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INSTITUTE FOR SIMULATION AND TRAINING

MIRAGE

Operator's Manual

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D. Russell
G. Prasad
R. Hofer Ph.D.

April 15, 1997

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3280 Progress Drive
Orlando FL 32826

University of Central Florida
Division of Sponsored Research

INSTITUTE FOR SIMULATION & TRAINING • IST

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MIRAGE

OPERATOR'S MANUAL

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Florida

Table of Contents

1. INTRODUCTION

This document is a description of the hardware and software components of the ***Mirage*** Virtual Sandtable System and an operation and troubleshooting manual for users. This manual was written by researchers at IST to describe the configuration and operation of the system which was delivered to the U.S. Army's Strategic Space Defense Command's Warfighting Analysis and Integration Center at Arlington Virginia in April, 1997.

1.1 ORIGIN AND PURPOSE OF THIS DOCUMENT

This document is a deliverable item, CDRL AB02, "Demonstration Analysis Report" required under the terms of TASC contract J-08200-S96085, D.O. 19, entitled "Virtual Sandtable Capabilities Demonstration at the Warfighter Analysis and Integration Center."

1.2 DESCRIPTION

This section describes the ***Mirage*** system and provides an overview of its hardware and software components.

1.2.1 APPEARANCE

Mirage is a 3D, stereoscopic, pseudo-holographic display system which generates an image that appears as a scale model resting on a horizontal table top in front of the viewer. The viewer may walk around the display, examining the image from various azimuths and altitudes or he may pan and zoom through the virtual space. The display is not immersive in the way that a head mounted stereoscopic display can be. Instead, ***Mirage*** creates an inset of a piece of the virtual world and places it into the viewer's frame of reference. The rest of the viewer's environment around the display table remains visible.

Mirage is a three dimensional display device. It produces real images which depict the spatial relationships of objects in the virtual world. Only the objects or portions of objects within the field of view are drawn. Foreground objects occult those farther away. Movement of the viewpoint results in differential shifting of the images of objects that are at different distances from the viewpoint.

Traditional displays are normally drawn on a vertical surface or on a head mounted pair of displays. In both cases the image is rendered assuming the viewer's line of sight will be perpendicular to the display surface. In ***Mirage*** the image is drawn on a horizontal tabletop display screen and the viewer's aspect angle is always oblique, usually between 30 and 80 degrees away from perpendicular.

As the user faces the table the image always shows what is in front of him. To change the view the user changes position with respect to the tabletop, walking around the display, examining the scene from various azimuths and altitudes. Moving closer or farther away does not change the apparent size of the objects in the scene, although it does change the angular field of view. The side of a building or tree that is hidden from one point of view becomes visible when the user walks to the opposite side of the table.

Being stereoscopic, ***Mirage*** presents each of the viewer's eyes with a different image, accounting for the different aspect angles, distances, and other characteristics of the image that is visible from those two locations. The viewer derives an understanding of the spatial relationships of objects within the scene from this additional cue when his brain fuses the two images.

Normal stereoscopic views of virtual worlds are usually attempts to generate realistic views so movement and separation of the right and left eye viewpoints are computed in the same scale that is used to define the virtual world. Objects one meter away from the viewer in the virtual world appear to be one meter away. Objects and features hundreds of meters away appear to be hundreds of meters away. ***Mirage*** uses stereo in a different way.

Mirage provides a view of the virtual world which appears to be that of a scale model placed on the table. A true scale model, such as an H.O. gauge train set, is small and very close to its operator (the viewer.) The distance between the viewer's eyes (typically 6 cm.) is a large enough fraction of the eyes' distance from the scene (typically 1.5 - 2.0 m.) that the parallax angle allows significant stereo separation and the objects "look" three-dimensional. Beyond five or six meters, however, stereoscopic vision is negligible and other cues (size, haze, etc.) are more useful indicators of distance. A "realistic" stereo view of a piece of terrain from a viewpoint hundreds or thousands of meters away appears "flat" with no more apparent relief than one sees when looking at the ground through the window of a high flying aircraft. An out-the-window view is not what was desired for ***Mirage***.

The solution is to maintain the same ratio of virtual interocular spacing to virtual distance as is found in the "real" world. That "real" world consists of the viewer's eyes and the tabletop. ***Mirage*** provides a capability to "zoom" in and out, changing the size of the portion of the virtual world that fits on the tabletop. As the viewer moves out, his virtual interocular spacing is increased. The result is that the viewer is scaled up to be a sort of Brobdingnagian individual who is very large with respect to the hills, buildings, roads, and rivers (if those are being drawn.) In addition, as the viewer moves, the viewpoint is moved in this same scale so that a small apparent movement on the part of the viewer becomes a large movement in the virtual world. The effect of this is that the entire scene appears to be close to the viewer and objects in it appear to be small and located on the tabletop.

The ***Mirage*** image appears to float in space around the plane of the horizontal display screen.. Objects at higher elevations in the virtual world appear to float above the table. Objects at lower elevations appear to be depressed beneath the table surface

1.2.2 HARDWARE COMPONENTS

The ***Mirage*** system comprises seven major hardware components which are illustrated in Figure 1.

1. Computer Image Generator
2. Projector
3. Head Tracker
4. Stereo Eyewear and Emitter
5. Control Inputs (Joystick, Keyboard, and Mouse)
6. Mirror
7. Projection table and screen

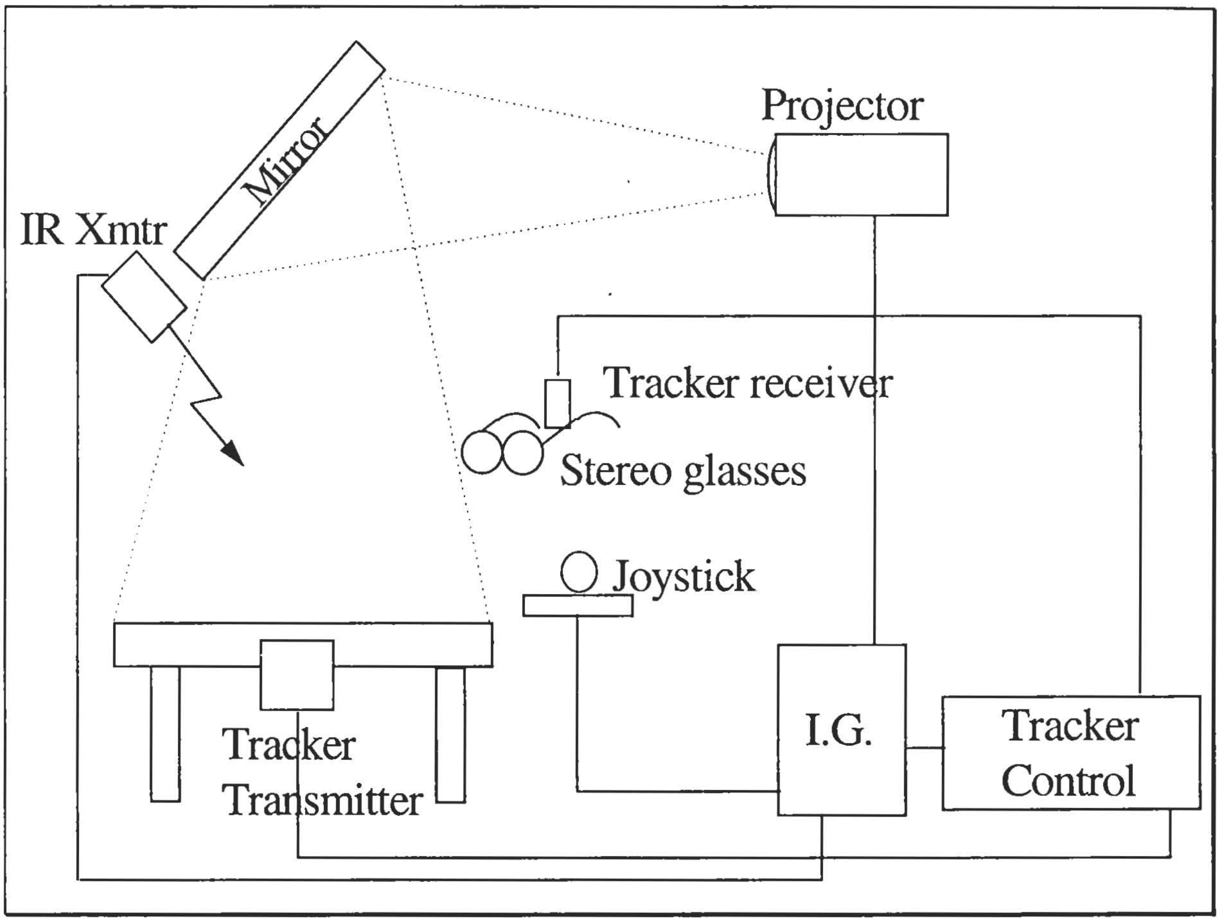


Figure 1. ***Mirage*** Hardware Components

1.2.3 SOFTWARE COMPONENTS

The software implementing the graphics, networking, and operator control and feedback functions forms the second component of the ***Mirage*** system.

Infrastructure - The ***Mirage*** software is based on portions of an object-oriented library of interface and facilitating functions called the Virtual Environment Library (VEL) which was written at IST. It contains drivers for the Flock of Birds[tm] (FOB) magnetic head tracker, the SpaceBall[tm] 6DOF joystick, and Crystal Eyes[tm]. VEL and ***Mirage*** specific functions are written in C++. A loader for Multigen Flight[tm] databases is included.

Projection - For ***Mirage***, an oblique projection is made onto a viewing surface that is horizontal and fixed with reference to the virtual world rather than with respect to the viewer. Because this was done using Silicon Graphics' Performer library it is accomplished by specifying asymmetrical viewing cones (or *"off-axis viewing frustra"*) in which the line connecting the center of projection with the eyepoint is not perpendicular to the projection plane.

Communications - ***Mirage*** communicates with simulators and other data sources via a network interface, using the version 2.0.4 of the DIS protocol.

1.3 ORGANIZATION OF THIS MANUAL

The remainder of this document is organized as follows:

- Section 2 lists acronyms and abbreviations used throughout this document
- Section 3 is a summary of actions necessary to start up and operate the system.
- Section 4 describes the hardware components that make up the operational system that was delivered.
- Section 5 describes the software components that make up the operational system and the software source code from which the system is built.
- Section 6 describes adjustment and calibration of hardware
- Section 7 describes normal operational use of the system
- Section 8 is a troubleshooting guide
- Section 9 lists the files containing executable modules, configuration data, visual and other databases, and source code delivered under the contract.
- Section 0 is a bibliography of related publications.

2. ACRONYMS AND ABBREVIATIONS

The following Acronyms and abbreviations are used throughout this manual.

AVI	Audio Visual Innovations, Inc.
CDRL	Contract Deliverable Requirements List
DIS	Distributed Interactive Simulation
DOF	Degrees of Freedom
FOB	Flock of Birds^{tm}
SSDC	Strategic Space Defense Command
VEL	Virtual Environment Library
WAIC	Warfighting Analysis and Integration Center

3. QUICK START

This section contains a brief summary of the steps required to turn on and start up ***Mirage*** and to shut down the system. More detailed explanations will be found in section 7, "Normal Operation".

3.1 STARTUP
It is assumed the Image Generator is already running.

1. Apply power (order is unimportant) to:
   - Projector
   - Distribution amplifier
   - FOB
   - Infra-red emitter
   - SpaceBall^{tm}

2. Log onto image generator

3. Change directory to /usr/people/mirage/mirage/bin

4. Start the ***Mirage*** application via the keyboard by typing the command
   demo

5. When the application begins and the main ***Mirage*** window appears, select a database type in order to view the available models.

6. Select the desired database and press the ***"Run Demo"*** button to begin viewing the database.

7. The SpaceBall^{tm} may be used to move the viewpoint. Pressing the select button located on the front of the ball allows the user to zoom in and out.

3.2 SHUT DOWN
1. Exit the demo application. The visualization software may be stopped by either pressing the escape key or the quit button on the graphical user interface. The demonstration software requires that the window containing the database list be closed in order for the Quit button on the main window to function.

2. Log out of the Image Generator

3. Turn off power to the equipment mentioned above in section 3.1.

4. *MIRAGE* HARDWARE ORGANIZATION
This section describes the physical components of the ***Mirage*** system as delivered to WAIC.

4.1 COMPONENTS
This section lists the specifications of the major hardware components of the ***Mirage*** system

4.1.1 TABLE

The table supports the viewing screen and the transmitter for the head tracker. The table (IST serial no. 000001) which was delivered to WAIC is 75 inches wide, 99 inches long, and 36 inches high with a 2 inch by 2 inch rail around the top to position the projection screen. A cradle to support the magnetic head tracker's transmitter is suspended from the framing under the table (see figure 2.) The table is constructed almost entirely of wood and glue to avoid distortion of the head tracker's magnetic fields by metal fasteners.

