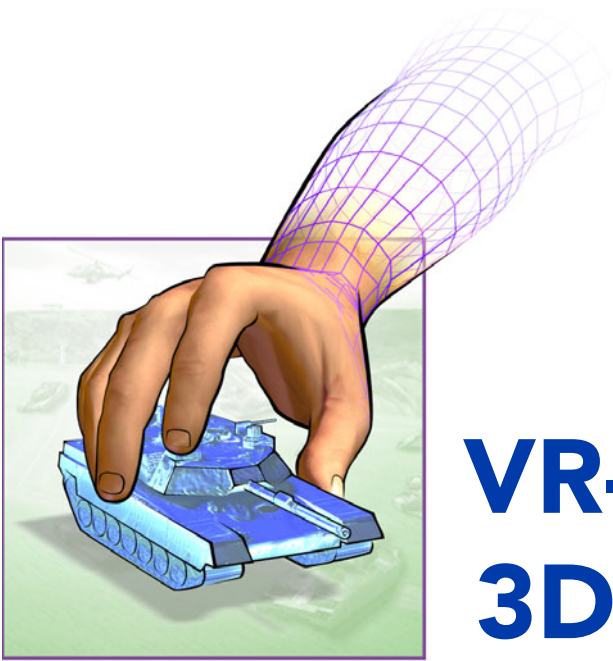
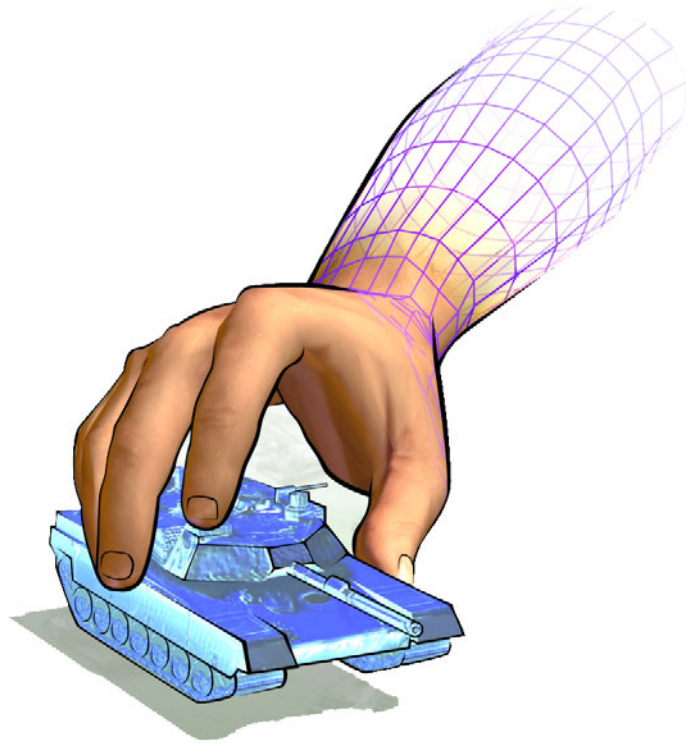




VR-Forces 3D Front End

User's Guide



VR-Forces 3D Front End

User's Guide

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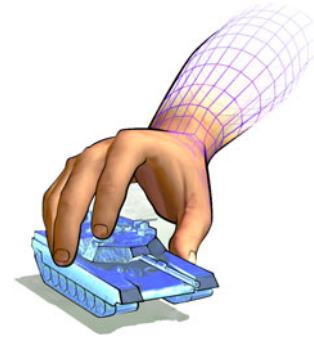
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Revision VRF-3.11-11-080313



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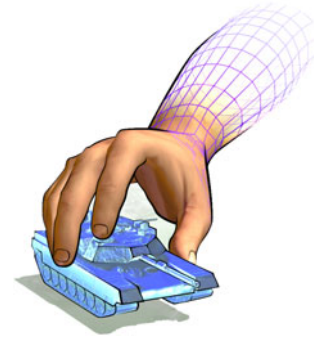
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VR-Forces 3D Front End Quick Reference Card



Preface

This manual is written for persons who will install or use the VR-Forces® 3D Front End. The manual assumes that you are familiar with your operating system and that you know how to work in your computer's graphical window environment.

Please see release documentation for information about changes and updates to VR-Forces since this manual went to press.

How This Manual is Organized

The chapters are organized as follows:

Chapter 1, *Installing the VR-Forces 3D Front End*, explains how to install the 3D Front End.

Chapter 2, *VR-Forces 3D Front End Concepts*, describes the features of the 3D Front End and the differences between it and the 2D front-end.

Chapter 3, *Starting the 3D Front End*, explains how to start the 3D Front End and discusses terrain databases and how to capture the display.

Chapter 4, *Configuring the 3D Display*, describes the 3D Front End interface and the head-up display, and explains how to set preferences for display features such as fog, textures, clipping planes, and field-of-view.

Chapter 5, *Creating Scenarios*, explains how to create scenarios.

Chapter 6, *Creating and Managing Entities*, explains how to create entities and describes entity-specific features.

Chapter 7, *Working with Graphical Objects*, explains how to create control objects and how to edit and display tactical graphics and remote graphics.

Chapter 8, *Controlling the Eyepoint*, explains the eyepoint and how to control it.

Chapter 9, *Displaying 3D Special Effects*, describes special effects such as track histories and trailing effects.

Chapter 10, *Using XR Mode*, explains XR mode and how to use it.

Chapter A, *MIL-STD 2525B Font Characters*, illustrates the characters in the MIL-STD 2525B font supplied with the 3D Front End.

VR-Forces Documentation

The VR-Forces documentation set is as follows:

- *VR-Forces User's Guide* describes how to install and use the VR-Forces program. It is distributed in printed format and as an online manual in Adobe Portable Document Format (PDF).
- *VR-Forces 3D Front End User's Guide* explains how to use the 3D features in the VR-Forces 3D Front End. Configuration of the 3D Front End is covered in *VR-Forces Configuration Guide*. It is distributed in printed format and in PDF format.
- *VR-Forces Configuration Guide* explains advanced features for configuring performance and how to edit VR-Forces configuration files. It includes documentation of the Entity Editor, OPD Editor, and Scenario Merge tools. It is distributed in printed format and in PDF format.
- *VR-Forces Developer's Guide* explains how to use the VR-Forces APIs. It is distributed in printed format and in PDF format.
- *VR-Forces Master Index* combines the index entries from the VR-Forces manuals to help you find references to subjects that are covered in two or more manuals or locate the manual in which a particular topic is discussed. It is distributed only in PDF format.
- *VR-Forces Migration Guide* collates API migration information for each release in the VR-Forces 3.x series. It is distributed only in PDF format.
- Online help. The VR-Forces GUI, the OPD Editor, and the TDB Tool have online help accessible from the Help menu.
- Class documentation. Classes are documented in HTML.
- *VR-Forces Release Notes*. Release documentation consists of release notes provided as a PDF file and in printed format.

The PDF files are in the *./doc* directory.

Online Manuals

The online manuals (PDF) use hypertext links for the entries in the table of contents, for all index entries, and for cross references. PDF documentation also supports full text searching.

To view and print PDF documents, you need a copy of the free Acrobat Reader software (version 5.0 or later). To obtain a copy, visit www.adobe.com.

MÄK Products

VR-Forces is a member of the MÄK Technologies® line of software products designed to streamline the process of developing and using networked simulated environments. The MÄK Technologies 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), the Distributed Interactive Simulation (DIS) protocol, and the Test and Training Enabling Architecture (TENA). 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, RTIsby®, that allows you to extend the RTI using plug-in modules. It also has a graphical user interface for the MÄK RTI rtiexec.
- ♦ VR-Forces®. VR-Forces is a computer generated forces application and toolkit. It provides an application with a graphical user interface, that gives you a two dimensional view of a terrain database.

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.

- ♦ MÄK Stealth and StealthXR. The Stealth displays a realistic, three-dimensional view of your virtual world. You can view this world from the inside of a simulated moving vehicle, or place the eyepoint at another moving or stationary location. The Stealth lets you switch rapidly among several predefined viewpoints while the simulation is underway.

StealthXR (exaggerated reality) is a separately-licensed component of the Stealth. It combines the features of traditional 2D and 3D displays into one exaggerated reality display. It provides a big picture understanding of a battlefield along with an immersive sense of perspective.

- ♦ **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 graphical user interface 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.
- ♦ **MÄK Plan View Display.** The Plan View Display (PVD) provides a two-dimensional, “big picture” of a virtual environment. It shows simulated entities, such as vehicles, soldiers, and tanks moving over a 2D-map display.
- ♦ **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 limited DIS translation.
- ♦ **MÄK Gateway.** The Gateway is a translator application that allows DIS exercises to operate as members of HLA federation executions that use the RPR FOM, thereby preserving the value of simulation code written to support DIS. The MÄK Gateway is a standalone application and does not require you to write additional code for its use.

How to Contact Us

For VR-Forces 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

Internet

MÄK web site home page:	www.mak.com
License key requests:	www.mak.com/support/licenses.php
Product version and platform information:	www.mak.com/support/productversions.php
For the free MÄK RTI trial version:	www.mak.com/products/rti.php
Support FAQ:	www.mak.com/support/faq.php

Post

Send postal correspondence to:	MÄK Technologies 68 Moulton St. Cambridge, MA, USA 02138
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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.
<i>Monospaced Italic</i>	Indicates command variables that you replace with appropriate values.
{ }	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 UNIX 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.
<i>Italic</i>	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.
i	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-Forces home directory. For example, the directory *vrforces/doc* appears in the text as *./doc*.

Hardware and Operating System Naming Conventions

Unless otherwise specified, references to UNIX include Linux, regardless of the type of computer it is running on. References to PCs refer to Intel processor-compatible computers running a version of Microsoft Windows.

Mouse Button Naming Conventions

An instruction to click the mouse button, refers to clicking the primary mouse button, typically the left button for right-handed mice and the right button for left-handed mice. The popup 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 which is distributed under the Boost License. All header files that contain Boost code are properly attributed. The boost website is: www.boost.org.

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

Permission is hereby granted, free of charge, to any person or organization obtaining a copy of the software and accompanying documentation covered by this license (the "Software") to use, reproduce, display, distribute, execute, and transmit the Software, and to prepare derivative works of the Software, and to permit third-parties to whom the Software is furnished to do so, all subject to the following:

The copyright notices in the Software and this entire statement, including the above license grant, this restriction and the following disclaimer, must be included in all copies of the Software, in whole or in part, and all derivative works of the Software, unless such copies or derivative works are solely in the form of machine-executable object code generated by a source language processor.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT. IN NO EVENT SHALL THE COPYRIGHT HOLDERS OR ANYONE DISTRIBUTING THE SOFTWARE BE LIABLE FOR ANY DAMAGES OR OTHER LIABILITY, WHETHER IN CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

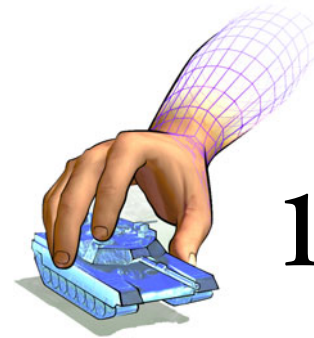
libXML and libICONV

VR-Link and all MÄK software which 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.

- ♦ 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/>

pThreads Library

VR-Exchange links with the pThreads win32 library. The library is distributed under the GNU Lesser General Public License (LGPL). MÄK has made no modification to this library. For information about the pThreads win32 library please see: <http://sourceware.org/pthreads-win32/>



Installing the VR-Forces 3D Front End

This chapter explains how to install the VR-Forces 3D Front End.

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1.1. Installing the VR-Forces 3D Front End

The 3D Front End is installed separately from the base VR-Forces. It does not provide a complete VR-Forces installation. It installs files specific to the 3D Front End into an existing VR-Forces installation directory. These files include the executable files and required DLLs, configuration files, and 3D terrain databases.



You must install the 3D Front End into an existing VR-Forces directory that contains the version of VR-Forces for which the 3D Front End was built.

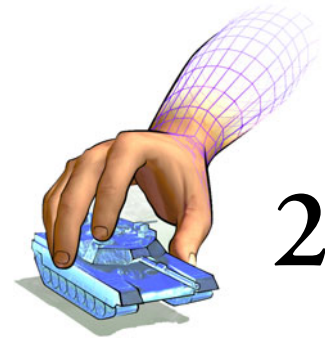
To install the 3D Front End:

1. Install VR-Forces. Follow the procedures in Chapter 2, *Installing VR-Forces*, in *VR-Forces User's Guide*.
2. Run the installer for the 3D Front End. Use the appropriate procedure from Chapter 2, *Installing VR-Forces*, in *VR-Forces User's Guide* for your platform.

In Windows, the installation wizard automatically chooses the default installation directory for the appropriate version of VR-Forces. If you installed VR-Forces to a different directory, change the installation directory in the 3D Front End installation wizard.



- ♦ On Windows, when the installation wizard notifies you that the installation directory already exists and asks if you want to install into this directory, click Yes.
 - ♦ On Linux, you must install the 3D Front End from the same directory from which you installed VR-Forces. For example if you installed VR-Forces from `/usr/local/mak`, you must install the 3D Front End from `/usr/local/mak`.
-



VR-Forces 3D Front End Concepts

This chapter provides an introduction to and conceptual background for the 3D features in VR-Forces.

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2.1. Introduction

The VR-Forces 3D Front End is an alternative graphical user interface (GUI) to the VR-Forces 2D plan view style GUI. It combines the 3D display and features of the MÄK Stealth with VR-Forces's simulation planning and management capabilities. If you are familiar with the Stealth, you will find it very easy to get used to the 3D Front End.

The 3D Front End's navigation controls give you complete freedom to travel anywhere as an unobtrusive observer. You can place the eyepoint at a specific location, or link it to one or more vehicles for automatic tracking of battlefield activities. While an exercise is underway, you can switch view modes quickly to see the scene from any perspective. The 3D view supports situational awareness and precise placement of entities into the scene when you create scenarios.

The 3D Front End supports most of the features of the 2D GUI. Please refer to *VR-Forces User's Guide* for explanations of general VR-Forces concepts, scenario creation, planning, and other features. This manual describes only the 3D features of the 3D Front End and any other procedures that are different from the procedures in the 2D GUI.

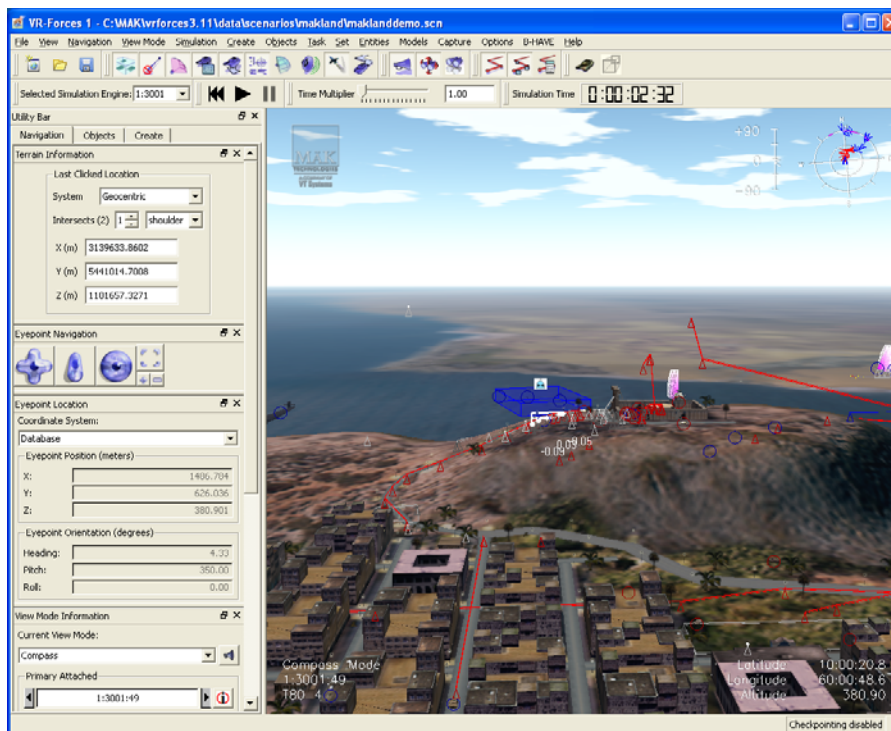


Figure 2-1. VR-Forces 3D Front End window

2.1.1. Differences Between the 2D and 3D Front Ends

The 3D Front End does not support the following features that are in the 2D front-end, or handles them differently:

- ♦ Intervisibility is not supported.
- ♦ You cannot create overlays or overlay objects in the 3D Front End. However, you can view and edit overlay objects being simulated by 2D front-ends. You can load scenarios created in 2D front-ends and if they have overlay objects, you can edit or delete them.
- ♦ Features that manipulate a 2D map are not meaningful in the 3D Front End and therefore are not supported. These include the minimap, panning and zooming controls, mirroring of extents, entity tracking and centering, and so on. However the 3D Front End has its own equivalent navigation through manipulation of the eyepoint and attaching the eyepoint to entities or graphics.
- ♦ Features that manipulate the state of entity icons are not supported, for example:
 - You cannot collapse the entities in an aggregate into one aggregate model. You can expand and collapse their representation in the Objects List Panel.
 - Ghosted icons for aggregates are not supported.
 - Entity models are not hidden when spot reports are enabled. There is no simulation of fog-of-war. However, you can still enable sending of spot reports.
 - Embarked entities may be visible when you expect them to be hidden, for example inside a vehicle. This depends on the extent to which the 3D models support the appearance of embarkation, not on the embarkation relationship simulated by VR-Forces.
- ♦ Terrain profiles are not supported.
- ♦ Time management is not supported in the 3D Front End. You can still configure the back-end as a time-managed federate.
- ♦ Pressing Escape does not escape from object creation.
- ♦ The cursor does not change when you enter creation or selection mode.
- ♦ There is no Stealth menu in the 3D Front End. To control the view in MÄK Stealths or in other 3D Front Ends, use the mirroring features. For details, please see Section 10.3, “[Using Mirroring](#)”, in *VR-Forces Configuration Guide*.
- ♦ Range rings are not supported. Range volumes are the 3D equivalent. For details, please see “[Displaying Range Volumes](#),” on page 9-10.
- ♦ The information presented in entity labels is not configurable. For details, please see “[Viewing Entity Labels](#),” on page 6-10.
- ♦ You cannot open multiple windows for a given instance of the 3D Front End.

2.2. VR-Forces 3D Front End Features

This section introduces some of the major features of the 3D Front End, which are described in greater detail later in this manual.

2.2.1. Realistic Display of Vehicles and Terrain

VR-Forces provides a realistic display using terrain and moving-model geometry in the MultiGen-Paradigm 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.

VR-Forces also displays:

- ♦ Smoking and flaming effects
- ♦ Trailing effects
- ♦ Muzzle flashes
- ♦ Track histories
- ♦ Detonation lines and detonation indicators
- ♦ Entity labels
- ♦ Explosions
- ♦ Chemical and biological hazards
- ♦ Range volumes.

VR-Forces presents terrain realistically, and lets you control fog, time-of-day, and other effects. For details, please see Chapter 4, [Configuring the 3D Display](#).

2.2.2. Multiple View Modes

VR-Forces offers view modes that let you:

- ♦ Manually control the eyepoint's position and orientation.
- ♦ Automatically track a vehicle's movement from a fixed viewpoint, as if watching from a control tower.
- ♦ Link the eyepoint's position with a vehicle's position. You can place the eyepoint inside the vehicle for a driver's-eye view, or fly in tandem with the vehicle, outside.
- ♦ Attach the eyepoint's position to one vehicle while automatically tracking the movement of a second vehicle.
- ♦ View an entity while traveling around it along an orbital path.
- ♦ Keep a user-defined group of entities in view.

You can save views to a file for re-use. VR-Forces comes with two pre-set views.

For more information, please see Chapter 8, [Controlling the Eyepoint](#).

2.2.3. Accurate Vehicle Positioning

VR-Forces can smooth the trajectories of moving vehicles to compensate for discontinuous positional data. VR-Forces's ground clamping feature can ensure that all ground entities are placed correctly on the terrain surface. For details, please see [“Using Ground Clamping,”](#) on page 6-11 and [“Setting Trajectory Smoothing,”](#) on page 6-13.

2.2.4. Head-up Display

VR-Forces can overlay text and graphical indicators onto the main graphics display. These indicators show information about the eyepoint's position and heading, the position and heading of nearby entities, and information about the entity to which the eyepoint is attached. For details, please see [“The Head-Up Display,”](#) on page 4-6.

VR-Forces also displays entity labels.

2.2.5. Remote Control

You can control the 3D Front End eyepoint remotely through view control messages, which can be generated by:

- ♦ MÄK applications such as the Logger, Plan View Display, and VR-Forces
- ♦ Applications that use the remote control API.

For details, please contact MÄK technical support.

2.2.6. Electromagnetic Emission Fields and Sensor Volumes

VR-Forces can represent electromagnetic emission fields such as those generated by mine detectors, radar, and other devices. The electromagnetic field appears as a translucent volume. For information about electromagnetic emissions, please see [“Displaying Electromagnetic Emissions Fields,”](#) on page 9-6.

2.2.7. Sound Effects

VR-Forces supports sound effects. For details, please see [“Configuring Sound Effects,”](#) on page 9-12.

2.3. XR (Exaggerated Reality) Mode

XR Mode is a separately-licensed component of VR-Forces. It combines the features of traditional 2D and 3D displays into one exaggerated reality display. It provides a big picture understanding of a battlefield along with an immersive sense of perspective. XR Mode includes the following features:

- Representation of entities using 3D models or billboard model sets
- Terrain scaling
- Icon and graphics scaling
- Orthographic or perspective views
- Height above terrain lines and labels
- Dynamic switching between satellite imagery and map views
- Direct import of DTED, GDB, CTDB, and OpenFlight terrain data.

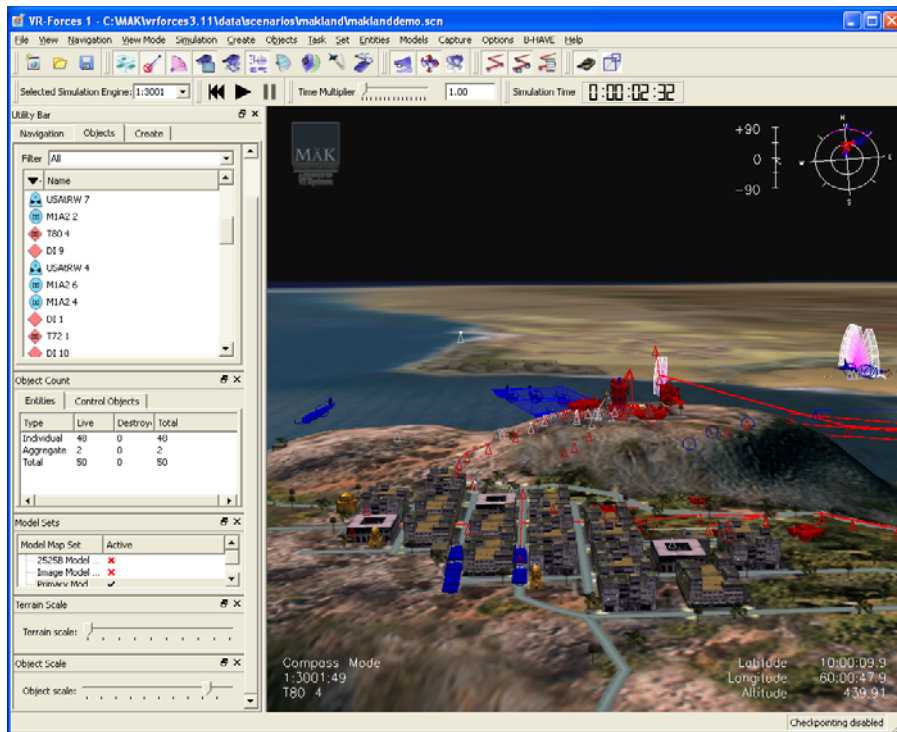


Figure 2-2. XR Mode view

For details about XR Mode features, please see Chapter 10, [Using XR Mode](#).

2.4. The Eyepoint

The eyepoint is the point in the three-dimensional simulated environment from which you view the entities and terrain. The eyepoint's position and orientation are controlled by three factors:

- ♦ The current view mode. Depending on the view mode, the eyepoint is unattached, is attached to one or two entities, or is attached to a view group.
- ♦ The movement of the entity (or entities), if any, to which the eyepoint is attached.
- ♦ Operation of positional controls using the:
 - Keyboard
 - Location toolbar
 - View Mode Information toolbar
 - Remote control API (stealth control messages).

i

The view modes treat aggregates as entities. Therefore, explanations about how view modes and positional controls affect the view of entities apply equally to aggregates.

For more information, please see Chapter 8, [Controlling the Eyepoint](#).

2.4.1. Controlling the Eyepoint's Position and Orientation

The eyepoint always has a location, or position, defined in terms of the coordinate system you are using, for example, latitude, longitude, and altitude for the Geodetic coordinate system, or X, Y, and Z values in database coordinates. It also has an orientation, expressed in heading, pitch, and roll. The eyepoint's location and orientation are displayed in the Eyepoint Location toolbar ([Figure 2-3](#)).

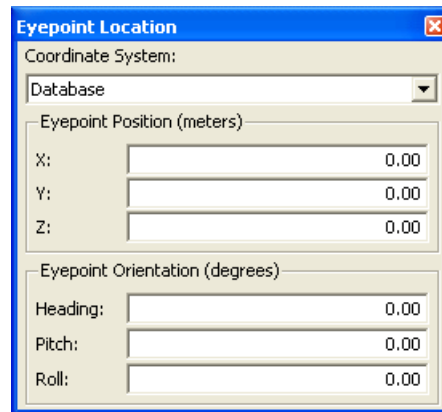


Figure 2-3. Eyepoint Location toolbar

You can change the position and orientation of the eyepoint. For details, please see [“Controlling the Eyepoint’s Position and Orientation,”](#) on page 8-3.

The orientation control does not change latitude, longitude, or altitude of the eyepoint. The eyepoint stays in the same location in space, but looks in different directions from that point.

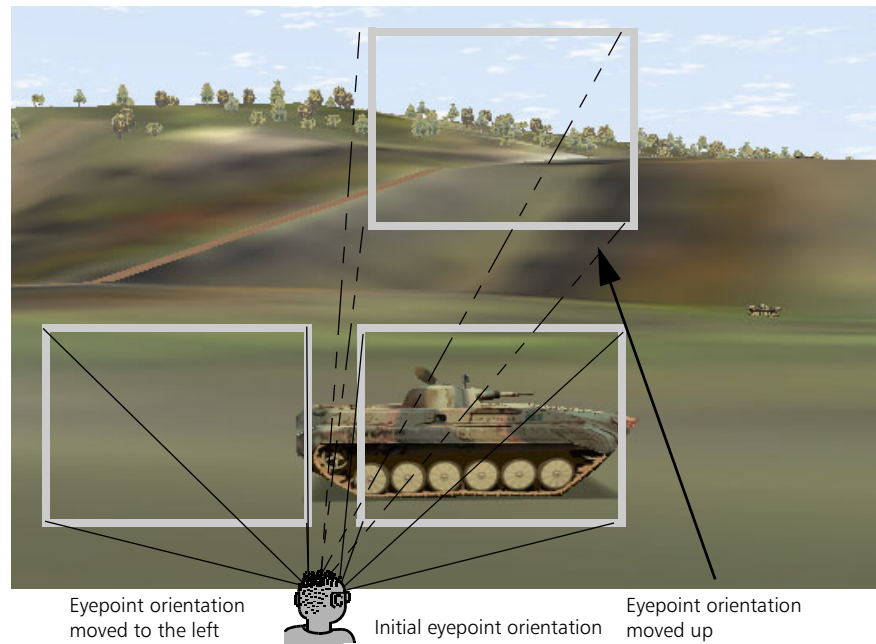
The position controls change the latitude, longitude, or altitude, or a combination of them for the eyepoint. The way in which the eyepoint changes is determined by the view mode you are using.

[Figure 2-4](#) contrasts the effects of changing the orientation with changing the position. Both pictures show the same set of views of a simulation. In the top set, the views are changed using the orientation control. The eyepoint can look in all directions, but does not itself move in space. Changing the orientation is analogous to standing in one place and turning your head in a circle to see your surroundings.

In the bottom set, the view is changed by using the position controls. The eyepoint moves in space to achieve the different views of the simulation.

The position and orientation controls work a little differently in each view mode. Therefore, [Figure 2-4](#) is a bit simplistic in that it doesn’t take into account any particular view mode or attachment to an entity. As you get used to working with the 3D Front End, you will learn how to achieve the effects you desire.

Use orientation controls to view different places in the simulation without changing the location of the eyepoint.



