RAGE Operations Manual

version 4.5.5

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Introduction

The Real-Time Advanced Graphics Engine (RAGE) is a Government off-the-shelf (GOTS) software suite from White Sands Missile Range (WSMR). RAGE provides end users, including Drone/UAV Controllers, Flight Safety Officers, Mission Planners, and Operations Personnel, with real-time situational awareness tools. RAGE is an interactive environment between the user and data. It allows for mission planning, rehearsal, live/virtual testing, post-testing playback, simulation, AVI creation, and live video feeds with user controlled manipulation. RAGE is built on “plug-in” type architecture. Users are allowed and encouraged to create plug-ins to help RAGE adapt to the user specific needs. Standard interfaces allow for simple integration with existing systems. RAGE also interfaces to the Fully Integrated Remote Enabled Camera Management (FIRECAM) software suite. FIRECAM is a full suite of streaming video, viewing, recording, switching, and system control hardware software. RAGE utilizes the latest technology in computer rendering, algorithms, and hardware. RAGE is a powerful tool and can be used and adapted to many applications. It is constantly being enhanced to provide additional capabilities. For information on how RAGE can benefit your application(s), contact the principal point of contact (POC) on the front cover of this manual.

RAGE is FREE to all United States Military Service and there are NO license fees associated with RAGE. RAGE has a Certificate of Net worthiness (CON), Cert-201007220, that falls under the ATEC umbrella. RAGE may be populated on as many machines as needed at NO extra cost. There are NO distribution fees. RAGE updates are sent out to users who register. Registering requires a POC, division, address, and phone number. Registering and updates are FREE. Please see front cover for principal POC.

System Requirements

RAGE will run on a computer or laptop with a minimum of two processors or two cores. Below is the minimum configuration for a system:

- CPU: 2.0 MHz dual core (Intel or AMD)
- GPU: Series 6 to present cards
- Memory: 2 GB preferred
- Hard Drive: 1 GB for RAGE - Terrains Database: 4 GB - default sample database

- Other databases are available. This will require more hard drive space than the default sample database. The databases can be anywhere between 10 and 105 GB and are transported to the install computer on a portable hard drive.

Optional Equipment/Software

- Microsoft Windows compatible USB joystick (user obtained or purchased through POC on front of cover)
- FIRECAM Suite software (free of cost, CON Cert-201007226)
- Universal Player software (free of cost, folded in RAGE)
- Test Data Optimal Processor software (TDOP) (free of cost)
- High-Speed Massive Memory Digital Recorder software (HSMM) (free of cost, folded into FIRECAM Suite)

Capabilities

- User created plug-ins for RAGE
- Real-time data input rates from less than 1 Hz to greater than 60 Hz
- 0.3 m-1 km satellite/aircraft imagery – pre-processed
- Multiple Digital Terrain Elevation resolution support
- Multiple Digital Ortho-rectified databases with high-resolution insets
- Full Earth background of up to 0.5 m imagery
- Model insertion with active sensor display corrected to real world model orientation and/or live gimbal input
- 3-D translucent field-of-view (FOV) rendering for sensor/transmitter volume (radar, cameras, jammers, communication systems, IDE)
- 3-D omni-directional sensors and regions of interest (ground/air)
- Real-time video augmented in the virtual scene
- Fully configurable Graphical User Interface (GUI)

- History trails (ground/air) to show moving data
- Free flight using industry standard flight-stick or GUI navigation buttons
- Real-time data input via Ethernet
- Sensor/transmitter FOV displays are updated independently in real-time
- Display of multiple target/test article parameters, including altitude, speed, heading, fuel, ailerons, rudder, elevator position, and landing gear
- Free-flight model attached and static look point FOV with support for on the fly changes
- Independent screen capture of full or 3-D display window
- Real-time line-of-sight (LOS) validation, plot profile, Fresnel calculation, editing, and file save capability
- Full KML and XML layers capabilities
- Active threat or engagement volume/corridor penetration signaled by user-defined color changes
- Real-time recording capability – through Universal Player
- Full mission scenario playback – through Universal Player
- Phased array radar configuration and setup
- Real-time position analysis and remote trigger operations
- Laser/flight corridor prediction analysis
- Radar planning
- Google Earth satellite imagery cache capable and usable as a standalone or online feature
- Complete 3-D model and landscape support. Examples: .3ds, .ac, .bsp, .dae, .dw, .dxf, .fbx, .gem, .iv, .ive, .logo, .lwo, .lws, .md2, .obj, .ogr, .flt, .osg, .shp, .stl, .wrl, .x

Real-Time Inputs

RAGE is capable of supporting 60,000 inputs a second from numerous sources including:

- Radar
- Telemetry
- GPS
- Optics mounts
- Sensor fused
- Drone/UAV data
- Simulation
- Real-time video
- Detection devices
- Gimbal feeds
- User-defined feeds through plug-in system

Basic Operation Overview

RAGE is designed to receive inputs from various sources and display these sources in real-time. Whether the sources are outputting a 1 or 60 Hz signal, RAGE will display it. RAGE receives these inputs through the onboard Network Interface Card (NIC) or other sources through custom plug-ins. The built-in network configuration in RAGE allows the user to set up various ports and types of data packets being received. RAGE will *listen* to these ports for the specific packet type being sent and display them in a 3-D viewing window.

The 3-D viewing window allows the user to see the data being received. The user can maneuver about the 3-D window by using the on-screen navigation buttons, mouse control, or with a standard USB joystick. Using the 3-D window allows for a situational type of environment where in the event data is lost or not projected properly, the user can easily identify it and make corrections.

Incoming data may also have 3-D models associated with it. This is done through the model configuration screen. The models can be set according to different types of data being received. Internal models are tracked through Distributed Interactive Simulation (DIS) protocol, but can be identified externally in the protocol desired by the user. An example might be two aircraft, an F-15 and the other an Apache helicopter. Both might be tracked from a radar system, each with their own identifier. It is this identifier that the model configuration will use to send the proper model. Models and sensor volumes may also be added to the 3-D window by the user.

The user has the capability to add 3-D models and sensor volumes to the 3-D window. Using the Track and Sensor tools, the user can manipulate these features on the fly. Sensor volumes also give feedback in the form of color changes based on a state change triggered by the data received in RAGE. Some sensors are also controllable by the user in the form of video cameras.

Real-time LOS is available in user configurable parameters. The user can analyze distances between points and view obscurations and outputting measurements in various reference forms. The user also has the option to view a 360 degree LOS scan of an area of interest. Adjustments to the parameters table for grid size, sample distance, source/destination offset, and altitude offset are available.

Fresnel calculations are also available under the real-time LOS tool. A parameters window allows for Fresnel zone (1-3), iterations, RF frequency, and power loss. A calculation progress bar is visible and calculation memory overrun protection is default.

RAGE can receive live video feeds directly through the built-in plug-in system. The plug-ins can also be created by the users to utilize RAGE for their own application. RAGE comes with a variety of pre-built plug-ins that are ready to use. The plug-ins are continuously being expanded by the RAGE development team and the user base. The video camera and their associated pan & tilts (P/Ts) can be controlled through RAGE using a standard USB joystick. Using the joystick in Plug-in Control mode allows the user to attach to the camera, control the camera features, and drive the camera mount to look at certain areas of interest.

RAGE is a powerful tool and can be used and adapted to many applications. It is constantly being enhanced to provide additional capabilities.

Opening Screen Overview

The RAGE opening screen illustrated in Figure 1 provides the user with two options: Configure or Start. Select [Configure] to access RAGE configuration. Configuration will allow the user to verify, add, delete, and update information for RAGE. Select [Start] to launch the actual RAGE application.

FIGURE 1, RAGE OPENING SCREEN

Debug/Status Window Overview

The debug window, illustrated in Figure 2, runs in the background on a separate screen. This window is used for monitoring what RAGE is doing and is a good tool for identifying what operations RAGE is performing at run time. The window can be used to assist the user if operations are not occurring as expected. Various information flows within this window. The window will display initial configuration loading to data packet information being received. When a problem is found, the debug window will display an error on loading. Where errors are not clear, some operations will output status messages so that the user can refer to the current health status to determine if data is not as expected (thus in error).

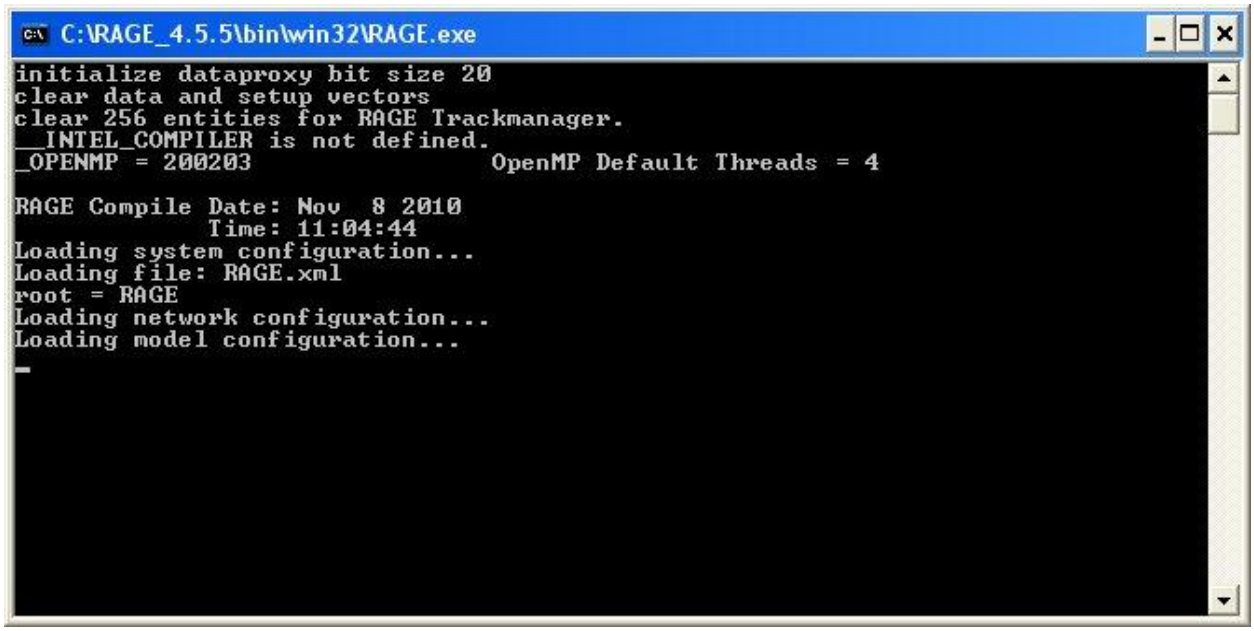


FIGURE 2, RAGE DEBUG/STATUS WINDOW

Configuration Overview

By selecting the Configure button on the opening screen, the following window will appear (Figure 3). Here the user has control of the configuration that RAGE will use while it is running. The user can make changes to the configuration and send the updates to RAGE while it is running. There is no need to shut down RAGE for most configuration changes. From this window, various aspects of the system configuration can be accessed. The configuration GUI, like the rest of the RAGE program, uses tabs on the side of the windows to navigate to different areas. The configuration window consists of three tabs: System, Network, and Models.

The **System** tab (Figure 3) is the main default window for configuration. This window contains all of the core options for setting up RAGE. The user must use the mouse and click on the "+" next to the word RAGE to expand the tree.

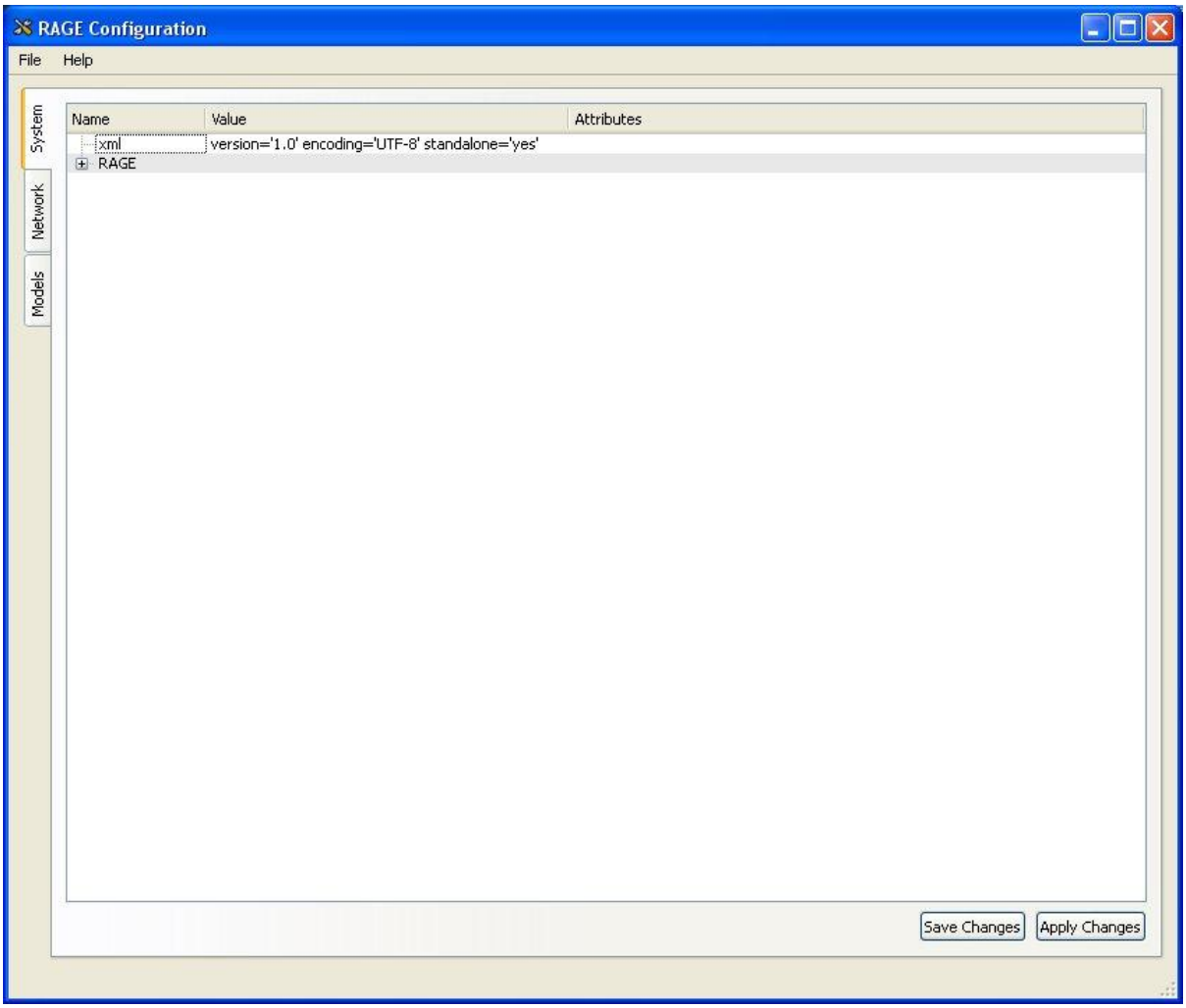


FIGURE 3, RAGE CONFIGURATION WINDOW

Expanding the tree now shows all the different main options that are available to the user. By selecting each “+” and expanding its tree, more in-depth options will be available for configuring (Figure 4).

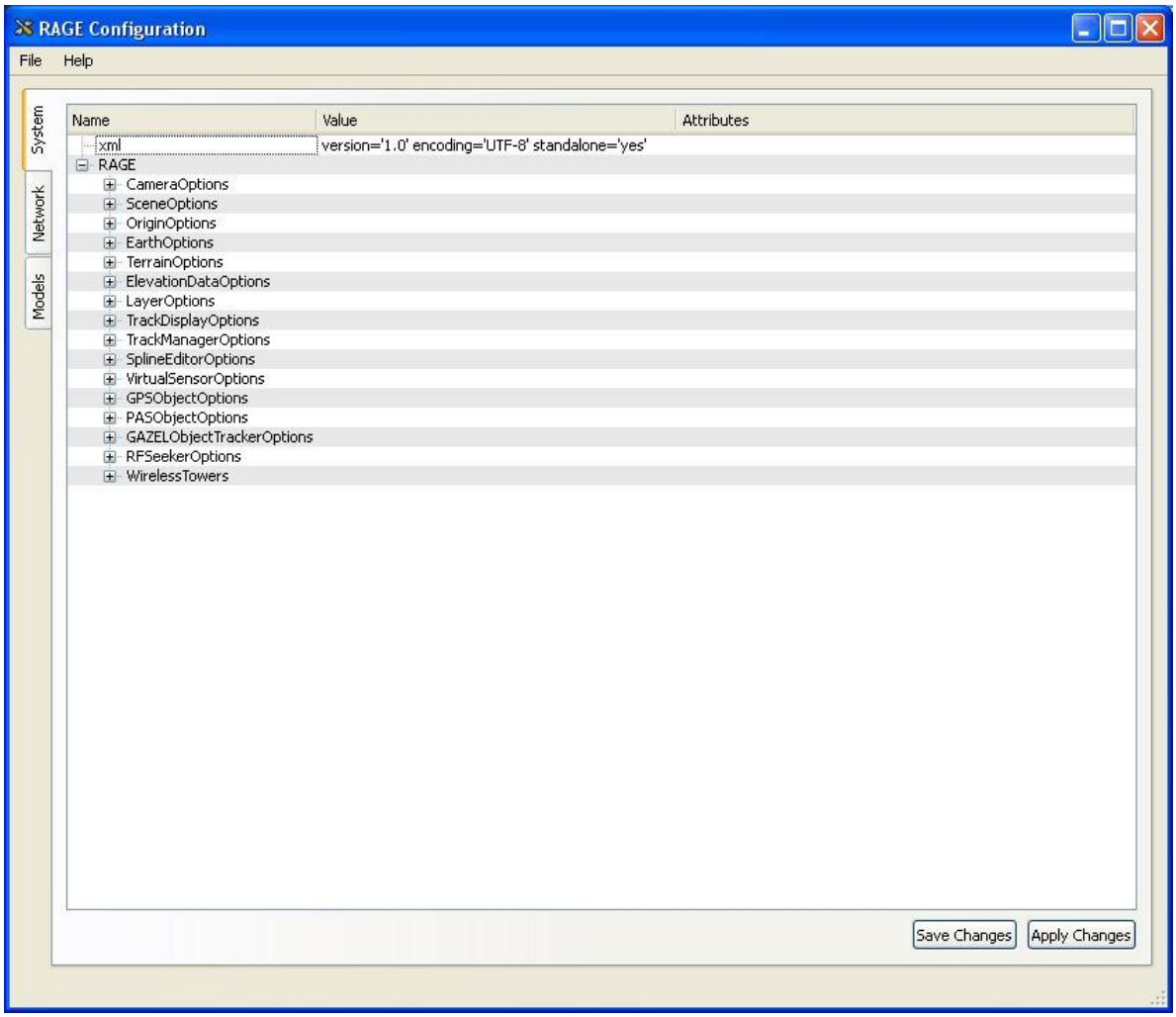


FIGURE 4, CLICK THE + TO EXPAND THE OPTIONS

The **Network** tab (Figure 5) is used to configure the data flowing into RAGE from the source. RAGE uses this configuration for *listening* to the different ports. The name block is used to set up the type of packet information being received from the source. RAGE comes installed with several built-in packet receivers. The plug-in for the corresponding network name must be added to the Plug-in Explorer. Figure 5 shows several sources available. These and others will be discussed in further detail in this documentation under Network Configuration.

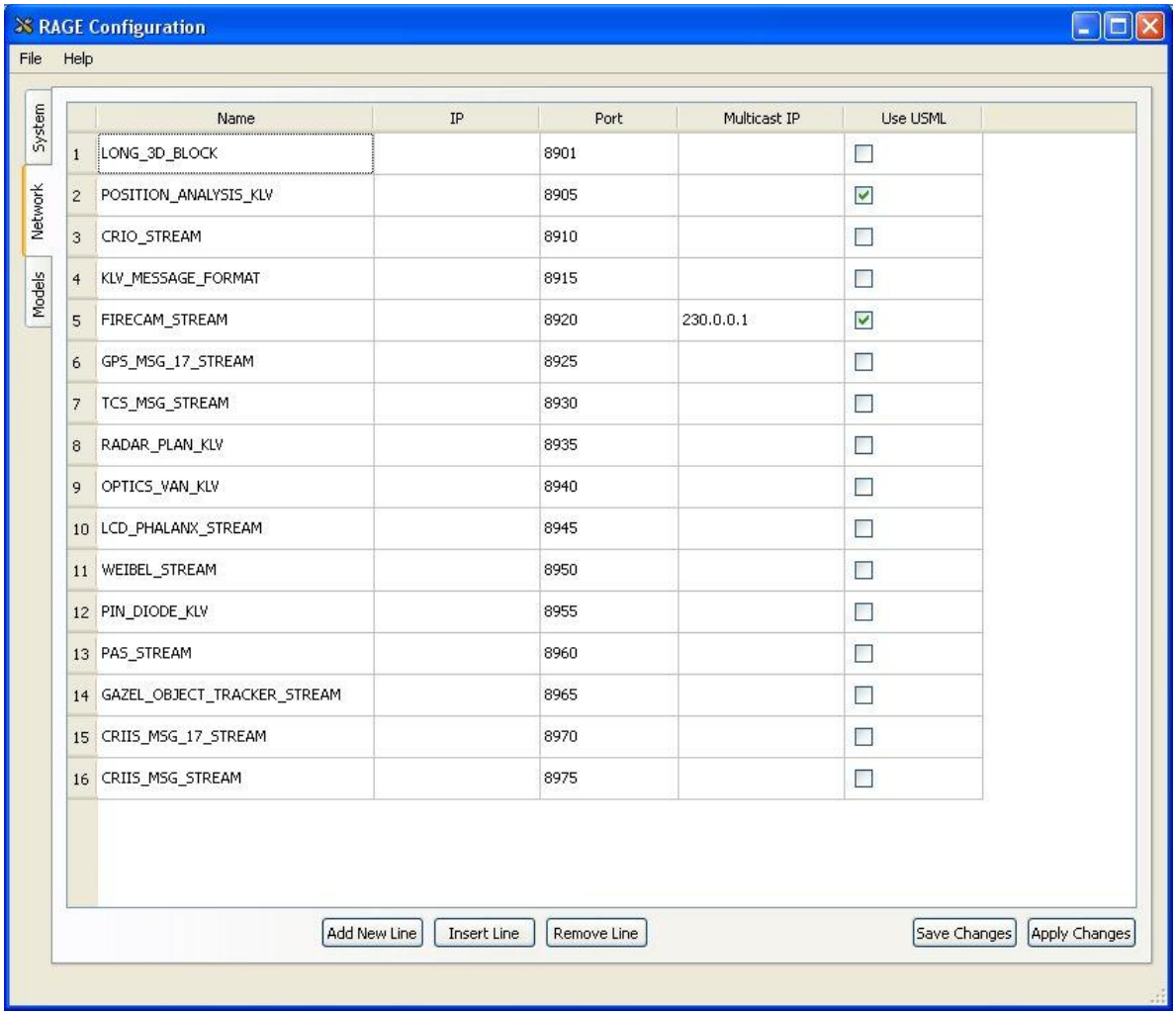


FIGURE 5, RAGE CONFIGURATION NETWORK TAB

The **Models** tab (Figure 6) is used to configure various 3-D models for association with incoming data. There are two windows within the Model tab – the models section and DIS Type Association. These two windows work together as one. The DIS type window sets up the model alias based on the information received from the source (e.g., radar, simulator). This in turn is handed off to the models section. The model alias from the DIS type is matched with the alias in the models section. Depending on what the alias is, the proper 3-D model file loads from the data directory. There are numerous models furnished in RAGE for the user. All the models can be found under RAGE 4.5\Data\Models\directory. If you don't see a model you need, contact the POC on the front of the manual to inquire about a specific model in the inventory.

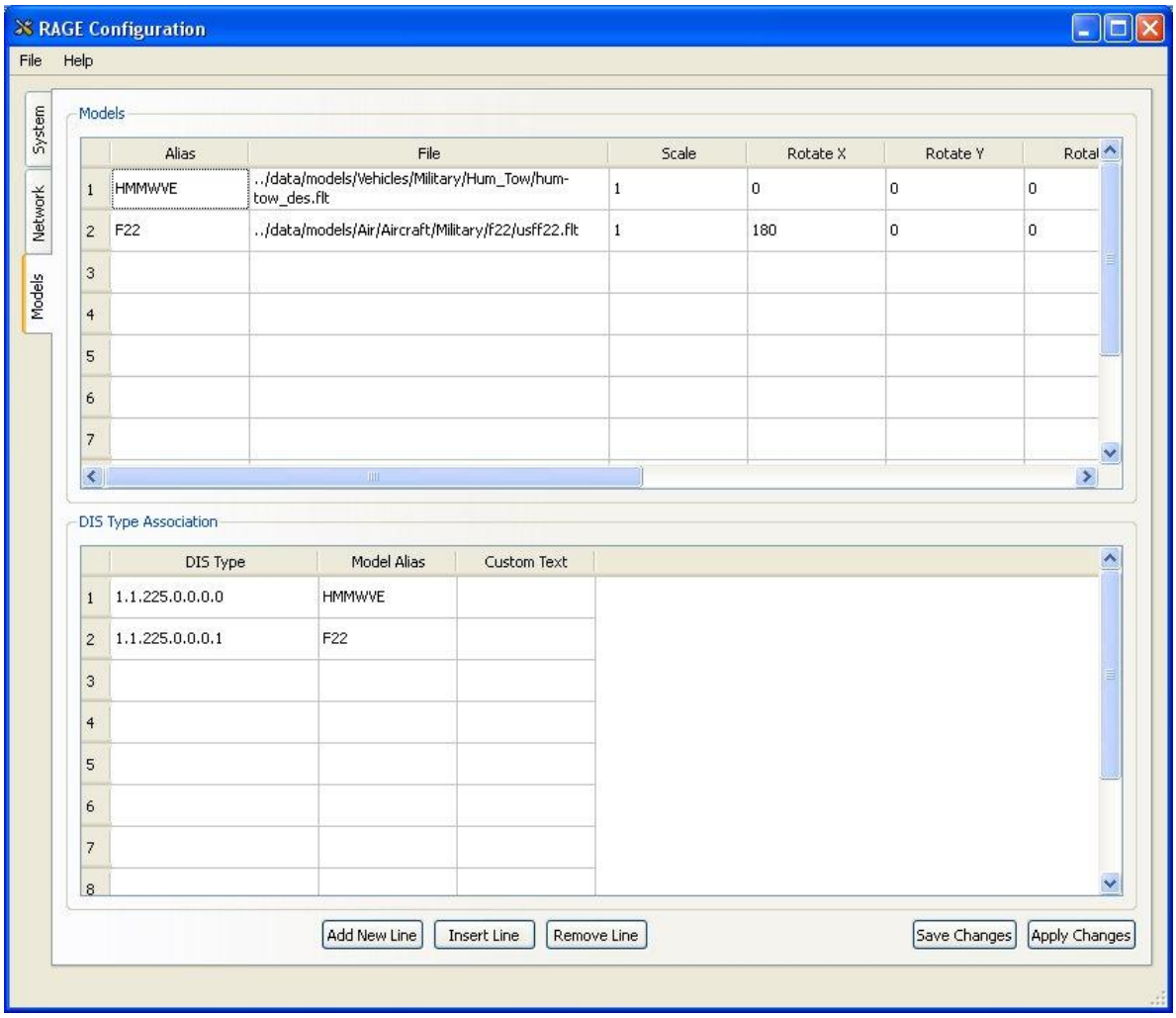


FIGURE 6, MODELS TAB

Start Window Overview

By selecting the Start button on the opening screen, the main RAGE 3-D run time window will appear (Figure 7). Here the user will use the various window tabs down the side, icons on the toolbar, mouse, keyboard, joystick, and menus to operate and control RAGE. The window is divided into two sections – the 3-D viewing window and the tabs down the left side of the screen. The 3-D viewing window displays all the data coming into the system and user setup information. This data can include inputs from all tracking sources, including pointing data from field mounts or cameras. User setup information can be sensor volumes, layers, etc. The tabs allow for different functionality in the 3-D window and quick access to information. The icons on the toolbar offer the user operation and setup functions for the 3-D window. The icons are the most common tools used in conjunction with the 3-D window.

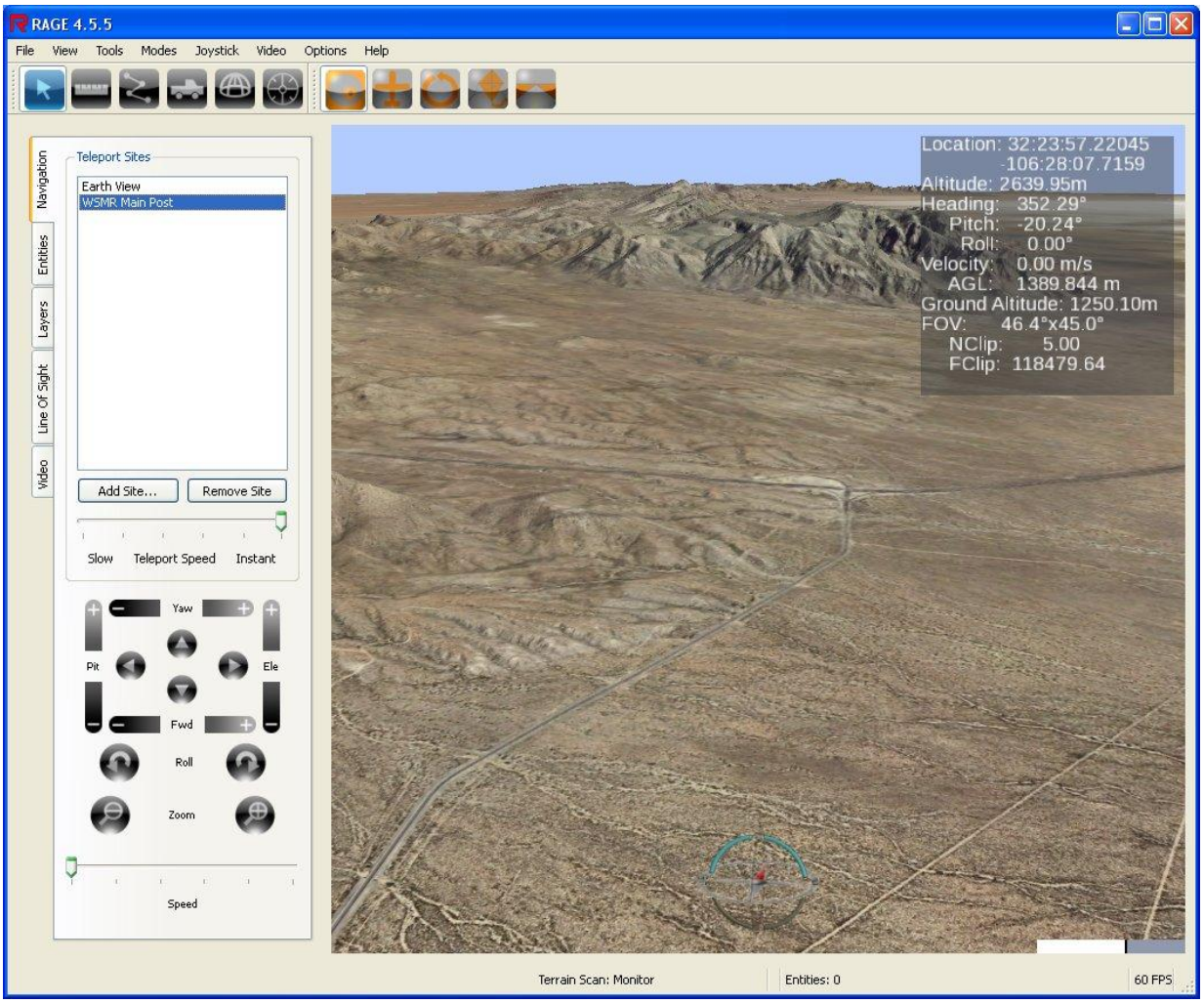


FIGURE 7, MAIN 3-D RAGE RUNTIME WINDOW

The Icon Tools (Figure 8) allow various tasks, such as quick annotations for mission planning, distance measurements, simulation, and hardware calibration. The Icon Tools are selectable from *Tools* on the Menu Bar or by selecting the appropriate tool from the main window's Icon Tool Bar.

FIGURE 8, ICON TOOLS

Tab Windows Overview

The **Navigation** tab (Figure 9) allows the user to move around inside the 3-D viewing window and create teleport sites. Selecting these sites will transport the user to the exact position stored when created. There is a teleport speed indicator that allows the user to set the speed at which the transport to the site is performed. The navigation buttons allow the user to move around in the 3-D viewing window by selecting the various controls. The speed indicator at the bottom is adjustable to allow for faster response in the 3-D viewing window.

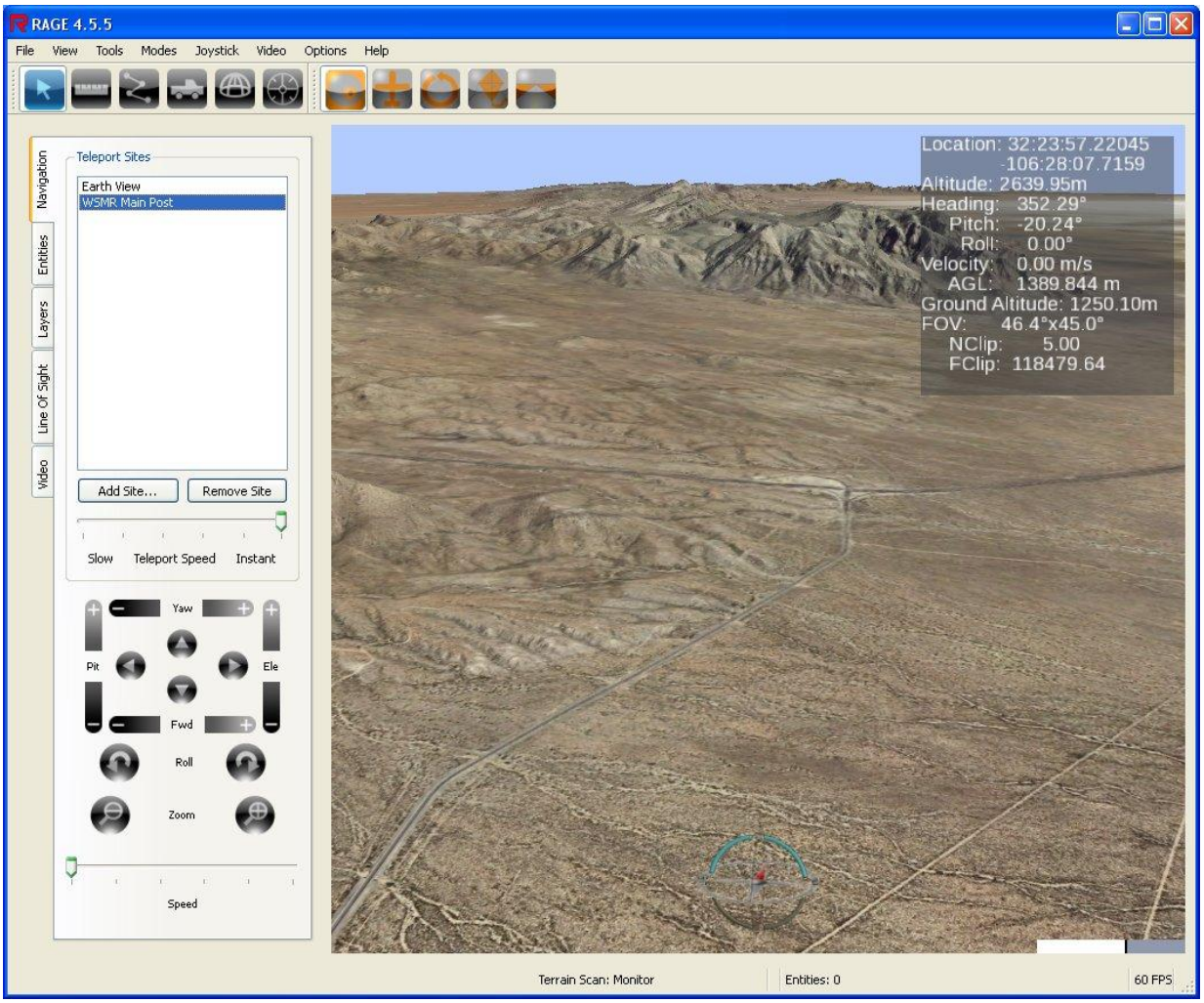


FIGURE 9, NAVIGATION TAB

The **Entities** tab (Figure 10) displays information on the incoming data. The user is able to select a given entity track and retrieve or control the information about the track. By selecting a given entity track and right clicking with the mouse, an action window menu will be displayed giving the user several options (Figure 11).

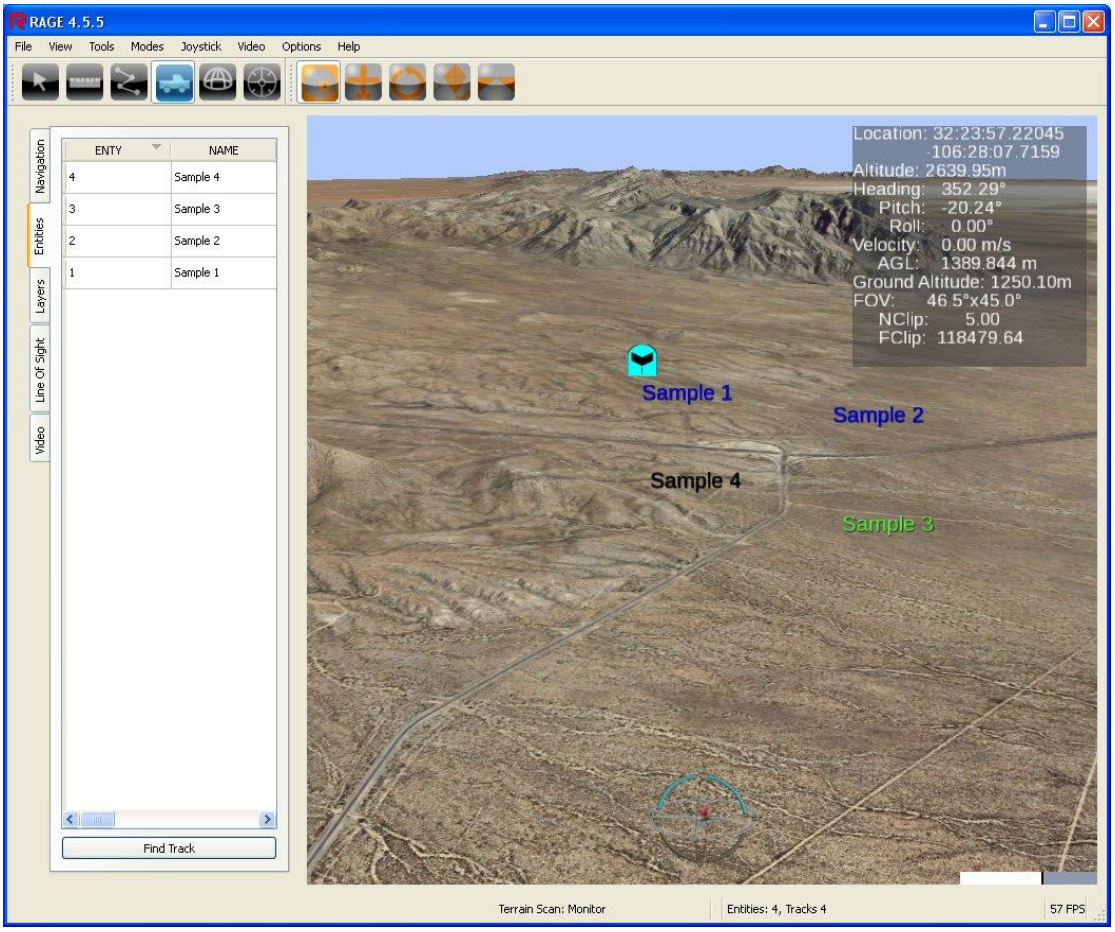


FIGURE 10, ENTITIES TAB

FIGURE 11, ENTITIES ACTION MENU OPTIONS

The **Layers** tab (Figure 12) enables various levels of boundary information to be displayed. Layers support standard KML and XML format. Layers can be created on the fly by using the Path Tool under Tools or imported from a spreadsheet through a Layer Converter Tool supplied in RAGE. These layers can be enabled or disabled by a check box in real-time.

