   is set to 28. The channel number comes from the entry
#   number; ((i*5)+350) equals 350 if i equals 0.
TAB O 350 V 28
#
#   These commands are the same as those above, except are for
```

```
#   channels 1 and 2 instead of 0. The table offset (entry)
#   numbers are determined by the channel number and the
#   equation; for example, ((i*4)+0) is equal to 4 when i is
#   equal to 1.
TAB O 4 V 2
TAB O 5 V 1000
TAB O 6 V 800
TAB O 7 V 0
TAB O 355 V 28
TAB O 8 V 2
TAB O 9 V 1000
TAB O 10 V 800
TAB O 11 V 0
TAB O 360 V 28
#
#   The CHAN command configures the view for the channel
#   processor. CHAN N 0 specifies channel number 0. MVIEW
#   specifies that this channel shows the main view. Heading is
#   set to 0 degrees, pitch is 0 degrees, roll is 0 degrees, X,
#   Y, and Z are all 0 feet, horizontal half angle is 24.0
#   degrees, and the vertical half angle is 18.46 degrees.
CHAN N 0 MVIEW HEAD 0 PITCH 0 ROLL 0 X 0 Y 0 Z 0
CHAN N 0 HOR 24.0 VER 18.46
#
#   These two commands are like that above, except are for
#   channels 1 and 2. The heading, pitch, roll, X, Y, Z, and
#   view half angles are set differently.
CHAN N 1 MVIEW HEAD -45 PITCH 0 ROLL 0 X 0 Y 0 Z 0
CHAN N 1 HOR 24.0 VER 18.46
CHAN N 2 MVIEW HEAD 45 PITCH 0 ROLL 0 X 0 Y 0 Z 0
CHAN N 2 HOR 24.0 VER 18.46
```

HOST INTERFACE

6.1 INTRODUCTION

This section describes the interface between the image generator (IG) system and the host computer through the Ethernet link. It describes the data block structures for IG and the host, the communications protocol, and Ethernet.

6.2 IG/HOST COMMUNICATIONS PROTOCOL

The host computer and the IG communicate using the protocol described below.

6.2.1 Host Block

The host block transmitted from the host contains a header placed at the front of the block. The header contains two pieces of information:

    message number: 4 bytes
    host operation code: 2 bytes

Message numbers start at 0 and go to $(2^{32}-1)$ then wrap around again to 0.

6.2.1.1 Host Operation Codes:

    0000   normal operation, data appended to host block
    0001   unassigned
    0002   request status block from IG, data appended to host block
    0003   request status block from IG, no data appended to host block
    0004   IG restart acknowledged, data appended to host block
    0005   request IG restart, no data appended to host block
    0006   IG restart acknowledged, request status block from IG,
           data appended to host block

0007   unassigned

NOTE: Even when appended data is specified (from the host), the actual number
of data items may be zero.

6.2.2 IG Block

The IG block transmitted to the host contains a header placed at the front of the
block. The header contains two pieces of information:

message number: 4 bytes (message number from the host block)
IG operation code: 2 bytes

6.2.2.1 IG Operation Codes:

0000   normal acknowledgment, no IG status block
0001   unassigned
0002   normal acknowledgment, status appended
0003   unassigned
0004   IG restarted, no IG status block
0005   unassigned
0006   IG restarted, IG status block appended
0007   unassigned

6.2.3 Protocol

The following sections describe the IG/host communication protocol in normal
operation.

6.2.3.1 Startup/Restart Procedure

The following explains the IG startup/restart procedure.

During startup/restart, the IG ignores any attempt(s) at communication by the host
while the IG is establishing its initial conditions and preparing for fly operation.
When initialization is complete, the IG enables communication with the host by
responding appropriately to a received host block. If the host is not sending blocks
to the IG, the IG waits in its initial condition state indefinitely until a block is
received. When the first block of any kind is received from the host after IG
initialization, the IG will set its message number to the same number as the host
message and then proceed as described under Normal Operation.

6.2.3.2 Normal Operation

The following describes how the IG system and the host computer communicate
during normal operation.

After the restart procedure is completed, the IG responds immediately to every valid, error-free block from the host by sending a block back to the host. Its block will have the same message number as the host block message number.

When the host sends a normal operation code (0000 hex) the IG normally responds with a normal acknowledgment code (0000 or 0002 hex). The only exception to this is when the IG has restarted and receives a normal data block without a restart acknowledge operation code. The IG acknowledges that data block with the proper message number, but it acknowledges it with an IG restarted operation code (0004 or 0006 hex). The IG continues this scheme (i.e., remain in a restarted condition but acknowledge host data blocks) until it receives a restart acknowledge operation code from the host (0004 or 0006 hex).

When the host sends a restart acknowledged operation code (0004 or 0006 hex), the IG will clear its restart condition. It then proceeds into normal acknowledgment mode.

When the host sends a request status code (0002, 0003 or 0006), the IG acknowledges the host data block immediately. The IG may or may not send its status block back within that frame. It does, however, log that request and then sends the status block when it can.

When the host sends a request restart operation code (0005 hex), the IG ceases normal operation and enters the restart procedure. The image will cease to be displayed. It will then go through the startup/restart procedure described above.

6.2.3.3 Miscellaneous

The following describes how the IG and the host computer communicate during times when data is not received, when errors occur.

If data has not been received from the host for five IG real-time fields, the IG logs the status on the operator console, ceases extrapolation and uses the last set of valid data received until valid data transfer from the host is resumed. The image continues to be displayed.

The IG ignores any host block received in error (e.g., CRC errors). The IG does not treat skipped message numbers as errors; they are treated as indicative of a data-loss problem.

Errors in five or more successive blocks from the host are logged on the IG terminal. Although the image continues to be displayed, extrapolation stops. The IG waits for five valid blocks before it continues on with the fly program. If an obvious catastrophic failure occur, appropriate operator intervention is expected.

The IG never demands any response from the host. It acts as a slave to the host.

The host and IG software and/or hardware are responsible for any error recovery needed at the Ethernet level if it does not affect this higher level protocol.

The host must allow at least 16.67 milliseconds between host block transmissions (60Hz).

6.3 ETHERNET STANDARDS AND DESCRIPTIONS

The Ethernet follows these industry standards for its type of interface

Hardware Standard:	IEEE 802.3.
Software Standard:	IEEE 802.3.

6.4 FRAME AND DATA FORMAT

The basic frame format is as follows:

pre-amble	sfd sync	dest. address	source address	length	data	crc
56 bits	8 bits	6 bytes	6 bytes	2 bytes	46-1500 bytes	4 bytes

The preamble, sfd sync, and crc blocks are generated by the Ethernet interface circuit; the rest of the blocks are software generated.

The data block has a minimum of 46 bytes; if fewer bytes are going to be sent, the software must pad the end of that block and determine the proper length.

NOTE: There will be a 0000 hex opcode at the end of the usable data block. The receiving software does not use any data beyond that point. The transmitting software must still do a proper pad if less than 46 bytes. IEEE 802.3 allows for this situation.

The message number and host/IG operation codes must begin the data block of the Ethernet frame.

Data block maximum will be 400 bytes for the host data block. Data block maximum will be 320 bytes for the IG status block. Source and destination addresses will be determined later.

NOTE: Values are in hex. This is the logical link control (LLC) data block within the Ethernet frame.

All data transmitted and received by both the IG and the host will follow this convention:

1. All information contained in a word (16 bits) shall have this structure:

15 14 13 12 11 10 09 08	07 06 05 04 03 02 01 00
msb	lsb
address n	address n + 1

2. All information contained in a longword (32 bits. ex: XYZ info.) shall have this structure:

15 14 13 12 11 10 09 08	07 06 05 04 03 02 01 00
msb	
address n	address n + 1
	lsb
address n+2	address n+3

3. All information contained in three words (48 bits. ex: lat/lon) shall have this structure:

15 14 13 12 11 10 09 08	07 06 05 04 03 02 01 00
msb	
address n	address n + 1
address n+2	address n+3
	lsb
address n+4	address n+5

NOTE: When data is transmitted, the msb is transmitted first and is followed by the other bytes down to the lsb.

6.5 EXPLANATION OF THE HOST BLOCK

The host computer interface section of the real-time system provides the ESIG-LC system the capability of receiving data from the host computer. (The host computer is not part of the ESIG-LC system and is not manufactured by Evans & Sutherland; it is the device that controls the simulation cockpit with its controls, display gauges, and motion simulators.)

All of the host-to-IG communication passes through the Ethernet interface. The ESIG-LC real-time system receives positional commands and environmental information from the host computer. Positional commands place the eyepoint within the host-controlled dynamic coordinate systems. The environmental information tells the RTS about the time of day, clouds, fog, light string switch settings, and etc. The Ethernet uses industry-standard hardware as the interface between the IG and host computers.

The Ethernet hardware places the information from the host computer directly into the ESIG-LC real-time system memory space. When the host block arrives, the Ethernet interrupt service routine processes an interrupt. The host data remains in the Ethernet buffer until the beginning of the next real-time system field. At this

time the Ethernet routine checks to see whether new data has been received; if it has been received, it is brought on-line. The extrapolation routine which corrects the positional data executes next; this routine uses the difference between the current time and the time the host information was received to extrapolate the new eyepoint position. The real-time system services the Ethernet interrupt, which tags the host data with the time so the extrapolation routine will know precisely when the data arrived.

The Ethernet routine checks to see whether new host data has been received since the last field calculations were made. If so, the new host data is moved into a data buffer and the Ethernet buffer is released; the Ethernet hardware has four buffers with which to work. It rotates through these buffers so that there is no possibility of overwriting data. The Ethernet routine returns the buffer to the Ethernet hardware as soon as it has moved and processed the data.

The host interface is based on a update-only philosophy, meaning that data only needs to be sent from the host to the IG system when it changes. IG conditions remain constant until either the host or the command line interpreter (CLI) sends an update. Data sent from the host to the IG system is preceded by an opcode which classifies the data. All opcodes are represented by a word of two bytes. Enable/disable switches have only the high-order bit of the high-order byte of the opcode set for enable/disable. Opcodes which contain further information are structured so that the opcode and accompanying information results in word lengths. When viewport and/or coordinate system (CS) information is sent, the whole block must be sent regardless of whether a value is being used; if the value isn't being used, it is filled with zeros.

6.6 HOST BLOCK OPCODES AND DESCRIPTIONS

Opcode (hex values) opcodes prepend the data to distinguish the data that the host sends.

6.6.1 End Opcode

0000   no more data (terminates the host block)

6.6.2 Enable/Disable Switches (Bit 15 is Set/Reset)

8001   storm enable
0001   storm disable

8002   ground fog enable
0002   ground fog disable

8003   patchy ground fog enable
0003   patchy ground fog disable

8004	scudded clouds enable
0004	scudded clouds disable
8005	clouds enable
0005	clouds disable
8006	rain enable
0006	rain disable
8007	lightning enable
0007	lightning disable
8008	random intensity enable
	enabled: light strings displayed with random intensity
0008	random intensity disable
	disabled: light strings displayed with modeled intensity
8009	own-ship wing tip strobe enable
0009	own-ship wing tip strobe disable
800A	own-ship anti-collision beacon enable
000A	own-ship anti-collision beacon disable

6.6.3 Codes That Contain Additional Information

000F	general visibility: VIS word follows (two words)
	word: visibility in multiples of four feet with maximum visibility of 49.6 miles (word is unsigned, 16 bits are used)
0010	ground fog RVR: RVR word follows (two words)
	word: RVR in multiples of four feet with maximum RVR of 49.6 miles (word is unsigned)
0011	horizon control select: HCS words follows (three words)
	byte: 1-5 for brightness, 0 is off (msb)
	byte: directional horizon enable/disable (lsb)
	0 = disabled
	1 = enabled
	word: directional horizon angle (16 bits are used)
	(see coordinate system heading angle for scaling)
0012	light switch: light switch number and intensity bytes follow (two words)
	byte: switch number = 0-63 (msb)
	byte: intensity = 1-5, 0 is off (lsb)

0013   landing light lobes: LLL word follows (two words)
      byte: (not used) (msb)
      byte: (lsb):
          bit 0: right outboard
          bit 1: right turnoff
          bit 2: right inboard
          bit 3: center
          bit 4: left inboard
          bit 5: left turnoff
          bit 6: left outboard
          bit 7: not used

0014   parcel select: parcel byte follows (two words)
         selects parcel for ground coordinate system in X/Y systems, and
         selects the colocatable parcel in Lat/Lon systems.
      byte: colocatable parcel select (msb) (0-255)
      byte: parcel number (lsb) (0-255)

0015   display select: display words follow (four words)
      byte: channel number 0-7 (msb)
      byte: not used (lsb)
      byte: display a (msb)
          a off = 0
          a on = 1
      byte: display b (lsb)
          b off = 0
          b on = 1
      byte: main/alternate viewport (msb)
          main viewport = 0
          alternate viewport = 1
      byte: main/alternate color (lsb)
          main color = 0
          alternate color = 1

0016   scene select: selects day, dusk or night scene (two words)
      byte: (not used) (msb)
      byte: scene (lsb)
          00: night
          01: dusk
          02: day

0017   cloud top: cloud top word follows (two words)
      word: expressed in increments of four feet. maximum altitude is
         24.8 miles (positive signed, 16 bits are used)

0018   cloud bottom: cloud bottom word follows (two words)
      word: expressed in increments of four feet. maximum altitude is
         24.8 miles (positive signed, 16 bits are used)

0019   polygon switch: poly switch number and intensity bytes follow
                (two words)
        byte: switch number = 0-63 (msb)
        byte: intensity = 1-5, 0 is off (lsb)

NOTE: To avoid overloading the IG system, no more than eight switches should be made per transfer.

6.6.4 Coordinate System (CS) Information

001A   designates CS info (14 words X/Y, 16 words LAT/LON)

The following bytes follow the opcode:
      byte: CS number (always present) (msb)
           numbers: 0-number provided in the system
      byte: model select (always present) (lsb) CS select number:
           0 = off
           1-255 = selectable
      byte: Parcel type (msb)
           0: local parcel
           1: placeable parcel
                (used for routed, converging traffic and animation)
      byte: Parcel index (lsb)
           0-255 (used for routed, converging traffic and animation)
      byte: control byte: routed traffic, converging traffic, and animation
           (always present) (msb)
           00:     no information
           1#:   load in information for routed traffic,
                   # is routed traffic scenario for this CS
           2#:   start routed traffic for this CS, # is scenario
           3#:   stop routed traffic, # is scenario
           4#: .   unload routed information, # is scenario
           5#:   load in information for converging traffic,
                   # is converging traffic scenario for this CS
           6#:   start converging traffic for this CS, # is scenario
           7#:   stop converging traffic, # is scenario
           8#:   unload converging information
           9#:   load in information for animation,
                   # is animation sequence number
           a#:   start animation
           b#:   stop animation
           c#:   unload animation information
      byte: XYZ bit field codes (always present) (lsb)
           bit 0:   X or lat present
           bit 1:   Y or lon present
           bit 2:   Z present
      byte: HPR bit field codes (always present) (msb)
           bit 0:   heading present

```
                              bit 1:    pitch present
                              bit 2:    roll present
              byte:    el bit field codes (always present) (lsb)
                              bit 0:    extrapolate information
                                        0 = do not extrapolate
                                        1 = extrapolate
                              bit 1:    coordinate system mode
                                        0 = XY coordinates
                                        1 = lat/lon coordinates
```

Either the XYZ or Lat/Lon sets will be used, depending upon the mode of the system (i.e., bit 1 of the el bit field codes).