Use position controls to view different places in the simulation by changing the location of the eyepoint

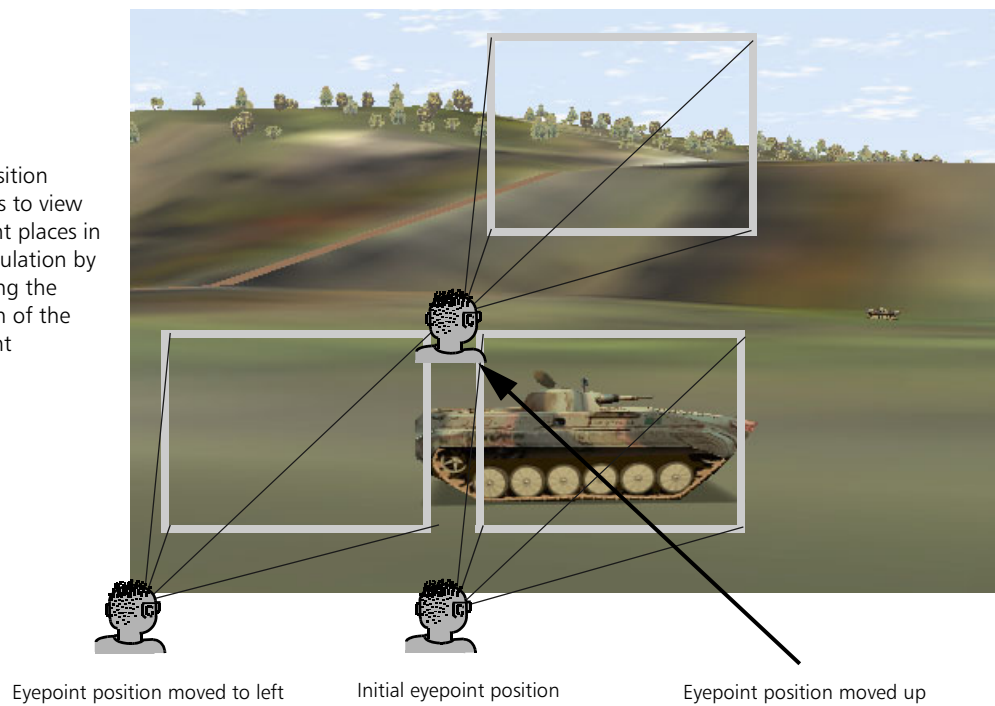


Figure 2-4. Orientation contrasted with position

2.5. View Modes

View modes describe the attachment state of the eyepoint and determine which of the orientation and position controls are active. The attachment states are:

- ♦ None
- ♦ One entity
- ♦ Two entities
- ♦ Group (multiple entities).

For a detailed description of each view mode, please see [“View Mode Descriptions,”](#) on page 8-16.

2.5.1. No Attachment

In the following view modes, the eyepoint is not attached to an entity:

- ♦ Absolute
- ♦ Pivot.

2.5.2. Attachment to One Entity

In the following view modes, the eyepoint depends on the movements of a single entity:

- ♦ Track
- ♦ Compass
- ♦ Orbit
- ♦ Tether
- ♦ Mimic
- ♦ Turret.

Depending on the view mode:

- ♦ The eyepoint position can be controlled by the entity’s position.
- ♦ The eyepoint orientation can be controlled by the entity’s position. The eyepoint remains at a fixed position and tracks a vehicle’s movement.
- ♦ The position and orientation can both be controlled by the entity. For example, the eyepoint can be placed in a vehicle cockpit, traveling, turning, and banking with the vehicle.

2.5.3. Attachment to Two Entities

Tether track and mimic track view modes link the eyepoint position to a primary entity, while tracking a second entity.

2.5.4. Attachment to a Group of Entities

Group and Wide Group view modes let you define a group of entities and keep all members of that group constantly in view.

2.6. Entity Models

VR-Forces comes with a collection of vehicle and lifeform models. You can provide your own models, and make VR-Forces aware of them by editing the original model mapping files, or by creating your own map files. For details about how to map models, please see Chapter 12, [Configuring 3D Entity Models](#), in *VR-Forces Configuration Guide*.

Models are mapped in the *ModelMap.mtl* file. This file is designed to be edited using the Model Mapper tool. For information about the Model Mapper tool, please see Chapter 13, [Using the Model Mapper](#), in *VR-Forces Configuration Guide*.

2.6.1. Dismounted Infantry and Civilian Entities

VR-Forces provides models for dismounted infantry and civilians. The models support the following characteristics:

- ♦ State: standing, walking, running, kneeling, prone, crawling, dead
- ♦ Weapon: none, port arms, aimed, surrender, detained
- ♦ Camouflage: desert, winter, forest.

By default, the 3D Front End uses simple models for soldiers and civilians. These models only have walking and standing animations, and decide which to use based on the entity's velocity, rather than its appearance bits. The civilian models support the state and weapon characteristics, but not camouflage.

The dismounted entity models are large and take up a lot of memory. Therefore, we map them in *infantryMap.mtl*, which is not loaded by the default *Stealth.mtl* file. If you want to use the models that support all the different states and camouflages, load *infantryMap.mtl*.

The RPR FOM/DIS enumerations do not include civilians or gender distinctions. VR-Forces uses the following conventions for these entities:

- ♦ Category:
 - 0 = dismounted infantry
 - 1 = civilian
- ♦ Subcategory:
 - 0 = male
 - 1 = female.

You can change the enumerations if you want to, by editing *infantryMap.mtl*.

VR-Forces does not include a model for female dismounted infantry.

2.7. Terrain Databases

VR-Forces can load the following database formats directly:

- ♦ OpenFlight
- ♦ MetaFlight
- ♦ The UTM projection and the Lambert Conical Conformal projection in CTDB C4B, C7L, and C7B databases
- ♦ MÄK terrain format (GDB)
- ♦ Digital terrain elevation data (DTED).

If you have an XR Mode license, you can also load paper map files that overlay raster files on GDB databases. The standard VR-Forces (that is, XR Mode not enabled) can load one texture. In XR Mode, you can load multiple textures.

If you load a database directly, VR-Forces initializes the coordinate system based on the terrain header. If you load a database from a configuration file, the coordinate system is read from the file.

VR-Forces supports the following database coordinate systems:

- ♦ UTM
- ♦ Geocentric
- ♦ Flat Earth
- ♦ Lambert Conformal Conic (LCC)
- ♦ Database.

VR-Forces comes with several terrain databases. These databases are stored in the *./data/terrain* directory in your VR-Forces tree.

- ♦ Hunter-Ligget – The Hunter-Ligget database represents an area on the California, U.S.A. coast. It is in *./data/terrain/hunter*. This database is copyrighted by Silicon Graphics, Inc., MultiGen-Paradigm Inc., and GEC Marconi Ltd. Please see the *README* file in *./data/terrain/hunter* for usage and distribution restrictions.
- ♦ Monterey – The Monterey database is a high-resolution, high-flight database suitable for air vehicle simulations. This database is copyrighted by MultiGen-Paradigm Inc. and Silicon Graphics Inc. Please see the *README* file in *./data/terrain/Monterey* for usage and distribution restrictions.
- ♦ Berkeley – the area around Berkeley, California, U.S.A.
- ♦ Makland – The Makland database is a fantasy database created by MÄK Technologies. It is located in the Indian Ocean off the East coast of Africa
- ♦ VR-Village – The VR-Village database is a fantasy database created by MÄK Technologies. It has a small, highly detailed village in a desert environment.
- ♦ Kabul – the area around Kabul, Afghanistan.
- ♦ Ground – a simple land terrain.
- ♦ California – a terrain covering a portion of California, U.S.A.

- ♦ TerraSim_SampleUrban_Metaflight – an urban terrain with buildings that have interior spaces. This is a MetaFlight terrain that does not have virtual textures.

2.8. Electromagnetic Sensor Volumes

Using information contained in electromagnetic emission messages, VR-Forces can represent emission fields created by radars and other devices. These emissions appear as translucent volumes attached to the emitting entity, as shown in [Figure 2-5](#).

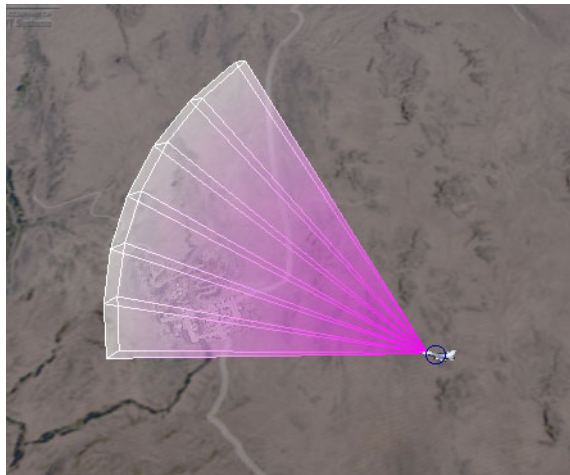
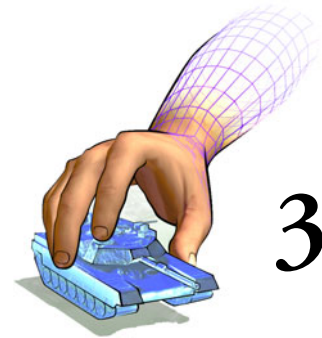


Figure 2-5. Electromagnetic Sensor Volume

The sensor volume's orientation, field of view, and point of origin are determined by values in the EM-Emission state updates. Other characteristics, such as radius and color, are determined by a combination of VR-Forces variables and values in the EM-Emission state update, as described in [“Controlling Sensor Volume Radius,”](#) on page 9-9 and [“Using Sensor Volume Colors,”](#) on page 9-6.

2.9. Presagis Vega Prime Support

The 3D Front End is built using Presagis Vega Prime. If you have a Vega Prime developer's license, you can use it to modify the 3D Front End's 3D visuals. You can use the Vega LynX Prime application to create custom configuration files (.acf files) for the 3D Front End. LynX Prime is included with the 3D Front End product distribution. Because it is built with Vega Prime, the 3D Front End can support Vega Prime modules such as the DI Guy module.



Starting the 3D Front End

This chapter explains how to start and stop the VR-Forces 3D Front End, load terrain databases, and capture the 3D display.

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3.1. Starting VR-Forces

The process for running the VR-Forces 3D Front End is almost identical to that of the 2D front-end. You can run in combined or separate mode. The only difference is that instead of running *vrfGui*, you run *vrf3DGui*.



A VR-Forces license allows you to run one front-end, either the 2D GUI, or the 3D Front End. If you want to run both GUIs at the same time, you must purchase an additional front-end license.

3.1.1. Command-Line Options

This section lists and describes the 3D Front End command-line options. It does not include options that apply only to the back-end. For back-end command-line options, please see *VR-Forces User's Guide*. Many command-line options have a short, one character version and a multicharacter version. In the following list, only the short versions are used. Long versions, where applicable, are included in the detailed descriptions.

```
vrf3dgui [  
  --ignoreRest  
  DIS options  
  HLA options  
  -a application_number  
  --acf acfFile  
  --addTranslationFile translationFile ...  
  --appIdRange startRange endRange  
  -B batch_file  
  -c channels  
  -C  
  -D  
  -d settings_file  
  --defaultConfigFile configuration_file  
  --fullScreen  
  -g  
  -G language_code  
  -h  
  --hideGui  
  -H ethernet_address  
  -i session_ID  
  -l filename ...  
  --lispFile filename ...  
  --loadPlugin plugin ...  
  --logDirectory directory  
  -L scenario_pathname  
  -m filename  
  --mft mftFileName  
  --mirror  
  -n notification_level
```

```
--noDefaultMtl
--noPluginDirectory
--outputLogFile logfileName
-p <int>
--pluginFile file
-s site_ID
--simulationModelSet SMSfile
--startAltitude altitude
--startOrientation orientation
--startPosition x,y,z
--startVideoRecording
-t site_ID
-v
-W width,height
--xr
-z back-end
-Z]
```

DIS-Only Options

```
-A destination_address
--disVersion version
-I
--mcastTtl ttl
-P port
--recvBufferSize size
--sendBufferSize size
-S multicast_address ...
-x exercise_ID
```

HLA-Only Options

```
-f library
--fomMapperInitData data
-F FED_file_name
--geographicDdm
--ignoreAdvisories
-N federate_name
--rid ridFile
--rprFomVersion version_number
-x execution_name
```

Protocol-Independent Arguments:

The following arguments are protocol-independent:

(-- | --ignore_rest) specifies that any additional command-line arguments are to be ignored.

(-a | --appNumber) *application_number* specifies the application number.

--acf *acfFile* specifies an ACF to load.

--addTranslationFile *translationFile* specifies one or more translation files to load.

--appIdRange *startRange endRange* specifies a range of application IDs that represent objects generated by VR-Forces.

-B *batch_file* runs the specified batch file. (For use with one back-end only, in separate mode.)

(-c | --numChannels) *channels* specifies either two or three multiple channels.

(-C | --useConsole) runs the GUI with a console window open (meaningful only on PCs).

(-d | --defaultSettingsFile) *settings_file* specifies a file from which to load saved settings and to which VR-Forces should save settings.

(-D | --doNotUseSettingsFile) specifies that VR-Forces should not load or save a settings file.

--defaultConfigFile *configuration_file* specifies a configuration file to load instead of *vrf3DGui.mtl*.

--fullScreen starts the 3D Front End in full screen mode.

-G *language_code* specifies the language used for the GUI text.

(-h | --help) displays help information in a console window.

--hideGui hides the 3D Front End's main window.

(-H | --hostAddressString) *ethernet_address* specifies the ethernet address to use on a computer that has multiple ethernet cards. Specifically, use this option if you do not want to use the first network address.

(-i | --sessionId) *session_ID* specifies a session ID.

(-l | --addConfigFile) *filename* specifies a configuration file to load. The intention of this command is to load configuration files that include the parameters normally specified in *vrf3DGui.mtl*. Do not use this command to override parameters in *Stealth.mtl*.

(-L | --scenarioFileName) "*scenario_pathname*" loads the specified scenario. The pathname can be absolute or relative from the *./bin* directory. Mutually exclusive with the -T option.

`--lispFile filename` (accepted multiple times) specifies MTL configuration files to load or lisp expressions to execute. The intention of this command is to load configuration files that include the parameters normally specified in *Stealth.mtl*. Do not use this command to override parameters in *vrf3DGui.mtl*.

`--loadPlugin plugin` specifies one or more plug-ins to load.

`--logDirectory directory` specifies the directory in which log files should be written.

`(-m | --defaultSymbolMapFile) filename` specifies a symbol map file to load.

`--mft mftFileName` specifies a MetaFlight file to load. For details about loading MetaFlight terrain databases, please see [“Loading MetaFlight Databases,”](#) on page 3-9.

`--mirror` enables mirroring.

`(-n | --notifyLevel) notification_level` sets the level for messages written to the console or the VR-Forces log file (*vrf.log*), 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.

`--noDefaultMtl` specifies not to load *Stealth.mtl*.

`--noPluginDirectory` specifies that VR-Forces should not load the configuration files in the *.plugins* directory.

`--outputLogFile logfileName` specifies the 3D Front End log file.

`(-p | --backendAppNum) application_number` specifies the application number for the back-end in combined mode. Use `-p` to override the default application number.

`--pluginFile file` specifies the configuration file that lists which plug-ins to load.

`(-s | --siteId) site_ID` specifies the site ID. This option applies only to the front-end in combined mode. It applies to *vrf3dGui* and *vrfSim* in separate mode.

`--simulationModelSet SMSfile` specifies the simulation model set. It must be declared separately for front-end and back-end even in combined mode.

`--startAltitude altitude` sets a starting altitude when one is not set in an MTL file used to load a database. (The MTL setting would override the command line argument.) The default is to use the Z from *startPosition* or 100. m above the height of terrain at the starting point if no *startPosition* variable is set. This is useful if you want to start at the center of a database, but at a different altitude.

`--startOrientation orientation` sets a starting orientation when one is not set in an MTL file used to load a database. (The MTL setting would override the command line argument.) The default is 0.,350.,0. (headed north, pitched slightly down, no roll)

`--startPosition x,y,z` specifies the coordinates of the starting eyepoint position (x,y,z).

`--startVideoRecording` start recording video when the 3D Front End starts.

`(-t | --backendSiteId) site_ID` specifies the site ID for the back-end in combined mode only. Use `-t` to override the default site ID.

`(-v | --version)` displays version information and exits.

`(-W | --windowSize) width,height` specifies the starting window size (W, H).

`--xr` starts the 3D Front End in exaggerated mode.

`(-z | --backendApplicationName) back-end` indicates that you want to run in combined mode, where *back-end* is the back-end executable, for example, *vrfSim*. The default is specified in the *vrf3DGui.mtl* configuration file. The back-end pathname may be relative or absolute.

`(-Z | --combinedMode)` allows you to specify combined mode without specifying a back-end. If you use `-Z`, VR-Forces runs with the default back-end executable, site application, and site ID.

HLA Arguments

The following arguments apply only to HLA federates:

`(-f | --fomMapperLib) library` specifies a FOM Mapper.

`(-F | --fedFileName) FED_file_name` specifies the name of the FED file.

`--fomMapperInitData data` specifies initialization data for a FOM Mapper library, if required.

`--geographicDdm` specifies use of geographic DDM. For more information, please see the discussion of Implicit DDM in *MÄK RTI Reference Manual*.

`--ignoreAdvisories` specifies that the application will ignore HLA advisory messages.

`(-N | --federateName) federate_name` specifies the federate name to use.

`--rid ridFile` specifies the RID file to use.

`--rprFomVersion version_number` specifies the version of the RPR FOM that you are using.

`(-x | --execName) execution_name` specifies the HLA federation execution name.

DIS Arguments

The following arguments apply only to DIS:

(-A | --destAddrString) *destination_address* specifies an address for point-to-point mode.

--disVersion *version* specifies the version of DIS to use.

(-I | --useAsyncIO) specifies use of asynchronous I/O.

--mcastTtl *tTl* specifies the multicast time-to-live value.

(-P | --disPort) *port* specifies the port number for DIS (default 3000).

--recvBuffersize *size* specifies the size of the receive buffer.

--sendBuffersize *size* specifies the size of the send buffer.

(-S | --mcastAddresses) *multicast_address* specifies one or more addresses for multicast mode.

(-x *exercise_ID* | --exerciseId) *exercise_ID* specifies the DIS exercise ID.

3.2. Loading Terrain Databases

If you are using multiple front-ends, only one of them can load or create the scenario (which includes a specification of the terrain database to use). The others must open the terrain database that is being used. For a brief description of the databases supplied with VR-Forces, please see “[Terrain Databases](#),” on page 2-12.

A 3D terrain database is usually loaded using commands in an MTL configuration file. We recommend that you create a separate configuration file for each database you use.

The 3D Front End can load a terrain database in any of the following ways:

- ♦ Specify a database configuration file to load at startup in *Stealth.mtl*
- ♦ Specify a database configuration file to load using the -l command-line option
- ♦ Load a database from the GUI.

3.2.1. Loading a Database at Startup

- To load a database at startup, add a load command to *Stealth.mtl*, for example:

```
(load mtl-path "berkeley.mtl")
```

For information about how to create a terrain database configuration file, please see Section 11.6, “[Terrain Database Configuration Files](#)”, in *VR-Forces Configuration Guide*.

- To specify a database to load in the startup command, use the `-l` command-line option, as follows:

```
vr3DGui -s 1 -a 3000 -l "berkeley.mtl"
```

3.2.2. Loading a Database from the GUI



- Do not try to change the database until VR-Forces has finished loading the default database, if any.
- If you have loaded a MetaFlight terrain database, you cannot load another database. For details, please see “[Loading MetaFlight Databases](#),” on page 3-9.

To load a database in the GUI:

1. Choose File → Open → Database. An Open dialog box opens to the *./terrain* directory.
2. Select a configuration file for the database you want to load (MTD or MTL) or navigate to a terrain database directory and load a supported database type.
3. Click Open. A progress graphic is displayed on the status bar to indicate VR-Forces is loading the database.

3.2.3. Loading Terrain Synchronously

You can load terrains synchronously or asynchronously. The default is to load asynchronously. However, loading synchronously is faster than loading asynchronously, especially when using VSB files. To load terrains synchronously, add the following line to the terrain database configuration file:

```
(setq loadAsynchronous 0)
```



When you load terrain synchronously, VR-Forces does not respond to user input while the terrain loads.

3.2.4. Loading MetaFlight Databases

A MetaFlight file is an XML-based metafile that combines a set of OpenFlight tiles into a large, pageable terrain database. Using MetaFlight and Large Area Database Management (LADBM), the 3D Front End can manage and display large databases. LADBM dynamically pages in only the geometry tiles that are closest to the eyepoint.

You can load MetaFlight files using the `--mft` command-line argument, through an ACF file, or through the Load Database command in the GUI. However, if you want to load a MetaFlight that has virtual textures, you must load it using the `--mft` command-line argument or the virtual textures will not be displayed. Therefore, it is recommended that you load MetaFlight files from the command line.



- ♦ To load or create a scenario that uses a MetaFlight terrain database that has a virtual texture, you must specify the database at startup using the `--mft` command-line option. Then load or create the scenario as you normally would. If you are creating a scenario, specify the database in the Select Simulation Database dialog box. (Specifying a database on the command line loads certain information the database needs, but you must still specify that same database for the scenario creation process.)
 - ♦ Once you load a MetaFlight file, you cannot load any other terrain databases during the 3D Front End session. You cannot load or create scenarios that use other terrain databases. To load a different MetaFlight file, or use a scenario that uses another database, you must shut down VR-Forces and restart it.
-

3.2.5. Using Geocentric Databases

The 3D Front End supports OpenFlight databases that use geocentric coordinates.

To specify a geocentric coordinate system, set the `databaseType` parameter to “Geocentric”:

```
(setq databaseType "Geocentric")
```

Your geocentric database should also be accompanied by an offset “origin”.

Specifying an Offset for a Geocentric Database

If a database uses true geocentric coordinates (that is, its origin corresponds to the center of the Earth), then the terrain being represented would be located a great distance from the origin. The platforms on which VR-Forces runs cannot maintain the necessary level of accuracy over such great distances. Therefore, to reduce the distances used in the calculations, VR-Forces works only with geocentric databases that are built within a local coordinate system whose origin is much closer to the location of the actual terrain (within 100km). The axes of this local coordinate system must be aligned to the axes of the geocentric frame.

- To specify the offset between a terrain's local origin and its geocentric position in a configuration file, set the `databaseOrigin` parameter, as follows:

```
(setq databaseOrigin "1843515.810292,4930762.483055,3593725.261248")
```

Specifying Offsets for Terrain Patches

You can specify offsets for individual terrain patches. Each FLT file that is the root of a terrain patch must have a corresponding information file that specifies the origin of the local coordinate frame. This file is an ASCII text file that has the name of the FLT file plus a `.info` extension. For example, for a patch in `tile-01.flt`, you would create a file called `tile-01.flt.info` in which you would enter the origin's geocentric coordinates in the following format:

```
4099243.06 3390300.22 3507108.17
```

If the database is very large, some regions may be more than 100 KM away from the origin specified in the `.info` file. In this case, you may want to break the database into smaller patches, each with its own nearby origin.

3.2.6. Editing Database Information

You can display and edit the following details about the loaded database:

- ♦ Coordinate system
- ♦ Origin
- ♦ Reference ellipsoid.

If the database has texture files, you can display a list of them.

To edit database information:

1. Choose File → Database Information. The Database Information dialog box opens (Figure 3-1).
2. Edit the data as desired.
3. Click OK.

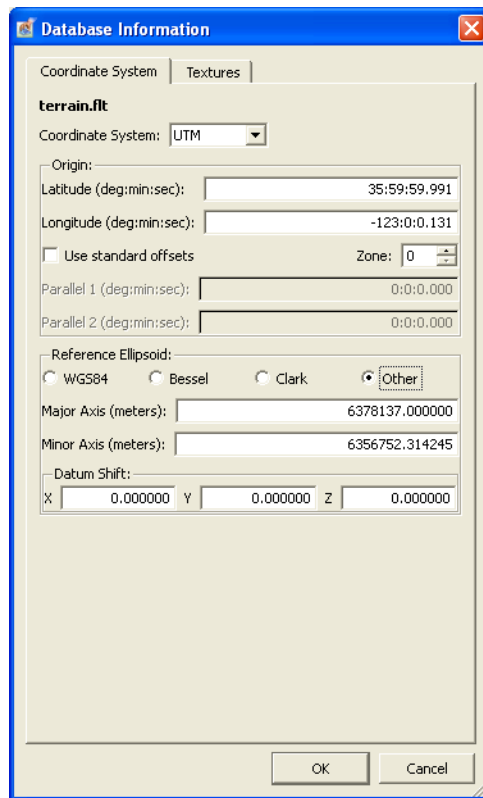


Figure 3-1. Database Information dialog box

To display a list of texture files:

1. Choose File → Database Information. The Database Information dialog box opens.
2. Select the Textures tab.

3.2.7. Closing a Terrain Database

- To close a terrain database, choose File → Close → Database.

3.3. Loading Vector Point Features from GDB Terrains

You would not typically load a GDB terrain in the 3D Front End because it does not have the texture data that a 3D terrain database has. However, you might have vector point feature data in the GDB terrain database that you are using for the back-end that is not present in the 3D terrain you are using in the 3D Front End. This is particularly likely if you have used the MÄK Terrain Database Tool to generate a GDB terrain from OpenFlight data and have then added vector point features in the TDB Tool's edit mode. (For details about adding features to GDB databases, please see *MÄK Terrain Database Tool User's Guide*.)

If you have GDB terrain databases that have vector point feature data that you want to view in the 3D Front End, you can load the features for display. You can load features from as many different GDB terrains as you want to.

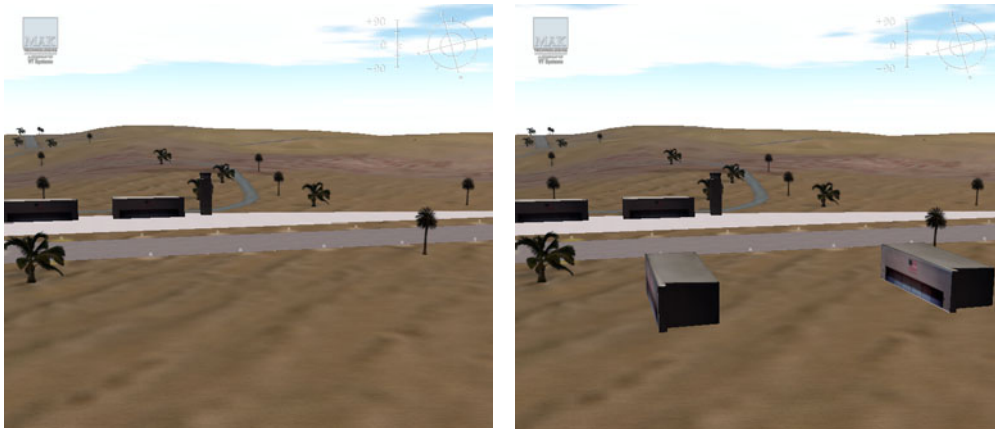


Figure 3-2. Terrain with point features imported



To be displayed, a feature must be mapped to a model. The point features that you can add to a terrain using the TDB Tool all have models provided with the 3D Front End. For details about mapping models, please see Chapter 12, *Configuring 3D Entity Models*, in *VR-Forces Configuration Guide*.

To load features:

1. Choose File → Load Features. An Open dialog box is displayed.
2. Select the GDB database whose features you want to load.
3. Click OK.

3.3.1. Removing Features from the Display

You cannot remove features selectively. This procedure removes all features that have been loaded into the display.

- To remove features from the display, choose File → Clear Features.

3.4. Exiting VR-Forces

When you exit VR-Forces in combined mode, the front-end and back-end terminate. If you are not running in combined mode, you must close each back-end individually.

- To exit VR-Forces, choose File → Exit.

3.5. Loading Entity Models at Startup

By default, the 3D Front End uses dynamic model loading. It does not load a model for an entity type until that entity enters an exercise. Dynamic model loading speeds up the startup process and can save memory. However, if many entities enter an exercise at the same time, performance could be affected, or the 3D Front End may drop some packets.

You can turn off dynamic model loading, in which case all models are loaded when VR-Forces starts up. This slows down startup time, but it enables the 3D Front End to display entities promptly when they enter an exercise. However, this method uses memory for models that might not be needed, which could reduce performance.

- To load all models at startup, set the `preloadModels` parameter in *ModelMap.mtl* to 1.

3.6. Support for Multichannel Displays

VR-Forces supports multiple channels. A channel is a particular view of a scene. If your graphics card supports multiple monitors, the view can be displayed on the monitors to create cockpit-style side views.

You can configure channels in the ACF file. You can also specify display of two or three channels with the `-c` command-line option. To display two channels, use `-c 2`; to display three channels, use `-c 3`. If you use these commands with one monitor, VR-Forces shows the channels within the single VR-Forces window.

For details about configuring multichannel displays, please see Section 10.3.4, “[Configuring Multi-Channel Displays](#)”, in *VR-Forces Configuration Guide*.

3.7. Capturing Images of the Display

VR-Forces users often want to capture images of the VR-Forces display to use in presentations, reports, and other literature. You can capture the display using commercial screen capture programs or with the 3D Front End's screen capture feature. VR-Forces can capture individual images and it can capture video to an AVI file.

3.7.1. Capturing a Raster Image of the Display

The screen capture process saves files either to a default name and format or to one you specify.

- To capture an image of the display, choose Capture → Capture Display, or Capture Display As.

If you select Capture Display, the file is saved as a file named *VR-Forces3D-date-time.format*, using the default directory and format. If you select Capture Display As, you can save the file to the location of your choice, in BMP, PNG, or JPG format.

