

VR-Vantage

Users Guide

VR-Vantage Steatlh
VR-Vantage PVD
VR-Vantage IG

VT MÄK
A company of VT Systems



VR-Vantage

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VR-Vantage IG
VR-Vantage PVD

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MÄK Products Glossary

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VR-Vantage Quick Reference Card

Preface

This manual is for persons who will install VR-Vantage and use it to view simulations. The manual assumes that you are familiar with basic administrative tasks and the graphical window environment for your operating system.

For the latest product information, please see release-specific documentation for your version of VR-Vantage.

How the Manual Is Organized

This manual is organized as follows:

Chapter 1, *Introduction to VR-Vantage*, describes the basic features of VR-Vantage.

Chapter 2, *Installing VR-Vantage*, explains how to install VR-Vantage software, the license manager, and an RTI.

Chapter 3, *Running VR-Vantage Applications*, explains how to start and stop VR-Vantage, load a terrain, and connect to a simulation.

Chapter 4, *VR-Vantage Concepts* explains VR-Vantage concepts that you should understand before you read other chapters in this manual.

Chapter 5, *Scenes and Environmental Effects*, explains how to configure the environment, including date and time, clouds, and precipitation.

Chapter 6, *The Observer and Observer Modes*, explains how to create and change observer modes, how to add observers, and how to communicate information about the observer.

Chapter 7, *Moving the Observer*, explains how to navigate the observer through the 2D and 3D scenes.

Chapter 8, *Attaching the Observer*, explains attach modes and how to attach the observer to entities and props.

Chapter 9, *Viewing Entities*, explains how to select entities and how to view information about them, including entity labels, force coloring, and height-above-terrain lines.

Chapter 10, *Viewing Entity Effects*, describes how to display various types of entity-related effects, such as ground clamping and smoothing, and entity related graphics, such as trailing effects and decal effects.

Chapter 11, *Aggregate Entities* explains how to manage the display of aggregate entities.

Chapter 12, *Intervisibility Objects* explains how to create and configure intervisibility objects.

Chapter 13, *Changing How the Terrain is Displayed* explains how to learn more about the terrain by displaying contour lines, grid lines, and coloring by elevation.

Chapter 14, *Using Sensors* explains how to view the terrain as if you had night vision goggles or an infrared view.

Chapter 15, *Sound Effects* explains how to enable and configure sound effects for entities and interactions.

Chapter 17, *Using Streaming Video* explains how to send the view in the VR-Vantage window to a video stream.

Chapter 18, *Tactical Graphics and Remote Graphics* explains how to manage tactical graphics and remote graphics.

Chapter 19, *Exaggerating Models and Terrain* describes features that only apply to XR observer mode.

Appendix A, *The VR-Vantage User Interface* describes some of the basic features of the VR-Vantage graphical user interface (GUI).

Appendix B, *Managing Network Connections*, explains how to configure network connections.

MÄK Products Glossary defines DIS and HLA terms and terms specific to VR-Vantage and other MÄK products.

The *VR-Vantage Quick Reference Card*, at the end of the manual, lists command-line options, key mappings, and mouse button mappings.

Documentation Set

Electronic versions of VR-Vantage documentation are in *vrvantagex.x/doc*. On Windows, the documentation is accessible from the VR-Vantage folder on the Start menu. The VR-Vantage documentation set is as follows:

- *VR-Vantage Users Guide* describes how to use the VR-Vantage applications.
- *VR-Vantage Configuration Guide* explains how to configure schemas, model definitions, and object definitions. It also describes how to create and manage terrains.
- *VR-Vantage Release Notes* lists system requirements, release-specific requirements, new features and updates, bug fixes, and known problems.
- Online help. The online help, accessible from the Help menu, replicates most of the information in *VR-Vantage Users Guide*.
- First Experience Guides. First Experience Guides are brief pamphlets that provide a guided tour of the most important features of each application. They are primarily for new users and persons evaluating VR-Vantage.
- VR-Vantage Developers Guide. The developers guide provides a high level introduction to the APIs, and class documentation, which is generated from the header files. You can open the developers guide and class documentation from the Windows Start menu on the VR-Vantage Documentation submenu or by opening *./vrvantage1.6/doc/classdoc/index.html*.

MÄK Products

VR-Vantage is a member of the VT MÄK line of software products designed to streamline the process of developing and using networked simulated environments. The VT MÄK product line includes the following:

- VR-Link® Network Toolkit. VR-Link is an object-oriented library of C++ functions and definitions that implement the High Level Architecture (HLA) and the Distributed Interactive Simulation (DIS) protocol. VR-Link has built-in support for the RPR FOM and allows you to map to other FOMs. This library minimizes the time and effort required to build and maintain new HLA or DIS-compliant applications, and to integrate such compliance into existing applications.

  VR-Link includes a set of sample debugging applications and their source code. The source code serves as an example of how to use the VR-Link Toolkit to write applications. The executables provide valuable debugging services such as generating a predictable stream of HLA or DIS messages, and displaying the contents of messages transmitted on the network.

- MÄK RTI. An RTI (Run-Time Infrastructure) is required to run applications using the High Level Architecture (HLA). The MÄK RTI is optimized for high performance. It has an API, RTIspy®, that allows you to extend the RTI using plug-in modules. It also has a graphical user interface (the RTI Assistant) that helps users with configuration tasks and managing federates and federations.
- VR-Forces®. VR-Forces is a computer generated forces application and toolkit. It provides an application with a GUI, that gives you a 2D and 3D views of a simulated environment.

  You can create and view local entities, aggregate them into hierarchical units, assign tasks, set state parameters, and create plans that have tasks, set statements, and conditional statements. VR-Forces also functions as a plan view display for viewing remote entities taking part in an exercise. Using the toolkit, you can extend the VR-Forces application or create your own application for use with another user interface.

- VR-Vantage™. VR-Vantage is a line of products designed to meet your simulation visualization needs. It includes three end-user applications (VR-Vantage Stealth, VR-Vantage PVD, and VR-Vantage IG) and the VR-Vantage Toolkit.
  - VR-Vantage Stealth displays a realistic, 3D view of your virtual world, a 2D plan view, and an exaggerated reality (XR) view. Together these views provide both situational awareness and the big picture of the simulated world. You can move your viewpoint to any location in the 3D world and can attach it to entities so that it moves as they do.
  - VR-Vantage IG is a configurable desktop image generator (IG) for out the window (OTW) scenes and remote camera views. It has most of the features of the Stealth, but is optimized for its IG function.
  - VR-Vantage PVD provides a 2D plan view display. It gives you the big picture of the simulated world.

  - The VR-Vantage Toolkit is a 3D visual application development toolkit. Use it to customize or extend MÄK's VR-Vantage applications, or to integrate VR-Vantage capabilities into your custom applications. VR-Vantage is built on top of OpenSceneGraph (OSG). The toolkit includes the OSG version used to build VR-Vantage.

- MÄK Data Logger. The Data Logger, also called the Logger, can record HLA and DIS exercises and play them back for after-action review. You can play a recorded file at speeds above or below normal and can quickly jump to areas of interest. The Logger has a GUI and a text interface. The Logger API allows you to extend the Logger using plug-in modules or embed the Logger into your own application. The Logger editing features let you merge, trim, and offset Logger recordings.
- VR-Exchange™. VR-Exchange allows simulations that use incompatible communications protocols to interoperate. For example, within the HLA world, using VR-Exchange, federations using the HLA RPR FOM 1.0 can interoperate with simulations using RPR FOM 2.0, or federations using different RTIs can interoperate. VR-Exchange supports HLA, TENA, and DIS translation.
- VR-TheWorld™ Server. VR-TheWorld Server is a simple, yet powerful, web-based streaming terrain server, developed in conjunction with Pelican Mapping. Delivered with a global base map, you can also easily populate it with your own custom source data through a web-based interface. The server can be deployed on private, classified networks to provide streaming terrain data to a variety of simulation and visualization applications behind your firewall.
- VR-inTerra. VR-inTerra is a C++ API for adding terrain agility to applications. It can load, page, or stream terrain from a wide variety of formats or sources into a single, consistent run-time representation, consisting of a collision graph and vector network.

How to Contact Us

For VR-Vantage technical support, information about upgrades, and information about other MÄK products, you can contact us in the following ways:

Telephone

Call or fax us at:	Voice:	617-876-8085 (extension 3 for support)
	Fax:	617-876-9208

E-mail

Sales and upgrade information:	info@mak.com
Technical support:	support@mak.com
VR-Vantage support:	vrv-support@mak.com

Internet

MÄK web site home page:	www.mak.com
License key requests:	www.mak.com/support/get-licenses.html
Product version and platform information:	www.mak.com/support/product-versions.html
For the free, unlicensed MÄK RTI:	www.mak.com/resources/bonus-material/cat_view/16-bonus-materials/24-mak-high-performance-rti.html
MÄK Community Forum:	www.mak.com/community-forum/1-forum.html

Post

Send postal correspondence to:	VT MÄK 150 Cambridge Park Drive, 3rd Floor Cambridge, MA, USA 02140

When requesting support, please tell us the product you are using, the version, and the platform on which you are running.

Document Conventions

This manual uses the following typographic conventions:

`Monospaced`	Indicates commands or values you enter.
`Monospaced Bold`	Indicates a key on the keyboard.
`Monospaced Italic`	Indicates command variables that you replace with appropriate values.
Blue text	A hypertext link to another location in this manual or another manual in the documentation set.
`{ }`	Indicates required arguments.
`[ ]`	Indicates optional arguments.
|	Separates options in a command where only one option may be chosen at a time.
`( | )`	In command syntax, indicates equivalent alternatives for a command-line option, for example, `(-h | --help)`.
/	Indicates a directory. Since MÄK products run on both Linux and Windows PC platforms, we use the / (slash) for generic discussions of pathnames. If you are running on a PC, substitute a \ (backslash) when you type pathnames.
Italic	Indicates a file name, pathname, or a class name.
sans Serif	Indicates a parameter or argument.
➤	Indicates a one-step procedure.
Menu → Option	Indicates a menu choice. For example, an instruction to select the Save option from the File menu appears as: Choose **File → Save**.
	Click the icon to run a tutorial video in the default browser.
	Indicates supplemental or clarifying information.
!	Indicates additional information that you must observe to ensure the success of a procedure or other task.

Directory names are preceded with dot and slash characters that show their position with respect to the VR-Vantage home directory. For example, the directory *vrvantagex.x1.6/doc* appears in the text as *./doc*.

Mouse Button Naming Conventions

An instruction to click the mouse button, refers to clicking the primary mouse button, usually the left button for right-handed mice and the right button for left-handed mice. The context-sensitive menu, also called a popup menu or right-click menu, refers to the menu displayed when you click the secondary mouse button, usually the right button on right-handed mice and the left button on left-handed mice.

Third Party Licenses

MÄK software products may use code from third parties. This section contains the license documentation required by these third parties.

Boost License

VR-Link, and all MÄK software that uses VR-Link uses some code that is distributed under the Boost License. All header files that contain Boost code are properly attributed. The Boost web site is: www.boost.org.

Boost Software License - Version 1.0 - August 17th, 2003

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libXML and libICONV

VR-Link and all MÄK software that uses VR-Link, links in libXML and libICONV. On some platforms the compiled libraries and header files are distributed with MÄK Products. MÄK has made no modifications to these libraries. For more information about these libraries please see the following web sites:

- The LGPL license is available at: http://www.gnu.org/licenses/lgpl.html
- Information about IconV is at: http://www.gnu.org/software/libiconv/
- Information about LibXML is at: http://xmlsoft.org/

Freefont OpenType Font Set

VR-Vantage applications and VR-Forces use the Freefont OpenType font set from the Free Software Foundation. It is covered by the General Public License (GPL). For details, please see: http://www.gnu.org/licenses/gpl.html

Third-Party Licenses for VR-Vantage Applications

VR-Vantage applications use a variety of third-party libraries. Developers who want to use these libraries may be required to purchase developer's licenses. Please see "Third-Party Software and Content," on page 1-10 for details.

1

Introduction to VR-Vantage

This chapter introduces you to the main features of VR-Vantage.

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1.1. The VR-Vantage Product Line

VR-Vantage is VT MÄK's line of visualization products. It is designed to meet your needs for visualizing the simulated battlefield. The VR-Vantage product line consists of the VR-Vantage Toolkit and the following applications that are built with it:

- VR-Vantage Stealth. VR-Vantage Stealth is your 2D/3D information station. It has a 3D view for situational awareness, simulation debugging, or after action review; a 2D view to provide the "big picture" of a simulation; and an exaggerated reality (XR) mode to improve your understanding of the 3D view when the observer is not close to entities. The Stealth provides the most data about your networked virtual world, and presents it in a clear and accessible way.
- VR-Vantage IG. VR-Vantage IG is a configurable desktop image generator for customers who need an out-the-window (OTW) view or a picture from a remote camera. Vantage IG is designed for easy integration into desktop trainers and war gaming simulations.
- VR-Vantage PVD. VR-Vantage PVD provides a 2D plan view display (PVD) of terrain and simulated objects. Plan view displays provide the "big picture" of simulated environments. They sacrifice the situational awareness of the 3D environment, but let you see the entire simulated world at a glance. Entities are represented using MIL-STD 2525B icons that are color coded to represent their force.



- The VR-Vantage applications share many features in common. Therefore, for simplicity, in his manual we use the term VR-Vantage to refer generically to the VR-Vantage applications when we describe common features.
- Some screen captures of dialog boxes may show features that are not supported by all VR-Vantage applications. For example, VR-Vantage IG does not support intervisibility or grid lines, while VR-Vantage PVD does not support cockpit displays.

The VR-Vantage Toolkit is an API that comes with all the software you need to completely rebuild visual applications like VR-Vantage Stealth and also allows you to customize and extend these applications to fit your unique requirements. The toolkit also gives you the power to embed any of VR-Vantage's capabilities directly into your simulation applications. The VR-Vantage Toolkit is based on OpenSceneGraph[1], so you can leverage value-added plug-ins built by the OSG community and MÄK partners.

For details about the VR-Vantage Toolkit, please refer to the API documentation.

1. "OpenSceneGraph is an Open Source, cross-platform graphics toolkit for the development of high-performance graphics applications such as flight simulators, games, virtual reality and scientific visualization. It is based on the concept of a SceneGraph, providing an object-oriented framework on top of OpenGL." (http://www.openscenegraph.org/projects/osg/wiki/About/Introduction)

Table 1-1 lists VR-Vantage features supported by different VR-Vantage applications.

Table 1-1: VR-Vantage features by application

Feature	Stealth	IG	PVD
3D projection	X	X	
2D projection	X		X
Model sets			
3D models	X	X	
3D colorized models	X		
2D icons	X		X

Table 1-2 lists VR-Vantage features supported in the 3D and 2D projections.

Table 1-2: VR-Vantage features by projection (Sheet 1 of 2)

Feature	3D	2D
Terrain agility and composability	X	X
Attach modes	X	X
Observer movement modes		
Observer frame	X	X
Level observer frame	X	
Laptop	X	X
2D level observer frame		X
Model sets		
3D models	X	X (Stealth only, top view)
3D colorized models	X	X (Stealth only, top view)
2D icons	X (Stealth only)	X
Other Features		
Advanced lighting	X	
Audio	X	X
Cockpit displays	X	
Communications lines	X	X
Detonation and muzzle flashes	X	
DI-Guy characters	X	

Table 1-2: VR-Vantage features by projection (Sheet 2 of 2)

Feature	3D	2D
Display units configuration	X	X
Dynamic ocean	X	
Environment effects	X	
Emitter volumes	X	X
Entity labels	Text panels	Configurable symbol decorations
Fire and detonation lines	X	X
Intervisibility	X	X
Paged terrain	X	X
Remote draw API	X	X (2D graphics only)
Sensors	X	X (Stealth only)
SpeedTrees	X	
Streaming terrain	X	X
Streaming video	X	X
Tactical graphics	X	X
Tactical smoke	X	
Track histories	X	X
Trailing effects	X	
View controls	X	X
Wireframe view	X	X
Zoom	X	X

1.2. VR-Vantage Features

VR-Vantage Stealth and IG deliver a realistic, three-dimensional view of terrain, vehicles, and other objects (Figure 1-1). VR-Vantage's navigation controls give you complete freedom to travel anywhere as an unobtrusive observer. You can place the observer at a specific location, or link it to a vehicle for automatic tracking of battlefield activities. While an exercise is underway, you can switch attach modes quickly to see the scene from any perspective. VR-Vantage can be visible to other applications or invisible, at your discretion.

VR-Vantage Stealth and PVD provide a two-dimensional plan view-style display (Figure 1-2).

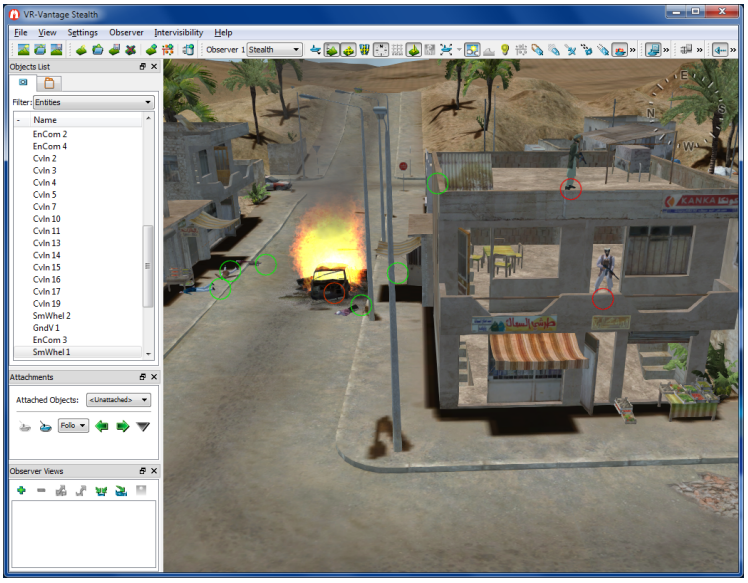


Figure 1-1. VR-Vantage Stealth 3D

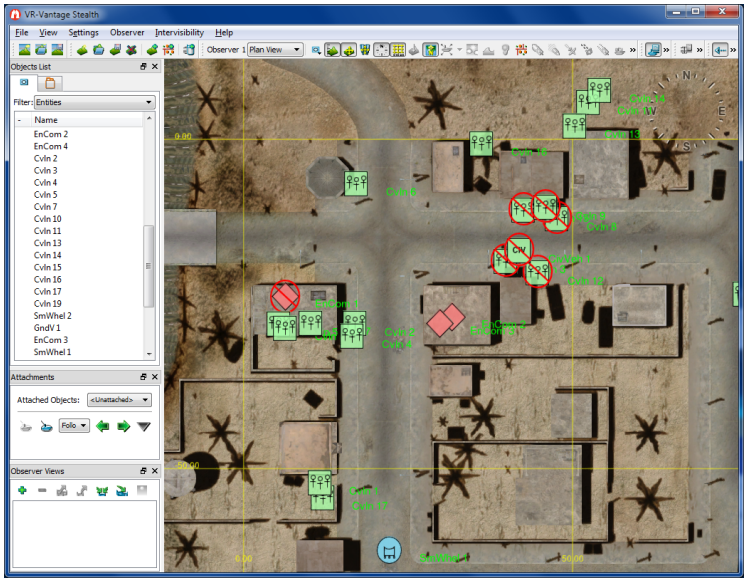


Figure 1-2. 2D view (VR-Vantage Stealth)

VR-Vantage provides a range of features that make it an essential tool during any phase of a Distributed Interactive Simulation (DIS), Common Image Generator Interface (CIGI), or High Level Architecture (HLA) project.

1.2.1. Support for HLA, DIS, and CIGI

You can connect and disconnect from simulations during runtime and can configure the connections in the graphical user interface (GUI). VR-Vantage supports the following simulation network protocols:

- HLA 1.3 and 1516. VR-Vantage supports the HLA 1.3 specification and the current draft of the IEEE 1516 C++ API maintained by the SISO Dynamic Link Compatible RTI API Product Development Group, and HLA Evolved (IEEE 1516-2010). It has built-in support for the HLA RPR FOM and can support other FOMs through the FOM Mapping feature.
- Distributed Interactive Simulation (DIS) protocols DIS 4, 5, and 6.
- Common Image Generator Interface (CIGI) 3.2 and 3.3. CIGI is an interface that allows an image generator (IG) to receive messages from a host to control what is drawn by the IG.

1.2.2. Realistic Display of Vehicles and Terrain

The VR-Vantage 3D projection provides a realistic display using terrain and moving-model geometry in the OpenFlight format. It includes many 3D vehicle models, some of which display movement of articulated parts, such as turrets and rotors. These models can change to show a damaged or destroyed state. You can provide your own models and map them to entity types. For details about terrain, please see Chapter 3, *Composing Terrains*, in *VR-Vantage Configuration Guide*. For details about models, please see Chapter 9, *Mapping Entity Types to Element Definitions*, in *VR-Vantage Configuration Guide*.

VR-Vantage also displays:

- Smoking and flaming effects.
- Trailing effects.
- Muzzle flashes.
- Track histories.
- Explosions.

VR-Vantage presents terrain realistically, and lets you control visibility, time-of-day, and other effects. For details, please see Chapter 5, *Scenes and Environmental Effects*.

1.2.3. Multiple Attach Modes

VR-Vantage offers attach modes that let you:

- Manually control the observer's position and orientation.
- Follow an entity, maintaining a consistent positional offset, with a matching heading.
- Mimic a vehicle's position and orientation. You can place the observer inside the vehicle for a driver's-eye view, or fly outside of it, moving in tandem with the vehicle.
- Tether the observer to an entity, maintaining a consistent positional offset without changing the observer's heading.
- Automatically track a vehicle's movement from a fixed viewpoint, as if watching from a control tower.

For more information, please see Chapter 7, *Moving the Observer*.

1.2.4. Accurate Vehicle Positioning

VR-Vantage can smooth the trajectories of moving vehicles to compensate for discontinuous positional data. The ground clamping feature can ensure that all ground entities are placed correctly on the terrain surface. For details, please see "Configuring Trajectory Smoothing," on page 10-5 and "Using Ground Clamping," on page 10-2.

1.2.5. eXaggerated Reality (XR)

The XR observer mode enhances your ability to understand the layout of forces in the 3D projection. The colorized notional icons are scaled to be visible regardless of the observer's distance from the entities. You can resize the icons to ensure that you have the right view for your needs. For more information, please see Chapter 19, *Exaggerating Models and Terrain*.

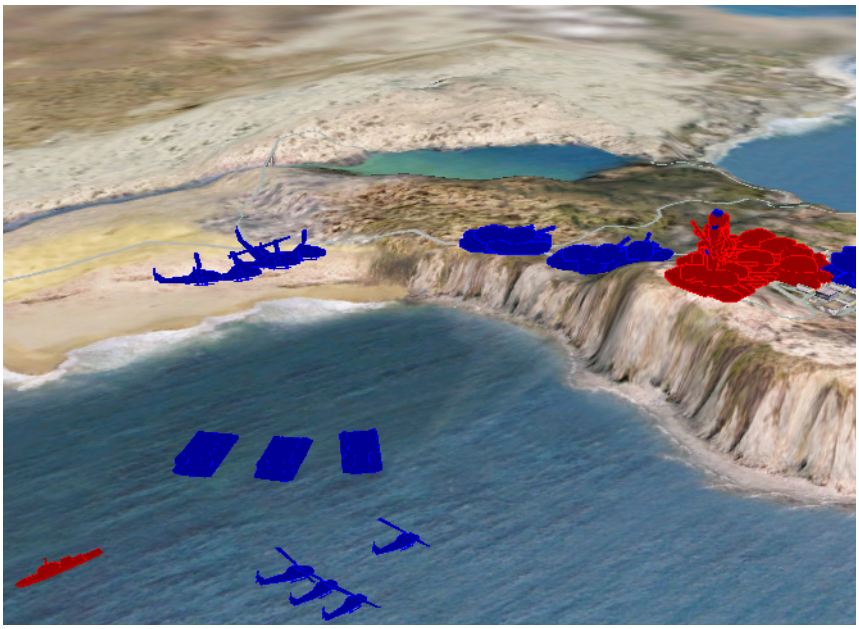


Figure 1-3. Model scaling and colorized models

1.2.6. Plan View Display

VR-Vantage PVD and the Plan View observer mode in VR-Vantage Stealth support many of the entity information features of the 3D projection plus features unique to a 2D view, such as grid lines. It supports the same terrain databases as the 3D projection.

1.2.7. Terrain Agility and Composability

VR-Vantage allows you to build your terrain at runtime using a variety of database and vector formats. It can load OpenFlight, DTED, CTDB, MetaFlight, and GDB (MÄK terrain format) databases. It can load feature data from shapefiles and GDB files. You can also superimpose geospatial images such as GeoTiffs or other raster image files on the terrain. You can save these composed terrains in the VR-Vantage MTF file format. For details, please see Chapter 3, *Composing Terrains*, in *VR-Vantage Configuration Guide*.

1.2.8. Dynamic Ocean

VR-Vantage provides dynamic ocean visualization in the Stealth and IG observer modes. The ocean shows waves, swells, and spray effects. Surface entities have realistic wakes and buoyancy behavior. Changes to wind speed and direction affect wave action.

1.2.9. Lighting Effects

VR-Vantage supports a variety of lighting effects:

- Dynamic lighting
- Ocean planar reflection
- Lens flare
- Crepuscular (sun) rays.

Using Shader-based Effects Maps

VR-Vantage supports several types of shader-based effects texture maps. Shaders are computer programs that simulate the effect of light on the terrain and objects in the simulation. VR-Vantage makes extensive use of them for visualization effects.

Texture maps are raster images that apply highly realistic textures to the terrain and models. By applying different types of texture maps to terrain and models, you can improve the visual qualities of your simulation without the overhead of high polygon counts.

VR-Vantage supports the following types of shader-based effects maps:

- Normal, or bump, maps. Normal maps give terrains the appearance of relief, such as a rocky landscape.
- Specular maps. Specular maps affect the highlight color of objects.
- Ambient occlusion maps. Ambient occlusion maps model areas that do not receive direct light, such as cracks and crevices and shaded areas of terrain and models. These areas are lit only by ambient light.
- Reflection maps. Reflection maps affect the reflectivity of surfaces, such as windows. Reflection maps reflect objects in the sky, not the terrain.

1.2.10. Streaming Video

VR-Vantage can send the view in the display window to a video stream. It supports several different open standards. If you have a supported viewer, you can use the simulated video as a flexible alternative to live video for demonstration, development, testing, and embedded training of operational video exploitation systems.

1.2.11. Remote Control

You can control VR-Vantage remotely through view control messages, which can be generated by MÄK applications such as the Data Logger and VR-Forces, and by programs that use the VR-Vantage Control Toolkit. For details, please see "Controlling the Observer from Other Applications," on page 7-26.

1.2.12. Flexible, Intuitive Graphical User Interface

VR-Vantage's graphical user interface (GUI) allows you to manipulate VR-Vantage from menus, dockable control panels, and the keyboard.

You can hide and display the control panels, keep them docked to the VR-Vantage window, or undock them to make more space available for the display window. The GUI controls can be hidden for full-screen demonstrations.

The GUI follows standard conventions for modern windowing systems. For additional details, please see Appendix A, *The VR-Vantage User Interface*. For descriptions of individual windows and dialog boxes, please see online help.

1.3. Third-Party Software and Content

The VR-Vantage product includes software and content licensed from third parties, including:

- SilverLining™: real-time sky and 3D cloud rendering from Sundog Software.
- GL Studio®: interactive cockpit instrumentation and HMI from DiSTI®.
- DI-Guy™: realistic human character animation from Boston Dynamics.
- SpeedTree®: animated, 3D foliage from Interactive Data Visualization (IDV).
- 3D models, terrain, and graphical content from Simthetiq, RealDB, TurboSquid, Terrex (now Presagis), and TerraSim.
- OpenSceneGraph: an open source 3D graphics toolkit hosted at http://www.openscenegraph.org.
- osgEarth: an open source streaming terrain plug-in by Pelican Mapping, at http://osgEarth.org.

! The run-time and developers' rights for VR-Vantage customers vary from vendor to vendor. Please read this section carefully to understand which rights are included with VR-Vantage licenses, and which rights require additional third-party licenses.

1.3.1. SilverLining

VR-Vantage uses SilverLining software and content to compute lighting and to render the sky, clouds, sun, and moon. SilverLining is developed by Sundog Software (http://www.sundog-soft.com).

Most VR-Vantage customers do not need to buy a SilverLining license of any kind. In general, a VR-Vantage customer has the right to use the SilverLining technology that is built into VR-Vantage in any VR-Vantage-based application (including custom applications built using the Toolkit). However, there are two exceptions:

- If you want to extend or change the way that MÄK has integrated SilverLining into VR-Vantage by writing directly to the SilverLining API, then you need a SilverLining Developer's License.
- If you are building a commercial video game or other "mass-market" (consumer-level) commercial product on top of the VR-Vantage Toolkit, and the resulting product includes the SilverLining functionality, then you need a SilverLining Developer's License.

SilverLining libraries, textures and other graphics resources are distributed in the VR-Vantage package solely so that VR-Vantage can use them. Use of SilverLining software or content outside of VR-Vantage-based applications is not permitted by the VR-Vantage license.

1.3.2. GL Studio

VR-Vantage uses GL Studio software and content to render interactive cockpit instrumentation displays. GL Studio is developed by DiSTI (http://www.disti.com).

VR-Vantage is delivered with several generic cockpit displays. You can use the built-in cockpit displays in any VR-Vantage-based application (including custom applications built using the Toolkit), without a GL Studio license of any kind.

If you want to build custom cockpits using the GL Studio editor or GL Studio API, you need a GL Studio Developer's license. If you want to execute custom cockpits in VR-Vantage-based applications (regardless of whether the custom cockpits are built by you or a third party), you need GL Studio Run-Time licenses.

GL Studio libraries and graphics resources are distributed in the VR-Vantage package solely so that VR-Vantage can use them. Use of GL Studio software or content outside of VR-Vantage-based applications is not permitted by the VR-Vantage license.

1.3.3. DI-Guy

VR-Vantage uses DI-Guy software and content for human character animation. DI-Guy is developed by Boston Dynamics (http://www.bostondynamics.com).

VR-Vantage comes with DI-Guy functionality built-in and with a large set of DI-Guy characters, appearances, and animations. A VR-Vantage customer does not need a DI-Guy license of any kind to use DI-Guy animated characters in a VR-Vantage-based application (including custom applications built using the VR-Vantage Toolkit).

However, you need a DI-Guy Developer's license if you want to:

- Develop new character types, or alter the geometry, appearances, textures, or motions of DI-Guy characters.
- Directly access the DI-Guy API to modify or extend the way that VR-Vantage uses the DI-Guy API or access DI-Guy functionality that MÄK has not already integrated into VR-Vantage.

DI-Guy libraries, models, textures, motion files, and other graphics resources are distributed in the VR-Vantage package solely so that VR-Vantage can use them. Use of DI-Guy software or content outside of VR-Vantage-based applications is not permitted by the VR-Vantage license.

1.3.4. SpeedTree

VR-Vantage uses SpeedTree software and content for animated real-time 3D foliage and vegetation. SpeedTree is developed by Interactive Data Visualization (IDV) (http://www.speedtree.com).

A VR-Vantage customer does not need a SpeedTree license of any kind to use the SpeedTree functionality that is built into the VR-Vantage applications that MÄK delivers. You may build and run plug-ins to our out-of-the-box applications without a SpeedTree license, as long as your plug-ins do not need to directly access the SpeedTree API.

However, you need a SpeedTree Developer's license if you want to:

- Write a plug-in that uses the SpeedTree API directly to extend or modify the way that SpeedTree is integrated into VR-Vantage.
- Use the VR-Vantage Toolkit to develop new applications, and you want your applications to include SpeedTree functionality.

SpeedTree libraries, models, textures, and other graphics resources are distributed in the VR-Vantage package solely so that VR-Vantage can use them. Use of SpeedTree software or content outside of VR-Vantage-based applications is not permitted by the VR-Vantage license.

1.3.5. 3D Models, Terrain, and Graphical Content

VR-Vantage includes a rich set of 3D models for vehicles, weapons, cultural features and urban clutter (signs, barriers, lampposts, and so on). It also includes several sample terrain databases to help you get started with VR-Vantage, and to help demonstrate VR-Vantage. Much of this content is derived from 3D data that we have licensed from third parties:

- Many of the high-quality vehicle models come from Simthetiq (http://www.simthetiq.com).
- Some models come from Real DB (http://www.realdb.qc.ca/company).
- Some of the middle-eastern building models and urban clutter objects that are used in our sample terrain databases were licensed from Turbosquid (http://www.turbosquid.com).
- The TerraSim_SampleUrban terrain database comes from TerraSim (http://www.terrasim.com).
- The HarrisAfghanVillage terrain database was created using source data from Harris Inc.
- The Berkeley Database was developed by Terrex (now Presagis) (http://www.presagis.com).

All of this content is distributed in the VR-Vantage package solely so that VR-Vantage can use it. Use of any of the VR-Vantage models, textures, terrains, or other content outside of VR-Vantage-based applications is not permitted by the VR-Vantage license.

1.3.6. OpenSceneGraph

VR-Vantage uses OpenSceneGraph for its underlying scene graph representation, rendering, file loading, and many other capabilities. OpenSceneGraph is an open source, cross-platform graphics toolkit for the development of high-performance graphics applications. The OpenSceneGraph source repository is maintained by Robert Osfield at http://www.openscenegraph.org/projects/osg. It is distributed under the OpenSceneGraph Public License (OSGPL), which is based on the GNU Lesser General Public License (LGPL).

MÄK will provide modified source code for OSG upon request, as per the OSGPL license. Please contact support@mak.com to obtain the download links for our modified source.

1.3.7. osgEarth

VR-Vantage uses osgEarth to import streaming terrain elevation and imagery data. The data can be streamed from external servers and sources or from a directory on the computer running VR-Vantage. osgEarth is an open source plug-in to OpenSceneGraph, maintained by Pelican Mapping at http://osgEarth.org. osgEarth is distributed under the GNU Lesser General Public License (LGPL).

MÄK will provide modified source code for osgEarth upon request, as per the OSGPL license. Please contact support@mak.com to obtain the download links for our modified source.

2

Installing VR-Vantage

This chapter explains how to install the VR-Vantage applications, VR-Vantage Toolkit, and data. You must also install the MÄK license manager. To use VR-Vantage with HLA, you must install an RTI.

Installing VR-Vantage 2-2
- Installing VR-Vantage on Windows 2-2
- Installing VR-Vantage on a Linux System 2-2
- Uninstalling VR-Vantage on Windows 2-3

The VR-Vantage Directory Structure 2-3

Installing and Setting Up the MÄK License Manager 2-4
- Specifying the License Server 2-5

Installing an RTI 2-7
- Installing the MÄK RTI 2-8

Localizing the Graphical User Interface 2-9
- Translating Other Interface Files 2-12
- Applying the Language Files 2-13

2.1. Installing VR-Vantage

A full VR-Vantage installation includes three components: the application, the License Manager software, and for HLA operation, an RTI (or Runtime Infrastructure.)

Before you install VR-Vantage, please read the Release Notes to see if there are any special instructions for installation.

VR-Vantage has two installers, an application installer and a data installer. You must run both installers. You must run the application installer first.

To install the VR-Vantage toolkit, you must enter an installation code. Be sure you have received your code from your MÄK salesperson before you start the installation process. If you do not have an installation code, you can install the runtime files. When you receive your installation code you can install the toolkit.

2.1.1. Installing VR-Vantage on Windows

Note the following:

- You must have administrator privileges to install MÄK products on Windows Vista.
- When you install large applications on Windows Vista or later, there may be a delay of up to several minutes from the time you try to run the setup program to the time that an installation dialog box is displayed. This is due to how Windows scans setup programs before it executes them. If you experience this problem, turning off User Access Control can reduce or eliminate this delay.

Windows versions of VR-Vantage are provided as executable installer files on DVD, or as downloaded files. The installers are named to indicate the compiler used to build that version of VR-Vantage and whether it is a 32 bit or 64 bit version.

➤ To install VR-Vantage, run the installers. Follow the instructions in the installation wizards. (You must run the application installer and the data installer.)

2.1.2. Installing VR-Vantage on a Linux System

Linux versions of VR-Vantage are provided as compressed tar files on DVD, or as downloaded files.

To install VR-Vantage on Linux:

1. Create the directory in which you want to install VR-Vantage.
2. Copy the tar file to the install directory.
3. Uncompress and untar the application file:

   `tar -vxzf application.tar.gz`

   where *`application`* is the product release identification.
4. Uncompress and untar the data package into the same directory as the application.

2.1.3. Uninstalling VR-Vantage on Windows

Because installation of VR-Vantage is a two step process, uninstallation is also a two-step process.

To uninstall VR-Vantage on Windows:

1. In the VR-Vantage root directory, run *unins001.exe*.
2. In the VR-Vantage root directory, run *unins000.exe*.

2.2. The VR-Vantage Directory Structure

The installation process creates the VR-Vantage directory tree shown in Figure 2-1 (runtime and toolkit). Table 2-1 describe the contents of the directories.

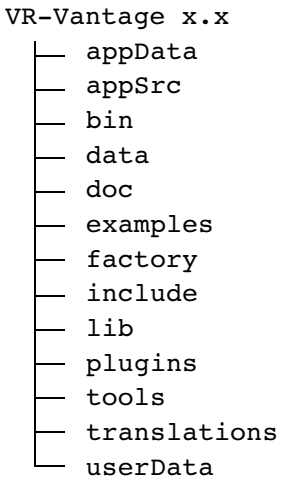


Figure 2-1. VR-Vantage directory tree

Table 2-1 describes the contents of the directories.

Table 2-1: Contents of VR-Vantage directories

Directory	Directory contents
./appData	Subdirectories contain data required by the VR-Vantage applications, such as model definitions and saved settings.
./appSrc	Source code for rebuilding the VR-Vantage applications.
./bin	Executables and dynamic link libraries.
./data	Sample databases, images, and vehicle models.
./doc	VR-Vantage documentation and class reference files.
./examples	Examples for the VR-Vantage Toolkit API.

Table 2-1: Contents of VR-Vantage directories

Directory	Directory contents
./factory	Default settings (for reverting to "factory" settings).
./include	Header files for the VR-Vantage Toolkit API.
./lib	Libraries for building applications with the VR-Vantage Toolkit API.
./plugins	Plug-in shared libraries.
./tools	Helper applications such as MÄK Terrain Database Tool and the CIGI Host Emulator.
./translations	Translation files for localizing VR-Vantage menus.
./userData	Terrain and scene files saved by application users.

2.3. Installing and Setting Up the MÄK License Manager

Before you can use a MÄK product, you must obtain a valid license file, install the MÄK License Manager, and configure the license server and client machines. The License Manager uses a client-server architecture, so you do not need to install the License Manager on every computer on which you install MÄK products. You only need to install it on the computer that you will use as the license server.



If you have already installed the License Manager for another MÄK product, you do not have to install it again. You just need to make sure you have licenses for your newly installed products.

The License Manager installer is included on MÄK installation media. It is separate from the product installers. You can download the installers from our web site at http://www.mak.com/license-support.html or you can download directly from:

- Windows: ftp://ftp.mak.com/out/MAKLicenseManager-win-setup.exe (32 bit systems).
  ftp://ftp.mak.com/out/MAKLicenseManager-win64-setup.exe (64 bit systems).
- Linux: ftp://ftp.mak.com/out/MAKLicenseManager-linux-setup.tar.gz.

Complete installation and configuration instructions are included with the License Manager installer. Instructions are also available at the license support page.

Some customers use dongle licenses instead of running a license server. Instructions for using dongles are in the License Manager documentation.

2.3.1. Specifying the License Server

The first time you run a MÄK application on a particular computer, the License Setup dialog box opens (Figure 2-2). It prompts you to enter the hostname of the license server and optionally, a port number.

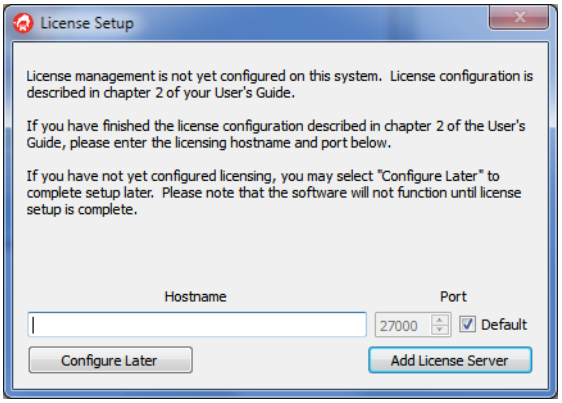


Figure 2-2. License Setup dialog box

If you do not know the hostname of the license server, click Configure Later. When you have the hostname, you can start the application again and complete the dialog box. You will not be able to run any MÄK applications until you set up license management.

If you know the hostname, type it in the Hostname box. Then click Add License Server. The application will start.

- If you are running MÄK products on the license server machine, it is also a client, so you must specify the license server on that machine too.
- If you change the license server, the saved configuration will no longer be valid and the License Setup dialog box will open the next time you start a MÄK application.
- You can clear the saved license configuration by deleting the cache file. On Windows XP, it is *C:\Documents and Settings\user_name\Application Data\MAK\license<n>.xml*. On Windows 7, it is *C:\Users\user_name\AppData\Roaming\MAK\licenses<n>.xml*. (The *AppData* directory is hidden by default.) On Linux, it is *.mak/license<n>.xml*. (There may be more than one cache file, for example, *licenses1.xml* and *licenses2.xml*.)

The MAKLMGRD_LICENSE_FILE Environment Variable

As an alternative to using the License Setup procedure described in the previous section, you can configure the license server in an environment variable. The MAKLMGRD_LICENSE_FILE environment variable identifies the server machine. If you set this environment variable, it overrides the settings stored by the License Setup procedure.

The syntax for the environment variable is: `@Server_name`. For example, if the server machine is oak, set the environment variable to `@oak`.

The following sections explain how to set environment variables on the different platforms that MÄK products run on.

Windows

To add the MAKLMGRD_LICENSE_FILE in Windows:

1. Open the Control Panel.
2. On Windows 7, click System and Security. On Windows XP, click Performance and Maintenance.
3. Click System.
4. In the sidebar menu, click the Advanced System Settings. The System Properties dialog box opens.
5. Click Environment Variables. The Environment Variables dialog box opens.
6. Click New . The New System Variable dialog box opens.
7. In the Variable Name field, enter MAKLMGRD_LICENSE_FILE.
8. In the Variable Value field, enter `@server_name`, where `server_name` is the name of the license server.
9. Click OK to back out of each dialog box and set the variable.



Different versions of Windows have slightly different wording of the various Control Panel options.

Linux

On Linux, you set environment variables in your *.cshrc* (or equivalent startup file). Set the variable similarly to the following example:

```
setenv MAKLMGRD_LICENSE_FILE @oak
```

If you are using the sh or bash shells, you set environment variables in your *.profile* file (or *.bashrc*). Set the variable similarly to the following example:

```
MAKLMGRD_LICENSE_FILE=@oak
export MAKLMGRD_LICENSE_FILE
```

Do not put spaces around the equal (=) sign.

You are ready to run the license server and use your new licenses or MÄK products.

2.4. Installing an RTI

An RTI is a software library (and perhaps supporting executables) that implements an HLA Interface Specification. In HLA, applications exchange FOM data through RTI calls, which means that all HLA applications need to use an RTI.



Because of differences in the low-level network mechanisms used by different RTI implementations (which include, but are not limited to packet layout), applications that want to interoperate in the same federation execution must use the same RTI implementation.

Because RTIs are usually provided as dynamic libraries that implement a fixed API, a federation can often switch from one RTI implementation to another between runs (without even recompiling the applications), but during each run, all participants must agree on which RTI to use, much as they must also agree on which FOM to use.

For the most recent information about the RTI versions supported by MÄK products, please see the release notes for your MÄK application.

2.4.1. Installing the MÄK RTI

To install the MÄK RTI, follow the instructions in Chapter 2 of *MÄK RTI Users Guide*.

Configuring Your System to Use the MÄK RTI

The RTI dynamic libraries must be located somewhere on your dynamic library search path. The path is specified in the PATH environment variable.The path is indicated by an environment variable as follows:

- Linux — LD_LIBRARY_PATH.
- Windows — PATH.

The MÄK RTI needs to know where to find the following configuration files:

- The federation configuration file (*.fed*, *.fdd*, or *.xml*) for your federation execution (required).
- The RID file (*rid.mtl*) (optional).

Put the configuration files in the directory from which you are running, or set the environment variable RTI_CONFIG to the directory that contains them.

Running Applications with the MÄK RTI

To run a MÄK application with the MÄK RTI:

1. Be sure the license server is running.
2. Start the application. The RTI Assistant will prompt you to choose an RTI configuration.
3. Choose a configuration. If necessary start the rtiexec.
4. Click Connect. The application should run.

In many cases, you do not need to run the rtiexec to use the MÄK RTI, however you can run the rtiexec if you want to. (It is required to use certain features of the MÄK RTI.) For more information, please see your RTI documentation.

2.5. Localizing the Graphical User Interface

You can localize your MÄK product's graphical user interface so that it uses languages other than English. To do this, you edit a resource file using the following procedure:

1. Start the Qt Linguist utility. It is *./translations/linguist.exe*
2. In the Qt Linguist window, choose **File** → **Open**. Select the file *./translations/product_untranslated.ts*. The Settings for filename dialog box opens (Figure 2-3).



Figure 2-3. Linguist settings dialog box

3. Select values for the source language, target language, and target region or country.
4. Click OK. The translation file is opened and a list of classes is displayed on the left side of the window (Figure 2-4).

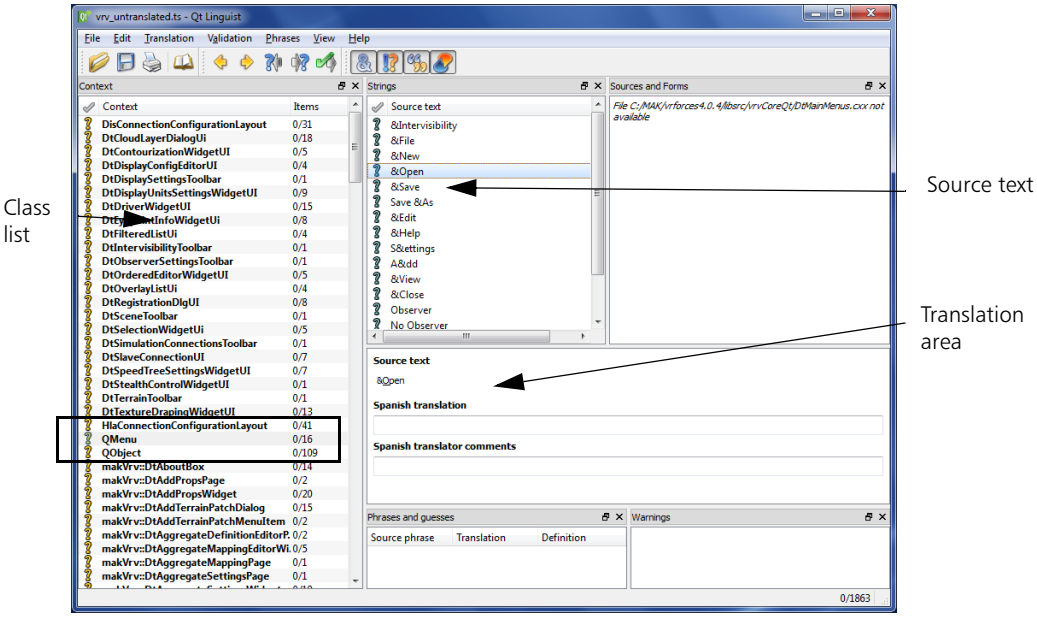


Figure 2-4. Linguist window

5. To translate text, you select each class in turn and translate the text associated with that class. You do not have to understand anything about what the classes mean, you just have to translate the text. In Figure 2-4, *QMenu* is selected. The Strings window lists text that can be translated. Text that has not been translated has a question mark in the checkmark column.

6. In the Source Text list, select the word you want to translate. The text is displayed under Source Text in the translation area (the window below the source text list.) Figure 2-5 shows the text Open selected.

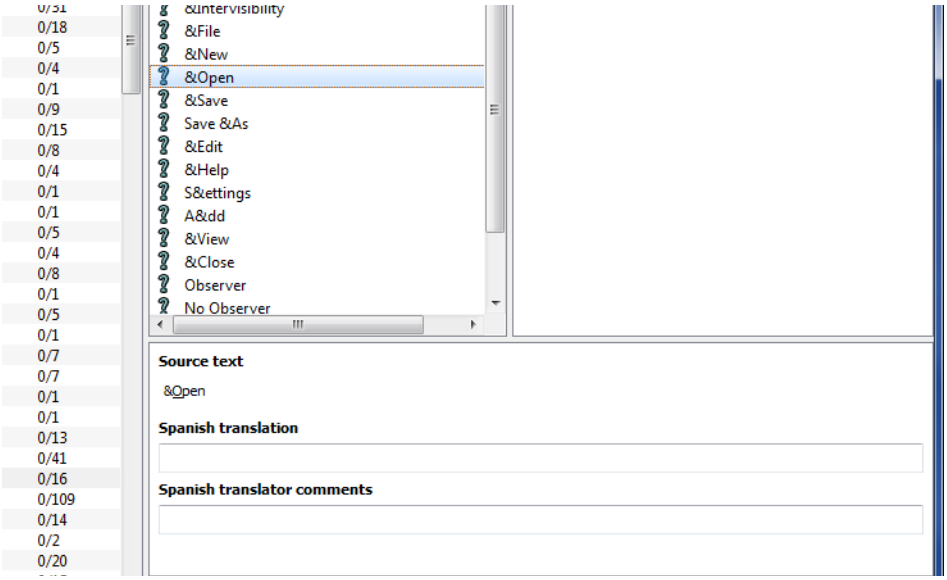


Figure 2-5. Text selected for translation

7. Place the cursor in the text box below *Language* Translation, where *Language* is the target language that you selected when you opened the translation file.
8. Type the translation text.
9. When you are done and you are certain of the translation, select the Done and Next button on the toolbar. A green check mark replaces the question mark (Figure 2-6). If you move to a different text string without clicking Done and Next, a yellow question mark is displayed for the string you translated. When you translate all elements for a class, a green check mark replaces the question mark next to the class name.

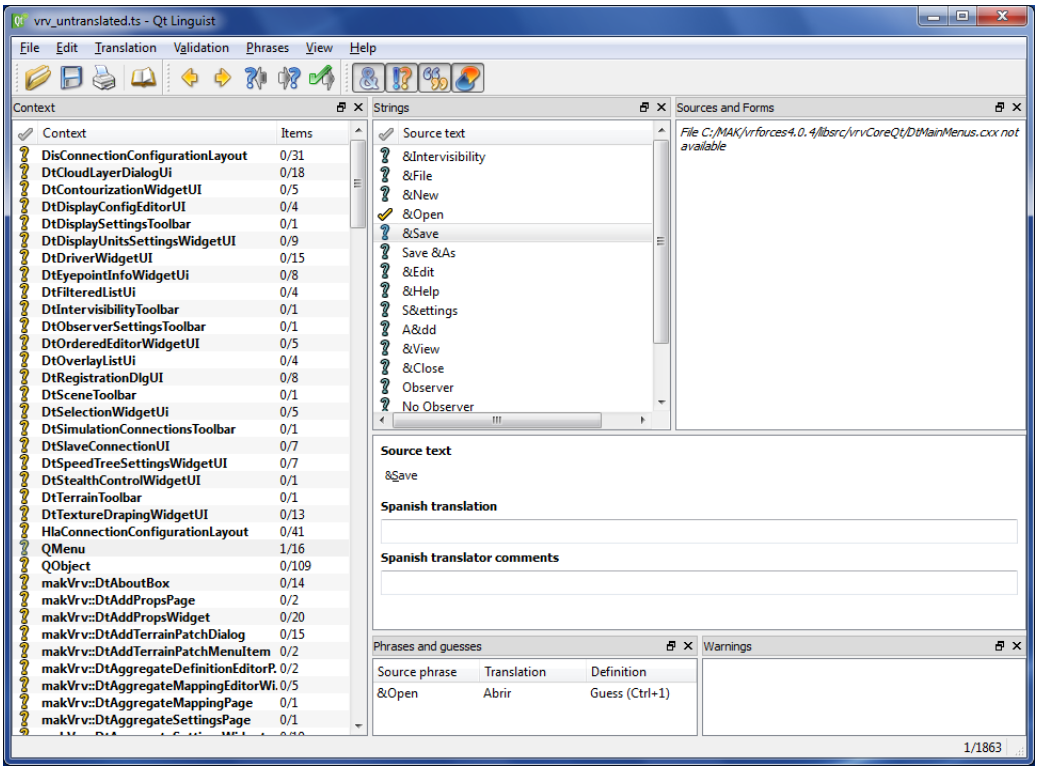


Figure 2-6. Completed translation for Open

10. Repeat this process for each element of source text for each class.
11. Choose **File** → **Release**. The file is saved in the format *filename.qm*.
12. Rename the file to a name that indicates the language to which you have translated the file, using the two-character abbreviation typically used with your language. For example, a Spanish translation would be renamed *product_es.qm*.
13. Save your translated *.ts* file.

2.5.1. Translating Other Interface Files

The *product_untranslated.ts* file contains all the text used in the VR-Vantage interface. However, there may be other text and messages that are not specific to VR-Vantage that are generated by the software that implements the VR-Vantage GUI. To translate this text, you need to translate the file *qt_untranslated.ts*. Follow the same procedure as you did for *stealth_untranslated.ts*.

2.5.2. Applying the Language Files

To put the language file into effect, use one of the following methods:

- Set your computer's environment to the proper language (LANG environment variable).
- Set the locale to the proper language.
- Start VR-Vantage with the `-G` *`locale`* command line option, where *`locale`* is the two-letter country code for the local language.

3

Running VR-Vantage Applications

This chapter explains how to start and stop VR-Vantage, how to load a terrain, and how to connect to a simulation network.

Starting VR-Vantage Applications 3-2
- Starting VR-Vantage on Windows 3-2
- Starting VR-Vantage on Linux or the Windows Command Line 3-4
- Command-Line Options 3-4
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Managing VR-Vantage Settings 3-13
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3.1. Starting VR-Vantage Applications

The typical sequence for using a VR-Vantage application is to:

1. Start the application.
2. Load a terrain database.
3. Connect to a simulation network.

- If you want to connect to an HLA simulation, you must have an RTI installed. For details, please see "Installing an RTI," on page 2-7.
- Before you can start VR-Vantage, the license manager must be running.

3.1.1. Starting VR-Vantage on Windows

To start VR-Vantage on Windows:

1. On the Windows Start menu, choose **Programs** → **MÄK Technologies** → **VR-Vantage 1.6** → *application*, where *application* is one of the VR-Vantage applications, such as VR-Vantage Stealth or VR-Vantage IG. (Applications are also distinguished as 32-bit or 64-bit, depending on which version you have installed.)

   The VR-Vantage window opens (Figure 3-1).