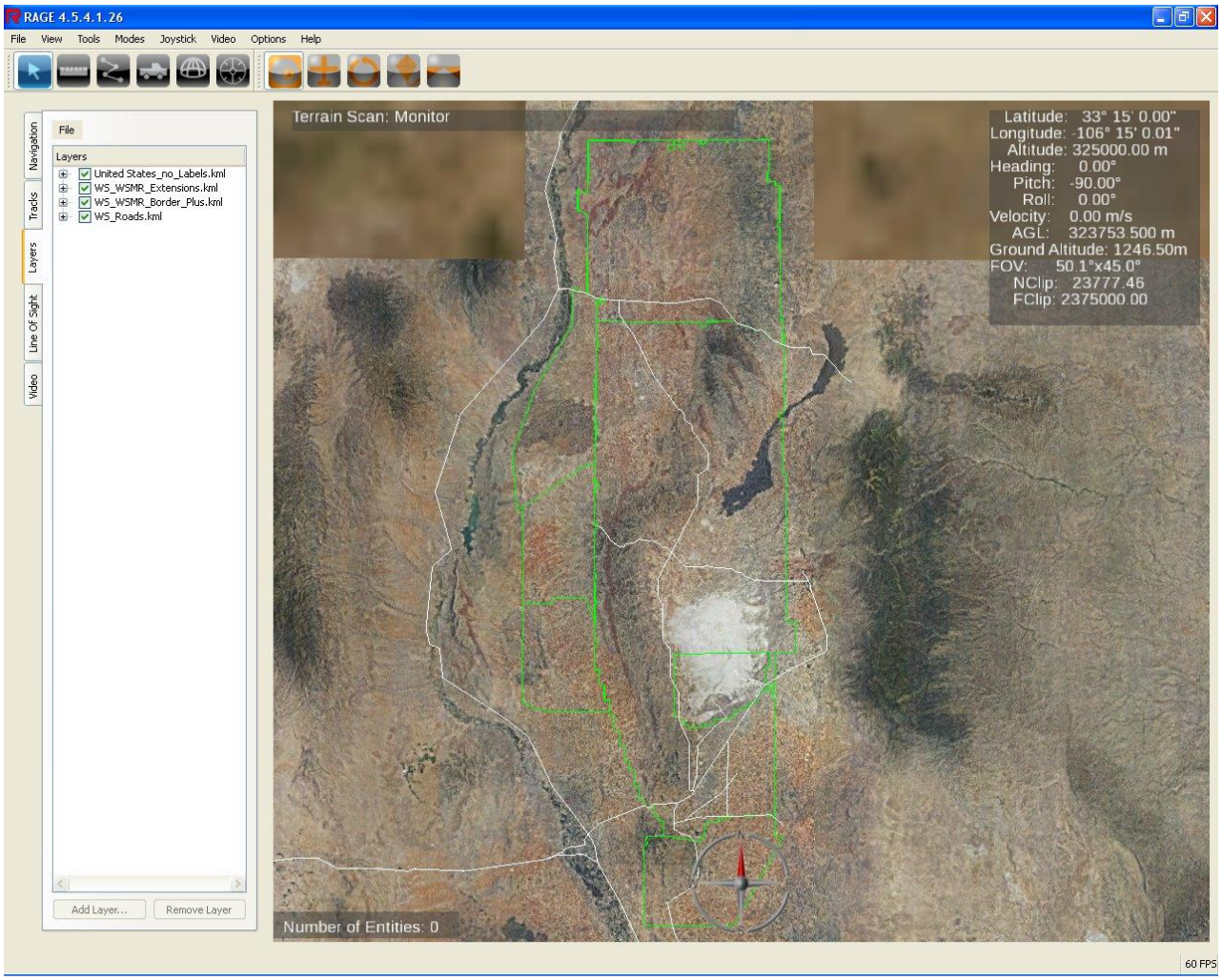


FIGURE 12, LAYERS TAB

The **Line Of Sight (LOS)** tab (Figure 13) used in conjunction with the Measurement Tool allows for measurements to be made from a point-to-point base and saved to a file. This information can be displayed in various reference forms. Measurement profiles are available for analysis by adding the measurement and selecting them from the LOS tab. Multiple measurements can be displayed at once for comparison. Color changes for obscuration versus clear LOS are also displayed. A LOS 360 degree grid can be generated on the fly from a point for a quick look analysis. These grids can also be edited and saved to a file. Accurate position information is displayed in the 3-D viewing window and can be enabled or disabled. Selected LOS from the tab window is automatically highlighted in the 3-D viewing window. A LOS action window menu allows the user to manipulate how the measurement lines will be displayed (Figure 14).

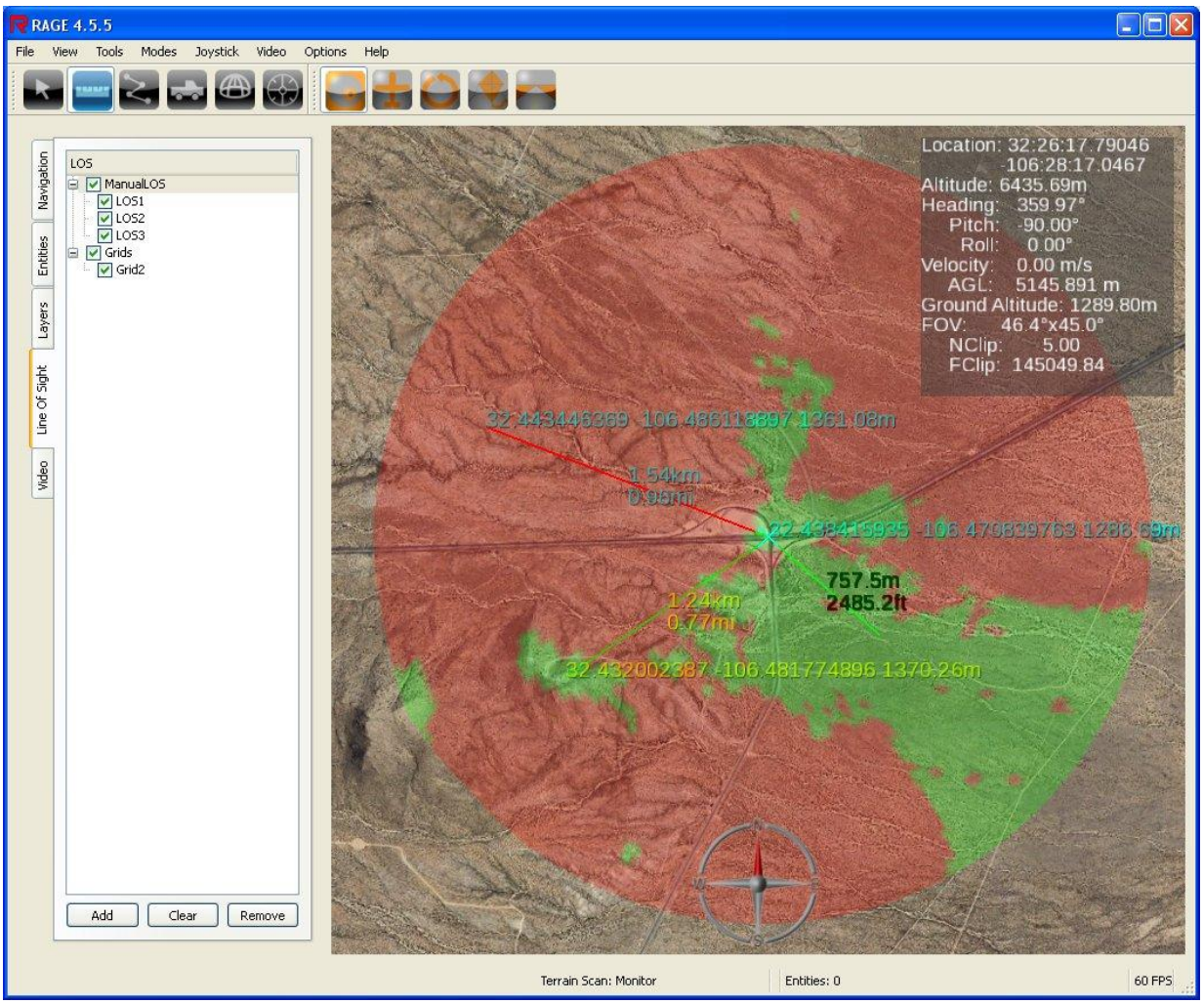


FIGURE 13, LINE OF SIGHT

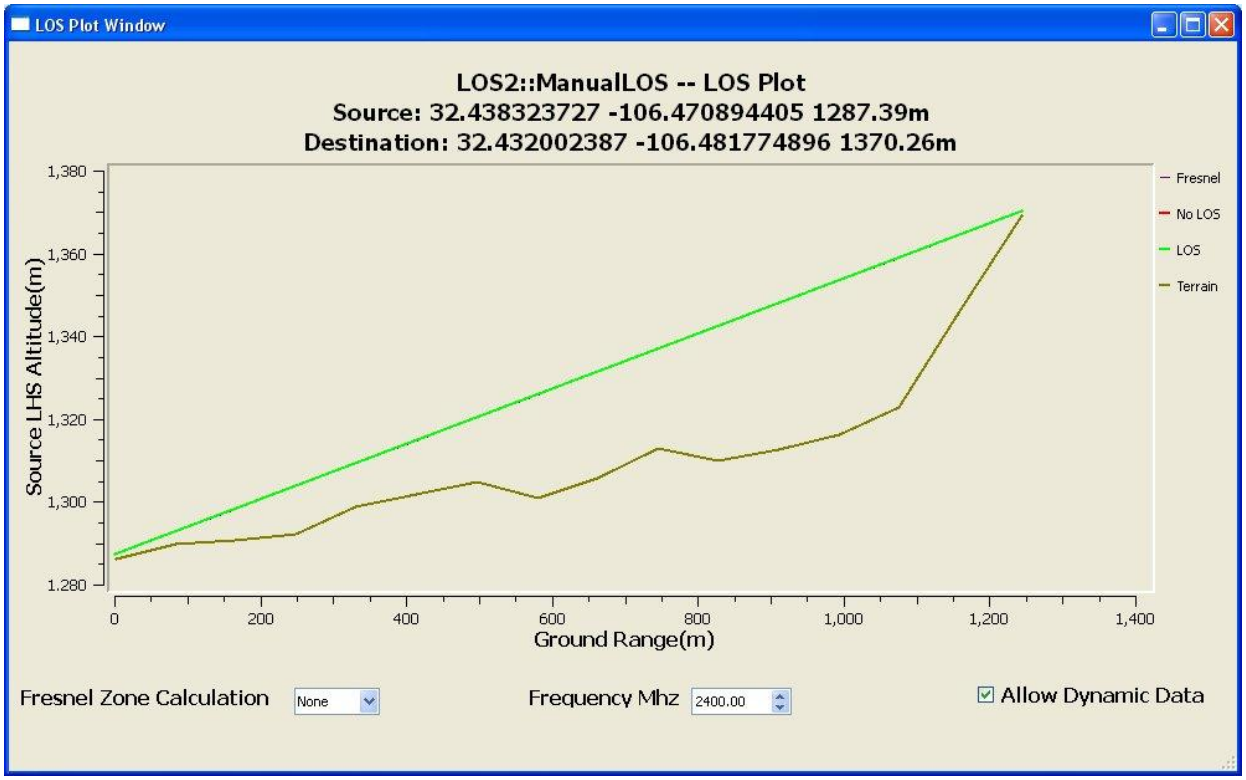


FIGURE 14, LINE OF SIGHT PLOT AND ACTION MENU

The **Video** tab (Figure 15) displays thumbnails of available streaming video sources. RAGE is capable of displaying thumbnail and full-resolution video in RGB32 format. The user must set up FIRECAM[1] Suite software at the source and send these videos to RAGE over the network. The FIRECAM stream must be enabled in the RAGE network configuration and plug-in must be loaded plug-in Explorer. By selecting a video, a user can control gimbal and camera interfaces remotely in real-time. A Microsoft compatible joystick is recommended for controlling the videos. See *Plug-in Explorer* and *Network Configuration*.

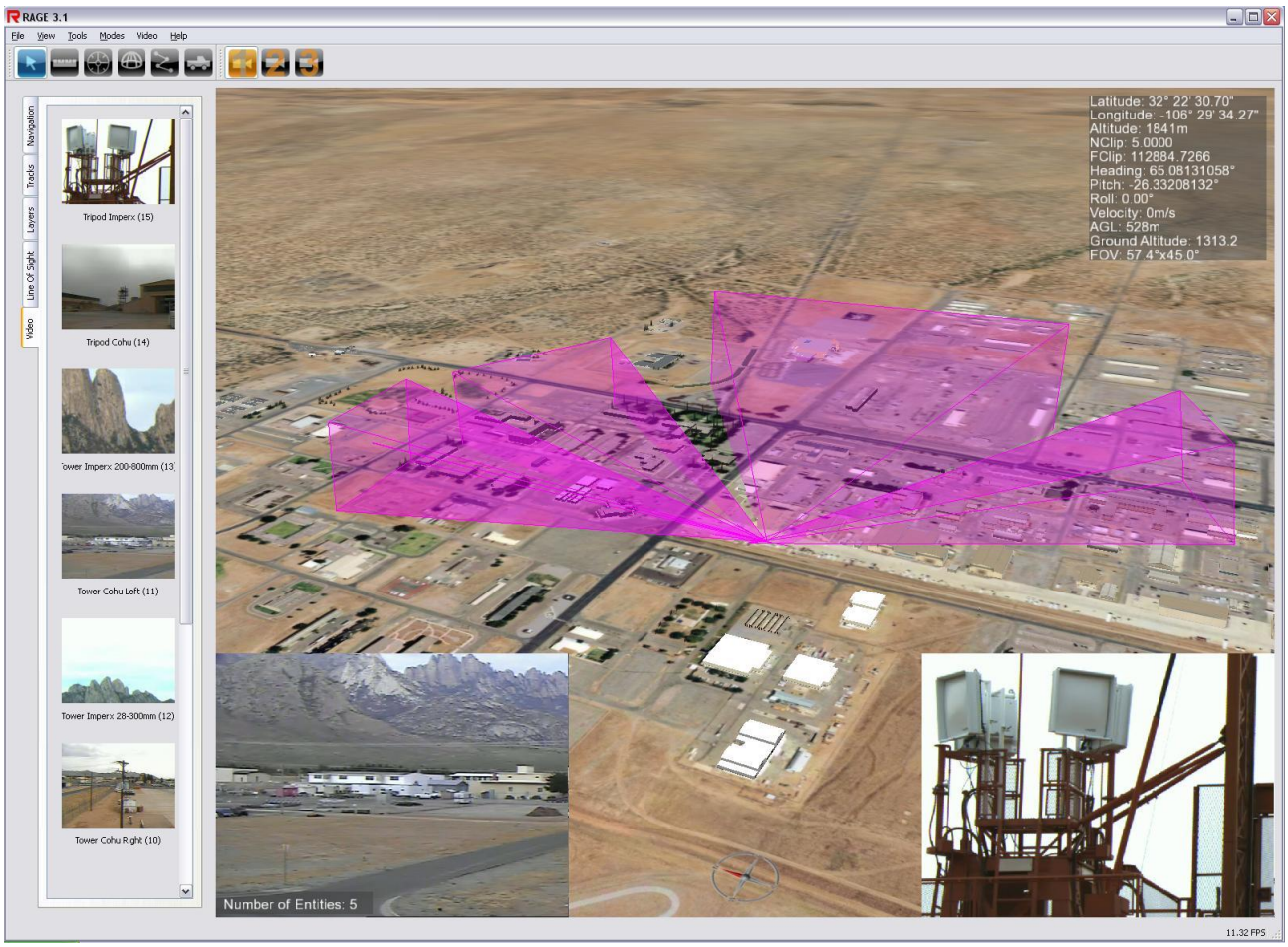


FIGURE 15, VIDEO TAB

[1] FIRECAM is optional free software available with RAGE for video implementation.

Input Devices

A two-button mouse with a scroll wheel is highly recommended to work with RAGE. RAGE has a built-in navigation window. The user can use these buttons to maneuver around the 3-D window with the aid of the mouse. Another widely used alternative is a standard Microsoft USB joystick. There are many joysticks on the market that are suitable for use in RAGE.

END OVERVIEW

Pre-Start Configuration Menu

The RAGE configuration menu contains various startups and running information. This information is capable of being saved for different mission scenarios. This is accomplished by using the [File], [Save As], feature from the Menu Bar. When a past mission setup is required, the [File], [Open], feature allows the information to be reloaded. In order to change a setting under System, Network, or Models, the user must double left-click on the value. A manual entry must then be completed. NOTE: When saving, make sure to save under the respective information tab (e.g., System, Network, Models).

System Configuration

The default System Configuration file is: RAGE.XML

CameraOptions – This allows the user to set RAGE at a startup location anywhere in the world. The user can set a precise location in decimal degrees with a unique angle based on roll, pitch, and yaw (heading).

InitialLocationAndOrientation

Latitude – Default is 33.25. Latitude is the south or north demarcation lines (parallels) used to map the world. The world is divided into two halves known as the Northern and Southern hemispheres. The Northern Hemisphere is any part of the world to the north of the equatorial (equator) line. This is represented by a positive number (33.0). The Southern Hemisphere is any part of the world to the south of the equatorial line. This is represented by a negative number (-33.0).

Longitude – Default is -106.25. Longitude is the east or west demarcation lines (medians) used to map the world. These lines start from a beginning point known as Prime (Greenwich) Meridian. Like the hemispheres from latitude, longitude works on the same principal. Heading east from the Prime Meridian, the value is positive (106.0). Heading to the west from the Prime Median, the value is negative (-106.0).

Altitude – Default is 32,500. Altitude or distance is from the height above the ellipsoid that RAGE will use. The height is in meters.

Roll – Default is 0.0. This is an up (climb) and down (descend) movement of the wings of the aircraft. An aircraft will rotate about its center of gravity, a point which is the average location of the mass of the aircraft. Rolling is caused by the deflection of the ailerons of the aircraft.

Pitch – Default is -90.0. This is the up (climb) and down (descend) motion produced by the aircrafts horizontal stabilizer and elevators. An aircraft will rotate about its center of gravity, a point which is the average location of the mass of the aircraft. Pitching is caused by the deflection of the elevators of the aircraft.

Yaw (heading) – Default is 0.0. This is the direction of the aircraft, vehicle, or vessel, the direction is truly pointing toward. Pointing refers to a compass projection from 0 to less than 360 degrees. At 360 degrees, the compass heading returns back to zero.

SceneOptions – This relates to the 3-D viewing window and how RAGE will handle various scene details.

DefaultCoordinateOutput – Default is DMS. This is a global switch that allows the user to set RAGE's coordinate position display information. All position information in the various areas of RAGE will be represented in the default value. The user has the following options: MGRS = Military Grid Reference System, UTM = Universal Transverse Mercator, DECIMAL = Decimal degrees, DM = Decimal Minutes, DMS = Degree Minutes Seconds. The options are NOT case sensitive.

UseSkyDome – **Default is true.** RAGE uses a sky image for the background. The sky image is represented by four themes: dawn, day, dusk, and night. Setting the UseSkyDome to *false* will disable the switching of the sky image background. This means RAGE will always display a lit 3-D window. Setting the UseSkyDome to *true* will use the sky image background based on the computer system clock. As the system clock changes throughout the day, the different backgrounds will be displayed respectively.

UseLOS – **Default is true.** NOTE: This is not being utilized at this time.

BuildingPreLoadFile – Default is BuildingList.xml. This file contains model identification, latitude, longitude, and height information about 3-D models that need to be loaded into a terrain database. The user can add models to this building list by editing (xml editor, notepad) this file. The building List.xml is located in RAGE_4.5\run folder. The folder (Culture), if available, is located in the terrain's directory. The terrain's directory is located in the root of the drive RAGE is installed on. Within this folder resides the appropriate database folder containing the model's information. If the Culture folder does not exist, the user can create the folder in the terrain's directory. Inside the Culture folder the user can create a folder to place models into. A BuildingList.xml will need to be created for each terrain database. See *Appendix C* for a BuildingList.xml example.

OriginOptions – This is the coordinate setting on the Earth that RAGE will use for the default terrain database. The origin option is used for the accuracy position in the Picking and LOS Measurement Tool. It is advised that the origin option setting be set to the center or near center of a terrain database. The user can set this location to be any where a terrain database is located.

OriginLatitude – **Default is: 33.0.** Latitude is the south or north demarcation lines (parallels) used to map the world. The world is divided into two halves known as the Northern and Southern hemispheres. The Northern Hemisphere is any part of the world to the north of the equatorial (equator) line. This is represented by a positive number (33.0). The Southern Hemisphere is any part of the world to the south of the equatorial line. This is represented by a negative number (-33.0).

OriginLongitude – **Default is: -106.0.** Longitude is the east or west demarcation line (medians) used to map the world. These lines start from a beginning point known as Prime (Greenwich) Meridian. Like the hemispheres from latitude, longitude works on the same principal. Heading east from the Prime Meridian, the value is positive (106.0). Heading to the west from the Prime Median, the value is negative (-106.0).

OriginAltitude – **Default is: 0.** Altitude or distance is from the height above the ellipsoid that RAGE will use. The height is in meters. NOTE: This setting should not be changed.

EarthOptions – RAGE uses Open Scene Graph (OSG) format for the background Earth image. EarthOptions allow the user to enable or disable the background Earth image and select from different background images. EarthOptions also allows the users to add their own 2-D image map under UserDefined. The extents of the user imagery must be known.

BlueMarbleImagery – This sub-category of EarthOptions allows the user to enable imagery from NASA Blue Marble project. NASA Blue Marble project enhances the imagery by providing a detailed look at the entire year in the life of Earth.

UserPagedBlueMarble – **Default is: true.** This will enable the Blue Marble Earth background for the RAGE display. Disabling this feature will display a black sphere and only the databases installed.

PagedBlueMarbleFile – **Default is**: **/BlueMarble/earth_med_noelev_16.osga.** This is the location and name of the Blue Marble Earth background image for RAGE.

SatelliteImagery – RAGE has the ability to use Google Earth imagery from the servers. The computer must be connected to the Internet. NOTE: It is advised that the user check with the local Information Assurance (IA) and System Administration (SA) officers before using the Google Earth switch. There is also the standalone switch where the imagery can be cached from the local hard drive or network drive. The pathing must be set in FileCachePath below.

UseSatelliteImagery – Default is: false. This will enable the use of satellite imagery from a local hard drive or network drive.

EnableWebDownload – **Default is: false.** This allows RAGE to access the Google Earth imagery from their servers in real-time. The imagery from the Google Earth servers will be cached to the local hard drive or network drive. NOTE: Check with local IA and/or SA officers prior to using this switch.

FileCachePath – Default is: ../../Terrains/SatelliteImageCache. This is the path RAGE will use to send and retrieve Google Earth imagery. The user can point this to wherever the imagery is located.

ImageryType – **Default is: satellite_with_roads.** There are three choices for Google Earth imagery. Depending on the setting, RAGE will download or play back the selected type of imagery. The choices are: map, satellite, or satellite_with_roads.

TerrainDetailLevel – Default is: 1. This sets the number of points to be used for draping the imagery over the elevation file. The higher the number, the more terrain features (i.e. mountains) appear. The detail level is in multiples of fours (1 = four corners of the tile, 2 = four squares or eight corners).

TerrainOptions – RAGE is capable of displaying multiple databases around the world. The terrain databases are pre-built using OSG tools. These databases are composed of several elements: elevation, imagery, and cultural information. All of these combine to form a 3-D terrain database.

Terrain – Default is: ecef. Earth-Centered, Earth-Fixed, is the coordinate system RAGE will use in the 3-D database (see *Glossary*). Currently, adding multiple databases is done by editing (notepad, xml editor) the RAGE.xml file found under the Run folder in the RAGE directory.

UseInScene – Default is: true. Setting this value to ***true*** will enable the database under File (below) to be loaded at the proper location. Setting this value to ***false*** will disable displaying the database. For multiple databases, select the UseInScene value (true/false) for each of the database accordingly. NOTE: RAGE must be restarted to load new terrains.

File – This is the location on the hard drive and name of the actual 3-D terrain database imagery file.

ElevationDataOptions – RAGE uses elevation files to perform reference *lookup* information. Whenever a reference point is needed in any of the tools, these elevation databases are accessed. The databases are located in the RAGE directory under ElevationDatabases. The database is defined by the latitude and longitude of the corners of the database and the number of elevation points within those boundaries.

UseElevationData – Default is: true. Setting this value to ***true*** will enable all allowable elevation files to be loaded. Setting this value to ***false*** will disable all elevation files.

LowResolutionDataFile – Default is: etopo2. This is the lowest resolution file and the Earth background model.

UseMediumResolutionData – Default is: false. At present, there is no medium resolution file being used.

MediumResolutionDataFile – N/A at present. There is no medium resolution file being used.

UseHighResolutionData – Default is: true. Setting this value to ***true*** will enable the high resolution elevation file to be loaded. Setting this value to ***false*** will disable the high resolution elevation file.

HighResolutionDataFile – Default is: WSMR_30m_ellipsoid. This is the default elevation file loaded at install. Adding multiple elevations would follow here (see *RAGE Configuration, page 1*).

LayerOptions – NOTE: LayerOptions is not being utilized at this time. This allows RAGE to display various boundary, culture, or reference point information. The layers can be added or removed from the Layers tab. The text display and size are also set here for the 3-D viewing window. Using the Path Tool in conjunction with layers allows for creating and saving custom layers. See *Path Tool*.

UseLayers – Default is: true. This is the switch to either enable or disable the display of layers in the 3-D viewing window.

UseTextLayers – Default is: true. This is the switch to either enable or disable the display of text in the 3-D viewing window.

TextSize – Default is: 20.0. This is the font size for the text display for the tracks, sensors, and layers in the 3-D viewing window.

AlwaysVisible – Default is: true. This is the switch to either enable or disable the layers and text in the 3-D viewing window.

TrackDisplayOptions – This relates to the Track Tool . It allows the adjustment of the display for a track entity. The TextSize is a font size for entity name. The IconSize associated with the entity is adjustable. The History Length is the time measured in seconds that the trail of the entity will exist on the 3-D viewing window.

TextSize – Default is: 32.0. This is the font size of the entity name being displayed in the 3-D viewing window.

IconSize – Default is: 64.0. This is the font size of the entity icon.

HistoryLength – Default is: 10.0. This is the time measured in seconds that the history trail of the entity will exist on the 3-D viewing window. NOTE: To disable history trails, set the HistoryLength to 0.0.

SensorDisplay – Sensor operations utilize what is called subdivision surfaces for the drawing of each sensor. Without getting complicated in the explanation, a higher number results in a larger number of triangles. Each subdivision number is a 4x increase in complexity. A subdivision number of 0 is the lowest number possible and results in a displayed surface of 20 triangles representing the shape.

> **MultilobeSubdivision** – **Default is: 5.** Multi-lobe sensors represent complex RF antenna patterns, and by default require more complex geometry for display.
>
> **SphereSubdivision** – **Default is: 3.** Sphere subdivision like the multi-lobe results in more complex drawing geometry for each subdivision number higher than 0. Subdivision 0 is 20 triangles, 1 is 80 triangles, and so on.

TrackLabels – relates to the Track Tool . This allows for the adjustment of the position of the text name in relation to the entity. The name will be displayed based on the callname position. ***Callname*** is the word that must be used to display text (e.g., If callname is next to north, then the entity name will be displayed above the entity's origin).

> **Center** – **Default is: blank.** This will display the entity name ***over*** the top of the entity origin.
>
> **North** – **Default is: blank.** This will display the entity name ***above*** the entity origin.
>
> **South** – **Default is: blank.** This will display the entity name ***below*** the entity origin.
>
> **East** – **Default is: callname.** This will display the entity name to the ***left*** of the entity origin.
>
> **West** – **Default is: blank.** This will display the entity name to the ***right*** of the entity origin.

TrackManagerOptions – This is a series of computing threads that handle all incoming Time Space Position Information (TSPI) data (e.g., sensor objects, moving entities). The TrackManager is configurable and adaptable to incoming data.

> **TrackTimeOutSecs** – This is the number of seconds to wait after the last received update before removing an incoming TSPI track.

InitialDataSize – RAGE will automatically size itself to match the data being received, however, to speed up the process, the user can predefine the storage size at least 25 percent more than total number of track inputs than is being expected.

InitialWorkerCount – RAGE will also change the number of threads (workers) to process the incoming data rate. The user can change this number manually to speed up the adaptation so that RAGE does not have to learn what the system will need while operations are occurring.

MaximumWorkerCount – This is the maximum limit of threads that RAGE will allow to be automatically created that try to process data. After this number of threads is created, RAGE will simply allow the working threads to process as much data as possible. Then RAGE will throw away anything that cannot be processed. If RAGE is taking up too much of the CPU usage, lowering this number will alleviate this problem, but it may result in data loss.

PositionFilter – RAGE uses what is known as an Alpha-Beta-Gamma filter to estimate velocity and acceleration and smooth certain data sets. This is a well known and highly adaptable data filter. For the most part, a user should not have to change anything in respect to the operation of this filter, but manual overrides have been offered here in case tuning for specific operations is required.

AlphaX – RAGE runs parallel filters on X, Y, and Z (up) components of all incoming data items. This value only affects the X (east/west) component of position data. The number should be between 0 and 1.0 exclusively. A smaller number produces a more filtered result; a larger number near 1.0 results in almost no filtering of incoming data.

AlphaY – This is similar to the AlphaX, but affects only the Y (north/south) component of position.

AlphaZ – This is similar to the AlphaX and AlphaY, but affects only the Z (up) component of position.

InputCount – This is the expected number of input items per second for the majority of items. RAGE will attempt to adapt this number to what the data really is, but will start with this number.

OutputCount – This is the expected display rate of data. RAGE will tune this information to what the display RATE really is, but will start with this number.

OrientationFilter – OrientationFilter, like PositionFilter, is filtered to get smoother results on estimating direction of travel of items that do not have incoming orientation.

AlphaHeading – Similar to Alpha XYZ, this affects the smooth estimation of heading of an object. The lower the number (near 0.0), the smoother the heading change, but also the slower the heading will react to moving data. The higher the number, the faster response to changes in heading, but there will be more noise in the estimation of the heading.

AlphaPitch – This is similar to Alpha heading, but affects only the pitch.

AlphaRoll – This is similar to Alpha heading and pitch, but affects only the estimated roll.

InputCount – This is the expected number of input items per second for the majority of items received. RAGE will attempt to adapt this number to what data really is, but will always start with this number.

OutputCount – This is the expected display rate of data. RAGE will tune this information to the display RAGE calculated, but will start with this number.

GroundClamping – Ground clamping options allow the user to force individual or all incoming files to match the known elevation of terrain (from the elevation files loaded in the configuration section *ElevationDataOptions*).

AboveGroundLevelOffset – This is the number of meters to add to the elevation at ground level for a track (e.g., if a data input comes in at a location where terrain is 1,273 m and AboveGroundLevelOffset is set at 0.5 m, then the data input will be given a height of 1273.5 m elevation).

SubSurfaceClampOffset – This is for items of DIS domain *subsurface* (usually submarines), which will always keep the elevation *below* the given elevation of that location by this number (e.g., if a data input comes in at a location where elevation is 0.0, or sea level, and the SubSurfaceClampOffset is 0.5 m, then the data input will be given a height of -0.5 m elevation).

UseDomainOverride – This override is primarily used when all data input is known to be of a specific type. If UseDomainOverride value is set to true, then all incoming data items will be set to the DIS domain value below.

DomainOverrideValue – DIS domain numbers are 0-Other, 1-Land, 2-Air, 3-Surface, 4-Subsurface, or 5-Space.

ClampToGeometry – If set to true, RAGE will attempt to clamp to the visual geometry (triangles representing ground) instead of the mathematical known elevation for that given location (although not currently available, it will be available in a future version of RAGE).

SplineEditorOptions – This relates to the Path Tool . It allows the user to create layers for boundary references or paths for entity simulation for playback in RAGE.

SplineWorkingDir – **Default is: blank.** This is the directory in which the data will be placed.

SplineSaveFile – **Default is: newSpline.dat.** This is the name of the file used to save the data.

SplineReadFile – **Default is: mySpline.dat.** This is the name of the file that is used as the default start file.

SplineASL – **Default is: 2500.0.** This is the above sea level starting point value for the spline.

SplineModel – **Default is: 1.0.** NOTE: This is not being utilized at this time.

SplineDrapeMode – **Default is: -1.0.** NOTE: This is not being utilized at this time.

SplineTrackSpeed – **Default is: 25.0.** This is the speed measured in miles per hour (mph) at which the entity will travel in playback simulation mode.

Network Configuration

RAGE accepts network traffic through the standard Ethernet port found on most computers. RAGE is capable of supporting up to 60,000 inputs per second (depending on hardware capability). The network configuration allows the setup of various types of format inputs. There are several data types already configured for use in RAGE under the plug-ins. RAGE uses plug-ins which allow for custom formats to be added with ease. This means that the core software does not need to be changed to add a new format. RAGE will only *listen* for a message format specified in the name block. Other options in the Network tab allow for setting up a particular Internet Protocol (IP) address, port address, and multi-cast IP, and Unlimited Size Message Layer (USML). See *Network Receiver Plug-ins*, *Plug-in Explorer*, *USML*.

The Network Configuration Menu is located under Configure in the RAGE Welcome Screen or through the [File] Configuration on the Main RAGE run time window.

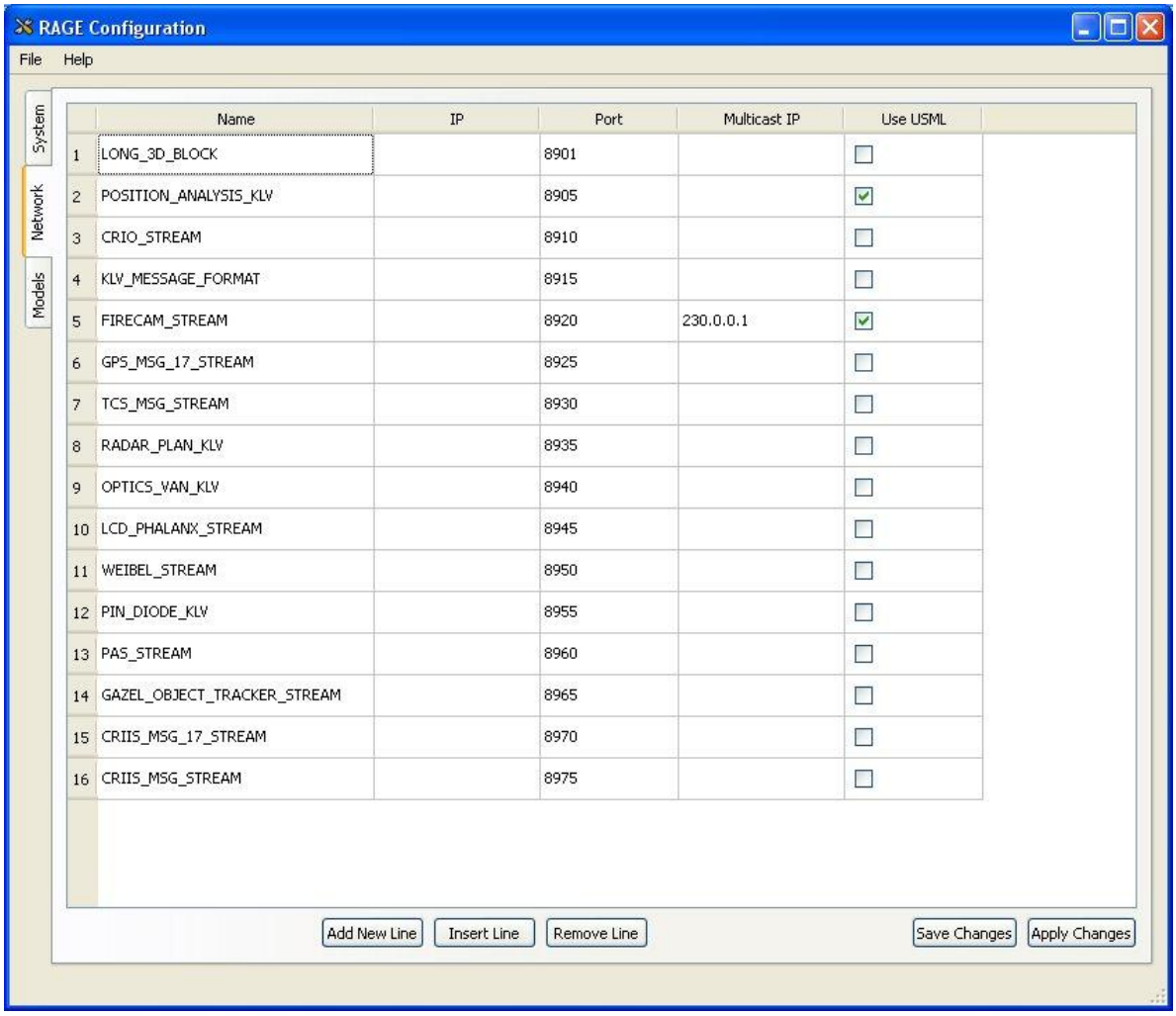


FIGURE 16, NETWORK CONFIGURATION MENU

Name (types of data input) – RAGE will only *listen* for a specific message format that is described in the name block. In addition to the Network Configuration, a plug-in might also have to be added through the Plug-in Explorer under Tools on the Menu Bar. There are two standard message formats set up as defaults in the Network Configuration. These do not require a plug-in to be added in the Plug-in Explorer. These are the LONG_3D_Block and KLV_MESSAGE_FORMAT. The message formats must be entered in the name block in all caps and spelled exactly below in Network Name convention. In addition to the Network Configuration, the others listed below where noted must be added through the plug-in explorer in RAGE. Plug-in Explorer is found under Tools, Plug-in Explorer.

Format Descriptions:

LONG_3D_BLOCK – ***Network Name: LONG_3D_BLOCK***
Default is: standard to RAGE. There is no plug-in for Long 3-D block. Long 3-D block format is a legacy format from the RAGE environment version 2.0. It is still used by a number of customers and therefore still supported by the current version of RAGE 4.5. See *Network Receiver Plug-ins*.

KLV_MESSAGE_FORMAT – ***Network Name: KLV_MESSAGE_FORMAT***
Default is: standard to RAGE. There is no plug-in for the KLV Message Format. Key Length Value message format is based on the Motion Imagery Standards Board (MISB) KLV standard: (http://www.gwg.nga.mil/misb/faq.html#section3.2). The dictionary supported by RAGE is distributed with the RAGE and FIRECAM suite. Additional non-standard dictionaries could be supported, but would then not fall under the KLV standards approved by MISB. See *Network Receiver Plug-ins*.

Common Range Integrated Instrumentation System (CRIIS) STD Msg Plug-in v1.2.5 – ***Network Name: CRIIS_MSG_STREAM***
This must be added through Plug-in Explorer along with the Network Configuration. The CRIIS is designed to be the “Truth Standard” for the Tri-Service Test and Evaluation community. CRIIS will replace the Advanced Range Data System (ARDS). The CRIIS is used in various package configurations.

CRIIS Msg 17 Plug-in v1.2.6 – ***Network Name: CRIIS_MSG_17_STREAM***
This must be added through Plug-in Explorer along with the Network Configuration. The CRIIS is designed to be the “Truth Standard” for the Tri-Service Test and Evaluation community. CRIIS will replace the ARDS. The CRIIS is used in various package configurations.

FIRECAM Plug-in Adranus 2.0 – ***Network Name: FIRECAM_STREAM***
This must be added through Plug-in Explorer, in addition to the Network Configuration. FIRECAM is a WSMR streaming video format. FIRECAM video streams are sent from FIRECAM supported devices (see the FIRECAM documentation) and received by either a simple window display (the FIRECAM client) or by RAGE, and integrated into the 3-D system as an augmented video source. See *Network Receiver Plug-ins*.

GAZEL Object Tracker Plug-in v1.0.0.7 – *Network Name: GAZEL_OBJECT_TRACKER_STREAM*
This must be added through Plug-in Explorer. The Generic Azimuth Elevation object tracker plug-in allows a user to attach to an object and command a P/T controller to point at that object. Override and additional options are controlled through the GAZELObjectTrackerOptions section of the RAGE.xml system configuration located in the Run folder.

GPS Msg 17 Plug-in v1.2.8 – ***Network Name: GPS_MSG_17_STREAM***
This must be added through Plug-in Explorer along with the Network Configuration. GPS message 17 is a standard message format used by the GPS group at WSMR for the ARDS. See *Network Receiver Plug-ins*.

Lcd Tracking Plug-in v1.8.0 – ***Network Name: LCD_PHALANX_STREAM***
This must be added through Plug-in Explorer along with the Network Configuration. This is a specific design for laser engagement. It allows the user to visualize the azimuth, elevation, and comparison against the Laser Clearing House windows. See *Network Receiver Plug-ins*.

Optics Van Plug-in v1.0 – ***Network Name: OPTICS_VAN_KLV***
This must be added through Plug-in Explorer along with the Network Configuration. As with the position analysis plug-in, this KLV reads a subset of the KLV system designed specifically for the optics customers. See *Network Receiver Plug-ins*.

PAS Messages Plug-in v1.0.0.2 – *Network Name: PAS_STREAM*
This must be added through Plug-in Explorer. The PAS Message plug-in allows a user to accept inputs directly from a 120,124, or 320 bit PAS message. Target IDs are entered into the entity identification field. Override and additional options are controlled through the PAS ObjectOptions section of the RAGE.xml system configuration located in the Run folder. See *Network Receiver Plug-ins*.

Pin Diode Plug-in v0.9 – ***Network Name: PIN_DIODE_KLV***
This must be added through Plug-in Explorer. The Pin Diode plug-in allows a user to monitor the current output and signal strength information from a Pin Diode. See *Network Receiver Plug-ins*.