Specifying the Default Image Format and Directory

You can configure the image format used to capture images of the display. You can also configure the directory in which images are saved.

To configure the default image format and directory:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Capture tab.
3. To specify the directory in which to save images, edit the Display Capture Directory box (Figure 3-3).

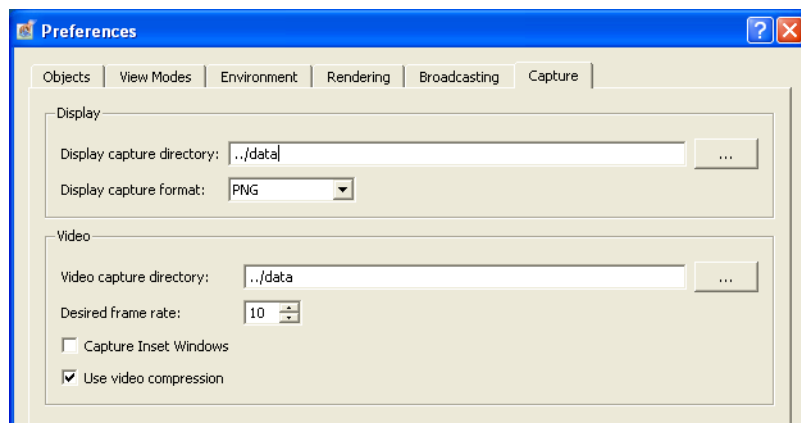


Figure 3-3. Preferences dialog box, configuring image capture

4. To specify the image format used, select an option in the Display Capture Format list.
5. Click Close.

3.7.2. Capturing Video of the Display

You can capture the display to an AVI file. You can specify the frame rate at which to capture the display. You can also specify whether or not to capture inset views. By default, video is saved to a file named *VR-Forces3D-<day-month-date-year-hour-minute-second-AM/PM>.avi*. You can specify that the video be saved to a different file name.



- ♦ The quality of video capture depends on the capability of your hardware.
- ♦ When capturing video, do not run VR-Forces in full screen mode. The larger the window is during capture, the larger the resulting AVI file will be.
- ♦ When capturing video, make sure the VR-Forces window has focus. If you activate other programs while VR-Forces is capturing video, the quality of the video capture can suffer.

-
- To capture the display to an AVI file, choose Capture → Capture Video, or press F9.
 - To pause video capture, choose Capture → Pause Video Capture, or press F9.
 - To stop video capture, choose Capture → Stop Video Capture, or press F10.
 - To save video capture to a file name other than the default, choose Capture → Capture Video As and specify a file name in the dialog box.

Configuring Video Capture

You can configure the directory in which video files are saved, the frame rate, and whether or not inset views are captured. For best performance, the frame rate must be a value that VR-Forces can actually achieve. Since video capture inherently degrades performance, you need to select a video capture frame rate that is less than the frame rate that VR-Forces would achieve when you are not capturing video. This depends on the capabilities of your computer. In testing this feature, a frame rate of 10-15 frames per second has provided good results.

To configure video capture:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Capture tab (Figure 3-3).
3. In the Video group box, enter the values you want for capture directory, frame rate, and capture of inset windows.

Developers may want to make changes to how VR-Forces records video. You can do this by writing a plug-in. For details, please contact MÄK technical support.

3.8. Creating Demonstration Recordings for VR-Forces

MÄK customers often want to create demonstrations for display in the MÄK Stealth, similar to the demonstration recordings supplied with the MÄK Data Logger. They particularly want the eyepoint and view mode to change automatically at appropriate times. To help you create demonstrations, the mirroring feature lets you record changes in the view to a file in the format used by the MÄK Data Logger 4.0 or later. (For more information about mirroring, please see Section 10.3, “[Using Mirroring](#)”, in *VR-Forces Configuration Guide*.)



To view a recording of view changes, you must use a different entity ID during playback than you did during recording. For details about setting the entity ID, please see “[Specifying the Entity Identifier](#)”, in *VR-Forces Configuration Guide*.

The general procedure for creating a demonstration is as follows:

1. Use the MÄK Data Logger to record the exercise that is the basis for your demonstration.
2. View the recorded exercise in the 3D Front End.
3. Determine the views that you want to use in your final demonstration and capture them using the View Save feature. (For details, please see “[Saving and Recalling Views](#),” on page 8-12.)
4. Enable recording of view changes. (For details, please see “[Recording View Changes to a Logger File](#),” on page 3-17.)
5. Play the base recording and change the 3D Front End view at the desired points in the recording.
6. Merge the recorded view changes with the original recording in the Logger. (Logger 4.1 or later supports file merge.)



If you use a recording program other than the MÄK Data Logger, capture the changes to the view that are sent to the network and merge them with the original recording in whatever way that application supports.

3.8.1. Recording View Changes to a Logger File

To record changes in the view to a Logger file:

1. Choose Options → Preferences. The Preferences dialog box opens.

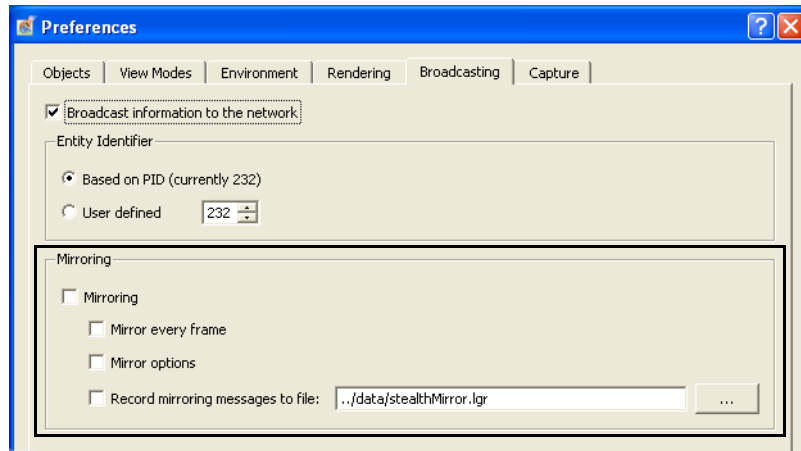
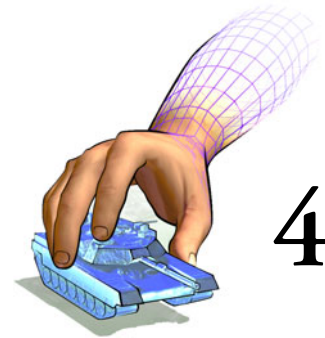


Figure 3-4. Preferences dialog box, Mirroring controls

2. Select the Broadcasting tab (Figure 3-4).
3. In the Mirroring group box, select the Mirroring check box.
4. Check Record Mirroring Messages To File.
5. Optionally, specify the file to use for saving the messages.



Configuring the 3D Display

This chapter describes features that control the VR-Forces display.

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Configuring the 3D Display

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4.1. Introduction to the VR-Forces Interface

The VR-Forces window ([Figure 4-1](#)) has a 3D display and a set of toolbars. You can execute VR-Forces commands and options from the menus, the toolbars, or the keyboard. When you start VR-Forces, it displays:

- ♦ Icon toolbars for file operations and toggling common options.
- ♦ The Utility toolbar, which has three tabs, Navigation, Objects, and Create.

The Navigation tab has the following toolbars:

- ♦ Terrain Information toolbar – provides coordinate information for the last selected entity or ground point
- ♦ Eyepoint Navigation toolbar – allows you to manipulate the eyepoint
- ♦ Eyepoint Location toolbar – displays the coordinates of the eyepoint
- ♦ View Mode Information toolbar – lets you select the view mode and attach VR-Forces to entities
- ♦ Capture and Restore View toolbar – lets you save and recall views.

The Objects tab has the following toolbars:

- ♦ Objects List Panel – provides different views of the entities and environmental objects in the scenario.
- ♦ Object Statistics toolbar – displays the number of entities, aggregates, and emitter system objects in the exercise.

If you have a license for XR Mode, the Terrain Texture toolbar is added to the Navigation tab. It displays the texture of the selected point in the terrain. The Terrain Scale, Object Scale, and Model Sets toolbars are added to the Objects tab. The Terrain Scale and Object Scale toolbars allow you to scale the size of objects and the terrain when XR Mode is active. The Model Sets toolbar lists the model sets available and allows you to select the one being used.

Toolbars have tool tip help that identifies the name of the toolbar and describes individual fields and controls. To view tool tip help, hover the cursor over the item for which you want a description.

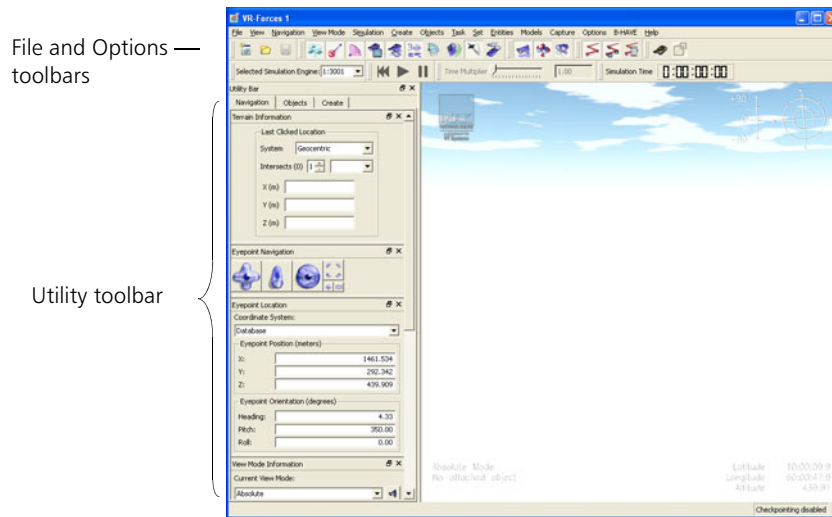


Figure 4-1. VR-Forces window at startup

4.1.1. Displaying and Hiding Toolbars

You can hide any of the toolbars.

- To hide or view a toolbar, select it or clear it on the View menu or the appropriate submenu.

Hiding All Toolbars

- To hide all of the toolbars (but not go into full screen mode), choose View → Hide GUI.

Redisplaying All Toolbars

- If you have hidden some or all of the toolbars, to redisplay them press **Shift+S**, or middle-click or right-click and choose Show GUI.

4.1.2. Saving the Screen Layout

You can save the layout of VR-Forces window and toolbars so that when you next start VR-Forces, it opens up with your preferred layout.

To save the layout:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. In the Save Settings On Exit group box, check Save Layout.

4.1.3. Viewing the Display in Full Screen Mode

You can display VR-Forces so that it covers the entire screen and does not display the title bar or border. In full screen mode, you can toggle the display of toolbars or menus on and off. This mode is intended for use in demonstrations. When menus and toolbars are hidden, you can still use all keyboard controls, access the middle-click menu, and you can still click entities in the display to attach the eyepoint to them.

- To view VR-Forces in full screen mode, choose View → Full Screen, or press **Ctrl+Enter**.
- To exit full screen mode, press **Ctrl+Enter**.

You can configure VR-Forces to start in full screen mode with the `--fullscreen` command-line option or the `enableFullScreen` parameter in *params.mtl*.

4.2. The Head-Up Display

The head-up display is a set of indicators and readouts superimposed onto the VR-Forces graphics display ([Figure 4-2](#)).

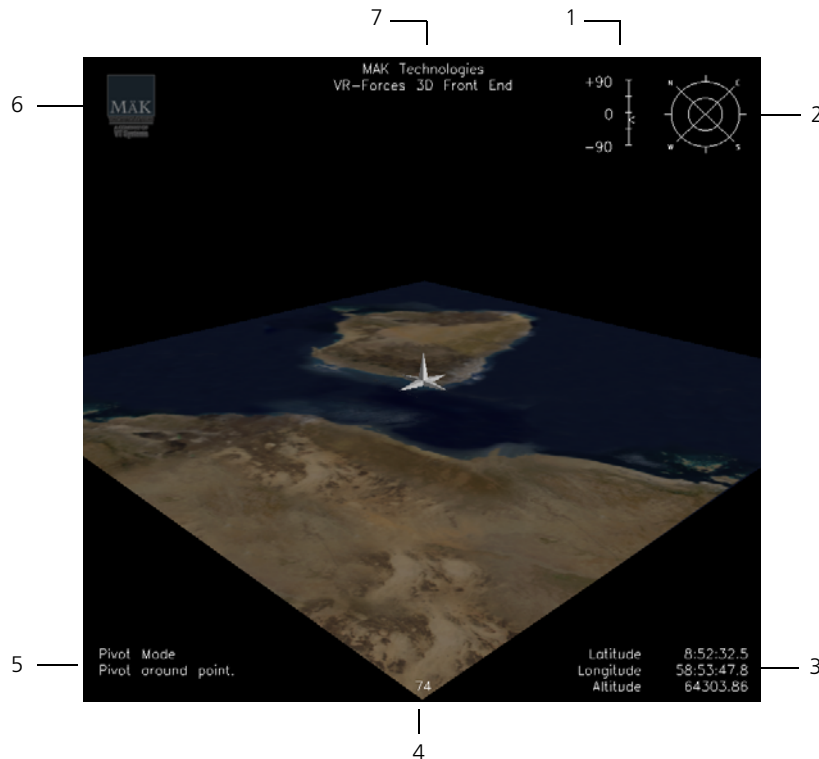


Figure 4-2. Head-up Display

The Head-up Display displays the following information (numbers in parentheses refer to [Figure 4-2](#)):

- ♦ Pitch (1) (The location of the Pitch display may move if you do not display a logo graphic.)
- ♦ The Entity Locator (2).
- ♦ Eyepoint coordinates (3).
- ♦ Frame rate (4) (off by default.)
- ♦ View mode and identifiers for the attached entity, if any (5).
- ♦ Logo graphic (6).
- ♦ Product and Company name (7) (off by default.)

4.2.1. Displaying the Head-up Display

You can toggle the head-up display on and off.

- To enable or disable the head-up display, choose Options → Head-up Display, or press **Shift+O**.

4.2.2. The Entity Locator

The Entity Locator (Figure 4-3) rotates to indicate the orientation of the eyepoint. It also indicates the location of entities relative to the eyepoint.

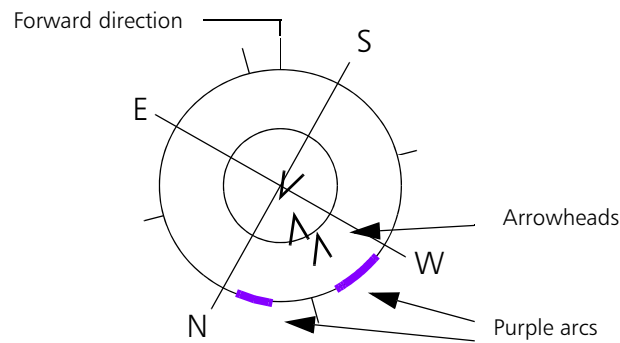


Figure 4-3. The Entity Locator

The default range for the Entity Locator is two kilometers.

If an entity is within the range of the locator's outer circle, it appears as an arrowhead oriented along the entity's heading. The arrowhead color indicates the entity's Force ID as follows:

- ♦ Blue = friendly
- ♦ Red = enemy
- ♦ Green = other.

If an entity is out of range, a segment of the outer ring turns purple to show the entity's relative bearing.

4.2.3. Displaying the Frame Rate

You can enable and disable a basic display of the frame rate (as shown in [Figure 4-2](#)). You can also display more complex statistics. For details about displaying statistics, please see “[Displaying Graphics Statistics](#),” on page 4-9.

To enable or disable display of the frame rate:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab.
3. In the Statistics group box ([Figure 4-4](#)), check or clear the Show Simple Frame Rate check box.

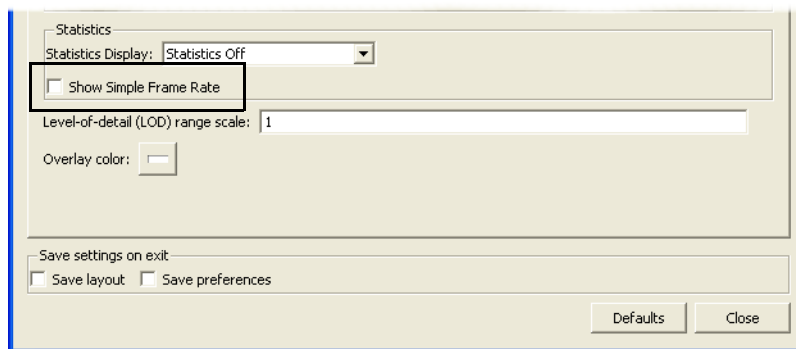


Figure 4-4. Preferences dialog box, Statistics options

4.2.4. Displaying Graphics Statistics

VR-Forces can display detailed information about the graphics in the scene and how much time is used for the three stages of graphics presentation in a frame loop. The three stages are as follows:

- ♦ Application: VR-Forces updates its state.
- ♦ Cull: VR-Forces prunes graphic information that will not be drawn.
- ♦ Draw: VR-Forces draws the information to the scene.

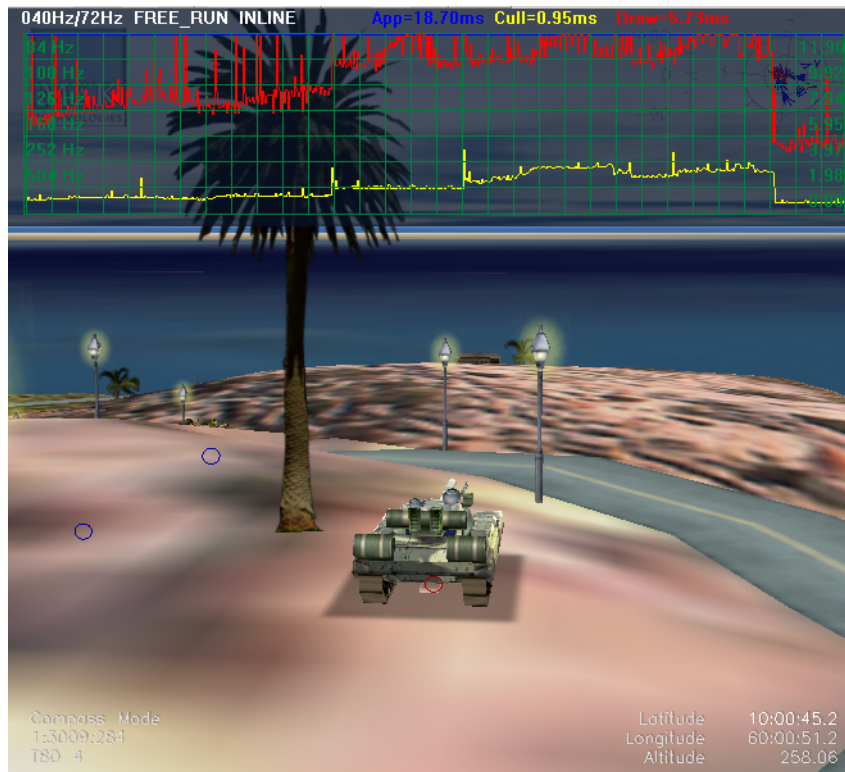


Figure 4-5. Graphics pipeline statistics

To display detailed VR-Forces statistics:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab (Figure 4-4).
3. In the Statistics group box, select a statistics view from the Statistics Display list.

4.2.5. Specifying the Head-up Display Color

To specify the color used for head-up display text:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab (Figure 4-4).
3. Click the Head-up Display Color button. A color picker opens.
4. Select the color that you want to use for the head-up display.
5. Click OK.

4.2.6. Configuring the Head-up Display

You can configure the head-up display color, logo graphics, and text using the following parameters in *params.mtl*:

- ♦ **overlayColor**, specifies the color of head-up display text.
- ♦ **overlayProductName**, specifies the application name, for example, VR-Forces. The default value is an empty string.
- ♦ **overlayCompanyName**, specifies a company name, for example, MÄK Technologies. The default value is an empty string.
- ♦ **enableOverlayLogo**, specifies whether or not to display a logo graphic.
- ♦ **overlayLogoFile**, specifies the bitmap image to use for the logo.

4.3. Setting Graphics Rendering Options

The Rendering tab on the Preferences dialog box has controls that affect how the terrain and models are displayed.

4.3.1. Displaying Texture

You can control whether or not VR-Forces displays the texture maps associated with models. When texture is turned off, models appear as assemblies of untextured polygons. [Figure 4-6](#) illustrates a scene with texture turned on and off.



Figure 4-6. Texture on and off

To turn texture on or off:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab.
3. In the Graphics mode group box ([Figure 4-7](#)), select the Texture check box to enable texture; clear it to disable texture. The display changes immediately.

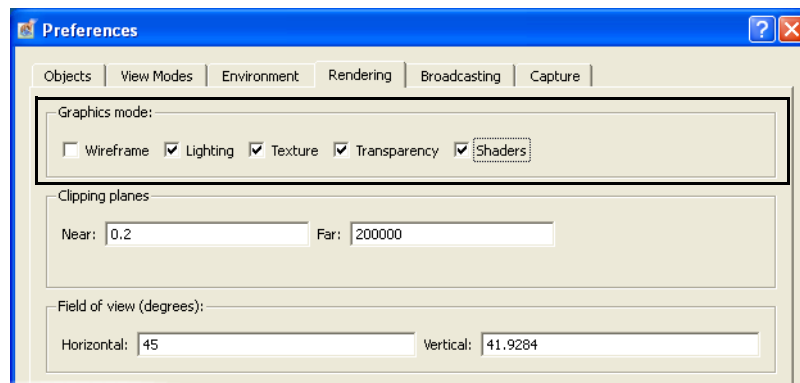


Figure 4-7. Preferences dialog box, Graphics Mode options

4.3.2. Displaying Models and Terrain in Wireframe Mode

In wireframe mode, VR-Forces displays the polygons that make up the terrain and objects (Figure 4-8).

To enable or disable wireframe mode:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab.
3. In the Graphics Mode group box (Figure 4-7), select the Wireframe check box to enable wireframe mode; clear it to disable wireframe mode. The display changes immediately.

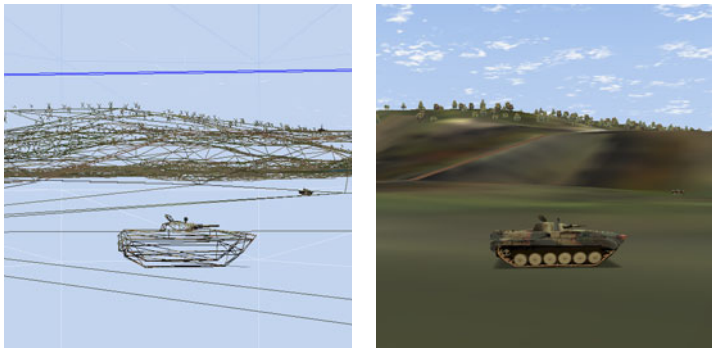


Figure 4-8. Wireframe on and off

4.3.3. Enabling Fog Effects

When fog is enabled, visibility is diminished and the atmosphere becomes hazier.

To enable or disable fog:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Environment tab.
3. In the Visibility group box (Figure 4-9), select the Fog check box to enable fog; clear it to disable fog. The display changes immediately.

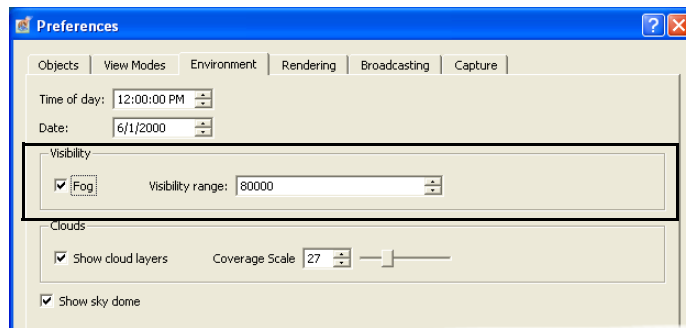


Figure 4-9. Preferences dialog box, Visibility options

4.3.4. Enabling Lighting Effects

When lighting is enabled, models appear shaded and take on a three-dimensional quality. When lighting is disabled, models still appear textured (if textures are enabled), but do not appear shaded. The distinctions may be relatively subtle, because the models supplied with VR-Forces have some built-in lighting effects.

To enable or disable lighting:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab.
3. In the Graphics Mode group box (Figure 4-7), select the Lighting check box to enable lighting; clear it to disable lighting. The display changes immediately.

4.3.5. Enabling Transparency

Transparency allows you to see through effects such as clouds and aggregate enclosures. If you disable transparency, these objects become opaque. In [Figure 4-10](#), note how the display of clouds and the shadow of the tank changes when transparency is disabled.



Figure 4-10. Transparency on and off

To enable or disable transparency:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab.
3. In the Graphics Mode group box ([Figure 4-7](#)), select the Transparency check box to enable transparency; clear it to disable transparency. The display changes immediately.

4.3.6. Enabling Shaders

Shaders control the realism of lighting in the scene, including the cloud cover. If you disable shaders, VR-Forces uses a simple lighting model. When shaders are enabled, some models and terrains that were built without shaders in mind show with strange highlighting. You may want to disable shaders if you experience this problem.

Figure 4-11 shows the effects of toggling shaders on and off.



Figure 4-11. Shaders on and off

To enable or disable shaders:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab.
3. In the Graphics Mode group box (Figure 4-7), select the Shaders check box to enable transparency; clear it to disable transparency. The display changes immediately.

4.4. Specifying the Level-of-Detail

A model file can contain several representations of an entity, each representation having its own degree of detail. When it is not necessary to display an entity in full detail (for example, when it is far away from the eyepoint), VR-Forces can use one of the less-detailed representations. The result is reduced stress on the computer and improved display performance with little noticeable loss of image quality.

VR-Forces chooses which representation to use based, in part, on the entity's perceptibility. Perceptibility is determined by several factors, including the entity's distance from the eyepoint, atmospheric conditions, display resolution, and the field of view setting.

As an entity moves away from the eyepoint or becomes otherwise less perceptible, VR-Forces displays a series of progressively less-detailed representations until the entity vanishes completely from the display. The model file contains predefined transition points that mark where one level of detail should fade into the next as perceptibility changes. The range between one transition point and the next is called a switch range.

A higher switch range value has the effect of compressing the switch ranges, thereby moving all switch points closer to the eyepoint. This causes detail to drop off more rapidly with distance, reducing system stress, and thereby helping to maintain the frame rate.

To specify the level-of-detail:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab.
3. Enter a value in the Level of Detail (LOD) Range Scale box. A value of 1.0 means use the switching range specified in the graphics model.

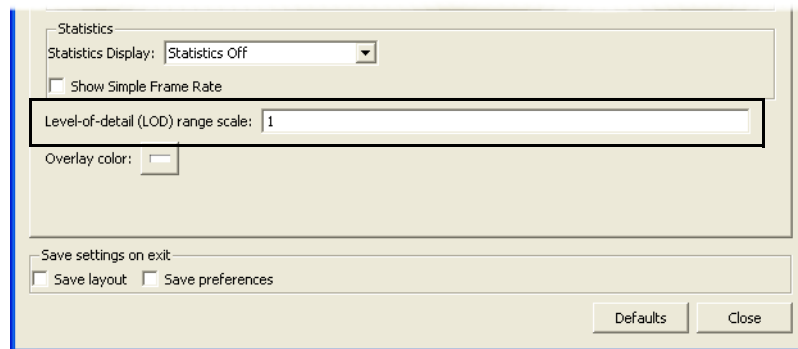


Figure 4-12. Preferences dialog box, Level of Detail

- To specify the LOD at startup, edit the `lodscale` parameter in `params.mtl`.

4.5. Setting the Eyepoint's Field-of-View

The field-of-view setting affects perspective in a manner similar to a camera lens. [Figure 4-13](#) illustrates different field-of-view settings.

A wide field-of-view creates an effect like that of a wide-angle lens. Objects appear smaller and farther away from the eyepoint, since the eyepoint coverage spans a wider area. Depth distances between objects become exaggerated.

A narrow field-of-view creates an effect like that of a telephoto lens. Objects appear larger and closer to the eyepoint, and the overall scene depth appears flattened. The distances between objects appears compressed.

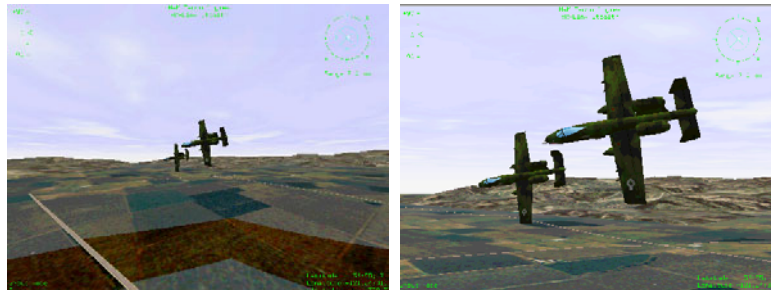


Figure 4-13. Field-of-view

To set the field-of-view:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab.
3. In the Field-of-View group box ([Figure 4-14](#)), enter values in the Horizontal and Vertical boxes. The vertical value represents the angle that describes half the height of the display ([Figure 4-15](#)). If you set the either value to -1, VR-Forces calculates the field-of-view based on the other value.