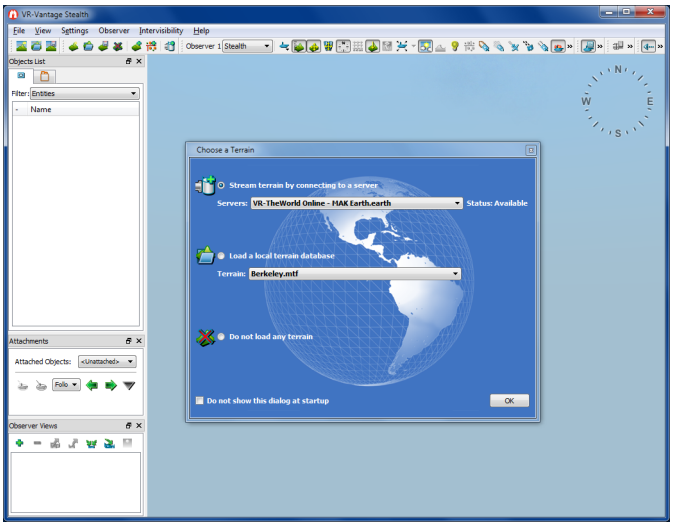


Figure 3-1. VR-Vantage window at startup

When you start VR-Vantage, if you receive the following message, it means that you did not install the data package:

```
Data package not found in specified data directory:
  'c:\MAK\vrvantage1.6\data'.
Please make sure the data package is installed.
```

VR-Vantage has an application installer and a data installer. You must install both of them.

2. Select one of the terrain loading options:
   - Select a terrain server, such as VR-TheWorldOnline, from the list. (When VR-Vantage starts up, it checks the availability of all of the terrain servers that are configured. It displays the availability of the selected server next to the list.)
   - Select a local terrain database from the list.
   - Do not load a terrain database.

   If you select a terrain database, VR-Vantage loads it (Figure 3-2).

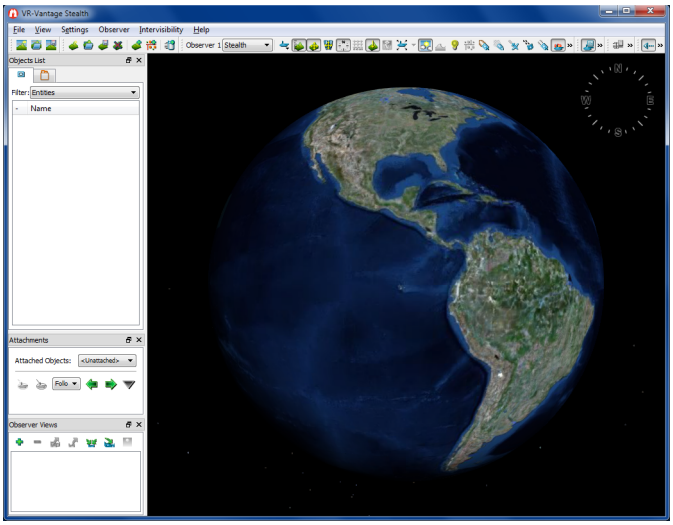


Figure 3-2. VR-Vantage window with a terrain loaded

3.1.2. Starting VR-Vantage on Linux or the Windows Command Line

To start VR-Vantage on Linux or the Windows command line:

1. Change directory to *./bin*.
2. Enter:

   application [*options*]

   where *application* is `vrvStealth`, `vrvIG`, or `vrvPVD`.

   VR-Vantage starts as described in the previous section.

"Command-Line Options," on page 3-4 describes the VR-Vantage command-line options.

3.1.3. Command-Line Options

Table 3-1 lists VR-Vantage's command-line options.

Table 3-1: VR-Vantage command-line options (Sheet 1 of 3)

Option	Description
`(--` | `--ignore_rest)`	Ignore all command-line options after this one. This option is useful for disabling part of a command line in a script for test purposes so that you do not have to retype all of the command options at a later point.
`--antiAliasing` *level*	Set the anti-aliasing level (0, 2, 4, 8, or 16. Default: 4.
`--appDataDir` *directory*	Specifies the location of application data.
`(-B` | `--bindObservers)` *"observer1,..., observern,saved_views_file"*	If you load a scene that has multiple observers, this command assigns the views in the specified saved views file to the specified observers. The first saved view is assigned to the first observer, the second to the second observer, and so on. If the observers are not specified as arguments, only the first observer in the display engine configuration gets a view assigned to it. The entire string must be quoted. There are no spaces after commas. You would ordinarily also specify a display configuration that contains the observers with `--dispSetting`. You must specify a terrain database for this command to work. For more information about using this command-line option, please see "Attaching the Observer at Startup," on page 8-14.
`(-c` | `--showConsole)`	Display a console window.
`(-C` | `--autoconnect)` {*filename* | *connector_name*}	Automatically connect to the network using the specified connector.

Table 3-1: VR-Vantage command-line options (Sheet 2 of 3)

Option	Description
`--dataDir` *directory*	Specifies the location of the data directory (terrains and so on).
`--depthBits` *bits*	Sets the depth of graphics to 24 bits or 32 bits. Default: 24.
`--displayEnginePort` *port*	Specifies the display engine port used by a remote display engine. Used only if `--slave` is specified.
`--dispSetting` *filename*	Specifies the display engine configuration to load.
`--entDispSetting` *filename*	Specifies the entity display setting to load.
`--envSetting` *filename*	Specifies the environment configuration file to load.
(`-E` | `--entTypeMap`) *filename*	Load the specified entity type mapping file. The file extension determines the type of mapping.
`--fullScreen`	Start with the window in full screen mode.
(`-F` | `--frameRate`) *rate*	If rate is 0, the frame rate is variable. Otherwise, specifies a fixed frame rate for rendering.
(`-G` | `--locale`) *language*	Specifies the locale (for localization).
(`-h` | `--help`)	Display command-line usage information.
(`-l` | `--logFileName`) *filename*	Specifies the log file name.
(`-L` | `--loadObservers` *filename1 filenamen*	Loads the saved observers in the specified files.
(`-n` | `--notifyLevel`) *notify_level*	Specifies the notification level for application messages, where *notification_level* is a number from 0 through 4. The least verbose message level is 0, the highest is 4. The default is 2.
`--noGui`	Start without the graphical user interface.
`--noVSync`	Start without vsynched windows.
`--plugin` *filename*	Load the specified plug-in. Can be used multiple times.
(`-s` |`--slave`)	Run as a remote display engine.
`--stencilBits` *bits*	Sets the number of stencil bits (0 or 8). Default: 0.
(*terrain_MTF_file* | *scene_MSF_file*)	Specifies a terrain (MTF) or scene (MSF) file to load.
`--unplug` *filename*	Do not load the specified plug-in. Can be used multiple times.
`--userDataDir` *directory*	Specifies the user data directory.

Table 3-1: VR-Vantage command-line options (Sheet 3 of 3)

Option	Description
`(-v | --version)`	Display version information and exit.

Windows syntax:
`-W | --withDisplayEngine port@netAddress;displayConfigFilename1 .... n`
Linux syntax:
`-W | --withDisplayEngine port@netAddress:displayConfigFilename1 .... n`
	Connect to a display engine running on another computer. For more information, please see *Loading Multiple Display Engine Configurations from the Command Line* under Section 1.1.6, "Loading a Display Engine Configuration," in *VR-Vantage Configuration Guide* .

3.1.4. Shutting Down VR-Vantage

➤ To shut down VR-Vantage, choose **File** → **Exit**.

3.2. Introduction to the VR-Vantage Graphical User Interface

The VR-Vantage graphical user interface (GUI) uses features that are common to most windowed applications, such as menus, toolbars, dockable panels, and context-sensitive help. For a brief introduction to these features and descriptions of common icons used in VR-Vantage, please see Appendix A, *The VR-Vantage User Interface*.

3.3. Opening a Terrain

VR-Vantage includes several terrains. When you open a terrain in VR-Vantage, you open an MTF file; you do not open a file in its native format (such as OpenFlight or DTED). This procedure explains how to open the MÄK-supplied terrains or a terrain that you have created and saved in the MTF format.

(If you want to open files directly from their native formats, you do so by loading terrain patches, raster maps, and feature layers. You can then save the resulting terrain to an MTF file. For details, please see "Terrain Agility and Composability," on page 4-2.) For details about how to compose a terrain from source data, please see Chapter 3, *Composing Terrains*, in *VR-Vantage Configuration Guide*. For details about opening a geocentric terrain from a terrain server, please see Section 3.7, "Connecting to Terrain Servers," in *VR-Vantage Configuration Guide*.

- When VR-Vantage starts up, it prompts you to load a terrain (unless you have disabled the feature). Thereafter, you would use the procedure described here to load terrains.
- The first time you load a terrain (including the terrains supplied with VR-Vantage), VR-Vantage caches textures in its fast load format. This is a slow process. However, once it is cached, the terrain will load quickly. If you want to avoid runtime caching, you can preprocess the terrain with the medfTool before you load it. If you want to disable runtime caching, you can do so as described in Section 3.10, "Configuring File Caching in VR-Vantage," in *VR-Vantage Configuration Guide*.

To open a terrain:

1. Choose **File** → **Open Terrain**, or click the Open Terrain button () on the Terrain Toolbar. The Open Terrain dialog box opens.
2. Select the terrain (MTF format) that you want to open.
3. Click Open.

3.3.1. Closing a Terrain

To close a terrain, use one of the following methods:

- Choose **File** → **Close Terrain**, or click the Close Terrain button () on the Terrain Toolbar.
- Choose **File** → **New Terrain**, or click the New Terrain button () on the Terrain Toolbar.
- Choose **File** → **New Scene**, or click the New Scene button () on the Scene Toolbar.
- Open a different terrain.

3.4. Connecting to a Simulation Network

To view a simulation, you must connect VR-Vantage to a simulation network. VR-Vantage includes connectors for DIS, CIGI, HLA 1.3 (RPR FOM 1.0 and RPR FOM 2.0, draft 17), HLA 1516 (RPR FOM 1.0 and RPR FOM 2.0, draft 17), and HLA Evolved (IEEE 1516-2010, also referred to as HLA 1516e). You can change the configuration values of the default connectors and you can add connectors. For details about creating and editing connections, please see Appendix B, *Managing Network Connections*.

When VR-Vantage starts up, it does not automatically connect to a simulation network unless you configure it to do so. The auto connect feature lets you specify that VR-Vantage automatically connect to a network through a connection when it starts up. If you do not use auto connect, you must connect manually. A connector's status is listed in the Status column in the Connection Status page of the Simulation Connections dialog box.



- You can connect to more than one simulation network at the same time.
- You can quickly get connection status, connect to a network, and disconnect on the Simulation Connections Toolbar. For details, please see "Using the Simulation Connections Toolbar," on page 3-11.

To connect to a simulation network:

1. Choose **Settings** → **Connection**. The Simulation Connections dialog box opens (Figure 3-3).

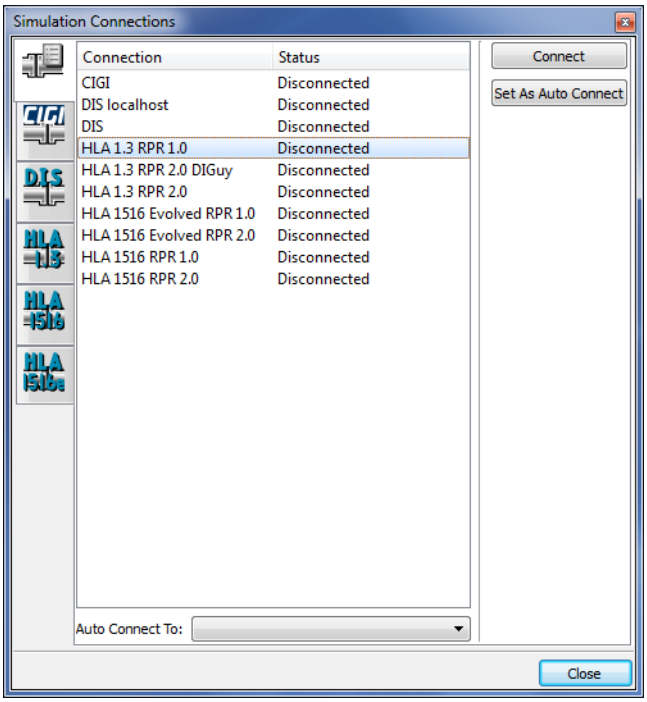


Figure 3-3. Connection Status page

2. Select the page for the connection type that you want to use.
3. Select a connector in the Connections list (Figure 3-4).

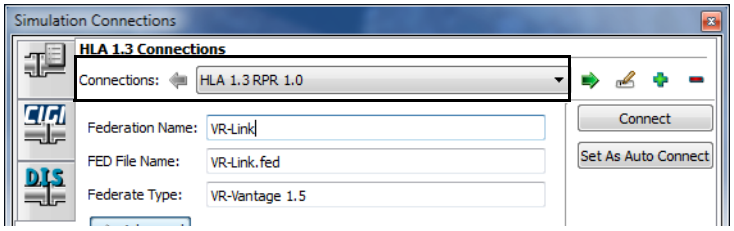


Figure 3-4. HLA 1.3 Connections page

4. Click Connect.

3.4.1. Setting Up Auto Connect

If you specify auto connection, VR-Vantage connects to the specified simulation network when it starts. If a connection is designated as an auto connection, a star is added to its entry in the connections list (Figure 3-5).

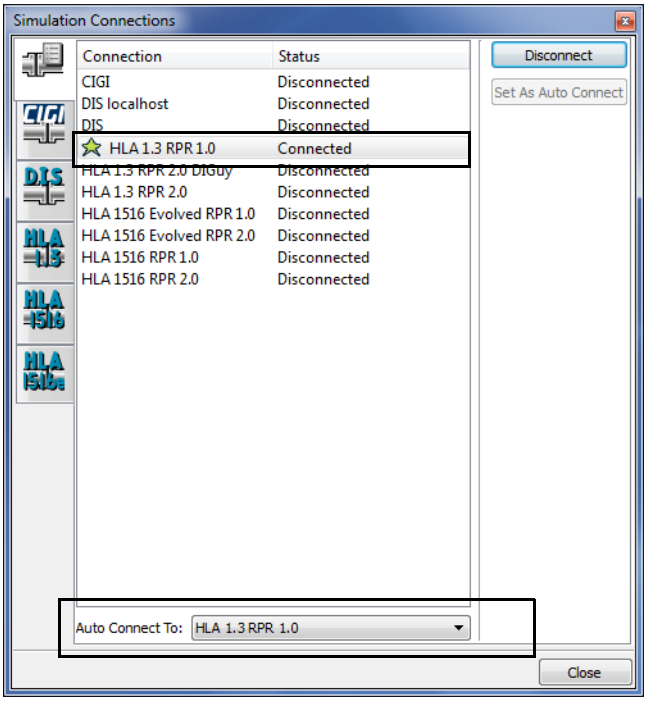


Figure 3-5. Auto connect enabled

To configure auto connection:

1. Choose **Settings** → **Connection**. The Simulation Connections dialog box opens.
2. To configure auto connect on the Connection Status page (Figure 3-5):
   a. Select the Connection Status page.
   b. Do one of the following:
   – Select the desired connection in the Connection list and click Set As Auto Connect.
   – Select a connection from the Auto Connect To list. (To disable auto connection, select the blank line.)

   To configure auto connect on a protocol-specific page:
   a. Select the page for the connection type that you want to use.
   b. Select a connector in the Connections list.
   c. Click Set As Auto Connect.

3.4.2. Disconnecting from the Simulation Network

To disconnect from the simulation network:

1. Choose **Settings** → **Connection**. The Simulation Connections dialog box opens (Figure 3-3).
2. On the Connection Status page or on a protocol-specific page, select the connection that you want to disconnect.
3. Click Disconnect.

3.4.3. Using the Simulation Connections Toolbar

The Simulation Connections Toolbar lets you quickly open the Simulation Connections dialog box to the Connection Status page. It also lets you quickly connect to and disconnect from a specific connection.



Figure 3-6. Simulation Connections Toolbar

➤ To view connection status, click the Connection Status button ( ).

To quickly connect to selected simulation connections:

1. Click the down arrow next to the Connect button ( ). A list of all configured simulation connections is displayed.

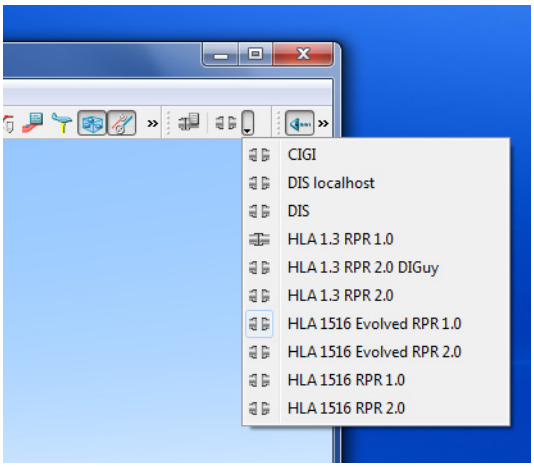


Figure 3-7. Connection list

2. Click the connection that you want to connect to when you use the toolbar.

- You can only select one connection in the list. To connect to multiple simulations, use the Connection Settings dialog box.
- The Connect button toggles between an open and closed state depending on the status of the connection.

3. Click the Connect button.

➤ To disconnect all connections, click the Disconnect button ( ).

3.5. Managing VR-Vantage Settings

VR-Vantage has the following types of settings:

- Independent, or display, settings are the individual settings managed on the Settings menu and the pages of the Display Settings dialog box. Changing an independent setting, such as enabling track histories or wireframe mode, does not affect other settings.

  Independent settings are categorized as being global settings or observer-specific settings. Global settings apply regardless of the observer mode. Observer-specific settings can be different for each observer mode. For more information, please see "Global Settings and Observer-Specific Settings," on page 3-15.

- Dependent settings are the schemas, model definitions, element definitions, and entity type mappings that collectively determine how entities and objects are modeled in the scene. Changing a dependent setting, such as a model definition may affect settings that depend on it, such as an entity definition.

VR-Vantage manages settings as follows:

- As you make changes to settings during a session, it saves the changes.
- It remembers the settings in effect when you exit and uses them as the default settings in your next session.
- During any particular session, you can revert to the default settings.
- You can save the current settings to a file.
- You can import saved settings.
- You can restore settings to those that were in effect when VR-Vantage was first installed (factory settings).

Dependent settings have two additional options that independent settings do not have:

- You can save or restore a specific setting.
- You can merge settings from a file into the current settings.

The procedures for saving and restoring settings are the same regardless of the types of settings. You start the process by clicking a button on a settings dialog box page. However, the way that VR-Vantage saves or restores settings depends on the type of setting, as follows:

- When you initiate a save or restore operation on independent settings, it only affects the settings on the dialog box page from which you started the save or restore. If you have changed a setting on another page, it is not affected.
- When you initiate a save or restore operation on dependent settings, all of the changes to all of the related settings get saved or restored. This ensures that the relationships do not get broken.

(Figure 3-8) illustrates the settings management buttons. The callout numbers are referenced in the list of button descriptions.



Figure 3-8. Settings buttons

- Revert to the default settings (1). Override any changes made to settings during this session.
- Restore the factory settings (2). Change settings to the settings used when VR-Vantage was installed. (The factory settings and default settings may be different.)
- Import settings from a file (3). Replace the current settings with those stored in the selected file.
- Merge in settings from a file (4). (Only supported for dependent settings.) Merging works as follows:
  - Saved settings that do not have a match in the current settings are added.
  - Saved settings replace matching settings.
  - Current settings that are not replaced (that is, for which there is no match in the saved settings) remain valid.

  Figure 3-9 illustrates how merged settings work. Setting A in the saved settings has no match in current settings, so it is added to the merged settings. Current settings B_2 and C_2 are replaced with saved settings B_1 and C_1. Current setting D has no match in saved settings, so it is retained in the merged settings.

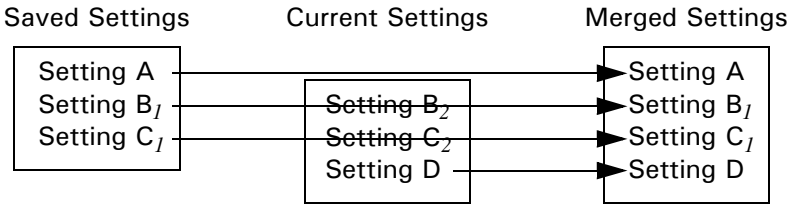


Figure 3-9. Merged settings

- Export settings to a file (5). Save the current settings to the selected file.
- Save the selected setting to a file (6). (Only supported for dependent settings.)



- The buttons described in this section are disabled on dialog box pages on which their function is not supported. This includes most of the pages on the Terrain Settings dialog box.
- Each VR-Vantage application saves settings to its own directory (*./appData/settings/stealth*, *./appData/settings/vantageIG*, and so on).
- If you load an alternative settings file at startup, it is treated like an imported settings file. If you save current settings as default, they get saved to the default files in *./appData/settings/*. They do not get saved back to the alternative file unless you explicitly export them to that file.

3.5.1. Synchronizing Settings Among VR-Vantage Installations

If your simulation is using several VR-Vantage applications or display engines, you may want to use the same settings across all of them, particularly if you have added model definitions and mappings to the factory settings. To synchronize settings, copy the data directories (*./appData*, *./data*, and *./userData*) from the computer on which you have updated them to the computers on which the other VR-Vantage applications and display engines are installed. Then import the settings into any Settings page that you customized on the source VR-Vantage machine.

3.5.2. Global Settings and Observer-Specific Settings

VR-Vantage has two types of independent settings – global settings and observer-specific settings.

Global settings affect the display regardless of which observer mode you are using. Global settings include entity labels, tactical graphics, and cockpit displays. The settings on the Settings menu are all global settings.

Observer-specific settings can be different for each observer mode. In fact, given a similar projection and model set, it is the different settings that distinguish one observer mode from another. For example, one difference between Stealth observer mode and Out-the-Window observer mode is that Stealth mode has view controls enabled and Out-the-Window mode has them disabled.

3.6. Optimizing Performance

The performance of a visualization product such as VR-Vantage depends on:

- Processor speed.
- Video card. (Always use the latest drivers for your video card.)
- Available memory.
- Size of the terrain database.
- The number and complexity of models loaded.
- Number of objects in the simulation and how active they are.

You can display statistics to help you evaluate VR-Vantage's performance. For details, please see "Displaying Performance Statistics," on page 3-17.

The following actions can affect performance:

- Increasing the size or density of a cloud layer.
- Displaying performance statistics.
- Use of ground clamping.
- Displaying track histories.
- Displaying height-above-terrain lines.
- Enabling advanced lighting and various lighting effects.
- Enabling dynamic ocean effects. If enabled, enabling wakes, buoyancy models, and spray effects.
- Anti-aliasing settings. For detals, please see "Configuring Graphics Quality," on page 3-19.

The following sections describe options for optimizing performance:

- Section 6.8, "Configuring SpeedTree Trees," in *VR-Vantage Configuration Guide*.
- Section 3.10, "Configuring File Caching in VR-Vantage," in *VR-Vantage Configuration Guide*.
- Section 9.2, "Clearing the Model Instancing Cache," in *VR-Vantage Configuration Guide*.
- Section 1.3.1, "Setting the Clipping Planes," in *VR-Vantage Configuration Guide*.
- "Enabling Texture Compression," on page 3-47.
- Section 3.1.1, "Considerations and Limitations for Building Terrains," in *VR-Vantage Configuration Guide*.
- "Filtering Entities Using Interest Management," on page 9-18.
- Section 3.5.3, "Setting the Ocean LOD Elevation," in *VR-Vantage Configuration Guide*.
- "Displaying Wakes and Spray Effects," on page 10-20.
- "Enabling Buoyancy for Surface Entities," on page 10-20.
- Chapter 16, *Lighting Effects*.

3.6.1. Displaying Performance Statistics

VR-Vantage can display two kinds of performance statistics — OSG statistics (Figure 3-10), and VR-Vantage statistics (Figure 3-11).

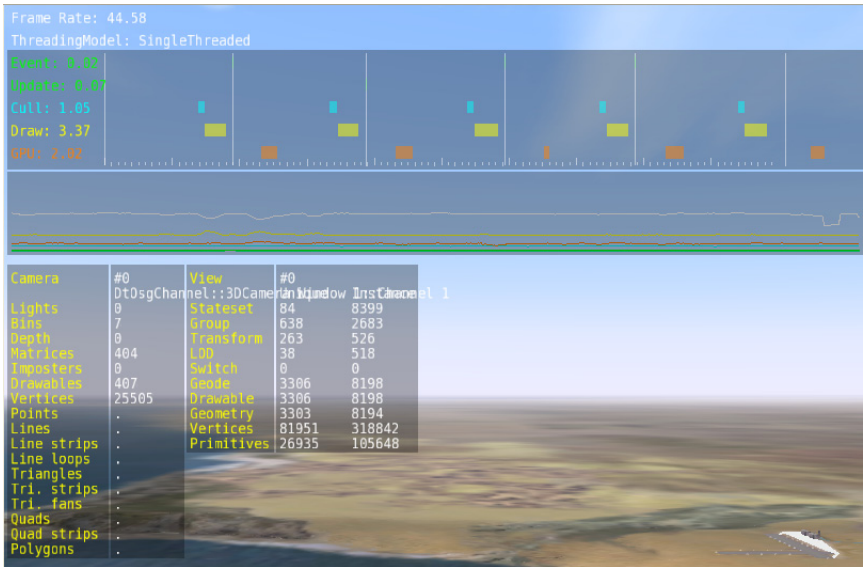


Figure 3-10. OSG performance statistics



Figure 3-11. VR-Vantage performance statistics

Displaying performance statistics may affect performance. Displaying OSG statistics may affect performance more than VR-Vantage statistics.

To display VR-Vantage performance statistics:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 3-12).

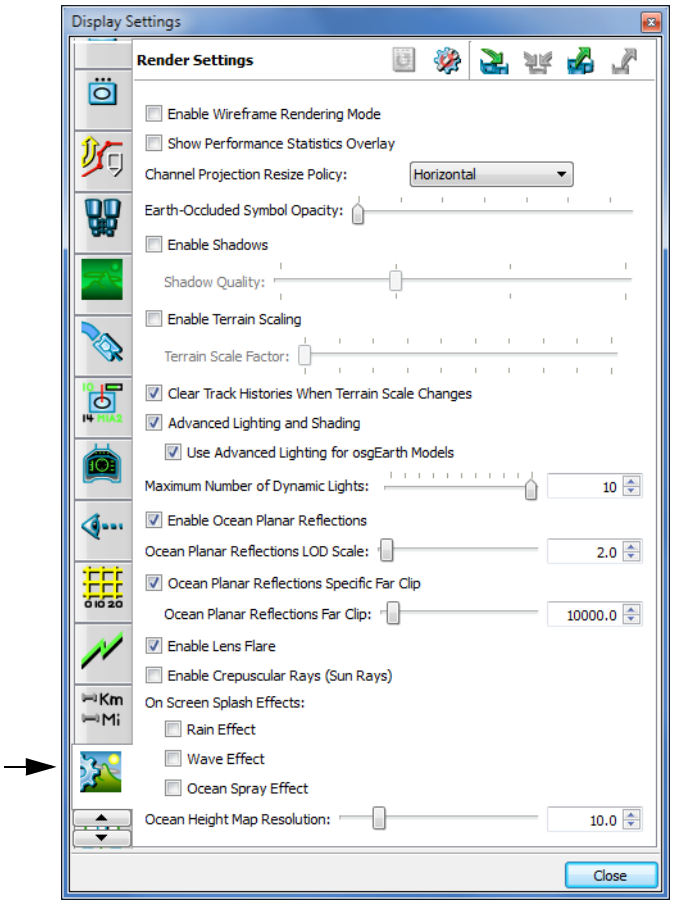


Figure 3-12. Render Settings page

3. Select the Show Performance Statistics Overlay check box. A statistics display is added to the window (Figure 3-11).

To display OSG performance statistics:

1. Press F2. The frame rate is displayed.
2. Continue pressing F2. Additional statistics are displayed. When all statistics are displayed, pressing F2 closes the display.

3.6.2. Configuring VSync

By default, VR-Vantage enables VSync (vertical synchronization), which synchronizes VR-Vantage's frame rate with your monitor's refresh rate. This prevents a visual anomaly called tearing, in which parts of two frames of data can be visible at the same time. Use of VSync can also significantly improve terrain and feature data streaming performance.

In some cases, if the frame rate cannot quite keep up with the refresh rate, VSync can force the frame rate to a noticeably lower rate. To avoid this problem, we recommend that you enable triple buffering for your video card. You must do this in the video card's configuration application; VR-Vantage cannot do this for you.

If you prefer not to use VSync, you can disable it at startup with the `--noVSync` command-line option, or you can configure your video card to force it to be off.

3.6.3. Configuring Graphics Quality

VR-Vantage has command-line options that let you configure graphics quality. Depending on the capabilities of your graphics card, you may need to adjust the default settings for anti-aliasing and graphics depth and stencil buffers. The command-line options are:

- `--anti_aliasing` *`level`*. Anti-aliasing is a technique used to reduce the jagged edges of digital graphics. You can set the level to 0, 2, 4, 8, or 16. Default: 4.
- `--depth_bits` *`depth`*. The number of bits in an image determines its quality and the number of colors it supports. You can set the depth to 24 or 32. Default: 24.
- `--stencil_bits` *`bits`*. The stencil buffer can be set to 0 or 8. Default: 8.

On older graphics cards, you may need to set anti-aliasing to 0 to improved performance.

Depending on your graphics card and driver, some combinations of these settings may be incompatible. For example, if you set stencil bits to 8, the depth must be set to 24 and anti-aliasing may need to be set to 0 or 2.

4

VR-Vantage Concepts

This chapter briefly describes the major functional and organizational concepts that underlie VR-Vantage and directs you to the sections that fully describe them.

Terrain Agility and Composability 4-2
- Elevation Data 4-3
- Images 4-3
- Feature Layers and Props 4-4

The VR-Vantage Display Engine 4-5
- How VR-Vantage Responds to Display Engine Connections 4-6
- The Display Engine's Connection States 4-6
- Windows and Channels 4-6
- Window Types 4-6

The Observer 4-7
- Switching Between the 2D and 3D Projections 4-7
- Observer Modes 4-7

Scenes 4-8

Introduction to VR-Vantage Object Modeling 4-9
- Model Formats for 3D Entities, Objects, and Effects 4-11
- Model Sets 4-11
- Mapping Entity Types to Element Definitions 4-12

4.1. Terrain Agility and Composability

VR-Vantage applications are terrain-agile. Rather than being restricted to loading terrains in a limited number of formats that have been created using various terrain-creation software, VR-Vantage lets you compose terrains from a variety of supported data formats. You can combine elevation data (terrain patches), imagery, and feature data to create terrains.

VR-Vantage offers the following basic methods for creating terrains:

- Compose a terrain by loading individual elevation, image, and feature data files. This method is best for relatively small terrains that do not require paging. It supports all of the coordinate systems that VR-Vantage supports. For more information, please see Section 3.1, "Creating a Composed Terrain," in *VR-Vantage Configuration Guide*.
- Specify a set of files to load using a *.earth* file. Use this method to stream terrain data from local or remote sources. This method is best for terrains with large amounts of elevation or image data, which would benefit from paging. SpeedTrees do not work with this terrain format. For more information, please see Section 3.7, "Connecting to Terrain Servers," in *VR-Vantage Configuration Guide*.

When you compose a terrain, you can save it as a MÄK terrain file (MTF), which is essentially a description of all of the data used to visualize the simulated 3D environment. Later, you can open the MTF file and VR-Vantage will automatically load all of the data that you loaded manually when you first created the terrain.

You can save terrains in a cached format that loads terrain data more quickly than if the terrain is created from the source data. For details, please see Section 3.10, "Configuring File Caching in VR-Vantage," in *VR-Vantage Configuration Guide*.

4.1.1. Elevation Data

VR-Vantage imports elevation data as terrain patches. It supports the following formats:

- MÄK terrain database (*.gdb*).
- MÄK encrypted data format (*.medf*).
- MÄK Stealth (6.2 and earlier) format (*.mtl*).
- MÄK terrain project or terrain descriptor file (*.mtp*, *.mtd*).
- OpenFlight (*.flt*).
- MetaFlight (*.mft*).
- DTED (*.dt0*, *.dt1*, *.dt2*, *.dted*).
- CTDB 4, 7, 7L (*.c4b*, *.c7b*, *.c7l*).
- Shape terrain data (*.shp*).
- Terrapage (*.txp*).
- Collada (*.dae*).
- 3DS.
- OBJ.
- OSG.
- LWO.

4.1.2. Images

You can import images in the following formats:

- GeoTiff (*.tif*, *.tiff*).
- JPEG (*.jpg*, *.jpeg*).
- PNG.
- RGB.
- Windows bitmap (*.bmp*).
- GIF.
- ECW.

You can load additional raster formats if you load them in a *.earth* file using the GDAL driver. For a list of formats supported by GDAL, go to http://www.gdal.org/ and select the Supported Formats link. For more information about *.earth* files, please see Section 3.7, "Connecting to Terrain Servers," and Appendix 8, *Editing Earth Files*, in *VR-Vantage Configuration Guide*.

4.1.3. Feature Layers and Props

A terrain can have objects such as buildings and trees embedded in it. These objects cannot be manipulated in this format. However, VR-Vantage lets you extract these types of objects from the terrain and render them independently as props.

Props are terrain elements that you can manipulate as separate objects. You can add props to a terrain by extracting them from a terrain patch or from a feature layer.

A feature layer is a file that contains feature data such as point features, linear features, and areal features. You can extract point features as props. You can extract props from MÄK Terrain Format (GDB) files, shapefiles (SHP), or DFAD data (DFD).

For more information, please see Section 3.9, "Adding Props to a Terrain," in *VR-Vantage Configuration Guide*.

4.2. The VR-Vantage Display Engine

VR-Vantage applications have a component called a display engine. The display engine renders visual data. A display engine can also control the display on remote display engines.

VR-Vantage includes an application called the VR-Vantage Display Engine. A VR-Vantage Display Engine has a very limited GUI. Its primary purpose is to provide windows that can be controlled by a VR-Vantage application's (master) display engine.

The master display engine can connect to multiple VR-Vantage Display Engines (typically running on other computers) and control what is displayed in their windows.



For the remainder of this manual, we will continue to use VR-Vantage as an inclusive term for referring to VR-Vantage applications, will assume that you remember that VR-Vantage has a display engine that can control VR-Vantage Display Engine applications, and will refer to VR-Vantage Display Engine applications as display engines or external display engines (to distinguish them from the display engine in VR-Vantage).

VR-Vantage drives all of the display engines it is connected to, as illustrated in Figure 4-1.

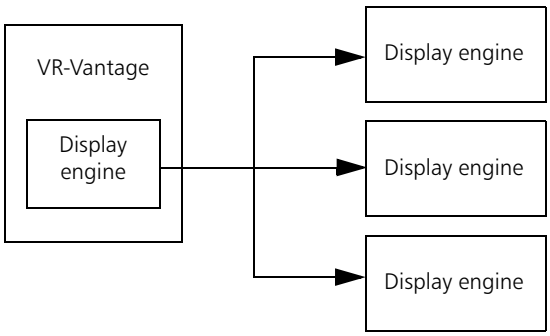


Figure 4-1. VR-Vantage and display engines



Display engines must have the same terrains, models, and other visualization data available as VR-Vantage. To replicate settings from a VR-Vantage application to a display engine, copy the data directories (*./appData*, *./data*, and *./userData*) from the computer on which VR-Vantage is installed to the computer on which the display engine is installed. Then import the settings into any Settings page that you customized on the VR-Vantage machine.

For a complete discussion of display engines, please see Chapter 9, *Display Engine Configurations*.

4.2.1. How VR-Vantage Responds to Display Engine Connections

VR-Vantage reloads the current scene each time a display engine is connected. This ensures that the display engine has an exact duplicate of the current scene. VR-Vantage does not perform any special actions when a display engine disconnects.

4.2.2. The Display Engine's Connection States

An external display engine is initially in an unconnected state. While it is unconnected, it cannot display a scene. When VR-Vantage connects to a display engine, the display engine creates an identical copy of the scene regardless of whether or not it can render it. The display engine is automatically sent a default display engine configuration that has a single channel on a single window. However, you can change this at runtime or programmatically. You could also load a saved configuration. If a display engine loses its connection to VR-Vantage, it clears its local scene and returns to an unconnected state.

4.2.3. Windows and Channels

A display engine (including the master display engine) can display multiple windows, each of which can have zero or more channels. The windows are all configured in VR-Vantage as part of a display engine configuration. You can save a display engine configuration and load it at a later time.

4.2.4. Window Types

To view a scene and simulation data, a display engine must have a window. VR-Vantage supports the following types of windows:

- Full screen. A full screen window uses the entire area of a monitor. It does not have any menus, panels, or other GUI controls.
- Resizable. A resizable window can be moved, resized, maximized, and minimized. It does not have any GUI controls. An inset view is an example of a resizable window. (For information about inset views, please see "Inset Views," on page 9-10, in *VR-Vantage Users Guide*.)
- Embedded. An embedded window is part of an application. The main display window in VR-Vantage is an embedded window. The application provides a variety of controls that affect the view in the window. You could, if you wanted to, change VR-Vantage's window to a different type, in which case it would no longer be embedded in themain application window.

A window can have zero or more channels. Each channel defines a viewable area on the screen. You must have at least one channel to see a rendered image in the window. Each channel can have its own observer.

4.3. The Observer

The observer, or eyepoint, is the location in the 3D or 2D environment from which you observe the scene. You can move the observer (navigate) through the scene. You can attach the observer to an entity or prop. When the observer is attached to an entity, it moves automatically with that entity. You can also control the observer from a remote application using view control messages.

You can have multiple observers in a VR-Vantage session. They might be associated with different windows. For example you could have an observer for the main window and one for an inset window.

The observer is such a pervasive component of VR-Vantage that it is not covered in just one section of this manual. For more information, please see:

- Chapter 6, *The Observer and Observer Modes*.
- Chapter 7, *Moving the Observer*.
- Chapter 8, *Attaching the Observer*.
- "Displaying Models for Remote Observers," on page 9-18.

4.3.1. Switching Between the 2D and 3D Projections

VR-Vantage Stealth supports both 2D and 3D projections. You can switch between them simply by changing the observer mode from Stealth or Out-the-Window, to Plan View. (Changing observer modes is described in "Changing the Observer Mode," on page 6-2.) When you go from a 3D observer mode to 2D, VR-Vantage calculates a zoom level so that the observer should appear as if it is roughly the same height above the terrain. When you go from a 2D observer mode to 3D, VR-Vantage calculates an altitude to do the same thing, and keeps the 3D view pointing down (so the change in overall view stays fairly small).

4.3.2. Observer Modes

Observer modes let you configure VR-Vantage settings that affect how the observer moves and what it sees. You can then quickly change from one group of settings to another by switching between observer modes. An observer mode specifies:

- A model set. A collection of models of a particular type, such as 3D models.
- A key map. A coordinated set of key mappings to movement functions.
- A projection (2D or 3D).
- Settings for entity graphics and observer movement.

VR-Vantage includes the following observer modes:

- Stealth. Stealth observer mode is a 3D projection configured for situational awareness.
- Out-the-Window. Out-the-Window observer mode is configured for when you use VR-Vantage IG or if you want to use VR-Vantage Stealth as a desktop image generator. It hides many of the explanatory visual effects present in the Stealth observer mode.
- Plan View. The Plan View observer mode provides a 2D "big picture" view of the terrain.
- XR. XR, or exaggerated reality, observer mode is a 3D mode that helps you understand the relationships between entities and the terrain when the observer is too far away from entities to view them at realistic sizes. It allows you to exaggerate entity size and terrain.

Table 4-1 lists the observer modes and default settings provided with VR-Vantage applications.

Table 4-1: Observer modes

Application	Observer Mode	Projection	Model Set	Key Map
VR-Vantage IG	Out-the-Window Inset	3D	3D Models	Observer Frame
VR-Vantage Stealth	Stealth Out-the-Window Inset	3D	3D Models	Observer Frame
	XR	3D	3D Colorized Models	Observer Frame
	Plan View	2D	2D Icons	2D Level Observer Frame
VR-Vantage PVD	Plan View	2D	2D Icons	2D Level Observer Frame
	Inset	2D	2D Icons	Observer Frame

You can edit observer modes and add new ones. For details, please see "Creating and Editing Observer Modes," on page 6-2.

4.4. Scenes

A scene contains an environment, the time of day, and possibly, a terrain. If particular environment settings are important to the simulations you are viewing, use of scenes can be an important convenience feature. A scene does not have to have a terrain. For example, when you start VR-Vantage, a default scene is loaded that does not have a terrain.

4.5. Introduction to VR-Vantage Object Modeling

The objects that VR-Vantage can display that are not part of the terrain, such as entities, tactical graphics, detonations, and cockpit displays, are generically called scene elements. Scene elements are defined in element definitions. When VR-Vantage joins an exercise, it receives information about objects over the network. The objects are identified using entity type enumerations. VR-Vantage maps these entity types to element definitions. (For more information about entity type enumerations and mapping them to element definitions, please see "Mapping Entity Types to Element Definitions," on page 4-12.)

An element definition is a set of visual definitions that tell VR-Vantage how to render (display) the object. Visual definitions specify the 3D model, 2D icon, or graphic, and the visual effects that the object supports, such as trailing effects, height-above-terrain lines, track histories, and so on. A scene element can have up to three different element definitions – one for each model set (3D, 3D Colorized, 2D Icon). VR-Vantage chooses the correct element definition to use based on the model set being used by the observer. (For more information about model sets, please see "Model Sets," on page 4-11.)

Element definitions are created and edited in the Visual Model Editors dialog box. In addition to letting you manage element definitions, this dialog box lets you create and manage model definitions and schemas. Model definitions specify values for some basic object parameters. Most importantly for most VR-Vantage users, model definitions specify the 3D model to use for element definitions in the 3D Models model set. What this means is that if you want to add a new model to VR-Vantage, you will specify the model file, such as an OpenFlight file, in a model definition and then specify that model definition in the element definition for the entity you want to add.

Schemas define the most basic scene elements, such as entity, SpeedTree, or line. Most VR-Vantage users will never have to create or edit a schema. However, if you create a new model definition, you will need to make sure it uses the correct schema and that it includes all required parameters.

Figure 4-2 illustrates these relationships using an M1A2 entity. VR-Vantage receives the entity type 1:1:225:1:1:3:-1 over the network (callout 1). In the Entity Type Mappings dialog box, this entity type is mapped to the M1A2 Abrams entity definition (2). (An entity definition is a specific type of element definition.) The M1A2 Abrams entity definition (in the Visual Model Editors dialog box) specifies all of the visual definitions for this entity (3). The Main Model visual definition has a **modeldefinition** parameter. The value for this parameter is TrackedM1A2DESERT (4). The TrackedM1A2DESERT model definition has a **filename** parameter that specfies *M1A2.medf* as the model to use for entities that use this model definition. The TrackedM1A2DESERT model definition has a **filename** parameter because it uses the Entity schema and the Entity schema requires a **filename** (5).

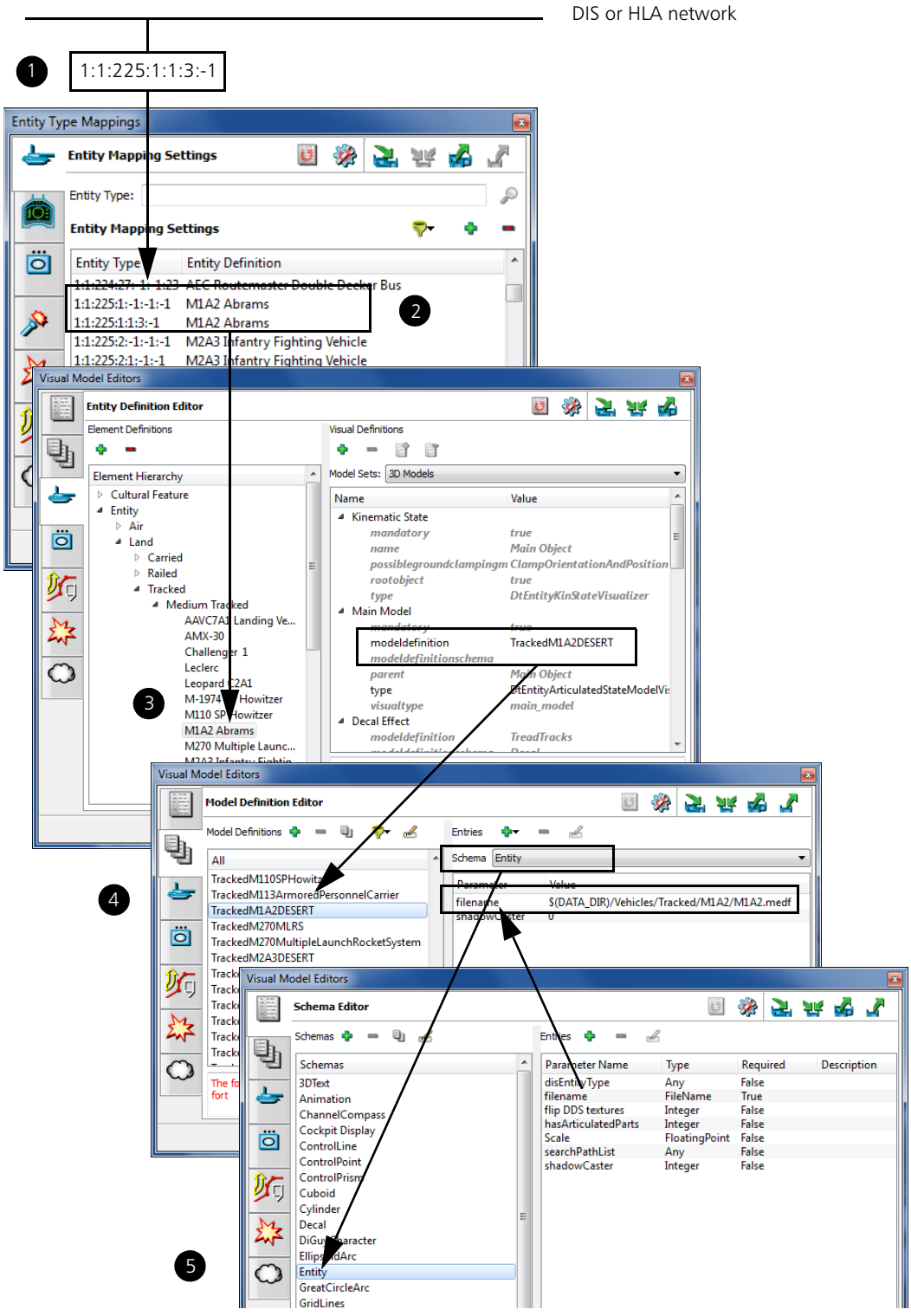


Figure 4-2. Element definitions and model mapping

4.5.1. Model Formats for 3D Entities, Objects, and Effects

VR-Vantage includes 3D models for vehicles, lifeforms, environmental objects, and effects. The models are in a compressed, encrypted format (extension *.medf*).



VR-Vantage includes a utility, the MEDF Tool, that lets you encrypt files in MEDF format. You cannot use it to decrypt encrypted files. For more information, please see Section 9.3, "Compressing Model Files," in *VR-Vantage Configuration Guide*.

You can provide your own models if they are in one of the following supported formats:

- OpenFlight
- 3ds
- OBJ.

4.5.2. Model Sets

The model or icon that is used for an object is determined by its element definition. For convenience, element definitions are organized into model sets. For example, all of the element definitions that specify 3D models are in the 3D Models model set, and so on. As a result, when you choose the 3D Models model set for an observer mode, all of the entities use a 3D model. (The model set is an observer-specific setting. This is not really an issue in VR-Vantage PVD and VR-Vantage IG, which each support only one model set. VR-Vantage Stealth lets you change model sets.)

Each VR-Vantage application includes one or more of the following types of object models and icons:

- 3D Models. Realistic 3D models. This is the default model set for the Stealth observer mode.
- 3D Colorized Models. 3D colorized models are cartoon-like models that create an exaggerated notional view of the world. This is the default model set for XR observer mode.
- 2D Icons. 2D MIL-STD 2525B font-based icons. This is the default model set for the Plan View observer mode. You can also configure VR-Vantage to use 2525a images or any arbitrary images for 2D icons.

Table 4-2 lists the VR-Vantage model sets and the VR-Vantage applications that support them.

Table 4-2: VR-Vantage model sets

Model Set	Application
3D Models	VR-Vantage Stealth VR-Vantage IG
3D Colorized Models	VR-Vantage Stealth
2D Icons	VR-Vantage Stealth VR-Vantage PVD



The model sets available in each VR-Vantage application are fixed. You cannot add model sets.

For information about changing model sets, please see "Changing the Model Set," on page 9-12.

4.5.3. Mapping Entity Types to Element Definitions

Entity type mapping is the process of associating an entity type enumeration for an entity or other scene element with an element definition.

DIS and HLA objects are specified by an entity type enumeration. An entity type enumeration is a list of seven components as specified by the DIS protocol and HLA RPR FOM. If none of the seven components contains a wildcard (-1) value, then the entity type refers to a specific entity. If some components contain a wildcard, then the entity type refers to a class of entities. A larger number of wildcards indicates a broader, more general class. For complete details about entity type enumerations, please see *Enumeration and Bit Encoded Values for Use with Protocols for DIS Applications* (DIS enumerations document). It is available at the IEEE World Wide Web site: http://shop.ieee.org/store/ and at the SISO web site: http://www.sisostds.org/.

When a VR-Vantage application discovers an entity, it reads the enumeration and then displays the entity using the element definition that is mapped to the enumeration.

5

Scenes and Environmental Effects

This chapter describes scenes and environment conditions.

Working with Scenes 5-2
- Creating a Scene 5-2
- Saving a Scene 5-2
- Opening a Scene 5-2

Setting the Date and Time of Day 5-3
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5.1. Working with Scenes

A scene contains an environment, the time of day, and a terrain filename. If particular environment settings are important to the simulations you are viewing, use of scenes can be an important convenience feature.

5.1.1. Creating a Scene

To create a scene:

1. Optionally, choose **File** → **New Scene**, or click the New Scene button () on the Scene Toolbar. If a terrain is currently loaded, it is removed from the scene.
2. Load the terrain that you want to include in the scene. For details, please see "Opening a Terrain," on page 3-7 and "Terrain Agility and Composability," on page 4-2.
3. Optionally, set the date and time of day.
4. Optionally, specify environment settings, as described in this chapter.

5.1.2. Saving a Scene

To save a scene:

1. Choose **File** → **Save Scene**, or click the Save Scene button () on the Scene Toolbar. The Save Scene dialog box opens. If you did not load a terrain when you created the scene, or if you built a terrain, but did not save it, you are prompted to specify a terrain for the scene.
2. Type a name for the scene.
3. Click Save.

5.1.3. Opening a Scene

To open a scene:

1. Choose **File** → **Open Scene**, or click the Open Scene button () on the Scene Toolbar. The Open Scene dialog box opens.
2. Select the scene you want to open.
3. Click Open.

5.2. Setting the Date and Time of Day

VR-Vantage changes the ambient, diffuse, and specular light based on the simulated time of day and the date. Figure 5-1 illustrates different time of day settings.

When you save a scene, VR-Vantage saves the time of day as part of the scene.



5:15 A.M., June 1 11:15 A.M., June 1

Figure 5-1. Time of Day

To set the date and time of day:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Date and Time page (Figure 5-2).

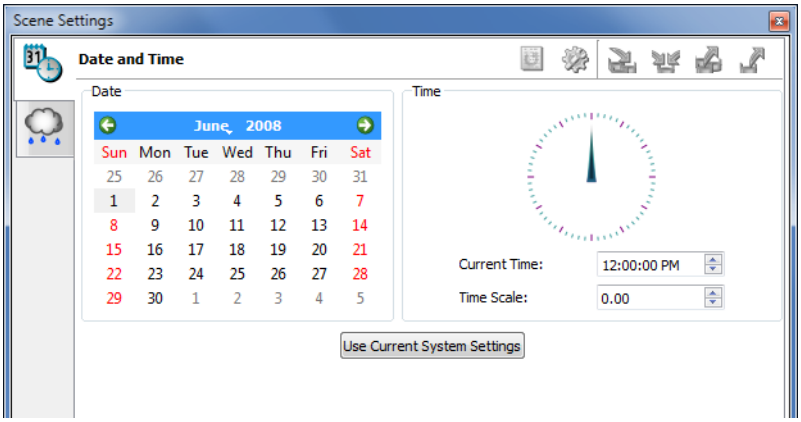


Figure 5-2. Date and Timepage

3. To specify the date, select a date in the calendar.

> If you change the month, you must explicitly select a date for it to be set.

4. To specify the time, in the Time group box, in the Current Time box, type or select a time value, in HH:MM:SS format. The analog clock display changes to reflect the current simulated time.
5. To set the date and time of day to the system settings, click Use Current System Settings.

5.2.1. Setting the Time Scale

VR-Vantage advances the date and time based on a time scale. By default the time scale is 0.00 and VR-Vantage does not advance time. A time scale of 1.00 means VR-Vantage advances time at real time. The time advance affects VR-Vantage's display of light, sun, star, and moon positions. It has no relationship to or effect on the simulation that VR-Vantage is displaying.

To set the time scale:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Date and Time page (Figure 5-2).
3. In the Time group box, type or select a value in the Time Scale box.

5.3. Specifying the Environment Conditions

VR-Vantage has a set of preconfigured environment conditions. Each environment condition has settings for:

- Weather:
  - Wind speed and direction.
  - Cloud cover.
  - Visibility.
  - Precipitation type and intensity.
  - Fog height and color.
- Marine:
  - Sea swell.
  - Sea state.
  - Surface transparency.
  - Underwater visibility.
  - Choppiness.
  - Surge depth.

Conditions range from clear to stormy and let you quickly set the weather without needing to adjust all the various weather parameters. However, if you want to, you can change any of the individual weather parameters. Changing a weather or marine setting does not affect the saved settings unless you specifically overwrite them.

You can save and import environment settings. When you save a scene, environment settings are saved as part of the scene. Environment settings support the standard VR-Vantage settings behaviors, as described in "Managing VR-Vantage Settings," on page 3-13.

You can add your own environment conditions. You can also set an environment condition as the default condition to use when VR-Vantage starts up. If you do not set a default condition, VR-Vantage saves the settings that were in effect when you last closed it.

To specify a weather condition:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Conditions Settings page (Figure 5-3).

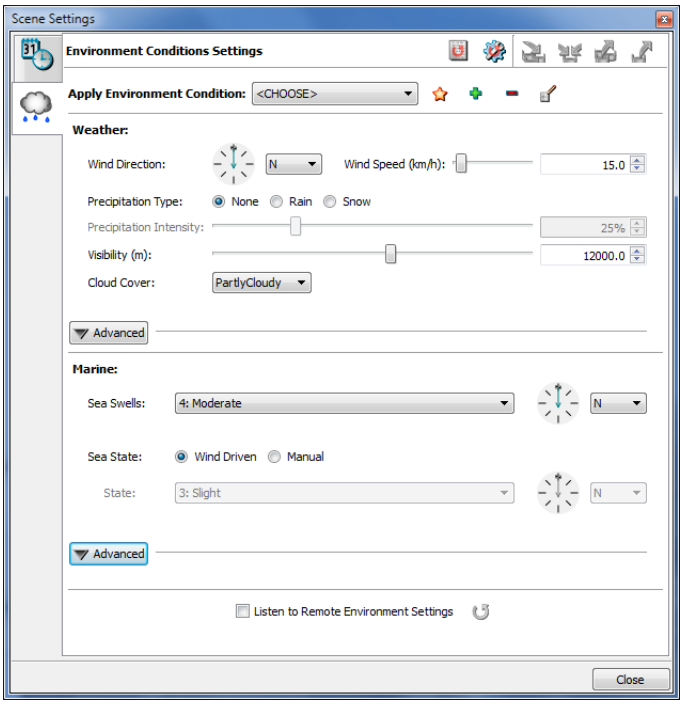


Figure 5-3. Environment Conditions Settings page

3. In the Apply Environment Condition list, select the condition you want.

5.3.1. Setting the Default Environment Condition

The default environment condition is the condition that in effect when you start VR-Vantage.