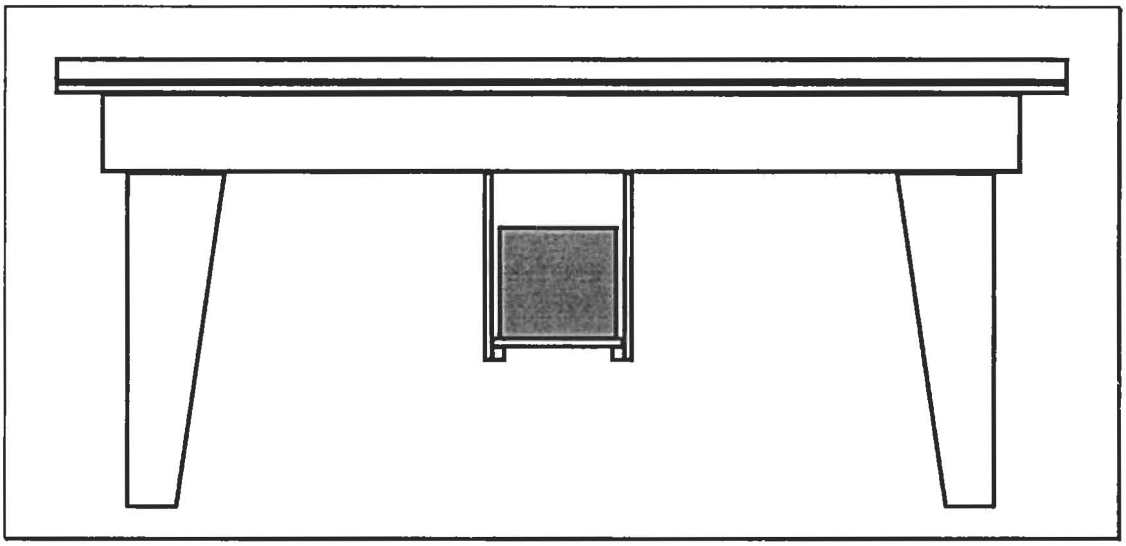


Figure 2. Projection Table

The table is heavily constructed of ¾ inch plywood and 2 inch by 6 inch fir framing to provide a rigid, flat surface for the screen and to be strong enough to support, without noticeable deflection, the weight of equipment and laborers who need to stand on it to assemble and adjust the other components. All joints are glued and the legs and transmitter cradle are attached using stainless steel bolts to minimize interference with the head tracker's magnetic field. The complete table weighs approximately 200 kg.

4.1.2 PROJECTION SCREEN

The projection screen is a 120" diagonal measurement low gain "DaMat Perm Wall Screen" in a "Perm Wall" frame (see figure 3). The manufacture is the DaLite Screen Company. The screen has a gain of approximately 1.1 and is attached to the back of the 1" square aluminum tubing frame using snap fasteners. The frame rests on the tabletop inside the wooden edge rail and is attached to the table with two stainless steel 6-32x3" machine screws.

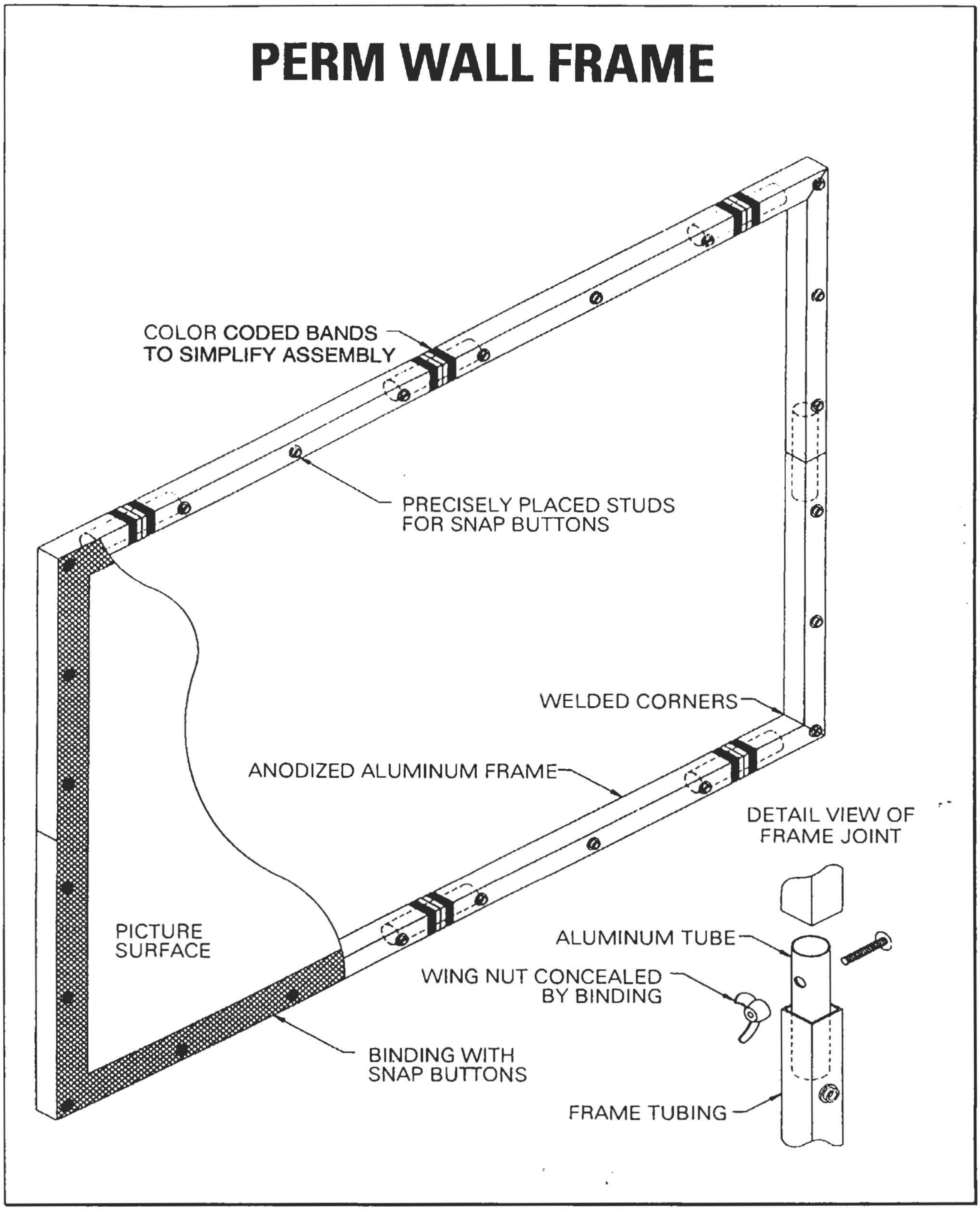


Figure 3. Projection Screen Frame

4.1.3 ARMATURE

A support framework was built for IST by Audio Visual Innovations, Inc. (AVI), the subcontractor that provided the projector, mirror, and screen. This structure holds the projector and mirror in proper relationship and provides attachment points for overhead mounting. It is constructed of steel rails made of UNISTRUT^{tm}. It is 120 inches in length and 16 inches in width and provides attachment points for the projector mount and mirror mount. It is painted black. Figure 4 shows a top view and Figure 4a is a side view of this armature with the attached mounting brackets for the projector and mirror.

4.1.4 MIRROR MOUNT

The mylar mirror is suspended from the armature by a framework modified by AVI from a Hudson Photographic Company Vertical Projection Stand, (model 183-282), shown in Figure 5 below.