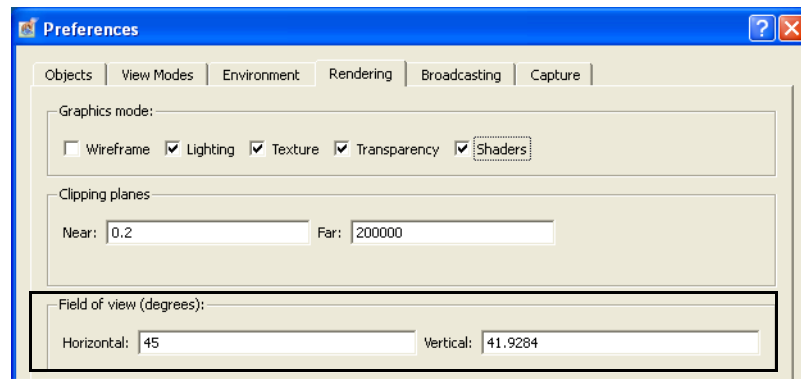


Figure 4-14. Preferences dialog box, Field-of-View setting

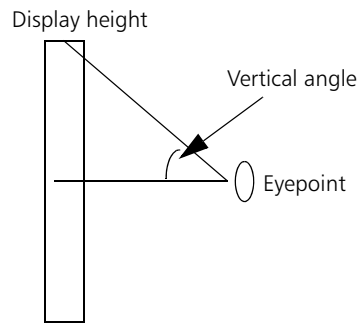


Figure 4-15. Horizontal field-of-view

- To specify the default eyepoint field-of-view, edit the **verticalFieldOfView** parameter in *params.mtl*.

4.6. Setting the Clipping Planes

To improve performance, the graphics engine does not process entities and terrain objects that fall outside of a specified distance range. This range is determined by the near and far clipping planes. [Figure 4-16](#) illustrates the effect of changing the Near Clipping value. [Figure 4-17](#) illustrates the effect of changing the Far Clipping value.

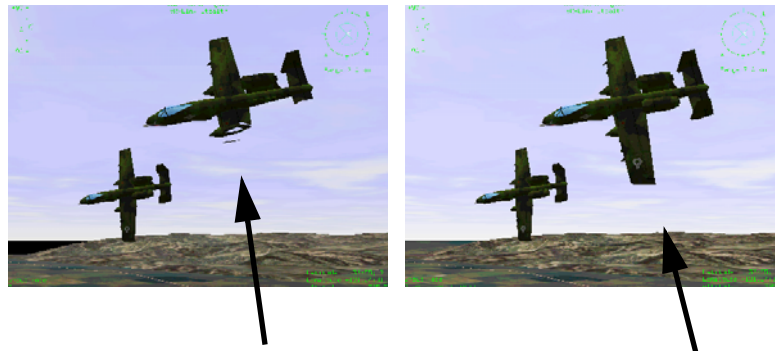


Figure 4-16. Near clipping

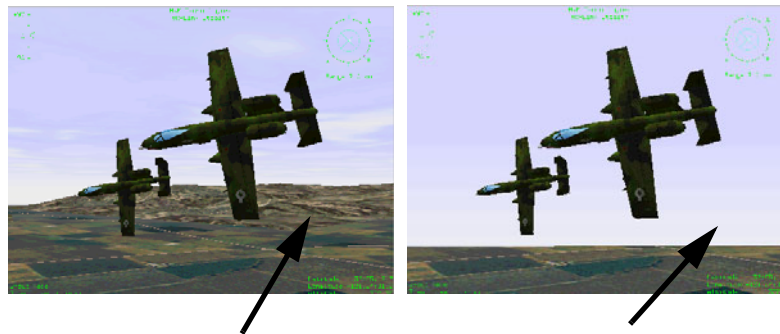


Figure 4-17. Far clipping

To set the location of the clipping planes:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab.
3. In the Clipping Planes group box ([Figure 4-18](#)), enter values, in meters, for the Near clipping plane and Far clipping plane.

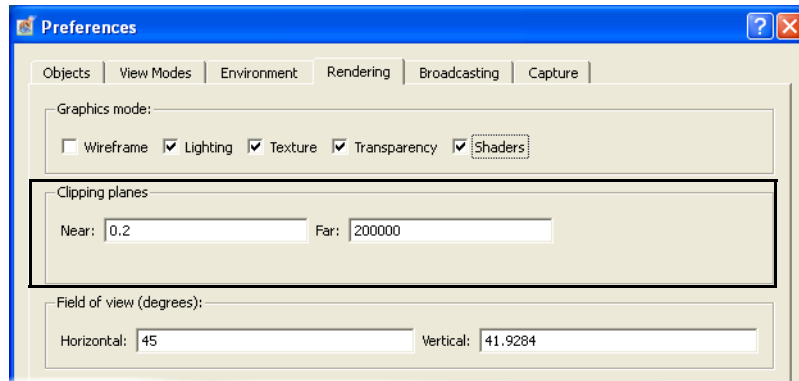


Figure 4-18. Preferences dialog box, Clipping planes setting

You can quickly change the clipping planes from the keyboard. This can be particularly helpful when you want to place entities inside a building and need to adjust the clipping plane to be able to see through walls.

- To set the clipping plane from the keyboard, press **Shift+)** (right parenthesis) or **Shift+(** (left parenthesis). The clipping plane value is displayed as you change it.
- To set VR-Forces's default clipping values, in meters, edit the `nearClippingPlane` and `farClippingPlane` parameters in *params.mtl*.

4.6.1. Using Dynamic Clipping Planes (XR Mode only)

In XR Mode, you can specify the use of dynamic clipping planes. Dynamic clipping planes automatically increase the near clipping plane when the eyepoint is zoomed far out. This helps prevent visual anomalies that can occur when distant objects are close to each other.

To specify dynamic clipping planes:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Rendering tab.
3. In the Clipping Planes group box (Figure 4-18), check Set Clipping Planes Dynamically.

4.7. Configuring Environmental Effects

This section describes options for controlling the simulated environment.

4.7.1. Setting the Time of Day

The time of day value controls the quality of the scene's ambient light. [Figure 4-19](#) illustrates different time of day settings.



Figure 4-19. Time of Day

To set the time of day:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Environment tab.
3. In the Time of Day box ([Figure 4-20](#)), enter the time of day for the simulation. The change takes effect immediately.

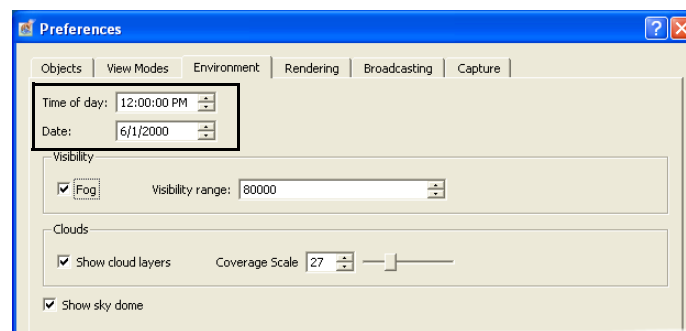


Figure 4-20. Preferences dialog box, time and date settings

- To change the default time of day, edit the `timeOfDay` parameter in `params.mtl`.

4.7.2. Setting the Date

VR-Forces changes the ambient light based on the time of day (see “[Setting the Time of Day](#),” on page 4-21). It can adjust the time of day at which it changes light based on the simulated date. It uses an ephemeris model to calculate sunrise and sunset, and phases of the moon.

To set the date:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Environment tab.
3. In the Date box ([Figure 4-20](#)), set the date in month/day/year format (MM/DD/YYYY). The change takes effect immediately.

4.7.3. Setting Visibility

The visibility range setting determines the denseness of the fog effect, which determines how far you can see. The Visibility Range value overrides the `farFogRange` parameter.

To set visibility:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Environment tab.
3. In the Visibility Range box ([Figure 4-21](#)), enter a range, in meters. The change takes effect immediately.

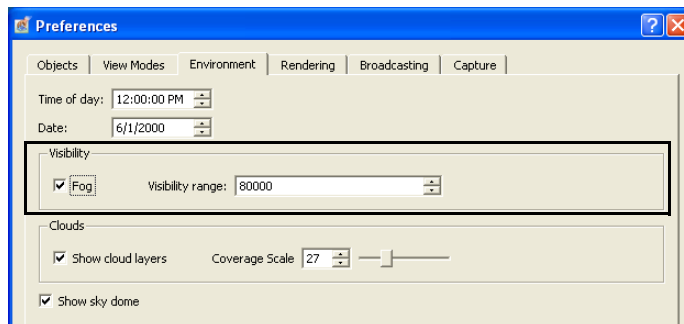


Figure 4-21. Preferences dialog box, Visibility settings

4.7.4. Enabling and Disabling the Display of Clouds

To enable or disable the display of the cloud layer:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Environment tab.
3. To enable the cloud layer, in the Clouds group box, select the Show Cloud Layers check box (Figure 4-22). To disable the cloud layer, clear Show Cloud Layers. The change takes effect immediately.

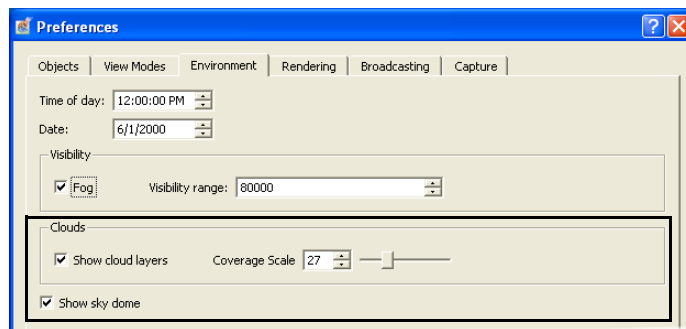


Figure 4-22. Preferences dialog box, clouds and sky dome settings

Configuring Cloud Layer Coverage

You can configure the percentage of the sky that is covered by the cloud layer.

To configure the coverage of the cloud layer:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Environment tab.
3. In the Clouds group box, enter a value for Coverage Scale, or adjust the slider to the desired amount of cloud layer coverage.

4.7.5. Enabling and Disabling the Display of the Sky Dome

The sky dome provides gradated background coloring to simulate the appearance of sky and the horizon.

To enable or disable the display of the sky dome:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the Environment tab.
3. To enable the sky dome, select the Show Sky Dome check box (Figure 4-22). To disable the sky dome, clear Show Sky Dome. The change takes effect immediately.

4.8. Saving Preferences

You can save your preferences so that they are automatically set when you start VR-Forces. Preferences are saved to *./config/guipreferences.mtl*.

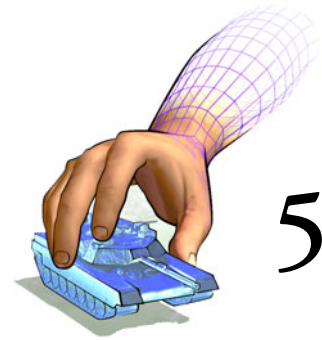
To save your preferences:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. In the Save Settings group box at the bottom of the dialog box, check Save Preferences.

4.8.1. Restoring the Default Preferences

You can restore all configuration options in the Preferences dialog box to the original (installed) default settings.

- To restore the settings in the Preferences dialog box to the initial values, in the Preferences dialog box, click Defaults.



Creating Scenarios

This chapter explains how to create a scenario.

Creating a Scenario	5-2
Loading a Scenario	5-5

5.1. Creating a Scenario



- ♦ This section assumes that you are familiar with the procedures for creating a scenario as described in *VR-Forces User's Guide*.
- ♦ If you are using multiple front-ends, only one of them should create or load a scenario. The others should load the database being used by the scenario. For details, please see “[Loading Terrain Databases](#),” on page 3-7.

When you create a scenario in the 2D front-end, the terrain database used in the front-end is almost always the same as the one used in the back-end (a GDB terrain). So, by default, when you create a new scenario, the New Scenario dialog box assumes that you want to use the terrain database that you chose in the Select Simulation Database dialog box for both the front-end and back-end.

However, when you create a scenario for the 3D Front End, you almost always use a different terrain database in the front-end. This is because the GDB terrain used by the back-end does not have the 3-dimensional texture information that users typically want to display in the 3D Front End. In the 3D Front End you will usually load a database that uses the OpenFlight format.

If you create scenarios that specify only a 2D or 3D terrain for the front-end, they are not easily portable between the two different front-ends. To avoid this problem, MTD files (which are the preferred file type to load in a scenario) can specify a 3D terrain that is appropriate to use with the GDB terrain configured in the file. (The 3D database is specified in the 3DViewMetafileRecord.)

The MTD files for the terrain databases provided with VR-Forces specify the appropriate 3D database to use with the GDB database configured in the file. When you create a scenario in either the 2D front-end or the 3D Front End, if you specify one of these terrains, you can run the scenarios in either front-end (2D or 3D) and the front-end will load the correct terrain.

If you use your own database, and you create an MTD file (in the TDB Tool) that specifies a 3D database in the 3DViewMetafileRecord, then your scenarios will also be seamlessly portable between the two front-ends.

If you do not specify an MTD file when you create a scenario, or if the MTD file you use does not have an entry for the 3DViewMetafileRecord, then you should specify a different database for the front-end than for the back-end.

To create a new scenario in the 3D Front End:

1. Choose File → New Scenario, or click the New Scenario button on the toolbar. The Select Simulation Database dialog box opens (Figure 5-1).

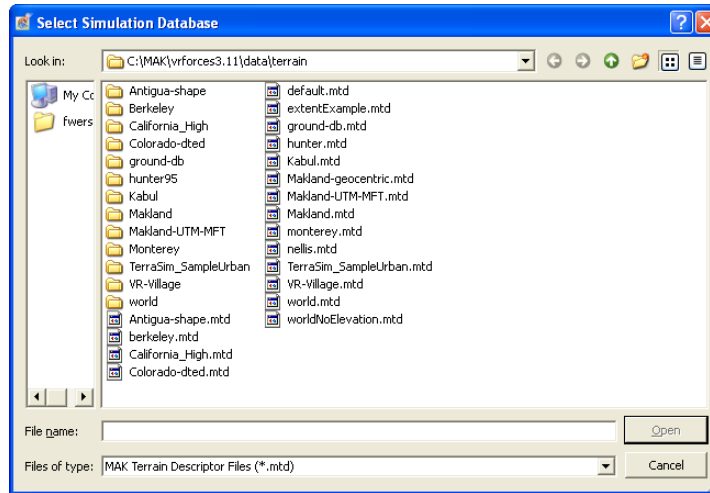


Figure 5-1. Select Simulation Database dialog box

2. In the file list, select a terrain database or an MTD file for the back-end to use. (MTD is the preferred file type.)
3. Click Open. The New Scenario dialog box opens (Figure 5-2).

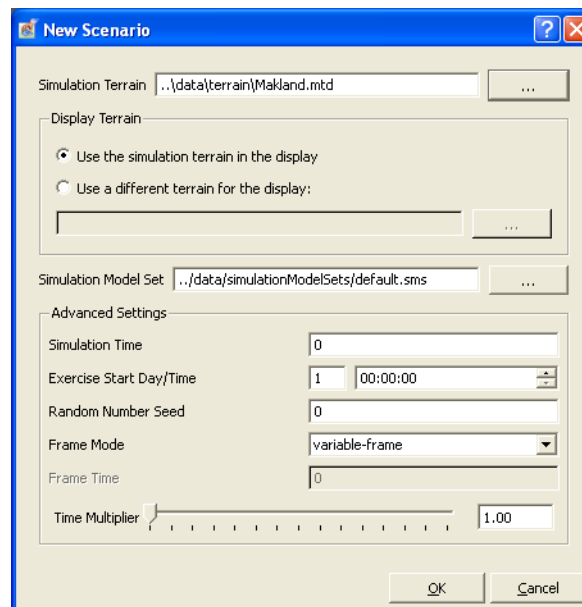


Figure 5-2. New Scenario dialog box

4. If in step 2 you did not select an MTD file that specifies a 3D terrain database, then in the Display Terrain group box, select Use A Different Terrain For The Display.
5. Specify a 3D terrain database by typing its path or browsing for it.
6. Change any of the parameters as desired. describes the parameters.
7. Click OK.



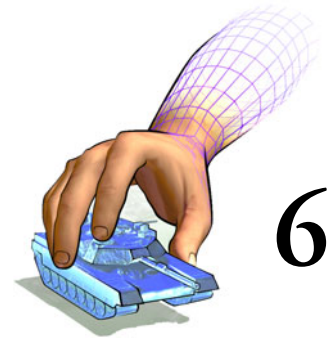
If the scenario is not portable between the 2D and 3D front-ends, we recommend that you save the scenario with a name indicating that it is for use in the 3D Front End. If you try to load a scenario that specifies a 3D terrain for the front-end into the 2D front-end, it will not load.

Table 5-1: Scenario parameters

Parameter	Description
Simulation Terrain	Specifies the terrain to be used by the back-end. By default, this is the terrain you selected in the Open Database dialog box. However, you can change it if you want to. Specify a geocentric database for the back-end if you are using large area databases.
Display Terrain	Specifies the terrain to be used by the front-end. The 2D front-end usually uses the same terrain as the back-end. The 3D Front End usually uses a different terrain than the back-end. If the MTD file that you selected in step 2 has an entry for the 3DViewMetafileRecord, VR-Forces automatically chooses the correct terrain files for the GUI that you are running.
Simulation Model Set	Specify simulation model sets. A scenario must specify at least one simulation model set. Default: <i>default.sms</i> .
Simulation Time	Specify the starting simulation time in seconds.
Exercise Start Day/Time	Specify the starting exercise time by day and hour.
Random Number Seed	Specify a random number seed as an integer ≥ 0 .
Frame Mode	Select a frame mode from the list.
Frame Time	Specifies the length of a frame, in seconds. This parameter is not enabled if Frame Mode is variable-frame.
Time Multiplier	Specify a time multiplier for the scenario. For HLA time-managed federations, this parameter is ignored. Default: 1.0 (real-time).

5.2. Loading a Scenario

The procedure for loading a scenario in the 3D Front End is identical to that for the 2D front-end. However, you are responsible for knowing whether or not the scenario specifies an appropriate terrain for use in the 3D Front End. As described in [“Creating a Scenario,”](#) on page 5-2, if the scenario specifies an MTD file that has a completed 3DViewMetafileRecord entry, it can be opened in either GUI without modification. However, if the MTD file does not have this information, or if the scenario does not specify an MTD file and it was created in the 2D GUI, then to use the scenario in the 3D Front End, you would have to edit the scenario file by hand to specify an appropriate terrain for use in the 3D Front End. (If the scenario specifies a GDB terrain for the front-end, the 3D Front End will load it, but it will not have the 3D texture that you would expect to see in a 3D display.)



Creating and Managing Entities

This chapter describes how to get information about entities and how to attach the eyepoint to entities.

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6.1. Creating Entities

Creating entities in the 3D Front End is similar to doing so in the 2D GUI, with the added ability to specify orientation and altitude at creation time (advanced placement mode). You can create entities from the Create menu and the Create tab, just as you would in the 2D GUI.

To create an entity in the 3D Front End:

1. If you are using multiple simulation engines, in the Selected Simulation Engine toolbar, select the simulation engine on which you want to create the entity.



When you create entities, you may want to disable entity labels to avoid having the labels pop up as you mouse over other entities.

2. Choose Create → *Entity_category* → *ForceType* → *Entity_type*, where:
 - *Entity_category* is a category of entity, such as Ground or Lifeform
 - *ForceType* is ForceFriendly, ForceOpposing, or ForceNeutral
 - *Entity_type* is a specific type within the category, such as M1A2 or T80.

The cursor changes to display a 3D model for the entity type you selected. A translucent help window is displayed that shows the X, Y coordinates of the cursor and which provides instructions for placing the entity and entering advanced placement mode.

3. To place the entity with the default altitude and orientation, click on the terrain where you want to place the entity. You can continue clicking at other locations to place additional entities.
4. To enter advanced placement mode, hold down the **Ctrl** key and click the mouse. VR-Forces enters advanced placement mode and a new help window is displayed.
5. Left-click and drag to change the location of the entity.
6. Hold down the **Shift** key and left-click drag to change the heading.
7. For air platforms, **Alt**-left-drag to change the altitude.
8. Right-click to exit advanced placement mode. You are now in placement mode and can continue to create entities of the selected type. Entities are created with the orientation and altitude of the last entity created in advanced placement mode.
9. Right-click to exit create mode.

6.1.1. Placing Entities Inside Buildings

One of the benefits of using the 3D Front End is the ease of placing entities in the precise location and orientation that you want them to be in, particularly inside buildings. However, placing entities inside small enclosed spaces can be hindered by the location of walls relative to the eyepoint. You can work around this problem by adjusting the near clipping plane to remove the display of walls and floors until you see the location where you want to place entities. For details about changing the clipping plane, please see “[Setting the Clipping Planes](#),” on page 4-19.



If you enable view constraints, it may restrict your ability to move the eyepoint into buildings.

6.2. Selecting Entities and Graphical Objects

Most procedures require you to select one or more entities or graphical objects. When an entity is selected, a box is drawn around it ([Figure 6-1](#)) and it is highlighted in the Objects List Panel.



Figure 6-1. Selected entity

To select entities, use one of the following methods:

- ♦ Click an entity in the display.
- ♦ Click an entity in the Objects List Panel.



Since there is no individual icon in the display to represent an aggregate, you can only select aggregates on the object list.

- ♦ In the display, hold down the left mouse button and draw a selection box around the entities that you want to select.
- ♦ **Ctrl**-click an entity to add or remove it from the list of selected entities without unselecting other entities.

6.3. Attaching the Eyepoint to an Entity

You can attach the eyepoint to an entity and follow it as it moves through the simulation. The Tether Track and Mimic Track view modes allow you to attach to a primary entity and a secondary entity.



All the procedures for attaching the eyepoint to an entity apply to attaching the eyepoint to an aggregate.

6.3.1. Attaching the Eyepoint to a Primary Entity

When you attach the eyepoint to an entity, the head-up display displays the view mode, the entity's object identifier, and the entity's name in the lower left corner of the display (Figure 6-2).



Figure 6-2. Entity information in the head-up display

Compass mode is the default attachment view mode.

To attach the eyepoint to an entity, use one of the following methods:

- ♦ Right-click an entity in the Objects List Panel of the Utility toolbar and click Attach.
- ♦ Choose View Mode → Attach Primary → Next (or Previous) to attach to the next (or previous) entity in the entity list.
- ♦ In the View Mode Information toolbar (Figure 6-3), click the next or previous arrow buttons in the Primary Attached field to attach to the next (or previous) entity in the entity list.

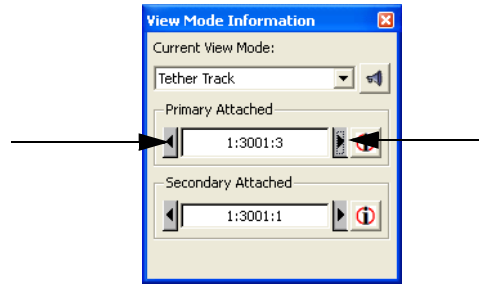


Figure 6-3. View Mode Information toolbar, Next and Previous buttons

- ♦ Press the period key (.) to attach to the next entity in the entity list, or the comma key (,) to attach to the previous entity in the list.
- ♦ **Alt**-click an entity in the display or the object hierarchy.
- ♦ Right-click an entity and on the popup menu, choose Attach.

i

When you select the next or previous entity from the menu, the keyboard, or the View Mode Information toolbar, VR-Forces chooses next and previous based on the order in which the objects were discovered. This may or may not represent the order in which entities are listed in the Objects List Panel.

6.3.2. Selecting a View Mode for Attached Entities

When you attach the eyepoint to an entity, VR-Forces sets the view mode to Compass, by default.

To change the view mode for attached entities, use one of the following methods:

- ♦ Choose View Mode → Set Current → *view*, where *view* is one of the views on the pull-right menu.
- ♦ On the View Mode Information toolbar, select a view mode from the Current View Mode list ([Figure 6-3](#)).
- ♦ Press the appropriate keyboard shortcut, as listed in [Table 6-1](#):

Table 6-1: View mode keyboard shortcuts

View mode	Shortcut
Absolute	z
Pivot	k
Compass	c
Mimic	v
Mimic Track	V
Orbit	b
Tether	x
Tether Track	X
Track	Z
Turret	m
Group	n
Wide Group	N

Please see [“Specifying Absolute Mode,”](#) on page 8-10, and [“Specifying Pivot Mode,”](#) on page 8-10, for details about Absolute mode and Pivot mode, which are independent of entities.

6.3.3. Attaching the Eyepoint to a Secondary Entity

In Tether Track and Mimic Track view modes, you can specify a secondary entity. You attach the eyepoint to secondary entities in essentially the same ways that you attach to primary entities.

To attach the eyepoint to a secondary entity, use one of the following methods:

- ♦ Right-click an entity in the Objects List Panel and select Attach Track.
- ♦ Choose View Mode → Attach Secondary → Next (or Previous) to attach to the next (or previous) entity in the entity list
- ♦ On the View Mode Information toolbar ([Figure 6-3](#)), click the next or previous arrow buttons in the Secondary Attached box to attach to the next (or previous) entity in the entity list
- ♦ Press the right square bracket (]) key to attach to the next entity in the entity list, or the left square bracket ([) key to attach to the previous entity in the list
- ♦ Right-click an entity in the display and on the popup menu, choose Attach Track.

6.3.4. Swapping the Primary and Secondary Entities

You can change the relationship between primary and secondary entities by swapping their position.

To swap the primary and secondary entities, use one of the following methods:

- ♦ Choose View Mode → Swap Primary and Secondary
- ♦ Press the tilde key (~).

6.4. The View Group

You can put entities into a view group and attach the eyepoint to the group. The view group is a convenience for viewing a subset of the total list of entities. There is only one view group. It exists only within the 3D Front End and it has no visibility to participants in a simulation. If the eyepoint is attached to the group, it tries to keep all of the entities visible in the VR-Forces window.



The view group is not the same thing as a selection group. There is only one view group. It supports the group view modes. You can have multiple selection groups. They support the ability to quickly select a set of entities. You cannot attach the eyepoint to a selection group in the 3D Front End. However, if you create a selection group in a 2D front-end, you can attach the 3D Front End or Stealth eyepoint to the entities in the selection group, which becomes the view group in the 3D display.

6.4.1. Creating a View Group



If a view group exists, creating a new view group replaces the previous one. (In other words, you can have only one view group at a time.)

To create a view group or add entities to one:

1. Choose View Mode → Manage Group. The Manage Group dialog box opens (Figure 6-4).
2. In the Attachable Entity/Aggregate List window, select the entities that you want to be in the view group.
3. Click the right-pointing arrow. The selected entities are added to the Group window.

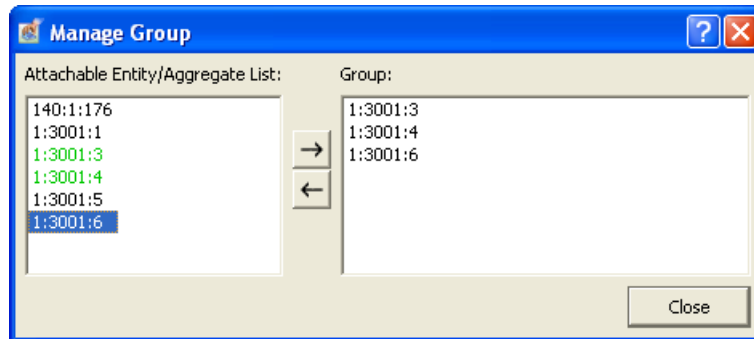


Figure 6-4. Manage Group dialog box

6.4.2. Attaching the Eyepoint to the View Group

- To attach the eyepoint to the view group, set the view mode to Group or Wide Group.



If you have not yet created a view group, a default group is created that contains one entity. You can then add entities to the group as described in “Creating a View Group,” on page 6-8.

6.4.3. Removing Entities from the View Group

To remove entities from the view group:

1. Choose View Mode → Manage Group. The Manage Group dialog box opens.
2. In the Group window, select the entities that you want to remove from the view group.
3. Click the left-pointing arrow. The selected entities are removed from the Group window.

6.4.4. Viewing the Members of the View Group

- To view the list of entities in the view group, choose View Mode → Manage Group, or view the Group Box list on the View Mode Information toolbar ([Figure 6-5](#)).



If you have not created a view group, you cannot select the Group or Wide Group view modes in the View Mode Information toolbar.

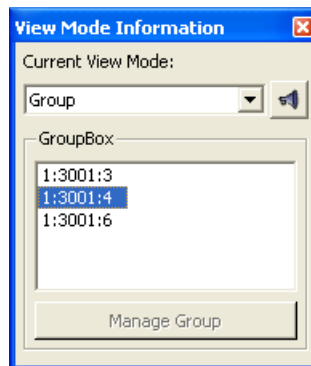


Figure 6-5. Entities in Group list

6.5. Viewing Information About an Entity or Aggregate

The 3D Front End can display the same entity information dialog boxes as the 2D front-end. You open them in the same ways. The 3D Front End also displays entity labels on the screen.