```
    XY Mode:          long:     X
                      long:     Y
                      long:     Z

    Lat/Lon Mode:  6 bytes:     Latitude
                   6 bytes:     Longitude
                      long:     Altitude

    Either Mode:      word:     Heading
                      word:     Pitch
                      word:     Roll
```

See Section 6.14, Coordinate System Parameter Description, for more details.

NOTE: All entries (heading, pitch and roll and either XYZ or lat/lon/alt) should be present at least once to properly initialize the coordinate system when it is enabled (i.e., model select not 0). From that point on the latest received value is retained.

NOTE: Although a bit might be reset implying no information is present, the block of data for a CS always remains the same. Therefore, the next opcode should not start until after the above bytes have been accounted for.

6.6.5 Viewport Information

001B	designates viewport information (15 words)

byte: channel # (always present) (msb)
          0-7 = channel number

byte: viewport select (always present) (lsb)
          0 = main viewport
          1 = alternate viewport

byte: unused (msb)

byte: XYZ bit field codes (always present) (lsb)
          bit 0:   X present
          bit 1:   Y present
          bit 2:   Z present

byte: HPR bit field codes (always present) (msb)
          bit 0:   heading present
          bit 1:   pitch present
          bit 2:   roll present

byte: angle/extrapolation bit field codes (always present) (lsb)
          bit 0:   vertical and horizontal viewport half angles present
          bit 1:   extrapolate (set/reset)

long: X
long: Y
long: Z

word: Heading
word: Pitch
word: Roll

word: vertical viewport half angle
word: horizontal viewport half angle

NOTE: The viewport half angles have the same format as heading, pitch, and roll.

NOTE: Although a bit might be reset implying no information is present, the block of data for a viewport always remains the same. That means that the next opcode should start right after the above bytes have been accounted for.

6.6.6 Height Above Terrain (HAT) and Collision Detection (CD)

8030	height above terrain (HAT) enable
0030	height above terrain (HAT) disable
8031	collision detection (CD) enable
0031	collision detection (CD) disable

0032   height above terrain test-point (eight words)
           byte: not used (msb)
           byte: test-point number (0-31) (lsb) (maximum of 3 per transfer)
           long: X-offset from eyepoint
           long: Y-offset from eyepoint
           long: Z-offset from eyepoint
           (Refer to Section 6.14 for the proper way to format XYZ information.)

0033   collision detection test-point (eight words)
           byte: not used (msb)
           byte: test-point number (0-31) (lsb) (maximum of 3 per transfer)
           long: X-offset from eyepoint
           long: Y-offset from eyepoint
           long: Z-offset from eyepoint
           (Refer to Section 6.14 for the proper way to format XYZ information.)

8034   collision detection indicator enable (if auto indicator disabled)
0034   collision detection indicator disable (regardless of auto indicator)

0035   collision detection Indicator Status Block (three words)
           word: color index (into the color palette) (0-1023)
           byte: color valid flag (0-1)
           byte: auto indicator flag (0-1)

6.6.7 Miscellaneous Opcodes

0040   ambient day scalar: word follows (two words)
           byte: not used (msb)
           byte: ambient day scalar (0-255) (lsb)

0041   ambient dusk scalar: word follows (two words)
           byte: not used (msb)
           byte: ambient dusk scalar (0-255) (lsb)

0042   ambient night: scalar: word follows (two words)
           byte: not used (msb)
           byte: ambient night scalar (0-255) (lsb)

0043   sun heading and pitch information (three words)
           word: sun heading
           word: sun pitch .
           (same scaling as heading and pitch angles for a coordinate system)

NOTE: It is not recommended that this opcode be used dynamically in an attempt
           to represent time of day.

0044	ground fog height (two words)
	word: ground fog height, expressed in feet, maximum altitude is 6.2 miles (positive signed, 16 bits are used)

0050	instructor monitor channel number: channel number word follows (two words)
	byte: (not used) (msb)
	byte: channels 0-7 (lsb)

6.6.8 Information Request Opcodes

001C	request CS status block (one word)
	This opcode solicits all CS information. The number of bytes depends on the number of CSs that the system provides. The IG has the option of sending this information in one or more packets (up to two).

NOTE: CS information will be returned in X/Y if it is sent in X/Y; CS information will be returned in lat/lon if it is sent in lat/lon. The extrapolated data will be returned for those CSs with the extrapolation bit set. CSN 1 will contain the lat/lon of the primary local parcel during lat/lon operation. Internally generated data for routed and converging traffic will also be returned.

001D	request Switch status block (one word)
	This opcode solicits environmental, light switch and polygon switch and miscellaneous information of 200 bytes approximately. Includes 64 light and polygon switches with environmental information.

001E	request CD-HAT status block (one word)
	This opcode solicits height above terrain (HAT) and collision detection (CD) from the IG. Opcode is up to 320 bytes. It can include up to 11 test points each.

001F	request Viewport status block (one word)
	This opcode solicits viewport information. Opcode is approximately 200 bytes, with a maximum of eight channels. The IG has the option of sending this information in one or more packets (up to three).

NOTE: These opcodes are sent only when a host block contains an operation code (see IG/host Communication Protocol) that specifically requests the IG status block. If there is no host operation code requesting IG status and one of the above opcodes is present, it is ignored. Conversely, if there is a host operation code requesting IG status and none of the above opcodes are sent, then the IG will assume opcode 001E as the one wanted. If there are multiple requests, then only the last request will be honored. Refer to the protocol section for more details.

6.7 EXPLANATION OF THE IG BLOCK

The information that is described in the following section is sent from the IG to the host only when the host requests it. The IG does not voluntarily send the information. The kind of information sent by the IG depends upon which opcode is sent from the host. (Refer to host block opcodes and descriptions, Section 6.6.8.)

The IG block is structured in a fashion similar to the host block with opcodes preceding the actual data. Opcodes and their accompanying information can come in any order; however, the data is structured according to the respective opcode.

The following section describes in detail all opcodes that may be a part of the IG block according to what the host has solicited.

6.8 IG STATUS BLOCK OPCODES AND DESCRIPTIONS

6.8.1 Opcodes

Opcodes distinguish the data that the IG sends. Values are in hex.

6.8.2 End Opcode

0000   no more data (terminates the IG block)

6.8.3 Enable/Disable Switches. (Bit 15 is Set/Reset)

8001   storm enabled
0001   storm disabled

8002   ground fog enabled
0002   ground fog disabled

8003   patchy ground fog enabled
0003   patchy ground fog disabled

8004   scudded clouds enabled
0004   scudded clouds disabled

8005   clouds enabled
0005   clouds disabled

8006   rain enabled
0006   rain disabled

8007   lightning enabled
0007   lightning disabled

8008	random intensity enabled
0008	random intensity disabled

enabled: light strings displayed with random intensity
disabled: light strings displayed with normal intensity

8009	own-ship wing tip strobe enabled
0009	own-ship wing tip strobe disabled

800A	own-ship anti-collision beacon enable
000A	own-ship anti-collision disable

6.8.4 Codes That Contain Additional Information

000F   general visibility: VIS word follows (two words)
     word: visibility in multiples of four feet with maximum
            visibility of 49.6 miles (word is unsigned, 16 bits are used)

0010   ground fog RVR: RVR word follows (two words)
     word: RVR in multiples of four feet with maximum RVR of
            49.6 miles (word is unsigned)

0011   horizon control select: HCS word follows (three words)
     byte: 1-5 for brightness, 0 is off (msb)
     byte: directional horizon enable/disable (lsb)
            0 = disabled
            1 = enabled
     word: directional horizon angle (16 bits are used)
            (see coordinate system heading angle for scaling)

0012   light switch: light switch intensities (33 words)
     light switch intensity bytes follow in order from 0-63

0013   landing light lobes: LLL word follows (two words)
     byte: (not used) (msb)
     byte: (lsb)
            bit 0:   right outboard
            bit 1:   right turnoff
            bit 2:   right inboard
            bit 3:   center
            bit 4:   left inboard
            bit 5:   left turnoff
            bit 6:   left outboard
            bit 7:   not used

0014   parcel select: parcel byte follows (two words)
                  selects parcel for ground coordinate system in X/Y systems,
                  and selects the colocatable parcel in Lat/Lon systems.
       byte: colocatable parcel select (msb) (0-255)
       byte: parcel number (lsb) (0-255)

0015   display select: display words follow (four words)
       byte: channel number 0-7 (msb)
       byte: not used (lsb)
       byte: display a (msb)
                  a off = 0
                  a on = 1
       byte: display b (lsb)
                  b off = 0
                  b on = 1
       byte: main/alternate viewport (msb)
                  main viewport = 0
                  alternate viewport = 1
       byte: main/alternate color (lsb)
                  main color = 0
                  alternate color = 1

0016   scene select: selects day, dusk or night scene (two words)
       byte: (not used) (msb)
       byte: scene (lsb)
                  00: night
                  01: dusk
                  02: day

0017   cloud top: cloud top word follows (two words)
       word: expressed in increments of four feet; maximum altitude
                  is 24.8 miles (positive signed, 16 bits are used)

0018   cloud bottom: cloud bottom word follows (two words)
       word: expressed in increments of four feet; maximum altitude
                  is 24.8 miles (positive signed, 16 bits are used)

0019   polygon switch: polygon switch intensities (33 words)
       polygon switch intensity bytes follow in order from 0-63

6.8.5 Coordinate System (CS) Information

001A   designates CS info: The following bytes follow the opcode:

byte: CS number (always present) (msb)
> numbers: 0-number provided in the system

byte: model select (always present) (lsb)
> 0 = off
> 1-255 = selectable

byte: not used (msb)

byte: not used (lsb)

byte: routed, converging traffic and animation status (always present) (msb)
> 00:   no routed traffic, converging traffic, or animation
> 01:   routed traffic mode
> 02:   converging traffic mode
> 03:   animation mode

byte: XYZ bit field codes (always present) (lsb)
> bit 0:   X or lat present
> bit 1:   Y or lon present
> bit 2:   Z present

byte: HPR bit field codes (always present) (msb)
> bit 0:   heading present
> bit 1:   pitch present
> bit 2:   roll present

byte: e1 bit field codes (always present) (lsb)
> bit 0:   extrapolated information
>   0 = not extrapolated
>   1 = extrapolated
> bit 1:   coordinate system mode
>   0 = XY coordinates
>   1 = lat/lon coordinates

Either the XYZ or Lat/Lon sets will be used, depending upon the mode of the system.

XY Mode:	long:	X
	long:	Y
	long:	Z
Lat/Lon Mode:	6 bytes:	Latitude
	6 bytes:	Longitude
	long:	Altitude
Either Mode:	word:	Heading
	word:	Pitch
	word:	Roll

> *NOTE:* Although a bit might be reset, implying no information is present, the block of data for a CS always remains the same. Therefore, the next opcode will not start until after the above bytes have been accounted for.

6.8.6 Viewport Information

001B   designates viewport information. The following bytes follow
              the opcode:

byte: channel number (always present) (msb)
        0-7 = channel number

byte: viewport select (always present) (lsb)
        0 = main viewport
        1 = alternate viewport

byte: unused (msb)

byte: XYZ bit field codes (always present) (lsb)
        bit 0:   X present
        bit 1:   Y present
        bit 2:   Z present

byte: HPR bit field codes (always present)(msb)
        bit 0:   heading present
        bit 1:   pitch present
        bit 2:   roll present

byte: angle/extrap bit field codes (always present) (lsb)
        bit 0:   vertical and horizontal viewport half angles present
        bit 1:   extrapolate (set/reset)

long: X
long: Y
long: Z

word: Heading
word: Pitch
word: Roll

word: vertical viewport half angle
word: horizontal viewport half angle

> *NOTE:* The viewport half angles have the same format as heading, pitch, and roll.

> *NOTE:* Although a bit might be reset implying no information is present, the block of data for a viewport always remains the same. That means that the next opcode will start right after the above bytes have been accounted for.

6.8.7 Height Above Terrain (HAT) and Collision Detection (CD)

8030	height above terrain (HAT) enabled
0030	height above terrain (HAT) disabled

8031	collision detection (CD) enabled
0031	collision detection (CD) disabled

0032   height above terrain test-point (10 words)
- byte: not used (msb)
- byte: test point number (0-31) (lsb)
- long: Distance (D) in plane equation Range: 2^{22} ft. Resolution: 2^{-9} ft.
- word: Nx: normal X in plane equation
- word: Ny: normal Y in plane equation