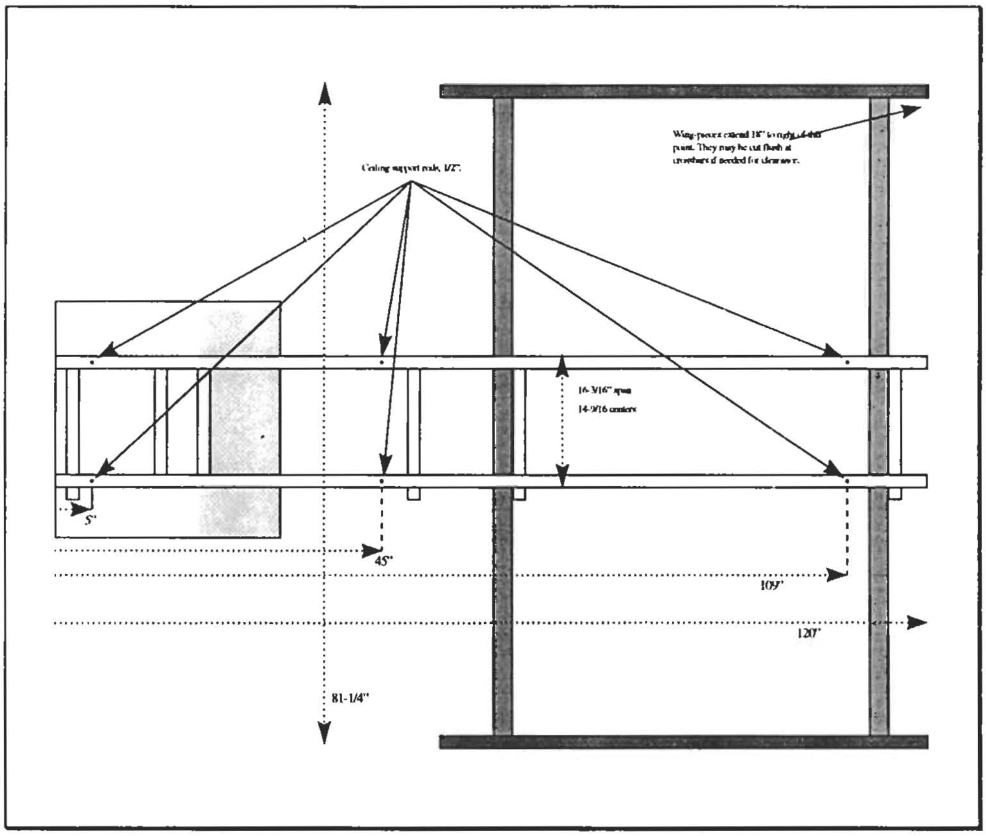


Figure 4. Support Framework - Top View

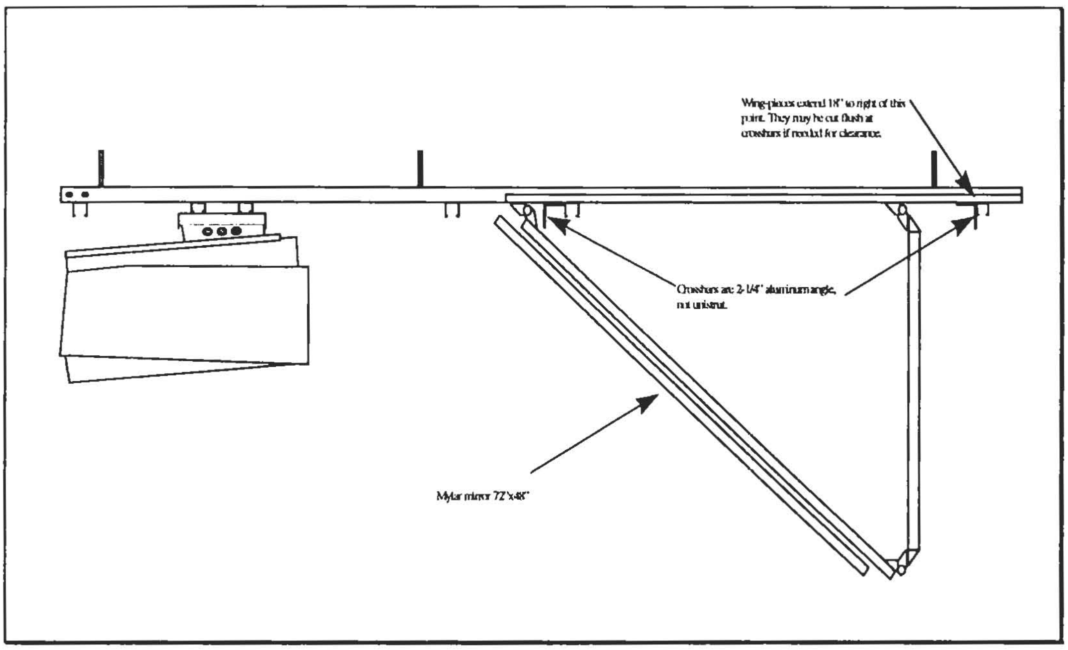


Figure 4a. Support Framework - Side View

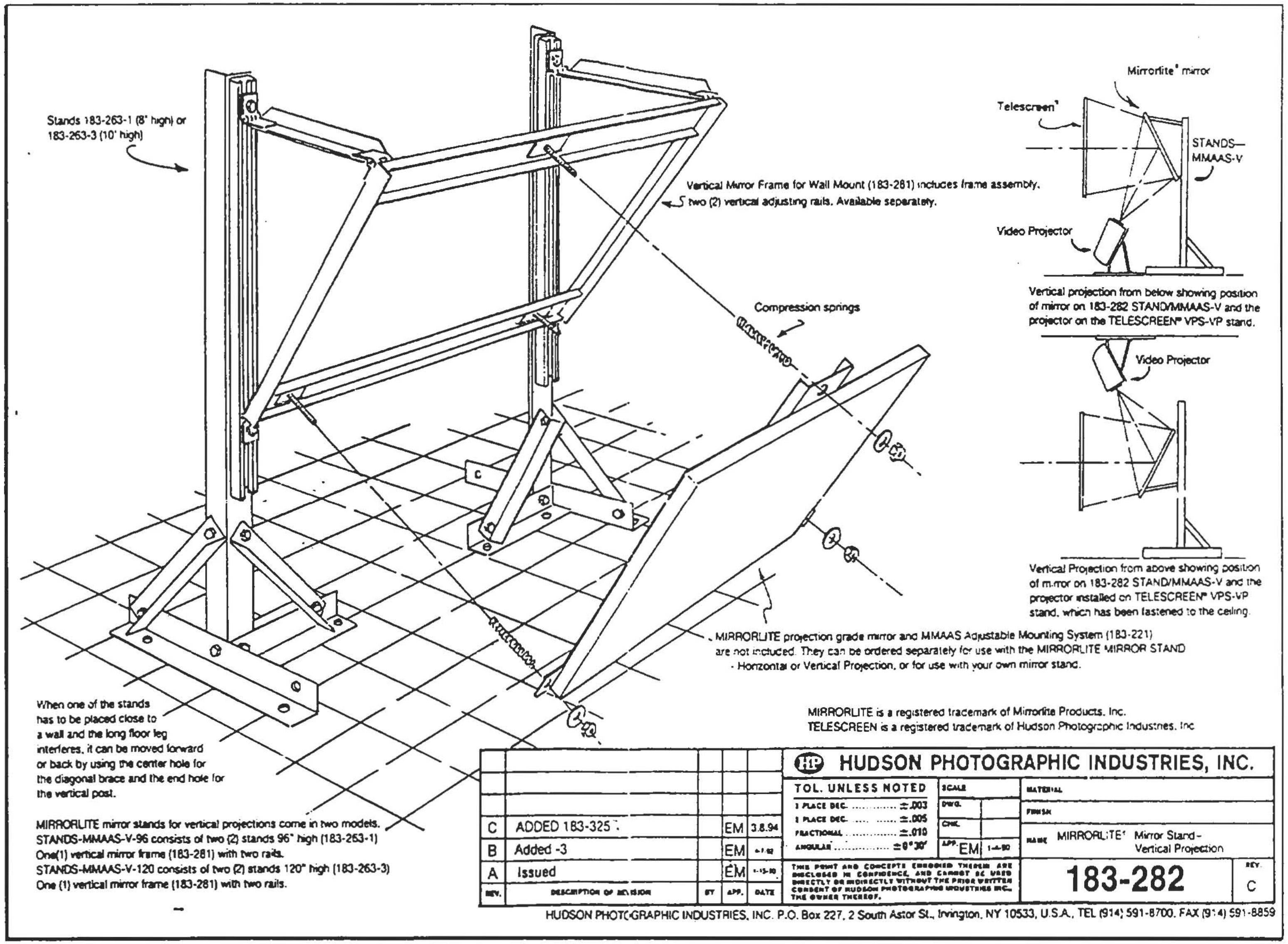
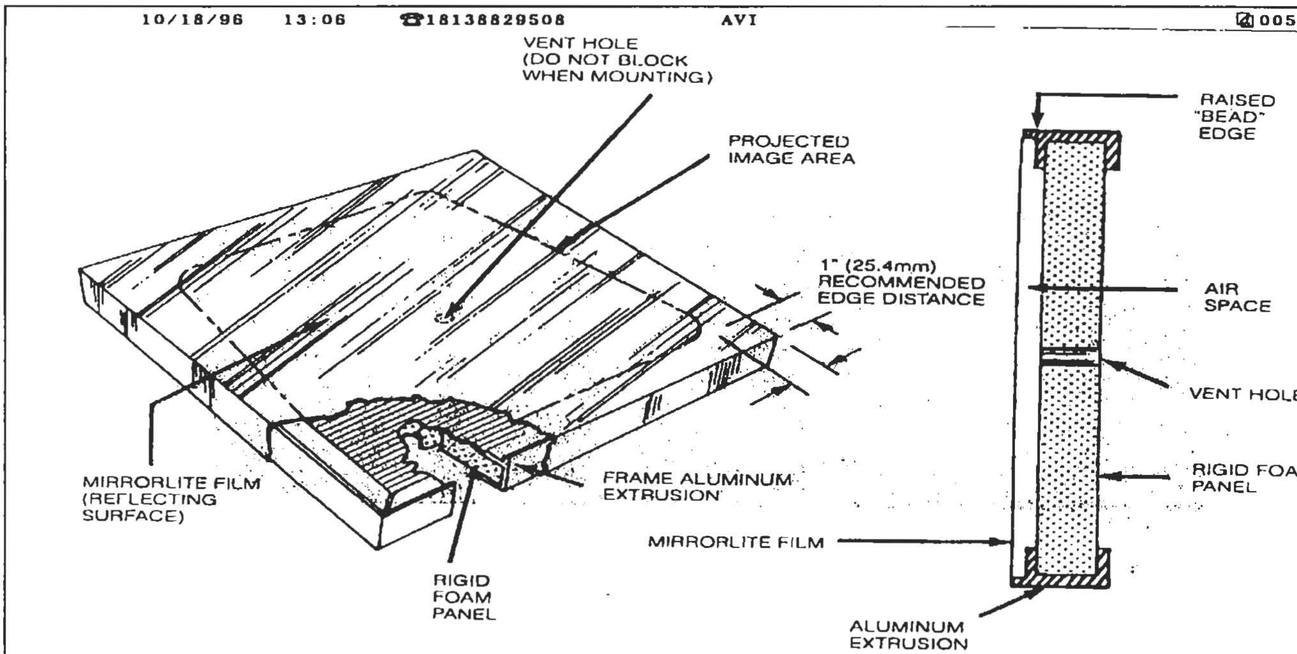


Figure 5. Hudson Mirror mount

4.1.5 MIRROR

The mirror is a Mirrorlite^{tm} Glassless Thin Film Mirror, type PGX with a reflectivity of 94%, made by Hudson Photographic Industries, Inc. (see figure 6) It measures 48" by 72". The mirror's reflective surface is a sheet of aluminized mylar stretched over an internal frame made of aluminum and polyurethane foam.



UNDERWRITERS LABORATORIES LISTINGS			
U.L. Recognized Component, 94HB category, file number E76232.			
U.L. Classified Building Units, file number R7754.			
Surface Burning Characteristics	Face	Back	Core
Flame Spread	15	40	25
[illegible]	[illegible]	[illegible]	[illegible]

SUGGESTED ARCHITECT'S SPECIFICATIONS

Optical mirror for rear projection system shall be: MIRRORLITE Glassless Thin Film Mirror Type-PGX* reflectivity 94%, by Hudson Photographic Industries Inc., Irvington, NY 10533, USA

Mirror Size:________high________long________thick
Mirror shall be equipped with Angular Adjusting MMAAS (183-221 Mounting System and Stands).

*If applicable, specify: MIRRORLITE mirror Type-PGR, reflectivity 86%

FOR INSTALLATION AND MOUNTING DETAILS, see HPI drawings 183-221 (MMAAS mounting system), 183-263 (Mirror Stand-Horizontal Projection), and 183-282 (Mirror Stand-Vertical Projection).

Figure 6. Mirror Construction

The mirror is suspended in front of the horizontally mounted projector to bend the optical path from horizontal to vertical. This reduced overall height while maintaining a large image size.

The mirror is attached to the mirror mount using the Mirrorlite[tm] Mirror Mounting Adjustable Angle System, model 183-221, (Figure 7 below) which provides three adjustable support points for the mirror.

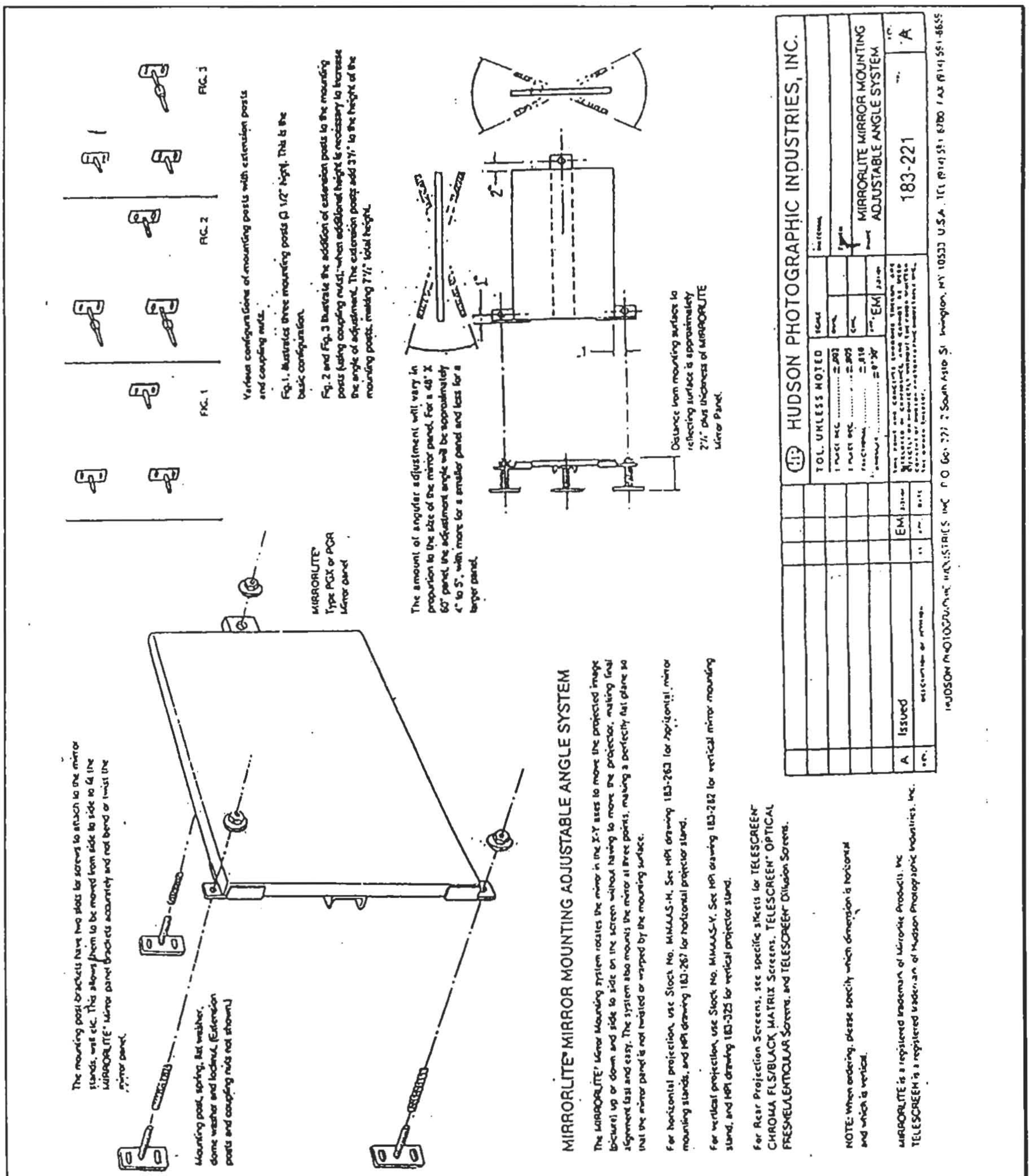


Figure 7. Adjustable Angle System

4.1.6 PROJECTOR

The projector is an Electrohome Marquee Series model 8111 with Automatic Convergence Unit (ACON) and a short-persistence P43 green phosphor tube which can handle the 96 Hz. refresh rate required for stereo. It has a horizontal scan rate ranging from 15 kHz to 130 kHz. Technical Details are listed in the owner's manual [ELEC1996] which was provided to WAIC at the time of initial hardware delivery in January 1997.

4.1.7 PROJECTOR MOUNT

The projector is attached to the armature using a commercially available mount designed for the Electrohome Marquee series of projectors. AVI used a Chief Manufacturing Inc. VCM-41E Projector Ceiling Mount (Figure 8) which allows roll, pitch, and yaw adjustment as well as slight horizontal adjustment.

Chief MANUFACTURING INC.