6.5.1. Viewing Entity Labels

VR-Forces displays entity labels that help you locate and identify entities (Figure 6-6). A label displays the entity's name, object identifier, entity type enumeration, force, speed, heading, and location. If an entity is too far from the eyepoint to display a model, the entity is identified by an oval. The color of an entity's label represents its force – blue for friendly, red for opposing, and green for neutral.

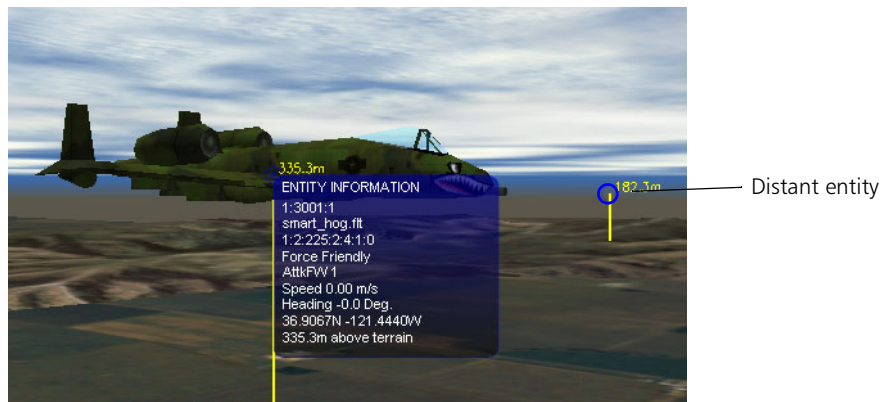


Figure 6-6. Entity labels

- To view expanded entity labels, move the cursor over the entity.

Turning Entity Labels On and Off

- To turn the display of entity labels on or off, choose Options → Entity Labels, or press the **1** key.

Changing the Colors of Entity Labels

You can change the force color used for entity labels by editing the following parameters in *params.mtl*:

- ♦ `forceFriendlyLabelColor`
- ♦ `forceOpposingLabelColor`
- ♦ `forceNeutralLabelColor`.

6.6. Aggregate Symbolology

Aggregates are displayed as a translucent enclosure with an aggregate icon. The icon and the enclosure color are configurable.

Figure 6-7 illustrates display of an aggregate. The box encloses the entities that make up the aggregate. The icon indicates the type of entities in the aggregate. The size of the icon is scaled to reflect the level of the hierarchy. Icons always face the viewer, regardless of the orientation and position of the aggregate.

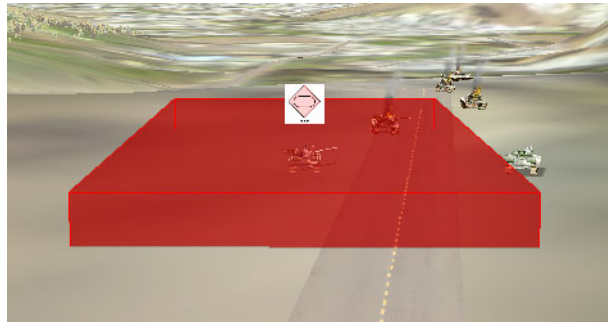


Figure 6-7. Aggregate enclosure and icon

For information about how to configure aggregate symbols, please see Section 12.2.2, “[The aggregateMap.mtl File](#)”, in *VR-Forces Configuration Guide*.

6.7. 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-Forces can clamp land and sea entities to the terrain surface. VR-Forces keeps an entity anchored to the terrain surface regardless of the altitude data contained in its state update.

- To turn ground clamping on or off, choose Options → Ground Clamping, or press the **g** key.

6.7.1. Configuring Ground Clamping

You can configure ground clamping to affect an entity's position or its position and orientation. You can also set the range within which entities are clamped.

To configure ground clamping:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. On the Objects tab, select the Entities and Aggregates tab.
3. Select an option from the Entity Ground Clamping List (Figure 6-8).

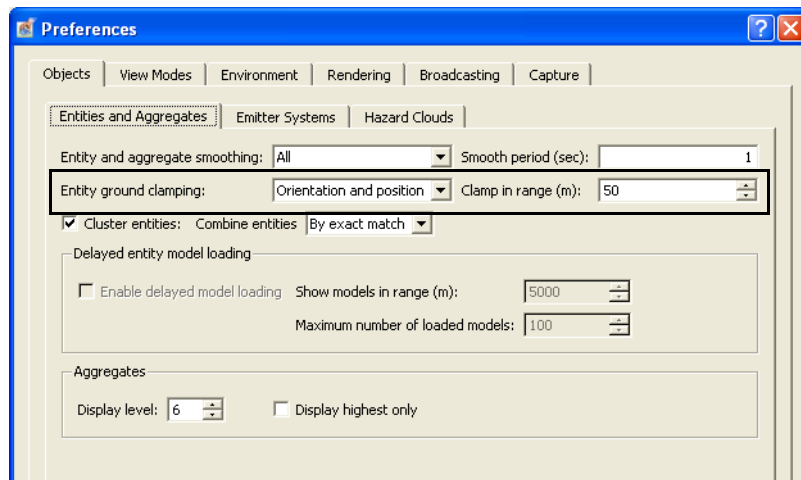


Figure 6-8. Ground clamping controls

4. To change the range, in meters, outside of which entities are not ground clamped, change the value in the Clamp In Range box.

You can also configure ground clamping with the following parameters in *params.mtl*:

- enableGroundClamping
- enableGroundOrientationClamping
- enableLifeformsAlwaysUpright
- groundClampThreshold
- groundClampingMinimumExtent
- groundClampingMaximumExtent.

These parameters are described in the comments in *params.mtl* and in Section 11.3, “The *params.mtl* File”, in *VR-Forces Configuration Guide*.

6.8. Setting Trajectory Smoothing

During the time between receipt of state update messages for an entity, the VR-Forces 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, the VR-Forces 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. The VR-Forces can eliminate these discontinuities by smoothing entity trajectories and rotation paths.

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

To configure trajectory smoothing:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. On the Objects tab, select the Entities and Aggregates tab.
3. Select an option from the Entity and Aggregate Smoothing list (Figure 6-9), as follows:
 - All (smooths all entities)
 - Attached (smooths the primary attached entity only)
 - None (no trajectory smoothing.)

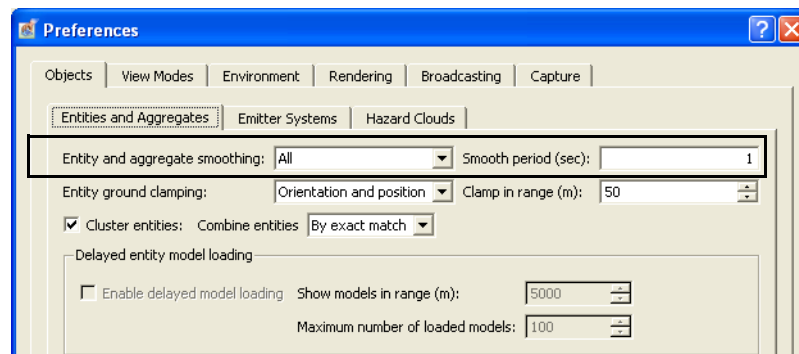


Figure 6-9. Trajectory smoothing controls

4. To change the smooth period, enter a number, in seconds, in the Smooth Period box.

6.8.1. Setting Smoothing Default Values

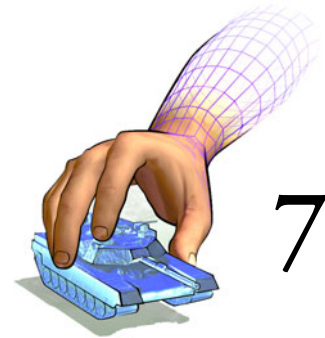
- To specify the default smoothing settings, edit the `whoToSmooth` or `smoothPeriod` parameters in *params.mtl*.

6.9. Configuring Absolute Dead-Reckoning (DIS only)

In an exercise, participants' computer-clocks may be unsynchronized, leading to inconsistent timing information in state updates. To bypass this problem, VR-Forces ignores the time stamp information contained in entity state updates and bases dead-reckoning calculations on update arrival times.

However, if participants' clocks are synchronized for absolute time stamping, you can improve dead-reckoning accuracy by enabling absolute dead-reckoning. This causes VR-Forces to use the time stamps contained within state updates if the sender is using absolute time stamping.

- To configure absolute dead-reckoning, edit the `timeStampType` parameter in *params.mtl*.



Working with Graphical Objects

This chapter explains how to create and manage control objects and tactical graphics.

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7.1. 3D Front End Support for Graphical Objects

The 3D Front End supports the same set of control objects as the 2D front-end. You can create and edit them. The 3D Front End does not support creation of overlays or of overlay objects. However, most overlay objects created and published by VR-Forces 2D front-ends are visible in the 3D Front End and are editable. If you create overlay objects in a scenario using the 2D front-end and you then load the scenario in the 3D Front End, you can edit the objects.

You can manage the display of overlay objects with the tactical graphics commands.

7.2. Creating Control Objects

The principal differences between creating control objects in the 3D Front End and the 2D front-end are:

- In the 3D Front End you can specify an altitude dynamically as you add vertices.
- The 3D Front End does not display an object creation dialog box. All objects are created with a default name and default attributes. You must edit the object after you create it to change its name or attributes.

To create a control object in the 3D Front End:

1. Choose Create → *object* or select an object to create on the Entity Palette. VR-Forces enters create mode. A small help panel is displayed in the window.
2. Move the mouse to the location where you want to place the point or first vertex.
3. For a waypoint or a route, optionally, specify an altitude for the vertex. For details, please see [“Specifying the Altitude of a Vertex,”](#) on page 7-3.
4. Right-click to place a waypoint. To create any of the other control objects, left-click to place the first vertex.
5. Continue adding additional vertices as needed for the object type. (Set the altitude before clicking to place the vertex.)
6. Right-click to complete creation of the object. VR-Forces exits object creation mode.

7.2.1. Specifying the Altitude of a Vertex

When you create a waypoint or route in the 3D Front End, you can dynamically set the altitude of its vertices. You can set altitude using the mouse wheel or by dragging the vertex. You can also set a vertex's altitude after you create it in the Edit *Object* dialog box.

If you change the altitude of a vertex when you are creating a route, the altitude is used for the succeeding vertices, just as it is in the 2D front-end.

You cannot specify an altitude for the vertices of an area or obstacle.

To specify a vertex's altitude using the mouse wheel:

1. Move the mouse to the location where you want to place the vertex.
2. Rotate the mouse wheel to set the altitude. A line shows the offset of the vertex from the ground.
3. Click to place the vertex.

To specify a vertex's altitude by dragging the vertex:

1. **Ctrl**-left-click. The cursor changes to drag mode. The help panel changes color.
2. Press **Alt** and drag the vertex to the desired height. A line shows the offset of the vertex from the ground.
3. Right-click to place the vertex and exit drag mode.



Sometimes dragging a vertex may not work. If this happens, you can still edit it in the Edit object dialog box.

7.3. Editing Graphical Objects

The 3D Front End provides the same options for editing graphical objects as the 2D front-end does.

- ♦ You can select an object and open an Edit dialog box.
- ♦ You can drag the object around the terrain. **Alt**-drag changes altitude for waypoints or routes.
- ♦ You can select and drag individual vertices.
- ♦ You cannot add or delete vertices using the mouse. You can only do so in the Edit dialog box.

Some options for editing control objects, such as changing the line style, do not change how an object is displayed in the 3D Front End. However, these changes are visible in any 2D front-ends or MÄK Plan View Displays that are participating in the simulation.

7.4. Displaying Tactical Graphics

You can hide the display of control objects and overlay objects (collectively called tactical graphics).

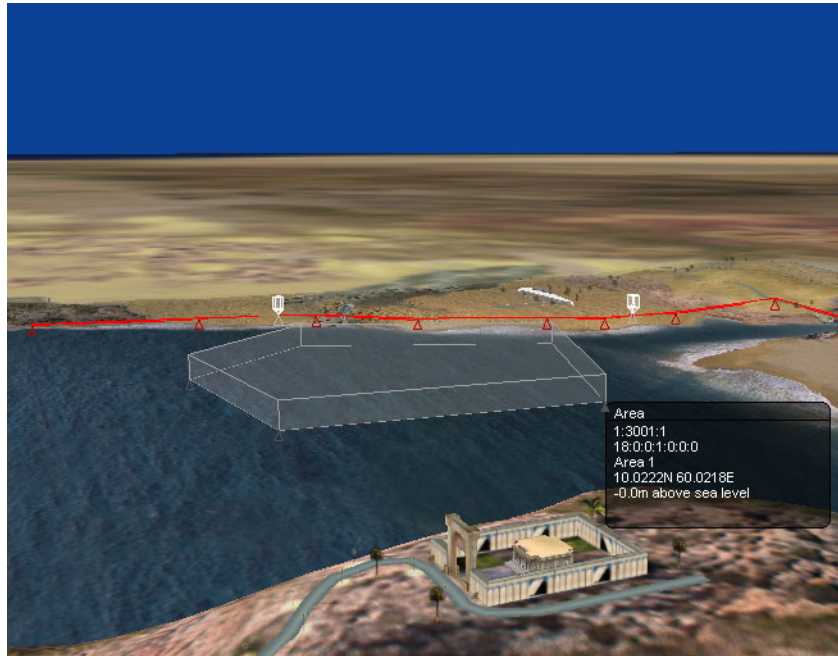


Figure 7-1. Tactical graphics

- To enable or disable the display of tactical graphics, choose Options → Display Tactical Graphics.

7.4.1. Displaying Tactical Graphics Labels

You can display the labels for tactical graphics objects and you can display their height. When labels are enabled, VR-Forces displays a triangle at each vertex of the object. If you hover the cursor over a vertex, an information panel is displayed (Figure 7-1). Height labels are relevant for tactical graphics that have a Z value above the ground (Figure 7-2).



Figure 7-2. Tactical graphics height labels

- To display tactical graphics labels, choose Options → Tactical Graphics Labels.
- To display height labels for tactical graphics, choose Options → Tactical Graphics Height Labels.

7.4.2. Displaying Tactical Graphics Layers

VR-Forces tactical graphics may be drawn on multiple layers. The 3D Front End lets you display or hide graphics individually, by type, and by layer. You can also enable and disable extrusion and scaling (XR Mode only) of tactical graphics.

To enable or disable the display of tactical graphics layers:

1. Choose Options → Tactical Graphics. The Tactical Graphics dialog box opens (Figure 7-3).

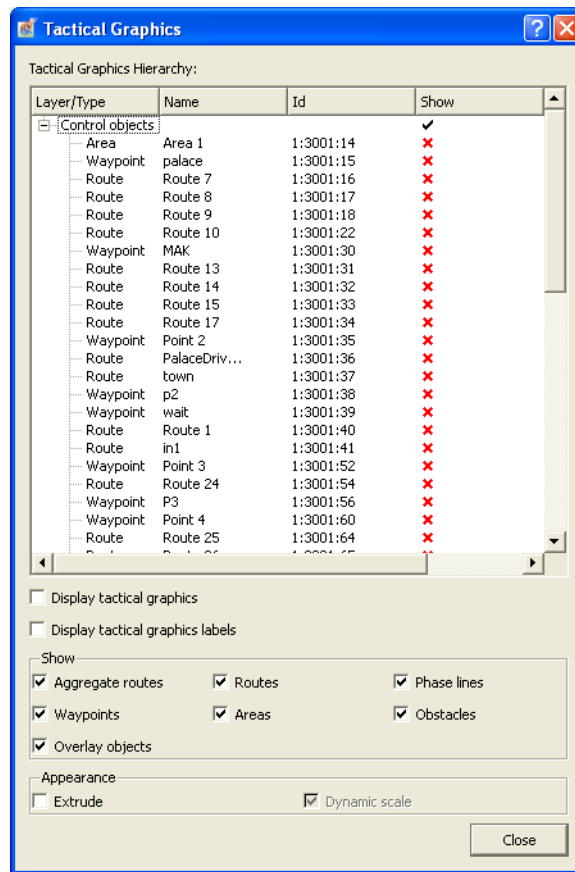


Figure 7-3. Tactical Graphics dialog box

2. To view the list of objects on each layer, expand the layer by clicking the + sign. Click - to collapse the layer.
3. To hide or show a layer or object, click the character in the Show column. A check mark indicates that the object or layer is visible. An X indicates that it is hidden.
4. To hide or show all objects of a particular type, check or clear the check box in the Show group box.

7.4.3. Extruding Tactical Graphics

Tactical graphics have a height value (configurable in *tacticalGraphicsMap.mtl*), that specifies the thickness of the graphic. If the graphic is placed above ground level, for example a route for a helicopter, the graphic might not intersect with the ground. If you want to see where the graphic intersects the ground, you can extrude it. The extrusion value is added to the height. The extrusion value is also configurable in *tacticalGraphicsMap.mtl*.

To enable or disable extrusion of tactical graphics:

1. Choose Options → Tactical Graphics. The Tactical Graphics dialog box opens ([Figure 7-3](#)).
2. Select the Extrusion check box to extrude graphics. Clear the text box to disable extrusion.

7.5. Displaying Remote Graphics

VR-Forces can display graphics generated by other applications using the Draw Control API. For details about the Draw Control API, please contact MÄK technical support.

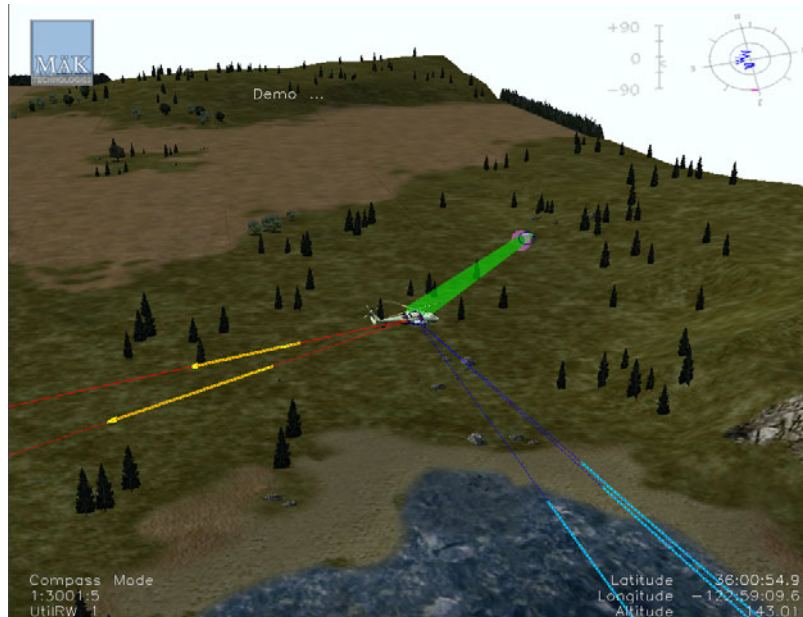


Figure 7-4. Remote graphics

Remote graphics are not objects in the sense of DIS or HLA objects. They are the result of commands to display a graphic. Therefore:

- ♦ If remote graphics are not enabled when VR-Forces receives a command to display a particular graphic, the command is ignored. Turning on graphics at a later point does not display that graphic.
 - ♦ Graphics persist until VR-Forces receives a command to remove them. However, you can hide the display of particular graphics, as described in [“Hiding and Displaying Remote Graphics,”](#) on page 7-9.
 - ♦ If VR-Forces is displaying remote graphics that have been captured and are being played back in a logging program, such as the MÄK Data Logger, moving the time-point in the file during playback can disrupt the original sequence of remote graphics commands resulting in an unexpected graphics display. There is no checkpointing of the graphics as there would be for simulated objects.
- To enable the display of remote graphics, choose Options → Display Remote Graphics.

7.5.1. Hiding and Displaying Remote Graphics

Remote graphics are displayed on layers. You can hide and show graphics by layer and by the individual graphics on each layer.

To hide or show remote graphics:

1. Choose Options → Remote Graphics. The Layers dialog box opens (Figure 7-5). The Objects tab lists graphics layers and the individual graphics on each layer. A check mark in the Show column indicates that VR-Forces should display the graphic. An X indicates the graphic is hidden.

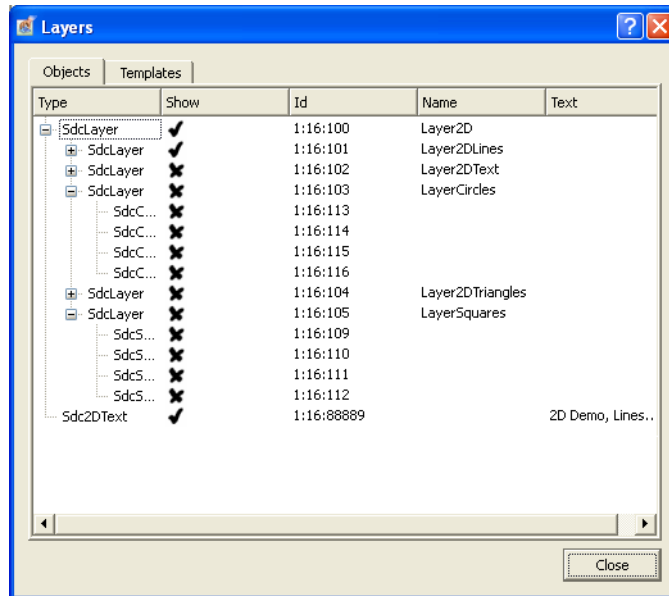


Figure 7-5. Layer dialog box, Objects tab

2. To hide or show specific remote graphics, click the symbol in the Show column.
3. Click Close.

7.5.2. Hiding and Displaying Remote Graphics Attributes

Remote graphics attributes are organized in template groups. A template group is a group of attributes associated with a particular object. You can hide and show attributes by template group and by the individual attributes in each group. [Figure 7-6](#) illustrates the display of remote graphics attributes. [Figure 7-7](#) illustrates some of the attributes that are displayed in [Figure 7-6](#) being hidden. Note how the names of the attributes shown on the Templates tab in [Figure 7-8](#) correspond to the names of the attributes displayed in VR-Forces.

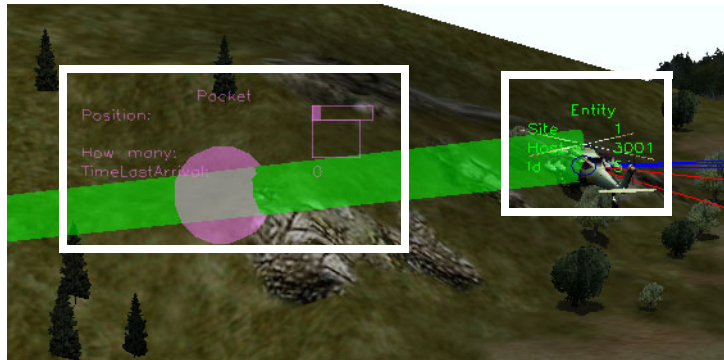


Figure 7-6. Remote graphics attributes

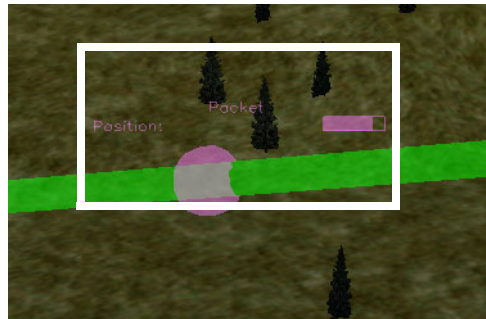


Figure 7-7. Some attributes have been hidden

To hide or show remote graphics attributes:

1. Choose Options → Remote Graphics. The Layers dialog box opens.
2. Select the Templates tab ([Figure 7-8](#)). It lists template groups and the individual attributes in each template. A check mark in the Show column indicates that VR-Forces should display the attribute. An X indicates the attribute is hidden.

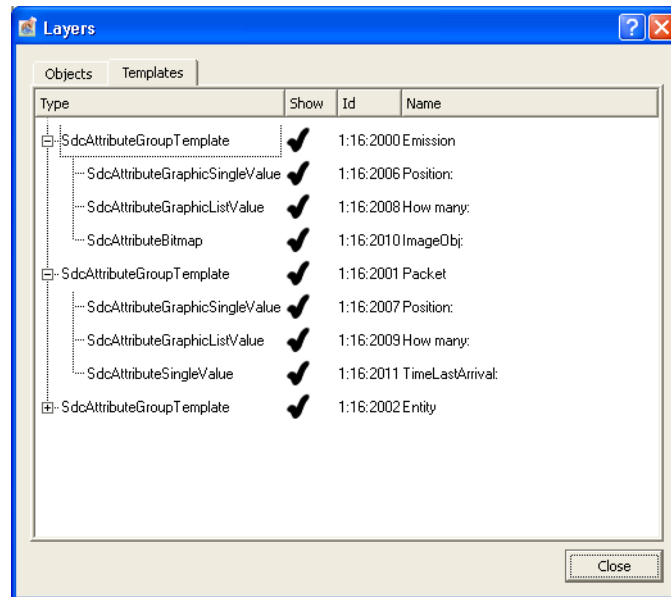
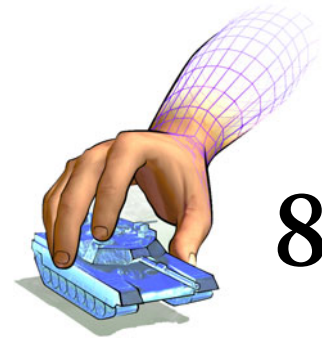


Figure 7-8. Layer dialog box, Templates tab

3. To hide or show specific template or individual attributes, click the symbol in the Show column.
4. Click Close.



Controlling the Eyepoint

This chapter explains how to move the eyepoint in the VR-Forces window.

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8.1. Controlling the Eyepoint's Position and Orientation

The location of the eyepoint is displayed in the Eyepoint Location toolbar (Figure 8-1). The Eyepoint Location toolbar displays the following information:

- The coordinate system being used
- The coordinates of the eyepoint
- The heading, pitch, and roll of the eyepoint.

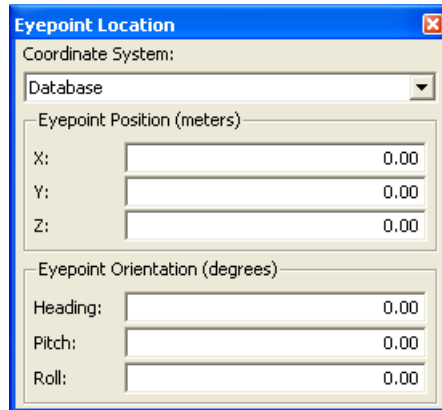


Figure 8-1. Eyepoint Location toolbar

The eyepoint position and orientation controls work differently depending on the view mode that you are using. Please see [“View Mode Descriptions,”](#) on page 8-16, for a detailed explanation of each view mode and of how the position and orientation controls are affected by each view mode.

8.1.1. The Initial Eyepoint Position

When VR-Forces starts, the eyepoint's initial position is determined as follows:

- If you do not load a database when VR-Forces starts, the eyepoint is at zero easting and zero northing, at an altitude of 100 meters (the default eyepoint.)
- If you load a database at startup or through the GUI by specifying a configuration file, the eyepoint is determined by the **startPosition** parameter in the database configuration file. If the **startPosition** parameter is not specified, the default position is used. Please see Section 11.6.4, [“Specifying the Default Eyepoint Position”](#), in *VR-Forces Configuration Guide* for details.
- If you load a database directly, for example, by specifying an OpenFlight file, the eyepoint is placed at approximately the geometric center of the database in standard mode and at one of the corners for XR Mode.

Setting the Eyepoint Position from the Command Line



If you specify the eyepoint's starting position, altitude, or orientation from the command line, it is overridden by any values specified in *params.mtl*.

- To specify starting eyepoint coordinates in database coordinates, use the `--startposition` command-line option.

For example, for UTM coordinates in meters, specify `--startposition` as follows:

```
vrf3DGui -s 1 -a 3000 --startposition easting,northing,up
```

For example:

```
vrf3DGui -s 1 -a 3000 --startposition  
58753.00,50595.96,1250
```

For geocentric coordinates in meters, do the following:

```
vrf3DGui -s 1 -a 3000 --startposition x,y,z
```

For example:

```
vrf3DGui -s 1 -a 3000 --startposition -2703155.25,  
-4426429.00,3701880.25
```

- To specify the altitude of the eyepoint at startup, use the `--startAltitude` command-line option, for example

```
vrf3DGui -s 1 -a 3000 --startAltitude 100.0
```

- To specify the orientation of the eyepoint at startup, use the `--startOrientation` command-line option, for example:

```
vrf3DGui -s 1 -a 3000 --startOrientation "0.0,350.0,0.0"
```

8.1.2. Changing the Eyepoint's Location

You can change the eyepoint's location from the Navigation menu, the Eyepoint Navigation toolbar, the Eyepoint Location toolbar, or the keyboard.

To change the location of the eyepoint, use one of the following methods:

- ♦ Choose Navigation → Move *direction*, where *direction* is Left, Right, Up, or Down.
- ♦ On the Eyepoint Navigation toolbar:
 - a. Place the cursor over the Location button (Figure 8-2).

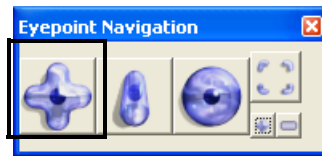


Figure 8-2. Navigation toolbar, Location button

- b. Click and hold the mouse button.
 - c. Drag the cursor in the direction that you want to move the eyepoint. The pinball in the Location button moves to show you the direction that the eyepoint is moving (Figure 8-3).