To set the default environment condition:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Conditions Settings page (Figure 5-3).
3. Click the Star button (). The Select an Environment Condition dialog box opens.
4. In the environment condition list, select the condition you want to be the default.
5. Click OK. The selected environment condition now has a star next to it in the Apply Environment Condition list.

5.3.2. Adding an Environment Condition

If you add an environment condition, it gets added to the Apply Environment Condition list.

To add an environment condition:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Conditions Settings page (Figure 5-3).
3. Click the Add button (). The Name an Environment Condition dialog box opens.
4. Type a name for the new condition.
5. Click OK.

5.3.3. Editing an Environment Condition

You can change the settings for an environment condition. Editing a condition essentially means overwriting a condition with the current set of weather and marine conditions.

To edit an environment condition:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Conditions Settings page (Figure 5-3).
3. Optionally, in the Apply Environment Condition list, select a condition you want to use as your starting point.
4. Change whatever conditions you want.
5. Click the Edit button ( ). The Select an Environment Condition dialog box opens.
6. In the Select Name list, select the condition you want to overwrite.
7. Click OK.

5.3.4. Deleting an Environment Condition

If you delete one of the built-in environment conditions, you can restore it from the factory settings.

To delete an environment condition:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Conditions Settings page (Figure 5-3).
3. Click the Delete button ( ). The Select an Environment Condition dialog box opens.
4. In the Select Name list, select the condition you want to delete.
5. Click OK.

5.4. Configuring the Weather

This section describes the individual weather conditions that you can set.

5.4.1. Setting the Wind Speed and Direction

You can set the wind speed and direction. If you do not specify the sea state manually, it is set based on the wind conditions. The maximum wind speed that you can set is 360 km/h.) The wind direction affects the angle at which precipitation falls.

To set wind speed and direction:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Conditions Settings page (Figure 5-4).

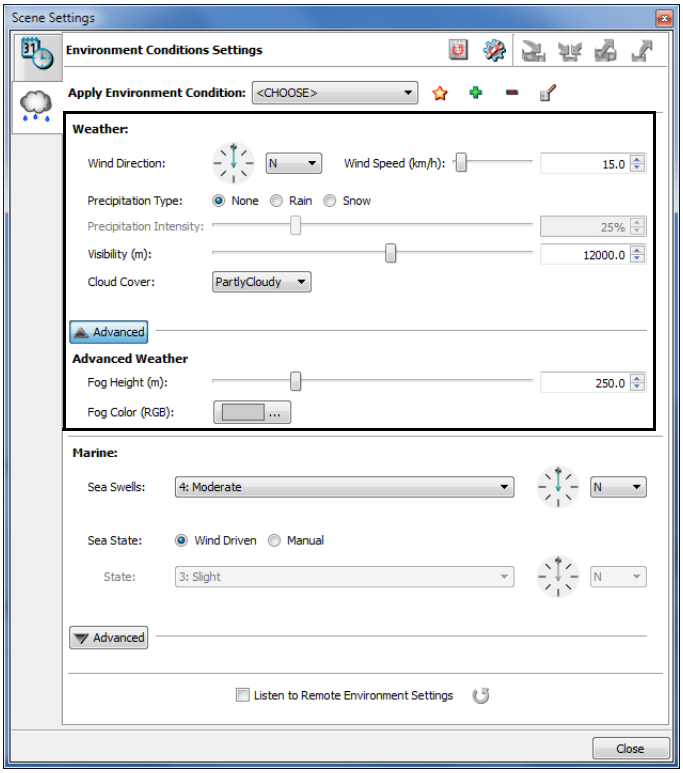


Figure 5-4. Environment Conditions Settings page

3. Drag the Wind Direction indicator to the desired compass point or select an option from the list.
4. Drag the Wind Speed slider or enter a value in the box.

5.4.2. Setting Visibility (Fog)

The visibility setting determines the denseness of the fog effect, which determines how far you can see.

To set visibility:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Conditions Settings page (Figure 5-4).
3. Adjust the Visibility slider or enter a value in the box.

Configuring Fog

You can set the fog height and color. The fog height affects how much sky the observer can see when looking up from ground level. For example, if you set the fog height to 50m and look up, you will see some amount of sky above you, and to the sides it will be very gray. If you then set it to 10m and look up, you will see mostly blue sky above you, but still quite a bit of gray to the sides.

To configure fog:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Conditions Settings page (Figure 5-4).
3. In the Weather section of the page, click Advanced. The dialog box expands to show options for fog.
4. To set the fog height, adjust the slider or enter a value in the box.
5. To set the fog color:
   a. Click the color swatch. A color picker dialog box opens.
   b. Select the color you want to apply to the fog. It is applied immediately, so you can easily see the effect of the new color and change it if you want to.
   c. Click OK.

5.4.3. Specifying Precipitation Type and Intensity

VR-Vantage supports display of rain and snow. You can configure the intensity of precipitation.

To specify the precipitation type and intensity:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Conditions Settings page (Figure 5-4).
3. Select a Precipitation Type. If you select rain or snow, the Precipitation Intensity setting becomes editable.
4. Adjust the Precipitation Intensity slider or enter a value in the box. The range is 0% through 100%.

5.4.4. Specifying Cloud Cover

VR-Vantage simulated varying amounts and types of cloud cover, from clear, to cloudy, to thunderstorm. When you choose an environment condition, it includes an appropriate degree of cloud cover. You can also change the cloud cover at any time.

To specify the cloud cover:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Conditions Settings page (Figure 5-4).
3. Select an option from the Cloud Cover list.

5.5. Configuring Marine Conditions

VR-Vantage supports a variety of dynamic ocean effects (Figure 5-5), including:

- Douglas Sea State. This includes wind waves (wind sea), swell character, and the directions of each. VR-Vantage allows each to be separately configured
- Wave chop.
- Surface transparency. The ability to see through the water from above sea level.
- Underwater visibility. The ability to see underwater.
- Swell.
- Surge depth.



Figure 5-5. Fishing boat

Enabling dynamic ocean effects can affect performance.

5.5.1. Enabling Marine Effects

Marine effects can reduce performance. Therefore, they are disabled by default.

➤ To enable marine effects, choose **Observer** → **Dynamic Ocean**, or click the Dynamic Ocean button ( ) on the Observer Settings toolbar.

5.5.2. Configuring Marine Conditions

The preconfigured environment conditions available on the Scene Settings page of the Scene Settings dialog box include marine conditions. You can also customize the marine settings at any time.

To configure marine effects:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Conditions Settings page (Figure 5-6).

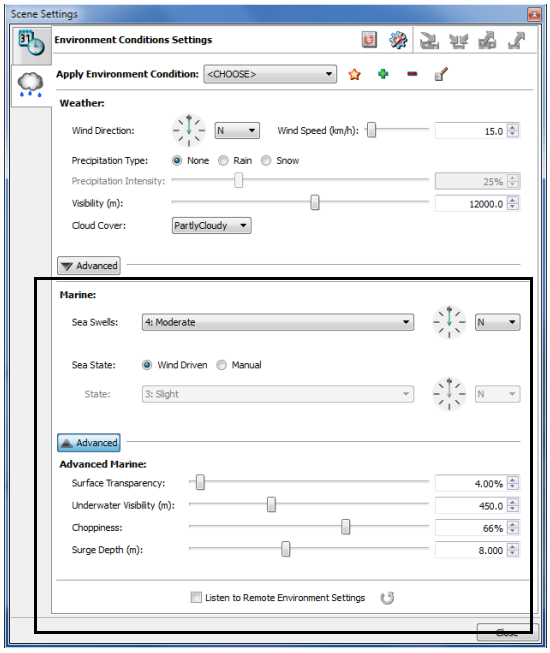


Figure 5-6. Marine Settings

3. Change settings as desired. The settings are described in Table 5-1.

Table 5-1: Advanced marine settings

Parameter	Description
Sea Swells	The amount of rise and fall of waves independent of wind. Choose from 10 fixed swell states. You can also set the compass direction from which swells originate.
Sea (wind) state	Determined by the wind direction and speed or set manually. If manual, one of the swell states for the Douglass sea state scale. You can also set the compass direction from which sea state originates.
Advanced Parameters	
Surface Transparency	The depth at which VR-Vantage begins to apply transparency to the water surface if the terrain has bathymetry or underwater polygons. This setting helps reduce Z-fighting along the shoreline. It does not mean that you can see some distance into the water when the observer is over deep water. The maximum value represents transparency to 500 meters.
Underwater visibility	The distance you can see underwater if the observer is underwater
Choppiness	The percentage of turbulence on the water.
Surge depth	When bathymetry data is present, this is the depth of the water at which full storm effects take place. As the water gets shallower, it gets calmer.

5.6. Displaying Screen Splash Effects

When it is raining, VR-Vantage can simulate raindrops hitting the oberver's camera lens. If the observer is close to the surface of the ocean (as if a periscope were being raised or lowered), VR-Vantage can simulate the effect of waves and water droplets splashing on the observer's camera (Figure 5-7).



Figure 5-7. Rain effect

To enable or disable screen splash effects:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 5-8).

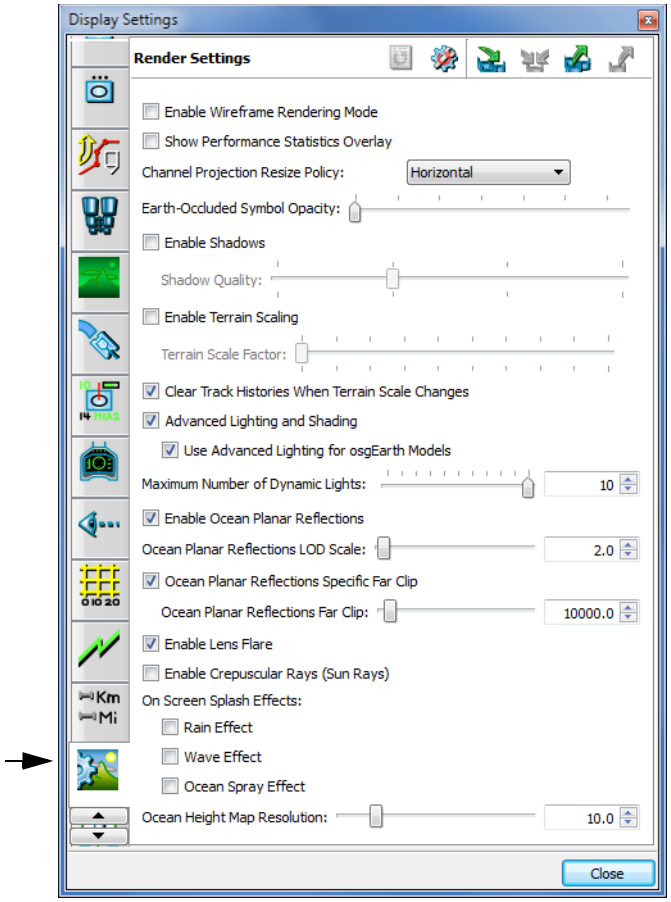


Figure 5-8. Render Settings page

3. Select or clear the Rain Effect, Wave Effect, or Ocean Spray effect check boxes.

5.7. Displaying Remote Environment Settings

The weather effects that you configure in VR-Vantage are just visual effects. They do not correspond to any weather effects in the simulation you are viewing, nor do entities in a simulation interact with them in any way. However, some simulation applications can simulate weather effects and these effects do affect entity behaviors, such as calculating line-of-sight. VR-Vantage can display weather effects generated by VR-Forces.

When this feature is enabled, the weather messages from VR-Forces override the settings in VR-Vantage for environment conditions and you cannot make any changes to them in VR-Vantage. If VR-Vantage does not receive any weather messages, it continues to use the environment conditions that were in effect when you enabled listening for remote environment settings.

To enable remote weather effects:

1. Choose **Settings** → **Scene**. The Scene Settings dialog box opens.
2. Select the Environment Condition Settings page (Figure 5-6).
3. Select the Listen to Remote Environment Settings check box.
4. Click the Refresh button ( ).

5.8. Disabling Lighting and Clouds

When you are using XR observer mode and you move the observer out from the terrain, the lighting and cloud effects can interfere with your ability to view entities. Therefore, VR-Vantage lets you quickly disable lighting effects and clouds. By default, they are enabled in Stealth observer mode and disabled in XR observer mode.

➤ To enable or disable lighting and clouds, choose **Observer** → **Sky**, or click the Show/Hide Sky button ( ) on the Observer Settings Toolbar.

6

The Observer and Observer Modes

This chapter explains how to create, edit, and change the observer mode. For details about moving the observer, please see Chapter 7, *Moving the Observer*. For details about attaching the observer to entities and props, please see Chapter 8, *Attaching the Observer*.

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Creating and Editing Observer Modes 6-2
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6.1. Changing the Observer Mode

When you change the observer mode, terrain may be displayed differently and the model sets used to display entities and objects may change. For descriptions of the observer modes, please see "Observer Modes," on page 4-7.

➤ To change the observer mode, choose **Observer** → **Set Observer Mode** → *mode*, or on the Observer Settings Toolbar (Figure 6-1), choose an option from the Observer Mode list.



Figure 6-1. Observer Settings Toolbar

6.2. Creating and Editing Observer Modes

VR-Vantage comes with 3D and 2D observer modes. (Table 4-1 lists the observer modes available for each VR-Vantage application.) They are configured with the display settings, key mappings, and model sets that users most commonly want to use. However, if they do not meet your needs, you can easily edit them or create new observer modes.

6.2.1. Creating an Observer Mode

To create an observer mode:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 6-2).

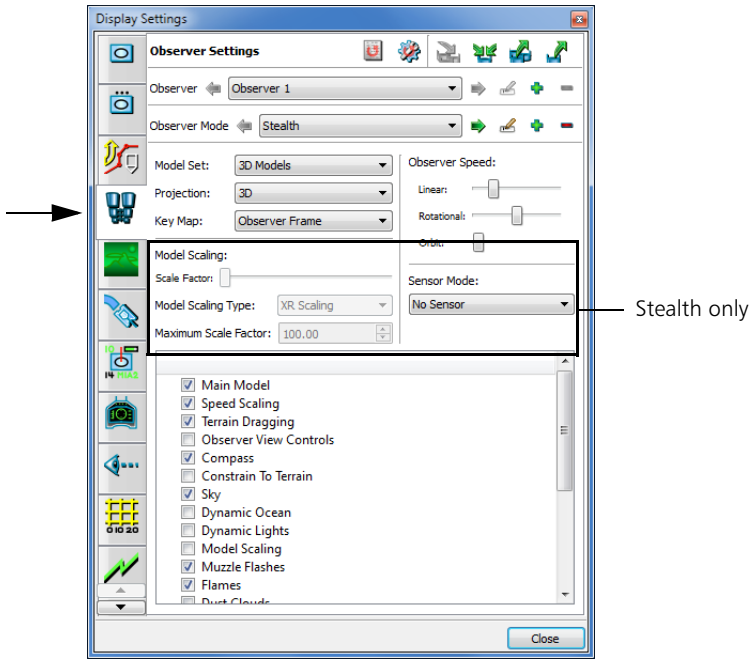


Figure 6-2. Observer Settings page

3. Click the Add button (+) to the right of the Observer Mode list. The Create New Observer Mode dialog box opens (Figure 6-3).

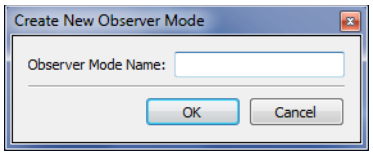


Figure 6-3. Create New Observer Mode dialog box

4. Type a name for the new observer mode.
5. Click OK.
6. In the Model Set list, select a model set. (VR-Vantage Stealth only.)
7. Select a projection (2D or 3D). (VR-Vantage Stealth only.)
8. Select the key map you want to use.
9. Enable or disable the mode-specific settings. The list of settings varies depending on the projection and model set, and application.

6.2.2. Deleting an Observer Mode

To delete an observer mode:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 6-2).
3. In the Observer Mode list, select the observer mode that you want to delete.
4. Click the Delete button ( ).

6.2.3. Editing an Observer Mode

To edit an observer mode:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 6-2).
3. In the Observer Mode list, select the observer mode that you want to edit.
4. Edit the attributes of the observer mode as desired.

6.2.4. Renaming an Observer Mode

To rename an observer mode:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 6-2).
3. In the Observer Mode list, select the observer mode that you want to rename.
4. Click the Rename button ( ). The Rename Observer Mode dialog box opens.
5. Type the new name.
6. Click OK.

6.3. Adding an Observer

You can add and remove observers. Having multiple observers lets you assign different observers to different windows or channels. Changing the position and orientation of the observer in one channel does not affect the view of a different observer in a different channel.



If you have multiple observers, the observer listed in the Observer Settings Toolbar is the observer assigned to the window that has focus. If you open the Display Engine Configuration Editor Panel and select a different observer in the Channel Attributes list, the data in relevant panels will change to reflect the values for the selected observer. However, as soon as you return focus to a window, the observer selection will change to match that of the window.

You can add observers in the Display Engine Configuration Editor Panel or on the Observer Settings page.

If you want to save your observers, save the display engine configuration in which you created them. (Saving an observer just saves its name. It does not save any information about a particular observer mode or location that you may have used for that observer. To save location information, save an observer view.)

6.3.1. Adding an Observer on the Observer Settings Page

To add an observer on the Observer Settings page:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 6-2).
3. Click the Add button () to the right of the Observer list. The Create New Observer dialog box opens.
4. Type a name for the new observer.
5. Click OK. The new observer is added to the list.
6. To save the observer, save the display configuration. (Saving the observer settings does not save observers.)

6.3.2. Adding an Observer in the Display Engine Configuration Editor

To add an observer on the Display Engine Configuration Editor Panel:

1. Choose **View** → **Display Engine Configuration Editor Panel**. The Display Engine Configuration Editor Panel opens (Figure 6-4).

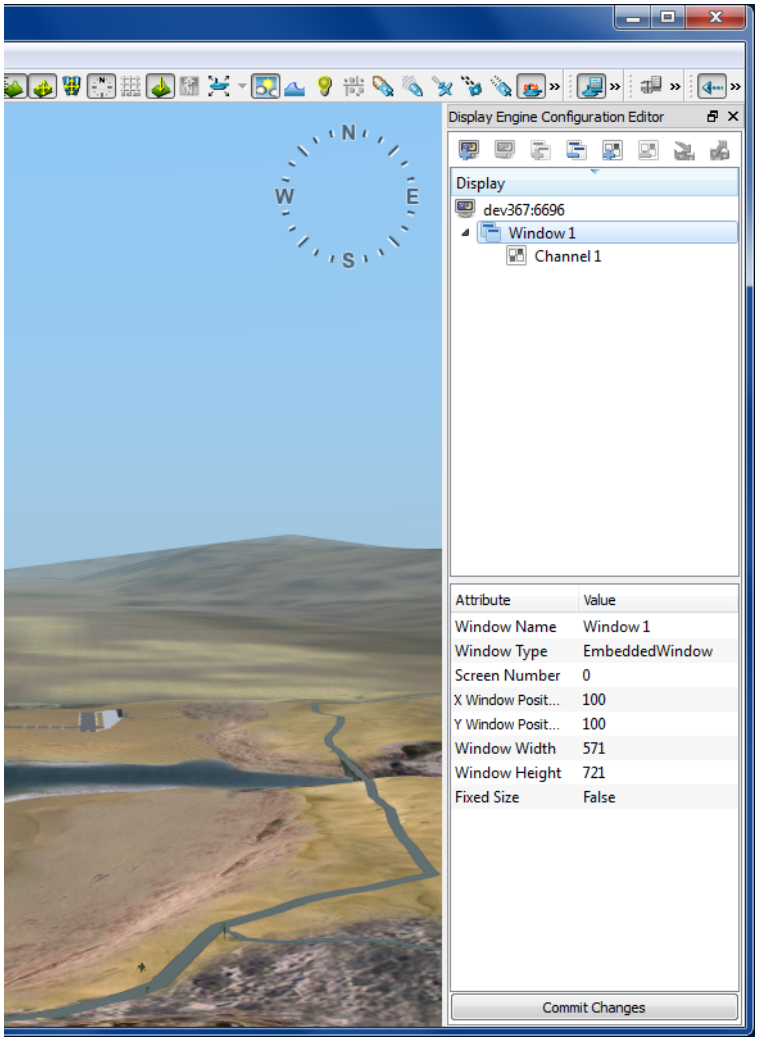


Figure 6-4. Display Engine Configuration Editor Panel

2. Select the channel on which you want to add an observer.
3. Click the Value field for the Observer Name attribute to make it editable.
4. In the list, select New (Figure 6-5).

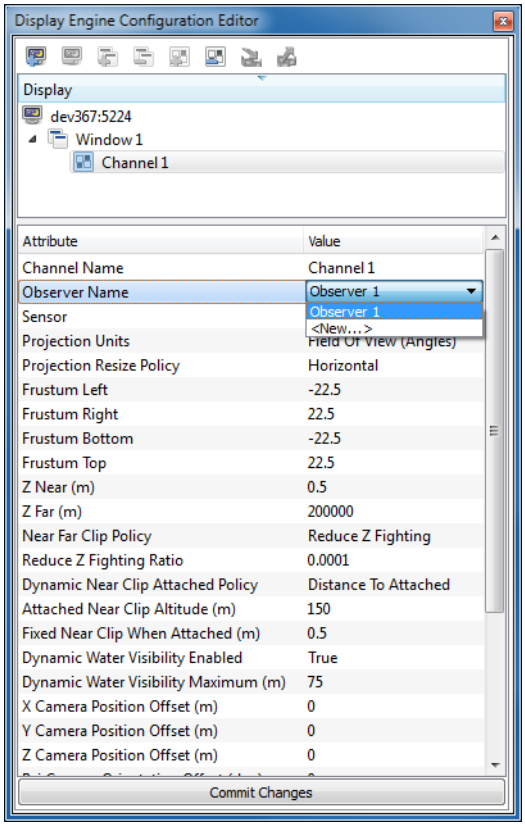


Figure 6-5. Observer Name attribute

5. Click Commit Changes. The Add Observer dialog box opens.
6. Type a name for the new observer.
7. Click OK. The new observer becomes the selected observer on the Observer Settings Toolbar, and is listed in the Observer Name attribute. (You may need to refresh the channel attributes before the observer name is listed.)
8. To save the observer, save the display configuration.

6.4. Removing an Observer

When you close VR-Vantage, all observers get removed. They are not saved unless you save a display configuration. You can also remove observers during a session.

To remove an observer:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 6-2).
3. In the Observer list, select the observer that you want to remove.
4. Click the Delete button (−). The observer is removed.
5. If the observer was saved as part of a display configuration, save the updated display configuration.

6.5. Communicating Information About the Observer

VR-Vantage can transmit state updates describing the observer's position and orientation, and can respond to view control messages sent by other applications.

6.5.1. Making the Observer Visible to Other Applications

By default, VR-Vantage sends state update messages to make its state information known to other applications. This makes it possible for a plan view display to represent VR-Vantage as an icon, or for one VR-Vantage application to synchronize its observer movement with that of another VR-Vantage application.

To enable or disable broadcasting of observer information:

1. Choose **Settings** → **Connection**. The Simulation Connections dialog box opens (Figure 6-6).

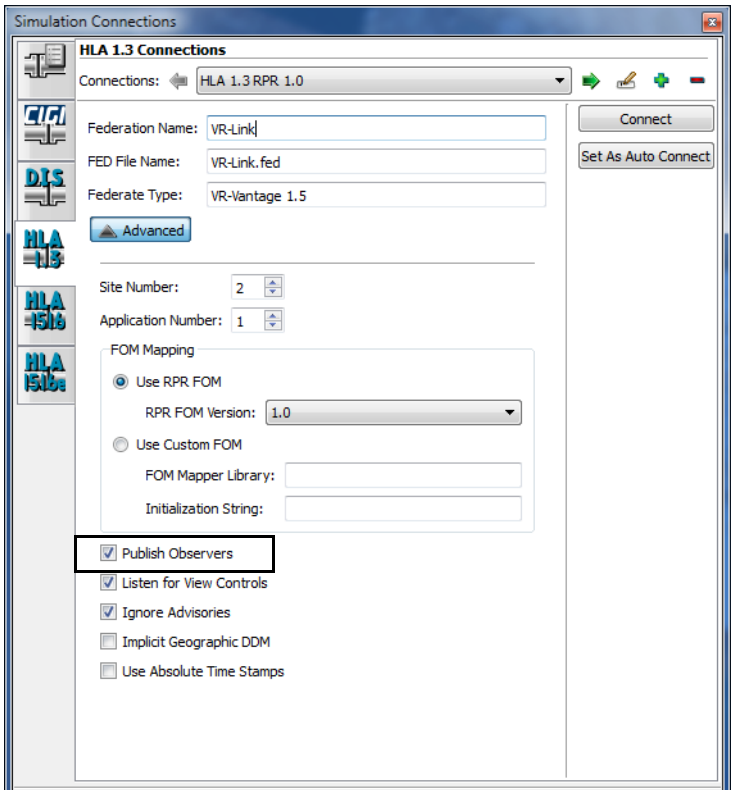


Figure 6-6. HLA 1.3 Connections page

2. Select the page for the connection that you want to configure.
3. Select or clear the Publish Observers check box.
4. Click Close.

Making the Observer Visible to Just One Application (DIS Only)

In DIS you can send observer information to just one other application, rather than to everyone in the exercise. To do this, on the DIS Connections page, instead of using a broadcast address, set the destination address to the address of a specific computer.

6.5.2. Viewing and Attaching to Other Observers

If an exercise includes other stealth applications, and they are sending state updates, VR-Vantage can detect them. A remote observer entity is listed in the object hierarchy, so you can attach the local observer to it just as you would attach to any other entity.

Observer icons are not normally visible in the VR-Vantage window, even when they appear in the entity list. If you want to display visual representations of remote observers, map a visual model to the observer's entity enumeration.

For related information, please see "Displaying Models for Remote Observers," on page 9-18.

7

Moving the Observer

This chapter explains how to move the observer (eyepoint) in the VR-Vantage window.

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7.1. Moving the Observer

When you view a simulation, you usually want to move the observer (eyepoint) to different locations to view the terrain and scene elements being simulated. In VR-Vantage, you can move the observer using the keyboard and the mouse. There are two basic contexts in which you can move the observer:

- You can move it independently of any scene element. This is called absolute, or free-fly mode.
- You can attach the observer to an entity, in which case it moves with the entity. (You can also attach the observer to a prop. For details about attaching the observer to an entity or prop, please see Chapter 8, *Attaching the Observer*.)

Absolute mode and the various attachment types are collectively called attach modes.

Regardless of which attach mode you are using, you can change the position and orientation of the observer. In the 3D projection, position is defined by X, Y, and Z coordinates that identify its location in the 3D world. Orientation describes the observer's yaw (heading), pitch, and roll (Figure 7-1).

In the 2D projection, the Z coordinate is fixed. You can change the X and Y coordinates. You can change the observer's yaw, but pitch and roll are fixed.

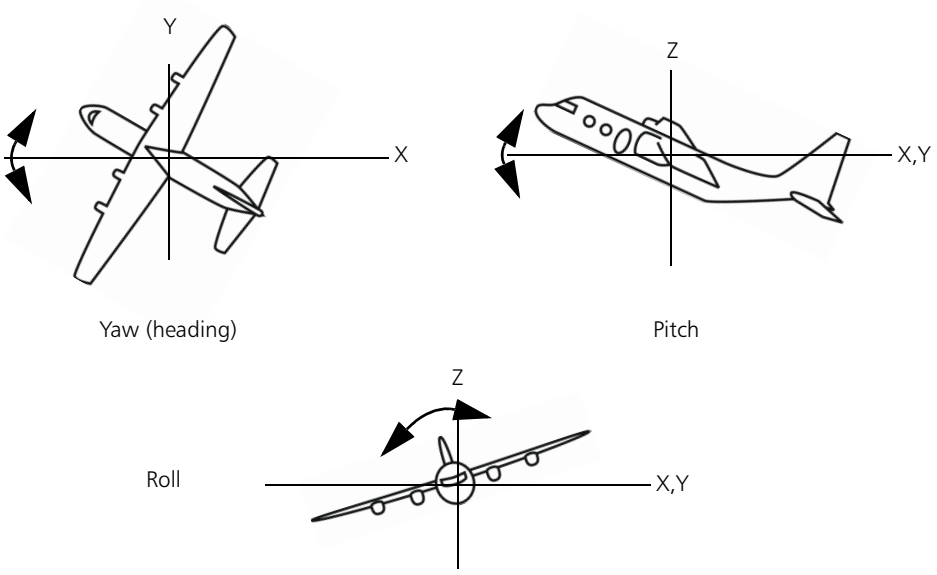


Figure 7-1. Orientation

7.1.1. Using the Compass to View the Observer's Heading

VR-Vantage can display a compass that always shows the heading of the observer. The compass is an observer mode setting. In Figure 7-2, the observer's heading is approximately Northwest.

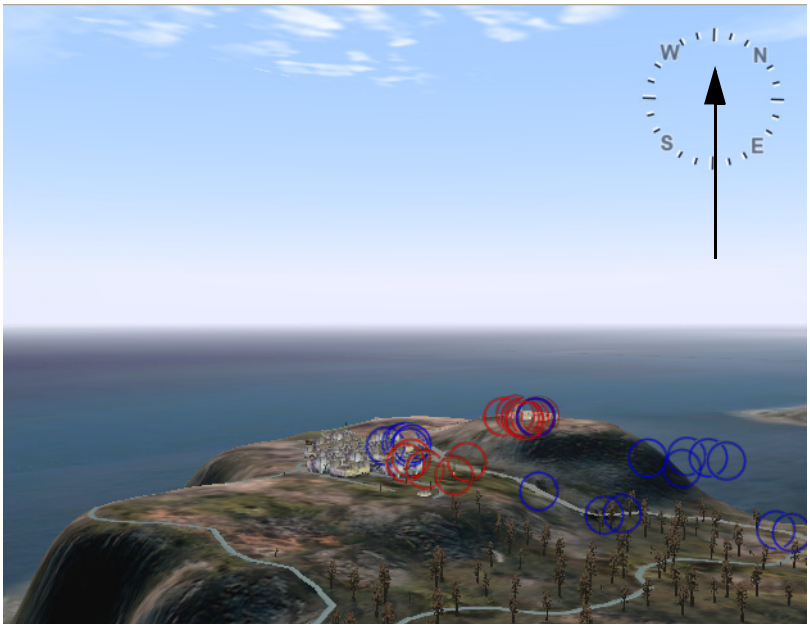


Figure 7-2. Compass

To enable or disable the compass:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 6-2).
3. Select the observer mode for which you want to change the compass setting.
4. In the list of observer settings, select or clear Compass.



You can also enable or disable the compass by choosing **Observer** → **Compass** or clicking the Compass button () on the Observer Settings Toolbar.

7.1.2. Editing the Compass's Attributes

You can configure the compass by editing its schema (ChannelCompass) and model definition (smallCompass and largeCompass). (For details about editing schemas, please see Section 6.1, "Creating and Editing Schemas," in *VR-Vantage Configuration Guide*.)

By default, all channels have the largeCompass keyword. To change the style of compass used for a channel, change the keyword in the Keywords attribute for the channel. To completely remove the compass, delete the keyword. For details about setting channel attributes, please see Section 1.3, "Changing a Channel's Attributes," in *VR-Vantage Configuration Guide*.

You can change where the compass is displayed in the window by editing the location attribute. The permissible values are top, topRight, right, bottomRight, bottom, bottomLeft, left, and topLeft.

You can change the color of the compass by editing the darkTickColor and lightTick-Color attributes. The color is defined using the OpenGL scheme for specifying RGBA. The first three values are the RGB color values. The fourth value specifies opacity. Each value can be from 0.0 through 1.0.

7.2. Observer Movement Functions and Keyboard Mappings

When you move the observer, you are executing observer movement functions. An observer movement function is a specific way that the observer can move, such as Move Observer Forward or Move Level Observer Forward. (These functions both move the observer forward, but they use different observer coordinate systems. Observer movement coordinate systems are described in "3D Observer Movement Coordinate Systems," on page 7-6.)

The various movement functions are mapped to the keys on the keyboard and to mouse buttons and the mouse wheel. If you use the default key mappings for the default observer modes, then most of the time, the observer will behave exactly as you would expect it to. However for some types of movement, such as forward and back, the observer can move differently depending on the projection, the observer coordinate system, or the attach mode. Therefore, VR-Vantage provides several key mappings that let you choose which type of observer movement to use. You can change these key mappings and create your own key mappings. (For details about editing key maps, please see Chapter 13, *Creating and Editing Key Mappings*, in *VR-Vantage Configuration Guide*.) This section describes how observer movement can vary based on the observer coordinate system and the attach mode.

7.2.1. 3D Observer Movement Coordinate Systems

In the 3D projection, the observer moves in the context of one of the following coordinate systems:

- Level Observer Coordinates: Movement is with respect to the terrain. The level observer coordinate system is defined by the current up vector (Z), and a plane normal to that vector into which the observer's X and Y axes are projected. (Essentially, this means that the observer's heading is used while its pitch and roll are considered to be 0.0.)



Movement is always with respect to a plane tangent to the earth's surface. However, in a projected terrain database, such as UTM, Lambert Conformal Conic, or flat earth, the plane is fixed, whereas in a geocentric terrain database the up vector (and hence the tangent plan) changes as the observer's position changes, so movement follows the curvature of the earth.

- Observer Coordinates: Movement is with respect to the observer's body coordinate system.
- Entity Level Body Frame Coordinates: Movement is with respect to an entity's body frame, but ignores pitch and roll.
- Entity Body Frame Coordinates: Movement is with respect to an entity's body frame, including pitch and roll.

The practical difference between observer coordinates and level observer coordinates is that in level observer coordinates, if you are looking down at the terrain, when you move forward and backward, you fly over the terrain, looking down. In observer coordinates, when you move forward and backward, you move down towards the terrain or away from it at whatever angle you are oriented towards it.

7.2.2. 2D Observer Coordinate System

When you use the 2D projection (VR-Vantage Stealth and PVD), the observer uses a variation of level observer coordinates. Movement is restricted to two dimensions, so there are no movement functions for changing the altitude, pitch, or roll. You can zoom in and out in the 2D projection, but this does not change the observer's altitude, it changes the field of view and resolution of the terrain image.

7.2.3. The Attached Context and Observer Movement (3D Only)

The key maps control navigation using a particular coordinate system (observer frame or level observer frame). They also support navigation in alternate coordinate systems. The alternate system varies depending on the attached context of the observer. It represents MÄK's opinion of which alternate coordinate system would be most useful given the attach mode that the observer is using.

The Move Attached Context *direction* (forward, back, up, down, left, right) functions move the observer in the context of its attach mode. Movement is modified by attach modes in the following ways:

- Follow mode: movement is in the entity's level body frame.
- Track mode: movement is in the entity's level body frame.
- Mimic mode: movement is in the entity's body frame.
- Tether mode: movement is in level observer frame.
- Unattached: movement is in level observer coordinates.

Figure 7-3 and Figure 7-4 illustrate the differences between moving the observer in an attached context and without an attached context.

Figure 7-3 illustrates movement in entity level body coordinates (Follow and Track modes). The Move Observer Left function (**`A`** in Observer Frame key map) moves the observer to the left in observer coordinates, that is left relative to the observer's heading. The Move Attached Context Left function (**`Shift`** + **`A`**) moves the observer left in the attached context. In entity level body frame, this means the observer moves left relative to the entity's heading.

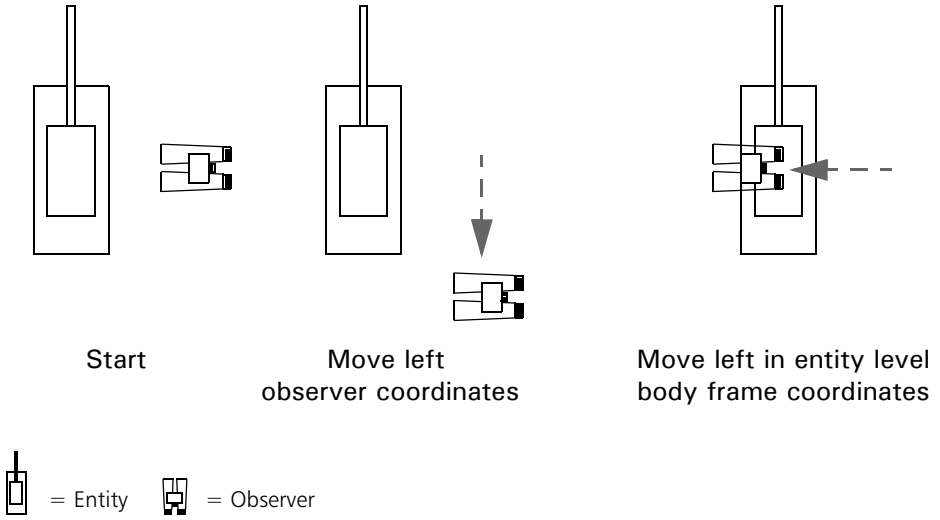


Figure 7-3. Observer movement in entity level body frame coordinates

Figure 7-4 illustrates movement in entity body frame (Mimic mode). The Move Observer Left function moves the observer to the left in observer coordinates, that is left relative to the observer's heading, but ignoring pitch and roll. The Move Attached Context Left function moves the observer left in the attached context. In entity body frame, this means the observer moves left relative to the entity's heading and its pitch and roll.

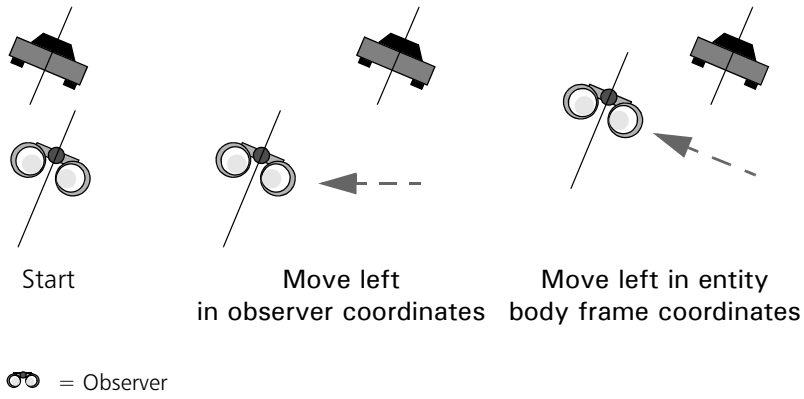


Figure 7-4. Movement in entity body frame coordinates

7.3. Moving the Observer from the Keyboard in the 3D Projection

VR-Vantage maps the observer movement functions to the keyboard using key maps that support the most typical ways that users want to move through the 3D world, either in absolute mode or attached to an entity.

! References to movement key combinations use the key mappings provided with VR-Vantage. If you change these key mappings, the instructions may no longer be valid.

As described in "Moving the Observer," on page 7-3, the observer typically moves with respect to the terrain in level observer coordinates or observer coordinates. The corresponding key maps are Level Observer Frame and Observer Frame.

Figure 7-5 illustrates the positional movement keys. Figure 7-6 illustrates the keypad layout for changing orientation and movement speed. For a complete list of movement functions and their keyboard and mouse mappings, please see *VR-Vantage Quick Reference Card* or the Key Mapping Editor.

! To use the keypad for navigation, NumLock must be on.



Figure 7-5. Primary movement keys, observer coordinates (3D)

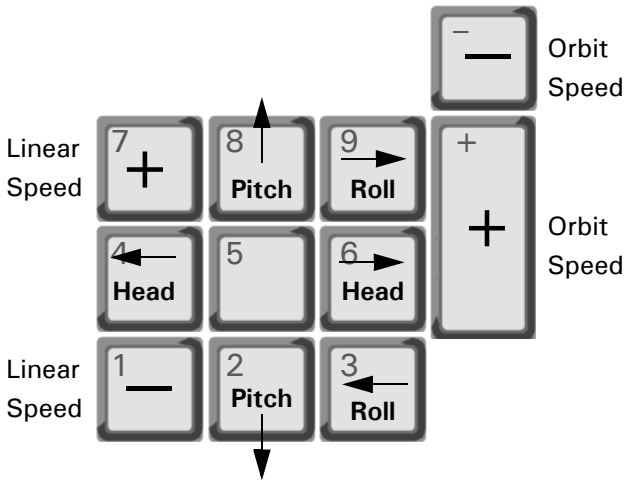


Figure 7-6. Keypad layout, heading, pitch, and roll (3D)

If your keyboard does not have a keypad, as on most laptops, the Laptop key map lets you use the arrow keys to control the left, right, up, and down movement mapped to 4, 6, 8, and 2 on keypads.

➤ To move the observer, press a key combination and hold it for as long as you want the observer to keep moving.

You can press more than one key at a time to combine movement functions. For example, pressing the move forward and move left keys at the same time moves the observer diagonally left and forward.

7.3.1. Navigation Options

This section lists the different ways that you can move the observer using the keyboard. For a complete list of movement functions and their keyboard and mouse mappings, please see *VR-Vantage Quick Reference Card*. You can:

- Move forward and backward (observer, level observer, entity, level entity, and attached context coordinates).
- Move up and down (observer, level observer, entity, level entity, and attached context coordinates).
- Move left and right (observer, level observer, entity, level entity, and attached context coordinates).
- Rotate (heading) left and right (observer and level observer coordinates).
- Rotate (pitch) up and down (observer and level observer coordinates).
- Rotate (roll) left and right (observer and level observer coordinates).
- Orbit left and right.
- Orbit up and down.
- Look (move camera) left and right.
- Look (move camera) up and down.
- Tilt (move camera) left and right.
- Reset the observer to the default position and orientation for the attached mode.
- Reset the camera to the default position and orientation.
- Zoom the view.

For details about orbiting, please see "Orbiting," on page 7-12. For details about moving the camera, please see "Moving the Camera," on page 7-12.



When you view a geocentric terrain and move the observer more than 6 million meters away from the earth's surface, the view is forced to focus toward the center of the earth. The practical effect of this mode is that the left and right movement keys orbit the eyepoint around the earth, rather than moving the entire earth to the left or right.

7.3.2. Orbiting

You can orbit the observer (revolve left, right, up, and down) around an attached object or the point on the terrain that is at the center of the window. (If the center of the screen is in the sky, orbit does not work.) When you orbit, the observer's heading continuously changes so that it always faces the point or object around which it orbits. You can change the camera to look at something other than the orbit point while you are orbiting.

To orbit around an object:

1. Attach the observer to the object.
2. Press the right or left arrow keys.

To orbit around a point:

1. If you are attached to an entity, detach (press **`z`**).
2. Press the right or left arrow keys.

7.3.3. Moving the Camera

By default, the observer always looks in the same direction as its heading. However, just as the turret on a tank can swivel and fire in directions other than its body's heading, the observer can look in a direction other than its heading. The ability to look around is enabled in the camera. You can move the observer's camera up, down, left, right, tilt left, and tilt right. (The default key mappings are **`Ctrl`** + *Keypad number*, where *number* is 2, 3, 4, 6, 8, or 9.)

To use the keypad for navigation, **`NumLock`** must be on.



You can tell that the camera is moving, but the heading is not by observing the compass. If you change the heading, the view of the terrain changes and the compass moves. If you move the camera, but keep the heading static, the view of the terrain changes, but the compass does not move.

➤ To move the camera, press the keys mapped to the camera movement functions.

7.4. Moving the Observer Using the Mouse (3D Projection)

You can change the observer's position and orientation with the mouse. (To see the full list of mouse mappings, view the Mouse Mappings page on the Application Settings dialog box.)

Using the mouse, you can:

- Drag the terrain.
- Drag the view.
- Orbit the terrain.
- Change orientation.
- Teleport (jump).

7.4.1. Dragging the Terrain

Dragging the terrain combines the move forward, backward, left, and right functions.

To drag the terrain:

1. Click a point on the terrain and hold down the left mouse button.
2. Drag the mouse left, right, forward, and backward.



Dragging the terrain is most effective when you are moving large distances, such as several kilometers. To move small distances, use the keyboard.

Disabling Terrain Dragging

There may be times when you want to disable terrain dragging.

➤ To disable terrain dragging, on the Observer Control Panel, clear the Allow Terrain Dragging check box (Figure 7-7).

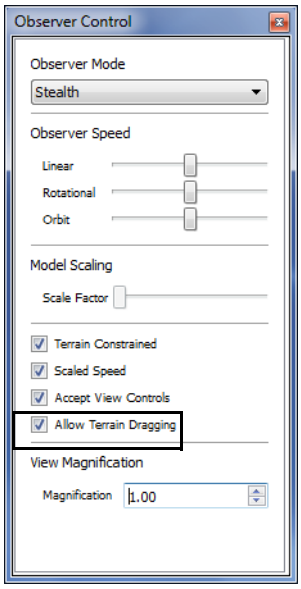


Figure 7-7. Observer Control Panel

7.4.2. Changing the Observer's Orientation with the Mouse

➤ To change the observer's orientation, hold down the right mouse button and drag the mouse. The observer rotates in the direction you drag the mouse.

7.4.3. Dragging the View

Dragging the view combines the observer up, down, left, and right movement functions. Unlike dragging the terrain, which requires you to click a point on the terrain, you can drag the view from any observer location.

➤ To drag the view, hold down the middle mouse button (or wheel) and drag the mouse.

7.4.4. Orbiting the Terrain with the Mouse

➤ To orbit the terrain with the mouse, press **`Ctrl`** and drag the mouse.

7.4.5. Teleporting the Observer

You can teleport the observer to an entity, a prop, or a place on the terrain. Teleporting moves the observer 90% of the way from its current position to the location or object clicked on.

To teleport the observer:

- **`Shift`**+click on the terrain or prop that you want to jump to.
- **`Ctrl`**+**`Shift`**+click on the entity that you want to jump to.

7.5. Moving the Observer in the 2D Projection

In the 2D projection, you move the observer using the mouse and keyboard just as you do in the 3D projection. Many of the key and button mappings for the 2D projection are the same as those in the 3D projection. However, the 2D mappings do not support movement that is not meaningful in two dimensions, such as up and down (altitude), pitch, and roll.



When Orient North is enabled, you cannot change the heading of the observer. For information about Orient North, please see "Forcing Orientation North (Plan ViewMode Only)," on page 7-19.

7.5.1. Moving the Observer from the Keyboard in the 2D Projection

Figure 7-8 illustrates the positional movement keys for the 2D projection. Figure 7-9 illustrates the keypad layout for changing heading and movement speed. For a complete list of movement functions and their keyboard and mouse mappings, please see *VR-Vantage Quick Reference Card*.

! To use the keypad for navigation, NumLock must be on.



Figure 7-8. Primary movement keys, observer coordinates (2D)

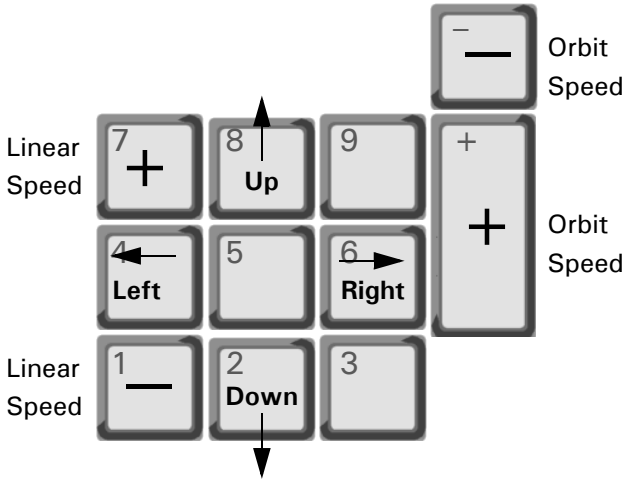


Figure 7-9. Keypad layout, heading, pitch, and roll (2D)

7.5.2. Moving the Observer Using the Mouse in the 2D Projection

You can change the observer's position and heading with the mouse. You can change the observer's position by dragging the terrain, as described in "Dragging the Terrain," on page 7-13. You can change heading by orbiting, as described in the next section. (To see the full list of mouse mappings, view the Mouse Mappings page on the Application Settings dialog box.)

Orbiting the Terrain with the Mouse

When Orient North is enabled, you cannot orbit. For information about Orient North, please see "Forcing Orientation North (Plan ViewMode Only)," on page 7-19.

➤ To orbit the terrain with the mouse, press the right mouse button and drag the mouse.

7.6. Zooming the Observer

You can zoom the observer in the 3D and 2D projections. Although the apparent effect is similar for top-down views, they are conceptually and behaviorally different.

7.6.1. Zooming the Observer in the 3D Projection

If you want to see something at a higher level of detail without moving the observer, you can zoom the observer view. Zooming the observer narrows the field of view and magnifies objects in the view. The magnification level is saved in saved views. 3D zoom has the following characteristics:

- When you zoom the observer view, its movement and mouse look speeds are decreased as the magnification increases, to allow for increased control.
- When you switch between 3D and 2D (Stealth only), VR-Vantage calculates a 2D zoom level to match the 3D view. If you then switch back to 3D, it remembers the observer location and zoom level.
- If you zoom in from a very high altitude there may be scene corruption due to insufficient precision in the z-buffer. This can be limited by moving the observer closer to the subject before zooming in. This issue is typically only encountered above 10,000 meters.
- When you zoom, VR-Vantage respects the environmental conditions at the observer's location. For example, if the observer is above the cloud layer, zooming does not let you see below the clouds. Or, if it is raining at the observer's location, the visibility will not improve as you zoom in on a distant object.

- After zooming in, when you zoom out, you can only zoom out to the 0 magnification level. That is, you can only zoom out back to the observer's location. If you want to see more of the terrain, you must move the observer to a greater distance from the terrain.
- Some terrains are not designed to be viewed at higher magnification. Performance may decrease if magnification increases the level of detail of large areas of the terrain. For example, suppose you are looking down a line of trees that is in the center of the view. At the normal magnification level there are a certain number of trees at each quality level, say 10 high, 20 medium, and 100 low (for a total of 130 trees). Suppose also that performance will be acceptable only when visualizing 15 or fewer high quality trees. If you magnify the scene 2x, you may now see 20 high, 40 medium, and 70 low quality trees. You see the same number of trees, but the performance will decrease because you are visualizing more high quality models.

➤ To zoom in, press the **=** key, press **Ctrl** and scroll the mouse wheel forward, or on the Observer Control Panel specify a value in the Magnification box.

➤ To zoom out, press the **–** (dash) key, press **Ctrl** and scroll the mouse wheel backward, or on the Observer Control Panel specify a value in the Magnification box.

---

i Each press of the **=** or **–** key, or increment of the mouse wheel, increases or decreases magnification by a factor of 1.25.

➤ To reset magnification to 1.0, press zero (**0**) or press the middle mouse button.

7.6.2. Zooming the Observer in the 2D Projection

In the 2D projection you can zoom the observer view closer to and away from the terrain. However, unlike in 3D, in which you cannot zoom out past the location of the observer, there is essentially no limit on zooming in and out because in 2D, the observer does not actually have altitude.

➤ To zoom in, press **e**, scroll the mouse wheel forward, or to step the zoom, press the **=** key.

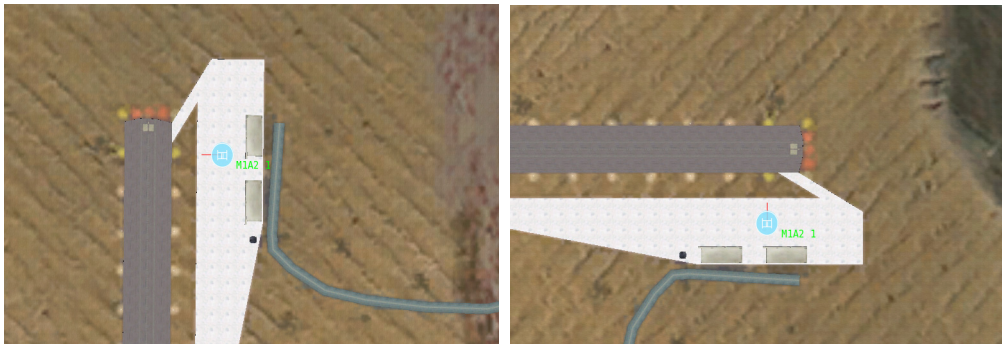
➤ To zoom out, press **q**, scroll the mouse wheel backward, or to step the zoom, press the **–** (dash) key.

➤ To reset the observer to the default zoom level, press the **Space bar**.

7.7. Forcing Orientation North (Plan ViewMode Only)

When you are in Plan View observer mode (VR-Vantage Stealth and VR-Vantage PVD only), by default the observer's heading is forced to stay North (up), regardless of the heading of the entity to which it is attached. You can disable this setting, in which case if you attach to an entity, the view of the terrain rotates to match the heading of the attached entity.

Figure 7-10 illustrates the view when the observer is attached to an entity with orientation forced to North or matched to that of the entity.



Orient North Orient to entity heading

Figure 7-10. Forcing orientation North

To enable or disable a northward orientation:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 10-5).
3. In the Observer Mode list, select Plan View.
4. In the list of observer settings, select or clear Orient North.



You can also enable or disable northward orientation by choosing **Observer** → **Orient North** or clicking the Orient North button ( ) on the Observer Settings Toolbar.

7.8. Enabling and Disabling View Constraints (3D Only)

View constraints control how the observer behaves when it approaches solid objects in the view, such as the ground, buildings, and vegetation. When constraints are enabled, the observer has a 1 meter bounding sphere that prevents it from moving through terrain or props.



If view constraints are enabled, you may not be able to move the observer into buildings to view entities. Changing the near clipping plane or transparency will let you see through walls, but in constrained mode, you will still not be able to move the observer through the walls.

To enable or disable view constraints, use one of the following methods:

- Press **/** (slash).
- Choose **Observer** → **Constrain to Terrain**.
- On the Observer Control Panel (Figure 7-11), select or clear the Terrain Constrained check box.
- Click the Constrain to Terrain button () on the Observer Settings Toolbar.

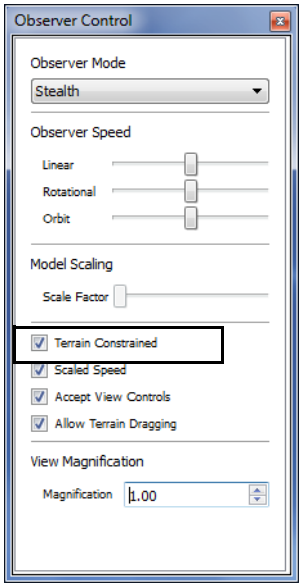


Figure 7-11. Observer Control Panel

7.9. Controlling Navigation Speed

When you navigate through the terrain, there are times you want to move quickly, covering large amounts of terrain, and times you want to move slowly, such as when you are moving down a street or within a building. VR-Vantage has the following options for controlling navigation speed:

- Set the navigation speed manually. The observer always moves at the specified speed.
- Use speed scaling to automatically move at different speeds under different circumstances. You can change the rate at which speed is scaled.