DELUXE VIDEO PROJECTOR CEILING MOUNTS
VCM-20, 30, 40, 50, 60, 70, 80, 90, 100 SERIES

INSTALLATION INSTRUCTIONS

The Deluxe Video Ceiling Mounts are designed to provide fast, simple and secure ceiling installation of video projectors. Special roll, pitch and horizontal adjustments simplify projection positioning for image alignment. The ceiling mount also has positive registration lock so the projector may be removed without losing projector mount registration.

WARNING: IMPROPER INSTALLATION MAY RESULT IN SERIOUS PERSONAL INJURY! All components must be securely fastened to each other and to the ceiling, **AND** the ceiling **MUST** be capable of supporting 700 lbs. (318 kg) of weight. If it cannot, the ceiling **MUST** be reinforced.

1. Be sure that the method of support you are using for the Deluxe Video Ceiling Mount is securely installed to the ceiling; if not, the ceiling must be reinforced. Improper installation may result in serious personal injury.

2. Attach the VCM housing to your method of support and tighten firmly so the VCM housing is parallel to the screen.

   PRECAUTION: ***Installing the ceiling mount requires the presence of two persons familiar with mechanical installations. A third assistant is recommended.***

3. Attach HB-Hanging Brackets according to the enclosed HB instructions. *Model of projector determines which Hanging Brackets are included with your VCM.*

4. With the help of your assistant, lift the projector and install it to the studs extending from the mounting plate (1). (*See Diagram 1*). Be sure HB-Hanging Bracket (2) is seated in slots. Tighten securely using the 5/16-18 flange nuts (3).

For projector alignment see attached sheet.

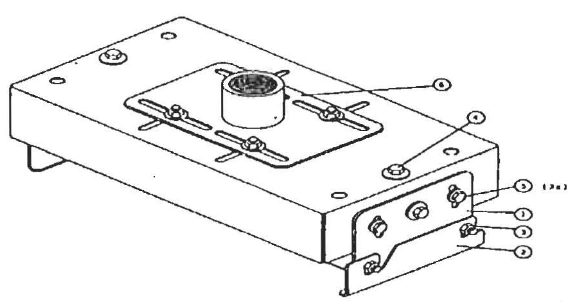


Figure 8. Chief Projector Mount

The mount bolts to the armature and the projector hangs from the mount by a Chief HB-41E video projector hanging bracket (Figure 9).

Chief MANUFACTURING INC.

HB-41E

VIDEO PROJECTOR HANGING BRACKET

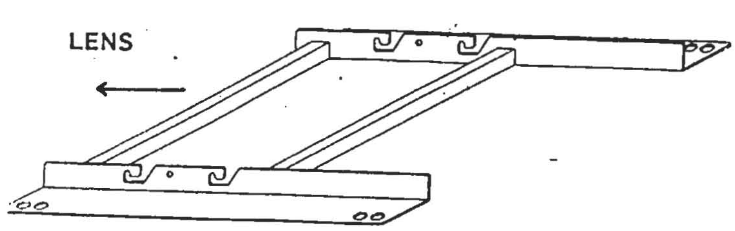
The HB-41E Hanging Bracket is designed to attach the Electrohome Marquee 8000 & 9000 series video projector series to the EVCM-100 Electric Ceiling Mount, VCM-41E Ceiling Mount or VCM-2C/3C Multiple Video Projector Stacking System.

Unpack and check contents:

(1) Mounting Rail
(8) 3/8-16 x 1" Bolt
(16) 3/8" Flat Washer
(8) 3/8-16 Hex Lock Nut
(4) 5/16-18 Flange Nut (VCM-41E and VCM-2C/3C only)

INSTALLATION INSTRUCTIONS

1. Turn your projector upside down.
2. With the "L" slots facing the rear of the projector, install the mounting rail to the projector using the hardware supplied. Tighten securely.
3. See EVCM-100, VCM-41E or VCM-2C/3C instruction for installing to mount.



0894IS07 - Rev. 1/96

Figure 9. Projector Hanging Bracket

4.1.8 STEREOGRAPHICS CRYSTAL-EYES EYEWEAR

To allow the user to see the stereoscopic projection, StereoGraphics Corporation CrystalEyes2(tm) eyewear is used to alternately occult each eye in synchrony with the image generator's output of left and right eye images. These are field sequential electro-stereoscopic liquid crystal shutter devices which are synchronized using an extended range infrared transmitter driven by a serial port on the image generator. The image generator provides 48 pairs of left and right eye images per second from its output buffer, synchronized with the transmitter. When a right eye image is being drawn the eyewear occults the viewer's left eye and vice versa.

Four pairs of StereoGraphics Crystal Eyes Eyewear, model CE-2, were provided to WAIC. A pair is illustrated in Figure 10 below.

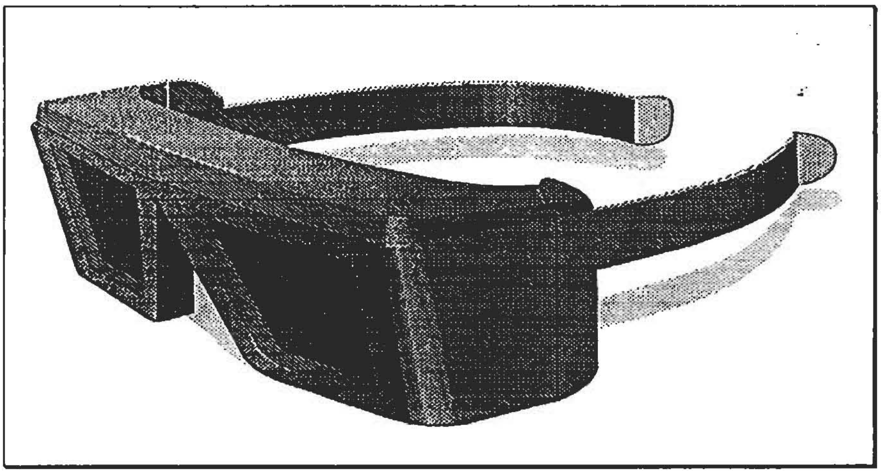


Figure 10. StereoGraphics Eyewear

4.1.9 STEREOGRAPHICS CRYSTAL-EYES INFRA-RED EMITTER

The StereoGraphics extended range infrared transmitter (model ELR) is positioned at the center of the bottom edge of the mirror and is aimed downward to bounce its signal off the screen to the viewer where it is detected by the sensor between the lenses on the front of the eyewear. The emitter receives a synchronization signal via RG-59 coaxial cable. The output signal from the image generator's stereo port is converted from twisted pair to a coaxial connector (BNC) using a special adapter (Part #82252) provided by StereoGraphics. The emitter also receives power on a separate connector from a 120VAC to 12VDC power supply (part #82011). The adapter is illustrated in figure 11.

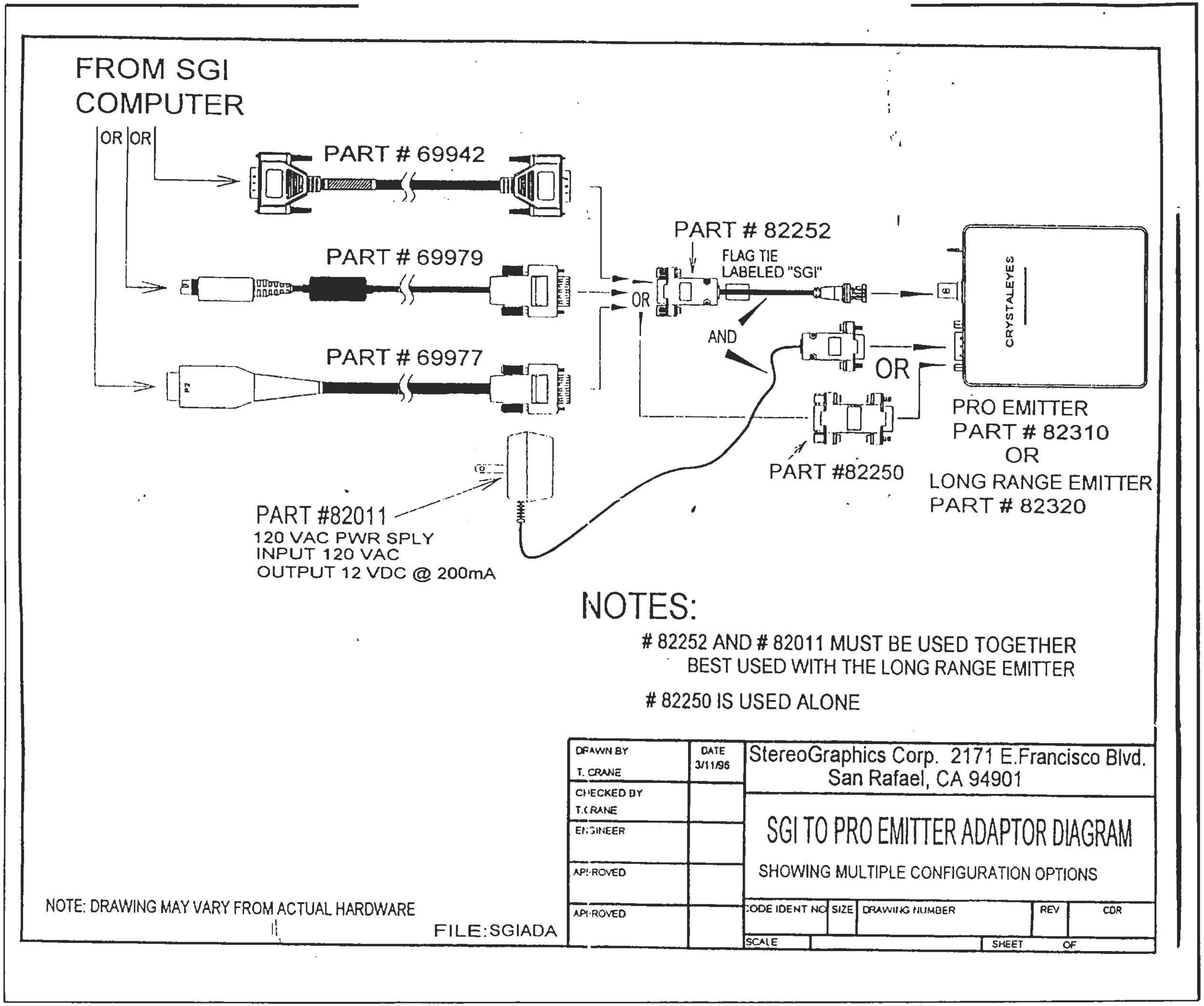


Figure 11. SGI to PRO Emitter Adapter

4.1.10 TRACKER

The position of the viewer is determined using an Ascension Technology Corporation Flock of Birds™ magnetic position sensor with extended range transmitter and one receiver which is attached to the side of the eyewear worn by the primary user. The receiver cable is suspended from the overhead frame to allow the user to walk around the table. The transmitter is suspended just below the center of the table. It is housed in a black cube measuring 12 inches on a side. Detailed technical information may be found in [ASCE1996].

4.1.11 IMAGE GENERATOR

The image generator is a Silicon Graphics Onyx-2 Reality Engine Deskside computer with two 200 MHz. R10000 processors, 256 MB main memory, 16 MB texture memory, and Reality Engine graphics pipe. The image generator provides stereo output in the form of 48 right and 48 left eye images per second to avoid flicker.

4.1.12 OPERATOR CONTROLS

Operator control is performed through a combination of the Onyx keyboard and mouse and a SpaceBall™ joystick.

The SpaceBall™ is used for:

- Moving the viewpoint horizontally or vertically
- Changing the scale (or magnification) of the image

The keyboard is used for:

- Initialization and configuration before starting the application
- Selection of certain modes during normal ***Mirage*** operation (via the numbered function keys)

The mouse is used for selection of options in:

- IRIX windows
- Mirage menu panels

4.1.13 FOOTPRINT

The floor space required by the entire system is shown in figure 12 below.