Figure 8-3. Pinball shows direction of movement

- d. Release the mouse button when you are finished.
- ♦ To move the eyepoint in small increments, click a direction on the Location button to move the eyepoint up, down, left, or right.
- ♦ In Absolute mode only, in the Eyepoint Location toolbar (Figure 8-1), enter the coordinates where you want the eyepoint to be located.
- ♦ Press the **4** (Left), **6** (Right), **9** (Up), or **3** (Down) keys on the numeric keypad (Num Lock must be on).

8.1.3. Changing the Eyepoint's Orientation

You can change the eyepoint's orientation from the Navigation menu, the Eyepoint Navigation toolbar, or the keyboard.

To change the eyepoint's orientation, use one of the following methods:

- ♦ On the Navigation menu, choose Navigation → Look *direction*, where *direction* is Left, Right, Up, or Down.
- ♦ On the Eyepoint Navigation toolbar:
 - a. Place the cursor over the Orientation button (Figure 8-4).

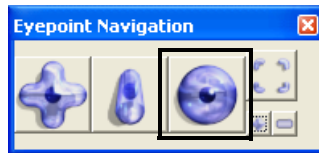


Figure 8-4. Navigation toolbar, Orientation button

- b. Click and hold the mouse button.
 - c. Drag the cursor over the display in the orientation that you want the eyepoint to look. The pinball of the button (Figure 8-5) moves to show you the orientation that the eyepoint is looking.



Figure 8-5. Pinball shows orientation

- d. Release the mouse button when you are finished.
- ♦ To move the eyepoint orientation in small increments, click a direction on the Orientation button to look up, down, left, or right.
- ♦ Press the **Up**, **Down**, **Left**, and **Right** arrow keys on the arrow keypad.

8.1.4. Moving the Eyepoint Forward and Backward

You can move the eyepoint forward and backward from the Navigation menu, the Eyepoint Navigation toolbar, or the keyboard.

To move the eyepoint forward or backward, use one of the following methods:

- ♦ Choose Navigation → Move *direction*, where *direction* is F (forward) or B (back).
- ♦ On the Eyepoint Navigation toolbar:
 - a. Place the cursor over the Forward/Backward button (Figure 8-6).
 - b. Click and hold the mouse button.
 - c. Drag the cursor over the display in the direction that you want the eyepoint to move. The pinball in the arrow moves to show you the direction that the eyepoint is moving.
 - d. Release the mouse button when you are finished.



Figure 8-6. Navigation toolbar, Forward/Backward button

- ♦ To move the eyepoint forward or backward in small increments, click either end of the arrow.
- ♦ Press the **Up** and **Down** keys on the numeric keypad.

8.1.5. Returning the Eyepoint to its Default Location

You can return the eyepoint to its default location for a given entity and view mode.

- To return the eyepoint to its default location, on the Eyepoint Navigation toolbar, click the Reset button (Figure 8-7).

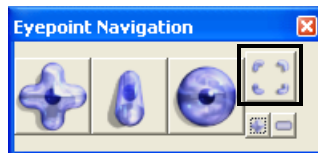


Figure 8-7. Navigation toolbar, Reset button

8.1.6. Adjusting the Sensitivity of Eyepoint Movement Controls

You can set the stepsize for the eyepoint movement controls. You can also increase and decrease sensitivity interactively.

To set the stepsize for the eyepoint movement controls:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the View Modes tab (Figure 8-8).

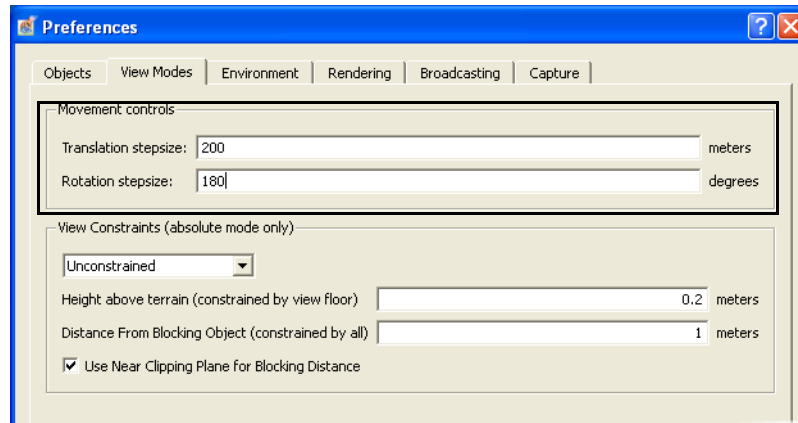


Figure 8-8. Preferences dialog box, movement controls

3. In the Movement Controls group box, specify the translation step size in meters and the rotation step size in degrees.

Adjusting Movement Control Sensitivity Interactively

To increase the sensitivity of the movement controls, use one of the following methods:

- ♦ Choose Navigation → Increase Stepsize
- ♦ Press the + key (plus sign) on the Eyepoint Navigation toolbar
- ♦ While pressing an Eyepoint Navigation toolbar control with the left mouse button, scroll the mouse wheel away from you.

To reduce the sensitivity of the movement controls, use one of the following methods:

- ♦ Choose Navigation → Decrease Stepsize
- ♦ Press the – key (minus sign) on the Eyepoint Navigation toolbar
- ♦ While pressing an Eyepoint Navigation toolbar control with the left mouse button, scroll the mouse wheel toward you.

8.1.7. Enabling the Keyboard Controls

The keyboard position and orientation controls work only when the VR-Forces window has focus. On Windows, you must turn on **NumLock** for the keyboard controls to work.

8.1.8. Specifying the Coordinate System for the Eyepoint Location Toolbar

VR-Forces can display the eyepoint location in the following coordinate systems:

- ♦ Geocentric
 - ♦ Database
 - ♦ Geodetic.
- To specify the coordinate system, on the Eyepoint Location toolbar (Figure 8-9), choose an option from the Coordinate System list.

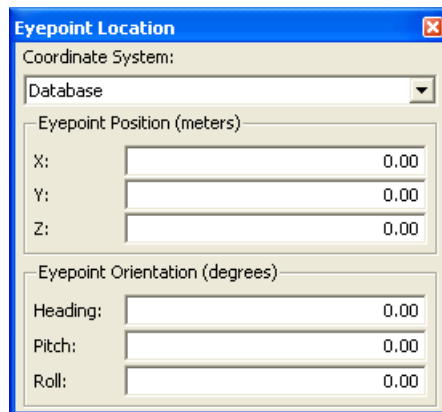


Figure 8-9. Eyepoint Location toolbar

8.1.9. Configuring the Eyepoint Reset Position

Each view mode has a reset position that lets you quickly position the eyepoint to a known location.

For many view modes, the reset command positions the eyepoint directly south of, or behind, the attached entity, 25 meters from the entity's point of origin. The reset position for Absolute mode is the default initial eyepoint position, as described in Section 11.6.4, “[Specifying the Default Eyepoint Position](#)”, in *VR-Forces Configuration Guide*.

- To change the reset eyepoint distance, edit the **viewDefaultOffset** parameter in *params.mtl*.

An additional parameter, **viewDefaultPitchOffset**, controls the eyepoint's pitch upon reset. The default pitch (-5.0 degrees) sets the eyepoint to look slightly downward.

8.2. Setting the Absolute and Pivot View Modes

Absolute mode and Pivot mode are independent of entities. They allow you to view the display relative to a location in the terrain.

8.2.1. Specifying Absolute Mode

Absolute mode specifies a point, including altitude, at which to set the eyepoint.

To specify Absolute mode:

1. Choose View Mode → Set Current → Absolute, or in the View Mode Information toolbar, select Absolute in the Current View Mode list.
2. Optionally, enter coordinate values for position and heading, pitch, and roll values for orientation, in the Eyepoint Location toolbar.

8.2.2. Specifying Pivot Mode

Pivot mode specifies a point in the terrain, at ground level, around which the display pivots using the position and orientation controls.

To specify Pivot mode, use one of the following methods:

- ♦ **Shift**-click the point in the terrain around which you want the display to pivot.
- ♦ Specify the coordinates of the pivot point. For details, please see [“Specifying the Coordinates of the Pivot Point,”](#) on page 8-11.
- ♦ If you have previously set a pivot point using one of the first two methods, choose View Mode → Set Current → Pivot, or in the View Mode Information toolbar, select Pivot in the Current View Mode list. VR-Forces changes to Pivot mode using the most recently selected pivot point.

Specifying the Coordinates of the Pivot Point

To specify the coordinates of the pivot point:

1. Choose View Mode → Pivot Point. The Set Pivot Point dialog box opens (Figure 8-10).

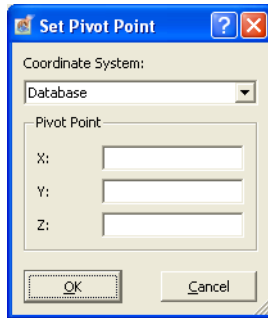


Figure 8-10. Set Pivot Point dialog box

2. Choose the coordinate system you want to use.
3. Enter the X, Y, and Z coordinates, or the Latitude, Longitude, and Altitude values (depending on the coordinate system chosen) for the pivot point.
4. Click OK.

Displaying the Pivot Point

You can display the location of the pivot point (Figure 8-11). If you do not want to use the pivot point model supplied with VR-Forces, you can provide your own model and specify it in the `pivotGraphicModel` parameter in *params.mtl*.

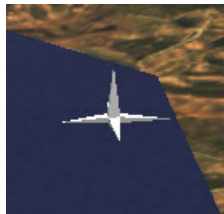


Figure 8-11. Pivot point model

- To enable or disable display of the pivot point, choose View Mode → Show Pivot Model, or press **Shift+k**.

8.3. Saving and Recalling Views

You can save views for later recall. A view saves the following information:

- ♦ View mode
- ♦ Object ID for the attached entity, if the eyepoint is attached to one
- ♦ Positional offset
- ♦ Marking text.

VR-Forces includes two preset views, Preset Sky View and Preset 20 View. The Preset Sky View looks down at the entire terrain from directly overhead. The Preset 20 View looks at the entire terrain from a 20° angle.

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- ♦ When you are in standard mode (as opposed to XR Mode), you must increase the default far clipping planes by a factor of approximately 100 for the preset views to work. You may also want to turn off the cloud layer and fog.
- ♦ Saved views are keyed to both the marking text and object identifier. When VR-Forces recalls a view, it checks the object ID first. If a matching entity cannot be found, the marking text is checked. Many CGF applications (including VR-Forces) reassign IDs when a scenario is restarted. Using the marking text allows saved views to work after a scenario is rewound. This also allows saved views to be protocol-independent.

- To save the current view, choose View Mode → Capture View, or on the Capture and Restore View toolbar (Figure 8-12), click the Save button. The view is listed in the window in the format #- view-mode entity_name.



Figure 8-12. Capture and Restore View toolbar



Views are captured only for the current session of VR-Forces. To save a view for future sessions, you must save it to a file. For details, please see [“Saving Views to a File,”](#) on page 8-13.

8.3.1. Recalling a View

To recall a view, use one of the following methods:

- ♦ In the Capture and Restore View toolbar, in the Captured Views list, select the view you want to use. The view changes immediately.
- ♦ Choose View Mode → Restore View. The most recently selected view is restored.

8.3.2. Deleting a View

To delete a view:

1. In the Capture and Restore View toolbar, in the Captured Views list, select the view you want to delete.
2. Click the Delete button or choose View Mode → Remove View.



The Remove View menu option removes the most recently selected view, regardless of whether or not the display is currently showing that view.

8.3.3. Saving Views to a File

You can save views to a file and load them at startup or manually.

To store saved views for future sessions:

1. Choose File → Save Views. A Save As dialog box opens.
2. Enter a name or select an existing view file and click Save.

8.3.4. Loading Views

You can load saved views at startup or manually.



If a saved view involves an attachment to a particular entity, you will not be able to recall that view unless an entity with the same ID or marking text exists.

To load a view file:

1. Choose File → Load Views. An Open dialog box opens.
2. Select the view file you want to load and click Open.

Loading a View File at Startup

To load a view file when VR-Forces starts, include it in *Stealth.mtl*, for example:

```
(load mtl-path "myviewstates.mtl")
```

8.4. Specifying View Constraints

View constraints control how the eyepoint behaves when it approaches solid objects in the view, such as the ground, buildings, and vegetation.

The view floor is a minimum height above the terrain, in Absolute mode, below which the eyepoint is not allowed to go. The view floor is measured relative to the terrain surface. While moving over hilly terrain, the eyepoint's height is automatically raised, if necessary, to keep it above the view floor. [Figure 8-13](#) illustrates how view floor works.

Setting view constraints prevents the eyepoint from going underground or through walls, and helps prevent the eyepoint from moving too close to terrain polygons. Otherwise, near-clipping could render these polygons invisible, resulting in a distracting visual anomaly.

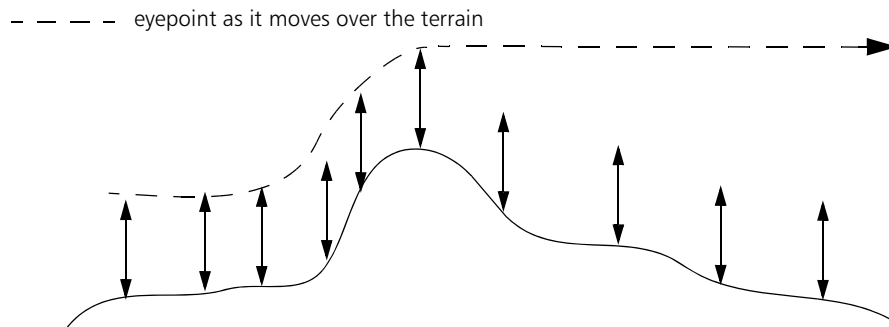


Figure 8-13. Keeping the eyepoint above ground

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

To specify view constraints:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. Select the View Modes tab (Figure 8-14).

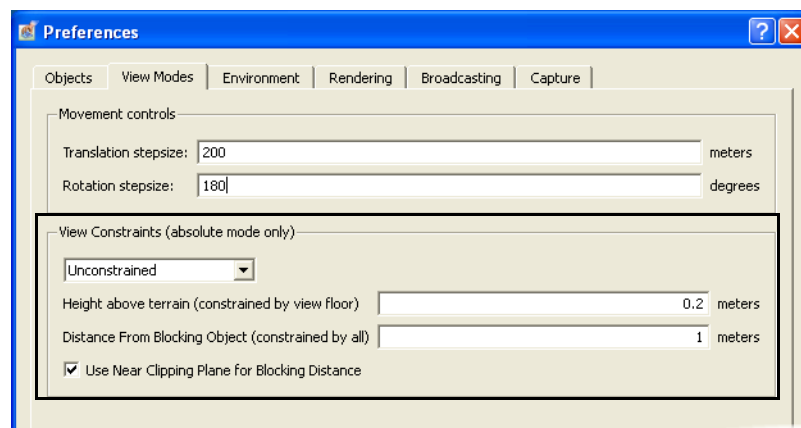


Figure 8-14. Preferences dialog box, view constraint control

3. In the View Constraints group box, select one of the following options in the drop-down list:
 - Unconstrained: The eyepoint is not prevented from moving through polygons.
 - Constrained to View Floor: The eyepoint cannot move below a specified distance above the ground.
 - Constrained to All: The eyepoint cannot move through polygons such as walls.
4. If you selected Constrained to View Floor, specify the height above the terrain in the Height Above Terrain text box. If you selected Constrained to All, specify the distance from blocking objects within which the eyepoint cannot move in the Distance From Blocking Object text box. You can use the near clipping plane as the blocking distance.

You can also specify the view floor height by editing the **viewFloor** parameter in *params.mtl*.

8.5. View Mode Descriptions

This section describes the view modes, how the manual position and orientation controls work in each view mode, and the default position, or reset position, for each view mode.

8.5.1. Positional Controls and Coordinate Frames

Depending on which view mode you are using, the positional controls may move the eyepoint with respect to the terrain, or with respect to the attached entity. When the eyepoint moves with respect to the terrain, we describe it as movement in a topographic coordinate frame. When the eyepoint moves with respect to the entity, we describe it as movement in a body coordinate frame.

8.5.2. Absolute Mode

In Absolute, or free-fly mode, the eyepoint is not attached to an entity. Position and orientation are controlled manually. The position and orientation controls move the eyepoint as described in [Table 8-1](#), within a topographic frame. When moving forward or backward, altitude remains constant.

Table 8-1: Orientation and position controls in Absolute mode

Control	Up/Down Arrow	Left/Right Arrow
Orientation	Controls pitch.	Controls yaw.
Fwd/Bkwd	Controls forward and backward position.	Not applicable.
Position	Controls altitude.	Moves eyepoint left or right.
Reset position	Return to the eyepoint position in effect when VR-Forces was started.	

8.5.3. Pivot Mode

In Pivot mode, the eyepoint is attached to a point on the terrain. The view rotates around the point. The position and orientation controls move the eyepoint as described in [Table 8-2](#), within a topographic frame. When moving forward or backward, altitude remains constant.

Table 8-2: Orientation and position controls in Pivot mode

Control	Up/Down Arrow	Left/Right Arrow
Orientation	Adds an offset to the eyepoint's pitch.	Rotates view horizontally around attachment point.
Fwd/Bkwd	Controls forward and backward position.	Not applicable.
Position	Rotates view vertically around attachment point.	Rotates view horizontally around attachment point.
Reset position	Return to the eyepoint position in effect when VR-Forces was started.	

8.5.4. Compass Mode

In Compass mode, the eyepoint's position and compass heading are dependent on the attached entity. The eyepoint position maintains a constant offset from the entity relative to the entity's own body coordinate frame. This creates the effect of riding along with a vehicle while being solidly connected to it ([Figure 8-15](#)).

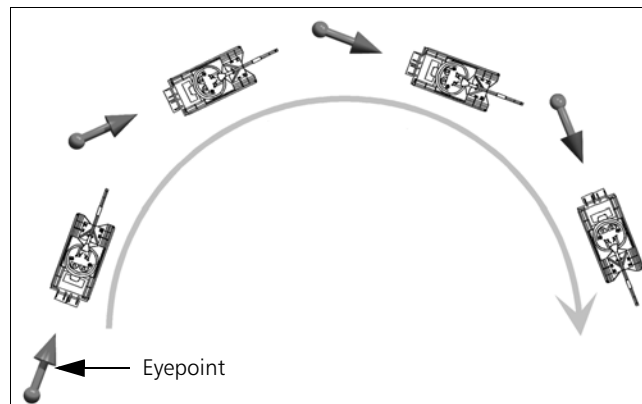


Figure 8-15. Compass mode

When you use the controls to change the eyepoint's position, it moves around the attached entity, along the surface of a sphere with the entity at its center. As the eyepoint changes position, its orientation changes automatically to keep the entity in view (unless you adjust the pitch offset so that this is no longer true).

When moving laterally, the eyepoint maintains a constant altitude and follows a circular path around a vertical axis as shown in [Figure 8-16](#). Orientation is measured relative to the attached entity. [Table 8-3](#) describes how the position and orientation controls work.

Table 8-3: Orientation and position controls in Compass mode

Control	Up/Down Arrow	Left/Right Arrow
Orientation	The pitch controls let you add an offset to the eyepoint's pitch.	Disabled.
Fwd/Bkwd	Moves the eyepoint away from or toward the entity, thereby enlarging or shrinking the sphere.	Not applicable.
Position	Moves the eyepoint up and down along the surface of the sphere.	Moves the eyepoint left or right along the surface of the sphere.
Reset position	Directly behind and slightly above the attached entity, at a distance that allows the entire entity to be fully visible. Orientation is set to 0,0,0 with respect to the entity.	

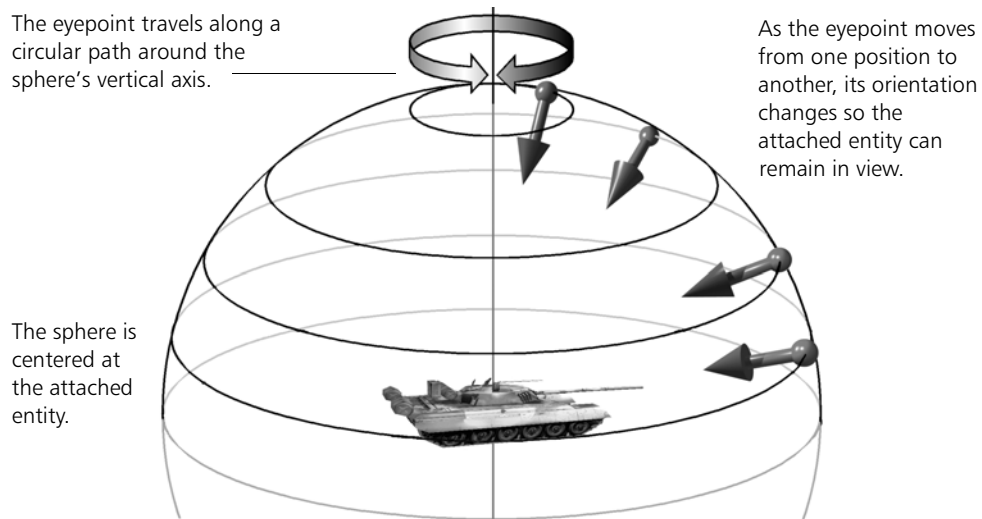


Figure 8-16. Eyepoint Movement and Orientation in Compass and Orbit Modes

8.5.5. Mimic Mode

In Mimic mode, the eyepoint's position, heading, pitch, and roll are dependent on an attached entity. The eyepoint behaves as though it is rigidly connected to the entity. Use Mimic mode to create the effect of riding in a vehicle cockpit, or following a vehicle from an external location while connected to it by a solid, invisible rod.

The controls move the eyepoint with respect to the entity's body coordinate frame. For example, if you move the eyepoint to a location behind an attached vehicle, it will remain constantly behind the vehicle, regardless of the vehicle's path or direction on the terrain. When the eyepoint's yaw, pitch, and roll are zero, it has the same orientation as the attached entity.

Position and orientation controls move the eyepoint as described in [Table 8-4](#), within the attached entity's body coordinate frame.

Table 8-4: Orientation and position controls in Mimic mode

Control	Up/Down Arrow	Left/Right Arrow
Orientation	Controls pitch.	Controls yaw.
Fwd/Bkwd	Controls forward and backward position.	Not applicable.
Position	Controls altitude.	Moves eyepoint left or right.
Reset position	Two meters above the attached entity's point of origin. Orientation is set to 0,0,0 with respect to the entity. With most vehicles, the reset position puts the eyepoint inside the cockpit, facing the front of the vehicle.	

8.5.6. Mimic Track Mode

Mimic Track mode lets you simulate the effect of sitting in the cockpit of one vehicle while tracking another vehicle. You designate a primary (attached) entity which determines eyepoint position, and a secondary (tracked) entity to determine eyepoint orientation.

The eyepoint maintains a roll of zero with respect to the primary entity, which creates the effect of riding in that entity's cockpit. Pitch and yaw are determined by the position of the secondary entity, which remains centered in the field of view.

[Table 8-5](#) describes the behavior of the orientation and position controls.

Table 8-5: Orientation and position controls in Mimic Track mode

Control	Up/Down Arrow	Left/Right Arrow
Orientation	Disabled.	Disabled.
Fwd/Bkwd	The forward/backward controls move the eyepoint forward or backward along the line of sight.	Not applicable.
Position	Increase or decrease eyepoint altitude with respect to the primary entity's body coordinate frame.	Moves the eyepoint left and right along the surface of a sphere with the secondary entity at its center. Movement is similar to left-to-right movement in Compass mode ("Compass Mode," on page 8-17), except that the eyepoint revolves around an axis which is vertical with respect to the primary entity, not vertical with respect to the terrain.
Reset position	Two meters above the primary entity's point of origin. Roll is set to zero with respect to the primary. Pitch and yaw are set so that the secondary entity is centered in the field of view.	

8.5.7. Orbit Mode

In Orbit mode, the eyepoint revolves continuously around the entity. This contrasts with Compass mode, in which the eyepoint stays in one place (relative to the entity) unless you move it manually.

In other respects, Orbit mode is very similar to Compass mode in that the eyepoint's position and compass heading are dependent on the attached entity. The positional controls move the eyepoint in a spherical fashion around the attached entity, as illustrated in [Figure 8-16](#). As the eyepoint changes position, its orientation changes automatically to keep the entity in view.

In Orbit mode orientation is measured relative to the terrain.

[Table 8-6](#) describes the behavior of position and orientation controls in Orbit mode. You can press the **c** key to freeze the eyepoint (by switching to Compass mode), and press the **b** key to return to Orbit mode.

Table 8-6: Orientation and position controls in Orbit mode

Control	Up/Down Arrow	Left/Right Arrow
Orientation	The pitch controls let you add an offset to the eyepoint's pitch.	Disabled.
Fwd/Bkwd	Moves the eyepoint away from or toward the entity, thereby enlarging or shrinking the sphere.	Not applicable.
Position	Moves the eyepoint up and down along the surface of the sphere.	Control orbit speed.
Reset position	Directly south of and slightly above the attached entity, at a distance that allows the entire entity to be fully visible. Orientation is 0,0,0 with respect to the terrain. Orbit speed is set to zero.	

8.5.8. Tether Mode

In Tether mode, the eyepoint’s position maintains a constant offset from the attached entity. Orientation is controlled manually. It is not affected by the entity’s yaw, pitch, or roll.

The controls move the eyepoint within a topographic frame, and let you place it at a desired position relative to the attached entity. For example, you might place the eyepoint 40 meters to the south of a vehicle. As the vehicle moves around the terrain, the eyepoint travels with the vehicle, maintaining a constant positional offset of 40 meters south. Figure 8-17 illustrates eyepoint behavior in Tether mode. Compare it to Compass mode in Figure 8-15. The arrow represents the location of the eyepoint with respect to the object being tracked.

Controls move the eyepoint as described in Table 8-7, relative to the attached entity.

Table 8-7: Orientation and position controls in Tether mode

Control	Up/Down Arrow	Left/Right Arrow
Orientation	Controls pitch.	Controls yaw.
Fwd/Bkwd	Controls forward and backward position.	Not applicable.
Position	Controls altitude.	Moves eyepoint left or right.
Reset position	Directly south of and slightly above the attached entity, at a distance that allows the entire entity to be fully visible. Yaw and roll are set to zero with respect to the terrain, and pitch is set to -5.0 degrees.	

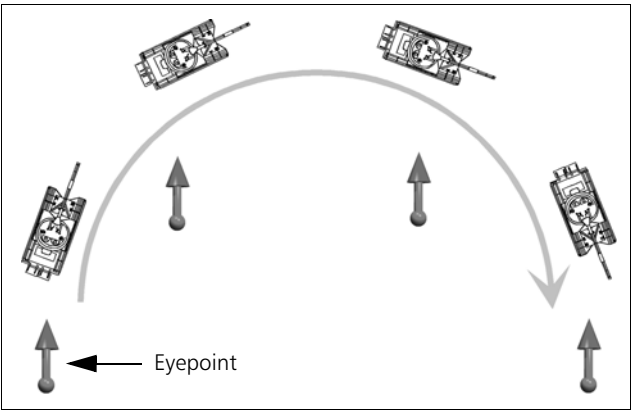


Figure 8-17. Eyepoint Behavior in Tether Modes

8.5.9. Tether Track Mode

Tether track mode lets you monitor the activities of a pair of entities. Eyepoint position and orientation are determined by the position of two entities in relation to each other.

In this mode, you designate a primary and a secondary entity. The eyepoint's coordinate frame is based on a ray running from the primary entity to the secondary entity, as shown in [Figure 8-18](#). The eyepoint repositions and reorients itself as a primary entity (helicopter) flies around a secondary entity (tank). When the eyepoint is aimed along this ray, its heading is zero.

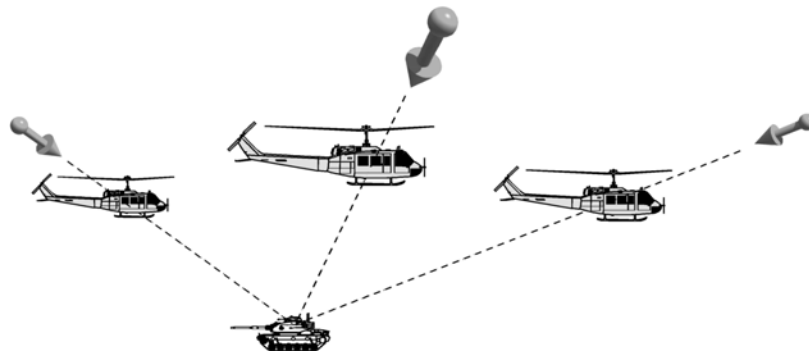


Figure 8-18. Eyepoint Behavior in Tether Track Mode

As the relationship of the entities changes, the coordinate frame (and therefore, the eyepoint) turns so that both entities can always remain in the line of sight. As the eyepoint moves with the entities, its roll is locked at zero degrees with respect to the terrain. The secondary entity always remains centered in the field of view. [Table 8-8](#) describes the behavior of the orientation and position controls.