In either case, the controls for changing speed are the same. Their effect varies depending on whether or not speed scaling is enabled.

7.9.1. Enabling or Disabling Speed Scaling

When speed scaling is enabled, VR-Vantage makes the following assumptions:

- If the observer is unattached, the higher above the terrain it is, the faster you want to move.
- The closer you are to an attached object, the more slowly you want to move.

To enable or disable speed scaling, use any of the following methods:

- On the Observer Control Panel (Figure 7-11), select or clear the Scaled Speed check box.
- Choose **Observer** → **Speed Scaling**.
- Press the multiply key (*) (not the asterisk key).
- Click the Speed Scaling button () on the Observer Settings Toolbar.

7.9.2. Changing the Observer's Movement Speed

You can change the observer's linear, rotational, and orbital speed. If speed scaling is enabled, these controls change the speed gain. If speed scaling is disabled, the controls change the absolute speed.

To change the observer's speed, use any of the following methods:

- Adjust one of the Observer Speed sliders on the Observer Control Panel (Figure 7-11) or on the Observer Settings page on the Display Settings dialog box. The default (center of the slider) is 1. The range is 0.1 to 10.
- Press one of the following keys to change linear speed:
  - **`Keypad 7`** (faster) or **`1`** (slower).
  - **`Ctrl`** + mouse wheel forward or back.
  - Movement key + mouse wheel forward or back.
- Press **`Keypad +`** (faster) or **`-`** (slower) to change orbital speed.



When you change the observer's speed using the keyboard or mouse, if the Observer Control Panel or the Observer Settings page is open, you can see the scale slider moving to the new setting.

7.10. Saving and Recalling Views

At any given moment, the state of the observer is called its view. You can capture views so that you can quickly return to them and you can save them for later use.

If the observer is not attached to an entity, its view is its position and orientation in the simulated environment. If the observer is attached to an entity, a view saves the following information:

- Attach mode.
- Positional offset.
- Marking text.



When you save a view in the 2D projection, the X and Y values are saved. The zoom level is not saved.

Saved views are managed in the Observer Views Panel (Figure 7-12).

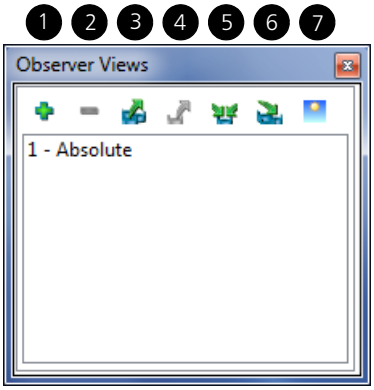


Figure 7-12. Observer Views Panel

Its buttons (as indicated by the callouts) have the following meanings:

- Save the current view (1).
- Delete the selected view (2).
- Save all views to a file (3).
- Save the selected view to a file (4).
- Load a saved views file and append it to the list (5).
- Load a saved views file and replace the current list (6).
- Clear the list (7).



Saved views are keyed to the marking text of the object to which the observer is attached.

To save the current view:

1. Choose **View** → **Observer Views Panel**. The Observer Views Panel opens (Figure 7-12).
2. Click the Add button (). The current view is added to the list.

> Views are remembered only while VR-Vantage remains running. To save a view for future use, you must save it to a file. Please see "Saving Views to a File," on page 7-24.

7.10.1. Recalling a View

➤ To recall a view, select it in the Observer Views Panel. The view changes immediately.

7.10.2. Deleting Views

To delete a view:

1. In the Observer Views Panel, select the view you want to delete.
2. Click the Delete button ().

Clearing the View List

➤ To remove all views from the list, in the Observer Views Panel, click the Clear List button ().

7.10.3. Saving Views to a File

You can save views to a file and load them at a later time. You can save an individual view or all of the views in the list.

The default location for saved views is *./appData/settings/application*, where *application* is the name of the VR-Vantage application.

To save the selected view to a file:

1. In the Observer Views Panel, click the Save Individual View button (). The Save Selected Observer dialog box opens.
2. Select the file to which you want to save the view, or type the name of a new file.
3. Click OK.

To save all views to a file:

1. In the Observer Views Panel, click the Save All Views button ( ). The Save Observer Views dialog box opens.
2. Select the file to which you want to save the views, or type the name of a new file.
3. Click OK.

7.10.4. Loading Views

You can load saved views and append them to the list in the Observer Views Panel, or you can replace the list in the panel with the saved views.

To load views and append them to the list of views:

1. In the Observer Views Panel (Figure 7-12), click the Load Views and Merge button ( ). The Open Observer Views dialog box opens.
2. Select the saved views file that you want to load.
3. Click OK.

To load views and replace the list of views:

1. In the Observer Views Panel, click the Load Views and Replace button ( ). The Open Observer Views dialog box opens.
2. Select the saved views file that you want to load.
3. Click OK.

7.11. Controlling the Observer from Other Applications

VR-Vantage can respond to view control messages sent by applications such as the MÄK Logger. You can also write VR-Link-based applications to send view control messages to VR-Vantage using the classes in the VR-Vantage Control Toolkit. You can use view control messages to:

- Specify the attach mode and attached entity.
- Set the observer's position and orientation.

Acceptance of view control messages is an observer mode setting. Some view controls are for global settings (that are not affected by observer modes), such as enabling or disabling wireframe mode. However, if an observer mode disables view controls, all view controls are disabled, including those for global settings.



The view control PDUs are experimental, and are not an official part of DIS. They are of PDU kind 202.

Some legacy applications were created with the Stealth Control Toolkit. The Stealth Control Toolkit is no longer distributed with VR-Vantage. It has been replaced with the VR-Vantage Control Toolkit. VR-Vantage responds to move, absolute, tether, mimic, track, tether track, mimic track, follow, orbit, and compass Stealth Control PDUs. It does not support the other PDUs in the Stealth Control Toolkit.

7.11.1. Enabling the Processing of View Control Messages

To enable or disable the processing of view control messages, use one of the following methods:

- On the Observer Control Panel (Figure 7-11), select or clear Accept View Controls.
- On the Connections page for the connector you are using, select or clear Listen for View Controls.
- Choose **Observer** → **Observer View Controls**, or click the View Control button () on the Observer Settings Toolbar.

8

Attaching the Observer

This chapter describes attachment modes and how to attach the observer to entities and props.

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  - Attaching the Observer in Mimic Track or Tether Track Mode 8-4
  - Filtering the Object Attachment List 8-4
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  - Observer Attachment Tutorial 8-15
  - Binding Multiple Observers Tutorial 8-16

8.1. Attaching the Observer to an Entity or Prop

You can attach the observer to an entity and follow it as it moves through the simulation. You can also attach the observer to props.



This procedure applies to Follow, Tether, Track, Mimic, and Space Follow modes. To attach in Tether Track or Mimic Track mode, please see "Attaching the Observer in Mimic Track or Tether Track Mode," on page 8-4.

To attach the observer to an entity or prop, do one of the following:

- Right-click an object in the Objects List Panel (Figure 8-1) or on the terrain and select **Attach** *mode*, where *mode* is one of the supported attach modes. (For details about attach modes, please see "Attach Modes in the 3D Projection," on page 8-5 and "Attach Modes in the 2D Projection," on page 8-13.)

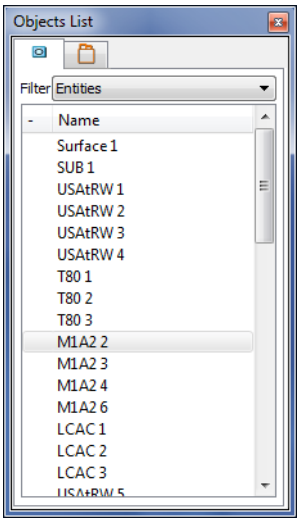


Figure 8-1. Objects List Panel

- Select an entity or prop. (For details about selecting entities and props, please see "Selecting Entities," on page 9-2 and "Selecting Props," on page 1-11.) On the Attachments Panel (Figure 8-2), click the Attach button () to attach with the current attachment mode.
- On the Attachments Panel, click the next or previous arrows to attach to the next (or previous) object in the object list.

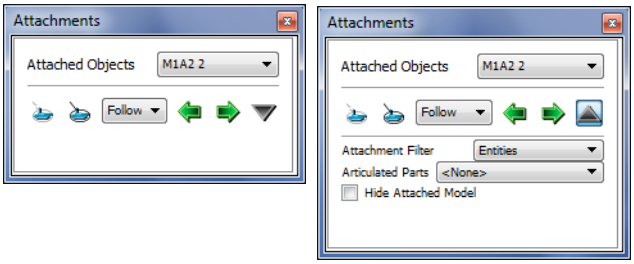


Figure 8-2. Attachments Panel



Figure 8-3. Attach Object Toolbar

- Press greater than (**>**) to attach to the next entity or prop in the object list without regard to the attachment filter. Press less than (**<**) to attach to the previous object. (For details about the attachment filter, please see "Filtering the Object Attachment List," on page 8-4.)
- Press period (**.**) to attach to the next entity or prop allowed by the attachment filter. Press comma (**,**) to attach to the previous object.



- When you select the next or previous object, VR-Vantage chooses next and previous based on the order in which the objects were discovered. This may or may not represent the order in which they are listed in the Objects List Panel.
- When you move the attachment from one object to the next, VR-Vantage preserves whatever changes you have made to the observer's view relative to the attached object. So if, for example, you moved the observer so that it is not looking at the attached object, when you attach to the next entity, the observer will not be looking at this object. It will be in the same relative position to the object that you previously established. To quickly return to the default offset for the attachment mode, press the **Space bar**.

8.1.1. Attaching to an Articulated Part

You can attach the observer to an articulated part on an entity, such as a turret. When you attach to an articulated part, the observer moves with the articulated part instead of the main body of the entity.

To attach to an articulated part:

1. Attach the observer to an entity, as described in "Attaching the Observer to an Entity or Prop," on page 8-2.
2. On the Attachments Panel (Figure 8-2), click the down arrow. The Attachments Panel expands.
3. In the Articulated Parts list, select the part to which you want to attach the observer.

8.1.2. Attaching the Observer in Mimic Track or Tether Track Mode

To attach the observer in Tether Track and Mimic Track modes, you must specify a primary attached entity and a secondary entity (the tracked entity).

To attach the observer in Mimic Track mode or Tether Track mode:

1. Right-click the primary entity in the Objects List Panel or in the window. A popup menu is displayed.
2. Choose **Attach Mimic Track** or **Attach Tether Track**. The cursor changes to show an arrow and a Plus sign.
3. Click the secondary entity in the Objects List or in the window.

8.1.3. Filtering the Object Attachment List

Although you can attach to entities and props, it is likely that at any given time you will only want to attach to one type of object (usually entities). To reduce the number of objects that you have to iterate through when using the keyboard or Attachments Panel arrows to pick the next or previous object, you can filter the attachment list.

To filter the attachment list:

1. On the Attachments Panel (Figure 8-2), click the down arrow. The Attachments Panel expands.
2. In the Attachment Filter list, select the type of scene element that you want to attach to.

8.1.4. Detaching from an Entity

➤ To detach the observer from the entity to which it is attached, on the Attachments Panel (Figure 8-2), click the Detach button (), or press **z**.

8.1.5. Hiding the Attached Model (3D Projection Only)

You can hide the model for the entity to which the observer is attached.

To hide the attached model:

1. On the Attachments Panel (Figure 8-2), click the down arrow. The Attachments Panel expands.
2. Select the Hide Attached Model check box.

8.1.6. Attaching to Props

Since props do not move, attaching the observer to a prop does not result in any observer movement. The principal benefit of attaching to a prop is to let you quickly refocus the observer on a particular location in the scene. If you attach in Track mode, using the keyboard movement keys allows you to orbit around the prop.

8.2. Attach Modes in the 3D Projection

Attach modes are combinations of position and orientation models and constraints that produce a useful behavior for the observer. Except for Absolute mode, attach modes describe how movement of the entity to which the observer is attached affects the position and orientation of the observer.

VR-Vantage supports the following attach modes:

- Absolute: The observer is not attached to an entity; it moves in space independently of all entities.
- Follow: The observer position and heading changes with the entity's position and heading.
- Mimic: The observer position and orientation changes with the entity's position and orientation.
- Mimic Track: The observer's position changes with the entity's position while its orientation is focused on a second entity.
- Space Follow: The observer is a fixed distance from the entity and the entity model is scaled to be observable from a great distance.
- Tether: The observer's position changes with the entity's position.
- Tether Track: The observer's position changes with the entity's position while its heading is focused on a second entity.
- Track: The observer's heading changes to track the entity's position and heading.

The attach modes are described in detail in the following sections. For details about how to attach the observer to an entity, please see "Attaching the Observer to an Entity or Prop," on page 8-2.

8.2.1. Absolute Mode

In Absolute, or free-fly mode, the observer is not attached to an entity. Movement of entities does not affect the observer in any way.

8.2.2. Follow Mode

In Follow mode, the observer maintains its relationship to the attached entity as follows:

- When the entity's position changes, the observer's position changes to maintain its offset.
- When the entity's heading changes, the observer's heading and position change to maintain the offset.
- When the entity's pitch or roll change, the observer pitch and roll do not change.

Figure 8-4 illustrates the characteristics of Follow mode.

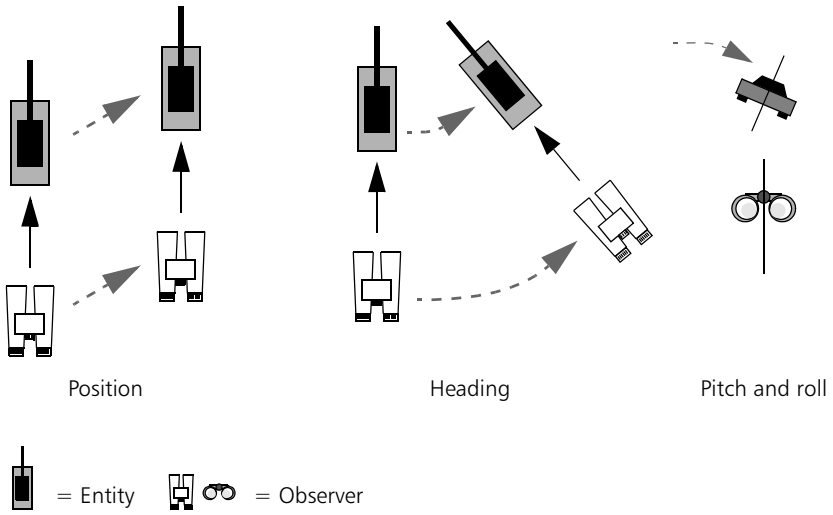


Figure 8-4. Follow mode

8.2.3. Mimic Mode

In Mimic mode, the observer behaves as though it is rigidly connected to the entity. Use Mimic mode to create the effect of riding in a vehicle cockpit, or of following a vehicle from an external location while connected to it by a solid, invisible rod. The observer maintains its relationship to the attached entity is as follows:

- When the entity's position changes, the observer's position changes to maintain its offset.
- When the entity's heading changes, the observer's heading and position change to maintain the offset.
- When the entity's pitch or roll change, the observer's pitch and roll change and the observer's position changes to maintain its offset.



When cockpit displays are enabled, you cannot change the position or orientation of the observer relative to the entity.

Figure 8-5 illustrates the characteristics of Mimic mode.

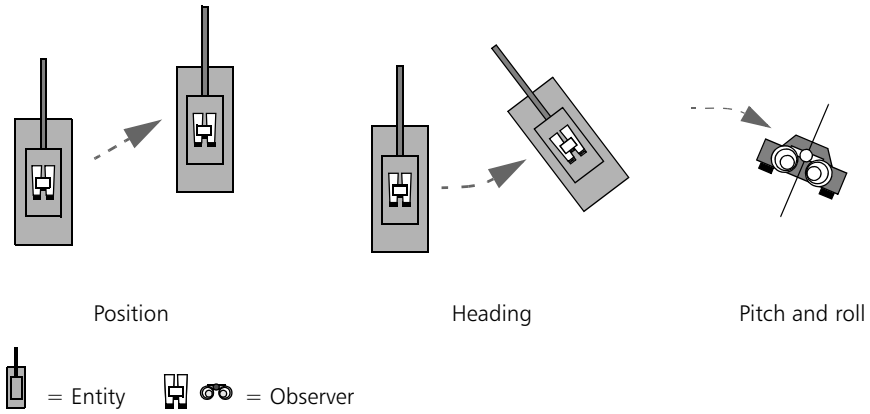


Figure 8-5. Mimic mode

8.2.4. Mimic Track Mode

Mimic Track mode combines Mimic mode and Track mode. The observer's position changes with that of the entity to which it is attached, as in Mimic mode, while its orientation changes to remain focused on a secondary, tracked entity.

Orientation controls are disabled.

Figure 8-6 illustrates the characteristics of Mimic Track mode.

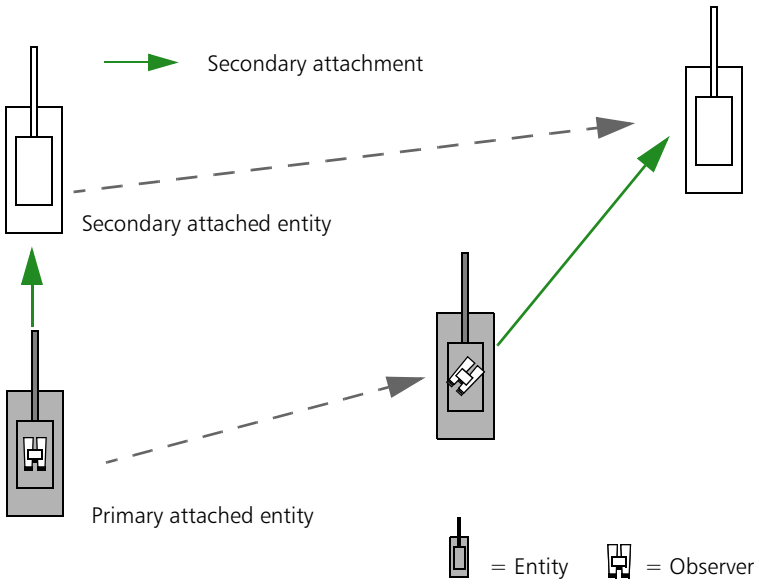


Figure 8-6. Mimic Track mode

8.2.5. Space Follow Mode

Space Follow mode attaches the observer above an entity, looking down at it. Although it can be used with any entity, its primary purpose is for attaching to space objects such as satellites. You can also usefully use it with fixed-wing and rotary-wing entities.

The observer is attached at a fixed distance, determined by the near clipping plane for the object. For a satellite, this distance is approximately 500,000 meters. Since it is not possible to see regular models at that distance, the attached object is scaled to be visible. (You cannot change the scaling of the attached object.) Other objects are not scaled (except to the extent that model scaling might be enabled in VR-Vantage Stealth).

The observer maintains its relationship to the attached entity as follows:

- When the entity's position changes, the observer's position changes to maintain its offset.
- When the entity's heading changes, the observer's heading changes.
- When the entity's pitch or roll changes, the observer's pitch or roll does not change.

You cannot move the observer towards or away from the attached entity. You can rotate the observer around the entity, but you cannot go below the horizontal plane of the entity.

Figure 8-7 illustrates the characteristics of Space Follow mode.

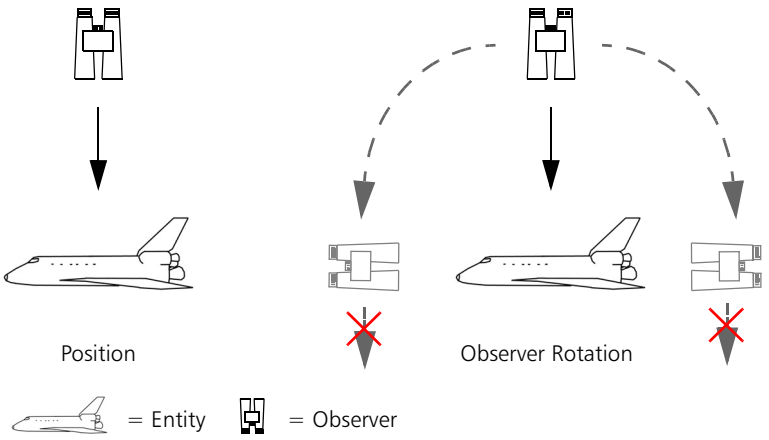


Figure 8-7. Space Follow mode

8.2.6. Tether Mode

In Tether mode, the observer's maintains a constant offset from the attached entity, but it is not affected by the entity's heading, pitch, or roll, as follows:

- When the attached entity's position changes, the observer's position changes to maintain its offset.
- When the attached entity's heading changes, the observer's heading does not change.
- When the attached entity's pitch or roll change, the observer's pitch and roll do not change.

Figure 8-8 illustrates the characteristics of Tether mode.

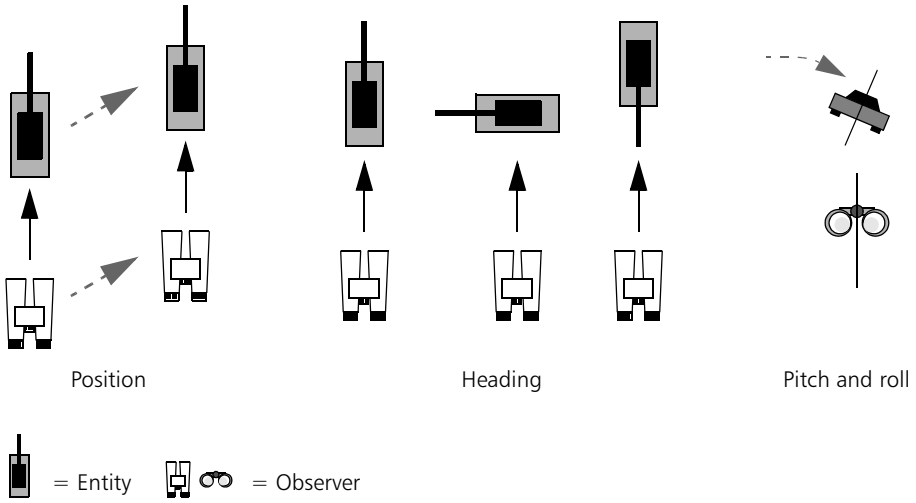


Figure 8-8. Tether mode

8.2.7. Tether Track Mode

Tether Track mode combines Tether mode and Track mode. The observer's position changes with that of the entity to which it is attached, as in Tether mode, while its orientation changes to remain focused on a secondary, tracked entity.

Orientation controls are disabled.

Figure 8-9 illustrates the characteristics of Tether Track mode.

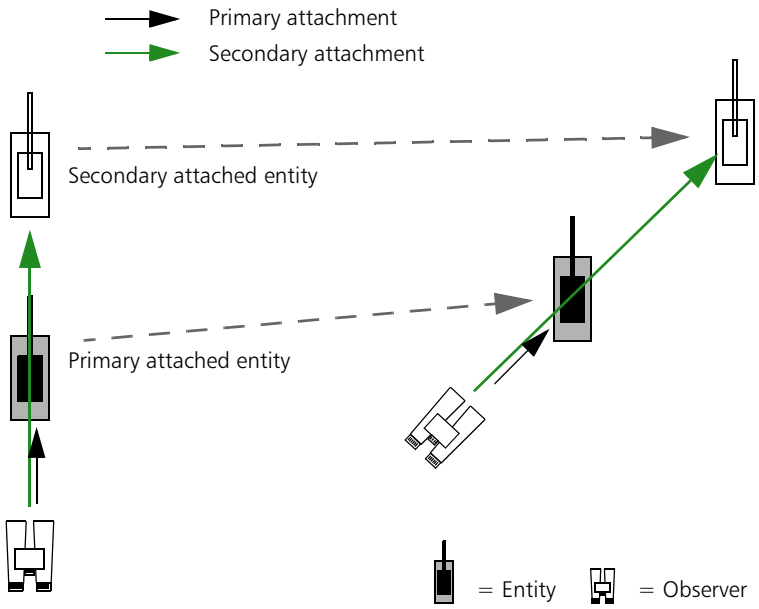


Figure 8-9. Tether Track mode

8.2.8. Track Mode

In Track mode, the observer's heading changes to track the attached entity's movement, keeping it centered in the field of view. The observer's position does not change. The observer maintains its relationship to the attached entity as follows:

- When the attached entity's position changes, the observer's heading changes to keep the entity centered in the observer's view; the observer's position does not change.
- When the attached entity's heading changes, the observer's heading does not change.
- When the attached entity's pitch or roll change, the observer's pitch and roll do not change.

Figure 8-10 illustrates the characteristics of Track mode.

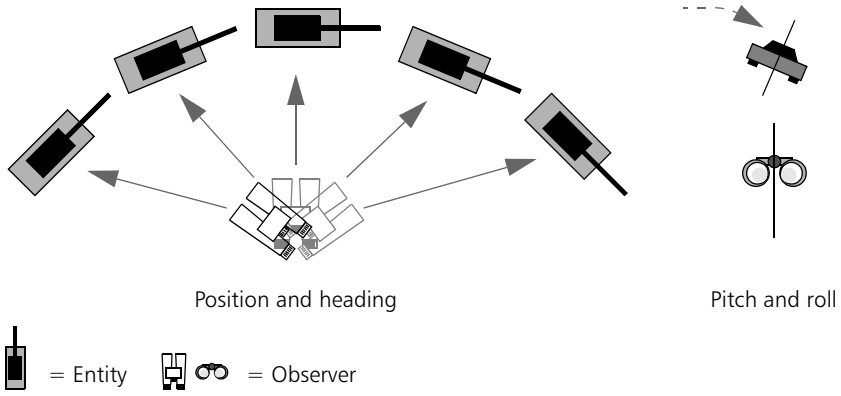


Figure 8-10. Track mode

8.3. Attach Modes in the 2D Projection

The 2D projection supports Follow mode and Tether mode. In Follow mode, the heading of the observer changes with the entity (if Orient North is disabled); in Tether mode, it does not. You can use the standard movement keys (w-a-s-d) to offset the observer with respect to the attached entity's position. You can use the orbit keys (left arrow, right arrow) to offset the observer's orientation with respect to the entity's orientation (in Follow mode) or the terrain.

If the observer is attached to an entity in the 3D projection and you switch to the 2D projection, the attach mode is mapped to either Follow or Tether modes, as shown in Table 8-1. If you then switch back to the 3D projection the original attach mode is restored.

Table 8-1: 3D to 2D attachment mode mapping

3D Attach Mode	2D Attach Mode
Follow	Follow
Mimic	Follow
Mimic Track	Follow
Space Follow	Follow
Tether	Tether
Tether Track	Tether
Track	Tether

8.4. Attaching the Observer at Startup

There may be times when you want to attach the observer to an entity as soon as VR-Vantage starts up. For example, suppose you are using VR-Vantage IG as a flight simulator. You might want it to start up and immediately display the cockpit view for the aircraft. VR-Vantage has a command-line argument, `--bindObservers`, that lets you bind the observer to an entity using saved views.

To start VR-Vantage with the observer bound to an entity:

1. Run a live or recorded simulation.
2. Attach the observer to the entity that you want it to be attached to when you start VR-Vantage. If you have multiple observers, create a saved view for each observer that you want to attach automatically.
3. Save the views.
4. If you have multiple observers, save the display engine configuration.
5. Start VR-Vantage with the `--bindObservers` command-line option and use your saved views file as the argument to `--bindObservers`. If you need to specify more than one observer, use `--dispSetting` to specify the display engine configuration file that defines the observers. You must also specify the terrain file to load.:

```
vrvIG --bindObservers
  "observer1,...,observern,../appData/settings/vantageIG
  /saved_views.osrx" --dispSetting displayconfig.dcx
  terrain_file.mtf
```

If the simulation is running, VR-Vantage attaches the observer to the entity in the saved view. If the simulation is not running, VR-Vantage attaches the observer when the entity is next discovered.



If your display engine configuration has more than one observer, you can save multiple views and automatically bind the observers to the views. The observers are bound to views on a one-to-one basis in the order that the observers are listed in the command and the saved views are listed in the file. If you only have one observer, it is automatically bound to the first view in the file.

8.4.1. Observer Attachment Tutorial

This tutorial implements the procedure described in the previous section using files provided with VR-Vantage and MÄK Data Logger. It attaches the observer to one of the aircraft in the maklandDemo recording.

To attach the observer to an entity at startup:

1. Start VR-Vantage IG.
2. Load the Makland terrain.
3. Start MÄK Data Logger (DIS or HLA 1.0).
4. Load the version of maklandDemo that is appropriate for the Logger version you are running.
5. Connect VR-Vantage IG to the correct simulation network.
6. Run the maklandDemo recording.
7. Attach the observer in Mimic mode to FtrFw4.
8. If the Observer Views Panel is not open, choose **View** → **Observer Views Panel**.
9. On the Observer Views Panel, click the Add button (+). The view is listed in the panel window.
10. Save the view to a file, for example *FtrFw4.osrx*.
11. Shut down VR-Vantage IG.
12. Start VR-Vantage IG with the following command line:

```
vrvIG --bindObservers "Observer 1,../appData/set-
  tings/vantageIG/FtrFw4.osrx" ../userData/terrains/Mak-
  land.mtf
```



In this example, it is not strictly necessary to specify the observer because there is only one observer. The observer name is included to illustrate the complete syntax of the command. If you had more than one observer in your display engine configuration and multiple views to attach them to, you could use a command like the following:

```
vrvIG --bindObservers "Observer 1,Observer A,../appData/set-
  tings/vantageIG/FtrFw4.osrx" --dispSetting displayConfig.dcx
  ../userData/terrains/Makland.mtf
```

You could also do this:

```
vrvIG --bindObservers "Observer A,Observer 1,../appData/set-
  tings/vantageIG/FtrFw4.osrx" --dispSetting displayConfig.dcx
  ../userData/terrains/Makland.mtf
```

The observers get bound to views in the order in which they are listed.

VR-Vantage includes an example saved view, *FtrFw4.osrx*, that you can use to try out this example.

8.4.2. Binding Multiple Observers Tutorial

This tutorial shows how to bind multiple observer views to multiple windows. The tutorial does the following:

- Creates three windows.
- Saves the display engine configuration.
- Saves different views for each window.
- Loads the terrain, saved views, and display engine configuration from the command line.

VR-Vantage loads the terrain, opens the three windows in the display engine configuration, and assigns a saved view to each window.

The tutorial uses VR-Vantage Stealth and both 2D and 3D windows. However, the same procedure would apply to applications that support just 2D or just 3D windows.

Create the Windows

To bind multiple observer views to multiple windows:

1. Start VR-Vantage Stealth.
2. Load *VR-TheWorldOnline.mtf*.
3. Choose **View** → **Display Engine Configuration Editor Panel**. The panel shows one window with one channel. The observer assigned to the channel is named Observer 1 (Figure 8-11).

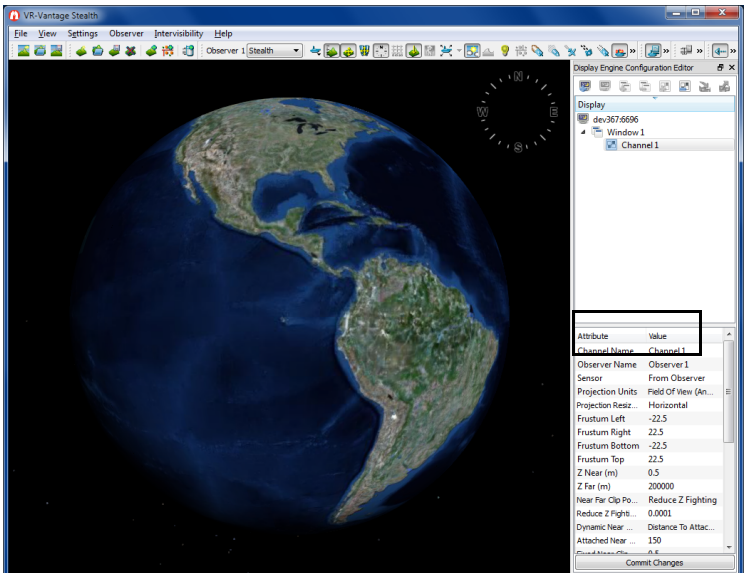


Figure 8-11. Observer 1

4. Choose **File** → **New Stealth Window**. A window titled Window 2 opens. It shows the same view as the main window. A window called Window 2 is added to the display engine configuration. The channel properties show that the window uses Observer 2 (Figure 8-12).

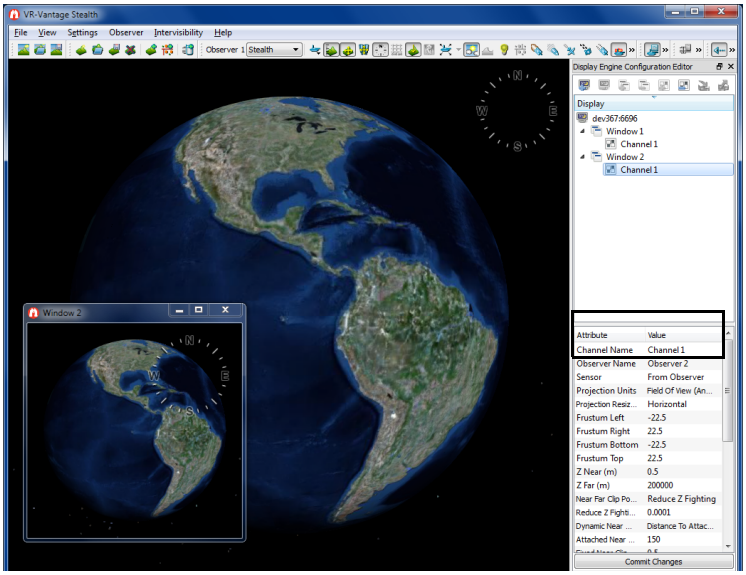


Figure 8-12. Observer 2

5. Choose **File** → **New Plan View Window**. A window titled Window 3 opens. It shows a portion of the view in the main window. A window called Window 3 is added to the display engine configuration. The channel properties show that the window uses Observer 3 (Figure 8-13).

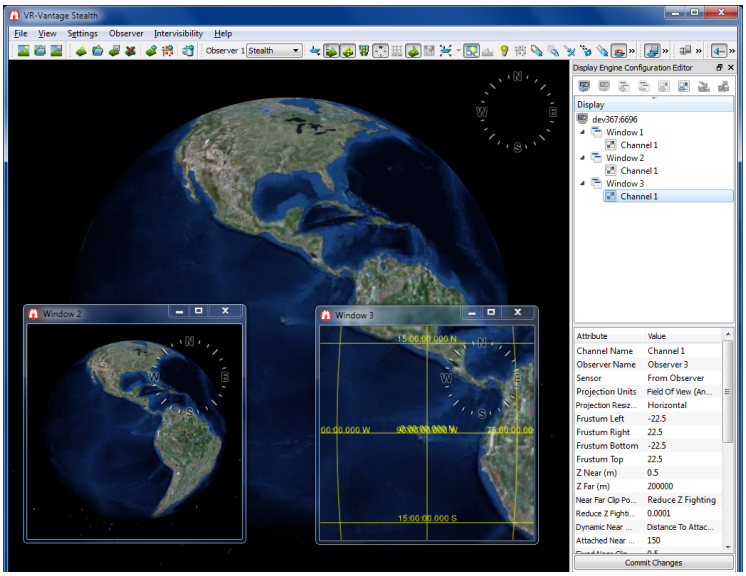


Figure 8-13. Observer 3

Save the Display Engine Configuration

To save the display engine configuration:

1. In the Display Configuration Editor Panel, select the display engine (the top line).
2. Click the Save Display Engine Configuration button (). The Save Display Engine Configuration dialog box opens.
3. Type a name for the configuration, for example, *BindObserversTutorial.dcx*.
4. Click Save.

Create and Save the Views

To create observer views for each observer and save them:

1. If the Observer Views Panel is not open, choose **View** → **Observer Views Panel**.
2. Click in the main window to give Observer 1 focus. Confirm this by looking at the observer name displayed on the Observer Settings Toolbar.
3. On the Observer Views Panel, click the Add button (). A view called 1 - Absolute is added.

4. Double-click the name of the view to make it editable. Change the name to Western Hemisphere.
5. Click in Window 2. Make sure that the Observer Settings Toolbar shows that the active observer is Observer 2.
6. Drag the view of the world to show Africa.
7. Add a new view to the Observer Views Panel.
8. Change the name of the view to Africa.
9. Click in Window 3. Make sure that the Observer Settings Toolbar shows that the active observer is Observer 3.
10. Drag the view of the world to show Australia. The various windows should now look something like (Figure 8-14).

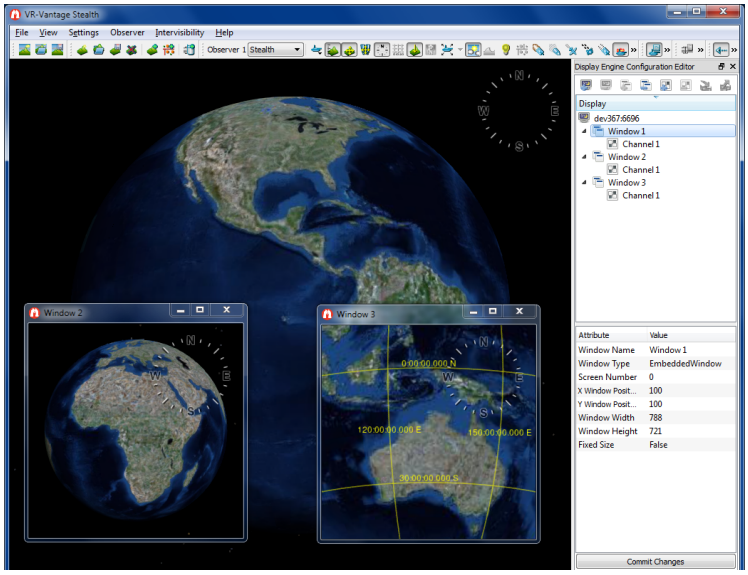


Figure 8-14. VR-Vantage Stealth with saved views assigned

11. Add a new view to the Observer Views Panel.
12. Change the name of the view to Australia.
13. Click the Save Observer Views button ( ). The Save Observer Views dialog box opens.
14. Type a name for the saved views, for example, *BindObserversTutorialViews.osrx*.
15. Click Save.
16. Shut down VR-Vantage.

Start VR-Vantage with the Views and Display Engine Configuration

➤ To load the display engine configuration and bind observers to the saved views, start VR-Vantage Stealth with the following command:

```
C:\MAK\vrvantage1.6\bin\vrvStealth.exe
  --dispSetting ..\appData\settings\stealth\BindObserversTutorial.dcx
  --bindObservers "Observer 1,Observer 2,Observer 3,
  ..\appData\settings\stealth\BindObserversTutorialViews.osrx"
  ..\userData\terrains\VR-TheWorldOnline.mtf
```

VR-Vantage Stealth starts up, loads the display engine configuration, opens the windows, and assigns the saved views to the windows (Figure 8-14).

9

Viewing Entities

This chapter describes how to select entities and manage how they are viewed.

Selecting Entities 9-2
Displaying Entity Labels 9-3
- Displaying Text Labels for 3D Models 9-5
- Turning Entity Labels On and Off 9-6
- Pinning 3D Text Labels to the Window 9-6
- Displaying Entity Labels for 2D Icons 9-7
- Configuring Shadowing and Background Color for 2D Labels 9-9

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9.1. Selecting Entities

Many procedures require you to select one or more entities. When an entity is selected, a box is drawn around it (Figure 9-1) and it is highlighted in the Objects List Panel.

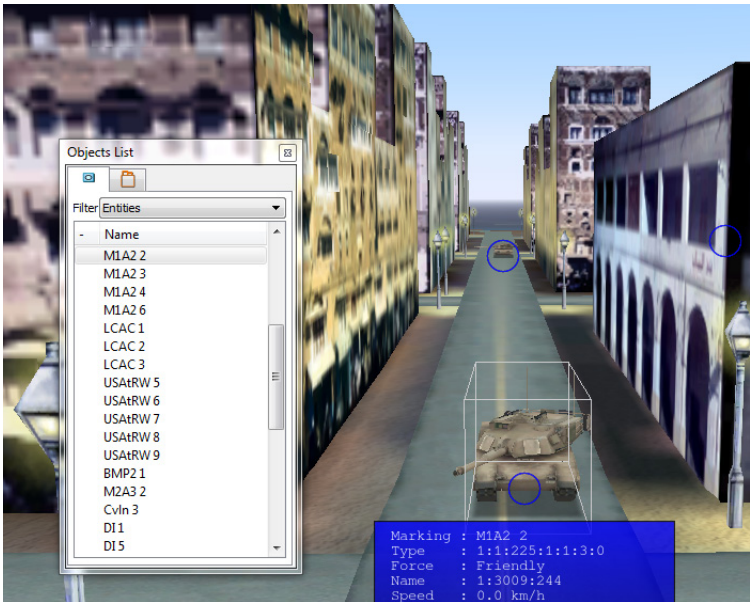


Figure 9-1. Selected entity

➤ To select an entity, click it in the window, or select it in the Objects List Panel.

For multiple selection, standard conventions for **Shift**-click and **Ctrl**-click apply.

9.2. Displaying Entity Labels

For 3D models, VR-Vantage displays entity labels that help you locate and identify entities (Figure 9-2). The entity label consists of an entity locator circle, which is always visible when entity labels are enabled, and a text label that is displayed when you mouse over an entity. All entities within the view have locator circles, whether the model is visible or not. The color of an entity's label represents its force – blue for friendly, red for opposing, and green for neutral.

A 3D text label displays the entity's:

- Marking text
- Entity type enumeration
- Force
- Name
- Speed
- Heading
- Latitude and longitude
- Altitude.

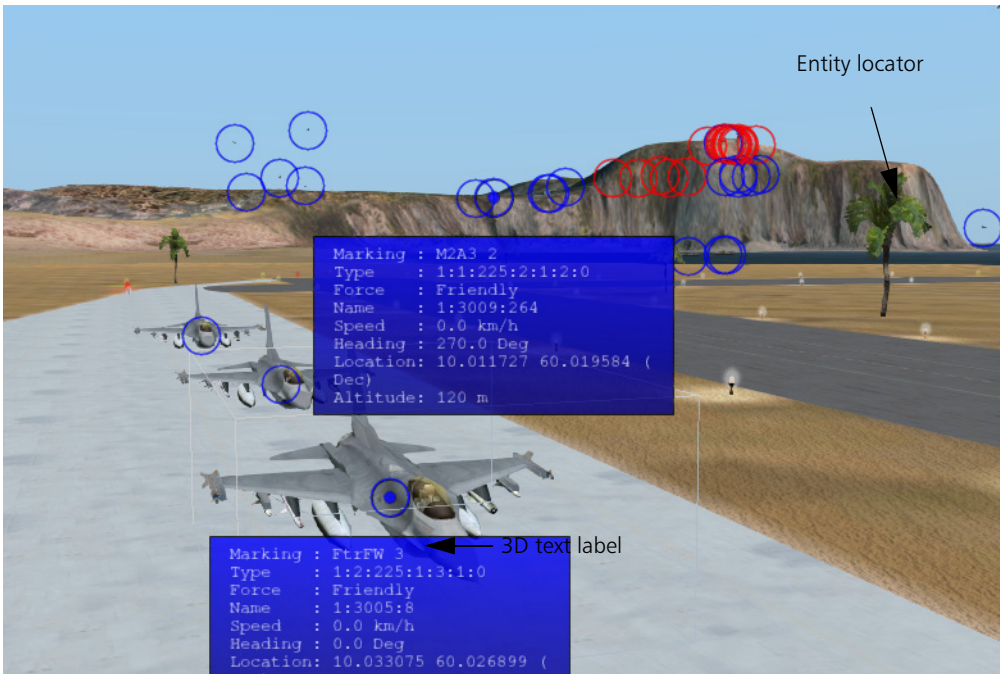


Figure 9-2. Entity labels for 3D models

For 2D icons (VR-Vantage PVD and VR-Vantage Stealth), entity labels are a set of individually enabled text labels (Figure 9-3). In VR-Vantage Stealth, entity labels for 2D icons are supported both in the 2D view and the 3D view. If you resize 2D icons, the labels also get resized. 2D icons can display the entity's:

- Acceleration
- Altitude above mean sea level
- Altitude above ground level
- Heading Indicator
- Location
- Name
- Orientation
- Velocity.

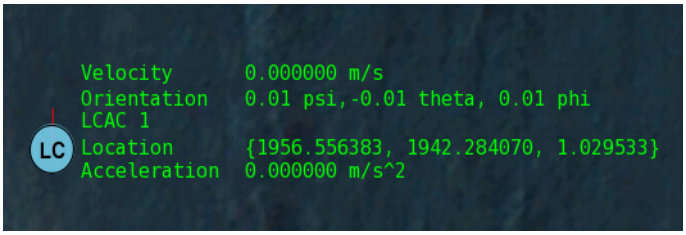


Figure 9-3. Entity labels for 2D icons

9.2.1. Displaying Text Labels for 3D Models

To view a 3D text label, use one of the following methods:

- Move the cursor over the circle that represents the entity.
- On the Display Settings dialog box, Entity Display Settings page, select Show Information Only For Selected Entities (Figure 9-4). Then select the entity whose label you want to see.

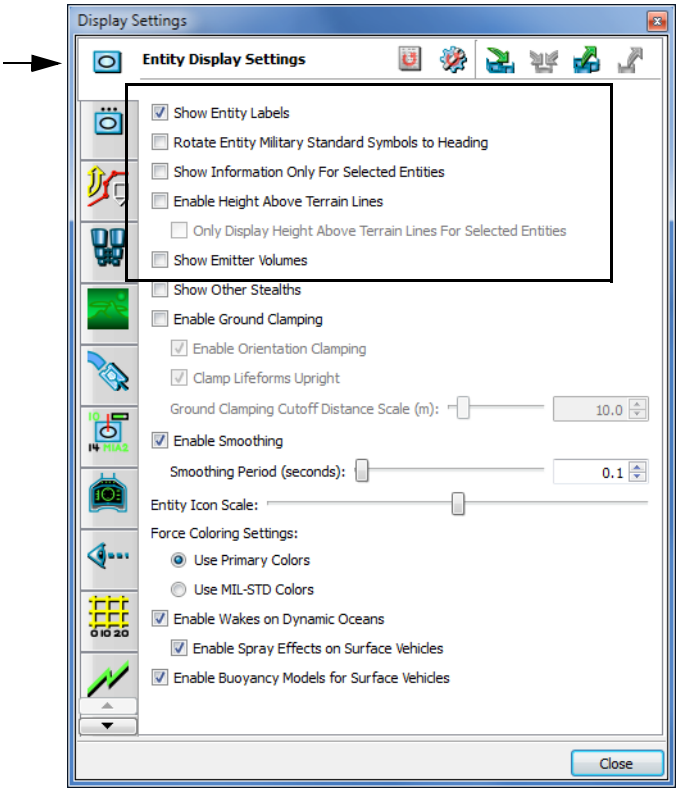


Figure 9-4. Display Settings, Entity Display Settings page

9.2.2. Turning Entity Labels On and Off

To turn the display of entity labels on or off:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 9-4).
3. Select or clear the Show Entity Labels check box.

> **i** You can also enable and disable entity labels by choosing **Settings** → **Entity Labels** or by clicking the Entity Labels button ( ) on the Display Settings Toolbar.

9.2.3. Pinning 3D Text Labels to the Window

You can pin 3D text labels to the window, making them stay visible after you move the cursor away from the entity.

To pin a 3D text label to the window or hide a pinned label:

1. Right-click an entity's locator circle. A menu is displayed.
2. Choose **Toggle Pinned Label**.

Pinning Multiple 3D Text Labels

You can display multiple text labels at one time.

To pin multiple text labels use either of the following methods:

- Right-click and choose **Toggle Pinned Label** for each entity whose label you want to pin.
- On the Display Settings dialog box, Entity Display Settings page, select Show Information Only For Selected Entities (Figure 9-4). Then, in the Objects List Panel, multi-select the entities whose labels you want to see.

9.2.4. Displaying Entity Labels for 2D Icons

You can enable and disable the display of labels for 2D icons by label type. This allows you to control how much screen space is taken up by the labels. You can control the display of entity labels in the Display Settings dialog box or on the Display Settings Toolbar.

To enable and disable display of 2D icon labels:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Symbol Decoration Settings page (Figure 9-5).

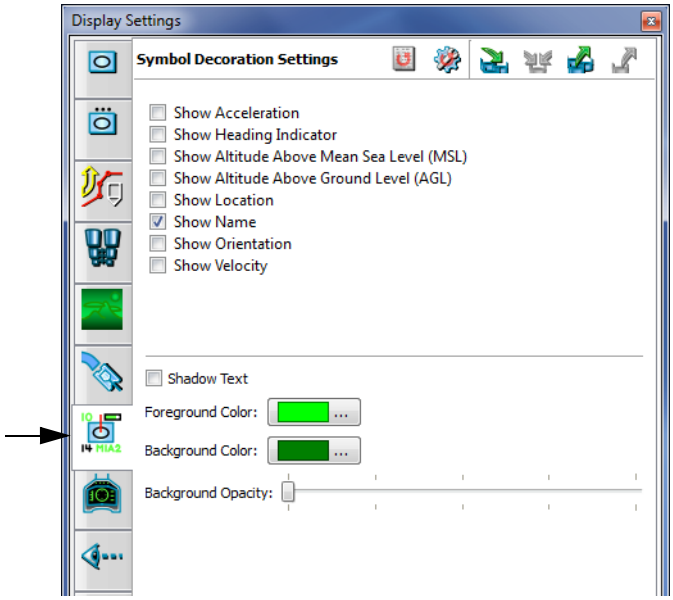


Figure 9-5. Symbol Decoration Settings page

3. Select the check box for each label that you want to display. Clear the check box for each label that you want to hide.

Enabling 2D Labels on the Display Settings Toolbar

The Entity Labels button on the Display Settings Toolbar lets you open a panel that lists the symbol decorations that you can show or hide.

To enable or disable 2D labels on the Display Settings Toolbar:

1. Click the arrow on the Entity Labels button ( ). A small panel is displayed. It is a persistent window.

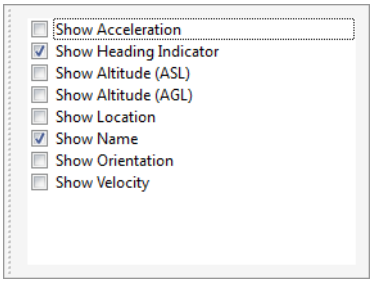


Figure 9-6. Symbol Decoration Panel

2. Select the symbol decorations that you want to display. Clear the ones you want to hide.
3. To hide the Symbol Decorations Panel, click the arrow on the Entity Labels button.

9.2.5. Configuring Shadowing and Background Color for 2D Labels

2D labels are drawn on a background that, by default, is transparent. However, you can increase the opacity of the background to make it visible and can change the background color.

You can add shadowing to the text of 2D labels. This may improve visibility when entities are on light colored terrain.

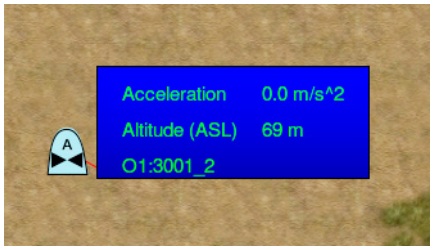


Figure 9-7. 2D label with background

To set the color and opacity of the 2D label background:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Symbol Decoration Settings page (Figure 9-5).
3. To change the opacity of the background, adjust the Background Opacity slider.
4. To change the color of the background:
   a. Click the Background Color color swatch. A color picker opens.
   b. Select the color you want to use for the background.
   c. Click OK.

To configure shadows for 2D labels:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Symbol Decoration Settings page (Figure 9-5).
3. Select or clear the Shadow Text check box.

9.3. Inset Views

You can display inset views of individual entities. Figure 9-8 shows a helicopter hovering over the runway in the Makland terrain with an inset view of an M1A2 tank driving through the town.



Figure 9-8. Inset view

! By default, when you create an inset view, the observer in the inset view is attached to the entity in Mimic mode. This has the side effect of causing the 3D model in the main window to disappear. (The reverse occurs if you attach the observer in the main window to the entity in Mimic mode.) To make the model reappear, select the inset view and change the attach mode or detach the observer.

You can change the observer position and orientation in an inset view using keyboard controls. You can also edit window and channel properties for the window in the Display Engine Configuration Editor.

To open an inset view of an entity:

1. Right-click the entity (or its entry in the Objects List Panel). A menu opens.
2. On the menu, choose **Create Inset View**.

9.4. Changing Force Colors

By default, entity labels, detonation lines, and other force-related entity graphics (including the 3D Colorized Model model set in VR-Vantage Stealth) are displayed using primary colors (red, blue, and green). You can change the force coloring to use MIL-STD 2525B colors (light blue, light green, and salmon).

To change force coloring:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 9-4).
3. Select the Force Coloring Settings option that you want.

9.5. Displaying HAT Lines for Entities (3D Only)

Height-above-terrain (HAT) lines are vertical lines that run from an entity to the ground and display the altitude of the entity (using whatever units are configured on the Display Units Settings page) (Figure 9-9). They help you understand the relationship of the entity to the terrain.

HAT lines are shown only for entities that could be above or below the ground, such as fixed and rotary-wing vehicles. You can show and hide these lines globally and you can specify that they be shown only for the selected entities.

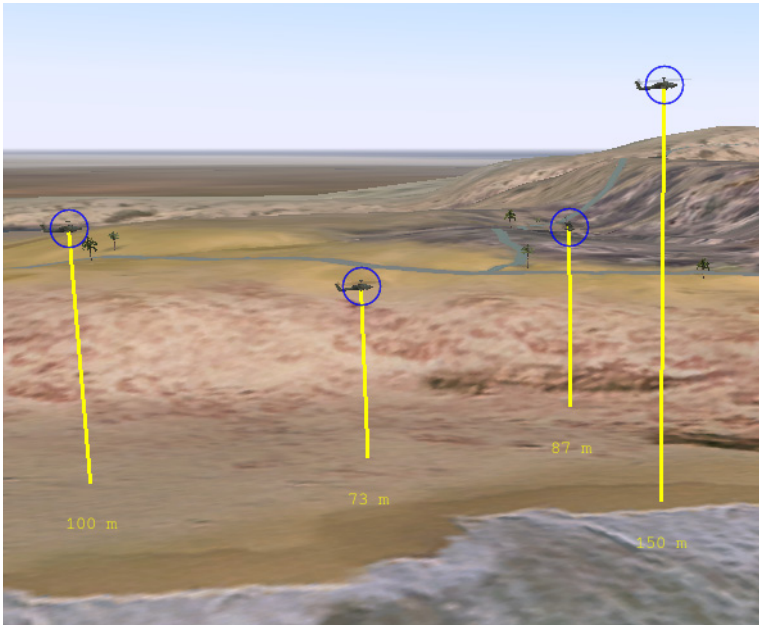


Figure 9-9. Entity height-above-terrain lines

Displaying height above terrain lines can reduce the frame rate.