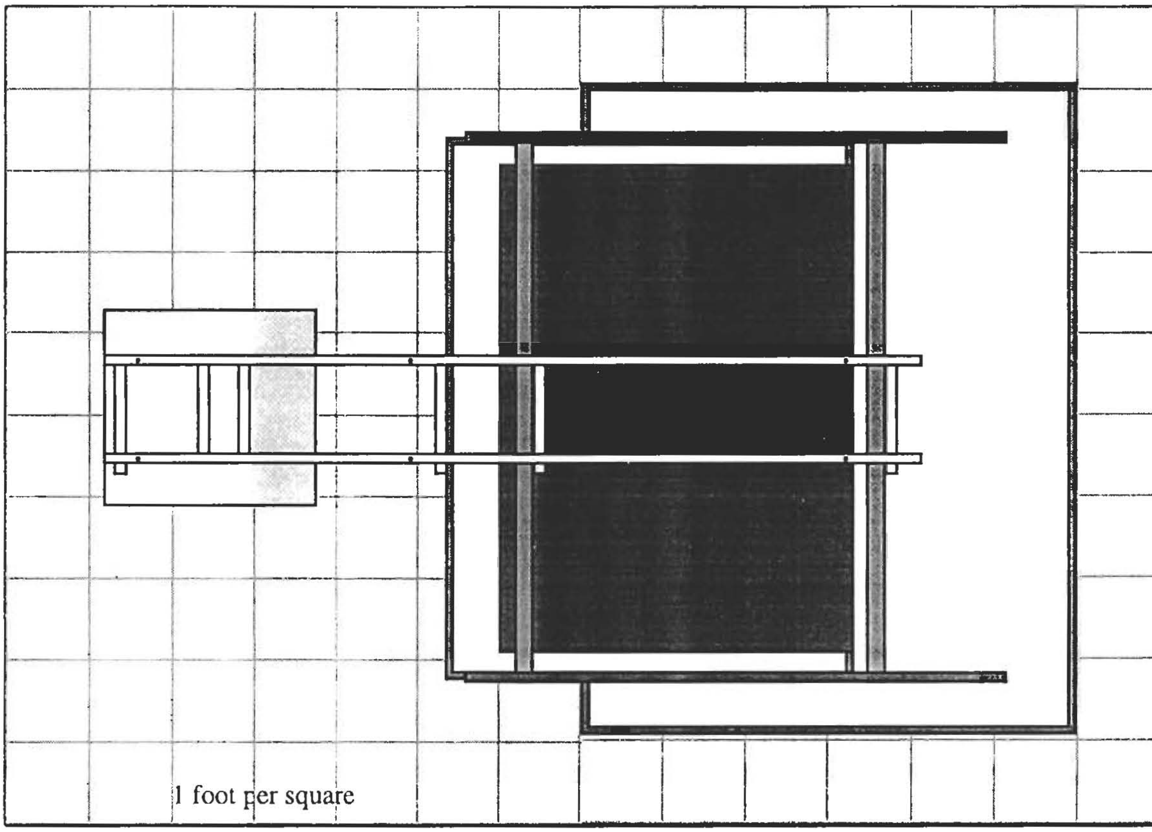


Figure 12. Floorplan

4.2 CONNECTIVITY

4.2.1 CABLING

The Mirage system requires four basic cable connections between the operating station and the image generator (not including the keyboard and mouse). These connections include:

- Video connection to the projector (RGB Cable - sync on green)
- Serial connection to SpaceBall^{tm} (DB9 to 8 pin DIN) provided by SpaceTec
- Serial connection to Flock of Birds (DB9 to DB9) standard PC modem cable.
- Stereo sync (DB9 to coaxial BNC connector) provided by StereoGraphics.

Cable end connections and types are illustrated in figures 13 and 13a below.

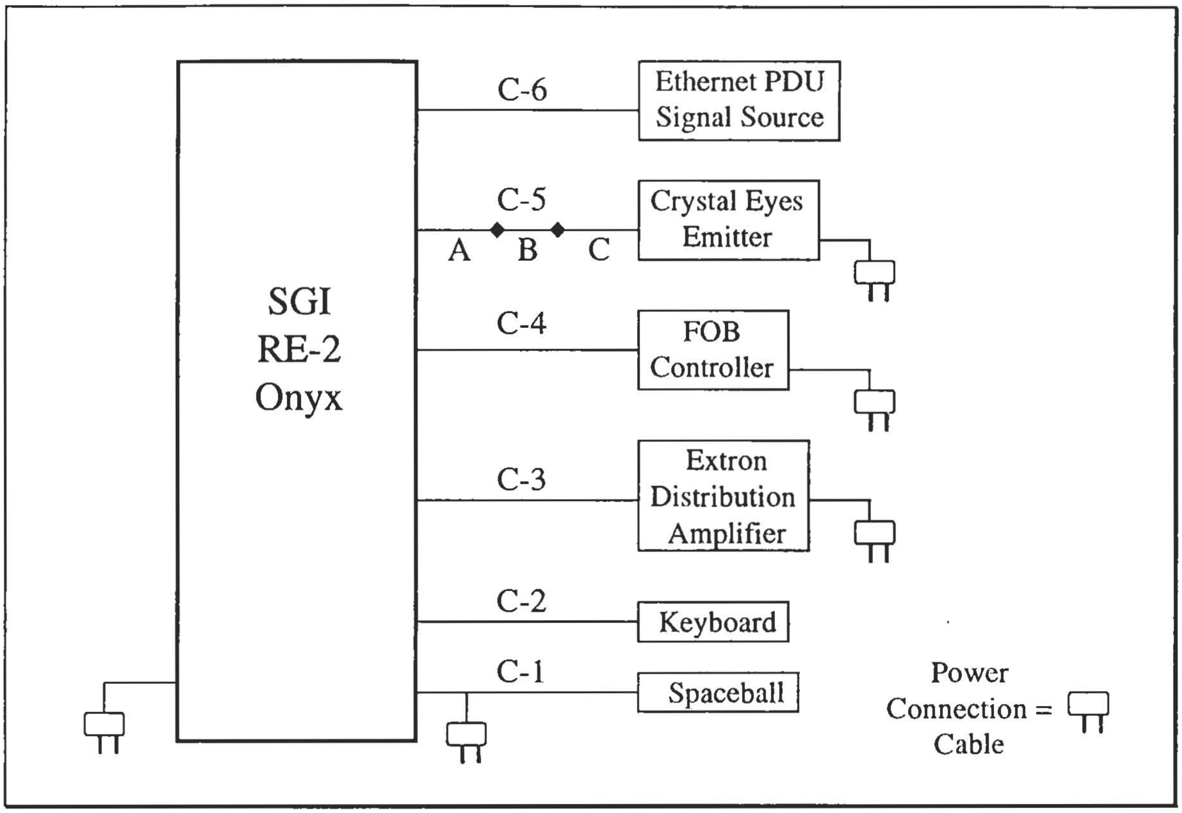


Figure 13. Mirage - Onyx RE-2 Connections

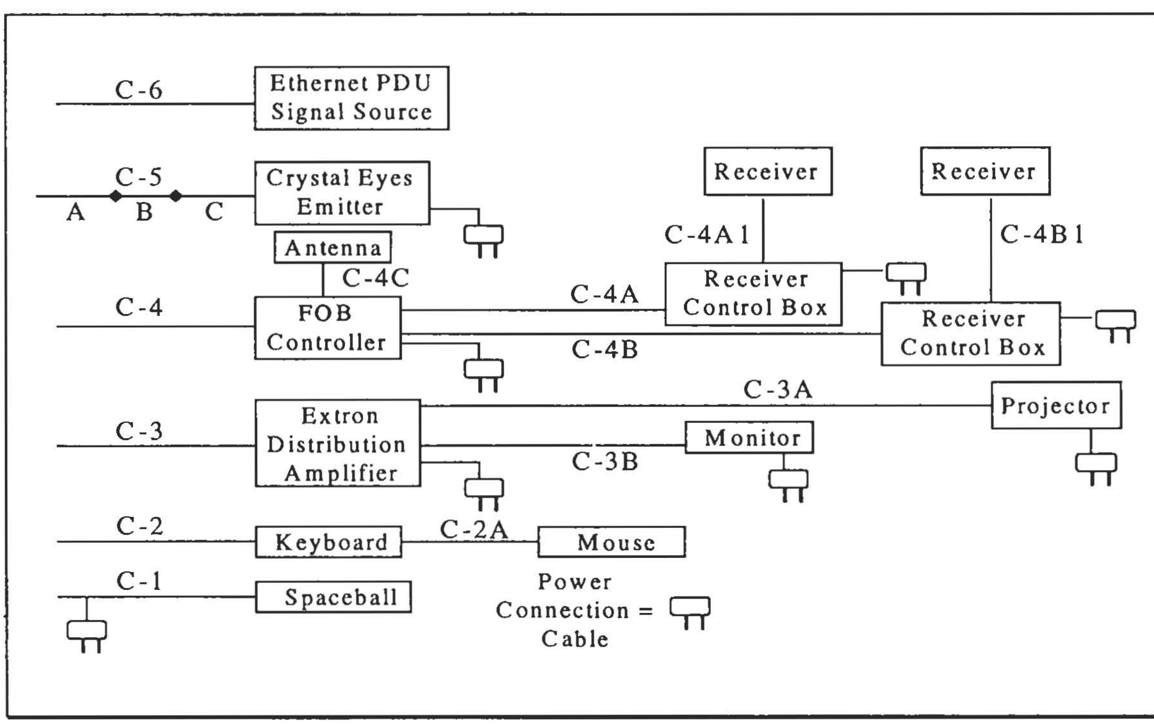


Figure 13a. MIRAGE Internal Cable Connections

4.2.2 NETWORK CONFIGURATION

The Onyx communicates with other systems via a 4 100Base-TX/6ASYNC XIO network interface board. As with all DIS software, communications of entity data is made through network broadcast traffic on a particular port. The port may be changed in the Entity Services configuration file described in Section 7.3.1.1.

4.2.3 POWER

For the entire Mirage configuration including image generator, seven standard 120 Volt outlets are required. The total current load of the system requires at least two 20 Amp circuits.

5. DESCRIPTION OF *MIRAGE* SOFTWARE SETUP

The ***Mirage*** execution environment and source code consist of a number of important pieces. The execution environment contains all of the components necessary to run the ***Mirage*** software and possibly view DIS entities. The source code provides all of the pieces necessary to compile the ***Mirage*** executable given that the appropriate libraries and compilers are available on the machine.

The software components required by the ***Mirage*** system are described in the following sections. The components required for execution versus compilation will be noted.

5.1 OS

The software delivered in conjunction with this report was developed under IRIX 6.4 to be run on an IRIX 6.4 machine. The operating system can be considered important for both execution and compilation. In its current state, the software should be capable of being recompiled for any IRIX version 5.3 or greater; however, changes in the makefiles will be required to complete the compilation.

5.2 COMPILER

The ***Mirage*** software was compiled with the SGI C++ Compiler version 6. The C++ execution environment that it has been tested on is version 7.1. In order to compile the software again, the C++ Compiler must be installed along with the IRIX n32 system and Performer libraries.

5.3 PERFORMER

Performer version 2.1 was used to develop the delivered version of the ***Mirage*** software. It should be noted that SGI only guarantees proper operation of Performer 2.1 on Infinite Reality machines. No problems have been encountered so far; however, it may be necessary to recompile the code with Performer version 2.0.1 if problems do arise. Components of Performer 2.1 are required to be installed on a machine for it to be capable of running the ***Mirage*** software. This Performer execution environment should be available on any IRIX OS CD-ROM.

5.4 *MIRAGE* APPLICATION

The ***Mirage*** application consists of a number of component parts. All of the required components will be extracted and placed within the proper directory structure by the tape archive provided in conjunction with this report. The tape labeled ***Mirage*** Execution Environment version 1.0 and dated March 28, 1997, will produce a directory structure consuming 97.8 MB (95.6 MB of which are sample databases and DIS geometry models). The files extracted comprise the execution environment for the ***Mirage*** software.

5.4.1 EXECUTABLES

Three executable files are extracted into the bin directory:

Mirage, entityServ, and MirageDemo

5.4.2 SCRIPT FILES

For each of the sample databases provided, a configuration/script file exists in the scripts directory. These files provide the ***Mirage*** software with the starting values for the system which are specific to the particular databases to be loaded. The file ***Mirage***.cfg, which provides default values for the system, can be found with these files.

5.4.3 DATABASES

The sample databases provided with the software are all in Multigen OpenFlight format. They are located in the models directory in the ***Mirage*** execution environment. The software is capable of loading any of the model formats supported by the Performer library (this list can be found either in the Performer manuals or in the online books). Models can be loaded from any directory provided that appropriate path entries are made in the configuration files prior to attempting to load the model (see section 7.3.2.2). The provided sample databases are:

Model Description	Location	Model Filename
Fort Hunter Liggett	mirage/models/HunterLt	hiflight.flt
Quantico Training Village	mirage/models/quantico/models	demo.flt
Range 400 Live Fire Range	mirage/models/range400/models	r400_tex.flt
ARI Building Walkthrough (Research Pavilion)	mirage/models/walkthrough/models	pav_third.flt

5.4.4 DIS INFORMATION

In the ***Mirage*** bin directory, the file named CC.performer.cfg contains information needed for DIS coordinate conversions. The UTM origin of the database to be loaded and used for DIS exercises should be entered in this file following the format of the information in the default file. DIS exercises also require that a port number be chosen for broadcast traffic to be received. This port may be set in the eserv.cfg file located in the same directory.

The ***Mirage*** system uses a separate program called Entity Services to access DIS information on the network. In order for DIS to be available to the system, a copy of Entity Services must be running on the host computer. This procedure is outlined in section 7.3.1.

5.5 SOURCE CODE

From a separate tape, named ***Mirage*** Source version 1.0, a complete set of source code may be extracted. The tape will extract a number of files into a directory called **src**. Below the src directory are a number of sub-directories which contain the actual code written to implement the ***Mirage*** software. For more information consult the README file in the src directory after extracting the tape archive.