Table 8-8: Orientation and position controls in Tether Track mode

Control	Up/Down Arrow	Left/Right Arrow
Orientation	Disabled.	Disabled.
Fwd/Bkwd	The forward/backward controls slide the eyepoint forward or backward along the line of sight.	Not applicable.
Position	The altitude controls increase or decrease eyepoint altitude within the coordinate frame defined by the ray connecting the primary and secondary entities.	The horizontal controls move the eyepoint left and right within the coordinate frame defined by the ray connecting the primary and secondary entities.
Reset position	Slightly higher than the primary entity, positioned and oriented so that both primary and secondary entities are fully visible. Yaw is zero and pitch is -5.0 degrees with respect to a ray connecting the primary and secondary entity. Roll is zero with respect to the terrain.	

8.5.10. Track Mode

In Track mode, the eyepoint's orientation is controlled by the attached entity. You control the eyepoint position manually. The eyepoint automatically follows the movements of the attached entity as if watching from a control tower, keeping it centered in the field of view. The position controls move the eyepoint as described in [Table 8-9](#), in a topographic frame.

Table 8-9: Orientation and position controls in Track mode

Control	Up/Down Arrow	Left/Right Arrow
Orientation	Disabled.	Disabled.
Fwd/Bkwd	Controls forward and backward position.	Not applicable.
Position	Controls altitude.	Moves eyepoint left or right.
Reset position	Directly south of, and slightly above, the attached entity. The distance from the entity is calculated to allow the entire entity and some surrounding terrain to be visible. Orientation is set to 0,0,0 relative to the terrain's coordinate system.	

8.5.11. Turret Mode

Turret mode is similar to Mimic mode, in that both the eyepoint's position and orientation are slaved to an attached entity. However, in Turret mode the eyepoint is linked to one of an entity's articulated parts, rather than to the entity as a whole.

Typically, Turret mode is used to fuse the eyepoint to the turret of a tank, although you can use this mode with other entity types that have articulated parts. To work correctly, the first articulated part must rotate around axes that correspond with the axes of its host entity.

By default, Turret mode tries to attach to an entity's first articulated part. Turret mode can link the eyepoint to other articulated parts based on mappings in *artPartAttachMap.mtl*. This configuration file associates entity types with an articulated part enumeration. For example, the following mapping ensures that subsurface entities always attempt to attach to the periscope:

```
(articulated-attach-point (list 1 4 -1 -1 -1 -1 -1) 2048)
```

Position and orientation controls move the eyepoint as described in [Table 8-10](#), within the articulate part's coordinate frame.

Table 8-10: Orientation and position controls in Turret mode

Control	Up/Down Arrow	Left/Right Arrow
Orientation	Controls pitch.	Controls yaw.
Fwd/Bkwd	Controls forward and backward position.	Not applicable.
Position	Controls altitude.	Moves eyepoint left or right.
Reset position	Two meters above the attached entity's (not the part's) point of origin. Orientation is set to 0,0,0 with respect to the part.	

8.5.12. Group and Wide Group Modes

In Group and Wide Group modes, the eyepoint is positioned to keep all members of a specified entity group within view. In Group mode, you can move the eyepoint around the group to view it from any direction. In Wide Group mode, the eyepoint is positioned for a broadside view of the group, so the entities are spread as widely as possible across the field of view.

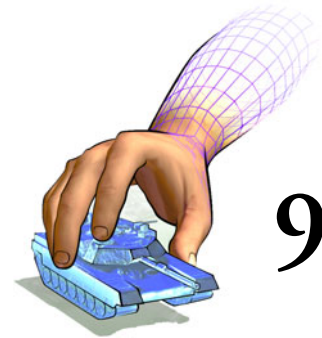
In Group mode, the left and right positional controls move the eyepoint in a path around the group's midpoint, similarly to Compass mode (see [“Compass Mode,”](#) on page 8-17). As it moves around the group, the eyepoint may move closer to or farther from the group's midpoint as needed to obtain the best view of all entities. Therefore, its path is not truly circular as it is in Compass mode. In Wide Group mode, the left and right positional controls are disabled, since position and orientation are set automatically to maintain a broadside view.

In either mode, as entities in the view-group move around in the terrain, the eyepoint's position, orientation, and distance from the group are adjusted automatically to provide a view of all members.

For information about defining view-groups, please see [“The View Group,”](#) on page 6-7.

Table 8-11: Orientation and position controls in Group and Wide Group mode

Control	Up/Down Arrow	Left/Right Arrow
Orientation	Controls pitch. Using this control may cause some members of the view-group to fall out of view.	Controls yaw. Using this control may cause some members of the view-group to fall out of view.
Fwd/Bkwd	Moves the eyepoint forward and backward, toward or away from the group's midpoint.	Not applicable.
Position	Moves the eyepoint up and down along the surface of a sphere centered at the group's midpoint.	Moves the eyepoint left and right along the surface of a sphere centered at the group's midpoint. (Disabled in Wide Group mode.)
Reset position	Group Mode Pointing north, and positioned far enough south of the view-group to allow all members to be visible. Wide Group Mode Positioned to one side of the group's greatest dimension (that is, the greatest distance between any two member entities). The eyepoint is oriented toward the group's midpoint, and maintains the distance needed to keep the entire group in view.	



Displaying 3D Special Effects

This chapter describes graphics that illustrate entity activity and interactions.

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Displaying Trailing Effects Per Entity or Globally	9-2
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9.1. Displaying Trailing Effects

VR-Forces supports trailing effects such as:

- ♦ Vapor trails for missiles and aircraft
- ♦ Dust clouds for vehicles
- ♦ Tire and tread tracks
- ♦ Wakes for surface vessels
- ♦ Footprints for dismounted infantry.

The configuration for trailing effects is in `./config/trailMap.mtl`.

Figure 9-1 illustrates some trailing effects.

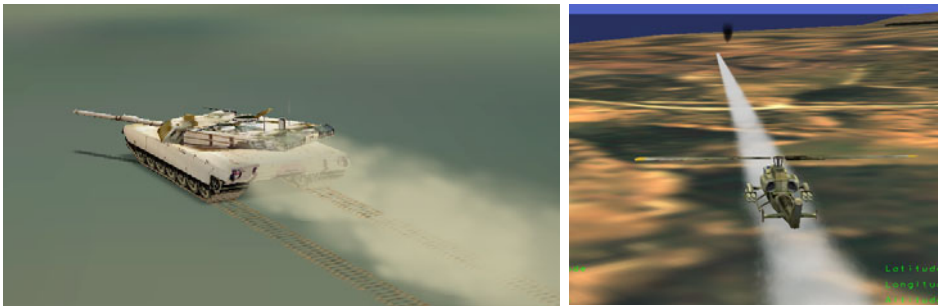


Figure 9-1. Tank tracks, dust cloud, and missile trail

- To turn trailing effects on or off, choose Options → Trailing Effects, or press the **t** key.
- To specify use of trailing effects at startup, edit the `enableTrailingEffects` parameter in `params.mtl`.

9.1.1. Displaying Trailing Effects Per Entity or Globally

If your simulation sends out trail information as part of an entity's appearance, you can enable trailing effects on a per-entity basis. If you do not send out trail information for each entity, then you should enable trails for all entities.

- To specify use of trailing effects on a per-entity basis, edit the `trailsBasedOnAppearance` parameter in `params.mtl`.

9.1.2. Specifying Models for Trailing Effects

Each trail needs to be associated with a trail model and models must be mapped to entity types. The process is the same as for mapping entity models, as described in Chapter 12, *Configuring 3D Entity Models*, in *VR-Forces Configuration Guide*. All parameters are described in the comments in `trailMap.mtl`.

9.1.3. Specifying an Offset for a Trail

You can specify more than one trail for an entity. This is useful for entities that have multiple exhausts, such as a twin engine aircraft. Please see the example in *trailMap.mtl*.

9.2. 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. You can enable and disable track histories for all entities or individual entities. When track histories are enabled, each entity leaves a track ribbon. The ribbon is colored based on the entity's force. [Figure 9-2](#) illustrates a track history (and a detonation line).

To configure the length of track histories, edit the `trajectoryHistoryLength` parameter in *params.mtl*.

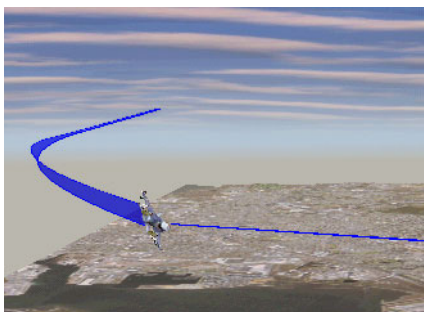


Figure 9-2. Track history

To enable or disable track histories for an individual entity:

1. Right-click the entity.
2. On the popup menu, choose Track History.

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- ♦ If track histories are disabled for all entities, this procedure still enables the track history for the selected entity.
- ♦ If individual track histories are enabled, disabling track histories for all entities also disables the individual histories.

- To enable or disable display of all track histories for all entities, choose Options → Track Histories, or press the **h** key.

9.2.1. Clearing the Display of Track Histories

If you display track histories for a while, the screen can get cluttered with all the trajectories. You can remove old track histories from the display.

- To clear the display of track histories, choose Options → Clear Track Histories, or press **Ctrl+H**.

9.2.2. Configuring the Colors of Track Histories

You can configure the colors used to display track histories.

- To configure the colors used to display track histories, edit the `forceFriendlyHistoryColor`, `forceOpposingHistoryColor`, and `forceNeutralHistoryColor` parameters in *params.mtl*.

9.3. Viewing Detonation Lines

If 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 blue, red, or green for the force of the shooter (Figure 9-3).

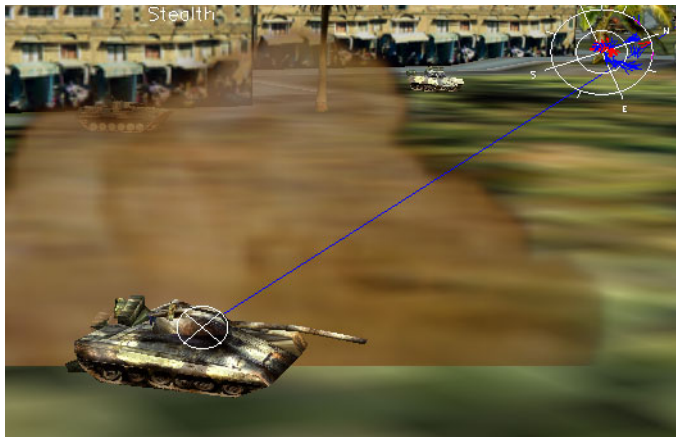


Figure 9-3. Detonation lines and detonations

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 display or hide detonation lines, choose Options → Detonation Lines, or press the **d** key.

9.3.1. Configuring the Colors of Detonations and Detonation Lines

You can specify the colors used for detonation lines and for detonations.

- To specify the colors used for detonation lines and detonations, edit the following parameters in *params.mtl*:
 - ♦ `forceFriendlyDetonationColor`
 - ♦ `forceOpposingDetonationColor`
 - ♦ `forceNeutralDetonationColor`
 - ♦ `detResultEntityImpactColor`
 - ♦ `detResultGroundImpactColor`
 - ♦ `detResultAirBurstColor`
 - ♦ `detResultDefaultColor`.

9.4. Displaying Electromagnetic Emissions Fields

- To display or hide electromagnetic emissions, choose Options → Emitter Systems or press the **e** key.
- To enable or disable the display of sensor volumes at startup, edit the `enableEmissionsDisplay` parameter in `params.mtl`.

9.4.1. Using Sensor Volume Colors

Sensor volume color can serve one of three purposes. It can:

- Represent emitter frequency.
- Represent the emitter pulse repetition frequency.
- Remain constant and represent nothing (the default behavior).

To specify the meaning of sensor volume colors:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. On the Objects tab, select the Emitter Systems tab (Figure 9-4).
3. Select an option from the Color Represents list.

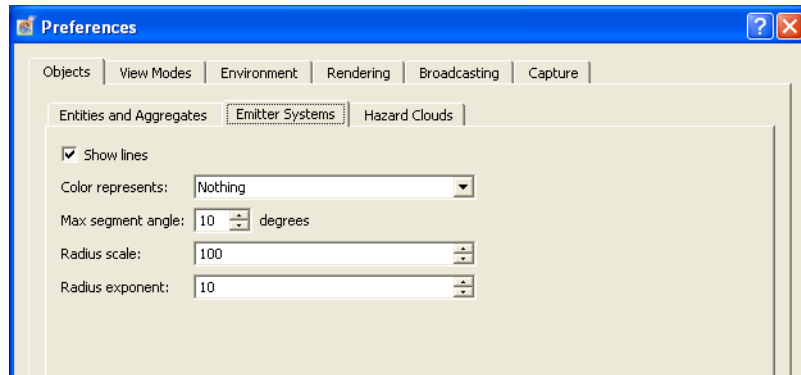


Figure 9-4. Preferences dialog box, Emitter Systems tab

- To specify the default color behavior, edit the `emissionsColorIndicates` parameter in `params.mtl`.

The following sections describe the color options in detail.

Using Sensor Volume Color to Represent Emitter Frequency

When sensor volume color represents frequency, color is determined by the frequency field of the EM Emission update message, and a pair of frequency-range parameters.

If the emitter frequency is lower than your specified low frequency, the sensor volume is red. As frequency rises above the specified low frequency, sensor volume color changes, progressing through the colors of the visible spectrum until the specified high frequency is reached. At the high frequency and above, the sensor volume is violet.

The default low and high frequency values are 800MHz and 1GHz, respectively.

- To specify low and high emitter frequencies, edit the `emissionsLowFrequency` and `emissionsHighFrequency` parameters in *params.mtl*.

Using Sensor Volume Color to Represent Pulse Repetition Rate

Sensor volume color based on pulse rate works the same way as color based on emitter frequency, described in [“Using Sensor Volume Color to Represent Emitter Frequency”](#).

The default low and high pulse repetition frequencies are 100Hz and 3KHz.

- To specify low and high pulse repetition frequencies, edit the `emissionsLowPrFrequency` and `emissionsHighPrFrequency` parameters.

Setting Default Sensor Volume Colors

When sensor volume color represents nothing, the color at the volume origin (the emitter location) is determined by the parameter `emissionsDefaultNearColor`, set to white by default. The color at the volume’s radius is determined by `emissionsDefaultFarColor`, set to magenta by default.

- To change the colors, edit `emissionsDefaultNearColor` and `emissionsDefaultFarColor` in *params.mtl*.

9.4.2. Configuring Sensor Volume Segments

VR-Forces displays a sensor volume as a group of spherical sections projecting from the sensing device. By default, for each 10 degrees (or portion thereof) in the sensor's field-of-view, VR-Forces draws one segment. For example, a sensor with a 35° or 40° field-of-view is displayed as a group of four 10° pyramids (Figure 9-5).

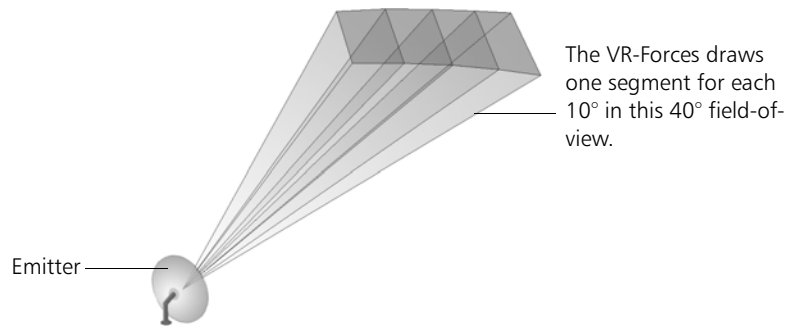


Figure 9-5. Sensor volume segments

Specifying the Segment Angle

To specify the segment angle:

1. Choose Options → Preferences. The Preferences dialog box opens.
 2. On the Objects tab, select the Emitter Systems tab (Figure 9-4).
 3. Enter a value in the Max Segment Angle box.
- To change the size of the arc represented by one segment, edit the `emissionsSegmentAngle` parameter in `params.mtl`.

Displaying Segment Outlines

By default, VR-Forces displays opaque outlines showing the segment edges along the surface of the sensor volume.

To display or hide segment outlines:

1. Choose Options → Preferences. The Preferences dialog box opens.
 2. On the Objects tab, select the Emitter Systems tab (Figure 9-4).
 3. Check or clear the Show Lines check box.
- To control whether these lines are on or off by default, edit the `emissionsShowLines` parameter in `params.mtl`.

9.4.3. Controlling Sensor Volume Radius

A sensor volume's radius (that is, the distance it extends from the emitter) is based in part on emitter power and in part on elevation and azimuth sweep data obtained from EM Emission state messages. A higher emitter power value results in a longer radius, while a wider field of view results in a shorter radius (because the radiated power is distributed over a wider area).

If VR-Forces relied exclusively on these values, the range of sizes among different sensor types could become too wide to be practical, with some emissions being barely visible, and other emissions covering the entire virtual world. Therefore, a configurable exponent weight and scale factor have been added to help fine tune the emitter beam radii. The radius exponent weight (a value between 0 and 1) slows the growth of the radius when power/area is greater than 1 and increases the growth of the radius when power/area is less than 0. The scale factor increases the radii of all beams by the given value.

To specify the sensor volume radius:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. On the Objects tab, select the Emitter Systems tab (Figure 9-4).
3. Enter a radius scale value in the Radius Scale box.
4. Enter a value for the radius exponent in the Radius Exponent box.

How VR-Forces Calculates the Radius

VR-Forces calculates sensor volume radius using the following formula:

$$\text{radius} = \text{scale factor} \times \left(\frac{\text{power}}{\text{area}} \right)^{\text{radius-exp}/2}$$

where power and area are defined within the PDU.

The radius scale is a factor, between 1 and 10,000, by which all sensor volume radii are multiplied.

- To specify the default radius scale, edit the `emissionsRadiusScaleFactor` parameter in `params.mtl`.

The radius exponent allows you to apply exponential changes to the sensor volume radii.

- To specify the default radius exponent, edit the `emissionsRadiusExponent` parameter in `params.mtl`.

9.5. Displaying Range Volumes

Range volumes display a translucent volume around an entity that describes the range of the entity's armaments (Figure 9-6). In the illustration, note the range volume for both the main gun and the machine gun. You can display range volumes for individual entities or for all entities.

Range volumes are configured in the *rangeRingsMap.mtl* file. They do not depend on information received over the network. For details, please see the comments in the file.

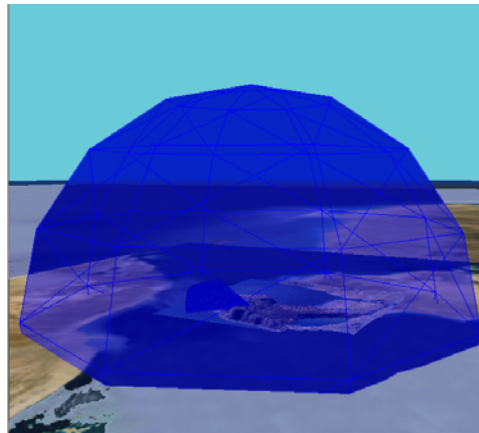


Figure 9-6. Range volume for M1A2 tank



Range volumes can be quite large. You may need to zoom out to see them.

To enable or disable the display of range volumes for an entity:

1. Select an entity.
 2. On the right-click menu, select Range Volume.
- To display range volumes for all entities, choose Options → Range Volumes.

9.6. Displaying Chemical and Biological Hazards

VR-Forces can display chemical and biological hazards, such as vapor clouds and liquid spills. You can enable and disable display of specific supported hazard types.

On the network, hazard clouds are represented with Environmental Process objects. Environmental Process objects contain an array of variable sized, generic records. For hazards, Environmental Process records contain records for chemical liquids, vapor clouds, and biological vapor clouds. These records describe the hazard's bounding sphere, display primitive (puff or box), position, orientation, velocity, expansion (using the sigma record attribute), and expansion rate (sigma delta). These liquids and vapors must be formatted correctly inside an Environment Process object for VR-Forces to display it correctly. Please see Appendix C, [Hazard Cloud Message Formats](#), in *VR-Forces Configuration Guide* for the record specifications.

A typical hazard cloud message contains a bounding sphere record, a display primitive record (either a gaussian cloud or uniform box), and a state record (either a Biological-Vapor, ChemicalVapor, or ChemicalLiquid). All records contain a type parameter that says what type of record it is. VR-Forces uses the information in Gaussian cloud records and uniform box records to visualize the hazard cloud. State records contain the index of the primitive record that describes its visual appearance.

To display chemical and biological hazards:

1. Choose Options → Preferences. The Preferences dialog box opens.
2. On the Objects tab, select the Hazard Clouds tab ([Figure 9-7](#)).

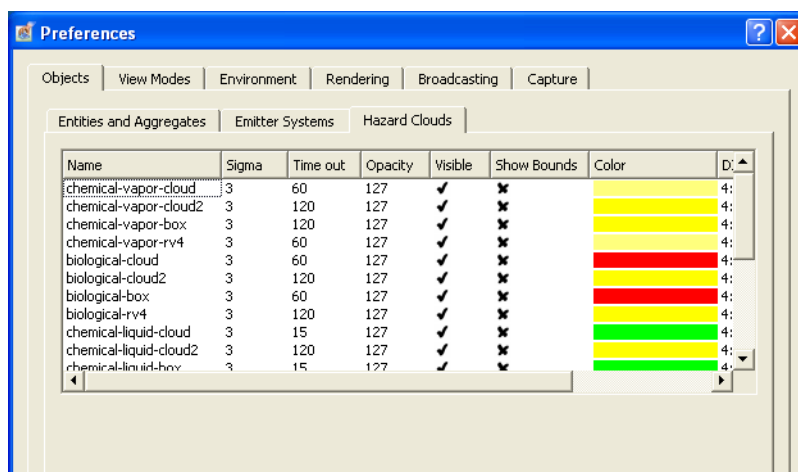


Figure 9-7. Specifying hazard clouds

3. Enable the hazard types you want to display and disable those that you do not want to display as follows:
 - If the Visible column, is checked, the hazard is enabled. Click the check mark to disable the display of that hazard.
 - If an X is displayed in the Visible column, the hazard is disabled. Click the X icon to enable the display of that hazard.
4. Set values for Sigma, Time Out, Opacity, and Color as follows:
 - For Sigma, Time Out, and Opacity, click the value you want to change. It becomes highlighted. Type a new value and press **Enter**.
 - To change the color, click the color swatch. In the Select Color dialog box, select the color that you want to use and click OK.
5. Click Close.

9.7. Configuring Sound Effects

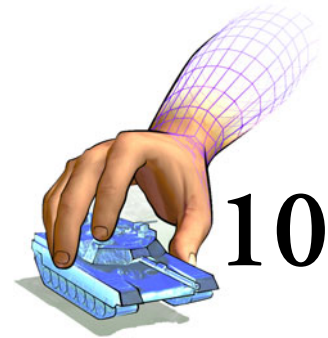
The Stealth supports sound effects on Windows. You do not need any supplementary hardware or software (other than a sound card and speakers.)

- To turn sound on or off, choose Options → Sound, or press the **s** key.
- To specify use of sound at startup, edit the **enableSound** parameter in *params.mtl*.

9.7.1. Associating Sounds With Entities and Events

VR-Forces's sound mapping commands let you associate sounds with entities such as vehicles and munitions, and with events such as collisions, munition firings, and detonations. To configure sound effects you add **entity-sound**, **fire-sound**, and **detonate-sound** parameters to the *soundMap.mtl* file.

The sample sound configuration file, *./config/soundMap.mtl*, contains a set of predefined sound mappings for common battlefield entities and events. You need to modify these mappings whenever you add or delete a sound. For instructions, please see the comments in *soundMap.mtl*.



Using XR Mode

This chapter describes Exaggerated Reality (XR) mode.

XR Mode Provides the Big Picture	10-2
Switching Between XR Mode and Standard Mode	10-3
Exaggerating the Terrain Scale	10-4
Exaggerating the Object Scale	10-5
Decluttering the Display	10-6
Configuring Clustering	10-7
Viewing an Entity's Height Above the Terrain	10-8
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Configuring Model Sets	10-10
Orthographic View	10-11
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Configuring XR Mode	10-13

10.1. XR Mode Provides the Big Picture

The standard 3D Front End view provides situational awareness at the entity or aggregate level. It is not ideal for getting the big picture of a simulation, because when you zoom out to see large areas of terrain, the entity models, which are scaled to the terrain, are too small to see. XR (exaggerated reality) Mode (Figure 10-1) provides a big picture view of the terrain. It allows you to sacrifice accuracy of entity models and their relationship to the terrain by exaggerating their size so that they are visible even from great distances. In many ways, it provides you with the benefits of a 2D plan view within the 3D Front End.

XR Mode lets you adjust both the terrain scale and object scale to help you understand relationships between entities and the terrain. It provides options for quickly switching between different views, such as a top-down view, and the typical perspective view.



XR Mode is an extra cost feature. It is not included in the base VR-Forces license. If you do not have a license for XR Mode, its features and controls are not visible in the GUI.

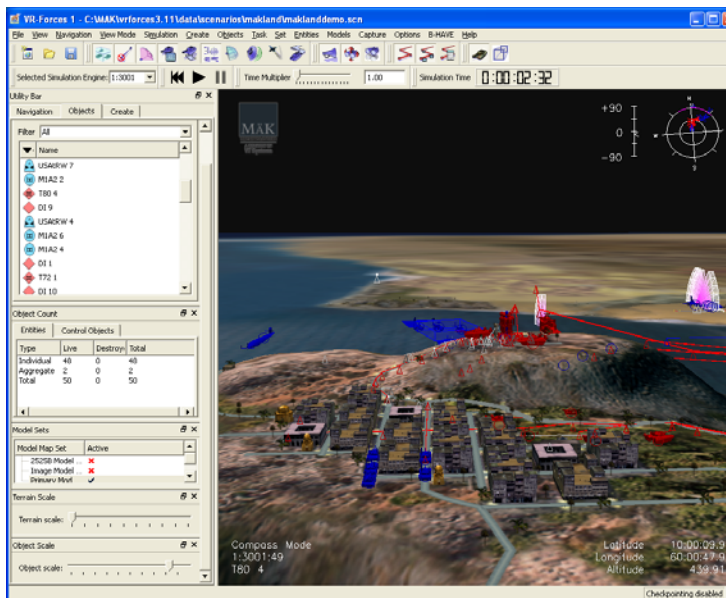


Figure 10-1. XR Mode mode

10.2. Switching Between XR Mode and Standard Mode

If you have a license for XR Mode, when you start the 3D Front End, it has the following toolbars that are not present in the standard product:

- ♦ XR Mode toolbar
- ♦ Model Sets toolbar
- ♦ Terrain Scale toolbar
- ♦ Object Scale toolbar
- ♦ Texture toolbar.

If you disable XR Mode, the Model Sets, Terrain Scale, and Object Scale toolbars are visible, but are disabled.

- To enable or disable XR Mode, choose Options → XR mode, or click the XR Mode icon on the XR Mode toolbar ([Figure 10-2](#)).



Figure 10-2. XR Mode toolbar

10.3. 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 10-3](#) and [Figure 10-4](#) illustrate terrain without scaling and exaggerated terrain. This can be particularly helpful for understanding the relationship of aircraft to the ground.

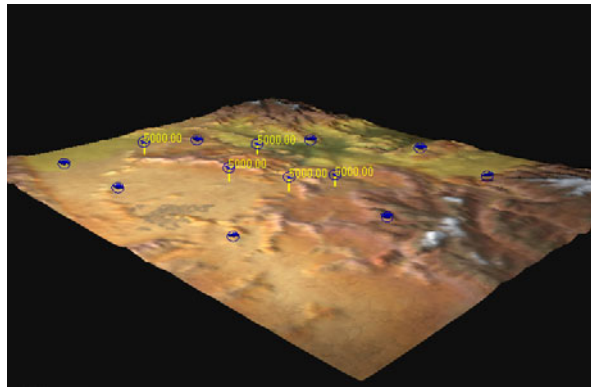


Figure 10-3. XR Mode view without terrain scaling

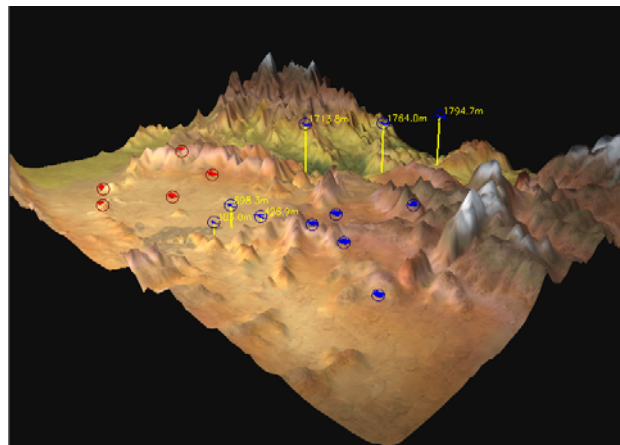


Figure 10-4. XR Mode view at increased terrain scale

- To scale the terrain, adjust the slider on the Terrain Scale toolbar ([Figure 10-5](#)).