To show or hide height-above-terrain lines:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 9-4).
3. To display lines, select the Enable Height Above Terrain Lines check box.
4. To display lines only for selected entities, select the Only Display Height Above Terrain Lines For Selected Entities check box.



In VR-Vantage Stealth, you can also enable and disable entity HAT lines by choosing **Settings** → **Entity Height Above Terrain Lines** or by clicking the Entity Height Above Terrain Lines button () on the Display Settings Toolbar.

9.6. Changing the Model Set

Each observer mode specifies a model set. You can change the model set associated with an observer mode by editing it (for details, please see "Editing an Observer Mode," on page 6-4), but you can also dynamically change the model set being used.

➤ To change the model set, choose **Observer** → **Set Model Set** → *model_set*, where *model_set* is one of the options on the menu, or select a model set from the Set Model Set button () on the Observer Settings Toolbar. (The button changes to show the currently selected model set.)

9.7. Entity Icons

The 2D Icons model set uses MIL-STD 2525B icons. Figure 9-10 illustrates basic icon shapes for friendly forces.

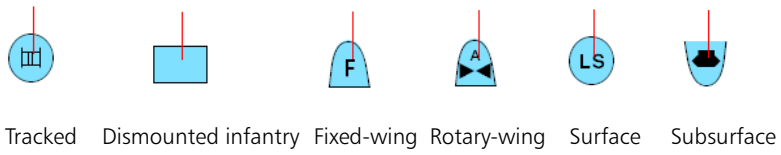


Figure 9-10. MILSTD-2525B icons

The color and shape code for 2D entity icons is:

- Light blue – friendly.
- Salmon – hostile.
- Light green – neutral.

Symbols have a black border except as follows:

- If there is no border on the bottom, the entity domain is above ground, for example, helicopters.
- If there is no border on the top, the entity domain is subsurface, for example, submarines.
- Selected entities have a white border.

Symbols that represent aggregate entities have aggregate identifiers above the symbol, as illustrated in Figure 9-11.

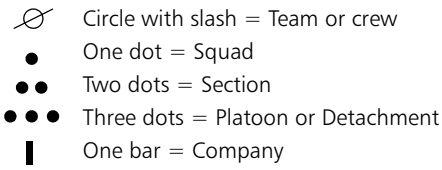


Figure 9-11. Unit echelon indicators

9.7.1. Changing the Size of 2D Icons

The Plan View observer mode (VR-Vantage Stealth and VR-Vantage PVD only) uses the 2D Icons model set for entities. (In VR-Vantage Stealth, you can use these icons in the 3D observer modes too.) You can change the size of 2D entity icons. When many entities are close together, reducing the size of the icons can reduce overlap.

To change the size of entity icons:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 9-12).

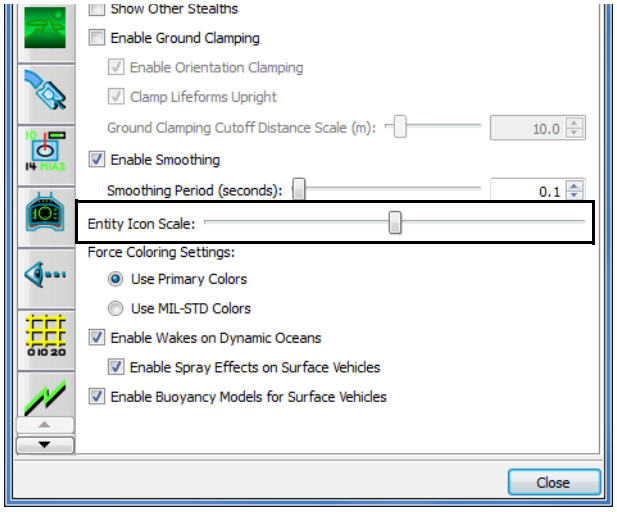


Figure 9-12. Entity Display Settings page

3. Adjust the Entity Icon Scale slider.

9.7.2. Rotating 2D Icons to an Entity's Heading

By default, when an entity's heading changes, the heading indicator points to the new heading, but the icon remains oriented towards zero degrees (North). You can specify that icons rotate to the heading of the entity.



Figure 9-13. 2D icon rotated to heading

To rotate icons to the entity's heading:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 9-4).
3. Select the Rotate Entity Military Standard Symbols to Heading check box.

9.8. Viewing Occluded 2D Icons

If you are using VR-TheWorld or a similar terrain in the 2D projection, it is possible that entities are being simulated on the opposite side of the world from the observer (they are occluded from view by the earth). Since 2D icons are displayed on a layer above the terrain, they do not get hidden from view by the terrain. VR-Vantage lets you configure the visibility of occluded entity icons. By default, occluded icons are displayed as 100% transparent. You can vary transparency from 100% transparent to 100% opaque.

To set the transparency of occluded 2D icons:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 9-14).

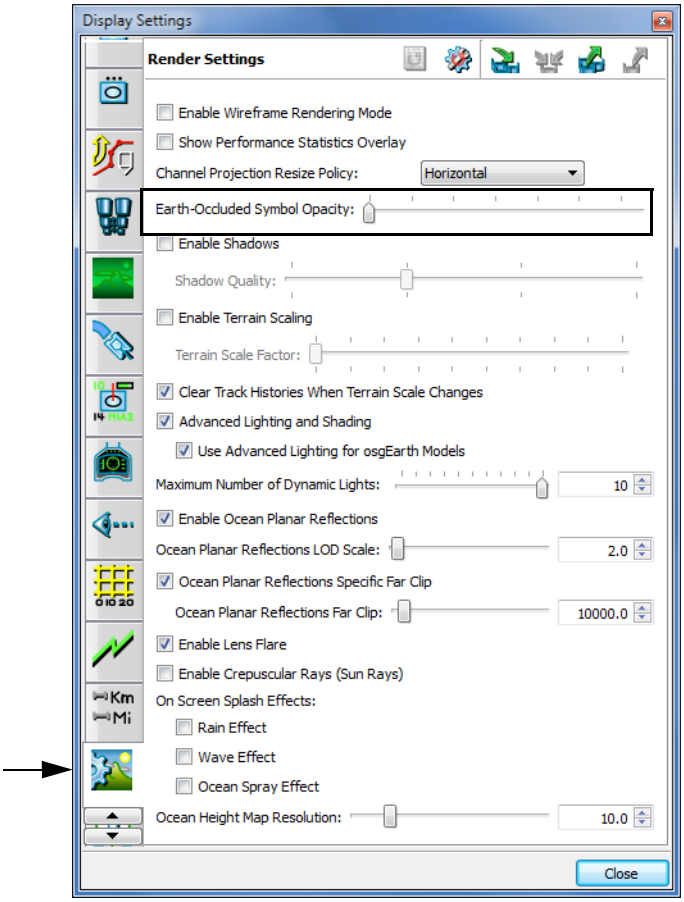


Figure 9-14. Render Settings page

3. Adjust the Earth-Occluded Symbol Opacity slider.

9.9. Hiding 3D Models

You can hide 3D models and 3D colorized models.

To hide 3D models:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 19-3).
3. In the list of observer settings, clear the Main Model check box.

9.10. Display of Embarked Entities

When VR-Vantage renders a scenario generated by VR-Forces, the scenario may include embarked entities. In the 3D projection, embarked entities are displayed just like any other object. In the 2D projection, VR-Vantage does not display icons for embarked entities. However, they are still listed in the Objects List Panel.

9.11. Viewing Object Counts

You can display the number of live and destroyed entities and aggregates in the simulation you are viewing and the number of VR-Forces control objects, by type.

➤ To display the object counts, choose **View** → **Objects Count Panel**. The Objects Count Panel is added to the display (Figure 9-15).

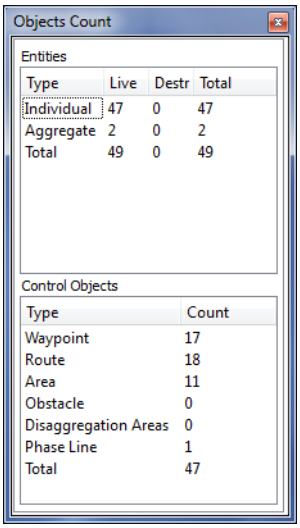


Figure 9-15. Objects Count Panel

9.12. Displaying Models for Remote Observers

VR-Vantage broadcasts the location and orientation of the observer. By default, it does not display a model for the observer. However, if there are other applications in an exercise that are broadcasting a stealth PDU (such as another VR-Vantage application), you might want to represent them with a model.

To display a model for remote observers:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 9-4).
3. Select the Show Other Stealths check box.

9.13. Filtering Entities Using Interest Management

VR-Vantage can use interest management to improve its performance in simulations that have high entity counts. Interest management is an implementation of HLA data distribution management (DDM). When interest management is enabled, VR-Vantage filters out all entities that are more than a specified distance from the observer.

9.13.1. Enabling Interest Management

To use interest management:

- You must use HLA (DIS does not support interest management).
- If you are using the MÄK RTI, you must use MÄK RTI 3.4a or later.
- You must configure your RTI to support DDM. (If you are using the MÄK RTI, you can configure your system to use *ddm-rid.mtl*, which has DDM enabled.)
- When you connect to an exercise, you must enable DDM in the connection settings.

To enable interest management:

1. Choose **Settings** → **Connection**. The Connection Settings dialog box opens.
2. Click Advanced to show all connection parameters.
3. Select the HLA connections page for the version of HLA that you are using.
4. Select the Implicit Geographic DDM check box.
5. Specify any other information required for the simulation.
6. Click Connect.

9.13.2. Configuring Interest Management

Interest management works by filtering out all entities beyond a specified distance from the observer. You can configure this distance (DDM region size) and you can configure the threshold for observer movement (region update threshold) before VR-Vantage recalculates which entities should be displayed.

VR-Vantage uses a geographic DDM scheme. The earth is divided into two dimensional regions, with X pointing north and Y pointing east. When you specify a DDM region size, you specify the length of one side of a region.

The region update threshold is a percentage of the distance from the center of the region to a side. When the observer moves beyond the threshold, the region is recalculated. For example, if the region size is 1000 meters, the distance from the center to a side is 500 meters. If the region update threshold is 50%, when the observer moves more than 250 meters from the center of the region, VR-Vantage recalculates the display region.

DDM regions use a two-dimensional grid, so the altitude of the observer is not considered when filtering entities. However, in 3D observer modes, you usually cannot see entity models once the observer is a certain distance above the terrain (although you can see entity labels). Therefore, you may want to filter out entities based on the observer's altitude, thereby increasing performance.

To configure interest management:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Interest Management Settings page (Figure 9-16).

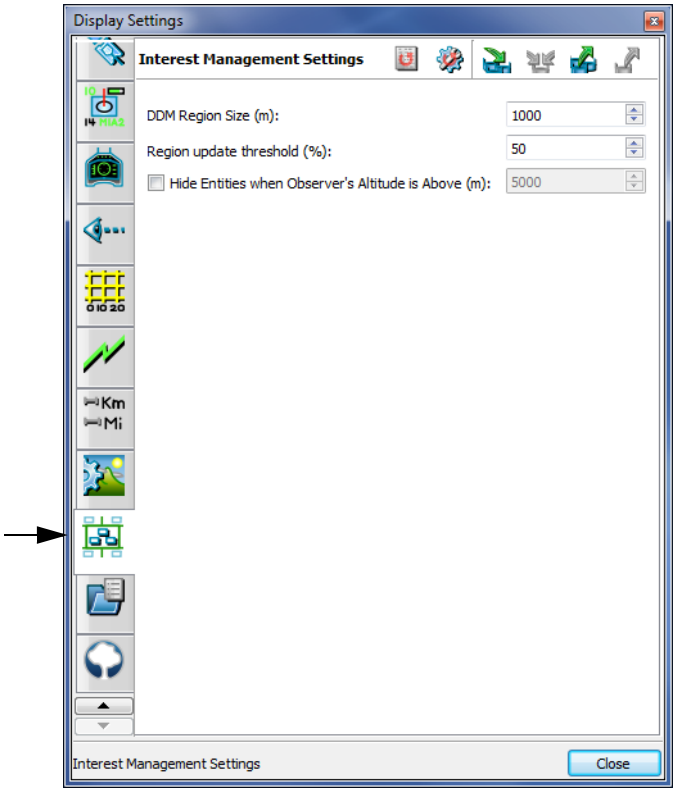


Figure 9-16. Interest Management Settings page

3. In the DDM Region Size box, type a value, in meters, for the region size.
4. In the Region Update Threshold box, type a value, as a percentage, for the update threshold.
5. Optionally, filter entities based on the observer's altitude, as follows:
   a. Select the Hide Entities When Observer's Altitude is Above check box.
   b. Specify the observer altitude at which to hide entities.
6. Click OK.

10

Viewing Entity Effects

This chapter describes how to display various types of entity-related graphics.

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Configuring Ground Clamping 10-3
Trajectory Smoothing 10-4
Configuring Trajectory Smoothing 10-5
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10.1. Using Ground Clamping

Because of differences in terrain databases among exercise participants, entities can sometimes appear to be underground or hovering above the terrain surface. To compensate, VR-Vantage can clamp land and sea entities to the terrain surface. When ground clamping is enabled, VR-Vantage keeps an entity anchored to the terrain surface regardless of the altitude data contained in its state update.

Use of ground clamping can reduce your frame rate. If you correlate the simulation and visualization terrain databases, you can eliminate the need to use ground clamping.

To enable or disable ground clamping:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 10-1).

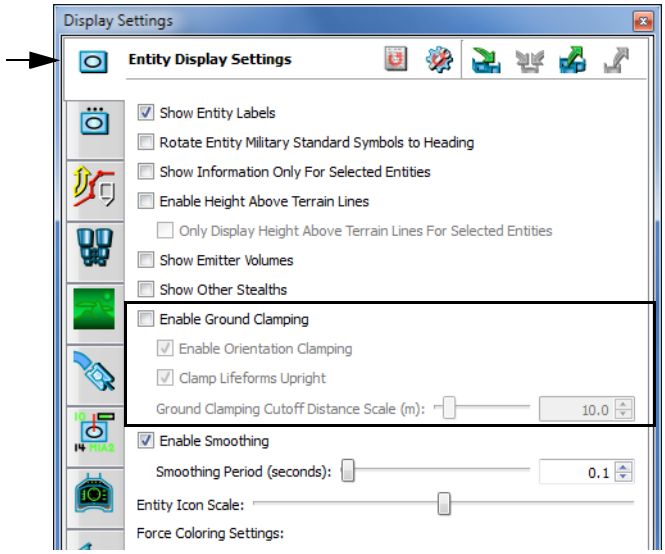


Figure 10-1. Ground clamping settings

3. Select or clear the Enable Ground Clamping check box.

You can also enable and disable ground clamping by choosing **Settings** → **Ground Clamping**, or clicking the Ground Clamping button (▾) on the Display Settings Toolbar.

10.1.1. Configuring Ground Clamping

You can configure the following aspects of ground clamping:

- Enable or disable ground clamping.
- Enable or disable orientation clamping.
- Force lifeforms to remain upright relative to the plane of their location when moving up slopes or steps, rather than being perpendicular to the terrain.
- The distance from the terrain within which entities are clamped.

To configure ground clamping:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 10-1).
3. To enable or disable a ground clamping option, select or clear its check box.
4. To specify the distance from the terrain in which entities are ground clamped, adjust the Ground Clamping Cutoff Distance Scale slider or type a value, in meters, in the box. You can also access the Ground Clamping Cutoff Distance Scale slider by clicking the down arrow next to the Ground Clamping button ( ) on the Display Settings Toolbar.



The setting for the Ground Clamping Cutoff Distance Scale maximizes at 100 meters. If you set it to the maximum, the distance is infinite and all entities are ground-clamped.

10.2. Trajectory Smoothing

From the time VR-Vantage receives a state update message for an entity, until it receives the next update, it calculates the location of the entity based on the heading and acceleration in the most recent state update. This process is called dead-reckoning. When the next state update arrives for the entity, VR-Vantage moves it to the new position. If the actual position is significantly different from the dead-reckoned position, the entity could appear to jump from the dead-reckoned position to the actual position. VR-Vantage can eliminate these discontinuities by smoothing entity trajectories and rotation paths.

Figure 10-2 illustrates dead-reckoning and smoothing.

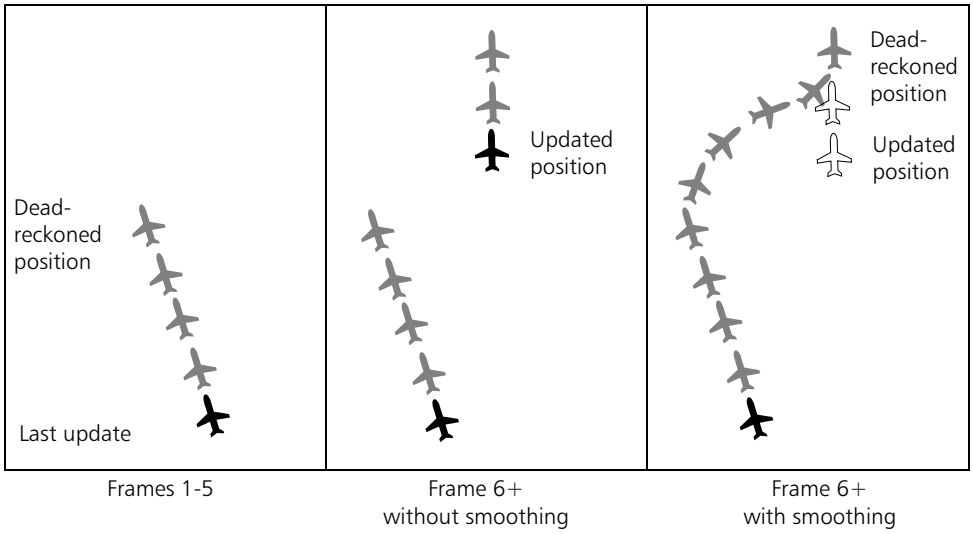


Figure 10-2. Dead-reckoning and smoothing

The smooth period is the period of time over which smoothing takes place. The default period is 1/10 second. If course corrections appear abrupt with this setting, you may want to increase the smooth period.



Smoothing makes fast-moving entities, such as fixed wing aircraft, look better. Slow moving entities, such as dismounted infantry, may look worse. If your simulation is mostly one or the other of these types of entities, enable or disable smoothing as appropriate for the best visualization experience.

10.2.1. Configuring Trajectory Smoothing

To configure trajectory smoothing:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 10-3).

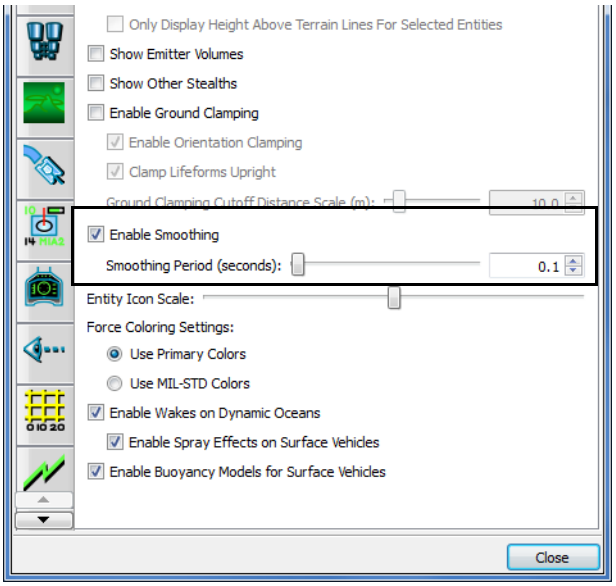


Figure 10-3. Smoothing settings

3. To enable or disable smoothing, select or clear the Enable Smoothing check box.
4. To change the smooth period, adjust the Smoothing Period slider or type a value, in seconds, in the box.

10.3. Displaying Trailing and Decal Effects (3D Only)

VR-Vantage supports trailing effects such as contrails for missiles and aircraft and dust clouds for vehicles. It also supports decal effects, such as tire tracks, footprints, and wakes. In essence, trailing effects are effects that are dispersed through the air, while decal effects are effects that are printed on the ground.

Trailing effects and decal effects are properties of an observer mode. You can enable and disable them on a per-observer basis.

Figure 10-4 illustrates some trailing effects.



Figure 10-4. Tank tracks, dust cloud

To enable or disable trailing effects or decal effects:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 10-5).

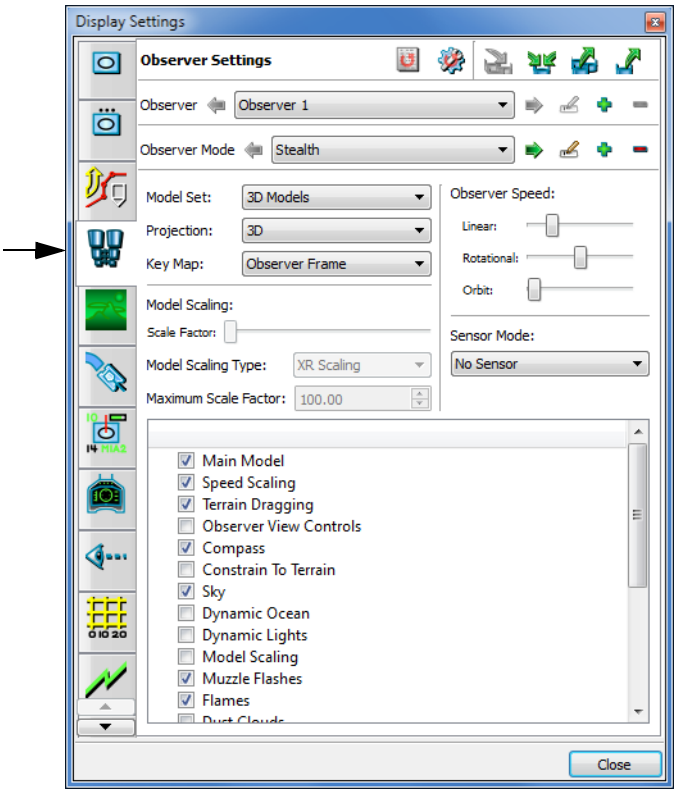


Figure 10-5. Display Settings dialog box, Observer Settings

3. Select or clear the check box for each effect that you want to change.



You can also enable and disable trailing and decal effects by choosing **Observer** → *effect* or clicking the appropriate button on the Observer Settings Toolbar.

10.3.1. Specifying Models for Trailing Effects and Decal Effects

Trailing effects and decal effects are configured through model definitions. (For the purposes of configuration, trailing effects are categorized as decals.) Each effect must have a model definition that uses a decal schema. Then, in an entity's entity definition, you configure a visualizer for the effect. For details about creating model definitions, please see Section 6.2, "Creating and Editing Model Definitions," in *VR-Vantage Configuration Guide*.

10.4. Displaying Track Histories

Track histories allow you to track the paths of entities during an exercise, including the path of munitions as they travel from the shooter to the target. When track histories are enabled, each entity leaves a track ribbon. The ribbon is colored based on the entity's force. Figure 10-6 illustrates track histories.

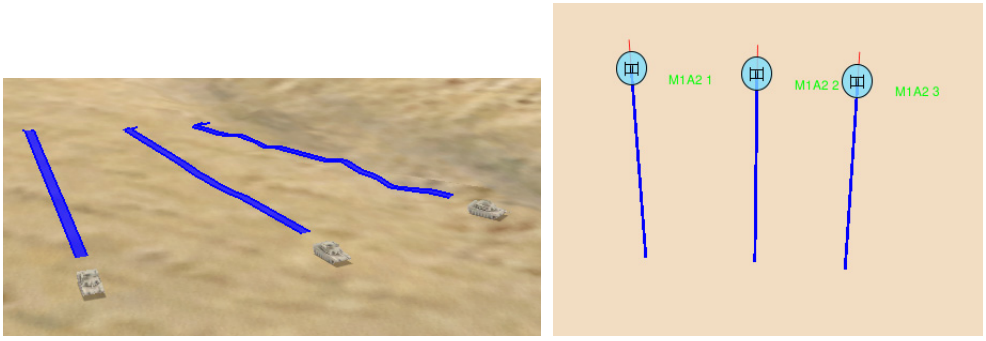


Figure 10-6. Track history

Track histories are a property of an observer mode. You can enable and disable them on a per-observer basis.

> Entity track histories have a significant performance and memory cost. For simulations with large entity counts, turning track histories off can significantly improve performance and memory usage.

To enable or disable display of all track histories:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 10-5).
3. Select the observer mode for which you want to change the Track Histories setting.
4. Select or clear the Track Histories check box.

> You can also enable or disable track histories by choosing **Observer** → **Track Histories** or clicking the Track Histories button ( ) on the Observer Settings Toolbar.

10.4.1. Configuring Track Histories

You can configure how long track history ribbons are drawn. A track history is composed of a series of segments, joined together to form a line. You can configure how long each segment is and how many segments at a time can be displayed. Drawing shorter segments improves the accuracy of the track history, but can degrade performance. Increasing the maximum number of segments provides a longer history, but can clutter up the screen if there are many entities and can also affect performance. Figure 10-7 illustrates the visual result of drastically changing the segment length. The left track history uses the default segment length of 0.5 meters. The right track history has a segment length of 5000 meters.



Figure 10-7. Track history segment length

When a track history reaches the maximum number of segments configured, it starts dropping segments from the beginning of the history (the oldest segments).

You can specify that track histories have an infinite length. In this case they never drop segments.

! If you specify infinite length for track histories, it is possible that you could eventually use up all the memory in your computer and the program would crash.

To configure track histories:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Track History Settings page (Figure 10-8).



Figure 10-8. Track History Settings page

3. If you want track histories to have an indefinite length, select the Infinite Track check box.
4. To change the number of segments that can be displayed for a track history, adjust the Track Length slider, or enter a value in the spin box.
5. To specify the length of each track history segment, enter a value in the Segment Length box.

10.5. Viewing Fire and Detonation Effects

VR-Vantage can display the following graphic effects when munitions are fired and detonated:

- Flaming effects.
- Smoke plumes.
- Detonations.
- Muzzle flashes.

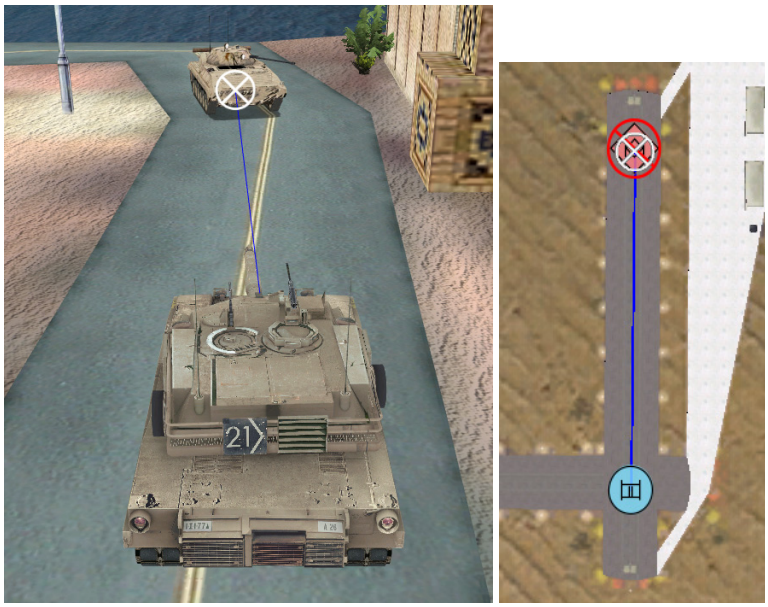
You control display of these effects from the Observer menu or Observer Settings toolbar.

➤ To enable or disable display of a fire or detonation effect, choose **Observer** → *effect*, where *effect* is Flames, Smoke Plumes, Detonations, or Muzzle Flashes, or click the appropriate button on the Observer Settings toolbar.

10.6. Viewing Fire and Detonation Lines

If fire and detonation lines are enabled, when an entity fires a munition, a line is drawn between the entity and the location of the detonation. The line is colored for the force of the shooter (Figure 10-9).

> Fire and detonation lines are not supported in VR-Vantage IG.



3D 2D

Figure 10-9. Fire line and detonation

A detonation is identified by a circle with an X through it. The detonation color indicates the result of the detonation, as follows:

- Entity impact – white.
- Ground impact – gray.
- Airburst – black.
- Other – white.

➤ To enable or disable display of fire and detonation lines, choose **Settings** → **Fire / Detonate Lines** or click the Fire/Detonate Lines button ( ) on the Display Settings Toolbar.

10.7. Displaying Tactical Smoke

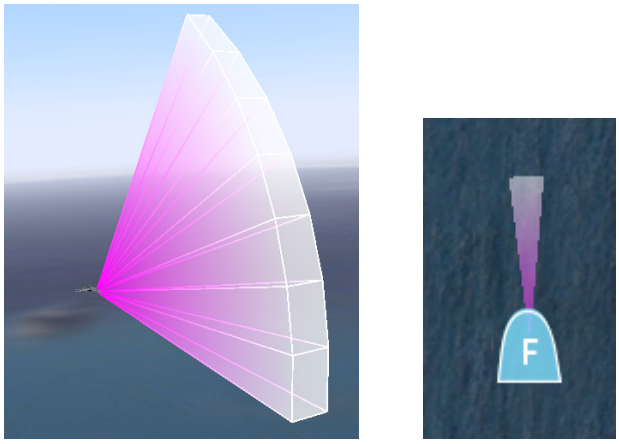
VR-Vantage can display tactical smoke munitions fired by entities. You may want to disable tactical smoke if it obscures the observer's view. Also, if many entities are generating smoke, it could affect performance.

> Do not confuse tactical smoke and smoke plumes. Smoke plumes are a visual effect displayed when an entity is on fire. Tactical smoke visualizes a smoke munition.

➤ To enable or disable display of tactical smoke, choose **Observer** → **Tactical Smoke**, or click the Tactical Smoke button ( ) on the Observer Settings toolbar.

10.8. Displaying Electromagnetic Emissions

VR-Vantage can display electromagnetic emissions (emitter volumes) for entities that have emitter systems (Figure 10-10). You can configure the colors used to represent emitter frequencies and you can configure the size of the emitter volumes.



3D 2D

Figure 10-10. Emitter volumes

To enable or disable display of electromagnetic emissions:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 9-4).
3. Select or clear the Show Emitter Volumes check box.



You can also enable or disable emitter volumes by choosing **Settings** → **Emitter Volumes**, or clicking the Emitter Volumes button () on the Display Settings Toolbar.

10.9. Displaying Radio Communication Lines

VR-Vantage can display squawk indicators when an entity sends a signal interaction. It can also display communication lines between entities when a VR-Forces entity (or an entity in an application built with the appropriate MÄK libraries) sends a radio message to another entity. You can configure a communication line's color and lifetime. Figure 10-11 displays squawk indicators and a line-of-sight communication line.



Figure 10-11. Radio communication line and squawk indicators

For communications over large distances, a line-of-sight communication line would travel through the earth. Therefore, you can also display communication lines drawn with the curvature of the earth (Figure 10-12).

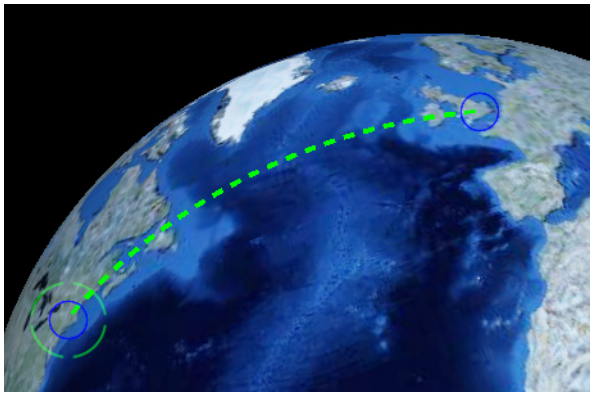


Figure 10-12. Curvature of the earth communication line

10.9.1. Enabling Radio Communications Graphics

You can globally enable or disable the ability to display radio communication lines. When they are enabled, you can enable and disable communication lines and squawk indicators separately.

To enable or disable radio communications graphics:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Radio Communications Settings page (Figure 10-13).

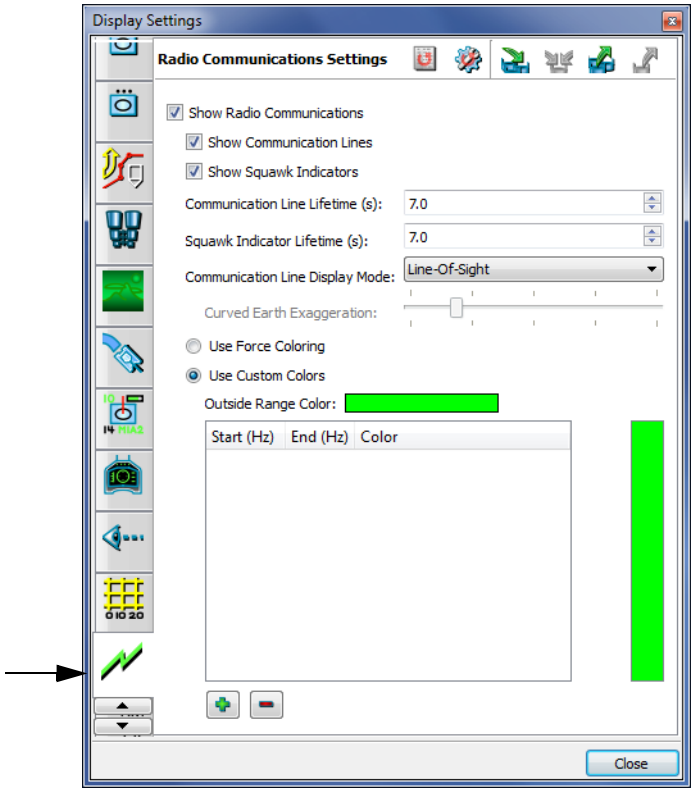


Figure 10-13. Radio Communications Settings page

3. Select or clear the Show Radio Communications check box.

> You can also enable and disable communication lines by choosing **Settings** → **Radio Communication Display** or by clicking the Radio Communications button (⟋) on the Display Settings Toolbar.

To enable or disable communication lines:

1. Enable radio communication lines.
2. Select or clear the Show Communication Lines check box.

To enable or disable squawk indicators:

1. Enable radio communication lines.
2. Select or clear the Show Squawk Indicators check box.

10.9.2. Configuring Radio Communication Lines Lifetime and Display Mode

You can configure how long a radio communication line is displayed. You can also configure whether it is displayed using line-of-sight or curvature of the earth.

To configure the lifetime and display mode for radio communication lines:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Radio Communications Settings page (Figure 10-13).
3. To specify how long a communication line or squawk indicator should be displayed, enter a value, in seconds, in the Communication Line Lifetime and Squawk Indicator Lifetime fields.
4. To specify the display mode, select on option in the Communication Line Display Mode list.
5. If you select Curvature of the Earth, adjust the Curved Earth Exaggeration slider to change the degree to which the curvature is exaggerated.

10.9.3. Configuring the Color of Radio Communication Lines

By default, radio communication lines are displayed as green lines. You can configure communication lines to use force coloring or to be colored based on the frequency of the message. When you color by frequency, you specify colors for the frequency ranges you are interested in and a color to use for all messages outside the specified frequencies.

To configure the color of radio communication lines:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Radio Communications Settings page (Figure 10-13).
3. To color radio communication lines using the force color, select the Use Force Coloring option.
4. To color radio communication lines by frequency:
   a. Select the Use Custom Colors option.
   b. Click the Add button (). A range is added to the frequency list with a default color (Figure 10-14).

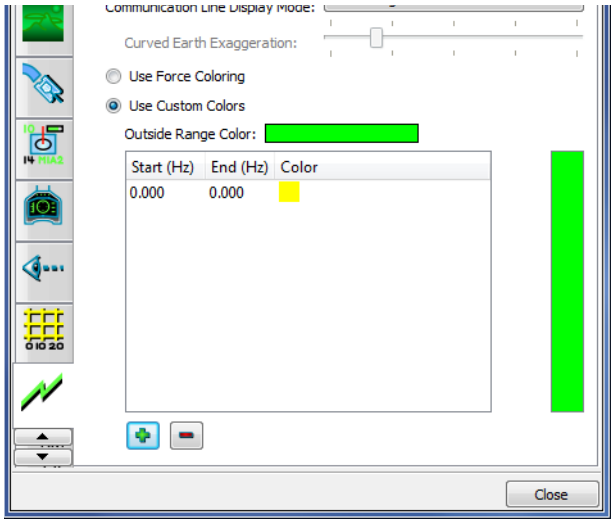


Figure 10-14. New frequency point

c. Double-click the starting value of the range to make it editable (Figure 10-15).

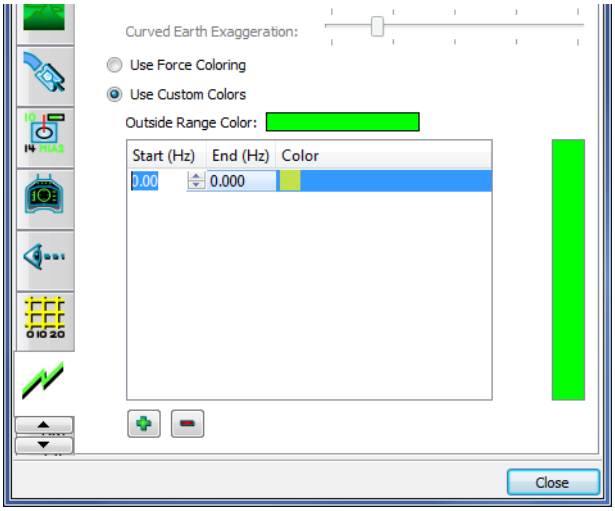


Figure 10-15. Editable frequency point

d. Type the starting frequency you want to use.

e. Edit the end frequency.

f. Double-click the color swatch and select a color for this range.

g. Optionally, add points for different frequency ranges.

h. Optionally, click the Outside Range Color color swatch and specify a color for all frequencies not specified in the frequency list.

If you configure multiple frequency ranges, you cannot add a range whose values are within those of an existing range.

10.10. Displaying Cockpit Displays (3D Only)

VR-Vantage can display cockpit displays created with GL Studio. It includes cockpits for fixed-wing, rotary-wing, and ground vehicle entities. As with other entity effects, cockpits have schemas and model definitions that you map to entity types. For details about cockpit display models, please see Section 6.5, "Adding New Cockpit Display Models," in *VR-Vantage Configuration Guide*.

Cockpits are displayed only when the observer is attached to an entity in Mimic mode.

To display cockpits:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Cockpit Display Settings page (Figure 10-16).

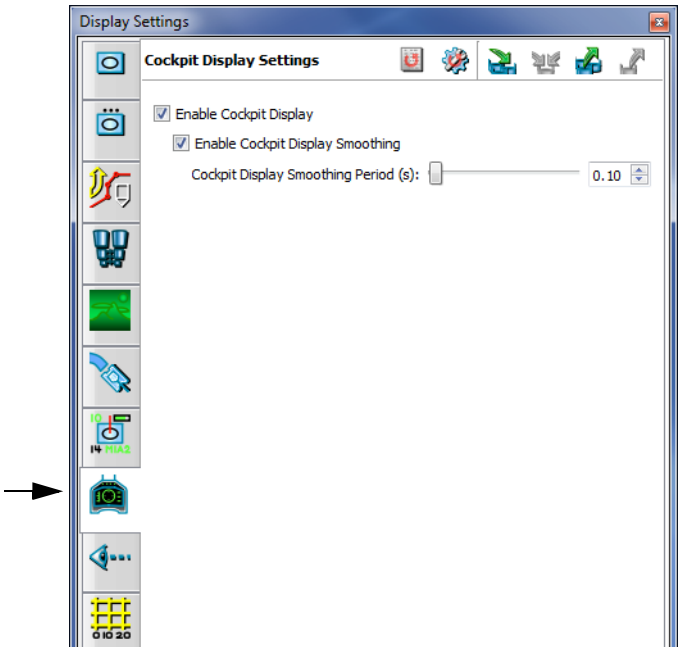


Figure 10-16. Cockpit display settings

3. To enable or disable cockpit displays, select or clear the Enable Cockpit Display check box.

4. Attach the observer to an entity in Mimic mode.



You can also enable and disable cockpit displays by choosing **Settings** → **Cockpit Displays** or by clicking the Cockpit Displays button () on the Display Settings Toolbar.

10.11. Displaying Shadows (3D Only)

VR-Vantage can display shadows for entities. Shadows are cast only on the terrain. They are not cast on buildings (props) or on other entities. Therefore, for example, entities on an aircraft carrier do not cast shadows on the deck.

You can enable and disable shadows and you can configure shadow quality. By default, fixed-wing, rotary-wing, and DI-Guy entities cast shadows. You can configure other entities to cast shadows by setting the **shadowCaster** attribute in their model definitions to 1. (For information about model definitions, please see Chapter 6, *Model and Element Definitions*, in *VR-Vantage Configuration Guide*.)



Updated model definitions do not take effect immediately. To view shadows, you must shut down VR-Vantage, restart VR-Vantage, and connect to the simulation.

To enable and disable shadows globally:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 10-17).

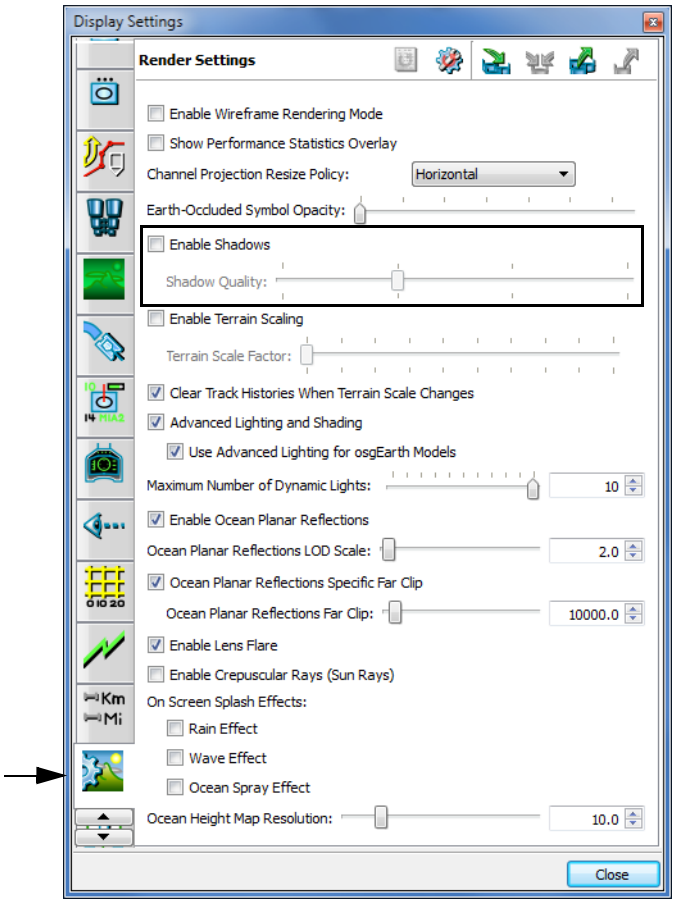


Figure 10-17. Display Settings, Render Settings page

3. Select or clear the Enable Shadows check box.



You can also enable and disable shadows by choosing **Settings** → **Shadows** or clicking the Shadows button () on the Display Settings Toolbar.

10.11.1. Configuring Shadows

You can configure the quality of shadows. To use this feature you must have high quality hardware.

To configure how shadows are rendered:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 10-17).
3. Select Enable Shadows. The Shadow Quality slider becomes enabled.

4. Adjust the Shadow Quality slider.

10.12. Displaying Wakes and Spray Effects

When dynamic ocean is enabled, surface entities display wakes and spray effects. However, these effects affect performance. You can disable them if you need to emphasize performance over visual effects.

To enable or disable wakes and spray effects:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 9-4).
3. To enable or disable wakes, select or clear the Enable Wakes on Dynamic Oceans check box, or toggle the Wake button ( ) on the Observer toolbar.
4. If wakes are enabled, select Enable Spray Effects on Surface Vehicles to enable spray effects. Clear the check box to disable them. Disabling wakes also disables spray effects.

10.13. Enabling Buoyancy for Surface Entities

When the dynamic ocean is enabled, surface entities can bob up and down with wave action. The buoyancy models affect performance. You can disable buoyancy if you need to emphasize performance over visual effects.

To enable or disable the buoyancy models:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Entity Display Settings page (Figure 9-4).
3. Select or clear the Enable Buoyancy Models for Surface Vehicles check box.

11

Aggregate Entities

If you are using a VR-Vantage application to view a simulation generated by VR-Forces, MÄK's computer generated forces application, you can manipulate the display of the aggregate entities that are in the simulation.

Introduction to Aggregate Entities 11-2
Expanding and Collapsing Aggregates 11-3
Displaying Ghosted Icons 11-5
Displaying Aggregate Icons and Bounding Volumes 11-8
Specifying the Color Scheme for Aggregate Bounding Volumes 11-8

11.1. Introduction to Aggregate Entities

Aggregate entities are entities that represent organizational groupings of entities in a military hierarchy, such as platoons, companies, and brigades. VR-Vantage Stealth and VR-Vantage PVD can represent the aggregate entities simulated by VR-Forces. VR-Vantage IG has partial support for displaying aggregates. VR-Forces can simulate aggregates in either of the following states:

- Disaggregated: Subordinates are simulated and published as individual entities (Figure 11-1). Members of the aggregate are displayed using individual models or icons.
- Aggregated: Subordinates are not simulated separately. The aggregate is represented by one icon.

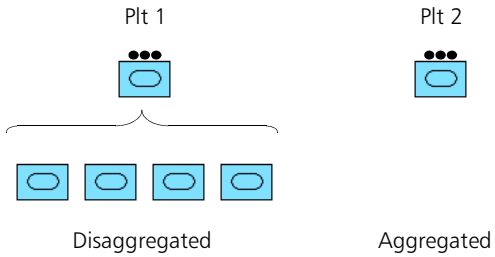


Figure 11-1. Disaggregated and aggregated entities

VR-Vantage can display disaggregated aggregates at the aggregate level, using a 2D icon (collapsed), or it can display the individual members of an aggregate (expanded). It can also display translucent volumes that show the bounding volume of the entire aggregate.

Since aggregated aggregates are sent over the network as one logical entity, VR-Vantage always represents them with one icon.



By default, the Objects List is filtered to just show entities. Therefore, if VR-Vantage is receiving aggregates, there will be aggregate icons in the display, but no corresponding entry in the Objects List. To see aggregates in the Objects List, change the filter to Aggregates or All.

The rest of this chapter explains how to manage these different display options.

11.2. Expanding and Collapsing Aggregates

You can display disaggregated aggregates in expanded or collapsed mode. When an aggregate is collapsed, it is displayed as one icon. When an aggregate is expanded, all the members of the aggregate are visible as individual entities and the aggregate icon is hidden. Multi-level aggregates can expand and collapse at each level of aggregation. For example a company could be collapsed to the company level (one icon), the platoon level (an icon for each platoon), or fully expanded.



VR-Vantage IG does not support expanding and collapsing of aggregates because it does not support the 2D Icons model set.

When you Expand or Collapse an aggregate, you can expand or collapse one level of aggregation or all levels. When you Expand or Expand All, expansion is downward from the current aggregate and does not affect any sibling aggregates. When you Collapse, contraction is upward in the hierarchy. Collapse All collapses all members of the aggregate to the topmost level.

Figure 11-2 illustrates these relationships. Assume a company with three platoons, each of which has four vehicles.

- If you Expand the top level aggregate, it expands to the platoon level. (1)
- If you select Plt C and choose Expand or Expand All, it expands just Plt C. (2)
- If you select the top level aggregate and expand all, it expands to the leaf level – 12 individual vehicles. (3)
- If the aggregate is fully expanded and you select one member of Plt C and choose Collapse, just Plt C collapses. (4)
- If you select any member of an expanded aggregate and select Collapse All, the entire aggregate collapses. (5)

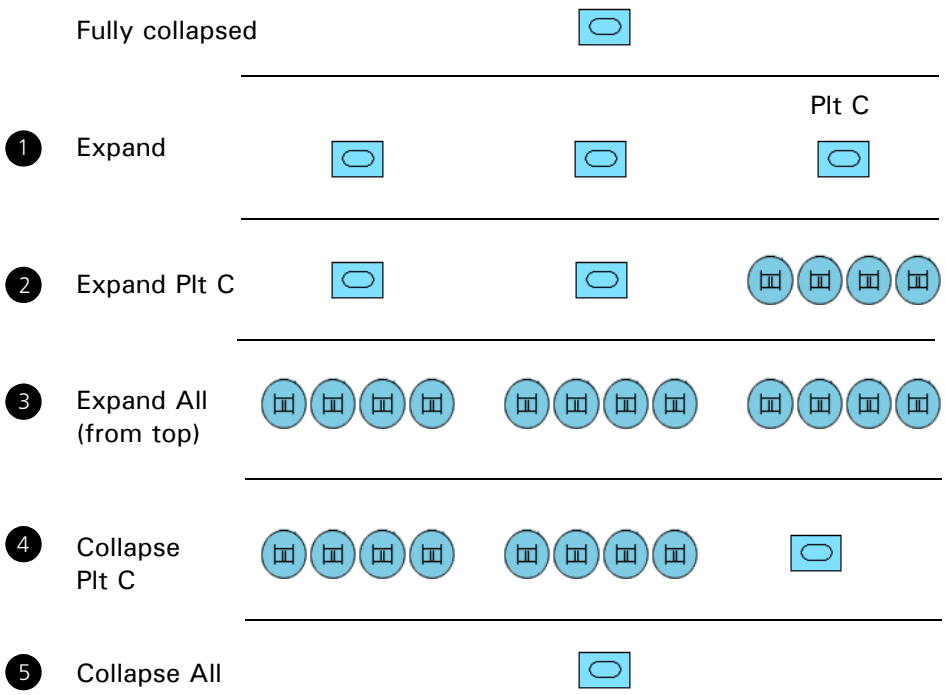


Figure 11-2. Aggregate expand and collapse

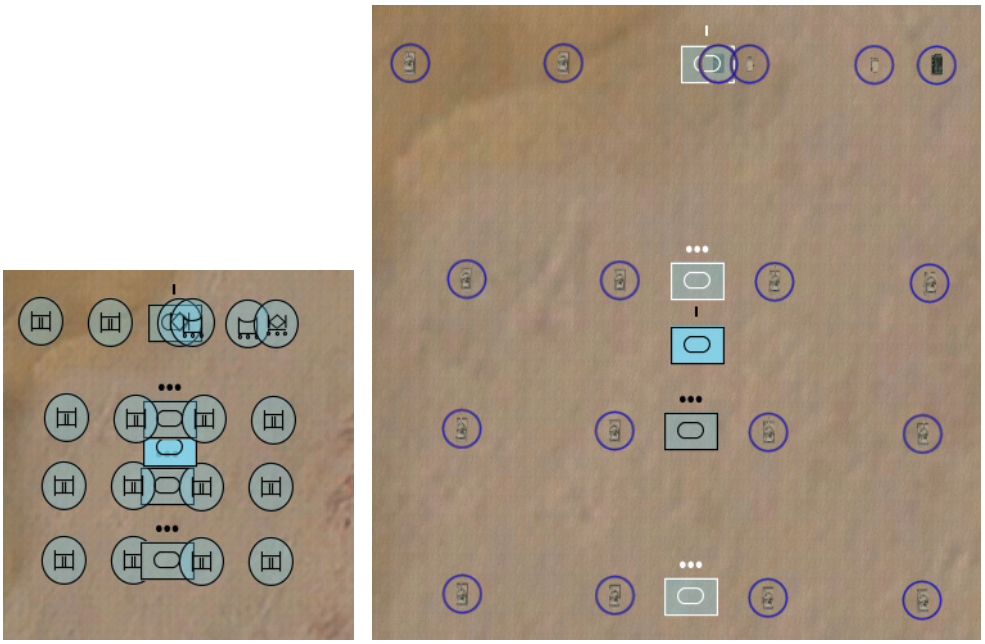
- To expand an aggregate, right-click the aggregate icon or its entry in the Objects List Panel and choose **Expand** on the popup menu.
- To expand an aggregate and all its subordinate aggregates, right-click the aggregate icon or its entry in the Objects List Panel and choose **Expand All** on the popup menu.
- To collapse an aggregate one level, right-click any member of the aggregate and choose **Collapse** on the popup menu.
- To collapse an aggregate to its root level, right-click any member of the aggregate and choose **Collapse All** on the popup menu.

11.3. Displaying Ghosted Icons

If you want to select aggregates, you need to collapse them so that you can select the aggregate icon. However, when you do this, you can no longer see where individual subordinate entities are located and if subordinates are destroyed, you cannot see which ones are destroyed and which are functional. VR-Vantage provides the following options for how aggregate icons are displayed so that you can work with them in a way that best meets your visualization and entity management needs:

- Display ghosted icons for hidden entities.
- Allow ghosted icons to be selected.
- Display all aggregate members.
- Manually expand and collapse the display.
- Display leaf-level aggregate members.

In the Plan View observer mode, when you display ghosted aggregates, the aggregate icon is displayed normally, and the subordinate members are displayed using semi-transparent icons. In 3D observer modes, aggregates that are subordinate to the top level aggregate are displayed using semi-transparent icons. Leaf-level entities are displayed using the appropriate model for the observer mode (Figure 11-3).



2D 3D

Figure 11-3. Ghosted icons

To configure the display of aggregate icons:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Aggregate Display Settings page (Figure 11-4).

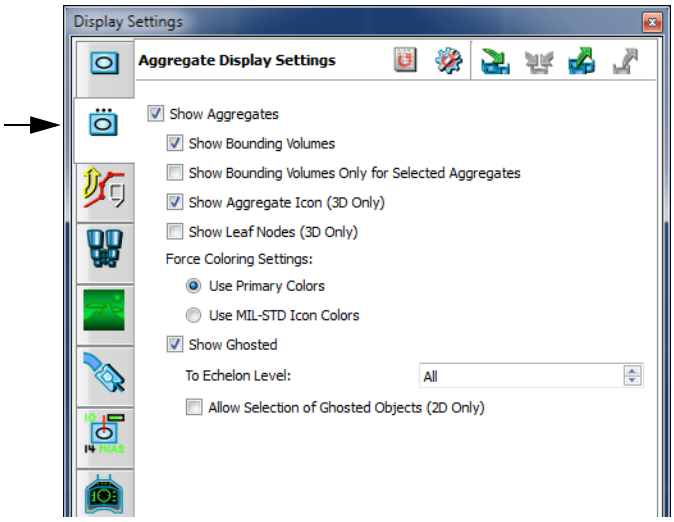


Figure 11-4. Aggregate Display Settings page

3. To display aggregate members based on the current level of aggregation only, clear Show Ghosted.
4. To display ghosted icons:
   a. Select Show Ghosted.
   b. In the To Echelon Level box, select the level of aggregation to show ghosted icons for. To show all levels without needing to consider how many levels there are, select All. Figure 11-5 illustrates the effect of changing the echelon level for displaying ghosted icons for the VR-Forces aggregate hierarchy shown.