5.6 MISCELLANEOUS UTILITIES

The demonstration interface provided with the ***Mirage*** software provides a simple mechanism for displaying available models and running the system. The demonstration interface uses a number of configuration files to define models available and indicate the appropriate ***Mirage*** configuration file associated with the databases. Adding new databases to the lists is simply a matter of modifying the configuration files. The names of the demonstration program configuration files match the buttons on the main panel:

military.list and **nonmilitary.list**

The file **military.list** currently has the following entries:

<config file>	<database description>
r400.cfg	Range 400
hunter.cfg	Fort Hunter Liggett
quantico.cfg	Quantico Village

In order to add a new database to the list displayed when the military databases button is pressed, simply add a new line to the file following this format. The same procedure may be applied to add new non-military databases as well.

6. HARDWARE ADJUSTMENT

6.1 TABLE

The table legs and FOB cradle may be unbolted for transport.

6.1.1 POSITIONING

The table should be positioned under the mirror to provide even spacing around the illuminated portion. If it is to be moved often it may be convenient to mark the locations of the feet on the floor using tape.

6.1.2 LEVELING

The bottom of each of the table legs contains a leveling screw which rests on the floor. These are 1/2" stainless steel hex head bolts which may be turned with a wrench if the table needs to be leveled.

6.2 MIRROR

The mylar surface of the mirror should be protected during movement or adjustment as oils and dirt from fingers will leave noticeable smudges and even gentle removal may stretch and distort the surface. The mirror may be wrapped in polyethylene sheeting or clean new cotton gloves may be worn.

6.2.1 ADJUSTMENT

The mirror should not require adjustment but if it does, use the three spring loaded bolts described in section 4.1.5 and illustrated in figure 7. The purpose of adjustment is to position the mirror so its horizontal axis is perpendicular to the axis of the projector and so that it deflects the beam exactly 90 degrees downward.

6.3 PROJECTOR

6.3.1 POSITIONING

The projector should not require repositioning. Its mount is fixed to the armature. The projector and hanging plate may be lowered using the hoisting tray and tackles provided when the equipment was delivered.

6.3.2 ADJUSTMENT

Whenever the relative positions of any of the projector, mirror, or table are changed the projector may need to be adjusted. This requires three operations which are described in detail in the projector manual [ELEC1996]. The operations are alignment, focus, and convergence. They are too complicated to describe here but the online help menus in the projector step the user through these.

6.3.2.1 ALIGNMENT

Alignment is the process of mechanically moving the three guns in the projector to converge their central axes at the center of the tabletop projection screen. This involves electrically centering the image on each CRT and mechanically positioning the CRT/lens assemblies.

6.3.2.2 FOCUSING

Focusing is the process of mechanically adjusting the lenses in each of the three guns to focus at both the center and the edges of the tabletop.

6.3.2.3 CONVERGENCE

Convergence is the process of electrically adjusting the guns for the best registration of different colored pixels on the screen

6.4 HEAD TRACKER

The FOB has few hardware adjustments beyond insuring that all cables are attached properly. The position of the transmitter can be critical, however.

6.4.1 POSITIONING

The transmitter is the black cube mounted under the ***Mirage*** table. This transmitter weighs nearly 50 pounds and should be handled carefully. When properly positioned, the transmitter will be under the table with the cable towards the back of the table and the bottom of the transmitter. If the transmitter is oriented in any other manner, the software will be unable to determine the appropriate location of the viewer.

6.4.2 CALIBRATION

Calibration of the FOB is performed in software. The calibration procedure consists of entering calibration mode, placing the tracker on the target, and pressing the calibration button (F12). The calibration procedure is covered in section 7.4.1.5.

6.5 STEREO EYEWEAR

The StereoGraphics eyewear is designed to turn on when the left temple piece is opened. They should, therefore, be kept closed when not in use to avoid draining the batteries. The eyewear must receive the synchronization signal from the emitter in order to function properly. If the image appears to flicker, the batteries are probably worn out and should be replaced. If the stereo aspect of the image disappears then the eyewear is probably not being illuminated by the emitter. The user should be sure to face the emitter if this happens.

6.5.1 EMITTER LOCATION

The infra-red emitter for the StereoGraphics Crystal Eyes is located on an aluminum bracket bolted to the lower edge of the mirror support frame. The emitter is attached to the bracket with Velcro tape. The bracket was designed to aim the emitter to bounce its beam off the table surface to the operator and other viewers. Two emitters were supplied when the system was delivered. The second unit can be daisy-chained with the first using RG-58 coaxial cable if it is later found necessary to increase the coverage of the signal.

6.5.2 BATTERY REPLACEMENT

The Stereographics CrystalEyes Eyewear is battery powered. Each set of eyewear requires two CR-2032 type batteries. These are replaced by swinging open a hinged battery compartment on the inside of the left side of the equipment. Batteries should be replaced when the eyewear begins to show a flickering effect.

7. NORMAL OPERATION

Normal operation of ***Mirage*** includes:

1. Powering up the Projection and tracking systems
2. Logging onto the system
3. Starting the ***Mirage*** application

4. Calibrating the head tracker
5. Loading and displaying databases and models
6. Changing the viewpoint
7. Viewing DIS entities
8. Stopping the ***Mirage*** application
9. Logging off of the system
10. Shutting down the Projection and tracking systems

Operations which are covered in other sections of this manual, but which are not considered part of normal operation are:

1. Powering on/off the Image generator
2. Initializing/Shutting down the operating system on the Image generator
3. Aligning, Focusing, and converging the projector
4. Modifying application menus

7.1 STARTUP

Starting the system requires application of power, logging onto the system as a user, and starting the ***Mirage*** application

7.1.1 POWERING ON THE HARDWARE

1. Power up the Extron Distribution Amplifier
2. Power up the projector. First, check to see if the projector is already turned on or in stand-by mode.
    - If the projector is already turned on the green light on the back should be glowing. If there is no image on the tabletop try moving the mouse to disable the screen saver.
    - If the projector is turned off, only the amber light should be glowing on the back. Turn on the projector with the remote control by pointing it at the mirror and holding the power button down for at least two seconds. You should hear two clicks, about a second apart. The projector will take about 5-10 seconds to come on. If you do not then see the login prompt, the screen saver might be running, so try moving the mouse to disable it.
    - If the projector is in standby mode, both the amber and green lights should be glowing. Turn on the projector by pressing the standby button on the remote.
3. Turn on power to all three tracker control boxes. You should see the red LEDs flash on the front panels of all three boxes.
4.

7.1.2 LOGGING ON

When the IRIX control window appears on the table, log onto the operating system with the ID and PASSWORD provided by the facility systems administrator

7.1.3 STARTING THE *MIRAGE* APPLICATION

The ***Mirage*** application may be started in a number of ways. The easiest method involves first running the demonstration panel which will then start the ***Mirage*** application with the desired database loaded. This may be accomplished by entering the ***Mirage*** bin directory and typing the command demo. This script will then change the display settings, run the DIS handling software (Entity Services), and start the demonstration software.

The CrystalEyes2[tm] eyewear turns on when the left temple piece is extended. The lenses may flicker momentarily when turned on. To maintain stereo vision, the path between the eyewear and the IR transmitter located at the bottom of the mirror should not be obstructed. The signal may be received directly or by bouncing off the tabletop surface.

7.2 BASIC FEATURES

7.2.1 WINDOWING

Window manipulation will allow the user to observe various simultaneously executing processes. Basic operations allowed by IRIX require selection of a window by placing the mouse pointer somewhere within the window to be affected. Depending on the user's personal preferences, the methods of moving windows and changing their precedence may change; however, these are default operations allowed by the 4Dwm window manager:

- ALT-F3 pushes the selected window to the back
- ALT-F7 grabs the pane and allows the user to move it with the mouse until a button is clicked
- An edge of a window may be moved, reshaping the window, by placing the cursor on the edge, holding down the left mouse button, then moving the mouse
- A window may be moved by placing the cursor in the top bar, holding down the left button, then moving the mouse

Please note that in order for several of the SpaceBall[tm] and function keys to operate as specified later in this document, the cursor must be located somewhere in the main graphics window of the ***Mirage*** application (see figure 14 below). If the cursor is over the ***Mirage*** graphical user interface (GUI) or outside the graphics window, neither the SpaceBall[tm] nor keyboard commands will be acknowledged.

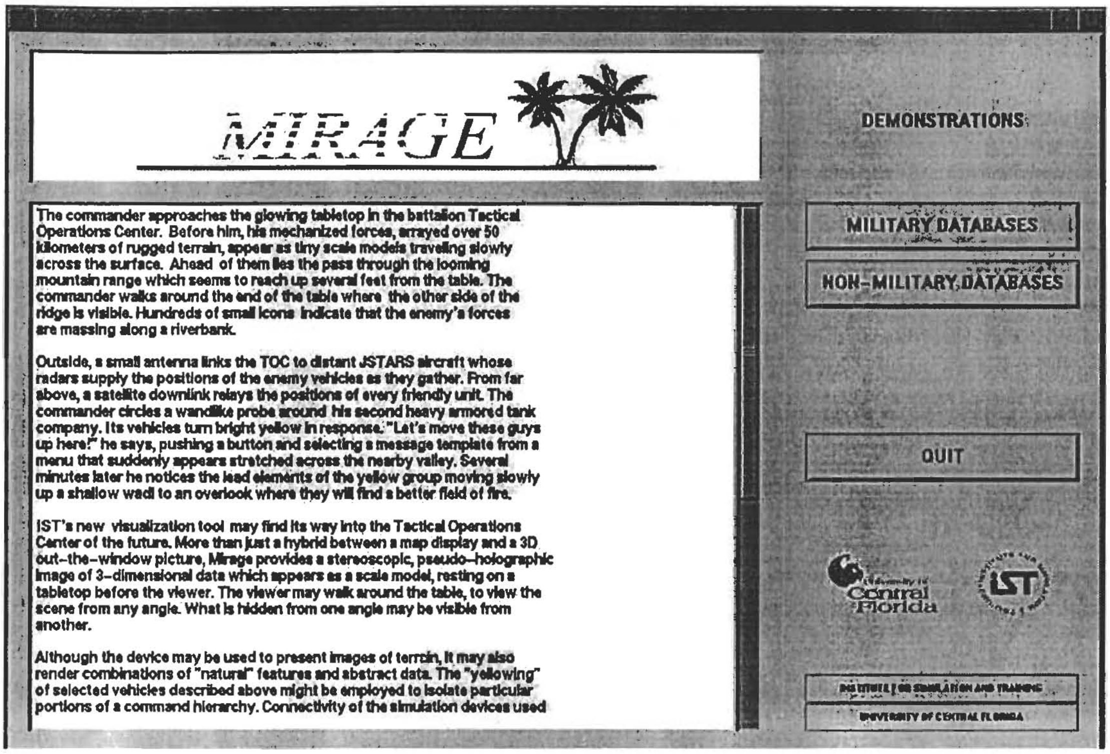


Figure 14. Mirage Graphics Window

7.2.2 DATABASE SELECTION

If the *Mirage* software has been started using the demo script, selecting a database is simply a matter of traversing windows in the GUI and selecting the desired database to view. When the demonstration software starts, the main Mirage window shows selection buttons for two database categories: **military** and **non-military**. Pressing either of these buttons causes a new window to appear with a list of available databases in that category. Figure 15 shows the list of military databases. Once the user has chosen from the list of available databases, pressing the **Run Demo** button will start the *Mirage* application with the desired database.

When running the software directly from the command line, the database is chosen by specifying the configuration file to be loaded. Basically, a different configuration file should be associated with each database to be viewed using the *Mirage* application. The contents of these configuration files will be discussed under section 7.3.2.

Figure 15. Military Databases Selection Window

7.2.3 GUI OPERATIONS

When the ***Mirage*** software starts, a small window appears which displays the word ***Mirage*** across the top. When the graphical window appears, this GUI is covered. In order to display the ***Mirage*** GUI, simply press function key 9 (F9) twice. Once the GUI appears, there are a number of options available. The buttons indicate the current state of the ***Mirage*** system. In order to hide this panel, simply move the cursor into the graphical window and press (F9). Once you have hidden the GUI, pressing the (F9) key will toggle between displaying and hiding the GUI.

7.2.4 CHANGING SCALE

The ***Mirage*** software allows the user to select a scale for the models which is appropriate for the viewer. This gives the effect of the model becoming either smaller or larger with respect to the viewer. This scale represents a factor relating the actual distance from the center of the table to the virtual distance from the objects in the virtual world. The scale factor may be (and probably should be) specified in the configuration file associated with a particular database. This allows the user to set the starting scale factor, but it is advantageous to change this scale factor interactively to improve viewing.