- word: Nz: normal Z in plane equation All normal resolution: 2^{-15}
- byte: not used (msb)
- byte: material code (0-255) (lsb)
- long: HAT Range: 2^{22} ft. Resolution: 2^{-9} ft.

8034	collision detection indicator enabled
0034	collision detection indicator disabled

0033   collision detection test-point (three words)
- byte: not used (msb)
- byte: not used (lsb)
- byte: test point number (0-31) (msb)
- byte: object code (lsb)
  - 0:   no collision
  - 1-255: object collision type

0035   collision detection indicator status block (three words)
- word: color index (into the color palette) (0-1023)
- byte: color valid flag (0-1)
- byte: auto indicator flag (0-1)

6.8.8 Miscellaneous Opcodes

0040   ambient day scalar: word follows (two words)
- byte: not used (msb)
- byte: ambient day scalar (0-255) (lsb)

0041   ambient dusk scalar: word follows (two words)
- byte: not used (msb)
- byte: ambient dusk scalar (0-255) (lsb)

0042   ambient night scalar: word follows (two words)
           byte: not used (msb)
           byte: ambient night scalar (0-255) (lsb)

0043   sun heading and pitch information (three words)
           word: sun heading
           word: sun pitch
                 (same scaling as heading and pitch for a coordinate system)

0044   ground fog height (two words)
           word: ground fog height Expressed in feet maximum altitude
                 is 6.2 miles (positive signed, 16 bits are used)

0050   instructor monitor channel number: channel number word follows
      (two words)
           byte: (not used) (msb)
           byte: channels 0-7 (lsb)

0051   invalid host opcode (three words).
           long: message number that had invalid host opcode.
                 This opcode will be returned to the host in the next available
                 packet, regardless if the host asked for the status or not.

6.9 HOST BLOCK EXAMPLES

The following is a description of the data the host computer transmits to the IG.

6.9.1 Environment Opcodes

0000
0044   message number 00000044
0000   operation code (normal operation, data appended)
8001   storm enabled
8006   rain enabled
8005   clouds enabled
0050   instructor monitor
0002   instructor monitor is number 2 channel
0017   cloud top
2000   cloud top is 32768 ft.
0018   cloud bottom
1000   cloud bottom is 16384 ft.
0000   end data

6.9.2 Coordinate System (CS) and Viewport Opcodes

0000	
0055	message number 00000055
0000	operation code (normal operation, data appended)
001A	CS information
0305	CS number 3, CS select number 5
0000	parcel type = 0. parcel index = 0
0003	no routed, conv traffic or anim, X,Y present
0701	h,p,r present, extrapolate, XY coordinates
0000	X msw
1002	X lsw = 8.0039 ft
0000	Y msw
300F	Y lsw = 24.0292 ft.
0000	Z msw
0000	Z lsw (still in block although not present, zeroed out)
00FF	heading = 1.4 degrees
02FF	pitch = 4.2 degrees
0000	roll = 0.0 degrees
001B	viewport information
0201	channel 2, alternate viewport
0007	upper byte unused, XYZ present
0703	h,p,r,v and h half angles present, extrapolate
0000	X msw
FFFF	X lsw = 127.99 ft.
0200	Y msw
0008	Y lsw = 65536.015 ft.
0000	Z msw
1010	Z lsw = 8.031 ft.
0000	heading = 0 degrees
7FFF	pitch = 179.99 degrees
00FF	roll = 1.4 degrees
1111	vertical half angle = 23.99 degrees
2222	horizontal half angle = 47.99 degrees
0000	end data

6.10 IG BLOCK EXAMPLES

6.10.1 IG Height Above Terrain/Collision Detection Response

The following is a description of the data that the IG sends to the host computer.

Request for height above terrain/collision detection only

0000	
0000	message number 00000000
0002	operation code (normal acknowledgment, status appended)
0032	height above terrain testpoint
0001	upper byte not used; testpoint number 1
0000	
0200	distance (D) = 1 foot
0010	normal X = 16/32768
0003	normal Y = 3/32768
0020	normal Z = 32/32768
0005	upper byte not used, material code 5
0000	
0401	HAT = 2 and 1/512 feet
0033	Collision detection testpoint
0000	this word not used
00FF	test point number 0, object collision type 255
0000	end data

6.10.2 IG Environment, Light and Polygon Switches Response

The following is a request for environmental, light and polygon switches.

0000	
0001	message number 00000001
0002	operation code (normal acknowledgment, status appended)
8001	storm enabled
0002	ground fog disabled
0003	patchy ground fog disabled

.
.   and so on for the enable/disable switches .
.

000F	general vis.
00FF	1020 ft. for vis

.
.   and so on for the opcodes containing additional information .
.

0012	light switch intensities
0102	light switch 0 = 01, light switch 1 = 02

0203   light switch 2 = 02, light switch 3 = 03

.   and so on for 64 light strings in order from 0 to 63 .

.

0019   polygon switch intensities
0102   polygon switch 0 = 01, polygon switch 1 = 02
0404   polygon switch 2 = 04, polygon switch 3 = 04

.   and so on for 64 polygon switches in order from 0 to 63 .

.

0040   ambient day scalar
00FF   upper byte not used, scalar = 255

.   and so on for ambient dusk and night scalars

.

0043   sun heading and pitch
0222   sun heading of 3 degrees
0B60   sun pitch of 16 degrees
0044   ground fog height
0020   height = 32 feet
0050   instructor monitor channel
0002   channel number = 2
0000   end data

6.10.3 IG CS Information Response

0000
0033   message number 00000033
0002   operation code (normal acknowledgment, status appended)
001A   CS information
0001   number = 0, select = 1
0000   not used
0007   no special effects, XYZ present
0701   h,p,r present, extrapolated, XY mode
0000   X msw
100F   X lsw = 8.029 ft.
0001   Y msw
100F   Y lsw = 136.029 ft.
0000   Z msw
FFFF   Z lsw = 127.99 ft.
00FF   h = 1.4 deg.
02FF   p = 4.21 deg.
1000   r = 22.5 deg.

.

.

0000   end data

6.11 IG STARTUP/RESTART PROCEDURE

The following is a description of the startup/restart procedure.

NOTE: Values are in hex. This is the LLC data block within the Ethernet frame.

Host:	0000	
	0000	message number 00000000
	0000	operation code (normal operation)
	8001	storm enable
	8006	rain enable
	000F	general visibility
	0100	visibility of 1024 feet
	0000	end data
IG:	0000	
	0000	message number (from the host block)
	0004	operation code (IG restarted, no status block)
	0000	end data
Host:	0000	
	0001	message number 00000001
	0000	operation code (normal operation)
	0012	light switch opcode
	0103	light switch 1, intensity of 3
	0000	end data
IG:	0000	
	0001	message number 00000001
	0004	(IG restarted, no status block)
	0000	end data
Host:	0000	
	0002	message number 00000002
	0006	operation code
		(IG restart acknowledged, request IG status block, data appended
	0050	instructor monitor channel
	0002	channel number 2
	001E	request HAT/CD information
	0000	end data
IG:	0000	
	0002	message number 00000002
	0002	operation code (normal acknowledgment, status block appended)
	0030	HAT disabled
	0031	CD disabled
	0034	CD indicator disabled

	0035	CD indicator status
	0000	color index
	0001	color indicator not valid, auto indication on
	0000	end data

Host:	0000	
	0003	message number 00000003
	0000	operation code (normal operation, data appended)
	001A	CS information
	0001	number = 0, select = 1
	0000	parcel type = 0, parcel index = 0
	0007	no special effects, lat,lon, Z present
	0703	h,p,r present, extrap, lat/lon enabled
	0000	latitude msw
	00FF	latitude
	FFFF	latitude lsw = .087 degrees
	0000	longitude msw
	0000	longitude
	FFFA	longitude lsw = .00034 degrees
	0000	Z
	0010	Z = 0.031 ft.
	0000	heading = 0 degrees
	0010	pitch = 0.087 degrees
	0011	roll = 0.093 degrees
	0000	end data

IG:	0000	
	0003	message number 00000003
	0000	operation code (normal acknowledgment)
	0000	end data

6.12 HOST/IG COMMUNICATIONS EXAMPLE

The following is a description of host/IG communication in normal transmit/receive mode.

Host:	0000	
	0043	message number 00000043
	0000	operation code (normal operation, data appended)
	8030	height above terrain enabled
	0000	end data

IG:	0000	
	0043	message number 00000043
	0000	operation code (normal acknowledgment)
	0000	end data

Host: 0000
           0044   message number 00000044
           0002   operation code (data appended, IG status block requested)
           001E   solicit HAT/CD information
           0032   HAT test-point
           0001   upper byte unused, test-point 1
           0000
           0400   X offset = 2 ft.
           0000
           0200   Y offset = 1 ft.
           0000
           0800   Z offset = 4 ft.
           0000   end data

IG: 0000
           0044   message number 00000044
           0000   operation code (normal acknowledgment)
           0000   end data

Host: 0000
           0045   message number 00000045
           0000   operation code (normal operation, data appended)
           0008   random intensity disable
           8004   scudded clouds enable
           0000   end data

IG: 0000
           0045   message number 00000045
           0002   operation code (normal acknowledgment,
                       status block appended)
           0032   height above terrain testpoint
           0001   upper byte not used, test point number 1
           0000
           0400   distance (D) = 2 ft.
           0001   normal X = 1/32768
           0004   normal Y = 4/32768
           0002   normal Z = 2/32768
           0003   upper byte not used, material code = 3
           0000
           0200   HAT = 1 ft.
           0000   end data

6.13 ERROR EXAMPLES

The following is a description of how the presence of errors are communicated between the IG and the host computer.

example a

Host: 0000
        0088   message number 00000088.
        0000   operation code (normal operation, data appended)
        0004   scudded clouds disabled
        0000   end data

IG: IG does not receive message 00000088

Host: 0000
        0089   message number 00000089
        0000   operation code (normal operation, data appended)
        8005   clouds enabled
        0000   end data

IG: IG does not receive message 00000089 and does not receive any data for five real-time fields. Extrapolation stops, a status message is written to the operator console, IG awaits valid block.

.
.
.

Host: Realizes there is a problem and continues sending data hoping the situation will extricate itself.
        0000
        0095   message number 00000095
        0000   operation code (normal operation, data appended)
        0000   end data

IG: Receives the block and responds:
        0000
        0095   message number 00000095 (same as received Host block)
        0000   operation code (normal acknowledgment, no IG status block)
        0000   end data

Communication now continues normally.

Example b

Host: 0000
          0044   message number 00000044
          0000   operation code (normal operation, data appended)
          000D   ground fog RVR
          00FF   RVR is 1020 ft.
          0000   end data

**** IG loses power, IG reboots ****

IG: Doesn't receive message 00000044 because its rebooting

Host: Notices that message 00000044 wasn't acknowledged, but the host
          continues transmitting hoping the situation corrects itself

.   host continues to send blocks

          0000
          0055   message number 00000055
          0000   operation code (normal operation, data appended)
          0086   rain enabled
          0000   end data

IG: Comes on line and receives message number 00000055. Responds with:
          0000
          0055   message number 00000055
          0004   operation code (IG restarted, no status block)
          0000   end data

Host: Realizes that IG restarted, and takes the following action:
          0000
          0056   message number 00000056
          0004   operation code (IG restart acknowledged, data appended)

.   opcodes and data necessary to start up the fly program

          0000   end data

IG: 0000
          0056   message number 00000056
          0000   operation code (normal acknowledge, no status block appended)
          0000   end data

Communication continues normally.

6.14 COORDINATE SYSTEM PARAMETER DESCRIPTION

Mode: If bit 1 of the el bit field byte is 0, then the coordinate system parameters will be in terms of X, Y, and Z. If the bit is 1, the coordinate system will be in terms of latitude, longitude, and altitude.

XYZ Mode: X is the lateral displacement from its base CS. Positive is to the right.
Y is the longitudinal displacement from its base CS. Positive is forward.
Z is the vertical displacement from its base CS. Positive is up.

X, Y, and Z are all signed 32 bit numbers, with a range of 2^{22} feet and a resolution of 2^{-9} feet (.023 inches).

word (16 bits) 0: sign, 2^{21}, 2^{20}, ... 2^{7}
word (16 bits) 1: 2^{6}, 2^{5}, 2^{4}, ... 2^{-9}

Lat/Lon/
Alt Mode: Latitude is the lateral displacement from its base CS. Positive is North.
Longitude is the longitudinal displacement from its base CS. Positive is East.
Altitude is the vertical displacement from its base CS. Positive is up.

Latitude and Longitude are 48 bit unsigned numbers. However, only 36 bits are used. These numbers have a range of 360° and a resolution of 5.23 E^{-9}° (.023 inches). Altitude is a signed 32 bit number the same as Z.

Latitude/Longitude:
word (16 bits) 0: 0,0,0,0,0,0,0,0,0,0,0, 180°, 90°, 45°, 22.5°, 11.25°
word (16 bits) 1: 0, 5.625°, 2.8125°, ... 3.43 E^{-4}°
word (16 bits) 2: 1.72 E^{-4}°, 8.58 E^{-5}°, ... 5.23 E^{-9}°

NOTE: any bit with a 0 in it is required to be 0.

HPR Mode: Heading is the relative angle from the base CS true North. Positive is clockwise.
Pitch is the relative angle to level (nose to tail). Positive is nose up.
Roll is the relative angle to level wings. Positive is left wing up.

Heading, Pitch, and Roll are 16 bit unsigned numbers, with a range of 360° and a resolution of 20 seconds.

word (16 bits) 0: 180°, 90°, ... 5.49 E^{-3}°

NOTE: E is scientific notation where 5.49 E^{-3} = 5.49 x 10^{-3}

X$^{\circ}$ = X in degrees.

The base coordinate system for the eyepoint is the ground coordinate system.

MISSION RECORD AND PLAYBACK (MIRP)