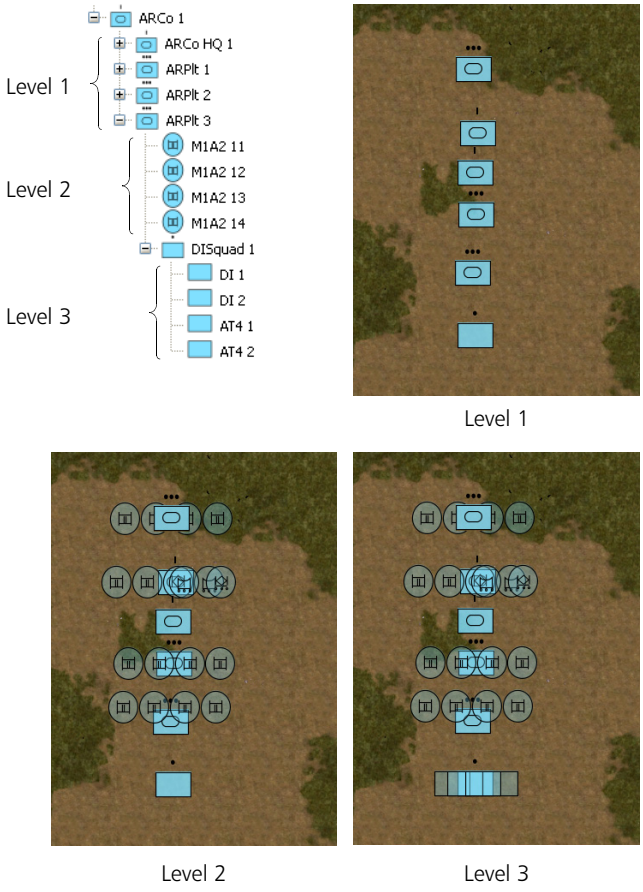


Figure 11-5. Displaying ghosted icons by echelon level

11.4. Displaying Aggregate Icons and Bounding Volumes

VR-Vantage lets you configure when to display aggregate icons and bounding volumes. Bounding volumes are translucent polygons that show the extents of the aggregate. This is useful when the individual entity icons or models are not displayed. You can configure icons and bounding volumes as follows:

- Enable and disable the display of aggregates. When disabled, only the 2D icons or 3D models for leaf level aggregate members are displayed.
- Enable and disable the display of bounding volumes. Bounding volumes are displayed only for collapsed aggregates. You can restrict the display of bounding volumes to the selected aggregates.
- In 3D observer modes, enable or disable the display of aggregate icons.

You can display aggregate icons without showing bounding volumes and vice versa.

To configure the display of aggregate icons and bounding volumes:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Aggregate Display Settings page (Figure 11-4).
3. To enable the display of aggregate icons, bounding volumes, or both, select Show Aggregates.
4. To display bounding volumes for collapsed aggregates, select Show Bounding Volumes.
5. To restrict the display of bounding volumes to the selected aggregates, select Show Bounding Volumes Only for Selected Aggregates.
6. To display aggregate icons in 3D observer modes, select Show Aggregate Icon (3D Only).



You can also enable and disable aggregates by choosing **Settings** → **Show Aggregates** or by selecting the Show Aggregates button () on the Display Settings Toolbar.

11.4.1. Specifying the Color Scheme for Aggregate Bounding Volumes

Aggregate bounding volumes can be displayed using primary colors or MIL-STD colors.

To specify the color scheme to use for aggregate bounding volumes:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Aggregate Display Settings page (Figure 11-4).
3. Select the Force Coloring Settings option that you want (Use Primary Colors or Use MIL-STD Icon Colors).

12

Intervisibility Objects

Intervisibility objects show line-of-sight between entities or objects in the simulation.

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Types of Intervisibility 12-3
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12.1. Intervisibility (Line-of-Sight)

You can display intervisibility (line-of-sight or LOS) between points, within areas, and between a point and all entities in a defined area. Intervisibility displays can be transient or permanent. Permanent intervisibility displays are objects. You can resize them and move them around the terrain. Intervisibility objects can be tied to a particular entity.

VR-Vantage IG does not support intervisibility.

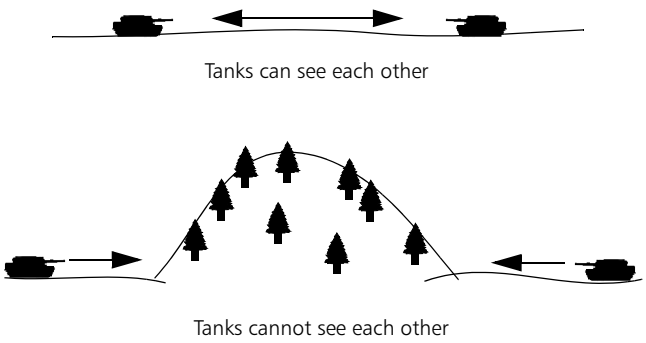


Figure 12-1. Intervisibility

You can configure parameters for intervisibility objects, such as the height above the terrain from which intervisibility is calculated. You can also change the colors used to display intervisibility.

- By default, intervisibility between entities is calculated from the center of their bounding volumes. It is possible that this may not match the line-of-sight calculations used by the simulation application whose output you are viewing. If so, entities may shoot at targets for which they do not appear to have line-of-sight.
- Linear and areal features do not block line-of-sight. Only point features block LOS.

12.2. Types of Intervisibility

VR-Vantage supports the following types of intervisibility:

- Point-to-point (intervisibility line).
- Intervisibility fan.
- Entity intervisibility.

The intervisibility fan and entity intervisibility are displayed as a circular area. However, intervisibility calculations are made within a cylindrical area extending above and below the terrain, so that intervisibility calculations can be made for air platform entities and subsurface entities.

In the 2D projection, intervisibility lines are fully visible on the terrain. In the 3D projection, they may pass through the terrain.

12.2.1. Point-to-Point Intervisibility

Point-to-point intervisibility (Figure 12-2) shows the line-of-sight between any two points. The portion of the line that is visible from the starting point is green. The portion that is not visible is red. You can change the colors used.

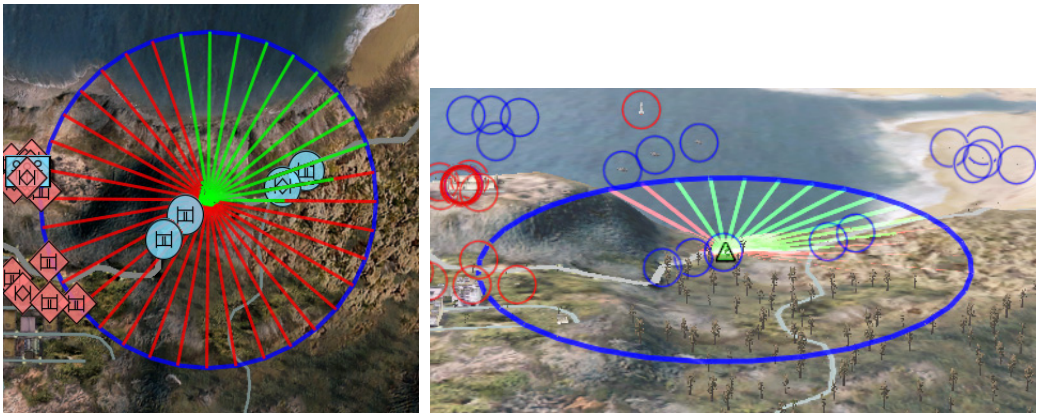


2D 3D

Figure 12-2. Point-to-point intervisibility

12.2.2. Intervisibility Fan

An intervisibility fan (Figure 12-3) shows a series of lines radiating from the center of a circle to its outer edge. Each ray shows intervisibility along its path from the origin to the border. You can configure the distance between rays. (For details, please see "Configuring Intervisibility Lines and Fans," on page 12-9.)



2D 3D

Figure 12-3. Intervisibility fan

12.2.3. Entity Intervisibility

Entity intervisibility (Figure 12-4) shows which entities are visible from the center of a defined area and whether or not the entities can see the center point. If you center the intervisibility circle on a point on the terrain, you can see which entities can see that point. If you lock the circle to an entity, you can see which entities can see that entity and which it can see. (For details, please see "Configuring Intervisibility Lines and Fans," on page 12-9.)



2D 3D

Figure 12-4. Entity intervisibility

12.3. Intervisibility Objects can be Transient or Permanent

You can configure intervisibility objects to be transient or permanent. (For details, please see "Configuring Intervisibility Lines and Fans," on page 12-9.) A transient intervisibility object displays intervisibility from the origin point (defined by a mouse click) to wherever you move the cursor. If you click the mouse again, you reset the origin. You cannot use the mouse for other actions until you exit intervisibility mode (by right-clicking). This mode is convenient when you want to quickly check intervisibility, but do not want to keep intervisibility objects in the display.

A permanent intervisibility object stays in the display after you create it. You can resize the object, edit drawing options, and move it around the display.

12.3.1. Creating a Transient Intervisibility Object

Transient intervisibility objects do not stay in the display after you quit intervisibility mode.

To display transient intervisibility:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Intervisibility Settings page (Figure 12-5).

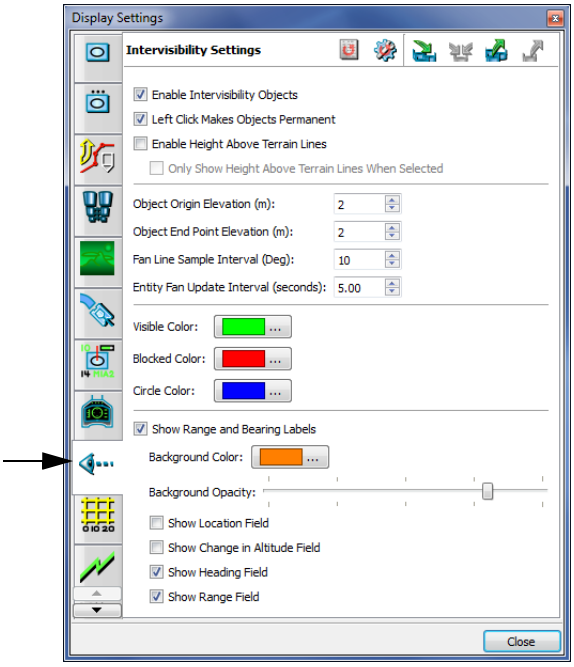


Figure 12-5. Intervisibility Settings page

3. Clear the Left Click Makes Objects Permanent check box.
4. Choose **Intervisibility** → **Create *intervisibility_type***, where *intervisibility_type* is a type of intervisibility object, or click one of the buttons on the Intervisibility Toolbar.
5. Click on the terrain to place the origin of the intervisibility object.
6. Move the cursor around the terrain to expand and contract the object. For point-to-point intervisibility, moving the cursor also changes the direction of the line.
7. To change the origin of the intervisibility display, click another location on the terrain.
8. Right-click to cancel intervisibility mode.

12.3.2. Creating a Permanent Intervisibility Object

Permanent intervisibility objects remain in the display after you create them.

To create a permanent intervisibility object:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Intervisibility Settings page (Figure 12-5).
3. Select Enable Intervisibility Objects.
4. Select Left Click Makes Objects Permanent.
5. Choose **Intervisibility** → **Create *intervisibility_type***, where *intervisibility_type* is a type of intervisibility object, or click one of the buttons on the Intervisibility Toolbar.
6. Click on an entity or on a location on the terrain where you want the origin of the intervisibility object to be located. An intervisibility object is displayed. As you move the cursor closer to the origin, or farther away from it, the circle or line contracts and expands. If you are displaying point-to-point, you can rotate the line around the origin before you specify the end point.
7. Click on the terrain where you want to fix the end point of a line or border of a circle.

12.4. Editing an Intervisibility Object

You can change the following aspects of an intervisibility object:

- Change the location of either end point of an intervisibility line, to change its length and direction.
- Change the origin of an intervisibility fan, thereby moving the entire fan.
- Change the diameter of an intervisibility fan.

If an intervisibility object is anchored to an entity, you cannot change the origin.

To change the length or diameter of an intervisibility object:

1. To edit a line, double-click its end point.

   To edit a fan, select the object, then double-click the outer ring of the fan.

   The cursor changes (✣).
2. Drag the end point or circle towards or away from the origin. If you are editing an intervisibility line, you can move the end point to any location.
3. Click to exit edit mode.

To revert to the original size of the intervisibility object, right-click while you are still in edit mode.

To move an intervisibility fan or line:

1. Double-click a fan's center point or any place on a line. The cursor changes.
2. Drag the object to a new location.
3. Click to set the location.

To revert to the original location of the intervisibility object, right-click while you are still in edit mode.

12.5. Configuring Intervisibility Lines and Fans

You can configure the following attributes of intervisibility objects:

- The elevation of the origin and end point.
- The sampling rate for intervisibility fans.
- The update rate for entity intervisibility fans.
- Display of height above terrain lines (3D) and height labels (3D and 2D).
- The colors used to display intervisibility objects.
- Display of range and bearing labels. For more information about range and bearing labels, please see "Displaying Intervisibility Line Information," on page 12-11.

When you change colors or the sampling rate, changes affect all existing intervisibility objects. Changes to the origin and end point elevation only affect newly created objects.

To configure intervisibility objects:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Intervisibility Settings page (Figure 12-5).
3. Change the settings as desired. Table 12-1 describes the settings.

Table 12-1: Intervisibility settings

Option	Description
Enable Height Above Terrain Lines	Enables or disables display of height above terrain lines (3D) and height labels (3D and 2D).
Show Height Above Terrain Lines Only for Selected	If selected, HAT lines are displayed only for the selected intervisibility objects.
Object Origin Elevation	The height, in meters, above the terrain at the origin point from which to calculate intervisibility.
Object End Point Elevation	The height, in meters, above the terrain at the end point to use to calculate intervisibility.
Fan Line Sample Interval	The distance, in degrees, between each ray in a intervisibility fan. After changing this value, press **`Enter`** or click away from the field.
Entity Fan Update Interval	How frequently, in seconds, to update the entity intervisibility fan.
Visible Color Blocked Color	The colors to use for the portion of an intervisibility line that an entity can see and the portion where visibility is blocked.
Circle Color	The color to use for the outer circle of an intervisibility fan.
Show Range and Bearing Labels	Enable or disable display of range and bearing labels.

Table 12-1: Intervisibility settings

Option	Description
Background Color	Specify the background color for range and bearing labels.
Background Opacity	Specify the opacity of the background for range and bearing labels.
Show Location Field	If range and bearing labels are displayed, show the location of the endpoints.
Show Change in Altitude Field	If range and bearing labels are displayed, show the difference in altitude between the endpoints.
Show Heading Field	If range and bearing labels are displayed, show the heading of each endpoint relative to the other point.
Show Range Field	If range and bearing labels are displayed, show the length of the intervisibility line.

12.6. Pinning an Intervisibility Object to an Entity

When you pin an intervisibility object to an entity, the intervisibility object moves with the entity and you know that its origin is centered on the entity.

To pin an intervisibility object to an entity:

1. Select the entity to which you want to pin the intervisibility object.
2. Choose **Intervisibility** → **Create *intervisibility_type***, where *intervisibility_type* is a type of intervisibility object, or click one of the buttons on the Intervisibility Toolbar. The origin is placed on the entity icon or model.
3. Specify the end point for the intervisibility object.

12.7. Showing and Hiding Intervisibility Lines

You can toggle the display of intervisibility lines on and off.

To enable or disable the display of intervisibility lines:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Intervisibility Settings page (Figure 12-5).
3. Select or clear the Enable Intervisibility Objects check box.



You can also enable and disable display of intervisibility objects by choosing **Intervisibility** → **Enable/Disable Intervisibility**, or by clicking the Enable/Disable Intervisibility button () on the Intervisibility Toolbar.

12.8. Displaying Intervisibility Line Information

You can display the following information about an intervisibility line:

- Location of each endpoint.
- Heading of the line from each endpoint.
- Altitude of each endpoint.
- Length of the line (range).



Figure 12-6. Intervisibility line information (2D)

The information label has a background. You can adjust the color and opacity of the background.

To display information about an intervisibility line:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Intervisibility Settings page (Figure 12-5).
3. Select or clear the Show Range and Bearing Labels check box.
4. Select the check boxes for the type of information you want to display. For descriptions of the check box options, please see Table 12-1.
5. To change the background color for the label:
   a. Click the Background Color button. A color picker opens.
   b. Select the color you want to use for the background.
   c. Click OK.
6. To change the opacity of the background, adjust the Background Opacity slider.

12.9. Deleting Intervisibility Objects

➤ To delete an intervisibility object, select the object and choose **Intervisibility** → **Delete**.

13

Changing How the Terrain is Displayed

This chapter how to find out information about a terrain by changing how it is displayed.

Displaying Feature Data (2D) 13-2
Displaying a List of Vector Features 13-3
Changing the Colors Used for Feature Data 13-4
Displaying Grid Lines 13-6
Configuring Grid Lines 13-7
Configuring Visible Surfaces (GDB Soil Types) 13-8
Coloring Terrain Based on Elevation 13-9
Configuring Elevation Color Settings 13-10
Displaying Contour Lines 13-12
Configuring Contour Lines 13-13
Displaying Models and Terrain in Wireframe Mode 13-13

13.1. Displaying Feature Data (2D)

If a terrain contains feature data, you can display it in the Plan View observer mode. Figure 13-1 shows a section of the Little Pond terrain with features disabled and enabled.



Figure 13-1. Feature data

This setting only displays features imported from GDB files or shapefiles. It does not display features streamed from a terrain server. If you load features using a *.earth* file, they are drawn (or not drawn) based on the configuration information in the file.

If your terrain has many features, displaying them can take a long time.

➤ To display feature data, choose **Observer** → **Features**, or click the Feature Data button ( ) on the Observer Settings Toolbar.

13.1.1. Displaying a List of Vector Features

If a terrain has vector features, they are listed on the Vector Network tab of the Terrain Panel. If you select a feature in the list, it is highlighted in the display, and vice versa (Figure 13-2).

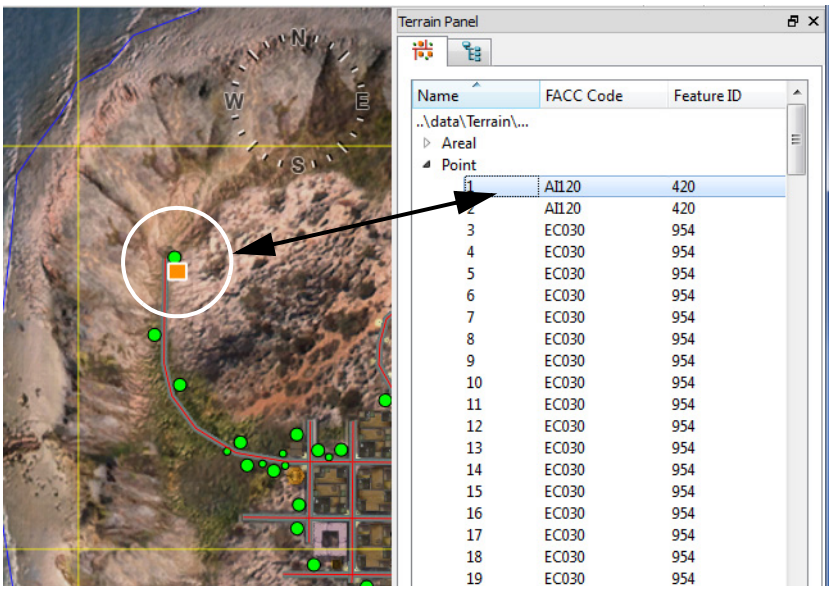


Figure 13-2. Vector feature selected

To display the feature list:

1. Choose **View** → **Terrain Panel**. The Terrain Panel opens.
2. Select the Vector Network tab (Figure 13-2).
3. Expand the top-level categories to see the lists of individual features.

13.1.2. Changing the Colors Used for Feature Data

If a terrain database contains feature data, you can change the colors used to display it. In Figure 13-3, we have changed the Woodland feature in the Little Pond terrain to be pink. Compare it to the default color (Figure 13-1).



Figure 13-3. Feature data with color change

To change the color of feature data:

1. Choose **Settings** → **Terrain**. The Terrain Settings dialog box opens.
2. Select the Feature Settings page (Figure 13-4).

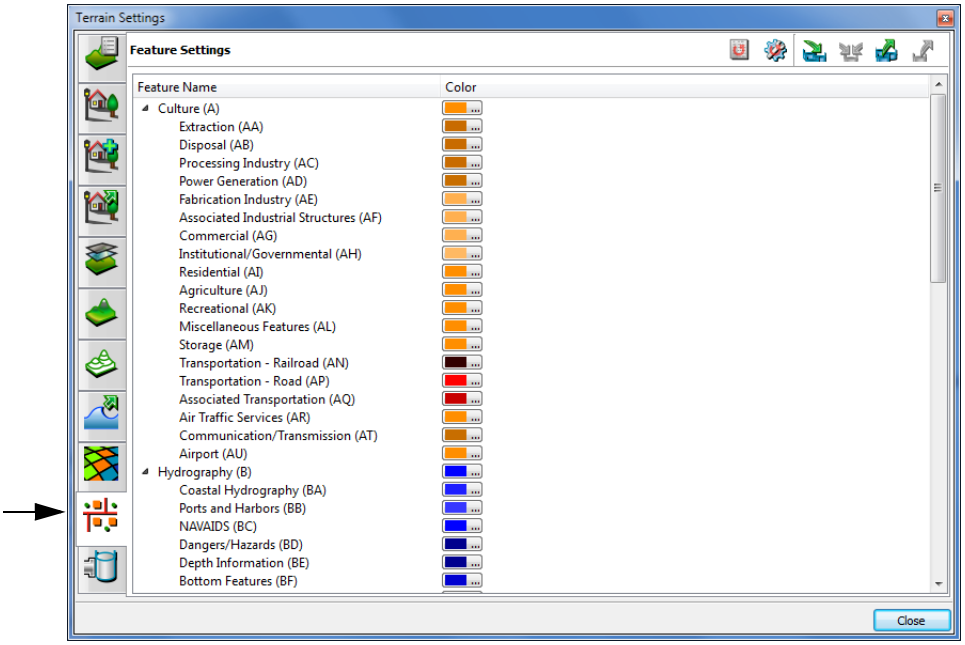


Figure 13-4. Feature Settings page

3. Click the color swatch for the feature that you want to change. A color picker dialog box opens.
4. Select the color that you want to use.
5. Click OK.

13.2. Displaying Grid Lines

VR-Vantage can display grid lines in the 2D view. Grid-lines are an observer-specific setting.

To enable or disable grid lines:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page (Figure 13-5).

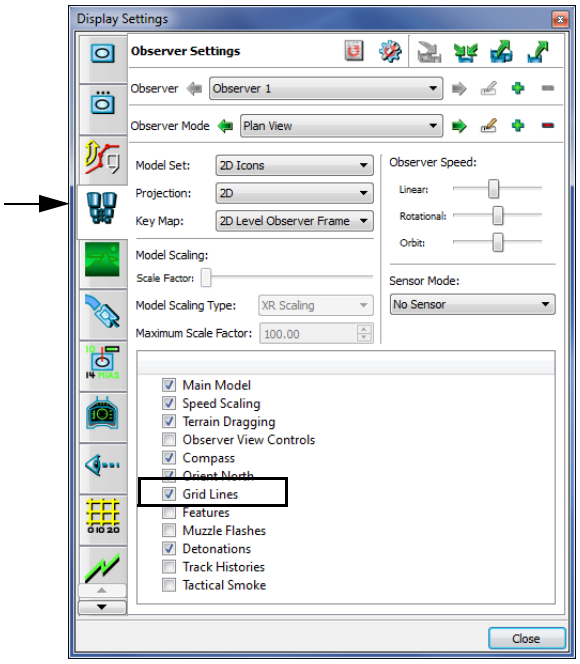


Figure 13-5. Observer Settings page

3. Select Plan View mode (or a locally created 2D observer mode).
4. Select or clear the Grid Lines check box.

> You can also enable or disable grid lines by choosing **Observer** → **Grid Lines** or clicking the Grid Lines button (▦) on the Observer Settings Toolbar.

13.2.1. Configuring Grid Lines

You can configure the coordinate system used for grid lines, the precision, and the spacing. Spacing can be fixed, in meters, or determined by VR-Vantage using a specified number of screen pixels. Fixed spacing can result in a very tight grid and unreadable labels as you zoom out. Auto spacing does not have this problem. However, the grid lines will constantly recalculate as you zoom in and out.

To configure grid lines:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Grid Lines Settings page (Figure 13-6).

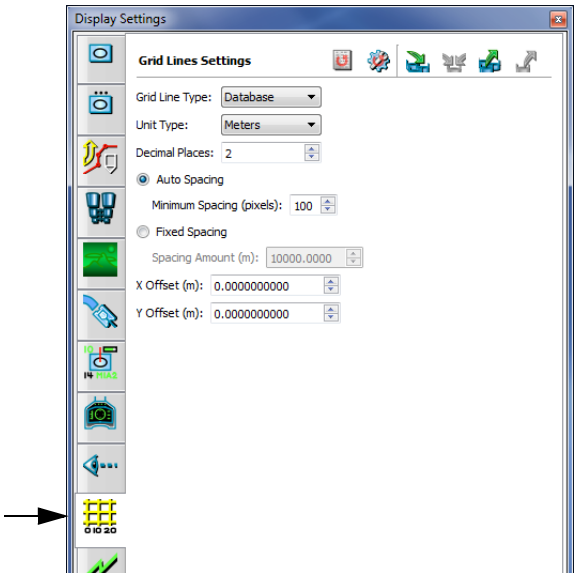


Figure 13-6. Grid Lines Settings page

3. To change the coordinate system used for grid lines, select an option in the Grid Line Type list. The list displays grid line types that are appropriate for the type of database loaded. (If no database is loaded, the coordinate system is set to Flat Earth.)
4. To specify the unit type for the grid line labels, select an option on the Unit Type list.
5. To specify the precision of the grid line labels, type a value in the Decimal Places box.
6. To change the spacing type, select AutoSpacing or Fixed Spacing and specify a value for the chosen spacing type.
7. To specify an offset from the origin, change the values for X Offset and Y Offset.

13.3. Configuring Visible Surfaces (GDB Soil Types)

If a terrain patch was loaded from a GDB file, you can display or hide GDB soil types. Figure 13-7 shows the *makland.gdb* terrain file. The view on the left shows all soil types. The view on the right has Building, Grass, Ocean, and Rock surfaces hidden.

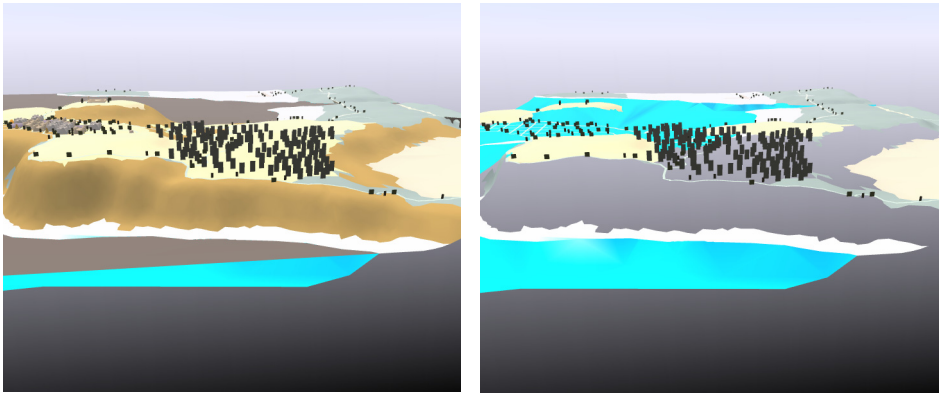


Figure 13-7. Visible surfaces toggled off

To display or hide GDB soil types:

1. Choose **Settings** → **Terrain**. The Terrain Settings dialog box opens.
2. Select the Visible Surfaces page (Figure 13-8).

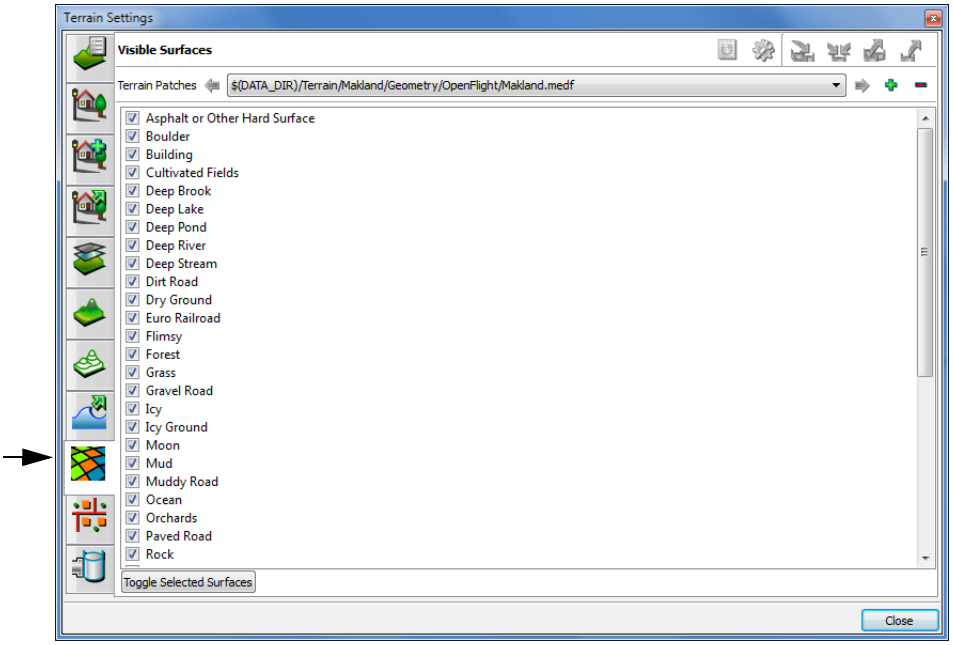


Figure 13-8. Visible Surfaces page

3. In the Terrain Patches list, select the terrain patch that you want to configure.

4. Select the check box for each soil type that you want to be visible.
5. Clear the check box for each soil type that you want to hide.
6. To change the state of multiple soil types at one time:
   a. Select (highlight) the names (not the check boxes) of the soil types whose state you want to change.
   b. Click Toggle Selected Surfaces.

13.4. Coloring Terrain Based on Elevation

You can color the terrain based on elevation. If you have a raster map, the color is superimposed on the image.

To enable or disable coloring of terrain by elevation:

1. Choose **Settings** → **Terrain**. The Terrain Settings dialog box opens.
2. Select the Elevation Color page (Figure 13-9).

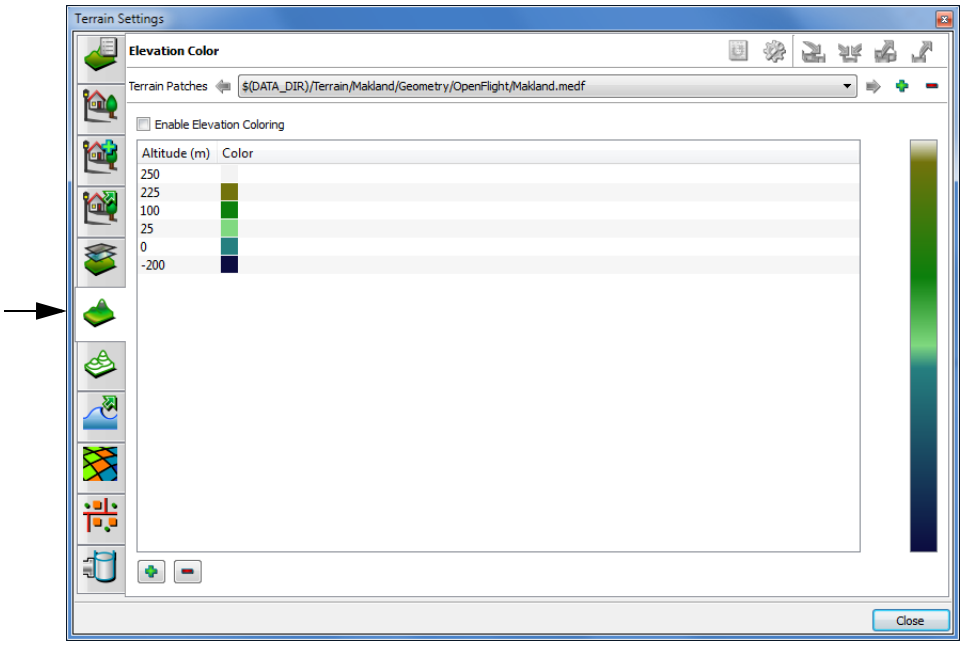


Figure 13-9. Elevation Color page

3. In the Terrain Patches list, select the terrain patch for which you want to enable elevation coloring.
4. Select or clear the Enable Elevation Coloring check box.

13.4.1. Configuring Elevation Color Settings

You can specify the color applied to terrain at a given altitude. You can add altitude points and remove them.

Inserting an Altitude Point

To insert an altitude point:

1. Choose **Settings** → **Terrain**. The Terrain Settings dialog box opens.
2. Select the Elevation Color page (Figure 13-9).
3. In the Terrain Patches list, select the terrain patch for which you want to insert an altitude point.
4. Select an altitude point in the list that is above or below the altitude point you want to add.
5. Click Insert Point. A new point is added with the same altitude as the one you selected.
6. Double-click the new altitude point to make it editable.
7. Set the altitude point to the altitude that you want.
8. Click away from the altitude point to set it.

Deleting an Altitude Point

To delete an altitude point:

1. Choose **Settings** → **Terrain**. The Terrain Settings dialog box opens.
2. Select the Elevation Color page (Figure 13-9).
3. In the Terrain Patches list, select the terrain patch for which you want to delete an altitude point.
4. Select the altitude point that you want to delete.
5. Click Delete Point.

Changing the Color of an Altitude Point

To change the color of an altitude point:

1. Choose **Settings** → **Terrain**. The Terrain Settings dialog box opens.
2. Select the Elevation Color page (Figure 13-9).
3. In the Terrain Patches list, select the terrain patch for which you want to change the color of an altitude point.
4. Double-click the color swatch for the altitude point whose color you want to change. A color chooser dialog box opens.
5. Select or specify a new color.
6. Click OK.

13.5. Displaying Contour Lines

You can display contour lines and intermediate contour lines on the terrain. Intermediate contour lines divide the contour line interval into fifths (Figure 13-10). You can configure the thickness of contour lines and the interval between them.

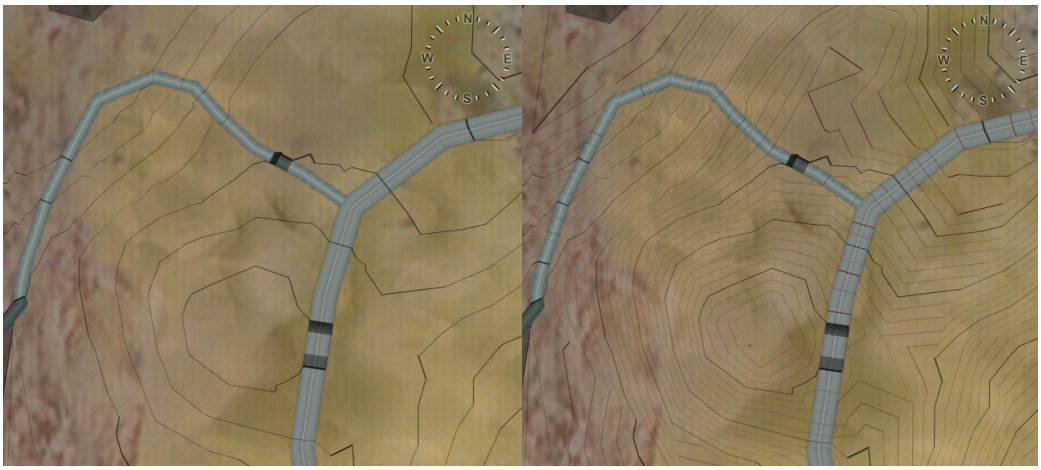


Figure 13-10. Contour lines and intermediate contour lines

To display contour lines:

1. Choose **Settings** → **Terrain**. The Terrain Settings dialog box opens.
2. Select the Contour Lines page (Figure 13-11).

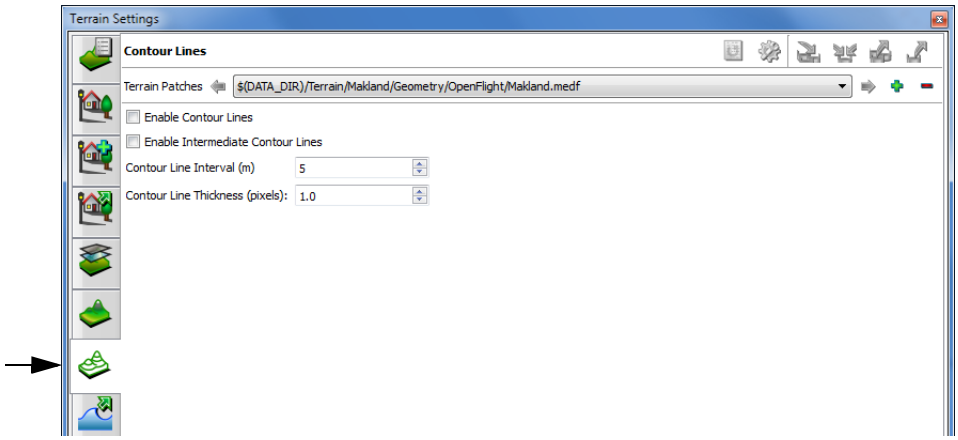


Figure 13-11. Contour Lines page

3. In the Terrain Patches list, select the terrain patch for which you want to enable or disable the display of contour lines.
4. Select Enable Contour Lines.
5. To enable intermediate contour lines, select Enable Intermediate Contour Lines.

13.5.1. Configuring Contour Lines

You can configure the thickness of contour lines and the interval between them.

To configure contour lines:

1. Choose **Settings** → **Terrain**. The Terrain Settings dialog box opens.
2. Select the Contour Lines page (Figure 13-11).
3. In the Terrain Patches list, select the terrain patch for which you want to configure the thickness and interval of contour lines.
4. In the Contour Line Interval text box, specify the distance, in meters, between contour lines.
5. In the Contour Line Thickness text box, specify the thickness, in pixels, for contour lines.

13.6. Displaying Models and Terrain in Wireframe Mode

In wireframe mode, VR-Vantage displays the polygons that make up the terrain and objects (Figure 13-12).



Figure 13-12. Wireframe off and on

To enable or disable wireframe mode:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 13-13).

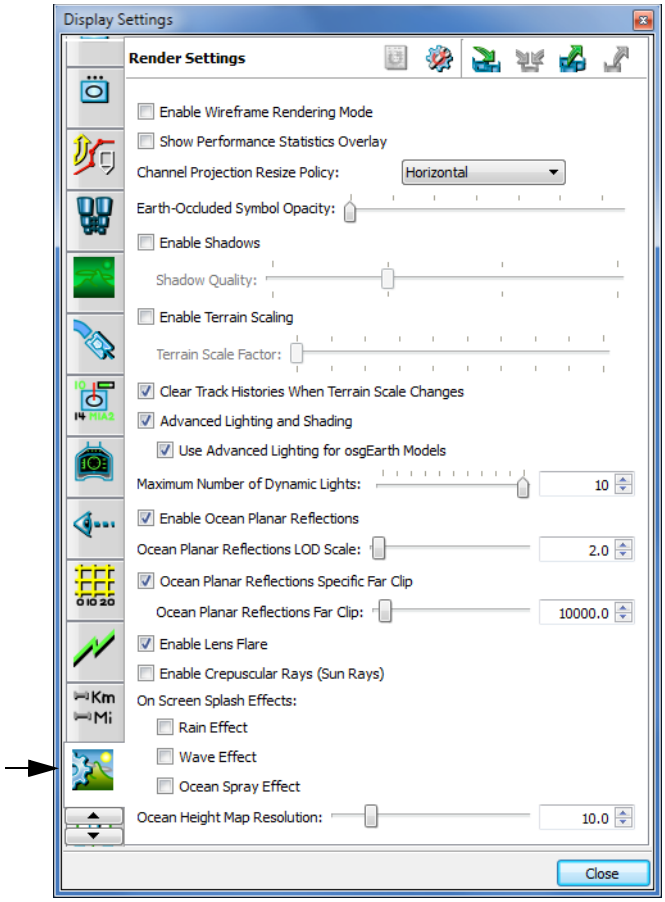


Figure 13-13. Render Settings page

3. Select the Enable Wireframe Rendering Mode check box.

You can also enable and disable wireframe mode by choosing **Settings** → **Wireframe Rendering** or clicking the Wireframe Rendering button ( ) on the Display Settings Toolbar.

14

Using Sensors

This chapter explains how to use the sensor feature to simulate a night-vision goggle (NVG) or infrared view of the scene.

Using Sensors 14-2
Enabling Sensors 14-3
Configuring Sensors 14-4
Adding New Sensors 14-5

14.1. Using Sensors

VR-Vantage Stealth and VR-Vantage IG can simulate the way that the 3D scene would look if an observer were using visual sensor devices such as night vision goggles or viewing the infrared spectrum. This is an observer-specific setting. You can adjust the contrast, blur, and noise of the view.

VR-Vantage includes one sensor module – CameraFX, which uses the SenSim libraries from JRM Technologies. The sensors do not take into account the materials of the objects that you are viewing. They simply filter the view to produce the desired effect. If you want physics-based sensor effects, you may want to try the SensorFX Plug-in to VR-Vantage, developed by JRM. For details, please contact your MÄK salesperson.

14.2. Enabling Sensors

Sensors are observer-specific (Figure 14-1).

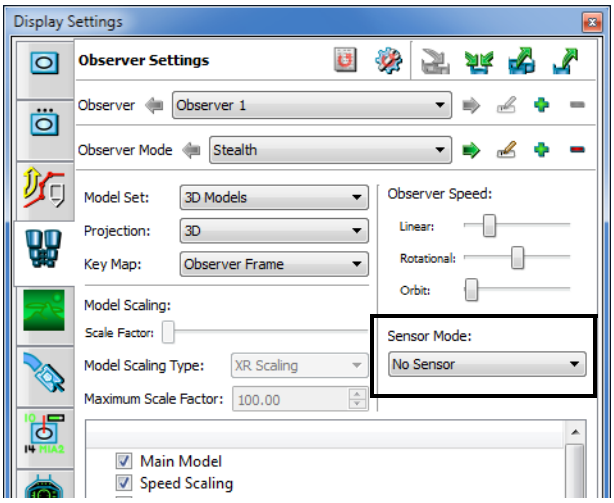


Figure 14-1. Sensor setting for observer mode

VR-Vantage includes the following observer modes that have sensors enabled:

- Out-the-Window (NVG).
- Out-the-Window (IR).
- Out-the-Window (IR BlackHot).

You can also specify use of a sensor configuration as a channel attribute.

To enable sensors, do one of the following:

- Select an observer mode that has a sensor configured.
- Edit an observer mode to use a sensor.
- Create a new observer mode and configure it with a sensor.
- Change the Sensor attribute for a channel.

For details about creating and editing observer modes, please see "Creating and Editing Observer Modes," on page 6-2. For details about editing channel attributes, please see Section 1.3, "Changing a Channel's Attributes," in *VR-Vantage Configuration Guide*.

14.3. Configuring Sensors

You can configure the following aspects of sensors:

- Blur. The sharpness of the image.
- Noise. The graininess of the image.
- Gain. The contrast and brightness of the image. (IR only)

You can configure a separate set of settings for each sensor type. VR-Vantage remembers the settings. When you change the settings for a sensor type, they affect the display only if that sensor type is in use. For example, if you select NVG in the sensor list on the Observer Settings page, and select IR in the Sensors list on the Sensor Settings page, the changes you make to the IR configuration do not affect the NVG display you are looking at. If you then switch to IR in the VR-Vantage window, the new IR settings take effect. (This probably sounds obvious, but the Sensor Settings page does not automatically display the configuration for the sensor that is being used. If you want to edit the sensor that you are currently using, you have to be sure that you have selected it to edit.)

To configure sensors:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Sensor Settings page (Figure 14-2).

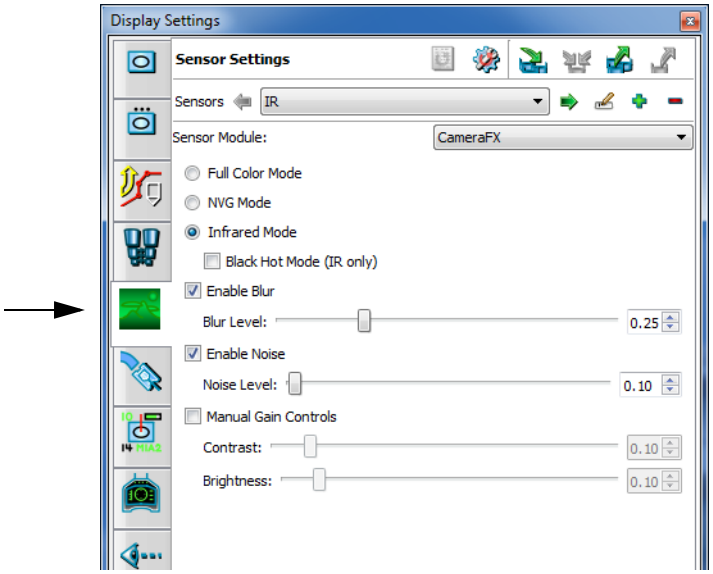


Figure 14-2. Sensor Settings page

3. In the Sensors list, select the sensor that you want to configure.
4. Select the Sensor module from the list.
5. Select the sensor mode. If you select Infrared Mode, select or clear the Black Hot Mode check box.



- It may seem obvious that if, for example, you select NVG from the Sensors list, you would select it for the sensor type. However, VR-Vantage lets you add additional sensor configurations to the list and in that case, you would need to specify the correct sensor type for the new sensor. For example, you might create a sensor called NVG-High Contrast. Then you would select NVG as the sensor type and adjust the contrast accordingly.
- Full Color Mode provides natural coloring, as you would see with no sensor modes applied. The benefit of creating a sensor mode using this option is that you can apply noise or blur to the scene.

6. Select the check boxes for the effects that you want to be enabled for this sensor configuration.
7. Adjust the values for the enabled effects.

14.4. Adding New Sensors

You can add, rename, and delete sensors.

To add a sensor:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Sensor Settings page (Figure 14-2).
3. On the Sensor line, click the Add button (). A new sensor called sensor_*number* is added. There are no configuration options on the page. (To rename the sensor, click the Rename button () and enter a new name.)
4. In the Sensor Module list, select CameraFX. The available configuration options are added to the page.
5. Select the type of sensor that you want this to be (Full Color, Infrared, or NVG).
6. Set the Blur, Noise, and Gain levels.

15

Sound Effects

This chapter explains how to enable and configure sound effects.

Introduction to Sound Effects 15-2
Enabling Sound Effects 15-2
Setting the Sound Volume 15-3
Specifying the Range in which Sounds are Heard 15-3
Associating Sound Files with Entities and Events 15-4
Mapping a Sound File to an Entity 15-5
Mapping Sound Files to Fire and Detonation Events 15-8

15.1. Introduction to Sound Effects

VR-Vantage can associate sound effects with entities, fire events, and detonation events. You can enable and disable use of sound effects and you can specify that sounds will be heard only when the observer is within a certain distance of the entity or event that generates them.

15.2. Enabling Sound Effects

To enable sound effects:

1. Choose **Settings** → **Audio Settings**. The Audio Settings dialog box opens.
2. Select the Audio Settings page (Figure 15-1).

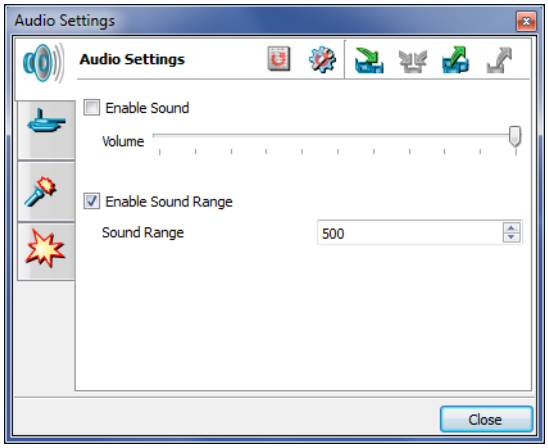


Figure 15-1. Audio Settings page

3. Select the Enable Sound check box.



You can also enable and disable sound effects by clicking the Audio button ( ) on the Display Settings toolbar.

15.2.1. Setting the Sound Volume

You can adjust the volume of sound effects.

To set the sound volume:

1. Choose **Settings** → **Audio Settings**. The Audio Settings dialog box opens.
2. Select the Audio Settings page (Figure 15-1).
3. Adjust the Volume slider.



You can also change the volume by clicking the arrow on the Audio button ( ) (on the Display Settings toolbar) and adjusting the Audio Volume slider.

15.2.2. Specifying the Range in which Sounds are Heard

You can specify that sound effects be played only if the observer is within a certain distance of the entities that can emit sounds. If sound range is enabled, as soon as the observer moves beyond the range from an entity, sound effects are shut off. If this option is disabled, sound effects are played for all entities in the scenario regardless of their distance from the observer. However, even if sound range is not enabled, as the distance between the observer and entities increases, sound levels drop off.

To specify the range in which sounds can be heard:

1. Choose **Settings** → **Audio Settings**. The Audio Settings dialog box opens.
2. Select the Audio Settings page (Figure 15-1).
3. Select the Enable Sound Range check box.
4. Specify a value in the Sound Range text box.

15.3. Associating Sound Files with Entities and Events

VR-Vantage includes a set of sound files (WAV format) for generic entity platforms and for fire and detonation events. The files are in *./data/Audio/Sounds*. Sound files are associated with entity type enumerations. You can change the mappings and add new mappings.

You add and edit mappings between entity types, fire events, or detonation events and sound files on pages in the Audio Settings dialog box. You can add or edit mappings using mapping dialog boxes or directly in the mappings windows. The mapping dialog boxes behave differently depending on the state of the mapping window when you open the dialog box, as follows:

- If you click the Add Mapping button and have not selected a mapping in the Entity Mapping Settings window, you are presented with a default entity type (all wildcards).
- If you click the Add Mapping button and have selected an existing mapping, the dialog box displays the mapping you selected. From here, you can edit the existing mapping or create a new one.

When you edit a mapping, the result depends on whether you edit the entity or event enumeration or the sound file. The differences are based on the requirements for uniqueness in a mapping. The uniqueness of an entity type or fire event mapping is based on the entity type enumeration. The uniqueness of a detonation event mapping is based on the entity type enumeration and the detonation result value. Table 15-1 lists the results of different editing actions.

Table 15-1: Editing sound mapping files

Action	Result
Edit enumeration in dialog box.	New mapping is added. The previous mapping is not changed.
Edit enumeration in place.	New mapping replaces previous mapping.
Edit sound file in dialog box or in window.	Mapping to current entity or event is updated.
Edit channel in dialog box or in window.	Mapping to current entity or event is updated.
Edit detonation result in dialog box.	New mapping is added. The previous mapping is not changed.
Edit detonation result in window.	New mapping replaces previous mapping.

15.3.1. Mapping a Sound File to an Entity

An entity type enumeration can only have one sound file mapped to it. A sound file can be mapped to as many entity types as you want.

Adding a New Entity Sound Mapping

To add a new entity sound mapping:

1. Choose **Settings** → **Audio Settings**. The Audio Settings dialog box opens.
2. Select the Entity Sound Editor page (Figure 15-2).

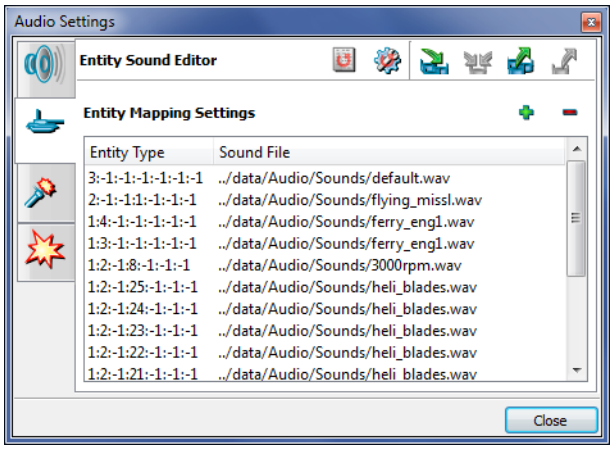


Figure 15-2. Entity Sound Editor page

3. Click the Add button (+). The Create New Entity Type Sound Mapping dialog box opens (Figure 15-3).

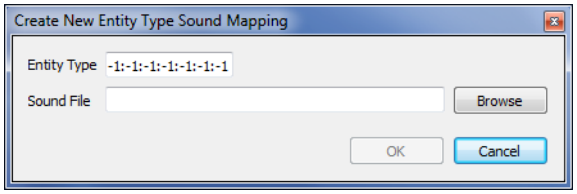


Figure 15-3. Create New Entity Type Sound Mapping dialog box



You cannot open the Create New Entity Type Sound Mapping dialog box with default options if one of the existing mappings is selected. If you have selected a mapping and want to return to the unselected state, click on white space in the mappings window or select one of the other tabs and then select the Entity Sound Editor tab again.

4. In the Entity Type box, type the enumeration for this mapping.

5. In the Sound File text box, type the pathname of a sound file or click Browse and select a file in the file chooser dialog box.
6. Click OK.



The OK button does not become enabled until you specify a valid entity type and sound file name.

Creating an Entity Sound Mapping from an Existing Mapping

When you edit a mapping, you can either change the sound file associated with the current entity type or create a new mapping with a different entity type.

To create a sound mapping from an existing mapping:

1. Choose **Settings** → **Audio Settings**. The Audio Settings dialog box opens.
2. Select the Entity Sound Editor page (Figure 15-2).
3. Select the mapping that you want to use as the starting point.
4. Click the Add button (). The Create Entity Type Sound Mapping from Existing Mapping dialog box opens (Figure 15-4).

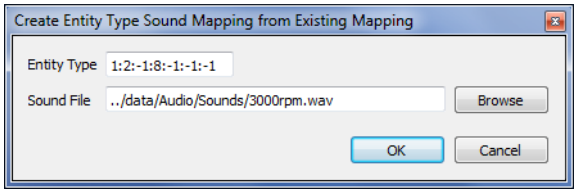


Figure 15-4. Create Entity Type Sound Mapping from Existing Mapping dialog box

5. To change the sound file associated with the entity type, type a new pathname or click Browse and select a sound file.
6. To create a new mapping, change the Entity Type enumeration.
7. Click OK. If you just changed the sound file, the mapping is updated. If you changed the entity type, a new mapping is added to the list.

Editing the Entity Type in the Mappings Window

If you edit the entity type in the mappings window (that is, without using a dialog box), it replaces the previous mapping.

To edit the entity type in the window:

1. Choose **Settings** → **Audio Settings**. The Audio Settings dialog box opens.
2. Select the Entity Sound Editor page (Figure 15-2).
3. Double-click the entity type you want to edit. It becomes editable (Figure 15-5).