The scale factor may be modified interactively by using the SpaceBall^{tm}. By pulling up on the SpaceBall^{tm} in **ZOOM** mode, the scale factor is increased, while pressing down causes the scale factor to decrease. This causes the viewpoint to appear to move either closer to or farther away from object displayed on the table.

7.2.5 TRAVERSING A DATABASE

An initial viewpoint may be set in the configuration file for a particular database but during operation this may be altered interactively using the SpaceBall(tm). If the SpaceBall(tm) is oriented correctly with respect to the table, then in PAN and Z modes (described in section 7.4.2)the viewpoint will move in the direction indicated by the movement of the SpaceBall(tm).

7.2.6 EXITING

There are two methods for exiting the ***Mirage*** software. The quickest method involves simply pressing the escape key (ESC) while the cursor is located in the graphical window. The second method involves pressing the Quit button on the GUI panel (this usually will require the user to first press F9 in order to display the panel).

7.3 EXTENDED FEATURES

7.3.1 ENTITY SERVICES

Entity Services provides the Mirage software with a link to the DIS world. While the actual Entity Services application runs separately from the Mirage software, a link between the two exists to allow the interchange of information. Basically, Entity Services handles all of the networking and dead reckoning associated with a DIS exercise, the Mirage software then obtains a list of active entities which must be interpreted in order to display appropriate models for the entities involved in a simulation. If DIS is never selected as active in the Mirage software, Entity Services is not required to be running; however, if the DIS active button is pressed and Entity Services is not running, the software will crash.

If the **demo** script is used to start the software, Entity Services will be started and stopped automatically. If the ***Mirage*** software is started from the command line, Entity Services must be started in a separate shell before DIS may be made active. In order to achieve this, the command

entityServ eserv.cfg

must be entered at the command line. This will start Entity Services with the options specified by the configuration file (eserv.cfg).

Entity Services was originally designed to provide DIS information for several applications running on the same physical host. Due to limitations in the operating system, only one application may receive information from a particular UDP broadcast port. In some cases, several applications may desire a connection to DIS traffic. In order to provide this capability, Entity Services was written to provide DIS information to a number of clients running on the host machine. When a client application logs on to Entity Services to receive DIS information, a new shared memory communications channel is opened and prepared for use by this new client. Entity Services uses a set of configurable shared memory keys to track these different client channels.

7.3.1.1 ENTITY SERVICES CONFIGURATION

The Entity Service requires a configuration file in order to operate. In most cases, the three shared memory key entries should be left as the defaults shown in the sample file. The configuration file has six variables that can be set:

7.3.1.1.1 ***eservHz n***

where n is the number of times per second that the Service should process entities and miscellaneous information.

7.3.1.1.2 ***port n***

where n is the UDP port number to use for broadcast network communication.

7.3.1.1.3 ***maxClients n***

where n is the maximum number of clients that this service should provide for. In the case of the ***Mirage*** system, n may be set to 1. It is unlikely that more than one client application will be running on the ***Mirage*** host computer at any one time.

7.3.1.1.4 ***smoothing t***

where t is either snapping, linear to indicate which smoothing method to use.

7.3.1.1.5 ***controlShmkey n***

where n is the shared memory key for the control channel.

7.3.1.1.6 ***nextShmkey n***

where n is the first shared memory key to use for client channels (state and miscellaneous)

7.3.1.1.7 ***deltaShmkey n***

where n is the value to add to nextShmkey for each channel after each client logs on (i.e. the difference between successive channel shared memory keys).

7.3.1.1.8 SAMPLE ENTITY SERVICES CONFIGURATION FILE

```
ESERV_CONFIG_FILE
eservHz  40.0
port  3000
maxClients  10
smoothing  linear
controlShmkey  0x00004000
nextShmkey     0x00008000
deltaShmkey    0x00000010
```

Note that the first line (ESERV_CONFIG_FILE) is required. Once a configuration file has been created, the Entity Service is run by using the name of the configuration file as a command-line argument. For example, the command:

entityServ eserv.cfg

will run the Entity Service using a configuration file named eserv.cfg.

7.3.1.2 COORDINATE CONVERSION CONFIGURATION

The coordinate conversions into and out of the DIS standard are conducted within the client application (in this case, ***Mirage***.) However, the idea is for the client interface to perform any necessary conversion prior to the client application receiving the data. This meets the strategic goal of placing conversion responsibility within the client application, and at the same time insulating the client programmer from explicitly performing the conversions.

In order to facilitate the conversions, there must be a configuration file present that contains the necessary information. In the case of ***Mirage***, a file of the name CC.performer.cfg is required with the following entry:

utmOffset <Easting in meters> <Northing in meters> <zone>

The utmOffset represents the UTM origin of the database.

7.3.2 *MIRAGE* CONFIGURATION FILES

In general, there are three directories in the ***Mirage*** execution environment which will contain scripts important to the operation of the software. The script directory contains scripts associated with different databases to be loaded by the software, the DIS directory will contain a several configuration files which link DIS entity type codes to models, and the bin directory will contain other files which are primarily created by the software. There is one configuration file which is loaded every time the software is run. This global configuration file is named ***Mirage***.cfg and may be modified to alter the default state of the ***Mirage*** system. Any modifications in this file will be apparent during any execution of the software regardless of the model specific configuration file chosen. The format of this file is exactly the same as the model specific configuration files; the commands which are understood in these files are listed in Section 7.4.4.

7.3.2.1 MODIFYING START LOCATIONS IN SCRIPTS

The starting viewpoint for a particular database may be set in the script associated with that database. This viewpoint is set in a line similar to the following:

view <x> <y> <z> <h> <p> <r>

In this command, x, y, and z specify the Performer coordinate location of the starting viewpoint. H, p, and r should be set to zero.

Note: H, p, and r would represent heading, pitch, and roll of the viewer. Mirage computes this information based on the tracker position, so these values are only included in the command for completeness.

If a new starting location is desired for an existing database, modifying the view line in the appropriate configuration file will change that databases staring view point. Other accepted commands are listed in Section 7.4.4.

7.3.2.2 ADDING/MODIFYING DATABASES IN SCRIPTS

The database to be loaded by a particular script is specified by the **loadmodel** command. This command has the following format:

loadmodel <x> <y> <z> <h> <p> <r>

In this case, all six of the arguments are used. X, y, and z specify the coordinate position in meters where the model should be placed while h, p, and r specify the desired heading, pitch, and roll of the model respectively. Multiple loadmodel lines may exist in a single configuration file.

Before a database will load properly, the ***Mirage*** software must know where the model and all of its textures are located. Another configuration file command is provided for this functionality. All directories which contain either model files or textures should be specified using the **addpath** command with the following syntax:

addpath <dir1>[:dir2}{:dir3]

While multiple directories may be specified as indicated, multiple addpath entries are allowed and will simply put additional entries in the search path list. In the configuration file, the addpath lines must appear before the loadmodel line. Other accepted commands for this file are found in Section 7.4.4.

7.3.2.3 ASSOCIATING MODELS WITH DIS ENTITY TYPES VIA SCRIPTS

In order to associate a particular model with a DIS enumeration, an information file must be created. The file's name should be relatively descriptive of the type of entity defined by the model and should end with a **".info"** extension. This information file (<model>.info) will contain at least one line with the following entry:

Model <filename>

where filename specifies the Multigen "Flight" format model to be loaded.

Once the information file has been created, a reference to it should be entered in the dismap.cfg file. This file contains an enumeration list of entity types from the DIS standard. The format of each line is described in the header information for the file.
It should be noted that once again, the software must be told where this model and all of its textures are located. Currently the software is configured to search for DIS models in the **models/disModels/models** directory of the ***Mirage*** execution environment. If their are models which the user would like to reference from other directories, simply put addpath lines directory which specify the appropriate directories in the ***Mirage***.cfg file in the script directory.

7.4 SUMMARY OF CONTROL INPUTS

Mirage is controlled through a combination of keyboard, SpaceBalltm, and mouse commands.

7.4.1 KEYBOARD FUNCTION KEYS

In order for keyboard function keys to be recognized, the cursor must be placed somewhere within the ***Mirage*** graphical window.

7.4.1.1 TOGGLE POLYGON/WIREFRAME

The F2 key will toggle between wireframe and shaded modes.

7.4.1,2 TOGGLE TERRAIN FOLLOWING

The F3 key will toggle ***terrain following*** on and off. Terrain following insures that the viewpoint will be centered exactly on the top of any object at the center of the table.

7.4.1.3 TOGGLE GUI PANEL

The F9 key toggles the GUI panel (figure 16) on and off. If the GUI panel is not visible, pressing the F9 key should bring the panel back into view. If multiple presses of the F9 key do not succeed in displaying the panel, either the cursor is not in the graphical window, or another problem exists.

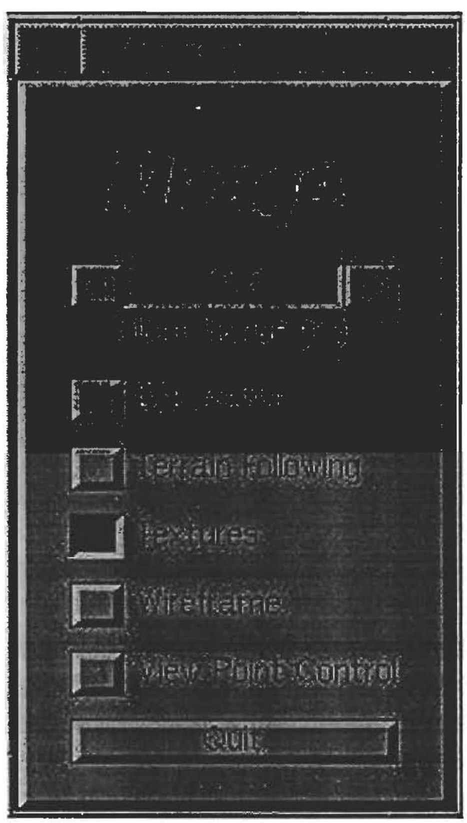


Figure 16. GUI Panel

7.4.1.4 TOGGLE DIS ENTITY SERVICES

The F10 key toggles DIS entities on and off.

7.4.1.5 CALIBRATE HEAD TRACKER

The F12 key calibrates the head tracker. When the F12 key is first pressed, a target (see figure 17) appears at the center of the table. Once this appears, the head tracking receiver located on the left temple of the eyewear should be placed at the center of the target. With the tracker receiver held in place on the target, the F12 key should be pressed again. Once the tracker has been calibrated, it should not be necessary to perform this procedure again unless the table or the source for the tracking equipment is moved.

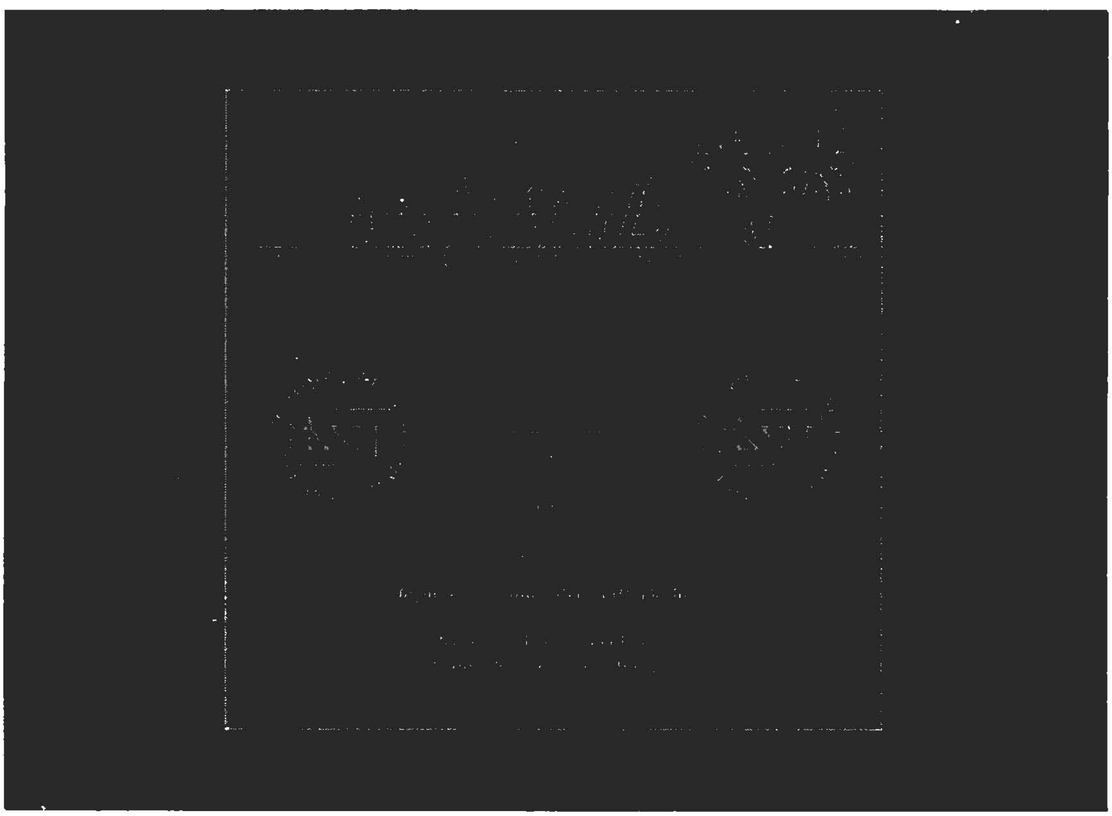


Figure 17. FOB Calibration reticle

7.4.2 SPACEBALL™ COMMANDS

The SpaceBall™ device provides the user with a six degree of freedom input system. The ball may be moved left, right, forward, backward, up, or down and may be twisted about any of these axes. In the ***Mirage*** software, the linear motions of the SpaceBall™ are used to control the viewpoint position and the twisting motions are ignored.