7.1 INTRODUCTION

The mission record and playback feature of ESIG-LC (MIRP) allows a flight to be recorded as it occurs on the image generator, and modified and/or played back at a later time. MIRP is activated and controlled through the ESIG-LC command line interpreter (CLI). Because it has numerous options and modes, MIRP is a powerful tool in creating complicated flight scenarios.

Because of changes made in the different versions of the software, MIRP missions recorded with versions of the real-time system previous to 07 cannot be used with RTS version 07 and above.

7.2 PROGRAM LIMITATIONS

As MIRP is an intensive task, there may be a limit to the amount of information that may be recorded. The complexity of the database, animation, routed and converging traffic and other tasks requiring CPU time influence this limit.

7.3 THEORY OF OPERATION

When initially recording a flight, MIRP writes the state of the ESIG-LC system to a user-specified file, including the current database name, environmental settings, and the coordinate systems to be recorded. By doing this, MIRP is able to reset the ESIG-LC environment back to the exact state at which a scenario was recorded.

Next, MIRP periodically records the selected coordinate system. Because the rate at which recording occurs is user-selectable, interpolation may be necessary during playback; this function is performed automatically by MIRP. MIRP also records any changes in the environment as they occur during the recording session. These

changes will occur during playback at the time they occurred during recording. Finally, MIRP closes the file and stops.

You may change any of the environmental settings of a scenario for playback; for example, you may record a scenario in a day scene and change it to be a night scene. The coordinate system recorded may be changed to a totally different coordinate system.

One mode of MIRP allows the eyepoint to fly behind another coordinate system. The eyepoint follows the particular coordinate system's path with a specified delay.

When the playback is specified, MIRP loads the database, sets up coordinate systems and changes environmental settings. When the playback begins, MIRP interpolates data and manages the flight appropriately.

Examples of all of the MIRP modes follow later in this chapter.

7.3.1 Program Information, Data and Input

MIRP is controlled through the command line interpreter (CLI). MIRP is a separate CLI command with its own options and qualifiers. You may specify which mode MIRP is to be operated under, what coordinate system is to be recorded, the interval between recordings, and environmental settings, through the CLI.

NOTE: As a general rule, all options characterizing a mission should be entered before the LOAD command.

7.3.2 Program Outputs

MIRP produces structured data that is stored in a user-specified file on the disk. This data contains the initial environmental settings of the system and coordinate system information that is recorded as the scenario progresses.

7.4 LIST OF COMMANDS

At the SPX> prompt, enter the MIRP command with one of the following options:

1.   **ABORT.** Exits current MIRP recording scenario and deletes the recorded file.

2.   **AUTHOR [string].** Name of person recording mission.

3.   **CHANGE [0-number of coordinate systems].** Changes the coordinate system to the coordinate system associated with the TO option.

4. CLIP. This clips the current MIRP playback file, and is only used in modes 6 and 7.

5. CURRENT [0-number of coordinate systems]. The coordinate system to be recorded. Default is 0 (the eyepoint).

6. FREEZE. Temporarily freeze the MIRP mission.

7. INTERVAL [integer]. Number of fields between snapshots of the coordinate system. Default is 10.

8. LOAD. Load the accessory initialization parameters.

9. MASK [decimal equivalent of binary mask]. Indicates which coordinate systems are to be recorded. The mask is the decimal equivalent of a binary bit mask, with each bit representing one of the channels in the system. The LSB represents DCS 0, the eyepoint. A 1 specifies that the CS will be recorded, a 0 specifies that the CS will not be recorded. For example, the binary value 10010001 specifies that CS numbers 7, 4, and 0 will be recorded because the bits in the 8th, 5th, and 1st positions are set to a value of 1. The value 145 would be entered, since it is the decimal equivalent of the binary 10010001.

10. MISSION [string]. Name of the mission.

11. MODE [0-7].

   0   Records a single coordinate system. The coordinate system number is specified by the CURRENT option.

   1   Records multiple coordinate systems. The coordinate system numbers are specified by the MASK option.

   2   Add a new coordinate system to a pre-recorded scenario. PLAYBACK specifies the mission file that was recorded earlier. The new coordinate system is specified by the CURRENT option. The new mission is saved in the file specified by the RECORD option.

   3   Changes a coordinate system on a pre-recorded scenario. PLAYBACK specifies the mission file that was recorded earlier. The CHANGE option specifies the coordinate system to be modified. The TO option specifies the new coordinate system number. The new mission is saved in the file specified by the RECORD option.

   4   Play back a mission from the file specified by the PLAYBACK option.

   5   Record the eyepoint following the flight path of the CS specified by the CURRENT option. The INTERVAL setting with this mode must be less than 5.

6   Mission front-end clipping. Removes a portion of the recorded scenario from the beginning of the mission. The portion displayed between the MIRP START command and the MIRP CLIP command is removed.

7   Mission back-end clipping. Removes a portion of the recorded scenario from the end of a mission. The portion of the mission which follows the MIRP CLIP command is removed.

12. **PLAYBACK [filename].** Filename of mission to play back.

13. **RECORD [filename].** Filename of the mission to record.

14. **RESUME.** Unfreeze a frozen MIRP mission.

15. **SECONDS [real number].** Used in mode 5 only. The number of seconds delay between the flight path of the leading DCS and the eyepoint.

16. **START.** Start the MIRP session. The LOAD option must be completed before this command is given.

17. **STOP.** Stop the MIRP session.

18. **TO [0-number of coordinate systems].** The resultant coordinate system to replace the coordinate system specified by the CHANGE option.

19. **XOFFSET [integer].** Used in mode 5. The delta in feet between the leading coordinate system and the eyepoint's x position.

20. **ZOFFSET [integer].** Used in mode 5. The delta in feet between the leading coordinate system and the eyepoint's z position.

7.5 MISSION RECORD

To record a mission, MIRP and database parameters first need to be initialized. The database parameters that MIRP is concerned with are world filename, parcel number, and environmental settings. Use the CLI MODEL command to set up the world file and the parcel number before beginning to record.

The MIRP parameters of particular concern when recording are:

1.   **ABORT.** Exits current MIRP recording scenario and deletes the recorded file.

2.   **AUTHOR.** This option indicates the mission author. Default is *SPX*.

3.   **CURRENT.** The qualifier for CURRENT may range from 0 to the number of CSs for the system. This option is only applicable to modes 0 and 5.

4.   **FREEZE.** Temporarily freeze the MIRP mission.

5. **INTERVAL.** Number of fields between recorded snapshots of the coordinate system. Default is 10.

6. **LOAD.** This option initializes the record file and writes initial header information to that file.

7. **MASK.** Indicates which coordinate systems are to be recorded. The MASK option is applicable only to mode 1.

8. **MISSION [string].** Name of mission.

9. **MODE.** For recording purposes, mode is either 0, 1, or 5.

   0   Records a single coordinate system. The coordinate system is specified by the CURRENT option.

   1   Records multiple coordinate systems. The coordinate systems are specified by the MASK option.

   5   Records the eyepoint following the flight path of a coordinate system specified by the CURRENT option.

10. **RECORD.** Filename of the mission to record.

11. **RESUME.** Unfreeze a frozen MIRP mission.

12. **SECONDS.** In mode 5, SECONDS defines the number of seconds delay between the leading coordinate flight path and the eyepoint.

13. **START.** Start the MIRP session. To be used only after the LOAD option has been completed.

14. **STOP.** End the MIRP recording session.

15. **XOFFSET.** Used in mode 5 only. The delta, in feet, between the leading coordinate system's and the eyepoint's x position.

16. **ZOFFSET.** Used in mode 5 only. The delta, in feet, between the leading coordinate system's and the eyepoint's z position.

7.6 MISSION PLAYBACK

To playback a mission that has been recorded, the following MIRP parameters must be set up:

1. **FREEZE.** Temporarily pauses the MIRP mission until the RESUME option is entered.

2. **INTERVAL.** Number of fields between recorded snapshots of the coordinate system. May be changed to speed up or slow down the mission playback.

3. **LOAD.** This option opens the mission file and reads in initial header information.

4. **MODE.** For playback purposes, mode is 4.

5. **PLAYBACK.** Filename of the mission to playback.

6. **RESUME.** Unfreeze a frozen MIRP mission.

7. **START.** Start the MIRP session. To be used only after the LOAD option has been completed.

8. **STOP.** Ends the MIRP playback session. If not specified, the mission playback will stop at the end of the recorded file.

7.7 MISSION MODIFY

MIRP can take the information in a previously recorded mission and change it to fit the user's application. In mission modify, the user may put a different coordinate system on a previously recorded coordinate system.

The MIRP parameters of interest when changing a coordinate system in a previous recorded mission are:

1. **CHANGE.** Changes the specified coordinate system to the coordinate system associated with the TO option.

2. **FREEZE.** Temporarily pauses the MIRP mission until the RESUME option is entered.

3. **INTERVAL.** Number of fields between recorded snapshots of the coordinate system.

4. **LOAD.** This option opens the mission file and reads in initial header information for the PLAYBACK file.

5. **MODE.** The mode is 3.

6. **PLAYBACK.** Filename of the mission to playback.

7. **RECORD.** Filename of the mission to record.

8. **RESUME.** Unfreeze a frozen MIRP mission.

9. **START.** Start the MIRP session. To be used only after the LOAD option has been completed. In this mode, it also creates and writes the new header information into the RECORD file.

10. **STOP.** Ends the MIRP playback session. If not specified, the mission will stop at the end of the playback file.

11. **TO.** The resultant coordinate system to replace the coordinate system specified by the CHANGE option.

NOTE: Both the AUTHOR and MISSION options may be used after the LOAD option is completed.

7.8 MISSION MERGE

MIRP can also modify a mission by adding more coordinate systems to a pre-recorded scenario. The MIRP parameters of interest when adding a coordinate system to a mission are:

1. **CURRENT.** CURRENT specifies the coordinate system to be added to the MIRP mission. This may range from 0 to the number of CSs for the system.

2. **FREEZE.** Temporarily pauses the MIRP mission until the RESUME option is entered.

3. **INTERVAL.** Number of fields between recorded snapshots of the coordinate system.

4. **LOAD.** This option opens the mission file and reads in initial header information for the PLAYBACK file.

5. **MODE.** The mode is 2.

6. **PLAYBACK.** Filename of the mission to playback.

7. **RECORD.** Filename of the mission to record.

8. **RESUME.** Unfreeze a frozen MIRP mission.

9. **START.** Start the MIRP session. To be used only after the LOAD option has been completed. In this mode, it also creates and writes the new header information into the RECORD file.

10. **STOP.** Ends the MIRP playback session. If not specified, the mission will stop at the end of the playback file.

NOTE: Both the AUTHOR and MISSION options may be used after the LOAD option is completed.

7.9 MISSION CLIPPING

MIRP can further tailor a pre-recorded mission scenario by clipping (removing) segments of time from the beginning or end of that mission. The MIRP parameters of particular concern when clipping a mission are:

1. CLIP. In mode 6, this designates when in the recording scenario to complete clipping of front-end data. In mode 7, it designates when to begin clipping of back-end data.

2. FREEZE. Temporarily pauses the MIRP mission until the RESUME option is entered.

3. INTERVAL. Number of fields between recorded snapshots of the coordinate system.

4. LOAD. This option opens the mission file and reads in initial header information for the PLAYBACK file.

5. MODE. Front-end clipping is mode 6, back-end clipping is mode 7.

6. RESUME. Unfreeze a frozen MIRP mission.

7. START. Start the MIRP session. To be used only after the LOAD option has been completed. In this mode, it also creates and writes the new header information into the RECORD file.

8. STOP. End the MIRP session. In mode 7, the STOP option is not needed; the CLIP option effectively ends the recorded scenario.

7.10 OTHER OPTIONS

Some other options that are available for use:

1. CLI Commands Any of the command line interpreter CLI commands may be entered during a recording of a mission. This allows the user to modify the environments of a mission during the recording. MIRP will record any changes made.

2. MIRP Playback The MIRP Playback can be controlled by command files. This facilitates demos.

7.11 EXAMPLES

7.11.1 Recording a Single CS

To record a single coordinate system mission, enter the following commands:

```
SPX> MIRP MODE 0 RECORD SAMPLE.DAT CURRENT 0 INTERVAL 30
        (record mode, record filename is SAMPLE.DAT,
        CS to be recorded is 0 (eyepoint), fields between
        snapshots is 30)

SPX> MIRP LOAD

SPX> MIRP START
    .
    .       (move CS 0 around)
    .
SPX> MIRP FREEZE

SPX> MIRP RESUME

SPX> VIS FEET 3000
        (change the visibility to 3000 feet. MIRP captures
        this) .

SPX> MIRP STOP
        (finished)
```

7.11.2 Recording More Than One CS

To record a mission with more than one coordinate system, enter the following:

```
SPX> MIRP MODE 1 RECORD SAMPLE.DAT INTERVAL 5 MASK 368
        (record mode, record filename is SAMPLE.DAT, fields
        between snapshots is 5, CSs 4, 5, 6, and 8 are
        recorded [368 is 101110000 binary])

SPX> MIRP LOAD

SPX> MIRP START
        (record the mission)

SPX> MIRP STOP
        (mission record finished)
```

7.11.3 .Playing Back a Mission

To play back a mission enter the following:

```
SPX> MIRP MODE 4 PLAYBACK SAMPLE.DAT INTERVAL 35
        (playback mode, playback filename is SAMPLE.DAT,
        interpolate for 35 fields between valid data)
```

```
SPX> MIRP LOAD

SPX> MIRP START
```

7.11.4 Modifying a Mission

To modify a mission enter the following:

```
SPX> MIRP MODE 3 PLAY SAMP.DAT RECORD SAMP1.DAT CHAN 0 TO 4
        (modify mode, playback filename is SAMP.DAT, new
        modified filename is SAMP1.DAT, CHANGE CS 0 TO 4)

SPX> MIRP LOAD
        (initial parameters are brought in)

SPX> MIRP START
        (modified file is written)
```

7.11.5 Merging Missions

To merge missions, enter the following:

```
SPX> MIRP MODE 2 PLAY SAMP.DAT RECORD SAMP1.DAT CURRENT 3
        (merge mode, playback filename is SAMP.DAT,
        record and merged filename is SAMP1.DAT,
        the CS to be recorded and merged with is 3)

SPX> MIRP LOAD
        (initial parameters are brought in)

SPX> MIRP START
    .
    .       (begin recording CS 3)
    .
SPX> MIRP STOP
        (record file is closed)
```

7.11.6 Recording a Delayed Flight Path (MODE 5)

```
SPX> MIRP MODE 5 CURRENT 7 SECONDS 3 XOFFSET 10 ZOFFSET -12
        (delayed flight mode, tracking CS 7, track 3 seconds
        behind, eyepoint's X offset is 10 ft. from CS 7,
        eyepoint's Z offset is -12 ft. from CS 7)

SPX> MIRP RECORD TEMP.DAT
        (record filename TEMP.DAT)
```

```
SPX> MIRP LOAD

SPX> MIRP START
        (eyepoint and CS 7 are recorded)

SPX> MIRP STOP
        (mission complete)
```

7.11.7 Mission Clipping

```
SPX> MIRP MODE 6 PLAYBACK TEMP.DAT RECORD TEMPA.DAT
        (clip front of mission; resultant file is TEMPA.DAT,
        previous file is TEMP.DAT)

SPX> MIRP LOAD

SPX> MIRP START
        .
        .
        .
SPX> MIRP CLIP
        (recorded data up to this point is removed)

SPX> MIRP MODE 7 PLAYBACK TEMP.DAT RECORD TEMPA.DAT
        (clip back of mission mode; resultant file is
        TEMPA.DAT, previous file is TEMP.DAT)