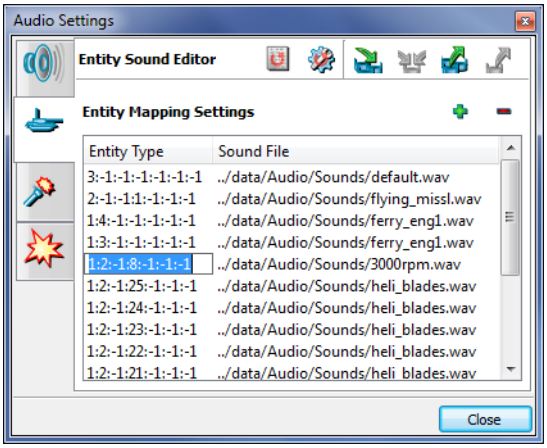


Figure 15-5. Editable entity type

4. Change the entity type enumeration.
5. Press **`Enter`**.

Editing the Sound Mapping in the Mappings Window

When you edit the sound mapping in the mappings window, the change does not affect any other mapping.

To edit the sound mapping in the window:

1. Choose **Settings** → **Audio Settings**. The Audio Settings dialog box opens.
2. Select the Entity Sound Editor page (Figure 15-2).
3. Double-click the sound mapping that you want to change. The Sound File dialog box opens.
4. Select the new sound file.
5. Click Open.

15.3.2. Mapping Sound Files to Fire and Detonation Events

When you map a sound file to a weapon fire or a detonation event, you can specify a channel for the sound. When you map a detonation sound, you can specify the detonation result for the mapping.

Specifying a channel for a sound event lets you control the number of sounds that can play concurrently. Sounds that are mapped to channel 0 can all play at the same time. Sounds mapped to any other channel can play only if no other event is using the channel. For example, suppose you map two weapon fire events to channel 1. One of the weapon type fires and the sound is generated. Then the second type of weapon event occurs. Since the first event is using channel 1, the second sound is not generated.

The DIS Enumerations document specifies a list of detonation results, such as Entity Impact, Ground Impact, and Air Hit. The detonation result is part of the detonation message sent over the network. You can specify that a detonation sound be played only for a certain type of detonation result. If you set the result to "any" it will play for any type of detonation. If, for a particular detonation type, you map one sound to "any" and another sound to a specific detonation result, the specific detonation result takes precedence.



You can change fire and detonation mapping settings directly, rather than using the sound mapping dialog box, just like you can change entity type sound mappings. For details, see the sub-procedures under "Mapping a Sound File to an Entity," on page 15-5.

To map a sound file to a weapon fire or detonation:

1. Choose **Settings** → **Audio Settings**. The Audio Settings dialog box opens.
2. Select the Fire Sound Editor page or Detonation Sound Editor page (Figure 15-6), as appropriate.

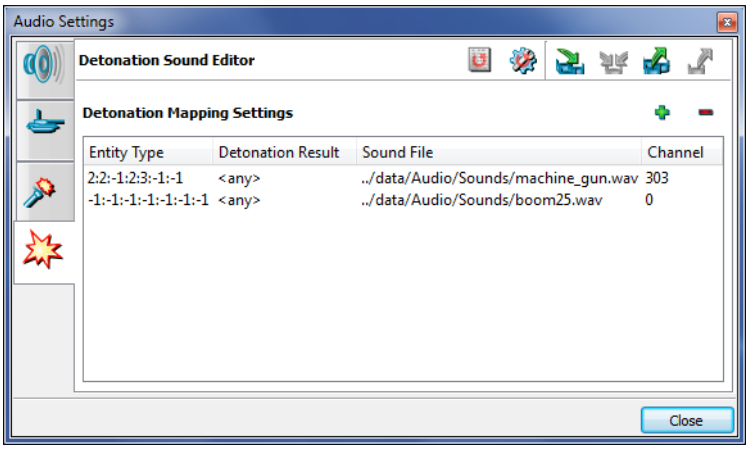


Figure 15-6. Detonation Sound Editor page

3. Click the Add button (+). The Create New Detonation (or Weapon Fire) Sound Mapping dialog box opens (Figure 15-7).

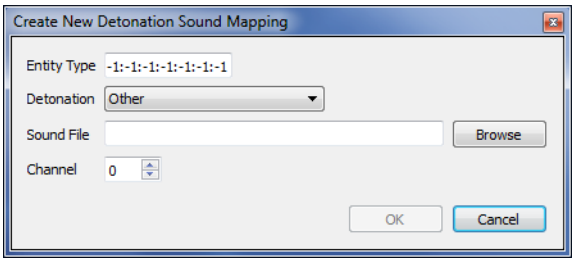


Figure 15-7. Create New Detonation Sound Mapping dialog box

When you click the Add button, if you have selected a mapping in the list, the Create New Sound Mapping from Existing dialog box displays the values for the selected mapping. If you change the entity type or detonation result, a new mapping is added with the new values.

4. In the Entity Type box, type the enumeration for this mapping.
5. Optionally, for detonation sounds, select an option on the Detonation list.
6. In the Sound File text box, type a pathname for the sound file you want to use or click Browser and select a file in the file choose dialog box.
7. Optionally, specify a channel in the Channel box.
8. Click OK.

16

Lighting Effects

This chapter describes the lighting effects supported by VR-Vantage

Displaying Lighting Effects 16-2
Displaying Dynamic Lighting 16-3
Enabling and Disabling Advanced Lighting and Shading 16-4
Enabling Advanced Lighting for osgEarth Models 16-5
Setting the Maximum Number of Dynamic Lights 16-6
Displaying Ocean Planar Reflections 16-6
Configuring Ocean Planar Reflections 16-8
Lens Flare 16-9
Displaying Sun Rays 16-10

16.1. Displaying Lighting Effects

VR-Vantage can simulate a variety of lighting effects, including:

- Dynamic lighting
- Ocean planar reflection
- Lens flare
- Crepusuclar (sun) rays.

Use of lighting effects affects performance. VR-Vantage lets you enable and disable some effects so you can adjust the mixture of performance and effects that best meets your needs.

16.2. Displaying Dynamic Lighting

VR-Vantage can display light cast by light sources such as headlights, street lamps, and spotlights. Display of dynamic lighting is an observer-specific feature. It is disabled by default.

Dynamic lights are either part of the terrain or part of an entity model. If they are part of an entity model, they can be set permanently on or they can be turned on and off by the appearance bit.

Figure 16-1 shows a night-time scene with dynamic lighting enabled. The HMMWV's tailights cast light to the rear. The headlights cast light forward, but are mostly overwhelmed by the spotlight, which also shines forward. Street lamps and windows are also casting light.



Figure 16-1. Dynamic Lighting enabled

To enable dynamic lighting,

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Observer Settings page.
3. In the list of settings, select Dynamic Lights.



You can also enable or disable dynamic lighting by choosing **Observer** → **Dynamic Lights** or clicking the Dynamic Lights button (💡) on the Observer Settings Toolbar.

16.2.1. Enabling and Disabling Advanced Lighting and Shading

You can change how lighting is rendered by enabling and disabling advanced lighting and shading. Figure 16-2 shows the same scene as the previous section. However in this view advanced lighting is turned off. Light points are still displayed, but no light is cast on the scene. Turning off advanced lighting may improve performance for some graphics cards.



Figure 16-2. Dynamic Lighting with advanced lighting disabled

To enable or disable advanced lighting:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 16-3).

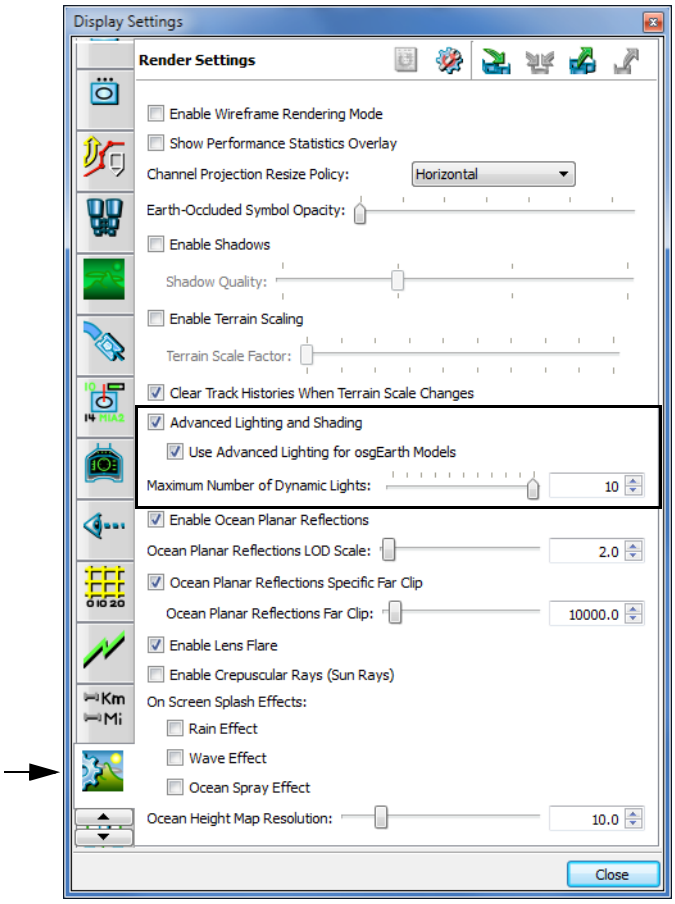


Figure 16-3. Advanced lighting and shading

3. Select or clear the Advanced Lighting and Shading check box.

16.2.2. Enabling Advanced Lighting for osgEarth Models

If advanced lighting and shading is enabled, you can apply advanced lighting effects to feature data streamed in using osgEarth. (osgEarth configures feature layers in a `model` element and calls these features models.) Enabling advanced lighting effects affects performance. This feature is disabled by default. This setting does not affect SpeedTrees.

To enable advanced lighting for osgEarth models:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 16-3).
3. Select the Use Advanced Lighting for osgEarth Models check box.

16.2.3. Setting the Maximum Number of Dynamic Lights

Use of dynamic lights affects performance. To optimize performance, you can set the maximum number of dynamic lights displayed. VR-Vantage displays the closest lights to the observer, up to the maximum number.

This setting does not affect the sun or moon.

To set the maximum number of dynamic lights:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 16-3).
3. Adjust the Maximum Number of Dynamic Lights setting.

16.3. Displaying Ocean Planar Reflections

VR-Vantage can show the reflection of terrain and objects on water (Figure 16-4). To see planar reflections, dynamic ocean must be enabled. (For details about enabling dynamic ocean, please see "Enabling Marine Effects," on page 5-17.

Displaying ocean planar reflections has a significant performance impact.



Figure 16-4. Ocean planar reflection

To enable or disable planar reflections:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 16-5).

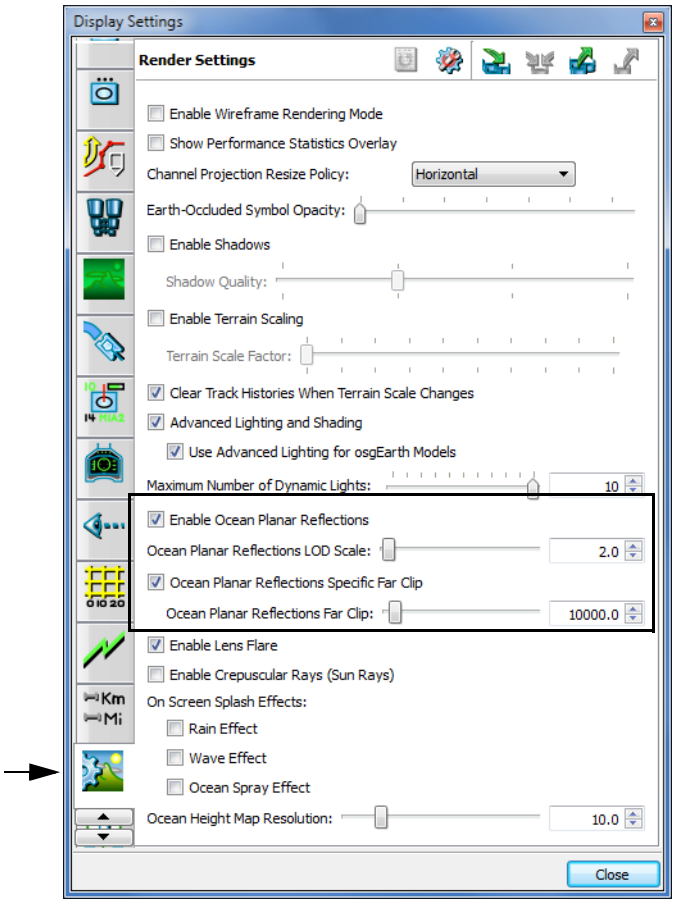


Figure 16-5. Ocena planar reflections settings

3. Select or clear the Enable Ocean Planar Reflections check box.

16.3.1. Configuring Ocean Planar Reflections

To reduce the performance impact of ocean planar reflections, you can configure the distance at which they are clipped (and therefore not displayed) and the LOD scale. The LOD scale affects the distance from the observer at which VR-Vantage switches LODs. The higher the value, the more quickly LODs are switched.

To configure ocean planar reflections:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 16-5).
3. To change the ocean planar reflectsion LOD scale, adjust the slider.
4. To set the ocean planar reflections far clip distance:
   a. Select the Ocean Planar Reflections Specific Far Clip check box.
   b. Adjust the slider or enter a value in the box.

16.4. Lens Flare

Lens flare is a visual artifact often seen when looking at light sources such as the sun through a camera lens (Figure 16-6). VR-Vantage can simulate lens flare when the observer looks towards the sun.



Figure 16-6. Lens flare

To enable or disable lens flare:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 16-3).
3. Select or clear the Enable Lens Flare check box.

16.5. Displaying Sun Rays

VR-Vantage can simulate the effect of sun rays beaming through clouds (Figure 16-7).

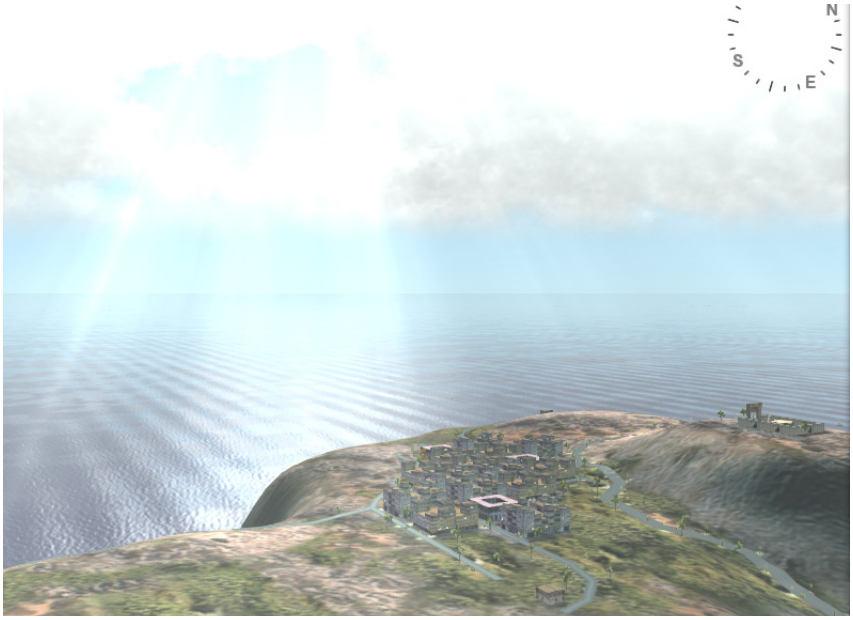


Figure 16-7. Sun rays (crepuscular rays)

To enable or disable sun rays:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 16-3).
3. Select or clear the Enable Crepuscular Rays (Sun Rays) check box.

17

Using Streaming Video

VR-Vantage can send the view in the display window to a video stream. It supports several different video formats.

Streaming Video 17-2
Starting a Video Stream 17-3
Setting Up Auto Start 17-4
Configuring Video Streams 17-4
Configuring the Number of Capture Buffers 17-7
Viewing Streaming Video 17-8
Viewing Streaming Video Using VLC 17-9

17.1. Streaming Video

VR-Vantage can capture the view in the display windows and send it as a video stream. Streaming video can be used for embedded training to stimulate devices that expect live video with simulated video. Video streams can be encoded and transported in several different ways using common open standards. VR-Vantage can encode metadata about the video image into the video stream following MISB (Motion Imagery Standards Board) metadata standards for UAV systems.



VR-Vantage does not include metadata plug-ins. They are distributed as bonus material. For details, please see your MÄK sales representative.

VR-Vantage processes captured video with image tasks. Some several image tasks transform the image and some transport the image. You can mix together multiple image tasks to accomplish your goal. You can replace or add your own image tasks through the API. The image tasks provided are:

- Shared Memory. VR-Vantage compresses the video and places it in shared memory. We provide an example application that shows how to read the shared memory data for your application.
- TCP. VR-Vantage acts as a server and connected clients are able to connect over TCP and get raw or compressed images through the connection.
- Web socket. VR-Vantage acts as a server and web browsers can connect to it and display the video stream.
- GStreamer. Gstreamer is a multimedia library that uses configuration files to build a pipeline. Pipelines allow for different encoding, multiplexing, and transport options. This is how VR-Vantage encodes video with MPEG-2 and H.264 encoding schemes and transport them over a network with embedded metatdata. (GStreamer is a complex SDK. If our implementation does not meet your needs for video streaming, please contact MÄK support. We will work with you to help you achieve your goals.)
- Image Compression. VR-Vantage compresses the video frame using JPG or PNG compression. This is typically used with video sinks that use image frames such as the WebSocket, shared memory, and TCP video sinks.
- Transform. VR-Vantage transforms the video frame by scaling, flipping, or converting the bit depth of the image. This is typically used with video sinks that use image frames such as the WebSocket, shared memory, and TCP video sinks. GStreamer is also capable of transforming the image and you may get better results using GStreamer alone than using a Transform operation and a GStreamer operation.



Streaming video can reduce performance.

17.2. Starting a Video Stream

You can start a video stream manually or specify that a video stream start automatically when VR-Vantage starts up.

To start a video stream:

1. Choose **Settings** → **Video Streams**. The Video Streams dialog box opens. Select the Video Streams page (Figure 17-1).

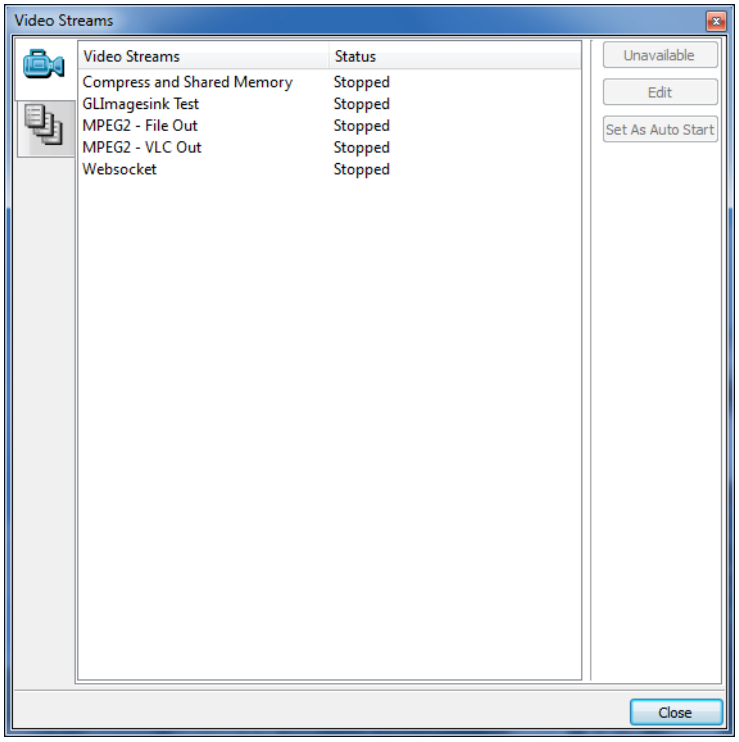


Figure 17-1. Video Streams page

2. Select the video stream that you want to start. If it is available, the Unavailable button changes to Start.
3. Click Start.
4. View the video in your viewing application.
5. Click Stop to stop the video stream.

17.2.1. Setting Up Auto Start

You can specify that a video stream start when VR-Vantage starts up.

To specify auto start:

1. Choose **Settings** → **Video Streams**. The Video Streams dialog box opens. Select the Video Streams page (Figure 17-1).
2. Select the video stream that you want to start automatically.
3. Click Set As Auto Start. VR-Vantage displays a star next to the video stream name.

17.3. Configuring Video Streams

You can configure the different streaming video streams to work with your playback environment. A video stream configuration has:

- A set of parameters that specify how VR-Vantage should capture the video.
- A pipeline. VR-Vantage sends video through a pipeline. The pipeline processes the video based on image tasks that you specify. You can specify one or more image tasks and can set the order in which they are executed. The video stream configurations included with VR-Vantage are examples of how to configure different types of video streams.

To configure a video stream:

1. Choose **Settings** → **Video Streams**. The Video Streams dialog box opens. Select the Video Streams Configuration page (Figure 17-2).

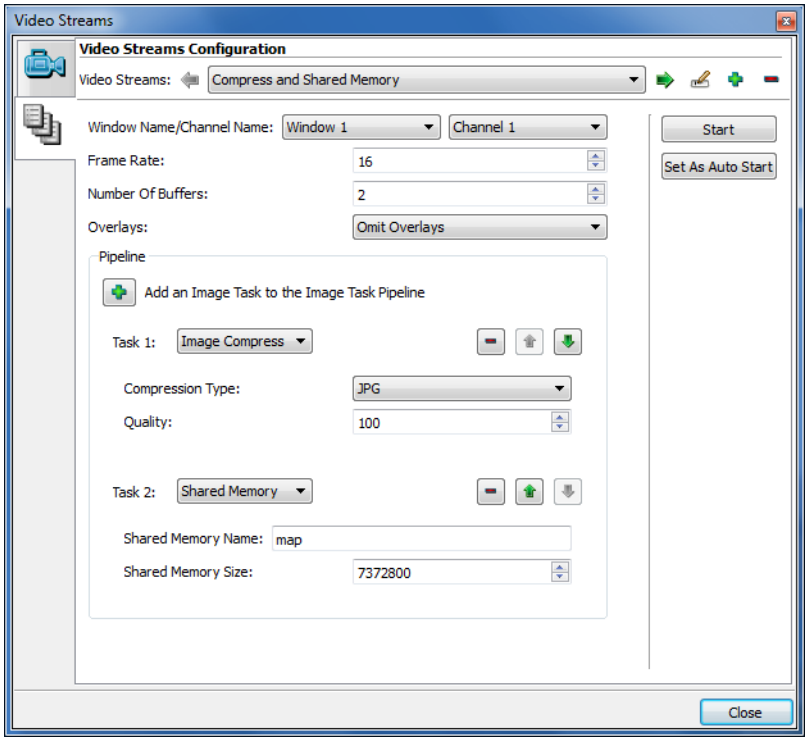


Figure 17-2. Video stream configuration page

2. In the Video Streams list, select the video stream that you want to configure.
3. Specify values for the capture parameters. Table 17-1 describes the parameters

Table 17-1: Video stream configuration capture parameters

Parameter	Description
Window Name	The window from which to stream video.
Channel Name	The channel, in the window specified by Window Name, from which to stream video.
Frame Rate	The frame rate at which to stream video.
Number of Buffers	The number of buffers affects how well VR-Vantage captures video from the rendering process. Depending on your hardware, more buffers may help rendering and capture performance at the cost of overall latency and video memory usage. See txxxxxxxx on how to configure the number of buffers..
Overlays	Omit or include 2D overlays, including 2D icons, the compass, and tactical graphics.

4. To add a task, in the Pipeline group box, click the Add button (+). A task is added to to the group box.

5. For the new task or any existing tasks, select an image task in the Task drop down list.
6. Select values for the parameters that are appropriate to the task. The supported tasks and their parameters are as follows:
   - TCP. Send the video over TCP.
     - Port. The port to which the video stream should be sent.
   - GStreamer.
     - Pipeline Configuration. This is a complex string that varies depending on on what you want done with the video by defining the GStreamer nodes that the video frames with be processed through. It is possible to resize, transform, compress, multiplex, and then send the results to disk as a file or to the network as a stream. We have several example defaults that show how to encode video, multiplex in metadata about the video stream, save to file and stream to a network. More information about GStreamer and how to build a configuration description can be found at http://gstreamer.freedesktop.org/.
   - Transform.
     - Flip Image. Optionally, flip the image.
     - Scale Image. Optionally, scale the image to the specified X, Y values.
     - Convert Bit Depth. Optionally, convert the image to the specified bit depth.
   - Shared Memory.
     - Shared Memory Name. The name of the shared memory space.
     - Shared Memory Size. The amount of shared memory. This must large enough to hold at least three frames of data as specified in the capture parameters.
   - Image Compress.
     - Compression Type. Select an option from the list.
     - Quality. Specifies the level of compression as a percentage. The higher the percentage, the less the compression and therefore, the better the quality.
   - Web Socket.
     - Connection Port. The port on which VR-Vantage will listen for a browser connection.
7. Optionally, add additional image tasks.
8. Optionally, change the order of the tasks.

17.3.1. Configuring the Number of Capture Buffers

When a frame is captured from the framebuffer in OpenGL, it is copied to an offscreen buffer that resides on the GPU. Then the buffer is copied across the bus from the GPU side to the CPU side where it can be pushed into the encoding system. With some video cards, this process can cause all rendering to stop until all the memory copying is completed between buffers and between GPU and system memory. Moving data across the bus can be a slow process. This is called stalling out the rendering pipeline and generally results in a significant drop in rendering performance.

You can see if this is happening by pressing F2 to get the on screen frames-per-second (FPS) display, then starting video streaming and watching to see if the FPS value drops. Another way to find out if there is an impact of using one buffer instead of multiple buffers is to start VR-Vantage Stealth from the command line with the `--showConsole` option and watch the timing values that are displayed in the console. If the readback and copy times are in the 10-15ms range, then the rendering pipeline is likely stalling. If they are in the 0-2 ms time range, then they are not adversely affecting performance.

Using one buffer instead of multiple buffers also affects the latency in the video stream. If a system can render, capture, and readback the data using only one buffer, then the data in the buffer is from the current frame and has no additional latency. If your system needs to use more than one buffer (two is typical) to prevent stalling the rendering pipeline, the buffer that is copied from GPU memory to CPU memory is from the previous capture and has one capture frame of latency. If frame capture is occurring at 25fps, then this means the frame that is pushed into the encoding process already has 40ms of latency in it.

17.4. Viewing Streaming Video

The method used to view a video stream depends on its configuration. This section describes viewing the video that results from the default configurations included with VR-Vantage.

- Compress and Shared Memory. This video stream configuration is an example of a pipeline that compresses and moves frames into a shared memory segment. To use this configuration you must provide an application that reads the frames from shared memory and displays them using whatever method it likes. The xxx example shows how to access frames from shared memory.
- GLImagesink Test. This video stream configuration uses a GStreamer pipeline task to stream video directly to an OpenGL viewer. If this configuration is started, a new OpenGL window opens containing the video stream.



The GStreamer pipeline task can only be used once per application run. To start another video stream using GStreamer, you must stop VR-Vantage and start it again.

- MPEG2 - VLC Out. The MPEG - VLC Out video stream configuration uses a GStreamer pipeline task to compress video using MPEG2 and then send the video to a UDP port. The port used is part of the pipeline configuration string (and is a parameter to the udpsink GStreamer element). There are commercial and freeware video viewers that can connect to and display MPEG video from a UDP stream. One such viewer is VLC. VLC is a commonly used application to show received network video streams. You can download VLC from http://www.videolan.org/vlc/index.html.
- MPEG2 - File Out. This video stream configuration uses a GStreamer pipeline task to output MPEG2 video to a file. The file that the video is written to is specified in the pipeline configuration, as a parameter to the filesink GStreamer element. If no path is included in the filename, the file is written to *./bin* (the directory of the VR-Vantage executable).
- Websocket. The Websocket video stream configuration streams capture frames to a web browser. When the video stream is started, it listens on the Connection Port specified for connections from a web browser. The URL should be specified has `hostname:port` (use localhost if connecting from the same machine). Typical usage is to put an Image Compress task element prior to this task element to send compressed images to the connected web clients.



Some older versions of browsers may not support Websockets.

17.4.1. Viewing Streaming Video Using VLC

For information about reducing latency in VLC, please see "Reducing Latency in VLC," on page 17-9.

To view video in VLC streamed from VR-Vantage:

1. Start the MPEG - VLC Out stream.
2. Start VLC.
3. Choose **Media** → **Open Network Stream**.
4. For the network URL, put "udp://@:5000" (if the parameter to udpsink is port=5000).

Reducing Latency in VLC

The default setting for viewing network streams in VLC includes quite a bit of buffering to make sure the video plays smoothly. This introduces a lot of latency on the receiving side. This section explains how to reduce that latency.



Reducing latency may lead to jitter. However, when working on a LAN, MÄK engineers have rarely had problems.

To reduce latency when using VLC:

1. Start VLC.
2. Choose **Tools** → **Preferences**. The Preferences dialog box opens.
3. Select Input & Codecs (Figure 17-3).
4. Select Use GPU Accelerated Decoding.
5. In the x264 Preset and Tuning Selection list, select ultrafast.
6. In the Network group box, in the Default Caching Policy list, select Lowest latency.
7. Click Save.

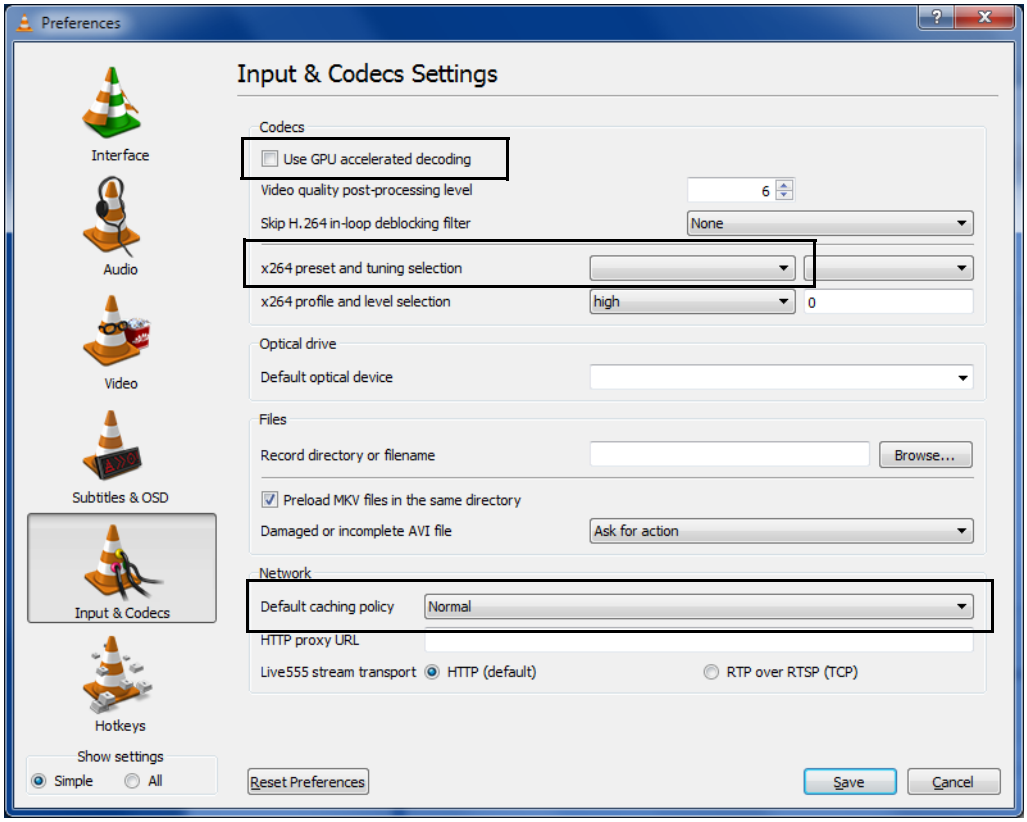


Figure 17-3. VLC Preferences, Inputs & Codecs

8. Choose **Media** → **Open Network Stream**. The Open Media dialog box opens.
9. Select the Network tab (Figure 17-4).
10. Enter the URL as udp://@:5000 (or whatever port you have your system set up for).
11. Select the Show More Options check box. The dialog box expands with more options.
12. Set Caching to 1ms. (Do not set caching to zero. VLC will crash.)

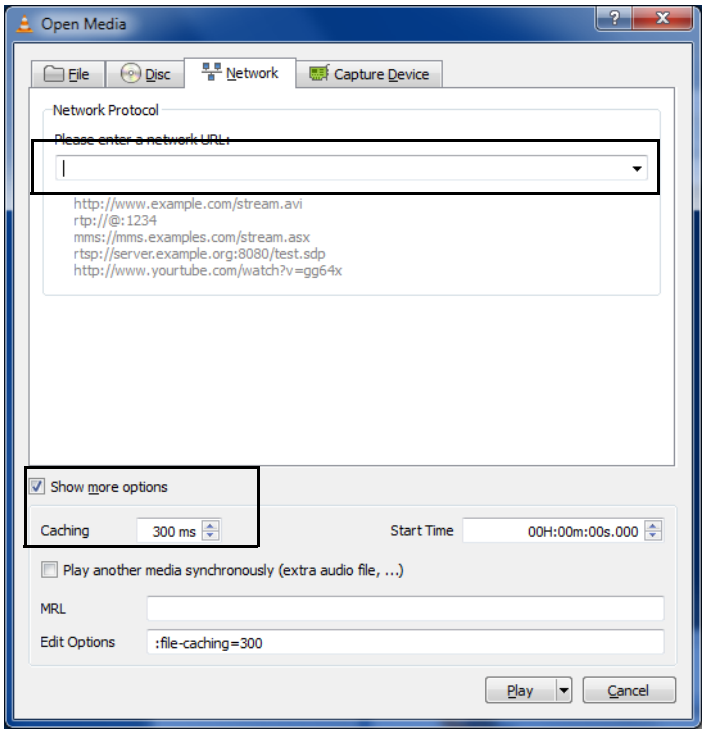


Figure 17-4. Open Media dialog box, Network tab

13. Click Play.

18

Tactical Graphics and Remote Graphics

Tactical graphics are graphical objects that represent points, lines, and areal objects used for various purposes in simulations. Remote graphics are graphics that are drawn onto the scene by remote programs that use the VR-Vantage Remote Draw API. This chapter explains how to display them in VR-Vantage.

Displaying Tactical Graphics 18-2
Overlays 18-4
Showing and Hiding Tactical Graphics 18-5
Showing and Hiding Vertex Labels 18-6
Displaying Height-Above-Terrain (HAT) Lines for Vertices (3D Only) 18-6
Displaying Remote Graphics 18-7
Viewing a List of Remote Graphics 18-9

18.1. Displaying Tactical Graphics

Tactical graphics are graphical objects that represent points, lines, areal objects, text, and symbols used for various purposes in simulations (Figure 18-1 and Figure 18-2). They could represent routes that entities are following, a destination point, or a way to show some sort of relationship, such as height-above-terrain (HAT) lines. VR-Vantage can display tactical graphics published by VR-Forces.

You can configure the display of tactical graphics as follows:

- Enable and disable the display of tactical graphics.
- Show or hide vertex indicators for point, linear, and areal objects.
- Show or hide height-above-terrain lines.
- Display height-above-terrain lines only for selected graphics.

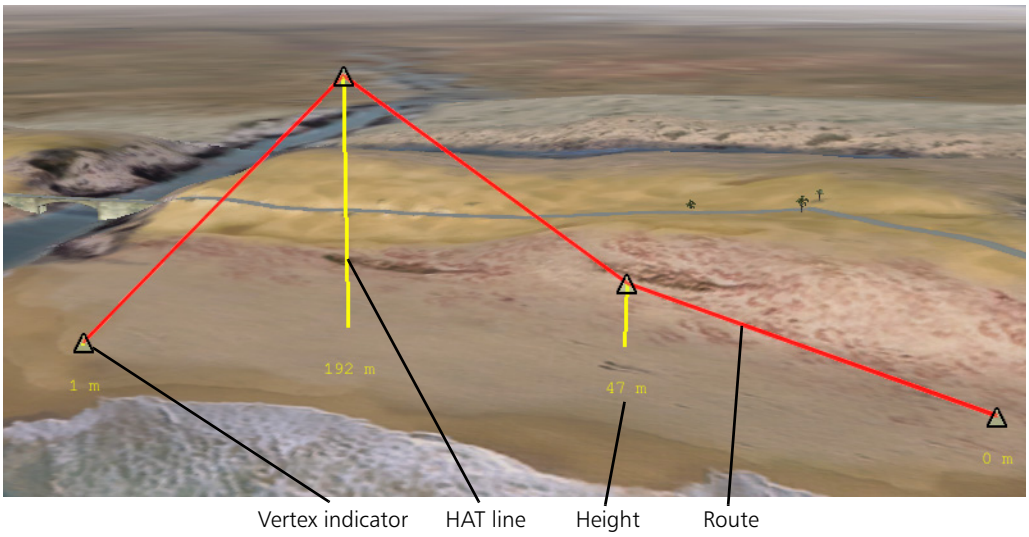


Figure 18-1. Tactical graphics with height-above-terrain lines (3D)

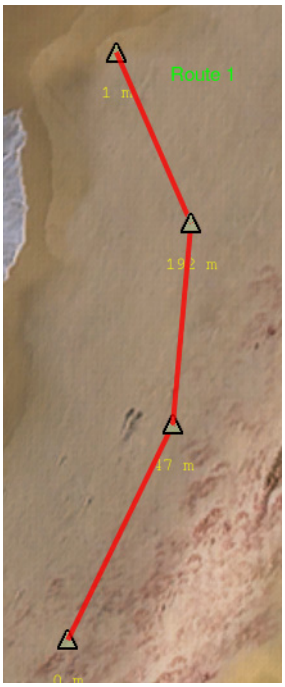


Figure 18-2. Tactical graphic (2D)

18.1.1. Overlays

All tactical graphics are assigned to overlays. Overlays are conceptually similar to clear plastic sheets that you might layer over a map so that you easily add and remove supplementary information.

There is always at least one overlay – the Default overlay. However, VR-Forces users can create multiple overlays. When VR-Vantage receives information about tactical graphics over the network, it lists the overlays and their respective graphics on the Overlays tab of the Objects List Panel (Figure 18-3).

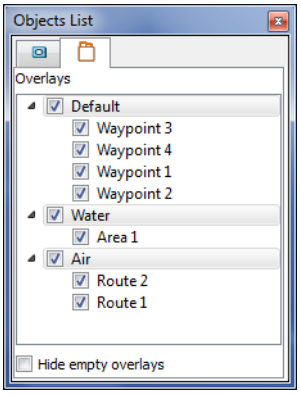


Figure 18-3. Overlays tab

18.1.2. Showing and Hiding Tactical Graphics

You can control the display of tactical graphics from the Display Settings dialog box, Tactical Graphics Display Settings page, from menu and toolbar options, and from the Objects List Panel Overlays tab.

To show or hide tactical graphics:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Tactical Graphics Display Settings page (Figure 18-4).

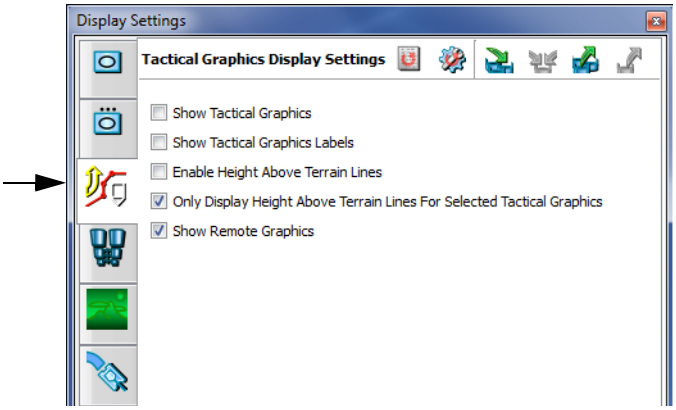


Figure 18-4. Tactical Graphics Display Settings page

3. Select or clear the Show Tactical Graphics check box.

> In VR-Vantage Stealth and PVD, you can also enable and disable tactical graphics by choosing **Settings** → **Tactical Graphics** or clicking the Tactical Graphics button ( ) on the Display Settings Toolbar.

Showing and Hiding Tactical Graphics on the Overlays Tab

On the Overlays tab, you can show and hide tactical graphics individually and by overlay.

To control the display of tactical graphics from the Overlays tab:

1. On the Objects List Panel, select the Overlays tab (Figure 18-3).
2. To hide all graphics on a particular overlay, clear the check box for that overlay.
3. To hide a specific tactical graphic, clear its check box.
4. To redisplay a hidden tactical graphic or overlay, select its check box.

18.1.3. Showing and Hiding Vertex Labels

In addition to displaying models for tactical graphics themselves, you can display graphics (labels) for the vertices of these objects. Vertex labels are enabled in Figure 18-1.

Displaying vertex labels can affect performance.

To show or hide vertex labels:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Tactical Graphics Display Settings page (Figure 18-4).
3. Select or clear the Show Tactical Graphics Labels check box.

In VR-Vantage Stealth and PVD, you can also enable and disable tactical graphics labels by choosing **Settings** → **Tactical Graphics Labels** or clicking the Tactical Graphics Labels button () on the Display Settings Toolbar.

18.1.4. Displaying Height-Above-Terrain (HAT) Lines for Vertices (3D Only)

You can display height-above-terrain (HAT) lines for the vertices of tactical graphics. These vertical lines between an object's vertices and the ground help you understand the relationship of the object to the terrain. The height for each vertex is displayed (using whatever units are configured on the Display Units Settings page) (Figure 18-1).

HAT lines are shown only for tactical graphics that could be above or below the ground, such as routes, and waypoints. You can show and hide these lines and you can specify that they be shown for all objects or only for the selected objects.

Use of height above terrain lines can reduce the frame rate.

To show or hide height-above-terrain lines:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Tactical Graphics Display Settings page (Figure 18-4).
3. To display HAT lines, select the Enable Height Above Terrain Lines check box.
4. To only display lines for selected objects, select the Only Display Height Above Terrain Lines For Selected Tactical Graphics check box.

18.2. Displaying Remote Graphics

VR-Vantage can display graphics sent from other applications using the VR-Vantage Remote Draw API (Figure 18-5).

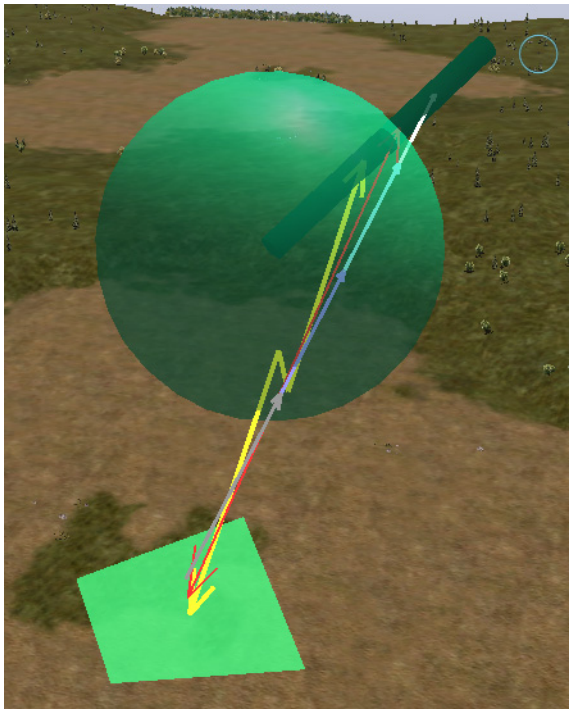


Figure 18-5. Remote graphics

To enable or disable the display of remote graphics:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Tactical Graphics Display Settings page (Figure 18-6).

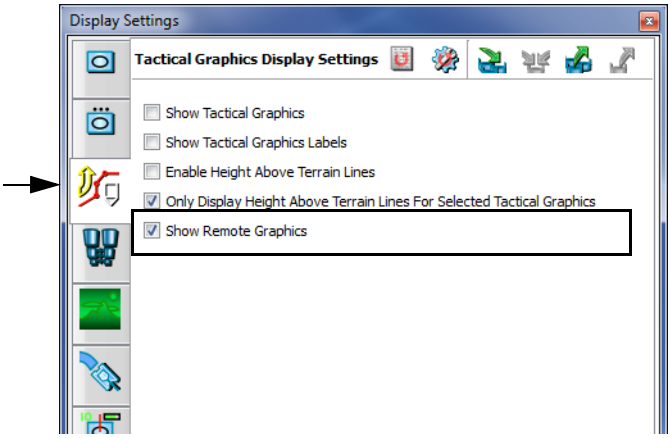


Figure 18-6. Tactical Graphics Display Settings page

3. Select or clear the Show Remote Graphics check box.

In VR-Vantage Stealth and PVD, you can also enable and disable remote graphics by choosing **Settings** → **Remote Graphics** or by clicking the Remote Graphics button ( ) on the Display Settings Toolbar.

18.2.1. Viewing a List of Remote Graphics

Remote graphics can be organized into sets. There is no fixed organization. Labeling of sets is entirely at the discretion of the programmer who develops the application that generates the graphics. The Remote Graphics Panel displays remote graphics in a hierarchy by set.

The VR-Vantage Remote Draw API lets developers send data about objects as attribute:value pairs, for example Speed:30 KM. The attributes are organized by type using attribute group templates. You can enable and disable the display of attribute information by group and by individual attribute. Figure 18-7 illustrates the attributes for the Entity and Packet attribute group templates displayed in Figure 18-8.

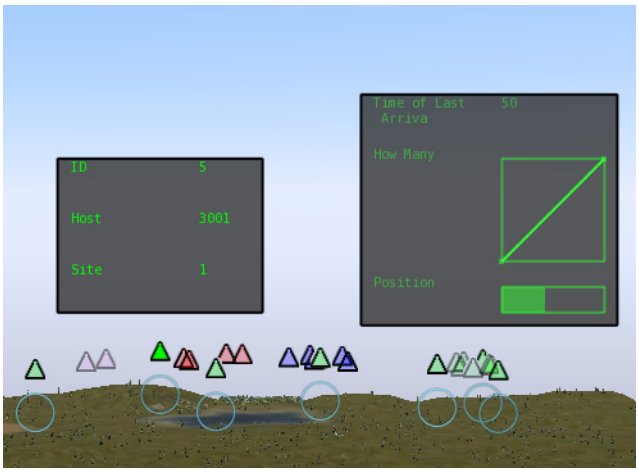


Figure 18-7. Remote graphics attribute group display

To view a list of remote graphics:

1. Choose **View** → **Remote Graphics Panel**. The Remote Graphics Panel is displayed (Figure 18-8). The Remote Graphics Sets tab lists remote graphics by set.

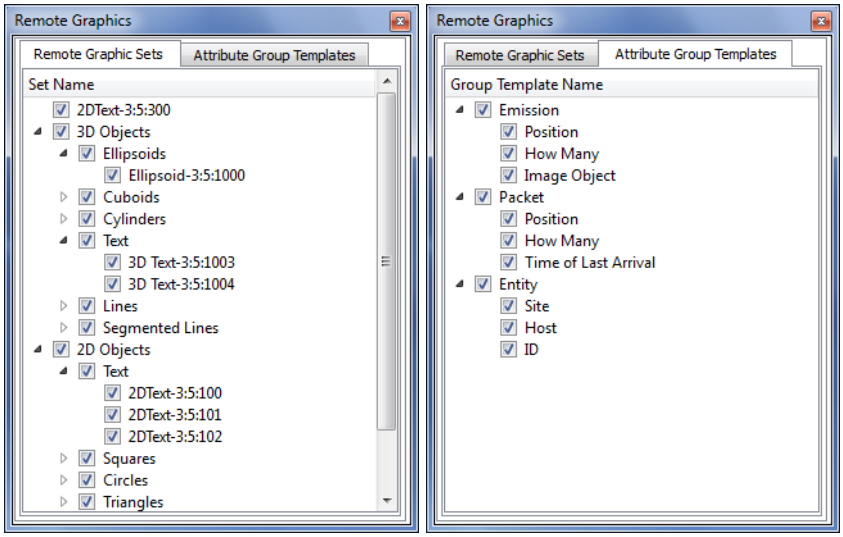


Figure 18-8. Remote Graphics Panel

2. To hide or display a remote graphic set or individual graphic, check or clear its check box in the Remote Graphics Sets list.
3. To view Attribute Group Templates, select the Attribute Group Templates tab. To see the attribute display, mouse over an object for which display data is available.

19

Exaggerating Models and Terrain

This chapter describes terrain scaling and model scaling – features primarily used in XR observer mode.

Exaggerating the Scale of 3D Entity Models 19-2
Exaggerating the Terrain Scale..... 19-5
Enabling Terrain Scaling..... 19-7
Scaling the Terrain..... 19-7
Track Histories and Terrain Scaling 19-8

19.1. Exaggerating the Scale of 3D Entity Models

If you view the terrain in Stealth observer mode, beyond a certain distance most 3D entity models are too small to see. Model scaling lets you exaggerate the scale of entity models to see them at a great distance. Figure 19-1 shows the same scene with model scaling off and on. When model scaling is off, only the largest entities are visible. When models are scaled, they are all visible.



Model scaling and XR mode is only supported by VR-Vantage Stealth.

VR-Vantage supports the following types of model scaling:

- XR scaling. XR scaling tries to give all entities approximately equal visibility. It does not preserve size relationships between entities. The visual effect of model scaling depends on an entity's size and the observer's distance from the entity. When the observer is close to an entity, scaling models may not make any noticeable difference in its size.
- Linear scaling. Linear scaling scales all entities by the current model scale factor. The distance from the observer is not taken into account. A model scale factor of 10 scales all entities to be 10 times normal size.

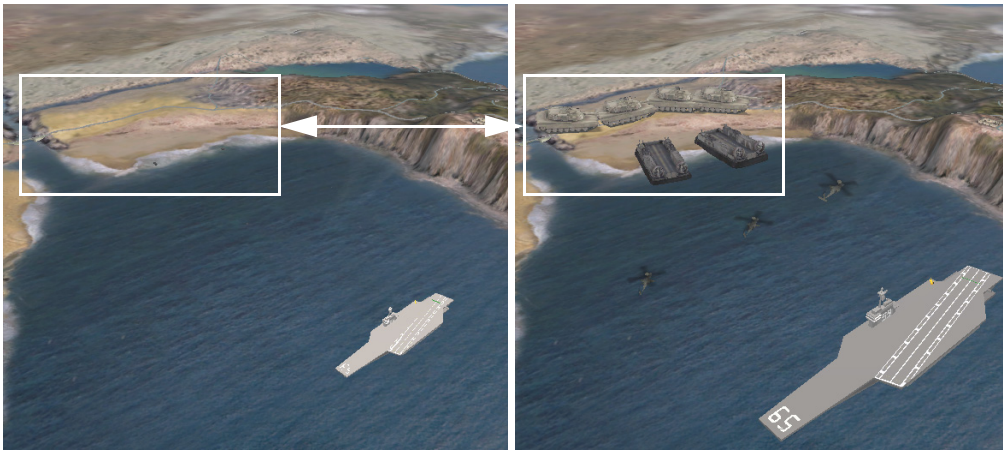


Figure 19-1. Model scaling off and on (Stealth observer mode)

Another way to quickly change the visibility of entities is to switch to XR observer mode. In XR mode, entities are immediately scaled and are represented by colorized 3D models to enhance their visibility.



Figure 19-2. XR mode

To scale entity models:

1. Choose **Observer** → **Advanced Settings**. The Display Settings dialog box opens to the Observer Settings page (Figure 19-3).

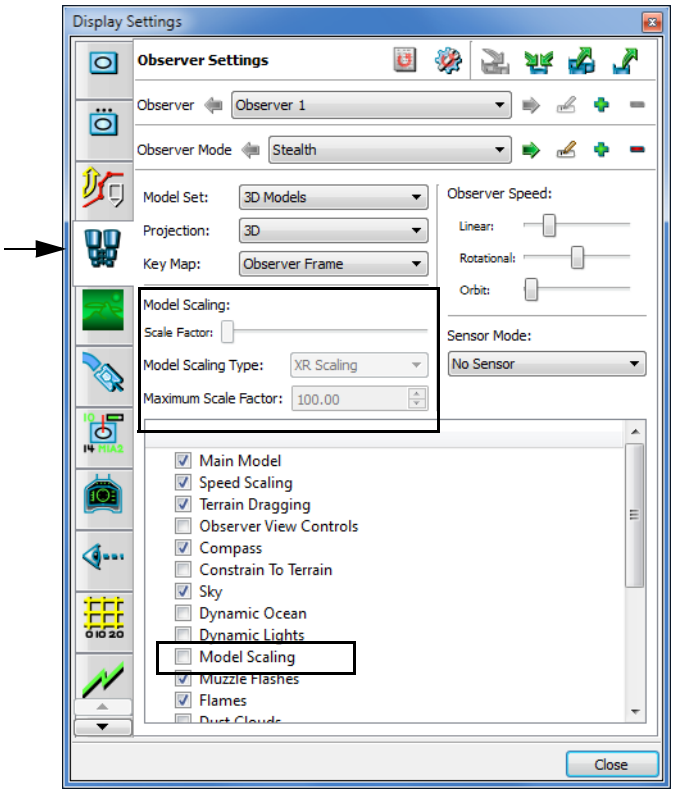


Figure 19-3. Observer Settings page

2. In the list of observer attributes, select Model Scaling.
3. In the Model Scaling Type list, select the type of scaling you want to use – XR or linear.
4. Optionally, change the Maximum Scale Factor.
5. Adjust the Scale Factor slider to the amount of scaling that you want.

You can also scale models from the Observer Settings Toolbar and the Observer Control Panel.

To scale models from the Observer Settings Toolbar:

1. If model scaling is not enabled, click the Model Scaling button ( ) on the Observer Settings Toolbar.
2. Click the down arrow on the button. The Scale Factor slider is displayed (Figure 19-4).



Figure 19-4. Scale Factor slider

3. Adjust the slider to scale the models.

> The Scale Factor slider is a dockable widget that you can undock and leave visible as long as model scaling is enabled.

To scale models from the Observer Control Panel:

1. If model scaling is not enabled, enable model scaling in the Observer Settings page or click the Model Scaling button ( ) on the Observer Settings Toolbar. The Scale Factor slider on the Observer Control Panel becomes enabled (Figure 19-5).

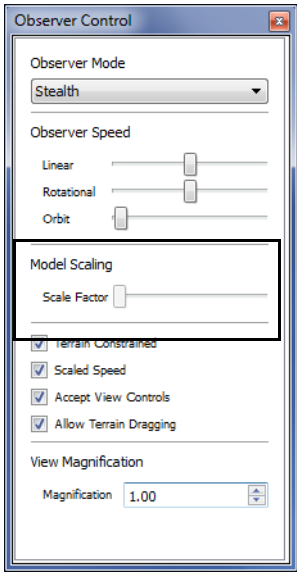


Figure 19-5. Observer Control Panel

2. Adjust the slider to scale the models.

19.2. Exaggerating the Terrain Scale

In XR mode, you can exaggerate the terrain scale to improve your sense of line-of-sight issues and other terrain factors that can affect an exercise. Figure 19-6 and Figure 19-7 illustrate terrain from the same observer location with and without terrain scaling. Notice how much easier it is to understand the relationship of the aircraft to the ground in the scaled view.