Position Analysis v3.1.8.3 – ***Network Name: POSITION_ANALYSIS_KLV***
This must be added through Plug-in Explorer along with the Network Configuration. Position Analysis plug-in allows an operator to compare a defined source against other locations (usually sensors), as well as record and playback data. Additional specific capabilities allow the plug-in to read and understand specific analysis messages for camera to data and CRIO sensor information. See *Network Receiver Plug-ins*.

Radar Planning Plug-in v1.01 – ***Network Name: RADAR_PLAN_KLV***
This must be added through Plug-in Explorer along with the Network Configuration. Radar Planning plug-in allows an operator to track several radar locations and their continued LOS over the span of an entire mission. See *Network Receiver Plug-ins*.

RadiantSourcePlug-in v2.0.1 – ***Network Name: There is no network configuration name***
The Radient Source plug-in allows an operator to monitor the path of a beam of energy through the surrounding air-spaces while tracking a moving object. The plug-in will provide eye-safe location for lasers, as well as beam size and location of crossing at the entrance and exit of all air-spaces defined. See *Network Receiver Plug-ins*.

RF Seeker Plug-in v1.0.0.3 – ***Network Name: GAZEL_OBJECT_TRACKER_STREAM***
This uses the same network name as the GAZEL plug-in. RF Seeker plug-in allows an operator to attach to an RF source and command a generic Azimuth Elevation P/T to seek the strongest RF signal from the source. See *Network Receiver Plug-ins*.

TCS Msg Plug-in v1.2.2 – ***Network Name: TCS_MSG_STREAM***
This must be added through Plug-in Explorer along with the Network Configuration. TCS plug-in allows the user to analyze the telemetry signal strength. It is used primarily for mission planning. Setting the parameters in the plug-in will allow for a signal level to be analyzed as a good or bad signal feedback. See *Network Receiver Plug-ins*.

TMLink v1.0 – ***Network Name: There is no description at this time***

VirtualSensors v1.0 – ***Network Name: None***
This must be added through Plug-in Explorer. There is no network configuration name. This allows the user to simulate tracking sensors with gimbal sets. Override and additional options are controlled through the VirtualSensorOptions section of the RAGE system configuration. See *Network Receiver Plug-ins*.

Weibel Plug-in v1.0.7 – ***Network Name: WEIBEL_STREAM***
The Weibel plug-in allows a user to accept inputs directly from the Weibel Radar output message without conversion. Override and additional options are controlled through the WeibelObjectOptions optional section of the RAGE system configuration. See *Network Receiver Plug-ins*.

IP Configuration – **Default is: blank.** This allows RAGE to *listen* to a specific IP.

Port address – **Default is: 8901.** This is the port number of the message traffic that is being sent from the source.

Multicast IP – **Default is: blank.** This allows RAGE to re-transmit the message format to a specified IP address.

Unlimited Size Message Layer (USML) – **Default is: unchecked.** Unlimited Size Message Layer uses protocol breakdowns of large packet transmissions so that NICs do not have to buffer, split, and recollect packets. USML then takes the responsibility of splitting large buffers (like video frames) into smaller packets and reassembling them in the right order.

Add New Line – This will insert a new line item at the end of the network list.

Insert Line – This will insert a new line item above the current selected (blue hi-light) line number.

Remove Line – This will permanently remove the current selected (blue hi-light) line item.

Models Configuration

3-D models allow for realistic and visual presentation during mission testing and simulation. The menu enables models to be loaded based on the DIS type of incoming data. The menu has several options for the configuration of a model; default models are preloaded in the table. Model options changed on the menu are uploaded immediately once the correction is applied. Models can be instantly changed without restarting the system. The Models tab page is broken into two sections – Models and DIS Type Association. These work in conjunction with one another. The DIS Type contains the incoming DIS data stream ID (i.e., 1.1.255.0.0.0.1). This DIS number has a model alias name associated with it. This in turn is handed off to the Models section. The model alias from the DIS type is matched with the alias in the models section. Depending on what the alias is, the proper 3-D model file loads from the data directory. By default, if incoming data contains no DIS number, then the first DIS Type Model will be loaded. More models are located in the *data/models* folder under the RAGE directory in a format called Flight (flt). Multigen Creator is third party software used in the model creation process.

The Models Configuration Menu is located under Configure in the RAGE Welcome Screen or through; [File] - Configuration, on the RAGE run time window.

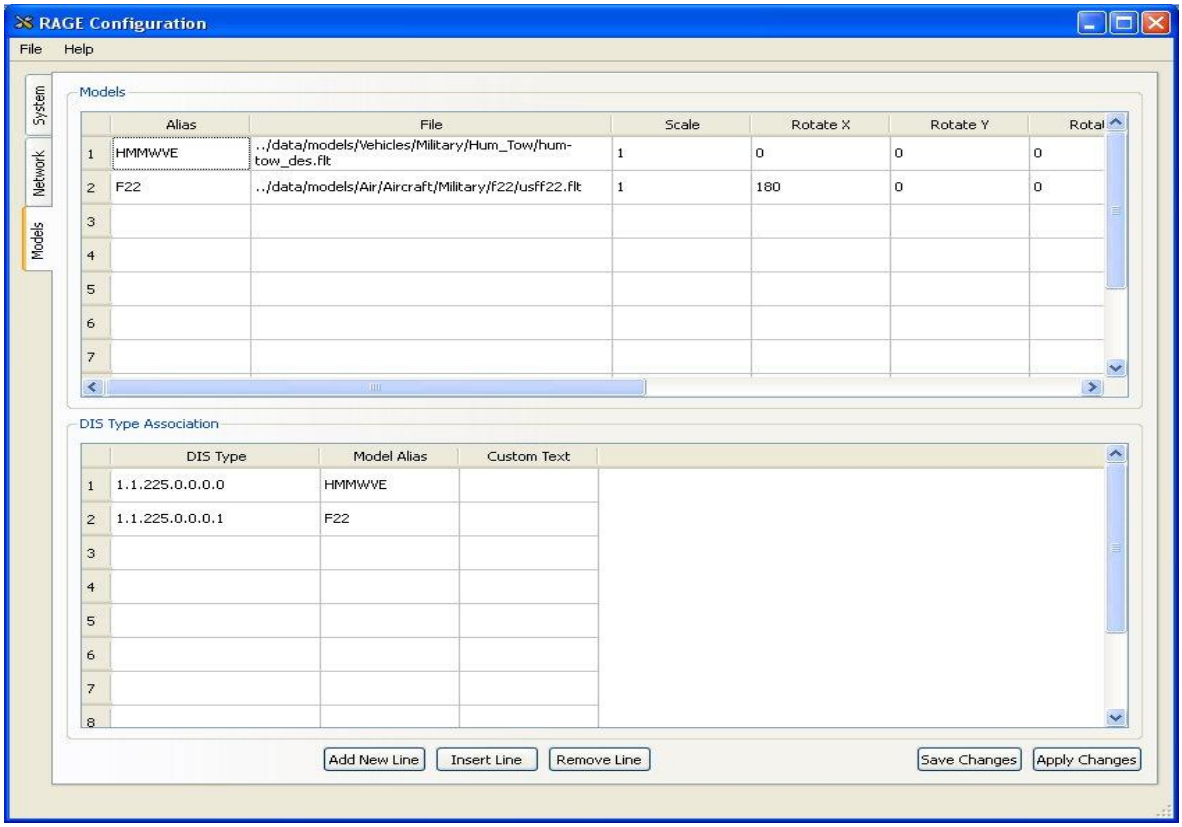


FIGURE 17, MODELS CONFIGURATION MENU

Models – This is the actual model setup where the models' name, scale factor, rotation, and Icon are identified.

> **Alias** – **Default is: HMMWVE.** The model alias from the DIS type and the alias from the models must agree in spelling and are case sensitive.
>
> **File** – **Default is: ../data/models/Vehicles/Military/Hum_Tow/hum-ow_des.flt.** This is the 3-D flight model that will be loaded on startup.
>
> **Scale** – **Default is: 1.** This allows for the size of the model to be enlarged for the 3-D window where 1.0 is the lowest value and represents the original size of the model.
>
> **Rotation** – **Default for all rotations is: 0.** The orientation of the model in the X, Y, and Z axis which can be modified to position a model correctly.
>
> **Icon Symbols** – **Default is: none.** Icons may be added to any model. Sample icons are located in the data/symbols folder under RAGE. Icons with a PNG extension can be created and placed in this folder.
>
> **Alignment** – **Default is: center and bottom respectively**. The placement of the icon symbol in respect to the model can be adjusted for visual presentation.

DIS Type Association – This associates the DIS type number to a Model Alias. When RAGE receives the DIS packet from the source, it is correlated with a model alias name. The models' alias name accesses the models from the table above. See *DIS*.

> **DIS Type** – **Default is: 1.1.225.0.0.0.0.**
>
> **Model Alias** – **Default is: HMMWVE.** This is the alias name associated with the model.
>
> **Custom Text – Default is: Blank.** NOTE: This is not being utilized at this time.

Add New Line – This will insert a new line item at the end of the models or DIS Type Association list. The user must select (left click) the proper section prior to adding new line.

Insert Line – This will insert a new line item above the current selected (blue hi-light) line number. The user must select (left-click) the proper section in order to insert a line.

Remove Line – This will permanently remove the current selected (blue hi-light) line item.

END RAGE CONFIGURATION MENU

Start - Run Time Window

The Run Time window (Figure 18) in RAGE is the main display window. Several tools and information are available at the click of a button. It is advised that a three-button mouse with scroll wheel be used. In addition, a Microsoft standard joystick is recommended, but not necessary. RAGE is an interactive environment between the user and data. It allows for mission planning, rehearsal, live/virtual testing, post-testing playback, simulation, AVI creation, and live video feeds with user controlled manipulation. RAGE is built on a plug-in type system. Users are allowed and encouraged to create plug-ins to help RAGE adapt to the user specific needs. A plug-in example is included at the end of this manual.

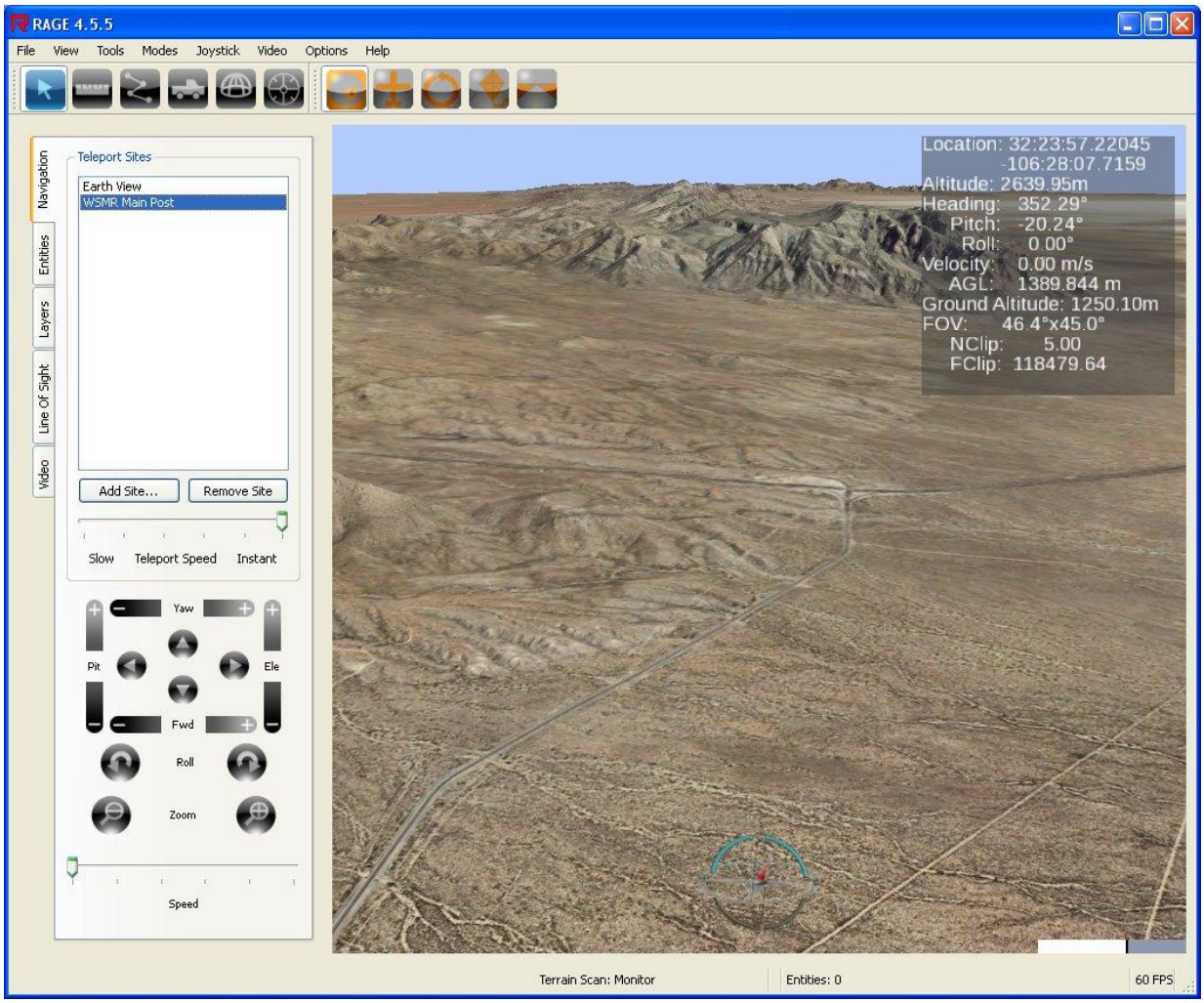


FIGURE 18, RUN TIME WINDOW

3-D Display Window

The 3-D display window (Figure 19) allows the user to visualize and interact with the incoming data to RAGE in real-time. In addition, the window allows the user to plan, validate, execute, explore, and control scenarios. Multiple high-resolution terrains can be added to RAGE anywhere in the world. Using the features under [View] on the Menu Bar allows for display window setup. Navigation of the 3-D display window is controlled via the Mouse, Scroll Wheel, Joystick, and Navigation buttons described below. Display screen capture is available under [Options], on the Menu Bar. See *Options*.

FIGURE 19, 3-D DISPLAY WINDOW

Mouse Control

It is recommended that a three-button mouse with scroll wheel be used. Depending on the tool being utilized, the mouse functions are the same with slightly varying differences in response. Further discussion on the mouse functions are detailed under the specific tool.

Scroll Wheel

The scroll wheel functions like the mouse control and has similar functions, depending on the tool being utilized. The scroll wheel can act as forward/reverse for flight or to increase/decrease the size of a sensor or zoom in/out in the Selection Tool mode.

Joystick Control

It is also recommended, but not necessary, that a Microsoft compatible USB joystick be used in conjunction with the mouse. The joystick makes multi-tasking easier with the mouse performing simple functions. The joystick mapping is designed for the Extreme 3-D Pro at this time. Future enhancements will enable the user to configure the desired mapping for any joystick or six degree of freedom (DOF) control stick.

Navigation Tab

The **Navigation** tab (Figure 20) serves two purposes. First, it allows the user to create and store *jump* points (sites) to specific areas of interest. The user can then select a teleport site and RAGE will instantly take the user to that stored location. Second, the user can control the viewing position in the 3-D Display Window by manipulating the various control buttons. It is recommended, but not necessary, that a joystick be used in conjunction for maneuvering. In addition, there are two slide bars that control the teleport speed and the speed of the movement when the navigation buttons are used.

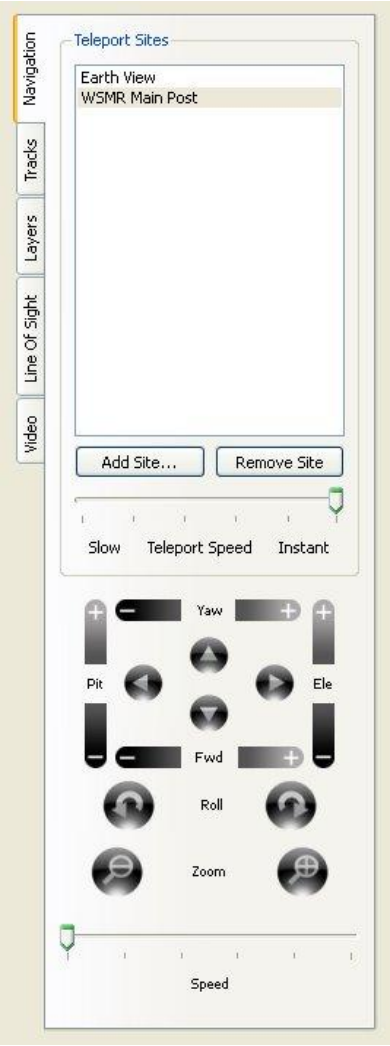


FIGURE 20, NAVIGATION TAB

Teleport Sites

Teleport Sites located on the Navigation tab make it easy to move from one point on the terrain to another. There is no limit to the number of locations of sites. These sites can be anywhere on the Earth. An initial setup of the location must be done by flying to the location of interest. Next, use the Add Site and insert a name. Then, to move from site to site, use the mouse to double left-click on the name of the site. The teleport speed allows the user to set the transition speed from one point to the next.

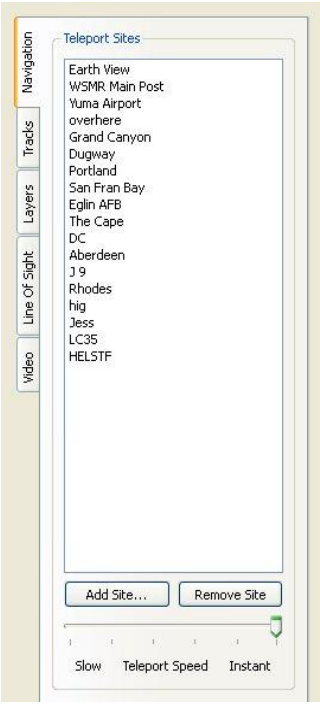


FIGURE 21, TELEPORT SITES

Add Site

To add a site using the navigation buttons or joystick, adjust the view and orientation on the area of interest in the 3-D display window. When the view is acceptable, use the mouse to left-click on the [Add Site] button under Teleport Sites. The Site name box will appear on the screen. Enter the desired name or number and select [OK] when complete.

Remove Site

To remove a site, use the mouse to left-click on the site name to be removed and select [Remove Site] button. The site name will be highlighted in blue.

Teleport Speed

Teleport Speed allows the speed of movement from one site to another to be set. By holding down the left mouse button while selecting the position arrow on the Teleport Speed bar, the speed can be set from slow to instant.

Navigation Buttons

The Navigation Buttons aid in the viewers' movement and position within the 3-D window display. The choices for the flight modes are: Terrain Scan, Airplane, and Orbit Navigation. Depending on the selection of the Navigation Orientation icon on the Menu Bar, the navigation buttons respond differently or are disabled. Using the flight profile of an aircraft, different modes of *flight* can be selected.

	Terrain Scan	Allows mobility in all directions using all buttons except the roll function, which has been locked out
	Airplane Navigation	Mobility movements in the 3-D viewing window will react as an aircraft profile; all buttons are enabled
	Orbit Navigation	Mobility movements are locked in a downward view with the Pitch function locked out
(-, +)	**Yaw**	A side to side motion of the viewer's position
(-, +)	**Pitch**	An up and down motion of the viewer's position
(-, +)	**Elevation**	Is the ascent or descent of the viewer's position
(-, +)	**Forward**	Causes the viewer's position to move forward or backwards
(-, +)	**Roll**	Up and down motion of the viewer's centerline position with respect to wings in airplane mode
(-, +)	**Zoom**	Allows for the viewer's FOV to be increased or decreased
↑ ← + → ↓	**Arrows**	Allows for viewer's movement to be on the same plane while not disturbing the pitch of the view
(-, +)	**Speed**	Allows the speed in which the movement of the viewer's position is reached

Entities Tab

The **Entities** tab displays all incoming live or simulated data. General information about the data entity is supplied in the table. The entities can be sorted by selecting the name at the top of each column on the table. More precise information can be gathered by using the mouse. Right clicking on any of the entities in the tab window will display an Action window. This Action window allows the user to select a command to be performed on the entity.

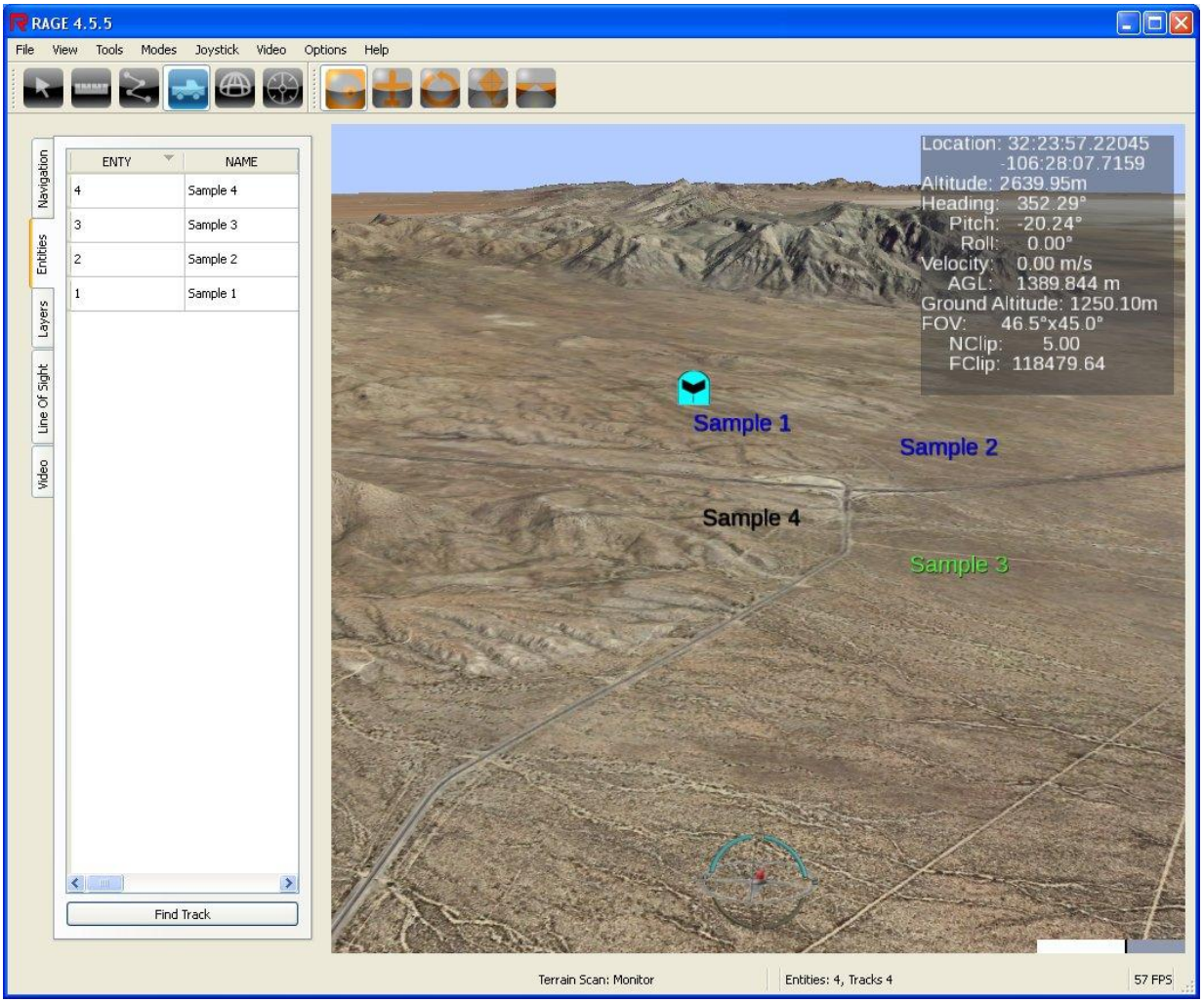


FIGURE 22, SAMPLE ENTITIES WITH VARIETY

In the Entities tab window, use the slider bar to view all the of the entity information. Below are the definitions of the window display. Right clicking on an entity will present the action window. See *Action Window*.

Entity – Default is: 1	This is the system number generated for this particular entity. The entity number is dynamic based on live data or it can be set by the user as a special identifier.
Name – Default is: Sample Track	This is the name of the entity. The name is dynamic based on live data or it can be set by the user for specific information.
Show – Default is: True	This will enable or disable the entity from being displayed in the 3-D viewing window. Using the mouse, double left-click to set the true or false state.
Application – Default is: 0	This is the DIS number associated with this entity. The application number is dynamic based on live data.
Site – Default is: 0	This is the DIS number associated with this entity. The site number is dynamic based on live data.
Find Track	This is located at the bottom of the tab window. It allows the user to teleport to a particular entity name, NOT the entity number. The end result will place the user at the entity point. Enter the name of the entity in the popup window and select OK.

Action Window

Below are the commands available for a track or sensor. The action window commands are accessible by right clicking on a track or sensor. This will present the action window. More detailed information about the commands below can be found in the Definitions and Terminology section at the end of this manual.

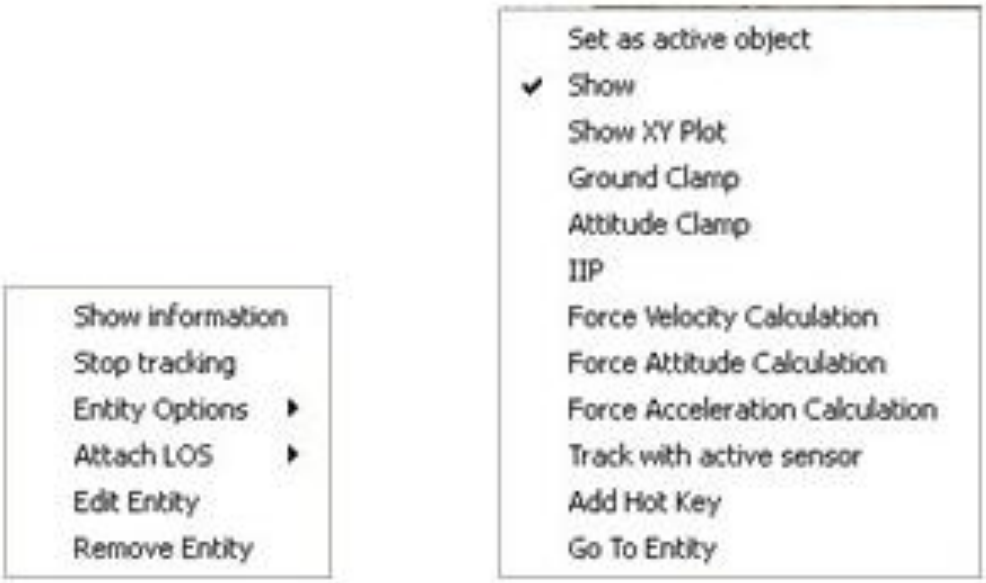


FIGURE 23, MAIN ACTION AND ENTITY OPTIONS WINDOWS FOR TRACKS AND SENSORS

Main Action Window Information for Tracks and Sensors

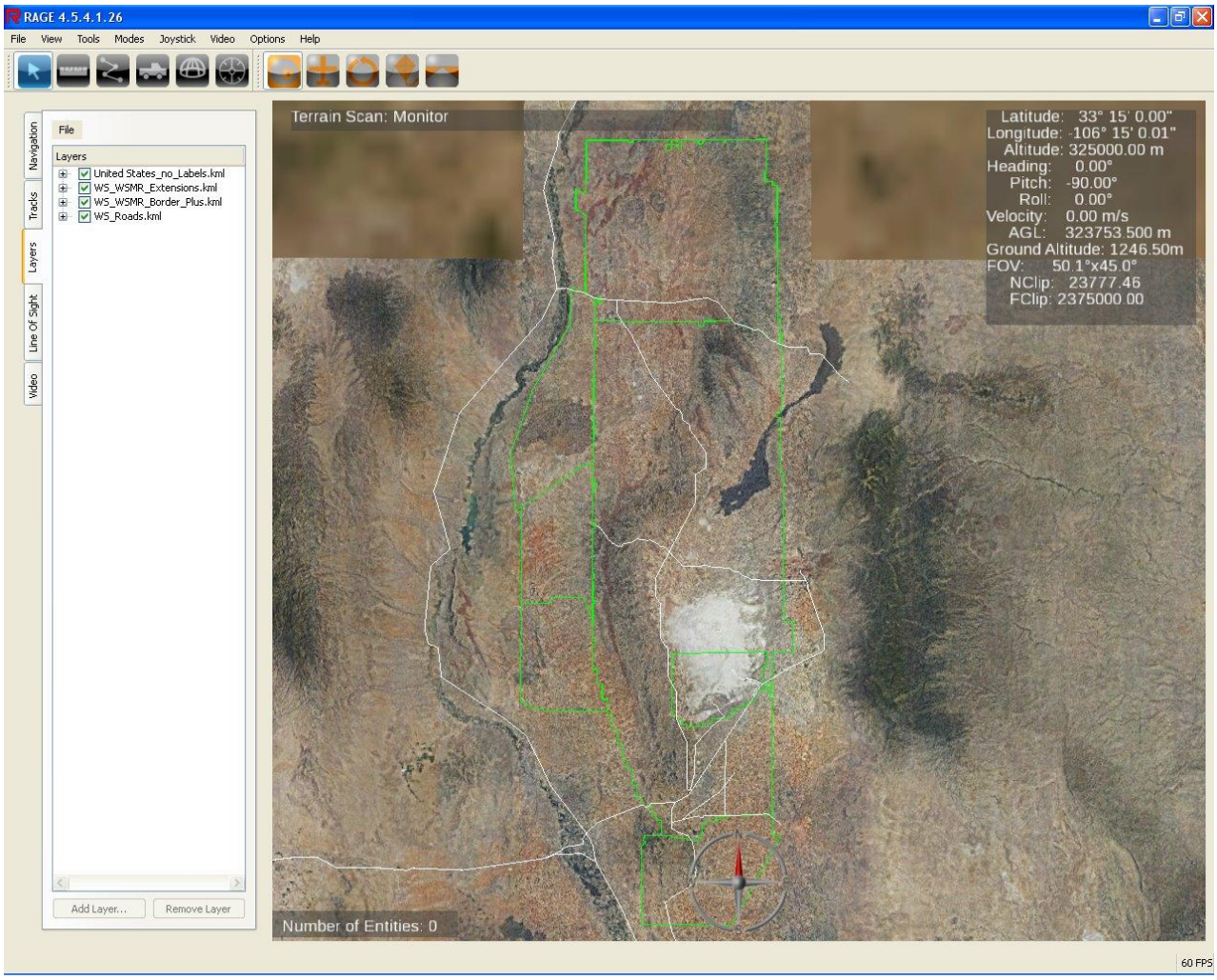
Show Information	This displays name, ID, type, time, positional information, and clamping status.
Stop tracking	This disables the tracking with active sensor.
Entity Options	This presents another action window with various controls and commands for the track or sensor.
Attach LOS	This allows the user to select entities for a real-time LOS analysis. Using the one (from) to many (to) entities allows for multiple analyses. LOS *from* is the starting or source point. LOS *to* is the ending or destination point(s).
Edit Entity	This allows the user to make changes to the track or sensor.
Remove Entity	This will permanently delete the track or sensor from the 3-D display window. If it is continuous data, the data object will return.

Entity Options Window Information for Tracks and Sensors

Set as active object	This sets the track or sensor to be the main object of interest.
Show	This enables/disables display of track or sensor in 3-D display.
Show XY Plot	This allows the user to plot velocity, acceleration, and position over time (See *XY Data Plot*).
Ground Clamp	This enables/disables clamping the track or sensor to ground.
Attitude Clamp	This enables/disables clamping the track or sensors pitch and roll to a fixed setting.
IIP (Instantaneous Impact Prediction)	This enables/disables the IIP solution for a track.
Force Velocity Calculation	
Force Attitude Calculation	
Force Acceleration Calculation	
Track with Active Sensor	This allows for a sensor to track an entity object.
Add Hot Key	This allows the user to add a single key-press to switch default commands to this sensor, device, or video.
Go To Entity	This place the user at the entity location.

Layers Tab

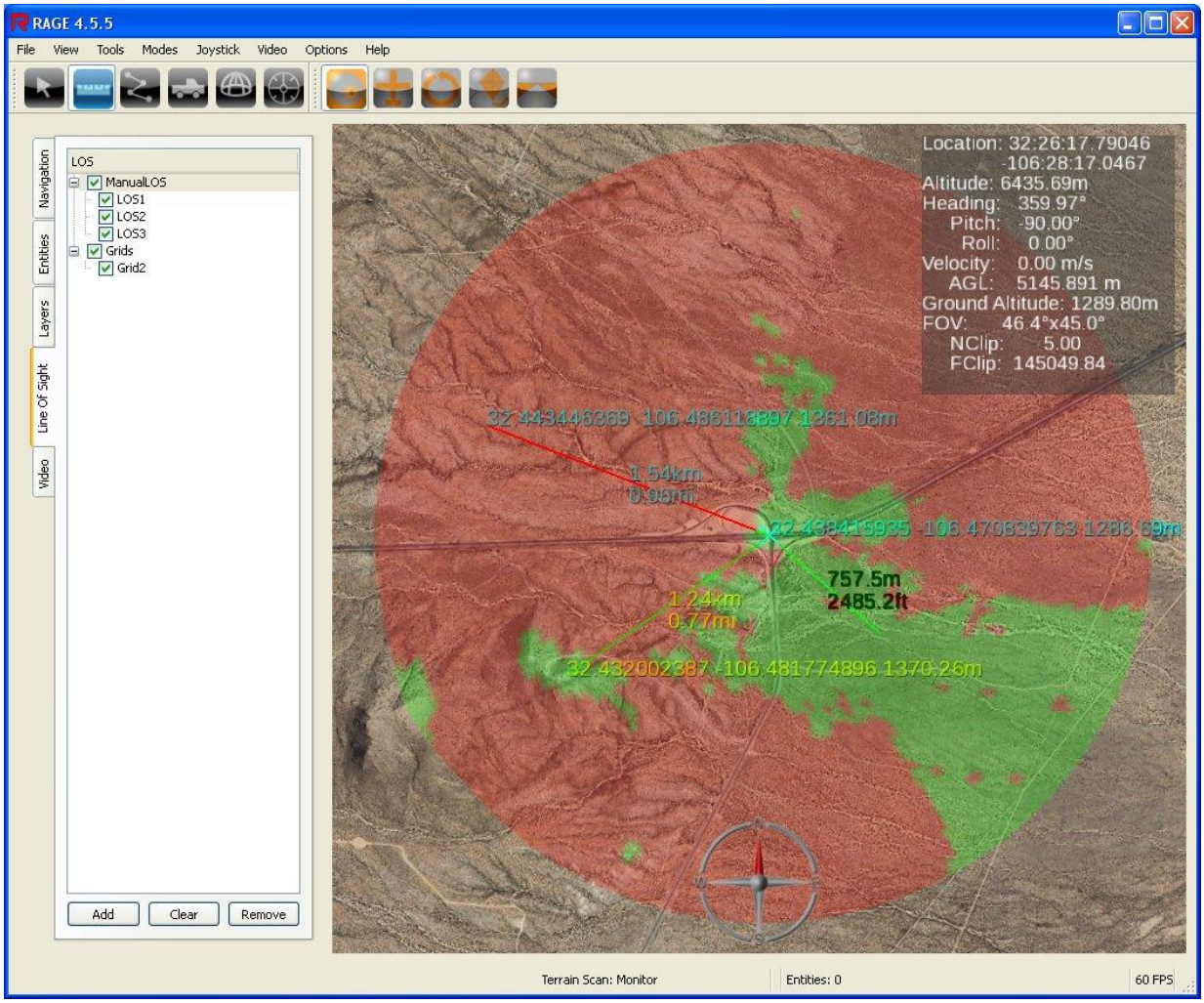
The **Layers** tab is used for boundary markers. Several layers are available in RAGE for WSMR and the surrounding area. The layers are built in a KML format. The user can create layers by using the Path Tool supplied in RAGE on the icon bar or under Tools on the Menu Bar. Layer names at present, are created by manually editing an XML file called Layers.XML (found in C:\RAGE 4.5\Run\) and placing the path and name of the particular KML file (ex. <File type="kml" >Layers/Continents\North America\North America.kml</File>). The layers in RAGE are fully capable of handling the Google Earth KML file format. There are several tools on the Internet that can convert .SHP files to .KML. RAGE in future releases will be able to import .SHP and other GIS files natively. See *Path Tool*.



File	Located on the Layer tab, left click on [File] and select [Open]. An Open Layer window appears. Select the Layers folder by double left-clicking. Next, left click on the desired file and select [Open]. The layer is now applied to the Layer table and 3-D viewing window.
Add Layer	NOTE: This is not being utilized at this time.
Remove Layer	NOTE: This is not being utilized at this time.
Check Box	Use the check box to enable/disable a layer or name. Use the mouse to left click on the checkbox to enable or disable a layer or name.
LayerConverter Tool	Located in the RAGE folder under ..\bin\win32, Layerconverter is a standalone tool that allows a user to import legacy data formats into KML layers.

Line Of Sight Tab

The **LOS** tab allows for multiple measurements to be compared and saved. Individual measurements can display a 2-D profile plot of the terrain. These 2-D plots can be saved for use in presentations. The LOS 2-D profile displays the source and destination points, any obstruction and its point, the total distance, whether or not the line is visible or obscured, and a terrain profile with scaling. The LOS tab is used in conjunction with the Measurement Tool on the Menu Bar. See *Measurement Tool*.



Add This enables a measurement to be added to the LOS table. Once a measurement has been taken (see *Measurement Tool*), left click on [Add Measurement]. This will add the measurement to the LOS table.

Clear This removes all of the LOSs from the table. Simply select the [Clear] button to remove all LOSs. A confirmation window will appear to acknowledge the [Remove All] request. Select the appropriate response.

Remove This removes one of the LOSs from the table. Use the mouse to left click on the desired LOS to be removed. Once highlighted, select [Remove]. A confirmation window will appear to acknowledge the [Remove] request. Select the appropriate response.

Show Plot This provides a 2-D plot of the measurement. It also allows the user to hide or show the measurement and remove the measurement from the table. Use the mouse to right click on the desired measurement. This will display a popup window. To display a 2-D plot of the measurement, select [Show Plot]. A 2-D profile will be displayed in a separate popup window. The user can position this plot along with the 3-D display window (full screen recommended) to produce a picture. This picture can then be imported into a presentation slide. See *Screen Capture*.

Edit Line/Grid This allows the user to manipulate the LOS by adjusting the Geo reference type, Altitude Units, Source and Destination location, Source and Destination Altitude offset, text, and name. All changes are applied by selecting OK.

Remove LOS This action will permanently delete the LOS from the tab window.

Video Tab

The **Video** tab allows the user to display and control in multiple videos in real-time, depending on the systems' performance characteristics. Used with the FIRECAM plug-in suite, it is a power tool for controlling camera systems.

FIRECAM Suite	FIRECAM is a suite of netcentric tools to manage routing of sensors, camera data, and video. It currently supports 24 channels per software video switcher. FIRECAM is a modular program and accepts new hardware easily through plug-ins. There are several modules within FIRECAM: FirePortal, Remote Control, Video Client, Video Server, Video Switcher, and the Universal Player. A screen shot of FIRECAM is illustrated in Figure 24.
FirePortal	This remotely controls and publishes data and video from the hardware using plug-ins.
Remote Control	This provides remote user control of a hardware device.
Video Client	This allows the users to view streaming video at remote locations. The client also includes built-in recording and playback capability.
Video Server	This is a legacy application and is used for some digital frame grabbers.
Video Switcher	This allows the user to view and control the streaming of data and video. The switcher supports gang recording and playback.
Universal Player	This supports synchronized playback of recorded video and TSPI data.