SPX> MIRP LOAD

SPX> MIRP START
        .
        .
        .
SPX> MIRP CLIP
        (recorded data from this point on is removed;
        scenario is ended.)
```

7.12 ERRORS

MIRP has the following error messages in addition to the ones present in the real-time system:

1. MIRP load aborted

2. ERROR: MIRP CHANGE DCS not recorded

3. ERROR: MIRP TO DCS already exists

4. ERROR: RECORD & PLAYBACK options are same

5. ERROR: CHANGE & TO options are same

6. ERROR: SECONDS * field rate must be > interval

7. ERROR: could not compress recording file

8. ERROR: could not read playback file

9. ERROR: playback file not on disk

10. ERROR: could not write to recording file

11. ERROR: [filename] recording file already exists

12. ERROR: could not open disk directory

13. ERROR: could not close disk directory

14. ERROR: could not find largest block

15. ERROR: could not create recording file

16. ERROR: could not close recording file

17. error reading new buffer

18. DCS end delimiter not found

19. header begin delimiter not found

20. header end delimiter not found

21. WARNING: MASK option is ignored

22. WARNING: CHANGE option is ignored

23. WARNING: TO option is ignored

24. WARNING: SECONDS option is ignored

25. WARNING: XOFFSET option is ignored

26. WARNING: ZOFFSET option is ignored

DATABASE ENTITIES IN THE REAL-TIME SYSTEM

8.1 INTRODUCTION

The ESIG-LC real-time system creates a simulation of a real-world scene from a metafile database. This database is created by the ESIG-LC modeling system, and contains records defining objects and other entities required to create the simulation. Various types of entities and their organization and use are discussed in this chapter. The ESIG-LC modeling system is discussed in the *ESIG-LC Modeling System Reference Manual*, E&S part number 901181-459.

8.2 METAFILE ORGANIZATION

The ESIG-LC metafile database contains different types of entities in a hierarchical arrangement. The most basic entity is a vertex or point. A polygon, a planar entity on the next level, is defined by three or four vertices. A light string is on the same level as a polygon, and is defined by a beginning and ending point, with an optional point on a curve in between. Both of these entities may also include other parameters such as color, intensity, and so forth.

Polygons and light strings are combined to form objects, the lowest level displayable entity in the database. Objects may be grouped in cells, which are linked together into meshes; a mesh can show the relationship between cells, define an animation sequence, or define a collision volume. Meshes are grouped into parcels, which define a world file.

Most of these database records reference others; for example, a polygon is made of a number of vertices and an object is made of a number of polygons or light strings. This results in a tree-shaped hierarchical order. The object manager (OM), the hardware device responsible for determining what objects are displayed, can decide which objects will be displayed by traversing only those branches of the tree containing the database objects that are potentially visible to the eyepoint. The cell is the decision point for this selection.

The world file contains two lists: a local parcel list and a placeable parcel list. These lists identify the parcels to be used in the training mission. In addition to the parcel lists, the world file contains information about the color palette and the texture maps required by the database.

A parcel is created as a stand-alone database and consists of a parcel, mesh, and object file. Parcels are of two types: local parcels, which are attached to the ground coordinate system, and placable parcels, which are attached to a dynamic coordinate system. Placeable parcels could include such things as an emergency landing field whose position is set by the host computer or a refueling aircraft which is positioned by the host computer.

The mesh data is a part of the parcel and is stored in the mesh file. The mesh data defines the separating planes and the relationship between the cells these planes define. These are the data structures used to create the visual priority between stationary objects in the database.

Object data, which is stored in the object file, is also part of the parcel. The object data is the geometrical information used by the image generator to create polygons and light points. It is referenced in priority order, based on the evaluation of the mesh and cell data.

8.3 COORDINATE SYSTEMS

ESIG-LC can operate as either an X/Y or a lat/lon system. The mode of operation is controlled by the host computer and dictates how the database is put together. The eyepoint positional information is received from the host computer in flat earth (XYZ) coordinates for an X/Y system, or in round earth (latitude/longitude/ altitude) coordinates for a lat/lon system. Both systems use the same type of database files, but there are some differences in the way they are used.

A standard ESIG-LC system comes with an eyepoint and three moving models with expansion capabilities to support 13 moving models. The eyepoint and each moving model are assigned to a coordinate system which contains positional and control information. The positional information contains angles for heading, pitch, and roll along with either an X/Y/Z translation vector, which specifies the origin of the coordinate system with respect to a different coordinate system (in an X/Y system), or a latitude/longitude/altitude, which specifies an absolute origin (in a lat/lon system). The control information includes a model select and data to drive the animation, routed traffic, and converging traffic routines in the real-time system.

8.3.1 Own-Ship, Ground, Sky, Dynamic Coordinate Systems

The real-time system uses sixteen coordinate systems internally for a standard ESIG-LC system. These coordinate systems are: the own-ship or eyepoint dynamic coordinate system (CS 0) which defines the origin and attitude of the eyepoint, the ground coordinate system (CS 1) which defines the origin for the local parcels, the

sky coordinate system (CS 2) which defines the origin and attitude of the generic sky, cloud, and landscape models, and the other dynamic coordinate systems (CS 3-15) which define the origin and attitude of the moving (or dynamic) models.

CS 0:   eyepoint coordinate system
CS 1:   ground coordinate system
CS 2:   sky coordinate system
CS 3-15:   dynamic coordinate systems

The ground coordinate system (CS 1) is the base origin. It is positioned at 0,0,0 for an X/Y/Z system, or by the latitude/longitude of the primary local parcel for lat/lon systems (the altitude is forced to 0). This means that the host computer needs only to provide the control information for this coordinate system, which includes the model select and animation information. Routed and converging traffic information is only sent for the dynamic coordinate systems.

The eyepoint is placed relative to the ground coordinate system by an X/Y/Z vector which is either sent by the host computer as part of the positional data for the own-ship coordinate system (in an X/Y system), or is internally generated by the real-time system from the latitude/longitude/altitude data (in a lat/lon system). Figure 8-1 shows ESIG-LC coordinate system chaining.
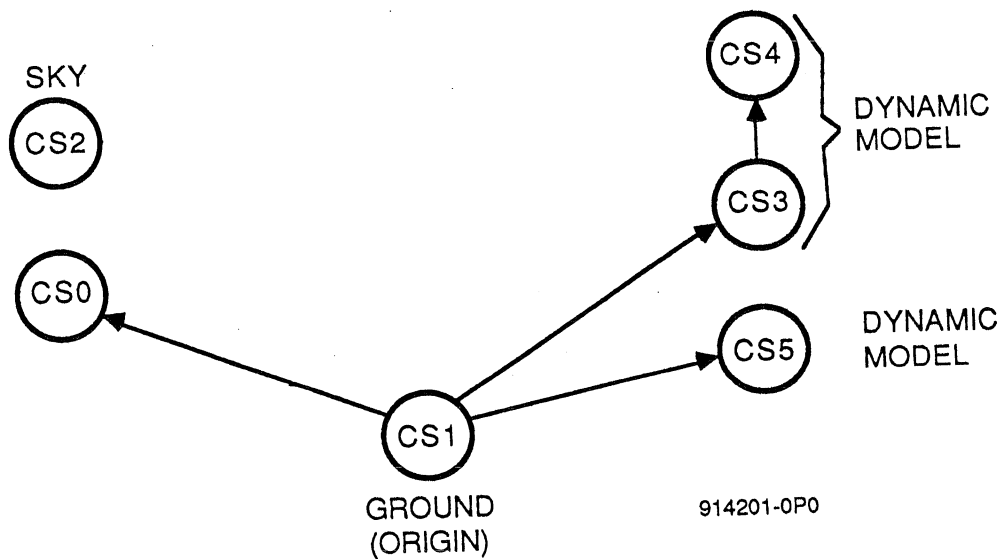
Figure 8-1. Sample ESIG-LC Coordinate System Chaining

The attitude of the eyepoint with respect to the ground coordinate system is specified by the Euler angles for heading, pitch, and roll. Valid control data for the own-ship coordinate system includes the model select and animation information, but is rarely used.

The generic sky, star, landscape and cloud models are kept internal to the real-time system and are placed relative to the sky coordinate system. The positional data is internally generated by the real-time system which causes these models to

translate with the eyepoint. The host computer only needs to send control data for this coordinate system when the database requires it, which is seldom. Valid control data includes the model select and animation information.

The moving models are positioned by the dynamic coordinate systems, which can be placed relative to the ground coordinate system, the own-ship coordinate system, or any different dynamic coordinate system. The host computer provides the control information and has the option of sending the positional data. If the positional data is sent, then routed and converging traffic information will be invalid. Positional data can be specified in latitude/longitude/altitude as long as the dynamic coordinate system is not placed relative to another dynamic coordinate system.

8.3.2 Model Selects

The model selects provide the means to change the displayable database during run-time operation. 255 selects are available for each coordinate system. Select zero turns off the coordinate system (i.e., no database attached to that coordinate system is displayed), and selects one through 255 activate either all or a subset of the database attached to that coordinate system, depending on how it is modeled.

The modeler can provide a model select at both the parcel and cell levels. A model select of one through 255 means the parcel or cell must be checked against the coordinate system model select to see whether it should be accepted or rejected. If the model selects match, then the parcel or cell is accepted and the database tree traversal continues down that branch. Therefore, objects contained in that branch are still eligible for making the displayable object list which is passed to the geometric processor. If the selects differ then that branch of the database tree is bypassed. A modeler provided select of zero specifies the parcel or cell is always accepted as long as the coordinate system model select is not zero (turned off).

8.3.3 Coordinate Systems and Fog Systems

A fog system consists of the visibility, defocus, and scud values to be applied to the polygons and light strings that make up an object. Three fog systems are managed by the real-time system and individually assigned to the coordinate system the object is on. The fog systems are the own-ship fog system, which is assigned to all objects attached to the own-ship coordinate system, the ground fog system, which is assigned to all objects attached to the ground and dynamic coordinate systems, and the sky fog system, which is assigned to the generic sky, cloud, and landscape models.

8.4 X/Y AND LAT/LON PARCEL MANAGEMENT

When ESIG-LC is operated as an X/Y system, the size of data the image generator can accommodate limits the distances from the ground coordinate system origin. The

local parcel assigned to this origin is explicitly named by the host computer via a parcel select number. Therefore, the training scenario is restricted to stay within that parcel. A lat/lon system allows circumnavigation of the earth without overflowing the positional variables. The real-time system manages the local parcels so that the nearest local parcel origin can be reassigned to the ground coordinate system origin. It is then possible to move around the entire earth by flying from one local parcel to another.

In a lat/lon system, each entry in the local parcel list contains the name of the parcel and its latitude and longitude. The latitude and longitude are not required for X/Y systems, but can be present. An entry in the placeable parcel list which contains the parcel name and the coordinate system to which it is attached is identical in both lat/lon and X/Y systems. The host computer manages the local and placeable parcels in X/Y systems, and the real-time system manages the parcels for lat/lon systems.

There can be up to five parcels on-line at any given time. Lat/lon systems require the number of local parcels that are in the proximity of the eyepoint to be determined first; the remaining spots are filled with active placeable parcels. X/Y systems have only one local parcel, so up to four placeable parcels can be activated.

8.4.1 The Primary Local Parcel

A lat/lon system requires the parcel selector to sort the local parcels based on distance from the eyepoint. This serves two purposes: first, it finds the local parcel nearest the eyepoint, which it designates as the primary local parcel and, second, it determines the order the local parcels are to be sent to the object manager. The latitude/longitude data for each local parcel is then converted to X/Y data which is used to offset it with respect to the primary local parcel. When another local parcel is nearer the eyepoint than the current primary parcel, the primary parcel is changed and the local parcels are then offset from this new point. The example in Figure 8-2 shows that the eyepoint is closest to local parcel one, so parcel one becomes the primary local parcel. Local parcels two and three are placed relative to local parcel one. Figure 8-3 shows that the eyepoint has moved so that the eyepoint is closest to local parcel three. A new offset vector to the other two parcels is generated.
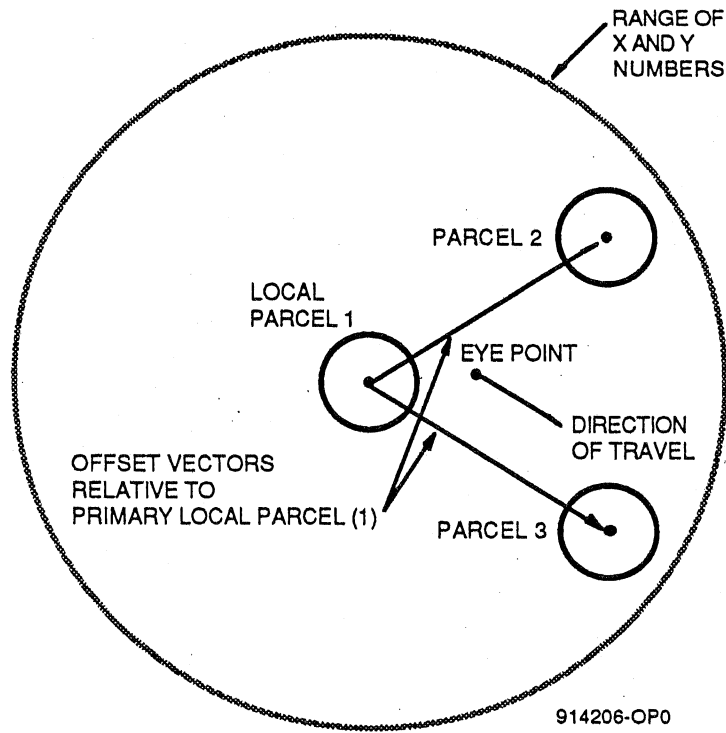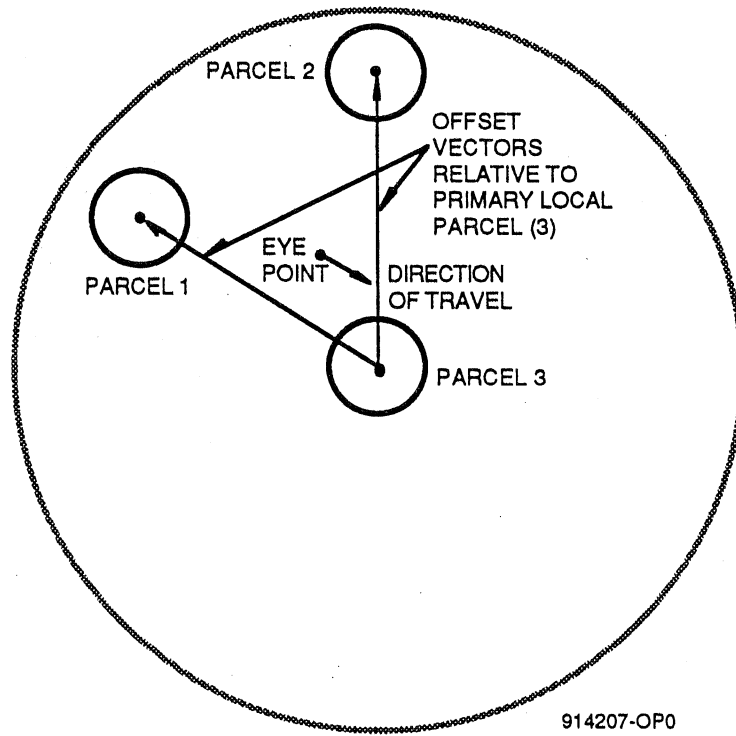
Figure 8-2. Parcel Management

Figure 8-3. Parcel Management

8.4.2 Fixed Listed Placeable Parcels

Placeable parcels are individually assigned to dynamic coordinate systems. The positional data for the dynamic coordinate system can be specified by the host computer or internally generated by the routed or converging traffic routines. The placeable parcels are listed in the world file in priority order, which eliminates the need for any run-time range sorting by the real-time system. Parcels are activated based on model select and proximity of the eyepoint. The search always begins at the top of the list and continues until the on-line parcel quota is reached.

8.4.3 Parcel Priority

Parcels are prioritized during both selection and rendering. During the selection process, local parcels are activated until no more parcels are within range of the eyepoint or until the maximum number of parcels has been allocated. If there is still room for additional parcels, active placeable parcels within range of the eyepoint are loaded until the maximum number of parcels is allocated.

During rendering, however, placeable parcels are given first priority. Higher priority at this level means that an object will appear to be in front of the lower priority object no matter what size either appears to be or how far away either object actually is from the eyepoint. Most placeable parcels are objects level with or above the ground, and are generally not obscured by objects on the ground such as those found in local parcels.

8.5 PAGING

Paging is the process of determining the database needs of the image generator for a given eyepoint. Using this process, a large database can be traversed without being stored entirely in memory. The real-time system determines which parcels need to be brought in from disk; the object manager (OM) determines which meshes and objects from these parcels are required in memory.

The process of paging begins when the real-time system generates a command list for the OM. These commands give details about each parcel currently on-line. They also inform the OM where to put the information that it must communicate back to the real-time system.

The OM uses two lists for each on-line parcel within the environment memory to make its database needs known to the real-time system, the object list and the mesh list. The object list contains the objects needed by the OM and tells whether or not they are on-line. The mesh list does the same for meshes. The real-time system uses this information to keep track of what memory must remain allocated and when disk transfers are required. When a requested mesh comes on-line, the OM searches it for additional database information it will need and places these requests in the queue. This process continues until all data needed for the current eyepoint is in

memory. When the eyepoint moves, new data requests are generated and data no longer within range of the eyepoint is emptied from memory.

8.6 REAL-TIME SYSTEM CONTROLLED DCS

The ESIG-LC real-time system supports different types of special effects through dynamic coordinate systems. These effects are discussed more fully in the *ESIG-LC Modeling System Reference Manual*.

8.6.1 DCS Types

8.6.1.1 Animation

Animation is used to simulate scenarios which change their appearance in incremental and usually repetitive steps, called frames. Examples of common scenarios usually performed with animation are explosions, smoke, fire, bow wakes, and airplane flaps. The frames are modeled so that the difference between one frame and the next is small enough to make the transition between them look like smooth motion.

Up to 16 animation scenarios may be loaded and run in the system simultaneously.

8.6.1.2 Converging Traffic

Converging traffic is used to test a pilot's ability to perform the correct evasive maneuver when another aircraft is approaching on a collision course. A converging traffic scenario consists of four variables input into the modeling system: angle-of-impact (heading, pitch, and roll), speed ratio, time-to-impact, and time-to-track. Angle-of-impact, speed ratio, and time-to-impact, combined with the current eyepoint position and speed, are used by the real-time system to place the converging aircraft in space, so it will converge in the desired fashion. The real-time system uses time-to-track to decide how long (out of the time-to-impact) the converging aircraft will track (i.e., converge on his position even if he does not fly straight and level). The smaller the difference between time-to-impact and time-to-track, the higher the level of difficulty for the pilot.

Up to 8 converging traffic scenarios may be loaded and run in the system simultaneously.

8.6.1.3 Routed Traffic

Routed traffic is used to maneuver a vehicle or craft along a pre-assigned path. This path can include changes in heading, pitch, roll and velocity. Examples of common routed traffic are pattern flying, taxiing aircraft, and ground traffic around an airport.

In the modeling system, between two and 16 points are input for the calculation of a curved path. The path between any two points is calculated by the system fitting a smooth curve through the current point and the next two points. If the curve entering a point is too different from the next curve which is leaving the point, a noticeable change of direction will occur. Usually, placing another point on the desired curve will fix this problem.

Up to 16 routed traffic scenarios may be loaded and run in the system simultaneously.

8.6.2 Operation

The control information of the coordinate system is used to manage animation, converging traffic, and routed traffic (ACR). This information contains the following components:

1. Coordinate system number: The coordinate system number to which the ACR is attached.

2. Model select: The model select that the ACR database is modeled on.

3. Parcel type: The type of parcel the ACR database is in. Zero is a local parcel and one is a placeable parcel.

4. Parcel index: The entry number of the parcel in the world file.

5. Scenario i: the modeled information for the ACR process (i.e., animation frames, placement information for converging traffic or path information for routed traffic).

6. Command code:

    a. LOAD ACR causes the real-time system to load the scenario information and position the routed traffic database at the starting point of the process. The setting of the model select (not the LOAD command) starts the actual paging process, if proximity dictates, which stores the ACR database in memory. Both routed and converging traffic are visible once the paging process begins. It is advisable to change the model select at the start of converging traffic. Animation will not become visible until after the START command has been issued.