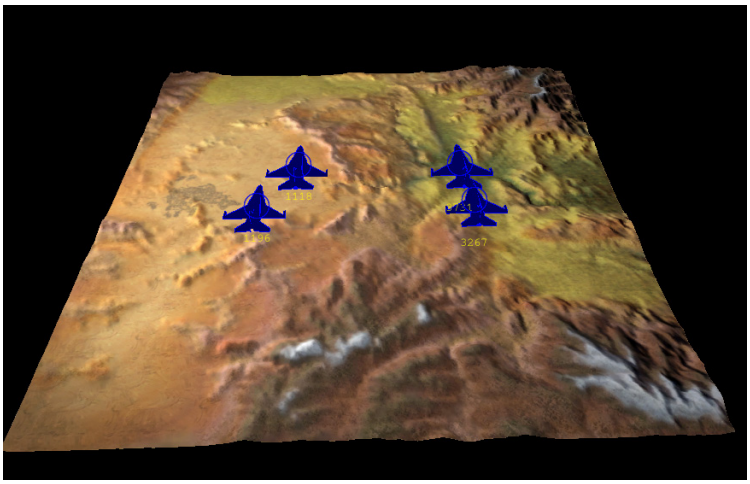


Figure 19-6. No terrain scaling

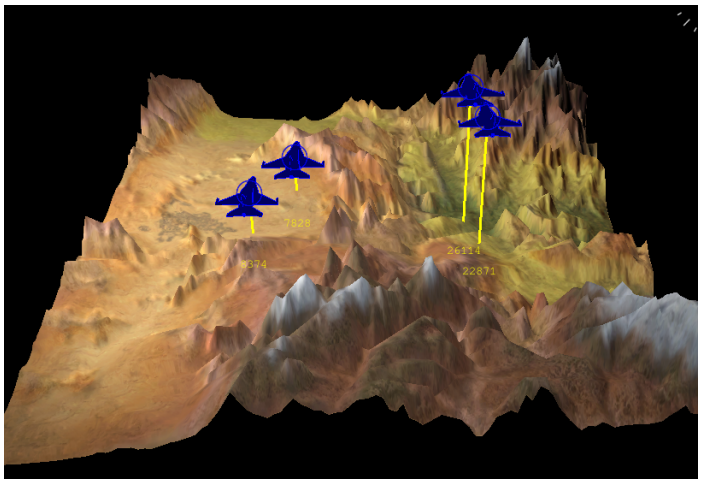


Figure 19-7. Terrain scaling

When you scale the terrain, terrain, props, and SpeedTrees all get scaled. Entities and entity labels get positioned so that they are in the correct position relative to the scaled terrain. However, the text on entity labels and other information panels displays their correct, unscaled location.

When you enable or disable terrain scaling or change the scale factor, track histories get cleared. You can specify that track histories not be cleared when you scale the terrain.

! Terrain scaling is not supported on geocentric terrains.

19.2.1. Enabling Terrain Scaling

➤ To enable or disable terrain scaling, choose **Settings** → **Terrain Scaling**, or click the Terrain Scaling button ( ) on the Display Settings toolbar.

You can also enable and disable terrain scaling on the Display Settings dialog box, Render Settings page.

19.2.2. Scaling the Terrain

To scale the terrain

1. Enable terrain scaling. (Choose **Settings** → **Terrain Scaling**, or click the Terrain Scaling button ( ) on the Display Settings toolbar.)
2. Click the arrow next to the Terrain Scaling button. The Terrain Scale Factor slider is displayed (Figure 19-8).



Figure 19-8. Terrain Scale Factor slider

3. Adjust the slider.

You can also scale the terrain on the Display Settings dialog box, Render Settings page.

19.2.3. Track Histories and Terrain Scaling

By default, when you enable or disable terrain scaling or change the scale factor, track histories get cleared and restarted. This is because track histories are not scaled and they would probably misrepresent the entity's track after the terrain was scaled. However, you can specify that track histories not be cleared when you scale the terrain.

To specify whether or not track histories are cleared when the terrain is scaled:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Render Settings page (Figure 19-9).

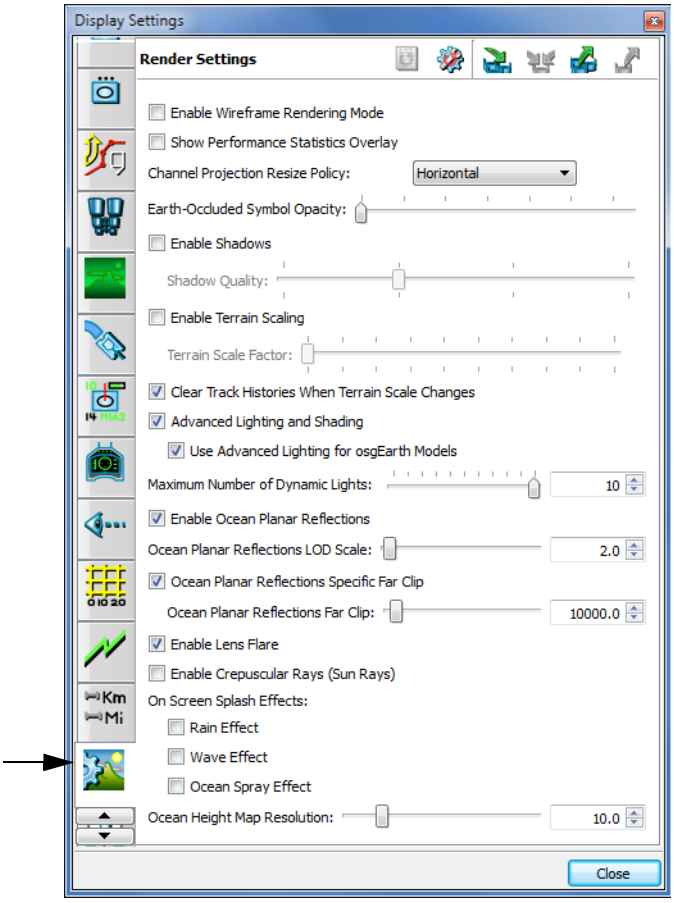


Figure 19-9. Render Settings page

3. Select or clear the Clear Track Histories when Terrain Scale Changes check box.

A

The VR-Vantage User Interface

The VR-Vantage graphical user interface has features typical for modern windowing systems and follows standard conventions for using menus and selecting objects. This appendix describes some features that might not be immediately obvious.

Dockable Panels and Toolbars A-2
- Docking and Undocking a Panel A-2
- Docking and Undocking a Toolbar A-3
- Displaying and Hiding Panels and Toolbars A-3
- Restoring the Layout of Toolbars and Panels A-4

Viewing the Window in Full Screen Mode A-4

Using Context-Sensitive Menus A-5

Common VR-Vantage Buttons A-5

File Extensions A-6

Specifying Display Units A-7

A.1. Dockable Panels and Toolbars

VR-Vantage has floating, dockable panels for many of its important functions (Figure A-1). It also has toolbars that let you quickly access the commands available on the menus.

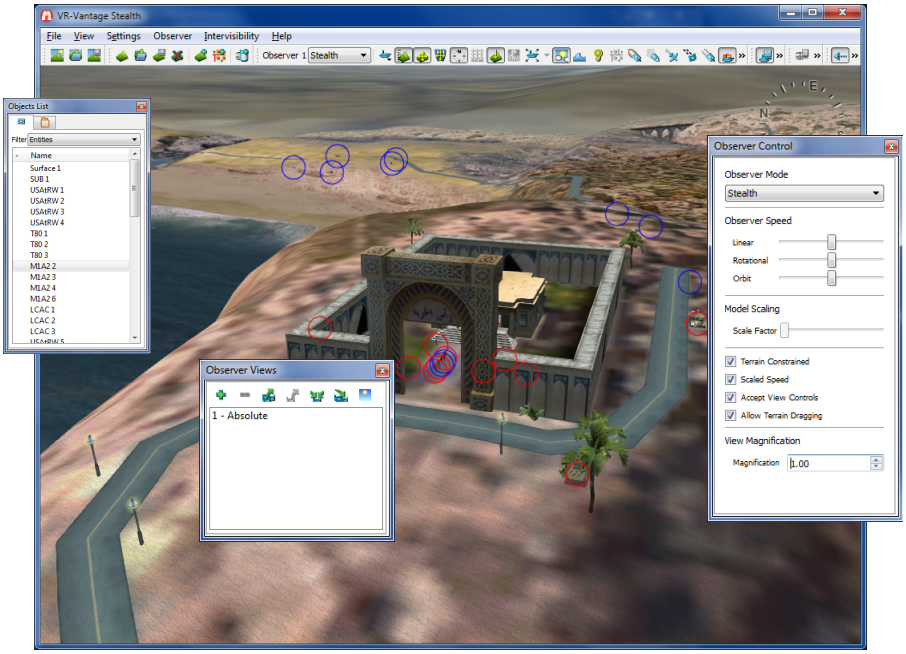


Figure A-1. VR-Vantage window and undocked panels

A.1.1. Docking and Undocking a Panel

To undock a panel:

1. Place the cursor over the panel's title.
2. Press and hold the left mouse button.
3. Drag the panel away from the window.

➤ To dock a floating panel, double-click its title bar.

A.1.2. Docking and Undocking a Toolbar

To undock a toolbar:

1. Place the cursor over the handle.



Figure A-2. Toolbar handle

2. Press and hold the left mouse button.
3. Drag the toolbar away from the window.

➤ To dock a toolbar, drag it back to the toolbar strip. The other toolbars will move to create a space to drop in the toolbar (Figure A-3).

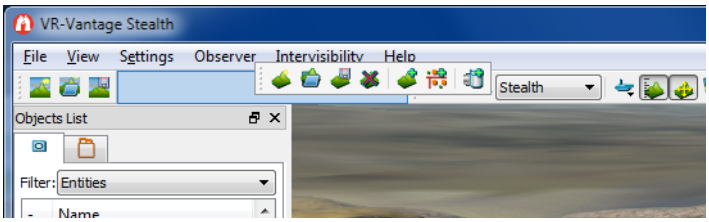


Figure A-3. Docking a toolbar

A.1.3. Displaying and Hiding Panels and Toolbars

You can hide any of the panels or toolbars.

➤ To hide or view a panel or toolbar, select it on the View menu.

A.1.4. Restoring the Layout of Toolbars and Panels

VR-Vantage saves the layout of toolbars and panels when you shut down. (It does not save the size and location of the main window.) You can restore the factory layout or the last saved layout.

To restore the layout of toolbars and panels:

1. Choose **Settings** → **Application**. The Application Settings dialog box opens.
2. Select the GUI Layout page (Figure A-4).

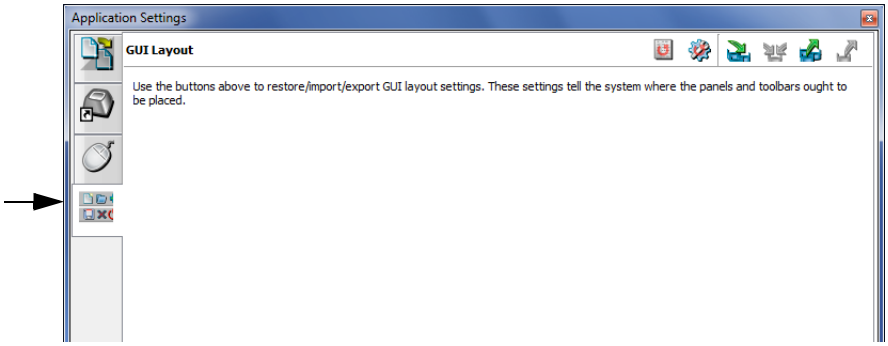


Figure A-4. GUI Layout page

3. Click the settings button for the operation you want to perform. (For a summary of common settings buttons, please see "Managing VR-Vantage Settings," on page 3-13.)

A.2. Viewing the Window in Full Screen Mode

You can display VR-Vantage so that it covers the entire screen and does not show the title bar or border. This mode is intended for use in demonstrations. When menus and panels are hidden, you can still use all keyboard controls, and you can still click entities in the window to attach the observer to them.

You can configure VR-Vantage to start in full screen mode with the `--fullScreen` command-line option.

➤ To view VR-Vantage in full screen mode, choose **View** → **Show Full Screen**, or press **`Ctrl+Enter`**.

➤ To exit full screen mode, press **`Ctrl+Enter`**.

A.3. Using Context-Sensitive Menus

VR-Vantage has context sensitive menus (also called popup menus or right-click menus) that you can display by clicking the right mouse button.

If you right-click an entity, tactical graphic, or other scene object, the menu displays the actions that you can take.

If you right-click the menu bar, you can select the commands available on the View menu.

A.4. Common VR-Vantage Buttons

VR-Vantage dialog boxes have a common set of buttons (Figure A-5). The callouts in (Figure A-5) correspond to the numbers in the list of button descriptions.



Figure A-5. Common buttons

- Add an item (definition, model, and so on) (1).
- Remove the selected item (2).
- Copy the selected item and add the copied version to the list (3).
- Select a filter of some type (4).
- Rename the selected item (5).
- Add from a list (6).
- Move up in the list (7).
- Move down in the list (8).
- Select the previous item (9).
- Select the next item (10).
- Add an attribute (11).
- Remove local attribute definition and use the parent's definition (12).
- Search (13).

A.5. File Extensions

Table A-1 lists the file extensions for VR-Vantage file types:

Table A-1: VR-Vantage file extensions

File type	Extension
Terrain	mtf
Scene	msf
View	osrx
Display configuration	dcx
Schema	smtx
Model definition	ommx
Element definitions (Entity definitions, Aggregate definitions, Tactical graphics definitions, Interaction definitions)	elem
Cockpit mapping	mhtx
Entity type mapping	metx
Aggregate mapping	magx
Weapon fire mapping	mwfx
Detonation mapping	mdtx
Tactical graphics mapping	mtgx
CIGI mappings	mcsx
Environment	envx
Key mapping	kmpx
GUI layout	uisx
Entity display settings	edsx
Aggregate display settings	adsx
Tactical graphics display settings	tdsx
Observer settings	omcx
Cockpit display settings	mhsx
Intervisibility settings	invx
Render settings	mrsx
File cache settings	usdx
Interest management settings	misx

Table A-1: VR-Vantage file extensions

File type	Extension
Loader settings	mlsx
Speedtree settings	forx

A.6. Specifying Display Units

You can specify the units used to display coordinate system, distance, altitude, and other measurements. Display units are configured by measurement type. This means that you can use different measurement units for different types of data. You can also specify the number of decimal places for measurement values. When you change a measurement display unit, the changes take effect immediately. They are saved and applied the next time you run VR-Vantage.



The following coordinate system and unit display information is independent of (and therefore not affected by) the settings described in this section:

- Coordinate system for cloud layers in the Add Cloud Layer dialog box.
- The coordinate system information for the observer location in the Observer Information Panel.
- Grid line coordinates, units, and precision.

The types of data and the display objects that they affect are as follows:

- Coordinate system
- Distance
- Altitude
- Velocity (speed)
- Acceleration
- Rotational velocity
- Orientation (heading).

Table A-2 describes the coordinate systems that you can specify.

Table A-2: Coordinate systems supported

Coordinate system	Description
Latitude/Longitude (degrees:minutes:seconds)	Location is displayed as two position fields and one altitude field. Displays coordinates in the latitude and longitude using the geodetic WGS84 coordinate system. Each angle will be displayed in degrees:minutes:seconds with seconds displaying base 10 fractional seconds.
Latitude/Longitude (decimal radians	Location is displayed as two position fields and one altitude field. Position coordinates in the latitude and longitude using the geodetic WGS84 coordinate system. Each angle will be displayed in decimal radians.
Geocentric	Location is displayed as three position fields. Position coordinates are displayed in the geocentric coordinate system. The position fields are always in meters.
UTM	Location is displayed as two position fields and one altitude field. Position coordinates are displayed in the Universal Transverse Mercator system. The first position field displays the zone and the x location in meters. The second position field displays the y position in meters.
MGRS	Location is displayed as two position fields and one altitude field. Position coordinates are displayed in the Military Grid Reference System. The first position field displays the zone. The second position field displays the grid location. The precision controls the number of digits used in the grid display.
Database	Location is displayed as three position fields. Location is displayed using VR-Vantage's current internal cartesian database system. The position fields will be displayed using the current distance units.

To specify measurement units:

1. Choose **Settings** → **Display**. The Display Settings dialog box opens.
2. Select the Display Units Settings page (Figure A-6).

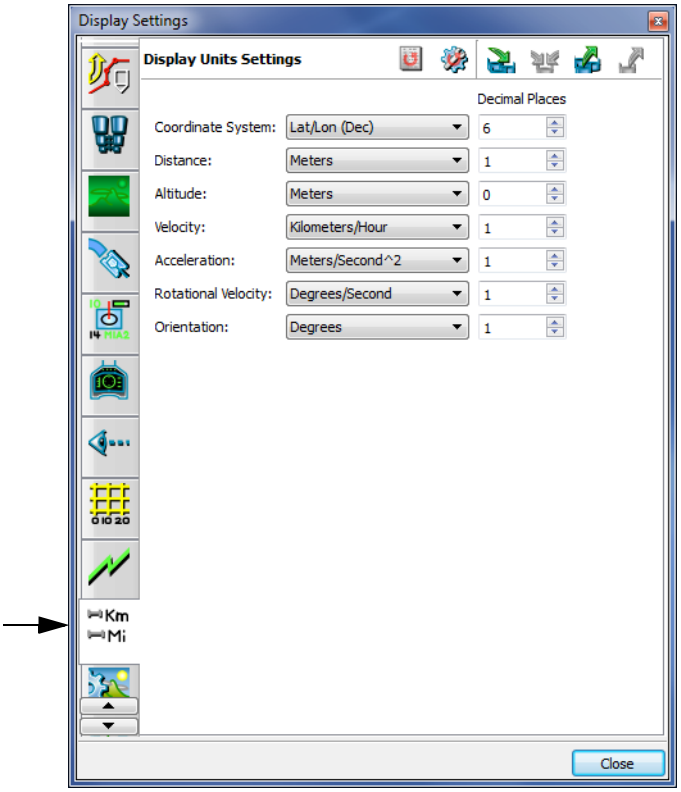


Figure A-6. Display Units Settings page

3. Select the measurement unit you want for each option from its list.
4. Type a precision for each measurement unit in the corresponding box in the Decimal Places column.

B

Managing Network Connections

This appendix provides details about how to configure network connections.

Managing Simulation Connections B-2
- Displaying Connections B-3
- Adding a Simulation Connection B-4
- Renaming a Simulation Connection B-5
- Deleting a Simulation Connection B-5

Configuring Connection Settings B-6
- HLA Connection Settings B-7
- DIS Connection Settings B-8
- CIGI Connection Settings B-10

B.1. Managing Simulation Connections

VR-Vantage uses connectors to access the various types of input it requires. To connect to a simulation you connect an appropriate simulation connection, for example, an HLA 1.3 connection or a DIS connection. The Simulation Connections dialog box lists connections and lets you manage them. You can:

- Add connections.
- Configure connections.
- Delete connections.
- Connect to the network using a specific connection.
- Disconnect a connection.
- Specify a connection to use automatically at startup.
- Enable or disable publishing of observers.
- Enable or disable acceptance of view control messages.

B.1.1. Displaying Connections

The Connection Status page on the Simulation Connections dialog box displays all of the configured connections and their connection status.

To view the list of connections:

1. Choose **Settings** → **Connection**. The Simulation Connections dialog box opens.
2. Select the Connection Status page (Figure B-1).

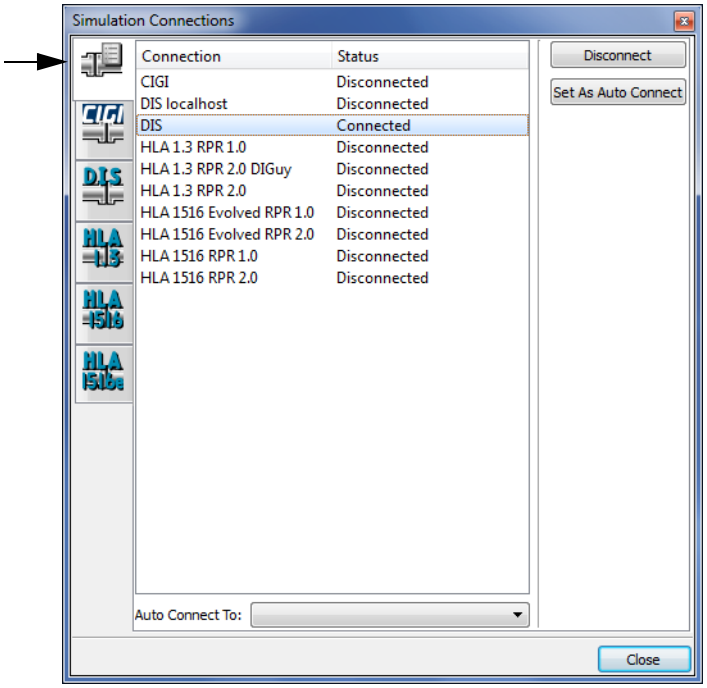


Figure B-1. Simulation Connections dialog box, Connection Status page

B.1.2. Adding a Simulation Connection

You might want to edit the parameters for an existing connection and add a new connection with the updated parameters. In HLA, you might want to add a connection that supports a different FOM or FOM Mapper.

To add a simulation connection:

1. Choose **Settings** → **Connection**. The Simulation Connections dialog box opens (Figure B-1).
2. Select the page for the connection type you want to add (Figure B-2).

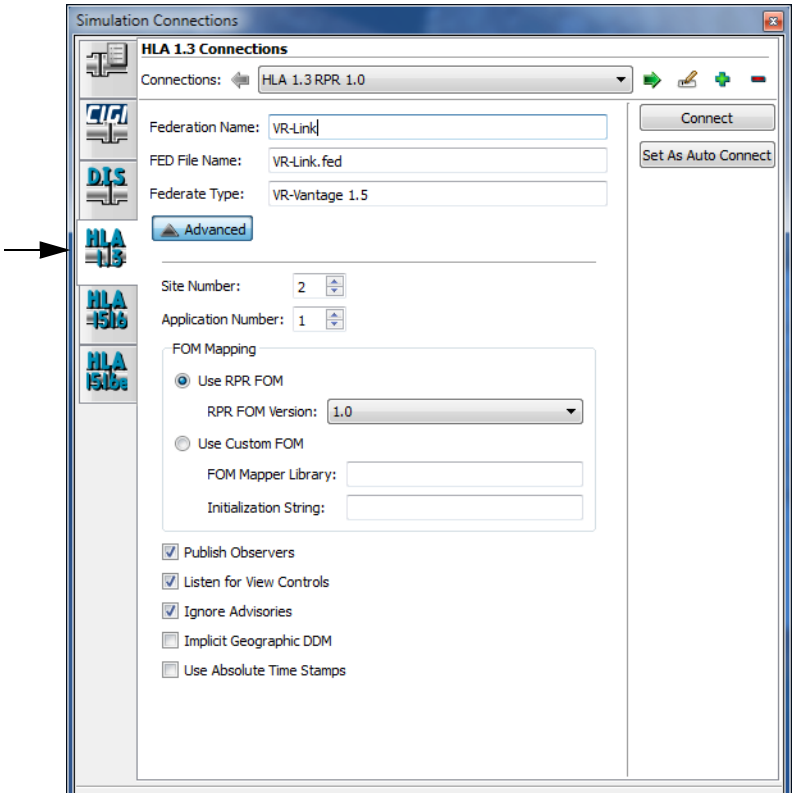


Figure B-2. Protocol-specific page

3. Click the Add button (+) to the right of the Connections list. A new connection is added to the list. (To change the name of the connection, follow the procedure in "Renaming a Simulation Connection," on page B-5.)
4. Set the connection parameters to the desired values. (For details about connection parameters, please see "Configuring Connection Settings," on page B-6.)
5. Optionally, click Set As Auto Connect to have VR-Vantage automatically connect using this connection when it starts up.
6. Click Close.

B.1.3. Renaming a Simulation Connection

To rename a simulation connection:

1. Choose **Settings** → **Connection**. The Simulation Connections dialog box opens (Figure B-1).
2. Select the page for the connection type that you want to rename.
3. In the Connections list, select the connection that you want to rename.
4. Click the Rename button (). The Rename Connection dialog box opens.
5. Type a new name for the connection.
6. Click OK.

B.1.4. Deleting a Simulation Connection

To delete a simulation connection:

1. Choose **Settings** → **Connection**. The Simulation Connections dialog box opens (Figure B-1).
2. Select the page for the connection type that you want to delete.
3. In the Connections list, select the connection that you want to delete.
4. Click the Delete button (). You are prompted to confirm the deletion.
5. Click Yes.

B.2. Configuring Connection Settings

The different simulation connection types have different parameters, but the process of configuring a connection setting is essentially the same regardless of the connection type.

HLA 1.3 and HLA 1516 have the same set of connection parameters. HLA Evolved has one additional parameter. They each have default connections configured for RPR FOM 1.0 and RPR FOM 2.0 draft 17.



The RPR FOM 2.0 DI-Guy connection has extensions to the FOM that provide support for changing DI-Guy characters based on messages sent from VR-Forces, MÄK's computer generated forces application. Generic support for DI-Guy is provided by all connections.

To configure connection settings:

1. Choose **Settings** → **Connection**. The Simulation Connections dialog box opens (Figure B-1).
2. Select the page for the connection type that you want to configure.
3. In the Connections list, select the connection that you want to configure, or add a new connection, as described in "Adding a Simulation Connection," on page B-4.
4. Click Advanced to display all of the parameters.
5. Specify values for connection parameters, as described in Table B-1, Table B-2, or Table B-3.

B.2.1. HLA Connection Settings

Table B-1 describes the connection settings for HLA 1.3, HLA 1516, and HLA 1516e.

Table B-1: HLA connection settings

Parameter	Description
Federation Name	Specifies the federation execution name.
FED File Name	Specifies the FED file. Default: the federation name with *.fed* appended.
Federate Type	Federate Type can be used to distinguish different categories of federates, and its only practical use is in save-and-restore.
Advanced	
Federate Name	Specifies a unique name that can be assigned to the federate. No two federates within the same federation can have the same name. If no name is specified, the RTI will automatically assign a unique name for the federate. (HLA 1516e only)
Site Number	Specifies the site number for the observer. The Site ID and Application Number uniquely identify the observer. This allows remote applications, such as VR-Forces, to send view control PDUs to a specific observer.
Application Number	Specifies the application number for the observer.
Use RPR FOM	Specifies use of a version of the RPR FOM.
RPR FOM Version	Specifies the RPR FOM version. VR-Vantage has built-in support for RPR FOM versions 0.5, 0.7, 0.8, 1.0, 2.0006, 2.0014, or 2.0017. You must specify the correct FED file for the version you use. If you use a different FOM, you must specify the correct FED file and FOM Mapper.
Use Custom FOM	Specifies use of a FOM other than the RPR FOM.
FOM Mapper Library	Specifies the name of a FOM Mapper library.
Initialize String	Specifies initialization data for the specified FOM Mapper, if required. It is your responsibility to know if your FOM Mapper needs initialization data.
FOM Modules	Lets you specify FOM Modules. Consult your RTI documentation for information about FOM Modules. (HLA 1516e Only)
Publish Observers	Specifies whether or not to publish an entity for the observer that is using this connection.
Listen for View Controls	Specifies whether or not to respond to view control messages sent by other applications.
Ignore Advisories	Enables or disables use of HLA advisory messages.

Table B-1: HLA connection settings

Parameter	Description
Implicit Geographic DDM	Enables or disables use of implicit DDM. Valid only with the MÄK RTI.
Use Absolute Time Stamps	Enables or disables use of absolute time stamps.

B.2.2. DIS Connection Settings

Table B-2 describes the connections settings for DIS connections.

Table B-2: DIS connection settings

Parameter	Description
Port	The DIS port to connect to.
Exercise ID	Specifies the exercise ID for VR-Vantage.
Site Number	Specifies the site number for VR-Vantage.
Application Number	VR-Vantage can send PDUs to the network to communicate the observer's position and orientation. By default, these PDUs are sent to the host machine's broadcast address. You may want to direct VR-Vantage data to a unicast address so it is received by only one application.
DIS Version	Specifies the DIS version (4, 5, or 6).
Network Interface Address	On computers with multiple network cards, the address of the network card to use.
Advanced	
Destination Address	Specifies the destination address for outgoing PDUs. Default: the computer's broadcast address.
Multicast Addresses	Specifies one or more multicast groups to subscribe to. Separate multiple addresses with a semi-colon (;). For more information about multicast addresses, please see the note that follows this table.
Send Buffer Size	Increasing the send and receive buffer size can reduce dropped packets. If the parameters are set to 0, the system default setting is used.
Receive Buffer Size	Increasing the send and receive buffer size can reduce dropped packets. If the parameters are set to 0, the system default setting is used.
Multicast TTL	Specifies the number of routers that a message can pass through when PDUs are sent to multicast addresses.

Table B-2: DIS connection settings

Parameter	Description
Use Asynchronous IO	Enables or disables asynchronous IO. Use of asynchronous IO can reduce dropped packets.
Use Absolute Time Stamps	Enables or disables use of absolute time stamps.
Show Self Published Objects	Broadcast the location of objects that VR-Vantage creates - primarily the observer.
Publish Observers	Specifies whether or not to publish an entity for the observer that is using this connection.
Listen for View Controls	Specifies whether or not to respond to view control messages sent by other applications.



Multicast subscription is a property of the host machine, not of individual applications. If several applications are running on the same machine using the same port, and some of those applications subscribe to multicast groups, all the applications will receive packets for all multicast groups to which any application is subscribed.

Therefore, if VR-Vantage is running on the same machine and using the same port as other applications that subscribe to multicast groups, VR-Vantage may receive traffic intended for the other applications.

B.2.3. CIGI Connection Settings

Table B-3 describes the connections settings for CIGI connections.

Table B-3: CIGI connection settings

Parameter	Description
CIGI Version	The version of CIGI being used.
Driver Mode	Synchronous or asynchronous.
CIGI Entity Mapping	The host-specific CIGI mapping to use. These mappings are configured in the CIGI Mapping Settings dialog box. For more information, please see Chapter 11, *Mapping CIGI Models and Components*, in *VR-Vantage Configuration Guide*.
Driver Frequency	The frequency at which VR-Vantage should try to communicate with the host. There is no guarantee that this frequency can be maintained.
Transport Type	The network transport type to use: Best Effort, Reliable Client, or Reliable Server.
Host IP Address	The IP address of the CIGI host.
Network Device Address	The device address for the network card to be used.
Listen Port	The port on which to listen for CIGI messages.
Send Port	The port on which to send CIGI messages.
Packet Buffer Size	Specifies the amount of space to allocate for packets.
CIGI Messages: Incoming CIGI Messages: Outgoing	The number and size of CIGI message buffers to maintain. Decreasing the number or size can slow down performance. Increasing the number or size can use up memory.

MÄK Products Glossary

This glossary defines terms used in MÄK product documentation.

absolute dead reckoning

A method of dead-reckoning in which an application uses the time stamps contained within state updates if the sender is using absolute time stamping. Contrast with relative dead reckoning.

aggregate

The combination of individual entities, aggregates, or both into a single object. For example, an organizational group such as a platoon.

API

Application Programming Interface.

articulated part

A part of an entity that is capable of movement relative to the entity, such as a turret or gun.

attached part

An object that is attached to another object, such as a rocket attached to a jet.

body coordinate frame

A coordinate framework centered on an entity. To represent the orientation of an entity, an application uses Euler angles or a rotation matrix that rotates from a reference frame to the body coordinate frame.

channel

A channel renders the view of an observer in a 3D visualization application.

clipping

A feature that prevents the display of terrain and objects or parts of objects, that are closer than or farther than specific distances from the observer.

clipping planes

The range of distances from the observer (near clipping and far clipping) in which an application clips objects.

culling

The process of discarding database objects which are not within view, and therefore need not be rendered and displayed.

Cartesian coordinates

A system for indicating location by means of three planes intersecting at right angles to one another at the origin.

Data Distribution Management

The set of HLA services used to specify the routing of data between publishers and subscribers. DDM adds greater control over the Declaration Management (DM) services that only specify filtering based on the class of the data (e.g., ground vehicle versus aircraft). DDM uses the data content to express regions of interest and regions of affect whose overlap establish a communication channel. An example is geographic filtering where a publisher indicates a region around the entity or effect and a subscriber indicates a region expressing its sensor range.

dead-reckoning

A process by which an application calculates the expected location of an entity during periods between state updates, based on velocity, acceleration, and rotational velocity.

DDM

Data Distribution Management.

Defense Modeling and Simulation Office

The former name of the executive secretariat for the Executive Council on Modeling and Simulation (EXCIMS), which provided a full-time focal point for information concerning Department of Defense modeling and simulation (M&S) activities. Renamed Modeling and Simulation Coordination Office. Currently the MSCO promulgates M&S policy, initiatives, and guidance to promote cooperation among DoD components to maximize efficiency and effectiveness.

DIS

Distributed Interactive Simulation.

DIS data packets

See Protocol Data Unit.

display engine

An object in an application that can render 3D data.

Distributed Interactive Simulation

The DIS protocol is a set of standards that govern how participating applications share information about the virtual world. The protocol specifies a set of packets, called protocol data units (PDUs), that communicate this information. Each PDU identifies the sender and contains other information depending on the PDU type. The DIS protocol also specifies when and how frequently PDUs are sent.

The DIS protocol has been superseded by the High-Level Architecture for use by the Department of Defense.

DMSO

See Defense Modeling and Simulation Office.

element definition

In VR-Forces and VR-Vantage, an element definition specifies all of the visualizers that control the various aspects of visualizing a scene element. For example, an element definition includes the main model or military symbology, trailing effects, cockpit displays, and so on.

emitter

A simulated device on an entity that emits electromagnetic radiation, for example, radar.

entity

An element in a simulation, such as a vehicle or a person, that is represented in the simulation through the issuance of state messages.

entity maintenance

A process by which the MÄK Data Logger compensates for discontinuities following a time jump. The Logger sends out interim state messages for entities that were present before the time jump so that they do not time out before the next update message arrives.

entity-type

A list of seven components as specified by the DIS protocol and the HLA RPR FOM. If none of the seven components contains a wildcard (-1) value, then the entity type refers to a specific, narrowly-defined entity. If some components contain a wildcard, then the entity type refers to a class of entities. A larger number of wildcards indicates a broader, more general class.

The components of an entity-type are:

- Entity kind
- Domain
- Country
- Category
- Subcategory
- Specific
- Extra.

environmental process

According to the IEEE 1278.1a specification (DIS), environmental process PDUs communicate simple environment variables, small scale environmental updates, and embedded processes.

Euler angles

A set of three angles used to describe the orientation of an entity as a set of three successive rotations about three different orthogonal axes (x, y, and z). These angles specify successive rotations needed to transform from a reference coordinate system to the entity's body coordinate system.

event

An interaction between objects or between an object and the terrain, such as firing of a munition, or a collision of entities.

exercise

The DIS term for a one or more interacting simulation applications. Compare to federation execution in HLA.

exercise connection

The object (*DtExerciseConn*) through which a VR-Link application connects to the network. State messages are sent through the exercise connection and information about remote entities is received through the exercise connection. (All MÄK products are VR-Link applications.)

exercise ID

A numeric identification for a DIS simulation exercise.

FED file

Federation Execution Data file. The Federation Execution Data is the subset of FOM data needed and read by the RTI. VR-Link applications also read the FED file.

federate

A connection to the RTI. Typically a single simulation application can be thought of as a federate.

federation

A group of HLA federates capable of playing in the same federation execution.

Federation Object Model

Defines the data content of a federation execution.

federation execution

The federation execution represents the actual operation, over time, of a subset of the federates and the RTI initialization data taken from a particular federation. A federation execution is the logical equivalent of a DIS simulation exercise.

field of view

Controls the perspective of the observer.

A wide field of view creates an effect like that of a wide-angle camera lens. Objects appear smaller and farther away from the observer, since the observer coverage spans a wider area. Depth become exaggerated.

A narrow field of view creates an effect like that of a telephoto lens. Objects appear larger and closer to the observer, and the overall scene depth appears flattened. The distances between objects appears compressed.

filter range

A setting that prevents distant entities from being processed while allowing distant terrain to appear normally.

FOM

See Federation Object Model.

FOM Module

In HLA Evolved, defines additional modular data content for a federation execution, usually extensions to an existing FOM. (Also supported by the HLA 1.3 and HLA 1516 versions of the MÄK RTI. Per the HLA Evolved interface specification:

"A partial FOM (containing some or all OMT tables) that specifies a modular component of a FOM. A FOM module may contain classes not inherent to it but upon which the FOM module depends, i.e., superclasses to the modular components. These superclasses will be included in the FOM module either as complete or scaffolding definitions."

frame rate

The rate at which the application displays updated images.

ground clamping

A process by which the a 3D visualization application keeps an entity anchored to the surface of its terrain database, regardless of the altitude data contained in its entity state message.

geocentric coordinates

A coordinate system calculated with respect to the earth's center. The origin of the geocentric coordinate system is the center of the earth. The positive X-axis passes through the prime meridian at the equator; the positive Y-axis passes through 90 degrees east longitude at the equator; and the positive Z-axis passes though the north pole.

geodetic coordinates

A coordinate system in which position is determined relative to a reference ellipsoid, such as the surface of the earth at sea level. In MÄK applications, geodetic coordinates consist of latitude and longitude in radians, and altitude in meters above the reference ellipsoid.

gridded data

Data that has been processed in a rectangular array of points, in X, Y or latitude/longitude, at which single data values define a two dimensional function. According to the IEEE 1278.1a specification, gridded data transmits information about large-scale or high-fidelity spatially and temporally varying ambient fields and about environmental processes and features.

guise

An alternative entity type used to display an object depending on the force ID. For example, a tank could look like an M1A1 to friendly forces and a T72 to hostile forces.

head-up display

A set of indicators and readouts superimposed onto a graphics display. Also called an overlay.

heartbeat

In DIS, the frequency with which current PDUs are sent to the network regardless of whether or not the entity's state has changed.

High-Level Architecture

The High Level Architecture (HLA) for simulations is a U. S. Department of Defense (DOD)-wide initiative to provide an architecture to support interoperability and reuse of simulations. The HLA supersedes DIS for the DOD.

HLA

See High-Level Architecture.

interaction

A message describing a simulation event. An interaction describes an event, it does not update an object's state.

Logger control PDUs

A set of DIS PDUs or HLA interactions that let you control the MÄK Logger remotely.

logical range

A suite of TENA Resources, sharing a common object model, that work together for a given range event. Similar in concept to the HLA Federation.

Local RTI Component

The libraries on a computer that implement an RTI. A federate communicates with the HLA network through the LRC.

LRC

See Local RTI Component.

MÄK Technologies Lisp

An adaptation of the Lisp language used in configuration files for MÄK products.

message

A general term used to refer to DIS PDUs and HLA interactions and state updates. In TENA, a message is similar to an HLA interaction.

MIM

The MOM & Initialization Module (MIM) allows for extensions to be made to the HLA standard MOM. It is a subset of the FOM that contains OMT tables that describe the HLA MOM. The MIM also contains additional predefined HLA constructs such as object and interaction roots, data types, transportation types and dimensions. HLA specifies a standard MIM that is incorporated into all FDDs automatically by the RTI. The standard MIM can be replaced with a user-supplied MIM containing the standard MIM plus extensions.

model definition

In VR-Forces and VR-Vantage, a model definition specifies the 3D model and other basic attributes of a model. It is referenced by an element definition.

Modeling and Simulation Coordination Office

The executive secretariat for the Executive Council on Modeling and Simulation (EXCIMS), which provided a full-time focal point for information concerning Department of Defense modeling and simulation (M&S) activities. The MSCO promulgates M&S policy, initiatives, and guidance to promote cooperation among DoD components to maximize efficiency and effectiveness. (Formerly DMSO)

MSCO

Modeling and Simulation Coordination Office. (Formerly DMSO.)

MTL

See MÄK Technologies Lisp.

orientation clamping

Adjusts the pitch and roll of an entity so that it appears properly seated when the terrain is inclined. For example, if a tank is moving horizontally across the face of a hill, orientation clamping prevents the tank from appearing level, and therefore, partially embedded into the hillside. Used with ground clamping.

object

An element in a simulation that has persistence, as opposed to an interaction, which is a transient element.

object handle

An integer that an application uses to identify a particular object in RTI service calls. An object handle is meaningful only to a particular federate. The same object can be known to different federates by different object handles.

object name

A character string that can be used to identify an object. In HLA, the object name is known to the RTI, and the RTI provides functions to find out an object's name, given its handle, and vice versa. Object names can be chosen by applications that register the objects with the RTI, however if you do not want to choose names for objects, the RTI will assign names for you.

observer

In MÄK 3D applications, the point of view into the scene. (Called the eyepoint in MÄK Stealth 6.x and earlier.)

PDU

See Protocol Data Unit.

Protocol Data Unit

A unit of data message (packet) that is passed on a network between DIS simulation applications.

radio transmitter

A simulated device on an entity, capable of transmitting radio communications.

radio receiver

A simulated device on an entity, capable of receiving radio communications.

Realtime Platform Reference FOM

An HLA reference FOM based on the DIS protocol.

recording

A Data Logger file that stores a history of the interactions in a simulation for playback.

reflected entity list

A list of entities simulated by remote applications (federates in HLA) and about which the local simulation has received information over the network.

reference FOM

A FOM designed to be used as a whole, or with modification, by a wide variety of similar federation executions.

relative dead reckoning

A method of dead reckoning in which an application approximates the location of an object based on the local time of receipt of the last state update message.

remote display engine

A display engine running in an application that is separate from the master application, and which is controlled by the master application.

RID file

See RTI Initialization Data.

RTI Initialization Data

The initialization data required by the RTI for operation.

Data required by an RTI during initialization, independent of the FOM being used. RID data is usually dependent on a specific implementation of the RTI.

RPR FOM

See Realtime Platform Reference FOM.

RTI

See Run-Time Infrastructure.

Run-Time Infrastructure

A library and other supporting software that implements the HLA interface specification. All federates communicate with one another in an HLA environment through RTI functions.

scene element

In VR-Vantage and VR-Forces, any object that is rendered in the scene, such as an entity model, interaction, or tactical graphic.

Simulation Interoperability Standards Organization

A group that seeks to promote modeling and simulation interoperability and reuse for the benefit of diverse M&S communities, including developers, procurers, and users, world-wide.

simulation time

In VR-Forces, simulation time is used in dead-reckoning of remote entities and thresholding of local entities. Typically, simulation time is set once during each iteration of the application's main simulation loop so that all entities are dead-reckoned based on the same value of current time.

SISO

See Simulation Interoperability Standards Organization.

smooth period

The period of time over which trajectory smoothing takes place.

smoothing

A method of ensuring that transitions from an entity's dead-reckoned position to its actual position are not so abrupt as to be visually disconcerting.

state

The current status of an object, including location, direction of movement, extent of damage, and so on.

tape

An alternative term for a Logger recording. Not a physical magnetic tape.

terrain following

In a 3D visualization application, causes the observer (eyepoint) to maintain a constant distance above the terrain surface. The observer's height changes in tandem with the peaks and valleys as it passes over the geography.

timeout

The period of time in which an application continues to display an entity after that entity's update messages have stopped appearing on the network. Time-outs are usually not used in HLA because there is no set frequency (no heartbeat) for transmitting messages.

timescale

A factor by which time is accelerated or slowed during playback of a Data Logger recording.

topographic coordinates

A right-handed Cartesian coordinate system whose X-Y plane is tangent to the earth's surface at the origin, with the positive X axis pointing north, the positive Y axis pointing east, and the positive Z axis pointing down. There are an infinite number of topographic coordinate systems – one for each point on the earth's surface.

topographic coordinate frame

A coordinate frame in the context of the terrain.

trajectory smoothing

A method used by to smooth positional discontinuities that could occur when new state updates arrive.

UDP port

A network channel through which an application sends and receives data for DIS exercises.

Universal Transverse Mercator

In general, a non-cartesian coordinate system in which the X, Y, and Z correspond to easting (nearly east), northing (nearly north), and height above an ellipsoid that approximates the surface of the earth.

UTM

See Universal Transverse Mercator.

view control messages

A set of programmatic messages that let you control the view in VR-Vantage applications remotely.

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VR-Vantage Quick Reference Card

Command-Line Options

Option	Description
(-- | --ignore_rest)	Ignore all command-line options after this one.
--antiAliasing *level*	Set the anti-aliasing level (0, 2, 4, 8, or 16. Default: 5.
--appDataDir *directory*	Specifies the location of application data.
-B | --bindObservers *"observer1, observern,saved_views_file"*	Assigns the views in the specified saved view file to the observers in the order that the observers are listed in the command. Must also specify terrain file. For multiple observers, must specify display engine configuration with --dispSetting.
(-c | --showConsole)	Display a console window.
(-C | --autoConnect) {*filename* | *connector_name*}	Automatically connect to the network using the specified connector.
--dataDir *directory*	Specifies the location of the data directory (terrains and so on).
--depthBits *bits*	Sets the depth of graphics to 24 bits or 32 bits. Default: 24.
--displayEnginePort *port*	Specifies the display engine port used by a remote display engine. Used only if --slave is specified.
--dispSetting *filename*	Specifies the display engine configuration to load.
--entDispSetting *filename*	Specifies the entity display setting to load.
--envSetting *filename*	Specifies the environment configuration file to load.
(-E | --entTypeMap) *filename*	Load the specified entity type mapping file. The file extension determines the type of mapping.
--fullScreen	Start in full screen mode.
(-F | --frameRate) *rate*	Specifies a fixed frame rate for rendering. If 0, it is variable.
(-G | --locale) *language*	Specifies the locale (for localization).
--gui *filename*	Specify GUI configuration file to load.
(-h | --help)	Displays command-line usage information.
(-l | --logFileName) *filename*	Specifies the log file name.
(-L | --loadObservers *filename1 filenamen*	Loads the saved observers in the specified files.
(-n | --notifyLevel) *notify_level*	Specifies the notification level for application messages. Range: 0-4.
--noGui	Start without the graphical user interface.
--noVSync	Disables vsynched windows.
--plugin *filename*	Load the specified plug-in. Can be used multiple times.
(-s | --slave)	Run as a remote display engine.
--stencilBits *bits*	Sets the number of stencil bits (0 or 8). Default: 0.
(*terrain_MTF_file* | *scene_MSF_file*)	Specifies a terrain (MTF) or scene (MSF) file to load.
--unplug *filename*	Do not load the specified plug-in. Can be used multiple times.
--userDataDir *directory*	Specifies the user data directory.
(-v | --version)	Display version information and exit.
-W | --withDisplayEngine *port@netAddress;displayConfigFile name1 .... n* -W | --withDisplayEngine *port@netAddress:displayConfigFile name1 .... n*	Connect to a display engine running in subordinate mode on another computer. On Windows, use a semi-colon (;). On Linux, use a colon (:).
(-a | --appNumber) *number*	Application number.
--fomModules *module*	Specifies a FOM Module. Can be used multiple times. (HLA Evolved only.)

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Command-Line Options

Option	Description
(`-p` | `--federateType`) *type*	The federate type distinguishes different categories of federates.
(`-S` | `--localSettingsDesignator`) *designator*	Specifies a string that is passed to the RTI during federate connect. (HLA Evolved only.)

Mouse Button Mappings

Navigation Action	Mouse Action	Context
Attach to entity.	**Shift** + left-click	Entity.
Attach to prop.	**Ctrl** + **Shift** + left-click	Prop.
Deselect all.	Left-click	Terrain or sky.
Drag terrain.	Left-click + drag	Terrain or prop.
Object selected, others unselected.	Left-click	Selected entity or prop.
Select entity or prop.	**Ctrl** + left-click	Unselected entity or prop.
Select object and unselect all others.	Left-click	Unselected entity or prop.
Teleport to location.	**Shift** + left-click	Terrain.
Teleport to prop.	**Shift** + left-click	Prop.
Teleport to entity.	**Ctrl** + **Shift** + left-click	Entity.
Unselect.	**Ctrl** + left-click	Selected entity or prop.
Display context-sensitive menu.	Right-click	Entity or prop.
3D Only		
Drag the view.	Middle mouse button drag	All.
Drag heading and pitch (mouse look).	Right Drag	All.
Orbit drag.	**Ctrl** + left-click + drag	Terrain or prop.
Zoom in (magnification).	**Ctrl** + mouse wheel forward	All.
Zoom out (magnification).	**Ctrl** + mouse wheel backward	All.
Reset magnification.	Middle mouse button	All.
Move observer forward.	Mouse wheel forward	All.
Move observer back.	Mouse wheel back	All.
Move observer level observer forward.	**Shift** + mouse wheel forward.	All.
Move observer level observer backward.	**Shift** + mouse wheel backward.	All.
2D Only		
Rotate terrain.	Right-click + drag	All. Orient North disabled.
2D Zoom in.	Mouse wheel forward; Middle button + drag	All.
2D Zoom out.	Mouse wheel backward; Middle button + drag	All.

VR-Vantage Quick Reference Card

K = numeric keypad (K8 means press Keypad 8). To use the numeric keypad for navigation, NumLock must be on.

Observer Keyboard Mappings

Observer Movement	Observer	Level Observer	Laptop	2D Level Observer
Move forward.	**w**	unmapped	**w**	unmapped
Move back.	**s**	unmapped	**s**	unmapped
Move left.	**a**	unmapped	**a**	unmapped
Move right.	**d**	unmapped	**d**	unmapped
Move up.	**q**, **Ctrl**+**q**	unmapped	**q**, **Ctrl**+**q**	unmapped
Move down.	**e**, **Ctrl**+**e**	unmapped	**e**, **Ctrl**+**e**	unmapped
Move forward level observer.	unmapped	**w**	unmapped	**w**
Move back level observer.	unmapped	**s**	unmapped	**s**
Move left level observer.	unmapped	**a**	unmapped	**a**
Move right level observer.	unmapped	**d**	unmapped	**d**
Move up level observer.	unmapped	**q**, **Ctrl**+**q**	unmapped	unmapped
Move down level observer.	unmapped	**e**, **Ctrl**+**e**	unmapped	unmapped
Move attached context forward.	**Shift**+**w**	**Shift**+**w**	**Shift**+**w**	**Shift**+**w**
Move attached context back.	**Shift**+**s**	**Shift**+**s**	**Shift**+**s**	**Shift**+**s**
Move attached context left.	**Shift**+**a**	**Shift**+**a**	**Shift**+**a**	**Shift**+**a**
Move attached context right.	**Shift**+**d**	**Shift**+**d**	**Shift**+**d**	**Shift**+**d**
Move attached context up.	**Shift**+**q**	**Shift**+**q**	**Shift**+**q**	unmapped
Move attached context down.	**Shift**+**e**	**Shift**+**e**	**Shift**+**e**	unmapped
Level yaw left.	K **4**	K **4**	Left arrow	Left arrow
Level yaw right.	K **6**	K **6**	Right arrow	Right arrow
Level pitch up.	**Shift**+**j**	**Shift**+**j**	**Shift**+**j**	unmapped
Level pitch down.	**Shift**+**k**	**Shift**+**k**	**Shift**+**k**	unmapped
Level roll right.	**Shift**+**i**	**Shift**+**i**	**Shift**+**i**	unmapped
Level roll left.	**Shift**+**m**	**Shift**+**m**	**Shift**+**m**	unmapped
Yaw left.	**Shift**+**h**	**Shift**+**h**	**Shift**+**h**	**Shift**+**h**
Yaw right.	**Shift**+**l**	**Shift**+**l**	**Shift**+**l**	**Shift**+**l**
Pitch up.	K **8**	K **8**	↑	unmapped
Pitch down.	K **2**	K **2**	↑	unmapped
Roll right.	K **9**	K **9**	K **9**	unmapped
Roll left.	K **3**	K **3**	K **3**	unmapped
Orbit right.	**Ctrl**+**d**, →	**Ctrl**+**d**, →	**Ctrl**+**d**	unmapped
Orbit left.	**Ctrl**+**a**, ¬	**Ctrl**+**a**, ¬	**Ctrl**+**a**	unmapped
Orbit up.	**Ctrl**+**w**, ↑	**Ctrl**+**w**, ↑	**Ctrl**+**w**	unmapped
Orbit down.	**Ctrl**+**s**, ↓	**Ctrl**+**s**, ↓	**Ctrl**+**s**	unmapped
Look up.	**Ctrl**+K **8**	**Ctrl**+K **8**	**Ctrl**+K **8**	**Ctrl**+K **8**
Look down.	**Ctrl**+K **2**	**Ctrl**+K **2**	**Ctrl**+K **2**	**Ctrl**+K **2**
Look left.	**Ctrl**+K **4**	**Ctrl**+K **4**	**Ctrl**+K **4**	**Ctrl**+K **4**
Look right.	**Ctrl**+K **6**	**Ctrl**+K **6**	**Ctrl**+K **6**	**Ctrl**+K **6**

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Observer Keyboard Mappings

Observer Movement	Observer	Level Observer	Laptop	2D Level Observer
Look tilt left.	**Ctrl**+K **3**	**Ctrl**+K **3**	**Ctrl**+K **3**	**Ctrl**+K **3**
Look tilt right.	**Ctrl**+K **9**	**Ctrl**+K **9**	**Ctrl**+K **9**	**Ctrl**+K **9**
Zoom In	**=**	**=**	**=**	**e**,**=**
Zoom Out	**-**	**-**	**-**	**q**, **-**
Suppress constrain to terrain.	**x**	**x**	**x**	**x**
Reset observer:	**Space**	**Space**	**Space**	**Space**
In absolute mode, go to the center of the scene. If attached, reset the attach position and orientation.				
Level observer.	K **5**	K **5**	**Shift**+**Space**+↓	K **5**
Toggle Force North Orientation	unmapped	unmapped	unmapped	unmapped
Toggle Orient To Target Constraint	unmapped	unmapped	unmapped	unmapped
Reset the camera.	K **0**	K **0**		K **0**
Detach.	**z**	**z**	**z**	**z**
Attach to the next entity allowed by the attachment filter.	Period (**.**)	Period (**.**)	Period (**.**)	Period (**.**)
Attach to next entity or prop.	**>**	**>**	**>**	**>**
Attach to the previous entity allowed by the attachment filter.	Comma (**,**)	Comma (**,**)	Comma (**,**)	Comma (**,**)
Attach to previous entity or prop.	**<**	**<**	**<**	**<**
Next attach mode.	**Shift**+**z**	**Shift**+**z**	**Shift**+**z**	**Shift**+**z**
Increase linear speed.	K **7**	K **7**	K **7**	K **7**
Decrease linear speed.	K **1**	K **1**	K **1**	K **1**
Increase orbit speed.	K **+**	K **+**	K **+**	K **+**
Decrease orbit speed.	K **-**	K **-**	K **-**	K **-**
Toggle speed scaling on or off.	K *****	K *****	K *****	K *****
Toggle constrain to terrain on or off.	**/**	**/**	**/**	**/**
Clear the current movement mode. This key is an escape mechanism if keys are not behaving as you expect. This is typically due to a loss of the window context.	**c**	**c**	**c**	**c**
Toggle view controls on or off.	**Shift**+**c**	**Shift**+**c**		**Shift**+**c**
Toggle entity labels on or off.	unmapped	unmapped	unmapped	unmapped



Link - Simulate - Visualize

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