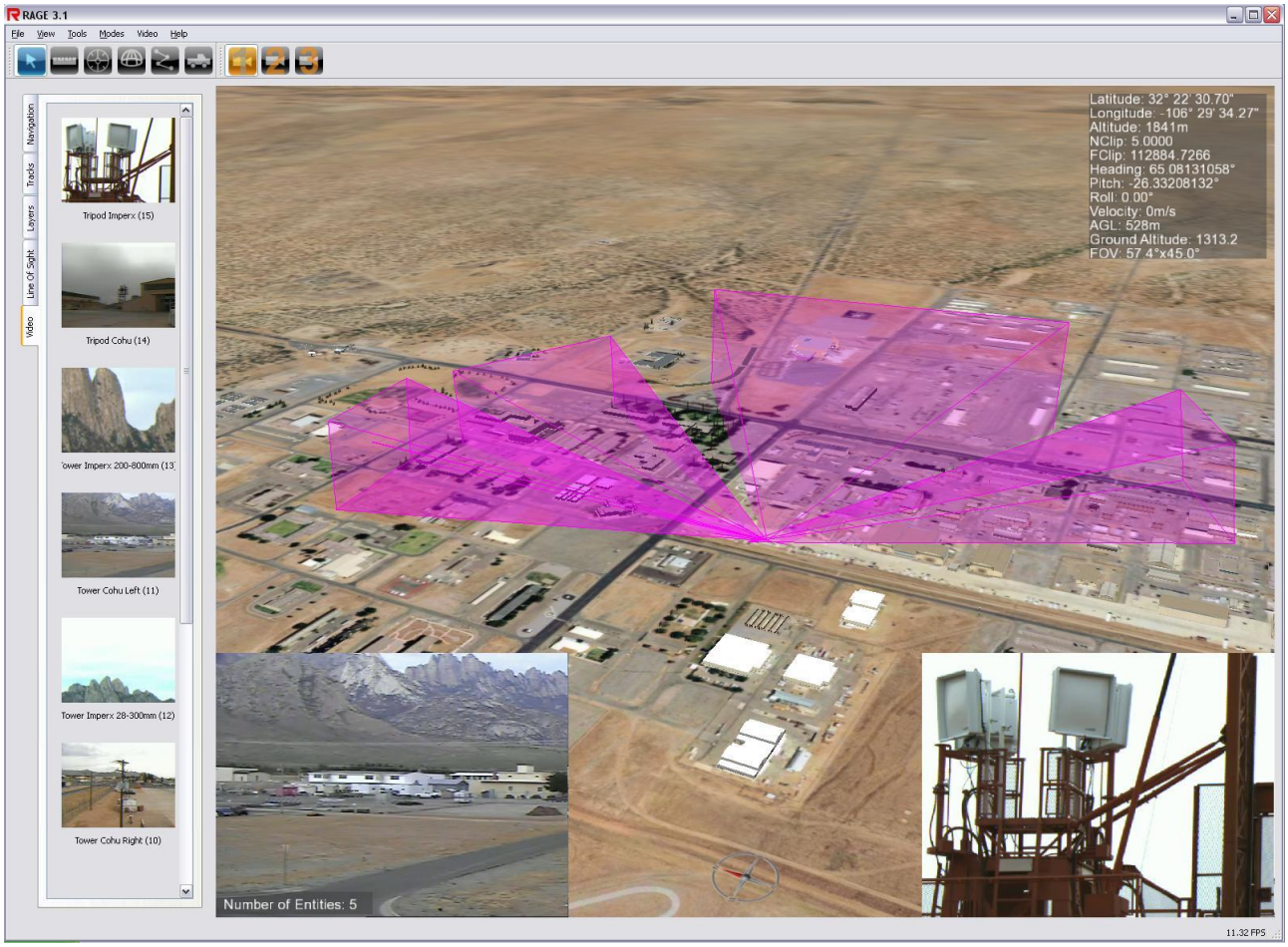


FIGURE 24, FIRECAM SUITE

Loading Video Channels

In order to view and control videos in RAGE, several steps must be taken.

Steps

1 Send the Video to RAGE. See FIRECAM documentation (this process has several steps and uses multiple tools to ensure streaming and controlling the video efficiently).

2 To begin, a USB joystick is needed to control the camera/lens gimbal at the source of the video. The joystick needs to be plugged into the RAGE computer chassis prior to starting RAGE. RAGE will go out and poll the ports for controller devices.

3 Start RAGE and configure the network. Start RAGE by double clicking on the RAGE icon on the desktop. Next, select [Configuration] from the RAGE Opening Screen. Select the Network Tab. Under Name in the Network table, double left-click the next available block under Name. Type in the following – Name: FIRECAM_STREAM. Now double left-click on the Port. Type the Port number the video is being transmitted on from the source.

4 Save and Apply Changes to configuration. Use the mouse to select [Save Changes] on the bottom of the RAGE configuration window. Next, select [Apply changes] next to Save Changes.

5 Close the Configuration Window and start RAGE. Right click on the [X] in the upper right corner to close the window. Select [Start] from the RAGE Opening Screen.

6 Load the FIRECAM plug-in. Use the mouse to locate and left click on [Tools] from the Menu Bar. Select [Plug-in Explorer]. The Plug-in Explorer window (Figure 25) will be displayed. Select [FIRECAM Plug-in] from the Discovered Plug-ins. Next, select the [Add] button. This will load the plug-in into RAGE.

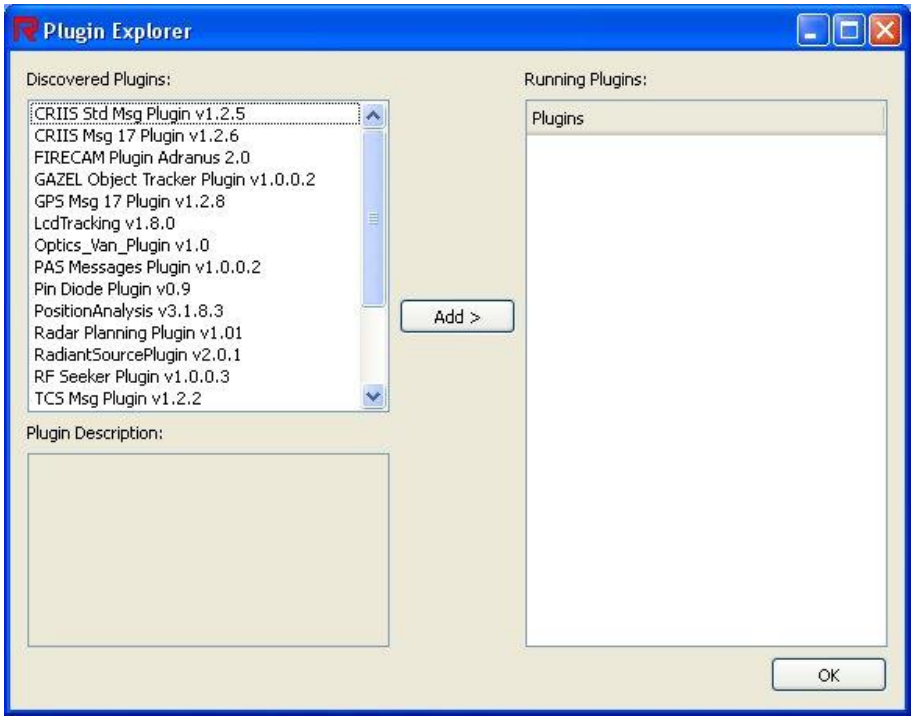


FIGURE 25, PLUG-IN EXPLORER WINDOW

7 Verify Receiving Video. To view incoming video, use the mouse to left click on the Video Tab on the side of the RAGE run time window. This will display the incoming video. If no videos are present, verify that the FIRECAM plug-in is installed under the Tools Plug-in Explorer on the Menu Bar.

8 Enable Joystick Control of Video. To take control of the video, using the mouse, locate and select [Joystick] on the Menu Bar. Select [Plug-in control]. This will enable the video that has been set as active (See *Joystick Control*) to be controlled.

9 Select [video to control]. To switch control quickly from video to video, use the mouse to double click the video of interest. The letters *ACT* will be displayed in the video to show Active control. If the video is being controlled for the first time, a window will pop up asking for control. Select [OK] to enable control of video. See *Joystick and Joystick Control* for video.

Action Window: The commands available for a video are on the following page. More detailed information about the commands can be found in the Definitions and Terminology Section at the end of this manual. To display the Action Window, use the mouse to right click on the video of interest.

Show Information – This displays the name and positional information.

Show XY Plot – This allows the user to plot velocity, acceleration, and position over time.

Toggle Hide/Show – This enables/disables display of track in 3-D display.

Set As Active Object – This sets the track to be the main object of interest or for control with joystick.

Toggle Ground Clamp – This enables/disables the clamping track to the ground.

Toggle Altitude Clamp – This enables/disables the clamping track to the altitude.

Toggle IIP – This enables/disables the IIP solution.

Track with Active Sensor – This allows for a sensor to track an object.

Stop Tracking – This disables the tracking with an active sensor.

Add Hot Key – This allows the user to add a single key-press to rapidly transition default commands to this sensor, device, or video.

Attach LOS – This allows the user to select entities for a real-time LOS analysis. Using the one (from) to many (to) entities allows for multiple analyses.

LOS From – Select the entity for a starting or source point.

LOS To – Select the entity(ies) for an ending or destination point(s).

Display on Channel 1 – The full resolution video selected will be displayed on Channel 1, located on the lower left of the 3-D viewing window. Use the mouse to right click on the video of interest, and then select [Display on Channel 1] from the action widow. To remove video using the mouse, select Video from the Menu Bar and select Clear Channel 1.

Display on Channel 2 – The full resolution video selected will be displayed on Channel 2, located on the lower right of the 3-D viewing window. Use the mouse to right click on the video of interest, and then select [Display on Channel 2] from the action widow. To remove video using the mouse, select [Video] from the Menu Bar and select Clear Channel 2.

Embedded Video – This transitions the video to the center of the 3-D viewing screen scaled for the FOV of the camera. This is not useful until RAGE is also transitioned to Embedded Camera mode. Select the Embed Video icon on the RAGE Menu Bar. When these two modes are combined, RAGE is considered a video augmentation allowing you to combine virtual and real-world information. See *Navigation Mode – Embedded Video*.

Start Recording – This sends the *start recording* signal to the FIRECAM network. This may be used to start a single camera's video (or many) to record depending on the configuration of the FIRECAM network of cameras. The data is recorded on a HHSMM computer. The software is located in the FIRECAM Suite. The HSMM computer is a specially configured computer system.

Stop Recording – This is the same as start recording, but sends the *stop recording* to the FIRECAM network of devices.

MENU BAR

File Menu

Located on the Menu Bar, [File] allows the user access to the RAGE configuration and the ability to load terrain and elevation databases.

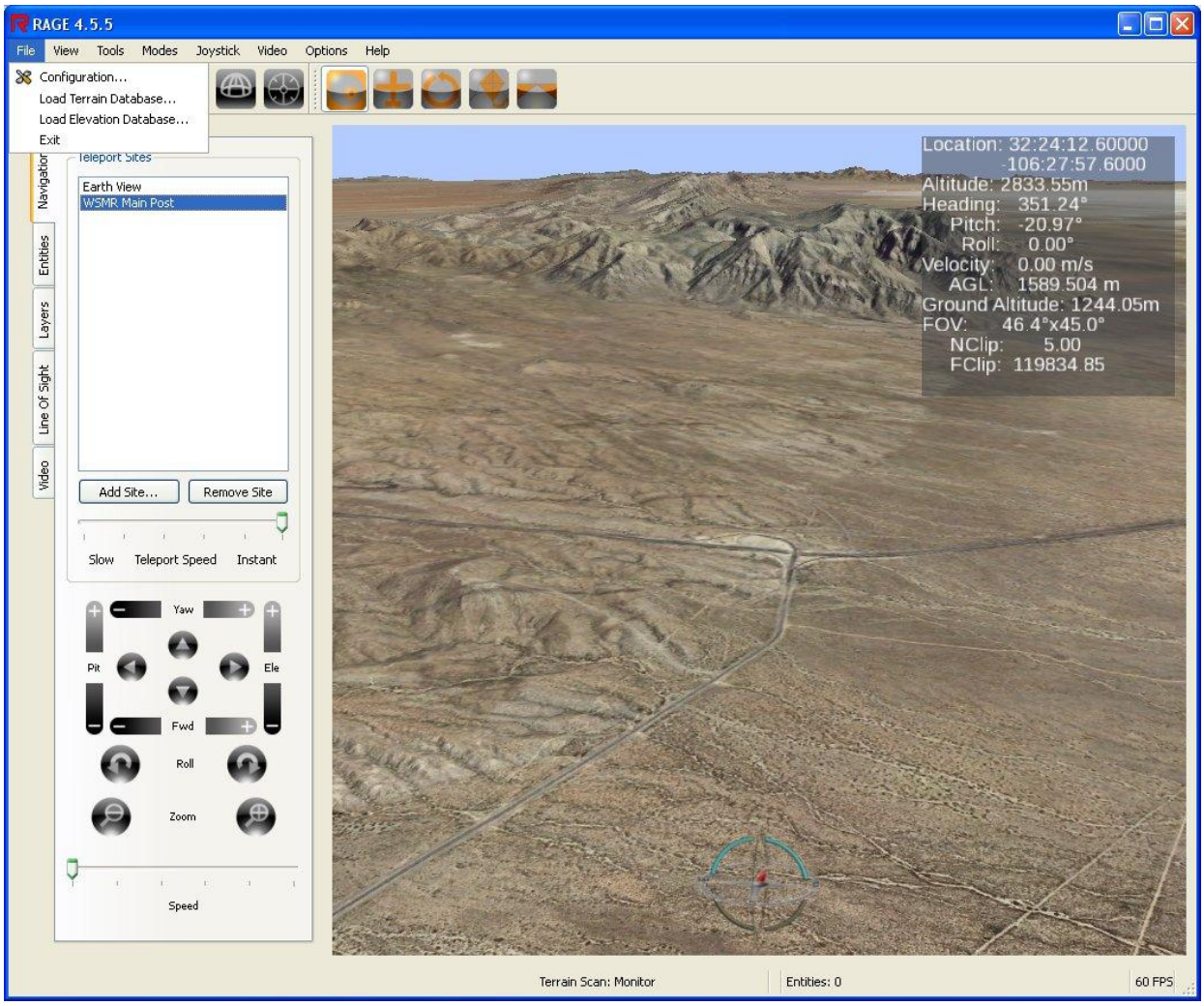


FIGURE 26, FILE MENU

Configuration	This is the configuration file for RAGE. RAGE does not have to be stopped in order to change the configuration of RAGE components.
Load Terrain Database	This allows the user to load a terrain database for testing. NOTE: This only loads temporally. The user will have to permanently set the path in the RAGE.xml configuration file.
Load Elevation Database	NOTE: This is not being utilized at this time.
Exit	Exit the RAGE program by closing down all threads.

View Menu

Located on the Menu Bar, [View] allows for customization of the 3-D viewing window display during run time. This is helpful in the event that the Heads Up Display (HUD) is not wanted or the terrain background in not needed.

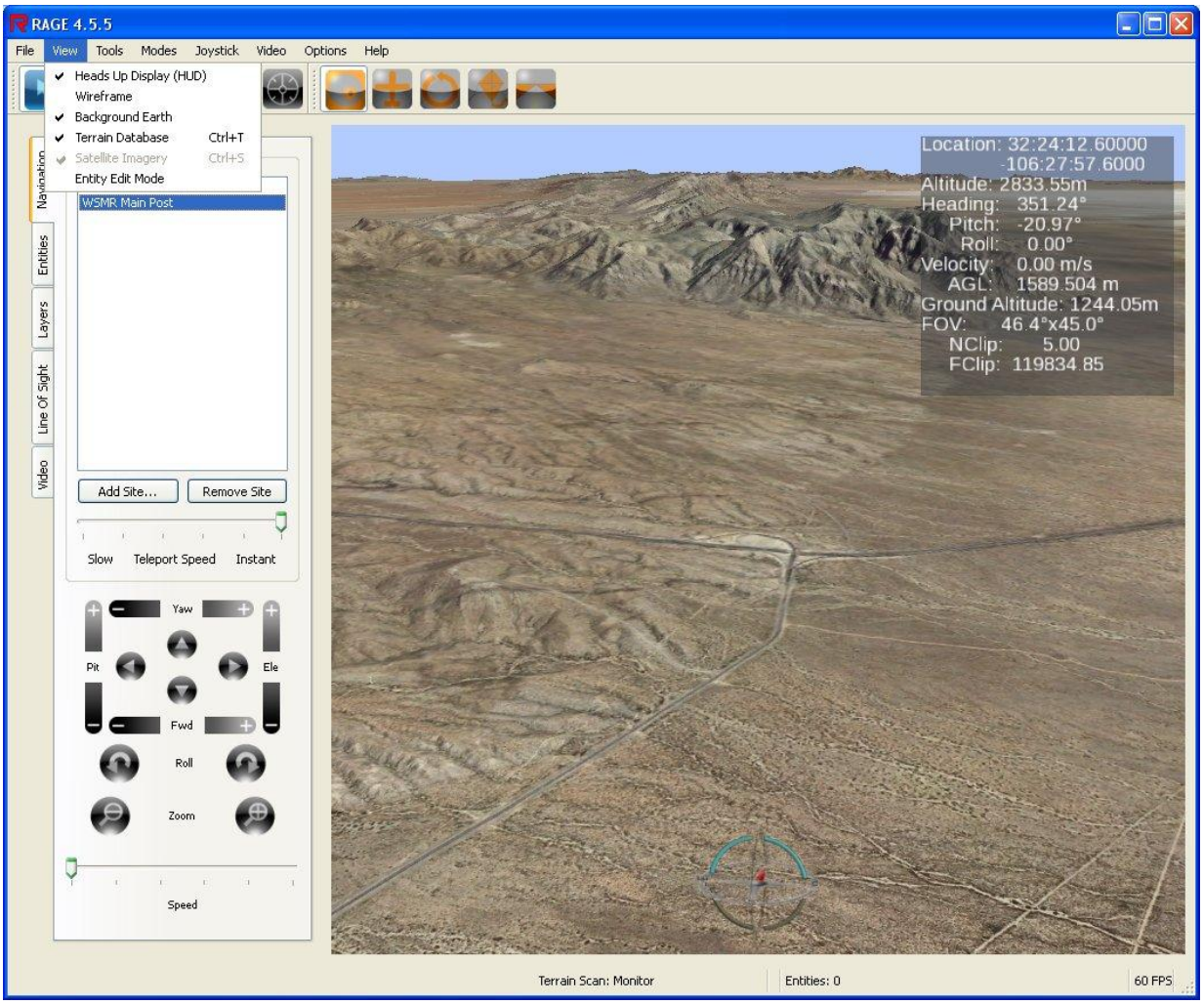


FIGURE 27, VIEW MENU

HUD	Located on the 3-D viewing window in the upper right hand corner, the HUD displays information about the viewer's location or location to an object of interest. Use the mouse to left click on [View] on the Menu Bar and select [HUD] to enable or disable the HUD in the 3-D viewing window.
WireFrame	This is a mesh composition of the underlying terrain. Wireframe simply removes the imagery to expose the mesh underneath. Use the mouse to left click on [View] on the Menu Bar and select [WireFrame] to enable or disable the mesh.
Background Earth	This is an image of the entire Earth from the USGS's 12-month average vegetation study. Use the mouse to left click on [View] and select [Background Earth] to enable or disable the imagery.
Terrain Database (Ctrl + T)	This is the 3-D terrain database where the events take place. Use the mouse to left click on [View] and select [Terrain] to enable or disable the 3-D imagery.
Satellite Imagery (Ctrl + S)	This allows RAGE to use Google Earth imagery by checking this option and setting the RAGE configuration Earth Option Satellite Imagery to true.
Entity Edit Mode	By selecting this option, it allows the user to manually move objects in the 3-D display window without getting a warning.

Tools Menu

Located on the Menu Bar, [Tools] allows the user to access certain tools. The same tools are also available on the Menu Bar as icons.

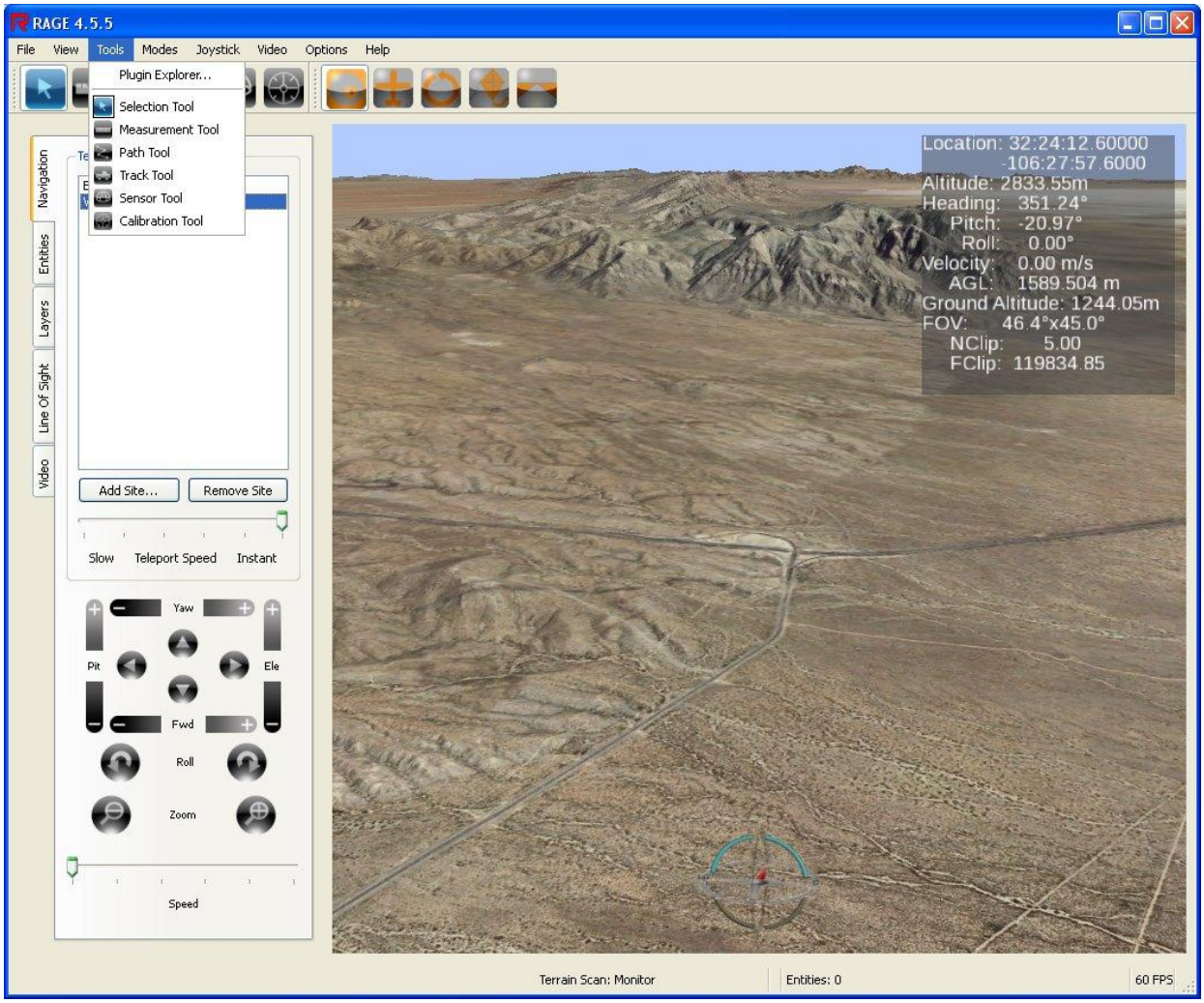


FIGURE 28, TOOLS MENU

Plug-in Explorer

This is a means of loading a small interface program that interacts with RAGE. The plug-ins are created by the user. An example of the plug-in interface is available at the end of this manual.

Selection Tool

This enables the user to *grab* the terrain with the mouse and move it around for navigation purposes. It also allows the user to select entities, sensors, and videos to manipulate and view information.

Measurement Tool

This is a tool used to calculate a position, distance, and LOS in the 3-D viewing widow. Measurements can be viewed in different reference types.

Path Tool

This is a tool used to create tracks or paths that can used by an entity. It is used mostly as a simulation path creator. The Path Tool can also be used as a layer creator. The user can scribe a boundary and save it as a layer.

Track Tool

This allows the user to select, configure, place, move, edit, or remove an entity at a desired location.

Sensor Tool

This allows the user to place sensors such as proximity, radar, laser, and optic mounts. The sensors are capable of real-time feedback. The user has control of size, shape, function, color, and location.

Calibration Tool

This is a GUI that allows the user to calibrate camera sensor gimbals based on the position of the embedded viewer in RAGE.

Plug-in Explorer

The Plug-in Explorer (Figure 29) is the primary source of extending capability within the RAGE environment. RAGE unveils a significant capability through the plug-in system to be used for customized user applications. These can be as simple as a user-defined data source for entity position data or as complex as the interactive Gimbal/Camera/Lens control and video streaming of the FIRECAM plug-in.

To initialize the Plug-in Explorer on the RAGE Menu Bar, left click select [Tools] and left click select [Plug-in Explorer]. The Plug-in Explorer Window will appear. NOTE: RAGE will remember the plug-in added. The next time RAGE is started, the plug-in will load automatically. To remove this from the RAGE startup, the user must edit (wordpad, xml editor) and delete the desired plug-in from the AutoLoadPlugins.xml located in the Run folder.

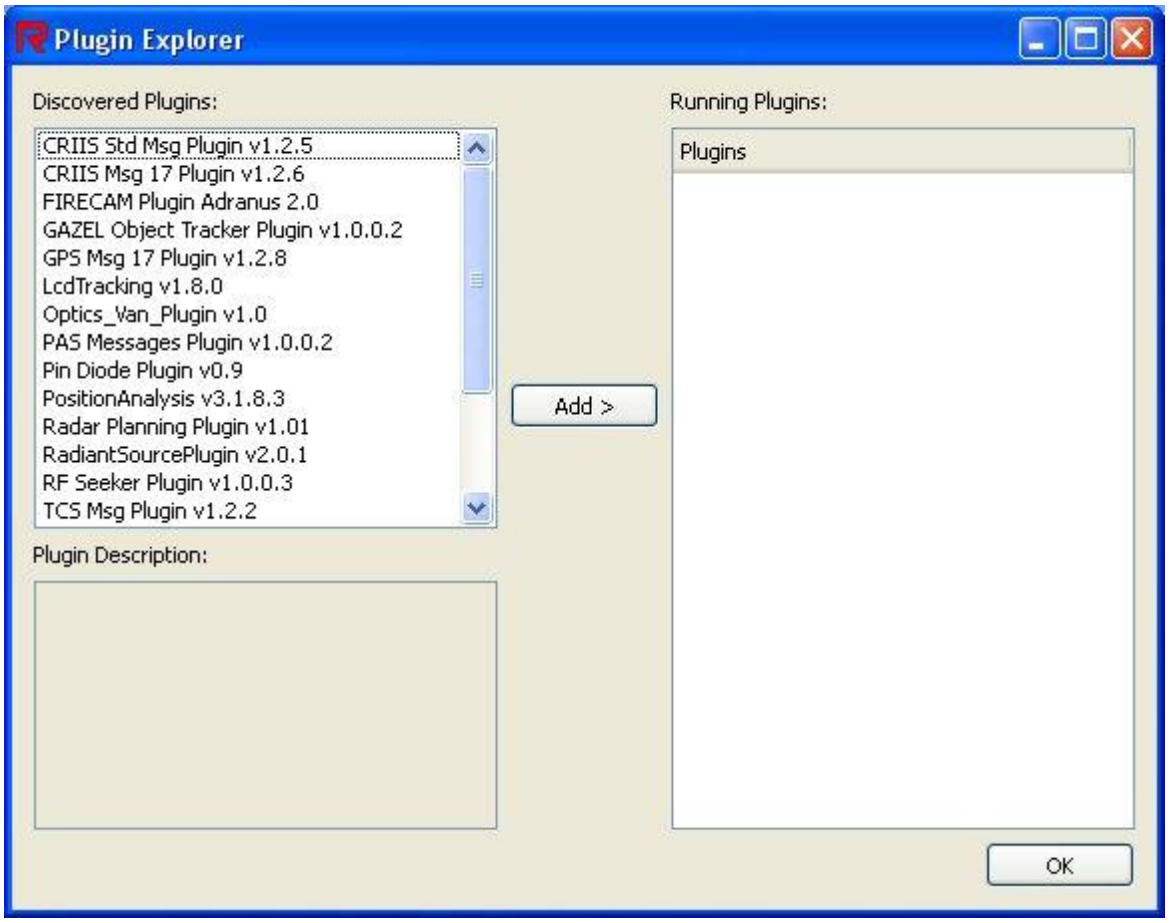


FIGURE 29, PLUG-IN EXPLORER

Discovered Plug-ins

This window displays all of the plug-ins detected in the folder. The folder that contains the plug-ins is found under C:\RAGE_4.5\RAGEPlugins\bin. If the user should create a plug-in DLL, this is the location that the DLL should be placed.

Plug-in Description

This window provides a description of the selected plug-in from the Discovered Plug-ins window.

Running Plug-ins

This window displays all of the plug-ins loaded into RAGE run time.

Add

This is used to add the plug-in from the Discovered Plug-ins window to the Running Plug-ins window. Using the mouse, left click select the desired plug-in from the Discovered plug-ins window. Next, select the [Add] button in the center of the Plug-in Explorer window. This adds the plug-in to RAGE run time. RAGE will remember the plug-ins added so that there is no need to keep reloading the plug-in every time RAGE is started. NOTE: To remove a plug-in from the Running Plug-ins window, the user will have to edit (wordpad, xml editor) the AutoLoadPlugins.xml file. This file is located in C:\RAGE_4.5\run.

Selection Tool

This tool allows the user to move through the terrain database by use of the mouse buttons. Using the scroll wheel on the mouse enables the user to zoom in and out. When the FIRECAM plug-in is installed, it allows for an instant *look here* command that will automatically slew the camera's gimbal to that point of interest.

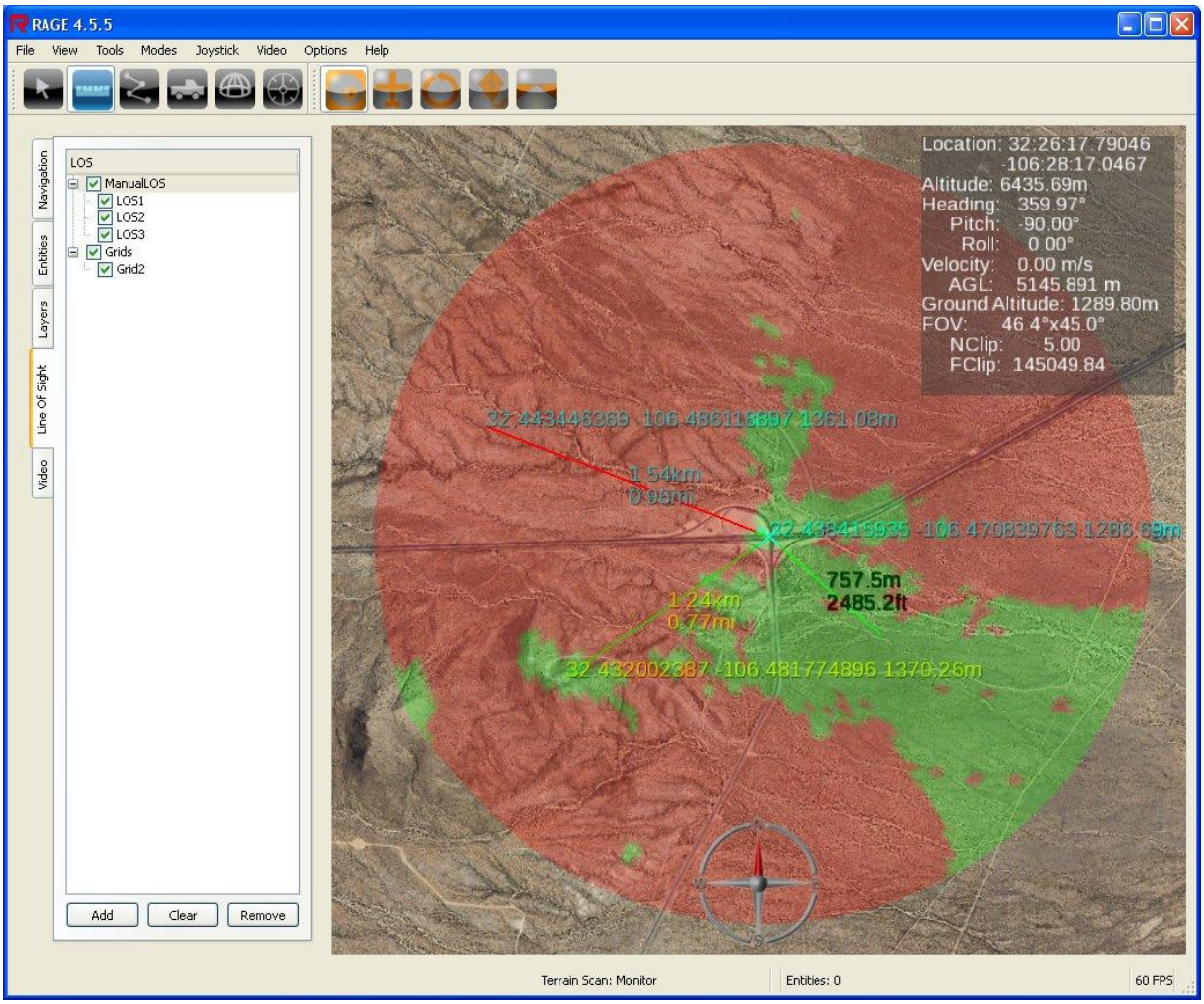
Left Click Hold This will move the user through the terrain database on the same plane using the same pitch of the user's view. With the selection chosen, hold down the left mouse button while moving the actual mouse. The user can also press and move and release the mouse to perform a "coasting" across the terrain database. To stop the coasting, the user must press and hold the button momentarily.

Right Click When the FIRECAM plug-in is installed and camera systems are being used, the user can select a point on the terrain or object and select [look here with active object]. This will cause the camera system that is active to immediately slew the camera sensor to that point of interest. This is only available with the FIRECAM plug-in suite.

Scroll Wheel This allows the user to zoom in and out from the terrain database. The scroll wheel acts like an accelerator. Moving the wheel faster in either direction will cause faster movement. The movement will slow to a stop after a few seconds of no input from the scroll wheel.

Measurement Tool

The Measurement Tool located on the Menu Bar is used in conjunction with the LOS tab, located on the left hand side of the run time window. This allows the user to view distances and single point geodetics. The distances will also display a visible or obscured view from point-to-point. The obscured measurement is taken one step further by displaying at what point the obscuration occurred. This is done both visually with color lines and in text in the 2-D plot. To view a 2-D plot of a measurement, the line must first be added to the LOS tab. Multiple measurement lines can be viewed at once. A LOS 360 degree grid can be generated and displayed from a single point. The grid calculation will use the available CPU resources of the computer to perform the calculations. The grid can also calculate and display the Fresnel Zone. The grid parameter edit window allows for custom calculations based on Zone, RF frequency, RF power loss, LOS valid, invalid, and Fresnel Colors. Multiple grids can be displayed with different colors for designation. Multiple 360 grids can be generated using a different user settable color combination to allow for visual discrepancies. Every 360 LOS grid is automatically added to the LOS tab. Each grid in the LOS tab is editable and is recalculated instantly. A Dynamic LOS is also available for moving objects. The user can set up a point-to-point or multi-point measure. This will automatically display the change in distance as the objects move in the 3-D display window. The geodetic reference datum for the measurements can be changed on the fly. Figure 30 illustrates the various measurement capabilities of the measurement tool.


RAGE 4.5.5
File View Tools Modes Joystick Video Options Help
Navigation
Entities
Layers
Line Of Sight
Video
LOS
ManualLOS
LOS1
LOS2
LOS3
Grids
Grid2
Add
Clear
Remove
Location: 32:26:17.79046
-106:28:17.0467
Altitude: 6435.69m
Heading: 359.97°
Pitch: -90.00°
Roll: 0.00°
Velocity: 0.00 m/s
AGL: 5145.891 m
Ground Altitude: 1289.80m
FOV: 46.4°x45.0°
NClip: 5.00
FClip: 145049.84
32.443446389 -106.486118897 1361.08m
1.54km
0.95mi
32.438415935 -106.470839763 1286.69m
757.5m
2485.2ft
1.24km
0.77mi
32.432002387 -106.481774896 1370.26m
Terrain Scan: Monitor
Entities: 0
60 FPS

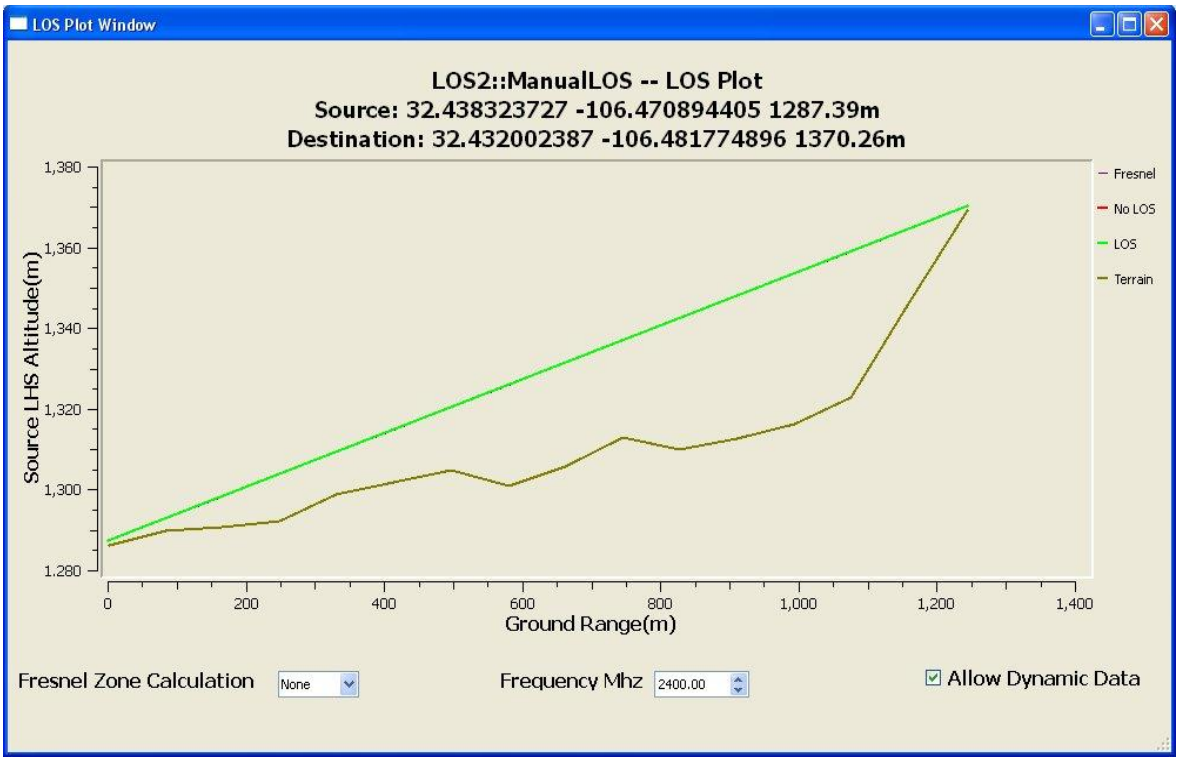


FIGURE 30, MEASUREMENT TOOL AND LOS PLOT OF SAMPLE 1

Mouse Left Click

This is used to create the measurement line. With the Measurement tool selected on the Menu Bar, left click select a starting point on the 3-D viewing window and hold down the left mouse button. While holding down the left mouse button, drag the crosshair to the ending point. The geodetics and distance are immediately displayed. When satisfied, release the left mouse button. To change the display characteristics of the line, right click on the newly created line and select Edit Measurement. From here, several variables are available.

Multiple Measurements

This is used in conjunction with the LOS tab. To view multiple measurements at once, click on the LOS tab, create a measurement in the 3-D window, click on [Add] in the LOS tab window, repeat another new measurement, and click on [Add] in the LOS tab window. The user can edit the names of each measurement to avoid confusion. Repeating this process will create multiple measurement lines. All LOS from the LOS tab window can be saved and retrieved by selecting File from the Menu and selecting Save As. See *Line Of Sight Tab*.

Mouse Right Click

This is used to edit measurement line attributes and create 360 degree LOS calculations. By right clicking on the 3-D display window, an action window will appear. Several options appear: Visible, Edit Measurement, LOS Grid, LOS Off Center Grid, Drag Source, and Drag Destination. By default, Visible is enabled.

Figure 31 displays a sample LOS Line Measurement with the line added to the LOS tab window (Blue hi-light). The line measurement was created by selecting the Measurement Icon from the tool bar. Using the left button on the mouse, click and hold down the button until the desired location is reached. Release the left button from the mouse and then select the Add button on the LOS tab window. The line shows a partial green area. This indicates that there is visibility from the starting point to where the red line starts. The red line indicates that no visibility is available for the duration of the line. By selecting the sample LOS in the tab window, the user can edit the parameters of the line to see at what point full visability is available. A 2-D plot seen in Figure 32 is also available by selecting Show Plot from the action window. The 2-D plot will display the line measurement information and a drawing of the elevation with the line and its obscuration point.