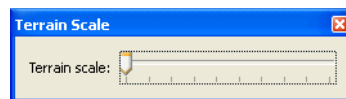


Figure 10-5. Terrain Scale toolbar

10.4. Exaggerating the Object Scale

If you were viewing the terrain in normal mode at the distances used in XR Mode, you would not be able to see entity icons because they would be too small. XR Mode lets you exaggerate the scale of entity icons and tactical graphics to see them at a great distance (Figure 10-6).

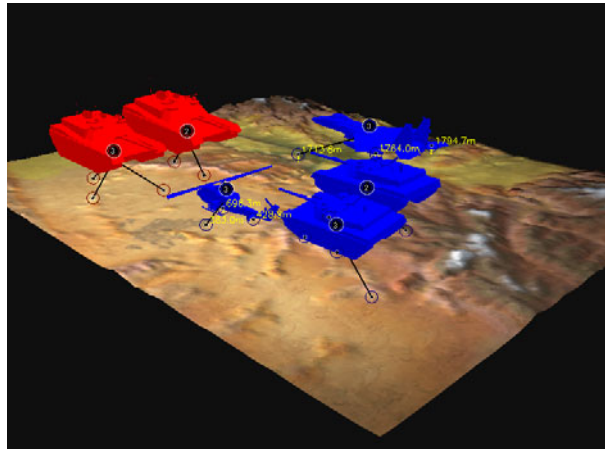


Figure 10-6. Scaled objects

- To scale objects, adjust the slider on the Object Scale toolbar (Figure 10-7).



Figure 10-7. Object Scale toolbar

To scale tactical graphics, you must enable dynamic scaling.

To enable or disable scaling of tactical graphics:

1. Choose Options → Tactical Graphics. The Tactical Graphics dialog box opens.
2. Select the Dynamic Scale check box. Clear the text box to disable scaling.



If tactical graphics do not appear to scale, try moving the eyepoint farther away from them.

10.4.1. Decluttering the Display

Although exaggerating the scale of entity icons, as described in the previous section, allows you to see entities from a great distance, if entities are close to each other on the ground, their exaggerated icons overlap in the XR Mode view (Figure 10-8, #1). This can defeat the purpose of the XR Mode view because the screen becomes cluttered with icons that are difficult to decipher. To resolve this problem, you can declutter the screen.

When you declutter the screen, overlapping entities are visualized with a single generic model (Figure 10-8, #2). (Entities overlap if their model's bounding boxes overlap.) The number of entities represented by the generic model is displayed above the model. Entities for different forces are clustered by force.

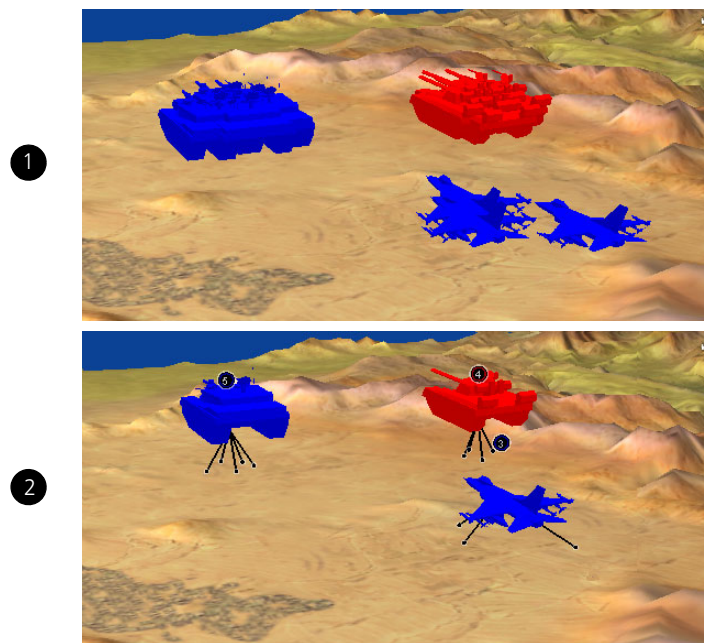


Figure 10-8. Clustering

Selecting a clustered model is equivalent to selecting the individual entities as a group. If you attach the eyepoint to a clustered model, you put it into Group mode for the clustered entities. If you ask for information about the clustered model, an Information dialog box for each member is displayed.

- To enable or disable clustering, choose Options → Clustered Entities.

10.4.2. Configuring Clustering

You can cluster entities according to one of two criteria – exact match, or by clustering rules. (In either case, the force type must also match.) If you use the exact match criteria, overlapping entities are combined if they have the exact same entity type. If you want to use clustering rules, you specify lists of entity types that should be clustered. For example, you might want to group entities by ground vehicles, helicopters, and fixed-wing types. Or, you might want to cluster ground vehicles into tracked and non-tracked groups. Cluster rules are specified in the *clusterRuleSet.mtl* file.

To configure clustering:

1. Choose Objects → Preferences. The Preferences dialog box opens.

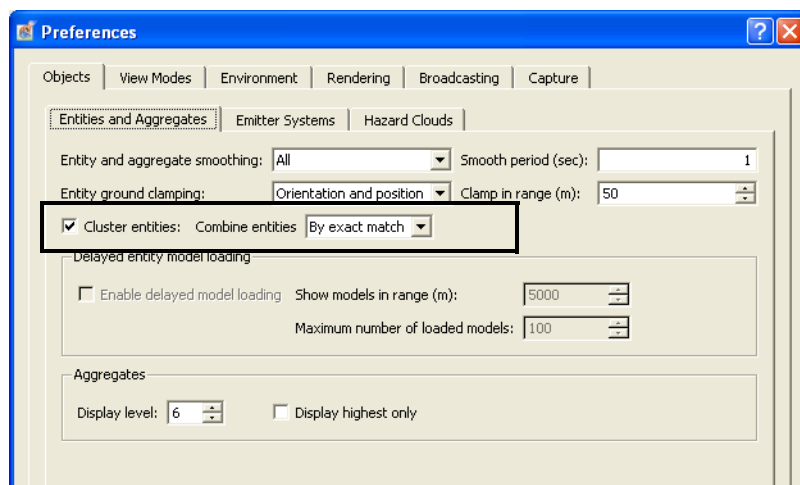


Figure 10-9. Preferences dialog box, clustering entities

2. On the Objects tab, select the Entities and Aggregates tab (Figure 10-9).
3. Check Cluster Entities.
4. In the Combine Entities list, select By Exact Match or By Cluster Rules.

10.5. Viewing an Entity's Height Above the Terrain

To help visualize an entity's height above the terrain, XR Mode can display height labels, vertical lines from the entity icon to the terrain. Entity labels display the height, in meters. [Figure 10-10](#) shows height and entity labels.

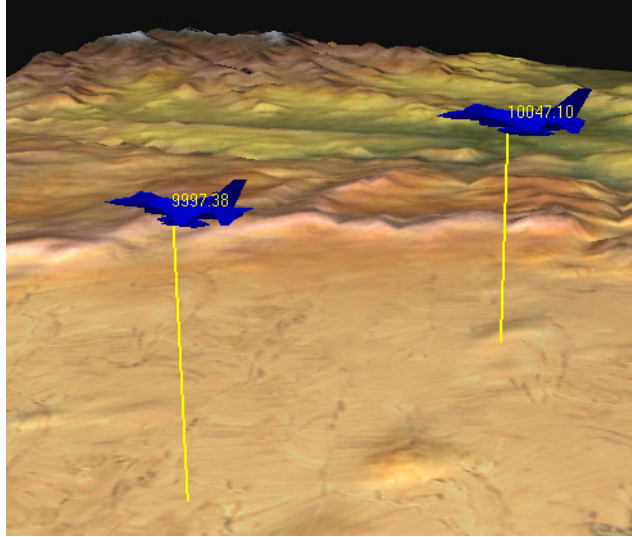


Figure 10-10. Height and entity labels



Display of height labels is also supported in standard mode if you have an XR Mode license.

- To display or hide height lines and labels, choose Options → Height Labels.

10.6. Changing the Model Map Set

The 3D Front End's primary model set uses 3D models to represent entities. VR-Forces also includes model sets that use MIL-STD 2525B icons or billboard models to represent entities. You can also create your own model sets.

The MIL-STD 2525B and image model sets use fixed images to represent entities. They do not display any of the entity behaviors that the primary models do. For example, they do not simulate movement of articulated parts, do not point in the correct direction, and do not have textures. However, they use much less memory than the primary models. If you are viewing an exercise that has many entities, you may improve performance by using one of these model sets.

To change the model set, use one of the following methods:

- ♦ In the Model Sets toolbar (Figure 10-11), click the symbol in the Active column for the model map set that you want to use. A check mark indicates that the model map set is active.

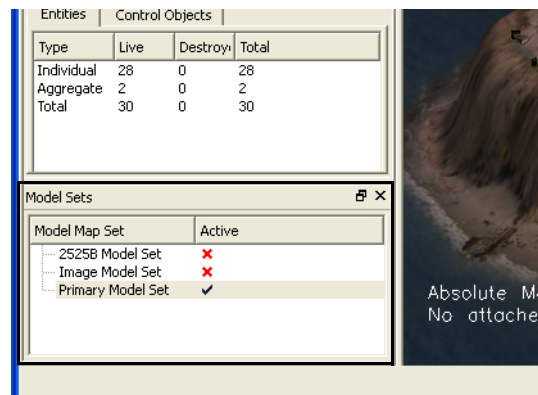


Figure 10-11. Model Sets toolbar

- ♦ Choose Models → Next Model Set (or Previous Model Set.) These options cycle through the model sets.

10.6.1. Configuring Model Sets

VR-Forces includes a primary model set, configured in *params.mtl* and *ModelMap.mtl*, and two alternative model sets, the 2525B Model Set and the Image model set. You can configure how these model sets, and other model sets that you might create, are displayed.

To configure a model set:

1. Choose Models → Model Map Sets. The Model Map Sets dialog box opens.

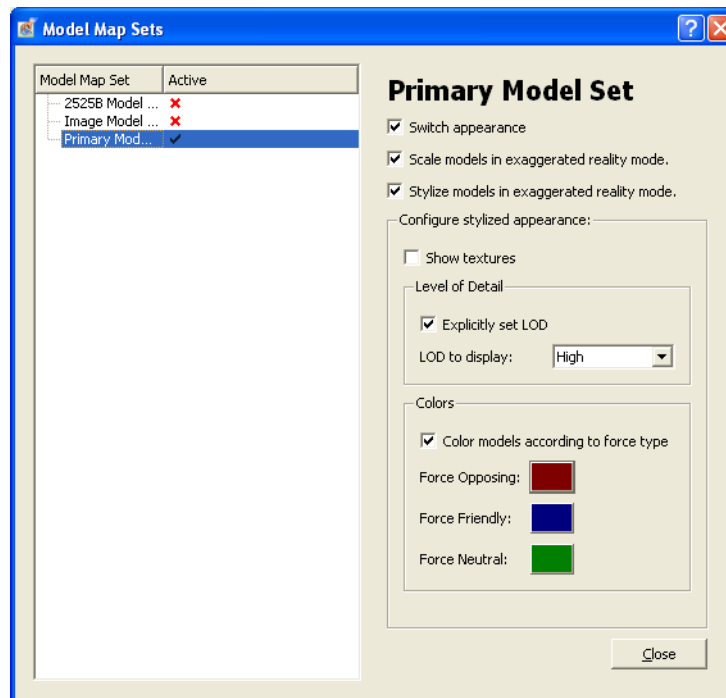


Figure 10-12. Model Map Sets dialog box

2. In the Model Map Set list, select the model map set that you want to configure.
3. Specify whether or not you want to display appearance states, smoke, and flames, by checking or clearing the Switch Appearance check box.
4. Specify whether or not you want to scale models in XR Mode by checking or clearing the check box.
5. Specify whether or not you want to stylize models in XR Mode.
6. If you checked the Stylize Models in Exaggerated Reality Mode check box, change the settings in the Configure Stylized Appearance and Colors group boxes as desired.
7. Changes take effect immediately. When you are finished, click Close.

10.7. Orthographic View

By default, the 3D Front End uses a perspective view, in which sight lines converge in the distance. Objects that are farther away look smaller. For normal situational awareness perspective view works well, because it mimics how we see. However, when you are viewing large terrain areas in XR Mode, perspective view makes it difficult to compare the relative locations of objects. In orthographic view, all objects are drawn to the same scale and parallel lines remain parallel. [Figure 10-13](#) compares perspective view and orthographic view of a terrain database.

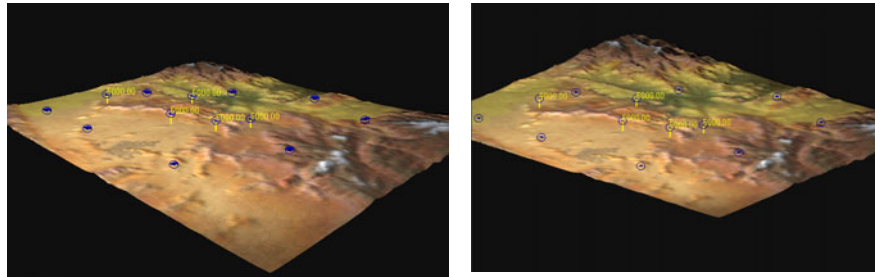


Figure 10-13. Perspective view (left) and orthographic view

- To set the display to orthographic mode, in XR Mode, choose Options → Orthographic.

10.8. Switching Between Database Textures

If you have a XR Mode license, you can load databases that have multiple textures (specified in MTD files) and you can switch between the textures. (This feature is enabled in standard mode and XR Mode.) [Figure 10-14](#) illustrates switching between textures. The texture is selected in the Texture toolbar, as shown. For details about MTD files, please see *MÄK Terrain Database Tool User's Guide*.



The Texture toolbar is enabled whenever a MTD file with at least one texture is loaded. If a MTD file is not loaded, or the MTD file has no textures, the toolbar is disabled.

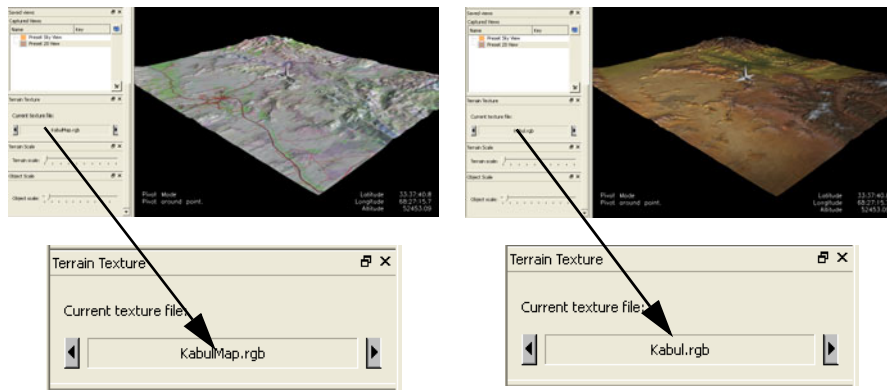


Figure 10-14. Switching between textures

- To switch between textures, click the left or right arrow in the Texture toolbar.

10.9. Configuring XR Mode

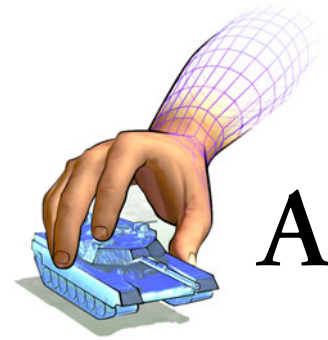
Configuration parameters for XR Mode are in *params.mtl* with the other VR-Forces configuration parameters. When you switch into XR Mode, the XR Mode-specific parameters override any similar parameters for the standard mode. [Table 10-1](#) lists the parameters that apply only to XR Mode. Parameters that can have different settings in XR Mode and standard mode, but are otherwise identical, such as `enableGroundClamping` and `xrEnableGroundClamping`, are described in Section 11.3, “[The params.mtl File](#)”, in *VR-Forces Configuration Guide*.

Table 10-1: XR Mode configuration parameters (Sheet 1 of 2)

Parameter	Description
<code>xrStartInExaggeratedMode</code>	Specifies whether VR-Forces should start in XR Mode or standard mode.
<code>xrEnableAppearanceSwitchForPrimary-ModelSet</code>	Enable (1) or disable (0) the display of appearance states, flames, and smoke.
<code>xrEnableDynamicClippingPlanes</code>	Enable (1) or disable (0) dynamic increase of the near plane when the viewer is zoomed out.
<code>xrDefaultTerrainScale</code>	Specifies the default XR Mode terrain scale. Range: [1 - 100].
<code>xrDefaultObjectScale</code>	Specifies the default XR Mode object scale. Range: [1 - 100].
<code>xrEnableClusteredEntityLabels</code>	Enable (1) or disable (0) labels for clustered entities.
<code>xrEnableEntityClustering</code>	Enable (1) or disable (0) clustering.
<code>xrEnableEntityHeightLabels</code>	Enable (1) or disable (0) height lines and labels.
<code>xrEnableStylizedForPrimaryModelSet</code>	Specifies whether models should display stylistically in XR Mode.
<code>xrEnableStylizedTextures</code>	If models are displayed stylistically, specifies whether models show texture.
<code>xrEnableStylizedLODMode</code>	If models are displayed stylistically, specifies the LOD. Explicitly set LODs do not change based on distance. You can show the lowest, middle, or highest detail.
<code>xrEnableStylizedColors</code>	If models are displayed stylistically, specifies whether models set their color based on force type.
<code>xrEnableStylizedForceFriendlyColor</code>	If models are displayed stylistically and color is enabled, specifies the friendly color.
<code>xrEnableStylizedForceNeutralColor</code>	If models are displayed stylistically and color is enabled, specifies the neutral color.
<code>xrEnableStylizedForceOpposingColor</code>	If models are displayed stylistically and color is enabled, specifies the opposing color.
<code>xrEntityClusterCriteria</code>	Specifies use of exact match (0) or cluster criteria rules (1) for clustering.

Table 10-1: XR Mode configuration parameters (Sheet 2 of 2)

Parameter	Description
xrHeightLabelAndLineInfo	Specifies that height line values are relative to the loaded terrain (0) or relative to sea level (1). Sea level calculations are much faster than height above terrain calculations. Default: 1.
xrHeightLabelAndLineColor	Specifies the color for height lines and labels. Default: yellow
xrSkyColor	Specifies the sky color for XR Mode. Default: dark grey.



MIL-STD 2525B Font Characters

This chapter illustrates the characters in the MIL-STD 2525B font.

MIL-STD 2525B Font Characters	A-2
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A.1. MIL-STD 2525B Font Characters

[“Configuring TrueType Font-based Unit Icons \(Windows Only\),”](#) on page 11-20, in *VR-Forces Configuration Guide*, discusses how to configure the use of TrueType fonts for building VR-Forces unit icons. The illustrations on the following pages list the characters in the MIL-STD 2525B font provided with VR-Forces.

Font Display for MilStd-2525-b

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000																
0020																
0030																
0040																
0050																
0060																
40A0																
40B0																
40C0																
40D0																
40E0																
40F0																
4100																
4110																
4120																
4130																
4140																
4150																
4160																
4170																
4180																
4190																
41A0																
41B0																
41C0																
41D0																
41E0																

Font Display for MilStd-2525-b

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
41F0																
4200																
4210																
4220																
4230																
4240																
4250																
4260																
4270																
4280																
4290																
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4310																
4320																
4330																
4340																
4350																
4360																
4370																
4380																
4390																

Font Display for MilStd-2525-b

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43A0																
43B0																
43C0																
43D0																
43E0																
43F0																
4400																
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4440																
4450																
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4470																
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44B0																
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44D0																
44E0																
44F0																
4500																
4510																
4520																
4530																
4540																

Font Display for MilStd-2525-b

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
4550																
4560																
4570																
4580																
4590																
45A0																
45B0																
45C0																
45D0																
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4680																
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46B0																
46C0																
46D0																
46E0																
46F0																

Font Display for MilStd-2525-b

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
4700																
4710																
4720																
4730																
4740																
4750																
4760																
4770																
4780																
4790																
47A0																
47B0																
47C0																
47D0																
47E0																
47F0																
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Font Display for MilStd-2525-b

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Font Display for MilStd-2525-b

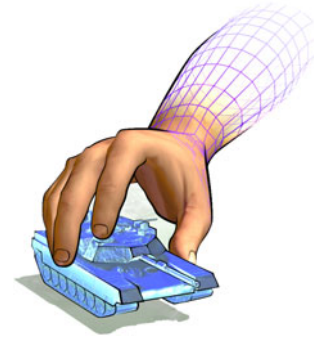
[illegible]

Font Display for MilStd-2525-b

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4DE0																
4DF0																

Font Display for MilStd-2525-b

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4E10																
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4E30																
4E40																
4E50																
4E60																



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VR-Forces 3D Front End Quick Reference Card

3D Front End Command-Line Options

Option	Description
--ignore_rest	Ignore all options after this one.
-a <i>app_number</i>	Application number.
--acf <i>filename</i>	Loads the specified ACF file.
--addTranslationFile	Specifies one or more translation files to load.
--appIdRange <i>low-high</i>	Range of application IDs for VR-Forces objects.
-B <i>file</i>	Runs the specified batch file.
-c <i>number_of_channels</i>	Specifies display of multiple channels (views).
-C	Runs GUI with a console window (Windows only).
-d <i>file</i>	A file for loading and saving settings.
--defaultConfigFile <i>file</i>	An alternate to <i>vrf3DGui.mtl</i> .
-D	Do not load or save a settings file.
--fullScreen	Starts the VR-Forces in full screen mode.
-g	Runs with a global Minimap.
-G <i>locale</i>	Specifies the language to use.
-h	Displays help information in a console window.
--hidegui	Displays the 3D scene without any graphical user interface features.
-H <i>address</i>	The ethernet address to use on a computer that has multiple ethernet cards.
-i <i>session_ID</i>	The session ID.
--ignore_rest	Ignore any options after this one.
-l <i>file</i>	Specifies a configuration file to load.
-lispFile [<i>mtl-file</i> " <i>mtl-command</i> " <i>param=value</i>]	Load an MTL file, execute an MTL command, or set a parameter.
--loadPlugin <i>file</i>	Plug-in file to load.
--logDirectory	Specifies the directory in which log files should be written.
-L " <i>scenario_path</i> "	Load specified scenario. Mutually exclusive with -T.
-m <i>filename</i>	Specifies a symbol map file to load.
--mft <i>mft_file</i>	Load the specified MetaFlight file for terrain paging.
--mirror	Enables mirroring.
-n <i>notify_level</i>	Specifies the notification level for messages. Range: 0-4, from least verbose to most verbose.
--noDefaultMtl	Prevents loading of the <i>Stealth.mtl</i> file.
--noPluginDirectory	Do not load MTL files in <i>./plugins</i> .
-o <i>file_name</i>	Overlay menu file to load.
--outputLogFile <i>file</i>	The name of the log file for messages.
-p <i>app_number</i>	The application number for the back-end in combined mode.
--pluginFile <i>file</i>	Specifies the plug-ins configuration file.
-s <i>site_ID</i>	Specifies the site ID.

3D Front End Command-Line Options

Option	Description
--simulationModelSet	Default SMS for the front-end.
--simulationModelSetFile	Default SMS for the back-end.
--startAltitude <i>altitude</i>	Specifies the initial eyepoint altitude, in meters.
--startOrientation <i>orientation</i>	Specifies the initial eyepoint orientation.
--startposition <i>x,y,z</i>	Specifies the initial eyepoint position in UTM or geocentric.
--startVideoRecording	Specifies that the Stealth start recording to video when it starts up.
-t <i>site_ID</i>	The site ID for the back-end in combined mode.
-v <i>version</i>	Specifies version information.
-W <i>size</i> or -W <i>width,height</i>	Sets the initial size of the graphics display, in pixels. Specify <i>size</i> for a square window, or a separate <i>width</i> and <i>height</i> .
--xr	If you have a XR Mode license, start VR-Forces in XR Mode.
-z	Specifies combined mode without specifying a back-end.
-z <i>back-end</i>	Run in combined mode.
DIS Only	
-a <i>app_num</i>	Specifies the application number.
-A <i>addr</i>	Destination address for outgoing PDUs.
--disVersion <i>num</i>	DIS: Sets the DIS protocol version: 4 = 2.0.4; 5 = IEEE 1278.1; 6 = 2.1.4
-I	Enables asynchronous IO.
--mcastTtl <i>ttl</i>	Specifies the multicast time-to-live.
-P <i>port</i>	The UDP port.
--recvBufferSize <i>size</i>	Specifies the receive buffer size.
--siteId <i>ID</i>	Specifies the site ID.
-S <i>mcast_addr</i>	Subscribes the VR-Forces to the specified multicast address.
--sendBufferSize <i>size</i>	Specifies the send buffer size.
-x <i>ExerciseId</i>	Sets the exercise ID.
HLA Only	
-f <i>fomMapperLibrary</i>	Specifies a shared library for a FOM Mapper.
--fomMapperInitData <i>data</i>	Specifies initialization data for a FOM Mapper.
-F <i>fed_file</i>	Use the specified FED file.
-N <i>federate_name</i>	Specifies the federate name.
--rid <i>RID_file</i>	Load the specified RID file.
--rprFomVersion	Specifies the version of the RPR FOM to use (0.5, 0.7, 0.8, 1.0, 2.0006, 2.0014, 2.0017).
-x <i>ExecutionName</i>	Sets the federation execution name.

VR-Forces 3D Front End Quick Reference Card

View Modes

View Mode	Key	Description
Absolute	z	Free-fly mode. The eyepoint position and orientation are controlled manually.
Compass	c	The eyepoint moves along the surface of a sphere centered at the attached entity. You control the eyepoint's longitude and latitude on the sphere, and its distance from the entity. The VR-Forces adjusts orientation automatically to keep the entity in view.
Group	n	Shows all entities in a user-defined view-group.
Mimic	v	Creates the effect of being inside the entity, or rigidly connected to it. Eyepoint position and orientation are slaved to the entity.
Mimic Track	V	Creates the effect of sitting in one entity while tracking another.
Orbit	b	The eyepoint continually orbits along the surface of a sphere centered at the attached entity. You control the eyepoint's orbit speed, latitude, and distance from the entity. The VR-Forces keeps the entity in view.
Pivot	k	The eyepoint rotates around a point on the terrain.
Tether	x	The eyepoint moves with the attached entity, keeping a constant distance from the entity, in a constant direction.
Tether Track	X	The eyepoint points along a ray that connects the entities. Both entities remain in view.
Track	Z	Tracks an entity from a desired location. Position is set manually; orientation is controlled by the entity.
Turret	m	Same as Mimic mode, but the eyepoint is slaved to the attached entity's first articulated part.
Wide Group	N	Shows all entities in a view-group. The entities are distributed as widely as possible across the field of view.

Keyboard Shortcuts

Function	Key	Function	Key	Function	Key
Aggregate Enclosure	A	New Scenario	Ctrl + N	XR mode	F2
Broadcasting	Shift + B	Open Batch File	Ctrl + Shift + B		
Capture Display	Ctrl + P	Open Database	Ctrl + O	Attach Next Entity as Primary	. (period)
Capture Video	F9	Paste	Ctrl + V	Attach Previous Entity as Primary	, (comma)
Capture View	Ctrl + V	Pause Simulation	Ctrl + Shift + P	Attach Next Graphic as Primary	>
Checkpoint Scenario	Ctrl + K	Pause Video Capture	F9	Attach Previous Graphic as Primary	<
Clear Track Histories	Ctrl + H	Range Volumes	R	Attach Next Entity as Secondary	]
Clustered Entities	Q	Redo	Ctrl + Y	Attach Previous Entity as Secondary	[
Clustered Entity Labels	Shift + Q	Rewind Simulation	Ctrl + B	Attach Next Graphic as Secondary	}
Clouds	!	Run Simulation	Ctrl + R	Attach Previous Graphic as Secondary	{
Copy	Ctrl + C	Save Scenario	Ctrl + S	Swap Primary and Secondary	~
Create Selection Group	Ctrl + G	Save Scenario As	Ctrl + Shift + S	Move Back	2
Delete	Delete	Schedule Scenario Checkpoint	Ctrl + Shift + K	Move Down	3
Edit Plan	P	Show Full Screen	Ctrl + Enter	Move Left	4
Emitter Systems	E	Show Pivot model	Shift + K	Move Right	6
Entity Labels	L	Sound	S	Move Forward	8
Exit	Ctrl + Q	Stop Video Capture	F10	Move Up	9
Fire and Detonation Lines	D	Tactical Graphics	Shift + G	Look Left	Left arrow
Fog	#	Tactical Graphics Labels	Shift + L	Look Right	Right arrow
Ground Clamping	G	Texture	%	Look Up	Up arrow
Global Plans	Ctrl + Shift + G	Track Histories	H	Look Down	Down arrow
Head-up Display	Shift + O	Trailing Effects	T	Reset	0 (zero)
Height Labels	Shift + H	Undo	Ctrl + Z	Increase Stepsize	7
Hide GUI	Shift + S	View Control Messages	Shift + C	Decrease Stepsize	1
Information	I	View Plan	Shift + P		
Load Scenario	Ctrl + L	View Primary Information	Ctrl + I	Next Model Set	=
Mirroring	Shift + M	Wireframe	W	Previous Model Set	+



Link - Simulate - Visualize