    b. START ACR begins the ACR process.

    c. STOP ACR stops the ACR process. The ACR database will freeze at its current position, remaining visible.

    d. UNLOAD ACR causes the real-time system to unload scenario information, which makes the animation database disappear. The routed and

converging traffic databases will remain visible until they are removed from memory. The altering of the model select (not the UNLOAD command) causes the ACR database to be removed from memory.

All ACR commands can be entered via the CLI or sent from the host computer without the target parcel being on-line. In addition, auto-load and auto-start mechanisms are stored in the database and are processed while the world file is loaded. ACR commands cannot be put in the site file, however. When the target parcel does come on-line, the ACR status will be the same as if the commands had been entered with the target parcel on-line. If the target parcel goes off-line, the status of all ACR routines are saved. When the parcel comes back on-line, it will continue from that status.

When invoking ACR near the eyepoint, make sure its associated database is completely resident in memory before starting the process. Otherwise, the database will be paging into memory and possibly be visible while the process is executing, creating unpredictable image results. This is especially true with animation and routed traffic which may start near the eyepoint.

If the process was started and then stopped, but not unloaded, it is not necessary to load the process again. The scenario information is still resident in memory. The amount of time required to make the ACR database resident in memory is ACR database dependent.

SYSTEM ERRORS

A.1 INTRODUCTION

This appendix covers the system errors that the real-time system reports. Some troubleshooting guides are included with the error description.

A.2 FATAL VS. NON-FATAL ERRORS

An error occurring in the ESIG-LC real-time system may be classified as either fatal or non-fatal. An error is considered fatal when it prevents proper image generation. All fatal errors force the real-time system to the pause state where user intervention is required. Errors that are not explicitly flagged fatal are considered non-fatal. The real-time system believes it can recover from these types of errors while maintaining image generation. Because not all recoveries are successful, non-fatal errors should not be ignored.

A.3 ERROR MESSAGES

The IG will sound a bell whenever it generates an error. The bell may be masked by changing the keyboard setup from Warning Bell to No Warning Bell.

A.3.1 ACR Error: <message>

An ACR error is reported when a fault is detected in the animation, converging, or routed traffic routine. Valid messages and their meanings follow:

No such scenario A non-existent scenario number was specified. Likely solution: Enter the correct scenario number.

Maximum number of loaded scenarios exceeded The maximum number of scenarios are already loaded. Likely solution: Unload an unneeded scenario to make room.

Scenario not loaded The specified scenario is not loaded. Likely solution: Load the scenario.

A.3.2 CLI Error: <message>

A CLI error is reported when a fault is detected while using the command line interpreter (CLI). Valid messages and their meanings follow:

File not found <filename> CLI could not find the file.

Command file Unknown: <filename> Unknown command file.

Bad command in file <command line> - Bad command in command file.

Illegal usage of command! The command, options, or qualifiers were entered improperly; or, a qualifier value was out of range.

A.3.3 Ethernet Error <message>

An Ethernet error is reported when a fault is detected in the Ethernet interface. Valid messages and their meanings follow:

Ethernet will not initialize Ethernet hardware problem.

Ethernet Status: Ethernet Initialized.

Ethernet Status: 5 valid packets; extrapolation resumed.

Ethernet tx error Transmission problem. Ethernet will re-initialize itself when this occurs.

Ethernet rx error Reception problem. Ethernet will re-initialize itself when this occurs.

Spurious interrupt error General Ethernet problem. Ethernet reinitializes itself when this occurs.

Ethernet Status: No data received for 5 fields Host has stopped responding. Refer to chapter 5, Host Interface, for details.

Last five host blocks have been invalid Incorrectly formatted data. Refer to chapter 5, Host Interface, for details.

A.3.4 [Fatal] File Open Error <filename>

The named file could not be successfully opened on the disk. This is usually caused when the file does not exist on the disk.

Likely solution:

1. Exit the real-time system.
2. FMU can be used to verify that the file is indeed missing.
3. Restore missing file to disk.

A.3.5 MIRP Error <message>

MIRP errors are listed and explained in Section 7.12.

A.3.6 [Fatal] Parameter error <message>

The named parameter is not compatible with the system configuration. Valid parameter names are:

Fov An invalid half angle has been detected in the view description of a channel processor.

Pixels An invalid pixel per line count has been detected in the resolution specification of a channel processor.

Lines An invalid line count has been detected in the resolution specification of a channel processor.

OM delay The OM delay time is insufficient to complete the OM command list.

Likely solution:

1. Exit the real-time system.
2. Check the SPX.SIT file for accuracy.

A.3.7 [Fatal] Timeout Error <device name [channel processor #,#,...]>

The named device (including the channel processor number when applicable) did not finish in time. Valid device names are:

OM Object manager
GP Geometric processor
DPin Input side of the display processor
DPout Output side of the display processor

TMS TMS320 co-processor

Likely solution:

1. Exit the real-time system.
2. Re-start the real-time system program either by cycling power or by invoking LOGIN.COM manually.
3. If problem persists, run diagnostics.

A.3.8 IG/Database Compatibility Error

WARNING: <message>

These compatibility warnings are designed to warn the user that there is an incompatibility between the IG and the database. Valid messages and their meanings follow:

Database not compatible with IG IG will not support some part of the database.

Invalid compatibility code RTS does not support this compatibility code.

A.3.9 [Fatal] RTS Error: <description of error>

This error message is printed when the real-time system detects an abnormal condition which prevents it from continuing.

GLOSSARY

Animation Sequence

A sequence of static images, which simulate dynamic motion or change when shown in succession. The ESIG-LC implementation of animation involves the modeling system, the real-time system, and the object manager. The modeler defines an animation sequence consisting of objects. The user activates animation by issuing commands to the real-time system. The RTS submits animation data to the object manager. Based on animation data from the RTS and the animation sequence modeled, the object manager submits the object(s) to be processed to the geometric processor. (See Section 8.6.1.1 for further information on this topic.)

ASCII Text File

A file composed of ASCII text characters; these characters are computer independent, and may be used by any type of system. ASCII text files used by the ESIG-LC system include reset files and site files.

Baud Rate

The rate at which data is transferred between hardware devices in bits per second.

Boot

To load or reload the operating system and initialize the computer system. This is initially done at the time the system is powered up, and is also done when the system is reset.

Buffer

A consecutive number of bytes allocated for temporary storage in memory.

Calligraphic Lights

A non-raster light point drawn on the display screen. Because the light point is not raster, as are all other lights and objects in the scene, it must be drawn separately from all raster lines on the display with a second pass over the screen by the electron gun. This increases the processing time required for the scene, but also results in a sharper light point. Calligraphic light points should be positioned as close together and number as few as possible to increase display efficiency.

CD

(see Collision Detection)

Cell

A member of the hierarchical database which is used as a decision point for the object manager. At the cell level, the OM will decide to display a high or low level of detail, and whether or not to display the objects and meshes that the cell points to. (See Section 8.2 for further information on this topic.)

Channel Processor

The hardware components of the ESIG-LC system needed to produce the image in each channel: the object manager, geometric processor, and display processor. The channelized architecture of ESIG-LC differs from previous generations in the SP product line in that images are computed for each individual channel, rather than for the entire system. (See Section 3.2.5 for further information on this topic.)

CLI

(see Command Line Interpreter)

Collision Detection

Collision detection is the process of testing whether a collision test point, usually a point offset from the eyepoint, has entered a defined volume. When collision detection is enabled, the OM will make a traversal of the database for each collision test point to see if the point being tested is within a defined collision volume. The OM makes a traversal for any given test point when the real-time system places instructions to do so in the OM command list; this may occur every

field or only once every several fields. The traversal for each point is in addition to the visual traversal. (See Section 5.3.7 for further information on this topic.)

Command File/Reset File

A text file containing a list of commands known to the Command Line Interpreter or operating system. When this file is run, the commands in the file are run as if they had been individually entered on the command line. (See Section 4.4 for further information on this topic.)

Command Line Interpreter

The part of the real-time system that interprets commands entered by the user on the command line. (See Chapter 4 for further information on this topic.)

Console

The text monitor and keyboard used for system operation and maintenance.

Converging Traffic

The simulation of other aircraft or objects approaching the eyepoint, sometimes on a collision course. This simulation is used to test the pilot's ability to perform evasive actions or other types of maneuvers. (See Section 8.6.1.2 for further information on this topic.)

Coordinate

The location of any point relative to the origin of the coordinate system that the point belongs to. For example, a point that is 10 units in the X direction from the origin, and 15 units in the Y direction, and 20 units in the Z direction away from the origin, has XYZ coordinates of (10,15,20).

Coordinate System

The reference system for all constructs in the database. Placing an object in relation to the coordinate system determines where in the scene the object will appear. Up to 16 coordinate systems may be present in the model:

0:	eyepoint coordinate system
1:	ground coordinate system
2:	sky coordinate system
3-15:	dynamic coordinate systems

Any object may be tied to a coordinate system. The sky and ground coordinate systems remain in one place and do not move, while dynamic coordinate systems may move in relation to other coordinate systems in real time. For example, the eyepoint (CS 0) may move in relation to the ground coordinate system (CS 1). (See Section 8.3 for further information on this topic.)

(see also Dynamic Coordinate System)

CS

(see Coordinate System)

Database

A database is a numerical representation of a visual scene that can be viewed in real-time with the visual system. The database will contain records defining various objects, cells, meshes, and etc. Database is synonymous with Model.

Database Manager

The part of the RTS responsible for having the correct parts of the database available to the hardware. This is a two part process. First the RTS determines which parcels are on-line and sends the parcel descriptors to the OM. The OM then requests the parts of the database within range of the eye, and the database manager retrieves these from the system disk. (See Section 3.4.9 for further information on this topic.)

DCS

(see Dynamic Coordinate System)

Degrees of Freedom

The number of types of movements a CS is allowed, usually three or six. Three degrees of freedom could be either rotational, (e.g, heading, pitch and roll) or translational (e.g., X/latitude, Y/longitude, Z/altitude). A six degree of freedom CS is both rotational and translational.

Display

The hardware used to display the visual image. This includes both monitors and projectors. (See Section 3.2.5.5 for further information on this topic.)

Display Processor

The hardware logic responsible for displaying the image as a set of lines and pixels. This is a two part process, both occurring each field. First, the polygons, lights and visibility information are combined into a single frame buffer, representative of the display screen. During the next field this buffer is output to the screen as the previous process is loading a new frame buffer. (See Section 3.2.5.4 for further information on this topic.)

DOF

(see Degrees of Freedom)

Done Interrupt

When a hardware device (e.g., OM, GP, DP) has finished its current field's task, it notifies the RTS by generating a done interrupt. The RTS uses this information in its control logic to manage the field rate and re-start the hardware devices for the next field.

DP

(see Display Processor)

Dynamic Coordinate System

Any coordinate system that may be moved in real time in relation to other coordinate systems. For example, the eyepoint (CS 0) may be moved in relation to the ground coordinate system (CS 1) which does not move. An aircraft or other object may be attached to the DCS so that it moves along with it. (See Section 8.3 for further information on this topic.)

(see also Coordinate System)

EM

(see Environment Memory)

Environmental Memory

This is the memory shared between the hardware devices and the real-time system. The OM and the GP both have their own EM. This is the memory that the RTS uses to communicate with the OM and the GP. This memory is also used for the

storage and manipulation of database entities. (See Section 3.2.5.1 for further information on this topic.)

EPROM

Erasable Programmable Read Only Memory. Read only memory which can be programmed, erased and reprogrammed.

Ethernet

A local communications network in which all stations monitor the coaxial cable (the ether) during their own transmission, terminating transmission immediately if a collision is detected. Because of its widespread commercial use and availability, Ethernet was selected as the basis for the IG host interface. (See Section 3.2.3 and Chapter 6 for further information on this topic.)

Ethernet Interface

The interface by which the host and the image generator (IG) communicate. The IG only responds to the host, it does not initiate the communication. This makes it a collision free interface. ESIG-LC uses the IEEE 802.3 standard for its hardware and software. (See Section 3.2.3 and Chapter 6 for further information on this topic.)

Euler Angle (HPR)

The Euler (oi'ler) angles describe the attitude of the aircraft. The first angle, the heading or yaw of the aircraft, is measured from the north toward the east in the horizontal plane. The second angle, the pitch of the aircraft, is measured up from the horizontal to the longitudinal axis of the aircraft. The third angle, the roll of the aircraft, is measured about the longitudinal axis of the aircraft.

Eyepoint

The point in space representing the position of the observer. The eyepoint may be moved to simulate the movement of the pilot's aircraft. The eyepoint has its own dynamic coordinate system. The scene that is displayed depends upon the eyepoint's position and orientation, and field of view information. Eyepoint is roughly synonymous with ownship, as ownship effects (landing light lobes, beacons, collision detection, etc.) use the eyepoint position.

Field

Half of a frame. To increase apparent resolution of the display, the image is generated as two separate fields, one containing the even-numbered scan lines, and the other containing the odd-numbered.

Field Time

The time required to draw one complete scene on the display screen. On a 50Hz computer, the screen will be redrawn 50 times a second; this is the upper limit for the speed of flashing lights, animation sequences, and etc. Field time can be slowed by the overload manager if the number of objects in the scene exceeds the system's capability to process them within the allotted time. The field time is also called the frame rate.

Filename

The name of a file consists of two parts, a name and an extension. The name consists of up to eight alphanumeric characters. The extension consists of a period followed by up to three alphanumeric characters, and identifies the file type; command files commonly use the extension .COM, site files use .SIT, and executable files use .EXE. The real-time system requires only the name part of the filename, and supplies the default extension. The user must specify the extension of the filename if it is different than the default.

Flag (set a flag)

Flags are variables internal to a software program which indicate a condition or state. Other commonly used names for these types of variables include switch and semaphore. Flags may be used within a program to indicate on/off status, warning or error conditions, or other status information. By using CLI commands, users may set flags internal to the ESIG-LC Real-Time System. For example, the command HAT + activates the height above terrain feature by setting an internal flag. The height above terrain code checks the value of this flag to determine whether to perform further processing.

Flight Dynamics Mode

The ESIG-LC image generation system is usually used as a component of a complete flight simulator. However, it is often desirable to simulate flight when the IG is not connected to the host computer. Accordingly, the real-time system software performs a small subset of the host computations; the flight dynamics module accepts user input from the flybox or the console keypad, and updates the eyepoint position based on speed and the Euler angles.

Flyback

The retrace period; the time between the completion of display and reposition of the CSM electron beam to the next position. The ESIG-LC real-time system is configurable for the different flyback times used by different display devices.

Flybox

An Input/Output device that includes a keyboard, display monitor, slide control, and joystick. The flybox can substitute for a terminal for purposes of command entry, plus may be used to navigate the DCS through the scene with the joystick and slidepad. (See Section 4.6.2 for further information on this topic.)

Frame Buffer

A large random-access memory in which the information for each pixel of the image is stored.

Geometric Processor

That part of the hardware which performs object translation, rotation, clipping, and perspective computations, as well as special effects processing such as texture motion and flashing, rotating, and strobe lights. (See Section 3.2.5.3 for further information on this topic.)

GP

(see Geometric Processor)

Hardware Pager

Once the RTS sends the OM a parcel description, the hardware pager portion of the OM determines which parts of the parcel need to be brought on-line and displayed. It does this by comparing transition zones to the proximity of the eye and requesting any objects/meshes from the RTS that should be on-line but are not.