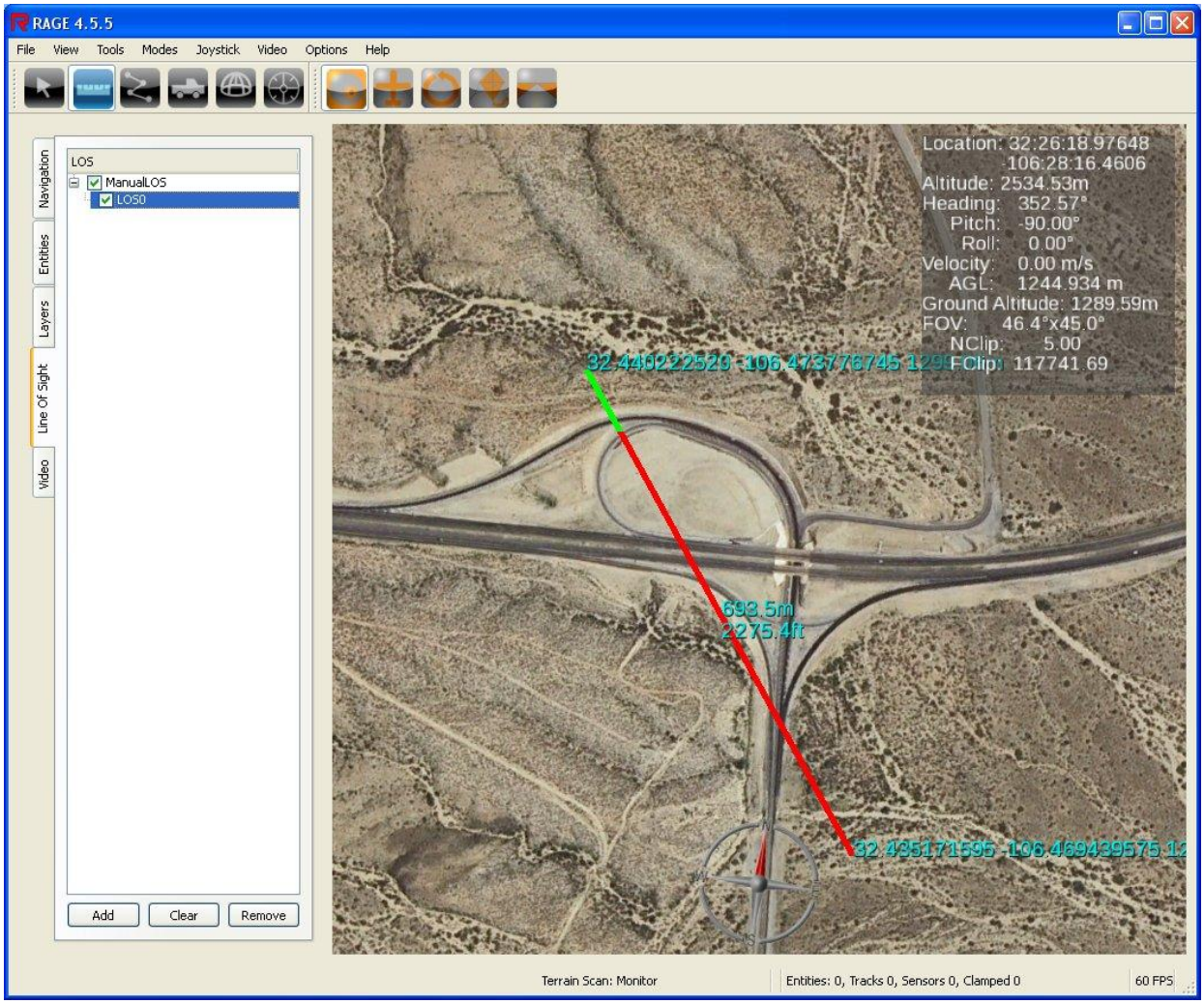


FIGURE 31, LOS SAMPLE LINE MEASUREMENT

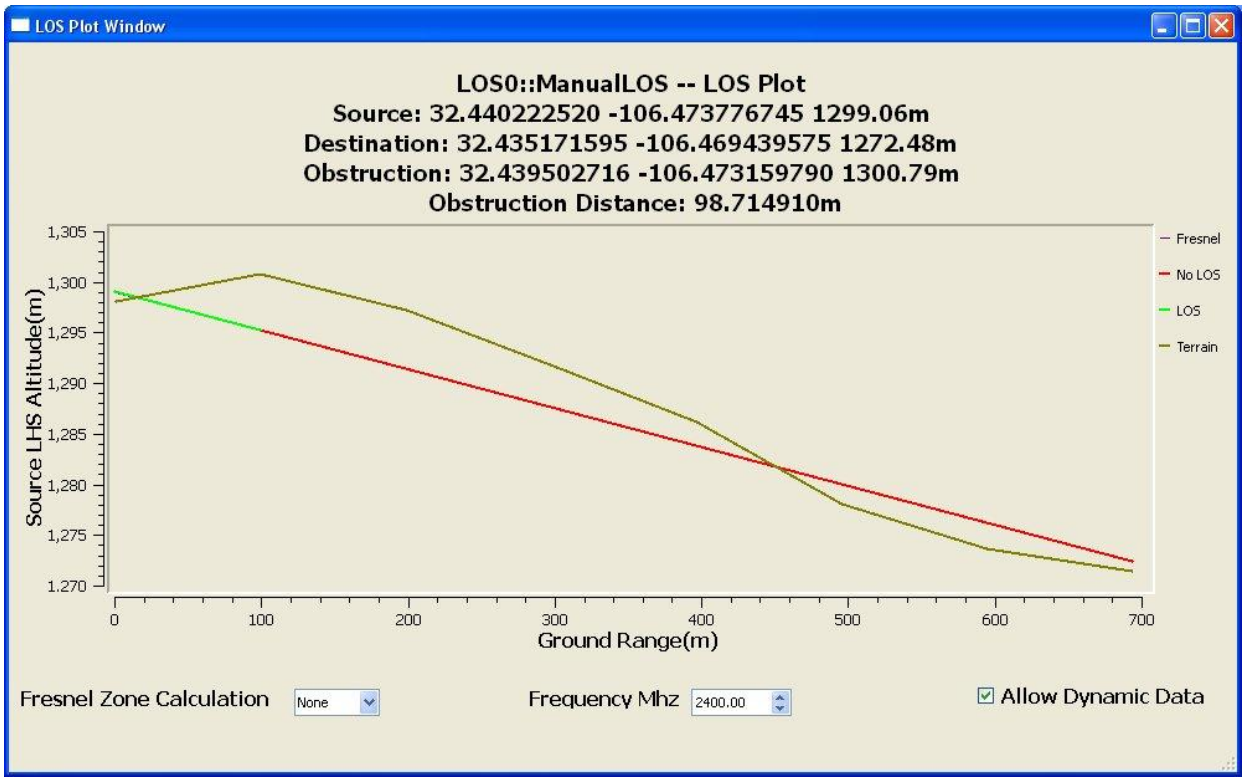


FIGURE 32, LOS SAMPLE LINE MEASUREMENT 2-D PLOT

Figure 33 shows the LOS Edit Menu. This is accessible by right clicking on the 3-D display window. The user can select from the following functions to edit and create LOS measurements.

FIGURE 33, LOS EDIT MENU

Visible	This enables/disables the current measurement line.
Edit Measurement	This allows the user to change the reference datum by selecting drop down menus in the value field. Locations may be edited by hand by double clicking the source and typing the numbers. Reference data includes: Geodetic Decimal, Geodetic DMS, MGRS, and UTM. See *FIGURE 34*.
LOS Grid	This creates a 360 degree grid originating from the selected source. The Fresnel zone can be calculated at the same time. Based on the user input on the Grid Properties window, sample points (resolution) and the grid size (meters) will now be displayed instantly. See *Line of Sight Tab*.
LOS Off Center Grid	This allows for long distance calculations of a destination area. It is used when the immediate source area is not a concern.
Drag Source	This enables the source of the line measurement to be moved without changing the destination.
Drag Destination	This enables the destination of the line measurement to be moved without changing the source.

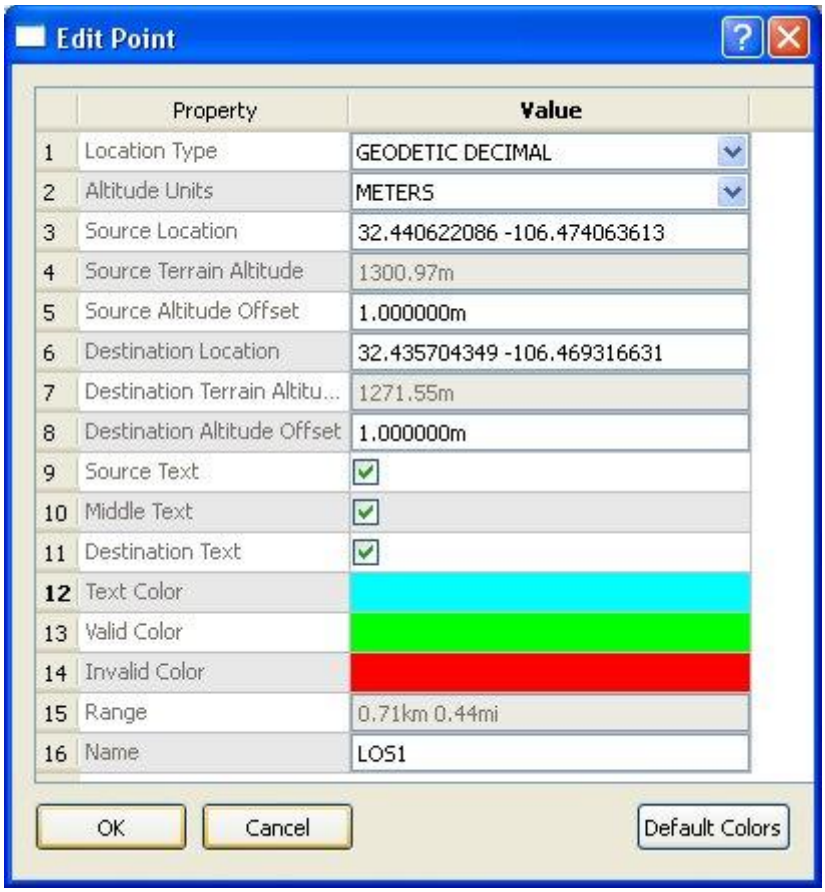


FIGURE 34, EDIT LOS LINE PROPERTIES WINDOW

Location Type

This allows the user to select different georeference displays. Use the down arrow to select references.

Altitude Units

This allows the user to select either meters or feet to display the geodetics. Use the down arrow to select units.

Source Location

This is the start point for the source location. This point can be modified by the user by double left-clicking on the value using the mouse.

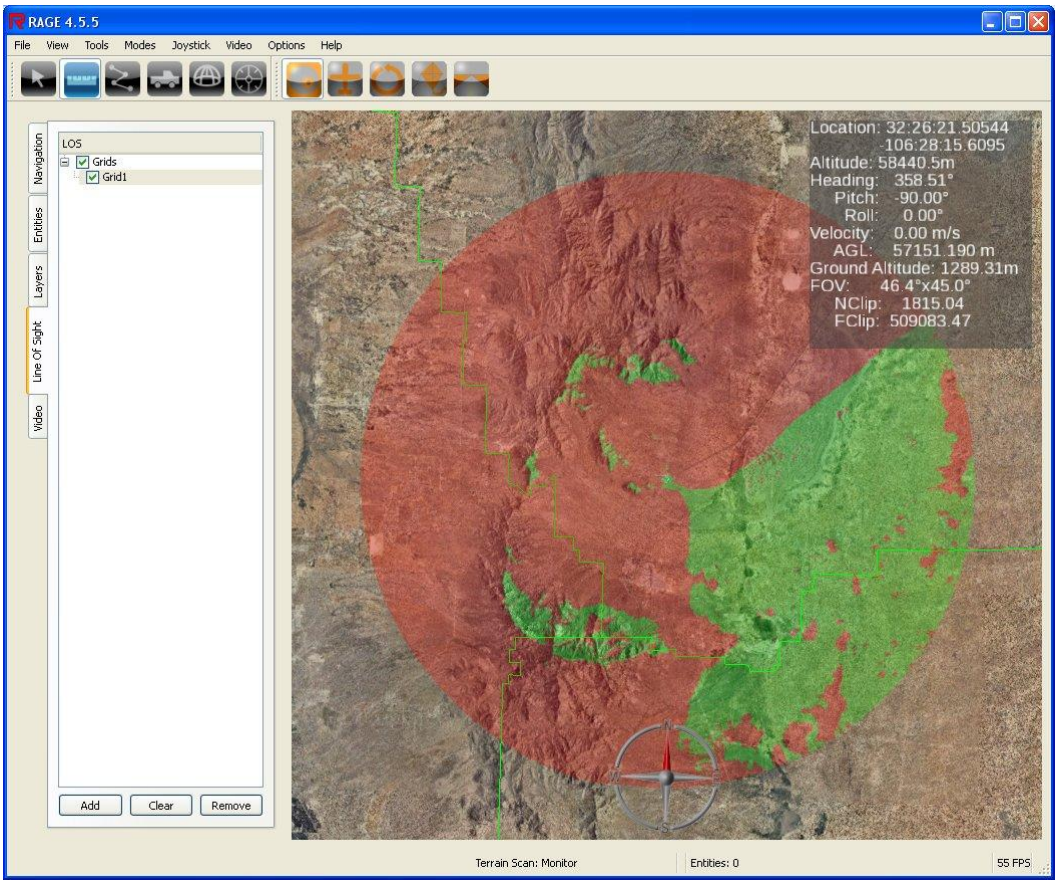
Source Altitude	This is the true height for the source point measured in RAGE at the surface. NOTE: What is displayed in the 3-D display widow for height is the Source Altitude plus the Altitude Offset value.
Source Altitude Offset	This enables the user to add or subtract meters or feet to the altitude height of the source. In this manner, an antenna height can be used for a calculation. The default number is 1.0 m. This point can be modified by the user by double left-clicking on the value using the mouse.
Destination Location	This is the end point for the destination location. This point can be modified by the user by double left-clicking on the value using the mouse.
Destination Altitude	This is the true height of the destination point measured in RAGE at the surface. Note: What is displayed in the 3-D display window for height is the Destination Altitude plus the Altitude Offset value.
Destination Altitude Offset	This enables the user to add or subtract meters or feet to the altitude height of the destination. In this manner, an antenna height can be used for a calculation. The default number is 1.0 m. This point can be modified by the user by double left-clicking on the value using the mouse.
Source Text	This allows the user to display the latitude, longitude, and height information for the source point.
Middle Text	This allows the user to display the distance of the measurement.
Destination Text	This allows the user to display the latitude, longitude, and height information for the destination point.
Text Color	This allows the user to select a color for the test being displayed on the 3-D display window. Every measurement can have a different color of text.

Valid Color	This displays the color for a valid or true LOS. Every measurement can have a different color for valid.
Invalid Color	This displays the color for an invalid or false LOS. Every measurement can have a different color for invalid.
Range	This is the distance of the line measurement in both meters and feet or kilometers and miles.
Name	The user has the option to create a name for the line. This can be modified by the user by double left-clicking on the value using the mouse.
Default Colors	By selecting this button, the default colors for the Text, Valid and Invalid colors will be reset.

LOS GRID MEASUREMENT

A grid differs from a line measurement in that a grid does a 360 degree sweep of an area based on the parameters in the properties window. The properties window is presented prior to the calculation of the LOS. The grid can also calculate the Fresnel Zone. The user has control of the zone, frequency, power loss, and color designation.

With the Measurement tool selected from the Menu Bar, using the mouse, left click on a point of interest. An action window will appear. Select [LOS Grid] from the list. A properties window will appear with the geodetic information for that particular point. From this window, the user can modify the attributes for the drawing of the LOS grid. To clear the grid on the LOS tab, using the mouse, left select the grid to be removed from the LOS tab and then right click and select remove LOS. Once the OK button is selected, a LOS progress meter will be display at the bottom of the RAGE display window. When the calculation is complete, the grid will be presented. To modify the grid, select the particular grid from the LOS tab at left and right click to access the action window and select Edit Grid



LOS SAMPLE GRID MEASUREMENT

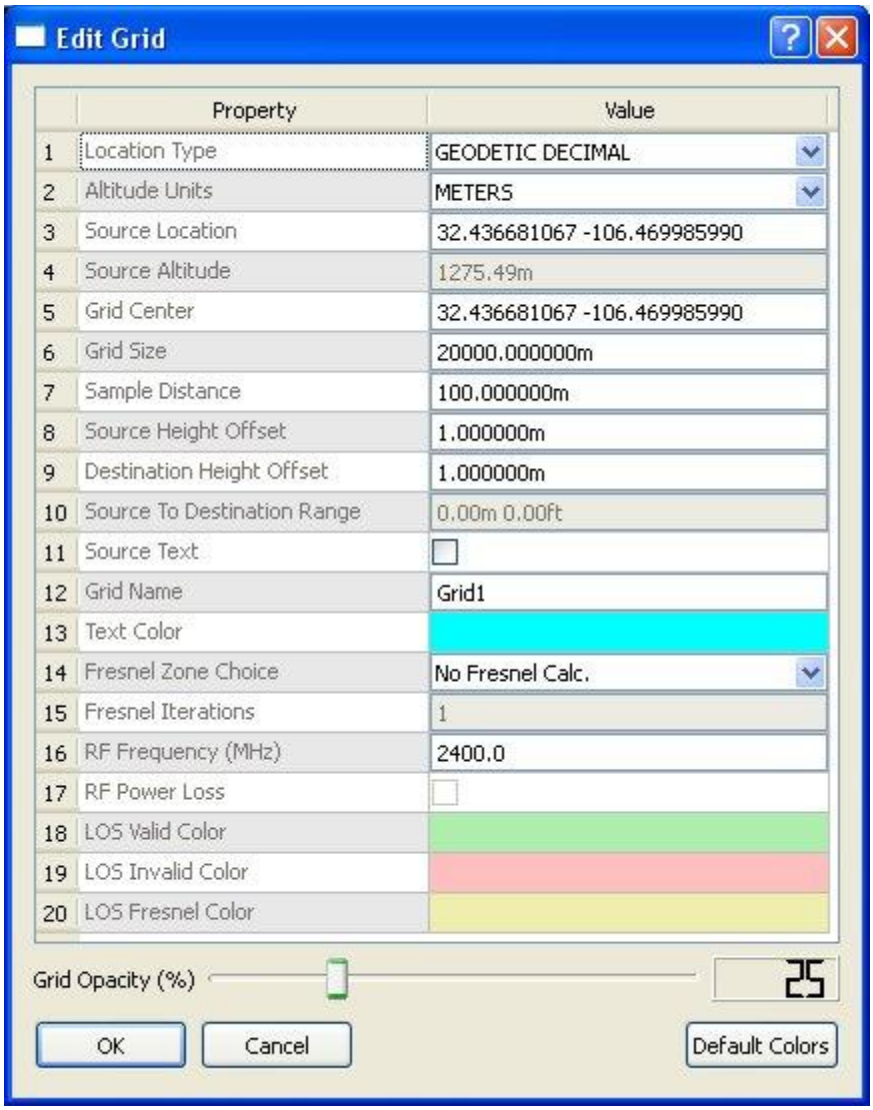


FIGURE 35, LOS EDIT GRID PROPERTIES WINDOW

LOS EDIT GRID PROPERTIES

Location Type	This allows the user to select different geodetic displays.
Altitude Units	This allows the user to select either meters or feet to display the geodetics.
Source Location	This is the start point for the source location. It can be modified by the user by double left-clicking using the mouse.
Source Altitude	This is the height measured in RAGE at the surface. This point can be modified by double left-clicking using the mouse.
Grid Center	This is the position of the center of the grid from which the calculation will take place.
Grid Size	This is the area for the grid from the center out to the edge that the calculation will take place.
Sample Distance	This is the distance that RAGE will take a sample reading for the calculation. The lower the number, the more points and a higher density the calculation will use and create.
Source height offset (m)	This is the distance in meters that the user can specify to allow for an offset in height at the source. This can be useful for adjusting for optical or antenna heights.
Destination height offset (m)	This is the distance in meters that the user can specify to allow for an offset in height at the destination. This can be useful for adjusting for antenna heights.
Source to Destination Range	This is the distance. Since only a single point is used for the calculation, it should be 0.0.
Source Text	This allows the user to display the geodetic information for the point.
Grid Name	This allows the user to create a name for calculation.

Fresnel Zone Choice	The drop down window allows the user to select no Fresnel calculation or the different levels of the Fresnel zone (1-3).
Fresnel Iterations	This allows the user to enter complexity of the Fresnel calculation. RAGE is capable of calculating 3-D Fresnel Zone.
RF Frequency	This allows the user to input the frequency to be calculated for the Fresnel zone.
RF Power Loss	This allows the user to select whether or not the RF power loss over distance is measured.
LOS Valid Color	By default, green is the valid color. The user can change this by double clicking on the color to pick a color from the palette.
LOS Invalid Color	By default, red is the invalid color. The user can change this by double clicking on the color to pick a color from the palette.
LOS Fresnel Color	By default, yellow is the Fresnel color. The user can change this by double clicking on the color to pick a color from the palette.
Grid Opacity (%)	The slider allows the user to control the level of visibility. By default, 25 is the percentage used. The box to the right displays the level of percentage.
Default Colors	By selecting this button, the default colors for the Text, Valid and Invalid colors will be reset.

LOS Off Center Grid

A LOS Off Center Grid is identical to a LOS grid calculation. The only difference is that the area around the source is not displayed. The Off Center Grid is used for long distance calculations where the area around the source of the transmission is not of concern.

Figure 36 shows the Off Center Grid calculation. The blue “X” is the source transmission. It shows no calculation around the source. At the destination, the grid is calculated based on the information from the parameters.

With the measurement tool selected, choose a starting point and ending point in the 3-D display window. Right click to display the action window and select LOS Off Center Grid. Modify the parameters if needed and select OK. The properties window is identical to the LOS grid property window.

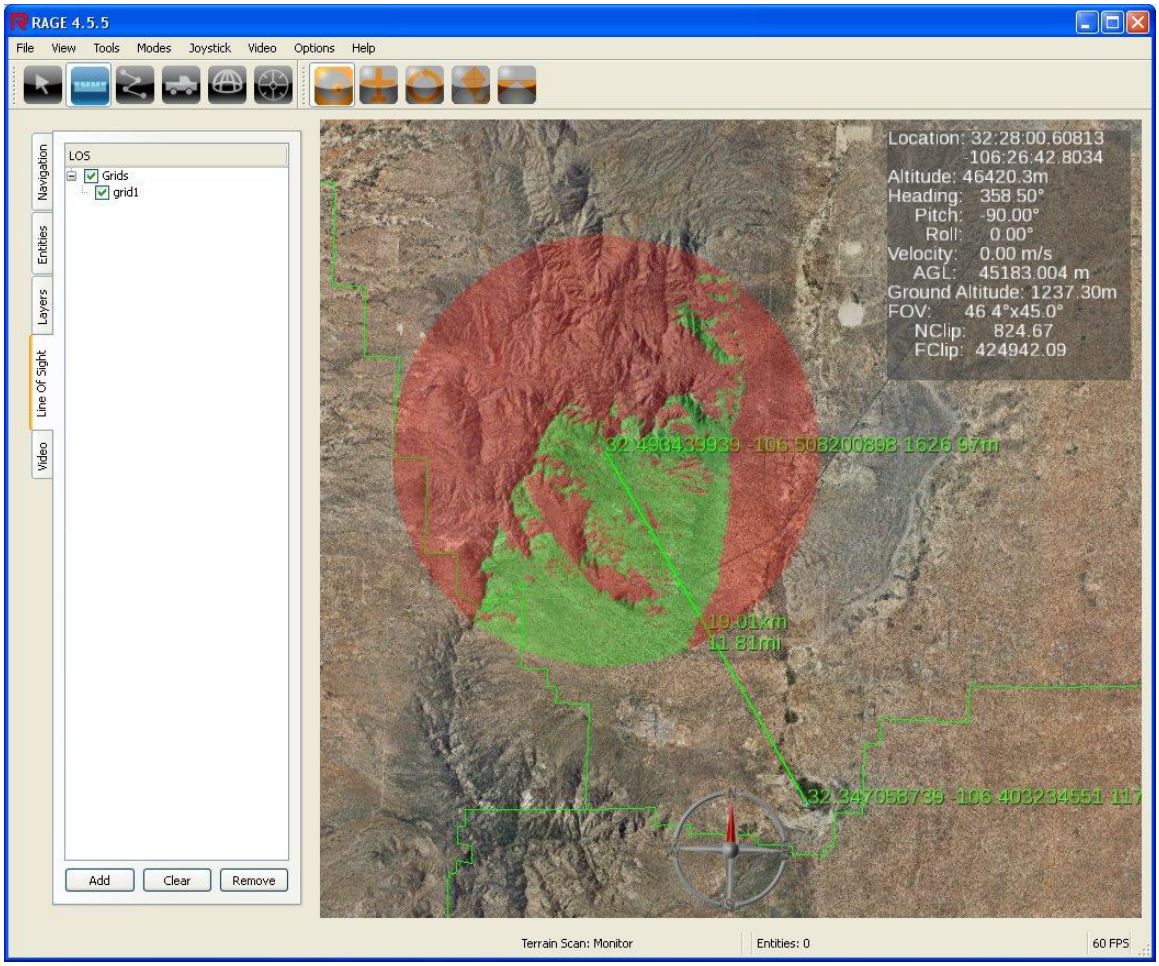


FIGURE 36, LOS OFF CENTER GRID MEASUREMENT

See *LOS Tab*. The LOS tab is used in conjunction with the measurement tool. It is advised to read about both tools before using them.

Path Tool

The Path Tool is a dual purpose tool. It allows the user to create a spline, which is used for simulating ground or air paths that an entity will follow. The entity can be assigned to this path using the model configuration table. These paths can then be run in a Universal Player. The Universal Player in turn will feed the path into RAGE. The other use of the Path Tool is to create boundary layers. These are layers that the operator can enable or disable in the Layers tab. Boundary layers are useful for display engagement, no fly zone, restricted, and mission corridor areas. Both uses of the Path Tool can be saved and named. They can also be reloaded if needed. See *Layers Tool.*

Left Click

Using the left click button of the mouse, select [Path Tool]. This will display a popup window (Figure 37) in the center of the screen. Left click on the blue window bar and drag the window to the side of the screen. Position the view in the 3-D viewing window with an overhead looking down position on the area of interest using the joystick. Use the left mouse button to start selecting points of interest on the surface. Every time a new point is selected, a line will be drawn to that point. When satisfied with the layout, select [File] and save the Current layout as a spline or as a KML layer. Select the [X] in the upper right corner to close the window after use.

Edit Point

In the event an error was made, select the point by right clicking and holding down the button. Next, move the point to the proper location and release the button. Select the [Save] point bar where the edit point bar was located. When the new position is saved, the edit point bar will return.

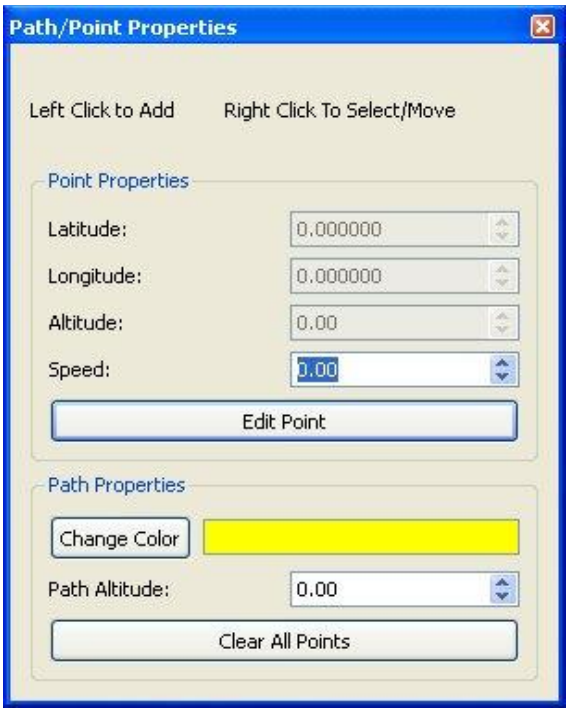


FIGURE 37, CLICK ON EDIT POINT

Change Color	This allows the user to select in which color the layout is presented.
Speed	NOTE: This is not being utilized at this time.
Clear All Point	This allows the user to start over by erasing all the data points.
Open Spline	Use the mouse to select [File] on the Menu Bar. This allows the user to retrieve past splines. Navigate to the area in which the spline was saved. By default, the splines are saved in the Run directory under RAGE.
Save Current As Spline	This allows the user to save the path created for playback with the Universal Player. To minimize the number of points used when created, the Universal Player plays this back as a spline, or a smooth curve connecting all the points created by the user.
Save Current As KML Layer	Saving as a KML layer allows for display only on the 3-D viewing screen with the chosen color option. The user can draw map lines, keep-out zones, or simply areas of interest.

Track Tool

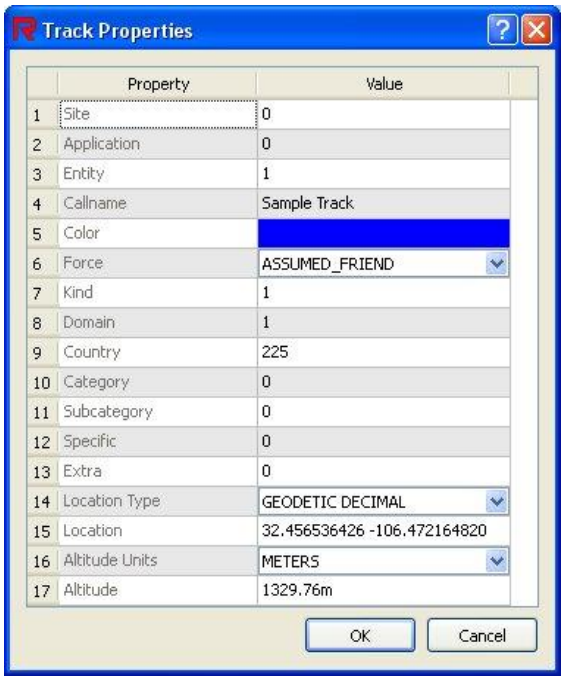
Track can be created and their attributes assigned. This allows the user to create an entity completely within RAGE, either for simple display or for testing/interactive purposes. Because of the design of RAGE, any operation that works on track files (entities) will also work on user created entities (i.e., If you want to test a camera's auto-track capability, you can create a virtual entity here and use it to auto track with). The camera should track back and forth as if it were tracking a real object as you move this one around. Sensors will also interact with a virtual entity, allowing the user to rehearse missions that utilize the sensor detection capabilities of RAGE prior to receiving live data.

Right Click

When the Track Tool is selected, it will add a track entity to the 3-D viewing scene. Right click on the surface in the 3-D viewing window area of interest. This presents a small window displaying *add track here*.

Add Track Here

This is the small popup window that appears when the right click is pressed on the mouse. This allows the user to add a track. Use the left click to select window. The Track Properties window (Figure 38) will be presented. See *Glossary of Terms* for definitions of different properties.



Track Properties

	Property	Value
1	Site	0
2	Application	0
3	Entity	1
4	Callname	Sample Track
5	Color	
6	Force	ASSUMED_FRIEND
7	Kind	1
8	Domain	1
9	Country	225
10	Category	0
11	Subcategory	0
12	Specific	0
13	Extra	0
14	Location Type	GEODETIC DECIMAL
15	Location	32.456536426 -106.472164820
16	Altitude Units	METERS
17	Altitude	1329.76m

OK Cancel

FIGURE 38, TRACK PROPERTIES CONFIGURATION TABLE

Edit Current Track

Once a track (entity) has been created, the user can edit the configuration of the track. Use the mouse to select [Track Tool] on the Menu Bar and right click on the track of interest. A small popup window is presented. Select [Edit Current track]. This will display the Track Properties Configuration table.

Remove Current Track

In the event a track needs to be removed, select [Track Tool] on the Menu Bar and use the right mouse button to select the track of interest. A small popup window is presented. Select [Remove current track]. It will take a few seconds for RAGE to stop the track thread. NOTE: This action permanently removes the track.

Clear Tracks

This allows the user to clear all the track threads from the RAGE environment. With the Track Tool enabled on the Menu Bar, left click on [File] on the Menu Bar then once more on Clear Tracks. A confirmation window will be presented acknowledging the operation. Left click select [Yes] or [No].

Open Track File

This allows the user to open previously saved track files. The default folder for the tracks is under Run in the RAGE directory. With the Track Tool selected on the Menu Bar, left click on [File] on the Menu Bar and select the [Open Track] file. Select the track file of interest and select [Open].

Save Tracks

This allows the user to save a track configuration under the default Tracks.xml file name. The default folder for the tracks.xml is under Run in the RAGE directory.

Save Tracks As

This allows the user to save a track configuration as a specified name. Many entities are created to provide situational awareness for a particular mission. This configuration can be saved with a specific name identifying the mission. The default folder for the tracks file is under Run in the RAGE directory.

Sensor Tool

Sensors can be created for several purposes. The dome sensors have the ability to detect other objects. The other sensor shapes within RAGE will eventually have detection capability, but currently only Domes does. When a Dome is set up as a detector role, it will change to the color specified in Detect Color anytime an entity enters its volume. RAGE does not care if the entity is externally generated or internally generated, so the user can test this feature prior to use. This allows the user to generate color markers for traveling entities to know when they reach certain locations or generate color indicators of vehicles straying where they do not belong. All of the sensors have the ability to display in different draw styles. Draw styles are meshes with different characteristics.

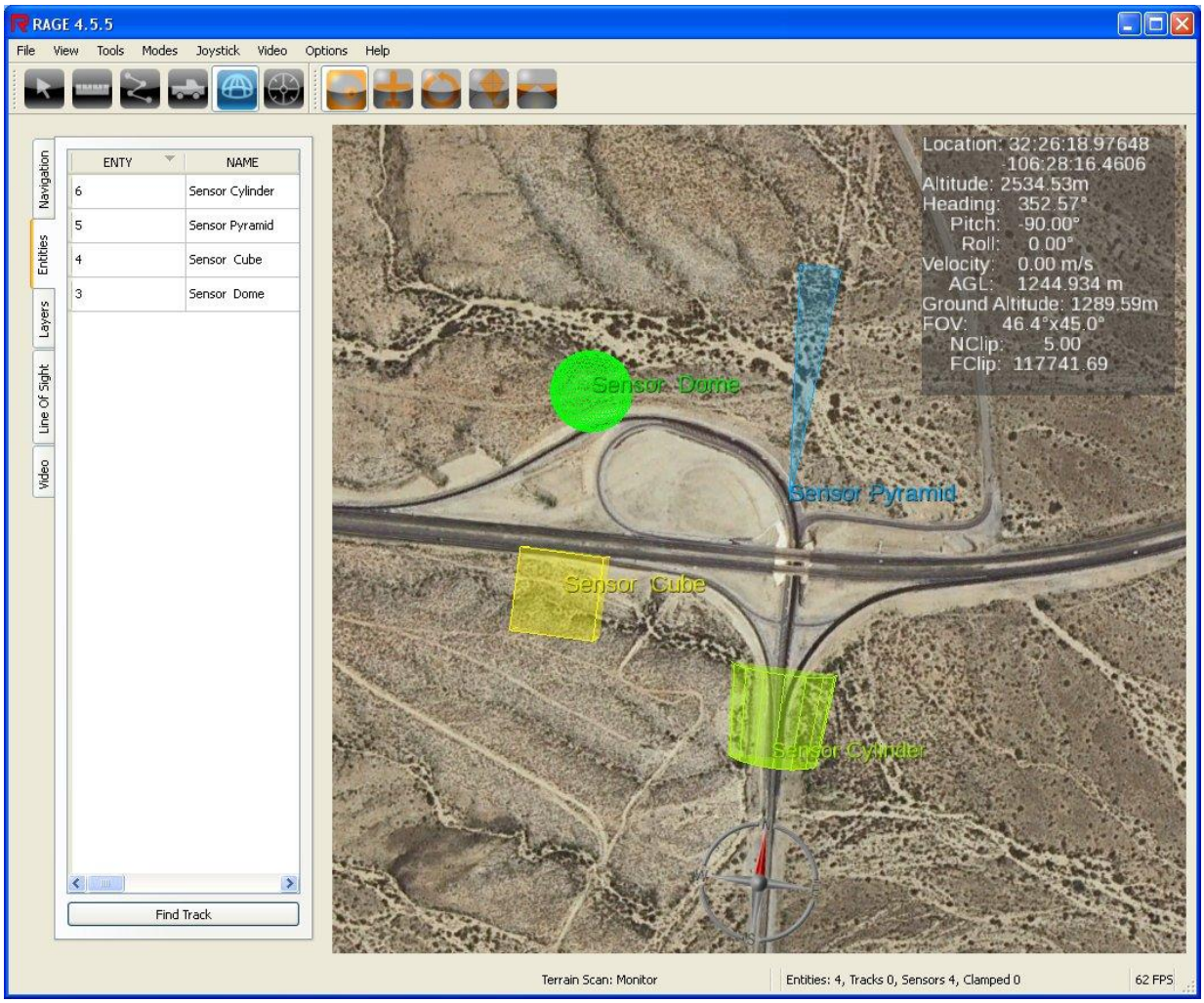


FIGURE 39, SENSOR DISPLAY WITH MULTIPLE SAMPLES SHOWN

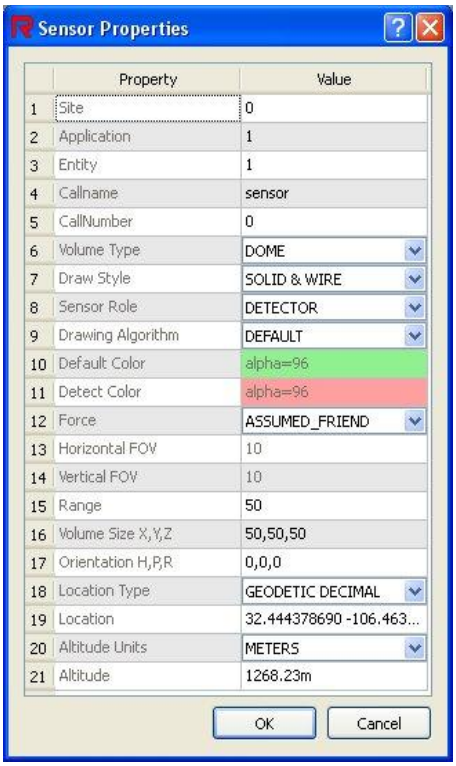


FIGURE 40, SENSOR PROPERTIES CONFIGURATION

Right Click	When the Sensor Tool is selected, it adds a sensor to the 3-D viewing scene. Right click on the surface in the 3-D viewing window area of interest. This presents a small window *add track here*.
Add Sensor Here	This is the small popup window that appears when the mouse is right clicked. This allows the user to add a sensor. Use the left click to select the window. The Sensor Properties window will be presented (Figure 40). See *Glossary of Terms* for definitions of different properties.
Edit Current Sensor	Once a sensor has been created, the user can edit the configuration of the sensor. Use the mouse to select the Sensor Tool on the Menu Bar and right click on the sensor of interest. A small popup window is presented. Select [Edit Current Sensor]. This will display the Sensor Properties Configuration table.
Remove Current Sensor	In the event a sensor needs to be removed, select [Sensor Tool] on the Menu Bar and use the right mouse button to select the sensor of interest. A small popup window is presented. Select the remove current sensor. It will take a few seconds for RAGE to stop the track thread. NOTE: This action permanently removes the sensor.
Clear Sensors	This allows the user to clear all the sensor threads from the RAGE environment. With the Sensor Tool enabled on the Menu Bar, left click on [File] on the Menu Bar and then left click on [Clear Sensors]. A confirmation window will be presented acknowledging the operation. Left click select [Yes] or [No].
Open Sensors File	This allows the user to open previously saved sensor files. The default folder for the sensors is located under Run in the RAGE directory. With the Sensor Tool selected on the Menu Bar, left click on [File] on the Menu Bar and select [Load Sensor]. Select the sensor file of interest and select [Open].
Save Sensors	This allows the user to save a sensor configuration under the default sensor.xml file name. The default folder for the sensor.xml is located under Run in the RAGE directory.

Save Sensors As This allows the user to save a sensor configuration as a specified name. Many sensors are created to provide situational awareness for a particular mission. This configuration can be saved with a specific name identifying the mission. The default folder for the sensor file is located under Run in the RAGE directory.

NOTE: See *Options on Tool Bar*. Select [All] for moving a group of sensors collectively.

Calibration Tool

The Calibration Tool allows the user to configure camera sensors on gimbals in the 3-D display window to the real world environment. The real world camera sensor gimbals must be capable of transmitting encoder gimbals angles. The better the resolution of the encoders, the better the slewing and tracking of the camera in the 3-D display window. The real world camera sensor gimbals do not need to know any information about its real world location. The user will be able to visually line up the 3-D camera sensor to the real world imagery by using a Video Transparency window.

Mount Values	*World Azimuth* – with respect to the RAGE compass. *World Elevation* – with respect to the RAGE compass. *World Roll* – with respect to the RAGE compass. *Azimuth Offset* – the difference between the RAGE compass and the gimbal encoder feedback. *Elevation Offset* – the difference between the RAGE compass and the gimbal encoder feedback. *Roll Offset* – the difference between the RAGE compass and the gimbal encoder feedback.
Clear Table	This removes all values from the calibration table.
Add Cal Point	This adds a calibration point to the table. More calibration points in the table will cause better tracking of the virtual camera sensor.
Reset Azimuth	This resets the azimuth value to zero. This will cause the virtual camera sensor to reset to zero.
Reset Elevation	This resets the elevation (pitch) value to zero. This will cause the virtual camera sensor to reset to zero.
Reset Roll	This resets the roll value to zero. This will cause the virtual camera sensor to reset to zero.
Speed	This is the speed at which the virtual camera sensor will move.
Video Transparency	This allows for the blending of the real world and 3-D virtual terrain video. A 50 percent mix is a good starting point.