When operating normally the SpaceBall™ beeps the International Morse code signal for the letter 'R' which is " * - *" or "di-dah-dit" when it is initialized. This occurs part of the way through loading of the database for a ***Mirage*** application. Problems with the

SpaceBall^{tm}'s Onyx interface may be signalled by other coded signals. Those familiar with Morse code may be able to read indications such as "CTS" indicating a problem with the "Clear To Send" connection.

The SpaceBall^{tm} is used to manipulate the display in three ways, corresponding to three modes.

1. In **PAN** mode the viewpoint is moved horizontally, in the X and Y dimensions, by applying corresponding horizontal forces to the ball.

2. In **Z** mode the viewpoint is moved vertically, in the Z dimension, by lifting or depressing the ball.

3. In **ZOOM** mode the scale of the image is increased or decreased by lifting or depressing the ball.

7.4.2.1 "SELECT" BUTTON

The select button is located on the back side of the ball itself. This button is operated like a trigger to enter the two most commonly used modes of the SpaceBall^{tm} which are **PAN** and **ZOOM**.

7.4.2.2 SPACEBALL^{TM} FUNCTION BUTTONS

Currently, only one other function button on the SpaceBall^{tm} provides any functionality. The "5" button on the SpaceBall^{tm} puts the device in **Z** mode. **Z** mode allows the user to lift or lower the point of view by pulling up or pushing down on the SpaceBall^{tm}. Changing the Z component of the viewpoint location is not the same as ZOOMING, in which the scale of the image is changed.

Z mode may not be entered while terrain following is enabled. If **Z** mode has been used it to lift or lower the viewpoint it may be found later that the range of the **ZOOM** mode is limited. If this happens, the situation may be cured by toggling the terrain following mode on using keyboard function key F3. This will reset the Z component of the viewpoint so the portion of the database mapped to the center of the image will appear to be at the level of the table top.

Figure 18 shows the state transitions allowed through use of the "5" button and the "SELECT" button

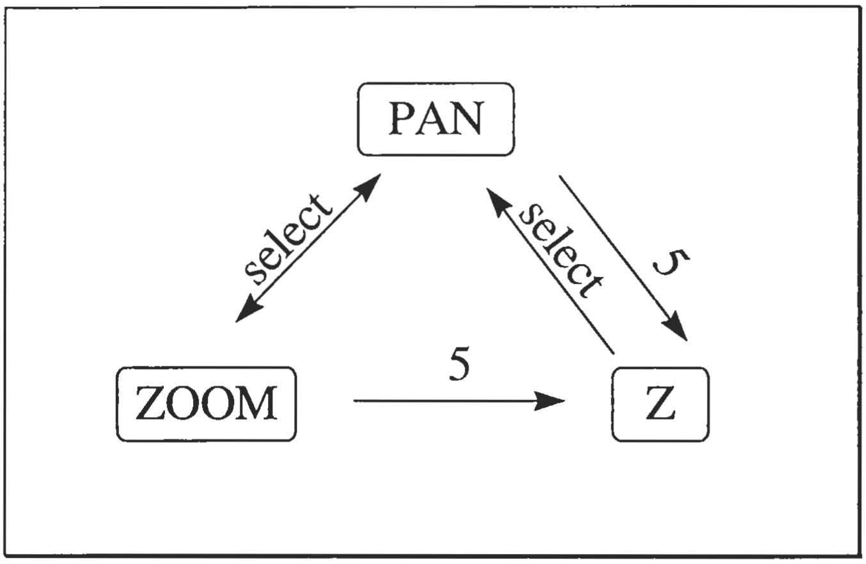


Figure 18. SpaceBall™ Mode State Transitions

7.4.3 MOUSE COMMANDS

In the configuration files, there is a command which allows the ***Mirage*** software to operate without the SpaceBall™. In this case, the mouse may be used to move around the database. The greatest loss of functionality in this case is that the mouse does not allow zooming. By pressing the left mouse button in the graphical window, the viewpoint will move in the direction of the cursor with respect to the center of the screen. This mode is only useful when a SpaceBall™ is unavailable for use.

7.4.4 *MIRAGE* CONFIGURATION FILE COMMANDS

The formats of the global ***Mirage*** configuration file and the model specific files are exactly the same. In most cases, entries in model specific files will override the options indicated in the global file; however, in some cases, a conflict may occur. Not all of these conflicts are documented. These are the available script options and a brief description of their function.

loadmodel <x> <y> <z> <h> <p> <r >
This command loads a model with the specified position and orientation. In general, this command is used to load the terrain to be visualized, but it may be used to load any model for viewing on the table.

addpath <dir1>[:dir2][:dir3]
The addpath command is used to add new directories to the search path used to find models and their associated texture files.

trackers <number of trackers>
The trackers command specifies the number of trackers associated with a tracking device. This should usually be set to 1.

tabletracker <head tracker number>
The tabletracker command specifies which of the trackers should be used to follow the position of the user. If an FOB with six trackers were used and the fifth tracker was located on the users head, this entry would be five. Again, this should usually be set to 1.

texture <texture state 0|1>
This represents the initial state of the graphics on the table. If this is set to zero object will be untextured.

wireframe <wireframe state 0|1>
The initial display state may be set to wireframe using this command.

dis <DIS active 0|1>
Activates or deactivates DIS entities in the ***Mirage*** environment. This should NOT be set to one in the global configuration file.

terrainfollow <terrainfollow active 0|1> [follow height]
If terrain following is set active by this command, the ***Mirage*** software will start with ***terrainfollowing*** active, the second argument to this command is a floating point value specifying a height above the terrain for the viewpoint to follow.

view <x> <y> <z> <h> <p> <r>
The view command is used to set the initial viewpoint for a particular database.

fob <port number>
The fob command specifies that an Ascension FOB is attached to the host computer via a serial cable connected to the serial port indicated by port number.

scalefactor <desired scale>
This indicates the starting scale factor for a particular model. This should be a real number between 0.1 and 100.0.

SpaceBall <SpaceBall active 0|1>
The SpaceBall™ may be set inactive causing the viewpoint to be moved by the mouse. This is only useful in the case where a SpaceBall™ is not connected to the host computer. ***Active*** is indicated by 1. ***Inactive*** is indicated by 0.

8. TROUBLESHOOTING

8.1 HARDWARE PROBLEMS

Symptoms	Possible Causes	Solution
"No Sync" message on Table	Distribution Amp Off	Turn on the Distribution Amplifier
	Onyx Booting	Wait for Onyx to finish booting
	Onyx Off	Turn Power on (see previous entry)
Image does not respond to tracker movement	FOB Off	Stop ***Mirage*** application, turn power on for the FOB, restart ***Mirage*** application.
	FOB Saturated	Stop ***Mirage*** application, turn off FOB, wait 15 seconds, turn power back on for FOB, restart ***Mirage*** application
Two images appear on table when CrystalEyes2tm eyewear is worn	Emitter power is off	Check for red light on emitter box, if it is off, check cable connections and power
	Eyewear Off	Check that the left temple of the eyewear is fully extended
	Eyewear Battery Low	Replace batteries in eyewear
Projector does not display an image	Projector in Standby Mode	Press standby button on remote control
	Projector Off	Press power button on remote control
Projector Image fuzzy	Calibration is off	Follow calibration instructions for the projector
SpaceBall^{tm} does not respond	Cursor out of window	Move the cursor into the graphics window (not on top of the GUI)
	SpaceBall^{tm} power off	Be sure that the SpaceBall^{tm} is plugged in and that power is supplied.
	SpaceBall^{tm} not plugged in to computer	Check cable connections to the host computer

8.2 SOFTWARE PROBLEMS

Symptoms	Possible Causes	Solution
Image does not respond to tracker movement	FOB Off	Stop ***Mirage*** application, turn power on for the FOB, restart ***Mirage*** application.
	FOB Saturated	Stop ***Mirage*** application, turn off FOB, wait 15 seconds, turn power back on for FOB, restart ***Mirage*** application
Pressing Quit on the ***Mirage*** demonstration software does not work	Database list is still displayed	First press quit on the open database list
Keyboard does not respond	Cursor outside of window	Move cursor into the graphics window
	Cursor over GUI	Move cursor off of the GUI and into the graphics window
	Keyboard unplugged	Check keyboard cables
SpaceBall^{tm} does not respond	Cursor out of window	Move cursor into the graphics window (not on top of the GUI)
	SpaceBall^{tm} power off	Be sure that the SpaceBall^{tm} is plugged in and that power is supplied.
	SpaceBall^{tm} not plugged into computer	Check cable connections to the host computer
Delayed response	System overloaded by other processes	Check that no one else is using the machine for background processes
	Old processes still running	Check that the software is not running twice on the machine
	Lack of temporary disk space	Delete any files of the name pfDataPool* in /usr/tmp
	Too many shared memory segments	Exit ***Mirage*** application and type **ipcs** to check shared memory segments, if there are many entries listed, use **iprm** to remove them.
No Stereo	Monitor not in proper mode	If the demo script was not used, the /usr/gfx/setmon commands from the script must be executed to put the display in the proper mode
Scene leans left or right	Tracking System may be miscalibrated	Follow calibration procedure to recalibrate tracking system
	Magnetic field distorted	Still under investigation

9. SOFTWARE AND DATABASES DELIVERED

This section lists all files delivered under the contract.

9.1 EXECUTABLES

Mirage
MirageDemo
entityServ

9.2 CONFIGURATION FILES

Mirage.cfg
quantico.cfg
hunter.cfg
range400.cfg
walkthrough.cfg
eserv.cfg
table.cfg

9.3 TERRAIN DATABASES

Fort Hunter Liggett	Used in I/ITSEC DIS Demonstrations 1993-95
Range 400	
Quantico Training Village	Derived from NAWCTSD/USMC TTES Project
ARI Building Walkthrough	Central Florida Research Park Research Pavilion (former home of IST)

9.4 MODELS

a10.flt	f117.flt	m3.flt
ah1.flt	f14.flt	m35.flt
ah64.flt	f15.flt	m577.flt
ah64rotor.flt	f16.flt	m9tx.flt
alfa.flt	f18.flt	mig21.flt
atf.flt	f22.flt	mig27.flt
av8b.flt	f23.flt	mig29.flt
avlbtx.flt	f5.flt	missile.flt
b52.flt	frigate.flt	oh58d.flt
bmp.flt	frigate2.flt	rah66.flt
bomb.flt	hellfire.flt	sa6.flt
breachertx.flt	hemtt.flt	sa9.flt
btr60.flt	hind.flt	stealth_box.flt
carrier2.flt	hindan.flt	su25.flt
ch47.flt	howitzer.flt	t62.flt
chinook.flt	hummv.flt	t72.flt
cobrahit.flt	m1.flt	typhoon.flt
dallas.flt	m113.flt	uh60.flt
e2cM.flt	m1tx.flt	v22_new.flt
efa.flt	m2.flt	zsu23.flt

9.5 SGI SYSTEM SOFTWARE

IRIX Version 6.4
Performer Version 2.1
Developer's Environment Version 7.1

10. BIBLIOGRAPHY

[ASCE1994] "The Extended Range Transmitter", Supplement to The Flock of Birds^{tm} Installation and Operation Guide, Ascension Technology Corporation, March 12, 1994.

[ASCE1996] "The Flock of Birds - Position and Orientation Measurement System Installation and Operation Guide", Ascension Technology Corporation, 22 June 1996.

[ELEC1996] "Marquee 8111 User's Manual", Electrohome Projection Systems, 1996.

[ISTTR9613] Smith, S.H., "'MIRAGE": IST's Virtual Sandtable", *Technical Report IST-TR-96-13*, Institute for Simulation and Training, University of Central Florida, February 1996, 14 pages.

[SMIT1996] Smith, S.H, and Garnsey, M., "Mirage - A New Kind of Visualization Tool", *Proceedings of the 18th Interservice/Industry Training Systems and Education Conference*, Orlando FL, December 2-5, 1996, on CDROM.

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