Host Block

An Ethernet packet containing host opcodes which is transferred between the host computer and the ESIG-LC image generator. (See Chapter 6 for further information on this topic.)

Host Computer

The ESIG-LC image generator is usually used by customers as a component of a complete flight simulator. In addition to the visual system, other components of the flight simulator may include a simulation cockpit with controls and instrumentation, a motion system to provide physical cues, and a host computer which translates inputs from the cockpit into commands to the instrumentation, visual, and motion systems. For the ESIG-LC image generator, the host computer is the source of positional and environmental data. (See Section 3.2.2 for further information on this topic.)

HPR Mode

A mode of operation for the flybox. (See Section 4.6.2 for further information on this topic.)

IEEE 802.3 (hardware standard)

The purpose of standards is to fix specifications that will allow manufacturers to make their devices communicate with devices manufactured by others. Communications network standards have generally focused on physical specifications (electrical, mechanical, functional control of data circuits), and data link specifications (establish, maintain, and release data links, error and flow control).

As Ethernet has become widely used, at least two standards have been defined: the Ethernet standard and the IEEE 802.3 standard. These standards specify that data will be transferred in a frame. The principal differences between the two standards are in the frame definition. The Ethernet standard frame consists of preamble, synchronization, destination address, source address, type, data, and error checking (FCS or CRC) fields. The IEEE 802.3 standard frame specifies length rather than type, and allows the use of a PAD field in the data section of the frame while Ethernet specifies a minimum packet size of 64 bytes.

The ESIG-LC host interface protocol uses the IEEE 802.3 standard. (See Section 3.2.3 and Chapter 6 for further information on this topic.)

IG

(see Image Generator)

Image Generator

The ESIG-LC image generator consists of a multiprocessor unit, one or more channel processors, and one or more display devices. The multiprocessor unit receives inputs from the host computer and console, and passes database and position data to the channel processors. Up to eight channel processors generate scene information in the

form of analog signals. These signals are passed to the display device where they are used to generate the visual scene. (See Chapter 3 for further information on the topic.)

Interlace (display)

A technique used to increase apparent resolution on raster scan display devices. Each image, or frame, is generated as two separate fields. One field consists of all even-numbered scan lines, and the other consists of all odd-numbered scan lines.

Interrupt

A signal indicating an asynchronous condition, usually used to stop the execution of a running program in order to run a program of higher priority. For example, the host computer transfers data independent of the ESIG-LC field rate; because the transfer may occur at any time, an interrupt is generated to signal when new host data is available. The RTS saves the contents of all registers, then services the host interrupt.

The 68000 microprocessor provides seven levels of interrupt priorities, numbered from one to seven, with level seven being the highest priority. The highest level used by the RTS, level six, indicates a host interrupt. More information about 68000 interrupts is available in the M68000 Programmer's Reference Manual, Section 4.4.2.

IO Device

Input/Output device. An IO device is used to communicate with the user, allowing commands to be entered by the user and messages to be returned by the computer.

Joystick

A graphical input device used for interactive positioning. The flybox used with the ESIG-LC visual system includes a joystick which may be used to manipulate the position of the eyepoint or other coordinate systems. (See Section 4.6.2 for further information on this topic.)

KLOD

Konstant for Level Of Detail. A constant generated by the RTS to manage overload conditions. This constant is used by the OM to proportionately reduce the transition ranges for all objects and thus reduce the processing time by reducing the amount of database to process. (See Section 5.3.23 for further information on this topic.)

Landing Light Lobes

These are lights on a airplane generally used during landings and taxiing. The ESIG-LC image generator simulates this ability by illuminating specified polygons in a lobe pattern.

Lat/Lon System

A database model that is configured to use latitude and longitude coordinates instead of XY coordinates for the placement of database entities and dynamic coordinate systems. The real-time system translates the lat/lon coordinates into XY for use by the hardware. (See Section 8.4 for further information on this topic.)

Level of Detail

The modeler may create different representations of an object, with each representation geared to a certain viewing distance. As the eyepoint moves through the simulated environment, the image generator selects the version of each scene detail that is appropriate to its viewing distance. When the eyepoint reaches a specified distance from the modeled object, the image generator may switch from a low level-of-detail to a high level-of-detail representation of the object. Thus, for example, relatively distant items may be drawn from comparatively simple representations, freeing up IG resources so that nearby scene details can be made more complex.

Light String

Any of a number of different types of database entities modeled to represent real-world lights. The light points within the string are equally spaced along a straight or curved line, and have the same defined color and intensity. Special light point attributes may further define such characteristics as flashing, strobe cycling, horizontal/vertical directionality, rotation, and sequencing.

Local Parcel

A local parcel is a parcel that is tied to the ground coordinate system, as opposed to placeable parcels, which are tied to a dynamic coordinate system. If a local parcel is an XY system then its origin is (0,0,0) in Cartesian coordinates. If, however, a local parcel is in a LAT/LON system then the origin is at the described latitude/longitude in the world file. The local parcel is normally used to represent an actual area of the world. (See Section 8.4 for further information on this topic.)

LOD

(see Level of Detail)

Login File

The file LOGIN.COM, which the operating system seeks and executes upon system boot. The file may contain a list of commands for configuring the system and/or starting tasks. If the real-time system task is started by the login file, then the system is considered to be turn-key. (See Section 2.4 for further information on this topic.)

Matrix Switcher (instructor monitor)

A switcher made by Matrix Inc., which is used to select which channel's video signal goes to the instructor monitor CSM. The RTS communicates the desired channel over a serial port.

Mesh

A collection of cells. Different types of meshes may define animation sequences, collision detection, or the visual priority of the cells within the mesh.

MIRP

(see Mission Record and Playback)

Mission Record and Playback

Mission Record and Playback (MIRP) is the real-time system feature that allows recording and playing back a mission. The recorded mission may also be modified. The MIRP commands are entered through the CLI. (See Chapter 7 for further information on this topic.)

Model

(see Database)

Model Select

A code allowing the user to specify which parts of the database to display. The modeler assigns model select numbers to cells when they are defined; the model select number may be specified during real-time to select which cells will be displayed. This allows two or more versions of the same object to be created and only one at a time displayed. (See Section 8.3.2 for further information on this topic.)

Modeling

The act of creating/editing a database model and the entities in it. See the *ESIG-LC Modeling Reference Manual*, E&S part number 901181-459, for more information about this process.

MP

(see Multi-Processor Card)

MTOS

Multi-Tasking Operating System. The ESIG-LC Operating System is based on MTOS-68K, sold by Industrial Programming, Inc., Jericho, N.Y. An operating system manages computer resources; a multi-tasking operating system permits users to divide programs into separate, individual segments called tasks. The IPI MTOS operating systems handle task (CPU) management, task coordination, time management, memory management, input and output. More information is available in the MTOS-68K User's Guide, 1981.

Multi-Processor Card

The multiprocessor (MP) card contains the front-end computer for the ESIG-LC image generator, the M68000 microprocessor. The ESIG-LC operating system, real-time system, modeling tools, and many utility programs run on the M68000 microprocessor. In addition, the MP card contains hardware to interface with the host computer over an Ethernet link, with a Winchester disk drive and tape streamer over a standard SCSI bus, with the system console over serial interface ports, and with the channel processors over a parallel bus. (See Section 3.2.4 for further information on this topic.)

Object

Any database construct that can be displayed. An object is an collection of polygons or light strings, for example to represent a building or an aircraft.

Object Manager

That part of the hardware that manages the database, sending to the geometric processor only those objects that will appear in the scene in priority order, based upon the eyepoint's field of view. Objects not appearing in the scene are not retrieved by the object manager, thus freeing memory and computation capabilities. (See Section 3.2.5.2 for further information on this topic.)

OM

(see Object Manager)

On-Line

In paging terms, this is when a database entity is in the environment memory. When the OM requests database from the RTS, the RTS brings that part of the database off the disk and into the environment memory and the data is marked on-line.

Opcode

A contraction of Operation Code. Opcodes are the basis of the interface language used to communicate between the host computer and the ESIG-LC image generator. For example, to transfer cloud top height data, the opcode 17 is used. According to the language definition, opcode 17 is followed by one sixteen-bit data word specifying the cloud top height. (See Chapter 6 for more information on this topic.)

Operating System

The software part of the system that performs Input/Output control for all system devices and file management. The operating system starts a task, then remains in the background managing the system while various tasks or applications such as the real-time system are run. (See Section 3.3 for more information on this topic.) (See also MTOS.)

Own Ship

Essentially the eyepoint. Used in the general sense of the aircraft instead of the pilot's eye. The ownship beacon and strobe radiate from the aircraft not the eyepoint, but in terms of simulation they are the same.

Pager

The routine responsible for determining what parts of the database are needed and bringing those desired parts of the database from the disk into the environment memory. (See Section 8.5 for more information on this topic.)

Paging

The process of determining what parts of the database are needed and bringing those desired parts of the database from the disk into the environment memory. (See Section 8.5 for more information on this topic.)

Parcel

An area or entity which is a complete database tree. The RTS deals with the database at the parcel level, deciding which parcel should be brought on-line by both a proximity test and model select test. The priority between parcels is determined by the RTS. (See Section 8.4 for further information on this topic.)

Pixel

Pixel is a contraction of Picture Element, and is the smallest element of resolution along a display scan line of raster.

Placeable Parcel

A placeable parcel is a parcel that is tied to a dynamic coordinate system, as opposed to local parcels, which are tied to the ground coordinate system. A placeable parcel has six degrees of freedom and will move as its base DCS moves. Placeable parcels have higher priority than local parcels and are generally used for moving models or generic airports. (See Section 8.4 for further information on this topic.)

Polygon

A planar database construct defined by three or four vertices. The visible side of the polygon is the one on which the vertices appear in a counter-clockwise order. The visible side may have color, intensity, and texture assigned to it. Polygons are used to build objects.

Priority

The scheme that determines what part of the database occults or hides another part of the database. In a fixed-order mesh, cells are displayed according to the order they are entered when defining the mesh; cells entered first have a higher priority than those entered later. In a relate mesh, cells are eyepoint dependent, so that cells on the same side of a separating plane as the eyepoint are displayed in front of other cells. This relation requires more computation time than a fixed ordering so should only be used when necessary.

Prompt

A computer response asking for user input.

Protocol (host/IG)

A protocol is a formally agreed-upon method of communication. A protocol is used in the host/IG communication described in Chapter 6.

Raster Light

Any light or light string that is drawn as a raster, as opposed to a calligraphic light point. A raster light will be drawn on the display screen at the same time the raster lines are drawn on the display, unlike a calligraphic light, which is drawn by making a separate pass over the display.

Raster Line

A raster is the structure of parallel scan lines covering the usable display screen area and forming the picture. A raster line is one horizontal scan of the electron beam across the screen of the display.

Real Time

Occurring instantaneously or immediately. Motion or movement of objects on the display to simulate movement or motion in the real world. (See Section 3.4 for more information on this topic.)

Real-Time System

The software part of the ESIG-LC system responsible for displaying the objects on the display in real time. It is the interface between the hardware, database and host.

Refresh Rate

Refresh rate is the frequency at which the display image fields are redrawn to preclude image flicker at a given scene brightness and to provide fresh eye stimulus for perception of motion cues.

Reset File

(see Command File)

RTS

(see Real-Time System)

Runway Visual Range

The distance a pilot will be able to see once he is near the runway. This distance is especially helpful to the pilot during ground fog and low visibility situations.

RVR

(see Runway Visual Range)

Shell Task

A task or program run under the operating system. This could be the real-time system, the modeling editor, a file manager, or any of a number of other programs. The operating system continues to run in the background while the task is running, managing devices and IO operations.

Site Configuration File

A file containing a list of commands used to configure the real-time system. These commands may be any of the CLI commands. The CLI TABLE command is used most often in site files. The default site file SPX.SIT will be run when the RTS is started unless a different file is specified. (See Chapter 5 for further information on this topic.)

SPX

SPX is a registered trademark of Rediffusion Simulation Corporation, and is used to designate CIG equipment designed and manufactured by Evans & Sutherland. CIG equipment marketed by Evans & Sutherland is called ESIG-LC.

SPXED

The ESIG-LC Modeling Editor, used to create and edit models that may be used on the ESIG-LC visual display system. (See the *ESIG-LC Modeling Reference Manual*, E&S part number 901181-459, for further information on this topic.)

SPXOS

The ESIG-LC Operating System. (See the *ESIG-LC Operating System Reference Manual*, E&S part number 901181-833, for further information on this topic.)

Statistics Processor

That part of the real-time system that keeps statistics on system performance. The statistics processor tracks the time required for all hardware devices (e.g., OM, GP and DP) to finish their tasks and conveys this information to the overload manager to take the appropriate action. (See Section 3.4.5 for more information on this topic.)

Streaming Tape

A tape storage device used to backup data from the hard disk storage device or to transfer large amounts of data from one hard disk to another.

Task

A single hardware/software process that may have many parts, but only one primary function. In the ESIG-LC system, foreground routines and background routines are usually spoke of as tasks. The operating system is used to switch between these tasks.

Timeout (hardware)

The RTS monitors the amount of extra time (i.e., the time past the field rate) that a hardware device (e.g., OM, GP and DP) requires to finish its task. If this time exceeds a site-configurable time, the RTS does a warm reset. If three consecutive timeouts occur, the system is paused and a message is sent to the operators console describing which hardware device was the culprit and in which channel.

Tree

The hierarchical organization of the database. The OM will traverse the branches of the database tree looking for meshes containing objects that should be displayed. A cell marks the decision point in the tree to determine whether the objects in the branch will be displayed or not.

Truncate

A process of discarding the least significant bits of a variable. The process does not take into account what these bits are as does the rounding process.

Vertex

A point in three-dimensional Cartesian space. The vertex may be attached to and defined by any of the coordinate systems. Verticies are used to define other database constructs.

Viewport

The defined view for a channel. This includes the heading, pitch and roll offsets from straight ahead and level. The horizontal and vertical half angles that define the view space and the X, Y and Z offsets from the eye point.

Warm Reset

A process of discarding the current field's data (flushing the hardware command lists) and starting normal operation the next field. This is done in response to a hardware timeout and allows the system to continue operation without much visual degradation.

Word

A 16 bit value. A signed word means that this value can represent both positive and negative values, where an unsigned word only represents positive values.

World File

A collection of database parcels which together represent the real world.

X/Y System

A database model that is configured to use XY coordinates instead of latitude and longitude coordinates for the placement of database entities and dynamic coordinate systems. (See Section 8.4.3 for more information on this topic.)

XYZ Mode

A mode of operation for the flybox. (See Section 4.6.2 for a complete explanation.)

ZMOD (fog)

A process of increasing the visibility, or decreasing fog as the eye increases in height (Z).

SYSTEM CAPACITY

The on-line capacity of RTS09 is as follows:

World files	1
Color files	8
Texture files	32 (standard texture option)
Parcel files	5
Loaded animation scenarios	16
Loaded converging scenarios	8
Loaded routed scenarios	16
Mesh files	5
Loaded mesh blocks	512
Object files	5
Loaded object blocks	96

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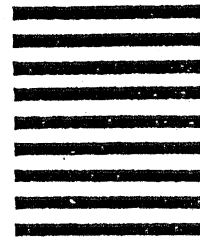
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