Camera Sensor Gimbal Calibration

Steps

1 Under Tools, Plug-in Explorer, add the FIRECAM plug-in. This will load the videos into RAGE. The videos can be seen under the Video tab down the left side of the main RAGE display window. Select the Video tab.

2 Select the Video tab down the left side of the main RAGE display window.

3 Joystick Control – Under Joystick on the task bar, select [Plug-in control].

4 Using the mouse, left click twice to select the video FOV cone or video from the tab window.

5 Select [OK] when the video interface window is displayed.

6 Select the Embedded Camera Icon on the toolbar.

7 The user will now be attached to the video camera sensor looking down range from the video source.

8 Using the mouse, right click select the video with the word [ACT]. Select from the action window embed video. The real-time video will now appear in the 3-D display window where the camera sensor is looking. The virtual camera sensor will more than likely not be aligned with real-world video.

9 Using the joystick and observing the real-time video in the Video tab, move the image to a visible geographical location (e.g., mountain peak, water tower, road, building). The geographical feature must be visible in the 3-D virtual terrain as well.

10 Once a suitable feature has been located, select the Calibration Icon from the toolbar. The Calibration Tool can also be selected from the Menu Bar Tools, Calibration Tool.

11 Observing the video image embedded in the RAGE 3-D display window, use the arrow buttons from the Calibration Tool window to drive the image to the real-time video location.

Modes Menu

The Navigation Mode allows the user to select different display modes and operate the 3-D viewing screen in different views. The Camera Mode allows the user to place the user's point of view at the source of an object or video frame of reference.

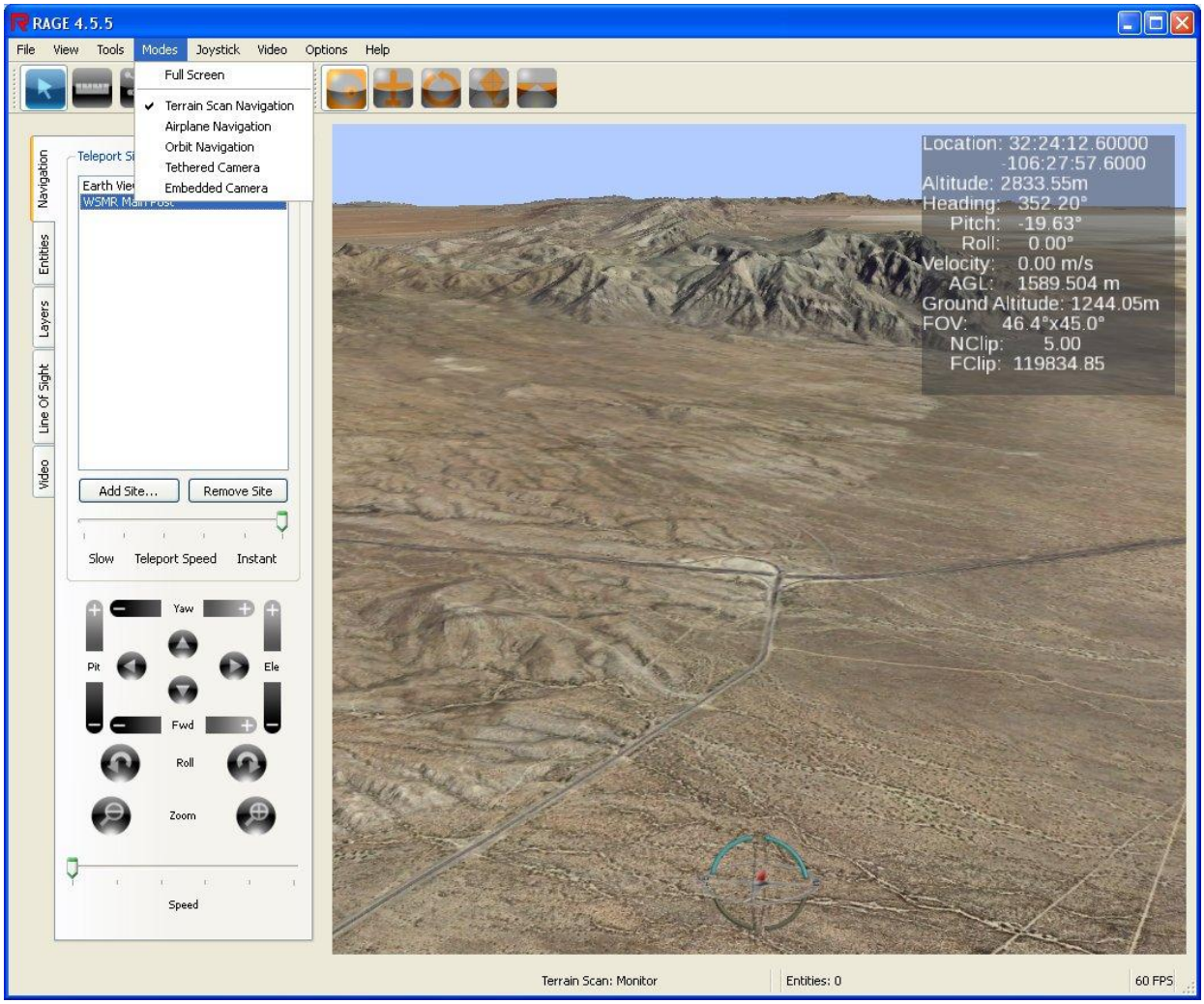


FIGURE 41, MODES MENU

Full Screen

Full Screen resizes the 3-D viewing window to the full size of the monitor. In the full screen mode, the tab windows and icon bar are hidden. Icons can be added to the full screen view by right clicking on the menu bar next to the help button. Select the icons to be viewed in full screen. To remove the icons from full screen view, right click on the menu bar next to the help button and uncheck the icons not needed. Tools can still be accessed on the menu bar. Using the mouse, left click on [Modes] and then left click [Select], [Full Screen]. To return to the default RAGE display window, left click again on modes and left click uncheck full screen.

Navigation Modes

Terrain Scan	Terrain Scan moves the 3-D viewer within RAGE above the terrain surface while maintaining the horizon as level (Roll is disabled).
Airplane	Airplane navigation mode enables full six degree of freedom movement, similar to Terrain Scan, but enables Roll.
Orbit	Orbit mode looks down on the surface of the earth, and motion moves the viewer in relation to the center of the earth. This mode resembles rotating the earth underneath the viewer.

Camera Modes

Tethered Camera	Tethered Camera attaches the viewer to a position relative to another object (a sensor or incoming entity). Movement is now relative to that tethered object, but the 3-D viewer will always look at the object that it is tethered to.
Embedded Camera	Embedded Camera attaches the viewer to the exact position of an object and orients the viewer to the same heading, pitch, and yaw. In the case of incoming entity data, this would be considered the same as a “cockpit view,” where the 3-D viewer looks out the front window from the point of view of an incoming object. In the case of incoming sensor data, this would be embedding the 3-D viewer to the sensor’s viewing angle information, essentially looking down the FOV of a camera.

Joystick

This allows the user to control both RAGE and the FIRECAM suite from a single joystick controller. Depending on the function the user needs to operate. Selecting the proper control source under Joystick on the Menu Bar will enable the control.

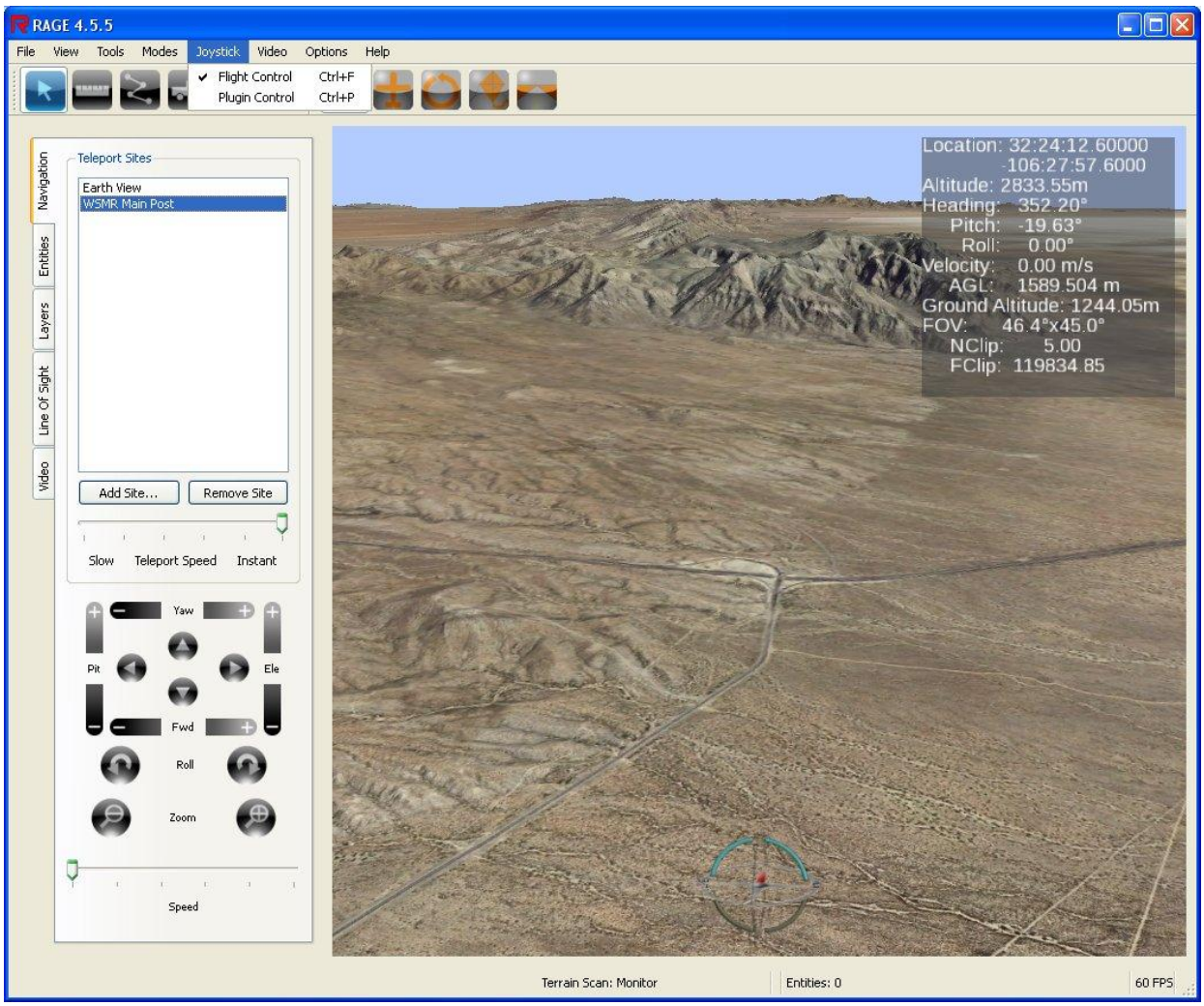


FIGURE 42, JOYSTICK MENU

Flight Control (Ctrl + F)	Joystick operations are used only within RAGE to control the navigation of the user in RAGE's 3-D screen view of the virtual world. Depending on the Navigation Mode, various buttons become active. This is the normal use of the joystick.
Plug-in Control (Ctrl + P)	Joystick commands are no longer used for 3-D navigation with RAGE as they are sent to the FIRECAM plug-in specified as commands. Depending on the plug-in developed, these commands may be used for various user operations (i.e., The FIRECAM plug-in converts joystick commands to control gimbals, camera exposures, and lens zoom/focus commands).

Joystick Control Function

The mapping of controls for video has been adapted to the Logitech Extreme 3-D Pro Joystick (Figure 43). Future enhancements to RAGE will allow the user to define these mapping controls to specific joysticks. The acceleration lever on the base is used as a gain for the speed of the response for the gimbal (P/T). The handle grip will drive the gimbal in the direction it is pushed (e.g., push left on the hand stick drives the gimbal to the left).

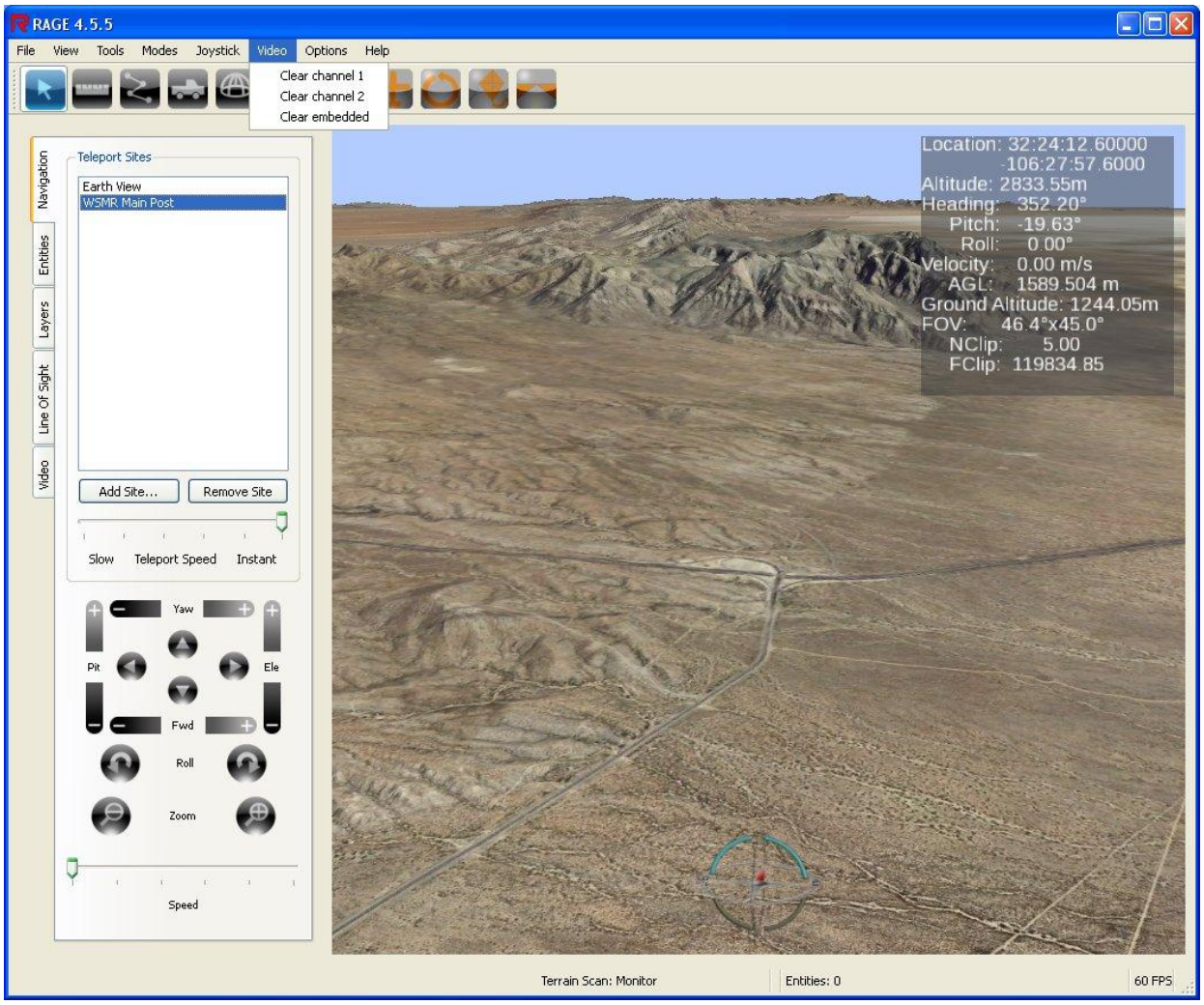
The trigger button allows the user to *lock* the video in place. One click on the trigger will enable the *lock* on the gimbal. There is no visible response that the trigger has *locked* the gimbal. To remove the *lock,* simply move the hand stick or click on the trigger a second time to release. The buttons on the top of the hand stick have specific functions for the zoom and focus control of the camera. The buttons labeled 5 and 3 will cause the camera to zoom in and out respectively. Buttons labeled 6 and 4 cause the focus to move in and out respectively. The four-way *Cully hat* has no function for the gimbal or the camera.

FIGURE 43, LOGITECH 3-D PRO JOYSTICK

Video

Video Clear Channel 1 & 2

Located on the Menu Bar, two full-resolution videos can be added (See *Video Tab*) to the 3-D viewing window. In the event the video needs to be removed, the individual channels can be selected. Channel 1 is located on the lower left of the display. Channel 2 is located on the lower right of the screen. Use the mouse to left click on Video, located on the Menu Bar, and select the appropriate channel to remove.



Clear Embedded: This is used in the calibration window. It clears the real-time video display being sent from the camera out in the field.

Options

Located on the Menu Bar, Options allows the user to select all points and move them as one unit. Remove history trails left behind by the movement of tracks. It also allows the user to create and capture jpeg images of the run time window or the 3-D display window.

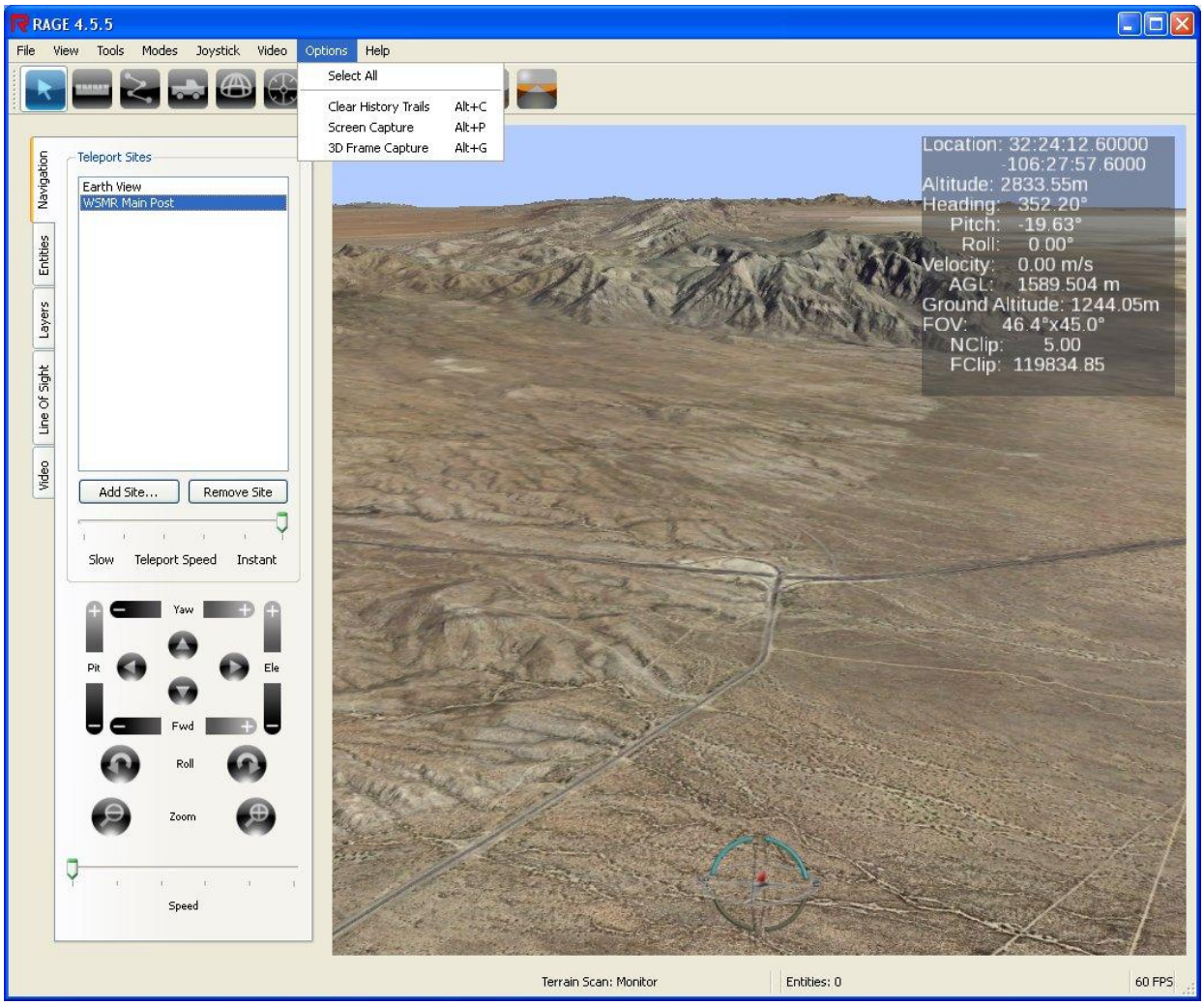


FIGURE 44, OPTIONS MENU

Select All

This allows the user the capability to move a group of sensors (see *Sensor Tool*) by selecting a single sensor and dragging the sensors to a new location. Upon releasing the sensors, the user will be prompted by a popup window if the sensor move was intentional. Selecting *yes* will remap the sensors to the new location. Select *no* and the sensors will return to their original position (see *Sensor Tool*).

Clear history Trails (Alt + C)

When data moves around on the 3-D viewing window, a trail is left behind to show where the object was. The duration of time the trail is on the 3-D viewing window is configurable in the RAGE Configuration Menu under System, TrackDisplayOptions, HistoryLength. The duration time is measured in seconds. Setting the units to 0.0 will disable the history trails. Use the mouse to left click on [Options] and left click [Select], then [Clear History Trail] to remove the trails.

Screen Capture (Alt + P)

This will create an image (png) of the entire display screen. If RAGE is not maximized, the background desktop will also be captured. The image will be placed in a folder called Screen Capture under the RAGE directory. Multiple images can be taken and the user may create a unique identifier for the image. Screen Capture will automatically advance the numbering sequence. The image will be captured at the resolution of the screen attributes. Using the mouse's left click, select [Options] on the Menu Bar and left click select [Screen Capture].

3-D Frame Capture (Alt + G)

This works similarly to Screen Capture, but only the 3-D viewing window will be captured. This capture does not matter if RAGE is maximized or not. Use the mouse to left click on [Options] on the Menu Bar and left click select [3-D Frame Capture].

RAGE Configuration

Default Settings Page 1

SceneOptions

UseSkyDome	true
UseLOS	true
3D BuildingPreLoadFile	BuildingList.xml

OriginOptions

OriginLatitude	33.00
OriginLongitude	-106.00
OriginAltitude	0 Note: Not being utilized at this time

EarthOptions

BlueMarbleImagery

UsePageBlueMarble	true
PagedBlueMarbleFile	../../terrains\backgroundEarth500m_12232009\BlueMarbleEarth.ive

TerrainOptions

Terrain coordinate_system="ecef"

UseInScene	true
File	../../terrains/WSMR_ALL_ECEF_1M/wsmr.ive

ElevationDataOptions

UseElevationData	true
LowResolutionDataFile	../ElevationDatabases/etopo2.geo.tif
UseMediumResolutionDataFile	false
MediumResolutionDataFile	
UseHighResolutionData	true
HighResolutionDataFile	../ElevationDatabases/WSMR_30m_ellipsoid.tif

LayersOptions

UseLayers	true
UseTextLayers	true
TextSize	20.0
AlwaysVisible	true

TrackDisplayOptions

TextSize	35
IconSize	64.0
HistoryLength	10.0 NOTE: Setting this to 0.0 will disable the history trails.

SensorDisplay

MultiLobeSubdivision	5
SphereSubdivision	3

TrackLabels

Center	
North	
South	
East	callname
West	

RAGE Configuration

Default Settings Page 2

TrackManagerOptions

TrackTimeOutSecs	5.0
InitialDataSize	256
InitialWorkerCount	4
MaximumWorkerCount	64

PositionFilter

AlphaX	0.3
AlphaY	0.3
AlphaZ	0.3
InputCount	30
OutputCount	30

OrientationFilter

AlphaHaeading	0.4
AlphaPitch	0.3
AlphaRoll	0.2
InputCount	30
OutputCount	30

GroundClamping

UseSurfaceClamp	false
AboveGroundLevelOffset	0
SubSurfaceClampOffset	0
UseDomainOverride	false
DomainOverrideValue	1
ClampToGeometry	true

SplineEditorOptions

SplineWorkingDir	
SplineSaveFile	newSpline.dat
SplineReadFile	mySpline.dat
SplineASL	2500.0
SplineModel	1
SplineDrapeMode	-1
SplineTrackSpeed	25.0

FIRECAMOptions

CIC_IP	239.28.105.1
CIC_Port	8902

VirtualSensorOptions

Sensors

OpticSensor

ID	1
Latitude	32.427160
Longitude	-106.150381
Altitude	1300

GPSObjectOptions

GPSPod

SerialNumber	500
Name	Novatel

RAGE Configuration

Default Settings Page 3

ForceColor	1
Kind	1
Domain	1
Country	225
Category	0
Subcategory	0
Specific	0
Extra	0
Verbose	3
GPSDeltaSeconds	-15

CRIISObjectOptions

CRIISPod

SerialNumber	1651
Name	CRIIS
ForceColor	1
Kind	1
Domain	1
Country	225
Category	0
Subcategory	0
Specific	0
Extra	199
Verbose	999
GPSDeltaSeconds	-15
UndersampleMod	2

Glossary of Terms

3-D – This is a three dimension plane. A 3-D object has a physical property of length, width, and height. The object can be viewed from multiple sides and angles.

3-D Frame Capture (Alt G) – This tool will capture a Portable Network Graphics (PNG) image and place it into the ScreenCapture folder under the RAGE 4.5 folder by default. The image can then be viewed by standard image processing software (i.e., paint). This is located under Options on the Menu Bar.

3-D Velocity – This is located in the Show XY Data Plot and is the total angular velocity in all three dimensions (X, Y, and Z). See *Show XY Plot*.

3-D Viewing Window – This is the main display window in RAGE for terrain and data information.

Above Ground Level (AGL) – This is used to reference altitude. Altitude is measured with respect to the underlying ground surface. See *Altitude.*

Add Hot Key – This allows the user to specify a single key press to switch default operation commands to be sent to the sensor, device, or video-source.

Airplane Navigation – This allows the user to fly in the 3-D display in an airplane-style mode. A standard USB flight joystick is needed for proper usage. All aspects of flying (roll, pitch, and yaw) are enabled for the user. See *Roll, Pitch, and Yaw*.

Allow Dynamic Data – This is located in the 2-D plots of the LOS measurements tab. It allows the user to see the 2-D plot change as the entity is moved around in the 3-D display window. To create a measurement in the 3-D display window, add the measurement to the LOS tab, then right click to select the measurement and select show plot.

Altitude (Alt) – This is height measured from sea level up to a given point. Altitude is related to flying. Altitude is measured from Mean Sea Level (MSL) or ground level. Sea and ground level measurements give different readings. RAGE is measured to the Ellipsoid or Above Ground Level (AGL). See *Above Ground Level (AGL)* and/or *Mean Sea Level (MSL)*.

Application – This is the portion of the entity ID system of the DIS standard that would be a variation of the primary source based on some other use of the primary data. For instance, Radar units 453 and 454 are both tracking entity 100. The radar numbers should be used in the *site* portion of the entity identification. Radar unit 453 is also processing smoothed data and a 30-second prediction, thus producing two extra sources of data for the same entity 100. These two would be enumerated as value differences in the application usually starting from 0 as the unmodified data and 1+ being additional sources from the radar unit. In summary, seeing Application:Site:Entity-ID information in DIS for this example: 0:454:100 would be raw radar for site 454; 0:453:100 would be raw radar for site 453; 1:453:100 would be filtered data; and 2:453:100 would be filtered and 30-second propagation of the radar data at site 453.

Assumed Friend – This is a force or entity with little field intelligence. The field intelligence gathered on said entity has a positive, but is unconfirmed as an allied. It's found under Track Properties.

Attach LOS – This allows the user to designate a *from* and *to* entity to evaluate a LOS. The entities can be moving or a combination of static and moving objects. The measurement displayed will change automatically with the movement variation. The user can also use the one to many entities for LOS analysis.

Attitude Clamp – This forces an object to clamp attitude to zero. This option is located under Selection Tool for an entity, sensor, or video. With Selection Tool enabled, right click on the object with the mouse to select the option.

Augmented Video Source – Referred to in this documentation as Augmented Video, this is the combination of live and virtual, such that they can interact and enhance each other. Augmented live video would be equivalent to the use of digital effects in football games as seen on TV. Augmented virtual space is the insertion of live video into the 3-D environment. When combined, RAGE and FIRECAM allow both forms of augmentation. In the embedded mode, virtual space identifiers (names, status information, etc.) follow objects into the live video space, allowing real-time annotation of live video with those object identifiers. By zooming out, the user can see virtual space identifiers outside of the live video scene, allowing the user to prepare or redirect video events based on entities outside of the normal FOV of the camera.

Azimuth – This is an arc of the horizon measured between a fixed point and the vertical circle passing through the center of the object (related to flying with a compass from north to 0-360 degrees). Azimuth is also known as the horizontal direction of an observer's heading.

BackGround Earth – This is a sphere used in RAGE with the NASA Blue Marble imagery wrapped around it to form the background image in RAGE. The background image contains no elevation information. This is different from a Terrain Database that combines elevation and imagery. See *Terrain Database, NASA Blue Marble*.

Calibration – This is a comparison of a device with unknown accuracy to a device with a known accurate standard to eliminate any variation in the device being checked.

Calibration Point (CAL Point) – This is one particular measurement in a sequence of measurements aimed at providing calibration. See *Calibration Tool, Calibration*.

Calibration Tool – This is a GUI that allows the user to calibrate camera sensor gimbals based on the position of the embedded viewer in RAGE. An example of such *viewer* can come from a real camera on a gimbal. This tool can be used to match the video from the real world camera to the virtual view in RAGE.

Callname – This is a specific name given to an entity track or sensor to identify it in the 3-D terrain and data manager. The default callname for track is *Sample Track*. The default callname for Sensor is *sensor*.

Callnumber – This is a numeric identification used for display only, similar to callname, but numeric only.

Category – This is part of the DIS eight fields under Track Properties. Category is an 8-bit enumeration. This field denotes values for land, air, surface, subsurface, and space. Under each of these are field values representing various categories.

Clear Embedded – This is part of the Calibration tool. Found under Video on the menu bar, clears the real-time video coming in from the field during calibration of the camera gimbals.

Color – This is found under the Track Properties. Entities have the capability to show up in the 3-D display window as color. The user can select specific color to represent the various forces. This has no other value than a visual for the user in the 3-D display window (e.g., Assumed_Friend = blue, Hostile = red, Unknown = yellow).

Country – This is part of the DIS fields under Track Properties. Country is a 16-bit enumeration representing the country in which a particular platform design is attributed (i.e., 225-United States).

Cube – This is a 3-D volume type found under Sensor Properties. It is represented as a six-sided box. The cube can be manipulated in size and shape by using the scroll wheel on the mouse and the arrow keys on the keyboard. It may also have independent different draw styles from other sensors as well as Sensor roles and color options. See *Draw Style, Sensor Role, Volume Type, Default, and Detect Color*.

Cylinder – This is a 3-D volume type found under Sensor Properties. It is represented as a tube. The tube can be manipulated in size and shape by using the scroll wheel on the mouse and arrow keys on the keyboard. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. See *Draw Style, Sensor Role, Volume Type, Default, and Detect Color*.

Default Color – This allows the user to set a standard color for sensors located under Sensor Properties, Default Color. To change the default color, double right-click on the color bar, select [Color], and select [OK].

Detect Color – This is similar to Default Color. It allows the user to select what the color will change to when detection from an entity is acknowledged. To change the Default Color, double right-click on the color bar, select [Color], and select [OK]. Detect Color is located under Sensor Properties.

Detector – This is a type of volume sensor located under Sensor Properties, Sensor Role. It acknowledges a change of state and signals the user by changing the color of the volume to that of the entity type.

Discovered Plug-ins – This window displays all of the plug-ins detected in the folder. The folder that contains the plug-ins is found under C:\RAGE_4.5\RAGEPlugins\bin. If the user should create a plug-in DLL, this is the location that the DLL should be placed. See *Plug-in Explorer.*

DIS Tokens – This is the same as DIS. The word *token* is related to type description. See *DIS*. This is located in the debug window at startup.

Distributed Interactive Simulation (DIS) – This is an open standard for conducting real-time platform-level virtual combat or war gaming across multiple host computers and is used worldwide. RAGE only uses seven of the fields in the DIS packets. The fields include: Aggregate Kind, Domain, Country, Category, Subcategory, Specific, and Extra (e.g., 1.1.225.0.0.0.1). Aggregate Kind will identify the grouping criterion used to group the aggregate. Domain will specify the domain in which the aggregate operates. Country will specify the country in which the aggregate is associated. Category will specify the category that describes the aggregate. Subcategory will specify the subcategory to which the aggregate belongs to based on the category field. Specific will identify specific information about the aggregate based on the subcategory field. Extra will identify extra information needed to describe the aggregate.

Domain – This is part of the DIS fields under Track Properties. Domain field is an 8-bit enumeration. Domain denotes the type of platform, 0-other, 1-land, 2-air, 3-surface, 4-subsurface, and 5-space.

Dome – This is a 3-D volume type found under Sensor Properties, Volume Type. Represented as a sphere, the sphere can be manipulated in size and shape by using the scroll wheel on the mouse and arrow keys on the keyboard. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. See *Draw Style, Sensor Role, Volume Type, Default, and Detect Color*.

Draw Style – This is found under Sensor Properties. Draw Style allows the user to create a visual difference in the way a sensor is displayed in the 3-D window. Possible styles are invisible, solid, wire, solid and wire, outline, solid and outline, wire and outline, and solid with wire and outline.

Earth-Centered, Earth-Fixed (ECEF) – This is a Cartesian coordinate system. It represents positions as an X, Y, and Z coordinate. The point (0, 0, 0) denotes the mass center of the Earth, hence the name Earth-Centered. The z-axis is defined as being parallel to the earth rotational axes pointing north. The x-axis intersects the sphere of the Earth at the zero latitude and zero longitude. This means the ECEF rotates with the Earth around its z-axis, therefore coordinates of a point fixed on the surface of the Earth do not change, hence the name Earth-fixed.

Edit Entity – This is located in the Entities tab by right click selecting an entity. This allows the user to pull up the properties window of the specific entity allowing the user to modify the information.

Elevation (Ele) – This is the measured distance, usually in altitude, of the object or viewer above a reference point (such as ground level). It is also known as the z-axis in (X, Y, Z). X = longitude (east/west), Y = latitude (north/south).

Elevation Database – This is a file of elevation points known as a grid. The database is defined by the latitude and longitude of the corners of the database and the number of elevation points within those boundaries.

Embedded Camera – RAGE maintains the ability to look directly down the camera view of an incoming sensor. This is equivalent to a cockpit view with an incoming track object. If using the embedded view of a FIRECAM sensor, RAGE can also display the streaming video on the screen sized to match the embedded sensor view.

Entity – This is any sensor or track object inside RAGE. A spline layer does not have any interactive properties, but a sensor set as *detect* can interact with any entity, either a track object or another sensor object.

Entity Edit Mode – Located under View, this allows the user to move tracks and sensors without being prompted by RAGE. The default mode is unchecked. Every time the user moves (drags) a track or sensor, RAGE prompts the user with a popup window signaling that the track or sensor has moved from a prior position and if the new location is acceptable. With Entity Mode checked, the user will not be prompted of the change in position. This is located under View on the Menu Bar.

Entity Options – Located in the Entities tab by right clicking on an entity, this presents the user with an action window for further commands or information on an entity.

Explosive – This is a type of volume sensor that acknowledges a change of state and signals the user by changing the color of the volume to that of the entity type color. Explosive is found under Sensor Properties, Sensor Role, Explosive.

Extensible Markup Language (XML) – This is a data format with strong support via computer industry standards for the languages of the world. It is a simple and very flexible text format derived from Standard Generalized Markup Language (SGML).

Extra – This is part of the DIS fields under Track Properties. This field is left for additional information needed to further identify a specific packet.

Far Clipping Plane (FClip) – This is related to FOV. It is some distance that is beyond the actual 3-D viewing window. Nothing beyond this point can be seen. The RAGE program viewing algorithm calculates this limit based on the Altitude. When that limit is reached, it is called the Far Clipping Plane. See *Near Clipping Plane (NClip)*.

Feet – This is related to altitude. It is a unit of measurement used as a standard means of length. The standard unit length of feet or foot is 12 inches. Altitude can be measured in feet or meters. See *Altitude, Meters*.

Field Of View (FOV) – This is an angle measured in degrees that defines the width of the viewing scene in the 3-D display window.

Flight Control – Located under Joystick on the Menu Bar, this allows joystick operations only within RAGE to control the Navigation of the user in RAGE's 3-D screen view of the virtual world. The user also has the option to use on the scene navigation buttons to move around the 3-D scene in the event no joystick is available. See *Plug-in Control*.

Force – This is a descriptor that enables the user to identify a group or entity roll as either a friend or enemy within the simulation. It is part of the DIS field under Track Properties.

Force Acceleration Calculation – Located under the Entities Tab, Entity Options, RAGE will calculate acceleration from past velocities and time.

Force Attitude Calculation – Located under the Entities Tab, Entity Options, RAGE will calculate attitude based on current velocity vectors.

Force Velocity Calculation – Located under the Entities Tab, Entity Options, when checked, RAGE ignores incoming data and calculates velocity from past times and position.

Forward (Fwd) – Related to flying, this is the forward motion or thrust used to propel the aircraft (viewer) forward.

Frequency Mhz – Located in the 2-D plot for a LOS measurement, this allows the user to input a frequency in MHz and see the results instantly in the 2-D plot window.

Fresnel Iterations – This allows the user to enter complexity of the Fresnel calculation. RAGE is capable of calculating a 3-D Fresnel zone.

Fresnel Zone Calculation – A Fresnel Zone is one of a number of concentric ellipsoids which define volumes in the radiation pattern of a circular aperture. Fresnel zones result from diffraction by the circular pattern. The Fresnel Zone Calculation is an equation used to calculate where zones are based on obstacles that are in phase and out of phase between the transmitter and the receiver of a system. There are three Fresnel zones: One will create signals that are 0-90 degrees out of phase; two will create signals that are 90-270 degrees out of phase; and the three will create signals that are 270-450 degrees out of phase.

Geo Coordinate – This is a coordinate system that enables every location on Earth to be specified in three coordinates, using mainly a spherical coordinate system. See *Spherical Coordinate*.

Geodetic Decimal – This is a metric measurement and representation of Earth using a three-dimensional positioning with latitude and longitude in decimal (e.g., latitude: 32.4567434, longitude: -106.454329).

Geodetic Degrees Minutes Seconds (DMS) – This is a traditional American measurement and representation of the Earth using a 3-D positioning with latitude, longitude in separated degrees, minutes (1/60 of a degree), and seconds (1/3,600 of a degree), with seconds represented by a decimal for very fine locations (e.g., latitude: 32. 27 24.2748, longitude: -106 27 15.5844).

Go To Entity – This is located in the Entities tab by right clicking select an entity. It will present an action window. Go to Entity will take the user to the specific entity selected in the 3-D display window.

Ground Acceleration – This is the 2-D portion of acceleration related only to an object's movement across the ground plane (X and Y movement only).

Ground Altitude – Related to flying, this is the vertical height above the terrain. It's the same as AGL.

Ground Clamp – This forces an object to match ground altitude as specified in the configuration section. This option is located under Selection Tool for an entity, sensor, or video. With Selection Tool enabled, right click on the object with the mouse to select the option.

Ground Velocity – This is the 2-D portion of velocity related only to an object's movement across the ground plane (X and Y movement only).

Heading – Related to flying, this is the direction of the aircraft, vehicle, or vessel the direction is truly pointing toward. Pointing refers to a compass projection from zero to less than 360 degrees. At 360 degrees, the compass heading wraps around back to zero.

Heads Up Display (HUD) – This is the transparent display that presents data without requiring the user to look away from his or her viewpoint.

History Trail, Clear – (ALT C) this is a line (surface/air) that represents where an object has been in the past. Clear History Trail is located under Options on the Menu Bar.

Horizontal Field Of View (HFOV) – This is the horizontal plane of an angle in degrees that defines the width of the viewing scene in the 3-D display window. See *Field of View (FOV)*.

Hostile – This is a type of force representation located under Track Tool Properties. Hostile would be considered an enemy with an offensive or resistive nature.

Icon – This is a small pictogram (picture) used to represent an application function. Each Icon is distinctive in display and functionality.

Instantaneous Impact Predictor (IIP) – This is the prediction of the motion of an object through the environment based on last known velocity, gravity based on altitude, and generalized atmosphere information by default. IIP information can also be sent externally to allow external calculations based on any customer algorithm.

Internet Protocol (IP) – Related to Network, this is the addressing used for identifying the source and destination addressed of data packets being delivered over a network.

Invisible – This will cause the sensor to function, but not be visible on the viewing screen. It is used in events that by triggering the invisible sensor, cause another event to happen. Invisible is located under Sensor Tool Properties, Draw Style.

IP (address) – Related to Network, this is a unique 32-bit address that identifies on which network the computer is located.

Keyhole Markup Language (KML) – This is a file format used to display geographic data. KML uses a tag-based structure and is based on the XML standard. KML is recognized by many commercial software packages. See *XML*.

Kind – This is part of the DIS fields under Track Properties. Kind defines the classification of each field. 0-other, 1-platform, 2-munition, 3-life form, 4-environmental, 5-culture feature, 6-supply, 7-radio, 8-expendable, and 9-sensor/emitter.

Latitude (Lat) – This is the angular distance in degrees, minutes, and seconds (or decimal degrees) of a point north or south of the equatorial (equator) line. These lines are separated by 15-degree increments from zero to 75 degrees. Lines of latitude are referred to as parallels.

Layers – These are representations of various culture and user defined regions of interest. These layers have color and are displayed as lines. They can be enabled/disabled by the user. The layers are found in the RAGE 4.5/run/layers folder.

Line Of Sight (LOS) – This is a measurement used to determine the validity of a visual point-to-point inspection. If the *to point* is being hindered, an obstruction will be noted. The LOS calculation is measured in real-time.

Longitude (Long) – This is the angular distance in degrees, minutes, and seconds of a point from east or west. The originating line is in Greenwich, England, and is known as the Prime Meridian. It is the same in function as the equatorial line for latitude. Lines of longitude are referred to as meridians.

Look here with active sensor – This is located in the Selection Tool. It allows the user to slew an active camera system to the point of interest. This is used exclusively in the FIRECAM plug-in suite. A camera system and the FIRECAM suite must be installed and configured to use this command.

Mean Sea Level (MSL) – This is the average height of the sea with reference to a suitable land surface.

Measurement Tool – This is a tool used to calculate a position and distance in the 3-D viewing widow. Measurements can be viewed in different reference types. They include Geodetic Decimal, Geodetic Degrees, Minutes and Seconds, MRGS, and UTM. The Measurement Tool is located in the toolbar.

Meters – This is a basic unit of length. One meter is equal to 3.28 feet.

Military Grid Reference System (MGRS) – This is a geocoordinate standard used by the military for locating points on the Earth. MGRS is derived from the UTM grid system.

Multi-cast – Related to network, these are messages sent to a specific group of hosts on the network.

Multi-lobe – These are sensors used for defining complex antenna patterns. Simple mathematical representations of common antennas are currently supported. A new definition of a user-defined sensor pattern will be available in some future version of RAGE. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. See *Draw Style, Sensor Role, and Volume Type, Default, and Detect Color*. Multi-lobe is located under Sensor Tool, Properties, Volume Type.

Navigation – This is the flight control and site selection for the 3-D viewing window. Using the Navigation tab allows for teleporting to different site locations, flight using control buttons, and speed settings for system response time.

Near Clipping Plane (NClip) – Related to FOV, this is the area directly in front of the viewer position in the 3-D viewing window. Nothing is visible within this area. The NClip will expand and contract based on the altitude respectively. The RAGE program viewing algorithm calculates the distance automatically. See *Far Clipping Plane (FClip).*

Network Listener – This is a thread process that watches for packet information (name) on a defined port number. The packet information (name) must be described by the user in the network configuration table (e.g., name = LONG_3D_BLOCK port = 8901).

Neutral – This is a type of force representation located under Track Tool Properties. Neutral would be considered not a friend or enemy, but undeclared.

Non-Participant – This is a type of force representation located under Track Tool Properties. Non-Participant would be an entity not affiliated with an exercise.

Orbit Navigation – This is a means of observing or monitoring the 3-D viewing window. In orbit mode, the user's pitch is locked to a -90 degree. The other navigation controls are still available for use.

Orientation H, P, R (heading, pitch, roll) – Related to flying, this is a 3-D coordinate system through the center of gravity with each axis of this coordinate system perpendicular to the other two axes also known as altitude. Orientation is the amount or rotation of the parts of the aircraft along these axes. See *Roll, Pitch, and Yaw*.

Outline – This is the definition of the area of the volume type by creating a 2-D drawing of the volume type. The 2-D drawing has no color fill or mesh within the area. The volume will still *test* using the 3-D full volume type. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. Outline is found under Senor Tool Properties. See *Draw Style, Sensor Role, and Volume Type, Default, and Detect Color*.

Passive – This is a volume type that has no interaction with the tracks or sensors. It is purely a draw only. Passive is located under Sensor Tool Properties, Sensor Role.

Path Tool – This is a tool used to create tracks or paths that can be used by an entity. It is used mostly as a simulation path creator. The Path Tool can also be used as a layer creator. The user can scribe a boundary and save it as a layer. Path Tool is located under Tools on the Menu Bar.

Pending – This is a type of force representation that has been identified and is being assessed as to its risk factor. Pending is located under Track Tool Properties, Force.

Pitch (Pit) – This is related to flying, the up (climb) and down (descend) motion produced by the aircraft's horizontal stabilizer and elevators. An aircraft will rotate about its center of gravity, a point which is the average location of the mass of the aircraft. Pitching is caused by the deflection of the elevators of the aircraft. See *Roll, Yaw, and Orientation*.

Plug-in Control – This allows the user full control of cameras and pointing devices such as P/Ts. Plug-in Control is used in conjunction with FIRECAM Plug-in from the Tools, Plug-in Explorer. See *Plug-in Explorer, Video, and Joystick*. Plug-in Control is located under Joystick on the Menu Bar and is user selectable under Joystick as either standard joystick (flight control) or Plug-in Control.

Plug-in Description – This window provides a description of the selected plug-in from the Discovered Plug-ins window. See *Plug-in Explorer.*

Plug-in Explorer – This is a means of loading a small interface program that interacts with RAGE. The plug-ins are created by the user. An example of the plug-in interface is available at the end of this manual. See *Plug-in Control, Video, and Joystick*. Plug-in Explorer is located under Tools on the Menu Bar.

Pyramid – This is a 3-D volume type represented as a four-sided triangle. The triangle can be manipulated in size and shape by using the scroll wheel on the mouse and arrow keys on the keyboard. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. See *Draw Style, Sensor Role, Volume Type, Default, and Detect Color*. Pyramid is located under Sensor Properties.

Radius – This is the distance from the center of the circle to any point on the circle.

Range – This is the distance from the origin point to a set distance depth of the volume. Range is used only for the pyramid and cylinder volumes, mainly for radars and lasers. It is located under Sensor Tool, Properties.

Real-time Advanced Graphics Engine (RAGE) – This is a 3-D visualization tool designed for displaying real-time data and high-resolution graphics. RAGE is an interactive environment between the user and data. It allows for mission planning, rehearsal, live/virtual testing, post-testing playback, simulation, AVI creation, and live video feeds with user controlled manipulation.

Remove Entity – This will permanently delete the entity from the 3-D display window.

RF Frequency – Radio Frequency (RF) is a rate of oscillation in the range of 30 kHz to about 300 GHz, which corresponds to the frequency of electrical signals normally used to produce and detect radio waves. In RAGE, the Fresnel calculation will use the frequency enter to calculate the Fresnel Zone and display this in the 3-D display window, as well as in the LOS measurement 2-D plot.

RF Power Loss – This is available in upcoming future release.

Roll – Related to flying, this is an up (climb) and down (descend) movement of the wings of the aircraft. An aircraft will rotate about its center of gravity, a point which is the average location of the mass of the aircraft. Rolling is caused by the deflection of the ailerons of the aircraft. See *Pitch, Yaw, and Orientation*.

Running Plug-ins – This window displays all of the plug-ins loaded into RAGE run time. The plug-in(s) located in this window will start automatically after RAGE is executed. There is no need to re-add the plug-in(s). To remove the plug-in from RAGE, the user must edit and delete the unwanted plug-in(s) from the AutoLoadPlugins.xml located in the Run folder under RAGE4.5. See *Plug-in Explorer.*

Satellite Imagery (Ctrl + S) – RAGE is capable of accessing Google Earth imagery from its server via the Internet or as a standalone cached imagery from the hard drive. The Satellite Imagery Option must be enabled in the EarthOptions under the RAGE system configuration. Checking the Satellite Imagery under View will enable the user to see Google Earth imagery. Satellite Imagery is located under View on the Menu Bar.

Screen Capture (ALT + P) – This allows the user to capture a full desktop screen resolution image. This image can be saved as a PNG. It is a bitmapped image format that employs lossless data compression. Screen Capture is located under Options on the Menu Bar.

Sensor Tool – This allows the user to place sensors such as proximity, radar, laser, and optic mounts. The sensors are capable of real-time feedback. The user has control of size, shape, function, color, and location. Sensor Tool is located under Tools on the Menu Bar.

Selection Tool – This enables the user to *grab* the terrain with the mouse and move it around for navigation purposes. It also allows the user to select entities, sensors, and videos to manipulate and view information. Selection Tool is located under Tools on the Menu Bar.

Set as Active Object – This enables the object or video to be the point of interest. As an object, Active Object will focus activity to be directed at said objects and can produce various responses from the sensors and cameras. From a video standpoint, active object will enable control of the cameras' control functions. Set as Active Object is located under Selection Tool for an entity, sensor, or video. With Selection Tools enabled, right click on the object with the mouse to select option.

Show – This allows the user to either enable or disable the object on the 3-D viewing window. With Selection Tool enabled, right click on the object with the mouse to select the option. Toggle Hide/Show is located under Selection Tool for an entity, sensor, or video.

Show Information – This displays the various track information of a given object, including name, DIS number, location, heading, and speed. Show Information is located under Selection Tool for an entity, sensor, or video. With Selection Tool enabled, right click on the object with the mouse to select option.

Show XY Plot – This allows the user to plot velocity, acceleration, and position over time. Show XY Plot is located under Selection Tool for an entity, sensor, or entity associated with the video. With Selection Tool enabled, using the mouse, right click on the object to select option. Under the Y plot data window, select the desired sample. Hold down the Ctrl button to select multiple samples.

Site – This identifies and describes a location by name or by DIS protocol entity identification value.

Solid – This defines the area type by creating an outline of the volume with color. There is no mesh or 2-D base outline associated with this type. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. Solid is located under Sensor Tools, Properties, Draw Style. See *Draw Style, Sensor Role, and Volume Type, Default, and Detect Color*.

Solid and Outline – This defines the area type by creating an outline of the volume with color. The 2-D base is added to the volume. The mesh is missing from this type. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. Solid and Outline is located under Sensor Tools, Properties, Draw Style. See Draw *Style, Sensor Role, and Volume Type, Default, and Detect Color*.

Solid and Wire – This defines the area type by creating a mesh for the volume type and coloring in the mesh. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. Solid and Wire is located under Sensor Tools, Properties, Draw Style. See *Draw Style, Sensor Role, and Volume Type, Default, and Detect Color*.

Solid, Wire, and Outline – This defines the area type by creating a mesh, coloring in the mesh, and adding the 2-D base outline for the volume type. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. Solid, Wire, and Outline is located under Sensor Tools, Properties, Draw Style. See *Draw Style, Sensor Role, and Volume Type, Default, and Detect Color*.

Specific – This is part of the DIS fields under Track Properties. Specific defines the specific life forms being utilized. Life form kind refers to dismounted infantry, scouts, seals, or other humans.

Speed – This is the rate at which an object moves a particular distance to time.

Spherical Coordinate System – This is a coordinate system for three dimensional space, where the position of a point is specified by three numbers: radial distance from a fixed origin; elevation angle of that point from a fixed plane; and azimuth angle of its orthogonal projection of that plane.

Stop Tracking – This is located under Selection Tool for an entity, sensor, or video. With Selection Tool enabled, right click on the object with mouse to select option.

Subcategory – This is part of the DIS fields under Track Properties. It specifies the number of individuals and allows representation of one or more life forms using one packet.

Suspect – This is a type of force representation. Suspect would be a force that has been identified, intelligence has been gathered, and there is a probable cause that the force is of an enemy nature. Suspect is located under Track Tools, Properties.

Teleport – This allows the user to be transported from one site location to the next either instantly or by adjusting the slider bar can be transported slowly. Teleport is located under the Navigation tab.

Terrain – This is the geographic area or region of the surface of the Earth. Seen in the 3-D viewing window, it allows the user to use visual landmark features to obtain geo-reference information.

Terrain Database – This is a geographic area or region that is built using elevation and imagery. Combined, these elements create a file that RAGE uses to display 3-D information in the 3-D viewing window.

Terrain Scan Navigation – This is a scan that moves the 3-D viewer within RAGE above the terrain surface while maintaining the horizon as level (roll is disabled). Terrain Scan Navigation is located under the Modes on the Menu Bar.

Terrorist – This is a type of force representation. Terrorist would be a force that has been identified, intelligence gathered, and is recognized that the force is an enemy. Terrorist is located under Track Tools.

Tethered Camera – This is a camera that attaches the viewer to a position relative to another object (a sensor or incoming entity). Movement is now relative to that tethered object, but the 3-D viewer will always look at the object that it is tethered to. Tethered Camera is located under Modes on the Menu Bar.

Time-Space-Position Information (TSPI) – This is the state of a physical body where the time, space (orientation), and position are recorded.

Toggle IIP – This enables/disables the IIP. With Selection Tool enabled, right click on the object with the mouse to select option. Toggle IIP is located under Selection Tool for an entity, sensor, or video. See *IIP*.

Tracks – Also known as entities, these are objects that can represent 3-D models or that can be a point. The user can manipulate these to simulate a test scenario.

Track Tool – This allows the user to select, configure, place, move, edit, or remove an entity at a desired location. Track Tool is located under Tools on the Menu Bar.

Track with Active Sensor – This sets the object as the primary focus point. The active sensor will then follow the object wherever it travels. With Selection Tool enabled, right click on the object with the mouse to select option. Track with Active Sensor is located under Selection Tool for an entity, sensor, or video.

Type (3-8) – This is a separate user configuration number. It has no functionality at this time. This is strictly for the user's configuration.

Unlimited Size Message Layer (USML) – This uses protocol breakdowns of large packet transmissions so that network cards do not have to buffer, split, and recollect packets. USML then takes the responsibility of splitting large buffers (like video frames) into smaller packets and reassembling them in the right order.

Units – This is a measurement of any value of a physical quantity that can be expressed as a comparison to a group of that quantity.

Universal Transverse Mercator (UTM) – This is a grid-based method of specifying locations on the surface of the Earth. It is a map projection that employs a series of zones. A Map projection is a method of representing the surface of a sphere on a plane.

Unknown – This is a type of force representation. Unknown would be a force that has been identified, but there has been no intelligence gathered on the force. Unknown is located under Track Tools, Properties.

Velocity – This is related to speed. Velocity is a vector, while speed is a scalar. Velocity is located under Selection Tool for an entity, sensor, or video. With Selection Tool enabled, right click on the object with the mouse to select option. See *Speed*.

Vertical Field Of View (VFOV) – This is the vertical plane of an angle in degrees that defines the width of the viewing scene in the 3-D display window. See *Field Of View (FOV)*.

Video – This allows for real-time video streams to be viewed and manipulated. The video streams use the FIRECAM Plug-in under Plug-in Explorer. The side window displays thumbnails at 10 Hz update, while the 3-D viewing can display two 30 Hz videos. The videos can be manipulated by a joystick to control many aspects of the camera. The Joystick plug-in must be set to Plug-in Control. See *Plug-in Control, Plug-in Explorer, and Joystick*.

Volume Size X, Y, Z – This is the default size of the volume at startup. X is the east-west, Y is the north-south, and Z is the vertical component of the volume. Default numbers are 50, 50, 50. The units are in meters. Volume Size X, Y, Z, is located under Sensor Tools, Properties.

Volume Type – This defines the 3-D geometric shape of the volume. There are several shapes available: cube, dome or sphere, pyramid, cylinder, and multi-lobe. The cube is a six-sided box. The dome or sphere is either half or a full 3-D ball, depending on where it is sitting. The pyramid is a five-sided triangle. The cylinder is a curvilinear or extruded circle. The volumes can be manipulated by using the arrow keys on the keyboard or the mouse. Volume Type is located under Sensor Tools, Properties.

Wire – This defines the area type by creating a mesh for the volume type. It is very similar to Wire and Outline, with the difference being that there is no 2-D outline on the base of volume. There is no color filling between the mesh. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. See *Draw Style, Sensor Role, Volume Type, Default, and Detect Color*. Wire is located under Sensor Tools, Properties, Draw Style.

Wire and Outline – This defines the area type by creating a mesh and a 2-D outline at the base for the volume type. There is no color filling between the mesh. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. See *Draw Style, Sensor Role, Volume Type, Default, and Detect Color*. Wire and Outline is located under Sensor Tools, Properties, Draw Style.

Wire Frame – This is the entire 3-D scene displayed with a mesh in the 3-D viewing window. This mesh is the 3-D underlying terrain void of all imagery. It may also have independent different draw styles from other sensors, as well as sensor roles and color options. See *Draw Style, Sensor Role, and Volume Type, Default, and Detect Color*. Wire Frame is located under View on the Toolbar.

X Acceleration – This is the acceleration of an object only along the x-axis. It is located in the XY Data Plot. See *Show XY Data Plot*.

X Velocity – This is the velocity of an object only along the x-axis. It is located in the XY Data Plot. See *Show XY Data Plot*.

Y Acceleration – This is the acceleration of an object only along the y-axis. It is located in the XY Data Plot. See *Show XY Data Plot*.

Yaw – Related to flying, this is a side to side movement of the nose of the aircraft. An aircraft will rotate about its center of gravity, a point which is the average location of the mass of the aircraft. Yawing is caused by the deflection of the rudder of the aircraft. See *Roll, Pitch, and Orientation*.

Y Velocity – This is the velocity of an object only along the y-axis. It is located in the XY Data Plot. See *Show XY Data Plot*.

Z Acceleration – This is the acceleration of an object only along the z-axis. It is located in the XY Data Plot. See *Show XY Data Plot*.

Zoom – This allows the user to increase or decrease the focal length or FOV within the 3-D viewing window. The FOV is displayed in the HUD on the upper right of the 3-D viewing window. Zoom is located on the Navigation tab.

Z Velocity – This is the velocity of an object only along the z-axis. It is located in the XY Data Plot. See *Show XY Data Plot*.

Network Receiver Plug-ins

A plug-in in RAGE refers to a dynamically loaded module (*Dynamic Link Library in Windows, Shared Object in Linux*) that contains a set of interfaces to RAGE. Plug-in writers are provided with the RAGE Application Programming Interface (API) that includes a set of abstract classes that are utilized to implement his/her own interface to RAGE.

These interfaces allow the plug-in writer to take advantage of a wide variety of capabilities such as:

- Publishing entities, models, or sensors into the 3-D environment
- Overriding navigation and joystick behavior
- Adding menu items
- Subscribing to elevation databases

LONG_3D_BLOCK – ***Network Name: LONG_3D_BLOCK***
Default is: standard to RAGE. There is no plug-in for the Long 3-D block. Long 3-D block format is a legacy format from the RAGE environment version 2.0. It is still used by a number of customers and therefore still supported by the current version of RAGE 4.5.

KLV_MESSAGE_FORMAT – ***Network Name: KLV_MESSAGE_FORMAT***
Default is: standard to RAGE. There is no plug-in for the KLV Message Format. Key Length Value message format is based on the Motion Imagery Standards Board (MISB) KLV standard: (http://www.gwg.nga.mil/misb/faq.html#section3.2). The dictionary supported by RAGE is distributed with the RAGE and FIRECAM suite. Additional non-standard dictionaries could be supported, but would then not fall under the KLV standards approved by MISB.

CRIIS STD Msg Plug-in v1.2.5 – ***Network Name: CRIIS_MSG_STREAM***
This must be added through Plug-in Explorer along with the Network Configuration. The CRIIS is designed to be the “Truth Standard” for the Tri-Service Test and Evaluation community. CRIIS will replace the ARDS. The CRIIS is used in various package configurations.

CRIIS Msg 17 Plug-in v1.2.6 – ***Network Name: CRIIS_MSG_17_STREAM***
This must be added through Plug-in Explorer along with the Network Configuration. The CRIIS is designed to be the "Truth Standard" for the Tri-Service Test and Evaluation community. CRIIS will replace the ARDS. The CRIIS is used in various package configurations.

FIRECAM Plug-in Adranus 2.0 – ***Network Name: FIRECAM_STREAM***
This must be added through Plug-in Explorer along with the Network Configuration. FIRECAM is a WSMR streaming video format. FIRECAM Video streams are sent from FIRECAM supported devices (see the FIRECAM documentation) and received by either a simple window display (the FIRECAM client), or by RAGE, and integrated into the 3-D system as an augmented video source.

GAZEL Object Tracker Plug-in v1.0.0.7 – ***Network Name: GAZEL_OBJECT_TRACKER_STREAM***
This must be added through Plug-in Explorer. The Generic Azimuth Elevation object tracker plug-in allows a user to attach to an object and command a P/T controller to point at that object. Override and additional options are controlled through the GAZELObjectTrackerOptions section of the RAGE.xml system configuration located in the Run folder.

GPS Msg 17 Plug-in v1.2.8 – ***Network Name: GPS_MSG_17_STREAM***
This must be added through Plug-in Explorer along with the Network Configuration. GPS message 17 is a standard message format used by the GPS group at WSMR for the ARDS.

Lcd Tracking Plug-in v1.8.0 – ***Network Name: LCD_PHALANX_STREAM***
This must be added through Plug-in Explorer along with the Network Configuration. This is a specific design for Laser engagement. It allows the user to visualize the azimuth, elevation, and comparison against the Laser Clearing House windows.

Optics Van Plug-in v1.0 – ***Network Name: OPTICS_VAN_KLV***
This must be added through Plug-in Explorer along with the Network Configuration. As with the position analysis plug-in, this KLV reads a subset of the KLV system designed specifically for the optics customers.

PAS Messages Plug-in v1.0.0.2 – *Network Name: PAS_STREAM*
This must be added through Plug-in Explorer. The PAS Message plug-in allows a user to accept inputs directly from a 120,124, or 320-bit PAS message. Target IDs are entered into the entity identification field. Override and additional options are controlled through the PAS ObjectOptions section of the RAGE.xml system configuration located in the Run folder.

Pin Diode Plug-in v0.9 – ***Network Name: PIN_DIODE_KLV***
This must be added through Plug-in Explorer. The Pin Diode plug-in allows a user to monitor the current output and signal strength information from a Pin Diode.

Position Analysis v3.1.8.3 – ***Network Name: POSITION_ANALYSIS_KLV***
This must be added through Plug-in Explorer along with the Network Configuration. Position Analysis plug-in allows an operator to compare a defined source against other locations (usually sensors), as well as record and playback data. Additional specific capabilities allow the plug-in to read and understand specific analysis messages for camera to data and CRIO sensor information.

Radar Planning Plug-in v1.01 – ***Network Name: RADAR_PLAN_KLV***
This must be added through Plug-in Explorer along with the Network Configuration. Radar Planning plug-in allows an operator to track several radar locations and their continued line LOS over the span of an entire mission.

RadiantSourcePlug-in v2.0.1 – ***Network Name: There is no network configuration name***
The Radient Source plug-in allows an operator to monitor the path of a beam of energy through the surrounding air-spaces while tracking a moving object. The plug-in will provide eye-safe location for lasers, as well as beam size and location of crossing at the entrance and exit of all air-spaces defined.

RF Seeker Plug-in v1.0.0.3 – ***Network Name: GAZEL_OBJECT_TRACKER_STREAM***
This uses the same network name as the GAZEL plug-in. RF Seeker plug-in allows an operator to attach to an RF source and command a generic Azimuth Elevation P/T to seek the strongest RF signal from the source.

TCS Msg Plug-in v1.2.2 – ***Network Name: TCS_MSG_STREAM***
This must be added through Plug-in Explorer along with the Network Configuration. TCS plug-in allows the user to analyze the telemetry signal strength. It is used primarily for mission planning. Setting the parameters in the plug-in will allow for a signal level to be analyzed as a good or bad signal feedback.

TMLink v1.0 – *Network Name: There is no description at this time*

VirtualSensors v1.0 – ***Network Name: None***
This must be added through Plug-in Explorer. There is no network configuration name. This allows the user to simulate tracking sensors with gimbal sets. Override and additional options are controlled through the VirtualSensorOptions section of the RAGE system configuration.

Weibel Plug-in v1.0.7 – ***Network Name: WEIBEL_STREAM***
The Weibel plug-in allows a user to accept inputs directly from the Weibel Radar output message without conversion. Override and additional options are controlled through the WeibelObjectOptions optional section of the RAGE system configuration.

GAZEL Object Tracker Plug-in for RAGE
User Instructions

Prepared by:
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The GAZEL Object Tracker Plug-in for RAGE is designed to interface with models 50 and 90 P/T units from QuickSet (Moog), equipped with a Lantronix XPort Ethernet to serial converter.

The purpose of the GAZEL Plug-in is to control a single pane antenna (SPA) mounted on a QuickSet P/T unit, getting its pointing information from a displayed object in RAGE, and allowing the user to graphically see where the antenna is pointing.

The setup information is in XML format in the main RAGE.xml configuration file. The antenna is moved to point at the target object and remain stationary until the angle offset to the target exceeds 40 percent of the beam width of the antenna, at which time the antenna will again be commanded to move to point at the target object.

Initial setup of the antenna and P/T may be done using a magnetic compass to determine the angle between north and the zero azimuth angles of the P/T. This information is inserted in the RAGE.xml file along with the maximum and minimum azimuth and elevation values.

Place the compass on the P/T and move the P/T until the compass points north and record the angle.

Manual control of the antenna is possible through the use of a utility from QuickSet or from RAGE.

Pedestal Setup:

1. Determine the azimuth span for the installation and mount the P/T so that its zero azimuth is pointing near the center of the span.
    a. The pedestal will travel plus and minus 217 degrees from center. If you have 360 degrees of coverage, the software will track as far as possible up to the 217 degrees and will swing around 360 degrees to continue.
    b. The software setup offset is in pedestal angles relative to the zero angle of the hardware.
2. The usual power for the QuickSet P/T is 24V DC. The control is via Ethernet. Use exterior rated cable for the connection. There is one connector that feeds both power and control signals.
3. If you are not absolutely certain about the power cables, connect the QuickSet's DC power and Ethernet and verify operation before applying 120V AC to the radio. Connecting 120V AC to the QuickSet's 24V DC input may destroy the unit.
4. The usual power for the CRIIS radio and amplifier is 120V AC. The data is via Ethernet. There are two connectors – one for the power and one for the data. Using a different type of cable for the radio connection seems advisable.
5. Configuring the Ethernet address of the QuickSet P/T.
    a. Communicating with the P/T may require changing its Internet Protocol (IP) address. This is best done using the Lantronix Device installer application, which can be downloaded from www.Lantronix.com.

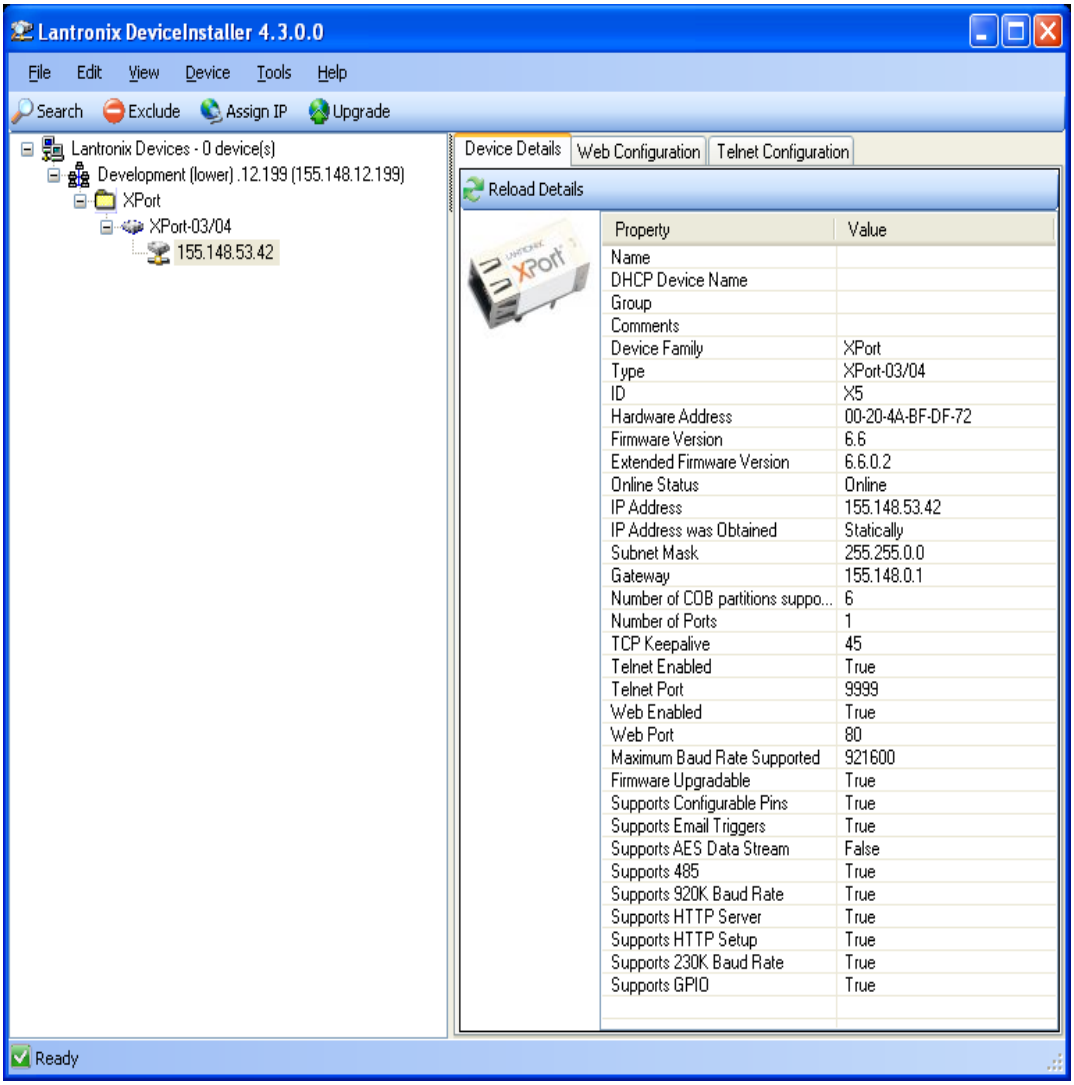

FIGURE 45, LANTRONIX DEVICE INSTALLER

b. Connecting the QuickSet Ethernet cable to a computer and starting the Lantronix Device installer application will yield this GUI.

c. If the device you are configuring is not reachable, you may need to change the IP of the host computer.

d. Click the device you are configuring.

e. Click Web Configuration on the application's task bar.

f. Click the green right arrow on the application's task bar.

g. Click Network

h. On the Network Settings page

   i. Select Use the following IP configuration:

ii. Enter the IP Address, Subnet Mask, and Default Gateway for your system.

i. Click Apply Settings and then close the GUI.

6. Calibrating the azimuth can be done with RAGE or the QuickSet utility.
   a. Using the QuickSet utility to calibrate:
      i. Connect the QuickSet Ethernet cable directly to a computer running QuickSet's QuickEye Remote Emulator application, QPT-201C. You will probably need a crossover cable.
      ii. Start the program and type ctrl-N
      iii. Select Connect->Connect Parameters
      iv. Check Ethernet
      v. Enter the IP address and port number for the P/T
      vi. Type ctrl-C to connect
      vii. Click the Center button
      viii. Check Pan Only
      ix. Pan until pointing north. If not possible:
         1. Point south
         2. Add or subtract 180 degrees to the results to make it between 360 and -360 degrees
      x. Note the Pan Current Position
         This angle must be inserted in the RAGE.xml configuration file value as the Pedestal->Azimuth->OffsetDegrees
      xi. Type ctrl-D to disconnect
      xii. Close the QuickEye Remote Emulator application
      xiii. Disconnect the Ethernet cable from the setup computer and connect the QuickSet Ethernet cable to RAGE network
   b. Using RAGE to calibrate:
      i. After calibration, be sure that the Ethernet cable is connected to the RAGE network.
      ii. Start the RAGE application.
      iii. Click the Configure button.
      iv. On the System tab, expand the RAGE xml tree.
      v. Expand the GAZELObjectTrackerOptions xml tree.
      vi. Expand the Tracker xml tree.
      vii. Expand the Pedestal xml tree.

viii. Expand the Location xml tree and verify or enter values.

ix. Expand the NetworkInterface xml tree and verify or enter values.

x. Click the Save Changes button if required.

xi. Click the Start button.

xii. Verify that it is loaded or load the GAZELObjectTracker plug-in.

xiii. Select the entities tab, right click under name, and select GAZEL->ManualControl.

xiv. Select the Name of the Tracker.

xv. Select Static Mode.

xvi. Use the slider to point north.

xvii. Put the Commanded values in the Pedestal->Azimuth->OffsetDegrees and Pedestal->Elevation->OffsetDegrees values.

xviii. Click the Save Changes button and reopen the Manual Control window.

xix. Verify that the Commanded value sliders are correct.

xx. Select Autotrack Mode.

xxi. Close GAZEL->ManualControl.

7. Operation

   a. Start RAGE.

   b. Click the Configure button to verify GAZEL Object Tracker settings in the configure file, RAGE.XML.

   c. Click the Start button to run RAGE.

   d. Verify that it is loaded or load the GAZELObjectTracker plug-in.

   e. Select the entities tab and right click on the name of the tracker of interest.

   f. Select GAZEL->Select this tracker.

   g. Right click on the name of the entity you want to track.

   h. Select GAZEL->Track this Entity.

GAZEL Object Tracker RAGE.XML Entry

```
<GAZELObjectTrackerOptions>
  <Tracker>
    <Name>Tower</Name>
    <Enabled>true</Enabled>
    <AntennaType>SPA</AntennaType>
    <Beam>
```

```
    <WidthDegrees>90.0</WidthDegrees>
    <HeightDegrees>20.0</HeightDegrees>
    <RangeMiles>10</RangeMiles>
    <Color>
        <red>0</red>
        <Green>0</Green>
        <Blue>0xff</Blue>
        <Alpha>0</Alpha>
    </Color>
    <FullPattern>true</FullPattern>
    <PatternSurfaces>99</PatternSurfaces>
    <WirePattern>true</WirePattern>
</Beam>
<PointerColor>darkblue</PointerColor>
<Pedestal>
    <ControlFormat>PTCR-20</ControlFormat>
    <Location>
        <Latitude>32:22:45.5</Latitude>
        <Longitude>-106:28:55.92</Longitude>
        <AltitudeMeters>1291.5</AltitudeMeters>
    </Location>
    <Azimuth>
        <MinimumDegrees>-190</MinimumDegrees>
        <MaximumDegrees>190</MaximumDegrees>
        <OffsetDegrees>0</OffsetDegrees>
        <HystersisDegrees>80</HystersisDegrees>
    </Azimuth>
    <Elevation>
        <MinimumDegrees>-5</MinimumDegrees>
        <MaximumDegrees>90</MaximumDegrees>
        <OffsetDegrees>0</OffsetDegrees>
        <HystersisDegrees>10</HystersisDegrees>
    </Elevation>
    <NetworkInterface>
        <RemoteIP>192.168.90.14</RemoteIP>
        <RemotePort>10001</RemotePort>
        <LocalPort>10001</LocalPort>
        <Protocol>UDP</Protocol>
    </NetworkInterface>
</Pedestal>
<DISEntityType>
    <Kind>1</Kind>
    <Domain>1</Domain>
    <Country>225</Country>
    <Category>0</Category>
    <Subcategory>0</Subcategory>
```

```
            <Specific>0</Specific>
            <Extra>0</Extra>
        </DISEntityType>
        <DISEntityID>
            <Site>12</Site>
            <Entity>14</Entity>
        </DISEntityID>
        <Target>
            <DISEntityID>
                <Site>0</Site>
                <Entity>3</Entity>
            </DISEntityID>
            <Stationary>false</Stationary>
            <Location>
                <Latitude>32:22:45.4</Latitude>
                <Longitude>-106:28:55.82</Longitude>
                <AltitudeMeters>1392</AltitudeMeters>
                <AzimuthDegrees>29</AzimuthDegrees>
                <ElevationDegrees>7</ElevationDegrees>
            </Location>
        </Target>
        <Verbose>0</Verbose>
    </Tracker>
```


Required Entries:

```
Tracker
    Name
        Pedestal
            Location
                Latitude
                Longitude
                AltitudeFeet or AltitudeMeters
            NetworkInterface
                RemoteIP
                RemotePort
```

Default Values:

```
GAZELObjectTrackerOptions
    Tracker
        Enabled                     true
        AntennaType                 SPA
        Beam
            WidthDegrees            90
            HeightDegrees           20
```

RangeMiles	10
Color	
Red	255
Green	255
Blue	255
Alpha	127
FullPattern	true
WirePattern	true
PatternSurfaces	3
PointerColor	
Red	0
Green	0
Blue	0
Alpha	127
Pedestal	
ControlFormat	PTCR-20
Azimuth	
MinimumDegrees	-217.5
MaximumDegrees	+217.5
OffsetDegrees	0
HystersisDegrees	45
Elevation	
MinimumDegrees	-60
MaximumDegrees	+60
OffsetDegrees	0
HystersisDegrees	3
NetworkInterface	
LocalIP	0.0.0.0
LocalPort	0
Protocol	UDP
DISEntityType	
Kind	0 (Other)
Domain	0 (Other)
Country	225 (United States)
Category	0 (Other)
Subcategory	0
Specific	0
Extra	0
DISEntityID	
Site	0
Entity	0
Target	
DISEntityID	
Site	0
Entity	0
Stationary	false

Location	
Latitude	NOT PROGRAMMED
Longitude	NOT PROGRAMMED
AltitudeMeters	NOT PROGRAMMED
AzimuthDegrees	NOT PROGRAMMED
ElevationDegrees	NOT PROGRAMMED
RangeMiles	10
Verbose	0

Selection Limits:

GAZELObjectTrackerOptions	
Tracker	
Beam	
WidthDegrees	360
HeightDegrees	180
Color	
Red	255
Green	255
Blue	255
Alpha	127
PointerColor	
Red	255
Green	255
Blue	255
Alpha	127
Pedestal	
Azimuth	
MinimumDegrees	-217.5
MaximumDegrees	+217.5
Elevation	
MinimumDegrees	-60
MaximumDegrees	+60

Valid Selections:

Tracker AntennaType: SPA (SinglePaneAntenna), OMNI, BirdCage

Tracker Pedestal NetworkInterface Protocol: UDP, TCPIP

Tracker Pedestal ControlFormat: PTR-20 (QuickSet Old Format), PTCR-20 (QuickSet New Format)

Tracker Target Applications: GPS, CRIIS, TCS, Weibel, Wireless Tower

COLOR: AliceBlue, AntiqueWhite, Aqua, Aquamarine, Azure, Beige, Bisque, Black, BlanchedAlmond, Blue, BlueViolet, Brown, BurgessWood, CadetBlue, Chartreuse, Chocolate, Coral, CornflowerBlue, Cornsilk, Crimson, Cyan, DarkBlue, DarkCyan, DarkGoldenrod, DarkGray, DarkGreen, DarkKhaki, DarkMagenta, DarkOliveGreen,

DarkOrange, DarkOrchid, DarkRed, DarkSalmon, DarkSeaGreen, DarkSlateBlue, DarkSlateGray, DarkTurquoise, DarkViolet, DeepPink, DeepSkyBlue, DimGray,DodgerBlue, FireBrick, FloralWhite, ForestGreen, Fuchsia, Gainsboro, GhostWhite, Gold, Goldenrod, Gray[X11], Green[X11], GreenYellow, Honeydew, HotPink, IndianRed, Indigo, Ivory, Khaki, Lavender, LavenderBlush, LawnGreen, LemonChiffon, LightBlue, LightCoral, LightCyan, LightGoldenrodYellow, LightGreen, LightGrey, LightPink, LightSalmon, LightSeaGreen, LightSkyBlue, LightSlateGray, LightSteelBlue, LightYellow, Lime, LimeGreen, Linen, Magenta,Maroon[X11], MediumAquamarine, MediumBlue, MediumOrchid, MediumPurple, MediumSeaGreen, MediumSlateBlue, MediumSpringGreen, MediumTurquoise, MediumVioletRed, MidnightBlue, MintCream, MistyRose, Moccasin, NavajoWhite, Navy, OldLace, Olive, OliveDrab, Orange, OrangeRed, Orchid, PaleGoldenrod, PaleGreen, PaleTurquoise, PaleVioletRed, PapayaWhip, PeachPuff, Peru, Pink, Plum, PowderBlue, Purple[X11], PurwaBlue, Red, RosyBrown, RoyalBlue, SaddleBrown, Salmon, SandyBrown, SeaGreen, Seashell, Sienna, Silver, SkyBlue, SlateBlue, SlateGray, Snow, SpringGreen, SteelBlue, Tan, Teal, Thistle, Tomato, Turquoise, Violet, Wheat, White, WhiteSmoke, Yellow, YellowGreen

Position Analysis Plug-in

Documentation is being written for the following Plug-in:

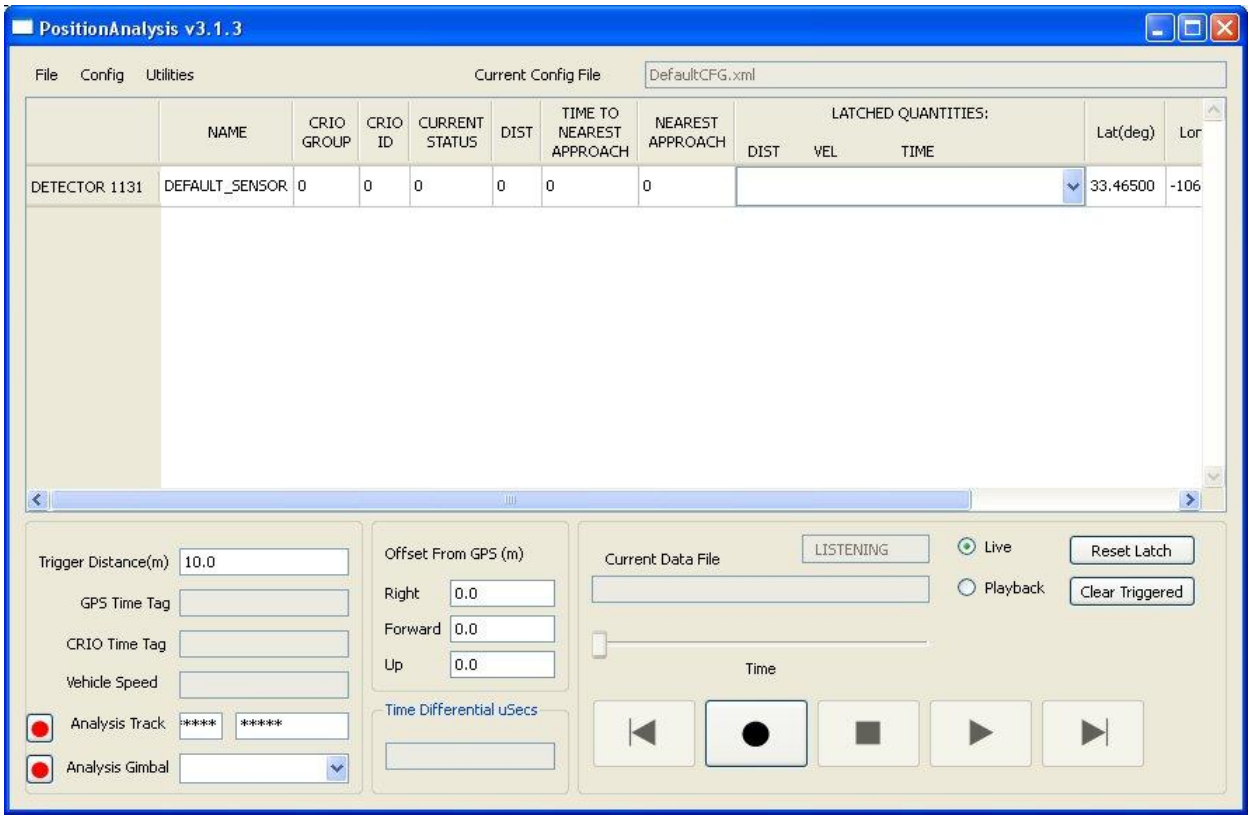

FIGURE 46, POSITION ANALYSIS PLUG-IN SCREEN

FIRECAM Plug-in

Documentation is being written for the following Plug-in:

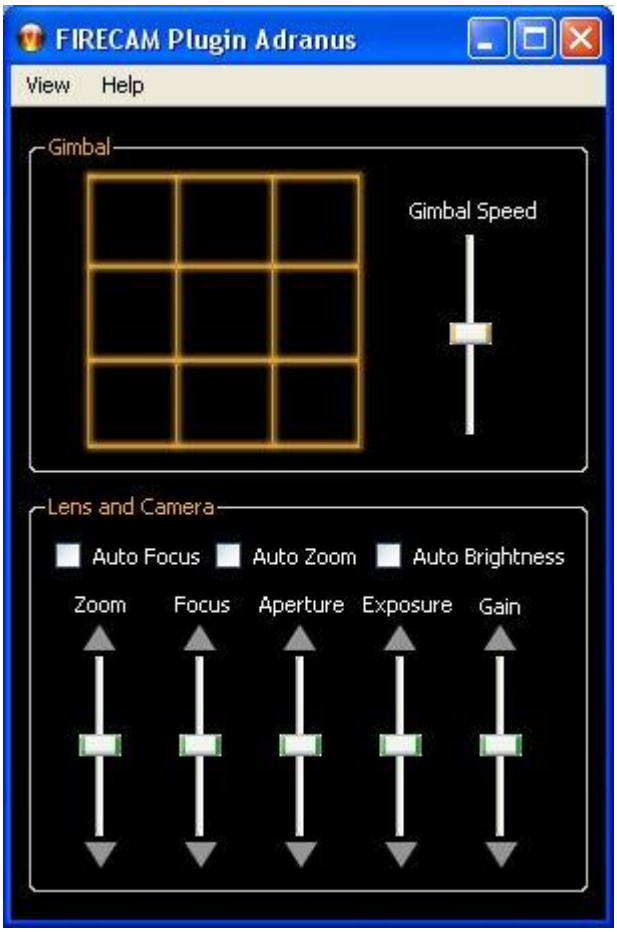

FIGURE 47, FIRECAM PLUG-IN SCREEN

LCD Plug-in (Laser Centurion Demonstrator)

Documentation is being written for the following Plug-in:

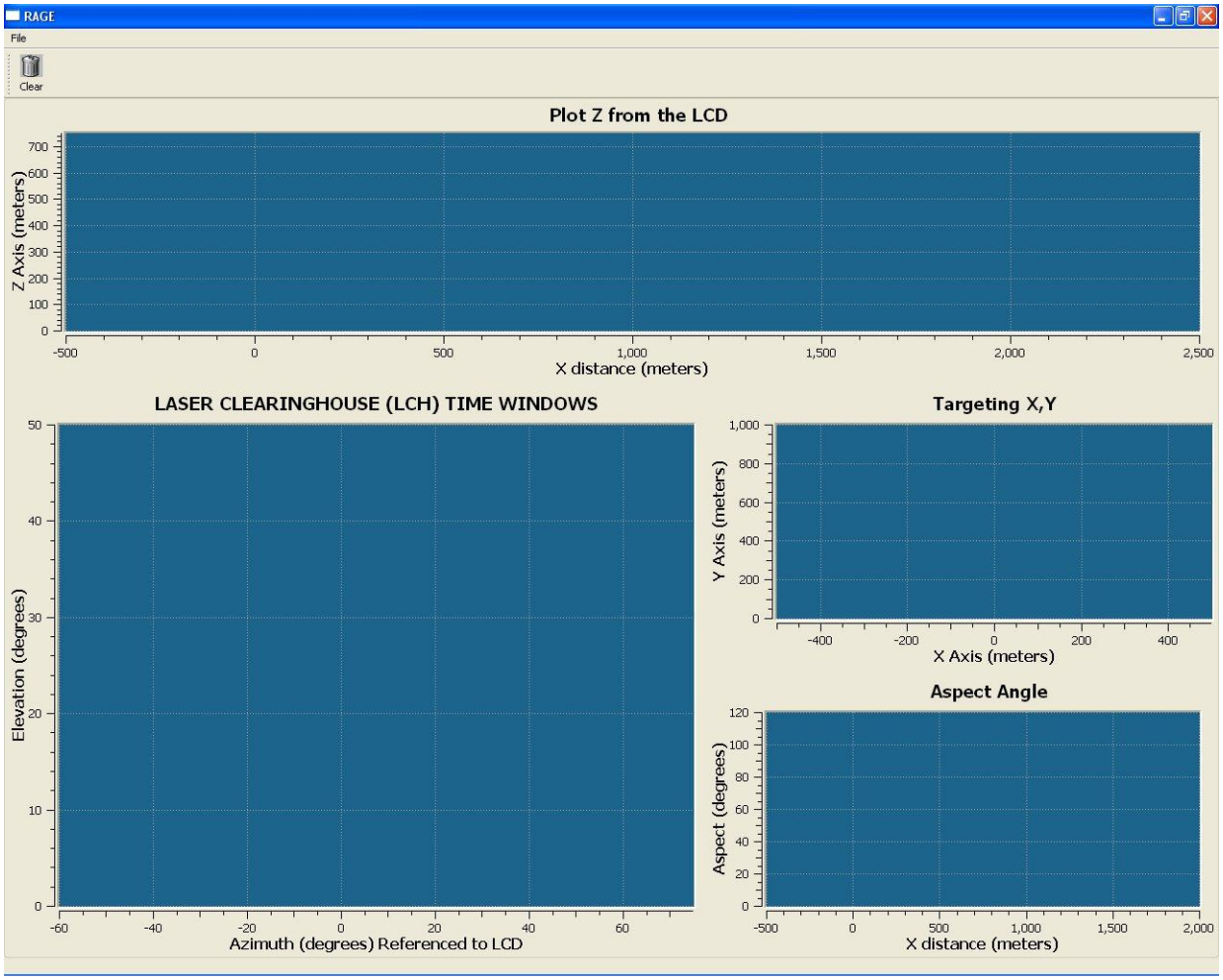

FIGURE 48, LCD PLUG-IN SCREEN

Radar Planning Plug-in

Documentation is being written for the following Plug-in:

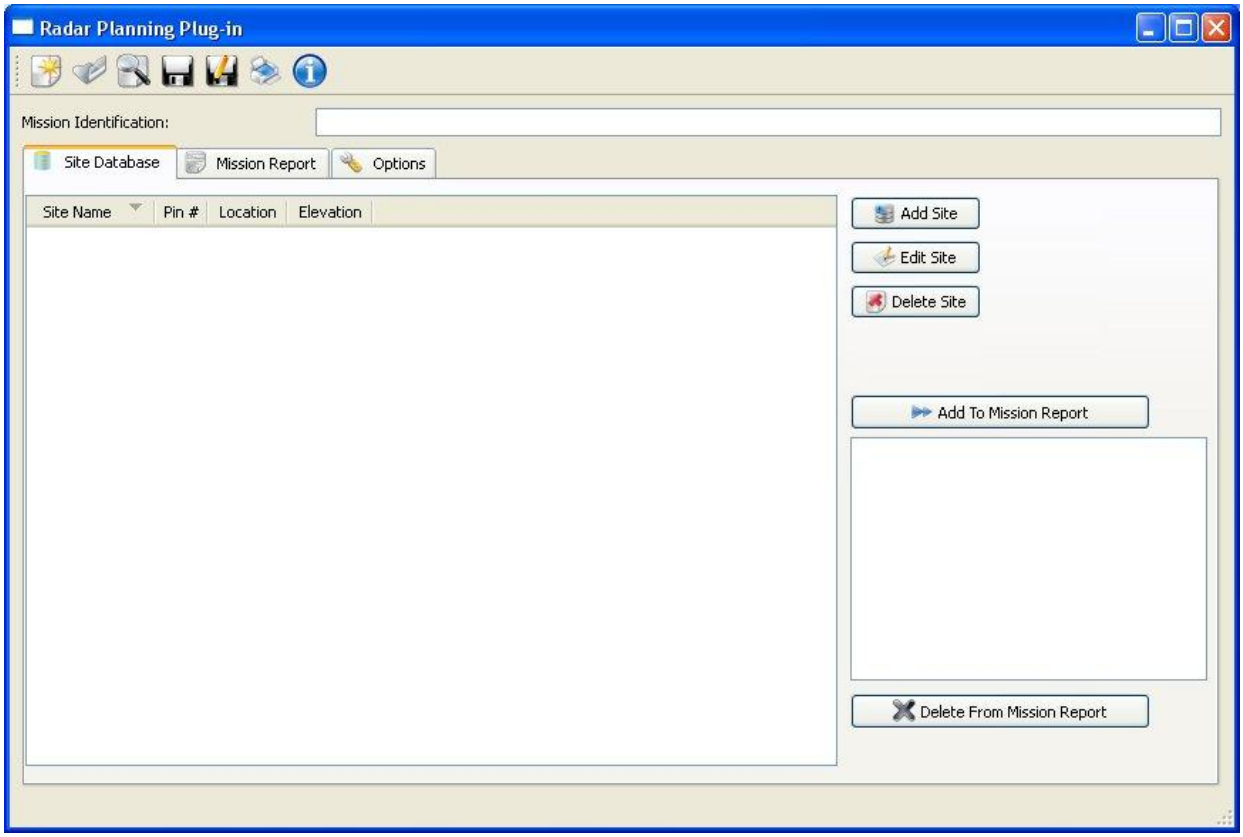

FIGURE 49, RADAR PLANNING PLUG-IN

Radiant Source Plug-in

Documentation is being written for the following Plug-in:

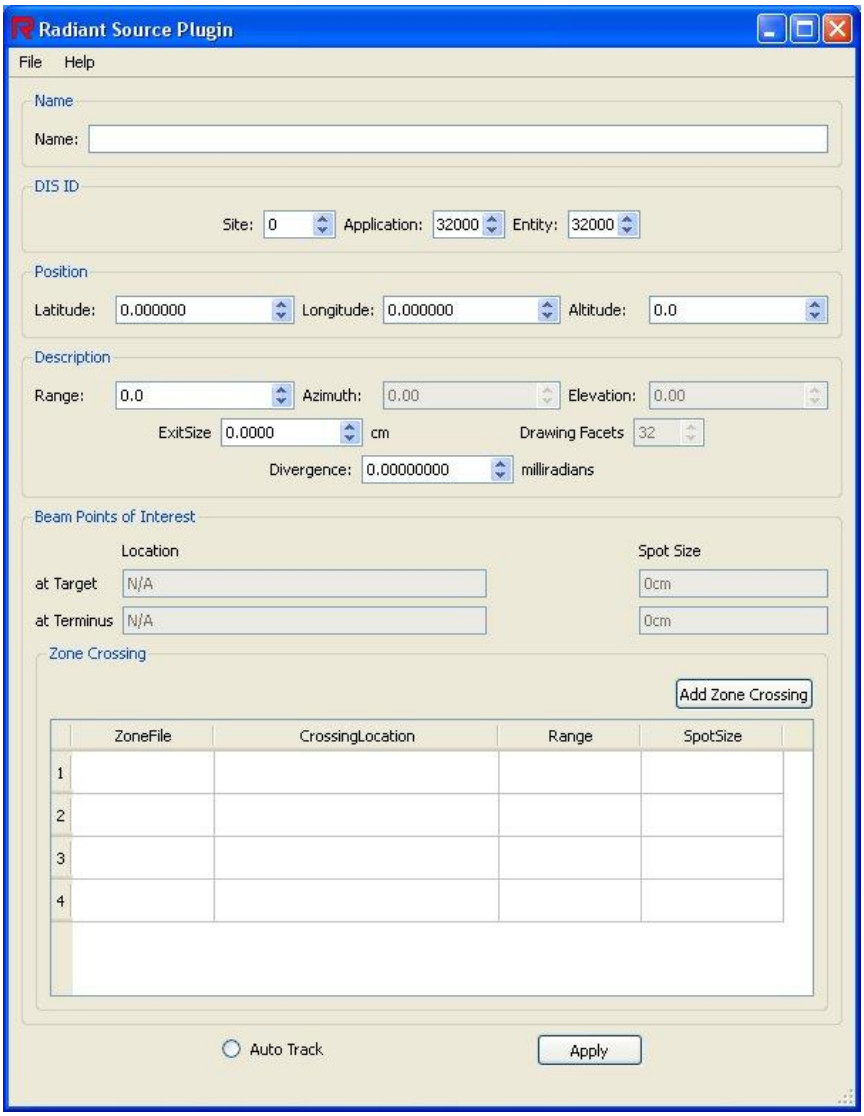

FIGURE 50, RADIANT SOURCE PLUG-IN

Appendix A: Plug-in Tutorial Example for Programmers

This tutorial provides an introduction to the main plug-in class **RAGEPlugin** and shows how to override two interfaces in the RAGE API (**EntityPublisher** and **DataParser**) in order to publish your own data into RAGE. The code shown in this tutorial is intended to be good enough so that you can perform a *cut and paste* operation, change a few class and variable names, and compile and start running your plug-in.

Complete Code

The goal of any RAGE plug-in writer is to accomplish three things:

1. Write a class that overrides RAGEPlugin because this is how RAGE is going to load your Dynamic Link Library or Shared Object
2. Write one or many classes that override one or more RAGE interfaces
3. Register the instances of those classes (objects) with RAGE

The following code illustrates these accomplishments:

```
//all these files come with the RageAPI
#include "RAGEPlugin.h"
#include "DataParser.h"
#include "EntityPublisher.h"
#include "RAGEEntityMetadata.h"

//this is a simplistic dummy structure
//to represent the user's own data format
struct MyOwnDummyStruct
{
	unsigned int id;
	float latitude;
	float longitude;
	float altitude;
};

//class that overrides two RAGE interfaces
class TutorialParser : public DataParser, public EntityPublisher
{
public:
	TutorialParser(){}
	virtual ~TutorialParser(){}

	//*****
	//BEGIN DataParser METHOD OVERRIDES
	inline DataParser* construct()
	{
		//return a copy of this parser
```

```
            return new TutorialParser(*this);
        }
        inline const char* getID()
        {
            //unique identifier for this type of parser
            return "Tutorial Parser";
        }

        //this method is called when RAGE receives data
        //for this parser on the network
        void parseData(char* dataBuffer, int dataSize)
        {
            //typecast the received data to my own struture
            MyOwnDummyStruct* myOwnStruct = (MyOwnDummyStruct*)dataBuffer;
            //create RAGE Entity structure
            RAGEEntityMetadata rageEntity;

            //RAGE uses Distributed Interactive Simulation
            //(DIS) methodology to identify objects but in
            //this case our structure just has a simple ID,
            //so we populate site and entity with our own
            //"meaningful ;-P" numbers
            rageEntity.ident.disID.entityID.site = 777;
            rageEntity.ident.disID.entityID.application = 777;
            rageEntity.ident.disID.entityID.entity = myOwnStruct->id;

            //specify the coordinate system that we are using,
            //in this case is Earth Centered Earth Fixed
            rageEntity.data.TspiPosRef = LatLong;

            //translate X Y Z to RAGE structure
            rageEntity.data.Lat = myOwnStruct->latitude;
            rageEntity.data.Lon = myOwnStruct->longitude;
            rageEntity.data.Alt = myOwnStruct->altitude;

            //call the postUpdate method in EntityPublisher
            //with the data
            postUpdate(rageEntity);

            //WE ARE DONE!!!!!!
        }
        //END OF DataParser OVERRIDES
        //*****

        //NOTE: No overrides needed for EntityPublisher

    };

    //main plugin class
    class TutorialPlugin : public RAGEPlugin
    {
    private:
        TutorialParser* mTutorialParser;

    public:
        TutorialPlugin()
        {
```

```
            //instantiate my interface object
            mTutorialParser = new TutorialParser();

            //call the addInterface method in RAGEPlugin
            //to register both interfaces with RAGE
            addInterface("DataParser", (DataParser*)mTutorialParser);
            addInterface("EntityPublisher",
(EntityPublisher*)mTutorialParser);
      }

      virtual ~TutorialPlugin(){}

      //*****
      //BEGIN RAGEPlugin METHOD OVERRIDES
      void initialize(){}
      void destroy()
      {
            if(mTutorialParser)
            {
                  delete mTutorialParser;
            }
      }
      //END OF RAGEPlugin OVERRIDES
      //*****
};

//dynamic load export functions, these must be included at the end each
plugin
EXPORT const char* getPluginID(){ return "Tutorial Plugin v0.1"; }
EXPORT RAGEPlugin* makePlugin(){ return new TutorialPlugin(); }
```

Code Walkthrough

The code contains a lot of comments since it is meant to be self-explanatory. Here is a detailed walkthrough.

```
#include "RAGEPlugin.h"
#include "DataParser.h"
#include "EntityPublisher.h"
#include "RAGEEntityMetadata.h"
```

All plug-in classes must include RAGEPlugin.h in order to inherit from it. This is how RAGE is going to load the DLL or SO file. DataParser and EntityPublisher are the interfaces that we are going to override. RageEntityMetadata contains RAGE's main entity structure.

```
struct MyOwnDummyStruct
{
      unsigned int id;
      float latitude;
```

```
	float longitude;
	float altitude;
};
```

This structure is really just a placeholder for your own data format. In this case, we are interested in publishing an entity (object) in RAGE, so we need a simple unique ID and an X, Y, Z, in order to know where to place this object.

```
class TutorialParser : public DataParser, public EntityPublisher
```

As mentioned before, one of the goals of writing a plug-in is to have one or many classes overriding one or more interfaces. In this case, we have a TutorialParser class that inherits/overrides from both DataParser and EntityPublisher interfaces.

A *data translator* is probably the most common type of plug-in for RAGE. A data translator plug-in is something that will take your user defined data format, put it into a RAGE structure, and display it in the 3-D environment. The most common way of *data feeding* is through a network interface. RAGE handles that part automatically.

A DataParser is an object that is fed with data received by a RAGE NetworkListener object. A DataParser is associated with a NetworkListener by its ID. The section explains how to set up Network Listeners in RAGE. An EntityPublisher is precisely that – something that publishes RAGE entities so that RAGE can display them in the 3-D environment.

```
	inline DataParser* construct()
	{
		return new TutorialParser(*this);
	}
	inline const char* getID()
	{
		return " Tutorial Parser ";
	}
```

Each NetworkListener in RAGE is associated with its own DataParser, therefore the construct method is used so that RAGE can get a copy of your parser for each new NetworkListener it instantiates. The *getID* method is used to associate a particular NetworkListener with this type of parser.

```
	void parseData(char* dataBuffer, int dataSize)
```

```
{
        MyOwnDummyStruct* myOwnStruct = (MyOwnDummyStruct*)dataBuffer;
        RAGEEntityMetadata rageEntity;
```

The dataParser method is called when the Network Listener receives a network packet for this parser. The dataBuffer parameter contains the data in binary format and dataSize tells us how big the binary packet is. In this case, a simple translation occurs from the binary data to the dummy structure through a typecast. Since your data is more than likely going to be much more complex than the dummy structure, this line is also meant as a placeholder for your own data translation process.

```
        rageEntity.ident.disID.entityID.site = 777;
        rageEntity.ident.disID.entityID.application = 777;
        rageEntity.ident.disID.entityID.entity = myOwnStruct->id;
```

RAGE uses a DIS identification methodology. This methodology uses a combination of site, application, and entity ID numbers. This case illustrates how we could just populate the *entity* portion with our simple ID and populate the other two with our own *meaningful* numbers if we choose to do so.

```
        rageEntity.data.TspiPosRef = LatLong;

        rageEntity.data.Lat = myOwnStruct->latitude;
        rageEntity.data.Lon = myOwnStruct->longitude;
        rageEntity.data.Alt = myOwnStruct->altitude;
```

Here we are specifying the coordinate system that we are using. In this case, Earth Centered Earth Fixed (ECEF) populate the RAGE entity with our own X, Y, Z, values.

```
        postUpdate(rageEntity);
```

Finally, postUpdate is a method inherited from EntityPublisher. By calling it, RAGE will be able to receive the data and display it at the right location inside the 3-D environment.

```
class TutorialPlugin : public RAGEPlugin
{
```

```
private:
	TutorialParser* mTutorialParser;

public:
	TutorialPlugin()
	{
		mTutorialParser = new TutorialParser();

		addInterface("DataParser", (DataParser*)mTutorialParser);
		addInterface("EntityPublisher",
(EntityPublisher*)mTutorialParser);
	}
```

Now we get to the main Plug-in class. You can see that it inherits from RAGEPlugin because this is how RAGE is going to load your plug-in. You can also see that this class instantiates our TutorialParser and registers it with RAGE by calling the addInterface method. We have to call the add Interface method for every interface we want to register with RAGE.

```
	void initialize(){}
	void destroy()
	{
		if(mTutorialParser)
		{
			delete mTutorialParser;
		}
		return true;
	}
```

The initialize and destroy methods are *optional* overrides of RAGE plug-in. They are provided for plug-in initialization and clean up.

```
EXPORT const char* getPluginID(){ return "Tutorial Plugin v0.1"; }
EXPORT RAGEPlugin* makePlugin(){ return new TutorialPlugin(); }
```

Finally, the two EXPORT methods are very important. You can change what they return, but you must keep the method names intact since they represent the hook from the DLL/SO into RAGE.

Setting Up the Build Environment

Windows (Visual Studio 2005)

1. Select the Create Project option from the Start Page.
2. Select Visual *C++->Win32 from the Project Types.*
3. *Select Win32 Console Application* for Templates. Type *Tutorial* for the project name and uncheck the create directory solution box, and then press OK.
4. What you will see next is the *Win32 Application Wizard*. Click Next.
5. Inside the *Application Settings* page, select the ***DLL*** and ***Empty project*** options.
6. Select finish to create the project.
7. Select the Release option from configuration manager.
8. Under solution explorer, right click on **Source Files** and select *Add->New Item…*
9. Select *Visual C++->Code* from Categories and *C++ file (.cpp)* from Templates. Type *TutorialPlugin* for the name. Select the Add button.
10. Paste the code provided in this documentation and save it.
11. Open up the project properties dialog. Under *Configuration Properties->C/C++->General*, add the include paths to **RageAPI/interfaces** and **RageAPI/types** inside *Additional Include Directories*. Press Apply and then OK.

You are now ready to compile.

Linux (Fedora 8 Eclipse)

1. Select *File->New->C++ Project* menu option. Type *Tutorial* for the project name and select **Shared Library** from the Project Types view.
2. Click Next. Under project settings, add the *RageAPI/interfaces* and *RageAPI/types* paths under *GCC C++ Compiler->Directories*.
3. Press finish to create the project.
4. Under project explorer, right click on the project, select *New->Source File* and name it *TutorialPlugin.cpp*.
5. Paste the code provided in this documentation and save it.

You are now ready to compile.

Running The Plug-in

If you followed the steps on the previous section, you should be able to get a DLL/SO file from the compilation. Copy the file into the ***RAGEPlugins/bin*** directory inside the RAGE installation path and start RAGE. After RAGE starts, go to ***Tools->Plugin Explorer*** menu option. A window (Figure 51) should appear with two lists. In the list on the left, you should see *Tutorial Plugin v0.1*. Press the Add button to start the plug-in. The name of the plug-in should now appear inside the list on the right (Figure 52). Expanding the tree should show that the Tutorial Plug-in contains both a DataParser and an EntityPublisher interface like it is shown on the following images. Congratulations! You are now ready to stream and display your own data format in RAGE.

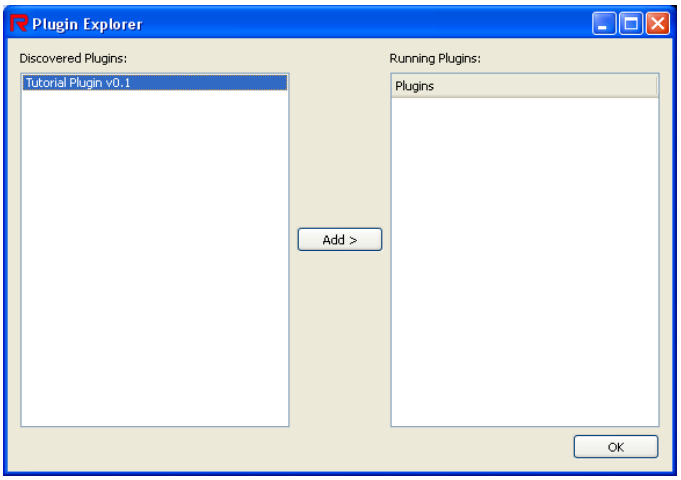

FIGURE 51, SELECT ADD TO START THE PLUG-IN

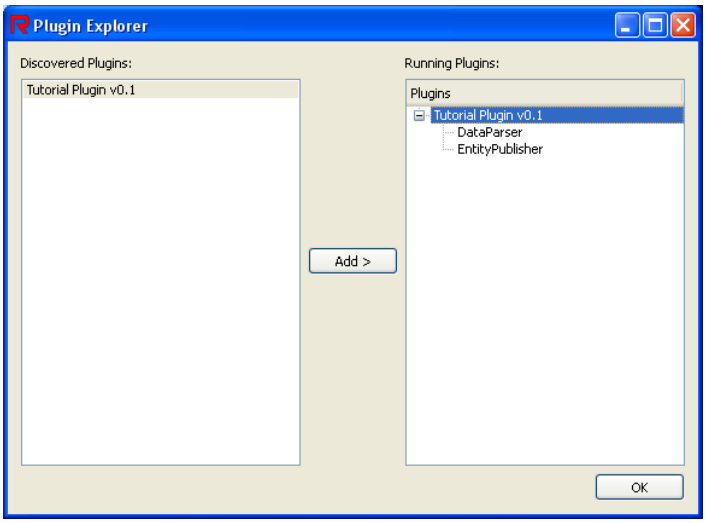

FIGURE 52, ADDED PLUG-INS

Interfaces

This section lists the main plug-in interfaces for RAGE. If you are looking for detailed method names, parameters, and class descriptions, please consult the Rage API or the generated doxygen documentation.

INTERFACE	FUNCTION
Configurable	Configure your plug-in using RAGE's configuration system
ControllerIfx	Use the joystick to provide control for your plug-in
DataParser	Use RAGE's Network Listener System with your own data format
ElevationSubscriber	Query RAGE's elevation databases
EntityPublisher	Display your own entities inside RAGE's 3-D environment
HudRenderer	Display information or graphics inside RAGE's HUD
KeyHandler	Provide your own key behavior
MouseHandler	Provide your own mouse behavior
RageMenuItem	Add menus to RAGE's main window
VideoPublisher	Display your own videos in RAGE
ViewController	Provide your own 3-D navigation system

Appendix B: LayerConverter Tool

The LayerConverter Tool allows the user to convert legacy layers into XML layers. The XML layers are used in the Track and Sensor Tool. The utility converts at the present: legacy XML layer, TSN Excel format, Survey Pin data, Legacy ASCII layer, and Tracks XML to Layer names. The converter utility is located in the RAGE directory under Bin\Win32\layerconverter.exe. Double left-click LayerConverter to launch the utility. Left click [Select the Import Type]. Select the appropriate type of file being converted. When the open window is displayed (Figure 53), navigate to the directory where the legacy layers are residing. Select the file of interest and select [Open]. When complete, *Done!* will appear in the LayerConverter window. The new layer will be saved in the same directory as the original file. In RAGE, select the Tracks or Sensor icon on the Menu Bar. With the icon selected, select [File] on the Menu Bar and select [Open Track] or [Sensor File] accordingly. Navigate to the directory containing the new XML layer and select the proper layer. Once the proper file is selected, select [Open] on the window.

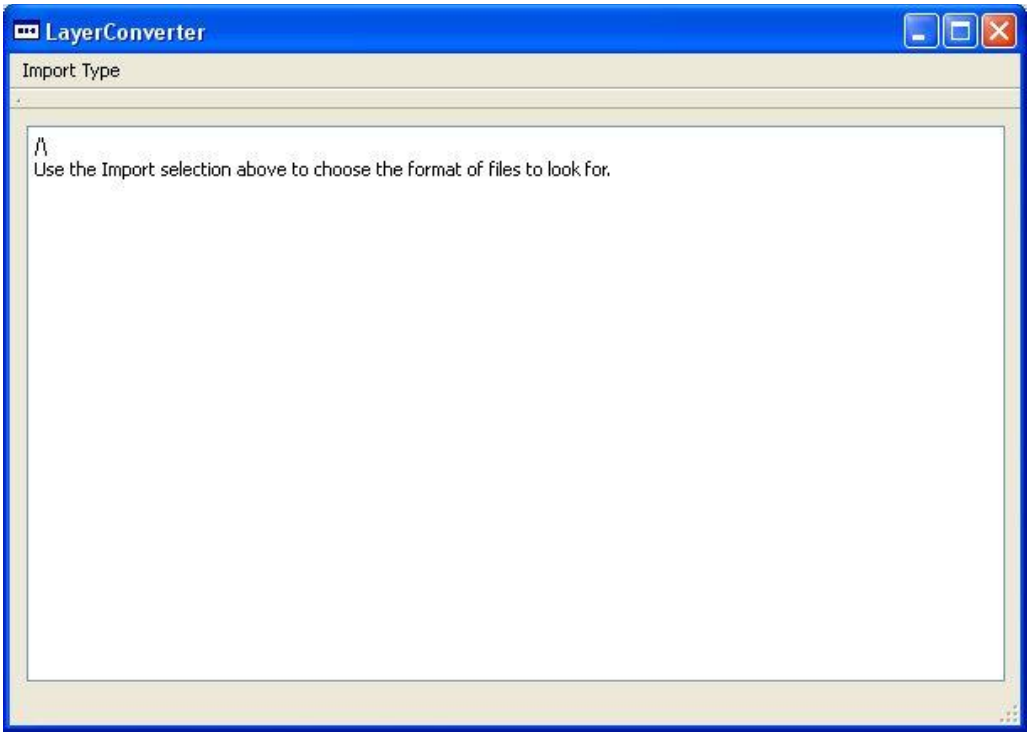

FIGURE 53, LAYERCONVERTER WINDOW MENU

XY Data Plot Tool

Located under Tracks, Sensor, and Video tools under the action window, the XY Data Plot Tool allows the user to graphically plot various acceleration and velocity vectors against Time. The sample rate and the units of measurement are user selectable. Future enhancements to the XY Data Plot Tool will allow the user a single button to capture the image for reporters. The Save Configuration button will allow the user to save the plot configuration and recall it in the future.

Steps

1 With the Selection Icon active on the 3-D viewing window, right click [Select the Object of Interest].

2 When the action window is displayed, left-click select the Show XY Plot label from the list.

3 The XY Plot Window will be displayed. Using the CTRL button from the keyboard and the mouse left button, hold down the CTRL key and left button and select the Y-Plot data items of interest.

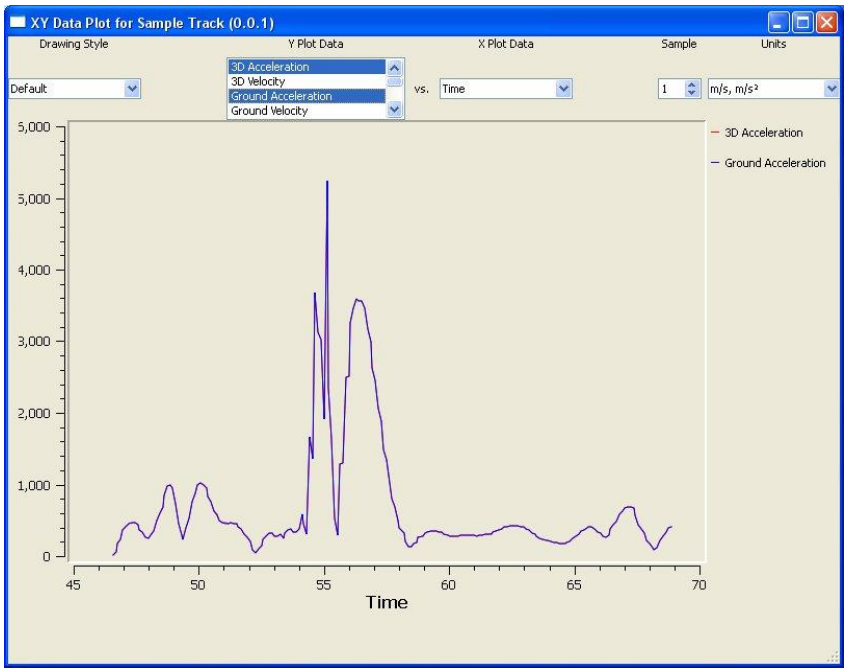

FIGURE 54, XY DATA PLOT DISPLAY

Appendix C: BuildingList.xml Example

Using xml editor or notepad, copy and paste the following script. This will make it easy to add more models to the BuildingList. Remember to SAVE the created script.

XML is not the same as HTML. XML was designed to transport and store data. HTML was designed to display data. XML stands for *Extensible Markup Language*. XML does not have predefined tags. The user must construct the <tags>. Every <tag> must have an open <tag> and close </tag> to it. Note the backslash </> in the close <"/"tag>. XML is just plain text wrapped up in user defined <tags>.

The first line below in the script is the XML header. It defines the XML version (1.0) and the encoding used (UTF-8). The <Building Table> is the root element or parent. Under the root element, <Building> is child element to the parent. The following: <Model>, <File>, <Scale>, <Heading Degrees>, <Pitch Degrees>, and <Roll Degrees> are all sub children of <Building>. <Location> is another child within the parent <Building>.

<Model> describes the 3-D model. <File> displays where to find the model, which database the model will be placed in, and what model to use. 3-D models can be recognized by their .FLT extension. <Scale> describes how big to make the model. The normal size default is 1.0. Then if necessary, the model can be altered by changing the Heading, Pitch, and Roll it is pointing (0-360). Zero is the default for all rotations.

<Location> describes a geodetic place on the Earth's surface to place the model. This is described as latitude, longitude, and altitude or height. The latitude and longitude MUST be represented in decimal degrees and the altitude in meters.

An easy way to place a model is to use RAGE at the same time as editing the BuildingList.xml. With RAGE running, select the Measurement Tool Icon from the Task bar. Select the point in the RAGE 3-D display window terrain. Drag the mouse slightly and the starting geodetic point will be displayed. Next, type the numbers for the latitude and longitude in the appropriate field. Latitude is the first series of numbers displayed, followed by the longitude, and lastly the altitude in meters.

To support many models, copy from <Building> to </Building>. Place this on a new line just after </Building>. There are no spaces between the lines. Edit the <File> and <Location> line of each model. When complete, remember to save the file.

BuildingList.xml script example


```xml
<?xml version='1.0' encoding='UTF-8' standalone='yes'?>
<BuildingTable>
    <Building>
      <Model>
      <File>\Terrains\culture\wsmr\WSMR_Bldg_1550.flt</File>
      <Scale>1.0</Scale>
      <HeadingDegrees>0</HeadingDegrees>
      <PitchDegrees>0</PitchDegrees>
      <RollDegrees>0</RollDegrees>
      </Model>
      <Location>
            <LatitudeDegrees>32.37826</LatitudeDegrees>
            <LongitudeDegrees>-106.48276</LongitudeDegrees>
            <AltitudeMeters>1270.0</AltitudeMeters>
      </Location>
    </Building>
    <Building>
      <Model>
      <File>\Terrains\culture\wsmr\WSMR_Bldg_1551.flt</File>
      <Scale>1.0</Scale>
      <HeadingDegrees>0</HeadingDegrees>
      <PitchDegrees>0</PitchDegrees>
      <RollDegrees>0</RollDegrees>
      </Model>
      <Location>
            <LatitudeDegrees>32.37830</LatitudeDegrees>
            <LongitudeDegrees>-106.48278</LongitudeDegrees>
            <AltitudeMeters>1270.0</AltitudeMeters>
      </Location>
    </Building>
</BuildingTable>
```

RAGE Folder File Descriptions

Bin Folder – The Bin folder contains all of the DLLs, OSG plug-ins, and the actual RAGE executable file.

BlueMarble Folder – The Blue Marble folder contains the background Earth imagery. This is overlaid on sphere and creates the Earth which is viewed in RAGE in the 3-D display window.

Data Folder – The Data folder contains subfolders which house the 3-D models and symbols for forces. The models folder contains Air, Building, Colored Spheres, Misc, Planets, Sea, Urban Town, Utilities, Vegetation, and Vehicles. Each of these folders contains subfolders containing the actual flight model for RAGE.

Elevation Databases Folder – The Elevation Database folder contains the Elevation (NED) files that RAGE uses to give the imagery shape (e.g., mountains, valleys). Multiple elevation files can be loaded into RAGE at one time. The elevation files use motherboard memory space.

Jre Folder – The Jre folder contains the Java run time environment.

RageAPI Folder – The RageAPI folder contains the header files for examples to build plug-ins. There is a tutorial that allows a user to create plug-in for RAGE designed for a specific application

RAGEPlugins Folder – The RAGEPlugins folder contains all the plug-ins created to date used by RAGE customers for a specific requirement. A description is available for each plug-in in the Network Configuration section.

Run Folder – The Run folder contains several subfolders. This is the primary location for files RAGE uses for configuration, layers, and RAGE documentation. RAGE uses XML files as configuration files.

Screen Capture Folder – The Screen Capture folder is the default folder where images are set as they are captured from the RAGE 3-D display window or full screen option.

Universal Player Folder – The Universal Player folder contains the DLLs and executable file of the Universal Player. The Universal Player allows users to view data in RAGE that was collected in the field and play back the data at varying rates.

Current Database Available for Distribution

WSMR, NM – Standard with installation

El Paso, Texas – Optional

Kirtland AFB, Albuquerque, NM – Optional

Cape Canaveral, Florida – Optional

Kwajalien Atoll Island, Marshall Islands – Optional

Dugway, Utah – Optional

Kodiak, Alaska – Optional

San Diego, California – Optional

San Francisco, California – Optional

Vandenberg AFB, California – Optional

Edwards/China Lake, California – Optional

Whidbey, Island, Washington – Optional

Huntsville, Alabama – Optional

Eglin AFB, Florida – Optional

Fort Deven, Massachusetts – Optional

Portland, Oregon – Optional

Washington, D.C. – Optional

Yuma Proving Grounds, Arizona – Optional

Grand Canyon, Arizona – Optional

Camp Pendleton, California – Optional